CLUSTER POWER TOOLS
SENSORS SETUP

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In this document we describe shortly how to prepare the compute nodes for the measurement.

Electric Current Measurement

We used the prepared CPU, GPU and ATX Bus power connector to measure the electric current and voltage of the cluster hardware components. Additionally we developed and build the devices for the power measurement of the entire compute nodes.

The measurement of the electric current is based on the well known methods. Fig. 1 shows the electrical scheme for it.

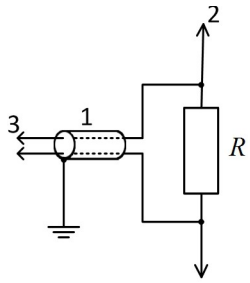


Fig. 1: Electric scheme for electric current measurement (Shunt Setup)

Component description:
1: Shielded cables with two lanes:
http://edgecdn.lappgroup.com/fileadmin/documents/technische_doku/datenblaetter/unitronic/DB0034302DE.pdf
The length of the wires is ~1.5 m
2: 12 V Bus
3: Connect to A/D converter
R: Shunt: 0.01 Ohm 10 W (L x B x H) 22 x 4 x 17 mm Isabellenhütte
PBV 0,01: http://www.produktinfo.conrad.com/datenblaetter/425000-449999/447323-da-01-en-Praezisionswiderstand_PBV.pdfTolerance 0.5%

The shunt according the scheme on Fig.1 must be integrated into the power cables, which are used for the connection of the hardware components, such as CPU, GPU, mother boards, cooler, hard disc and so on, to the power supply. Fig.2 shows a prepared CPU-8 pin connector.

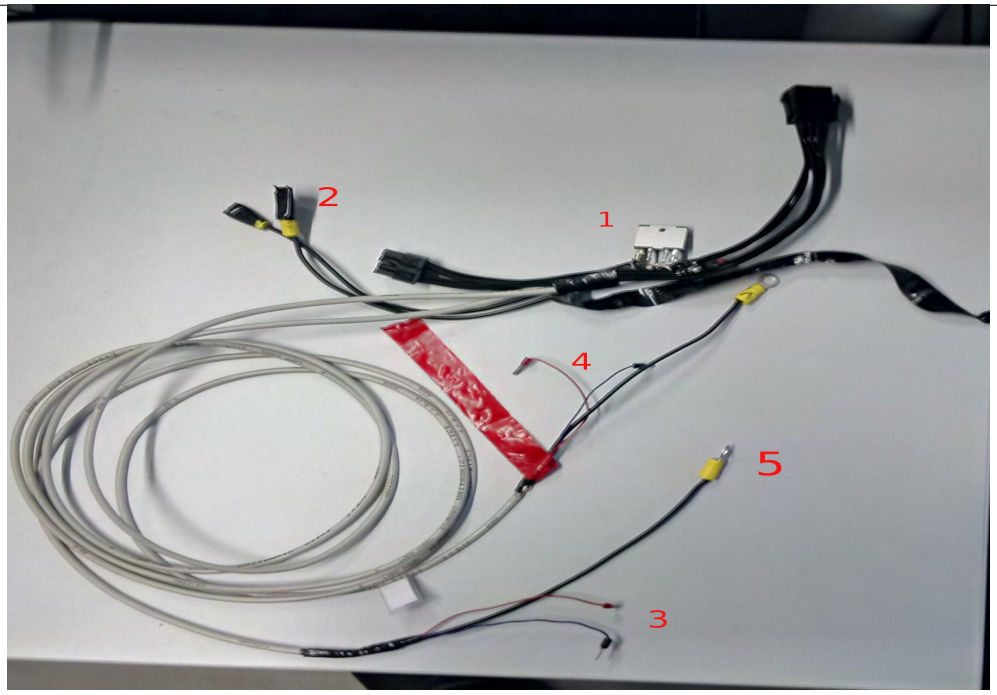


Fig. 2: Prepared CPU-8 pin connector

Component description:
1: Shunt
2: grounding at the near to the load (e.x. CPU) – not shown on the electric scheme 1 above
5: grounding at the near to the A/D Converter
3: To the input of A/D Converter (current measurement)
4: To the input of A/D Converter (voltage measurement)

Note: Don't use the both grounding (2 and 5) simultaneously: Try it one after another, what is better for your setup. Of course the grounding reduces the noises. However, the most noises are produced by Power Supply and Voltage Regulator Modules of CPU and RAM. Be carefully by choice of the Power Supply. The desktop Power supply produces usually few noises than server power supply.

