2400 and 2500 Series
Microwave Signal Generators

Registered 04 June 1996 Amended 10 September 2001

CE Certified Product

ISO 9001 Certified Process

Registrar: BSI, Certification FM 34226

Programming Manual

Programming Manual, Part Number 34783, Rev A, July 2009

All technical data and specifications in this publication are subject to change without prior notice and do not represent a commitment on the part of Giga-tronics, Incorporated.

Warranty

Giga-tronics 2400/2500 Series instruments are warranted against defective materials and workmanship for one year from date of shipment. Giga-tronics will at its option repair or replace products that are proven defective during the warranty period. This warranty DOES NOT cover damage resulting from improper use, nor workmanship other than Giga-tronics service. There is no implied warranty of fitness for a particular purpose, nor is Giga-tronics liable for any consequential damages. Specification and price change privileges are reserved by Giga-tronics.

CONTACT INFORMATION

Giga-tronics, Incorporated

4650 Norris Canyon Road

San Ramon, California 94583

Telephone: 800.726.4442 (only within the United States)

925.328.4650

Fax: 925.328.4700

On the Internet: www.gigatronics.com

Regulatory Compliance Information

This product complies with the essential requirements of the following applicable European Directives, and carries the CE mark accordingly.

89/336/EEC and 73/23/EEC	EMC Directive and Low Voltage Directive
EN61010-1 (1993)	Electrical Safety
EN61326-1 (1997)	EMC – Emissions and Immunity

Manufacturer's Name:
Giga-tronics, Incorporated

Manufacturer's Address
4650 Norris Canyon Road
San Ramon, California 94583
U.S.A.

Type of Equipment:
Microwave Signal Generator

Model Series Number
2400 Series
2500 Series

Model Numbers:
2408C, 2420C, 2426C,
2440C

2508B, 2520B, 2526B,
2540B, 2550B

Declaration of Conformity on file. Contact Giga-tronics at the following;

Giga-tronics, Incorporated
4650 Norris Canyon Road
San Ramon, California 94583
Telephone: 800.726.4442 (only within the United States)
925.328.4650
Fax: 925.328.4700

Record of changes to this Manual

Use the table below to maintain a permanent record of changes to this document. Replacement pages will be issued as a TPCI (Technical Publication Change Instruction), and will be inserted at the front of the binder. Remove the corresponding old pages, insert the new pages, and record the changes here. Do the same thing with TCPI pages that are issued after you have received this manual.

TPCI Number	TPCI Issue Date	Date Entered	Comments

Table of Contents

Table of Contents i
Chapter 1. Safety 1
1.1 Unsafe Operating Conditions 1
1.2 Safety Warnings Used in This Manual 1
1.2.1 Personal Safety Alert 1
1.2.2 Equipment Safety Alert 1
1.2.3 Notes 1
Chapter 2. Introduction 3
2.1 Overview 3
2.2 Physical Description of the 2400/2500 4
Chapter 3. Hardware Interfaces 5
3.1 Introduction 5
3.2 Configure the 2400/2500 Hardware Interface 6
3.2.1 Using the Included USB Cable 6
3.2.2 Assign a GPIB Address to the 2400/2500 6
3.2.3 Configure the Computer's RS-232 for Remote Operation 6
3.2.4 Configure the 2400/2500 Ethernet Connection 7
Chapter 4. Programming Interfaces 9
4.1 Introduction 9
4.2 Select the Remote Programming Language 9
4.3 Dynamic Link Library (DLL) 10
4.3.1 Adding the DLL to Programming Projects 10
4.3.2 Programming Examples Using the DLL 11
4.3.3 DLL Functions 17
4.4 SCPI Command Set 96
4.4.1 SCPI Command Format 96
4.4.2 SCPI Commands 97
4.5 IEEE 488.2 Common Commands 120
4.6 GT-12000 Native Commands 122
4.6.1 GT-12000 Native Commands: CW and System 122
4.6.2 GT-12000 Native Commands: List Mode 123
4.6.3 GT-12000 Native Commands: Amplitude Modulation 125
4.6.4 GT-12000 Native Commands: Frequency Modulation 126
4.6.5 GT-12000 Native Commands: Phase Modulation 127
4.6.6 GT-12000 Native Commands: Pulse Modulation 128
4.7 Emulation 129
4.7.1 HP 834X Emulation Commands 129

4.7.2 HP 8663 Emulation Commands 132
4.7.3 HP 8673 Emulation Commands 134
4.7.4 HP 8360 Emulation Commands 138
4.7.5 HP 8370 Emulation Commands 139
4.7.6 GT900 Emulation Commands 140
4.7.7 Option 55F: Wavetek 90X Emulation Commands 142
4.7.8 Systron Donner 16XX Emulation Commands 143
Chapter 5. Automation Xpress 149
5.1 Introduction 149
5.1.1 Benefits of Using Automation Xpress 149
5.2 Install Automation Xpress 150
5.3 Start Automation Xpress 152
5.4 Automation Xpress GUI Description 154
5.4.1 Tool Bar 155
5.4.2 Indicators and RF Button 165
5.5 Auto Programmer 167
5.5.1 Introduction 167
5.5.2 Auto Programmer Examples 168
Chapter 6. Status Register System 171
6.1 Introduction 171
6.2 Status Byte and Service Request Enable Registers 173
6.3 Standard Event Status and Standard Event Status Enable Registers 174
6.4 Questionable Status Condition and Enable Registers 175
Chapter 7. 2400/2500 Specific Commands 177
Chapter 8. List Mode Operation 179
Chapter 9. LabVIEW Drivers 181
9.1 Overview 181
9.2 LabVIEW Drivers 183
9.2.1 LabVIEW Drivers for DLL Functions 183
9.2.2 Non-DLL LabVIEW Drivers 187
Appendix A. Remote Error Messages 189
Appendix B. DLL Error Messages 193
Appendix C. FM Sensitivity/Deviation RangeTable 197

Chapter 1. Safety

1.1 Unsafe Operating Conditions

If you notice any of the following conditions while operating electronics equipment, IMMEDIATELY de-energize the equipment.

- The instrument fails to operate normally, or operates erratically.
- The power cable, receptacle, or plug on the instrument is damaged
- The instrument causes electrical shock or operates at abnormally high temperature.
- A liquid or foreign substance falls into the instrument
- The instrument generates an abnormal sound, smell, smoke, or sparking light.

If any of the above conditions occurs, contact Giga-tronics to get the instrument repaired.

Continuing to operate the instrument with any of the above conditions could cause death or serious damage to the instrument and any equipment connected to it.

1.2 Safety Warnings Used in This Manual

1.2.1 Personal Safety Alert

WARNING: Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

1.2.2 Equipment Safety Alert

CAUTION

CAUTION: Indicates a situation which can damage or adversely affect the 2400 and 2500 or associated equipment.

1.2.3 Notes

Notes are denoted and used as follows:

NOTE: Highlights or amplifies an essential operating or maintenance procedure, practice, condition or statement.

This page is intentionally blank

Chapter 2. Introduction

2.1 Overview

Manual Convention:

- **For simplicity, when generically referring to Giga-tronics Microwave Signal Generators in the 2400 and 2500 Series, the term "2400/2500" may be used. Specific models within either series are referred to when necessary.**

This manual describes how to program and remotely control the 2400/2500 and 2500B Series Microwave Signal Generators for automated testing.

Giga-tronics designed the 2400/2500 for high performance and flexibility, and accordingly, there are different ways to set up the instrument for automated testing. All methods for setting up the 2400/2500 for automated testing are described in this manual.

However, the easiest and most effective way to use the 2400/2500 for automated testing is through Automation Xpress, an automated testing application developed by Giga-tronics that is included on the CD-ROM that shipped with the 2400/2500.

Automation Xpress provides the fastest switching of power and frequency during automated testing. This maximizes device throughput, keeping your testing costs as low as possible.

Features of Automation Xpress:

- 1.0 ms frequency and power switching during testing
- Eliminate the need to learn GPIB or other native language commands by using the Auto Programming feature, which automatically records a sequence of actions and converts those actions into program code. You can then import this code into the program environment of your choice, such as Visual C++ or Visual Basic.
- The Xpress Auto-programming feature virtually eliminates training time by providing scripts and sequences guaranteed for accuracy.
- Transit and execution times for single-function calls such as changing CW frequency are ten times faster using Automation Xpress compared to standard message-based commands.
- Automation Xpress sends large amounts of data (i.e., large lists) more than 100 times faster than SCPI commands.

2.2 Physical Description of the 2400/2500

If you need information about the controls, indicators, display, or any other physical aspects of the 2400/2500, refer to the Operation Manual for the series you are interested in:

2400/2500 Operation Manual part number: 34802

2500B Operation Manual part number: 34737

Chapter 3. Hardware Interfaces

3.1 Introduction

The 2400/2500 has four connectors to choose from for connecting to a computer:

- GPIB
- LAN (Ethernet)
- RS-232
- USB

Figure 1 below shows the locations of the connectors on the 2400/2500 rear panel. Descriptions of the connectors are given in Table 1 below.

NOTE: Your 2400/2500 may look slightly different, depending on series and model.

Figure 1. 2400/2500 Rear Panel

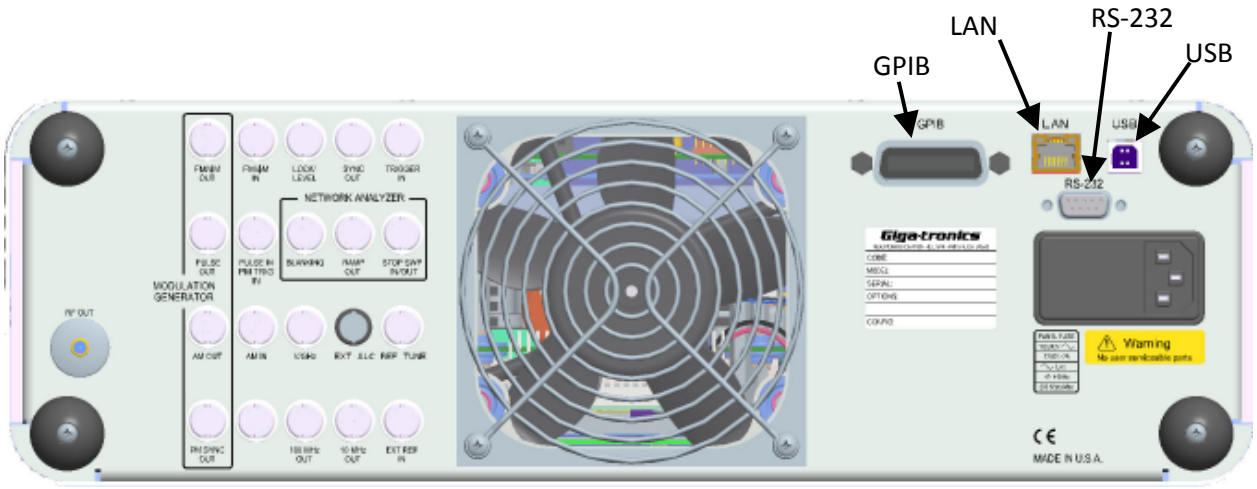


Table 1 2400/2500 Hardware Interfaces Description

Name	Description
GPIB	A 24-pin IEEE STD 488.2 connector for control of the instrument during remote operation using GPIB.
RS-232	A DB-9 connector for control of the instrument during remote operation using RS-232 serial communications. A USB to Serial Cable Port Adapter is included with the 2400/2500 for controlling the instrument via the USB port on a host computer.
USB	A USB connector for control of the instrument during remote operation using USB 2.0 (full speed) communications
Ethernet	An Ethernet connector for control of the instrument during remote operation using LAN interface communications.

3.2 Configure the 2400/2500 Hardware Interface

3.2.1 Using the Included USB Cable

A USB 2.0 Type A Male to Type B Male cable shipped with the 2400/2500, and provides you with the simplest way to connect a computer to the 2400/2500. The cable connects between a USB port on the computer, and the USB port on the 2400/2500.

To use this cable, you must first install Automation Xpress and the USB driver on the computer. See Table 40 on page 150.

3.2.2 Assign a GPIB Address to the 2400/2500

To connect a computer to the 2400/2500 via GPIB, the 2400/2500 must be assigned a GPIB address. The procedure below describes how to assign a GPIB address to a 2400/2500.

Table 2 Setup GPIB Address

Step	Action
1.	On the front panel of the 2400/2500, press SYSTEM to display the System menus, and if the SYSTEM 2 menu does not appear in the display, press the bottom-most interactive softkey until it does.
2.	Enter the desired GPIB address using either the numeric keypad or △ ▽.
End of Procedure	

3.2.3 Configure the Computer's RS-232 for Remote Operation

Table 3 below gives information for configuring an RS-232 port on a computer to communicate with the 2400/2500.

Table 3 RS-232 Communication Settings

Baud rate	115200
Data Bits	8
Parity	None
Stop bits	1
Handshake	None

3.2.4 Configure the 2400/2500 Ethernet Connection

The following procedure explains how to set the DHCP, IP Address, and Subnet Mask of the 2400/2500 when using the Ethernet (LAN) connector on the rear of the 2400/2500. The instrument is identified via Ethernet connection during remote operations using the IP address set in this procedure. Each unit on the network must have a unique IP address.

Table 4 Configure Remote Operation Using the LAN

Step	Action
1.	Press SYSTEM to invoke the System menus, and if the SYSTEM 4 menu does not appear in the display, press the bottom-most interactive softkey until it does.
2.	Are you going to connect the LAN using Dynamic Host Configuration Protocol (DHCP), or configure the LAN connection manually? **If the LAN connection will be done by DHCP:** go to the next step. **If the LAN connection will be configured manually:** go to Step 4.
3.	Press the DHCP softkey and set DCHP to On using the △ ▽ keys. The instrument will try to connect to the DCHP server and the IP address and Subnet Mask will be set automatically from the first server that establishes communication via the LAN connection. Go to Step 7. ***NOTE:*** If the 2400/2500 fails to connect to the DCHP server, the unit will attempt to reconnect again. If it fails to connect to the DCHP server a second time, the 2400/2500 will attempt to reconnect once every hour. During this period, the IP address and subnet mask values will be zero.
4.	Press the DHCP softkey and set DCHP to Off using the △ ▽ keys.
5.	Press the IP Address softkey to highlight the IP Address menu item. Enter the IP address using the numeric keypad. ***NOTE:*** An IP address consists of four sets of three-digit numbers, separated by decimal points. The following example demonstrates how to properly enter an IP address: 190.165.001.034 An invalid IP entry will be displayed as Invalid IP Input in the Step Size/Error Message section of the display. Examples of invalid addresses are values greater than 255, less than zero (negative sign), values greater than three digits per set or more or less than 4 sets of three-digit values.
6.	Press the Subnet Mask softkey to highlight the Subnet Mask menu item. Enter the subnet mask number using the sequence defined in the previous step.
7.	Confirm that the server has connected to 2400/2500 by observing the Link Status menu item. This menu item is an indicator only. No entry key functions are processed.
End of Procedure	

This page is intentionally blank

Chapter 4. Programming Interfaces

4.1 Introduction

This chapter describes the different programming interfaces and methods for remotely controlling a 2400/2500.

4.2 Select the Remote Programming Language

The 2400/2500 can communicate using a variety of languages. Every 2400/2500 is capable of communications using the SCPI (Standard Commands for Programmable Instruments) language or any Giga-tronics native command set. Optional Command Sets are available as well.

Table 5 below describes how to use the 2400/2500 front panel in local operating mode to select a language from the Language Menu.

Table 5 Select the Remote Language

Step	Action
1.	• If the instrument **IS NOT** in remote operating mode, press the LOCAL button once to invoke the Language menus in the display. • If the instrument **IS IN** remote operating mode, press the LOCAL button twice - once to take it out of remote operating mode, then again to invoke the Language menus in the display.
2.	If the desired language does not appear in the parameter area of the display, press the bottom-most interactive softkey to go to the next menu. There are three screens for the Language menus. Use the bottom softkey to go through the screens until you find the language you want to use.
3.	If the message “Option not installed” appears next to a given language in the menu area of the display, that language is optional and not currently available in the instrument. Contact Giga-tronics customer support to inquire about purchasing additional language options.
4.	Once you have located the desired language, press the associated interactive softkey in the display to select it.
End of Procedure	

4.3 Dynamic Link Library (DLL)

A DLL is a collection of routines that can be used by applications or other DLLs. A DLL is provided on the CD-ROM that is included with the 2400/2500 Microwave Signal Generator. When you install Automation Xpress from the CD-ROM onto your computer, the DLL is loaded onto your computer. The routines in the DLL can be used in Visual C++, Visual Basic, and other applications.

4.3.1 Adding the DLL to Programming Projects

The following procedures describe how to include the DLL into Visual C++ and Visual Basic projects.

4.3.1.1 Add the DLL to a Visual C++ Project

Table 6 Add the DLL to a Visual C++ Project	
Step	**Action**
1.	Create a Visual C++ project.
2.	Copy GT2400.dll from C:\Program Files\Giga-tronics\AX\bin into your project's executable folder for run time calls. (e.g. folder named "Debug")
3.	Copy GT2400.lib from C:\Program Files\Giga-tronics\AX\lib into your project.
4.	Copy all files from C:\Program Files\Giga-tronics\AX\include into your project.
5.	Copy the following line into your application C/C++ files: "#include "GT2400.h"
6.	Make DLL function calls as needed from any .cpp files where GT2400.h file is included.
7.	Build your application.
End of Procedure	

4.3.1.2 Add the DLL to a Visual Basic Project

Table 7 Add the DLL to a Visual Basic Project	
Step	**Action**
1.	Create a Visual Basic project.
2.	Copy GT2400.dll from C:\Program Files\Giga-tronics\AX\bin into your project's executable folder for run time calls.
3.	Copy DLLDeclare.bas from C:\Program Files\Giga-tronics\AX\VBModule to the project folder.
4.	Make DLL function calls as needed from any files in the project.
5.	Build the application.
End of Procedure	

4.3.2 Programming Examples Using the DLL

4.3.2.1 CW Operation Using Visual C++

NOTE: Only bold faced code lines are unique to a specific operation mode. All other lines are supporting lines shared by both CW and List modes.

Step	Description
1.	Perform steps 1 through 5 in Table 6 on page 10 to add the DLL to a Visual C++ project.

2.	Write the following code:
	`#include "GT2400.h"`
	`#include "stdio.h"`
	`#define SUCCESS 0`
	`//This routine sets CW frequency and power of a 2400/2500 synthesizer`
	`//at your choice through GPIB at address 6.`
	`void main(void)`
	`{`
	`STATUS status;`
	`unsigned long instrumentHandle;`
	`double Frequency = 1000;`
	`double Power = 0;`
	`status = GT2400_OpenConnection(0,6,0,&instrumentHandle);`
	`if(status < SUCCESS )`
	`{`
	`char statusText[256];`
	`GT2400_GetErrorMessage(status, statusText);`
	`printf("Status Message %s\n",statusText);`
	`}`
	`status = GT2400_SetRF(instrumentHandle, 1);`
	`printf("Frequency (MHz) =");`
	`scanf("%lf",&Frequency);`
	`printf("Power (dBm) =");`
	`scanf("%lf",&Power);`
	`status = GT2400_SetCW(instrumentHandle,Frequency,Power,0,0);`
	`status = GT2400_CloseAllConnections();`
	`}`

3.	Build the project.
4.	Run the program.
End of Example	

4.3.2.2 Programming Example; CW Operation Using Visual Basic

Step	Description
1.	Perform steps 1 through 3 of Table 7 on page 10 to create a Visual Basic project.
2.	Write the following

```
'This routine sets CW frequency and power of a 2400/2500 synthesizer
'through GPIB at address 6.

      Dim status As Long
      Dim instrumentHandle As Long
      Dim Frequency As Double
      Dim Power As Double
      Dim statusText As String

      statusText = Space(100)

      status = GT2400_OpenConnection(0,6,0,instrumentHandle)

      If status < SUCCESS Then
            GT2400_GetErrorMessage(status, statusText)
            MsgBox  statusText
      End If

      status = GT2400_SetRF(instrumentHandle, 1)

      Frequency = 20000 'MHz
      Power = 10
      status = GT2400_SetCW(instrumentHandle,Frequency,Power,0,0)

      status = GT2400_CloseAllConnections()
```

3.	Build the project.
4.	Run the program.
End of example	

4.3.2.3 Programming Example; List Operation Using Visual C++

Step	Description
1.	Perform steps 1 through 5 of Table 6 to create a Visual C++ project.

2.	Write the following code:
	
	#include <windows.h>
	#include <stdio.h>
	#include "gt2400.h"
	#define SUCCESS 0
	
	//This routine can load any list file to 2400/2500 synthesizer
	//and set up repeat type and trigger type at user choice.
	void main(void)
	{
	long status;
	char listFileName[80];
	char statusText[256];
	unsigned long instrumentHandle;
	short tmp;
	
	status = GT2400_OpenConnection(0, 6, 0, &instrumentHandle);
	if(status < SUCCESS)
	{
	GT2400_GetErrorMessage(status, statusText);
	printf("Status Message %s\n",statusText);
	}
	printf("Please enter the file name to be loaded:\n ");
	scanf("%s",&listFileName);
	status = GT2400_LoadListFromFile(listFileName, statusText);
	if (status < SUCCESS) //Error during loading
	{
	GT2400_GetErrorMessage(status, statusText);
	printf("Status Message %s\n",statusText);
	}
	status = GT2400_DownloadList(instrumentHandle, listFileName);
	
	printf("Enter Repeat Type (0 = single step; 1 = single sweep; 2 = continuous) =");
	scanf("%d",&tmp);
	status = GT2400_SetRepeatType(instrumentHandle, tmp);
	
	printf("Enter Trigger Type (0 = External trigger; 1 = Software trigger or GET) =");
	scanf("%d",&tmp);
	status = GT2400_SetTriggerType(instrumentHandle, tmp);
	
	status = GT2400_SetRF(instrumentHandle, 1);
	
	status = GT2400_CloseAllConnections();
	}

Continued next page

Step	Description
3.	Build the project.
4.	Run the program.
5.	Send trigger.
End of example	

4.3.2.4 Programming Example; Generate Two Frequencies

The following example shows how to write code for generating two CW frequencies, separated by a 40 second delay.

Step	Description

1.	//This example sets two CW frequencies in sequence, separated by a 40 second delay.
	#include "GT2400.h"
	#include "stdio.h"
	#include "winbase.h"
	
	void main(void)
	{
	long STATUS;
	unsigned long instrumentHandle;
	
	printf("f= 23.456789 MHz, Power = 5 dBm\n");
	
	STATUS = GT2400_OpenConnection(0, 6, 0, &instrumentHandle);
	
	STATUS = GT2400_SetRF(instrumentHandle, 1);
	
	STATUS = GT2400_SetCW(instrumentHandle, 23.456789, 5);
	
	printf("Waiting for 40 seconds....\n");
	
	//Reserve time for frequency counter to operate correctly
	Sleep(40000);
	
	printf("f= 33.4567891 MHz, Power = 0 dBm\n");
	
	STATUS = GT2400_SetCW(instrumentHandle, 33.4567891, 0);
	
	STATUS = GT2400_CloseAllConnections();
	}

End of example	

4.3.2.5 Programming Example: List Operation Using Visual Basic

Step	Description
1.	Perform step 1 through step 3 of Table 7 on page 10 to create a Visual Basic project.

2.	Write following:
	'This routine can load any list file to 2400/2500 synthesizer
	'and set up repeat type and trigger type.
	
	Dim status As Long
	Dim listFileName As String
	Dim statusText As String
	Dim instrumentHandle As Long
	
	statusText = Space(100)
	
	status = GT2400_OpenConnection(0, 6, 0, instrumentHandle)
	If status < SUCCESS Then
	GT2400_GetErrorMessage(status, statusText)
	MsgBox statusText
	End If
	
	'Please replace C:\Temp\ListTest.txt with your list file name.
	listFileName = "C:\Temp\ListTest.txt"
	status = GT2400_LoadListFromFile(listFileName, listFileName)
	If status < SUCCESS Then
	'Error during loading
	GT2400_GetErrorMessage(status, statusText)
	MsgBox statusText
	End If
	
	status = GT2400_DownloadList(instrumentHandle, listFileName)
	
	'Repeat Type (0 = single step; 1 = single sweep; 2 = continuous) =")
	status = GT2400_SetRepeatType(instrumentHandle, 1)
	
	' Trigger Type (0 = External trigger; 1 = Software trigger or GET) =")
	status = GT2400_SetTriggerType(instrumentHandle, 0)
	
	status = GT2400_SetRF(instrumentHandle, 1)
	
	status = GT2400_CloseAllConnections()

3.	Build the project.
4.	Run the program.
5.	Send trigger.
End of example	

4.3.3 DLL Functions

This section describes the DLL functions in detail.

4.3.3.1 DLL Function; GT2400_FindInstruments

GT2400_FindInstruments

Purpose

Find the addresses of instruments, either through GPIB or RS232, connected to PC.

Syntax

```
STATUS GT2400_FindInstruments(    const short connectionType,
                                  short addresses[],
                                  short *pCount)
```

Parameter	Description
connectionType	Input: Connection type. 0 = GPIB, 1 = RS232 2,3 = SPECIAL (NOT FOR COMMON USE) 4 = GPIB Connection via remote SERVER PC (TCP/IP)
addresses	Output: Array of GPIB addresses or COM port numbers of all the Giga-tronics instruments connected. (Note: In case the RS232 connection interface is selected, the first element returned in this array is the first serial port that is connected to a Giga-tronics instrument followed by the remaining serial port numbers on the PC.) Example 1: There are total of 4 COM ports on a PC, and only COM port 1 is connected to a Giga-tronics instrument, the returned result will be addresses[0] = 1 addresses[1] = 2 addresses[2] = 3 addresses[3] = 4 Example 2: There are total of 4 COM ports on a PC, and only COM port 3 is connected to a Giga-tronics instrument, the returned result will be addresses[0] = 3 addresses[1] = 4
pCount	Output: Total number of instruments connected to PC through the specified interface.

4.3.3.2 DLL Function; GT2400_OpenConnection

GT2400_OpenConnection

Purpose

Establish the communication between the PC and the 2400/2500 with the specified connection interface and address. For an Ethernet connection, call GT2400_SetIPAddress function first to establish the TCP/IP address of the instrument.

Syntax

STATUS **GT2400_OpenConnection(** **const short** connectionType,
const short address,
const short resetDevice
unsigned long *instrumentHandle)

Parameter	Description
connectionType	Input: Connection interface: 0 = GPIB 1 = RS232 2,3 = SPECIAL (NOT FOR COMMON USE) 4 = GPIB Connection via remote SERVER PC (TCP/IP) (not supported after Revision 3.3) 5 = reserved 6 = Ethernet (TCP/IP) (supported from Rev 3.3)
address	Input: GPIB address number if ConnectionType = 0 or COM port number if ConnectionType = 1 ***Note***: GPIB communication board index can be set if GPIB interface is selected. The 2 byte (SHORT) "address" contains GPIB board index and address. The most significant byte is used to set GPIB board index and the least significant byte is used to set GPIB address. The default GPIB board index is 0. Example: GPIB board index = 1; GPIB address = 6 Parameter, address = 0x100 | 0x6 = 0x106 (in Hex.) or 262 (in Decimal)
resetDevice	Input: 1 = Reset instrument in start up 0 = No reset
instrumentHandle	Output: The unique identification of the connected instrument. This handle can be used later to operate on multiple instruments.

4.3.3.3 DLL Function; GT2400_CloseGPIBConnection

GT2400_CloseGPIBConnection

Purpose

Close one specific GPIB connection.

Syntax

STATUS **GT2400_CloseGPIBConnection**(**const unsigned long** instrumentHandle)

Parameter	Description
instrumentHandle	Input: The unique identification of the connected instrument.

4.3.3.4 DLL Function; GT2400_CloseAllConnections

GT2400_CloseAllConnections

Purpose

Close all connection. You should always call this function before you close your application to avoid memory leak.

Syntax

STATUS **GT2400_CloseAllConnections**(**void**)

4.3.3.5 DLL Function; GT2400_SetGPIBAddress

GT2400_SetGPIBAddress

Purpose

Set the GPIB address.

Syntax

STATUS **GT2400_SetGPIBAddress**(**const unsigned long** instrumentHandle,
const short address,
unsigned long *updatedInstrumentHandle)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument.
address	Input: GPIB address.
updatedInstrumentHandle	Output: Updated instrument handle after this function completes.

4.3.3.6 DLL Function; GT2400_SetServerIPAddr (for Rev 3.0 and above)

GT2400_SetServerIPAddr (for Rev 3.0 and above)

Purpose

Set the TCP/IP address of remote SERVER PC. (example: 194.177.0.482)

Syntax

STATUS **GT2400_SetServerIPAddr**(**char** ipAddr[])

Parameter	Description
ipAddr	Input: TCP/IP address of remote SERVER PC

4.3.3.7 DLL Function; GT2400_GetIPAddress (supported from Revision 3.3)

GT2400_GetIPAddress (supported from Revision 3.3)

Purpose

Get the TCP/IP address of the instrument. (example: 194.177.0.482).

Syntax

STATUS **GT2400_GetIPAddress**(**char** ipAddr[])

Parameter	Description
ipAddr	Output: TCP/IP address for the instrument

4.3.3.8 DLL Function; GT2400_SetIPAddress (supported from Revision 3.3)

GT2400_SetIPAddress (supported from Revision 3.3)

Purpose

Set the TCP/IP address for the instrument. (example: 194.177.0.482) For establishing Ethernet connection with the instrument, this function needs to be called prior to calling GT2400_OpenConnection function.

Syntax

STATUS **GT2400_SetIPAddress**(**char** ipAddr[])

Parameter	Description
ipAddr	Input: TCP/IP address for the instrument

4.3.3.9 DLL Function; GT2400_ResetInstrument

GT2400_ResetInstrument

Purpose

Reset the instrument to factory defaults.

Syntax

STATUS **GT2400_ResetInstrument**(**const unsigned long** instrumentHandle)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument

4.3.3.10 DLL Function; GT2400_GetRF

GT2400_GetRF

Purpose

Get the state of RF output

Syntax

STATUS **GT2400_GetRF**(**const unsigned long** instrumentHandle,
short *RFState)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
RFState	Output: 1 = RF is on 0 = RF is off

4.3.3.11 DLL Function; GT2400_SetRF

GT2400_SetRF

Purpose

Set the RF on or off.

Syntax

STATUS **GT2400_SetRF**(**const unsigned long** instrumentHandle,
const short RFState)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
RFState	Input: 1 = Turn on 0 = Turn off RF output

4.3.3.12 DLL Function; GT2400_GetAttenuation

GT2400_GetAttenuation

Purpose

Get the attenuation value.

Syntax

STATUS **GT2400_GetAttenuation**(**const unsigned long** instrumentHandle,
short *pAttenuation)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument.
pAttenuation	Output: current attenuation in the instrument. If returned value = -10, it is in AUTO attenuation mode; Else If returned value = -99, there is no attenuator option installed; Else attenuation is in MANUAL mode with value = *pAttenuation

4.3.3.13 DLL Function; GT2400_SetAttenuation

GT2400_SetAttenuation

Purpose

Set the attenuation of the output power of the 2400/2500.

Syntax

STATUS **GT2400_SetAttenuation**(**const unsigned long** instrumentHandle,
const short attenuation)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
attenuation	Input: attenuation value, e.g. If attenuation = -10, set to auto attenuation; Else If attenuation >= 0, set to manual attenuation with value = attenuation. attenuation = [0, 10,20,30,40,50,60,70,80,90]

4.3.3.14 DLL Function; GT2400_GetALCLeveling

GT2400_GetALCLeveling

Purpose

Get the current ALC leveling source of the instrument.

Syntax

STATUS **GT2400_GetALCLeveling**(**const unsigned long** instrumentHandle,
short *alcLeveling)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
alcLeveling	Output: Current ALC leveling source of the instrument = 0: Internal = 1: Power Meter = 2: Positive Diode = 3: Negative

4.3.3.15 DLL Function; GT2400_SetALCLeveling

GT2400_SetALCLeveling

Purpose

Set the ALC leveling source to the instrument.

Syntax

STATUS **GT2400_SetALCLeveling**(**const unsigned long** instrumentHandle,
const short alcLeveling)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
alcLeveling	Input: ALC leveling source set to the instrument = 0: Internal = 1: Power Meter = 2: Positive Diode = 3: Negative

4.3.3.16 DLL Function; GT2400_GetErrorMessage

GT2400_GetErrorMessage

Purpose

Convert STATUS code to the corresponding description.

Syntax

```
STATUS GT2400_GetErrorMessage(    const long errorID,
                                  char statusText[])
```

Parameter	Description
errorID	STATUS of any DLL function
statusText	Text description of the STATUS

4.3.3.17 DLL Function; GT2400_GetDLLVersion

GT2400_GetDLLVersion

Purpose

Return the DLL version.

Syntax

STATUS GT2400_GetDLLVersion(**char** version[])

Parameter	Description
version	DLL version

4.3.3.18 DLL Function; GT2400_GetCW

GT2400_GetCW

Purpose

Read the current CW setting (data) from the instrument.

Syntax

```
STATUS GT2400_GetCW(    const unsigned long instrumentHandle,
                        double *frequency,
                        double *power)
```

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
frequency	Output: CW frequency (in MHz)
power	Output: CW power (in dBm)

4.3.3.19 DLL Function; GT2400_GetCWDataLimit

GT2400_GetCWDataLimit

Purpose

Get the CW data limits of the instrument.

Syntax

```
STATUS GT2400_GetCWDataLimit(   const unsigned long instrumentHandle,
                                double *pMinFrequency,
                                double *pMaxFrequency,
                                double *pMinPower,
                                double *pMaxPower)
```

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
pMinFrequency	Output: Minimum frequency allowed (in MHz)
pMaxFrequency	Output: Maximum frequency allowed (in MHz)
pMinPower	Output: Minimum power allowed (in dBm)
pMaxPower	Output: Maximum power allowed (in dBm)

4.3.3.20 DLL Function; GT2400_SetCW

GT2400_SetCW

Purpose

Set CW.

Syntax

STATUS **GT2400_SetCW**(**const unsigned long** instrumentHandle,
const double frequency,
const double power)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
frequency	Input: CW frequency (in MHz)
power	Input: CW power (in dBm)

4.3.3.21 DLL Function; GT2400_GetPowerOffset

GT2400_GetPowerOffset

Purpose

Get the current power offset value of the instrument.

Syntax

STATUS **GT2400_GetPowerOffset**(**const unsigned long** instrumentHandle,
double *powerOffset)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
powerOffset	Output: Current power offset value of the instrument

4.3.3.22 DLL Function; GT2400_SetPowerOffset

GT2400_SetPowerOffset

Purpose

Set the power offset value to the instrument.

Syntax

STATUS **GT2400_SetPowerOffset**(**const unsigned long** instrumentHandle,
const double powerOffset)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
powerOffset	Input: Power offset value set to the instrument

4.3.3.23 DLL Function; GT2400_GetPowerSlope

GT2400_GetPowerSlope

Purpose

Get the current power slope value of the instrument.

Syntax

STATUS **GT2400_GetPowerSlope**(**const unsigned long** instrumentHandle,
double *powerSlope)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
powerSlope	Output: Current power slope value of the instrument

4.3.3.24 DLL Function; GT2400_SetPowerSlope

GT2400_SetPowerSlope

Purpose

Set the power slope value to the instrument.

Syntax

STATUS **GT2400_SetPowerSlope**(**const unsigned long** instrumentHandle,
const double powerSlope)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
powerSlope	Input: Power slope value set to the instrument

4.3.3.25 DLL Function; GT2400_DownloadList

GT2400_DownloadList

Purpose

Download a list to the GT2400 synthesizer. The file can be prepared beforehand by either MS Excel, or any text editor or AutomationXpress GUI or AutomationXpress DLL list editing functions.

Syntax

STATUS **GT2400_DownloadList**(**const unsigned long** instrumentHandle,
const char listPath[])

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
listPath	Input: Complete path (path + list name) of the list being downloaded to the unit

4.3.3.26 DLL Function; GT2400_GetRepeatType

GT2400_GetRepeatType

Purpose

Get the repeat type of the list to be triggered.

Syntax

STATUS **GT2400_GetRepeatType**(**const unsigned long** instrumentHandle,
short *repeatType)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
repeatType	Output: 0 = single step; 1 = single sweep; 2 = continuous

4.3.3.27 DLL Function; GT2400_SetRepeatType

GT2400_SetRepeatType

Purpose

Set the repeat type of the list to be triggered.

Syntax

STATUS **GT2400_SetRepeatType**(**const unsigned long** instrumentHandle,
const short repeatType)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
repeatType	Input: 0 = single step; 1 = single sweep; 2 = continuous

4.3.3.28 DLL Function; GT2400_GetTriggerType

GT2400_GetTriggerType

Purpose

Get the trigger type to trigger the list.

Syntax

STATUS **GT2400_GetTriggerType**(**const unsigned long** instrumentHandle,
short *triggerType)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
triggerType	Output: 0 = External trigger; 1 = GET; 2 = Software trigger

4.3.3.29 DLL Function; GT2400_SetTriggerType

GT2400_SetTriggerType

Purpose

Set the trigger type to trigger the list.

Syntax

STATUS **GT2400_SetTriggerType**(**const unsigned long** instrumentHandle,
const short triggerType)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
triggerType	Input: 0 = External trigger; 1 = GET; 2 = Software trigger

4.3.3.30 DLL Function; GT2400_SetListScanDirection

GT2400_SetListScanDirection

Purpose

Set the list scan direction.

Syntax

STATUS **GT2400_SetListScanDirection**(**const unsigned long** instrumentHandle,
const short direction)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument.
direction	Input: 0 = scan from first point to last point; 1 = scan from last to first.

4.3.3.31 DLL Function; GT2400_SoftwareTrigger

GT2400_SoftwareTrigger

Purpose

Use the software to trigger the current list.

Syntax

STATUS **GT2400_SoftwareTrigger**(**const unsigned long** instrumentHandle)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument

4.3.3.32 DLL Function; GT2400_GroupExecutionTrigger

GT2400_GroupExecutionTrigger

Purpose

Send a Group Execution Trigger (G.E.T. is defined in IEEE 488) to all the instruments connected to PC via GPIB.

Syntax

STATUS **GT2400_GroupExecutionTrigger**(**void**)

4.3.3.33 DLL Function; GT2400_GetListDataLimit

GT2400_GetListDataLimit

Purpose

Get the list data limits of the instrument.

Syntax

```
STATUS GT2400_GetListDataLimit(   const unsigned long instrumentHandle,
                                  short *pMaxListPts,
                                  double *pMinStepTime,
                                  double *pMaxStepTime,
                                  double *pMinRFOffTime,
                                  double *pMaxRFOffTime,
                                  double *pMinSyncOutDelay,
                                  double *pMaxSyncOutDelay)
```

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument.
pMaxListPts	Output: Maximum number of list points
pMinStepTime	Output: Minimum list step time (in ms)
pMaxStepTime	Output: Maximum list step time (in ms)
pMinRFOffTime	Output: Minimum list RF off time (in ms)
pMaxRFOffTime	Output: Maximum list RF off time (in ms)
pMinSyncOutDelay	Output: Minimum list sync out delay (in ms)
pMaxSyncOutDelay	Output: Maximum list sync out delay (in ms)

4.3.3.34 DLL Function; GT2400_LoadListFromFile

GT2400_LoadListFromFile

Purpose

Load a list from a disk file to PC RAM.

Syntax

STATUS **GT2400_LoadListFromFile**(**const char** filename[],
char errText[])

Parameter	Description
filename	Input: Name of the file being loaded.
errText	Output: If there is an error detected by STATUS, errText will hold the description of the problems.

4.3.3.35 DLL Function; GT2400_CreateNewList

GT2400_CreateNewList

Purpose

Create a new list in PC RAM.

Syntax

STATUS **GT2400_CreateNewList**(**const char** listPath[])

Parameter	Description
listPath	Input: Complete path (path + list name) of the list whose content is requested

4.3.3.36 DLL Function; GT2400_SaveListToFile

GT2400_SaveListToFile

Purpose

Save a currently active list from RAM to a disk file.

Syntax

STATUS **SaveListToFile** (**const char** filename[],
char errText[])

Parameter	Description
filename	Input: File name of list to be saved in.
errText	Output: If there is an error detected by STATUS, errText will hold the description of the problems.

4.3.3.37 DLL Function; GT2400_ActivateAList

GT2400_ActivateAList

Purpose

Activate the selected list so that the list is ready to respond to a trigger.

Syntax

STATUS **GT2400_ActivateAList**(**const char** listPath[])

Parameter	Description
listPath	Input: Complete path (path + list name) of the list to be activated

4.3.3.38 DLL Function; GT2400_GetListData

GT2400_GetListData

Purpose

Get the contents of the selected list from DLL allocated RAM into user application.

Syntax

```
STATUS GT2400_GetListData(      const char listPath[],
                                double *stepTime,
                                double *rfOffTime,
                                double *syncOutDelay,
                                unsigned char *syncInfo,
                                short *attenSetting
                                double *frequency,
                                double *power,
                                short *pListLen)
```

Parameter	Description
listPath	Input: Complete path (path + list name) of the list whose content is requested.
stepTime	Output: Step time of all list points (in ms)
rfOffTime	Output: RF off time of all list points (in ms)
syncOutDelay	Output: Sync out delay (in ms)
syncInfo	Output: Sync out pulse information for every list pt
attenSetting	Output: The attenuation setting for the current list
frequency	Output: Array of frequencies in the list (in MHz)
power	Output: Array of power in the list (in dBm)
pListLen	Output: Number of points in the list

4.3.3.39 DLL Function; GT2400_GetListDataWithCorrection

GT2400_GetListDataWithCorrection

Purpose

Get the contents of the selected list from DLL allocated RAM into user application.

Syntax

```
STATUS GT2400_GetListDataWithCorrection (  const char listPath[],
                                           double *stepTime,
                                           double *rfOffTime,
                                           double *syncOutDelay,
                                           unsigned char *syncInfo,
                                           short *attenSetting
                                           double *frequency,
                                           double *power,
                                           double *correction,
                                           short *pListLen)
```

Parameter	Description
listPath	Input: Complete path (path + list name) of the list whose content is requested.
stepTime	Output: Step time of all list points (in ms)
rfOffTime	Output: RF off time of all list points (in ms)
syncOutDelay	Output: Sync out delay (in ms)
syncInfo	Output: Sync out pulse information for every list pt
attenSetting	Output: The attenuation setting for the current list
frequency	Output: Array of frequencies in the list (in MHz)
power	Output: Array of power in the list (in dBm)
correction	Output: Array of correction in the list (in dBm)
pListLen	Output: Number of points in the list

4.3.3.40 DLL Function; GT2400_SetCorrection

GT2400_SetCorrection

Purpose

Edit the correction of the selected list.

Syntax

STATUS **GT2400_SetCorrection** (**double** *correction)

Parameter	Description
correction	Input: Array of correction

4.3.3.41 DLL Function; GT2400_GetCorrection

GT2400_GetCorrection

Purpose

Get the correction of the selected list.

Syntax

STATUS **GT2400_GetCorrection** (**double** *correction)

Parameter	Description
correction	Output: Array of correction

4.3.3.42 DLL Function; GT2400_EditApplyCorrection

GT2400_EditApplyCorrection

Purpose

Set flag if correction should apply.

Syntax

STATUS **GT2400_EditApplyCorrection** (**bool** correctionOn)

Parameter	Description
correctionOn	Input: 1 to turn on correction 0 to turn off

4.3.3.43 DLL Function; GT2400_EditAListPoint

GT2400_EditAListPoint

Purpose

Edit a selected point in a list.

Syntax

STATUS **GT2400_EditAListPoint**(**const short** position
const short insertType,
const char listPath[],
const unsigned char syncOutEnable,
const double frequency,
const double power)

Parameter	Description
position	Input: position in the list being edited. 0 < position ≤ current list length
insertType	Input: Insert Type: 0 = REPLACE 1 = INSERT BEFORE 2 = INSERT AFTER
listPath	Input: Complete path (path + list name) of the list
syncOutEnable	Input: Enable/disable sync out pulse generated in the editing point
frequency	Input: Frequency of the point being updated (in MHz)
power	Input: Power of the pt being updated (in dBm)

4.3.3.44 DLL Function; GT2400_EditListPoints

GT2400_EditListPoints

Purpose

Edit multiple selected list points in a list with one function call.

Syntax

```
STATUS GT2400_ EditListPoints (   const short position,
                                  const short insertType,
                                  const char listPath[],
                                  const unsigned char *syncOutEnable,
                                  const double *frequency,
                                  const double *power,
                                  const short listLen,
                                  char errorTxt[])
```

Parameter	Description
position	Input: position in the list being edited. 0 < position ≤ current list length
insertType	Input: Insert Type: 0 = REPLACE, 1 = INSERT BEFORE 2 = INSERT AFTER (Note: if insertType = REPLACE, the existing list will be replaced with the newly created list.)
listPath	Input: Complete path (path + list name) of the list
syncOutEnable	Input: Byte array that enables or disables sync out pulse generated in list.
frequency	Input: Array of frequency for list points (in MHz)
power	Input: Array of power for list points (in dBm)
listLen	Input: Number of list points being edited
errText	Output: If there is an error detected by STATUS, errText will hold the description of the problem.

4.3.3.45 DLL Function; GT2400_EditFreqRangeByStepFreq

GT2400_EditFreqRangeByStepFreq

Purpose

Establish a list or insert a sub-list to an existing list by inputting start frequency, stop frequency, step frequency, and power.

Syntax

```
STATUS GT2400_ EditFreqRangeByStepFreq(  const short position,
                                         const short insertType,
                                         const char listPath[],
                                         const double startFrequency,
                                         const double stopFrequency,
                                         const double stepFrequency,
                                         const double power)
```

Parameter	Description
position	Input: position in the list being edited, 0 < position ≤ current list length
insertType	Input: Insert Type: 0 = REPLACE 1 = INSERT BEFORE 2 = INSERT AFTER (Note: if insertType = REPLACE, the existing list will be replaced with the newly created list.)
listPath	Input: Complete path (path + list name) of the list
startFrequency	Input: Start frequency (in MHz)
stopFrequency	Input: Stop frequency (in MHz)
stepFrequency	Input: Frequency step (in MHz)
power	Input: Power for all list points (in dBm)

4.3.3.46 DLL Function; GT2400_EditPowerRangeByStepPower

GT2400_EditPowerRangeByStepPower

Purpose

Establish a list or insert a sub-list to an existing list by inputting start power, stop power, step power, and frequency.

Syntax

STATUS **GT2400_ EditPowerRangeByStepPower**(**const short** position,
const short insertType,
const char listPath[],
const double startPower,
const double stopPower,
const double stepPower,
const double frequency)

Parameter	Description
position	Input: position in the list being edited, 0 < position ≤ current list length
insertType	Input: Insert Type: 0 = REPLACE 1 = INSERT BEFORE 2 = INSERT AFTER (Note: if insertType = REPLACE, the existing list will be replaced with the newly created list.)
listPath	Input: Complete path (path + list name) of the list
startPower	Input: Start power (in dBm)
stopPower	Input: Stop power (in dBm)
stepPower	Input: Step power (in dBm)
frequency	Input: Frequency for all list points (in MHz)

4.3.3.47 DLL Function; GT2400_EditFreqRangeByNumOfPts

GT2400_EditFreqRangeByNumOfPts

Purpose

Establish a long list or insert a sub-list to an existing list by inputting start frequency, stop frequency, power, and number of list points.

Syntax

```
STATUS GT2400_EditFreqRangeByNumOfPts(  const short position,
                                        const short insertType,
                                        const char listPath[],
                                        const double startFrequency,
                                        const double stopFrequency,
                                        const double power,
                                        const short numOfPts)
```

Parameter	Description
position	Input: position in the list being edited, 0 < position ≤ current list length
insertType	Input: Insert Type: 0 = REPLACE 1 = INSERT BEFORE 2 = INSERT AFTER (Note: if insertType = REPLACE, the existing list will be replaced with the newly created list.)
listPath	Input: Complete path (path + list name) of the list
startFrequency	Input: Start frequency for range insertion (in MHz)
stopFrequency	Input: Stop frequency for range insertion (in MHz)
power	Input: Power for all list points (in dBm)
numOfPts	Input: Number of list points being created

4.3.3.48 DLL Function; GT2400_EditPowerRangeByNumOfPts

GT2400_EditPowerRangeByNumOfPts

Purpose

Establish a long list or insert a sub-list to an existing list by inputting start power, stop power, frequency, and number of list points.

Syntax

STATUS **GT2400_EditPowerRangeByNumOfPts**(**const short** position,
const short insertType,
const char listPath[],
const double startPower,
const double stopPower,
const double frequency,
const short numOfPts)

Parameter	Description
position	Input: position in the list being edited, 0 < position ≤ current list length
insertType	Input: Insert Type: 0 = REPLACE 1 = INSERT BEFORE 2 = INSERT AFTER (Note: if insertType = REPLACE, the existing list will be replaced with the newly created list.)
listPath	Input: Complete path (path + list name) of the list
startPower	Input: Start power (in dBm)
stopPower	Input: Stop power (in dBm)
frequency	Input: Frequency for all list points (in MHz)
numOfPts	Input: Number of list points being created

4.3.3.49 DLL Function; GT2400_EditListSyncOutOption

GT2400_EditListSyncOutOption

Purpose

Edit the sync out option for the current list.

Syntax

STATUS **GT2400_EditListSyncOutOption**(**const char** listPath[],
const short syncOutOption)

Parameter	Description
listPath	Input: Complete path (path + list name) of the list being edited
syncOutOption	Input: Sync out option: 0 = No sync out 1 = Sync out at first list pt 2 = Sync out at last list pt 3 = Sync out at every list pt

4.3.3.50 DLL Function; GT2400_EditRFOffTime

GT2400_EditRFOffTime

Purpose

Set the RF off time of a current list in PC RAM.

Syntax

STATUS **GT2400_EditRFOffTime**(**const double** RFOffTime)

Parameter	Description
RFOffTime	Input: RF off time for all list points (in ms) 0.1ms ≤RFOffTime ≤ 1000ms

4.3.3.51 DLL Function; GT2400_EditStepTime

GT2400_EditStepTime

Purpose

Set the step time of a current list in PC RAM.

Syntax

STATUS **GT2400_EditStepTime**(**const double** stepTime)

Parameter	Description
stepTime	Input: Step time of the active list (in ms) 0.15ms ≤ stepTime ≤ 1000ms

4.3.3.52 DLL Function; GT2400_EditSyncOutDelay

GT2400_EditSyncOutDelay

Purpose

Set the delay time for the sync out pulse generated.

Syntax

STATUS **GT2400_EditSyncOutDelay**(**const double** syncOutDelay)

Parameter	Description
syncOutDelay	Input: Delay time of sync out pulse (in ms) 0.1ms ≤ syncOutDelay ≤ 1000ms

4.3.3.53 DLL Function; GT2400_CloseAllLists

GT2400_CloseAllLists

Purpose

Remove all existing lists from PC RAM.

Syntax

STATUS **GT2400_CloseAllLists**(**void**)

4.3.3.54 DLL Function; GT2400_CloseAList

GT2400_CloseAList

Purpose

Remove the selected list from PC RAM**.**

Syntax

STATUS **GT2400_CloseAList**(**const char** listPath[])

Parameter	Description
listPath	Input: Complete path (path + list name) of the list being removed

4.3.3.55 DLL Function; GT2400_DeleteAllListPoints

GT2400_DeleteAllListPoints

Purpose

Delete all points of a selected list. The contents of the memory are cleared but the memory is still reserved for this list until the list is closed.

Syntax

STATUS **GT2400_DeleteAllListPoints**(**const char** listPath[])

Parameter	Description
listPath	Input: Complete path (path + list name) of a list

4.3.3.56 DLL Function; GT2400_DeleteAListPoint

GT2400_DeleteAListPoint

Purpose

Delete a point of a selected list from PC RAM.

Syntax

STATUS **GT2400_ DeleteAListPoint**(**const char** listPath[],
const short listPointIndex)

Parameter	Description
listPath	Input: Complete path (path + list name) of the list whose point is deleted
listPointIndex	Input: Index of the list point being deleted

4.3.3.57 DLL Function; GT2400_SetAMState

GT2400_SetAMState

Purpose

Set AM on/off.

Syntax

STATUS **GT2400_SetAMState**(**const unsigned long** instrumentHandle,
const unsigned short AMState)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
AMState	Input: 1 = AM is on 0 = AM is off

4.3.3.58 DLL Function; GT2400_SetAMSource

GT2400_SetAMSource

Purpose

Set AM source to external/internal.

Syntax

STATUS **GT2400_SetAMSource**(**const unsigned long** instrumentHandle,
const short AMSource)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
AMSource	Output: 1= External source 0 = Internal source

4.3.3.59 DLL Function; GT2400_SetAMExtSensitivity

GT2400_SetAMExtSensitivity

Purpose

Set AM sensitivity when AM source is external.

Syntax

STATUS **GT2400_SetAMExtSensitivity**(**const unsigned long** instrumentHandle,
double AMExtSensitivity)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
AMExtSensitivity	Input: AM sensitivity 0.0 < AMExtSensitivity < 95.0 (%/V)

4.3.3.60 DLL Function; GT2400_SetAMIntWavefrm

GT2400_SetAMIntWavefrm

Purpose

Set the AM internal waveform.

Syntax

STATUS **GT2400_SetAMIntWavefrm**(**const unsigned long** instrumentHandle,
const short AMIntWaveform)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
AMIntWaveform	Input: AM internal waveform 1 = SINE 2 = SQUARE 3 = TRIANGLE 4 = RAMP 5 = NOISE

4.3.3.61 DLL Function; GT2400_SetAMIntRate

GT2400_SetAMIntRate

Purpose

Set the AM internal rate.

Syntax

STATUS **GT2400_SetAMIntRate**(**const unsigned long** instrumentHandle,
const double AMIntRate)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
AMIntRate	Input: AM internal rate (in Hz) 0.01 Hz <= AMIntRate <= 1 MHz

4.3.3.62 DLL Function; GT2400_SetAMIntDepth

GT2400_SetAMIntDepth

Purpose

Set the AM internal depth.

Syntax

STATUS **GT2400_SetAMIntDepth**(**const unsigned long** instrumentHandle,
const double AMIntDepth)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
AMIntDepth	Input: AM internal depth 0.0 <= AMIntDepth <= 95.0

4.3.3.63 DLL Function; GT2400_SetFMState

GT2400_SetFMState

Purpose

Set the FM on/off.

Syntax

STATUS **GT2400_SetFMState**(**const unsigned long** instrumentHandle,
unsigned short FMState)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
FMState	Input: 1 = FM is on 0 = FM is off

4.3.3.64 DLL Function; GT2400_SetFMSource

GT2400_SetFMSource

Purpose

Set the FM source to external/internal.

Syntax

STATUS **GT2400_SetFMSource**(**const unsigned long** instrumentHandle,
const short FMSource)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
FMSource	Input: 1 = External source 0 = Internal source

4.3.3.65 DLL Function; GT2400_SetFMExtMode

GT2400_SetFMExtMode

Purpose

Set the FM source to external/internal.

Syntax

STATUS **GT2400_SetFMExtMode**(**const unsigned long** instrumentHandle,
const short FMExtMode)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
FMExtMode	Input: 1 = WIDE 0 = NARROW

4.3.3.66 DLL Function; GT2400_SetFMExtSensitivity

GT2400_SetFMExtSensitivity

Purpose

Set the FM external sensitivity.

Syntax

STATUS **GT2400_SetFMExtSensitivity**(**const unsigned long** instrumentHandle,
const double FMExtSensitivity,
const double freq)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
FMExtSensitivity	Input: FM sensitivity (in Hz) (Please refer to FM sensitivity/deviation range table in Appendix C)
freq	Input: CW frequency (in Hz)

4.3.3.67 DLL Function; GT2400_SetFMIntWavefrm

GT2400_SetFMIntWavefrm

Purpose

Set the FM internal waveform.

Syntax

STATUS **GT2400_SetFMIntWavefrm**(**const unsigned long** instrumentHandle,
const short FMIntWaveform)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
FMIntWaveform	Input: FM internal waveform 1 = SINE 2 = SQUARE 3 = TRIANGLE 4 = RAMP 5 = NOISE

4.3.3.68 DLL Function; GT2400_SetFMIntRate

GT2400_SetFMIntRate

Purpose

Set the FM internal rate.

Syntax

STATUS **GT2400_SetFMIntRate**(**const unsigned long** instrumentHandle,
const double FMIntRate)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
FMIntRate	Input: FM internal rate (in Hz) 0.1 Hz <= FMIntRate <= 1 MHz

4.3.3.69 DLL Function; GT2400_SetFMIntDev

GT2400_SetFMIntDev

Purpose

Set the FM internal deviation.

Syntax

STATUS **GT2400_SetFMIntDev**(**const unsigned long** instrumentHandle,
const double FMIntDeviation,
const double freq)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
FMIntDeviation	Input: FM deviation (in Hz) (Please refer to FM sensitivity/deviation range table in Appendix C)
freq	Input: CW frequency (in Hz)

4.3.3.70 DLL Function; GT2400_SetPMState

GT2400_SetPMState

Purpose

Set the PM on/off.

Syntax

STATUS **GT2400_SetPMState**(**const unsigned long** instrumentHandle,
const unsigned short PMState)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
PMState	Input: 1 = PM is on 0 = PM is off

4.3.3.71 DLL Function; GT2400_SetPMSource

GT2400_SetPMSource

Purpose

Set the PM state to internal or external.

Syntax

STATUS **GT2400_SetPMSource**(**const unsigned long** instrumentHandle,
const short PMSource)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
PMSource	Input: 1 = external source 0 = internal source

4.3.3.72 DLL Function; GT2400_SetPMExtPolarity

GT2400_SetPMExtPolarity

Purpose

Set the PM state to internal or external.

Syntax

STATUS **GT2400_SetPMExtPolarity** (**const unsigned long** instrumentHandle,
const short PMExtPolarity)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
PMExtPolarity	Input: 1 = active low 0 = active high

4.3.3.73 DLL Function; GT2400_SetPMMode

GT2400_SetPMMode

Purpose

Set the PM internal control mode.

Syntax

STATUS **GT2400_SetPMMode**(**const unsigned long** instrumentHandle**,**
const short mode)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
mode	Input: PM operation mode 0 = PM OFF 1 = Triggered mode 2 = Continuous mode 3 = Gated mode

4.3.3.74 DLL Function; GT2400_SetPMIntTrigPolarity

GT2400_SetPMIntTrigPolarity

Purpose

Set the PM trigger polarity for internal source.

Syntax

STATUS **GT2400_SetPMIntTrigPolarity**(**const unsigned long** instrumentHandle,
const short PMIntPolarity)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
PMIntPolarity	Input: PM trigger polarity for internal source 1 = falling 0 = rising

4.3.3.75 DLL Function; GT2400_SetPMIntWidth

GT2400_SetPMIntWidth

Purpose

Set the PM waveform for internal source.

Syntax

STATUS **GT2400_SetPMIntWidth**(**const unsigned long** instrumentHandle,
const double PMIntWidth)

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
PMIntWidth	Input: PM pulse width (in usec) 0.1 usec <= PMIntWidth <= 10 msec

4.3.3.76 DLL Function; GT2400_SetPMIntRFPulseDelay

GT2400_SetPMIntRFPulseDelay

Purpose

Set the PM RF pulse delay for internal source.

Syntax

STATUS **GT2400_SetPMIntRFPulseDelay** (**const unsigned long** instrumentHandle**,**
const double PMIntRFPulseDelay);

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
PMIntRFPulseDelay	Input: PM RF pulse delay (in usec) 0.1 usec <= PMIntRFPulseDelay <= 1.0 sec

4.3.3.77 DLL Function; GT2400_SetPMIntPRI

GT2400_SetPMIntPRI

Purpose

Set the PM trigger PRI (Pulse Repetition Interval) for internal source.

Syntax

```
STATUS  GT2400_SetPMIntPRI(     const unsigned long instrumentHandle,
                                const short mode,
                                const double PMIntPRI);
```

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
mode	Input: PM operation mode 0 = PM OFF 1 = Triggered mode 2 = Continuous mode 3 = Gated mode
PMIntPRI	Input: PM PRI (in usec) 0.2 usec <= PMIntPRI <= 1.0 sec

4.3.3.78 DLL Function; GT2400_SetPMIntSyncDelay

GT2400_SetPMIntSyncDelay

Purpose

Set the PM sync out delay for internal source.

Syntax

STATUS **GT2400_SetPMIntSyncDelay** (**const unsigned long** instrumentHandle**,**
const double PMIntSyncDelay);

Parameter	Description
instrumentHandle	Input: The unique identification of the instrument
PMIntSyncDelay	Input: PM sync out delay (in usec) 0 usec <= PMIntSyncDelay <= PRI – 0.1 usec

4.4 SCPI Command Set

The SCPI format and commands supported by 2400/2500 is explained in this section.

4.4.1 SCPI Command Format

SCPI conformance requires adherence to a strict syntax structure. The typographic conventions employed in the tables within each of the subsystem descriptions under “SCPI Command Subsystems”, below, are summarized in this section.

Case Sensitivity SCPI commands are not case-sensitive and can be entered in either uppercase or lowercase characters.

Abbreviating Commands

- Letters noted in upper case.
- If entering more than the required letters, the entire command must be entered. For example, if the command syntax is shown as INITiate, either INIT, init, INITIATE, or initiate can be used.

Optional Commands If the syntax shows a portion of a SCPI command in square brackets, that portion is an implied command which can be omitted. An implied command is the default command among the commands available at its level. For example, in the case of the command INITiate:[IMMediate], the immediate mode is the default mode, therefore, entering INIT has the same effect as entering INIT:IMM.

NOTE: The square brackets **[ ]** themselves are not actually part of the command; hence, they should be omitted even if the optional command is entered.

Queries Most SCPI commands have an accompanying query form that can be sent to cause the instrument to return the current state of the parameter setting. For example, the query form of the TRIGger: SOURce BUS|EXTernal command is TRIGger:SOURce? Some SCPI commands are events that cause something to happen at a particular time but do not create a setting or value to be checked afterwards. Consequently, they have no query form.

4.4.2 SCPI Commands

The 2400/2500 SCPI commands are divided into subsystems. The following sections describe the 2400/2500 SCPI commands, and are organized according to subsystems.

4.4.2.1 SCPI Commands; Output Subsystem

Table 8 Output Subsystem SCPI Commands

Command Syntax	Description
OUTPut[:STATe] ON|OFF|1|0	Turns the signal at the RF OUT connector on or off.
OUTPut[:STATe]?	Queries the RF OUTPUT state. The return value is as follows: **1** The signal at the RF OUT connector is currently on. **0** The signal at the RF OUT connector is currently off.

4.4.2.2 SCPI Commands; Source Subsystem – CW Mode

All commands in the Source subsystem begin with [SOURce]; however, [SOURce] is the default command, which is optional.

Table 9 Source Subsystem – CW Mode SCPI Commands

Command Syntax	Description
[SOURce]:FREQuency[:CW|:FIXed] <freq> [HZ | KHZ | MHZ | GHZ]	Sets CW frequency to the value specified by <freq>. The units are assumed to be in Hertz if no unit designator is supplied.
[SOURce]:FREQuency[:CW|:FIXed]?	Queries the current CW frequency. The value returned is in Hz.
[SOURce]:MODE CW|FIXed|LIST|FSWEep|PSWEep	Sets the operational mode of the synthesizer: • CW or FIXed is used to set the source to output a non-swept signal. • LIST is used to set the source to use LIST mode. • FSWEep is used to set the source to frequency sweep. • PSWEep is used to set the source to power sweep.
[SOURce]:MODE?	Queries the current operating mode of the instrument.

Table 9 Source Subsystem – CW Mode SCPI Commands	
Command Syntax	**Description**
[SOURce]:PHASe:[ADJust:] n (RADians|DEGrees)	Sets the relative phase of the output signal. The default units are in radians where the range is -2 *pi* < n < +2 *pi*. The command also accepts phase offsets in degrees where the range is -360° < n < +360°. Radians are the default units if no units are specified. Changing frequency automatically resets the phase offset to zero.
[SOURce]:POWer:ALC:SOURce INTernal |DIODe|PMETer|DPOSitive	Selects the source of the feedback signal for the ALC. The DIODe parameter assumes a negative crystal detector is used. DPOSitive allows for the use of a positive crystal detector.
[SOURce]:POWer:ATTenuation:AUTO ON|OFF	Sets the Attenuator to Auto (ON) or Manual (OFF).
[SOURce]:POWer:ATTenuation 0|10|20|30|40|50|60|70|80|90	Sets the Attenuator to the specified fixed (manual) value.
[SOURce]:POWer:ATTenuation?	Queries the Attenuator setting.
[SOURce]:POWer:[:LEVel:][IMMediate:] [AMPLitude:] <level> (DM | DBM | dBV)|MAXimum|MINimum	Sets the CW power level to the value specified by <level>. The units are defined as DM, DBM, or dBV.
[SOURce]:POWer:[:LEVel|:IMMediate| :AMPLitude]?	Queries the CW power level The value returned is in dBm.
[SOURce]:ROSCillator:SOURce?	Queries the source of the reference oscillator. The return value is as follows: INT The internal oscillator is being used as the reference. EXT A signal at the EXT REF IN connector is being used as the reference.

4.4.2.3 SCPI Commands; Source Subsystem – Power

Table 10 Source Subsystem – Power SCPI Commands	
Command Syntax	**Description**
[SOURce]:POWer:ALC:SOURce INTernal|DIODe|PMETer|DPOSitive	Selects the source of the feedback signal for the ALC. The DIODe parameter assumes a negative crystal detector is used. DPOSitive allows for the use of a positive crystal detector.
[SOURce:]POWer:ALC:SOURce?	Queries the type of leveling for output power automatic level control
[SOURce:]POWer:ATTenuation:AUTO?	Queries attenuation mode: auto or manual
[SOURce:]POWer:CENTer d	Sets the center of power
[SOURce:]POWer:CENTer?	Queries the center of power
[SOURce:]POWer[:LEVel][:IMMediate][:AMPLitude:]STEP[:INCRement] d (DB)	Selects the increment value for the Synthesizer output power level
[SOURce:]POWer[:LEVel][:IMMediate][:AMPLitude:]STEP[:INCRement]?	Query the increment value for the Synthesizer output power level

4.4.2.4 SCPI Commands; Source Subsystem – Correction

Table 11 Source Subsystem – Correction SCPI Commands	
Command Syntax	**Description**
[SOURce]:CORRection:LOSS <offset> [DB]	Sets the power offset to the value specified by <offset>. The units are dB.
[SOURce]:CORRection:LOSS?	Queries the power offset. The value returned is in dB.
[SOURce]:CORRection:SLOPe <slope>	Sets the power slope to the value specified by <slope>. The units are dB/GHz.
[SOURce]:CORRection:SLOPe?	Queries the power slope. The value returned is in dB/GHz

4.4.2.5 SCPI Commands; Source Subsystem – List Mode

Table 12 Source Subsystem – List Mode SCPI Commands

Command Syntax	Description
[SOURce]:LIST:DIRection UP|DOWN	Sets the direction of a list when it is run. If UP is set, the list will run from start to end. If DOWN is set, the list will run from end to start. The default is UP.
[SOURce]:LIST:DIRection?	Queries the currently set list run direction. The return value is as follows: UP The list is set to run from start to end. DOWN The list is set to run from end to start.
[SOURce]:LIST:DWELl <t1>,<t2>,……,<tn>	Specifies the dwell point times (<t1>,<t2>,……,<t*n*>) of the list set, the dwell point times are delimited by commas. The 2400/2500 list dwell setting is global for all list points. The first dwell time parameter applies to all subsequent points. Setting additional dwell times is optional. The units are seconds.
[SOURce]:LIST:DWELl:POINts?	Queries the number of points in the dwell time list.
[SOURce]:LIST:FREQuency <f1>,<f2>,<f3>,……,<fn>	Specifies the frequency points (<f1>,<f2>,<f3>,……,<f*n*>) of the list set. The frequency points are delimited by commas.
[SOURce]:LIST:FREQuency:POINts?	Queries the number of points currently in the frequency list.
[SOURce]:LIST:POWer <p1>,<p2>,<p3>,……,<pn>	Specifies the power points (<p1>,<p2>,<p3>,……,<p*n*>) of the list set. The power points are delimited by commas.
[SOURce]:LIST:POWer:POINts?	Returns the number of points currently in the power list
[SOURce]:LIST:PRECompute	Converts (pre-computes) the raw data of list saved NVRAM into DSP format. Return 0 when done.
	Continued next page

Table 12 Source Subsystem – List Mode SCPI Commands	
Command Syntax	**Description**
[SOURce]:LIST:REPeat SWEEp|STEP|CONTinuous	Sets the repeat mode for the current list. The choices are: • SWEEp - Upon triggering, the entire list is executed from the beginning, then execution stops. • STEP - Upon triggering, the current list point is executed, then execution stops. The next trigger executes the next point in the list. The list's first point is considered to be the initial current point, and the point following the list's final point. • CONTinuous - The entire list repeats indefinitely.
[SOURce]:LIST:REPeat?	Queries the repeat mode of the current list
[SOURce]:LIST:SEQuence <m1>,<m2>,<m3>,….,<mn>	Defines a sequence for stepping through the existing list when [SOURce]:LIST:SEQuence:AUTO is set to OFF. The points specified in this command (<m1>,<m2>,<m3>,….,<mn>) are indexes into a new sub-list, and only points in this sub-list will be triggered. For example, if one of the indexes defined with this command is 3, then the third point in the frequency, dwell, and power lists will be sequenced.
[SOURce]:LIST:SEQuence:POINts?	Queries the number of points in the sequence list
[SOURce]:LIST:SEQuence:AUTO ON|OFF	Sets list sequence AUTO mode. The choices are: • ON The list sequence set with the [SOURce]:LIST:SEQuence command will not take effect, so all list points will run when triggered. • OFF The list will run only the points set with the [SOURce]:LIST:SEQuence command. The default is ON. ***NOTE***: This command is also used to change the 2400/2500 mode from CW or Ramp to List mode. Example: LIST: SEQ: AUTO ON switches to List Mode
	Continued next page

Table 12 Source Subsystem – List Mode SCPI Commands	
Command Syntax	**Description**
[SOURce]:LIST:SYNC <sync>	Sets sync out option to <sync>. The sync out option determines how a pulse is emitted from the SYNC OUT connector during List operation. The choices are: • 0 No pulses are emitted from the SYNC OUT connector during List operation. • 1 A pulse is emitted from the SYNC OUT connector when the first list point is executed. • 2 A pulse is emitted from the SYNC OUT connector when the last list point is executed. • 3 A pulse is emitted from the SYNC OUT connector when each point in the list is executed.
[SOURce:]LIST:DELete:LIST <list>	Clear all the points from list <list>
[SOURce:]LIST:POWer:RANGe:ADD <list> <point>	Insert the power list range to the list <list> after point number <point>
[SOURce:]LIST: POWer:RANGe:DWELl <value> [S|MS|US]	Set the list dwell time for the list range to <value>
[SOURce:]LIST: POWer:RANGe:FREQuency <value> [HZ|KZ|KHZ|MZ|MHZ|GZ|GHZ]	Set the frequency for the list range to <value>
[SOURce:]LIST: POWer:RANGe:STARt <value> [DM|DBM]	Set the start power for the list range to <value>
[SOURce:]LIST: POWer:RANGe:STEP <value> [DB| DBM]	Set the step power for the list range to <value>
[SOURce:]LIST: POWer:RANGe:STOP <value> [DM|DBM]	Set the stop power for the list range to <value>
[SOURce:]LIST:RANGe:ADD <list> <point>	Insert the frequency list range to the list <list> after point number <point>
[SOURce:]LIST:RANGe:DWELl <value> [S|MS|US]	Set the list dwell time for the list range to <value>
[SOURce:]LIST:RANGe:POWer <value> [DM|DBM]	Set the power output for the list range to <value>
[SOURce:]LIST:RANGe:STARt <value> [HZ|KZ|KHZ|MZ|MHZ|GZ|GHZ]	Set the start frequency for the list range to <value>
[SOURce:]LIST:RANGe:STEP <value> (HZ|KZ|KHZ|MZ|MHZ|GZ|GHZ)	Set the step frequency for the list range to <value>
	Continued next page

Table 12 Source Subsystem – List Mode SCPI Commands	
Command Syntax	**Description**
[SOURce:]LIST:RANGe:STOP <value> (HZ|KZ|KHZ|MZ|MHZ|GZ|GHZ)	Set the stop frequency for the range to <value>
[SOURce:]LIST:SEQuence:AUTO?	Query list sequence AUTO mode
[SOURce:]LIST:SYNCout <value>	Generate a pulse at a rear panel BNC output according to <value> 0-none 1-start 2-end 3-all list points
[SOURce:]LIST:SYNCout?	Query the sync out “mode”
[SOURce:]LIST:SYNCout:DELay <value>	Set Sync out delay in uSec. Min is 50 Max is 1000000 (1 second)
[SOURce:]LIST:SYNCout:DELay?	Query the sync output delay

4.4.2.6 SCPI Commands; Status Subsystem

Table 13 Status Subsystem SCPI Commands

Command Syntax	Description
STATus:OPERation:CONDition?	Queries the contents of the Operation Condition register
STATus:OPERation:ENABle n	Sets the contents of the Operation Event Enable register
STATus:OPERation:ENABle?	Queries the contents of the Operation Event Enable register
STATus:OPERation: [:EVENt]?	Queries the contents of the Operation Event register
STATus:OPERation:NTRansition n	Defines which bits in the Operation Condition register will set the corresponding bit in the Operation Event register on a one to zero state change.
STATus:OPERation:NTRansition?	Queries which bits in the Operation Condition register will set the corresponding bit in the Operation Event register on a one to zero state change.
STATus:OPERation: PTRansition n	Defines which bits in the Operation Condition register will set the corresponding bit in the Operation Event register on a zero to one state change.
STATus:OPERation: PTRansition?	Queries which bits in the Operation Condition register will set the corresponding bit in the Operation Event register on a zero to one state change.
STATus:PRESet	Sets several Operation and Questionable registers to known states
STATus:QUEStionable:CONDition?	Returns the value of the Questionable Status Condition Register. The value returned is a decimal value representing the current state of the register.
STATus:QUEStionable:ENABle <ques>	Sets the Questionable Status Enable Register. Range of <ques> is 0 - 65535

Continued next page

Table 13 Status Subsystem SCPI Commands	
Command Syntax	**Description**
STATus:QUEStionable: ENABle?	Queries the contents of the Questionable Event Enable register
STATus:QUEStionable: [:EVENt]?	Returns the contents of the Questionable Event register
STATus:QUEStionable: NTRansition n	Defines which bits in the Questionable Condition register will set the corresponding bit in the Questionable Event register on a one to zero state change
STATus:QUEStionable: NTRansition?	Queries which bits in the Questionable Condition register will set the corresponding bit in the Questionable Event register on a one to zero state change
STATus:QUEStionable: PTRansition n	Defines which bits in the Questionable Condition register will set the corresponding bit in the Questionable Event register on a zero to one state change
STATus:QUEStionable: PTRansition?	Queries which bits in the Questionable Condition register will set the corresponding bit in the Questionable Event register on a zero to one state change

4.4.2.7 SCPI Commands; System Subsystem

Table 14 System Subsystem SCPI Commands

Command Syntax	Description
SYSTem:COMMunicate:GPIB[:SELF]:ADDRess <address>|MAXimum|MINimum	Sets the instrument's GPIB address. The choices are as follows: <address> Any integer between 1 and 30. MAXimum Sets the GPIB address to 30. MINimum Sets the GPIB address to 1.
SYSTem:COMMunicate:GPIB[:SELF]:ADDRess?	Queries the instrument's GPIB address.
SYSTem:COMMunicate:SERial:BAUD <rate>	Sets the RS-232 interface baud rate. The supported values for <rate> are 9600, 19200, 38400, and 115200.
SYSTem:COMMunicate:SERial:BAUD?	Queries the current RS-232 interface baud rate.
SYSTem:COMMunicate:SERial:BITS <bits>	Sets the number of RS-232 interface data bits. The supported values for <bits> are 7 and 8.
SYSTem:COMMunicate:SERial:BITS?	Queries the number of RS-232 interface data bits.
SYSTem:COMMunicate:SERial:PARity[:T YPE] EVEN | ODD | NONE	Sets the RS-232 interface parity type. The choices are as follows: EVEN Selects even parity. ODD Selects odd parity. NONE Parity is not used.
SYSTem:COMMunicate:SERial:PARity?	Queries the RS-232 interface parity setting.
SYSTem:COMMunicate:SERial:SBITS <sbits>	Sets the number of RS-232 interface stop bits. The supported values for <sbits> are 1 and 2.
SYSTem:COMMunicate:SERial:SBITS?	Queries the number of RS-232 interface stop bits.
SYSTem:ERRor[:NEXT]?	Queries the next error in the instrument's error/event queue. If the error/event queue is empty, "0, No Error" is returned. See Table 59 in Appendix A for a summary of available error messages
SYSTem:LANGuage NATive	Switches from the SCPI command set to the native (GT12000) command set.
SYSTem:LANGuage:NATive <native_cmd>	Issues the native (GT12000) syntax command specified by <native_cmd> from within SCPI without leaving the SCPI syntax.
	Continued next page

Table 14 System Subsystem SCPI Commands	
Command Syntax	**Description**
SYSTem:PRESet	Sets device-specific functions to a known state that is independent of the past-use history of the device. The command does not reset any part of the status reporting system. (Same as the *RST command.)
SYSTem:VERSion?	Queries the SCPI version to which the instrument applies. The response is in the form *YYYY.V* where *YYYY* is the year-version and *V* is the revision number within that year.
SYSTem:OPENlooppm ON|OFF	Controls open loop PM
SYSTem:OPENlooppm?	Queries Controls open loop PM
SYSTem:TIMer?	Query real-time operating system timer

4.4.2.8 SCPI Commands; Trigger Subsystem

Table 15 Trigger Subsystem SCPI Commands

Command Syntax	Description
TRIGger[:IMMediate]	Initiates an immediate sweep cycle in List mode. If Repeat Type is set to either single step or single sweep, then the sweep returns to IDLE when complete. (Same as a *TRG, that is a single instrument trigger, as opposed to a GroupExecuteTrigger.)
TRIGger:SOURce BUS|EXTernal	Selects the trigger source for List mode. The sources are: • BUS Sets the trigger source to GPIB/GET. • EXTernalSets the trigger source to BNC. (Trigger commands do not function when TRIGger:SOURce is set to EXT).
TRIGger:SOURce?	Queries the trigger source for List mode. The return value is as follows: • BUS The trigger source is set to GPIB/GET. • EXTernalThe trigger source is set to BNC. If not set, NOT IN SWEEP MODE is returned.

4.4.2.9 SCPI Commands; Source Subsystem – Ramp Sweep

Table 16 Source Subsystem - Ramp Sweep SCPI Commands

Command Syntax	Description
[SOURce]:FREQuency:STARt <f_start> [HZ | KHZ | MHZ | GHZ]	Sets the ramp start frequency to the value specified by <f_start>. Hertz is assumed as the units if units are not specified. The start frequency must be set less than the stop frequency. If this rule is violated, the start and stop frequencies are set to the same value.
[SOURce]:FREQuency:STARt?	Queries the ramp start frequency. The return value is in Hertz.
[SOURce]:FREQuency:STOP <f_stop> [HZ | KHZ | MHZ | GHZ]	Sets the ramp stop frequency to the value specified by <f_stop>. Hertz is assumed as the units if no units is specified. The start frequency must be set less than the stop frequency. If this rule is violated, the start and stop frequencies are set to the same value.
[SOURce]:FREQuency:STOP?	Queries the ramp stop frequency. The return value is in Hertz.
[SOURce]:SWEep: TIME <time>	Sets the sweep time for ramp sweep to the value specified by <time>. The units are seconds.
[SOURce]:SWEep:TIME?	Queries the sweep time for ramp sweep. The return value is in seconds.
[SOURce]:POWer:STARt d (DM | DBM | dBV)	Sets the ramp sweep start power level. The assumed units are defined as DM, DBM, or dBV.
[SOURce]:POWer:STARt?	Queries the ramp start power. The return value is in dBm.
[SOURce]:POWer:STOP d (DM | DBM | dBV)	Sets the ramp sweep stop power level. The assumed units are defined as DM, DBM, or dBV.
[SOURce]:POWer:STOP?	Queries the ramp stop power. The return value is in dBm.
[SOURce]:POWer:SPAN d	Sets the amplitude span
[SOURce]:POWer:SPAN?	Queries the amplitude span

4.4.2.10 SCPI Commands; Source Subsystem – Modulation

All commands in the Source subsystem begin with [SOURce], however, [SOURce] is the default command, and therefore it is optional.

Table 17 Source Subsystem – Modulation SCPI Commands

Command Syntax	Description
[SOURce]:AM:DEPTh <am_depth>	Sets the internal amplitude modulation depth to a percentage value as specified by <am_depth>.
[SOURce]:AM:DEPTh?	Queries the internal amplitude modulation depth. The return value is in percent.
[SOURce]:AM:INTernal:FREQuency <am_freq> [HZ | KHZ | MHZ | GHZ]	Sets the rate of the internal amplitude modulation generator to the value specified by <am_feq>. Hertz is assumed if no unit is specified.
[SOURce]:AM:INTernal:FREQuency?	Queries the rate of the internal amplitude modulation generator. The return value is in Hertz (Not available with Option 17 or 17A).
[SOURce]:AM:INTernal:FUNCtion:SHAP e OFF|SINE|SQUare|TRIangle|PRaMP|NOI Se	Sets the shape of the internal amplitude modulation generator waveform. The choices are: • OFF Turns the internal amplitude modulation generator off. • SINE Sets the internal amplitude modulation generator waveform to sine wave. • SQUare Sets the internal amplitude modulation generator waveform to square wave. • TRIangle Sets the internal amplitude modulation generator waveform to triangle wave. • PraMP Sets the internal amplitude modulation generator waveform to a positive-going ramp. • NOIse Selects the internal noise generator as the amplitude modulation generator.
[SOURce]:AM:INTernal:FUNCtion:SHAPe?	Queries the shape of the internal amplitude modulation generator waveform. Returns: "Off", "Sine", "Square", "Triangle", "Pos Ramp", or "Noise".
[SOURce]:AM:SCALing <am_scaling>	Sets the external amplitude modulation scaling to a percentage per volt value as specified by <am_scaling>.

Continued next page

Table 17 Source Subsystem – Modulation SCPI Commands	
Command Syntax	**Description**
[SOURce]:AM:SCALing?	Queries the external amplitude modulation scaling. Return value is a percentage per volt.
[SOURce]:AM:SOURce INTernal|EXTernal	Sets the amplitude modulation source. The choices are: • INTernal Sets the internal AM generator as the AM source. • EXTernal Selects external AM. The modulation source in this case is the signal applied at the rear-panel AM IN connector.
[SOURce]:AM:SOURce?	Queries the amplitude modulation source. Returns "INTernal" or "EXTernal"
[SOURce]:AM:STATe ON|OFF|1|0	Sets amplitude modulation mode on or off. The choices are as follows: • 1|ON Sets AM mode to on. • 0|OFF Sets AM mode to off.
[SOURce]:AM:STATe?	Queries the state of amplitude modulation mode. The return values is are follows: • 1 AM mode is currently on. • 0 AM mode is currently off.
[SOURce]:AM:SENSitivity d	Sets the modulation depth of an AM signal.
[SOURce]:AM:SENSitivity?	Queries the modulation depth of an AM signal.
[SOURce]:FM:BANDwidth NARRow|WIDE	Sets the Frequency Modulation bandwidth to Narrow or Wide.
[SOURce]:FM:BANDwidth?	Queries the Frequency Modulation bandwidth. Return “Narrow” or “Wide”.
[SOURce]:FM[:DEViation] <fm_dev> [HZ | KHZ | MHZ | GHZ]	Sets the internal frequency modulation deviation to the value specified by <fm_dev>. Hertz is assumed for the units if no units is specified.
[SOURce]:FM[:DEViation]?	Queries the internal frequency modulation deviation that is currently set. The return value is in Hertz.
[SOURce]:FM:INTernal:FREQuency <fm_freq> [HZ | KHZ | MHZ | GHZ]	Sets the rate of the internal frequency modulation generator to the value specified by <fm_freq>. Hertz is assumed for the units if units are not specified.
	Continued next page

Table 17 Source Subsystem – Modulation SCPI Commands	
Command Syntax	**Description**
[SOURce]:FM:INTernal:FREQuency?	Queries the current rate of the internal frequency modulation generator. The return value is in Hertz.
[SOURce]:FM:INTernal:FUNCtion:SHAPe OFF|SINE|SQUare|TRIangle|PRaMP	Sets the shape of the internal frequency modulation generator waveform. The choices are: • OFF Turns the internal frequency modulation generator off. • SINE Sets the internal frequency modulation generator waveform to sine wave. • SQUare Sets the internal frequency modulation generator waveform to square wave. • TRIangle Sets the internal frequency modulation generator waveform to triangle wave. • PRaMP Sets the internal frequency modulation generator waveform to a positive-going ramp.
[SOURce]:FM:INTernal:FUNCtion:SHAPe ?	Queries the shape of the internal frequency modulation generator waveform. Returns: "Off", "Sine", "Square", "Triangle", or "Pos Ramp".
[SOURce]:FM:SENSitivity <fm_sens>	Sets the Frequency Modulation external sensitivity to the value specified by <fm_sens>. The value is in Hertz per volt.
[SOURce]:FM:SENSitivity?	Queries the frequency modulation external sensitivity. The return value is in Hertz per volt.
[SOURce]:FM:SOURce EXTernal| INTernal|DC	Sets the frequency modulation source. The choices are: • INTernal Sets the internal FM generator as the PM source. • EXTernal Selects external FM. The modulation source in this case is the signal applied at the rear-panel FM/ϕM IN connector. • DC Maximum deviation for DC mode is 125 kHz for ±1 volt external input from 500 MHz to maximum frequency of the instrument.
[SOURce]:FM:SOURce?	Queries the phase modulation source. Returns either "Internal" or "External".
	Continued next page

Table 17 Source Subsystem – Modulation SCPI Commands	
Command Syntax	**Description**
[SOURce]:FM:STATe ON|OFF|1|0	Sets the frequency modulation mode on or off. The choices are: • 1|ON Sets FM mode to on. • 0|OFF Sets FM mode to off.
[SOURce]:FM:STATe?	Queries the frequency modulation mode. The returned values are: • 1 FM mode is currently on. • 0 FM mode is currently off.
[SOURce]:FM:COUPling AC|DC	Sets the coupling between the modulator and the modulating signal
[SOURce]:FM:COUPling ?	Queries the coupling between the modulator and the modulating signal
[SOURce]:PM[:DEViation] <fm_dev> [HZ | KHZ | MHZ | GHZ]	Sets the internal phase modulation deviation to the value specified by <fm_dev>. Hertz is assumed for the units if unit is not specified.
[SOURce]:PM[:DEViation]?	Queries the internal Phase Modulation deviation that is currently set. The return value is in Hertz.
[SOURce]:PM:INTernal:FREQuency <fm_freq> [HZ | KHZ | MHZ | GHZ]	Sets the rate of the internal Phase Modulation generator to the value specified by <fm_freq>. Hertz is assumed for the units if no unit is specified.
[SOURce]:PM:INTernal:FREQuency?	Queries the current rate of the internal phase modulation generator. The return value is in Hertz.
[SOURce]:PM:INTernal:FUNCtion:SHAPe OFF|SINE|SQUare|TRIangle|PRaMP	Sets the shape of the internal phase modulation generator waveform. The choices are: • OFF Turns the internal phase modulation generator off. • SINE Sets the internal phase modulation generator waveform to sine wave. • SQUare Sets the internal phase modulation generator waveform to square wave. • TRIangle Sets the internal phase modulation generator waveform to triangle wave. • PRaMP Sets the internal phase modulation generator waveform to a positive-going ramp.
	Continued next page

Table 17 Source Subsystem – Modulation SCPI Commands	
Command Syntax	**Description**
[SOURce]:PM:INTernal:FUNCtion:SHAPe ?	Queries the shape of the internal phase modulation generator waveform. Returns: "Off", "Sine", "Square", "Triangle", or "Pos Ramp".
[SOURce]:PM:SENSitivity <fm_sens>	Sets the phase modulation external sensitivity to the value specified by <fm_sens>. The value is in Hertz per volt.
[SOURce]:PM:SENSitivity?	Queries the phase modulation external sensitivity. The return value is in Hertz per volt.
[SOURce]:PM:SOURce EXTernal| INTernal|DC	Sets the phase modulation source. The choices are: • INTernal Sets the internal PM generator as the PM source. • EXTernal Selects external PM. The modulation source in this case is the signal applied at the rear-panel FM/ϕM IN connector.
[SOURce]:PM:SOURce?	Queries the phase modulation source. Returns either "Internal" or "External".
[SOURce]:PM:STATe ON|OFF|1|0	Sets the phase modulation mode on or off. The choices are: • 1|ON Sets PM mode to on. • 0|OFF Sets PM mode to off.
[SOURce]:PM:STATe?	Queries the frequency modulation mode. The return values are: • 1 PM mode is currently on. • 0 PM mode is currently off.
[SOURce]:PM:TYPE NARrow|WIDE	Sets the phase modulation bandwidth to Narrow or Wide.
[SOURce]:PM:TYPE?	Queries the phase modulation bandwidth. Return “Narrow” or “Wide”.
[SOURce]:PM:INTernal:FUNCtion[:SHAPe]?	Queries the frequency of the specified internal signal source.
	Continued next page

Table 17 Source Subsystem – Modulation SCPI Commands	
Command Syntax	**Description**
[SOURce]:PULM:EXTernal:POLarity NORMal|INVerted	Determines the polarity of the signal at the PULSE IN connector that produces an RF output during pulse modulation. The choices are: • NORMal RF at the RF OUT connector will be on when the signal at the PULSE IN connector is at a TTL high. • INVerted RF at the RF OUT connector will be on when the signal at the PULSE IN connector is at a TTL low.
[SOURce]:PULM:EXTernal: POLarity?	Queries the pulse modulation polarity. Returns either "NORMal" or "INVerted".
[SOURce]:PULM:INTernal:TRIGger:POLarity RISing|FALLing	Sets the internal trigger polarity of PM
[SOURce]:PULM:INTernal:TRIGger:POLarity?	Queries the internal trigger polarity of PM
[SOURce]:PULM:SOURce EXTernal:INTernal	Set the pulse modulation source. The choices are: • INTernal Sets the internal PM generator as the PM source. • EXTernal Selects external PM. The modulation source in this case is the signal applied at the rear-panel PULSE IN connector.
[SOURce]:PULM:SOURce?	Queries the source of pulse modulation. Returns either "INTernal", or "EXTernal".
[SOURCe:]PULM:STATe ON|OFF|1|0	Sets the pulse modulation mode on or off. The choices are: • 1|ON Sets Pulse mode to on. • 0|OFF Sets Pulse mode to off.
[SOURce]:PULM:STATe?	Queries the pulse modulation is on or off
[SOURce]:PULM:INTernal:BURSt:NUMberofpulse n	Sets the pulse count for the pulse modulation internal burst
[SOURce]:PULM:INTernal:BURSt:NUMberofpulse?	Queries the pulse modulation internal burst pulse count
[SOURce]:PULM:INTernal:BURSt:PERIod d (Sec|MSec|USec|NSec)	Sets the period for the pulse modulation internal burst
[SOURce]:PULM:INTernal:BURSt:PERIod?	Queries the pulse modulation internal burst period
	Continued next page

Table 17 Source Subsystem – Modulation SCPI Commands	
Command Syntax	**Description**
[SOURce]:PULM:INTernal:BURSt:RFDelay d (Sec|MSec|USec|NSec)	Sets the RF delay for the pulse modulation internal burst
[SOURce]:PULM:INTernal:BURSt:RFDelay?	Queries the pulse modulation internal burst RF delay
[SOURce]:PULM:INTernal:BURSt:TRIGtype CONTinuous|GATEd|TRIGgered	Sets the trigger type for the pulse modulation internal burst
[SOURce]:PULM:INTernal:BURSt:TRIGtype?	Queries the pulse modulation internal burst trigger type
[SOURce]:PULM:INTernal:FUNCtion:SHAPe OFF|SINGlet|DOUBlet|TRIPlet|QUADlet	Selects the pulse modulation waveform
[SOURce]:PULM:INTernal:FUNCtion:SHAPe?	Queries the pulse modulation waveform
[SOURce]:PULSe:DELay <pm_delay> (S|MS|US)	Sets the delay of the internal pulse modulation generator waveform to the value specified by <pm_delay> (Not available with Option 17 or 17A).
[SOURce]:PULSe:DELay?	Queries the delay of the internal pulse modulation generator waveform (Not available with Option 17 or 17A). The return value is in seconds.
[SOURce]:PULSe:FREQuency <pm_freq> [HZ | KHZ | MHZ | GHZ]	Sets the internal pulse modulation rate to the value specified by <pm_freq> (Not available with Option 17 or 17A). Hertz is assumed if no unit is supplied.
[SOURce]:PULSe:FREQuency?	Queries the internal pulse modulation rate (Not available with Option 17 or 17A). The return value is in Hertz.
Continued next page	

Table 17 Source Subsystem – Modulation SCPI Commands	
Command Syntax	**Description**
[SOURce]:PULSe:MODE OFF | TRIGered | CONTinuous | GATEd	Sets the internal pulse modulation mode (Not available with Option 17 or 17A). The choices are: • OFF - Turns internal pulse modulation mode off. • TRIGgered - Sets the instrument to produce a single internally generated RF output pulse when a valid trigger signal is received at the PM TRIG IN connector. • CONTinuous - Sets the instrument to produce an internally generated pulse modulated RF output signal continuously. • GATEd - Sets the instrument to produce an internally generated pulse modulated RF output signal for the duration of the externally provided gate signal at the PM TRIG IN connector.
[SOURce]:PULSe:PERiod <pm_per>	Sets the period of the internal pulse modulation generator to the value specified by <pm_per>. (Not available with Option 17 or 17A). The default units are in Hertz unless otherwise specified.
[SOURce]:PULSe:SYNCdelay <pm_sync>	Sets the delay of the pulse modulation sync signal. The delay range of the Pulse Sync Output function is 100 nSec. to 10 mSec. (Not available with Option 17 or 17A) The default units are in Hertz unless otherwise specified.
[SOURce]:PULSe:WIDTh <pm_width> (S|MS|US)	Sets the internal pulse modulation width to the value specified by <pm_width> (Not available with Option 17 or 17A).
[SOURce]:PULSe:WIDTh?	Queries the internal pulse modulation width. The return value is in seconds. (Not available with Option 17 or 17A).
[SOURce]:PULSe:DELay:STEP d (Sec|MSec|USec|NSec)	Sets the increment value for pulse delay
[SOURce]:PULSe:DELay:STEP?	Query the increment value for pulse delay
[SOURce]:PULSe:EXTernal:SYNCdelay d (Sec|MSec|USec|NSec)	Sets the external PM sync out delay
[SOURce]:PULSe:EXTernal:SYNCdelay?	Queries the external PM sync out delay
	Continued next page

Table 17 Source Subsystem – Modulation SCPI Commands	
Command Syntax	**Description**
[SOURce]:PULSe:MODE?	Queries the PM mode
[SOURce]:PULSe:PERiod:STEP d (Sec|MSec|USec|NSec)	Selects the increment value for pulse repetition interval
[SOURce]:PULSe:PERiod:STEP?	Queries the increment value for pulse repetition interval
[SOURce]:PULSe: SYNCdelay?	Queries the internal PM sync out delay
[SOURce]:PULSe: WIDTh:STEP d (Sec|MSec|USec|NSec)	Sets the increment value for pulse width
[SOURce]:PULSe:WIDTh:STEP?	Queries the increment value for pulse width

4.4.2.11 SCPI Commands; Unit Subsystem

Table 18 Unit Subsystem	
Command Syntax	**Description**
UNIT:ANGLe RADians|DEGrees	Sets the default suffix that will be assumed for the numeric argument for phase adjust programming commands if no suffix is used
UNIT:ANGLe?	Queries the default suffix that will be assumed for the numeric argument for phase adjust programming commands if no suffix is used
UNIT:FREQuency HZ|KZ|KHZ|MZ|MHZ|GZ|GHZ	Sets the default suffix that will be assumed for the numeric argument of all frequency-related programming commands if no suffix is used
UNIT:FREQuency?	Queries the default suffix that will be assumed for the numeric argument of all frequency-related programming commands if no suffix is used
UNIT:TIME Sec|Msec|USec	Sets the default suffix that will be assumed for the numeric argument of all power level-related programming commands if no suffix is used
UNIT:TIME?	Queries the default suffix that will be assumed for the numeric argument of all frequency-related programming commands if no suffix is used

4.4.2.12 SCPI Commands; Display Subsystem

Table 19 Display Subsystem	
Command Syntax	**Description**
DISPlay:MENU:STATe n	1: Turns the current menu page to “Remote”; 2, 3: Turns current page On
DISPlay:TEST ALL|DIAGonal|HORIZontal|NONE|OFF	Test the screen

4.5 IEEE 488.2 Common Commands

Table 20 IEEE 488.2 Common Commands

Command	Name	Description
*CLS	Clear Status	Clears the event registers in all status groups. It also clears the Event Status Register and the Error/Event Queue.
*ESE<ese>	Standard Event Status Enable	Sets the Standard Event Status Enable Register. A service request is issued whenever the specified event has occurred. Range of <ese>: 0 – 255.
*ESE?	Standard Event Status Enable	Returns the value of the Standard Event Status Enable Register. The value returned is a decimal value representing the current state of the Standard Event Status Enable Register.
*ESR?	Standard Event Status Register	Returns the value of the Standard Event Status Register. The value returned is a decimal value representing the current state of the Standard Event Status Register.
*IDN?	Identification	Returns the instrument identification.
*OPC	Operation Complete	Causes the Operation Complete bit (that is, Bit 0 of the Standard Event Status Register) to be set to 1 when all pending selected device operations have been finished. List Mode only.
*OPC?	Operation Complete	Places an ASCII character 1 into the device's output queue when all pending selected device operations have been finished. Unlike the *OPC command, the *OPC? query does not affect the OPC Event bit in the Standard Event Status Register (ESR).
*RST	Reset	Sets the device-specific functions to a known state that is independent of the past-use history of the device. The command does not reset any part of the status reporting system.
*SRE<sre>	Service Request Enable	Sets and enables the value of the Service Request Enable Register. Range of <sre>: 0 to 255.
*SRE?	Service Request Enable	Returns the value set by the *SRE command for the Service Request Enable Register.
*STB?	Read Status Byte	Returns the value of the current state of the Status Byte.

Continued next page

Table 20 IEEE 488.2 Common Commands		
Command	**Name**	**Description**
*TST?	Self-Test	Self-Test Query. It returns '0' if the test succeeds, and '1' if the test fails. The test sets a predefined group of CW frequencies and power levels. After each frequency and power is set, the firmware reads the instrument's LOCK/ LEVEL status. If failing the lock/level, the test is failed. In order to avoid damage to the device the 2400/2500 is connected to, maximum attenuation is set if it is available, or the power level is set to minimum for the duration of the test. The system will be restored to the pre-test condition upon completion.
*WAI	Wait-to-Continue	Causes the synthesizer to complete all pending tasks before executing any additional commands.

4.6 GT-12000 Native Commands

4.6.1 GT-12000 Native Commands: CW and System

The native commands below are CW and System Commands.

Table 21 GT-1200 Native Commands: CW and System Commands

Number	Command Name	Comments
1	**IP**	The same as *RST
2	**CW x HZ |KHZ|MHZ|GHZ**	Set CW frequency to x HZ |KHZ|MHZ|GHZ
3	**PL x DM|DBM|DB**	Set CW power level to x dBm
4	**ERR?**	Send error back
5	**RF n**	Set RF on (n=1) or off (n=0)
6	**SHRL**	Set attenuation to AUTO mode
7	**AT n DB**	Set attenuation to MANUAL mode independently of the level control in 10 dB increments
8	**SHPS n DB**	Set attenuation to MANUAL mode independently of the level control in 10 dB increments

4.6.2 GT-12000 Native Commands: List Mode

Table 22 GT-12000 Native Commands: List Mode Commands

Number	Command Name	Comments
9	**IH**	Clear all lists
10	**L1**	Set repeat type to continuous
11	**L2**	Set repeat type to single sweep
12	**L4**	Set repeat type to single step
13	**LA m, n**	Add a new point to the end of the existing list. (Note: Parameter n must be the index of the last point starting from 0, i.e. n = 0, 1, 2, and so on)
14	**LC m**	Clear list
15	**LL m,n, x DM|DBM|DB**	Set power level of point n in existing list to x. (Parameter n starts from 1, i.e. n = 1, 2, and so on)
16	**LF m,n, x HZ |KHZ|MHZ|GHZ**	Set frequency of point n in existing list to x. (Note: Parameter n starts from 1, i.e. n = 1, 2, and so on)
17	**LT m,n, x S|MS|US**	Set the dwell time of point n in existing list to x. (Note: Parameter n starts from 1, i.e. n = 1, 2, and so on)
18	**LGD d S|MS|US**	Set list range dwell time to d (Note: This command is used by both frequency and power range insertion)
19	**LGA d HZ|KZ|KHZ|MZ|MHZ|GZ|GHZ**	Set list range start freq to d.
20	**LGB d HZ|KZ|KHZ|MZ|MHZ|GZ|GHZ**	Set list range stop freq to d.
21	**LGC d HZ|KZ|KHZ|MZ|MHZ|GZ|GHZ**	Set list range step freq to d.
22	**LGL d DM|DBM|DB**	Set frequency list range power output to d.
23	**LGIF n d**	Insert frequency list range to the end of the existing list. n and d are ignored
24	**LGLA d DM|DBM|DB**	Set list range start level to d.
25	**LGLB d DM|DBM|DB**	Set list range stop level to d.
26	**LGLC d DM|DBM|DB**	Set list range step level to d.

Continued next page

Table 22 GT-12000 Native Commands: List Mode Commands		
Number	**Command Name**	**Comments**
27	**LGLF d HZ|KZ|KHZ|MZ|MHZ|GZ|GHZ**	Set list range frequency to d.
28	**LGI n**	Insert frequency range as list n
29	**LGIP n d**	Insert power list range to the end of the existing list. (Note: Parameter n and d are not used, and kept in the command for backward compatibility)
30	**LR n**	Set the existing list waiting on trigger to run. (Note: Parameter n is not used, and kept in the command for backward compatibility)
31	**LS? n**	Pre-compute list n (Note: Parameter n is not used, and kept in the command for backward compatibility)
32	**RFB n**	Set RF blanking off/on (RFD 1 = RF blanking On, 0 = RF blanking OFF)
33	**TR n**	Set trigger mode (n=0 BNC, n=1 GPIB/GET)
34	**SETYIGCAP n**	Set YIG CAP in or out If n = 0, YIG CAP is always out; Else if n =1, YIG CAP switches with delay; Else if n = 2, YIG CAP is in low noise.
35	**YIGCAPDELAY n**	Set YIG CAP delay in usec (100-2000 us)
36	**YIGCAPDELAY?**	Query YIG CAP delay time

4.6.3 GT-12000 Native Commands: Amplitude Modulation

Table 23 GT-12000 Native Commands: Amplitude Modulation

Number	Command Name	Comments
37	**AD d**	Sets the amplitude modulation depth to a percentage value.
38	**AM n**	Activates and selects the source of the Amplitude Modulation according to the following: n = 0 Deactivate Amplitude Modulation. n = 1 Activate external AM n = 2 Activate internal AM and select sine wave. n = 3 Activate internal AM and select square wave. n = 4 Activate internal AM and select triangle wave. n = 5 Activate internal AM and select positive ramp. n = 6 Activate internal AM and select negative ramp. n = 7 Activate internal AM and select noise. n = 8 Activate internal AM and select zero output.
39	**AR d HZ|KZ|KHZ|MZ|MHZ|GZ|GHZ**	Sets the rate of the internal amplitude modulation generator.
40	**SC n**	Activates and selects the source of the Scan Amplitude Modulation according to: n = 0 Deactivate Scan AM. n = 1 Activate external Scan AM. n = 2 Activate internal Scan AM and select sine wave. n = 3 Activate internal Scan AM and select square wave. n = 4 Activate internal Scan AM and select triangle wave. n = 5 Activate internal Scan AM and select positive ramp. n = 6 Activate internal Scan AM and select negative ramp. n = 7 Activate internal Scan AM and select noise. n = 8 Activate internal Scan AM and select zero output.
41	**SD d**	Sets the depth of Scan AM to d dB.

4.6.4 GT-12000 Native Commands: Frequency Modulation

Table 24 GT-12000 Native Commands: Frequency Modulation		
Number	**Command Name**	**Comments**
Case #	**Case Name**	**Comments**
42	**FD d HZ|KZ|KHZ|MZ|MHZ|GZ|GHZ**	Sets the Frequency Modulation deviation to d.
43	**FM n**	Activates and selects the source of the Frequency Modulation according to the following: n = 0 Deactivate Frequency Modulation. n = 1 Activate external FM. n = 2 Activate internal FM and select sine wave. n = 3 Activate internal FM and select square wave. n = 4 Activate internal FMand select triangle wave. n = 5 Activate internal FMand select positive ramp. n = 6 Activate internal FM and select negative ramp. n = 7 Activate internal FMand select zero output.
44	**FR d HZ|KZ|KHZ|MZ|MHZ|GZ|GHZ**	Sets the FMinternal rate to d. (Requires Option 24)
45	**FT n**	Sets the mode of Frequency Modulation according to: n = 1 Narrow mode n = 2 Wide mode n = 3 Phase mode narrow n = 4 Phase mode wide

4.6.5 GT-12000 Native Commands: Phase Modulation

Table 25 GT-12000 Native Commands: Phase Modulation		
Number	**Name**	**Comments**
46	**PHD d HZ|KZ|KHZ|MZ|MHZ| GZ|GHZ**	Set trigger mode (n=0 BNC, n=1 GPIB/GET) **not yet implemented**
47	**PHM n**	Activates and selects the source of the Phase Modulation (ΦM)according to the following: n = 0 Deactivate ΦM. n = 1 Activate external Phase Modulation. n = 2 Activate internal ΦM and select sine wave. n = 3 Activate internal ΦM(with Option 24) and select square wave. n = 4 Activate internal ΦMand select triangle wave. n = 5 Activate internal ΦMand select positive ramp. n = 6 Activate internal ΦMand select negative ramp. n = 7 Activate internal ΦMand select zero output. **not implemented**
48	**PHR d HZ|KZ|KHZ|MZ|MHZ| GZ|GHZ**	Sets the ΦMinternal rate to d. **not yet implemented**
49	**PHT n**	Sets the mode of ΦMaccording to the following: n = 1 Narrow mode n = 2 Wide mode **not yet implemented**

4.6.6 GT-12000 Native Commands: Pulse Modulation

Table 26 GT-12000 Native Commands: Pulse Modulation		
Number	**Name**	**Comments**
50	**PM n**	Activates and selects the source of the Pulse Modulation according to the following: n = 0 Deactivate Pulse Modulation. n = 1 Activate external positive true PM. n = 2 Activate internal PM. n = 3 Activate external negative true PM. n = 4 Activate internal PM and select external rising edge trigger. n = 5 Activate internal PM and select external falling edge trigger.
51	**PR d HZ|KZ|KHZ|MZ|MHZ|GZ |GHZ**	Sets the pulse modulation internal rate to d.
52	**PW d S|MS|US**	Sets the pulse modulation internal width to d. (Requires Option 24)
53	**PWV n**	Selects the waveform generated by the internal pulse modulation generator according to the following: n = 0 Selects no waveform. n = 1 Selects singlet waveform. n = 2 Selects doublet waveform. n = 3 Selects triplet waveform. n = 4 Selects quadlet waveform.
54	**PI d S|MS|US**	Sets the interval between pulses when waveform is set to doublet, triplet, or quadlet. (Requires Option 24)
55	**PY d S|MS|US**	Sets the delay of the internal pulse modulation generator waveform.

4.7 Emulation

4.7.1 HP 834X Emulation Commands

NOTE 1: Not all HP834X commands are implemented. For a complete list of commands see the Operating Manual of a particular instrument. Some commands may have to be customized for your application.

Table 27 HP 834X Emulation Commands

Number	Command Name	Comments
1.	**A1**	Leveling, internal
2.	**A2**	Leveling, external (crystal)
3.	**A3**	Leveling, external (power meter)
4.	**AL m n**	Alternate state on (m = 1)/off (m = 0) n – memory register number
5.	**AM m**	Amplitude modulation on (m = 1)/off (m = 0)
6.	**AS m**	Alternate state select, foreground (m = 0)/background (m = 1)
7.	**AT d [DB]**	Attenuator set (when decoupled from the ALC)
8.	**AU**	Auto (forces shortest sweep time)
9.	**BC**	Change frequency band
10.	**CF d t**	Center frequency (t = terminator is required)
11.	**CS**	Clear both status bytes
12.	**CW d t**	CW frequency (t = terminator is required)
13.	**DF d t**	Delta frequency (t = terminator is required)
14.	**DN**	Down step
15.	**DU m**	Display updating, blanks (m = 0) or unblanks (m = 1) the front panel
16.	**EF**	Entry Display off
17.	**EK**	Enable rotary knob
18.	**FA d t**	Start frequency (t = terminator is required)
19.	**FB d t**	Stop frequency (t = terminator is required)
20.	**FM m**	Frequency modulation on (m = 1)/off (m = 0)
21.	**FM1 d**	FM sensitivity (d = 1 or 10)
22.	**IF**	Increment frequency
23.	**IP**	Instrument preset
24.	**M1 d t**[2]	Marker 1 on (t = terminator is required)
25.	**M2 d t**	Marker 2 on (t = terminator is required)

Continued next page

Table 27 HP 834X Emulation Commands		
Number	**Command Name**	**Comments**
26.	**M3 d t**	Marker 3 on (t = terminator is required)
27.	**M4 d t**	Marker 4 on (t = terminator is required)
28.	**M5 d t**	Marker 5 on (t = terminator is required)
29.	**MC**	Marker to center frequency
30.	**MP m**	Marker sweep, M1-M2, on (m = 1)/off (m = 0)
31.	**NA 1b**	Network analyzer configure (1b = 1 binary byte)
32.	**OA**	Output active parameter value
33.	**OB**	Output next band frequency
34.	**OC**	Output coupled parameters (start frequency, stop frequency, sweep times)
35.	**OI**	Output identification
36.	**OK**	Output last lock frequency
37.	**OM**	Output mode data
38.	**OPCF**	Output center frequency value
39.	**OPCW**	Output CW frequency value
40.	**OPDF**	Output delta frequency (span) value
41.	**OPFA**	Output start frequency value
42.	**OPFB**	Output stop frequency value
43.	**OPPL**	Output power level value
44.	**OPSF**	Output CW frequency step value
45.	**OPST**	Output sweep time value
46.	**OR**	Output power level value
47.	**OS**	Output status bytes
48.	**PL d t**	Set output power level (t = terminator is required)
49.	**PM m**	Pulse modulation on (m = 1)/off (m = 0)
50.	**PS0**	De-activate power sweep
51.	**PS1**	Activate power sweep
52.	**RC n**	Recall instrument state (n = 0…9)
53.	**RE 1b**	Extended status byte mask (1b = 1 binary byte)
54.	**RF m**	RF on (m = 1)/off (m = 0)
55.	**RM 1b**	Status byte mask (1b = 1 binary byte)
56.	**RS**	Reset sweep
57.	**S1**	Sweep, continuous
58.	**S2**	Sweep, single
59.	**S3**	Sweep, manual
60.	**SF d t**	Step frequency size (t = terminator is required)

Continued next page

Table 27 HP 834X Emulation Commands		
Number	**Command Name**	**Comments**
61.	**SG**	Sweep, single
62.	**SHCF d t**	Set frequency step size (t = terminator is required)
63.	**SHPL d t**	Set power level step (t = terminator is required)
64.	**SHPS d t**	Decouple ATN, ALC (t = terminator is required)
65.	**SHS1 m**	Blank (m = 1)/unblank (m = 0) display
66.	**SHSL d t**	Control reference level (t = terminator is required)
67.	**SL m d t**	Power slope (t = terminator is required), on (m = 1)/off (m = 0)
68.	**SP d t**	Set power step size (t = terminator is required)
69.	**SV n**	Save instrument state (n = 0…9)
70.	**T1**	Trigger, free run
71.	**T2**	Trigger, line
72.	**T3**	Trigger, external
73.	**TI 1b**	Test GPIB interface (1b = 1 binary byte)
74.	**TL d t**	Time line (t = terminator is required)
75.	**TS**	Take sweep
75.	**UP**	Up step
[2] Hardware wise markers are not implemented.		

4.7.2 HP 8663 Emulation Commands

Table 28 HP 8663 Emulation Commands

Number	Command	Description
1.	**AP**	Turn RF on
2.	**AP d (DM|DB|+D|-D)**	Set RF output amplitude to a specified level and turn RF on
3.	**AO/A0**	Turn RF off
4.	**AM d (PC)**	Turn AM on and set AM sensitivity in %
5.	**CT**	Set the configure trigger for sweeping
6.	**DN**	Decrement active parameter by the step size
7.	**FA d (HZ|KZ|MZ|GZ)**	Set start frequency for sweeping
8.	**FB d (HZ|KZ|MZ|GZ)**	Set stop frequency for sweeping
9.	**FM**	Internal/External FM configuration
10.	**FR d (HZ|KZ|MZ|GZ)**	Set CW frequency
11.	**FS d (HZ|KZ|MZ|GZ)**	Set sweep span frequency
12.	**IS**	Set increment step size for all value-selected parameters
13.	**MO**	Turn off all modulation
14.	**MS**	Read status message
15.	**N1**	Set linear sweep steps to 100 steps
16.	**N2**	Set linear sweep steps to 1000 steps
17.	**N3 d (HZ|KZ|MZ|GZ)**	Set linear sweep step size to d
18.	**N4**	Set the initial step size to 10% of the start frequency; all subsequent step sizes are increased 10%
19.	**N5**	Set the initial step size to 1% of the start frequency; all subsequent step sizes are increased 1%
20.	**PC**	Percent
21.	**PL**	Turn pulse modulation on
22.	**RC n**	Recall previously stored instrument states from register 1 to 9 (note: 0 is reserved for system reset)
23.	**RD**	Decrement one step frequency
24.	**RM**	Read RQS mask
25.	**RU**	Increment one step frequency

Continued next page

Table 28 HP 8663 Emulation Commands		
Number	**Command**	**Description**
26.	**SP n**	Call special function n
27.	**ST n**	Store instrument state to register 1 to 9
28.	**T1**	Set step time to 0.5 ms/sweep
29.	**T2**	Set step time to 1 ms/sweep
30.	**T3**	Set step time to 2 ms/sweep
31.	**T4**	Set step time to 10 ms/sweep
32.	**T5**	Set step time to 100 ms/sweep
33.	**TR**	Trigger configure trigger for sweep
34.	**UP**	Increment active parameter by one step size
35.	**W1**	Set sweep mode to OFF
36.	**W2**	Set sweep mode to AUTO (continuous)
37.	**W3**	Set sweep mode to MANUAL
38.	**W4**	Set sweep mode to SINGLE
39.	**@1 b**	Set RQS mask (binary input)

4.7.3 HP 8673 Emulation Commands

Table 29 HP 8673 Emulation Commands

Number	Command	Description
1.	**A0, A1, AO**	Turn AM Off
2.	**A2**	Set AM to 30% range
3.	**A3**	Set AM to 100% range
4.	**AP d (DB|DM)**	Set CW output power level
5.	**B0**	Set filter switching mode to normal
6.	**B1,BY**	Set filter switching mode to bypass
7.	**C1**	Set Internal Automatic Leveling Control
8.	**C2**	Set external Automatic Leveling Control with negative diode
9.	**CF d (GZ|MZ|KZ|HZ)**	Set center frequency
10.	**CFOA**	Read center frequency
11.	**CS**	Clear status and extended status byte
12.	**CW d (GZ|MZ|KZ|HZ)**	Set CW frequency
13.	**D0,D1**	Turn FM Off
14.	**D2**	Set maximum FM deviation range to 30 KHZ
15.	**D3**	Set maximum FM deviation range to 100 KHZ
16.	**D4**	Set maximum FM deviation range to 300 KHZ
17.	**D5**	Set maximum FM deviation range to 1 MHZ
18.	**D6**	Set maximum FM deviation range to 3 MHZ
19.	**D7**	Set maximum FM deviation range to 10 MHZ
20.	**DF**	Set Delta Frequency
21.	**DFOA**	Read Delta Frequency
22.	**DN**	Decrement CW frequency by frequency increment step
23.	**DO**	Turn FM Off
24.	**DW d (MS)**	Set sweep dwell time in ms
25.	**DWOA**	Get sweep dwell time in ms
26.	**F1 d (GZ|MZ|KZ|HZ)**	Set frequency increment step
27.	**FA d (GZ|MZ|KZ|HZ)**	Set sweep start frequency

Continued next page

Table 29 HP 8673 Emulation Commands		
Number	**Command**	**Description**
28.	**FAOA**	Read start frequency
29.	**FB d (GZ|MZ|KZ|HZ)**	Set sweep stop frequency
30.	**FBOA**	Read stop frequency
31.	**FI d (GZ|MZ|KZ|HZ)**	Set frequency Increment step
32.	**FIOA**	Get frequency increment
33.	**FN d (GZ|MZ|KZ|HZ)**	Set frequency increment step
34.	**FO d (GZ|MZ|KZ|HZ)**	Set frequency offset
35.	**FR d (GZ|MZ|KZ|HZ)**	Set CW frequency
36.	**FS d (GZ|MZ|KZ|HZ)**	Set Delta frequency
37.	**FSOA**	Read delta frequency
38.	**FT d (GZ|MZ|KZ|HZ)**	Set frequency offset
39.	**FTOA**	Read frequency offset
40.	**IF**	Increment Frequency (Manual sweep mode only)
41.	**IP**	Instrument Preset
42.	**K0**	Disable auto peak operations
43.	**K1**	Enable and Performs auto peak operations
44.	**K2**	Perform auto peak operation without settling
45.	**LE d (DB|DM)**	Set CW output power level
46.	**LEOA**	Read CW power
47.	**MG**	Read error code
48.	**N0**	Disable tune knob
49.	**N1**	Enable tune knob
50.	**OC**	Output couple [START][CENTER][DWELL][LF and EOI]
51.	**OK**	Output lock frequency
52.	**OR**	Output request mask (in binary)
53.	**OS**	Output status and extended status bytes
54.	**P0,P1**	Pulse off
55.	**P2**	Set pulse normal mode
56.	**P3**	Set pulse complement mode
		Continued next page

Table 29 HP 8673 Emulation Commands		
Number	**Command**	**Description**
57.	**PL d (DB|DM)**	Set CW output power level
58.	**PO**	Pulse off
59.	**R0**	Turn RF off
60.	**R1**	Turn RF on
61.	**RA d (DB|DM)**	Set output level range
62.	**RAOA**	Read output level range
63.	**RC0**	Instrument Preset
64.	**RC n**	Recall Instrument state
65.	**RD**	Range down by 10 dB
66.	**RF0**	Turn RF off
67.	**RF1**	Turn RF on
68.	**RM b**	Prefix to set Request mask (in binary)
69.	**RO**	Turn RF off
70.	**RU**	Range up 10 dB
71.	**SHDF d (GZ|MZ|KZ|HZ)**	Set frequency negative offset
72.	**SHFB d (GZ|MZ|KZ|HZ)**	Set frequency positive offset
73.	**SHFS d (GZ|MZ|KZ|HZ)**	Set frequency negative offset
74.	**SM**	Set Manual Sweep mode
75.	**SP d (SS)**	Set number of sweep steps
76.	**SP d (GZ|MZ|KZ|HZ)**	Set sweep step size
77.	**SPOA**	Read current number of steps
78.	**SS d (SP)**	Set number of sweep steps
79.	**SS d (GZ|MZ|KZ|HZ)**	Set sweep step size
80.	**SSOA**	Read current step size
81.	**ST**	Store instrument state
82.	**UP**	Increment CW frequency by frequency increment step
83.	**VE d (DM|DB)**	Set vernier setting
		Continued next page

Table 29 HP 8673 Emulation Commands		
Number	**Command**	**Description**
84.	**VEOA**	Read vernier setting
85.	**W0**	Sweep mode off
86.	**W1**	Sweep mode off
87.	**W2**	Auto sweep mode
88.	**W3**	Manual sweep mode
89.	**W4**	Single sweep arm or execute
90.	**W5**	Single sweep arm only
91.	**W6**	Single sweep arm and execute
92.	**WO**	Sweep mode off

4.7.4 HP 8360 Emulation Commands

The HP8360 command set is made up of the standard SCPI commands with the additional commands listed in the table below. In standard SCPI, all queries are terminated with a <CR> <LF> whereas in HP8360 emulation mode, only a <LF> is used. Also, standard SCPI requires an EOI as a terminator for GPIB communication; in HP8360 emulation, a <CR>, a <LF>, or a <CR><LF> is acceptable in place of an EOI. In HP8360 emulation mode, the front panel display will show the current menu and data values as remote commands are received. The *IDN? will return “HEWLETT-PACKARD,8360”

Default differences:

AM Scaling: Fixed at 100 %

FM Mode: Fixed to wide (AC)

PM Start Trigger: Immediate

PM Stop Trigger: Immediate

PM Polarity: Active High

Table 30 HP 8360 Emulation Commands

Command	Description
[SOURce]:PULM:INTernal:TRIGger:SOURce EXTernal|INTernal	
[SOURce]:PULM:INTernal:TRIGger:SOURce?	
[SOURce]:PULM:INTernal:GATE o	
[SOURce]:PULM:INTernal:GATE?	
[SOURce]:PULM:INTernal:PERiod d (Sec|MSec|USec|NSec)	Sets the period of a pulsed waveform.
[SOURce]:PULM:INTernal:PERiod?	Queries the period of a pulsed waveform.

4.7.5 HP 8370 Emulation Commands

The HP8370 command set is made up of the standard SCPI commands with the additional commands listed in Table 31 In standard SCPI, all queries are terminated with a <CR> <LF> whereas in HP8370 emulation mode, only a <LF> is used. Also, standard SCPI requires an EOI as a terminator for GPIB communication; in HP8370 emulation, a <CR>, a <LF>, or a <CR><LF> is acceptable in place of an EOI. In HP8370 emulation mode, the front panel display will show the current menu and data values as remote commands are received. The *IDN? will return “HEWLETT-PACKARD,8370”.

Default differences in this mode are:

PM Start Trigger: BNC connector

PM Stop Trigger: BNC connector

PM Polarity: Active High

CW Frequency: 3 GHz

CW Power: Min Power

FM impedance: 600 Ohms

AM impedance: 5 k Ohms

Table 31 Hewlett Packard 8370 Command Set

Command	Description
TRIGger[:STARt]:SOURce IMMediate|BUS|EXTernal	Selects the trigger source for List mode. The sources are: BUS: sets to GPIB/GET EXT: sets to BNC (Trigger commands do not function when in EXT) (IMM only for 83732 mode)
TRIGger[:STARt]:SOURce?	Queries the trigger source for List mode
TRIGger:STOP:SOURce IMMediate|BUS|EXTernal	Sets the stop trigger source.
TRIGger:STOP:SOURce?	Queries the stop trigger source.

4.7.6 GT900 Emulation Commands

Table 32 Giga-tronics GT900 Command Set	
Command	**Description**
DISP o	Switch Display on/off
FA d	Set CW frequency or Sweep start frequency according to the operation mode (in MHz)
FB d	Set Sweep stop frequency (in MHz)
FC d	Set Sweep step frequency (in MHz)
GEN t	Set operation mode. GEN FIXED – CW mode GEN LSWP – Locked Frequency sweep mode GEN USWP – Unlocked Frequency sweep mode
LEVEL d	Set output power level in dBm
LVLCRS d	Enable Manual attention mode and set attenuation in step of 10 dB
LVLFNE d	Set ALC power and in step of 0.1 dB. (Note: the output power is the sum of the 'LVLCRS' and 'LVLFNE' arguments.
MOD t	Set modulation mode MOD OFF – turn all modulation off MOD PULSE – turn internal pulse on MOD EXT+ – turn external positive pulse on MOD EXT- – turn external negative pulse on MOD AM – turn external AM on MOD SQR – turn internal square wave pulse on
MODRATE t	MODRATE FIXED – Set AM rate to 1 kHz
PWIDTH t	PWIDTH FIXED – Set PM width to 1 usec
RF o	Turn RF on/off
	Continued next page

Table 32 Giga-tronics GT900 Command Set	
Command	**Description**
SWEEP t	Set frequency sweep mode SWEEP AUTO – automatic repetitive sweep SWEEP ONCE – single sweep SWEEP STEP – single step sweep SWEEP TRIG – BNC triggered single sweep SWEEP STPTRIG – BNC triggered single step sweep SWEEP RESET – reset and immediate terminate sweeping SWEEP NULL – same as RESET except when AUTO finish current sweep before reset
SWPRATE t	Set sweep rate SWPRATE A – set sweep rate to 10 sec SWPRATE B – set sweep rate to 5 sec SWPRATE C – set sweep rate to 2 sec SWPRATE D – set sweep rate to 1 sec SWPRATE E – set sweep rate to 500 msec SWPRATE F – set sweep rate to 200 msec SWPRATE G – set sweep rate to 100 msec SWPRATE H – set sweep rate to 50 msec SWPRATE I – set sweep rate to 20 msec SWPRATE J – set sweep rate to 10 msec

4.7.7 Option 55F: Wavetek 90X Emulation Commands

Table 33 Option 55F: Wavetek 90X Emulation Commands	
Operation Mode Command	**Function**
A d	Set power level amplitude in dBm
B o	Select instrument modes: 1-continuous 2-front panel activated mode
F d	Set CW frequency in Hz
I	Command terminator to execute all previously sent commands
L o	Set power option to level or unlevel
P o	Toggle RF output on/off
S o	Set filter option on/off
Z	Reset the instrument to the factory default

4.7.8 Systron Donner 16XX Emulation Commands

4.7.8.1 Operation Mode

Table 34 Systron Donner 16XX Emulation Command Set — Operation

Synthesized Signal Source Operation Mode Commands	Internal Operation Mode Function
O0	Selects CW Mode
O1	Selects EXT FM Mode
O2	Selects EXT AM Mode
O3	Selects EXT FM and EXT AM Modes
O4	Selects EXT ALC Mode
O5	Selects EXT ALC and EXT FM Modes
O6	Selects EXT ALC and EXT AM Modes
O7	Selects EXT ALC, EXT FM, EXT FM Modes
OI	SPECIAL 'RF ON' State: Sets GPIB = 17; Sets CW Frequency = 2 GHz; Sets Manual Attenuation = 90 dB, Output Power = -70 dBm; Sets AM, FM, PM Modulation OFF; Selects EXT AM, EXT FM, EXT PM Modes; Enables PM 'Auto' ON, Sets PM Polarity Active 'HIGH'

Operation mode programming examples:

1. **O0** sets CW mode of operation.
2. **O1O4** or **O5** sets EXT FM and EXT ALC modes of operation.

4.7.8.2 Frequency

Table 35 Systron Donner 16XX Emulation Command Set — Frequency	
Frequency Setting Commands	**Internal Frequency Control Function**
H	Selects 10 GHz digit
0-1	Value of 10 GHz digit
G	Selects 1 GHz digit
0-9	Value of 1 GHz digit
F	Selects 100 MHz digit
0-9	Value of 100 MHz digit
E	Selects 10 MHz digit
0-9	Value of 10 MHz digit
D	Selects 1 MHz digit
0-9	Value of 1 MHz digit
C	Selects 100 kHz digit
0-9	Value of 100 kHz digit
B	Selects 10 kHz digit
0-9	Value of 10 kHz digit
A	Selects 1 kHz digit
0-9	Value of 1 kHz digit

Note: Digit values in a frequency-programming command string that are not preceded by an alphabetic character will decrement in position from highest-to-lowest frequency digit position value, based on the location in the string of the last alphabetic character entered.

Frequency programming examples:

1. **H12345678, H1G2F3E4D5C678,** or **A8B7C6D5E4F3G2H1** sets frequency = 12,345.678 MHz
2. With frequency = 12,345.678 MHz, **G4C1B2A3** changes frequency to 14,345.123 MHz
3. With frequency = 14,345.123 MHz, **H0F9E87** changes frequency to 4,987.123 MHz

4.7.8.3 Power Level

Table 36 Systron Donner 16XX Emulation Command Set — Power	
Output Power Level Setting Commands	**Internal Function (- dB W)**
N	Selects 100 dBW digit
0-1	Value of 100 dBW digit
M	Selects 10 dBW digit
0-9	Value of 10 dBW digit
L	Selects 1 dBW digit
0-9	Value of 1 dBW digit
K	Selects 0.1 dBW digit
0-9	Value of 0.1 dBW digit

NOTES:

1. Values entered are for NEGATIVE (-) dB referenced to 1 Watt (dBW). Do not enter a negative (-) sign.
2. For reference: 0 dBW = + 30 dBm or -30 dBW = 0 dBm.
3. To convert from dBm to dBW, subtract 30 from the dBm value.

   For example, -12.3 dBm = -42.3 dBW which is entered in the program command string as **N0M4L2K3** (no negative sign).
4. Digit values in a power level programming command string that are not preceded by an alphabetic character will decrement in position from highest-to-lowest power level digit position value, based on the location in the string of the last alphabetic character entered.

Power Level programming examples:

1. **N0M3L2K1, N0M321,** or **K1L2M3N0** sets power level to –32.1 dBW (-2.1 dBm).
2. With power level = -32.1 dBW (-2.1 dBm), **M2** changes the level to –22.1 dBW (+ 7.9 dBm).
3. With power level = -32.1 dBW (-2.1 dBm), **L0K0 or L00** changes level to –30 dBW (0 dBm).

WARNING	THE VALUES SHOWN HERE ARE FOR HISTORICAL AND COMPARATIVE REFERENCE ONLY! THE 2400/2500 SIGNAL GENERATOR OUTPUT POWER VALUES ARE RADICALLY DIFFERENT AND WILL NEED TO BE TAKEN IN TO CAREFUL CONSIDERATION WHEN USING SYSTRON DONNER ATTENUATION PROGRAMMING COMMANDS!

4.7.8.4 Configuration Versus Output Power

Table 37 Systron Donner Configuration Versus Outpur Power	
Systron Donner 16XX Configuration	**TYPICAL Maximum Leveled Output Power**
Standard	+ 3 dBm
Option 01	+ 4 dBm
Options 01 and 03	+ 1 dBm
Options 01 and 05	+ 1 dBm
Option 02	+ 5 dBm
Options 02 and 03	+ 2 dBm
Option 03	0 dBm
Option 05	0 dBm

4.7.8.5 Step Attenuator Commands

Table 38 Systron Donner Step Attenuator Commands	
Step Attenuator Control Commands	**Internal Step Attenuation Value**
N2	0 dB
N3	10 dB
N4	20 dB
N5	30 dB
N6	40 dB
N7	50 dB
N8	60 dB
N9	70 dB
N:	80 dB
N;	90 dB
N<	100 dB
N=	110 dB

4.7.8.6 Vernier Attenuation Commands

Table 39 Systron Donner Vernier Attenuation Commands

Vernier Attenuation Setting Commands	Output Level Relative to MAXIMUM Leveled Power Output
N2000 <not recommended>	+ 10.0 dBr
N2010 <not recommended>	+ 09.0 dBr
N2020 <not recommended>	+ 08.0 dBr
N2030 <not recommended>	+ 07.0 dBr
N2040 <not recommended>	+ 06.0 dBr
N2050 <not recommended>	+ 05.0 dBr
N2060 <not recommended>	+ 04.0 dBr
N2070 <not recommended>	+ 03.0 dBr
N2080 <not recommended>	+ 02.0 dBr
N2090 <not recommended>	+ 01.0 dBr
N2100	00.0 dBr *
N2110	- 01.0 dBr
N2120	- 02.0 dBr
N2130	- 03.0 dBr
N2140	- 04.0 dBr
N2150	- 05.0 dBr
N2160	- 06.0 dBr
N2170	- 07.0 dBr
N2180	- 08.0 dBr
N2190	- 09.0 dBr
N2200	- 10.0 dBr
N2210	- 11.0 dBr
N2220	- 12.0 dBr
N2230	- 13.0 dBr
N2240	- 14.0 dBr
N2250	- 15.0 dBr

Notes:

(1) * -- MAXIMUM Leveled Output Power at a given frequency.

(2) For each frequency, use command **O0N2100** (CW, attenuation set for 0 dBr) to verify MAXIMUM leveled power accuracy prior to using attenuation programming commands. This should help determine a realistic baseline for attenuation programming and scaling.

This page is intentionally blank.

Chapter 5. Automation Xpress

5.1 Introduction

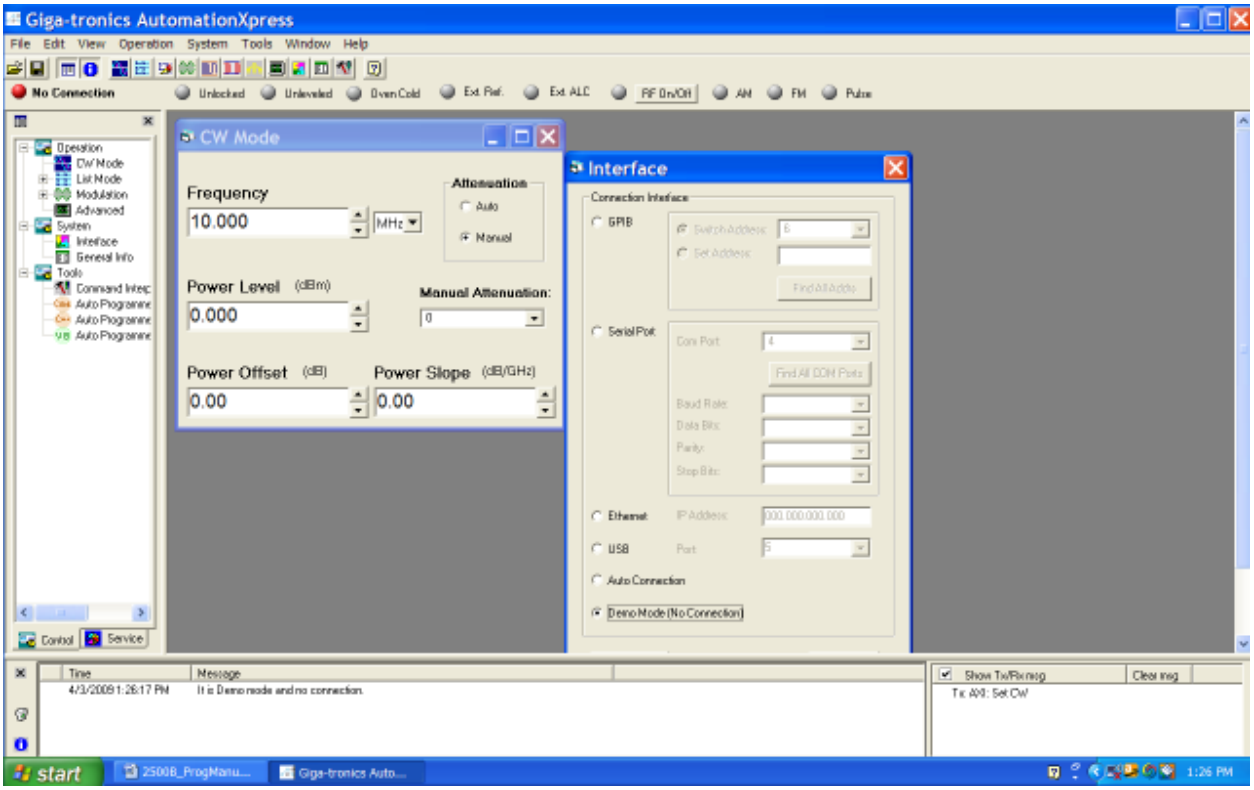
Automation Xpress was developed as a way to program the 2400/2500 for automated testing. The Automation Xpress graphical user interface (GUI) is shown in Figure 2 below.

5.1.1 Benefits of Using Automation Xpress

Automation Xpress includes an application program interface (API) in the form of a Dynamic Link Library (DLL). The API enables a programmer to individually command frequency changes while taking advantage of the fast-frequency-switching architecture of the 2400/2500. Automation Xpress significantly reduces the processor burden of the 2400/2500 by transferring the instrument-state processing burden to a PC. Once an instrument-state calculation for generating a frequency is performed, the majority of the time required to switch frequency is the data transfer from the controller to the 2400/2500.

The switching-time specification for Automation Xpress is 1.0 ms with modern processor and memory configurations. Typical frequency-switching time, excluding the controller processor overhead, is approximately 1 ms when the GPIB End or Identify signal is used as a starting point for the switching-time measurement to the Lock/Level signal. That signal indicates that the frequency change has been completed.

Figure 2. Automation Xpress Graphical User Interface (GUI)



5.2 Install Automation Xpress

This section describes how to install and uninstall Automation Xpress on a host computer.

Included with the 2400/2500 are the following components for installing and using Automation Xpress.

- Automation Xpress software CD
- USB Port Adapter software driver
- USB 2.0 Type A Male to Type B Male cable, used for connecting a computer to the 2400/2500

Have these items ready for the following procedure for installing Automation Xpress.

Table 40 Install and Uninstall Automation Xpress

Step	Action
1.	In the host computer, 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 AXsetup.exe file.
4.	Click NEXT. The Setup program begins installing the Automation Xpress software.
5.	In the Choose Automation Xpress destination location dialog, select the location where you want the software to be installed.
6.	Click NEXT to accept the default location (recommended) or Enter the directory location where you want the Automation Xpress software to install and then click NEXT.
7.	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.
8.	When the Automation Xpress Installation is complete, the Setup Complete dialog box appears. Click FINISH.
9.	After Automation Xpress has successfully installed onto your PC, you can click FINISH or continue with the USB Driver installation.
Install USB software driver ***NOTE:*** You can also install the USB driver when you connect a USB cable between the computer and 2400/2500. This is described Table 42 on page 152.	
Continued next page	

Table 41 Install and Uninstall Automation Xpress , Continued	
Step	**Action**
10.	Click Install USB.
11.	Follow the instructions on the computer display
12.	You must restart your computer for the USB driver to function. You can restart the computer now, or later. ***NOTE:*** The computer MUST be restarted before using the USB port and cable with the 2400/2500.
As an alternative, you can install the USB driver from the Automation Xpress directory on the computer:	
13.	Open Windows Explorer.
14.	Open the USB Driver folder.
15.	Double click on the file Setup.exe, and follow the instructions that appear.
Remove the USB driver	
16.	Open Windows Explorer, and locate the Automation Xpress directory.
17.	Open the USB Driver folder.
18.	Double-click on the file Setup.exe and start the USB Driver installation.
19.	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. Respond “Yes.” Continue with the program until completion.
Uninstall Automation Xpress	
20.	Click the WINDOWS > START button and choose SETTING > CONTROL PANEL.
21.	In the control panel, click ADD/REMOVE PROGRAMS.
22.	From the REMOVE PROGRAMS properties dialog box, select Automation Xpress and REMOVE. Or: Insert the Automation Xpress CD into CD drive. Double click on the Automation Xpress Installation program. Click on the "Uninstall Giga-tronics Automation Xpress from this computer" and click NEXT to continue.
End of Procedure	

5.3 Start Automation Xpress

The easiest way to connect a computer to the 2400/2500 is to use the USB male-to-male cable that is included with the 2400/2500. Automation Xpress must first be installed in the computer to use the cable. Use the following procedure to connect the cable and open Automation Xpress.

Table 42 Install the USB Cable and Start Automation Xpress

Step	Action
1.	Install Automation Xpress as described in Table 40 on page 150.
2.	Turn on the 2400/2500.
3.	Locate the USB male-to-male cable that was included with the 2400/2500.
4.	Connect the USB cable between the host computer and the 2400/2500.
5.	Follow the instructions in the dialog boxes on the computer display to install the USB driver for the cable.
6.	On the computer, start Automation Xpress. AX opens with a Connection Selections dialog box (see Figure 3 below). Select USB and click on OK.

Figure 3. Connection Selection Dialog Box

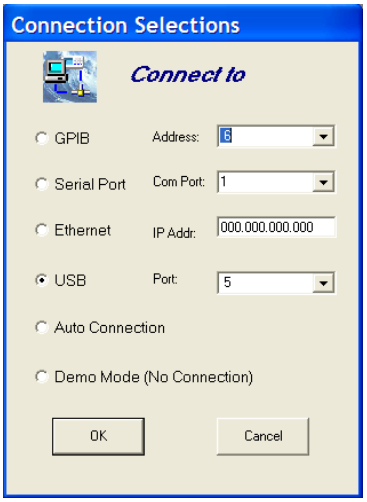
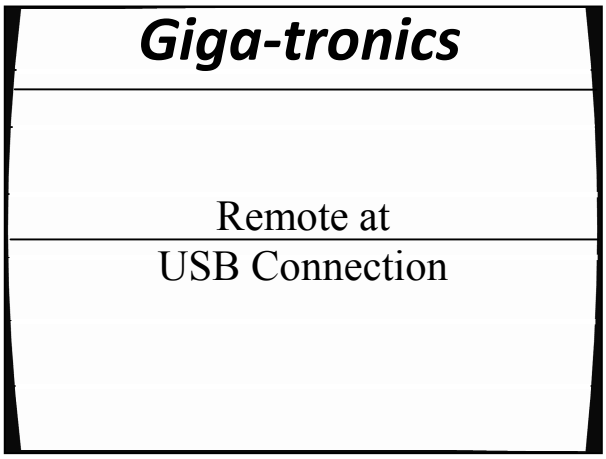
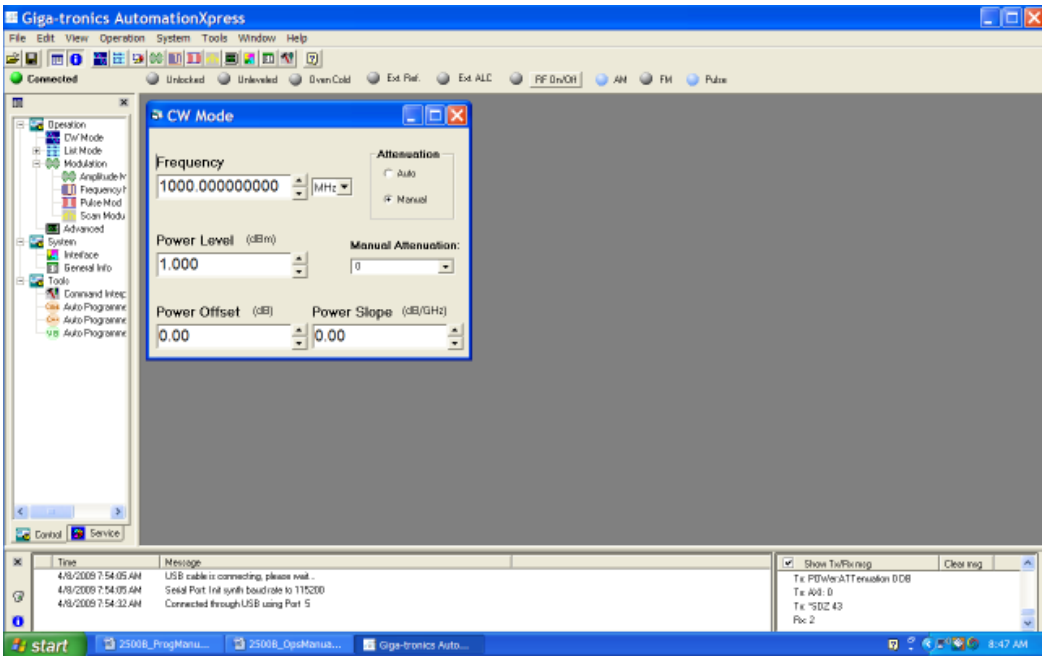


Table 42 Install the USB Cable and Start Automation Xpress	
Step	**Action**
7.	The Remote Connection screen appears on the 2400/2500 display (see Figure 4 below). **Figure 4. Remote Connection Screen** 
8.	The CW Mode Dialog Box appears in the AX GUI (see Figure 5 below). **Figure 5. AX GUI: CW Mode Dialog Box** 
End of Procedure	

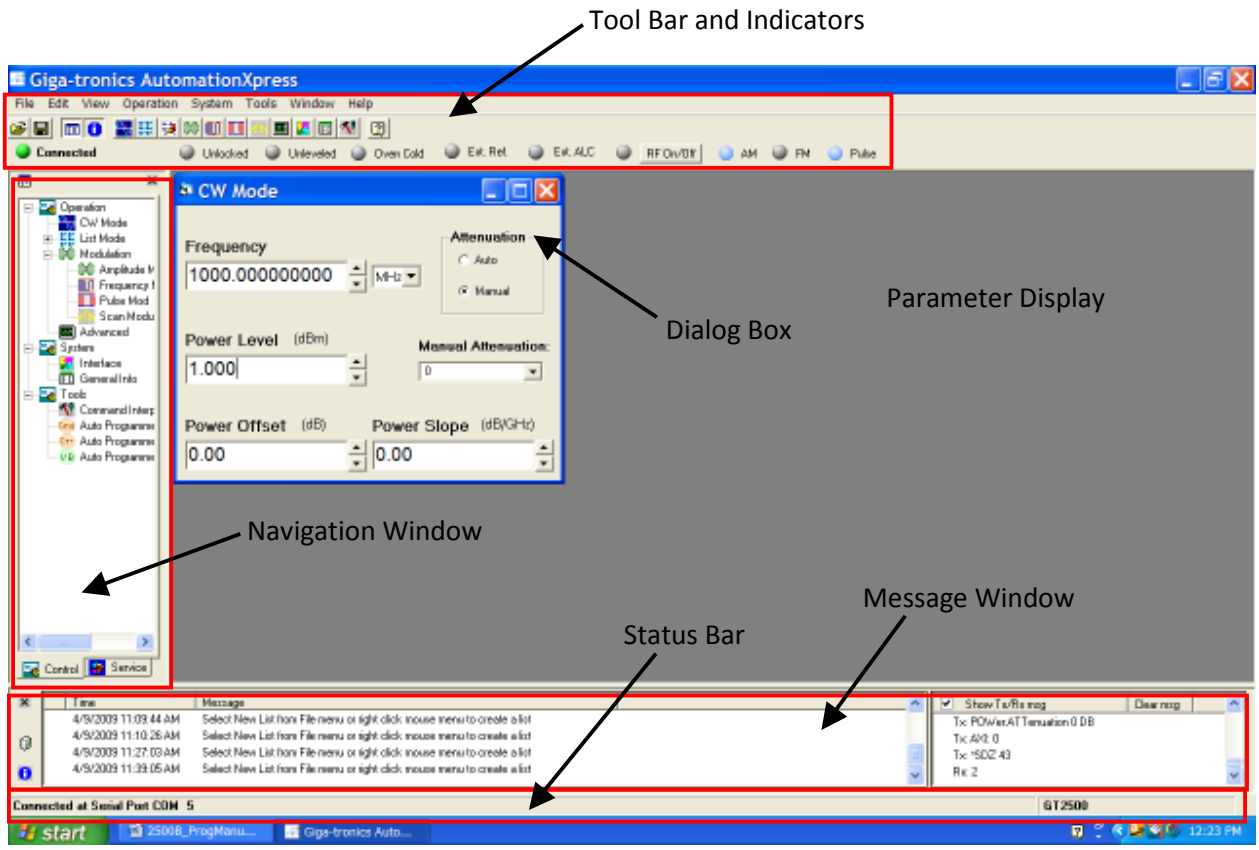
5.4 Automation Xpress GUI Description

The main areas of the AX GUI are shown in Figure 6 below. These areas are described in detail on the following pages.

NOTE: There is an extensive Help feature in Automation Xpress that helps you quickly learn how to get the most out of Automation Xpress.

To open Help in the Automation Xpress GUI: Click on Help > Contents.

Figure 6. Main Areas of the AX GUI

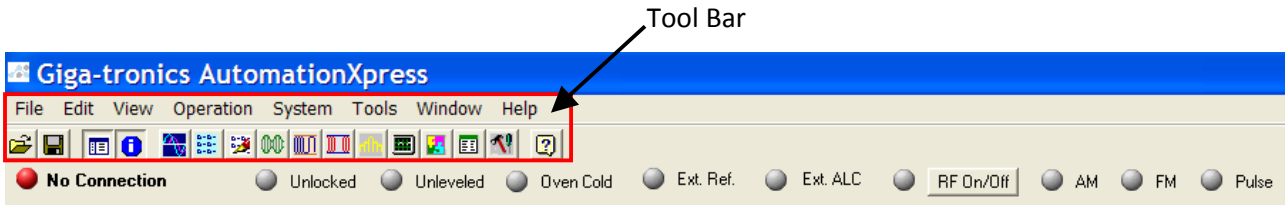


5.4.1 Tool Bar

This section describes the Tool Bar area of the AX GUI (see Figure 7).

The Tool Bar provides access to the functions and settable parameters of Automation Xpress.

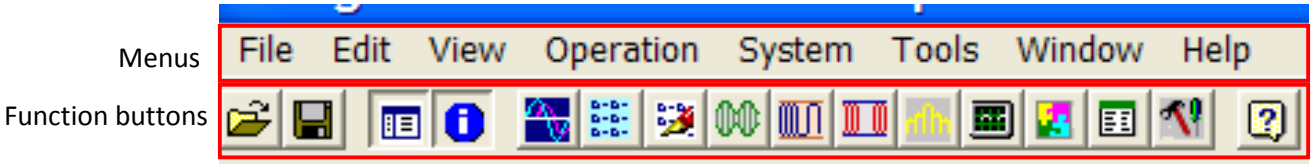
Figure 7. AX GUI: Tool Bar and Indicators



The Tool Bar has two areas (see Figure 8 below):

- The top Menu area; the menus are described on the following pages.
- The bottom Function area; the Function buttons are described on page 164.

Figure 8. Tool Bar

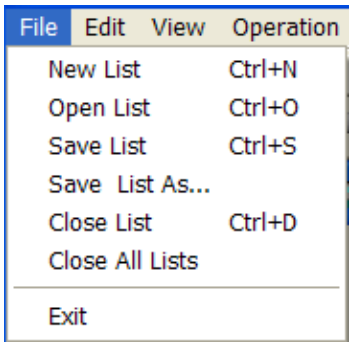


5.4.1.1 File Menu

The File Menu allows you to use standard file operations to manipulate lists (see Figure 9).

NOTE: The selections in the File Menu are inactive (grey) until you click on Operation > List Mode > List Controller.

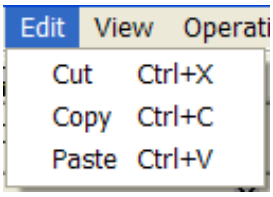
Figure 9. Automation Xpress File Menu



5.4.1.2 Edit Menu

The Edit Menu provides standard text editing tools (see Figure 10).

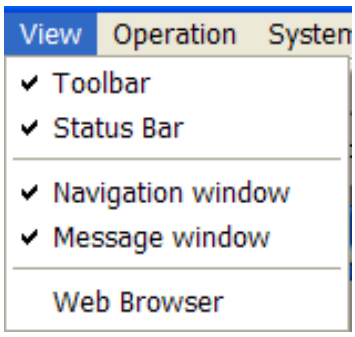
Figure 10. Edit Menu



5.4.1.3 View Menu

The View Menu lets you select which windows are viewed in the Automation Xpress GUI (see Figure 11).

Figure 11. View Menu



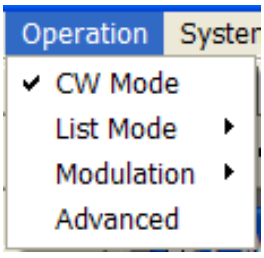
5.4.1.4 Operation Menu

The Operation Menu (see Figure 12) lets you select and set the parameters of the following:

- CW Mode
- List Mode
- Modulation
- ALC
- Advanced

These are described in detail on the following pages.

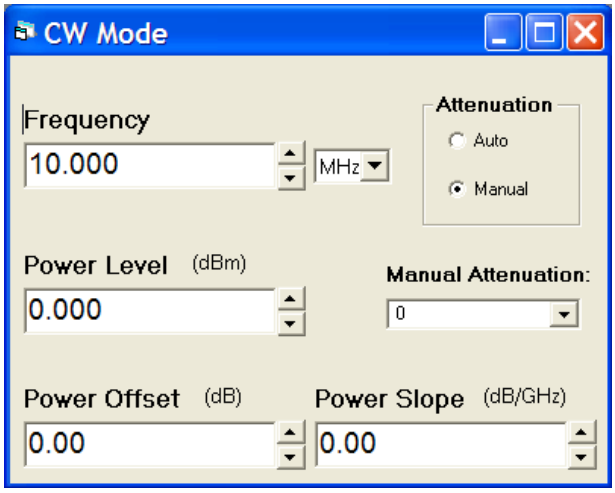
Figure 12. Operation Menu



5.4.1.4.1 Operation > CW Mode

The CW Mode window (see Figure 13) opens by default whenever Automation Xpress is launched.

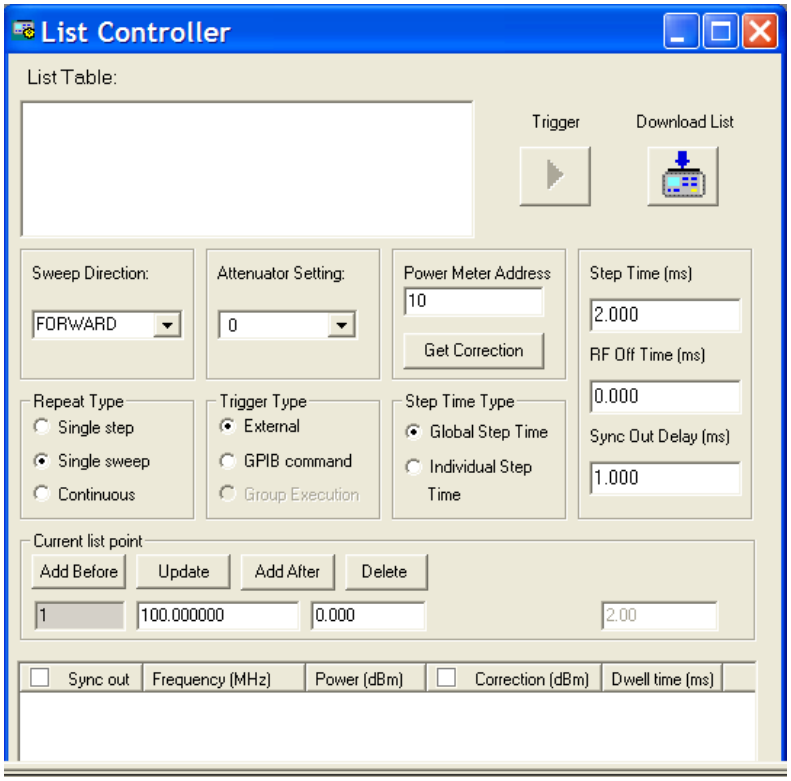
Figure 13. CW Mode Window



5.4.1.4.2 Operation > List Mode > List Controller

Open by clicking Operation > List Mode > List Controller. See Figure 14 below.

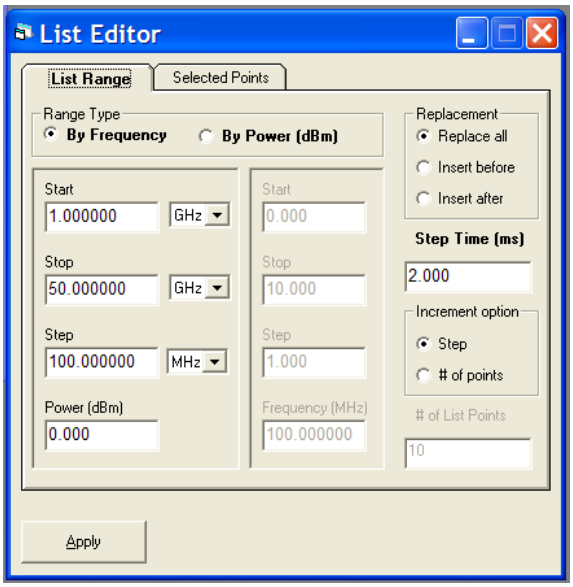
Figure 14. List Controller Window



5.4.1.4.3 Operation > List Mode > List Editor

Open by clicking Operation > List Mode > List Editor. See Figure 15 below.

Figure 15. List Editor

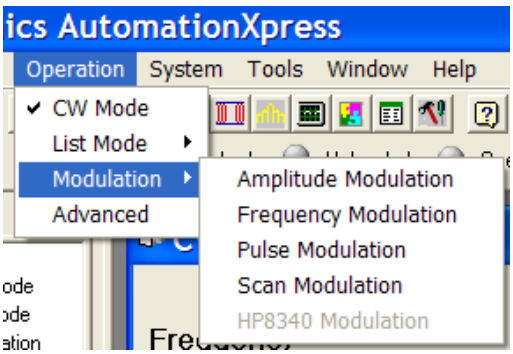


5.4.1.4.4 Operation > Modulation >

See Figure 16 below. Within the Operation Menu are the following choices (depending on the model type and options in your 2400/2500) of modulation settings windows:

- Amplitude Modulation
- Frequency Modulation
- Pulse Modulation
- Scan Modulation

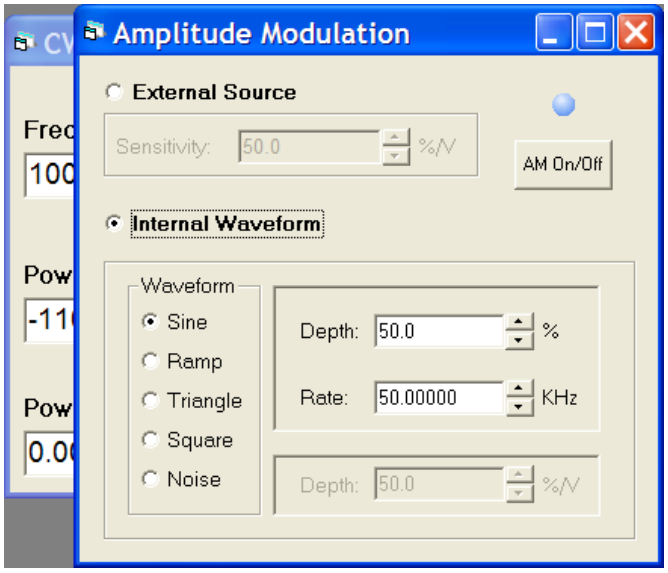
Figure 16. Operation > Modulation



5.4.1.4.5 Operation > Modulation > Amplitude Modulation

The Amplitude Modulation window is shown in Figure 17.

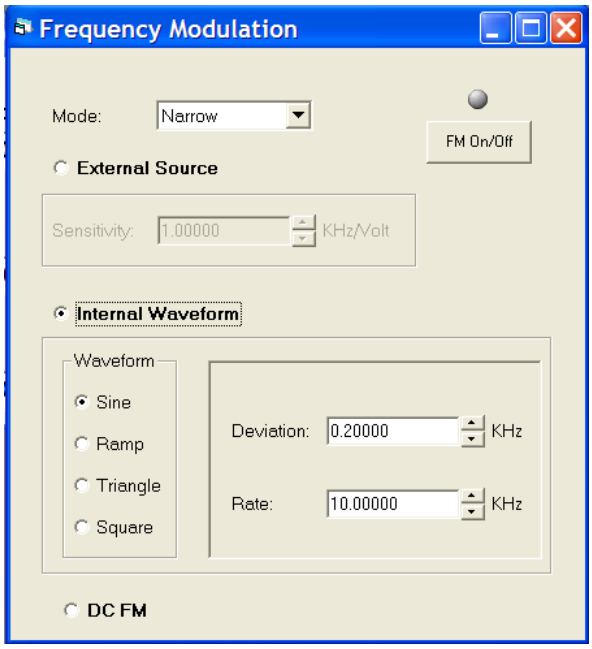
Figure 17. Amplitude Modulation Settings Window



5.4.1.4.6 Operation > Modulation > Frequency Modulation

The Frequency Modulation window is shown in Figure 18.

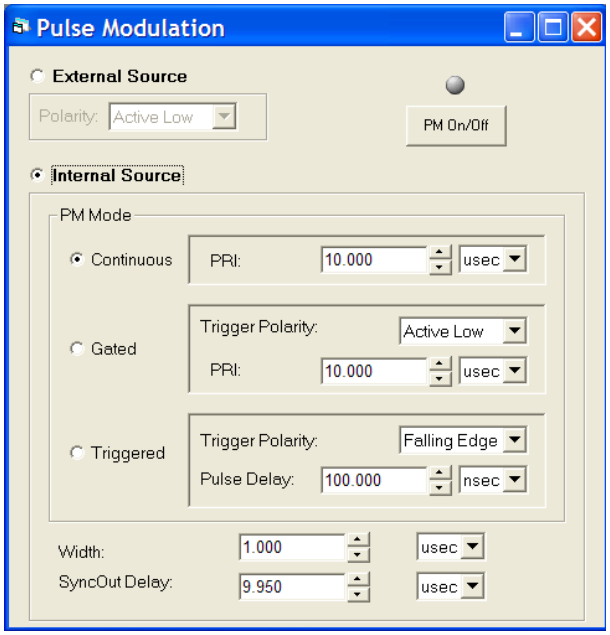
Figure 18. Frequency Modulation Settings Window



5.4.1.4.7 Operation > Modulation > Pulse Modulation

The Pulse Modulation window is shown in Figure 19.

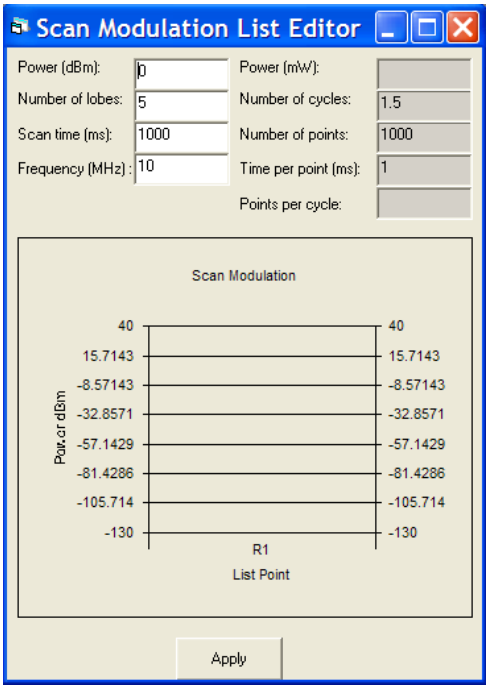
Figure 19. Pulse Modulation Settings Window



5.4.1.4.8 Operation > Modulation > Scan Modulation

The Scan Modulation window is shown in Figure 20.

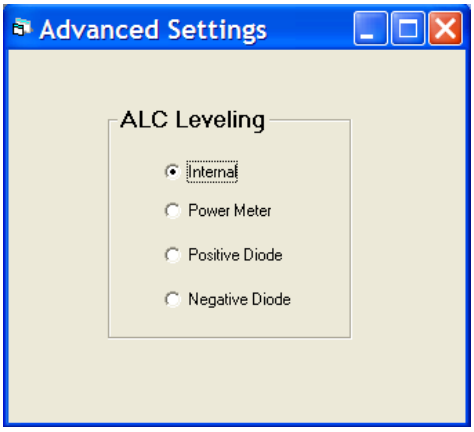
Figure 20. Scan Modulation Settings Window



5.4.1.4.9 Operation > Advanced

The Advanced Settings window is shown in Figure 21.

Figure 21. Advanced Settings Window

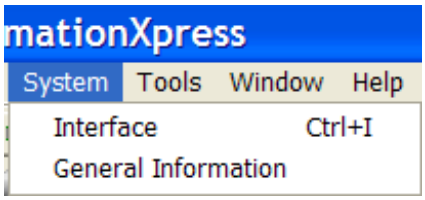


5.4.1.5 System Menu

The System Menu (see Figure 22) has two windows to choose from:

- Interface: This window lets you select the connection interface (GPIB, Serial Port, Ethernet, USB, Auto Connection, Demo Mode) between the host computer and 2400/2500, and to set some of the parameters of each connection interface.
- General Information: this window shows information about the 2400/2500 that is connected to the computer.

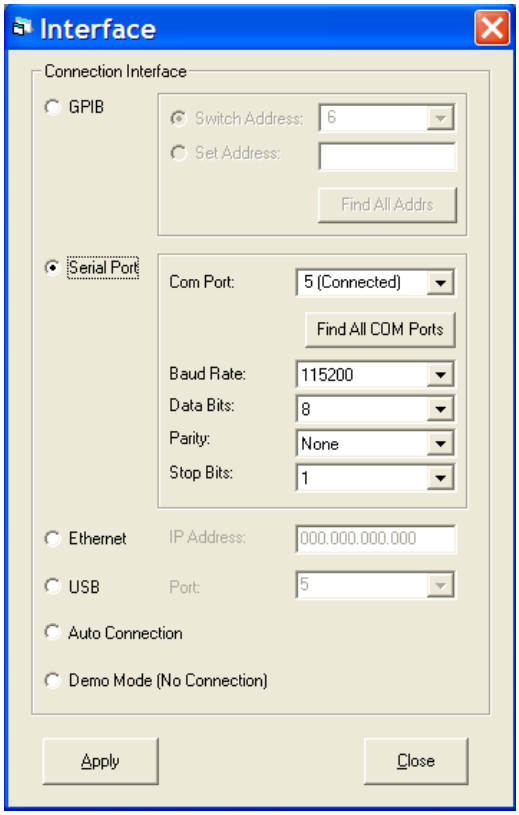
Figure 22. System Menu



5.4.1.5.1 System > Interface

The Interface window is shown in Figure 23.

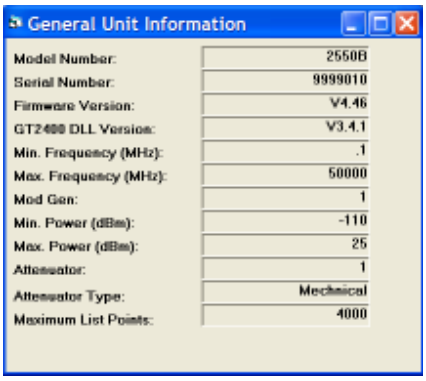
Figure 23. Interface Settings Window



5.4.1.5.2 System > General Information

The General Information Window has information about the 2400/2500 connected to the computer (see Figure 24).

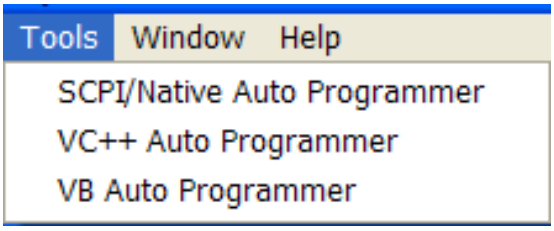
Figure 24. System > General Information



5.4.1.6 Tools Menu

The Tools Menu (see Figure 25) lets you select the format for Auto Programmer to save test routines.

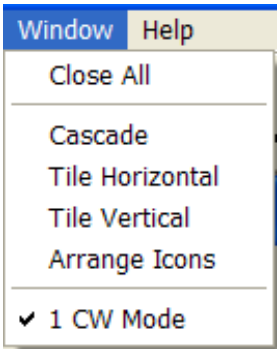
Figure 25. Tools Menu



5.4.1.7 Window Menu

The Window Menu (see Figure 26) lets you configure the arrangement of the windows in the Automation Xpress.

Figure 26. Window Menu

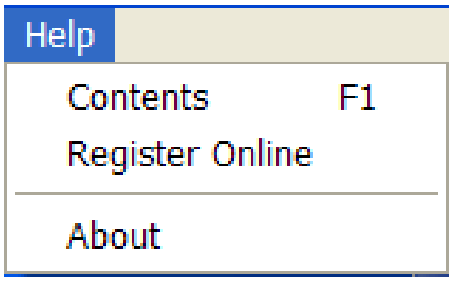


5.4.1.8 The Help Menu

The Help Menu (see Figure 27) lets you select the following:

- Contents: Opens the online Help.
- Register Online: Lets you register your copy of Automation Xpress via the Web
- About: Shows information about your copy of Automation Xpress and System Information about your computer.

Figure 27. Help Menu



5.4.1.9 Function Buttons

Table 43 below describes the functions of the buttons in the Tool Bar (see Figure 8 on page 155).

Table 43 Tool Bar Function Buttons

Button	Function
	Open List
	Save List
	Navigation Window
	Message Window
	CW Mode
	List Controller
	List Editor
	Amplitude Modulation
	Frequency Modulation
	Pulse Modulation
	Scan Modulation
	Advanced Operations
	Interface
	General Info
	Command Interpreter
	Help

5.4.2 Indicators and RF Button

Figure 28 shows the Indicator bar in Automation Xpress. Table 44 describes the functions of the indicators and button.

Figure 28. Automation Xpress GUI Indicators

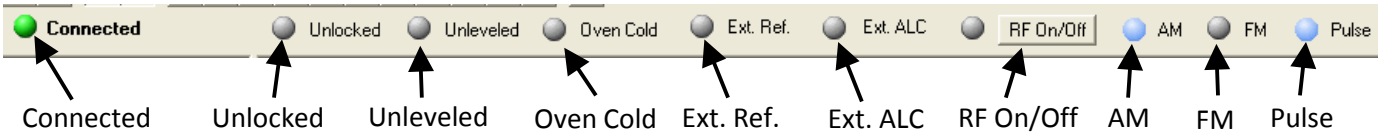


Table 44 Automation Xpress Indicators

Name	Function
Connected	• Green — Connected; the computer is connected to a 2400/2500, and Automation Xpress has established a connection to the 2400/2500. • Red — No Connection; Automation Xpress is not connected to a 2400/2500
Unlocked	Indicates the phase lock loop is unlocked. This indicator has two states: • Gray — normal • Yellow — warning
Unleveled	Indicates that the power output cannot be increased any further, even though the power output displayed may show an increase. The unleveled point varies with frequency. This indicator has two states: • Gray — normal • Yellow — warning
Oven Cold	Indicates that the internal temperature of the 2400/2500 has not reached operational temperature. It is not recommended to use the 2400/2500 while this indicator is active.
Ext. Ref.	Indicates the 2400/2500 is operating with an external reference applied. • Gray — Without External Reference • Blue — With External Reference
Ext. ALC	Indicates that the 2400/2500 is using external Automatic Load Control (ALC). • Gray — not using external reference • Blue — using external reference
RF On/Off	This is a button and associated indicator that switches the RF output ON and OFF, and indicates the state of the output via the indicator. • Gray — RF Off • Blue — RF On

Continued next page

Table 44 Automation Xpress Indicators	
Name	**Function**
AM	Indicates that the 2400/2500 is in AM mode. • Gray — AM Off • Blue — AM On
FM	Indicates that the 2400/2500 is in FM mode. • Gray — FM Off • Blue — FM On
Pulse	Indicates that the 2400/2500 is in pulse modulation (PM) mode. • Gray — PM Off • Blue — PM On

5.5 Auto Programmer

5.5.1 Introduction

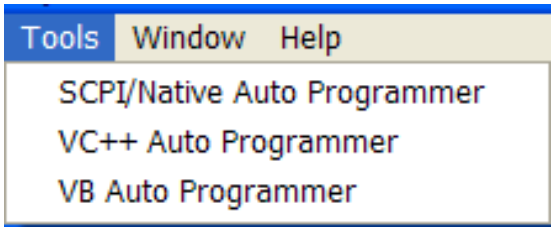
Auto Programmer is a function within Automation Xpress that allows you to remotely program the 2400/2500 using only the buttons and settings within Automation Xpress. Auto Programmer interprets your sequence of actions in Automation Xpress, and converts them into a format usable within a programming application.

The general procedure for using Auto Programmer is shown below. Example procedures for using Auto Programmer start on the following page.

Table 45 General Procedure for Using Auto Programmer

Step	Action
1.	Connect a computer to the 2400/2500 (see Hardware Interface on page 5).
2.	Install Automation Xpress onto the computer (seeInstall Automation Xpress on page 150).
3.	Start Automation Xpress (see Start Automation Xpress on page 152).
4.	On the Automation Xpress toolbar, click on Tools (see Figure 29 below), and select which format you wish to work in. You have the following selections to choose from (see Figure 29): • SCPI/Native language • Visual C++ • Visual Basic
5.	As you configure the settings within Automation Xpress, the equivalent commands appear in the Auto Programmer window. These commands are saved, line by line.
6.	When you have finished creating the test routine, do either of the following: • Click Export to File; this creates a text file. • Click Create Project (applies to Visual C++ or Visual Basic).
7.	Save the file.
8.	Use the file to create a signal-generation application for the 2400/2500.
End of Procedure	

Figure 29. Automation Xpress Tools Menu



5.5.2 Auto Programmer Examples

5.5.2.1 Generate Code for a C/C++ File

This method is to generate the code by exporting to a file. The advantage of this method is simplicity. You only see the file directly related to your actions on GUI. However, you will have to create a project for it in order to compile. This can be achieved easily by looking at the result of second method.

Table 46 Generate code to a C/C++ File

Step	Action
1.	Turn on Auto Programmer: Click Tools > select VC++ Auto Programmer. ***NOTE:*** Operations in the Automation Xpress GUI are automatically recorded after the Auto Programmer window appears.
2.	Use Automation Xpress to set the parameters for your test routine.
3.	Export the code lines to a file by clicking the Export to file button.
4.	The exported file is ready to be integrated into a project.
End of Procedure	

5.5.2.2 Generate a Visual C++ Project

This is a true one button push method. The result of this method is a program which you can run.

The advantage of this method is completeness. You can click the “RUN” button in the VC++ environment and the VC IDE will compile, link, and run it for you. You may use other variables name other than what Auto Programmer has chosen for you.

Before using Auto Programmer to create a file, you must create a project in Visual C++. You will save the file created in Auto Programmer to the project’s directory.

Table 47 Generate code to a C/C++ Project

Step	Action
1.	Turn on Auto Programmer: Click Tools > VC++ Auto Programmer. ***NOTE:*** Operations in the Automation Xpress GUI are automatically recorded after the Auto Programmer window appears.
2.	Use Automation Xpress to set the parameters for your test routine.
3.	When you have completed the test routine, in the Auto Programmer window, click Create Project.
4.	Browse to the directory for the Visual C++ project and save the file.
5.	In the Visual C++ project, click Build. The project is ready to run.
End of Procedure	

5.5.2.3 Generate Code to a Visual Basic File

This method generates code by exporting to a file. The advantage of this method is simplicity. You only see the file directly related to your actions in the Automation Xpress GUI. However, you will have to create a project for it in order to compile. This can be achieved easily by looking at the result of second method.

Table 48 Generate code to a Visual Basic File	
Step	**Action**
1.	Turn on Auto Programmer: Click Tools > VB Auto Programmer. ***NOTE:*** Operations in the Automation Xpress GUI are automatically recorded after the Auto Programmer window appears.
2.	Use Automation Xpress to set the parameters for your test routine.
3.	When you have completed the test routine, in the Auto Programmer window, click Create Project.
4.	Browse to the directory for the Visual Basic project and save the file.
5.	In the Visual Basic project, Click Build. The project is ready to run
End of Procedure	

5.5.2.4 Generate a Visual Basic Project

This is a true one button push method. The result of this method is a program which you can run.

The advantage of this method is completeness. You can click the “RUN” button in the VB environment and the VB IDE will compile, link, and run it for you. You may use other variables name other than what Auto Programmer has chosen for you.

Before using Auto Programmer to create a file, you must create a project in Visual Basic. You will save the file created in Auto Programmer to the project’s directory.

Table 49 Generate code to a Visual Basic Project	
Step	**Action**
1.	Turn on Auto Programmer: Click Tools > VB Auto Programmer. ***NOTE:*** Operations in the Automation Xpress GUI are automatically recorded after the Auto Programmer window appears.
2.	Use Automation Xpress to set the parameters for your test routine.
3.	When you have completed the test routine, in the Auto Programmer window, click Create Project.
4.	Browse to the directory for the Visual Basic project and save the file.
5.	In the Visual Basic project, click Build. The project is ready to run.
End of Procedure	

5.5.2.5 Generate a SCPI command script

The following example sets up an arbitrary list for external triggers. Each external single pulse moves the list point one step forward.

Table 50 Generate SCPI Command Script	
Step	**Description**
1.	Turn on AutoProgrammer. Note: Opening the AutoProgrammer window (Tools | AutoProgrammer from menu) turns on the AutoProgrammer. Operations on GUI will be recorded from this point on.
2.	Select SCPI option from the radio button. (It is default so this may be skipped)
3.	Load a list from hard disk to AX Recorded function calls:
4.	Set repeat type to single step
5.	Set trigger type to External
6.	Click download button
7.	Export the command script to a file by clicking Export to a file button.
8.	Ready to be executed by command interpreter.

5.5.2.6 Generate GT12000 command script

The following example sets up an arbitrary list for external triggers. Each external single pulse moves the list point one step forward.

Table 51 Generate GT1200 Command Script	
Step	**Description**
1.	Turn on AutoProgrammer. Note: Opening the AutoProgrammer window (Tools | AutoProgrammer from menu) turns on the AutoProgrammer. Operations on GUI will be recorded from this point on.
2.	Select GT12000 option from the radio button. (It is default so this may be skipped)
3.	Load a list from hard disk to AX Recorded function calls:
4.	Set repeat type to single step
5.	Set trigger type to External
6.	Click download button
7.	Export the command script to a file by clicking Export to a file button.
8.	Ready to be executed by command interpreter.

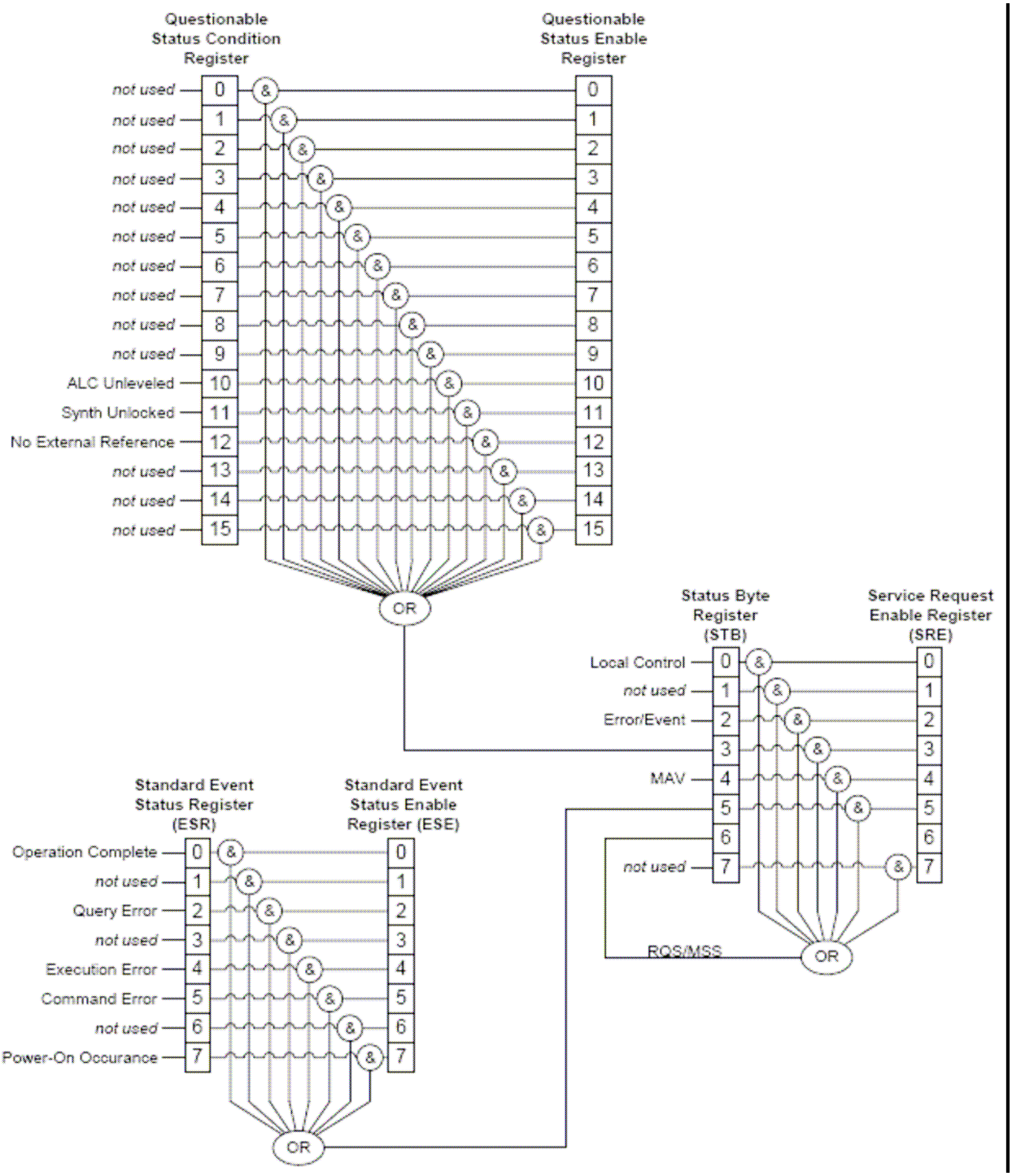
Chapter 6. Status Register System

6.1 Introduction

The Status Register System holds information about the 2400/2500 during remote operation. Several status registers can be queried for specific information about the state of the instrument or the status of events relating to its operation. These registers can be queried directly or can be configured to initiate a service request whenever an expected condition has occurred. One or more conditions can be monitored at one time by the 2400/2500.

Figure 30 on the next page shows the relationships between the registers of the 2400/2500 Status Register System.

Figure 30. 2400/2500 Status Register System



6.2 Status Byte and Service Request Enable Registers

The Status Byte Register is the primary status register. It is the top-level register used to track changes in the state of the 2400/2500. The summary bits of lower-level status registers are set in the Status Byte Register when certain conditions occur that are being monitored by and have been enabled in those lower-level registers. The *STB? query can be used to read the contents of the Status Byte Register.

The Service Request Enable register controls which bits in the Status Byte Register can generate a service request. The bits in the Service Request Enable Register are logically ANDed with the equivalent bits in the Status Byte Register, and the results of those AND operations are logically ORed to produce a service request. The RQS/MSS bit (bit 6) in the Status Byte Register is set when the logic OR operation produces a service request. The *SRE command can be used to set the contents of the Service Request Enable Register, and the *SRE? query can be used to read the contents of the Service Request Enable Register.

Table 52 describes each bit in the Status Byte Register.

Table 52 Status Byte Register Bit Assignments

Bit	Function	Description
0	Local Control	Local Control. This bit is set whenever the Local button is pressed while the source is in remote operation
1	Not Used	Not used. Always 0.
2	Error/Event	Error/Event. This bit is set whenever a SCPI error has occurred.
3	QUES Status	QUES Status (Questionable Status). This bit is set whenever a condition defined in the questionable status register has occurred. See the section entitled “Questionable Status Condition and Enable Registers”, below, for details.
4	MAV	MAV. Message Available. This bit is set whenever a message is available.
5	ESB	ESB. Standard Event Status Register. This bit is set whenever a condition defined in the Standard Event Status Register has occurred. See the section entitled “Standard Event Status and Standard Event Status Enable Registers”, below, for details.
6	RQS/MSS	RQS/MSS. Interrupt Request. This bit is set whenever an event identified by the service request mask has occurred.
7	Not Used	Not used. Always 0.

6.3 Standard Event Status and Standard Event Status Enable Registers

The Standard Event Status Register is one of the lower-level status registers. It monitors certain common instrument status conditions. When a condition occurs that is being monitored by this register, *and* that condition has been enabled by the Standard Event Status Enable Register, bit 5 is set in the Status Byte Register. The *ESR? query can be used to read the contents of the Standard Event Status Register.

The Standard Event Status Enable Register controls which bits in the Standard Event Status Register can set bit 5 of the Status Byte Register. The bits in the Standard Event Status Enable Register are logically ANDed with the equivalent bits in the Standard Event Status Register, and the results of those AND operations are logically ORed to produce a summary bit. The ESB bit (bit 5) in the Status Byte Register is set when the logic OR operation sets the summary bit. The *ESE command can be used to set the contents of the Standard Event Status Enable Register, and the *ESE? query can be used to read the contents of the Standard Event Status Enable Register.

Table 53 describes each bit in the Standard Event Status Register.

Table 53 Standard Event Status Register Bit Assignment

Bit	Function	Description
0	Operation complete	Operation Complete. This bit is set whenever all pending operations are completed (such as a list computation).
1	Not used	Not used. Always 0.
2	Query error	Query Error. This bit is set whenever a query error has occurred.
3	Not used	Not used. Always 0.
4	Execution error	Execution Error. This bit is set whenever an execution error has occurred.
5	Command error	Command Error. This bit is set whenever an invalid GPIB command has been received.
6	Not used	Not used. Always 0.
7	Power on occurrence	Power On Occurrence. This bit is set whenever the instrument has been powered off and then on again during manual and remote operation.

6.4 Questionable Status Condition and Enable Registers

The Questionable Status Register is one of the lower-level status registers. It monitors certain 2400/2500-specific status conditions. When a condition occurs that is being monitored by this register, bit 3 is set in the Status Byte Register. The STATus:QUEStionable:CONDition? query can be used to read the contents of the Questionable Status Register.

Table 54 describes each bit in the Questionable Status Register.

Table 54 Questionable Status Register - Bit Assignment

Bit	Function	Description
0	Not used	Not used
1	Not used	Not used
2	Not used	Not used
3	Not used	Not used
4	Not used	Not used
5	Not used	Not used
6	Not used	Not used
7	Not used	Not used
8	Not used	Not used
9	Not used	Not used
10	ALC unleveled	ALC Unleveled. This bit is set whenever the output power is operated in an unleveled condition.
11	Synth unlocked	Synthesizer Unlocked. This bit is set whenever the synthesizer has lost phase lock.
12	No external reference	No External Reference. This bit can be monitored whenever an external reference is applied to the synthesizer for phase locking multiple synthesizers. This bit is set whenever the external reference signal is lost.
13	Not used	Not used
14	Not used	Not used
15	Not used	Not used

This page is intentionally blank.

Chapter 7. 2400/2500 Specific Commands

The commands in the following table are specific to the 2400/2500 Series of instruments, and are independent of the SCPI and GT-12000 native command sets.

Table 55 2400/2500 Specific Commands

Command	Name	Description
*RCL <reg>	Recall Instrument State	Recalls a previously saved instrument state from memory Range of <reg>: 0 - 9
*SAV <reg>	Save Instrument State	Saves the current instrument state to memory Range of <reg>: 0 - 9
*TRG	Trigger Device	Triggers the synthesizer if BUS is the specified trigger source (see “TRIGger:SOURce BUS|EXTernal” on page 108).
/SCPI	SCPI	Changes command syntax to SCPI
/NATive	Giga-tronics Native	Change command syntax to GT-12000 "native"

This page is intentionally blank.

Chapter 8. List Mode Operation

2400/2500 list mode operation is not available from the front panel. In order to use list mode, remote programming must be used.

Automation Xpress is the preferred method of using the 2400/2500 in remote operation. For information on using Automation Xpress, refer to Chapter 5 on page 148, or to the Automation Xpress online help system.

Command-based remote interface commands can also be used to program list mode operation.

Table 56 is an example that shows the SCPI commands that are used to program the 2400/2500 to step its output power level from 8 to 5 to 0 dBm, while keeping the frequency constant at 5 GHz. The dwell time, that is, the time spent on each step, is 200 ms. In this example, software triggering is used, and the sweep mode is set to single-sweep. The last command in the sequence triggers the list.

Table 56 Example of List Mode Operation

Sequence	Command	Description
1	LIST:SEQ:AUTO ON	Activate list mode.
2	LIST:FREQ 5000000000.0,5000000000.0,5000000000.0	Add 3 list points to a list with frequency 5 GHz.
3	LIST:POW 8.000,5.000,0.000	Set the power for the 3 list points to 8, 5 and 0 dBm respectively.
4	LIST:DWEL 0.200000, 0.200000, 0.200000	Set the dwell (step) time for the 3 list points to 0.2 seconds.
5	LIST:PRECompute	Pre-compute the created list data.
6	LIST:REPeat SWEEP	Set the list repeat type to single sweep.
7	TRIGger:SOURce BUS	Set the list trigger mode to GPIB (software) triggering.
8	OUTP ON	Turn the RF output on.
9	*TRG	Trigger the list.

This page is intentionally blank.

Chapter 9. LabVIEW Drivers

9.1 Overview

Giga-tronics provides two libraries of drivers that can be used to create LabVIEW applications that work with Giga-tronics 2400 and 2500 series instruments. Most of these drivers directly correlate to functions in the DLL that are included in the CD-ROM or flash drive that ships with 2400 or 2500 series instruments. The remaining drivers perform utility functions.

NOTE: All LabVIEW drivers for the 2400C have the suffix ".vi", for Virtual Instrument.

The two libraries are:

1. GT2XXX.LLB; this library supports the following:
    i. All user-accessible functions available to the user in the GT2400 DLL.
    ii. Service Request functions.
    iii. Connection functions.
    iv. IEEE 488.2 functions.
    v. Function Call error query with text translation.

2. GT2XXX_U.LLB; this utility library supports the following:
    vi. Event Status Register query with text translation.
    vii. Utility Clean Up VI calling GT2400_CloseConnection VI.
    viii. Utility Default Instrument Setup VI sets the instrument to factory default.

The LabVIEW drivers support all user-accessible functions in the GT2400 DLL listed in this manual. Any other functionalities that are not supported by the function call VIs can be accessed via the connection function VIs; GT2XXX_Write.vi, GT2XXX_Read.vi, and GT2XXX_Query.vi; or a combination of function call and/or connection VIs.

Note the following:

- The GT2XXX.LLB library includes application VIs utilizing the function call VIs.
- VI Tree VI includes all GT2XXX.LLB and GT2XXX_U.LLB VIs in the Block Diagram view.

The naming convention of the LabVIEW drivers is GT2XXX to denote that the library works for both 2400 and 2500 series signal generators.

Continued next page

LabVIEW function call VIs contain the GT2400 DLL functions. The function call VIs have the same name as the associated DLL functions except the prefix is GT2XXX instead of GT2400. Also, all the input, output parameters and the return value of the functions have the same equivalent variable type, and in most cases the variable names are kept the same.

The VIs includes ErrorIn and ErrorOut clusters (similar to a structure in C). These clusters hold three pieces of information regarding VI error

- Error state
- Error code
- Error origination.

The VIs are designed to update the ErrorOut cluster based on the status returned by the DLL functions. Additionally, if an error is received through ErrorIn, the VI simply passes the error to its ErrorOut cluster without performing the core functionality.

There are two types of VI names:

- GT2XXX followed by an underscore, “GT2XXX_”. These are VIs that call the corresponding DLL function.
- GT2XXX followed by a space, “GT2XXX “. These do not call DLL functions.

NOTE: An exception to this categorization is the naming for VI GT2XXX_Initialize.vi. This VI is categorized as a function call VI, but the function it wraps is not GT2400_Initialize function, but instead it is GT2400_OpenConnection function.

The tables on the following pages list the LabVIEW drivers for the 2400C.

9.2 LabVIEW Drivers

9.2.1 LabVIEW Drivers for DLL Functions

Table 57 below is a list of LabVIEW VIs for instrument DLL functions.

Location of the VIs: Except where otherwise noted, all of the VIs in Table 57 are located in:
C:\Program Files\National Instruments\LabVIEW 7.1\instr.lib\GT2xxx\GT2XXX.llb\

Table 57 LabVIEW for DLL Functions

Icon	Driver Name
	GT2XXX_ActivateAList.vi
	GT2XXX_CloseAList.vi
	GT2XXX_CloseAllConnections.vi
	GT2XXX_CloseAllLists.vi
	GT2XXX_CloseGPIBConnections.vi
	GT2XXX_CreateNewList.vi
	GT2XXX_DeleteAListPoint.vi
	GT2XXX_DeleteAllListPoints.vi
	GT2XXX_DownloadList.vi
	GT2XXX_EditAListPoint.vi
	GT2XXX_EditApplyCorrection.vi
	GT2XXX_EditFreqRangeByNumOfPts.vi
	GT2XXX_EditFreqRangeByStepFreq.vi
	GT2XXX_EditListPoints.vi

Continued next page

Table 57 LabVIEW for DLL Functions	
Icon	**Driver Name**
	GT2XXX_EditListSyncOutOption.vi
	GT2XXX_EditPowerRangeByNumOfPts.vi
	GT2XXX_EditPowerRangeByStepPower.vi
	GT2XXX_EditRFOffTime.vi
	GT2XXX_EditStepTime.vi
	GT2XXX_EditSyncOutDelay.vi
	GT2XXX_FindInstruments.vi
	GT2XXX_GetAttenuation.vi
	GT2XXX_GetCorrection.vi
	GT2XXX_GetCW.vi
	GT2XXX_GetCWDataLimit.vi
	GT2XXX_GetDLLVersion.vi
	GT2XXX_GetErrorMessage.vi
	GT2XXX_GetListData.vi
	GT2XXX_GetListDataLimit.vi
	GT2XXX_GetListDataWithCorrection.vi
	GT2XXX_GetRF.vi
	GT2XXX_GroupExecutionTrigger.vi
	GT2XXX_Initialize.vi
Continued next page	

Table 57 LabVIEW for DLL Functions	
Icon	**Driver Name**
	GT2XXX_LoadListFromFile.vi
	GT2XXX_QueryCmd.vi
	GT2XXX_ReadCmd.vi
	GT2XXX_ResetInstrument.vi
	GT2XXX_SaveListToFile.vi
	GT2XXX_SetAMExtSensitivity.vi
	GT2XXX_SetAMIntDepth.vi
	GT2XXX_SetAMIntRate.vi
	GT2XXX_SetAMIntWavefrm.vi
	GT2XXX_SetAMSource.vi
	GT2XXX_SetAMState.vi
	GT2XXX_SetAttenuation.vi
	GT2XXX_SetCorrection.vi
	GT2XXX_SetCW.vi
	GT2XXX_SetFMExtMode.vi
	GT2XXX_SetFMExtSensitivity.vi
	GT2XXX_SetFMIntDev.vi
	GT2XXX_SetFMIntRate.vi
	GT2XXX_SetFMIntWavefrm.vi
Continued next page	

Table 57 LabVIEW for DLL Functions	
Icon	**Driver Name**
	GT2XXX_SetFMSource.vi
	GT2XXX_SetFMState.vi
	GT2XXX_SetGPIBAddress.vi
	GT2XXX_SetListScanDirection.vi
	GT2XXX_SetPMExtPolarity.vi
	GT2XXX_SetPMIntDelay.vi
	GT2XXX_SetPMIntPRI.vi
	GT2XXX_SetPMIntRFPulseDelay.vi
	GT2XXX_SetPMIntSyncDelay.vi
	GT2XXX_SetPMIntTrigPolarity.vi
	GT2XXX_SetPMIntWidth.vi
	GT2XXX_SetPMMode.vi
	GT2XXX_SetPMSource.vi
	GT2XXX_SetPMState.vi
	GT2XXX_SetRepeatType.vi
	GT2XXX_SetRF.vi
	GT2XXX_SetTriggerType.vi
	GT2XXX_SoftwareTrigger.vi
	GT2XXX_WriteCmd.vi
End of Table	

9.2.2 Non-DLL LabVIEW Drivers

Table 58 is a list of LabVIEW VIs in alphabetical order that are not wrapper VIs to the DLL function calls. All the VIs in this list has a prefix of "GT2XXX ".

Location of the VIs: Except where otherwise noted, all of the VIs in Table 58 are located in:

C:\Program Files\National Instruments\LabVIEW 7.1\instr.lib\GT2xxx\GT2XXX.llb\

Table 58 Non-DLL Function Call LabVIEW Drivers

Icon	Driver Name
	GT2XXX Check Status.vi C:\Program Files\National Instruments\LabVIEW 7.1\instr.lib\GT2xxx\GT2XXX_U.llb\GT2XXX Check Status.vi
	GT2XXX Clear Status Bytes.vi
	GT2XXX Error Query (multiple).vi
	GT2XXX Error Query.vi
	GT2XXX Init Heap Space To Empty.vi
	GT2XXX Instrument Preset.vi
	GT2XXX Lock Ulock Knob.vi
	GT2XXX Output Active Parameter Value.vi
	GT2XXX Output Center Frequency.vi
	GT2XXX Output CW Frequency.vi
	GT2XXX Output CW Level.vi
	GT2XXX Output Delta Frequency.vi
	GT2XXX Output Parameter For Freq Sweep.vi
	GT2XXX Output Start Frequency.vi
	Continued next page

Table 58 Non-DLL Function Call LabVIEW Drivers	
Icon	**Driver Name**
	GT2XXX Output Stop Frequency.vi
	GT2XXX Parameter Step (Up, Down).vi
	GT2XXX Reset.vi
	GT2XXX Revision Query.vi
	GT2XXX Run List.vi
	GT2XXX Set CW.vi
	GT2XXX Set Frequency.vi
	GT2XXX Set Power.vi
	GT2XXX Store Recal Setup.vi
	GT2XXX Toggle Display.vi
	GT2XXX Utility Clean Up Initialize.vi C:\Program Files\National Instruments\LabVIEW 7.1\instr.lib\GT2xxx\GT2XXX_U.llb\GT2XXX Utility Clean Up Initialize.vi
	GT2XXX Utility Default Instrument Setup.vi C:\Program Files\National Instruments\LabVIEW 7.1\instr.lib\GT2xxx\GT2XXX_U.llb\GT2XXX Utility Default Instrument Setup.vi
End of Table	

Appendix A. Remote Error Messages

Commands including SCPI, GPIB, or register commands issued to the 2400/2500 may fail to execute. There are several reasons for the failure, such as wrong command string, wrong number of parameters, invalid parameter values, or invalid operation mode. This section defines the error codes and error strings for each possible failure. When an error occurs, the 2400/2500 will queue the errors to an internal event buffer. When using the GPIB interface, a 2400/2500 will send a service request to the controller and the controller software is responsible for querying the status message. When using the RS232 interface, the controller software should poll the 2400/2500 for the error condition. A user can also query the 2400/2500 using the ERR? query (GT12000 language mode) or SYStem:ERR? (SCPI language mode).

The message structure is {error #, 2400/2500 error message}.

The following table describes the 2400/2500 remote error messages.

Table 59 2400/2500 Remote Error Messages

Error Number	Error Message
1	Command syntax error.
2	Invalid register-based command.
3	Command data checksum error.
4	Invalid RF state (0=off, 1=on)
5	Invalid *SAV/*RCL register (0 - 9 supported).
6	CW or RAMP POWER frequency is out of range.
7	CW or RAMP FREQUENCY power is out of range.
8	List range editing error, start frequency is out of range.
9	List range editing error, stop frequency is out of range.
10	List range editing error, step frequency is out of range.
11	List range editing error, Power level is out of range.
12	List range editing error, start power is out of range.
13	List range editing error, stop power is out of range.
14	List range editing error, step power is out of range.
15	List range editing error, frequency is out of range.
16	List range editing error, dwell time is out of range.
17	System out of list memory.
18	Invalid list point parameter.

Continued next page

Table 59 2400/2500 Remote Error Messages	
Error Number	**Error Message**
19	List does not exist.
20	Invalid list trigger repeat type. Single Step, Single Sweep, and Continuous are supported.
21	Invalid list trigger type. BNC, GPIB GET, GPIB Command, and Immediate are supported.
22	Immediate trigger only works with Continuous trigger repeat type.
23	RAMP option is not enabled.
24	RAMP Power span is out of range.
25	RAMP start Power is out of range.
26	RAMP stop Power is out of range.
27	RAMP Frequency span is out of range.
28	RAMP start Frequency is out of range.
29	RAMP stop Frequency is out of range.
30	RAMP time is out of range.
31	Sweep frequency is out of range.
32	Sweep power is out of range.
33	Invalid internal PM polarity. RISing or FALLing are supported.
34	Invalid External PM polarity, NORmal or INVerted are supported.
35	Invalid PM source. INTernal or EXTernal are supported.
36	Invalid PM action. 0 - deactivate, 1 - activate, 2 - activate internal PM, 3 - activate external pulse negative true, 4 - Activate internal PM, external rising edge trigger, 5 - Activate internal PM, external falling edge trigger.
37	Invalid PM waveform. 0 - waveform off, 1 - waveform single, 2 - waveform double, 3 - waveform triple, 4 - waveform quadruple.
38	Modulation option is not enabled.
39	Internal modulation generator option is not enabled.
40	Scan option is not enabled.
41	Invalid AM action. 0 - Deactivate AM, 1 - Activate external AM, 2 - Activate internal AM with sine wave, 3 - Activate internal AM with square wave, 4 - Activate internal AM with triangle wave, 5 - Activate internal AM with positive ramp, 6 - Activate internal AM with negative ramp, 7 - Activate internal AM with noise, 8 - Activate internal AM, but set output to zero.
42	Invalid AM mode. LINear or LOGarithmic is supported.
	Continued next page

Table 59 2400/2500 Remote Error Messages	
Error Number	**Error Message**
43	Invalid AM source. INTernal or EXTernal is supported.
44	Invalid AM scan mode. 0 - Deactivate AM, 1 - Activate external scan modulation, 2 - Activate internal scan modulation with sine wave, 3 - Activate internal scan modulation with square wave, 4 - Activate internal scan modulation with triangle wave, 5 - Activate internal scan modulation with positive ramp, 6 - Activate internal scan modulation with negative ramp, 7 - Activate internal scan modulation with noise, 8 - Activate internal scan modulation, but set output to zero.
45	Invalid FM source. INTernal or EXTernal is supported.
46	Invalid FM mode. 1 - FM Narrow, 2 - FM Wide.
47	Invalid FM action. 0 - Deactivate FM, 1 - Activate external FM, 2 - Activate internal FM with sine wave, 3 - Activate internal FM with square wave, 4 - Activate internal FM with triangle wave, 5 - Activate internal FM with positive ramp, 6 - Activate internal FM with negative ramp, 7 - Activate internal FM with zero output.
48	Invalid boolean value is specified. 0 - OFF, 1 - ON.
49	List sync out delay is out of range.
50	Invalid list trigger direction: 0 – Forward (from first to last list point), 1 – Backward (from last to first list point).
51	Invalid list sequence number (some sequence numbers might be less than 0 or exceed available list index).
52	List has not been pre-computed before running. Pre-computing a list is required before running a list.
53	Running a list is not allowed due to an un-calibrated unit.
54	Index of the first dimension in characterization array is out of range.
55	Index of the second dimension in characterization array is out of range.
56	Index of the third dimension in characterization array is out of range.
57	Index of the fourth dimension in characterization array is out of range.
58	Invalid name for characterization variables.
59	No heap space is available for storing characterization data.
60	Heap is not allocated for storing characterization data.
61	A float variable has been viewed previously.
62	Unable to erase data in flash.
63	Checksum mismatches for characterization data in flash and heap.
64	Heap allocation has been done previously.
	Continued next page

Table 59 2400/2500 Remote Error Messages	
Error Number	**Error Message**
65	List RF off time is out of range.
66	Incorrect password for setting minimum list step time.
67	Unable to update parameter block data.
68	List step time is out of range.
69	FM deviation is out of range.
70	FM sensitivity is out of range.
71	PM internal PRI is out of range.
72	PM internal width is out of range.
73	PM internal sync out delay is of out of range.
74	CW power slope is out of range.

Appendix B. DLL Error Messages

Table 60 DLL Error Messages

Error Code	Values	Meaning
ERROR_NO_CONNECTION	-1001	Connection cannot be established between PC and the instrument.
ERROR_INVALID_INSTR_HANDLE	-1002	The input instrument handle is invalid.
ERROR_INVALID_ADDR	-1003	The input GPIB address is invalid or the specified GPIB address has been opened.
ERROR_GPIB_ADDR_OUT_RANGE	-1004	The input GPIB address is out of valid range (1 to 30)
ERROR_INVALID_COMPORT	-1005	The input COM port number is invalid.
ERROR_FAIL_SAVE_REG	-1006	Failure to save data into Windows registry.
ERROR_FAIL_OPEN_REG	-1007	Failure to load data from Windows registry.
ERROR_NO_MEMORY	-1008	List insertion is failed due to insufficient PC memory.
ERROR_ATTEN_OUT_RANGE	-1009	Attenuation is out of valid range.
ERROR_ATTEN_NOT_INSTALLED	-1010	Attenuator is not installed in the instrument.
ERROR_SYNC_DELAY_OVER_RANGE	-1011	Sync out delay is out of valid range.
ERROR_RF_OFF_TIME_OVER_RANGE	-1012	RF off time is out of valid range.
ERROR_RF_OFF_OVER_STEP_TIME	-1013	RF off time exceeds list step time.
ERROR_LIST_NOT_EXIST	-1014	The input list path does not exist.
ERROR_SOURCELIST_NOT_EXIST	-1015	The source list does not exist.
ERROR_DESTLIST_NOT_EXIST	-1016	The destination list does not exist.
ERROR_FREQ_OUT_RANGE	-1017	Input frequency is out of valid range.
ERROR_BAD_FREQ_INPUT	-1018	Start frequency is greater than stop frequency in list range insertion.
ERROR_STEP_OUT_RANGE	-1019	Step frequency is out of valid range in list range insertion.
ERROR_STEPTIME_OUT_RANGE	-1020	List step time is out of valid range.
ERROR_POWER_OUT_RANGE	-1021	Input power is out of valid range.
ERROR_UNKNOWN_INSERT_TYPE	-1022	List insertion type is not valid.
ERROR_INVALID_IN_POSITION	-1023	List insertion position for new list points is not valid.

Continued next page

Table 60 DLL Error Messages		
Error Code	**Values**	**Meaning**
ERROR_LISTPT_EXCEED_LIMIT	-1024	Total number of list points exceeds the limit.
ERROR_INVALID_FILE_NAME	-1025	Input file name is invalid.
ERROR_READ_FILE	-1026	Unable to read the input file.
ERROR_INVALID_FILE	-1027	Input file is invalid. It may be caused by incorrect file format.
ERROR_WAIT_EV_TIMEOUT	-1028	Time out before operation completed
ERROR_BAD_POWER_INPUT	-1029	Input power is invalid.
ERROR_INVALID_COMMAND	-1030	Input command is invalid.
ERROR_INVALID_EVENT	-1031	Input event is invalid
ERROR_NULL_PTR	-1032	Function-call failure caused by passing a null pointer.
ERROR_POW_OFFSET_OUT_RANGE	-1033	Power offset is out of valid range.
ERROR_POW_SLOPE_OUT_RANGE	-1034	Power slope is out of range
ERROR_INVALID_INPUT	-1035	Input data is invalid.
ERROR_DB_SYNCHRONIZATION	-1036	Unable to synchronize the instrument database in PC.
ERROR_BAD_READING	-1037	Invalid data is returned from the instrument.
ERROR_FUNC_STACK_OVERFLOW	-1038	Stack buffer for function calls is overflow.
ERROR_EMPTY_STACK_BUFFER	-1039	No data is stored in function-call buffer.
ERROR_CMD_STACK_OVERFLOW	-1040	Stack buffer for commands is overflow.
ERROR_EMPTY_COMMAND_BUFFER	-1041	No data is stored in command buffer.
ERROR_INVALID_AUTO_PATH	-1042	Failed to find Auto Programmer directory.
ERROR_ARRAY_OVERFLOW	-1043	Input array is overflow.
ERROR_INVALID_LOCK_LEVEL	-1044	Lock and level settings are invalid.
ERROR_YIGCAP_OVER_LIMIT	-1045	YIG CAP delay is out of valid range.
ERROR_INVALID_WAVEFORM	-1100	Input waveform is invalid.
ERROR_AM_SCALING_OUT_RANGE	-1101	AM scaling is out of valid range.
ERROR_AM_DEPTH_OUT_RANGE	-1102	AM depth is out of valid range.
ERROR_AM_FREQ_OUT_RANGE	-1103	AM frequency is out of valid range.
ERROR_FM_SEN_OUT_RANGE	-1104	FM sensitivity is out of valid range.
		Continued next page

Table 60 DLL Error Messages		
Error Code	**Values**	**Meaning**
ERROR_FM_FREQ_OUT_RANGE	-1105	FM frequency is out of valid range.
ERROR_FM_DEV_OUT_RANGE	-1106	FM deviation is out of valid range.
ERROR_EXT_REF_NOT_CONNECTED	-2000	External reference is not connected.
ERROR_EXT_REF_TOO_HIGH	-2001	Frequency in External reference is too high.
ERROR_EXT_REF_TOO_LOW	-2002	Frequency in External reference is too low.
ERROR_EXT_REF_UNSTABLE	-2003	Frequency in External reference is unstable.
ERROR_EXT_REF_CAL_FAIL	-2004	External reference calibration is failed.
ERROR_SERIAL_ERROR	-3000	Unable to write data to or read data from serial port.
ERROR_Q_STRING_FULL	-3001	String queue in buffer is full.
ERROR_OPEN_COMPORT	-3002	Unable to open the selected COM port.
ERROR_SERIAL_WRITE	-3003	Serial port writing error.
ERROR_SERIAL_READ	-3004	Serial port reading error.
ERROR_SERIAL_RD_TIMEOUT	-3005	Serial port read times out.
ERROR_LOW_MEMORY	-3006	Insufficient memory in RAM to create Serial port instance
ERROR_SERIAL_SETTING	-3007	Serial port setting is invalid.
ERROR_COM_PORT_OPENED	-3008	Selected COM port is already opened.

This page is intentionally blank.

Appendix C. FM Sensitivity/Deviation RangeTable

Frequency modulation		
Mode	Narrow	Wide
Rate (Internal only)	DC – 50 KHz	1 KHz – 8 MHz
Frequency	Maximum Sensitivity/Deviation	Maximum Sensitivity/Deviation
10 – 15.99 MHz	2 KHz	40 KHz
16 – 30.99 MHz	4 KHz	80 KHz
31 – 62.99 MHz	8 KHz	160 KHz
63 – 124.99 MHz	16 KHz	320 KHz
125 – 249.99 MHz	32 KHz	640 KHz
250 – 499.99 MHz	64 KHz	1.25 MHz
500 – 999.99 MHz	125 KHz	2.5 MHz
1.0 – 1.99 GHz	250 KHz	5 MHz
2.0 – 3.99 GHz	500 KHz	10 MHz
4.0 – 7.99 GHz	1 MHz	20 MHz
8.0 – 15.99 GHz	2 MHz	40 MHz
16.0 – 31.99 GHz	4 MHz	80 MHz
32.0 – 40.00 GHz	8 MHz	160 MHz

End of Document