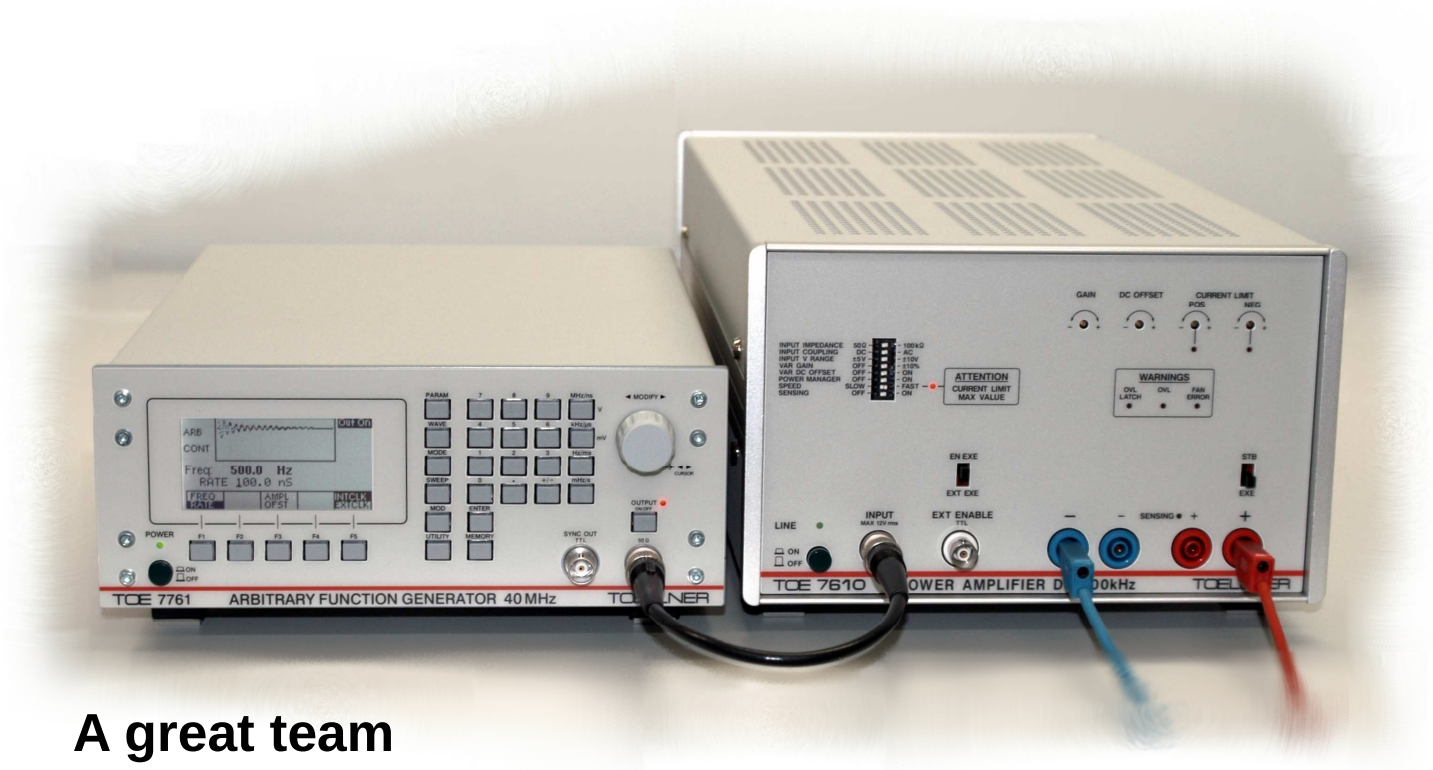

A great team for fast test signals

Fast test signals together with sufficient power are increasingly in demand, whether for simulating residual ripple in a vehicle wiring system or for simulating noise pulses. Of equal importance are a high setting accuracy together with exact repeatability of the test signals. The new TOE 7761 arbitrary function generator from Toellner together with the TOE 7610 four-quadrant amplifier satisfy practically all requirements.

Arbitrary power supplies are being increasingly used both in the development phase and in test setups in order to investigate the response of electrical systems in the event of irregularities in the supply voltage. In a vehicle, for example, the various electric and electronic components must be able to handle voltage dips or peaks when starting up or switching off inductive loads without damage and without malfunctions. These components must therefore also be tested using adjustable voltage characteristics with a sufficient power.

