Giga-tronics

Automation Xpress™

a development tool for ATE

User Guide

Take your programming to the next level

TABLE OF CONTENTS

LIST OF FIGURES

1 Introduction

1.1 Overview

Automation Xpress is an easy to use application development tool for use with Giga-tronics 24XX/25XX Series Microwave Synthesizers and Automation Xpress Interface. Automation Xpress offers fast remote operation that goes beyond just fast frequency switching.

The AXI ensures very fast remote programming using Automation Xpress from any ATE/TPS program to a 24XX/25XX series instrument, providing faster CW frequency switching time, faster overall download, and faster function execution times of large amounts of data. The transit and execution times for single function calls, such as changing CW frequency is 10 X faster than sending the command via standard message based commands. With Automation Xpress now sending large amounts of data, such as large lists, the transit and execution times are > 100X faster as compared to SCPI. This makes lengthy and repetitive tasks faster and more efficient, maximizing test throughput, while minimizing testing time and system downtime. Automation Xpress provides the tools necessary to successfully program the 24XX/25XX series. The Xpress Auto-programmer can virtually eliminate the need for training, providing programming scripts and sequences that are guaranteed for accuracy.

Automation Xpress eliminates the need for you to learn the various GPIB commands. With a click of the mouse, the Auto-Programming feature automatically records the sequence of your actions and converts those actions into program code. Auto-programming provides the option of seamlessly converting the recorded action sequence into a generated program that can be imported into to the program environment of your choice, such as Visual C++ and Visual Basic. Auto-programming generates the same results as the action sequence created manually. The value is a reduction in test downtime, reduced programming costs, and greater profitability.

The key to reducing the cost of testing is faster frequency switching. The 24XX/25XX Series Microwave Synthesizer offers unmatched frequency and power switching in list mode; however this approach may not be suitable for some remote programming situations. Automation Xpress combined with the Automation Xpress Interface option ensures unmatched 2.5 ms CW frequency and power switching performance, providing fast and flexible data exchange rates for faster testing and more device throughput.

1.2 Document Summary

This document contains Getting Started section and Automation Xpress graphic user interface window section. The Getting Started section includes the software installation and uninstallation. Automation Xpress graphic user interface window section describes the user interface windows in details. The user interface windows are Main window including menu bar, toolbar, navigation and message windows, CW window, List window, Modulation window including Amplitude Modulation, Frequency Modulation, Phase Modulation and Pulse Modulation window, Advanced Setting window, Interface window, General Info window, Command Interpreter, Auto programmer windows and Firmware Download window.

Please refer to GT2400 and 2500 Series Microwave Signal Generators Programmer Manual for the Dynamic Link library or DLL functions details.

2   Getting Started

The Automation Xpress (AX) user guide teaches you how to use and integrate Giga-tronics advanced Automation Xpress software into your programming environment. This user guide provides detailed description of the AX Graphical User Interface (GUI).

You will learn step-by-step instructions for using the Automation Xpress Auto-Programming feature for advanced programming in Visual C++.

2.1   Package Contents

The Automation Xpress software package includes the following software and documentation:
- Automation Xpress CD-ROM(Part#33478)
- USB Port Adapter and USB driver software (included in Automation Xpress CD).
- Automation Xpress User Guide (Part #33484)
- GT2400 and 2500 Series Microwave Signal Generators Programmer Manual.

The Automation Xpress CD contains everything you need to install and run the Automation Xpress application, such as the Automation Xpress Installer, the USB device, and the help document files.

For information about the software and hardware you need to use Automation Xpress, see the Install ReadMe file on the CD.

To install and run Automation Xpress software and use the USB Port adapter, you must-have the following hardware and software:

- An IBM-compatible PC
- Microsoft Windows 2000, or Window XP
- CD-ROM drive, 4X or better
- USB V.1.1 or above compliant port
- At least 20MB of disk space
- 128 MB RAM or greater recommended
- National 2400s IEEE-488.2 GPIB Interface Card

2.2 Installation and Uninstallation

To install Automation Xpress software, follow the steps below:

1. Insert the Automation Xpress CD into the CD/DVD drive.
2. Click on My Computer and select the drive with the Automation Xpress CD.
3. Double click the AX setup.exe file.

The following installation screen will appear:
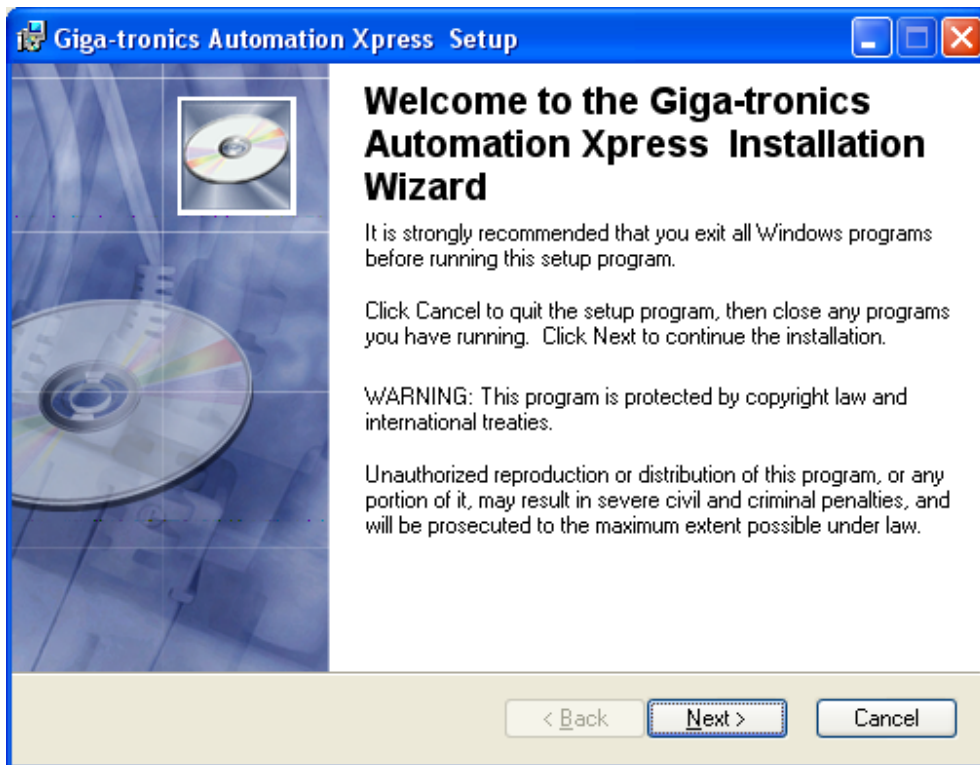
4. Click NEXT.
5. The Automation Xpress installation process will begin.
6. The Setup program begins installing the Automation Xpress software (please note that without Option 48 installed on the 2400/2500 Series, the setup program will automatically install the basic version of the Automation Xpress software).
7. In the Choose Automation Xpress destination location dialog, select the location where you want the software to be installed.
8. Click NEXT to accept the default location (recommended)
   OR
9. Enter the directory location where you want the Automation Xpress software to install and then click NEXT.
10. In the Setup Type dialog box, select the type of installation you would like to perform and then click NEXT.
- Full Setup Type installs all the required Automation Xpress files (recommended).

- Custom Setup Type allows you to choose which components you would like to install.
11. When the Automation Xpress Installation is complete, the Setup Complete dialog box appears. Click FINISH.
12. After Automation Xpress has successfully installed onto your PC, you can click FINISH or continue with the USB Driver installation.

2.3   Installing the USB Device and Drivers

The USB to Serial Cable Port Adapter provides you the simplest way to attach Notebook or Desktop computer to the 2400/2500 Series Microwave Synthesizer. This portable expansion cable directly connects to your computer via a Universal Serial (USB) port. This section of the Automation Xpress user's guide describes how to connect adapter to your computer, install software and hardware drivers, and attach and configure devices.

To use the USB Port Adapter, you must first install the USB Port Adapter driver software onto your computer. Then, you can connect it to your computer and install hardware drivers for the adapter's port(s).

WARNING: YOU MUST INSTALL THE DRIVER
SOFTWARE BEFORE CONNECTING THE
ADAPTER TO YOUR COMPUTER.
OTHERWISE THE ADAPTER WILL NOT WORK CORRECTLY.

2.3.1   Installing the USB Driver with Automation Xpress Installation

- After Automation Xpress has installed, click Install USB
- Follow the instructions for the next screens

You must restart you computer for the USB Adapter driver to function. You can restart your PC immediately or at a later time.

2.3.2   USB Driver Installation from the Automation Xpress Directory

If the USB Adapter driver was not installed at the time of the Automation Xpress installation, it can be installed from the Automation Xpress directory.

- Using the Windows Explorer, locate the Automation Xpress directory
- Select the USB Driver folder and open
- Double click on the Setup.exe file and begin the USB driver installation

2.3.3   Removing the USB Driver

Conflicts with other USB/RS-232 drivers can occur if a similar driver is already installed or is going to be installed. It is recommended that the same Make and Manufacturer USB adapter be used on your PC only. To remove the USB Adapter driver, perform the following:

- Using Windows Explorer, locate the Automation Xpress directory.

- Select the USB Driver folder and open.
- Double click on the Setup.exe file and begin the USB driver installation

The installation utility will recognize that a USB adapter has previously been installed. The installation utility will ask if you want to remove the driver.

2.3.4 Removing the USB Driver

Conflicts with other USB/RS-232 drivers can occur if a similar driver is already installed or is going to be installed. It is recommended that the same Make and Manufacturer USB adapter be used on your PC only. To remove the USB Adapter driver, perform the following:

- Using Windows Explorer, locate the Automation Xpress directory.
- Select the USB Driver folder and open.
- Double click on the Setup.exe file and begin the USB driver installation

The installation utility will recognize that a USB adapter has previously been installed. The installation utility will ask if you want to remove the driver.

2.4 Uninstall Automation Xpress

To uninstall Automation Xpress from your computer, do either following:

1. Click the WINDOWS > START button and choose SETTING > CONTROL PANEL.
2. In the control panel, click ADD/REMOVE PROGRAMS.
3. From the REMOVE PROGRAMS properties dialog box, select Automation Xpress and REMOVE.

OR

1. Insert the Automation Xpress CD into CD drive.
2. Double click on the Automation Xpress Installation program.
3. Click on the "Uninstall Giga-tronics Automation Xpress from this computer" and click NEXT continue.

2.5 Starting Automation Xpress

You start Automation Xpress just as you would any software application.

To start Automation Xpress in Windows:

1. Choose START> PROGRAMS> Gigatronics-MSS> AX. The Automation Xpress registration window will appear.

2.6 Registering Automation Xpress

Registering your software helps Giga-tronics offer technical support and inform you about new software developments. You can register quickly by using the registration screen that appears when you first start Automation Xpress. In addition, you can choose to register at any time by choosing HELP > REGISTER Automation Xpress. This registration requires that you be connected to the Internet, as it opens the Giga-tronics registration Web page. You can also register by phone, mail or email.

- Click REGISTER ONLINE, to register your Automation Xpress software online

OR

- Click REGISTER BY MAIL, to register your Automation Xpress software by mail.
- Register your software to receive notification of product updates and to be eligible for technical support.

2.6.1 Registering by mail or Fax:

- Open HELP> REGISTER BY MAIL. The Automation Xpress registration by mail dialog box appears.
- Enter your name, address, phone, and fax in the edit boxes provided, and click OK when finished.
- Click the PRINT REGISTRATION FORM button. Automation Xpress prints out a copy of your completed registration form.
- Fax the form to Giga-tronics at the number that appears on the form, or mail it to the Giga-tronics address that appears on the form.

2.7 Getting Help

Automation Xpress includes complete documentation in the Help section located on the-menu bar under Help, including all the information in this user guide, plus tutorials.

To get Help about Automation Xpress:
1. On the Automation Xpress Main window, click the HELP drop down menu.
2. The list of Help topics appears.
3. You can use the CONTENTS tab in HELP to find topics grouped by subject, or use the INDEX tab to search for information by typing in a subject, title, or specific word or phrase.
4. To return to the list of topics after reading about a specific topic, click HELP TOPICS.

2.8 Learning Automation Xpress

A variety of resources are available to help you learn Automation Xpress, including this user manual, GT2400 and 2500 Series Microwave Signal Generators Programmer Manual and a help system with tutorials you can launch from the Automation Xpress application. The Automation Xpress Help Tutorial is a series of short, lessons that focus on specific Automation Xpress features and operations, from the basics of how to create and download lists to Auto-Programming.

The Automation Xpress application contains dialog boxes and ToolTips designed to assist you in using the program. ToolTips appear when your pointer pauses over a user interface element.

2.9 Interfaces

The 2400/2500 series allow a user to remotely control the instrument from a computer through GPIB, RS-232, USB or Ethernet cables

2.9.1 GPIB

The 2400/2500 series permits data bus control in accordance with the IEEE Standard Digital Interface for Programmable Instruments, IEEE STD 488.2. Table 1, shows the IEEE 488 standard subsets that are implemented in the 2400/2500.

Table 1: Implemented IEEE 488 Subsets

Subset	Title	Implementation
SH1	Source Handshake	Complete Capability
AH1	Acceptor Handshake	Complete Capability
T8	Talker	Basic Talker
TEO	Extended Talker	No Capability
L4	Listener	Basic Listener
LEO	Extended Listener	No Capability
SRO	Service Request	Complete Capability
RL2	Remote/Local	Complete Capability
PPO	Parallel Poll	Complete Capability
DCO	Device Clear	No Capability
DTO	Device Trigger	Complete Capability
CO	Controller	No Capability

The GPIB address is assigned from the front panel of the instrument. The available range of addresses is 1 through 30.

2.9.2   RS-232

2.9.2.1   Comport Settings

The default settings for the 2400/2500 synthesizer is as follows.

Parameter	Setting
Baud Rate	115200
Data Bits	8
Parity	No
Stop Bits	1
Handshake	None

There is no manual panel control for changing any of these settings. RS-232 port settings can be changed using the Automation Xpress software or via remote commands (see SYST:COMM commands in the SCPI command section for details). All remote commands must be terminated with a line feed (ASCII character 10).

2.9.3   USB

A USB cable can be selected to remotely control the instrument. An appropriate COM port must be chosen for the USB connection.

2.9.4   Ethernet

To establish an Ethernet connection, please select an IP address.

3 Automation Xpress Graphic User Interface

This section describes the graphic user interface windows in details. The user interface windows are Main window including a menu bar, a toolbar, navigation and message windows, CW window, List window, Modulation window including Amplitude Modulation, Frequency Modulation, Phase Modulation and Pulse Modulation window, Advanced Setting window, Interface window, General Info window, Command Interpreter, Auto programmer windows and Firmware Download window.

3.1 Main Window

The Automation Xpress Main window appears automatically when the software is launched. The Main window is easy to understand and use. The Main window consists of a menu bar at the top of the work area, a toolbar below the menu bar, a large work area, a navigation window, a message display window and a status bar located at the bottom. The large work area provides an area for the multiple Automation Xpress windows to open in. The following figure shows each area of the Main window.

