

made to measure

OPERATING INSTRUCTIONS AND SYSTEM DESCRIPTION FOR THE

FiberOptoMeter III

Fiber Photometry System
with 470 nm and 565 nm LEDs



Version 1.0
npi 2019

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1. Safety Regulations

VERY IMPORTANT: Instruments and components supplied by npi electronic are NOT intended for clinical use or medical purposes (e.g. for diagnosis or treatment of humans), or for any other life-supporting system. npi electronic expressly disclaims any warranties for such purpose. Equipment supplied by npi electronic shall be operated only by selected, trained and adequately instructed personnel. For details please consult the GENERAL TERMS OF DELIVERY AND CONDITIONS OF BUSINESS of npi electronic, D-71732 Tamm, Germany.

- 1) **GENERAL:** This system is designed for use in scientific laboratories and should be operated by trained staff only. General safety regulations for operating electrical devices are to be considered.
- 2) **AC MAINS CONNECTION:** While working with the npi systems, always adhere to the appropriate safety measures for handling electronic devices. Before using any device please read manuals and instructions carefully.
The device is to be operated only at 115/230 Volt 60/50 Hz AC. Please check for appropriate line voltage before connecting any system to mains.
Always use a three-wire line cord and a mains power-plug with a protection contact connected to ground (protective earth).
Before opening the cabinet disconnect mains power-plug.
Disconnect mains power-plug when replacing the fuse or changing line voltage. Replace fuse only with an appropriate specified type.
- 3) **STATIC ELECTRICITY:** Electronic equipment is sensitive to static discharges. Some devices such as sensor inputs are equipped with very sensitive FET amplifiers, which can be damaged by electrostatic charge and must therefore be handled with care. This can be avoided by touching a grounded metal surface when changing or adjusting sensors. **Always turn power off when adding or removing modules, connecting or disconnecting sensors, headstages or other components from the instrument or 19" cabinet.**
- 4) **TEMPERATURE DRIFT / WARM-UP TIME:** All analog electronic systems are sensitive to temperature changes. Therefore, all electronic instruments containing analog circuits should be used only in a warmed-up condition (i.e. after internal temperature has reached steady-state values). In most cases a warm-up period of 20-30 minutes is sufficient.
- 5) **HANDLING:** Please protect the device from moisture, heat, radiation and aggressive chemicals.
- 6) **SPECIAL WARNING:** THIS INSTRUMENT HAS A HIGH POWER OPTICAL OUTPUT.

2. Special Safety Notice for Instruments with high optical irradiation



**HIGH OPTICAL IRRADIATION!
RISK TO EYES AND SKIN!**

Observe extreme caution when working with this instrument!

- 1) Always attach the provided plug to the fiber output, if the fiber is not connected.
- 2) Collimated light emitted from the unit does pose a potential risk to eyes and skin if viewed directly or skin is left exposed to the light.
- 3) Protect your eyes and skin from fiber output and collimator output.
- 4) Do not wear any reflective items like watches or rings when working with the instrument.
- 5) Servicing should be only done by qualified personnel aware of the hazards!
- 6) If in doubt, return to supplier for servicing!

3. System Description

3.1. General description

The FiberOptoMeter III (FOM III) is built into a desktop housing. It is equipped with an internal power supply.

This FiberOptoMeter III can be used for fiber coupled optical stimulation with two different wavelengths and fluorescent recordings in two wavelength bands through the same fiber. The fiber is connected with an SMA connector.

There are two independent LED controls on the front panel as well as one output of the detector signal. Channel A controls a blue LED (470 nm) and channel B controls a lime-green LED (565 nm).

3.2. Modes of operation

The FiberOptoMeter III illumination channels work independently and can be controlled in three different modes: CONT, TTL and ANALOG. Indicator LEDs next to the control elements will light up, to show, which of the inputs and potentiometers is active:

- **CONT:** the LED of the respective channels is continuously on, the output power is set with the ANALOG 10-turn potentiometers
- **TTL:** the LED is controlled by the TTL inputs: a TTL HIGH signal switches the LED on. The output power is set with the ANALOG 10-turn potentiometers.
- **ANALOG:** the LED is controlled by an analog input voltage at the ANALOG IN BNC connector. Input range is 0 ... 1 V.
- **OFF:** The LED is off, independent of any analog or TTL input signal or potentiometer setting.

The output of the internal photodetectors is provided at the OUTPUT BNC connector. Range is -5 ... 5 V.


Note: This special version of the FOM has an additional output on the rear panel providing the unfiltered detector signal. This allows to connect the associated LPBF-02GD Filter directly.

3.3. Front panel elements:




Figure 1: FOM III front panel view.

POWER ON LED

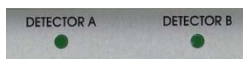
 LED indicating that the FiberOptoMeter III is switched on.

CHANNEL LED A and B

 LED indicating that the respective channel is active i.e. that the mode switch is either in CONT, TTL or ANALOG position. The LED will not light up in OFF mode.

DETECTOR LED A and B

LED indicating that the respective detector is active and ready to record.
Start-up can take up to 1 min. after power on



Note: the color of the LED does not exactly correspond to the actual color of the stimulation LED inside the FOM III housing.

All front panel elements below are identical for both channels (see Figure 1). Following are the descriptions for channel A.

10-turn potentiometer



Potentiometer for control of the LED output power. The red LED next to it indicates that the amplitude is controlled by the potentiometer (only in CONT and TTL mode, see chapter 3.2).

MODE rotary switch



Switch for selecting the mode of operation (see chapter 3.2).

ANALOG IN BNC connector



An analog input signal (0 ... 1 V) can be used to control the LED output power. The red LED next to it indicates that this input is active (only in ANALOG mode).

TTL IN BNC connector



A TTL signal (0 ... 5 V) can be used to control the LED on and off switching. The red LED next to it indicates that this input is active (only in TTL mode). The output power is controlled by the 10-turn potentiometer (see above).

OUTPUT BNC connector



The output signal from the detector is provided at this BNC connector. Range is -5 V ... 5 V. The DETECTOR LED has to be active, this indicates that the detector is ready.

FIBER OUT SMA connector



The optical fiber is connected to this SMA port.



HIGH OPTICAL IRRADIATION!
RISK TO EYES AND SKIN!

3.4. Rear panel elements:



Figure 2: FOM III rear panel view.

On the rear panel of the FiberOptoMeter III housing there is the mains connection, a fuse box, and the power switch (see Figure 2).

Rear panel elements in this special version:

BNC connector



An analog OUTPUT providing the unfiltered signal of FiberOptoMeter III. It can be connected to the rear panel input connector of associated LPBF-02GB.

POWER OUTPUT connector



Snap-in connector providing the supply power for the associated LPBF-02GD filter device. For disconnection outer sleeve of connector has to be turned counterclockwise.

Important: This POWER OUTPUT connector is intended to be used for connection of the associated LPBF-02GD filter only. Connection of any other devices might lead to damage of the FOM III and the connected device.

4. Exchangeable Filters



Figure 3: Filter cube insert for FOM-02D.

This FiberOptoMeter-III is equipped with special filter cubes for easy exchange of filters and dichroic mirrors (see Figure 3). The filter cubes consist of an outer frame and a removable inner cube, which is held by magnets. These cubes are self-centering and can be removed and inserted by hand - no tools are required.



To access the cubes, disconnect the FiberOptoMeter-III from the mains power line, remove the four lid screws (see Figure 4 on the left) using a suitable screwdriver and remove the lid. Afterwards, reinstall the lid and fix it with the four screws.

Figure 4: Lid screws to be removed to open the FiberOptoMeter-III housing.

To exchange the filters and dichroics in the inner cubes, please follow the instructions provided by this video: <https://www.youtube.com/watch?v=qWIfiwuL-gQ>. You can find further information on these cubes via the Thorlabs website: search for DFM1/M, there is also the above mentioned video embedded.

Note: A tool kit is provided for exchange of the filters and dichroics. It consists of a hex key, a screw driver, a filter ring fastening tool and cotton gloves. It is highly recommended to wear these gloves while handling the filters to avoid scratches and contamination (e.g. finger prints).

Note: To prevent damaged filters during transportation, the FOM III is shipped with the filter cubes secured with tape. Remove the tape to exchange the cubes

5. References

Zhang Q, Yao J, Guang Y et al.: Locomotion-Related Population Cortical Ca²⁺ Transients in Freely Behaving Mice. **Front Neural Circuits**. 2017 Apr 7; 24(11). doi: 10.3389/fncir.2017.00024

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Adelsberger H, Grienberger C, Stroh A, Konnerth A.: In vivo calcium recordings and channelrhodopsin-2 activation through an optical fiber. **Cold Spring Harb Protoc**. 2014 Oct 1; 2014(10):pdb.prot084145. doi: 10.1101/pdb.prot084145.

6. Technical Data

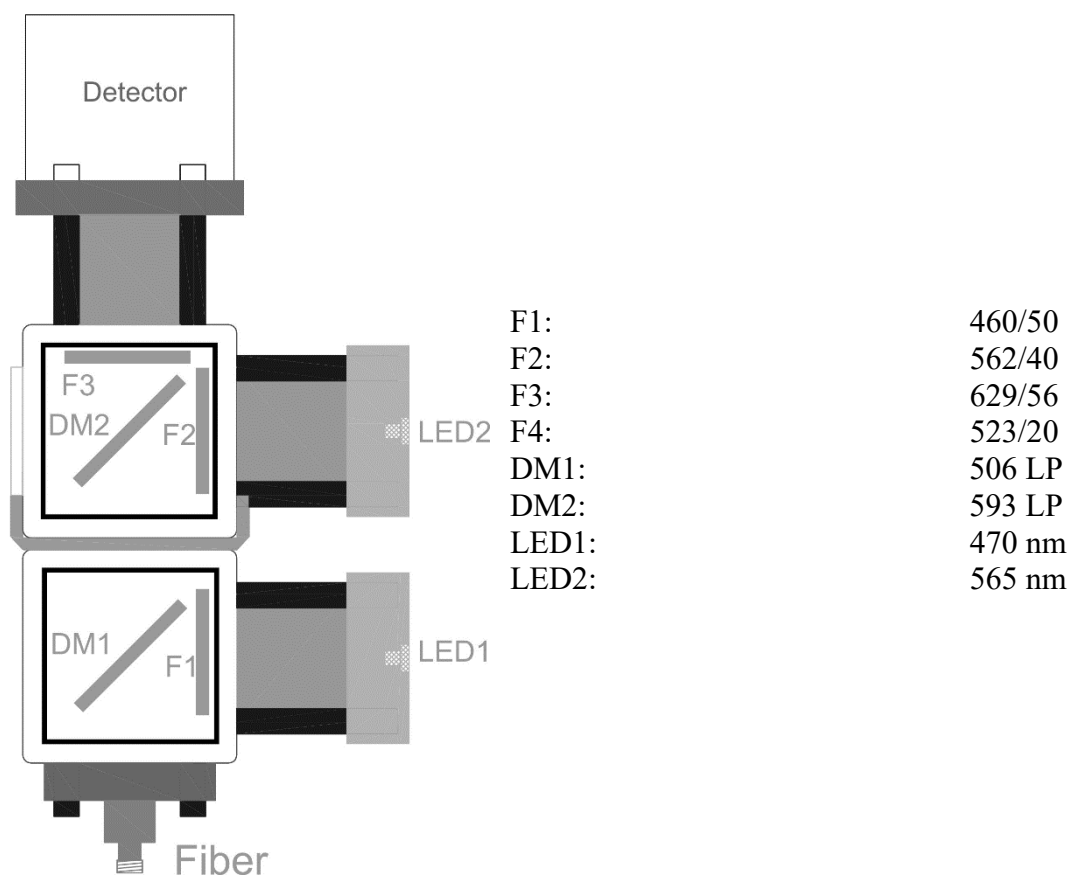


Figure 5: Schematic drawing of optical components with description of filter and dichroic wavelengths. To improve the GCaMP measurement, the Filter F3 can be replaced by filter F4.

Table 1: suggested configurations for GCaMP and RCaMP.

	LED 470 nm	LED 565 nm
GCaMP	ON	OFF
RCaMP	OFF	ON

Note: For RCaMP monitoring cube with DM1 not necessary. It can remain in place, but it will reduce the output signal by ~10%.

Note: To improve the GCaMP measurement, the Filter F3 can be replaced by filter F4

Signal Outputs:

OUTPUT A: Filter F3: 620/52 nm (Cube 2.A)
OUTPUT B: not installed

Dimensions: (W x D x H) 365 mm x 260 mm x 130 mm