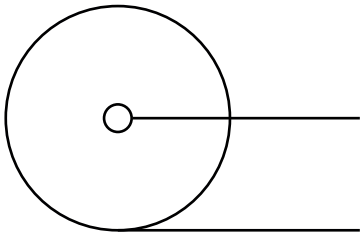
Comparison of Noise Levels

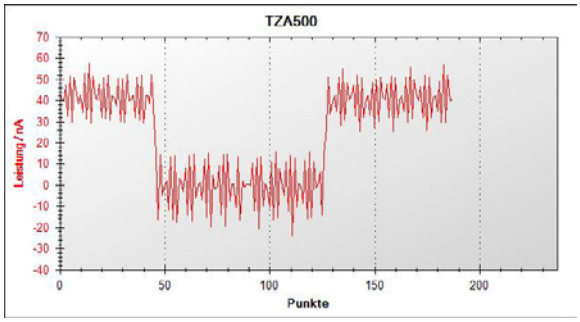
The TZA500 series of transimpedance amplifiers is offered in several different configurations to suit customer's applications. Since this amplifier is designed for measuring low level currents, it is of particular interest to consider the noise level of the amplifier in different configurations.

One option which has a major influence is the choice of input receptacle. Many customers prefer the BNC option for single ended applications since this connector type is so popular in the industry. However, when one considers that the "ground return" path is in fact also a signal path, this option shows its weakness. Since this signal path is open to any external interference, the noise of the measurement will be higher than when using the BR2 option which uses twin signal leads with an external shield.

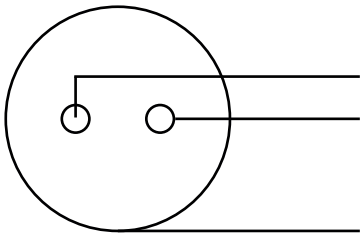
In the following diagrams we have compared the results for a square wave 40nA input under noisy environmental conditions. Clearly the BR2 receptacle is the better choice for low noise measurements.

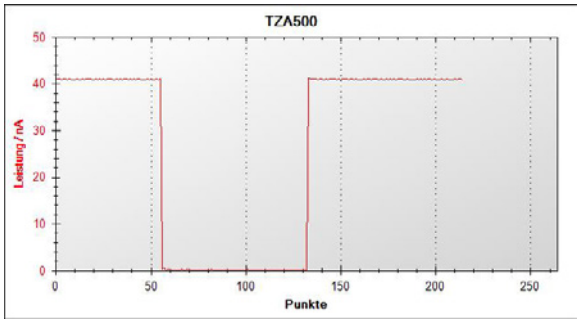
BNC





BR2





Whenever trying to achieve maximum signal-to-noise ratio, it is best to eliminate noise sources as much as possible rather than trying to reduce their effects technically. Proper attention to shielding is very effective in most cases. However, in some cases when detecting very low currents or working in very noisy environments, even the shielding of the BR2 cable is not enough.

For these extreme situations we offer the BR2 version with a differential input stage amplifier.
The topologies of the two amplifier types are shown on the next page.

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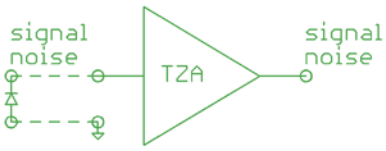
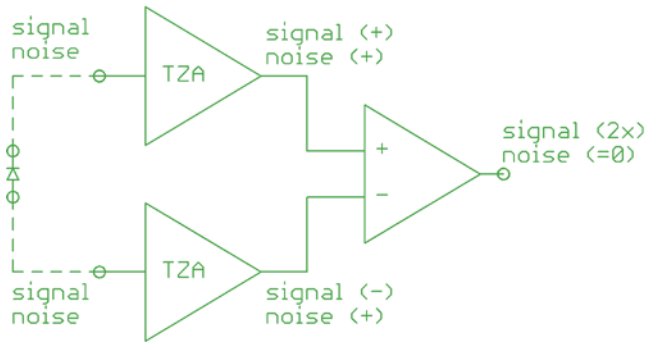
Single ended input

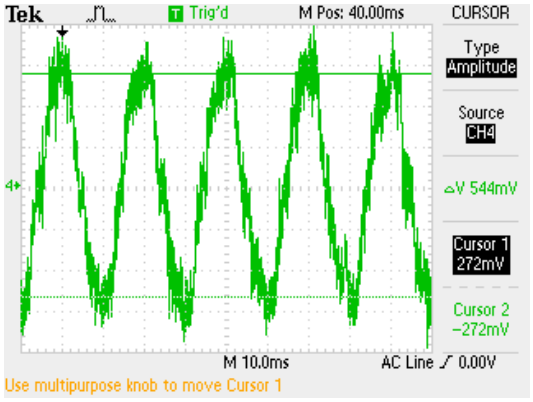


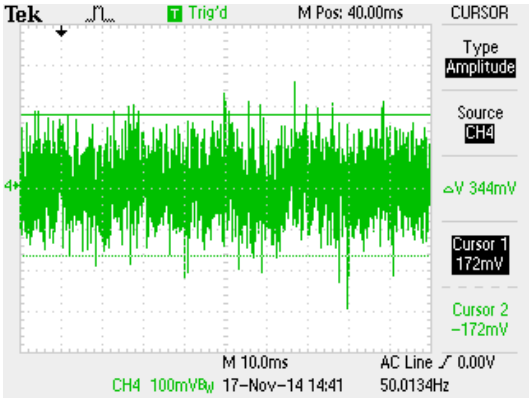
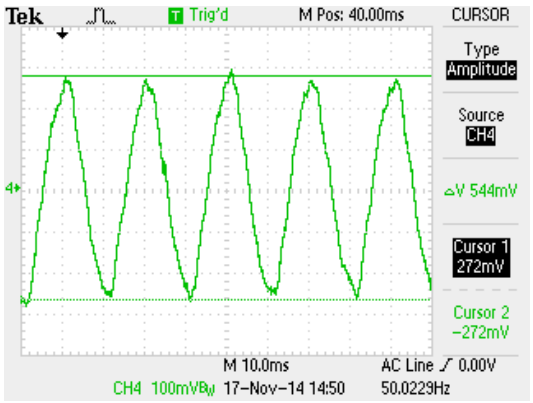
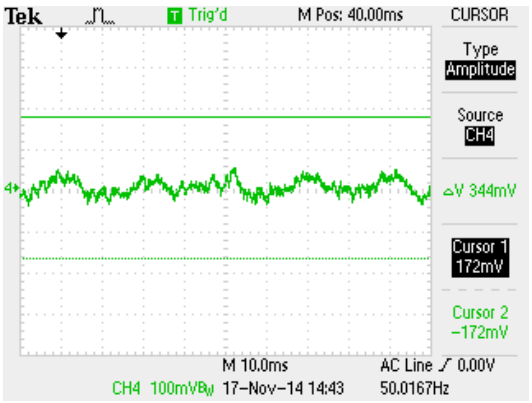
Differential input



With the single ended input stage, any common mode noise introduced at the distal end of the cable is amplified by the input stage. The differential amplifier on the other hand amplifies only the signals which are generated by the source – in this case a photodiode. Common mode noise introduced at the photodiode, for example pickup from a motor or a transformer near the source, is subsequently eliminated in the differential stage following the transimpedance inputs.

The following oscilloscope screen shots demonstrate this dramatically. In each case, a 50cm open ended cable was placed near the transformer of the oscilloscope and connected to the amplifiers. The results were measured at maximum gain (=108 V/A) followed by a x100 voltage amplifier. Clearly the 50Hz pickup from the transformer (corresponding to 54pA peak-to-peak) has been almost totally eliminated with the differential input amplifier.





If the full speed of the amplifier is not required, a further noise reduction can be obtained by selecting a reduced bandwidth. This feature is available in the software of the TZA500. The following screen shots show signals from the same setup but with the bandwidth reduced to 100Hz.