HARDWARE OF RECORDING AND DATA COLLECTION SYSTEMS OF PLASMA INSTALLATIONS [[1]](#footnote-1)\*)

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The report is devoted to an overview of the recorders developed at the G. I. Budker Institute of Nuclear Physics of the SB RAS (Russia, Novosibirsk) intended for use in data acquisition systems of plasma installations. All developed recorders have a common construction architecture based on the FPGA (programmable logic integrated circuit) with an integrated ARM processor module. Formally, all considered recorders can be divided into three types: ultra-high-speed recorders ADC105000/8 and ADC105000/4, high-speed recorders ADC12500/2, ADC14250/4, ADC14500/4 and ADC14125/2, and galvanically isolated recorders ADC161/4 and ADC13-9/8.

A feature of the first type of recorders (ADC105000/8 and ADC105000/4) is the use of the time-scale transformation method (SCA - switch capacitor array) to build the main recording paths. Within this method, the current amplitude values of the signals are recorded in analog form by a large number of elementary sampling and storage cells. These values are read and converted into digital equivalents using ADC with sampling rate about 1-30 MSPS. The eight-channel recorder ADC105000/8 (5GSPS, 10 bit) is the basis of the Thomson scattering diagnostic at the GDT facility at the BINP SB RAS. The four-channel version of the ADC105000/4 recorder is intended in diagnostics of electron beam losses of the SKIF synchrotron radiation source (Russia, Novosibirsk).

In the recorders: ADC12500/2, ADC14250/4, ADC14500/4 and ADC14125/2 the direct conversion method is used to capture the waveform, based on the "digitization" of the current amplitude values of the signals by high-speed ADCs. Based on the ADC12500/2 (500MSPS, 12 bit) dual-channel recorder, a two-channel neutron-gamma spectrometer with real-time event separation and a two-channel recorder of the energy spectrum and thermonuclear neutron flux intensity were implemented at the BINP SB RAS. Two-channel recorder ADC14125/2 (125MSPS, 14 bit) is used in the diagnostics of plasma density at the Globus-M2 tokamak (Russia, St. Petersburg) by dispersion interferometer. The ADC14250/4 (250MSPS, 14 bit) four-channel recorder is focused on building data acquisition systems for installations and complexes used in research on plasma physics and controlled thermonuclear fusion, as well as in the field of high energy physics. Currently, a four-channel ADC14500/4 (500MSPS, 14 bit) universal-purpose module based on a 14-bit ADC is under development.

The third type of recorders are galvanically isolated ADC161/4 and ADC13-9/8 modules. Their feature is the ability to work in high-voltage diagnostic systems of plasma installations, while data is transmitted to the diagnostic server through a special interface node connected to the recorders via fiber-optic communication lines. The eight-channel ADC13-9/8 (1,25MSPS, 13-9 bit) module is used to measure the longitudinal particle and heat fluxes at the GDT facility at the BINP SB RAS. The four-channel recorders ADC161/4 (1MSPS, 16 bit) are designed for measurements under high interference conditions at the GDT facility at the BINP SB RAS.

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/L/Mu/ru/CM-Puryga.docx) [↑](#footnote-ref-1)