

OPERATING INSTRUCTIONS AND SYSTEM DESCRIPTION FOR THE

4-CHANNEL EXTRACELLULAR AMPLIFIER SYSTEM FOR TETRODES



VERSION 2.2
npi 2015

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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.

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" rack-mount 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 (inserted)
- ✓ Front covers

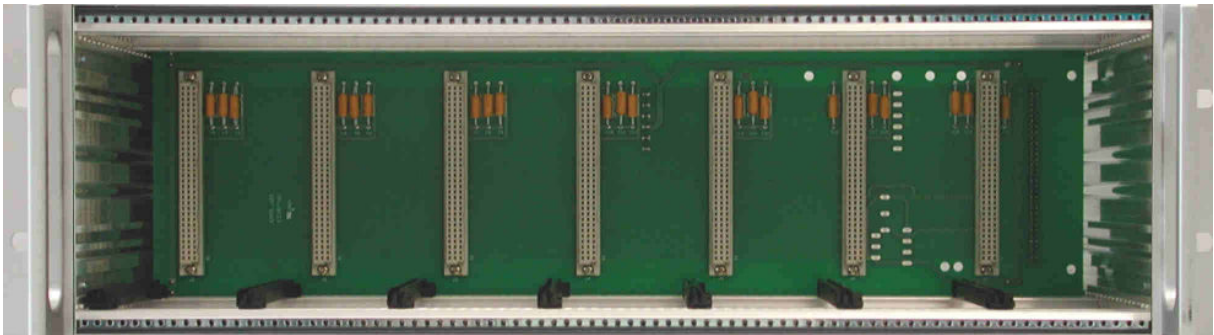


Figure 1: Left: front view of empty EPMS-07 housing.

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 (see Figure 2, right).

2.3. EPMS-H-07 Housing

In addition to the standard power supply of the EPMS-07, the EPMS-H-07 has a built-in high voltage power supply. This is necessary for all MVCS / MVCC modules, the HVA-100, HV-TR150 and HVC-03M modules. The output voltage depends on the modules in use.

2.4. 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 (inserted)
- ✓ 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.

2.5. EPMS-03

The following items are shipped with the EPMS-03 housing:

- ✓ EPMS-03 cabinet with built-in power supply
- ✓ Mains cord
- ✓ Fuse 034 A / 0,2 A, slow (inserted)
- ✓ Front covers



Figure 2: Left: front view of EPMS-03 housing. Right: rear panel detail of EPMS-03 and EPMS-07 housing.

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 (see Figure 2, right).

2.6. 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 one of three connectors on the front panel of the PWR-03D to the rear panel of the respective EPMS-E housing. (see Figure 3, Figure 4). A POWER LED indicates that the PWR-03D is powered on (see Figure 3, left). Power switch, voltage selector and fuse are located at the rear panel (see Figure 3, right).

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

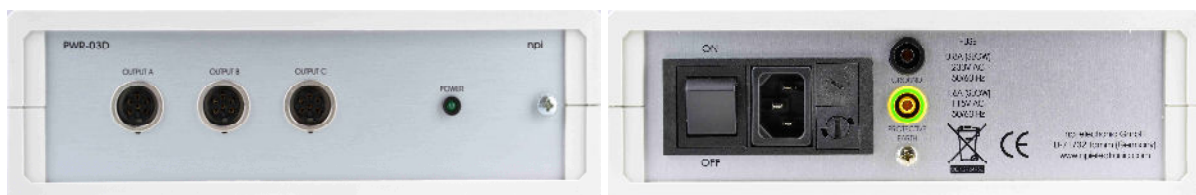


Figure 3: Left: PWR-03D front panel view Right: PWR-03D rear panel view.

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

2.7. System Grounding

EPMS-07/EPMS-03

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 CHASSIS connector at the rear panel. It can be connected to the SYSTEM GROUND (SIGNAL GROUND) on the rear panel of the instrument (see Figure 4).

The chassis can be linked to PROTECTIVE EARTH by connecting it to the PWR-03D with the supplied 6-pole cable **and** by interconnecting the GROUND and PROTECTIVE EARTH connectors on the rear panel of the PWR-03D (see Figure 3). Best performance is generally achieved without connection of the chassis to protective earth.

Important: Always adhere to the appropriate safety measures.

Figure 4: Rear panel connectors of the EPMS-E-07

2.8. Technical Data

EPMS-07, EPMS-E-07 and EPMS-H-07

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

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

EPMS-07 and EPMS-H-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 (PWR-03D) 115/230 V AC, 60/50 Hz, fuse 1.6/0.8 A, slow

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

EPMS-03

Power supply: 115/230 Volts AC, 60/50 Hz, fuse 0.4 A / 0.2 A slow

Maximum current supply: 500 mA

Dimensions: 3U high (1U=1 3/4" = 44.45 mm), 254 mm deep, 265 mm wide

3. EXT-T1M Amplifier / Filter Module

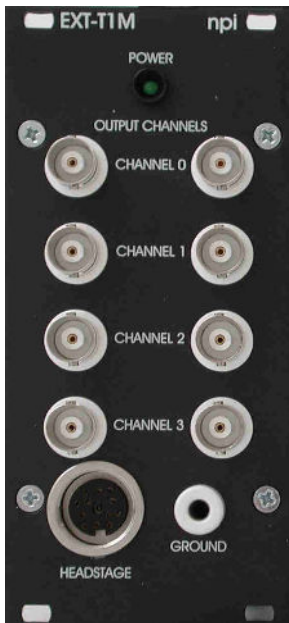


Figure 5: EXT-T1M front panel view

The EXT-T1M module is an amplifier/filter module for a tetrode headstage. The signals recorded from the tetrode attached to the headstage are amplified and filtered, and linked to the BNC connectors CHANNEL 0 to CHANNEL 3. Every CHANNEL is available at two BNC connectors. The GROUND plug provides system grounded and POWER LED indicates that the system is powered on. Measurements are done in single-ended configuration against GND.

Amplification factors (x100, x200, x500; x1000) and corner frequencies of high pass (DC, 0.1, 0.3, 1 Hz) and low pass (100, 500, 3k, 8k Hz) filter can be set internally by DIL switches (see Table 1). The DIL switches for the respective channels and filter/gain settings are shown in Figure 6.