We use Antec Earth Watts PLATINUM 650 W and 1300W.

Voltage Measurement

A lot of A/D Converters don't allow to measure 12 V (limit is 10V): We use voltage divider to reduce the voltage. Fig. 3 shows the electric schema of the divider

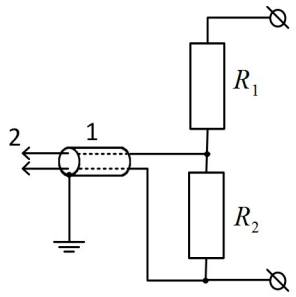


Fig. 3: Electric scheme for voltage measurement (Divider Setup I):

Component description:
1: Shielded cables with two lanes:
http://edgecdn.lappgroup.com/fileadmin/documents/technische_doku/datenblaetter/unitronic/DB0034302DE.pdf
The length of the wires is ~1.5 m
2: Connect to A/D converter
R1 and R2: Chip-resistors SMD 1068 220Ω and 10kΩ (Tolerance ±1.0%).
The two terminals on the left side are connected to the 12v Bus (see Fig.1)

The resistors are installed on a SMT-Adapter, which can be found under the address:

http://www.proto-advantage.com/store/product_info.php?products_id=2200053

Fig. 4 shows the setup and Fig5. shows two photos of the divider.

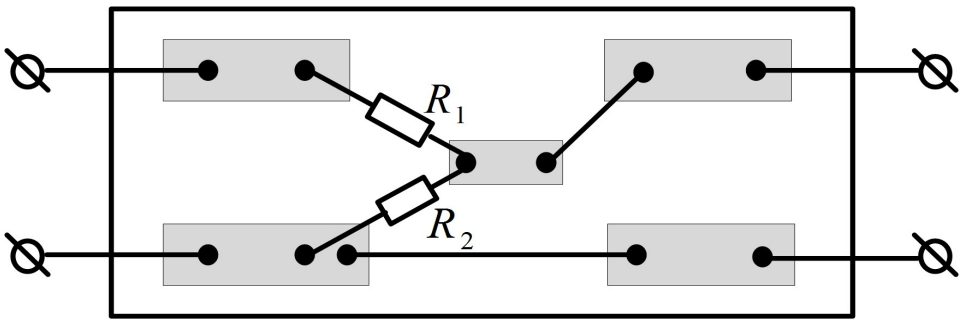
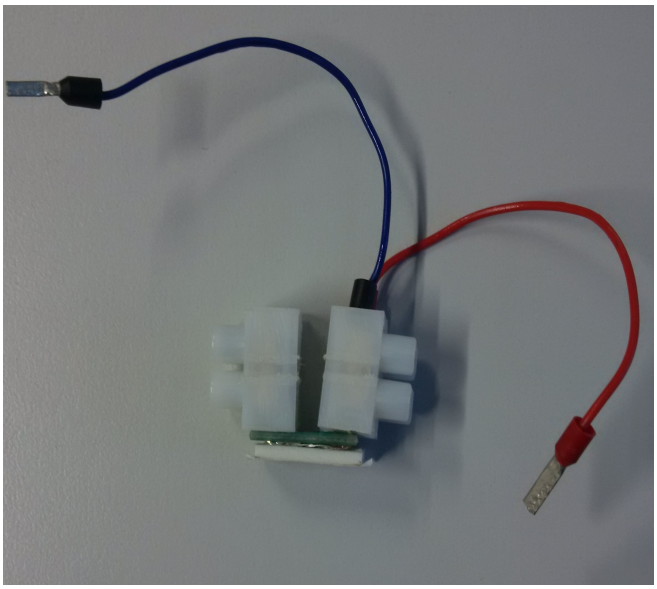


