

# DAAAC™

## Software Manual

June 2025

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Document No. VS2021-01

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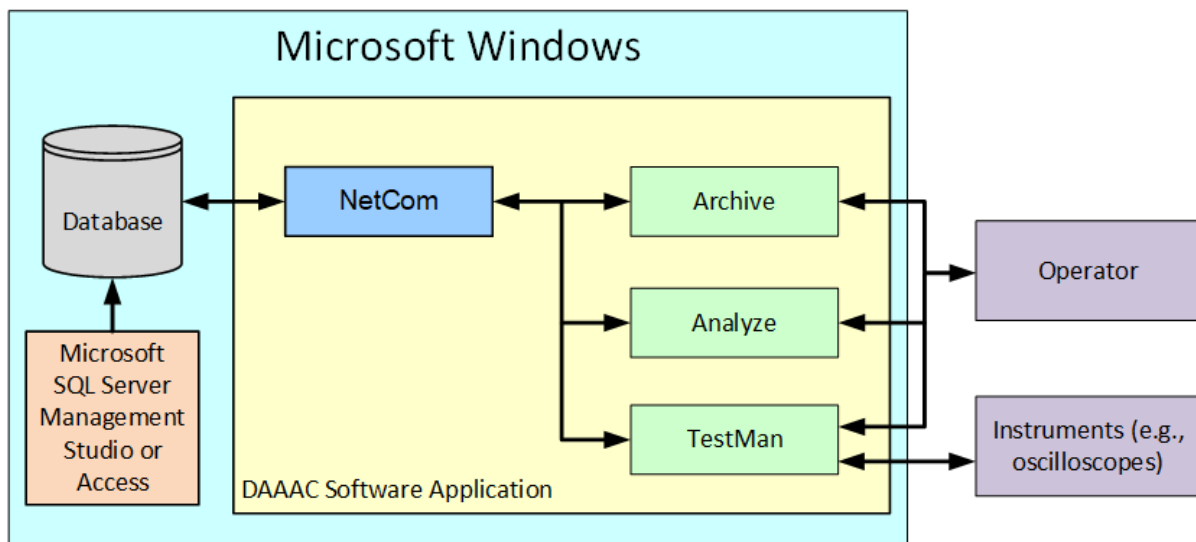
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# 1 DAAAC

## 1.1 Introduction

The DAAAC data acquisition management software simplifies single-shot and repetitive single-shot laboratory testing by centralizing data acquisition, analysis, archival, and instrument control in a single, turnkey package. DAAAC is specifically designed to address the demanding recording requirements associated with high-value, transient events.

The DAAAC user interface consists of three modules – Archive, TestMan, and Analyze – that operate as one system, documenting and organizing all test parameters, instrumentation, signal path components, and event data. The Archive module is DAAAC's database manager. From Archive, users can select databases, import or export data and organize and transfer stored data. The Analyze module displays and prints data and provides tools for examining and processing waveforms and images. The TestMan module supports both single-shot data acquisition and multi-shot test sequences. It manages instrument inventories and communication, and provides a consistent graphical interface for management of various instrument types. TestMan also manages signal path component inventories and definitions. These signal path definitions are used to automatically process (aka, “reduce”) data during the acquisition sequence. An additional DAAAC module, NetCom, provides the interface between the other DAAAC modules and the database. While NetCom is an important part of DAAAC, it is not one that you will interact with. Figure 1-1 depicts the DAAAC modules and their highest-level relationships. One of the most important aspects of the DAAAC architecture is that these modules, although separate executables, use inter-process communication (IPC) to exchange information and operate as a single, integrated software application.



**Figure 1-1. The DAAAC system components**

## **1.2 DAAAC Installation Types**

Each DAAAC installation can be customized via software keys. This section describes the use of the keys that determine the characteristics of a particular installation, and then discusses the common installation types.

### **1.2.1 DAAAC Keys**

DAAAC installations are customized to the needs of specific user groups. All DAAAC installers include a set of custom software keys that lock and unlock various DAAAC features, depending on the configuration purchased. Keys are used to enable particular instrument drivers and signal path component types. They are also used to enable custom capabilities that are not generally useful to all operators. For this reason, menus and toolbars that appear in a particular DAAAC installation may not exactly match those discussed in this document. Keys and keyed features are discussed in more detail throughout this manual.

### **1.2.2 Acquisition System**

The Acquisition installation (models D4S and D5S) includes all DAAAC modules and is used to acquire, reduce, manually process, and store data.

### **1.2.3 Analysis Only**

The Analysis Only installation (models DA40 and DA5) excludes TestMan from the installation. No acquisition or data reduction is available. It is a low-cost option for installations that are often used to review and analyze data collected by other DAAAC installations. Archive may be used to connect to existing databases through NetCom. Analyze is used to recall, review, and manipulate waveform and image data using a variety of processing tools.

### **1.2.4 Analysis with Reduction**

This installation (models DAR4S and DAR5S) excludes TestMan's instrument communication and data acquisition capabilities, but does include signal path definition and supports automated data reduction. It also includes all capabilities of the Analysis Only system.

### **1.2.5 Database Server**

The Database Server installation (model DBS) is used in networked systems that include a dedicated computer to host the database. These installations include the DAAAC Archive and NetCom modules, which provide the interfaces to the database server application. The Analyze module may also be included, but it is not a required component.

## **1.3 DAAAC Data Configuration**

DAAAC is primarily designed to collect and store waveform and image data from diagnostic instruments. In addition, all elements of the system configuration used to generate and collect the waveforms/images are stored. Collected data is stored in a relational database, with dedicated tables for each object type. The table below provides a description of the primary objects and organizational elements that managed by the DAAAC software. A diagram of the entire DAAAC database, including all tables and their relationships, is shown in Section 12.

Database	The Database stores the <i>raw</i> waveforms and image data captured from diagnostic instruments during an acquisition, and the associated <i>processed</i> waveforms and images that result from applying automatic or manual processes to the raw data. The database also maintains a complete definition of the DAAAC configuration at the time of the acquisition and establishes links between the various data objects so that configuration parameters are associated with the collected waveforms and images.
----------	---

Data Organization	
Shot	A shot is a single instance of arming the active instruments, detecting triggers from all armed instruments and receiving the data from those instruments. The number of raw waveforms and images received in a shot will equal the total number of instrument channels configured. If instruments are configured to produce data in burst mode (Section 4.6.4.4) those instruments will produce multiple waveforms in a single shot. Shots are distinguished by a serial value (shot number), which is automatically incremented by DAAAC.
Sequence	A sequence is a group of shots acquired using automated data acquisition (via a sequencer, an optional DAAAC component). A sequence is typically defined by specifying automated changes to individual instrument settings, using a fixed set of signal generation and diagnostic hardware.
Test	A test is a named collection that is associated with multiple shots and/or sequences. As such, it is a management tool that allows the grouping of shots that share some common collection attribute such as customer, test asset, instrument configuration, execution configuration, time period, etc.
Waveform	A waveform consists of collections of X,Y (independent, dependent) pairs of data, received from a single instrument, producing a one-dimensional plot of the data. Waveforms are the primary acquisition, display, and processing object in most DAAAC installations.
Image	<i>Images</i> are two dimensional data arrays, with two independent values representing the horizontal and vertical position (pixel) and a dependent value at each pixel. Image data is typically the result of acquisition from cameras, but can also be generated by analysis operations (e.g., generating a spectrogram from a waveform).
Raw Data	<i>Raw data</i> is waveform or image data retrieved directly from an instrument, during an acquisition sequence.



Processed Data	<i>Processed data</i> is typically generated by performing a series of user-configured operations on a raw data object. Data generated in this manner is linked to its associated raw data in the database. Processed data can also be manually generated or imported.
----------------	--

Hardware Organization	
Station	A <i>station</i> is a single node in a networked collection of acquisition computers. Each DAAAC installation with acquisition capabilities is a <i>station</i> . A <i>standalone</i> configuration is an installation that runs on a single host computer and has a single station. A <i>networked</i> configuration consists of multiple stations, with acquisition sequences coordinated through a dedicated station called <i>Test Director</i> .
Instrument	An <i>instrument</i> represents diagnostic or signal generation hardware attached to the station. Each instrument is enabled via a software driver, developed by Voss Scientific, and the suite of instruments available to a given customer is determined by that customer's keys. The instrument has a custom configuration dialog that allows the user to set parameters that will be used to configure the physical instrument before an acquisition event.
Channel	Each recording port (diagnostic instrument) or output port (signal generator) is an instrument <i>channel</i> . In a multi-channel instrument, DAAAC can be configured to receive data from or transmit data through any combination of the available instrument channels.
Cal Item	<i>Cal Items</i> represent the hardware and software components that are used to automatically process raw data. Hardware cal items represent the physical components that sense a signal (sensors, probes), modify the signal (amplifiers, attenuators), and transmit that signal (cables) to a recording device. Cal items are defined by their characterization parameters, often including a characterization curve (e.g., the item's frequency dependent response).
Signal path / cal line	A linked collection of cal items that represents all physical and processing components from a sensor to the associated diagnostic instrument channel is referred to as a <i>signal path</i> or <i>cal line</i> . Because signal paths are associated with an instrument channel, they are configured to process a particular class of data (e.g., narrowband waveform, wideband waveform, image).
Graph	The collection of all defined signal paths and any links between those signal paths is called the <i>graph</i> . Individual instruments, channels, and cal items, when added to the graph, are referred to as graph <i>nodes</i> .

Configurations	
Current, Historical, Named	A <i>configuration</i> is not a single data object, but a collection of objects that represents the state of the system at a point in time. It includes the instrument list, instrument settings, acquisition and reduction settings, the cal graph, and cal items. The <i>current</i> configuration represents the present state of the system. <i>Historical</i> configurations are those in effect when data was acquired. <i>Named</i> configurations are manually created by the user.

## 1.4 Manual Organization

This section has provided a very brief introduction to the capabilities, organization and terminology of DAAAC. The remainder of the manual will provide a detailed look into DAAAC and examine all of the features available in each of the modules.

- Section 2 - Getting Started. This section begins with a simple description of the DAAAC installation and licensing process for use on a single computer. It then proceeds through every phase of the first execution of DAAAC, using a simple tutorial. This process will create a database and a station, and add a digitizer. A test will be added, the instrument configured and an acquisition sequence executed. Finally, the chapter will demonstrate configuration of a simple data reduction process in TestMan, computing processed data from acquired raw data.
- Section 3 - Common DAAAC  
. This section describes general use elements that are common to the four main DAAAC modules and are common across the various possible installations and key sets. Among the items discussed are the toolbar, the status bar, general menu options and many others.

The following sections present the individual DAAAC modules. Each section begins with a narrative discussion of the module, providing a complete presentation of the purpose, configuration and operation of the module. Subsections discuss important elements of each module.

Each module's introductory subsection is followed by a subsection that describes the toolbar icons. A table shows the toolbar icons with associated descriptions. Subsections following the table present detailed discussions of the toolbar functions.

Each module's third subsection presents the module's menu structure. This discussion is also tabular and is hierarchical. The first table presents the main menu items, left-to-right on the module. Each of the main entries is then broken out into a table that contains the menu entries under the main menu. The entries are presented by name, followed by a description. In many cases the description in the table is sufficient and no further detail is provided. Where the menu entry needs clarification, a section below the table provides the additional detail, item-by-item. The detail will include a discussion and any shortcuts to the operation.

Many menu items open one or more dialog boxes. Dialog boxes are either described in the context of the associated menu and toolbar items, or are included in the module's fourth subsection. Dialog boxes are presented with an image of the dialog along with a narrative and/or a table detailing the dialog's controls.

The module sections are:

- Section 4 TestMan. TestMan is the latest DAAAC module, and it combines the functionality of the previous DAAAC Acquire and CalMan modules. TestMan is used to configure and execute the automated sequence of operations that comprise the data acquisition and reduction processes. It is also used to manage the inventory of instruments and signal path hardware.
- Section 5 Archive. The Archive module manages the various databases that have been created under DAAAC. It is used to specify the active database and to transfer data in and out of the DAAAC system and between DAAAC databases.
- Section 6 Analyze. Raw and Processed data is displayed in Analyze after data acquisition and reduction by TestMan. Existing data may also be recalled from the database or imported into DAAAC. Once displayed in Analyze, the data can be examined and manipulated.
- Section 7 NetCom. The NetCom module coordinates data transfer between the other modules and the database. NetCom has a minimal user interface.

Additional sections cover specific aspects of the DAAAC software:

- Section 8 Cal Items. Provides a detailed narrative description of every cal item (signal path component). Some cal items have common interfaces and are presented as a group. The organization of the entries varies depending on the type and complexity of the cal item.
- Section 9 Data Reduction. Describes the methods available to automatically process the data acquired on the recording instruments.
- Section 10 FOMs. FOMs are statistics calculated for waveform and image data. Every FOM available within DAAAC is presented two tables, the first for waveforms and the second for images.
- Section 11 Software Installation. Describes the process used to install and license DAAAC on a new computer or update an existing DAAAC installation.
- Section 12 Database Architecture. A diagram that shows the various tables in the DAAAC database and their relationships to each other.

# 2 Getting Started

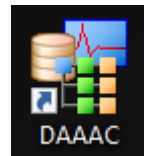
## 2.1 Installing DAAAC

DAAAC uses an automated software installer and a 3<sup>rd</sup>-party licensing application. See Section 0 for installation instructions.

## 2.2 First Execution

This section will walk the first-time user through a simple, but complete, system configuration and execution for a DAAAC installation on a single computer. A database will be created. TestMan will be configured by adding an instrument to the inventory and then to the instrument list and configuring the instrument. A test will be created and a shot will be taken and the data displayed for review in Analyze. A simple data reduction signal path will then be configured and a second shot will generate both the raw and processed (reduced) data that will again be presented for review in Analyze.

Begin by double-clicking the DAAAC shortcut that the installer placed on the desktop. If a desktop icon was not created, DAAAC is launched via the Archive.exe application, typically located at C:\Program Files (x86)\DAAAC. When DAAAC starts, any modules that open in *minimized* mode will be accessible from the task bar along the bottom of the desktop.



### 2.2.1 Database

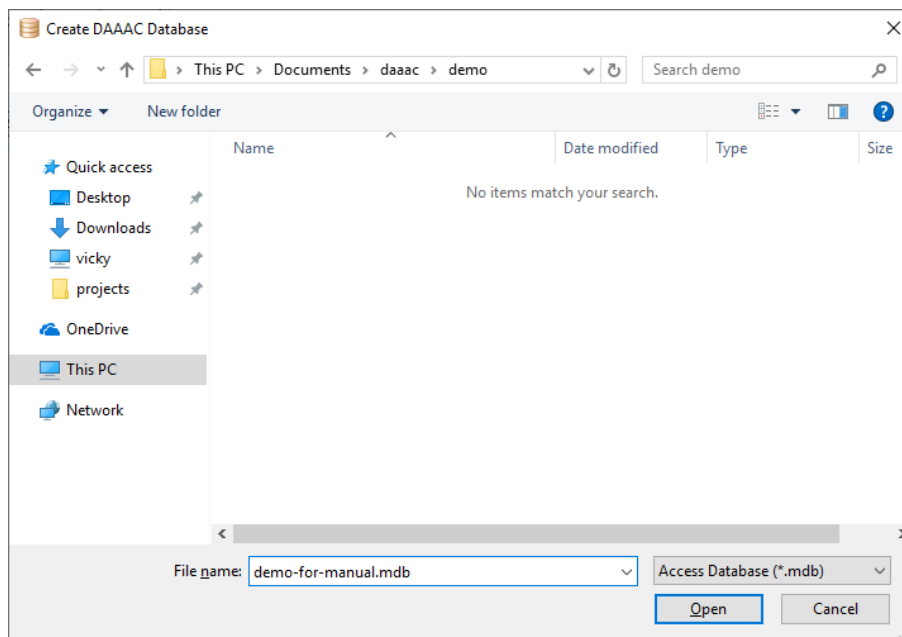
Click on the Archive task to display it. In a new installation the first task is to create a database to contain the configuration information, acquired data, and processed data.

DAAAC can use either a Microsoft Access (Jet engine) database or a Microsoft SQL Server database. The Jet database stores data in a single (.mdb) file, which can be stored anywhere on the host computer or networked drive. While simple to configure and easy to use, the Jet database format is limited to 2 GBytes total size. Large-scale system installations will often use a SQL Server database, which supports the large databases that are commonly generated by multi-station or auto-sequenced configurations. Note that SQL Server is a Microsoft application that must be separately purchased, installed, and configured. A related option is the use of SQL Server Express, which is provided by Microsoft at no cost. SQL Server Express operation is identical to that of the full SQL Server package, but Express is limited to 10 GBytes total size. The following discussion assumes the use of the Jet database engine to store DAAAC data.

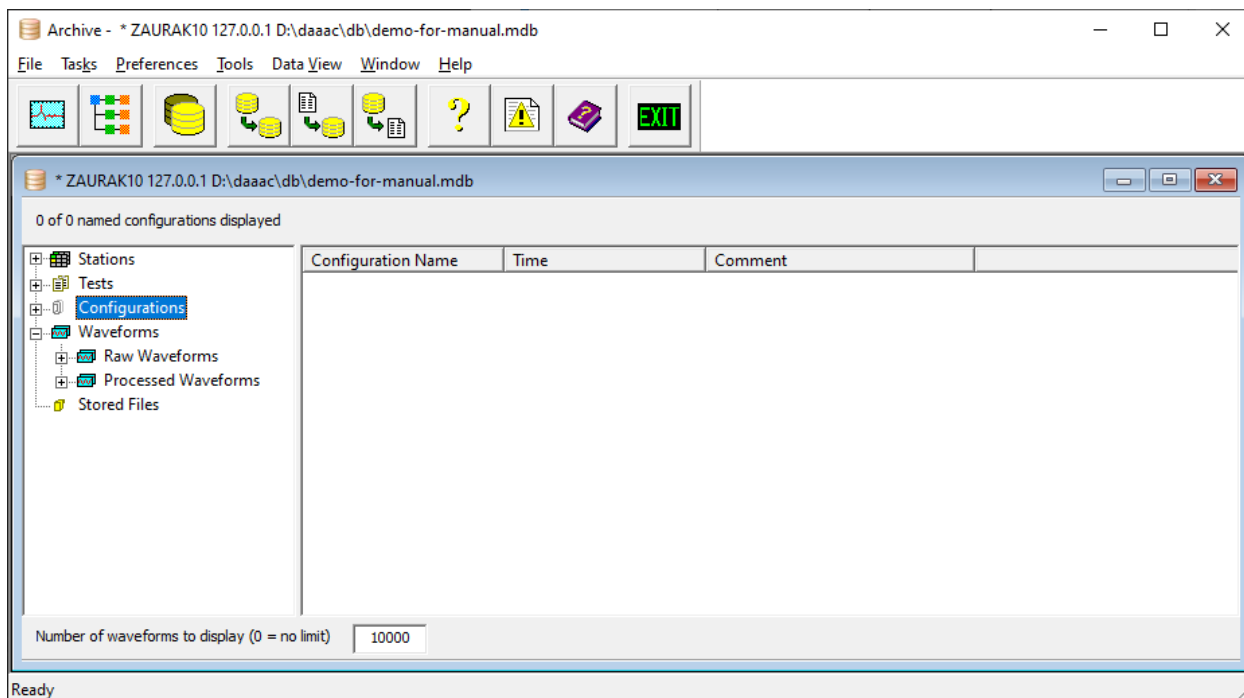
On first execution, Archive will begin the process of preparing a database by opening a standard Windows browser dialog. Navigate to an appropriate folder (creating new folders from within the browser dialog as necessary), specify a file name, and click Open. The new database will be created and displayed as a document window in the Archive module (Figure 2-2). This document will be discussed in detail in Section 5.1.1.

DAAAC can have multiple Jet databases open at the same time, however only one database is *active*. The active database will store information generated by actions in Archive, TestMan, and Analyze. Additional databases can be used to support data transfer, but only the active database is used to define

and support the acquisition, import, and processing operations. The location of the active database is stored in the Windows registry and automatically loaded when Archive starts.



**Figure 2-1. Creating a new database**



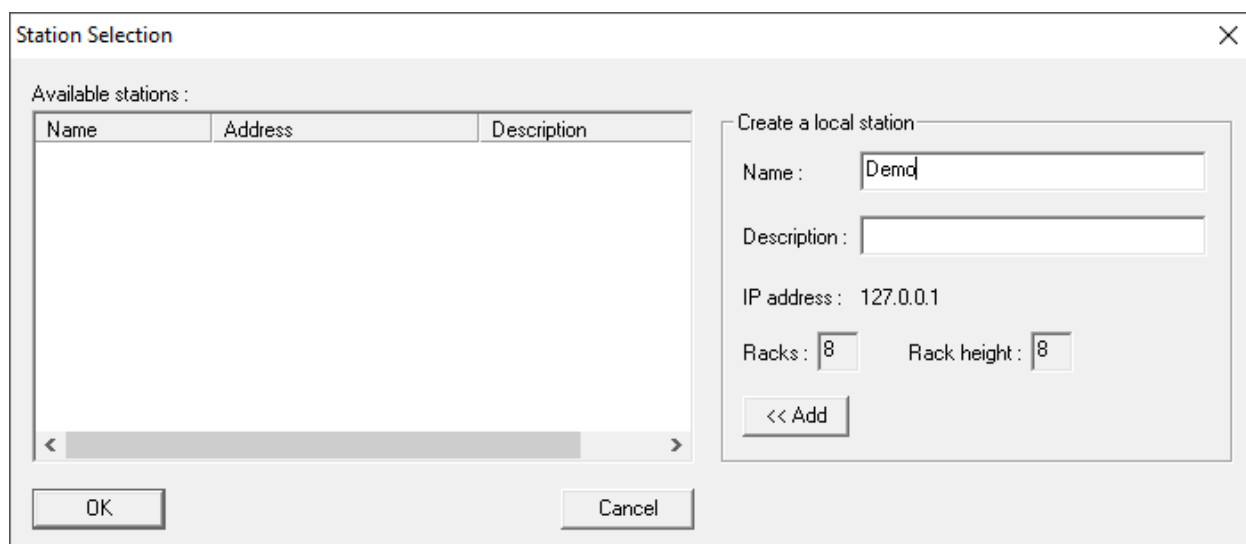
**Figure 2-2. Database window in the Archive module**

## 2.2.2 TestMan

This section walks through each step of the process of configuring TestMan to capture data for the first time. Throughout the process an example is presented that can be duplicated by the first-time user on any installation that includes TestMan. An oscilloscope driver will be used in this tutorial. We recommend using either the Voss Wave device (a simulated oscilloscope) or an available oscilloscope / digitizer of your choosing.

### 2.2.2.1 Add Station

Before any action can be performed by DAAAC, at least one station must be added to the database. In a standalone installation, only one station will be added. The TestMan module will automatically open the station configuration dialog on first execution as in Figure 2-3.



**Figure 2-3. Create and select a station**

As shown on the right side of the figure, the station is identified by name (required) and description (optional). The network address of the station is set here. Shown in Figure 2-3, the address is fixed at 127.0.0.1, which is the universal address of the local machine. After specifying the station name and an optional description, you press the Add button to add the station definition to the list on the left. Then select the station from the list and press OK to continue.

### 2.2.2.2 Add an Instrument to the Inventory

TestMan maintains an inventory of instruments that are available for use in acquisition tasks. Before indicating that an instrument will participate in acquisitions, the instrument must first be added to the inventory. This can either be done as a distinct operation, or is typically be done as part of the process of adding an instrument to the acquisition set. This tutorial will examine the latter process. To get to the acquisition instrument list, first click on the Instruments tab in the bottom-left corner of the window. Then, right-click in an empty space on the instrument list and select Add from the popup menu. The Inventory dialog will appear.

Instrument Inventory

Select :

(1) Manufacturer	(2) Model	(3) Serial Number
Acqiris	DSO90804	123
Agilent	DSO90808	
Anritsu	DSO91204	
BNC	DSO-S 104A	
Cameras/Spectrometers	DSOS254A	
HP	DSOS404A	
Keysight	E4448A	
LeCroy	E5061B	
Misc.	E8257D	
National-Instruments	MSO-X 3104T	
Positioners	N5181A	
Rohde & Schwarz	N57XXA	
Stanford Research	N9010A	

Generate    Serial Number : 123    Add to s/n list

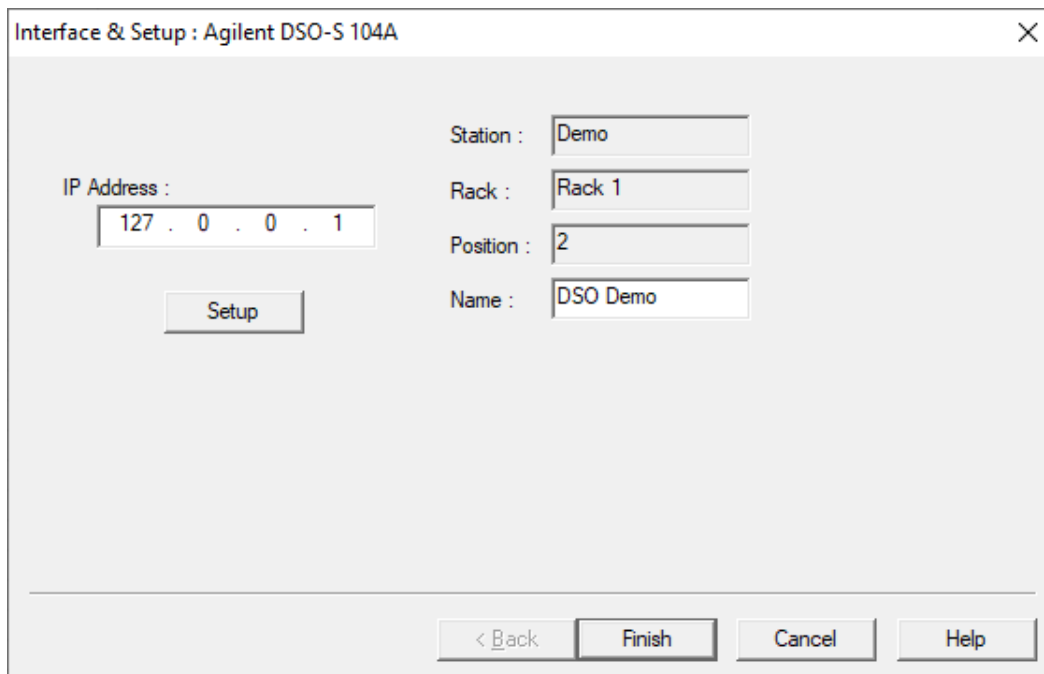
< Back    Next >    Cancel    Help

**Figure 2-4 - Adding an Instrument to the Inventory**

Select the manufacturer of the appropriate instrument from the Manufacturer list (Voss Scientific if using the virtual wave driver, Agilent if following this tutorial). The entries in this list will vary depending on the key set installed. Select the appropriate model (Wave, if using the Voss virtual wave driver, DSO-S 104A if following this tutorial) from the Model column. The instrument must be added to the inventory by serial number. The serial number may either be manually typed or generated by DAAAC. Either type into the Serial Number control or click Generate to auto-create a new serial number. Click Add to s/n list to add a new serial number to the inventory. The item will appear, by serial number, in the Serial Number column.

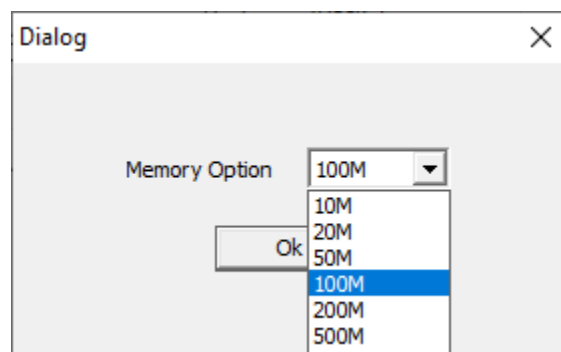
#### 2.2.2.3 Add Instrument to Instrument List

Select an instrument from the serial number list then click Next in the dialog of Figure 2-4. A dialog will appear that will allow the instrument to be named and configured. The instrument address, if known, can be specified at this step. If not known, the address can be specified after the instrument is added. The dialog may also have a Setup button enabled. If it does (as the instrument here does), the button must be pressed to complete the setup.



**Figure 2-5 - Add Instrument Dialog**

Clicking **Setup** opens an additional instrument configuration dialog. In the case of the this driver, it asks you to choose a memory option.

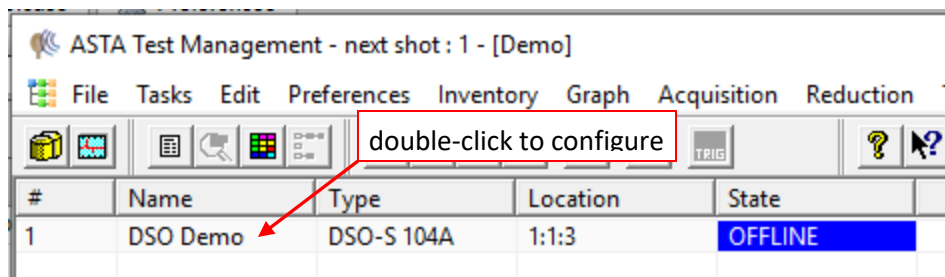


**Figure 2-6 DSO-S 104A Setup Dialog**

**Note:** For all drivers with a **Setup** button, the configuration presented in the setup dialog is permanent once the dialog is closed. Selections should be made to accurately reflect the hardware options since it cannot be changed later during instrument configuration.

Click **OK**, then **Finish**. The instrument will appear at the next available slot in the instrument list.





**Figure 2-7. TestMan with an acquisition instrument added**

#### 2.2.2.4 Instrument States

Before proceeding, it is important to note that each instrument is displayed with a *state indicator* in Testman's main instrument list. Not all instruments in the list will necessarily be in the same state. The state of the instrument is designated by text in the state column and by the color of the instrument background. **Error! Reference source not found.** describes the instrument states and displays the associated color for each state. Several states are related to the acquisition sequence and are discussed in Sections 2.2.2.8 and 4.2.2.3.

If an instrument is displayed as **OFFLINE** in DAAAC, make sure the instrument is turned on, physically connected via the appropriate hardware interface, and the instrument address is correctly specified in TestMan. Note that several communication interfaces require installation of 3<sup>rd</sup> party drivers on the control computer. For example, most instruments that communicate over Ethernet will require installation of a VISA (Virtual Instrument Software Architecture) driver. Many instrument and interface manufacturers provide software that can be used to configure their devices and aid in troubleshooting.

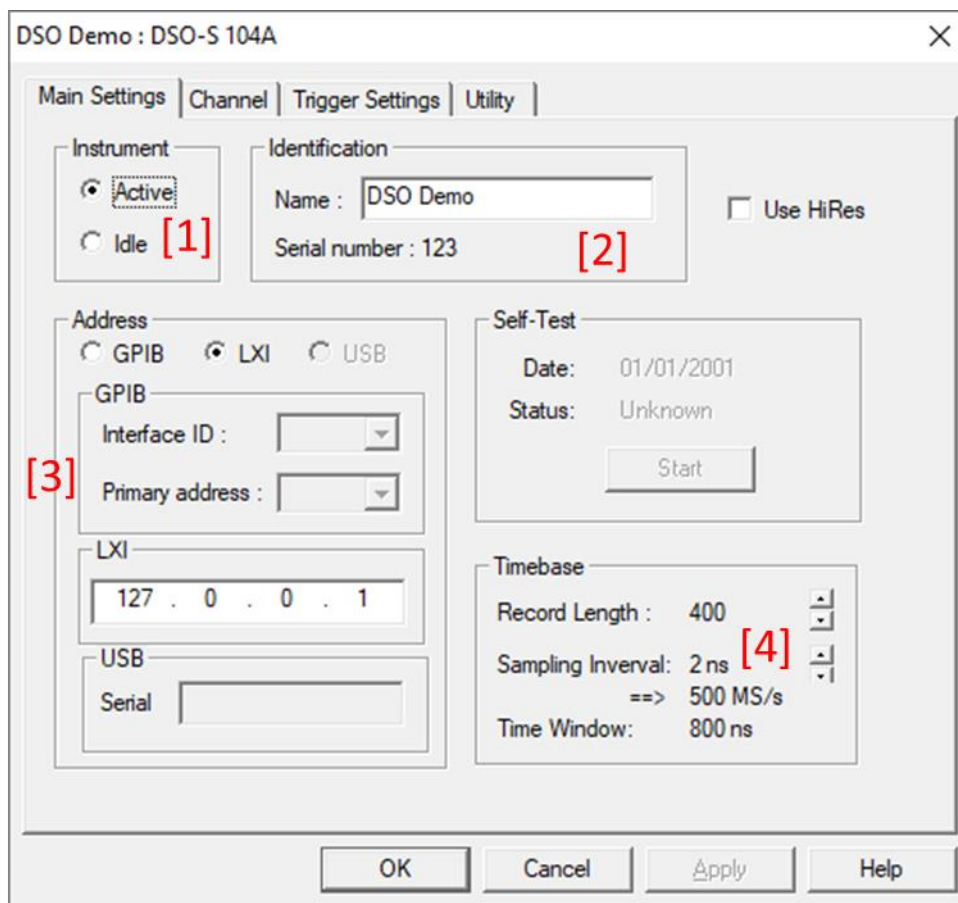
**Table 2-1- Instrument states and color codes**

State	Meaning
IDLE	Instrument is not in use (will not participate in the acquisition sequence).
ACTIVE	Instrument is selected for use and is communicating with DAAAC.
OFFLINE	Instrument is selected for use, but not communicating with DAAAC.
INITIALIZED	Instrument is active, and has been initialized by DAAAC.
ARMED	Instrument is armed and ready for trigger.
TRIGGERED	Instrument has triggered and waiting to download data.
SET	Instrument outputs have been configured. For output-only devices, such as trigger generators, controllable attenuators, and signal sources.
READ OUT	Instrument is downloading data.
ERROR	An error has occurred while communicating.

#### 2.2.2.5 Configure an Instrument

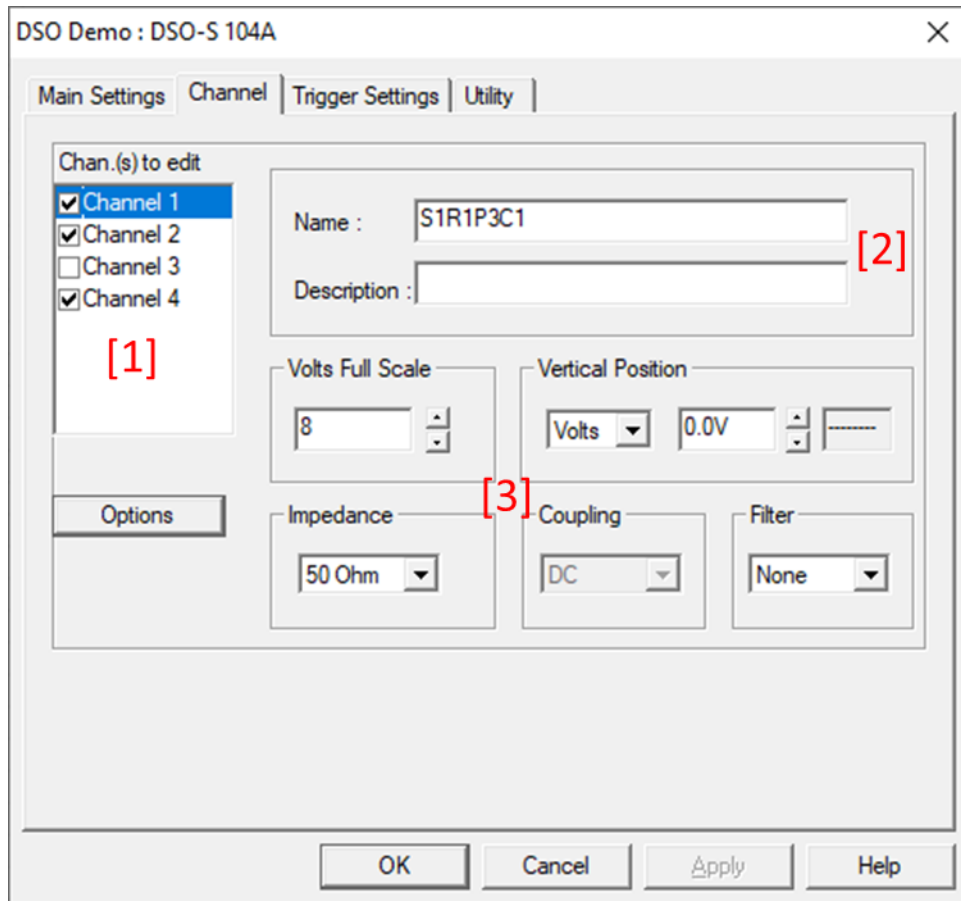
Once added in DAAAC and available on the specified communication bus, the instrument can be used in an acquisition sequence. However, the instrument settings represent default values and should be configured to support the expected signal configuration and levels. Instrument settings are configured

in DAAAC, then transmitted to the instrument at the start of the acquisition sequence. To configure the instrument, double-click on it in the instrument list. A tabbed dialog will be displayed. Each instrument dialog is specific to the type of instrument being configured. Instrument dialogs will have, as a minimum, a Main Settings tab, a Channel Settings tab and a Utility tab. Many instruments also have a dedicated Trigger Settings tab, which is common for oscilloscopes/digitizers.



**Figure 2-8. DSO-S 104A configuration dialog, Main Settings tab**

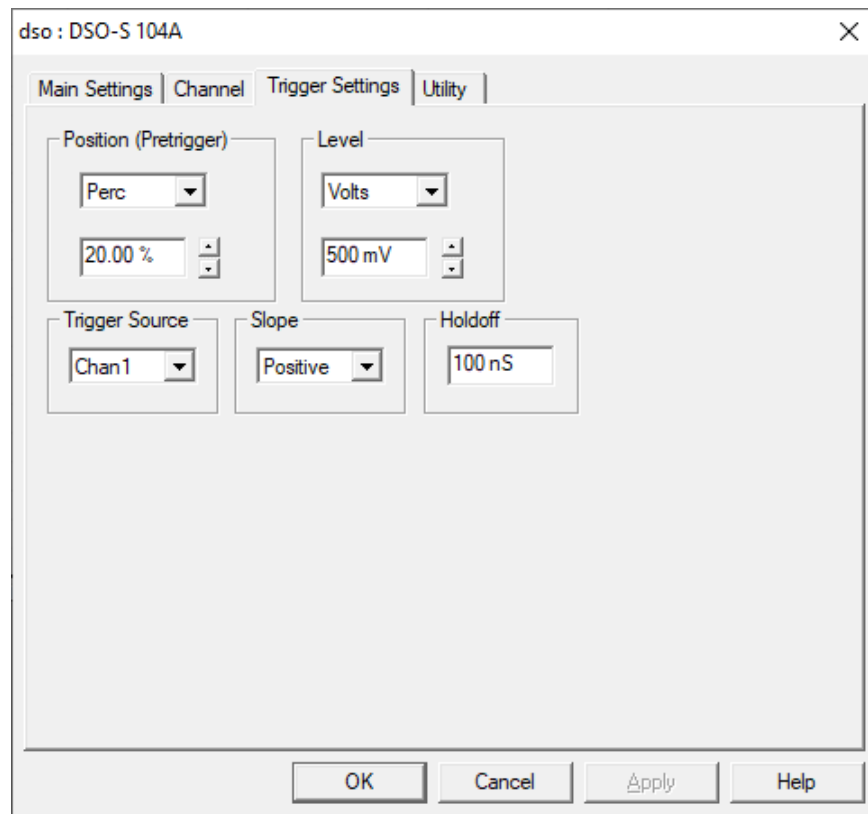
The Main Settings tab (Figure 2-8) will always include controls to set the instrument to active or idle (see area [1] in the figure) and to allow the instrument to be renamed (area [2]). Instrument names are not required but help to identify multiple instances of the same instrument type. The remaining controls will depend on the type, manufacturer and model of the instrument. For the instrument shown, area [3] allows you to choose the connection type and address: GPIB, Ethernet, or USB. If not configured when the instrument was added, the address must be specified here to enable communication with the instrument. As is the case with most oscilloscopes/digitizers, area [4] allows you to set the record length and sampling interval settings. Configuration choices made on this page affect the data recorded on all instrument channels.



**Figure 2-9. Oscilloscope channel settings**

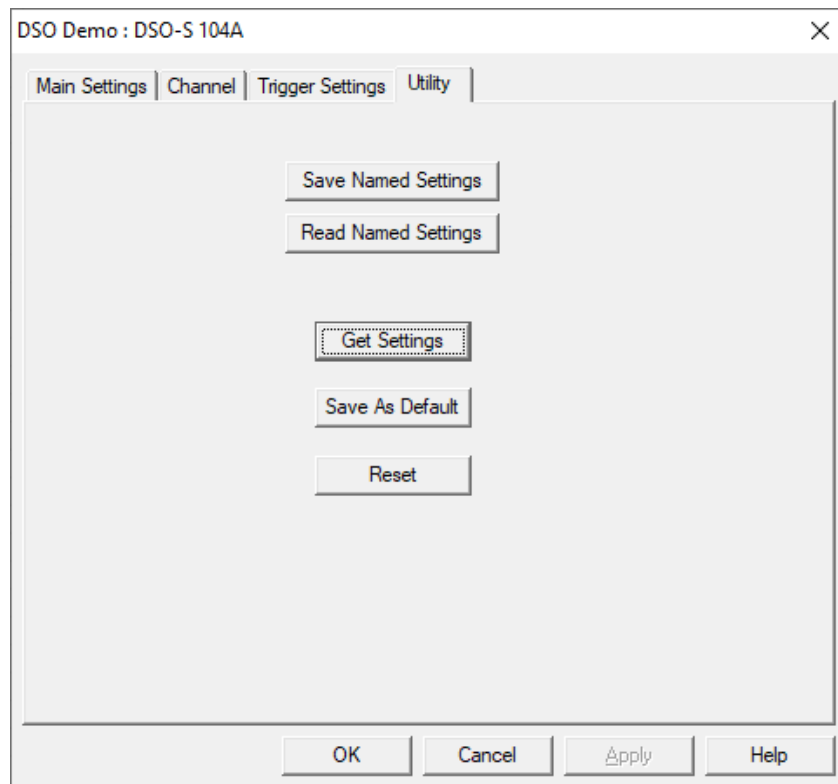
In all drivers that record data, the Channel Settings tab is used to name each channel, determine which channels are to be captured, and configure the instrument's channel specific settings. Channel names are required and must be unique across all instruments within the same station. The combination of station and channel name are used to uniquely identify the associated acquisition data. TestMan will prevent you from accidentally duplicating channel names. The default channel names are set automatically using internal location settings that typically produce unique names. In this demonstration, we will change the default channel names to "Channel 1" ... "Channel 4".

Additional channel controls depend on the driver. In Figure 2-9, area [1] is used to turn channels on and off (notice that Channel 3 does not have its checkbox checked, so data will not be captured there). Each channel has been assigned a name and description and has been given a voltage range that corresponds to the expected input signal level. Other controls have been left at their default values.



**Figure 2-10. Oscilloscope trigger settings**

Instruments that can be triggered via an input signal or computer commands will either include a Trigger Settings tab (Figure 2-10) or will include trigger controls on the Main Settings tab. The trigger settings shown here are typical of those for oscilloscopes and include a trigger source and level, as well as specification of the trigger location within the overall waveform record.





**Figure 2-11 – DSO-S 104A utility functions**

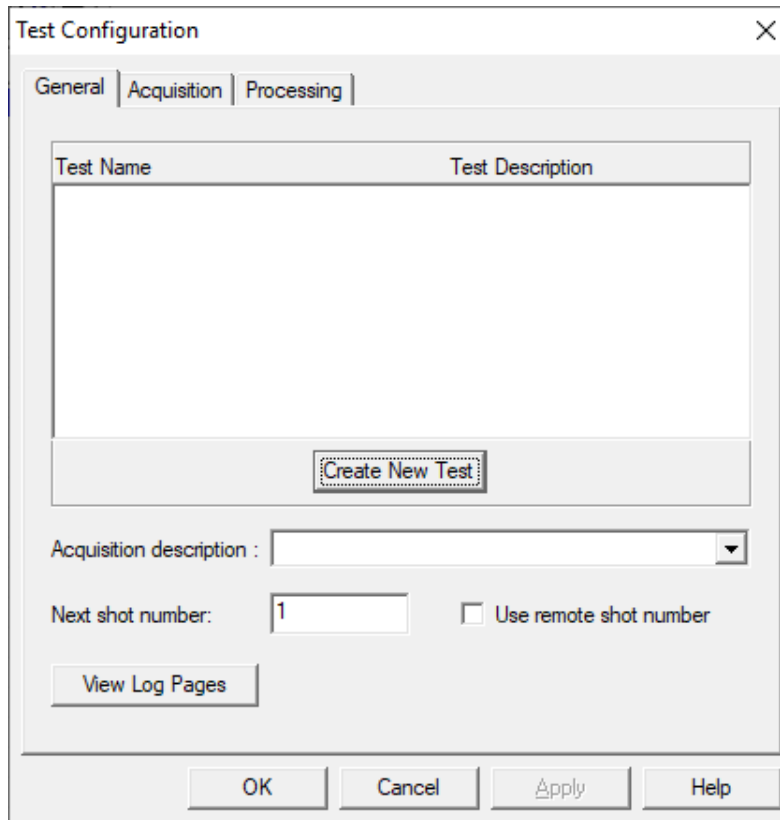
The Utility dialog tab is common to all drivers. The Saved Named Settings button allows you to save the current instrument configuration (as specified in DAAAC) to a file, which can later be restored to this instrument (or another instance of the same type of instrument) using Read Named Settings.

The Get Settings button retrieves the existing settings from the instrument. This function is useful when the settings on the instrument are out of sync with DAAAC, which can happen if you use the instrument front panel to change settings.

After configuring all settings in the instrument dialog, click OK to transmit those settings to the instrument and return to the main TestMan window.

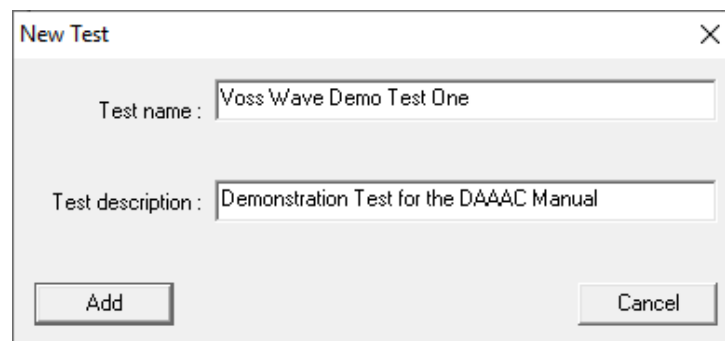
#### 2.2.2.6 Create a Test

In order to run an acquisition, the acquisition must first be associated with a test. A test is created and/or selected as a part of acquisition configuration. The Test Configuration dialog will appear when the acquisition is started by clicking the  toolbar button (Acquisition | Go menu) to run an acquisition or can be accessed before executing an acquisition, via the  toolbar button (Acquisition | Configure menu).



**Figure 2-12. Test Configuration Dialog**

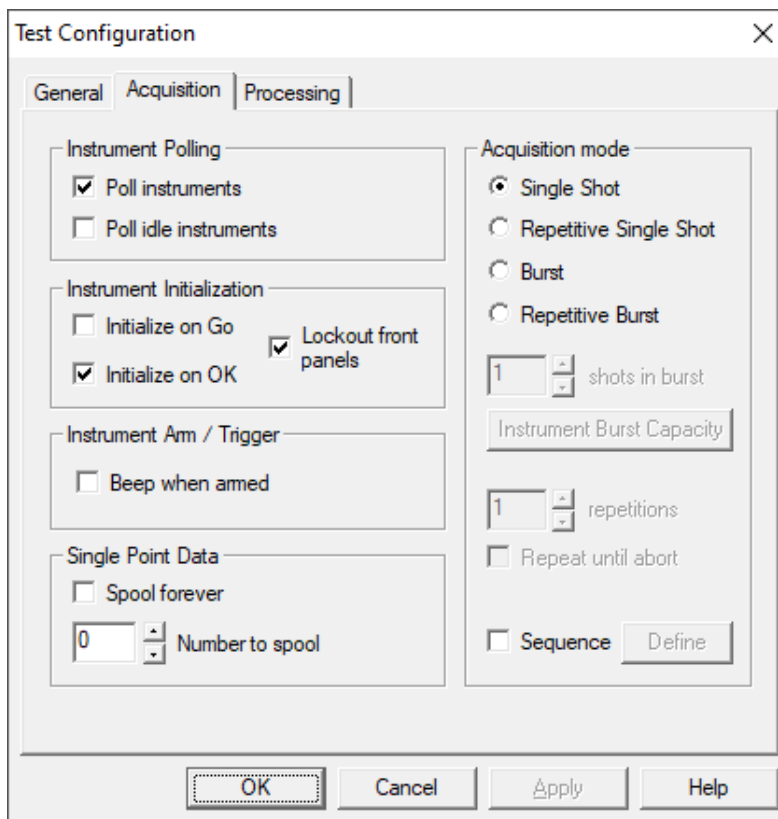
The Test Configuration dialog is used to configure many other acquisition parameters. These are covered in Section 4.8.9.1. Here, the interest is in creation of a new test to associate with the data that we will acquire. Select the General tab and press Create New Test. A dialog will appear that allows the creation of a new test.



**Figure 2-13. New Test Dialog**

After naming the test, click Add. The dialog will close and the test name will be added to the Global Settings dialog Test Name list.

Next, select the Acquisition tab and set the Acquisition mode to Single Shot, which tells the system to execute a single acquisition sequence, collecting one waveform/image per recording channel.




**Figure 2-14. Specifying the acquisition settings**

After configuring the items in this dialog, press OK to proceed with the acquisition.

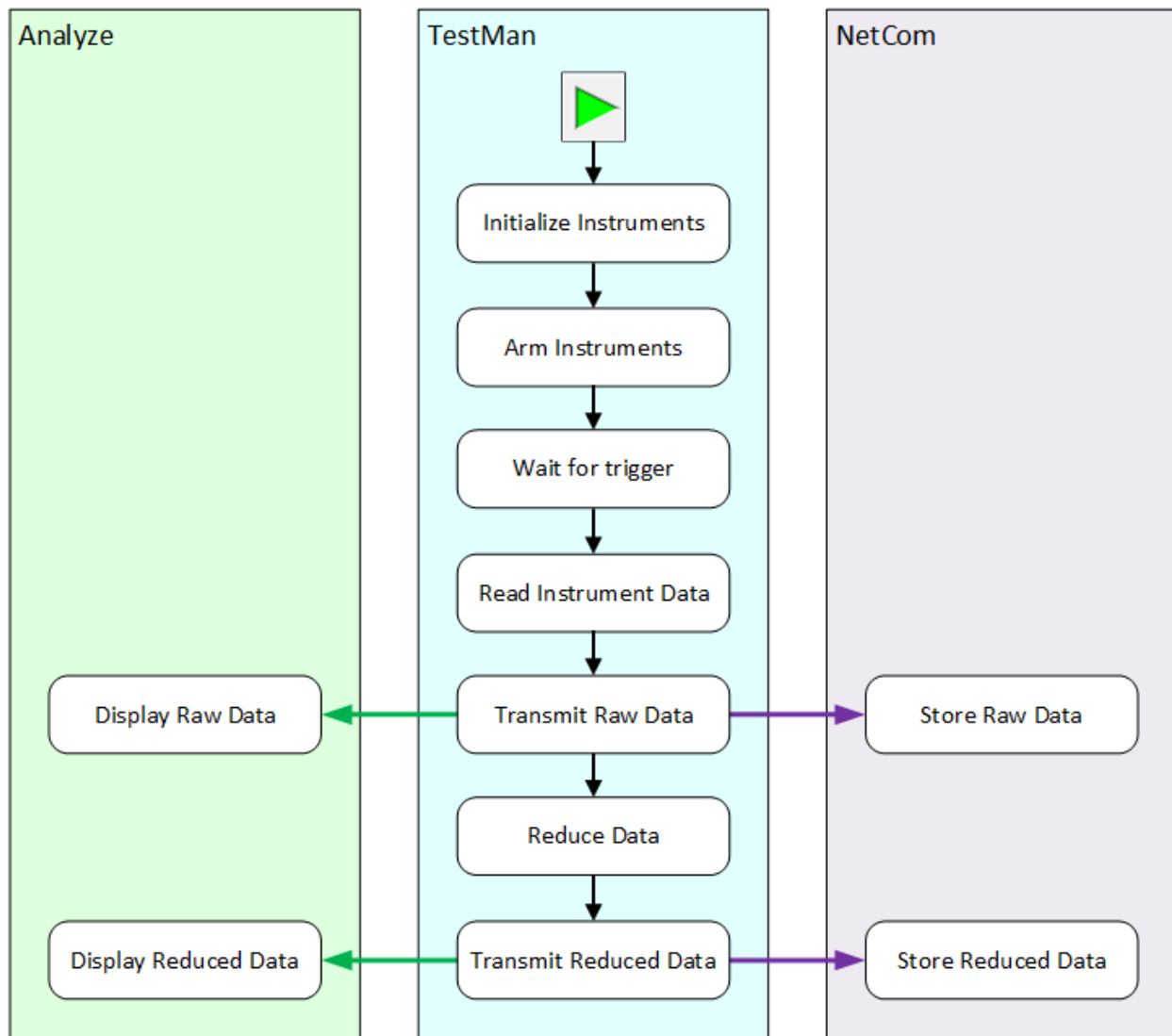
#### 2.2.2.7 Acquisition Sequence

Before proceeding with the tutorial example, this section will present a brief overview of the automatic acquisition process, as shown in Figure 2-15. A more-detailed description is provided in Section 4.2.2.

Once the TestMan module has been populated with configured instruments and the module is able to communicate with at least one of those instruments, automatic acquisition begins by pressing  on the TestMan tool bar. TestMan will then display the Test Configuration dialog.


Once a test is selected and the acquisition mode specified, TestMan initializes and arms all active instruments. It then repeatedly polls the instruments until either all instruments have triggered or the user aborts the acquisition. Next, TestMan retrieves the data from all triggered instruments, then transmits the acquisition data to NetCom for storage in the database and to Analyze for display. The data is then reduced (converted from raw units to quantities of interest using the signal path definitions – see Section 2.2.3) and the reduced data is transmitted to NetCom and Analyze.

This is a simplified description of the procedure. The actual operation includes additional steps that depend on the configuration of TestMan and Analyze. Detailed descriptions will be presented in the following sections.



**Figure 2-15. Acquisition sequence for a single shot event**

#### 2.2.2.8 Execute the Shot

Click . Create the test as described in Section 2.2.2.6. The acquisition will proceed automatically through the sequence shown in Figure 2-15, stopping before the Reduce Data step, because data reduction has not yet been configured. During the acquisition sequence, the instruments will cycle through the states shown in Figure 2-16.



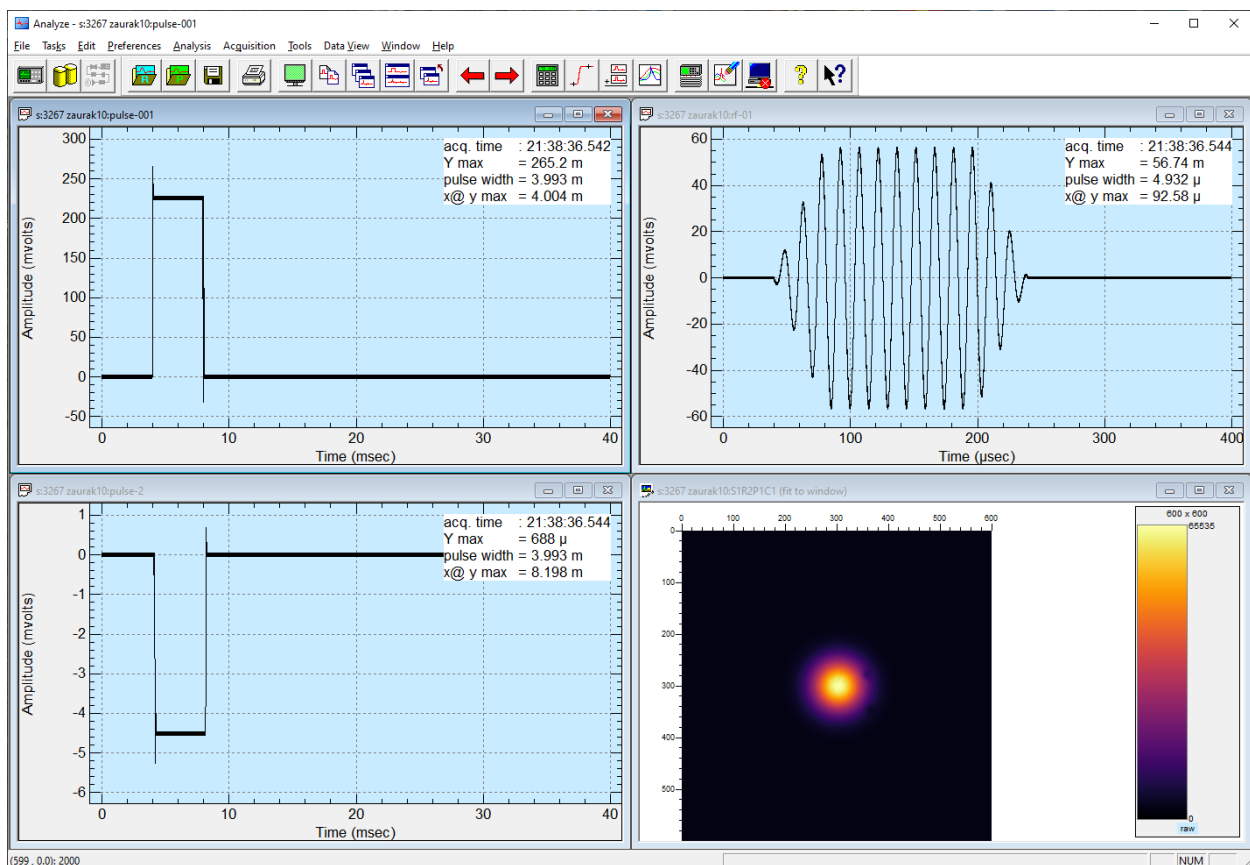


**Figure 2-16. Instrument states during a standard acquisition sequence**

### 2.2.2.9 Review the Data

Once the data has been retrieved from the instruments, TestMan will automatically send the data to the database and to the Analyze module. Analyze automatically displays the data as it is received. Figure 2-17 shows an Analyze display of acquisition data from a virtual wave device (3 channels enabled) and a virtual image device.

Feel free to experiment with any of the options in Analyze. Many options are available by right-clicking on a data plot. Others will be accessed through the toolbar and menu system. All of the manual processing options will be described in detail in Chapter 6. Return to TestMan to reconfigure the instrument, e.g. to change the vertical scales or record length, and repeat the measurement as desired.



**Figure 2-17 – Acquisition data displayed in Analyze**

The acquisition data is automatically stored in the database and associated with the acquisition settings. Switching to the Archive module, a list of the acquisition data in the database can be seen by navigating the tree control on the left side of the main display window (Figure 2-18).

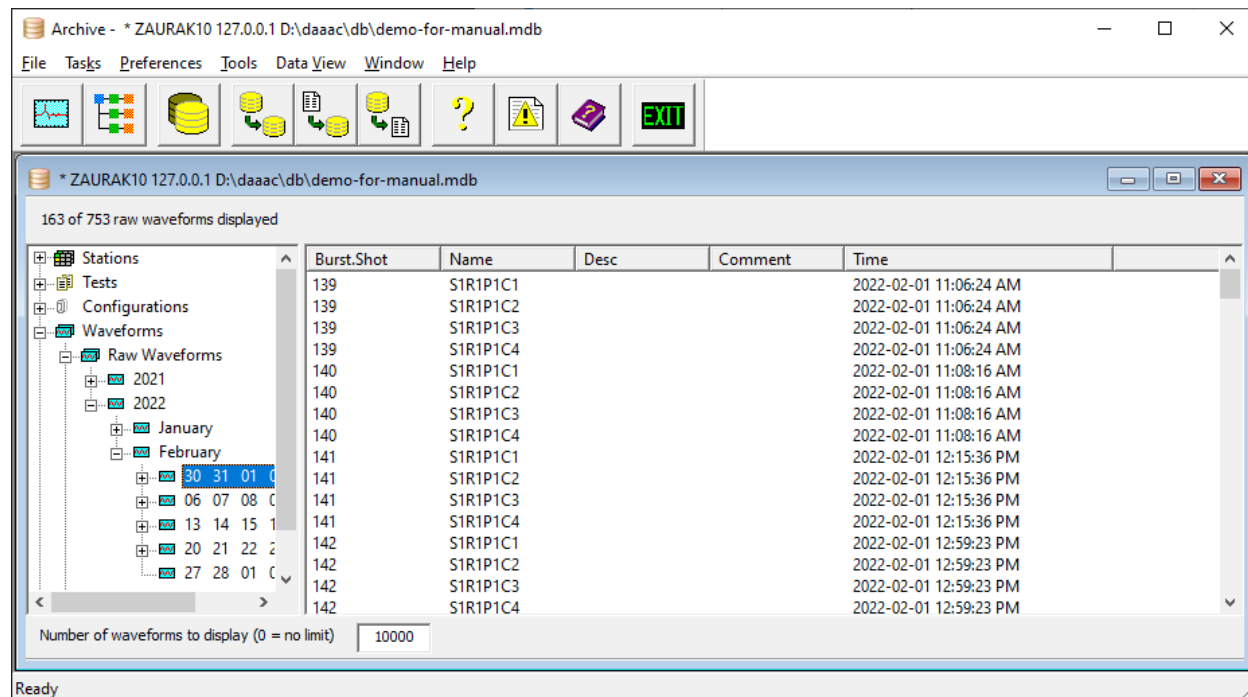


Figure 2-18 - Acquired Data in Archive

### 2.2.3 Data Reduction in TestMan Using the Cal Graph

The next task in this tutorial is to configure TestMan to perform a simple automated data reduction on the acquired waveforms. TestMan's full data reduction capabilities will be described in Section 4.3. For the purposes of this tutorial, only those steps necessary to demonstrate data reduction will be covered.

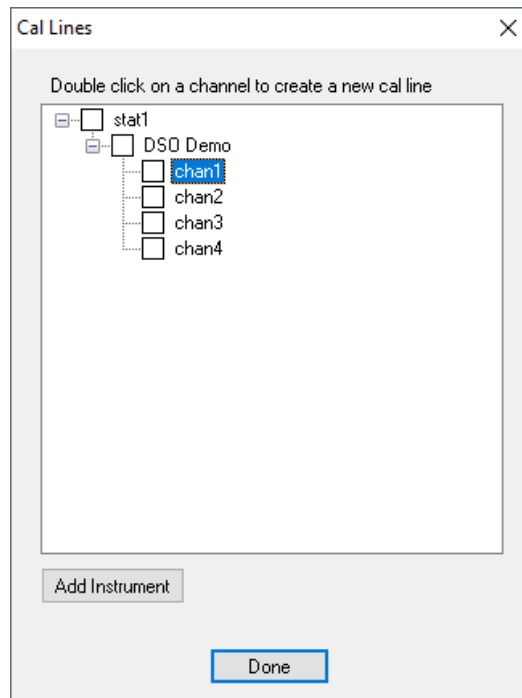
TestMan's cal graph is used to perform two types of processing:

1. Accounting for the influence of physical components in the acquisition signal path that alter the data, such as cables, attenuators, and sensors. Raw data is processed by following the signal path, starting at the associated instrument channel node, and sequentially adjusting the data to account for the influence of the physical components, until an estimation of the signal that entered the sensor/probe is reached.
2. Performing additional processing to augment or facilitate the signal path component processing. This manipulation uses "soft" cal items and is typically used to automate data analysis operations that would otherwise be performed manually in the Analyze module. Examples include applying a frequency domain filter, integrating a waveform, overlaying multiple waveforms, or applying arithmetic with waveform operands.

The simple reduction executed in this example will perform the second of these functions. The processing steps applied will have no particular meaning. The purpose is strictly demonstration. The processing steps will be as follows:

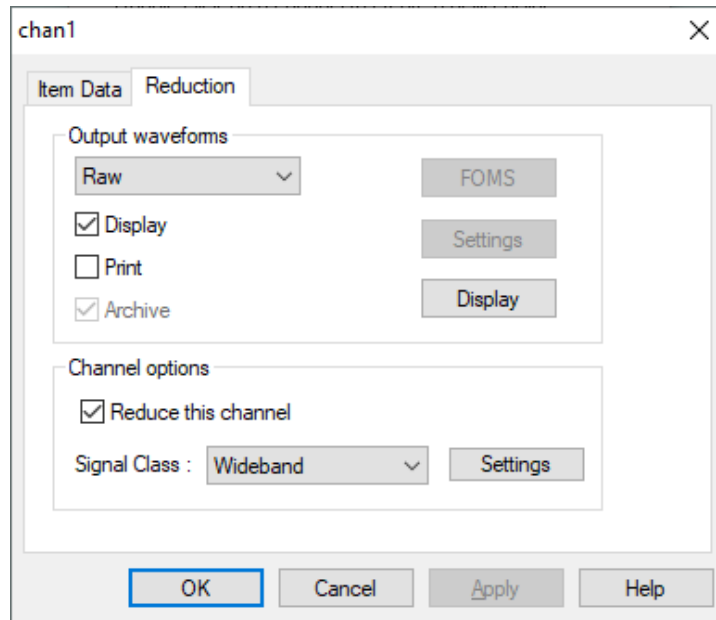
- The chan1 raw waveform will be linearly transformed using the equation  $y_{out} = 12.25y_{in} - 0.2$
- The chan2 raw waveform will be multiplied by chan1 raw data.
- A Fast Fourier Transform (FFT) will be performed on the chan4 waveform.

In TestMan, click on the Graph tab in the bottom-left corner of the window. Select the Station | Graph Lines item in the main menu, or right click on the station node in the upper left of the graph and select Insert Signal Path from the popup menu, or right click on the instrument node and select Insert Channel from the popup menu. In the dialog that appears, expand the tree and double-click on the chan1 entry to add a Cal Line.



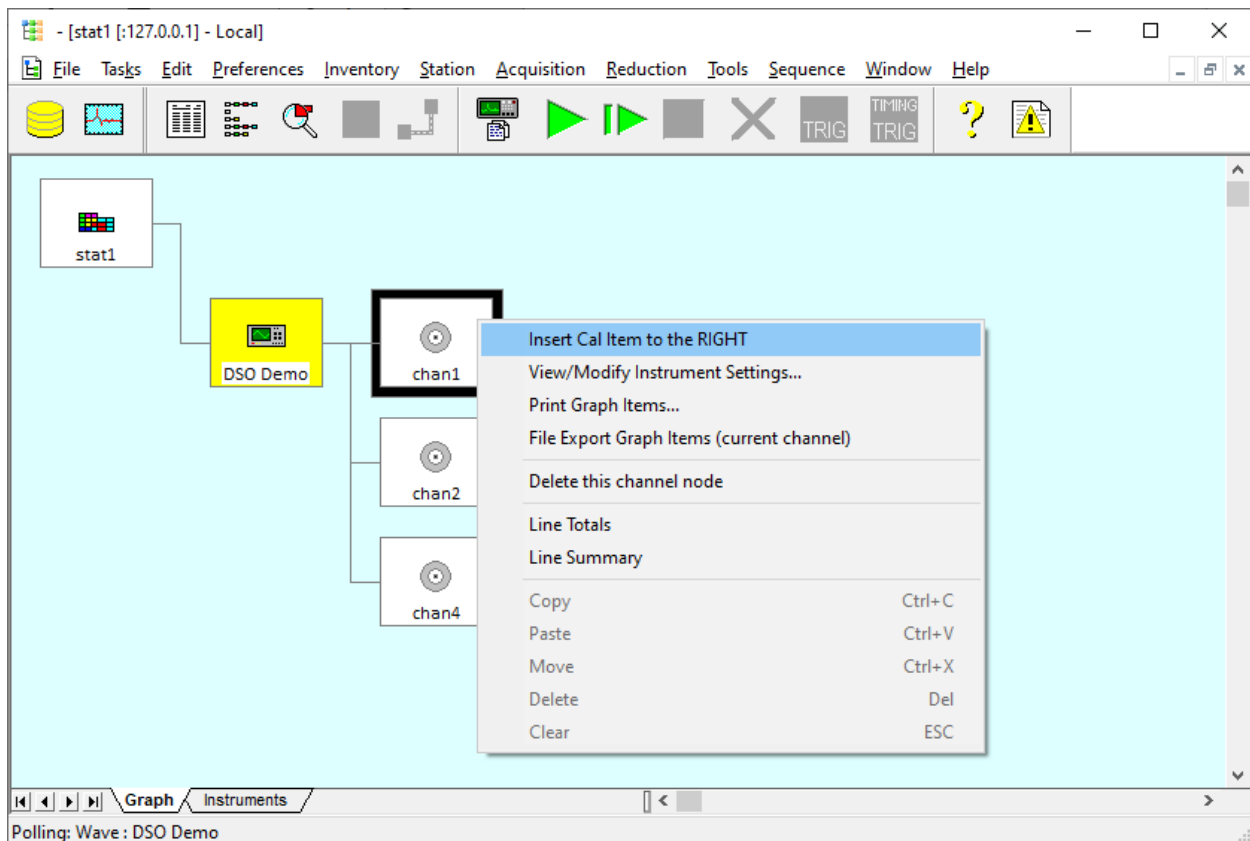
**Figure 2-19 - Add Cal Lines**

A dialog is displayed to configure the cal line for automated processing. Accept the defaults (Reduce this channel should be checked) and click OK.



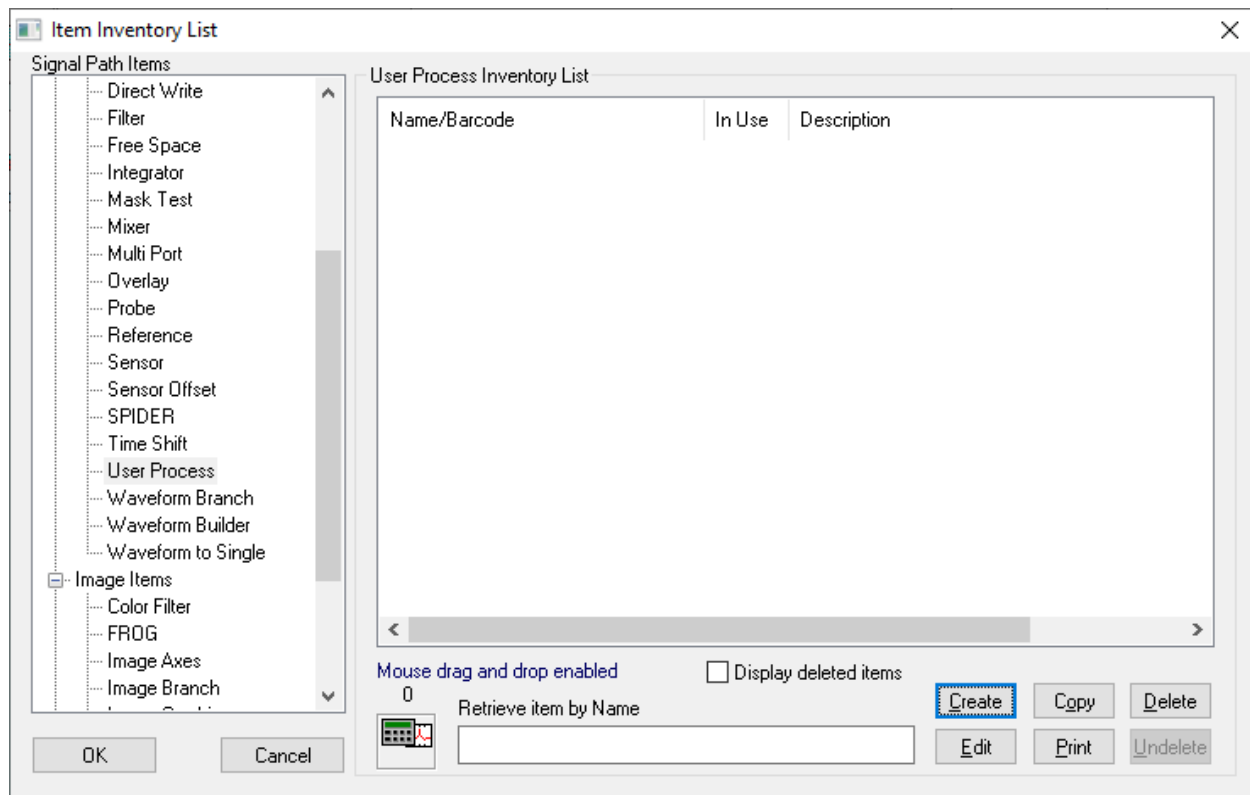
**Figure 2-20. Configuring a cal line**

Repeat the process of Figure 2-19 through Figure 2-20 for channels 2 and 4. Click Done on the cal line creation dialog (Figure 2-19). The station window is updated with new channel nodes that are linked by gray lines to the associated instrument node. To the right of, and slightly below, the station node is a node that represents the instrument. To the right of the instrument node, vertically aligned, are the three nodes that represent the instrument channels.



**Figure 2-21. Adding items to a channel**

Right-Click on the chan1 node and select Insert Cal Item to the RIGHT from the popup menu (Figure 2-21). The Item Inventory List dialog will appear to select the item to insert in the graph.



**Figure 2-22. TestMan item inventory list**

At this point, the inventory list is empty. A cal item must be added to the item inventory before it can be used in a Cal Line. The inventory list displays items grouped by category (waveform items and image items) and item type. Expand the tree on the left side to display the available waveform item types. In the Signal Path Items list, select Waveform Items | User Process then click the Create button.

The image shows a 'User Processing' dialog box with a close button (X) in the top right corner. It has a tabbed interface with the 'Item Data' tab selected. Inside this tab, there are two main sections. The first section, 'Name/Description', contains two text input fields: 'Name' with the value 'xform' and 'Description' with the value 'linear transform'. The second section, 'Titles', contains four text input fields arranged in two rows: 'X Title' and 'Y Title' on the left, and 'X Units' and 'Y Units' on the right. All these fields are currently empty. Below the 'Titles' section is a button labeled 'User Processing Definition'. At the bottom of the dialog box are four buttons: 'OK', 'Cancel', 'Apply', and 'Help'.

**Figure 2-23. Create a User Process cal item**

A dialog opens that allows the Cal Item to be named and configured. Leave the title and units fields empty, which will retain the titles and units from the input waveform. Click **User Processing Definition** to define the transform.

The user process item is defined as a macro operation, which can perform any number of user-specified operations, in series, on the data. In the dialog that appears, first select the **Macros** tab and click **Start** to begin the macro recording process. While recording, the dialog will expand to show the list of functions added to the macro and the **Start** button becomes a **Stop** Button. Switch to the **Calculator** tab. Select  $y * C$  and enter 12.25 in the calculator that appears. Then select  $y - C$  and enter 17.2. OK the dialog, which will automatically stop and macro recording process and save the macro. The Inventory dialog will display the new xform item in the User Process inventory list. Select the newly created item in the inventory list and OK the dialog. The xform item appears as a new node to the right of the chan1 node in the station graph. The entire process is shown in the following sequence of figures.

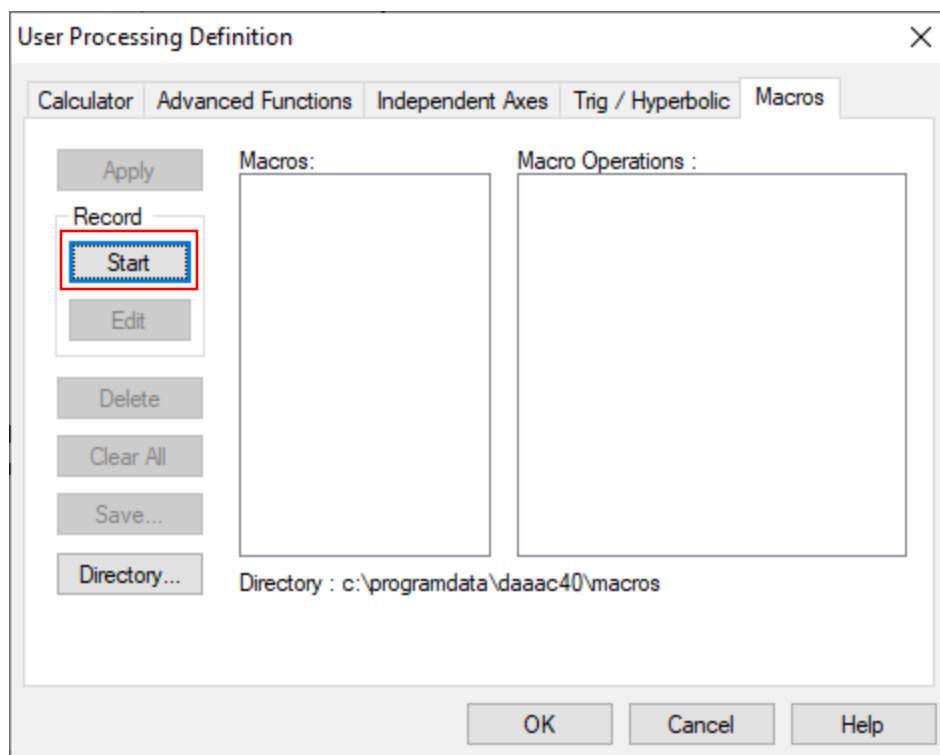


Figure 2-24. Click Start to record the User Process macro

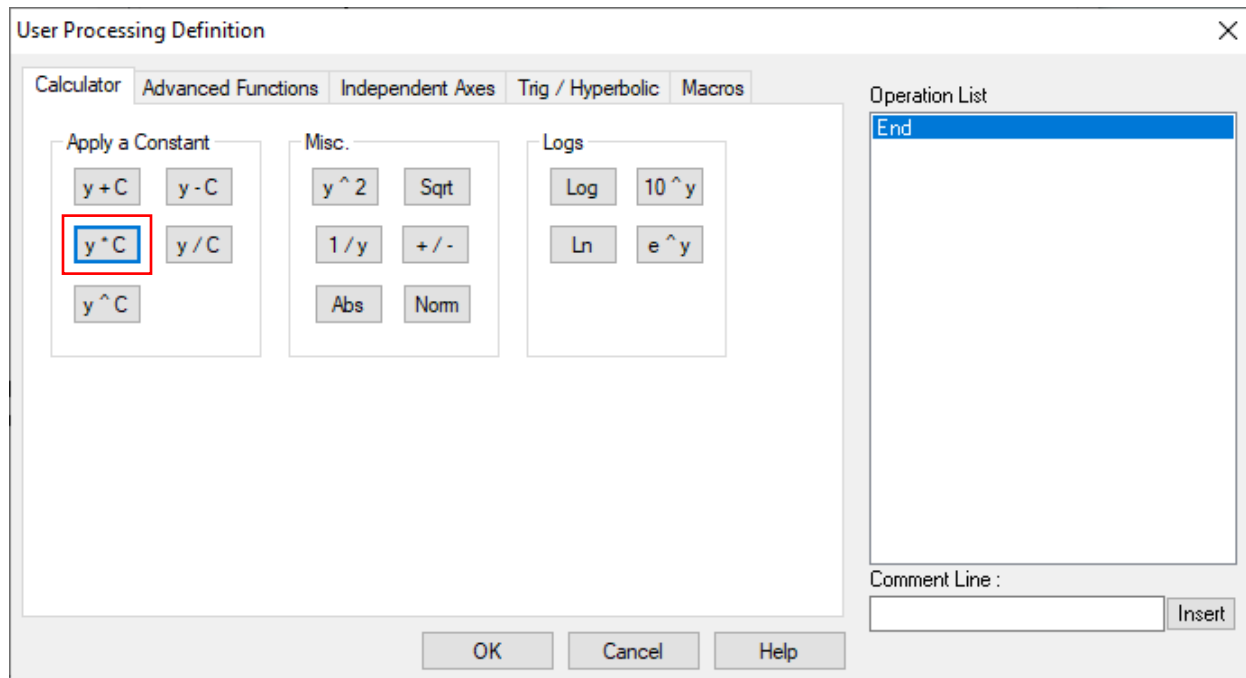


Figure 2-25. Select the Calculator tab then select  $y * C$



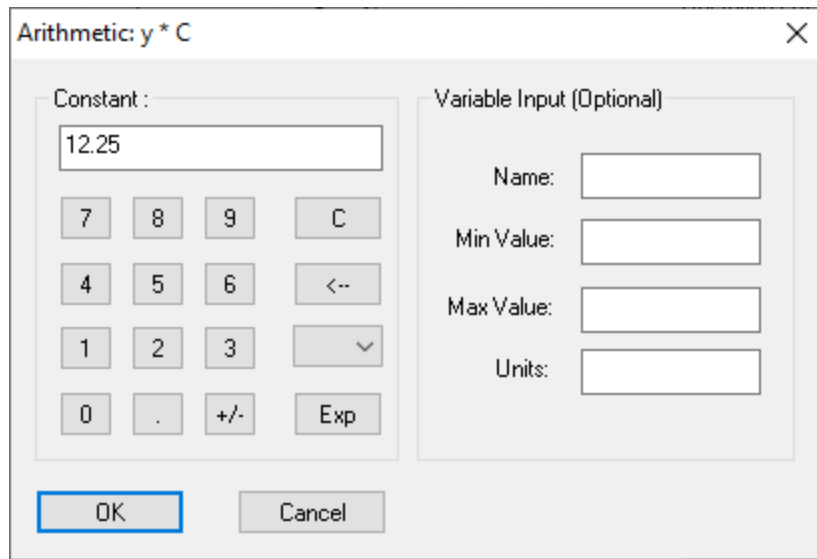


Figure 2-26. Enter scale constant 12.25

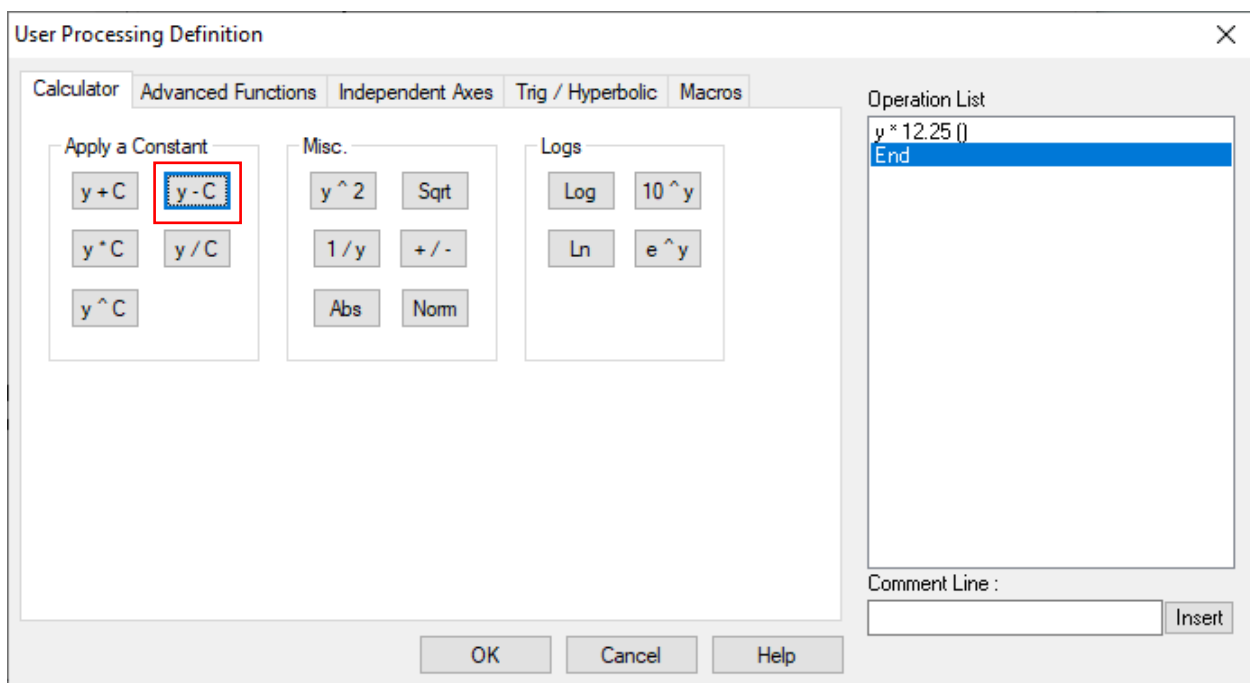
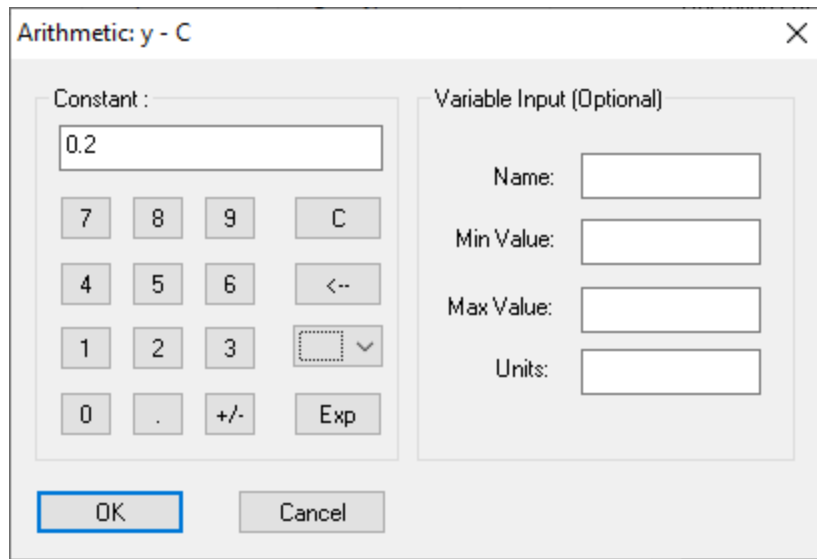
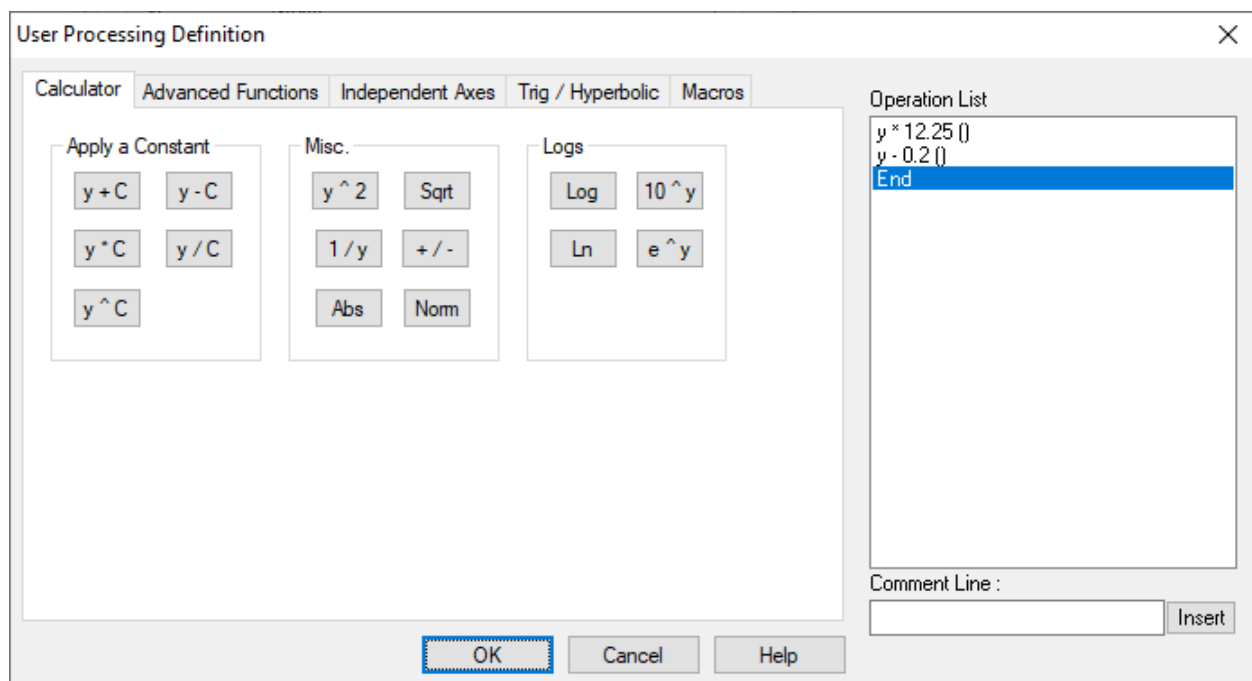


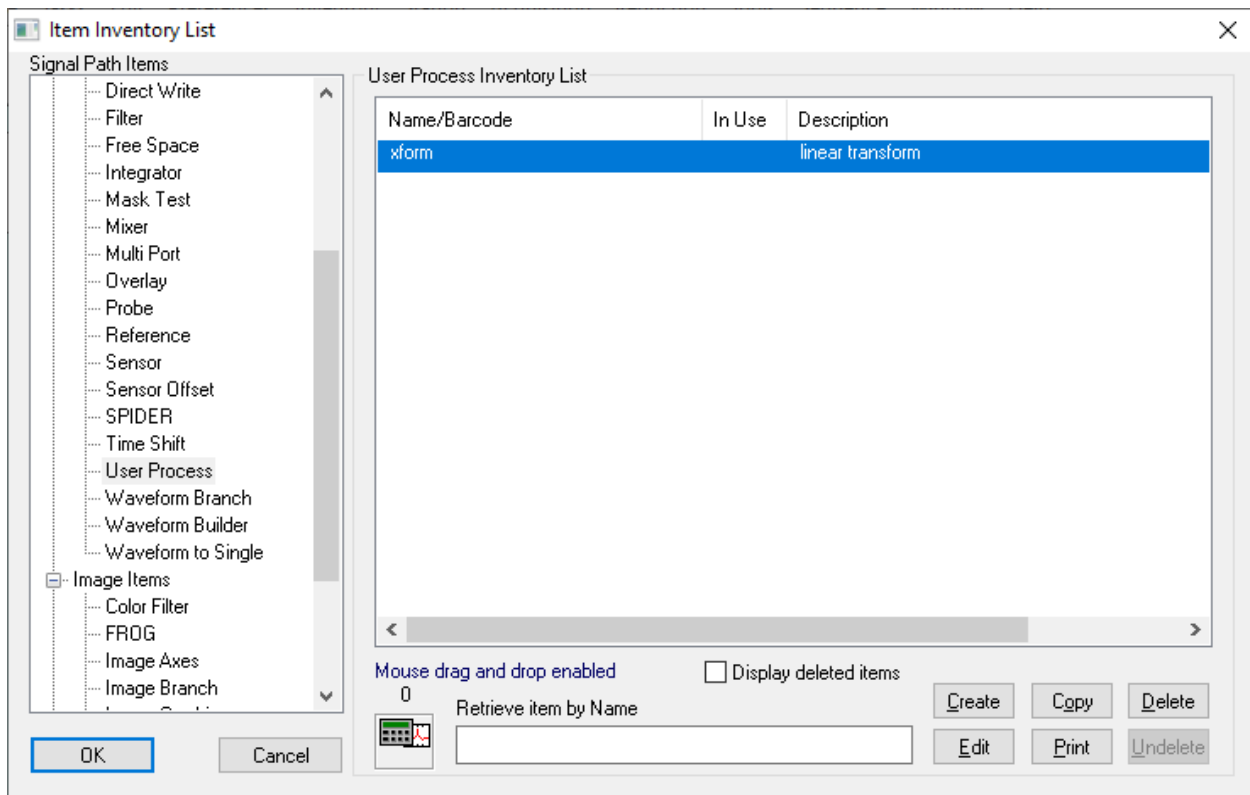
Figure 2-27. Select y – C



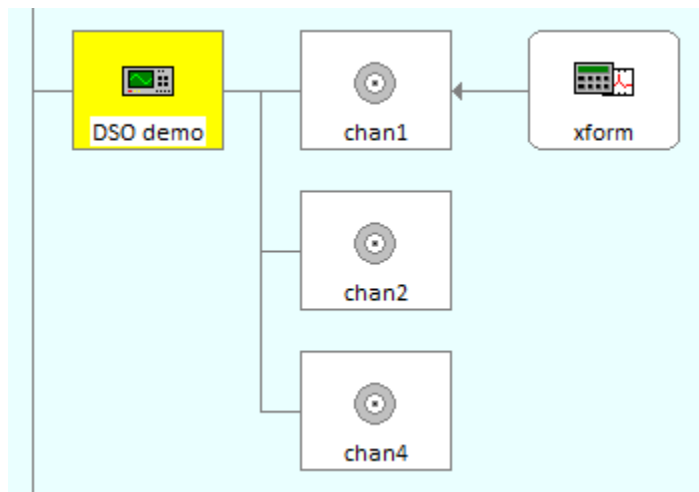
**Figure 2-28. Enter offset constant 0.2**



**Figure 2-29. The final macro list**

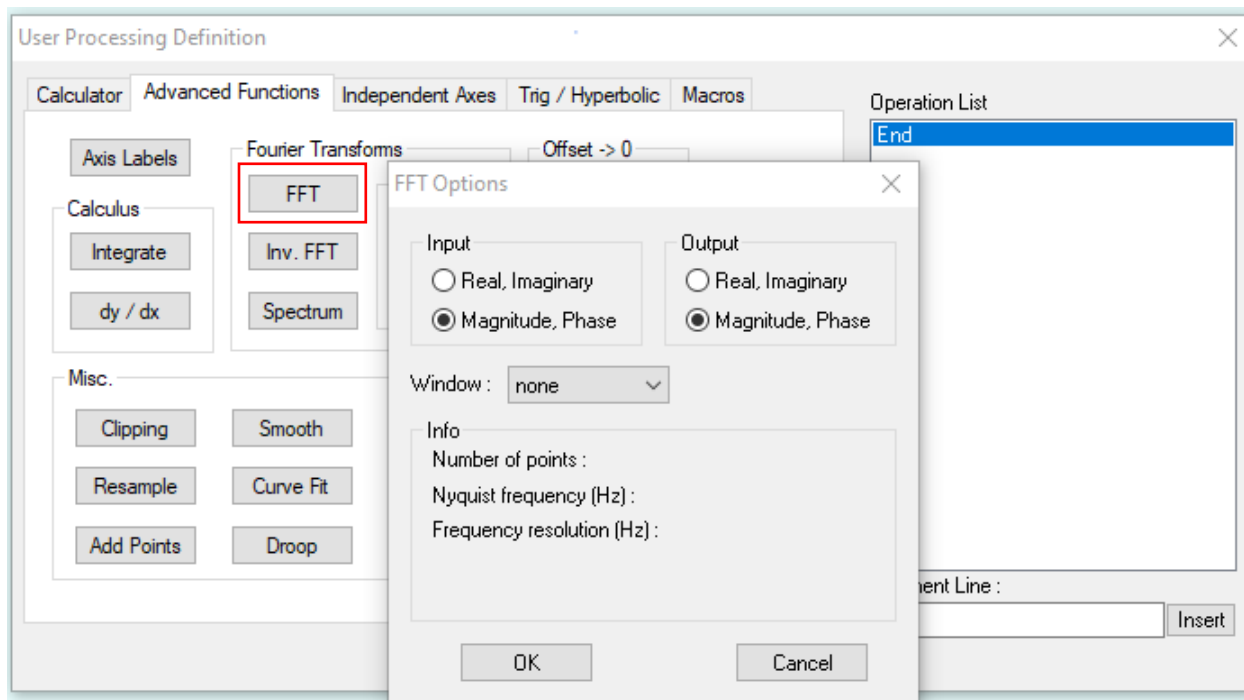


**Figure 2-30. Inventory dialog with the new cal item added**

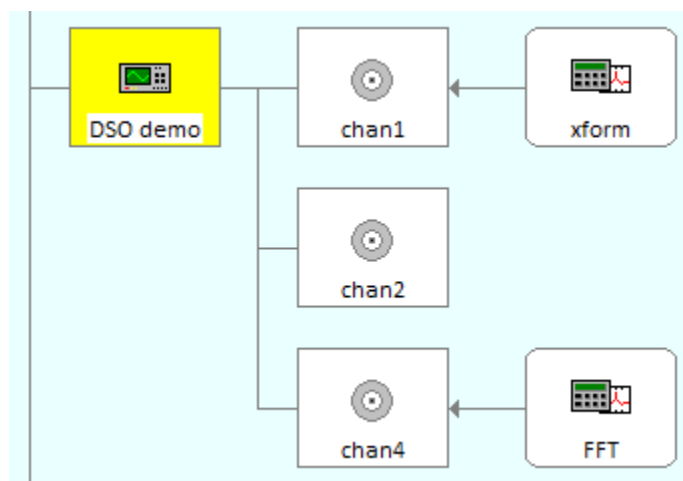


**Figure 2-31. Station graph with the new user process node**

Repeat the process, starting at Figure 2-22, to insert a User Process item to the right of the chan4 node. When defining the macro, select the Advanced Functions tab. Click FFT (Figure 2-32) and accept the defaults in the dialog that appears (or configure the transform as preferred.) Close the series of dialogs.



**Figure 2-32. FFT selection on the Advanced Functions tab**



**Figure 2-33. Station graph with the FFT node**

Next add a Combine cal item type to the right of the chan2 node. In the Combine dialog, select Multiply for the operation type. OK the dialogs. Again, the reduction node appears to the right of the chan2 node. During reduction, the output waveform from the chan2 node will be the first operand for the combine node. The Combine node must be linked to the node that will provide the second waveform operand. Right-click on the combine node and choose **Select Combine Operand** from the popup menu. Then click with the left mouse button on the chan1 node. A line joins the chan1 node with the bottom of the combine node, indicating the relationship.

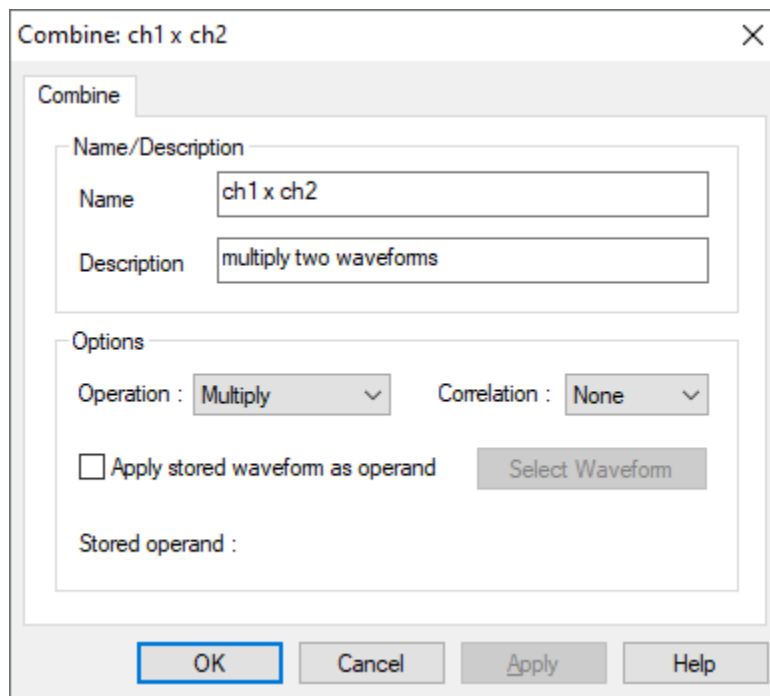


Figure 2-34. Combine item configuration - select Multiply

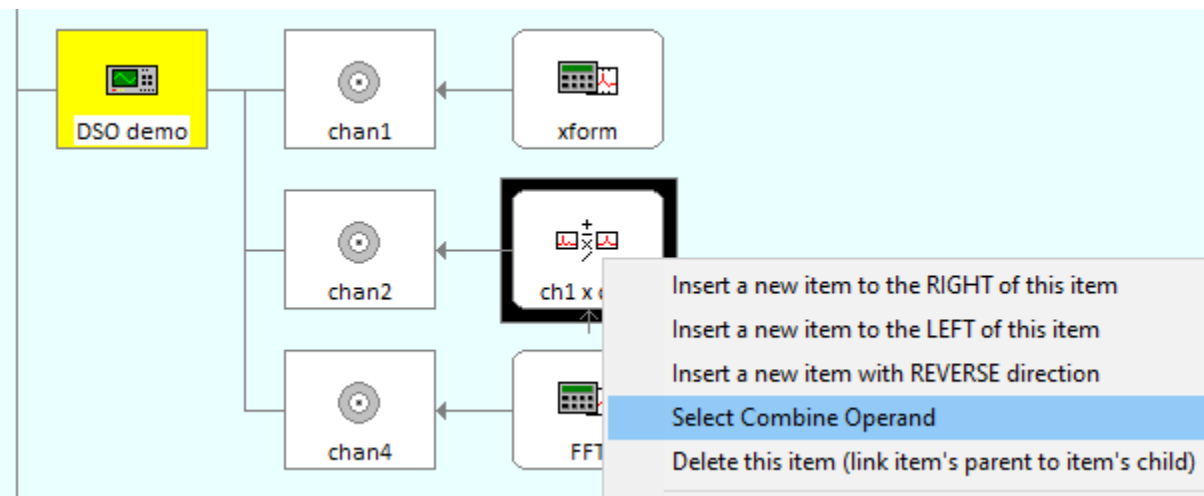
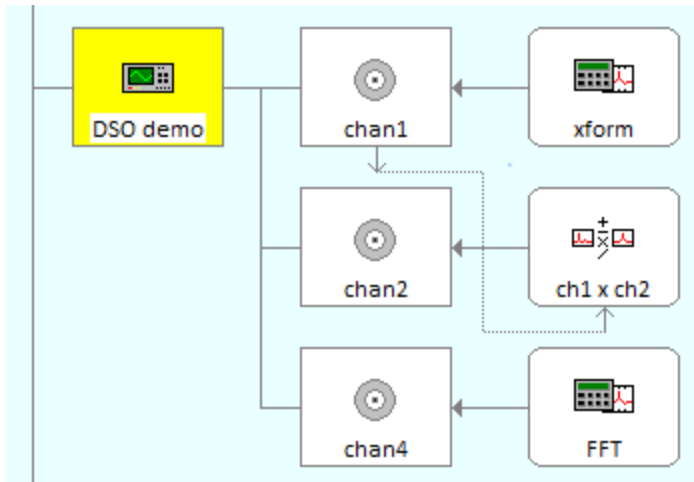

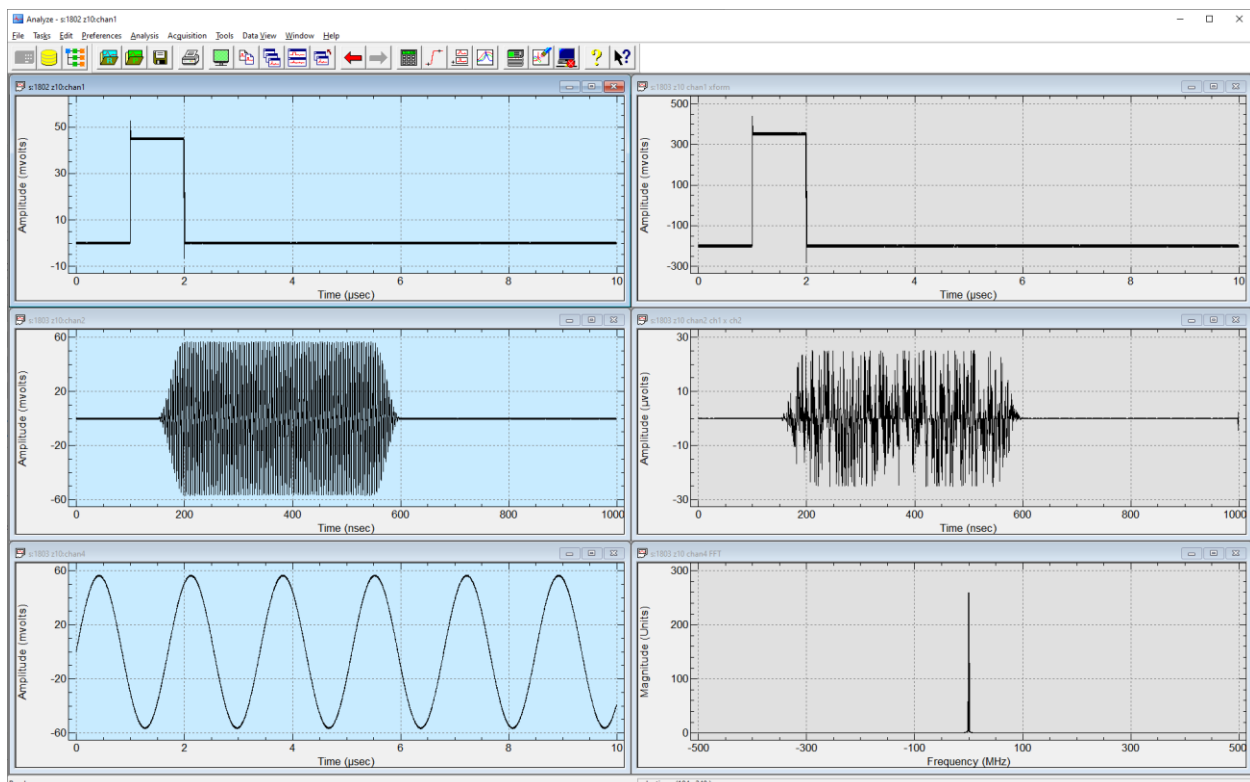


Figure 2-35. Linking the Combine node to an operand node



**Figure 2-36. The final cal graph configuration**

The Cal Graph is now fully configured as specified (Figure 2-36). Click on the  toolbar button to execute the acquisition and reduction sequence. Once again, TestMan will arm the instrument, wait for data and collect and display the raw data. The raw data will then be reduced by TestMan and the resulting processed data will be written to the database and displayed in Analyze (Figure 2-37).








