

ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

Artisan Technology Group
(217) 352-9330 | sales@artisantg.com | artisantg.com

Full-service, independent repair center
with experienced engineers and technicians on staff.

We buy your excess, underutilized, and idle equipment
along with credit for buybacks and trade-ins.

Custom engineering
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

Expert team | Trust guarantee | 100% satisfaction

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

Find the *Keysight / Agilent 8509B* at our website: ***Click HERE***

HP 8509A/B Lightwave Polarization Analyzer

Programming Guide



HP Part No. 08509-90017
Printed in USA October 1994

Notice.

The information contained in this document is subject to change without notice.

Hewlett-Packard makes no warranty of any kind with regard to this material, including but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Hewlett-Packard shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

Windows and QuickBasic are trademarks of Microsoft Corporation.

© Copyright Hewlett-Packard Company 1994
All Rights Reserved. Reproduction, adaptation, or translation without prior written permission is prohibited, except as allowed under the copyright laws.
1400 Fountaingrove Parkway, Santa Rosa, CA 95403-1799, USA

Certification

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, to the extent allowed by the Institute's calibration facility, and to the calibration facilities of other International Standards Organization members.

Warranty

This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by Hewlett-Packard. Buyer shall prepay shipping charges to Hewlett-Packard and Hewlett-Packard shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to Hewlett-Packard from another country.

Hewlett-Packard warrants that its software and firmware designated by Hewlett-Packard for use with an instrument will execute its programming instructions when properly installed on that instrument. Hewlett-Packard does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error-free.

Limitation of Warranty

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. HEWLETT-PACKARD SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Exclusive Remedies

THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. HEWLETT-PACKARD SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

Safety Notes

The following safety notes are used throughout this manual. Familiarize yourself with each of the notes and its meaning before operating this instrument.

Caution Caution denotes a hazard. It calls attention to a procedure that, if not correctly performed or adhered to, would result in damage to or destruction of the instrument. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met.

Warning **Warning denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a warning note until the indicated conditions are fully understood and met.**

 The instruction documentation symbol. The product is marked with this symbol when it is necessary for the user to refer to the instructions in the documentation.

"CE" The CE mark is a registered trademark of the European Community. (If accompanied by a year, it is when the design was proven.)

"ISM1-A" This is a symbol of an Industrial Scientific and Medical Group 1 Class A product.

"CSA" The CSA mark is a registered trademark of the Canadian Standards Association.

General Safety Considerations

Warning	**This is a Safety Class I product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor, inside or outside the instrument, is likely to make the instrument dangerous. Intentional interruption is prohibited.**
Warning	**No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock, do not remove covers.**
Caution	Before switching on this instrument, make sure that the line voltage selector switch is set to the voltage of the power supply and the correct fuse is installed.

How to Use This Guide

This guide uses the following conventions:

Front-Panel Key	This represents a key physically located on the instrument.
`Softkey`	This indicates a "softkey," a key whose label is determined by the instrument's firmware.
`Screen Text`	This indicates text displayed on the instrument's screen.

Contents

1. Introduction

2. Starting Up the System For HP-IB Control

3. HP-IB Overview

Bus Structure 3-1
Data Bus 3-1
Handshake Lines 3-2
Control Lines 3-2
Sending Commands 3-3

4. HP-IB For the HP 8509

HP-IB to DDE Interface 4-2
'Command Line' Setup Options 4-3
/Errors Only 4-3
/HP8509=<Name of executable> 4-3
/HP8509TimeOut=<Number of Minutes> 4-3
HP 8509 Control Frame 4-4
HP-IB Frame 4-5
Data Separator 4-5
Cr/Lf 4-5
Comma 4-5
HP-IB Exit State 4-5
Controller 4-6
Non-Controller 4-6
Dynamic Data Exchange (DDE) Frame 4-6

5. Basic Instrument Control

Data Requesting Commands 5-3
Operation Complete 5-4
Preparing For HP-IB Control 5-5

6. Interacting with the HP 8509A/B Through the DDE

Establishing DDE Links 6-1
Sending HP 8509 Commands via DDE 6-4
Retrieving HP 8509 Data via DDE 6-5

7. Measurement Programming

Calibrate the Instrument 7-2
Set Up the Instrument 7-2
Connect the Device 7-2
Take Data 7-2
Transfer Data 7-2

8. Remote Command Reference

Command Syntax 8-1
Abbreviations / Definitions 8-4
Changes from Version 1.2 Software 8-5
`*OPC[?]` 8-5
`Cal:Calibrate` 8-5
`Disper:Close` 8-5
`Source? Source:External? Source:Internal?` 8-5
Common Commands 8-6
`*IDN?` 8-6
`*OPC[?]` 8-6
Device Specific Commands 8-6
`Analog?` 8-6
`Analog:Done` 8-6
`Analog:{ Off | Raw | Stokes } [?]` 8-6
`Angles:{ AB? | AC? | BC? }` 8-7
`Angles:{ Degrees | Radians }[?]` 8-7
`Angles:Done` 8-7
`Angles:{ Off | On }` 8-7
`Average:Display:{ Off | On }` 8-7
`Average:Display{ ? | :<NumPoints> }` 8-7
`Average:Done` 8-7
`Average:Measure{ ? | :<NumPoints> }` 8-8
`Cal?` 8-8
`Cal:Calibrate` 8-8
`Cal:{ Done | Save }` 8-8
`Cal:Delete:<Wavelength nm>` 8-8
`Cal:List?` 8-8
`Cal:{ Off | On }` 8-8
`ClearParams` 8-9
`DBase:Close` 8-9
`DBase:Compact` 8-9
`DBase:Filename?` 8-9
`DBase:Open:<"filename">` 8-9
`DBase:Repair` 8-9
`Disper` 8-9
`Disper?` 8-10
`Disper:ActiveWindow?` 8-10
`Disper:Atten{ ? | :<dBm value> }` 8-10
`Disper:Calibrate` 8-10
`Disper:{ Cascade | Single }[?]` 8-11
`Disper:Chain[?]` 8-11
`Disper:Clear` 8-11
`Disper:Close` 8-11

Disper:DBase:Load:<"title"> 8-11
Disper:DBase:Save:<"title"> [:<"date code"> [:<"serial number">]] 8-12
Disper:Done 8-12
Disper:FiberLen{ ? | :<km> } 8-12
Disper:FindMinPoints[:<Num Samples>] 8-12
Disper:HPIB[?] 8-13
Disper:Manual 8-13
Disper:Manual? 8-13
Disper:Measure 8-13
Disper:NewThruCal 8-14
Disper:Power? 8-14
Disper:Power:{ dBm | uWatt }[:<value>] 8-14
Disper:Restart 8-14
Disper:Save:<"filename"> 8-15
Disper:Settle:{ Point | Start }{ ? | :<Delay msec>} 8-15
Disper:Start 8-15
Disper:Trace:<"filename"> 8-16
Disper:Units{ ? | :ps | :ps/L | :ps/sqrtL | :fs | :fs/L | :fs/sqrtL } 8-16
Disper:VTune[?] 8-16
Disper:VTune:{ Start | Stop }{ ? | :<Voltage> } 8-16
Disper:WLen? 8-16
Disper:WLen:Points{ ? | :<NumPoints> } 8-17
Disper:WLen:{ Start | Stop | Delta }{ ? | :<Wavelength nm>} 8-17
Disper:WLen:Steps{ ? | :<NumPoints> } 8-18
Display:Angles:{ Off | On } 8-18
Display:Angles:{ Degrees | Radians } 8-18
Display:Power:{ Linear | Log } 8-18
Display:Update{ ? | :<NumPoints> } 8-19
Drive? 8-19
Drive:<MS-DOS Drive Spec> 8-19
GetFile:<"filename"> 8-19
GetMarker:{ A | B | C } 8-19
GetMarker?:{ A | B | C } 8-19
Jones? 8-20
Jones:{ Absolute | Relative }[?] 8-20
Jones:Calibrate[A | B | C] 8-20
Jones:Clear 8-20
Jones:Done 8-21
Jones:{ External | Internal }[?] 8-21
Jones:{ MagRadians | MagDegrees | RealImag }[?] 8-21
Jones:Measure[A | B | C] 8-21
Jones:NewThruCal 8-22
Jones:ReStart 8-22
Load:Config:Preset 8-22
Load:Config:<"filename"> 8-22
Load:Single:<"filename"> 8-22
OperVer[?] 8-23
OperVer:{ Start | Cancel | Done } 8-23
PdlMaxMin[?] 8-23
PdlMaxMin:{ Max | Min } 8-23
PdlMaxMin:Delta? 8-23

PdlMaxMin:{ Reset | Clear | Done } 8-23
Poincare:Center:{ Stokes | A | B | C } 8-23
Poincare:Clear 8-24
Poincare:Hold:{ Off | On } 8-24
Poincare:Marker:{ A | B | C } 8-24
Poincare:Marker:Clear 8-24
Polarizer:{ A | B | C | None } [?] 8-24
Polarizer:Angle{ A | B | C }{ ? | :<Degree Value> } 8-24
Polarizer:Done 8-24
Polarizer:{ External | Internal } 8-25
PolDep? 8-25
PolDep:{ Absolute | Relative }[?] 8-25
PolDep:Calibrate[A | B | C] 8-25
PolDep:Clear 8-25
PolDep:Done 8-26
PolDep:{ Internal | External }[?] 8-26
PolDep:{ JonesData? | PolDepData? } 8-26
PolDep:{ JonesMode | PolDepMode }[?] 8-26
PolDep:{ MagRadians | MagDegrees | RealImag }[?] 8-27
PolDep:Measure[A | B | C] 8-27
PolDep:NewThruCal 8-27
PolDep:ReStart 8-27
PolMarker:{ A | B | C } 8-27
PolMarker?:{ A | B | C } 8-28
Range:Auto{ ? | :Off | :On } 8-28
Range:{ Done | Down | Up } 8-28
Range{ ? | :<GainValue> } 8-28
RawDat? 8-29
RefFrame? 8-29
RefFrame:{ Off | On }[?] 8-29
RefFrame:{ 2pt | 3pt }[?] 8-30
Save:Config:<"filename"> 8-30
Save:Disper:<"filename"> 8-30
Save:Jones:<"filename"> 8-30
Save:PolDep:<"filename"> 8-30
Save:Single:<"filename"> 8-31
SerialNum? 8-31
SetMarker:<S0>:<s1>:<s2>:<s3>:{ A | B | C } 8-31
Single 8-31
Single:Done 8-31
Single:DBase:Load:<"title"> 8-31
Single:DBase:Save:<"title"> [:<"date code"> [:<"serial number">]] 8-31
Single:Freq{ ? | :<Hertz> } 8-32
Single:Mode{ ? | :Single | :Timed | :FreeRun } 8-32
Single:Period{ ? | :<Seconds> } 8-32
Single:Points{ ? | :<NumPoints> } 8-32
Single:Start 8-32
Source? 8-32
Source:External? 8-33
Source:External:{ Off | On } 8-33
Source:External:<Wavelength nm> 8-33

Source:HPIB[?] 8-33
Source:Hpib:{ Off | On | <Wavelength nm> } 8-33
Source:Internal? 8-34
Source:Internal:{ Off | 1310 | 1550 } 8-34
Source:Manual[?] 8-34
Source:Shutter? 8-34
Source:Shutter:{ Off | On } 8-34
Source:VTune[?] 8-35
Source:VTune:{ Start | Stop }{ ? | :<Voltage> } 8-35
Status? 8-35
Stokes:<NumPoints> 8-35
Stokes?:<NumPoints> 8-35
TLS? 8-36
TLS:Address{ ? | :<HP-IB Address> } 8-36
TLS:Isc{ ? | :<HP-IB card ISC> } 8-36
TLS:Power{ ? | :<Power> } 8-36
TLS:{ SettlePoint | SettleStart }{ ? | :<Millisec's> } 8-36
TLS:Power:Unit{ ? | :dBm | :Watt } 8-37
Trace:Points:<NumPoints> 8-37
Version? 8-37
WaveScan[?] 8-37
WaveScan:Analysis? 8-37
WaveScan:Analysis:{ Extrema | Peaks }:{ FullScan | FirstToLast } . 8-38
WaveScan:Atten{ ? | :<dBm value> } 8-38
WaveScan:Clear 8-38
WaveScan:Close 8-38
WaveScan:DBase:Load:<"title"> 8-38
WaveScan:DBase:Save:<"title"> [:<"date code"> [<"serial number">]] 8-38
WaveScan:Feature{ ? | :<Min Feature Size> } 8-38
WaveScan:FiberLen{ ? | :<km> } 8-38
WaveScan:Hpib[?] 8-39
WaveScan:Manual[?] 8-39
WaveScan:Measure 8-39
WaveScan:Mode{ ? | :<Mode Constant> } 8-39
WaveScan:PmdResult{ ? | :Avg | :Max | :Median} 8-40
WaveScan:Polarizer{ ? | :A | :B | :C | :None } 8-40
WaveScan:Power? 8-40
WaveScan:Power:{ dBm | uWatt }[:<value>] 8-40
WaveScan:Save:<"filename"> 8-40
WaveScan:Settle:{ Point | Start }{ ? | :<Delay msec> } 8-41
WaveScan:Units:{ ? | :ps | :ps/L | :ps/sqrtL } 8-41
WaveScan:VTune[?] 8-41
WaveScan:VTune: { Start | Stop }{ ? | :<Voltage> } 8-41
WaveScan:WLen? 8-41
WaveScan:WLen:{ Start | Stop | Delta }{ ? | :<Wavelength nm>} . . . 8-42
WaveScan:WLen:Points{ ? | :<NumPoints> } 8-42
Zero 8-42

9. Example Programs

Index

Figures

2-1. HP-IB Setup 2-1
4-1. HP-IB to DDE Gateway 4-2
4-2. HP-IB Connections In a Typical Setup 4-7

Tables

8-1. Conventions 8-2

1

Introduction

This chapter is an introduction to programming the HP 8509 polarization analyzer over HP-IB (Hewlett-Packard Interface Bus) and over the DDE (dynamic data exchange). Its purpose is to provide concise information about the operation of the instrument under remote control. Some background information on the HP-IB and DDE is provided. A tutorial introduction using elementary programming examples illustrates the basics of HP 8509 remote control. The document also provides a command reference with a brief description of each HP-IB/DDE command recognized by the HP 8509. Examples are provided on two disks that are included with the *HP 8509 Users/Reference Guide.* The programs on these two disks illustrate the exact executable syntax, but the code is not explained in great detail. See the README.TXT files on each disk for more information.

- Example Programs Disk - DOS Format, IBASIC and VISUAL BASIC/DDE example.
- Example Programs Disk - LIF Format, HP BASIC example for an HP 9000 series 200/300 controller.

