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# DGD Generator DGD-1000

Instruction Note

July 30, 2019





## **Table of Contents**

<b>1. Specifications .....</b>	<b>3</b>
<b>2. Overview.....</b>	<b>4</b>
<b>3. Device Description .....</b>	<b>5</b>
<b>3.1. Front Panel .....</b>	<b>5</b>
<b>3.2. Rear Panel .....</b>	<b>7</b>
<b>4. Operation Instructions .....</b>	<b>8</b>
<b>4.1. Unpacking.....</b>	<b>8</b>
<b>4.2. Setup.....</b>	<b>8</b>
<b>4.3. Polarization Alignment .....</b>	<b>9</b>
<b>4.4. Remote Control .....</b>	<b>10</b>
<b>4.4.1. Command List.....</b>	<b>10</b>
<b>4.4.2. USB Setup .....</b>	<b>15</b>
<b>4.4.3. Ethernet Setup .....</b>	<b>15</b>
<b>4.4.4. GPIB Setup.....</b>	<b>16</b>
<b>4.4.5. Control Software.....</b>	<b>18</b>
<b>4.4.5.1. Software Installation .....</b>	<b>18</b>
<b>4.4.5.2. Software Interface .....</b>	<b>19</b>
<b>4.5. Troubleshooting.....</b>	<b>27</b>

## 1. Specifications

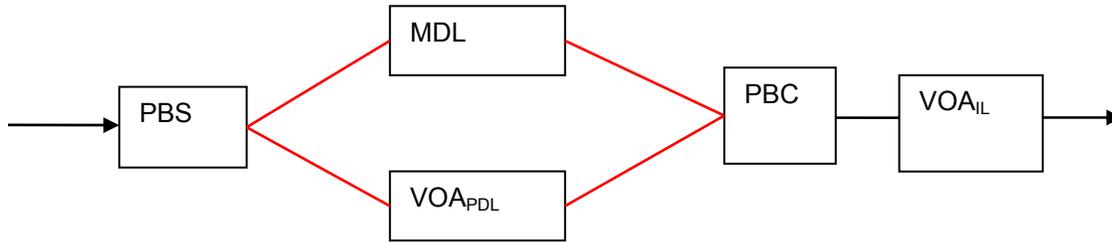
Wavelength Range	Single band: C band, L band, or O band Dual band: CL
DGD Range	0 to 200 ps or 0 to 400 ps
DGD Resolution	0.2 ps
DGD Accuracy <sup>1</sup>	± (0.2 + 2% of DGD) (ps)
DGD Repeatability <sup>1</sup>	± (0.2 + 2% of DGD) (ps)
DGD Change Rate	Up to 64 ps/s
IL	≤3.5 dB
PDL	≤0.3 dB
Return Loss	>50 dB
Optical Power Handling	>300 mW
Input/Output Fiber Type	SMF-28
Optical Connector Type	FC/APC, FC/PC, SC/APC, OR SC/PC
Operating Temperature	0 to 40 °C
Storage Temperature	-20 to 60 °C
Power Supply	100 – 240 VAC, 50 – 60 Hz
Communication Interfaces	USB, GPIB and Ethernet
Dimensions	2U, 19" ¼ rack width 14" (L) x 14" (W) x 3.5" (H)

**Notes:**

1. At 23 ± 5°C.

## 2. Overview

The DGD-1000 is an instrument designed to generate specific values of differential group delay (DGD), the relative delay between orthogonal polarization components of light, with no second order polarization mode dispersion (PMD). It generates DGD by splitting the input light into its orthogonal polarization components and adding a variable delay to one branch before recombination.



**Figure 1 Schematic diagram of DGD-1000**  
Red = PM fiber, black = SM fiber

Figure 1 shows a schematic diagram of the DGD-1000. The input light first passes through a polarization beam splitter (PBS), which splits it into two orthogonal polarization components. One branch includes a motorized delay line (MDL), which is used to control the relative delay between the two polarization components to generate the specified amount of DGD. The other branch includes a variable optical attenuator (VOA) that is used to balance the loss in the two branches such that the polarization dependent loss (PDL) seen by the input signal is minimized. The two polarization components are recombined by a polarization beam combiner (PBC). Finally, the recombined light passes through a second VOA, which is used to control the overall insertion loss (IL) of the instrument such that the IL is independent of DGD setting.

Both VOAs are factory calibrated to minimize PDL and balance IL at all wavelength and DGD settings. However, the user has the ability to manually add an offset to both VOA settings. This feature can be used both to compensate for drift that can occur over time, and for input polarization alignment, as will be discussed later.

### 3. Device Description

#### 3.1. Front Panel

The front panel of the DGD-1000 is shown in Figure 2.



**Figure 2 DGD-1000 front panel**

Front panel features:

- Power: Power on/off switch
- Input: Adapter for optical fiber input
- Output: Adapter for optical fiber output

#### Fiber Connectors

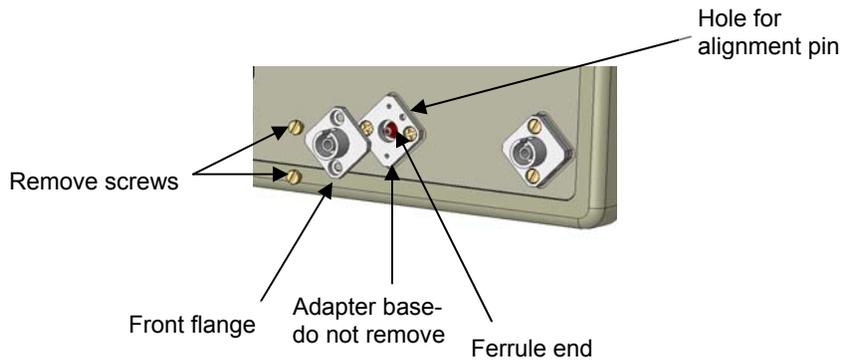
The DGD-1000 has two fiber connectors on the front panel to accommodate the input and output optical beams. The front panel adapters are universal connector interfaces (UCI), which feature a male-type adapter top piece that can be removed for direct access to the ferrule end for routine cleaning and maintenance without removing the entire adapter from the panel. This feature helps avoid high insertion loss, high return loss and measurement instability caused by dirty or contaminated connectors. In addition, the DGD-1000's universal interchangeable adapter allows the user to switch to ST, SC, or FC connectors without opening the instrument panel. Although the DGD-1000 is shipped with a customer specified fiber adapter, other interchangeable inserts are available. For additional information on different input fiber adapter inserts, please contact General Photonics.

External fiber connectors should be cleaned using industry standard cleaning methods before connection to the DGD-1000. If this procedure is followed before each connection, the instrument's internal connector ferrules should not need regular cleaning. However, high insertion loss or measurement instability that does not improve after cleaning the external connectors may indicate that the instrument's internal connector ferrules require cleaning.

#### Ferrule Cleaning Procedure

Each connector ferrule is contained in a universal connector interface consisting of a front piece that connects to the external fiber connector, and a base piece that is mounted on the front panel of the instrument, as shown in Figure 3. To clean a connector ferrule, first, make sure no external

connector is connected to the universal connector interface. Then, using a Phillips screwdriver, remove the two small screws connecting the front and back parts of the adapter, and carefully pull the front flange straight out. (Note: never remove the adapter base from the front panel). The ferrule end should now be exposed. Clean the ferrule using standard cleaning procedures (compressed air or a fresh lint-free tissue and alcohol or other connector-cleaning solvent), taking care to avoid scratching the ferrule surface. Finally, replace the front flange (position it so that the key notch faces up, and the small alignment pin lines up with the hole in the base piece, before pushing it in) and the screws. For frequent measurements, we recommend that the user prepare a patch cord fiber to avoid wear on the internal connector.



