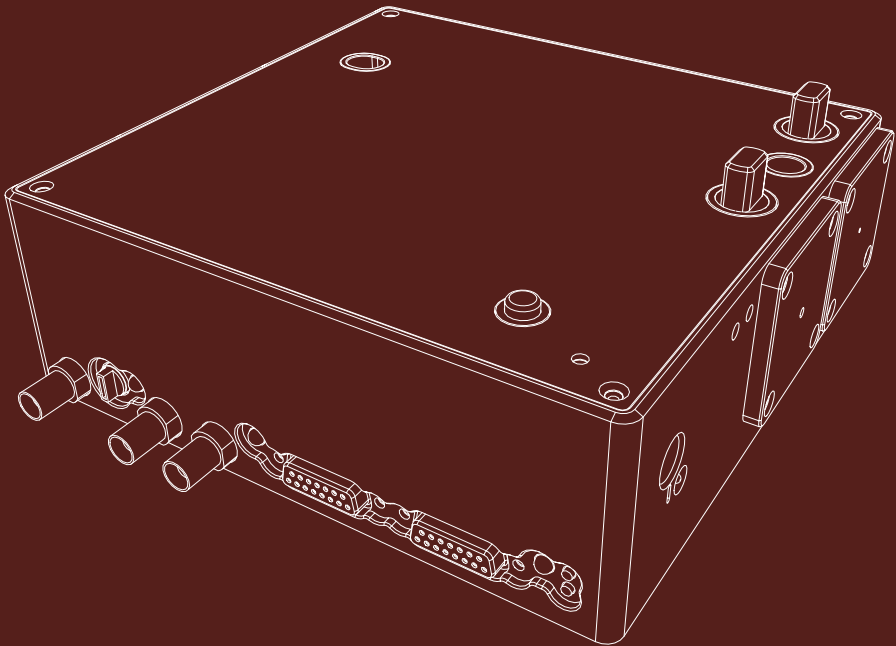


SuperK SELECT

Product Guide

Revision 1.3 10-2023



PRODUCT GUIDE

This guide includes information for the following NKT Photonics products:

SuperK SELECT

Multi Channel Tunable Filter

Item number:

A203-XXX-XXX

SuperK External RF Driver

RF Signal Generator

Item number:

A901-100-000

SuperK COMMAND

Fast Wavelength Switching Signaling Interface

Item number:

A203-000-001



CAUTION: Do not open the device chassis. All chassis are equipped with warranty labels (see [Figure 40](#)) on their covers. The warranty is void if a device is opened.

Manufactured by:

NKT Photonics A/S

Blokken 84, Birkerød-3460 Denmark

The information in this publication is subject to change without notice.

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Specifications are listed as metric units. Imperial units listed are conversions.

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Guide Overview

This product guide is intended to provide functional, operational and installation information for the SuperK SELECT. The guide includes chapters that cover SELECT description, installation, operation and parameter configuration.



WARNING: Do not operate a laser with the SELECT before first reading and understanding all warnings, cautions and handling information stated within the document:

SuperK SELECT Safety, Handling and Regulatory Information

The paper copy of this guide is included with your accessory; it can also be downloaded from:

<https://www.nktphotonics.com/product-manuals-and-documentation/>

Terminology The guide may refer to the SuperK SELECT as the SELECT, device or accessory.

Target Audience This guide is for technical personnel involved in the selection, planning and deployment of lasers and photonic equipment in laboratory and industrial settings. The guide assumes a reasonable knowledge level of lasers, photonic principles and electrical interface connectivity.

Chapters Inside This guide includes the following chapters:

- Chapter 1 “**Description**” — Describes the accessory including its general operational principles, management and interfaces.
- Chapter 2 “**Installation**” — Includes information and procedures on how to correctly install the accessory chassis.
- Chapter 3 “**Output Power Considerations**” — This chapter discusses beam optimization and the strategies involved.
- Chapter 4 “**Using CONTROL**” — This chapter provides the details on how to manage the accessory using NKT Photonics CONTROL software interface.
- **Specifications** — The guide includes appendices that cover specifications, support contact details, how to install the management software, and a special appendix on configuring and using a SuperK COMMAND module.

Added information and Safety Notices Lasers with their accessories are highly dangerous devices that can cause serious injury and property damage. This guide use the following symbols to either highlight important safety information or provide further information in relation to a specific topic.



NOTE: Highlights additional information related to the associated topic and/or provides links or the name of the NKTP guides describing the additional information.



CAUTION: Alerts you to a potential hazard that could cause loss of data, or damage the system or equipment.



WARNING: The laser safety warning alerts you to potential serious injury that may be caused when using a laser with the accessory.

Revision This section records the document revision details.

Release date	Version and changes
2020-October	1.0 revised format updated from earlier manuals and documents.
2021-January	1.1 Updated support contact details in appendix B.
2021-April	1.0 Rolled back to revision 1.0 due to internal system reasons.
2021 October	1.1 Updated λ bands for AOTF crystals in <i>nIR2</i> column of Table 1 on page 16 .
2022 February	1.2 Updates include minor grammar corrections and improvements in language clarity. Some figures have also been modified for clarity. <ul style="list-style-type: none">• Updated description of “Auxiliary input” on page 20.• Updated “Installing CONTROL” on page 63 with Windows 10 screenshots.
2023 October	1.3 Updated the style of the document.

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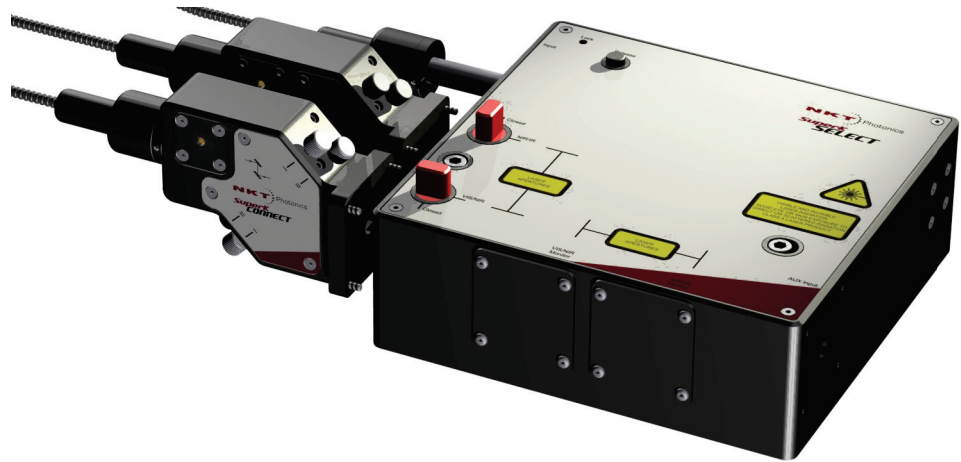
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Description

The SuperK SELECT is a plug & play filter accessory for the SuperK series of lasers. It can tune and select multiple wavelengths from the emission spectrum of a SuperK laser. The SELECT also includes a range of unique features which makes it an accessible, flexible and accurate tuning accessory to obtain any wavelength at a configured power level from the output spectrum of SuperK series lasers.

AOTF technology The SELECT uses Acousto-Optic Tunable Filter technology (AOTF). Each AOTF can tune to over one octave of optical frequency. Using a single AOTF, the SELECT can tune simultaneously up to 8 wavelengths and using an optional second AOTF crystal, the SELECT widens its spectrum emission to a maximum of 16 tunable wavelengths. Note that the crystals are driven by a separate External RF Driver that is connected to the SELECT.

Figure 1 SuperK SELECT with dual AOTF outputs – general view



The SuperK SELECT is versatile and supports the following features:

- Choice of wavelength splitting range
- Single or dual AOTF crystal
- Free space collimated or fiber coupled output beam delivery types



WARNING: The SuperK SELECT is for use with the SuperK laser series which are comprised of Class 3B and 4 lasers. Only persons who are familiar with laser safety regulations are allowed to operate any of these systems.



NOTE: This product has not been UL-approved; however, all integrated safety components are UL-approved.

AOTF crystal types The SELECT can be specified with a variety of AOTF crystals that filter wavelengths from the SuperK emission spectrum from 400 to 2000 nm. Table 1 lists the crystal models available and the combinations which can be fitted in a dual AOTF SELECT. When dual crystals are fitted to the SELECT, the crystal wavelength bands are selected to either extend the bandwidth or select entirely different bands. For dual combinations shown in Table 1, where the bandwidth is extended, there is a gap due to the dichroic mirrors in the SELECT. This is due to performance of the mirrors where their reflection and transmission losses are at the maximum.

Table 1 AOTF crystal models – wavelength bands (nanometers)

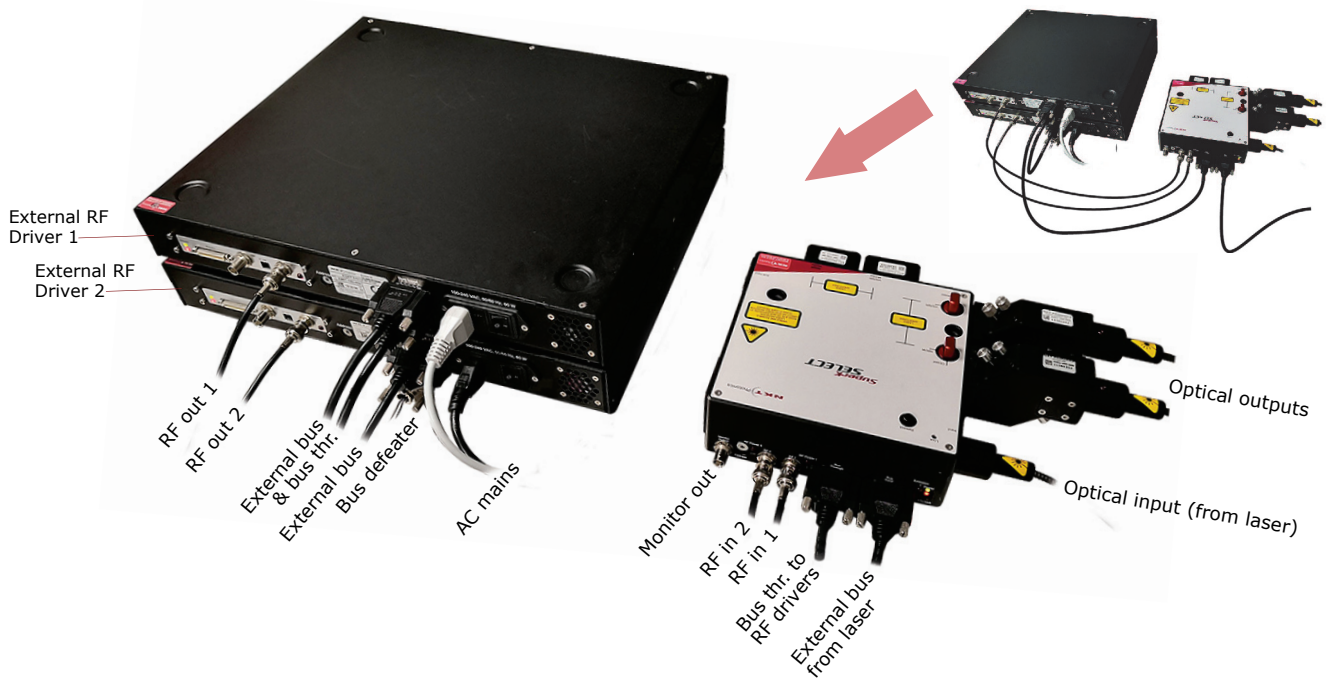
AOTF 2 AOTF 1		Single crystal SELECT – λ band			
		VIS-nIR 500-900 nm	nIR 640-1100 nm	nIR2 800-1400 nm	IR 1100-2000 nm
UV-VIS 400-650 nm		690-900 400-650	690-1100 400-650	800-1400 400-650	1100-2000 400-650
		Single crystal SELECT – λ band	690-1100 430-670	800-1400 430-700	1100-2000 430-700
			690-1100 450-670	800-1400 450-700	1100-2000 450-700
		Single crystal SELECT – λ band	-	900-1400 500-850	1100-2000 500-900
			-	-	1200-2000 640-1100
		Single crystal SELECT – λ band	-	-	1200-2000 800-1100
	-		-	-	

Dual crystal SELECT – λ bands

RF driver An NKT Photonics External RF Driver (ERD) unit is connected to the SELECT's RF1 input. A single ERD generates the necessary RF signals to drive a single AOTF crystal. The RF signals generated by the driver are configured to drive an AOTF for up to 8 output wavelengths. For a SELECT equipped with dual AOTFs and a single ERD, only one AOTF can be configured for operation at one time. To operate both AOTFs simultaneously, an additional ERD is connected to the SELECT's RF2 input. The External RF Driver is described in "External RF driver" on page 24.

Figure 2 shows a SELECT system equipped with dual AOTFs and dual ERDs. All units communicate through the External bus system and each ERD transmits an RF signal over coaxial cable to the SELECT. Each AOTF of the SELECT receives an RF signal from one of the two ERDs. The RF signals act on the crystal AOTFs tuning them to filter the configured wavelengths emitted from the optical outputs.

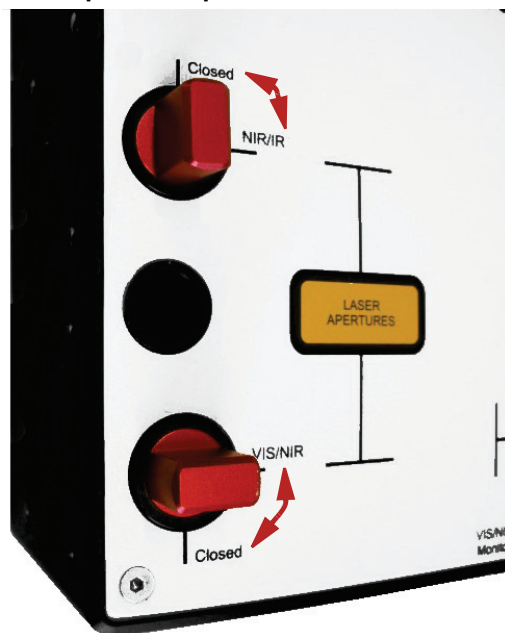
Figure 2 SuperK SELECT standard dual RF driver system view



Features

- Output** Emission from the SuperK SELECT output ports uses free space beams. To deliver either the NIR/IR or the VIR/NIR output beam, a Fiber Delivery System (FDS) consisting of SuperK CONNECT and Fiber Delivery accessories can be fitted to the SELECT.
- Interlock** The SuperK SELECT is designed to connect with the SuperK laser's interlock system. Emission is immediately disabled when the interlock circuit is broken such as for example, an interconnected safety door switch. Refer to [“Electrical Connections”](#) on page 33.
- Shutters** As a safety feature, each optical output of the SuperK SELECT is equipped with a mechanical shutter. When a shutter is closed, it blocks all optical emission. The shutters are manually operated by turning the shutter knob between the Open and Closed positions as shown in [Figure 3](#).

Figure 3 Optical output shutters – VIR/NIR set open and NIR/IR set closed



CAUTION: When the laser outputs are not in use, NKTP recommends to CLOSE the shutters.



NOTE: You can view the position of the shutters in the status panel of CONTROL, see [“Status Indicators”](#) on page 45.

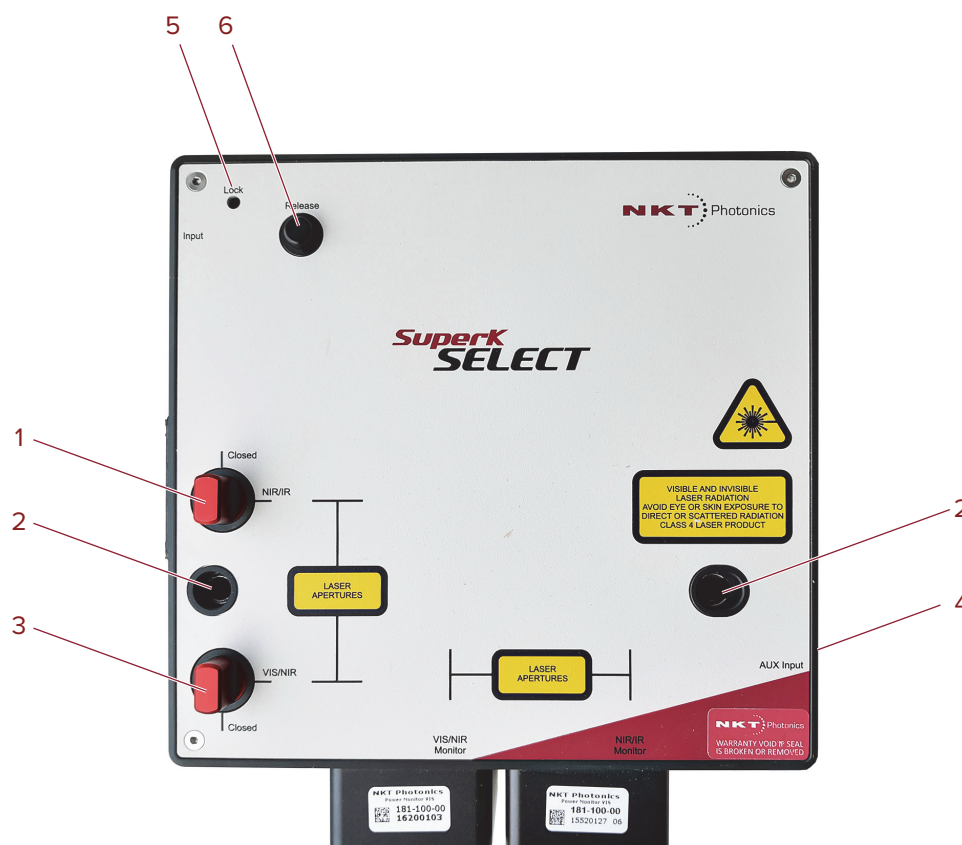
- Power lock (optional)** The Power Lock option enables you to lock and stabilize the emission power level of the SuperK SELECT using a built-in photodetector. The detector output is connected to the External Feedback BNC connector of the SuperK laser (if equipped).

The long-term (multiple hours) stability of a locked output level is typically stabilized to better than +/- 0.5 % depending on the wavelength. See [“Monitor ports”](#) on page 22

Interfaces

Top panel The top panel is shown in [Figure 4](#) and includes shutter controls and mounting holes.

Figure 4 Top panel



- | | | | |
|---|--------------------------------|---|---------------------------|
| 1 | NIR/IR output shutter control | 4 | Auxiliary input |
| 2 | Mounting holes | 5 | Collimator locking screw |
| 3 | VIS/NIR output shutter control | 6 | Collimator release button |

Collimator release button and locking screw

The beam output from a SuperK laser is from a barrel shaped collimator on the end of an armored fiber. When inserted into the optical input receptacle, it is automatically retained by a locking mechanism that securely holds the barrel in place. To release the collimator from the input receptacle, press the collimator *Release* button (6). When the collimator is inserted, use the nearby locking screw (5) to securely fasten it.

Mounting holes

The two mounting holes (2) are designed to fasten the SuperK SELECT to either metric or imperial optical tables that have screw holes spaced at either 25 mm or 1" pitch.



NOTE: Two set of mounting screws are supplied in the NKTP Tool kit. One set with metric threads and one set with imperial.

NIR/IR output shutter

This shutter can be set to block or unblock the NIR/IR output emission the aperture. Setting the shutter to *Closed*, blocks emission and setting it to *Open*, unblocks emission from the aperture.

VIS/NIR output shutter

This shutter can be set to block or unblock the VIS/NIR filtered output emission from the aperture. Setting the shutter to *Closed*, blocks emission and setting it to *Open*, unblocks emission from the aperture.

Output monitors

See [“Monitor optical output apertures” on page 21.](#)

Auxiliary input

A beam from an optional extra laser light, is transmitted through the AUX input port, where after it bypasses the VIS/NIR AOTF it is combined with the output from the VIS/NIR output. The AUX input is intended for use with legacy SuperK lasers that are limited in bandwidth to add for example, a 405 nm light source to the output. When not used, a cover plate is mounted on the aperture.

AUX Output (not shown)

This is an IR output where unused and unfiltered light from the input beam of the SuperK laser is emitted from the SELECT. The port is intended for use with for example, another SuperK SELECT operating at higher wavelengths. When not used, a cover plate is mounted on the aperture to block emission.

Optical apertures Optical apertures are located on two of the side panels of the SELECT as shown in [Figure 5](#) and described in the following.

Figure 5 Optical Interfaces



- | | | | |
|---|--|---|--|
| 1 | Optical input aperture | 3 | VIS/NIR output aperture |
| 2 | NIR/IR output aperture – with shipping cover | 4 | Monitor optical output apertures – with power monitors mounted |

Optical input aperture

The Optical input aperture is a receptacle that houses the output collimator from a SuperK laser. The laser's output collimator is inserted into the aperture until it clicks and locks in place. To remove the collimator, press the release button. The collimator can be secured by tightening the lock screw.

The optical input includes an interlock switch. If a SuperK collimator is not fully inserted in the input receptacle, the switch detects this and prevents emission (refer to [Figure 7](#)).

NIR/IR output aperture

This is a free space output aperture from the NIR/IR AOTF.

VIS/NIR output aperture

This is a free space output aperture from the VIS/NIR AOTF.

Monitor optical output apertures

See [“Monitor ports” on page 22](#).



NOTE: All output apertures include 4 screw holes for mounting for example, a fiber coupler with a SuperK CONNECT accessory. Mounting holes are threaded to accept an M3 screw.

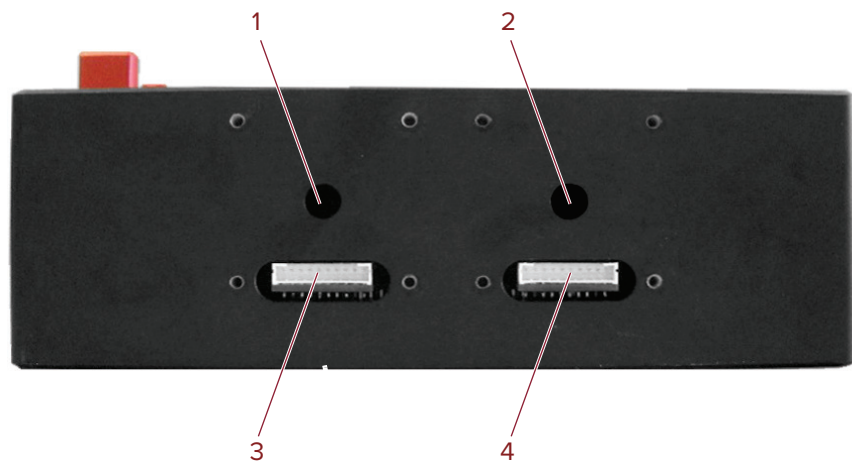
Monitor ports Monitor ports are located on the side panels of the SELECT as shown in [Figure 5](#). The ports and connectors shown in the figure are optionally fitted with power monitors before leaving the factory. The power monitors receive a tiny fraction of the VIS/NIR and NIR/IR output beams. The power monitors use a detector which the SELECT uses to compose a signal that represents the output pulses.

Feedback power locking

The monitor signal is transmitted from the *Monitor Output* BNC port which is fed to the external feedback port of a SuperK laser. This sets up a feedback loop that stabilizes the laser emission power level.

The system only allows one output monitor signal to be transmitted from the monitor port. Therefore, a feedback loop can only be configured for a single AOTF output (configured in CONTROL) “[Power monitor selector](#)” on page 48

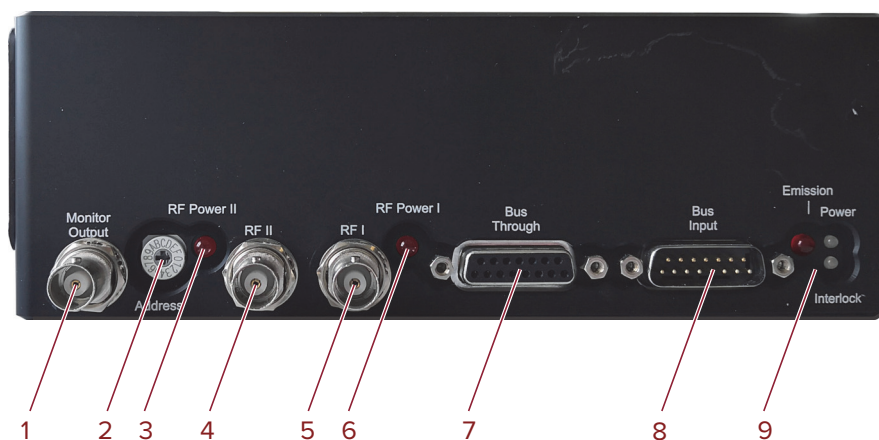
Figure 6 Optical Interfaces



- | | |
|-------------------------------------|------------------------------------|
| 1. VIS/NIR optical monitor aperture | 3. VIS/NIR power monitor connector |
| 2. NIR/IR optical monitor aperture | 4. NIR/IR power monitor connector |

Electrical Interfaces Figure 7 shows the electrical interfaces located on a side panel of the SELECT.

Figure 7 Electrical Interfaces and optical input



- | | | | |
|---|--------------------------------|---|---|
| 1 | Monitor output | 6 | RF Power I LED |
| 2 | Accessory bus address selector | 7 | Bus through port (External bus output) |
| 3 | RF Power II LED | 8 | Bus input port (External bus input) |
| 4 | RF Power II input | 9 | Emission, Power and Interlock LEDs ⁱ |
| 5 | RF Power I input | | |

i. See “Status LEDs” on page 27

Monitor output (optional)

The monitor output port transmits an electrical signal representing optical output pulses from one of the optical outputs. Sampling from the VIS/NIR and NIR/IR outputs is performed using optional power monitors (see “Monitor ports” on page 22) that are fitted to the SELECT.



NOTE: The port’s function is optional and only available on custom orders as the monitors need to be factory fitted and calibrated with the SELECT. Contact NKT Photonics sales engineering for further information.

Accessory bus address selector

Multiple accessories can be connected on an External bus daisy chain from a SuperK laser. Each accessory requires a unique bus address. Use this dial to set the bus address of the SELECT.

The address selector can set the bus address with up to 16 addresses from 0x0 to 0xF (hex). To set accessory addresses in the system:

1. Ensure the laser and External RF Driver (s) are turned OFF.
2. On each accessory, set a unique address.
3. Power ON the laser and External RF Driver(s)

RF Power II LED

Indicates if RF power is received at the RFII input from an External RF Driver.

RFII input

For operating dual AOTFs synchronously, connect the RF output of a second External RF Driver to this BNC port. The SELECT automatically switches the output RF signals from the two External RF Drivers to the AOTFs.

RFI input

This BNC port receives the RF signal from the External RF Driver RF output. The system automatically switches the signal to the AOTF as configured in CONTROL.

RF Power I LED

Indicates if RF power is received at the RFI input from an External RF Driver.

BUS Through

Connects additional accessories to the External bus in a daisy chain configuration. A bus defeater must be connected to this port if no other accessories are used with the SuperK laser. Without a bus defeater at the end of the accessory External bus daisy chain, the interlock loop circuit is left open and emission is then disabled at the SuperK laser.

Bus input port

The bus input port connects accessories in a daisy chain with a SuperK laser. SuperK lasers and their accessories connect using the NKT External bus protocol. The bus carries data communications, DC power and the interlock signal from the laser to accessories connected on the bus.

Emission, Power and Interlock LEDs

See “Status LEDs” on page 27.

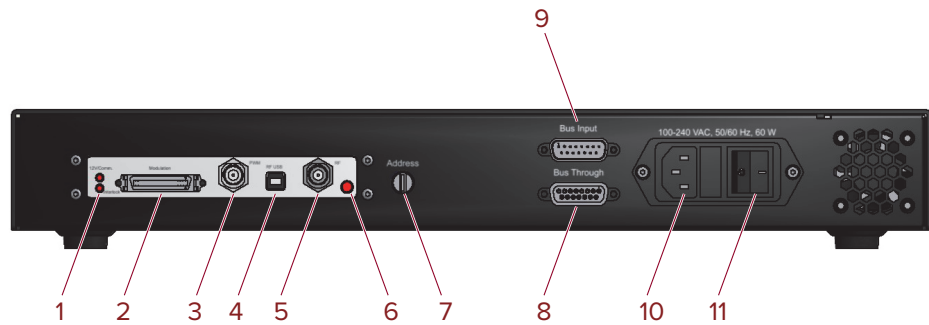
External RF driver

An External RF Driver (ERD) is an electrical driver for the AOTFs of the SELECT. The ERD transmits an RF signal applied to an AOTF that to derive up to 8 desired wavelengths from the SuperK output spectrum.

The ERD is connected to the External bus of the SuperK laser system and is managed using NKT Photonics CONTROL software. Based on the configuration in CONTROL and the AOTF calibration, the ERD transmits an appropriate RF signal to an AOTF crystal. The RF signal applied to the AOTF determines which wavelengths are filtered (up to a maximum of 8 wavelengths).

Figure 8 External RF Driver unit – general view



ERD - rear panel **Figure 9 External RF Driver – rear panel**

- | | | | |
|---|----------------------------------|----|-------------------------------------|
| 1 | Power/comms and interlock LEDs | 7 | Address selector (external bus) |
| 2 | Modulation connector | 8 | Bus through port (external bus) |
| 3 | PWM – reserved for future use | 9 | Bus input (external bus) |
| 4 | RF USB – reserved for future use | 10 | AC mains input - C14 line connector |
| 5 | RF Out | 11 | AC mains ON/OFF switch |
| 6 | RF Out LED indicator | | |

LEDs

- Power/comms LED – Indicates External bus communication and if power is connected.
- Interlock LED– indicates if the Interlock circuit is open.
- RF LED – RF signal is transmitting

Modulation connector

If Fast Wavelength Switching (FWS) is required, an optional SuperK COMMAND module is connected to this port. A COMMAND module can connect to external signaling to drive FWS through the ERD and the SELECT. For more information refer to [Appendix D](#).

Reserved for future use

PWM and RF USB ports are reserved for future use at this time and so are currently not for use with the SELECT system.

RF out

BNC output port transmitting an RF signal to one of two RF input ports on the SELECT.

Address selector

When multiple modules are connected to the External bus daisy chain, this switch must be set to a unique number for the module before turning on power.

Bus input & through port

DB-15 in and out ports for External bus daisy chain connectivity

AC mains input

Standard C14 input connector for a C13 power cord.

AC ON/OFF switch

Toggles AC power on or off to the ERD.

SuperK SELECT Control

Software Description Both the SuperK laser and the SELECT accessory are controlled using NKT Photonic's CONTROL management software installed on a PC or the front panel interface.

A management PC with CONTROL installed on it can connect to the laser using either the USB serial port or the 10/100 BASE-T Ethernet ports on the laser. CONTROL communicates with the SELECT through the laser's External bus connection.

Chapter "[Using CONTROL](#)" contains information on using NKTP's CONTROL software and how to connect to and control the SELECT. It also includes instructions on how to set the UV center wavelength to a resolution of 0.1 nm to match the intended application.

CONTROL software installation

Refer to the procedure found in [Appendix C](#).

Status LEDs

The SELECT includes three status LEDs as described in Table 2. The LEDs are located on a side panel next to the External bus input as shown in Figure 10.

The emission LED is lit ON RED when the connected SuperK laser's emission is enabled. When ON RED, laser light is present at the primary and auxiliary optical output ports.



WARNING: If any of the aperture shutters are closed, emission is blocked. The position of the shutters does not affect the status of the emission LED, only the emission status of the connected SuperK laser.

Figure 10 SELECT Status LEDs

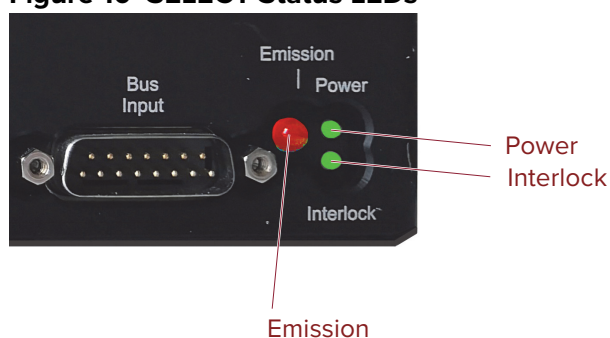



Table 2 SELECT Status LEDs

LED Name	Condition	Description
Emission	ON RED	Emission enabled ⁱ
		The SuperK laser system emission is ON and class 4 emission is present at the primary and auxiliary optical output ports.
		The position of the mechanical shutters at each output port does not change the status of the emission LED.
	OFF	Emission disabled
Power	ON GREEN	The SELECT is powered ON; the external bus 12V DC power is OK.
	ON RED	DC supply voltage is low.
	FLASHING GREEN/ AMBER	Indicates data transmission on the external bus.
	OFF	The SELECT is OFF; no DC power connected.
Interlock	ON GREEN	Interlock safety circuit is closed; laser emission permitted.
	ON RED ⁱⁱ	Interlock safety circuit is open; laser emission is disabled.

i. **Warning:** SuperK emissions are rated Class 4.

ii. Check the SuperK laser for interlock error information.



WARNING: DO NOT OPERATE the SuperK laser until you are familiar with the controls and have taken all precautions necessary as described in the laser's safety handling and regulatory information document.

Chassis labels

The SuperK SELECT chassis includes multiple labels that indicate hazards and safety and product information. The labels are located on the panels as described in Table 4 with the panels shown in Figure 11 and Figure 12.

Table 3 Chassis labels

Label	Panel	Description
Class 4 Laser Warning	Top	Safety information indicating the laser emission radiation class and precautions to take when the laser is operating.
Laser Aperture	Top	Safety information alert indicating the location of the aperture where laser radiation is emitted from the device.
Manufacturing	Side	Manufacturing information including address, part and serial number, date manufactured and regulatory compliance.
Laser Radiation Warning	Top	Safety information alert indicating this area of the device is near a source of dangerous laser emissions.

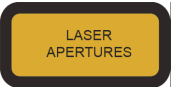
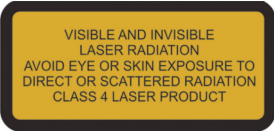
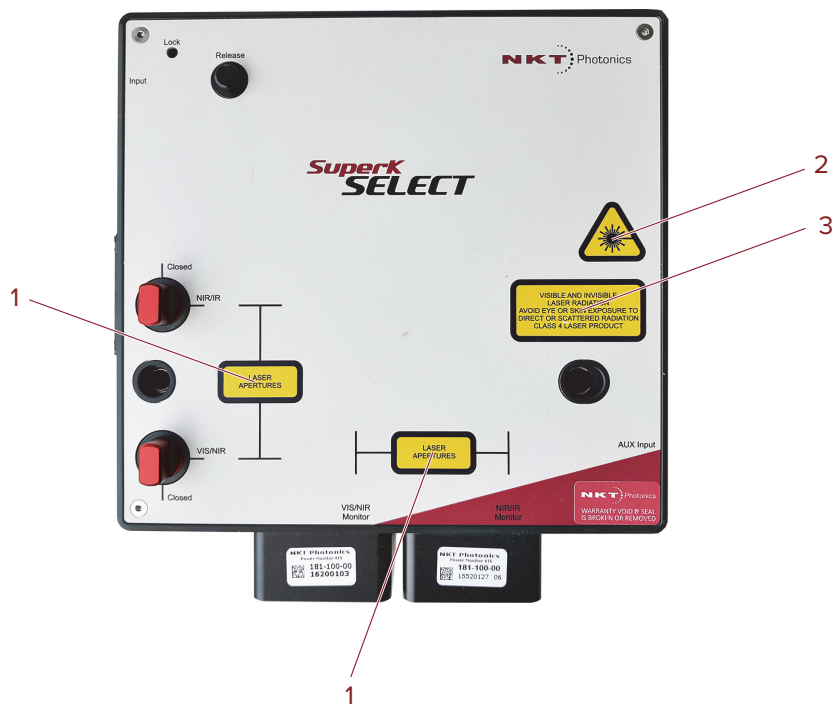


Table 4 Chassis labels

Figure 11 Side panel manufacturing label



Figure 12 Top panel labels



- | | | | |
|---|-------------------------|---|---------------------------------|
| 1 | Laser Apertures | 3 | Class 4 Laser Radiation Warning |
| 2 | Laser Radiation Warning | | |

i. **NOTE:** Laser apertures are located on the side panel below the label.

2 Installation



CAUTION: For reliable operation, the SuperK SELECT should not be exposed to corrosive agents or excessive moisture, heat or dust.



CAUTION: Ambient operating environment specifications are listed in [Table 9](#).



CAUTION: This product is not UL-approved but all safety components are UL-approved.

Installation process The following steps outline the installation process:

1. Prepare a suitable installation platform for the SELECT and External RF Driver(s) – see section “[General](#)” below.
2. Place and fasten the SELECT to the prepared installation platform ensuring the optical outputs are aligned with the intended application.
3. Place the External RF Driver(s) so that they can be connected conveniently to AC power mains and the laser/SELECT.
4. Turn all optical output shutters to the *Closed* position.
5. Insert the SuperK output collimator into the *Optical Input* receptacle. See “[Optical Connections](#)” on [page 32](#).
6. Follow the procedures applicable under “[Electrical Connections](#)” on [page 33](#) to connect the External bus and RF connections.
7. Ensure all bus addresses for each accessory are unique See “[Accessory bus address selector](#)” on [page 23](#).
8. Switch the SuperK laser power ON. (For some SuperK lasers this means connecting DC power.)
9. Switch ON the External RF Driver(s).
10. Observe and ensure the power and Interlock LEDs are ON Green. See “[Status LEDs](#)” on [page 27](#) to interpret their status condition. The Interlock must be connected to a door switch. For more information, refer to the documentation for your laser.

General All chassis types must be installed on a level surface that is free from vibrations. The SuperK SELECT can be fastened to both metric and imperial optical tables. The ambient temperature surrounding the laser and SELECT system should be stable and free from anything that could cause temperature fluctuations. Temperature changes and vibrations may affect the device operation and result in abnormal operation.



CAUTION: The SuperK SELECT is intended for use with the SuperK Class 3B and 4 lasers systems only. Using the SuperK SELECT with a laser source other than a SuperK laser may result in hazardous radiation exposure.



WARNING: To operate these systems, you must be familiar with laser safety regulations and have received instruction in the safe use of lasers.

Optical Connections

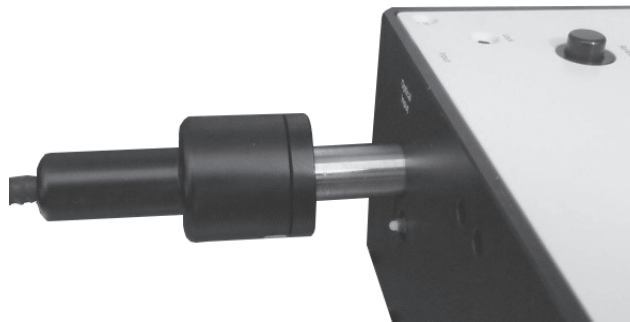
Follow the steps in [Procedure 1](#) to insert the output collimator of the SuperK laser into the *Optical Input* receptacle of the SuperK SELECT.

Inserting the SuperK collimator

Procedure 1 Inserting a SuperK output collimator

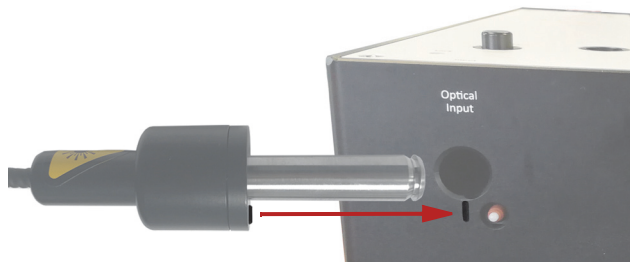
1. Disconnect power from the laser.
2. If not already installed, position the SuperK SELECT at its final operating location and securing it to a suitable mounting surface.
3. Partially insert the laser's output collimator barrel into the Optical Input receptacle as shown in [Figure 13](#).

Figure 13 Partially inserting the collimator



4. Holding the collar, rotate the collimator until the alignment key of the collimator aligns with the slot at the optical port of the chassis ([Figure 14](#)).

Figure 14 Collimator alignment key and slot



NOTE: When the key is aligned with the slot, the axial orientation of the collimator is correctly aligned.

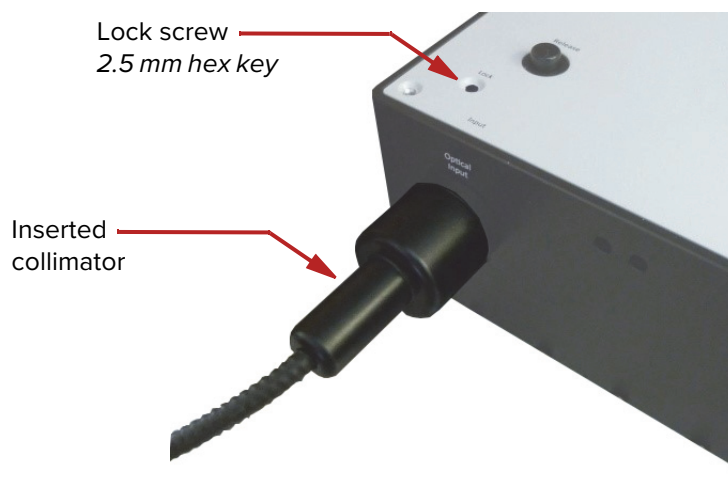
5. Push the collimator into the receptacle until its collar rests against the chassis. As you push it in, the collimator will encounter some resistance, and you may feel two distinct clicks as it locks in place.



NOTE: Again, when seating the collimator in the aperture, you may need to rotate the collimator slightly to align the collimator key with the alignment slot.

6. To secure the collimator in the receptacle, tighten the lock screw shown in [Figure 15](#) using a 2.5 mm hex key (Allen key).

Figure 15 Collimator lock screw



Optical output All optical outputs are free space. NKT Photonics can provide SuperK CONNECT accessories and collimators as described in the document:

SuperK CONNECT and Fiber Delivery Product Guide

Electrical Connections

For dual ERD systems – see [“Dual ERD system”](#) on page 35.

Single ERD system For basic operation, connect the External bus from the SuperK laser to the SELECT and to the External RF Driver (ERD) where the bus is looped back with the included bus def eater. The RF coaxial BNC port of the ERD must be connected to the RF1 BNC port of the SELECT. Finally, a 50 Ω RF terminator should be placed on the unused RF2 BNC port of the SELECT. Follow [Procedure 2](#) to make the connections.

Procedure 2 Electrical connections for a SELECT with a single ERD

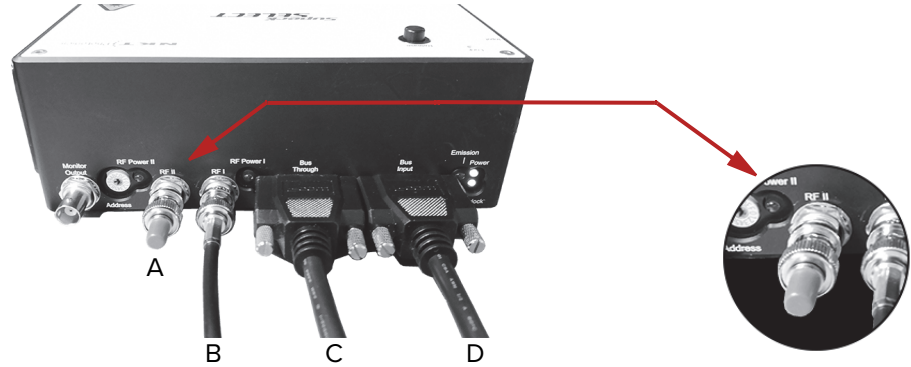
1. Disconnect power from the laser.



CAUTION: If the laser is powered ON when connecting the external bus cable, DAMAGE can occur to both the laser and the SELECT.

- Using an External bus cable, connect the *External bus* connector of the SuperK laser to the *Bus Input* connector (item D of Figure 16) of the SELECT.

Figure 16 Connecting a SELECT - single ERD

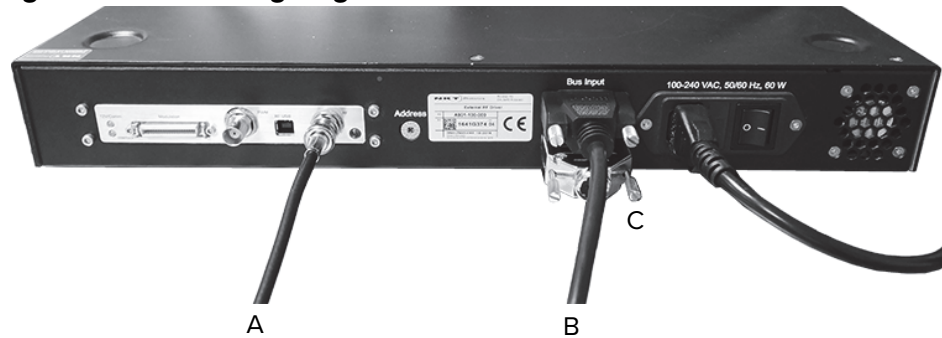


- A: 50 Ω coaxial terminator
- B: RF1 from RF_{out} ERD
- C: Bus Through to External BUS_{ERD}
- D: Bus Input from External BUS_{SuperK laser}

NOTE: Connect a 50 Ω BNC terminator to the unused RF input port.

- Using another External bus cable, connect the *Bus Through* connector of the SELECT (item C of Figure 16) to the *Bus Input* connector of the ERD. (item B of Figure 17)

Figure 17 Connecting single ERDs



- A: RF_{ERD} to RF1_{Select}
- B: External bus_{from Select}
- C: Bus defeater

- Connect the bus defeater (Figure 18) to the *Bus Through* connector of the ERD (item C of Figure 17).

Figure 18 Bus defeater



- Using the RF coaxial cable, connect the *RF BNC* port of the ERD (item A of Figure 17) to the *RF 1* port of the SELECT (item B of Figure 16).

i **NOTE:** To reduce RF leakage, connect a 50 Ω terminator to the unused RF port of the SELECT (see [Figure 16](#) item A).

- Set the address bus select switches to a unique address for the SELECT and ERD as shown in [Figure 19](#).



CAUTION: All modules on the External bus must use a unique address. A bus conflict and system communication failure occurs when two or more modules are set to the same address.

Figure 19 Setting External bus addresses - single ERD system



- Connect AC mains power to the ERD.
- Turn ON the laser and ERD. Check that the SELECT is available in the Device Selector panel of CONTROL (see [“Device Selector”](#) on page 44).

Dual ERD system For basic operation, connect the External bus from the SuperK laser to the SELECT and to both External RF Drivers (ERDs) where the bus is looped back using the included bus defeater on the last module in the bus chain. The RF coaxial BNC ports of ERD 1 and ERD 2 must be connected to the RF1 and RF 2 BNC ports respectively on the SELECT. Follow [Procedure 3](#) to make the connections.

Procedure 3 Electrical connections for a SELECT with dual ERDs

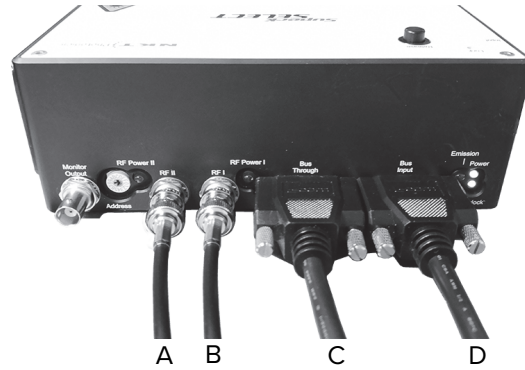
- Disconnect power from the laser.



CAUTION: If the laser is powered ON when connecting the external bus cable, DAMAGE can occur to both the laser and the SELECT.

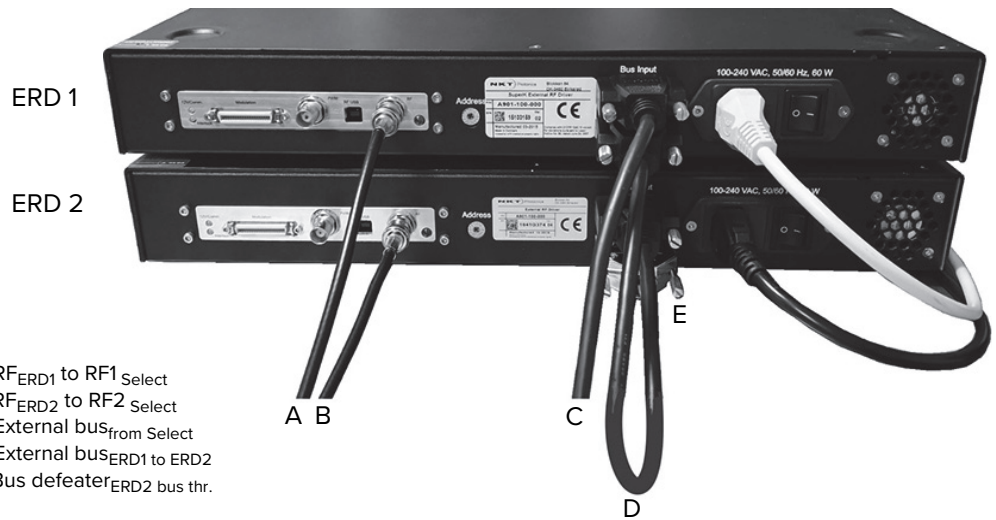
- Using an External bus cable, connect the *External bus* connector of the SuperK laser to the *Bus Input* connector (item D of Figure 20) of the SELECT.

Figure 20 Connecting a SELECT - dual ERD



- A: RF2 from RF_{out} ERD2
- B: RF1 from RF_{out} ERD1
- C: Bus Through to External BUS_{ERD1}
- D: Bus Input from External BUS_{SuperK laser}

- Using the other External bus cable, connect the *Bus Through* connector of the SELECT (item C of Figure 20) to the *Bus Input* connector of ERD 1 (item C of Figure 21).



- A: RF_{ERD1} to RF1_{Select}
- B: RF_{ERD2} to RF2_{Select}
- C: External bus_{from Select}
- D: External bus_{ERD1 to ERD2}
- E: Bus defeater_{ERD2 bus thr.}

- Connect the *Bus Through* connector of ERD 1 to the *Bus Input* connector of ERD 2 (item D of Figure 21).
- Place the bus defector (Figure 18) onto the *Bus Through* connector of the ERD (item E of Figure 21).

NOTE: Ensure to terminate the External bus with an NKT Photonics bus defector, Without the bus defector, the interlock circuit remains open disabling laser emission.

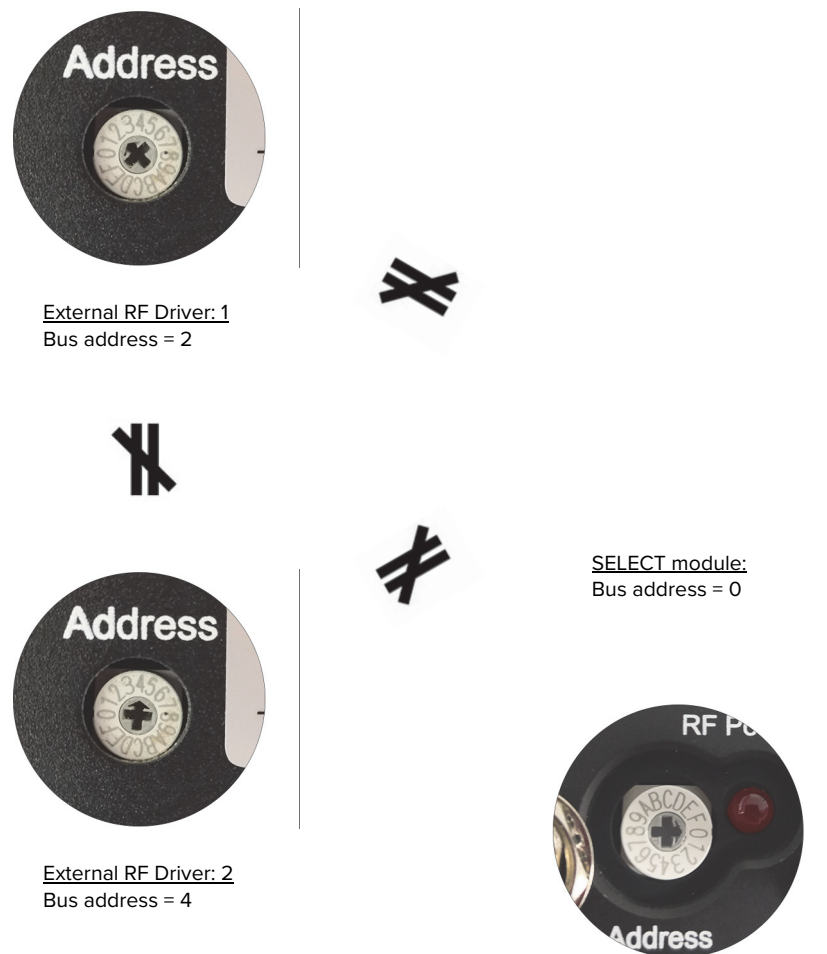
- Using an RF coaxial cable, connect the *RF BNC* port of the ERD 1 (item A of Figure 21) to the *RF 1* port of the SELECT (item B of Figure 20).

7. Using the other RF coaxial cable, connect the *RF* BNC port of the ERD 2 (item B of [Figure 21](#)) to the *RF* 2 port of the SELECT (item A of [Figure 20](#)).
8. Set the bus address select switches to a unique address for the SELECT and each ERD as shown in [Figure 22](#).



CAUTION: All modules on the External bus must use a unique address. A bus conflict and the system communication failure occurs when two or more modules are set to the same address.

Figure 22 Setting External bus addresses - dual ERD system



9. Connect AC mains power to ERD 1 and 2.
10. Turn ON the laser and both ERDs. Check that the SELECT is available in the Device Selector panel of CONTROL (see “[Device Selector](#)” on page 44).

Adding additional accessories If additional accessories are to be connected to the SuperK laser External bus, follow the steps in [Procedure 4](#).

Procedure 4 Connecting additional accessories

1. Remove the bus deflector from the *Bus Through* connector on your current system. This is on the last accessory module in the External Bus daisy chain.

2. Using an External bus cable, connect the *Bus Through* connector from the current last module to the *External bus* connection of the newly added accessory.
3. Repeat step 2 for each new accessory.
4. On last accessory module in the External bus daisy chain, connect the *Bus Defeater* on its *Bus Through* connector.
5. Before powering on the system, set all bus address selector switches to a unique address.

The order of the modules on an External bus chain is not important. It is important that power is OFF when connecting and the address selector switch of each module is set to a unique address before power is turned ON.



CAUTION: If the laser is powered ON when connecting the external bus cable, DAMAGE can occur to both the laser, SELECT and ERDs.



NOTE: To enable emission on a SuperK laser, the power supply and the door-switch interlock must be connected. Refer to the instruction manual for the SuperK laser system for more information.



NOTE: All bus cables used with a SuperK laser system must be shielded and a maximum of 3 meters long.

3 Output Power Considerations

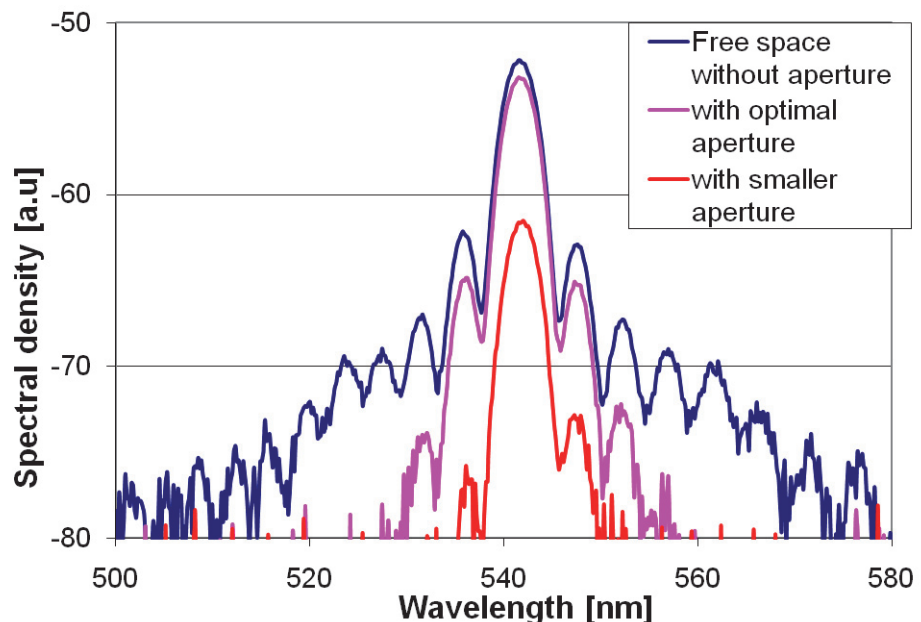
Output beam quality

The output beam from the AOTF crystal naturally includes side lobes (see figure 8-1). The side lobes have a different spatial distribution than the main peak. This makes it possible to filter the beam spatially by inserting a small aperture or by coupling to a single mode fiber.

Free space delivery In order to optimize the output beam quality, it is filtered through a small aperture. Figure 23 shows the spectral output of a single AOTF channel as a function of the size of the aperture. When there is no aperture, the main peak has numerous side lobes on either side of the main peak. Decreasing the size of the aperture decreases the power in the side lobes. Power decreases initially in the outer side lobes followed by the inner side lobes and eventually the main peak.

In practice, the power in the first order side lobe and in the main peak is coupled, so it is not possible to block the first order side lobes without significantly decreasing the power in the main peak. The optimal aperture occurs when the main peak and first order side lobes are transmitted but the higher order side lobes are heavily damped.

Figure 23 Spectral output of a single AOTF channel



Fiber Delivery If a fiber delivery system¹ is mounted to the outputs of the SuperK SELECT, the single mode coupling acts as a spatial filter. In this case, no aperture in the beam path is required. Side lobe suppression will depend on the numerical aperture of the delivery fiber.

¹ Refer to the *SuperK CONNECT FDS Product Guide*

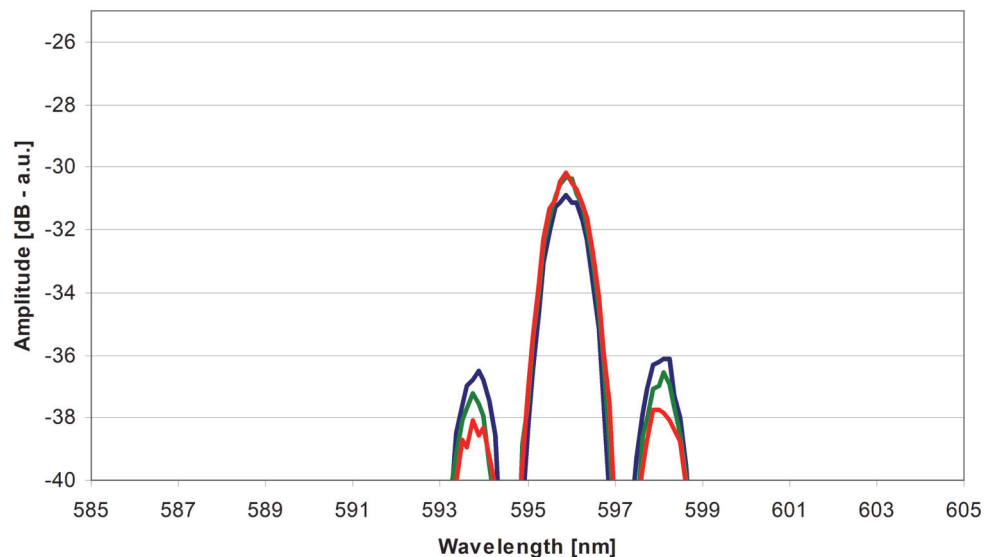
Optimum RF power

RF power When operating the AOTF, RF power is one important factor to consider. As RF power is increased, the central peak of the selected wavelength increases gradually up to a point. Beyond this point, increasing RF power causes side band power to increase instead of the central peak power. This is illustrated in [Figure 24](#). The RF power level beyond which the central peak does not increase is called the optimum RF power.



NOTE: The systems shipped from NKT Photonics A/S, have their optimum RF power mapped as a function of wavelength. Your SELECT system RF level is already optimally mapped at the NKT Photonics factory and unless you swap-out certain hardware, no further optimization is required.

Figure 24 AOTF transmission spectrum for varying RF powers



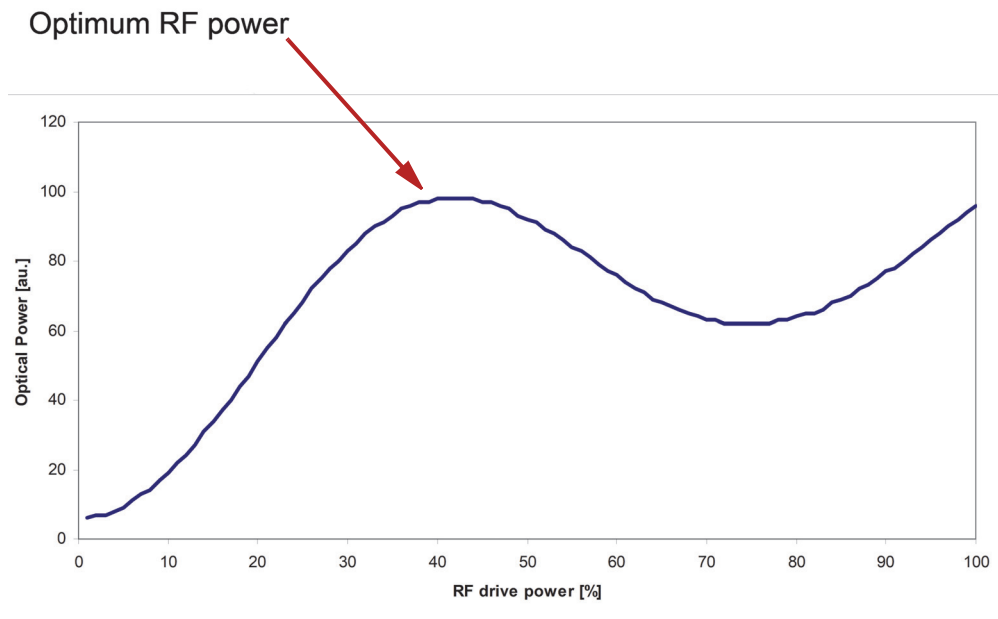
In [Figure 24](#), the red curve is optimum, whereas the green and blue curves illustrate the result when RF power level is increased beyond the optimum. Side band power increases and the amplitude of the central peak decreases.

In summary, the power ratio between the sidebands and the primary transmission (central) peak is determined by the selected configuration and the operational parameters. For example, the selected wavelength, RF power and RF cable lengths used.

Fiber coupled In an application where the beam does not need to be perfectly single mode, you can gain some output power increasing the RF power level beyond the optimum. However, when single mode operation is needed, such as when using a fiber delivery system, going beyond the optimum RF power level results in decreasing output power. This is illustrated in [Figure 25](#) where for a specific wavelength the fiber coupled power is plotted as a function of RF power. Once

the RF driver power reaches a level between 40 and 50 percent, no further output optical power is achieved by further increasing the RF driver power.

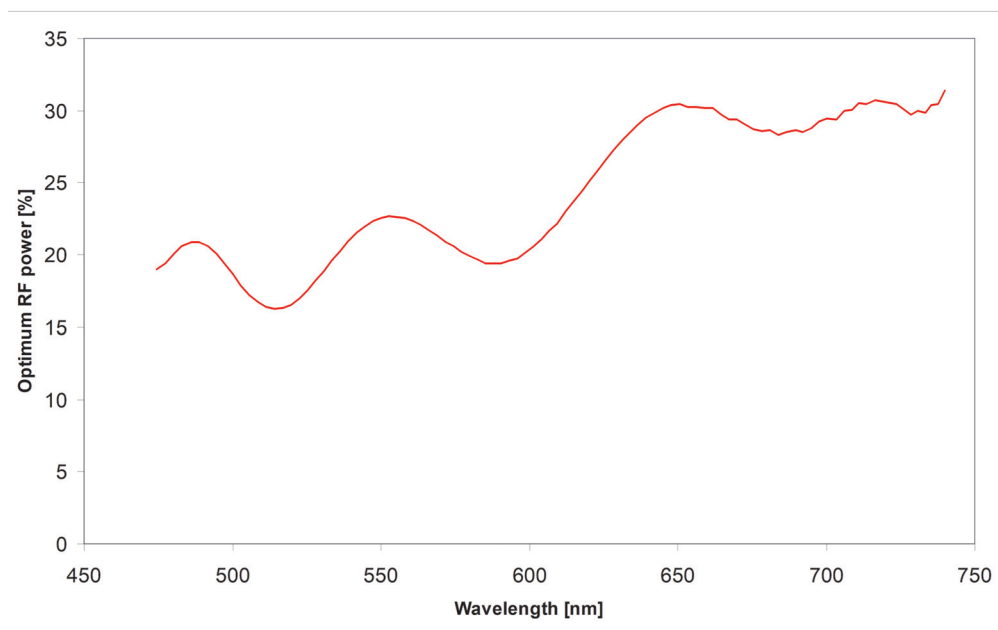
Figure 25 Optical power for a specific wavelength as a function of RF power



Optimum RF power level

The optimum RF power depends on several factors, one of which is the selected wavelength. Figure 26 illustrates how the optimum RF power level for a typical visible AOTF system varies as a function of wavelength. The shape of the curve in Figure 26, depends on the components used and the RF cabling used between them.

Figure 26 Wavelength versus optimum RF power level



Remapping the Optimum RF level Since your SELECT system RF level is already optimally mapped at the NKT Photonics factory, the following procedure is not necessary unless the original hardware has been swapped-out.

When remapping is required

The mapping depends on the specific hardware configuration (driver, crystal and cables). If you decide to swap-out any part of your system’s factory configuration remapping may be required. NKT Photonics suggests you contact our support team before going forward with this procedure.

Remapping procedure

If the AOTF system configuration is changed and a remapping of the optimum RF power level is needed, follow the steps in [Procedure 5](#). Perform the procedure for all wavelengths that you wish to implement.



CAUTION: Refer to the notice above in “[When remapping is required](#)” before you perform this procedure. This procedure is unnecessary for factory stock systems using the original supplied hardware.

Procedure 5 Remapping the optimum RF power level

1. Select wavelength.
2. Measure optical power as a function of RF power. This should result in a curve similar to the one shown in [Figure 25](#).
3. Determine the optimum RF power as the first peak on the curve (see [Figure 25](#)).
4. Select the next wavelength and repeat from step 2.

Beam walk-off

Beam walk-off is a phenomena that displaces the beam alignment of the system upon a wavelength change. Beam walk-off in the AOTF of the SELECT is a function of wavelength due to the grating’s first order diffraction.

Reduction in output power When using an NKT Fiber Delivery System or similar, the beam output from the SELECT AOTF is aligned with the FDS optics to achieve optimum light coupling efficiency. When changing the SELECT output wavelength, beam walk-off may be pronounced enough to cause the coupling efficiency of the FDS to degrade considerably.

Realignment When power reduction is due to beam walk-off, realignment is necessary to restore the optimum coupling efficiency and thus output power. The FDS must be realigned using the procedures in the NKT Photonics document:

SuperK Fiber Deliver System Product Guide

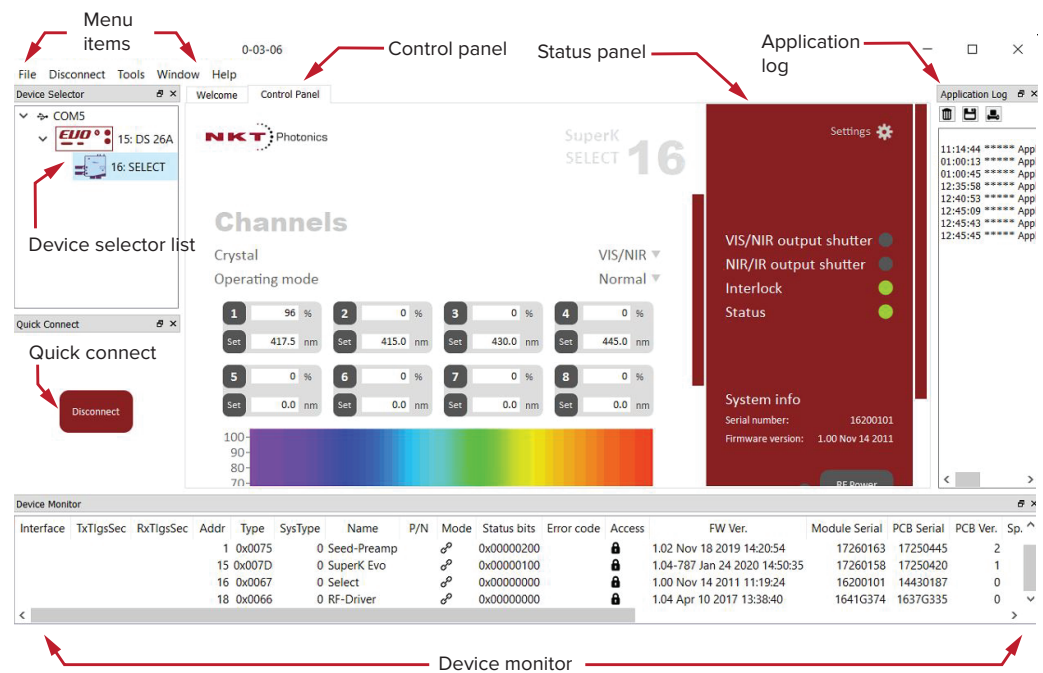
4 Using CONTROL

CONTROL overview

CONTROL includes multiple panels and a selection of menu drop down items in the upper left corner. [Figure 27](#) shows CONTROL's main panels and menu; their functions are described in the table below. This chapter only describes CONTROL functions related to the SuperK SELECT, for all other functionality, refer to the specific SuperK documentation.

Panel	Function	See
Device Selector	Selectable list of connected devices (lasers and accessories) sorted by the PC port they are connected to.	Device Selector on page 44
Quick Connect	Provides a button when clicked, scans all available PC ports for connected NKTP products.	Refer to SuperK laser documentation.
Status Panel	This panel displays the selected device status, emission control and a CONTROL settings menu.	Status Panel on page 45
Menu Items	Five drop down menus with multiple functions.	Refer to SuperK laser documentation.
Control Panel	The control panel provides adjustable settings for the selected device. For the SuperK SELECT, CONTROL includes configuration for wavelength and power level for up to 16 channels.	Control panel on page 49
Application Log	This panel displays debug log output that can also be saved to a file.	Refer to SuperK laser documentation.
Device Monitor	To help with troubleshooting, this panel displays multiple port and device module parameters.	Refer to SuperK laser documentation.

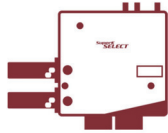
Figure 27 CONTROL panel navigation



Device Selector

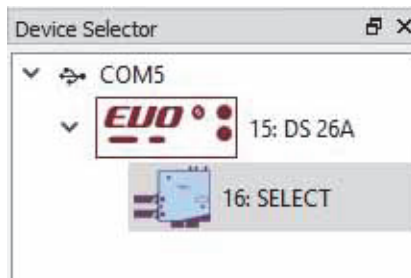
In the *Device Selector* panel, you can find icons of SuperK nodes that CONTROL is currently communicating with. To manage any device, click on its corresponding icon. When the icon is highlighted blue, its *Control* panel and *Status* panel are displayed. In the device selector list, the SELECT is represented by the icon shown in [Figure 28](#).

Figure 28 Device selector icon



[Figure 29](#) shows a device selector list with a SuperK EVO laser and SuperK SELECT accessory. An icon for the SELECT connected to the EVO has been clicked on and selected which is indicated by the highlighted bar around the icon.

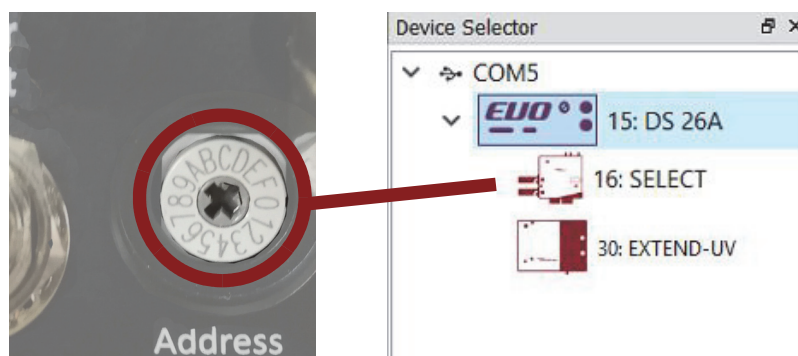
Figure 29 Device selector



External RF Drivers (ERD) are not shown in the device selector. ERDs operate in conjunction with the SELECT and any relevant configuration (for example, selected wavelengths) from the SELECT configuration panels modifies the settings for the External RF Driver(s).

Address selector When multiple accessories are used with a single SuperK laser, the laser's External bus connects accessories in a daisy chain topology. For each device, the address selector wheel must be set to one of 16 (0x0 to 0xF) unique addresses. [Figure 30](#) shows a case where multiple accessories share the External bus. Refer to "[Electrical Connections](#)" on [page 33](#) for information on connection accessories.

Figure 30 Device selector set to 0xE bus address



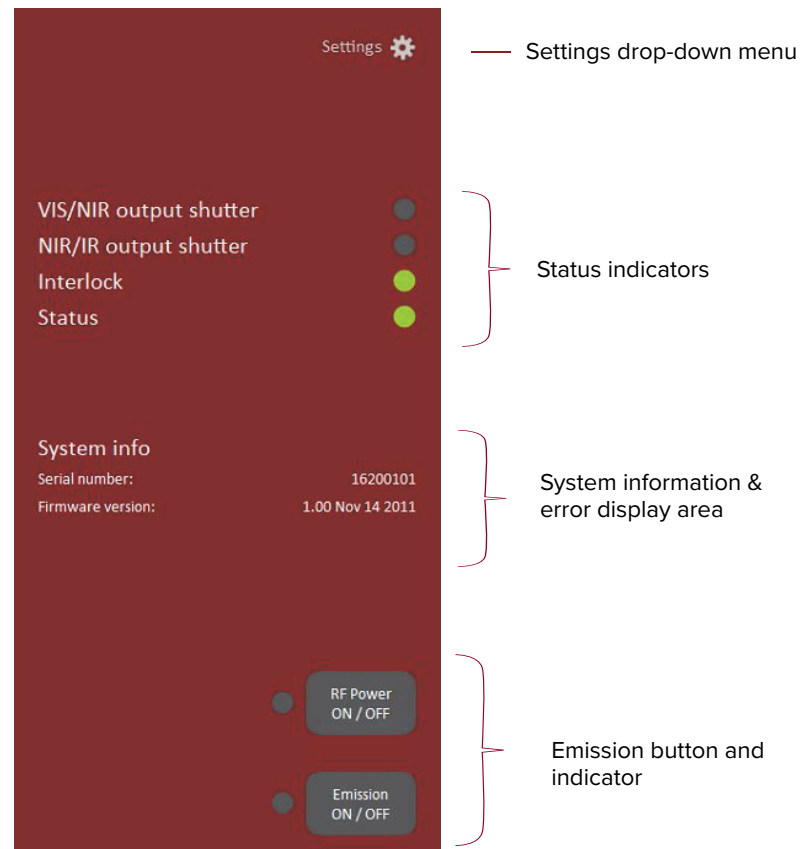


CAUTION: Only turn ON the SuperK laser and connected accessories after all connected accessories are configured with a unique address.

Status Panel

The Status Panel contains status indicators, error messages, an emission control button, and a CONTROL settings menu.

Figure 31 Status Panel



Status Indicators The panel displays the following indicators:

VIS/NIR output shutter

Indicates the position of the mechanical shutter for the VIS/NIR output shutter. The shutter is either in the closed or open position.

- ON Green – the VIS/NIR output shutter is in the open position, laser emission can pass through the aperture.
- OFF Grey – the VIS/NIR output shutter is in the closed position, emission is blocked.

NIR/IR output shutter

Indicates the position of the mechanical shutter for the NIR/IR output shutter. The shutter is either in the closed or open position.

- ON Green – the NIR/IR output shutter is in the open position, laser emission can pass through the aperture.
- OFF Grey – the NIR/IR output shutter is in the closed position, laser emission is blocked.

Interlock

Indicates the status of the Interlock circuit and whether emissions can be turned on or not. The indicator is either:

- ON Red – the interlock circuit is open or shorted to ground – no emission allowed
- ON Green – the interlock circuit is closed and reset – emission allowed

To clear the ON Red indicator, close the interlock circuit and reset it. Any shorts to ground or circuit opens must be removed.

Status

Indicates the operational status of the laser. The indicator has the following states:

- ON Green – the SELECT is ready for operation.
- ON Red – the SELECT has experienced a fault and has shutdown. An error code is displayed underneath the Status indicator. Contact NKT Support if the fault cannot be cleared - see [“Support Contact Details” on page 61](#).

System Info The System Info section shows the following:

- SELECT Serial number
- SELECT Firmware version

See [“View” on page 49](#) on toggling on and off the display of system information.

RF Power button The RF power button toggles the supply of the External RF Driver (ERD) RF signal power to the AOTF crystal(s). When clicked ON, the button indicator turns ON RED and the crystal filters the beam according to the RF signal ([“Channel buttons and text input fields” on page 50](#)). When clicked OFF, no filtered output is possible.

When this button is checked ON, the RF LED of the ERD is lit ON Red.

Emission button The emission button enables or disables the SuperK laser emission. The button indicator turns ON Red when laser emissions are enabled. When disabled, the indicator is OFF Grey. This button is the same button available in the CONTROL status panel of the connected SuperK laser. Refer to the SuperK laser documentation for further information on managing emission.


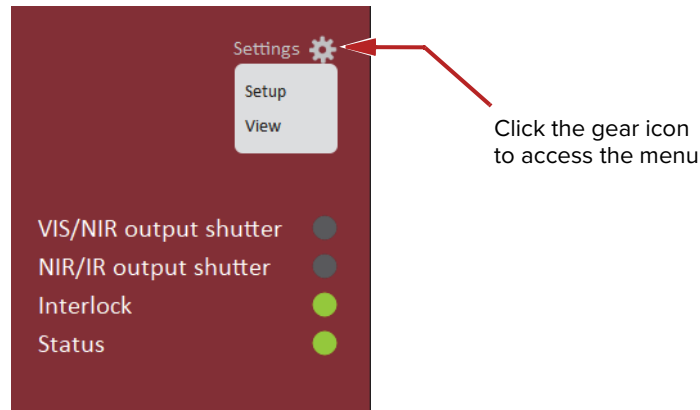
Control settings The CONTROL settings are accessible by clicking the gear icon  in the upper right corner of the Status panel. Clicking the gear icon provides access to the Setup and View setting menus as shown in Figure 32:

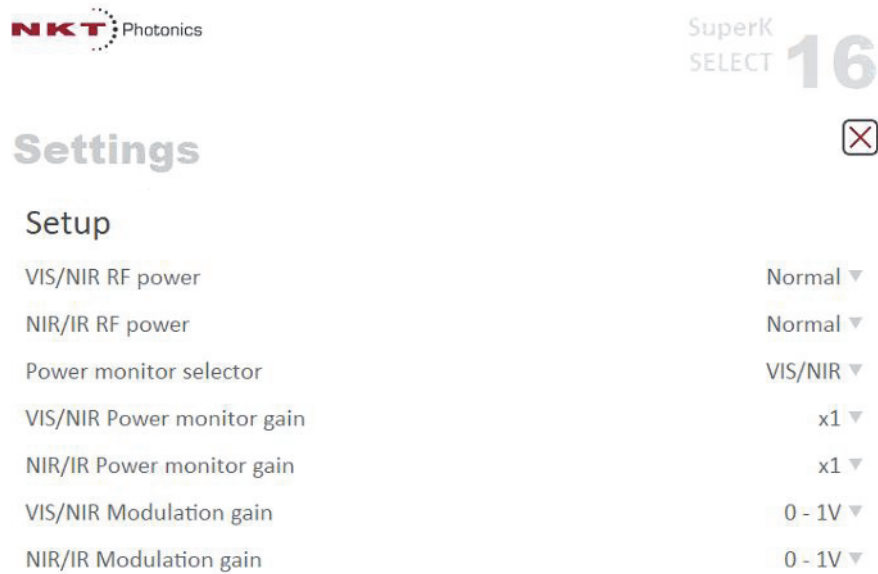
Figure 32 CONTROL settings



Setup

The setup page is shown below in Figure 33. Multiple settings for each output are available and described in the following.

Figure 33 Setup menu page



VIS/NIR RF power – or – NIR/IR RF power – Range: *Normal* or *Overdrive*
In *Normal* mode, the power level in the main spectral peak increases as RF power is increased. Power coupling to a fiber deliver system is optimized when operating in this mode.



NOTE: The RF power settings for each crystal are calibrated at the factory together with the External RF Driver equipped with the system. Unless the crystal or External RF Driver is changed, this setting should always be set as *Normal* mode.

In *Overdrive* mode, as RF power increases, the main spectral peak only increases up to a particular level of RF power. After that, increasing RF power leads to an increase in side band power level and the power in the main peak starts to decrease. This mode results in slightly higher output power. However, power coupling into a fiber deliver system is less efficient due to higher side band power.



CAUTION: Only use *Overdrive* mode when either a new AOTF crystal or new External RF Driver is added to the SELECT. In these cases, the optimum RF power calibration curve, set at the factory, is no longer valid and a new calibration may be required as described in “[Optimum RF power level](#)” on page 41. Using the *Overdrive* mode, results in slightly higher RF power applied to the crystal which can cause issues with the beam lobes.

Power monitor selector

Range: *VIR/NIR* or *NIR/IR*

You can employ the Feedback power locking feature of the SuperK laser by using the optional monitor output port of the SELECT. This parameter sets monitor output port to transmit either the *VIR/NIR* or *NIR/IR* monitor signal.

Connect the port to the SuperK laser’s external feedback port to feed the SELECT’s power monitor signal to the laser. External power monitoring is optional and installed at the factory – see “[Monitor ports](#)” on page 22.



NOTE: The power monitor signal can only represent the level of one of the output ports as configured by the *Power monitor selector* setting.

VIS/NIR or NIR/IR power monitor gain

Range: *X1* to *X128*

These settings increase or decrease the level of the monitor signal output from the monitor output port. A gain of up to 128 times can be set and the setting only functions when a least one power monitor and a monitor output port is installed on the SELECT – see “[Monitor ports](#)” on page 22.

VIS/NIR or NIR/IR modulation gain

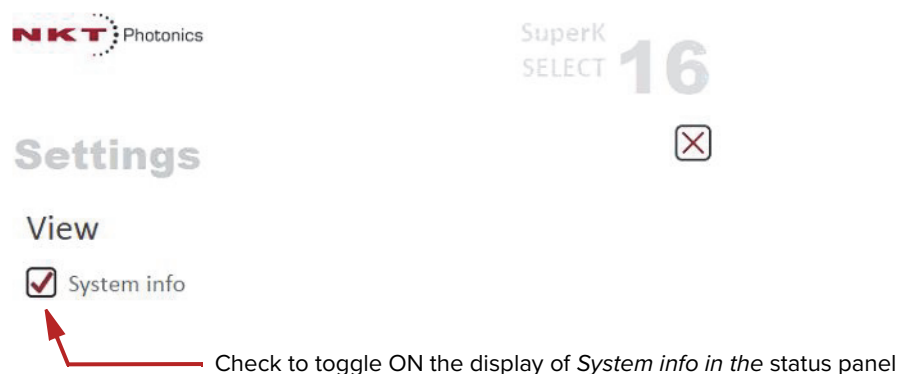
Range: 0-1 V, 0-5 V, 0-10 V

When operating using *Fast wavelength switching* mode, the input modulation gain should match modulation input signal(s) connected to an optional SuperK COMMAND device. This setting allows you to choose between 3 different input voltage ranges for the Modulation inputs. The SuperK COMMAND is an optional device specifically designed for Fast Wavelength Switching using an FSK signal. For more information refer to [Appendix D](#).

View

The *View* settings toggles on or off the display of the SELECT system info in the status panel.

System info – check or uncheck the box next to “System info” to toggle ON or OFF the display of system information within the status panel.

Figure 34 CONTROL settings**Control panel**

The Control panel features three *Operating modes*:

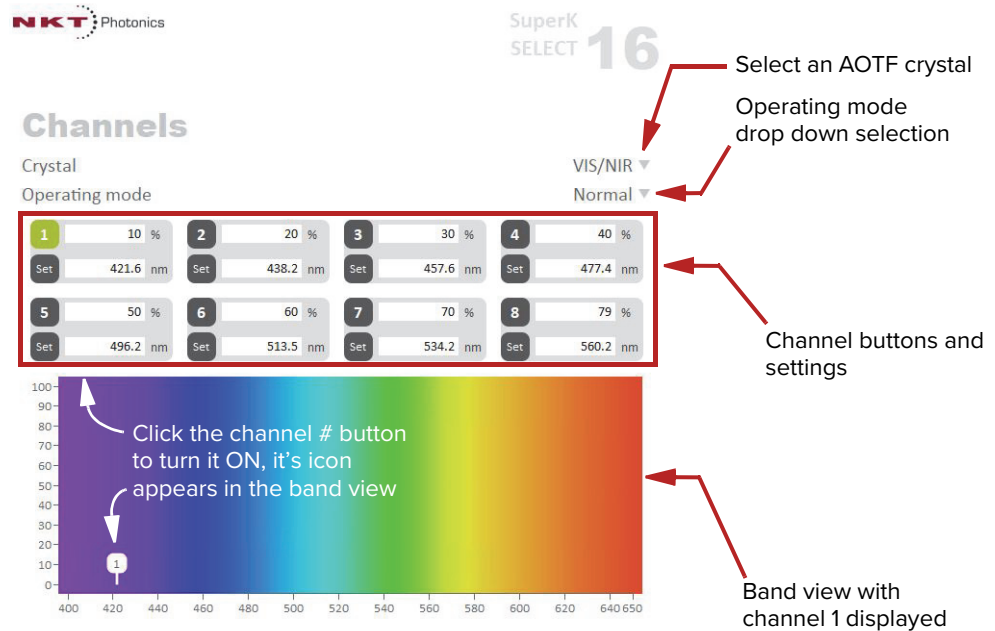
- *Normal* – Up to 8 constant wavelengths can be configured for each crystal.
- *Fast Wavelength Switching* – wavelengths are switched based on settings and signaling from an external application with an optional COMMAND module.
- *Wavelength Sweep* – the SELECT steps through multiple wavelengths at a set rate.

Normal Operating mode

The Control panel displays the output channel settings for the selected AOTF crystal. For each crystal (VIS/NIR or NIR/IR output), up to 8 wavelengths and their individual power levels are set using the channel buttons. Select and configure a crystal's channels by clicking on the *Crystal* drop down menu, see [Figure 35](#).

i **NOTE:** If the system is equipped with a single External RF Driver, only a single crystal or output is available for operation. You can select either AOTF using the *Crystal* selection drop down menu under *Channels*.

Figure 35 Channel controls - general operation



Crystal

Select either the VIS/NIR or NIR/IR AOTF crystal. The channel controls and “Band view” for the selected crystal is displayed.

i **NOTE:** The *Crystal* selection arrow (i.e. the AOTF selection) is locked when a single ERD is equipped and the system RF power is ON (see “RF Power button” on page 46). For dual External RF Driver systems, crystal selection is available (when two RF driver signals are present) thus channels can be activated on both AOTFs.

i **NOTE:** To select the other AOTF crystal on a single ERD equipped system, first delete the configured channels from the currently selected *Crystal* and turn OFF RF power from the ERD.

Channel buttons and text input fields

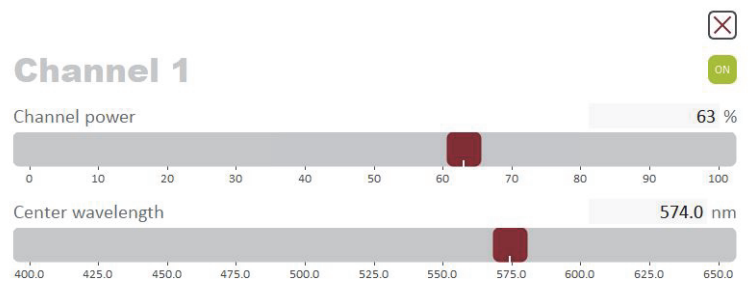
8 channel buttons and their settings are available for each crystal. You can set the power level and wavelength of each channel using the text input fields or clicking the set button to launch a separate set of slider controls. Clicking the channel button ON (green) enables the channel and it appears as a numbered symbol in the “Band view”. When the channel button is ON and laser emission is enabled, an output beam is emitted from the crystal at the set channel parameters.

Set button

Instead of the band view, you can display sliders for each channel. Click the set button to display the sliders for the channel setting. Click-hold and adjust the

sliders with your mouse to set the power and center wavelength of the channel. To close the slider view, click the X in the upper right corner.

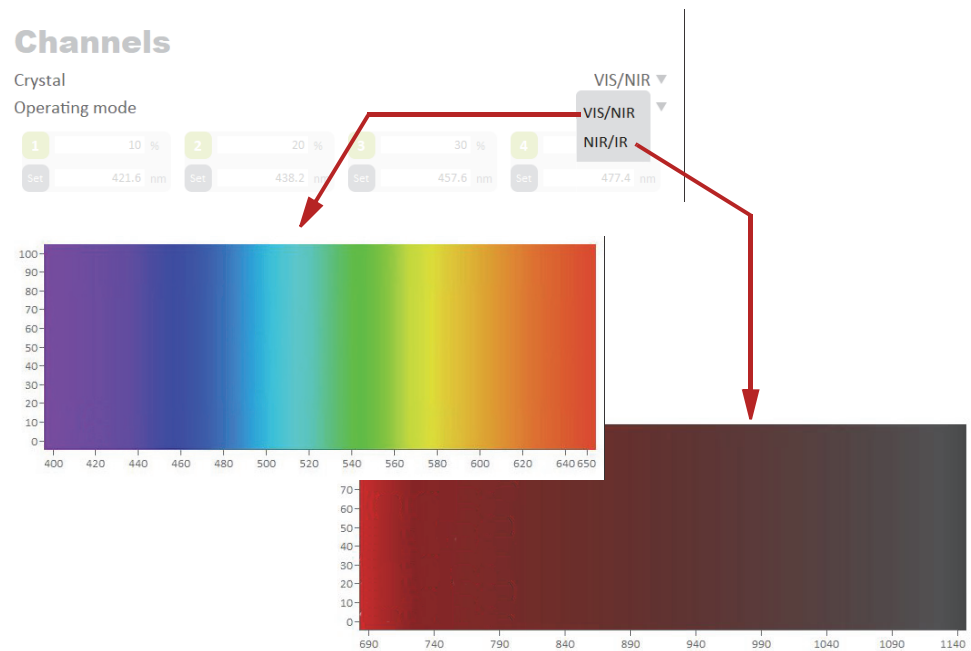
Figure 36 'Set button sliders



Band view

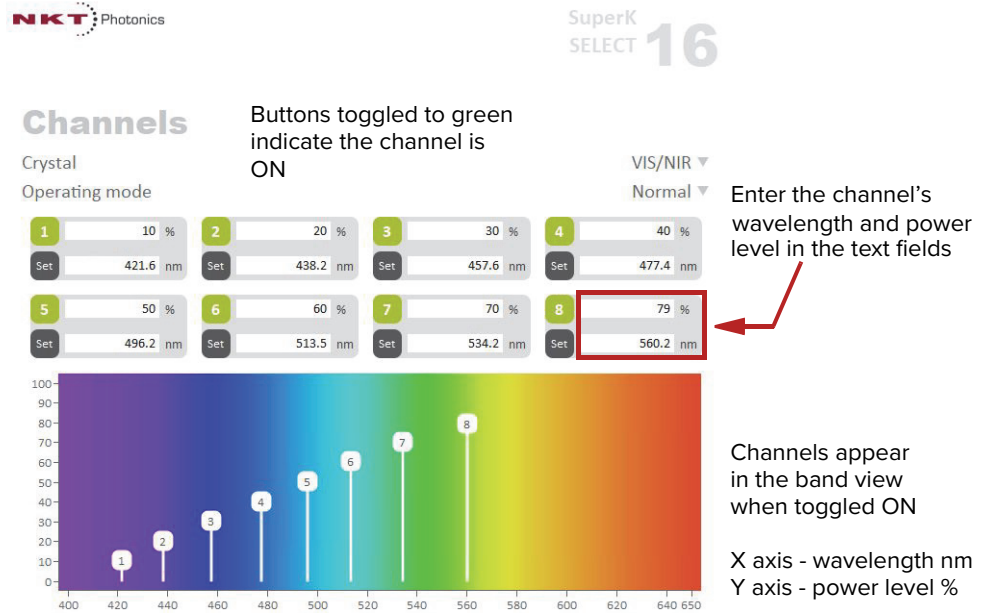
The band view displays a visual representation of the range of light wavelengths available for a crystal. The range of wavelengths displayed, depends on the selected crystal. For example, when the output port for the VIR/NIS crystal is selected, the band shown ranges from 400 to 650 nm. If you select the NIR/IR output port crystal, the band range changes to 690 nm to 1140 nm. The Y-axis of the band view represents power in percentage. Within the band view, numbered symbols appear for each wavelength (channel) switched ON.

Figure 37 Band views per output channel (crystal)



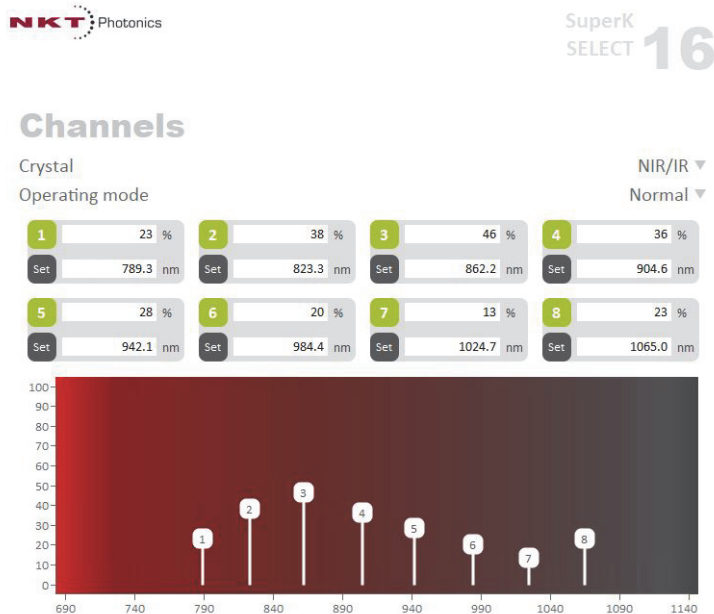
When a channel is ON, it appears in the band view as shown in Figure 35. If all 8 channels are ON, 8 channels will appear in the band view as shown in Figure 38 and Figure 39.

Figure 38 VIS/NIR output with all channels ON



NOTE: To simultaneously operate 8 channels in both the VIR/NIR and NIR/IR band views, two External RF Drivers must be equipped with the system. If only one ERD is equipped and RF power is ON, the currently selected crystal operates. The system locks access to the other crystal.

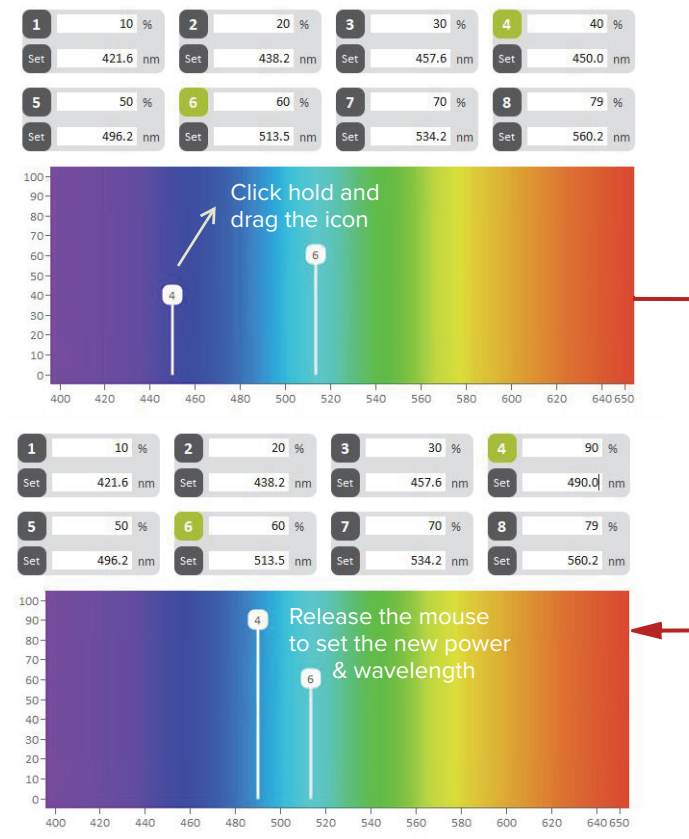
Figure 39 NIR/IR output with all channels ON



Dragging channels

Using your mouse, you can click-hold on a channel symbol and slide it within the band view, thereby adjusting the wavelength and power level – see [Figure 40](#).

Figure 40 Dragging channels in the band view



Fast wavelength switching mode

In fast wavelength switching mode, you can either switch between individual wavelengths or configured profiles of up to 8 channels (wavelengths). To switch wavelengths or profiles, a SuperK COMMAND module is connected to the External RF Driver. The COMMAND module has multiple inputs that accept external signals to drive the selection of either wavelengths or profiles. The COMMAND module is also capable of modulating the amplitude of the selected wavelengths from the SELECT. Wavelength switching and amplitude modulation can be achieved within approximately 10 μ s. Refer to [Appendix D](#) for a description of the SuperK COMMAND and detailed configuration instructions.

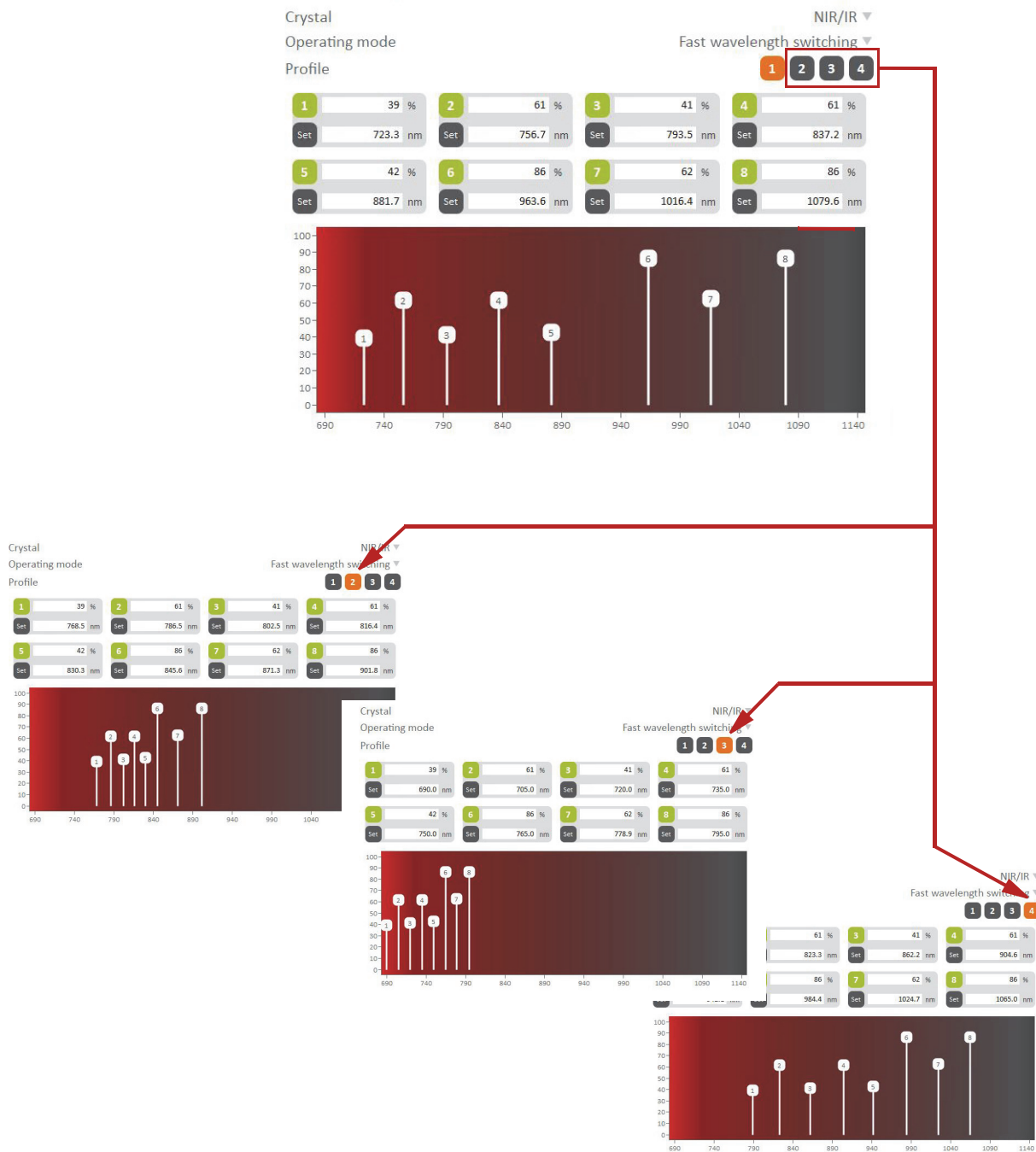
Wavelength Profiles

[Figure 41](#) shows the configuration page for fast wavelength switching. In the window, to the right of **Profile**, are 4 profile buttons. Clicking on each button displays a channels page for each of the 4 profiles. Refer to the procedures in [Appendix D](#) to configure the profiles for use with a SuperK COMMAND module.



NOTE: As stated to implement fast wavelength switching mode, a SuperK COMMAND module must be integrated with the system. Refer to [Appendix D](#) for detailed information.

Figure 41 Fast wavelength switching mode

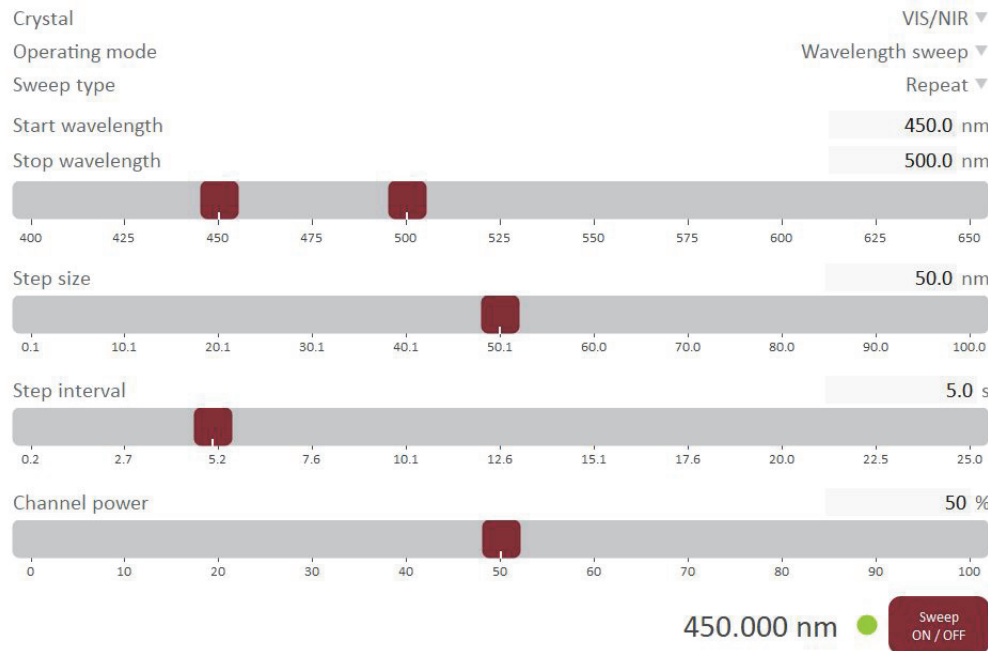


Wavelength sweep mode The “Wavelength sweep” mode allows for a relatively slow wavelength sweep/step function. You can set a range of wavelengths to step through and repeat

as long as the *Sweep* button is clicked ON. [Figure 42](#) shows an example of a *Wavelength sweep* configuration with description below.

Figure 42 Wavelength sweep

Channels



Wavelength sweep example

In [Figure 42](#), Wavelength sweep mode is set to perform the following sweep:

- *Start wavelength* is 400 nm
- *Stop wavelength* is 500 nm
- *Step size* is 50 nm
- *Step interval* is 5 seconds
- *Channel power* is 50%

For this example, three wavelengths are repeatedly selected: 400, 450 and 500 nm. The system emits 400 nm for 5 seconds then 450 nm for 5 seconds and finally 500 nm for 5 seconds before repeating the sweep. You can set the controls as desired to achieve any sweep possible within the setting limits.

A Specifications

Table 5 Optical

Parameter	
Number of tunable lines	1 – 8 (per AOTF)
Filter bandwidth of AOTF (UV-VIS) 1) [nm]ⁱ	1.8 – 8.5
Filter bandwidth of AOTF (VIS1x/VIS4x) 1) [nm]ⁱ	0.5 – 1.85 / 2.5 – 8.5
Filter bandwidth of AOTF (VIS-nIR) 1) [nm]ⁱ	3.5 – 14
Filter bandwidth of AOTF (nIR1/nIR2) 1) [nm]ⁱ	1.8 – 5 / 2.6 – 9.6
Filter bandwidth of AOTF (IR) 1) [nm]ⁱ	6.4 – 19.8
AOTF deflection efficiency [%]	> 90 (1 – 8 channel operation)
Polarizationⁱⁱ	Linear
Output mode	Fiber or free-space collimated
Mechanical shutter	Integrated for both ports
Laser safety interlock	Integrated

i. Collimated free-space output, FWHM bandwidth.

ii. Horizontal with respect to base.

Table 6 Interfaces

All Chassis Models	
External bus	DB-15 Female
Monitor	BNC (Optional - Custom feature, contact NKT Photonics)

Table 7 Mechanical dimensions

Specification	Select Module	External RF Driver
Size (H x W x D)	68 x 272 x 212 mm	66 x 441 x 370 mm
Weight	7.9 kg	5.0 kg

Table 8 Electrical specifications – External RF Drivers

Specification	
Supply voltage	100 to 240 VAC
Power dissipation	60 W maximum
Fuse	T2A/250V

Table 9 Operating and storage environment

Specification	Select Module	External RF Driver
Operating Temperature	18°C to 28°C	15°C to 37°C
Storage Temperature	-20°C to 50°C	N/A
Operating Humidity (non-condensing)	20 to 80% RH	20 to 80% RH
Operating Altitude	3000 m maximum	N/A
Operating Air Pressure	700 hPa to 1060 hPa	N/A

Table 10 Safety and regulatory compliances

Safety	Regulatory
EN 60825-1:2014: Safety of laser products Part 1: Equipment classification and requirements [Laser Class 4]	2014/30/EU: EMC directive 2014/35/EU: Low Voltage directive
EN 61010-1:2010: Safety requirements for electrical equipment for measurement, control, and laboratory use Part 1: General requirements	EN 61326-1:2013: Electrical equipment for measurement, control and laboratory use EMC requirements – Part 1: General requirements

Figure 43 Mechanical dimensions – Select module

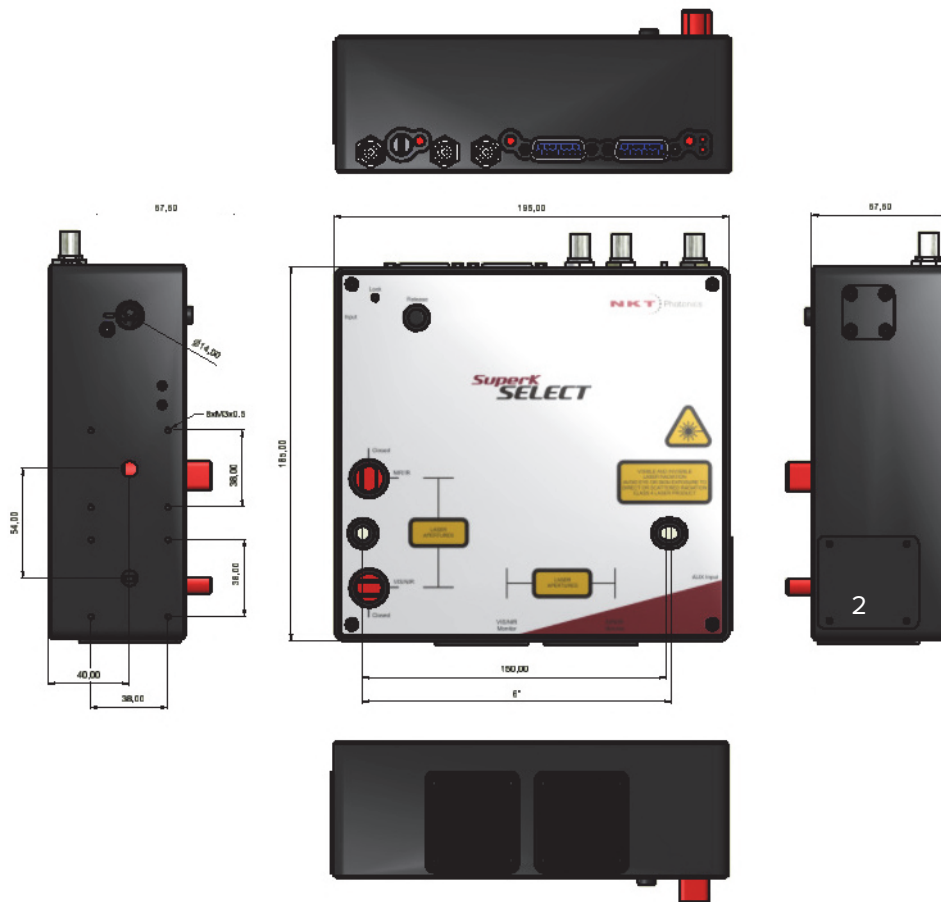
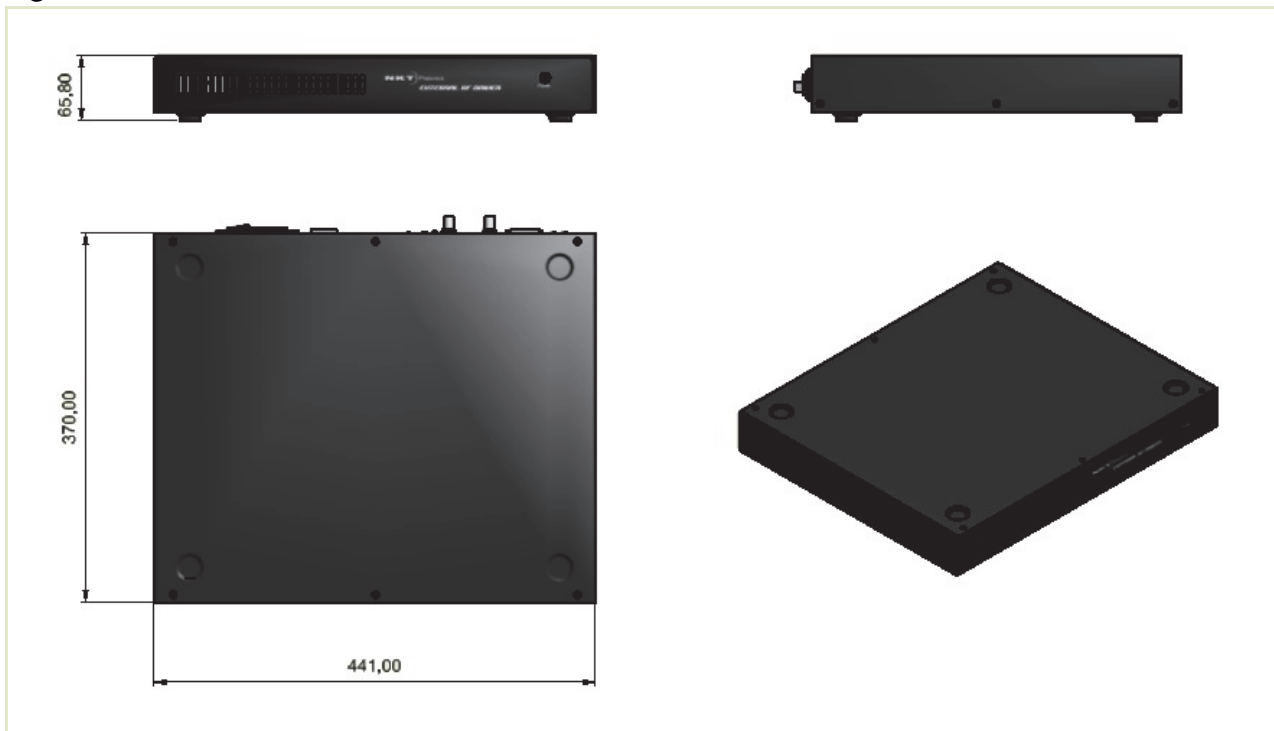


Figure 44 Mechanical dimensions – External RF Driver



B Service and Support Information

Servicing

The accessory has no user serviceable components. In case of malfunction, contact NKT Photonics using the support channels in section “[Support Contact Details](#)”.



CAUTION: Do not open the accessory chassis. The accessory is equipped with warranty labels (see [Figure 45](#)) on the covers of the its chassis. The warranty is void if the system is opened.

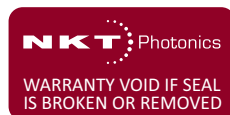


CAUTION: The accessory contains electro-static discharge (ESD) sensitive components. To avoid permanent ESD damage, use ESD protection precautions when handling the accessory. Always connect the accessory’s earth point to a ground earth within your facility.

Opening the chassis There are no user serviceable components inside the accessory chassis. Should your accessory malfunction, and it cannot be serviced on site, it must be shipped to the NKT Photonics office in Denmark.

WARRANTY VOID IF REMOVED label The unit is sealed with a label “WARRANTY VOID IF REMOVED”. It is strictly prohibited to remove the chassis cover.

Figure 45 Warranty seal



Support Contact Details

For technical or general support, NKT Photonics can be contacted for help regarding issues and questions with your accessory.

Online Support Web-page

1. Go to:

<https://www.nktphotonics.com/support/>

2. Scroll down and click or press:



3. Select the type of help required, fill in the form, and click or press *Submit*.

Shipping Address NKT Photonics A/S
Blokken 84
DK-3460 Birkerød
Denmark

C CONTROL Software

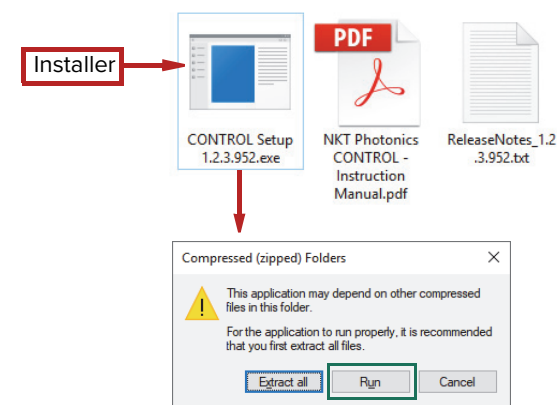
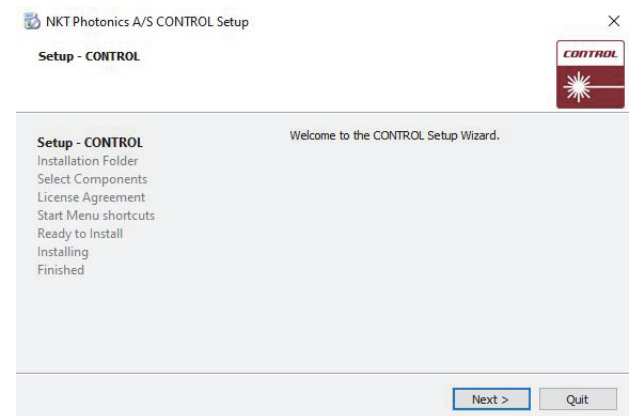
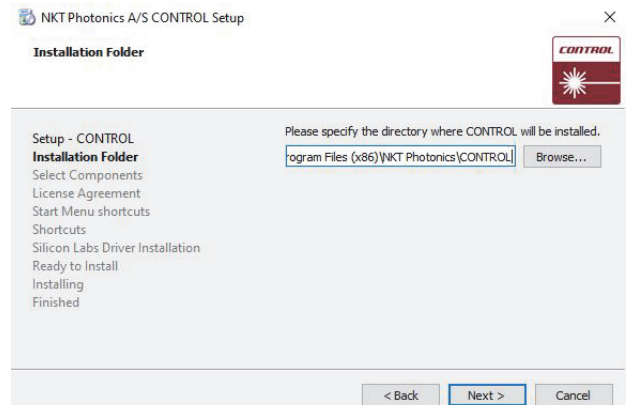
Installing CONTROL

Download the software from:

<https://www.nktphotonics.com/support/>

Follow the steps in [Procedure 6](#).

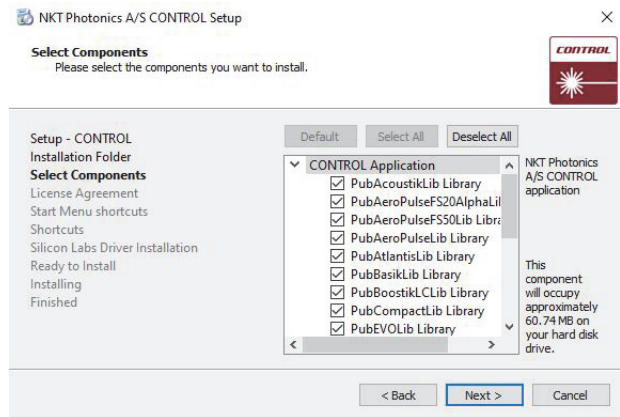
Procedure 6 Installing CONTROL

	Action
1	<p>On the PC, launch the installer package and then click the Run button.</p> 
2	<p>The installation wizard appears.</p> <p>Click Next to continue.</p> 
3	<p>Accept to use the default installation directory or select another directory by clicking the <i>Browse</i> button.</p> <p>Click <i>Next</i> to continue.</p> 

Action

- Uncheck the components you do not require. By default, all components are installed.

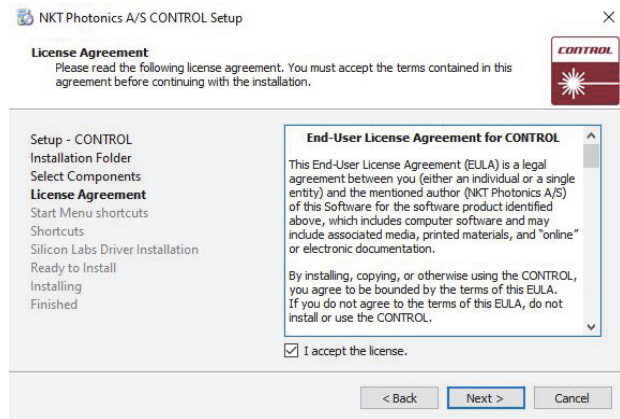
Click *Next* to continue.



- Read the End-User License Agreement, and check “I accept the license.” box.

Not checking the box ends the installation wizard.

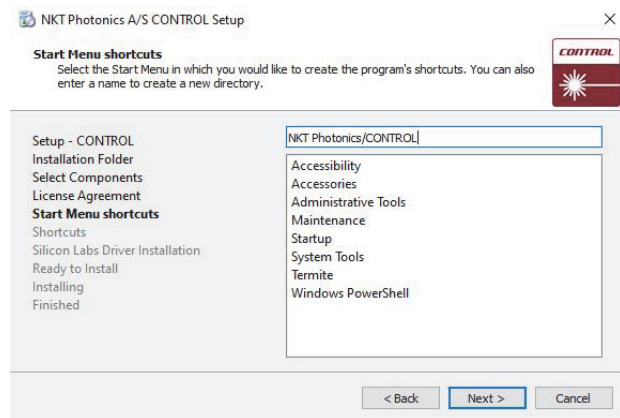
Click *Next* to continue.



- The wizard creates a start menu folder with program short-cuts.

Use the default name or enter a new name for the folder.

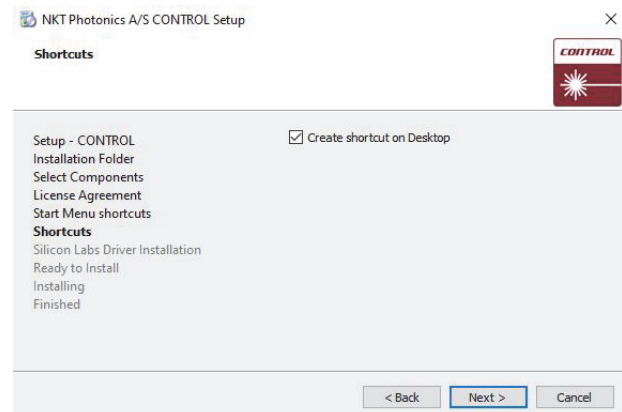
Click *Next* to continue.



Action

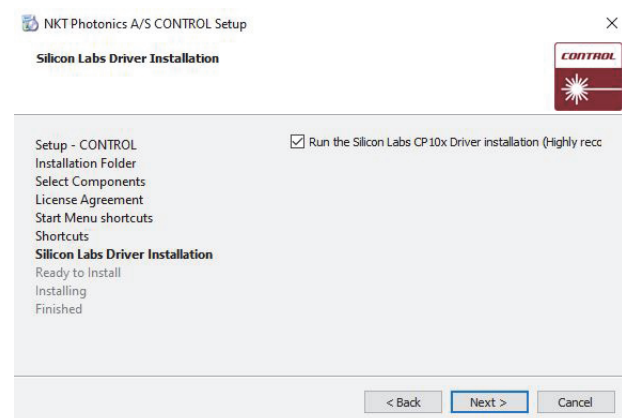
- 7 Check the box to create a desktop shortcut to access Control.

Click *Next* to continue



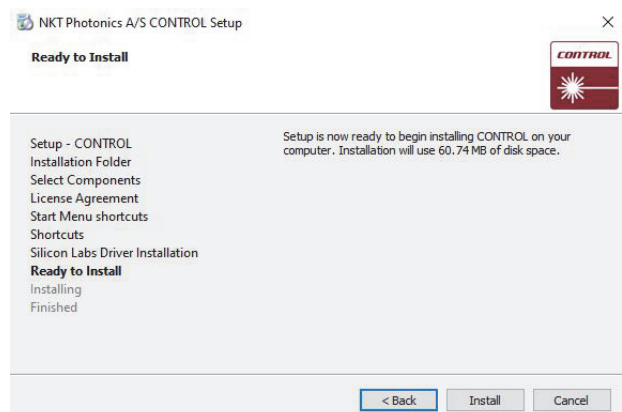
- 8 Check the 'Run the Silicon Labs CP10x driver installation' box and click *Next*.

Note: If you do not have the driver installed USB connectivity will fail.



- 9 Click *Install* to install NKTP CONTROL software on your PC.

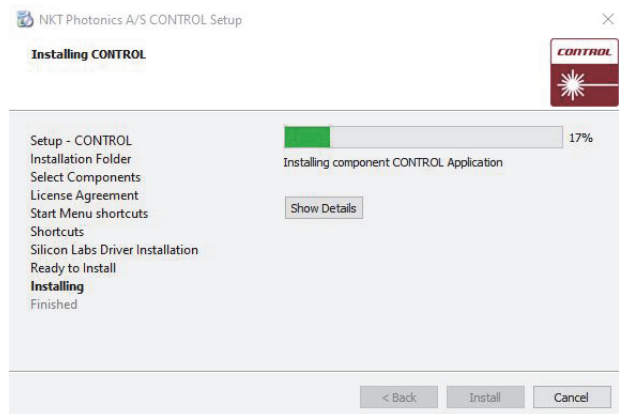
Click *Cancel* if you want to abort the installation..



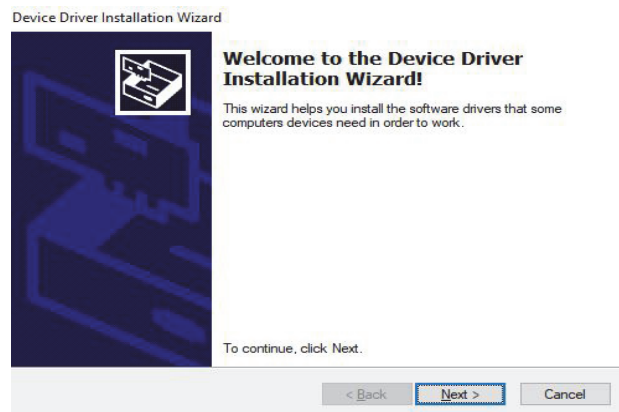
Action

10 The wizard displays a progress meter for the installation.

Note: a normal install should only take a few seconds.

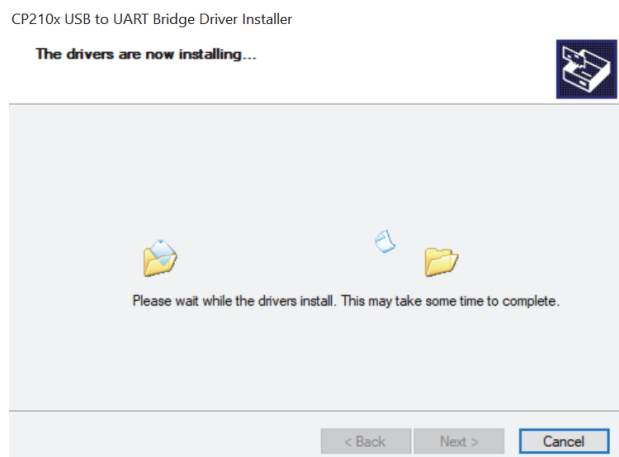


11 Click *Next* to install the UART drivers for the PC USB port.



12 The drivers are installed.

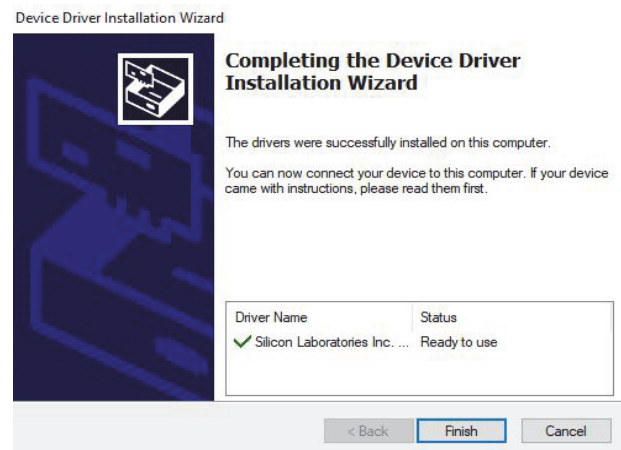
Note: Depending on your computer this occurs so fast you may not see this.



Action

13 The Silicon Labs drivers is installed successfully.

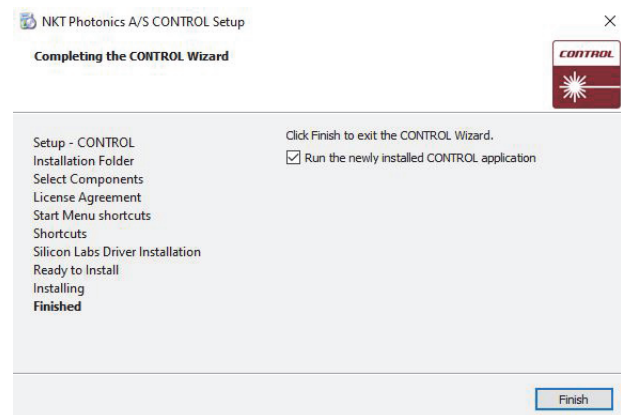
Click *Finish* to end the driver installation.



14 CONTROL is now installed.

Check the Run box to launch CONTROL when the *Finish* button is clicked.

Click *Finish* to end the installation wizard.

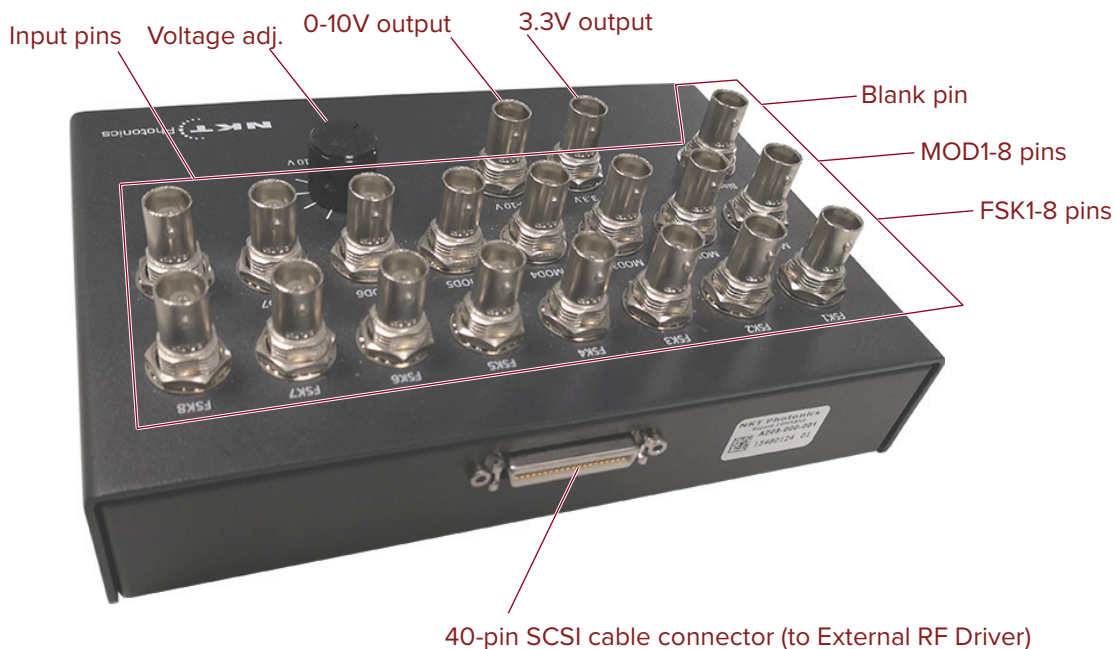


D Using a SuperK COMMAND module

Description

A SuperK COMMAND is a multi-input module that connects to the RF driver of a SELECT system. The module accepts timing and modulation signals from external applications. These signals are then used to drive and synchronize fast wavelength switching and amplitude modulation of the output beam from an AOTF crystal of a SuperK SELECT system. When using a COMMAND module, the system can achieve wavelength switching based on external signal input at speeds down to 10 microseconds.

Figure 46 COMMAND electrical connectors



All input pins are BNC connectors and include:

- **8 FSK** pins (FSK 1 to 8) – these pins typically connect to a logic signals from an application of interest. The FSK pins are used to select the AOTF's configured wavelength profiles and their respective channels.
- **8 Modulation** pins (MOD 1 to 8) – A modulating signal can also be applied to modulate the emission amplitude. Note that these pins must be pulled high when the FSK pins and the BLANK pin are used for wavelength or profile selection.
- **1 Blank** pin – The BLANK pin or blanking pin accepts a logic low or logic high. The pin is used in combination with the FSK pins to select a wavelength or profile from the CONTROL configuration. Switching or selection of wavelengths or profiles is based on truth tables.

Truth tables

When using a COMMAND module with the SELECT, wavelength or profile selection is based on truth table results from a combination of the input signals. The result determines the wavelength of a channel or entire profile as configured in CONTROL. Examples of this are described in section “[Signaling and CONTROL configuration](#)” on page 71.

Connect to a SuperK SELECT system

40-pin cable

The COMMAND module includes a straight through 40-pin cable which must be connected from the COMMAND module to the ERD’s Modulation connector (see “[Modulation connector](#)” on page 25).

Figure 47 shows the cable connected from the COMMAND module to the ERD.



CAUTION: Ensure all SuperK system modules are powered OFF before connecting the COMMAND module

Figure 47 Connecting a COMMAND module



External signal requirements Electrical specifications for the COMMAND inputs are shown in

Table 11 COMMAND input specifications

Pin	Value	Comment
FSK1 to FSK8	0-3.3 V or TTL	
MOD1 to MOD8	0-1 V, 0-5 V, 0-10 V	Configured in CONTROL
BLANK	0-3.3 V or TTL	

Signaling and CONTROL configuration

For fast wavelength switching, CONTROL configuration determines the wavelengths. Signals connected to the COMMAND module determine the wavelength(s) selected from the configuration. Refer to the figures in the following examples to see how channel configuration relates to the input signals connected to the COMMAND module from an application.

2 or 4-channel FWS For switching 2 or 4 individual wavelengths, connect application signals to module pins **Blank** and **FSK1**. [Table 12](#) shows a truth table demonstrating the wavelengths selected based on the input signals levels from your application.

[Figure 48](#) shows the configuration in CONTROL and how the configuration is selected based on the signal levels at the two pins. To set up 2 or 4-channel fast wavelength switching, follow the steps in [Procedure 7](#).

Table 12 2 or 4 channel FWS truth table

FSK1	Blank	Wavelength selected
Low	Low	Profile 1 Channel 1
High	Low	Profile 2 Channel 1
Low	High	Profile 3 Channel 1
High	High	Profile 4 Channel 1

Procedure 7 Setting up 2 or 4 channel fast wavelength switching

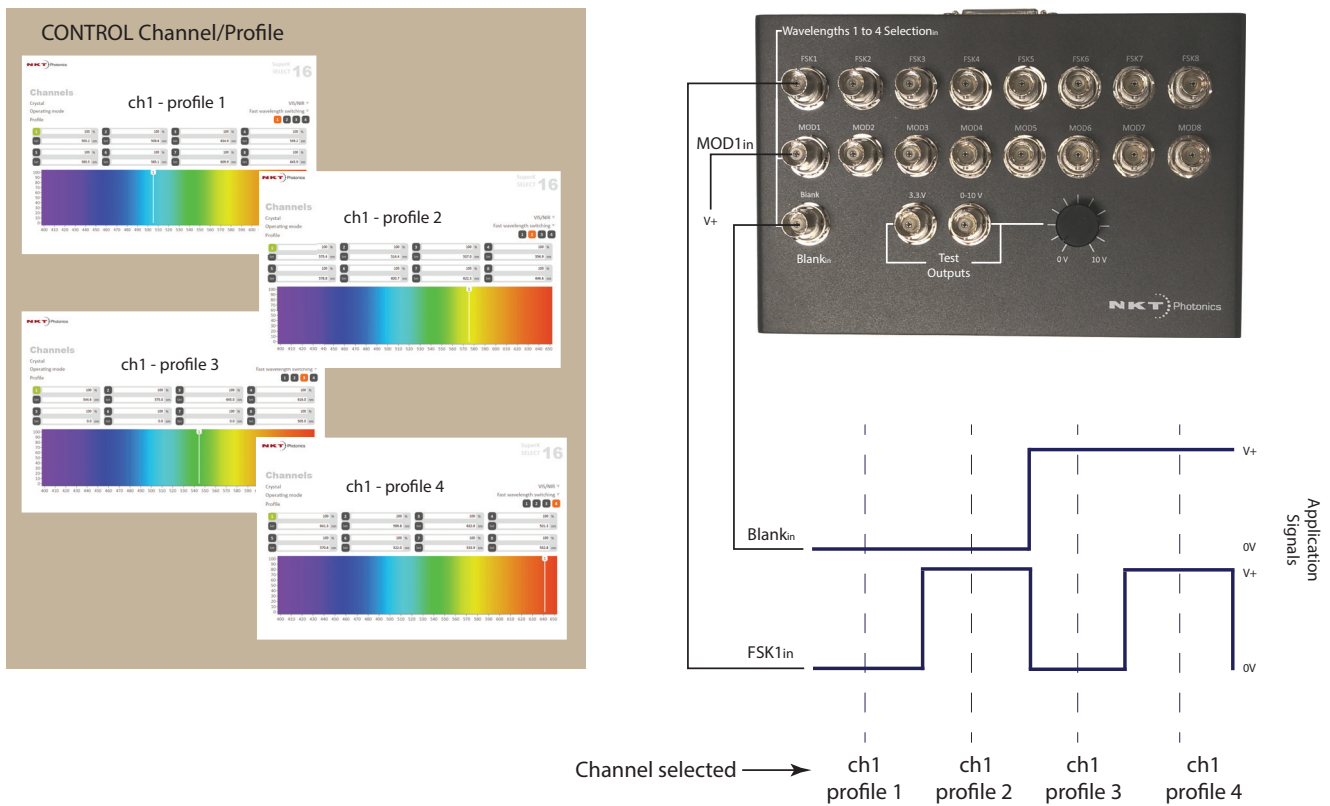
1. In CONTROL, click on the SELECT device icon and set the *Operating mode* to *Fast Wavelength Switching*.
2. Select either the VIS/NIR or NIR/IR crystal.
3. Set the modulation gain in the Setup page to the 0-5 V range (see [“VIS/NIR or NIR/IR modulation gain”](#) on page 49).
4. In each of the 4 *Profiles*, configure channel 1 with a desired wavelength. When only 2 wavelength switching is required, you can configure channel 1 in the first two profiles only. [Figure 48](#) shows channel 1 configured in each of the 4 profiles of a VIR/NIR crystal.



NOTE: Do not set channels 2 to 7 in the four profiles, leave them OFF.

5. Set the power level desired in one of the profile channels. This sets the power level to be identical for all configured channels in each profile.
6. Using a BNC cable, connect the MOD1 pin to the +3.3 V output pin on the COMMAND. When wavelengths are switched with constant amplitude, the MOD pin must be pulled high.
7. Connect the FSK1 and BLANK pins to your application.
8. The system is ready and channels are selected based on the signals shown in Figure 48.

Figure 48 Fast wavelength switching: 2 or 4 λ setup



Four 8-channel profile switching

The system is also capable to switch the AOTF across all four 8-channel profiles in *Fast Wavelength Switching* mode by connecting application signals to module pins **Blank** and **FSK1**. Table 12 shows a truth table demonstrating the profiles selected based on the input signals levels.

Figure 49 shows the configuration in CONTROL and how the profiles are selected based on the input signals to the two pins. To set up four 8-channel profile switching, follow the steps in Procedure 8.

Table 13 4 profile FWS truth table

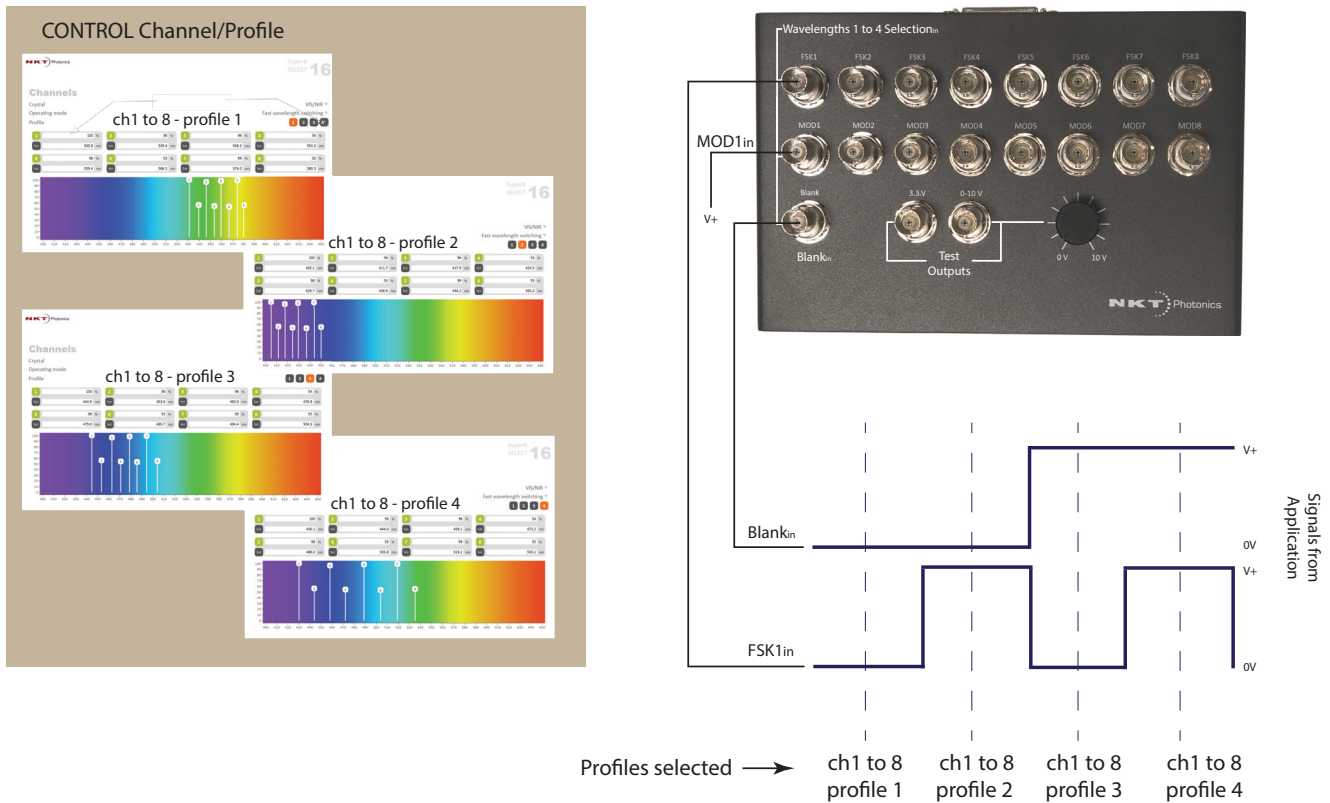
FSK1	Blank	Profile selected
Low	Low	Profile 1 Channels 1 to 8
High	Low	Profile 2 Channels 1 to 8

Low	High	Profile 3 Channels 1 to 8
High	High	Profile 4 Channels 1 to 8

Procedure 8 Setting up four 8-channel profile switching

1. In CONTROL, click on the SELECT device icon and ensure the mode is set to *Fast Wavelength Switching*.
2. Select the VIS/NIR or NIR/IR crystal.
3. Set the modulation gain in the Setup page to the 0-5V range (see “VIS/NIR or NIR/IR modulation gain” on page 49).
4. In each of up to 4 *Profiles*, configure from 2 to 8 *Channels*. Each profile can have multiple desired wavelengths set ON. Figure 49 shows 4 profiles each with 8 channels configured for a VIR/NIR crystal.
5. Set the power level desired of the profile channels. This sets the power level to be identical for the same channels in each profile.
6. Using a BNC cable, connect the MOD1 pin to the +3.3 V output pin on the COMMAND. When profiles are switched with constant amplitude, the MOD pin must be pulled high.
7. Connect the FSK1 and BLANK pins to your application.
8. The system is ready and profiles are selected based on the signals shown in Figure 49.

Figure 49 Fast wavelength switching: 4 profile setup



16-channel FWS For switching of up to 16 individual wavelengths, connect application signals to module pins **Blank** and **FSK pins 1 to 8**. [Table 14](#) shows a truth table demonstrating the wavelengths selected based on the input signals from your application.

Use profile 2 to configure the first 8 channels and profile 4 to configure the next 8. [Figure 50](#) shows the configuration in CONTROL and how the configuration is selected based on the input signals to the nine pins. To set up 16-channel fast wavelength switching follow the steps in [Procedure 9](#).

Table 14 16-channel FWS truth table

FSK1	FSK2	FSK3	FSK4	FSK5	FSK6	FSK7	FSK8	Blank	Wavelength selected
High	Low	Low	Low	Low	Low	Low	Low	Low	Profile 2 Channel 1
Low	High	Low	Low	Low	Low	Low	Low	Low	Profile 2 Channel 2
Low	Low	High	Low	Low	Low	Low	Low	Low	Profile 2 Channel 3
Low	Low	Low	High	Low	Low	Low	Low	Low	Profile 2 Channel 4
Low	Low	Low	Low	High	Low	Low	Low	Low	Profile 2 Channel 5
Low	Low	Low	Low	Low	High	Low	Low	Low	Profile 2 Channel 6
Low	Low	Low	Low	Low	Low	High	Low	Low	Profile 2 Channel 7
Low	Low	Low	Low	Low	Low	Low	High	Low	Profile 2 Channel 8
High	Low	Low	Low	Low	Low	Low	Low	High	Profile 4 Channel 1
Low	High	Low	Low	Low	Low	Low	Low	High	Profile 4 Channel 2
Low	Low	High	Low	Low	Low	Low	Low	High	Profile 4 Channel 3

Low	Low	Low	High	Low	Low	Low	Low	High	Profile 4 Channel 4
Low	Low	Low	Low	High	Low	Low	Low	High	Profile 4 Channel 5
Low	Low	Low	Low	Low	High	Low	Low	High	Profile 4 Channel 6
Low	Low	Low	Low	Low	Low	High	Low	High	Profile 4 Channel 7
Low	Low	Low	Low	Low	Low	Low	High	High	Profile 4 Channel 8

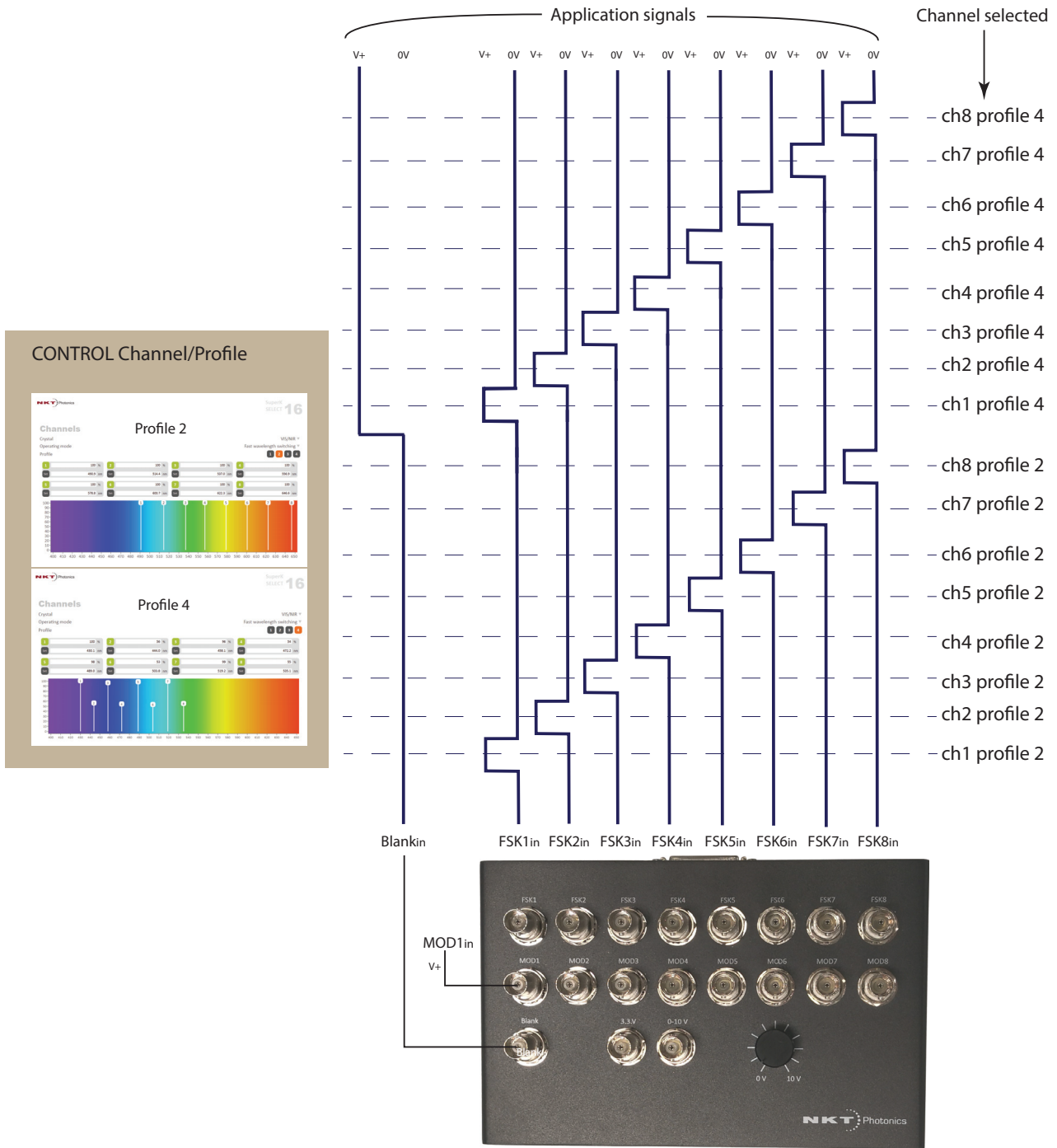


NOTE: You can also configure 16 wavelengths using profiles 1 and 3; however, the logic of the signaling required for wavelength selection is reversed at the COMMAND module.

Procedure 9 Setting up 16-channel fast wavelength switching

1. In CONTROL, click on the SELECT device icon and ensure the mode is set to *Fast Wavelength Switching*.
2. Select the VIS/NIR or NIR/IR crystal.
3. Set the modulation gain in the Setup page to the 0-5V range (see “VIS/NIR or NIR/IR modulation gain” on page 49).
4. In each *Profile 2* and *4*, configure 2 to 8 channels with their desired wavelengths. [Figure 50](#) shows 8 channels configured in profiles 2 and 4 of a VIR/NIR crystal.
5. Set the power level desired for a channel. The power level across profile channels is constant. For example if you set channel 2 in profile 2 to 50%, the power level of channel 2 in profile 4 will also be 50%.
6. Using BNC cabling and splitters, connect the **MOD1 to 8** pins to the +3.3 V output pin on the COMMAND. When wavelengths are selected with FSK inputs, the corresponding MOD pin must be pulled high.
7. Connect the **FSK1 to 8** and **BLANK** pins to your application.
8. The system is ready and channels are selected based on the signals shown in [Figure 50](#).

Figure 50 Fast wavelength switching: 16 λ setup



Modulating emission power To modulate the amplitude of selected channels, a modulating signal can be connected to the MOD1-8 signals (i.e. instead of them being pulled high). For four-channel or four-profile FWS configurations only MOD1 is connected to a varying signal to modulate the channels. Use MOD1 to MOD8 as needed to modulate channels in a 16-channel FWS configuration.

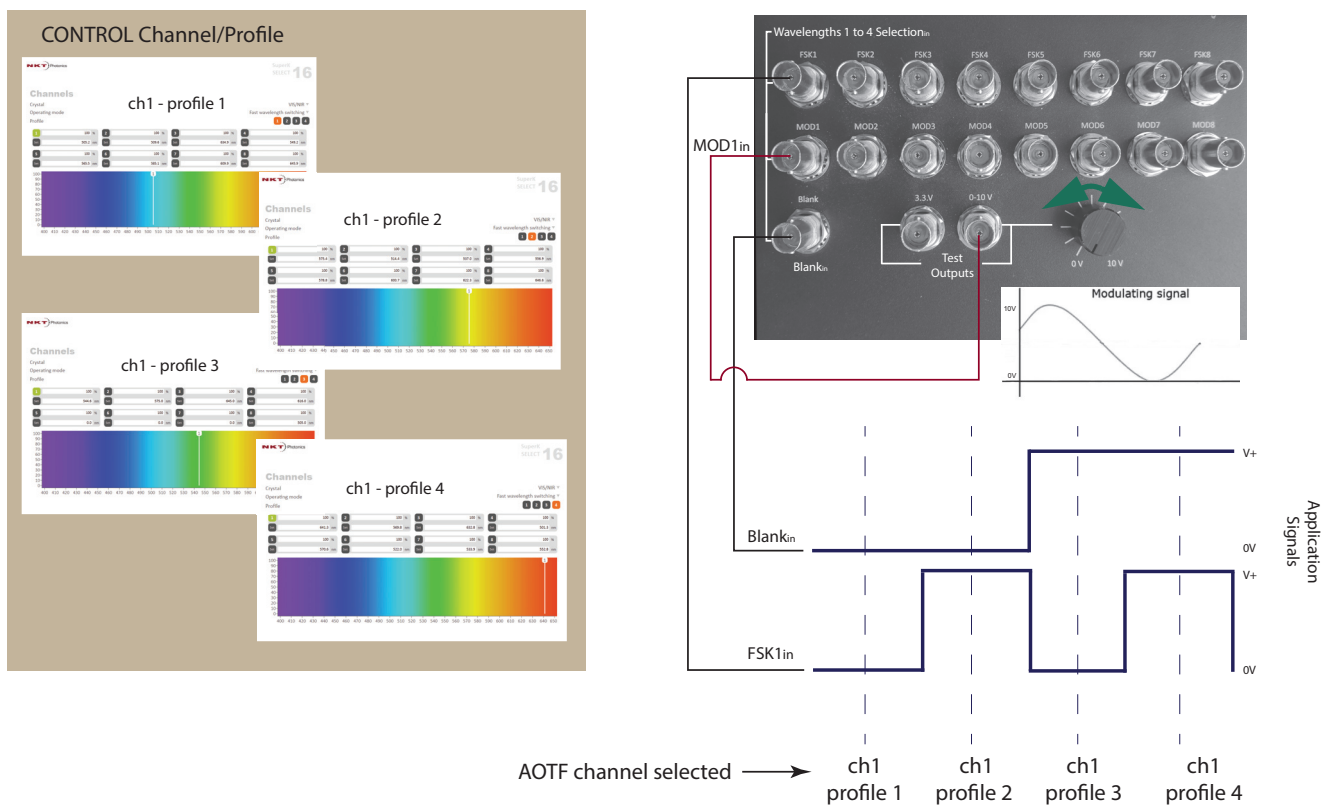
Modulation amplitude

CONTROL must be configured for the modulation signal range. See “VIS/NIR or NIR/IR modulation gain” on page 49.

Simulate modulation

1. Using a 4-channel FWS configuration, connect the 0-10 V output pin of the COMMAND to MOD1 instead of the +3.3 V output.
2. Set the modulation gain in the Setup page to the 0-10 V range (see “VIS/NIR or NIR/IR modulation gain” on page 49).
3. With the system running, vary the voltage of the 0-10 V pin using the adjustment knob next to the pin.
4. Observe that the output emission level varies directly with the 0-10 V output pin voltage.

Figure 51 Fast wavelength switching: simulated modulated 4 λ setup



Item:
Customer Revision:
NKT Photonics Revision:
Release Date:

800-614-01
1.3
2-0
10-2023

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