The main focus of this chapter is on HP-IB control of the HP 8509 polarization analyzer through an external PC controller running IBASIC for Windows. Most of the commands in the command reference (section 8) are available using Microsoft Windows DDE, as well as HP-IB. The material presented in this chapter is not intended to teach programming or to discuss HP-IB or DDE theory except at an introductory level. Related information can be found in the following references:

- Information concerning HP Instrument BASIC for Windows is available in *Installing and Using HP Instrument BASIC for Windows* (HP part no. E2200-90000).
- Information on HP Instrument BASIC is available in the *HP Instrument BASIC User's Handbook* (HP part no. E2083-90000).
- Information on using the HP-IB is available in the *Tutorial Description of the Hewlett-Packard Interface Bus* (HP literature no. 5952-0156).
- Microsoft documentation of DDE.

Additional information about the HP 8509 measurement procedures can be found in the following references:

- *HP 8509 User's/Reference Guide* (HP part no. 08509-90010).

2

Starting Up the System For HP-IB Control

The HP 8509 can be remotely controlled from HP-IB according to the setup illustrated in Figure 2-1 and the procedures described below:

1. Power up the HP 8509 system according to the instructions provided in the *Installation and Quick Start Guide* document (HP part no. 08509-90002).
2. Connect an HP-IB cable from the HP-IB board of the system controller PC to the HP 8509 Vectra HP-IB board connector. The board connector is in the back of the HP 8509 Vectra.
3. Start up the HP 8509 application by double-clicking on the HP 8509 icon in the HP 8509 instrument window.
4. Start the HPIB2DDE application by double-clicking on the HPIB2DDE

   icon in the HP 8509 window. The HP 8509 window is within the Program Manager window. If the Program Manager window is obscured by the HP 8509 instrument window, merely double-click anywhere outside the existing windows. This will bring up a window called the Task List. Double-click on the Program Manager entry to bring its window to the front of the screen. The HP 8509 window should become visible. The HPIB2DDE icon resides within the HP 8509 window. Once the HPIB2DDE application has been started, if desired, the HPIB2DDE window can be minimized by clicking on the down arrow in the top right-hand corner of this window.
5. Begin sending HP-IB Commands from the controlling external PC.

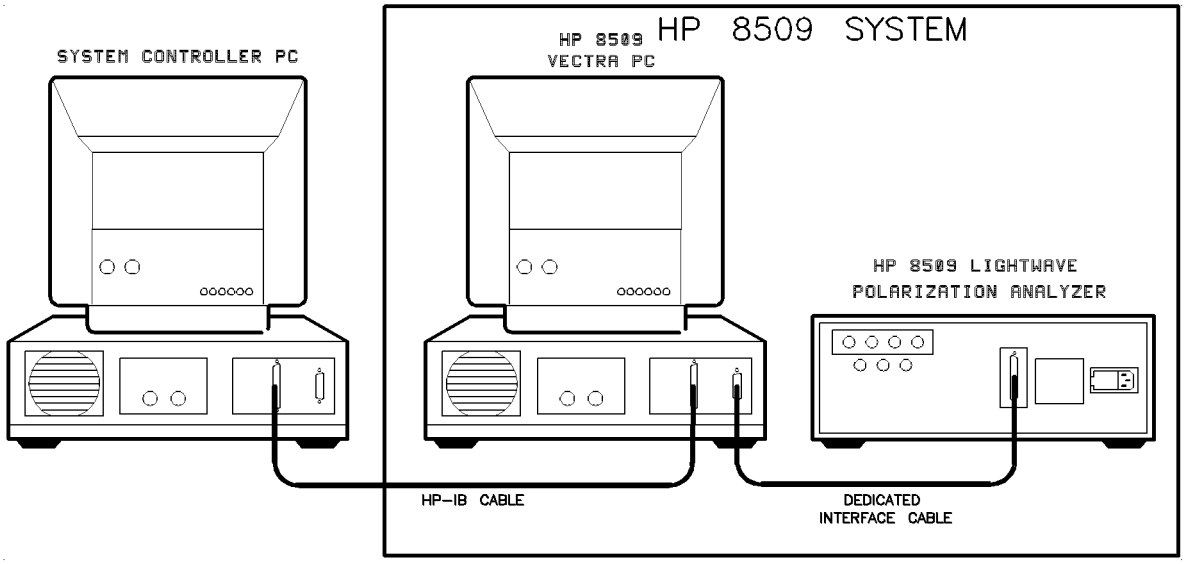


Figure 2-1. HP-IB Setup

3

HP-IB Overview

HP-IB (the Hewlett-Packard Interface Bus) is a high-performance bus that allows individual instruments and computers to be combined into integrated test systems. The bus and its associated interface operations are defined by the IEEE 488.1 standard. The IEEE 488.1 standard defines the interface capabilities of instruments and controllers in a measurement system, including some frequently used commands.

HP-IB cables provide the physical link between devices on the bus. There are eight data lines on each cable that are used to send data from one device to another. Devices that send data over these lines are called **Talkers**. **Listeners** are devices that receive data over the same lines. There are also five control lines on each cable that are used to manage traffic on the data lines and control other interface operations. **Controllers** are devices that use these control lines to specify the talker and listener in a data exchange.

When an HP-IB system contains more than one device with controller capabilities, only one of the devices is allowed to control data exchanges at any given time. The device currently controlling data exchanges is called the **Active Controller**. Also, only one of the controller-capable devices can be designated as the system controller. The HP 8509 can function as a talker, a listener, or a controller at different times.

HP-IB addresses provide a way to identify devices on the bus. The active controller uses HP-IB addresses to specify which device talks and which device listens during a data exchange. This means that each device's address must be unique. A device's address is set on the device itself, using either a front-panel key sequence or a rear-panel switch. The factory default address for the HP 8509 is 29.

Bus Structure

Data Bus

The data bus consists of eight lines that are used to transfer data from one device to another. Programming commands and data sent on these lines is typically encoded in the ASCII format, although binary encoding is often used to speed up the transfer of large arrays. Only ASCII format is available to the HP 8509. In addition, every byte transferred over HP-IB undergoes a **handshake** to ensure valid data.

Handshake Lines

A three-line handshake scheme coordinates the transfer of data between talkers and listeners. This technique forces data transfers to occur at the speed of the slowest device, and ensures data integrity in multiple listener transfers. With most computing controllers and instruments, the handshake is performed automatically, which makes it transparent to the programmer.

Control Lines

The data bus also has five control lines that the controller uses both to send bus commands and to address devices. The HP 8509 makes explicit use of the EOI line through the HP-IB END statement used to terminate all command transmissions. A brief description of the five HP-IB control lines is provided below.

IFC Interface Clear. Only the system controller uses this line. When this line is true (low) all devices (addressed or not) unaddress and go to an idle state.

ATN Attention. The active controller uses this line to define whether the information on the data bus is a **command** or is **data**. When this line is true (low) the bus is in the

command mode and the data lines carry bus commands. When this line is false (high) the bus is in the data mode and the data lines carry device-dependent instructions or data.

SRQ Service Request. This line is set true (low) when a device requests service; the active controller services the requesting device.

REN Remote enable. Only the system controller uses this line. When this line is set true (low) the bus is in the remote mode and devices are addressed either to listen or talk. When the bus is in remote and a device is addressed, it receives instructions from HP-IB rather than from its front panel. When this line is set false (high) the bus and all devices return to local operation.

EOI End or Identify. This line is used by a talker to indicate the last data byte in a multiple byte transmission, or by an active controller to initiate a parallel poll sequence. The analyzer recognizes the EOI line as a terminator and it pulls the EOI line with the last byte of a message output (data, markers, plots, prints, error messages).

Sending Commands

Commands are sent over the HP-IB via a controller's language system, such as IBASIC, QuickBasic or C. The keywords used by a controller to send HP-IB commands vary among systems. When determining the correct keywords to use, keep in mind that there are two different kinds of HP-IB commands:

- Bus management commands, which control the HP-IB interface.
- Device commands, which control analyzer functions.

Language systems usually deal differently with these two kinds of HP-IB commands. For example, for most HP instrumentation, HP BASIC can use a unique keyword to send each bus management command, but always uses the keyword OUTPUT to send device commands. It must be noted, however, that for the HP 8509, all commands must be sent using the OUTPUT statement.

The following example shows how to send a typical device command in IBASIC:

```
OUTPUT 729; "POINCARE:CLEAR" END
```

This sends the command within the quotes (POINCARE:CLEAR) to the HP-IB device at address 729. If the device is an HP 8509, the command instructs the analyzer to clear all measured traces from the Poincare sphere.

ADDITIONAL INFORMATION
The HP-IB card select code is 7 and the HP-IB address is 29. The select code is set by adjusting switches on the HP-IB card inside the computer.

4

HP-IB For the HP 8509

The HP 8509 system can be described as a Windows application, running on a Vectra PC, which controls an external instrument containing the system hardware. The system hardware consists of all devices required by the HP 8509 software to conduct polarization measurements. Remote control of the HP 8509 system is achieved through direct communication with the system's Windows application software. Use an external controller for remote control of the HP 8509.

Given that the HP 8509 software is a Windows application, Dynamic Data Exchange (DDE) can be used to communicate with and control the HP 8509 system. DDE is a "standard" communication technique which is provided by a majority of Windows applications. In effect, in order to remotely communicate via HP-IB with the HP 8509 system, HP-IB messages must be translated to DDE messages. Under these conditions, the HP-IB interface is seen as a Windows application directly communicating with the HP 8509 system software.

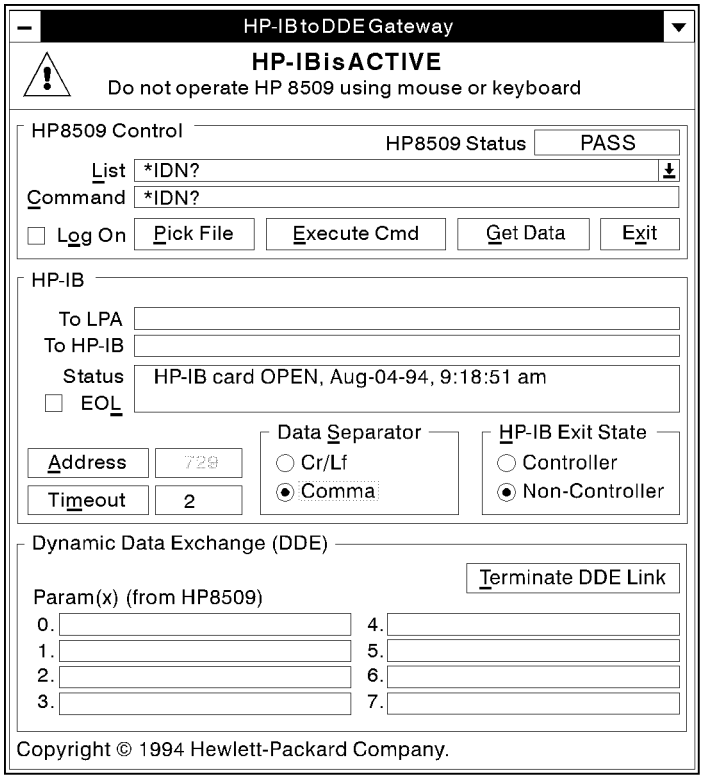
A second Windows application called HPIB2DDE provides the translation between HP-IB commands and the DDE messages for the HP 8509 software. The HPIB2DDE program is accessible within the HP 8509 system window. In order to run HPIB2DDE, an HP-IB interface board must be installed on the HP 8509 system Vectra PC and configured for running under Microsoft Windows. The external PC controller running Windows IBASIC must also have an HP-IB interface board configured for running under Microsoft Windows. The controller PC can send HP-IB messages directly to the HP 8509 system and to other HP-IB controllable instruments. The current version of HPIB2DDE assumes, as a default, that the HP-IB select code of the HP 8509 system is 7 and that the HP-IB board address is set to 29. Figure 4-2 demonstrates a typical system configuration.

Warning **When receiving HP-IB commands, the HP 8509 does not lock out manual operation. Take care not to disrupt remote control through manual command execution. Furthermore, HP-IB commands which lock out manual operations are not currently available for remote control of the HP 8509. When beginning remote operation of the HP 8509, be sure to quit, then restart the application if there has been any manual operation of the HP 8509 during the current session of the HP 8509 application.**

HP-IB to DDE Interface

The HP 8509B Lightwave Polarization Analyzer uses Dynamic Data Exchange (DDE) for remote operation. The HPIB2DDE.EXE application connects the DDE system to the HP-IB bus. Therefore, it is required to run this application before attempting remote operation of the HP 8509B using HP-IB. To start the HPIB2DDE.EXE application, select the `HPIB TO DDE GATEWAY` icon in the HP 8509 Group.

There are three basic parts to this window, the 'HP 8509 Control' frame, the 'HP-IB' frame, and the 'Dynamic Data Exchange (DDE)' frame. The HPIB2DDE.EXE application window appears as below when the application starts. The 'HP-IB to DDE Gateway' is a floating window when the program starts. This means that the window will always appear on top of any other window. To defeat this feature, minimize the window by clicking once on the down arrow in the top right corner. When the application is restored by double clicking on its icon, the window will no longer float.



pq7167_c

Figure 4-1. HP-IB to DDE Gateway

'Command Line' Setup Options

The HP-IB gateway program may be configured using command line parameters at runtime. Two command line parameters are available and may be added to the HP-IB gateway icon's properties. This selection can be found by highlighting the icon by clicking once on it, then selecting "File | Properties" in the Windows Program Manager. Add the command line parameter after the name of the program in the 'Command Line' text box.

/Errors Only

Add this command line parameter to configure the HP-IB gateway to record *only* HP-IB bus errors, DDE link errors, Windows critical errors, and HP8509 commands which did not return a status of PASS, when 'Log On' is checked. If this parameter is not specified, all bus transactions, including errors, are recorded in the log file. During program execution this feature may be turned on and off by clicking the right mouse button on the 'Log On' check box.

/HP8509=<Name of executable>

The Windows DDE system uses the name of the executable file to establish a DDE link to the HP8509 program. Future versions of the HP8509 may use a different name to establish this link. This command line parameter is useful only if your HP8509 software is updated to a version greater than version 2.0. If this parameter is not used, the <Name of executable> used is HP8509_2.

/HP8509TimeOut=<Number of Minutes>

This parameter specifies the number of minutes the 'HP-IB to DDE Gateway' program should wait for data from the HP8509 when the HP- IB controller requests data (sends a query). If this parameter is not specified, the default value used is 1 minute. If the HP8509 takes longer than the specified time to return data to the HP-IB controller, the 'HP-IB to DDE Gateway' will reset the DDE channel in an attempt to clear the problem, and record the attempt in the log file (if open) as a DDE timeout error. The 'HP-IB to DDE Gateway' will reset itself in this manner ten times. After ten attempts, the 'HP-IB to DDE Gateway' program will issue a critical error and HP-IB operation will stop until the user acknowledges the critical error issued by the 'HP-IB to DDE Gateway.'

