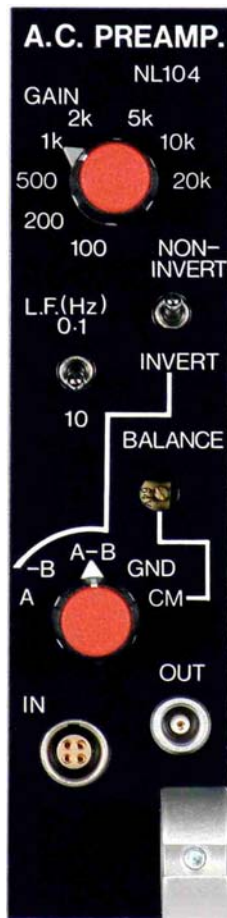


## NL104A - AC Pre-Amplifier



### Introduction

The NL104A AC Preamplifier is a low noise AC coupled differential amplifier. It can be used alone for making recordings from low resistance electrodes (see below) or with the NL100AK headstage for microelectrode recordings. It can be operated in single ended (inverting or non-inverting), or differential modes. It has a wide dynamic balance adjustment for asymmetrical inputs (useful for balancing out interference and short artefacts), a choice of two input time constants and a choice of eight gains. The NL104A has provision for limiting the high frequency response (a jumper on the printed circuit board, with -3dB limits indicated) eliminating the need for subsequent filtering in some applications.

### Balancing the NL104A

An internal 50Hz oscillator is provided for precisely balancing the input.

Set the input switch to the CM position, the rotary gain switch to x1000 and adjust the BALANCE potentiometer using a small screwdriver until the 50Hz signal at the output is minimal. A 3.5mV signal will be present when the common mode rejection is 80dB (or 10,000 to 1). Better rejection ratios are possible with careful adjustment of the BALANCE control, but assessment is difficult without filtering the output signal since the typical output noise will be 5mV ( $5\mu\text{V} \times 1000$ ) with 10kHz BW.

When the NL104A is used to make differential recordings (input switch in the A-B position), the BALANCE control is adjusted to minimise common mode signals such as mains interference or shock artefacts present in the recording. The adjustment will differ from one situation to another, depending on the relative magnitudes of the interference signals at the two inputs and on differences in input electrode resistance, etc. The internal common mode oscillator makes it possible to quickly return the NL104A to a balance after such adjustments.

### Specification Summary

Gain	:	100, 200, 500, 1K, 2K, 5K, 10K, or 20K
Input resistance	:	10Mohms
High frequency cut off	:	100, 700, 6K or WB (>40k) Hz selectable
Low frequency cut off	:	0.1Hz or 10Hz
Common mode rejection ratio	:	10,000:1 at 50Hz (80dB)
Input noise	:	<10 $\mu\text{V}$ (pk to pk) with input grounded and bandwidth 0.1Hz to 10kHz
Dynamic balance adjustment	:	gain for one input can be varied +25% with respect to the other
Output voltage range	:	$\pm 12\text{V}$ (max)

**CAUTION:** When using the NL104A AC Pre-Amplifier, either with or without the NL100AK headstage, do not switch the NL900 POWER switch on or off while the biological preparation is connected to the inputs. Switch the power on before these connections are made and disconnect the preparation before the power is switched off during an experiment. This routine will reduce the risk of damage to the FET input transistors and avoid the possibility of injecting micro-amp currents into the preparation during the supply settling period.

