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LNLD Differential Amplifier
Remote Control Interface (SP 1'004a)

User's Manual | Revision 1.1 | June 2016

Features

- Fits to the *LNLD Differential Amplifier (SP 1'004)*
- Helpful if the *Differential Amplifier* is difficult to access
- Remote control of gain and LP cut-off frequency
- Reads and displays the *Overload* LED
- Reads and displays the *Offset Compensation* LED
- Intuitive operation with a color backlighted touchscreen
- No deterioration of noise performance of the amplifier
- Also controllable by simple ASCII-commands via serial port
- Restores the last settings at power up
- Small size (130 x 70 x 40 mm), low weight (190 g)
- 4 meters 10 pin interconnection flat cable included
- 3 meters 9 pin D-SUB RS-232 cable (1:1) included
- Wide input (100…240 VAC) wall-plug power supply included

Description

To reach the best noise performance of the *Low Noise Low Drift Differential Amplifier (LNLD Diff Amp)* it is recommended to install it as close as possible to the sample. That's why the device is often mounted directly on the break-out box on top of the cryostat. So it may be difficult to access the knobs on the front panel where the gain and the low-pass filter cut-off frequency are selected. Further the important red *Overload* and green Offset LED may not be visible.
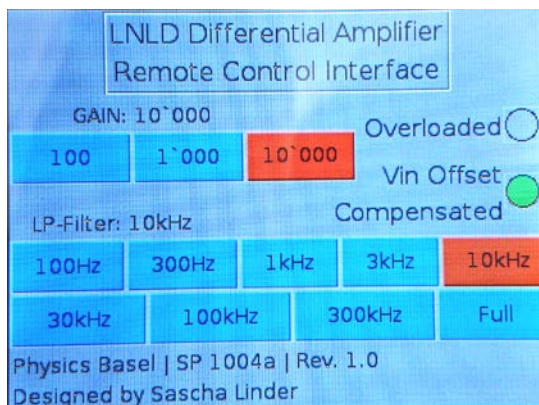
For such installations this *Remote Control Interface (SP 1'004a)* is a helpful device. It allows controlling the gain and the low-pass filter cut-off frequency remotely and it also displays the status of the *Overload* and *Offset Compensation* LED.

By pressing the corresponding field on the touchscreen (see photo on the left) the *GAIN* and *LP-Filter* settings are remotely changed. Since the fields are on the touch screen are pretty small, the operation with the fingernail is proposed. The *Overload* indicator changes its color from gray (OFF) to red (ON) if the amplifier gets overloaded. The *Vin Offset Compensation* indicator changes its color from gray (OFF) to green (ON) if the input stage of the amplifier is compensated. The actual settings are periodically stored and after power up the last settings are automatically recovered. The booting of the device takes around one and a half minute; during the booting phase the gain is set to 1'000 and the cut-off frequency may varying.

In parallel to the manual touch-control of the *GAIN* and *LP-Filter* settings the device can also communicate via a standard RS-232 serial port with a computer. By sending simple text commands (ASCII) the *GAIN* and *LP-Filter* settings can be altered and the actual settings (*GAIN, LP-Filter, Overload and Vin Offset Compensation*) can be readout.

Settings and Connections

While using the remote control interface it is important that the two rotary switches on the *LNLD Diff Amp (SP 1'004)* are set to the position "Remote" (see photo on the left). The *GAIN* has to be in the position "x*1'000, Remote*" and the *fcut* must be set to the position "*100Hz, Remote*"

If local settings (by the two rotary switches) are preferred the cable at the *Remote Control I/O*

connector has to be disconnected or the remote control interface has to be turned off.
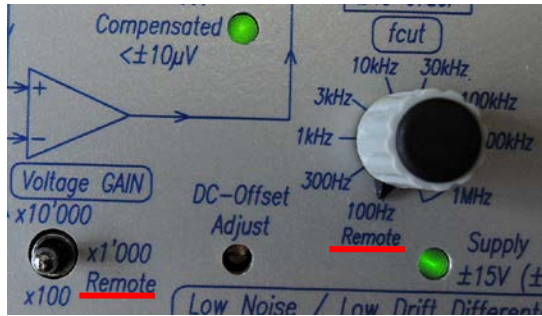
The *Remote Control I/O* connectors (10 pin) of the remote control interface and the *LNLD Diff Amp* have to be interconnected by a 1:1 cable (see below). A 4 meter long flat interconnection cable is included and it is equipped on both sides with the suitable connectors (*Minitek 2x5P, 89947-710LF*). Note that the plugs are coded with a recess on the upper side and the connector has a central key which must be orientated to the upper side of the devices so that the flat cables leave the connectors on the top.
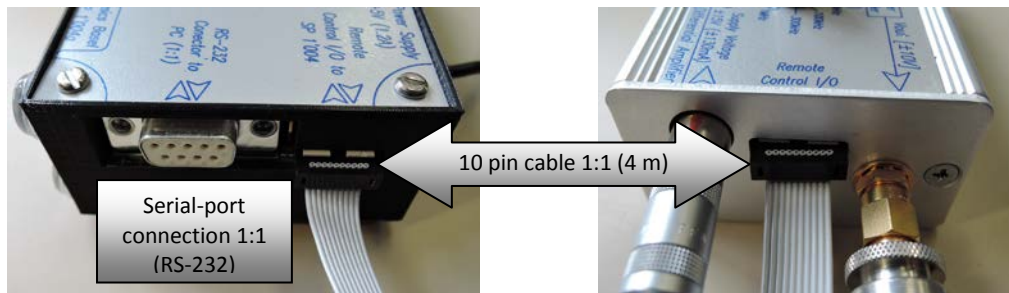
The remote control signals are galvanically isolated by optocouplers inside the *LNLD Diff Amp.* Therefore no ground-loops or interference can occur when using the remote control interface. Nevertheless, make sure that no high-frequency noise is coupled into the remote control I/O interconnection cable. Otherwise the high-frequency noise may capacitive coupling into the sensitive electronics of the amplifier. In low-interference laboratory environment an unshielded flat cable up to a length of around 5 meters should be fine. If the remote control cable has to travel over a large distance in noisy environments, a shielded interconnection cable between the remote control interface and the *LNLD Diff Amp* may be necessary.

For further information about the remote control see the datasheet of the *LNLD Diff Amp (SP 1'004)*, chapter "12. Remote Control".

The included wide input (100…240 VAC) wall-plug power supply (HNP10I-microUSB, 5 V, 2.1 A) has to be connected to the remote control interface on the top right side (see left).
Make sure that the orientation of the microUSB connector and the plug are correct before connecting.
The remote control interface can be turned off by disconnecting this connector or by switching off the mains of the wall-plug power supply.

Serial Communication

Besides the manual selecting of the *GAIN* and the *LP-Filter* cut-off frequency, the remote control interface can also communicate with a computer. The communication between the remote control interface and the computer works via a serial connection using the RS-232 standard. A 9 pin D-SUB cable with a 1:1 wiring has to be used for the interconnection. Such a cable with a length of 3 meters is included. The settings of the serial port are the following:

> Baudrate = 9'600
> Databits = 8
> Stopbits = 1
> Parity = None
> Flow control = None

A simple text communication (ASCII - which is not case sensitive), is used for data transmission. Therefore a terminal program (e.g. putty, running on a PC) can be used for testing the communication. If a command cannot be correctly interpreted, the remote control interface sends a help text-string.

SET Commands

The *GAIN* and the *LP-Filter* cut-off frequency of the *LNLD Diff Amp* can be programmed by sending the ASCII commands "SET". Each command must be terminated by a Carriage-Return <CR> (0x0D). When the command was correctly interpreted, the remote control interface responds with an "OK" followed by a Carriage-Return <CR> (0x0D) and a Line-Feed <LF> (0xA).