Note This timeout occurs only when the HP-IB controller requests data. The 'HP-IB to DDE Gateway' queues all commands from the HP-IB bus a synchronous to HP8509 operation. The programmer should hard code appropriate delays in the controlling program after sending HP8509 commands that take more than 30 seconds (or 1/2 the timeout limit) to complete. Remember – commands may still be in the 'HP-IB to DDE Gateway' command queue when the controlling program requests data. The execution time to complete the commands still in the queue may exceed the timeout limit.

HP 8509 Control Frame

The elements in this frame provide a path for the development of HP-IB remote programs. With the HPIB to DDE Gateway, you can send HP-IB commands, retrieve data, and save bus traffic to a file for later analysis. The elements of the HP 8509 Control Window are described below.

`HP 8509 Status`

Shows the status of the current DDE operation. Valid choices are:

PASS: the remote command successfully completed.

FAIL: the remote command failed and did not complete.

PROBLEMS: the remote command experienced a problem during execution.

UNKNOWN: the remote command was not recognized.

BUSY: the remote command is in the process of execution.

NO DDE LINK: the DDE link is not established.

`List`

This is a list of all the DDE commands. This list drops down to select a command for the **Command** text box. This list box is loaded by reading in the file "DDE_CMD.TXT" located in the application directory.

`Command`

This text box is used to specify a command to send via DDE to the HP 8509 application. During normal operation of the HP-IB to DDE Gateway, the individual commands that are being transmitted to the HP 8509 also appear in this text box.

Log On

When checked, HP-IB bus transactions are recorded to the file selected with Pick File, and the Pick File button is disabled. The /ErrorsOnly feature may be turned on and off by clicking the right mouse button on the 'Log On' check box.

Pick File

Selects a file for logging HP-IB bus transactions. This button is disabled when Log On is selected. This filename is saved in the file C:\Windows\WIN.INI under the heading [HPIB2DDE] and is restored the next time the HPIB2DDE application is started.

Execute Cmd

Sends the command in the **Command** text box via DDE to the HP 8509 application.

Get Data

Retrieves data via DDE from the HP 8509 application. The data is linked to the text boxes found in the Dynamic Data Exchange (DDE) window.

Exit

Closes the HPIB2DDE gateway application.

HP-IB Frame

This frame provides you with an interface to the HP-IB bus parameters. The elements of the HP-IB window are described below.

`To LPA`

Shows the user the command being sent to the HP 8509 that was received on the HP-IB bus.

`To HP-IB`

Shows the user the data being sent to the HP-IB bus that was read from the HP 8509.

`Status`

Shows the HP-IB card status and the time and date of any error. HP-IB bus errors, DDE errors, and Windows system errors are also logged to a file when (Log On) is selected.

(EOL)

Select this box if every HP-IB bus action is to end with a line feed. This setting is saved in the file C:\WINDOWS\WIN.INI under the heading [HPIB2DDE] and is restored to this setting the next time the HPIB2DDE application is started.

(Address)

Put the address of the HP 8509 here. To change the address, select (Terminate DDE Link) to enable (Address). Change the HP 8509 device address then select (Initiate DDE Link) to re-enable the HP-IB bus and the DDE link.

This setting is saved in the file C:\WINDOWS\WIN.INI under the heading [HPIB2DDE] and is restored to this setting the next time the HPIB2DDE application is started.

ADDITIONAL INFORMATION
(Terminate DDE Link) and (Initiate DDE Link) are toggle selections.

(Timeout)

Allows you to set the HP-IB timeout. This setting is saved in the file C:\WINDOWS\WIN.INI under the heading [HPIB2DDE] and is restored to this setting the next time the HPIB2DDE application is started.

Data Separator

This setting is saved in the file C:\WINDOWS\WIN.INI under the heading [HPIB2DDE] and is restored to this setting the next time the HPIB2DDE application is started.

Cr/Lf. Sets the data separator to carriage return/line feed delimited.

Comma. Sets the data separator to comma delimited.

HP-IB Exit State. Allows you to set the HP-IB card to Controller or Non-Controller when the program exits. This setting is saved in the file C:\WINDOWS\WIN.INI under the heading [HPIB2DDE] and is restored the next time the HPIB2DDE application is started.

Controller. Some applications may require that the HP-IB card in the HP 8509 is set to Controller when the HP 8509 itself is not being controlled by the HP-IB bus. Other systems may require that the HP-IB card never becomes a controller while on the HP-IB bus.

Non-Controller. The HP-IB card is Non-Controller while the HPIB to DDE gateway application is running.

Dynamic Data Exchange (DDE) Frame

This frame is used to display data that is being transmitted via DDE to the HPIB to DDE Gateway application. The elements of this frame are described below.

Param(x) (from HP 8509)

Used to establish a DDE link for data from the HP 8509 and the HPIB2DDE.EXE application.

Terminate DDE Link / Initiate DDE Link

Used to connect or disconnect the HP-IB bus to the DDE. When the DDE link is established (selection shows Terminate DDE Link), the HP-IB card is opened and DDE transactions can take place. When there is no DDE link (selection shows Initiate DDE Link), the HP 8509 Status selection show "NO DDE LINK" in yellow and the HP-IB card is closed and the device address may be changed. Clicking the right mouse button on this command button while in 'Terminate Link' mode will cause only the HP-IB bus to close, and allow the HP-IB gateway to be used for a DDE client, without interference from the HP-IB bus.

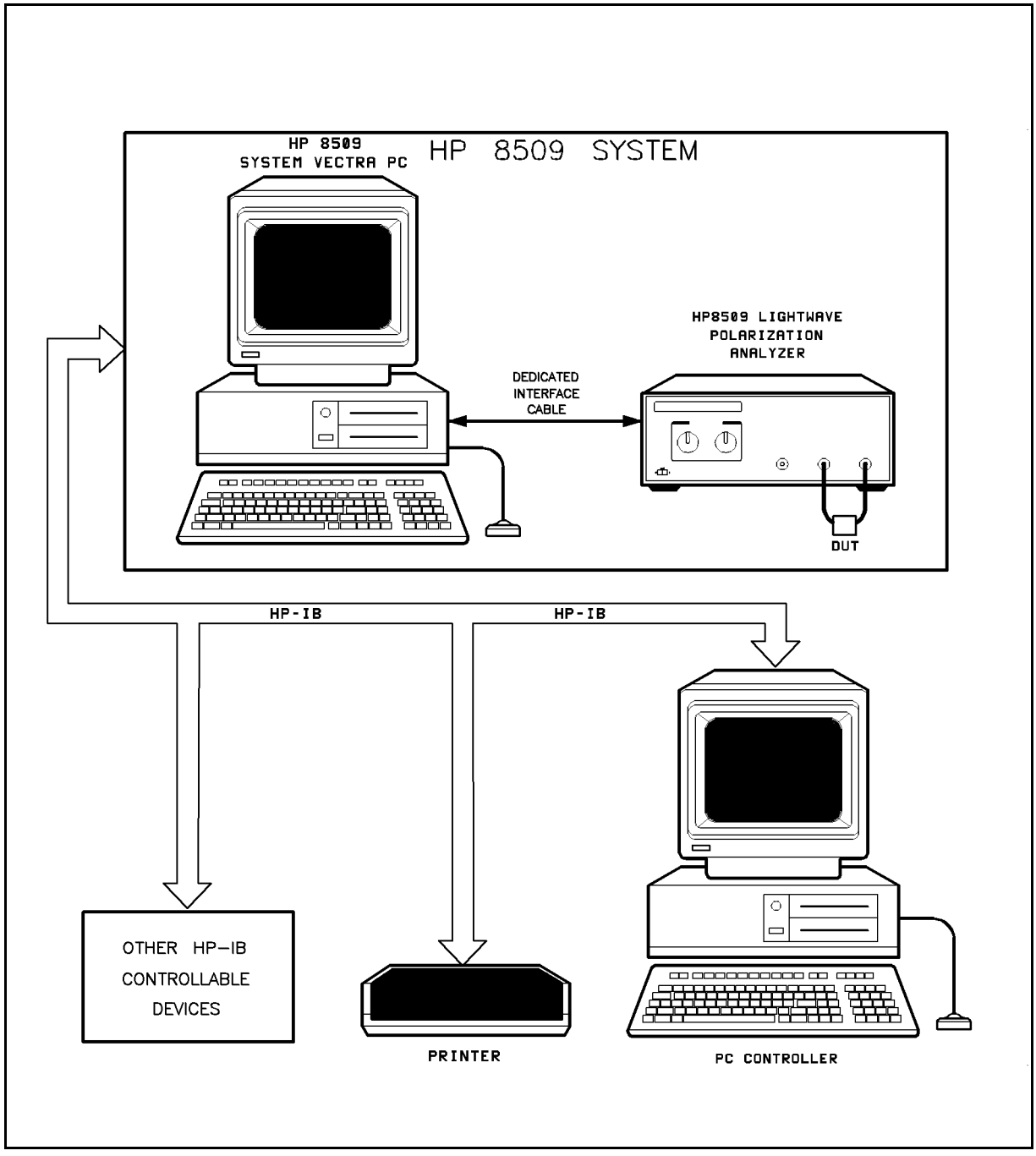


Figure 4-2. HP-IB Connections In a Typical Setup

Given the translation mode under which HP-IB control is achieved for the HP 8509 system, certain constraints exist dictated by the HPIB2DDE application. The constraints are relative to the full set of capabilities provided by the HP-IB interface (see references). The constraints are listed below.

- Data is transmitted and received as ASCII strings. In other words, only formatted data transfers are possible.
- EOI is used to indicate the completion of data transmission. The EOI can be set by using an HP-IB **END** statement to

  terminate the sending of a command.
- EOL (default <cr><lf>) is NOT used by default. This can be

  toggled from the HPIB2DDE application window and will stay at the last setting. EOL should be toggled "on" for HP-IB control

  through an external PC controller running IBASIC for Windows. EOL stands for End Of Line and refers to a string which defines the end of a command line when an OUTPUT statement is sent. The HP-IB END statement serves as the line terminator.
- Use only ENTER/OUTPUT (formatted data transfers).
- Set the timeout to at least five seconds to give the PC time to recognize and respond to HP-IB activity. The HPIB2DDE is polling the HP-IB card and needs time to see the request.

It is important to note that the HP 8509 utilizes only a subset of the HP-IB bus capabilities. Only two HP-IB bus management commands are supported by the current HP 8509 system. These are *OPC? and *IDN?. Other bus management commands, commonly supported by Hewlett-Packard instrumentation, are not available for the remote control of the HP 8509.

When receiving HP-IB commands, the HP 8509 does not lock out manual operation. The user must take care not to disrupt remote control through manual command execution. Furthermore, HP-IB commands which lock out manual operations are not currently available for remote control of the HP 8509. When beginning remote operation of the HP 8509, quit, then restart the application if there has been any manual operation of the HP 8509 during the current session of the HP 8509 application.

A second alternative for remote control of the HP 8509, other than using an external PC controller, is to use an HP 9000 series 200/300 controller running HP BASIC Version 5.0 or later. The platform is the same as that shown in Figure 4-2, except that the PC controller is replaced by an HP 9000 series 200/300 controller. The HP 8509 system can be thought of as just another instrument on the HP-IB bus.

IBASIC syntax is fully compatible with HP BASIC syntax. In effect, the same syntax can be used to create both IBASIC and HP BASIC programs. However, the user should be aware that IBASIC and HP BASIC file formats differ. IBASIC files are usually created in DOS text format, while HP BASIC files are created in LIF format. In effect, a program created in IBASIC will not directly run under HP BASIC though the same syntax can be utilized under HP BASIC to create a program with identical functionality. Utilities exist under the UNIX operating system to translate DOS formatted files to LIF format and vice versa.

5

Basic Instrument Control

A computer controls the HP 8509 by sending it commands over HP-IB. The commands sent are specific to the HP 8509. Each command is executed automatically upon receipt. During remote control, the analyzer is receptive to manual control. The user must take care not to disrupt remote operations. Most commands are equivalent to front panel functions. For example, after preparing the system for HP-IB control, type:

```
OUTPUT 729; "POINCARE:CLEAR" END
```

on the alpha command line and execute by clicking the RUN button on the IBASIC control pad.

The Poincare sphere on the HP 8509 display is now cleared from all measurement traces and measurement continues at the current state of polarization. The construction of the command is:

`OUTPUT 729;`	*The BASIC data output statement. The data is directed to interface 7 (HP-IB), and on out to the device address 29 (the HP 8509).*
`"POINCARE:CLEAR" END`	*The HP 8509 mnemonic for clearing the Poincare sphere. The mnemonic, less the quotation marks, is sent literally by the OUTPUT statement, followed by the terminating END statement.*

The **POINCARE:CLEAR** command performs the same function as selecting the DISPLAY menu and within that menu selecting the **CLEAR SPHERE** option. As can be noted, the command mnemonic **CLEAR** is derived from the menu option for equivalent manual control. Most of the HP 8509 HP-IB commands, where possible, are derived from the equivalent menu option label. Otherwise, they are derived from the common name for the function.

As can be noted from the example above, the HP 8509 command syntax is in the form of COMMAND:P1:P2:P3: ... where P1:P2:P3 ... are the parameters pertaining to the command and the number of parameters depends on the function performed by the command. If, for example, the function of the command is to perform a type of measurement, the number of required parameters will vary with measurement process complexity. Please refer to the HP 8509 Command Reference section of this document or to the Remote Access files in the HP 8509 instrument window for specific command information.

The **END** following the **CLEAR** terminates the command inside the HP 8509 (EOI set true) and prepares the HP 8509 for the next command. If there is a syntax error in the command, the HP 8509 will ignore the command and look for the next terminator. When it is found, incoming commands process normally. Characters between the syntax error and the next terminator are lost.

The **OUTPUT 729;** statement will transmit one item at a time when a terminating **END** is used. It will transmit literal information enclosed in quotes, numeric variables, and string variables. Without the **END**, a carriage return, line feed is transmitted after each item. This is suppressed by terminating the command with an **END** statement.

Setting a display state is just one form of command the HP 8509 will accept. It will also accept commands that require specific, user defined operands. For example, execute:

```
OUTPUT 729; "SETMARKER:1:0:1:0:A" END
```

In response, the HP 8509 will place marker A at the Poincare sphere location corresponding to the Stokes parameters S_0=1, s_1=0, s_2=1, and s_3=0. This corresponds to full 45 degree linear polarization. The HP 8509 will also accept commands that turn various functions on and off. Execute:

```
OUTPUT 729; "POINCARE:HOLD:ON" END
```

This causes the HP 8509 to freeze the Poincare sphere display at the current measurement trace. To initiate continuous measurement, execute:

```
OUTPUT 729; "POINCARE:HOLD:OFF" END
```

As can be noted, the command is **POINCARE**. The accompanying parameters are the **HOLD** function and the function indicator of **ON** or **OFF**.

The HP 8509 does not distinguish between upper and lower case letters. For example, execute:

```
OUTPUT 729; "poincare:hold:on" END
```

Some of the HP 8509 HP-IB commands deal with data storage and retrieval using the HP 8509 system Vectra PC memory. For example, execute:

```
OUTPUT 729; "DRIVE:C" END
```

This sets drive C in the HP 8509 system Vectra PC as the location for all data storage. Some commands directly store information into the designated drive. For example, execute:

```
OUTPUT 729; "SAVE:CONFIG:SYSTEM.CFG" END
```

This causes the current system state or configuration to be saved into the file **SYSTEM.CFG**. The file is created in the HP8509 directory of the drive, (usually drive C) known as the working directory. This directory is specified by the program manager in the "File/Properties" menu. The default working directory is the directory where HP 8509 software is installed. The file can be saved in another directory if an appropriate DOS format directory path is specified. A saved system state can later be recalled by executing:

```
OUTPUT 729; "LOAD:CONFIG:\HP8509\SYSTEM.CFG" END
```

Through this command, a user determined instrument state can be achieved. Note that the appropriate path to the configuration file must be specified. Refer to the "Command Reference" section of this document for command specific information.

Data Requesting Commands

Some of the HP-IB commands request data from the HP 8509. This data is returned as an ASCII string or as a series of ASCII strings separated by commas. It can be accessed by following the data-request command with an **ENTER** remote command. An example is given below:

```
OUTPUT 729; "JONES:MEASURE" END
OUTPUT 729; "JONES?" END
ENTER 729; String$
```

The device command **JONES:MEASURE** directs the HP 8509 to conduct a Jones matrix measurement of an inserted DUT. The results are requested through the **JONES?** command. The data is transferred through the **ENTER** remote command and placed in a string variable named **String$**.

There are two types of HP-IB commands which request data from the HP 8509 system. Some commands, such as **JONES:MEASURE**, cause a measurement to be conducted by the HP 8509 while others request information regarding a particular instrument state. As an example of the second type execute:

```
OUTPUT 729; "DRIVE?" END
ENTER 729; String$
```

The command **DRIVE?** causes the HP 8509 system to return the letter of the drive which is currently set up for data transfers. This letter is read from the HP 8509 into the string variable named **String$.**

The IBASIC statement **ENTER** addresses the HP 8509 to talk. This allows the HP 8509 to transmit information to the controller PC. Specifically, the **ENTER** statement takes the stream of binary data output by the HP 8509 and reformats it back into an ASCII string through the HPIB2DDE application. The controller PC places the data transmitted by the HP 8509 into the string variable listed in the **ENTER** statement. The string variable dimensions must match the data the HP 8509 has to transmit. If the variable is not sufficiently large, data is lost.

Operation Complete

Occasionally there is a need to find out when certain operations have completed inside the HP 8509. For instance, a program should not have the operator connect the DUT while the HP 8509 is still measuring the measurement thrupath.

To provide such information, the HP 8509 has an Operation Complete reporting mechanism that will indicate when certain key commands have completed operation. The mechanism is activated by sending ***OPC?** immediately after an OPC'able command. The HP 8509 will output a 1 when the command completes execution. The ***OPC?** command should occur in the same output statement as the command being OPC'd.

As an example, when ready for remote control, type in the following program:

```
10    OUTPUT 729; "JONES:ABSOLUTE" END     Set up for an absolute measurement.

20    OUTPUT 729;                          Conduct the thrupath calibration and OPC the
      "JONES:CALIBRATE;*OPC?" END           thrupath calibration measurement.

40    DISP "Measuring"

50    ENTER 729; String$                   The program will halt at this point until the HP
                                            8509 completes the measurement and issues a 1.

60    DISP "DONE"

70    END
```

This program causes the controller PC to display the **Measuring** message for about 3 seconds while the instrument executes a thrupath calibration in preparation for an absolute Jones matrix measurement. The controller PC will display **DONE** just as the instrument completes the measurement procedure. When the **DONE** message appears, the program could then continue on, being assured that there is a valid thrupath calibration in memory.

ADDITIONAL INFORMATION
Some operations on the HP 8509 may take more time than the HP-IB bus provides for a timeout. Therefore, when you send ***OPC?**, either execute a delay before **ENTER**, or trap the HP-IB timeout error using **ON TIMEOUT** ... in the IBASIC program to allow for this delay.

Preparing For HP-IB Control

At the beginning of a program, the HP 8509 has to be taken from an unknown state and brought under computer control. One way to do this is with an abort/clear sequence. **ABORT 7** is used to halt bus activity and return control to the computer. **CLEAR 729** will then prepare the HP 8509 to receive commands by clearing syntax errors, the input command buffer, and any messages waiting to be output.

The abort/clear sequence makes the HP 8509 ready to receive HP-IB commands. The next step is to put the HP 8509 into a known state. The easiest way to do this is to send **LOAD:CONFIG:PRESET**, which returns the instrument to the preset state.

The user can specify different configuration parameters and then save them by sending **SEND:CONFIG:<"filename">**.

To load the user specified configuration parameters send **LOAD:CONFIG:<"filename">**. For syntax, see Chapter 8, Remote Command Reference.

Running the following program brings the HP 8509 to a known state, ready to respond to HP-IB control.

```
10      ABORT 7                              This halts all bus action and gives active control
                                             to the computer.

20      CLEAR 729                            This clears all HP-IB errors, resets the HP-IB
                                             interface, and clears syntax errors.

30      OUTPUT 729; "LOAD:CONFIG: PRESET"    Preset the instrument. This resets all
        END                                  instrument window menu settings.

40      END
```

6

Interacting with the HP 8509A/B Through the DDE

This chapter focuses on using Microsoft Visual BASIC for Windows (VB) to create a custom application for programmed control of the HP 8509 to directly and continuously exchange data with other Windows-based applications that support the Dynamic Data Exchange (DDE). DDE data exchanges are called "conversations". DDE conversations are started by establishing DDE links. Applications using DDE to converse with the HP 8509 for automatic control can be custom programs using a computer language such as 'C' or Visual BASIC for Windows. They can also be applications such as Microsoft Excel, that allow users to interface to the DDE system.

Establishing DDE Links

The HP8509 allows other applications to establish DDE links to text-based controls called 'labels' in the HP8509 firmware. To establish a DDE link an application must know three things about the item it wants to link to:

- The name of the application it wants to talk to.
- The subject of the conversation, called a topic.
- The name of the item with which the DDE conversation should take place.

Since the name of the HP 8509 application may change with future updates of the firmware, you should provide a mechanism for the HP 8509 application to change without requiring the program to be re-compiled. Following is a VB code fragment that allows you to specify the HP 8509 application name as a command line parameter to his program. The command line parameter may be specified in the Windows Program Manager properties dialog, accessed in the menu File|Properties. Place the parameter after the name of the program in the Command entry.

```
' Use this code fragment to get the name of the HP8509
' application at run time. The command line parameter
' that this code fragment looks for is:
'  /HP8509=<Name of HP8509 Program>
' If parameter not present, use the default name.
' Use the variable Hp8509DdeName$ when establishing DDE links.
```

```
Const HP8509_DDE_DEFNAME$ = "HP8509_2" ' Get the name of the HP8509 Application
   UCaseCmd$ = Trim$(UCase(Command$))
   i% = InStr(UCaseCmd$, "/HP8509=")
   If i% = 0 Then
       Hp8509DdeName$ = HP8509_DDE_DEFNAME$
   Else
       i% = i% + 8
       j% = InStr(i%, UCaseCmd$, " ")
       If j% = 0 Then j% = Len(UCaseCmd$) + 1
       Hp8509DdeName$ = Mid$(UCaseCmd$, i%, j% - i%)
   End If
```

The HP8509 uses nine link items. One item is used to convey DDE status information. The name of this DDE link item is: Status. Eight items are used to send data to the application via DDE. The name of these DDE link items are:

- Param(0)
- Param(1)
- Param(2)
- Param(3)
- Param(4)
- Param(5)
- Param(6)
- Param(7)

The DDE link items are specified in VB with the LinkItem property. The DDE Application and the DDE topic are combined in VB, separated by the pipe character (|), and is called the LinkTopic property. The DDE link topic of the HP8509 is "lpadde", so combined with the application name, the VB LinkTopic property is "HP8509_2|lpadde".

Microsoft Windows uses 3 types of DDE links for DDE conversations.

- **Automatic**: The source supplies data to the application every time the data defined by the LinkItem changes. This link is also commonly called a HOT Link.
- **Manual**: The source supplies data only when the destination requires it. This link is also commonly called a COLD Link.
- **Notify**: The source notifies the destination when the data changes, but supplies data only when the destination requests it.

For the HP 8509, use Automatic links for the DDE link item **Status** and Manual links for the DDE link items **Param(x)**. A VB Code fragment that establishes a DDE link to the HP 8509 from a users application follows.

```
' This code fragment establishes a DDE link to the
' HP 8509 application from the labels
'  lblParam(0) to lblParam(7), and lblStatus
' in the user's application.

On Error GoTo Err_cmdLink_click

' Establish a new link with the HP 8509
For i% = 0 To 7
   ' Remove any existing link first
   lblParam(i%).LinkMode = LINK_NONE
   DoEvents ' Free Windows to allow it to do the Link
   lblParam(i%).LinkTopic = Hp8509DdeName$ & "|lpadde"
   lblParam(i%).LinkItem = "Param(" & Format(i%) & ")"
   lblParam(i%).LinkMode = LINK_MANUAL
   DoEvents ' Free Windows to allow it to do the Link
Next i%

lblStatus.LinkMode = LINK_NONE
DoEvents ' Free Windows to allow it to do the Link
lblStatus.LinkTopic = Hp8509DdeName$ & "|lpadde"
lblStatus.LinkItem = "Status"
lblStatus.LinkMode = LINK_AUTOMATIC
DoEvents ' Free Windows to allow it to do the Link

' Use to be sure that HP8509 data buffers are clear
lblStatus.LinkExecute "ClearParams"
DoEvents ' Free Windows to allow it to do the Link
Exit Sub

Err_cmdLink_click:
   Select Case Err
   Case 200 To 299
      MsgBox "Failed to Link to HP8509", 0, "DDE Link Error"
   Case Else
      ' Other error handler here
   End Select
   Exit Sub
```

Sending HP 8509 Commands via DDE

To send commands to the HP 8509 using DDE use the LinkExecute method in VB. Be sure that a previous DDE conversation is complete before sending the DDE command. The following VB code fragment illustrates how to send the DDE command "Poincare:Center:A" once the DDE Links have been established. The "ClearParams" command is sent as a precaution to clear out the HP 8509 data buffers (Param(x) labels). It is required that these buffers are empty before any commands are sent to the HP 8509. Generally the data buffer is empty unless a previous command prepared a response by the HP 8509. If you are not sure if the buffers were previously cleared, clear them before sending a command.

```
Do While lblStatus.Caption = "BUSY"
   DoEvents
Loop

' Use to be sure that HP 8509 data buffers are clear
lblStatus.LinkExecute "ClearParams"

lblStatus.LinkExecute "Poincare:Center:A"
DoEvents ' Free Windows to allow it to do the LinkExecute
```

Retrieving HP 8509 Data via DDE

To retrieve HP 8509 data, use the VB LinkRequest method. The HP 8509 places data in the Param(x) labels. Use LinkRequest with the controls which are linked to the Param(x) labels in the HP 8509. Be sure that there are no pending DDE conversations before attempting to get the data, otherwise all the data may not be present. Also, clear the data buffers (Param(x) labels) in the HP 8509 after getting the data. The following VB code fragment illustrates how to get data from the HP 8509 via DDE.

```
Do While lblStatus.Caption = "BUSY"
   DoEvents
Loop

For i% = 0 To 7
   lblParam(i%).LinkRequest
   DoEvents ' Free Windows to allow it to do the Link
   ' Since data is sequential, once there is an
   ' empty label we're done.
   If lblParam(i%).Caption = "" Then Exit For
Next i%

' Required to do after getting the HP8509 data
frmHpib.lblStatus.LinkExecute "ClearParams"
```

7

Measurement Programming

Earlier sections of this document outlined how to get commands into the HP 8509. The next step is to organize the commands into a measurement sequence. A typical measurement sequence consists of the following steps:

1. Zero the instrument.
2. Calibrate the instrument.
3. Set up the instrument.
4. Connect the device.
5. Take data.
6. Transfer data.

The actions within each step in the measurement sequence depend upon the type of measurement conducted. The instrument should be zeroed prior to starting a measurement sequence. Zeroing can be done remotely by sending the `ZERO` command.

For accurate measurements, it is important that the receiver is not detecting any power while the zeroing routine is being performed.

1. If you have an HP 8509A you will be prompted to "Block the external laser." To do this, cover the OPTICAL INPUT connector with a connector cap or a piece of dark paper.
2. If you have an HP 8509B, you will *not* be prompted to, but you *must* either cover the OPTICAL INPUT connector as in step 1, above, *or* turn off your external source. If the external source is connected to the HP 8509B External Source input, its power will be blocked automatically so that no power will emerge from the Optical Output connector during the zeroing operation.

While the zeroing routine is running, a green "zero" message will appear inside the power display in the upper left corner of the HP 8509 basic measurement screen, and the mouse pointer appears as an hourglass. When the "zero" message disappears, and the mouse pointer changes back to an arrow, the zeroing routine is finished.

Calibrate the Instrument

A wavelength calibration can be automatically performed on the HP 8509, if desired. This can be done remotely by sending the **CAL:CALIBRATE** and **CAL:ON** commands. It should not be necessary to perform more than one instrument calibration per day or even one per week, depending on room temperature changes and the accuracy required. If in doubt, a calibration should be performed. For more information on instrument calibration please refer to the HP 8509 *User's/Reference Guide*.

Set Up the Instrument

All pertinent measurement parameters must be set. Set the type of source (internal/external, wavelength) and set for internal or external polarizers. The number of steps in the set up procedure depends on the type of measurement to be conducted. Some of the measurements require a thrupath measurement calibration and/or application of a two-point or three-point reference frame prior to the execution of the DUT measurement. One of the measurements, polarization mode dispersion, requires setting parameters such as the start and stop wavelengths, the number of steps, and the step wavelength separation.