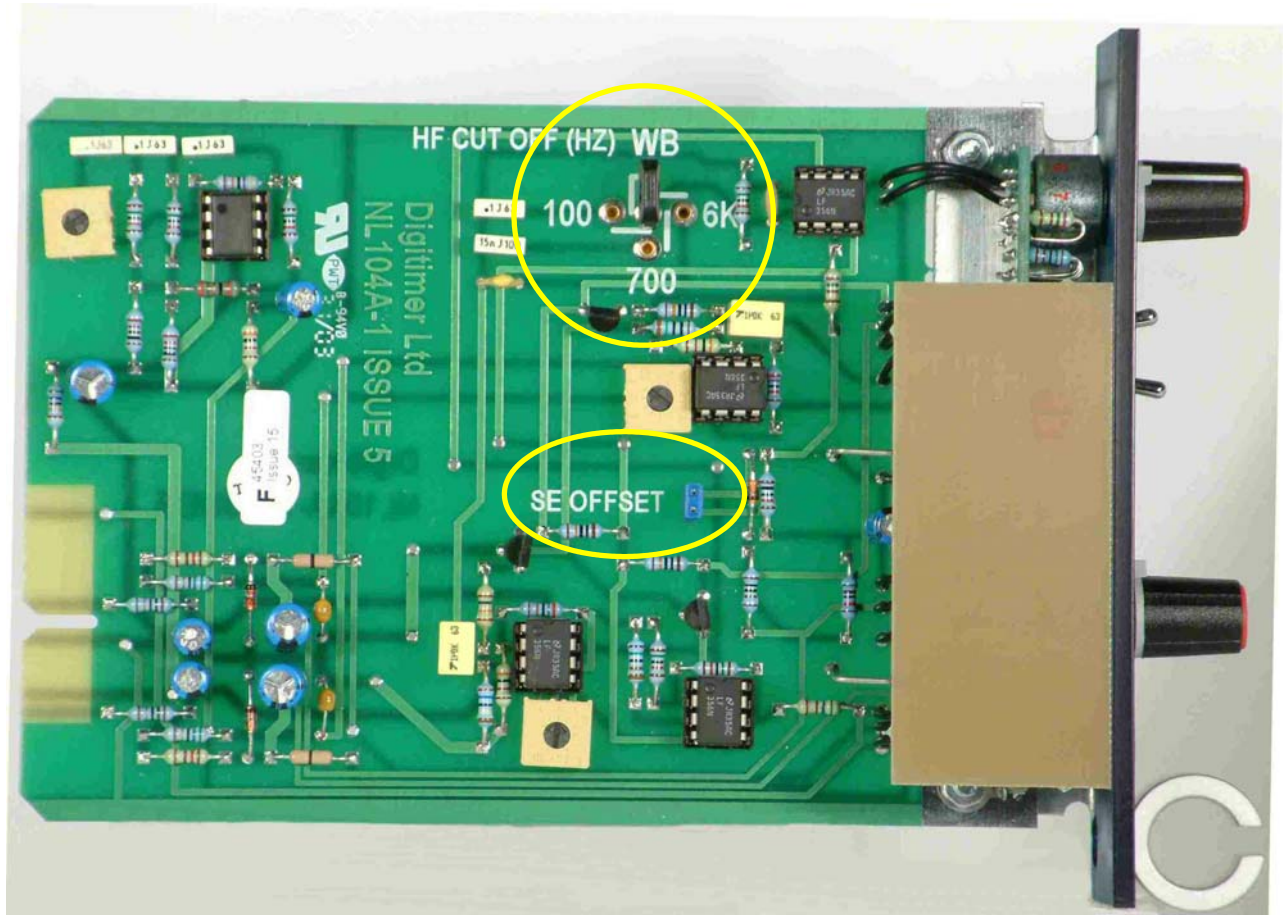


Fig. NL104A-1 : View of Module's circuit board with the on-board jumpers indicated.

### **On-board jumpers**

The photograph above shows the two on-board jumpers circled.

**HF-CUT** - this is shown in the upper circle. The jumper is pulled away from the board removing it from the on-board gold sockets. To select the HF-CUT required aligned the jumper with the centre pin and one of the other sockets as indicated below.

Centre and upper sockets	WB (no effective HF-CUT, modules specification of 40kHz applies)
Centre and right-hand sockets	6kHz HI-CUT filter
Centre and lower sockets	700Hz HI-CUT filter
Centre and left-hand sockets	100Hz HI-CUT filter

**SE OFFSET** - this is shown in the lower oval and allows the NL104A to be used with a NL100AK for Single-Ended (**SE**) recordings. As each output of a NL100AK has a DC offset (which is nulled out by the "A-B" front panel switch position) this has to be offset when the NL104A is used. For NL100AK use, the jumper is pulled away from the board, off the two pins, and then returned to just one pin (for storage). For SE recordings made WITHOUT an NL100AK headstage, the jumper is pulled away from the board and then returned on to both the two pins (as shown).

### **Rear Connections and jumpers**

The rear edge connector in the NL900 rack allows adjacent modules to be connected together without the need of external front panel leads.

**INPUT** - there is no appropriate signal that can be rear connected to this module.

**OUTPUT** - the Output signal is always passed to the Input of the module to the immediate right.

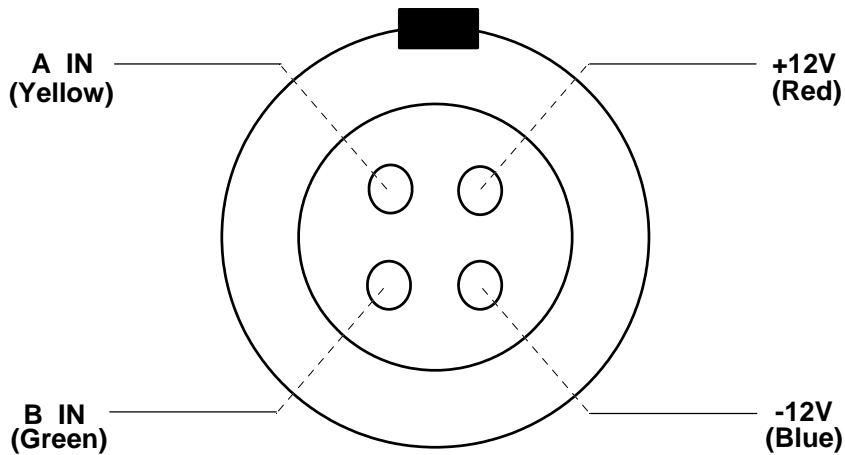


Fig. NL104A-2 : External view of Input socket as well as wire colours used in connecting plugs.

The colours indicated in Fig. NL104A-2 refer to the insulated wires of the assembled cable, NL953K. The +15V and -15V pins in the input socket supply power to the NL100AK headstage; 4mA @ 15V is available at these pins for input preamplifiers of the user's own design if the NL100AK is unsuitable.

If the NL104A is connected directly to the biological preparation through a long miniature screened cable, it must be borne in mind that the frequency response of the NL104A may be substantially reduced. 1.5m (5ft) of miniature 4-conductor screened cable will have approximately 150pF capacitance between each conductor and the screen. If connection is made through 1Mohm electrodes, frequency response will begin to fall off above 10kHz. For lower resistance electrodes, the frequency response is of course affected to a lesser extent.

We reserve the right to alter specifications and price without prior notification.

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