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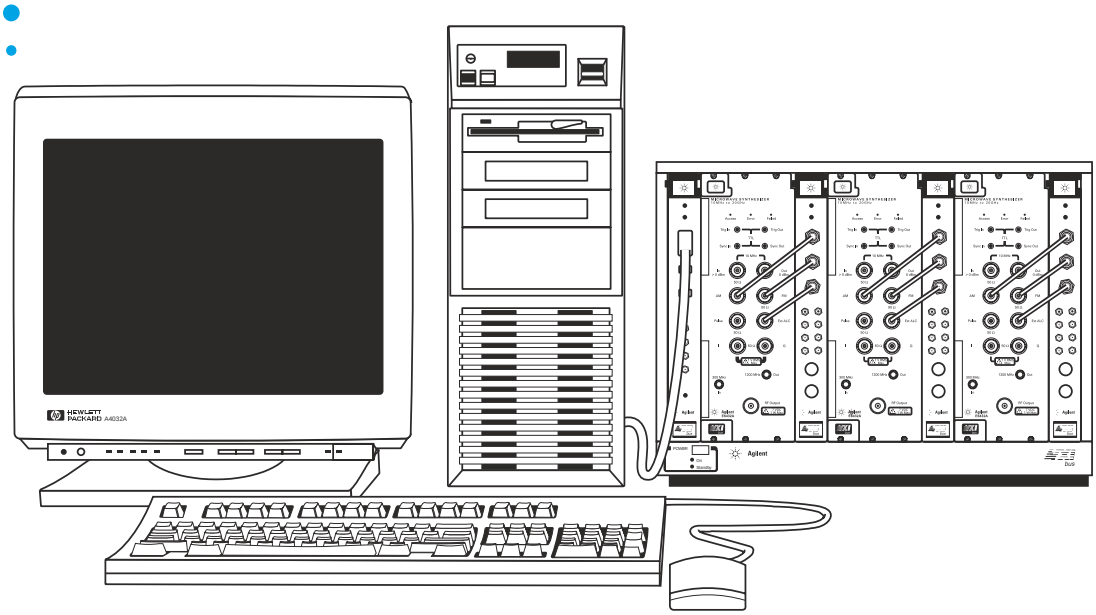
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Agilent E6432A

VXI Microwave Synthesizer

Product Note

An Introduction to the Agilent E6432A *plug&play* Driver



High performance microwave capability in VXI

- 10 MHz to 20 GHz
- –90 dBm to +20 dBm
- < 400 µs frequency switching time
- 1 Hz frequency resolution
- AM, FM and Pulse modulators
- VXI *plug&play* driver

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Introduction

Today's VXI instruments communicate with application programs through *plug&play* drivers. In some cases, these drivers are just one way to communicate. For the E6432A microwave synthesizer, its *plug&play* driver is the only means of communication with the host controller or its application programs.

This product note provides an overview of the communication process, the range of hardware and software configurations supported, and an introduction to the features of the instrument made available through the *plug&play* driver.

The E6432A microwave synthesizer is a register-based device, rather than a message-based device. There are two reasons for this. First, the E6432A is designed to be a system source rather than a bench source, so its user interface and command set are simple and straightforward. A register-based design supports this application. Secondly, the E6432A employs a fast-switching architecture in both frequency and amplitude switching. Switching times of less than 400 µs can be achieved in real customer applications only if the E6432A processing time is kept to well under 50 µs. This can only be accomplished with a register-based design.

Most modern automated test systems use programming environments and VXI interfaces that support the *plug&play* driver architecture. These systems will easily integrate the E6432A. For systems using older, legacy software and VXI interfaces, support for the E6432A may require rewriting and/or changing interfaces. These conditions will be covered in this note.

Programming Environments

To support the E6432A *plug&play* driver, the operating system foundation required by the host controller is Microsoft Windows NT® 4.0, with Service Pack 3 or above installed. Other operating systems, such as Windows 95/98, UNIX®, or MacOS are not supported at introduction.

Application programs running on Windows NT that are compatible with the E6432A *plug&play* driver are:

- HP VEE 4.0 or higher
- National Instruments LabView and LabWindows/CVI versions 4.0 or higher
- Microsoft Visual Basic version 5.0 or higher
- Microsoft Visual C/C++ versions 5.0 or higher

Application programs such as Agilent Basic for Windows have no provision for communicating with *plug&play* drivers and are therefore not supported.

VXI Interfacing

There are several interfacing choices available from host controller to VXI instruments. Three of these are supported by the E6432A *plug&play* driver. They are:

- VXI Embedded Control (for example, E6234A running Windows NT)
- National Instruments VXI-MXI-2
- IEEE-1394 ("Firewire") (for example, E8491A)

The remaining VXI interfaces (HP and National Instruments GPIB-VXI, and National Instruments MXI-1) are unsupported.

The VXI data specification for the E6432A is A16/A24, D16/D32. Due to the large size of frequency registers, floating point arithmetic is a must. The interface must be capable of allocating a large block size of A24 address space (256k). GPIB interfaces are unsupported because they are fundamentally message-based interfaces. They are not designed to communicate with register-based instruments without special, proprietary software that must be written and downloaded into their memories prior to using the *plug&play* driver.

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National Instruments has two versions of the MXI interface that are usable in a host controller. The older VXI-MXI-1 slot 0 controller and its host card (the AT-MXI interface) do not operate correctly with E6432A, due to the AT-MXI interface's inability to access more than 64k of A24 address space. (Remember, a minimum of 256k is required.) The newer MXI interface from National Instruments (the VXI-MXI-2 interface) and its host controller card (the PCI-MXI interface) work properly with all of the application programs listed.

A new serial interface for VXI based on IEEE-1394 is available from Agilent (the E8491A). This interface has nearly the same performance as MXI-2 in many applications. The E8491A is supported for use with the E6432A.

Embedded controllers are available from both Agilent and National Instruments. Those controllers that contain the Intel Pentium® processor and run Microsoft Windows NT 4.0 are supported for use with the E6432A.

Initializing the Instrument

After installing the interfaces and drivers using the procedures given in the user documentation, it is time to apply power to the VXI mainframe and check out the system.

Register-based devices typically do not contain a processor and firmware that perform bootstrap and self-test functions at power on. These functions are jointly executed by the host controller and the device. For the E6432A, the functions are performed when the host controller issues the ViInitialize function call through the *plug&play* driver. When power is first applied to the E6432A, the red FAIL LED is lit. This LED remains lit until a successful completion of the ViInitialize function call. Within this function call are commands that:

- issue the bootstrap commands to initialize the onboard assist processor
- perform a comprehensive digital self-test
- perform a limited analog self-test
- preset the instrument to a known state
- query the error buffers for any error conditions
- issue the command to extinguish the red FAIL LED after a successful completion

In the programming examples shown later, we will show that in VEE, the ViInitialize function call is sent automatically at the first call to the instrument. In NI LabView, the ViInitialize function call must be sent explicitly as the first call to the instrument.

The Soft Front Panel

All functions of the E6432A are represented in the soft front panel (SFP). The online help system documents the SFP and the *plug&play* driver completely. The E6432A SFP is accessed through the Start menus of Windows NT. If no VXI interface is installed on the computer, or the hardware is not present, the SFP may be run in Demo Mode as a learning and demonstration tool. The online help system will be fully functional.

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Features of the *plug&play* Driver

Driver functions are divided into these major categories:

- Initializing the instrument
- Setting and enabling frequency and power
- Selecting and enabling modulation types
- Selecting and enabling trigger modes
- Selecting operation modes
- Managing the list
- Querying status and errors

Table 1 is a list of instrument functions available for setting output functions.

Table 1

Set RF Output (On/Off)	HPE6432_SetRfOutputState
Get RF Output (On/Off)	HPE6432_GetRfOutputState
Set Freq, ALC, Atten, Bit	HPE6432_SetFreqAlcAttenBit
Set Freq, ALC, Atten	HPE6432_SetFreqAlcAtten
Get Freq, ALC, Atten	HPE6432_GetFreqAlcAtten
Set Frequency	HPE6432_SetFrequency
Set ALC, Atten	HPE6432_SetAlcAtten
Set Output Power	HPE6432_SetOutputPower
Power Search	HPE6432_PowerSearch
Set Reference Source (Int/Ext)	HPE6432_SetRefSource
Get Reference Source (Int/Ext)	HPE6432_GetRefSource
Set Dwell Time	HPE6432_SetDwellTime
Get Dwell Time	HPE6432_GetDwellTime
Set Settling Time	HPE6432_SetSettlingTime
Get Settling Time	HPE6432_GetSettlingTime

List Modes, Trigger Modes and Markers

The E6432A *plug&play* driver includes a comprehensive online help system, with complete documentation that should be used as the primary reference source for the instrument. All aspects of using and programming the E6432A and the SFP are fully documented. The help system may be installed and run on a separate computer without other modules of the *plug&play* driver installed.

In many instances, the systems programmer has a predefined list of test frequencies, amplitudes, and marker events that are defined by the needs of the test program. Often, signal sources and measuring receivers must be coordinated to be at the same test frequencies simultaneously to make measurements. Users want to minimize system time between measurements, since performing precision measurements can be time consuming.

To assist the programmer with efficient synchronization between signal source and measuring receiver, the E6432A implements a list mode that holds up to 128k list entries. Each entry may hold a frequency value, an ALC value, an attenuator value, and a mode byte that sets various conditions at that entry point. For example, the mode byte has bits for enabling or disabling RF blanking at that entry point, putting out a sync marker at that entry, or enabling long blanking to provide extra settling time at that entry.

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To make the most of this list mode, comprehensive triggering is available for executing the list entries in the most useful way for the test program. Input triggering can be from the front panel SMB connector, over the VXI TTL backplane triggers, VXI0-VXI7, or manually via the SFP. Any one of the backplane triggers can be assigned to Trigger In. The Trigger Out, or settled marker, is a synchronization signal that can be used as a data-ready flag, a trigger to a measuring receiver, or a timing signal for the host controller. It is always available at the front panel. Any one of the VXI backplane triggers can be assigned to Trigger Out.

Sync In is a reset trigger. It may be set to abort a list and reset the list pointer to the beginning of list memory. It may be used to run a list. It may be disabled. Any one of the VXI backplane triggers may be assigned to Sync In. Sync Out is the programmable marker. Any entry in the list mode may enable the Sync Out marker. If enabled, it will coincide with the Trigger Out, or settled marker, for that list entry. Any one of the VXI backplane triggers may be assigned to Sync Out.

Table 2 summarizes the trigger, marker, and blanking modes.

Table 2

Trigger In	Automatic (default)	Trigger In disabled
	trigger once	wait for trigger, then run list once
	triggered	wait for trigger to advance to next list entry
Trigger Out		settled marker - always enabled
Sync In	auto (default)	Sync In disabled
	wait	wait for sync to start list
	restart	abort list and restart from beginning
	wait for start/restart	combines wait for start and abort/restart
Sync Out	disabled (default)	list entry does not generate sync marker on settled (Trigger Out still enabled)
	enabled	list entry generates sync marker on settled (and Trigger Out marker)
Repeat		run list continuously until aborted
Blanking	enabled (default)	blank RF while tuning (minimum 270 µs settling time on frequency changes)
	disabled	do not blank RF while tuning
Long blanking	disabled (default)	frequency settled to within 50 kHz when Trigger Out edge occurs
	enabled	RF blanking extended to 350 µs. Frequency settled to noise level when Trigger Out edge occurs.
Attenuator switch		blanking always extended to 20 ms

An **example function call** to download an array of list entry points is:

ViSTATUS HPE6432_WriteListPoints (ViSession instrumentHandle, ViUInt32 startingPoint ViReal64 Frequency[ ], ViReal64 ALC_value[ ], ViInt16 Attenuator[ ], ViInt16 featureBits[ ], ViInt16 alcOffset[ ], ViUInt32 numberOfPoints);

Once downloaded, the list is executed by calling Hpe6432_run_list(). Depending on the trigger mode set, the list is run all the way through, repeated until aborted, or executed one entry per input trigger.

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Figure 1
A typical VEE program for controlling a signal source in a test program.

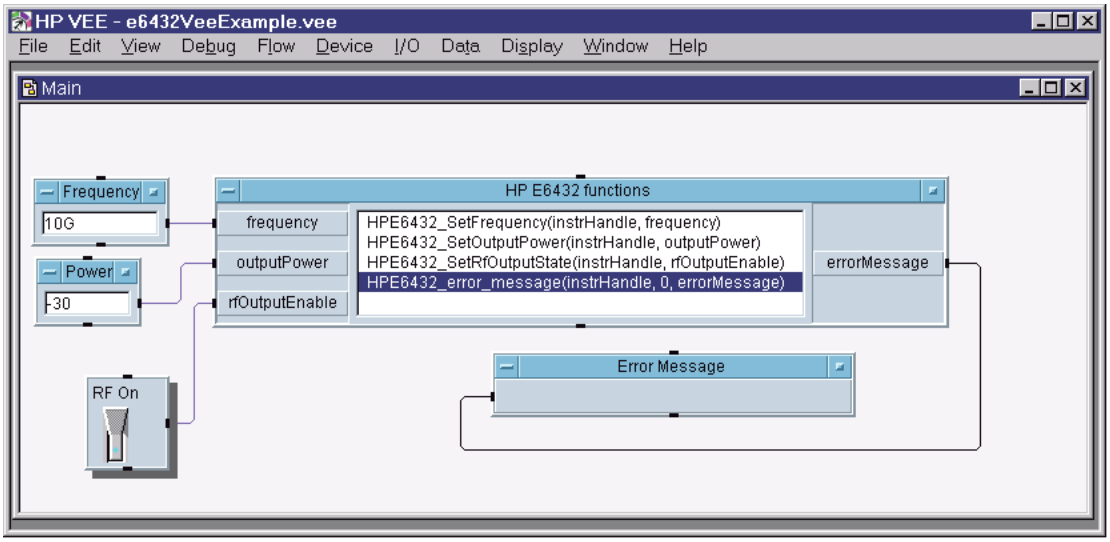
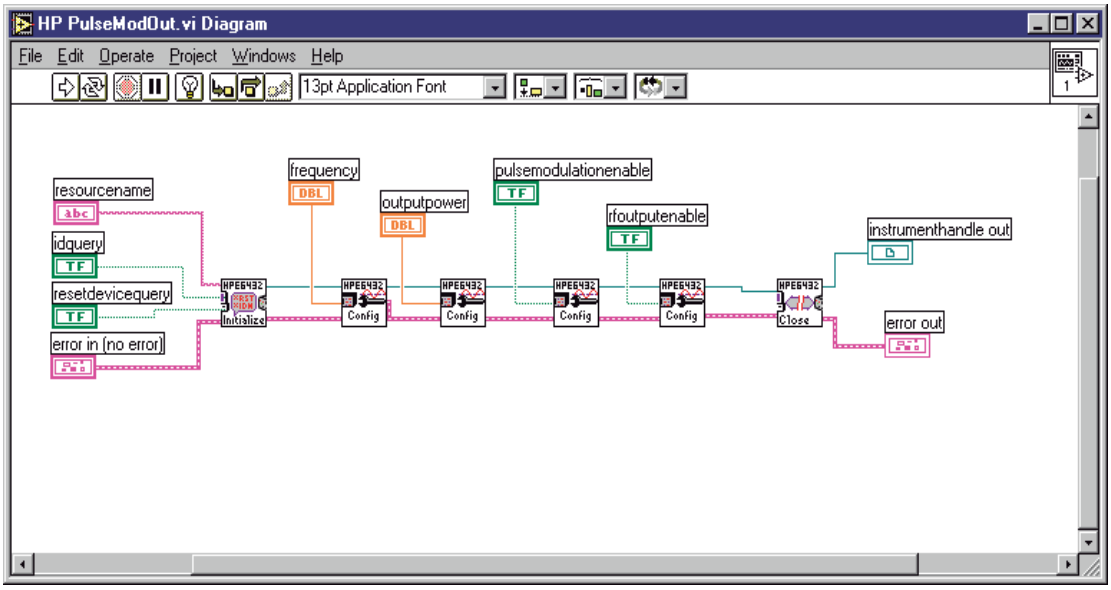
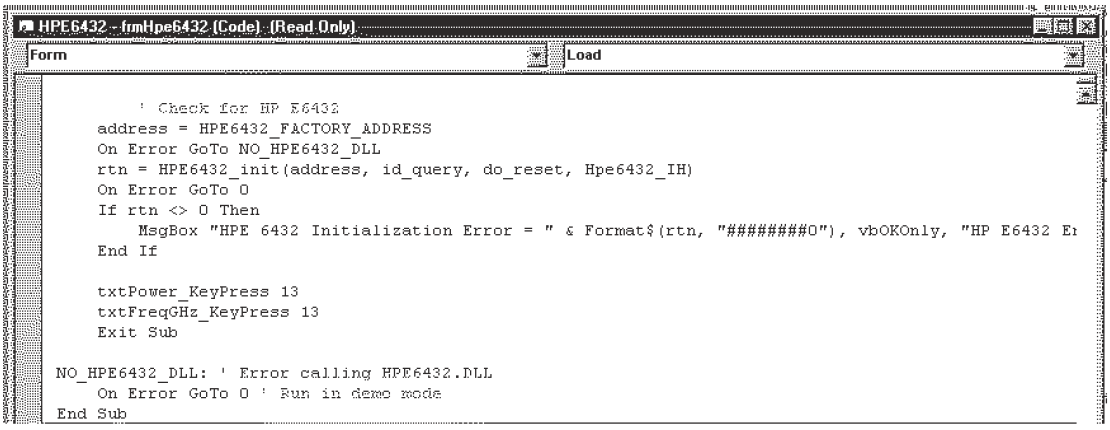


Figure 2
A LabView program that initializes the Agilent E6432A, sets frequency and amplitude, enables or disables pulse modulation, and closes the session.



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Figure
A Visual Basic programming example calling the initialization routine. Note that all functions return VI_SUCCESS, which is zero for success and non-zero for error conditions.



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Warranty Information

All Agilent products described in this document are warranted against defects in material and workmanship for a period of one year from date of shipment.

Related Agilent Literature

Creating Frequency Lists Using a Spreadsheet and ActiveX Product Note
literature number 5968-8434E

E6432A Configuration Guide
literature number 5967-6272E

E6432A Product Overview
literature number 5967-6178E

E6432A Technical Specifications
literature number 5968-1242E

High Performance Microwave Capability in VXI Brochure
literature number 5967-6313E

Test Systems and VXI Products Catalog
literature number 5980-0307E

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Printed in U.S.A. March 26, 2001
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