

doric

Integrated Connectorized Fluorescence Mini Cubes

User Manual

Version 1.0.3

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Overview

1.1 Integrated Connectorized Fluorescence Mini Cube

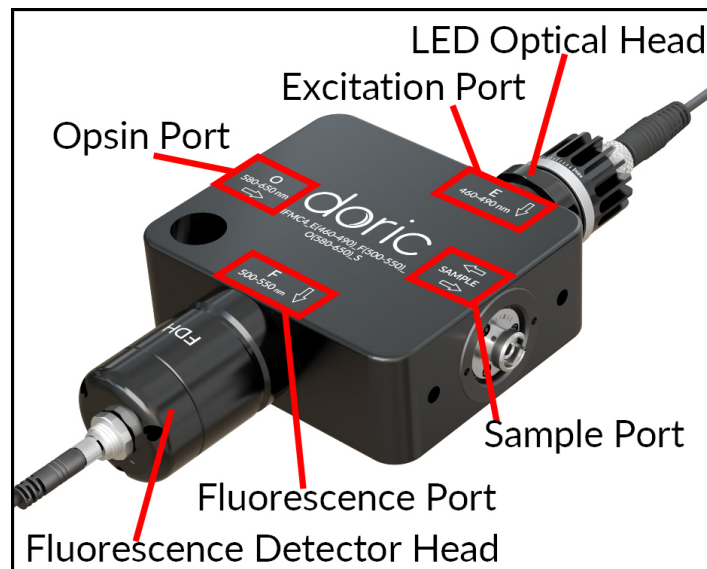


Figure 1.1: 4-port Fluorescence Mini Cube

The *integrated Fluorescence Mini Cube* is an optical assembly that allows the combination of multiple excitation and detection signals. The cubes are classified by their number of ports, with 3, 4, 5, 6 and 7 port cubes available. The ports are each classified according to their usage, and are also qualified by a wavelength band corresponding to the bandwidth of optical filters within the cube.

- **E** and **IE** (Fig. 1.1) represent entry ports for fluorescence and isosbestic point excitation light. Each port of this type comes with a *Built-in LED Optical Head* that contains the following elements.
 - The **Intensity Adjustment Ring** (Fig. 1.2a) allows additional adjustment of the overall output intensity of light.
 - The **M8 connector port** (Fig. 1.2a) is used to connect the optical head to the *LED Driver* using a *Male-Female M8 Cable*.
 - The **Heat-sink Fins** (Fig. 1.2a) are used to evacuate heat from the light source, allowing stable output power. Ensure the fins are not blocked to allow proper cooling.
- **F** (Fig. 1.1) represents ports for fluorescence emission light. Each port of this type comes with a *Built-in Doric Fluorescence Detector Head*.

- The **M5 Connector** (Fig. 1.2b) allows the *Fluorescence Detector Head* to be connected to the *Fluorescence Detector Amplifier* using an M5 male/male connection cable.
- For extremely low light level applications, the fluorescence ports (F, F1, etc.) can have a *Built-in Photomultiplier Tube* rather than a *Built-in Fluorescence Detector Head*.
- **O** (Fig. 1.1) represents optogenetic activation or silencing ports. These are always FC receptacles to allow connection to laser or fluorescence light sources.
- **S** (Fig. 1.1) represents the exit port to the sample. These are always FC receptacles to allow connection to an experimental subject.

