

2.2.3 Juno+ USB Interface

Convert your laptop or desktop PC into an Ophir sensor power/energy meter

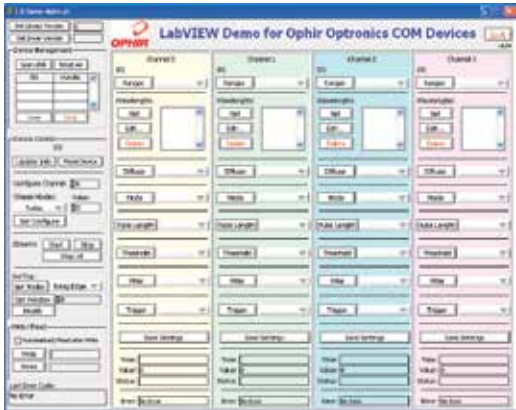
- From sensor to interface to PC - powered from USB
- Autonomous mode: Outputs voltage relative to measurement while connected via USB to a standalone power supply and not a PC
- Plug and play with all standard Ophir smart sensors
- Position & size measurement with BeamTrack sensors
- Record every energy pulse at up to 10kHz
- Analog output
- Log power and energy, average, statistics, histograms and more with included StarLab application
- Pulsed Power measurements with Thermopile detectors
- Low Frequency Power - power measurement from pulse cycle energy (for VCSEL)
- LabVIEW VIs and COM Object interface



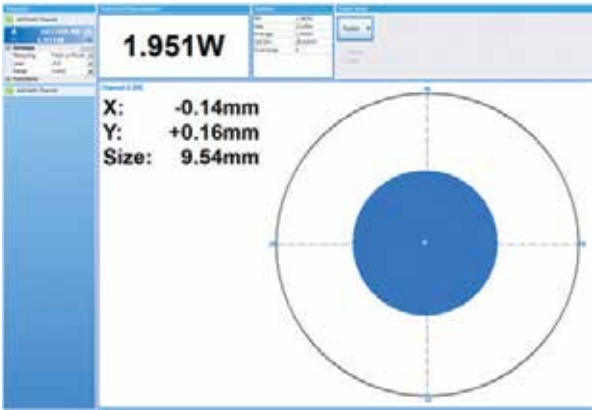
Smart Sensor to Juno+ to PC

Ophir’s basic smart compact Juno+ module turns your PC or laptop into a full-fledged Ophir laser power/energy meter. Just install the software, plug the sensor into the Juno+

module and connect the Juno+ with a standard USB cable to the PC USB port. You can connect several Juno+ modules to the PC.



