

Agilent
3.125 Gb/s Serial BERT
N5980A

Programming Guide

Notices

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Safety Summary

General Safety Precautions

The following general safety precautions must be observed during all phases of operation of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument.

Agilent Technologies Inc. assumes no liability for the customer's failure to comply with these requirements.

Before operation, review the instrument and manual for safety markings and instructions. You must follow these to ensure safe operation and to maintain the instrument in safe condition.

General

This product is a Safety Class 1 instrument (provided with a protective earth terminal). The protective features of this product may be impaired if it is used in a manner not specified in the operation instructions.

All Light Emitting Diodes (LEDs) used in this product are Class 1 LEDs as per IEC 60825-1.

Environment Conditions

This instrument is intended for indoor use in an installation category II, pollution degree 2 environment. It is designed to operate at a maximum relative humidity of 95% and at altitudes of up to 2000 meters.

Refer to the specifications tables for the ac mains voltage requirements and ambient operating temperature range.

Before Applying Power

Verify that all safety precautions are taken. The power cable inlet of the instrument serves as a device to disconnect from the mains in case of hazard. The instrument must be positioned so that the operator can easily access the power cable inlet. When the instrument is rack mounted the rack must be provided with an easily accessible mains switch.

Ground the Instrument

To minimize shock hazard, the instrument chassis and cover must be connected to an electrical protective earth ground. The instrument must be connected to the ac power mains through a grounded power cable, with the ground wire firmly connected to an electrical ground (safety ground) at the power outlet. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury.

Do Not Operate in an Explosive Atmosphere

Do not operate the instrument in the presence of flammable gases or fumes.

Do Not Remove the Instrument Cover

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made only by qualified personnel.

Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel.

Safety Symbols on Instruments



Indicates warning or caution. If you see this symbol on a product, you must refer to the manuals for specific Warning or Caution information to avoid personal injury or damage to the product.



Notice for European Community: This product complies with the relevant European legal Directives: EMC Directive 89/336/EEC and Low Voltage Directive 73/23/EEC.



General Recycling Mark for plastic parts used in the product.

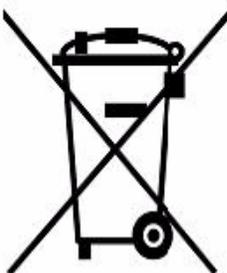


Safety requirements for electrical equipment for measurement, control, and laboratory use CAN/CSA C22.2 No. 1010.1 (1993) UL 3101, 3111 (First Editions). This equipment has also been evaluated to IEC 61010 edition 1 including amendments 1 and 2.



Conformity Mark of the Australian ACA for EMC compliance.

Environmental Information

 	<p>This product complies with the WEEE Directive (2002/96/EC) marking requirements. The affixed label indicates that you must not discard this electrical/ electronic product in domestic household waste.</p> <p><i>Product Category: With reference to the equipment types in the WEEE Directive Annex I, this product is classed as a "Monitoring and Control instrumentation" product.</i></p> <p>Do not dispose in domestic household waste.</p> <p>To return unwanted products, contact your local Agilent office, or see www.agilent.com/environment/product/ for more information.</p>
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1 Introduction

Introduction

This document provides the information you need for remote programming the N5980A Serial BERT.

Communication Overview

To communicate with the N5980A Serial BERT from a remote computer, you have to connect the USB port on the rear of the instrument to a USB port of your PC.

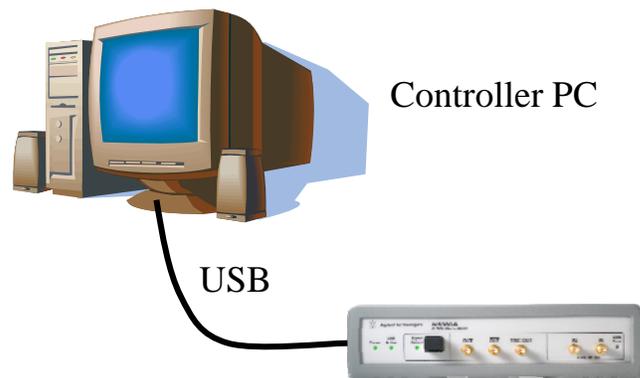


Figure 1: N5980A Serial BERT setup diagram

Note: the N5980A Serial BERT does not have a LAN or a GPIB interface.

**Agilent I/O
Libraries**

To communicate with the N5980A Serial BERT, you do not need the Agilent I/O Libraries! The communication with the instrument is not done using the VISA libraries.

The remote access can only be done by directly using Windows Sockets.

The N5980A Serial BERT is not visible with the Agilent Connection Expert, i.e. it does not provide USB API programming through or with the Agilent IO Libraries!

Because the N5980A Serial BERT does not use the Agilent IO Library infrastructure you cannot use e.g. the VISA Assistant or the Interactive IO program to send SCPI commands to the instrument.

Please refer to the Sample Code in the enclosed examples to control the N5980A from within a remote program.



2 Programming Basics

SCPI Compatibility

The SCPI commands represent the instrument's advanced analysis, and pattern generation features that can be controlled from within the remote programs.

The N5980A Serial BERT is not fully SCPI1997 standard compliant. The remote programming language is close to SCPI. The instrument does not have full featured SCPI parser.

The missing standard SCPI features are:

- Status handling/registers
No commands are available to query or set the status of the instrument.
- Support of short and long form of SCPI commands
Commands may only sent in the exact format given below.
Example: `:SOUR1:PATT PRBS7`
You may not use: `:SOURce1:PATTern PRBS7`
- There are no default suffixes
You always have to add the suffix to the command
Example: `:SOUR1:PATT?`
You may not omit the "1" in "SOUR1".
- Multiple SCPI commands in one line
You always have to specify the full command.
SCPI standard allows: `:SOUR1:PATT PRBS7;EADD ONCE`
N5980A needs: `:SOUR1:PATT PRBS7; :SOUR1:PATT:EADD ONCE`
The commands must always be complete, even for the second parameter that belongs to the same root node inside a transaction.
- Only a few of the standard SCPI commands are available, e.g. `*OPC` is missing.

Please refer to the Sample Code in the enclosed examples to control the N5980A from within a remote program.

**Remote Access
Using Windows
Sockets**

The N5980A Serial BERT does not use the Agilent IO Library infrastructure. You therefore cannot send SCPI commands to the instrument using that infrastructure (e.g. with the VISA Assistant or the Interactive IO program).

However, you can send the commands “directly”. You have to send them directly to the IP address (and a certain port number) of the PC that is controlling the N5980A Serial BERT.

The software controlling the N5980A Serial BERT will receive the commands and forward them to the USB interface the Serial BERT is connected to.

In other words the N5980A Serial BERT software (running on the PC that is controlling the instrument) acts as “gateway”: it receives the commands over the network and forwards them to the Serial BERT via the USB interface.

As a consequence the remote programming software needs to take the SCPI commands and send them to the IP address (and a certain port number) of the PC that is controlling the N5980A Serial BERT.

The remote programming software will do this using Windows Sockets.

The details will be shown in the examples below and in the Sample Code in the enclosed examples.



3 Setting Up The Environment

Introduction

This section describes step by step the setup required to programmatically access the N5980A Serial BERT.

Controller PC Requirements

The N5980A Serial BERT software runs on a controller PC which is connected to the instrument using an USB link.

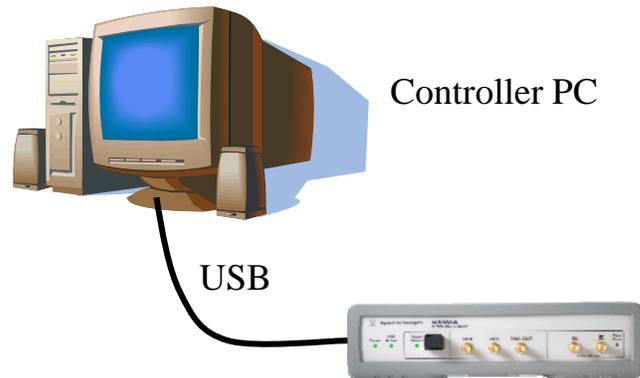
The PC has to meet the following requirements:

- Pentium III with > 450 MHz
- Minimum RAM: 256 MB
- 20 MB of free disk space
- Operating System:
 - Windows 2000 SP4
 - Windows XP SP2
- Microsoft .NET 2.0 Framework
(If the .NET 2.0 Framework is not already installed, download it from the Microsoft Download Center or alternatively execute the program `dotnetfx.exe` that is included on the installation CD).

Connect The Instrument

Connect the Serial BERT:

- Connect the power cord at the rear panel Power In connector
- Connect the instrument to the controller PC via USB using the USB connector at the rear panel as shown in the following picture



Check the green Power LED at the front panel.