**Figure 2-37. Raw and processed (reduced) waveforms**

This concludes, the tutorial section, which covered basic setup of an acquisition and data reduction process in DAAAC. The remaining sections will describe the full capabilities of each DAAAC module.

# 3 Common DAAAC Interfaces

## 3.1 Toolbar

The module toolbars are typically visible under the application's main menu, and can be selectively displayed via the Preferences menu. Commonly used operations are placed in the toolbars, but note that some operations may only be available via the application menu or right-click menus. All DAAAC toolbars can be docked under the menu, on any edge of the application window, or floated anywhere on the screen. To move a toolbar, use the left mouse button to grab it in any area that does not contain a button. All DAAAC modules include toolbar buttons to select other modules, display the module information, and view the DAAAC log. The following table displays the common toolbar buttons. Other available toolbar buttons are specific to each module and depend on the installation keys.

Toolbar button	Description
	Switch to the Archive module
	Switch to the TestMan module
	Switch to the Analyze module
	Display module information
	Select and display the DAAAC log

## 3.2 Status Bar

Status bars are displayed at the bottom of each DAAAC module's main window. To display or hide the status bar, use the Status Bar item in the Preferences menu.

Configure the acquisition and global parameters      Polling: Wave : vv2      Row: 12 Col: 4 [40%]

The left region of the status bar describes the actions associated with the application's menus toolbar buttons, while the mouse is hovering over the item. During some multi-step operations and automatic sequences, the status bar will also provide instructions or sequence information. In some cases, the center region of the status bar also displays the present module state (e.g., during an acquisition sequence and when polling instruments in TestMan).

### 3.3 Menus

While each DAAAC module contains a unique set of functionalities, many operations are common to all modules or fall into common categories. The menu structure is therefore similar in all DAAAC modules, with the following layout listed left to right:

Menu	Description
File	File functions (open, close, save) and printing.
Tasks	Task switching between DAAAC modules.
Edit	Cut, Copy, Paste and Undo operations.
Preferences	Default settings and display / layout preferences.
<module specific>	Variable number of module-specific menus.
Tools	High-level operations that are specific to each module.
Data View	Interfaces to view the specific data objects supported by the module.
Window	Functions to arrange the module-specific data windows.
Help	On-line help, about box, system log viewer.

The common items under each of these menus are discussed in the following subsections. Module-specific menu items are discussed in the sections for those modules.

#### 3.3.1 Tasks Menu

The Tasks menu switches from one DAAAC module to another. If the requested module is not running, DAAAC will start the module. The same function can be performed by selecting a module's button from the toolbar (see Section 3.1).

#### 3.3.2 Help Menu

The Help menu contains the following commands:

Menu Item	Description
Help Topics	Displays the on-line help window
About	Displays DAAAC's version number and configuration information.
Open Source Notice	Displays the list of open source libraries used in DAAAC.
License	Displays the DAAAC license agreement.



### 3.3.2.1.1 Help Topics

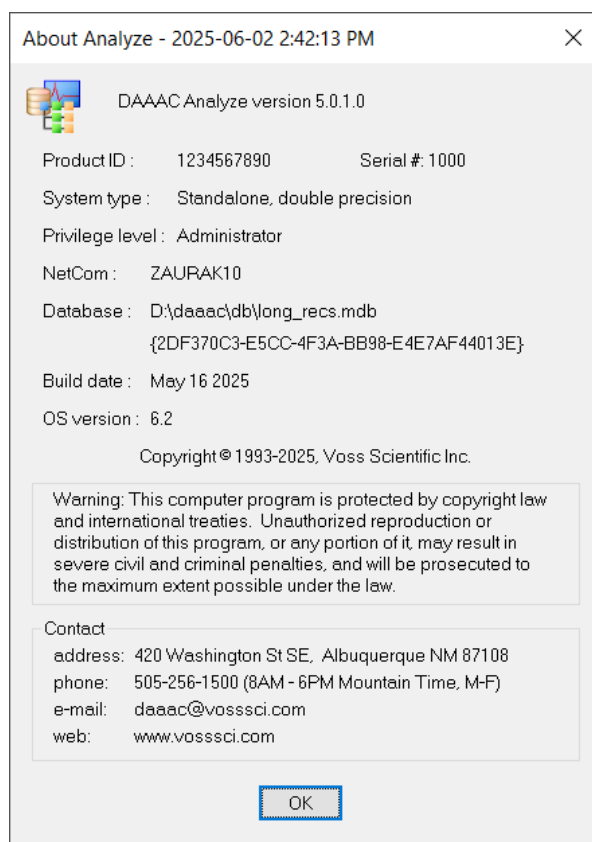
Help Topics opens the help viewer. Select a topic using the window on the left to display the associated help page. Note that on-line help is deprecated and may not be available in all modules. This document should instead be the primary reference for DAAAC operations.

The topic selection window contains tabs with different methods to select content:

Tab	Description
Contents	Displays a tree with the high level topic areas. Help topics are organized by overviews, procedures and features. Tutorial and setup instructions are also available from Help's Table of Contents.
Index	Contains an alphabetical listing of the individual Help topics. Includes a search field to search for content across all help topics

### 3.3.2.1.2 About Box

About displays the copyright notice and version information for each DAAAC module.



**Figure 3-1 - The DAAAC "About" Box**

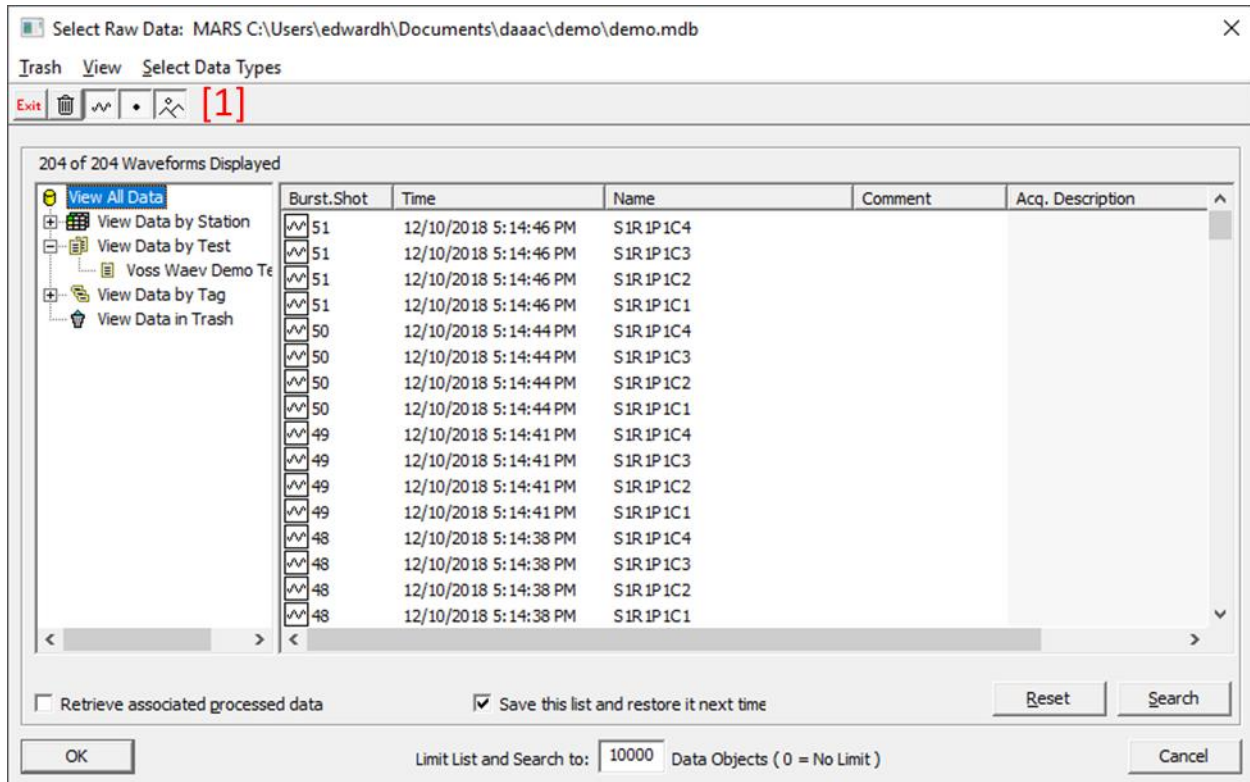
When contacting Voss Scientific regarding a DAAAC installation, please indicate the serial number and build date, as shown in this dialog.

Item	Description
Product ID	An ID associated with each unique set of DAAAC keys
Serial #	The unique serial number for this license
System Type	Standalone (single computer) or networked
Privilege Level	not currently selectable – all DAAAC systems use Admin
Warning Level	not currently selectable – all DAAAC systems use Verbose
NetCom	The computer on which the NetCom module resides
Database	The current active database
Build Date	The date and build number of the current release

The copyright notice and contact information are displayed at the bottom of the dialog.

### 3.4 Data Selection Dialog




The Data Selection dialog is displayed when selecting raw and processed waveform and image data from the database. For example, it can open waveforms for editing in Analyze, or it can select a waveform as a characterization curve in TestMan. This interface also is used to delete waveforms and images from the database, and to view associated data records (instrument settings, signal paths, system configurations) linked to an acquired waveform / image.



**Figure 3-2 - The Waveform Selection Dialog**

The left pane contains the categories Station, Test, Tags (see Section 6.2.14 for a discussion on tagged waveforms) and Trash. Click the + or – leaves to expand or contract each category. Click on the top level Waveforms entry to see all available data in the right pane.



In area [1] in Figure 3-2, there are five icons. The three right-most icons are buttons that are used to toggle which types of data are displayed in the dialog:

-  Toggle waveforms
-  Toggle single point data
-  Toggle images

The right pane contains the current list of waveforms and images. The contents of this list can be changed by selecting a category from the control on the left or by performing a Search operation. Clicking on a list column header sorts the list items by that column's field. The default sort parameter is Time. Right-clicking on a waveform in the list displays a popup menu that allows viewing the Log Page, Acquisition, Instrument, or Cal Line settings in effect when the data was acquired.

You may also select Restore Historical Configuration from the right-click menu to restore the full system configuration that was in effect when the data was acquired. Restoring a historical configuration will replace the current acquisition, instrument, and signal path configurations with the historical settings. Note that replacing the acquisition settings will also reset the shot & burst numbers to their historical values.

The Waveform Selection dialog contains the following menu items, toolbar items, and controls:

Item	Description
<i>Trash Menu</i>	Options for removing waveforms from the database.
Delete Waveforms	Removes all currently selected waveforms from the database. When waveforms are first deleted, they are tagged as deleted (moved to trash) and not displayed in the waveform list, but they remain in the database. When deleting, a dialog is then displayed asking if associated waveforms (raw if deleting processed, and processed if deleting raw) also should be removed. Choose Yes to delete the selected waveforms and their associated waveforms. Choose No to only delete the selected waveforms.
Recover Waveforms	Deleted waveforms that have not been emptied from the Trash can be recovered. To recover deleted waveforms, they must be displayed in the list. Select View Trashed Waveforms (see below) or click the Trash icon in the left pane to see data in the trash. Select the data to recover from the list, then select Recover Waveforms from the Trash menu. A dialog is displayed asking if associated waveforms (raw if recovering processed, processed if recovering raw) also should be recovered. Choose Yes to recover the selected waveforms and their associated waveforms. Choose No to only recover the selected waveforms.
Empty Trash 	When selected, all waveforms and images in the Trash are permanently removed, after a confirmation prompt.  <b>Warning!</b> The Empty Trash command permanently removes the items from the database. They cannot be recovered.
View Trashed Waveforms (View menu)	Displays deleted items in the waveform list along with the items that have not been deleted. Deleted data (items currently in the trash) is shown with a red icon. Items that have been emptied from the trash are not displayed.  To view only the deleted waveforms, select the View Data in Trash item in the left pane.
Select Data Types 	Toggles the display of waveform, single point and image data. If a data type is not selected, items of that type will be hidden in the display list.
Retrieve associated processed waveforms	When checked, any processed waveforms/images linked to the selected data will also be retrieved. This includes any reduced data that has a common raw data source and any manually processed data that is derived from the selected data.  The associated processed waveforms are not displayed in the list, but will be retrieved. This control has no effect when only viewing the waveform list, such as when this dialog is activated from Archive.

Retrieve associated raw waveforms	Available when retrieving only processed waveforms. When checked, any raw data linked to the selected processed data are also retrieved.  The associated raw waveforms are not displayed in the list, but will be retrieved. This control has no effect when only viewing the waveform list, such as when this dialog is activated from Archive.
Save this list and restore it next time	Select this item to have the Selection dialog remember the list of data that is displayed when the dialog is dismissed. That list will be displayed when the Selection dialog is next invoked.
Limit List and Search	Limits the number of items displayed in the data list. Only the first $N$ (where $N$ is the number entered into this field) items retrieved from the database are displayed. Enter "0" to display all items.
Reset	Resets the list of waveforms and images to show all data under the selected category (category specified by the tree control on the left). Used after the list had been reduced via the Search function.
Search	This activates a dialog used to search within the current list of displayed items. See Section 3.4.1, "Waveform Search Dialog," for details.

The data retrieval dialog is accessed via the following methods:

- Archive: File | Export Waveforms menu item
- Archive: Data View | Raw Waveforms, Data View | Processed Waveforms menu items
- TestMan: Reduction | Off-line Reduction menu item
- Analyze: File | Retrieve | Raw, File | Retrieve | Processed menu items
- Analyze: Analysis | Reduce Processed menu item

### **3.4.1 Waveform Search Dialog**

Activated from the Data Selection dialog (Section 3.4), the Search Criteria dialog is used to search for items within the Data Selection display list that match the specified parameter values. The parameter list differs for raw and processed data and includes text fields (e.g., channel name, comment, acquisition description) and numeric fields (e.g., shot number, data limits). Text parameter searches are case-insensitive and match substrings. Note that Figure of Merit (FOM) parameters will not match unless the waveforms in the database had the appropriate FOMs computed before they were stored. See Sections 4.4.7.2.3, 6.4.4.1, and 4.8.3 for selection of automatically computed FOMs.

	Parameter	Search Criteria
1	<input type="checkbox"/> Burst	
2	<input checked="" type="checkbox"/> Shot	1400-1500
3	<input type="checkbox"/> Date/Time	
4	<input checked="" type="checkbox"/> Channel Name	S1R1P1
5	<input type="checkbox"/> Channel Desc	
6	<input type="checkbox"/> Comment	
7	<input type="checkbox"/> Device Type	
8	<input type="checkbox"/> Data Type	
9	<input type="checkbox"/> Acquisition Description	
10	<input type="checkbox"/> Off Top	TRUE
11	<input type="checkbox"/> Off Bottom	TRUE
12	<input type="checkbox"/> Weak	TRUE
13	<input type="checkbox"/> X min	
14	<input type="checkbox"/> X max	
15	<input type="checkbox"/> Y min	
16	<input type="checkbox"/> Y max	

Save Load Reset

OK Cancel Apply Help

**Figure 3-3. Waveform/image search dialog**

Item	Description
Parameter	Lists all search parameters. Checking multiple parameters combines those parameters using the AND operator. The available parameters are different for raw and processed data.
Search Criteria	The search string for the corresponding parameter field. Searches for non-numeric values are case insensitive and match substrings. Burst and shot fields support value lists and ranges (e.g. "4, 8, 20" and "800-850"). The channel name field supports name lists (e.g., "chan1, chan2, pulse4").
Save	Stores the current search criteria to a text file.
Load	Loads the search criteria from a file.
Reset	Clears all selected parameters and search criteria

Check the parameter to search, then enter the search string into the associated Search Criteria field. More than one field may be searched at a time by checking each parameter that applies to your search criteria – multiple search fields are applied using the logical AND operator (i.e., returned data will meet

all selected criteria). The search is not case sensitive and any matching sub-strings are returned. For example, to find all waveforms from Station 1, Rack 1 (regardless of Position or Channel, such as S1R1P\*C\*), check the Title Parameter and enter S1R1 into the Search Criteria field. All titles that contain S1R1 will be displayed.

When you select OK, the search results are displayed in the Select Waveform dialog's right pane. Use Reset in the Data Selection dialog to clear the search results and reload the default list.

### 3.5 Waveform Import Wizard

ASCII data that contains point data on individual lines, with point fields delimited by tabs, spaces, commas, semi-colons or any other distinct character may be imported as waveforms into DAAAC. The process begins by selecting the import file in a standard Windows browser dialog, with file type Unknown ASCII or Multi-column ASCII Text with Header. Other import types may display a subset of the steps shown below. The waveform import dialogs are accessed from:

- Archive: File | Import Waveforms menu item;
- Analyze: File | Import Waveforms menu item.

#### 3.5.1 Step 1 – Specify the lines that contain the waveform point data

Once a waveform file is selected, the file contents appear in a dialog as in Figure 3-4. The dialog is used to specify the start of the point data (file line number) and the number of sequential points to include in the waveform. Set the number of points to 0 or leave blank to import all points from the specified starting line to the end of the file. Select Next after specifying the range of file lines.

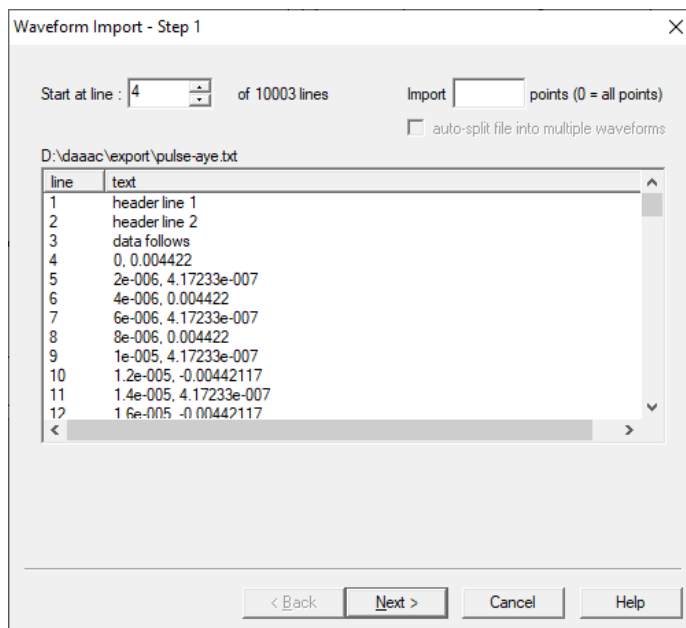


Figure 3-4 Waveform Import dialog step 1

### 3.5.2 Step 2 – Select the point data delimiters

The next step is to specify the delimiters that separate the data columns in each file line. The data columns that result from the delimiter selections are updated automatically, as shown as in Figure 3-5. After specifying the delimiters, select Next to continue.

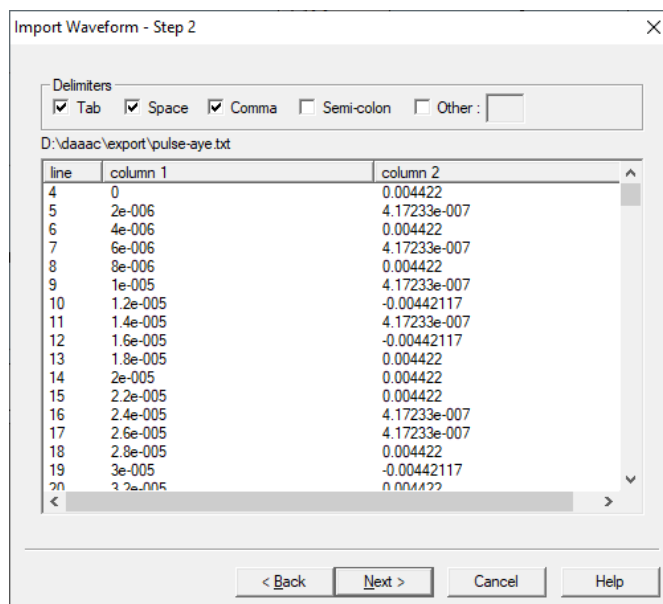


Figure 3-5 Waveform Import dialog step 2

### 3.5.3 Step 3 – Select the independent and dependent data columns

After the input file has been properly segmented into columns, the columns that contain the independent and dependent data must be selected (Figure 3-6). First choose the column type (independent = X axis, dependent = Y axis), then click on a column heading to make the association. As a column is selected its header title will change from “column N” to “x axis” or “y axis”. After selection, click Next to continue.



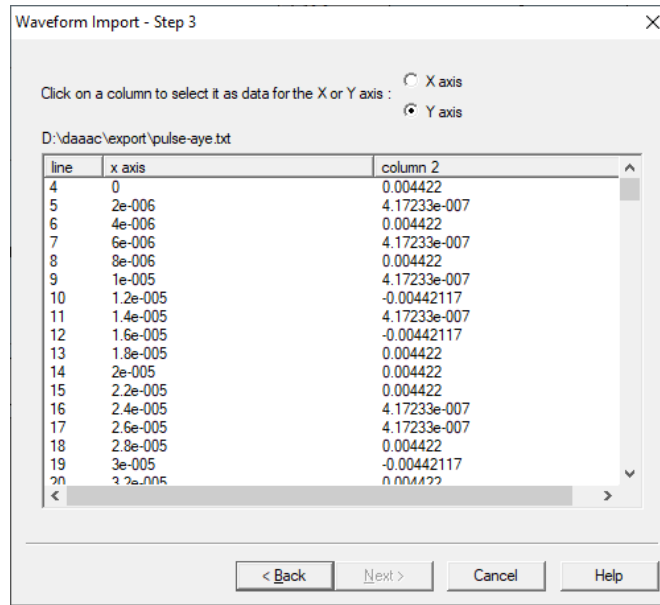


Figure 3-6 Waveform Import dialog step 3

### 3.5.4 Step 4 – Specify the waveform titles and units

The last wizard page is used to specify the waveform titles, units, and comments (Figure 3-7). For batch imports of multiple files, select Use this import specification... to apply the same settings to all remaining waveforms (bypassing these dialogs). Press Finish to import the data.

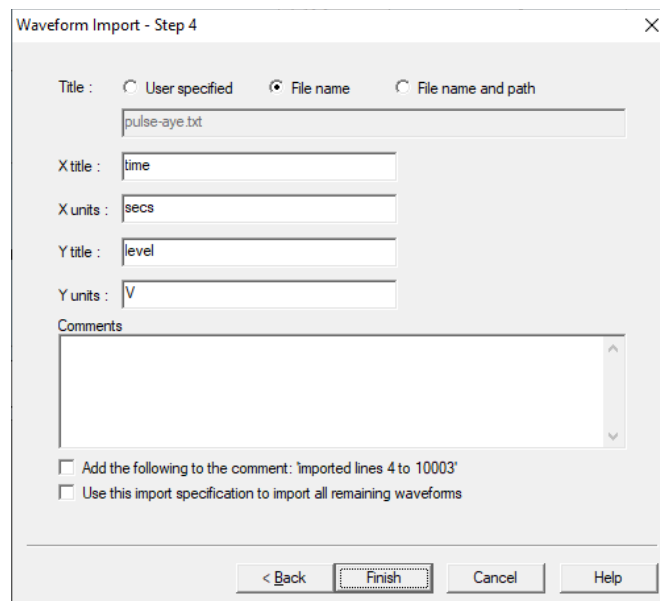


Figure 3-7 Waveform Import dialog step 4

## 3.6 Numeric Data Entry

Many of the DAAAC interfaces for entry of numeric data support engineering suffixes. Instead of entering “3e-3” or “0.003”, you can simply enter “3 m”. Numeric controls that do not support suffixes

are either expecting integer values, or the expected units already contain a suffix. For example, controls with units of “Hz” or “seconds” will support suffixes – controls with units of “GHz” or “milliseconds” or “number of points” will not. Supported suffixes are as follows:

**Table 3-1- Engineering suffixes for numeric data**

Suffix	Name	Scale		Suffix	Name	Scale
y	yacto	$10^{-24}$		k	kilo	$10^3$
z	zepto	$10^{-21}$		M	mega	$10^6$
a	atto	$10^{-18}$		G	giga	$10^9$
f	femto	$10^{-15}$		T	tera	$10^{12}$
p	pico	$10^{-12}$		P	peta	$10^{15}$
n	nano	$10^{-9}$		E	exa	$10^{18}$
μ (u)	micro	$10^{-6}$		Z	zetta	$10^{21}$
m	milli	$10^{-3}$		Y	yotta	$10^{24}$

### 3.7 Keyed Features

Although all DAAAC installations use a common set of executables and libraries, many individual drivers and capabilities are “keyed” to allow the creation of custom installations. While some of the keyed features are cost items (e.g., instrument drivers, test director mode), most items are keyed to avoid cluttering the user interface with unnecessary functionality.

In some cases, keyed items not included in your DAAAC system will appear in a disabled or “grayed-out” state. Other types of keyed items, such as instrument drivers and TestMan inventory items, will not be visible if not included in your DAAAC keys. If you have any questions about enabling keyed features, contact Voss Scientific.

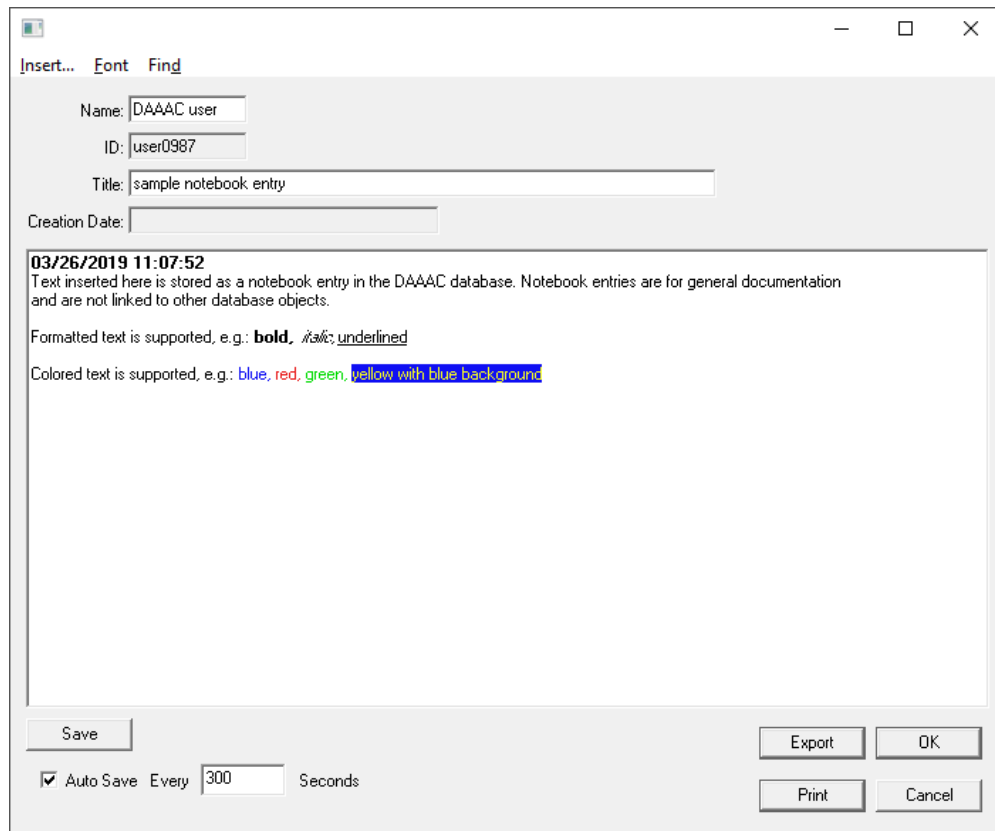
### 3.8 Notebook

The Notebook tool is a general documentation tool available from the Tools | Notebook menu in all DAAAC Modules. To create a notebook entry, specify a User ID and click New. The Notebook editor window opens. Enter a user/entry name and specify the document title. Entry text can be formatted to have any of the properties in the following table:

**Table 3-2- Notebook editor options**

Option	Menu	Shortcut
Bold	Font->Bold	<Ctrl-B>
Underlined	Font->Underline	<Ctrl-U>
Italics	Font->Italic	<Ctrl-I>
Superscript	Font->Superscript	<Ctrl-P>
Subscript	Font->Subscript	<Ctrl-S>
Black	Font->Color->Black	<Ctrl-K>
Red	Font->Color->Red	<Ctrl-D>
Yellow	Font->Color->Yellow	<Ctrl-W>
Blue	Font->Color->Blue	<Ctrl-L>
Green	Font->Color->Green	<Ctrl-G>
Insert Current Date	Insert...->Date Only	<Ctrl-F5>
Insert Current Time	Insert...->Time Only	<Shft-F5>
Insert Current Date & Time	Insert...->Date/Time	<F5>

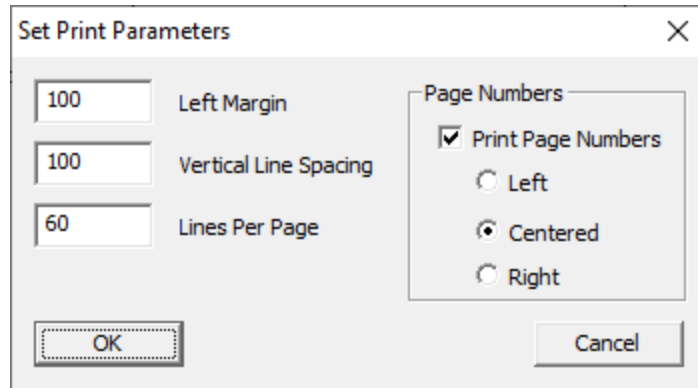
Standard text editing commands Cut <Ctrl-X>, Copy <Ctrl-C> and Paste <Ctrl-V> can be used in the notebook editor.



**Figure 3-8. The notebook entry editor**

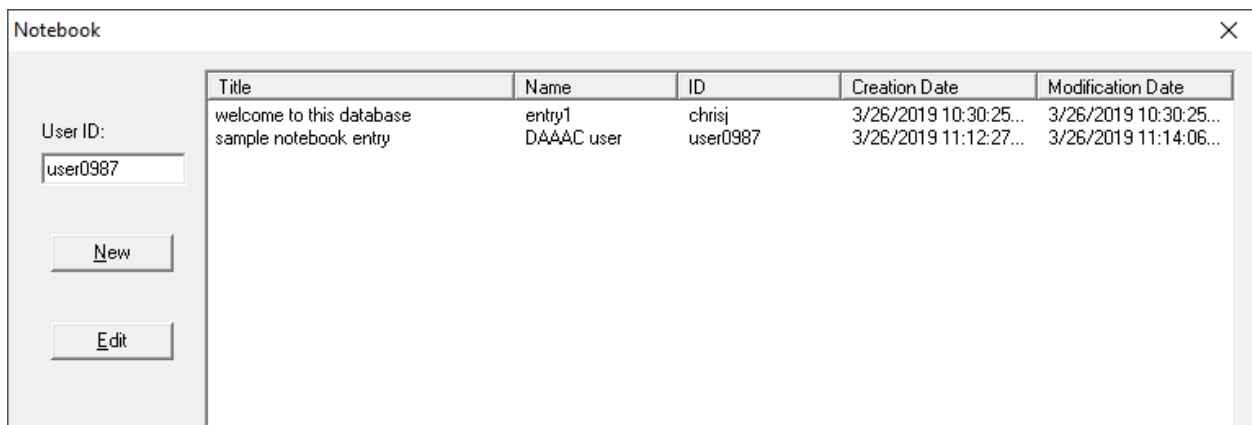
Click Export save the notebook entry as a text, comma separated values, or Rich Text format file.

The Print button opens the standard Windows print configuration dialog. After selecting the printer, an additional dialog is displayed that allows output to be adjusted for left margin spacing and text horizontal and vertical spacing. Once these parameters are properly configured for a particular printer they should not need to be adjusted again. The dialog also enables or disables the printing of page numbers and assigns a location on the page if they are to be printed.



**Figure 3-9. Notebook entry printer configuration**

When OK is clicked in the Notebook editor window, the window is closed and the document is displayed in the Notebook management window. Clicking OK closes that window and stores the document to the database. When the notebook is opened, all archived entries are recalled and listed in the management window. Existing entries may be opened for viewing by anyone. Existing entries may also be edited, provided the specified user ID matches the ID associated with the document.



**Figure 3-10. Notebook management view**

# 4 TestMan

## 4.1 TestMan Overview


TestMan has been introduced in the tutorial in Section 2.2 in sufficient detail to configure and perform a simple acquisition. However, TestMan has many other capabilities not covered in that section. This chapter presents a complete detailed review of the module's capabilities. Keep in mind that none of the DAAAC modules operates completely independently of the others. A complete understanding of TestMan will only be gained with the understanding of the other modules as well.

TestMan is DAAAC's data acquisition control and data reduction module. It configures the acquisition station, manages instrument inventories and settings, communicates with the instruments, runs the automatic and manual data acquisition sequences, documents the signal path components, and performs automated data reduction.

The TestMan module uses a configuration window with two views – the Instrument display and the Graph display. The Instrument view displays the current acquisition instruments in a compact list that allows the user to easily see the status of each instrument in the station. The Graph view represents the signal path components and automated processing nodes, and describes how data is reduced after it has been acquired. The Graph and Instrument views are displayed as tabs in TestMan's station (document) window. Click on the Graph or Instrument tab, located in the lower left of the window, to display the associated view.

TestMan is used to configure the acquisition and data reduction sequence. Available user controls include acquisition mode (single shot, burst, repetitive, live, and sequenced), automated reduction and automated data export. TestMan is also used to document the acquisition with parameters such as test name, shot number and acquisition description.

TestMan uses a collection of instrument drivers that require no operator programming and control the instrument functions required to configure the instruments before the acquisition event and retrieve the acquired data after the event. The instrument drivers that are available on your system depend on the installed system keys.

Once TestMan is configured properly (station and instruments are configured, sequences are defined, and signal paths are documented) the automated data acquisition sequence can begin when TestMan's  toolbar button is pressed or Acquisition | Go menu is selected. Instruments are initialized, then armed. Once the instruments trigger, TestMan reads the data, reduces it, sends it to Analyze for display and printing, and sends it to the database for archival. If an automated test sequence has been configured, the specified instrument settings are modified and the acquisition sequence repeats.

	Name	Model	Loc...	Address	State
	wv1	Wave	1:1:1		ACTIVE
	wv2	Wave	1:1:2		INITIALIZED
	dsos104	DSO-S 104A	1:1:3	U:MY55020119	OFFLINE
	11801	Tek 11801	1:1:4	G:0:6	OFFLINE
	AW-8321	API-Weinschel 8321	1:1:5	0.0.0.0	IDLE
	pico	PicoScope 6404C	1:1:6		IDLE
	72304sx	DPO72304SX	1:1:7	192.168.1.123	IDLE
	img	Image	1:1:8		INITIALIZED
	ext_wfm	External Raw Wfm	1:2:1		ACTIVE
	dg1	DG535	1:2:3	G:0:1	IDLE
	dg645	DG645	1:2:5	192.168.1.212	IDLE

Figure 4-1. Example TestMan instrument configuration

## 4.2 TestMan Instrument List

TestMan's instrument list display (Figure 4-1) contains instrumentation available for use during acquisitions. Each list row includes an instrument's: type icon (e.g., oscilloscope, camera, signal/trigger generator); name; model; rack location; communication address; and state. The instrument states are designated by a text field with a colored background, as shown in right column of Figure 4-1. The various instrument states are described in Section 2.2.2.4.

To select the displayed instrument columns, right click on the column header row and enable/disable columns on the menu. To change the column sizes, drag the vertical bars in the header that separate the columns. To change the column order, drag and drop a column header.

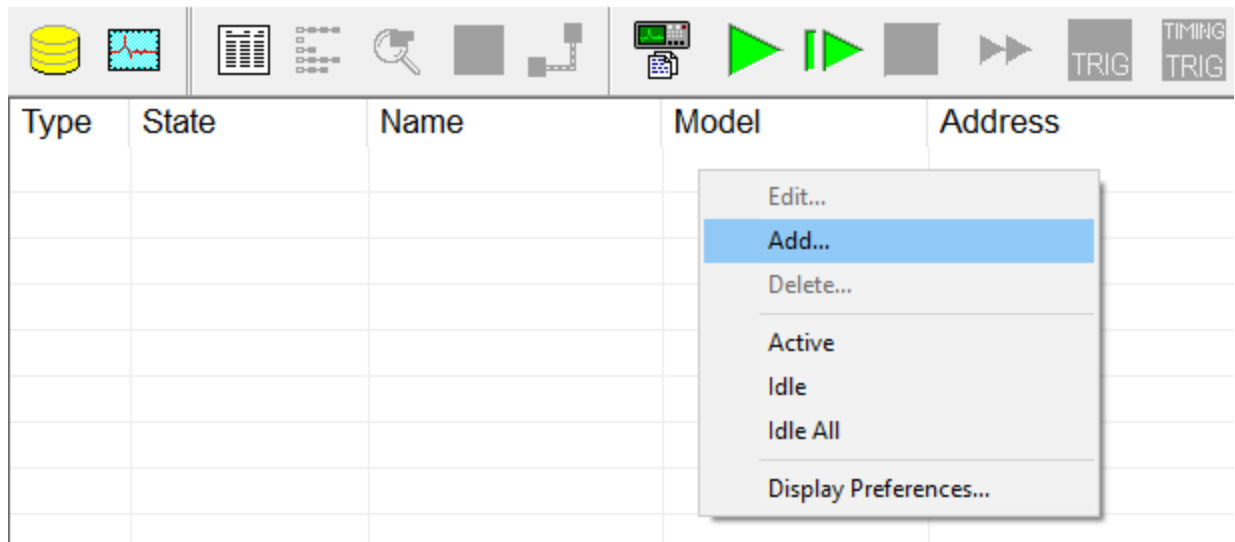
### 4.2.1 Adding an Instrument

Adding an instrument to the list is a matter of selecting the instrument, by serial number, from the inventory of instruments in the open database. Often, before an instrument can be selected, it must first be added to the database inventory. The instrument is selected for addition to the inventory from a list of all available instruments. The selection (in number and type) of instruments available depend on the options purchased with DAAAC and is determined by the installed keys.

#### 4.2.1.1 Adding an Instrument to the Inventory.

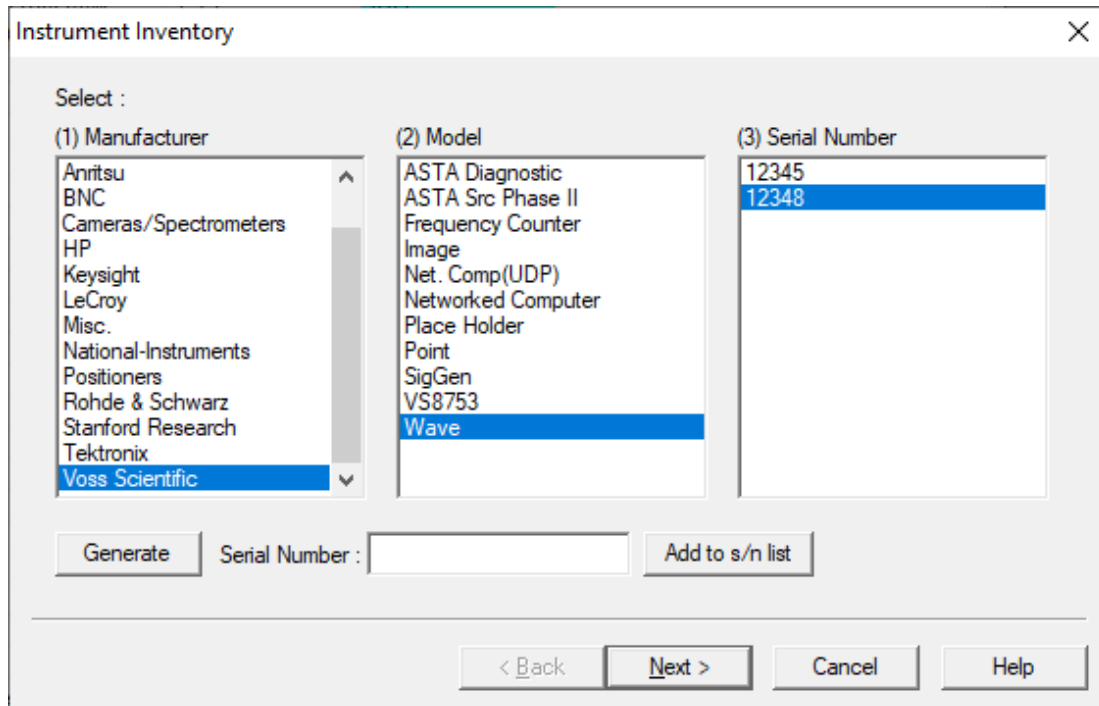
To add an instrument to the database inventory:

1. Right-click on an empty space in the instrument list and select Add from the popup menu



**Figure 4-2 – Add a New Instrument**

2. The dialog of Figure 4-3 appears. The lists that appear under Manufacturer and Model will depend on the drivers allowed by the installed DAAAC keys. The list under Serial Number will depend on the selected items under Manufacturer and Model and instruments that have already been added to the inventory.



**Figure 4-3 - Database Inventory Dialog**

3. Select the Manufacturer. The list of available instrument drivers will appear in the Model list.
4. Select the desired model. Any instruments of that model already added to the inventory, will appear, by serial number, in the Serial Number list.
5. Create a serial number. Either type an appropriate value into the Serial Number control, or click Generate to automatically create a random and unique value. Unless the system is configured for strict inventory control, serial numbers are not required to be unique and the same serial number can be used to add multiple instruments.
6. Click Add to s/n list. The instrument will be added, by serial number, to the Serial Number list. The instrument is now in the inventory and may be added to the acquisition instrument list

#### 4.2.1.2 Adding an instrument to the instrument list.

This process can be continued immediately from the previous sequence or begin by repeating steps 1 through 4 of Section 4.2.1.1.

7. Select an instrument, by serial number, from the Serial Number control in Figure 4-3.
8. Click Next
9. An interface dialog will appear. It can be used to add a name for the instrument and review other instrument properties. The nature of the dialog is variable. For instruments with a GPIB interface, the GPIB addresses are configured here. The dialog may also include a Setup button.
10. If the dialog includes a Setup button, the button must be clicked. Perform any configuration in the dialog that appears. Note that once the values in the Setup dialog are configured and the instrument is added to the list, the values may be recalled for review but cannot be altered.
11. Click Finish to add the instrument to the list.

#### 4.2.1.3 Configure the instrument in the List

12. Double-click the instrument driver icon in the list. The tabbed instrument-specific configuration dialog will open.
13. Most dialogs consist of four tabs – Main, Channel, Trigger, and Utility (see Section 4.2.3). The Main tab configures the acquisition. The Channels tab enables or disables the various signal channels and adjusts individualized channel properties. The Trigger tabs configures the trigger inputs and levels. Configure the instrument as appropriate and close the dialogs. Once all instruments are configured, TestMan is prepared for acquisition.


### 4.2.2 Acquisition Sequencing

Section 2.2.2.7 presented a basic description of an automatic acquisition sequence. That description was not only simplified, it also focused on a single acquisition mode. TestMan supports numerous distinct acquisition modes:

- Single Shot – run a single acquisition;
- Repetitive Single Shot – repetitively run single shot acquisitions using the same configuration;
- Burst – run an acquisition that uses the instruments' segmented memory / fast re-arm capabilities;
- Repetitive Burst – repetitively run burst acquisitions using the same configuration;
- Sequenced – run multiple acquisitions with a pre-programmed sequence of instrument settings;
- Live – rapidly collect and display data without archival.



#### 4.2.2.1 Automatic Data Acquisition.

After the instrument settings have been specified, automatic data acquisition is initiated by pressing the  button. Once pressed, the acquisition will proceed without until all data have been acquired and processed per the module configuration. The sequence is as follows:

1. Display the Test Configuration dialog to configure the acquisition settings
2. Initialize all uninitialized instruments
3. Arm all instruments
4. Repeatedly poll all instruments until all instruments have armed or until the user-programmed timeout is reached.
5. Read out the data from the instruments.
6. Write the data to a spool file, a temporary binary file on the acquisition computer.
7. Transmit the data. In networked systems the data is multicast, sent to the database server and all analysis stations.
8. NetCom receives and stores the data in the database.
9. Analyze receives and displays the waveforms and images.
10. If there is no reduction, TestMan deletes the spool files, otherwise...
11. If there is data reduction, TestMan reads the data and deletes the spool files.
12. TestMan reduces the data and spools the processed data.
13. TestMan transmits the processed data to NetCom for archival and to Analyze for display.
14. For repetitive acquisition return to step 2 as necessary. Most instruments return to the initialized state at the end of the acquisition sequence, so will not require repeated initialization.

Items to note about this sequence.

- At this level, there is no distinction between single-shot and burst mode acquisition.
- The sequence involves other DAAAC Modules, NetCom and Analyze. Analyze is optional, but NetCom is required to complete the archival process.

#### 4.2.2.2 Interrupting an acquisition sequence

While running an acquisition, the sequence can be interacted with in a number of ways. The table in Section 4.6 describes the toolbar buttons that can be used to control the sequence.

#### 4.2.2.3 Acquisition Sequence in the TestMan Module

As the TestMan module moves through the acquisition stages, the instruments change color to indicate the current acquisition action. Figure 4-4 illustrates this process for a typical recording device.



**Figure 4-4. Acquisition Sequence in the TestMan Module**

Non-recording devices, such as trigger generators, controllable attenuators, and signal sources, will use the **SET** state in place of one or more of the states shown in Figure 4-4. The timing of the change to the SET state will depend on when the device outputs are activated. For example, a controllable attenuator will go directly to SET as soon as it is initialized. A signal generator that is externally triggered will proceed through INITIALIZED and ARMED states, then go to SET when it receives its input trigger.

### 4.2.3 Acquisition / Sequence Toolbar buttons

Before and during a sequence, the acquisition and sequence toolbar buttons will dynamically change states to present the available actions at any point in the sequence. The various acquisition buttons are shown with labels in Figure 4-5. Note the different button combinations that are available during different stages of the sequence. The Single Step and Stop buttons shown below are only available in systems that support multi-shot sequencers (see Section 4.2.2). All toolbar buttons are described in Section 4.6.

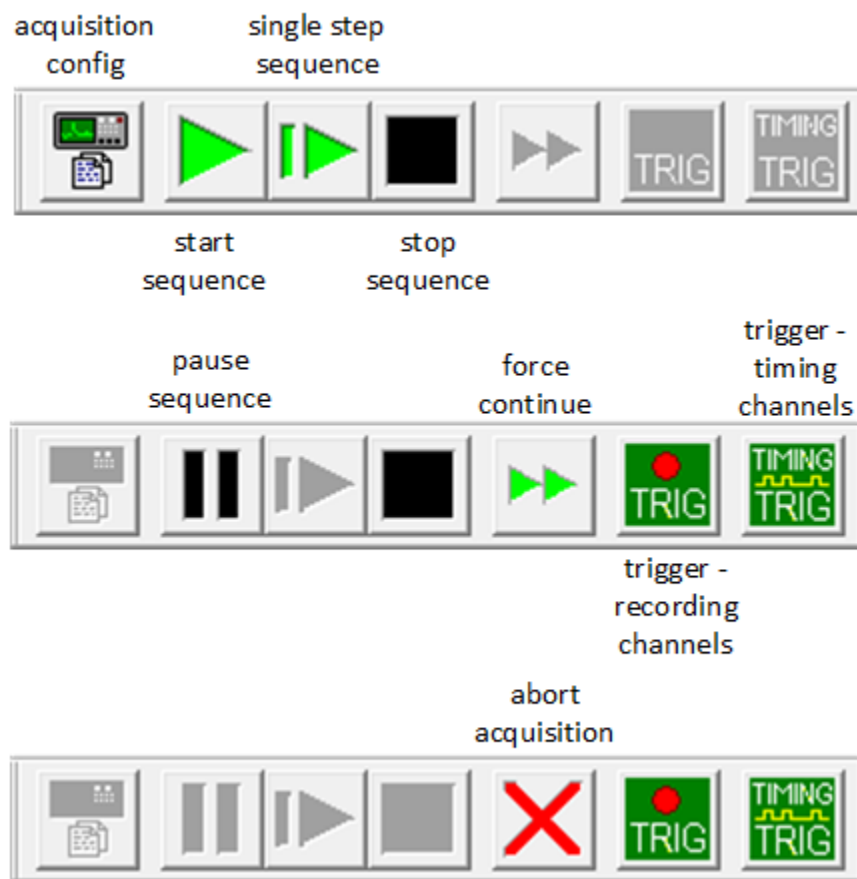


Figure 4-5 - Acquisition sequence buttons on the toolbar

### 4.2.4 Instrument Control dialogs

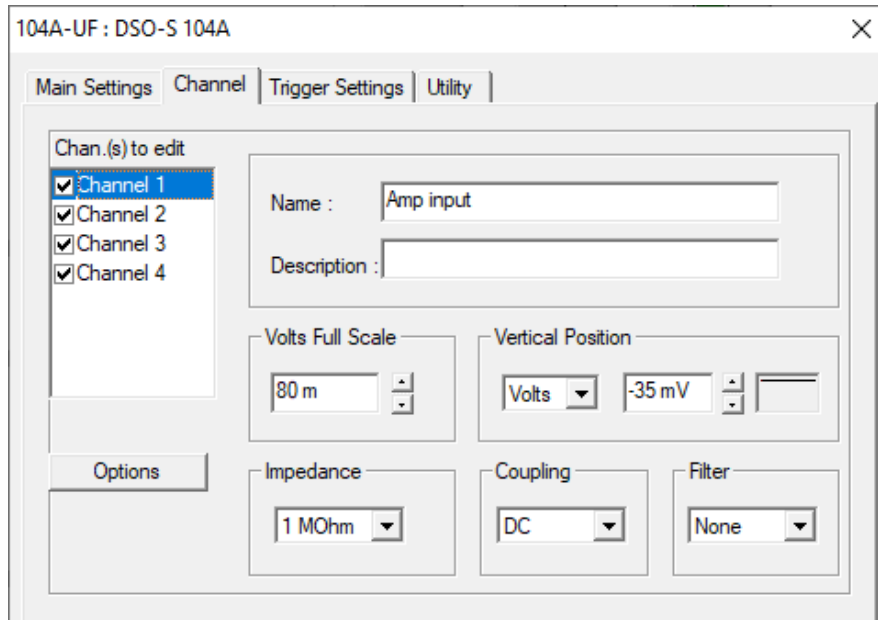
Instrument Control dialogs typically contain Main, Channel, Trigger and Utility pages. They are accessed by double-clicking the instruments in the instrument list or in the graph.

The Main page contains electrical address information, settings that are common across all instrument inputs and outputs, and operations such as calibration. Some instruments will also show the trigger controls on the Main page. The Channel page contains settings that are set on a per-channel basis for the instrument, such as vertical scale and offset. Auxiliary functions performed on a per-channel basis, such as auto-export, are contained on this page also. The Trigger page contains all controls that configure the trigger inputs, levels, and logic. The Utility page contains general functions to support storage of instrument settings and reset.

The screenshot shows the 'Main Settings' tab of the '104A-UF : DSO-S 104A' configuration window. The window has four tabs: 'Main Settings', 'Channel', 'Trigger Settings', and 'Utility'. The 'Main Settings' tab is active and contains the following sections:

- Instrument:** Radio buttons for 'Active' (selected) and 'Idle'.
- Identification:** A text box for 'Name' containing '104A-UF' and a label for 'Serial number' with the value '1'. A checkbox for 'Use HiRes' is also present.
- Address:** Radio buttons for 'GPIB', 'LXI' (selected), and 'USB'.
  - GPIB:** Fields for 'Interface ID' and 'Primary address', both with dropdown menus.
  - LXI:** A field showing the address '192 . 168 . 0 . 10'.
  - USB:** A field for 'Serial'.
- Self-Test:** Fields for 'Date' (01/01/2001) and 'Status' (Unknown), with a 'Start' button.
- Timebase:** Fields for 'Record Length' (10 k), 'Sampling Interval' (400 ps), and 'Time Window' (4 μs). A conversion indicator shows '==> 2.5 GS/s'.

**Figure 4-6. Instrument configuration, Main page**



**Figure 4-7. Instrument configuration, Channel page**

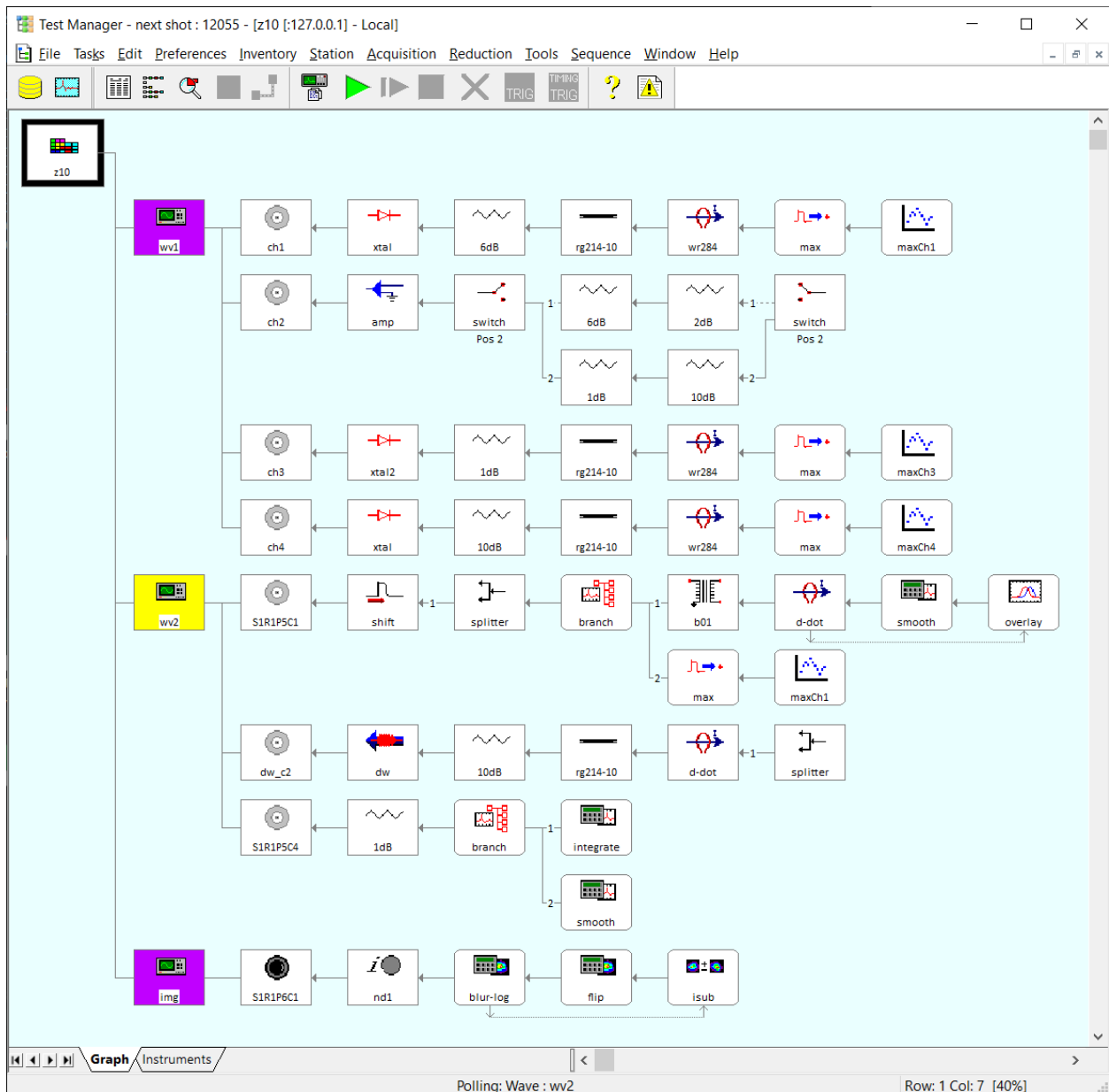
Instrument Control dialogs are far too numerous and varied to permit detailed examination in this document. Figure 4-6 and Figure 4-7 show the Main and Channel tabs for a typical digitizer driver. A few configuration parameters are common to all drivers and are worth noting here.

- The Main Settings tab will include two radio buttons that can switch the instrument to Active or Idle, or will include an Active checkbox.
- The Main Settings tab will include a section that identifies the instrument. The Name field can be modified, but the serial number is fixed.
- The Channel tab will show a list of all available data channels. Channels may be selected for data transfer or disabled from this tab.
- Each of the data channels can be assigned a name and description from the Channel Settings tab. Channel names must be unique across all instruments in a station.

### 4.3 TestMan Cal Graph

TestMan displays acquisition stations as a hierarchical graph of Cal Items linked into Cal Lines (instrument channels). This graph represents the physical components and electrical connections in the acquisition signal paths, displaying each item, from the sensor that detects the signal to the destination instrument channel. Graph items can also represent user-specified automatic software processing steps. TestMan reduces the “raw” data from the recording instruments (e.g., in units of Volts) to physical quantities of interest (e.g., in units of V/m, W/cm<sup>2</sup>), based on the signal path configurations and the characterizations of each Cal Item in those signal paths.

A graph, example shown in Figure 4-8, displays the components used in the acquisition system, along with their connections, in four distinct tiers. Individual graph items – called nodes – represent the signal line components, the instruments and the controlling computer (station). Except for the Station and Instrument nodes, each component has a settings dialog that configures the properties that determine the automated processing for that component.



**Figure 4-8 – The TestMan Cal Graph display**

The first graph column contains the single Station node at the graph's top-left corner. The node's right-click menu can be used to create new lines and print the graph, but the station itself has no settings.

The second column contains instrument nodes. Like the station node, the instrument node has no reduction settings, but double-clicking on an instrument node will open up that instrument's acquisition settings dialog. The instrument node's menu is used to add new signal lines or print portions of the graph.

A single column of channel nodes occupies the third column. Channels are used to specify the type of data present in this signal line (e.g., image, wideband waveform, narrowband waveform), and whether

or not this line is part of the automated reduction process. See Sections 4.3.3 and 9 for details on channel reduction settings.

The majority of the graph is typically comprised of multiple horizontal lines of Cal Item nodes. Nodes representing Cal Items are attached to the right of the channel, to create a Cal Line. Cal Items are added to the graph from an Inventory List that manages the available items. Once a Cal Item has been added, its settings dialog can be accessed by double-clicking the Cal Item node or pressing [Enter] after selecting the node. In addition to displaying a hardware item's electrical characteristics, the settings dialog is also used to specify what happens to computed data during the reduction process.

Edges between the station, digitizers, and channel nodes show the hierarchical relationships between those components (stations contain instruments that contain channels). Edges between the channels and signal path components represent physical links (e.g. an attenuator connected to a cable) and data flow. Edges typically extend horizontally between connected signal path components and do not indicate direction (several special cases are discussed below).

The user builds a graph by connecting new nodes to existing nodes, beginning with the station node. The user specifies the component connections, but component placement and edge routing are automatically determined by the software.

Data reduction is enabled at two levels – the channel and the individual Cal Items. The channel level control turns reduction on and off for the entire Cal Line. Each Cal Item node also has controls to specify what happens to the data computed at that node. Among other things, the user can select whether each node's data is displayed, printed, or archived. Note that if reduction is turned on for a particular channel, all nodes in the corresponding Cal Line will be processed, even if some or all of the Cal Items are not configured to display / print / archive their data.

#### **4.3.1 Cal Graph Terminology**

Several terms introduced in the previous section are presented here in more detail. In particular, note the distinction between an *Item* and a *Node*.

- *Item* (also *Cal Item* or *inventory item*) – the definition of a signal path component or processing algorithm that includes all information required to characterize the component for purposes of data reduction. Cal Items are maintained in the TestMan inventory.
- *Hard item* – hardware components in the signal path that include characterization data, which is used during the data reduction sequence to “unfold” the effects of the component on the signal passing through that component. Examples: attenuator, amplifier, cable, filter, sensor.
- *Soft item* – user specified algorithms to automatically process data during the reduction sequence. Examples: user process, waveform / image branch, overlay, combine.
- *Node* – the basic building block of the Cal Graph, representing the acquisition station, instruments, instrument channels, and Cal Items. Most nodes are containers for hard or soft<sup>1</sup> Cal Items that have been added to the graph. The node is used to access the associated cal item settings, maintain connection information and store data reduction settings. Nodes that represent hardware items are drawn with right-angle corners, while nodes that represent soft items have rounded corners.

---

<sup>1</sup> While several restrictions and special cases exist for placement of cal items in the graph, hard and soft items/nodes are largely treated in the same manner.

- *Edge* – lines that show the connections between nodes, representing either physical connections or operator/operand relationships.
- *Cal Line* – A (mostly) linear collection of Cal Item nodes, originating at a channel node, and connected by edges. Data collected by the channel is processed at each node as it moves to the right from the channel node along the Cal Line.
- *Graph* – the complete collection of nodes and edges that defines the system configuration. The first three columns in the graph contain nodes that represent the station, instruments, and instrument channels, respectively. Cal Item nodes are placed to the right of the channel nodes.

#### **4.3.2 Role of the Cal Graph in acquisition**

During the acquisition sequence, the graph is used to perform automatic data reduction for each acquisition channel. Auto-reduce data (Test Configuration dialog | Processing tab, see Section 4.6.4.3 ) must be selected in TestMan for reduction to be performed as part of the acquisition sequence.

After the acquisition phase is complete, TestMan traverses each line of the graph that is associated with an acquisition waveform/image and computes reduction outputs for each Cal Item in the line. TestMan then sends the data to the database to be archived and to Analyze to be displayed and/or printed.

Each of the Cal Items in the signal line must be configured properly for the reduction to be effective. Many hardware Cal Items are characterized with a curve, which is often a frequency dependent gain curve produced by a network analyzer. Characterization curves can also be specified as a simple polynomial, which is often used with devices such as attenuators and splitters that have relatively constant or linear response over the expected frequency range.

Some Cal Items contain additional property settings to further characterize the physical item. For example, Cables require a length entry to compute the time delay based on the cable type. Sensors contain many different numerical values and settings (e.g. equivalent area, impedance, transmission line) to characterize the specific type of sensor.

In addition to the Cal Items that represent physical components, there are several items that support automated, custom data processing. For waveform processing, these include the User Process, Combine, Overlay, and Waveform to Point items. Systems that support image acquisition also include Cal Items for image processing and image-to-waveform conversion.

Each graph node that represents a Cal Item or instrument channel contains a Reduction page for selecting output handling (display, print, archive), Figures of Merit (FOMs), and display options. FOMs are metrics taken directly from or computed from the reduced data (see Sections 4.8.30 and 10). The FOMs dialog lists the Figures of Merit that may be selected, configured and attached to the Cal Item's reduction output. These FOMs then are archived with the data and can be displayed with the reduced data in Analyze.

#### **4.3.3 Data reduction**

When performing data reduction for physical components (e.g., amplifier, cable, mixer, filter, sensor), TestMan proceeds to reverse the effects of each component on the input signal. Starting with the data at the recording instrument (e.g., digitizer, camera, spectrometer, network analyzer), TestMan works backwards through each component until it has computed the physical quantities detected by the probe/sensor. The processing used to correct for the components depends on both the signal type (e.g., wideband waveform, narrowband waveform, image) and the component type. See Section 9 for a description of the supported signal classes and associated data reduction methods.

For example, before a raw waveform is acquired by an instrument, suppose it passes through a sensor, an attenuator and a 10-foot cable. Before it is recorded as raw data by the instrument, the measured field has been converted and altered by the three signal path components. TestMan reduces the data by starting with the raw captured input signal then compensating for the loss through the cable and attenuator. The sensor reduction is based on the specific sensor type used, and would involve a conversion of units (e.g. voltage to power density, E-field, or amps). TestMan determines the data conversion by applying each item's reduction algorithm, which is used in conjunction with the item's characterization data.

Item Data pages for many Cal Items include a curve specification that characterizes the item's effect on the input signal. Selecting Curve in the item interface activates the curve dialog, which is used to either create a polynomial or selects a calibration waveform file. Preferably, this curve should be the waveform that resulted from a direct characterization of the particular device, such as a network analyzer sweep.

The graph can also contain items that do not represent physical components. When performing data reduction on these "soft" items, TestMan is simply applying user-specified processing in an automated fashion. Common user processing includes waveform scaling, integration, dividing one channel's data by another, creating overlays and extracting rows from images. There are three primary advantages to processing data via the signal path components in the graph: 1) it automates the entire data processing effort – once the Cal Graph is configured, multiple data channels over multiple acquisitions can be processed with a few mouse clicks; 2) it provides complete documentation – a permanent record of the processing steps is associated with the processed data; and 3) it uses a simple graphical interface that does not require the user to write code.

#### **4.3.4 Direction and Input / Output naming conventions**

Nodes may have a notion of signal "inputs" and "outputs" (or also "parent" and "child"), but it is important to understand that the input and output sides may change depending on the context. For example, examine the Cal Graph shown in Figure 4-8 with digitizers on the left side and sensors on the right. During data acquisition data flows from right to left (from the sensor to the digitizer), so the node outputs are on the left side. During data reduction data flows from left to right (digitizer to sensor), so outputs are on the right side. A physical component like a splitter has multiple outputs that would be drawn on the left side. A processing component like an image branch has multiple outputs on the right side. Some Cal Items that represent physical components, such as switches, can be oriented with their multiple ports on either side. Physical inputs and outputs are referred to as *ports*, which indicates flow from sensor to digitizer. Data processing node inputs and outputs will be preceded by the tag "*reduction*", indicating flow from digitizer to sensor.

The following section presents particular Cal Items or classes of Cal Item that have multiple input and/or output ports.

##### **4.3.4.1 Multi Input / Output nodes**

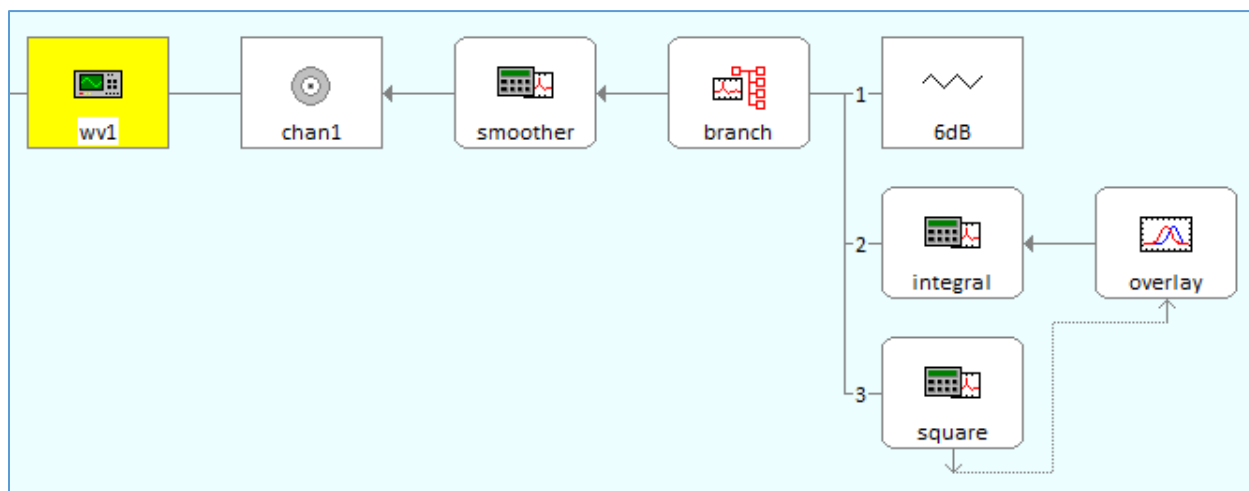
The majority of the Cal Items have a single input and a single output, whether referring to their physical connections or data flow during reduction. Here the special cases are presented – those nodes that have either multiple inputs or multiple outputs (at present no items are supported that have both).

##### **4.3.4.2 Waveform and Image branch**

These soft items make multiple copies of the input data during the reduction sequence for processing along parallel paths. Figure 4-9 shows a branch node with the primary path and two additional branched



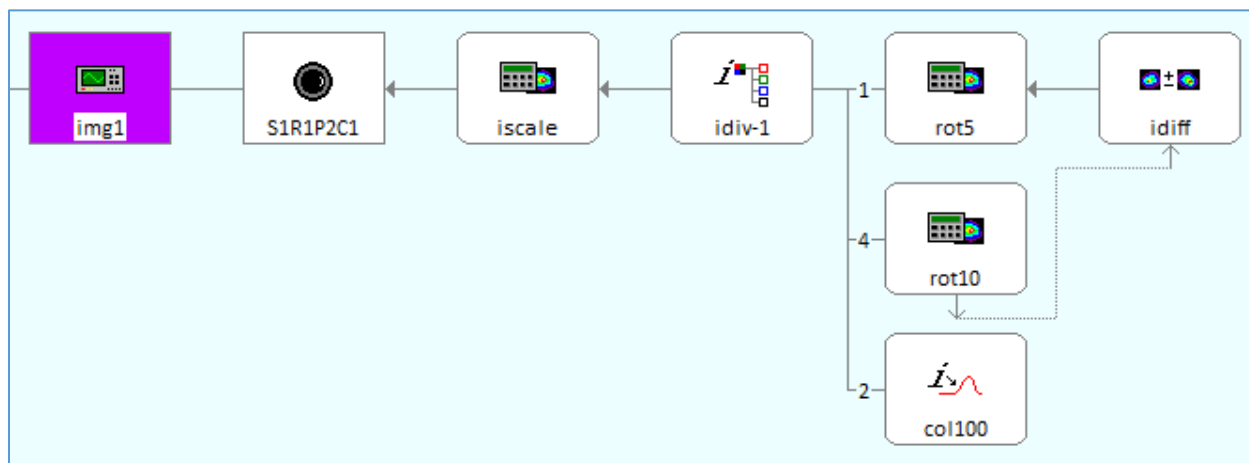
processing paths. Only the primary path, on the same line as the branch node, can contain hardware components. Unlike hardware components, all branch node reduction outputs are identical (i.e. the reduced data generated for each output is the same). To create a new branch, select Insert an item to the RIGHT from the branch node's right-click menu or drag-n-drop the item onto the branch node. Branches are displayed and reduced in the order added.



**Figure 4-9. Waveform branch node.**

#### 4.3.4.3 Multiple reduction output (multi-out)

Soft items with multiple reduction outputs are limited to the Image Divider, but will soon include the FROG item, the Mixer item and any other item that generates multiple output waveforms and/or images during reduction. Multi-out items behave like branch nodes, but have unique outputs. Connection of a node to the multi-out's output side requires user selection of an available reduction output. A label identifying the selected reduction output is displayed next to the connected node (Figure 4-10).



**Figure 4-10. Image divider node with three reduction outputs.**

#### 4.3.4.3.1 Switches and multi-port (adder/splitter)

These items are hardware components that have a single port on one side, multiple ports on the other side, and can be oriented with their multi-port sides towards the instrument or towards the sensor. A multi-port item that splits one signal from a sensor into multiple outputs is called a *splitter*. A multi-port item that combines multiple sensor signals into a single output is called an *adder*.

If the switch or multi-port has multiple inputs (ports on the sensor side), parallel sub-lines are constructed to indicate the components connected to each port. All sublines are located below the main line, in the order constructed (see the switch in the first row of Figure 4-11). If the switch/multi-port item is added with multiple outputs (ports on the instrument side), one of its outputs is on the same line as the switch/multi-port item and all other outputs are connected via graph lines to other signal lines (see the splitter node in the third row of Figure 4-11). In addition, switches select a single input or output port to be connected at any given time. The current switch position is displayed under the switch node and the active port's connecting edge is displayed with a solid line, while all other port edges are displayed with a dashed line. Double-click on a switch node to change its active port.

Switch/multi-port items have individual characterization curves for each port, so each port is numbered. An available port number must be selected whenever a node is attached to the switch/multi-port's multiple port side. The port number is then displayed in the graph near each node that connects to the switch/multi-port.

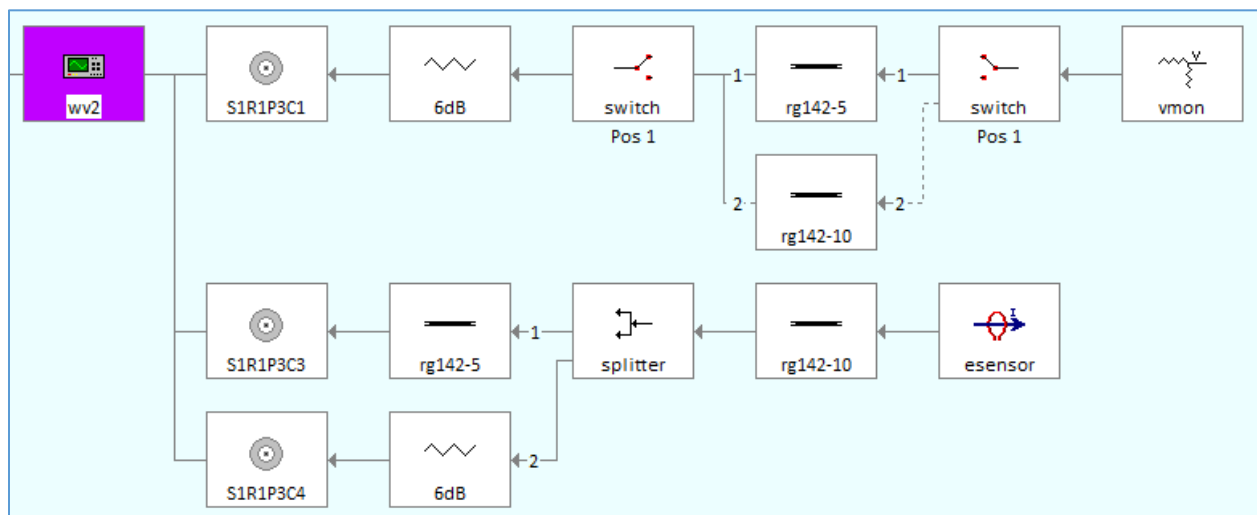
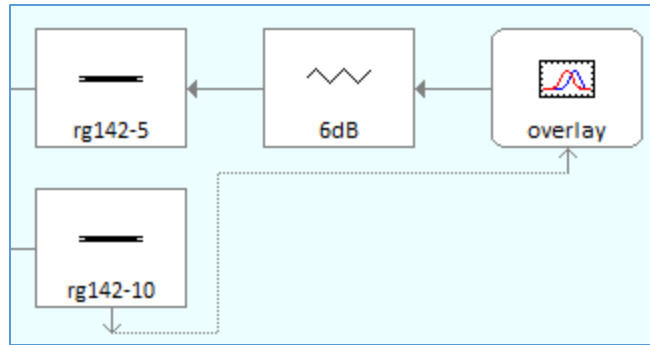


Figure 4-11. Switches and multi-port (splitter) nodes

#### 4.3.4.3.2 Combine and Overlay

This group of soft items are initially added to the graph like any other single-input/single-output node. Once added in the normal manner, the user can select outputs from other nodes as combine/overlay reduction operands. To specify an operand, choose Select Combine / Overlay Operand from the combine/overlay node's right-click menu, then click on the operand node. Directional connecting edges from operand node to combine/overlay node originate and terminate at the bottoms of the nodes and are drawn using a dotted line (see Figure 4-12). To remove a node as an operand, choose Unlink from Combine/Overlay from the operand node's right-click menu.



**Figure 4-12. Overlay node**

### **4.3.5 Cal Items Inventory**

Cal Item nodes are the graphical representations of signal line components. Each component (or component group) in the physical acquisition line should be represented in the Cal Graph, and the Cal Item should accurately characterize the real component. All Cal Items are inventoried and therefore must be created, configured, and added to the database before they can be used in the graph.

Cal Items are created in the main Inventory List that is accessed from the Inventory menu or toolbar button. See Section 4.4.7 for more information.

## **4.4 Working with the Cal Graph**

### **4.4.1 Creating the graph**

To create a new graph:

1. Right-click on any instrument node and select “Insert channel...” from the menu. The Cal Lines dialog will open.
2. If necessary, expand the channels for the desired instruments by clicking “+” next to the instrument name.
3. Double-click the desired channel. The New Cal Line dialog will open.
4. Enter an optional description, then choose OK. The new channel’s settings dialog will open.
5. Configure the channel settings, being sure to specify the signal class, then choose OK.
6. Continue adding channels from the Cal Lines dialog if desired.
7. Choose Done to close the Cal Lines dialog and return to the graph.

Populate the new Cal Line by using either the Inventory List available from the Inventory menu, or by using the Drag and Drop Inventory List.

### **4.4.2 Editing the graph’s appearance**

Many aspects of the displayed graph’s appearance can be changed, including the size, colors, and style of the components within the graph.

To edit the graph’s appearance:

- Right-click over a blank area in the graph and select the Display Preferences menu to configure all settings;
- Press the Ctrl key and scroll the mouse wheel to directly change the graph zoom value.

#### **4.4.3 Printing the current graph**

When printed, all Cal Items in the graph are listed and grouped by instrument and channel. The items are printed in the order that they appear in the graph. Cal Item information includes item type, name, description, delay and calibration factor.

As an option, barcodes can be printed above each Cal Item. Settings for barcode printing are found in the Barcode Tuning dialog, which is available by selecting Preferences | Barcode Print Setup from the menu.

To print the current graph:

1. From the File menu, select Print Graph Items. Alternatively, select Print Graph Items from a station, instrument or channel node to print that portion of the graph.
2. A Print Configuration dialog will be displayed to select the printout format. Specify the settings and press OK.
3. The standard Print dialog will then appear to select and configure the printer. Specify the printer settings and press OK to generate the printout.

#### **4.4.4 Exporting the graph to DXF**

Graphical representations of selected instruments in the current graph can be exported in DXF format.

To export the graph to a DXF file:

1. From the File menu, select DXF Export Graph. A dialog will open that instructs you to use the mouse to select the instruments that should be exported. Press OK.
2. With the mouse, click on the instruments that should be included in the DXF file.
3. When all of the desired instruments are selected, click within the background space of the graph to end instrument selection. A Save As dialog will open.
4. If desired, navigate to a directory for the DXF file to be exported to and enter a name for the file.
5. Choose Save. A confirmation dialog will open to display the number of lines exported to the DXF file and the directory location of it.
6. Choose OK to close this confirmation dialog and return to the Cal Graph.

#### **4.4.5 Instruments**

##### **4.4.5.1 Inserting instruments**

Instruments that are available in TestMan's inventory from can be added to the Cal Graph for reduction. (Refer to Section 4.7.14 for instructions on adding instruments to TestMan's inventory.) Note that when new instruments are added in TestMan, an instrument node is automatically added to the graph. Instrument nodes are also automatically added and placed into the graph as necessary when a channel is selected from the Cal Lines dialog.

To insert an instrument:

1. Select the Station | Graph Lines menu. The Cal Lines dialog will appear.
2. In the tree control, expand the instrument to be added, then double-click a channel. The New Cal Line dialog will appear.
3. Enter an optional description, then choose OK. The channel's Reduction page will appear.
4. Change the Reduction settings as desired, then choose OK. The new channel will be checked under the new instrument in the Cal Lines dialog.

5. If desired, continue adding channels by following steps 2 through 4, or choose Done. The instrument and its configured channels will appear in the graph.

#### 4.4.5.2 Deleting instruments

When an instrument node is deleted from the graph, its channels are removed and the Cal Items attached to those channels are removed and returned to the inventory list. Deleting an instrument from the graph does not remove it from the instrument list (i.e., the instrument is still displayed in the instrument list and is available for data acquisition). Deleting an instrument from the instrument list, on the other hand, also removes it from the graph.

To delete an instrument from the graph:

1. Right-click the instrument node and select the “Delete this instrument node” menu item.
2. A confirmation dialog will appear before the instrument is deleted.
3. Choose OK to delete the instrument node and all of its children, or Cancel to leave the instrument in the graph.

#### 4.4.6 Channels and Cal Lines

##### 4.4.6.1 Inserting channels

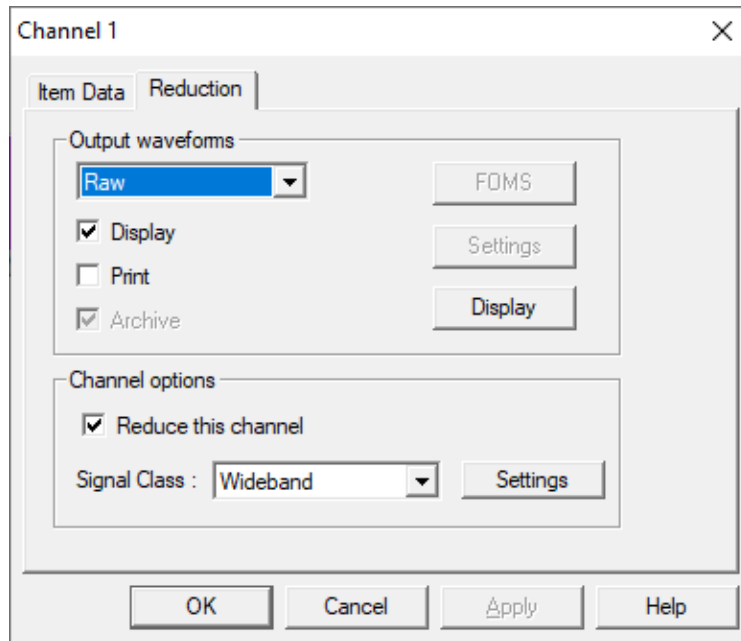
Channels mark the beginning of the Cal Line. They are placed to the right of the instruments from which they extend. An acquisition line must begin with an instrument’s channel.

To insert a channel:

1. Either right-click an instrument choose the “Insert channel” menu item, or choose Station | Graph Lines from the main menu bar
2. The Cal Lines dialog will appear. (See Figure 4-16)
3. Double-click the instrument to open its list of channels, then double-click the desired channel. The New Cal Line dialog will appear.
4. Enter an optional description, then choose OK. The channel’s Reduction page will appear.
5. Modify the settings as necessary, then choose OK.
6. If desired, continue selecting channels to add from the Cal Lines dialog by repeating steps 2 through 4.
7. Choose Finished. The new channels will be added to the graph.

Once an instrument and its first channel are inserted into the graph, subsequent channels for this instrument are inserted the same way.

**The Channel Reduction** page configures the reduction settings for channels. It will be activated automatically when a new channel is created, and can be accessed at any time by double-clicking on a channel node.



**Figure 4-13. Cal Item Configuration Dialog - Channel Reduction Page**

**Output waveforms.** Contains a list of the waveforms that are generated by the cal item. When this dialog is opened by double-clicking on the channel, it will only contain one option “Raw”

**Display.** When checked, the associated output data will be displayed in the Analyze module

**Print.** When checked, the associated output data will be sent to printer

**Archive.** When checked, the associated output data will be saved to the database

**FOMs.** Click this button to open the Figures of Merit dialog (Figure 4-20) to select which FOMs will be calculated for the selected output waveform. This option is disabled when editing channel settings because FOMs can only be calculated on reduced waveforms

**Settings.** Opens a settings dialog that has specific configuration settings for the selected output waveform

**Display.** Opens the Display Options dialog which allows you to set the display axis limits

**Reduce this Channel.** When checked, reduction is performed during online or offline reduction. If it is not checked, no items in the line will be reduced.

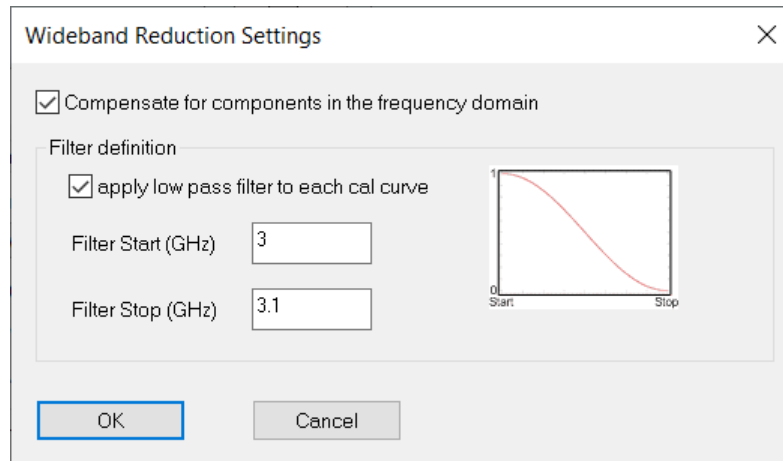
**Signal Class.** Selects the type of data that this line will process (wideband, narrowband, image, or frequency sweep). The Settings button (described below) activates a configuration dialog that sets the reduction options based on the Signal Class.

**Settings.** Activates a configuration dialog corresponding to the currently selected Signal Class

Be sure to specify the proper signal class before adding Cal Items to the Cal Line. The various Cal Items are not compatible with all signal classes (e.g., you cannot add an image processing Cal Item to a channel with a wideband signal class).

#### 4.4.6.1.1 Wideband settings, Channel Reduction page

When the Wideband setting is selected from the Signal Class control on the Channel Reduction page, clicking Settings opens the Wideband Reduction Settings dialog. The dialog is used to configure the reduction settings for wideband waveform data.



**Figure 4-14. Wideband Reduction Configuration**

#### Compensate for Components in the Frequency Domain

If not selected, the DC (0 Hz) value of the characterization curve is applied directly to the input waveform in the time domain. If the curve is not defined at 0 Hz, the curve value at the lowest frequency is used.

If selected, the input waveform is converted to the frequency domain. The gain at each input waveform frequency is looked up in the gain vs. frequency characterization curve, and then applied to the input waveform. The reduced waveform is then converted back to the time domain.

**Filter Definition.** This filter is used to prevent over-amplification of high frequency noise in the input waveform. The filter is applied to the input waveform after it is converted to the frequency domain. The applied filter is a cosine function that rolls from a scale value of 1.0 to a scale value of 0.0

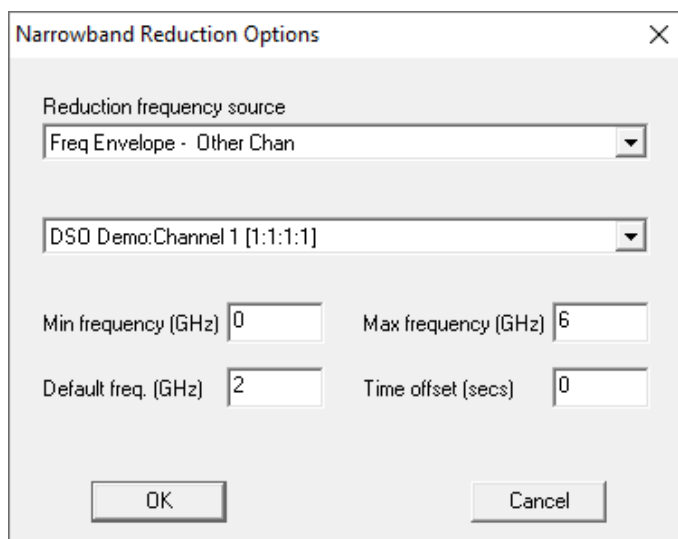
**Filter Start.** Indicates the starting frequency (in GHz) of the roll-off filter. At the start frequency, the filter scale value is 1.0

**Filter Stop.** Indicates the end frequency (in GHz) of the roll-off filter. At this frequency, the filter scale value is 0.0.

#### 4.4.6.1.2 Narrowband settings, Channel Reduction page

When the narrowband Signal Class is selected, Settings opens the Narrowband Reduction Options dialog. It configures narrowband parameters for the Cal Line. Narrowband reduction assumes that at each point in time, only one frequency is present in the signal. That frequency, however, may change over time. Narrowband channels may also use mixer or crystal detection to convert high frequency signals to lower frequencies prior to recording. Mixer and direct-write channels are capable of performing the down-conversion in a manner that allows construction of a frequency vs. time waveform. This waveform can

then be referenced by other channels to determine the frequency at any point in the signal, and thus use the appropriate correction factor.



**Figure 4-15. Narrowband Reduction Configuration**

From the Frequency Source during Reduction list, select the source of the frequency vs. time information. The options are as follows:

**Freq Envelope - Other Chan.** Use the frequency vs. time information from some other channel. Select the channel from the list in this dialog box.

**Freq Envelope - This Chan.** Derive the frequency vs. time information from this channel's data.

**Local Constant.** Use the default frequency (specified in this dialog) over the entire waveform.

**Global Constant.** Use the global frequency (specified in the Global Reduction Parameters dialog, Section 4.7.8.2) over the entire waveform.

**Instrument Setting.** Use the setting from a computer-controlled instrument that provides the system's reference frequency (see Section 4.5).

The Min Freq and Max Freq values limit the returned value from the frequency lookup. The Time Offset accounts for time delays between the data on this channel and the data from the frequency vs. time reference channel. The specified time offset is subtracted from this Cal Line's waveforms before the frequency vs. time lookup is performed.

#### **4.4.6.1.3 Image settings, Channel Reduction page**

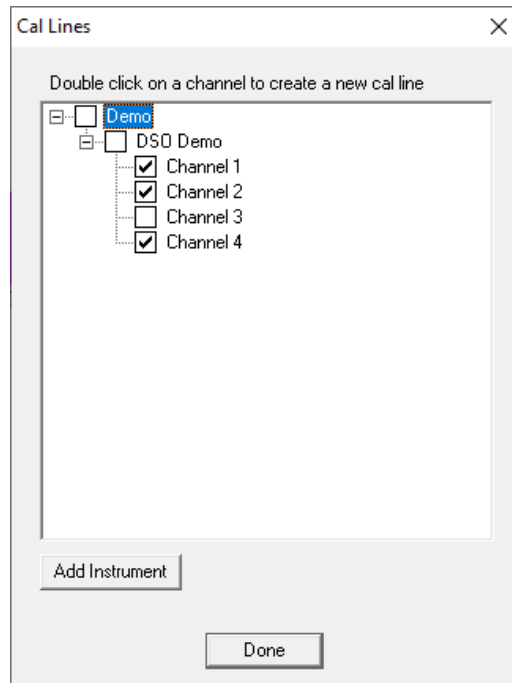
The Image signal class has no channel reduction settings at this time.

#### **4.4.6.2 Inserting Cal Lines**

Because Cal Lines start with a channel, Cal Line creation begins when channel nodes are inserted into the graph. See Section 4.4.6.1 for instructions. Once the Channel is included in the graph, Cal Items can be added to complete the Cal Line



**The Cal Lines dialog** lists all available instruments and channels for the current station. A check mark beside the channel indicates that it is already selected and displayed in the Cal Graph. Only those channels that have not been selected are available. The dialog is opened by selecting the instrument in the graph, right-clicking and selecting Insert channel from the popup menu. An alternative is to go to the menu Graph | Lines option.



**Figure 4-16. Cal Lines Dialog**

Channels are selected for insertion into the graph by double-clicking them. Channels are always placed in the graph beside and under their corresponding instrument. If necessary, an instrument node is automatically created when a channel is selected.

#### 4.4.6.3 Deleting channels

To delete a channel:

1. In the Cal Graph, activate the channel with the right mouse button to display its menu.
2. Select Delete this item. A confirmation dialog will appear.
3. Choose OK to delete the channel, or Cancel to leave it in the graph.

An alternate method is to select the channel so that it is active, then press [Delete].

When a channel is deleted, all Cal Items for the deleted Cal Line are removed from the graph and returned to the inventory. When the last or only channel under an instrument is deleted, the instrument node also will be removed.

#### 4.4.6.4 Copying Cal Lines

To copy a Cal Line:

1. Click on the left-most Cal Item in the Cal Line segment to be copied. It should be the Cal Item that marks the beginning of the Cal Line segment. This does not have to be the first Cal Item on the line, and it cannot be an instrument or a channel node.
2. Press [Ctrl]+[C] to copy the Cal Line segment to your computer's Clipboard.
3. Click on the Cal Item to the left of where the Cal Line segment should be copied. Press [Ctrl]+[V] to insert the Cal Line segment. The copied Cal Line segment will appear in the destination Cal Line.

If the copied Cal Line contains Multi-Port Cal Items such as Adders, then all lines attached to it will be copied as well. When copying Splitters, the outputs that branch to other lines will be disabled, but the first output to the left will be enabled and set to Port 1 automatically.

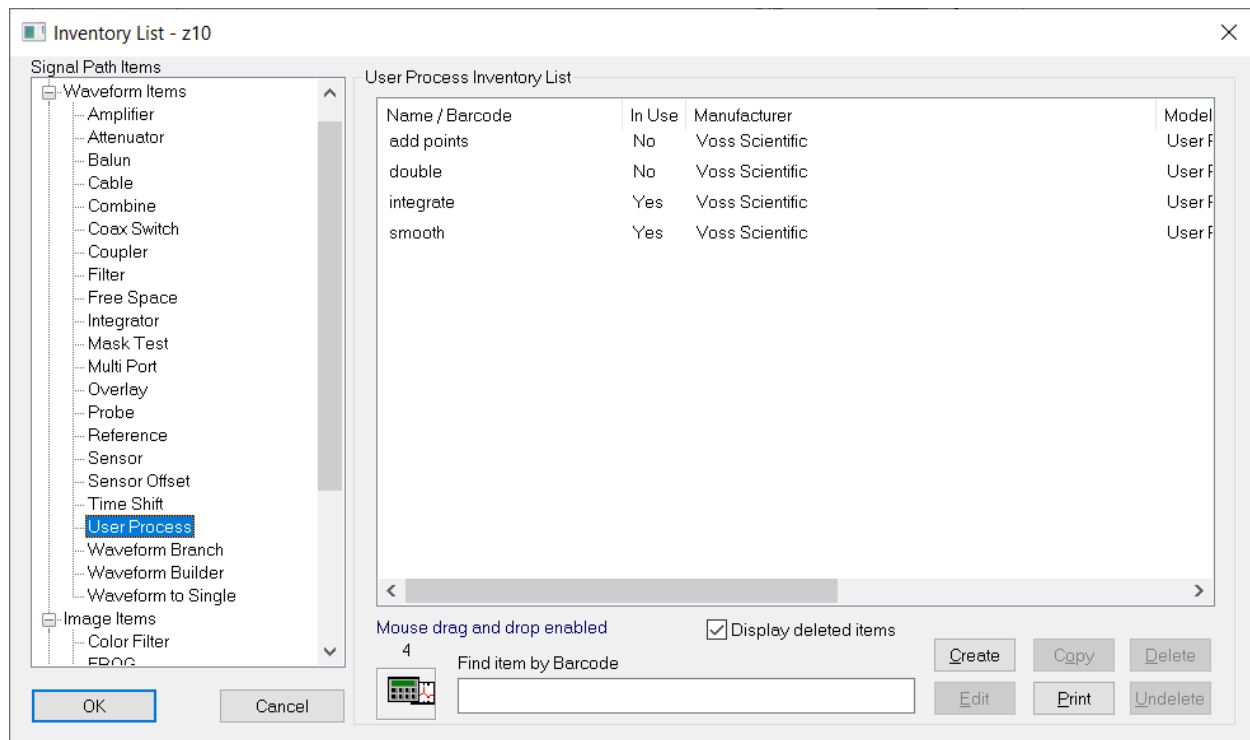
#### **4.4.7 Cal Items**

##### **4.4.7.1 Inventory List dialog**

The Inventory List dialog creates, edits and deletes Cal Items and is also used to select items for insertion into the graph. The list is available from Inventory | Inventory List or by selecting a channel or Cal Item, right-clicking and choosing Insert Cal Item from the popup menu.

**Cal Item Type.** This list contains all Cal Item devices supported by TestMan. Select the Cal Item type to edit, create, delete or print. Items already existing in the database are listed in the right-hand list. When the Cal Item Types selection changes, the currently inventoried types are displayed in the Inventory List, an icon of the current item is displayed and the total number of items listed in the Inventory List is displayed.

**<Type> Inventory List.** This list contains the Cal Items already in the inventory for the current type selected from the Cal Item Types list on the left. The items displayed in this list depend on the features of the installed DAAAC™ system. For all systems, at least Name, In Use and Description are listed. For performance reasons, the Description field is not initially displayed for any item. To display the description, select the item with the mouse by clicking it once.



**Figure 4-17. Cal Item Inventory List**

A compact drag-and-drop inventory list is also available, but is used only for inserting items into the graph; you can't create or edit items from this dialog. See Section 4.4.7.4 for specifics.

**Name/Retrieve Item by Name.** Retrieves items for editing if the name is known. This speeds retrieval operations for large inventory systems. After this field is completed, use [Tab] to exit the field. This retrieves the item from the database. If found, it will be listed alone in the Inventory List box. If it is not in the database, a message is displayed.

**Create.** To create a new Cal Item, select the type of item from Cal Items Type list (Amplifier, Attenuator, Balun, Bdot, etc.), then select Create. An Inventory Data page for that Cal Item will open. Enter the data to configure the new Cal Item, then select OK. The new Cal Item is then added to the Inventory List.

**Edit.** To edit the settings for an existing Cal Item, either double-click the item in the Cal Item's Inventory List column, or highlight the desired item then select Edit. Edit the item as desired, then select OK. The Cal Item is then updated in the Inventory List.

**Print.** To print a listing of the entire inventory of items, or only the current items displayed in the Inventory List, select the print command. This activates a message dialog that requires you to select an option. Choose either "Only the items displayed in the item inventory list" to print the current selection's inventory, or select "The ENTIRE list of items in the inventory" to print all of the Cal Item types. Selecting the entire list of items in the inventory prints all Cal Items in the database, which may require considerable time if the database is large.

**Delete.** To delete a Cal Item, highlight the item in the Item Inventory List and press Delete. Be certain that you really want to delete the item because it will be permanently removed from the list and cannot be undeleted without special access privileges.

**Display Deleted Items.** Include items that have been deleted in the Inventory List.

#### 4.4.7.2 Creating Cal Items

Before Cal Items can be added to the Cal Lines in TestMan's graph, they must be created and added to the Inventory List.

To create and add Cal Items to the Inventory List:

1. From the Inventory menu, select Inventory List. The Item Inventory List dialog will appear.
2. Select a Cal Item Type from the left column. A list of similar Cal Items will appear in the right column, if any have been previously created.
3. Choose Create. An empty Cal Item dialog will appear.
4. Enter a name and description, as well as any item-specific settings.
5. Choose OK. The new Cal Item will appear in the right column of the Inventory List.
6. To close the Inventory List, choose OK.

The new Cal Items are now ready to be inserted into Cal Lines. For more information, see Section 4.4.7.4

##### 4.4.7.2.1 Item Data page, Cal Item dialog

The Item Data page is first displayed when opening the Cal Item dialog. The dialog is opened when creating a cal item in the inventory list or by double-clicking a cal item in the graph to edit it. It contains item type-specific properties, most of which can be edited. At a minimum, the page will contain a name and description. The name field must be unique, as this is the primary identifier for the Cal Item. The description field is optional. Figure 4-18 shows the Item Data page for a Cable cal item.

Cable: rg142-10

Item Data

Name/Description

Name: rg142-10

Description: 10' rg142

Cable Type: RG142

Connectors

Connector A: SMA Male

Connector B: SMA Male

Delay: 14.73 ns

Length: 10.00 feet

☒ electrical delay is included in the phase data

Curve Setup

Gain Curve

TDR Curve

OK Cancel Apply Help

**Figure 4-18. Example item configuration dialog**

Cal Items that are used in the graph multiple times share a single copy of the item characterization data. For example, if the gain for a 6 dB attenuator is changed from -6.1 to -6.2, every occurrence of that attenuator in the graph will use the new -6.2 value. Data entered on the Reduction page, however, is unique to each node in the graph (see Section 4.4.7.2.3).

#### **4.4.7.2.2 Inventory Data page, Cal Item dialog [keyed option]**

The Cal Item Inventory Data page is used for entering and displaying Cal Item inventory data for systems under strict inventory control. Strict inventory control means that each item must be uniquely identified by manufacturer/model/serial number and no item may be used more than once in a system configuration graph. When strict inventory control is enabled, the Inventory Data page is the first page of every Cal Item's interface. The page does not appear in systems without strict inventory control.

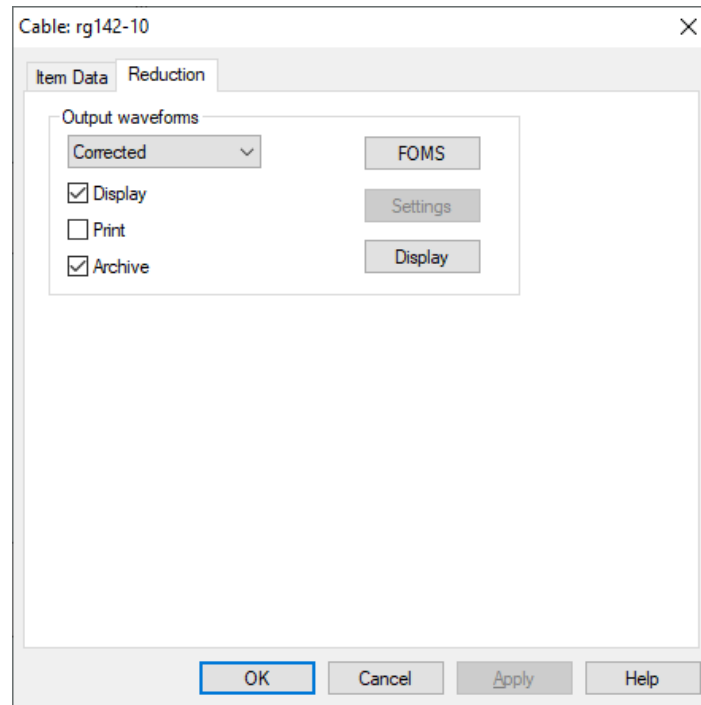
The Inventory Data page is the same for all Cal Items. The first three fields — Serial number, Manufacturer and Model number— create a unique database key. When combined, this key must be unique among all Cal Items.

PropID (property identification) and File # fields are available for additional documentation, but are not required as unique identifiers.

Although not part of the Cal Item's database key, Barcode is a required field. Each barcode entry must be unique. In inventory-controlled systems, the Barcode is used in place of the Item Name to identify the item.

#### **4.4.7.2.3 Reduction page, Cal Item dialog**

The Reduction page of the Cal Item dialog is used to specify post-reduction options for each node in the graph. If the associated cal item generates multiple output waveforms and/or images, each node output will have its own set of reduction options. Most items generate a single output and use the default output waveform name, "Corrected". Cal Items that generate multiple waveforms and/or images will list outputs by name. For example, a mixer has outputs "Power vs Time", "Freq vs Time", "Uncorrected Spectrum", an "Corrected Spectrum". Reduction options are only available for Cal Items that have been added to the graph, i.e., reduction items are associated with graph nodes. If the same Cal Item is added to the graph multiple times, each occurrence of the item has its own set of reduction options.



**Figure 4-19. Cal Item Reduction Tab**

**Output list.** Lists the available output data objects (waveforms or images) generated by this cal item. Most items have a single output called “Corrected”.

**Display.** When enabled, the resulting, reduced waveform is displayed in the Analyze module (if Analyze is running and configured to display reduced data) during reduction.

**Print.** When enabled, the resulting, reduced waveform is printed from the Analyze module (if Analyze is running and configured to accept reduced data) during reduction.

**Archive.** When enabled, the resulting reduced waveform will be stored in the database.

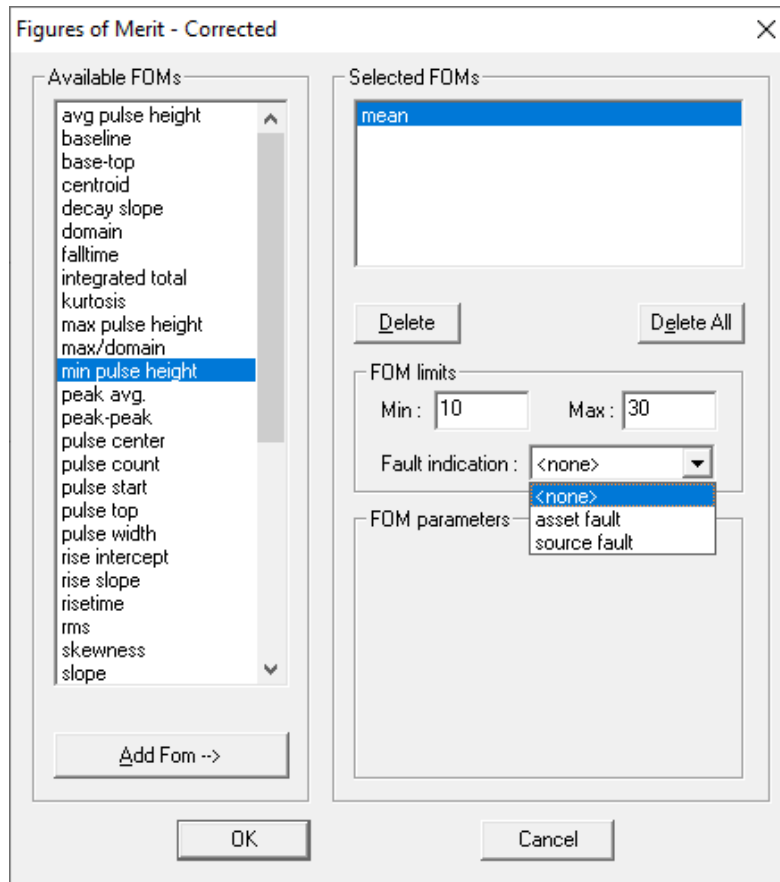
**FOMs.** Activates the FOMs dialog, which configures various Figures of Merit. See the discussion immediately below.

**Settings.** Activates the appropriate Settings dialog, based on the output waveform type selected. Currently, the Mixer and Direct Write items’ outputs are the only waveforms that can be configured.

**Display.** Set the display axes limits. X and Y Axis limits may be independently assigned to auto-scale or use fixed, user-defined values.

#### **4.4.7.2.3.1 FOMs page**

The FOMs page configures Figures of Merit for the current Cal Item. FOMs are metrics derived or computed from the graph node’s output data. FOMs are archived with the data and displayed on the waveform in the Analyze module. See Section 10 for a complete description of the available FOMs. FOMs and their associated limits are important when running automated test sequences, as they can be configured to indicate faults in the test asset and/or source hardware.



**Figure 4-20. FOMs Configuration**

**Available FOMs.** List of available FOMs. To add a FOM to the reduction waveform, highlight the desired name in this list, then select Add FOM

**Add FOM.** Add the currently selected FOM name to the Selected FOMs list

**Selected FOMs.** Listing of selected FOMs

**Min.** The minimum acceptable value for the highlighted FOM in Selected FOMs

**Max.** The maximum acceptable value for the highlighted FOM in Selected FOMs

**Fault Indication.** If the FOM is outside of the range specified by the Min/Max fields, this type of fault will be emitted. See Section 4.5.7 for more information about faults

**FOM parameters.** Specific settings for the highlighted FOM in Selected FOMs

To specify and configure a FOM, highlight the desired FOM from the list of Available FOMs, then select Add Fom to add the FOM to the Selected FOMs list. The FOM is moved from the available list to the Selected FOMs list; each FOM may be selected only once.

To delete a FOM from the Display FOMs list, highlight it and press the [Del] key or the Delete button. It then will be removed from the Selected FOMs list and added back to the available list.

Each FOM type defines different parameters. These parameters may be entered when the FOM is created (added to the Display FOMs list), or may be edited when the FOM in the Display FOM List is highlighted. The edited data is accepted when the dialog is dismissed or when another FOM is selected.

To edit the min, max and FOM-specific parameters, click on a FOM in the Selected list. The min and max values are available for all selected waveform FOMs, but need not be entered. If they are entered and the computed FOM value falls outside the specified limits, the waveform is marked “out of spec”. Out-of-spec waveforms are displayed with a yellow background in Analyze. To disable use of the min and max limits, set both values to 0.

If a waveform is marked “out of spec” because the computed FOM value is outside the specified limits, you can additionally have it emit either an “asset fault” or a “source fault”. See Section 4.5.7 for more information about faults.

**Curve dialog.** Many Cal Items are characterized by a curve, such as gain vs. frequency. The Curve dialog configures this type of characterization data for a Cal Item. This dialog can be accessed through the Curve button on the Item Data page for such Cal Items. A curve can be either a polynomial value (up to eighth-order) or a measured characterization waveform, typically produced using a network analyzer.

The screenshot shows the 'Curve Specification' dialog box. At the top, 'Curve Type' is set to 'Polynomial' with a dropdown arrow. To its right, the text 'Gain vs. Frequency (GHz, dB)' is displayed. Below this, a polynomial equation is shown with input fields for coefficients:  $-2.9 + -0.2x + 0.02x^2 + 0x^3 + 0x^4 + 0x^5 + 0x^6 + 0x^7 + 0x^8$ . In the center is a graph with a green background. The y-axis is labeled '(dB)' with values -3 and -3.4. The x-axis is labeled '(GHz)' with values 0 and 2. A black curve starts at approximately (0, -2.9) and slopes downward. To the right of the graph, 'Display domain' settings are shown: 'Min (GHz):' with a value of 0.0 and 'Max (GHz):' with a value of 3. Below the graph, there are two text fields: 'Title:' containing 'polynomial preview' and 'Comment:' containing ' $f(x) = -2.9 + -0.2x + 0.02x^2$ '. At the bottom left, under 'Retrieve Waveform', are three buttons: 'Processed', 'Raw', and 'File Import'. At the bottom right, under 'Send Waveform to Analyze', is a 'Send' button. At the very bottom are 'OK' and 'Cancel' buttons.

**Figure 4-21 - Cal Item Curve Configuration – Polynomial Configuration.**



**Polynomial.** When selected, activates the Polynomial curve interface. The defined polynomial then is used to characterize the Cal Item during reduction.

**Get Raw.** When selected, activates the Polynomial curve interface. The defined polynomial then is used to characterize the Cal Item during reduction.

**Get Processed.** Select a Processed waveform from the database (enabled when Curve Type is set to “Waveform”)

**File Import.** Import a waveform file from the disk (enabled when Curve Type is set to “Waveform”)

Polynomial curve specifications are typically used for items that have a relatively flat or linear response over the operational frequency range, although higher order polynomials are supported. Note that the standard units for polynomials are dB vs. GHz. The use of GHz instead of Hz removes the need for excessively small scaling factors for the high-order terms. Also note that most items use gain vs. frequency, which means that attenuation is specified as a negative gain value. For example, the cal factor for a 6 dB attenuator would be -6.

If a characterization waveform has been created for the Cal Item with a network analyzer or other instrument, the waveform can be directly assigned to characterize the Cal Item. The Waveform view of the Curve Specification dialog displays the current waveform, and allows selection of a new waveform. If you select Raw or Processed, a retrieve file dialog will appear for selection of a waveform from the database.

If File Import is selected, an Open File dialog will appear for choosing a data file to import. Once the file is selected, the Waveform Import Titles dialog will appear, to enter axis titles and units. This version of the file importer supports only comma-separated ASCII data without header information. Magnitude-only files should contain x, y pairs; real / imaginary and magnitude / phase files should contain x, y, z triples. Real / imaginary format files will be automatically converted to magnitude / phase. Frequency (x axis) data should be in units of Hz. If the data appears to be in units of GHz, you will be prompted to auto-convert the values to Hz. Phase data, if present, should be in units of radians. Because phase data can contain multiple cycles, it's range in radians can be similar to that of data in degrees. The software therefore does not auto-convert data that is in degrees. While most components use (Hz, dB, radians), some components use other units so be sure to check the expected units text at the top of the Curve Specification dialog.

To import additional data formats, first import the file using the Archive module's importer, then modify the waveform as necessary in Analyze and store the result, then select the resulting waveform using the Processed button in the Curve Specification dialog.

#### 4.4.7.3 Printing the Cal Item inventory

Printing Cal Items is available only from the Inventory List dialog of the Inventory menu. You can either print the inventory of Cal Items by type or print the entire inventory of Cal Items.

To print the Cal Item inventory:

1. Open the Inventory List by selecting it from Inventory | Inventory List
2. If you want to print the inventory of only one type of Cal Item, select the type from the left column
3. Choose Print. The Inventory Printing dialog will appear
4. Select whether the inventory for a single type of Cal Item should be printed, or if the entire inventory of Cal Items should be printed

5. Choose OK to continue, or Cancel to abandon the printing. If OK is selected, the standard Print dialog will appear.
6. Make any changes that may be necessary to the print settings, then choose OK.
7. Choose OK to close the Inventory List.

#### 4.4.7.4 Inserting Cal Items

Cal Items can be added to the right or left of other Cal Item nodes in the graph, but only to the right of channel nodes. Two methods are available for inserting Cal Items into the Cal Graph: the main Inventory List, and Drag-and-Drop Inventory List.

From within the graph, the Inventory List inserts a single Cal Item to either side of other Cal Items, or to the right of channels.

To add a Cal Item to the graph:

1. Right-click the Cal Item beside which the new Cal Item should be inserted.
2. Select an “Insert New Item” command from the popup menu. The Inventory List will appear.
3. Select the type of Cal Item from the left column, then a specific Cal Item from the right column.
4. Choose OK. The selected Cal Item will appear in the graph.

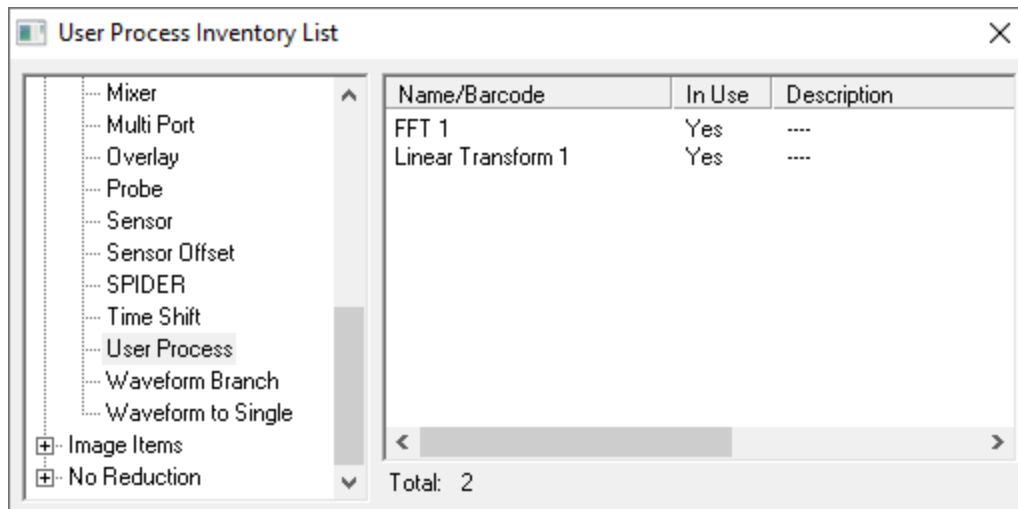
An alternate method is to use the Drag-and-Drop Inventory List. Unlike the regular Inventory List, this list is used only for adding items to the graph; items cannot be created, edited or deleted from the Drag and Drop list.

Some Cal Items require additional information before they can be inserted into the graph. When adding Splitters or Coax-Switches, TestMan will ask you to select an output port. This port will be linked to the Cal Item beside which the new Cal Item is to be inserted. Likewise, an input port must be selected for Cal Items that are attached to the right of Adders. See Section 8.3 for more information.

##### 4.4.7.4.1 Using the Compact Drag and Drop Inventory List

Once the Cal Items are created with the Inventory List dialog, they can be added to Cal Lines with the compact Drag-and-Drop Inventory List. The Inventory | Drag and Drop Inventory List... dialog inserts Cal Items into TestMan’s graph by “dragging” them from the list, then “dropping” them on top of other Cal Items in the graph. The new Cal Item then is inserted to the right of the target Cal Item.

Note that the main inventory list dialog also supports drag-n-drop operation. This interface provides a more compact version of that dialog that is often used when adding numerous items to the graph.



**Figure 4-22 - Drag-and-Drop Item Insertion Dialog.**

**Left List.** Lists the Cal Item types supported by the current DAAAC installation

**Right List.** Current inventory of all Cal Items of the type selected in the left-side list.

To add Cal Items with the Drag and Drop Inventory List:

1. Using the Scroll bars, position the graph so that the Cal Item's intended drop position is visible. The graph cannot be scrolled while dragging and dropping a Cal Item with the mouse.
2. Open the Drag and Drop Inventory List by selecting it from the Inventory menu, then move it to a convenient location that does not cover the destination Cal Line.
3. Highlight the Cal Item type in the left column. A list of specific Cal Items will be displayed in the right column.
4. Click on and hold the specific Cal Item in the right list with the left mouse button, then drag it to the drop position in the graph. The mouse pointer will change into a standard Window's arrow, plus the Cal Item icon.
5. Drop the Cal Item onto an existing node. The tip of the mouse pointer's arrow is the center of the drop point, and it must be within a Cal Item node's boundary for the drop to be valid. The new item will always be inserted to the right of this target Cal Item.
6. When done adding Cal Items to the graph, close the Drag and Drop Inventory List by clicking its Close box in the top-right corner.

When running in networked mode, a separate Drag and Drop Inventory List must be opened for each graph that will have Cal Items added. For example, when two stations are open, a separate inventory dialog must be opened for each. Also, when dragging items out of the window assigned to this dialog, the pointer will change to a circle to indicate dropping will not be allowed. The pointer with the Cal Item icon indicates that the current window is valid.

#### 4.4.7.5 Copying and Moving Cal Items

Cal Items can be copied or moved from one Cal Line to another, but some restrictions apply. Strict inventoried systems may copy only the few Cal Item types that are never under inventory control. These are the Combine, Overlay and User-Process Cal Items. Cal Items or Cal Lines may be copied only to other Cal Lines.

To copy or move Cal Items individually or as a group:

1. Use the mouse to drag a selection box around the Cal Item—or a series of Cal Items within a single Cal Line—to select it/them. When you release the mouse button, the selected Cal Items will be highlighted.
2. With the left mouse button, click into and drag the selected Cal Items to the node where they should be copied. When you release the mouse button, a popup menu will appear beside the cursor.
3. Choose Copy or Move. The selected items will be copied or moved to the right of the selected destination node. Choosing Cancel from the popup menu will abort the operation.

If any Cal Items that are moved include Multi-port nodes – or are attached to Multi-port Cal Items – any links to the Multi-port items will be broken. See Section 8.3 for more information on Multi-port items.

An alternate method of copying or moving Cal Items is to use the keyboard. Cal Items can be selected with the arrow keys. Holding the [Shift] key selects a range of Cal Items. Once the Cal Items are selected, press [Control] + [C] or select Copy from the Edit menu to copy the Cal Items to the computer's Clipboard. Scroll the graph to the destination, then press [Control] + [V] to paste copied Cal Items or [Control] + [X] to move the Cal Items to the new location.

For more information, see Section 4.4.6.4.

#### 4.4.7.6 Editing Cal Items

After a Cal Item is placed in TestMan's graph, most of its properties can be edited. However, for strict inventoried systems, inventory data may not be changed.

To edit a Cal Item:

1. Double-click the Cal Item node in the graph, or press [Enter] if it is active and highlighted. The appropriate Cal Item dialog will appear. Make the required changes.
2. Choose OK to implement the changes, or Cancel to abandon the changes.

A Cal Item's settings are also available from the Inventory List by selecting it from right-hand column, then choosing Edit.

Some Cal Item settings cannot be changed after the item is created. For example, the number of ports for Multi-Port Cal Items can only be specified when the item is created. Also, the direction of the signal (multi-in/multi-out) may not be changed for Multi-Port Cal Items once placed in the graph. Properties related to the component's calibration/characterization settings may be updated at any time.

#### 4.4.7.7 Deleting Cal Items

Cal Items can be deleted either individually or as a group within a Cal Line. To delete a Cal Item:
























1. Select the Cal Item or group of Cal Items to be deleted by dragging a selection box around the Cal Items to be deleted. They will be highlight to indicate that they are marked for deletion.
2. Click any Cal Item in the series of selected Cal Items and press the [Delete] key, or chose Delete from the Edit menu. A confirmation dialog box will appear.
3. Select Yes to remove all selected Cal Items, No to remove only the currently active Cal Item, or Cancel to abort the deletion without making changes to the graph.










An alternate method is to click inside the block of highlighted Cal Items with the right mouse button to activate the pop-up menu, then select Delete from the pop-up menu.












When a Cal Item is deleted, it is returned to the Inventory List for use later. Likewise, channels that have been deleted become available again from the list of Cal Lines in the Cal Lines dialog.

#### 4.4.7.8 Cal Item Types

TestMan supports three general categories of Cal Items – Waveform Reduction, Image Reduction and No Reduction. As the names imply, Waveform items operate on waveform and single-point data; Image items operate on image data; No Reduction items are only for signal path documentation and do not support data processing. The item types currently supported under each category are shown below. Section 8 presents each of the Cal Items in detail.

<b>Waveform</b>		
 Antenna	 Amplifier	 Attenuator
 Balun	 Cable	 Coax Switch
 Combine	 Coupler	 Crystal
 Direct Write	 Filter	 Free Space
 Integrator	 Mixer	 Multi-port
 Overlay	 Probe	 Sensor
 Sensor Offset	 Time Shift	 User Process
 Waveform Branch	 Waveform to Single	

<b>Image</b>		
 Color Filter	 Image Branch	 Image Combine
 Image Divider	 Image Process	 Image to Contour
 Image to Waveform	 Image Axes	 ND Filter

<b>No reduction</b>		
 Bdot	 BiasT	 BPM
 CVR	 Delay/Phase	 Edot
 Feed through	 Reference	 Terminator
 Transformer	 Volt Divider	

Descriptions of the specific controls for each item type can be found in Section 8. Cal Items with special abilities or additional configuration requirements are discussed in the following sections.

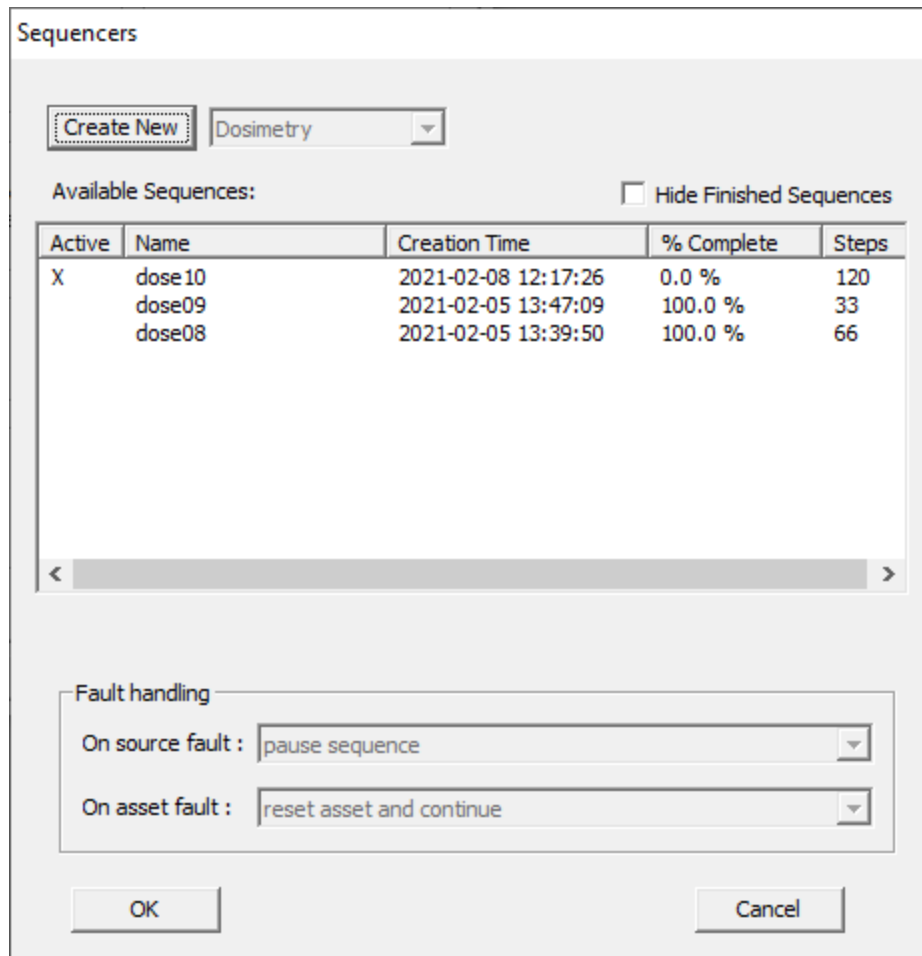
## 4.5 TestMan Sequence Mode [keyed option]

TestMan has an optional capability called sequence mode, which allows the user to automate the execution of a series of acquisitions, where instrument parameters are varied according to predefined criteria. Any waveforms collected while running a sequence are automatically tagged with the name of the sequence (see Section 6.2.14 for a discussion on tagged waveforms).

### 4.5.1 Creating a Sequence

To create a sequence:

- 1) Open up the Configure Acquisition dialog (menu: Acquisition | Configure)
- 2) Select the Acquisition tab
- 3) Ensure Acquisition Mode is set to “Single Shot” and the “Sequence” checkbox is checked
- 4) Click “Define”. The “Sequencers” dialog will open up (Figure 4-23)
- 5) Select a sequence type from the drop list at the top and click “Create New”. The following sections explain how to define each type of sequence



**Figure 4-23 Sequencers dialog**

#### **4.5.2 Creating a Scanner sequence**

The dialog in Figure 4-24 is used to create a Scanner sequence. The first item to take note of is the list of Control Parameters. This list is generated from the instruments list: all instruments with sequence-configurable controls appear here. For example, in Figure 4-24, the instruments named LO #1 and LO #2 each allow the sequence to control the Frequency and Power parameters, and the Aeroflex instrument allows the attenuator level to be set on each of its two channels.

Double-clicking on the control parameter you would like to configure opens the Scan Parameter dialog (Figure 4-25). There are seven options that allow you to specify how the parameters are stepped: Instrument, Fixed, Stepped (linear), Stepped (exponential), Random, Derived, and List. Each option is described below.

Depending on the number of steps for each modifiable control parameter, a sequence may have hundreds or even thousands of shots.

When N parameters are configured in the Scanner sequence dialog (Figure 4-24), the sequencer uses N-nested loops to explore the entire parameter space. As noted in the dialog, control parameters are ordered from innermost loop to outermost loop in the dialog. You can rearrange their order by dragging within the parameter list.

Sequencer : Scanner

Name :  Total scan points : 1

Control parameters (ordered innermost to outermost in scan loop) :

	Instrument [chan]	Parameter	Type
1	aeroflex [1]	Attenuator Level 1	Ignore
2	aeroflex [2]	Attenuator Level 2	Ignore
3	LO #1 [0]	LO Frequency	Ignore
4	LO #1 [0]	LO Power	Ignore
5	LO #2 [0]	LO Frequency	Ignore
6	LO #2 [0]	LO Power	Ignore

Options

☒ Run an acquisition to validate the asset before starting the sequence

Test point repetitions : no asset fault :  asset fault detected :

☒ Skip current innermost parameter value after detection of  repetition faults

☒ Skip steps after detection of  faults (cumulative over the inner scan loop)

☐ Skip steps after no faults detected on  consecutive steps

Skip remaining steps for  innermost control parameters

Attempt to reset the asset up to  times following an asset fault

☐ Run an acquisition to validate the asset after each reset

OK Cancel

Figure 4-24 Scanner sequencer dialog

Scan Parameter

Name : 83623A:LO Frequency

Hardware limits

Minimum	10 M	Min. step : 1
Maximum	20 G	

Type :

Reference :

Start value:

End value:  1 G

Multiplier:

No. values:

Values

OK Cancel



**Figure 4-25 Scan Parameter dialog**

#### 4.5.2.1 Parameter Types

**Instrument.** This parameter will not be changed by the sequencer. It will retain whatever value it was set to in the instrument's settings dialog.

**Fixed.** This parameter will be set by the sequencer to the value specified in this dialog box. It will not be varied.

**Stepped (linear).** You must specify a start value, an end value, and either a step size or the number of steps to use. The sequencer will vary this control parameter on each shot from the start value to the end value at the specified step size.

**Stepped (exponential).** You must specify a start value, an end value, and either a multiplier or the number of steps to use. The sequencer will vary this control parameter on each shot, starting at the start value and multiplying by the multiplier until the end value is met or exceeded.

**Random.** You must specify a min value, a max value, and a count. This control will be randomly set to a value between min and max (inclusive) on each shot.

**Derived.** This control parameter is set based on the value of another control parameter. Choose the reference control parameter from the "Reference" drop list and set the coefficients A, B, and C in the following equation, where X is the value of the reference control parameter, and Y is the calculated value for this control parameter.  $Y = AX + B + \frac{C}{X}$

**List.** Specify a list of values for this control parameter. The sequencer steps through this list in order to set the value for each shot.

#### 4.5.2.2 Scanner Options

The Options section of the dialog in Figure 4-24 contains various settings that affect how the sequence is run. These settings are described here.

**Run an acquisition to validate the asset before starting the sequence.** If selected, an acquisition is run before the sequence starts, to check for an operational asset. If an asset fault is detected, the sequence is not started and the user is alerted.

**Test Point Repetitions.** This field allows you to set the number of times to repeat a specific shot (a shot is one acquisition with a specific set of instrument control parameters). The first box, "no asset fault" sets the number of times to repeat the shot if no asset fault is detected (See Section 4.5.7 for a discussion on faults). The second box, "asset fault detected" sets the number of times to repeat if an asset fault is detected. For example, if the first box is set to 3 and the second is set to 5, the shot will repeat 3 times if no asset fault is detected, but if any of those shots result in a fault it will be repeated 5 times.

**Skip current innermost parameter value after detection of N repetition faults.** This option is designed to be used in conjunction with the test point repetitions options. If the specified number of faults occur within a repetition of the same step, the current value of the innermost parameter is skipped for the remainder of the scan sequence. The faults are not required to be consecutive. For example, assume the inner loop of the scan sets a frequency, the current frequency value is 1.1 GHz, the fault limit is 3, and the number of repetitions for the asset fault case is 5. If 3, 4, or 5 acquisitions at the current step result

in faults, then the 1.1 GHz control value will be skipped for all remaining sequencer steps. Note that the number of faults specified here cannot be greater than the number of repetitions for the asset fault case.

**Skip steps after detection of N faults.** If this option is enabled and N faults have been detected within the current inner loop, the sequencer will skip the remainder of the inner loop steps, moving to the next value(s) at the outer loop(s). For example, assume power is the inner loop and frequency is the outer loop, with the number of faults set to 4. If 4 asset faults are detected while executing the power loop, the remainder of the power settings will be skipped and the scanner will move to the next frequency setting and the starting power setting. Note that the faults do not have to be consecutive and if repetition is use, each repetition fault will count towards the fault total.

**Skip steps after no faults detected on N consecutive steps.** If this option is enabled and N steps are executed without any faults, the sequencer will skip the remainder of the inner loop steps, moving to the next value(s) at the outer loop(s). It is essentially the inverse of the above. If it is enabled, the sequencer will skip to the next step in the sequence if N consecutive shots **do not** result in a fault

**Attempt to reset the asset up to N times following an asset fault.** Generally, when an asset fault is received, it means the asset is in an abnormal state and must be reset. This field tells the sequencer how many times to attempt to reset the asset following a fault, before declaring that the asset needs manual intervention and aborting the sequence.

**Run an acquisition to validate the asset after each reset.** If selected, an acquisition is run each time the DUT is reset, to check for an operational asset. If an asset fault is detected during the validation acquisition, the sequence is stopped and the user is alerted.

#### 4.5.3 *Creating a Genetic sequence*

The genetic algorithm sequencer performs a nondeterministic and sparse traversal of a parameter space. A genetic algorithm is an evolutionary optimization algorithm based on the process of natural selection. The algorithm uses a population of candidate solution vectors, with each member being described by its “chromosome” – a set of control parameter values. Multiple generations of the population are created until the algorithm’s termination criteria are satisfied.

Termination criteria typically include discovery of a near-optimal solution, and a threshold on the number of algorithm iterations. After beginning with a random population, each new generation is obtained from the previous generation using crossover and mutation. Crossover combines attributes from two or more members of the population to create a new member. Mutation introduces random changes to a member’s chromosome. At each stage, the algorithm preferentially selects members based on their fitness, a metric that indicates that member’s ability to provide an optimal solution to the problem at hand.

A general genetic algorithm sequence is:

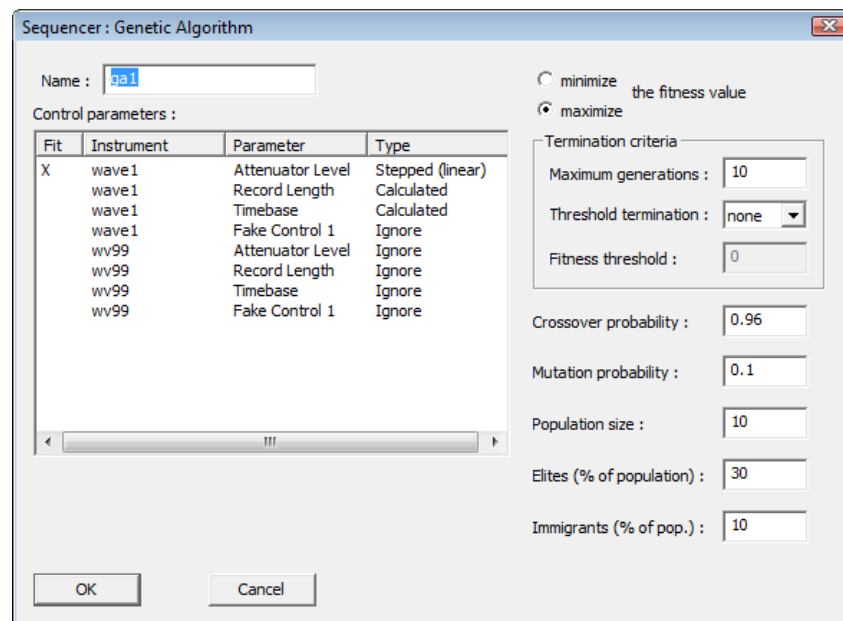
1. Begin with a set of randomized test points in the search space, the *population*.
2. Evaluate each point in this set for its *fitness*.
3. Sort the population by its fitness.
4. Randomly select test points from above the population median for crossover. Call these the *parents*.
5. Split the parent chromosomes at the same random partition point. Create pairs of *offspring* test points, initialized to opposite chromosome sections from the parents.

6. Replace least-fit test points with the new offspring test points.
7. Apply a random offset to each of the controls in the new test points (*mutation*).
8. Replace least-fit test points with new randomized test points.
9. Repeat steps 2-8 until a desired *fitness level* or number of iterations is achieved. Fitness level may be defined using one or more members of the population (e.g., the highest fitness levels among all members, or the average fitness level of the top 50%).

The creation of a new generation from its predecessor is the core of the genetic algorithm. Several variations of this algorithm exist, with the following presently implemented:

1. Sort the existing population by fitness.
2. Copy a user specified number of “elites”, those with the best fitness, directly to the next generation.
3. Select breeding pairs from the current generation. The algorithm presently uses tournament selection with  $\frac{1}{2}$  the total population.
4. Create two offspring from each breeding pair, using one-point crossover with a random split point. This method splits the parents’ chromosomes and then swaps the second part of the split chromosomes.
5. Mutate the children, with user specified probability.
6. Generate a user specified number of “immigrants”, which are entirely new individuals with random chromosomes.

Figure 4-26 shows the available settings for configuration of a genetic algorithm. The number of elites and immigrants are specified by the user as a percentage of the population. The remainder of the population will be comprised of offspring. A single fitness control is allowed and is marked in the list of control parameters. All other control parameters are either part of the chromosome or are unused. The algorithm supports user specification of fitness value minimization or maximization.



**Figure 4-26 Genetic algorithm sequencer configuration**

#### 4.5.4 Sequence Live Display

When you start running a Scanner sequence for the first time, you will be asked if you would like to create a live display. The live display (Figure 4-30) is best suited for two-parameter scans and provides a real-time visualization of the parameter combinations were tested and which ones induced faults. The live display is configured using the Sequencer Live Display Config dialog box (Figure 4-27). The fields in this dialog are described below.

**Plot Name.** Display title for this plot (multiple Live Displays can be configured for any one sequence)

**Plot Type.** Options are Linear, Log Y, Log X, and Log-Log. They refer to how the axes are scaled

**Label.** The display label for this axis

**Auto Scale.** If enabled, the axes will automatically scale to fit the data. Otherwise, the axes limits must be set by the user with the Min and Max fields

**Configure Source.** Opens the Axis Config dialog (Figure 4-28) to select the source data for each axis

The axes values are configured using the Axis Config dialog. To use this dialog, first select either Sequence Control Param or FOM from the Axis Value Source list. If you select the former, you must choose the control parameter with which to associate this axis. If you select the latter, you will need to select the Instrument, Channel, Cal Item, Output Waveform, and a FOM to calculate. This axis will then be associated with the chosen FOM.

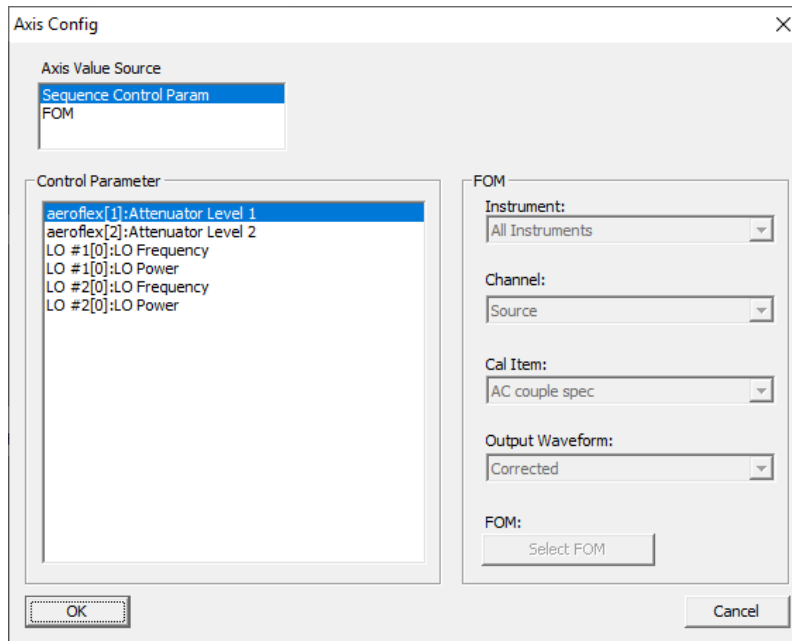
The dialog box is titled "Live Display Config" and contains the following sections:

- Plot Name:** A text field containing "Demo".
- Plot Type:** A dropdown menu set to "Linear".
- Vertical Axis:**
  - Label:** A text field containing "Frequency".
  - Min:** A text field containing "0.0".
  - Max:** A text field containing "1".
  - Auto Scale:** A checked checkbox.
  - Configure Source:** A button.
  - Control param:** A text field containing "LO #1[0]:LO Frequency".
- Horizontal Axis:**
  - Label:** A text field containing "Power".
  - Min:** A text field containing "0.0".
  - Max:** A text field containing "1".
  - Autoscale:** A checked checkbox.
  - Configure Source:** A button.
  - Channel:** A text field containing "Fwd Pwr, Cal item: 6 dB, Fom: peak avg."
- Faults:** A table with the following data:

Fault Name	Enabled	Channel	Cal Item	FOM Name
Test Fault 1	Yes	S269R1P6C1	Effect	Y max
Test Fault 2	Yes	S269R1P6C1	Effect	mean

At the bottom are "OK" and "Cancel" buttons.

Figure 4-27 Sequence Live Display Config dialog



**Figure 4-28 Axis Config dialog for live plots**

#### **4.5.5 Test Execution Window**

When running a sequence, TestMan uses a dedicated child window with two tabs to display data during test execution. The first tab displays the sequence state and the second tab displays one or more live display plots (Figure 4-30). The window is automatically created and displayed upon commencement of a sequence and continues to display live updates while the sequence runs. The execution windows does not replace the test configuration window (instruments and graph), so both may be viewed while the test is running.

The Sequence State window contains four sections: Sequence Overview, Sequence Log, Fault Density Plot, and Step Inspector. The Live Display tab contains a sub-window for each live display that has been configured.

##### **4.5.5.1 Sequence Overview**

This section is in the top-left corner of the window and contains an overview of the current state of the sequence. It lists the parameters that are being varied, the current value and step for each parameter, and various other statistics about the sequence.

##### **4.5.5.2 Sequence Log**

The Sequence Log is the large list on the right side of the window. It contains an entry for every shot that has been completed in the sequence. Fields include a timestamp, step number, repetition number, shot number, control values, list of faults, and user-defined notes. Notes can be added at any time by double-clicking on a row in the log.

#### 4.5.5.3 Fault Density Plot

The Fault Density Plot is immediately below the Sequence Overview and provides a nice visual of what regions of the parameter space resulted in faults. The horizontal axis tracks the innermost loop in the sequence, and the vertical axis tracks the second innermost loop. It is most useful for two-parameter Scanner type. Each rectangle within the plot represents a step in the sequence, and the color of the rectangle indicates the percentage of repetitions at that step that resulted in a fault. Black indicates 100% were faults, green indicates 0% were faults, and a gradient from yellow to orange for percentages that fall between 0 and 100%.

#### 4.5.5.4 Step Inspector

The Step Inspector is right below the Fault Density Plot. Clicking on a rectangle in the Fault Density plot will bring up details for that step in the Step Inspector. These details include all control parameter values, the range of shots (for multi-rep steps), the number of reps, and the number of faults.

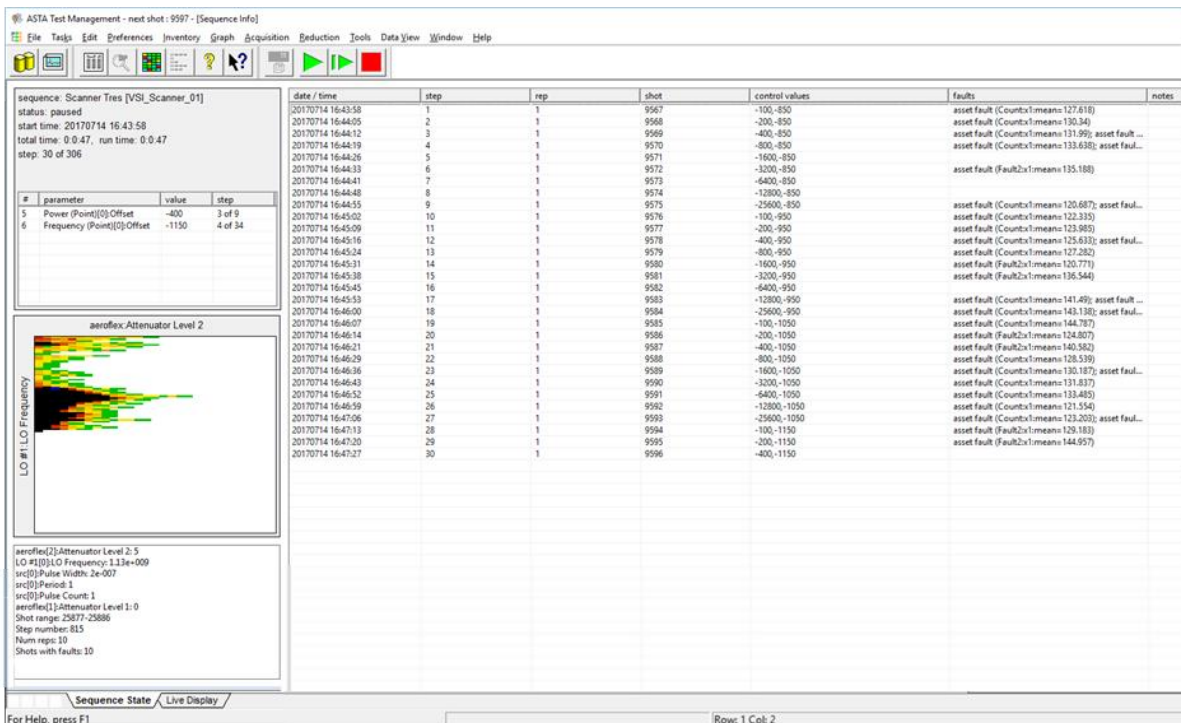
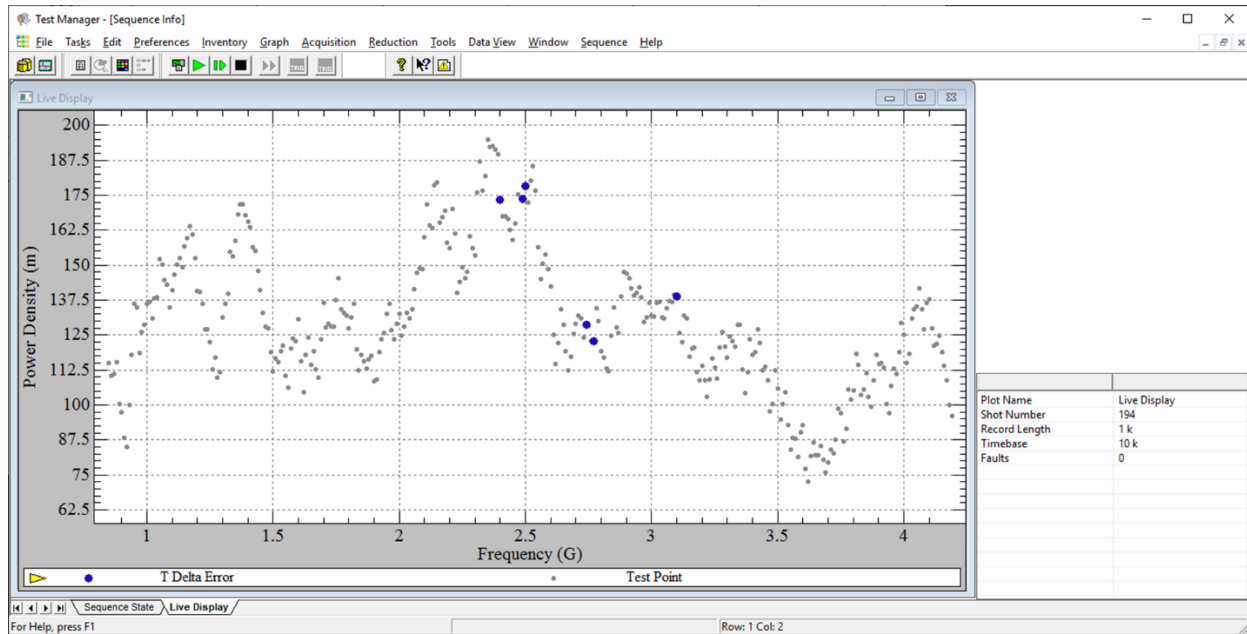


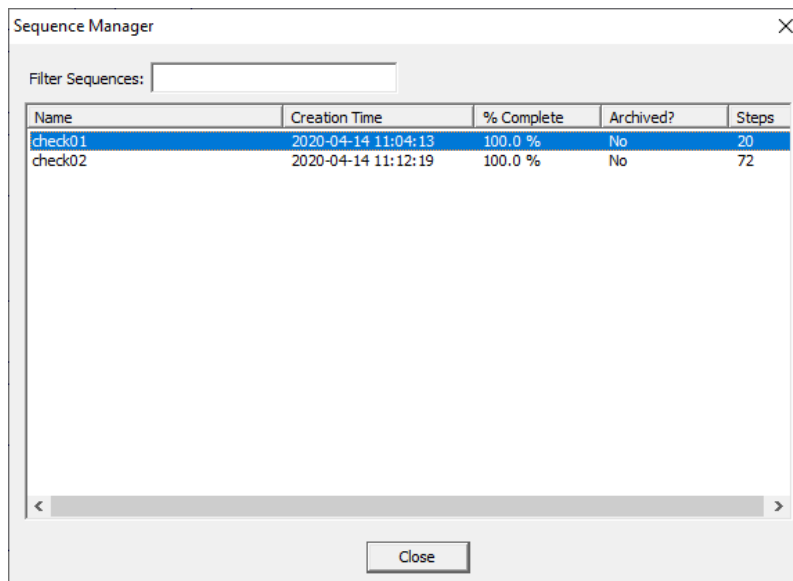
Figure 4-29 Test execution window showing the sequence state



**Figure 4-30 Test execution window showing a live data plot**

#### 4.5.6 Managing Sequences

The Sequence Manager dialog can be opened by navigating to the Sequence | Manage menu and provides a centralized way to export and view past sequences. This dialog shows a list of all sequences that have been created. Double-clicking on a sequence in this list allows you to view a read-only copy of the sequence settings. Right-clicking on a sequence brings up a context menu with the following options: Export; Fault Density Plot; Archive; and View.



**Figure 4-31 Sequence manager dialog**

#### 4.5.6.1 Export

Exporting a sequence brings up the Export Sequence dialog (Figure 4-32). This dialog allows you to export in two formats: CSV and for ANODE.

**CSV Export.** CSV Export will export the data as a table with one row per shot. It will include the following default columns: timestamp, shot number, repetition, faults, and sequence control values. You can also have it export certain FOMs for each shot. To do this, first select a channel and Cal Item, then select from the FOMs dropdown list, and finally click the “Add to Export List” button.

**ANODE Export.** This mode allows you to export a series of files that are intended to be fed into Leidos’ ANODE software. ANODE is used to generate Probability of Effect (Pe) curves from large sets of data. This export mode will prompt you to choose either one or two independent variables. Independent variables can be either FOMs or Control Parameters.

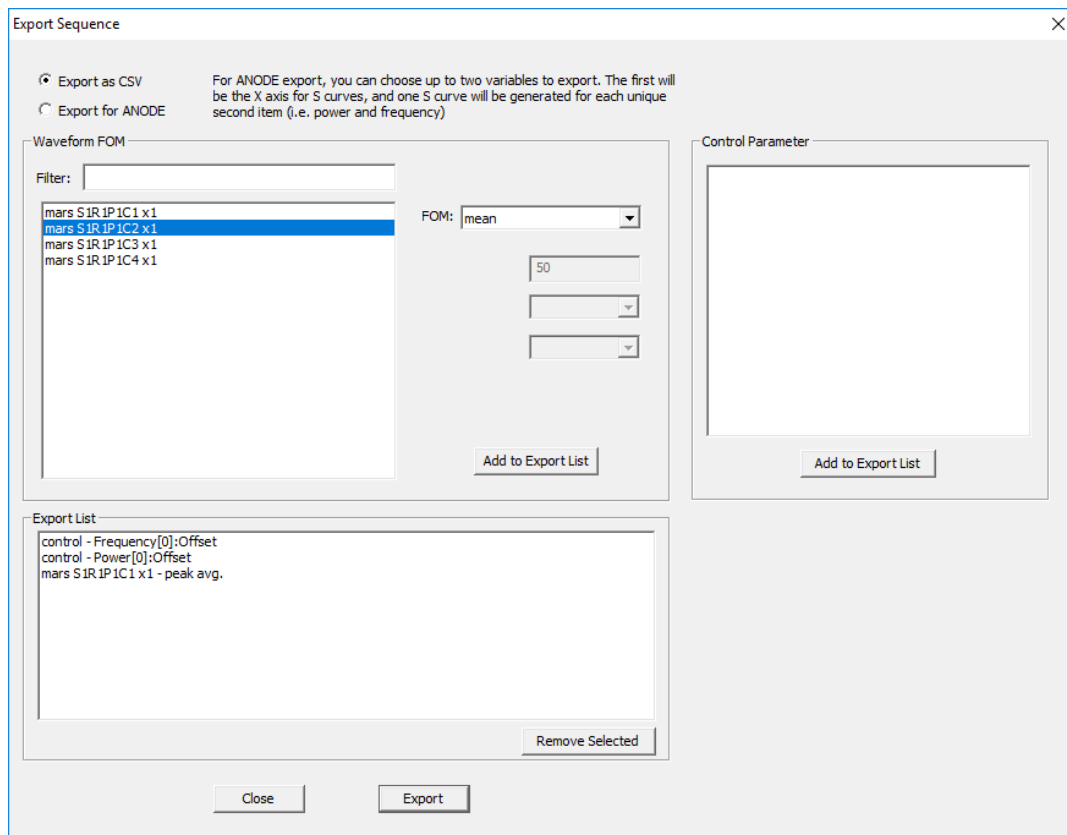


Figure 4-32 Export sequence dialog

#### 4.5.6.2 Fault Density Plot

The Fault Density Plot export tool is a more sophisticated version of the Fault Density Plot that is found in the Sequence State tab of the Test Execution Window (Section 4.5.5.3). In this export tool (Figure 4-33), [1] is the preview window. This window is updated in response to changes made via the controls



on the left side. Sections [2] and [3] each contain a list of the controls that were part of the sequence and allow the user to define the controls that represent each axis. Clicking on either of the “Edit Values” buttons at [4] turns the preview window into Axis Edit Mode. While in this mode, the user can click on the plot to toggle axis values on/off at any point.

The buttons at [5] are used to support disjoint ranges for control parameters. For example, in Figure 4-33, the test spans the frequency ranges 850 MHz to 1.7 GHz and 2.9 GHz to 3.1 GHz. Without the Auto Scale Gaps feature, 1.7 GHz data would appear immediately adjacent to 2.9 GHz data. The “Auto Scale Gaps” button works under the assumption that there may be gaps in the test domain and scales the plot accordingly. The “Reset Scale” button shows only the available data, with no gaps.

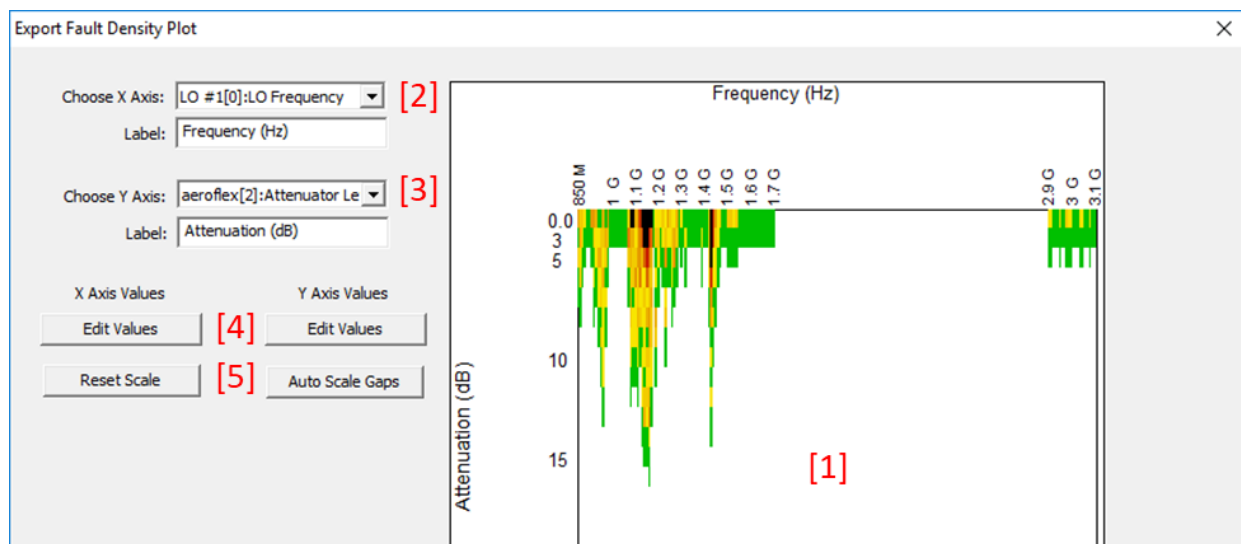


Figure 4-33 Fault density plot export dialog

#### 4.5.6.3 Archive

This option toggles whether or not the sequence is considered “archived”. Archived sequences still appear in the Sequence Manager dialog, but they do not appear in the Sequencers Dialog (Figure 4-23). This feature exists to avoid cluttering up the Sequencers Dialog.

#### 4.5.6.4 View

This option allows you to view the sequence as if it were currently running: the Test Execution Window (Section 4.5.5) for this sequence is opened.

### 4.5.7 Sequence Faults

There are currently two classes of sequence faults: asset faults and source faults. Each is used to indicate that there was a problem during the sequence.

When an asset fault is emitted, it means that an error was detected on the asset. The sequencer will attempt to reset the asset to a known state and the sequence will continue. If it is unable to reset the asset successfully, the sequence will be paused for user intervention.



When a source fault is emitted, it means that a critical error occurred. The default behavior is to stop the sequence and wait for user intervention.

The primary means of emitting sequence faults is via FOMs. You can configure FOMs to be calculated on data collected during a shot, and if the value for any FOM is out of range, a sequence fault will be emitted (see Section 4.4.7.2.3.1)







## 4.6 TestMan Toolbars

Toolbars are displayed across the top of the TestMan window, below the menu bar. The toolbars provide quick access to many of TestMan's primary functions. Display of individual toolbars is selected in the Preferences menu (Section 4.7.4). The following toolbars and buttons are available:



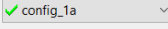

### Module toolbar

	Switch focus to the Archive module.
	Switch focus to the Analyze module.









### Graph / Station toolbar

	Open the Item Inventory list.
	Open the Insert Cal Line dialog.
	Open the graph search dialog to find nodes by name, description, or location.
	Open the Station Selection dialog [networked systems only].
	Take control of selected acquisition stations [networked systems only]. See Section 4.8.8.
	Release control of controlled acquisition stations [networked systems only].



### Named Configuration toolbar

	Display the named configuration management dialog (Section 4.8.1).
	Update selected named configuration using the current settings.
[named config list]	Lists all available named configurations and selects a configuration for Restore and Update operations. The most recently restored or saved named configuration is displayed with a check mark, e.g.,  .
	Restore the selected named configuration. See Section 4.8.1.3.

## Acquisition toolbar

	Open the Test Configuration dialog, used to configure single and multi-step acquisitions.
	Start the acquisition sequence.
	Run a single sequence step and then pause. Useful for sequences that require operator involvement at each step. [sequencer systems only]
	Stop at the conclusion of the current shot. Enabled in the Repetitive Single Shot and Sequence modes.
	Finish the acquisition with only the instruments that have triggered up to this point. This button is accessible once at least one instrument is in a triggered state. It is used in cases where some instruments fail to trigger, but data should be collected from the instruments that did trigger.
	Abort the current acquisition. The Abort button is accessible after an acquisition has been started and until an instrument has triggered. If the acquisition is aborted, no data is collected for the shot.
	Send a software (force) trigger to all recording devices that have not yet triggered. In most cases, untriggered digitizers will return baselines.
	Send a software trigger command to all timing instruments (delay generators) that are set to computer/manual trigger mode.

## Help toolbar

	Display the About dialog.
	Select and view a DAAAC log file.

### 4.6.1 Station Selection [networked acquisition]

When running a networked acquisition over multiple stations, the participating remote stations must first be selected for use by the Test Director station. This toolbar button displays a dialog to select the acquisition stations (Section 4.8.7). When that dialog is OK'd, TestMan closes all open station windows, then opens a document window for each selected station. Note that if Test Director has a local station, that station is always selected and displayed.





Toolbar:

### 4.6.2 Take / Release Control [networked acquisition]

The Take Control button transfers control from the remote stations to the Test Director station. Only selected remote stations (those displayed in TestMan's document windows - see previous section) are controlled. Once controlled, Test Director can manipulate the instruments in the remote station, and

those stations will be included in any acquisition sequences run from the Test Director station. To return control to the individual stations, use the Release Control button.


Toolbar:  (take control),  (release control)

#### **4.6.3 Start Acquisition (Go)**

Selecting the Start Acquisition button on the Toolbar begins an acquisition sequence. The Test Configuration dialog is displayed (see Section 4.6.4), then all uninitialized instruments are initialized, the instruments are armed and TestMan begins polling each instrument, waiting for a trigger. When all triggers are detected (or when a user-programmed timeout is reached), the data is downloaded from each instrument, sent to Analyze and stored in the database. If automatic data reduction is enabled, TestMan then reduces the data and sends the reduced data to the database and to Analyze.

Toolbar: 

#### **4.6.4 Test Configuration**

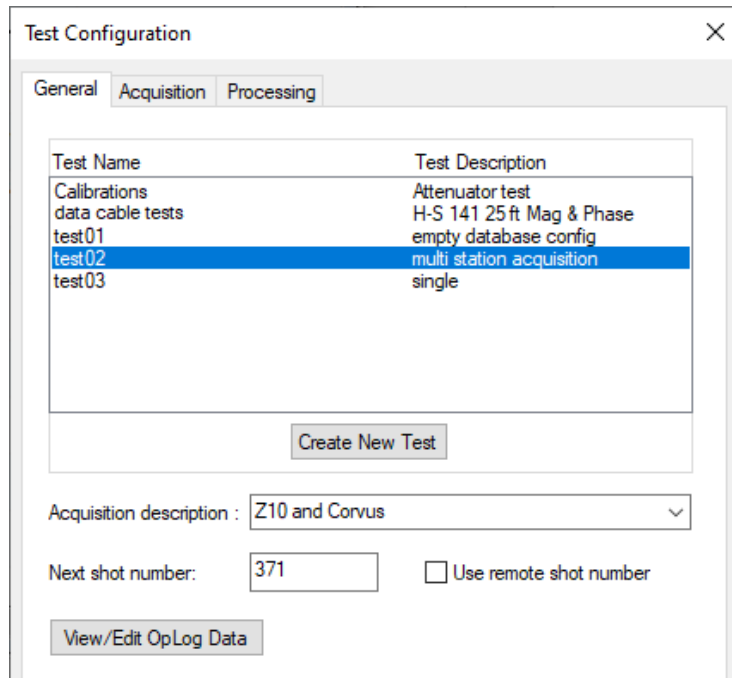
The Test Configuration dialog was introduced in Section 2.2.2.6 solely for the purpose of creating a test to allow the tutorial acquisition to occur. This dialog is also used to configure multiple aspects of the acquisition and data processing sequences. The Test Configuration dialog will be opened automatically when an automatic execution sequence is initiated by the  toolbar button or the Acquisition | Go menu item. The dialog can also be accessed at any time using the menu Acquisition | Acquisition Configuration.

The Test Configuration dialog's three pages support settings that apply to the acquisition and reduction sequence. The following sections describe each page in detail.

Toolbar: 

##### **4.6.4.1 General page, Test Configuration dialog**

The General page of the Global Settings dialog displays test names and descriptions, creates new tests, and configures settings related to shots for the currently selected test. This is the default page for the Global Settings dialog, and is activated when the Get Waveforms, Global Settings, Go or Arm buttons are selected.



**Figure 4-34 Test Configuration dialog - general settings**

The Test Name and Description list groups all system data by test at the highest level. The upcoming shot or burst data can be associated with an existing test, or a new test can be created.

**Test Name and Description.** Listing of previous and current test. The highlighted line selects the current test.

**Create New Test.** Activates the New Test dialog, used to enter test name and description. Each new test created with this function is then listed in the main window of this dialog.

**Acquisition Description.** An optional descriptive string for the current acquisition.

**Use Remote Shot Number.** If checked, the shot number is obtained from a remote source, such as a DAAAC log or API software. This is an optional feature, not included in most systems.

**Next Shot Number.** A serial value to be prepended to the Test Name to uniquely identify the acquired waveform. This value is automatically incremented by TestMan, or may be manually assigned. This control is disabled if Use Remote Shot Number is Enabled.

**View Log Pages.** Display or edit the Log Pages, which contain user-defined test data. This is an optional feature, not included in most systems.

#### 4.6.4.2 Create New Test

The Create New Test button creates new Tests for association with groups of acquisitions. Enter the test name and an optional description. When Add is selected, the test is created and added to the list on the General page. The new test then becomes the current test and is highlighted in the list. See Section 4.8.9.1.5.

#### 4.6.4.3 Processing page

The Processing page of the Global Settings dialog configures automated processing settings for the next shot, including data reduction and exports.

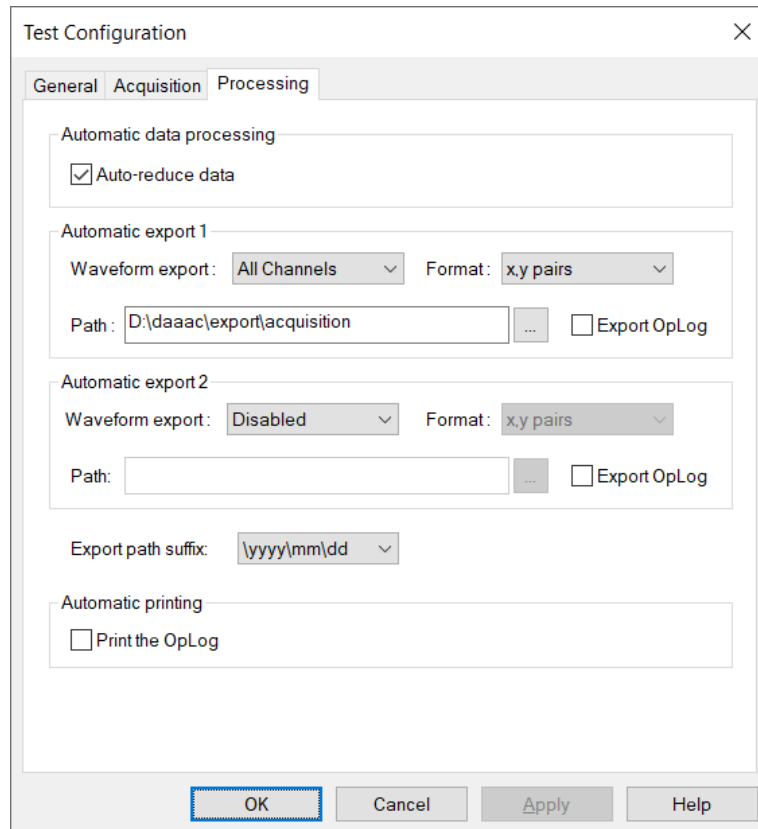


Figure 4-35 Test Configuration dialog - processing page

**Auto Reduce Data.** If selected TestMan will automatically reduce data following the acquisition of raw data from the instruments. If not selected, the reduction sequence can be initiated manually at any time.

**Automatic Export 1 & 2.** Supports automatic export of raw waveform data to two different locations and/or in two different formats.

**Waveform Export.** Allows selection of channel specific export, global export (all raw waveforms), or no export.

**Format.** File format used if global export (all waveforms) is selected.

**Path.** Location for raw waveform export files.

**Export Log.** Export an ASCII representation of the Log Page data, if defined.

**Export path suffix.** Applies the selected suffix to the specified export path(s). If the suffix is based on the current date, the path will change daily and all required subfolders will be automatically created. For

example, if the export path is C:\daaac\export and the suffix format is \yyyy\mm\dd, then data acquired on 10 AUG 2024 will be exported to the folder “C:\daaac\export\2024\08\10”.

**Print the OpLog.** Print the associated OpLog data if any have is defined.

#### 4.6.4.4 Acquisition page

The Test Configuration dialog’s Acquisition page configures acquisition-related settings for the next shot or sequence of shots. These settings include the acquisition mode (single shot, repetitive single shot, burst and repetitive burst), the sequencer, instrument front-panel locked out, and conditions for instrument initialization.

Test Configuration

General Acquisition Processing

Instrument Polling

☒ Poll instruments

☐ Poll idle instruments

Instrument Initialization

☐ Initialize on Go

☒ Initialize on OK

☒ Lockout front panels

Instrument Arm / Trigger

☒ Beep when armed

Single Point Data

☐ Spool forever

0 Number to spool

Acquisition mode

☐ Single Shot

☐ Repetitive Single Shot

☐ Burst

☒ Repetitive Burst

12 shots in burst

Instrument Burst Capacity

3 repetitions

☐ Repeat until abort

☐ Sequence Define

If no instruments trigger during an acquisition, create an empty shot record and increment the shot number?

☐ yes ☒ no ☐ ask

OK Cancel Apply Help

**Figure 4-36 Test Configuration dialog - acquisition page**

**Device Polling.** Instrument polling during idle time.

**Poll Interface.** When checked, instruments are polled and their status is updated at the time interval specified in the Poll Period field. Polling occurs during idle times, and not during acquisition. When polling, TestMan checks for the presence of a device at the address of each instrument in the configuration. This feature allows TestMan to determine whether a device is present, powered on and connected at each address. It reduces the incidence of interface-related errors when communication is attempted with an instrument.

**Poll Idle Instruments.** When checked, TestMan will poll all instruments in the instrument list, including those that have been set to idle (not participating in acquisitions). This polling mode is useful in situations where the user has many instruments in the rack, some of which the user knows are unavailable. Certain instrument drivers take several seconds to timeout when they are not connected, which slows the polling loop. This feature speeds up the polling loop in such cases by skipping those instruments that are marked as idle.

**Instrument Initialization.** Defines when to initialize instruments and sets front panel lock-out.

**Initialize on Go.** When checked, all instruments are initialized when the GO button is selected, regardless of their present status. Some instruments take a long time to initialize, so skipping repeated initializations by leaving this unchecked can speed up the sequence.

**Initialize on OK.** When checked, each instrument is initialized when OK is selected from the instrument's dialog. The instrument dialog is activated by double-clicking the instrument icon in TestMan's rack display.

**Lock Out Front Panels.** When this option is checked, TestMan attempts to lock out the instrument's front panel. This setting prevents users from inadvertently making the instrument settings inconsistent with the DAAAC settings.

**Arm/Trigger.** Options for the arm and trigger portions of the acquisition sequence

**Beep When Armed.** Causes the system to beep while armed, at an interval specified by the registry key HKLM\Software\VSI\DAAAC\BeepPeriod (default interval is 2 seconds).

**Single Point Data.** Settings for acquiring single-point, tabular data. Single point data can be accumulated over multiple shots to create multi-point tables or waveforms.

**Spool Forever.** Allows the data from single-point instruments (e.g., time interval meters, power meters, voltmeters) to be accumulated across many shots/bursts. This allows for easy trend analysis and graphing at the analysis stations. If enabled, single-point data from a given instrument channel is spooled cumulatively until the control is turned off.

**Number to Spool.** Number of single-point values to spool. This setting overrides the number of shots in Repetitive Single Shot/Burst mode. This value is ignored if Spool Forever is checked.

**Acquisition Mode.** Available modes for acquiring data.

**Single Shot.** The system arms each participating instrument for a single shot (trigger event). After the system triggers, data is read out, sent to the database and automatically processed if auto-reduction is enabled. If this control is selected, Shots to acquire, Shots in Burst, Repeat until abort and Instrument Burst Capacity are disabled.

**Repetitive Single Shot.** Like single shot except that when the acquisition sequence is complete the system will automatically re-arm the specified number of times. If this control is selected, Shots in Burst and Instrument Burst Capacity are disabled.

**Burst.** The system arms each instrument for the specified number of shots. Multiple shots (a burst) are stored internally in the digitizers and rearm rates are determined solely by the hardware. After the system triggers (all shots in the burst have been acquired), data is read out, sent to the database and automatically processed if auto-reduction is enabled. If this control is selected, Shots to acquire and Repeat until Abort are disabled.



**Repetitive Burst.** Like burst except that the system is automatically re-armed the specified number of times after the completion of each acquisition sequence. If this control is selected, Shots to acquire, Shots in Burst, Repeat until abort and Instrument Burst Capacity are enabled.

**Bursts to Acquire.** The number of shots or bursts for the current acquisition. This control may be enabled if Acquisition Mode is Repetitive Single Shot, Repetitive Burst or Pushbutton Acquisition. Otherwise it is disabled. In any case, the control is disabled if Repeat Until Abort is checked.

**Shots in Burst.** The number of shots per burst when in single or repetitive burst mode. This control is enabled if Acquisition Mode is Burst or Repetitive Burst. Otherwise it is disabled.

**Repeat Until Abort.** When checked, DAAAC acquires data until the Stop button is selected. The Shots/Bursts to Acquire field is not used in this mode. If this control is checked, Shots to Acquire will be disabled.

**Sequencer.** Executes the selected acquisition mode (single shot or burst) repeatedly in an automated sequence. See Section 4.5.

**Instrument Burst Capacity.** Activates the Burst Capacity dialog (Section 4.8.9.3.5), which displays the number of channels and the burst capacity for each instrument. This control is enabled if the Acquisition Mode is Burst or Repetitive Burst.

**Empty Shot Record Creation.** Configures the action to be taken in the event that an acquisition is started but no instruments trigger. Select yes to create an empty shot record, no to create no shot record, or ask to ask the operator if a shot record should be created.

## 4.7 TestMan Menus

The TestMan module's main menu has the following items:

Item	Description
File menu	Prints and exports graph and layout data
Tasks menu	Invokes other DAAAC modules
Edit	Supports graph editing operations
Preferences	Sets module and display preferences
Inventory	Manages the available signal path components
Station	Manages multiple stations and the station's graph
Acquisition	Configures and executes the acquisition sequence
Reduction	Configures and executes the data reduction sequence
Tools	Miscellaneous support tools
Sequence	Manages data collected by the sequencer [optional]

Cal System	Provides access to the cal system capabilities [optional]
Window	Arranges the displayed station windows
Help	Displays module information and log files

#### 4.7.1 File menu

TestMan's File menu includes the following items:

Item	Description
Print Graph Items	Prints a graphical or tabular representation of the entire graph. Subsets of the graph can be printed via the right click menu in the graph's instrument and channel nodes.
Export Graph	Exports the graph to a file in either DXF or CSV format.
Export Timing Configuration	Export the timing instrument settings to a CSV file.
Export Acquisition Configuration	Export the acquisition instrument settings to a CSV file.
Named Configurations	Save and recall system configurations (Section 4.8.1).

#### 4.7.2 Tasks menu

The Tasks menu lists the DAAAC Archive and Analyze modules, allowing the user to start, if necessary, then switch the focus to the selected module.

#### 4.7.3 Edit menu

Entries in the Edit menu operate on one or more selected cal nodes. To select nodes, click the mouse in the empty graph space above and to the left of a node, then drag the mouse to the empty graph space below and to the right of a node. This action encloses the node group in a selection rectangle. Releasing the mouse selects all enclosed nodes as a group. Only items on a single graph row can be selected as a group. After selecting the desired nodes, the Edit menu items will be enabled. Note that actions performed in the Edit menu cannot be undone. The Edit menu includes the following functions:

Item	Description
Copy	Copies the selected items to the clipboard. Disabled if no data has been selected. Data copied to the clipboard replaces its previous contents. Shortcut: <Ctrl-C>.
Paste	Pastes the selected nodes from the clipboard to the graph location after the active node (click on a node to make it active). This item is disabled if the clipboard is empty. Shortcut: <Ctrl-V>

Move	Moves the selected nodes to the graph location after the active node (click on a node to make it active). Shortcut: <Ctrl-X>
Delete	Removes the selected nodes from the graph. Shortcut: <Del>.
Clear	Clears the current selection.

#### 4.7.4 Preferences menu.

The Preferences menu controls TestMan's Cal Graph visual display and other global options.

Item	Description
Readout Order	Opens a dialog to specified the order in which the instrument data is read, after all instruments have triggered in an acquisition sequence.
Raw FOMs	<p>Opens the FOM Selection interface, which specifies the Figures of Merit (FOMs) that are to be automatically computed and stored with newly acquired (raw) data. It also governs the order in which FOMs are displayed with the raw data in Analyze.</p> <p>Automated FOM calculation for reduced data is specified via the Reduction tab of each graph node (Section 4.8.30). Automated FOM calculation for manually processed data is specified in the Analyze module (Section 6.4.4.1). Section 10 contains a detailed description of the available FOMs for waveform and image data.</p>
Graph Display	Opens the Graph Display dialog that allows users to customize the appearance of the graph. The dialog may also be called up by right-clicking in an empty area of the graph and selecting Graph Display... from the popup menu.
Graph Item Defaults	Opens a dialog that allows the user to specify the default values for parameters that are common to all Cal items when a new node is added to the graph. The Item Reduction Defaults dialog sets the default settings that each new Cal Item will have when first added to TestMan's Cal graph. These options can be changed at any time after the Cal Items are in the graph by activating their Reduction page from the Cal Item dialog. The Reduction page is also accessible from the Global Reduction Options Map.
Barcode Print Setup	Activates a dialog that allows the user to configure the print format of barcodes and print test barcodes.
Module Bar	Toggles visibility of the buttons used to switch between DAAAC modules.
Graph / Station Bar	Toggles visibility of the buttons used to manage the graph and stations.

Named Configuration Bar	Toggles visibility of the buttons used to manage named configurations.
Acquisition Bar	Toggles visibility of the buttons used to control the acquisition.
Help Bar	Toggles visibility of the help buttons.
Status Bar	Toggles between showing and hiding the status bar.
Large Icons	Toggles between showing larger or smaller icons on the toolbar
Logs	Opens the Log Settings dialog to select which events are logged.

#### 4.7.5 *Inventory menu.*

The Inventory menu contains commands that activate inventory list dialogs.

Item	Description
Inventory List	Activates the main inventory list, which creates, edits, deletes and prints Cal Items. Also, the Inventory List can be activated from the graph and used for insertion items into the graph (right-click a Cal Item to activate the popup menu and select the direction of insertion—left or right).
Drag and Drop Inventory List	Activates a dialog for inserting Cal Items into the graph by dragging the item from the list onto the graph. This is more efficient than the standard Inventory List when the Cal Items are already created and many Cal Items are to be added at a time to the graph.

#### 4.7.6 *Station menu*

The Station menu contains commands that control the acquisition stations and the cal lines within each station.

Item	Description
Station Selection	Activates the Remote Station Selection dialog for selecting the stations that will participate in a networked acquisition. Check the desired stations in the list then select OK to close all open station windows and open the selected stations. This interface is only available for networked systems.
Take Control	Makes the local station the Test Director, and attempts to assume control of all displayed stations. A progress dialog is displayed while taking control of the remote stations. This interface is only enabled for networked systems when no remote stations are presently controlled.

Release Control	Releases controlled of all presently controlled remote stations. This interface is only enabled for networked systems when the local station (Test Director) is controlling remote stations.
Lines	Opens a dialog that maps the instruments and channels available to a given station. The map can be used to insert new lines into the Cal graph for channels not yet assigned Cal lines.
Write Layout to Log	Writes the instrument settings for all displayed station windows to the DAAAC log, in JSON format.
Write Graph to Log	Writes the graph configurations for all displayed station windows to the DAAAC log, in JSON format.

#### 4.7.7 Acquisition menu

The Acquisition menu includes the functions that execute the acquisition sequence.

Item	Description
Configure	Displays the Test Configuration dialog (Section 4.6.4), which is used to configure parameters for the data acquisition sequence. Does not execute the sequence.
Go	Displays the Test Configuration dialog, then starts the automated data acquisition sequence (Section 4.2.2).
Single Step	Runs a single step of a multi-step acquisition when in Sequenced mode or Repetitive Single Shot mode.
Pause	Pauses a multi-step acquisition at the conclusion of the current step. Used in Sequenced mode and Repetitive Single Shot mode.
Stop	Stops a multi-step acquisition at the conclusion of the current step. Used in Sequenced mode.
Abort	Aborts the current acquisition. Available only when the system is armed but no instruments have triggered yet.
Continue	Stops polling for triggered instruments and retrieves any available data. Available only when some but not all instruments are triggered. Also continues a paused or stopped acquisition in Sequenced mode.
Force Trigger	Sends a Force Trigger command to all acquisition instruments that have not yet triggered.
Timing Trigger	Sends a Trigger command to all timing instruments that are set to computer/manual mode.

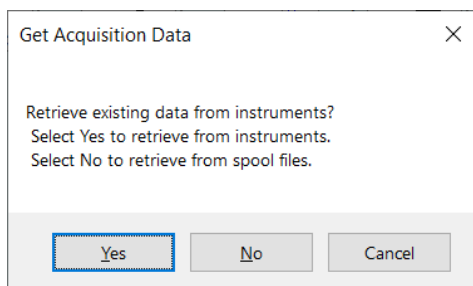
Go (no config)	Start the acquisition sequence immediately, without displaying the acquisition configuration dialog. Shortcut: <F2>
Live mode	Run acquisition repetitively without archival and reduction.
Get Existing Data	Retrieve existing data directly from instruments or from the DAAAC spool files.

#### 4.7.7.1 Live Mode

This acquisition type runs acquisitions repetitively without archival and reduction. It is typically used to tune / position cameras. When initiated, a separate live window will be created for each active channel. Data will then be retrieved from the instruments and displayed as fast as possible. Live acquisition continues until the Stop button is pressed, at which time all live display windows are closed. This mode requires instrument driver support. Live mode is supported by most camera drivers and some digitizer drivers. Shortcut: <F3>

#### 4.7.7.2 Get Existing Data

This acquisition type retrieves existing data directly from instruments or from the DAAAC spool files. This acquisition mode can be used for error recovery, when a previous acquisition sequence did not complete and the acquired data is still available on the instrument or in spool files. It can also be used to acquire data that was collected on an instrument that was previously running without acquisition software control. When selected, the operator will specify instrument or spool data, then specify the acquisition settings (test, shot number, etc.) to associate with the data. The acquisition sequence then jumps directly to the readout stage, collecting data either from the active instruments or from the spool file folder. The rest of the acquisition sequence proceeds normally, archiving and reducing the data as indicated in the system configuration.



### 4.7.8 Reduction Menu

The Reduction menu includes operations to configure and execute data reduction.

Item	Description
Global Selection Map	Displays a dialog to quickly configure reduction outputs for all graph items.
Global Parameters	Displays a dialog to configure reduction settings that are applied to all graph items.

Off-line Reduction	Reduces user selected historical data, using the current signal path definition and cal item settings.
--------------------	--

#### 4.7.8.1 Global Selection Map

The Global Selection Map configures reduction options for TestMan's current graph. Each entry in this dialog contains the same reduction functions that can be found in each graph node's reduction page. Use this interface when changes are necessary for many Cal Items, or to easily view the entire reduction configuration.

The map displays all instruments, Cal Lines and Cal Items in a table. Line reduction can be toggled on and off, and output options for each line can be set. The entire graph's display/print/archive options can be set or cleared at one time.

The instrument is displayed in the first column. There are no options for the instrument entry.

Each channel is displayed in the second column. The first row for each channel contains a Line Reduction check-box, which is the same check-box option contained in the channel's dialog. When checked, reduction will be performed for the entire line. Double-clicking this column within the Line Reduction text activates the channel's reduction dialog. Any changes made in the reduction dialog are updated in the options map when OK is selected.

Every channel row and every Cal Item row contain a Waveform type and associated Display / Print / Archive columns. The channel waveform name is always shown as "Raw". Channel rows include a Display and Print check box for the associated raw waveform, but no Archive check box as the raw data is archived before the reduction process starts. Most Cal Items produce a single output waveform, labelled as "Corrected". Cal Items that produce multiple output waveforms (e.g., Direct Write, Mixer) will display each output on a separate row.

Global Reduction Options Map

Instrument	Channel	Cal Item	Waveform	Display	Print	Archive
ww1						
	pulse-001	<input checked="" type="checkbox"/> Line Reduction	Raw	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		6dB	Corrected	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		scale	Corrected	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	rf-01	<input checked="" type="checkbox"/> Line Reduction	Raw	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		direct	Power vs. Time	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
			Freq vs. Time	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
			Spectrum	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	pulse-2	<input checked="" type="checkbox"/> Line Reduction	Raw	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		10dB	Corrected	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	S1R1P5C4	<input checked="" type="checkbox"/> Line Reduction	Raw	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
pico						
	pico-A	<input checked="" type="checkbox"/> Line Reduction	Raw	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		6dB	Corrected	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		y <sub>max</sub>	Corrected	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		sub	Combined	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		double	Corrected	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			Raw	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		y <sub>min</sub>	Corrected	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5104						
ima						

Search

Double-click a Cal Item cell to configure the item

OK Cancel

Toggle Line Reduction

Set all

Clear all

Toggle columns above

Set Set Set

Clear Clear Clear

Set All Clear All

**Figure 4-37. Global reduction options map**

Double-clicking inside the Cal Item name field activates the appropriate Cal Item dialog. This is the same dialog that is activated from the graph. Any changes made in this dialog are enacted when OK is selected. Likewise, changes made in the Reduction page of the Cal Item dialog are updated in the Global Reduction Options Map when the item dialog is OK'd.

The buttons beneath the Cal Item name column set or clear all channel-line reduction options. The buttons beneath each output column (display, print and archive) set or clear each column. Set All sets all output types in the map and Clear All clears all of them.

Select OK when you have made the required modifications. All reduction information is then updated in the graph. Selecting Cancel abandons any changes made. If any settings in any of the Cal Item dialogs have been altered (by double-clicking the Cal Item column), then Cancel will be disabled and all changes become permanent.

#### 4.7.8.1.1 Searching the Global Reduction Options Map

To search the Global Reduction Options Map:

1. Select the Search button. The Search Global Reduction Options Map dialog will open.



2. Select the field type to search (instrument, channel, or item). In the Search String field, enter the text to search for.
3. Select Find. If the item is found, its first occurrence will be highlighted in the map. Choose OK when done searching.

#### 4.7.8.2 Global Reduction Parameters

The Global Data Reduction Parameters dialog displays settings that apply to the entire graph during data reduction. The dialog has two groups of controls: Station Parameters and Data Export.

Station Parameters are specific to each acquisition station and are stored with the station's graph. There is presently one Station Parameter, the default narrowband frequency. The specified frequency will be used for all narrowband channels that select Global Constant as their reduction frequency source (see Section 4.4.6.1.2).

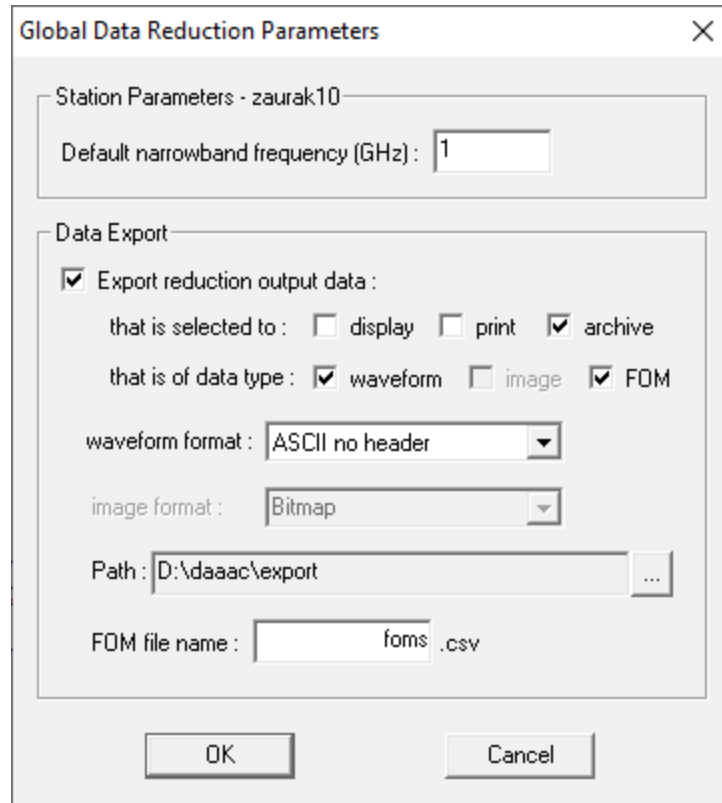
The Data Export controls are used to specify which data is automatically exported during each reduction sequence. The export settings are stored in the registry (HKEY\_CURRENTUSER), so will apply to all databases for a given user login. Export is global (applies to all reduction outputs), but can be filtered by each output's display / print / archive settings. For example, selecting the archive checkbox here will only export output data that have the archive flag set. Data exported can also be filtered by type – waveform / image / FOM. Waveforms can be exported with or without header information. Automatic export of image data is not yet supported.

The path control selects the location of all automatic export files. Waveform files will be named using their channel name, cal item name, and shot number (e.g. pulse-001\_6dB\_s003265.txt). All waveform files use a .txt extension. The FOM file name control specifies the name of the single file that will collect all exported figure-of-merit values. The FOM file always uses a .csv extension and is stored in the same folder as the exported waveforms.

If specified via this dialog, FOMs are collected during each data reduction then written to the specified file after all items have been reduced. The display/print/archive filters also apply to FOM exports. For example, if archive is checked and display and print are not checked then only the FOM values for archived waveforms will be exported.

Each row in the FOM export file contains the collected FOMs for a single shot. If burst acquisition is used, or if off-line reduction is performed on multiple shots, one row will be created for each unique shot number. Columns display the burst number, shot number, and each unique FOM. FOM columns are labelled using <channel name>:<cal item name>:<output waveform name>:<FOM name>. A header line is written at the start of a new file and each time the FOM selections change. The file rows will generally be ordered by burst/shot number, but can contain discontinuities if export is turned off for a period or if off-line reduction is used to process historical data.

Many applications, such as Notepad and the File Explorer preview window do not interfere with updates and can be used to view the exported FOMs while reduction is running. However, some applications (notably Microsoft Excel) will lock a file while open in that application. If the FOM export file cannot be written, a message will be displayed reminding the user to close the file. After dismissing the reminder, a second attempt will be made to update the file. If the second attempt fails, an error message will be logged.



**Figure 4-38. Global data reduction parameters**

#### 4.7.8.3 Off-line Reduction

Automated reduction during the acquisition sequence is referred to as “on-line” reduction. TestMan can also be used to perform “off-line” reduction at any time, using any raw data in the database.

To perform an off-line reduction:

1. Select the Reduction | Off-line Reduction... menu item.
2. The raw waveform selection dialog will appear. Select the waveforms and images to reduce. Data from multiple shots can be selected. Any selected data that does not have a corresponding Cal Line will be ignored.
3. Select OK in the selection dialog. TestMan will begin reducing the selected data. TestMan’s status bar will display the current channel and shot being reduced. When all reduction complete, the reduced data will be transmitted to the database and the Analyze module.

Note that off-line reduction always uses the *presently loaded* signal path configuration, item characterization data, and global settings to reduce the data. To instead reduce data with historical definitions, the historical configuration must be restored (see Section 3.4) before the reduction operation.

#### 4.7.9 Tools menu

The Tools menu provides a variety of useful services and data viewers.

Item	Description
Gang Calibration	Runs the calibration process for multiple instruments.
Run Instrument Apps	Starts any external applications required by acquisition instruments. For example, the Keysight M8131 SFP application must run to enable SCPI communication.
Off-line Reduction	Reduces user selected historical data, using the current signal path definition and cal item settings.
Graph Search	Opens the Item Search dialog (Section 4.8.24), to locate an item in the Cal Graph.
Conversions	A simple calculator that provides conversion of distance units and scalar / dB conversion for power or voltage.
Notebook	Displays the notebook viewer / editor (Section 4.8.10).
Test Summary	Displays the current Test Summary (Info.txt) record (Section 4.8.12).

#### ***4.7.10 Sequence menu [keyed option]***

The Sequence menu supports management of data collected with the DAAAC sequencer.

Item	Description
Manage	Displays all defined sequences and their present state information.
Import Sequence Files	Imports sequence data from external files.
View Sequence Log	Displays the log file, showing each step for the current sequence.

#### ***4.7.11 Cal System menu [keyed option]***

The Cal System menu supports user access to Cal System installations.

Item	Description
Log In	Logs a user in for access to the Cal System functionality.
Log Out	Terminates a user session in the Cal System.

#### ***4.7.12 Window menu***

The Window menu manages the station child windows. Standalone systems have a single station, while networked systems can have multiple open stations.

Item	Description
Cascade	Arranges station windows in an overlapped fashion.
Tile Horz / Vert	Arranges station windows in non-overlapped tiles.

#### 4.7.13 Help menu

The Help menu displays program information and logs.

Item	Description
Help Topics	<i>Deprecated.</i> On-line help is not presently implemented for the TestMan module. Instead, refer to this document.
About	Displays general information about the DAAAC installation and the current configuration.
Open Source	Displays a list of the open source libraries used in DAAAC.
License Agreement	View the DAAAC system End User License Agreement (EULA)
DAAAC Logs	Display the selected daily log. Defaults selection is current day's log. Can also select other DAAAC logs, such as the NetCom log.

#### 4.7.14 Instrument List menu

The instrument list pop-up menu is activated by clicking with the right mouse button inside TestMan's instrument list display. It contains functions for adding or modifying instruments, and for temporarily setting an instrument's active state.

When activated in an empty row or to the right of the list columns, menu items related to the configuration of a single instrument are disabled. When activated on a row that contains an instrument, all commands are available.

**Edit.** Opens the settings dialog to configure the selected instrument.

**Add.** Adds an instrument at the selected rack location

**Delete.** Deletes the selected instrument.

**Active.** Temporarily activate the selected instrument. This selection is NOT persistent and will be lost when the software is shut down unless the instrument dialog is opened by double clicking and dismissed with OK.

**Idle.** Temporarily idle the selected instrument. This selection is NOT persistent and will be lost when the software is shut down unless the instrument dialog is opened by double clicking and dismissed with OK.

**Idle All.** Temporarily idle all instruments.

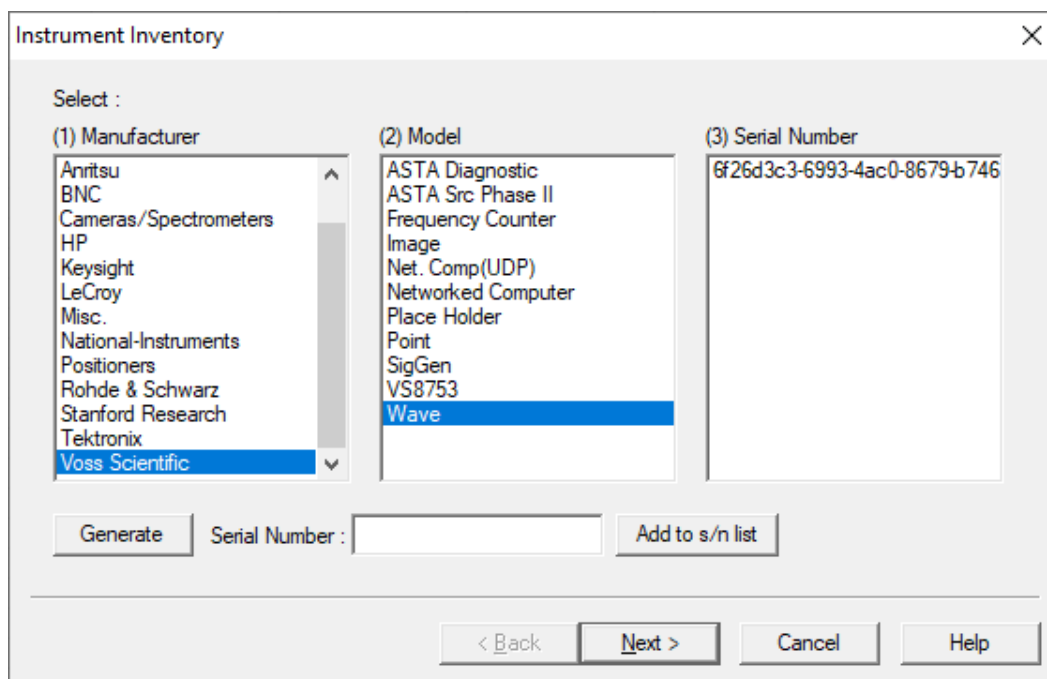
**Trigger Groups.** Display the Trigger Group Definition dialog to link multiple timing instruments.

#### 4.7.14.1 Add Instrument Menu Item

Adding an instrument to the inventory and selecting it for acquisition was presented briefly in the “Getting Started” tutorial. This section discusses the process in greater detail.

Add Instrument uses a two-step wizard to: 1) select an instrument from the inventory; and 2) specify interface settings and select instrument hardware options.

The first page in the setup wizard used to select an instrument from the existing inventory by specifying its manufacturer, model, and serial number. The list of supported instrument types in the inventory list is controlled by your system keys. Only those manufacturers supported by your license are displayed.



**Figure 4-39. Selecting an Instrument from the Inventory**

First, select the Manufacturer from the left list. All models supported by your system for the selected manufacturer are then displayed in the center list.

For example, to install the Stanford Research DG535, select the Stanford Research manufacturer name. If your system includes a DAAAC driver for the DG535, it will be listed in the center list. Note that some devices are not listed under a specific manufacturer name, but under a general group name such as Cameras/Spectrometers or Misc. The manufacturer Voss Scientific, if present, contains virtual instruments used to test the acquisition and reduction sequences.

Select a Model from the center list. A list of serial numbers will appear in the right list if any instruments of this model type have been added to the database. If no serial numbers exist for the selected manufacturer & model, enter a serial number in the edit control and select Add to s/n list. The new serial number will appear in the list. Optionally, the Generate button can be used to populate the serial number control with a unique identifier.

Select a serial number from the Serial Number list, then select Next to continue with the configuration step. The Next button will only be enabled after a manufacturer, model and serial number have been selected.

If your system does not enforce strict inventory control, then a given item instance (manufacturer, model, serial number) may be added to the acquisition instrument list multiple times.

Once you have selected an instrument from the inventory, the Interface dialog configures the communication interface (Ethernet, GPIB, USB, etc.), instrument hardware options, and the instrument name. The displayed interface configuration information is specific to the instrument's interface type, and some interface types have no required parameters at this step. If an instrument has any configurable hardware options, then the Setup button will be enabled. If Setup is enabled you must click it and specify the options before adding the instrument.

After specifying the required parameters, click on Finish to add the instrument to the rack.

The screenshot shows a dialog box titled "Interface & Setup : Agilent DSO-S 104A". It contains the following fields and buttons:

- IP Address : 127 . 0 . 0 . 1
- Station : Demo
- Rack : Rack 1
- Position : 1
- Name : DSO-S
- Setup button (located below the IP Address field)
- Navigation buttons at the bottom: < Back, Finish, Cancel, Help

**Figure 4-40. Instrument Interface Configuration**

## 4.8 TestMan Dialogs

The following dialogs are accessed through the TestMan menu system and toolbars or from other dialogs in the TestMan module.

### 4.8.1 Named Configurations

#### 4.8.1.1 Dialog

Name	Comment
demo	various demo instruments
minii01	one virtual instrument, no graph

**Figure 4-41. Save Named Configuration dialog**

#### 4.8.1.2 Discussion

DAAAC configurations are automatically stored and linked to raw data whenever an acquisition sequence is executed. Named Configurations can be created at any time, to manually store the current DAAAC settings for later restoration. The configuration includes displayed stations, instruments and their settings, acquisition settings, the cal graph, and cal item settings.

[Networked Systems]. Restoring a configuration from Test Director will update the list of selected stations and the settings for all selected stations. Configurations can only be restored when Test Director is not in control of remote stations.

Note that processing the configuration change in TestMan requires closing all existing instrument connections, then restoring connections to the restored instrument set. In most cases the operation completes within a few seconds. However, depending on the instrument models and number of instruments, that operation may take 10s of seconds to complete.

#### 4.8.1.3 Details

Item	Description
Name	A unique name for the configuration.
Comment	Optional description or comment to help identify the configuration.
Save	Save the current configuration, using the given name and comment.
List	All previously stored Named Configurations.
Restore	Install the configuration selected in the list box as the current system configuration, replacing the existing configuration. When restoring a named configuration from within TestMan (via this dialog or the toolbar), the current shot & burst numbers are retained. Restoring a named or historical configuration from Archive or Analyze will replace the current shot & burst numbers with those associated with the stored configuration.
Update	Update the selected configuration, using the current configuration.
Delete	Remove the currently selected configuration from the database. Once a Named Configuration is deleted, it cannot be recovered.

#### 4.8.1.4 Access

- File | Named Configurations menu item



## 4.8.2 Readout Order

### 4.8.2.1 Dialog

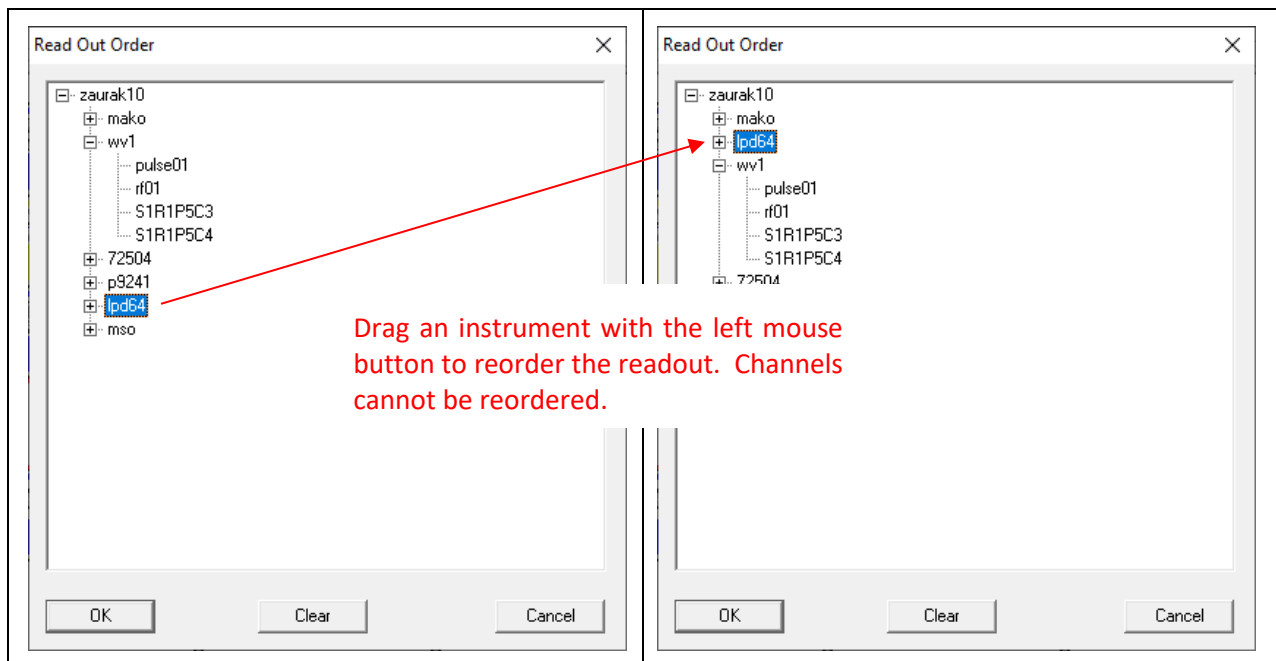


Figure 4-42 Changing the readout order

### 4.8.2.2 Discussion

The Readout Order dialog specifies the order in which instrument channels are transmitted and subsequently displayed by analysis stations. To change the display order, select a digitizer (or station if more than one) with the left mouse button and drag it to a different location on the list. When an item is released, it is inserted in the list immediately after the item it is dropped on. The order of channels within an instrument cannot be changed. Stations must be read out as a group. You cannot specify an order that interleaves instruments from different stations. Select Clear to restore the default order.

### 4.8.2.3 Details

Item	Description
List	A hierarchy of all stations, instruments, and channels in the current configuration.
Clear	Return to the original readout order.

### 4.8.2.4 Access

- Preferences | Read Out Order menu item

### 4.8.3 Figure of Merit Selection

#### 4.8.3.1 Dialog

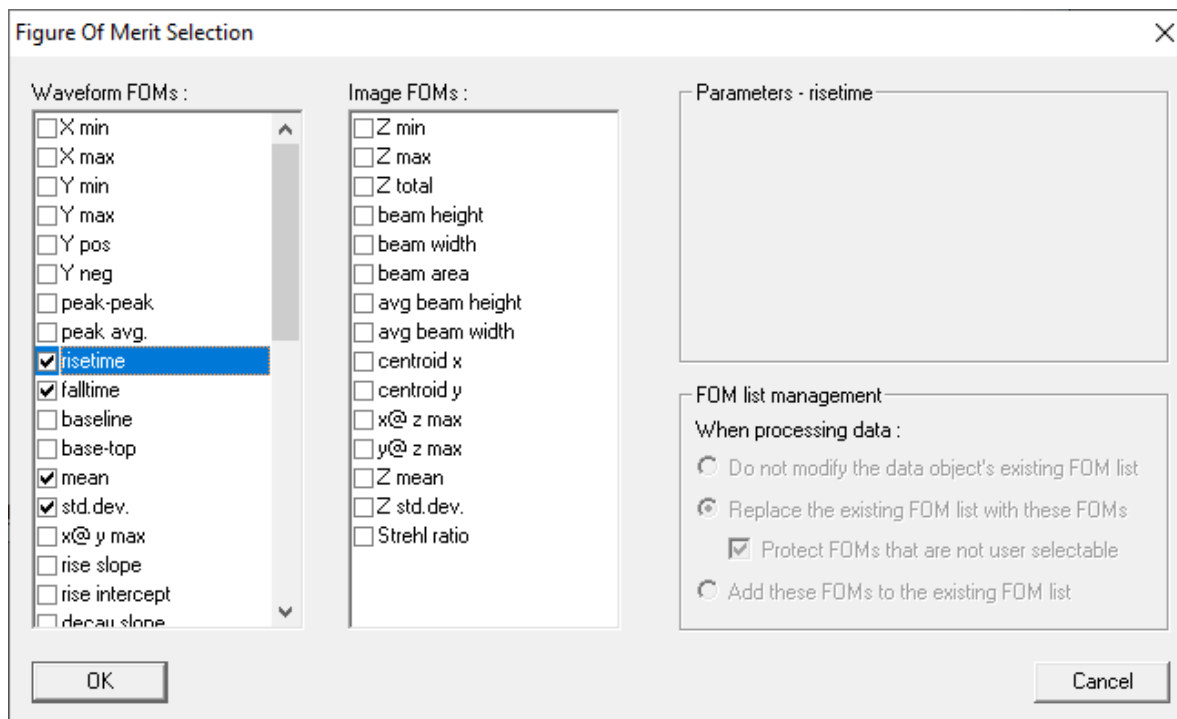


Figure 4-43 Selecting figures of merit to apply to raw waveforms and images

#### 4.8.3.2 Discussion

This dialog is used to select the Figures of Merit (FOMs) that will be derived from the raw waveform and image data during an acquisition sequence. The available FOMs are defined in Section 10.

To select a FOM for computation and display, check the FOM name in the list. To change the display order, select the FOM name with either mouse button and drag it to the desired location in the list.

Additional FOMs can be computed and stored with existing data at any time, using the Properties interface in the Analyze module (Section 6.5.5.2).

#### 4.8.3.3 Details

Item	Description
List	A fixed collection of the available FOMs, along with check boxes to allow a specific set of FOMs to be enabled (checked). Unchecked FOMs will not be applied.
OK	Close the dialog. Accept any changes made to the enabled FOMs.
Cancel	Dismisses the dialog without adjusting FOMs.

#### 4.8.3.4 Access

- Preferences | Raw FOMs menu item

## 4.8.4 Add Instruments – Instrument Inventory

### 4.8.4.1 Dialog

Instrument Inventory

Select :

(1) Manufacturer

- Anritsu
- BNC
- Cameras/Spectrometers
- HP
- Keysight
- LeCroy
- Misc.
- National-Instruments
- Positioners
- Rohde & Schwarz
- Stanford Research
- Tektronix
- Voss Scientific**

(2) Model

- ASTA Diagnostic
- ASTA Src Phase II
- Frequency Counter
- Image
- Net. Comp(UDP)
- Networked Computer
- Place Holder
- Point
- SigGen
- VS8753
- Wave**

(3) Serial Number

- 12345**
- 12348

Generate    Serial Number :     Add to s/n list

< Back    Next >    Cancel    Help

Figure 4-44 Add Instrument/Inventory dialog

### 4.8.4.2 Discussion

Instrument Inventory is the first page displayed by the Add Instrument setup wizard. It is used to select an instrument (manufactory, model and serial number) from the existing inventory. A manufacturer, model, and serial number must be selected before the wizard will allow the next page to be activated.

The dialog may also be used to add a new instrument to the inventory. To add a new instrument:

1. Select a Manufacturer
2. Select a Model
3. Generate a serial number. Either type a serial value into the Serial Number control or click Generate to create a computer-defined value. Press Add to s/n list to add the serial number to the list of available items.
4. Select an item from the Serial Number list.
5. Click Next> to proceed with the setup.

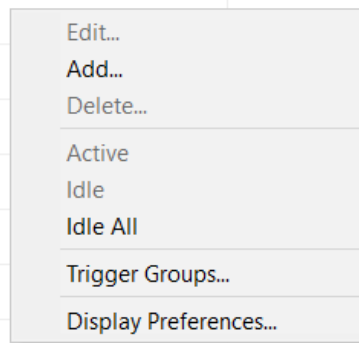
### 4.8.4.3 Details

Item	Description
Manufacturer	Listing of available manufacturers, which is dependent on the capabilities allowed to the installed DAAAC system.

Model	Listing of available model numbers corresponding to the currently selected manufacturer. Models are added to the inventory by the use of the Add Instrument dialog.
Serial Number (List)	Listing of available serial numbers corresponding to the currently selected model. Serial numbers are added to the inventory by the use of the Add Instrument dialog.
Generate Serial #	Creates a new and globally unique (GUID) serial number. Each number generated by this function is guaranteed to be unique.
Serial Number (Edit)	Allow serial number to be specified by user.
Add New Item	Adds the current serial number to the Serial Number listing.
Next (button)	Activates the next page in the setup wizard. Next is valid only if a serial number is highlighted.

#### 4.8.4.4 Access

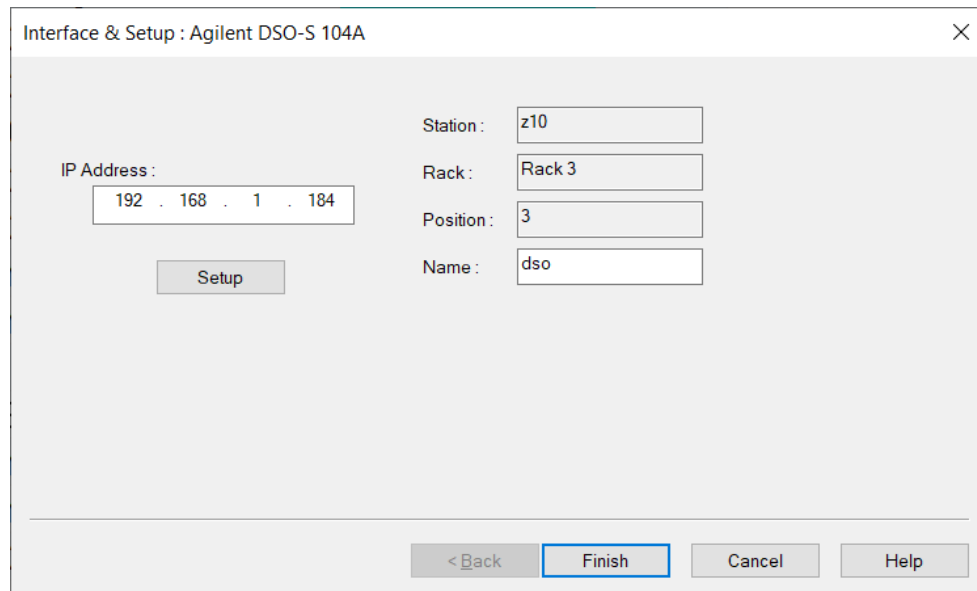
- Station Config | Add Instrument menu item
- Right-click in the station window's instrument tab and select Add from the popup menu.



**Figure 4-45 Instrument list right-click popup menu**

## 4.8.5 Add Instruments – Interface & Setup

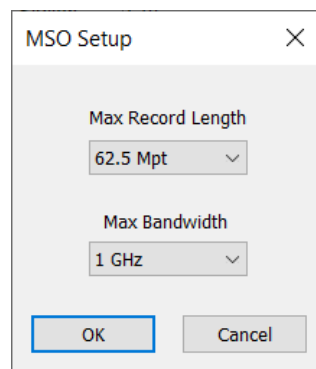
### 4.8.5.1 Dialog



The dialog box titled "Interface & Setup : Agilent DSO-S 104A" contains the following fields and buttons:

- IP Address: 192 . 168 . 1 . 184
- Station: z10
- Rack: Rack 3
- Position: 3
- Name: dso
- Buttons: Setup, < Back, Finish, Cancel, Help

Figure 4-46 Instrument setup dialog



The dialog box titled "MSO Setup" contains the following fields and buttons:

- Max Record Length: 62.5 Mpt
- Max Bandwidth: 1 GHz
- Buttons: OK, Cancel

Figure 4-47. Example setup dialog for instrument specific options

### 4.8.5.2 Discussion

The Add Instrument : Interface dialog configures communication data and assigns a name for the instrument. This dialog can be activated only from the Instrument dialog (first page of the Add Instrument To Rack wizard, on the second page in the Setup wizard. In some cases only some of these fields are displayed (e.g. different information is required for USB, Ethernet, and GPIB communication interfaces). Instruments that support multiple communication interfaces may only show one of those at this step. All interfaces will be available to select and configure after the instrument is added. If present the Setup Button must be clicked and the instrument options specified. These are instrument model specific and may include interface information, memory options or other hardware options. Parameters

entered in any dialog that appears when Setup is clicked are typically permanent and cannot be changed once Finish is clicked.

#### 4.8.5.3 Details

Item	Description
IP Address	Ethernet. IP address is the instrument's unique address.
Board Number, Primary Address	GPIB. Board number is the identifier (typically 0) for the computer interface. Primary address is the value in the range 0-30 that identifies the instrument's GPIB port.
Station	Current station name.
Rack	Name of the rack in which this instrument will reside.
Position	Position in the rack for this instrument.
Name	Optional name for the instrument.
Finish	Completes the task of adding an instrument to the rack.

#### 4.8.5.4 Access

- Station Config | Add Instrument menu item
- Right-click in an empty position in a rack and select Add from the popup menu.

The dialog appears, when adding a new instrument, after Next > is selected on the Add Instruments wizard.

## 4.8.6 Common Instrument Settings

### 4.8.6.1 Dialog

Channel	Instrument	Active	Channel	Active	VFS	V Offset	Timebase	Trigger Pos.	Zero base	Description
S1R1P1C1	vv1	<input checked="" type="checkbox"/>	S1R1P1C1	<input checked="" type="checkbox"/>	N/A	N/A	1 $\mu$ S/s	N/A	<input type="checkbox"/>	
S1R1P1C2			S1R1P1C2	<input checked="" type="checkbox"/>	N/A	N/A			<input type="checkbox"/>	
S1R1P1C3			S1R1P1C3	<input type="checkbox"/>	N/A	N/A			<input type="checkbox"/>	
S1R1P1C4			S1R1P1C4	<input type="checkbox"/>	N/A	N/A			<input type="checkbox"/>	
S1R1P4C1		<input type="checkbox"/>	S1R1P4C1	<input type="checkbox"/>	N/A	N/A	1 $\mu$ S/s	N/A	<input type="checkbox"/>	
S1R1P4C2			S1R1P4C2	<input checked="" type="checkbox"/>	N/A	N/A			<input type="checkbox"/>	
S1R1P4C3			S1R1P4C3	<input type="checkbox"/>	N/A	N/A			<input type="checkbox"/>	
S1R1P4C4			S1R1P4C4	<input type="checkbox"/>	N/A	N/A			<input type="checkbox"/>	
S1R1P5C1	dso	<input checked="" type="checkbox"/>	S1R1P5C1	<input checked="" type="checkbox"/>	N/A	N/A	N/A	N/A	<input type="checkbox"/>	
S1R1P5C2			S1R1P5C2	<input checked="" type="checkbox"/>	N/A	N/A			<input type="checkbox"/>	
S1R1P5C3			S1R1P5C3	<input checked="" type="checkbox"/>	N/A	N/A			<input type="checkbox"/>	
S1R1P5C4			S1R1P5C4	<input checked="" type="checkbox"/>	N/A	N/A			<input type="checkbox"/>	
ext_c1	ext_vv	<input type="checkbox"/>	ext_c1	<input checked="" type="checkbox"/>	N/A	N/A	N/A	N/A	<input type="checkbox"/>	
ext_c2			ext_c2	<input checked="" type="checkbox"/>	N/A	N/A			<input type="checkbox"/>	
S1R3P1C3			S1R3P1C3	<input type="checkbox"/>	N/A	N/A			<input type="checkbox"/>	
S1R3P1C4			S1R3P1C4	<input type="checkbox"/>	N/A	N/A			<input type="checkbox"/>	

Done Print

Figure 4-48 – Common Instrument Settings dialog

### 4.8.6.2 Discussion

The Instrument Common Settings dialog lists all instruments and channels that exist in all open stations. It also displays several settings common to all instruments. This grid is an efficient method for quickly viewing these common settings, and gives the ability to change them without having to activate the instrument's dialog. Instrument Active, Channel Active, Zero base and Auto Export can be toggled on/off directly from the map. Alternatively, the instrument's dialog may be activated by right-clicking on the instrument's name.

If the current system is networked, then each station's name is listed in the left-most column. Also, if any crate instruments exist, they are listed to the left of the instrument name. Channels are listed within instrument names; the instrument is listed once for all of its channels.

### 4.8.6.3 Details

Item	Description
Station	For networked systems only, the station name is displayed in the far-left column.
Crate	If a crate exists (VXI or CAMAC), then the Crate column is to the left of the instrument column. Each instrument within the crate is then listed in the instrument column.
Instrument	Lists the instrument name. The instrument name is listed once for all channels; the first channel is listed on the same row as the instrument name. The name can be edited in place. Double-click the name to highlight it, then edit the name and press

	[Tab] to exit the field. The instrument's name must be unique and contain only valid characters. To activate the instrument's dialog, right click on the name. Changes made in this dialog are automatically updated in the map when OK is selected.
Active	When checked, the instrument is active.
Channel	The channel name for the instrument name last listed. The instrument's first channel is listed on the same row as the instrument. The name can be edited in place. Double click the name to highlight it, then edit the name and press [Tab] to exit the field. The channel name must be unique and contain only valid characters.
Active	When checked, the corresponding channel is active.
VFS	Allows adjustment of volts full scale on the selected channel if instrument supports this capability.
V Offset	Vertical offset for selected channel as a percentage of full scale.
Timebase	Digitization rate in samples / second.
Trigger Pos.	Trigger position in sec within the acquisition record.
Zero Base	
Auto Export 1	Auto export data from this channel to Auto Export path 1 when enabled in Global settings.
Export Type 1	Select format of exported data from a list of ASCII, DaDisp, DaDisp flat, and Dappen.
Auto Export 2	Auto export data from this channel to Auto Export path 2 when enabled in Global settings
Export Type 2	Select format of exported data from a list of ASCII, DaDisp, DaDisp flat, and Dappen.
Print	Prints the information that is displayed on the grid.

#### 4.8.6.4 Access

- Station Config | Instrument Settings menu item – not yet available in TestMan

#### 4.8.7 Remote Station Selection

The Remote Station Selection dialog is used from a Test Director station, to select remote stations that will participate in the acquisition sequence.



#### 4.8.7.1.1 Dialog

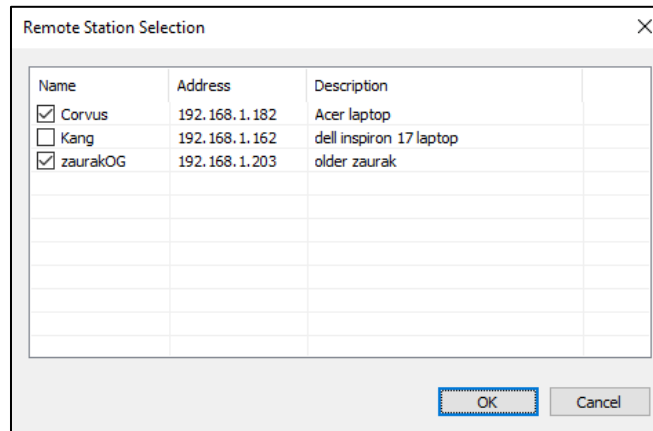


Figure 4-49 Remote Station Selection dialog

#### 4.8.7.1.2 Discussion

Check the boxes in the Name column to select the remote stations that will participate in the acquisition sequence. Press OK to close all existing station windows and then open the selected stations.

### 4.8.8 Take Control

The Take Control dialog is displayed while Test Director attempts to connect to and gain control of the displayed remote acquisition stations (see Section 4.6.2).

#### 4.8.8.1.1 Dialog

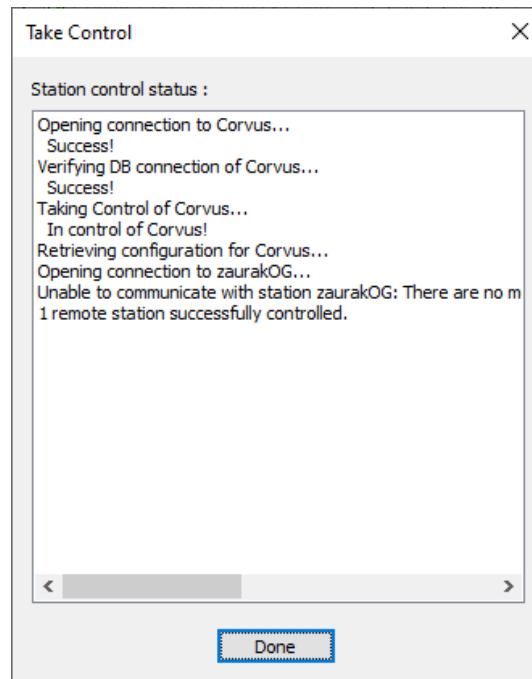


Figure 4-50 Take Control dialog

#### 4.8.8.1.2 Discussion

Under normal operations, this dialog will be displayed briefly and will disappear automatically as soon as all stations are under Test Director control. However, if some stations cannot be controlled (e.g., they are offline or busy), the dialog will display the control summary and wait for the operator to review and dismiss the dialog. If a station cannot be controlled because it is presently busy performing some other task, Test Director may also alert the operator and ask for the appropriate course of action. Two specific busy states require operator input:

- **BUSY - running an acquisition.** If network communication dropped during a previous acquisition sequence, a station could get out of sync (i.e., it missed some messages from Test Director, so didn't complete its sequence). In that case, after the acquisition finishes on Test Director, the remote station's state can sometimes be corrected by releasing control then taking control again (after the network communication issue has been resolved). This busy message would then be displayed, with an option to reset the remote station to a known (idle) state and attempt control again.
- **BUSY - performing an operation.** For example, if a named configuration is restored and immediately followed by an attempt to take control, a station could still be processing the configuration change when it receives a control request. This busy message would be displayed, with an option to try again to take control.

If you select **No** in response to a busy message, Test Director will continue without controlling the station and report that the station could not be controlled. In that case, the recommended course of action would be to resolve the issue on the remote station that is causing the busy response, then attempt to take control again.

#### 4.8.9 Test Configuration

Test Configuration is a tabbed dialog that is used to configure high-level acquisition and data processing settings for the TestMan module. The dialog is typically displayed before starting an acquisition sequence, but can be used at any time outside an active acquisition sequence.

#### 4.8.9.1 Test Configuration – General tab

##### 4.8.9.1.1 Dialog

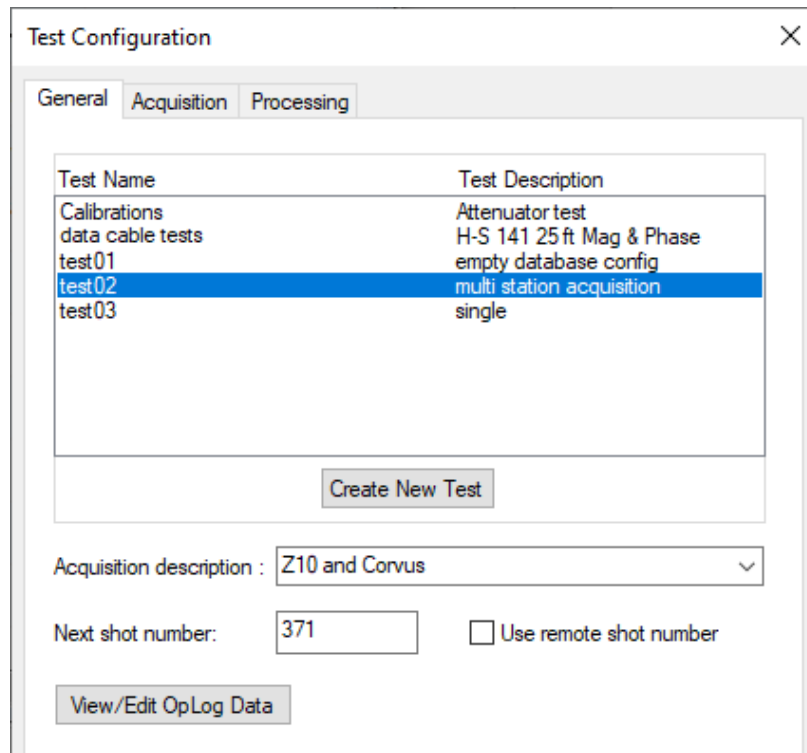


Figure 4-51 Test Configuration dialog, General tab

##### 4.8.9.1.2 Discussion



The General page of the Test Configuration dialog displays tests and descriptions, creates new tests, and configures general acquisition settings. The selected test is used to associate related acquisition data.

##### 4.8.9.1.3 Details

Item	Description
Test Name and Description	Listing of previous and current test. The highlighted line selects the current test.
Create New Test	Activates the New Test dialog, used to create a new test name.
Acquisition description	An optional descriptive string for the current acquisition settings.
Next shot / burst number	The shot / burst number to use for the next acquisition. All acquired and reduced data will reference this number. The shot number is automatically incremented at the end of the acquisition sequence.

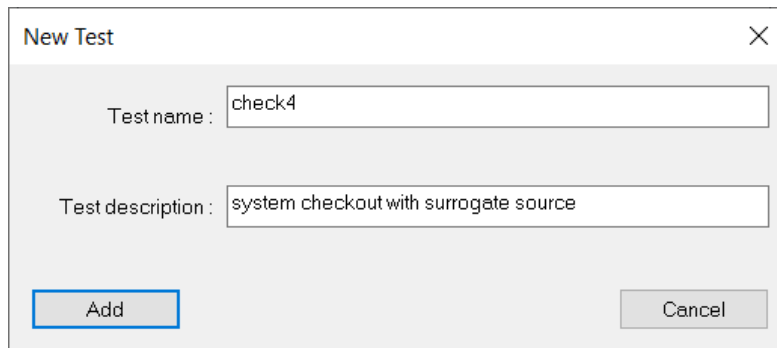
Use Remote Shot Number	If selected, the shot / burst number is obtained from a remote source, such as a DAAAC log, API software, or custom software.
View OpLog Data	Display or edit the operations log pages (the OpLog). OpLogs contain auxiliary, user-defined data related to the acquisition. The associated log page definition is selected in Archive (see Section 5.5.5)

#### 4.8.9.1.4 Access

- Acquisition | Configure menu item
-  toolbar button
-  toolbar button

#### 4.8.9.1.5 Create New Test

##### 4.8.9.1.5.1 Dialog



**Figure 4-52 Test creation dialog**

##### 4.8.9.1.5.2 Discussion

This dialog is used to add a new test, by name, to the database. Tests are used to associate related acquisition data.

##### 4.8.9.1.5.3 Details

Item	Description
Test Name:	Unique identifier for the test. The test will be stored in the database under this name.
Test Description:	Text to provide detail regarding the purpose of creating this particular test.
Add	Add the test to the database by this name.

##### 4.8.9.1.5.4 Access

- Create New Test button in the Test Configuration dialog, General tab

## 4.8.9.2 Test Configuration – Processing tab

### 4.8.9.2.1 Dialog

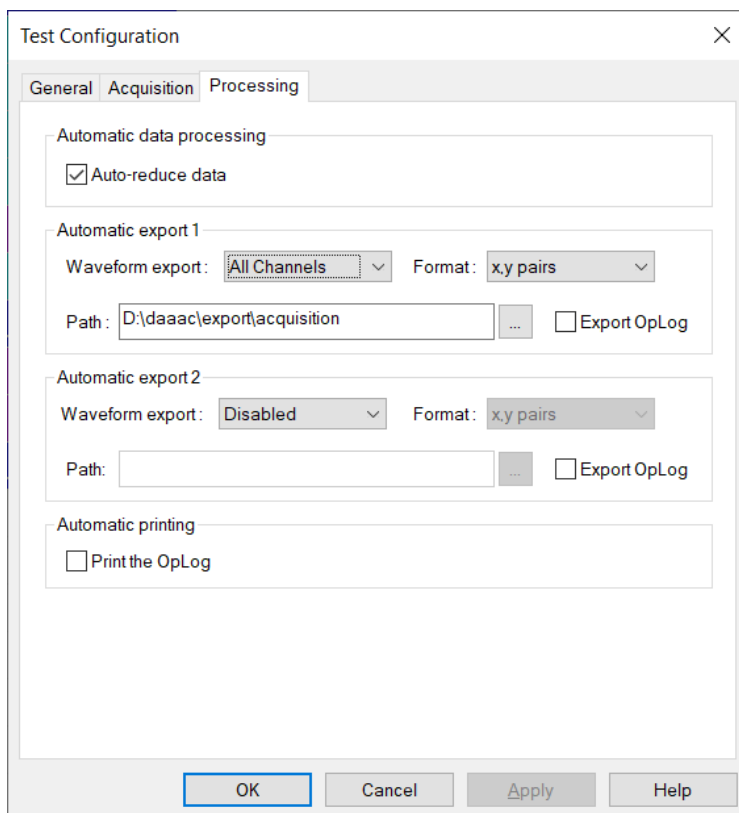


Figure 4-53 Test Configuration dialog, Processing tab

### 4.8.9.2.2 Discussion



The Processing page of the Test Configuration dialog configures automated processing settings for the next shot, including data reduction and exports.

### 4.8.9.2.3 Details

Item	Description
Auto reduce data	If selected, data reduction is performed on the raw data immediately following the acquisition of that data from the instruments. The reduction sequence can also be initiated manually at a later time from Analyze.
Automatic Export 1 & 2	Supports automatic export of raw waveform and image data to two different locations and/or two different file formats.
Waveform export	Allows selection of channel specific export, global export (all raw waveforms and images), or no export.

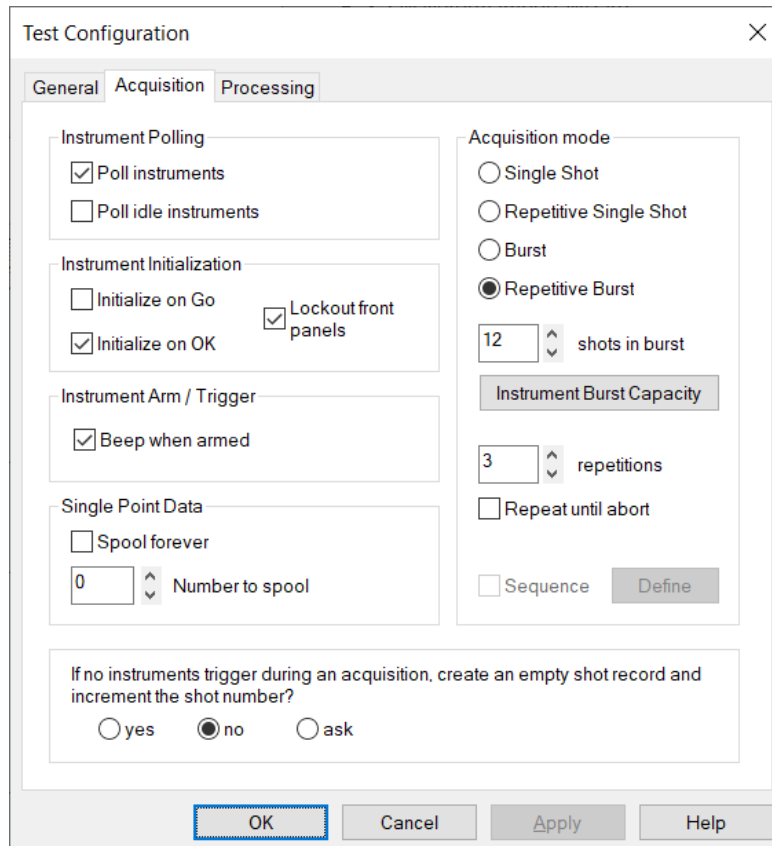
Format	Waveform file format used if global export (all waveforms) is selected. Image data, if exported, always uses TIFF.
Path	Location for raw waveform export files.
Export Log	Export an ASCII representation of the Log Page data, if defined.
Auto-print Log	Print the associated Log Pages if any have been defined.

#### 4.8.9.2.4 Access

- Acquisition | Configure menu item
-  toolbar button
-  toolbar button

### 4.8.9.3 Test Configuration – Acquisition tab

#### 4.8.9.3.1 Dialog



Test Configuration

General Acquisition Processing

Instrument Polling

☒ Poll instruments

☐ Poll idle instruments

Instrument Initialization

☐ Initialize on Go

☒ Initialize on OK

☒ Lockout front panels

Instrument Arm / Trigger

☒ Beep when armed

Single Point Data

☐ Spool forever

0 Number to spool

Acquisition mode

☐ Single Shot

☐ Repetitive Single Shot

☐ Burst

☒ Repetitive Burst

12 shots in burst

Instrument Burst Capacity

3 repetitions

☐ Repeat until abort

☐ Sequence Define

If no instruments trigger during an acquisition, create an empty shot record and increment the shot number?

☐ yes ☒ no ☐ ask

OK Cancel Apply Help

**Figure 4-54 Test Configuration dialog, Acquisition tab**

#### 4.8.9.3.2 Discussion



The Acquisition page of the Test Configuration dialog configures acquisition-related settings for the next shot / sequence. These settings include the acquisition mode (single shot, burst, sequence) and instrument communication preferences. If an instrument's front-panel is locked out, the instrument does not need to be initialized at the start of an acquisition. This saves significant time when the configuration includes instruments that are slow to initialize.

#### 4.8.9.3.3 Details

Item	Description
Poll Instruments	When checked, active instruments are continually polled and their states are updated in the station displays. Instrument state polling does not occur during the acquisition sequence. This feature allows DAAAC to determine whether there is a device present, powered on, and connected at each address, and reduces the incidence of interface-related errors when communication is attempted with an instrument.
Poll idle instruments	If checked, idle instruments are also polled. Uncheck to speed up polling and improve system response when several instruments are off-line.
Initialize on Go	When checked, all active instruments are initialized (regardless of their present state) when an acquisition is started.
Initialize on OK	When checked, the instrument is initialized when OK is selected from the instrument's configuration dialog.
Lock Out Front Panels	When checked, the instrument front panels (on the physical devices) are disabled. Note that not all instruments implement the command to lock out the front panel.
Beep when armed	Causes the system to beep while armed, at an interval specified by the registry key HKLM\Software\VSI\DAAAC\BeepPeriod.
Single Point Spooling	Allows the data from instruments that make single point measurements (e.g., power meters, time interval meters) to accumulate across multiple shots/bursts. The resulting multi-point waveforms are displayed and stored, in place of the associated single point values.
Spool Forever	If enabled, single point data continues to accumulate until this control is turned off.
Number to Spool	Number of single-point data values to collect into multi-point waveforms. The number is ignored if Spool forever is checked.
Single Shot	Arm the instruments one time for a single trigger.
Repetitive Single Shot	Arm the instruments for a single trigger, then repeat the entire acquisition sequence the specified number of times.

Burst	The system arms capable instruments for a burst of shots. The number of shots expected per burst is the number in the Shots in Burst field.
Repetitive Burst	The system arms instruments for a burst of shots, then repeats the entire acquisition sequence the specified number of times. The number of bursts expected is specified in the Bursts to Acquire field. The number of shots expected per burst is specified in the Shots in Burst field.
Shots in Burst	The number of shots per burst when in single or repetitive burst mode.
Instrument Burst Capacity	Activates the Burst Capacity dialog, which displays the number of channels and the burst capacity for each instrument.
Repetitions	The number of acquisitions (shots or bursts) for repetitive acquisition modes.
Repeat until abort	When checked, DAAAC acquires data repetitively until the STOP is selected.
Sequence	Check and press the Define button to define a multi-shot acquisition sequence. Unlike the repetitive modes, the sequence mode can automatically change settings between shots.

#### 4.8.9.3.4 Access

- Acquisition | Configure menu item
-  toolbar button
-  toolbar button



#### 4.8.9.3.5 Burst Capabilities

##### 4.8.9.3.5.1 Dialog

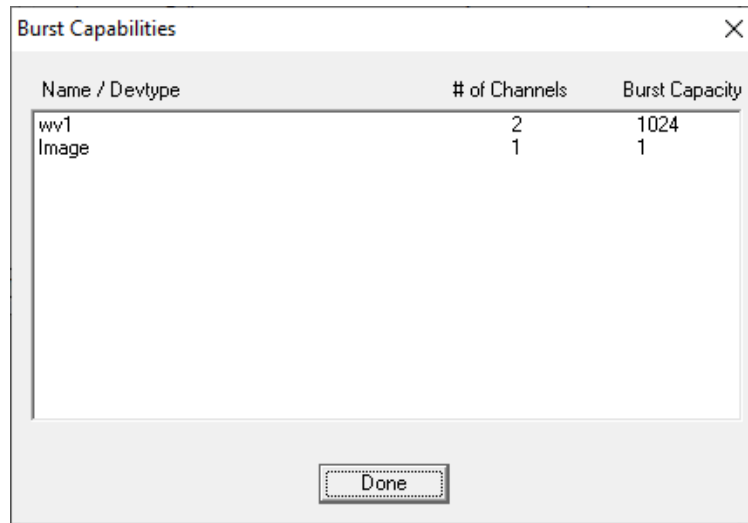


Figure 4-55 - Burst Capabilities of Attached Instruments

##### 4.8.9.3.5.2 Discussion

The Burst Capabilities dialog displays the number of channels and burst capacity per channel that each instrument in the current acquisition is capable of acquiring. Specifying a number of shots in a burst that exceeds an instrument's capacity is acceptable; the instrument will acquire as many waveforms as it can without ill effect. For example, assume one of two instruments in the configuration can acquire 100-shot bursts and the other can acquire 10-shot bursts. If 20 shots are requested in the current burst, then the first instrument will return 20 waveforms for each enabled channel, and the second will return 10. Burst capability is known by several different names, such as Fast Frame and segmented memory. Burst capability is an optional DAAAC feature and may not be present.

##### 4.8.9.3.5.3 Details

Item	Description
Name/Devtype	Lists, by name, the attached instruments that are capable of capturing and returning burst data.
# of Channels	The number of independent data channels from which data may be captured from the instrument
Burst Capacity	The number of waveforms that can be captured and recalled, per channel, in a burst.

##### 4.8.9.3.5.4 Access

- Instrument Burst Capacity button on the Acquisition tab of the Test Configuration dialog

## 4.8.10 Notebook

### 4.8.10.1 Main Dialog

#### 4.8.10.1.1 Dialog

Title	Name	ID	Creation Date	Modification Date
welcome to this database	entry1	chrisj	3/26/2019 10:30:25...	3/26/2019 10:30:25...
sample notebook entry	DAAAC user	user0987	3/26/2019 11:12:27...	3/26/2019 11:14:06...

Figure 4-56 Notebook management Dialog

#### 4.8.10.1.2 Discussion and Detail

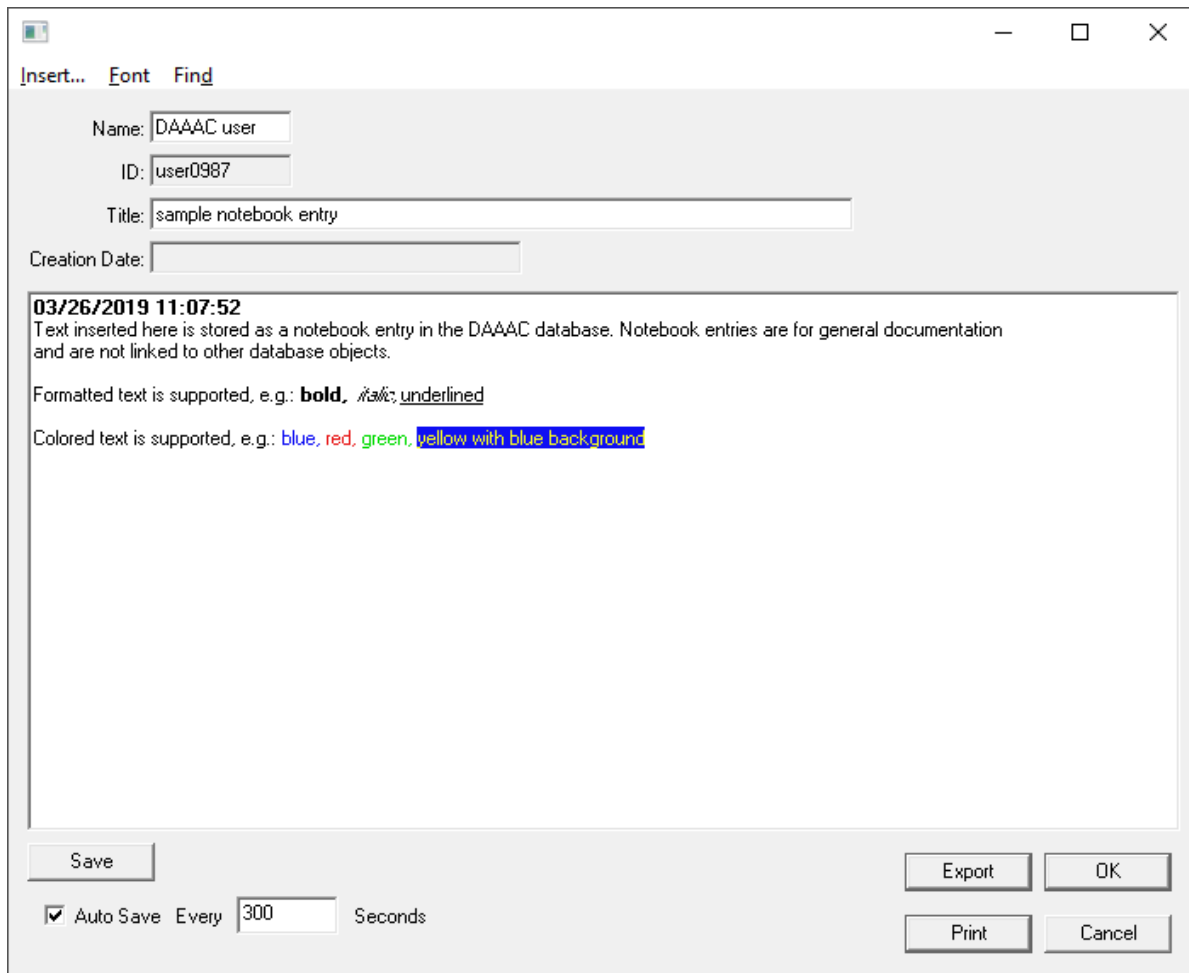
See Section 3.7 for a complete description of the Notebook tool.

#### 4.8.10.1.3 Access

- Tools | Notebook menu item

## 4.8.10.2 Notebook Editor

### 4.8.10.2.1 Dialog



The screenshot shows a dialog box titled "Notebook entry editor". At the top, there are three menu items: "Insert...", "Font", and "Find". Below these are four input fields: "Name:" with the value "DAAAC user", "ID:" with the value "user0987", "Title:" with the value "sample notebook entry", and "Creation Date:" which is empty. The main area of the dialog is a large text box containing the following text: "03/26/2019 11:07:52", "Text inserted here is stored as a notebook entry in the DAAAC database. Notebook entries are for general documentation and are not linked to other database objects.", "Formatted text is supported, e.g.: **bold**, underline", and "Colored text is supported, e.g.: blue, red, green, yellow with blue background". At the bottom of the dialog, there is a "Save" button, a checkbox labeled "Auto Save" which is checked, a text box with the value "300" and the label "Seconds", and four buttons: "Export", "OK", "Print", and "Cancel".

Figure 4-57 Notebook entry editor

### 4.8.10.2.2 Discussion and Detail

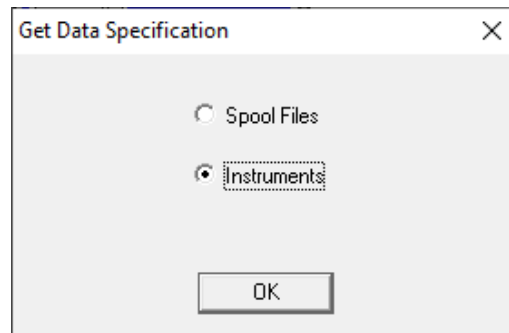
Please see the Main Manual, Section 3.7 for a complete description of the Notebook tool.

### 4.8.10.2.3 Access

- Tools | Notebook menu item

## 4.8.11 Get Data Specification

### 4.8.11.1 Dialog



**Figure 4-58 - Data Specification Dialog**

### 4.8.11.2 Discussion

The Get Data Specification dialog is activated after Get Existing Data menu item is selected. It selects the source for the data, either from temporary spool files or directly from active instruments. When OK is selected, the data is read from the selected source, stored in the database, and linked to a new acquisition record.

### 4.8.11.3 Details

Item	Description
Spool Files	Intended for disaster recovery if a computer fails after reading data from the instruments, but before it is successfully stored in the database. After readout, data is stored locally in temporary spool files before it is transmitted to the database. This file data may be recovered by restarting the computer (or software) if necessary, and selecting Acquisition   Get Existing Data then Spool Files.
Instruments	The data is read directly from all instruments that are presently marked active in TestMan.

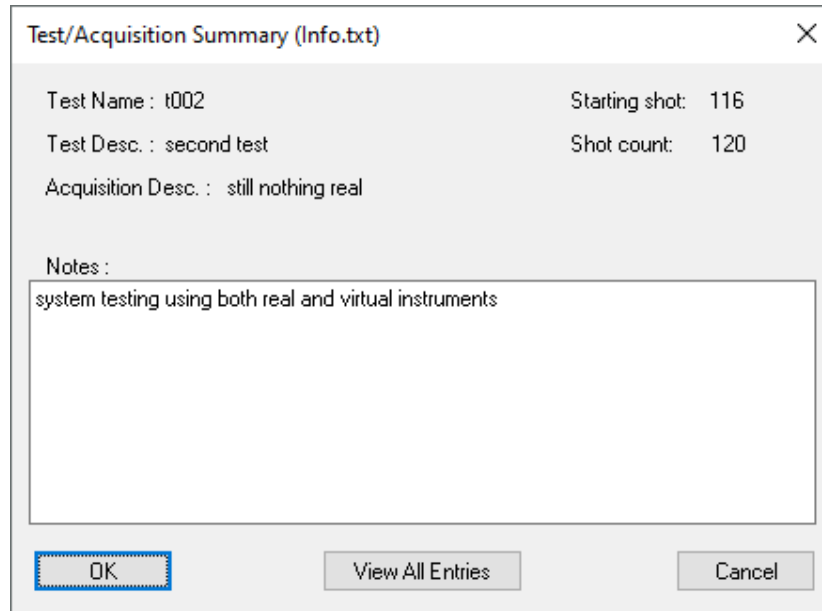
### 4.8.11.4 Access

- Acquisition | Get Existing Data menu item

## 4.8.12 Test Summary (Info.txt)

### 4.8.12.1 Test Summary Viewer / Editor

#### 4.8.12.1.1 Dialog



Test/Acquisition Summary (Info.txt)

Test Name : t002                      Starting shot: 116  
Test Desc. : second test              Shot count: 120  
Acquisition Desc. : still nothing real

Notes :  
system testing using both real and virtual instruments

OK      View All Entries      Cancel

**Figure 4-59 Info.txt editor dialog**

#### 4.8.12.1.2 Discussion

This dialog displays the information for the current or historical Test Summary record. A new test summary record is created each time any of the following acquisition configuration settings are modified: selected test, acquisition description, acquisition mode. Changing the shot/burst number does not create a new Test Summary record.

#### 4.8.12.1.3 Details

Item	Description
Test Name	Name of the associated test.
Test Description	Description of the associated test.
Acquisition Description	The associated acquisition description.
Starting shot	The first shot number associated with this record
Shot count	The total number of shots associated with this record
Notes	User comments, up to 1024 characters.

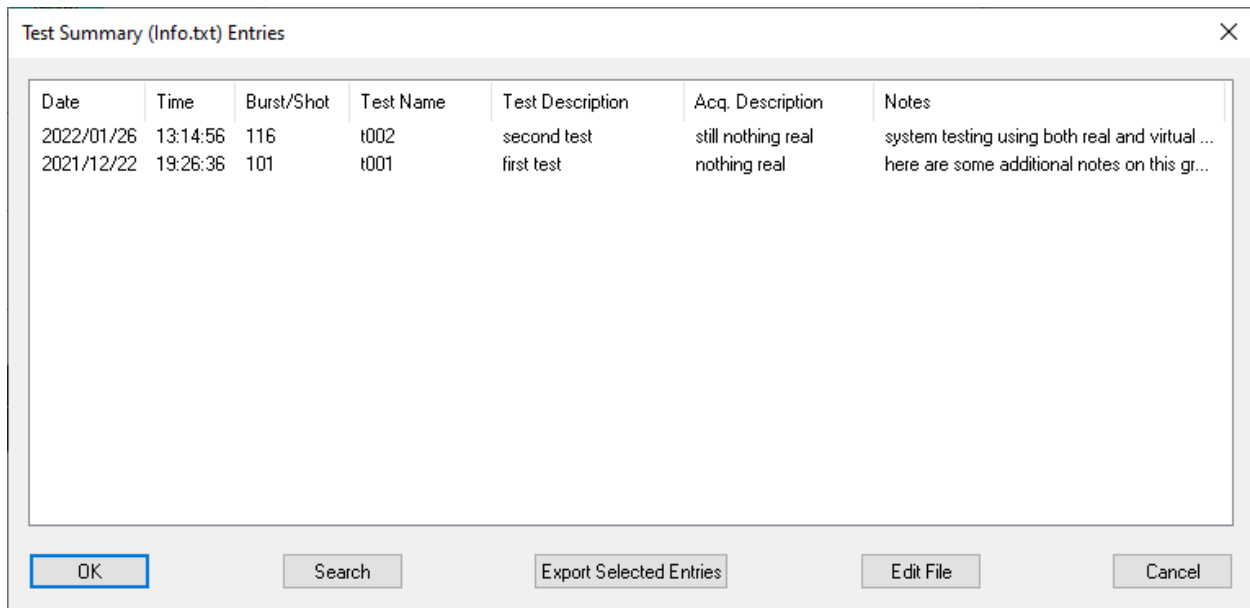
View All Entries	Activates the Test Summary Entries dialog (Section 4.8.12.2), which displays all test summary records.
------------------	--

#### 4.8.12.1.4 Access

- Tools | Test Summary menu item to view the current record.
- Select an item in the Test Summary Entries dialog and press OK to view a historical record.

### 4.8.12.2 Test Summary (Info.txt) Entries

#### 4.8.12.2.1 Dialog



**Figure 4-60 Viewer for all Test Summary records**

#### 4.8.12.2.2 Discussion

This dialog displays all Test Summary records in the active database. The entries can be exported to text or Excel-formatted files. Once exported, the text file may be opened for editing. The set of test records may be searched via the parameters discussed in 4.8.12.3. Select a record and press OK to view/edit that record.

#### 4.8.12.2.3 Details

Item	Description
Date	Date that the test was first executed
Time	Time that the test was first executed
Start Burst/Shot	Displays the first shot number for this test.

Test Name	Displays the first 39 characters of the Test Name.
Test Description	Displays the first 39 characters of the Test Description.
Acquisition Description	Displays the first 39 characters of the Acquisition Description.
Comment field	Comments up to 1024 characters.
Search	Opens the dialog of 4.8.12.3.1, allowing the list of test entries to be searched for specified values in the various fields.
Export	Opens a standard Windows file browser dialog. The dialog may be used to navigate to a folder and assign a name to a text or Excel file to which the Info.txt information will be written.
Edit File	Opens a standard Windows file browser dialog. The dialog may be used to navigate to a previously exported text-formatted Info.txt file. The file will be opened using the Windows default editor for *.txt files.

#### 4.8.12.2.4 Access

- View All Entries button in the Test Summary dialog.

### 4.8.12.3 Search Info.txt

#### 4.8.12.3.1 Dialog

**Search Info.txt records** [X]

☐ case sensitive search

**Search Criteria**

Test Name : ☒ demonstration

Test Description : ☐

Acquisition Description : ☒ virtual

Comment : ☐

Date >= : ☐ YYYY/MM/DD

Date <= : ☐ YYYY/MM/DD

OK Reset Cancel

**Figure 4-61 Info.txt Search dialog**

#### 4.8.12.3.2 Discussion

Search Info.txt looks for the Info.txt record that contains the search criteria. Search criteria may include date range, individual words, or text strings in any portion of the record. Words or text strings may be an exact match (with or without case sensitivity) or any subset. The characters or words entered in a search box must occur as a sub-string in the specific field for a match to occur.

#### 4.8.12.3.3 Details

Item	Description
Case Sensitive Search	When checked, the text in the selected search field(s) must match the search text exactly. When unchecked, character strings that match the search strings, regardless of the case (upper or lower) of the various characters in the search fields.
Test Name:	When checked, the Test Name field in the Info.txt records will be searched for the specified text.
Test Description:	When checked, the Test Description field in the Info.txt records will be searched for the specified text.
Acquisition Description:	When checked, the Acquisition Description field in the Info.txt records will be searched for the specified text.
Comment:	When checked, the Comment field in the Info.txt records will be searched for the specified text.
Date >=:	When checked, only records whose Date field is at or later than the time specified will be selected..
Date <=:	When checked, only records whose Date field is at or earlier than the time specified will be selected.
Reset	Clear all fields and uncheck all boxes.


#### 4.8.12.3.4 Access

- Search button in the Test Summary Entries dialog.



### 4.8.13 Print Graph

#### 4.8.13.1 Dialog



The dialog box is titled "Print Entire Graph" and contains several sections for configuring the printout. The "Printout Type" section has two radio buttons: "Graphic" (selected) and "Tabular". There are two checkboxes: "Print Barcode" (checked) and "Print 'Extra'" (unchecked). A text field for "Cal Freq (GHz)" contains the value "1.00". The "Heading" section has a checked "Title" checkbox with a text field containing "demo cal graph", and checked "Date" and "Time" checkboxes. The "Page Break" section has an unchecked checkbox "Print one channel (acquisition line) per page". The "Reduction" section has an unchecked checkbox "Print only those lines with reduction turned ON". At the bottom are "OK" and "Cancel" buttons.

**Figure 4-62 Graph print configuration**

#### 4.8.13.2 Discussion

When printed, all graph Cal Items are listed and grouped by instrument and channel. The items are printed in order as they appear in the graph. Cal Item information includes item type, name/barcode, description, delay, and calibration factor.

#### 4.8.13.3 Details

Item	Description
Graphic/Tabular	Print items graphically (similar to the display) or as a textual table
Print Barcode	Print the instrument's barcodes, if they are assigned, along with the tabular instrument information.
Print 'Extra'	Show additional item information (e.g., cable type, attenuator type)
Cal Freq. (GHz)	The frequency used to compute a single gain value, for items with frequency dependent characterization curves.
<b>Heading</b>	
Title	Print the specified title.
Date	If checked, show the printout date on the document

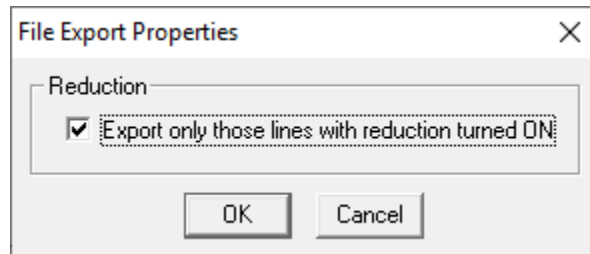
Time	If checked, show the printout time on the document
Print one channel (acquisition Line) per page.	If checked, print each channel on its own page
Print only lines with reduction turned ON	If checked, print only the signal paths that are configured to perform data reduction.

#### 4.8.13.4 Access

- File | Print Graph Items menu item
- Right-click on a Station, Instrument or Channel node in the graph and select Print Graph Items... from the popup menu.

### 4.8.14 Graph Export Properties

#### 4.8.14.1 Dialog



**Figure 4-63 Export properties**

#### 4.8.14.2 Discussion

Determines if file export of the graph is to include all signal paths or only those that have reduction enabled. Note that cancelling this dialog will cancel the export.

#### 4.8.14.3 Access

- File | File Export Graph Items (entire graph) menu item
- Right-click on the Station node or an Instrument node in the graph and select Export Graph from the popup menu.

## 4.8.15 Graph Display Preferences

### 4.8.15.1 Dialog

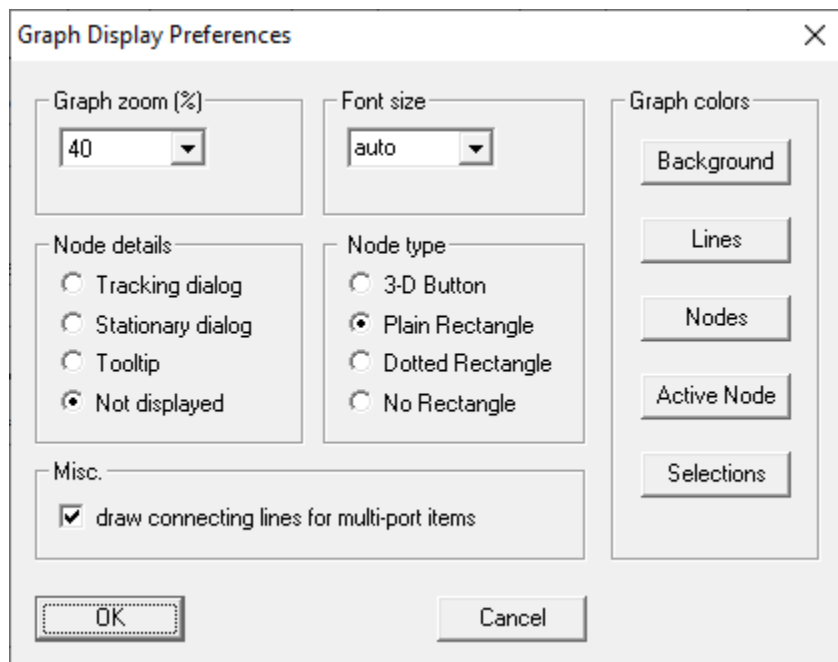


Figure 4-64 Graph display preferences

### 4.8.15.2 Discussion

The Display Preferences dialog modifies the graph's appearance. These functions only alter the graph's appearance and are available to suit user preferences. They have no effect on data reduction operations.

### 4.8.15.3 Details

Item	Description
Graph zoom	Controls the display size of the graph nodes.
Font size	Size of the node text
<i>Node details</i>	Information window displayed when the mouse hovers over a node
Tracking dialog	Small dialog displayed at the bottom-right corner of the node
Stationary dialog	Small dialog displayed at a fixed screen location
Tooltip	Standard Windows tooltip displayed below the cursor
Not displayed	No information window
<i>Node type</i>	Drawing method for the graph nodes

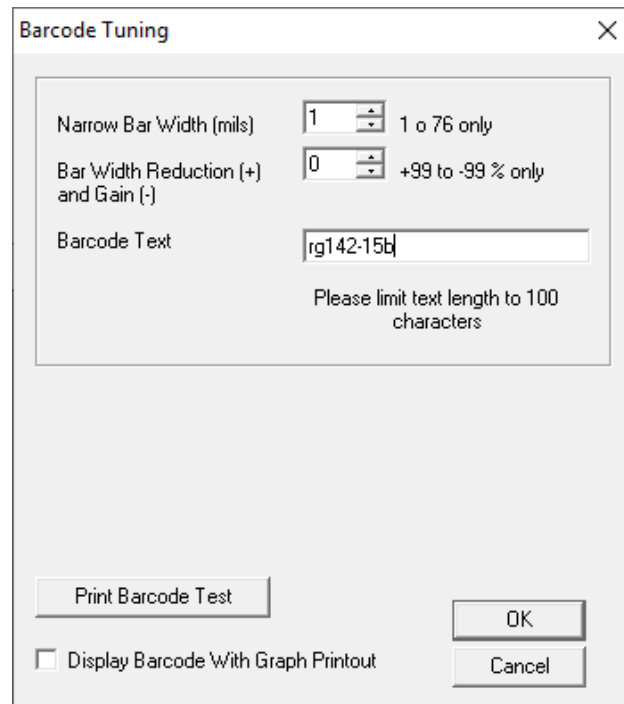
3-D Button	Nodes are displayed as raised, dialog-type 3D buttons.
Plain Rectangle	Nodes are displayed as simple, single-line rectangles.
Dotted Rectangle	Cal Items are displayed as a transparent (dotted) rectangle.
No Rectangle	No box/rectangle is drawn around each graph item, and the lines connecting Cal Items, instruments, and channels are changed to dotted lines.
Draw connecting lines	Toggles display of the connecting lines from items with multiple ports. Does not affect the connection lines for branch nodes, adders, or switches in the adder orientation.
<i>Graph colors</i>	Select the colors of the graph items using a color-picker dialog
Background	The region behind the graph
Lines	The lines that connect the nodes and the node outlines
Nodes	The node background
Active node	The highlight rectangle around the active node
Selections	The region that highlights selected nodes (using click-drag node selection)

#### 4.8.15.4 Access

- Preferences | Graph Display menu item
- Right-click on an empty portion of the graph, then select Display Preferences from the popup menu.

## 4.8.16 Print Barcode

### 4.8.16.1 Dialog

The image shows a 'Barcode Tuning' dialog box with a close button (X) in the top right corner. Inside the dialog, there are three main sections. The first section has 'Narrow Bar Width (mils)' with a spinner box set to '1' and a label '1 to 76 only'. The second section has 'Bar Width Reduction (+) and Gain (-)' with a spinner box set to '0' and a label '+99 to -99 % only'. The third section has a text box labeled 'Barcode Text' containing 'rg142-15b', with a note below it saying 'Please limit text length to 100 characters'. At the bottom, there is a 'Print Barcode Test' button, a checkbox labeled 'Display Barcode With Graph Printout' which is currently unchecked, and 'OK' and 'Cancel' buttons.

**Figure 4-65 Barcode Print Dialog**

### 4.8.16.2 Discussion

The Barcode Print Setup dialog configures the size of the barcode when printing graphical of channels. This configuration is necessary because the printer resolutions vary in size and aspect ratio.

Bar codes are constructed of narrow and wide vertical bars. The Narrow Bar Width (mils) sets the width of the narrow bars, which in turn scales the wide bars. The Bar Width Reduction increases (-) or decreases (+) the width of both types.

Check Display Barcode With Graph Printout to print a barcode for each item when printing the graph. Trial and error may be required to find the optimal settings. If the barcode is too wide to fit in the allocated space at the top of the Cal Item, an error message will be printed instead. If the bar code is too narrow, the barcode reader may not read the codes properly.

Use the Print Barcode Test to print a barcode of the text entered into the Barcode Text field.

### 4.8.16.3 Details

Item	Description
Narrow Bar Width (mils)	Sets the width of the narrow bars and scales the wide bars accordingly. Values are from 1 to 76 are permitted.

Bar Width Reduction (+) and Gain (-)	Decreases (positive numbers) or increases (negative numbers) the width of both narrow and wide bars.
Barcode Text	Sample text for use with Print Barcode Text (next item).
Print Barcode Text	Prints the Barcode Text (last item) with the current settings.
Display Barcode with Graph Printout	When checked, a barcode is printed at the top of each item node when printing a graphic description of Cal Lines.

#### 4.8.16.4 Access

- Preferences | Barcode Print Setup menu item

### 4.8.17 Item Reduction Defaults

#### 4.8.17.1 Dialog



**Figure 4-66 Reduction defaults dialog**

#### 4.8.17.2 Discussion

Cal Manager's Reduction Defaults dialog is used to set the default reduction settings when new Channels and Cal Items are inserted into the graph.

#### 4.8.17.3 Details

Item	Description
<i>Channel Opts</i>	
Reduce Channel	Reduce this channel's data during the reduction process.

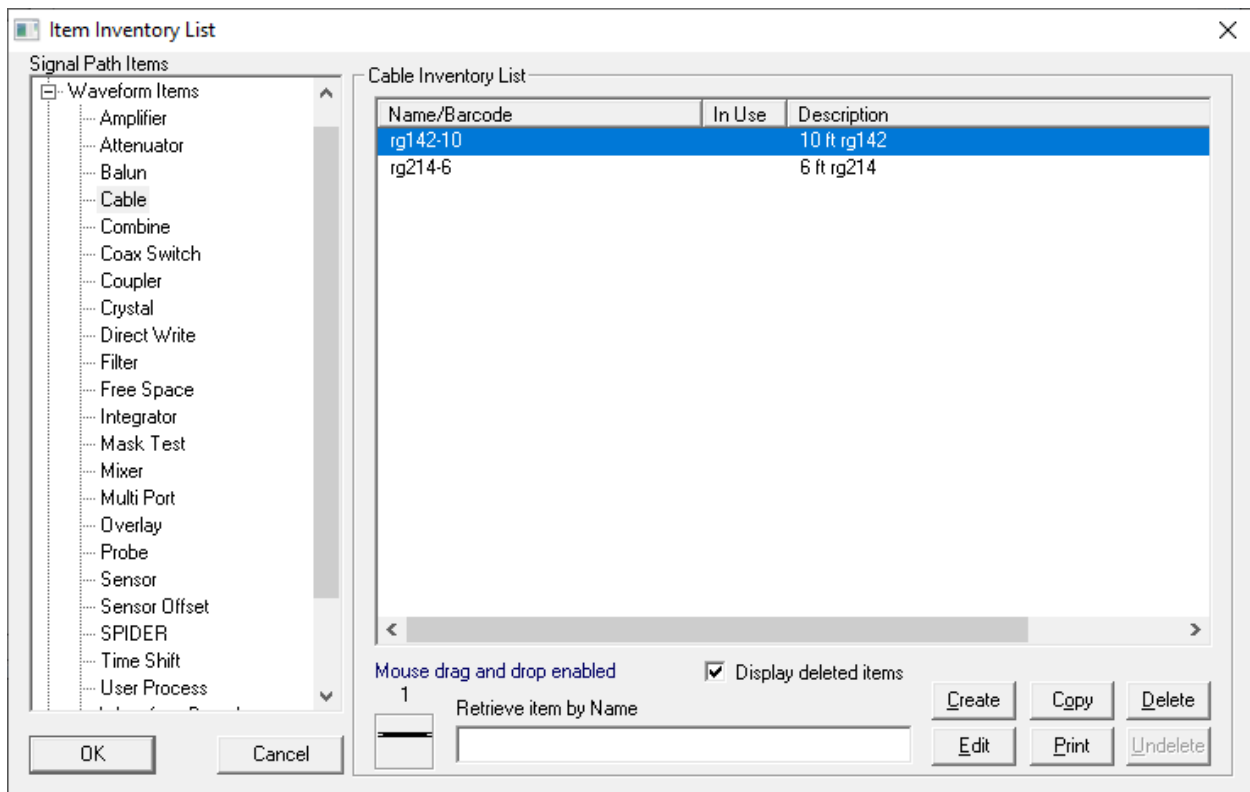
Display Waveform	Display the channel's raw waveform in Analyze during the reduction process.
Print Waveform	Print the channel's raw waveform during the reduction process.
<i>Item Options</i>	
Display Waveform	Display the item's reduced waveform in Analyze during the reduction process.
Print Waveform	Print the item's reduced waveform during the reduction process.
Archive Waveform	Archive the item's reduced waveform during the reduction process.

#### 4.8.17.4 Access

- Preferences | New Item Defaults menu item

### 4.8.18 Inventory List

#### 4.8.18.1 Dialog



**Figure 4-67 Item Inventory dialog**

#### 4.8.18.2 Discussion

The Inventory List dialog allows the creation editing, and deletion of Cal Items. It is also used from within the graph to select items for insertion into the graph. When this dialog is activated from the CalGraph's

window menu (Inventory | Inventory List...), it becomes a “modeless” dialog that may remain active for dragging and dropping items onto the graph. It can remain active while the remainder of the program is used.

When this dialog is activated through the pop-up menu item “Insert a new item to the RIGHT | LEFT of this item,” it is in the normal “modal” mode. This mode allows selecting an item for inserting into the graph by double-clicking the item, or by selecting the item and then selecting the OK button. When the dialog is in this mode, it must be dismissed before any other part of the program may be used.

Note: another inventory list dialog, a smaller “drag and drop” inventory list is available from the Inventory menu item, but is used only for inserting items into the graph--you can’t create or edit items from this dialog. See Drag and Drop Inventory List for specifics.


#### 4.8.18.3 Details

Item	Description
Signal Path Items	This list contains all supported cal item types. The list groups items in three parts: Waveform Items, Image Items, and No Reduction. Select a cal item type to view all items of that type or to create a new item of that type. The available items are displayed in the Inventory List, item type icon is displayed, and the total number of items listed in the Inventory List is displayed.
<Type> Inventory List	This list contains the available items for the selected item type. The item Name / Barcode, In Use, and Description fields are displayed. For performance reasons, the Description field is not displayed until the item is selected.
Retrieve item by Name / Barcode	Locates items in the Inventory List if the name / barcode is known. Enter the name, then use [Tab] to exit the edit field and search for the item. If found, it will be listed alone in the Inventory List. Only exact name matches are retrieved. Clear the field to show all items of the selected type.
Edit	To view or edit the settings for an existing item, either double-click the item in the Inventory List, or click on the desired item then select Edit.
Create	To create a new Cal Item, select the type of item from Cal Items Type list, then select Create. An Inventory Data page for that Cal Item will open. Enter the data to create the configuration for this item, then select OK. The new Cal Item is then added to the Inventory List.
Copy	To copy a Cal Item, highlight the item in the <Type> inventory list and press Copy. This will create a new item of the <Type>, and then activate the new item’s user-interface with the Name/Barcode field blank so that a new and unique name can be entered. Remember, this field is the database key and it must be unique. The description field is copied along with item specific properties, with “(copy)” appended to the end of the description.
Delete	To delete a Cal Item, highlight the item in the <Type> inventory List and press Delete. Deleted items can be restored - see Undelete below.



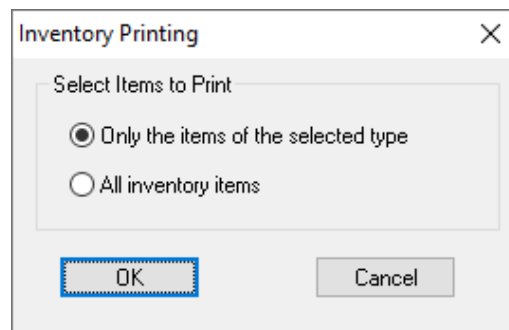
Undelete	Undelete a previously deleted item that is selected in the inventory list. Check the Display deleted items control to display deleted items in the list.
Display deleted items	Check this item to display all deleted items. Deleted items' name or barcode are printed in red.
Print	To print a listing of the entire inventory of items, or only the current items displayed in the Inventory List, select the print command.

#### 4.8.18.4 Access

- Inventory | Inventory List menu item
- Select a channel or item node, right-click, then select "Insert a new item to the RIGHT (or "LEFT") of this item" from the popup menu.
-  toolbar button

#### 4.8.18.5 Inventory Printing

##### 4.8.18.5.1 Dialog



**Figure 4-68 Inventory print range selection**

##### 4.8.18.5.2 Discussion

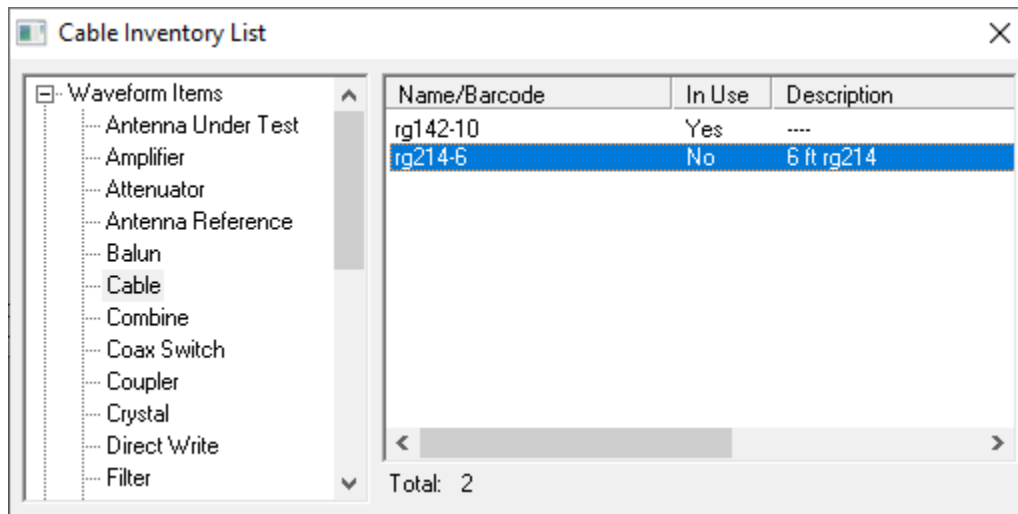
This control appears when the Print button is clicked in the Item Inventory dialog. It is used to select the range of items to print. Selecting All inventory items prints all cal items in the database, which may require several pages if the database is large.

##### 4.8.18.5.3 Access

- Open the Item Inventory dialog (Section 4.8.18), then click Print.

## 4.8.19 Drag-and-Drop Inventory List

### 4.8.19.1 Dialog



**Figure 4-69 Drag-and-drop item inventory list**

### 4.8.19.2 Discussion

This Drag-and-Drop Inventory List is a compact dialog used to insert cal items into the graph by dragging them from the list, then dropping them on top of other nodes in the graph. The new cal item node is inserted to the right of the target node.

This dialog contains only two lists: the device types and the associated cal items in the inventory. This dialog is only used to place cal items in the graph. It does not edit, create, delete or print items.

### 4.8.19.3 Details

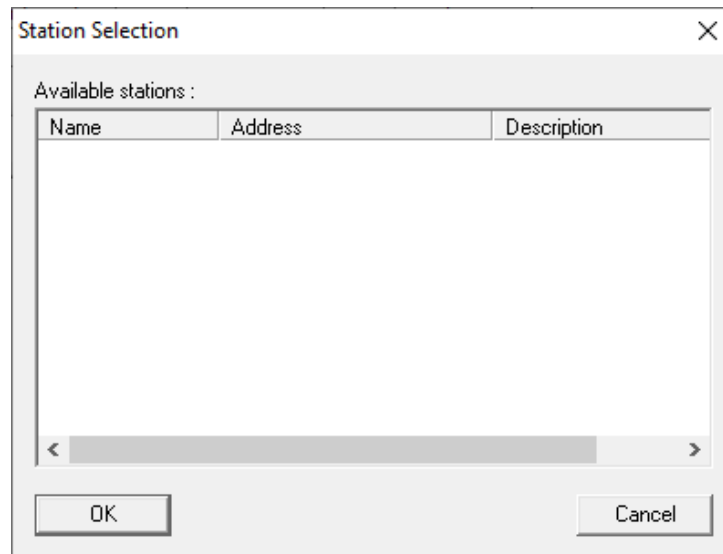
Item	Description
Type list (left)	Lists the Cal Items types supported by the current installation. Select a type from this list to display all items of that type in the item list.
Item list (right)	Current inventory of all cal items of the type selected in the left-side list.

### 4.8.19.4 Access

- Inventory | Drag and Drop Inventory List menu item

## 4.8.20 Stations Selection

### 4.8.20.1 Dialog




**Figure 4-70 Station selection dialog**

### 4.8.20.2 Discussion

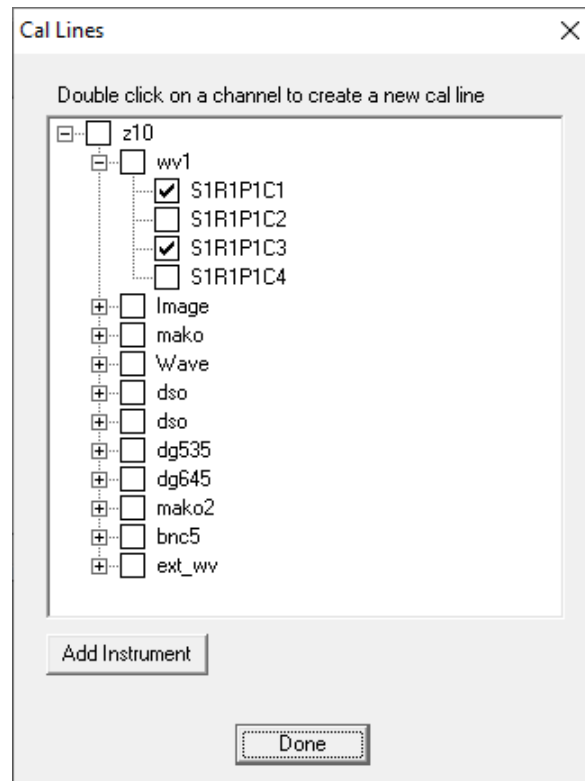
The Stations dialog selects the station windows displayed in TestMan. This feature is not implemented yet.

### 4.8.20.3 Access

- Graph | Stations menu item
-  toolbar button

## 4.8.21 Lines Selection

### 4.8.21.1 Dialog




**Figure 4-71 Cal line selection dialog**

### 4.8.21.2 Discussion

The Cal Lines dialog lists all available instruments and channels for the current station. A check mark beside the channel indicates that it is already selected and displayed in Cal Manager's graph. Double-click on an unchecked channel to add it to the graph. The Channel dialog will then be displayed, to specify the channel's reduction settings. Channels are always placed in the graph beside and under their corresponding instrument node. The instrument node is automatically created when its first channel is added. Once the channel node is included in the graph, cal items can be added to define the signal path.

New instruments can be created here by pressing the Add Instrument button.

### 4.8.21.3 Access

- Graph | Lines
- Right-click on the station node in the graph and select "Insert Instrument" or "Insert Signal Path" from the popup menu.
- Right-click on an instrument node in the graph and select "Insert Channel" from the popup menu.
-  toolbar button

## 4.8.22 Global Reduction Options

### 4.8.22.1 Dialog

Global Reduction Options Map

Instrument	Channel	Cal Item	Waveform	Display	Print	Archive
ww1						
	pulse-001	<input checked="" type="checkbox"/> Line Reduction	Raw	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		6dB	Corrected	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		scale	Corrected	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	rf-01	<input checked="" type="checkbox"/> Line Reduction	Raw	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		direct	Power vs. Time	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
			Freq vs. Time	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
			Spectrum	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	pulse-2	<input checked="" type="checkbox"/> Line Reduction	Raw	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		10dB	Corrected	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	S1R1P5C4	<input checked="" type="checkbox"/> Line Reduction	Raw	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
pico						
	pico-A	<input checked="" type="checkbox"/> Line Reduction	Raw	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		6dB	Corrected	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		y <sub>max</sub>	Corrected	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		sub	Combined	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		double	Corrected	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			Raw	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		y <sub>min</sub>	Corrected	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5104						
ima						

Search

Double-click a Cal Item cell to configure the item

OK Cancel

Toggle Line Reduction

Set all

Clear all

Toggle columns above

Set Set Set

Clear Clear Clear

Set All Clear All

Figure 4-72 Reduction options map

### 4.8.22.2 Discussion

The Global Reduction Options Map configures reduction options for the current graph. Each entry in this dialog contains the same reduction functions that can be found in each of the Cal Item's reduction page, including the channel's line reduction switch. This dialog is more efficient to use when changes are necessary for many Cal Items.

This map displays all instruments, Cal Lines, and Cal Items attached to each channel. Line reduction can be toggled on and off, and output options for each can be set. The entire graph's reduction options (and most other properties) can be set or cleared at one time.

The Instrument is displayed in the first column. There are no options for the instrument entry.

Each channel is displayed in the second column. The first row for each channel contains a Line Reduction check-box, which is the same check-box option contained in the channel's dialog. When checked, reduction will be performed for the entire line. Double-clicking this column within the Line Reduction text activates the channel's dialog. This is the same dialog that is displayed and used from the graph. Any changes made in the item's dialog are recorded when OK is selected. These changes are updated in the graph's node when OK is selected.

Every channel row and every Cal Item row contain a Waveform type. The channel waveform name is Raw. Most Cal Items' waveform type is Corrected. However, some nodes do contain other waveform types. Every channel contains a Display and Print check box—the same options that are contained in the channel's Reduction page dialog.

All cal items attached to the channel are then listed just after the channel name. Each cal item row contains the same options: Cal Item (name), Waveform (type), and the waveform output selection: Display, Print, and Archive columns. If the Cal Item generates more than one output, then each output is listed on a separate row and each has its own set of Display, Print, and Archive check-boxes.

Double clicking inside the cal item name field activates the item's dialog. This is the same dialog that is activated from the graph. Any changes made in this dialog are recorded when OK is selected. Also, any changes made in the Reduction page of this dialog are updated in this global map when OK is selected.

A Search button at the bottom left opens a dialog that searches this map for an instrument name, channel name, or an item name. If found, the row containing the target string will be highlighted.

The Set and Clear buttons beneath the Cal Item name column set or clear all of the channel-line reduction options. The buttons beneath each of the output columns (display, print, and archive) set or clear each column. Set All sets all output types in the map and Clear All clears all of them.

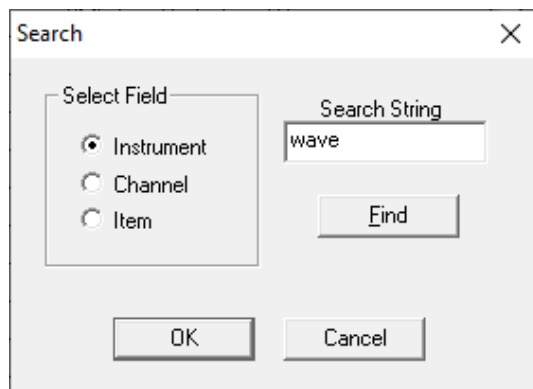
Select OK when you have made the required settings. All reduction information is then updated in each node of the graph. If any settings in any of the item's dialogs have been altered by double-clicking the cal item column, then Cancel will be disabled and all changes become permanent.

#### 4.8.22.3 Access

- Reduction | Global Selection Map

#### 4.8.22.4 Reduction Map Search

##### 4.8.22.4.1 Dialog



**Figure 4-73 Reduction map search dialog**

#### 4.8.22.4.2 Discussion

The reduction map search dialog searches the map for the first occurrence of the search specified string among nodes of the specified type.

#### 4.8.22.4.3 Details

Item	Description
Select Field	Determines the field in the map to search: Instrument, Channel or Cal Item.
Search String	The search string. Searches are case insensitive and match substrings.
Find	Searches the map and scrolls the display to put the match in the top row.

#### 4.8.22.4.4 Access

Search button from the Global Reduction Options Map dialog

## 4.8.23 Global Reduction Parameters

### 4.8.23.1 Dialog

Global Data Reduction Parameters

Station Parameters - z10

Default narrowband frequency (GHz) : 1.5

Data Export

☒ Export reduction output data :

that is selected to : ☒ display ☐ print ☒ archive

that is of data type : ☐ waveform ☐ image ☒ FOM

waveform format : ASCII no header

image format : Bitmap

Path : D:\daaac\export\foms

FOM Export

FOM file name : foms2023.csv

Condition for file change : Burst change

☒ Place each channel's data on a separate row

☐ show labels next to values

☐ Repeat header lines with each data row

OK Cancel

**Figure 4-74 Global data reduction parameters**

### 4.8.23.2 Discussion

The Global Data Reduction Parameters dialog contains data reduction settings that are applied globally, across the entire graph.

### 4.8.23.3 Details

Item	Description
Default narrow band frequency	Enter a floating-point value for the global constant. The Default Frequency value is used with the narrowband channel nodes during data reduction. The value is specific to each acquisition station (it is stored with the station's graph).



Export reduction output data	Automatically exports the selected reduction data as it is created. Export is global (applies to all reduction outputs), but can be filtered by each output's display / print / archive settings. For example, selecting the archive checkbox here will only export output data that have the archive flag set. Data exported can also be filtered by type – waveform / image / FOM. Automatic export of image data is not yet supported.
waveform format	file format for all exported waveforms
image format	File format for all exported images [disabled – image export not yet supported]
Path	Destination for exported data files
FOM export	If selected, FOM values calculated during reduction are automatically exported at the end of the reduction sequence. The values are written to a CSV file, with a header row followed by one or more rows with: burst, shot, acquisition time, and FOM values. Each shot is written on a separate row. The default configuration appends new FOM data to the existing file, only writing the header row when the FOM output definition changes. The controls described below can alter the default configuration.
file name	Name of the single file that holds all exported FOM values.
file change condition	Specifies if separate FOM export files should be created whenever the burst or shot number changes.
channels on separate rows	Check this control to place each channel's FOM values on separate rows. If unchecked, all FOM values are placed on the same row with the burst, shot, and acquisition time.
place labels with values	When each channel is written on a separate row, check this control to write the FOM name before each FOM value.

#### 4.8.23.4 Access

- Reduction | Global Parameters menu item

## 4.8.24 Item Search

### 4.8.24.1 Dialog

Item Search

Name rg58\_10

Description

Location

Search is the First Field With Text

Options

☒ Start at Graph Top ☒ Match Exact (Case and Length)

☐ Start at Current Position

Search Cancel

**Figure 4-75 - Item Search Dialog**

### 4.8.24.2 Discussion


The Search dialog searches the graph for text that may be in any Cal Item. The search will be for the first field that contains text. For example, if all three fields contained a text string, the search is conducted for only the text in the first field. Likewise, if the Description and Location field contain text, the search will be for the entry in the Description field, the Location text is ignored.

### 4.8.24.3 Details

Item	Description
Name	Name field from the Cal Item data page to find. (Barcode instead of name for strict inventoried systems).
Description	Description from the Cal Item data page to find.
Location	Rack Location to find.
Start at Graph Top	The search begins at the top of the graph, not at the current line.
Start at Current Position	The search begins at the current line and ends at the end of the graph.
Match Exact (Case and Length)	If checked, the search will be for an exact match. That is, both the case and length of the string must be exactly the same (no sub strings). If not checked, the case is not considered and any substring found in the graph will be considered a match.

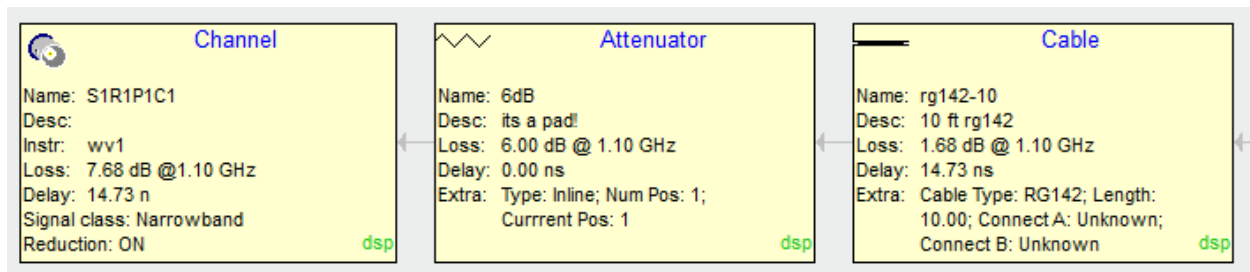
Search	When selected, begins the search. If a match is found, the first matching graph node will be highlighted.
--------	---

#### 4.8.24.4 Access

- Tools | Search menu item
- 

### 4.8.25 Line Summary

#### 4.8.25.1 Image



**Figure 4-76 – Excerpt from a line summary display**

#### 4.8.25.2 Discussion

Line Summary is a special window used to display the contents of a single cal line in a graphical summary format. All Cal Items in the Cal Line are displayed in the same order as in the main graph window (starting with the Channel item at the far left). However, each item's node displays a detailed summary of the current state of that node.

Double-click any item's node to activate its user interface. Right-click anywhere in the window to activate a pop-up menu that contains items to activate a configuration dialog (Display Properties dialog), print the current line and close the summary window.

A Line Summary window displays specific information about each item in the cal line. The first node in the line, the channel node, displays name, description, instrument attached with, total loss and delay for the entire channel, channel to mixer loss and delay if the channel contains a mixer, signal class (narrow band, wide band, image, antenna), and reduction status (on or off). Each cal item node displays its name, description, its loss at frequency, and delay as well as item specific information. A cable's specific information, for example, is cable type, length and connector types. Loss is calculated at the configured (global or channel specific) frequency for narrowband channels, and calculated at 0 Hz for wideband channels.

The waveform reduction selections for each node (display, print, archive) are displayed in the lower right corner of each node. External links to each node are also displayed, for example the link to a Combine is printed at the bottom of each combined node. Links with other nodes are displayed at some position on or around the node, such as this item's link to a Combine node on another line.

#### 4.8.25.3 Access

- Tools | Line Summary
- Right-click on a channel node and select "Line Summary" from the popup menu.

#### 4.8.25.4 Display Properties

##### 4.8.25.4.1 Dialog

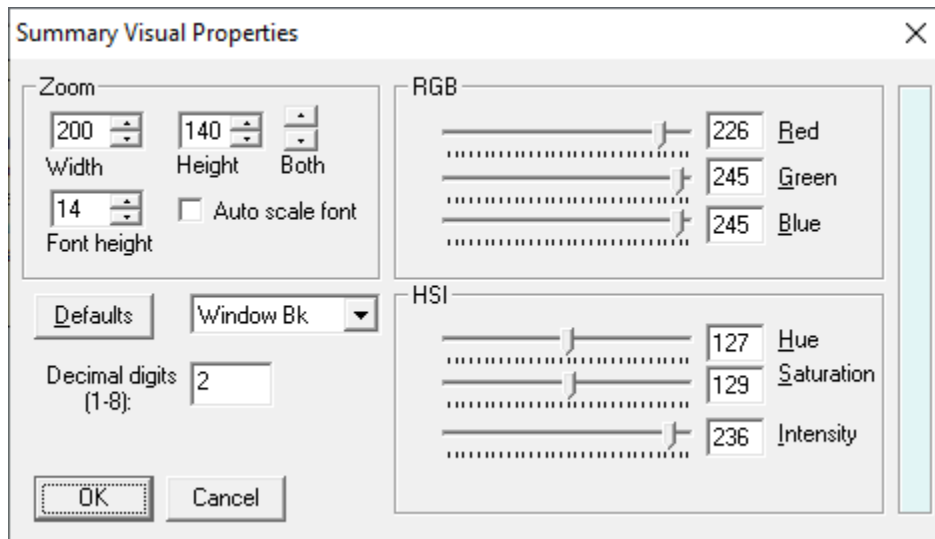


Figure 4-77 Line Summary display options

##### 4.8.25.4.2 Discussion

The Display Properties dialog, activated from the Line Summary window, is used to change the visual properties of the nodes in the summary.

##### 4.8.25.4.3 Details

Item	Description
Width	Set the node width. Units are screen pixels.
Height	Set the node height. Units are screen pixels
Both	Modify both width and height. Units are screen pixels.
Font Height	Set the height of the font used to display the node text.
Auto scale font	Scale the font size automatically when the node height is changed.
Defaults	Set all properties to the default values.
Drawing item list	A list of line summary drawing items. Select an item to specify its color.
RGB	Red, Green, and Blue color controls.
HIS	Hue, Saturation, and Intensity color controls.

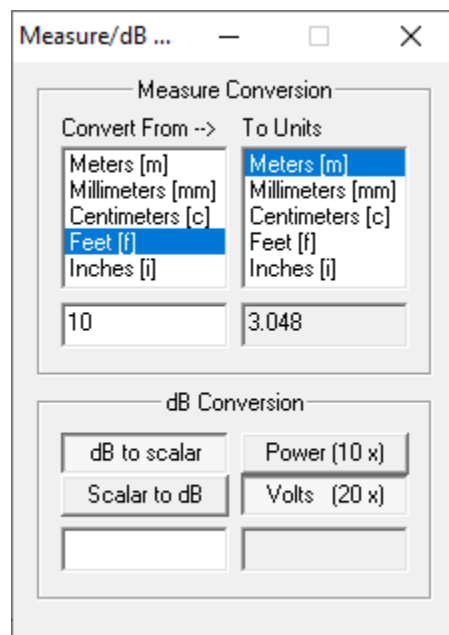
Decimal digits	Enter the number of significant decimal digits to print.
----------------	--

#### 4.8.25.4.4 Access

- Display Properties menu item, available when the Line Summary window is active
- Right click in the Line Summary window and select “Display Properties” from the popup menu.

### 4.8.26 Conversion Tool

#### 4.8.26.1 Dialog



**Figure 4-78 Conversion calculator tool**

#### 4.8.26.2 Discussion

This tool provides a convenient calculator for converting a value expressed in a given unit of length to another. It also converts a scalar value to dB or a value expressed in dB to scalar.

#### 4.8.26.3 Access

- Tools | Conversions

## 4.8.27 Line Totals

### 4.8.27.1 Dialog

Line TotalsS1R1P1C1

Signal class : Narrowband

Frequency (GHz) : 1.1

Total loss (dB) : 7.679

Total delay (sec) : 14.73 n

Chan to det loss (dB) :

Chan to det delay (sec) :

Det to sensor loss (dB) :

Det to sensor delay (sec) :

Done

**Figure 4-79 Signal line calculations**

### 4.8.27.2 Discussion

This dialog presents a summary of the effects of the signal path items on the signal at a given frequency.

### 4.8.27.3 Details

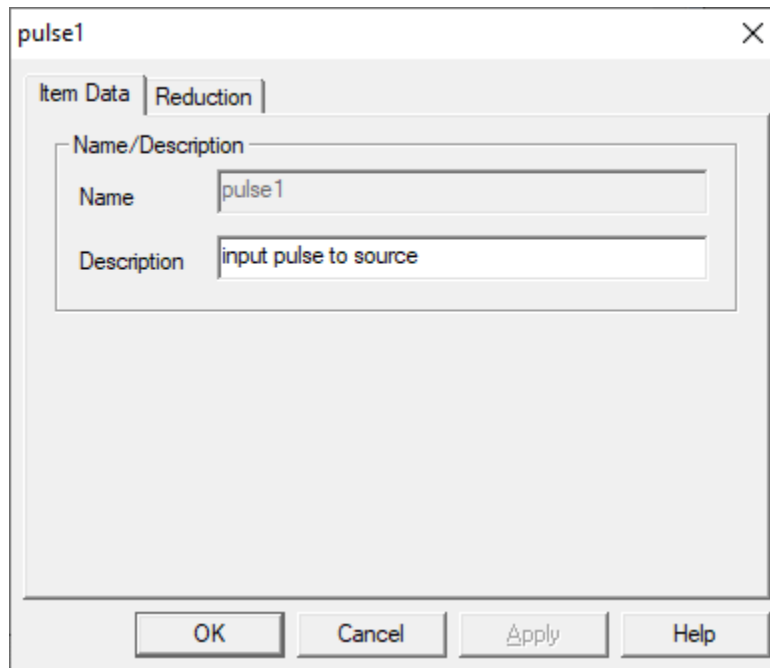
Item	Description
Signal class	Channel's signal class (e.g. wideband, narrow band, image)
Frequency	Frequency used to evaluate the loss through the components
Total loss	Total signal loss over the entire signal path at the selected frequency
Total delay	Total time delay over the entire signal path
Chan to det loss	Signal loss from the instrument to the detector (for narrowband only)
Chan to det delay	Time delay from the instrument to the detector (for narrowband only)
Det to sensor loss	Signal loss from the detector to the sensor (for narrowband only)
Det to sensor delay	Time delay from the detector to the sensor (for narrowband only)

### 4.8.27.4 Access

- Right-click on a channel node and select "Line Totals" from the popup menu.

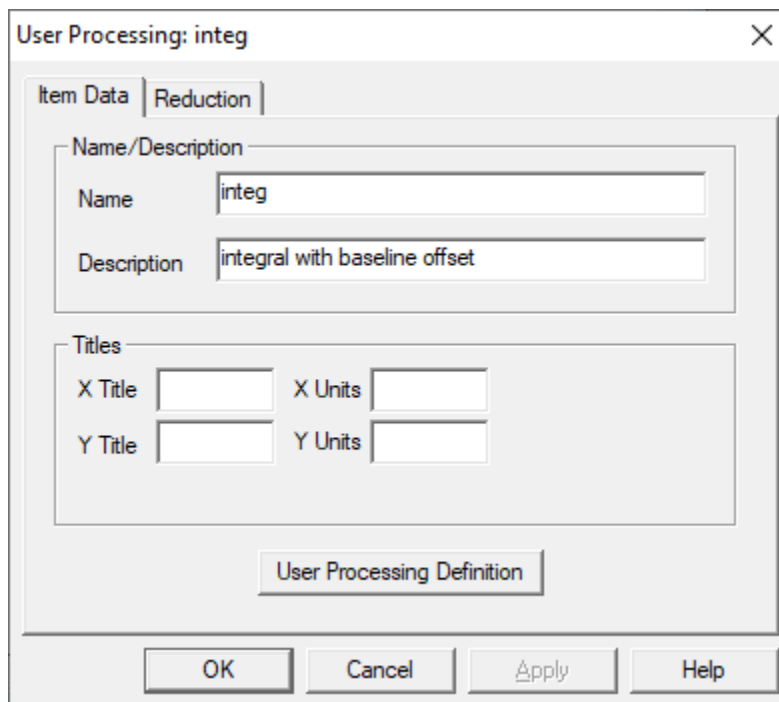
## 4.8.28 Item Data

### 4.8.28.1 Dialog



The screenshot shows a dialog box titled "pulse1" with a close button (X) in the top right corner. It has two tabs: "Item Data" (selected) and "Reduction". Under the "Item Data" tab, there is a section labeled "Name/Description" containing two text input fields. The "Name" field contains the text "pulse1" and the "Description" field contains the text "input pulse to source". At the bottom of the dialog, there are four buttons: "OK", "Cancel", "Apply", and "Help".

Figure 4-80 Channel item data



The screenshot shows a dialog box titled "User Processing: integ" with a close button (X) in the top right corner. It has two tabs: "Item Data" (selected) and "Reduction". Under the "Item Data" tab, there is a section labeled "Name/Description" containing two text input fields. The "Name" field contains the text "integ" and the "Description" field contains the text "integral with baseline offset". Below this, there is a section labeled "Titles" containing four text input fields arranged in a 2x2 grid. The top row contains "X Title" and "X Units", and the bottom row contains "Y Title" and "Y Units". At the bottom of the dialog, there are four buttons: "OK", "Cancel", "Apply", and "Help".

Figure 4-81 User Process item data

**Image to Waveform**

Name/Description

Name: mean100cols

Description: mean of 100 columns

Select mode

☐ Single column
 ☒ Multi column
 ☐ Single row
 ☐ Multi row

Operation / Statistic : mean

Define waveform

Column: Begin 50 End 150 ☐ All columns  
 Row: 0 Max ☒ Entire column

OK Cancel Apply Help

**Figure 4-82 Image to Waveform item data**

**Cable: rg142-10**

Item Data Reduction

Name/Description

Name: rg142-10

Description: 10 ft rg142

Cable Type: RG142

Connectors

Connector A: Other Connector B: Other

Delay : 14.73 ns Length : 10.00 feet

☒ electrical delay is included in the phase data

Curve Setup

Gain Curve TDR Curve

OK Cancel Apply Help

**Figure 4-83 Cable item data**



#### 4.8.28.2 Discussion

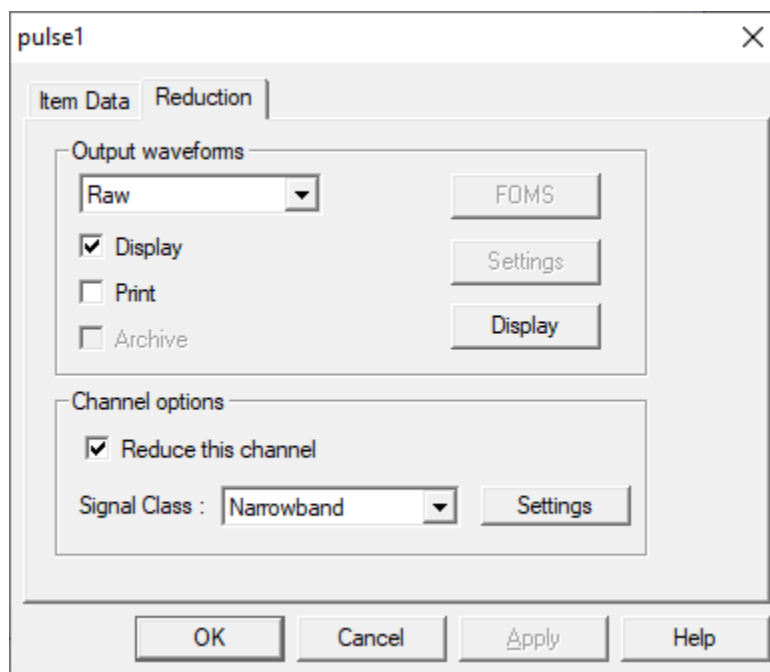
Several versions of the Item Data dialog tab may appear, depending on the type of Item from which the dialog is accessed. Figure 4-80 through Figure 4-83 show the dialog accessed from a channel node and from various item nodes. Specific Items are addressed in detail in Cal Items. Many of these dialogs access subdialogs with additional detailed configuration controls.

#### 4.8.28.3 Access

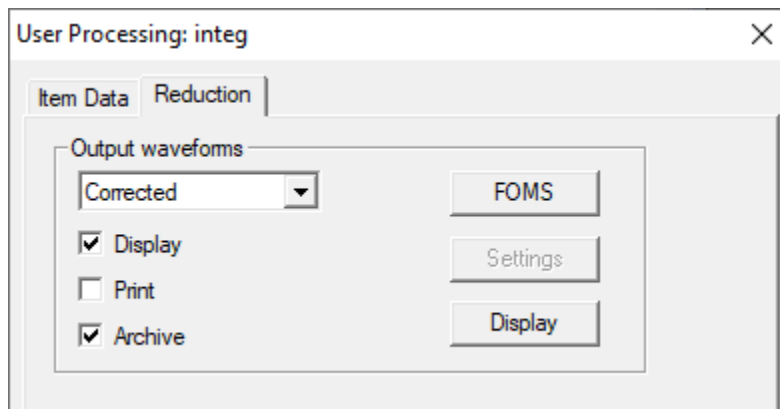
The dialog appears when an Item is created or edited in the Inventory List dialog or when a channel or item node is double-clicked in the graph.

### 4.8.29 Reduction

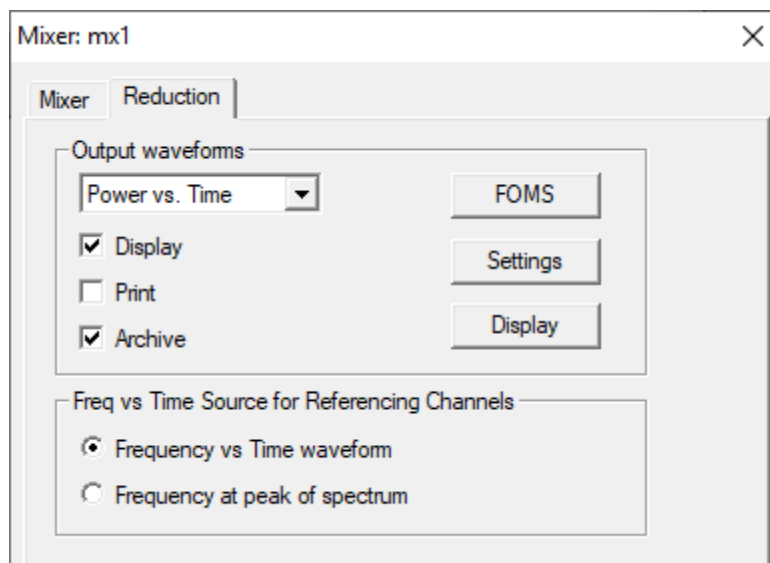
#### 4.8.29.1 Dialog



**Figure 4-84 Channel node reduction dialog**



**Figure 4-85 Standard item reduction dialog**



**Figure 4-86 Mixer reduction dialog with item specific controls**

#### 4.8.29.2 Discussion

Three versions of the Reduction dialog are presented in Figure 4-84 through Figure 4-86. The first is opened from a Channel node and is the most complex. In addition to features of other dialogs, the type of reduction and whether reduction is to be performed are selected here. The other two figures represent a standard Cal Item and an item with additional controls (mixer shown here), respectively.

#### 4.8.29.3 Details

Item	Description
Corrected Output waveforms	This lists the available waveforms supported by the current item. In this version of DAAAC, all items except Mixers support only the Corrected type. Mixers support the

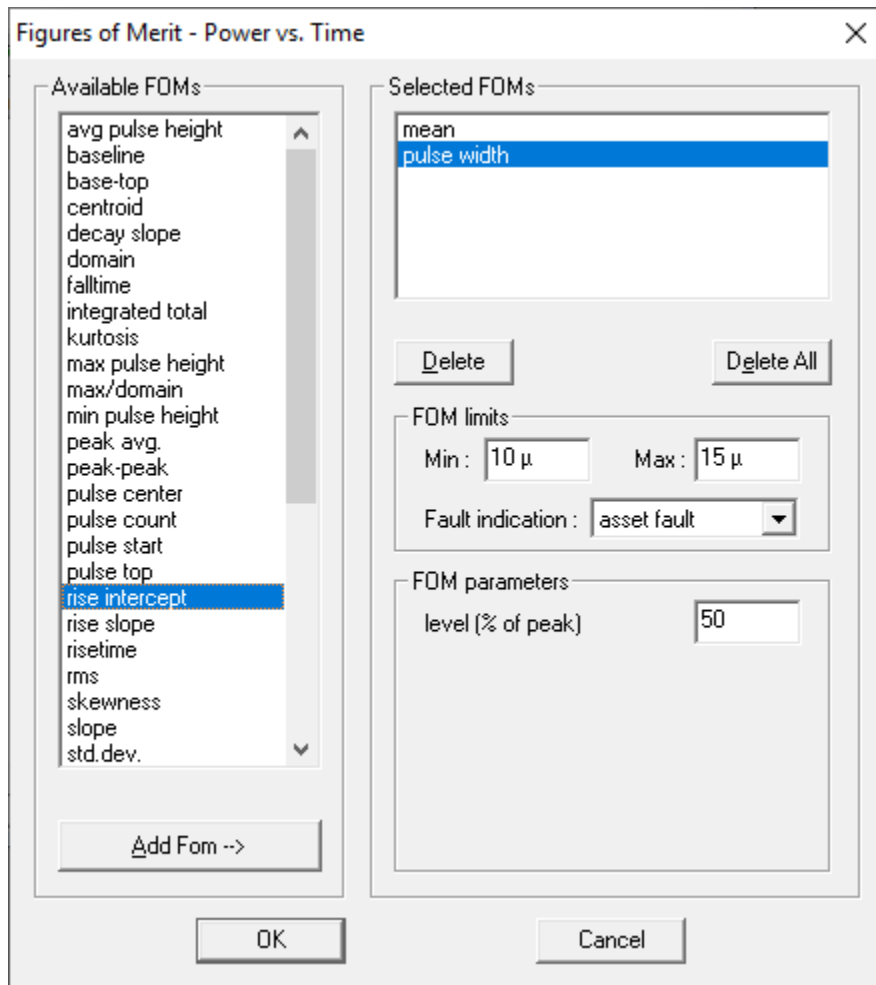
	following waveform types: Power vs. Time, Freq. vs. Time, Uncorrected Spectrum, and Corrected Spectrum.
Display	When on, the resulting, reduced waveform is displayed in the Analyze module (if Analyze is running and configured to display reduced data) during online reduction.
Print	When on, the resulting, reduced waveform is printed from the Analyze module (if Analyze is running and configured to accept reduced data) during online reduction.
Archive	When on, the resulting, reduced waveform archived to the database.
FOMs	Activates the FOMs dialog, which configures various Figures of Merit, based on waveform properties.
Settings	Activates the appropriate Settings dialog, based on the output waveform type selected. Currently, the Mixer item's waveform types are the only waveforms that can be configured.
Display (Button)	Open a subdialog that allows display limits to be set.

#### 4.8.29.4 Access

This dialog is opened when a Channel or Item node is double-clicked in the graph.

### 4.8.30 Reduction, FOMs

#### 4.8.30.1 Dialog



**Figure 4-87 Figure of Merit configuration**

#### 4.8.30.2 Discussion

This page configures Figures of Merit for the current Cal Item. FOMs are values derived or computed from the reduction waveform (see Section 10). They are displayed with the waveform in the Analyze module, which must be configured to do so.

To specify and configure a FOM, highlight the desired FOM from the Corrected list, then select Add From to add the FOM to the Display FOMs list. The FOM is moved from the corrected list to the Display FOMs list; each FOM may be used only once. To delete a FOM from the Display FOMs list, highlight it and press [Del]. It then will be removed from the Display FOMs list and added back to the Corrected list.

Each FOM type defines different parameters. These parameters may be entered when the FOM is created (added to the Display FOMs list), or may be edited when the FOM in the Display FOM List is highlighted. The edited data are accepted when the dialog is dismissed or when another FOM is selected.

This dialog page is available from each Cal Item's Reduction page for the current reduction waveform.

Section 10 presents a complete description of the available FOMs for waveform and image data.

#### 4.8.30.3 Details

Item	Description
Available FOMs	List of supported FOMs. To add a FOM to the reduction waveform, highlight the desired name in this list, then select Add FOM.
Add FOM	Adds the currently selected FOM name to the Selected FOMs list.
Selected FOMs	List of FOMs selected from the Available FOMs list. To remove a FOM from this list, highlight the name and press Delete.
<i>FOM limits</i>	Waveforms with FOMs that fall outside the specified limits are flagged as “out-of-spec” and can indicate a fault condition. Out-of-spec waveforms can be color coded when displayed in Analyze. To disable FOM limit checking, set min and max to the same value.
min	The minimum “in-spec” FOM value.
max	The maximum “in-spec” FOM value.
Fault indication	If the FOM is outside the specified limits, it can set a fault condition. Faults are used by TestMan when running a test sequence, and detection of faults can alter the flow of that sequence.
FOM parameters	FOM specific settings. Controls will appear here when specific parameters are required to define the FOM calculation.

#### 4.8.30.4 Access

Select the FOMS button on the Reduction page of any node’s configuration dialog.

### **4.8.31 Reduction, Settings**

#### 4.8.31.1 Dialog

Variable – supports some signal path items’ reduction output waveforms.

#### 4.8.31.2 Discussion

The Settings dialog is item dependent and will allow the user to configure additional reduction settings for that item’s output waveforms, as necessary. For example, the Mixer item generates multiple output waveforms (Spectrum, Power vs Time, Frequency vs Time), each having specific reduction settings.

#### 4.8.31.3 Details

#### 4.8.31.4 Access

Select the Settings button on the Reduction page of any node’s configuration dialog.

## 4.8.32 Reduction, Display Options

### 4.8.32.1 Dialog

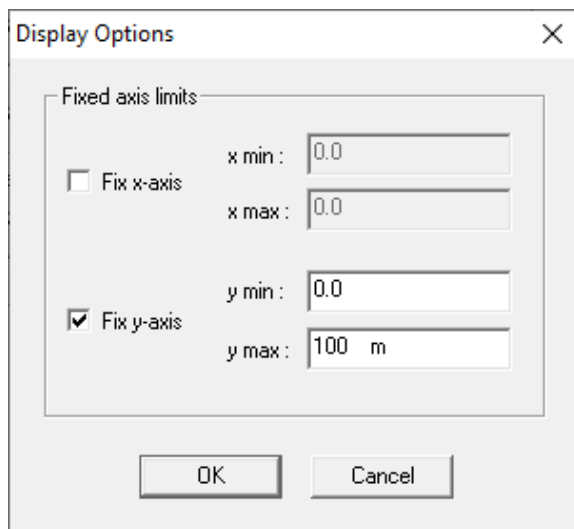


Figure 4-88 Display options dialog

### 4.8.32.2 Discussion

Use this dialog to set the X and Y Axis limits on the plot of the reduced data.

### 4.8.32.3 Details

Item	Description
Fix x-axis	Use fixed X-Axis display limits, set to the given x min and x max values.
x min:	The lower limit of the horizontal (independent) axis for fixed displays. If the waveform contains X data less than this value, the data will be truncated when displayed.
x max:	The upper limit of the horizontal (independent) axis for fixed displays. If the waveform contains X data greater than this value, the data will be truncated when displayed.
Fix y-axis	Use fixed Y-Axis display limits, set to the given y min and y max values.
y min:	The lower limit of the vertical (dependent) axis for fixed displays. If the waveform contains Y data less than this value, the data will be truncated when displayed.
y max:	The upper limit of the vertical (dependent) axis for fixed displays. If the waveform contains Y data greater than this value, the data will be truncated when displayed.

### 4.8.32.4 Access

Select the Display button on the Reduction page of any node's configuration dialog.

# 5 Archive

Archive provides the primary user interface to the DAAAC database. From Archive, you can create and select databases, import and export file data and organize and transfer data. Archive is also the starting point for the DAAAC application. When you launch “DAAAC” from the desktop icon you are actually starting the Archive module, which then launches the other modules.

## 5.1 Archive Overview

The database is used to store configurations and collected data such as waveforms, instrument settings, and signal path component characterizations, and to link all this data together so that the conditions under which any set of data was recorded are associated with that data.

All DAAAC modules, including Archive, connect to the database via the NetCom module. If the installed DAAAC system supports networked operation, NetCom also acts as a communicator between the DAAAC modules and the network. NetCom is started automatically when Archive starts, and it must always be running for any DAAAC module to access the database, whether standalone or networked.

New databases are created from Archive, and Archive is used to select the DAAAC system’s operating (active) database. Archive displays open databases in a two-pane window, which presents information such as stations, tests, named configuration, and waveform data. Archive can have several databases open at the same time – each displayed in its own window. Only one of these databases is considered active, however. The active database is the one that the DAAAC modules use to store and retrieve system configuration information, and collected waveform and image data. An asterisk (\*) before the title in the database window indicates the active database. On startup, DAAAC automatically connects to the active database from the previous session.

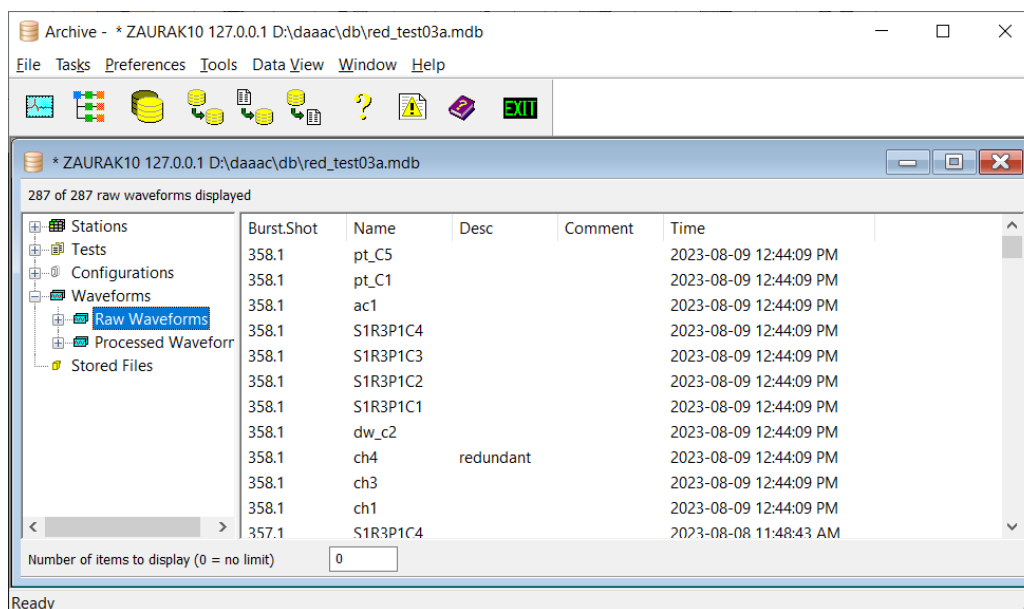


Figure 5-1 - Archive view with an open database

### 5.1.1 Archive views

Archive displays each database connection in a two-pane document window. The view's title displays the computer network name, IP address, directory path and current database name. In non-networked systems the IP address will always be 127.0.0.1, which refers to the local computer. Selection of items in the tree view on the left determines what is displayed in the list on the right. There several view types:

- Stations
- Tests
- Configurations
- Waveforms
- Stored Files

The following sections describe these views in detail.

#### 5.1.1.1 Stations View

Selecting Stations from the tree on the left shows the list of stations. In standalone mode, there will only be one station in this list.

#### 5.1.1.2 Tests View

Selecting Tests from the tree on the left shows a list of all tests for which data has been collected. Clicking on a test in the tree will display a list of all waveforms associated with that test.

#### 5.1.1.3 Configurations View

Selecting Configurations from the tree on the left displays all existing Named Configurations in the right pane. The tree also displays a <current config> entry that represents the current (unnamed) configuration.

Named Configurations can be restored from this view. Select Configurations in the tree , then select and right-click on a configuration displayed in the right pane, then select **Restore Named Configuration** from the pop-up menu to restore the specified Named Configuration. The restore process is described in Section 4.8.1.

#### 5.1.1.4 Waveforms View

Waveform View displays raw and processed waveform data in the window's left pane in hierarchical directories, using a calendar layout (see Figure 5-1). Click either the + leaf to expand the directories, or the - leaf to collapse the directories. Data associated with the tree selection is displayed in the right pane. Data is grouped by year, month, week and day as the tree is expanded.

All data for the selected time period are displayed in the right pane. For example, if the year 2021 is selected, the right pane will display all waveforms acquired during 2021. If November is then selected, all data from November 2021 will be displayed. Likewise, when a single week or day is selected, all data acquired during that period will be displayed.



#### 5.1.1.5 Stored Files View

Stored Files View displays external files that have been manually stored in the database. Files are added by right-clicking on the Stored Files entry in the left pane and selecting a menu item. Once added, files are shown in the right pane and can be viewed or exported by right-clicking on an entry.

## 5.2 Working with Archive

This section presents a series of step-by-step instructions to guide the user through the various operations performed in the Archive module.

### 5.2.1 *Creating databases*

To create a database:

1. From the File menu, select New. A standard Windows browser dialog will appear.
2. Browse to the directory into which the new database should be created.
3. Enter a file name. If the file name already exists, you must confirm your intent to overwrite the existing file.
4. Choose Open. DAAAC will create the new database (or reinitialize an existing database) and open it in Archive.

Creation of a new database does not affect the active database, or any other databases open in Archive.

An alternate method of database creation is to use the Change Database operation. In the Change Database dialog, enter a new, unique database name instead of selecting an existing database name. Archive will then create the database and copy the system configuration from the currently open database into the new database, if desired. This is often the preferred way to create a new database as it also makes the new database the active database.

#### **Shortcut**

Keys: [Ctrl]+[N]

#### 5.2.1.1 Create DAAAC Database dialog

A standard Windows file/directory selection dialog is used to choose a directory folder and enter a name for the new DAAAC database. The file dialog can also be used to create new folders and delete existing databases or other files.

#### **Shortcut**

Keys: [Ctrl]+[N]

### 5.2.2 *Opening databases*

To open an existing database:

1. From the File menu, select Open.
2. Browse to the location of the database.
3. Select the database.
4. Choose Open. DAAAC will open the database in Archive.

This operation will open a database for viewing and for copying data to another database, including DAAAC's current database. It does not close any databases that may be open and it does not make this

newly opened database the active database. See Section 5.2.3, immediately below, for instructions on changing DAAAC's current system database.

Note: Since the Open action does not change the active database, this operation is typically used prior to a drag-and-drop transfer of data between databases.

### **Shortcut**

Keys: [Ctrl]+[O]

### **5.2.3 Changing databases**

In a non-networked system, the active database may be changed at any time, other than during an acquisition or reduction sequence.

To change databases:

1. Switch to Archive if necessary.
2. Select Change Database from the Archive toolbar. Archive will check with the other DAAAC modules to ensure that the change is permitted at this time.
3. The file directory dialog will be activated for selecting an existing database, or for entering a name to create a new database. Specify the database name and press the Open button.
4. If a new database was specified, Archive will display a dialog to select data to transfer from the active database to the new database. You may choose to transfer the current configuration and/or waveform data. If no items are selected for transfer, a new empty database is created.
5. The currently active database is closed, and then the selected database will open.
6. If the TestMan module is running, it's configuration will be reloaded from the selected database. If the selected database does not include station data, TestMan will prompt the user to specify the acquisition station information.

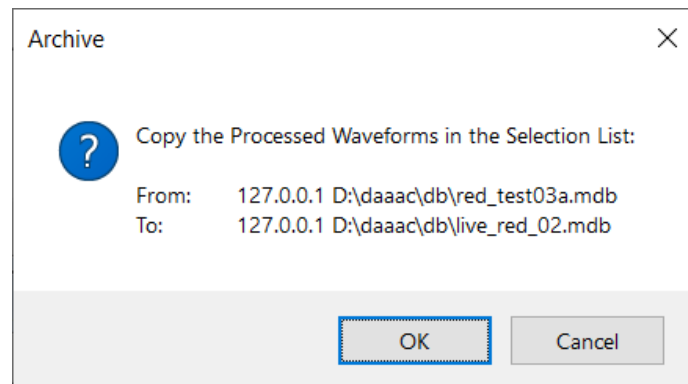
### **5.2.4 Transferring data**

Data from an open database may be transferred (copied) to another database, including the active database. The Current Configuration, Named Configurations, and raw or processed data can be copied from one database to another. To transfer data using dialog boxes for data selection, see the Transfer toolbar button (Section 5.3) and Transfer dialog (Section 5.5.7).

To transfer data from one database to another using the drag-and-drop method:

1. Open the source and the destination databases in Archive. Use the File | Open menu item to open additional database windows without changing the current database.
2. In the source database's left pane, select the configuration or data to be copied.
  - Current configuration: Expand the Configurations branch in the left pane. Select the <current config> item under that branch.
  - Named configurations: Expand the Configurations branch in the left pane. Select the desired named configuration under that branch.
  - Waveforms: Select the Waveforms branch in the left pane, then select either the Raw or the Processed branch. Expand the calendar control as needed. Select any portion of the calendar control from the left pane (day, week, month, etc.) or select any group of waveforms from the right pane.
3. Drag the selection and drop it in the destination database window. While dragging, the pointer will display the text of the item(s) to transfer. If the pointer does not change, the selection does

not support the transfer operation or the pointer is not positioned properly. After the selection is dropped, Archive will ask you to verify the copy.



**Figure 5-2. Confirm the Copy**

4. Choose OK to begin the transfer operation. As Archive selects and transfers the data, the Transfer Status dialog will appear. If necessary, choose Suspend or Abort.



**Figure 5-3. Transfer Progress**

5. Upon completion, one or more "Transfer Complete" messages will appear.

### **5.2.5 Importing and Exporting data**

Several methods are available to copy data between external files and DAAAC databases. Additional import and export methods are available in the Analyze module (see Section 6.2.12).

#### **5.2.5.1 Importing processed data**

The standard file import operation reads external data files and stores them in the database as processed data. To import and store as processed data:

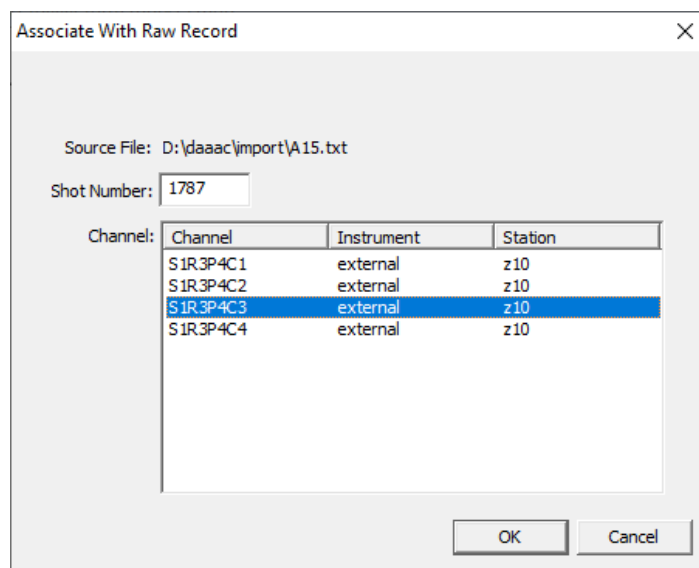
1. Select the File | Import Processed Data menu item or the Import Data toolbar button;
2. Select the file type and one or more files to import;
3. Use the displayed Import Wizard pages to read the selected file (see Section 3.5);

#### **5.2.5.2 Importing raw data**

External files can be imported and stored as raw data, by association of the file date with a shot and placeholder channel from a previously configured External Raw Wfm or External Raw Image

instrument. The associated External Raw instrument must be present and active during a shot to later associate raw imported data with that shot. To import raw data:

1. Select the File | Import Raw Data menu item;
2. Select the file type and a single file to import;
3. Use the displayed Import Wizard pages to read the selected file (see Section 3.5);
4. Specify a shot number and select an instrument channel. Only channels from External Raw Wfm and External Raw Image instruments that were active during the selected shot will be displayed. Then select OK to import the file and store it in the database as raw data.



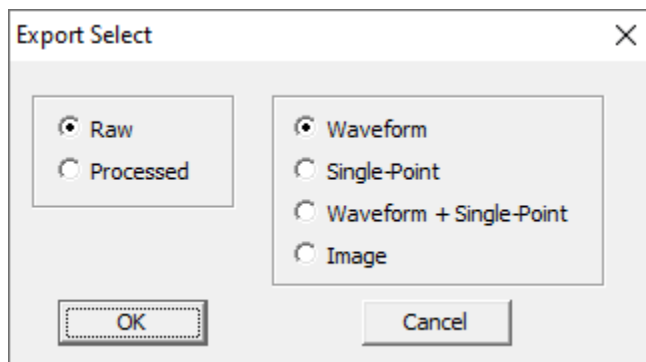
**Figure 5-4. Association of imported data with a shot and channel**

Note that each raw import must be associated with a unique shot number and channel. If the selected shot and channel already have an associated waveform, the importer will display a warning message and the selection dialog will be displayed again to choose a different shot and channel.

#### 5.2.5.3 Exporting data

Waveform and image data can be exported from the DAAAC database to external files. To export data:

- Select the File | Export Data menu item or the Export Data toolbar button;
- Select raw or processed data and the data type to export;



**Figure 5-5. Selection of the export data type**

- Select one or more database records of the specified type;
- Select the output file folder/name and type, then press Export to export the selected items. If multiple waveforms are selected for export, the file dialog does not allow selection of a file name and all exported waveforms are automatically named. Auto-named files use the format specified via the Preferences | Options menu, Other tab. The file extension depends on the selected file type.

### 5.2.6 Editing Stations and Tests

Select Stations or Tests in the tree control (left pane) of any open database window to display the list of stations or tests.

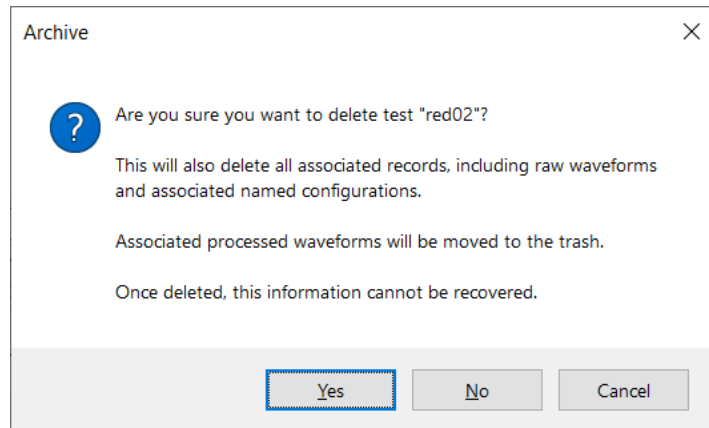
**Edit a Station.** Right-click on an item in the station list (right pane) and select Edit Station from the popup menu. A dialog will allow modification of the station name and IP address. Note that IP addresses can only be modified for networked stations. Changes to the station name and/or IP address will modify all historical database records that reference the station.

**Figure 5-6. Modification of station identifiers**

**Rename a Test.** Right-click on an item in the test list (right pane) and select Rename Test from the popup menu. Changes to the test name will modify all historical database records that reference the test.

### 5.2.7 Deleting Stations and Tests

Select Stations or Tests in the tree control (left pane) of any open database window to display the list of stations or tests. From the display station / test list, select an item and press [Delete] to remove the selected item. Note that deletion of a station or test will also delete associated data records, such as waveforms. A confirmation dialog will be displayed before the selected items are deleted.



**Figure 5-7. Confirmation dialog for test deletion**











### **5.2.8 Deleting waveforms**

To delete waveforms from the active database, use the Waveform Selection dialog to move selected data to the database's Trash receptacle. Waveforms may be held in Trash indefinitely. Waveforms in the Trash can be restored back to the database or permanently removed. The process is described in detail in Section 3.4. To open the Waveform Selection dialog, select:

- Data View | Raw Waveforms...; or
- Data View | Processed Waveforms...

### 5.3 Archive Toolbar

Archive's Toolbar provides the following functions.

Select	To
	Switch to the Analyze module.
	Switch to the TestMan module.
	Change the active database. Disabled for SQL Server databases. (see Section 5.2.3)
	Transfer data from one database to another using the Transfer dialog (see Section 5.5.7)
	Import data from external files and store in the database as processed data.
	Export database waveforms or images to external files.
	Display program information (About box).
	Select and display a DAAAC log file.
	Display online help. <i>Deprecated</i> – recommend using this manual as the primary DAAAC reference.
	Exit Archive and close the other DAAAC modules configured to auto-stop (see Section 5.5.1).

### 5.4 Archive Menus

The Archive module's main menu has the following items:

Item	Description
File menu	Performs database and data file operations
Tasks menu	Invokes other DAAAC modules
Preferences	Sets module and display preferences
Tools	Performs database and network administrative operations
Data View	Selects and views existing records in the active database
Window	Arranges the displayed database windows
Help	Displays module information and on-line help

#### 5.4.1 File menu

The following commands are available under Archive's File menu:

Item	Description
New	Creates a new DAAAC database
Open	Opens an existing database
Change	Changes the active database
Close	Closes the current database window.
Transfer Out...	Transfer (copy) data from the active database to an external database.
Transfer In...	Transfer (copy) data from an external database to the active database.
Import Raw Data...	Import waveform/image files into the database as raw data.
Import Processed Data...	Import waveform/image files into the database as processed data.
Export Waveforms...	Export database waveforms/images to external files.
1... N	Lists the N (up to 10) most-recent databases
Exit	Exits Archive



#### 5.4.1.1 New, File menu

File | New creates a new, empty DAAAC database. A standard Windows file browser dialog is used to select the database name and location. If you select a database that already exists, it will ask you to confirm that you want to overwrite the existing database. **Warning: If you select an existing database name and accept the overwrite notice, Archive will reinitialize that database, destroying any existing contents.** Archive will then display the new database in its own window, along with any databases that are already open. The active database is not affected by this operation. Data can be copied from the active database into the new database, including test configurations and raw or processed waveforms.

A new database also can be created when you select Change Database. See Section 5.2.3, for more information. Creation of a new database using the Change operation is often preferable, because it allows you to automatically copy the current DAAAC configuration into the new database during the creation process.

Note that this process will create an Access database on a station running a local copy of NetCom. This menu item will not create an MS-SQL database. Creating a database from the file menu normally applies only to standalone operation.

#### Shortcuts

Keys: [Ctrl]+[N]

#### 5.4.1.2 Open, File menu

Open is used to connect to additional databases while maintaining the connection to the active database. This command creates a new database window with a connection to a selected database from the local or a remote computer. A standard Windows file browser dialog is used to select the database name and location. Secondary databases opened with this command are only used to copy and view configurations. Archive does not make the newly opened database the current system database. To do that, use the Change command (see Section 5.2.3).

You can have any number of databases open simultaneously, but only one will be the active database. Note that any database window *except* the currently active database may be closed.

#### Shortcuts

Keys: [Ctrl]+[O]

### 5.4.2 Tasks menu

The Tasks menu switches between DAAAC's other user modules: Analyze and TestMan. If the module is already running, it will become the top, active module. If the module is not running, it will be started and activated. The toolbar contains an icon for each of the other DAAAC modules.

#### Shortcuts



### 5.4.3 Preferences menu

Archive's Preferences menu selects default application settings and layout preferences.

Item	Description
Options	DAAAC module startup and shutdown behavior, database pre-start cleanup, data migration, and Log Page selection.
Logs	Selects the information that is collected in the DAAAC logs.
Toolbar	Display/Hide Archive's toolbar.
Status Bar	Display/Hide Archive's status bar.

#### 5.4.3.1 Preferences | Options menu

This menu item opens the Options dialog (see Section 5.5), which configures various DAAAC and database settings.

Page	Description
Modules	The Modules page contains settings that control the behavior of the DAAAC modules when Archive is started and stopped. Checking AutoStart starts the module when Archive first opens. Checking AutoStop stops the module when Archive exits. Checking Minimized minimizes the module's window after it is started via AutoStart.
Database	The Database page is used to set database size limits and to select pre-start cleanup for SQL databases.
Data Migration	Data Migration controls the automatic migration/copy of SQL data to the offline Access databases that are created for each day, by date.
Other	Export file name format. Contains a list of file name formats for automatic and batch exports.  Log page definition [keyed option]. Selects the active log page definition from a list of available log page names. The Log page is defined and accessed in TestMan.

#### 5.4.4 Tools menu

Archive's Tools menu provides utilities for modifying how Archive functions, processing database records, and performing network administration.

Item	Description
Stop NetCom / Administrative	The Stop NetCom menu will terminate the running NetCom module. User confirmation is required. Because NetCom is the communications link between all

	<p>DAAAC modules and the database, most DAAAC operations are not available when NetCom is stopped.</p> <p>The Administrative menu is available only when NetCom is stopped. Administrative tools are described in the following section.</p>
Migrate Data	Manually start the operation to migrate acquisition data. See Section 5.5.8.
Minimize Tables	Removes records with no linkages (e.g. orphaned as a result of deleting data) and compacts the database file. Only used with standalone Access databases.
Rectify Inventory	Copies graph items from a dedicated Cal System database. [optional feature, not present in most systems]
Logs : Truncate Error Log	Delete the current system error log file.
Logs : Truncate Netcom Log	Delete the current Netcom Log file.
Notebook	Open the laboratory notebook interface. Allows user specific text entries to be added to the database. See Section 3.8

#### 5.4.4.1 Tools | Administrative menu

The Administrative menu is available from Archive's Tools menu when NetCom is not running. This sub-menu is typically only used with networked systems and contains utilities that perform network and database administrative functions. These functions are not required for normal operations.

Item	Description
Change Database	<p>Selects the ODBC Data Source used by NetCom in the Network Mode. Change Database changes DAAAC's current default database to any existing database. This function cannot be used to create a new database.</p> <p>A file directory is displayed so that you may select a database name from the disk. When the database is opened, Archive informs the other DAAAC™ modules so they can reload appropriate data: TestMan will close the current station and open the new database's station.</p>
Start NetCom	Starts the NetCom database interface module. See Chapter 7 for details regarding the importance and role of NetCom. NetCom is typically started automatically when DAAAC starts, so this menu is only used after NetCom has been manually stopped.
Stop NetCom	Stop NetCom stops DAAAC's Netcom module. Because NetCom is the communications link between all DAAAC modules and the database, DAAAC

	cannot operate without NetCom running. Not supported when using a SQL Server database.
Manage Data Sources	Manage Data Sources accesses the ODBC Data Source Administrator. For more information, open the ODBC Data Source Administrator, then select Help.
Initialize Database	Initializes a selected SQL Server database, by creating all required DAAAC tables. <b>WARNING:</b> This function completely overwrites the contents of the selected database! It is intended for use with empty, uninitialized databases.
Inventory Control	Sets the Location Code for inventory control, as well as selects the calibration database. [optional feature, not present in most systems]
Standalone	Selects standalone or networked modes. Standalone disables networking, and the entire acquisition system is expected to reside on the current computer.

#### 5.4.5 Data View Menu

Archive's Data View menu provides utilities for examining database records.

Item	Description
Table Info	The Table Info option opens a dialog that shows the active database file size and lists the various database tables alphabetically with the number of records in each table.
Raw Waveforms...	Activates the Select Raw Waveforms dialog, to view listings of the raw data in the active database. See Section 3.4 for a general discussion.
Processed Waveforms...	Activates the Select Processed Waveforms dialog, to view listings of the processed data in the active database. See 3.4 for a general discussion.
Sweep Info	Displays a summary of the collected sweep data. [optional feature, for Antenna Range systems]
Test Summary	Displays a summary of the acquisitions under each Test Name.

#### 5.4.6 Window menu

Archive's Window menu provides the following functions:

Item	Description
Cascade	Overlaps and cascades all open database windows.

Tile Horizontally	Tiles all database windows horizontally.
Tile Vertically	Tiles all database windows vertically.
Arrange Icons	Arranges all minimized window icons.
1... N	Lists all open database windows.

#### 5.4.7 Help menu

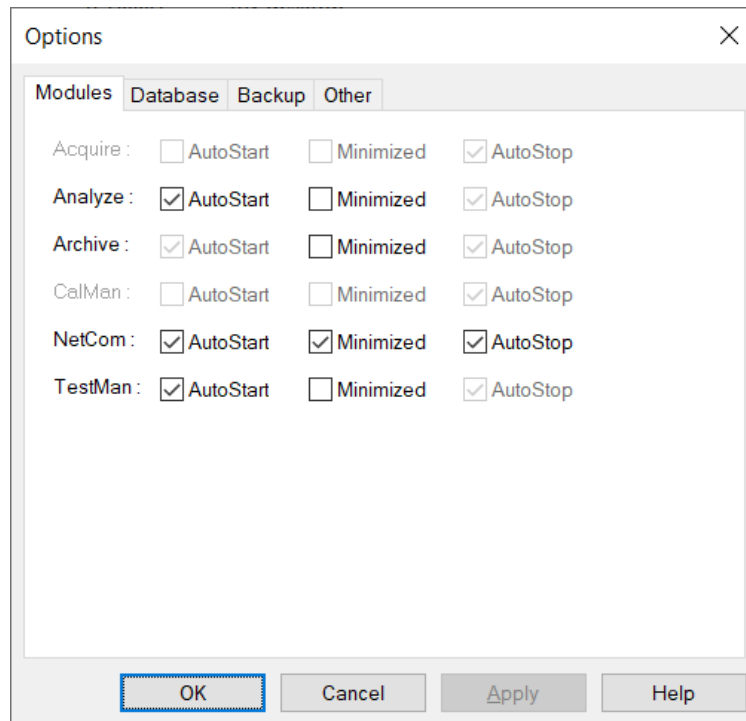
Archive's Help menu provides information concerning how to use DAAAC, as well as information about the current system and database.

Item	Description
Help Topics	Opens the Help Topics Contents.
About Archive	Displays information about the DAAAC installation.
Open Source Notice	Displays the open source components used in the DAAAC application.
License Agreement	Displays the DAAAC End User License Agreement (EULA).
DAAAC Logs	Selects and views the contents of the daily DAAAC log files – error, warning, and informational messages generated by all DAAAC modules.
NetCom Log	Views the contents of the NetCom log file – database related status and error messages generated by the NetCom module.
Data Migration Log	Views the contents of the Data Migration log file. The log records the dates on which data were migrated, the files the data were migrated to, and which expired data have been deleted, along with any errors encountered during migration.

## 5.5 Archive Dialogs

### 5.5.1 Options, Modules

#### 5.5.1.1 Dialog



**Figure 5-8 - Module Startup/Shutdown preferences Tab**

#### 5.5.1.2 Discussion

The Modules page contains switches that control the behavior of the DAAAC modules when Archive is started and stopped. If AutoStart is checked, the module is started automatically when Archive is first started. If Minimized is checked, the module's window is minimized after it starts. If AutoStop is checked, the module is closed when Archive exits.

#### 5.5.1.3 Access

- Preferences | Options menu item, Modules tab

## 5.5.2 Options, Database

### 5.5.2.1 Dialog

The screenshot shows the 'Options' dialog box with the 'Database' tab selected. The dialog has four tabs: 'Modules', 'Database', 'Backup', and 'Other'. The 'Database' tab contains two main sections. The first section, 'Database file size limits (use 0 to disable test)', has two columns: 'Access' and 'SQL Server'. Under 'Access', the 'Warning threshold (MBytes):' is set to 1900 and the 'Maximum (MBytes):' is set to 1950. Under 'SQL Server', the 'Warning threshold (MBytes):' is set to 9500 and the 'Maximum (MBytes):' is set to 9900. The second section, 'SQL Server maintenance', contains a checkbox labeled 'Perform prestart cleanup' which is currently unchecked. At the bottom of the dialog are four buttons: 'OK', 'Cancel', 'Apply', and 'Help'.

**Figure 5-9 Database management tab**

### 5.5.2.2 Discussion

The Database page is used to configure automated database maintenance and notices. Note that some options only apply to standalone MS Access database, while others only apply to networked SQL Server databases.

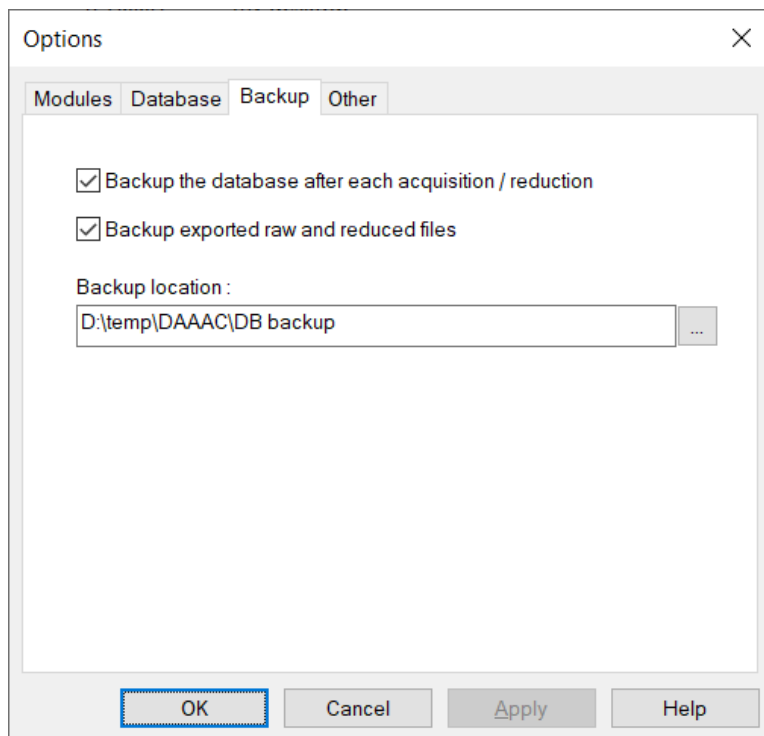
Item	Description
Warning Threshold	Sets the file size warning level for Access and SQL Server databases. When the threshold is reached, a database warning will be issued at the start of each acquisition event.
Max DB size	Sets the file size limit for Access and SQL Server databases. When this limit is reached, no new acquisition events will be permitted. Note that Access databases created by DAAAC have a hard limit of 2 GBytes. SQL Server Express has a hard limit of 10 GBytes, while the full version of SQL Server is effectively unlimited.
Prestart cleanup	Run the SQL Server cleanup utility each time DAAAC is started.

### 5.5.2.3 Access

- Preferences | Options menu item, Database tab

### 5.5.3 Options, Backup

#### 5.5.3.1 Dialog



**Figure 5-10 Backup preferences tab**

#### 5.5.3.2 Discussion

The Backup page is used to configure automated backup of exported files and the database. A status dialog will be displayed during the backup. However, in many cases the backup takes very little time so the dialog will only appear briefly.

Item	Description
Backup the database...	Copies the active database file to the specified location at the conclusion of each acquisition event. Only applies to Access (.mdb) files <sup>2</sup> . Any previous backup copies are overwritten.
Backup exported files	Copies all auto-exported files to the specified location at the time those files are created.
Location	Location for all backup files.

#### 5.5.3.3 Access

- Preferences | Options menu item, Backup tab

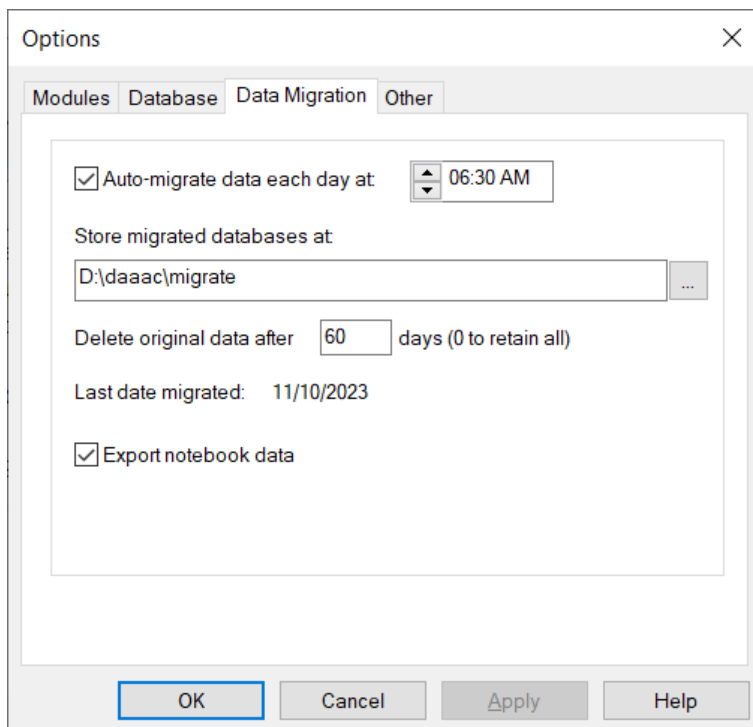
---

<sup>2</sup> SQL Server database file backups can be configured in SQL Server Management Studio



## 5.5.4 Options, Data Migration (automatic)

### 5.5.4.1 Dialog



**Figure 5-11 Data Migration tab**

### 5.5.4.2 Discussion

The Data Migration page is used to configure automatic migration, which copies acquired waveform / image data and the associated configuration data from the on-line SQL Server database to individual Access databases. One or more Access databases are created for each date in the SQL Server database that has acquisition data. This page is only available for networked installations, which store data in SQL Server databases. Migration can also be started manually – see Section 5.5.8.

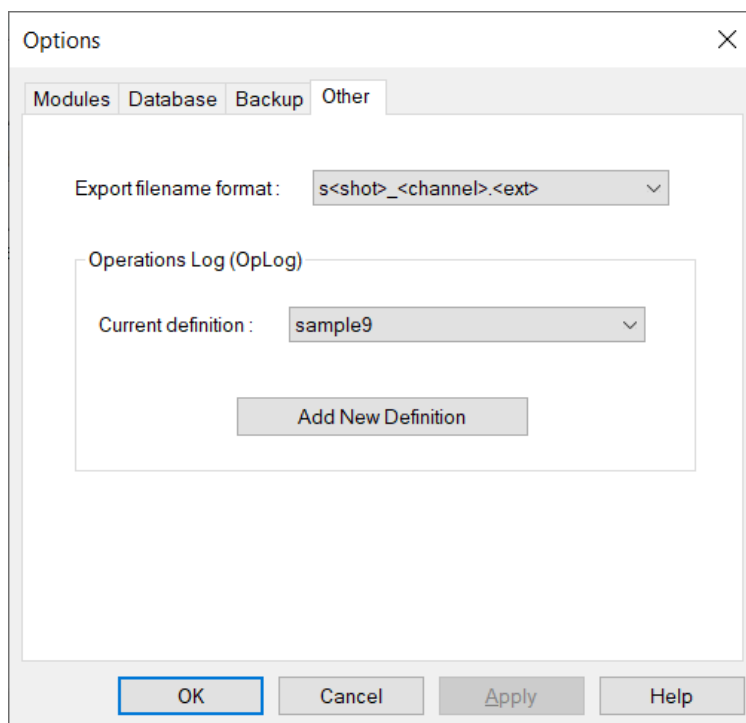
Item	Description
Migrate at	Enable auto-migration to occur daily at the specified time. Note that migration will include data from the current date, so would typically occur at the end of the day.
Storage folder	Root level directory for the generated Access databases. Access files, with names based on the migration date, are automatically created in this folder.
Delete original data...	Remove the migrated waveforms / images from the SQL database after the specified number of days has elapsed. Data removal will only occur if the associated migration (Access) database has been created.
Export Notebooks	Export Notebook records from the SQL database to the specified storage folder. A separate Rich Text Format (RTF) file is created for each notebook entry.

#### 5.5.4.3 Access

- Preferences | Options menu item, Data Migration tab

### 5.5.5 Options, Other

#### 5.5.5.1 Dialog



**Figure 5-12, Other options tab**

#### 5.5.5.2 Discussion

Item	Description
Export filename format	Specifies the file name format for automatic and multi-file data exports. Supported formats include various combinations of the channel name and/or shot number.
OpLog, Current Definition	Specifies the active operations log (OpLog) definition. [OpLogs are an optional component.] The operations log is updated during the acquisition sequence and can be viewed in TestMan (see Section 4.8.9.1).
OpLog, Add New Definition	Adds a new operations log definition to the database.

#### 5.5.5.3 Access

- Preferences | Options menu item, Other tab

## 5.5.6 Database Table Information

### 5.5.6.1 Dialog

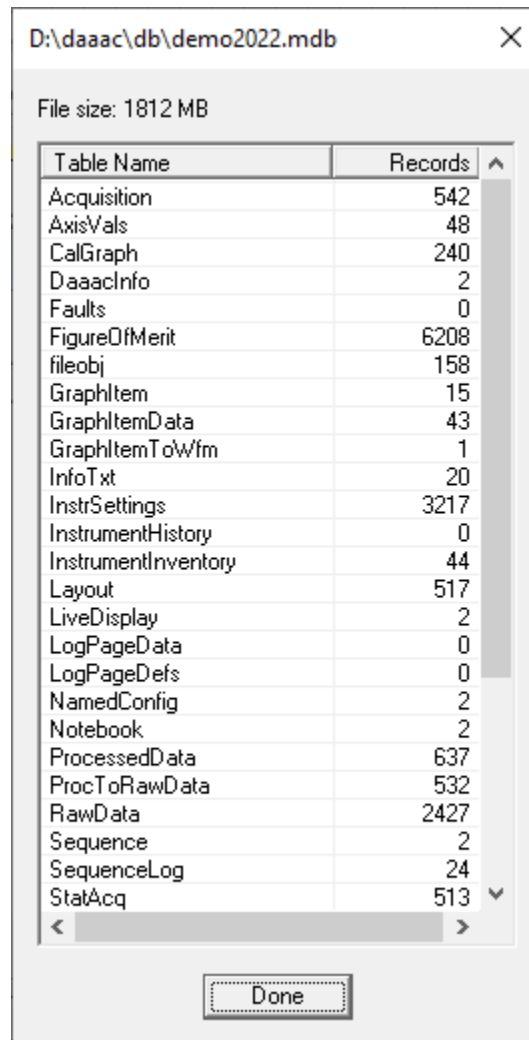


Table Name	Records
Acquisition	542
AxisVals	48
CalGraph	240
DaaacInfo	2
Faults	0
FigureOfMerit	6208
fileobj	158
GraphItem	15
GraphItemData	43
GraphItemToWfm	1
InfoTxt	20
InstrSettings	3217
InstrumentHistory	0
InstrumentInventory	44
Layout	517
LiveDisplay	2
LogPageData	0
LogPageDefs	0
NamedConfig	2
Notebook	2
ProcessedData	637
ProcToRawData	532
RawData	2427
Sequence	2
SequenceLog	24
StatAcq	513

**Figure 5-13 - Database table information viewer**

### 5.5.6.2 Discussion

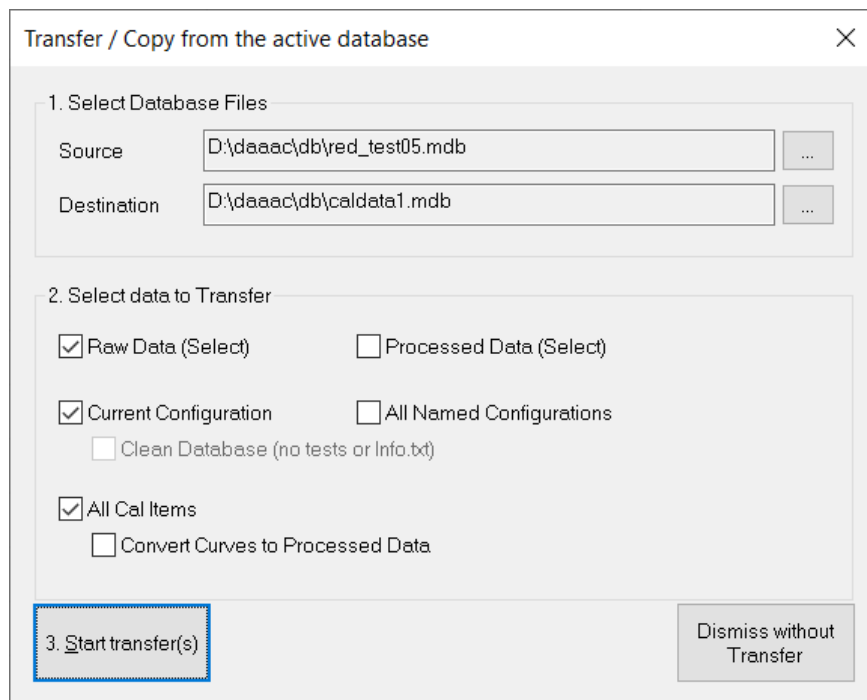
This dialog lists each of the tables in the active database, along with the number of records in that table. The database size is displayed above the table list. This display is for informational purposes only and does not support modification of the database records. See Database Architecture, Section 12, for a map of the database tables and links.

### 5.5.6.3 Access

- Data View | Table Info menu item

## 5.5.7 Transfer/Copy Data

### 5.5.7.1 Dialog



**Figure 5-14 Data Transfer dialog**

### 5.5.7.2 Discussion

This dialog is used to copy raw and processed data, system configurations, and cal Items from the active database to another existing database, or from an external database to the active database.

### 5.5.7.3 Details

The active database will be displayed as the source or destination database, depending on the transfer direction (transfer out or in). The other database file is selected by the user. If a destination database does not exist yet, use the File | New menu to create it before using this transfer operation. Select Raw, Processed, Current Configuration, Named Configurations, and/or Cal Items transfer. Then click Start Transfer. If raw and/or processed is selected, a Data Selection dialog (Section 3.4) will be displayed to choose the specific waveforms/images to transfer. Transferring waveforms/images also transfers all associated settings (e.g. acquisition configuration, instrument settings, cal graph). Current/named configuration transfers include acquisition instruments, the cal graph, and cal items, but not waveforms. Current configuration and waveform transfers only copy the cal items that are in used in the associated graphs. To transfer the entire cal item inventory, check All Cal Items. Cal Item transfers also copy any waveforms used as characterization curves. Unlike the selected raw and processed waveforms, characterization curves are transferred without associated settings.


Note that if multiple record types (current configuration, named configurations, raw waveforms, processed waveforms, cal items) are transferred, a separate status dialog and completion message will be displayed for each type.

#### 5.5.7.4

Item	Description
Source:	The name of the database from which the data is to be copied. For Transfer Out operations, this field is not selectable and is set to the active database.
Destination:	The name of the target database to which the data will be copied. For Transfer In operations, this field is not selectable and is set to the active database.
Raw data	Check to select and copy raw waveforms and images, along with all system configurations that are associated with the selected data.
Processed data	Check to select and transfer processed waveforms and images.
Current Configuration	Check to copy the current set of system configuration data.
All Named Configurations	Check to copy all named configurations.
All Cal Items	Check to copy the entire inventory of cal items to the destination database. If unchecked, only the items used in any transferred cal graphs will be copied.
Convert Curves to Processed	Store all cal curve transferred waveforms in the target database as processed waveforms, regardless of their raw/processed designation in the source database.
Start Transfer	Initiate the copy operation for each selected record type.

#### 5.5.7.5 Access



-  toolbar button (Transfer Out)
- Automatically displayed (Transfer Out) when a new Access database is created
- File | Transfer Out and File | Transfer In menu items

## 5.5.8 Data Migration (manual)

### 5.5.8.1 Dialog

**Data Migration**

Transfer days

☒ Multiple days      Start date : 2025-03-17

☒ transfer data acquired today

☐ Single day      Date : 2025-04-02

Store migrated databases at:

D:\daaac\migrate

Delete original data after 1461 days (0 to retain all)

☐ Export notebook data

Notes:

Migration will overwrite any matching databases in the target folder.  
Migration of multiple days may take several minutes.

OK Cancel

**Figure 5-15 Manual data migration settings**

### 5.5.8.2 Discussion

This dialog is used to configure and launch a database migrate operation. The operation is identical to the automatic migration process (see Section 5.5.4), but allows the user to specify the acquisition date range to migrate. This operation is only available for networked installations, which store data in SQL Server databases.

Item	Description
Multiple days / single day	Specifies migration over range of dates or for a single day.
Start date	Specifies the starting date for the migration. Acquisition data collect on or after this date will be migrated.
Transfer today	If checked, will migrate data acquired today.

Storage folder	Root level directory for the generated Access databases. Access files based on the migration date are automatically created under this directory.
Delete original data...	Remove the migrated waveforms / images from the SQL database after the specified number of days has elapsed. Data removal will only occur if the associated migration (Access) database has been created.
Export Notebooks	Export Notebook records from the SQL database to the specified storage folder. A separate Rich Text Format (RTF) file is created for each notebook entry.

#### 5.5.8.3 Access

- Tools | Migrate Data menu item

# 6 Analyze

## 6.1 Analyze Overview

The DAAAC Analyze module is used to view, analyze, and manipulate waveform and image data. TestMan transmits raw and reduced data to Analyze during automated data acquisition and reduction sequences. Data can also be retrieved from the DAAAC database or imported from external files.

Analyze uses individual windows to display waveforms, data tables, and images, as shown in Figure 6-1. Each window can be resized, tiled, minimized or maximized. Within each window, data can be manipulated with various analysis functions and associated configuration data can be viewed.

Waveform and image data can be analyzed with cursor operations (view individual points/pixels and remove and/or expand sections of the data), processed with a calculator-like interface (arithmetic, calculus, transforms, smoothing, filtering, and numerous other functions), overlaid with other data, and combined by applying arithmetic functions. Custom data processing functions are also available to support application specific analysis.

Data associated with acquired and reduced waveforms and images can also be viewed in Analyze. For example, raw data is linked to the associated acquisition and instrument settings, while reduced data is linked to the signal path and reduction settings. Analyze is also used to examine and edit waveform specific data, such as titles, comments, and figures of merit.

Waveforms and images displayed and manipulated in Analyze can be stored in the DAAAC database, as processed data, or exported to external files.

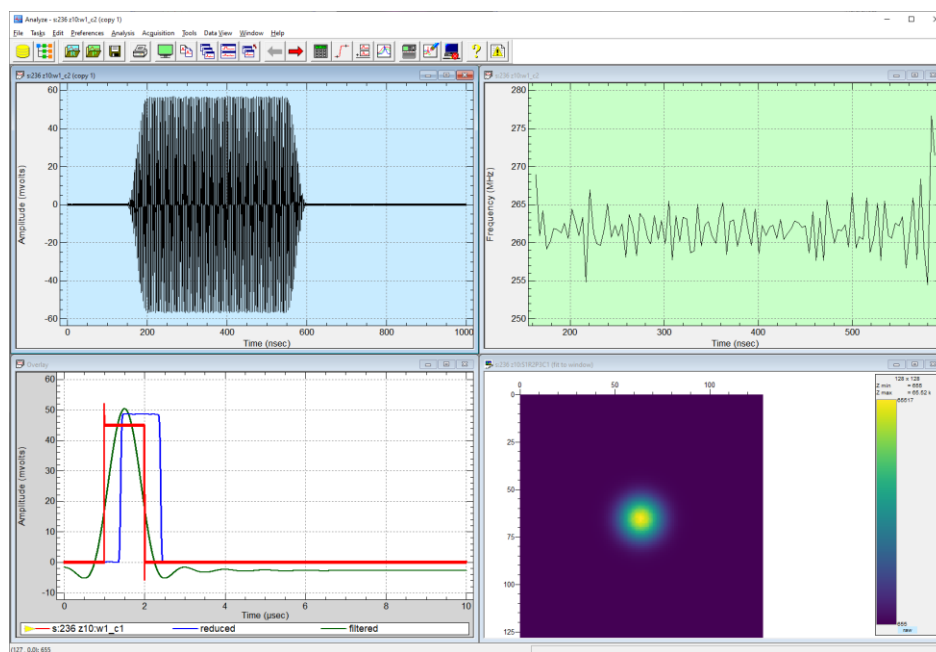


Figure 6-1 Examples of waveform and image data displayed in the Analyze module



## **6.2 Working with Analyze**

### **6.2.1 *Preparing for data acquisition***

During an acquisition or reduction sequence, Analyze is responsible for the display of waveform and image data. Settings in Analyze do not affect TestMan's acquisition and reduction sequences, nor do they affect archival of data during acquisition and reduction.

Analyze must be running to display and print incoming, newly acquired and reduced data – TestMan will not automatically start Analyze. Before acquisition, TestMan's instrument channel and signal path options should first be configured to generate the desired raw and reduced outputs. Then open the Acquisition Configuration dialog to select what and how data is displayed and printed by Analyze (see Section 6.5.16).

During acquisition, TestMan reads the newly acquired data from the instruments and notifies Analyze to prepare to receive the data. Raw data is then transmitted to Analyze for direct display and printing. If automatic data reduction is enabled, the reduction outputs are also transmitted to Analyze. Raw and processed data then can be manually analyzed and edited, and the results of that manual analysis can be stored in the database.

### **6.2.2 *Retrieving waveforms and images***

Raw and processed waveforms and images can be retrieved and displayed from the active database. Using the Select Waveforms dialog, waveforms can be located either by Station, by Test or by specifying search criteria. See Section 3.4, for more information.

To retrieve waveforms and images:

1. From the Analyze File menu, select Retrieve, then either Raw or Processed. The Select Waveforms dialog will appear, shown in Figure 6-2.
2. Select View All Data, View by Station or View by Test from the directory in the left pane. The available waveforms and images will be displayed in the right pane. By default, this data will be displayed in order of time and date. The data can also be sorted by Burst/Shot, Name, Description, or other category by clicking on the associated column heading.
3. Select the desired waveforms in the right pane. Use [Shift] to select a contiguous series of waveforms and images, or [Ctrl] to individually select multiple items.
4. Select the option to retrieve any associated raw or processed data, if these are desired.
5. Choose OK.

Each selected waveform and/or image will be displayed in a new window.

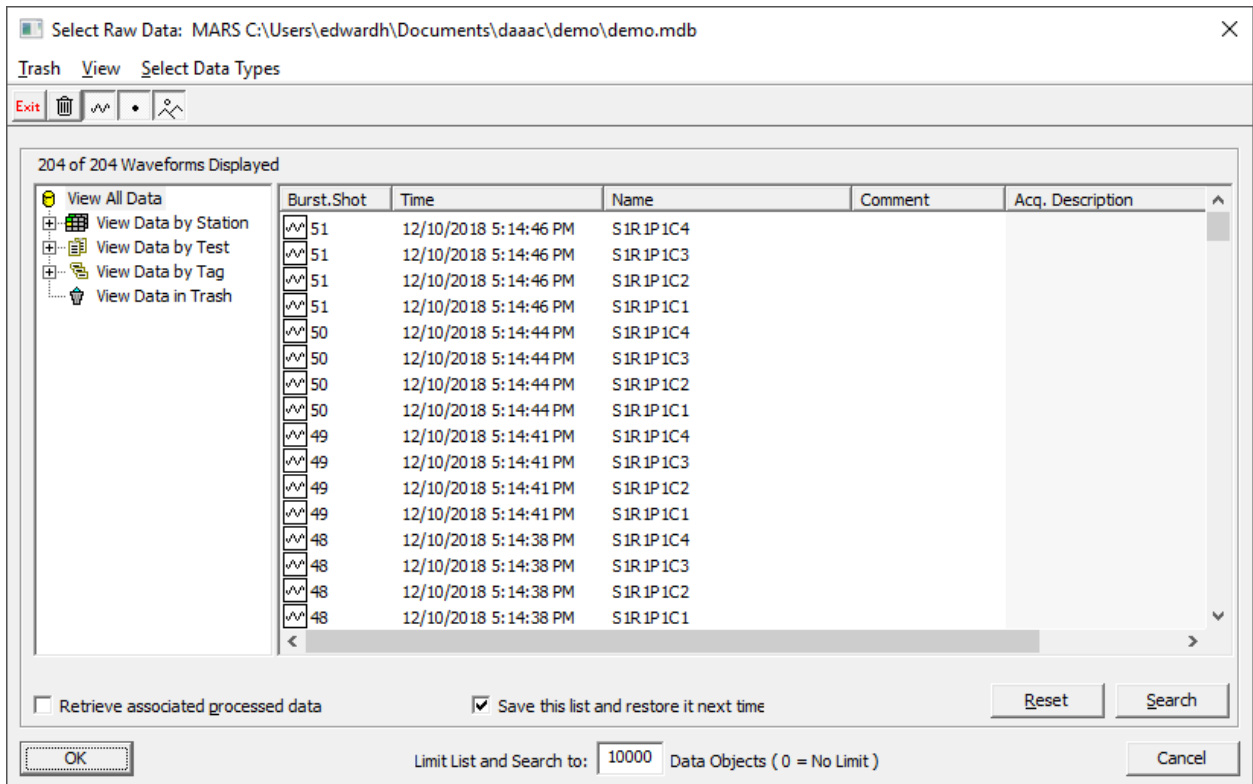


Figure 6-2 Waveform selection dialog

## Shortcuts

Toolbar:  to retrieve raw data;  to retrieve processed data.

### 6.2.3 Copying waveforms and images

Creation of waveforms and image copies supports comparison of data before and after modifications, via the Overlay or Combine operations described below.

To copy a waveform or image:

1. Select the displayed waveform or image that should be copied, so that it becomes active.
2. Select the Window | Copy menu item. Analyze will create a copy of the original waveform/image and place it in a new window.

The Copy function is also available on the waveform and image right-click menus.

### 6.2.4 Creating waveforms

Analyze can create constant, ramp, step, pulse and other waveforms from parameters entered into the New Waveform dialog.

To create waveforms:

1. Select the File | New menu item to display the New Waveform dialog.

**New Waveform** [X]

**Create Waveform**

**X-axis specification**

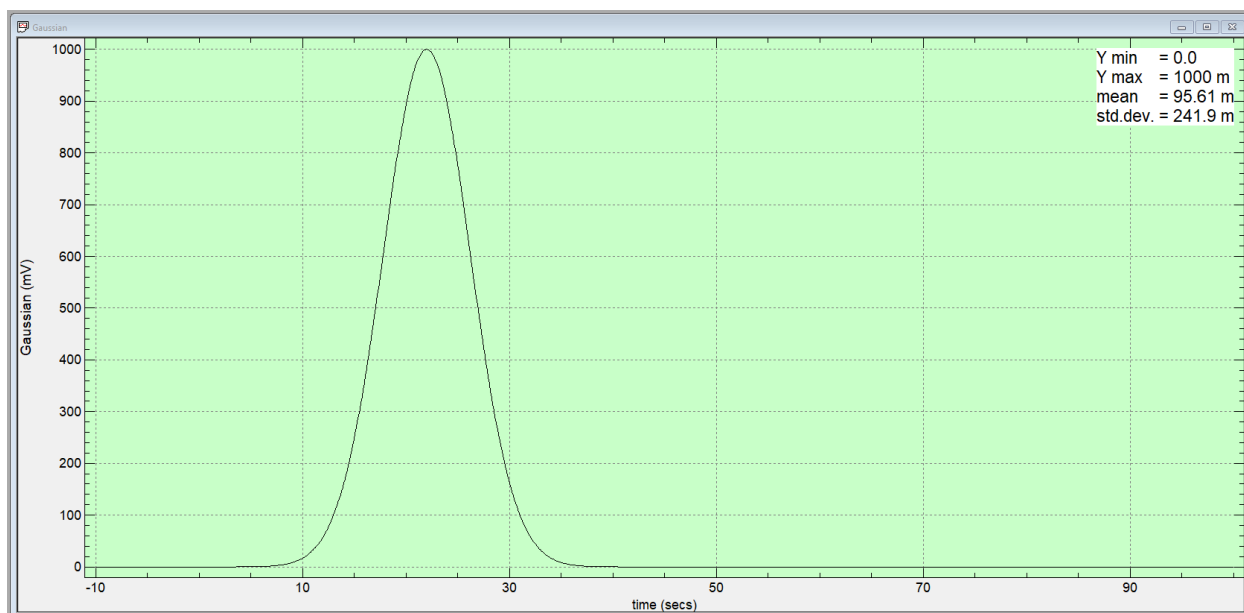
Number of points :  Delta x :   
 Minimum value :  Maximum value :

**Waveform type (Y-axis)**

Function :    
 Mean :  Standard dev. :   
 Formula :  $f(x) =$

**Figure 6-3. Creating a user-specified waveform**

2. Select the Function for the Y axis data. The available function types include Constant, Ramp, Step, Pulse, Modulated Pulse, Gaussian or Formula.
3. Enter the x- and y-axis parameters.
3. Choose Create, then OK.



**Figure 6-4. User generated Gaussian waveform**

### 6.2.5 Processing waveforms and images

The primary interface for manually processing waveform and image data is the Process Data dialog, accessed from the Analysis | Process menu item or the waveform/image right-click menu. Numerous operations are available on multiple tabs, from simple arithmetic, to integration, filtering, and spectral analysis. See the descriptions of each tab in Sections 6.5.9 (waveform operations) and 6.5.10 (image operations).

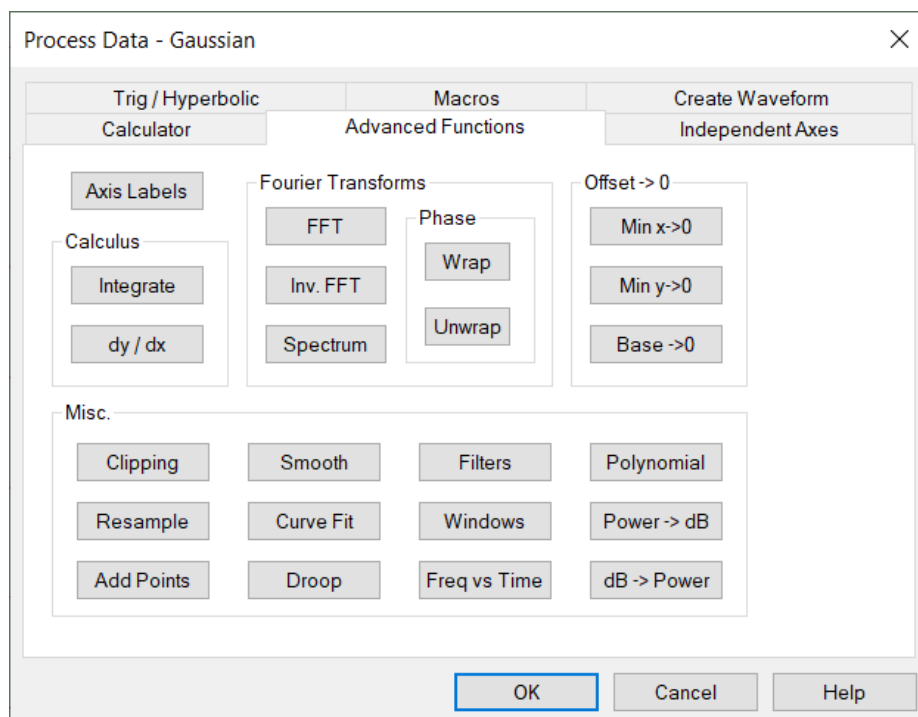


Figure 6-5 Process Data dialog for waveform data

### Shortcuts

Toolbar:

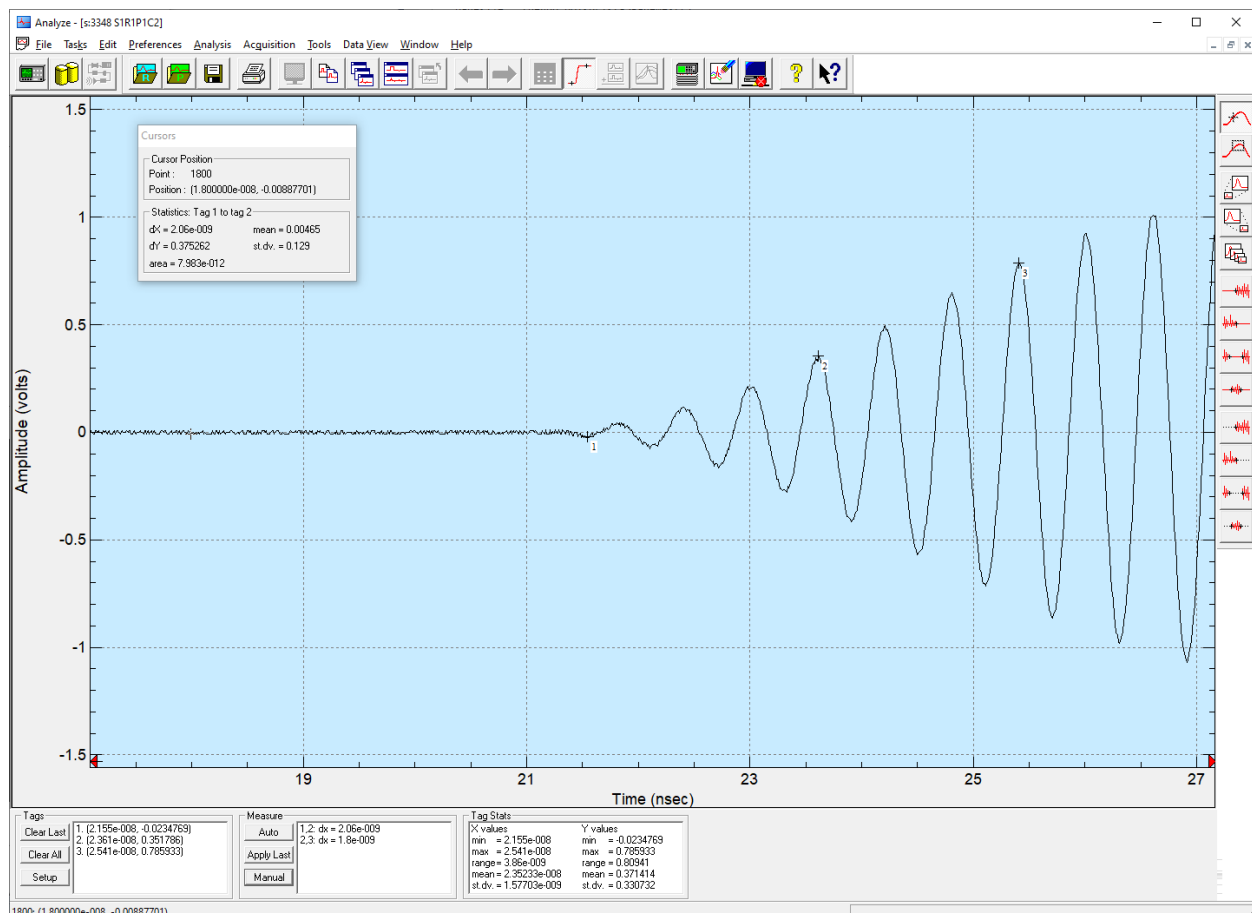


Keys: [F5]

### 6.2.6 Using cursors to examine waveform or image values

The cursors operation allows examination of waveform or image details and also supports basic editing on selected regions of a waveform or image. To activate cursors, select the Analysis | Cursors menu item or use the waveform/image right-click menu or the toolbar button. When cursors are activated the data window is maximized and additional dialogs and toolbars are displayed, as shown in Figure 6-6. A cursor tracker follows the mouse position and marks the associated waveform point. The tracker can also be moved using the keyboard arrow keys. Values for the tracker point are shown in the floating dialog. Left clicking on the mouse (or pressing the [Enter] key) places a numbered tag at the current tracker location. The locations of all tagged points are displayed in the toolbar below the waveform, along with additional tag statistics. Once two tags have been placed, the waveform view can “zoom in” on the

selected region, using the Zoom button from the toolbar on the right. Placing two tags and zooming in can be repeated multiple times to view waveform details on smaller time scales. The cursor toolbar buttons also support zooming out (one step or all steps) and basic waveform editing (zeroing or deleting data relative to the tagged points).



**Figure 6-6 Waveform cursors interface**

The cursors menu and toolbar button toggle and remain selected while cursors are on. To turn off cursors, select the (checked) cursors menu item or (depressed) toolbar button again. Turning cursors off automatically un-zooms the waveform view to show its entire domain.

The cursor interfaces and operations are discussed in Section 6.4.5.1.

## Shortcuts

Toolbar:

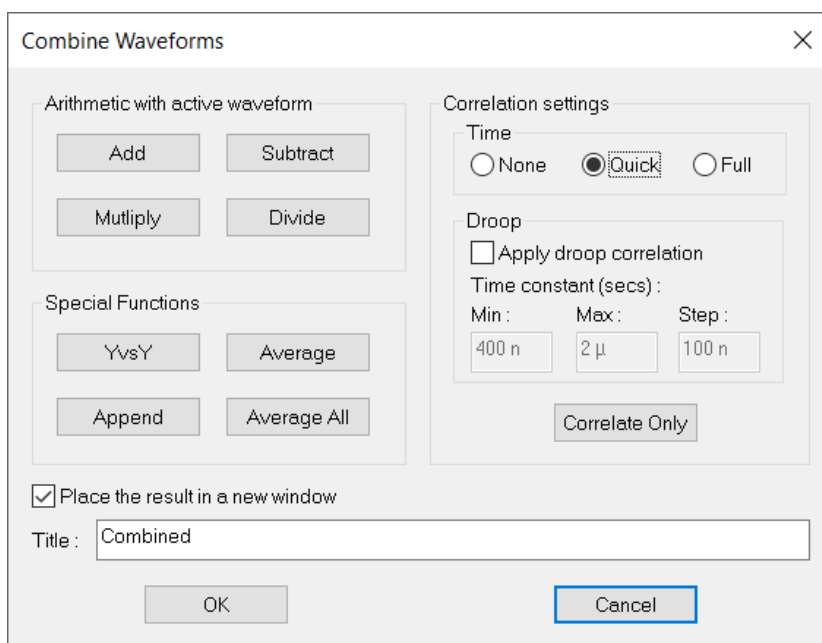


Keys: [F6]

## 6.2.7 Combining waveforms or images

To combine waveforms displayed in Analyze:

1. Activate the first waveform by clicking on it.
2. Open the Combine Waveforms dialog (Figure 6-7) by selecting the Combine toolbar button, pressing [F7], or selecting the Analysis | Combine menu item.
3. Select a function. The window title of the first waveform will change to "Selected".
4. Click the second waveform (or multiple waveforms for the Average operation).
5. If applying the Average operation, click outside a waveform (e.g., on the Analyze title bar) to end selection.
6. The result of the math operation will either replace the contents of the active window or, if selected, be placed in a new window. If the operation is Correlate Only, only the selected window will be modified. Math operations are applied only in the domain of the first selected waveform.



**Figure 6-7 Waveform Combine dialog**

An analogous interface is available for combining images. The same procedure outlined above is used to combine images.

### Shortcuts



Toolbar:

Keys: [F7]

### 6.2.8 Overlaying waveforms

Multiple waveforms can be overlaid in a single plot. The Process Data dialog and Cursors can be used with overlay waveforms.

To overlay waveforms:

1. Select the Overlay toolbar button, press [F8], or select the Analysis | Overlay menu item.
2. Select the waveforms to be overlaid by clicking within each. Their window titles will change to "Selected".
3. Click the mouse outside of a waveform, such as on the Analyze title bar or status bar. Analyze will generate and display a new waveform plot that overlays all selected waveforms.
4. Select Properties from the right-click menu to adjust the overlay titles and display options.

The overlay legend, shown at the bottom of Figure 6-8, displays the waveform titles for each sub-waveform. A yellow triangle marks the selected waveform in the legend. Click on any legend entry to change the selection. The selected waveform is drawn on top of all other waveforms, is the reference for the Cursor tracker, and is the default operand for Process Data functions. Process Data functions can also be applied to all sub-waveforms in an overlay. Overlay waveforms can be selected for use in a new overlay. In this case all sub-waveforms in the existing overlay are added to the new overlay.

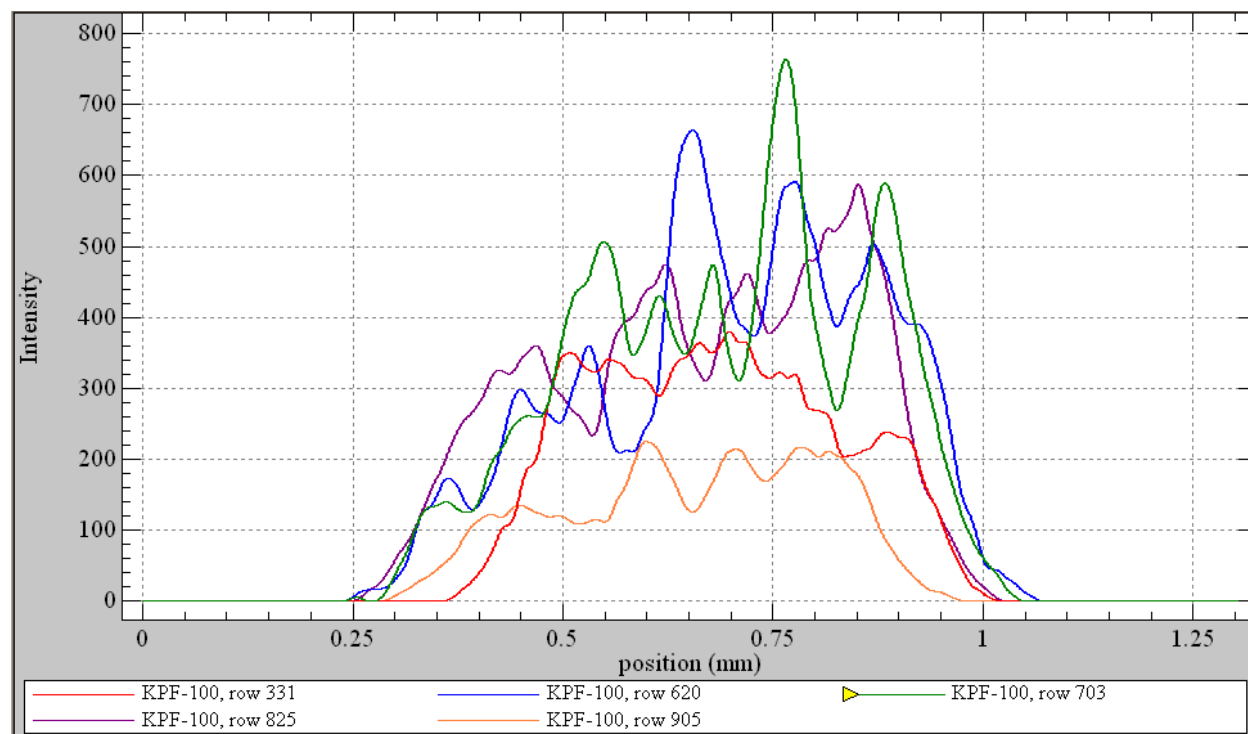


Figure 6-8. Five overlaid waveforms

#### Shortcuts

Toolbar: 

Keys: [F8]

[shift] + [F8] automatically overlays all displayed waveforms

### **6.2.9 Reducing waveforms and images**

Analyze can be used to perform automatic data reduction on raw or processed database waveforms, via the TestMan module.

#### **6.2.9.1 Off-line reduction of raw data**

Offline reduction is the act of applying the current reduction configuration to existing raw waveforms. It is typically performed to reduce raw data that was not automatically reduced during the acquisition sequence, or to re-reduce data after changes have been made to the reduction configuration. To execute an offline reduction:

1. Configure the TestMan graph to reduce data on the desired instrument channels (see Section 4.3).
2. In Analyze, select the Analysis | Off-line Reduction menu item (alternatively, select the Reduction | Off-line Reduction menu item in TestMan).
3. Select one or more raw data items to reduce.
4. Select OK to start the reduction process.

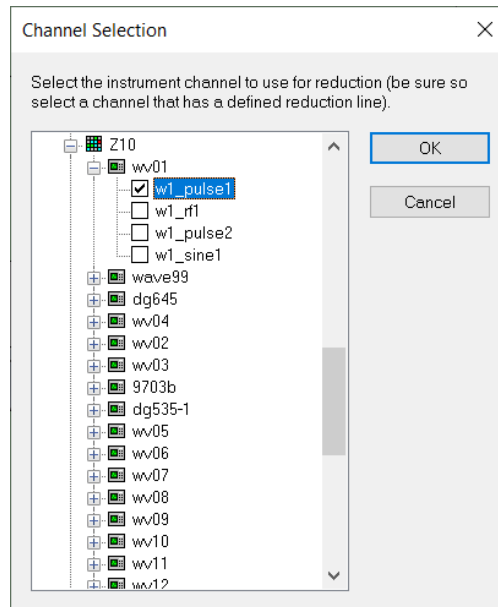
The selected data will be mapped to the associated channels in the graph and the reduction configuration for those channels will be applied, resulting in the display of reduced data in Analyze and/or storage of the reduced data in the database.

#### **6.2.9.2 Reduction of processed data**

The standard cal graph configuration in TestMan is used to support automatic data reduction of raw data from the associated instrument channels. However, the graph can also be used to reduce processed waveforms, such as data imported from external files. To reduce processed waveforms:

1. Configure the TestMan graph to reduce data on the desired instrument channels (see Section 4.3).
2. In Analyze, select the Analysis | Reduce Processed menu item.
3. Select one or more raw data items to reduce.
4. Select an instrument channel to assign to the processed data, then select OK to start the reduction process.





**Figure 6-9. Channel selection for reducing processed data**

The selected processed data will be mapped to the specified instrument channel in the cal graph and the reduction configuration for that channel will be applied, resulting in the display of reduced data in Analyze and/or storage of the reduced data in the database. Note that reduction of processed data is performed on one instrument channel at a time.

### **6.2.10 Printing waveforms and images**

Analyze can print one or all currently open and displayed waveforms.

To print waveforms:

1. To print a single waveform, click the desired waveform to make it the active waveform.
2. From the Analyze File menu, select either Print to print the active waveform or select Print All to print all open waveforms. The Print Title dialog will appear.
3. Select Title, Date and Time in the checkboxes if they should be printed as a header to the waveforms, then change the Title, if desired.
4. Choose OK. The waveforms will be spooled to the printer chosen in Print Setup.

If printing an individual waveform, the Print function is also available by right clicking on the waveform. The print all function prints all displayed waveforms on a single page. Images are always printed one per page.

### **Shortcuts**



Toolbar: (print all)

### **6.2.11 Storing waveforms and images**

Processed and raw waveforms, overlays and images that have been edited in Analyze can be saved in the database for later retrieval. Note that unlike the acquisition settings configured in TestMan,

waveforms modified in Analyze are not automatically stored in the database. All data stored from Analyze will be saved as processed data – including raw data that has not been modified (in this case a processed copy of the raw data will be stored). Storing data from Analyze always creates a new copy in the database – it does not alter existing database records.

To store data:

1. Select a displayed waveform or image so that it is active.
2. From the File menu, select Store, then either Active to store only the active waveform or All to store all open waveforms and images. Data can also be stored by right-clicking on a displayed data window and selecting Store from the pop-up menu. Stored data will be available for later application using Retrieve | Processed.

## Shortcuts



Toolbar:

### 6.2.12 Importing and exporting data

Waveform and image data can be imported from external files and exported to external files. Select the File | Import Waveforms menu item to import waveform data. A dialog will be displayed to select the file and specify the file type, followed by the Import Wizard (see Section 3.5). The Unknown ASCII type supports general text based files with and without header information, using a wizard-dialog to specify the points of interest, delimiters, and meta-data. Other formats are available, including several instrument output types and custom formats. Select the File | Import Image menu item to import images stored in a text based or custom file format. See also Section 0 to open an image stored in a common image format. Waveforms and images imported in the Analyze module are immediately displayed, but are not stored in the database. To store data imported into Analyze, right click on the display window and select the Store menu item. To import data directly into the database, use the batch import utility in the Archive module (Section 5.2.5.1).

To export a waveform or image from Analyze, right-click on a displayed data window and select the Export menu item. Note that waveforms can be “exported” to image formats using screen capture. In this case, the waveform should be sized appropriately on the screen before it is exported.

### 6.2.13 Opening external image files

Analyze modules that include image processing can open files with many common image formats, including JPEG, Windows Bitmap and TIFF.

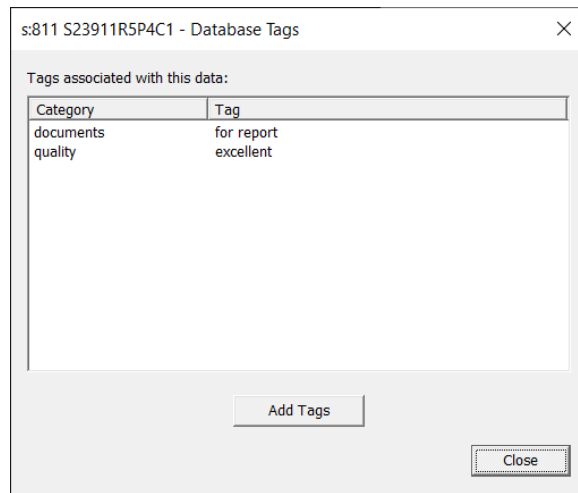
To open images:

1. From the File menu, select Open image. The Open a File dialog will appear.
2. Select a file format from Files of type.
3. Locate and select the image file within the directory to the left. A preview of the image will appear if Enable Preview is checked.
4. Choose OK.

### 6.2.14 Tagging waveforms and images

The data tag feature allows you to associated user-defined identifiers with raw data. To add a tag to a waveform or image:

1. Retrieve a waveform or image using the Retrieve Raw dialog.
2. Right-click on the displayed data and click on the Database Tags menu item. The Database Tags (Figure 6-10) dialog will open, showing all tags that are associated with this data.



**Figure 6-10. Current Tags dialog**

3. Click the Add Tags button to open the Quick Tag dialog (Figure 6-11)












**Figure 6-11. Quick Tag dialog**










4. The Available Tags list shows all tags that have been previously created. Click the Tag with Selected button to add the selected tag(s) to the current waveform.
5. If the required tags are not available, use the Create New Tag section of the dialog box. The required fields are Tag Name and Category. Select from the drop list of existing categories or choose "As Defined" to specify a new category. Both Description fields are optional. Once finished naming the tag, click the Tag with New button. This will both create the tag type (it will appear in the Available Tags list) and will also add the tag to the current waveform.

**Viewing Tagged Waveforms.** Waveforms can be organized according to tag name using the Select Raw Data and Select Processed Data dialogs. The tree view control on the left hand side provides an option to select waveforms by tag name and tag category.

### 6.3 Analyze Toolbar

The Analyze toolbar provides direct access to many of this module's features. To hide or display the toolbar, choose Toolbar from the Preferences menu, or press [Alt]+[P]+[T].

Select	To
	Retrieve raw waveforms.
	Retrieve processed waveforms.
	Store all displayed waveforms in the database, as processed data.
	Print all displayed waveforms and images.
	Set the Global Display/Print options for waveforms, overlays and images.
	Copy the active waveform or image.
	Cascade the data windows.
	Tile the data windows.
	Close all windows and clear the data buffer.

	Display the previous page of acquisition & reduction data in the data buffer.
	Display the next page of acquisition & reduction data in the data buffer.
	Process the active waveform or image.
	Use cursors to examine waveform or image values.
	Combine waveforms or images using basic arithmetic.
	Overlay multiple waveforms in a single graph.
	Configure Analyze to receive acquired and reduced data. This icon is disabled if Work off-line or Use Cursors is selected.
	Reset running overlays, as selected in the Acquisition Settings dialog. This icon is disabled if Work off-line or Use Cursors is selected.
	Work off-line. If selected, ignores all acquired and reduced waveform and image data transmitted from TestMan during acquisition and reduction sequences.

## 6.4 Analyze Menus

### 6.4.1 File menu

The File menu includes the following commands, some of which are available only when data is open while others are available only when no data is open:

Item	Description
New Waveform...	Display the New Waveform dialog, used to create a custom waveform. This dialog is also displayed as a property page in the Process Data dialog. See Section 6.2.4 for details.
New Image...	Display the New Image dialog, used to create a test image. See Section for details.
Retrieve   Raw	Retrieves raw waveform data from the database for display and processing in Analyze.

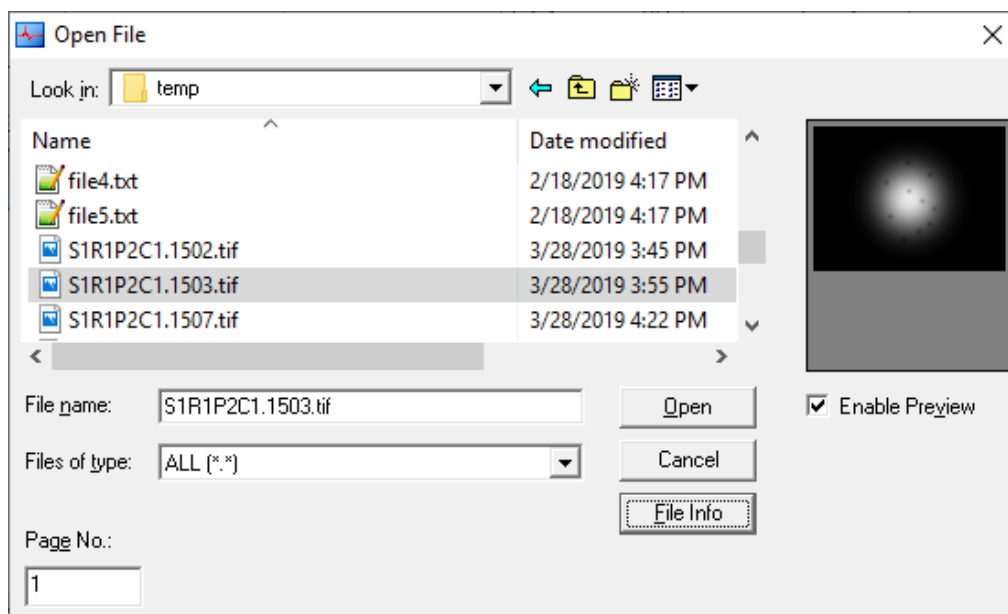
Retrieve   Processed	Retrieves processed waveform data from the database for display and processing in Analyze.
Store   Active	Stores a copy of the currently active waveform in the database. If the waveform already exists, it is NOT replaced, but a second copy is created and stored.
Store   All	Stores all displayed waveforms in the database as processed waveforms. If the waveforms already exist, they are NOT replaced, but stored in the database as copies.
Import Waveform	Imports a waveform from an external file.
Open Image	Opens and displays an external file that contains data in a standard image format (e.g, TIFF, Windows Bitmap, JPEG).
Import Image	Open a standard windows browser to navigate to an image to be imported into Analyze. Files of type ASCII Z List (*.txt), ASCII Z Array (*.txt), Sensors Unlimited Binary (*.img), Imaging Technology Binary (*.img) and Femtosoft FROG (*.dat) may be imported.
Export	Open a standard windows browser to navigate to a location and identify a file name for the exporting of data. Waveform data may be exported to a text file (*.txt) as columns of X/Y pairs or the Analyze waveform image may be stored to a bitmap or JPEG format.
Screen Capture	Selecting this option initiates a process in which the user may select any visible window on the desktop. A browser dialog is then opened to allow the image of the window to be saved in bitmap (*.bmp) or JPEG form.
TWAIN   Acquire	Retrieve data from the selected TWAIN source.
TWAIN   Select	Selects the TWAIN data source.
Close	Closes the active waveform or image. Analyze does not prompt to save modified data before closing. Closing a waveform or image without saving it will result in lost data.
Properties	Properties displays general and statistical information about the data in the active window, as well as allowing the setting of label and display options for the data. General data information and acquisition information are available under the General page; parameters and Figures of Merit (FOM) are available under the Statistics page; data title and comments and axis titles and units can be set under the Labels page; and the plot type and styles can be set under the Display page.
Print	Print... spools the selected waveforms to the printer. Before executing Print, Analyze will ask which title should be included, as well as if the date and time

	the waveforms were printed should be included. Analyze can print as many as 64 waveforms per page, but can print tabular data only on single sheets.
Print All	Print All spools all active waveforms to the printer. Before executing Print All, Analyze will ask which title should be included, as well as if the date and time the waveforms were printed should be included. Analyze can print as many as 64 waveforms per page, but can print tabular data only on single sheets.
Print Setup	Print Setup opens the standard Windows printer configuration dialog allowing the adjustment of such parameters as page orientation, paper size and source and which printer to send the document to.
Exit	Exits Analyze

#### 6.4.1.1 Open Image, File menu

Open Image activates a file directory dialog for selecting an image file. The selected image is displayed in a new window. Supported image formats include the following:

- Bitmap (Windows)
- GIF
- JPEG
- MS Paint
- Photo CD
- PCX
- PhotoShop PSD
- TGA
- TIF
- Windows Metafile



**Figure 6-12 Image retrieval browser**

Enable Preview displays a thumbnail of the image selected in the file window. A preview of the file is displayed for those formats that support thumbnail displays. Select File Info to view additional information about the image selected in the file window.

#### 6.4.2 Tasks menu

The Tasks menu switches execution focus to TestMan or Archive. It causes the program to start if it is not already running.


#### 6.4.3 Edit menu

The Edit menu provides the following commands:

Item	Description
Undo	Undo reverses the last operation, if possible. If Undo is disabled, the last action cannot be reversed. Undo is only enabled when the currently active waveform is the waveform to which the last operation was applied. [Ctrl]+[Z] or [Alt]+[Backspace] are the shortcuts.
Cut	Cuts the current selection to the Clipboard. Not available in this version of DAAAC.
Copy	Copies the current selection to the Clipboard. Not available in this version of DAAAC.
Paste	Pastes the contents of the Clipboard into the current document. Not available in this version of DAAAC.

#### 6.4.4 Preferences menu

The Preferences menu provides the following commands for setting user preferences in Analyze:

Item	Description
Display Options  shortcut: 	The Display/Print Options dialog configures the display and print options for waveforms, overlays and images. Fields are divided into Global Options – those options that will be immediately applied to all displayed items, and New Object Defaults – those options that are applied when an item is created for display in Analyze. Most new object defaults can be modified after the object is created by selecting Properties from the objects right-click menu.
Processed FOMs	Selects Figures of Merit (FOMs) to be computed for processed data. Add view options moved from the View menu.
Tools	Toggles the presentation of the toolbar in the program window
Status Bar	Toggles the presentation of the status bar in the program window.



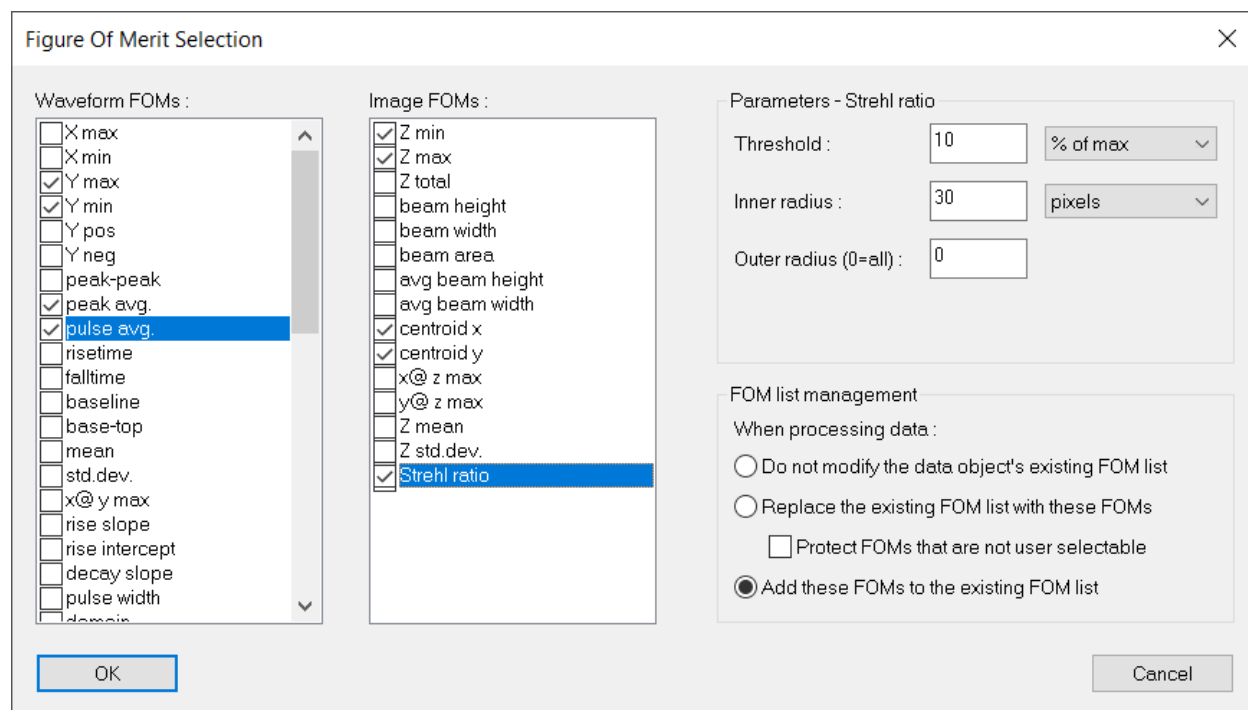
Large Icons	Toggles the appearance of the icons on the tool bar between smaller and larger.
-------------	---

#### 6.4.4.1 Processed FOMs, Preferences menu

Processed FOMs selects the Figures of Merit that are computed when a manually processed waveform is created. The list of computed FOMs determines which FOMs are displayed with the waveforms and which FOMs can be searched for when retrieving a manually processed waveform that has been stored in the database.

The Processed FOMs dialog allows the user to select how the specified list of FOMs is applied. The specified FOM list can either: 1) replace the existing list; 2) be appended to the existing list; or 3) only be used when the data has no existing FOMs.


Unlike FOM selection in TestMan, most FOMs specified here to not include user-defined parameters. For those FOMs that do include parameters, the parameter values are not stored in the database with the FOM.



**Figure 6-13 Analyze FOM selection**

### 6.4.5 Analysis menu

The Analysis menu offers the following commands for processing and examining waveforms and images:

Item	Description
Process  shortcuts:  , <F5>	<p>Process activates the Process Data dialog, that applies math operations to the active waveform. For overlay waveforms, the operations are applied to the currently selected waveform, which is marked with a yellow triangle in the waveform key.</p> <p>The Image Process dialog applies math operations to the active image. It's layout is similar to that of the Waveform Process dialog. Like the waveform dialog, all operations applied from this interface are applied immediately to the active image. Pressing the Cancel button will undo all operations applied while the dialog was open.</p>
Cursors	Toggles Cursors operations for the detailed examination of waveform or image data points.
Combine	Combines waveforms or images by applying various math operations. See Sections 6.5.11 (waveforms) and 6.5.12 (images).
Create contour plot	Generates a contour waveform, based on the z values in the active image.
Visualize...	Creates a surface or contour plot rendering of an image.
Overlay	Overlays two or more selected waveforms into a single window.
Overlay all	Overlays all displayed waveform data.
Extract	Extracts a single waveform from an Overlay and places its data in a new window.
Off-line Reduction	Off-line Reduction performs data reduction using previously acquired raw waveform data. One or more raw waveforms (instrument channels) can be selected at a time. The reduction is always performed using the <i>current</i> settings in TestMan, and the data is displayed/printed using the Acquisition settings in Analyze. To reduce data using historical reduction settings, first restore the appropriate configuration using one of the methods described in Sections 3.4 and 4.8.1.3.
Reduce Processed	Reduce processed data, using the signal line information from an instrument channel.
Custom	Performs custom analysis, including Velocity..., Cal Report..., Antenna Field..., and Modulation Stats.

Apply Last Op	Apply Last Op applies the last waveform processing operation to the active waveform. Although the last operation may be applied any number of times, Undo reverses only the last application. Shortcut <F4>.
Macro List	This selection open a modeless dialog that lists available macros. Any number of macros can be selected and applied to the selected waveform.
Image Adjuster	This selection open a modeless dialog that allows the brightness, contrast and gamma setting of the selected image to be adjusted.

#### 6.4.5.1 Cursors, Analysis menu

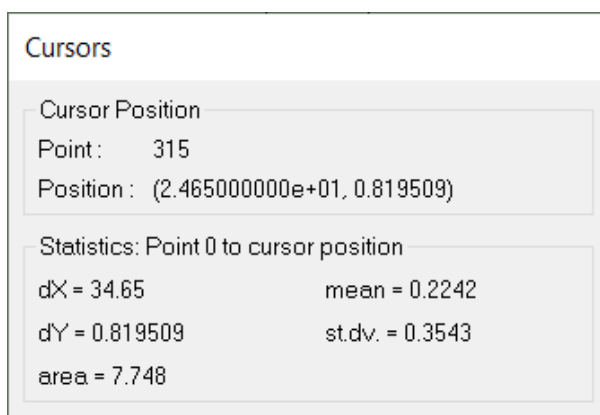
Cursors enables the “cursor” operations for the current waveform, which allows examining individual waveform point data, and extracting parts of the waveform by setting tags with the mouse cursor.

When Cursors is activated, the active waveform is maximized and its toolbar is displayed (initially on the right side of the window but can be moved anywhere). The active waveform is maximized, but can be reduced or minimized. Also, other waveforms can be activated, but Cursors will continue to operate on the original waveform until the option is turned off with the main menu or right mouse button popup menu.

A floating dialog is also initially displayed, containing information about the current cursor point and general waveform statistics. The cursor point information is also displayed in Analyze’s status bar.

Waveform statistics are computed from the first point in the waveform to the current position if no tags have been placed on the waveform. If a single tag has been placed, the statistics are computed from the tag position to the cursor’s current position. If two or more tags have been placed, the statistics are computed between Tag 1 and Tag 2. See “Cursor Measurement Selection dialog” below for step-by-step instructions on placing measurement tags.

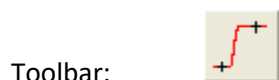
To close the Cursors position dialog, activate its window by clicking on it, then press [Esc]. The main Cursors window will remain on until turned off from the menu or toolbar.



**Figure 6-14 Cursor tracking information**

Cursors can be used on raw, processed and overlay waveforms. For overlay waveforms, Cursors tracks the currently selected waveform, which is marked with a yellow triangle in the overlay waveform key.

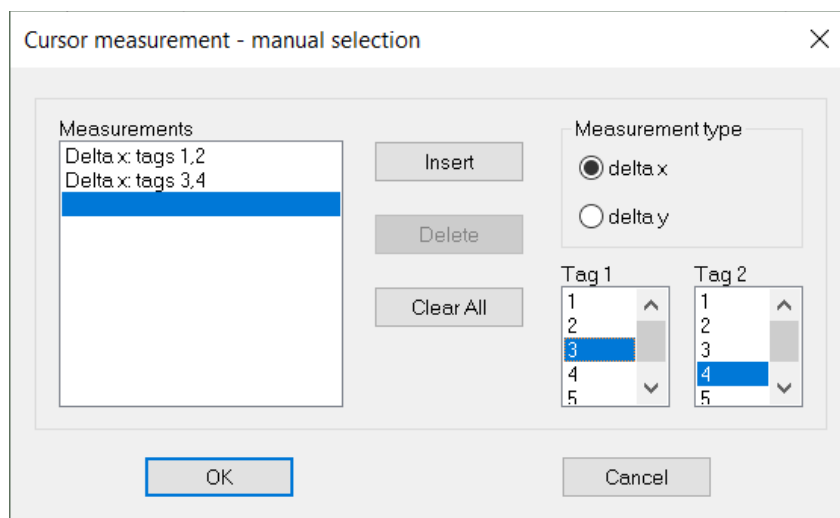
### Shortcuts



Keys: [F6]

#### 6.4.5.1.1 Cursor Measurement Selection dialog

Within Cursor Operations, the Cursor Measurement Selection feature displays the delta x and delta y measurements between tags. The selected measurements are displayed in the measurement list on the Cursor Statistic area of the Cursor Operations window and printed in the waveform's legend when the waveform is printed from the Cursor Operations window.



**Figure 6-15 Cursor measurement selection**

To add a measurement to the displayed list:

1. Place two (or more) tags on the waveform by clicking on the desired points with the mouse. (The keyboard arrow keys also can be used for greater accuracy.)
2. Select Setup from the Measure group in the Cursor Operations window. The Cursor Measurement Selection dialog will appear.
3. Choose Measurement type.
4. Select Tag 1 and Tag 2 to define the beginning and ending positions of the measurement.
5. Choose Insert.
6. Continue selecting tags for measurements as needed.
7. Choose OK.

To delete measurements from the list:

1. Open the Cursor Measurement Selection window.
2. Select the measurement to be deleted from the left list.

3. Choose Delete. To remove all listed measurements, choose Clear All.
4. Choose OK.

If any tag used to compute a measurement is deleted, the measurement will be automatically removed from the list.

To print the waveform with the tags and measurements:

1. Place the tags on the waveform and define the measurements.
2. Select Print from the File menu or from the pop-up menu available by clicking on the waveform with the right mouse button.
3. Make any necessary changes to the waveform's print title, date, and time options.
4. Choose OK.

Selecting Print All from the File menu or the Toolbar prints all waveforms that are open in Analyze, including any tags that are defined in Cursor Operations. Print All will not include the legend of tags and measurements however.

#### **6.4.5.1.2 Zooming, Cursor View functions**

Zoom In enlarges the selected region. The waveform is re-scaled using the first and second tags as the waveform x-axis limits.

Zoom Out shrinks to the previously selected region. The waveform is rescaled using the previous set of tags as the waveform x-axis limits.

Zoom Off displays the entire waveform. The waveform is re-scaled using the minimum and maximum x-axis values as the waveform limits.

#### **6.4.5.1.3 Zeroing, Cursor Edit functions**

Zero Between sets the y values of all points that fall between first and second tags to zero. Zero Outside sets the y values of all points outside the region between the first and second tags to zero. Zero Left sets the y values of all points left of the first tag to zero. Zero Right sets the y values of all points right of the first tag to zero.

For all methods of zeroing, the tag points are not modified.

#### **6.4.5.1.4 Deleting, Cursor Edit functions**

Delete Between removes all points that fall between first and second tags. Delete Outside removes all points outside the region between the first and second tags. Delete Left removes all points left of the first tag. Delete Right removes all points right of the first tag.

For all methods of deleting, the tag points are not modified.

#### **6.4.5.2 Overlay and Overlay All, Analysis menu**

The Overlay function plots multiple waveforms in a single window. This function is normally used to make qualitative and quantitative comparisons of related waveforms.

To create an overlay waveform, select this operation, then click on each waveform to be added to the overlaid window. Click outside of the waveform (e.g., on the Analyze title bar) to end selection.

Alternatively, you can overlay all displayed waveforms by selecting Analysis | Overlay All from the menu. A new window is then created that contains the selected waveforms, and a color-coded legend. The

initial display properties are determined by the settings in Preferences | Display Options, Overlay tab. Display settings may be changed after the overlay is created by right-clicking on the overlay and selecting Properties from the menu.

The first waveform in the overlay is the active waveform and is marked with a yellow triangle in the legend. To make a different waveform active, use the left mouse button to click its entry in the legend. The active waveform is always drawn on top of all other waveforms. Cursors and Process operations apply to the active waveform.

Some operations, such as Combine, cannot be performed on overlay waveforms.

Overlay All automatically creates a single plot that overlays all non-overlay waveforms presently displayed in Analysis. No user selection is necessary.

### Shortcuts



Toolbar:

Keys: [F8], [Shift+F8] (overlay all)

#### 6.4.5.3 Custom menu, Analysis menu

The Custom submenu of the Analysis menu includes the following specialized analysis functions:

Item	Description
Data Miner	Calculates and plots FOMs for selected waveforms. Unlike the FOM vs Shot retrieval, the Data Miner calculates FOMs on the fly and does not require them to be in the database.
FOM v Shot	Plot the selected FOM data ordered by shot number. FOMs are retrieved from the database, so must have been previously calculated and stored.
FTIR preprocess	Adjust cycle to cycle variation of FTIR waveforms, based on a reference waveform.
Image Builder	Constructs output images using existing database waveforms.
Mask Test	Applies the selected Mask Test cal item to the active waveform.
Modulation Stats	Analyzes a waveform that includes carrier and modulation components.
Waveform Builder	Constructs output waveforms using existing database waveforms.

Due to their highly custom nature and limited application, many items in this menu are keyed and do not appear in all systems.

##### 6.4.5.3.1 Data Miner, Custom menu

Data Miner builds an output waveform that uses one or more FOM values to define its axes. This operation is typically used to plot FOMs over a range of shots / bursts. FOM values are calculated

directly from the specified waveforms, and do not need to be present in the database. The general process for generating an output waveform is:

1. Specify the range of burst or shot numbers to retrieve;
2. Create the “formula variables”, FOM values that will be used to define the X and Y axis data;
3. Specify the X and Y axis formulas, for example:
  - a. Simple outputs use the keyword “sequence” for the X axis and a single formula variable for the Y axis;
  - b. FOM vs FOM plots are generated by specifying formula variables for both X and Y axes;
  - c. Algebraic formulas can be used to specify the outputs for one or both axes (e.g., “fom1^2 / 50” vs “fom2 \* fom3”).
4. [optional] Press Save to permanently store the waveform definition as a file;
5. Press OK to generate the output waveform.

**Data Mining & Reduction**

Sequence type : ☐ Burst ☒ Shot ☐ Keyword :

Sequence :  Shot in Burst :

**Formula variables**

Name	Type	Channel / Title
delta	Raw	S1R1P1C1
poly_max	Proc	poly
singC1	Raw	S1R2P3C1
p1_max	Proc	Z10 pulse1 max
smoothMax	Proc	Z10-abc pulse1 smoother

**Output waveform formulas**

x-axis :

y-axis :

**Post-processing** ☐ Sort x-axis

**Stored mining definitions**   ☒ Auto-load last defn.

**Figure 6-16 Data Miner configuration**

To create a formula variable, press the Add button in the Formula variables section (see Figure 6-16). This will display a dialog to configure the variable, as shown in Figure 6-17.

