**Tallinn University of Technology**

# Data sheet: Impedance Analyzer IA-2

## System key features

- USB-connected and powered (default option);
- Impedance measurement channels: 2;
- Frequency range: 1 kHz to 1 MHz (*Firmware option under development: 1 Hz to 1 MHz)*;
- ENOB: 16 (dynamic range: 90 dB);
- Measurement speed: 1000 multi-frequency measurements per second;
- Options: (1) embedded into the end-user's device as a module (with various communication options), (2) stand-alone device to be connected by USB to PC;
- Size: Module (L: 60 mm, W: 35 mm, H: 6 mm). Enclosure (L: 90 mm x W: 50 mm x H: 15 mm).

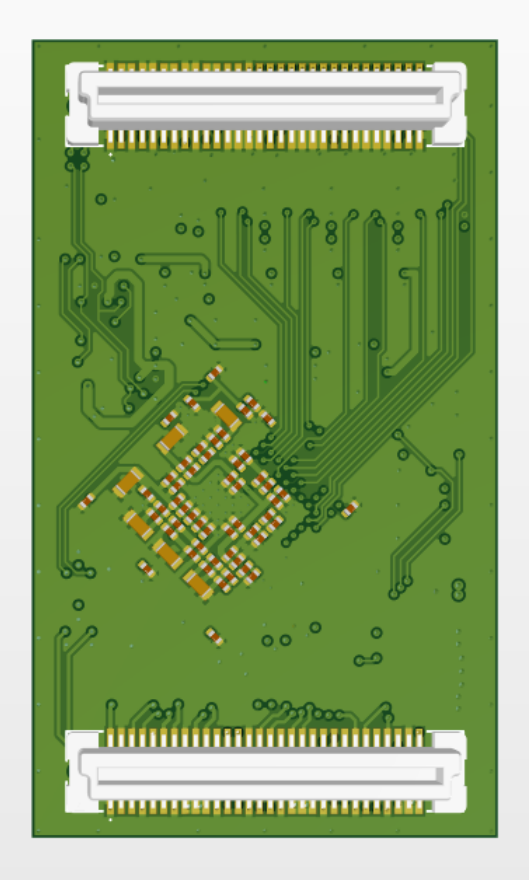

**Figure 1: PCB module view.**

## Applications

- Scientific laboratory research (e.g., physiological processes, hydration/moisture, corrosion thickness, battery state-of-health, composite inspection, dielectric spectroscopy, biomaterial characterization);
- Industrial manufacturing process monitoring and control (e.g., material composition, structure, interfaces, and dynamics).

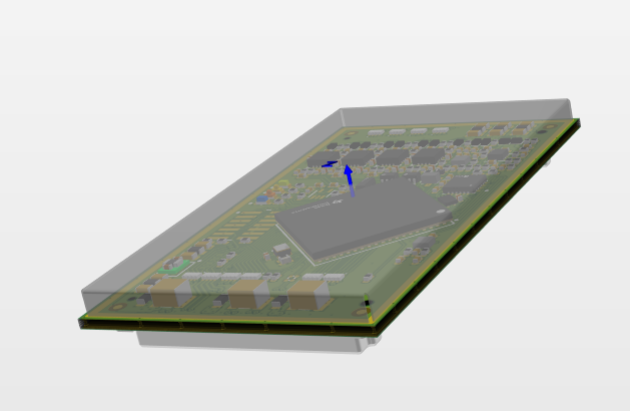

**Figure 2: Module in enclosure view.**

## General Description

This is a globally unique, compact, multi-channel solution for fast and accurate impedance spectroscopy, implemented as connector-interlinked modular units that can be easily designed into a wide range of new devices.

## Technical Specifications

**Table 1: System technical specification**

| Parameter | Value | Unit |
|---|---|---|
| Simultaneous impedance measurement channels | 2 | pcs |
| Measurement frequency range | 0.001-1000 | kHz |
| Impedance measurement range | 0.001-1000000 | Ohm |
| Impedance spectrum measurement time | up to 1 | ms |

**Table 2: Measurement module technical specification**

| Parameter | Value | Unit |
|---|---|---|
| PWM output channels for impedance measurement | 2 | pcs |
| Programmable output levels | 128 | pcs |
| Output voltage range | ±0.05-±3 | V |
| Output resistance | 100 | Ohm |
| Differential ADC for impedance measurement | 4x16 | bit |
| Input voltage range | 0 to ±5 | V |
| Input impedance (capacitance): | 1 (10) | MOhm (pF) |
| Programmable gain | 0.25, 0.5, 1, 2, 4, 8 and 16 | - |
| ADC for signal acquisition (single ended channels) | 2x12 | bit |
| Digital GPIO channels | 4 | pcs |
| Power output and input pins | +3.3, +5.0, -5.0, GND | V |

Communication connectors available: USB2, SPI, UART and I2C interface. Analog output (2 channels, 0 to 3V). Digital GPIO (6 channels) Synchronization output. Power input pins: +3.3 V, +5.0 V, -5.0 V, GND. Connector type: 2x Amphenol BergStack, 0.8 mm, 80 pin (10144517-061802LF) that mates with 10144518-061802LF.