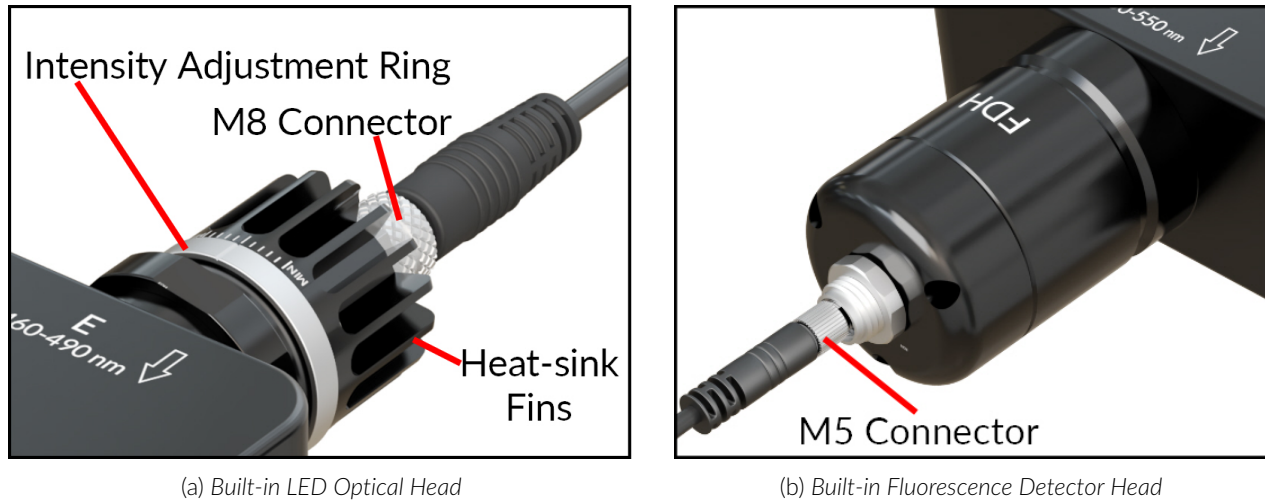


Figure 1.2: iFMC Built-in components

1.2 Fluorescence Detector Head

The Fluorescence Detector Amplifier amplifies the signal coming from the detector head and transmits it to a recording system using a BNC output. It contains the following elements.

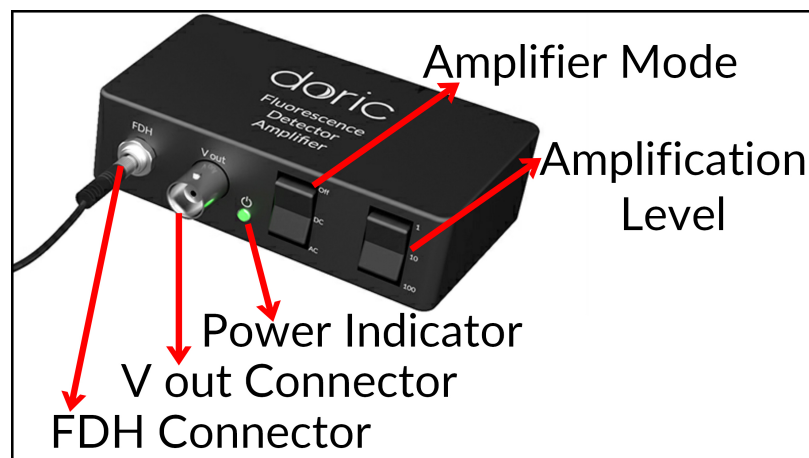


Figure 1.3: Doric Fluorescence Detector Amplifier Elements

- The **FDH Connector** (Fig. 1.3) is an M5 type connector used to link the amplifier and the head using a shielded M5 cable.

- The **V out Connector** (Fig. 1.3) is a BNC type connector used to connect the fluorescence detector with a DAQ system.
- The **Power Indicator** light (Fig. 1.3) shines green when the detector is on.
- The **Amplifier Mode** switch (Fig. 1.3) is used to switch the detection mode from **Off** to **AC** or **DC**.
- The **Amplification Level** switch (Fig. 1.3) allows the choice of amplification levels at 1, 10 or 100 times.
- The **Power Supply** connector, located on the back of the unit, is used to connect the 12 V power supply to the amplifier.

1.3 Electrical Cables

The *Integrated Fluorescence Mini Cube* is provided with two electrical cable types. The *Fluorescence Detector Cable* is a shielded twisted pair M5 connectorized electrical cable used to connect the *Built-in Fluorescence Detector Head* and the *Fluorescence Detector Amplifier*. The *Optical Head Cable* is a male-female M8 connectorized cable used to connect the *Built-in Optical Head* to a *LED Driver*.

1.4 Integrated Fluorescence Mini Cube With 3 Ports



Figure 1.4: 3-port Integrated Fluorescence Mini Cube

The 3-port Integrated Fluorescence Mini Cube Configuration (Fig. 1.4) has a single excitation port **E** and a single fluorescence port **F**. Currently available models include configurations for **GFP-like** (Table 1.1) and **RFP-like** (Table 1.2) fluorophores.

Table 1.1: GFP-like Configurations

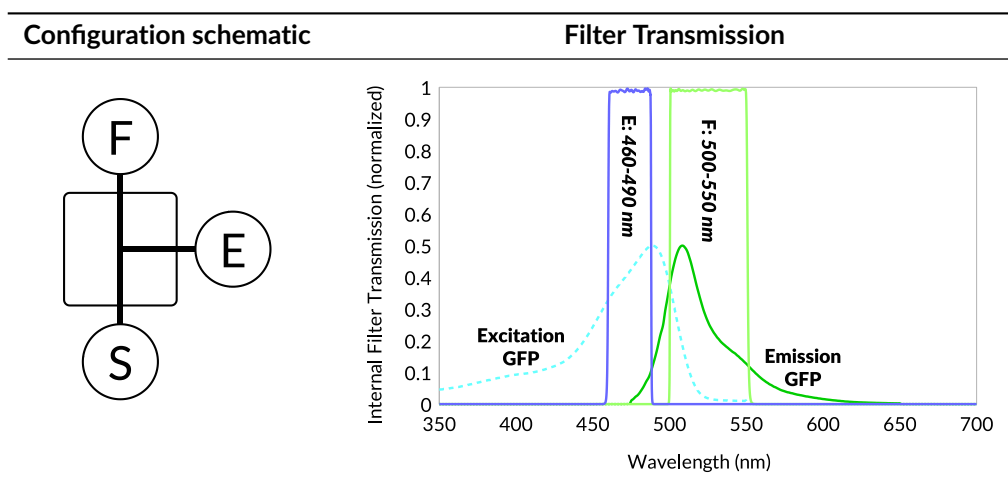
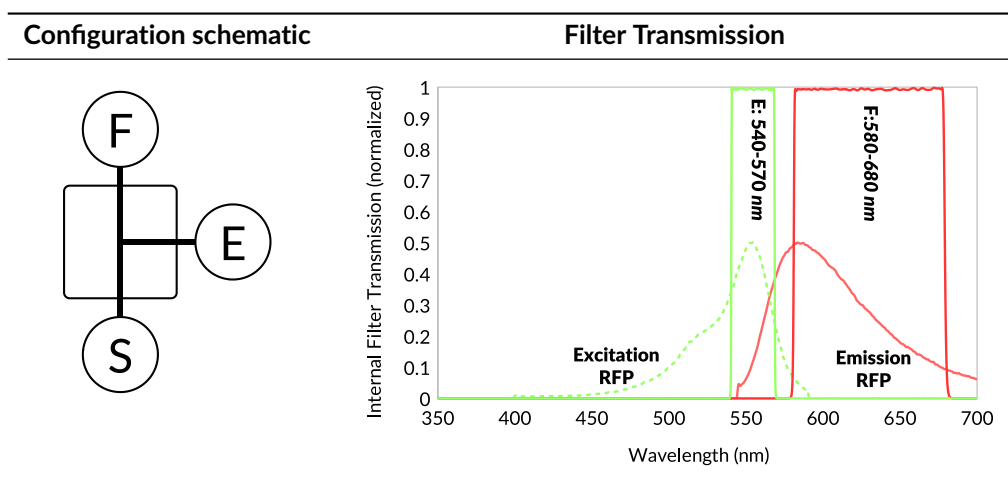


Table 1.2: RFP-like Configurations



1.5 Integrated Fluorescence Mini Cube With 4 Ports



Figure 1.5: 4-port Integrated Fluorescence Mini Cube

The 4-port Integrated Fluorescence Mini Cube (Fig. 1.5) has several different popular configurations.

- The first involves an excitation **E**, an optogenetic activation/silencing **O**, a fluorescence detection **F** and sample **S** ports. Such cubes are used for **GCaMP** fluorescence measurement combined with the activation of **red opsins** (Table 1.3).
- The second involves a fluorescence excitation **E**, isosbestic point excitation **IE**, a fluorescence detection **F** and sample **S** ports. This configuration can be used for **locked-in or sequential detection of autofluorescence** and **fluorophore excitation** (Table 1.4).
- The third involves a fluorescence excitation **E**, two fluorescence detection **F1/F2** and sample **S** ports. This configuration can be used for **CFP-YFP FRET experiments** (Table 1.5).

Table 1.3: Excitation, Fluorescence and Opsin Activation

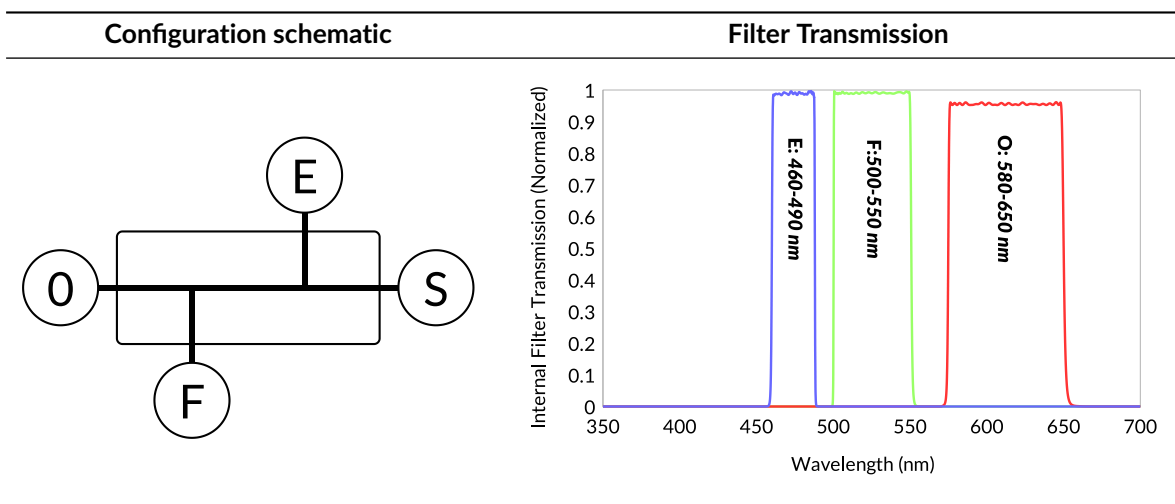


Table 1.4: Locked-in or Sequential Detection of GCaMP Isosbestic and Functional Excitations

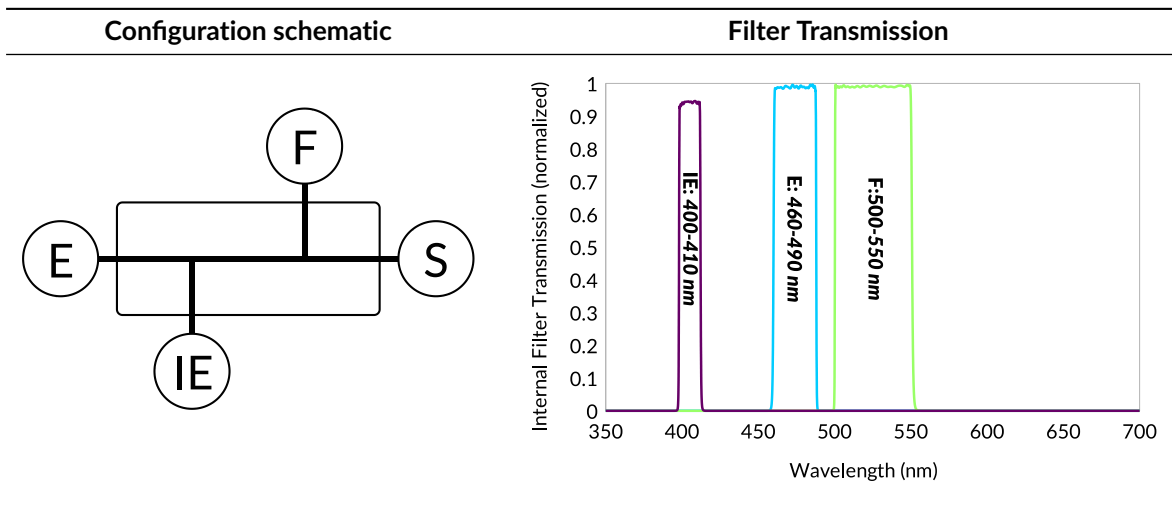
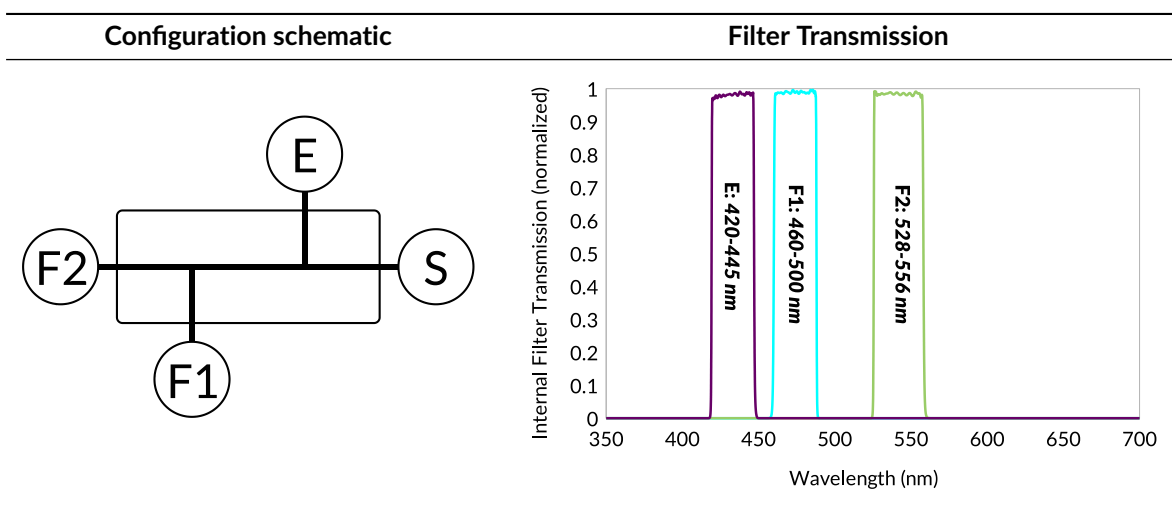


Table 1.5: CFP-YFP FRET Cube (One Excitation and Two Fluorescence Detection Ports)



1.6 Integrated Fluorescence Mini Cube With 5 Ports



Figure 1.6: 5-port Integrated Fluorescence Mini Cube

The 5-port Integrated Fluorescence Mini Cube (Fig. 1.6) has two different popular configurations.

- The first involves a fluorescence excitation **E1**, an isosbestic point excitation **IE**, two fluorescence detection **F1,F2** and sample **S** ports. This configuration can be used to separate the **isosbestic point** and **fluorescence** with minimal cross-talk (Table 1.6).
- The second involves two excitation **E1/E2**, two fluorescence detection **F1/F2** and a sample **S** ports. This configuration can be used for **green fluorophore** and **red fluorophore** excitation and detection (Table 1.7).

Table 1.6: GCaMP Isosbestic and Functional Excitations, and Opsin Activation

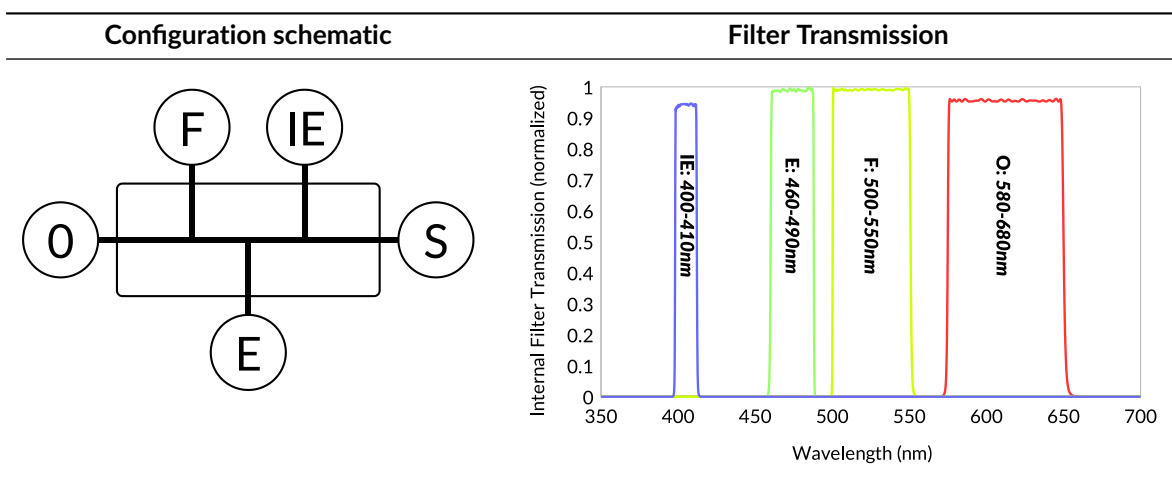
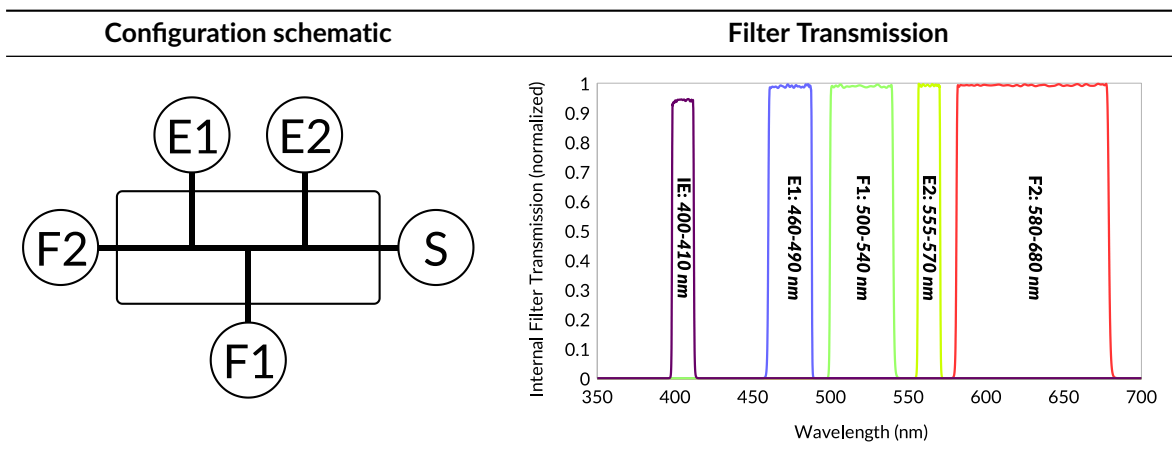


Table 1.7: Separated Two Fluorophores Fluorescence Cube



1.7 Integrated Fluorescence Mini Cube With 6 Ports

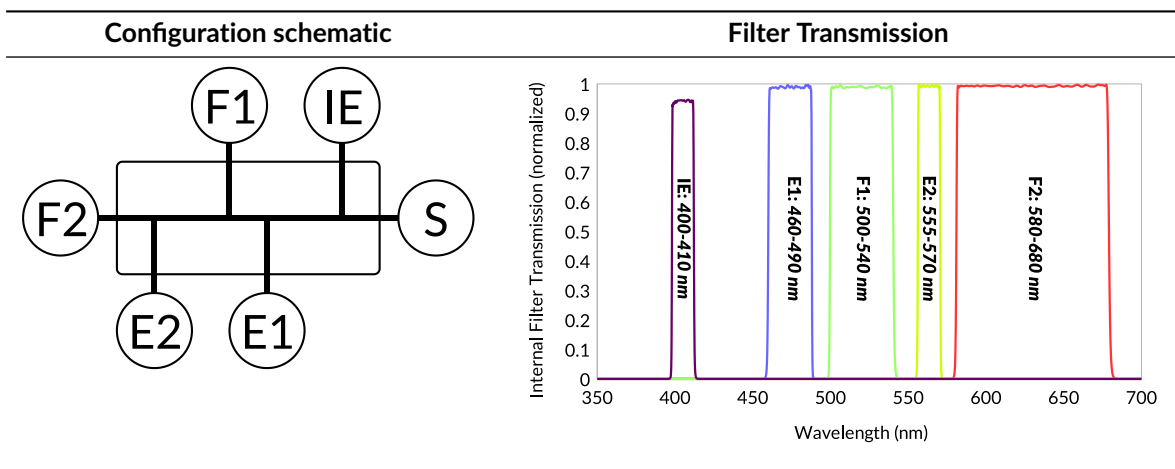


Figure 1.7: 6-port Integrated Fluorescence Mini Cube

The 6-port Fluorescence Mini Cube (Fig. 1.7) has one popular configuration.

- There are two excitation **E1/E2**, an isosbestic excitation **AE**, two fluorescence detection **F1/F2** and a sample **S** ports. This configuration can be used to detect the fluorescence of **two different fluorophores** in comparison with sample **isosbestic excitation** (Table 1.8).

Table 1.8: Two Fluorophores Fluorescence and GCaMP Isosbestic Excitation



1.8 Integrated Fluorescence Mini Cube With 7 Ports

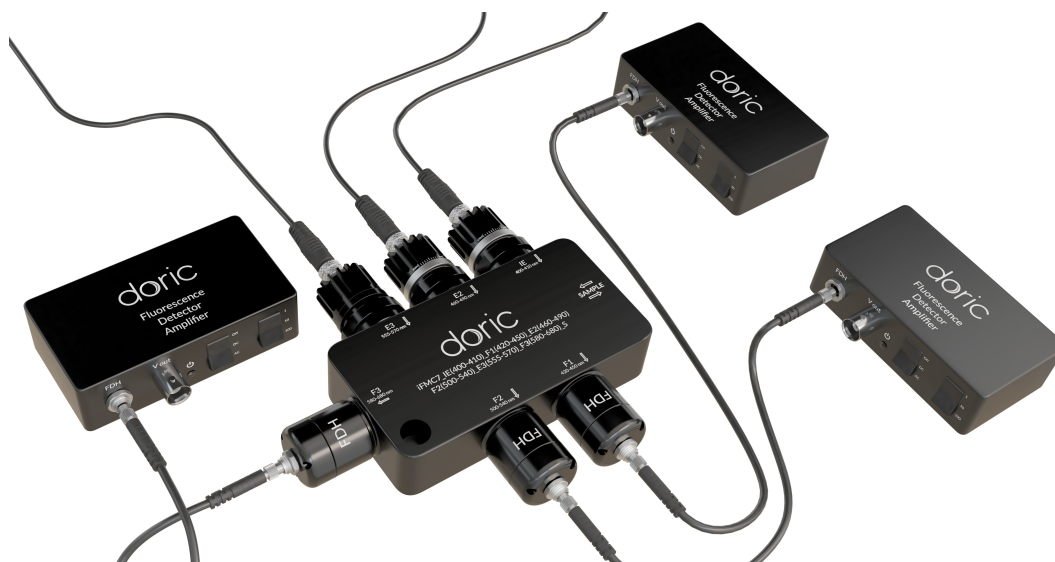
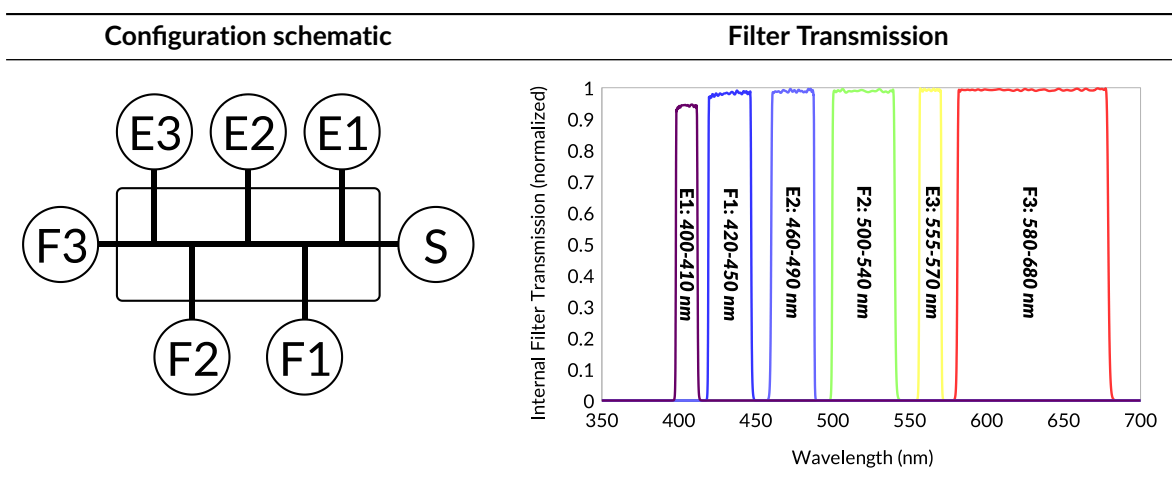


Figure 1.8: 7-port Integrated Fluorescence Mini Cube

The 7-port Integrated Fluorescence Mini Cube (Fig. 1.8) has a single popular configuration. The configuration involves three excitation **E1/E2/E3**, three fluorescence detection **F1/F2/F3** and one sample **S** port. This configuration can be used to detect the fluorescence of **three different fluorophores** simultaneously (Table 1.9).

Table 1.9: Three Fluorophores Fluorescence



Operations Guide

2.1 Getting Started

The usage of the *Fluorescence Mini Cube* is straightforward.

1. Each type of *Fluorescence Mini Cube* has a screw hole to secure the cube. The hole accepts 1/4 (or M6) screws.
2. Clean the connector end tips of the patch cords before connecting them to *Fluorescence Mini Cube*. Use isopropyl alcohol or a similar cleansing solution.
3. With an FC connector, the connector key must be oriented to enter within receptacle slot to ensure good connection (Fig. 2.1).

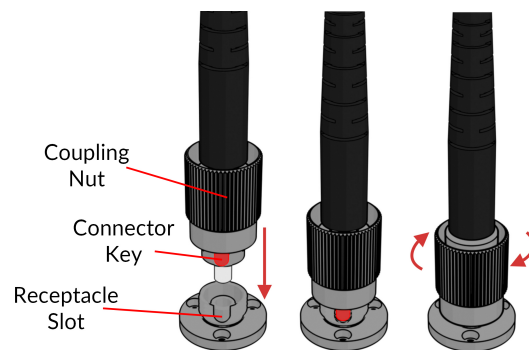


Figure 2.1: FC connector, Fiber Installation

- **⚠** To reduce the risk of eye injury, **it is sound practice to AVOID LOOKING DIRECTLY AT THE CONNECTOR OPENINGS** when the light source is turned on.
4. When not in use, place the plastic cap on the connectors for protection and cleanliness.

For its usage inside a system (Fig. 2.2), see [Fiber Photometry Application Note](#). For use with a photomultiplier tube (Fig. 2.3), see the [Photomultiplier Tube User Manual](#).

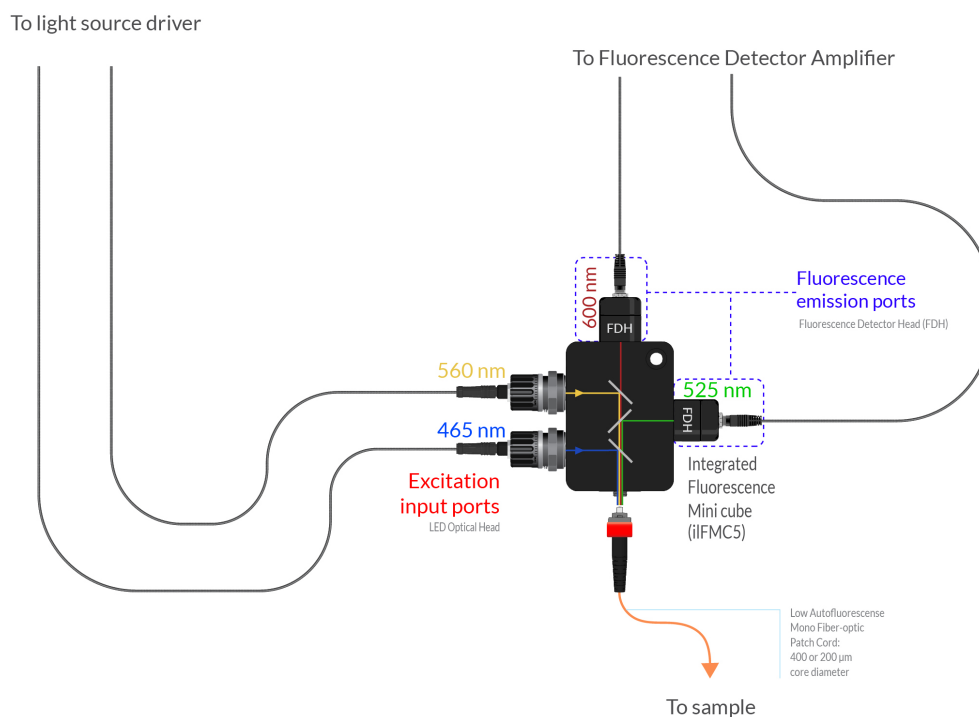


Figure 2.2: Connections to the Integrated Fluorescence Mini Cube

















Figure 2.3: Hamamatsu H10722-20 Photosensor modules directly attached to the Fluorescence Mini Cube

Specifications

3.1 Specifications

Table 3.1: Typical Connectorized LED Output Power vs Optical Fiber Core Diameter

LED	TYPICAL OUTPUT POWER @1000 mA (mW) ¹			Overdrive @2000 mA (pulsed)	Intensity Adjustment		
	Central Wavelength (nm)	Bandwidth FWHM (nm)	Core 200 μ m 0.53 NA			Core 400 μ m 0.53 NA	Core 960 μ m 0.63 NA
	365	~12	6.0	23	100	1	(TDB)
	385	~12	6.0	23	100	1	(TDB)
	405	~15	5.0	23	100	1	(TDB)
	420	~15	5.5	23	100	1	(TDB)
	450	~25	8.0	23	100	x1.7	(TDB)
	465	~25	7.5	23	100	x1.7	(TDB)
	505	~30	3.0	12	50	x1.6	(TDB)
	515	~40	3.0	9.5	40	x1.5	(TDB)
	560	~100	2.0	8.5	40	-	(TDB)
	595	~20	2.0	8.5	40	x1.2	(TDB)
	625	~20	3.5	14	70	x1.6	(TDB)
	635	~20	6.5	25	100	x1.6	(TDB)
	850	~35	6.0	22	40	-	(TDB)
	940	~35	2.0	10	40	-	(TDB)
	5500K	-	4.5	17	80	-	(TDB)

¹All power values taken at a maximum current of 1000 mA, except for 365, 385, 405 and 420 nm LEDs (500 mA).

Table 3.2: General specifications

SPECIFICATION	VALUE	NOTES
Dimensions		
iIFMC 3	97.6 x 80.5 x 29.0 mm ³	Includes Connectors, LED and Detectors
iIFMC 4	124.1 x 110.5 x 29.0 mm ³	Includes Connectors, LED and Detectors
iIFMC 5	112.3 x 135.9 x 29.0 mm ³	Includes Connectors, LED and Detectors
iIFMC 6	138.1 x 130.9 x 29.0 mm ³	Includes Connectors, LED and Detectors
iIFMC 7	124.6 x 144.2 x 29.0 mm ³	Includes Connectors, LED and Detectors
*Typical fiber configuration for test		
Excitation path		
-From FMC to Sample	400 μ m core, NA 0.57	-
Emission path		
-From Sample to FMC	400 μ m core, NA 0.57	-

Table 3.3: Typical filter transmission bandwidth

Fluorescence Mini Cubes	Excitation (nm)	Emission (nm)
iIFMC3		
-GFP-like	460-490	500-550
-RFP-like	540-570	580-680
iIFMC4		
-Excitation, Fluorescence and Opsin Activation	460-490, 580-650	500-550
-Locked-in or Sequential Detection and Fluorophore Excitation	400-410, 460-490	500-550
-FRET (One Excitation and Two Fluorescence Detection Ports)	420-445	460-500, 528-556
iIFMC5		
-Separated Two-fluorophore Fluorescence	460-490, 555-570	500-540, 580-680
-GCAMP Isosbestic and Functional Excitations, and Opsin activation	400-410, 460-490, 580-650	500-550
iIFMC6		
-Two-fluorophore and GCaMP Isosbestic Excitation	400-410, 460-490, 555-570	500-540, 580-680
iIFMC7		
-Three-fluorophore Fluorescence	400-410, 460-490, 555-570	420-450, 500-540, 580-680

Support

4.1 Maintenance

The product does not require any maintenance. Do not open the enclosure. Contact Doric Lenses for return instructions if the unit does not work properly and needs to be repaired.

4.2 Warranty

This product is under warranty for a period of 12 months. Contact Doric Lenses for return instructions. This warranty will not be applicable if the unit is damaged or needs to be repaired as a result of improper use or operation outside the conditions stated in this manual. For more information, see our [Website](#).

4.3 Contact us

For any questions or comments, do not hesitate to contact us by:

Phone 1-418-877-5600

Email sales@doriclenses.com

The logo for Doric Lenses, featuring the word "doric" in a lowercase, sans-serif font. The letter 'o' is stylized with a white highlight on its left side, giving it a three-dimensional appearance.

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