Formula Variable Definition

Variable name:

Data selection

Type: ☒ Waveform ☐ Single Point ☐ Image

☒ Raw Channel:  Station:

☐ Processed Title:

Conversion to single value

Figure of Merit:  ☒ Windowed

Calculation region

start time (secs):  stop time (secs):

Exclusion criteria

☒ Waveform off-scale: top

☐ Waveform off-scale: bottom

☐ Value above max threshold:

☐ Value below min threshold:

OK Cancel

Raw waveforms (532 displayed)

Burst/Shot	Name	Time
2539	S1R4P7C1	2025-05-28 1:14
2539	external	2025-05-28 1:14
2539	rf1	2025-05-28 1:14
2539	pulse1	2025-05-28 1:14
2538	S1R4P7C1	2025-05-28 1:10
2538	external	2025-05-28 1:10
2538	rf1	2025-05-28 1:10
2538	pulse1	2025-05-28 1:10
2537	S1R4P7C1	2025-05-28 11:5
2537	external	2025-05-28 11:5
2537	rf1	2025-05-28 11:5
2537	pulse1	2025-05-28 11:5
2536	S1R4P7C1	2025-05-28 9:59
2536	external	2025-05-28 9:59
2536	rf1	2025-05-28 9:59
2536	pulse1	2025-05-28 9:59
2535	S1R4P7C1	2025-05-28 9:54
2535	external	2025-05-28 9:54
2535	rf1	2025-05-28 9:54
2535	pulse1	2025-05-28 9:54
2534	S1R4P7C1	2025-05-27 5:43
2534	rf1	2025-05-27 5:43
2534	pulse1	2025-05-27 5:43
2533	S1R4P7C1	2025-05-27 5:39
2533	rf1	2025-05-27 5:39
2533	pulse1	2025-05-27 5:39

Display limit:  0=all

**Figure 6-17 Formula Variable definition for Data Miner operations**

To configure a formula variable:

1. Specify the variable name. The name must be unique within a data miner definition.
2. Select the data type (waveform, single point, image) and select raw or processed. The list on the right side will be populated with the data that matches the selected type.
3. Select a waveform in the list to fill in the raw channel name or processed title, or manually enter the name or title.
4. Select the Figure of Merit to calculate. Some FOM types have parameters – specify any displayed parameter values.
5. [optional] To limit the FOM calculation domain, select Windowed and specify the calculation region.
6. [optional] To exclude some waveforms from the calculation based on their levels, specify the exclusion criteria.
7. Press OK to create the formula variable and return to the Data Miner definition.

The following tables describe the individual controls in the data miner and formula variable dialogs.



Control	Description
Sequence type	Selects retrieval of data via burst number, shot number, or keyword
Sequence	A list (e.g., 101, 114, 130, 145) or range (e.g., 1200 – 1299) of bursts or shots to retrieve
Shot in Burst	For burst retrieval. A list or range of shots in burst to retrieve. Use “*” to retrieve all shots in each burst.
Formula variables	The list of variables that can be used in the X and Y axis definitions
Add	Create a new formula variable
Delete	Delete the selected formula variable from the list
Delete All	Delete all formula variables in the list
Defaults	Specify default values for creation of new formula variables
X-axis	The formula used to generate the output waveform’s x values. Use the keyword “sequence” to use the associated burst/shot value.
Y-axis	The formula used to generate the output waveform’s y values.
Sort x-axis	If selected, sorts the output data by x value.
Stored definitions	Definitions can be save from and read to a binary format (.dmd) file
Load	Replace the current definition with the definition in the selected file.
Save	Save the current definition to the selected file. All formula variables will be saved, including any that are not used in an axis formula.

Control	Description
Variable name	A name assigned to this FOM retrieval definition, which can be used in axis formulas.
Data selection	
Type	Specifies the data type to retrieve: waveform, single point, or image.
Raw / Processed	Raw data is selected by channel name; processed by title. All searches use substring matching and are case insensitive.

Data list	Displays the available data that matches the specified data type. Selecting a list item will populate the raw channel name or processed title.
Conversion to single value	Specifies the method used to convert waveform / image data to a single value.
Figure of Merit	Selects the FOM value to calculate. Available FOMs are based on the selected data type. If the FOM calculation has parameters, additional controls will be displayed to specify those values.
Windowed	Select this control to calculate the FOM over a limited domain. If selected, the calculation region controls will be enabled.
Exclusion criteria	Excludes waveforms based on their levels. If any of the selected criteria are met, the waveform will not be used to generate an output value.
Off-scale: top	Exclude waveforms marked “off-top” (clipped at their upper limit)
Off-scale: bottom	Exclude waveforms marked “off-bottom” (clipped at their lower limit)
Value above threshold	Exclude waveforms with levels above the specified high threshold
Value below threshold	Exclude waveforms with levels below the specified low threshold

**Output generation.** For each burst/shot in the specified sequence, the Data Miner will retrieve the waveforms associated with each formula variable and calculate the specified FOM value. The collected FOM values will then be used to generate a plot, based on the specified X and Y axis formulas. If a specification does not produce any output data or fails to produce data over the entire sequence, a warning message will be displayed. If the sequence is configured to retrieve data by shot number, any matching shots will be retrieved, including data that was originally acquired in burst mode. If configured to retrieve data by burst number and the X axis is set to “sequence”, the burst numbers will be the integer portion of the x values and the shot-in-burst will be a fraction. See the burst display discussion in the Fom v Shot section below.

#### 6.4.5.3.2 Fom v Shot, Custom menu

FOM v Shot retrieves processed waveform FOM values from the database, to show trends and relationships over a series of shots or bursts. The FOMs are typically computed by cal items during data reduction. The shot or burst number is used as the independent x-axis value, and the FOM value is the dependent y-axis variable.

The entire active database is searched and all matching waveform names and associated FOMs are extracted and plotted as waveforms. Processed waveforms with the specified name must exist in the database, and the selected FOMs must have been computed and stored with the processed waveform.

Any number of FOMs may be selected for the given waveform name, and any number of waveform names may be added to the plot list. The output may be directed to an Overlay where each separate FOM is normalized and stacked one on top of the other. Alternatively, all can be overlaid without normalization in one window, or each FOM can be plotted in separate windows.

A filter may be applied to limit the FOMs to a range of shots or bursts and the x-axis may be either the shot/burst number or it can be numbered sequentially from 1 to n shots/bursts.

**Fom vs Shot plots**

Search attributes

Waveform name: Z10 w1\_rf1 dw-Spectrum

FOM name: x@ y max

Y title: x@ y max Y units: Hz

Add FOM to plot list Check waveform name

FOMs to plot

Waveform	Fom	y-title	y-units
S1R1P1C1 smoother	risetime	risetime	s
Z10 S1R1P1C1 smoot...	pulse width	width	s

Delete Delete All

Destination

☒ Output to window(s)

☐ Export to text file

Select File

D:\da...\smoother\_1245-1254.txt

Filter

Filter by: ☒ Shot ☐ Burst

Start shot: 1245

End shot: 1275

<= 0 retrieves all

Waveform window type

☒ Separate windows

☐ Overlaid in one window

☐ Stacked in one window

X-axis numbering

☒ Use FOM's shot #

☐ Start x-axis at 1

Stored plot definitions

Load Save ☒ Auto-load last definition

Processed waveforms (7148 displayed)

Name	Time	Comment
s:903 Z10 wv6_c1 poly	2024-09-23 9:59:42 AM	Polynomial
s:903 Z10 wv6_c1 cab1	2024-09-23 9:59:42 AM	
s:903 Z10 wv6_c1 3dB	2024-09-23 9:59:42 AM	
s:903 Z10 wv6_c1 6dB	2024-09-23 9:59:42 AM	
s:903 Z10 wv5_c1 poly	2024-09-23 9:59:42 AM	Polynomial
s:903 Z10 wv5_c1 cab1	2024-09-23 9:59:42 AM	
s:903 Z10 wv5_c1 3dB	2024-09-23 9:59:42 AM	
s:903 Z10 wv5_c1 6dB	2024-09-23 9:59:42 AM	
s:903 Z10 w1_rf1 cab2	2024-09-23 9:59:41 AM	
s:903 Z10 w1_rf1 dw-Spectrum	2024-09-23 9:59:41 AM	
s:903 Z10 w1_rf1 dw-Freq vs. Time	2024-09-23 9:59:41 AM	
s:903 Z10 w1_rf1 dw-Power vs. Time	2024-09-23 9:59:41 AM	
s:903 Z10 w1_pulse1 add	2024-09-23 9:59:41 AM	
s:903 Z10 w1_pulse1 poly	2024-09-23 9:59:41 AM	Polynomial
s:903 Z10 w1_pulse1 cab1	2024-09-23 9:59:41 AM	
s:903 Z10 w1_pulse1 3dB	2024-09-23 9:59:41 AM	

Display limit: 0 0=all Get Wfms

Associated FOMs

x@ y max

OK Cancel

**Figure 6-18 FOM vs Shot configuration**

When plotting FOMs by burst number, the number of shots per burst determines how the FOM is plotted. The burst number is the integer portion of the x values and the shot-in-burst number is used as the fraction, evenly distributing the shots across each burst. Fom v Shot determines the number of shots in a burst by testing the first burst, as defined by the burst filter. For example, if the number of shots per burst is set to 4 and the first burst number to plot is 12, then the first four points have x values of 12.00, 12.25, 12.50, and 12.75. Caution: If the number of shots per burst changes within the selected burst range, then how Analyze plots the FOM is undetermined. Therefore, the burst filter should always be set to include only those bursts that contain the same number of shots. If uncertain about the number of

shots per burst in a range of bursts or for all bursts, send the data to a text file (from the Destination group, select Output to text file). This file listing displays shot number, FOM name, FOM value, burst and shot in burst.

<b>Search attributes</b>	
Waveform Name	Processed waveform title to find in the database. Searching raw waveforms is not supported.
FOM Name	A list of all available FOMs. The FOM selected here must already have been computed for the given waveform (during data reduction in TestMan). More than one FOM name can be associated with a waveform name.
Y title	Y-axis title of the plot that will be generated for the specified waveform name and FOM
Y units	Y-axis units of the plot that will be generated for the specified waveform name and FOM
Add FOM to plot list	Add the waveform name and to the list of FOMs to plot.
Check waveform name	Confirm that a waveform with the given name exists in the database.
FOMs to plot	List of the selected waveform, FOM name pairs to search for and plot.
<b>Destination</b>	
Output to window(s)	Search results are sent to a window. The Waveforms/FOMS values are plotted like a waveform. The independent axis (x) is the shot number (also extracted from the database) and the dependent axis (y) is the actual FOM value.
Output to text file	Search results are sent to a text file and in a columnar format that is easily imported into a spreadsheet. The data sent to the file is as follows: Shot, Fom Name, Fom Value, Burst, Shot In Burst.
Select File	Activates the Window's File Directory dialog for selecting a path and a file name to overwrite.
<b>Waveform window type</b>	
Stack in one window	All FOM plots are normalized and stacked above each other in an Overlay. This is useful when FOMs have different value ranges, but it is necessary to view the FOM plots in the same window to see any correlation.
Overlaid in one window	All FOM plots are overlaid in the same area. This is meaningful only when all plots have the same range of values.
Separate windows	Each FOM plot is plotted in an individual window.
<b>Filter</b>	
Filter is Shot number	The shot number is used to specify the range of acquisitions.

Filter is Burst number	The burst number is used to specify the range of acquisitions.
Start Shot / Burst	The first shot/burst in the series of acquisitions that will be used to retrieve the specified waveform names and associated FOMs.
End Shot / Burst	The last shot/burst in the series of acquisitions that will be used to retrieve the specified waveform names and associated FOMs.
<b>X-axis numbering</b>	
Use FOM/Burst shot	The first x-axis value will be the “Start Shot/Burst” number.
Start x-axis at 1	The first x-axis value will be 1. If filtering FOMs by burst, Analyze again will determine the shots per burst and assign a percentage to each shot within the burst for the plot.

#### 6.4.6 Acquisition menu

The Acquisition menu offers the following commands for specifying how Analyze handles acquired and automatically reduced data.

Item	Description
Work Offline	Sets Analyze to ignore acquisition and reduction data being transmitted from TestMan.
Fast Arm	Automatically rearms TestMan for another acquisition. If TestMan is not running, Fast Arm has no effect.
Configuration	The Acquisition Configuration dialog sets the display and print options for incoming acquired and reduced data. The Acquisition Configuration options determine only how Analyze manages acquired and reduced data transmitted from other modules or computers. Analyze does not control what data are transmitted or when data are transmitted.
Reset Overlays	Reset all running overlays displayed during acquisition. See the Acquisition Configuration interface for running overlay options.

#### 6.4.7 Tools menu

The Tools menu includes the following general utilities:

Item	Description
Conversions	Displays a dialog to provide measurement conversions.
Cable Curve	Generates cable characterization curves (magnitude only), based on a specified cable type and length.
Notebook	Displays the notebook viewer / editor. See Section 3.8.

### 6.4.8 Data View menu

The Data View menu includes the following commands:

Item	Description
Next Waveform	<i>Deprecated.</i> Activates the next waveform in a multi-waveform display. Enabled only in older Analyze versions to toggle between real / imaginary or magnitude / phase waveform pairs following a Fast Fourier Transform.
Go to Signal Line	Activates TestMan and highlights the channel node in the graph that is associated with the selected waveform.
Go To Instrument	Activates TestMan and opens the interface for the instrument that acquired the selected waveform/image. This command can be used on a raw or reduced data, but has no effect on imported or user created data, or on overlays. The instrument's dialog is activated so that changes can be made to the current instrument settings.
Log Page	Displays the associated log page in effect when this data was created, if one exists. This display shows historic settings and cannot be edited.
Acquisition Settings	Displays the associated acquisition settings in effect when this data was created, if any exist. This display shows historic settings, which cannot be edited.
Signal Line	Displays the associated Signal Line configuration in effect when this data was created, if any exist. This display shows historic settings, which cannot be edited.
Instrument Settings	Instrument Settings displays the associated instrument settings in effect when this data was created, for the associated channel. This display shows historical settings, which cannot be edited.

### 6.4.9 Window menu

The Window menu provides the following commands for displaying waveforms in Analyze:

Item	Description
Next Page	<p>Next Page displays the next page of waveforms. Next Page (and Previous Page) are enabled when there are more acquisition/reduction waveforms in the display buffer than will fit on one display page. The number of waveforms per page and the buffer size are set in Acquisition Configuration dialog (Section 6.4.6).</p> <p>If the remaining number of waveforms in the buffer is less than the Graphs Per Screen setting in the Acquisition Configuration dialog, then all remaining waveforms are displayed.</p>

Previous Page	<p>Previous Page displays the next page of waveforms. Previous Page (and Next Page) are enabled when there are more acquisition/reduction waveforms in the display buffer than will fit on one display page. The number of waveforms per page, and the buffer size, are set with the Acquisition Configuration dialog (Section 6.4.6).</p> <p>Selecting Previous Page removes the current waveforms from the display, then displays the last set of waveforms.</p>
Copy	<p>Copy creates a copy of the active waveform or image and displays it in a new window. The new, copied data then becomes the active window and all data windows are tiled, with the new copy window shown in the upper left. Modifications to the copy have no effect on the original data.</p>
Cascade	Overlaps all open windows.
Tile	Tiles all open waveforms without overlapping.
Arrange Icons	Arranges icons of minimized windows.
Close All	Close All closes windows and removes all waveforms from the waveform buffer. The size of this buffer is set in the Acquisition Configuration dialog (Section 6.4.6).
1, 2, ...	Activates the selected window.

#### **6.4.10 Help menu**

The Help menu provides the following information:

<b>Item</b>	<b>Description</b>
Help Topics	Opens an index of help topics.
About Analyze	Displays Analyze's version number, build date and other information.
License Agreement	Displays the DAAAC end-user license agreement.
DAAAC Logs	Open the daily log file in Notepad (or other default text file viewer). The log includes status and error messages from the DAAAC applications.

## 6.5 Analyze Dialogs

### 6.5.1 New Waveform

#### 6.5.1.1 Dialog

**Figure 6-19 Creating a user-defined waveform**

#### 6.5.1.2 Discussion

The Create Waveform processing page creates a new waveform, such as one used as a filter or test waveform. Create Waveform typically is used to create a new waveform window, but also can replace the data in an existing waveform. The Create Waveform page is not accessible during macro recording.

#### 6.5.1.3 Details

Item	Description
Number of points	The total number of X,Y pairs in the waveform. Adjusting this value will result in adjustment of the Delta X value if the min and max values have been specified.
Delta X	The constant step size between independent X points of the waveform. This value can be automatically determined by the values assigned to Minimum value, Maximum value and Number of points. $\text{Delta X} = (\text{maximum} - \text{minimum}) / (\text{number of Points} - 1)$



	Once the relationship is established, adjusting Delta X will adjust the Maximum value to keep the relationship consistent. This control is disabled if the “User specified x,y data” function is selected.																								
Minimum value	The X (independent) value of the left-most point in the waveform. Adjusting this value will results in adjustment of Delta X if it is established. This control is disabled if the “User specified x,y data” function is selected.																								
Maximum value	The X (independent) value of the right-most point in the waveform. Adjusting this value will results in adjustment of Delta X if it is established. This control is disabled if the “User specified x,y data” function is selected.																								
Function	<p>Select from one of:</p> <ul style="list-style-type: none"><li>• Constant</li><li>• Ramp</li><li>• Step</li><li>• Pulse</li><li>• Modulated Pulse</li><li>• Gaussian</li><li>• Sinusoid</li><li>• Random</li><li>• Formula</li><li>• User specified Y data</li><li>• User specified X,Y data</li><li>• Binary filter</li></ul> <p>Changing the function updates the other dialog controls, to display the required function parameters (see below).</p>																								
Parameter 1, Parameter 2	<p>Parameter control labels and values depend on the selected function type:</p> <table><tr><th>Function</th><th>Parameter 1</th><th>Parameter 2</th></tr><tr><td>Constant</td><td>Constant</td><td>&lt;none&gt;</td></tr><tr><td>Ramp</td><td>Value at x min</td><td>Value at x max</td></tr><tr><td>Step</td><td>Step position</td><td>&lt;none&gt;</td></tr><tr><td>Pulse</td><td>Step up position</td><td>Step down position</td></tr><tr><td>Modulated Pulse</td><td>Short period</td><td>Long period</td></tr><tr><td>Gaussian</td><td>Mean</td><td>Standard deviation</td></tr><tr><td>Sinusoid</td><td>Frequency 1</td><td>Frequency 2</td></tr></table>	Function	Parameter 1	Parameter 2	Constant	Constant	<none>	Ramp	Value at x min	Value at x max	Step	Step position	<none>	Pulse	Step up position	Step down position	Modulated Pulse	Short period	Long period	Gaussian	Mean	Standard deviation	Sinusoid	Frequency 1	Frequency 2
Function	Parameter 1	Parameter 2																							
Constant	Constant	<none>																							
Ramp	Value at x min	Value at x max																							
Step	Step position	<none>																							
Pulse	Step up position	Step down position																							
Modulated Pulse	Short period	Long period																							
Gaussian	Mean	Standard deviation																							
Sinusoid	Frequency 1	Frequency 2																							
Formula: f(x) =	<p>Defines the formula to be applied to the automatically generated independent values to produce the dependent data. Use the letter ‘x’ in the formula to indicate the independent variable.</p> <p>Binary arithmetic operators are +, -, *, /, and ** (x**3 = x³).</p> <p>The letter ‘e’ in a constant precedes an exponent, e.g., 1.45e-3 = 0.00145</p>																								

	Supported functions are:																																																			
	<table><tr><th>Name</th><th>Description</th><th>Example</th></tr><tr><td>acos</td><td>arccosine</td><td>acos(0.5)</td></tr><tr><td>asin</td><td>arcsine</td><td>asin(sqrt(3)/2)</td></tr><tr><td>atan</td><td>arctangent</td><td>atan(1.0)</td></tr><tr><td>atan2</td><td>arctan(y, x) of point (x,y)</td><td>atan(0.5, sqrt(3)/2)</td></tr><tr><td>cos</td><td>cosine</td><td>cos(x*3.1416)</td></tr><tr><td>cosh</td><td>hyperbolic cosine</td><td>cosh(1.0)</td></tr><tr><td>exp</td><td>e<sup>x</sup></td><td>exp(x)</td></tr><tr><td>fabs</td><td>absolute value (x)</td><td>fabs(-2.0)</td></tr><tr><td>fmod</td><td>modulus(x,y), remainder of x when dividing by y</td><td>fmod(x*6, 1.0)</td></tr><tr><td>log</td><td>log<sub>e</sub>x</td><td>log(x)</td></tr><tr><td>log10</td><td>log<sub>10</sub>x</td><td>log(1.5e3)</td></tr><tr><td>sin</td><td>sine</td><td>sin(x)</td></tr><tr><td>sinh</td><td>hyperbolic sine</td><td>sinh(1.0)</td></tr><tr><td>sqrt</td><td>square root</td><td>sqrt(x)</td></tr><tr><td>tan</td><td>tangent</td><td>tan(x)</td></tr><tr><td>tanh</td><td>hyperbolic tangent</td><td>tan(1.0)</td></tr></table>	Name	Description	Example	acos	arccosine	acos(0.5)	asin	arcsine	asin(sqrt(3)/2)	atan	arctangent	atan(1.0)	atan2	arctan(y, x) of point (x,y)	atan(0.5, sqrt(3)/2)	cos	cosine	cos(x*3.1416)	cosh	hyperbolic cosine	cosh(1.0)	exp	e <sup>x</sup>	exp(x)	fabs	absolute value (x)	fabs(-2.0)	fmod	modulus(x,y), remainder of x when dividing by y	fmod(x*6, 1.0)	log	log <sub>e</sub> x	log(x)	log10	log <sub>10</sub> x	log(1.5e3)	sin	sine	sin(x)	sinh	hyperbolic sine	sinh(1.0)	sqrt	square root	sqrt(x)	tan	tangent	tan(x)	tanh	hyperbolic tangent	tan(1.0)
	Name	Description	Example																																																	
	acos	arccosine	acos(0.5)																																																	
	asin	arcsine	asin(sqrt(3)/2)																																																	
	atan	arctangent	atan(1.0)																																																	
	atan2	arctan(y, x) of point (x,y)	atan(0.5, sqrt(3)/2)																																																	
	cos	cosine	cos(x*3.1416)																																																	
	cosh	hyperbolic cosine	cosh(1.0)																																																	
	exp	e <sup>x</sup>	exp(x)																																																	
	fabs	absolute value (x)	fabs(-2.0)																																																	
	fmod	modulus(x,y), remainder of x when dividing by y	fmod(x*6, 1.0)																																																	
	log	log <sub>e</sub> x	log(x)																																																	
	log10	log <sub>10</sub> x	log(1.5e3)																																																	
	sin	sine	sin(x)																																																	
	sinh	hyperbolic sine	sinh(1.0)																																																	
	sqrt	square root	sqrt(x)																																																	
	tan	tangent	tan(x)																																																	
	tanh	hyperbolic tangent	tan(1.0)																																																	
	Trigonometry functions use units of radians.																																																			
Example formula: sin(6*x)**2 * 2**x + 8.45e-3.																																																				
Data Values	Opens a dialog used to specify the X and Y values at each point if the “User specified x,y data” function is selected, or the Y values if “User specified y data” is selected, or the filter regions if “Binary filter” is selected.																																																			

#### 6.5.1.4 Access

- File->New Waveform
- <Ctrl-N>

### 6.5.1.5 Waveform Value Editor

#### 6.5.1.5.1 Dialog

The Waveform Value Editor dialog box contains a table with 16 rows and 2 columns: 'X value' and 'Y value'. The 'X value' column contains values from -10 m to -8.35 m in increments of 0.11 m. The 'Y value' column contains values for the first five rows: -72.1, 19.19, 123.2, 188.4, and 190.7, with the remaining rows being empty. Below the table, there is a text field labeled 'Fill empty Y cells with the value :' containing '0.0', and a checkbox labeled 'Auto-truncate (remove empty cells at end of array)' which is currently unchecked. At the bottom are 'OK' and 'Cancel' buttons.

	X value	Y value
1	-10 m	-72.1
2	-9.89 m	19.19
3	-9.78 m	123.2
4	-9.67 m	188.4
5	-9.56 m	190.7
6	-9.45 m	
7	-9.34 m	
8	-9.23 m	
9	-9.12 m	
10	-9.01 m	
11	-8.9 m	
12	-8.79 m	
13	-8.68 m	
14	-8.57 m	
15	-8.46 m	
16	-8.35 m	

Fill empty Y cells with the value :

☐ Auto-truncate (remove empty cells at end of array)

**Figure 6-20 User specified waveform values**

#### 6.5.1.5.2 Discussion

A grid control is used to specify function values, with column types that depend on the associated function type:

Function	Column 1	Column 2
User specified Y data	X values (not editable)	Y values
User specified X,Y data	X values	Y values
Binary filter	Filter “on” locations (X values)	Filter “on” widths

The number of rows is determined by the number of waveform points specified in the New Waveform dialog. When used with the Y data and X,Y data functions, the specified “Fill empty cells” value will be used to fill any Y values that have not been specified in the rows above. Unspecified values at the end of the list can be truncated, reducing the specified number of waveform points. When used with the Binary

Filter function, each row specifies a filter “on” location and width. The value of the function will be 1 in the “on” regions and 0 in all other regions.

#### 6.5.1.5.3 Details

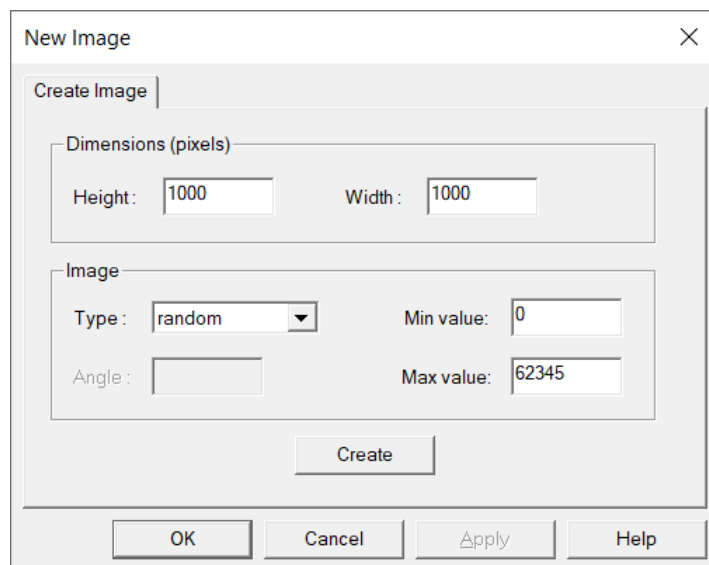
Item	Description
X value	A list of values of the length specified in Number of points. If the function selected is “User specified x,y data”, the user enters an independent X value for each of the points. If the function is “User specified y data”, this list is disabled and filled with serial integer values starting at ‘1’.
Y value	A list of values of the length specified in Number of points. The user enters an independent Y value for each of the points. Unspecified points can be truncated from the end of the list using Auto-truncate. Alternatively, unspecified points can be set to the single constant value in Fill empty Y cells with the value:
Fill empty Y cells with the value:	Specify a constant value to fill all unspecified Y values. The values are filled when the focus leaves the control.
Auto-truncate	If checked, any unspecified values at the end of the Y list will be truncated causing the waveform to be shortened.

#### 6.5.1.5.4 Access

- In the New Waveform dialog, select the “User specified y data”, “User specified x,y data”, or “Binary filter” function and click Data Values.

### 6.5.2 New Image

#### 6.5.2.1 Dialog



**Figure 6-21 Creating a user-defined image**

#### 6.5.2.2 Discussion

The Create Image dialog is used to create a test image.

#### 6.5.2.3 Details

Item	Description
Height, Width	The image dimensions
Type	The type of test image to generate
Min, Max value	The minimum and maximum z values in the generated image

#### 6.5.3 *Select Waveforms*

See Section 3.4, Data Selection Dialog.

#### 6.5.4 *Import Waveforms*

See Section 3.5, Waveform Import Wizard.

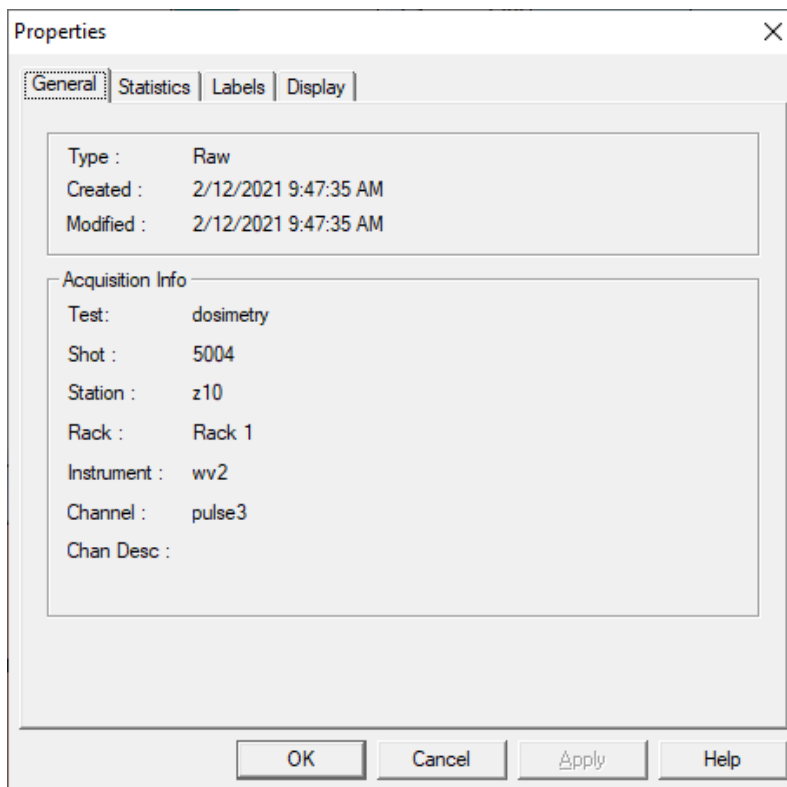
#### 6.5.5 *Properties Dialog*

The Properties dialog contains multiple pages that display information about the data in the active window. The exact contents of each page depend on the data type – waveform, overlay or image. Properties is available from the File menu, or by selecting Properties from any waveform, overlay, or image right-click pop-up menu.

Item	Description
General page	Waveform type (raw or processed), times created and modified and general acquisition information.
Statistics page	Number of points, minimum and maximum values for both axes and any Figures of Merit that are selected for calculation.
Labels page	Define main waveform title, axis titles and units and general comments for the waveform.
Display Options page	Selections for rendering the data.

### 6.5.5.1 General Page

#### 6.5.5.1.1 Dialog



**Figure 6-22 Properties dialog - General properties tab**

#### 6.5.5.1.2 Discussion

The General page of the Properties dialog displays information about the active waveform, including the waveform type and the associated acquisition information. Imported data and waveforms created from the Create Waveform dialog (File | New, or Process | Create Waveform) have no acquisition information, so this section will be empty.

#### 6.5.5.1.3 Details

Item	Description
Type	Waveform type: raw, processed, or auto processed.
Created	Date and Greenwich Mean Time (GMT) created.
Modified	Date and Greenwich Mean Time (GMT) last modified.
Test	The name of the test that the data was acquired under.
Shot	The shot number when the data was acquired.
Station	Station name the data was acquired from.
Rack	Rack name the data was acquired from.

Instrument	Instrument name the data was acquired from.
Channel	Channel name the data was acquired from.

#### 6.5.5.1.4 Access

- File->Properties
- Click on a plot, right-click, then select Properties... from the popup menu.

#### 6.5.5.2 Statistics Page

##### 6.5.5.2.1 Dialog

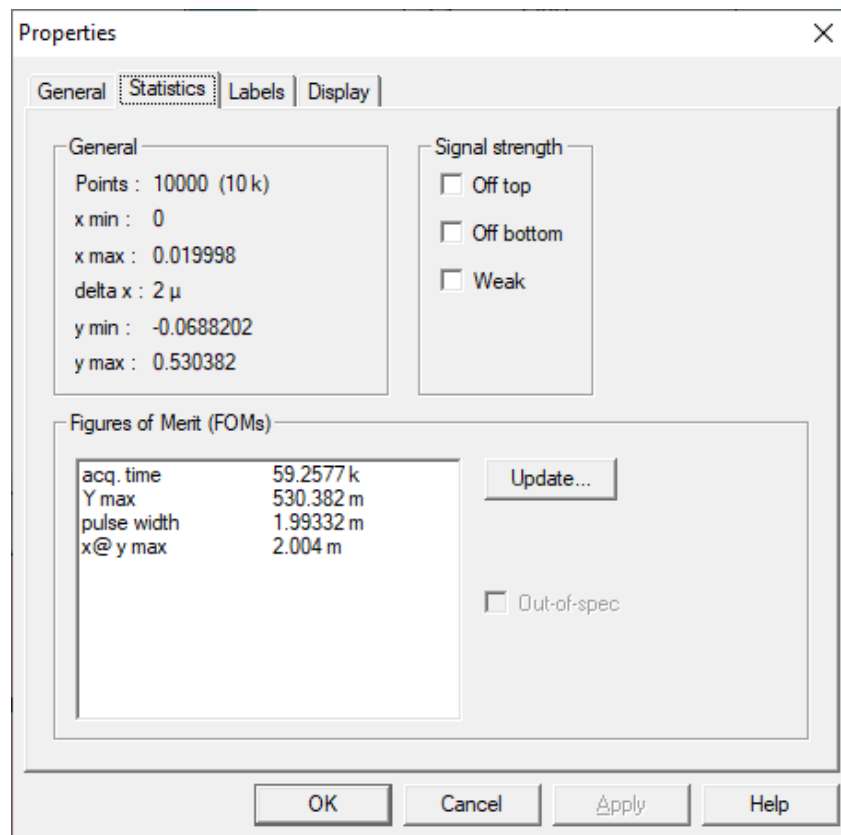


Figure 6-23 Properties dialog - Statistics tab for waveform data

#### 6.5.5.2.2 Discussion

The Statistics page of the Properties dialog displays the waveform point data, selected waveform FOMs, and signal strength statistics.

#### 6.5.5.2.3 Details

Item	Description
Points	Total number of x/y pair, floating point waveform points that make the waveform.
x min	Minimum independent axis value.

x max	Maximum independent axis value.
y min	Minimum dependent axis value.
y max	Maximum dependent axis value.
Figures of Merit (FOMs)	Name and values of all computed Figures of Merit. FOMs are defined in Cal Manager for reduced, processed data, and in Analyze for newly acquired raw data.
Update FOMs	Displays the FOM selection dialog, which is used to select and calculate figures of merit for this waveform.
Signal strength	Off top, Off bottom or Weak are checked if the signal is clipped at the top or bottom, or if the signal used less than ten percent of the instrument's full scale setting.

#### 6.5.5.2.4 Access

- Click on a waveform plot, then File->Properties
- Click on a waveform plot, right-click, then select Properties... from the popup menu.

#### 6.5.5.3 Image Statistics Page

##### 6.5.5.3.1 Dialog

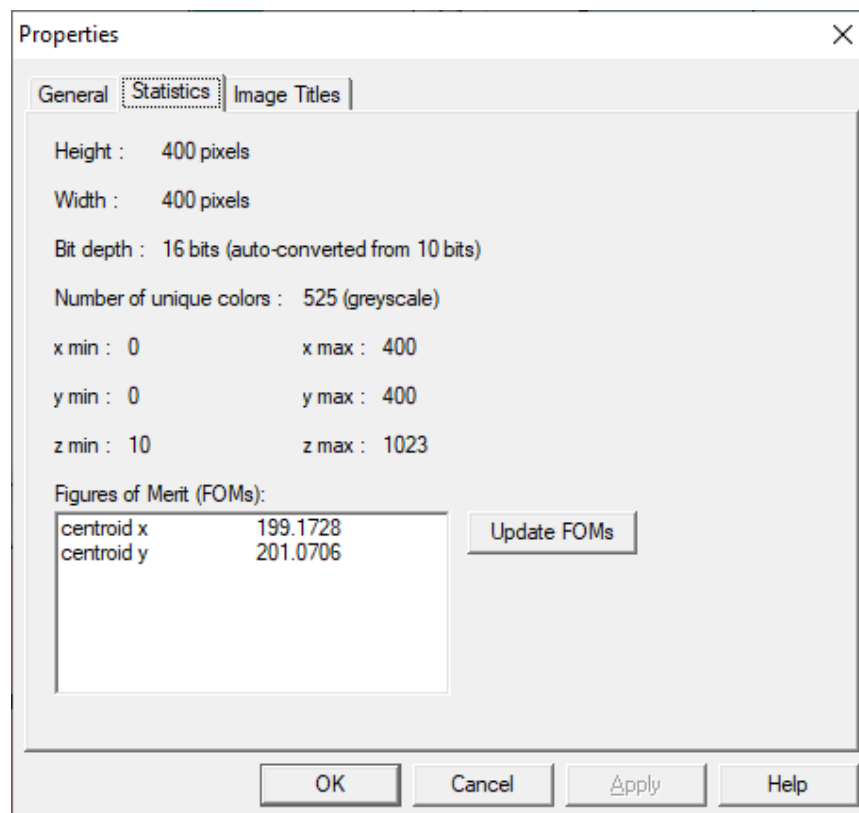


Figure 6-24 Properties Dialog - Statistics tab for image data



#### 6.5.5.3.2 Discussion

The Statistics page of the Properties dialog displays the image size and depth data, as well as color information, axis limits, and FOMs.

#### 6.5.5.3.3 Details

Item	Description
Height	Size of the vertical dimension, in pixels.
Width	Size of the Horizontal dimension, in pixels.
Bit depth	Number of bits used to represent the intensity values. DAAAC uses an internal 16-bit representation for all grayscale data greater than 8 bits. Data from a 10-bit camera, for example, will be auto-converted to 16-bit data.
Number of unique colors	Total number of unique colors or intensity levels present in the image.
X min	Minimum scaled (not necessarily pixel) value on the horizontal axis.
X max	Maximum scaled (not necessarily pixel) value on the horizontal axis.
Y min	Minimum scaled (not necessarily pixel) value on the vertical axis.
Y max	Maximum scaled (not necessarily pixel) value on the vertical axis.
Z min	Minimum intensity value. Will be blank for color images.
Z max	Maximum intensity value. Will be blank for color images.
Figures of merit	Name and values of all computed Figures of Merit.

#### 6.5.5.3.4 Access

- Click on an image plot, then File->Properties
- Click on an image plot, right-click, then select Properties... from the popup menu.

## 6.5.5.4 Labels Page

### 6.5.5.4.1 Dialog

The screenshot shows the 'Properties' dialog box with the 'Labels' tab selected. The 'Waveform' section has a 'Title' field containing 's:5004 pulse3' and a 'Comments' text area containing 'demonstration waveform from virtual device'. The 'X-axis' section has a 'Title' field containing 'Time' and a 'Units' field containing 'sec'. The 'Y-axis' section has a 'Title' field containing 'Amplitude' and a 'Units' field containing 'volts'. The dialog box has a standard Windows-style title bar with a close button (X) and a tabbed interface with 'General', 'Statistics', 'Labels', and 'Display' tabs. At the bottom are 'OK', 'Cancel', 'Apply', and 'Help' buttons.

Figure 6-25 Properties dialog - Labels tab for waveform data

### 6.5.5.4.2 Discussion

The Labels page of the Properties dialog displays and configures the current title, axis labels, and comments. Changes made to fields in this dialog are updated on the current waveform, but for the changes to become permanent, the waveform must be stored to the database.

### 6.5.5.4.3 Details

Item	Description
Title	The current waveform title. This may be changed to any value.
Comments	Enter and edit comments for the waveform. These comments can be displayed at the top left corner of the waveform.  If the waveform is a processed waveform, produced from auto reduction, and the Cal Item is a User Process, then the macro operations for that Cal Item are listed in this field as comments.
X-axis Title	The independent axis title.
X-axis Units	The independent axis unit of measure.

Y-axis Title	The dependent axis title.
Y-axis Units	The dependent axis unit of measure.

#### 6.5.5.4.4 Access

- Click on a waveform plot, then File | Properties
- Click on a waveform plot, right-click, then select Properties... from the popup menu.

#### 6.5.5.5 Image Titles

##### 6.5.5.5.1 Dialog

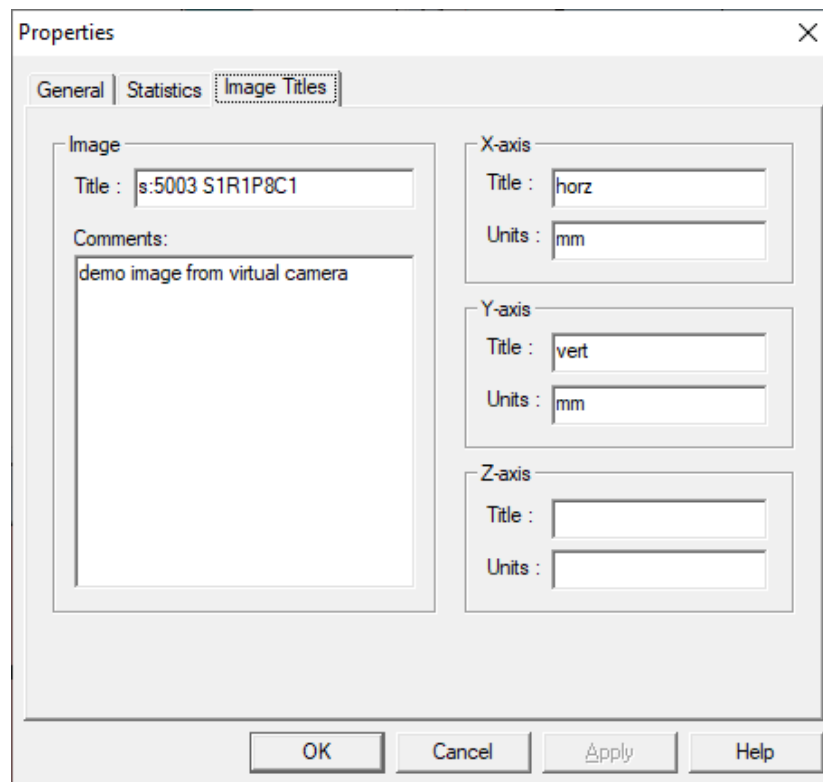


Figure 6-26 Properties dialog - Titles tab for image data

##### 6.5.5.5.2 Discussion

The Labels page of the Properties dialog displays and configures the current title, axis labels, and comments. Changes made to fields in this dialog are updated on the current image, but for the changes to become permanent, the image must be stored to the database.

##### 6.5.5.5.3 Details

Item	Description
Title	The current waveform title. This may be changed to any value.
Comments	Enter and edit comments for the image. These comments can be displayed at the top left corner of the waveform.

X-axis Title	The horizontal axis title.
X-axis Units	The horizontal axis unit of measure.
Y-axis Title	The vertical axis title.
Y-axis Units	The vertical axis unit of measure.
Z-axis Title	The dependent axis title.
Z-axis Units	The dependent axis unit of measure.

#### 6.5.5.5.4 Access

- Click on an image plot, then File | Properties
- Click on an image plot, right-click, then select Properties... from the popup menu.

#### 6.5.5.6 Details Page

##### 6.5.5.6.1 Dialog

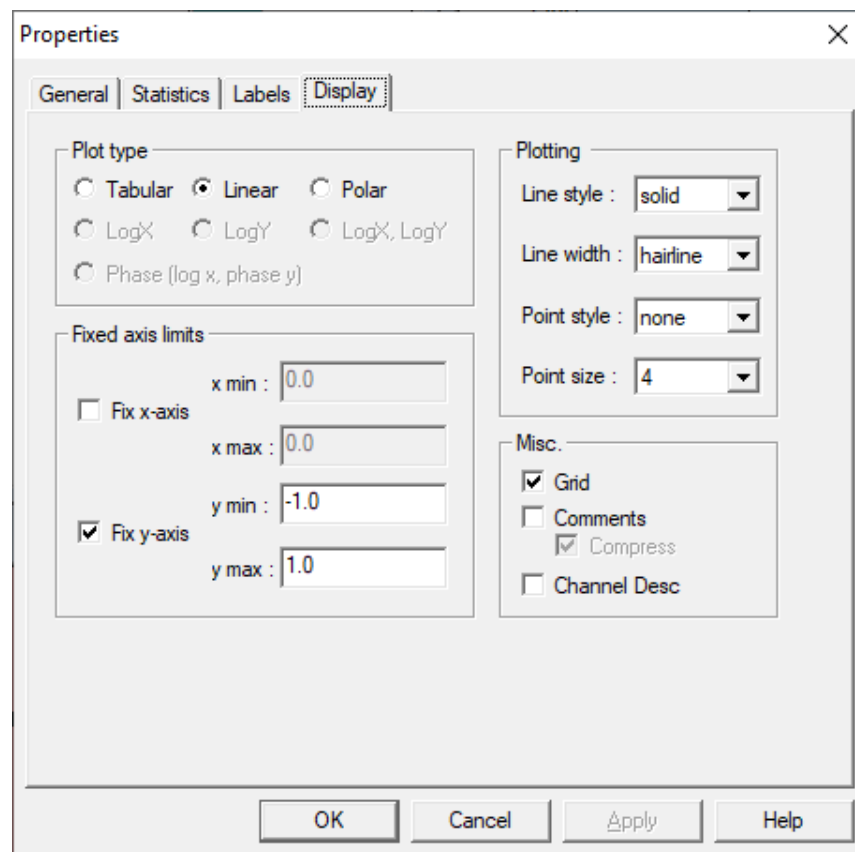


Figure 6-27 Properties dialog - Display tab for waveform data

##### 6.5.5.6.2 Discussion

The Display Options page of the Properties dialog selects the waveform display options. Waveforms can be displayed as a Cartesian plot or in tabular format. If displayed as a plot, you can select fixed limits for the x or y axis. The fixed axis limits affect the display only, and remain in effect until turned off.

#### 6.5.5.6.3 Details

Item	Description
Tabular	Data is displayed in tabular format as x/y pair floating point numbers.
Linear	Data is displayed graphically as a waveform.
LogX	Log display of the x-axis only.
LogY	Log display of the y-axis only.
LogX, LogY	Log display of both x and y axes.
Phase	Enabled for network analyzer data only, with log scale for the x-axis and +/- 180 degrees for the y-axis.
Fix x-axis	When checked, the specified x min and x max limits are applied to the waveform. Valid limits should be entered in the x min and x max fields before this option is applied. Because the waveform display uses round values, the limits entered may be rounded.
x min	The x min value for the waveform. The waveform's x-axis display minimum will be set to this number, regardless of the actual data limits.
x max	The x max value for the waveform. The waveform's x-axis display maximum will be set to this number, regardless of the actual data limits.
Fix y-axis	When checked, the specified y min and y max limits are applied to the waveform. Valid limits should be entered in the y min and y max fields before this option is applied. Because the waveform display uses round values, the limits entered may be rounded.
y min	The y min value for the waveform. The waveform's y-axis display minimum will be set to this number, regardless of the actual data limits.
y max	The y max value for the waveform. The waveform's y-axis display maximum will be set to this number, regardless of the actual data limits.

#### 6.5.5.6.4 Access

- Click on a waveform plot, then File | Properties
- Click on a waveform plot, right-click, then select Properties... from the popup menu.

## 6.5.5.7 Overlay Labels Page

### 6.5.5.7.1 Dialog

The screenshot shows the 'Properties' dialog box with the 'Labels' tab selected. The dialog has four tabs: 'General', 'Labels', 'Axes', and 'Display'. The 'Labels' tab contains the following fields:

- Overlay**
  - Title: Overlay
  - Comments: (empty text area)
- Waveforms**
  - Titles: s:5002 pulse3 (dropdown menu)
- X-axis**
  - Title: Time
  - Units: sec
- Y-axis (left)**
  - Title: Amplitude
  - Units: volts
- Y-axis (right)**
  - Title: Amplitude
  - Units: volts

At the bottom of the dialog are four buttons: OK, Cancel, Apply, and Help.

**Figure 6-28 Properties dialog - Labels tab for overlay data**

### 6.5.5.7.2 Discussion

The Overlay Labels page of the Properties dialog displays and configures the current title, axis labels and comments. Changes made to fields in this dialog are updated on the current waveform, but the waveform must be stored to the database for the changes to become permanent.

### 6.5.5.7.3 Details

Item	Description
Title	The current overlay title. This may be changed to any value.
Comments	Enter and edit comments for the waveform. These comments can be displayed at the top left corner of the waveform.
Waveform titles	Titles for the individual waveforms in the overlay. Modifying these titles will update the titles in the overlay legend.
X-axis Title	The independent axis title.
X-axis Units	The independent axis unit of measure.
Y-axis (left) Title	The left dependent axis title.
Y-axis (left) Units	The left dependent axis unit of measure.

Y-axis (right) Title	The right dependent axis title.
Y-axis (right) Units	The right dependent axis unit of measure.

#### 6.5.5.7.4 Access

- Click on an overlay plot, then File | Properties
- Click on an overlay plot, right-click, then select Properties... from the popup menu.

#### 6.5.5.8 Overlay Axes Page

##### 6.5.5.8.1 Dialog

Figure 6-29 Properties dialog - Axes tab for overlay data

##### 6.5.5.8.2 Discussion

The Overlay Display Options page of the Properties dialog selects the overlay waveform display options. The options configured below affect the display only, and remain in effect until they are turned off.

##### 6.5.5.8.3 Details

Item	Description
Fix y-axis	When selected, the values in the y min and y max fields are applied as limits to the waveform display. Because the waveform display uses round values, the limits entered may be rounded.

y min	The minimum y axis value to display on the left axis.
y max	The maximum y axis value to display on the left axis.
Fix x-axis	When selected, the values in the x min and x max fields are applied as limits to the waveform display. Because the waveform display uses round values, the limits entered may be rounded.
x min	The minimum x axis value to display.
x max	The maximum x axis value to display.
Show labels	When selected, shows y axis labels on the left side of the graph.
Multiplier, Offset	The multiplier and offset are applied directly to the left axis limits to create the limits for the right axis.
Waveform	Selects the waveform to be configured.
Vertical scale	Select left or right to display the waveform using the left or right axis scale.
Horizontal offset	X-axis offset for shifting the waveform display (commonly used to view waveforms recorded at different times).

#### 6.5.5.8.4 Access

- Click on an overlay plot, then File | Properties
- Click on an overlay plot, right-click, then select Properties... from the popup menu.



## 6.5.5.9 Overlay Display Page

### 6.5.5.9.1 Dialog

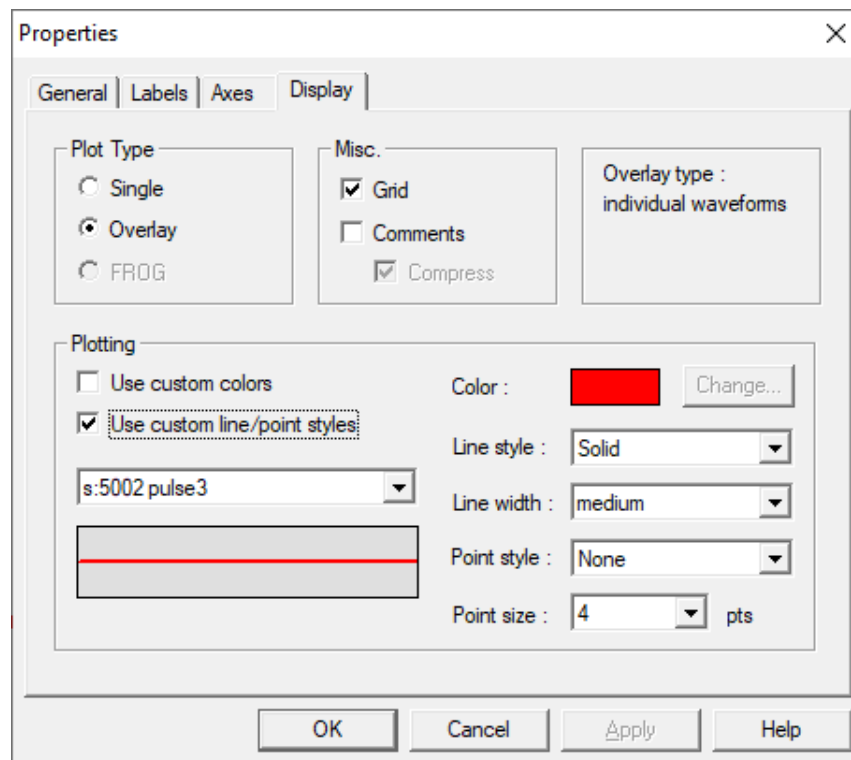


Figure 6-30 Properties dialog - Display tab for overlay data

### 6.5.5.9.2 Discussion

### 6.5.5.9.3 Details

Item	Description
Plot Type	Single displays one sub-plot at a time. Select the displayed plot by clicking on its entry in the legend. Overlay displays all plots. FROG supports Frequency Resolved Optical Gating output data, and displays a normalized intensity plot using the left vertical axis and a phase plot using the right vertical axis. Phase data is only displayed in the domain where the intensity is above 5% of the max intensity value.
Grid	Shows or hides plot grid lines.
Comments	Displays any waveform comment text above the plot area.
Compress	Replaces any newline characters with spaces in the displayed waveform comment.
Use custom colors	When checked, allows the user to assign a color to the plot shown in Waveform Selection. The selected color will be updated in Waveform Preview. When

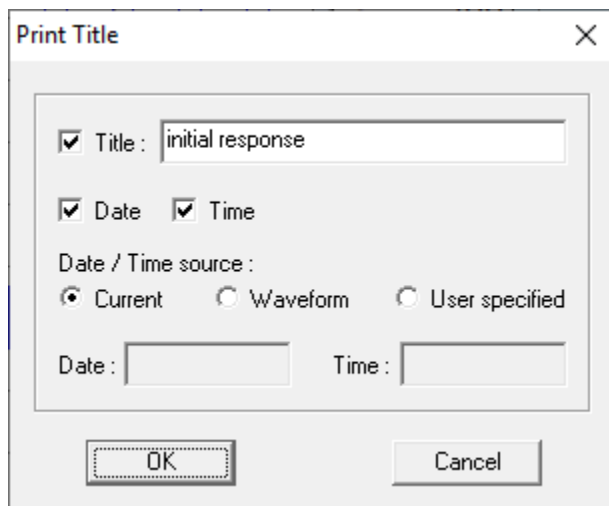
	checked Color: is enabled, otherwise the control is disabled and colors are assigned automatically to all traces.
Use custom line/point styles	When checked, allows the user to assign a line style, line width and point style to the plot shown in Waveform Selection. The selected styles will be updated in Waveform Preview. When checked Line style:, Line width: and Point style: are enabled, otherwise the controls are disabled and styles are assigned automatically to all traces.
Waveform Selection (Unlabeled)	Select, by name, the waveform to be reviewed and/or adjusted.
Waveform Preview (Unlabeled)	Shows a sample of the appearance of the trace selected in Waveform Selection. The appearance is updated as properties are selected for adjustment.
Color:	Opens a color dialog to assign a user-selected color to the waveform selected in Waveform Selection (Unlabeled). The color is updated in Waveform Preview (Unlabeled). This control is disabled unless Use custom colors is checked.
Line style:	Assign the selected line style to the waveform named in the Waveform Selection list.
Line width:	Assign specified line weights to the waveform named in the Waveform Selection list.
Point style:	Assign the selected point style to the waveform named in the Waveform Selection list.
Point size:	Adjust the dimensions of the point style selected for the waveform named in the Waveform Selection.

#### 6.5.5.9.4 Access

- Click on an overlay plot, then File | Properties
- Click on an overlay plot, right-click, then select Properties... from the popup menu.

## 6.5.6 *Print Title*

### 6.5.6.1 Dialog



**Figure 6-31 Analyze print configuration dialog**

### 6.5.6.2 Discussion

The dialog controls the inclusion of a title and date and/or time stamp in the printout.

### 6.5.6.3 Details

Item	Description
Title	Text to be written at the top of the printout.
Date	Check to print a date stamp on the document.
Time	Check to print a time stamp on the document.
Current	Use the current date/time for the printout date and time fields.
Waveform	Use the waveform creation date/time for the printout date and time fields.
User specified	Use an operator specified date/time for the printout date and time fields.
Date:	User provided date value to be printed on the document.
Time:	User provided time value to be printed on the document.

### 6.5.6.4 Access

- File | Print
- <Ctrl-P>

## 6.5.7 *Display Options*

This dialog has several pages that set display options for the various data types (e.g., waveforms, images, overlays). In most pages, settings are grouped as either Global Options or New Object Defaults. Global Options are applied to all displayed data on creation of the display object and

whenever the display settings are changed in this dialog. New Object Defaults are only applied the first time the object is displayed – modifying settings in this category will not affect waveforms and images that are already displayed.

### 6.5.7.1 All Types

#### 6.5.7.1.1 Dialog

Figure 6-32 Analyze display options dialog

#### 6.5.7.1.2 Discussion

The All Types page configures display settings that are common to all data types.

#### 6.5.7.1.3 Details

Item	Description
Axis labels font	Specifies the font typeface and size for axis labels. Note that regardless of the size selected, the font size will scale with the data window size.
FOMs, Display	When checked, selected Figures of Merit (FOMs) are displayed at the specified location on the waveform (see FOMS, Location).

FOMs, Overwrite waveform	When checked, the FOMs are displayed after the waveform is displayed, overwriting any area of the waveform in the same area as the FOMs. When unchecked, the FOMs are displayed transparently. That is, the FOMs are displayed first, then the waveform is displayed. If the waveform exists in the area of a FOM, the waveform data will overwrite the FOM.
FOMs, Location	Selects the location on the waveform to display the FOMs.
FOMs, Font size	Selects the size of the font for the display FOMs.
Raw data title	Selects the components of the displayed title for raw data
Reduced data title	Selects the components of the displayed title for reduced data

## 6.5.7.2 Waveform

### 6.5.7.2.1 Dialog

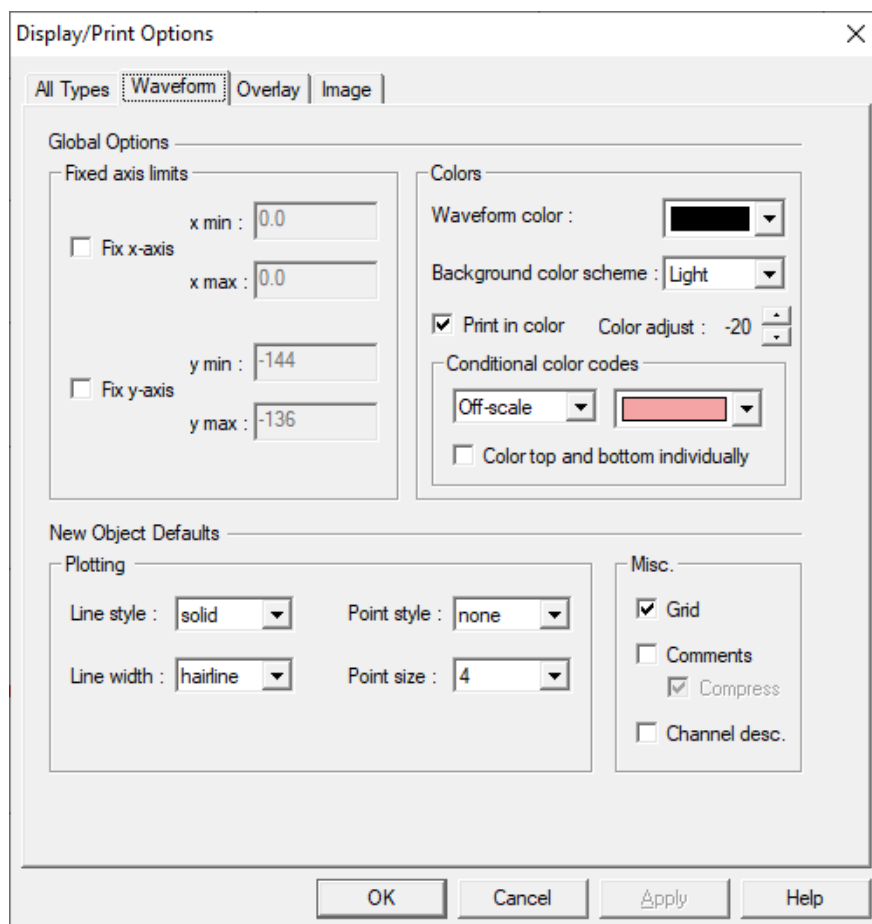


Figure 6-33 Waveform display options

### 6.5.7.2.2 Discussion

The Waveform page configures display and print options for waveforms.

### 6.5.7.2.3 Details

Item	Description
<i>Global Options</i>	Changes to these options are applied immediately to all currently displayed waveforms.
Fix x-axis	When checked, the specified x min and x max display limits are globally applied to all waveforms. Valid limits should be entered in the x min and x max fields before this option is applied.
x min	The x min value for the waveform. The waveform's x-axis display minimum will be set to this number, regardless of the actual data limits.
x max	The x max value for the waveform. The waveform's x-axis display maximum will be set to this number, regardless of the actual data limits.
Fix y-axis	When checked, the specified y min and y max display limits are globally applied to all waveforms. Valid limits should be entered in the y min and y max fields before this option is applied.
y min	The y min value for the waveform. The waveform's y-axis display minimum will be set to this number, regardless of the actual data limits.
y max	The y max value for the waveform. The waveform's y-axis display maximum will be set to this number, regardless of the actual data limits.
Waveform color	Selects the color for the waveform trace.
Background color scheme	Selects the color scheme for the plot background. Off displays no background color; all other selections display color codes based on the data type and error conditions.
Print in color	Print waveforms using color for both the plot and the background (only applies to color printers). Printed colors will match the displayed colors.
Color adjust	Adjusts the saturation level for color printing. Scale is -100 to +100.
Conditional color codes	Allows selection of color-coding for off-scale, out-of-spec, or weak data. The off-scale condition supports individual top and bottom coloring – the top half of the window will be colored if the data is off-top and the bottom half of the window will be colored if the data is off-bottom.
<i>New Object Defaults</i>	Items in this section affect newly created waveforms, but do not affect waveforms that are already displayed. Many of these items can also be modified after the waveform is created by selecting Properties from the waveform's right-click menu.
Line style	Selects the line style for the waveform plot. Choices are none, solid, dash, and dot.
Line width	Selects the line width for the waveform plot. Choices are hairline, thin, medium, and thick. Hairline is the default and is usually the best choice if the waveform contains many points. Medium or thick are useful for preparing presentation slides.
Point style	Selects the point style for the waveform plot. Choices are none, circle, square, triangle, diamond, cross, and X.

Point size	Selects the size for the display of data points in the waveform plot. Has no effect if the point style is none.
Grid	When checked, a grid is displayed with the waveform.
Comments	When checked, any comments entered in the Labels page of the Properties menu for the current waveform are displayed at the top left of the waveform frame. The comment line will be truncated if it exceeds one line.
Compress Comments	Replaces newline characters with commas when displaying the comment field. This action decreases the amount of vertical space required to display the comment, but can cause the comment text to be clipped horizontally.
Channel Desc	Displays the channel description (from the associated acquisition channel) above the plot area.
Raw waveform title	Raw waveforms in the database do not have an associated title, but when displayed they dynamically create a title from a combination of burst number, shot number, station name and channel name.
Burst / Shot-Raw	Display the burst or shot (or "burst.shot" in burst mode) in the raw waveform's title.
Station-Raw	Display the station name in the raw waveform's title.
Channel-Raw	Display the channel name in the raw waveform's title.

### 6.5.7.3 Overlay

#### 6.5.7.3.1 Dialog

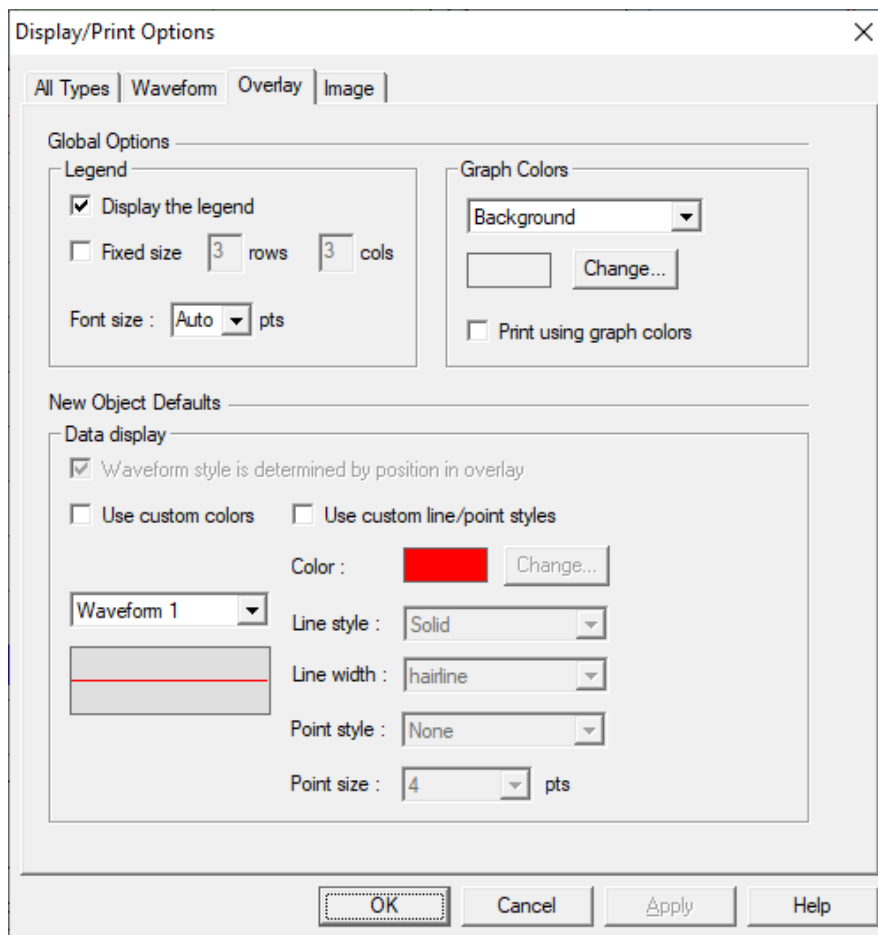


Figure 6-34 Overlay display options

#### 6.5.7.3.2 Discussion

The Overlay Display Options dialog configures the global display and print options for overlay waveforms. Changes to the Legend and Graph Colors settings are applied to all currently displayed overlays. Items in the Data Display group are used as the initial values when a new overlay is created. Modifying the Data Display values will not affect existing overlays.

Note: selection of custom line styles with large line widths can substantially increase the time required to render waveforms with large numbers (10,000 or more) of data points.

#### 6.5.7.3.3 Details

Item	Description
Display legend	When checked, displays the legend at the bottom of an overlay plot.



Fixed size legend	When checked, fixes the size of the overlay legend to the specified number of rows. If unchecked, the legend will contain enough rows to accommodate all entries.
Graph colors	Configures the various background and border colors for the display.
Use graph colors when printing	If selected, the printed overlay will use the specified background and border colors (even if the printer does not support color). If not selected, the printed graph will use black borders and white backgrounds.
Waveform style is determined by position in overlay	Selecting this item causes the color and line style of overlay waveforms to be determined by their position in the overlay (e.g., the first waveform in the legend will always be red, the second will always be blue, etc.). If this item is not selected, then the color / line style is tied to the waveform data, not to its position in the overlay. If a new waveform is inserted in the overlay, the existing waveforms will change position in the overlay but will retain their original color and line style. This item can only be disabled if both custom colors and line styles are enabled. This mode only affects the display of running overlays, which are the only overlays that support waveform insertion.
Custom colors	Allows the user to define the colors for each waveform in an overlay. Uncheck to use the default color scheme.
Custom line styles	Allows the user to specify line styles and widths for each waveform in an overlay. Uncheck to use solid lines for all waveforms.
Change color	Configures the color for the currently selected waveform.
Line style	Configures the line style for the currently selected waveform.
Line width	Configures the line width for the currently selected waveform. Choices are hairline, thin, medium, and thick. Hairline is the default and is usually the best choice if the waveform contains many points. Medium or thick are useful for preparing presentation slides.

#### 6.5.7.3.4 Access

- Preferences | Display Options



## 6.5.7.4 Image

### 6.5.7.4.1 Dialog

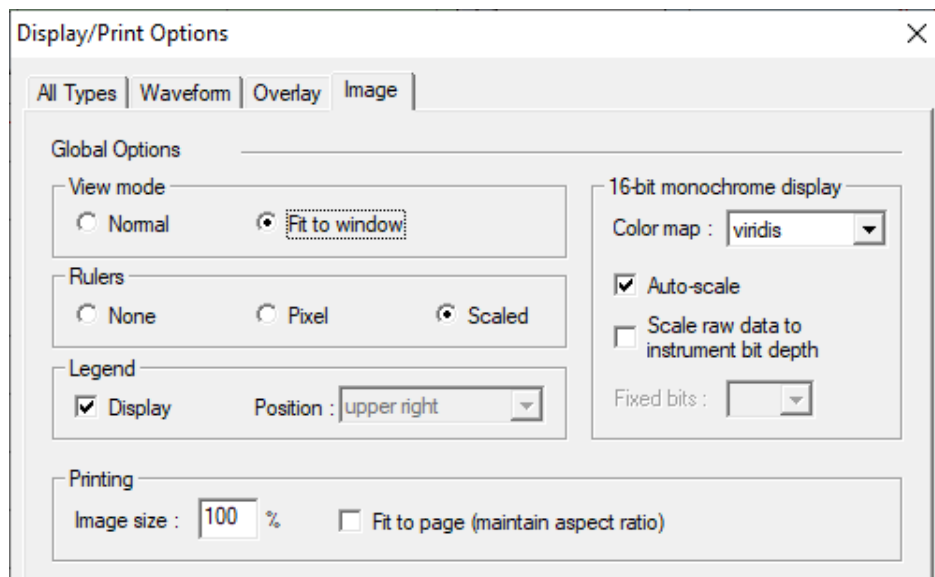


Figure 6-35 - Image display options

### 6.5.7.4.2 Discussion

The Image Options dialog configures the global display and print options for images. Changes to these options are applied to all currently displayed images.

### 6.5.7.4.3 Details

Item	Description
View mode	<p>Normal – displays the image at its actual size, using scroll bars to provide access to the entire image if necessary.</p> <p>Fit to widow – scales the image to fit the size of the window, while maintaining the proper aspect ratio.</p> <p>In either mode, the image can be zoomed in or out. Fit to window mode is temporarily disabled whenever the image is not viewed at 100% of actual size.</p>
Rulers	<p>None – do not display rulers with the image.</p> <p>Pixel – display rulers using unscaled (pixel) units.</p> <p>Scaled – display rulers using scaled units.</p> <p>Rulers provide axis scales for the image. Note: the ruler display is automatically turned off when the window size is not large enough to adequately display both the rulers and the image.</p>
Legend	<p>Displays a legend with the image. The legend includes image FOMs, the color map, and a raw/processed indicator.</p>

16-bit monochrome display	<p>Specifies display settings for images in 16-bit monochrome format. Note that data from all instruments with monochrome bit depth greater than 8 bits (9 to 16 bits) is converted to 16-bit monochrome.</p> <p>Color map – selects the color map used to render the data.</p> <p>Auto-scale – If selected, maps the range of image values to span the entire color map. If not selected, the range 0 to <math>2^{16}-1</math> spans the entire color map.</p> <p>Scale raw data to instrument bit depth – if selected, the range 0 to <math>2^n-1</math> spans the entire color map, where <math>n</math> is the instrument bit depth.</p>
Printing	<p>Image size – allows the image to be scaled for printing. Due to the high resolution of printers compared to monitors, the scale percentage will typically be much larger than 100% (e.g., a 600x600 pixel image would print at only 1"x1" on a 600 dpi printer with 100% scaling)</p> <p>Fit to page – scales the image to fill the printed page, while maintaining the proper aspect ratio.</p>

#### 6.5.7.4.4 Access

- Preferences | Display Options



## 6.5.8 Figure of Merit (FOM) Selection

### 6.5.8.1 Dialog

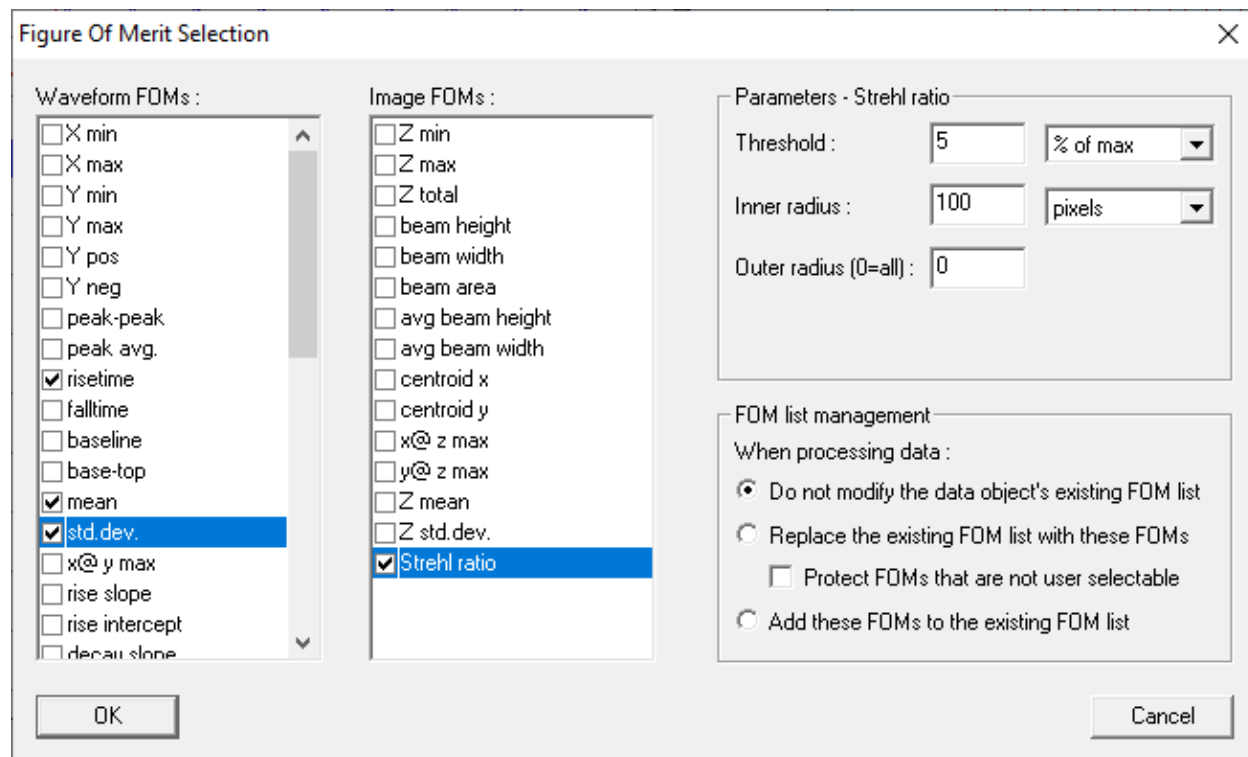


Figure 6-36 Figure of Merit selection

### 6.5.8.2 Discussion

The Figure of Merit Selection dialog box is used to global select the Figures of Merit (FOMs) that are computed when a manually processed waveform is created, or when an existing waveform is manually processed (from the Analyze module). The list of computed FOMs determines which FOMs are displayed with all waveforms, and which FOMs can be searched for when retrieving the waveform. Changing the FOM List has no effect on existing, processed waveforms. FOMs for automatically processed waveforms are selected in Cal Manager. FOMs for raw waveforms are selected globally in Acquire.

Three methods are available for using the selected FOMs:

- Do not modify an existing FOM list – If the waveform already has a FOM list, it will not be modified (i.e., the waveform's existing FOM values will be update to reflect the processing, but FOMs will not be added to or removed from the waveform's FOM list). Waveforms that do not have a FOM list will use the list specified in this dialog.
- Replace existing FOM list with these FOMs – Whenever a waveform is processed, its existing FOM list is deleted and the FOMs specified in this dialog are added. Some special FOMs, such as off-scale indicators and markers are automatically computed and are not user selectable. If Protect FOMs that are not user selectable is checked, these special FOMs are not deleted before adding the new FOMs.
- Add these FOMs to the existing list – In this case, any newly selected FOMs are appended to the waveforms existing FOM list. This mode protects all existing FOMs, while adding any new selections that were not already displayed.

Modification of the FOM list only affects displayed waveforms as they are created or processed in Analyze. Changes to the FOM list do not modify the FOMs associated with waveforms in the database.

### 6.5.8.3 Access

- Preferences | Processed FOMs

## 6.5.9 Process Waveform Data

This option opens a tabbed dialog that allows data operations to be applied directly and immediately to the selected waveform. An analogous dialog is available for image data as described in 6.5.10.

The dialog is also used to process overlaid waveforms. In that case, an Apply to all waveforms checkbox is displayed at the bottom of the dialog. Checking the box will apply the selected operations to all overlaid waveforms. If the box is unchecked, the selected operations will only be applied to the active waveform. Caution should be used when applying operations only to the active waveform, as some operations can result in overlaid sub-waveforms with very different horizontal or vertical limits.

### 6.5.9.1 Calculator tab

#### 6.5.9.1.1 Dialog

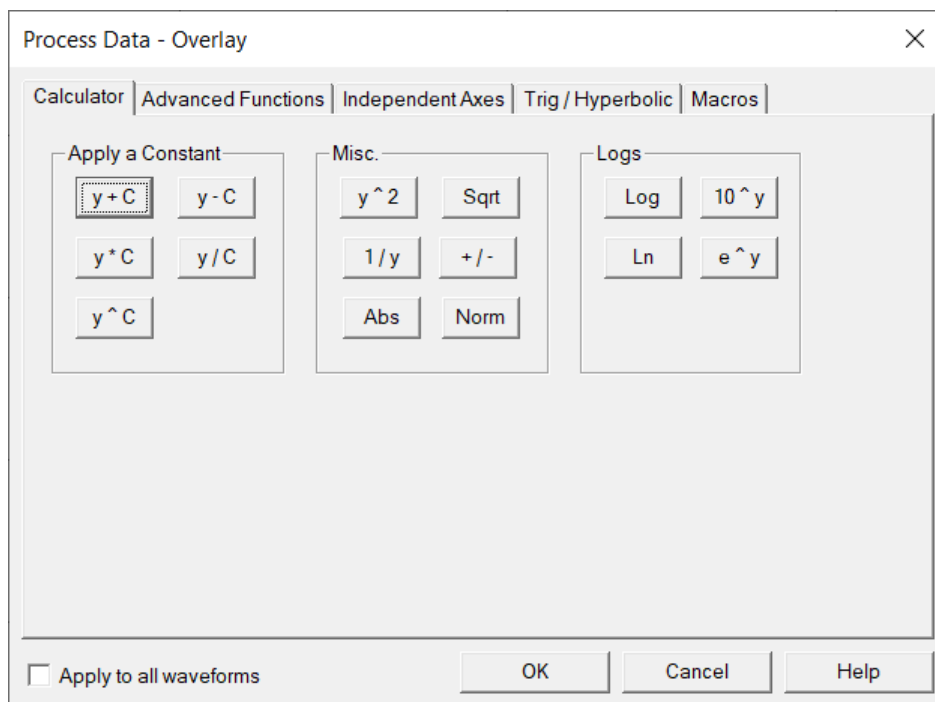


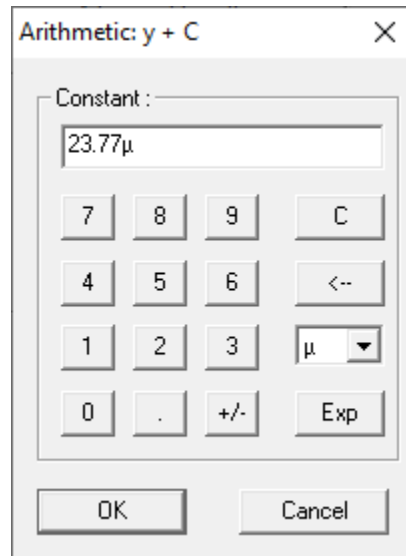
Figure 6-37 Process Waveform dialog - Calculator tab

#### 6.5.9.1.2 Discussion

The Calculator waveform processing page applies common calculator functions to the waveform (e.g., multiplication by a constant, logarithms, absolute value). Operations on this page are immediately applied to the active waveform. To undo any applied operations, use Cancel on the Process Data property sheet.

### 6.5.9.1.3 Numeric Entry

#### 6.5.9.1.3.1 Dialog



**Figure 6-38 Waveform Processing – Numeric Entry dialog**

#### 6.5.9.1.3.2 Discussion

The Numeric Entry dialog supplies a constant value required for several operations. The dialog's title bar indicates which operation the constant is for. The constant can be entered using the calculator style buttons, or it can be typed directly into the edit field. Constants can be entered with an exponent (e.g., 2.4e-3 for  $2.4 \times 10^{-3}$ ) or with engineering suffixes (e.g., 2.4m for  $2.4 \times 10^{-3}$ ).

#### 6.5.9.1.3.3 Access

- Select any processing operation that requires a constant value.

## 6.5.9.2 Advanced Functions tab

### 6.5.9.2.1 Dialog

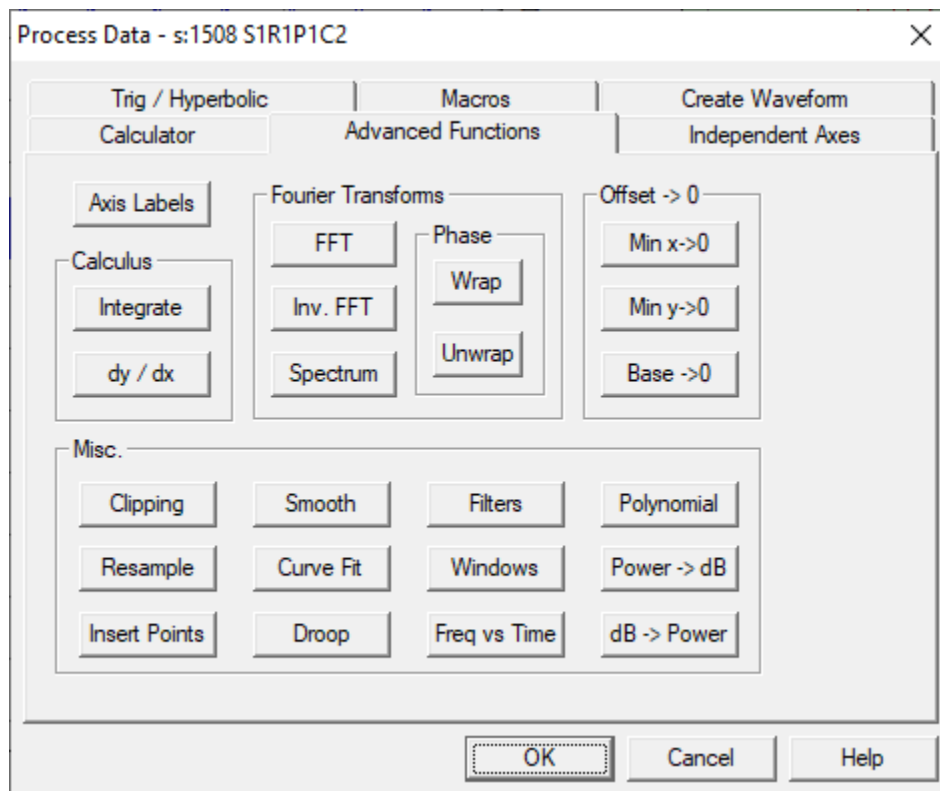


Figure 6-39 Process Waveform dialog - Advanced Functions tab

### 6.5.9.2.2 Discussion

The Advanced Functions waveform processing page applies advanced functions to the waveform, such as integration, FFTs, curve fits and filtering. Operations on this page are applied immediately to the active waveform, after displaying a configuration dialog as required. To undo any applied operations, use Cancel on the Process Data property sheet. Operations without custom configurations dialogs are described in the table below. Operations with configuration dialogs are described in the following sections.

Operation	Description
dy/dx	Calculates the numerical derivative of the waveform using the central difference method (the slope at point $i$ is based on the values of points $i-1$ and $i+1$ ). The derivate has the same number of points as the original waveform, using the 2 <sup>nd</sup> derivate to approximate the values at the end points. Numerical derivatives are accurate when the data is relatively smooth and adequately sampled, but are sensitive to noise.
Min x->0	Horizontally shifts the waveform so its minimum x value is 0.
Min y->0	Vertically shifts the waveform so its minimum y value is 0.

Droop	Applies droop correction, using the specified time constant. $y_i = y_i + \frac{1}{\tau} \int_{x_0}^{x_i} y dx$
Power -> dB	Converts y values from linear to logarithmic scale, using $y_i = 10 \log y_i$
dB -> Power	Converts y values from logarithmic to linear scale, using $y_i = 10^{\frac{y_i}{10}}$

### 6.5.9.2.3 Axis Titles

#### 6.5.9.2.3.1 Dialog

Figure 6-40 Waveform Processing - Axis Labels dialog

#### 6.5.9.2.3.2 Discussion

The Axis Titles dialog is used to select new axis titles and unit labels while processing a waveform. Enter the appropriate labels and select OK to update the waveform's titles and unit labels. To remove an existing title or unit label, enter an empty label (delete the existing label from the edit field) and select Apply empty titles / units before selecting OK. If Apply empty titles / units is not selected, only the fields containing text are applied to the waveform.

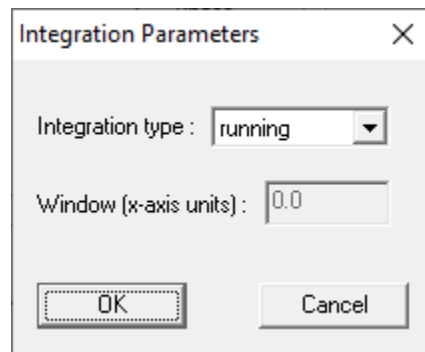
#### 6.5.9.2.3.3 Access

- Axis Labels button on the Process Data dialog's Advanced tab.



#### 6.5.9.2.4 Integration Parameters

##### 6.5.9.2.4.1 Dialog



**Figure 6-41 Waveform Processing - Integration Parameters dialog**

##### 6.5.9.2.4.2 Discussion

The Integration Parameters dialog specifies the type of integration performed:

- Running – each output point contains the integral of the waveform up to that point.
- Windowed – each output point contains the integral over a user specified window that is centered on the current point. The integration window is automatically clipped at the ends of the waveform. For example, given a waveform with domain 0s to 200ms and an integration window of 50 ms. The window at the 100 ms point will cover the full 50 ms (75 ms to 125 ms), but the integral at the 10 ms point will only cover 35 ms (0 s to 35 ms).

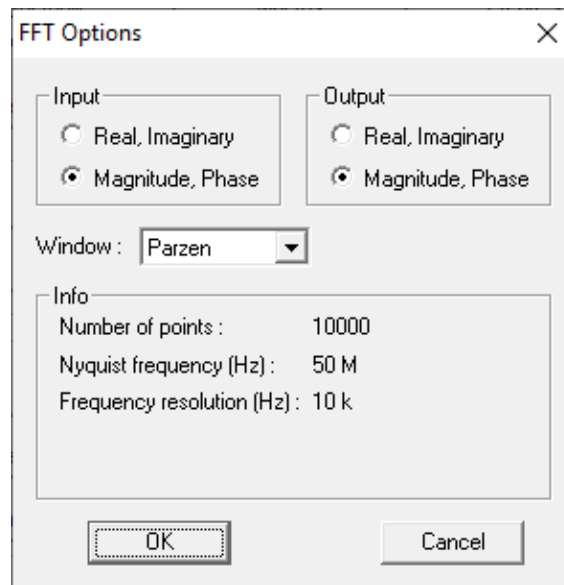
The trapezoidal method is used to perform the integration in both cases.

##### 6.5.9.2.4.3 Access

- Integrate button on the Process Data dialog's Advanced tab.

### 6.5.9.2.5 FFT Options

#### 6.5.9.2.5.1 Dialog



**Figure 6-42 Waveform Processing - FFT dialog**

#### 6.5.9.2.5.2 Discussion

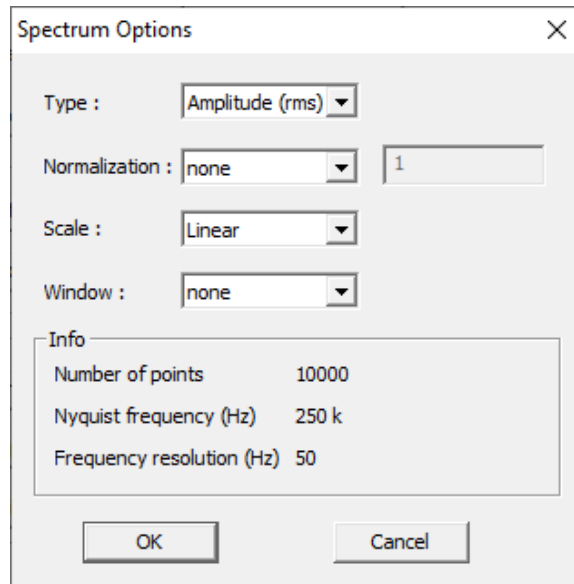
The FFT dialog configures a Fast Fourier Transform (FFT) and its inverse. Select the input and output types to match the type of input waveform being processed and the desired output waveform (real, imaginary) or (magnitude, phase). DAAAC cannot automatically detect the input units. The input waveform can either be magnitude only or a complex waveform. If the FFT dialog is being used to configure an FFT (not an inverse), the Window list will allow selection of an appropriate window type, which is applied before the FFT. Supported window types are Hamming, Hann, Parzen, and Welch. Note that the FFT algorithm requires the number of points to be a power of 2, and will automatically apply symmetric 0-padding to the waveform as necessary.

#### 6.5.9.2.5.3 Access

- FFT and Inv FFT buttons on the Process Data dialog's Advanced tab.

### 6.5.9.2.6 Spectrum Options

#### 6.5.9.2.6.1 Dialog



**Figure 6-43 Waveform Processing - FFT dialog**

#### **6.5.9.2.6.2 Discussion**

The Spectrum Options dialog configures a spectrum operation, which is a magnitude FFT with the negative frequency content “folded” onto the positive frequencies.

#### **6.5.9.2.6.3 Details**

Item	Description
Type	Select either an amplitude or a power spectrum
Normalization	Scales the amplitudes using the specified value
Scale	Present the spectrum using either linear or log scale
Window	Apply the selected window to the data before the FFT operation.

#### **6.5.9.2.6.4 Access**

- Spectrum button on the Process Data dialog’s Advanced tab.

### 6.5.9.2.7 Wrap / Unwrap

#### 6.5.9.2.7.1 Dialog

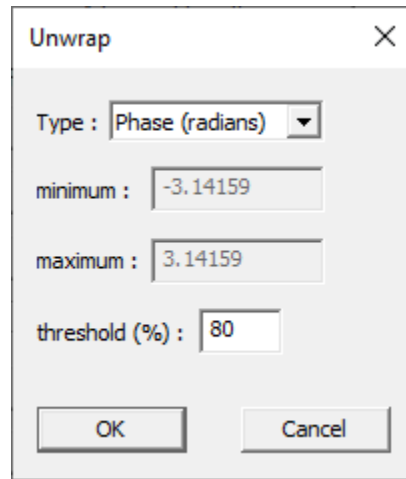


Figure 6-44 Waveform Processing - Unwrap dialog

#### 6.5.9.2.7.2 Discussion

The wrap function is used to force the y values into the specified data range, by “wrapping” the data. While traversing the data points from left to right, if the data goes above the specified maximum, the waveform’s remaining y values subtract the specified data range (maximum – minimum). If the data drops below the minimum value, the waveform’s remaining y values add the data range. Unwrapping attempts to invert the wrapping operation. Each time a single point transition greater than the specified threshold (% of the data range) is detected, the operation assumes that the data was wrapped and removes the specified wrapping value (maximum – minimum). Unwrap is typically used to processed wrapped phase data that was collected on a network analyzer (see Section 9.2).

#### 6.5.9.2.7.3 Access

- Wrap and Unwrap buttons on the Process Data dialog’s Advanced tab.

### 6.5.9.2.8 Baseline to Zero

#### 6.5.9.2.8.1 Dialog

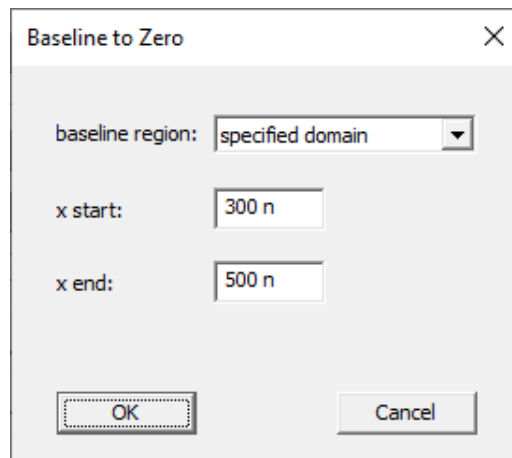


Figure 6-45 Waveform Processing - Unwrap dialog

#### 6.5.9.2.8.2 Discussion

Baseline zeroing is typically used to remove digitizer baseline drift. A baseline (y-mean) value is calculated over a portion of the waveform, and that value is subtracted from each waveform point. The baseline region can be specified as a percentage of the waveform or a specific domain.

#### 6.5.9.2.8.3 Access

- Base -> 0 button on the Process Data dialog's Advanced tab.

### 6.5.9.2.9 Clipping

#### 6.5.9.2.9.1 Dialog

Clipping

☐ standard ☒ advanced

standard

x-axis

☐ minimum : 0.0

☐ maximum : 0.0

y-axis

☐ minimum : 0.0

☐ maximum : 0.0

advanced

delete data points between the specified x value(s)

minimum x = 2.7m

maximum x = 3.2m

☒ absolute ☐ % of domain

Clip Done

Figure 6-46 Waveform Processing - Clipping dialog

#### 6.5.9.2.9.2 Discussion

The Clipping dialog removes, limits, or zeros the waveform data relative to the specified data values. Several options are providing for specifying which portion of the data to clip.

#### 6.5.9.2.9.3 Details

Item	Description
Standard	Data is clipped based on simple x and y axis limits
Advanced	Clipping based on relative or absolute x or y values
x-axis minimum	remove all data points with x values less than the specified minimum
x-axis maximum	remove all data points with x values greater than the specified maximum
y-axis minimum	set all y values less than the specified minimum to the minimum value
y-axis maximum	set all y values greater than the specified maximum to the maximum value
advanced operation statement	uses three independent selections (operation, relationship, x / y criteria) to build a fully configurable clipping operation
delete, zero	selects the operation to be applied to the points that meet the criteria

below, above, between, outside	selects the relationship between the points to be operated on and the specified transition criteria
specified x value(s); the location of the specified y value(s); specified window around the y-max location	selects an operation based on x value or y value criteria
x= , min x=, max x=; x at y=, min x at y=, max x at y=; window before y- max, window after y-max	clipping parameters that depend on the selection of the relationship and x / y criteria above
absolute / %	allows specification of transition points as an absolute number or as a % of a maximum waveform value

#### 6.5.9.2.9.4 Access

- Clipping button on the Process Data dialog's Advanced tab.

#### 6.5.9.2.10 Resample

##### 6.5.9.2.10.1 Dialog

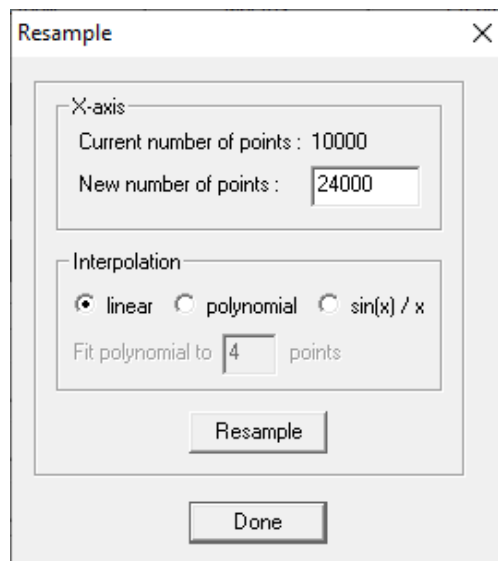


Figure 6-47 Waveform Processing - Resample dialog

#### 6.5.9.2.10.2 Discussion

The Resample operation changes the number of points in the active waveform. Select the new number of points and the interpolation type, then choose Resample. When the operation is complete, the dialog will be updated to show the new number of points.

##### 6.5.9.2.10.2.1 Access

- Resample button on the Process Data dialog's Advanced tab.

#### 6.5.9.2.10.3 Add Points

##### 6.5.9.2.10.3.1 Dialog

The screenshot shows the 'Add New Points' dialog box. It has a title bar with the text 'Add New Points' and a close button (X). The dialog is divided into two main sections. The first section, 'Insert a point', contains two input fields: 'x value' with the text '6.25μ' and 'y value' with the text '200m'. To the right of these fields is an 'Insert' button. The second section, 'Zero-pad', contains a label 'Existing points : 10000', a dropdown menu for 'Number of points after padding' showing '16384', another dropdown menu for 'Location of new points' showing 'before & after', a checked checkbox labeled 'fit a line and decay to zero', and an 'Apply' button. At the bottom of the dialog is a 'Done' button.

**Figure 6-48 Waveform Processing - Add Points dialog**

##### 6.5.9.2.10.3.2 Discussion

The Insert Points dialog inserts new points into the active waveform. Two insertion methods are supported:

1. Insert. Specify the x and y values and choose Insert to add a new point to the waveform. Points cannot be inserted at existing x locations. The Insert operation can be applied repeatedly.
2. Zero-pad. Add points with value 0.0 to the ends of the waveform. If selected, the added values will decay to 0.0, using a cosine roll-off function.

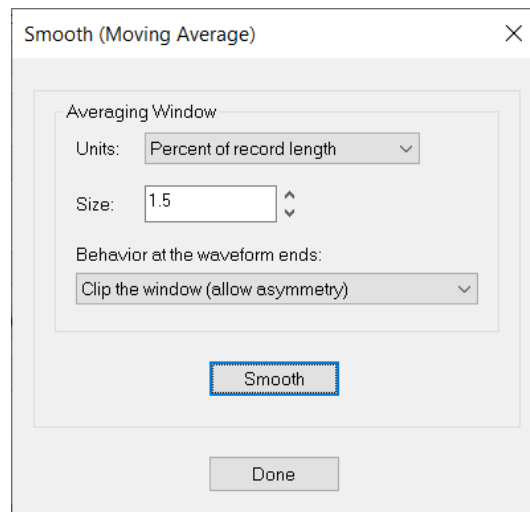
##### 6.5.9.2.10.3.3 Access

- Insert Points button on the Process Data dialog's Advanced tab.



#### 6.5.9.2.10.4 Smoothing

##### 6.5.9.2.10.4.1 Dialog



**Figure 6-49 Waveform Processing - Smoothing dialog**

##### 6.5.9.2.10.4.2 Discussion

The Smooth dialog applies a running average to the active waveform. Specify the smoothing window as a percentage of the waveform, as an absolute number of points, or as a time (x-axis) window. Note that windows specified in x-axis units are converted to number of points, and that conversion assumes equally spaced values. The smoothing algorithm replaces each point with the average of the points in the specified smooth window. Boxcar averaging is used, with all points in the smooth window weighted equally. As the smoothing window approaches the waveform ends, the window will extend beyond the waveform data. The behavior at the waveform ends is configurable, with the following options:

- Clip the waveform ends after smoothing – clip the window as required while applying the smoothing (see next option), then remove any waveform points near the ends that did not allow use of the full smoothing window.
- Clip the window (asymmetric) – shrink the smoothing window only on the side that extends past the waveform points. The resulting window size will shrink and the window will be asymmetric about the original window center point.
- Shrink the window (symmetric) - shrink the smoothing window on the side that extends past the waveform points and mirror that shrinkage on the opposite side. The resulting window size will shrink and the window will retain symmetry about the original window center point.
- Repeat the end value beyond the ends – maintain the original window size and repeat the waveform endpoint value as required to fill the window.

#### 6.5.9.2.10.5 Access

- Smooth button on the Process Data dialog's Advanced tab.

### 6.5.9.2.11 Curve Fit

#### 6.5.9.2.11.1 Dialog

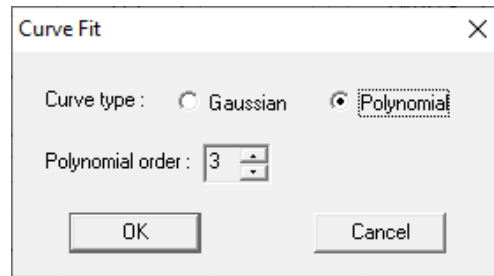


Figure 6-50 Waveform Processing - Curve Fit dialog

#### 6.5.9.2.11.2 Discussion

Two curve types are available for fitting: Gaussian and Polynomial.

- Gaussian fit:

The mean and variance of the x values are computed (each x value is weighted by its corresponding y value), and then used to plot a Gaussian distribution. This curve is then scaled to make the areas under the Gaussian and the original waveform equal. The original waveform is then replaced by the Gaussian. The mean and variance of the Gaussian curve are stored in the waveform's comment field.

Note: The Gaussian fit is very sensitive to baseline offsets at the ends of the waveform. If the fit curve is shorter and broader than desired, try zeroing the baseline (see Advanced Functions property page) before performing the fit.

- Polynomial fit:

Specify the order of the polynomial to fit to the data. The specified polynomial is created by performing a least squares fit to the waveform. The original waveform is then replaced by the fit polynomial. The coefficients of the resultant polynomial are stored in the waveform's comment field.

#### 6.5.9.2.11.3 Access

- Curve Fit button on the Process Data dialog's Advanced tab.

## 6.5.9.2.12 Filter

### 6.5.9.2.12.1 Dialog

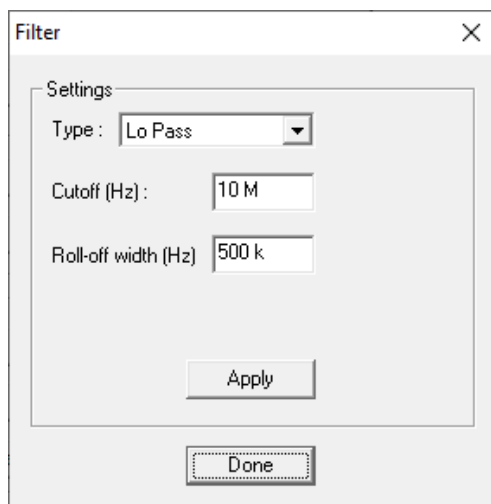


Figure 6-51 Waveform Processing - Filter dialog

### 6.5.9.2.12.2 Discussion

The Filter dialog processes waveform data using a variety of frequency domain and level-based filters.

### 6.5.9.2.12.3 Details

Item	Description
Lo Pass	Converts the time domain waveform to the frequency domain, sets the amplitude of all points above the given pass frequency to zero, then converts the waveform back to the time domain. If the Roll-off width is greater than 0, a cosine function is used to gradually attenuate the frequency components. The data at Cutoff – (Roll-off width / 2) is not attenuated. The data at Cutoff is set to 50% of the original amplitude. The data at Cutoff + (Roll-off width / 2) is set to 0.
Hi Pass	Behaves like the Lo Pass filter, but removes content below the specified pass frequency.
Band Pass	Behaves like the Lo Pass filter, but removes content outside the specified frequency range.
Band Stop (Notch)	Behaves like the Lo Pass filter, but removes content inside the specified frequency range.
Level	Sets the y-values of each point to the average value of the current "level". Levels are defined as groups of collocated points whose point-to-point delta is less than the given threshold. Commonly used to remove noise from signals that contain data at discrete levels.
Threshold	Sets all y-values below the threshold level to zero. Commonly used to remove baseline noise prior to integration.

Envelope	Constructs the envelope of an RF waveform, using the absolute value of the peaks at each half-cycle.
----------	--

#### 6.5.9.2.12.4 Access

- Filter button on the Process Data dialog's Advanced tab.

