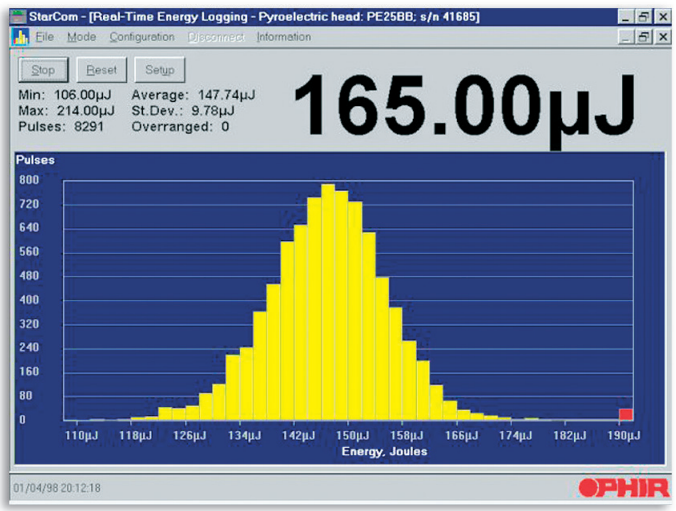
StarCom 32



StarCom 32

Communications Software for Ophir Laser Power/Energy Meters

User Manual and Programmer's Guide

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Chapter 1.

Introduction

Overview

Welcome to StarCom for Windows. StarCom is a full-featured data interface for Ophir Optronics LaserStar, NOVA, Orion, Nova-II, and Vega power and energy meters.

StarCom features include:

- Automatic installation procedure.
- Upload logged data from a LaserStar, NOVA, Orion, Nova-II, or Vega display. You can also provide real-time data logging to a PC via the RS-232 communication cable.
- Display logged or uploaded data in a numeric, graphics or combined format. Graphics parameters are selected automatically and can also be manually adjusted.
- Communication with a device, using device's system of commands. (See Appendix A5, "Syntax Definitions and Commands").
- Output graphics data to a printer.
- Save data to a PC file, which can be imported afterward to a text document or spreadsheet.
- Resize the StarCom window to have several other programs running on your screen.
- All these and some other options are provided via an easy to use intuitive menu driven graphics user interface.

System Requirements

To use StarCom for Windows you need:

- A personal computer with a 486DX-4/100 or higher processor.
- Typical available hard disk space required: 2-4 MB (actual requirements will vary based on an amount of data to store in PC files).
- 4 MB of memory (6 MB or more recommended).
- VGA or higher resolution graphics card with 512 KB of video memory (1 MB or more recommended).
- CD-Rom Drive
- Mouse or other pointing device.
- Optional printer.

- Microsoft Windows 98, 2000, XP or Vista (32 bit). Note: if you have Windows 3.1, you can find the last 16 bit version of StarCom on the Ophir Web site at http://www.ophiropt.com.
- Ophir Display (LaserStar, Nova, Orion, Nova-II, or Vega) with optional RS232 adapter.

1.1 Getting Started

1.1.1 Installing StarCom on Your PC

Note 1:

Version 2.02 of StarCom will only be able to read stored files from LaserStar displays with ROM version 1.57 and later. If you have an older version LaserStar (you can check this by turning on the display with no head attached), contact your Ophir agent to update the LaserStar software.

Note 2:

If a previous (32-bit) Version of StarCom already exists in the PC, it is recommended to remove the previous version using the Add/Remove Programs function in the Windows Control Panel.

Note 3:

Make sure no other application is active during StarCom installation.

Note 4:

In Windows 2000, XP, or Vista, the installation must be performed with Administrator privileges. If logged in without Administrator privileges the installation will not be allowed.

1. Start Windows as you normally would. Make sure there are no other applications running before you continue with the installation of StarCom.
2. Insert the StarCom CD-ROM in the CD-Rom drive. Select Install StarCom from the Menu offered.
3. Follow the On-Screen instructions.
4. If you receive a message "File 'XXXXX' is unacceptable", select "Ignore".
5. StarCom is ready to work right after the installation has been successfully completed. StarCom functionality is the same for all platforms.

1.1.2 Communication Setup

1. Install the StarCom software on your PC as described above.
2. Plug any Ophir head into your LaserStar, NOVA, Nova-II, or Vega display.
3. Connect your device to a computer serial port by means of the Ophir RS232 cable.
4. Turn on the display and run StarCom. Wait until the main panel appears on the screen. The instrument should be automatically connected and “disconnect” should appear on the screen. If the instrument is not connected, an error message will appear. In order for the instrument to connect, you have to be connected to the proper COM channel, see the next paragraph.
5. Set up the proper communication port number using the "Configuration" menu (usually COM1: or COM2:).
6. Switch to the "Real-Time Power logging" from the "Mode" menu. Wait until the panel appear on a screen and press the "Start" button.
7. If StarCom starts to log power readings, then the communication port is correctly configured. If the message "COM1: is currently being used by another device." appears, then you have selected a communication port which is already being used by another device (a mouse, for instance). Try a different comm. port and continue from the step 6.
8. If the single message "Can not communicate with the instrument" appears on the screen and steps 1 - 5 have been performed correctly, try a different comm. port and continue from the step 6. Also, make sure you do not have StarCom opened another time in a different menu because it cannot operate if open already in a different menu.

Chapter 2.

StarCom Operation Modes

Note 1:

For further information about using the RS-232 interface of Ophir devices see Appendix A.

Note 2:

Unless otherwise noted, Device refers to LaserStar, Nova, Orion, Nova-II, or Vega displays.

2.1 Terminal Mode

Terminal mode enables the PC to communicate with the device via the RS-232 data cable.

Note:

StarCom Terminal mode will not communicate with a modem or any device other than the LaserStar, Nova, Orion, Nova-II, or Vega because of the specific protocols used by the Terminal. (See appendix A5 for a full description of Ophir RS232 commands).

The following discussion assumes that steps 1 - 6 of section 1.2 have been performed already and the proper Comm. port is set up.

To enter Terminal mode, select "Terminal" from the "Mode" menu. The Terminal panel will appear on the screen with a blinking cursor in the upper left corner. StarCom is now ready to transmit commands to the instrument.

To issue a command just type it on the screen and press the "Enter" key. There is no need in the command to use the prefix symbol "$". The keyboard will be locked until the command is responded to or StarCom detects a loss of communications, whichever comes first.

The response to a command appears on the screen on the next line.

You can repeat the last command by pressing the "Enter" key at the beginning of an empty line.

To repeat a previously issued command, press "Enter" with the cursor located somewhere on the line containing the desired command.

You can scroll through the Terminal screen using arrow keys and the horizontal and vertical scroll arrows.

To exit Terminal mode, press the "Esc" key or click on the window close icon with the mouse.

2.2 Power Mode

2.2.1 Power Graph Setup

To enter the setup menu, use the "Setup" button on the "Real-Time Power Logging" panel. If operating with the dual channel LaserStar, choose channel A or B or choose ratio with A/B or B/A or choose difference with A-B or B-A.

The power graph setup menu allows you to setup the real-time power logging scales, power graph limits, time period, and statistics information. There are five sections in the power setup menu:

- **Graph Limits**, to select power graph limits.
- **Time period**, to select the logging time period.
- **Grid Style**, to select graph grid style.
- **Display**, to select the display mode.
- **Statistics**, to specify which statistics to show.

Graph Limits (This setting affects Real-time and Off-line power modes).

This menu sets the power graph lower and upper limits. You can specify the numeric value in the range 0-999 (1-999 for the upper limit) using the scroll arrows or by typing a number into the entry box. To specify the desired range you may need to select the proper units label from the "Units" box and the appropriate multiplication factor from the "Scale" box. These settings can be changed at any time; even while power logging is in progress. In the dual channel ratio mode (where there are no units), the user sets the lower and upper numerical limits and the exponent. The ratio is from 0 to 10 with an exponent range of -15 to +15. The power difference is from -999 to +999.

Time Period (This setting affects the Real-time power mode only).

With time period, you can specify the data logging time period in the range from 0 seconds to 24 hours in steps of one second, where a zero value stands for a single reading.

Grid Style (This setting affects Real-time and Off-line power modes).

Select your favorite graph grid-lines style: horizontal lines only, vertical lines only, both lines (default), or neither of them.

Display (This setting affects the Real-time power mode only).

- Numeric only. Some users find it very useful to have large numbers on the screen, which enables them to monitor readings from afar. This feature is especially useful with the Nova that has a small display screen.
- Graphic only. This is a full screen power graph. The measurements are not displayed numerically.
- Both Graphic and Numeric. This is a combined mode showing both a numerical and graphical display. This is the default mode.

Statistics (This menu affects the Real-time power mode only).

Selects the contents of statistics information to be shown. The following choices are available:

- No statistics information on the screen.
- Minimum and Maximum values only.
- Average and Standard Deviation values only.
- Full statistics (default).

After the setup is completed, use "OK" button to exit setup screen, saving the configuration. To exit without changing the power mode setup, press the "Esc" key or use the "Cancel" button.

2.2.2 Real-Time Power Logging

Real-time power logging is the sequential acquisition of the last power measurement made by the device. Power readings are transmitted at a rate of approximately 15Hz. All points are displayed, but only for time periods less than 6 minutes. For longer time periods, 6000 points are kept distributed evenly over the time period. Received data can be shown in graphic and/or numeric form, stored in a PC file and outputted to a printer.

StarCom also provides a method of circumventing the limitation on the size of the file. In the main menu, choose Configuration➔ Data Log File ➔ ON. In this mode, StarCom will write every reading to a file with default name starcom.pwr. When logging power ratio or power difference, the data is written to the default file starcom.dpr. When the user wishes to save, he chooses a name and the file is copied from the default file to his chosen file.

Note:

Unlimited logging writes 15 points/sec in power logging and this can result in a very large file for long-term power logging. Also, you can log energy at a lower rate with unlimited logging since each point is individually written to disk file.

The following discussion assumes that the steps 1 - 6 of section 1.2 have been performed, and the proper communication port has been set up.

To switch to real-time power mode, select "Real-Time Power logging" from the "Mode" menu. Wait until the menu appears on the screen. The commands are as follows:

Power Logging is controlled by 3 simple command buttons

- **Start/Stop**. This is used to start and pause power measurements. The caption on the button toggles between "Start" and "Stop", according to the current state. The initial state before starting data logging or after pause is "Start". When data logging is in progress, the button caption changes to "Stop". Data logging can be paused at any given time before the time period is up. You also can continue logging afterwards.
- **Reset**. Stops power logging and clear the graph.
- **Setup**. Opens the Power Graph Setup screen. (See above).

In addition there are two on-screen check boxes

- **Rescale**. When checked will rescale a completed power log. Upper Graph limit will be set to the maximum power measured. Lower Graph Limit will be set to the minimum power measured. When unchecked, Graph Limits will revert to those selected in the Power Graph Setup screen.
- **Limits Warning**. When checked, power readings below the lower Graph Limit will be displayed as "UNDER". Power readings above the upper Graph Limit will be displayed as "OVER".

2.2.3 Off-Line Power

The Off-line power mode allows you to view power data logged by the device or stored in a PC file in the form of a power versus time graph. Full statistics including the number of logged/stored points, number of overrange points, minimum value, maximum value, average value, and a standard deviation is shown. In the dual channel ratio mode, power ratio vs. time is displayed.

Information about the head type and its serial number is also provided.

To zoom in on some part of the graph, locate your mouse pointer at the beginning/end of the desired area, drag over it and release the button. The graph will be zoomed in time-axis. The "zoom out" button will appear on the screen. You can further enlarge a region by zooming again on a zoomed region. Use the "zoom out" button or the right mouse button to return to the initial (before the first zoom operation) state.

Note 1:

Zoom is limited to show not less than 15 data points on the screen.

Note 2:

StarCom power displays are limited to 60,000 points. For large files, all readings beyond 60,000 will be ignored for display purposes.

2.3 Energy Mode

2.3.1 Energy Histogram Setup (for single channel only)

To set up energy histogram, use the "Setup" button in the "Real-Time Energy Logging" menu.

The energy setup menu is described below:

Histogram Limits (This section only affects Real-time energy mode).

Use this operation to select the energy histogram lower and upper limits.

You can specify a value in the range 0-999 (1-999 for the right limit) using the scroll arrows or by typing a number into an entry box. To specify the desired range you may need to select the proper units from the "Units" box and a multiplication factor from the "Scale" box.

Note:

You cannot change histogram limits while data logging is in progress. You will have to reset the histogram first.

Histogram Bins (This setting will affect both Real-time and Off-line energy modes).

This setting specifies the number of data bins in the energy histogram (from 5 to 100 in steps of 5) and the initial capacity of each bin.

Note:

You cannot change the histogram bin settings while data logging is in progress. You first have to reset the histogram.

2.3.2. Energy Ratio Setup (for dual channel LaserStar).

To set up energy ratio histogram, use the "Setup" button in the "Real-Time Energy Logging/ Ratio" menu.

The energy setup menu is described below:

Ratio Limits

Use this operation to select the energy ratio lower and upper limits. You can specify a value in the range 0-10 for both the lower and upper limits and an associated exponent by using the scroll arrows or by typing a number into an entry box.

Note:

Ratio limits cannot be changed while data logging is in progress. You will have to press reset first.

Energy Limits (This setting will affect both Real-time and Off-line energy modes).

This setting specifies the x-axis of the graph and is related to the energy values of channel A. Use this operation to select the lower and upper energy limits for channel A. You can specify a value in the range 0-999 (1-999 for the right limit) using the scroll arrows or by typing a number into an entry box. To specify the desired range you may need to select the proper units from the "Units" box and a multiplication factor from the "Scale" box.

Note:

Settings cannot be changed while data logging is in progress. You first have to press reset.

2.3.3. Display Options (Real-time mode for single and dual channel)

You can select the display to be one of the following:

- **Numeric only**. Some users find it very useful to have a large numerical display on the screen that enables them to monitor readings from a distance. This is especially useful with the Nova (which has a small screen). *For highest real time data transfer rate with a Pyroelectric head attached to a LaserStar, Nova-II, or Vega work in Numeric only mode.*
- **Histogram and Numeric**. This allows you to monitor a histogram and at the same time to display the numeric value. This is the default. (For the dual channel ratio display, the display is a scatter diagram graphic display of ratio vs. channel A energy instead of a histogram).

Statistics (This function will only affect the Real-time energy mode).

Select the contents of statistics information to be shown:

- No statistics information on the screen.
- Minimum and Maximum values only.
- Average and Standard Deviation values only.
- Full statistics.

