Laser Software

Developers Guide

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OVERVIEW

This document describes interfacing a New Wave Research laser to a computer or other device using a RS232 serial connection. It covers how to use the supplied software, as well as how to write your own software for controlling the laser.

Lasers Supported

The information in this manual applies to lasers manufactured by New Wave Research that include an imbedded microcontroller and a RS232 (serial) computer interface, **with the exception of lasers produced prior to 2001, and those equipped with the "older" electronics package,** which use an older microcontroller and command set, and are not compatible with the software written for the newer systems.

Models supported include:

- Polaris
- Tempest
- QuikLase II
- Orion
- EzMark
- EzLaze II
- Jasper

Models which are NOT supported:

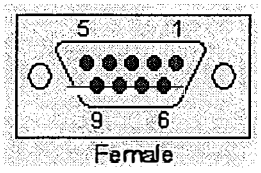
- MiniLase
- QuikLase

Hardware Connection

The computer (or other controller) is connected to the laser by connecting a cable from a RS232 serial port on the computer to the RS232 port on the back of the laser. A straight-through cable should be used when connecting the computer to the laser, DO NOT USE A NULL-MODEM CABLE. Pinouts for the laser and computer are supplied below for reference.

Laser RS232 Port Pinout

The RS232 port on the back of the laser is a female DB9 connector. The pins are numbered as shown here (as viewed when looking at the back of the laser):

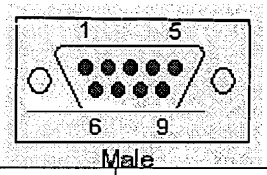


Pin No.	Name	Description
1	+12VDC	Power for remote box. 1A maximum current.
2	Tx	RS232 Transmit

3	Rx	RS232 Receive
4	NC	No connection
5	Gnd	Ground
6	NC	No connection
7	NC	No connection
8	NC	No connection
9	NC	No connection

PC Serial Port Pinout

Most PC's come with at least one serial port; usually it is a male DB9 (9-pin) connector on the back of the computer. Some older computers use a DB25 (25-pin) connector, which have a different pinout.

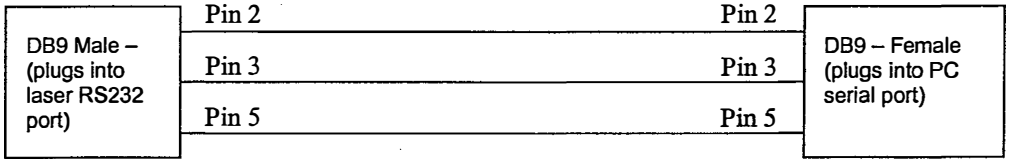


Pin No.	Name	Description
1	DCD	Data Carrier Detect †
2	Rx	RS232 Receive
3	Tx	RS232 Transmit
4	DTR	Data Terminal Ready †
5	Gnd	Ground
6	DSR	Data Set Ready †
7	RTS	Request to Send †
8	CTS	Clear to Send †
9	RI	Ring Indicator †
† denotes signal not used by the laser interface		

Making an Interface Cable

If you wish to make your own cable to connect a PC to the laser, all you need to do is to connect pins 2,3 and 5 on the laser RS232 port to the same pins on the DB9 serial connector on the PC, as shown below:

Laser RS232 Interface Cable



Special Note About Connecting a Palm™ Handheld Computer

It is possible to connect a Palm™ handheld computer to the laser and control it from the handheld. Many Palm computers use a serial port to connect to the PC, this same port can be used to connect to a laser, however special cabling is required. Contact New Wave Research for details on connecting a Palm to a laser.

SOFTWARE INTERFACE

It is possible to control the laser using a variety of methods: you can use the software supplied by New Wave Research, or you can write your own. Each method is briefly described below.

LaserExec Software

LaserExec is a Windows™ program with a graphical user interface that lets you interactively control the laser from the computer. It has the ability to store and recall settings, and control most laser functions. It includes on-line help that details its use and operation. It is described in further detail later.

Writing Your Own Programs

If you need to incorporate control of the laser into your own software, then New Wave Research provides a variety of tools and methods to make your job easier.

