PGU-IMP-Micro

Overview

- Potentiostat, Galvanostat
- Manual operation (restricted)
- Control in- and outputs for external control
- Fully automatic operation with built-in interface
- Mains operation, 115V / 230V

Description

As part of a research project in 2002, we developed our new **PGU-series**. The aim of this development was to standardize the previous models of the IMP-series and the 1000 series in order to build them modular and flexible as well as to equip them with some additional features. Thereby we did not want to waive the tried, like the manual operation. Thus, the recent circuits were expanded with the function of automatic measuring range switching. In addition, the devices have been designed so that they can be equipped with an interface for the computer control.

The device design is very flexible and offers the possibility to build different types out of a base device.

The **PGU-IMP-Micro** is a special further development of our standard impedance potentiostat PGU 10V-1A-IMP-S. Partner and driving force is, as well as on previous projects, the IKTS in Dresden. The purpose was to build a potentiostat that can reliably measure high impedances. So far, we are in the position to reliably measure an impedance of 5 Tera-Ohms with a parallel capacity of approximately 25pF. Aspired are 10 Tera-Ohms. Currently this is only possible by special circuit measures. Thus, the device has no power amplifier, i.e. the input operational amplifiers also deliver equal the output signal.
In addition, the input amplifier is twice present, once for high frequencies and once for high impedances at lower frequencies.

The measuring system works with 24-bit converters. This gives a theoretical resolution of 1µV, which would correspond to a current of 1aA. Realistically, this is not the case. 0.5 to 1fA resolution can be achieved under ideal conditions (also statically).

The scanner (DAC) reached at 26 bit a resolution of 330nV at a range of ±10V. Stages of digital systems are therefore no longer observed.

For fast functions and of course for the impedance measurement, a sine wave generator is installed, which delivers sine and triangle waves with frequencies up to 10MHz. Theoretically a scan rate of 8000kV/s cab reached, limited by the bandwidth of the device are practically about 100kV/s. For detection of fast events and also for the impedance measurement, a fast measurement system is installed (USB-Scope), which can detect signals up to 20MHz with a sampling rate of 100 MS per channel.

If you use the device with the built-in measurement modules and controlled by EcmWin, you have some major options:

1. **Autoranging**: The current ranges are switched by monitoring a largest / smallest current value in standard mode. In Impedance operation, the current range will change as a function of the adjusted frequency and the calculated impedance.

2. **Offset correction**: The measured outputs of the impedance signals are active offset corrected. Thus, the AC component of the signal is shifted to the zero line and can be maximally enhanced for better measurement.

3. **Limit control**: The measurement process can be controlled by entering appropriate values in the software. Undesirable extremes are avoided.

4. **Sequential Measurement**: Methods such as OCP, Scan, Hold experiment, Impedance measurement or electrochemical noise can be linked together in random. With the help of intelligent jump functions very complex measurement routines can be generated. Virtually any method described in the literature can be created with it.

Version: 11/2021

Technical Details

Compliance	13V/5mA.
Polarisation Range	±10V Potentiostat , ±5mA Galvanostat.
Current Ranges	16 Ranges from 5mA to 100pA.
Resolution	100pA = 10.000mV at 100pA Range, 10fA = 1mV With additional build in amplifier: 10fA = 1mV. The 24Bit ADC has a resolution of 1µV, this means 1µV = 1aA
Input Impedance RE	10^{13} / 10^{15} Ohm.
Control Outputs	Potential, Current, Current with a 10Hz Filter, Current x10 Amplifier.
Impedance	0.1 Ohm to 1TOhm
Frequency range	1µHz to 100kHz
Amplitude	0,1mV to 5000mV
ADC	24 Bit, max. Resolution 1µV
DA:	26 Bit at ±10V 330nV Steps
Resolution of Setvalue	0,2%
Resolution of Measurement	0,3%
Samplerate	Standard measurement 500Hz at 24 bit, 5kHz at 16 Bit, 40MHz Impedance measurement with 12 bit, resolution via preamplifier 10µV
Interface	Ethernet/USB für Impedance
Software	EcmWin/ EcmView
Methods	OCP, constant value, cyclic, Puls, Differential Puls, Sequence measurement, Impedance measurement, Graphical display of potential-/current- and current density over time and current density over potential.
EIS	Built-in sine generator with 2-channels. Max sine frequency per channel 10MHz. High speed data acquisition with 100 MS per channel (14 bit).

Version: 11/2021

Connection

Automation of measurements is done with our ***EcmWin*** software. Standard measurement methods are:

- OCP
- Pulse and constant value experiments (potentiostatic/dynamic)
- Pulse and constant value experiments (galvanostatic/dynamic)
- Reversed scan
- Cyclic voltammetry measurement
- Sequence measurement with battery charging and discharge functions
- Impedance measurement

All experiments work with limit control. Data are stored in ASCII format, so simply further processing. Collection and storage of data are done at a maximum 1000 values/sec per channel. Evaluation of the impedance measurement is performed with the program ZView of Solatron. Therefore ***EcmWin*** provides the measured data in a suitable format.
To evaluate the standard measurement you will use our own ***EcmView*** software.

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