LabVIEW



Juno+ with BeamTrack sensor and StarLab showing beam power, position and size

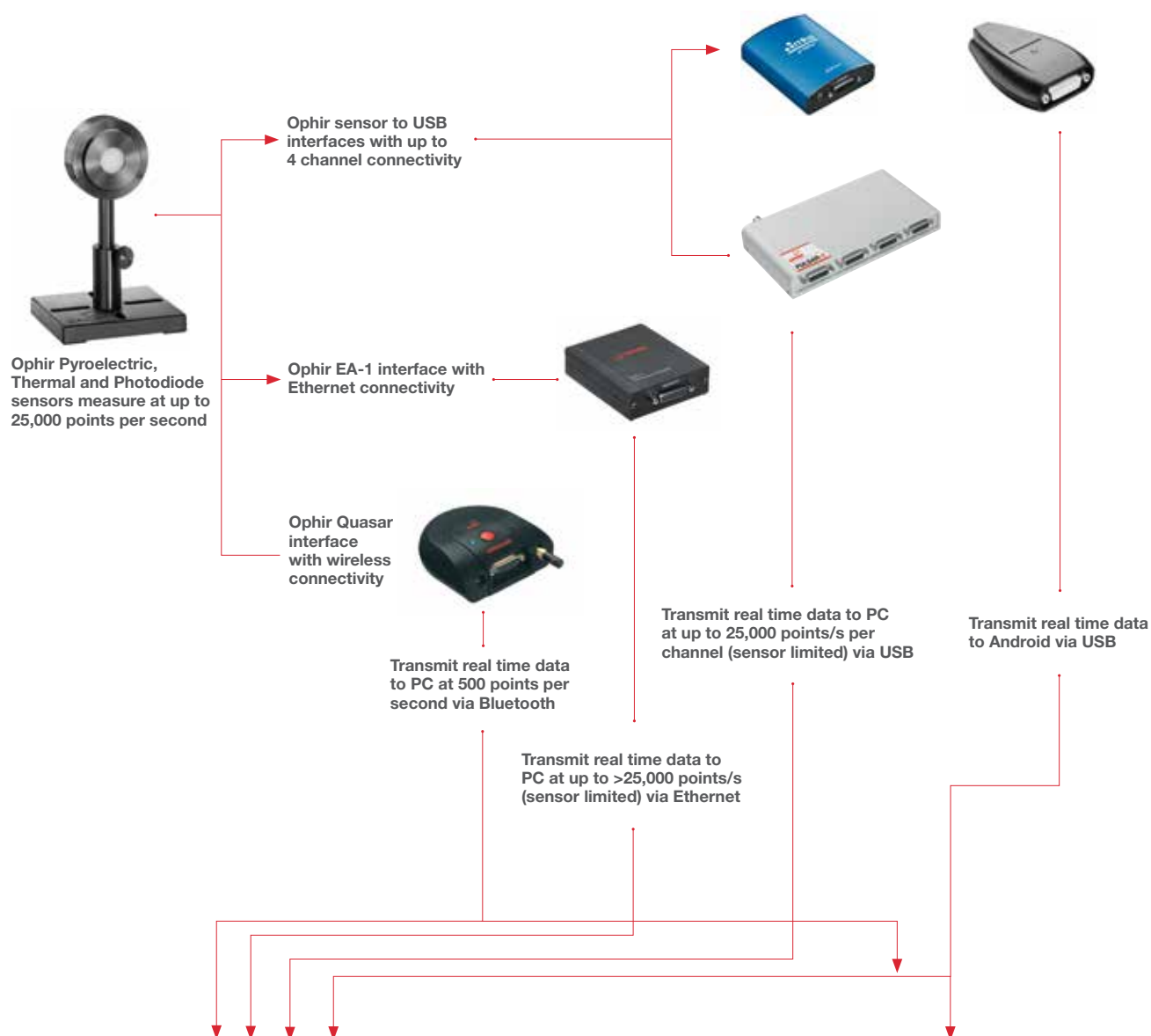
| Specifications | |
|---|--|
| Power Measurement | |
| Power log period | 1s to Unlimited |
| Energy Measurement | |
| Max logging rate | 10,000Hz ^(a) |
| Trigger input and output | N.A. |
| Timing | Supports time stamp for each pulse - resolution 1µs |
| General | |
| Number of sensors supported | One sensor per unit. Can combine several units with software for display of up to 8 sensors on one PC |
| Compatible sensors | Supports all standard Ophir Pyroelectric (PE-C series), Thermal, BeamTrack and Photodiode sensors. Works with our PD300RM sensors. |
| Power supply | Powered from USB |
| Outputs | USB and user selectable 1, 2, 5 and 10 Volt full scale analog output |
| Dimensions | 105mm L x 80mm W x 29mm H |
| Compliance | CE, UKCA, China RoHS |
| Note: (a) This is the data logging rate for every single point in turbo mode. Above that rate, the instrument will sample points but not log every single point | |

Ordering Information

| Item | Description | Ophir P/N |
|----------------------------------|---|-----------|
| Juno+ | Module to operate one Ophir sensor from your PC USB port. Comes with software | 7Z01252 |
| Juno+ USB cable | USB-A to MINI-B Cable (1 unit supplied with Juno+) | 7E01217 |
| Standard Analog Output Connector | 2.5mm mono jack (1 unit supplied with Juno+) | 7E02008 |

2.2 PC Interfaces

2.2.1 PC Connectivity Options for Power/Energy Measurement



StarLab Software (data transmitted via USB, Ethernet or Bluetooth)

StarViewer Application (data transmitted via Bluetooth and USB)



StarLab Software



StarViewer Android Application

2.2.8 Summary of Computer Options for Ophir Meters and Interfaces

Communications

With Ophir RS232, GPIB, Bluetooth, USB and Ethernet communication options you can transfer data from the sensor to the computer in real time or offline. You can also control your Ophir power meter from the computer.

- USB on Nova II, Vega, StarBright, Centauri (optional on StarLite) power meters and Juno, Juno+, Pulsar PC interfaces
- Bluetooth wireless on Quasar interface
- RS232 on LaserStar, Nova II, Vega, StarBright, Centauri and Juno-RS optional on Nova
- GPIB optional on LaserStar
- Ethernet on EA-1 interface

Ophir Power Meter and Interface Specifications

| Model | Centauri | StarBright | Nova II / Vega | StarLite | LaserStar | Nova | Juno / Juno+ | Juno-RS | Pulsar-1, 2 or 4 | EA-1 | Quasar Bluetooth |
|------------------------------------|--|---|---|---|---|---|---|---------------------------------------|--|---|---|
| Communication method | USB / RS232 | USB / RS232 | USB / RS232 | USB ^(c) | RS232 / GPIB | RS232 | USB | RS232 | USB | Ethernet | Bluetooth |
| Power Measurement | | | | | | | | | | | |
| Power log period | 1s to 1000hr. | 1s to 1000hr. | 12s to 600hr. | N.A | 12s to 600hr. | 5s to 24hr. | 1s to Unlimited | 1s to Unlimited | 1s to Unlimited | 1s to Unlimited | 1s to Unlimited |
| Max points stored onboard | Unlimited | Unlimited | Nova II 5400 Vega 27000 | N.A | 5400 | 300 | N.A | N.A | N.A | N.A | N.A |
| Max points direct on PC | Unlimited | Unlimited | Unlimited | N.A | Unlimited | Unlimited | Unlimited | Unlimited | Unlimited | Unlimited | Unlimited |
| Analog output | 1V, 2V, 5V, 10V F.S. | 1V, 2V, 5V, 10V F.S. | 1V, 2V, 5V, 10V F.S. | 1V F.S. | 1V F.S. | 1V F.S. | N.A / 1V, 2V, 5V, 10V F.S. | 1V, 2V, 5V, 10V | N.A | N.A | N.A |
| Energy Measurement | | | | | | | | | | | |
| Max logging rate | 25,000Hz USB 30Hz RS232 | 5000Hz USB 30Hz RS232 | >2000Hz USB ^(a) >30Hz RS232 | 20Hz ^(c) | >30Hz RS232 >1500Hz GPIB ^(a) | >10Hz | 10,000Hz ^(a) | 500Hz ^(a) | 25,000Hz ^(a) | >25,000Hz ^(a) | 500Hz |
| Max onboard data logging rate | 25,000Hz | 5000Hz | 4000Hz ^(a) | N.A | >1500Hz ^(a) | >10Hz | N.A | N.A | N.A | N.A | N.A |
| Max points stored USB/onboard | Unlimited | Unlimited | Nova II 59,400 Vega 250,000 | N.A | 59,400 | 1000 | N.A | N.A | N.A | N.A | N.A |
| Trigger input and output | Trigger input to synchronize measurement of pulses | N.A | N.A | N.A | N.A | N.A | N.A | N.A | BNC trigger input to enable measurement of missing pulses. Can also be configured to give trigger output | N.A | N.A |
| Timing - time stamp for each pulse | resolution 1µs | resolution 1µs | N.A | N.A | N.A | N.A | resolution 1µs | resolution 1µs | resolution 1µs | resolution 1µs | resolution 10ms |
| General | | | | | | | | | | | |
| Com Object | yes | yes | yes | yes ^(c) | no | no | yes | no | yes | yes | no |
| LabVIEW VIs | yes | yes | yes | yes ^(c) | yes | yes | yes | no | yes | no | no |
| Maximum baud rate | 115200 | 115200 | 38400 | N.A | 38400 | 19200 ^(b) | N.A. | 115200 | N.A. | N.A. | N.A. |
| PC file format | Text files, spreadsheet compatible ASCII | | | | | | | | | | |
| TTL Out | yes | N.A | N.A | N.A | N.A | N.A | N.A | N.A | N.A | N.A | N.A |
| Number of sensors supported | 2 / 1 sensors per unit. Can combine several units with software for display of up to 8 sensors on one PC | One sensor per unit. Can combine several units with software for display of up to 8 sensors on one PC | One sensor per unit. Can combine several units with software for display of up to 8 sensors on one PC | One sensor per unit. Can combine several units with software for display of up to 8 sensors on one PC | One sensor per unit. Can combine several units with software for display of up to 8 sensors on one PC | One sensor per unit. Two sensors per unit for dual channel mode | One sensor per unit. Can combine several units with software for display of up to 8 sensors on one PC | One sensor per unit | 4 / 2 / 1 sensors per unit. Can combine several units with software for display of up to 8 sensors on one PC | One sensor per unit. Can combine several units with software for display of up to 8 sensors on one PC | One sensor per unit. Can combine several units with software for display of up to 7 Quasars on one PC |
| Compatible sensors | Supports most Ophir pyroelectric, thermal and photodiode sensors | | | | | | | | | | |
| Power supply | Powered from internal rechargeable battery power supply | Powered from internal rechargeable battery power supply | Powered from internal rechargeable battery power supply | Powered from internal rechargeable battery power supply | Powered from internal rechargeable battery power supply | Powered from internal rechargeable battery power supply | Powered from USB | 12V wall cube plugs into jack on rear | 12V wall cube plugs into jack on rear | 12V wall cube plugs into jack or PoE | Powered from internal rechargeable battery power supply |
| Dimensions | 47 x 200 x 130mm | 212 x 114 x 40mm | 208 x 110 x 43mm / 210 x 109 x 36mm | 211 x 114 x 40mm | 194 x 228 x 57mm | 205 x 95 x 39mm | 77 x 55 x 23mm / 105 x 80 x 29mm | 114 x 80 x 29mm | 103 x 190 x 33mm | 93 x 73 x 29mm | 94 x 96 x 36mm |