#### 6.5.9.2.13 Window Function

##### 6.5.9.2.13.1 Dialog

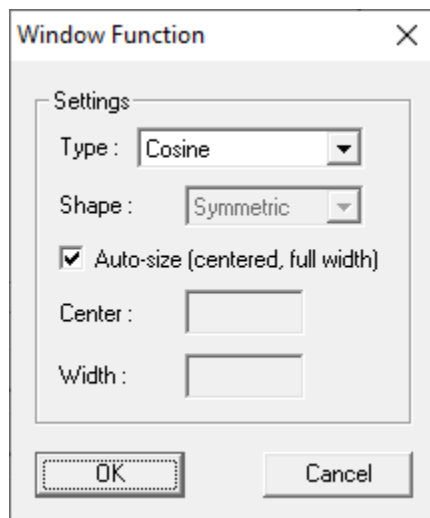


Figure 6-52 Waveform Processing – Window Function dialog

##### 6.5.9.2.13.2 Discussion

Applies the selected window shape to the waveform's y data. The waveform is multiplied by the window, with the window values ranging from 0 to 1.

##### 6.5.9.2.13.3 Details

Item	Description
Type / Shape	Specifies the window shape.
Auto-size	If selected, sets the window to be centered on the waveform and span the entire waveform.
Center, Width	Specifies the window center and width if auto-size is off. Waveform points outside the resulting window, if any, will be set to 0.

#### 6.5.9.2.13.4 Access

- Window button on the Process Data dialog's Advanced tab.

#### 6.5.9.2.14 Frequency Vs Time

##### 6.5.9.2.14.1 Dialog

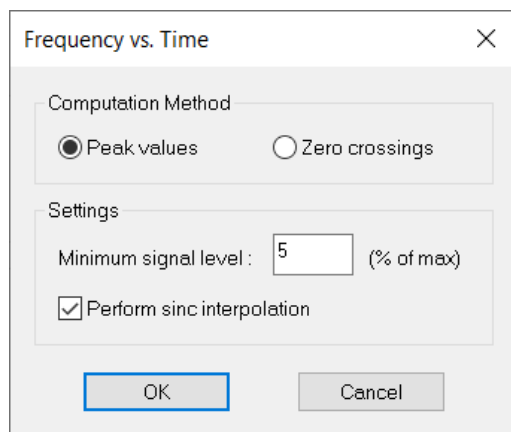


Figure 6-53 Waveform Processing - Frequency vs. Time dialog

##### 6.5.9.2.14.2 Discussion

The Frequency vs. Time dialog is used to compute a frequency vs. time (FvsT) plot for a given sinusoidal waveform. FvsT can be computed by measuring the time from peak to peak or from zero-crossing to zero-crossing. The Minimum signal level field is used to select a waveform threshold for valid data. If the waveform does not reach the threshold between peaks (or zero-crossings), that portion of the signal is considered to be noise and is not used to compute a frequency value. Selection of Perform sinc interpolation will resample the waveform at 5x the number of points, using sinc interpolation ( $\text{sinc}(x)/x$ ), before computing the frequencies. The resulting FvsT waveform will replace the input sinusoidal waveform.

##### 6.5.9.2.14.3 Access

- Freq vs Time button on the Process Data dialog's Advanced tab.

#### 6.5.9.2.15 Polynomial

##### 6.5.9.2.15.1 Dialog

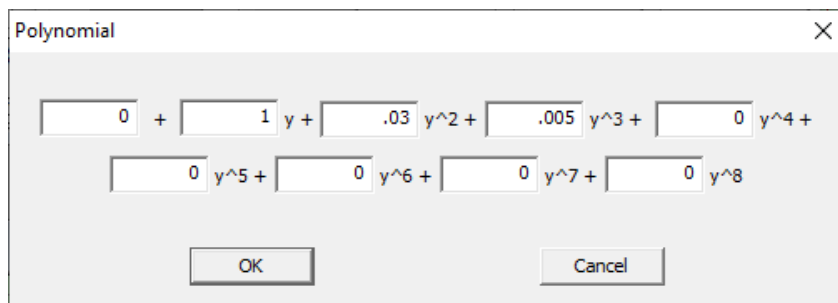


Figure 6-54 Waveform Processing – Polynomial dialog

#### 6.5.9.2.15.2 Discussion

Applies the specified polynomial to each of the waveform's y values.

#### 6.5.9.2.15.3 Access

- Polynomial button on the Process Data dialog's Advanced tab.

### 6.5.9.3 Independent Axes tab

#### 6.5.9.3.1 Dialog

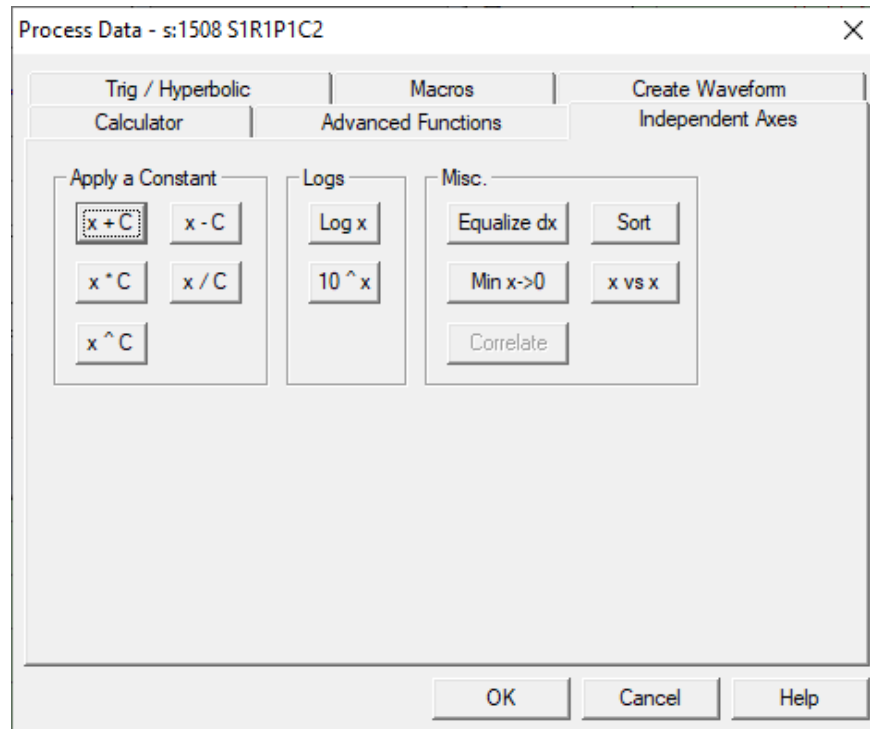


Figure 6-55 Process Waveform dialog - Independent Axes tab

#### 6.5.9.3.2 Discussion

The Independent Axes waveform processing page processes the x values of the x,y pair data. Operations on this page are immediately applied to the active waveform. To undo all applied operations, use Cancel on the Process Data dialog.

Note: The calculator dialog presented in Section 6.5.9.1.3 is also accessible from the Independent Axes tab by clicking any of the buttons that apply a constant.

#### 6.5.9.4 Trig / Hyperbolic tab

##### 6.5.9.4.1 Dialog

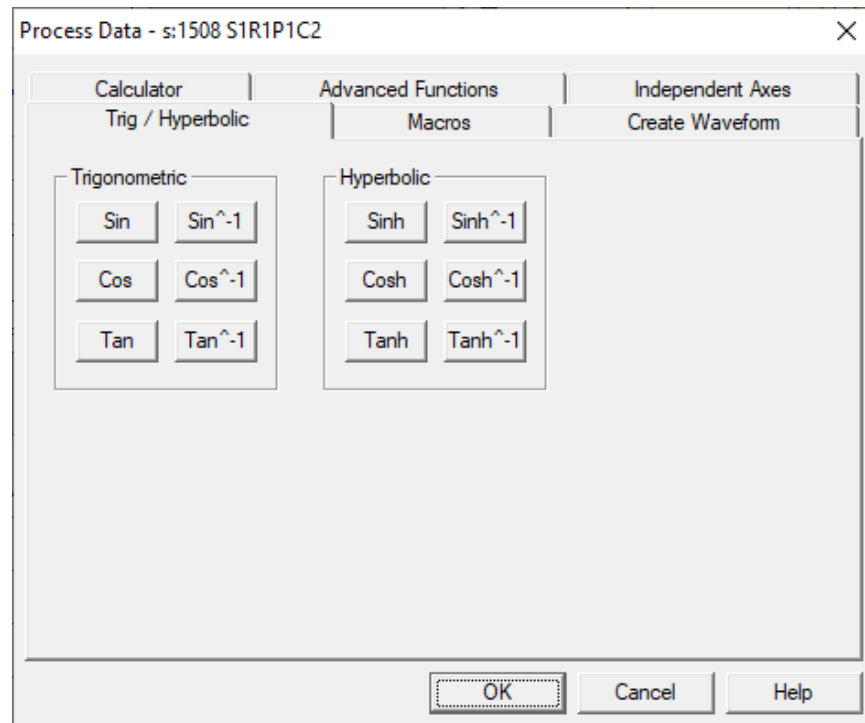


Figure 6-56 Process Waveform dialog - Trig/Hyperbolic tab

##### 6.5.9.4.2 Discussion

The Trigonometry waveform processing page performs basic trigonometric functions on the waveform, such as sine, cosine, and tangent. Trigonometric operations are typically used to generate test waveforms or filters. Operations on this page do not have configuration parameters and are immediately applied to the active waveform. To undo all applied operations, use Cancel on the Process Data dialog.

### 6.5.9.5 Macros tab

#### 6.5.9.5.1 Dialog

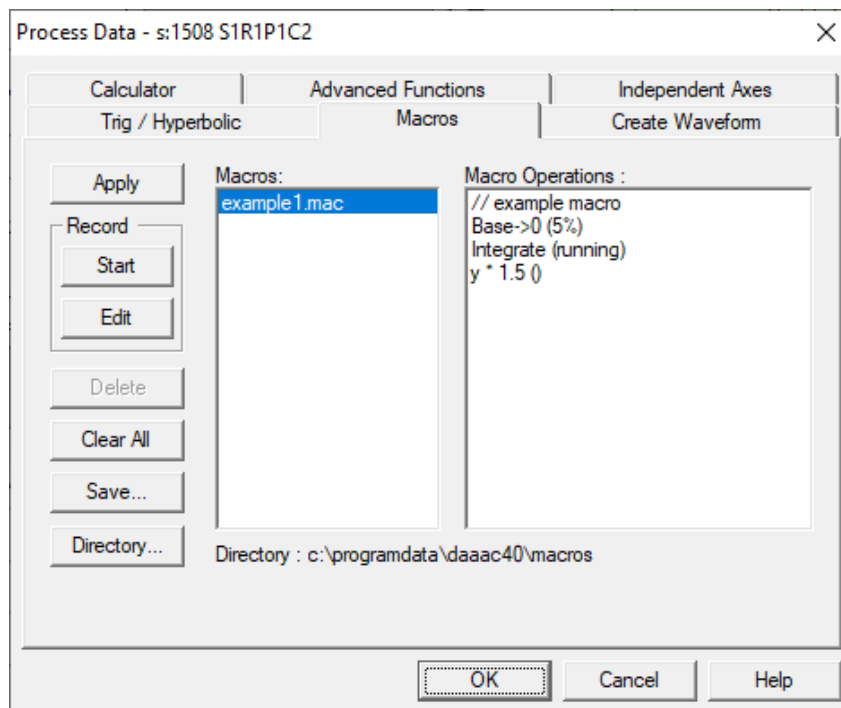


Figure 6-57 Process Waveform dialog - Macros tab

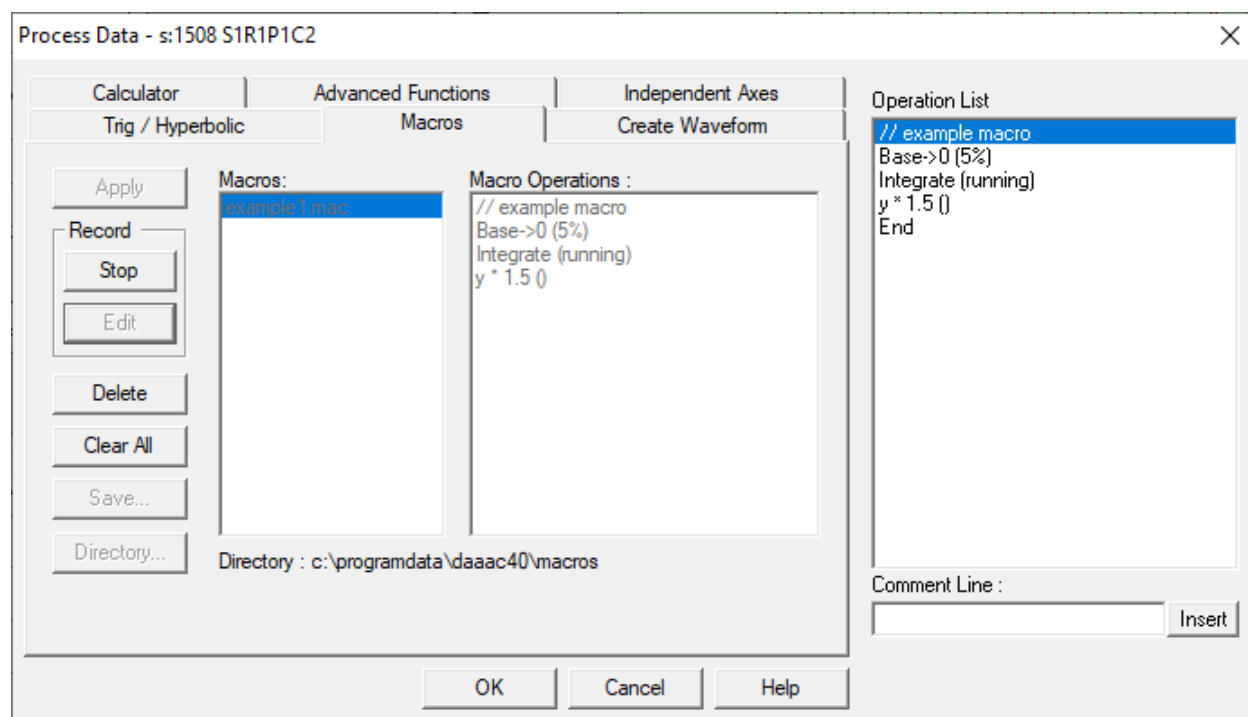


Figure 6-58 Process Waveform dialog - Macro edit mode



#### 6.5.9.5.2 Discussion

The Macro waveform processing page combines operations from the other processing pages into a single macro operation. Macros can be created, saved to files, read from files, and applied to the waveform from this page.

To create a macro, choose (Record) Start and the processing sheet will expand and display a list of operations with a single item called End (marks the end of the list). You can now select any other page (except Create Waveform) and select an operation to include in the macro. New operations are always inserted before the highlighted operation in the macro operation list. You can also insert descriptive comment lines to the macro operation list. When you are done recording, return to the macro page and choose (Record) Stop. A <new> entry will be placed in the list of available macros, and the macro definition will appear in the Macro Operations list.

Newly recorded macros are stored in temporary memory. You can apply the new macro to the waveform by choosing Apply, but if you select any other macro from the list, the new macro will be overwritten. To create a permanent macro, choose Save and specify a name. The macro will then appear in the list with the specified name.

To apply a stored macro, use Directory to select the macro definition directory. A list of available macros will appear in the Macro list. Select a macro from the list and choose Apply. The definition of the currently selected macro will appear in the Macro Operations list.

Each macro is stored as a separate binary file that can be copied or moved, or opened by any DAAAC module that supports macro operations. Use the Directory button to select the current macro directory.

Undo and Apply Last Operation - Macros are treated as atomic operations, i.e. Undo and Apply Last will undo or apply all of the operations included in the macro.

### 6.5.9.6 Create Waveform tab

#### 6.5.9.6.1 Dialog

Process Data - s:1508 S1R1P1C2

Calculator | Advanced Functions | Independent Axes

Trig / Hyperbolic | Macros | Create Waveform

X-axis specification

Number of points : 1001      Delta x : 1 m

Minimum value : 0.0      Maximum value : 1

Waveform type (Y-axis)

Function : Gaussian      Data Values

Mean : 0.6      Standard dev. : 0.1

Formula :  $f(x) =$

Create

OK      Cancel      Help

**Figure 6-59 Process Waveform dialog – Create Waveform tab**

#### 6.5.9.6.2 Discussion

The Create Waveform processing page creates a new waveform, such as one used as a filter or test waveform. Note that creating a waveform from the Process Data dialog will replace the data in an existing waveform. To create a new waveform without overwriting existing data, use the File | New Waveform menu item or Ctrl+n (see Section 6.2.4). The Create Waveform page is not accessible during macro recording.

## 6.5.10 Process Image Data

### 6.5.10.1 Standard Processing tab

#### 6.5.10.1.1 Dialog

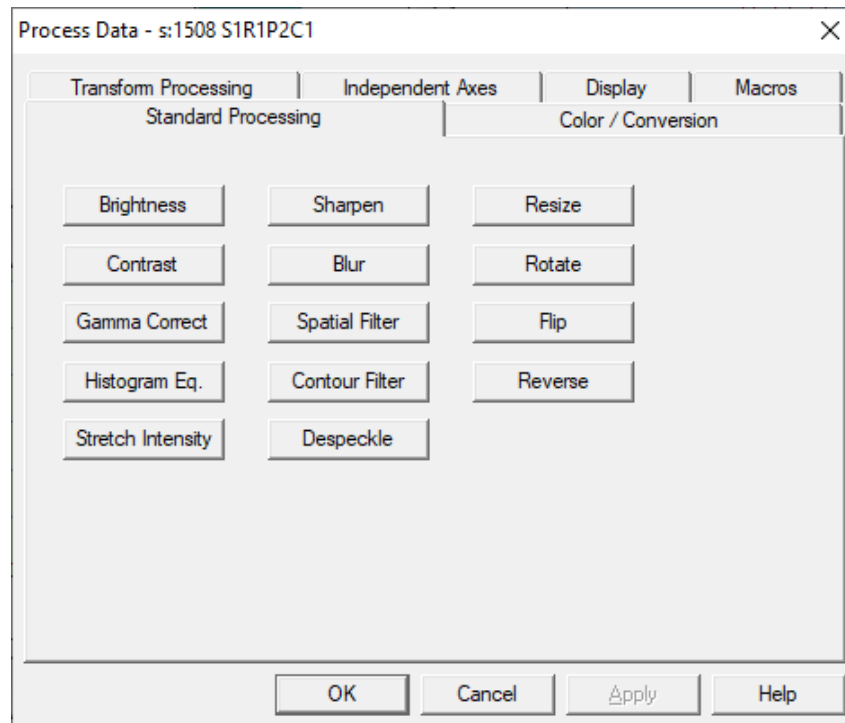


Figure 6-60 Process Image dialog - Standard Processing tab

#### 6.5.10.1.2 Discussion

The standard processing page includes the operations typically found in basic image processing applications. The majority of these operations are used to adjust the image itself, and are not for processing the underlying floating-point data. Application of any operation on this page, with the exceptions of Resize, Flip and Reverse, will delete the associated floating-point data, if present.

### 6.5.10.1.3 Image Brightness, Contrast, Gamma Correct, Sharpen, Blur

#### 6.5.10.1.3.1 Dialog

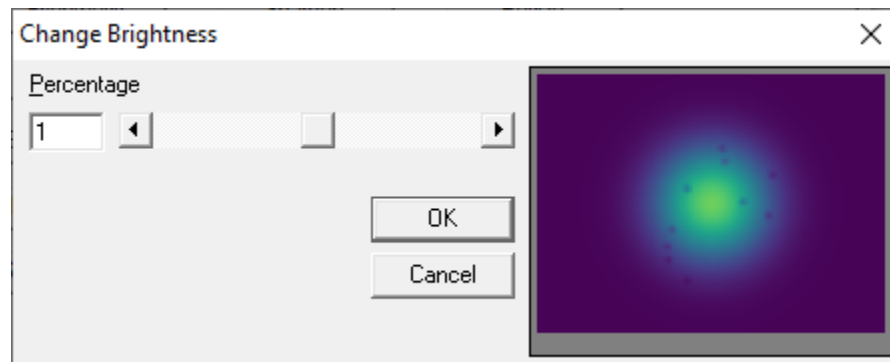


Figure 6-61 Image Brightness dialog

#### 6.5.10.1.3.2 Discussion

The dialog of Figure 6-61 is specifically directed to adjusting the image brightness, but is the same interface for Contrast, Gamma Correction, Sharpen and Blur. The image is represented to the right and is updated as the change is applied. The parameter may be adjusted by either working the slide bar or typing directly into Percentage. Whichever control is used, the other control will be updated, along with the sample image, to reflect the change.

### 6.5.10.1.4 Image Spatial Filter

#### 6.5.10.1.4.1 Dialog

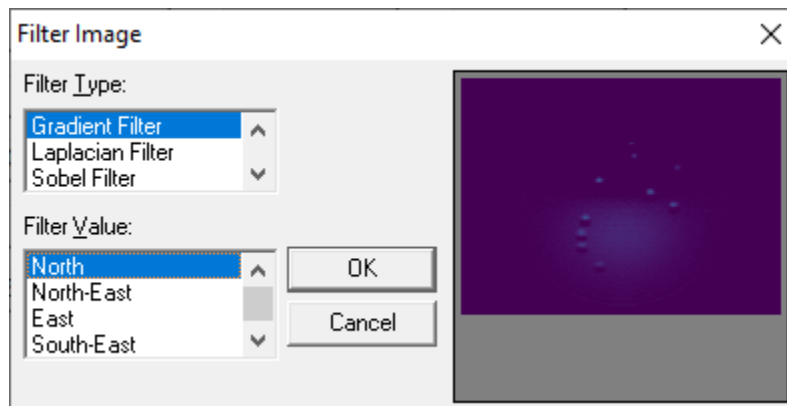


Figure 6-62 Image Spatial Filter dialog

#### 6.5.10.1.4.2 Discussion

This Filter dialog allows selection of numerous spatial filter types. A preview of the selected filter is displayed in the window to the right. Analogous filters that process the underlying floating-point data are available via the Convolution operation on the Transform Processing tab – see Section 6.5.10.3.5.

### 6.5.10.1.5 Image Contour Filter

#### 6.5.10.1.5.1 Dialog

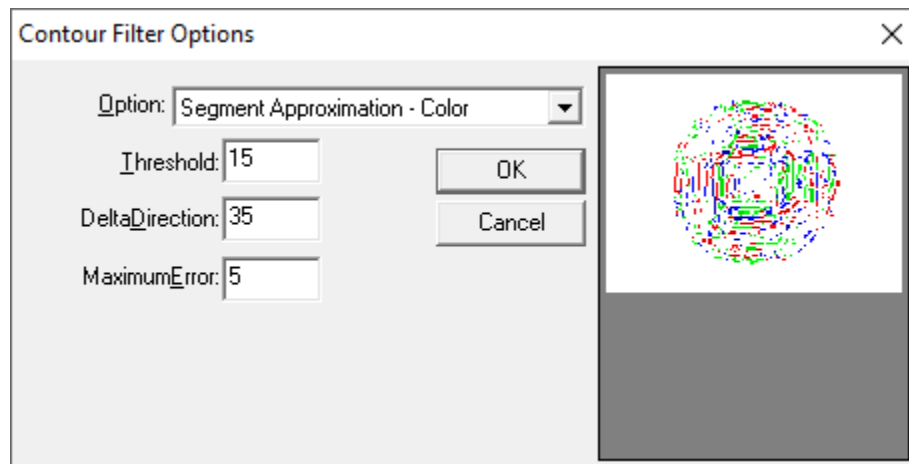


Figure 6-63 Image Contour Filter dialog

#### 6.5.10.1.5.2 Discussion

Replaces the image with an image of contour lines derived from the original image. Contour curves (as an array of x,y data pairs) are not calculated.

### 6.5.10.1.6 Image Resizing

#### 6.5.10.1.6.1 Dialog



Figure 6-64 – Image Resize dialog

#### 6.5.10.1.6.2 Discussion

Resizes the image to the specified width and height. If Keep Aspect is selected, whenever the width or height is changed the other control will be automatically adjusted to maintain the original image's aspect ratio.

### 6.5.10.1.7 Image Rotation

#### 6.5.10.1.7.1 Dialog

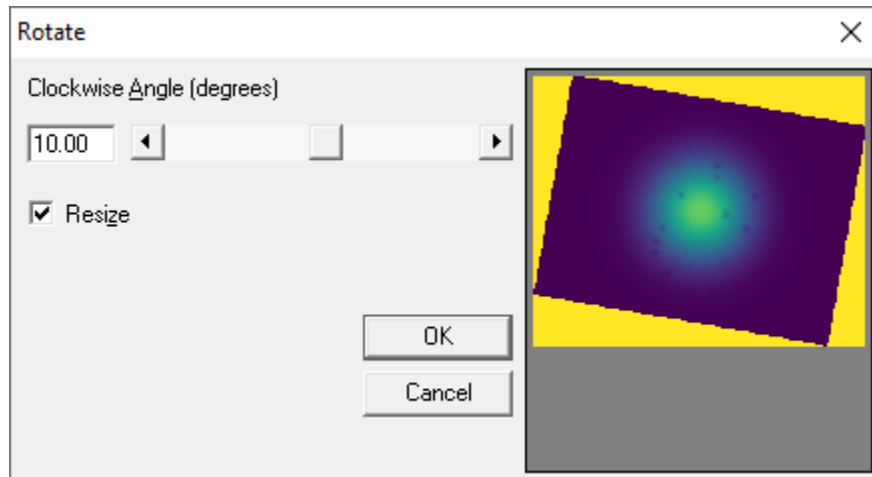


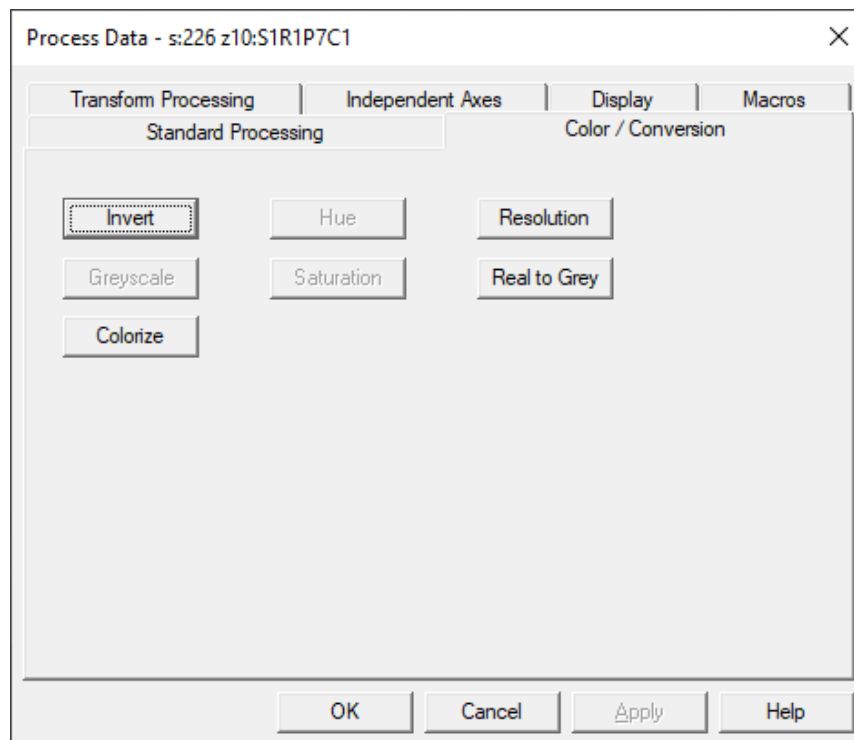
Figure 6-65 Image Rotation dialog

#### 6.5.10.1.7.2 Discussion

Rotates the image by the specified angle. If Resize is selected, the image will be automatically resized to retain all data in the original image. If Resize is not selected, rotation of the image by any angle that is not a multiple of 90 degrees will result in data clipping.

## 6.5.10.2 Color Conversion tab

### 6.5.10.2.1 Dialog



**Figure 6-66 Process Image dialog - Color Conversion tab**

### 6.5.10.2.2 Discussion

The color / conversion page is used to modify image colors, change image bit depth, and convert between grayscale and color images. Note that some operations on this page are only available when the image is grayscale, and others are only available when the image is color. Application of any operation on this page will delete the associated floating-point data, if present. Operations without parameters are described in the table below. Operations with configuration dialogs are described in the following sections.

Operation	Description
Invert	Invert each pixel's color or greyscale value
Greyscale	Replace each color value with the associated greyscale value, typically using the relative luminance of the sRGB values.
Real to Grey	Convert the image's associated floating-point values to the nearest integer value in the range 0 to 65535 (16-bit integer), then use those integer values as the greyscale image values.

### 6.5.10.2.3 Colorize

#### 6.5.10.2.3.1 Dialog

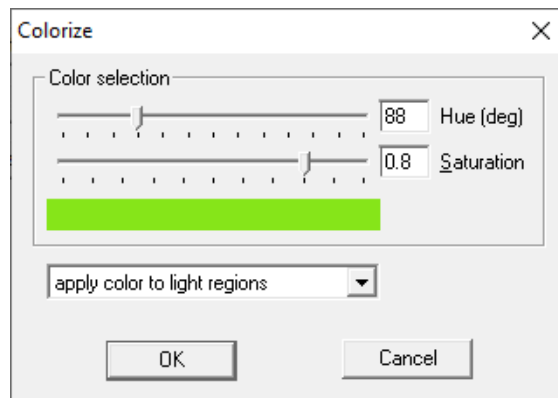


Figure 6-67 Image Colorize dialog

#### 6.5.10.2.3.2 Discussion

Creates a color image from a monochrome image, using the specified hue and saturation. Color can be applied to the lightest image regions, resulting in an image that spans black to the color, or can be applied to the darkest image regions, resulting in an image that spans the color to white.

### 6.5.10.2.4 Change Hue / Saturation

#### 6.5.10.2.4.1 Dialog

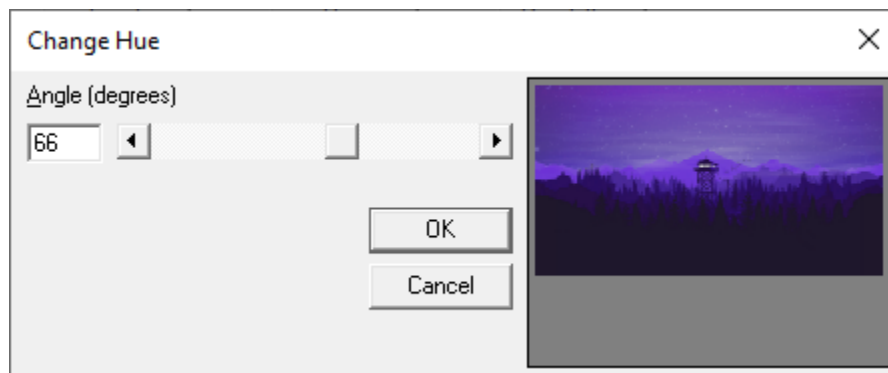


Figure 6-68 Image Saturation dialog

#### 6.5.10.2.4.2 Discussion

Changes a color image's hue or saturation value. A preview image is shown on the right side of the dialog.



### 6.5.10.2.5 Color Resolution

#### 6.5.10.2.5.1 Dialog

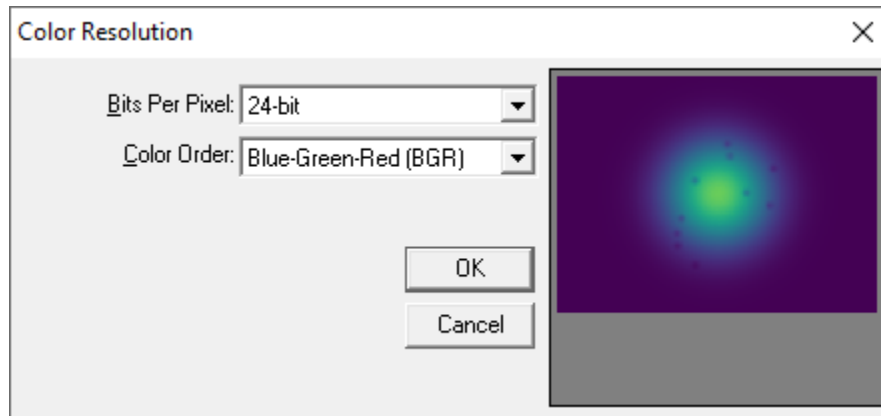


Figure 6-69 Image Resolution dialog

#### 6.5.10.2.5.2 Discussion

Changes the image's pixel resolution. Both color and grayscale options at various bit depths are available. A preview image is shown on the right side of the dialog.

### 6.5.10.3 Transform Processing tab

#### 6.5.10.3.1 Dialog

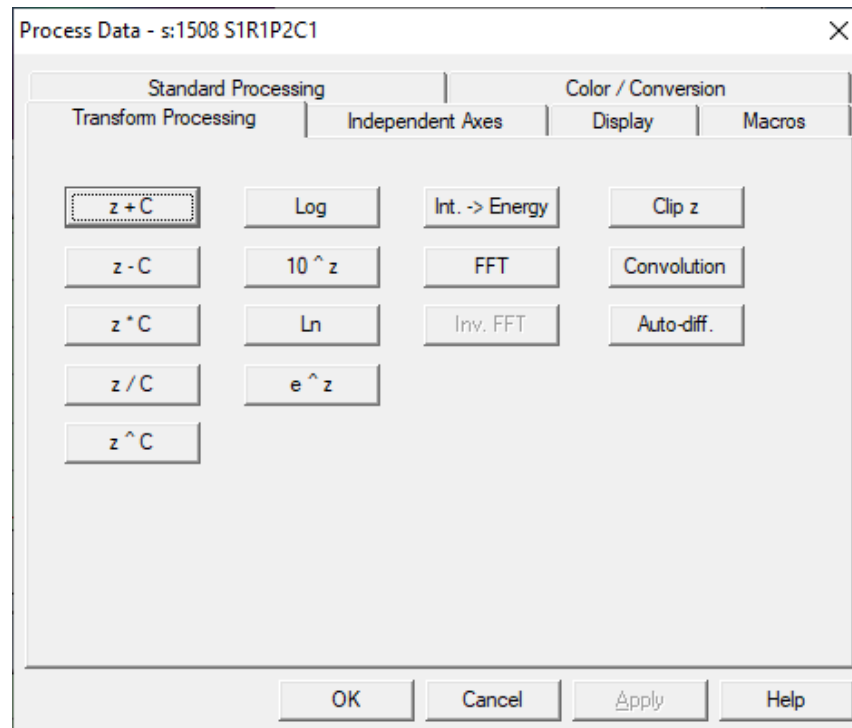


Figure 6-70 Process Image dialog - Transform tab

#### 6.5.10.3.2 Discussion

The transform processing page is used to manipulate the image's underlying floating-point data array. All operations on this page operate on the floating-point z-axis data. If the image does not contain floating point data, an array of float data is created, using the pixel intensity at each location. Following any operation on the floating-point z data, the corresponding bitmap is updated to reflect the change to the data. This representative bitmap uses 16-bit grayscale values.

Several buttons on the Transform Processing tab open the Numeric Entry dialog shown in Section 6.5.9.1.3.

#### 6.5.10.3.3 Image FFT

##### 6.5.10.3.3.1 Dialog

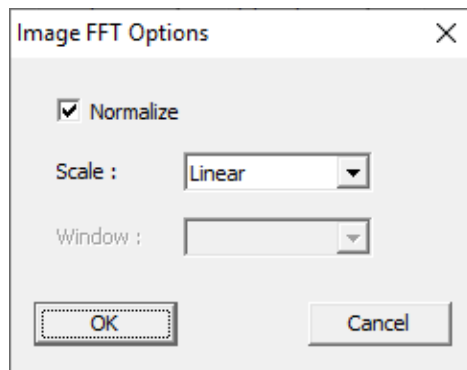


Figure 6-71 Image FFT Options dialog

##### 6.5.10.3.3.2 Discussion

Applies a two-dimensional FFT to the image data. Output values can be displayed in linear or log scale, with optional normalization.

### 6.5.10.3.4 Image Clipping

#### 6.5.10.3.4.1 Dialog

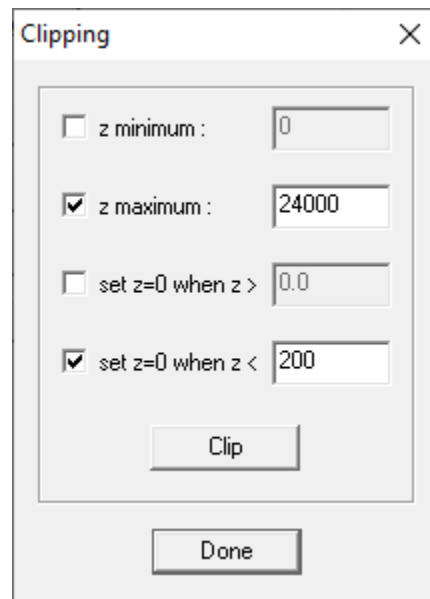


Figure 6-72 Image Clipping dialog

#### 6.5.10.3.4.2 Discussion

Image clipping limits or zeros the Z values that fall outside the specified criteria.

Item	Description
z minimum	Set all pixels less than the specified minimum to that minimum value
z maximum	Set all pixels greater than the specified maximum to that maximum value
set z=0 when z>	Set all pixels greater than the specified threshold to 0
set z=0 when z<	Set all pixels less than the specified threshold to 0
Clip	Applies the selecting clipping operations. Does not dismiss the dialog, so multiple rounds of clipping can be applied.

### 6.5.10.3.5 Image Convolution

#### 6.5.10.3.5.1 Dialog

**Convolution**

Kernel

Type: Anomaly Removal

Rows: 3 Cols: 3 Scale (1/C): 12

Weights:

	1	2	3
1	1	2	1
2	2	0.0	2
3	1	2	1

Selective Processing

Target those pixels that meet any of the following criteria:

☐  $z \leq 0.0$  ☒  $z \geq 200$

☒ Apply convolution kernel only to the target pixels

☐ Ignore target pixels when applying kernel to other pixels

☐ Auto-adjust scale to account for ignored pixels

Edge Handling

☒ Shrink kernel and auto-adjust scale

☐ Extend edges by filling with a constant: 1

☐ Extend edges by repeating border values

Apply Done

Figure 6-73 Image Convolution dialog

#### 6.5.10.3.5.2 Discussion

The Convolution dialog is used to perform a two-dimensional discrete convolution between the active image and the specified kernel. Kernel types are specified using the type lists and presently have fixed sizes of 3x3. Selective processing may be configured to either apply the kernel only to pixels with specified values, or to exclude pixels with specified values from the computation. Selective processing is commonly used with the Anomaly Removal kernel to remove bad pixels. Edge handling specification will be supported in a future release, but is presently fixed.

Many of these kernel convolutions are analogous to operations on the Standard Processing property page such as Spatial Filter, Sharpen, and Blur. While those operations manipulate the image only, kernel convolutions operate on the underlying floating-point data.

## 6.5.10.4 Independent Axes tab

### 6.5.10.4.1 Dialog

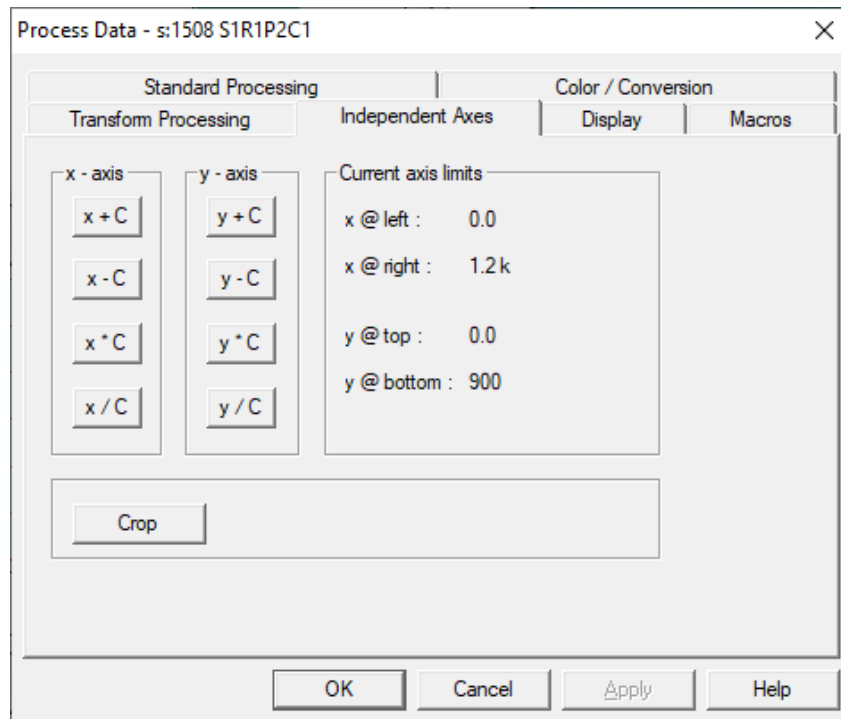


Figure 6-74 Process Image dialog- Independent Axes tab

### 6.5.10.4.2 Discussion

The independent axes page is used to scale and offset the real values for the x and y axes. Minimum and maximum axis values are displayed based on the current scale and offset values. Note that because bitmaps display the first pixel in the upper left corner of the image, the y maximum is often at the bottom row and the y minimum is often at the top row.

### 6.5.10.4.3 Image Cropping

#### 6.5.10.4.3.1 Dialog

	Pixel	Scaled
x left :	0	0.0
x right :	1199	1.199 k
y top :	0	0.0
y bottom :	899	899

threshold : 0      ☒ absolute  
☐ % of max

Region : Rectangle

Rotation :

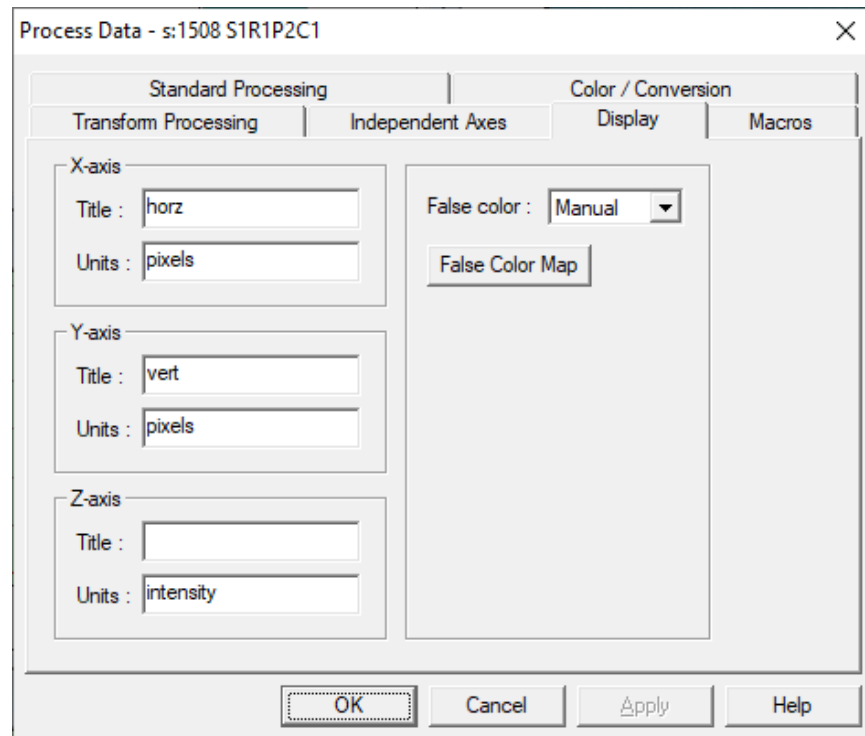
**Figure 6-75 Image Cropping dialog**

#### 6.5.10.4.3.2 Discussion

Crops the image based on the specified region. Regions can be defined using extents (left, right, top bottom) or using a center and size (height, width). The clipping center can be entered explicitly (x, y position), or the image's centroid can be used. If the centroid method is selected, a threshold value can be used to ignore low intensity noise during centroid calculation. Positions and sizes can be entered in pixel or scaled units. The clipping region can be either rectangular or ellipsoidal.

## 6.5.10.5 Display tab

### 6.5.10.5.1 Dialog



**Figure 6-76 Process Image dialog - Display tab**

### 6.5.10.5.2 Discussion

The image display page is used to change the image's axis labels and set image specific false color display. False color mode can be set to off, automatic, or manual.

- Off uses the default (global) display mode for images.
- Automatic maps the entire z-axis data range to a color map that follows a standard color progression (black, magenta, blue, cyan, green, yellow, orange, red, white).
- Manual allows the user to specify the mapping between z values and color. At present, setting the axis labels is not supported as part of a macro operation. In addition, only manual false coloring is supported as part of a macro operation.

### 6.5.10.5.3 Image False Color Map

#### 6.5.10.5.3.1 Dialog



Figure 6-77 Image False Color Map dialog

#### 6.5.10.5.3.2 Discussion

Specifies a waveform specific false color map. If used, this color map overrides the map selected in the global image display options.

### 6.5.10.6 Macro

#### 6.5.10.6.1 Discussion

See the Waveform processing Macro discussion, Section 6.5.9.5.

### 6.5.10.7 Access

Select any waveform data display, then...

- Analysis | Process...

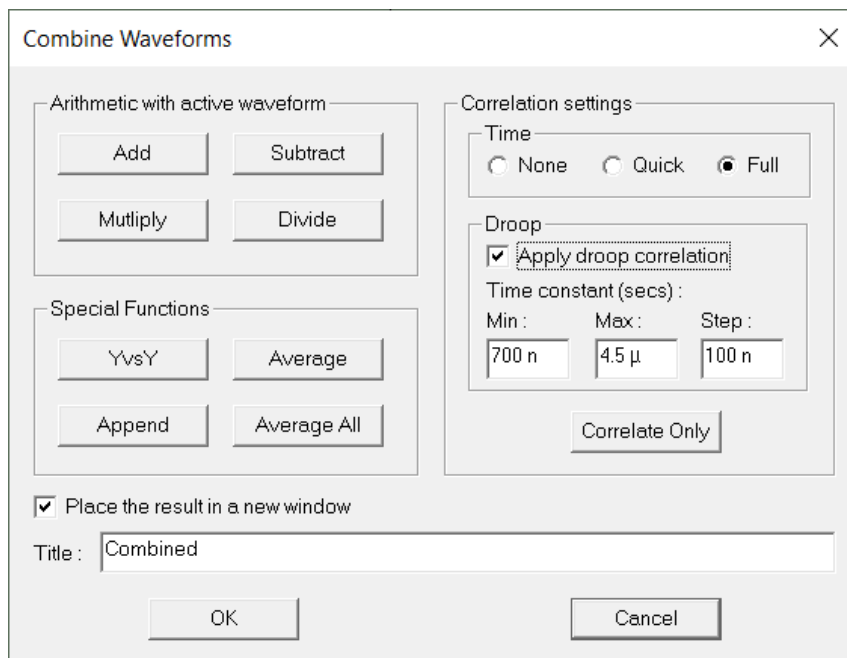


- Right-click, then select Process... from the popup menu.



## 6.5.11 Combine Waveforms

### 6.5.11.1 Dialog



**Figure 6-78 Combine Waveforms dialog**

### 6.5.11.2 Discussion

The Combine Waveforms dialog allows the application of basic math operations on waveform operands.

**Waveform arithmetic:** Supports addition, subtraction, multiplication and division of waveforms. The first operand is the active waveform, the second operand is selected by the user. The operation is computed in the domain of the first operand. The second waveform will be interpolated, if necessary, to match the domain of the first waveform. Any data outside the domain of the first waveform is ignored.

**YvsY:** Creates an output waveform using the y-axis data from the first waveform as the y-axis data, and making the x-axis data from the second waveforms y-axis data.

**Average:** Averages the active waveform with any other selected waveforms.

**Create new waveform:** Creates a new waveform window for the result of the operation. If selected, an edit control allows the user to specify the title for the new waveform. If not selected, the result replaces the data in the active window.

**Correlation:** Automatically correlates the active and selected waveform before applying the combine operation. The selected waveform is always correlated to the active window (i.e., the selected window is modified, the active window is not). Two types of correlation are supported:

**Time correlation:** Quick correlation finds the position of the first point which is 1/2 the absolute peak value, for each waveform. The algorithm then shifts the second operand waveform to time align the half-max points. Full correlation uses the cross-correlation operator  $corr(f, g) = \int_{-\infty}^{\infty} f(\tau + t)g(\tau)d\tau$  to find the shift value that maximizes waveform correlation. Note that the full correlation

implementation utilizes the correlation theorem<sup>3</sup>, which requires FFTs of the operands. As a result, operands will be 0-padded to have  $2^n$  points (see Section 6.5.9.2.5). If the operands are weakly correlated and the padding is a significant portion of the waveforms, the resulting time correlation value will be 0 because the padded portions have a stronger correlation than the other waveform data. To apply full correlation without padding, resample the operand waveforms to  $2^n$  points before using the correlation operation.

Droop correlation: Applies droop correction to the selected waveform,  $f_{out}(x) = f_{in}(x) + \frac{1}{\tau} \int_0^x f_{in}(x) dx$ , to provide a better fit to the active waveform. The range of time constants,  $\tau$ , to check must be specified. The time constant that provides the best fit is used to droop correct the selected waveform.

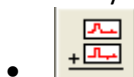
If both Time correlation and Droop correlation are selected, time correlation will be performed first.

Correlate Only: Performs time and/or droop correlation without any other processing.

### 6.5.11.3 Access

Select a waveform plot, then:

- Analysis | Combine



## 6.5.12 Combine Images

### 6.5.12.1 Dialog

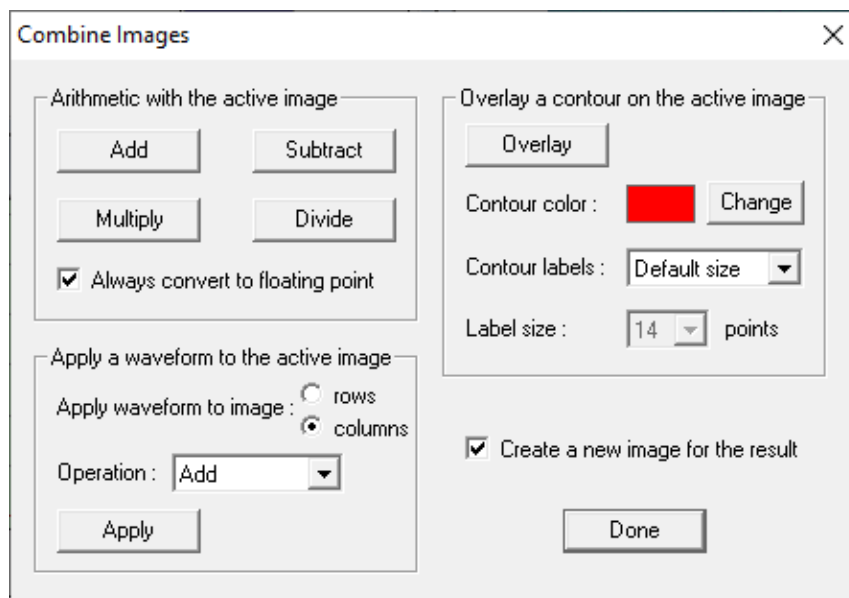


Figure 6-79 Combine Images dialog

<sup>3</sup> Given two real functions  $f$  and  $g$ , the Fourier transform of their correlation is the product of the Fourier transform of  $f$  and the complex conjugate of the Fourier transform of  $g$

### 6.5.12.2 Discussion

The Combine Images dialog allows the application of basic math operations on image operands.

**Image arithmetic:** Supports addition, subtraction, multiplication and division of images. The first operand is the active image, the second operand is selected by the user. The operation is computed pixel by pixel over the dimensions of the first operand. Any data outside the dimensions of the first image is ignored.

**1-D filter:** Applies a 1-D (waveform) filter to each row or each column of the active image. The selected filter's domain should match the limits of the images x or y axis.

**Overlay:** Plots the selected contour plot on the active image.:

**Contour color:** Selects the color of the contour lines.

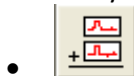
**Font:** Selects the font size for the contour labels.

**Create new image:** Creates a new image window for the result of the operation. If not selected, the result of the operation replaces the data in the active window.

### 6.5.12.3 Access

Select an image plot, then:

- Analysis | Combine



## 6.5.13 Extract Waveforms

### 6.5.13.1 Dialog

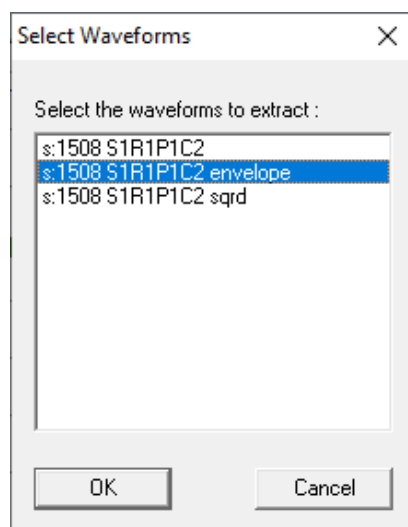


Figure 6-80 Selecting waveforms for extraction from an overlay

### 6.5.13.2 Discussion

Extracts copies one or more waveforms from an overlay plot, creating a new waveform window for each extracted waveform. The overlay plot is not modified.

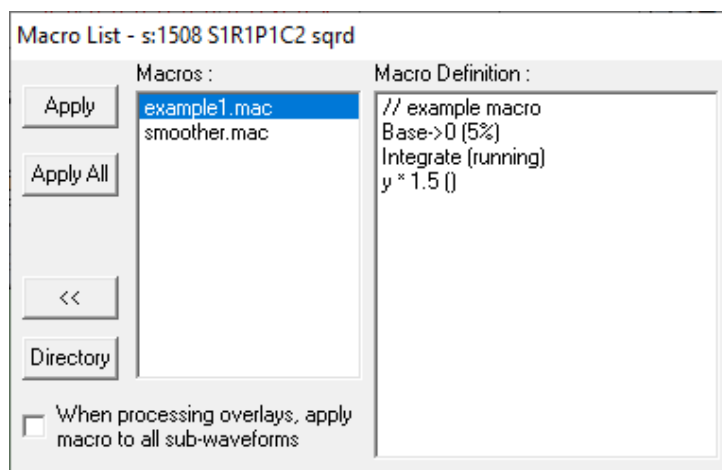
### 6.5.13.3 Access

Select an overlay plot, then:

- Analysis | Extract
- Ctrl + F8

## 6.5.14 Macro List

### 6.5.14.1 Dialog



**Figure 6-81 Macro quick-access dialog**

### 6.5.14.2 Discussion

This dialog provides quick access to macros that have already been created as described in 6.5.9.5. Selection of a macro from the list on the left displays the macro definition in the list on the right. The selected macro can be applied to the active waveform / image, or to all displayed waveforms / images. Application of a waveform macro to image data or of an image macro to waveform data will have no effect.

The Macro List dialog is modeless, meaning that, once activated, it remains visible in front of the Analyze window but allows operations in Analyze to be performed independently of the dialog window. Modeless activation allows a variety of macros to be applied to a changing selection of waveform and/or image plots. To close the dialog, simply reselect (uncheck) its menu option.

### 6.5.14.3 Access

- Analysis | Macro List

## 6.5.15 Image Adjuster

### 6.5.15.1 Dialog

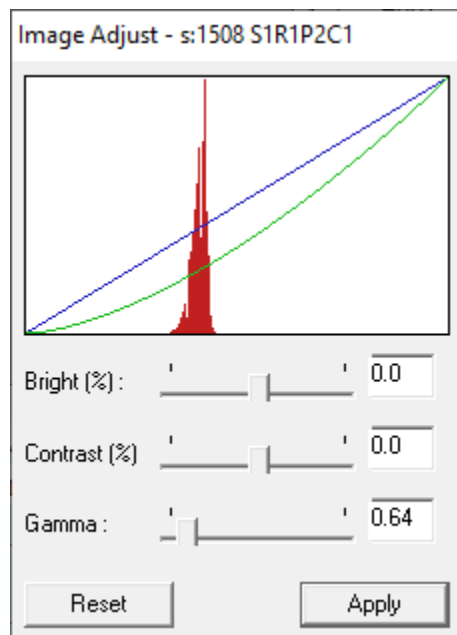


Figure 6-82 Image display adjustment dialog

### 6.5.15.2 Discussion

This dialog presents a simple interface to quickly adjust fundamental display parameters of the image plot in the active window. The Image Adjust display window shows the active image's histogram and a curve that represents the current brightness, contrast and gamma settings for that image. Adjustments made in this interface are used to render the image, but do not affect the underlying data until the Apply button is pressed. Selecting Apply will apply the current settings to the image data (making them permanent), then reset the display settings to their default values (bright = 0%, contrast = 0%, gamma = 1.0).

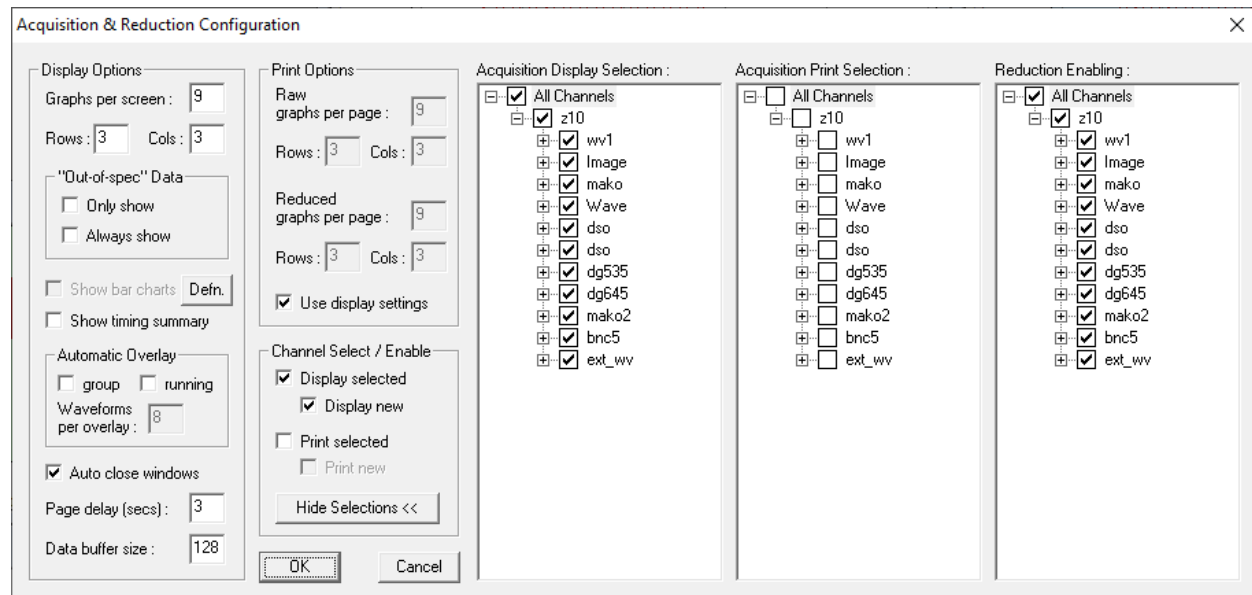
The Image Adjust dialog is modeless, meaning that, once activated, it remains visible in front of the Analyze window but allows other operations in Analyze to be performed independently of the dialog window. Selecting a different image window will automatically update this dialog's display and settings. Adjustments can therefore be performed on several image plots simply by selecting each new image. To close the dialog, simply uncheck its menu option.

### 6.5.15.3 Access

- Analysis | Image Adjuster

## 6.5.16 Acquisition Configuration

### 6.5.16.1 Dialog



**Figure 6-83 Acquisition Configuration dialog**

### 6.5.16.2 Discussion

The Acquisition Configuration dialog sets the display and print options for incoming acquired or reduced data. The Acquisition Configuration options determine only how Analyze manages acquired and reduced data transmitted from other modules or computers. Analyze does not control what data are transmitted or when data are transmitted.

### 6.5.16.3 Details

Item	Description
Graphs per screen	Sets the maximum number of graphs to display simultaneously. Changes to this value automatically updates the Rows and Cols fields.
Rows, Cols	Sets the number of Rows and Columns of waveforms to display on the screen. Changes to the Rows or Cols values automatically updates the Graphs per screen field.
Out-of-spec	Out-of-spec waveforms are reduced waveforms that are not within the minimum and maximum FOM (Figure of Merit) values that can be defined for each Cal Item in the signal paths specified in the CalMan module.
Out-of-spec, only show	Among the group of waveforms that are selected for display, show only those waveforms that are outside the tolerances established in CalMan.

Out-of-spec, always show	Always display waveforms that are outside the tolerances established in CalMan, regardless of the other display settings.
Show bar charts / Defn.	Display specified bar charts during acquisition, following the acquired data. Only enabled if a valid definition file was loaded when Analyze started. Select the Defn. button to specify the location of the bar chart definition file. The bar chart definition file format is described below in Section 6.5.16.5.
Show timing summary	Display a timing channel summary following the display of the acquired data.
Automatic Overlay	<p>Automatically display multiple waveforms as a overlay graphs. Each overlay will contain data from multiple shots on a single channel. If auto-printing is enabled, the waveforms will also be printed as overlays. During acquisition the individual waveforms are automatically stored in the database, but the auto-overlay waveform is not stored. The overlay waveform can be saved to the database manually (right-click on the overlay, select Store). Automatic overlay types:</p> <p><i>Group</i> – overlay multiple shots within a burst. For example, if a burst of 10 shots is acquired with 4 waveforms per overlay, 3 overlay waveforms will be created for each channel. The first two overlays will contain 4 waveforms and the last overlay will contain 2 waveforms. This option is only available on systems that support burst mode acquisition.</p> <p><i>Running</i> –overlay waveforms over multiple shots in single shot or repetitive single shot mode. On each shot, the overlays will continue to append the new waveforms, up to the specified number of waveforms, N. Once the overlay is filled, waveforms from the most recent N shots are displayed. Running overlays can be reset by selecting the Reset Overlays item in the Acquisition menu or on the toolbar.</p>
Waveforms per overlay	Sets the number of waveforms to combine into a single overlay, if automatic overlay mode is enabled.
Auto close windows	Automatically close all windows before displaying acquired and reduced data from an acquisition station.
Page delay	Sets the minimum amount of time to wait between filling the screen with graphs and clearing the screen for the next graph.
Data buffer size	Specifies the size of the buffer for displayed waveforms. Analyze stores this number of waveforms internally, which allows paging through the buffer one screen at a time. When the buffer is full, new waveforms will replace the oldest waveforms in the buffer.
Print Options, Graphs per page	Sets the number of graphs to print per page.

Print Options, Use display settings	If checked, disables the print options for the number of graphs per page and instead uses the display settings for graphs per screen.
Display selected channels	Enables the display of acquired data. If unchecked, no raw data will be displayed regardless of the other settings.
Display new channels	Displays channels from instruments that have been recently added to DAAAC (in the TestMan module), but that have not yet been configured in Analyze.
Print selected channels	Enables printing of acquired data. If unchecked, no raw data will be printed, regardless of the other settings.
Print new channels	Prints channels from instruments that have been recently added to DAAAC (in the TestMan module), but that have not yet been configured in Analyze.
Show / Hide Selections	Toggles display of the channel specific display, print and reduction selection controls (see below).
Display Selection	Selects the channels to be displayed by Analyze.
Print Selection	Selects the channels to be printed by Analyze.
Reduction Enabling	Enables the display and print options for each channel's reduced waveforms. Specification of which reduction waveforms are displayed and printed is made per waveform in TestMan's cal graph. Reduction channels that are unchecked here will not be displayed or printed, regardless of their settings in TestMan.

#### 6.5.16.4 Access

- Acquisition | Configuration



- 

#### 6.5.16.5 Bar Chart Display Configuration

During an acquisition, Analyze can display single-point data as bar charts. Defined bar charts windows are displayed with the raw data, and are displayed in addition to the individual single-point channels (i.e., bar charts do not replace the display of individual single-point channels). Multiple bar chart windows can be defined, each with data from one or more channels. To configure bar chart displays:

1. Create a bar chart definition file (see below);
2. Select the file using the Defn. button in the Acquisition Configuration dialog (Section 6.5.16.3);
3. Select Show bar charts in the Acquisition Configuration dialog.



The bar chart definition file is a text file with the following keyword, value pairs:

Keyword	Value	Value type	Required
NUMCHARTS	Number of defined charts (display windows)	Number	X
CHART	Chart ordinal number	Number	X
CHARTTITLE	Chart title (display window title)	String	
CHANNEL	<station_name>:<channel_name>	String	X
NOMVALUE	Nominal value (draw a reference line at this level)	Number	
BARMIN	Minimum bar display value	Number	X
BARMAX	Maximum bar display value	Number	X
YELHI	Upper limit for warning range (yellow display)	Number	
YELLO	Lower limit for warning range (yellow display)	Number	
GRNHI	Upper limit for good range (green display)	Number	
GRNLO	Lower limit for good range (green display)	Number	
ENDCHANNEL	n/a (termination marker for channel definition)	n/a	X
ENDCHART	n/a (termination marker for chart definition)	n/a	X
END	n/a (termination marker for definition file)	n/a	X

Example definition file:

```

NUMCHARTS 2
CHART 1
CHARTTITLE primary values
CHANNEL zk10:sp_ch1
NOMVALUE 10e-6
BARMIN 0.0
BARMAX 20e-6
YELHI 15e-6
YELLO 5e-6
GRNHI 11e-6
GRNLO 9e-6
ENDCHANNEL
CHANNEL zk10:sp_ch2
NOMVALUE 9.5e-6
BARMIN 0.0
BARMAX 15e-6
YELHI 13e-6

```

```

YELLO 2e-6
GRNHI 10e-6
GRNLO 9e-6
ENDCHANNEL
CHANNEL zk10:sp_ch3
NOMVALUE 10.8e-6
BARMIN 0.0
BARMAX 20e-6
YELHI 15e-6
YELLO 6e-6
GRNHI 12e-6
GRNLO 9e-6
ENDCHANNEL
ENDCHART
CHART 2
CHARTTITLE misc data
CHANNEL zk10:sp2_ch7
BARMIN 5e-3
BARMAX 10e-3
GRNHI 7e-3
GRNLO 5e-3
ENDCHANNEL
ENDCHART
END

```

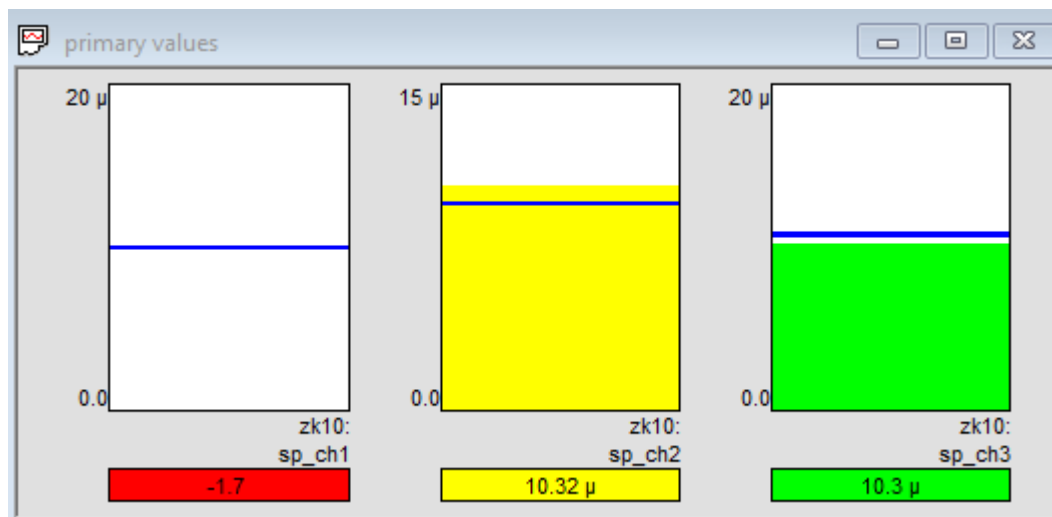


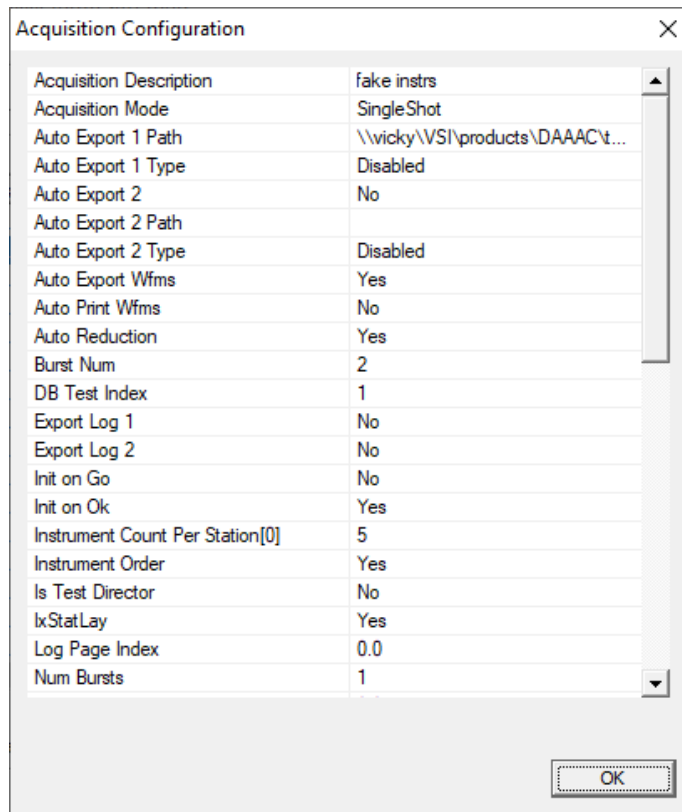
Figure 6-84 Bar chart display window CHART 1 in the example

Notes:

- Each line should contain one keyword and value, or one termination keyword
- Required and optional items must be ordered as shown above.
- The definition must contain at least one chart and one channel

## 6.5.17 Acquisition Settings viewer

### 6.5.17.1 Dialog



**Figure 6-85 Analyze acquisition settings review**

### 6.5.17.2 Discussion

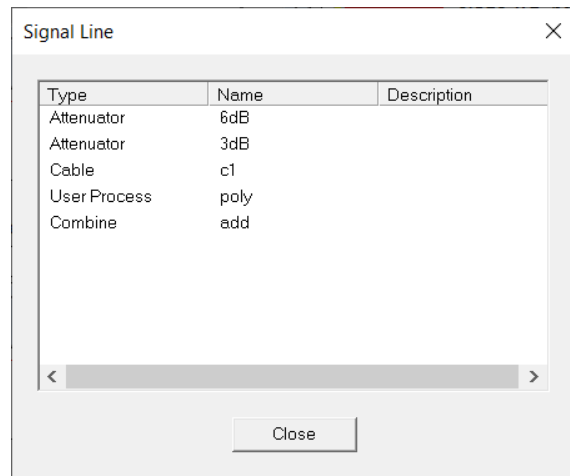
Presents a read-only view of the acquisition settings associated with a waveform or image.

### 6.5.17.3 Access

- Right-click on a displayed waveform or image and select View Associated | Acquisition Settings.

## 6.5.18 *Signal Line viewer*

### 6.5.18.1 Dialog



**Figure 6-86 Analyze signal path settings viewer**

### 6.5.18.2 Discussion

Presents a read-only view of the signal line items associated with a waveform or image. Double-click an item in the list to display that item's settings.

### 6.5.18.3 Access

- Right-click on a displayed waveform or image and select View Associated | Cal Line.

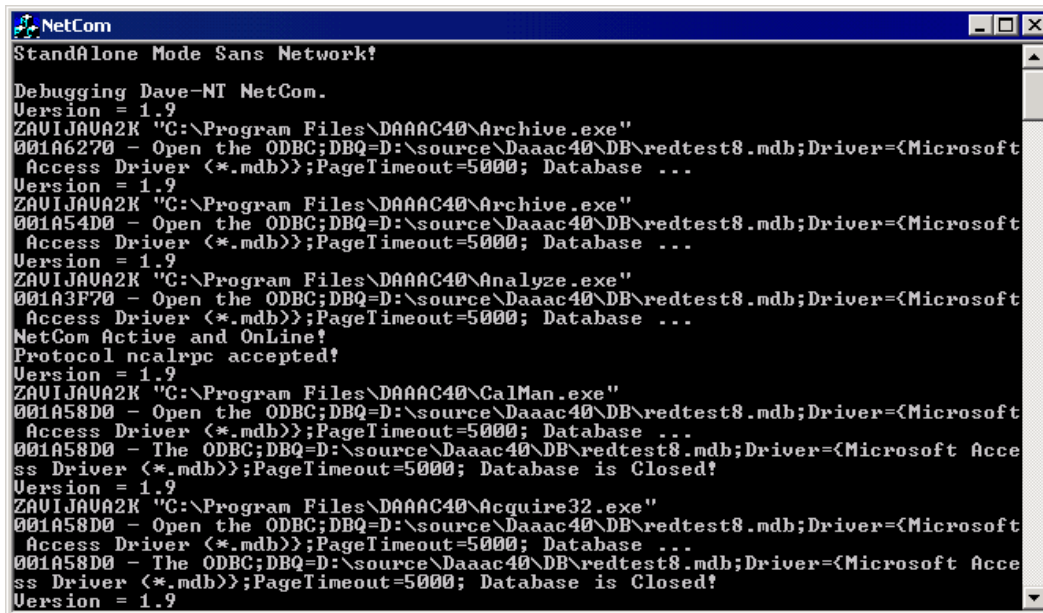
# 7 NetCom

## 7.1 Overview

NetCom is the communicator between DAAAC's modules, the database, and the network. NetCom starts automatically when Archive starts, and it must be running for DAAAC to access the database.

The database stores the system configurations and such data as waveforms, instrument settings and Cal Item data. As such, DAAAC relies on an active, open database. Each module (Archive, Analyze and TestMan) must have access to this database, and NetCom provides that access.

NetCom does have a minimal user interface that displays status information, but you will rarely need to interact directly with this module. NetCom's configuration settings can be modified from Archive, as described in Section 0.



```
NetCom
StandAlone Mode Sans Network!

Debugging Dave-NT NetCom.
Version = 1.9
ZAUIJAVUA2K "C:\Program Files\DAAAC40\Archive.exe"
001A6270 - Open the ODBC;DBQ=D:\source\Daaac40\DB\redtest8.mdb;Driver=(Microsoft
Access Driver (*.mdb));PageTimeout=5000; Database ...
Version = 1.9
ZAUIJAVUA2K "C:\Program Files\DAAAC40\Archive.exe"
001A54D0 - Open the ODBC;DBQ=D:\source\Daaac40\DB\redtest8.mdb;Driver=(Microsoft
Access Driver (*.mdb));PageTimeout=5000; Database ...
Version = 1.9
ZAUIJAVUA2K "C:\Program Files\DAAAC40\Analyze.exe"
001A3F70 - Open the ODBC;DBQ=D:\source\Daaac40\DB\redtest8.mdb;Driver=(Microsoft
Access Driver (*.mdb));PageTimeout=5000; Database ...
NetCom Active and OnLine!
Protocol ncalrpc accepted!
Version = 1.9
ZAUIJAVUA2K "C:\Program Files\DAAAC40\CalMan.exe"
001A58D0 - Open the ODBC;DBQ=D:\source\Daaac40\DB\redtest8.mdb;Driver=(Microsoft
Access Driver (*.mdb));PageTimeout=5000; Database ...
001A58D0 - The ODBC;DBQ=D:\source\Daaac40\DB\redtest8.mdb;Driver=(Microsoft Acce
ss Driver (*.mdb));PageTimeout=5000; Database is Closed!
Version = 1.9
ZAUIJAVUA2K "C:\Program Files\DAAAC40\Acquire32.exe"
001A58D0 - Open the ODBC;DBQ=D:\source\Daaac40\DB\redtest8.mdb;Driver=(Microsoft
Access Driver (*.mdb));PageTimeout=5000; Database ...
001A58D0 - The ODBC;DBQ=D:\source\Daaac40\DB\redtest8.mdb;Driver=(Microsoft Acce
ss Driver (*.mdb));PageTimeout=5000; Database is Closed!
Version = 1.9
```

# 8 Cal Items

This section presents a formatted description of every available item in the cal item inventory. The format is as follows:

- Section E.x – Cal Item Name
- Section E.x.1 – Category –
  - Waveform Reduction – used to process waveform data
  - Image Reduction – used to process image data
  - No Reduction – used for documentation purposes only

And type

- Hard – represents a hardware item in the signal path
  - Soft – represents a software processing operation
- Section E.x.2 – Discussion. Complete description of the Item
- Section E.x.3 – Item Data
- Section E.x.3.1 – Dialog Image
- Section E.x.3.2 – Dialog Discussion. Description of the item dialog
- Section E.x.3.3 – Dialog Details. Tabular description of every dialog control, by name.
- Section E.x.3.4 – Subdialogs. Image, discussion and details of subdialogs accessed from the Item dialog, if any.
- Section E.x.4 – Cal Item Icon.

Note that Section E.1 groups the most common Cal Items, with similar or identical interface, into a single entry. The remaining E.x sections refer to special cases of Cal Items.

When added to a graph cal items have an associated reduction dialog. The reduction dialog and its various subdialogs are discussed in detail in 4.8.29.

## 8.1 Standard Cal Items

### 8.1.1 *Category*

WAVEFORM Reduction – Hard Item.

### 8.1.2 *Discussion*

This section describes the CalMan functional interface for a group of Cal Items that use a single curve to characterize the item. This group includes:

- Amplifier – scales the level of an input signal, increasing by the gain of the amplifier.
- Attenuator – attenuates the level of an input signal. Like the amplifier, uses a gain factor, but unlike the amplifier the gain values are negative.

- Balun – connects a balanced electrical load (e.g. a d-dot sensor) to an unbalanced load (e.g., a cable).
- Cable – transmits a signal from one location to another. A cable introduces impedance and capacitance that are applied linearly to the signal as a function of cable length. A TDR curve can also be specified, but is not used to process the data.
- Coupler – A device for sampling the through signal. Note that only the through signal is characterized. To characterize multiple item outputs, use a multi-port item.
- Filter – limits the signal's frequency content.
- Integrator – integrates the input signal. *Active* integrators apply the specified characterization curve, while passive integrators apply droop correction,  $f_{out}(x) = f_{in}(x) + \frac{1}{\tau} \int_0^x f_{in}(x) dx$ , using the provided time constant,  $\tau$ . An impedance curve can also be specified, but is not used to process the data.

### 8.1.3 Item Data

#### 8.1.3.1 Dialog

**Figure 8-1 The Balun item uses the standard dialog**

#### 8.1.3.2 Discussion

Most Hard Cal Items are derived from the standard form of Figure 8-1. This includes a unique item name and descriptive text. A Curve button opens the dialog of 8.1.3.3.1. It is used to specify the curve that characterizes the effects of the item on the input signal. A Delay field is used to specify the signal propagation time through the item in nanoseconds. During reduction, the delay value is subtracted from the time domain signal's x-axis values. Many items modify this standard interface by removing the Curve or Delay field and/or adding additional fields as specified immediately below.

### 8.1.3.3 Details

Item	Description
Name	This field requires a unique name, and duplicates are not allowed. For relaxed inventoried systems, only; this does not appear in strict inventoried systems.
Description	Optional description for this Cal Item.
Curve	Opens the Curve dialog shown below, to define the curve that characterizes the input signal response to the device.
Delay ns	Signal propagation delay through the item.

#### 8.1.3.3.1 Dialog Variations by Cal Item

The following table presents controls for standard cal items that differ from the standard dialog shown in Figure 8-1.

Cal Item	Item	Description
Amplifier	Pulse Cal Date	The date the last Pulse Calibration was performed on the item. This item is informational for the purpose of documentation. It does not affect the function of the Cal Item at reduction.
	Std Dev	Standard deviation from the last pulse calibration. This value is not used during data reduction.
	Pulse Cal.	Calibration factor from the last pulse calibration. This value is not used during data reduction.
Attenuator	Inline	The attenuator type is Inline. An inline attenuator has a single input. The number of positions is set to 1 and cannot be changed.
	Rotary	The attenuator type is rotary. Rotary attenuators can have more than one input port / attenuation value.
	Number of positions	The number of input ports for rotary type (multiple input) attenuators. Characterization curves should be specified for each position.
	Current position	The current input port to the rotary type. Determines which input is currently used during data reduction. The inline type's current position is always 1.
	Edit Curve	Activates the Curve dialog for specifying the characterization value or waveform.



	Curve at position	For rotary attenuators only, selects which curve will be viewed / edited when Edit Curve is pressed.
Cable	Cable type	The cable type helps determine how reduction is performed for this item. The velocity of propagation is known for each type, and the delay is automatically calculated according to the length of the cable, as entered in the Length field. The cable type selected should match the actual cable type in use. If type Other is selected, the delay is not computed from the length, but can be entered manually.
	Connector A/B	Cable-end connector types. Informational - not used in data reduction.
	Length	The actual length of the real cable in feet. The length field is used in conjunction with the Cable Type field to compute the delay.
	Delay	The electrical delay, as calculated from the cable length and type or manually entered. The waveform will be shifted by this amount during data reduction.
	Electrical delay included in phase data	If checked, the cable delay is determined from the slope of the characterization phase data. In this case, the characterization phase curve should not remove ("dial out") the delay. If phase data is not available, the fixed delay value will be used.
	Gain Curve	Activates the Curve dialog so that a characterization waveform may be assigned to this item for reduction.
	TDR Curve	Activates the Curve dialog so that a characterization waveform may be assigned to this item. The TDR curve is not used in reduction.
Filter	Filter Type	Informational - not used during data reduction.
Free Space	Distance	The free space distance between radiating and receiving components (antennas).
	Units	The units of the free space distance.
Integrator	Type	Allows selection of Active or Passive integrators.
	Time constant	Specifies the integration time constant in microseconds.
	Gain	Activates the Curve dialog for viewing / editing the characterization waveform.
	Impedance	Not presently supported

Multi-Port	Number of Ports	Number of ports on the multi-port (input or output) side of the item
	Curve Setup (port)	Determines which port's characterization curve will be viewed / edited when Curve is selected.
Probe	Probe Type	Available probes are Voltage Monitor, Current Monitor, and Arbitrary (any other).
	Input units	Volts, amps or other.
	Conversion factor	Scalar factor to convert probe output to probe input.
	Integrate Signal	If a differential probe, checking this box will integrate the signal before processing.
Time Shift	Time shift	While most items have a delay value that is subtracted from the x-axis values during the reduction process, the time shift value is added to the x-axis values. The time shift value may be positive or negative.

#### 8.1.3.4 Subdialogs

Standard items are characterized by a response curve, which can either be defined by a polynomial or a waveform. Select the curve type to display the polynomial or waveform controls, or select None if the item has no curve. The expected units of the characterization curve are shown with the curve type.

#### 8.1.3.4.1 Curve – Polynomial

##### 8.1.3.4.1.1 Dialog

The screenshot shows the 'Curve Specification' dialog box. At the top, 'Curve Type' is set to 'Polynomial' and the title is 'Gain vs. Frequency (GHz, dB)'. Below this, polynomial coefficients are entered in a sequence of boxes: 0, -1, -0.2, 0.03, 0, 0, 0, 0. These correspond to terms from  $x^0$  to  $x^8$ . A central graph displays a red line representing the polynomial  $f(x) = -1x + -0.2x^2 + 0.03x^3$  over a frequency range of 0 to 2 GHz. The y-axis represents gain in dB, ranging from -3 to 0. To the right of the graph, the 'Display domain' is set with 'Min (GHz): 0.0' and 'Max (GHz): 2'. Below the graph, the 'Title' field contains 'polynomial preview' and the 'Comment' field contains the formula  $f(x) = -1x + -0.2x^2 + 0.03x^3$ . At the bottom, there are buttons for 'Retrieve Waveform' (with sub-options 'Processed', 'Raw', 'File Import') and 'Send Waveform to Analyze' (with a 'Send' button). 'OK' and 'Cancel' buttons are at the very bottom.

**Figure 8-2 Curve definition using a polynomial characterization**

##### 8.1.3.4.1.2 Discussion

Polynomial curve specifications are typically used for items that have a relatively flat or linear response over the operational frequency range, although higher order polynomials are supported. Note that the standard units for polynomials are dB vs. GHz. The use of GHz instead of Hz removes the need for excessively small scaling factors for the high-order terms. Also note that most items use gain vs. frequency, which means that attenuation is specified as a negative value. For example, the cal factor for a 6 dB attenuator would be -6. A preview curve is generated over the specified domain, as polynomial coefficients are entered.

##### 8.1.3.4.1.3 Details

Item	Description
Polynomial	When selected, activates the Polynomial curve reduction fields. The defined polynomial then is used to characterize the Cal Item during reduction.
dB	The polynomial can be a constant value (power == $x^0$ ), or up to a tenth-order polynomial. To create the polynomial, enter a coefficient value in the dB field.

	Next, select the associated Power ( $x^0$ .. $x^{10}$ ). Finally, select Accept to add the specified monomial to the total polynomial. The Current Polynomial box displays the complete polynomial. An existing term's coefficient may be modified by selecting the desired Power value, entering a new dB value, then selecting Accept.
Power	Current polynomial power.
Current Polynomial	The configured polynomial. The polynomial will be displayed from lowest to highest power ( $f(x) = a + bx + cx^2 + dx^3 + \dots$ ), regardless of the order of entry.
Accept	Enters the monomial specified by the current dB and Power values into the polynomial.

#### 8.1.3.4.2 Curve – Waveform

##### 8.1.3.4.2.1 Dialog

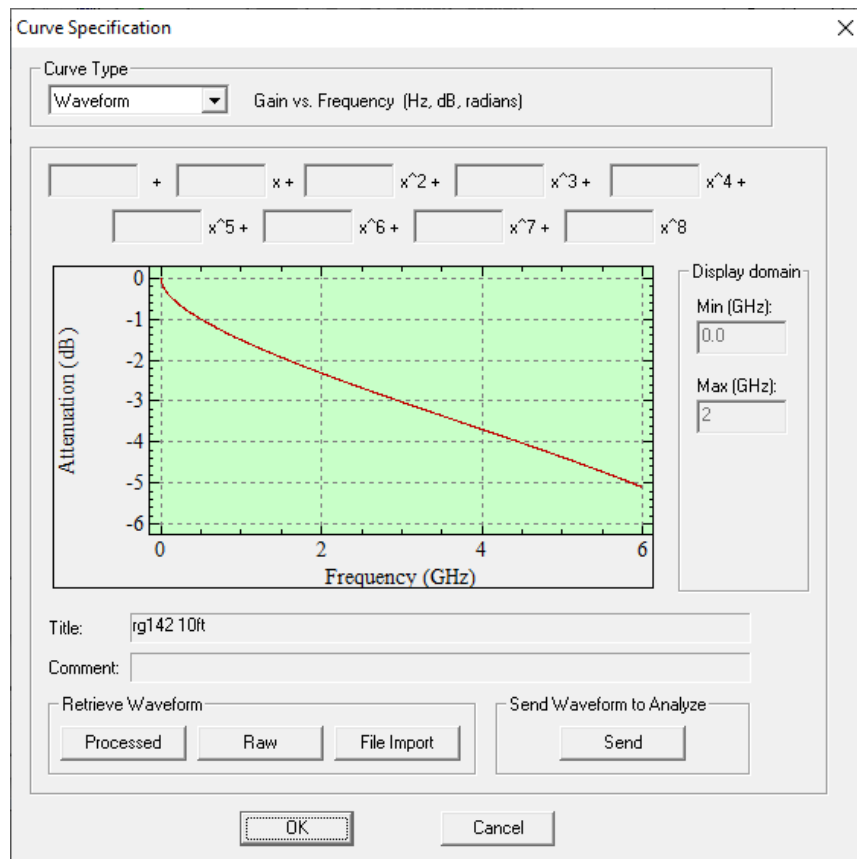


Figure 8-3 Curve definition using waveform characterization

##### 8.1.3.4.2.2 Discussion

If a characterization waveform has been created for the cal item with a network analyzer or other instrument, the waveform can be directly used to characterize the item. The Waveform view of the

Curve Specification dialog displays the current waveform, and allows selection of a new waveform. If you select Raw or Processed, a retrieve file dialog will appear for selection of a waveform from the database.

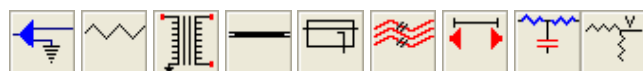
If you select File Import, an Open File dialog will appear for choosing a data file to import. Once the file is selected, the Waveform Import Titles dialog will appear, that allows you to enter axis titles and units. This version of the file importer supports only comma-separated ASCII data without header information. Magnitude-only files should contain x, y pairs; real / imaginary and magnitude / phase files should contain x, y, z triples.

To import additional data formats, first import the file in Archive, then select the imported waveform using the Processed button in the Curve Specification dialog. Note that the standard units for waveform characterization files are dB vs. Hz. Some components use other units, so be sure to check the expected units text at the top of the Curve Specification dialog.

#### 8.1.3.4.2.3 Controls

Item	Description
Waveform	When selected, activates the Waveform curve fields. The selected waveform is then used to characterize the cal item during data reduction. When a waveform is selected (Raw, Processed, or Get File), the waveform selected is displayed.
Processed	Select a processed waveform from the database.
Raw	Select a raw waveform from the database.
File Import	Select a waveform from an external file. The waveform will be imported as processed data and linked to this item.
Send	Open the characterization waveform in the Analyze module.

#### 8.1.4 Icons



## 8.2 Rotary and Controllable Attenuators

While attenuators are grouped under the standard items, above, some attenuator settings require additional discussion. The attenuator type (rotary or inline) and number of positions must be specified when the item is created, and cannot be changed after the item is created. An inline attenuator has a single characterization curve and a rotary attenuator has multiple attenuation values. Each attenuation position has a corresponding characterization curve. The rotary attenuator's current position (attenuation setting) is manually selected from the item's dialog.

A controllable attenuator is linked to a computer controlled instrument. To create a controllable attenuator, select the Inline type and add the item to the graph. You can then specify the controllable attenuator source. If there are no entries in the attenuator source list, then add the associated instrument before configuring this item. Changes to the source attenuator instrument will automatically update the item's controllable attenuation value. Note that the attenuator reduction will apply both the

controllable attenuation value and the item's gain curve if present. If the only attenuation comes from the controllable instrument, leave the item curve empty.

### 8.3 Multi-port Cal Items

Multi-port cal items are signal path items that can accommodate more than one input or output port. Because of their unique capabilities, they require special consideration when created, and when inserted in and removed from the graph.

Note that the terms *input* and *output* depend on which way the data is flowing. During acquisition, data flows in from the sensor side of the cal line, and out to the instrument side. The reduction sequence proceeds in the opposite direction, so data flows in from the instrument and out towards the sensor. Physical components (attenuators, cables, splitters, switches, etc.) typically use the acquisition flow, while user processing components (combine, overlay, image process, etc.) use the reduction flow.

Cal Manager supports the following multi-port cal items:

- Adder (Multi Port)
- Splitter (Multi Port)
- Coax Switch
- Combine
- Overlay
- Image Branch
- Waveform Branch

Adders and splitters are both derived from the same Multi Port cal item in the inventory list. When first created, the number of ports must be specified, but the type (adder or splitter) is not defined until the item is placed in the graph.

Coax switches are multi-port cal items because they can have multiple input or output ports. However, only one port can be active at a time. This active port can be set only from within the configuration dialog after the item is inserted into the graph.

Combine, Overlay, Image Branch, and Waveform Branch items support user-defined processing. Their ports do not correspond to physical connections in the signal line.

#### 8.3.1 Multi Port – Adders & Splitters

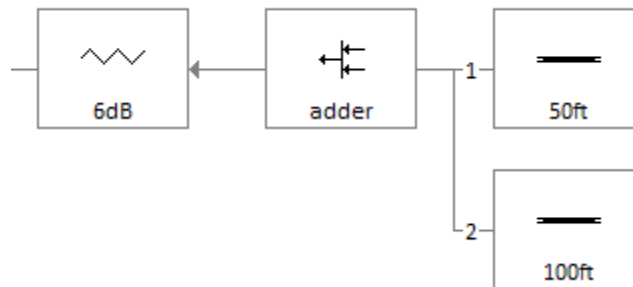
##### 8.3.1.1 Category

WAVEFORM Reduction – Hard

##### 8.3.1.2 Adder Nodes

Adders are multi-port cal items that have multiple active input ports and are created from the Multi Port item in the inventory list. The number of ports must be specified when the Multi Port item is created, and cannot be changed after the item is created.

Data reduction is not available for Adder items, as the relative contributions of each adder input to the total adder output signal are unknown.



**Figure 8-4 Adder node in a cal line**

To attach cal items to Adders:

1. Insert the cal item to the right of the Adder by either:
  - right-clicking the Adder and selecting Insert a new item to the RIGHT of this item from the popup menu;
  - using the inventory list to drag-and-drop the cal item onto the Adder.
2. Select a port from the Port Selection dialog that is displayed next. If Cancel is selected from this dialog, the cal item will not be attached to the Adder.

If the new cal item is the first item attached to the Adder, it will reside to the immediate right and on the same line. Subsequent inputs are placed on lines just beneath the Adder's line. A port must be selected from the Port Selection dialog that is displayed before the item can be attached. Additional cal items then can be attached to these external inputs.

### 8.3.1.3 Splitter Nodes

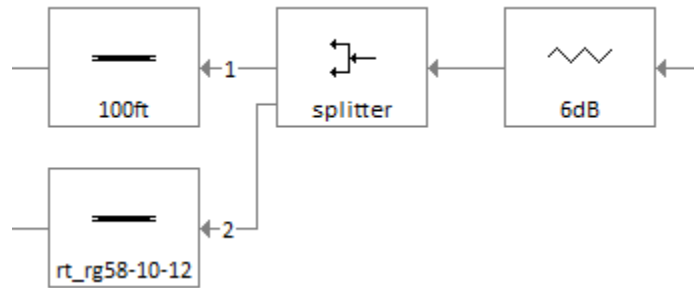
Splitters are multi-port cal items that have multiple, active output ports. The splitter is derived from the Multi Port cal item in the inventory list. The number of ports must be specified when the Multi Port item is created, and cannot be changed after the item is created.

Outputs from the splitter are linked only after the item is added to the graph. The first output port connects to the cal item to the splitter's immediate left. This link is required and automatically made when the splitter is added to the graph. Because the item to the left is on the multi-port side of the splitter, a connection port must be specified.

In the graph display, the splitter node is marked by a small arrow along its bottom edge. Nodes that are attached to splitters contain an arrow pointing inward toward the center of the attached item, to indicate the direction of the signal as it is acquired.

When cal items are inserted to the right of a node that connects to a splitter, that splitter output is reassigned to the new node. In other words, splitter outputs must be connected to the ends of other cal lines, not the middle. The only line that can have items after the splitter connection is the line containing the splitter itself. When a node connected to a splitter output is deleted, the associated splitter port is freed and made available for reassignment to another node.

Splitter outputs may not be assigned so that the output path would eventually link to an input of the same splitter (self-referential or cyclic input). An output from a splitter may not be on the same line as the Splitter, or connect to Adder item inputs. Any attempt to make an illegal connection will trigger a warning message, with an explanation of why the connection is illegal.



**Figure 8-5 - Splitter node linked to two cal lines**

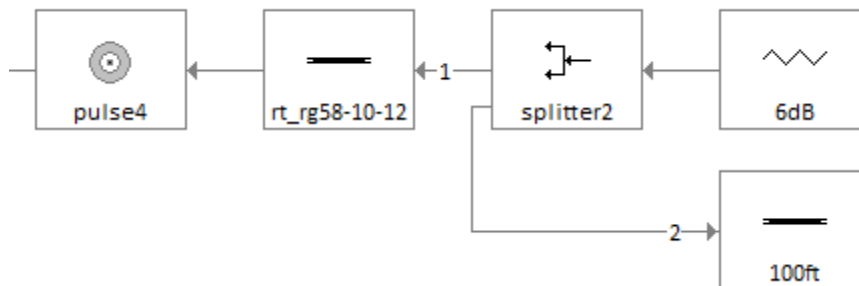
To set splitter outputs:

1. right-click the splitter and select the pop-up menu item **Set Output to Another Node**.
2. left-click the node that is to accept the output signal from the splitter. This node must be one that is the absolute last node on a line.

To disconnect the node from the splitter, right-click the node to activate the pop-up menu then select **Disconnect From Source**. This also frees the port for use with another node.

To draw connecting lines from the Splitter to its external input, select **Draw connecting lines for multi-port items** from the Display Preferences dialog. Single-clicking on a node connected to a splitter output will highlight the connection.

**Reverse Direction Nodes.** Consider a system with signal paths that include a path from a source to an radiating antenna, with a coupler that branches to a diagnostic channel. Reduction along the path from the instrument channel to the signal source uses standard techniques – reduction of each component inverts the effects of that component. Reduction along the other path, from the instrument channel to the transmit antenna, requires a different method. Instead of applying the inverse of the cal value, the reduction should directly apply the cal value (e.g., reducing an attenuator decreases the signal levels). To support this type of reduction, nodes can be added to a splitter using *reverse direction*. Nodes added in this manner do not connect with other nodes that move towards a channel on the left – they reverse direction and form a new path that moves to the right (see Figure 8-6). In the figure, the item on port 2 has been added with reverse direction. Items that attenuate the signal along the port 2 path will decrease the waveform amplitude during the reduction. To add a node with reverse direction, right-click on a splitter and select **Insert a new item with REVERSE direction** from the popup menu.



**Figure 8-6 - Splitter with reverse direction node on port 2**



### 8.3.1.4 Multi-Port Item

#### 8.3.1.4.1 Dialog

Multi Port:

Item Data

Name/Description

Name: splitter

Description: 2-way splitter

Delay: 0 ns

Number of Ports: 2

Curve Setup

Curve at port 1

OK Cancel Apply Help

**Figure 8-7 Multi Port (adder / splitter) configuration dialog**

#### 8.3.1.4.2 Discussion

Adders and Splitters use the Multi Port configuration dialog, which includes standard Curve and Delay controls. In addition, the number of input ports (Adder) or output ports (Splitter) must be assigned. Once assigned, the number of ports cannot be changed after the dialog is closed. Each port on the multi-port side has a characterization curve. The selected curve is assigned to a port using Curve Setup.

#### 8.3.1.4.3 Details

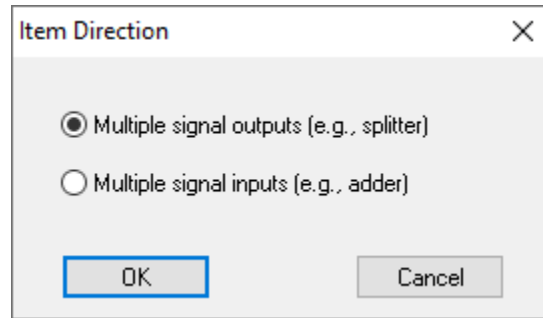
Item	Description
Name	A unique cal item name, used to identify the item in the inventory list and graph.
Description	Descriptive text.
Delay	Propagation delay through the Adder / Splitter
Number of Ports	The number of input ports for an Adder or output ports for a Splitter.
Curve at port	Specifies the characterization curves for each port.

#### 8.3.1.4.4 Subdialogs

##### 8.3.1.4.4.1 Curve

The Curve dialog as described in Section 8.1.3.4.1.

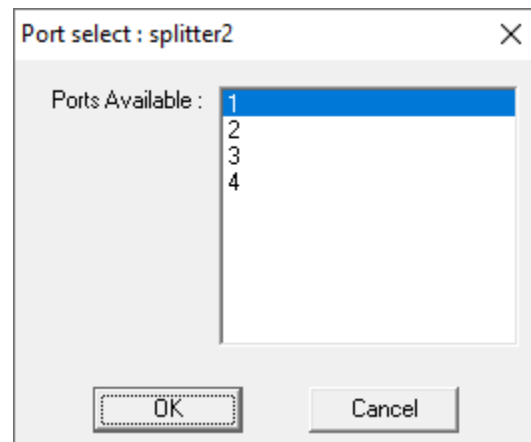
##### 8.3.1.4.4.2 Item Direction



**Figure 8-8 Choosing direction when inserting a Multi Port item in the graph**

The Item Direction dialog appears when a Multi Port item is added to the graph. It is used to configure the node as an adder – sum multiple signal inputs into one output signal; or a splitter – divide a single input into multiple signal outputs. *Inputs* here refer to the side of the component connected to the probe/sensor, while *outputs* refer to the side connected to the recording instruments.

##### 8.3.1.4.4.3 Port Selection



**Figure 8-9 Port Selection dialog**

The Port Selection dialog appears when the Adder/Splitter node is first added to a cal line. It also appears when a new item is added to the right of an Adder or when Set Output to Another Node is selected from the right-click popup menu of a splitter. The dialog is used to select the port to which the input (Adder) or output (Splitter) node will be connected. The choice of ports will determine the characteristic curve to be applied to the data when reducing the item.

#### 8.3.1.5 Icon



### 8.3.2 Coax Switch

#### 8.3.2.1 Category

WAVEFORM Reduction – Hard

#### 8.3.2.2 Discussion

Coax Switches are multi-port items that can have a single port on one side and multiple ports on the other. Only one of the ports on the multi-port side can be active at a time. The number of ports must be specified when the switch is created in the Inventory List, and cannot be changed after the item has been created.

When the switch is placed in the graph, the switch direction must be specified – either multi-input or multi-output type. Here inputs and output refer to the direction of flow as the signal is captured, from sensor to instrument channel. If the switch is a multi-output switch (like a splitter), a port number must be specified when connecting nodes to its left. If it is a multi-input switch (like an adder), a port number must be when connecting nodes to its right. In Figure 8-10, the switch on the left was added as a multi-input node and the switch on the right as a multi-output node.

Attaching Coax Switches and selecting ports is done the same way as with Adders and Splitters (Multi Port items). See Sections 8.3.1.2 and 8.3.1.3.

To select the active port, double-click the switch node to display the Coax Switch's user interface. Select Current position to specify the active port. The selected position is stored in the graph node, so the same switch item can be used in multiple graph locations with different positions. As shown in Figure 8-10, the switch position is displayed below the node and links from active ports are drawn with solid lines while links to inactive ports are drawn with dashed lines.

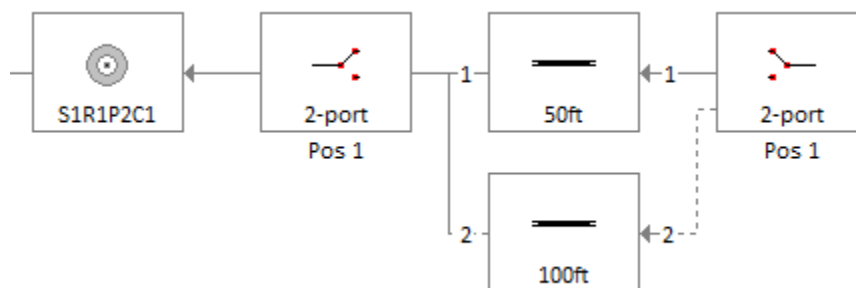
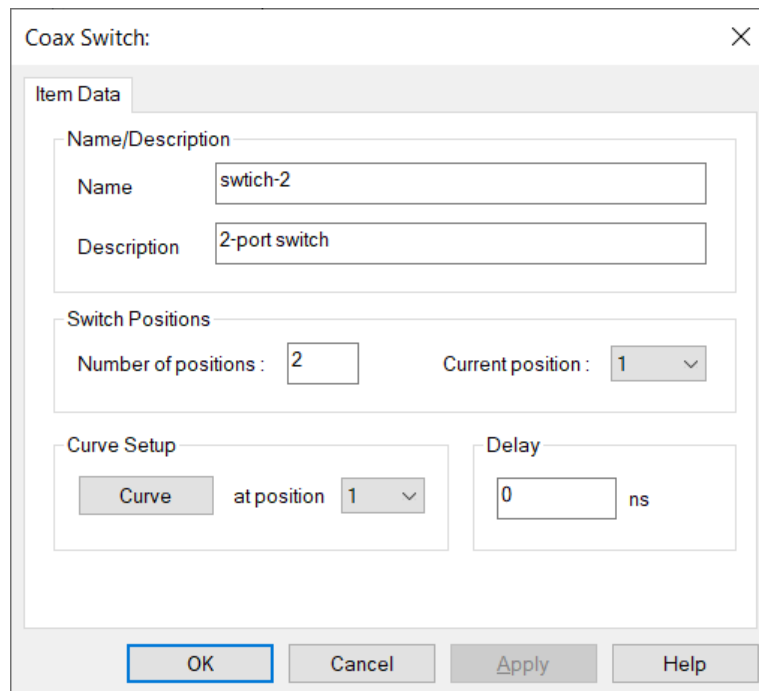


Figure 8-10 Coax Switch nodes in the graph

### 8.3.2.3 Item Data



The image shows a 'Coax Switch' configuration dialog box. It has a title bar with a close button (X). Inside, there's a tab labeled 'Item Data'. Below the tab, there are three main sections: 'Name/Description', 'Switch Positions', and 'Curve Setup'. The 'Name/Description' section has two text boxes: 'Name' with the value 'switch-2' and 'Description' with the value '2-port switch'. The 'Switch Positions' section has a 'Number of positions' text box with the value '2' and a 'Current position' dropdown menu with the value '1'. The 'Curve Setup' section has a 'Curve' button, an 'at position' dropdown menu with the value '1', and a 'Delay' section with a text box containing '0' and the unit 'ns'. At the bottom of the dialog are four buttons: 'OK', 'Cancel', 'Apply', and 'Help'.

