

## High-speed Langmuir probe current decoupler.

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The Langmuir probe is the instrument of choice for the KI-1 installation of the Institute of Laser Physics of the Siberian Academy of Sciences [1]. This is high-volume 1.2m diameter and 5m long installation for space plasma modelling experiments. The Langmuir probe [3–4] is used to measure ion current of 100J laser produced plasma in presence of background plasma. This probe is designed to obtain floating potential close to the plasma potential what can be up to 1kV. So, to record current curve of experimental data plasma potential to be excluded what requires special signal transferring path to be established. Some additional requirement to this path is high level of EMI produced by numerous laser dischargers of MegaWatt-class.

To decouple plasma potential of current signal special signal transferring path was built. It is based on connector-less fiber-optic of 1mm plastic and carries light at 650 nm, emitting by fast IF-E91 LEDs, and receiving by an IF-D91 photodiode for coupling. While the isolating property of fiber-optic is excellent the reliability, stability, distance and noise performance are limited. To minimize contribution of this limitation to signal path performance it was equipped with specific

units as shown on picture. The first unit is impedance matching. It required to obtain probe sorting voltage stability while current value can vary from few mA to 1.2A. PMOS power transistor is used in common-gate configuration. The second unit is current scale matching. Based on current mirror configuration it enable to divide current value on LED not to exceed rated value. The third unit is current limiter. This is optron controlled limiter to prevent probe structure damage if discharge is occurred. NMOS power transistor allows current limiting as fast as 20ns. The fourth unit is transimpedance amplifier. It is fast, low-noise photocurrent amplifier, which provides bandwidth not less 50 MHz and dynamic range not less 12 bit. The fifth unit is differential line driver. Since fiber-optic signal degrade with distance rapidly the long line caring signal to electronic control room would be an electrical one. Differential line is a standard interface to high-speed high-resolution waveform digitizers in harsh EMI environment.

This signal transferring path was used as a part of measuring system of KI-1. It is claimed designed performance was achieved, experimental data taking run was supported sufficiently.

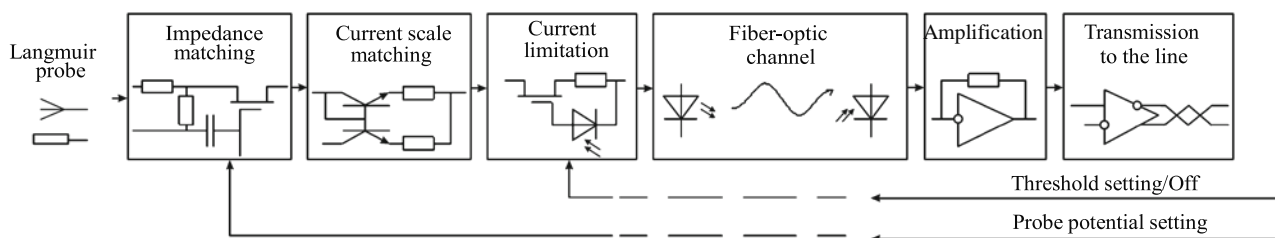


Fig. 1. A block diagram of a fiber optocoupler.

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