

OPERATING INSTRUCTIONS AND SYSTEM DESCRIPTION FOR THE

PA-2S

TWO CHANNEL AMPLIFIER MODULE FOR EPMS SYSTEMS with 8 kHz Lowpass Filter



VERSION 1.5
npi 2006

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About this Manual

This manual should help to setup and use the PA-2S amplifier correctly and to perform reliable experiments.

If you are not familiar with the use of instruments amplification of small bio-electrical signals please read the manual completely. The experienced user should read at least chapter 3.

Important: Please read chapter 1 carefully! It contains general information about the safety regulations and how to handle highly sensitive electronic instruments.

Signs and conventions

In this manual all elements of the front panel are written in capital letters as they appear on the front panel.

System components that are shipped in the standard configuration are marked with ✓, optional components with ⇨.

Important information and special precautions are highlighted in gray.

1. Safety Regulations

VERY IMPORTANT: Instruments and components supplied by npí 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. npí electronic disclaims any warranties for such purpose. Equipment supplied by npí 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 npí electronic, D-71732 Tamm, Germany.

- 1) **GENERAL:** This system is designed for use in scientific laboratories and must be operated only by trained staff. General safety regulations for operating electrical devices should be followed.
- 2) **AC MAINS CONNECTION:** While working with the npí 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. Components of the EPMS-07 Housing

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

- ✓ EPMS-07 cabinet
- ✓ Power cord
- ✓ Fuse 2 A / 1 A, slow
- ✓ Front covers

2.2. General System Description / Operation

The npI – EPMS-07 is a modular system for processing of bioelectrical signals in electrophysiology (see Figure 1). The system is housed in a 19” rackmount cabinet (3U) containing a power supply and 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.

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.



Figure 1: Example of a measurement system located in an EPMS housing with two channel iontophoresis and balance module (MVCS-02, MVCC-02), bridge amplifier module (BRAMP-01R) and an extracellular amplifier module (EXT-01C)

2.3. System Grounding

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.

2.4. Technical Data

- 19" rackmount cabinet, 3U high (1U=1 3/4" = 44.45 mm), for up to 7 plug-in units
- Power supply: 115/230 Volts AC, 60/50 Hz, fuse 2 A / 1 A slow, 45-60 W

3. PA-2S Amplifier Module

3.1. PA-2S Components

The following items are shipped with the PA-2S system:

- ✓ Amplifier module for the EPMS-07 system
- ✓ User manual

3.2. System Description

The PA-2S amplifier is a plug-in unit for the npi EPMS-07 modular system. It is designed to amplify small bio-electrical signals. Two channels are available and can be used independently from each other in AC or DC mode. DC offsets can be compensated either by the using the OFFSET controls (coarse and fine) or they can be eliminated using the AC position of the input switches. The inputs and outputs are BNC connectors.

Input and output configurations are selectable. The PA-2S can be connected internally to other modules of the EPMS-07 system, e.g. to one channel of an EXT-08, to a DPA-2F or to an INT-20M module. Both INPUT and OUTPUT signals can be linked internally to other EPMS modules. The LC Display shows which amplifier / channel is used (see below) and indicates if the linear region of the amplifier is exceeded.

The input impedance is 1 M Ω (other impedances are available on request). The GAIN range is x10 to x1000 and can be set by a rotary switch (10-20-50-100-200-500-1000 switch). The OUTPUT is filtered by an 8 kHz lowpass filter.

