Laser Line Tunable Filter (LLTF) CONTRAST™ User Manual

Working with a LLTF

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The device complies with Electromagnetic Compatibility (EMC) **Directive 2004/108/EC** as part of the requirement leading to the CE marking of the Laser Line Tunable Filter CONTRAST™. This directive calls for the **EN 61326-1 (2013)** product standards relative to *Electrical equipment for measurement, control and laboratory use*.

This device complies with **part 15 of the FCC Rules**. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and

(2) This device must accept any interference received, including interference that may cause undesired operation.

This **class A** digital apparatus complies with Canadian **ICES-003**.

The device complies with Low voltage (LVD) **Directive 2006/95/EC** as part of the requirement leading to the CE marking of the Laser Line Tunable Filter CONTRAST™. This directive calls for the **IEC 61010-1:2010 (Third Edition)** product standards relative to *Safety requirements for electrical equipment for measurement, control, and laboratory use*.

The Laser Line Tunable Filter CONTRAST™ is protected by one or more of the following patents: **US7577990**; **AU2005217410**; **CA2557180**; and **patents pending.**

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1. About This Manual

Each manual generally covers one instrument with the features and accessories particular to and/or contained within that instrument. If you have more than one instrument from Photon etc, there will be a user manual for each.

If you want to adapt a new Photon etc. instrument to your actual instrument, you will need to ship your instrument to us and another user manual will be shipped to you for your complete Photon etc. system. All our instruments can be controlled by an external computer with PHySpec, Photon etc's proprietary software.

The basis of PHySpec software made for your instrument or system is covered in this user manual.

2. Customer Service

Photon etc. aims to provide the latest innovations in optical and photonic instrumentation. We pride ourselves in offering our clients reliable instruments, based on the latest scientific advances. Our desire is to develop a long term relationship with our customers by providing products adapted to their specific needs, combined with personalized service and support. Feel free to contact one of our experts for advice and solutions adapted to your requirements.

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To ask our experts about a specific application: expert@photonetc.com

For technical support: support@photonetc.com

3. Revision History

The table below describes all the changes made to this document.

Version	Description	Date
1.0.0	Initial release of the LLTF CONTRAST™ Getting Started Manual.	2013-04-24
1.1.0	General cleaning instructions added and 'Refer to manual' warning notice.	2013-04-29
1.2.0	Trademark added to CONTRAST™.	2013-04-30
1.3.0	CE Compliant.	2013-05-01
1.4.0	Exclusion for RoHS and WEEE	2013-06-18
1.5.0	Release of PHySpec V2, and new Harmonic Filter option	2013-11-28
1.6.0	Warning on Harmonic Filter module	2013-12-18
1.7.0	Adding section Sequencer. Updating Calibration and Troubleshooting sections.	2014-02-19
1.8.0	Updating section Sequencer. Adding functionality (manual mode)	2015-02-25
1.9.0	Adding Product Specifications section	2015-04-27
1.10.0	Updating the system control interface images Updating the installation procedure Updating the calibration procedure Updating images of the instrument	2015-09-23

4. Introduction

The LLTF CONTRAST™ is based on the Bragg Tunable Filter (BTF) technology using Thick Holographic Volume Bragg Grating. This technology allows user to select, by transmission or reflection, a narrow bandwidth (FWHM) as low as 0.3 nm for a spectral range of hundreds of nanometers. The instrument then provides a monochromatic beam at a wavelength specified by the user. A calibration procedure ensures that the proper wavelength is produced by the instrument at any given time.

OEM
Original Equipment Manufacturer

LLTF CONTRAST™ is offered as an OEM product for incorporation into other equipment. When a laser or supercontinuum source is injected in the input port of the filter, a filtered laser beam is emitted at the output port of the instrument. The customer is responsible for the laser safety certification of the final product assembly.

This is a sealed unit. There is no reason to open the LLTF CONTRAST™. The removal of any panels exposes users to injuries and will also invalidate the warranty.

5. Safety Precautions

A laser beam is emitted from the side face of the unit where the laser aperture label is fixed. This is a collimated beam and should not be looked at directly. The customer is responsible for the laser safety certification of the final assembly product. The customer is responsible to determine the appropriate class of the laser system and comply with the safety measures for that class (refer to standard IEC 60825-1).

An external interlock connection is available if requires. The supplied D-plug (LEMO Circular Push Pull Connectors 2P STRAIGHT FEMALE P/N: EGG0K302CLL) has a wire loop that closes the interlock.

The enclosure should not be removed under any circumstances. The protective output cap should not be removed when the instrument is powered. Be aware that unwarranted accesses, procedures, or modifications to the instrument can result in injuries or can damage the instrument.

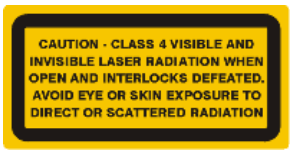
Note: This equipment has been tested and found to comply with the limits for a **Class A** digital device, pursuant to **Part 15 of the FCC Rules**. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

5.1. Labels Fixed to the Unit

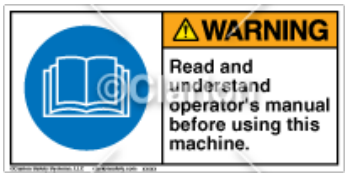
A: Warning Triangle

B: Laser Aperture

C: Classification Label



D: Classification Label



E: Refer to Manual Label

LABEL POSITIONS:

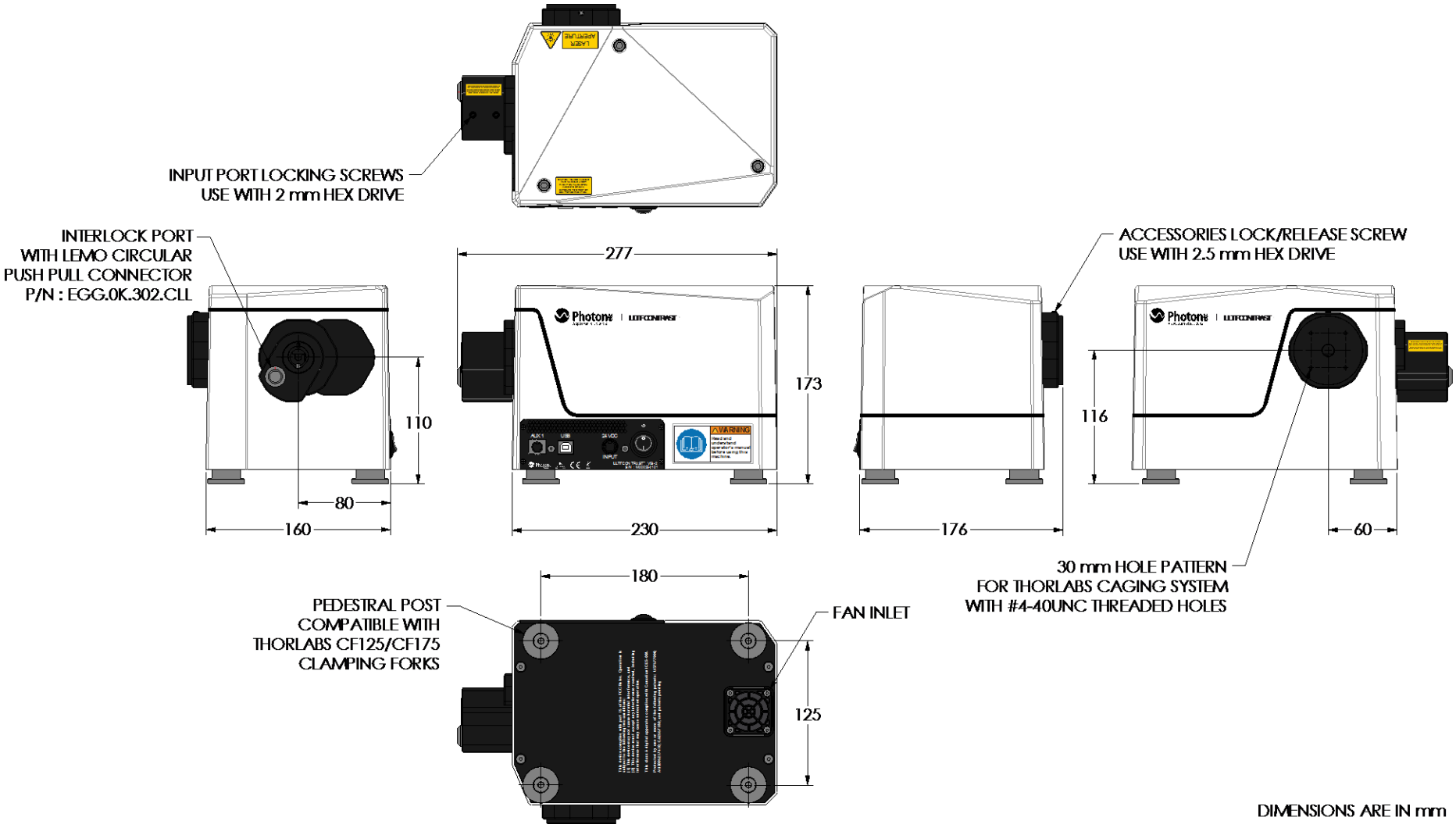
Label **A** and **B** are fixed to the top cover, close to the optical output.

Label **C** is fixed to the top cover.

Label **D** is fixed on the input port option.

Label **E** is fixed on the LLTF front face, close to the interrupter.

6. Product Overview



6.1. LLTF CONTRAST™ CONTROL PANEL

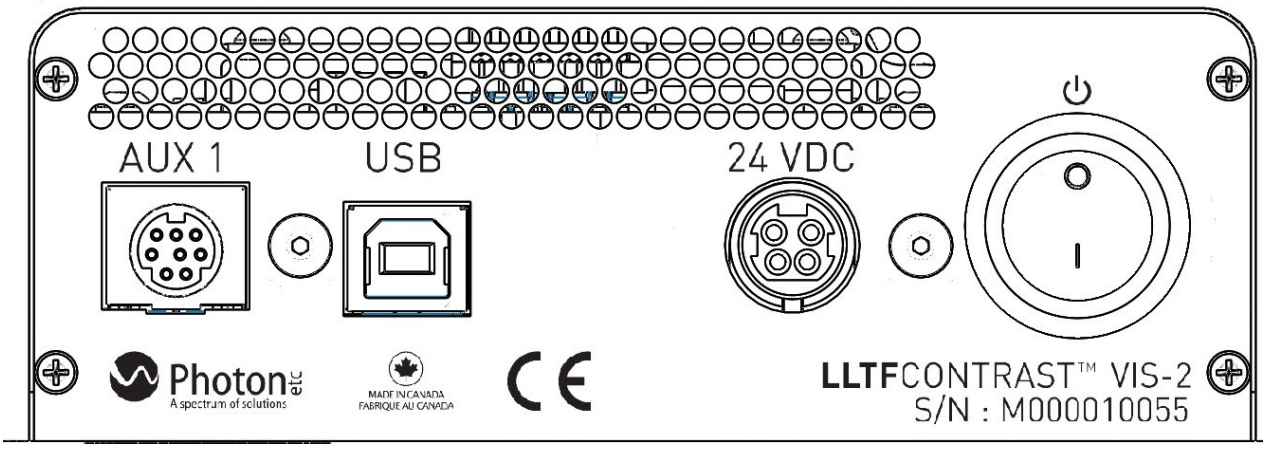


Figure 1: LLTF CONTRAST™ control panel

Item	Description
24VDC	Input power supply
AUX1	Auxiliary digital outputs
USB	USB 2.0 Standard-B Type plug for filter communication

7. Product Specifications

7.1. Optical Specifications

Spectral Range:	400 nm to 1000 nm for VIS instrument
	1000 nm to 2300 nm for SWIR instrument
	Custom range for High Resolution instrument
Bandwidth (FWHM):	< 2.5 nm for VIS instrument
	< 5 nm for SWIR instrument
	Custom bandwidth for High Resolution instrument available
Wavelength Resolution (Relative):	FWHM / 8
Peak Efficiency**:**	Up to 60%
Out-of-Band Rejection:	< -60 dB @ +/- 40 nm from central wavelength for VIS instrument
	< -60 dB @ +/- 80 nm from central wavelength for SWIR instrument
Optical Density (OD):	> OD6.5 (measured at 1064 nm)
Input Average Power:	< 4 W average power for HP4 instrument
	< 8 W average power for HP8 instrument
	< 20 W average power for HP20 instrument
Input Peak Power:	< 5 GW / cm2 peak power @ 1064 nm, 8 ns
Input Beam Diameter:	< 5 mm
Pointing Stability	< 1 mm lateral displacement @ 1m from filter (no angular displacement)
Tuning Speed	35 ms for 0.1 nm displacement
	45 ms for 0.2 nm displacement
	55 ms for 1 nm displacement
	60 ms for 2 nm displacement
	65 ms for 5 nm displacement
	70 ms for 10 nm displacement

7.2. Other Specifications

Over All Dimensions (L x W x H):	277 mm x 176 mm x 173 mm
Electrical Power:	24 VDC / 2 A
Software provided:	PHySpec included (SDK plugin interface available)

8. System Requirements

The following conditions are required to obtain the specifications of your instrument and to maximize its lifetime. Keep in mind that the instrument is primarily designed for controlled laboratory environments. Even if the instrument is rugged and compact, its performance depends on the surface stability. We strongly recommend a vibration-free environment for best performance.

8.1. Optical requirements

Input Beam Divergence:	< 0.45 mrad
Input Beam Polarization State:	Linear and vertical

8.2. Electrical Requirements

Power:	120-240 V, 50/60 Hz, 50W

8.3. Environmental Requirements

Handling:	Careful handling is required when moving the instrument. Instrument not compliant with any shock standards
Orientation:	Upright position, sitting on its legs
Operating Temperature:	5 °C to 40 °C
Storage Temperature:	0 °C to 50 °C
Operating Humidity:	10% to 85% non-condensing
Storage Humidity:	5% to 90% non-condensing

8.4. Computer requirements

Operating System:	Windows Vista (32 & 64 bits), Windows 7 (32 & 64 bits), Windows 8 (32 & 64 bits)
Connectivity:	USB 2.0
Memory:	512 Mo

9. First Steps with LLTF CONTRAST™

Before installation, a laser safety assessment should be performed to determine the appropriate safety measures to apply (laser safety goggles, laser protective barriers and curtains, pertinent sign information etc. as specified in standard IEC 60825-1).

WARNING: BEFORE CONNECTING THE LASER TO THE LLTF CONTRAST™, MAKE SURE THAT THE LASER IS NOT IN OPERATION, AND NO LIGTH IS EMMITED FROM THE LASER.

9.1. Visual Inspection

Before using the instrument for the first time, you should visually inspect the instrument for evidence of damage. If the electrical connectors or the optical ports are damaged, contact your distributor for instructions on how to proceed.

9.2. Connect the Cables

All the cables necessary to proper operation are included with the system. Connect the device to the computer with it respective power and communication cables.

- LLTF CONTRAST™ Filter and USB cable.
- LLTF CONTRAST™ Filter and power block.

9.3. Software / Drivers Installation

1. If a version of PHySpec is already installed and you do not want to control the instrument it was installed for, uninstall it first.
2. Insert USB key in the computer.
3. Execute PHySpec_2.x.x-setup.exe located on the USB key.
4. Follow the wizard instructions to install PHySpec on your computer.
5. Connect the instrument to the computer. Power up the instrument to initiate the installation of the USB driver.

9.4. Input Port Connection

1. Identify the **Alignment Key** of the **Laser Ferrule**, and the **Alignment Lock** of the input port of the LLTF.
2. Carefully insert the **Laser Ferule** into the input port of the LLTF, by maintaining proper alignment of the **Alignment Key** and **Alignment Lock**.
3. When the **Laser Ferule** is fully inserted into the input port, secure the ferule by tightening the two set screws on the top of the input port, by using the provided 2mm Allen key.
4. Connect any Interlock mechanism with the **Interlock** connector supplied with the LLTF CONTRAST™.

WARNING: DO NOT REMOVE THE LASER FERULE WHEN THE LASER IS IN OPERATION. IT COULD RESULT IN PERSONAL INJURIES OR DAMAGE TO THE LASER OR TO THE LLTF.

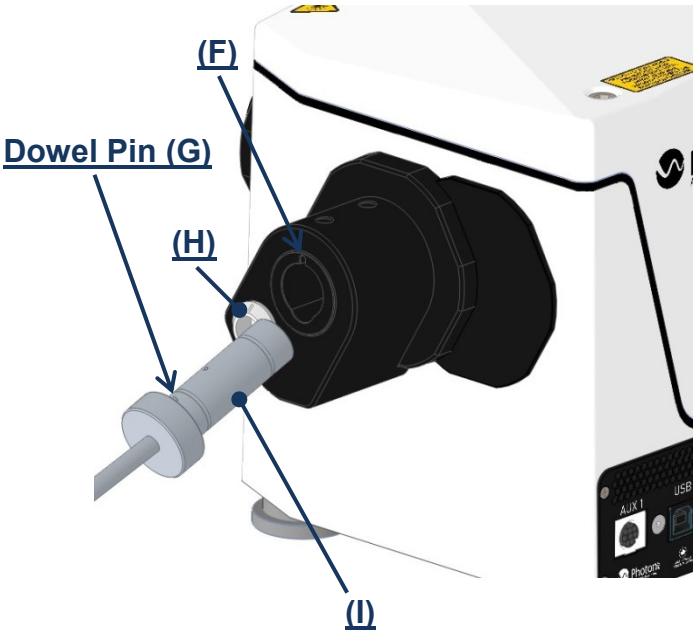


Figure 3: Alignment Key (F) Alignment Lock (G), Interlock (H), Laser Ferule (I)

Figure 2: Securing Set Screws

9.5. FIBER OPTIC OPTIONAL OUTPUT

1. Remove the Output CAP by using the provided 3mm Allen key.

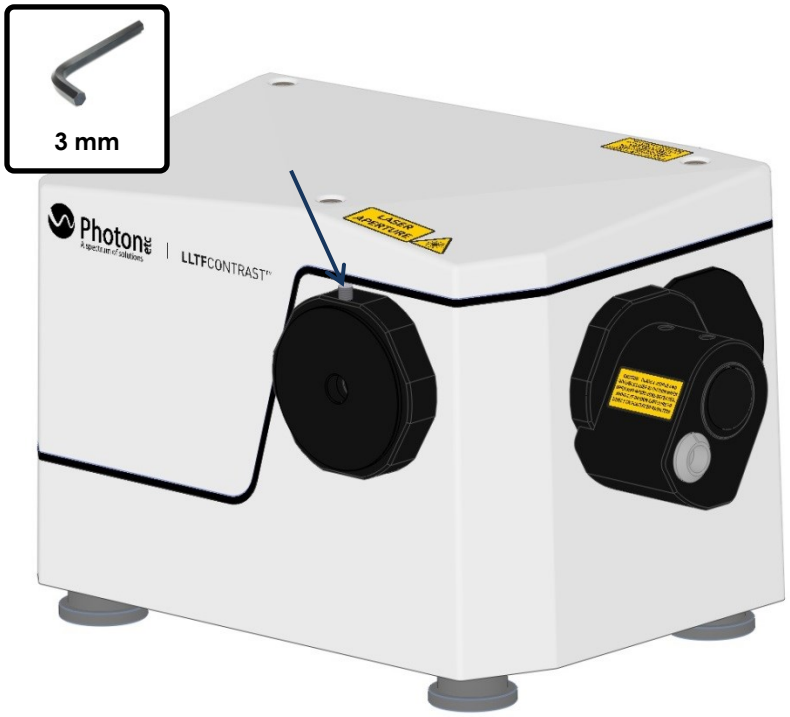


Figure 4: Output Cap

2. Identify the **Alignment key** of the LLTF, and the **Alignment lock** of the Fiberoptic module.

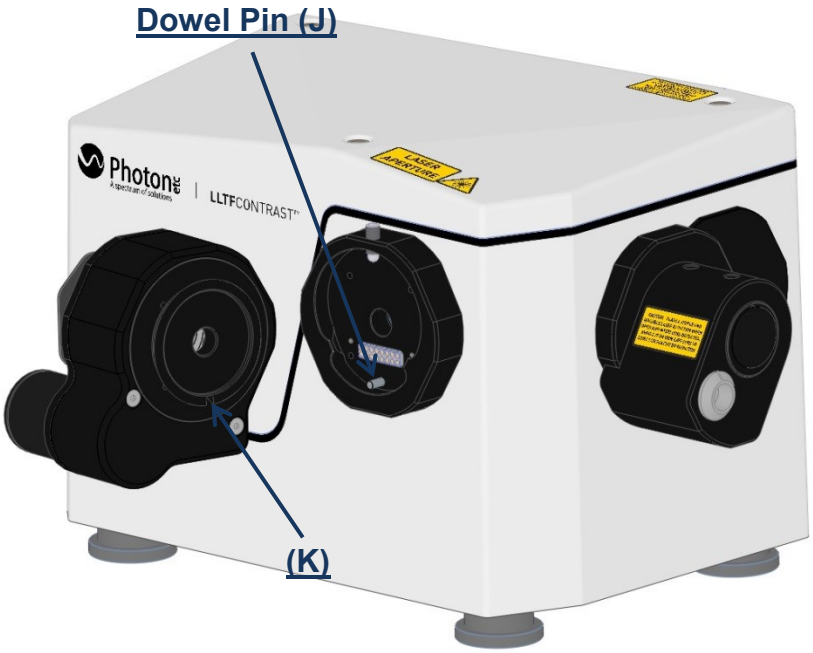


Figure 5: Alignment Key (J) and Alignment Lock (K)

3. Carefully insert the Fiberoptic module into the output port of the LLTF, by maintaining proper alignment of the **Alignment key** and **Alignment lock.** When the Fiberoptic module is fully inserted into the output port, secure the module by a **SLIGHT tightening (5 lbf.in / 0.6 N.m)** of the set screw on the top of the output port, by using the provided 3mm Allen key.

