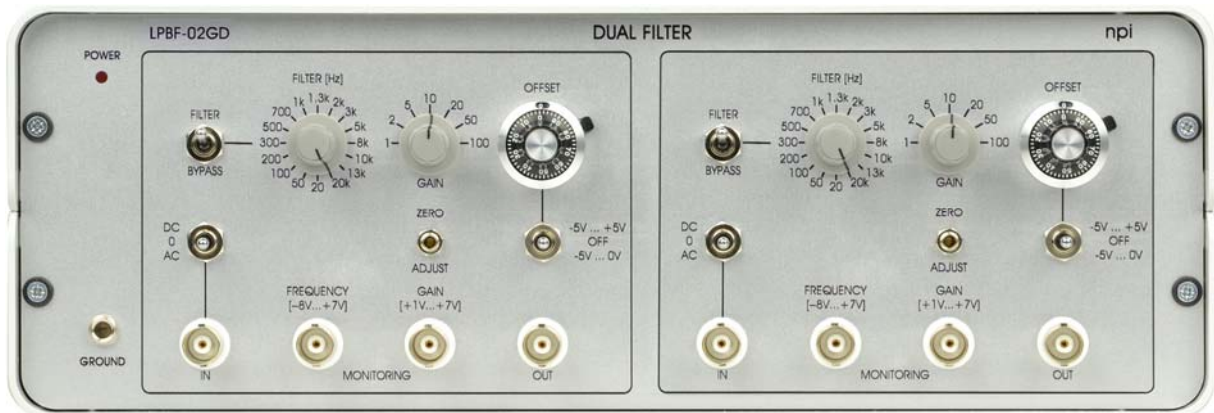


Made to measure

LPBF-02GD

LOW PASS FILTER / AMPLIFIER

With 8-pole Bessel characteristics



Version 1.0
npi 2020

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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 disclaims any warranties for such purpose. Equipment supplied by npi electronic must 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 must be operated by trained staff only. General safety regulations for operating electrical devices should be followed.
- 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, unplug the instrument.
Unplug the instrument 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. Electrostatic discharge 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 corrosive chemicals.

3. LPBF-02GD Amplifier / Filter

3.1. LPBF-02GD Components

The following items are shipped with the LPBF-02GD system:

- ✓ Amplifier / Filter in desktop housing
- ✓ User manual
- ✓ Power supply

3.2. System Description

The LPBF-02GDB amplifier/filter is designed for the processing of small bio-electrical signals. The LPBF-02GDB is available as single channel or dual channel version in a stand-alone desktop housing. The input voltage range is ± 12 V. All inputs and output are BNC-connectors.

The unit is equipped with a unipolar input stage with an AC/O/DC switch. The input stage is followed by the offset compensation adjustable with a ten-turn potentiometer.

The gain stage allows the amplification of the signal from 1-100 in 1-2-5 steps. The gain is selected by a seven position rotary switch.

The amplified signal is applied to the output filter. This Bessel lowpass filter has sixteen corner frequencies (20 Hz – 20 kHz). The output filter can also be bypassed by using a toggle switch.

The position of the GAIN switch and of the FILTER switch can be read from monitor outputs (1V / step).

3.4. Description of the Front Panel and Operation

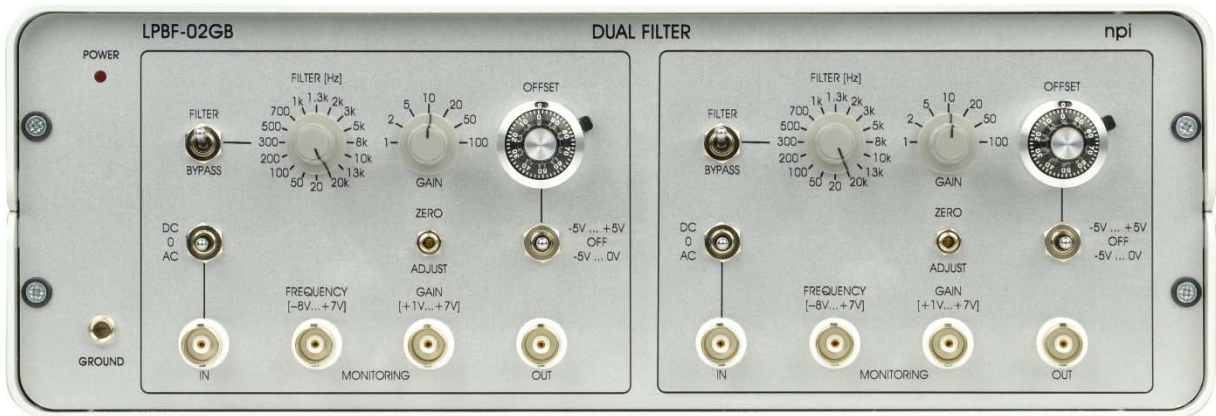


Figure 1: front panel view of LPBF-02GD

In the following description of the front panel elements only one channel is described. The elements are listed clockwise, starting from top left.

FILTER / BYPASS switch



Switch for bypassing the lowpass Bessel filter

FILTER switch



16-position rotary switch for selecting the corner frequency of the lowpass Bessel FILTER (range: 20 Hz to 20 kHz). The LOWPASS FILTER can be bypassed using the FILTER / BYPASS switch (see above).

GAIN switch



7-position rotary switch for selecting the GAIN factor, x1, x2, x5, x10, x20, x50 or x100.

OFFSET unit

The OFFSET unit consists of OFFSET potentiometer and OFFSET range switch



OFFSET potentiometer

10-turn potentiometer for compensating for a DC OFFSET

OFFSET range switch

3-position switch for selecting the OFFSET range, ± 5 V, -5 V...0 V, or for setting the OFFSET compensation to OFF

Note: The overall OFFSET compensation is the product of the reading of both controls.

Important: Position 5 of the OFFSET potentiometer corresponds to 0 mV offset in the ± 5 V range, and to 2.5 V in the -5 V...0 V range.

OUT connector



BNC connector that provides the processed signal

GAIN [+1 V...+7 V] MONITORING connector



BNC connector MONITORING the position of the GAIN switch ($+1$ V... $+7$ V, 1 V / step)

FREQUENCY [-8 V...+7 V] MONITORING connector



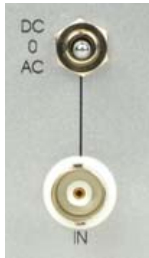
BNC connector MONITORING the position of the FILTER switch (-8 V... $+7$ V, 1 V / step)

ZERO ADJUST trim pot



Trim pot for compensation of amplifier offsets. Tuning is done by setting the OFFSET RANGE switch to OFF and trimming any remaining offsets to ZERO.

INPUT unit



The INPUT unit consists of the IN connector and the AC / 0 / DC input coupling switch

IN connector

BNC connector to connect the signal to be processed

AC / 0 / DC input coupling switch

The position of the input coupling switch decides how the input signal is coupled:

AC: the input signal is AC coupled with a corner frequency of 0.1 Hz

DC: the input signal is DC coupled

0: the input signal is grounded

3.5. Rear panel elements:



Figure 2: LPBF-02GD rear panel view.

On the rear panel of the LPBF-02GD housing there are three connector for connection to the FOM-02D:

POWER SWITCH



Switch to power the LPBF-02GD ON and OFF.

POWER SUPPLY 18V AC, 1.8A connector



Connector for connecting the power supply.

Important: Only use the power supply that came with this LPBF-02GD. Connection of any other power supply might lead to damage of the LPBF-02GD and the power supply.

OFFSET RANGE SWITCH



Switch to choose the Offset Range (5V or 1V)
Going to a lower range means higher resolution of the OFFSET potentiometer

4. Literature

Kettenmann, H. & Grantyn, R. (eds.) (1992) Practical Electrophysiological Methods, WileyLiss, New York

Ogden DC (1994) Microelectrode Techniques. The Plymouth Workshop Handbook Second Edition, The Company of Biologists Limited, Cambridge

Tietze, U and Ch. Schenk (1999) Halbleiter-Schaltungstechnik (Semiconductor Techniques) 11. Edition, Springer, Berlin, Heidelberg, New York; (English version available).

Windhorst, U. and H. Johansson (eds.) (1999). Modern Techniques in Neuroscience Research, Springer, Berlin, Heidelberg, New York

5. Technical Data

LPBF-02GD

Input range:	± 12 V
Input impedance:	1 M Ω , related to ground
Input capacitance:	30 pF
AC coupling at input:	corner frequency of 0.1 Hz (if AC / 0 / DC switch at BNC connector is switched to AC)
OFFSET compensation:	set by ten-turn potentiometer, range ± 5 V, -5 V...0 V or OFF, selected by toggle switch, OFF position separately adjustable with trim pot OFFSET RANGE can be chosen between 1V or 5V
LOWPASS Filter:	eight pole Bessel filter, attenuation: -48 dB/octave, corner frequencies (Hz): 20, 50, 100, 200, 300, 500, 700, 1k, 1,3k, 2k, 3k, 5k, 8k, 10k, 13k, 20k, bypass switch frequency monitor: -8 V to +7 V, 1 V / switch step
GAIN:	rotary-switch: 1-2-5-10-20-50-100 gain monitor: +1 V to +7 V, 1 V / switch step
Output:	range: ± 12 V into 1 k Ω / ± 1 V into 50 Ω
Dimensions:	(W x D x H) 365 mm x 260 mm x 130 mm