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# **DLD-100 SERIES**

# **USER MANUAL**



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#### Introduction,

Thank you for choosing a DLD-100 series Digital Light Detector for your work. Abet Technologies' design goal was to take advantage of the power of digital technologies to create an easy to use instrument. Please tell your friends and colleagues if we succeeded. Please tell us if we missed something and we will try to make it even easier to use.

This family of photo diode instruments is equipped with transimpedance amplifiers with software controlled gain, high speed 16 bit Analog to Digital converters and USB 2.0 communication capability. Synchronous detection can be obtained with the external Sync feature. Data acquired by the instrument is streamed to an ActiveX component allowing the use of the ever increasing PC computing power for signal processing and presentation.

A number of basic data acquisition, display and saving executables are included with the system. The true ActiveX component, with its comprehensive set of properties, allows for easy integration into applications developed using ActiveX compliant software packages, be it LabVIEW<sup>TM</sup>, Excel, MATLAB<sup>TM</sup>, Visual Basic, Visual C++, etc. Explicit script containing examples are included to show the ease of using ActiveX control properties within such programs.

A highly adaptable design allows for easy integration into your optical setup using a number of standard interfaces or one of our inexpensive adapters.

We hope this instrument will serve you well. Please check with us for your other optical, light source or detection needs – Abet Technologies product line is growing.



#### 1 **Please read before installing**

Your shipment includes the detector you chose, a power supply, any accessories you ordered, and an installation CD. The CD includes driver software for Microsoft<sup>®</sup> Windows XP or later, a .pdf copy of this manual as well as a number of demonstration and application programs. A USB cable is not included unless ordered separately.

Your Digital Light Detector fully conforms to PnP Windows technology. Here are the minimal system requirements that will assure trouble free operation:

- Windows XP, service pack 2 or higher
- Memory 256 MB or more
- USB 2.0 hub (check your computer documentation to determine the version of your USB hub). Please note: add-on USB 2.0 boards can occasionally create communication problems – we strongly suggest that you use this detector with a computer equipped with a manufacturer's installed USB 2.0 hub.
- MFC71.dll, MFC71u.dll and Msvcr71.dll are present in your Windows\System32 folder
- Microsoft .NET Framework 1.1 installed on your computer

Please go to Windows Update Website, http://www.microsoft.com/downloads/search.asp to obtain and install any of the required missing components. For your convenience the installation CD contains a "How to obtain Microsoft support files from online services.htm" document, which can help to guide you through the process if you need extra help.

If any of the MFC71.dll, MFC71u.dll or Msvcr71.dll are needed, reasonably recent versions of those files can be found in the root folder of the installation CD. However, we suggest checking Microsoft web site for their most up to date versions. Please place these .dll's in the Windows\System32\ folder of your computer.

The Microsoft .NET Framework 1.1 is the latest Windows XP technology required by many applications. You can check for its presence by going to the Control Panel and Clicking on Add/Remove Programs. Please use the slider on the right hand side to scroll through all the installed programs since there is often a large empty space between a few initial software names and the rest of the installed programs in this function.

🖬 Add/Remove Programs									
Currently installed programs:	Sort by: Name	•							
🕵 Microsoft .NET Framework 1.1	Size	<u>42.4MB</u>							
Click here for support information.									
To change this program or remove it from your computer, click Change or Remove.	⊆hange	<u>R</u> emove							
Microsoft Data Access Components KB870669		•							
	Currently installed programs: Currently installed programs: Currently installed programs: Click here for support information. To change this program or remove it from your computer, click Change or Remove. Microsoft Data Access Components KB870669	Currently installed programs:       Sort by: Name         Currently installed programs:       Sort by: Name         Microsoft .NET Framework 1.1       Size         Click here for support information.       Size         To change this program or remove it from your computer, click Change or Remove.       Change         Microsoft Data Access Components KB870669       Microsoft Data Access Components KB870669							

Microsoft .NET Framework 1.1, if missing, needs to be installed after a download from the Microsoft site.

#### 2 **Getting started**

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Things can be quite confusing when first trying to use a highly flexible instrument like this DLD-100 detector. Here is a quick explanation of which instructions below will get you to a quick start.

#### 2.1 I don't like to program

- Follow the installation instructions in section 3 of this manual
- Sections 4 and 4.1 introduce you to the use of the device and its ActiveX control. You do not need to look at sections 4.1.1, 4.1.2, or 4.1.3 these are for those who like or need to do their own programs.
- Section 4.2.1 guides you through the installation of a simple digital oscilloscope application that you can then start using without any additional programming steps
- If you need to do spectral scans using your DLD-100 detector and a monochromator you will need to follow the steps in section 4.2.2.
- In case of emergency take a look at the troubleshooting sections 5 and 5.1.

#### 2.2 I like to do things my way

- Follow the instructions in sections 3 and 3.1
- Follow the instructions in section 3.1.1 only if you plan to use any of the .exe applications included with your DLD-100 detector
- Take a look at sections 4 through 4.1.3 for general information on system usage, methods and properties. Section 4.3.4 demonstrates interfacing to multiple DLD-100 detectors and running multiple instances of their ActiveX controls.
- Select a section of this manual that discusses demonstration program matching the programming platform you are using:
  - Section 4.1 and all the subsections apply to all platforms, including LabView
  - Review section 4.3.1 if MatLab is your platform
  - Review section 4.3.2 if Visual Basic and/or Excel are your platforms
  - Review section 4.3.3 if Visual Basic.NET is your platform
- In case of emergency take a look at the troubleshooting sections 5 and 5.1.