Storage Mode & Storage Rate (This function only affects the method of data collection for future saving in a PC file).

Unlike power mode, you cannot specify the logging time period. You have to stop logging process using the "Start/Stop" button in the "Real-Time Energy Logging" menu. Logging can, theoretically, last forever. However, StarCom limits the number of pulses saved to 60,000 pulses. (In the dual channel mode 60,000 pairs of pulses are stored thus giving up to 120,000 points).

Even with the above limitation, you still have a powerful mechanism of data collection:

You can define which 60,000 pulses to store: the first ones or last ones. You can also specify to store all pulses or one out of 3, 5, 10, 30, 50, 100, 200, 300, 400, 500, 600, 800 or 1000. Furthermore, the value to be selected out of the specified number can be, in turn, an average or a sample of the selected group.

StarCom also provides a method of circumventing the limitation on the size of the file. In the main menu, choose Configuration➔ Data Log File ➔ ON. In this mode, StarCom will write every reading to a file with default name starcom.nrg. When logging energy ratio, the data is written to the default file starcom.dnr. When the user wishes to save, he chooses a name and the file is copied from the default file to his chosen file.

Note:

With unlimited logging you can log energy at a lower rate with unlimited logging since each point is individually written to disk file.

Timestamp

When storing data in a file, StarCom adds another column to the data with a timestamp. This timestamp is added automatically in power logging mode and if chosen in the setup in energy logging mode. (See section 2.4.1 for more information).

Note:

You cannot change these settings while data logging is in progress. You have to reset first.

To exit the setup screen, press the "OK" button. This will save the new configuration. To exit without changing the setup, press "Esc" or "Cancel".

2.3.4 Real-Time Energy Logging

Real-time energy logging is the sequential acquisition of the last energy measurement made by the device. Received data can be shown as a histogram or in numeric form and can be stored in a PC file and later outputted to a printer. In the dual channel mode, you can also acquire and display the ratio of the energies of two channels. In this case, the ratio is displayed as a scattergram as a function of the energy of channel A.

The following discussion assumes that the steps 1 - 6 of section 1.2 have been performed already and the proper communication port is set up.

To switch to real-time energy mode, select "Real-Time Energy logging" from the "Mode" menu. In the dual channel mode you can choose channel A, channel B or ratio. Wait until the menu appears on the screen.

Energy Logging is controlled by 3 simple command buttons:

- **Start/Stop**. This is used to start and pause energy logging. The caption on the button toggles between "Start" and "Stop", according to the current state. The initial state before starting data logging or after pause is "Start". When data logging is in progress, the button caption changes to "Stop". Data logging can be paused at any given time. You also can continue logging afterwards.
- **Reset**. Stops energy logging and clear the graph.
- **Setup**. Opens the Energy Histogram (or Ratio) Setup screen. (See sections 2.3.1 and 2.3.2 above).

2.3.5 Off-Line Energy Mode (Single or dual channel LaserStar)

The Off-line energy mode allows you to view energy data logged by the device or stored in a PC file in a form of an energy histogram. Full statistics information including a number of logged/stored pulses, number of overrange pulses, minimum value, maximum value, average value, and a standard deviation value is displayed.

Information about the head type and serial number is also provided.

The initial histogram limits are selected automatically to be ± 3 standard deviations from the mean readings to ensure that up to 99% of pulses will be shown in the range. The histogram limits can be adjusted at any time.

Adjusting Histogram Limits:

Set the numeric value to the range 0-999 (1-999 for the right limit) by using the scroll arrows or by typing a number into the box. To specify the desired range, you may need to select the proper units label from the "Units" box and a multiplication factor from the "Scale" box.

You may also specify the number of a histogram data bins (the initial value is taken from the energy setup). These settings can be changed at any time and applied to the histogram by using the "Apply" button. You can "undo" all the changes made since the last use of "Apply" by pressing the "Cancel" button.

Note :

StarCom energy displays are limited to 60000 points without timestamp information. For large files, all readings beyond 60000 will be ignored for display purposes. Similarly, timestamp information will also be ignored. (See section 2.4.1 for a description of the timestamp).

2.3.6 Off-Line Energy Ratio (dual channel LaserStar)

The Off-line energy mode allows you to view energy data logged by the device or stored in a PC file in a form of an energy ratio scattergram. Full statistics information including a number of logged/stored pulses, number of overrange pulses, minimum value, maximum value, average value, and a standard deviation value is displayed.

Information about the head type and serial number is also provided.

The initial ratio limits are selected automatically to be ± 3 standard deviations from the mean readings to ensure that up to 99% of pulses will be shown in the range. The chart limits can be adjusted at any time.

Adjusting the Ratio Limits:

Select the energy ratio lower and upper limits. You can specify a value in the range 0-10 for both the lower and upper limits and an associated exponent by using the scroll arrows or by typing a number into an entry box.

Adjusting the channel A energy limits:

This setting specifies the x-axis of the graph and is related to the energy values of channel A. Use this operation to select the lower and upper energy limits for channel A. You can specify a value in the range 0-999 (1-999 for the right limit) using the scroll arrows or by typing a number into an entry box. To specify the desired range you may need to select the proper units from the "Units" box and a multiplication factor from the "Scale" box.

Note:

StarCom energy ratio displays are limited to 60000 couples without timestamp information. For large files, all entries beyond 60000 will be ignored for display purposes. Similarly, timestamp information will also be ignored.

2.3.7 RP heads

The StarCom program in general treats RP type heads the same as thermal heads when measuring power and as pyroelectric heads when measuring energy with the following differences:

a. Real time energy logging in the RP is available either in absolute or relative mode. When logging in relative mode, the data points are dimensionless (as they are in the LaserStar RP display).
b. The StarCom dual channel mode will not work with RP heads.
c. The LaserStar RP detects missing pulses. StarCom will display the number of missing pulses when a file is uploaded from the RP.

2.4 Saving Data in a PC File

Power or energy data logged from the device both in real-time and in off-line modes can be saved in a PC file.

Saving data (For the sake of illustration we will take real time mode but off-line is similar):

1. Start real-time power logging as explained in the section 2.2.2.
2. As soon as the first data point has been logged you can already save it in a PC file. Select the "Save" item from the "File" menu and wait until the "Save data in file" panel appears on the screen.
3. Enter a file name to for the data as you normally would in other Windows applications. You can use the default filename extensions for power and energy files. You can also upload files using wildcard filenames (e.g. *.nrg) so as to filter selected files.
4. Use the "Save" button to save data into a file. Press the "Esc" key or use the "Cancel" button to exit without saving.

2.4.1 Data File and Timestamp Format

According to the type of data to be saved in the PC file (power or energy), StarCom uses one of three ASCII data file formats. Since the data is in text form, this enables you to easily import the data into documents or spreadsheets.

Power data files consist of a single line header, specifying the file type and two columns of data: power readings in Watts in the left column and a timestamp showing the relative time as X.XX seconds in the right column.

Energy data files consist of a single line header, specifying the file type and a single column of energy readings in Joules. Timestamp information is provided in a second column only if the

user chose that option in the Energy Histogram Setup Screen.

Dual Channel data files consist of a single line header, specifying the file type and two columns of readings as well as a third column with time information for dual channel power files. Time information is provided in energy ratio files only if the user chose that option in the Energy Ratio Setup Screen. The data is stored as two columns of data regardless of whether the display is chosen to be ratio, difference or single channel display.

2.4.2 Making and Saving Notes

StarCom allows you to keep notes with your measurements and store them along with the file. To add notes to a file, select Information >> Notes from the main menu. The notes window will open and you can then add your notes. These notes will be saved when you save the file and also will be printed at the top of the page if you print the file. When opening a stored file, select Information >> Notes to see the stored notes.

2.5 Uploading Stored Data from a PC file

Power or energy data stored in a PC file can be easily be uploaded into StarCom.

Note:

You do not need the instrument to be connected in order to upload stored data. The communication port does not even have to be configured.

Uploading Data from a PC file

Select "Open" from the "File" menu or "Show PC-file" from the "Mode" menu and wait until the "Load data from file" menu appears on the screen.

Choose a filename as you normally would in other Windows applications. You can use the filename extension as a filter to display lists of energy only or power only data files.

Use the "Open" button to upload and display a file in the off-line power or off-line energy mode. (The proper mode is activated automatically).

In a dual channel file, you are requested to choose whether you want to display the data for Channel A only, B only, or ratio.

Press "Esc" or "Cancel" to exit without downloading. (See sections 2.2.3 and 2.3.3 for more information about off-line mode).

2.6 Uploading Logged Data from an Ophir Display

All three Ophir devices can store logged data in internal memory. This enables a user to collect measurements in the field and afterwards store the results on PC and/or use StarCom to analyze the data.

2.6.1 Uploading NOVA Data Files

The NOVA has a single data file stored in memory. As soon as a device is switched off, the data is lost. In order to permanently store the data, you must upload it to StarCom and save it to a PC file. See section 2.4 for explanations about how to store data in a PC-file.

The following discussion assumes communications has been properly set up as described in section 1.2.

Uploading data:

Attach the NOVA to a PC communication port with the Ophir RS232 adaptor cable. Be careful not to switch the NOVA off. Run StarCom and select "Show Device-File" from the "Mode" menu. The "Data Loading" screen will now appear with a running progress bar and a "Cancel" button. Data uploading is in progress. If any problem will occur during the data uploading process, an appropriate message will appear on the screen. When all the data available in your NOVA is uploaded, the data will be displayed in the proper off-line data view mode. Press "Esc" or the "Cancel" button to cancel data acquisition.

2.6.2 Uploading LaserStar, Nova-II, and Vega Data Files

The LaserStar, Nova-II, and Vega devices can store up to 11 data files in nonvolatile data storage memory.

The following discussion assumes communications has been properly set up as described in section 1.2. Device refers LaserStar, Nova-II, or Vega.

Attach the Device to a PC communication port using the Ophir RS232 cable. Switch the device on. Run StarCom and select "Show Device-File" from the "Mode" menu. Wait until the "Log File Selection" table appears on the screen. Non-empty files are listed in the table with the information about their size, type of the logged data, head type used for logging and a head serial number.

Select a file to be uploaded and press "Enter" or use the "Open" button. Press "Esc" or "Cancel" to cancel data acquisition.

The "Data Loading" screen will now appear with a running progress bar and a "Cancel" button. Data uploading is in progress. If any problem will occur during the data uploading process an appropriate message will appear on the screen. When all the data available in the device file has been uploaded, the data will be displayed in the proper off-line data view mode. Press "Esc" or the "Cancel" button to cancel data acquisition. Note that for fastest uploading of the files, the instrument should be set to its highest baud rate.

2.7 Printing Graphics Data

To print the power graph or energy histogram from either real-time or off-line mode, select "Print" from the "File" menu. The power graph or energy histogram will be printed on the default printer. You can specify the default printer by selecting the "Printer setup" item from the "File" menu.

2.8 Running Multiple Instances of StarCom

StarCom32 was originally meant for single-instance execution. However, it is possible to run two instances of StarCom with two devices simultaneously. In order to do this, do as follows:

1. Create a subdirectory in “C:\Program Files” called “StarCom32_1”.
2. On the desktop, create a shortcut whose target is "C:\Program Files\StarCom32\starcom32.exe" and whose “Start In” is "C:\Program Files\StarCom32_1".
3. Rename the shortcut StarCom1.
4. Attach an Ophir device to the PC in COM1. Ensure that no device is in COM2.
5. Double-click on StarCom1.
6. StarCom32 will generate a default configuration file. If you cannot communicate with the device, set the Comm Port in the Configuration Menu to COM1.
7. After verifying communication with the device, exit StarCom and detach the device from the PC.
8. Create a subdirectory in “C:\Program Files” called “StarCom32_2”.
9. Create a shortcut whose target is "C:\Program Files\StarCom32\starcom32.exe" and whose “Start In” is "C:\Program Files\StarCom32_2".
10. Rename the shortcut StarCom2.
11. Attach an Ophir device to the PC in COM2.
12. Double-click on StarCom2.
13. StarCom32 will again generate a default configuration file. If you cannot communicate with the device, set the Comm Port in the Configuration Menu to COM2.
14. At this point StarCom1 and StarCom2 will be independent of each other, therefore enabling 2 copies of StarCom32 to be running at the same time.

Chapter 3.

Troubleshooting

Commonly Encountered Problems and Solutions:

Problem: A new version of StarCom has been installed and either the old version remains or the new version fails to operate.

Solution: The old .CFG and .EXE files must be removed prior to installation as described in section 1.1.

Problem: Upon starting the program, the message "Can not communicate with instrument" appears on the screen.

Solution:

- Make sure you have only a single instance of StarCom running with this comm. port.
- Try to use another comm. port.
- The Ophir device may be switched off.
- The device may have a low battery.
- Verify that the device is attached to the computer communication port with the Ophir data cable.
- Verify that the device (LaserStar, Nova-II, or Vega only) is not set to 38400. StarCom is limited to 19200.

Problem: During StarCom installation, the following Message Box comes up "could not create the file named:c:\tamp\vb4sttmp.cct please verify that destination drive is not write protected".

Solution: The problem is that the "temp" directory did not exist. The installation will run properly after the "c:\temp" directory is created. The "Installation Kit" assumes that the "temp" directory is defined in the "autoexec.bat" and the actual directory exists on the disk.

Problem: StarCom cannot read Data files stored in the LaserStar. Other than that, the instrument operates properly.

Solution: If you have a LaserStar with an early software version (ROM 1.45 and below), it cannot be read by StarCom 2.xx and above. If this is case, have your LaserStar software updated by your agent.

Problem: During StarCom installation, the following Message Box appears: "Setup cannot continue because some system files are out of date on your system. Click OK if you would like setup to update these files now. You will need to restart Windows before you can run setup again. Click Cancel to exit setup without updating system files."

Solution: If you click OK, the application installs the correct file. If you select Cancel, the operation stops. The setup process will not complete successfully until the correct file has been installed on the system. After the machine has rebooted, re-run the Setup.exe program. Note: This solution will not help for Windows 2000. There is a known Visual Basic bug. Microsoft recommends upgrading your Windows 2000 with at least Service Pack (3).

Problem: StarCom loses connection with the NOVA instrument when uploading logged power data.

Solution: After finishing on-board log of Data, press left-most key of Nova once and afterwards upload the Data to the PC.

Problem: When installing StarCom 3.03 in Windows 95, user is informed of DLL error: "Setup.exe is linked to missing export OLEAUTO32.DLL:185.". When continuing the installation (by clicking OK), the following message appears: "A device attached to the system is not functioning."

