Environmental monitoring using the Embedded Local Monitoring Board (ELMB)

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ELMB

- A board that provides:
  - 64 channel multiplexed 16 bit ADC with multiple ranges (25, 55 mV, 1, 2.5, 5 V) and unipolar or bipolar operation.
  - Three 8 bit digital ports for input or output.
  - Easy integration of sensors via adaptors.
- Culminates via the CAN bus
  - LHCb has USB-CAN controllers.
  - Power can be provided on the same controller.
- Integrated very well in WinCC via OPC server.
- https://twiki.cern.ch/twiki/bin/view/Atlas/DcsElmb

Top side

50x67mm

Bottom side

Optional ADC on the back side

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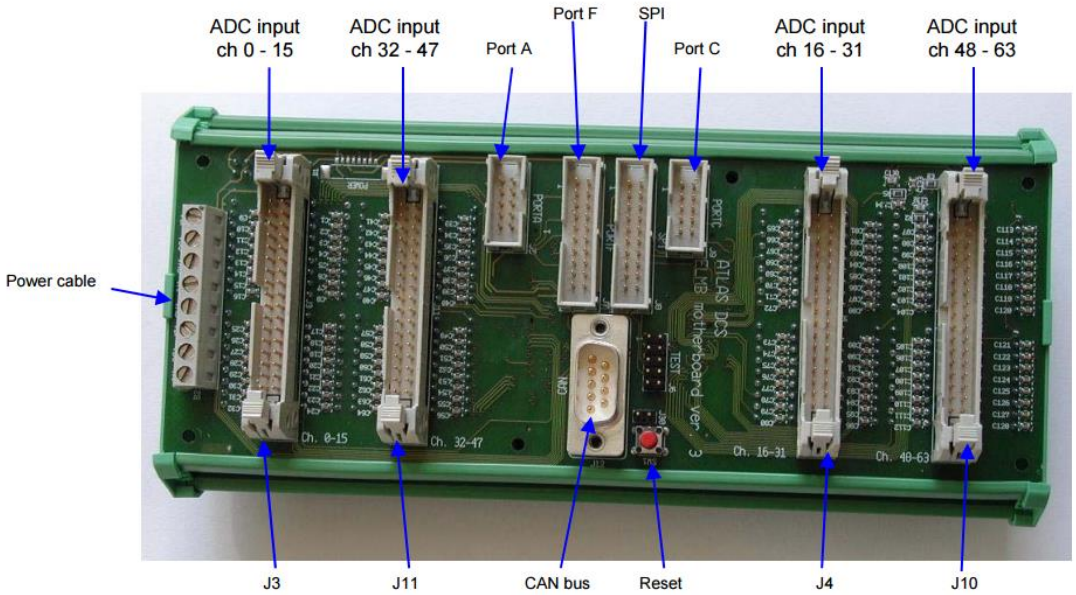
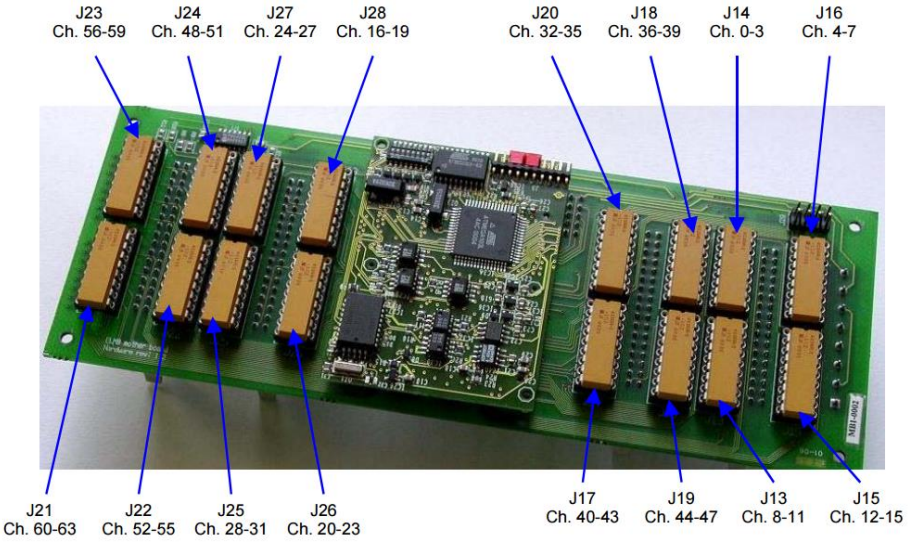
ELMB motherboard