32-bit Windows Operating Systems (Windows™ 95/98, Window™ NT, Windows™ 2000, Windows™ XP)

If you are working in a 32-bit Windows™ environment, then you can make use of the supplied ActiveX Control component to quickly and easily integrate laser control into most development environments. New Wave Research also supplies Windows Dynamic Link Libraries (DLLs), Delphi VCL components, and Dynamic Data Exchange (DDE) interfaces for controlling our lasers from Windows. Any of these methods frees you from having to use and understand each laser's particular command set, and ensures future compatibility for your software. **If you are using Windows, then the ActiveX control interface is the preferred method, for reasons of ease-of-use, future expandability, and ease of maintenance.**

Other Operating Systems

For other operating systems, we provide complete documentation of the serial command set for each laser. Using this, you can write your own programs for any system that supports serial communications. **Using this method requires that you completely read and understand the command set documentation, and requires that your program take responsibility for initializing the laser and setting all the required laser parameters; in addition, your program will need to periodically check the laser status and respond to events such as interlock conditions accordingly.** The laser command sets are provided in separate documents.

LASEREXEC SOFTWARE

LaserExec is a Windows™ application supplied by New Wave Research for controlling a laser over the RS232 port. It is simple and easy to install and use, and is useful for doing simple, interactive control of the laser from the PC.

System Requirements

To install and use LaserExec you need the following:

- Intel-compatible PC running Windows™ 95, 98, NT 4, 2000 or XP.
- An unused serial port on the PC (a USB-to-RS232 adapter may be used).
- A cable for connecting the PC serial port to the laser's RS232 port.
- Approximately 1MB free disk space.

Getting the Latest Version

Go to New Wave Research's web site at www.new-wave.com to check for updates and download them from there.

Installation

LaserExec is installed when you install the Laser Software Developer's Kit (SDK). It can be also be installed on any computer by simply copying the LaserExec.EXE file.

Using LaserExec

Before starting the program, make sure the RS232 port on the laser is connected to the serial port on the computer, and the laser is turned on. When the program is started, LaserExec will check for a laser connected to any of the available serial ports on the computer, and initialize the laser.

Press F1 at any time while running LaserExec to view the on-line help for the program, and get detailed instructions on operating the software.

WRITING PROGRAMS TO CONTROL THE LASER

Before starting to write your own program to control a laser, check with New Wave Research for any updates to the documentation and laser interface by contacting New Wave Research Technical Support:

Getting Technical Support

If you have any questions, contact New Wave Research via any of the following methods:

Internet

Check New Wave Research's web site at www.new-wave.com for software and documentation updates.

Email

support@new-wave.com

Phone/Fax

Phone 510/249-1550

Fax 510/249-1551

Supported Platforms and Development Environments

Currently, New Wave Research supplies software, examples and documentation for developing your applications using the following operating systems and environments:

- **Operating Systems**: Windows™ 95/98, Windows™ NT 4.0, and Windows™ 2000 and XP.
- **Development Environments**: Microsoft Visual C++, Microsoft Visual Basic, Borland Delphi, Borland C++ Builder, and any other Window development environment that supports ActiveX controls.

Choosing an Interface Method

You can choose a variety of different methods for implementing control of the laser in your own software. Each method has its advantages and disadvantages. In general, you should try and avoid using the laser's RS232 command set directly and use one of the provided object-oriented approaches where possible. Most modern Windows™ development environments support ActiveX controls or DDE interfaces – using one of these frees you up from having to understand the complexities of the low-level laser command set, and also frees you from having to change your software should changes be made to the command set in the future.

The pros and cons of each method are described below:

ActiveX Control

ActiveX controls are special program objects that can be easily integrated into Windows™ programs. Most Windows development environments allow you to import an ActiveX control into your program and set its properties at design-time and easily manipulate it at run-time.

Advantages:

- Supported by a wide variety of Windows development environments (Visual C++, Visual Basic, Delphi, LabVIEW, C++ Builder and more...). Can also be used within many applications such as Microsoft Word and Excel.

- Built-in support for serial communications.
- Easy to use.
- Object-oriented design – simplifies many tasks and handles errors in a consistent way.
- Future compatibility – your software is isolated from future changes to the laser's low-level command set, or interface hardware. All you need to do is download and install the latest ActiveX control to ensure compatibility.

Disadvantages

- Installation – must be installed and registered on the user's system. (Most installation programs can do this automatically).
- Only supported by 32-bit versions of Windows.

Delphi Control

The Delphi control is similar to the ActiveX control, but is supplied in a special format for use with Borland Delphi or C++ Builder only.

Advantages:

- Easy to use, requires little or no code be written.
- Requires no special installation on user's machine, can be compiled into your application.
- Object-oriented design – simplifies many tasks and handles errors in a consistent way.
- Built-in support for serial communications.
- Future compatibility – your software is isolated from future changes to the laser's low-level command set, or interface hardware. All you need to do is download and install the latest control to ensure compatibility.

Disadvantages

- Works with Borland Delphi and Borland C++ Builder only.

Direct Control using the RS232 Command Set

The command set is the lowest level of control for the laser. Using the command set should be considered a last alternative because the disadvantages heavily outweigh the advantages.

Advantages:

- Platform and operating system independent. This is the only option currently available for DOS, Windows 3.1, PalmOS, Unix, Linux and other non-Windows platforms.

Disadvantages

- Requires in-depth knowledge of the low-level command set, and serial interface programming. The burden is on the programmer to conform to the command protocol and syntax.
- Future compatibility problems – it is possible that in the future New Wave Research may make enhancements to the command set, or may change the interface hardware (to USB for example) such that you are required you to change your software.

ACTIVEX CONTROL

Installation/Requirements

When you install the software developer's kit (SDK), the ActiveX control is installed on your computer and registered with the system. If you plan to use the ActiveX control in your own software, you need to make sure that you distribute the ActiveX control with your software, and that your installation program handles registering the control with Windows. The ActiveX control is in a file named **NWLaserXControl.OCX**. Contact New Wave Research if you have any questions about how to distribute this file.

Using the ActiveX Control

Once installed, the ActiveX control is registered with the Windows operating system under the object name **NWLaserXControl**, containing the CoClass **NWLaserX** which implements the properties and methods needed to control the laser.

A help file is also included which details the specific properties and methods of the control.

In general, to use the control in your own software, follow these steps:

1. Create an instance of the laser control object. (Some development environments do this for you automatically when you add the control to your application).
2. Set the PortNumber property to the COM port that is connected to the laser.
3. Call the InitializeLaser function, it will return TRUE if successful.
4. Set any properties (RepRate, OutputLevel etc...) to their desired values.
5. Set the LaserEnabled property to True, this turns on the laser power supply and cooling system.
6. Check the LaserStatus to make sure that all the safety interlocks are satisfied -- the laser will not fire if any interlocks are tripped.
7. Call FireLaser to start the laser firing, call StopLaser to stop it.

Examples

Visual Basic

The following is a simple code fragment showing how to create an instance of the laser control object, and an example of enabling the laser.

```
Dim Laser As Object

Sub EnableLaser
    ' Create a laser object if it hasn't been done yet
    If Laser Is Nothing Then
       Set Laser = CreateObject("NWLaserXControl.NWLaserX")
    End If

    If Laser.Initialize Then
       Laser.RepRate = 10 ' set the rep rate to 10Hz
```

```
        Laser.LaserEnabled = True ' turn on the laser power supply, get it
ready…
    End If
End Sub
```

DELPHI COMPONENT

Installation/Requirements

The Delphi laser control component is supplied as a library package file (.BPL).

To install the component into Delphi, see the Delphi documentation on how to install third-party components. Once installed, the laser control component should appear on your component palette under the tab named "New Wave".

A help file is also included, which can be integrated with Delphi's on-line help so that you can get help on using the component right from within Delphi. See your Delphi manual for information on importing third-party help files.

Using the Component

To use the component, simply place it on a form in your application, set the necessary properties, and you are done! You will probably also want to add some error handling, and the ability to change some of the properties at run-time. The supplied help file is the best source of up-to-date information on the details of using the component.

RS232 COMMAND SET REFERENCES

The RS232 command set represents the lowest-level way to control the laser. In almost all cases, it is preferable to use the ActiveX control or the Delphi component, as these objects will do everything that the command set will do, and are much easier to use. It is recommended that you only use the command set if you are programming in an environment that doesn't support ActiveX controls.

Because the command sets are slightly different for different models of lasers, the command sets for each laser are documented separately. These documents are included with the Laser SDK, and available for downloading from the New Wave Research website at www.new-wave.com.