Notes: (a) The above refers to the rate for logging every single point in turbo mode. Above that rate, the instrument will sample points but not log every single point.
(b) For pyroelectric sensors, maximum guaranteed baud rate is 9600.
(c) StarLite must be USB enabled in order to work with StarLab. If your StarLite has not been USB enabled, please contact your Ophir distributor in order to obtain a USB Activation Code.

2.3 Software Solutions

2.3.1 StarLab

StarLab turns your PC into a laser power/energy multi-channel station

Extensive Graphic Display of Data

- Line Plot, Histogram, Bar chart, Simulated Analog Needle
- Multiple data sets on one graph or separate graphs on the same screen

Advanced Measurement Processing

- Power/Energy Density, Scale Factor, Normalize against a reference
- Multi-channel comparisons
- User defined mathematical equations: channels A/B, (A-B)/C etc.
- Position & size measurement with BeamTrack sensors

Data Logging for Future Review

- Can be displayed graphically or saved in text format
- Easily exported to an Excel spreadsheet

Fully supports IPM, Ariel, Centauri, StarBright, StarLite, Vega, Nova II, Pulsar, Juno, Juno+, Juno-RS, Quasar and EA-1 devices with all standard Ophir sensors

Flexible Display Options with StarLab

Choose which channels to display



Setup screen



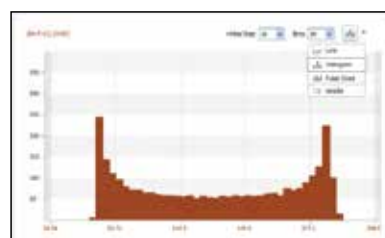
One of the above screens is maximized

You may choose to display them separately

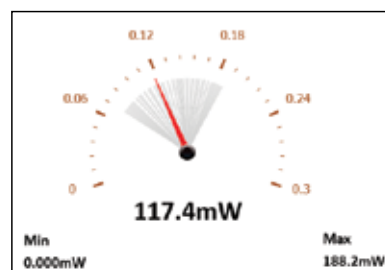
Maximize one of the sources



Choose line graph



or histogram



or needle display

Multiple Sensors displayed together

- Click on one of the channels
- The numerical values are from the channel chosen



Here multi line graph display has been chosen

- Settings and functions may be opened to adjust then minimized as needed
- Additional functions are available from the "Functions" tab



Here multi line histogram display has been chosen

Functions and Logging

Functions

- Click on f(x) to open another trace combining measured values



- Define function combining measured values

- New trace is now added per defined function

Logging

Click on log button and logging of values starts

Files are stored here. They may be viewed graphically OR numerically



```

PC Software:StarLab version 3.00 Build 19
Logged:25/05/2014 at 09:33:22
Channel 8:Veiga Thermopile 3A-P-V1 (s/n:999999) VG2.31 (s/n:657028)
Channel 9:Veiga Photodiode PD300 (s/n:694646) JKL.24 (s/n:606180)
Math M:(A-B)/A2

Channel 8:Statistics
Min:3.440mw
Max:12.22mw
Average:7.882mw
Std.Dev.:3.078mw
Overrange:0

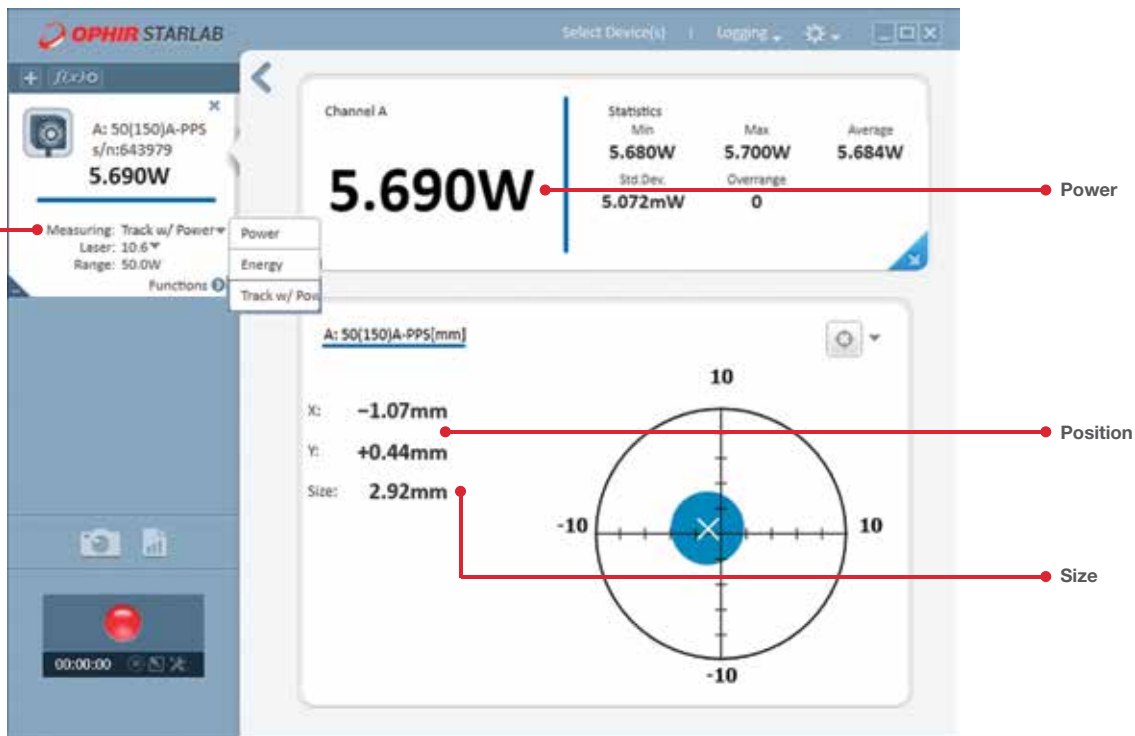
First Pulse Arrived : 25/05/2014 at 09:33:22.562000

Timestamp      Channel 8      F(B)      Channel A      Math M
0.000      1.762e-002      6.620e-003
0.064      1.836e-002      7.360e-003
0.128      1.911e-002      8.110e-003
0.192      1.986e-002      8.860e-003      1.067e-002      6.554e-006
0.203      2.057e-002      9.570e-003      8.480e-003      1.444e-007
0.256      2.057e-002      9.570e-003      6.540e-003      9.811e-006
0.269      2.123e-002      1.023e-002      4.900e-003      2.841e-005
0.321      2.123e-002      1.023e-002      3.550e-003      5.285e-005
0.354      2.182e-002      1.082e-002
0.384      2.232e-002      1.132e-002
0.406      2.232e-002      1.132e-002
0.449      2.291e-002      1.192e-002
0.865      2.258e-002      1.158e-002      3.400e-004      1.339e-004
0.870      2.216e-002      1.116e-002      3.600e-004      1.259e-004
0.928      2.164e-002      1.064e-002      4.800e-004      1.141e-004
0.936      2.104e-002      1.004e-002      7.600e-004      9.761e-005
0.993      2.038e-002      9.380e-003      2.370e-003      4.914e-005
1.003      1.558e-002      4.580e-003
1.056      1.558e-002
1.070      1.558e-002
1.120      1.558e-002
1.136      1.558e-002
1.144      1.558e-002
1.203      1.558e-002
1.664      1.558e-002

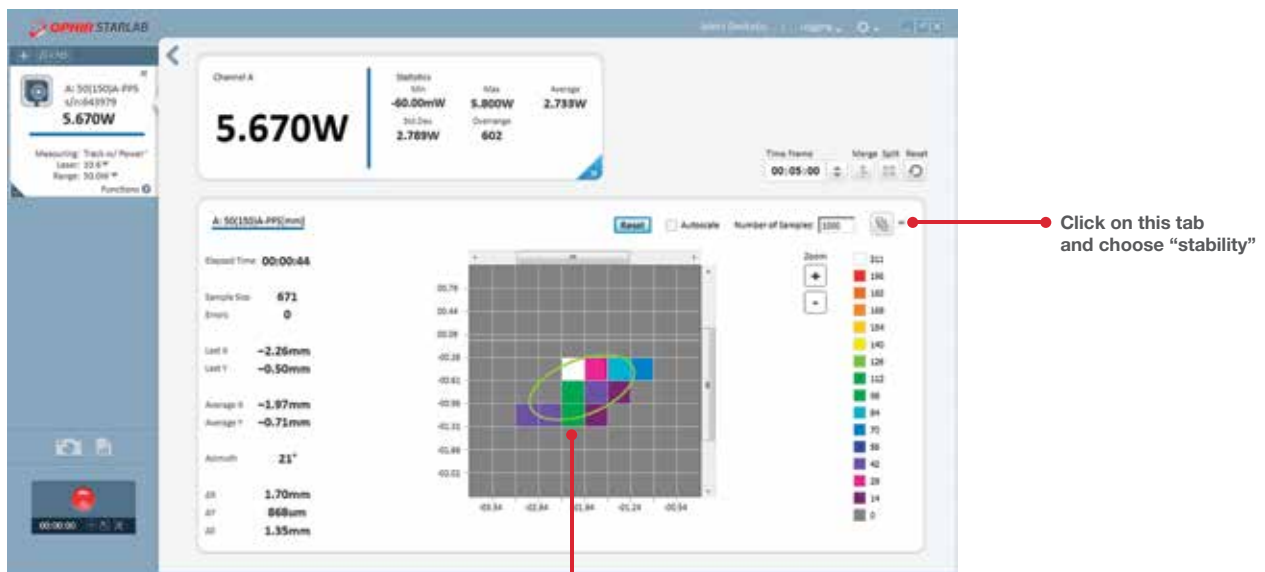
```

BeamTrack Power/Position/Size Screens

- Open Measuring type tab and choose Track



Power / Position / Size screen



Position stability screen

- Displays beam center wander weighted for dwell time at each position

2.3.2 System Integrator Solutions

Besides their use as stand-alone, fully featured laser power/energy meters, Ophir devices are easily incorporated into larger end-user applications. This allows system integrators to leverage Ophir's excellence in measurement capabilities with legacy analysis packages.

Communication Protocols

All Ophir devices support one or two forms of communication with the PC.

| Device | USB | RS232 | GPIO | Bluetooth | Ethernet |
|--------------|-----|-------|------|-----------|----------|
| Centauri | • | • | | | |
| StarBright | • | • | | | |
| Vega | • | • | | | |
| Nova II | • | • | | | |
| *StarLite | • | | | | |
| LaserStar | | • | • | | |
| Nova | | • | | | |
| Juno / Juno+ | • | | | | |
| Juno-RS | | • | | | |
| EA-1 | | | | | • |
| Pulsar | • | | | | |
| Quasar | | | | • | |

* With USB activation code

USB

Ophir provides a common interface for communication and control of all of our USB speaking devices.

OphirLMMMeasurement is a COM object that is included as part of the StarLab installation (StarLab 2.10 and higher) that allows the system integrator to take control of the Centauri, Ariel, StarBright, StarLite, Juno, Juno+, Nova II, Pulsar, USBI and Vega devices; integrating them into his in-house measurement and analysis package.

For communication via USB, device drivers and additional support software must be installed on your PC. These components are installed as part of the StarLab application's installation process.

RS232

RS232 communication is the simplest to integrate into your Customized Solutions (OEM) application. Integrated Development Environments (IDE's) such as Microsoft Visual Studio provide functions and methods for accessing the PC's com port.

The following is all that you need to get your RS232 applications up and running

- User Commands document contains an alphabetical listing and detailed description of all commands available with the Centauri, StarBright, Vega, Nova II and Juno-RS devices.
- Appendix A5 of the StarCom User Manual contains an alphabetical listing and detailed description of all commands available with the Nova and LaserStar devices.
- Appendix A4 of the StarCom User Manual gives an example of polling the Nova device for measurements. This was written in VB6.
- An appropriate RS232 assembly
- Nova RS232 Assembly (P/N 7Y78105 ^(a)) for use with the Nova device

- Nova II / Vega RS232 cable (P/N 7E01206) for use with the Nova II and Vega devices (included with the Nova II / Vega)
- LaserStar RS232 cable (P/N 7E01121, included with the LaserStar)
- StarBright / Centauri RS232 cable (P/N 7E01213, included with the StarBright and Centauri)
- Juno-RS RS232 cable (P/N 7E11216, included with the Juno-RS)

GPIO

Besides RS232, the LaserStar can also communicate via GPIO (IEEE 488.1). Using the SDK supplied by the vendor of your GPIO controller hardware, a LaserStar IEEE cable (P/N 7Y78300 ^(b)) and the StarCom User Manual, you can integrate the LaserStar into your GPIO solution.

Bluetooth

Bluetooth system integration for the Ariel and Quasar is easily accomplished, in a similar way to our RS232 devices. For more information (and a list of commands), please contact Ophir.

Ethernet

The EA-1 Ethernet Adapter device provides system integration using a Telnet connection over an Ethernet network. A list of user commands is provided, similar to the RS232 commands described above. See the EA-1 User Manual for more details, available on the website.

System Integrators will need the following components:

- OphirLMMMeasurement COM Object.pdf. lists and describes the methods and events available for configuring, controlling and uploading measurements from Ophir devices.
- OphirLMMMeasurement.dll. COM object component developed and supplied by Ophir for communication with the Centauri, StarBright, StarLite, Juno, Juno+, Nova II, Pulsar, USBI and Vega devices. The COM object is registered when the application is installed. OphirLMMMeasurement COM Object.pdf describes how to register it on another PC where the Ophir application has not been installed.
- Standard USB cable (P/N 7E01202) for use with the Pulsar device (included).
- Standard mini-B USB cable (P/N 7E01217) for use with the Juno and Juno+ devices (included).
- Nova II / Vega USB cable (P/N 7E01205) for use with the Nova II and Vega devices (included).
- StarBright / StarLite / Centauri micro-B USB cable (P/N 7E01279) for use with StarBright, StarLite and Centauri devices (included).

Ophir provides example projects of COM Object clients in VC#, VB.NET and LabVIEW. These are found in the Automation Examples subdirectory of our StarLab PC Application.

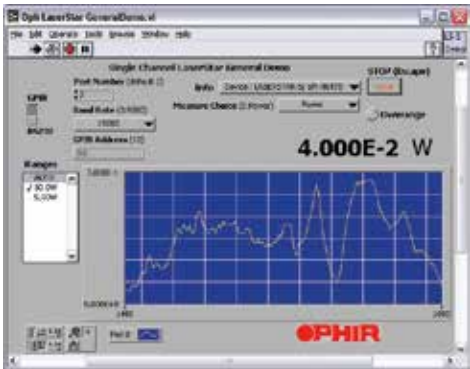
Note: (a) P/N 7Y78105 replaces P/N 78105

Note: (b) P/N 7Y78300 replaces P/N 78300

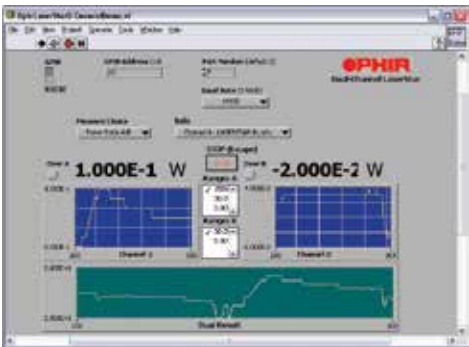
2.3.4 LabVIEW Solutions

Ophir has long recognized the growing LabVIEW community of developers. For over 10 years, we have been providing LabVIEW libraries for all of our devices. These are full open-source applications that can be used as is or tailored by the LabVIEW programmer to his specific needs. These starter applications are basic software only that allows the LabVIEW programmer to experiment freely to fully feel the strength of our devices' respective command sets. These applications contain VIs (Virtual Instruments) to

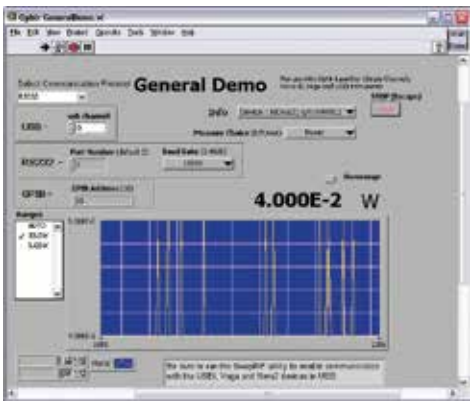
control the instrument. You can combine VIs to create successively larger and more versatile larger VIs by simply connecting them together. Users can create sophisticated, custom applications in minutes. In most cases, applications can be built and tested even before the instrument even arrives. The versatility of these tools is limitless. All of our LabVIEW libraries can be downloaded from our web site: www.ophiropt.com



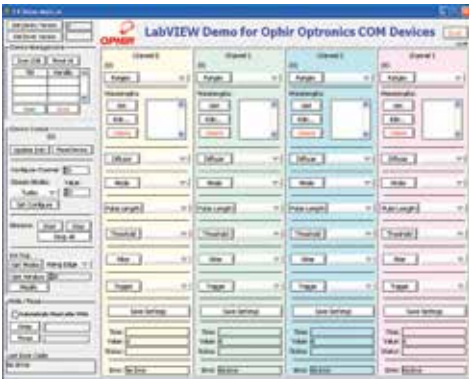
VI Libraries
Ophnova.lib
Library supplied for use with the Nova. Communication is in RS232 and is based on NI-VISA.



Ophlstrd.lib
Library supplied for use with the Dual-Channel LaserStar. Communication can be set to RS232 or GPIB and is based on NI-VISA.



OphInstr.lib
This library can be configured to work with the Nova II, Vega, or Single-Channel LaserStar devices. It can also work with the Juno or Juno+ with a Thermopile or Photodiode sensors. It can be set to RS232, USB or GPIB. It is based on NI-VISA for all 3 communication protocols.



LabVIEW COM Demo.lib
Library supplied for use with all of our USB speaking devices (Ariel, Centauri, StarBright, StarLite, Juno, Juno+, Nova II, Pulsar, Vega). Makes use of our COM object. Included with our StarLab application.