**Figure 3 Diagram of universal connector interface**

### 3.2. Rear Panel

The AC power plug, fuse, and communication interface connectors are mounted on the rear panel, as shown in Figure 4.

The DGD-1000 includes USB, Ethernet, and GPIB interfaces for external computer operation of the system. A command list and a LabView based control program are provided.

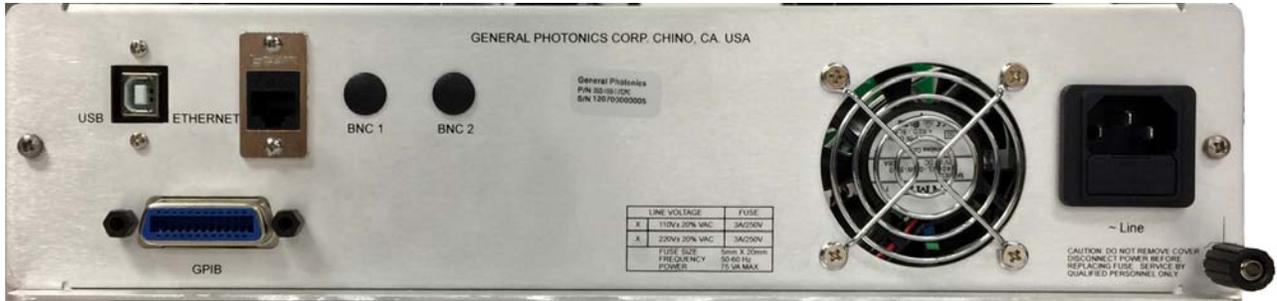


Figure 4 Rear panel

Rear Panel Features:

USB 2.0 interface port	Line: External AC input connector
Ethernet interface port	Cooling fan
GPIB interface port	⏏: Chassis ground
BNC 1: not used	
BNC 2: not used	

#### Fuse location:

Figure 5 shows the location of the fuse compartment under the power cord plug. There are two fuses in the compartment- the one in use and a spare. The fuse further inside the compartment is active. The one closer to the compartment opening is the spare.

Replace the fuse with one with the exact rating of the original.



Figure 5 Fuse compartment

## 4. Operation Instructions

### 4.1. Unpacking

Inspect DGD-1000 for any physical damage due to shipping and transportation. Contact carrier if any damage is found. Check the packing list to see if any parts or accessories are missing.

#### Packing List

Item #	Description
1	DGD-1000
2	Power cord
3	USB cable
4	User guide
6	Software cd

### 4.2. Setup

1. Place the DGD-1000 on a stable surface. An optical table is not required, but for best results, the instrument should be kept stationary, away from possible sources of vibration such as strong fans. Because this instrument operates by separating and then recombining the orthogonal polarization components of light, it is very susceptible to polarization instability caused by mechanical vibration.
2. Connect power cord and plug it into wall receptacle. Make sure the ground pin of the power cord is connected to earth ground.
3. Connect the DGD-1000 to the control computer via the desired remote control interface (USB, Ethernet, or GPIB).
4. Connect input and output fibers. Make sure laser source is turned off while cleaning connectors and making connections. It is also advisable to fix SM fibers in place during testing, for example, by taping them down to the testing surface and keeping them away from fans, etc.
5. Power on the instrument. It will start up in the most recently used DGD setting.

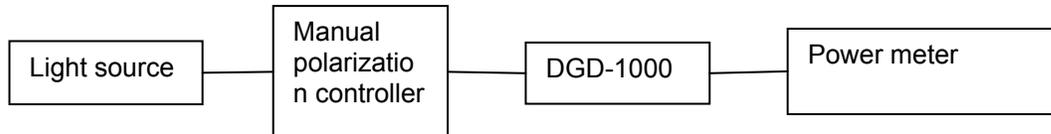
#### A note regarding DGD resets:

A DGD reset reestablishes the home position of the MDL and sets the MDL to the setting corresponding to DGD = 0. If the same DGD setting is being used for testing in consecutive testing sessions over a few days or so, it is not necessary to perform a reset when the DGD-1000 is powered back on. However, in order to maintain the specified DGD accuracy, it is recommended that a reset be performed before the first use of the instrument, after extended periods of non-use, or after testing sessions with many changes in DGD settings.

### 4.3. Polarization Alignment

The worst-case effect on an input signal at any DGD setting will occur when the polarization of the input signal is split equally between the slow and fast axes of the DGD generator. Since the input fiber of the DGD-1000 is SM, light of any state of polarization (SOP) can enter it.

The SOP of the input light can be aligned for worst-case effect using the following procedure.



**Figure 6 Setup for polarization alignment**

Assemble the setup shown in Figure 6. Fix the fibers between the light source and the DGD-1000 in place.

For a single polarization signal:

1. Set the DGD-1000's PDL offset value to 2 dB.
2. Adjust the manual polarization controller to find the maximum and minimum output powers from the DGD-1000. Record these values.
3. Adjust the manual polarization controller until the output power is halfway between the maximum and minimum output powers.
4. Set the DGD-1000's PDL offset back to zero.
5. Use this condition for worst-case DGD testing.

This procedure can also be used to find the worst-case input SOP condition for a dual-polarization signal. However, the power of the two polarization inputs must be imbalanced during SOP adjustment.

1. Adjust the power of the two input signals such that there is at least a 4 dB difference between them.
2. Set the DGD-1000's PDL offset value to 2 dB.
3. Adjust the manual polarization controller to find the maximum and minimum output powers from the DGD-1000. Record these values.
4. Adjust the manual polarization controller until the output power is halfway between the maximum and minimum output powers.
5. Set the DGD-1000's PDL offset back to zero.
6. Adjust the power of the two input signals so that they are equal.
7. Use this condition for worst-case DGD testing.

## 4.4. Remote Control

General Photonics provides a test program for remote control of the DGD-1000. The control software is included on the accompanying cd. The following sections include the remote control command list, setup for different control interfaces, and installation and application procedures for the control software.

### 4.4.1. Command List

The commands and responses listed below are the same for all communication protocols: USB, Ethernet, and GPIB.

Command Notes:

1. Each command sequence can be queried by using “?” in place of set parameters to check the command’s current parameter settings. There is no space between the command sequence and “?”.
2. There is a space between a command sequence and a set parameter. Settable parameters are listed in the table using triangular brackets < >.
3. Command segments listed in the table in square brackets [ ] are optional; they are included for human interpretability.
4. Many command segments can be written out as full words or in predefined abbreviated forms consisting of 3 or 4 letters. The abbreviated commands are capitalized in the command sequences listed in the table. E.g. the error code query command can be written out as :SYSTem:ERRor? or :SYST:ERR? or :ERR? (since the first part is optional).
5. Multiple commands can be concatenated in one string, using semicolons as separators, up to a limit of 128 characters per string.
6. An end-of-string (EOS) is required to execute a complete command string, the EOS can be configured as Line Feed (LF), Carriage Return (CR), or both (LF+CR).
7. If the instrument beeps after a command is sent, check the EOS setting to make sure it matches the format of the command being sent. Also, check that the command is correctly formatted before resending.
8. If the instrument does not carry out a command and does not beep, it may not have received the EOS character. Make sure that the command string ends with the correct EOS. The default EOS is CR + LF (0D 0A in HEX).
9. Since the DGD-1000 uses a mechanical motorized delay line to change DGD settings, it can take some time to move between DGD settings that are far apart. The DGD-1000 will not recognize or implement a new command until execution of the previous command has been completed. The query \*OPC? can be used to determine whether an operation is complete. Once the instrument responds to \*OPC? with “1”, then the next command can be sent.

### SCPI Common Commands and Queries (GPIB specific)

These commands are common to all GPIB-enabled devices.

Command	Parameters	Response	Description
*IDN?		<company>, <model>, <serial>, <firmware ver>	Query the instrument identification.
*VER?		<string>	Query firmware version. (e.g. DGD-1000_V1.0_ymdd)
*RST		NA	System reset. Reinitializes system (restarts CPU and reestablishes MDL home position) and resets control parameters to default values.  Wavelength    1550 GPIB address   5 Ethernet control mode: DHCP DGD            0 DGD offset    0 PDL offset    0 IL offset      0 ΔDGD rate    5 (= 32ps/s)
*OPC?		0 or 1	Operation Complete query. 1: operation complete. 0: operation in process. This query is used to verify that the previous operation is complete before sending a new command.

### System Information

These commands query system information.

Command Sequence	Parameters	Description/Example
[:SYSTem]:ERRor?		Return error sequence, 20 error messages max, errors read out in LIFO sequence. Sending this query clears the error buffer. The response is "NA" if the error buffer is empty.
:CALibration:DATE?		Query the instrument's calibration date.

## Communication Setup

These commands cover communication related settings.

[:SYSTem]:TERMinator:EOS	< LF  CR  RL>	Set/query End Of String (EOS) setting. CR: carriage return (0x0D) LF: line feed (0x0A) RL: CR+LF (0D 0A) The EOS setting command must be sent using the current EOS setting. The new setting affects all subsequent commands and queries. <i>Ex: :SYST:TERM:EOS RL</i>
[:SYSTem]:GPIB:ADDRess	< integer>	Set/query GPIB address. Range: 0 to 30. Factory setting: 5 <i>Ex: :SYST:GPIB:ADDR 10</i>
[:SYSTem]:NET:IP	< string>	Set/query IP address. <i>Ex: :SYST:NET:IP 192.168.1.122</i>
[:SYSTem]:NET:MASK	< string>	Set/query net mask. <i>Ex: :SYST:NET:MASK 255.255.255.0</i>
[:SYSTem]:NET:GWAY	< string>	Set/query gateway address. <i>Ex: :SYST:NET:GWAY 192.168.1.1</i>
[:SYSTem]:NET:NSERver	< string>	Set/query nameserver. <i>Ex: :SYST:NET:NSER 206.13.30.12</i>
[:SYSTem]:NET:MODE	< SIP   DHCP>	Set/query Ethernet mode (Static or Dynamic) <i>Ex: :SYST:NET:MODE DHCP</i>

Note: NET commands (IP, MASK, GWAY, NSERver) are used to set parameters for static IP addressing. However, the query versions will return values for either static or dynamic IP depending on MODE setting.

## Control Commands

This set of commands allows the user to access the basic functions of the DGD-1000.

### Wavelength

The DGD-1000 is calibrated to automatically adjust the settings of both VOAs to minimize the PDL and to keep the IL constant at all DGD settings. However, there is some wavelength dependence, so the calibrations take the operating wavelength into account. The wavelength setting is used to ensure that the correct calibrations for the VOAs are used.

### DGD Control

The DGD-1000 uses an MDL in one branch of the optical path to control the relative delay. The user only has to specify the DGD setting. The instrument automatically selects and implements the corresponding MDL position setting.

## DGD Reset

The DGD reset function runs the MDL through an initialization process during which it establishes the home (zero) position of the MDL and then sets the DGD to zero. When running tests that require accurate DGD and involve multiple DGD settings, it is advisable to periodically reestablish the zero position of the MDL. A DGD reset should also be performed before testing if the instrument has not been used for an extended period of time.

## Offset Commands

The DGD-1000 has 3 offset controls.

The DGD offset is used to balance the delay in the two branches of the optical path. The optical paths are balanced during assembly such that when it is shipped, the optical delay in the two branches is equal when the DGD setting is zero. However, over time or depending on operating conditions, it is possible for the optical delay in one or both paths to diverge from their original values. The DGD offset command allows the user to manually adjust the delay offset to rebalance the optical paths. For example, if the measured delay does not match the DGD-1000's delay setting, the user can adjust the delay offset until the measured delay equals the delay setting.

The PDL offset is used to minimize the PDL generated by the DGD-1000. PDL occurs when there is a differential in loss in the two branches of the optical path following the PBS. The VOA in the branch without the MDL (see Figure 1) is used to make the loss in that path equal to the loss in the path with the MDL so that the two polarization components of light experience the same loss at any DGD setting. The settings of this VOA are factory calibrated for minimum PDL. However, there are times when the user might want to manually adjust the PDL. For example:

1. Manual calibration: If losses in the two branches diverge over time; the PDL offset can be used to rebalance them by adjusting the PDL offset to minimize the PDL.
2. Polarization alignment: As described in section 4.3, the PDL offset can be used to intentionally generate some PDL to enable the user to use the output power as a metric to adjust the input polarization state of the signal to achieve the worst-case PMD effect from any particular DGD setting.
3. PDL generation: The DGD-1000 can be used as a variable PDL generator by setting the DGD to zero and adjusting the PDL offset to achieve the desired PDL value.

The IL offset is used to control the IL of the DGD-1000. The VOA following the PBC (see Figure 1) is used to adjust the loss to keep the total IL of the DGD-1000 constant as the DGD setting changes. The VOA settings are factory calibrated to do this. However, over time, the losses can drift. The IL offset command allows the user to manually add an offset to the setting of the second VOA to offset this drift.

Command Sequence	Parameters	Description/Example														
[:CONTRol]:STATus:PRESet		Resets control parameters to default values: Wavelength 1550 DGD offset 0 PDL offset 0 IL offset 0 ΔDGD rate 5 (= 32ps/s)														
[:CONTRol]:WAVElength	< float>	Set/query wavelength setting. Setting saved to memory. Unit: nm Range: 1520 to 1620 nm. Default: 1550														
[:CONTRol]:DGD	< float>	Set/query DGD setting. DGD unit: ps Range: 0 to 200 ps. Setting stored in memory.														
[:CONTRol]:DGD:RESEt		Reset DGD. Reestablish MDL home position, then move MDL to position corresponding to DGD=0 ps.														
[:CONTRol]:DGD:SPEEd	< string>	Set/query DGD change speed. Setting stored in memory. <table border="1" data-bbox="841 953 1187 1178"> <thead> <tr> <th>Setting</th> <th>Speed (in ps/s)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1</td> </tr> <tr> <td>2</td> <td>4</td> </tr> <tr> <td>3</td> <td>8</td> </tr> <tr> <td>4</td> <td>16</td> </tr> <tr> <td>5</td> <td>32 (default)</td> </tr> <tr> <td>6</td> <td>64</td> </tr> </tbody> </table> <i>Ex: :CONT:DGD:SPEE 3            (set speed to 8 ps/s).</i>	Setting	Speed (in ps/s)	1	1	2	4	3	8	4	16	5	32 (default)	6	64
Setting	Speed (in ps/s)															
1	1															
2	4															
3	8															
4	16															
5	32 (default)															
6	64															
[:CONTRol]:OFFSet:DGD	< float>	Set/query DGD offset value. Value is stored in memory. Used to minimize DGD error in case of shift from calibrated values. Unit: ps Range: -5 to 5 ps. Default value: 0														
[:CONTRol]:OFFSet:PDL	< float>	Set/query PDL offset value. Value is stored in memory. Used to minimize PDL in case of shift from calibrated values. Unit: dB Range: -0.5 to 5 dB. Default value: 0														
[:CONTRol]:OFFSet:IL	< float>	Set/query IL offset value. Value is stored in memory. Used to balance IL in case of shift from calibrated values. Unit: dB Range: 0 to 5 dB. Default value: 0														

### SCPI Error and Status Codes

Error code	Description
-100	Command error: generic syntax error code
-222	Parameter out of range
0	No error

#### 4.4.2. USB Setup

The DGD-1000 uses a USB 2.0 connection and requires a USB driver to be installed.

Running the “setup.exe” file provided with the instrument will install the control program and NI drivers, and will also copy (but not install) the USB drivers to the control computer. USB drivers will be located in the folders “C:\DGD-1000\USB2Driver\CDM v2.12.18 WHQL Certified-32” and “C:\DGD-1000\USB2Driver\CDM v2.12.18 WHQL Certified-64”.

To install the USB 2.0 driver, connect the instrument to a USB 2.0 or higher port of the control computer with a compatible USB cable and power it on. In most cases, the first time the instrument is connected to an internet-connected Windows computer and powered on, Windows Update will automatically download and install the necessary driver. This can be verified by using Device Manager. The DGD-1000 should be listed under “Ports (COM & LPT)”. If it shows up under “Other Devices”, the driver may need to be updated or reinstalled.

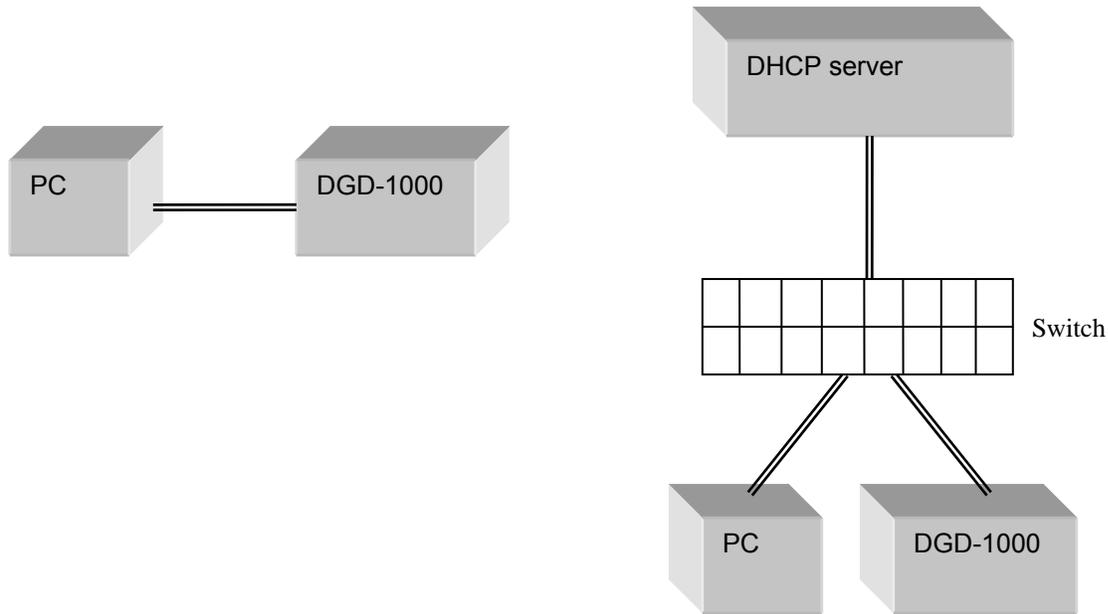
To manually update the driver, right click the entry under “Other Devices” and select “Update Driver Software”. On the next screen, select “Browse my computer for driver software”, then point the locator to the folder containing the driver corresponding to the control computer’s operating system (32 or 64 bit). Check the “Include subfolders” box and complete the installation. Once the driver is successfully installed, the DGD-1000 should appear in Device Manager under “Ports (COM & LPT)”.

#### 4.4.3. Ethernet Setup

There are two connection configurations for Ethernet control:

**Static IP:** the administrator assigns the instrument a fixed IP address. In this mode the instrument can be directly connected to the control PC, as shown in Figure 7. For this configuration, a cross-linked network cable must be used.

**Dynamic IP:** the DHCP server assigns the instrument an available address when requested. Connect the instrument with a DHCP server (running on router or exchange server), as shown in Figure 8. For this configuration, a standard straight-linked network cable must be used.



**Figure 7 Direct connection: MPC-201 to PC** **Figure 8 Connection with DHCP server**

Once the physical connections are established, the instrument's Ethernet configuration can be set up by sending the corresponding setup commands from another interface (e.g. USB).

For static IP control, the net mask and gateway for the instrument should be the same as those for the control computer. The first 3 groups of numbers in the IP address should be the same as those for the control computer (192.168.2, for example). The last number can be any available number, but cannot be the same as the IP address of the control computer. The range of numbers is 1 to 254. If the computer's IP address is 17, for example, the user can set the IP address for the instrument to any number in the range 1-254 except 17.

For static IP control, make sure that the control computer is also set to use a static (defined) IP address (check the TCP/IP properties to find the computer's Ethernet setup information).

For dynamic IP control, make sure that the control computer is set to obtain its IP address automatically. This information is also under TCP/IP properties.

To connect the instrument directly to a PC, use a PC to PC cable. To connect the instrument to a LAN, use a standard network cable.

#### **4.4.4. GPIB Setup**

Connect the instrument to the computer with a GPIB cable.

The DGD-1000's GPIB address can be set or queried by sending the corresponding command via a different interface (e.g. USB).

To send commands via GPIB, enter the GPIB address in the communication program being used. The instrument will then be ready to receive commands. The command lists, responses, and error codes are given in section 4.4.1.

To ensure proper communication, use a GPIB cable that is fully compatible with the IEEE 488.1 standard. All GPIB/IEEE 488 interface connections must be made before turning on the instruments.

#### 4.4.5. Control Software

A LabView control program is provided with the instrument. The interface allows the user to set the output DGD, to set control parameters such as wavelength and DGD/PDL/IL offsets, and to modify the communications setup.

Both the source code and an executable version of the program are provided. The source code serves as a programming example, and can also be modified by the user as needed for particular applications.

##### 4.4.5.1. Software Installation

###### Computer/System Requirements

Recommended configuration for control computer:

RAM:	8 GB
Hard Drive Space:	300 GB
CPU:	i5-4200
System:	Windows 10 64 bit

NI Drivers: These drivers are needed to run the executable version of the control program. They are installed automatically by the setup file.

NI LabVIEW Runtime 2014 SP1 f10

NI-488.2 Runtime 17.0;

NI-VISA Runtime 17.0;

Note: These drivers will be installed by the setup file.

###### Install control program and NI Drivers

Running the setup.exe file will start an installation wizard. Follow the directions given by the wizard.

The setup.exe file installs the main control program as well as some National Instruments (NI) drivers required by the control program (see list above). It also copies the USB drivers for the DGD-1000 to the control computer's C drive. They can be found in the folders "C:\DGD-1000\USB2Driver\CDM v2.12.18 WHQL Certified-32" and "C:\DGD-1000\USB2Driver\CDM v2.12.18 WHQL Certified-64".

Note that although the USB drivers are copied to the control computer by the setup file, they are not actually installed until the first time the DGD-1000 is connected to the control computer. For most Windows 10 systems, the USB driver will automatically install when the device is detected, but in some cases, it may need to be manually updated or reinstalled.

The following programs/drivers are required to run the LabView source code:

LabVIEW 2014 or above

NI-488.2 17.0

NI-VISA 17.0

### 4.4.5.2. Software Interface

The control software can be used to control the DGD-1000 via USB, GPIB, or Ethernet. Note that, while the GPIB and Ethernet setup can be changed from the control program, they must be changed using a communication method other than the one to be changed. Therefore, if the user wants to change the instrument’s GPIB address or Ethernet parameters, it is recommended that the DGD-1000 be connected to the control computer initially via USB as well as via GPIB or Ethernet, so that the USB connection can be used to perform the GPIB or IP setup.

#### VISA Setup

When the program is run, it will open on the VISA setup tab.

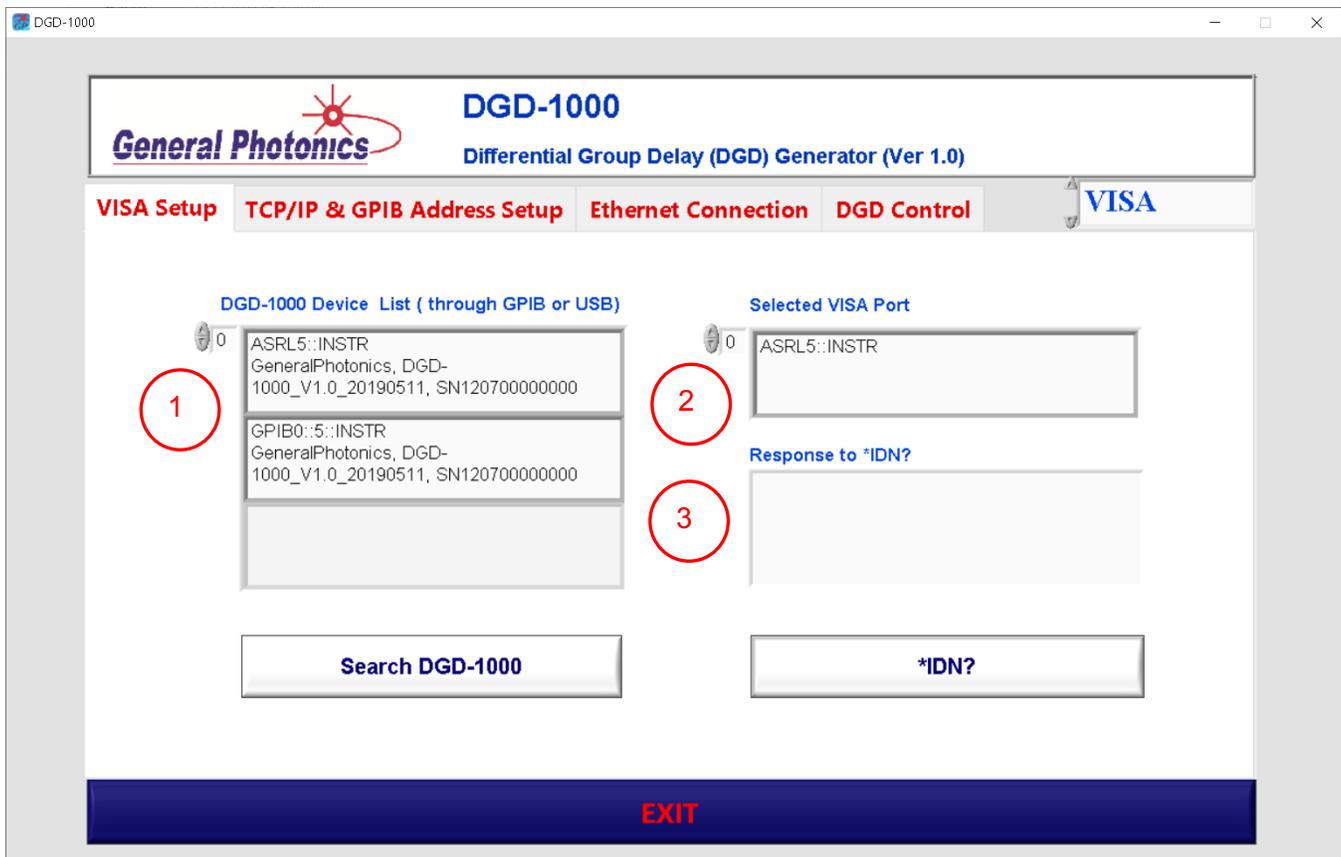


Figure 9 Control Program VISA Setup screen

The program will auto-detect all DGD-1000s connected to the control computer via USB or GPIB, and will display the corresponding device and port information in the table on the left (marked 1 in the example above). In this example, there is one DGD-1000 instrument (serial number 120700000000) connected to the computer via USB (COM port 5) and GPIB (GPIB port 5). Either connection can be used to control this instrument. If connections are changed or new devices are connected, the “Search DGD-1000” button can be used to refresh the device detection and list the new connections.

The instrument and port used for communication can be selected using the “Selected VISA Port” section on the upper right side (marked 2 in the figure above). The up/down arrows next to the display box can be used to scroll through available ports/instruments. In the example above, USB port 5 is selected for communication.

To verify that communication has been established with the correct instrument through the selected port, click the “\*IDN?” button on the lower left. This will send the identification query to the instrument and display the response in the “Response to \*IDN?” box.

Note: Selecting “VISA” from the VISA/Ethernet pull-down at the top right of the screen at any time will switch the display back to the “VISA Setup” tab.

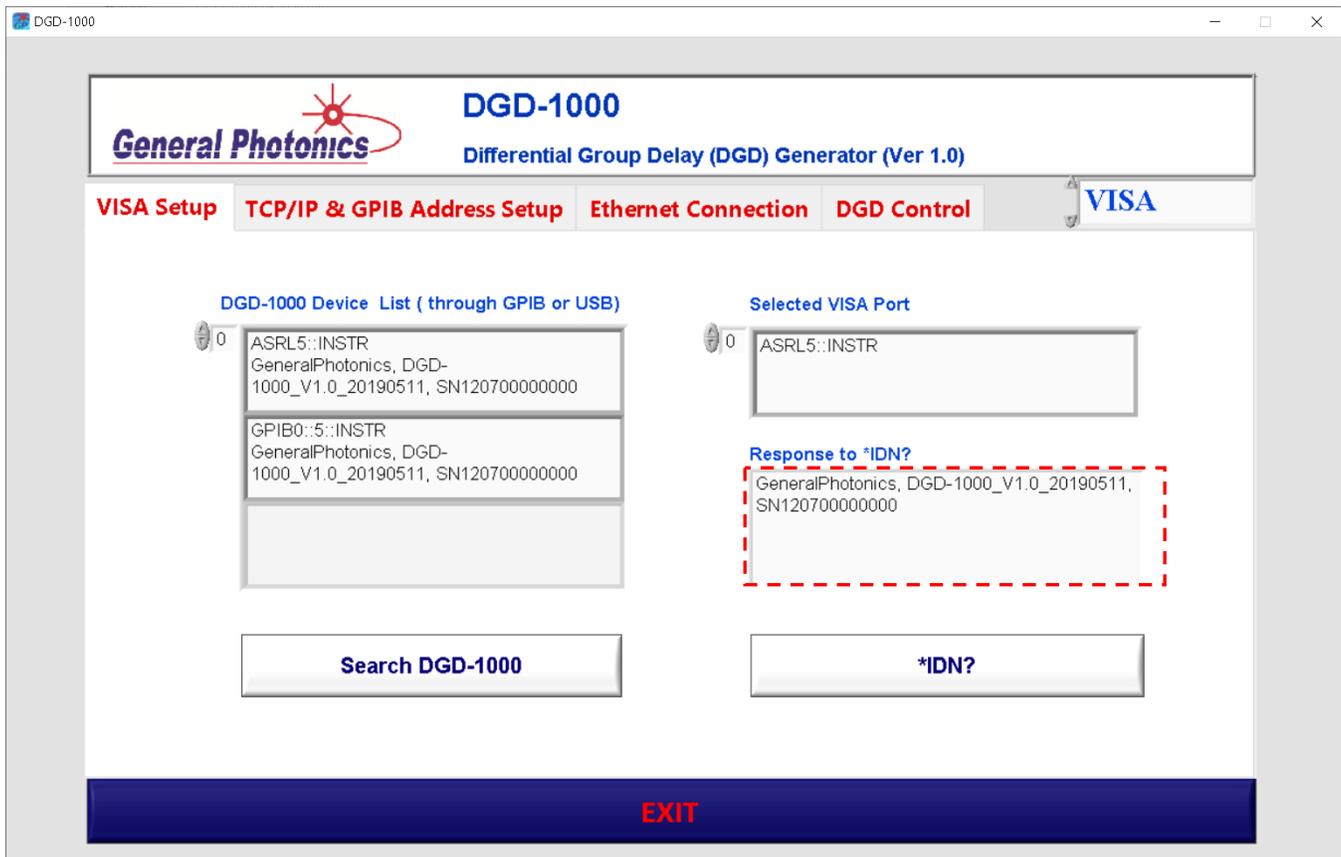
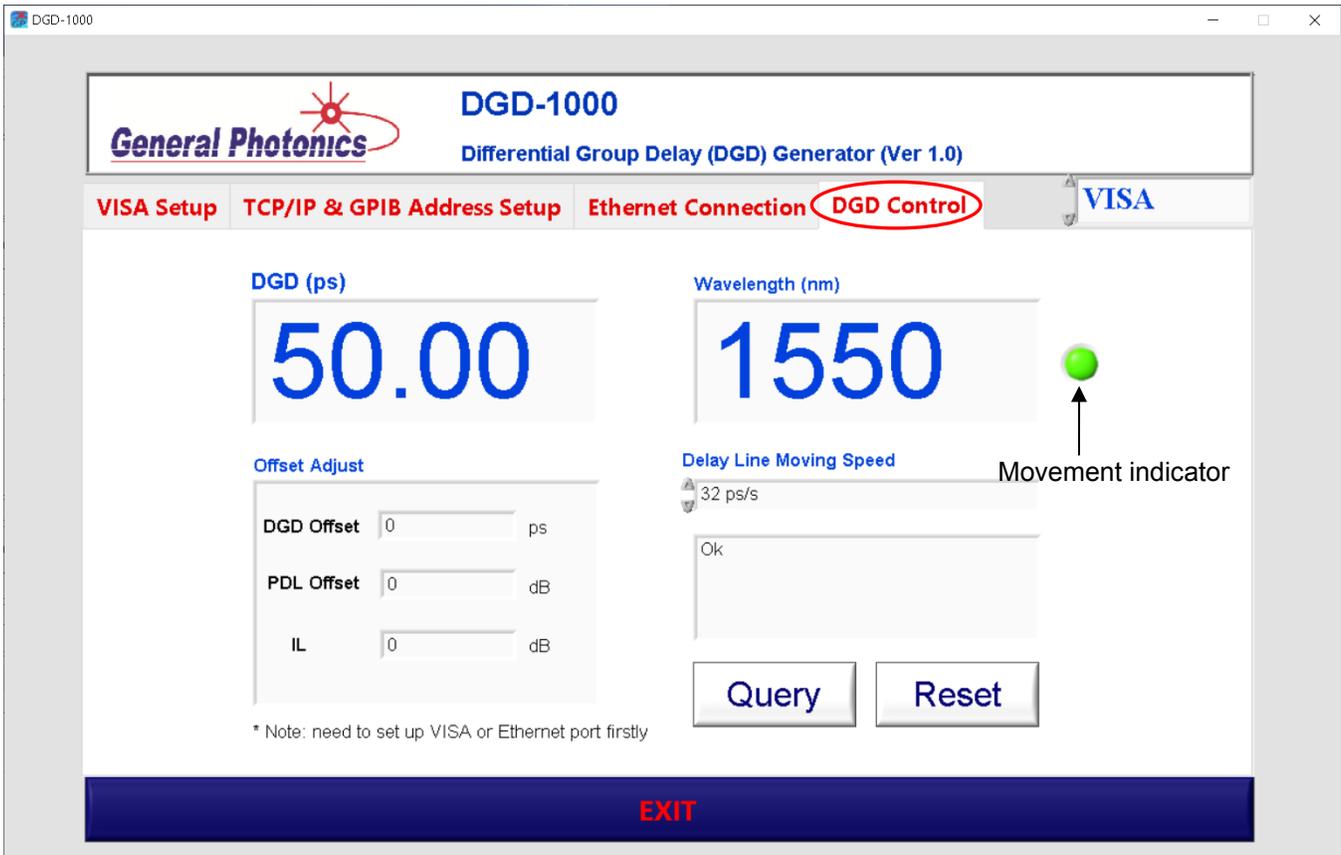


Figure 10 Control Program VISA Setup screen with IDN response

Once this is done, the instrument can be controlled via the selected USB or GPIB port by switching to the “DGD Control” tab.

### DGD Control

This is the main control tab for the DGD-1000. It allows the user to control the output DGD, as well as to set other control parameters.



**Figure 11 Control Program DGD Control screen**

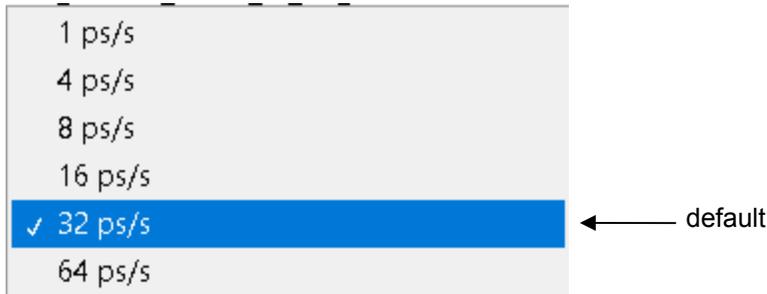
When this tab is first opened, the program reads and displays the current instrument settings. Parameters can be changed by typing a new value in the corresponding box and then pressing ENTER on the keyboard or clicking on the cursor outside of the box that was just edited.

- DGD (ps): Output DGD value.  
Range: 0-200 ps
- Wavelength (nm): Wavelength setting.  
Range: 1520-1620 nm      Default: 1550 nm
- DGD Offset: Relative delay offset, used to compensate for drift  
Range: -5 to 5 ps      Default: 0 ps
- PDL Offset: Relative loss offset, used to compensate for drift, generate PDL,  
or perform SOP alignment

Range: -0.5 to 5 dB                      Default: 0 dB

IL Offset:                      Absolute loss offset; can be used to compensate for IL variation with DGD setting  
Range: 0 to 5 dB                      Default: 0 dB

Delay Line Moving Speed: pull-down menu to select delay line speed.



Movement indicator: The movement indicator blinks while the delay line is moving and turns solid green after it has reached the new position.

Query: Reads back and displays current instrument settings.

Reset: System reset. Restarts the CPU, reestablishes the MDL home position, and resets control parameters to default values. Note that this will also reset the GPIB address to 5 and close all connections. After performing a system reset, it is necessary to return to the VISA Setup or TCP/IP Setup and Ethernet Connection tabs to reestablish communications setup and connections before continuing.

### TCP/IP & GPIB Address Setup

This tab allows the user to set or query the instrument's GPIB or Ethernet settings. Note that a communications protocol cannot be used to change its own setup (e.g. the GPIB address cannot be changed via GPIB). When this tab is first opened, the program will read back and display the instrument's current GPIB address and Ethernet parameters.

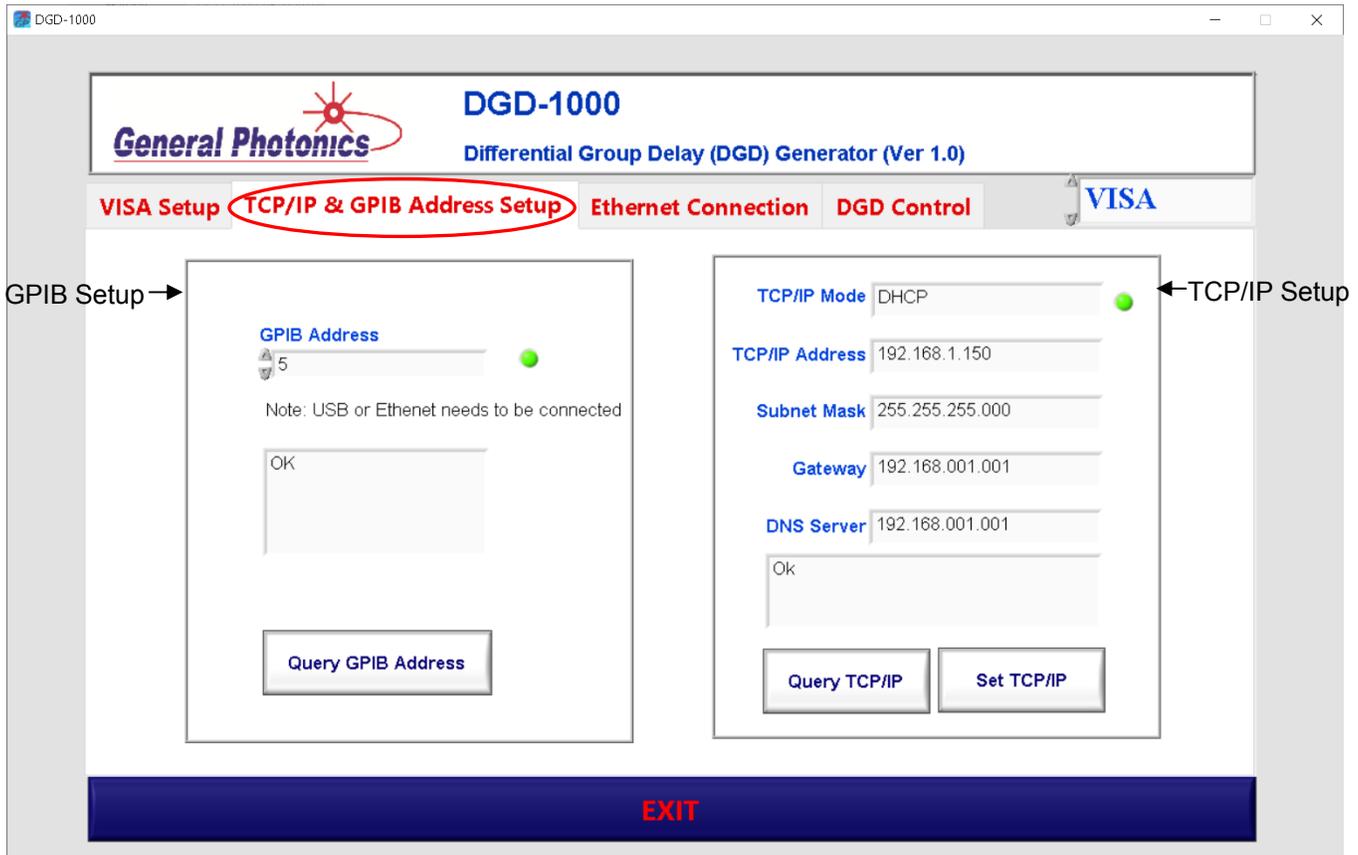


Figure 12 Control Program TCP/IP & GPIB Address Setup screen

### GPIB

The GPIB setup block on the left allows the user to set or query the instrument's GPIB address. The GPIB address can be changed by typing a new number in the box and pressing ENTER or clicking outside the box, or by using the arrows next to the display to increment or decrement the value.

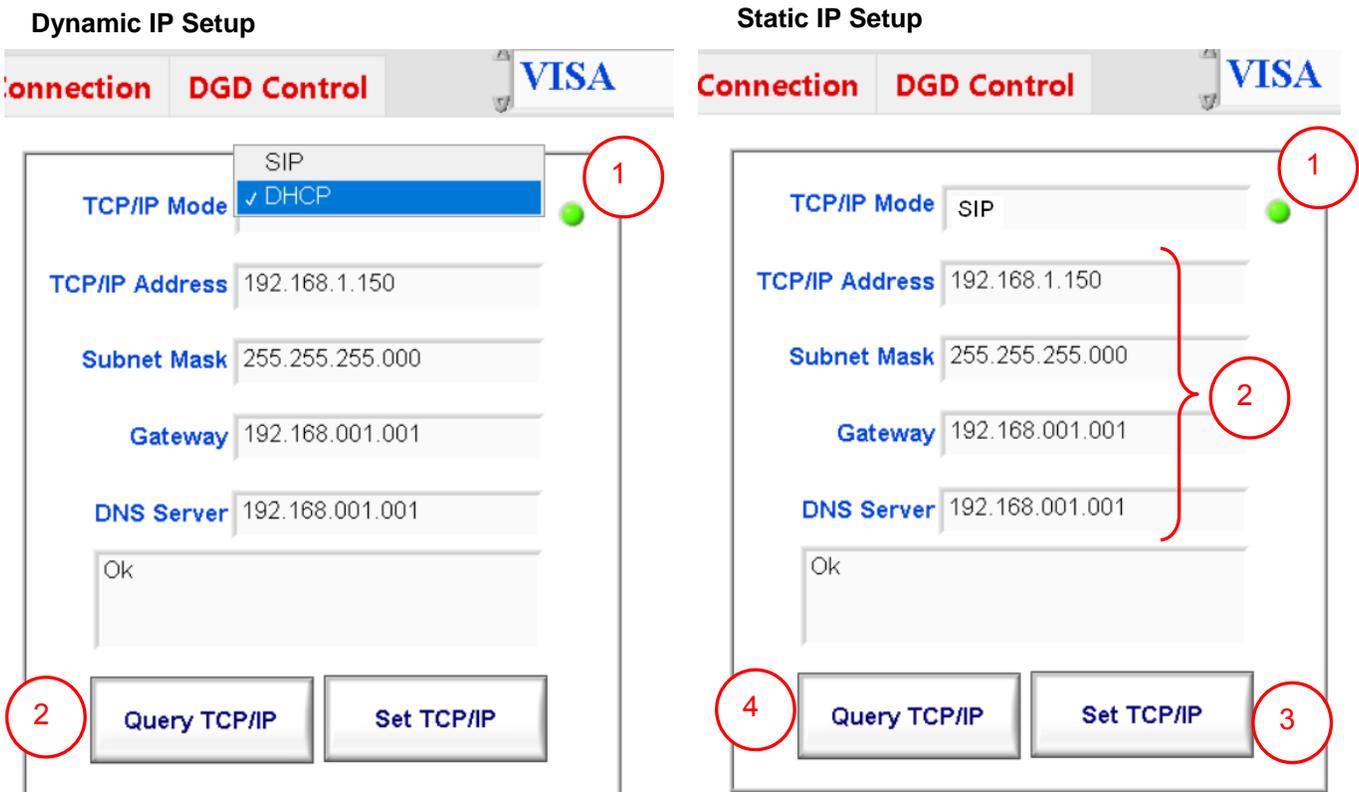
GPIB address range: 0-30. Default: 5

The indicator will turn off, then turn green after the GPIB address is successfully changed. The "Query GPIB Address" button can also be used to read back the address to verify that it has been changed.

To use a new GPIB address for communication, switch to the "VISA Setup" tab (Figure 9), search for available ports, and select the new GPIB address as the active communication port. Then, switch to the "DGD Control" tab.

TCP/IP

The TCP/IP address setup block on the right side allows the user to set or query the instrument's IP setup parameters. The setup must be done before the Ethernet connection can be used to communicate, so for initial setup, the VISA/Ethernet pull-down should be left on VISA, and the instrument should be connected to the control computer via USB or GPIB as well as Ethernet.



**Figure 13 Control Program TCP/IP Setup**  
**Left: Dynamic IP      Right: Static IP**

*Dynamic IP*

In dynamic IP mode, the IP address is not fixed, but is assigned by the DHCP server upon request. To set the DGD-1000 to dynamic IP mode and request an IP address from the server, select “DHCP” from the “TCP/IP Mode” pull-down menu. Then click the “Query TCP/IP” button at the bottom of the screen to read back the TCP/IP parameters. Copy the IP address to use for communication.

Note: If the instrument is unable to obtain a dynamic IP address, then when the TCP/IP parameters are queried, the IP address will show up as 0.0.0.0.

### Static IP

To set the DGD-1000 to static IP mode, select “SIP” from the “TCIP/IP Mode” pull-down menu. Enter the static IP parameters in the corresponding boxes, then press ENTER or click outside of the box after each entry. Click “Set TCP/IP” to set the new parameters. The “Query TCP/IP” button can be used to read back the parameters to verify that they have been successfully updated. Copy the IP address to use for communication.

### Ethernet Connection

This tab is used to establish an Ethernet connection.

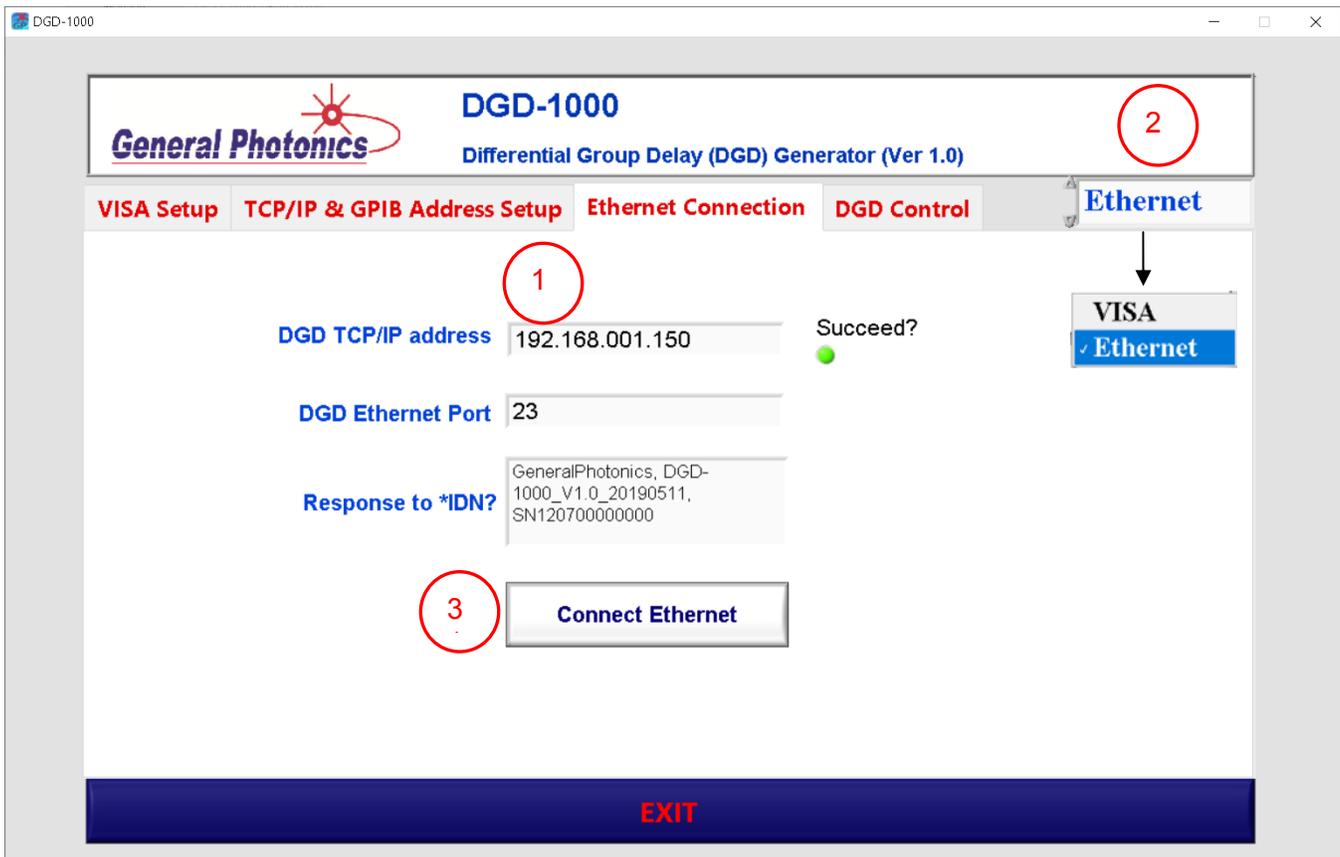
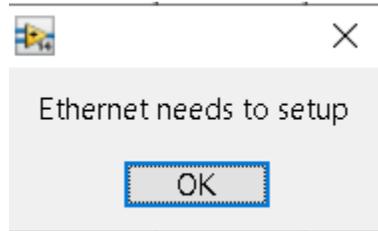


Figure 14 Control Program Ethernet Connection screen

After setting up the Ethernet parameters from the “TCP/IP & GPIB Address Setup” tab, switch to the “Ethernet Connection” tab. Enter the IP address to be used for communication into the “DGD TCP/IP address” box. (The easiest way to do this is to query the IP setup from the “TCP/IP & GPIB Address Setup” tab, copy the IP address, then switch over to the “Ethernet Connection” tab and paste in the address.) The default port number is 23. In general, this does not need to be changed. Select “Ethernet” from the “VISA/Ethernet” pull-down menu, then click the “Connect Ethernet” button at the bottom of the screen to establish the connection. If the connection is successful, the “connection successful” indicator will turn green and the instrument ID information will be displayed in the “Response to \*IDN?” box.

Note: Selecting “Ethernet” from the “VISA/Ethernet” pull-down menu automatically switches the display to the “Ethernet Connection” tab. However, if the user tries to connect via Ethernet without setting up the Ethernet parameters first, the following error message will be displayed:



In this case, click “OK” on the pop-up, then set up the IP parameters and establish the Ethernet connection before continuing with DGD control via Ethernet.

#### Exiting the program

At any time when the MDL is not moving, the “EXIT” button at the bottom of the screen can be used to exit the program. When a testing session is finished, the program should be exited before powering off the DGD-1000.

#### 4.5. Troubleshooting

Symptom	Possible Cause
Polarization instability	Mechanical vibration or fiber movement Make sure that the instrument is on a stable surface away from fans or other sources of vibration, and the fibers are fixed in place.
DGD inaccuracy	<ol style="list-style-type: none"> <li>MDL drift from position reference Use DGD reset to reestablish position reference.</li> <li>Delay offset drift between the two branches Adjust the DGD offset to compensate for the drift.</li> </ol>
High PDL	Drift in IL difference between the two branches. Adjust the PDL offset to equalize the loss in the two branches.
Instrument not detected	<p>USB:</p> <ol style="list-style-type: none"> <li>Check cable connection. Make sure the cable is in good condition and properly connected on both sides.</li> <li>Check Device Manager. The instrument should show up under "Ports (COM &amp; LPT)". If it shows up under "Other Devices", the USB driver may not have installed properly. Try updating it. If that doesn't work, uninstall and delete it and reinstall it.</li> </ol> <p>Ethernet:</p> <ol style="list-style-type: none"> <li>Check that the proper cable is used (straight-wired if connected to a router, cross-linked for direct PC connection).</li> <li>Check that the computer and instrument's Ethernet setups match (both must be set for DHCP or static IP, and for static IP, the IP setup parameters must be consistent).</li> </ol> <p>GPIB:</p> <ol style="list-style-type: none"> <li>Check that the cable is properly connected.</li> <li>Check that the computer is using the correct GPIB address for the instrument.</li> </ol>
No response to commands	<ol style="list-style-type: none"> <li>Check that the EOS character being used matches the instrument's EOS character setting.</li> <li>Check the command format, and verify that any command parameters are within range.</li> <li>Make sure that the previous operation is complete before sending a new command (use *OPC? query).</li> </ol>