Menu Bar   Navigation Window   Toolbar   LED Indicators   Work Area

Figure 1 Main window
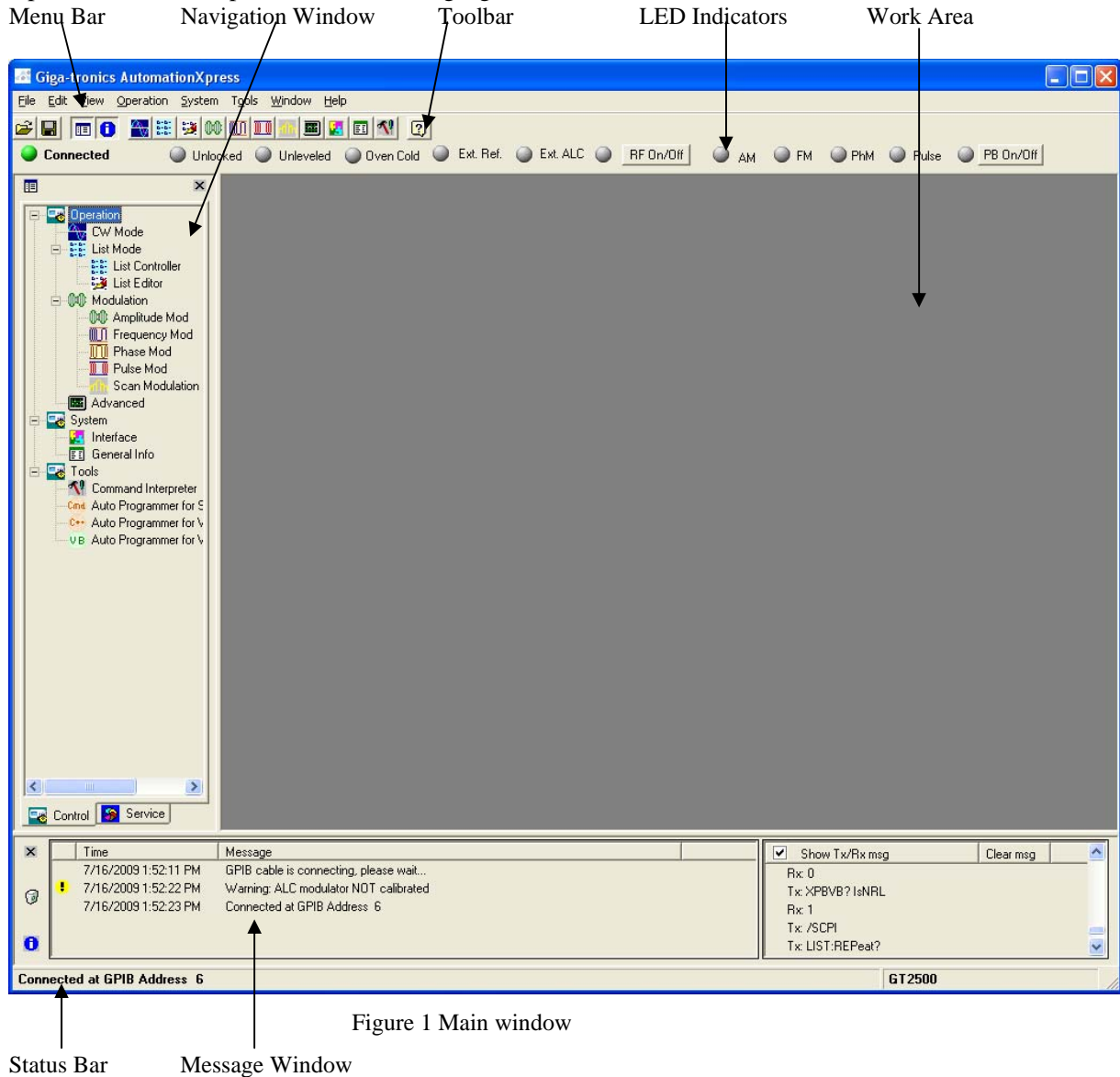
Status Bar   Message Window

3.1.1 Menu Bar

The Menu bar is the Automation Xpress command center. The Menu bar contains menus and drop down submenus of all the commands available in Automation Xpress. The menus will change depending on what window you are currently in.

3.1.1.1 File

Name	Description
Open	Opens a saved file into the Main work area.
New List	Creates a list in the List Controller window.
Save List	Saves the current list in the List Controller window to a file.
Save List As	Saves the current list in the List Controller window to a new file.
Close List	Closes the current list.
Close All Lists	Closes all the lists.
Exit	Exits the Automation Xpress Software program.

3.1.1.2 Edit

Name	Description
Cut	Cuts the contents of the current selection to the clipboard.
Copy	Copies the contents of the current selection to the clipboard.
Paste	Pastes the clipboard information into the selection.

3.1.1.3 View

Name	Description
Toolbar	Show/Hide the Automation toolbar.
Status Bar	Show/Hide the Automation status bar.
Navigation Window	Show/Hide the Navigation window.
Message Window	Show/Hide the Message window.
Web Browser	Opens the Microsoft Explorer web browser.

3.1.1.4 Operation

Name	Description
CW Mode	Opens the CW Mode window saved file into the Main work area.
List Mode	Displays the Operations windows.
List Editor	Opens the List Editor window.
List Controller	Opens the List Controller window
Modulation	Displays the Modulation windows.
Amplitude Mod	Opens the Amplitude Modulation window
Frequency Mod	Opens the Frequency Modulation window.
Phase Mod	Opens the Phase Modulation window.
Pulse Mod	Opens the Pulse Modulation window.
Scan Modulation	Opens the Scan Modulation window.
Advanced	Opens the Advanced Settings window.

3.1.1.5 System

Name	Description
Interface	Opens the Connection Interface Window. This option is only available when navigating in the Control tab.
General Information	Opens the General Information window. This option is displayed when navigating in the Control tab.

3.1.1.6 Tools

Name	Description
Command Interpreter	Opens the Command Interpreter window.
Cmd Auto-programmer	Opens the Auto Programmer window to be used with SCPI or GT12000 (Native) script.
VC ++ Auto-programmer	Opens the Auto Programmer window to be used with Microsoft Visual C++.
VB Auto-Programmer	Opens the Auto Programmer window to be used with Microsoft Visual Basic.

3.1.1.7 Windows

Name	Description
Close All	Closes all open windows.
Cascade	Arranges all windows into a stack, with each window offset slightly.
Tile Horizontal	Arranges all windows to overlap horizontally.
Tile Vertical	Arranges all windows to overlap vertically.

3.1.2 Toolbar

The toolbar contains buttons that operate as shortcuts to menu commands. Below is a description of each button and what the button controls. The Automation Xpress Toolbar allows you to set up the Automation Xpress Operations window. Common features provided in the Menu bar drop down menus, can also be selected by clicking on the appropriate icon on the Toolbar.

Position your mouse pointer over a tool or control and pause. A tool tip appears showing the name and keyboard shortcut (if any) for the item.
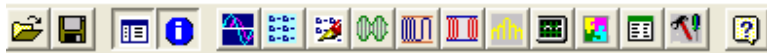
Icon	Description
	Opens a list file.
	Saves a list to a file.
	Show/Hide the Navigation window.
	Opens and closes the Message Display Area.
	Opens the CW Mode window.
	Opens the List Controller window.
	Opens the List Editor window.
	Opens the Amplitude Modulation window.
	Opens the Frequency Modulation window.
	Opens the Pulse Mode window.
	Opens the Scan Modulation window.
	Opens the Advanced Settings window.
	Opens the System Interface window.
	Opens the General Information window.
	Opens the Command Interpreter window.
	Opens the Help Menu.

3.1.3 LED Indicators

The LED indicators ensure and deliver testing confidence. The status LED indicators displays the conditions of the communications link between the controller and the 2400/2500, the Lock and Level condition of the current RF setting, the source of the synthesizer time base reference, and the state of the RF output. Control of the output is also located on the LED Indicator Toolbar. The toggle control is used to enable or disable the generator output. Click the RF On/Off button to enable and disable the RF output.
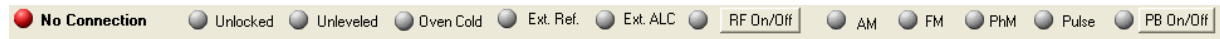
Name	Description
No Connection	A green LED indicates that Automation Xpress has established Communication with the 2400/2500. A red LED indicates Automation Xpress is not communicating with the instrument.
Unlocked	Displays Unlock status. A gray LED (normal mode) indicates the frequency is locked. A yellow LED (warning mode) indicates that the frequency is unlocked.
Unleveled	Displays Unleveled status. A gray LED (normal mode) indicates that the power is leveled. A yellow LED (warning mode) indicates that the frequency is un leveled.
Oven Cold	Display Oven Cold status. A gray LED (normal mode) indicates oven is warm. A yellow LED (warning mode) indicates that oven cold is detected.
Ext Ref	Displays the External Reference status. A blue LED indicates that an external reference is detected and the instrument locked to it. A gray LED indicates that there is no external reference.
Ext. ALC	Displays the External ALC status. A blue LED indicates that an external ALC is detected. A gray LED indicates that there is no external ALC. Select Power Meter, Positive Diode or Negative Diode under Advanced Settings window to set external ALC indicator to blue.
RF ON/OFF	Turns RF On/Off. A blue LED indicates the RF is on. A gray LED indicates the RF is off.
AM LED	Displays the AM status. A gray LED indicates the amplitude modulator is off. A blue LED indicates the amplitude modulator is on.
FM LED	Displays the FM status. A gray LED indicates that the frequency modulator is off. A blue LED indicates the frequency modulator is on.
PhM LED	Displays the phase modulation status. A gray LED indicates that the phase modulator is off. A blue LED indicates the phase modulator is on.
Pulse LED	Displays the Pulse status. A gray LED indicates the pulse modulator is off. A blue LED indicates the pulse modulator is on.
PB On/Off	Turn power boost On/Off. A blue LED indicates the power boost is on. A gray LED indicates the power boost is off.

3.1.4   Navigation Window

The Navigation window provides a tree structure of Automation Xpress. The Navigation window enables you to quickly navigate between the different Automation Xpress control windows. The Navigation window consists of two separate tabbed menus, Control and Service. The control and service tabs are arranged by functionality. When an item is selected from the Navigation window, the corresponding window will open in the main work area. You can SHOW and HIDE the Navigation window at any time by selecting VIEW>Navigation Window. The following sections provide a detailed description on the Control and Service Tab windows.
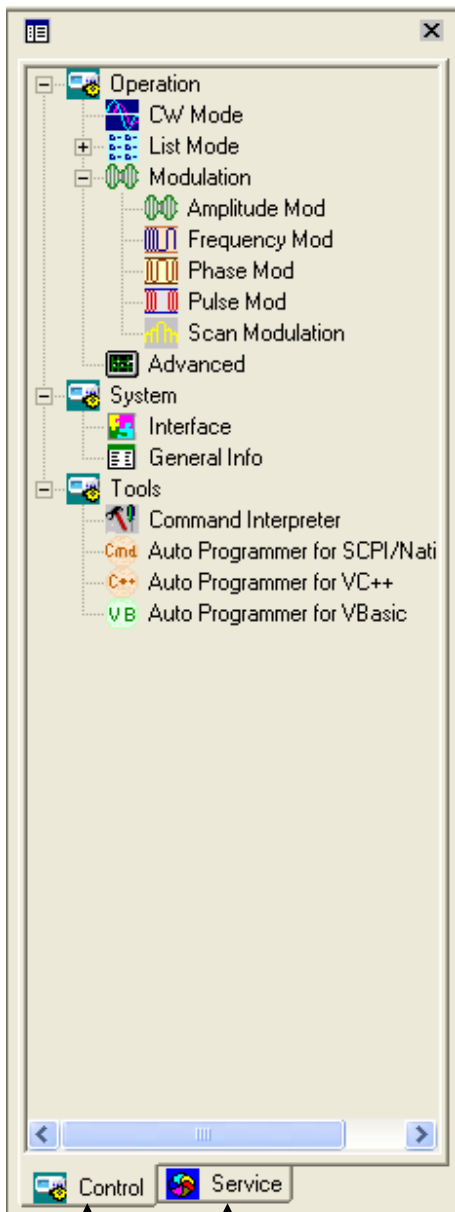
Figure 2 Navigation window

Control Tab   Service Tab

3.1.5   Message Window

The Message window displays the status messages from the instrument. The Message window is divided into a left and right side. The left side of the Message window displays the system status messages, warning messages and error messages. The right side of the Message window is referred to as the Communication message area. The Communication message area displays the Tx/Rx messages. You can clear all messages displayed in the left message window at any time by selecting the Clear message icon. To clear all messages in the Communication message area, click Clear msg bar.
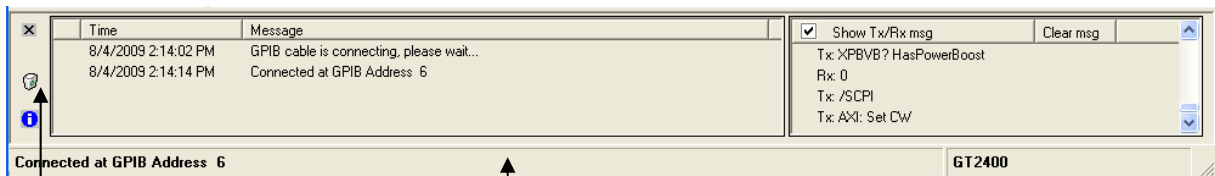
Figure 3 Message window

Clear message icon   Status bar

3.1.6   Status Bar

The Status bar shown in the above figure is used to display the current system connection status. Panel one of the status bar displays the connected GPIB address or a COM port number of the serial port. The Status bar also displays the DEMO MODE, if there is no connection with the instrument. Panel two of the status bar displays GT2400 or GT2500.

3.2 Control Tab Windows

The Control tab is located on the bottom of the Navigation window. Click Control tab to allow you to select basic operation windows.

3.2.1 Operation

3.2.1.1 CW Mode

The CW Mode window combined with the List Controller window provides a powerful combination for faster and more efficient synthesizer operation. Unlike the common front panel operation, the CW Mode leverages the streamlined Windows familiar environment, improving testing throughput and performance.

In CW Mode, you can set the frequency and power quickly with your mouse. Eliminate the tedious task of entering numbers individually from the front panel. With a click of your mouse, you can send commands directly to the instrument effortlessly. For models with option 26, 90 dB step attenuator, you can manually control the step attenuator or let the 2400/2500 automatically switch the attenuator.
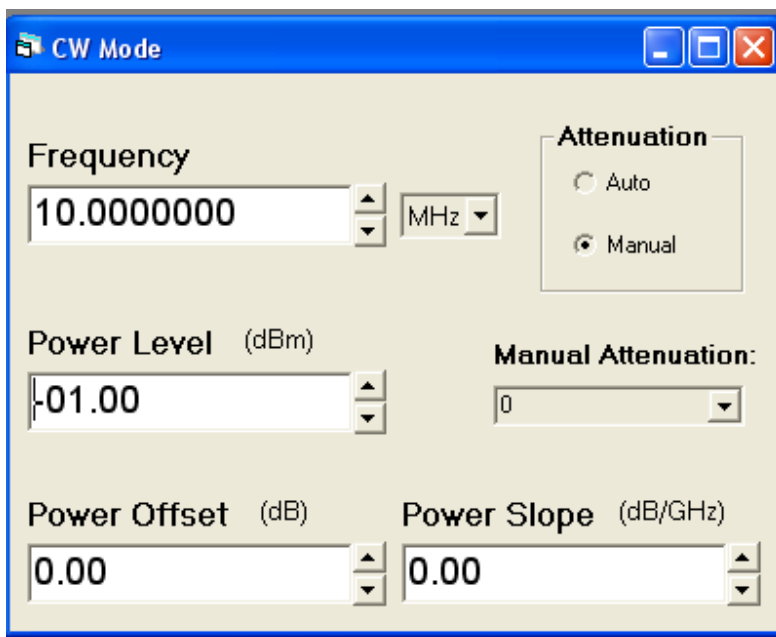
Figure 4 CW Mode window

Name	Description
Frequency	Lets you input CW frequency directly or use the up/down arrow keys to change the value of the frequency.
Frequency Unit	Lets you select the units for frequency.
Power Level	Lets you input power directly or use the up/down arrow keys to change the value of the power.
Manual Attenuation	Lets you select the manual attenuation value when the manual attenuation radio button is selected under Attenuation. After the manual attention radio button is selected you can then set the amount of attenuation using the Attenuation drop down box. In manual attenuation mode, the output power range will be limited to a 45db settable range around the attenuator.