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### **3** Installation

- 1. Connect your DLD to the USB 2.0 hub
- 2. Connect the power supply to the DLD and plug the power supply into the mains
- 3. Windows will recognize the new hardware and request the location of the required drivers. Insert the installation and point to that drive to complete the first installation steps. Follow system instructions. At the end of this step the following should have occurred:
  - a. AbetGeneric.inf installation file has been compiled by the system and placed into Windows/INF folder as OEMxx.inf and OEMxx.pnf files
  - b. Abet.sys has been copied into Windows/System32/drivers/ folder
  - c. DLD AX.ocx has been copied into Windows/System32 and registered

You can confirm successful installation by opening the Control Panel, System, Device Manager:

System Properties
System Restore Automatic Updates Remote
General Computer Name Hardware Advanced
Device Manager
The Device Manager lists all the hardware devices installed on your computer. Use the Device Manager to change the properties of any device.
Device Manager
Drivers
Driver Signing lets you make sure that installed drivers are compatible with Windows. Windows Update lets you set up how Windows connects to Windows Update for drivers.
Driver <u>S</u> igning <u>W</u> indows Update
Hardware Profiles
Hardware profiles provide a way for you to set up and store different hardware configurations.
Hardware <u>P</u> rofiles
OK Cancel Apply

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and checking the list of registered instruments for the USB Digital Light Detector entry:



## 3.1 Installing Application and Demo programs

The installation CD contains a number of demonstration and application programs. Demonstration programs are fairly simple and include source code. Use them to quickly get up to speed on using your unit's ActiveX<sup>®</sup> interface to integrate its operation into the Windows software environment you are going to use. Application programs come as .exe files and let you start collecting data right out of the box.

Run the **Setup.exe** program included on your installation CD. This will place all the necessary programs in a new folder. The default path is C:\Program Files\ABET TECHNOLOGIES\AbetDemoSetup\. You will need to go to that folder to run the DLD applications and demos. Once you decide which ones you wish to use more often you can place their shortcuts on your Desktop for fast access.



# 3.1.1 Installing MATLAB<sup>TM</sup> Component Runtime engine

Go to the C:\Program Files\ABET TECHNOLOGIES\AbetDemoSetup\ destination directory (or the directory path and name you chose in the previous step) and execute **MCRInstaller.exe**.

C:\Program Files\ABET TECHNOLOGIES\AbetDemoSetup									
File Edit View Favorites Tools Help									
4-Back + → → 1									
Address 🔁 C:\Program Files\ABET TECHNOLOGIES\AbetDemoSetup									
Folders ×									
B-     Gord Corporation     ABET TECHNOLOGIES	AbetDemoSetup	Abet Scan Demo	Diagnostics M5 Tools	Excel Demo	How to obtain Microsoft s	Matlab Demo Script	Time Domain Demo		
⊕	MCRInstaller.exe Application Modified: 10/29/2004 7:24 PM	Abet.sys	AbetGeneric	DLD_AX.ocx	How to obtain Microsoft s	InstMsiW.Exe	MCRInstaller.e xe		
Andor Technology     Asymetrix     Asymetrix     Common Files     ComPlus Applications     ComPlus Applications     Compus are	Size: 83.9 MB Attributes: (normal)	MCRInstall	mfc71.dll	wfc71u.dll	msvcr71.dll	Setup.ini			
Type: Application Size: 83.9 MB					83	.9 MB	My Computer		

This will install a powerful runtime engine driving the included MATLAB<sup>TM</sup> based applications. This installation takes a little time and shows its progress as follows:

MATLAB Component Runtime
MATLAB® Component Runtime
Cancel < Back

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Welcome to the MATLAB Component Runtime										
The installer will guide you through the steps required to install MATLAB Component Runtime on your computer.										
NOTE: THIS INSTALLATION SHOULD TAKE ABOUT 5 MINUTES TO COMPLETE.										
WARNING: This computer program is protected by copyright law and international treaties. Unauthorized duplication or distribution of this program, or any portion of it, may result in severe civil or criminal penalties, and will be prosecuted to the maximum extent possible under the law.										
Cancel < <u>B</u> ack <u>Next</u> >										
🛃 MATLAB Component Runtime										
Select Installation Folder										
The installer will install MATLAB Component Runtime to the following folder.										
To install in this folder, click "Next". To install to a different folder, enter it below or click "Browse".										
Eolder:										
<u>D</u> isk Cost										
Install MATLAB Component Runtime for yourself, or for anyone who uses this computer:										
⊙ Everyone ○ Just me										
Cancel < <u>B</u> ack <u>N</u> ext >										

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	Function Focused Innovatio
HATLAB Component Runtime	
Installing MATLAB Component Runtime	
MATLAB Component Runtime is being installed.	
Please wait	
Cancel < <u>B</u> ack	<u>N</u> ext >
MATLAB Component Runtime	
Installation Complete	
MATLAB Component Runtime has been successfully installed.	
Click "Close" to exit.	
Cancel < Back	Close

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## 4 Using your Digital Light Detector

The specification section contains information on the DLD detector mechanical mounting and interfacing features. A number of industry standard optical systems mounts are designed in (post mounting, C-mount, and a 30 mm cage system with 6 mm rods).

Please use normal precautions when mounting and operating the system. Prevent your detector from being exposed to electrical shocks, having its detector element window contaminated, having its ventilation holes covered and overheating, etc.

### 4.1 ActiveX component

All the power of the DLD-100 detector is available through its ActiveX interface. You will access it through the various demonstration and application programs, ours or yours, as explained below. Here we will introduce its control and property pages. A full list of properties will follow later.



ActiveX can only be accessed from within another program; here we show the DLD AX within Microsoft ActiveX Control test Container.



DLD AX always displays the Average, RMS and Vpp (peak to peak) signal voltages of the last acquisition event. An analog bar on the left hand side is used for a visual feedback. Position of the bar represents the Average voltage and its width represents the RMS voltage.

Right clicking within the ActiveX control area brings up the DLD AX Control Properties page containing information about your detector and also used for setting up your signal acquisition parameters. You need to exit properties page, once all the parameters are selected, before data acquisition can occur.

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DLD_AX Control Properties										
General Extende	ed									
Channel Select Si	Number Points	Head Model DLD-100-Si-3	Serial Number							
Time Const. 2.7ms 5.5ms 11ms	I Free Run I Ext Trig.		Si-UV-3MM Input AC DC Gain							
Nyquist, [Hz]_	Symbolic Link Abet-0		10E5 ▲ 10E6 ■ 10E7 ▼ Output ■							
187500 ADC_Clk Freg, [H	łz]		Corr.Factor							
375000 🚔		Canad								

There are a few information windows and a few adjustable parameter windows on this properties page. Most are self explanatory.

The smallest transmission packet in USB 2.0 is 1024 data points. Rather than sending a single reading and filling the rest of the points with zeros we decided to collect data at the full Analog to Digital chip conversion frequency of 375 kHz and stream packets of data in multiples of 1024. This determines the allowable acquisition window time constants: 2.7 ms, 5.5 ms... 1.4 sec. That is also a reason for the DLD\_AX control always displaying averages and RMS instead of a single reading. However, each individual signal reading is accessible from within your application using one of the system properties.