Connect the Device

Have the operator connect and adjust the device under test (DUT). All adjustments take place at this stage so that there is no danger of taking data from the device while it is being adjusted.

Take Data

With the device connected and adjusted, conduct the desired measurement. The process of taking data is different depending upon the type of measurement that is conducted. For the majority of measurements, the taking of data is automatically performed. Certain measurements, however, such as PMD under manual mode, require a high degree of operator interaction.

When taking data, the operator must ensure proper synchronization. This can be done by using the *OPC? command.

Transfer Data

Lastly, read the results out of the instrument. The data output command is designed to ensure that the data transmitted reflects the current state of the instrument. The data, as previously discussed, can be read from the instrument using the **ENTER** remote command. All measured data is returned by the HP 8509 system as a sequence of comma-separated strings. The operator must take care to reformat or parse this data if so desired.

8

Remote Command Reference

Command Syntax

None of the commands are case dependent. Commands may be sent in upper case, lower case, or mixed case. Any item not enclosed in angle brackets (<,>) must be considered a literal command.

Most of the commands in this chapter are available using Microsoft Windows DDE, as well as HP-IB. Any restrictions to the use of a command are noted in the chapter for that command.

When receiving HP-IB commands, the HP 8509 does not lock out manual operation. Do not disrupt remote control through manual command execution. Furthermore, HP-IB commands which lock out manual operations are not currently available for remote control of the HP 8509. When you begin remote operation of the HP 8509, quit, then restart the application if there has been any manual operation of the HP 8509 during the current session of the HP 8509 application.

Table 8-1. Conventions

: colon	Command Separator	Separates parameters. A parameter must be supplied to the right of every colon.
? question	Query	The command causes the instrument to prepare a response. No further commands may be sent until the response is retrieved.
{} braces	Mandatory Selection	Select one of the options in the braces as a parameter. If braces indicate option is part of a parameter, select option and append it to the parameter.
[] brackets	Optional Selection	Similar to Mandatory Selection except that selecting a parameter is optional.
| pipe	Selection Separator	Separates mandatory selection and optional selection parameters. Spaces may be added in this document for clarity.
<> angle brackets	Described parameter	A description of the parameter. Supply a parameter corresponding to the description in the brackets.
<"filename">		The filename of the file to save or load. The path, if specified, should exist, or an error will occur. If the path is not specified the default path will be used. The default path for any filename is the windows working directory. This is usually the same as the HP8509 application directory, but can be changed in the Windows Program Manager by highlighting the HP8509 icon and selecting `File | Properties`. If the current drive is changed using the `Drive:<Drive Spec>` command, then the default directory is the default directory of the current drive. The filename must be enclosed in double quotes (") if it includes any colons (:), otherwise the double quotes are optional.

Table 8-1. Conventions (continued)

<"title">		The title to use for a Save/Load operation with the HP8509 database. A maximum of 80 characters can be used for the `<"title">`. Use only printable characters in the range of ASCII 32 (space) and ASCII 126 (~ tilde) for titles. Trailing spaces are ignored, leading spaces are not ignored. The title must be enclosed in double quotes (") if it includes any colons (:), otherwise the double quotes are optional.
<"serial number">		The serial number of the device under test for the measurement being saved. Used for a Save operation with the HP 8509 database. This field is optional. If it is not provided, this entry in the database is left blank. A maximum of 25 characters can be used for the serial number. Use only printable characters in the range of ASCII 32 (space) and ASCII 126 (~ tilde). Trailing spaces are ignored, leading spaces are not ignored. The serial number must be enclosed in double quotes (") if it includes any colons(:), otherwise the double quotes are optional."
<"date code">		The date code of the device under test for this measurement being saved. used for a Save operation with the HP 8509 database. This field is optional. If it is not provided, this entry in the database is left blank. A maximum of 16 characters can be used for the date code. use only printable characters in the range of ASCII 32 (space) and ASCII 126 (~ tilde). Trailing spaces are ignored, leading spaces are not ignored. The date code must be enclosed in double quotes (") if it includes any colons (:), otherwise the double quotes are optional.

Abbreviations / Definitions

.

analyzer window	The first window to open when the HP 8509A/B lightwave polarization analyzer software starts.
DDE	Dynamic Data Exchange. A mechanism Microsoft Windows uses for applications to communicate with each other. HP 8509A/B supports DDE links as documented in the HP 8509A/B manual.
DGD	Differential Group Delay. Differential propagation time of polarization modes. Usually expressed in units of time.
frame	A boxed-in region within a window, usually with a title, that contains user interface elements such as option buttons, command buttons, text boxes, etc.
JME	Jones Matrix Eigenanalysis. Mathematical technique used to calculate optical parameters such as DGD.
LPA	Lightwave Polarization Analyzer. The HP 8509A/B is an LPA.
Not Recommended	The particular command is supported in this version. However, it may not be supported in future versions of the HP 8509A/B.
OSS	Optical Source Setup- The window used to adjust the optical source (laser) parameters.
PDL	Polarization Dependent Loss. The loss (or gain) variation of an optical signal due to polarization.
PMD	Polarization Mode Dispersion. Average DGD over wavelength range.
string	A series of characters. The codes for string characters range from 0 to 128 and are the same as those defined by the ASCII character set. Only the printable characters, codes 32 to 126, are used in HP-IB bus communications for messages. Codes 13, 10 (`<CR><LF>`) are often used for EOL (end of line) (see HP-IB configuration and setup information).
TLS	Tunable Laser Source. HP 8167/8 are tunable laser sources.
VTUNE	Tunable Laser Source controlled by analog voltage output VOUT A of the HP 8509A/B. Using a VTUNE source prevents the use of the analog outputs for any other purpose.
WS	Wavelength-Scanning. A method used to determine the polarization mode dispersion of an optical system by examining cyclical characteristics of the output polarization (using the normalized Stokes parameters) over a wavelength range.

Changes from Version 1.2 Software

Every effort has been made to assure the compatibility of version 2.0 remote commands with version 1.2 remote commands. In some instances this has not been possible due to fundamental changes in the design of the HP 8509 software. Please note the changes below and change your existing programs to accommodate the changes, if necessary.

`*OPC[?]`

On some fast controllers, the windows operating system may not release system resources fast enough to acknowledge an `*OPC?` that is sent in a separate bus transaction. In general, it is a good idea to limit the number of HP-IB bus transactions by grouping the HP 8509 commands together, separated by a semicolon. Four thousand (4,000) characters may be sent in one HP-IB bus transaction to the HP 8509. It is recommended to send `*OPC?` to the HP 8509 as part of the same HP-IB bus transaction as the command that is being `*OPC`'d.

`Cal:Calibrate`

This command will always return "PASS" when used with DDE. After this command is issued, either from HP-IB or DDE, the HP 8509 system will be occupied performing the calibration. No other activity on the HP 8509 Vectra PC will take place until the calibration completes. The command `*OPC[?]` has no effect, since the HP 8509 system will not respond to any commands while a calibration is in progress. The `Cal:Calibrate` command takes about 25 seconds on a Vectra 486/66. The programmer should hard code a delay in the program which controls the HP 8509, after issuing this command. After the delay, issue the `Status?` command to determine if the `Cal:Calibrate` command was successful.

`Disper:Close`

In version 1.2 this command caused the PMD window to close. In version 2.0 there can be many PMD child windows open, all within a main "Multiple Document Interface" (MDI) parent window. This command will close only the first PMD:JME child window which was opened. The MDI parent window, which holds all of the PMD child windows, will close automatically after the last PMD child window is closed.

`Source?  Source:External?  Source:Internal?`

Version 1.2 of the HP 8509 had only one set of settings to control a TLS, so when querying the TLS, the returned value was the setting of the TLS for the HP 8509 instrument. This is not true for version 2.0 of the HP 8509 software. In version 2.0 each PMD window and the analyzer window each have their own set of TLS settings. When using the above `Source: ...` commands, be aware that the TLS settings returned are for the ANALYZER WINDOW ONLY. Version 2.0 provides other commands to query the TLS settings for the PMD windows.

Note: When *setting* the TLS parameters using the `Source:External:<Wavelength nm>`,`Source:External:{Off|On}`, and `Source:Internal:{Off|1310|1550}` commands, all windows' TLS settings are changed. This conforms to version 1.2 operation.

Common Commands

`*IDN?`

Returns a string that uniquely identifies the analyzer. The string is in the form:

`<Manufacturer>,<Model Number>,<Serial Number>,<Firmware Version>` for example:

`"HEWLETT-PACKARD,HP 8509B,3206A00156,2.10"`

HP-IB Operation Only

`*OPC[?]`

Operation complete. The query will return an ASCII "1" when all pending overlapped operations have been completed. The command is used to ensure the completion of a particular function as requested by a prior command. Append this command to the command being OPC'd, separated with a semicolon.

Device Specific Commands

`Analog?`

Returns `Off`, `Raw`, or `Stokes` depending on the setting of the analog outputs (see `Analog:{ Off | Raw | Stokes }`).

`Analog:Done`

Closes the `Analog` frame in the analyzer window.

`Analog:{ Off | Raw | Stokes } [?]`

Selects and turns on or off the output of the four BNC connectors on the rear panel of the HP8509. If "stokes" is sent, the output of the four BNC connectors will be four voltages proportional to the Stokes parameters S0, s1, s2 and s3. When raw is sent, the four voltages will be proportional to the currents induced on the four photodiodes of the HP8509 receiver. The voltages are always in the range of −10 to 10 volts. When "off" is sent, the four BNC outputs will be turned off. Please refer to the HP 8509 User's/Reference Guide for more in depth information. The query returns "1" if the particular control is selected in the `Analog` frame of the analyzer window, and "0" if not selected.

`Angles:{ AB? | AC? | BC? }`

Returns the angle between the specified markers, its cosine, and the cosine squared of half the angle. The largest angle measurable is 180 degrees or PI radians. The angles and appropriate markers must be turned on in order to obtain the desired angle. (See `Angles:{ Off | On }`)

`Angles:{ Degrees | Radians }[?]`

Sets the units of the displayed angles to either radians or degrees. The query returns `"1"` if the condition is true, `"0"` otherwise. (See `Angles:{ Off | On }`.)

`Angles:Done`

Not Recommended Command may not be available in future versions. Plan your programming to use the alternate command:

`Angles:Off`

Closes the `Marker Angles` frame in the analyzer window.

`Angles:{ Off | On }`

Displays the angles between markers A and B, markers A and C, and markers B and C. The measured angles are displayed in the `Marker Angles` frame in the analyzer window. The angles are measured from the Poincare sphere coordinate location of the markers. The markers must be turned on in order to obtain the measured angles.

`Average:Display:{ Off | On }`

Turns on or off the moving average of a measurement trace on the Poincare sphere display.

`Average:Display{ ? | :<NumPoints> }`

Specifies the number of points `<NumPoints>` to be used in the moving average of the Poincare sphere display. The query returns the number of points set in the `Averaging` frame of the analyzer window and the state of the display averaging; `"0"` if off, `"1"` if on.

`Average:Done`

Closes the `Averaging` frame in the analyzer window.

`Average:Measure{ ? | :<NumPoints> }`

The number of points (NumPoints) to be averaged, at each measurement point, when conducting any measurement. This number may be set using `<NumPoints>`, or queried using `?`.

`Cal?`

Returns the status of the Calibration apply option buttons; "0" means Calibration is Off, "1" means Calibration is On.

`Cal:Calibrate`

Performs an instrument calibration which optimizes the measurement performance of the analyzer. The calibration is performed at the current user-defined source wavelength. Refer to the HP 8509A/B User's/Reference Guide for more in-depth information on the instrument calibration capabilities of the HP 8509A/B.

`Cal:{ Done | Save }`

The `Done` parameter terminates the instrument calibration sequence. The `calibration` window is removed from the screen. The `Save` parameter saves in memory, an instrument calibration performed at a given source wavelength. The source wavelength is specified through the source command. All saved calibrations can be accessed when the `Cal:On` command is sent.

`Cal:Delete:<Wavelength nm>`

Deletes from memory the instrument calibration performed at the specified source wavelength.

`Cal:List?`

Returns a list, in the form of a comma-separated string, of the wavelengths for which calibrations have been performed. The wavelengths are given in nanometers.

`Cal:{ Off | On }`

The `Off` and `On` parameters enable or disable the instrument calibration corrections. When enabling a calibration, the instrument will search for a saved instrument calibration performed at the current source wavelength. If a calibration is not present, then calibration corrections cannot be enabled.

`ClearParams`

Used to clear the DDE parameters in the LPA after data is retrieved. A DDE LinkPoke can also be used to clear the parameter boxes. DDE Parameters should always be cleared after data is retrieved so that another query isn't confused by residual data that was previously left behind. The HP-IB gateway automatically sends this DDE command after retrieving data.

DDE only.

`DBase:Close`

Closes the currently opened database file.

`DBase:Compact`

Compacts the currently opened database file.

`DBase:Filename?`

Returns the name of the currently opened database file.

`DBase:Open:<"filename">`

Opens the database file specified in <"filename">.

`DBase:Repair`

Repairs the currently opened database file.

`Disper`

Displays the `PMD:JME` window on the HP 8509B instrument display. Be sure to send 'Disper' before sending any other 'Disper: ... ' commands.

HP 8509B only.

`Disper?`

Upon command execution, the analyzer returns the current wavelength, the measured dispersion at the current wavelength, and the average of the measured dispersion up to and including the current wavelength. The command can be used under manual mode to check the status of a running measurement process. The data is returned as a comma separated ASCII string in the following format:

`<Wavelength(nm)>, <Current Dispersion>, <Average Dispersion>`

The units for the returned dispersion data are selected with `Disper:Units:`. The default units are ps.

HP 8509B only.

`Disper:ActiveWindow?`

Upon command execution, the analyzer returns the comma separated data from the currently active `PMD:JME` window. The number of data points is returned in `Param(0)`. The wavelengths are returned in `Param(1)`. The polarization mode dispersion delay is returned in `Param(2)`. The units for the returned dispersion data are selected with `Disper:Units:`. The default units are ps.

HP 8509B only.

`Disper:Atten{ ? | :<dBm value> }`

The attenuation for the HP-IB tunable laser source. The query returns the attenuation in dBm. Using `<dBm value>` sets the attenuation for an HP-IB tunable laser source.

HP 8509B only.

DDE Only.

`Disper:Calibrate`

Clears any current thrupath calibration and begins a new PMD:JME calibration sequence at the current wavelength setting. This command is used when the command `Disper:Cascade` has been sent to specify that a thrupath calibration is required prior to the PMD:JME measurement of a given device under test. Once the PMD:JME controls have been accessed, the `Disper:Calibrate` command must be sent before any `Disper:Measure` commands can be sent.

HP 8509B only.

`Disper:{ Cascade | Single }[?]`

Sets the polarization mode dispersion measurement (PMD) process for measuring a single device under test or for the measuring of a device under test included in a chain of devices under test. The `Cascade` parameter is used to de-embed the effects of components inserted along the measurement path of the desired device under test. If `Cascade` is set, a thrupath calibration must first be conducted at each measurement wavelength. Once the thru calibration process is completed, the PMD measurement process can be executed. The query returns an ASCII `1` if the specified setting (single or cascade) is being used in the PMD measurement and a `0` if it is not.

HP 8509B only.

`Disper:Chain[?]`

Not Recommended Command may not be available in future versions. Plan your programming to use the alternate commands:

`Disper:Cascade` and `Disper:Cascade?`

HP 8509B only.

`Disper:Clear`

Aborts a PMD:JME measurement process. This command is valid only if the optical source is set to manual. The command does not erase the current thrupath calibration corrections.

HP 8509B only.

`Disper:Close`

Closes the PMD:JME measurement window. The PMD:JME measurement process is ended. The original version 1.0 command closed the PMD:JME window. In version 2.0 the PMD:JME window is a child of the `HP8509 Graphs` window. The HP 8509 Graphs window closes when the last graph is closed.

`Disper:DBase:Load:<"title">`

Loads a measurement from the current database using the specified title.

HP 8509B only.

`Disper:DBase:Save:<"title"> [ :<"date code"> [ :<"serial number"> ]]`

Saves a measurement to the current database using the specified title.

HP 8509B only.

`Disper:Done`

Not Recommended Command may not be available in future versions. Plan your programming to use the alternate command:

`Disper:Close`

`Disper:FiberLen{ ? | :<km> }`

The length of optical fiber used to normalize PMD:JME measurements. The query returns the length of the fiber. Using the parameter `<km>` sets the length of optical fiber.

HP 8509B only.

`Disper:FindMinPoints[:<Num Samples>]`

Activates the PMD:JME feature that automatically determines the minimum number of points required to prevent aliasing in the specified wavelength range. PMD:JME measurements are activated with this feature. The only tunable laser sources supported with this feature are HP-IB HP 8167/8 and VTune tunable laser sources. HP 8509B control of the HP-IB bus is available only using DDE. Therefore, this feature will not work for the HP 8167/8 tunable laser sources when using the HP-IB bus for remote operation of the HP 8509B. Only the VTune tunable laser source can be used with HP-IB. The `<Num Samples>` value specifies the number of sections of the Poincare sphere the test for aliasing. The default value for `<Num Samples>` is `4` if no value is specified.

HP 8509B only.

`Disper:HPIB[?]`

Sets the tunable laser source for a PMD:JME measurement to an HP-IB tunable laser source. The HP 8509B looks for a tunable laser source at the address specified with `TLS:Address` and uses it if it is either an HP 8167 or HP 8168 tunable laser source. Be sure that the wavelength range is set correctly for the connected HP-IB tunable laser source before issuing this command. To change tunable laser source selections between HP 8167 and HP 8168:

1. Issue the command `Disper:Manual`
2. Change the wavelength range using `Disper:WLen:`
3. Change the HP-IB address using `TLS:Address:<HP-IB Address>`
4. Issue the command `Disper:HPIB`

The query returns an ASCII "1" if the PMD:JME next measurement process will be in HP-IB mode and a "0" if it will not be in this mode. Also returns the name of the current laser source.

HP 8509B only.

DDE only.

`Disper:Manual`

Places the polarization mode dispersion measurement in manual control mode. When the instrument is under manual control, the user must set the external source to the appropriate wavelength for each wavelength step between the start and stop wavelengths. In manual control mode, you must send the command 'Disper:Measure' once to begin the measurement process and once for each wavelength point as returned by the command 'Disper:WLen:Points?'.

HP 8509B only.

`Disper:Manual?`

Returns an ASCII "1" if the PMD:JME next measurement process will be in manual mode and a "0" if it will not be in this mode. Also returns the name of the current laser source.

HP 8509B only.

`Disper:Measure`

Triggers a PMD:JME measurement at the current source wavelength setting.

HP 8509B only.

`Disper:NewThruCal`

Not Recommended This command is ignored. It is provided for compatibility with old code. Command will not be available in future versions. Plan your programming to use the alternate commands:

`Disper:Calibrate`

HP 8509B only.

`Disper:Power?`

Returns the power and the power units for the tunable laser source.

HP 8509B only.

DDE Only.

`Disper:Power:{ dBm | uWatt }[:<value>]`

Sets the units for the tunable laser source. If the `<value>` parameter is specified, the power setting can also be changed. If the power setting is not valid for the TLS, the command fails.

Note: When changing only the units, the numerical value of the power does not change. Be sure to change the value of the power to correspond to the new units.

HP 8509B only.

DDE Only.

`Disper:Restart`

Not Recommended Command may not be available in future versions. Plan your programming to use the alternate command:

`Disper:Clear`

HP 8509B only.

`Disper:Save:<"filename">`

Saves a polarization mode dispersion measurement trace into the file `<"filename">`. The trace is saved as a series of ASCII strings separated by commas. The saved trace information is in the form of:

wavelength_1 (nm), wavelength_2 (nm), dispersion

wavelength_2 (nm), wavelength_3 (nm), dispersion

...

...

...

wavelength_n-1 (nm), wavelength_n (nm), dispersion

The above is for the dispersion measurement at "n" user defined wavelengths. The units for the dispersion measurement are selected using the `Disper:Units:` command. The default units are ps. For path information on "filename", see "Command Syntax" at the beginning of this chapter.

HP 8509B only.

`Disper:Settle:{ Point | Start }{ ? | :<Delay msec>}`

The settling time to wait, either initially (`Start`) or per point (`Point`), after setting a tunable laser source to the desired wavelength in the sweep range during a PMD:JME measurement. The query returns the current value.

See also: `WaveScan:Settle:{ Point | Start }{ ? | :<Millisec's> }`

HP 8509B only.

`Disper:Start`

Not Recommended Command may not be available in future versions. Plan your programming to use the alternate command:

`Disper:Measure`

HP 8509B only.

`Disper:Trace:<"filename">`

Not Recommended Command may not be available in future versions. Plan your programming to use the alternate command:

`Disper:Save:<"filename">`

HP 8509B only.

`Disper:Units{ ? | :ps | :ps/L | :ps/sqrtL | :fs | :fs/L | :fs/sqrtL }`

Sets the units to use in PMD:JME measurements. The query returns the units of measure for PMD:JME.

HP 8509B only.

`Disper:VTune[?]`

Sets the `Optical Source Setup` source selection to VTune in order to control a VTUNE tunable laser source.

The query returns an ASCII "1" if the PMD:JME next measurement process will be in VTUNE mode and a "0" if it will not be in this mode. Also returns the name of the current laser source.

HP 8509B only.

`Disper:VTune:{ Start | Stop }{ ? | :<Voltage> }`

The VTUNE start or stop voltage. The query returns the voltage value, the parameter `<Voltage>` sets the value.

HP 8509B only.

`Disper:WLen?`

Returns the next wavelength (in nm) at which the PMD:JME measurement will be conducted. This command is typically used only when the tunable laser source is "Manually Tuned."

HP 8509B only.

`Disper:WLen:Points{ ? | :<NumPoints> }`

Sets the number of points between the start and stop wavelengths for the polarization mode dispersion (PMD) measurement. Each point corresponds to a wavelength for PMD measurement. If the number of points does not correlate with the delta value and the start and stop wavelengths, the delta value is reset to accommodate the number of points according to:

WlenDelta = (WlenStop − WlenStart) / (WlenPoints − 1)

The query returns the number of points specified in the current PMD:WS measurement settings.

HP 8509B only.

`Disper:WLen:{ Start | Stop | Delta }{ ? | :<Wavelength nm>}`

Specifies the Start, Stop, or Delta wavelengths for the PMD:JME measurement. Changing any of these values causes the number of points in the `Optical Source Setup` window to change according to:

WlenPoints = ((WlenStop − WlenStart) / WlenDelta) + 1

The query returns the value of the setting in nanometers. Using the `<Wavelength nm>` parameter sets the value.

Note: The `Start` and `Stop` values can never have the same value. For example, when segmenting a wavelength range over several measurements and sweeping from low to high, always issue the command `Disper:WLen:Stop` before the command `Disper:WLen:Start` when specifying the next wavelength segment. This will prevent the `Start` and `Stop` values from being equal when switching from one segment to the next.

HP 8509B only.

`Disper:WLen:Steps{ ? | :<NumPoints> }`

Not Recommended Command may not be available in future versions. Plan your programming to use the alternate command:

`Disper:WLen:Points{ ? | :<NumPoints>}`

Sets the number of steps between the start and stop wavelengths for the polarization mode dispersion (PMD) measurement. Each step corresponds to two adjacent wavelengths for PMD measurements. If the number of steps does not correlate with the delta value and the start and stop wavelengths, the delta value is reset to accommodate the number of steps according to:

WlenDelta = (WlenStop − WlenStart) / WlenSteps

The query returns the number of steps specified in the current PMD:WS measurement settings.

Note: The value returned/set by `Disper:WLen:Points` is one more than the value returned/set by `Disper:WLen:Steps`. `Steps` are transitions between the `Points`.

HP 8509B only.

`Display:Angles:{ Off | On }`

Not Recommended Command may not be available in future versions. Plan your programming to use the alternate command:

`Angles:{ Off | On }`

`Display:Angles:{ Degrees | Radians }`

Not Recommended Command may not be available in future versions. Plan your programming to use the alternate command:

`Angles:{ Degrees | Radians}`

Sets the displayed angles to degrees or radians (see `DISPLAY:ANGLES: { ON,OFF }`).

`Display:Power:{ Linear | Log }`

The lightwave power measurement can be displayed either in log format (dBm) or linear format (uW). The setting can be changed through this command.

`Display:Update{ ? | :<NumPoints> }`

The number of points plotted to the Poincare sphere between updates of the other displays, power, DOP, and Stokes. A large number of points plotted to the Poincare sphere will slow down updates of the other displays. A small number of points plotted to the Poincare sphere will slow down the plotting on the Poincare sphere. This number may be set using `<NumPoints>`, or queried using `'?'`.

`Drive?`

Returns the letter of the drive currently set up for HP-IB initiated data storage.

`Drive:<MS-DOS Drive Spec>`

Sets the specified drive for HP-IB initiated data transfers. Drive C is the HP 8509A/B system default drive. If using drive C, all saved data files using HP-IB will be placed in the HP 8509A/B directory unless a specific directory path is specified for the file. If another drive, such as A or B, is designated, all files will be saved to the root directory unless an alternate path is specified.

`GetFile:<"filename">`

This command will, via HP-IB, transfer an ASCII data file from the HP 8509A/B system Vectra PC to the external controller. The file is transferred as an ASCII string. An `ENTER` HP-IB command must be used to access the file from the HP 8509A/B Vectra PC. The file must be placed into a large enough string variable. Otherwise, data will be lost. In the `HPIB2DDE` window, the user can specify whether the string separator is a comma or a carriage return/linefeed. The user should specify the format which coincides with the string variable specified in the `ENTER` HP-IB command statement. For path information on `"filename"`, see "Command Syntax" at the beginning of this chapter.

HP-IB Operation only.

`GetMarker:{ A | B | C }`

Not Recommended. See `GetMarker?:{ A | B | C }`.

`GetMarker?:{ A | B | C }`

Places the specified marker at the current state of polarization and returns the results S_0, s_1, s_2, s_3. S_0 is the power in milliwatts, and s_1, s_2, s_3 are the normalized Stokes parameters which serve as coordinates on the Poincare sphere.

```
Jones?
```

Not Recommended Command may not be available in future versions. Plan your programming to use the alternate command:

```
PolDep:{ JonesData? | PdlData?}
```

HP 8509B only.

```
Jones:{ Absolute | Relative }[?]
```

Not Recommended Command may not be available in future versions. Plan your programming to use the alternate command:

```
PolDep:{ Absolute | Relative}[?]
```

HP 8509B only.

```
Jones:Calibrate[A | B | C]
```

Not Recommended Command may not be available in future versions. Plan your programming to use the alternate command:

```
PolDep:Calibrate[A | B |C]
```

HP 8509B only.

```
Jones:Clear
```

Not Recommended Command may not be available in future versions. Plan your programming to use the alternate command:

```
PolDep:Clear
```

HP 8509B only.

`Jones:Done`

Not Recommended Command may not be available in future versions. Plan your programming to use the alternate command:

`PolDep:Done`

HP 8509B only.

`Jones:{ External | Internal }[?]`

Not Recommended Command may not be available in future versions. Plan your programming to use the alternate command:

`PolDep:{ External | Internal}[?]`

HP 8509B only.

`Jones:{ MagRadians | MagDegrees | RealImag }[?]`

Not Recommended Command may not be available in future versions. Plan your programming to use the alternate command:

`PolDep:{ MagRadians | MagDegrees | RealImag}[?]`

HP 8509B only.

`Jones:Measure[A | B | C]`

Not Recommended Command may not be available in future versions. Plan your programming to use the alternate command:

`PolDep:Measure[A | B | C]`

HP 8509B only.

`Jones:NewThruCal`

Not Recommended Command may not be available in future versions. Plan your programming to use the alternate command:

`PolDep:NewThruCal`

HP 8509B only.

`Jones:ReStart`

Not Recommended Command may not be available in future versions. Plan your programming to use the alternate command:

`PolDep:Clear`

HP 8509B only.

`Load:Config:Preset`

Loads the factory default configuration for the LPA.

`Load:Config:<"filename">`

Loads the user created configuration file `<"filename">`. For compatibility with previous versions, the search path for `"filename"` is:

1. The windows working directory.
2. The HP 8509A/B application directory.
3. The Windows directory (usually C:\WINDOWS).

For path information on `"filename"`, see "Command Syntax" at the beginning of this chapter.

`Load:Single:<"filename">`

Loads a timed measurement from the file `<"filename">`.

For path information on `"filename"`, see "Command Syntax" at the beginning of this chapter.

`OperVer[?]`

Opens the `Operation Verification` window. The query returns the results of the operation verification procedure in the following format:

`<Result of OperVer>,<Max DOP%>,<Mean DOP%>,<Min DOP%>,<Angle AB>,<Angle AC>`

where `<Result of OperVer>` is "1" if success, "0" if fail.

`OperVer:{ Start | Cancel | Done }`

Opens the `Operation Verification` window, if not already open, and activates the specified command button.