Install User Software

For a detailed description of the User Software installation please check the N5980A User Guide (page12ff). The following list only is a brief summary:

- Insert the CD
- Start setup.exe
- The installer will guide you through the installation process.
- The installer checks the installation of the Microsoft .NET 2.0 Framework.
- By default the program will install to:
C:\Program Files\Agilent\N5980A\

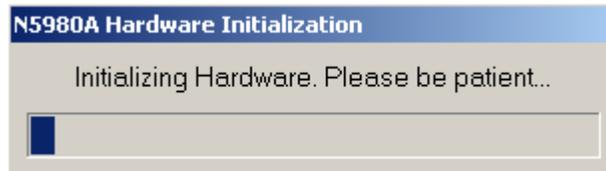
Check The Setup

Now verify your setup by starting the N5980A Serial BERT software:

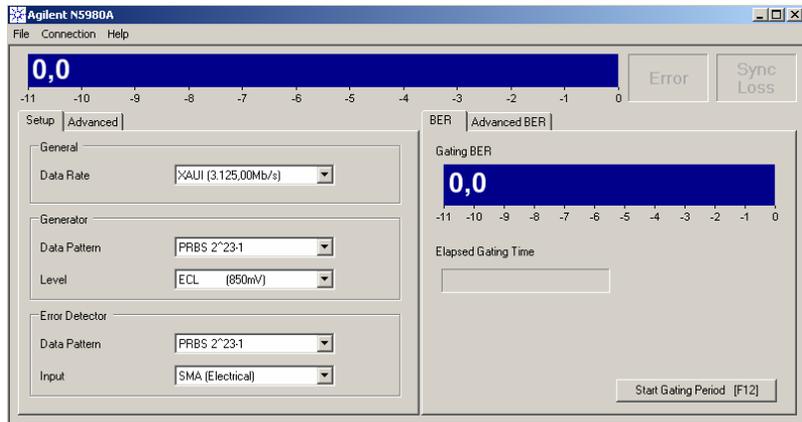
- Launch the program (Go to Program File and click on N5980A as described in the N5980A User Guide on page 14)



- The hardware initialization takes between 3 and 5 minutes. The following picture is shown:



- Upon completion of Hardware Initialization, the User Interface starts and the following window appears:



- Please also check the red USB Active LED at the front panel.

Please refer to the User Guide (page 16) on how to operate the N5980A User Interface.



4 A Typical Remote Program

Introduction

This section shows and explains a typical remote program written in Visual Basic 2005.

Before You Begin

As already mentioned in chapter 2 “Programming Basics” on page 8, the User Software of the N5980A acts as “gateway” between the remote program (LAN) and the instrument (USB). This implies the following:

- The User Software with the user interface on the controller PC must be running if you want to do remote programming with the N5980A. It acts as a gateway: it receives remote programming commands via LAN and forwards them over USB.

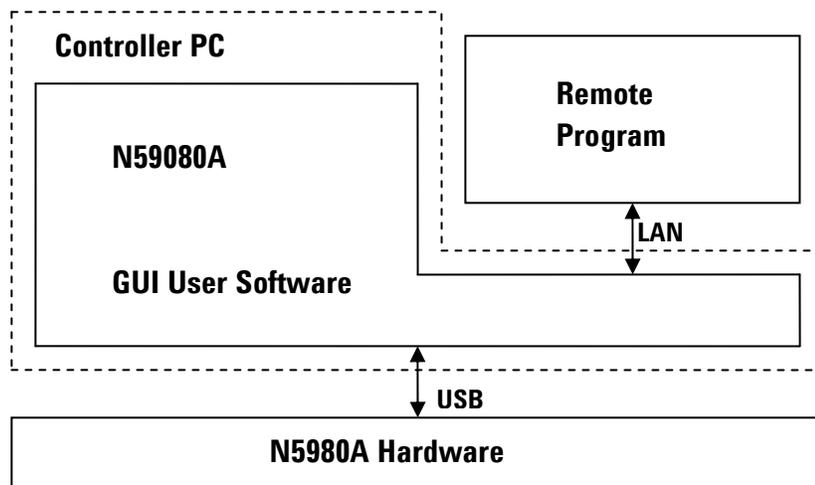


Figure 2: How does the remote program connect to the instrument?

- Your remote program may be running on the controller PC, but it can run on any other PC in the network. Therefore the following 2 principal setups are possible:

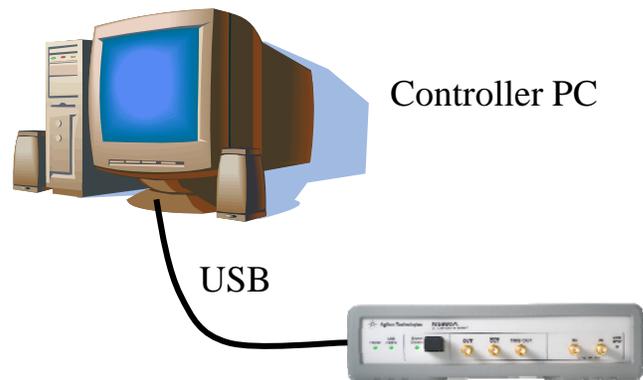


Figure 3: N5980A User Software and Remote Program run on the same PC

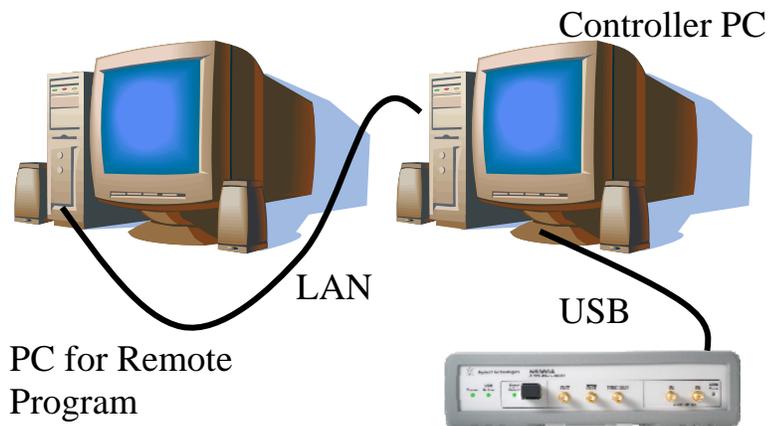


Figure 4: User Software and Remote Program run on different PCs

Example Program On your CD in the directory `Programming Examples\MyN5980AExample_VB` there is an example in Visual Basic 2005.

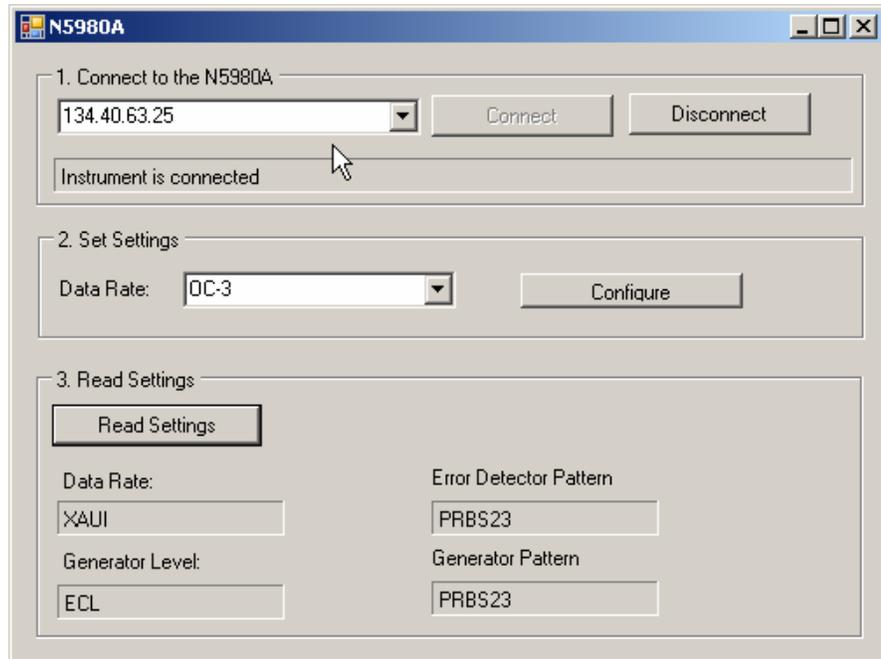


Figure 5: Visual Basic 2005 Example Program

At the top you can enter the IP address of the controller PC and press Connect. You then can set that Data Rate and at the bottom you can press a button to read settings of the N5980A.

Program Structure

Besides the code that is handling the buttons and fields of the form in Figure 5 there are the following core methods:

- **Connect**
This method connects the remote program to the User Software on the control PC. Key parameters are the IP address and the port number (Default: 5025).
- **Disconnect**
This method closes the network connection.
- **SendCommand**
This method takes a SCPI command that is contained in the input parameter “scpi_string” and sends it over the network stream to the User Software running on the Controller PC.
In case the SCPI command is query then the method picks up the response and returns it to the caller.

A Visual Basic 2005 program needs the following references:

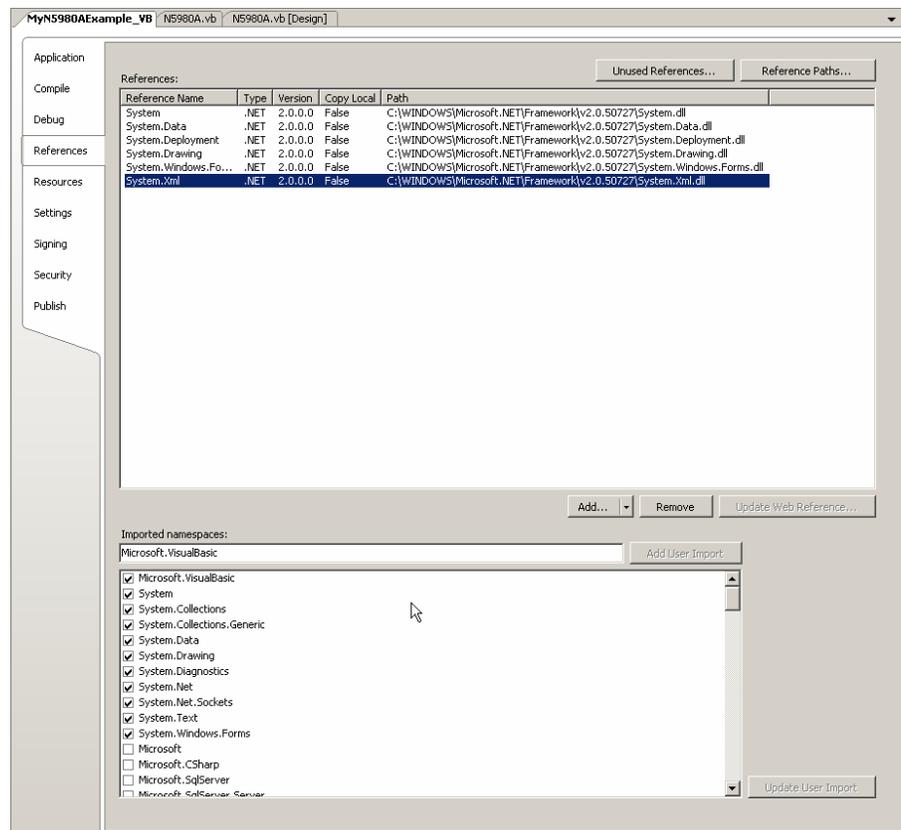


Figure 6: Required References of a Visual Basic 2005 Program

Other Example Programs

There are further example programs included on your CD:

- **C#:** **directory:**
 Programming Examples\MyN5980AExample_Csharp
- **VB:** **directory:**
 Programming Examples\MyN5980AExample_VB
- **LabVIEW** **directory:**
 Programming Examples\MyN5980AExample_LabVIEW
- **Agilent VEE** **directory:**
 Programming Examples\MyN5980AExample_VEE



5 SCPI Command Reference

Introduction

Please refer to the N5980A User Guide for the complete SCPI command reference of the N5980A. In this document there is only a very brief summary.

The SCPI commands can be subdivided into the following command sets:

- SCPI Common Commands

This is a common command set. It contains general housekeeping commands. The common commands are always headed by an asterisk. A typical example is the reset command: *RST. The standard command set also contains query commands. Query commands always end with a question mark.

Note: The N5980A is not fully SCPI1997 Standard compliant! Only a subset of the required command set is supported.

- SCPI Instrument Control Commands

The N5980A does not feature a fully standard compliant SCPI parsers. Therefore a number of restrictions apply:

- Status handling/registers

No commands are available to query or set the status of the instrument.

- Support of short and long form of SCPI commands

Commands may only sent in the exact format given below.

Example: :SOUR1:PATT PRBS7

You may not use: :SOURce1:PATTern PRBS7

- There are no default suffixes

You always have to add the suffix to the command

Example: :SOUR1:PATT?

You may not omit the "1" in "SOUR1".

- Multiple SCPI commands in one line

You always have to specify the full command.