**Figure 8-11 Coax Switch configuration dialog**

Item	Description
Number of positions	Total number of ports (input or output).
Current position	The switch position, and port that will be traversed during data reduction.
Curve at position	Specifies the characterization curves for each port / position.
Delay	Inherent time delay of the component.

#### 8.3.2.3.1 Subdialogs

The Curve dialog as described in Section 8.1.3.4.1.

### 8.3.2.4 Icon



## 8.3.3 Combine

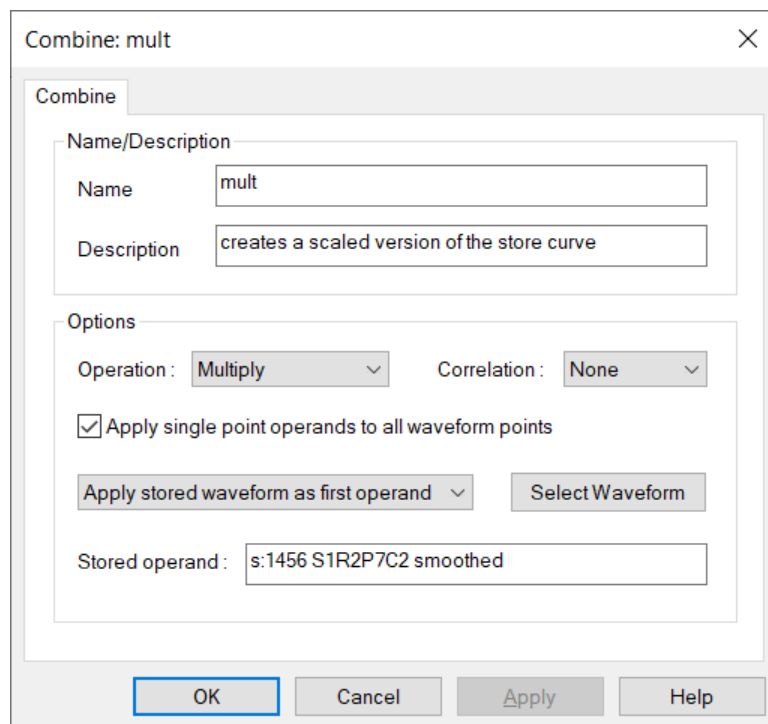
### 8.3.3.1 Category

WAVEFORM Reduction – Soft

### 8.3.3.2 Discussion

Combine items are multi-port items that use arithmetic to combine the reduction outputs from multiple nodes. Combine items are added to the graph, then linked to other nodes (the other operands). To link a combine node to an operand node, right-click on the combine node in the graph and select the **Select Combine Operand** menu item, then click on the operand node (or click outside all nodes to cancel the link action). The combine node's links to its operand nodes are drawn with a dotted line. The data from the node to the immediate left of the combine node is typically the left (first) operand of the operation. For example, if the operation is subtraction the node to the left of the combine is the minuend and all other operands are subtrahends. The left (first) operand always determines the domain of the output. A database waveform or polynomial can also be selected as an operand. Stored operands can optionally be selected as the left (first) operand (see Section 0).

### 8.3.3.3 Item Data



**Figure 8-12 Combine configuration dialog**

Item	Description
Operation	The combine operation: Add, Subtract, Multiply, Divide, Y vs Y, Correlate only.
Correlation	If selected, automatically aligns the waveforms before overlaying. Quick correlation matches the 50% points of pulses' rising edges, Full correlation applies the frequency domain correlation function.

Apply single point to all	If selected, a single-point waveform's y value will be applied to all points in the other operand waveforms. If not selected, the single-point y value will only be applied at the location where the single-point's x value matches the other operands' x values.
Stored waveform application	<p>A specified polynomial or stored waveform can be selected as an operand for the combine operation. The following options are available:</p> <ul style="list-style-type: none"> <li>• No stored waveform. A stored waveform is not applied.</li> <li>• Apply stored waveform as first operand. The specified stored waveform will be applied as the first (left) operand. This means that the stored waveform will determine the domain of the output.</li> <li>• Apply stored waveform as last operand. The specified stored waveform will be applied after all other operands.</li> </ul>
Select Waveform	Opens the standard Curve dialog to either define a polynomial or select a stored waveform to be an operand in the combine operation.

#### 8.3.3.3.1 Subdialogs

The Curve dialog as described in Section 8.1.3.4.1.

#### 8.3.3.4 Icon



### 8.3.4 Overlay

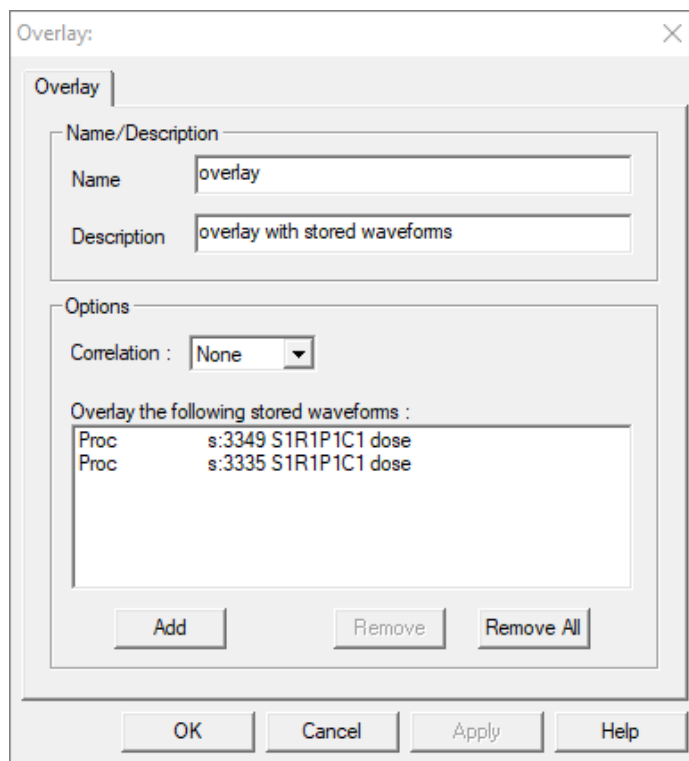
#### 8.3.4.1 Category

WAVEFORM Reduction – Soft.

#### 8.3.4.2 Discussion

Overlays are created and linked in the same way as the Combine node, but because they produce a display-only object (one that cannot be further processed), an Overlay output is always transparent to the other nodes in the line. During reduction, a node to the right of an Overlay will receive its input data from the node to the left of the Overlay. Overlay nodes can be placed anywhere in the graph.

### 8.3.4.3 Item Data



**Figure 8-13 Overlay configuration dialog**

The Overlay item takes the signals from multiple Cal Items and/or waveforms stored in the database, and collects them in a single overlaid waveform. The Overlay may be comprised of up to eight database waveforms and any number linked of input sources (graph nodes).

Item	Description
Correlation	<p>If selected, automatically aligns the waveforms before overlaying.</p> <ul style="list-style-type: none"> <li>• Quick correlation matches the 50% points of pulses' rising edges,</li> <li>• Full correlation applies the frequency domain correlation function.</li> </ul>
Overlay the following stored waveforms:	A list of database waveforms that will be included in the overlay.
Add	Adds a new waveform to the list of stored waveforms. Uses the Curve dialog to select the waveform.
Remove	Removes the current selection from the stored waveform list
Remove All	Removes all items from the stored waveform list

#### 8.3.4.4 Subdialogs

The Curve dialog as described in Section 8.1.3.4.1.

#### 8.3.4.5 Icon



### 8.4 Mixer

#### 8.4.1 Category

WAVEFORM Reduction – Hard

#### 8.4.2 Discussion

Mixers are used to perform down-conversion from high frequency narrowband signals to lower frequency signals that can be recorded by a lower bandwidth instrument. The mixer has a special role in narrowband waveform reduction, because it creates a frequency vs. time reference that can be used by this channel and by other narrowband channels that use crystal (diode) detectors (see Section 9.1).

The mixer is one of the few cal items that produces multiple output waveforms. In addition to creating a power vs. time waveform, the mixer can also generate frequency vs. time and spectrum plots. During data reduction, the power vs. time waveform is the output passed on to the next item in the signal path. Each of the output waveform types has configuration settings (Figure 8-14 and see Section 9.1), which are accessible from the Settings button on the Reduction page. Because the output waveform settings are specific to each node, they are not accessible until the mixer is added to the graph.

The mixer is also one of the few items that uses multiple characterization curves. Because the mixer combines the RF data with a variable LO source, complete characterization requires curves measured at multiple LO frequencies, spanning the range of possible LO settings. Selection of the operating LO frequency can be done manually, or by specifying an available LO instrument channel. If the mixer references an LO channel, any changes to the associated local oscillator instrument will update the current LO frequency in the mixer node.



**PVST Setup** [X]

☒ Perform half-cycle envelope calculation

☒ Reset domain to match input waveform

☒ Equalize points (resample)

Resample number of points :

**Frequency vs. Time** [X]

Computation Method

☐ Peak values ☒ Zero crossings

Settings

Minimum signal level :  (% of max)

☒ Perform SinX/X Interpolation

**Spectrum** [X]

Type

☒ Amplitude ☐ Power/Energy

Normalization

☒ Absolute ☐ Normalized

Scale

☒ Linear ☐ Log

Minimum dynamic range (dB) :

Frequency Limits

Min. Frequency (GHz) :

Max. Frequency (GHz) :

Window :  [v]

**Figure 8-14 Settings dialogs for mixer output waveforms**

### 8.4.3 Item Data

**Figure 8-15 Mixer configuration dialog**

Item	Description
LO Source	Source of the LO frequency and power values (defaults to user specified)
Frequency (GHz)	Current local oscillator frequency.
Power (dBm)	Current local oscillator power.
Frequency position:	High if the LO setting is above the RF frequency, Low if below.
Curve @ LO =	Local oscillator frequency associated with the specified characterization curve
Curve	Activates the Curve dialog for specifying a characterization waveform.

#### 8.4.3.1 Subdialogs

The Curve dialog as described in Section 8.1.3.4.1.

#### **8.4.4 Icon**



### **8.5 Direct Write**

#### **8.5.1 Category**

WAVEFORM Reduction – Soft

#### **8.5.2 Discussion**

A Direct Write item is used to generate power vs time and frequency vs time data for narrowband signal paths that have no detector (i.e., no mixer or crystal). The Direct Write item is identical to a lossless Mixer with the LO set to 0 Hz (see Sections 8.4 and 9.1).

#### **8.5.3 Icon**



### **8.6 Crystal (diode detector)**

#### **8.6.1 Category**

WAVEFORM Reduction – Hard

#### **8.6.2 Discussion**

Crystals are used to convert a high frequency RF signal to an envelope of that signal, which can then be recorded on a low bandwidth instrument. They are only available for use with channels that are configured for narrowband signals. Because crystals convert signals to an envelope, they do not include any frequency information and therefore rely on an external frequency source for data reduction (see Section 9.1). Crystals are characterized by one or more power vs voltage (dBm, log(V)) curves collected at fixed frequencies. During data reduction, the voltage envelope is converted to a power envelope (RMS power in Watts).

8.6.3 Item Data

Crystal: xtal2

Crystal

Reduction

Name :

xtal2

Description :

Settings

1

GHz

Curve

Polarity :

Positive

●

Negative

The "Signal Class" of the channel's "Reduction" page must be "NarrowBand" to perform data reduction for the "Crystal"

OK

Cancel

Apply

Help

Figure 8-16 Crystal configuration dialog

Item	Description
Frequency	Specifies the frequency of the associated curve. Allows a list of frequencies, each having a unique reduction curve. New frequencies are entered into the list when you tab out of the Frequency edit field. To delete a frequency from the list, simply blank out the number, then tab out of the field.
Curve	Activates the Curve dialog for specifying a characterization waveform at the given frequency.
Polarity	Specifies the crystal polarity. Any signal content that has opposite polarity to that specified here will be set to zero during data reduction.

8.6.4 Icon



8.7 Sensors

8.7.1 Category

WAVEFORM Reduction - Hard

8.7.2 Discussion

The Sensor Cal Item (along with the Probe) is the typical hardware item at the end of the signal path. As such, it provides the final conversion to physical quantities during data reduction. Sensor hardware is

specified by first selecting the Sensor Class, which specifies the desired output quantities. Once the class is selected, the user interface builds a list of supported hardware for that class. Depending on the class, the user may also specify Transmission Line parameters. Changes to sensor type or transmission line type will automatically update the interface with the appropriate configuration parameters.

#### 8.7.2.1 Sensor reduction formulae

This section provides the reduction equations for each supported sensor type and transmission line type. The first section contains the supported conversion units, followed by constants used in the formulae, and the constitutive equations.

**Signal Classes:**

Narrowband	(RF)
Wideband	(UWB)

**Sensor Classes: (units)****Field sensors:**

Power Density	(W/cm <sup>2</sup> )
E-Field	(V/m)
B-Field	(T)

**Transmission line sensors:**

In Line Power	(W)
In Line Volts	(V)
In Line Amps	(A)

**Sensor Types:**

		Sensor class (no TM line)	Sensor class (with TM line)
<b>Field sensors:</b>	<b>Signal class</b>		
1. D-dot	RF, UWB	PD, E, B	V, I, P
2. B-dot	RF, UWB	PD, E, B	V, I, P
3. Self-integrating E-sensor	RF, UWB	PD, E, B	V, I, P
4. Open ended waveguide	RF	PD, E, B	NA
5. General Antenna	RF, UWB	PD, E, B	NA
6. Voltage divider	RF, UWB	NA	V, I, P
7. Current tap off	RF, UWB	NA	V, I, P
8. General coupler	RF	NA	P

Transmission line types:	Signal class	Sensor class	Sensor type
None	RF, UWB	PD, E, B	1,2,3,4,5
TEM coaxial	RF, UWB	V, I, P	1,2,3
TEM Strip/grnd	RF, UWB	V, I, P	1,2,3
TEM Parallel strips	RF, UWB	V, I, P	1,2,3
TM01 circular	RF	P	2
TE11circular	RF	P	2
TE10 rectangular	RF	P	1,2,3
Direct monitor	RF, UWB	V, I, P	6,7,8

#### Constants:

Permeability of Vacuum (Henry / meter)

$$\mu_0 = 4\pi \times 10^{-7}$$

Impedance of Free Space ( $\Omega$ )

$$\eta_0 = 376.730$$

Speed of Light (meter / second)

$$c = 2.997925 \times 10^8$$

Permittivity of Vacuum (Farad / meter)

$$\epsilon_0 = 8.854 \times 10^{-12}$$

Free Space

$$V = IZ$$

$$\frac{dP}{dA} = \frac{E^2}{\eta} \times 10^{-4} = \frac{(cB)^2}{\eta} \times 10^{-4}$$

Transmission Line

$$E = cB$$

$$P = VI = \frac{V^2}{Z} = I^2Z$$

#### D-Dot – Direct Write

Constitutive equation:

$$E(t) = \frac{1}{\varepsilon_r \varepsilon_0 A_{eq}} \left[ \frac{1}{2\pi F_c R} V_{out}(t) + \frac{1}{R} \int V_{out}(t) dt \right]$$

where

$\varepsilon_r$  = relative permittivity

R = sensor impedance ( $\Omega$ )

$A_{eq}$  = sensor equivalent area ( $m^2$ )

$F_c$  = cutoff frequency (3dB bandwidth) (Hz)  
 $\cong \sqrt{10^{16}/A_{eq}}$

Required parameters:

R ( $\Omega$ ),  $A_{eq}$  ( $m^2$ ),  $\varepsilon_r$ ,  $V_{out}(t)$  (V)

Output Units: Volts/meter

#### D-Dot – Detected

Constitutive equation:

$$E(t) = \frac{\sqrt{50P_{out}(t)}}{\varepsilon_r \varepsilon_0 Z_0 A_{eq} 2\pi F(t)}$$

Required parameters:

$Z_0$  ( $\Omega$ ),  $A_{eq}$  ( $m^2$ ),  $\varepsilon_r$ , F(t) (Hz),  $P_{out}(t)$  ( $W_{rms}$ )

Output Units: Volts/meter (rms)

#### B-dot – Direct Write

Constitutive equation:

$$B(t) = \frac{1}{A_{eq}} \int V_{out}(t) dt$$

Required parameters:

$A_{eq}$  ( $m^2$ ),  $V_{out}(t)$  (V)

Output Units: Tesla

#### B-Dot – Detected

Constitutive equation:

$$B(t) = \frac{\sqrt{50P_{out}(t)}}{A_{eq} 2\pi F(t)}$$

Required parameters:

$A_{eq}$  ( $m^2$ ), F(t) (Hz),  $P_{out}(t)$  ( $W_{rms}$ )

Output Units: Tesla (rms)

#### Self-integrating E sensor – Direct Write

Constitutive equation:

$$E(t) = \frac{V_{out}(t)}{\varepsilon_r h_{eq}}$$

Required parameters:

$h_{eq}$  (meters),  $\varepsilon_r$ ,  $V_{out}(t)$  (V)

Output Units: Volts/meter

#### Self-integrating E sensor – Detected

Constitutive equation:

$$E(t) = \frac{\sqrt{50P_{out}(t)}}{\varepsilon_r h_{eq}}$$

Required parameters:

$h_{eq}$  (meters),  $\varepsilon_r$ ,  $P_{out}(t)$  ( $W_{rms}$ )

Output Units: Volts/meter

#### Open-Ended Waveguide – Detected (only)

Constitutive equation:

$$\frac{dP}{dA}(t) = \frac{P_{out}(t)}{A_{eff} \times 10^4} \quad A_{eff} = A_{geom} 10^{\frac{5-2.74f}{10}}$$

$$A_{geom} = wh \quad f_c = \frac{c}{2w}$$

Required parameters:

$P_{out}(t)$  ( $W_{rms}$ ), F(t) (Hz)

Output Units: ( $W/cm^2$ )(rms)



### Waveguide List

Size	Height (m)	Width (m)
WR975	.1238	.2477
WR650	.0826	.1651
WR430	.0546	.1092
WR284	3.61	.0721
WR187	.0237	.0475
WR137	.01740	.0348
WR90	.01143	.0229

### General Antenna – Direct Write

Constitutive equation:

$$E(t) = \frac{V_{out}(t) \sqrt{\frac{\eta_0}{50}} \times 100}{\sqrt{A_{eff}}}$$

$$A_{eff} = 10^{\left(\frac{A_{eff}(dB)}{10}\right)}$$

Required parameters:

$V_{out}(t)$  (V),  $A_{eff}$  (cm<sup>2</sup>)

Output Units: (V/m)

### General Antenna – Detected

Constitutive equation:

$$\frac{dP}{dA}(t) = \frac{P_{out}(t)}{A_{eff}}, A_{eff} = 10^{\left(\frac{A_{eff}(dB)}{10}\right)}$$

Required parameters:

$P_{out}(t)$  (W<sub>rms</sub>),  $A_{eff}$  (cm<sup>2</sup>)

Output Units: (W/cm<sup>2</sup>)(rms)

### Voltage Divider – Direct Write

Constitutive equation:

$$V(t) = \frac{V_{out}(t)}{C}, C_{mult} = 10^{\left(\frac{C_{dB}}{20}\right)}$$

Required parameters:

$V_{out}(t)$  (V), C

Output Units: Volts

### Voltage Divider – Detected

Constitutive equation:

$$V(t) = \frac{\sqrt{50P_{out}(t)}}{C}, C_{mult} = 10^{\left(\frac{C_{dB}}{20}\right)}$$

Required parameters:

$P_{out}(t)$  (W<sub>rms</sub>), C

Output Units: (volts)(rms)

### Current Tap Off – Direct Write

Constitutive equation:

$$V(t) = \frac{V_{out}(t)}{C}, C_{mult} = 10^{\left(\frac{C_{dB}}{20}\right)}$$

Required parameters:

$V_{out}(t)$  (V), C( $\Omega$ )

Output Units: Amps

### Current Tap Off – Detected

Constitutive equation:

$$I(t) = \frac{\sqrt{50P_{out}(t)}}{C}, C_{mult} = 10^{\left(\frac{C_{dB}}{20}\right)}$$

Required parameters:

$P_{out}(t)$  (W<sub>rms</sub>), C( $\Omega$ )

Output Units: Amps

### General Coupler – Detected (only)

Constitutive equation:

$$P(t) = \frac{P_{out}(t)}{C}, C_{mult} = 10^{\left(\frac{C_{dB}}{20}\right)}$$

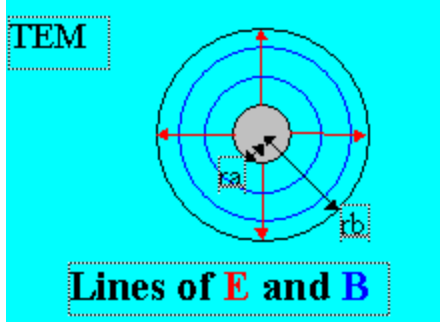
Required parameters:

$P_{out}(t)$  (W<sub>rms</sub>), C

Output Units: (watts)(rms)

## Transmission Line Formulae

### TEM coaxial line



Constitutive equation:

$$V(E) = -r_b \ln\left(\frac{r_a}{r_b}\right) E$$

$$I(B) = \frac{2\pi r_b}{\mu_0} B$$

$$Z = \frac{59.95}{\sqrt{\epsilon_r}} \ln\left(\frac{r_a}{r_b}\right)$$

Required parameters:

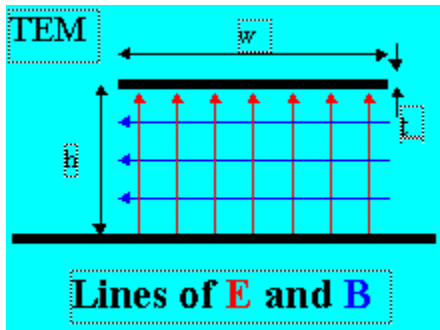
$r_a$  (radius of center conductor in meters),

$r_b$  (radius of center conductor in meters),

$\epsilon_r$ , and either E(t) or B(t) from sensor.

Output Units: either V(t) (volts) or I(t) (Amps)

### TEM Strip over a ground plane



Constitutive equation:

$$V(E) = hE$$

$$I(B) = \frac{\pi w}{\mu_0} B$$

$$Z = \frac{60}{\sqrt{\epsilon_r}} \ln\left(\frac{6}{u} + \frac{2\pi - 6}{u} e^{-\left(\left(\frac{30.666}{u}\right)^{0.7528}\right)} + \sqrt{1 + \left(\frac{2}{u}\right)^2}\right)$$

where

$$u = \frac{w}{h} + \frac{t}{\pi h} \ln\left(1 + \frac{h}{t} \frac{4e}{\coth^2(\sqrt{6.517w/h})}\right)$$

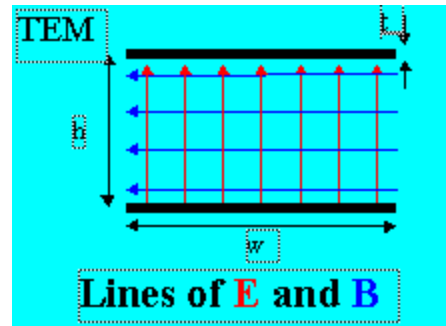
Required parameters:

$h$  (meters),  $w$  (meters),  $t$  (meters),

$\epsilon_r$ , and either E(t) or B(t) from sensor.

Output Units: either V(t) (volts) or I(t) (Amps)

### TEM parallel strips



Constitutive equation:

$$V(E) = hE$$

$$I(B) = \frac{\pi w}{\mu_0} B$$

$$Z = \frac{120}{\sqrt{\epsilon_r}} \ln\left(\frac{6}{u} + \frac{2\pi - 6}{u} e^{-\left(\left(\frac{30.666}{u}\right)^{0.7528}\right)} + \sqrt{1 + \left(\frac{2}{u}\right)^2}\right)$$

where

$$u = \frac{2w}{h} + \frac{2t}{\pi h} \ln \left( 1 + \frac{2h}{t} \frac{4e}{\coth^2(\sqrt{2 \times 6.517w/h})} \right)$$

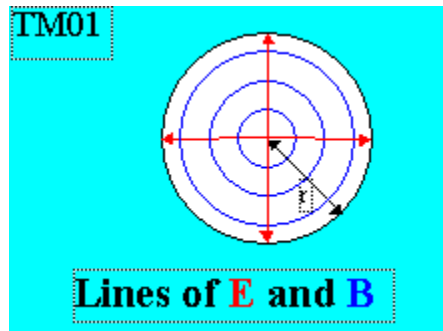
Required parameters:

h (meters), w (meters), t (meters),

$\epsilon_r$ , and either E(t) or B(t) from sensor.

Output Units: either V(t) (volts) or I(t) (Amps)

### TM01 Circular Waveguide



Constitutive equation:

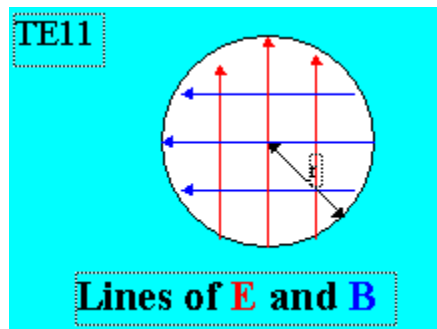
$$P = 7.4948 \times 10^{14} (Br)^2 \sqrt{1 - \left( \frac{2.405c}{2\pi fr} \right)^2}$$

Required parameters:

r (meters), f (Hz), and B(t) from sensor.

Output Units: P(watts) (rms)

### TE11 Circular Waveguide



Constitutive equation:

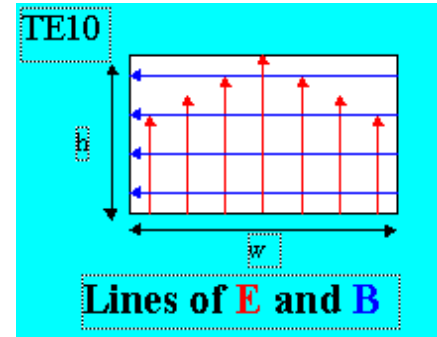
$$P = 3.4234 \times 10^{-2} (r^2 B f)^2 \times \sqrt{1 - (1.84118c/2\pi r f)^2}$$

Required parameters:

r (meters), f (Hz), and B(t) from sensor.

Output Units: P(watts) (rms)

### TE10 Rectangular Waveguide



Constitutive equation:

$$P = \frac{hwE^2}{2\eta} \sqrt{1 - \left( \frac{c}{2fw} \right)^2}$$

$$P = \frac{hw\eta}{2} \left( \frac{B_y}{\mu} \right)^2 \frac{1}{\sqrt{1 - \left( \frac{c}{2fw} \right)^2}}$$

Required parameters:

h (meters), w (meters), f (Hz),

$\epsilon_r$ , and either E(t) or B(t) (rms) from sensor.

Output Units: P (watts) (rms)

### 8.7.3 Item Data

The screenshot shows the 'Sensor' dialog box. The 'Name' field is set to 'AD-70'. The 'Description' field is empty. The 'Sensor Class' is set to 'Power Density (W/cm^2)'. The 'Delay' is set to '0 ns'. The 'Sensor' is set to 'ACD-type D-dot Sensor'. The 'Transmission Line' is set to 'Type: None'. The 'Equiv. Area (m^2)' is set to '.001'. The 'Impedance (Ohms)' is set to '100'. The 'Bandwidth (Hz)' is set to '3.162 G'. The 'N/A' checkbox is unchecked. The 'Curve' button is visible. The 'x-position', 'y-position', and 'z-position' are all set to '0'. The 'Relative Permittivity' is set to '1'. The 'OK', 'Cancel', 'Apply', and 'Help' buttons are at the bottom.

**Figure 8-17 Sensor dialog**

The sensor item can be configured to simulate many different classes and types of sensors. The Sensor Class must be selected to configure the desired output units, and the Sensor Type must be selected to best describe the actual sensor in the acquisition line. Some sensor types are defined parametrically, while others use a characterization curve.

Item	Description
Sensor Class	Desired output units for the reduced waveform
Delay	Signal propagation delay through the sensor
Sensor Type	Available sensor types (d-dot, b-dot, antenna, etc.)
Sensor parameters	Parameter list dependent on the selected sensor type
Curve	Specifies a characterization curve, for sensor types that require one
Transmission Line Type	Available transmission lines (circular, rectangular, etc.)
Transmission parameters	Parameter list dependent on the selected transmission line type

Relative Permittivity	$\epsilon_r$ in the formulas above, is the ratio of the associated dielectric permittivity to the vacuum permittivity ( $\epsilon_0$ ). Also known as <i>dielectric constant</i> .
-----------------------	--

### 8.7.3.1 Subdialogs

The Curve dialog as described in Section 8.1.3.4.1.

### 8.7.4 Icon



## 8.8 Time Shift

### 8.8.1 Category

WAVEFORM Reduction – Soft

### 8.8.2 Discussion

Time Shift modifies the waveform's X data by adding the specified shift value. This item is intended for use with time domain waveforms.

### 8.8.3 Item Data

**Figure 8-18. Waveform to Single Point dialog**

The waveform shift value is specified in nanoseconds.

### 8.8.4 Icon



## 8.9 User Process

### 8.9.1 Category

WAVEFORM Reduction - Soft

### 8.9.2 Discussion

The User Process Cal Item gives the user the ability to specify custom processing as part of the data reduction sequence. This Cal Item does not represent a physical signal line device.

When the User Processing Definition button is selected, the Process Data dialog is activated. The dialog contains standard calculator functions and many other waveform-processing functions. A list of processing operations can then be specified. These operations will be applied during reduction in the order listed. The Process Data dialog is also available in Analyze and contains the same processing functions. The processing list used by this item is simply a macro list, identical to those created in Analyze.

When a new User Process item is created, the Process Data dialog will start on the Macro tab. Press the Record-Start button, then select individual operations (on the other tabs) to add to the list. When you are done adding operations, press Record-Stop or simply close the Process Data dialog. If the cal item already contains a list of operations, the Process Data dialog will start up in record mode, with the current list of operations displayed. See 6.5.9 for more information on the Process Data dialog and creating macros.

An analogous cal item, Image Process, is available for automatically processing image data.

### 8.9.3 Item Data

User Processing: integ

Item Data

Name/Description

Name: integ

Description: integral with baseline offset

Titles

X Title: [ ] X Units: [ ]

Y Title: [ ] Y Units: [ ]

User Processing Definition

OK Cancel Apply Help

Figure 8-19 User Process dialog

Item	Description
X Title	Displayed x axis title for the reduced waveform
Y Title	Displayed y axis title for the reduced waveform
X Units	Displayed x units for the reduced waveform
Y Units	Displayed y units for the reduced waveform
User Processing Definition	Activates the Process Data dialog, which defines various waveform math functions that are used to apply to the input waveform.

#### 8.9.3.1 Subdialogs

This item uses the same Process Waveform dialog used for manual processing, see Section 6.5.9.

### 8.9.4 Icon



## 8.10 Waveform Branch

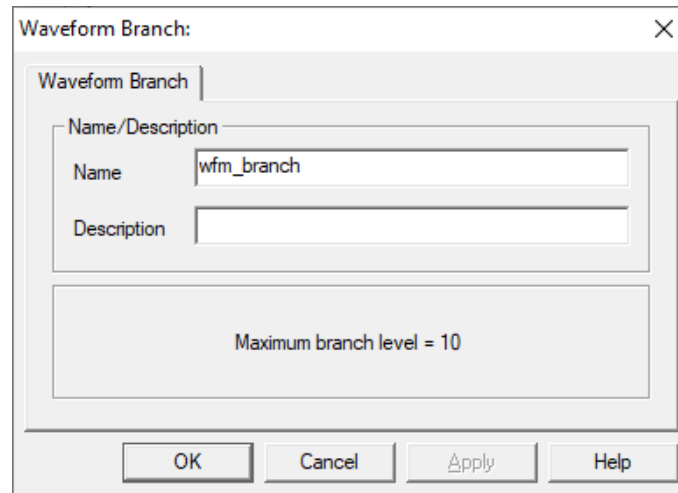
### 8.10.1 Category

WAVEFORM Reduction – Soft.

### 8.10.2 Discussion

Waveform Branch nodes create multiple copies of their input during reduction, to produce multiple outputs for further processing. They are used to perform multiple computations on the same data. If desired, the various branches can then be recombined later using a Combine node. Waveform Branch nodes are added and linked in the same way as Adder nodes (see section 8.3.1.2).

### 8.10.3 Item Data



**Figure 8-20 Waveform branch dialog**

The Waveform Branch cal item requires no configuration beyond a unique name.

### 8.10.4 Icon



## 8.11 Waveform Builder

### 8.11.1 Category

WAVEFORM Reduction – Soft.

### 8.11.2 Discussion

The Waveform Builder collects single point data over multiple shots and produces a waveform with the collected points. This item is designed to follow a Waveform to Single item in the graph. The Waveform to Single node converts a waveform to a single value on each shot (see Section 8.12), then the Waveform Builder compiles those values over multiple shots.



### 8.11.3 Item Data

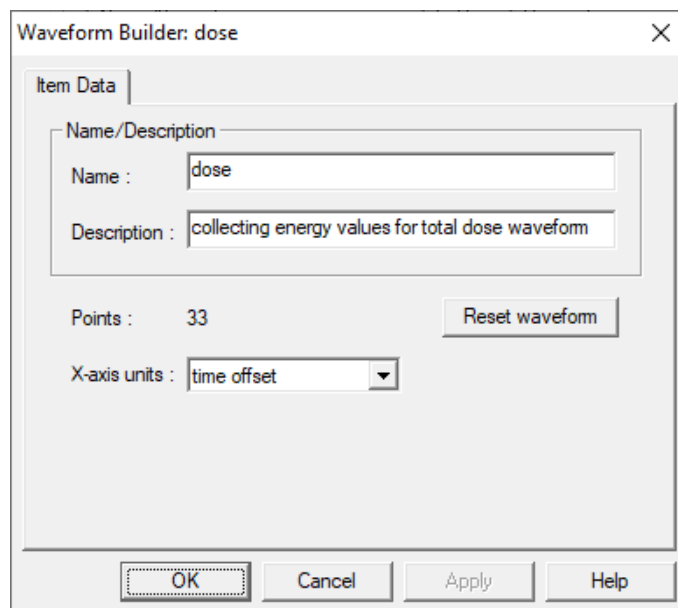
The image shows a software dialog box titled "Waveform Builder: dose". It has a tab labeled "Item Data". Inside the tab, there is a "Name/Description" section with two text input fields: "Name" containing "dose" and "Description" containing "collecting energy values for total dose waveform". Below these fields, there is a "Points" label followed by the value "33" and a "Reset waveform" button. Further down, there is an "X-axis units" label followed by a dropdown menu currently showing "time offset". At the bottom of the dialog are four buttons: "OK", "Cancel", "Apply", and "Help".

Figure 8-21 Waveform builder dialog

Item	Description
Points	Displays the current number of points compiled by this item.
Reset	Removes all points from the compilation waveform
X-axis units	Specifies the value to use for the x axis data – point index (0,1,2,...), shot number, or time offset. If time offset is selected, the x values represent the time difference from the acquisition time of the first point to the acquisition time of the current point.

### 8.11.4 Icon



## 8.12 Waveform to Single

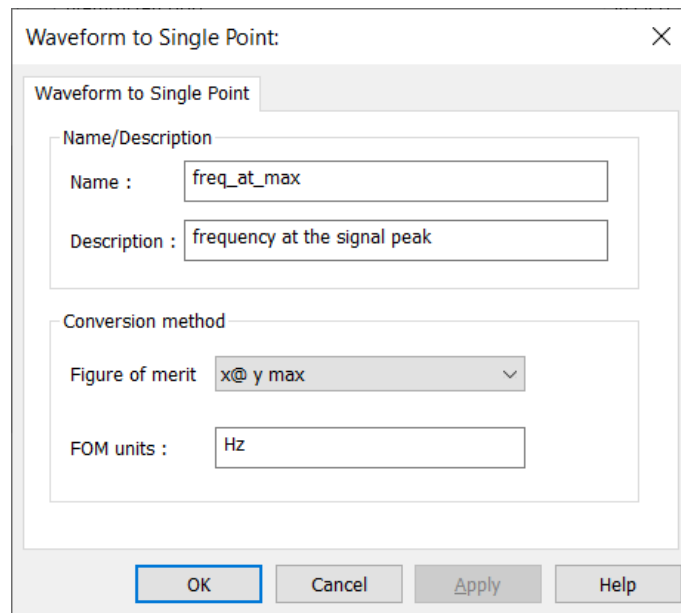
### 8.12.1 Category

WAVEFORM Reduction – Soft

### 8.12.2 Discussion

Waveform to Single converts an input waveform to an output single-point waveform. The conversion is performed by calculating the specified figure of merit (FOM) on the input data.

### 8.12.3 Dialog



The dialog box is titled "Waveform to Single Point:" and has a close button (X) in the top right corner. It contains two main sections: "Name/Description" and "Conversion method".

**Name/Description:**

- Name :
- Description :

**Conversion method:**

- Figure of merit :
- FOM units :

At the bottom, there are four buttons: "OK", "Cancel", "Apply", and "Help".

**Figure 8-22 Waveform to Single Point dialog**

The conversion is specified by selecting a FOM to calculate. Output units are not automatically determined by the selected FOM and must be specified manually.

### 8.12.4 Icon



## 8.13 Image Combine

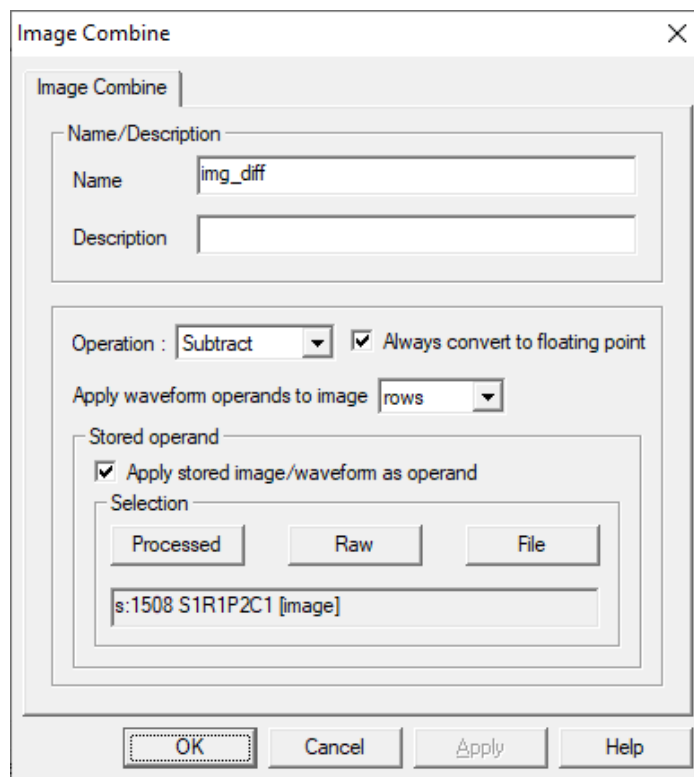
### 8.13.1 Category

IMAGE Reduction - Soft

### 8.13.2 Discussion

This cal item produces an output image that is the simple arithmetic combination of two input images. The images may be added, subtracted, multiplied or divided. The first operand image is taken from the image item node to the left of the combine node. The second image operand may be either another item node, a raw or processed image stored in the DAAAC database, or an image stored in a file. All operations are performed in the intersection domain of the two operands, i.e., no operation is performed in domains where only one operand exists.

### 8.13.3 Item Data



**Figure 8-23 Image Combine dialog**

Item	Description
Operation	The operator used to combine the input images – add, subtract, multiply or divide.
Always convert to floating-point	If either operand has floating point data, the operation will be performed using floating point values. If this option is checked, the operation will always be performed using floating point data, regardless of the input data types.
Apply stored image as operand	Checking this box indicates that the second operand will be a stored image. The operand will then be selected using the Processed, Raw, or File button.
Processed	Open the Waveform Selection dialog to select a processed image as the second combine operand.
Raw	Open the Waveform Selection dialog to select a raw image to be selected as the second combine operand.
File	Image file input is not yet supported.
Stored operand	Displays the title of the selected stored operand.

### 8.13.3.1 Subdialogs

Waveform Selection dialog. See Main manual, Section 3.4.

### 8.13.4 Icon



## 8.14 Image Divider

### 8.14.1 Category

IMAGE Reduction - Soft

### 8.14.2 Discussion

This item splits a single input image into multiple output images. The image may be deinterlaced, in which case the node produces two output images: one from the even-numbered image pixel rows and one from the odd-numbered rows. The other option is to segment the image by independently defined quadrants into four separate images.

### 8.14.3 Item Data

Image Divider

Image Divider

Name/Description

Name: rectdiv

Description: rectangular division

Divider Settings

Division type: Rectangular

Rotation (degrees): 0

Number of regions: 4

☒ Use default region sizes

Region definition

Region: 1

Left: 0 Top: 0 Right: 0 Bottom: 0

(all units in pixels)

OK Cancel Apply Help

Figure 8-24 Image Divider dialog

Item	Description
Division Type:	Select between Deinterlacing or quadrants (Rectangular). With Rectangular selected, Rotation, Use default region sizes, and Region are enabled. Left, Right, Top and Bottom may also be enabled. With Deinterlacing selected, all other controls are disabled.
Rotation (degrees):	For rectangular division, the image can be rotated before it is divided.
Number of regions:	Number of output images. This value is fixed at 4 if the division type is Rectangular and 2 if the type is Deinterlacing.
Use default region sizes	If the Rectangular division type is selected, this control determines if the selected regions are to be divided automatically by segmenting the input image in half vertically and horizontally, or if each region is to be independently specified by selecting the left, right, top and bottom pixel limits.
Region:	If the Division Type: is Rectangular and Use default region sizes is disabled, this control selects the region to which the values entered in Left, Right, Top, and Bottom are to be applied.
Left, Right, Top, Bottom	Specifies the image bounds for the selected region.

#### **8.14.4 Icon**



### **8.15 ND Filter**

#### **8.15.1 Category**

IMAGE Reduction - Soft

#### **8.15.2 Discussion**

This item represents neutral density filters, and applies the specified linear or log factor to each of the image's Z values.

### 8.15.3 Item Data

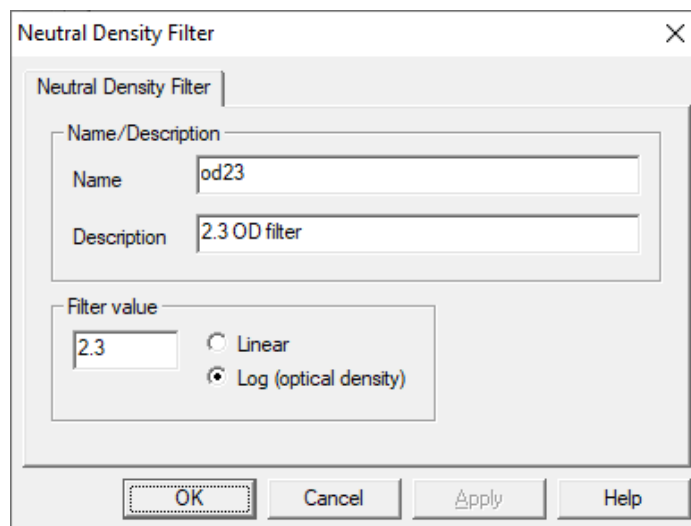
A screenshot of the 'Neutral Density Filter' dialog box. The dialog has a title bar with a close button. Inside, there's a section titled 'Neutral Density Filter' with a sub-section 'Name/Description' containing 'Name' (value: 'od23') and 'Description' (value: '2.3 OD filter'). Below this is a 'Filter value' section with a text box containing '2.3' and two radio buttons: 'Linear' (unselected) and 'Log (optical density)' (selected). At the bottom are four buttons: 'OK', 'Cancel', 'Apply', and 'Help'.

Figure 8-25 Neutral Density Filter dialog

Item	Description
Filter Value	The scale factor to apply to all Z values
Linear / Log (optical density)	Filter value is linear or log scale. If optical density (OD) is specified, the filter value will be converted to a linear value ( $= 10^{OD}$ ) before being applied to the image values.

### 8.15.4 Icon



## 8.16 Image Process

### 8.16.1 Category

IMAGE Reduction - Soft

### 8.16.2 Discussion

The Image Process item produces a single output image by applying a user-defined list of operations (macro) to the input. Operations may include filtering, transforming and color adjustment. The available processing operations are identical to those that can be applied manually in Analyze, using the Image Process dialog (see Section 6.5.10).

### 8.16.3 Item Data

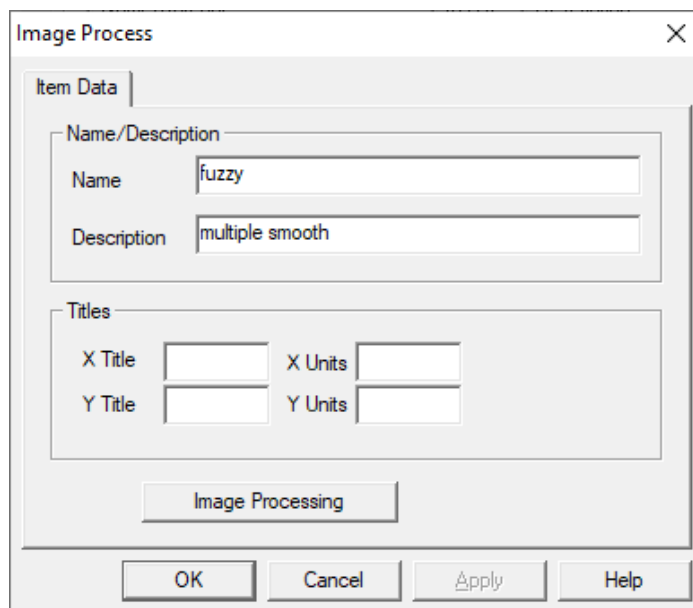


Figure 8-26 Image Process dialog

Item	Description
X Title	Horizontal axis title
X Units	Horizontal axis units
Y Title	Vertical axis title
Y Units	Vertical axis units
Image Processing	Opens the Process Image dialog, to define the processing steps.

#### 8.16.3.1 Subdialogs

This item uses the same Process Image dialog used for manual processing. See section 6.5.10.

### 8.16.4 Icon



## 8.17 Image to Contour

### 8.17.1 Category

IMAGE Reduction - Soft

### 8.17.2 Discussion

This item converts the input image to and output contour plot. The contour plot represents boundaries of values in the input image and can serve as a crude edge detector. Contour boundaries are defined by:

- Custom list of levels. The custom list may be initiated by performing a level range configuration, then copying them to the List of Levels using Create List. The list may then be edited.
- Level Range. Define a uniform series of levels by specifying a minimum and maximum value, a step size and a count of the levels.
- Automatically. Distribute the specified number of boundaries uniformly over the value range of the image.

### 8.17.3 Item Data

**Figure 8-27 Image to Contour dialog**

The dialog is used to specify the contour level boundaries. For all methods of specification, a count of the number of levels must be provided. Boundaries may then be specified by placing custom and independent levels into a list, specifying a value range over which to uniformly distribute the levels or allowing the node to automatically and uniformly distribute the specified number of boundaries over the image's value range.

Item	Description
List of levels	When selected, individual, specific contour levels may be manually entered into the list of contour levels to display. With this control selected, +, - and X are enabled. Min, Max, Step and Create List are disabled.



+, -, X	<p>These controls are enabled only when List of levels is selected. They are used to edit the list of labels in the associated list box. The list box may be initially populated by automatically defining a Level Rand, then clicking Create List to move the uniform level distribution to the list box.</p> <p>+ Add the current level to the list.</p> <p>- Remove the currently selected level from the list.</p> <p>X Remove all list entries.</p>
Level range	When selected, a range of contour levels, from Min to Max incremented by Step, may be created. Selecting this option disables +, - and X. Min, Max, Step and Create List are enabled.
Min	Enter the minimum contour level to display. This is enabled only when Level range is selected. Adjusting this value will adjust Step to keep the combination of Min, Max, Step and Levels consistent.
Max	Enter the maximum contour level to display. This is enabled only when Level range is selected. Adjusting this value will adjust Step to keep the combination of Min, Max, Step and Levels consistent.
Step	Enter the increment value for the number of Levels to plot. This is enabled only when Level range is selected. Adjusting this value will adjust Levels to keep the combination of Min, Max, Step and Levels consistent.
Levels	Enter the number of levels to plot for the increment value entered in Step. In Level range mode, adjusting this value will adjust Step to keep the combination of Min, Max, Step and Levels consistent.
Create List	Use this button to generate a uniform list of levels in the List of levels list box, using Min, Max, Step and Levels to compute the values. This is enabled only when Level range is selected.
Auto scale	When selected, the program will create a default range of levels for the number of contours (approximately) for the value entered in the Levels field. This selection disables +, -, X, Min, Max and Step.

#### 8.17.4 Icon



## 8.18 Image to Waveform

### 8.18.1 Category

IMAGE Reduction - Soft

### 8.18.2 Discussion

This item converts an image to a waveform, by extracting a single image row or column, or by combining multiple selected image rows or columns. If multiple columns or rows are selected, a user specified operator is used to combine the multi-selection into a single output waveform.

Because this item converts image data to waveform data, all graph nodes to the left of the item must process image data while all graph nodes to the right of the item must process waveform data.

### 8.18.3 Item Data

Figure 8-28 Image to Waveform dialog

Item	Description
Single column	Output is a single image column. Enter the column number to extract. If Entire column is checked, all values from that column are used. If not checked, specify the row begin and end range.
Single row	Output is a single image row. Enter the row number to extract. If Entire row is checked, all values from that row are used. If not checked, enter the column begin and end range.
Multi column	The output is the combination of multiple columns. Enter the begin to end columns to process. If Entire column is checked, all values from the selected columns are used. If not selected, enter row begin and end range. Select the operation to combine the columns into a single output waveform.

Multi row	The output is the combination of multiple columns. Enter the begin to end columns to process. If Entire column is checked, all values from the selected columns are used. If not selected, enter column begin and end range. Select the operation to combine the rows into a single output waveform.
Average	average data values over the selected rows or columns – not implemented
Sum	sum data values over the selected rows or columns
Integrate	integrate data values over the selected rows or columns – not implemented
Column Begin, End	Specifies the range of columns to use for multi-column selection, or a partial row for row selection.
Row Begin, End	Specifies the range of rows to use for multi-row selection, or a partial column for column selection.
All columns / rows	Specifies that all columns (or rows) should be processed when using multi-column (or multi-row) selection.
Entire column / row	Specifies that the entire column (or row) should be extracted when using column (or row) selection.
Selection graphic	Displays the type of image selection specified using the other controls. Note that if partial rows or columns are selected, the graphic does not indicate the exact ranges.

#### **8.18.4 Icon**



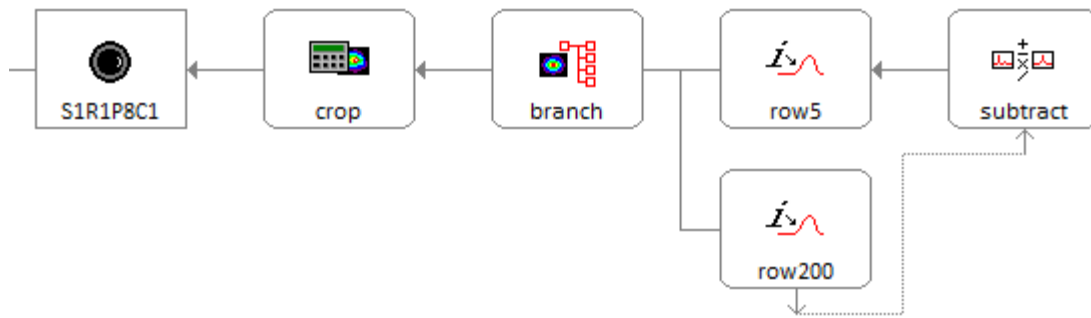
### **8.19 Image Branch**

#### **8.19.1 Category**

IMAGE Reduction - Soft

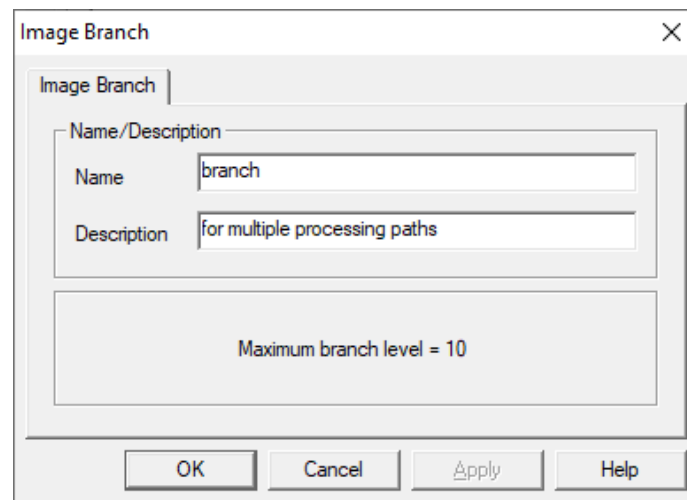
#### **8.19.2 Discussion**

Image Branch nodes create multiple copies of their input during reduction, to produce multiple outputs for further processing. They are used to perform multiple computations on the same data. If desired, the various branches can then be recombined later using a Combine node. Image Branch nodes are added and linked in the same way as Adder nodes (see section 8.3.1.2).



**Figure 8-29. Branching image data**

### 8.19.3 Item Data



**Figure 8-30 Image Branch dialog**

The dialog has no controls other than name and description. The maximum number of branches, including the primary output, is fixed at 10.

### 8.19.4 Icon



# 9 Data Reduction

The TestMan module and its signal path graph can be used to automate the data reduction process, converting data recorded at the instruments to measured fields and quantities at the sensor inputs. Data is processed according to its signal class, which is specified in each channel node (Reduction tab of the Channel node dialog). The supported signal classes are described in Table 9-1 below and the following sections.

**Table 9-1- Data reduction signal classes**

Signal Class	Recording devices	Application
Narrowband	Digitizer, oscilloscope	For time domain waveforms with content at a single frequency at each point in time, but possibly with frequency changes over time.
Wideband	Digitizer, oscilloscope	For time domain waveforms with content at multiple frequencies.
Image	Camera	For image data.
Frequency Sweep	Spectrum Analyzer, Network Analyzer	For frequency domain waveforms.

In all cases, reduction begins with the raw data collected at the recording instrument and proceeds left to right through the graph, reversing the effects of each signal path component. Raw data channels are reduced in the order that they are read from the instruments, independent of the channel order in the graph. After all signal paths have been processed, additional reduction passes are performed as necessary to process graph nodes that combine multiple data sources (e.g., Combine and Overlay items).

## 9.1 Narrowband

Narrowband data is a time domain RF waveform that has a single characteristic frequency at any point in time. That frequency, however, may change over time. The reduction process therefore requires the determination of the associated frequencies over the waveform's time domain. This frequency vs time (FvsT) information is obtain from a recording channel that uses Direct Write or Mixer detection, by calculating the frequency at each half-cycle of the raw RF signal. The FvsT waveform is then used by that channel and other channels to look up the appropriate conversion values. Several specialized settings and cal items are used in the reduction of narrowband RF data, as described below.

### Signal Line (Channel node)

When the signal class is specified as Narrowband in the channel node, the following reduction settings apply to the entire signal path (see also Section 4.4.6.1.2).

Narrowband settings:

- Frequency source – source of the frequency to be used when performing any reduction that requires knowledge of the frequency at a particular point in time. Possible sources of this frequency information are:
  - User specified global constant (see Section 4.7.8.2, Global Data Reduction Parameters)
  - User specified constant unique to each narrowband channel
  - Frequency vs. Time waveform generated from this channel
  - Frequency vs. Time waveform generated from some other channel

Frequency vs. Time waveforms can be generated by: (1) narrowband channels that contain a Mixer or Direct Write item in their signal path; (2) narrowband channels with no detector (which implies direct write recording).

- Min, max, default frequency – limits and defaults used during reduction
- Time offset – when performing an FvsT lookup, this value is used to account for time offsets between a channel and its associated FvsT source channel. Typically, this value represents timing differences between the raw waveforms on the FvsT and reduction channels. The specified time offset will be subtracted from the reduction channel's x-axis values before performing the FvsT lookup. Note that any time shifting introduced by signal path hardware (e.g., cables) is not applied when looking up frequencies. The hardware time shifts are instead accumulated during the reduction and only applied to the final output waveforms. However, time shifts applied by soft items (e.g., x-axis shift in a User Process node) do affect the FvsT lookup and may need to be accounted for using this parameter.

**Table 9-2- Sources for narrowband reduction frequency**

Channel / Data type	Frequency type	Notes
Narrowband, signal path includes a Mixer or Direct Write node	FvsT, fixed value	Mixer & Direct Write reduction settings allow selection of FvsT or Peak of Spectrum as the reduction frequency, with several calculation options.
Narrowband, no detector	FvsT	Calculated using times between the peak values of each cycle
Frequency Sweep	fixed value	uses the frequency of the peak value
Narrowband, single point	fixed value	assumes the single value is a frequency

### Mixer

Item settings:

- Local oscillator frequency, frequency position (high or low), and power. Frequency and power can be user specified or obtained from an appropriate instrument in Acquire. The LO power setting is not used in the data reduction process.
- Multiple gain vs. IF curves. Each curve corresponds to a specified LO frequency.

Outputs:

1. Power vs. Time. Power vs. Time is sent to the next node in the reduction sequence. Includes options for half-cycle envelope calculation, domain adjustment, and resampling. Note the assumption of 50  $\Omega$  termination in these formulas.
  - i. Half-cycle ON – calculated the peak value of the voltage at each waveform half-cycle. Convert the half cycle peaks to RMS voltage, then average power using
 
$$V_{rms} = V_{peak}/\sqrt{2}; P_{avg} = V_{rms}^2/50.$$
  - ii. Half-cycle OFF – convert each voltage point to instantaneous power using  $V^2/50$
2. Frequency vs. Time. Includes options for computation method (peaks or zero-crossings), threshold, and resampling.
3. Uncorrected Spectrum. Includes options for spectrum type (amplitude, power), scaling, axis clipping, and FFT windowing.
4. Corrected Spectrum. Same as Uncorrected, but with the LO frequency applied.

Other reduction settings:

- The FvsT data for reference by other channels can be selected as either the full frequency vs. time computation, or the peak frequency from the spectrum.

FvsT computation options specified in a Mixer node will also be applied to the computation of the FvsT data generated from the associated raw waveform, if the channel is specified as an FvsT source.

### Direct Write

The Direct Write component is a “soft” item that creates a power envelope from a direct write voltage vs time signal. It can also generate a frequency vs time and/or spectrum waveform that can be used as a frequency reference for narrowband reduction channels. This item is equivalent to a lossless mixer with LO frequency = 0.

Item settings:

None

Outputs:

1. Power vs Time.
2. Frequency vs. Time,
3. Spectrum

Other reduction settings:

- Same as those in the mixer item. FvsT reference is selected as either the full frequency vs. time computation or the peak frequency from the spectrum.

FvsT computation options specified in a Direct Write node will also be applied to the computation of the FvsT data generated from the associated raw waveform, if the channel is specified as an FvsT source.

### Crystal

Settings:

- Multiple power (dBm) vs. voltage (log(V)) curves. Each curve corresponds to one signal frequency.
- Polarity (positive or negative)

Outputs:

1. Power vs Time. Input voltages are converted to power by looking up the values in the supplied curves. Linear extrapolation is used if the voltage is outside the curve domain. Interpolation between curves is used if the current frequency falls between the associated frequencies of the crystal's curves.

## Sensor

### Settings:

Settings depend on the selected sensor type and may include specification of physical dimensions (e.g. for a B-dot, D-dot, or waveguide) and/or characterization curves (e.g. for a general antenna). The required characterization parameters and conversion formulae for each sensor type are listed in Section 8.7.

### Outputs:

1. Corrected. Output units are selectable and the choices depend on the selected sensor type. Sensor reduction algorithms are implemented for both detected (*mixer*, *crystal*, or *direct write* node in the line – items that convert voltage to power) and direct (narrowband with no conversion to power, and wideband) cases – see Table 9-3 below. Note that the detected sensor reduction algorithms do not distinguish between *average* and *instantaneous* input power (e.g., the D-dot algorithm always uses the formula  $V = \sqrt{50P(t)}$  to convert power to voltage), so the output levels are also *average* or *instantaneous*.

**Table 9-3- Sensor input signal types**

signal class	“detector” item	options	sensor input	reduction method
narrowband	mixer	half-cycle ON	avg. power	detected
narrowband	mixer	half-cycle OFF	inst. power	detected
narrowband	crystal		avg. power	detected
narrowband	direct write	half-cycle ON	avg. power	detected
narrowband	direct write	half-cycle OFF	inst. power	detected
narrowband	none		inst. voltage	direct
wideband	none		voltage	direct

## 9.2 Wideband

Wideband data is a time domain waveform that has broad frequency content. Reduction of this data type is performed in the frequency domain. The raw time domain waveform is first converted to its frequency domain representation (magnitude, phase). That waveform is then convolved with each signal path component's frequency domain characterization curve. These characterization curves typically specify gain as a function of frequency and may also include phase as a function of frequency. Before displaying the reduction outputs, the data is converted back to the time domain.



## Signal Line (Channel node)

When the signal class is specified as Wideband in the channel node, the following reduction settings apply to the entire signal path (see also Section 4.4.6.1.1).

Wideband settings:

- Reduce in the frequency domain. When selected, the raw data is converted from time domain to frequency domain and all component characterization curves are applied in the frequency domain. If not selected, each component's gain at DC (0 Hz) is used to generate a scalar value that is applied to the time domain waveform. If the component curve does not include a value at 0 Hz, the curve value at the lowest frequency is used.
- Low pass filter. If specified, a low pass filter is applied to the magnitude component of each signal path item's characterization curve, before the curve is applied to the acquisition waveform. The low pass filter is used to prevent over-amplification of any high frequency noise present in the acquisition waveform.

## Characterization curves

Most signal path items that represent hardware are characterized by a gain vs frequency curve. These curves are often obtained using a network analyzer, and will include either magnitude or magnitude, phase data at each measured frequency. Note that the following limitations apply when using characterization curves to reduce acquisition data:

- Expected units. Characterization curves used to reduce wideband data should be in the form of magnitude (dB) vs frequency (Hz) or magnitude, phase (dB, radians) vs frequency (Hz).
- Interpolation and extrapolation. If the raw data and characterization data do not have the same frequency values, the characterization curves will be interpolated to the frequency values of the raw data. If a raw data frequency value is outside the domain of the characterization curve, the curve value at the nearest endpoint will be used (extrapolation is not used).
- Phase data. The preferred method for collecting phase data for cables is to "dial out" the electrical delay (the linear component of the phase) on the network analyzer before recording the characterization curve. This creates a phase curve with no wrapping that contains only the residual phase vs frequency – the information that will be used to correct for dispersion effects in the time domain waveform. The dialed out delay should then be entered in the cable's delay field. If the only available curve includes wrapped phase data, it can be unwrapped in the Analyze module (see Section 6.5.9.2.7), then stored as processed data. The data reduction process will not attempt to unwrap phase data. If the phase includes the unwrapped linear component, it can be used to automatically determine the cable delay (see cable options in Section 8.1.3.3.1).

## 9.3 Image

Image data is typically produced by monochrome, 12-bit to 16-bit cameras. The image data reduction process in DAAAC primarily supports reduction using soft items (e.g., image user process). In addition, row and column data can be extracted from the image, resulting in outputs that can be processed using waveform soft items.

## **9.4 Frequency Sweep**

Frequency Sweep data is collected on a device that produces frequency domain waveforms, such as a spectrum analyzer or network analyzer. It is reduced using the same method as wideband data (Section 9.2), without the conversions between time and frequency domains.

# 10 Figures of Merit (FOMs)

This section presents the available FOMs for waveform and image data (Table 10-1 and Table 10-2). Both tables include columns for the FOM name, description, and parameters. Parameters are exposed to the user in TestMan to allow the FOM calculation to be configured. In Analyze, the parameter values are fixed, using values specified in the tables below. The waveform FOM table also includes a Waveform Type column, which describes the expected waveform shape for application of the FOM. Although the FOM calculations may be applied to any type of waveform, they often have meaning only for specific waveform types.

Note that the following terms are used interchangeably in the FOM descriptions below:

## **Independent data**

- X Value
- Horizontal Value
- Independent Value
- Time
- Position

## **Dependent data**

- Y Value
- Vertical Value
- Dependent Value
- Level

**Table 10-1- DAAAC Figures of Merit (FOMs) for Waveforms**

<b><u>FOM</u></b>	<b><u>Description</u></b>	<b><u>Parameters</u></b>	<b><u>Waveform Type</u></b>
avg pulse height	Find the average pulse height by averaging the maximum value from each pulse in a multi-pulse waveform. For each pulse, the search starts when the signal rises above the high threshold. It stops at the next point detected below the low threshold.	Fixed: high threshold: 50% of Y max low threshold: 10% of Y max	Pulse train
baseline	The average Y value of the points at the specified percentage of the start (left side) of the waveform.	% Record Length: Percentage of the number of waveform points used to compute the average. Fixed: % Record Length = 5.0	Single pulse or pulse train
base-top	Difference between the waveform top and baseline, where <i>baseline</i> is the average of the first <i>n</i> points of the waveform that are within Low × Absolute Max of the baseline, and <i>top</i> is the average of the first <i>m</i> points of absolute value greater than High × Absolute Max. <i>Absolute Max</i> is either Y max or Y min, whichever is of greater magnitude.	Fixed Low = 0.02 High = 0.98	Single pulse
centroid	Given by $\sum(X_i Y_i) / \sum(Y_i)$	None	All
decay slope	The slope of a linear fit of the points between Max % and Min % of Y max as the waveform falls from Y max.	Fixed Min = 30.0 Max = 90.0	Positive single pulse
discrete integral	The sum of all Y values and the linearly interpolated Y values at the given interval between the points.	Period – the X-axis interval for interpolated points between the waveform values.	Reduced waveforms
domain	The span of the independent axis. Given as $X_{\max} - X_{\min}$ .	None	All

falltime	The time it takes the signal to fall from a high threshold to a low threshold. Calculated as the time between the first transition of the low threshold after a transition of the high threshold, and the high transition that immediately precedes the low transition.	Start threshold (% of peak): the low signal value at which the time calculation starts. Stop threshold (% of peak): the high signal value at which the time calculation ends. Fixed: Start threshold = 10.0% Stop threshold = 90.0%	Single pulse
Kurtosis	The fourth moment of a distribution (related to the distribution's tails). Calculates the <i>excess kurtosis</i> .	None	All
max pulse height	In a multi-pulse waveform, finds the pulse with the highest peak value and returns that peak value. For each pulse, the search starts when the signal rises above the high threshold. It stops at the next point detected below the low threshold.	Fixed: high threshold: $0.5 \times Y_{\max}$ low threshold: $0.1 \times Y_{\max}$	Pulse train
max/domain	$Y_{\max}$ / domain ( $Y_{\max}$ as defined below, <i>domain</i> as defined above).	None	All
mean	The mean Y value over all waveform points. $\frac{1}{n} \sum y$	None	All
min pulse height	In a multi-pulse waveform, finds the pulse with the lowest peak value and returns that peak value. For each pulse, the search starts when the signal rises above the high threshold. It stops at the next point detected below the low threshold.	Fixed: high threshold = $0.5 \times Y_{\max}$ low threshold = $0.1 \times Y_{\max}$	Pulse train
off scale	Set by instrument drivers if the raw data is off-scale. Not user-selectable.	None	Raw Waveforms
peak avg.	The average of all Y values that lie between the first signal crossing from below to above the threshold and the last signal crossing from above to below the threshold. Stops searching for threshold transitions when the signal goes below threshold/2.	Threshold: Percentage of peak value Fixed: Threshold = 50.0%	Single pulse

peak-peak	The range between the minimum and maximum waveform dependent values.	None	All
pulse avg.	The average of all Y values that lie between the first time the signal is at or above the threshold and the last time the signal is at or above the threshold. See Section 0	Threshold: Percentage of peak value Fixed: Threshold = 10.0%	Single pulse
pulse center	The location of the midpoint between the pulse start and stop, where start and stop are based on the level transitions across the specified threshold. See Section 0	Threshold (% of peak)	Single pulse
pulse count	Count the number of positive peaks in a pulse train. A pulse is distinguished by signal that rises above the high threshold and then falls below the low threshold.	Fixed: Low threshold = $0.1 \times Y_{\max}$ High threshold = $0.5 \times Y_{\max}$	Bipolar periodic or positive pulse train.
pulse start	The location of the level transition at the specified threshold, before the waveform peak location. See Section 0	Threshold (% of peak)	Single pulse
pulse top	Compute the average of all Y data between two user-specified time values (requires user knowledge of the pulse domain).	Start time: X position of the left-most point in the average. Stop time: X position of the right-most point in the average.	Reduced waveforms, single pulse or any pulse within a pulse train.
pulse width	The pulse duration, with the pulse start and stop based on level transition times at the specified threshold. See Section 0	Threshold: Percentage (of peak value)	Single pulse
rise 0-cross	The location of the 0-crossing nearest to and before the waveform peak. Does not perform a line fit / extrapolation – requires the data to cross the level 0.0	None	Single pulse

rise intercept	The x-axis intercept of a linear fit of the first series of points between 10% and 90% of $Y_{\max}$ as the waveform rises to $Y_{\max}$ .	Fixed: High threshold = $0.9 \times Y_{\max}$ Low threshold = $0.1 \times Y_{\max}$	Positive single pulse or first pulse in a positive pulse train
rise slope	The slope of a linear fit of the first series of points between 10% and 90% of $Y_{\max}$ as the waveform rises to $Y_{\max}$ .	Fixed: High threshold = $0.9 \times Y_{\max}$ Low threshold = $0.1 \times Y_{\max}$	Positive single pulse or first pulse in a positive pulse train
risetime	The time it takes the signal to change from low threshold (% of peak) to high threshold (% of peak). Peak may be $Y_{\max}$ or $Y_{\min}$ . This FOM is the time between the first high threshold transition and the low threshold transition that immediately precedes the high threshold transition.	Start threshold (% of peak): the low signal value at which the time calculation starts. Stop threshold (% of peak): the high signal value at which the time calculation ends. Fixed: start threshold = 10.0% stop threshold = 90.0%	Positive single pulse
rms	Root mean square, given by $\sqrt{\frac{1}{n} \sum y_i^2}$ where $n$ is the number of points.	None	All
skewness	The 3 <sup>rd</sup> moment of a probability distribution. A measure of the asymmetry about the mean.	None	All
slope	The slope of the line fit to all waveform points.	None	All
std dev.	Standard deviation, $\sqrt{\frac{1}{n-1} \sum (y_i - \bar{y})^2}$ (using Bessel's correction), where $n$ is the number of points	None	All
std. dev. Pulse height	The standard deviation of the pulse heights in a pulse train. See also max pulse height, min pulse height.	Fixed: high threshold: $0.5 \times Y_{\max}$ low threshold: $0.1 \times Y_{\max}$	Positive pulse train
sum	The sum of all Y values	None	All
total area	The numeric integral of the waveform (trapezoidal method).	None	All

total dose	See the discrete integral FOM		Reduced waveforms
x intercept	The x-intercept of the line fit to all waveform points	None	All
X max	The maximum waveform independent value.	None	All
X min	The minimum waveform independent value.	None	All
x @ y max	The horizontal position (independent value) at the first occurrence of the maximum dependent value.	None	All
x @ y	The interpolated position of the first (left-most) occurrence of the specified Y value in the waveform. If the value is not found, the right-most X position ( $X_{\max}$ ) will be returned.	Y value (absolute or % of peak): The dependent value to search for.	Reduced waveforms
Y max	The maximum waveform dependent (vertical) value.	None	All
Y min	The minimum waveform dependent (vertical) value.	None	All
Y @ point	The y value at the given point index	0-based point index	Reduced waveforms
y @ x max	The dependent value at the position of the first occurrence of the $X_{\max}$ value (typically the last point of the waveform).	None	All
Y neg	The difference between the baseline and $Y_{\min}$ . ( <i>baseline</i> defined above.)	None	Single pulse
Y pos	The difference between $Y_{\max}$ and the baseline. ( <i>baseline</i> defined above.)	None	Single pulse

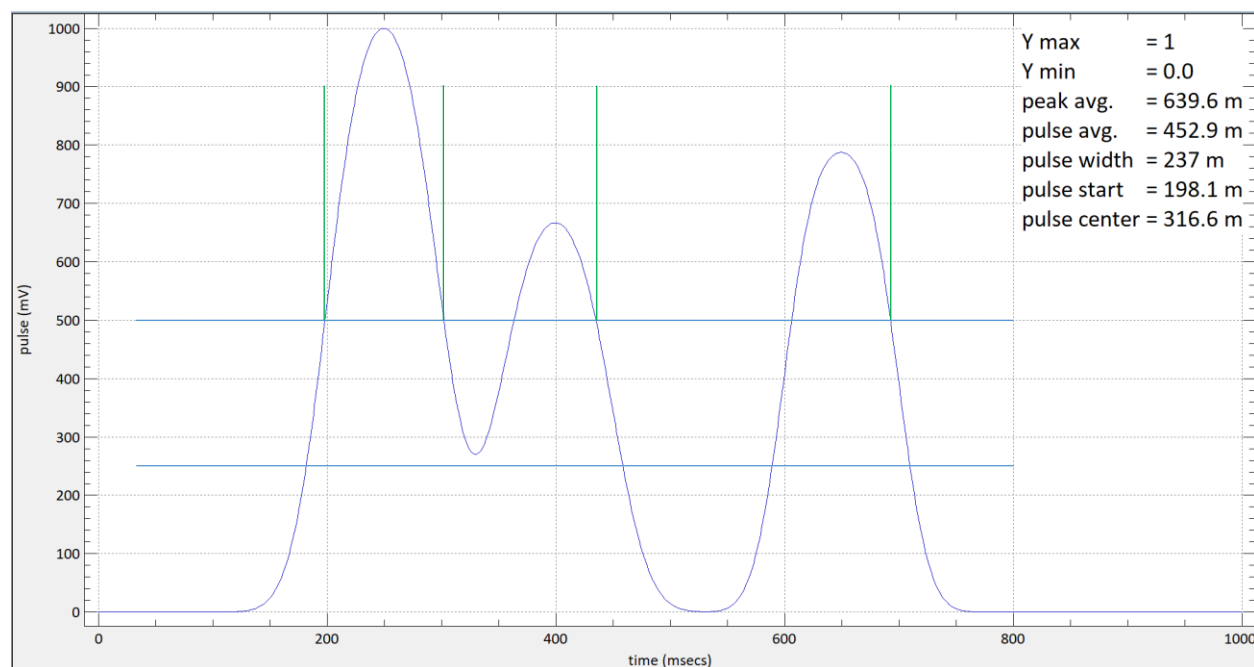


## 10.1 Pulse domain calculations

Determination of the pulse boundaries is different for the various FOMs. The following method is used for the peak avg, pulse center, pulse start, and pulse width FOMs:

1. Determine the location of the waveform's peak value;
2. Find the pulse start – move left from the peak location, recording the location of the level transition (high to low) across the specified threshold. If there are multiple transitions, use the transition location that is most distant from the peak;
3. Stop searching for the pulse start when the level drops below half the threshold;
4. Find the pulse end – move right from the peak location, recording the location of the level transition (high to low) across the specified threshold. If there are multiple transitions, use the transition location that is most distant from the peak;
5. Stop searching for the pulse end when the level drops below half the threshold;

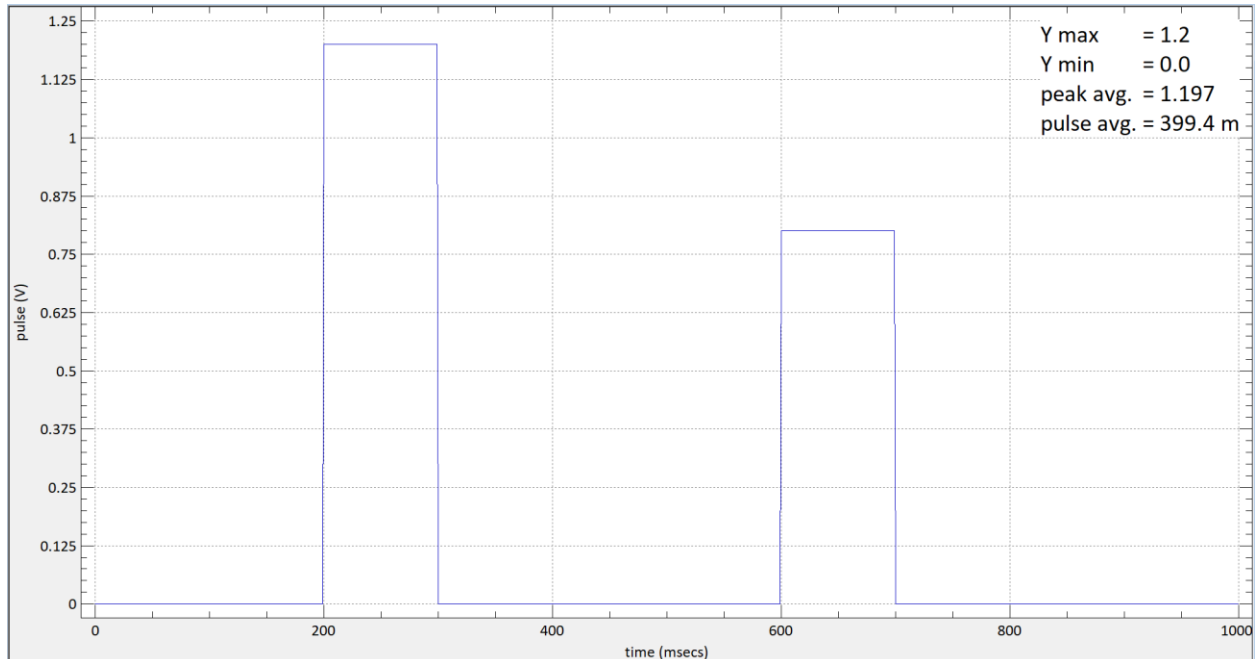
For example, refer to the waveform in Figure 10-1. The threshold is 500mV (50% of peak) and the peak value is located at 250ms. Moving left from the peak finds a single threshold transition at 198ms. Moving right, the search finds a threshold transition at ~300ms and again at 435ms. The search terminates at 460ms when the level drops below 250mV (half the threshold value), so does not record the transition at ~700ms. The pulse domain is [198ms, 435ms] for calculation of peak avg, pulse center, pulse start, and pulse width.



**Figure 10-1 Waveform with pulse FOMs**

Pulse avg performs a similar calculation to peak avg, but pulse avg uses a lower default threshold (10% for pulse avg vs 50% for peak avg), and it searches from the waveform ends towards the middle, stopping at the first location at or above the specified threshold. The pulse domain used for pulse avg will always be greater than or equal to that of peak avg. For example, refer to the waveform in Figure 10-2. Note that the peak avg only includes the pulse from 200ms to 300ms. Because the level drops to 0 between the two pulses, the transition at 700ms is not included the pulse domain calculation. Pulse

avg, on the other hand, finds the threshold transitions at the extremes of the waveform, using 200ms as the pulse start and 700ms as the pulse end. The pulse avg value is much less than the peak avg value, because pulse avg includes both the smaller pulse from 600 to 700ms and the baseline between the two pulses.



**Figure 10-2 Waveform with peak and pulse average FOMs**

**Table 10-2 - DAAAC Figures of Merit (FOMs) for Images**

<b><u>FOM</u></b>	<b><u>Description</u></b>	<b><u>Parameters</u></b>
avg beam height	This FOM is not yet implemented.	Threshold: percentage (of peak)
avg beam width	This FOM is not yet implemented.	Threshold: percentage (of peak)
beam area	The total number of image pixels above the threshold. If the X and Y axis data is scaled the FOM is also scaled by these values.	Threshold: percentage (of peak) Fixed: threshold = 50.0%
beam height	The number of pixels in the image column with the longest continuous group of pixels above the threshold. If the Y data is scaled the FOM is also scaled by these values.	Threshold: percentage (of peak) Fixed: threshold = 50.0%
beam width	The number of pixels in the image row with the longest continuous group of pixels over	Threshold: percentage (of peak) Fixed: threshold = 50.0%

	the threshold. If the X axis data is scaled the FOM is also scaled by these values.	
centroid x	The position of the horizontal center of intensity of the image. If the X axis data is scaled the FOM is also scaled. For data above the threshold, the FOM is given by: $(\sum_{(i=1..n)} Z_i \times X_i) / (\sum_{(i=1..n)} Z_i)$ where $n$ is the number of pixels over the threshold.	Threshold: percentage (of peak) Fixed: threshold = 50.0%
centroid y	The position of the vertical center of intensity of the image. If the Y axis data is scaled the FOM is also scaled. For data above the threshold, the FOM is given by: $(\sum_{(i=1..n)} Z_i \times Y_i) / (\sum_{(i=1..n)} Z_i)$ where $n$ is the number of pixels over the threshold.	Threshold: percentage (of peak) Fixed threshold = 50.0%
Strehl ratio	Voss Scientific variant of the Strehl ratio: the ratio of the inner aperture integral to the outer aperture integral	Centroid threshold: absolute or % of max pixel value inner radius: pixels or scaled value outer radius: pixels or scaled value (0 = use full image)
x @ z max	The X position of the first pixel in the image with the maximum value. The search is conducted from minimum to maximum Y position and from minimum to maximum X at each Y position.	None
y @ z max	The Y position of the first pixel in the image with the maximum value. The search is conducted from minimum to maximum Y position and from minimum to maximum X at each Y position.	None
Z max	The largest pixel value in the image.	None
Z mean	The summed value of all pixels divided by the number of pixels.	None
Z min	The smallest pixel value in the image.	None
Z std dev.	The standard deviation of all pixel values in the image.	None
Z total	The total of all pixel values in the image.	None

# 11 Software Installation

## 11.1 DAAAC Install

To install the DAAAC software under Windows 10 or 11<sup>4</sup>:

- CD – insert the CD and follow the installation program's instructions. If auto-run is disabled on your computer, run the file DAAAC-Setup.exe from the root of the CD drive.
- Download:
  - Zip file (.zip) – on the target computer, extract all files from the downloaded zip file and then run the file DAAAC-Setup.exe;
  - Self-extracting executable (.exe) – run the downloaded executable on the target computer. It will extract the installer files and launch the installer application.
- If your installer is keyed for networked installations, it will prompt you to specify the IP address of your DAAAC database server (NetCom). DAAAC can also be reconfigured for networked or standalone operation after it has been installed.

## 11.2 DAAAC License

If DAAAC is started and is unlicensed, you will be prompted to run the License Manager.

Initially, the status field will say "unauthorized". The 4-digit serial number is printed on the DAAAC installation CD or included with the download instruction email. Call with (or e-mail) the site code, and we will provide the site key. Enter the serial number and site key then select License. The message "authorization successful" should be displayed. Close the license manager - DAAAC can now be run.

The unlicensed software can be pre-installed on any number of computers (e.g., for backup purposes), but each license is valid for a single computer. Once the system is licensed, the License Manager can be used to transfer a license from computer to computer without contacting Voss Scientific:

1. From the new DAAAC computer, register the transfer (creates a transfer file on a removable or network drive);
2. Transfer the license out of the licensed computer (removing the license from that computer);
3. Transfer the license into the new computer.

DAAAC License Manager

Current License Information

Status : Unauthorized Serial Number : 1000

Authorization

Site Code : 399C EBD3 A29C 945C 78

Site Key : License

For authorization please contact Voss Scientific Inc. (Albuquerque, NM)  
voice : (505) 256-1500  
e-mail : daaac@vosssci.com

Transfer

1 Register Transfer 2 Transfer Out 3 Transfer In

Help View License Agreement Unlicense

Close

<sup>4</sup> DAAAC is a 32-bit application – its basic components will operate under 64-bit Windows operating systems, but operating system specific versions of installers to support your acquisition hardware may be required.

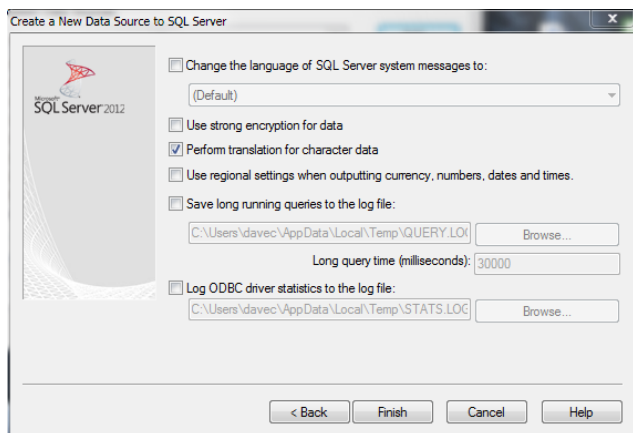
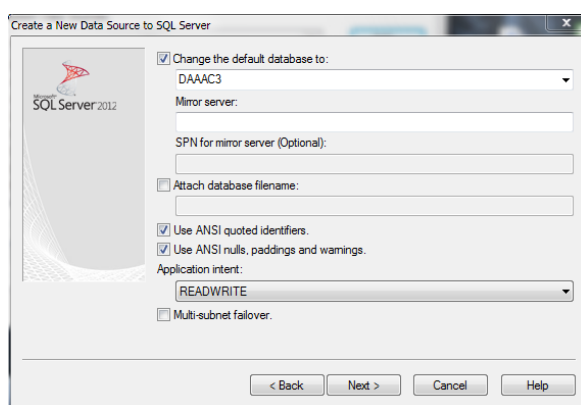
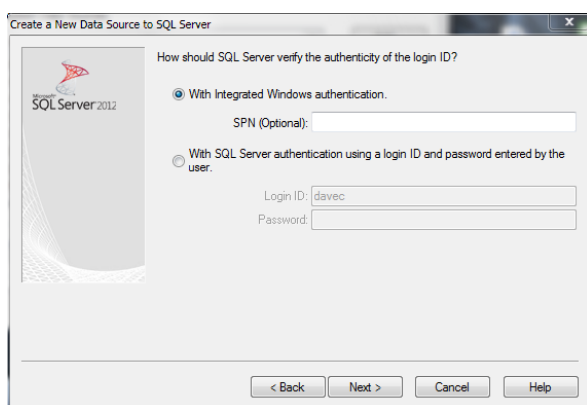
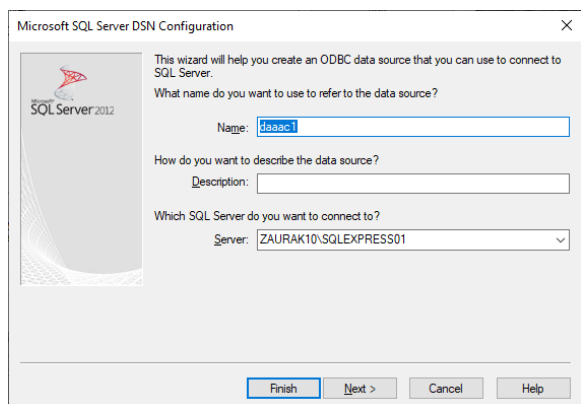
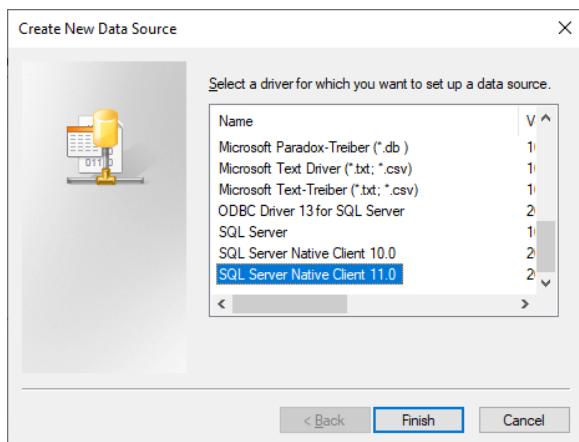
## 11.3 SQL Server Install

Microsoft SQL Server is an optional backend database for storage of DAAAC data and is used in some standalone and in all networked DAAAC installations. The following steps describe the process for configuring a DAAAC database server with SQL Server.

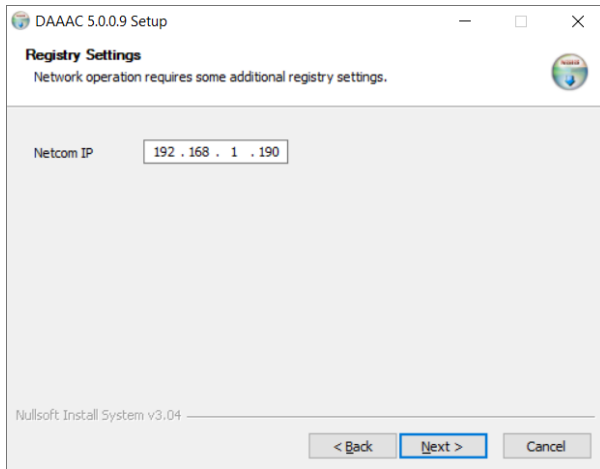
1. The database server computer (the computer running NetCom) should have its hostname set before proceeding, since it will be used later in the configuration. Changing the hostname after completing this procedure would require the user to also change the ODBC data source (step 4). Changing the IP address of the database server after completing this procedure would require changes to the Windows registry (step 6).
2. Install Microsoft SQL Server and SQL Server Management Studio.
3. In SQL Server Management Studio, create a database that: (a) is owned by the Windows login account that will be used to run the NetCom server; or (b) has a database user account for that Windows login. A database user account should at least have read, write, and admin privileges. Other privileges may be required for some operations (e.g., DDL admin for database initialization). The database can have any name.
4. Create an ODBC System DSN that uses the SQL Server driver and connects to the computer running SQL Server. The ODBC DSN should be created on the server that runs the DAAAC NetCom module, but this does not have to be the same server that runs SQL Server. The ODBC DSN architecture (32-bit vs. 64-bit) must match the calling application, DAAAC, which is presently 32-bit. The 32-bit ODBC application is C:\Windows\SysWOW64\odbcad32.exe. The data source wizard includes the following fields:
  - a. Driver – select the latest SQL Server Native Client.
  - b. Data source name – can have any name, but typically uses the same name as the database created in SQL Server (step 3 above).
  - c. Server – is the name of the SQL Server to use, often just the hostname. The hostname can be determined by running the command ‘hostname’ from a command prompt. Note: in some installations, the server name will include both the host name and an instance name (e.g., <hostname>\SQLEXPRESS). The server name used here should match the server name used to connect in SQL Server Management Studio (also shown at the top of the tree after connecting in Management Studio).
  - d. Default database – the list should show available databases; this confirms that the server name is correct<sup>5</sup>. Select the database name created in step 3 above.
  - e. After the final wizard page’s Finish button, a summary dialog will present with a Test Data Source button, which should succeed.

---

<sup>5</sup> If the DAAAC operator account does not have administrative privileges, start the ODBC application using “Run as administrator”. If the SQL Server installation does not support the administrator account, the ODBC application will not be able to connect to SQL Server. In this case the default database list will not be populated, but the database name can be manually entered. The Test Data Source step will also fail. However, the DAAAC software will still be able to access the SQL Server database when it is run from the account that was used in step 3 above.



5. Install DAAAC (see Section 11.1). On the installer's Registry Settings page, shown below, specify the IPv4 address of the computer that runs the DAAAC NetCom component (typically the acquisition computer for a single station configuration, or a dedicated database server computer for a multi-station configuration).



6. The Windows registry settings in Software\VSI\DAAAC will be configured by the DAAAC installer. These settings are used to specify either standalone (single station) or networked (multiple acquisition stations and dedicated database server) installations. In most cases manually changing these settings is neither required nor recommended. However, these settings are specific to each user (stored in the HKEY\_CURRENT\_USER section of the registry). If the software is installed under a different user account than that of the end user, these registry settings will need to be configured for the end user.

HKCU\Software\VSI\DAAAC (configured by the installation program):

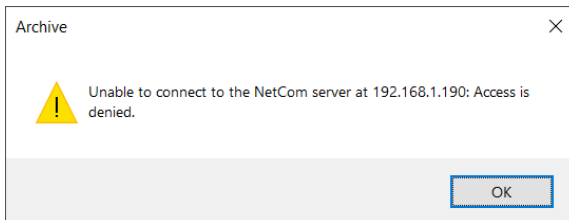
NetcomIP	IPv4 address of the NetCom server. Set to 127.0.0.1 if StandAlone = Yes.
NoNet	(Yes / No) Yes = single station installation for use with MS Access databases. No = multi-station installation, for use with MS SQL Server and/or multicast acquisition & reduction data
StandAlone	(Yes / No) Yes = local NetCom with Access database. No = NetCom is on a dedicated server connected to SQL Server.

For networked installations, the settings in Software\VSI\NetCom\Database must be manually configured on the database server (NetCom) computer. Registry settings used by the database server are shown below with their expected values:

HKCU\Software\VSI\NetCom\Database (manually configured)

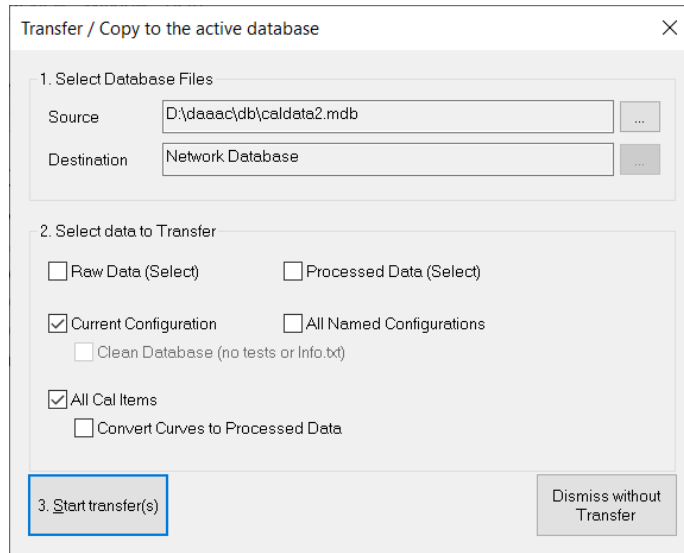
Entry	Description
DSN	Data source name specified in ODBC data source (step 4b)
TrustedConnect	(Yes / No) Database logon/connect method. Yes – use domain authentication. No – use UID & PWD registry values. TrustedConnect = Yes is recommended.
PWD	Database logon password (only used if TrustedConnect = No)
UID	Database logon user ID (only used if TrustedConnect = No)

7. Start Archive on the NetCom computer. This will launch the NetCom process in a command window. When connecting to an uninitialized database, the DAAAC modules will fail to start or will issue connection error messages (example below). Dismiss these messages, then initialize the database by selecting the menu item Tools | Administrative | Initialize Database in Archive. Select the Machine Data Source tab, then select the System DSN created in step 4 and press OK. **WARNING** – initializing a database will remove any existing data. It should only be used with empty databases. Press the Exit button in the Archive toolbar, then restart DAAAC. On restart, the DAAAC modules should successfully connect to the database.



8. [optional] From Archive, restore DAAAC configuration data from an existing standalone database. For example, to get the current configuration:
  - a. Select the File | Transfer In menu item;
  - b. In the transfer dialog, select a standalone database (.mdb file) as the transfer source;
  - c. Specify the items to transfer (e.g., Current Configuration);
  - d. Press the Start Transfer button to transfer the data.





Alternatively, use the drag-n-drop method to transfer the configuration:

- a. open a DAAAC standalone database (.mdb file) using File | Open;
- b. select the Database view from the .mdb window, then drag the Database View tree item and drop it onto the left side (tree control) of the active database window;
- c. Archive will display a confirmation dialog for the Copy Current Configuration operation, Select OK to initiate the transfer.

# 12 Database Architecture

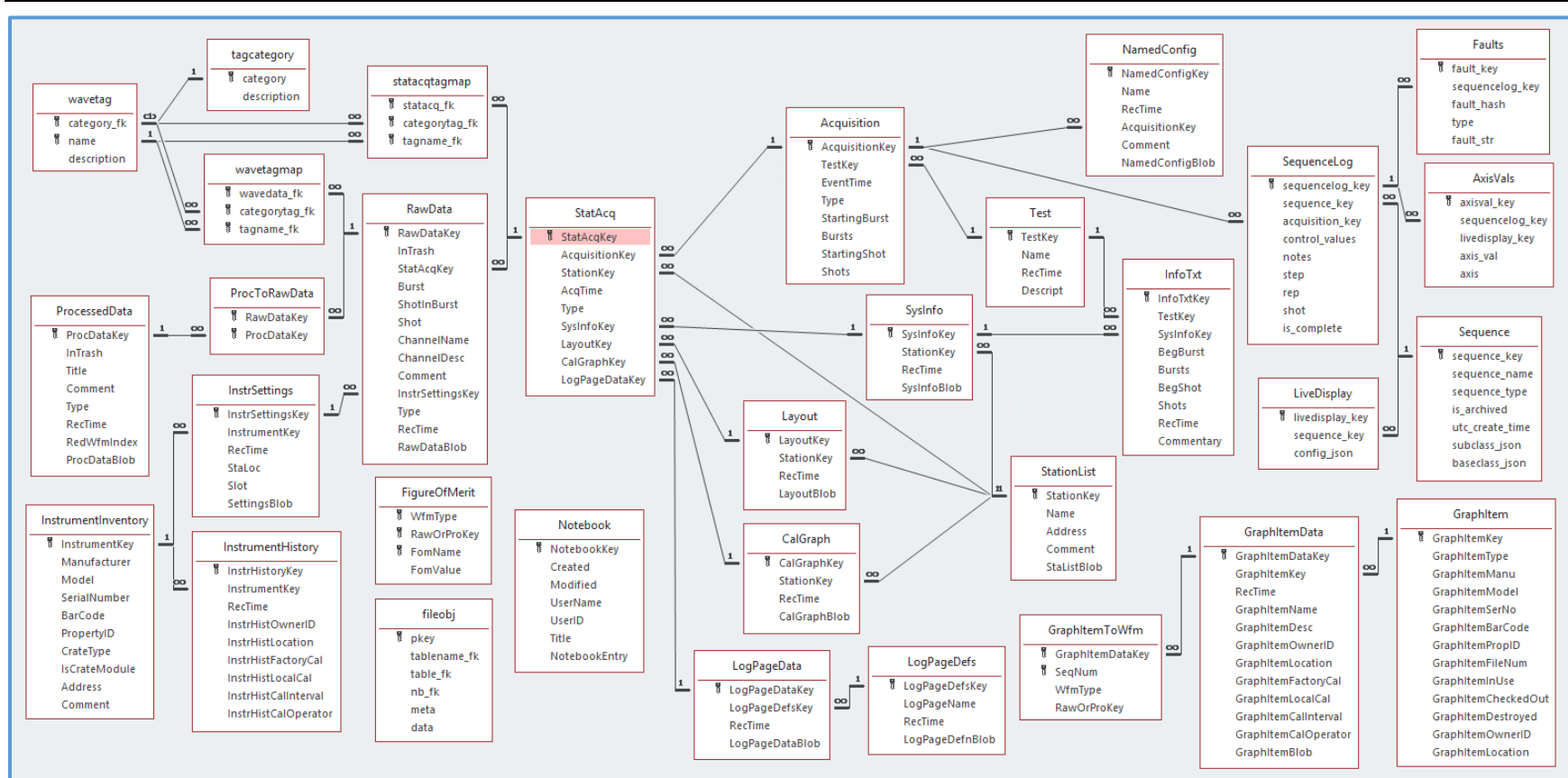


Figure 12-1 DAAAC database architecture

# 13 Glossary

**Analyze** The DAAAC module that displays and prints waveform and image data, and provides tools for examining, analyzing, and manually processing waveforms and images.

**Archive** The DAAAC module that manages databases. Archive is used to change databases, import or export data, and organize and transfer data.

**Burst** A series of acquisitions (shots) that is collected at high rates, utilizing the rapid re-arm capabilities of the acquisition hardware. See also **Shot**

**Cal Items** The DAAAC representation of the physical signal path components (e.g., sensors, attenuators, cables) and the components for automated signal processing (e.g., user process, overlay, combine).

**Cal Line** A data acquisition signal path, including all components from the recording instrument channel to the sensor. May include cal items that represent both physical components and software processes. See also **Cal Items**

**Channel** An instrument input or output port.

**Characterization data** The defining set of parameters that describes the behavior of a Cal Item within a signal line and can be used to mathematically reverse the effects of that component on the signal.

**Database** The storage location for DAAAC's configuration data and for the data acquired and calculated while running DAAAC.

**Figure of Merit (FOM)** A metric computed from waveform or image data (e.g., risetime, peak to peak, pulse width, centroid).

**Graph** The collection of signal lines in the acquisition system. Includes connection information for instruments, channels, and signal line components. See also **Node**

**Instrument** Any device that is controlled via the TestMan module. Often a device that collects and converts an analog signal into digital data, but also includes signal generators and controllable signal path hardware.

**Inventory data** Identification data that is unique for each Cal Item. Inventory data includes serial numbers, bar code numbers, model numbers, and property control numbers.

**Inventory List** The inventory of available Cal Items, organized by item type.

**Multi-Port** A cal item that represents signal line components with multiple input or output ports, such as Adders or Splitters.

**Named Configuration** A configuration that has been named and stored in the database, for later recall.

**NetCom** The DAAAC module that provides an interface between the other DAAAC modules and the database.

**Networked Installation** A system that is configured to run DAAAC components on multiple computers, typically with multiple data acquisition computers and a dedicated database computer. See also **Standalone**

**Nodes** Elements in TestMan's graph that represent the various signal line components. Each graph node represents either a station, an instrument, a channel, or a Cal Item.

**ODBC** The Object Database Connectivity application programmer's interface (API) for standardized access to database management systems.

**Operations Log (OpLog)** Auxiliary, user-defined data related to the acquisition, which is populated by an external application but stored in the DAAAC database.

**Processed waveforms / images** Data that have been modified after acquisition, manually generated, or imported.

**Raw waveforms / images** Data that have been retrieved from an instrument and have not been modified.

**Reduced waveforms / images** Data that have been generated via the reduction process. See also **Reduction**

**Reduction** The process of converting raw data (instrument units) to physical quantities of interest, using a collection of Cal Items that represent the components on the raw data's associated signal path.

**Registry** The Windows storage location for applications settings. DAAAC uses the registry for user specific settings that are not stored in the database.

**Sequence** A pre-defined series of acquisitions that can include automated changes to instrument settings between successive acquisitions.

**Shot** The unit of data acquisition across multiple instruments. A shot can represent either the entire acquisition event (single-shot), or a frame within burst acquisition. See also **Burst**

**Signal lines/paths** see **Cal Lines**.

**Standalone Installation** A system that is configured to run all DAAAC components on a single computer. See also **Networked**

**Station** A single computer that has instrumentation connected to it via communication interfaces, to form a data acquisition system.

**Test** An organizational unit for acquisition data that typically spans multiple shots and/or sequences.

**TestMan** The DAAAC module that is responsible for instrument communication, executing acquisition sequences, and performing automated data reduction.

**Trash** The cache of deleted waveforms and images. Data in the trash can be recovered.

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