`PdlMaxMin[?]`

Shows the `PDL:Max-Min` window on the HP 8509A/B screen. The query returns the `PDL:Max-Min` data as follows:

`Dbm Max, s1 Max, s2 Max, s3 Max, Dbm Min, s1 Min, s2 Min, s3 Min`

`PdlMaxMin:{ Max | Min }`

Centers the Poincare Sphere on the Max or Min point

`PdlMaxMin:Delta?`

Returns the Max-Min power in dBm

`PdlMaxMin:{ Reset | Clear | Done }`

Activates the appropriate button on the `PDL:Max-Min` window

`Poincare:Center:{ Stokes | A | B | C }`

If the parameters `A`, `B`, or `C` are sent; upon command execution, the Poincare sphere is rotated so that the specified marker is at the center of the Poincare sphere display. The marker must first be set before the command is executed. If the parameter `Stokes` is sent, the Poincare sphere is rotated so that the current state of polarization is at the center of the Poincare sphere display.

`Poincare:Clear`

Clears all visible measurement traces on the Poincare sphere. After clear, measurement continues at the current state of polarization.

`Poincare:Hold:{ Off | On }`

Toggles `Hold` on or off. When toggled, on the Poincare sphere display is held at the current measurement state. When toggled off, continuous measurement is initiated.

`Poincare:Marker:{ A | B | C }`

Places the specified marker at the currently measured state of polarization as shown on the Poincare sphere. The specified marker is turned on and the marker measurement is displayed on the HP 8509A/B instrument window. The marker measurement is in terms of the normalized Stokes parameters S_0, s_1, s_2, s_3.

`Poincare:Marker:Clear`

Clears all measurement markers from the Poincare sphere and turns them off.

`Polarizer:{ A | B | C | None } [?]`

When using internal polarizers, the command inserts the specified polarizer at the source output. The query returns `1` if the particular polarizer is inserted, `0` if not.

`Polarizer:Angle{ A | B | C }{ ? | :<Degree Value> }`

The `<Degree Value>` parameter sets the angle for the specified external polarizer. The user must be careful to enter the correct angles. Each polarizer will pertain to a marker as defined by the user. The query returns the value of the specified internal or external polarizer, depending on the setting. Note: Using `<Degree Value>` is valid only when the polarizers are `External` as the internal polarizers are fixed. This command will execute when the polarizers are in internal mode, but the angles specified will not be used in calculations until the polarizers are put in external mode using `Polarizer:External`. See also: Polarizer:{ External | Internal }

HP 8509B only.

`Polarizer:Done`

Closes the `Polarizers` frame in the analyzer window.

HP 8509B only.

`Polarizer:{ External | Internal }`

Sets up the analyzer for the use of internal or external polarizers. When using internal polarizers, the specified polarizer is automatically inserted. When set to external polarizers, the appropriate polarizer must be inserted by the user when so required.

HP 8509B only.

`PolDep?`

Not Recommended Command may not be available in future versions. Plan your programming to use the alternate command:

`PolDep:{ JonesData? | PolDepData? }`

`PolDep:{ Absolute | Relative }[?]`

Specifies the type of polarization dependent loss (PDL) measurement. An absolute measurement requires a thrupath calibration prior to the PDL measurement. A relative measurement does not require a thrupath calibration. The query returns `"1"` if the condition is true, `"0"` otherwise.

PolDep:Absolute is HP 8509B only.

`PolDep:Calibrate[A | B | C]`

The command is used for an absolute polarization dependent loss (PDL) measurement. Triggers a measurement-thrupath calibration. If a PDL calibration was previously performed, execute `PolDep:NewThruCal` before `PolDep:Calibrate`. Otherwise the calibration constants will NOT be updated. When optional selections `A`, `B`, or `C` are used, external polarizers are assumed to be used. The user must insert the appropriate polarizer and send a command for each polarizer. The polarizer angles pertaining to each of the three markers (a, b, and c) must be specified using the polarizer command. (See `Polarizer:Angle{ A | B | C }:<Degree value>`.) The `PolDep:NewThruCal` and the `PolDep:Calibrate[A | B | C]` commands are valid only for absolute measurements, that is, when the transmission measurement is either Delta, Max, or Min.

HP 8509B only.

`PolDep:Clear`

Aborts or re-starts a polarization dependent loss measurement process. Any current measurements are cleared. The command does not erase the thrupath calibration corrections from memory.

`PolDep:Done`

Ends a polarization dependent loss (PDL) measurement process. The PDL measurement controls are removed from the screen.

`PolDep:{ Internal | External }[?]`

Specifies whether internal or external polarizers will be utilized in a polarization dependent loss measurement. Internal polarizers are those which are a part of the HP 8509B system. The user must implement and specify external polarizers through the polarizer command. The query returns the selected polarizers.

HP 8509B only.

`PolDep:{ JonesData? | PolDepData? }`

When the mandatory selection is `PolDepData?`, the instrument returns data in one of two ways, depending on whether it is in absolute mode or relative mode.

For absolute measurements the analyzer returns the polarization dependent loss as either Delta, Max, Min.

`delta_transmission, max_transmission, min_transmission`

For relative measurements it returns the polarization dependent loss as Delta.

`delta_transmission`

When the mandatory selection is `JonesData?`, the analyzer returns the Jones matrix as:

`j00.real,j00.imag,j01.real,j01.imag,...,j11.imag`

or

`J00.magnitude,j00.phase,j01.magnitude,j01.phase,...,j11.phase.`

Before sending this command using either selection, be sure that a measurement has been taken. To take a measurement: If the analyzer is in absolute mode, a calibration is performed first using `PolDep:Calibrate[A | B | C ]`. The measurement is performed using `PolDep:Measure[A | B | C ]`. Use optional selection `A`, `B`, or `C` when external polarizers are selected.

`PolDep:{ JonesMode | PolDepMode }[?]`

Selects the data format as polarization dependent loss values or Jones values. This is similar to selecting the option button at the bottom of the window. Use this command to open the `Polarization Dependence` window. The query returns `"1"` if the condition is true, `"0"` otherwise.

`PolDep:{ MagRadians | MagDegrees | RealImag }[?]`

Sets the format of the Jones matrix numerical results to a polar (magnitude and phase) or rectangular (real, imaginary) format. Through this command, the angle of the polar numerical results can be presented either in radians, degrees, or as complex numbers. The query returns "1" if the indicated format is selected, "0" if not selected.

`PolDep:Measure[A | B | C]`

Calculates the polarization dependent loss of a given device under test. The results can be read from the analyzer through the use of the `poldep?` HP-IB remote command. With internal polarizers, the measurement is performed automatically. When optional selections `A`, `B`, or `C` are used, then external polarizers are assumed to be used. The user must insert the appropriate polarizer and send a command for each polarizer. The polarizer angles pertaining to each of the three markers (A, B, and C) must be specified using the polarizer command.(See `Polarizer:Angle{ A | B | C }:<Degree value>`.)

`PolDep:Measure` is HP 8509B only.

`PolDep:NewThruCal`

Clears any current thrupath calibration and begins a new calibration sequence. A calibration must first be done using `PolDep:Calibrate[A | B | C]`. The `PolDep:NewThruCal` and the `PolDep:Calibrate[A | B | C]` commands are valid only for absolute measurements, that is, when the transmission measurement is either Delta, Max, or Min.

HP 8509B only.

`PolDep:ReStart`

Not Recommended Command may not be available in future versions. Plan your programming to use the alternate command:

`PolDep:Clear`

`PolMarker:{ A | B | C }`

Not Recommended Command may not be available in future versions. Plan your programming to use the alternate command:

`PolMarker?:{ A | B | C }`

`PolMarker?:{ A | B | C }`

When using the internal polarizers, the parameters for this command are such that `A` refers jointly to polarizer A and marker A, similarly for parameters `B` and `C`. When the internal polarizers are used, this command inserts the specified polarizer (A for 0 °, B for 60 °, and C for 120 °) at the source output. The marker pertaining to the specified polarizer (A, B, or C) is placed, as observed on the Poincare sphere, at the resulting state of polarization. Command execution also returns the resulting state of polarization in the form of the normalized Stokes parameters S_0, s_1, s_2, s_3.

When external polarizers are used, this command should be executed when the desired state of polarization has been set using an external polarizer. The command execution places the specified marker, as observed on the Poincare sphere, at the resulting state of polarization. The resulting state of polarization is returned as the normalized Stokes parameters S_0, s_1, s_2, s_3.

The main purpose of this command is for use in placing and reading markers when external polarizers are utilized. Specifically, this is done when performing a Jones matrix measurement, a polarization dependent loss measurement, or when the application of a two- or three-point reference frame is required.

`Range:Auto{ ? | :Off | :On }`

Through this command, the range function auto mode is, as specified by the user, turned `On` or `off`. The query returns an ASCII `"1"` if the range function is in auto mode and an ASCII `"0"` if it is not.

`Range:{ Done | Down | Up }`

When the auto function is turned `Off`, the user may, through this command, increase `Up` or decrease `Down` the power measurement range of the HP 8509A/B. (See `Range:Auto{ ? | :Off | :On }`). Using the `Done` parameter closes the `Range` frame in the analyzer window.

`Range{ ? | :<GainValue> }`

The query returns the gain range and the state of the autorange check box in the `Range` frame. “0” = not checked, “1” = checked.

Using `<GainValue>` allows the range to be set and returns an error if autorange is on. The valid values for `<GainValue>` are 0 to 6, where 0 is the highest gain and 6 is the lowest gain. (This corresponds to `Range:{ Done | Down | Up }`). See `Range:Auto:{ Off | On }`.

`RawDat?`

Returns the raw ADC voltages, with offsets subtracted, associated with the four photodiode detectors within the HP 8509A/B receiver. The voltages are returned in terms of a scaled value in the range 0 to 65,535. Each value within that scale is proportionally related to a value from −10 to 10 volts. The subtracted offsets correspond to the voltage values generated by the detectors under zero input conditions. The resulting information can be converted to voltage through the following equation:

rawdat (volts) = (obtained rawdat/65536 * 20) − 10

`RefFrame?`

This command will return information regarding the quality of a currently applied reference frame. If a two-point reference frame has been established, the command will return the polarization angle and a grade for the frame quality. If a three-point reference frame has been established, the command will return the transmission ratio and a grade for the frame quality. The definitions of the returned parameters are provided below:

polarization angle = 90 / (pi * Acos(angle between 2pts))

In the above equation, "angle between 2pts" refers to the angular separation, as observed in the Poincare sphere, between the two state-of-polarization points used to establish the two-point reference frame.

transmission ratio = The ratio of the highest polarization dependent loss to the lowest polarization dependent loss of the thrupath used to establish the three-point reference frame. A small transmission ratio is a desirable result.

The grading system for the applied reference frame is:

* invalid = 0
* very poor = 1
* poor = 2
* fair = 3
* good = 4

`RefFrame:{ Off | On }[?]`

Applies or un-applies a two- or three-point reference frame. (See

`RefFrame:{ 2pt,3pt }[?]`.) If using internal polarizers, the reference frame is set up and applied (or not applied) automatically. With external polarizers, the appropriate markers must first be placed and read using the `PolMarker?:{ A | B | C }` command. The query returns an ASCII `"1"` if the specified function (`Off | On`) is active and a `"0"` is returned if it is not active.

`RefFrame:{ 2pt | 3pt }[?]`

Specifies the type of reference frame to be applied. The query returns an ASCII "1" if the specified function `{ 2pt | 3pt }` is active and a "0" if it is not active. See `RefFrame:{ Off | On }[?]`.

`Save:Config:<"filename">`

Saves the current instrument configuration into the file `<"filename">`. For path information on "filename", see "Command Syntax" at the beginning of this chapter.

`Save:Disper:<"filename">`

Not Recommended Command may not be available in future versions. Plan your programming to use the alternate command:

`Disper:Save:<"filename">`

`Save:Jones:<"filename">`

Not Recommended Command may not be available in future versions. Plan your programming to use the alternate command:

`Save:PolDep:<"filename">`

`Save:PolDep:<"filename">`

Saves a Jones matrix measurement/polarization dependent loss measurement to the file "filename". The file format is:

```
<Absolute Measurement Flag>,<PDL Delta>,<PDL Max>,<PDL Min>
<J00.real>,<j00.imag>
<J01.real>,<j01.imag>
<J10.real>,<j10.imag>
<J11.real>,<j11.imag>
```

Where `<Absolute Measurement Flag>` is "1" if the measurement is absolute and "0" if the measurement is relative. In the case of a relative measurement, `<PDL Max>` and `<PDL Min>` are both "0". For path information on "filename", see "Command Syntax" at the beginning of this chapter.

`Save:Single:<"filename">`

Saves a timed measurement to the "filename". The file format for the data is:

<Wavelength of Source>

<S0, milliWatts>, <S1>, <S2>, <S3>, <DOP %>

.

. (one line for each point)

.

The Stokes parameters are un-normalized. For path information on "filename", see "Command Syntax" at the beginning of this chapter.

`SerialNum?`

Returns the serial number of the HP 8509A/B lightwave polarization analyzer.

`SetMarker:<S0>:<s1>:<s2>:<s3>:{ A | B | C }`

Sets the specified marker to a polarization state given by the normalized Stokes parameters s_1, s_2, s_3 and S_0, the power in milliwatts. The placed marker can be observed on the Poincare-sphere-coordinates pertaining to S_0, s_1, s_2, s_3.

`Single`

Places the `Timed measurement` frame on the analyzer window.

`Single:Done`

Using `Done` closes the `Timed measurement` frame in the analyzer window.

`Single:DBase:Load:<"title">`

Loads a measurement from the current database with the specified title.

`Single:DBase:Save:<"title"> [ :<"date code"> [ :<"serial number">]]`

Saves a measurement to the current database with the specified title.

`Single:Freq{ ? | :<Hertz> }`

Sets the timed measurement sampling frequency to be used. The frequency must correspond to a period with a resolution of 1 millisecond. The query returns the frequency.

`Single:Mode{ ? | :Single | :Timed | :FreeRun }`

Sets the timed measurement mode. The query returns the mode.

`Single:Period{ ? | :<Seconds> }`

Sets the timed measurement period. The query returns the period.

`Single:Points{ ? | :<NumPoints> }`

Sets the number of sample points used in the reading of a timed measurement trace.

`Single:Start`

Triggers the reading of a timed measurement trace.

`Source?`

Upon command reception, the analyzer returns a string which specifies the source settings of the `HP 8509 analyzer` window. In addition, the wavelength, in nm, of the active source is returned. If a source is not currently turned on, the parameter `off` is returned instead of the source wavelength. The string is in the form of:

```
<Name of Laser Source>,{ <Wavelength nm> | off }
```

The names of the laser sources are:

```
Voltage tuned
HP8167A/HP-IB
HP8168A/HP-IB
Internal
Manually tuned
```

Note: The source settings for the analyzer window, the `PMD:JME` window, and the `PMD:WS` window are independently set. When a polarization mode dispersion measurement (PMD) is initiated, the analyzer window inherits the settings of that PMD measurement. The `Source?` command returns the setting of the analyzer window at the time of the command.