When Free Run is checked data is collected continuously and no application graphics are updated. Use it when only looking at the DLD\_AX control and its displayed readings and bar graph. When data is to be displayed or saved by another application Free Run needs to be unchecked.

Synchronized data collection can be driven from a TTL external trigger. When external trigger is used, first point taken is delayed  $2.730677 \pm .000011$  ms. Each following point is then taken at 1/375 kHz A/D digitization cycle increments. **Please note:** do not check Ext Trig. Box if the TTL trigger is not present. This will generate a timeout condition.

AC or DC coupling can be chosen, depending on what kind of signal you are monitoring. Average voltage value is the meaningful reading for DC setting; RMS value is the meaningful reading in AC mode.

The Gain selection box allows you to choose transimpedance gain, in V/A, depending on your signal conditions. Choose the highest gain compatible with the required time response and staying within the linear range of the instrument ( $\pm$  7V) to get the most resolution from the 16 bit digitizer's  $\pm$  10V input range.

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Symbolic link list box displays enumerated devices which can be assigned to this ActiveX instance (useful when more than one DLD detector is being used simultaneously).

Correction factor, associated with the chosen gain, can be used to improve system response linearity when switching gains or provide the means for displaying calibrated values.

Bias window allows for setting offset voltage for a given gain setting which can be used to minimize the impact of amplifier DC bias, dark signal or stray light.

If the signal is too strong for the selected gain, a Signal Overflow warning appears as shown below for data taken with one of the application programs. Lower the gain or attenuate the signal so that meaningful data can be collected.



#### 4.1.1 Methods

#### Methods

AboutBox () Acquire () ReadBufferCH1 (VARIANT BufferA, long BufferSize) ReadBufferCH2 (VARIANT BufferA, long BufferSize) TransferCH1\_Point(long index) TransferCH2\_Point(long index) Return Type void boolean void void double double

### 4.1.2 Properties

**Return Type** BSTR BSTR **Property name** SymbolicLink; FirmwareRev;

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OutputCouplingModeOnCH1 LBIndex

OutputCouplingModeOnCH2 LBIndex;

InputCouplingModeOnCH1LBIndex;

InputCouplingModeOnCH2LBIndex;

HeadEEPROMRev;

TimeConstLBIndex;

EnumerationChain;

NyquistSamplFreq;

ChannelSelIdx;

SerialNumber

DeviceStatus;

NumberPoints:

SetTemperature;

SetADC ClkFreq;

RawDataBufferCH1;

RawDataBufferCH2; CH1 Gain LBIndex;

CH2 Gain LBIndex;

Peak2PeakCH1:

Peak2PeakCH2;

THETA; IntExtTrigSel;

FreeRun;

HeadModel;

AmplitudeCH1; AmplitudeCH2;

AverageCH1;

AverageCH2:

OverflowCH1;

OverflowCH2; SymbolicLink;

RMS CH1;

RMS CH2;

UserBiasCH1;

UserBiasCH2;

LapsTime;

FIRFilterBufferPointerCH1;

FIRFilterBufferPointerCH2;

UserCalibrationFactorCH1;

UserCalibrationFactorCH2;

Function Focused Innovation™

BSTR short BSTR short double short short LONG boolean long double double long long short short short short BSTR BSTR long boolean VARIANT BOOL BSTR BSTR BSTR LONG LONG BSTR BSTR BSTR BSTR BSTR BSTR BSTR DOUBLE DOUBLE DOUBLE DOUBLE LONG **Typical values** 

# TimeConstLBIndex:

		Acquisition window
ChannelSelIdx:		for single channel model
NyquistSamplFreq:	87500	Factory set
OutputCouplingModeOnCH1_LBIndex:	1	0 for AC, 1 for DC
DeviceStatus:	1	Factory use only
NumberPoints:	2048	Read only
SetTemperature:	10	N/A
SetADC_ClkFreq:	375000	N/A: defined by oscillator clock frequency
RawDataBufferCH1:	53346336	Pointer to User Buffer. Read only. System may c crash during attempt to write to it.
CH1_Gain_LBIndex:	1	Gain selection from list box
CH2_Gain_LBIndex:	1	Gain selection from list box

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Set/Get – List box index selecting duration of the



Function Focused Innovation™ InputCouplingModeOnCH1LBIndex: 0 DC/AC coupling InputCouplingModeOnCH2LBIndex: 0 DC/AC coupling Peak2PeakCH1: '0.010171' Read property Read property Peak2PeakCH2: THETA: 0 Reserved for future use IntExtTrigSel: 0 Trigger source True or False Free run. True or False FreeRun: 1 'DLD-100-Si-3mm' HeadModel: Head type Read property AmplitudeCH1: '0.002764' Read property AmplitudeCH2: N/A internal pointer FIRFilterBufferPointerCH1: 157810720 FIRFilterBufferPointerCH2: 61931552 N/A internal pointer AverageCH1: '0.001994' Read property " AverageCH2: Read property " Read property. Empty string when OK OverflowCH1: " OverflowCH2: Read property. Empty string when OK SymbolicLink: Driver symbolic link. Multiple DLD's will 'Abet-0' typically enumerate as follows Abet-1, Abet-2... In order to connect ActiveX object with active device this property value must match device name issued by Windows. WinObj.Exe utility allows you to learn about driver names for enumerated devices EnumerationChain: 'AEAEEEEEEEEEE'; String identifying enumerated and active devices on the USB bus. Read only property. In this example Abet-0 and Abet-2 are enumerated. This version of ActiveX can enumerate 16 detectors on the USB bus. assuming that 16 USB 2.0 hubs are available. EnumerationStatus: 1; Number of detected devices. ServiceLinkInfo: 'www.abet-technologies.com'; String which can be used by the application for fetching technical info for your detector model, via Internet Web browser. Read property. RMS CH1: '0.002764' Read property RMS CH2: Read property UserCalibrationFactorCH1: 1.0 Set/Get UserBiasCH1. 0.0 Set/Get UserCalibrationFactorCH2: Set/Get 1.0 UserBiasCH2: 0.0 Set/Get LapsTime: 20 Free Run refresh rate in ms

#### Please note:

- Do not use Properties for CH2 in single channel detector models.
- Abet reserves the right to change names of properties in the future as product development needs dictate.
- Set temperature property is only valid for detectors with Thermo Electric Cooler. -

In case of overflow condition, excess signal, applications return Not a Number: NaN is the IEEE arithmetic representation for Not-a-Number. A NaN is obtained as a result of mathematically undefined operations like 0/0 or inf-inf.

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### 4.1.3 Usage of methods

DLD\_AX1, h\_Ax are handles to ActiveX control. Handle name depends on language in use. VB 6.0 provides system dependend name while in Matlab it can be defined as follows: h Ax=actxcontrol('DLDAX.DLDAX.Ctrl.1', rect, '');

AboutBox () this method calls AboutBox Usage: VC++ AboutBox() VB 6.0 DLD AX1.AboutBox Matlab invoke (h Ax, 'AboutBox') Return Type void Acquire() this method starts data acquisition Usage: VC++ Acquire(); **VB 6.0** DLD AX1.Acquire() Matlab invoke(h Ax,Acquire'); Return Type boolean **NumberPoints** this property gets the size of the acquired data buffer ReturnType long RawDataBufferCH1 this property holds value of the pointer to dynamically allocated user memory size of allocated memory block is equal to NumberPoints property is only for use with Matlab or C/C++. do not write to this property - the value of this property must be cast to the pointer type 'double\*' within C/C++ code in order to get access to memory double \* p databuffer; //declare pointer p databuffer = (double\*)RawDataBuffer; /\*cast value of RawDataBuffer as an pointer. Elements of data in buffer can be accessed by de-referencing \*/ getUSB USERBuffer is a Matlab mex function for use with DLD<sup>TM</sup> this mex dll which takes care of necessary casting and passing data into matlab compliant variable Usage: MatLab A=getUSB USERBuffer(double(h Ax.RawDataBufferCH1), double(h Ax.NumberPoints)); %Gets Data into MatLab ReadBufferCH1 (VARIANT BufferA, long BufferSize)

this method reads data to variant array. Because of the Variant type, memory usage is substantial.

Usage:



VB 6.0 Dim CH1(8192) As Double 'Declare VB Array Call DLD\_AX1.ReadBufferA( CH1, DLD\_AX1.NumberPoints )

Return Type void

TransferCH1\_Point (long index)

this method reads single data point from ActiveX data buffer Because of passing data by value this method is slow for large data vectors

Usage:

 VB.NET Dim CH1() As Double 'Declare VB Dynamic Array Dim i As Integer
 ReDim CH1(DLD\_AX1NumberPoints)
 DLD\_AX1.Acquire() 'Acquire data
 For i=0 To DLD\_AX1NumberPoints -1 CH1(i) = DLD\_AX1.TransferCH1\_Point(i) 'Transfer raw data Next

Index i must be lower than DLD\_AX1NumberPoints

Return Type double

### 4.2 Applications (.exe programs)

#### 4.2.1 Time Domain application

This application, a form of digital oscilloscope, allows you to acquire, display, average (if you so choose) and save the data.

It requires the previously installed MATLAB<sup>TM</sup> runtime engine. Starting from the C:\Program Files\ABET TECHNOLOGIES\AbetDemoSetup\ directory (or the path you chose) open the folder Time Domain Demo and run **timedomain\_acq.exe.** You may wish to place a shortcut to this application on you desktop if it will be frequently used.



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It may take 5 - 40 sec before the program starts depending on your PC speed (the MATLAB<sup>TM</sup> Control Runtime engine is quite sizeable). Once active, the following screen appears:



DLD\_AX starts in a Free Run mode and is continuously updated. Clicking on any of the acquisition mode buttons turns the free running mode off and activates the selected acquisition mode.

Right clicking within the DLD\_AX control area, as explained previously, allows you to set acquisition parameters: length of individual data stream, V/A transimpedance gain, AC or DC coupling, and external trigger when present.

**Continuous acquisition**: signal is acquired during the selected time window (Time const.) and the acquired waveform display is continuously updated.



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**Single acquisition** - signal is acquired during a single selected time window (Time const.) and the acquired waveform displayed.

Averaged acquisition:

- Enter the number of acquisition time windows you want to average in the Average Count cell
- Click Averaged Acq button and observe the data being averaged



The data for the current waveform can be saved in .txt or .mat format by opening the <u>F</u>ile drop down menu. This data contains all the individual readings within the acquisition window and can be quite sizeable (1024, 2048, 4096...524288 points, depending on time window selected).

### 4.2.2 Abet Scan spectral acquisition application

This application allows you to control a monochromator and a DLD-100 series detector to perform spectrometric scans, display the results and save the data.

It requires the previously installed MATLAB<sup>TM</sup> runtime engine. This version works with Oriel MS260 and MS130 monochromators using RS232 communications. The monochromator needs to be attached to either COM1 or COM2 serial port. Starting from the C:\Program Files\ABET TECHNOLOGIES\AbetDemoSetup\ directory (or another path you chose) open the folder Abet Scan Demo and run **AbetScan.exe.** You may wish to place a shortcut to this application on you desktop if it will be frequently used.

It may take 5 - 40 sec before the program starts depending on your PC speed (The MATLAB<sup>TM</sup> Control Runtime engine is quite sizeable). Once active, the following screen appears:

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The program checks COM1 and COM2 ports for a connected monochromator and when found displays:

Status:	×
Found Connected Spectrometer on	СОМ1
OK	

Click OK to continue.

You now need to set up the scan and detector parameters. If you have never run the system before you may go to the file menu and load the last configuration.mat file to see an example of setup information:

Select File to	Open	? ×
Look in: 🔁	Abet Scan Demo 💽 🖛 🛍 📸 🧱	-
🗋 abetscan_	mcr	
astconfigu	uration.mat	
scan_temp	o_data1.mat	
1		
File name:	lastconfiguration.mat 0	ben
Files of tupe:		ncel
r iies or type.		

A set of values is loaded into the scan control and detector DLD\_AX areas:

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This table can be edited by modifying the Scan start, stop and step values (in nm) and the change over wavelengths for gratings and filters. You can modify the detector parameters in the usual way by right clicking on the active area of the DLD AX control. You can then name and save you new configuration through the File drop down menu.



Click the Scan Start button once you are ready to acquire spectral data:

The <u>T</u>ools menu gives you access to zooming features.

Data for the current scan can be saved in .txt or .mat format by opening the File drop down menu. If you try to run a monochromator scan without the scan table loaded a warning screen will remind you to do so:

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Setup Error

Vrong scanning parameters!

OK

You can also use this application to control the monochromator and detector to look at signal levels at various wavelengths with the available gratings and filters individually settable. A Shutter button allows you to check dark signal level. Please consult you monochromator manual for additional information.

#### 4.3 Demonstration programs

The following programs, with their explicit scripts, demonstrate the simplicity of invoking DLD\_AX from various software environments.

## 4.3.1 MATLAB<sup>TM</sup> demo

If you are a MATLAB<sup>TM</sup> user (version 6.5 or above) take a look at the abetdemo.m file in the C:\Program Files\ABET TECHNOLOGIES\AbetDemoSetup \Matlab Demo Script directory (or the path you chose during the installation). This m-file, when executed, collects 8096 data points and displays them in a plot:



You can use this file as a starting point for your own application development using the example script as a guide for communication with the DLD\_AX control.

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## 4.3.2 Visual Basic from within Excel demo

If you are an Excel user take a look at the DET\_DEMO.xls file in the C:\Program Files\ABET TECHNOLOGIES\AbetDemoSetup \ Excel Demo directory (or another path you chose during the installation). Please allow macros to be run when Excel asks you to do so. This demo, when the Acquire button is clicked, takes a single reading (of 1024 points) and loads the Average, RMS, peak to peak and first 50 points into the cells as shown below:

N 🗠	licrosoft E	xcel - DET_DEMO.	.xls											
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2	DMS	0.000100		Acquisition	0							-0.74340		
3	Vnn	1 219788		Counting	0							-0.74420		
4	трр	1.210700	·	Coupling	0							-0.74304		
5			101/									-0.74304		
6			1 č									-0.74091		
7												-0.73999		
8												-0.73907		
9												-0.73816		
10												-0.73755		
11												-0.73694		
12			1	A	0.000	476/	• I					-0.73541		_
13				Averad	erage = 0.86617[V]					-0.73511		_		
14			1 🖬 '							-0.73389				
15												-0.73358		
16			ЧП									-0.73267		
17				RMS = 0	0 410471	VI						-0.73114		
18						*J						-0.73083		
19												-0.72992		
20						_						-0.729		
21				Vnn = 1	210705	Л						-0.72809		
22				$v \mu \mu = 1$	.213131	/]						-0.72717		
23				••		-						-0.72626		
24												-0.72504		
25												-0.72443		
26			-10V				READY					-0.72382		
27												-0.7226		
28												-0.72137		
29		Acquire										-0.72107		
30												-0.72076		
31												-U./1924		
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To take a look at the Visual Basic script producing these results enter the Design Mode by clicking its button on the Control Toolbox tool bar.

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Microsoft	Excel - DET_DEMO.xls											J D
Eile Edit	<u>V</u> iew Insert Format	<u>T</u> ools <u>D</u> ata <u>W</u> indow	/ <u>H</u> elp Ado <u>b</u> e PDF						Type a	question for he	elp 👻 🗕	8
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A	B	C D	E F	G	Н		J	K	L	M	N	
Average	0.866166	Gain	1							-0.74548		
2 RMS	0.410468	Acquisition	0							-0.74426		_
3 Vpp	1.219788	Coupling	0							-0.74365		
1										-0.74304		_
5	10\	<u>/</u>								-0.74213		_
5										-0.74091		_
					-					-0.73999		_
					-					-0.73907		_
					-					-0.73816		_
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1					_					-0.73694		_
2				617F\/	1					-0.73541		_
5		AVEIAY	c = 0.00	017[V				-		-0.73511		_
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5	0	+			-					-0.73368		_
<u>.</u>		DMC -	0 44047	n /1	-					-0.73267		_
/			0.41047	VI	-					-0.73114		_
3					-					-0.73083		_
9					-					-0.72992		_
1					-					-0.729		_
1		Vnn = 1	219/91		-					-0.72809		+
2				v]	-					-0.72717		_
3					-					-0.72626		_
4					-					-0.72504		-
5	10)				DEAD					-0.72443		-
2	-101	v			READI					-0.72382		-
0										-0.7226		+
8	4									-0.72137		_
9	Acquire									-0.72107		_
4										-0.72076		_
										-0.71924		_
	a sector in the sec	- /										

and then double clicking on the Acquire button:

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When finished, close the Visual Basic window and click the design button again to return to the application.

#### 4.3.3 Visual Basic.NET Demo

Another datalogger demo is SimpleDLD\_Log.sln project in the C:\Program Files\ABET TECHNOLOGIES\AbetDemoSetup \ SimpleDLD\_Log directory (or the path you chose during the installation). You will need VB.net 2003 installed on your computer to compile the project. The executable is provided in 'bin' folder. The project needs Microsoft Script Control 1.0 present on your system. If the scripting control is not available through VB.NET toolbox you must download it from <u>http://msn.microsoft.com/</u>, then install and register it. For users interested in VB.NET programming we recommend book Mastering Visual Basic.NET by Evangelos Petroutsos, Published by SYBEX, ISBN 0-7821-2877-7.



	Function Focused innovation
C:\Program Files\ABET TECHNOLOGIES\AbetDemoSetup\SimpleDLD_Log	
File Edit View Favorites Tools Help	1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -
Address 🔄 C:\Program Files\ABET TECHNOLOGIES\AbetDemoSetup\SimpleDLD_Log	▼ <sup>2</sup>
Folders     ×       Image: Abet Scan Demo     Image: Abet Scan Demo       Image: Abet Scan Demo </td <td>ion</td>	ion
Type: Microsoft Visual Studio Solution Object Size: 911 bytes	911 bytes 🖳 My Computer 🥼

This application demonstrates the use of DLD\_AX within the VB.NET environment (data takes a long time to refresh - if you are in a hurry use MATLAB).



A sinusoidal modeling function is shown since room lights were used for this demo. Any VB recognized arithmetic function can also be used. Chapter 14 of the book mentioned above provides good insight and many examples.