Standard power supplies are able to carry out larger changes in the output voltage in the millisecond range. Faster changes are frequently impossible because of the control properties, the smoothing capacitors and the performance of the discharge circuits for the smoothing capacitors, if such are present at all. On the other hand, edges with a duration of only a few microseconds can only be simulated using a function generator possessing a power output or a series-connected amplifier.

The TOE 7610 four-quadrant amplifier from Toellner is available in various voltage versions up to ± 60 V, and processes powers as a source or sink up to 150 W. The power bandwidth extends from DC up to more than 100 kHz. With a reduced control range, e.g. with a changing signal of a few volts around a DC voltage level, rising or falling edges of 1 µs can be implemented.

Control is possible using the new TOE 7761 arbitrary function generator which allows step rates in a wide range from 12.5 ns up to 100 s per sampling point. This corresponds to a maximum sampling rate of 80 MSamples/s. A test signal may contain up to 1 000 000 sampling points so that sufficiently long test sequences can be generated even with high sampling rates. With a resolution of 14 bits per sampling point, extremely exact simulation of all signal waveforms is possible.

Application example

Fast noise pulses are generated in a vehicle wiring system when switching motors and inductive loads. The noise voltages are sometimes significantly higher than the vehicle system voltage, so that the devices operated in a vehicle wiring system must also be able to handle negative voltage peaks without problem.

The interference can frequently be simulated using a decaying sinusoidal signal with a frequency of a few kHz, upon which a number of spikes are superimposed at the switching instant. Fig. 1 shows a typical voltage response in a vehicle wiring system when switching a load. The voltage response shown was simulated using the arbitrary function generator, and recorded on a resistive load at the output of the series-connected amplifier. The needle pulses were simulated as square-wave pulses with a duration of 1 µs.

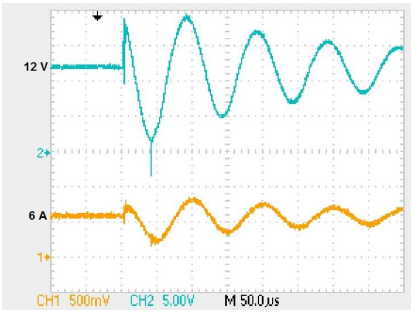

Fig. 1: Noise pulse in the 12-V vehicle wiring system

The amplifier does not have a lower cut-off frequency, and can handle the tasks of a DC or AC source equally. As a four-quadrant amplifier it provides source and sink modes for positive and negative voltages, and thus permits equally fast rising and falling signal edges in the microsecond range.

Fig. 2 shows the first voltage jump at the beginning of the fault at a higher resolution. In this example, the fault is initiated by two pulses in opposite directions, where an edge steepness of approx. 1 µs is reached on the load. Compared to a power supply with sink, the edge steepness is greater by a factor of at least 100. Altogether, the completely simulated signal comprises approx. 20 000 data points which are sampled at a rate of 0.1 µs per point. This already permits very exact simulation of the noise.

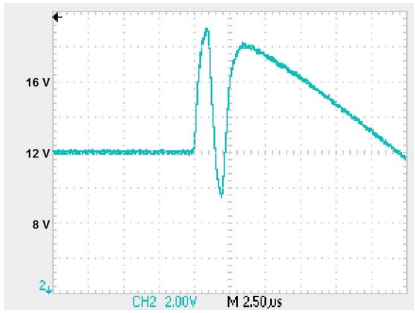

Fig. 2: Simulated noise peak with a load current of 6 A

The possibilities of the TOE 7761 arbitrary function generator are far from exhausted by this, since significantly longer signal waveforms can be provided in the main memory. Furthermore, it is possible to use the memory to provide several test signals which can be selected in rapid succession.

Summary

A four-quadrant power amplifier with DC gain extends the testing facilities for fast noise signals with pulse rise times in the microsecond range. Together with an arbitrary function generator as the controlling source, the result is a flexible test system for generating almost any signal waveforms at a high accuracy and speed. A large memory depth allows long test sequences, or offers great flexibility for rapid changes in the test signals.

Application of a four-quadrant amplifier together with an arbitrary signal source is also interesting in areas other than the simulation of vehicle wiring systems. Examples include ultrasonic applications or the use as a DC and AC source for electric motors.

Resistance to continuous loads together with excellent specifications and a product range including various voltage versions open up a wide field of applications for the TOE 7610 amplifier range together with the TOE 7761 arbitrary signal generator.

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