Fig. 4: Scheme of the Adapter with the resistors(Divider Setup II):

Component description:
1: Shielded cables with two lanes:
http://edgecdn.lappgroup.com/fileadmin/documents/technische_doku/datenblaetter/unitronic/DB0034302DE.pdf
The length of the wires is ~1.5 m
2: Connect to A/D converter
R1 and R2: Chip-resistors SMD 1068 220Ω and 10kΩ (Tolerance ±1.0%).
The two terminals on the left side are connected to the 12v Bus (see Fig.1)



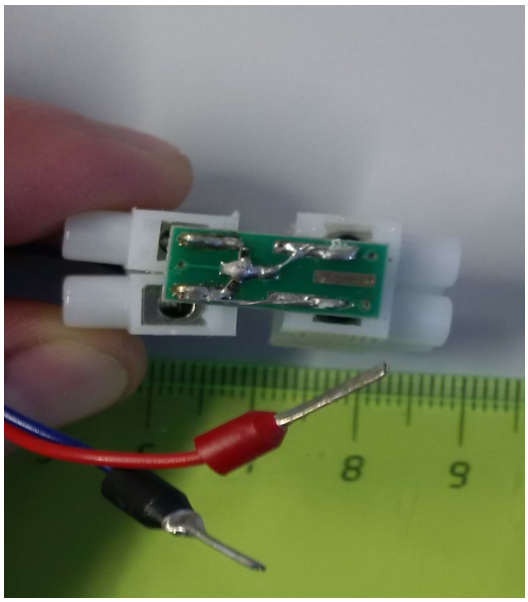


Fig 5. Voltage divider for the power measurement

Alternating current (AC) Measurements

To measure the power of entire compute nodes we use the same A/D converters and the additional devices, which are also sampled by us. The additional devices allows to record the voltage and current profile in AC. Fig. 6 shows the voltage and electric current profiles, which are captured for a power supply of a compute node.

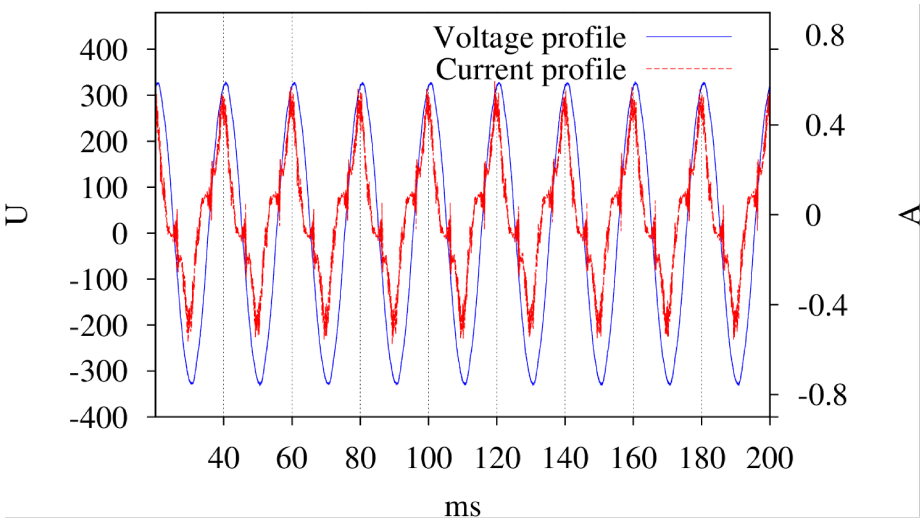


Fig. 6: Voltage and current profile of a power supply in a compute node

The Fig.7 shows an electric schema of the additional devices for the measurement in Alternating current: