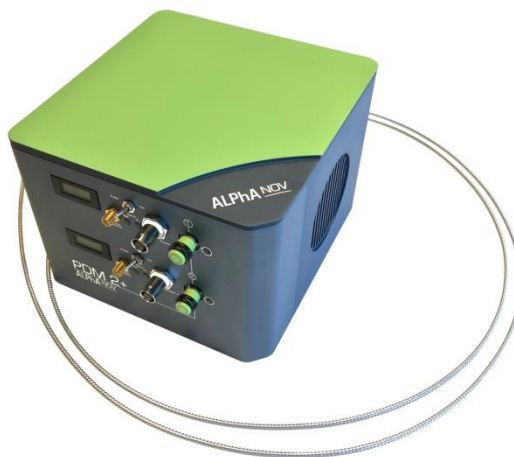


PDM2+ HP Laser

Quick Start Guide



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Disclaimer

Every effort has been made to make this document as complete and as accurate as possible, but no warranty of fitness is implied. The information is provided on an as-is basis. Riscure shall have neither liability nor responsibility to any person or entity with respect to any loss or damage arising from the information contained in this document.

The information contained in this document is subject to change without notice.

This tool must be used according to its user guide. Any operation related to maintenance, repair or calibration must be carried out by qualified personnel. Consequently, in case of failure, contact Riscure to find out about the procedure to follow.

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What is in the box

The box contains a PDM2+ HP laser source, an optional power supply unit and cables to connect it to a Laser Station.



Box content checklist

Quantity	Description	
1	PDM2+ HP, class-4, with - Wavelength 976 nm or 1064 nm depending your purchase - single mode fiber with green fiber end protection cap - installation CD	
1	Power adapter - Mains 100 V to 240 V AC, 50 Hz to 60 Hz - Output 12V DC - 1x mains power cable	
1	Fiber Coupler with lens	
1	Power control cable with T-section	
1	Pulse control cable with T-section	

Quantity	Description	
1	Interlock cable	
1	Interlock dummy (may be plugged to the "Interlock" port of the PDM2+HP module)	
1	Quick Start Guide (this guide)	
1	Alphanov test report and manual	

Depending on your order, the laser has one the following wavelengths:

- 976 nm, near infrared for thin substrate (approximately < 75 μm)
- 1064 nm, near infrared

What does it do?

The PDM2+ HP is a high power single mode fiber diode laser source capable of:

- Generating smallest laser spots due to single mode laser source and single mode fiber,
- Generating high intensity pulses due to combination of two high power diode laser sources,
- Operating at high switching frequency and random pulse duration due to the nature of diode lasers compared to pumped laser (as e.g. laser cutters and diode pumped solid state lasers)
- Fitting in any set-up due to the flexibility of the glass fiber.

The PDM2+ HP laser is attached to Laser Station 2 or Twin Scan and operated for optical Fault Injection (FI) attacks on semiconductors.

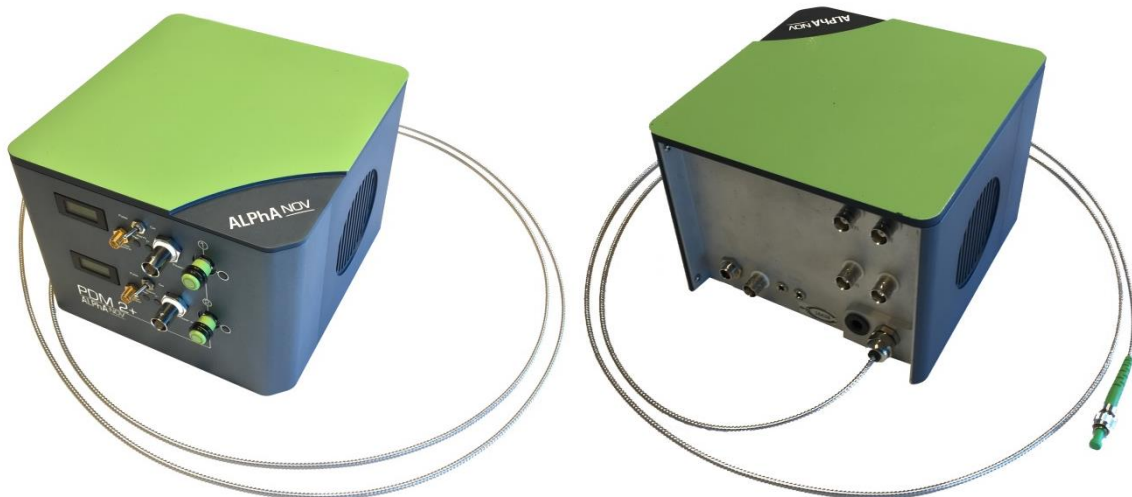


Figure 1 PDM2+ HP laser.

Safety instructions



PDM2+ HP laser is power compatible with a Class 4 laser product as defined in International Standard IEC 60825-1.

The PDM2+ HP laser system needs to be used in combination with the Riscure Safety Box.

Refer to following manuals for safety and conformity information:

- **Riscure Laser Station manual**
- **PDM2+ HP manual**

How to build a setup

Follow the next steps to install the PDM2+ HP laser on the Diode Laser Station or Laser Station.

ESD sensitivity

The laser is sensitive to electro static discharge. Prevent damage to the laser:

- Apply proper grounding to equipment and to your body during connecting or disconnecting of cables or plugs.
- Connect cables to grounded equipment first before connecting to the laser.
- Do not touch connectors on the laser box with bare ungrounded wires or body (your finger).

Connecting the Power Adapter, Interlock cable and USB



Figure 2 Connections at back of PDM2+ HP laser from left to right: power supply, interlock cable and USB jack-plug

- Connect the power cable from the power adapter to the connector at the back of the PDM2+ HP laser tagged Power.
- If Interlock dummy is plugged to the "Interlock" port of the laser module, then remove.
- Connect the interlock cable to the "Interlock" port. The other side of the interlock cable should be connected to the interlock system inside the Safety Box.



Attention:

*Do not leave the "Interlock" port of PDM2+ HP laser module open.
Otherwise the laser module will not fire.*

*Always connect the port to the interlock system of the Safety Box via the
interlock cable, or connect the port to the Interlock dummy plug.*

- Connect the USB cable to the connector at the back of the PDM2+ HP laser tagged USB. Connect the other side of the USB cable to your PC.

Set the PDM 2+ HP laser module to "Pulsed firing" mode

- Set the Pulse / Cw switches towards "Pulse" for pulsed firing of the laser instead of continuous wave. (See Figure 3)

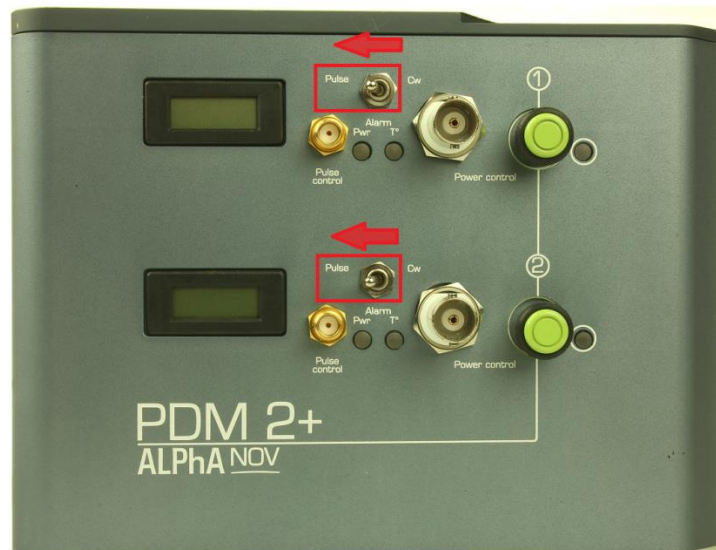


Figure 3 Switch flipped to "Pulse" side for pulse

Connect the power control cables

- Two BNC connectors should be connected to "Power control" ports at the front of the PDM2+ HP laser module. (See Figure 4)



Figure 4 Power control cables attached to "Power control" port of a PDM 2+ laser module

Connect the pulse control cables and settings switches

- Two SMA connectors of the pulse control cable should be connected to the two connectors at the front of the PDM2+ HP laser tagged "Pulse control".

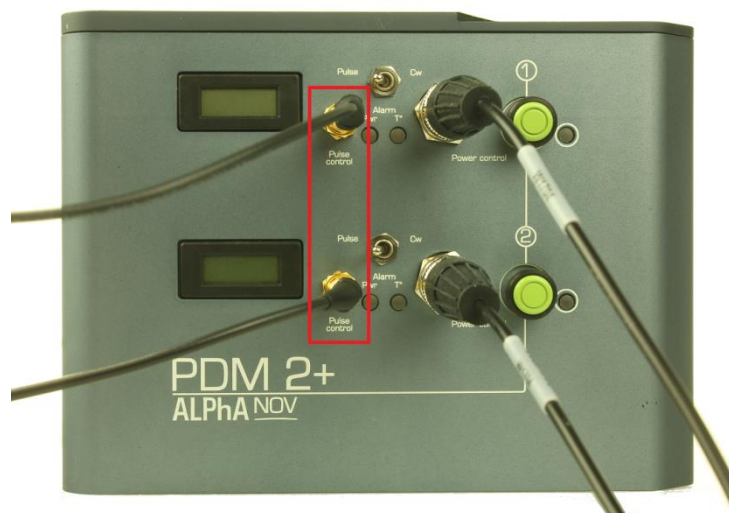


Figure 5 Pulse control cables connected to the "Pulse control" ports of a PDM 2+ HP laser module

Drive the "Power control" and "Pulse control" with a VC Glitcher

- The SMB connector at the non-splitting end of the "Pulse control cable" should be connected to the "digital glitch" port of a VC Glitcher device.
- The SMB connector at the non-splitting end of the "Power control cable" should be connected to the "pulse amplitude" port of a VC Glitcher device.

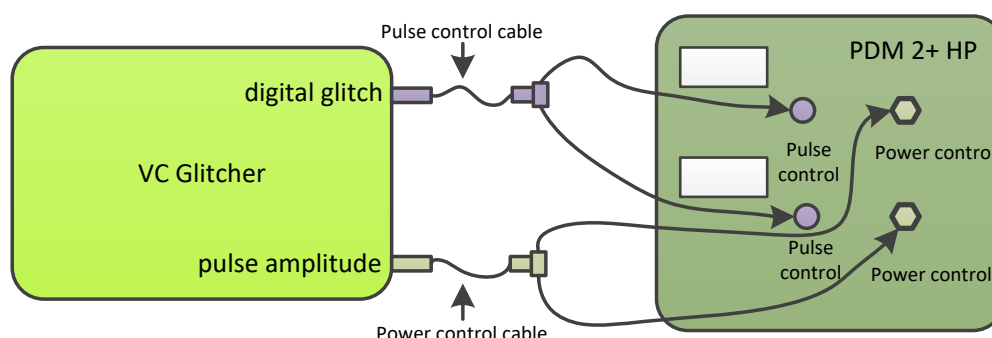


Figure 6 Connection between a VC Glitcher and a PDM 2+ HP laser module

Drive the "Power control" and "Pulse control" with a Spider

- The SMB connector at the non-splitting end of the "Pulse control cable" should be connected to the "glitch out 1" port of a Spider device.
- The SMB connector at the non-splitting end of the "Power control cable" should be connected to the "voltage out 1" port of a Spider device.

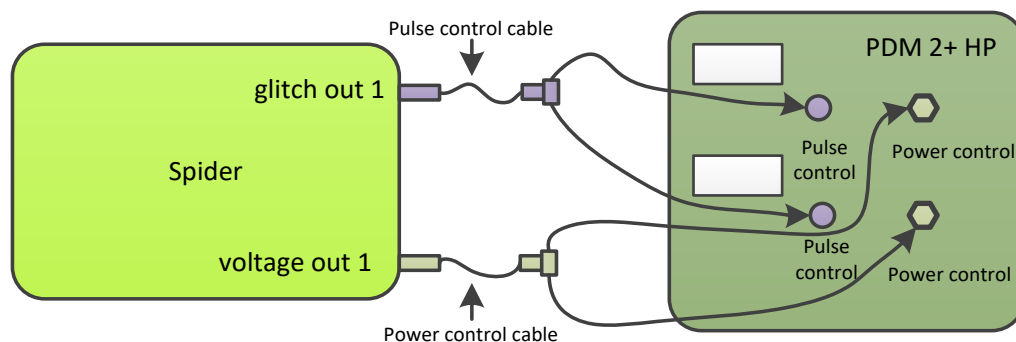


Figure 7 Connection between a Spider and a PDM 2+ HP laser module

Connecting lens to Fiber Coupler

- The lens may be delivered separately from the fiber coupler. The lens can be connected to the fiber couple as indicated in the figure



Figure 8 Screw metal lens (left) to black fiber coupler (right)

Connecting the Fiber Coupler

- The laser station needs to be equipped with an interface ring as shown in picture above. If you have just removed Twin Scan then this interface ring is missing. The figure shows three arrows pointing towards fixation screws of the ring. Please fix these screws with a 2 mm hex key.

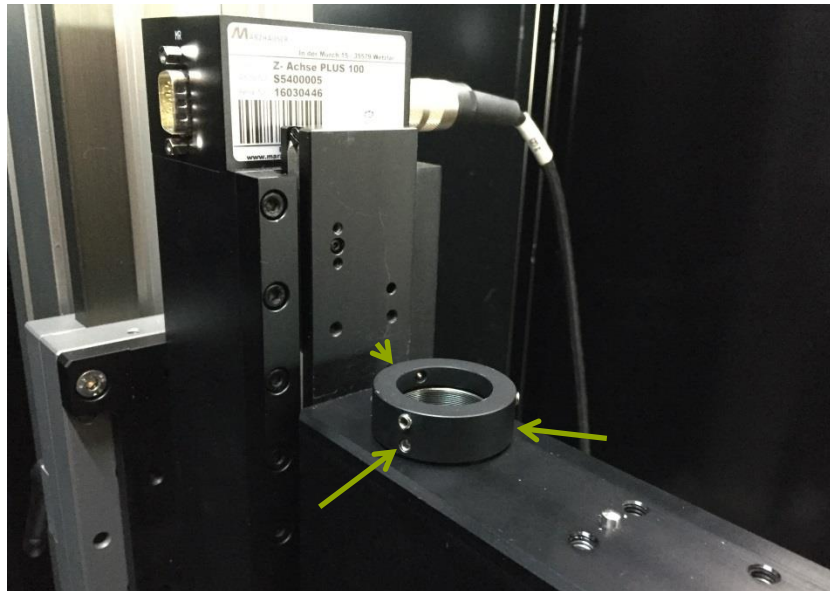


Figure 9 Interface ring with indication of fixation screw positions

- The fiber coupler needs to be mounted on top of the interface ring and fixed. To fix, please tighten three hex screws with a 2 mm hex key.



Figure 10 Fiber coupler on interface ring

- Remove any protection caps before connecting fiber to coupler.



Figure 11 Remove any protection caps (red and green in picture - actual color may differ) before connecting fiber to coupler

- The fiber end connector should be inserted into the fiber coupler connector with care to prevent damage to the fiber end or dirt at the end. The fiber and adaptor connectors have a pin – gap alignment mechanism as indicated by the arrow the picture above. Please rotate fiber to align connectors. After alignment fix fiber connector to coupler.



WARNING:

Avoid contamination of the fiber tip. Contamination happens if the fiber tip is touched. Contamination needs to be removed with alcohol (>99% pure).

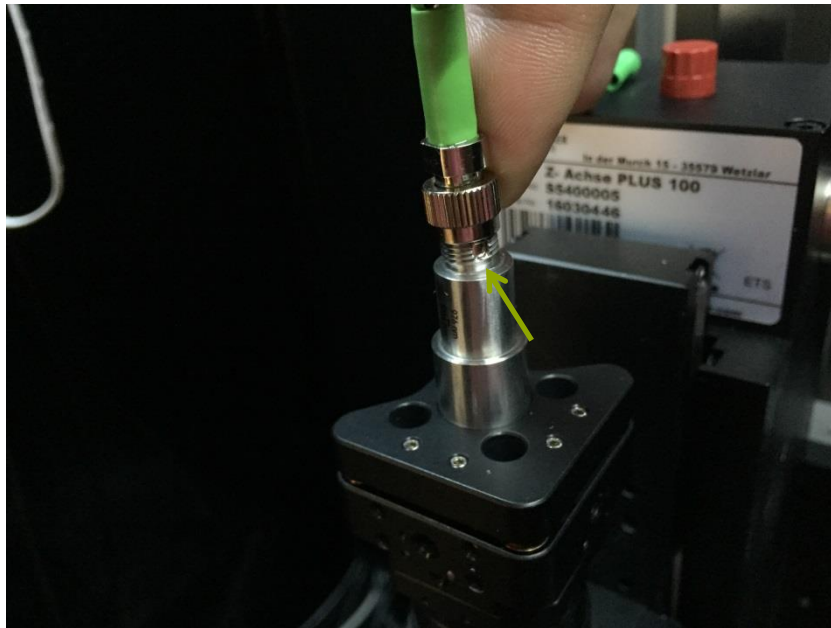


Figure 12 Align fiber end connector with fiber coupler connector



You may notice that the adaptor connector is slightly tilted. This is by design.

Check the Interlock cable connection

- Proper connection of the interlock cable is essential for safe operation of the PDM2+ HP module.
- Check connection of interlock cable between:
 - the interlock connector at the back of the PDM2+ HP module and
 - one of the two cables coming out of the interlock switch box of the Riscure Safety Box.
- The interlock switch box is mounted against the ceiling of the Safety Box.
- The interlock switch box will switch off the PDM2+ HP module once the door is opened or the emergency switch is pressed.

Installation of Alphanov software

Introduction

The integration of the PDM2+ HP laser with Inspector for laser fault injection runs via the VC Glitcher or Spider. The configuration of the PDM2+ HP for this mode of operation is pre-configured in the PDM2+ HP. This configuration is persistent and will be maintained when the PDM2+ HP is switched off.

The only configuration which is not persistent is the ON/OFF status setting of the laser. Hence, a user needs the Alphanov software to switch the laser in ON state after power up of the device.

The users may want to use the PDM2+ HP in other modes of operation e.g. with internal triggering. The user may want to know the configuration of the PDM2+ HP laser for diagnostic purpose.

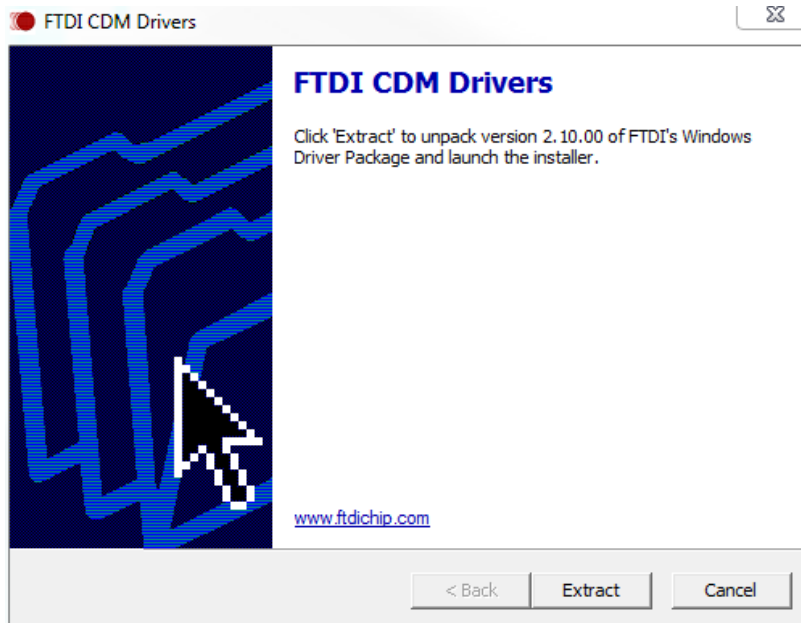
For these reasons, you need to install the Alphanov software.

Installing Alphanov software

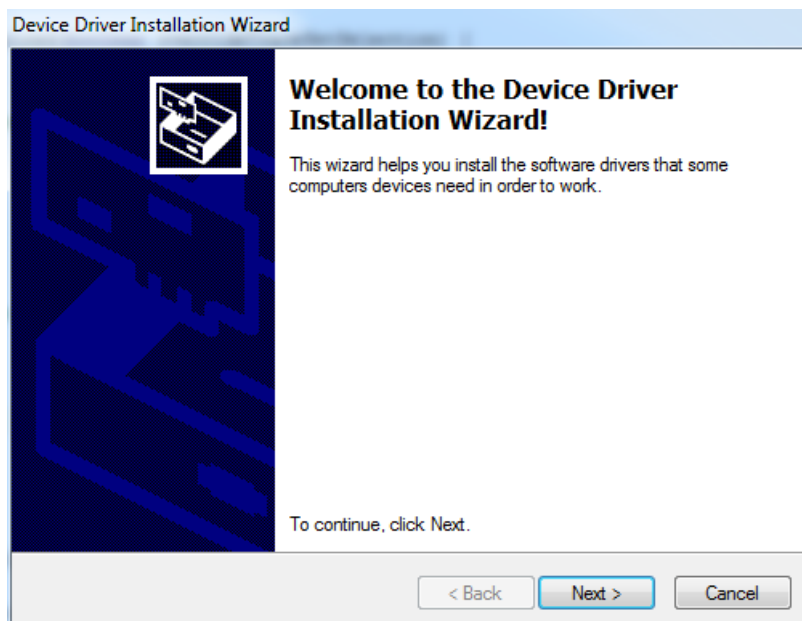
Please follow the next steps for installation of the Alphanov software.

1. Insert the Alphanov CD into your CD drive
2. Execute the Install.exe as **administrator**.

3. Select extract the unpack the FTDI driver



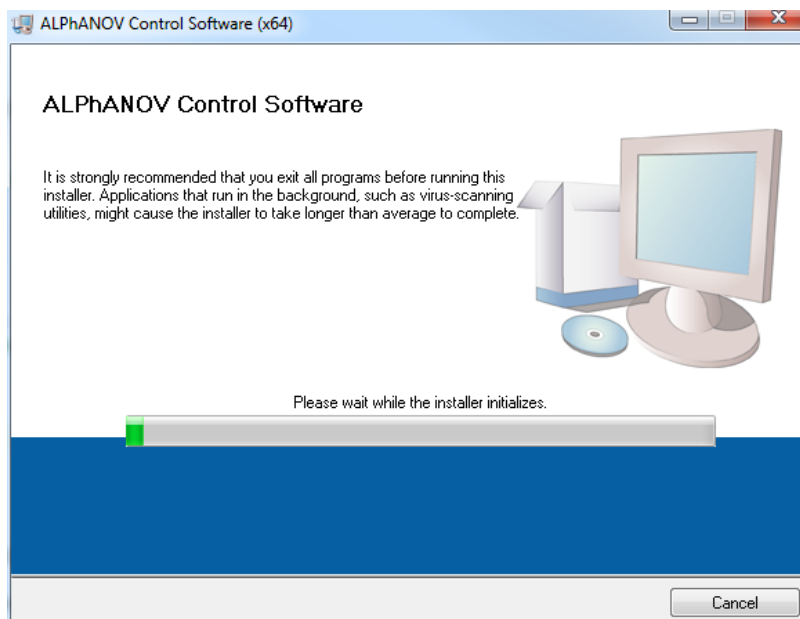
4. Press next to start the installation



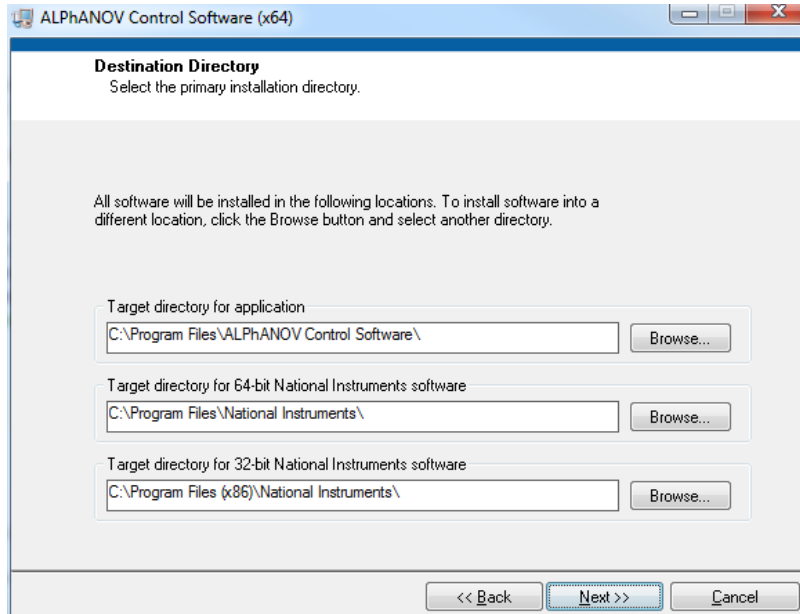
5. Press finish to complete the installation of the device driver



6. The installation of the Alphanov control software will start



7. Make a choice for the installation location



Destination Directory
Select the primary installation directory.

All software will be installed in the following locations. To install software into a different location, click the Browse button and select another directory.

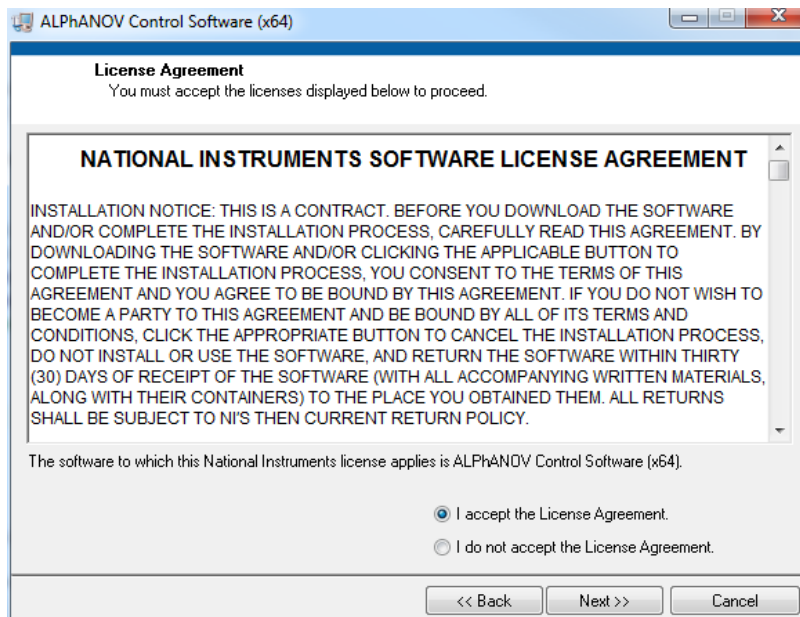
Target directory for application
C:\Program Files\ALPhANOV Control Software\ Browse...

Target directory for 64-bit National Instruments software
C:\Program Files\National Instruments\ Browse...

Target directory for 32-bit National Instruments software
C:\Program Files (x86)\National Instruments\ Browse...

<< Back Next >> Cancel

8. Accept the license agreement



License Agreement
You must accept the licenses displayed below to proceed.

NATIONAL INSTRUMENTS SOFTWARE LICENSE AGREEMENT

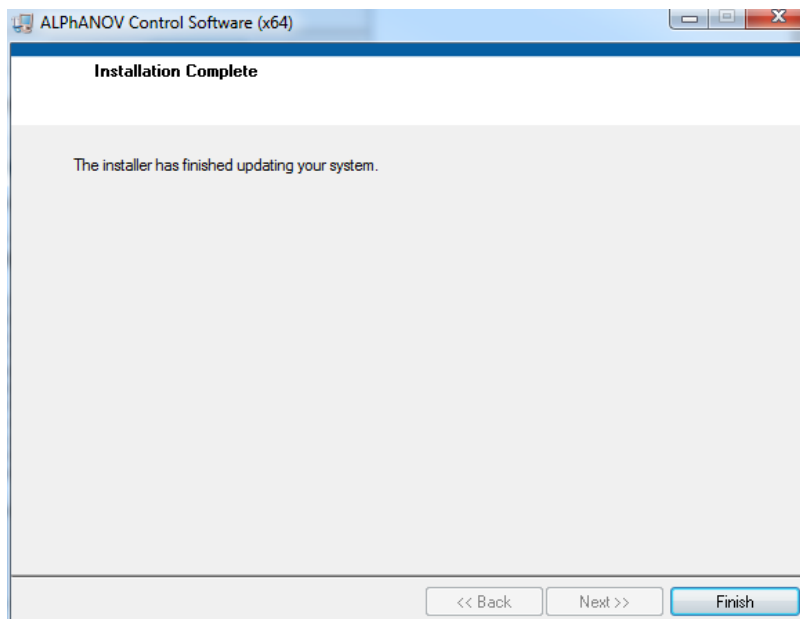
INSTALLATION NOTICE: THIS IS A CONTRACT. BEFORE YOU DOWNLOAD THE SOFTWARE AND/OR COMPLETE THE INSTALLATION PROCESS, CAREFULLY READ THIS AGREEMENT. BY DOWNLOADING THE SOFTWARE AND/OR CLICKING THE APPLICABLE BUTTON TO COMPLETE THE INSTALLATION PROCESS, YOU CONSENT TO THE TERMS OF THIS AGREEMENT AND YOU AGREE TO BE BOUND BY THIS AGREEMENT. IF YOU DO NOT WISH TO BECOME A PARTY TO THIS AGREEMENT AND BE BOUND BY ALL OF ITS TERMS AND CONDITIONS, CLICK THE APPROPRIATE BUTTON TO CANCEL THE INSTALLATION PROCESS, DO NOT INSTALL OR USE THE SOFTWARE, AND RETURN THE SOFTWARE WITHIN THIRTY (30) DAYS OF RECEIPT OF THE SOFTWARE (WITH ALL ACCOMPANYING WRITTEN MATERIALS, ALONG WITH THEIR CONTAINERS) TO THE PLACE YOU OBTAINED THEM. ALL RETURNS SHALL BE SUBJECT TO NI'S THEN CURRENT RETURN POLICY.

The software to which this National Instruments license applies is ALPhANOV Control Software (x64).

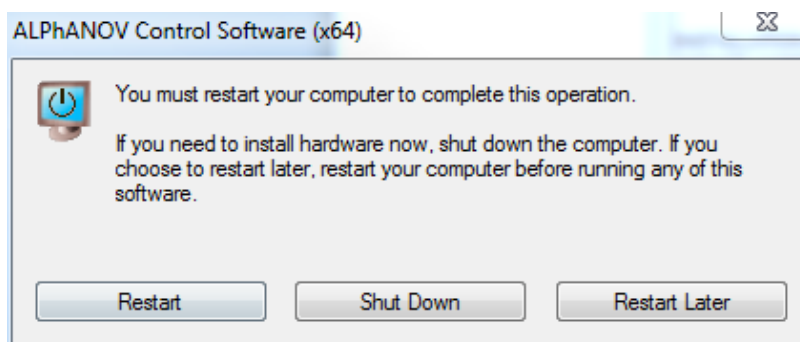
☒ I accept the License Agreement.
☐ I do not accept the License Agreement.

<< Back Next >> Cancel

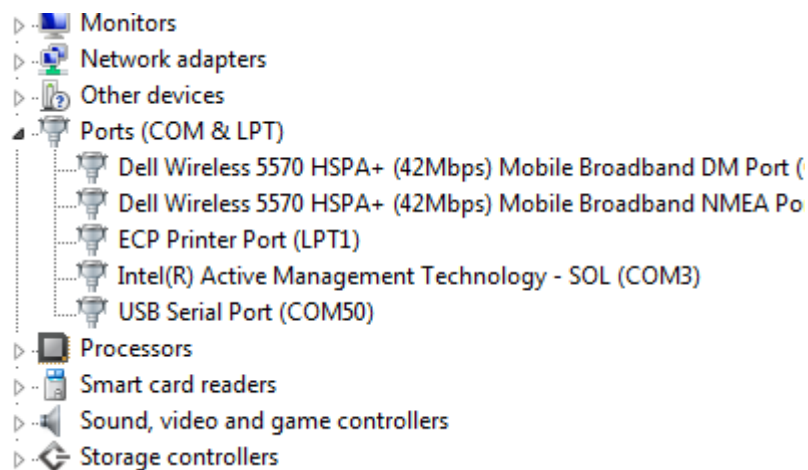
9. The set-up may take a couple of minutes. Press finish to complete



10. After installation you need to reboot your PC.

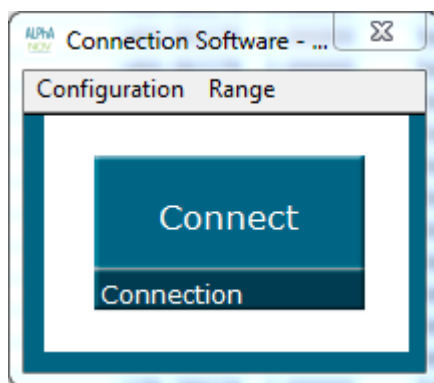


11. You may verify proper installation of the hardware driver. At first, connect the PDM2+ HP laser via USB to your PC. Secondly, check in the Windows Device Manager window for the presence of USB Serial port under the Ports tab.

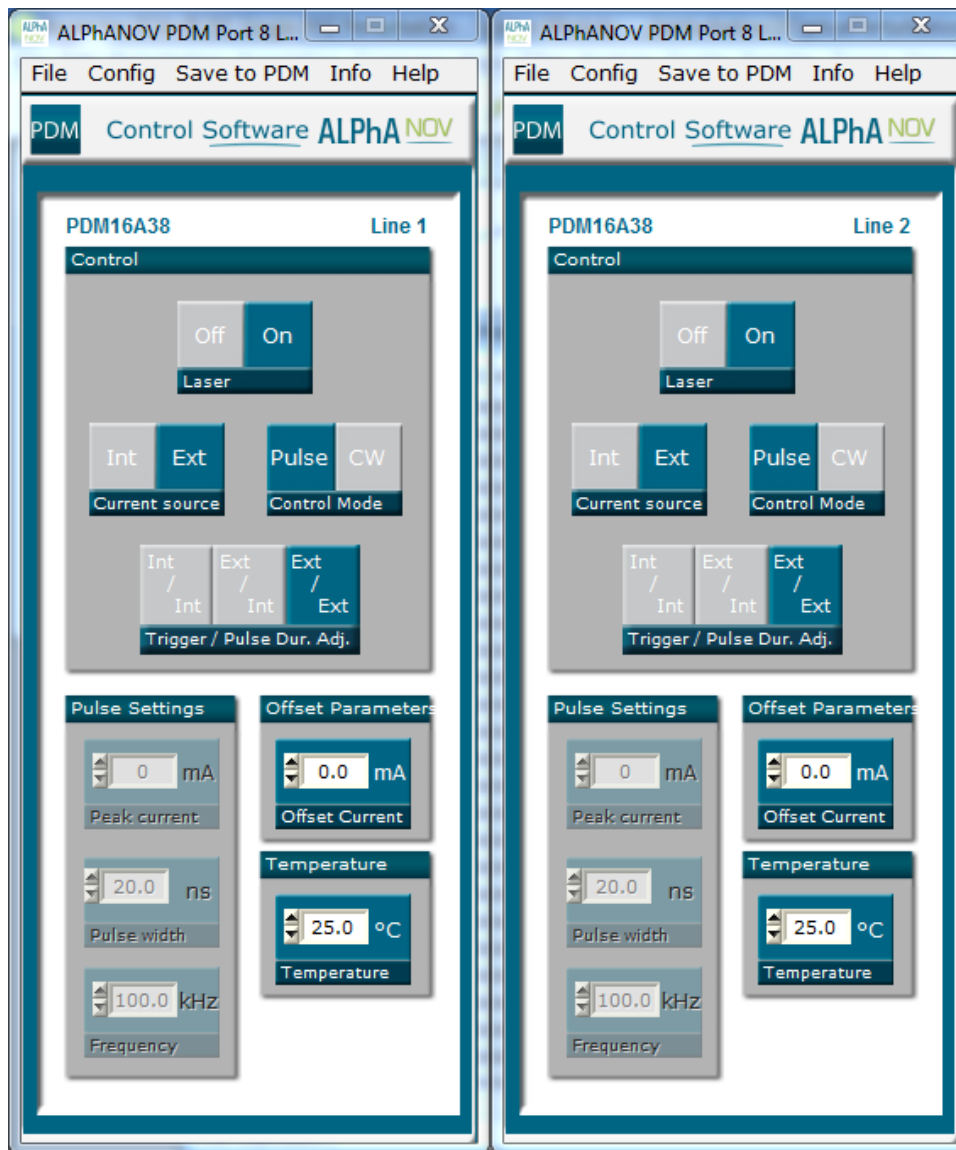


12. You may verify proper installation of the Alphanov control software by starting the software via Windows Start menu and select ALPhANOV control software.

13. Press Connect to make the connection to the PDM2+ HP device.



14. Two settings windows will appear for both lasers inside the PDM2+ HP. Note: configuration may be off. If so, follow next step.



15. The screenshot above shows the appropriate settings for operating the PDM2+ HP laser via the VC Glitcher of Spider. Please correct if necessary.
Switch the lasers to ON state by selecting ON in both windows

If above windows are visible with shown settings then you have correctly installed the software and configured the laser.

How to operate the laser

Operating the laser with VC Glitcher

Please follow the next steps to start operating the PDM2+ HP laser with a VC Glitcher:

1. Make all connection as described in chapter *How to build a set-up* including the connections between VC Glitcher and laser.
2. Connect the VC Glitcher to your PC via USB and connect the power adapter to the VC Glitcher
3. Follow installation steps as described in chapter *Installation of Alphanov software*.
4. Open the Alphanov controller software and set both laser to ON in the settings windows.
5. Mount the NIR camera to your set-up. The laser spot will be less visible with a camera for visible light.
6. Start the Inspector software package and open a Single XYZ or Dual XYZ Perturbation module.
7. Go to camera tab, select the NIR camera at the device field and open de camera view.
8. Remove the chip target from underneath the objective and insert another reflective white surface.
9. Focus the camera image using the manual focus wheel or the wheel on the XYZ joystick. If this does not work, check if you have installed and selected the Tango device to control the motorized focus unit.
10. Go to the Glitch Source tab, select the connected Glitcher device at the Glitcher field, select any laser source, set "Test glitch source power to 100%" and set "Test glitch source cycles" to 100 cycles. Press "Test glitch source". You should shortly see a clear white dot in the camera image.
11. Put the chip target back underneath the objective and start the perturbation at low laser power (e.g. 1% laser power and 1 glitch cycle)

Operating the laser with Spider

Please follow the next steps to start operating the PDM2+ HP laser with a Spider:

1. Make all connection as described in chapter *How to build a set-up* including the connections between Spider and laser.
2. Connect the Spider to your PC via USB and connect the power adapter to the Spider
3. Follow installation steps as described in chapter *Installation of Alphanov software*.
4. Open the Alphanov controller software and set both laser to ON in the settings windows.
5. Mount the NIR camera to your set-up.
6. Start the Inspector software package and open a Single XYZ > Embedded > Spider or Dual XYZ Perturbation > Embedded > Spider module.
7. Go to camera tab, select the NIR camera at the device field and open the camera view.
8. Remove the chip target from underneath the objective and insert another reflective surface.
9. Focus the camera image using the manual focus wheel or the wheel on the XYZ joystick. If this does not work, check if you have installed and selected the Tango device to control the motorized focus unit.
10. Go to the Target tab, select the appropriate Sequence, select Spider COM port, set "Test Laser Power" to 100% and set "Laser Active Duration" to 100k ns. Press "Single Test Firing". You should shortly see a clear white dot in the camera image.
11. Put the chip target back underneath the objective and start the perturbation at low laser power (e.g. 1% laser power and 1 glitch cycle)

Aligning the laser spot position

The light spot as produced in step 10 of previous sections “Operating the laser with VC Glitcher” or “Operating the laser with Spider” may show up as in the example images Figure 13 or Figure 14. For low power level or short pulse duration an image as in Figure 13 will appear showing only the primary brightest spot. For high power level or long pulse duration an image as in Figure 14 will appear showing the primary spot fully saturated and also showing secondary spots. Since the brightness of the secondary spots are much less as the primary spot, the secondary spot will not introduce faults.

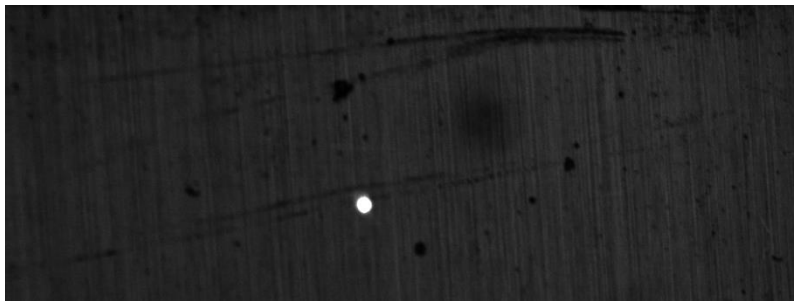


Figure 13 Example image: camera saturation only within primary spot

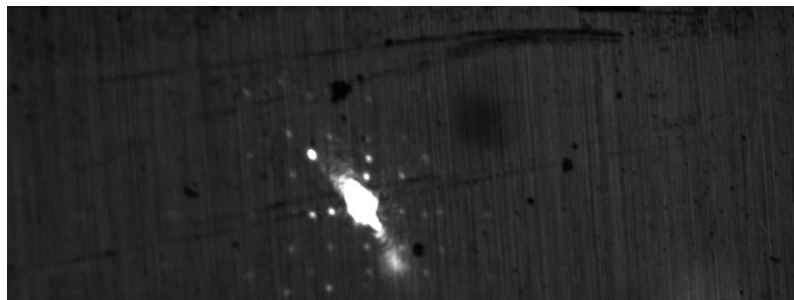


Figure 14 Example image: camera saturation at primary and secondary spots and misaligned fiber coupler

Figure 14 shows also that the saturated primary spot is not circular. This can be corrected by aligning the fiber coupler, see Figure 15.

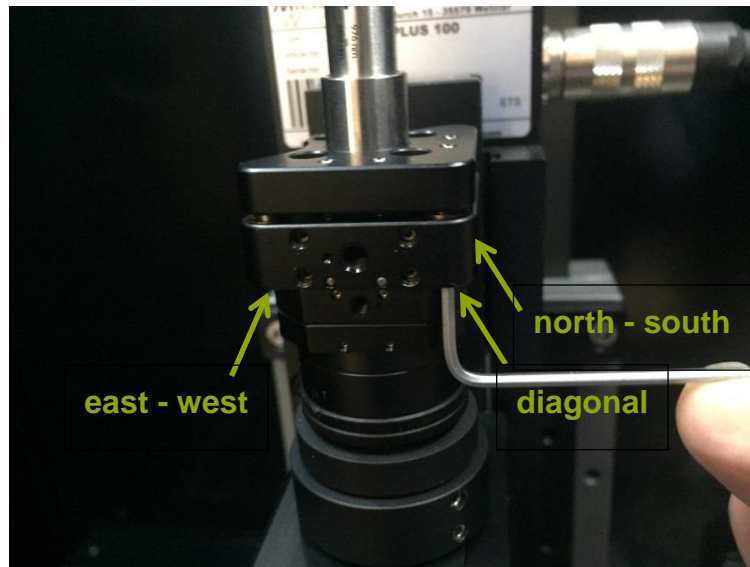


Figure 15 Position of alignment screws for fiber coupler

Figure 15 shows the fiber coupler with arrows indicating the position of the three alignment screws for east-west, diagonal and north-south alignment. A course alignment is performed by shifting the laser spot towards the center of the image. Fine adjustment is performed by making the spot more circular. As a result, user should see a circular spot close to the center of the image, see Figure 16.

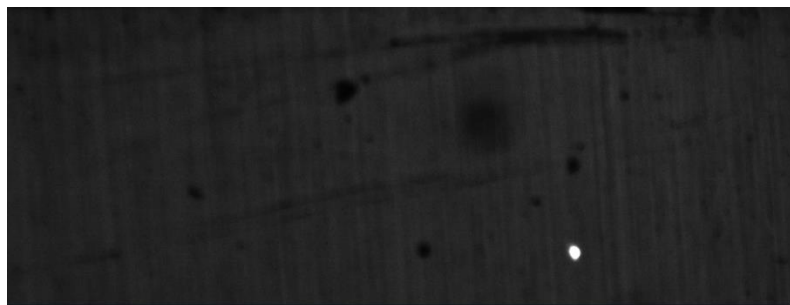


Figure 16 Moved camera spot

Protect you Device under Test

The PDM2+ HP laser generates pulses of high intensity which can damage the device under test. It is strongly advised to start the perturbation analysis at a low power level e.g. several percent. After shooting laser pulses at various locations over the area of interest and at various moments within the time interval of interest

without any changes in the device's response, the analyst can tune up the power level to run a succeeding scan over area and time interval at a higher power level.

Keep the fiber end clean

The fiber end can become easily contaminated by dust or dirt if the fiber end touches another object e.g. your finger. The contamination will reduce the laser power. The contamination should be removed as soon as possible to avoid permanent contamination. The contamination can often be removed by 99% pure alcohol or acetone.

Avoid mechanical stress in fiber

Avoid bending curvatures below 8 cm radius. Too sharp bending may damage the fiber.

Specifications

Wave length	980 nm	1064 nm
Application: back side laser fault injection for	thin substrate	standard substrate thickness
Laser pulse duration	2 ns to cw	
Maximum pulse repetition rate	250 MHz	
Spot size 5x / 20x / 50x / 100 x objective, no SSR	Ø 15 µm / Ø 4 µm / Ø 1.5 µm / Ø 1 µm	
Laser pulse power @ 100 ns pulse	~ 5.2 W	~ 4.6 W
Trigger input for pulse control	0 – 3.3 V, 50 Ω	
Analog input power control	0 – 3.3 V, high impedance	
Manual switch	switches between pulse and continuous wave	
Power adapter	110 – 220 V AC to 12 – 15 V DC	
Interlock	open connection blocks operation	

Help and troubleshooting

Common problems

There are no issues reported.

Still have questions?

Visit the Riscure Support portal: <http://support.riscure.com>.