`Source:External?`

The analyzer returns the wavelength, in nm, of the currently activated external source for the analyzer window.

`Source:External:{ Off | On }`

Not Recommended Command may not be available in future versions. Plan your programming accordingly.

Specifies the use of an external source and the state `{ Off | On }` of the utilized external source.

DDE only.

Note: The external TLS controlled is the last TLS selected. The LPA will automatically select the Manual TLS as the default unless another TLS (HP-IB controlled HP 8167/8 or Voltage Tuned) has previously been selected.

`Source:External:<Wavelength nm>`

Specifies the external source wavelength. The wavelength should be specified in nm. The settings for all open windows are affected. See Note in `Source:External:{Off|On}` for information on TLS.

`Source:HPIB[?]`

Sets the tunable laser source for the analyzer window to an HP-IB TLS. The HP 8509A/B looks for a tunable laser source at the address specified with `TLS:Address` and uses it if it is either an HP 8167 or HP 8168 tunable laser source. The query returns two parameters.

first: `"0"` (not HP-IB TLS), `"1"` (HP-IB TLS)

second: The name of tunable laser source.

DDE only.

`Source:Hpib:{ Off | On | <Wavelength nm> }`

Specifies the state, `Off | On`, or the wavelength setting of the HP-IB source. When turned on or set using `<Wavelength nm>`, the HP 8509A/B system automatically determines which tunable laser source (HP 8167 or HP 8168) is connected to the HP-IB bus at the address set using `TLS:<HP-IB address>`

DDE only.

`Source:Internal?`

Returns the wavelength, in nm, of the currently activated internal source in the analyzer window.

HP 8509B only.

`Source:Internal:{ Off | 1310 | 1550 }`

Specifies the internal source in the analyzer window. If the parameters `1310` or `1550` are sent, the specified internal source (1310 or 1550 nm) is turned on. If the `off` parameter is sent, any currently active internal source is turned off.

HP 8509B only.

`Source:Manual[?]`

Places the analyzer window in manual control mode. When the instrument is under manual control, the user must set the tunable laser source to the appropriate wavelength for each wavelength point. The query returns two parameters.

first: `"0"` (not manually tuned), `"1"` (manually tuned)

second: The type of optical-source-setup source.

`Source:Shutter?`

Returns an ASCII `"1"` if the shutter is currently activated (on) and returns an ASCII `"0"` if the shutter is not activated (off). See `Source:Shutter:{ Off | On }`.

HP 8509B only.

`Source:Shutter:{ Off | On }`

This command controls the shutter located in the path to the optical output port of the HP 8509A/B. The two HP 8509A/B internal sources and any external source coupled into the external source port of the HP 8509A/B share a common instrument internal path to the optical output port of the HP 8509A/B. By sending the parameter `on`, a shutter in the path to the optical output port can be activated so that the source output is blocked. The shutter can also be removed by sending the parameter `off`.

HP 8509B only.

`Source:VTune[?]`

Sets the `Optical Source Setup` source selection to VTune in order to control a VTUNE tunable laser source. The query returns two parameters.

first: `"0"` (not VTUNE), `"1"` (VTUNE)

second: The type of optical-source-setup source.

`Source:VTune:{ Start | Stop }{ ? | :<Voltage> }`

The VTUNE start or stop voltage. The query returns the voltage value, the parameter `<Voltage>` sets the value. The settings for the analyzer window is affected if not a query. The query returns settings for the analyzer window.

`Status?`

This command waits until all previous commands have executed and then returns the status of the last command. In this way it is similar to `*OPC?`. Append the `Status?` command to the command whose status is requested (separate the commands with a semicolon). If `Status?` returns either "FAIL" or "PROBLEMS", then a description of the problem may follow the return value. Return values are:

`"PASS"`	- Command successful.
`"FAIL" <Optional Description>`	- Command failed.
`"PROBLEMS" <Optional Description>`	- Errors occurred during execution.
`"UNKNOWN"`	- Command not recognized.

`Stokes:<NumPoints>`

Not Recommended Command may not be available in future versions. Plan your programming to use the alternate command:

`Stokes?:<NumPoints>`

`Stokes?:<NumPoints>`

Measures the input signal and returns degree of polarization (DOP) and Stokes parameter test data in the form of S_0, s_1, s_2, s_3, DOP. The measurement is made by averaging over "npnts" points. S_0 is linear power (milliwatts), s_1, s_2, s_3 are the normalized Stokes parameters (range $+1.0$ to -1.0), and DOP is the degree of polarization (range 0 to ~1.2).

TLS?

Returns the name of the current tunable laser source. Valid return values are:

Voltage tuned

HP8167A/HP-IB

HP8168A/HP-IB

Manually tuned

Unknown

TLS:Address{ ? | :<HP-IB Address> }

This setting is used for all windows. The HP-IB address of a tunable laser source on the HP-IB bus.

DDE only.

TLS:Isc{ ? | :<HP-IB card ISC> }

This setting is used for all windows. The ISC of the HP-IB card installed in the HP 8509A/B Vectra PC.

DDE only.

TLS:Power{ ? | :<Power> }

This setting is used for the analyzer window only. The power setting of the HP-IB tunable laser source. The units are set in TLS:Unit:<units>.

DDE only.

TLS:{ SettlePoint | SettleStart }{ ? | :<Millisec's> }

Not Recommended Command may not be available in future versions. Plan your programming to use the alternate command:

Disper:Settle{ Point | Start }{ ? |:<Millisec's> }

DDE only.

`TLS:Power:Unit{ ? | :dBm | :Watt }`

The units of power for the HP-IB tunable-laser-source power. This setting is used for the `analyzer` window only. See also: `Disper:Power:{ dBm | uWatt }[:<value>]` and `WaveScan:Power:{ dBm | uWatt }[:<value>]`. If the power setting is not valid for the TLS, the command fails.

DDE only.

`Trace:Points:<NumPoints>`

Not Recommended Although this command was documented for Version 1.x code, it was never implemented. This command is NOT VALID. Command will not be available in future versions. Plan your programming to use the alternate command:

`Single:Points{ ? | :<NumPoints>}`

`Version?`

Returns the current version number of the HP 8509A/B software.

`WaveScan[?]`

Shows the `PMD:WS` window on the display. Be sure to send 'WaveScan' before sending any other 'WaveScan: ... ' commands. The query returns the polarization mode display (PMD) values of the measurement as follows:

Current wavelength (nm), Total PMD, PMD for s_1, PMD for s_2, PMD for s_3

Note: The running totals are returned. The measurement may not be complete.

`WaveScan:Analysis?`

Returns the type of analysis used to calculate the polarization mode display (PMD). Valid values are:

`Peaks,FullScan`

`Peaks,FirstToLast`

`Extrema,FullScan`

`Extrema,FirstToLast`

`WaveScan:Analysis:{ Extrema | Peaks }:{ FullScan | FirstToLast }`

Sets the type of analysis to use in calculating the polarization mode dispersion (PMD).

`WaveScan:Atten{ ? | :<dBm value> }`

The attenuation for the HP-IB tunable laser source. The query returns the attenuation in dBm. Using `<dBm value>` sets the attenuation for an HP-IB tunable laser source. If the attenuation setting is not valid for the TLS, the command fails.

DDE Only.

`WaveScan:Clear`

Aborts a PMD:WS measurement process. This command is valid only if the optical source is set to Manual.

`WaveScan:Close`

Closes the `PMD:WS measurement` window. The PMD:WS measurement process is ended.

`WaveScan:DBase:Load:<"title">`

Loads a measurement from the current database using the specified title.

`WaveScan:DBase:Save:<"title"> [ :<"date code"> [<"serial number"> ]]`

Saves a measurement to the current database using the specified title.

`WaveScan:Feature{ ? | :<Min Feature Size> }`

The query returns the minimum size of features (maxima and minima) that are considered for the analysis type selected. The query returns the value for the minimum size of features.

`WaveScan:FiberLen{ ? | :<km> }`

The query returns the length of optical fiber used to normalize PMD:WS measurements. Using `<km>` sets the length of optical fiber.

`WaveScan:Hpib[?]`

Sets the tunable laser source for a PMD:WS measurement to an HP-IB tunable laser source. The HP 8509A/B looks for a tunable laser source at the address specified with `TLS:Address` and uses it if it is either an HP 8167 or HP 8168 tunable laser source. Be sure that the wavelength range is set correctly for the connected HP-IB tunable laser source before issuing this command. To change tunable laser source selections between HP 8167 and HP 8168:

1. Issue the command `WaveScan:Manual`
2. Change the wavelength range using `WaveScan:WLen:`
3. Change the HP-IB address using `TLS:Address:<HP-IB Address>`
4. Issue the command `WaveScan:HPIB`

The query returns an ASCII "1" if the PMD:WS next measurement process will be in HP-IB mode and a "0" if it will not be in this mode. Also returns the name of the current laser source.

DDE Only.

`WaveScan:Manual[?]`

Places the PMD:WS measurement in manual control mode. When the instrument is under manual control, set the tunable laser source to the appropriate wavelength for each wavelength point between the start and stop wavelengths. The query returns two parameters. In manual control mode, send the command "WaveScan:Measure" once to begin the measurement process and once for each wavelength point as returned by the command "WaveScan:WLen:Points?"

The query returns an ASCII "1" if the PMD:WS next measurement process will be in MANUAL mode and a "0" if it will not be in this mode. Also returns the name of the current laser source.

`WaveScan:Measure`

Initiates a PMD:WS measurement. If the tunable laser source is "Manually Tuned", then send this command for each point in the wavelength range.

`WaveScan:Mode{ ? | :<Mode Constant> }`

The Mode Calculation Constant (k) is set or queried.

`WaveScan:PmdResult{ ? | :Avg | :Max | :Median}`

The PMD:WS total is calculated in one of three different ways, using the average, maximum, or median value of the polarization mode display (PMD) values calculated for the s_1, s_2, and s_3 traces. This command selects the type of PMD total to calculate. the query returns the type of PMD result.

`WaveScan:Polarizer{ ? | :A | :B | :C | :None }`

The internal polarizer to insert before starting the PMD:WS measurement. The query returns the selected polarizer.

HP 8509B Only

`WaveScan:Power?`

Returns the power and the power units for the tunable laser source.

DDE Only.

`WaveScan:Power:{ dBm | uWatt }[:<value>]`

Sets the power units for the tunable laser source (TLS). If the `<value>` parameter is specified, the power setting can also be changed. If the power setting is not valid for the TLS, the command fails.

Note: When changing only the units, the numerical value of the power does not change. Be sure to change the value of the power to correspond to the new units.

DDE Only.

`WaveScan:Save:<"filename">`

Saves a PMD:WS measurement trace into the file `<"filename">`. The trace is saved as a series of ASCII strings separated by commas. The each line of the saved trace information is in the form of:

Wavelength_1, Power(dBm), s_1, s_2, s_3, DOP(%)

.

.

.

Wavelength_n, Power(dBm), s_1, s_2, s_3, DOP(%)

The above is for the dispersion measurement at "n" user defined wavelengths. The Stokes parameters are normalized. For path information on "filename", see "Command Syntax" at the beginning of this chapter.

`WaveScan:Settle:{ Point | Start }{ ? | :<Delay msec> }`

The settling time to wait, either initially (Start) or per point (Point), after setting a tunable laser source to the desired wavelength in the sweep range during a PMD:WS measurement. The query returns

the current value. See also: `Disper:Settle:{ Point | Start }{ ? | :<Millisec's> }`

`WaveScan:Units:{ ? | :ps | :ps/L | :ps/sqrtL }`

The units to use in PMD:WS measurements. The query returns the selected units.

`WaveScan:VTune[?]`

Sets the `Optical Source Setup` source selection to VTune in order to control a VTUNE tunable laser source.

The query returns an ASCII "1" if the PMD:WS next measurement process will be in VTUNE mode and a "0" if it will not be in this mode. Also returns the name of the current laser source.

`WaveScan:VTune: { Start | Stop }{ ? | :<Voltage> }`

The VTUNE start or stop voltage. The query returns the voltage value, the parameter <Voltage> sets the value.

`WaveScan:WLen?`

Returns the next wavelength (in nm) at which the PMD:WS measurement will be conducted. This command is typically used only when the tunable laser source is "Manually Tuned".

`WaveScan:WLen:{ Start | Stop | Delta }{ ? | :<Wavelength nm>}`

Specifies the Start, Stop, or Delta wavelengths for the PMD:WS measurement. Changing any of these values causes the number of points to change according to:

WLenPoints = ((WLenStop − WLenStart) / WLenDelta) + 1

The query returns the value of the setting in nanometers. Using the `<Wavelength nm>` parameter sets the value.

Note: The `Start` and `Stop` values can never have the same value. For example, when segmenting a wavelength range over several measurements and sweeping from low to high, always issue the command `WaveScan:WLen:Stop` before the command `WaveScan:WLen:Start` when specifying the next wavelength segment. This will prevent the `Start` and `Stop` values from being equal when switching from one segment to the next.

`WaveScan:WLen:Points{ ? | :<NumPoints> }`

Sets the number of points between the start and stop wavelengths for the polarization mode display (PMD) measurement. Each point corresponds to a wavelength for PMD measurement. If the number of points does not correlate with the delta value and the start and stop wavelengths, the delta value is reset to accommodate the number of points according to:

WLenDelta = (WLenStop − WLenStart) / (WLenPoints − 1)

The query returns the number of points specified in the current PMD:WS measurement settings.

`Zero`

Causes the measurement offsets to be referenced as a zero measurement state. The measurement offsets correspond to the voltages generated by the receiver photodiodes under a zero input condition. A zero valued measurement state can thus be established by the user at any time during a measurement process.

9

Example Programs

The example programs are provided on two disks that are included with the *HP 8509 User's/Reference Guide.* The programs on these disks demonstrate the exact executable syntax of the code. One disk is in DOS format and the other is in LIF format. The DOS formatted disk is for system operation with Windows. There are example programs on the DOS disk for controlling the HP 8509. One example illustrates remote operation of the HP 8509 over the HP-IB bus. This program is written using HP IBasic for Windows and runs on a PC configured as an HP-IB controller and connected to the HP 8509 via the HP-IB bus. Another example illustrates remote operation of the HP 8509 using Windows DDE on the HP 8509 Vectra PC. This program is written using VisualBasic for Windows and runs simultaneously with the HP 8509 software on the HP 8509 Vectra PC. The LIF formatted disk is for system operation under HP BASIC running in an HP 9000 series 200/300 external controller.

Artisan Technology Group is an independent supplier of quality pre-owned equipment

Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP