Fiber Photometry Console

User Manual

Version 1.1.2

Contents

1

Overview

1.1 System Overview

In neuroscience, the fiber photometry denotes a method whereby chronically implanted optical fiber delivers excitation light to neurons tagged with a fluorescent calcium indicator(s) and collects their overall activity-induced fluorescence. Within the field of view, the fiber photometry sums up the activity-induced fluorescence of all neurons expressing the indicator(s).

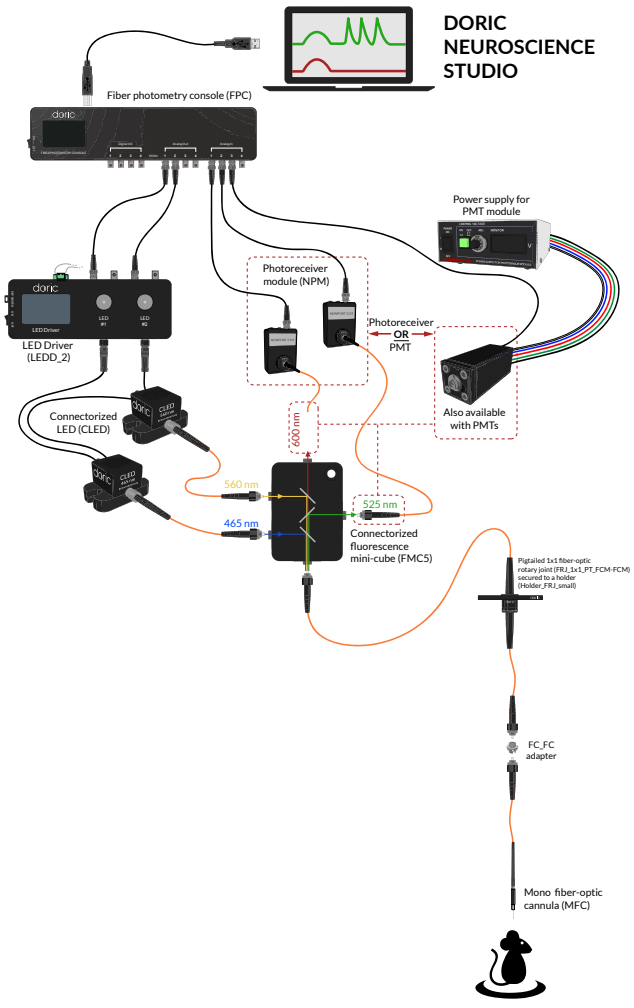

Figure 1.1: *Typical Modular Fiber Photometry Measurement Setup*

The typical set-up for freely behaving animals consists of the fiber photometry console, the excitation light source(s), a connectorized fluorescence mini cube with beam splitters that combine the excitation wavelengths and separate the fluorescence light, the fiber-optic rotary joint, the optical cannula with connecting fiber-optic patch cords and photodectors capable of sensing the low level light. *In vitro* or head-fixed animal photometry setup uses a probe holder and an optical probe instead of the rotary joint and the optical cannula. The fluorescence emission can be collected with one photodiode and subsequently demodulated or, after spectral separation, collected with respective photodiodes.

1.2 Fiber Photometry Console

This FPGA based data acquisition unit synchronizes the output control and the acquisition of the input data. This device seamlessly integrates with Doric Neuroscience Studio software, which provides the user-interface for multi-channel photometry experiments.

The software interface enables control over the CW excitation light pulses, square or sinusoidal waveform of an external source (i.e. LED driver) with 4 digital input/outputs and 4 analog voltage outputs. The software interface displays real-time data of up to 4 detectors input signals and performs data acquisition. The other new functionalities are being developed and users can upload them as they become available.

The Fiber Photometry Console inputs and outputs are shown in figures 1.2 and 1.3.

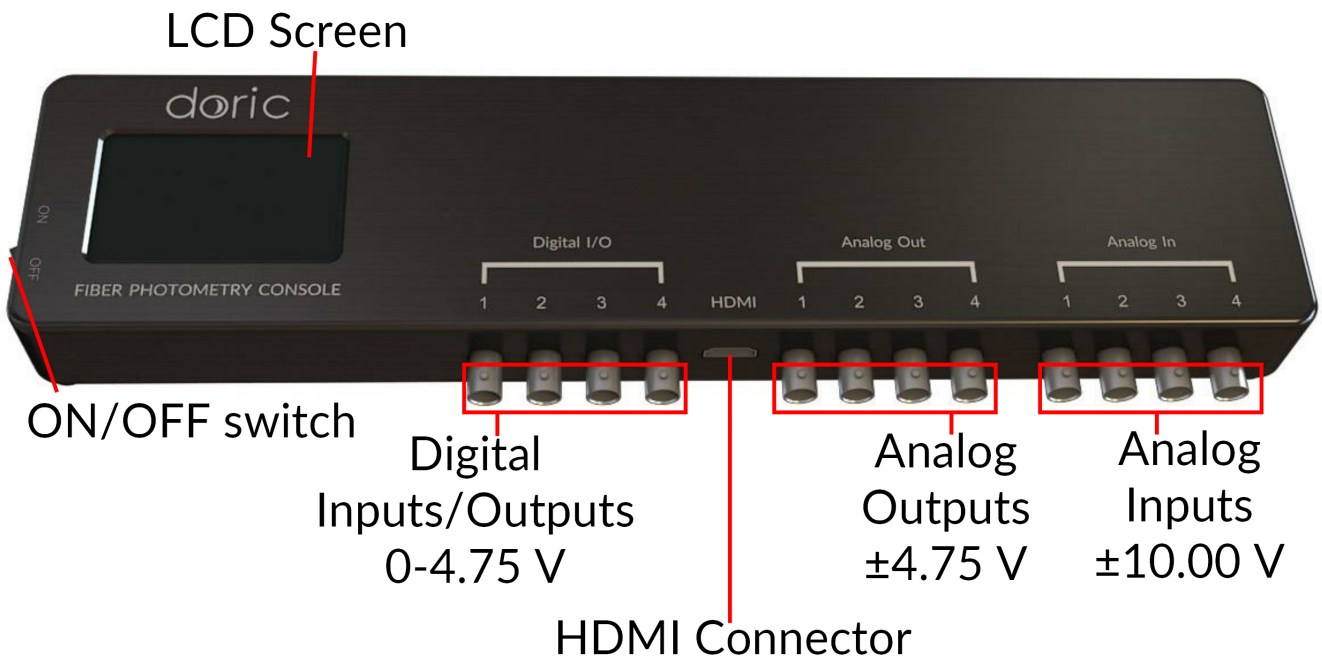

Figure 1.2: *Front view of the Fiber Photometry Console: Inputs and outputs*

- The **LCD Screen** displays console information.
- The **Digital/IO** ports sends 0-4.75 V TTL pulses.
- The **HDMI** port acquires digital signals and digital communication SPI and LVDS via a custom pinout HDMI connector.
- The **Analog-out** ports send a variable ± 4.75 V analog signal signal.
- The **Analog-in** ports acquire analog signals up to ±10 V.
- The **Power On/Off** opens and closes the device.

Figure 1.3: *Back view: Maintenance and Power Supply*

- The **12V port** connects to the 12 VDC Power supply.
- The **USB port** allows a USB-B connection to a computer.
- The **Service** port is a USB-B port through which the firmware of the device can be updated.
- The **USB-3** charging port is currently disabled.

2.1 Connecting the Fiber Photometry Console

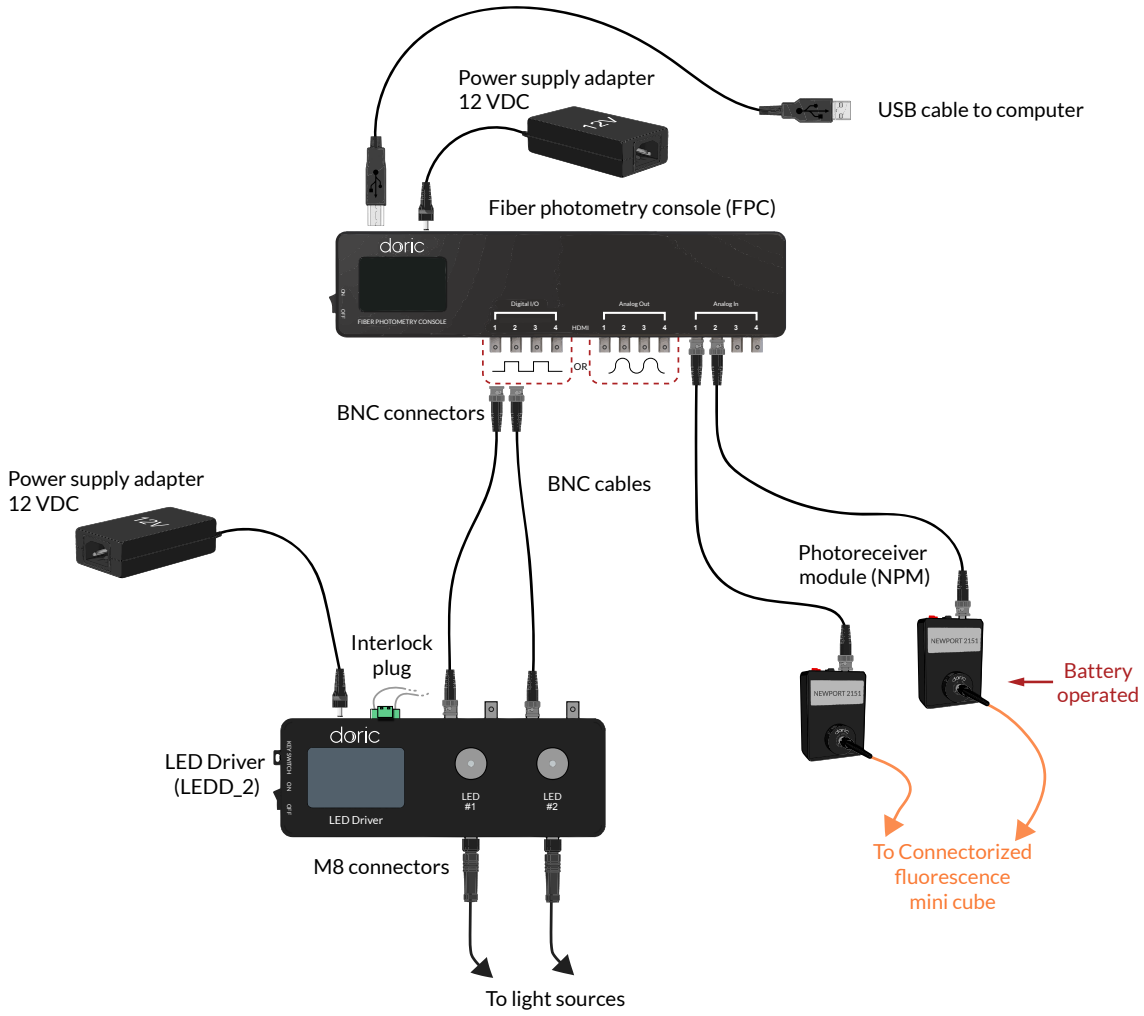

Figure 2.1: *Connections to the Fiber Photometry Console*

Follow this quick start procedure to install and connect the system. We recommend the following order to avoid device and driver detection problems. If you need more information about each device or the software, refer to their respective user manuals.

1. **Install Doric Neuroscience Studio Software.** Follow the on-screen instructions to install the Doric Neuroscience Studio Software on the hard drive of your computer. For more details, refer to the Doric Neuroscience Studio Software User Manual.

2. **Connect the Fiber Photometry Console.** The console unit is operated with a 12 VDC power supply adapter. It is important to disconnect all other elements from the inputs/outputs before turning on the console. When the console is powered, turn on the switch, then connect the console to the computer via a USB cable. It is important to **power on the console before connecting the USB cable**. Failure to do so can lead to an unstable state in which the console draws power from the USB cable instead of the power adapter. A Windows USB driver will be automatically installed. Open the software to complete the installation of others devices.

3. **Connect outputs**. Digital outputs can send TTL pulses (0 - 4.75 V square pulses) while analog outputs can send a sinusoidal signal. Connect devices to Digital I/O or Analog Out of the *Fiber Photometry Console* with a BNC cable (Fig. 2.1).

4. **Connect inputs**. Digital inputs receive TTL pulses (0 - 5 V square pulses) while analog inputs receive analog signal (±10 V signals) that can be displayed and saved using the *Doric Neuroscience Studio*.

3

Specifications

Table 3.1: *General Specifications*

SPECIFICATION	VALUE	NOTE
Power supply	110 - 240 VAC ; 50 - 60 Hz	Power supply adapter included
DC power supply	12 VDC	
Mass	797 g	
Dimensions	36 cm x 3.63 cm x 9.82 cm	Depth includes connectors
Digital input voltage	0 to +5 V	Min Hi Level: 4 V; Max Low Level: 0.55 V
Digital output voltage	0 to +5 V	
Digital input impedance	3 kΩ	
Digital output impedance	30 Ω	
Digital time propagation delay	4.6 ns	
Digital time input resolution	82 µs	
Digital time output resolution	10 µs	
Analog output voltage	± 4.75 V	
Analog output sample frequency	25 MS/s	
Analog output max. frequency	10 khz	
Analog output impedance	6 Ω	
Analog time propagation delay	20 ns	
Analog input voltage	±10 V	
Analog input sample frequency	15 kS/s	
Channel-to-channel isolation	110 dB	
Analog input impedance	100 to 124 kΩ	

[1]Chopping Enabled: This mode provides very low noise with lower output rates. Chopping does not eliminate the offset error and drifts caused by input resistors. Noise performance depends on the selected analog input range and the chopping mode. The analog input is always operated with chopping mode in order to optimise the offset drift and to allow a better noise performance. When starting an acquisition, input data rate (Samples per second) can be selected according to the needs of each test. Higher data rate provides higher RMS noise. Analog inputs are reversed and then calculated as an average of two conversions in order to reduce the offset error.

Table 3.2: *Analog input noise and resolution specifications with chopping mode enabled*

Data rate	Real Rate	Time resolution	- 3dB Frequency	RMS noise	Effective resolution [1]
0.3 kSps *C	372 Hz	2686 µs	200 Hz	9.6 µV	20.0 bits (9.5 µV/bit)
1.0 kSps *C	1 001 Hz	999 µs	520 Hz	15.5 µV	19.3 bits (15.5 µV/bit)
2.5 kSps *C	2 534 Hz	395 µs	1 300 Hz	26.1 µV	18.5 bits (27.0 µV/bit)
6.0 kSps *C	6 041 Hz	166 µs	3 100 Hz	46.0 µV	17.7 bits (47.0 µV/bit)
12. kSps *C	12 166 Hz	82 µs	6 300 Hz	120 µV	16.3 bits (123.9 µV/bit)

[1] Effective resolution for linear mode at ± 10 V input range. Input resolution is 16 bits (0.152 mV). Lower data rates provides higher effective resolution. The lock-in mode allows higher effective resolution. In this case, effective resolution is higher than RMS noise for every listed frequency.

Table 3.3: *Recommended Environmental Specifications*

DESCRIPTION	OPERATION	STORAGE
Use	Indoor	Indoor
Temperature	0-40 ° C	0-40 ° C
Humidity	40-60% RH, non condensing	40-60% RH, non condensing

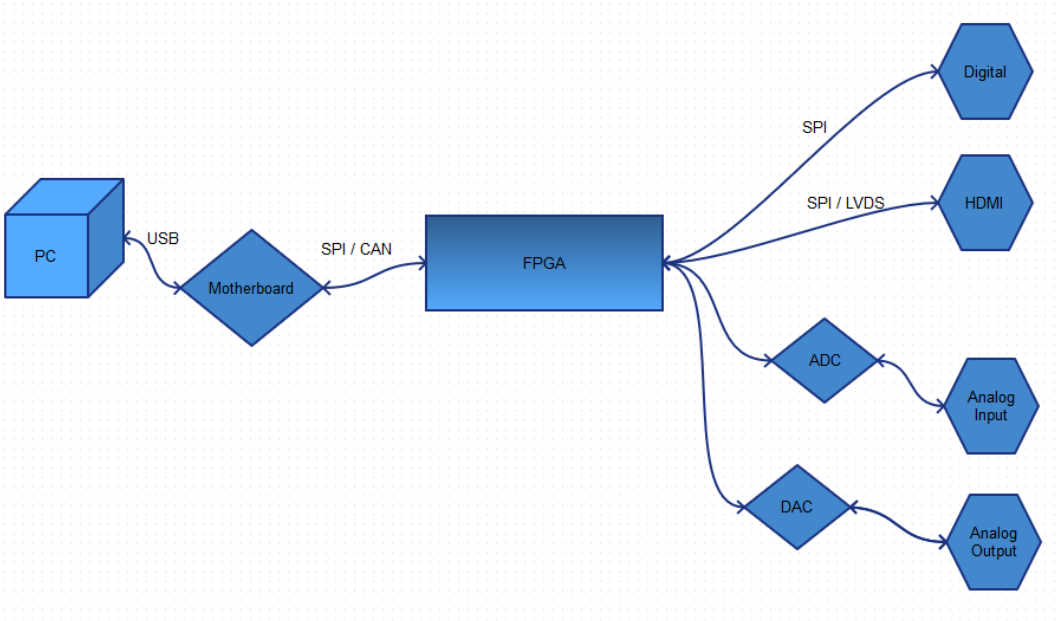

Figure 4.1: *Electronic Bloc diagram*

4

Support

4.1 Important handling information

Warning: Do not open the box to avoid electrical injury.

4.2 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.

4.3 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.

4.4 Contact us

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

Phone 1-418-877-5600

Email sales@doriclenses.com