Attenuation	This section controls the step attenuator state when option 26 is installed in the 2400/2500 synthesizer. The attenuator can be set to automatically switch or to be controlled manually. The step attenuator has a 90 dB range and switches in 10 dB steps. The maximum settable range in automatic mode is -110 dBm to +25 dBm. The maximum settable range in manual mode is 40 dB.
Auto	Selecting auto attenuation causes the step attenuator to automatically switch at specific power levels for the full range of the synthesizer.
Manual	Selecting manual attenuation control prevents the step attenuator from automatically switching to a new state when a new power level is selected.

3.2.1.1.1 Setting Parameters in the CW Mode Window

Editing frequency, power, and step attenuator control and settings are performed with the CW Mode window. The power setting is always entered in dBm units.

1. Double clicking on the CW Mode icon in the Navigation window opens the CW Mode window.
2. Using your mouse, highlight the field you would like to change. Either by positioning your mouse on the desired digit to adjust and using the Up/Down arrows located on the right side of the text box to increase or decrease the value. Or by directly high-light the field you would like to change and type your number directly, then press enter.
3. To change the step size in the text box, highlight the desired step size digit. Double-clicking on the field will select the entire value to the decimal point. To select the entire number, click and drag the mouse over the entire field. The field can also be changed using the numeric keypad on the controller keyboard. All or part of the field can be changed depending on the section of the number that is highlighted.

Pressing enter on your keyboard, changing the frequency unit, or using the up/down keys will send a command from your computer to the instrument.

3.2.1.1.2 Step Attenuator Control (Option 26)

The step attenuator is controlled manually or automatically. Under certain conditions, it is desirable not to have the step attenuator automatically switch. The first switch point is at -5 dBm. Additional switch points occur at 10 dB increments starting with -5 dBm to the minimum setting of the 2400/2500. The Manual Attenuation drop down box will display the current state of the step attenuator when the Attenuation field is set to Manual Mode.

3.2.1.2   List Mode

The List Mode Operation consists of two list windows, the List Controller window and the List Editor Window. The List Controller window is used to manage and run lists. The List Editor window is used to create new lists, add new points to an existing list or delete one or more points in a selected list. Once a list is loaded into the List Controller window, individual points can be modified. There is no limitation for the number of lists stored in Automation Xpress, however only one list can be stored in the 2400/2500 synthetic instrument.

Automation Xpress offers three distinct methods for creating lists. You can create a list by:
1. Creating a list using Automation Xpress's List Controller window.
2. Creating a list using Automation Xpress's List Editor window.
3. Importing a list you created in Microsoft Excel or a text editor program.

The following sections describe how to use List Controller and the List Editor Windows in details.

3.2.1.2.1 About List Operation

The list operation is an operation that executes a series of pre-programmed instrument states (points). The list is capable of storing more than 4000 points. Each point in the list defines the GT2400/2500 frequency, power, sync output conditions for a fixed period of time (step time), as shown in the following figure. A remote command or external TTL trigger can be used to initiate the list. Only one list can be stored in the 2400/2500 at any one time.
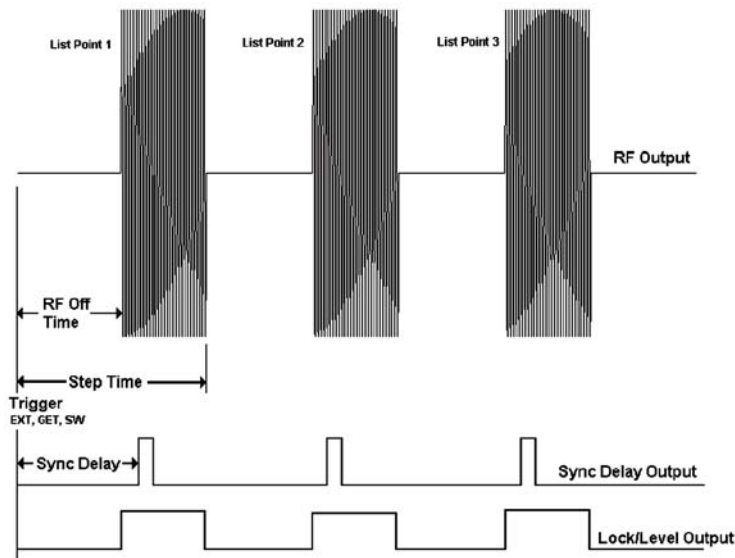
Figure 5 List Attributes

3.2.1.2.2 List Controller

The List Controller window is used to manage and run lists. In the List Controller window, you can create a new list or open a file to load a list. The List Controller also allows you to specify how a list is executed by controlling features such as step time repeat mode and trigger type. The list can be edited using either this window or the List Editor window.
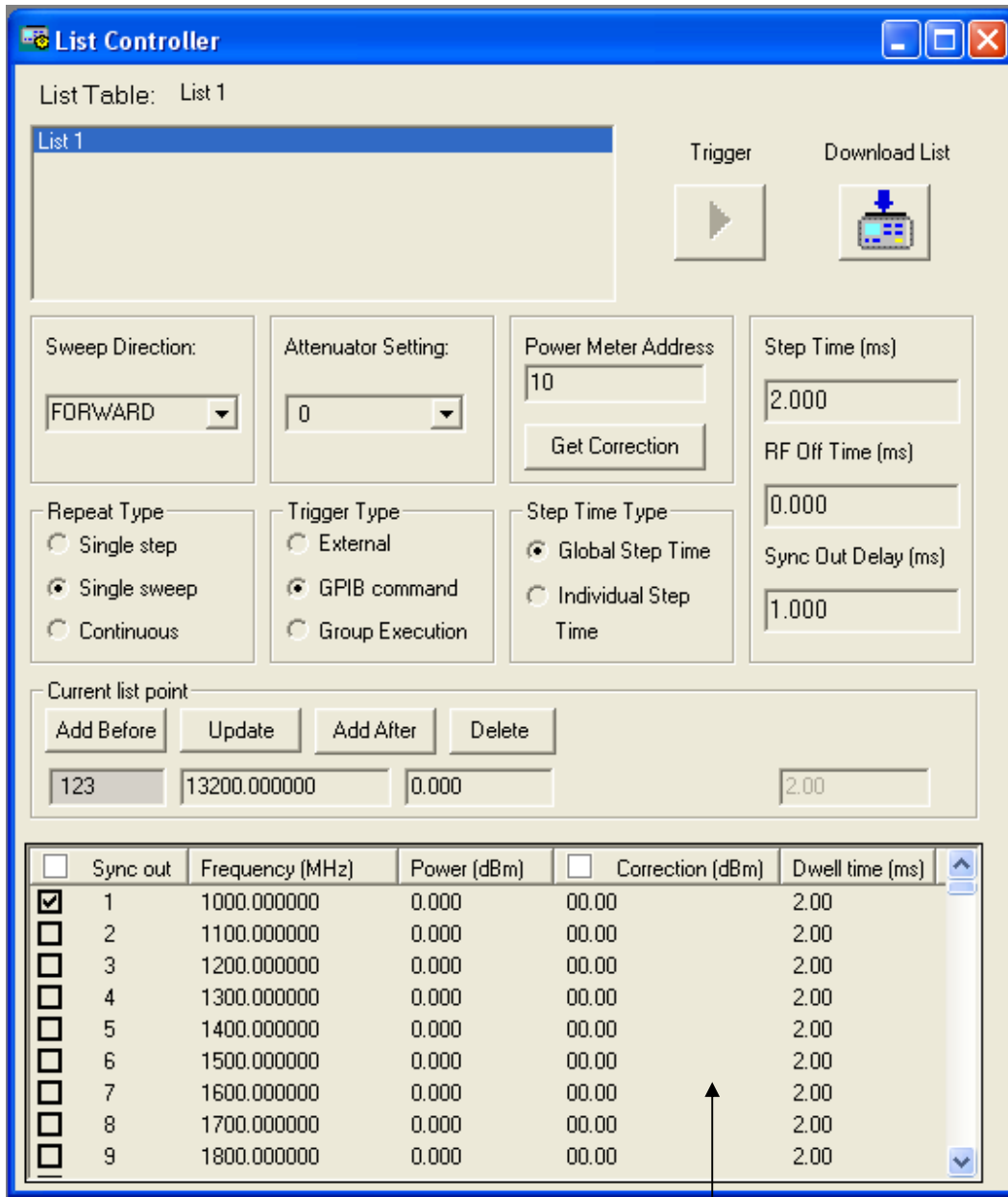
Figure 6 List Controller window

List Data Field

Name	Description
List Table	The list table displays all existing list names. Here you can select the current running list. You can also select a new list from the File Menu to add a new list file name to the box or right click your mouse button to add a new list name to the box. Select Open List from File Menu to add a list file name with the path to the box.
Trigger button	Click to trigger the list. The type of trigger is defined by the trigger type.
Download List button	Downloads the selected list to the instrument.
Sweep Direction	Lets you set the direction of the list sweep. The list can be swept in forward or reverse

	direction.
Attenuator Setting	Sets the attenuation of the instrument.
Power Meter Address	Input Giga-tronics 86xx Power Meter Address
Get Correction Button	Click the button to generate list correction data. Create a list first. Connect the instrument to an 86xx power meter with an appropriate GPIB address. Click the button to generate list correction data and update the Correction (dBm) column of the List Data Field.
Repeat Type	Lets you set the repeat list mode parameters for the current list. This determines how a list will be executed. There are three repeat mode options to select from.
Single Step	Lets you execute the list one point at a time. Each point in the list is executed for each trigger received.
Single Sweep	Lets you execute the list one point at a time. Each point in the list is executed for each trigger received.
Continuous	This option will immediately execute the current running list, repeating it indefinitely.
Trigger Type	Sets the type of trigger to initiate a list.
BNC	Sets the trigger type to BNC. A list will be triggered whenever a TTL signal is received at the external Trigger In BNC on the rear panel of the 2400/2500.
GPIB Command	Sets the trigger type to GPIB. Clicking the trigger button will issue a single 2400/2500 trigger.
Group Execution	Sets the trigger type to Group Execution. Clicking the trigger button will trigger all 2400s/2500s on the GPIB bus.
Step Time Type	Select Step Time Type. It contains two options.
Global Step Time	All step time (Dwell time) of a list is the same value.
Individual Step Time	Let a user to set the individual selected step time (Dwell time). This selection enables Dwell time text box to allow a user to input Dwell time of selected list point.
Step Time	Sets the step time for all list points. Units are in (ms).
RF Off Time	Sets the RF Off time for all list points. Units are in (ms).
Sync Out Delay	Sets the delay of the sync output. Units are in (ms).
Current List Points	The Current List Point field allows you to modify an individual list point in the active list.
Add Before	Lets you add a list point before the selected list item in the List Data Field.
Update	Lets you modify the frequency and power of the selected list item in the List Data Field. First, select the list point you would like to modify, then modify the frequency and power input parameters.
Add After	Click to add a list point after the selected list item in the List Data Field.
Delete	Click to delete the selected list point in the current list.
Sync Out	Sync out can be set for every list point. (Sync out pulse is generated in checked points).
Frequency	Lets you input a frequency value for a newly added list point. Frequency units are in MHz.
Power	Lets you input a power value for a newly added list point. Power units are in dBm.
Correction	Default value is 0 dBm. If you want to correct the data, click Get Correction button to generate list correction data and update the Correction (dBm).
Dwell time	Lets you input a Dwell time value for a newly added list point. Units are in ms. Select Individual Step Time under Step Time Type to enable Dwell time text box input.
List Data Field	Displays individual list point information of the active list.

3.2.1.2.3 List Editor

The List Editor window provides a useful way to create or insert a range of list points to your current running list. The List Editor window contains two tabbed sets of controls: List Range and Selected Points. The List Editor edits the list that is currently selected in the List Controller window.

List Range Tab

Clicking on the List Range tab will open all the List Range controls. The List Range controls lets you add a range of points that step in value from a starting to an ending value. This range of points can be a frequency range at a specific power value or a power range at a specific frequency value. In addition, you can choose to add these points above or below or even to replace the point/s selected in the List Controller window.
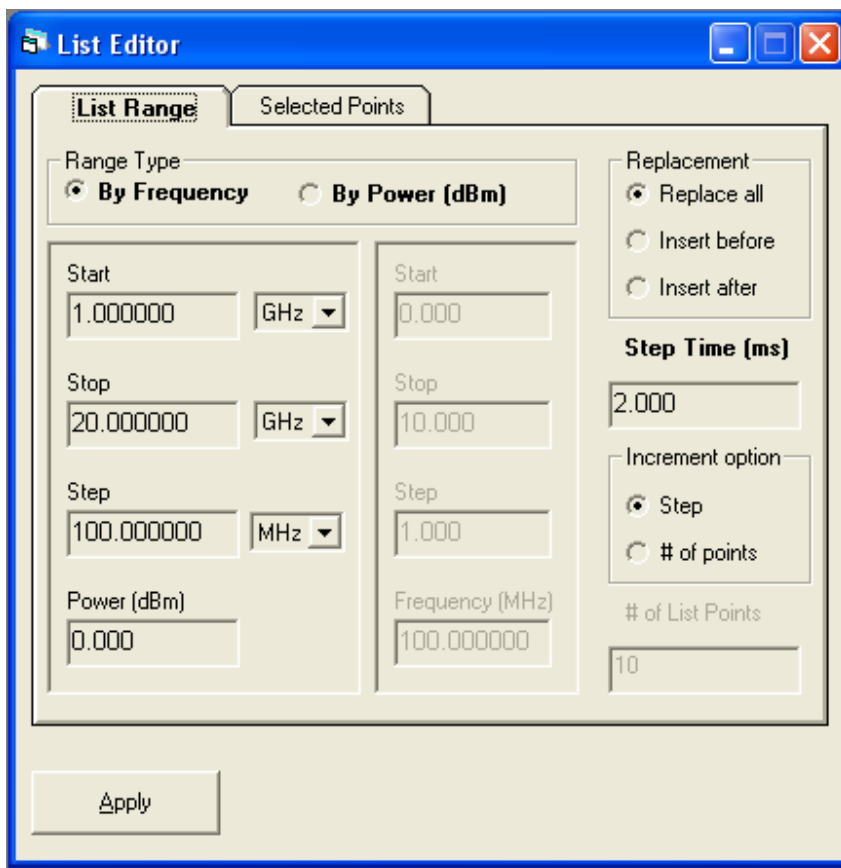
Figure 7 List Editor – List Range tab window

Name	Description
Range Type	Lets you create or insert a frequency or power list range.
Start Input Field	Lets you input the list range starting point.
Stop Input Field	Lets you input the ending list range point.
Step Input Field	Lets you input the step parameter for list creation.
Power/Frequency Input	Lets you set the power or frequency for all created list points.
Apply Button	Updates the current list with the new list range information.