3.4. Description of the Front Panel

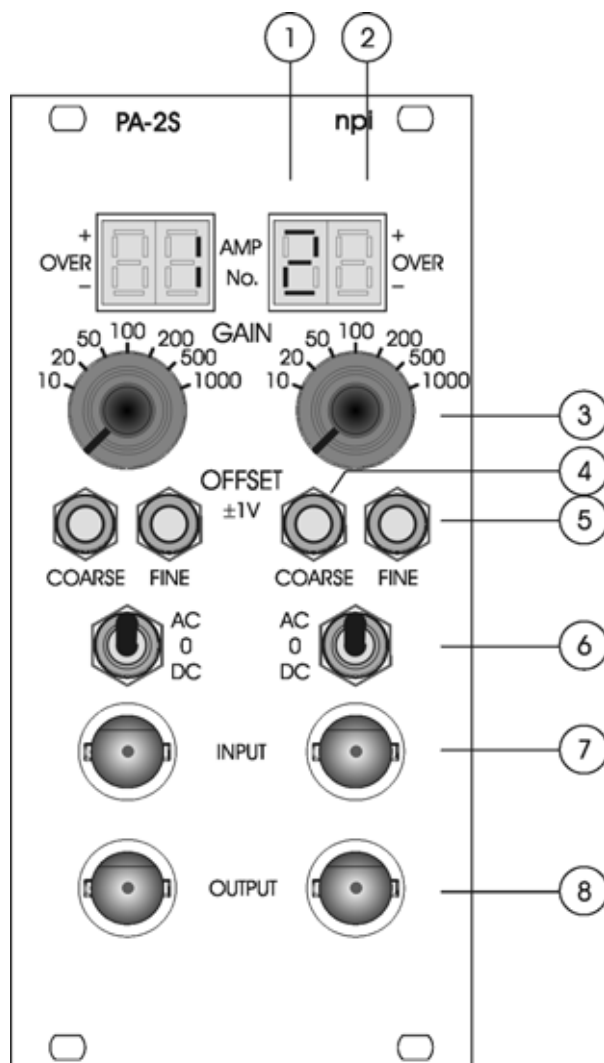


Figure 2: PA-2S front panel view

In the following description of the front panel elements each element has a number that is related to that in Figure 2. 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.

The PA-2S has two channels with identical operation elements that are numbered and described only once.

(1) AMP No. LED



The PA-2S can be connected internally to other modules of the EPMS-07 system, e.g. to one channel of an EXT-08. The display indicates which amplifier (channel) is used as input signal. If no other module is internally connected the LED is off. See also manual of the EPMS-07 module that is connected.

(2) OVER + / - LED

LED that indicates if the amplifier exceeds ± 10 V. The linear range of the amplifier is ± 12 V.

(3) GAIN switch

Rotary switch to set the GAIN (amplification of the input signal).

(4) OFFSET trimpots

Trimming potentiometer to compensate for a DC OFFSET (other than the standard values).

FINE: range ± 250 mV

COARSE: range ± 2.5 V

(5) AC / 0 / DC switch

Switch to set the coupling of the INPUT signal. The switch sets the coupling of both the input at INPUT BNC (#6) and the input that is internally connected.

AC: the input signal is AC coupled with a corner frequency of 1 Hz

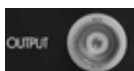
DC: the input signal is DC coupled

0: the input of the PA-2S is grounded, possible offsets are not affected.

(6) INPUT BNC

BNC connector to connect the input signal. Input impedance $1\text{ M}\Omega$ (other impedances on request).

Important: The signal connected to the INPUT BNC is added to the internally connected signal.

(7) OUTPUT BNC

BNC connector providing the amplified signal.

3.5. Operation

Select the desired GAIN using the GAIN switch (#3, Figure 2). Connect the signal to be amplified to one of the amplifiers of the PA-2S using the INPUT BNC connector (#6, Figure 2). Connect a filter, an oscilloscope or a data acquisition system to the OUTPUT BNC connector (#7, Figure 2). In this configuration, i.e. no other module is internally connected, the LCD APM. No. (#1, Figure 2) is off.

If other modules are connected internally via the system bus no additional connections are required. The individual modules are configured by factory with DIP switches in the respective module. Please contact npf if changes in configuration are required.

4. Literature

Boulton, A.A., Baker, G.B. & Vanderwolf, C.H. (eds.) (1990) *Neurophysiological Techniques, Basic Methods and Concepts*, Humana Press, Clifton, New Jersey.

Kettenmann, H. & Grantyn, R. (eds.) (1992). *Practical Electrophysiological Methods* Wiley-Liss, New York.

Ogden, D. (ed.) (1992) *Microelectrode Techniques - The Plymouth Workshop Handbook*, Second Edition, The Company of Biologists Ltd., Cambridge.

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

5. Technical Data

Input range:	± 12 V
Input Impedance:	1 M Ω
Input capacitance:	30 pF
AC coupling at input:	corner frequency of 1 Hz (if AC/0/DC switch at BNC connector is switched to AC)
Offset Compensation:	± 2.5 V (coarse) or ± 250 mV (fine)
Gain:	rotary-switch, 10-20-50-100-200-500-1000
Overload:	starting to light up at ± 10 V
Output:	impedance 250 Ω , max ± 12 V, short circuit protected, filtered by 8 kHz lowpass filter
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 (depending on which modules are plugged in)

Dimensions: 19" rackmount cabinet, 3U high (1U = 1 3/4" = 44.45 mm)