

Linear Audio Auto-ranging Attenuator User Guide

AR MKII V3.19



User Guide

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Introduction

The Linear Audio Auto-ranging Attenuator (AR) is an automatic signal levelling unit intended for use with audio soundcard and similar measurement equipment. The AR attenuates or amplifies the signal to be measured to the level expected by the soundcard.

Power supply

The AR runs off an internal 'SilentSwitcher' which can be powered through a B-type USB connector on the back side. Normally this should be run off a standard 5V USB charger. For extremely sensitive measurements, the AR can be run off a standard 5V PowerBank for full mains isolation.

Display and controls

The controls and indicators of the AR are logically grouped according to the signal flow from input to output, see **figure 1**.



Figure 1 AR front panel layout

At the left side are the signal input jacks; there is a BNC jack for single-ended signals and a combined XLR/TRS jack for balanced signals. Selection of either input is via the two momentary illuminated pushbuttons above the connectors, **SE** and **Bal**.

The display in the middle shows input- and output signal levels in V_{RMS} and the attenuation or gain the input signal is subjected to, as described later. The display

color can be set to Green, Red or Blue with an internal jumper (see *Display color and contrast*).

At the right side of the front panel are two output connectors for single ended and balanced output signals for connection to the soundcard input. Connectors are TRS type. When the balanced output is used, the single ended output is disabled.

Above the output connectors are the **Hold** momentarily pushbutton (to be described) as well as the **Over-** and **Under-range** LED indicators. These will light up when the input signal is too small (Under-range) or too large (Over-range) for the unit to auto-range to the nominal output level.

The Under- and Over-range indicators are normally off or will briefly flash when the unit changes the attenuation or gain setting while auto-ranging. When **Hold** (see *Manual Operation*) is activated, the Over- and Under-range indicators may be lit continuously depending on the input signal levels and actual attenuation or gain setting.

The **ON** switch is self-explanatory.

Default settings

At switch-on the unit defaults to single ended input and auto-range mode. The display briefly shows a log-on message as well as the nominal output level the unit will use to auto-range to (see *Automatic mode; Range selection*).

Display color and contrast

The display has three-color LEDs for backlighting and any one (or several at the same time) can be selected with jumpers. There is also a trim pot to adjust the contrast setting; the optimum setting may be different for different colors. **Figure 2** shows the location of the jumpers and the trimpot at the back of the front panel PCB.

Automatic mode

The AR usually operates, as its name implies, in automatic mode. In this mode, which is default at switch-on, the signal to be measured is input at either the single ended or the balanced input, and the AR provides a single ended and balanced output at a level suitable for a soundcard. This output level remains within a predetermined level window. No further user action is required in this mode of operation.

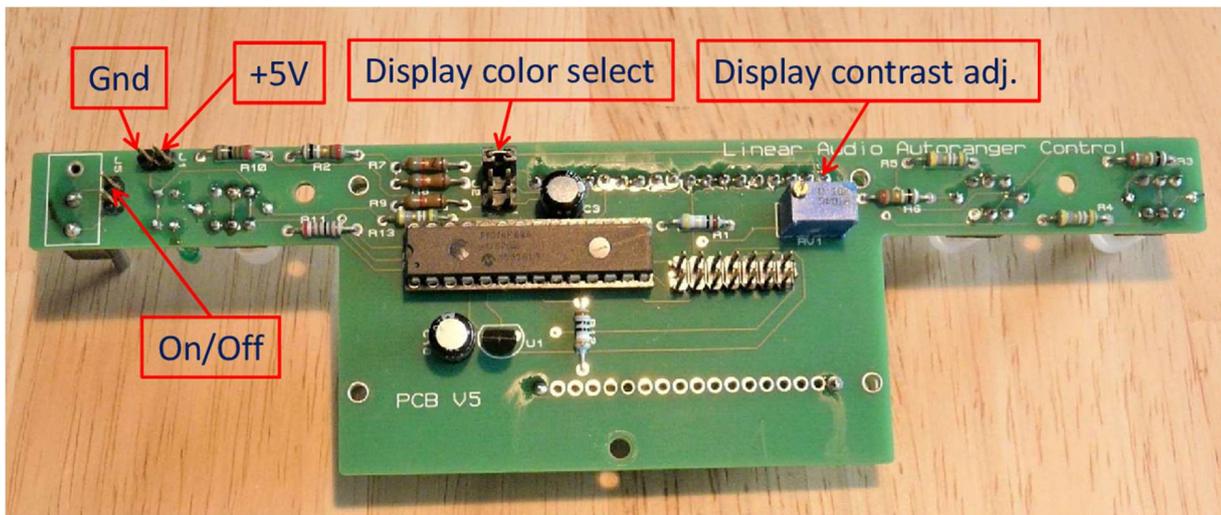


Figure 2 Display color and contrast setting on front panel PCB

Range selection

Several nominal output levels (in V_{RMS}) are available, namely: 0.5V, 1.0V, 1.5V, 2.0V, 2.5V, 3.0V and 4V. The window around each of these levels is approximately +2.5dB to -4.8dB. This translates to about equal voltage levels around the nominal value. Levels outside the window will initiate an up- or down scaling. For instance, on the 1.5V setting, levels above about 2V and below about 1V initiate autoranging.

Selection of the desired nominal range is done front-panel pushbuttons at switch-on (see *Changing nominal level*).

Manual operation

The AR can also operate in Manual Mode. This mode is initiated by pressing the **Hold** button. When pressed, the Hold button will light, the specific attenuation or gain setting in force at that moment will be locked in and will be maintained independent of changes in the level of the signal at the AR input. Be aware that prolonged overload with high input voltages while the unit is in Hold mode on a gain setting or a low attenuation setting may damage the unit.

When in **Hold** mode, the input selection pushbuttons take on a secondary function. Pressing the **SE** input button will increase the attenuation (or decrease the gain) in 6dB steps until the maximum attenuation of -42dB is reached.

Pressing the **Bal** input button while in **Hold** mode will decrease the attenuation (or increase the gain) in 6dB steps until the maximum gain of +18dB is reached.

During Hold, all manual settings will be maintained independent of the input signal level. Pressing **Hold** again will disengage the manual operation and the AR will range to the required setting for the current input signal level.

As auto ranging is disabled during manual operation, either the Over-range or the Under-range LED indicator may be active.

Level sweep. One important use of the manual settings is for level sweeps. For instance, suppose you want to measure your amplifiers' harmonic distortion as a function of signal level. You would then set the maximum amplifier output level expected and let the AR auto-range it for the desired soundcard input level. You then press **Hold** to lock in the attenuator setting. You can now sweep the amplifier output level from zero to the predetermined maximum level and the input level to the soundcard will vary from zero to the maximum setting. As always, depending on the test software used, you may need to correct the result for the AR attenuation setting in force during the measurement.

Changing nominal level

The default setting for the AR out-of-the-box is a nominal output level of 1.5V_{RMS}. This will be fine for many uses. However, for cases where the soundcard performs better with a higher or lower level, or has a better THD+N performance at higher or lower level, a different nominal level can be selected.

Switch off the AR and switch it on again while keeping the **Hold** button depressed until the display shows a selection menu for the nominal settings: '<1.0 1.5V 2.0>', similar to **Figure 3**.

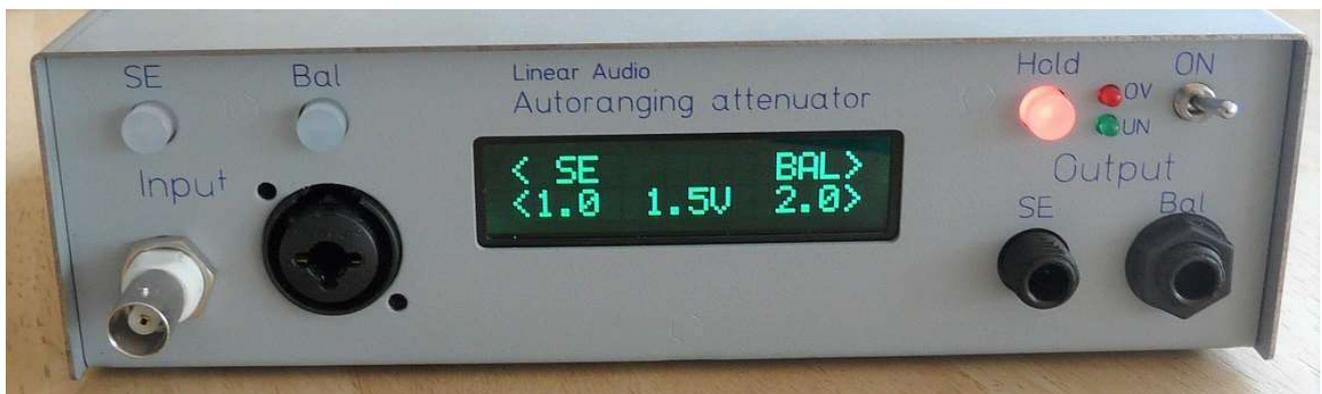


Figure 3 Nominal output selection menu

At this point, the input selection pushbuttons again take on a secondary function. Pressing the **SE** input button will select the nominal setting on the left of the display; pressing the **BAL** pushbutton selects the nominal setting at the right side of the display. This can be continued until the lowest (0.5V) or highest (4.0V) setting has been reached. Note that the selected setting will be locked in for every time you switch the unit on unless you again select another setting.

Output voltage limit

There are two 2-pin jumper headers on the attenuator board, J6 and J7. You find them just above the two output connectors. When the jumpers are placed, the output signal is limited to about 5V peak. This is meant as protection for sound cards that cannot handle more than 5V. If the jumpers are removed, the maximum output signal can reach 10V_{RMS} or 14V peak. Check your sound card documentation, if not needed do not place the jumpers for the lowest distortion.

Enjoy your AutoRanger, and don't forget to check at <https://linearaudio.nl/la-autoranger> once in a while for any updates.