A FIVE-CHANNEL TRIGGER SIGNALS AMPLIFIER*

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At present, plasma physics is actively investigating objects whose lifetime can be tens or even units of nanoseconds, for example, the electric explosion of conductors, Z- and X-pinches, and others [1-6]. It is often necessary to use additional high-voltage equipment to diagnose [1–3] or form [4-6] these objects in an experiment. Moreover, this equipment must be synchronized with the main generator with a jitter of less than ±10 ns.

High-voltage gas trigatrons are widely used as an intermediate stage for starting high-current pulse generators with an operating voltage of over 30 kV. They make it possible form voltage pulses with an amplitude of 15-20 kV and a rise time of less than 20 ns. Low-voltage multichannel trigger generators (TG) are often used as the primary trigger device, which form a pulse with an amplitude of up to 300 V. It is often impossible to provide an acceptable level of the triggering signal for a trigatrons spark gap directly from the TG. In this case, either a large trigatrons jitter is observed, or it does not start at all. In addition, in some cases it is necessary to increase the length of the cable between the TG and a trigatrons spark gap that leads to the attenuation of the trigger pulse. This can also negative effects on the trigatrons operation.

A five-channel trigger signal amplifier was developed to solve these problems. A voltage pulse with an amplitude of -1 kV is formed at the output of each channel. The amplifier was tested in operation with a high-voltage gas trigger, which formed a voltage pulse with an amplitude of -18 kV to start a pulse power generator. As a result of the tests, it was shown that the jitter at the output of the high-voltage gas trigger (-18 kV) did not exceed ±3 ns, and the jitter of the high-current generator was no more than ±10 ns.

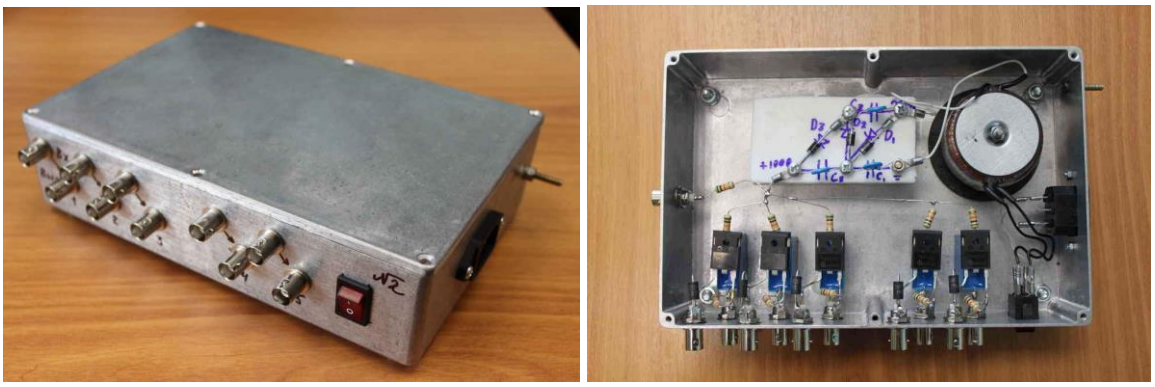

Fig.1. External and internal view of the five-channel trigger signal amplifier.

REFERENCES

[1] S.I. Tkachenko, V.M. Romanova, A.R. Mingaleev et al, “Study of plasma parameter’s distribution upon electrical wire explosion”, Eur. Phys. J. D, vol. 54, pp. 335–341, 2009.

[2] D.B. Sinars, T.A. Shelkovenko, S.A. Pikuz et al, “The effect of insulating coatings on exploding wire plasma formation”, Phys. Plasmas, vol. 7, pp. 429-432, 2000.

[3] R.B. Baksht, A.G. Rousskikh, A.S. Zhigalin, V.I. Oreshkin, and A.P. Artyomov, ”Stratification in Al and Cu foils exploded in vacuum”, Phys. Plasmas, vol. 22, 103521, 2015.

[4] A.G. Rousskikh, A.V. Shishlov, A.S. Zhigalin, *et al*, “Small-sized vacuum-arc-discharge x-ray radiograph,” Plasma Sources Sci. Technol., vol. 20, 035011, 2011.

[5] A.P. Artyomov, S.A. Chaikovsky, A.G. Rousskikh and A.V. Fedunin, “Soft x-ray source based on the point Z-pinch for pulse radiography”, Journ. of Phys.: Conf. Series, vol. 1556, 012083, 2020.

[6] R.K. Cherdizov, R.B. Baksht, V.A. Kokshenev et al, “Effect of tailored density profiles on the stability of imploding Z-pinches at microsecond rise time megaampere currents”, Plasma Phys. Control. Fusion, vol. 64, 015011, 2022.

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