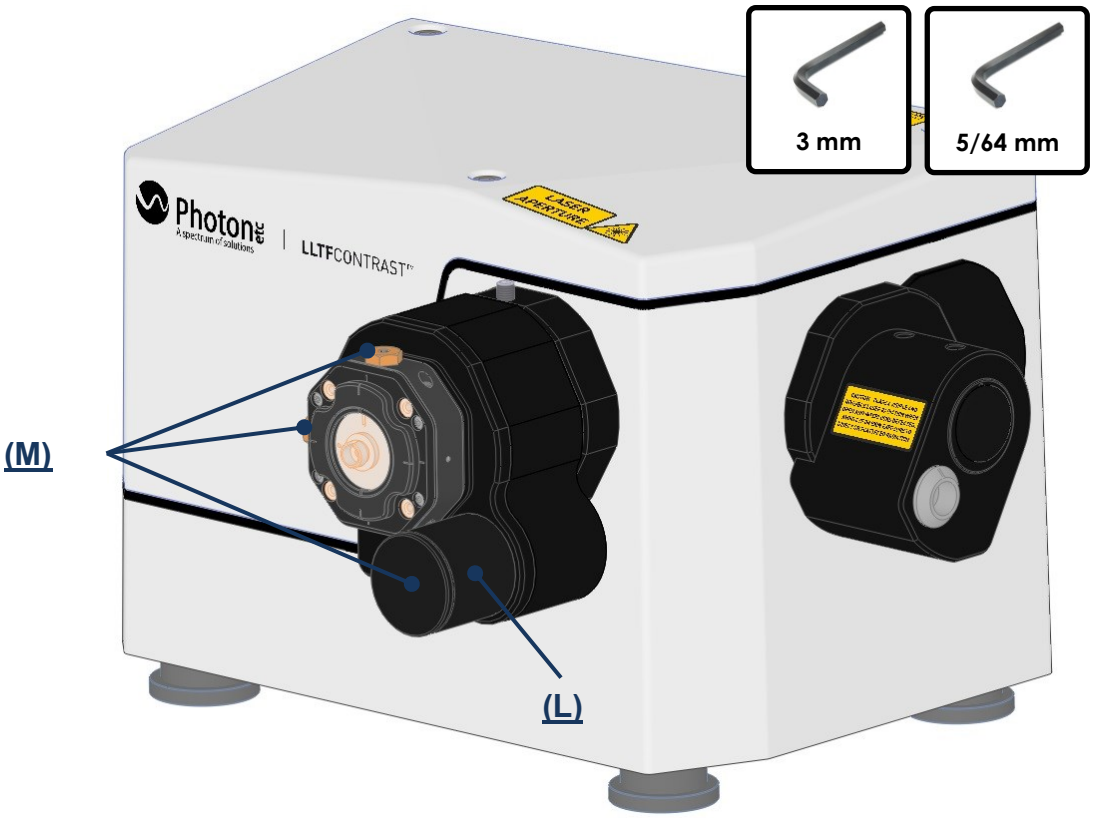


Figure 6: Fiberoptic Module showing Security Cap (L), and X-Y-Z Adjustment (M)

4. Remove the **Security Cap** and connect the optical fiber to the Fiberoptic port module.
5. Maximize the power coupled into the optical fiber by using the **X-Y-Z Adjustment** of the Fiberoptic port module with the provided 5/64 Allen key.
6. When the power coupled into the optical fiber is optimized, replace the **Security cap** if needed.

9.6. Other Optional Output

All other optional output module are installed in the same manner as the Fibered Input / Output option by carefully inserting it into the output port of the LLTF, and maintaining proper alignment of the **Alignment key** and **Alignment lock.** All other optional output module should also by secure by a **SLIGHT tightening (5 lbf.in / 0.6 N.m)** of it set screw.

WARNING: TURN OFF AND DISCONNECT THE LASER LINE TUNABLE FILTER CONTRAST™ FROM POWER SUPPLY BEFORE INSTALLING / REMOVING ANY ACTIVE OPTIONAL MODULE

10. Instrument Control

10.1. Starting and configuring the instrument

1. The instrument requires a 24 V DC power supply.
2. Verify that the USB cable is plugged in the computer and the instrument. Power up the instrument by toggling the power switch.
3. Start PHySpec using the shortcut on the desktop. Connect to the instrument by selecting the *System* menu and then *Connect*. Choose your LLTF System from the drop-down list.

If the instrument is not automatically detected, check the connection between the computer and the instrument and verify that the USB-Serial Port driver is correctly installed in Windows Device Manger.

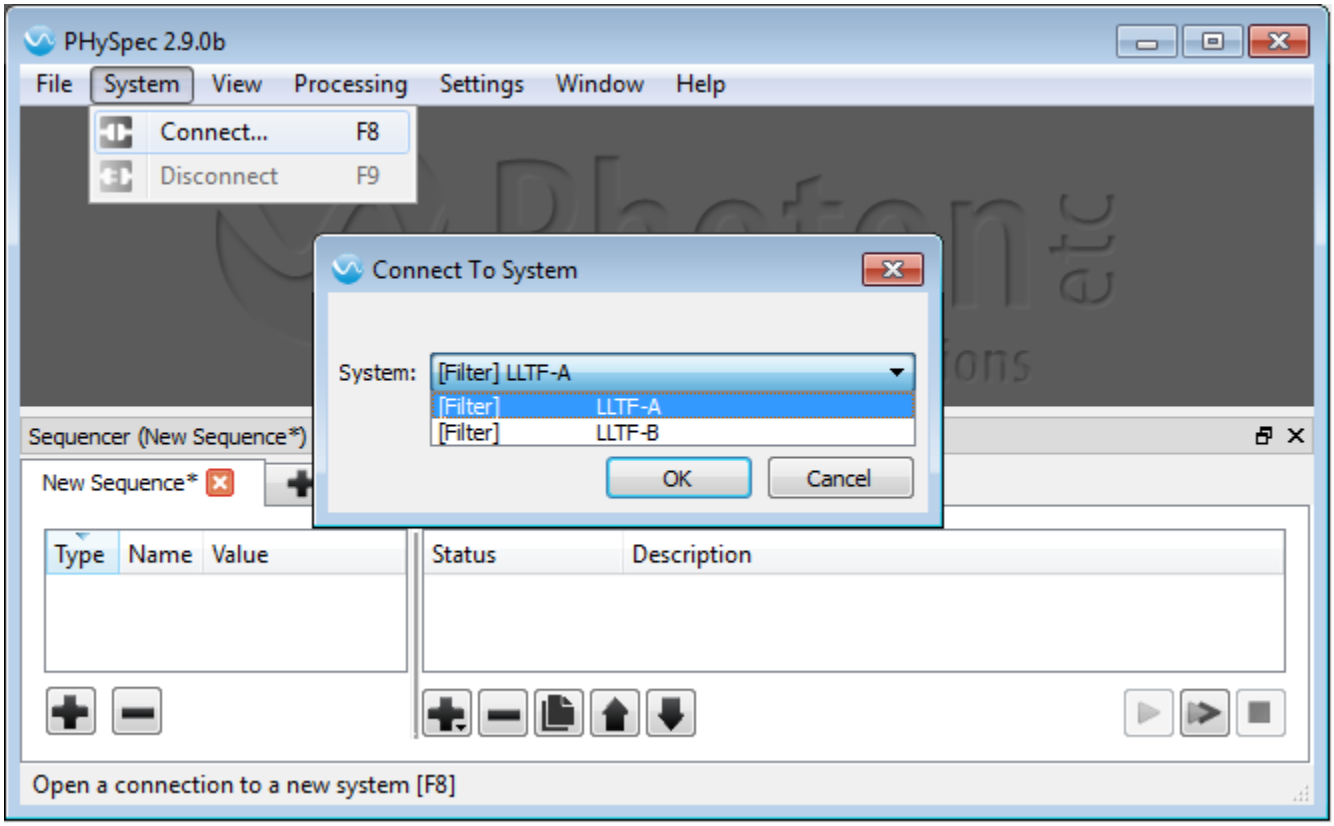


Figure 7: System connection to PHySpec

4. The instrument control interface will pop up in the top left corner of the window.

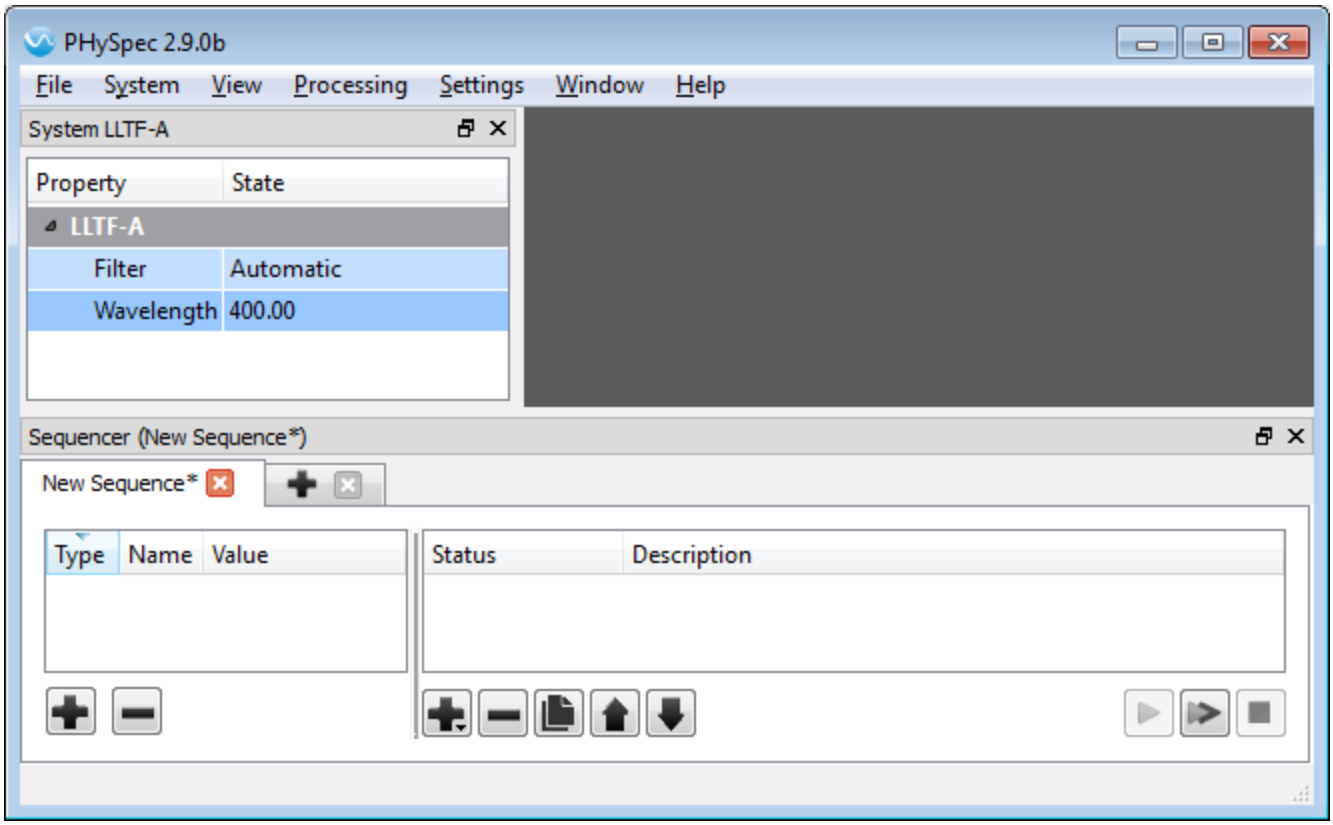


Figure 8: LLTF CONTRAST™ System (instrument control panel)

10.2. CONTROL INTERFACE

The control interface panel appears once the instrument is initialized (Figure 8).

10.2.1. Filter

The full spectral range of each LLTF CONTRAST™ VIS-2 and SWIR is covered by two gratings:

LLTF CONTRAST™ **VIS-2**:	Grating #1 from 400 nm to 650 nm Grating #2 from 650 nm to 1000 nm
LLTF CONTRAST™ **SWIR**:	Grating #1 from 1000 nm to 1750 nm Grating #2 from 1750 nm to 2300 nm

This field defines how each grating of the LLTF CONTRAST™ is controlled. In automatic mode, the grating is automatically chosen depending of the desired wavelength. This is the most common uses for the instrument. In manual mode, you can control each grating separately, one at the time.

For more flexibility, either in automatic or manual mode, it is possible to select a wavelength a few nanometers outside of the guaranteed wavelength range (please refer to the Certificate of Compliance of your instrument). In this case, the performances of the LLTF CONTRAST™ outside these certified bounds **ARE NOT GUARANTEED**.

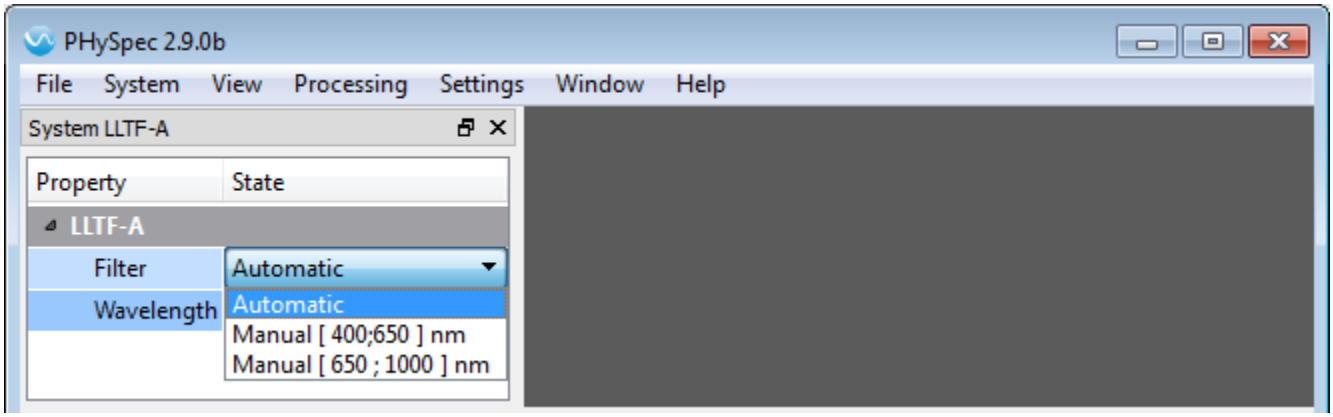


Figure 9: Control Panel - Filter

10.2.2. Wavelength

This field selects the central wavelength of the LLTF CONTRAST™ in nanometers (nm). You can write the desired wavelength in the field or use the arrows to increment the current wavelength by one. The wavelength modification is effective immediately. Remember that the Automatic or Manual Filter settings apply.

10.2.3. Harmonic Filter

This field will be available if there is a harmonic filter shipped with your instrument. You can enable or disable the harmonic filter control. Choosing *Automatic* will remove automatically the second harmonic of the desired wavelength. Choosing `Off` will remove the harmonic filter of the optical path.

10.3. Wavelength Calibration

The factory calibration gives a good absolute wavelength positioning that should be enough for most usage. There are a few factors that impact absolute positioning and warrant a user calibration. When there is more than a 10 °C temperature difference between factory temperature (25 °C) and ambient temperature, a calibration should be performed for best absolute positioning. Another situation where a calibration may be needed is when the instrument suffered heavy shocks or strong vibrations. The calibration process involves measuring one or two wavelengths from your instrument for each grating needing a calibration.

10.3.1. Manual Calibration

It is strongly recommended to use a supercontinuum laser source and an Optical Spectrum Analyzer (OSA) to perform a manual calibration. The following steps assume that both of these instruments are available. The calibration for each grating is independent. To calibrate the entire spectral range, the two gratings have to be manually calibrated in turns. A manual calibration can be done with one or two reference wavelengths.

1. Connect the supercontinuum laser source to the LLTF CONTRAST™.
2. Select a reference wavelength in PHySpec inside the desired grating spectral range.
3. With the OSA, measure the real wavelength produced.

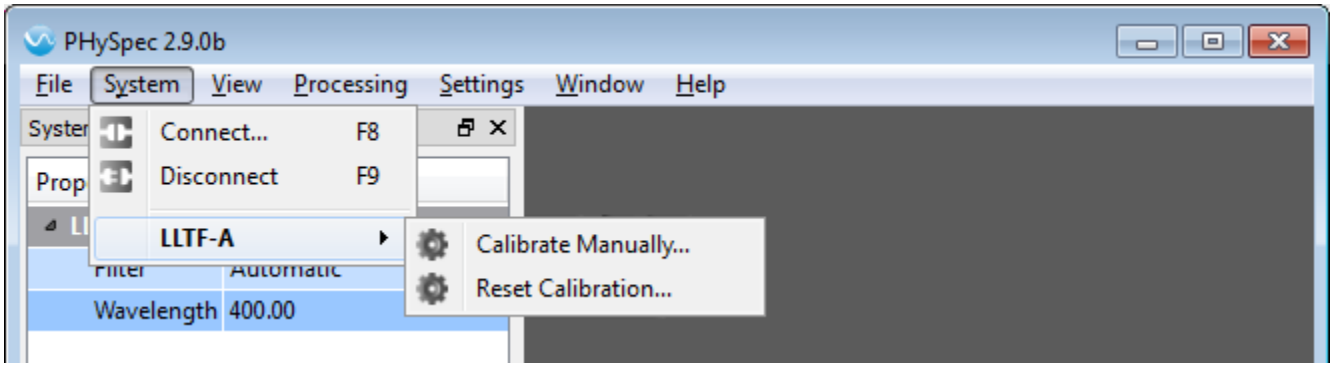


Figure 10: Calibration menu

4. Select the menu `System` and navigate to `Calibrate Manually` in the sub-menu relating to the instrument. In the Manual Calibration dialog box, add a reference wavelength with the matching real wavelength measured with the OSA.
5. If another reference wavelength is needed, repeat step 2 to 4. At most two reference wavelengths can be used for a manual calibration.
6. To apply the new calibration to the grating press `Calibrate`. The change is effective immediately and remembered the next time PHySpec is started.
7. To calibrate another grating, repeat from step 2 by selecting a reference wavelength inside this next grating spectral range.

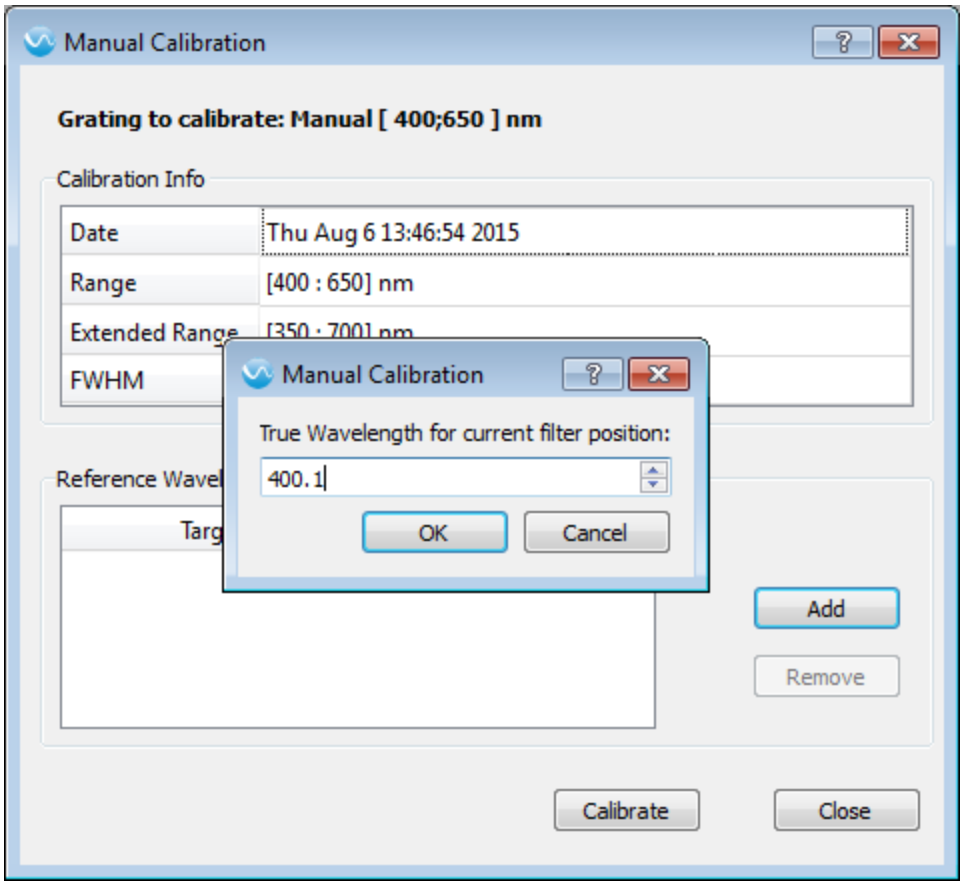


Figure 11: Calibration interface

10.3.2. Factory Calibration

Sometimes, following a manual calibration that degraded the performance, it may be needed to fall back to the factory calibration. There is a way to revert to the factory calibration by selecting the menu `System` and navigating to `Reset Calibration`. A dialog box will prompt you to choose which grating to reset to factory calibration. The factory calibration is applied immediately after approving the reset. Once applied, the previous manual calibration is no longer available.

10.4. SEQUENCER

The Sequencer is available for all Photon etc's instrument. It is meant to automate instrument actions, data processing and simplify data acquisition. It does not allow the same flexibility as a full-fledge SDK, but it is quite useful to automate a tedious succession of actions that would be done by using PHySpec graphical interface otherwise.

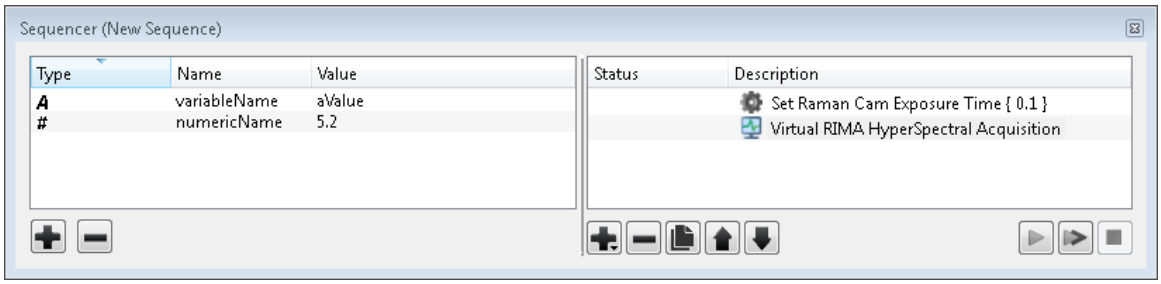


Figure 12: Sequencer interface

All the buttons located at the bottom left allow you to add, remove, copy and move an action in the list. Each line in the Sequencer is an action. There is a for-loop construct, a variable edition action and a directive action that pause the sequence to wait for the user input before resuming the sequence. To edit an action, double-click on the appropriate line. The Sequencer also uses a set of variable declared in the left panel. Once declared, a variable can be used in any action and it is resolved when the sequence is executed.

The quickest way to experience the Sequencer is to open, and update if necessary, the provided sequence. The sequence is stored in the USB key. In PHySpec V2, go to the menu "File -> Open Sequence" and select "LLTF-Contrast-Scan.seq". Once the sequence is loaded successfully, you can execute it by pressing the double arrow button. Do not forget to connect your instrument before executing the sequence. The sequence provide scans from 400 nm to 1000 nm, by 1 nm step, with a delay of 10 ms between each step, and repeat this scan 100 times.

10.4.1. Variables

You can define textual and numerical variables. Those variables can be useful in sequences incorporating advanced logic, for example incrementing a parameter in a for-loop construct. They can be used as inputs for all available actions. You can create a variable using  button, and then select its type. An existing variable can be edited with a double-click on its name or value.

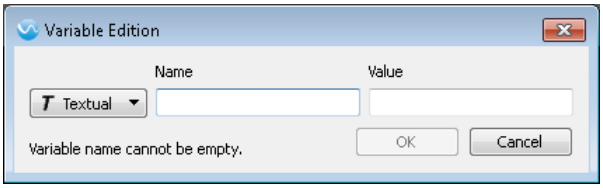


Figure 13: Variable edition

10.4.2. Actions

Actions are the core of the sequencer. An action can be an acquisition (hyperspectral, video, etc.), an instrument command or setting (wavelength or exposure time), a data processing, or a logical statement.

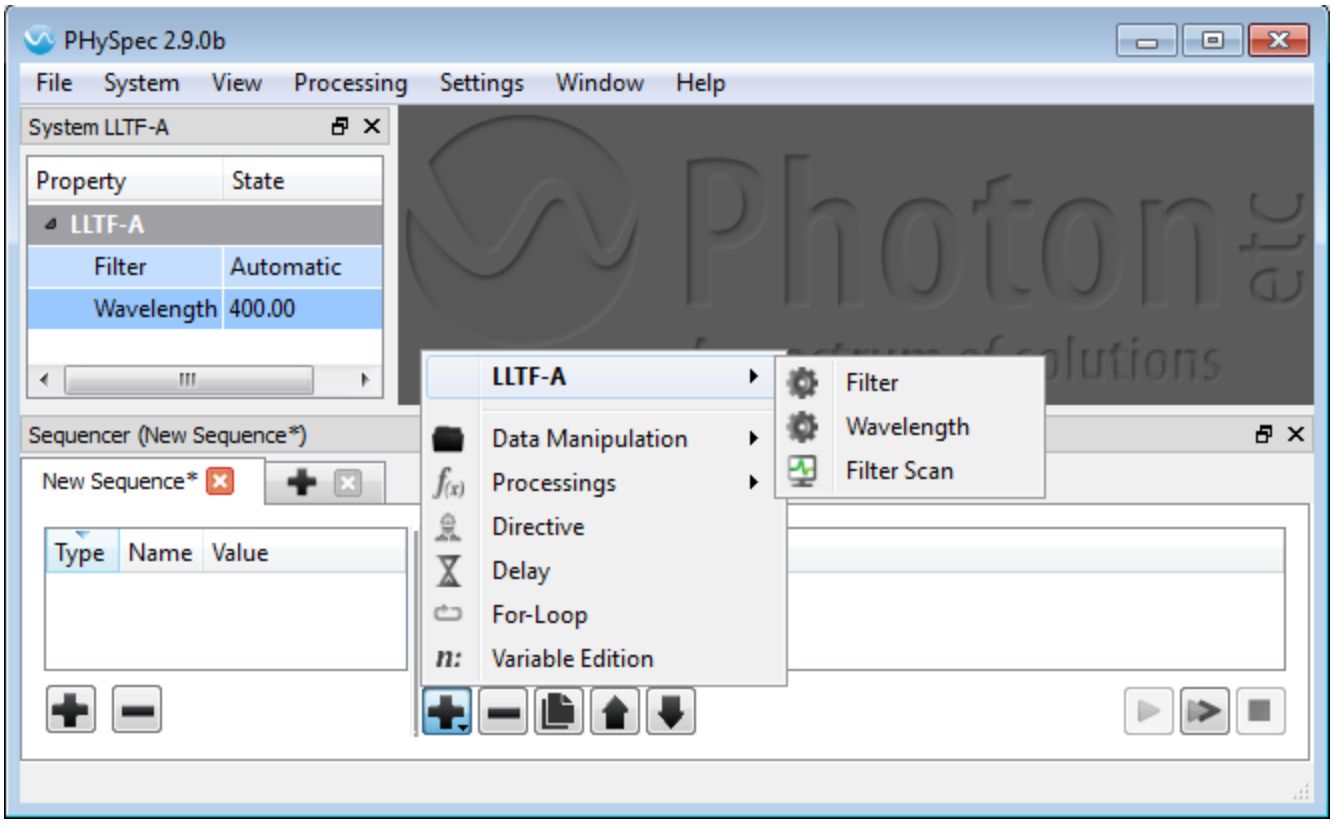


Figure 14: Add sequencer action

The table below describes all the buttons located at the bottom left of the sequencer.

	Add a new sequencer action. A menu will roll down with all the possibilities according to the loaded system.
	Delete currently selected action.
	Duplicate currently selected action.
	Move up currently selected action.
	Move down currently selected action.
	Run (execute) only currently selected action. The progression of the action will be indicated in the status column.
	Run (execute) all actions in the sequence. The progression of each action will be indicated in the status column.
	Abort a currently running sequence.

10.4.2.1. System nodes

Those nodes are related to the system currently connected. They are used to modify the system state or to acquire data. The validity of the parameters is only checked when the sequence is executed.

10.4.2.2. Data manipulation

Allow to import/export/unload data such as cubes or images. The data is selected by its position in the data list (see *data explorer*).

10.4.2.3. Processing

There is various processing available such as rectification or registration auto-detection.

10.4.2.4. Directive

When the sequence reaches this node, a popup appears showing a user-defined message. It can be useful when you need a human intervention, like moving a sample. The sequence will continue when the user press ok.

10.4.2.5. Delay

Specify a delay in seconds.

10.4.2.6. For-Loop

All nodes in-between the Loop node and the End For node are executed the number of times indicated in the Loop node.

10.4.2.7. Variable Edition

Variable Edition node is the only node type who can affect a variable value during the sequencer execution. Textual variable edition only support concatenation ('+') of the following types of entry:

Entry Type	Example
Static text between quotes	"Lorem Ipsum"
Reference to textual variable	textVarName
Reference to numeric variable (implicit conversion)	numVarName
Reference to the number of cube(s) currently loaded (implicit conversion)	@CubeCount
Reference to the number of image(s) currently loaded (implicit conversion)	@ImageCount
Explicitly converted arithmetic equation	**STR(**(34 + numVarName / numVarName**)**

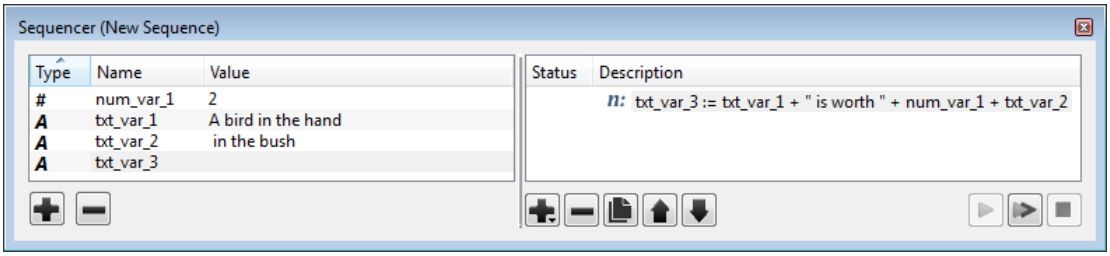


Figure 15: Textual variable edition: Assign to txt_var_3 the value "A bird in the hand is worth 2 in the bush"

Numerical variable edition supports basic arithmetic operations with the following operator "+, -, /, *" on numerical entries, numerical variables, reference to the number of loaded cube(s) and references to the number of loaded image(s).

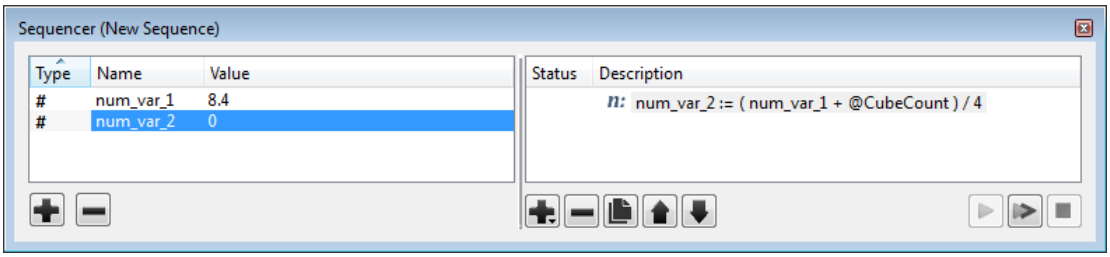


Figure 16: Numeric variable edition: Assuming no loaded cube, assign to num_var_2 the value 2.1

11. Maintenance

11.1. Basic cleaning instructions

Your instrument is designed to provide years of reliable service. There is no specific need to clean the instrument. If needed (dust, spot), basic cleaning instructions consist to:

- Remove dust on the enclosure with dry cloth.
- Remove stains on the enclosure with a cloth damped with soapy water or isopropanol.
- The Input / Output port doesn't need to be cleaned.

WARNING: NEVER SPRAY ANYTHING INSIDE THE INSTRUMENT (WATER SPRAY AND/OR DUST SPRAY TYPE).

11.2. Storage Conditions

When the instrument is not in function, these conditions should be respected:

- In order to reduce the accumulation of dust in the instrument and especially on the optics, block the optical port;
- Keep humidity level low;
- Avoid thermal shocks to avoid condensation;
- The storage temperature should be between 0°C and 50°C.

Please notice that the condensation can harm the optical path, the throughput and the electrical board.

12. Appendix A: Troubleshooting

Before contacting technical support, read the following solutions to see if any can apply. This list is by no mean exhaustive and only provides solutions for the more common problems. When contacting technical support, always attach the *Health Report* to the email to speed up the process. The *Health Report* is a plain text file generated by clicking on *Generate Health Report* in the *Help* menu. It contains technical information relative to the system and software to help diagnose several problems.

12.1. Generate a Verbose Health Report

The *Health Report* is meant to be understandable by a normal user, but more information may be needed to diagnose a problem. Starting *PHySpec* from the *PHySpec – Support* link located in the installation folder writes more information into the *Health Report* to help technical support. It is not recommended to start *PHySpec* from the support link as a typical behavior. If the troubleshooting steps don't solve your problem, follow the instructions below to send us an email containing all the pertinent information.

1. Start PHySpec with the *PHySpec – Support* link located in the installation folder (*C:\Program Files\Photon etc\PHySpecV2*).
2. In *PHySpec*, select the menu *Help* → *Generate Health Report...*
3. A dialog box will appear requesting your comment. Enter your comments and your observations while troubleshooting and press *OK*.
4. Save the health report in an easily accessible place.
5. Send us the health report by email it to support@photonetc.com.

12.2. LLTF CONTRAST™ fails to initialize

1. Unplug the power supply and the USB cable from the filter.
2. Connect the USB cable between the filter and the computer.
3. Plug the power supply to the filter and toggle the filter switch to *ON*.
4. Start *PHySpec* software on the computer connected to the LLTF CONTRAST™.

12.3. LLTF CONTRAST™ is not detected by PHySpec

1. Unplug all your connections and plug them again;.
2. Make sure the USB connection is physically linked from your computer to your instrument.
3. Check that the power cord is connected to power. Double check that the switch is *ON*.
4. Make sure you meet the computer requirements.
5. Start *PHySpec* and connect the system.

12.4. HARMONIC FILTER MODULE IS NOT WORKING PROPERLY

1. Power up the LLTF CONTRAST™, but do not turn *ON* the laser.
2. Start *PHySpec* with the *PHySpec – Support* link located in the installation folder (*C:\Program Files\Photon etc\PHySpecV2*).
3. Connect the system.
4. Set the harmonic filter to *Enabled*.
5. Position the filter to 500 nm for VIS2 LLTF, and 1250 nm for SWIR LLTF.
6. Check that the harmonic filter is raised by looking into the output hole.
7. Position the filter to 850 nm for VIS2 LLTF, and 2000 nm for SWIR LLTF.
8. Check that the harmonic filter is lowered by looking into the output hole.
9. Repeat the steps 4 to 7 five times and note the state of the harmonic filter each time.
10. Set the harmonic filter to *Disabled*.
11. Position the filter to 500 nm for VIS2 LLTF, and 1250 nm for SWIR LLTF.
12. Check that the harmonic filter is raised by looking into the output hole.
13. Position the filter to 850 nm for VIS2 LLTF, and 2000 nm for SWIR LLTF.
14. Check that the harmonic filter is raised by looking into the output hole.
15. Repeat the steps 10 to 14 five times and note the state of the harmonic filter each time.
16. Note the ambient temperature of the room and check the harmonic filter temperature.
17. Set the harmonic filter to *Disabled*.
18. Position the filter to 500 nm and wait for 15 minutes.
19. Check that the harmonic filter is raised by looking into the output hole.

13. Appendix B: CE DECLARATION

CE

DECLARATION OF EUROPEEN CONFORMITY

Name: Photon etc. inc.
Address: 5795 Ave de Gaspé, Office 222, Montréal, Qc, H2S 2X3, Canada

Photon etc. declare that the **Laser Line Tunable Filter CONTRAST™** product is compliant with requirements for CE marking, and applies to the following product models:

LLTF CONTRAST™
LLTF CONTRAST™ VIS-2
LLTF CONTRAST™ SWIR

Devices covered by this declaration complies with Directives and Standards:

- Electromagnetic Compatibility (EMC) **Directive 2004/108/EC** calling for the **EN 61326-1 (2013)** product standards relative to *Electrical equipment for measurement, control and laboratory use*;
- Low voltage (LVD) **Directive 2006/95/EC** calling for **IEC 61010-1:2010 (Third Edition)** product standards relative to *Safety requirements for electrical equipment for measurement, control, and laboratory use*;

The following test report confirm the compliance:

- EN 61326-1 (2013) Test report **TR-0305-301** performed by Laboratoire d'essais CEM inc., 1490-D, Nobel, Boucherville, Qc, J4B 5H3, Canada;
- IEC 61010-1:2010 (Third Edition) Test report **101150954BOX-001** performed by Intertek Testing Services, 70 Codman Hill Road, Boxborough, MA 01719, USA.

Montréal, May 23, 2013

Daniel Gagnon, Jr. Eng., M. Eng.
Director of Mechanical Engineering and Production

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