Replacement	Lets you select the replacement type for adding list Points. There are three list replacement options.
Replace	Selecting this option will replace your current running list with the newly configured list.
Insert Before	Selecting this option will insert the new range of list points before the selected list item in the List Data Field.
Insert After	Selecting this option will insert the new range of list points after the selected list item in the List Data Field.
Step Time (ms)	Sets the step time for all list points. Units are in (ms).
Increment Option	Lets you insert list points by either step size or by the number of list points.
Step	Lets you specify the step size for list creation.
# of Points	Lets you specify the number of points for the list range. Software determines the step size of the list using the following formula: $$\frac{\text{STOP PARAMETER - START PARAMETER}}{\text{\# OF POINTS}}$$
# of List Points	Lets you enter the number of list points for list range calculation.

Selected Point Tab

Clicking on the Selected Points tab will display all of the Selected Point controls. The Selected Point tab enables you to update the frequency and power values of the points selected in the List Controller window. You can also select or unselect BNC Sync Out for the selected points.
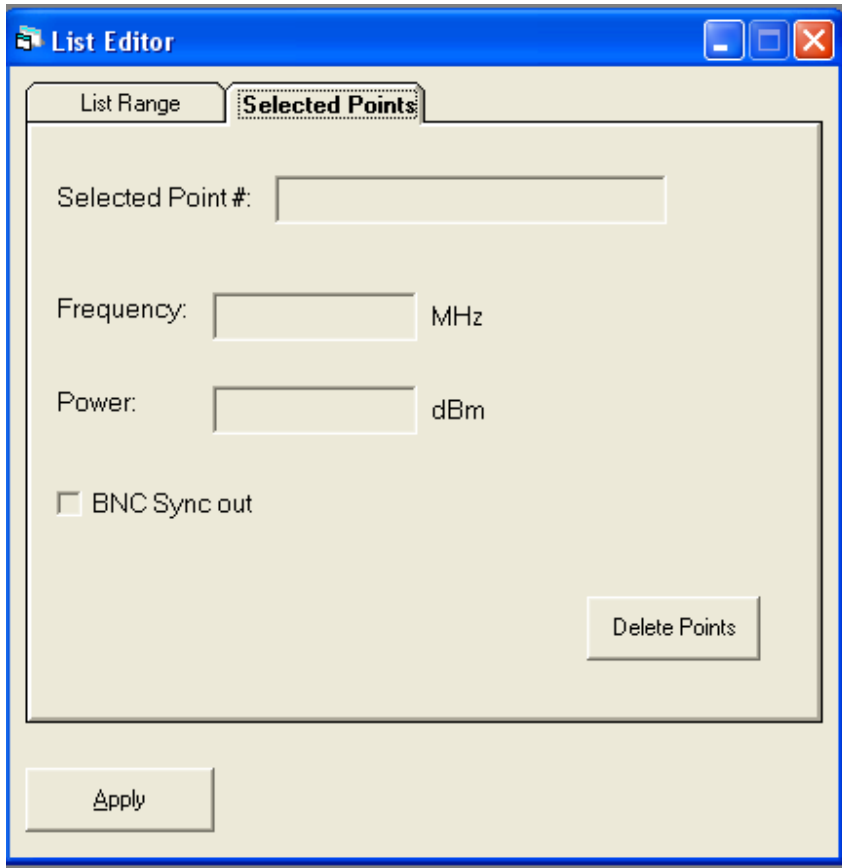
Figure 8 List Editor – Selected Points tab window

Name	Description
Selected Point #	Lets you select a list point(s) from the List Controller window and edit the frequency and power parameters.
Frequency Input Field	Lets you set the frequency for the selected list point(s) in the List Controller window.
Power Input Field	Lets you select the power for the selected list point(s).
BNC Sync Out	Lets you set the BNC Sync Out for the selected point(s).
Apply Button	Applies the changes to the selected list point(s).
Delete Points	Deletes the selected point(s).

3.2.1.2.4 Dynamic Range and Step Attenuator Control

Automation Xpress's list mode prevents the step attenuator from switching automatically. However, this restriction is not applied when programming the 2400/2500 without Automation Xpress software.. Care should be taken whenever programming power lists for 2400/2500's equipped with Option 26 Step

Attenuator, 90 dB step attenuator installed. Operating a power list with the step attenuator set to automatic may cause excessive attenuator switching that can shorten the life the step attenuator. The maximum settable dynamic range with the step attenuator set to manual is 40 dB. Power levels in the list must be within a ±20 dB range of the manual step attenuator setting. When programming a power list, the step attenuator should be set to manual and set to the middle of the power list dynamic range.

3.2.1.2.5 Create a List Using the List Controller Window

The List Controller window provides access to the list parameters needed to operate the 2400/2500 in list mode. In addition to operational control, the List Controller also maintains list files stored in memory or on a storage media such as the controller hard drive.

The List Table box located within the List Controller window displays lists you have created. You select a list from the List Table box to edit and to download to the 2400/2500.

To begin creating a new list, a list name must be established first. You must have the List Controller window open to create a new list. If you already have a list file with a valid for-mat, skip this section and go directly to ("Running a List" section). Automation Xpress provides two methods for creating a new list.

Naming a list is as follows.
1. Open the List Controller window by selecting the OPERATION MENU dropdown and select>LIST CONTROLLER.
2. Select> FILE MENU and select >NEW LIST.
3. The Create a List dialog box will appear. Type a new list name in the List Label field and click>OK.

Figure 9 Create a List window

OR
1. Open the List Controller window by selecting the OPERATION MENU dropdown and select>LIST CONTROLLER.
2. In the List Controller window, place your mouse over the List Table box and right mouse click. Select >NEW LIST from the list pop up menu.
3. The Create a List dialog box will appear. Type a new list name in the List Label field and click>OK.

Once a new list name has been established, list point information can be added to the newly created list. Lists can be stored in the memory allocated by Automation Xpress or on your computers hard drive or any other valid storage medium.

3.2.1.2.6 Editing a List Point

To edit a list point in the List Controller window, move your mouse over the list point and click on it. This will select and highlight the current list point to edit.
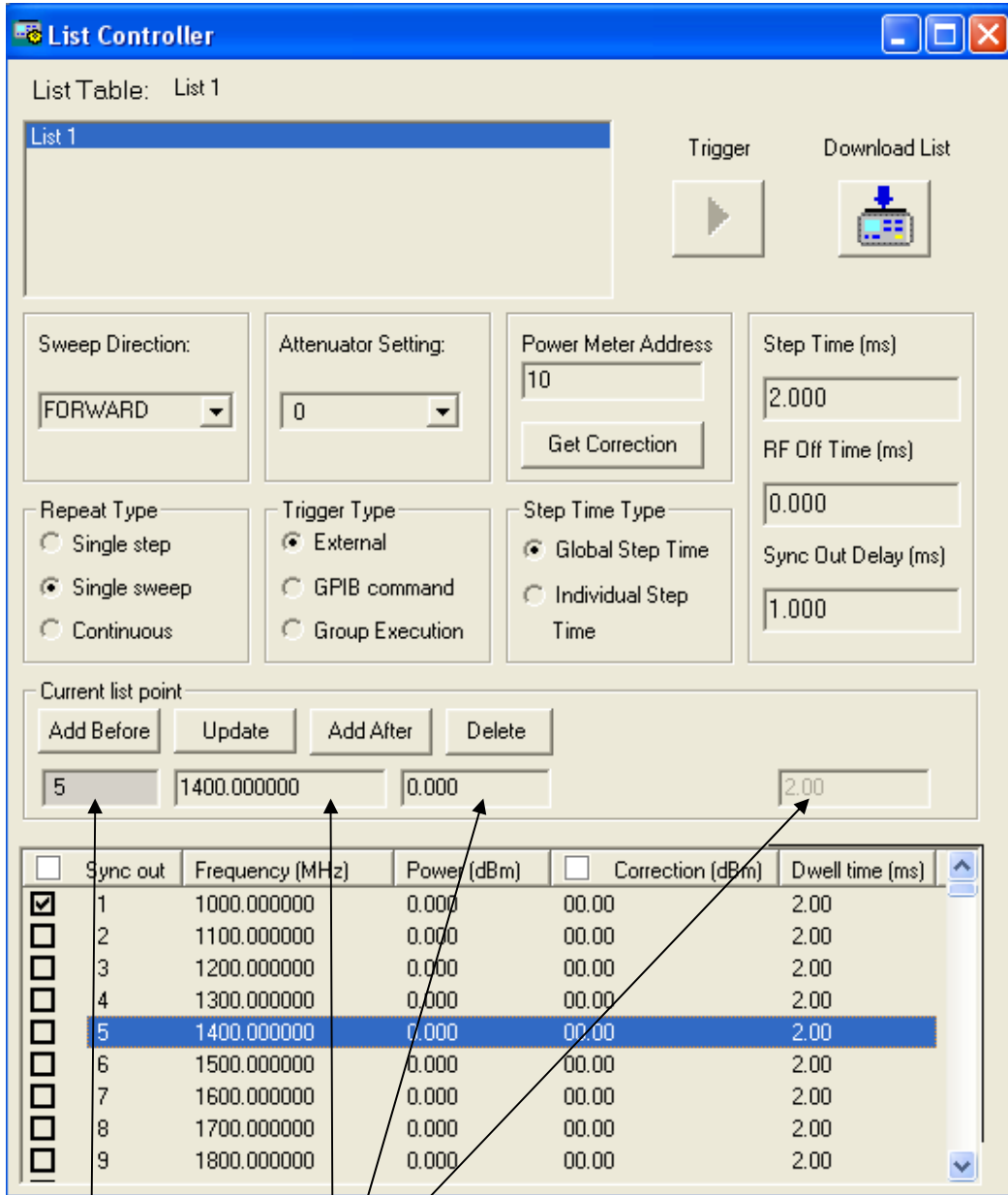
Current List point field   Selected point to edit

The list point information will be displayed in the Current List Point field. You can make changes to the current list point by typing directly into this field. When you are finished editing the list point, the grayed out UPDATE button will become active and you can now click the UPDATE button to apply the change.

New list points can be added before or after the list point in the Current List Point field by clicking on the ADD BEFORE or ADD AFTER buttons. Click on the UPDATE button to update the selected list point.

A list point can also be removed from the list by clicking on the DELETE button. Any time the list has been modified; it must be downloaded into the 2400. Once a list has been downloaded, the DOWNLOAD button will be disabled. Any change in the list editor window, triggering method, step attenuator state or delay setting will enable the DOWNLOAD button, indicating that a change has been made and the list must be downloaded into the 2400/2500.

After a list is configured and editing is complete, the list must be downloaded from the Automation Xpress program to the 2400/2500 instrument.

3.2.1.2.7 Create a List in the List Controller Window Tutorial

The following example describes the creation of a simple list using the List Controller Window. The list will consist of 3 points with frequencies at 2, 8, 12 GHz. The power setting is 10 dBm for all points in the list. The first list point will also output a sync. signal.

1. With the mouse over the List Table box, right click and select NEW LIST.
2. Type LIST 2 in the List Label of the Create a List input box and click OK.
3. Double click on the Frequency box in the Current List Point field and enter 2000
4. Double click on the Power box in the Current List Point field and enter 10.
5. Click on Add After to add the first list point to the new list. Add Before can also be used
6. Repeat step 3 and enter 8000.
7. Click on ADD AFTER to add the new point. Note that the power setting does not change from the last entered list point.

The power setting does not change from the previous list point. The List controller maintains all information from the previous list point to reduce list point data entry.

1. Click on the Sync Out checkbox to disable the sync. signal for this point
2. Repeat step 3 and enter 12000. Click on Add After to add the new point

3.2.1.2.8 Create a List Using the List Editor Window

The List Editor window is used to create new lists, add new points to an existing list or delete one or more points in a selected list. The List Editor window provides a useful way to edit a range or add points to your current running list by step frequency or step power. You can edit or add a list point(s) to your current running list by specifying the start, stop, step, dwell time, and power level.

The List Editor is used to quickly create simple lists where frequency and power is incremented or decremented in fixed steps. The list step is set using either a fixed step value or calculated by taking the difference between the start and stop points and then dividing the range by the number of requested points. The List Editor is used in conjunction with the List Controller, and permits new points to be added to or replace the list in the active list window.

Configuring a frequency or level list range

Configuring a frequency or level list range in the List Editor window requires three basic parameters: start parameter, stop parameter, and the frequency or level setting of all points in the new list range.

Choose the list range type you wish to create by selecting between the BY FREQUENCY or BY POWER (dBm) option.

Type the value of the start parameter into the START PARAMETER field and select the appropriate unit. If you have selected to create a list with power as a parameter, all units displayed are measured in dBm.

Type the value of the stop parameter into the STOP PARAMETER field.

Enter the power level of the list range.

The list step time can be set from within the List Editor window or the List Controller window at the time of the list download to the instrument.

Setting the list step size

You can set the list step size by directly entering a value into the Step Parameter field. The total number of points will be determined by the size of the step. The list size can also be set to a fixed number of points. The Increment Option field provides you with a choice of either method to set the list step size.

From the INCREMENT OPTION field> click on the STEP option radio button. Selecting the STEP option will activate the STEP PARAMETER field of the List Range. When the STEP option is selected, the list will include the start and stop values plus the maximum allowable frequencies determined by the step size. The spacing between sequential list points will be equal with the exception of the last two list points if difference between the start and stop parameter is not evenly divided by the step parameter.

From the INCREMENT OPTION field> click on the # OF POINTS option. Selecting the # OF POINTS option will activate the NUMBER OF LIST POINTS field. The list is created with a fixed number of points specified in the Number of Points field. The size of the step is determined by difference of the start and stop parameter divided by the number of points. The spacing between sequential list points will be equal.

Setting the Replacement Type

An existing list can replace or be inserted into the active list. The Replacement field pro-vides you with the option to replace the entire list or insert the new list information before or after a selected list point in the active list. When you want to insert a new list point(s) into the active list, select the desired list point in the active list window of the List Controller by clicking on the list point.

1. Click REPLACE ALL to replace all list points with the new list information.

2. Click INSERT BEFORE to insert the new list point(s) before the selected list point in the active list window of the List Controller.

3. Click INSERT AFTER to insert the new list point(s) after the selected list point in the active list window of the List Controller.

3.2.1.2.9 Create a List Example in the List Editor Window

The following is a short example for creating a list using the List Editor window. The list will switch frequency starting at 2.0 GHz and stopping at 8 GHz. The frequency step size is 100 MHz, power level is set to +5 dBm and the step time is set to 1 msec.

Create a new list name by either selecting the file menu or right mouse click with the mouse in the List Table window of the List Controller window.

Click on the BY FREQUENCY selection.

Click on the REPLACE ALL selection.

Click on the STEP selection

Enter the following information:

Entry Field	Value
Start	2.0
Stop	8.0
Step	100
Power (dBm)	5.0

The Units selections should be set to factory defaults. If not, use the GHz units for the start and stop fields. Use the MHz units for the step field.

1. Enter 1.0 into the STEP TIME field.

2. Click on the APPLY button

3.2.1.2.10 Create a List Using Microsoft Excel or a Text Editor

Automation Xpress list files are text-based files that conform to a very simple format. This enables you to generate list files using a text editor or spreadsheet software. All that is required is that the program must be capable of saving to a text file (.txt).

List File Format

A list file must be constructed to a format that Automation Xpress will recognize. If a list file is improperly structured, the list will not load into Automation Xpress.

The first line of the text file defines the list Step time, RF Off time, Sync Out Delay and the step attenuator setting. The step attenuator setting is set in the 10 dB increments from 0 to 90 dB. The following rows correspond to the list points in the list. The first list point begins on row two of the text file. Each row defines the Sync Out Signal state, frequency, power, correction and dwell time settings. The parameters in the text file are separated with a comma, space, semi-colon or tab. A line feed (Enter key) is used to terminate each row in the list file. The following describes the list parameters in the text file.

<Step Time> <RF Off Time> <Sync Out Delay> <Step Attenuator>
<Sync State> <Frequency> <Power> <Correction> <Dwell time>

Units are not included in the list file. The following table identifies the parameter unit type and range.

Parameter	Units	Range

Step Time	milliseconds	0.15 - 1000
RF OFF Time	milliseconds	0.1 - 1000
Sync Out Delay	milliseconds	0, 0.1 - 1000
Step Atten	dB	0 - 90
Sync State	1 or 0	1 or 0
Frequency	MHz	Min to Max frequency
Power	dBm	Min to Max power
Correction	dBm	Within the power limits
Dwell Time	milliseconds	0.15 - 1000

Text File Example

The list point step time is 2 msec., the RF Off time is 3 msec., Sync out delay is 1 msec., and the step attenuator (Option 26) is set to 10 dB. If Option 26 is not present, the value is set to 0. Each list point will output a sync signal. List point 1, 2, and 3 will have frequency settings of 100, 200, 300 MHz respectively. List point 1, 2, and 3 will have power settings of 0, 2, 4 dBm respectively. All points will be set to 0 dBm correction and 2 msec. dwell time. A space or tab delimiter is used to separate the list parameters in each line of the list text file.
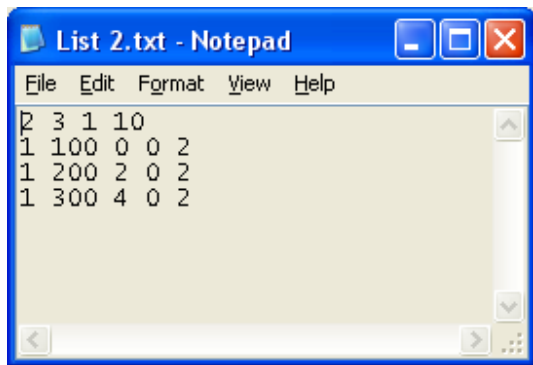
Figure 10 List file example

The text file can be imported by using FILE MENU and selecting the OPEN FILE. If the file is correctly structured, the list will be loaded and a message will indicate that the list successfully loaded. The text file must be closed before it can be loaded into Automation Xpress.

3.2.1.2.11 Running a List

There are additional parameters that define how a list is triggered and how it will execute when a trigger is received. These parameters are set to factory default settings and can be modified to meet a wide range of applications requiring list operation. This section will describe how to run a list and set the list parameters in details.

Setting the Trigger Type

Trigger type defines the source of the trigger that will execute the list

External- This selection sets the list trigger to the external Trigger Input on the rear panel of the 2400/2500.

GPIB- This selection sets the list trigger to GPIB. The IEEE 488.2 command *TRG is sent to the 2400/2500 via GPIB to trigger a list.

Group Execution- This selection sets the 2400/2500 to execute a list when a Group Executable Trigger is received via the GPIB.

Setting the Repeat Type

Repeat type defines how the list will sweep. Select one of the following:

Single Step- This mode will switch one list point for every trigger received

Single Sweep- This mode will execute the entire list when a single trigger is received.

Continuous - This mode will execute the list and repeat until the list operation is aborted when a single trigger is received.

Setting the Sweep Direction

Sweep direction defines the direction of the list sweep.

Forward- This setting causes the list to execute starting with the first point in the list and progress to the last point in the list.

Reverse - This setting causes the list to execute starting with the last point in the list and progress to the first point in the list.

Downloading a List

Once a list has been loaded into Automation Xpress and all the necessary parameters have been edited, the list must be downloaded from the PC to the instrument. Click Download List button to download a list.

Once a list has been downloaded, the Download List button will disable. Any parameter change in the current list or new list selection will require the new or modified list to be downloaded again.

The Automation Xpress download operation uses a binary format to program the current list in Automation Xpress to the 2400/2500. Large lists will take several moments to download and compile. Using Automation Xpress's download provides a significant improvement

Triggering a List

After a list has been successfully downloaded, the 2400/2500 is ready for the list to be triggered. If either the GPIB or Group Execution is selected in the Trigger Type field, the Trigger button with enable after a successful list download has occurred. Click the TRIGGER button to initiate the list.

Setting the step time, dwell time and Sync out Delay Time

Step time is a setting that determines the time for each list point. It is a single setting and applies to all points in the list if the Global Stem Time selected under Step Time Type . The step time setting includes

the list point switching time and the dwell time at the point. List point switch time can vary according to the type of transition defined by the list point. If the individual Step Time is selected, it will enable Dwell time text box to allow a user to input Dwell time of selected list point. The settable range is 0.15 to 1000 msec.

Sync Out signal is a TTL signal that can be used to synchronize the list output with a measuring sys-tem such as a power meter or receiver. The Sync Out Delay is a setting that enables you to adjust the Sync Out signal with respect to a list point output. The sync. pulse occurs after the list point is executed at the specified delay setting. This is especially useful for measuring systems that use a Moving Average method in a measurement system. The Sync Out Delay must always be smaller than the List Step Time setting.

List Operation Example

The following steps describe a typical list operation. A valid list file named Example1.txt is loaded into the List Controller window. Repeat Type and Trigger Type and Sweep Direction are selected and the list is downloaded to the instrument. The instrument output is activated and the list is triggered to single sweep in the reverse direction via the List Controller window.

From the List Controller window, move the mouse over the List Table field, right mouse click and select OPEN LIST.

Select Example 1.txt and click OPEN.

Click on SINGLE SWEEP in the Repeat Type field

Click on GPIB in the Trigger Type field

Click on the drop down arrow of the SWEEP DIRECTION and select REVERSE.

Click on DOWNLOAD LIST button.

Click on RF ON/OFF to activate the RF output

Click on TRIGGER button.

3.2.1.3 *Modulation*

Clicking on the Modulation Icon will expand the Modulation menu and display it's sub-items. An additional click will hide the Modulation sub-items.

3.2.1.3.1 Amplitude Modulation (AM)

Double clicking on the Amplitude Modulation icon will open the Amplitude Modulation window. The Amplitude Modulation window allows a user to enable or disable Amplitude Modulation. In addition the user can select an External or Internal Source. For an External Source the user can specify the AM Mode and the Scaling. For an Internal Source the user can specify the AM Mode, the Waveform, the Depth, and the Frequency.
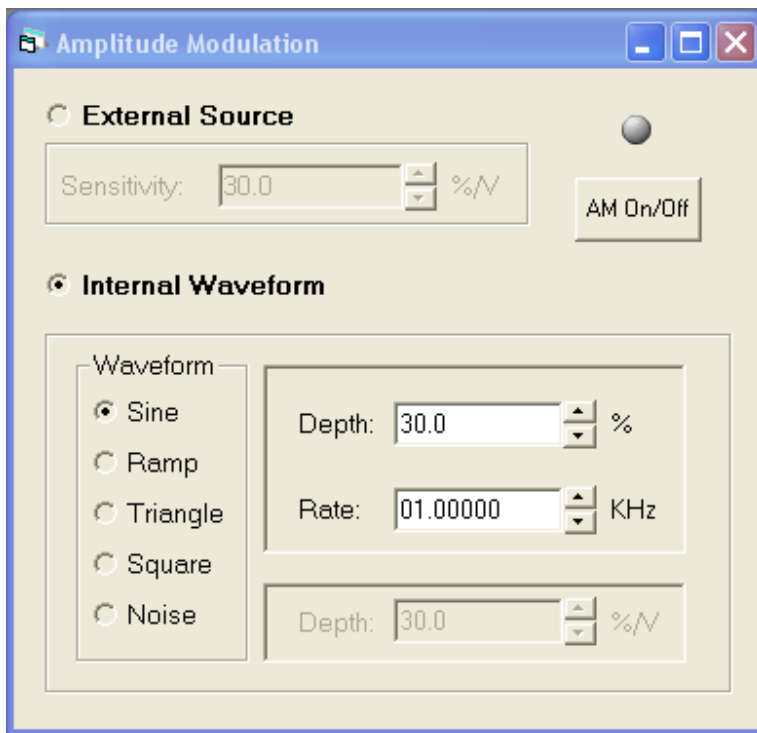
Figure 11 Amplitude Modulation window

Name	Description
External Source	Enable external AM source. If external source is enabled, all internal related controls are gray out.
Sensitivity (External)	Adjust the value of external sensitivity.
Internal Source	Enable internal AM source. If internal source is enabled, all external related controls are gray out.
Waveform	Select waveform option for internal AM. The available options are sine, triangle, ramp, square, and noise.
Sensitivity (Internal)	Adjust the value of internal sensitivity, and is only enabled when waveform is set to noise.
Rate	Adjust the value of internal Rate, and is only enabled when waveform is set to sine, triangle, ramp or square.

Depth	Adjust the value of internal depth, and is only enabled when waveform is set to sine, triangle, ramp or square.
AM ON/OFF	Turn AM On/Off

3.2.1.3.2 Frequency Modulation (FM)

Double clicking on the Frequency Modulation icon will open the Frequency Modulation window. The Frequency Modulation window allows a user to enable or disable Frequency Modulation. In addition the user can select an External or Internal Source. For an External Source the user can specify the Sensitivity. For an Internal Source the user can specify the Deviation, the Waveform, and the Rate.

Figure 12 Frequency Modulation window

Name	Description
Mode	Set Mode to Narrow or Wide. If unified FM is detected, Mode selection is hided.
External Source	Enable external FM source. If external source is enabled, all internal related controls are gray out.
Sensitivity (External)	Adjust the value of external sensitivity.
Internal Waveform	Enable internal FM source. If internal source is enabled, all external related controls are gray out.
Waveform	Select waveform option for internal FM. The available options are sine, triangle, ramp, and

	square.
Deviation	Adjust the value of internal deviation, and is only enabled when waveform is set to sine, triangle, ramp or square.
Rate	Adjust the value of internal Rate, and is only enabled when waveform is set to sine, triangle, ramp or square.
DC FM	Enable DC FM.
FM ON/OFF	Turn FM On/Off

3.2.1.3.3 Phase Modulation

Double clicking on the Phase Modulation icon will open the Phase Modulation window. The Phase Modulation window allows a user to enable or disable Phase Modulation. In addition the user can select an External or Internal Source. For an External Source the user can specify the Sensitivity. For an Internal Source the user can specify the Deviation, the Waveform, and the Rate.
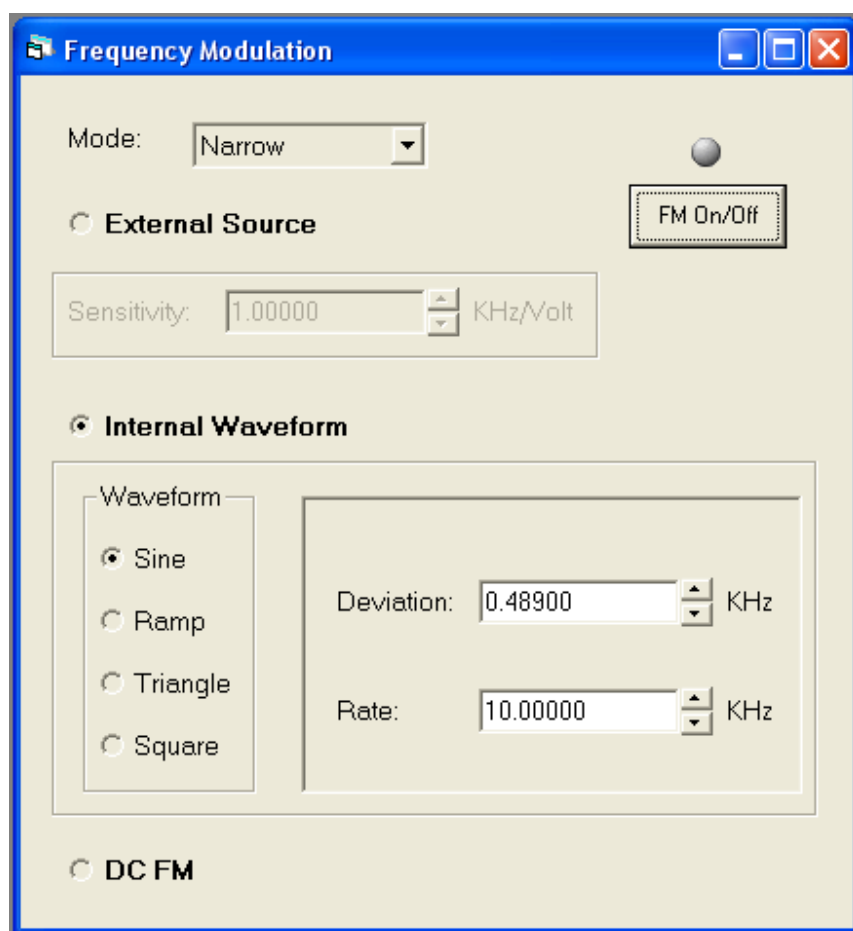

Figure 13 Phase Modulation window
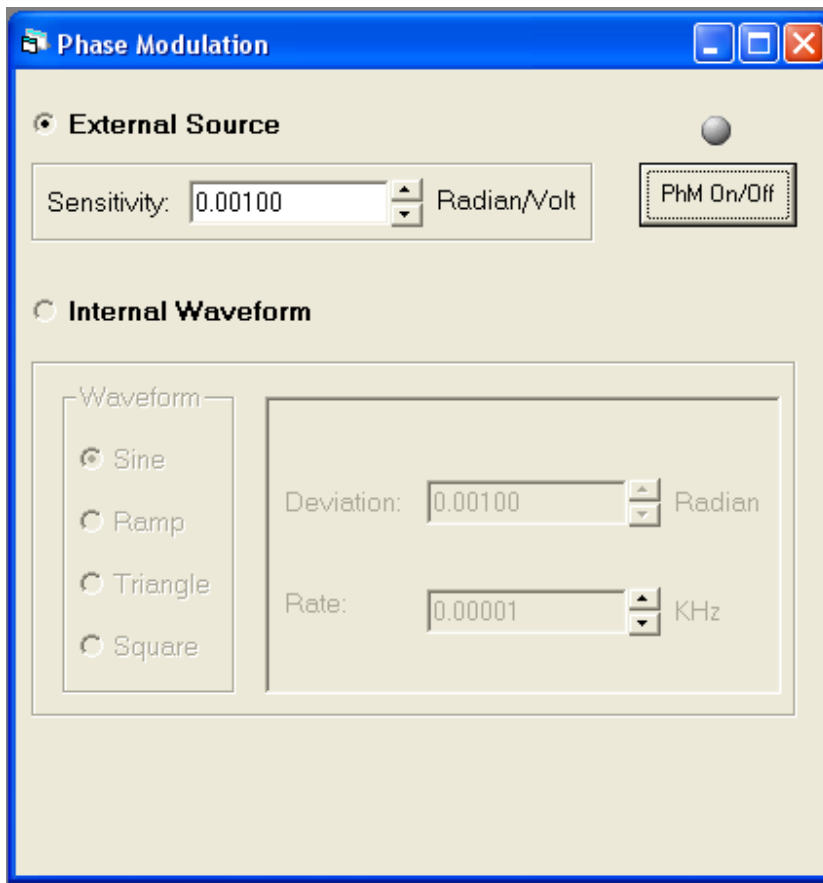
Name	Description
External Source	Enable external Phase Modulation source. If external source is enabled, all internal related controls are gray out.
Sensitivity (External)	Adjust the value of external sensitivity.
Internal Waveform	Enable internal Phase Modulation source. If internal source is enabled, all external related controls are gray out.

