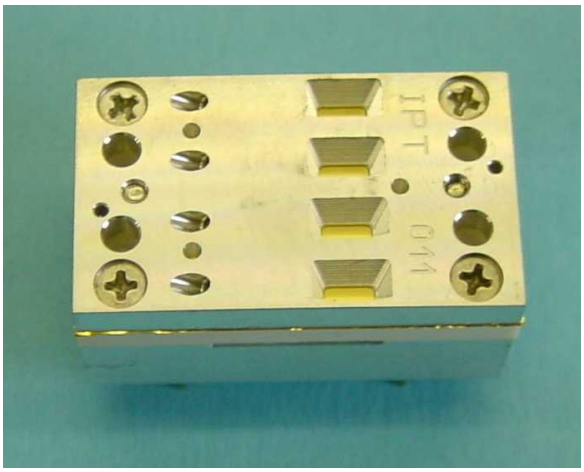
Bolometer System

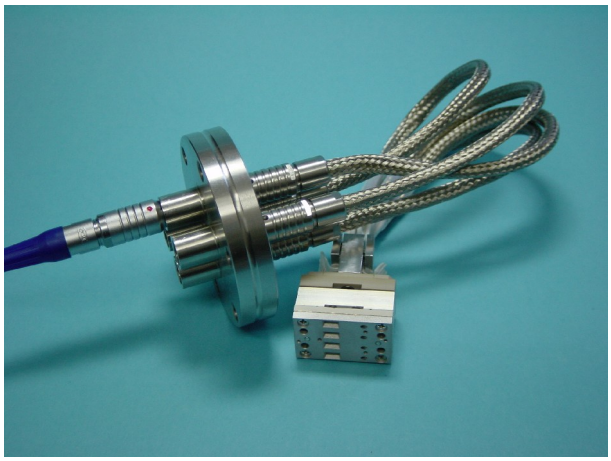
The bolometer system is a diagnostic for absolute measurement in the soft x-ray to infrared range, in order to measure the radiation losses spatially and temporally resolved in plasma machines. The bolometer (dimensions: 20x33x15 mm^3) is a highly integrated four-channel detector with independent metal resistor bridges. It has worked successfully for many years in world wide nuclear fusion experiments.

Special features:

- Absolute measurement in soft-x-ray to infrared
- Low noise
- Insitu-calibration
- Linear response to absorbed radiation
- Operation in high magnetic fields and at high temperature
- Survives high nuclear radiation doses
- Detection limit: 10^{-6} W/cm^2
- Low thermal drift: dU/dT < 10^{-4} V/K



4-Channel bolometer



Bolometer with vacuum feedthroughs and low-noise vacuum cable

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Electronic system

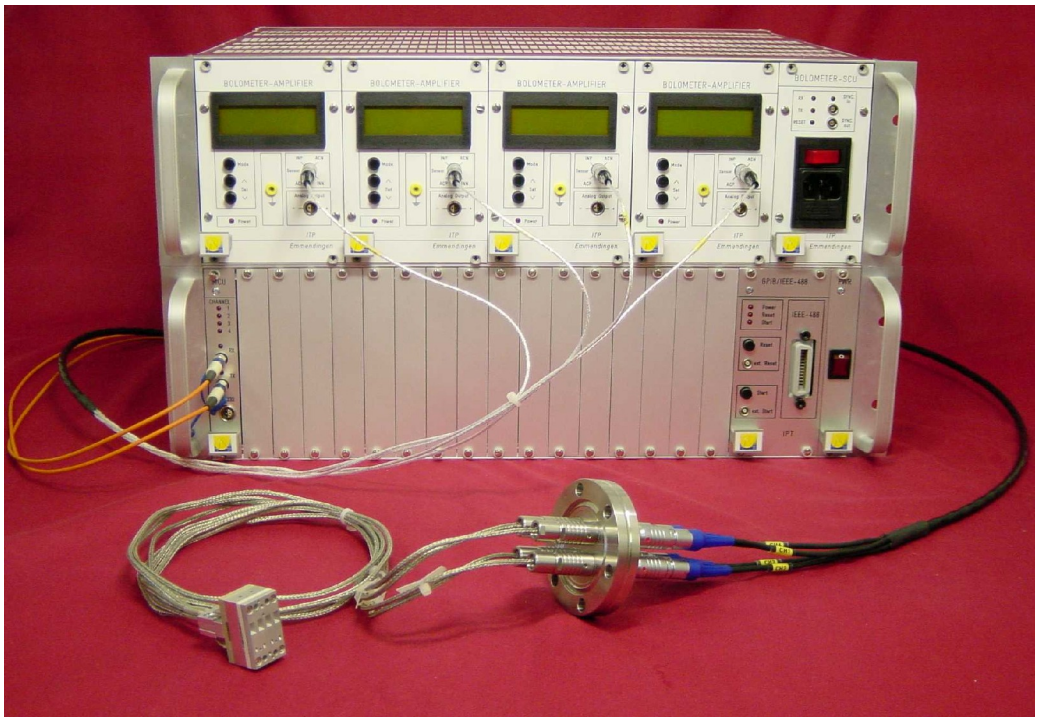
This is the set up of the complete bolometer system. The electronics consists of the following two sub racks:

Amplifier sub rack:

It contains 4 bolometer amplifiers providing a 4-Channel bolometer and 1 Sub Control Unit (SCU). The individual amplifiers and SCU are electrically isolated from the 19”-box which is connected to the protective earth (PE) of the line voltage. The internal communication is realised by a bus board. Usually this sub rack is placed near the experiment.

Main Control sub rack:

This sub rack contains 1 Main Control Unit (MCU) for the communication to the amplifier sub rack (connected by optical cables) and 1 GPIB interface, also isolated from the 19”-box as in the case of the amplifier box and also equipped with an internal bus board. The rack usually is placed in the control room.



complete 4-channel system

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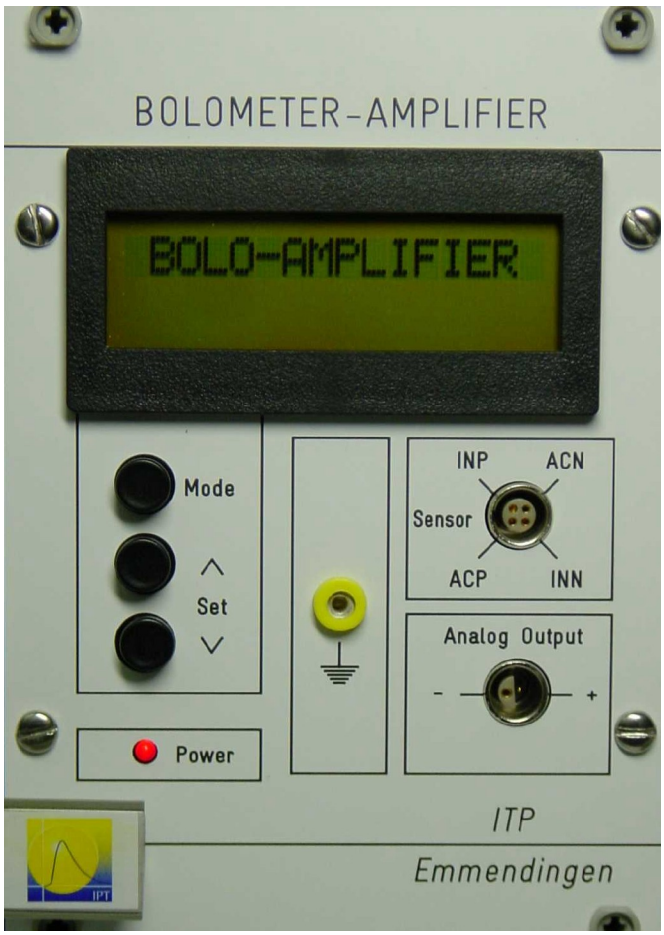
Amplifier

The bolometer amplifier is a carrier frequency amplifier. It provides the bolometer wheatstone bridge with a high stabilised and very pure sine voltage (U=20V_p / 20kHz) with opposite polarity for symmetric operation. The carrier frequency is synchronised with a frequency of the SCU.
The amplifier receives the amplitude modulated signal of the bolometer and performs the amplification, demodulation, filtering and offset adjustment of the analogue signal. This signal is provided to the analogue output at the front panel.



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Sub Control Unit

The sub control unit controls four amplifiers in one system. It connects the main supply voltage to the back plane and builds the serial communication to the main control unit by using two optical cables (Rx and Tx).

It generates the carrier frequency for the bolometer amplifiers and puts it to the back plane and also to the “Sync. Out”-connector at the front panel with the help of a RS-422 transmitter. If you are going to work with an amplifier as a stand-alone-device, the amplifier will generate the carrier frequency internally, the setting will turn to “$C_{Freq.}$ = intern” automatically.
It is possible to synchronise two or more SCU' s with the help of the Lemo connectors on the front panel. Therefore the “Sync. out” has to be connected to the “Sync. in” of a second SCU by using RS-422 standard. At the “Sync. in” of the first SCU you can supply another carrier frequency, if it has to be a little different from 20 kHz.
Moreover, the sub control unit generates a reset pulse for the amplifiers when receiving a reset command.

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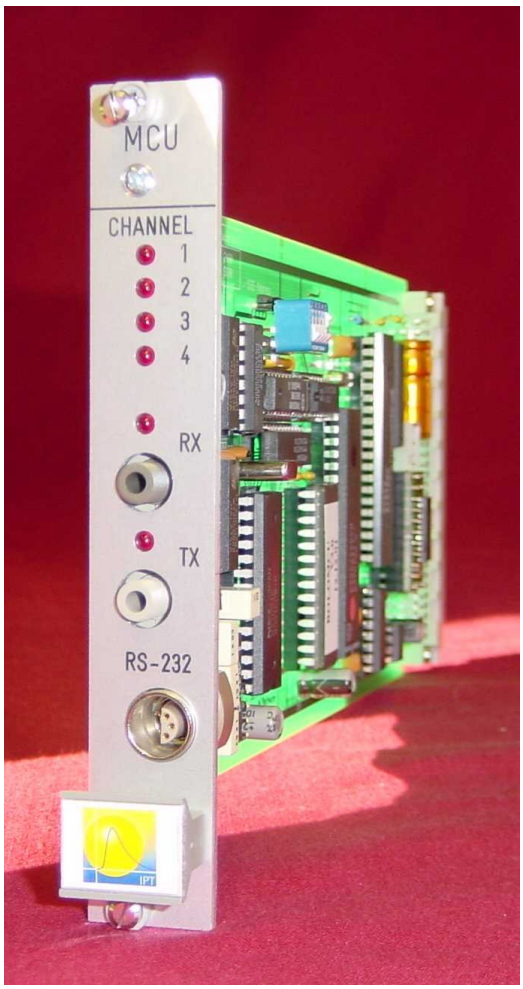
Main Control Unit

The MCU serves four amplifiers and indicates a well working communication by 4 LEDs on the front panel. Totally, you can locate 17 MCUs in the sub rack, this would be a system for 68 channels. It communicates with the GPIB interface and is connected to the SCU by an optical interface based on RS232.
The RS-232 Lemo connector at the front panel can be used for test purposes and monitoring of the GPIB communication.
Every MCU in the box has a GPIB address to be set by a dip switch on the board with a valid range from 1 to 31.



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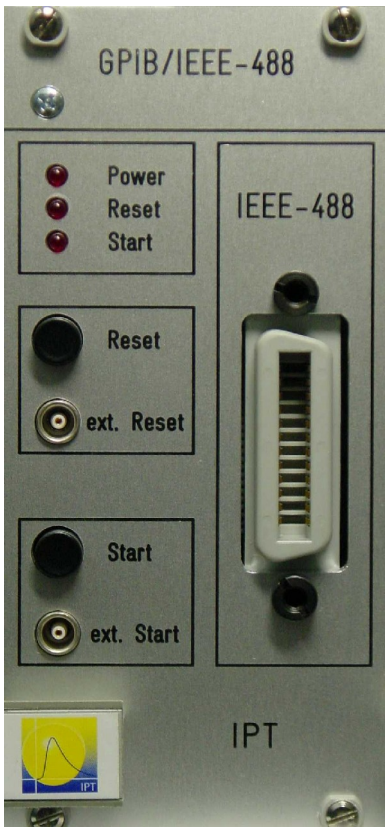
GPIB Interface

The GPIB interface unit interconnects the IEEE connector on the front panel with the MCU. The applier can send a command or receive settings from the amplifiers.

The commands “Start” and “Reset” can be triggered by a software command, the button and the supply of an TTL signal on the front panel.

The “Start” command triggers a zero procedure in the amplifiers and makes the processor to switch off. The controllers in the amplifiers are now in a sleep mode during the measurement.

In order to wake up the controller again for new settings, the “Reset” function has to be triggered.



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