#### 4.3.4 Demo of multiple detector usage

Using multiple DLD devices is quite straight forward under the USB 2.0 standard. Here we show an example of setting up and using two detector heads.

Connect your two detectors to the PC USB 2.0 hub.

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Verify the presence of multiple detectors in Device Manager

🚇 Device Manager	
<u>A</u> ction <u>V</u> iew   ← →    配   😫   🧟	
E	
🖻 🖅 🗇 Disk drives	
📄 🕀 🖳 Display adapters	
🗄 🖓 DVD/CD-ROM drives	
🗄 🚭 Floppy disk controllers	
Eloppy disk drives	
🗈 🚭 IDE ATA/ATAPI controllers	
📔 🚊 🥵 Instruments	
SB DIGITAL LIGHT DETECTOR	
E International	
📄 😳 🌿 Keyboards	
Image: Image	
E Monitors	
E - ■ Network adapters	-
J. J. J.	

Those devices typically will be enumerated by Windows as Abet-0 and Abet-1. This can be verified by Checking SymbolicLink ListBox in property page. In case of non-sequential enumeration, e.g. Abet-1, Abet-5; or other than starting from Abet-0 enumeration we recommend checking detector model property and serial number for each SymbolicLink. In case of discrepancies please power DLD's down and reboot your computer.

Insert two instances of the same DLD AX control into the Microsoft ActiveX container:



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At this point those two ActiveX instances are talking to the same physical device because they are using the same symbolic link e.g. Abet-1.

Enumeration scheme always enables last detected device with its symbolic link. Right click on each ActiveX instance in turn and from SymbolicLink: List Box chose the device you want to enable in each control:

DLD_AX Control P	roperties			×
General Extende	ed			
Channel Select: Si	Number Points: 1024	Head Model: DLD-100-Si-3		
Time Const.	☐ Free Run ☐ Ext Trig. s-> 2		Si-UV-3MM Input DC Gain 10E5	
Nuquist [Hz]	Symbolic Link:		10E6 10E7 V Output DC	
187500 Clk Freq, [Hz] 375000	102		Corr.Factor 1 Bias 0	
Info Link: www.abet.com				
	OK	Cancel	Apply He	elp

A notification dialog box appears after each selection:

DLD_AX	×
⚠	SymbolicLink has changed
	ОК

confirming established link with the selected DLD.

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Signals measured by the two devices are then displayed individually within their controls:



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An example of programmatically instantiated dual detector display is contained in MATLAB<sup>TM</sup> script twoheads.m which can be found in C:\Program Files\ABET TECHNOLOGIES\AbetDemoSetup \Matlab Demo Script directory (or another path you chose during the installation). When executed, the following figure is produced:



If you are not an MATLAB<sup>TM</sup> user, you can still view the contents of the twoheads.m file by opening it with any word processor.



## 5 Troubleshooting and cautionary notes

**USB error messages:** Check to be sure that your computer has an original USB 2.0 or higher interface and is not using either USB 2.0 add-on boards or hubs. Add on boards are occasionally not as robust in their communication capabilities. The diagnostic tools discussed in this manual can be used for their error utility capabilities. When all else fails power down and reboot the detector and the computer.

Average reading is not zero in AC coupling mode: When switching from DC to AC mode the decoupling capacitor discharges slowly – let it settle and system will behave.

The system may time out when external trigger mode is selected and a trigger is not supplied.

During data acquisition the computer should maintain power to the USB Hub. Some computers do not do a very good job of it when various Power Saving options are turned on. We suggest that you set power schemes to always ON (and leave hibernation to the bears):

Power Options Properties	×					
Power Schemes Advanced Hibernate UPS						
Select the power scheme with the most appropriate settings for this computer. Note that changing the settings below will modify the selected scheme.						
Power schemes						
Always On						
Save As Delete						
Settings for Always On power scheme						
Turn off monitor: After 20 mins						
Turn off hard disks: Never						
System standby: Never						
OK Cancel Apply						

The Windows operating system is not a real time OS. Therefore, one cannot assume that time critical functions will be treated as such. Windows system internal higher priority processes can occasionally cause unpredictable effects in time dependent data collection. Please run a minimum number of programs simultaneously to help assure uninterrupted data acquisition.

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If you encounter glitches or discontinuities in your data acquisition you may set your application's priority to "Realtime": Press Ctrl\_Alt\_Del to invoke Windows task manager, choose Processes tab, find your program and right click it. In properties menu choose Realtime. A warning will appear – disregard it and see if data acquisition performance improves (other running programs may slow down but will typically work OK).

🗏 Windows Task Manager 📃 🗖 🔀										
File Options	View Shu	t Down Help								
Applications Processes Performance Networking Users										
Image N	ame	User Name	CPU	Mem Usage						
taskmgr.e	exe NUEXE	ZB SVSTEM	00	4,344 K 232 K						
matlab.ex	(e	ZB	00	44,248 K	=					
alg.exe		LOCAL SERVICE	00	3,232 K						
MsPMSPS	v.exe	SYSTEM	00	4,052 K 1.336 K						
svchost.e	exe	SYSTEM	00	3,836 K						
retrorun.	exe	SYSTEM	00	2,880 K						
cisvc.exe		SYSTEM	00	148 K						
avgupsvo	.exe reve	SYSTEM	00	2,852 K 14 604 K						
winhln32.	exe	7B	00	680 K						
NetgearA	G.exe	ZB	00	3,640 K						
NotifyAle	rt.exe	ZB	00	13,516 K						
qttask.ex	e	ZB	00	4,876 K						
hpgs2wn	d.exe	ZB	00	2,956 K						
Support.e	exe	ZB	00	4,912 K						
hkcmd.ex	e	ZB	00	3,284 K						
WINWOR	D.FXF	7R	00	30.664 K						
Show p	rocesses fro	m all users		End Proces	s					
Processes: 57	CPU Us	age: 4%	Commit Chai	Processes: 57 CPU Usage: 4% Commit Charge: 341M / 1248M						

#### Head Malfunction:

DLD_AX	×
	Head CheckSum Error!
	ExpectedSum=3002 Calculated Sum=3a3
[	ок

Head EEPROM bytes dump will follow.



Call your sales representative or the factory.

#### 5.1 About the included diagnostics tools:

If you ever need to check on the status of the ActiveX world these tools can come in handy.

Abet DevCon.exe is a modified Microsoft USB tree interrogator showing properties of installed Abet Devices.

TSTCON32.exe is Microsoft ActiveX test container. Please see Microsoft MSDN documentation for information on how to use it:

http://msdn.microsoft.com/library/default.asp?url=/library/en-us/vccore98/HTML/ core test container.asp

From the Edit menu you can insert Abet Technologies' DLD\_AX control

Insert Control	<u>?</u> ×
DirectSS Class DirList Class DiskManagement.Control Displays a collection of ListItems such Displays a hierarchical list of Node obje DLD_AX Control Downloadable Speech API Downloadable Whistler 4.0 DSDisplayPanel Class DSStatusBar Class C:\DOCUME~1\ADMINI~\DLD_AX.ocx	OK Cancel Implemented Categories Required Categories

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👪 Untitled - ActiveX Control Test Container	- O X
File Edit Container Control View Options Tools Help	
D 🚅 🔒 👗 🛍 🛱 🔄 📦 😭 🗖 💽 👂 🐩 🤋	
Run Macro:	

From the Control Menu invoke methods will bring a dialog of available methods and properties:

nvoke Methods			? >
Method Name:		7	Invoke
Acquire (Method)	<u>×</u>		Class
Parameters:			Liose
Parameter	Value		Туре
J			
Parameter Value:		Parameter Type:	1
			Set Value
Return Value:			
Exception Description			
Exception Source:			
		Exception Help	

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By right clicking the ActiveX control area DLD\_AX Control Properties will be shown:

The property page look depends on the type of head you are using

DLD_AX Control P	roperties			×
General Extende	ed			
Channel Select: InGaAsP Time Const. 2.7ms 5.5ms 11ms	Number Points: 1024 Free Run Ext Trig. x-> 1	Head Model: DLD-100-InGa4	InGaAsP-3MM Input DC Gain 10E5	
Nyquist, [H2] 187500 Clk Freq, [H2] 375000 = Info Link:	Symbolic Link: Abet-0 Serial Number: 101		10E6 10E7 ▼ Output DC Corr.Factor 1 Bias 0	
,				
	ОК	Cancel	Apply Help	

Below are some examples:

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DLD_AX Control P	roperties			2
General Extend	ed			
Channel Select: Si InGades F Time Const. 2.7ms 5.5ms 11ms Detected Devices Nyquist, [H2] 187500 Clk Freq, [H2] 375000 Info Link: www.Abet-Tech	Number Points: 1024 Free Run Ext Trig. Symbolic Link: Abet-0 Serial Number: 103 Set. Point, [deg C 10 +	Head Moo DLD-100- InGaAs- Input AC DC Gain 10E5 10E6 10E7 Output DC Corr.Fact 1 Bias 0	Jel: Sandwitch-2 Ex Si-UN Input AC Gain 10E5 10E 10E 0utpu DC Corr.F 1 Bias 0	5 A
	ОК	Cancel	Apply	l Help
DLD AY Control P	roperties			 
General Fxtende	d			
Channel Select:	Number Points:	Head Model	: -5-T1 ⊂Si-UV-T	FC-
Time Const. 2.7ms 5.5ms 11ms	I▼ Free Run I™ Ext Trig.		Input AC DC Gain	×
Detected Device:	≫ 1 Symbolic Link: Abet-0		10E5 10E6 10E7 Output	×
Nyquist, [Hz] 187500 Clk Freq, [Hz]	Serial Number: 100 Set. Point, [deg C]		Corr.Fac 1 Bias	tor
375000 🚍	10		0	
www.abet.com				
	ОК	Cancel	Apply	

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DLD_AX Control P	roperties			×
General Extende	ed			
Channel Select: Si Time Const 2.7ms 5.5ms 11ms Detected Device	Number Points: 1024 Free Run Ext Trig.	Head Model: DLD-100-Si-3	Si-UV-3MM Input AC Cain 10E5 10E6	
Nyquist, [H2] 187500 Clk Freq, [H2] 375000 == Info Link: www.abet.com	Symbolic Link: Abet-0 Serial Number: 102		00E7 ▼ Output DC Corr.Factor 1 Bias 0	
	OK	Cancel	Apply Help	

#### Nonsequential Enumeration:

Situation of non sequential enumerations happens when one of DLD's was hot removed or disconnected and then reinserted to the bus. It may lead to some confusion for inexperienced users. Simplest solution: power down detector and PC and start fresh.

To keep track of enumeration scheme in your custom program please interrogate property

EnumerationChain: 'AEAEEEEEEEEEE'

Interpretation of this string is as follows:

Abet-0 Empty Abet- 2 Empty Empty Empty Empty .....etc.

By issuing the SymbolicLink = "Abet-2" your program will connect you with that device.

If device is plugged into a different hub port than that used during original installation Windows may ask to repeat installation. By pointing to Windows\system32\drivers folder Windows will find the Abet driver and continue installation. No need to use CD-ROM.



Files Needed			
<u>o</u>	The file 'Abet.sys' on (Unknown) is needed.	OK	
		Cancel	
	Type the path where the file is located, and then click OK.		
	Copy files from:		
	C:\WINDOWS\system32\drivers	Browse	



## 6 Specifications

All specifications are subject to model dependent modifications.

- Compatible with PC's running Windows XP or later
- USB 2.0 or higher (cable not included)
- ActiveX interface. Each ActiveX communicates with one DLD at a time. Multiple ActiveX instances can run simultaneously allowing ratiometric measurements.
- A photodiode of your choice (system frequency response depends on diode capacitance and gain see typical curves below). Just about any diode in a package up to TO-8 size can be accommodated.
- Room Temperature and TE cooled models. TE cooler controller built in
- Software selectable transimpedance gains of  $10^5$ ,  $10^6$ ,  $10^7$  and  $10^8$  V/A
- 16 bit, 375 kHz Analog to Digital Converter.
- Si/InGaAs sandwich models with dual A/D channels two fully independent transimpedance amplifier and ADC channels are included for sandwich detectors
- TTL Sync through SMA connector. When external trigger is used, first point taken is delayed 2.730677 ± .000011 ms. Each following point is then taken at 1/375 kHz A/D digitization cycle increments.
- Universal voltage power supply. 100 240 V, 50/60 Hz
- CE mark





Some typical frequency response curves at various gain settings:

Frequency characteristics of a 3 mm silicon diode, AC coupled

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Frequency characteristics of a 5 mm silicon diode, DC coupled

The slight waviness of some of the plots above is in all likelihood the result of source misbehavior rather than that of the detector but we had no easy way of independently verifying it.