Waveform	Select waveform option for internal Phase Modulation. The available options are sine, triangle, ramp, and square.
Deviation	Adjust the value of internal deviation, and is only enabled when waveform is set to sine, triangle, ramp or square.
Rate	Adjust the value of internal Rate, and is only enabled when waveform is set to sine, triangle, ramp or square.
PhM ON/OFF	Turn Phase Modulation On/Off

3.2.1.3.4 Pulse Modulation (PM)

Double clicking on the Pulse Modulation icon will open the Pulse Modulation window. The Pulse Modulation window allows you to enable or disable Pulse Modulation. In addition, you can select an External or Internal Source. For an External Source, you can specify Polarity and sync out delay. For an Internal Source, you can specify the pulse width, sync out delay for Triggered, Continuous, and Gated modes. For each of these modes PRI, trigger polarity, and pulse delay can be specified depending on the mode of operation. For Internal Source, General and Burst Mode tabs are included. Burst Mode tab is hided if the burst mode is not enabled in the instrument.

Pulse Modulation with General Tab Selected Window
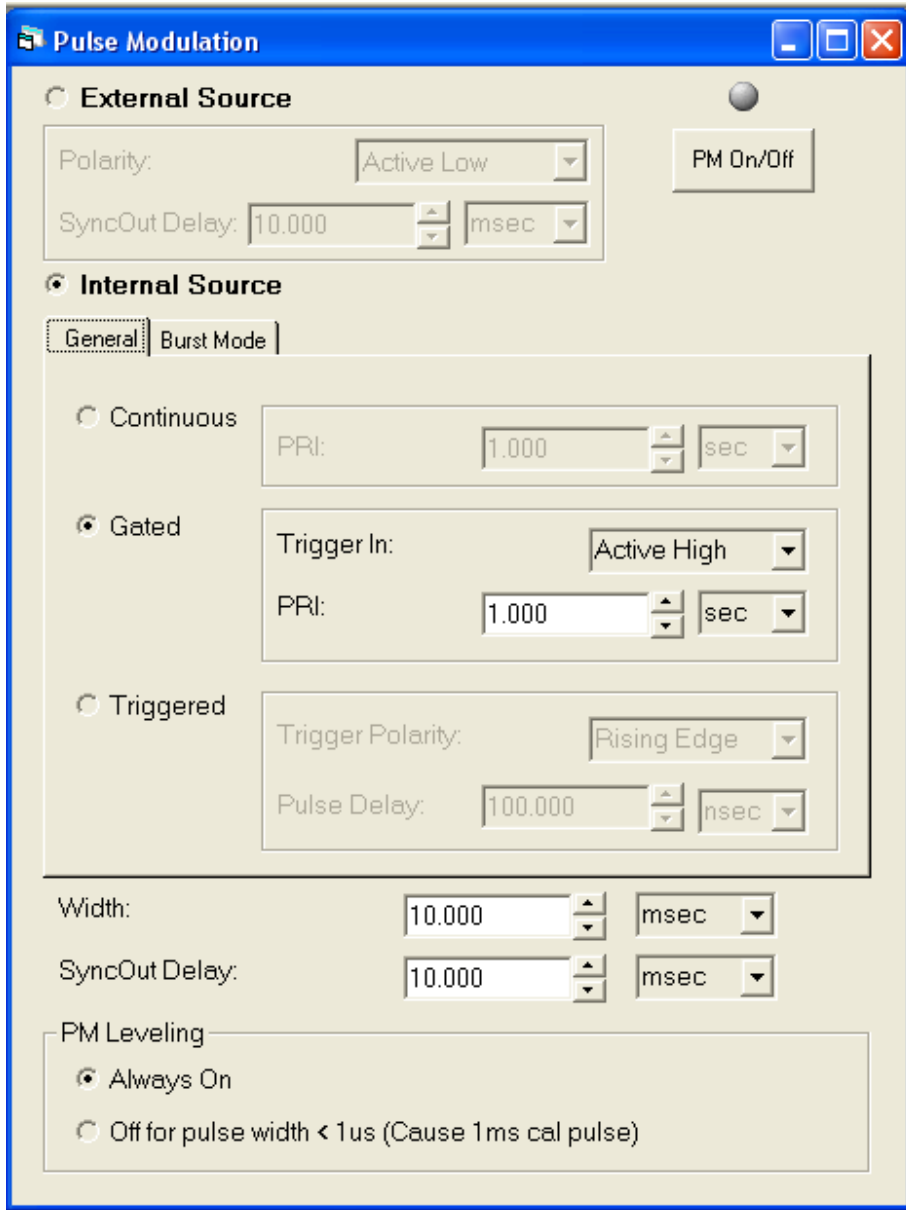
Figure 14 Pulse Modulation - General tab window

Name	Description
External Source	Enable external PM source. If external source is enabled, all internal related controls are gray out.
Polarity	Set external Polarity to either Active High or Low
SyncOut Delay	Adjust value of external trigger delay.
Internal Source	Enable internal PM source. If internal source is enabled, all external related controls are gray out.
General Tab	Select this tab to show general pulse modulation internal data settings.

Continuous (PM Mode)	Selecting this mode outputs a continuous train of pulses specified by the PRI and pulse width parameters. Continuous operation allows you to adjust the period of the pulsed RF output. Note: The period must be greater than the pulse width setting. Automation Xpress will automatically reset the pulse width to be lower than the period in cases where the period entered is less than the pulse width.
Gated (PM Mode)	Selecting this mode outputs a burst of pulses specified by the PRI and pulse width parameters for the duration of the gating signal. Gated operation allows you to generate a multiple pulse burst controlled by an external gate. This function allows you to control the pulse width, sync pulse delay, pulse repetition interval and trigger polarity of the pulse. The instrument will output a pulse train for the duration of the gating signal. If the gate signal is terminated after a pulse has been initiated, the instrument will complete the pulse burst specified by the pulse width.
Triggered (PM Mode)	Selecting this mode outputs one pulse per external trigger received following the sync delay. Triggered operation allows you to generate an RF pulse with a controllable pulse width and delay setting. The RF pulse is output after an external trigger is received and the delay time has been reached.
PRI	Adjust value of internal trigger PRI.
Trigger In	Set Trigger In to Active High or Active Low.
Trigger Polarity	Set the external trigger polarity to either Falling or Rising.
Pulse Delay	Adjust the pulse delay.
Width	Adjust value of internal pulse width.
SyncOut Delay	Adjust value of internal trigger delay.
PM Leveling	PM Leveling field is enabled if PM Leveling enabled in the instrument.
Always On	Set open loop PM to "Off" means PM leveling is always on.
Off for pulse <1us	Set open loop PM to "On" means PM leveling is off for pulse widths less than 1 us.
PM ON/OFF	Turn PM On/Off

Pulse Modulation with Burst Mode Tab Selected Window
Burst Mode tab is enabled if the burst mode enabled in the instrument. Burst Mode tab is hided if the
burst mode is not enabled in the instrument.
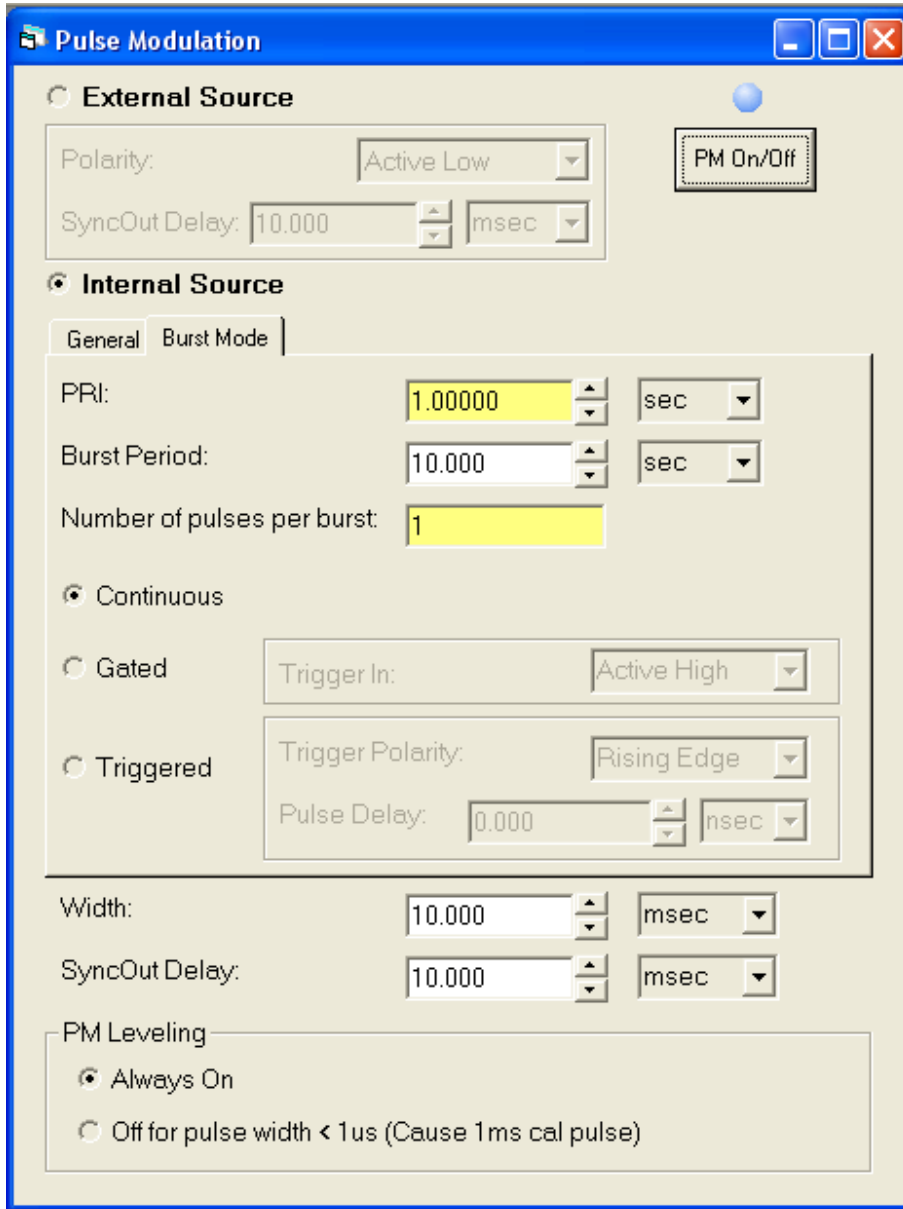
Figure 15 Pulse Modulation - Burst Mode tab window

Name	Description
Burst Mode Tab	Select this tab to show pulse modulation internal burst mode data settings. Burst Mode tab is hided if the burst mode is not enabled in the instrument.
PRI	Adjust value of internal trigger PRI.
Burst Period	Adjust value of Burst Period.
Number of pulse	Adjust value of Number of pulse per burst.

per burst	
Continuous (PM Burst Mode)	Selecting this mode outputs a continuous train of pulses specified by the PRI and pulse width parameters.
Gated (PM Burst Mode)	Selecting this mode outputs a burst of pulses specified by the PRI and pulse width parameters for the duration of the gating signal.
Triggered (PM Burst Mode)	Selecting this mode outputs one pulse per external trigger received following the sync delay.
Trigger In	Set Trigger In to Active High or Active Low.
Trigger Polarity	Set the external trigger polarity to either Falling or Rising.
Pulse Delay	Adjust the pulse delay.

3.2.1.3.5 Scan Modulation

Double clicking on the Scan Modulation icon will open the Scan Modulation window. The Scan Modulation window will automatically create a Scan Modulation List. The user can specify the following items for Scan Modulation setup: Power, Number of Lobes, Scan Time, and Frequency. By clicking the Apply button a Scan Modulation List is generated, loaded into the List Controller, and displayed graphically.
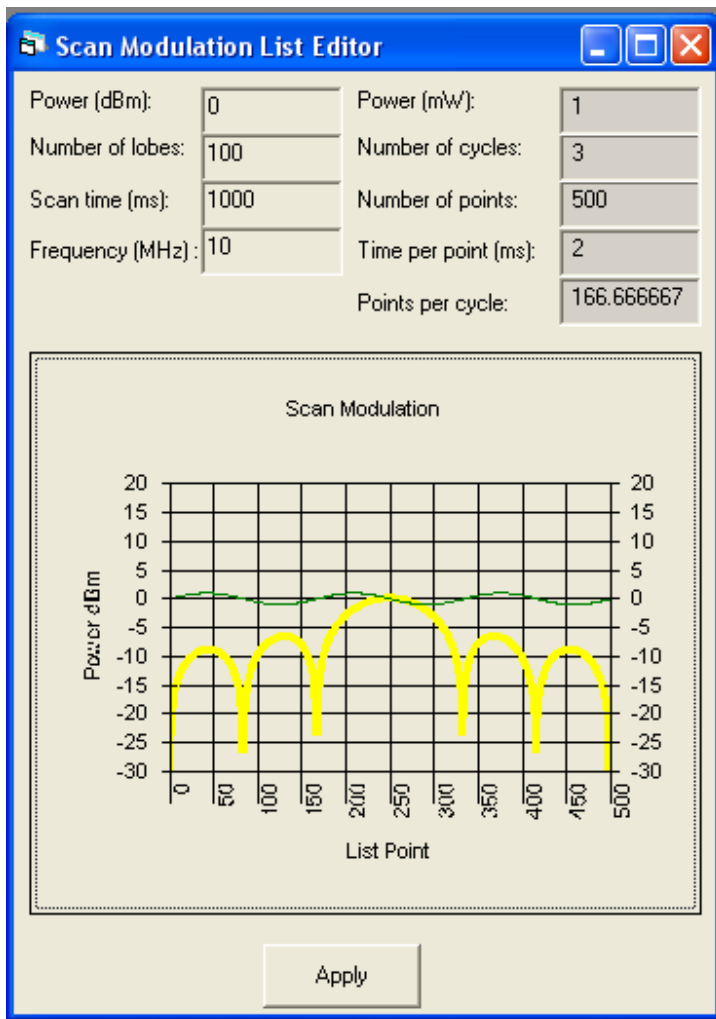
Figure 16 Scan Modulation window

Name	Description
Power (dBm)	Set power in dBm.
Number of Lobes	Set the number of lobes in Scan.
Scan Time	Set the scan time.
Frequency (MHz)	Set frequency for the Scan.
Scan Modulation Graph	Display the waveform generated by the inputs

Apply button	Apply all the input to create a list ramp or square. If the List Controller window is not already opened, or if the list window is open and no list file is active in the list window, the list file creation window request you to enter a list file name. If a list is already active in the List Controller window, this action will automatically replace the current list in the List Controller.
Points per cycle	Display the number of points in every cycle
Time per point (ms)	Display the time taken for every point.
Number of points	Display the number of list points generated in graph.
Number of cycles	Display the number of cycles in the graph.
Power (mW)	Display power in mW.

Using Scan Modulation

Scan modulation uses list mode to generate a SinX/X waveform.

1. Double click on the Modulation Icon in the Navigation window to access the Scan Modulation window. Double click on the Scan Modulation icon to activate the Scan Modulation window.
2. Enter the power level of the scan waveform in the Power field. This power setting is the highest level in the scan waveform.
3. Enter the number of lobes of the SinX/X waveform. The number of lobes must be an odd integer from 1 to 49.
4. Enter the scan time in milliseconds. The scan time is the total sweep time of the SinX/X waveform.
5. Enter the frequency of the scan waveform in MHz.
6. Click Apply to create a list that will generate the SinX/X waveform. If the List Controller window is not already opened, or if the list window is open and no list file is active in the list window, the list file creation window request you to enter a list file name. If a list is already active in the List Controller window, this action will automatically replace the current list in the List Controller window.

3.2.1.4 Advanced Settings

Double clicking on the Advanced icon will open the Advanced Settings window. This window is used to choose ALC leveling selections. The available options are Internal, Power Meter, Positive Diode, and Negative Diode. Power Meter, Positive Diode, and Negative Diode selections are the external ALC Leveling.
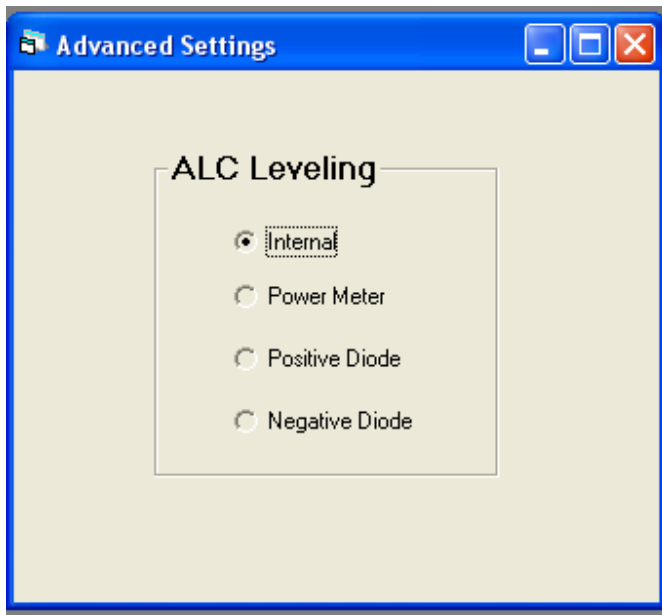

Figure 17 Advanced Settings window

3.2.2 System

3.2.2.1 Interface

The Interface window allows you to set the communications interface between the PC and the instrument. You can choose GPIB, RS-232 (serial port), USB or Ethernet cable. You can choose a specific GPIB address or a COM port or an IP address or you can allow Automation Xpress to automatically detect the 2400/2500 on any of the communication interfaces.
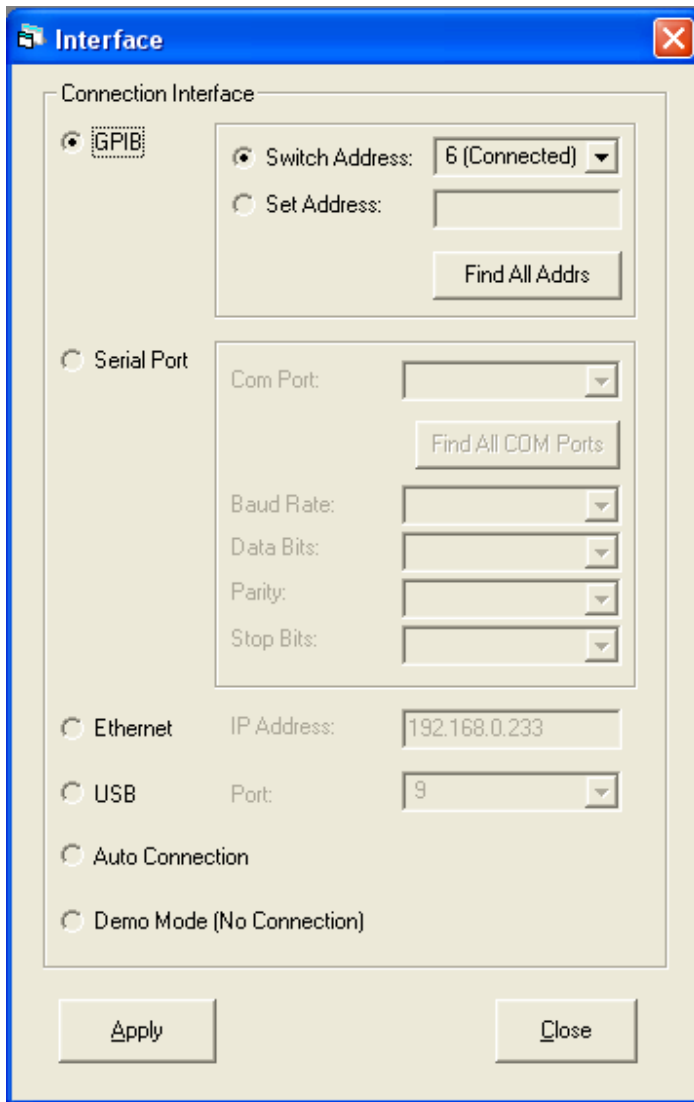

Figure 18 Interface window.

Name	Description
Connection Interface	Lets you select the cable connection used to connect your PC with the hardware device.
GPIB	Selecting the GPIB option will set the connection through the GPIB interface.
Switch Address	Lets you switch to another 2400/2500 if it is connected to the PC via one of the

	communications interfaces.
Set Address	Lets you change the GPIB address of the 2400/2500 that is connected via the GPIB interface. You must click APPLY for the new address to be set.
Serial Port	You can select from COM 1 through 30. The COM port selection must be a valid port with a synthesizer connected to the port. The port connection can be an adapted USB or RS-232.
COM Port	Lets you select the COM Port.
Baud Rate	Lets you select the baud rate. 115200, 38400, 19200 or 9600 baud rate can be selected. 115200 is he current default setting.
Data Bits	Lets you select the data bits. There are two options: 8 and 7. "8" is the current default setting.
Parity	Lets you select the data bits, which has three options: Odd, Even and None. "None" is the current default setting.
Stop Bits	Let's you select the data bits, which have two options: 1 and 2. "1" is the current default setting.
Ethernet	You can select an IP address.
IP Address	Let you select an IP address.
USB	You can select from COM 1 through 30 via a USB cable. The COM port selection must be a valid port with a synthesizer connected to the port.
Port	Let you select a USB COM port.
Auto Connection	This option automatically detects any 2400/2500 synthesizer connected to the PC through the GPIB, RS-232, USB and/or Ethernet. This feature can be used when the address or connection type to the 2400/2500 is not known. This feature will take a few moments to search all available connections.
Demo Mode	Automation Xpress will run in the demonstration mode as if a 2400/2500 was connected to the controller. Some features such as Auto-Programming will not function because they require a 2400/2500 to complete the communication process.
Apply	Clicking the Apply button will apply the selected cable connection options.

3.2.2.2 General Information

The General Information window provides important information about your current Microwave Synthesizer. The General Information window describes your current model, serial information, current firmware version, and hardware specifications
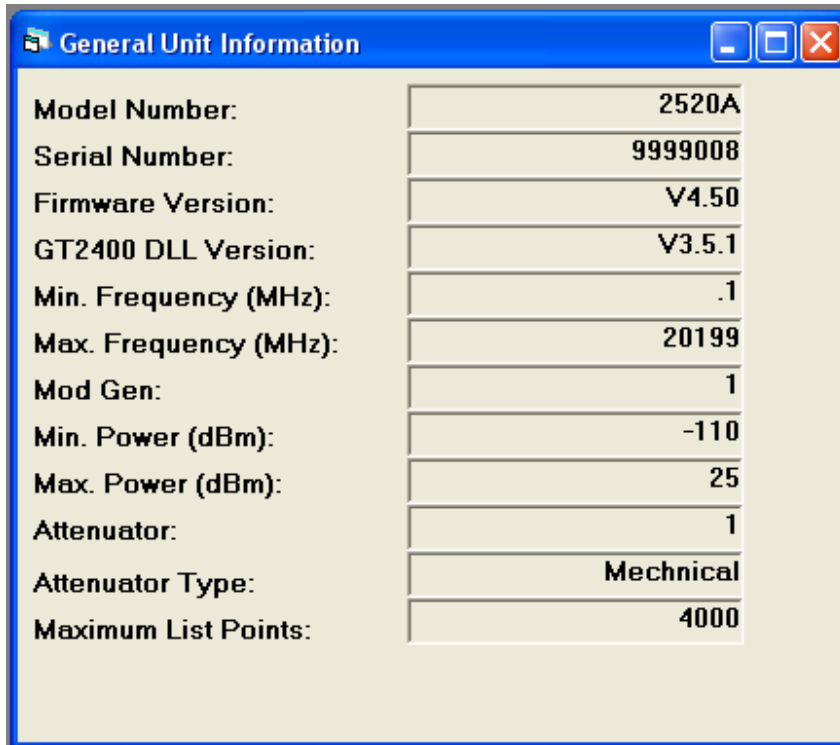

Figure 19 General Information window

3.2.3 Tools

Clicking the Tools icon in the navigation window will open the Tools menu with all of its icons displayed. An additional click will hide the Tools sub-items.

3.2.3.1 Command Interpreter

The Command Interpreter window allows you to directly input GPIB commands or load the script command(s) from a file and send the commands to the instrument. The commands in the Command window can be executed by double clicking on the command or by highlighting it and pressing the ENTER key. The commands can be executed in the order of input, starting with the command at the top of the Command Window. A sequence of commands in the Command Window can run once or in a continuous loop.

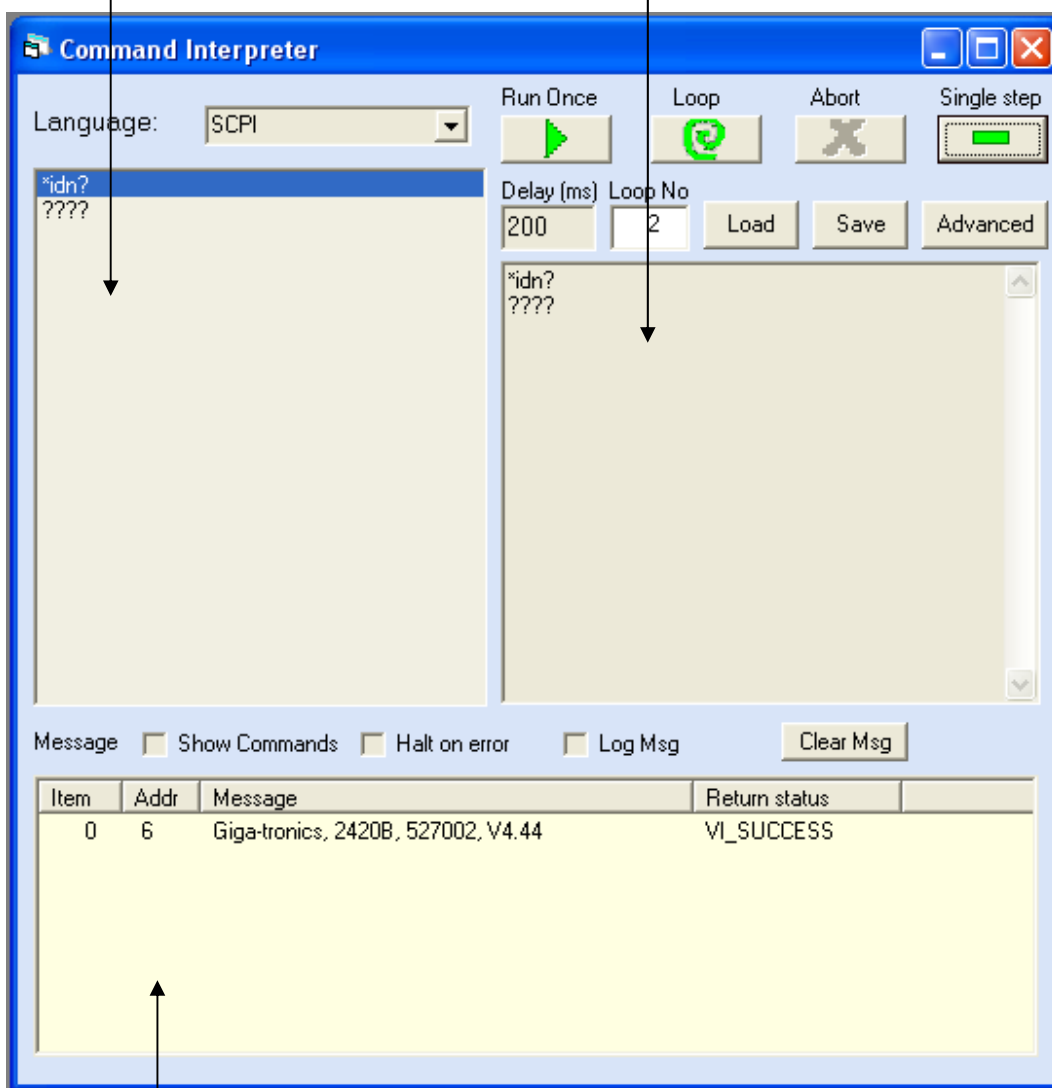Command window   Command entry

Figure 20 Command Interpreter window

Message window

Name	Description
Language	Lets you select between SCPI (Standard Commands for Programmable Instruments) or GT12000 command format.
Command Window	Displays function calls or commands. A double click on any of the commands in this window will send the selected command to the instrument.
Show Commands	Checking this box will display the sent command before the returned message
Message window	This window displays all the returned messages from the instrument. If the "Show Commands" checkbox is checked, this feature will then display both the command and the returned message for the corresponding command.
Halt on Error	Checking this box will stop the execution when an error is detected.
Log Msg	Checking this box to let you save the returned message to a file.
Clear Msg button	Clicking this button clears all the returned messages.
Command Entry	Lets you add new commands to the Command window. Text entered in this window is automatically copied to the Command window.
Run Once	Clicking this button executes the command sequence in the Command window, starting from the first command or from the selected command to the end.
Loop button	Lets you execute the sequence in the Command window continuously.
Abort button	Pressing this button will abort the looping feature. Only enabled when the "Loop" button is clicked.
Single step	Click button to execute the single command. Let you execute the command sequence in the Command window, starting from the first command or from the selected command to the end.
Delay text box	Allow you to set a delay time between commands in the Command window.
Loop No text box	Clicking this button executes the command sequence in the Command window, starting from the first command or from the selected command to the end.
Load button	Lets you load script(s) to the Command window from a file.
Save button	Lets you save the script in the Command window to a file.
Advanced button	Click button to pop up the Connection Selections window. Select GPIB or serial port cable. Click OK button to connect the Command Interpreter window to the selected connection and set AX to Demo Mode (no connection).

3.2.3.1.1 Entering Commands in the Command Interpreter

The default language for the instrument is SCPI. The Command Interpreter does not automatically control the instrument command set interface. The command language can be change to SCPI or GT12000 (Native) in the Command Interpreter using either the /SCPI or / GT12000 command. There are no query commands to determine which command interface the instrument is set to.

Manual Entry Method. Move the mouse over the Command Entry field and left click. Type the command. The text will automatically be copied in the Command Window. The Command Entry field functions like any text editor and commands can be edited using techniques such as overwrite, replace, insert.

Performing a Query. Enter "????" (four question marks) in the Command Entry field. Instrument responses are displayed in the Message Window.

3.2.3.1.2 Executing Commands in the Command Window

The Command Interpreter enables you to execute commands as a sequence or individually. A command sequence can be executed in a single run or can be executed in a continuous loop.