SCPI standard allows: :SOUR1:PATT PRBS7;EADD ONCE

N5980A needs: :SOUR1:PATT PRBS7; :SOUR1:PATT:EADD ONCE

The commands must always be complete, even for the

second parameter that belongs to the same root node inside a transaction.

- Only a few of the standard SCPI commands are available, e.g. *OPC is missing.

Brief Summary Of SCPI Common Commands

The following common commands are supported by the N5980A:

- Read identification string from the instrument
 - *IDN?
- Returns 1 when all pending commands have been executed.
 - *OPC?
- Reports all instrument options.
 - *OPT?
- Resets the instrument to factory default settings
 - *RST
- Performs the instrument self test.
 - *TST?

For further details please refer to the N5980A User Guide.

Brief Summary Of SCPI Instrument Commands

The following common commands are supported by the N5980A:

- **Setting of the Data Rate**
 - :FREQ?
 - :FREQ
- **Storing and recalling instrument setting**
 - :MMEM:STOR:STAT
 - :MMEM:LOAD:STAT
- **Read the error queue**
 - :SYST:ERR?
- **SMA Output (Electrical Generator):**
 - :SOUR1:PATT

- :SOUR1:PATT?
 - :SOUR1:PATT:EADD
 - :SOUR1:PATT:EADD:RATE?
 - :SOUR1:PATT:EADD:RATE
 - :SOUR1:VOLT
 - :SOUR1:VOLT?
- **SFP Output (Optical Generator)**
 - :SOUR2:PATT
 - :SOUR2:PATT?
 - :SOUR2:PATT:EADD
 - :SOUR2:PATT:EADD:RATE
 - :SOUR2:PATT:EADD:RATE?
- **Trigger Output**
 - :SOUR3:PATT?
 - :SOUR3:PATT
- **Error Detector**
 - :SENS1:SYNC:TYPE
 - :SENS1:SYNC:TYPE?
 - :SENS1:PATT?
 - :SENS1:GATE:PER
 - :SENS1:GATE:PER?
 - :SENS1:FETC:ECO?
 - :SENS1:FETC:ECO:DELT?
 - :SENS1:FETC:ERAT?
 - :SENS1:FETC:ERAT:DELT?
 - :SENS1:INP :SENS1:INP?
 - :SENS1:GATE:STAT
 - :SENS1:GATE:STAT?

(FAQ)



6 Frequently Asked Questions (FAQ)

Introduction

The following chapter contains a list of frequently asked questions and answers.

Frequently Asked Questions (FAQ)

Question: Can I connect more than one N5980A Serial BERT to my Controller PC?

Answer: No, it is only possible to connect one N5980A per Controller PC.

Question: Do I see the N5980A using the Agilent Connection Expert?

Answer: The User Software of the N5890A does not use the Agilent IO Libraries and infrastructure to communicate with the N5980A hardware. As a consequence the N5980A is not visible with the Agilent Connection Expert.

Question: Can I use the VISA Assistant or the Interactive IO utility that comes with the Agilent IO Libraries to test the connection to my N5980A?

Answer: Since the N5980A does not use the Agilent IO Libraries infrastructure it is not possible to use neither the VISA Assistant nor the Interactive IO utility. The N5980A is invisible for both tools.

Question: Are there IVI-COM drivers available for my N5980A?

Answer: There is no IVI-COM driver available and currently there are no plans to develop an IVI-COM driver.

Question: Why do I have to start and run the N5980A User Software when I want to access the instrument via remote programming?

Answer: It is necessary to run the User Software on the Controller PC while doing remote programming. The User Software functions as a “gateway” between the network (LAN) the remote programming connects to and the N5980A, that is connected via USB to your Controller PC. This is also the case when your remote program runs on the Controller PC. You always must have the User Software running.

Question: Is it possible to follow the changes my remote program is doing?

Answer: Changes in the settings of the N5980A done by a remote program are reflected in the GUI, i.e. if the remote program selects a new data rate, it is possible to see this in the User Software that is running on the Controller PC.

Question: Can I write and test my remote program without having a physical instrument available?

Answer: Yes, this is possible. When there is no instrument connected to the Controller PC and the User Software is started it enters a so-called “off-line” mode, which allows the demonstration of the instrument. The software acts as if there was an instrument connected. You can write and test your remote program using the User Software running in “off-line” mode. However, there are some obvious limitations to the setup, e.g. you cannot make any real measurements for which you need real hardware.

Question: Is it possible to use LabVIEW or Agilent VEE to remotely control the N5980A?

Answer: Yes you can use both programming languages. There are example programs that come with the N5980A.