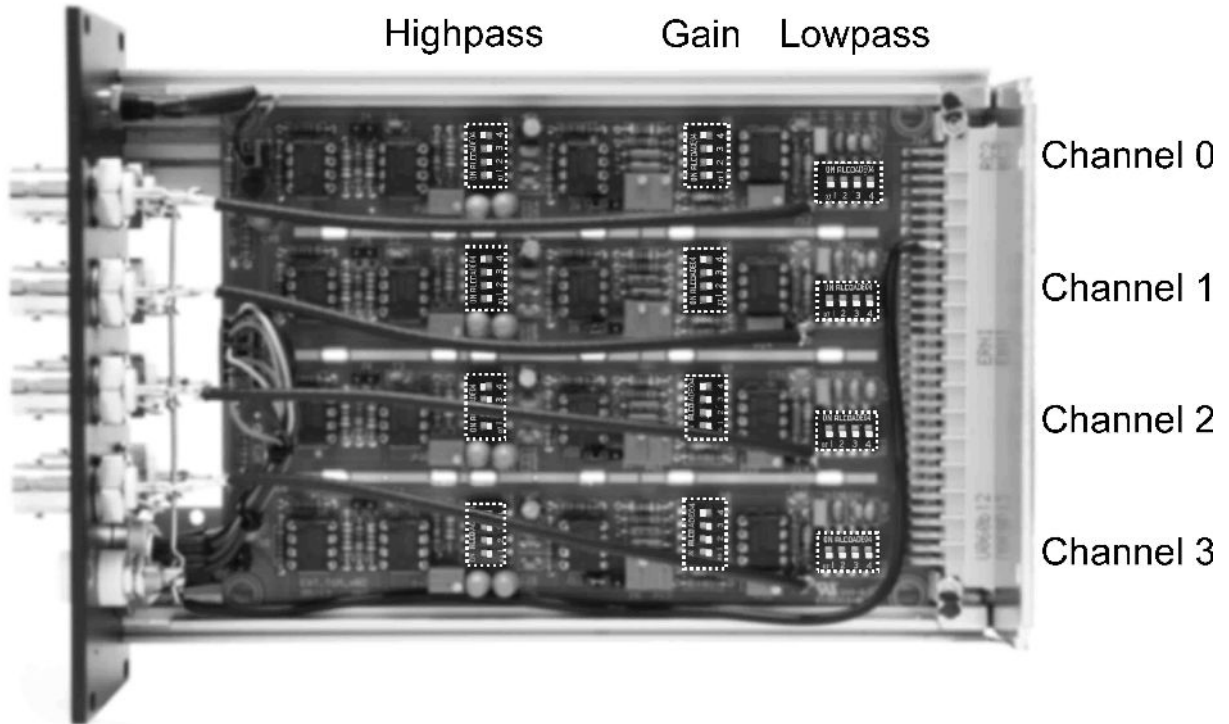


Figure 6: Position of the DIL switches for filter and gain selection on the EXT-T1M circuit board.

High-pass switch		Gain switch		Low-pass switch	
Position	Frequency	Position	Amplification	Position	Frequency
1	DC	1	100	1	100 Hz
2	0.1 Hz	2	200	2	500 Hz
3	0.3 Hz	3	500	3	3 kHz
4	1 Hz	4	1000	4	8 kHz

Table 1: Filter frequencies and amplification factors for the respective DIL switches. Default settings set upon delivery are highlighted in grey.

To access the DIL switches inside the EXT-T1M housing, the EXT-T1M must be removed from the EPMS-07 housing (switch power off). The cover on the right is secured with one screw. Remove this screw and slide the cover towards the rear of the module to remove it. Make sure you re-insert this metal cover and secure it with the screw before inserting the EXT-T1M module into the EPMS-07 housing.



The four filter frequencies or gain settings, respectively, are dedicated to one of the four little white switches of every DIL switch (see picture on the left). I.e. to set a certain gain or filter frequency, only one of the switches is in upper position, the other three must be in the lower position. If more than one switch is in upper position, this results in an undefined mixture of frequencies/gain settings.

The only exception is the low-pass filter: if all four switches are in lower position, the low-pass filter is set to wideband, i.e. 30 kHz.

4. Headstage



Figure 7: headstage of the EXT-T1M

Headstage Elements

P_{EL} Connector for the tetrode (see also Figure 8)

REF Not connected

GND Ground connector

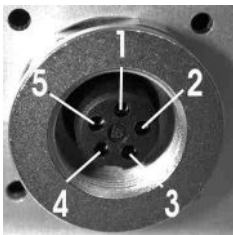


Figure 8: tetrode connector (headstage)

- 1 Ground connector (GND)
- 2 Channel 1 connector (CH1)
- 3 Channel 3 connector (CH3)
- 4 Channel 4 connector (CH4)
- 5 Channel 2 connector (CH2)

5. Technical Data

Input resistance:	$>10^{12} \Omega$, range ± 1 V
Output:	Output range: ± 12 V into $1 \text{ k}\Omega$ / ± 1 V into 50Ω load
Size:	front panel 12 HP (60.6 mm) x 3U (128,5 mm), 7" (175 mm) deep
Headstage Size:	70 x 26 x 26 mm
Holding Bar:	length: 150 mm; diameter: 8 mm.