Solution: StarCom 3.03 is written in Visual Basic 6. Older versions of Windows 95 do not fully support Visual Basic 6. You have three alternatives

1. Download VBRun60sp5.exe from "http://support.microsoft.com/?kbid=290887". This is Microsoft's suggestion and the preferred solution.
2. If you aren't working with an RP head, use version 2.06 instead.
3. If you must work with Windows 95, upgrade to OSR2. We have tested and proven that StarCom 3.03 can be installed and run on this platform.

Problem: In StarCom32 3.00, "Run-time error 13: Type mismatch" when connecting to the COM port.

Solution: The problem is fixed in StarCom32 3.03.

Appendix A

Guide to Programmers

A1 Introduction

This section explains how to use the RS232 interfaces for all of Ophir Optronics' power and energy meter products. It is primarily a guide for programmers wishing to write programs that use the RS232 interface.

This section covers all five of the instruments made by Ophir Optronics which provide an RS232 interface, namely models Laser-Star, Nova, Orion, Nova-II, and Vega. The five instruments use the same instruction set and instruction format, but since the various instruments offer differing functions, some instructions can not be used with all instruments. Also, some instruments have built-in RS232 hardware, and some use external interface electronics.

All instruments allow power and energy data to be transferred using the interface and can be controlled remotely using the interface. They can also be used to gather a limited amount of data while not connected to a computer, and later transfer the gathered data to a computer using the interface.

Section A2 - A6 is organized as follows:

A2 Explains the hardware used for RS232 for each of the instruments, and how to prepare cables if required.

A3 Describes examples of different tasks that may be required from an RS232 interface, and explains in which groups of commands can be used to perform each task.

A4 Provides general help for programmers about writing programs using RS232 interfaces.

A5 This is the reference section, defining the technical details of the communication protocols and listing the available commands and their exact syntax.

A6 Shows some flowcharts, which summarize techniques described in sections A3-5.

A2 Description of Hardware

A2.1 Nova, Old Style RS232 Adapter

This section refers to the old style Nova RS232 Adapter, Ophir P/N 1Z04281X.

The NOVA instrument requires a special optional RS232 adapter, which contains active circuitry in its 25-pin plug. Connect the 25-pin plug to your computer and connect the other end between the NOVA instrument and the detector head.

Note:

If a 9-pin connector is required at the computer end, an inexpensive standard adapter can be purchased.

If the cable needs to be extended, do not cut off the 25-pin plug or attempt to extend the 15-pin connections, but add an extension lead from the 25-pin plug to the computer. To make such an extension lead, connect leads as follows:

NOVA 25-pin adapter		Direction	Computer		
Pin	Function		Function	25-Pin	9-Pin
2	Receive	<<	Transmit	2	3
3	Transmit	>>	Receive	3	2
4	RTS	<<	RTS	4	7
5	CTS	>>	CTS	5	8
7	Ground	<-->	Ground	7	5
20	DTR	<<	DTR	20	4

Note:

If writing your own software, make sure to raise DTR and RTS. This ensures that the connector gets the proper power supply.

In the case of a 25-pin connector at the computer, IDC connectors and ribbon cable can be used in places where electromagnetic interference is not expected to cause problems.

A2.2 Nova, New Style RS232 Adapter

This section refers to the new style Nova RS232 Adapter, Ophir P/N 1Z10140-1Z10145.

The NOVA and ORION instrument requires a special optional RS232 adapter, which contains active circuitry in the D15-D15 adapter section. Connect the 9-pin plug to your computer and connect the other end between the NOVA instrument and the detector head.

Where a 25-pin connector is required at the computer end, an inexpensive standard adapter can be purchased.

The following summarizes the pin connections of the D9 plug.

NOVA 9-pin adapter		Direction	Computer 9-pin Port	
Pin	Function		Function	Pin Number
3	Receive	<<	Transmit	3
2	Transmit	>>	Receive	2
5	Ground	<-->	Ground	5

Note:

In NOVA instruments whose ROM version is 2.36 or earlier, the baud rate is fixed at 4800. Nova instruments with ROM versions 2.40 and higher offer the following baud rates: 300, 1200, 4800, 9600 and 19200. To set the baud rate, unplug the head of the Nova and switch the on. Press "select" until "Baud rate" is highlighted and press "go". Press "select" until the required baud rate is displayed and press "exit". The baud rate is now saved to EEROM (non volatile) memory.

A2.3 LaserStar

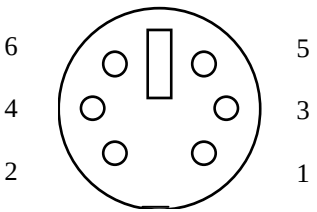
On the rear panel of the LaserStar is a 25-pin D-type connector. Use the cable provided with the instrument to connect the instrument to a computer. The 25-pin connector on the LaserStar instrument is not a dedicated RS232 connector since it also provides connections for the optional IEEE adapter, analog output and external trigger input. Therefore, standard RS232 cables should NOT be used and may cause damage if used. If you have to make your own cables, then connect ONLY the three wires as shown below:

LaserStar		Direction	Computer		
Pin	Function		Function	25-Pin	9-Pin
3	Transmit	>---------->	Receive	3	2
2	Receive	<----------<	Transmit	2	3
7	Ground	<---------->	Ground	7	5

Follow the instructions in your LaserStar manual in order to set up the baud rate and polled/automatic transmission mode.

A2.4 Nova-II and Vega

The Nova-II and Vega have a Mini-DIN socket on the rear panel that can support two types of communications cable – USB and RS232. This section describes the design of the RS232 cable.



Nova-II & Vega mini-DIN		Direction	Computer	
Pin	Function		Function	9-Pin
6	Transmit	>---------->	Receive	2
4	Receive	<----------<	Transmit	3
2	Ground	<---------->	Ground	5

Note:

Ground is actually carried through the metal casing from the D9 connector on the PC side to the metal casing of the mini-DIN on the Nova-II side. Inside the connector, the casing is shorted to pin 5 and pin 2 respectively.

A3 Using the Interface

See also section A5.4 for full details of each command. This section describes in broad terms how to achieve various tasks using the interface. The setup required is explained briefly, and further details are generally to be found in the instruction manual supplied with your instrument. Similarly, some of the interface commands are listed, but their full syntax is detailed in chapter 5.

Modes of Operation

The communication interface can be used in three distinct ways. These modes will be referred to as polled mode, stream mode and stored data mode. The polled mode is the most usual method for working, and is available for all instruments.

A3.1 Polled Mode

In polled mode, the host computer sends an instruction, and the instrument returns a reply. The instrument then stops transmitting until it receives a new command.

Measuring Power

Transmit "$SP" (Send power) from the host computer to the instrument. If the instrument is currently measuring power, the instrument will return the currently measured power in Watts as an ASCII string in scientific notation. If you want the computer to set up measurement range or laser wavelength using the interface, see below under “Controlling the Instrument”.

Measuring Energy of a Single Pulse

The command "$SE" (Send Energy) returns the energy in Joules of the last pulse to be measured. In order to establish whether a new pulse has been detected, or whether this pulse has already been read using the interface, use the "$EF" (Energy Flag) command. For thermopile heads, if you want to determine whether the instrument is ready to measure a pulse, that is, whether a pulse may be fired by your laser, use the "$ER" (Is Energy Ready?) command. See also the flowchart in the appendix.

Measuring on a Dual-Channel LaserStar

When two heads are connected to a dual-channel LaserStar, both readings can be read with one command. After issuing the $SB (Send Both) command, the LaserStar will respond with an ASCII string containing both readings (channel A first, channel B second).

A3.2 Stream Mode

In stream mode, the PC issues a Continuous Send ($CS) command. The instrument then transmits data without additional commands from the computer. The device continues reporting readings until issued another command. Stream mode is supported by the LaserStar in GPIB as well as by the Nova-II and Vega devices in USB. It is also available in RS232 after issuing the $DU command. The NOVA and Orion do not support stream mode. For a detailed description of Stream Mode, see “Alphabetic Listing of Commands”.

A3.3 Stored Data Mode

Stored-data mode is used when data such as laser power must be recorded in a situation where communication or connection cannot be made while the measurements are in progress.

The instrument stores a limited amount of data, and is then brought to a computer to which the data where the data is transferred. This transfer actually takes place in using polled mode

instructions. This mode is useful when working away from the computer or working with one computer and several instruments simultaneously and also when recording a burst of high-speed laser pulses where there is insufficient time between pulses to transfer the data using RS232.

Nova

First use the soft keys of the instrument to get to the "Log data" screen, and collect the required data using the instrument alone. When this is done, connect the instrument to a computer. The computer should first use the "$LI" (Log buffer Info) command to establish how much data was recorded and at what rate. Next the "$LR" (Log buffer pointer Reset) command should be transmitted once to tell the instrument that the first data point to be transmitted is the first one stored in the buffer. Next, stored data are read in blocks of 10 by using the "$LS" (Logged data Send) command. The "$LS" command is repeated for all required data blocks.

LaserStar, Nova-II, and Vega

The LaserStar, Nova-II, and Vega devices can store up to 11 files in on-board static RAM. They will maintain the contents of these files even after being turned off (up to about 3 months). In order to select a file to upload, use the “LF” command with a parameter in the range 0 - 10. Afterwards, you can proceed as in the standard, stored data mode. See section A5.4 for details of more advanced commands ($LC, $LD, $LL).

A3.4 Commands for Controlling the Instrument

So far it has been assumed that the instrument is set up manually, that is by actually pressing the soft keys of the instrument by hand. Such set-up may include selection of power or energy measurement mode, the selection of an appropriate measurement range, and selection of wavelength. Often, this is sufficient, especially since the instruments can be set to start up in any combination of these when switched on. However when considering industrial automated tests, or tests requiring a variety of different ranges, it becomes useful to control the settings of the instrument using the host computer's software. The following provides a summary of the instructions for remote control of an instrument. Programmers are advised to check in A5 that all the commands they intend to use are available for the instrument in question. See A5 for full details and restrictions.

A3.4.1 Commands for Changing an Instrument's status or settings

"$FC"(Force Configuration)
"$FE" (Force Energy)
"$FP" (Force Power)
"$FS" (Force Screen)
"$RE" (Reset instrument)
"$SK" (Simulate Key) Simulates a manual press of one of the soft keys. "$WL", "$WW" (Wavelength) Sets the wavelength to a particular wavelength or laser type.

A3.4.2 Status Inquiry Commands

The following are inquiry commands that return some information about what the instrument is doing and what settings are active. They do not change any settings.

"$BC" (Battery condition)
"$RN" (Range Now)
"$KL" (Key legends)
"$VE" (Software Version of ROM)
"$FZ" (FreeZe updating the display)
"$DI" (send DIsplay bitmap). This reads the display's pixels.

A4 General Advice for Programmers

A4.1 Trying out the interface

Before writing an application, try out the device's command interface interactively, using the terminal utility provided by Microsoft Windows. Select the terminal application and set the following options:

Terminal Emulation:	TTY, Generic
Terminal Preferences:	Local Echo
Baud Rate:	9600
CR-> CR/LF:	Both
Data bits:	8
Stop bits:	1
Parity:	None
Flow control:	None
Parity check:	No
Carrier Detect:	No

You can now issue commands and see the instrument's responses.

A4.2 Writing RS232 Communications Subroutines.

At Ophir, we've developed applications that communicate with our devices in the following development environments.

1. Borland Pascal (In-house calibration facility)
2. Delphi (In-house calibration facility)
3. Visual Basic (StarCom)
4. Visual C++ (Test Applications)
5. LabVIEW (VI's package)
6. LabWindows (Test Application)

A4.3 Sample program in Visual BASIC:

This sample is written in Visual Basic 6.0. It allows the User to query the Nova for one measurement of power (Command1), or one measurement of energy (Command2). An option to stop the energy query is also provided (Command3). It assumes that a thermopile head is attached to the Nova.

1. Create Form1
2. Add Microsoft Comm Control to the Form
3. Add 3 command buttons on the form

Private bGoon As Boolean 'Flag to stop energy loop

```
'Measure power
Private Sub Command1_Click()
   Dim strResponse As String
   Call OpenComm                ' open commm
   ' force power
   Call WriteFrame("FP", strResponse)
   ' todo: Wait until device enters power mode (about 1/2 second)
   ' send power
   Call WriteFrame("SP", strResponse)
   MSComm1.PortOpen = False     ' close the port
   Call MsgBox(strResponse)     ' display power result
End Sub
```

```
'measure thermo energy till user press stop button (Command3).
Private Sub Command2_Click()
  Dim strResponse As String
  Call OpenComm              ' open commm
  ' force energy
  Call WriteFrame("FE", strResponse)
  ' todo: need to wait till device enter in power mode 1/2 second
  bGoon = True      'Flag that starting energy loop

  While bGoon      ' bGoon will be set to false when user click on button stop
    'check energy was measured
    ' send EF
    Call WriteFrame("EF", strResponse)
    If InStr(strResponse, "1") Then
      ' send energy
      Call WriteFrame("SE", strResponse)
    End If
    DoEvents    ' give a chance to perform communications and other events
  Wend
  MSComm1.PortOpen = False              ' close the port
End Sub

 'stop energy measurements
Private Sub Command3_Click()
  bGoon = False
  Call MsgBox("Energy Loop Stopped")
End Sub

 'open comm
Private Sub OpenComm()
  ' set comm settings (baud rate 9600 no parity, 8 data and 1 stop bit
  MSComm1.Settings = "9600, N, 8, 1"
  MSComm1.CommPort = 2    ' com2
  MSComm1.InputLen = 0                ' read the entire buffer on input
  ' The NOVA instrument does not have a built-in RS-232 support.
  ' An external plug with the RS-232 scematic uses the voltage
  ' coming from the PC via DTR and RTS lines. Therefore we set
  ' these line to be "high".
  MSComm1.DTREnable = True          ' set Data Terminal Ready line to "high"
  MSComm1.RTSEnable = True          ' set Request To Send line to "high"
  MSComm1.PortOpen = True           ' open the port
End Sub
```

```
'Write command and wait for device response
Private Sub WriteFrame(ByVal strCmd As String, ByRef strResponse As String)
   Dim strFullCmd As String
   strFullCmd = "$" + strCmd + Chr(13)
   MSComm1.Output = strFullCmd
   strResponse = ""

   ' This is an infinite loop because demo only
   ' In a proper application the correct approach is to use events from the
   ' COMM object. Should also add a Timer to keep the application from
   ' getting stuck if no response comes from the Nova

   Do
      ' check if something in received buffer
      If MSComm1.InBufferCount > 0 Then
         strBuff = MSComm1.Input
         strResponse = strResponse + strBuff
         If InStr(strResponse, Chr(10)) Then
            Exit Do
         End If
      End If
   Loop While 1
   strResponse = strResponse
End Sub
```

A5 Syntax definitions

A5.1 Communication Parameters

The following communications parameters are used:

Data byte length:	8 Bits
Stop bits:	1
Parity:	None
Parity checking:	None
CTS line:	Not used except in NOVA
DTR, RTS lines:	Must be high at all times for NOVA only.
XON/XOFF:	Not supported

Available Baud rates:

NOVA until version 2.36:	4800 Fixed.
NOVA version 2.40 & Higher and Orion:	300, 1200, 4800, 9600, 19200
LaserStar, Nova-II, and Vega:	300, 1200, 4800, 9600, 19200, 38400.

A5.2 Instruction Format

In polled mode, all instructions have the following format:
The "$" symbol (that is ASCII 36 decimal)
The two letters that constitute the command: These may be upper or lower case in any combination.

An optional space character
Any parameters if required
A carriage return <CR> character (that is ASCII 13 decimal)
An optional line-feed <LF> character.

The instrument does not start to process a command until the <CR> is received. The instrument responds with either a valid response or an error message.

A valid response always begins with an asterisk "*". (ASCII 42 decimal) This is true even for instructions which do not return any data, such as $SK. Thus where an instruction is listed as "Returns: nothing" in section A5.4, an asterisk is still returned. It is important to check that an asterisk has been received by the computer as a way of ensuring that the instrument has accepted the instruction and that the instrument is ready for the next command. It is also important to remove the asterisk from numeric data received before trying to convert it to a numeric variable in software.

Error messages begin with a question mark "?" (ASCII 63 decimal). The text of the error message usually explains the nature of an error in a short English phrase.

Examples of error messages are:
? UNKNOWN COMMAND 'XX'
? PARAMETER ERROR
? THIS HEAD CANNOT MEASURE ENERGY
? HEAD NOT CONNECTED
All responses are terminated with a <CR> character. Programs should not send further commands until the <CR> has been received. NOVA and Laser-Star instruments also send a line-feed character after the <CR>.
Where data are returned in scientific notation, this is the familiar E notation, such as "*1.234e5" which represents the number 123400.

In automatic mode, each transmission is terminated with a <CR> and a <LF>.

A5.3 Additional restrictions for NOVA instruments

When writing applications for the NOVA instrument, the following three additional rules apply.

1. The modem control lines DTR and RTS must be high at all times.
2. The computer should transmit only when CTS is asserted
3. RS232 operation of pyroelectric heads in their most sensitive ranges may not be reliable. This is because pyroelectric heads are very sensitive and the pulsing caused by the RS232 communication can cause false triggering.

A5.4 Alphabetic Listing of Commands

The following section is an alphabetic listing of all the commands intended for normal use. There are other commands not listed here to which the instruments will respond. These are used for automatic calibration and test at Ophir. Do not experiment with commands other than those listed here; it is possible to corrupt the calibration of the instrument by doing so. However it is unlikely that such damage will occur accidentally: Instructions that write to the permanent memory of the instruments contain checksums that will not generally arise accidentally from random data.

Except for the following list of commands, commands noted as supported on the Nova are also supported on the various Orion displays.

- AT command
- Energy specific commands on Orion-TH, Orion-PD, and Orion-PD200 devices
- Power specific commands on Orion-PE
- Wavelength specific commands (example WL) on the Orion-PD200

$AF Average Flag (Request for data)

	LaserStar	Nova-II	Vega	With all heads

Description: Checks if a new averaged reading has been prepared since previous use of $SG command
Parameters: None.
Returns: 0 (no new average) or 1 (new average prepared).
Limitations: From LaserStar version 2.50. From Nova-II and Vega versions 2.05
See also **$AQ, $SG**

Other Details:
Thermopile (and RP) heads do not have an averaging option when measuring energy. If the command is sent when in energy mode, the instrument will return an error string

$AQ Average Query (Remote control)

	LaserStar	Nova-II	Vega	With all heads

Description: Query and set the average setting of the head.
Parameters: 0 for query (default if no parameter sent)
1 for first setting ("NONE")
2 for second setting
etc.
Returns: String containing index of presently active Average setting as well as literal description of set of all available Average settings. If Remote User specified an unsupported index, will prefix a '?' to the response.
Limitations: From LaserStar version 2.50. From Nova-II and Vega versions 2.05
See also $AF, $SG

Other Details:
Thermopile (and RP) heads do not have an averaging option when measuring energy. If the command is sent when in energy mode, the instrument will return the error string.

$AR All Ranges (Request for data)

	LaserStar	Nova-II	Vega	With all heads

Description: Returns all ranges available to head. This is prefixed by the index of the presently active range.

Example: For a PD300 in the 30 microwatt range (with filter out), the LaserStar would return "* 3 dBm AUTO 30.0mW 3.00mW 300uW 30.0uW 3.00uW 300nW 30.0nW"

Parameters: None

Limitations:
1. Available for LaserStar ROM version 1.75 and later.
2. If no head is connected, the device will return "?NO HEAD CONNECTED"

Other Details:

1 The character 'u' was chosen to represent the prefix "micro".
This is for 2 reasons. The first is that extended ASCII (values above 127) is not 488.2 compliant. Secondly, different fonts on different PC's might not recognize ASCII 230 as 'µ'. The character 'u' is considered the correct prefix (see the 488.2 standard page 74 table 7-2).

2 The index of the highest numeric range is 0.
The index of AUTO (when applicable) is -1
The index of dBM (when applicable) is -2

These values were chosen because they are consistent with the parameter of the $WN (Write raNge) command. If this PD300 was sent a "$WN 3" it would be put in the 30 microwatt range.

$AT ATtenuation factor (Request for data)

Nova				With all heads

Description: For Nova 304 and above. Returns percentage of beam that Nova has been programmed for and its inverse.

Example: Nova programmed for 100% would respond "* 1.0 1"

$AW All Wavelengths (Request for data)

	LaserStar	Nova-II	Vega	With all heads

Description: Returns string fully describing the wavelengths that the head is configured to work with.

Example 1. PD300 with Filter Out. The LaserStar returned:

"CONTINUOUS 350 1100 1 633 488 978 NONE NONE NONE"

The remote access user would know that it is a continuous curve head (from the prefix CONTINUOUS), that the range of wavelengths is 350nm through 1100nm that the present wavelength that the head is configured to measure for is 633 (from the index 1) and the 6 favorite settings as they would be displayed on the LaserStar (above 10000nm would be displayed as 10.0). The second and third parameters delimit the range of values that the $WL command would succeed with.

Example 2 3AP head. The Nova-II returned.

"DISCRETE 1 VIS NIR"

The remote access user would know that this head is configured for a discrete set of wavelengths (from the prefix DISCRETE), that the head is presently configured to work at the VIS wavelength (from the index 1) and that the set of wavelengths that the head could be configured to work with (via the $WW command) is "VIS" and "NIR".

$BC Battery condition (Request for data)

Nova	LaserStar	Nova-II	Vega	

Description: Requests the status of the battery.
Parameters: None
Returns: 1 if battery is OK, 0 if battery is low.
Limitations: None.

$BM BC20 mode (Remote control)

Nova				With BC20 heads

Description: For BC20 smart heads, changes mode from HOLD (0) to CONTINUOUS (1).
Limitation: From ROM version 3.09 and higher
Parameters: BC 0 = hold mode, BC 1 = continuous mode
Returns: "?NOT A BC20 HEAD" : Head isn't a BC20-SH
"?PARAM ERROR" If missing parameter or parameter is greater than 1
"*" : If successful

$BQ BC20 Query (Remote control)

	LaserStar	Nova-II	Vega	With BC20 heads

Description: Query and set BC20 smart heads mode (HOLD or CONTINUOUS).
Parameter Value: 0 for query
1 for HOLD (if applicable)
2 for CONTINUOUS
Response: string containing index of present BC20 Mode as well as a literal description of both modes If Remote User specified an unsupported index, will prefix a '?' to the response.
Errors: "?NO HEAD CONNECTED" If no head connected
"? BQ COMMAND NOT SUPPORTED FOR THIS HEAD" for photodiode, pyroelectric, and nanoJoule heads. Will also be returned for non-BC20 thermopile heads.
Limitations: LaserStar version 2.27 and higher supports this command. All versions of Nova-II and Vega support this command.

$BR Baud Rate (Remote control)

	LaserStar	Nova-II	Vega	

Description: Query device for present Baud Rate (with option to change present setting)
Parameter Value: 0 for query
1 for 9600
2 for 19200
3 for 38400
4 for 300
5 for 1200
6 for 4800
Response: String containing index of present Baud Rates as well set of all supported baud rates. If Remote User specified index greater than 6, will prefix a '?' to the response.

$BT BeamTrack (Request for data)

		Nova-II	Vega	BeamTrack heads

Description: Query device for latest BeamTrack position and size measurements
Parameters: None
Response: String containing error flags, x position of laser, y position of laser and size.
Limitation: For BeamTrack sensors on Nova-II / Vega only

Response Format: "F" <Errors> "X" <X> "Y" <Y> "S" Size.
Where F is followed by Hex map of error codes
X is followed by the location of the laser spot on the X-axis in mm
Y is followed by the location of the laser spot on the Y-axis in mm
S is followed by the size of the laser beam in mm

Example: * F 00000000 X -1.50 Y -0.9 S 6.50
There were no errors, the spot size is 6.5mm and is found at the coordinates (-1.5, -0.9)

The following is the listing of possible error codes. Other codes may be returned by the sensor but can be ignored; they are either meant as diagnostic information for Ophir personnel or are reserved for future use

0x00001000: Position not measured (sensor can't measure position)
0x00002000: Signal too low (signal is just noise, not a meaningful measurement)
0x00004000: Position Measurement out of range (laser beam hit detector too far off center)
0x00008000: General Position Measurement Error

$CH Change Channel (Remote control)

	LaserStar			

Description: Sets active LaserStar channel for communications.
Parameters: $CH A to set channel A to active, $CH B to set B to active
Returns: *A if A is made active, *B if B is made active or CHANNEL NOT PRESENT
Limitations: For dual channel LaserStar

$CR Read Channel (Request for data)

	LaserStar			

Description: Requests the current channel for communications.
Parameters: None.
Returns: *A if channel A and *B if channel B.
Limitations: None.

$CS Continuous Send (Request for data)

	LaserStar	Nova-II	Vega	With all heads

Description: Requests the device to report all measurements that it makes. Also known as Stream Mode.

Parameters:

Parameter 1	[0|1]:	Off (0) or On (1)	
Parameter 2	[0-65535]:	Transmit one of X readings. If 0 or 1, LaserStar will transmit every reading.	
Parameter 3	[1|2|3]:	Response Format	
		Standard (1):	* 1.234e-3<LF>
		Compressed (2):	*1234<LF>
		Extended (3):	See Below

If this command is sent while the LaserStar is in dual-channel mode the LaserStar will add "A " (or "B ") between the leading star ("*") and the reading. For Example, if LaserStar is in measuring power ratio and User requests $CS 1 75 2 once every 5 seconds the LaserStar will send.

*A 2050<LF>
*B 1020<LF>

The last 2 parameters are optional. If not present, the LaserStar will default to sending every measurement in standard format.

Any command (including undefined ones) received by the LaserStar or Nova-II will turn this mode off. (Similarly, SDC, DCL, and IFC will turn this mode off for a LaserStar communicating in GPIB).

Keypresses will not turn this mode off (e.g. if started in channel-A-only mode, and then the User switch to power ratio mode, the LaserStar will continue to report measurments as if it was still in channel-A-only mode).

For a LaserStar communicating via GPIB, this command assumes a total dedication of the GPIB to the LaserStar as Talker and some other device(s) as Listener. This limitation does not apply to the Nova-II or Vega communicating via USB.

Note :

As of LaserStar 2.09, the $CS command can be driven to return measurement-sensitive response formats. This mode, known as Extended $CS, is entered if the last parameter is set to 3.

Extended Formats. The following is the list of measurement-sensitive response formats:

1. For Pyroelectric and nanoJoule heads measuring exposure (same format as response to $EE command).
2. Frequency (if changed since last reported) for Pyroelectric, nanoJoule, and RP heads. "*** <energy-reading> "FREQ" <present-frequency>**"
3. String describing state of Single-Shot energy measurement for thermopile and RP heads:
   - *RESET: Waiting for head to stabilize
   - *WAITING: Waiting for start of pulse
   - *SUMMING: In process of measuring a pulse
   - *<energy>: Successful energy measurement
   - *OVER: Measured Energy was overrange
   - *PEAK OVER: Energy too great at peak to be measured (Error Condition)
   - *ENERGY OVER: Total energy too great to be measured (Error Condition)
4. Power readings as before
5. RP relative readings as before
6. RP absolute readings are reported in 3 different stages.
   Stage 1. Relative readings until DCF is established
   Stage 2. <First-absolute-reading> "DCF" <dcf to apply to previously reported relative eadings>
   Stage 3. <Absolute-reading>

Note:

Stage 1 might be left out. Stage 3 is not reached until after stage 2. Therefore the Remote control user can always know if this measurement is absolute or relative

7. RP energy (absolute or relative) with missing pulses "*** <energy-reading> "MISSING" <number of missing pulses between this measurement and the preceding one>**".

Note 1:

As of LaserStar 1.75, the $CS command can be used also in RS232 if communicating in full duplex mode. (See $DU command below). All versions of the Nova-II support $CS in RS232 (after receiving the $DU command).

Note 2:

If operating at above approximately 400Hz, there may be some degradation of LaserStar, Nova-II, and Vega screen functions such as keypresses and screen updates. This will not affect the actual data being transmitted.

Note 3:

Extended mode formats are supported in the LaserStar from ROM version 2.09. All versions of the Nova-II and Vega support extended response formats.

In order to use the $CS command correctly, the following steps are suggested.

For each channel:

1. Establish Communication channel ($CH command).
2. Establish which head is being used ($HI command).
3. Establish what is being measured ($SI command).
4. Establish what range we're in ($SX command).

Based on the above information we know what to expect from the $CS command.

Example 1. If there is only a thermopile head in channel A measuring power in autoranging, we know that the LaserStar will not insert "A " in the response. Furthermore, we know that we shouldn't use compressed mode (2 for value of 3rd parameter) because the range might change. Also if the 2nd parameter is 75, we know to expect a reading every 5 seconds. Therefore the command would take on the form "$CS 1 75 1<LF>".

