

*Made to measure*

## LPBF-01GX

# AMPLIFIER / FILTER MODULE FOR EPMS SYSTEMS

WITH 8-POLE BESSEL FILTER  
WITHOUT GAIN



Version 1.3  
npi 2014

## Table of Contents

1. Safety Regulations .....	3
2. EPMS-07 Modular Plug-In System .....	4
2.1. General System Description / Operation .....	4
2.2. EPMS-07 Housing .....	4
2.3. EPMS-E-07 Housing .....	4
2.4. PWR-03D .....	4
2.5. System Grounding .....	6
EPMS-07 .....	6
EPMS-E-07.....	6
2.6. Technical Data.....	6
EPMS-07 .....	6
EPMS-E-07.....	6
3. LPBF-01GX Amplifier / Filter Module.....	7
3.1. LPBF-01GX Components .....	7
3.2. System Description.....	7
3.4. Description of the Front Panel and Operation.....	8
4. Literature.....	10
5. Technical Data .....	11

## 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.

## 2. EPMS-07 Modular Plug-In System

### 2.1. General System Description / Operation

The npI EPMS-07 is a modular system for processing of bioelectrical signals in electrophysiology. The system is housed in a 19" rackmount cabinet (3U) has room for up to 7 plug-in units. The plug-in units are connected to power by a bus at the rear panel.

The plug-in units must be kept in position by four screws (M 2,5 x 10). The screws are important not only for mechanical stability but also for proper electrical connection to the system housing. Free area must be protected with covers.

### 2.2. EPMS-07 Housing

The following items are shipped with the EPMS-07 housing:

- EPMS-07 cabinet with built-in power supply
- Mains cord
- Fuse 2 A / 1 A, slow
- Front covers

In order to avoid induction of electromagnetic noise the power supply unit, the power switch and the fuse are located at the rear of the housing.

### 2.3. EPMS-E-07 Housing

The following items are shipped with the EPMS-E-07 housing:

- EPMS-E-07 cabinet
- External Power supply PWR-03D
- Power cord (PWR-03D to EPMS-E-07)
- Mains chord
- Fuse 1.6 A / 0.8 A, slow
- Front covers

The EPMS-E-07 housing is designed for low-noise operation, especially for extracellular and multi channel amplifiers with plugged in filters. It operates with an external power supply to minimize distortions of the signals caused by the power supply.

### 2.4. PWR-03D

The external power supply PWR-03D is capable of driving up to 3 EPMS-E housings. Each housing is connected by a 6-pole cable from the one of the three connectors on the front panel of the PWR-03D to the rear panel of the respective EPMS-E housing. (see Figure 1, Figure 3). A POWER LED indicates that the PWR-03D is powered on (see Figure 1). Power switch, voltage selector and fuse are located at the rear panel (see Figure 2).

**Note:** The chassis of the PWR-03D is connected to protective earth, and it provides protective earth to the EPMS-E housing if connected.



Figure 1: PWR-03D front panel view



Figure 2: PWR-03D rear panel view

**Note:** This power supply is intended to be used with npi EPMS-E systems only.

## 2.5. System Grounding

### EPMS-07

The 19" cabinet is grounded by the power cable through the ground pin of the mains connector (= protective earth). In order to avoid ground loops the internal ground is isolated from the protective earth. The internal ground is used on the BNC connectors or GROUND plugs of the modules that are inserted into the EPMS-07 housing. The internal ground and mains ground (= protective earth) can be connected by a wire using the ground plugs on the rear panel of the instrument. It is not possible to predict whether measurements will be less or more noisy with the internal ground and mains ground connected. We recommend that you try both arrangements to determine the best configuration.



### EPMS-E-07

The 19" cabinet is connected to the PROTECTIVE EARTH connector at the rear panel. The chassis is linked to protective earth only if the PWR-03D is connected. It can be connected also to the SYSTEM GROUND (SIGNAL GROUND) on the rear panel of the instrument (see Figure 3).

**Important:** Always adhere to the appropriate safety measures.

Figure 3: Rear panel connectors of the EPMS-E-07

## 2.6. Technical Data

19" rackmount cabinet, for up to 7 plug-in units

Dimensions: 3U high (1U=1 3/4" = 44.45 mm), 254 mm deep

### EPMS-07

Power supply: 115/230 V AC, 60/50 Hz, fuse 2 A / 1 A slow, 45-60 W

### EPMS-E-07

External power supply (for EPMS-E): 115/230 V AC, 60/50 Hz, fuse 1.6/0.8 A, slow

Ø Dimensions of External power supply: (W x D x H) 225 mm x 210 mm x 85 mm

### **3. LPBF-01GX Amplifier / Filter Module**

#### **3.1. LPBF-01GX Components**

The following items are shipped with the LPBF-01GX system:

- Amplifier / Filter module for the EPMS-07 system
- User manual

#### **3.2. System Description**

The LPBF-01GX amplifier/filter is designed for the processing of small bio-electrical signals. The LPBF-01GX is available as plug-in unit for the EPMS-07 plug-in-system. The input voltage range is  $\pm 12$  V. All inputs and output are BNC-connectors.

The unit is equipped with an 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 is not installed.

The amplified signal is applied to the output filter. This four-pole 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

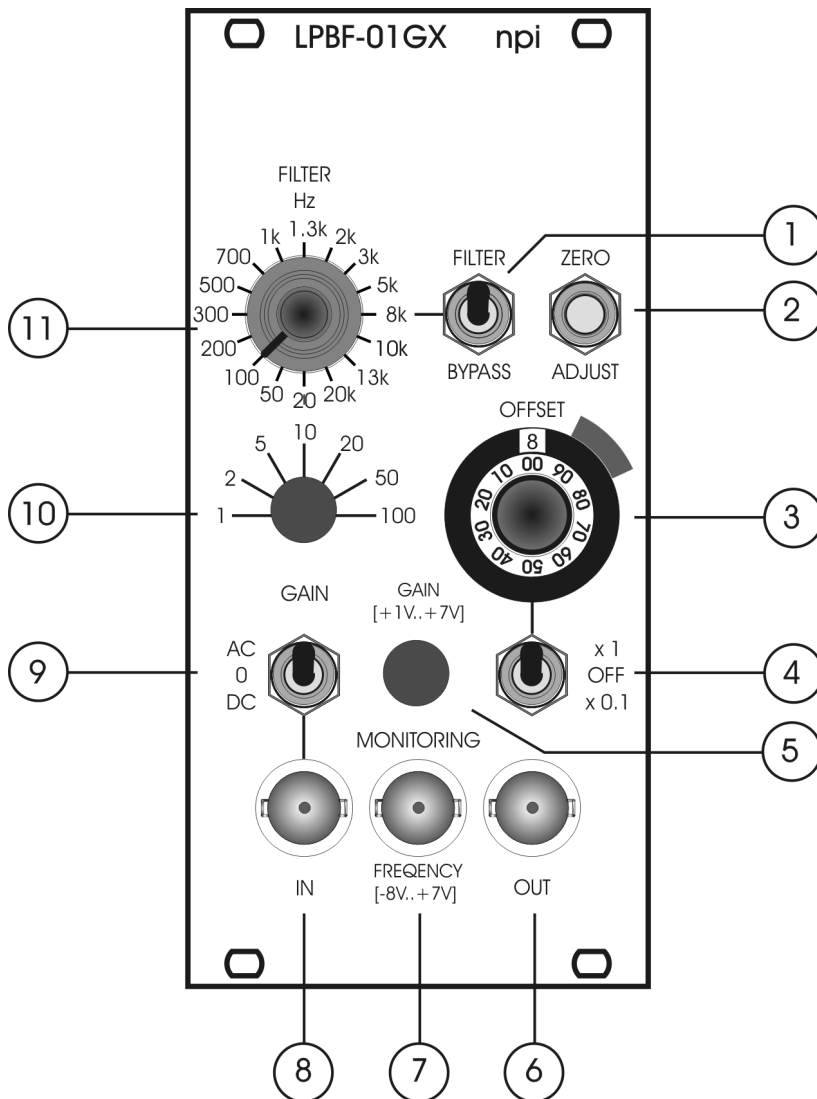


Figure 4: front panel view of LPBF-01GX

In the following description of the front panel elements each element has a number that is related to that in Figure 4. The number is followed by the name (in uppercase letters) written on the front panel and the type of the element (in lowercase letters). Then, a short description of the element is given.

**(1) FILTER BYPASS switch**



Switch for bypassing the lowpass Bessel filter



(2) ZERO ADJUST trim pot



Trim pot for compensation of amplifier offsets. Tuning is done by setting switch #4 to OFF and trimming any remaining offsets to ZERO

**OFFSET unit**



The OFFSET unit consists of (3) OFFSET potentiometer and (4) OFFSET range switch

(3) OFFSET potentiometer

10-turn potentiometer for compensating for a DC OFFSET

(4) OFFSET range switch

3-position switch for selecting the OFFSET range,  $\pm 0.1$  V or  $\pm 1$  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. The offset compensation only works if the input coupling switch is set to DC.

(5) GAIN [+1 V...+7 V] MONITORING connector

Not installed

(6) OUT connector



BNC connector that provides the processed signal

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



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

## INPUT unit



The INPUT unit consists of (8) IN connector and (9) AC / 0 / DC input coupling switch

(8) IN connector  
BNC connector to connect the signal to be processed

### (9) 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

### (10) GAIN switch

Not installed

### (11) 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 switch (#1).

## 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-01GX

Input range:	$\pm 12$ V
Input impedance:	1 M $\Omega$ , 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 $\pm 0.1$ , $\pm 1$ V or OFF, selected by toggle switch, OFF position separately adjustable with trim pot
LOWPASS Filter:	eight pole Bessel, 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, 1V / switch step
GAIN:	not installed
Output:	range: $\pm 12$ V into 1 k $\Omega$ / $\pm 1$ V into 50 $\Omega$
Size:	front panel 12 HP (60.6 mm) x 3U (128,5 mm), 7" (175 mm) deep

### EPMS-07 SYSTEM

Power requirements:	115/230 V AC, 60/50 Hz, fuse 2 A / 1 A, slow, 45-60 W (dependent on the modules plugged in)
Dimensions:	19" rackmount cabinet, 3U high (1U = 1 3/4" = 44.45 mm)