
NL844 - 4-channel Remote Pre-Amplifier



Introduction

The **NL844** is a small, four channel, low noise, high impedance differential pre-amplifier designed for use close to the preparation or human subject. The unit is intended for use with the NL820A Isolator, from the NeuroLog™ system, and used this way complies with BS EN 60601 for patient safety to class I, type BF.

It has controls for LF-cut, Gain and Impedance checking of each amplifier electrode.

The front panel inputs use the 'new' 1.5mm DIN safety connectors as required by the latest specifications in the BS EN 60601 (IEC601 / BS5724) series - Section 2.25 (ECG machines) & Section 2.26 (EEG machines).

This unit is particularly suited for use where there are very large stimulus artefacts, for example when used close to a magnetic stimulator coil. In these cases the stimulus artefact would normally swamp the pre-amplifier inputs resulting in a 'tail' with a long time constant that obliterates the response. The special circuitry of the NL844 eliminates this as long as good recording practice is followed (see page 2).

The input circuit automatically adjusts to the DC input conditions and a non-linear filter subsequently modifies its time constant if the differential input signal exceeds its normal $\pm 20\text{mV}$ working range. Therefore fast, short artefacts do not block the subsequent stages. This results in an amplifier with a very fast recovery time from stimulus artefact pulses.

Each channel has a connector for the non-inverting (+) input that is often called the 'Reference' on EEG machines and inverting (-) input that is often called the 'Active' on EEG machines. As the amplifier is differential both must be used on active channels. The 'COM' connector must always be connected to the patient to provide a reference potential for the amplifiers.

A deblock button provides the user with a method of removing any DC potential from the internal coupling capacitors that may occur whilst arranging the electrodes on the patient. This function can also be performed remotely via the 'MUTE' socket on the NL820A.

Front Panel

The Front Panel of the NL844 showing the 4 - differential input channels and 'COM' connectors along with the deblock button.

The only Front Panel control is the Deblock push-button. Pressing this modifies the internal circuitry so that any "blocked" AC-stages are discharged of their DC offsets.

Good Recording Practice

Some of the secrets of obtaining low interference signals are:-

- Equal length and design/material electrode leads to a channel.
- Equal routing of electrode cables for a channel.
 - Leads should be gently twisted together so as NOT to form gaps between them.
- Low electrode impedance (<5k ohms).
- Equal electrode impedance on both sides of an amplifier.
- Routing of electrode leads away from any electrical/magnetic stimulating source.
 - If leads do need to cross, ensure that they do so at right angles.
- The two wires of stimulating leads should be gently twisted together so as to NOT form gaps.
- Placement of the 'COM' electrode on the patient between the stimulation site and the recording site.
 - A physically large 'COM' electrode can stop surface conduction of the stimulus to the recording electrodes.

Rear Panel

The rear panel contains the toggle switches for the control of channel enable (on/off), LF-cut and gain, controlled in blocks of two channels.



The left hand side of the Rear Panel of the NL844 showing the controls for Impedance Check, Channel Enable, LF-cut and Gain. Also the power LED. The cable connection to the NL820A is off to the right-hand side.

Switch function (from the left):-**Impedance Check**

- | | | |
|----------|------------|---|
| - Up | +VE | - Impedance checking of the +ve (non-inverting) inputs |
| - Centre | OFF | - Impedance checking off (as required whilst recording) |
| - Down | -VE | - Impedance checking of the -ve (inverting) inputs. |

Active Channels - upper switch described, lower switch is the same but for Channels 3 & 4

- | | | |
|----------|--------------|---|
| - Up | CH1 | - Channel 1 is on, enabled (Channel 2 is off) |
| - Centre | OFF | - Channels 1 and 2 are both off |
| - Down | CH1+2 | - Channel 1 and 2 are enabled for recording. |

LF Cut - upper switch described, lower switch is the same but for Channels 3 & 4

- | | | |
|----------|-------------|---|
| - Up | 30Hz | - Channels 1 and 2 are set for a LF-Cut of 30Hz |
| - Centre | 10Hz | - Channels 1 and 2 are set for a LF-Cut of 10Hz |
| - Up | 3Hz | - Channels 1 and 2 are set for a LF-Cut of 3Hz |

Gain - upper switch described, lower switch is the same but for Channels 3 & 4

- | | | |
|----------|-------------|---|
| - Up | x100 | - Channels 1 and 2 are set for a gain of 100 |
| - Centre | x1k | - Channels 1 and 2 are set for a gain of 1,000 |
| - Up | x10k | - Channels 1 and 2 are set for a gain of 10,000 |