Example 2. Pyroelectric head in energy mode in channel B. We know that it is safe to use compressed mode (because the head is not autoranging). Furthermore, the LaserStar will not insert "B " because we're in single-channel mode. We probably want to set the 2nd parameter to 1 (in order to get every pulse). Therefore the command should take the form "$CS 1 1 2<LF>".

$DI LCD Data Image: NOVA (Request for data)

Nova				

Description: Requests image bitmap data of LCD
Parameters: <column> <Number of columns> 0..121 1..4
Returns: 1 to 4 long words (4-byte) in hexadecimal format
Limitations: NOVA only.
Example: $DI 38 2 (could return * 6BA5490F 88BAB001)
See also $FZ

Other Details:
A screen dump is made possible with this command. Each column of the LCD of a NOVA has 32 pixels. Each column is thus encoded into a 4-byte word in hexadecimal. Data for up to 4 consecutive columns can be read with each command.

$DI LCD Data Image: LaserStar (Request for data)

	LaserStar			

Description: Requests image bitmap data of LCD
Parameters: Row number (0 to 63)
Returns: A 60 character, 30-byte hexadecimal string.
Limitations: LaserStar only.
See also $FZ

Other Details:
A screen dump is made possible with this command. Each row of the LCD of the LaserStar has 240 pixels. These are taken in groups of 4 and encoded as hexadecimal digits.

$DI LCD Data Image: Nova-II (Request for data)

		Nova-II		

Description: Requests image bitmap data of LCD
Parameters: Row number (0 to 239)
Returns: An 80 character, 40-byte hexadecimal string.
Limitations: Nova-II only.
See also $FZ
Other Details:
A screen dump is made possible with this command. Each row of the LCD of the Nova-II has 320 pixels. These are taken in groups of 4 and encoded as hexadecimal digits.

$DQ Diffuser Query (Remote control)

	LaserStar	Nova-II	Vega	Pyroelectric heads

Description: Query and set the diffuser setting of the head.
Parameters: 0 for query (default if no parameter sent)
1 for Diffuser Out
2 for Diffuser In
Returns: String containing index of presently active diffuser setting as well as literal description of set of available diffuser settings.
Limitations: From LaserStar version 1.97. Nova-II and Vega support this command in all versions.

$DU Duplex (Remote control)

	LaserStar	Nova-II	Vega	

$DU [0|1] (DUplex)

This LaserStar, Nova-II, and Vega classically communicate via half-duplex (also called synchronously). That is to say, they receive a command and then issue a response. They can't receive back-to-back commands or issue back-to-back
responses. This command allows the remote access user to put the device in full-duplex mode (with parameter value of greater than 0). (This is a prerequisite for RS232 use of the $CS command).

The LaserStar responds

* LASERSTAR IN FULL DUPLEX MODE to $DU 1
* LASERSTAR IN HALF DUPLEX MODE to $DU 0
? 'DU' IS AN RS232 SPECIFIC COMMAND if communication is via GPIB (or USB in case of Nova-II)

$EE Exposure Energy (Remote Control)

	LaserStar	Nova-II	Vega	Pyroelectric heads

Description: Requests presently accumulated exposure measurement.
Parameters: None.
Returns: String containing up do date exposure measurement, number of pulses, time elapsed in tenths of seconds. Will return appropriate error string if device is not in exposure mode.
Limitations: LaserStar support of this command from Version 1.98 and higher. Nova-II and Vega support this command in all versions.

Example: "* 1.064E-1 2773 124": 106.4mJ, 2773 pulses, 12.4 seconds.

$EF Energy Flag (Request for data)

Nova	LaserStar	Nova-II	Vega	Thermopile, Pyroelectric

Description: Requests value of energy flag.
Parameters: None.
Returns: 0 or 1.
Limitations: For use with thermopile heads measuring single shot energy (or when measuring Pyroelectric power or energy on a LaserStar or Nova-II).
See also $SE, $FE, $ER

Other Details:
The energy flag equals 1 if an energy measurement has been completed and has not yet been read using the $SE command. See EXAMPLE2.BAS and the flowchart for energy in AA 6.

$ER Energy Ready (Request for data)

Nova	LaserStar	Nova-II	Vega	Thermopile heads

Description: Requests Energy-Ready status.
Parameters: None.
Returns: 0 or 1.
Limitations: Must be measuring single shot energy.
See also $SE, $EF, $FE

Other Details:
The energy ready status equals 1 if the instrument is ready to measure a single-shot laser pulse. In systems that also control firing laser pulses, this command can be used and should return a 1 before the laser pulse is fired.

$ET Energy Threshold (Remote control)

	LaserStar	Nova-II	Vega	Thermopile heads

Description: Query and set the energy threshold setting of the head.
Parameter Value: 0 for query (default if no parameter sent)
1 for low
2 for medium
3 for high
4 for optical (for heads with photodiode trigger)
Returns: String containing index of presently active energy threshold as well as literal description of set of available thresholds.
Limitations: From LaserStar version 1.96. Nova-II and Vega support this command in all versions.

$FC Force Configuration (Remote control)

	LaserStar (dual)			2 heads connected

Description: Causes the certain instrument's configuration to be set up.
Parameters: L a digit 0...7 A a digit 0...4 B a digit 0...4.
Returns: Two readings as an ASCII string in scientific notation.
Limitations: Dual-channel LaserStar only. Both heads must be connected.

Other Details:
Force the following LaserStar mode, depending upon values of L, A and B.

Value of L	LaserStar mode	
0	Channel A only	
1	Channel B only	
2	Dual-Channel:	Independent
3	Dual-Channel:	Ratio (A/B)
4	Dual-Channel:	Ratio (B/A)
5	Dual-Channel:	Difference (A-B)
6	Dual-Channel:	Difference (B-A)
7	Dual-Channel:	Multiplication (A*B)

Value of A and B	Head mode
0	Power
1	Energy
2	Kelvin
3	Celsius
4	Fahrenheit
5	RP absolute energy
6	RP relative energy

Note:
This command will force heads out of autoranging when using modes 3 - 7.

$FE Force to Energy screen (Remote control)

Nova	LaserStar	Nova-II	Vega	Thermopile, Pyroelectric

Description: Causes the instrument to go to single shot energy measurement screen, irrespective of current status.
Parameters: None.
Returns: Nothing.
Limitations: None.
See also $FP, $FS, $SK

$FE Force to Energy screen (Remote control)

	LaserStar			RP heads

Description: Causes the instrument to go to the specified energy measurement screen, irrespective of current status. If no parameter is sent, this command will force the instrument into the currently configured energy screen.
Parameters: 'S': Single Shot Energy.
'R': Relative Mode RP Energy.
'A': Absolute Mode RP Energy.
Returns: Nothing.
Limitations: None.
See also $FP, $FS, $SK

$FO Force Oscilloscope mode (Remote control)

Nova	LaserStar	Nova-II	Vega	Pyroelectric, RP heads

Description: Forces device into Scope Mode screen.
Parameters: None.
Returns: ?NO HEAD CONNECTED if no head attached.
Limitations: ?THIS HEAD DOESN'T SUPPORT SCOPE MODE for Thermopile and Photodiode heads.

$FP Force to Power screen (Remote control)

Nova	LaserStar	Nova-II	Vega	Thermopile, Pyroelectric

Description: Causes the instrument to go to power measurement screen, irrespective of current status.
Parameters: None.
Returns: Nothing.
Limitations: None.
See also $FE, $FS, $SK

$FP Force to Power (illuminance) screen (Remote control)

Nova	LaserStar	Nova-II	Vega	Illuminance heads

Description: Causes the instrument to go to a specified illuminance measurement screen, irrespective of current status. If no parameter is sent, this command will force the instrument into the currently configured illuminance screen.

Parameters: 'L': Lux.
'F': Footcandles.
Returns: Nothing.
Limitations: None.
See also $FP, $FS, $SP

$FQ Filter Query (Remote control)

	LaserStar	Nova-II	Vega	Photodiode, RP heads

Description: Query and set the diffuser setting of the head.
Parameters: 0 for query (default if no parameter sent).
1 for Filter Out.
2 for Filter In.
Returns: String containing index of presently active filter setting as well as literal description of set of available filter settings.
Limitations: From LaserStar version 1.96. Nova-II and Vega support this command in all versions.

$FS Force to Screen N (Remote control)

Nova	LaserStar	Nova-II	Vega	All heads

Description: Causes the instrument to go to the screen listed below irrespective of current status.
Parameters: N a digit 0...3.
Returns: Nothing.
Limitations: None.
See also $FP, $FE, $SK

Other details: Will cause the following screen to appear, dependent upon the value of N

Value of N	Screen that will appear
0	Main power measurement screen.
1	Energy screen.
2	The screen seen when soft-key "MORE" is pressed in the Nova; "MENU" screen in the LaserStar and Nova-II.
3	The screen seen when no head is connected.

$FX Force Exposure (Remote control)

	LaserStar	Nova-II	Vega	Pyroelectric heads

Description: Will force head into exposure measurement screen.
Parameters: None.
Returns: Nothing.
Limitations: LaserStar version 1.98 and higher. All Nova-II and Vega versions.
Error Messages: If the head cannot measure exposure; the instrument returns an appropriate error message.

$FZ FreeZe updating the display (Remote control)

Nova	LaserStar	Nova-II	Vega	

Description: Stops or restarts the instrument writing to the display.
Parameters: 1 (=Freeze), or 0 (= Unfreeze).
Returns: Nothing.
Limitations: None.
See also $DI
Other details:
Use before and after dumping the pixel map of the LCD display by using the $DI command.

$HC Head Configuration (Remote Control)

	LaserStar	Nova-II	Vega	All heads

Description: Save configuration of head Startup, Calibration, or Response settings.
Parameters: S (Startup), C (Calibration), R (Response).
Limitations: LaserStar version 2.00 and higher. All Nova-II and Vega versions.
Returns: *SAVED
*UNCHANGED
?FAILED

$HI Head Information (Request for data)

Nova	LaserStar	Nova-II	Vega	All heads

Description: Requests a string of general information.
Parameters: None.
Returns: Returns type, serial number, name, and measurement capabilities of head.
Examples:

* XX 0 NOHEAD	00000000: If no head connected.
* TH 12345 03AP	00000183: For Thermopile head that can measure power and energy.
* TH 21212 Temperature	00040000: For Thermopile head that can measure temperature.
* PY 22323 PE10	80000003: For Pyroelectric head.

Bit 0 is lit if head can measure power.
Bit 1 is lit if head can measure energy.
Bit 18 is lit if head can measure temperature.
Bit 31 is lit if head can measure frequency.
All other bits are reserved and are not guaranteed to be 0 or 1.

$HT Head Type (Request for data)

Nova	LaserStar	Nova-II	Vega	All heads

Description: Requests code for type head.
Parameters: None.
Returns: Returns code for head type. LaserStar and Nova-II append the measurement mode as well (see SI command for details). Nova appends an "X".
Limitations: Nova version 3.29 and higher. LaserStar version 2.42 and higher. Nova-II and Vega on all versions.

List of Head Type codes:
1. TH: Thermopile
2. BC: BC20
3. TP: Temperature Probe
4. SI: Photodiode
5. LX: CIE head
6. RP: RP head (LaserStar Only)
7. PY: Pyroelectric
8. NJ: nanoJoule meter
9. XX: No head connected

$IC Instrument Configuration (Remote Control)

	LaserStar	Nova-II	Vega	

Description: Save instrument configuration.
Parameters: None.
Limitations: LaserStar version 1.96 and higher. All Nova-II and Vega versions
Returns: *SAVED
*UNCHANGED
?FAILED

$II Instrument Information (Request for data)

Nova	LaserStar	Nova-II	Vega	

Description: Requests a string of information about the instrument.
Parameters: None.
Returns: Returns id, serial number, and name of instrument being queried.
Examples:

* NOVA 22211 NOVA
* LS-A 54545 LASERSTAR-S for a single-channel LaserStar
* LS-A 23452 LASERSTAR-D for channel A of a dual-channel LaserStar
* LS-B 23453 LASERSTAR-D for channel B of a dual-channel LaserStar
* NV-2 565343 NOVA2
* VEGA 556334 VEGA

$KL Key Legends (Request for data)

Nova	LaserStar	Nova-II	Vega	

Description: Requests the legends visible for all the softkeys.
Parameters: None.
Returns: A string of up to 40 characters.
Limitations: None.
See also $SK

Other Details:

The string returned contains the legends for each soft key delimited by the open quote character "`". A tilde "~" character preceding a legend indicates an active highlighted key. On the NOVA, whenever a bargraph replaces the soft keys, a blank string is returned.

$LC Log Choose (Request for Data)

	LaserStar	Nova-II	Vega	

Description: Will set the pointer to the next datum to upload.
Format: $LC <1-54000>
Returns
*<index>: for success.
*<max-index>: if parameter is greater than number of points stored.
? "point not in range": parameter greater than number of points stored.

$LD Log Delete (Request for Data)

	LaserStar	Nova-II	Vega	

Description: Will delete previously selected Log File.
Format: $LD <filesize>: <filesize> must equal actual filesize. This is a security measure.
Returns:
* for success
? "no file chosen" if no file was chosen with the $LF command

$LF Log File (Request for Data)

	LaserStar	Nova-II	Vega	

Description: Chooses which file to upload. No other Logging Command is legal until a legal File has been chosen.
format: $LF <0-10>
where 0 represents the present logging session.
1 - 10 are the legal file values.
Response could be one of the following:
*<param>: <filesize> : for success
? "no such file" : for bad choice of file

$LI Log data overall Information (Request for data)

Nova	LaserStar	Nova-II	Vega	

Description: Requests information about logged data.
Parameters: None.
Returns: A string up to 60 characters.
Limitations: Meaningless unless logged data are stored.
See also $LR, $LS

The format of the returned string is as follows
" " <exp> <min> <max> <points> <samples>
Where

" " is one or more spaces.
<exp> is the exponent used for all stored data.

To convert the mantissa data <mant> returned by $LI and this <exp> to a real power or energy in watts or joules, use the formula RealPower = <mant> * Antilog(<Exp> -3) where antilog (x) means 10 raised to the power of x.

<min> is the lowest mantissa in the memory.
<max> is the highest mantissa in the memory.
<points> is the number of data points stored.
<samples> is the time between samples in seconds multiplied by 30 for logged power data and 0 for logged energy data.

In the LaserStar, this command returns the following additional information (between <samples> and trailing CR).

<units> <corrupt> <checksum> <name> <max_in_range> <serial _number>
where:

<units> is units logged (J, W, V, A, K, etc..)
<corrupt> is 1 if data may have been corrupted, else 0.
<checksum> is the hexadecimal checksum word of the logged samples.
<name> is a NULL terminated string containing the name of the second head used to log the dual channel data. For single channel logs, it will contain the string "NONE".
<max_in_range> is the maximum value that is still properly within range for the second head. Contains 0 in single channel log.
<serial_no_b> is the serial number for the second head in dual channel log. Contains 0 in single channel log.
<missing_pulse> 1 if log contains missing pulses information (for RPheads), otherwise 0.

$LL Log Last

	LaserStar	Nova-II	Vega	

Will send the last bundle of data in the same format as $LS command.

$LR Reset Log buffer pointer (Remote control)

Nova	LaserStar	Nova-II	Vega	

Description: Sets the next data point to be read using $LS to be the first one in the memory
Parameters: None.
Returns: Nothing.
Limitations: Meaningless unless logged data are stored.
See also $LI, $LS

$LS Logged data send block (Request for data)

Nova	LaserStar	Nova-II	Vega	

Description: Requests for a block of logged data points.
Parameters: None.
Returns: A string up to 60 characters.
Limitations: Meaningless unless logged data are stored.
See also $LI, $LR

Other Details:
Since all data stored in data logging mode are collected in the same measurement range, there is no need transmit the exponent associated with each data point for each point, so this is read once using $LI. When blocks of data are read from the memory using this $LS command, only the mantissa is sent across the interface. The string returned contains ten mantissas in ASCII (text, not binary) form separated by spaces. If a block contains more points than were recorded, those points will have a mantissa of -9999.

In the LaserStar, Nova-II, and Vega, each datum takes on the form "+8888 ". That is 1 character for sign, 4 characters exactly for mantissa, and 1 space. This will allow the PC software to do format checking to verify that no characters have been lost in transmission.

Furthermore, in dual-channel files, the 10 points can be seen as 5 couples where the first of every couple is a datum for channel A and the second is a datum for channel B.

$MF Max Frequency (Remote control)

	LaserStar	Nova-II	Vega	Pyroelectric, RP heads

Description: Get maximum frequency for present pulse width setting
Parameters: None.
Returns: ?NO HEAD CONNECTED if no head attached.
Limitations: Not for Thermopile and Photodiode heads.

$NE Next Energy (Request for data)

	LaserStar	Nova-II	Vega	Thermopile heads

Description: Request to send next energy reading.
Parameters: None.
Returns: Returns next energy reading (when available) instead of previous energy reading.
Limitations: **In GPIB, when reading is available and LaserStar discerns that it is not Talk Addressed, the LaserStar will assert SRQ.**

$PL Pulse Length (Remote control)

	LaserStar	Nova-II	Vega	Pyroelectric heads

Description: Query and set maximum pulse-length (in time) that head is configured to measure.
Parameters: 0 for query (default if no parameter sent).
1 Set to Short Pulse mode
2 Set to Long Pulse mode
Returns: String containing index of presently active pulse width setting as well as literal description of set of available pulse width settings.
Limitations: From LaserStar version 1.97. Nova-II and Vega support this command in all versions.

$RE REset instrument (Remote control)

Nova	LaserStar	Nova-II	Vega	

Description: Has same action switching instrument off and on again.
Parameters: None.
Returns: Nothing.
Limitations: None.

$RN Range Now (Request for data)

Nova	LaserStar	Nova-II	Vega	All heads

Description: Requests the measurement range that the instrument is now using.
Parameters: None.
Returns: A number in the range -2 to 6.
See also:$WN

The number returned should be interpreted as follows:
0 : The highest power or energy measurement range for this head.
1 : The second to highest measurement range.
2 : etc: The next highest range.
-1: Auto-ranging.
-2: dBm autoranging for photodiodes.

$SB Send Both readings (Request for data)

	LaserStar (Dual)			All heads

Description: Requests dual-channel data currently detected.
Parameters: None.
Returns: Two readings as an ASCII string in scientific notation.
Limitations: Dual-channel LaserStar only. Both heads should be plugged in and measure.

Other Details:
Either one or both readings can be replaced with the "N" sign in the case when a LaserStar does not have new readings since the last $SB command.

$SE Send Energy (Request for data)

	LaserStar	Nova-II	Vega	Thermopile, Pyroelectric

Description: Requests single pulse energy currently measured.
Parameters: None.
Returns: Energy in Joules as an ASCII string in scientific notation.
Limitations: Must be measuring single shot energy.

Other Details:
Will return the energy of the last pulse whose measurement cycle is complete. Will return energy of one pulse more than once if request is repeated. Use with $EF to ensure reading each pulse only once.

Errors reported
?HEAD NOT MEASURING ENERGY if head isn't measuring energy.
See also $ER, $EF, $FE

$SE Send Energy (Request for data)

Nova				Pyroelectric heads

Description: Requests next energy pulse to be measured.
Parameters: Timeout in hundreds of milliseconds.
Returns: Energy in Joules as an ASCII string in scientific notation.
Limitations: Must be measuring power.

Other Details:
Timeout is an optional parameter. If left out, the Nova will wait until it has a new reading to report. If new energy reading is available, returns immediately. Otherwise will return the next energy reading measured.

Errors reported
?PARAM ERROR bad operand
?TIMEOUT: NO PULSE when the requested time period elapsed w/o pulse coming in.
See also $FE

$SE Send Energy (Request for data)

Nova				Thermopile heads

Description: Requests single pulse energy of reading currently displayed.
Parameters: None.
Returns: Energy in Joules as an ASCII string in scientific notation.
Limitations: Must be measuring single shot energy.

Other Details:

Will return the energy of the last pulse whose measurement cycle is complete. Will return energy of one pulse more than once if request is repeated. Use with $EF to ensure reading each pulse only once.
Errors reported:

?NOT IN MAIN ENERGY SCREEN if not measuring energy.
See also $ER, $EF, $FE

$SF Send Frequency (Request for data)

Nova	LaserStar	Nova-II	Vega	Pyroelectric, RP heads

Description: Requests the pulse frequency detected.
Parameters: None.
Returns: Frequency in Hertz as an ASCII string in scientific notation.
Limitations: NOVA: ROM versions 2.40 and higher.
See also $SP, $SE

$SG Send averaGe (Request for data)

	LaserStar	Nova-II	Vega	All heads

Description: Requests most recent average calculated by the instrument.
Parameters: None.
Returns: Power or Energy average as an ASCII string in scientific notation.
Limitations: Does not average Energy for Thermopile heads.
From LaserStar version 2.50. From Nova-II and Vega versions 2.05

Other Details:
Returns most recent Average Reading calculated by the instrument. Will return the same Average more than once if the request is repeated before a new Average has been prepared. Use with $AF to ensure reading each Average only once.

Errors reported
?HEAD NOT MEASURING POWER if thermopile head is measuring energy
See also $AF, $AQ

$SI Send unIts (Request for data)

Nova	LaserStar	Nova-II	Vega	All heads

Description: Requests units of measurement.
Parameters: None.
Returns: Responds with one character to describe what the head is measuring (Amps, Joules, Volts, Watts, Lux, Footcandles) Responds with X if head isn't measuring anything.
Limitations: None.

Note:
For photodiode heads in dBm mode, will return "d". Relate to this as if the response was "W".

Note:
For Photometer, will return "l" when measuring LUX and "c" when measuring Footcandles.

$SK Simulate Key-press (Remote control)

Nova	LaserStar	Nova-II	Vega	

Description: Has same action as pressing a softkey.
Parameters: One digit, 0-4 for LaserStar; 0-3 for NOVA; 0-8 for Nova-II and Vega).
Returns: Nothing.
Limitations: None.
Example: $SK 2 (equivalent to pressing second key from left).
See also $KL, $FP, $FE, $FT, $FS

$SL Set Lock (Remote control)

Nova				Heads with lock feature

Description: Locks and unlocks calibration capability.
Parameters: One digit, 0 or 1.
Returns: LOCKED or UNLOCKED.
Limitations: For heads with EEROM locking feature only.
Operation: $SL 0. Turns off EEROM locking. A head with the EEROM Locking feature can have its parameters changed permanently. Returns "*UNLOCKED" $SL 1. Turns on EEROM locking. A head with the EEROM Locking can have none of its parameters changed permanently. Returns "*LOCKED".

$SP Send Power (Request for data)

	LaserStar	Nova-II	Vega	Pyroelectric heads

Description: Requests present power reading.
Parameters: None.
Returns: Power in Watts as an ASCII string in scientific notation.
Limitations: Must be measuring power.

Other Details:

Will return the last power measurement made. Will return power more than once if request is repeated. Use with $EF to ensure reading each power measurement only once.

Errors reported:
?HEAD NOT MEASURING POWER if head isn't measuring energy.
See also $EF, $FP

$SP Send Power (Request for data)

Nova	LaserStar	Nova-II	Vega	Non-Pyroelectric heads

Description: Requests next power reading.
Parameters: None.
Returns: Power in watts as an ASCII string in scientific notation.
Limitations: Must be measuring power (for Photometer may be measuring Lux or Footcandles).

Other Details:
Will never return more than 15 results per second; if requests are sent rapidly enough, results will synchronize to exactly 15 times per second.

errors reported:
?HEAD NOT MEASURING POWER in LaserStar
?NOT IN MAIN POWER SCREEN in Nova
See also FP

$SP Send Power (Request for data)

Nova				Pyroelectric heads

Description: Requests next power measurement.
Parameters: Timeout (in hundreds of milliseconds).
Returns: Power in watts as an ASCII string in scientific notation.
Limitations: Must be measuring power.

Other Details:
Timeout is an optional parameter. If left out, the Nova will wait until it has a new reading to report. If new power reading is available, returns immediately. Otherwise will return the next power reading measured.

Errors reported:
?PARAM ERROR bad operand.
?TIMEOUT: NO PULSE when the requested time period elapsed w/o pulse coming in.
See also FP$

$SX Send Max (Request for data)

	LaserStar	Nova-II	Vega	All heads

Description: Requests for the maximum allowable reading on present scale.
Parameters: None.
Returns: Returns Max allowable reading for present range in scientific notation or AUTO if in autoranging.
Examples: *AUTO if head is in autoranging.
*3.000E-2 if head is in 30mW range.

$TM Turbo Mode (Remote Control)

	LaserStar (GPIB)	Nova-II (USB)	Vega (USB)	Pyroelectric heads

$TM [0 - 65535] (Turbo Mode)

Description:

This is a GPIB (USB) specific command. It puts the LaserStar (Nova-II) into Turbo Mode calculations. Absolutely everything is closed down except pulse measurement and transmission of result on the GPIB (USB). The device screen shows "LaserStar is in Turbo Mode on Channel B". There is no analog output, battery check, response to backlight switch, or response to keypad. The optional parameter allows the user to inform the device of the expected frequency. If left out, the device will do Turbo Mode measurements without applying any corrections based on frequency.

Details:
The LaserStar (Nova-II or Vega) returns one of the following return codes:

? 'TM' IS A GPIB SPECIFIC COMMAND	if RS232 communications are being used.
?NO HEAD CONNECTED	if no head is connected.
?HEAD CAN'T WORK IN TURBO MODE	for photodiode and thermopile heads.
?FREQUENCY TOO HIGH	if expected frequency is beyond the head's capability.
?HEAD NOT IN SHORT PULSE MODE	for head presently configured to work with long pulses.
?FAILED TO START TURBO MODE	if didn't succeed in setting up Turbo Mode.
*TURBO MODE STARTED	on successful configuration of Turbo Mode.

After responding *TURBO MODE STARTED, the device configures itself to transmit pulses in compressed format (see $CS command). However, it does not append a '*' at the beginning or a <LF> (linefeed) at the end. This way it is just pumping out a datastream.

Limitations:

Turbo Mode is exited upon receipt of a new message. The device turns off its datastream and puts itself back into normal functionality.

Serial Poll, Parallel Poll, and being unTalked temporarily suspend Turbo Mode.

SDC (Selective Device Clear), DCL (Device Clear), IFC (Interface Clear) turn off Turbo Mode.

$VE VErsion of ROM (Request for data)

Nova	LaserStar	Nova-II	Vega	

Description: Requests version number of ROM software.
Parameters: None.
Returns: String up to 10 characters; may contain non-numeric characters.
Limitations: None.

$WD Wavelength adD - Continuous (Remote control)

	LaserStar	Nova-II	Vega	See limitations below

Description: Add a wavelength to list of favorite wavelengths that the head is configured to work with.
Parameters: Index: Location in list of wavelengths in which to insert the wavelength selected (must between an unused value between 1 and 6 as returned by the $AW command).
Wavelength: New favorite wavelength (must be between the lower and upper wavelength limits as returned by the $AW command).
Returns: Nothing.
Example: $WD 4 633 (set wavelength stored in index 4 to 633nm).
Limitations: Can only be used with heads that have continuous wavelength correction curves, i.e. photodiode heads and some pyroelectric and thermopile heads.

See also: $AW $WE $WI $WL

$WE Wavelength Erase - Continuous (Remote control)

	LaserStar	Nova-II	Vega	See limitations below

Description: Delete from list of favorite wavelengths the wavelength at location <Index>. Index must be between 1 and 6 and not the presently active index.
Parameters: Index in list of wavelength to delete.
Returns: Nothing.
Example: $WE 4 (erase wavelength at index 4).
Limitations: Can only be used with heads that have continuous wavelength correction curves, i.e. photodiode heads and some pyroelectric and thermopile heads.

See also: $AW, $WD, $WI, $WL

$WI Wavelength Index (Remote control)

	LaserStar	Nova-II	Vega	All Heads

Description: Configure head to work with wavelength at location <Index> in list of favorite wavelengths.
Parameters: Index of selected wavelength.
Returns: Nothing.
Example: $WI 4 (set head to work with wavelength at index 4).
Limitations: None.

See also: $AW, $WD, $WE, $WL, $WW

$WL Set WaveLength - Continuous (Remote control)

Nova	LaserStar	Nova-II	Vega	See limitations below

Description: Sets the wavelength setting. This is especially useful for automated spectral scans or with tunable lasers.
Parameters: Wavelength as an integer in nanometers.
Returns: Nothing.
Example: $WL 633 (set wavelength to 633nm).
Limitations: Can only be used with heads that have continuous wavelength correction curves, i.e. photodiode heads and some pyroelectric and thermopile heads. Do not enter wavelengths outside the head measurement range.
See also: $AW $WD $WE $WI

$WN Write raNge (Remote Control)

Nova	LaserStar	Nova-II	Vega	All heads

Description: Configure head to measure in a specific range.
Parameters: A number in the range -2 to 6.
Returns: None.

The number returned should be interpreted as follows:
0 : The highest power or energy measurement range for this head.
1 : The second to highest measurement range.
2 : etc: The next highest range.
-1: Auto-ranging.
-2: dBm autoranging (for heads that support this capability).

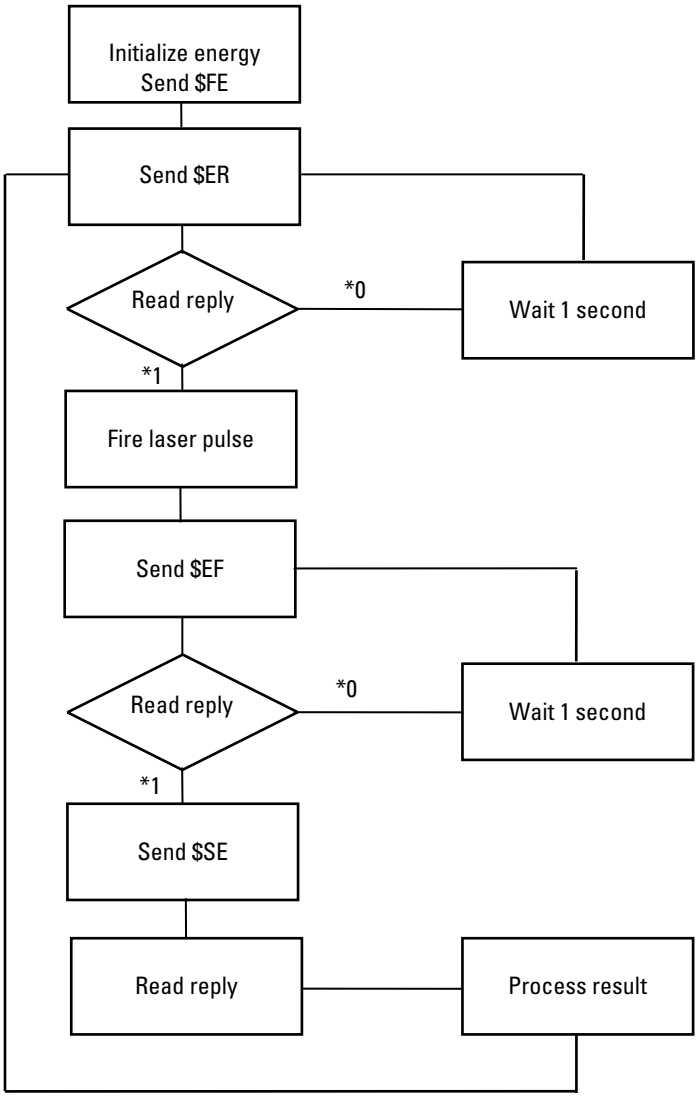
See also: $RN, $AR

$WW Set WaveLength – Discrete (Remote control)

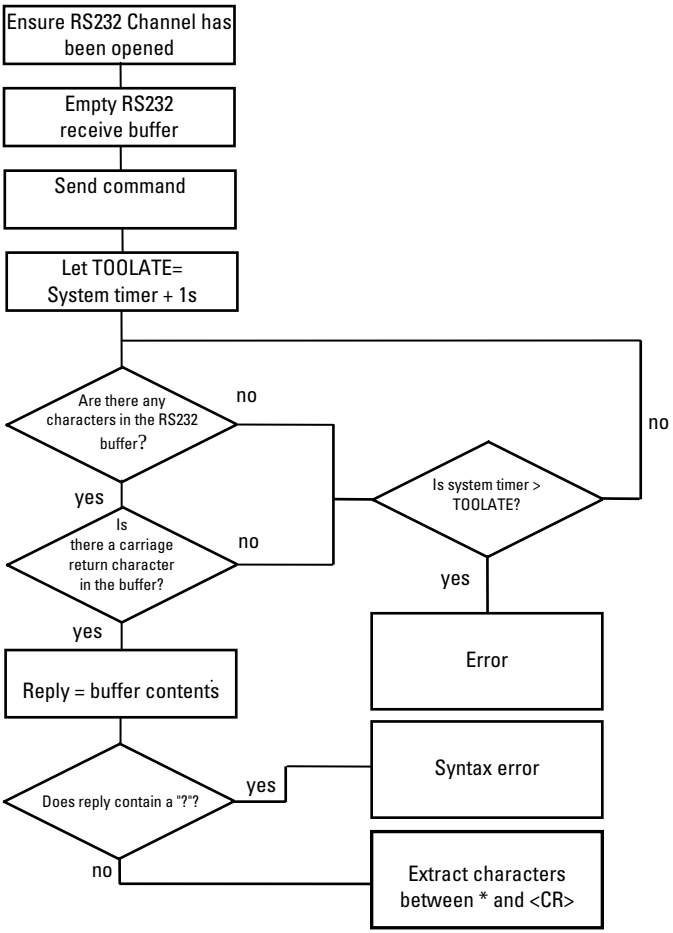
Nova	LaserStar	Nova-II	Vega	See limitations below

Description: Configure head to work with laser as defined in <wavelength-string> (must be a string as returned by the AW command).
Parameters: Laser legend as a string.
Returns: Nothing.
Example: $WW YAG (set laser wavelength to YAG setting).
See also: $AW
Limitations: Can only be used with heads that have discrete wavelength correction factors (thermopile, RP, and some pyroelectric heads). Not available in NOVA with ROM versions prior to 2.40.
Other Details:
Leading and trailing spaces and letter case are ignored, thus "$WW yag" has the same effect as "$ww YAG ".

A6 Flow Charts



Flow Chart 1
Measuring Several Energy Pulses



Flow Chart 2

Low Level Sending an RS232 instruction with time-out and error handling.

Appendix B: GPIB Interface

Note:

This appendix assumes a working knowledge of IEEE 488.1 (GPIB). For a detailed explanation of GPIB, the reader should look at the following references.

1. ANSI/IEEE Standard 488.1-1997, IEEE Standard Digital Interface for Programmable Instrumentation.
2. TNT4882 Programmer Reference Manual (National Instruments part number 320724-01) Appendix C "Introduction to the GPIB".

Hardware/Software Requirements

In order to connect your LaserStar to the GPIB you need the following:
1. LaserStar with ROM version LS1.74 or higher.
2. Optional IEEE connector (based on National Instrument's TNT4882 ASIC).

The following platforms have been in-house tested for communication with the LaserStar:
1. National Instruments GPIB Controller/Analyzer both in LabVIEW 4.1and in Win32 Interactive Control.
2. Keithely's IEEE-488 Interface Board using Borland Pascal version 7.0.

Addressing the LaserStar

The LaserStar's IEEE address (for talking and listening) is factory set to 10 (hex 0x0a). In order to change, simply do the following:
1. Power up the LaserStar with no head connected but with the IEEE connector plugged in.
2. Notice that the baud rate parameter is replaced by "IEEE ADDRESS".
3. Move the cursor to the IEEE address parameter and adjust its value (remember, addresses must be between 0 and 30).

Note:

The LaserStar only supports primary addressing.

IEEE 488.1 Capabilities

The LaserStar supports the following IEEE 488.1 interface function subsets. See the ANSI/IEEE Std. 488.1-1987 manual for a detailed explanation.

1. SH1 Complete Source Handshake Capability
2. AH1 Complete Acceptor Handshake Capability
3. T5 Complete Talker Capability
4. TE0 No Extended Talker Capability
5. L3 Complete Listener Capability
6. LE0 No Extended Listener Capability
7. SR1 Complete Service Request Capability
8. RL0 No Remote/Local Capability
9. PP1 Remote Parallel Poll Configuration
10. DC1 Complete Device Clear Capability
11. DT0 No Device Trigger Capability
12. C0 No Controller Capability

Service Requests

The following events will cause the LaserStar to assert SRQ:

1. As part of response to $NE command if the LaserStar has not yet been Talker Addressed. When serial polled, the LaserStar will report a status byte of 0x43 (RQS bit (Bit 6) + device dependent status code of 3).
2. If too often, the LaserStar has tried to prepare a response and found that previous responses that it prepared have not been transferred on the GPIB. The LaserStar will report a status byte of 0x45 (RQS bit (Bit 6) + device dependent status code of 5).

Note :

The LaserStar has a simplistic approach to SR1. It assumes that if it asserts SRQ it will be Serial Polled (thereby causing itself to unassert SRQ as part of the response to the Serial Poll) before another event happening that would cause it to change its status byte (for example, being made a Talker after setting the status byte to 0x43). It also assumes that there won't be back-to-back reasons to assert SRQ without a Serial Poll in between. This means that the LaserStar won't be robust if the controller is abusive about (or misuses) Serial Polling. But it should be robust enough in the general case.

Parallel Polling

As stated above, the LaserStar supports PP1 (remote configuration of Parallel Polling). The TNT4882 allows implementation of ist (individual status) that reflects the instrument's rsv message. Thus, if the LaserStar asserts SRQ, it will also respond positively to a Parallel Poll. Bear in mind, however, that only a Serial Poll will cause the LaserStar to unassert SRQ. As such, we will see the following responses:

Case 1 (Serial followed by Parallel)

1. Serial Poll TRUE
2. Parallel Poll FALSE

Case 2 (Serial followed by Serial)

1. Serial Poll TRUE
2. Serial Poll FALSE

Case 3 (Parallel followed by Serial)

1. Parallel Poll TRUE
2. Serial Poll TRUE

Case 4 (Parallel followed by Parallel)

1. Parallel Poll TRUE
2. Parallel Poll TRUE

Device Dependent Commands

Every command supported in RS232, is also supported in IEEE. Additionally, the LaserStar supports the following GPIB specific commands. See section A5.4 for a complete listing of device dependent commands. Especially interesting for use with GPIB are the commands $NE, $TM and $CS.

Appendix C: Virtual Instruments for LabVIEW

1. Overview
2. Installation
3. Libraries Contents
4. Ophir VIs Error Messages
5. Ophir Communication Commands

Note:

This appendix contains an abridged version of the LabVIEW VI documentation. The complete documentation as well as the VI's themselves are available from the Internet at http://www.ophiropt.com.

The files are also available on the Ophir Displays distribution CD-Rom.

C1 Overview

Ophir Vis Version 3.10 contains libraries that support communication with Ophir's Nova, LaserStar (both single and dual channel), USBI, Nova-II, and Vega instruments

Libraries for Nova and LaserStar were developed in LabVIEW 6.1. These are identical to the Version 2.00 counterparts. They have been tested and found compatible with LabVIEW 7.0 as well.

The library for Nova-II, Vega, and USBI support was developed in LabVIEW 7.0. It also includes support for the Single Channel LaserStar.

The Nova VIs support Nova 2.92 and above. The LaserStar Single and Dual Channel VIs support LaserStar 1.75 and above. Nova-II is supported from version 1.47. USBI is supported from version 1.37. Vega is supported from version 1.85.

Note:
Customers working with earlier versions of LabVIEW (4.1 or higher) can download Version 1.00 of our VI's from the Ophir web site.

Components are provided that drive and query the instruments' measurements. This allows the LabVIEW programmer to concentrate on his application without getting bogged down with Ophir's device dependent commands. Demo applications are provided, as well.

For Nova, the VI's establish communication in RS232. For LaserStar, the VIs can establish communication in RS232 and also in GPIB. Nova-II and Vega devices can communicate in RS232 or USB. The USBI device can communicate in USB only.

The VI's of each instrument can be divided into 3 different groups:

A. Communication Settings and Management
B. Configuration Query and Control
C. Measurement Query

A. Communication Settings and Management

1. Choice of RS232 or GPIB (for LaserStar) or USB (for Nova-II, Vega, and USBI)
2. RS232 Port Number and Baud Rate
3. GPIB Device Address (Default LaserStar GPIB Address is 10)
4. Send Message to the Device.
5. Receive Message from the Device

B. Configuration Query and Control

1. Query Head's ability to measure power, energy, and frequency
2. Force instrument into Power or Energy measurement mode
3. For LaserStar Dual-Channel it includes dual-channel Comparisons Capabilities (Power Ratio, Energy Ratio, Power Difference, Energy Difference, Dual-Channel Independent)

C. Measurement Query

The measurement VIs returns Value (Number and String) and Units being measured (e.g. "W" for Watts). They also give Device and Head Information like Type and Serial Numbers. For LaserStar they also provide remote range configuration.

C2 Installation and getting started

Installation

Note:

LabVIEW must be closed during installation.

2.1 For use with Nova:

1. Download the file **ophnova.exe**
2. Run the file with the following syntax: **ophnova.exe -d**
3. This will create the directory **OphirVi\Ophnova**
4. Copy the directory **OphirVi\Ophnova** to **..\LabVIEW\Instr.lib**

2.2 For use with LaserStar:

1. Download the file **ophlstar.exe**
2. Run the file with the following syntax: **ophlstar.exe -d**
3. This will create the directory **OphirVi\Ophlstar**
4. Copy the directory **OphirVi\Ophlstar** to **..\LabVIEW\Instr.lib**

2.3 For use with LaserStar Dual Channel:

1. Download the file **ophlstrd.exe**
2. Run the file with the following syntax: **ophlstrd.exe -d**
3. This will create the directory **OphirVi\Ophlstrd**
4. Copy the directory **OphirVi\Ophlstrd** to **..\LabVIEW\Instr.lib**

2.4 To use the Instrument Library (for use with Single Channel LaserStar, Nova-II, Vega, or USBI):

1. Download the file **ophinstr.exe**
2. Run the file with the following syntax: **ophinstr.exe -d**
3. This will create the directory **OphirVi\Ophinstr**
4. Copy the directory **OphirVi\Ophinstr** to **..\LabVIEW\Instr.lib**

2.5. You can also download the documentation files into your PC
ophirvis.pdf : Detailed explanation of Ophir Instrument VIs.
readme.pdf : This document.

2.6. Open LabVIEW Application.

Getting Started

As noted above, each instrument library contains a general demo application VI.
For those who plan on writing their own LabVIEW applications, we suggest working with our application first to get a "feel" for using our VIs .

C3 Libraries Contents

C3.1 Nova VI Library

The NOVA Library contains 30 VIs. The following is an alphabetic listing of the Nova Library Vis.

1. Oph Nova BuildFrame.vi.
   Builds the communication frame to send to the Nova.
2. Oph Nova Capa.vi.
   Analyzes head capabilities (the last part of Nova response to "HI" command).
3. Oph Nova CheckVersion.vi.
   Checks if Nova's version works with the VIs version (must be 292 or above).
4. Oph Nova ConfigDevice.vi.
   Force Configuration: sends "FP" or "FE" command and checks for success.
5. Oph Nova ConfigQuery.vi.
   Checks Nova version and returns Head Capabilities.
6. Oph Nova EnergyDemo.vi.
   Demo for energy measurement.
7. Oph Nova EnergyFlag.vi.
   Returns True when Nova has measured a new energy pulse.
8. Oph Nova EnergyMethod.vi.
   Returns appropriate energy-measurement-method.
9. Oph Nova EnergyReady.vi.
   Returns True when Nova is ready to measure next energy pulse.
10. Oph Nova Error Message.vi.
    Displays text describing present error condition.
11. Oph Nova Extract.vi.
    Finds all numbers in the given string and puts them into an array as single-precision numbers.
12. Oph Nova GeneralDemo.vi.
    General Demo for power, energy and frequency measurements.
13. Oph Nova HeadCapa.vi.
    Analysis of HeadInfo.vi and returns power, energy and frequency head capabilities.
14. Oph Nova HeadInfo.vi.
    Returns Nova's response to "HI" command.
15. Oph Nova InfoStrings.vi.
    Insertion of HeadInfo.vi and InstrInfo.vi responses in array of Strings.
16. Oph Nova InitCom.vi.
    Initializes the VISA Communication session.
17. Oph Nova InitMeasure.vi.
    Configures Nova for power or energy measurement.

18. Oph Nova InstrInfo.vi.
    Returns Nova response to “II” command.
19. Oph Nova Measure.vi.
    Measurement execution: power, energy or frequency.
20. Oph Nova Over.vi.
    Returns True if measurement is Overrange.
21. Oph Nova PowerDemo.vi.
    Demo for power measurement.
22. Oph Nova PowerMethod.vi.
    Returns appropriate power-measurement-method.
23. Oph Nova PyroEnergy.vi.
    Send “SE” command and get the Nova’s response.
24. Oph Nova PyroPower.vi.
    Send “SP” command and get the Nova’s response.
25. Oph Nova SendFrequency.vi.
    Send “SF” command and get the Nova’s response.
26. Oph Nova SendPower.vi.
    Send “SP” command and get the Nova’s response.
27. Oph Nova SendReceive.vi.
    Send command frame to Nova and get the response frame.
28. Oph Nova StringToValue.vi.
    Conversion of Value String into Value Number.
29. Oph Nova Terminal.vi.
    Terminal Demo: Send and Receive messages.
30. Oph Nova ThermoEnergy.vi.
    Send “EF”-“SE” command and get the Nova’s response.

C3.2 Single Channel LaserStar

The Single Channel LaserStar Library contains 30 VIs. The following is an alphabetic listing of the LaserStar Single Channel Library VIs.

1. Oph LaserStar BuildFrame.vi.
   Oph LaserStar BuildFrame.vi.
2. Oph LaserStar Capa.vi.
   Analyzes head capabilities (the last part of LaserStar response to “HI” command).
3. Oph LaserStar CheckVersion.vi.
   Checks if LaserStar’s version works with the VIs version (must be 1.75 or above).
4. Oph LaserStar ConfigDevice.vi.
   Force Configuration: sends “FP” or “FE” command and checks for success.
5. Oph LaserStar ConfigQuery.vi.

Checks LaserStar Version and returns head capabilities.

6. Oph LaserStar EnergyDemo.vi.
   Demo for energy measurement.
7. Oph LaserStar EnergyFlag.vi.
   Returns True when LaserStar has measured a new energy pulse.
8. Oph LaserStar EnergyReady.vi.
   Returns True when LaserStar is ready to measure next energy pulse.
9. Oph LaserStar Error Message.vi.
   Displays text describing present error condition.
10. Oph LaserStar Extract.vi.
    Finds all numbers in the given string and puts them into an array as single-precision numbers.
11. Oph LaserStar GeneralDemo.vi.
    General Demo for power, energy and frequency measurement.
12. Oph LaserStar HeadCapa.vi.
    Analysis of HeadInfo.vi and returns power, energy and frequency head capabilities.
13. Oph LaserStar HeadInfo.vi.
    Returns LaserStar's response to "HI" command.
14. Oph LaserStar InfoStrings.vi.
    Inserts HeadInfo.vi and InstrInfo.vi responses in array of Strings.
15. Oph LaserStar InitCom.vi.
    Initializes the VISA Communication session.
16. Oph LaserStar InitMeasure.vi.
    Configures LaserStar for power or energy measurement.
17. Oph LaserStar InstrInfo.vi.
    Returns LaserStar response to "II" command.
18. Oph LaserStar Measure.vi.
    Measurement execution: power, energy or frequency.
19. Oph LaserStar Over.vi.
    Returns True if measurement is Overrange.
20. Oph LaserStar PowerDemo.vi.
    Demo for power measurement.
21. Oph LaserStar PowerMethod.vi.
    Returns appropriate power-measurement-method.
22. Oph LaserStar PyroPower.vi.
    Send "EF"-"SP" command and get the LaserStar's response.
23. Oph LaserStar RangesList.vi.
    Get List of ranges and current range.
24. Oph LaserStar RangesModif.vi.
    Modify current range.
25. Oph LaserStar SendEnergy.vi.

Send “EF”-“SE” command and get the LaserStar’s response.

26. Oph LaserStar SendFrequency.vi.
    Send “SF” command and get the LaserStar’s response.

27. Oph LaserStar SendPower.vi.
    Send “SP” command and get the LaserStar’s response.
28. Oph LaserStar SendReceive.vi.
    Send command frame to LaserStar and get the response frame.
29. Oph LaserStar StringToValue.vi.
    Conversion of Value String into Value Number.
30. Oph LaserStar Terminal.vi.
    Terminal Demo: Send and Receive messages.

C3.3 Dual Channel LaserStar

The LaserStar (Dual Channel) Library contains 34 VIs. The following section is an alphabetic listing of the LaserStar Dual Channel Library VIs:

1. Oph LaserStarD BuildFrame.vi.
   Builds the communication frame to send to the LaserStar.
2. Oph LaserStarD Capa.vi.
   Analyzes head capabilities (Last part of LaserStar response to “HI” command).
3. Oph LaserStarD ChannelQuery.vi.
   Returns the currently Active Channel.
4. Oph LaserStarD CheckVersion.vi.
   Checks if LaserStar version works with the VIs (must be 1.75 or above).
5. Oph LaserStarD ConfCommand.vi.
   Low Level “FC L A B”, “FP” or “FE” command.
6. Oph LaserStarD ConfigDevice.vi.
   Prepares LaserStar for single/dual-channel power/energy measurement.
7. Oph LaserStarD ConfigQuery.vi.
   Checks LaserStar version and returns head capabilities (for both heads).
8. Oph LaserStarD EnergyFlag.vi.
   Returns True when LaserStar has measured a new energy pulse.
9. Oph LaserStarD EnergyReady.vi.
   Returns True when LaserStar is ready to measure next energy pulse.
10. Oph LaserStarD Error Message.vi.
    Displays text describing present error condition.
11. Oph LaserStarD Extract.vi.
    Finds all numbers in the given string and puts them into an array as single-precision numbers.

12. Oph LaserStarD GeneralDemo.vi.
    General Demo for single/dual power, energy and frequency measurements.
13. Oph LaserStarD HeadCapa.vi.
    Analysis of HeadInfo.vi. Returns power, energy and frequency capabilities.
14. Oph LaserStarD HeadComp.vi.
    Low Level 2 heads general capability.
15. Oph LaserStarD HeadInfo.vi.
    Returns LaserStar's response to "HI" command.
16. Oph LaserStarD InfoStrings.vi.
    Inserts HeadInfo.vi and InstrInfo.vi responses in array of Strings.
17. Oph LaserStarD InitCom.vi.
    Initializes the VISA Communication session.
18. Oph LaserStarD InitMeasure.vi.
    Configures LaserStar for power or energy measurement.
19. Oph LaserStarD InstrInfo.vi.
    Returns LaserStar response to "II" command.
20. Oph LaserStarD Measure.vi.
    Measurement Execution: power, energy, frequency, ratio, Difference, etc.
21. Oph LaserStarD NrgCmp.vi.
    Low Level 2 Heads energy capability.
22. Oph LaserStarD Over.vi.
    Returns True if measurement is Overrange.
23. Oph LaserStarD PowerMethod.vi.
    Returns appropriate power-measurement-method.
24. Oph LaserStarD PyroPower.vi.
    Send "EF"-"SP" command and get the LaserStar's response.
25. Oph LaserStarD RangesList.vi.
    Get List of ranges and current range.
26. Oph LaserStarD RangesModif.vi.
    Modify current range.
27. Oph LaserStarD SelectChannel.vi.
    Set channel-specific commands to work with Channel A or B.
28. Oph LaserStarD SendBoth.vi.
    Send "SB" command and get the LaserStar's response.
29. Oph LaserStarD SendReceive.vi.
    Send command frame to LaserStar and get the response frame.
30. Oph LaserStarD SendEnergy.vi.
    Send "EF"-"SE" command and get the LaserStar's response.
31. Oph LaserStarD SendFrequency.vi.
    Send "SF" command and get the LaserStar's response.
32. Oph LaserStarD SendPower.vi.
    Send "SP" command and get the LaserStar's response.
33. Oph LaserStarD StringToValue.vi.

Conversion of Value String into Value Number.

34. Oph LaserStarD Terminal.vi.
    Terminal Demo: Send and Receive messages.

C3.4 Ophir Instrument Library

The Instrument Library contains 30 VIs. This library was developed in LabVIEW 7.0. It supports communication with the single-channel LaserStar, Nova-II, Vega, and USBI devices. The following is an alphabetic listing of the Instrument Library VIs.

1. Ophir BuildFrame.vi.
   Builds the communication frame to send to the instrument
2. Ophir Capa.vi.
   Analyzes head capabilities (the last part of the instrument's response to "HI" command).
3. Ophir CheckVersion.vi.
   Checks the instrument and its version number. If LaserStar, version must be 1.75 or above. If Nova-II, version must be 1.47 or above. If USBI, version must be 1.37 or above. If Vega, must be version 1.85 or above
4. Ophir ConfigDevice.vi.
   Force Configuration: sends "FP" or "FE" command and checks for success.
5. Ophir ConfigQuery.vi.
   Checks instrument version and returns head capabilities.
6. Ophir EnergyDemo.vi.
   Demo for energy measurement.
7. Ophir EnergyFlag.vi.
   Returns True when instrument has measured a new energy pulse.
8. Ophir EnergyReady.vi.
   Returns True when instrument is ready to measure next energy pulse.
9. Ophir Error Message.vi.
   Displays text describing present error condition.
10. Ophir Extract.vi.
    Finds all numbers in the given string and puts them into an array as single-precision numbers.
11. Ophir GeneralDemo.vi.
    General Demo for power, energy and frequency measurement.
12. Ophir HeadCapa.vi.
    Analysis of HeadInfo.vi and returns power, energy and frequency head capabilities.
13. Ophir HeadInfo.vi.
    Returns instrument's response to "HI" command.
14. Ophir InfoStrings.vi.
    Inserts HeadInfo.vi and InstrInfo.vi responses in array of Strings.
15. Ophir InitCom.vi.

Initializes the VISA Communication session.

16. Ophir InitMeasure.vi.
    Configures instrument for power or energy measurement.
17. Ophir InstrInfo.vi.
    Returns instrument response to “II” command.

18. Ophir Measure.vi.
    Measurement execution: power, energy or frequency.
19. Ophir Over.vi.
    Returns True if measurement is Overrange.
20. Ophir PowerDemo.vi.
    Demo for power measurement.
21. Ophir PowerMethod.vi.
    Returns appropriate power-measurement-method.
22. Ophir PyroPower.vi.
    Send “EF”-“SP” command and get the instrument’s response.
23. Ophir RangesList.vi.
    Get List of ranges and current range.
24. Ophir RangesModif.vi.
    Modify current range.
25. Ophir SendEnergy.vi.
    Send “EF”-“SE” command and get the instrument’s response.
26. Ophir SendFrequency.vi.
    Send “SF” command and get the instrument’s response.
27. Ophir SendPower.vi.
    Send “SP” command and get the instrument’s response.
28. Ophir SendReceive.vi.
    Send command frame to instrument and get the response frame.
29. Ophir StringToValue.vi.
    Conversion of Value String into Value Number.
30. Ophir Terminal.vi.
    Terminal Demo: Send and Receive messages.

C4 Ophir VIs Error Messages

Error #	Description	Comment
-1301	Instrument Version not Valid for Vis	
-1302	No Head attached to Device	
-1303	No Head plugged in Device Channel A	LaserStar Dual
-1304	No Head plugged in Device Channel B	LaserStar Dual
-1305	No Heads attached to Device	LaserStar Dual
-1310	Head cannot measure power	
-1311	Head cannot measure energy	
-1312	Head cannot measure frequency	
-1313	Head in channel A cannot measure power	LaserStar Dual
-1314	Head in channel A cannot measure energy	LaserStar Dual
-1315	Head in channel A cannot measure frequency	LaserStar Dual
-1316	Head in channel B cannot measure power	LaserStar Dual
-1317	Head in channel B cannot measure energy	LaserStar Dual
-1318	Head in channel B cannot measure frequency	LaserStar Dual
-1319	Cannot measure power ratio	LaserStar Dual
-1320	Cannot measure power difference	LaserStar Dual
-1321	Cannot measure energy ratio	LaserStar Dual
-1322	Cannot measure energy difference	LaserStar Dual
-1325	Invalid Energy-Measurement-Method	Nova
-1326	Invalid Power-Measurement-Method	
-1327	Energy Ready not Valid for this Head	
-1328	Energy Flag Failed	
-1330	“FP” Command Failed	
-1331	“FE” Command Failed	
-1333	Head isn’t measuring Frequency	
-1335	“FP” or “FE” Command Failed	
-1336	Force Dual Configuration Failed	LaserStar Dual
-1338	Write Range Failed	Instrument, LaserStar Dual
-1339	Measurement Failed	
-1340	Device not in Dual Channel Mode	LaserStar Dual

Note: for all Libraries VISA Error Codes -10738077360 to –1073807231

C5 Ophir Communication Commands used by the VIs

See Appendix A for a full description of Ophir Communication Commands.

AR	All Ranges
CH	CHange channel
CR	Channel Read
EF	Energy Flag
ER	Energy Ready
FC	Force Configuration
HI	Head Information
II	Instrument Information
SB	Send Both
SE	Send Energy
SF	Send Frequency
SI	Send unIts
SP	Send Power
VE	VErsion
WN	Write raNge