Double click on a command in the Command Window to execute a single command. Using this method, the commands in the Command Window can be executed in any order.

Click RUN ONCE to execute the commands shown in the Command Window. AX executes commands starting with the first command and progresses through the command list to the last command in the sequence.

Click LOOP to execute the commands starting with the first command, progressing to the last command in the sequence and repeating until the action is aborted.

The Abort button will become active when the Run Once or Loop buttons are selected. Click on the ABORT button to terminate a command sequence operation.

Click Single Step to execute the single command. Let you execute the command sequence in the Command window, starting from the first command or from the selected command to the end.

The Command Interpreter also allows you to set a programmed delay between commands.

Click on the DELAY CONTROL and enter a command delay time in milliseconds. The maximum delay setting is 9999 milliseconds.

3.2.3.1.3 Messages

The Message Window displays information regarding commands sent to the instrument and any query information returned from the instrument. The message feature also allows you to halt a command sequence when an error or invalid remote operation has occurred. The message feature will also let you save the message history to a file.

Click the SHOW COMMANDS option to display commands sent to the instrument and any information returned from the instrument in the form of a query Click the HALT ON ERROR option to stop a sequence run whenever a remote operation error is encountered, such as a communications failure. This feature does not interrupt the command sequence if an invalid command is encountered.

3.2.3.1.4 Messages Loading, and Saving a Command Sequence

Along with directly entering a command sequence into the Command Interpreter, a command sequence can be loaded into the Command Interpreter from a text file. The only requirements to properly load a text file into the Command Interpreter, is the command(s) must be syntactically correct and each line must consist of one command and terminated with a line feed. All text editors automatically add a line termination each time the Enter key is pressed.

3.2.3.1.5 Loading a text script file into the Command Interpreter

To load a text script file into the Command Interpreter window, perform the following:

Click on the Load button. An Open Script browser window will appear and you will be prompted to select a file to load. Select the appropriate file and click on the Open button.

3.2.3.2 Auto-Programmer for SCPI/Native Script

Double clicking on the Auto Programmer for SCPI/Native Script icon will open the Auto Programmer window for SCPI/Native Script. As long as the Auto Programmer for SCPI/ Native Script window is open, the operations on the Control Package are recorded. You can select between SCPI and GT12000(Native) Script. When you have finished, you can export the code to a file or clear the recorded actions.
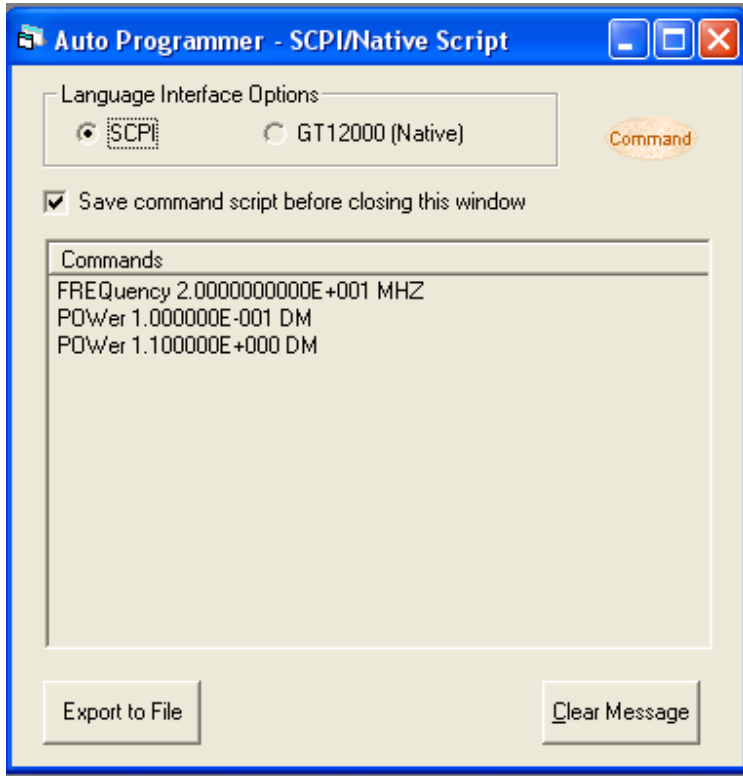

Figure 21 Auto-Programmer - SCPI/Native Script window

Name	Description
Language Interface Option	Lets you generate command scripts of the operations performed in Automation Xpress.
SCPI	Automation Xpress will capture the SCPI commands as they are executed.
GT12000	Automation Xpress will capture the GT12000 (Native) commands as they are executed.
Save Command checkbox	Lets you save the command script before exporting. The default option is checked.
Command capturer box	Displays the executed commands.
Export to File	Clicking this button exports the commands shown in the Command Capturer box to a file.
Clear Message	Clicking this button will clear the function calls or commands displayed in the Command capturer box.

3.2.3.3 Auto-Programmer for MS Visual C++

Double clicking on the Auto Programmer for VC++ icon will open the Auto Programmer window for MS VC++ window. As long as the Auto Programmer for VC++ is open, the operations on the Control Package are recorded and translated into code at your choice. You can select between SCPI and GT12000(Native) Script. When you have finished, you can export the code to a file or clear the recorded actions. Auto Programmer for VBasic is similar to Auto Programmer for VC++.

Please refer to GT2400 and 2500 Series Microwave Signal Generators Programmer Manual for the Dynamic Link library or DLL functions details.
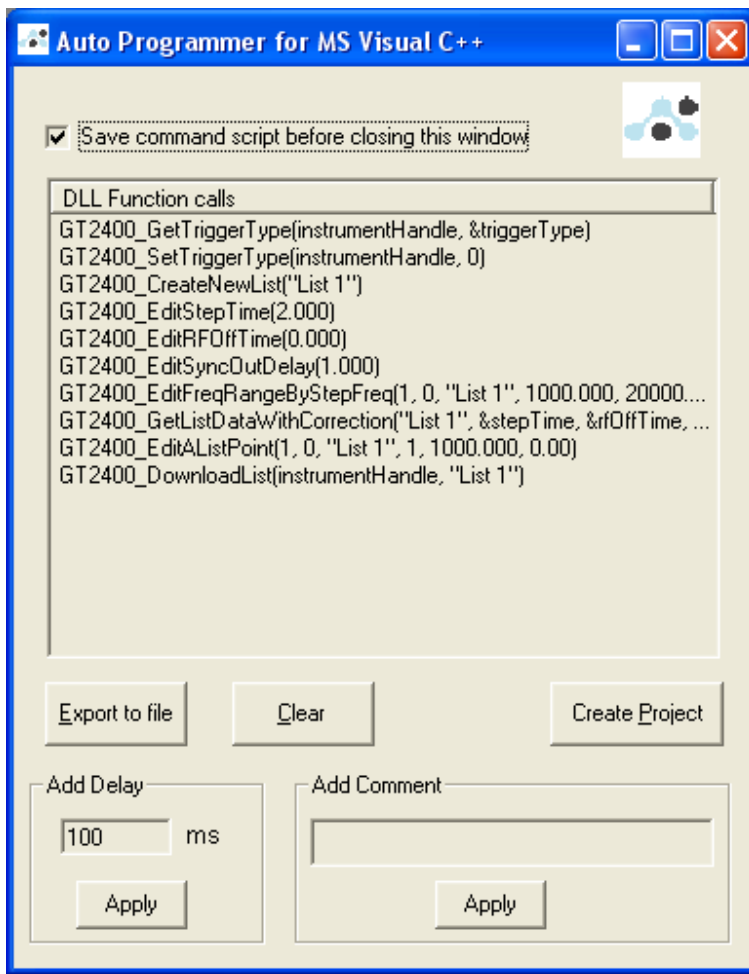

Figure 22 Auto Programmer for VC++ window

Name	Description
Save Command Script checkbox	Checking this box will automatically save the command script when the Auto-Programmer window is closed.
DLL Function Calls	Displays the AX DLL function calls.
Export to File	Clicking this button to export DLL function calls to a text file.
Clear	Clicking this button to clear DLL function calls.
Create Project	Clicking this button will open the Create Project window. It is used to create the Microsoft Visual C++ project with the recorded DLL function calls.
Add Delay	Click Apply button to add Sleep(xxxx) ms delay to DLL functions.

| Add Comment | Click Apply button to add comment to DLL functions. |

3.3   Service Tab Windows

Clicking on the Service menu tab in the Navigation window 3.1.4 will open the Service menu. When the Service menu displays, the Service menu icons will appear in the Navigation window as follows.

Figure 23 Navigation window - Service tab

3.3.1 Test

Clicking the Test icon in the navigation window will open the Test menu with all of its icons displayed.

3.3.1.1 *LCD Test*

Double clicking the LCD Test icon will open the LCD test window. From this window you can select and run one of the following tests: All, Horizontal, Diagonal, None, and Off.
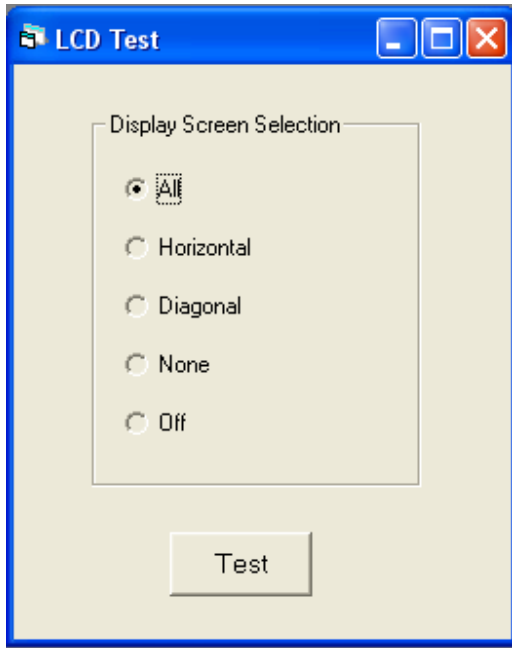

Figure 24 LCD Test window

Name	Description
All	Turns on all pixels on the GT2400/2500 display.
Horizontal	Turns on pixels to form horizontal lines on the unit display.
Diagonal	Turns on pixels to form diagonal lines on the unit display.
None	Turns off all pixels on the unit display.
Off	Turns all LCD tests off.
Test	Click Test button to start the test.

3.3.1.2 SCPI Status Reporting

Clicking the SCPI Status Reporting Menu icon in the Navigation window will open the SCPI Status Reporting window. This window is used to do the Status Report settings.
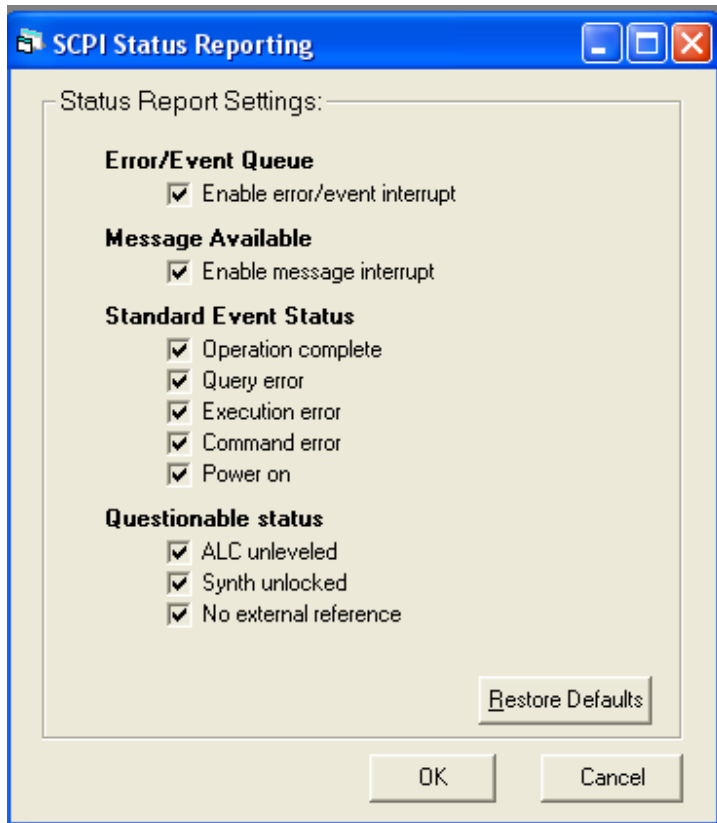

Figure 25 SCPI Status Reporting window

3.3.2 Tools

Clicking the Tools icon in the Service tab menu of the Navigation window will open the Tools menu. Opening the Tools menu will display the Tools sub-menus.

3.3.2.1 Firmware Download

Double clicking the Firmware Download icon will open the Firmware Download window. This window allows you to download the firmware files via the Serial port, USB with COM port selected, GPIB or Ethernet. An appropriate COM port or GPIB address or Ethernet IP address must be selected. Click Download File button and select a firmware file with chk extension to download the firmware to the instrument.

The firmware version should be 4.5 or above for USB/GPIB/ Ethernet firmware download. If the instrument firmware version is lower than 4.5, please use the serial port for the firmware download.
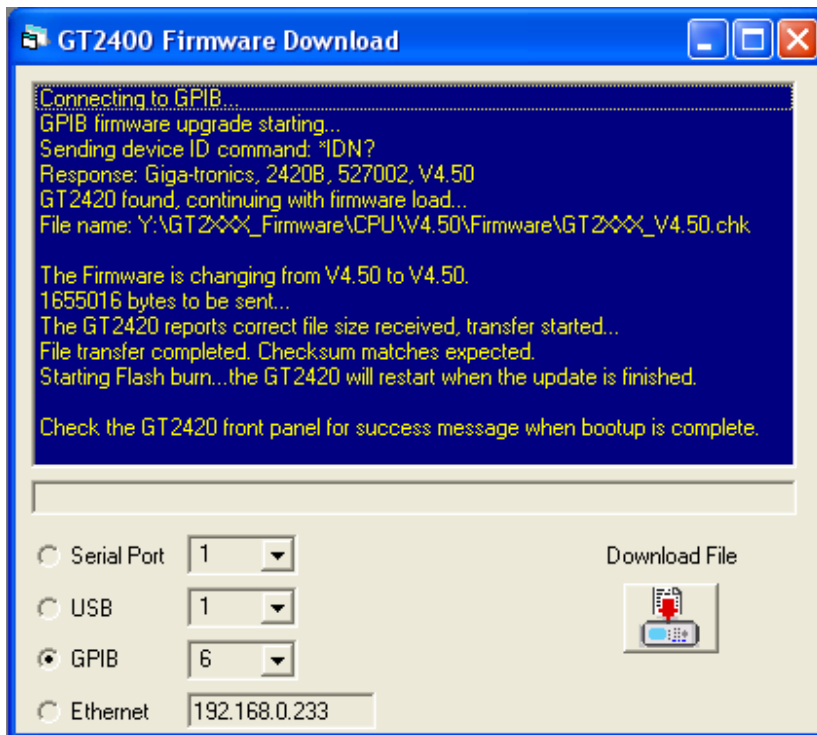

Figure 26 Firmware Download window

Giga-tronics Support Services

At Giga-tronics, we understand the challenges you face. Our support services begin from the moment you call us. We help you achieve both top-line growth and bottom-line efficiencies by working to identify your precise needs and implement smart and result orientated solutions. We believe and commit ourselves in providing you with more than our superior test solutions.

For technical support, contact:
Tel: 1-800-726-GIGA (4442) or (925) 328-4669
Email: support@gigatronics.com