Impedance Checking

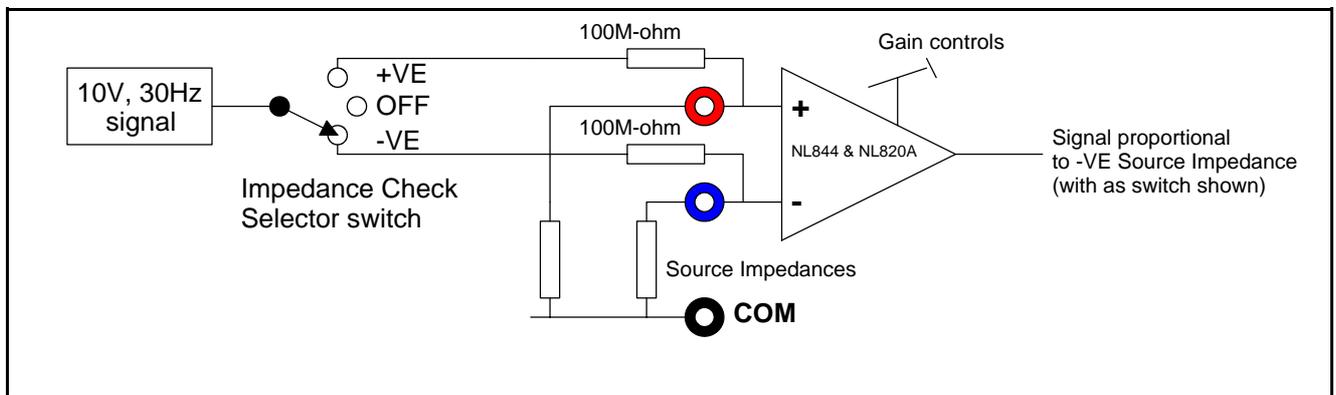
When the rear panel Impedance checking switch is placed in either the +VE or -VE positions, a 100nA current at 30Hz is injected into the signal source of all channels on either the Red or Blue sockets respectively.

This current signal generates a voltage across the source impedance (preparation/patient) at the level of 100µV for each 1000Ω of source impedance. This signal will be amplified by the Gain selected on the NL844 and NL820A before it is available for monitoring at the output of the NL820A.

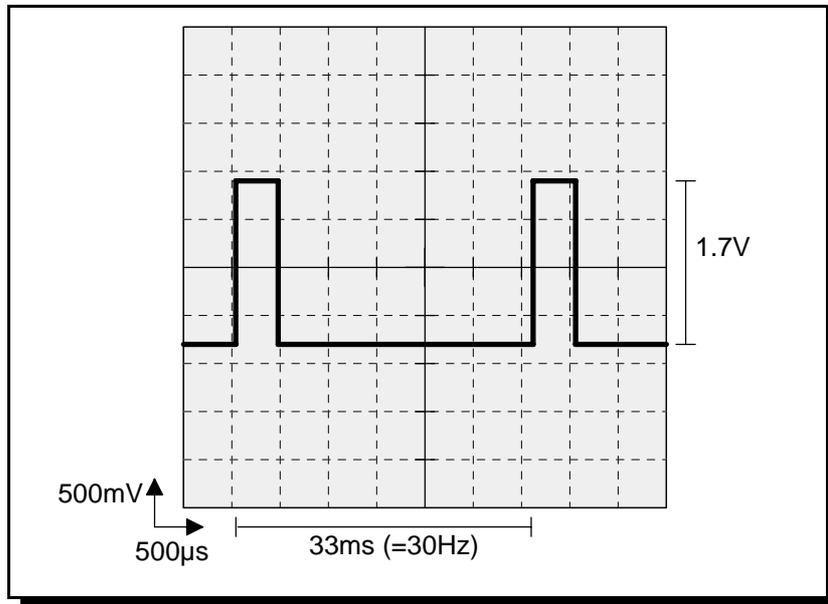
An indication of the signal seen, depending on the Gain setting and the Source Impedance is presented here.

| Gain Setting | Source Impedance | | |
|--------------|------------------|-------------|-------------|
| | 1,000Ω | 5,000Ω | 10,000Ω |
| x100 | 10mV pk-pk | 50mV pk-pk | 100mV pk-pk |
| x1k | 100mV pk-pk | 500mV pk-pk | 1V pk-pk |
| x10k | 1V pk-pk | 5V pk-pk | 10V pk-pk |

Technically, this is ...



The signal that can be expected to be seen on a display, is similar to this ...



Note that the 1.7V amplitude is at the Output of the amplifier system. If the gain has been set to x2 on the NL820A and x1,000 on the NL844 the signal at the input to the NL844 would be 1.7V / 2,000 = 850µV.

As the transfer function is 100µV/1kΩ, this would imply ...

$$\text{the Source Impedance is } 850\mu\text{V} / 100\mu\text{V} = 8.5 \times 1\text{k}\Omega = 8,500\Omega.$$

NB: This signal has a 6:1 duty cycle, as shown and may be upside down from that shown.

Specification Summary

Input signal - maximum for linear response.

| | |
|-----------------|--------|
| AC Differential | ±20mV |
| DC Differential | ±400mV |
| Common Mode: | >9.5V |

Input Impedance 100MΩ
Input Connectors 1.5mm TouchProof (DIN 42802)

Gain x100, x1000, x10,000 (with control of channels in pairs)

Common Mode Rejection >120dB @ 10Hz; >110dB @ 50Hz; >90dB @ 1kHz

Noise <7μV pk-pk (<1.4μV rms) RTI @ 3Hz - 10kHz
<0.4μV pk-pk (<80nV rms) RTI @ 3Hz - 100Hz

Impedance Checking 100nA current injection at 30Hz, 6:1 duty cycle.
i.e. 100μV/kΩ RTI (Referred To Input)

LF-cut (-3dB) 3, 10, 30Hz (with control of channels in pairs)
HF-cut (-3dB) >35kHz on all gains when used with NL820A

Deblock Manual push button or logic signal via the 'MUTE' socket on the NL820A
(actually shifts LF-cut to >220Hz.)

Dimensions 153 x 51 x 178 mm (W x H x D)
Weight 780g (Including cable)
Cable 2m (nom)

Accessories Available

| | |
|--------------|---|
| NL844P/10-Bk | - 10 mating plugs, Black |
| NL844P/10-Bu | - 10 mating plugs, Blue |
| NL844P/10-Rd | - 10 mating plugs, Red |
| NL844P | - 9 mating plugs, 1 x Black, 4 x Blue & 4 x Red |

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

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