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Typical dimensions of a DLD. A <sup>1</sup>/<sub>4</sub>-20 tapped hole under the detector element allows for mounting of the DLD on an optical bench. ThorLabs ER 6 mm series rod mounting holes on a 30 mm pattern allow adaptation of any optical mount compatible with that caging system. C-mount 1.00-32 threads allow the use of a multitude of commercially available accessories and adapters.

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## 7 Declaration of Conformity

DECLARATION OF CONFORMITY					
Manufacturer	's name:	Abet Technologies			
Manufacturer	's address:	282 Oronoque Road			
		Milford, CT 06460			
		USA			
Declares that	the product:				
	Product Name	Digital Light Detectors			
	Model Number:	Abet Technologies Model DLD-100 series			
Conforms to t	he following Product Specificatio	ms:			
	Safety:	EN 61010-1 (2001 - 02)			
	EMC:	EN 50081-1: 1992			
		EN 55022: 1994 / EN 55011: 1993 Class B			
		EN 50082-1: 1992			
		/EC 801-2:1991 / IEC 1000-4-2: 1995			
		ENV 50140: 1993 / EC 1000-4-3: 1995 / EN 61000-4-3: 1995			
		IEC 801-4: 1988 / IEC 1000-4-4: 1995			
Complies with	the following Directives:				
	- the EMC Directive	89/336/EEC			
	- the Low Voltage Directive	73/23/EEC			
And according	ity, carries the CE mark.				
A					
Milford, CT	February, 2005	Mar S.M.	(Signature)		
		Allen Smith	(Name)		
		President	(Title)		

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#### 8 Warranty and Returns

Abet Technologies warrants that all goods described in this manual (except consumables such as lamps, bulbs, filters, ellipses, etc.) shall be free from defects in material and workmanship. Such defects become apparent within the following period:

- All products described here, except spare parts: one (1) year or 3000 hours of operation, whichever comes first, after delivery of the goods to the buyer.
- 2. Spare parts: ninety (90) days after delivery of goods to the buyer.

Abet Technologies' liability under this warranty is limited to the adjustment, repair and/or replacement of the defective part(s). During the above listed warranty period, Abet Technologies shall provide all materials to accomplish the repaired adjustment, repair or replacement. Abet Technologies shall provide the labor required during the above listed warranty period to adjust, repair and/or replace the defective goods at no cost to the buyer ONLY IF the defective goods are returned, freight prepaid, to a Abet Technologies designated facility. If goods are not returned to Abet Technologies, and the user chooses to have repairs made at their premises, Abet Technologies shall provide labor for field adjustment, repair and/or replacement at prevailing rates for field service, on a portal-to-portal basis.

Abet Technologies shall be relieved of all obligations and liability under this warranty of:

- The user operates the device with any accessory, equipment or part not specifically approved or manufactured or specified by Abet Technologies unless buyer furnishes reasonable evidence that such installations were not the cause of the defect. This provision shall not apply to any accessory, equipment or part which does not affect the safe operation of the device.
- 2. The goods are not operated or maintained in accordance with Abet Technologies' instructions and specifications.
- 3. The goods have been repaired, altered or modified by other than authorized Abet Technologies personnel.
- 4. Buyer does not return the defective goods, freight prepaid, to a Abet Technologies facility within the applicable warranty period.

IT IS EXPRESSLY AGREED THAT THIS WARRANTY SHALL REPLACE ALL WARRANTIES OF FITNESS AND MERCHANTABILITY. BUYER HEREBY WAIVES ALL OTHER WARRANTIES, GUARANTEES, CONDITIONS OR LIABILITIES, EXPRESSED OR IMPLIED, ARISING BY LAW OR OTHERWISE, WHETHER OR NOT OCCASIONED BY ABET TECHNOLOGIES' NEGLIGENCE. agreement is invalidated, the remainder of the agreement shall remain in full force and effect.

#### CONSEQUENTIAL DAMAGES

Abet Technologies shall not be responsible for consequential damages resulting from misfunctions or malfunctions of the goods described in this manual. Abet Technologies' total responsibility is limited to repairing or replacing the misfunctioning or malfunctioning goods under the terms and conditions of the above described warranty.

#### INSURANCE

Persons receiving goods for demonstrations, demo loan, temporary use or in any manner in which title is not transferred from Abet Technologies, shall assume full responsibility for any and all damage while in their care, custody and control. If damage occurs, unrelated to the proper and warranted use and performance of the goods, recipient of the goods accepts full responsibility for restoring the goods to their condition upon original delivery, and for assuming all costs and charges.

#### RETURNS

Before returning equipment to Abet Technologies for repair, please call the Customer Service Department at (203) 540-9990. Have your purchase order number available before calling Abet Technologies. The Customer Service Representative will give you a Return Material Authorization number (RMA). Having an RMA will shorten the time required for repair, because it ensures that your equipment will be properly processed. Write the RMA on the returned equipment's box. Equipment returned without a RMA may be rejected by the Abet Technologies Receiving Department. Equipment returned under warranty will be returned with no charge for the repair or shipping. Abet Technologies will notify you of any repairs not covered by the warranty, with the cost of the repair, before starting the work.

Please return equipment in the original (or equivalent) packaging. You will be responsible for damage incurred from inadequate packaging, if the original packaging is not used.

Include the cables, connector caps and antistatic materials sent and/or used with the equipment, so that Abet Technologies can verify correct operation of these accessories.

#### SOFTWARE DISCLAIMER

Abet Technologies makes no warranty or representation, either expressed or implied, with respect to the Software or its contents, quality, performance, merchantability, or fitness for a particular purpose. In no event will Abet Technologies, its distributors, or dealers be liable to you or any other party for direct, indirect, special, incidental, consequential, or other damages arising out of the use of or inability to use the Software or its contents even if advised of the possibility of such damage.

This warranty shall not be extended, altered or varied except by a written document signed by both parties. If any portion of this

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