To set the *GAIN*, the following command must be used:
"SET G" followed by a <SPACE> and then the desired gain "1E2", "1E3", "1E4" or "100", "1000", "10000" ended with a <CR>.
For example, to set the *GAIN* to 100 the following ASCII command must be used:
SET G 100 <CR> or **SET G 1E2** <CR>
The device responds with:
OK <CR> <LF>

To set the *LP-Filter* cut-off frequency, the following command must be used:
"SET F" followed by a <SPACE> and then the desired *LP-Filter* cut-off frequency (100 Hz…1 MHz/full) and ended with a <CR>. The cut-off frequency can be typed with Hz or without and the "k" is interpreted correctly.
For example setting the *LP-Filter* cut-off frequency of the amplifier to 1 kHz can be done with one of the following commands:
SET F 1000 <CR>
SET F 1000Hz <CR>
SET F 1k <CR>
SET F 1kHz <CR>
In all cases above the device responds with:
OK <CR> <LF>

To set the *LP-Filter* cut-off frequency of the amplifier to its maximum 1 MHz (full) the following command must be used:
SET F FULL <CR>
The device responds with:

OK `<CR>` `<LF>`

GET Commands

By using the "GET" ASCII commands the actual settings of the amplifier can be read out. The command must be terminated by a Carriage-Return `<CR>` (0x0D). When sending "GET" without a parameter the remote control interface responds with the *GAIN*, the *LP-Filter* cut-off frequency and the status of the *Overload* and *Offset Compensation* LED on four separated lines; each line is terminated with a Carriage-Return `<CR>` (0x0D) and a Line-Feed `<LF>` (0xA).

For example, when the *LNLD Diff Amp* is actually set to a GAIN of 1'000, the *LP-Filter* cut-off frequency is set to 1 kHz, the *Overload* LED is turned OFF and the *Vin Offset Compensated* LED is turned ON, the "GET" command reads the following:

GET `<CR>`
The device responds with:
Gain: 1000 `<CR>` `<LF>`
Filter: 1kHz `<CR>` `<LF>`
Overload: OFF `<CR>` `<LF>`
Vin Offset Compensated: ON `<CR>` `<LF>`

To read-out only the actual *GAIN*, the command "GET G" must be used:
GET G `<CR>`
The device responds with:
Gain: 1000 `<CR>` `<LF>`

To read-out only the actual *LP-Filter* cut-off frequency, the command "GET F" must be used:
GET F `<CR>`
The device responds with:
Filter: 1kHz `<CR>` `<LF>`

To read-out only the actual *Overload* status, the command "GET O" must be used:
GET O `<CR>`
The device responds with:
Overload: OFF `<CR>` `<LF>`

To read-out only the actual *Vin Offset Compensated* status, the command "GET C" must be used:
GET C `<CR>`
The device responds with:
Vin Offset Compensated: ON `<CR>` `<LF>`

Commands Send Automatically

When a changing *Overload* or Offset Compensated status is detected, a text message is automatically send via the serial port. This allows that an attached computer can react on the *Overload* state transition and automatically changes the GAIN [V/A], for example.

When the *Overload* status changes from OFF to ON, the following message is send automatically:
Overload: ON <CR> <LF>

When the *Overload* status changes from ON to OFF, the following message is send automatically:
Overload: OFF <CR> <LF>

When the Offset Compensated status changes from OFF to ON, the following message is send automatically:
Vin Offset Compensated: ON <CR> <LF>

When the Offset Compensated status changes from ON to OFF, the following message is send automatically:
Vin Offset Compensated: OFF <CR> <LF>

Background

The remote control interface is based on a single-board computer "Raspberry Pi B+" running a Linux operation system. The 2.8" touchscreen has a resolution of 320 x 240 pixels and comes from the company "Adafruit". The application of remote control interface is written in the programming language "Phyton".