Connector side

Adaptor side



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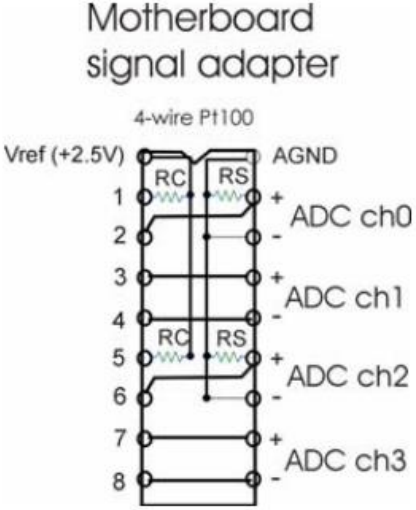
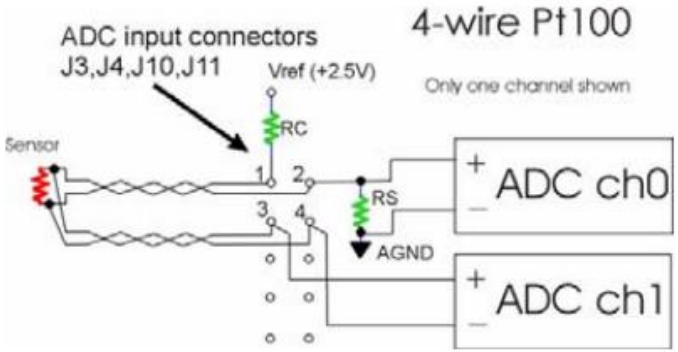
pt100 adaptor



Schematic diagram



Using two channels eliminates the voltage drop on the wires.
Calibration with an accurate resistor instead of the sensor possible.
RC should keep the current through the sensor low.

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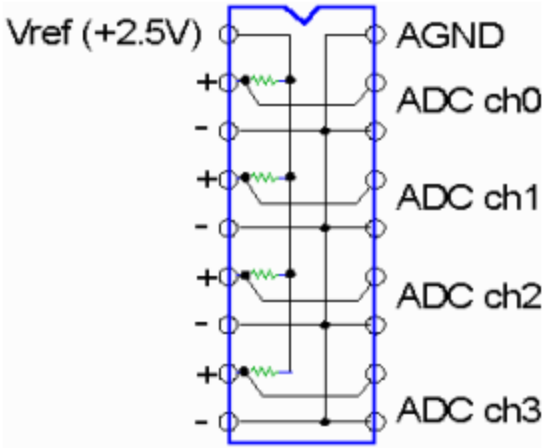
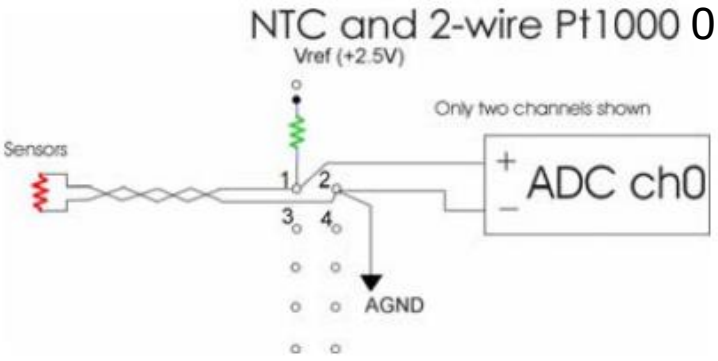
NTC and pt10000

Adaptor



Schematic diagram



Use correct bias resistor depending on sensor
Default option 1 MΩ
For pt1000 there was a batch of 250 sensors with R=200 kΩ

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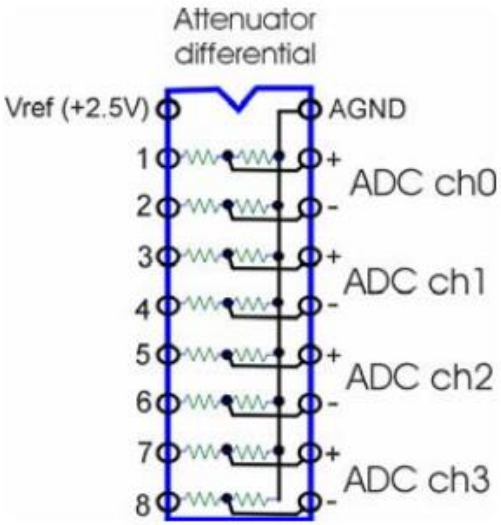
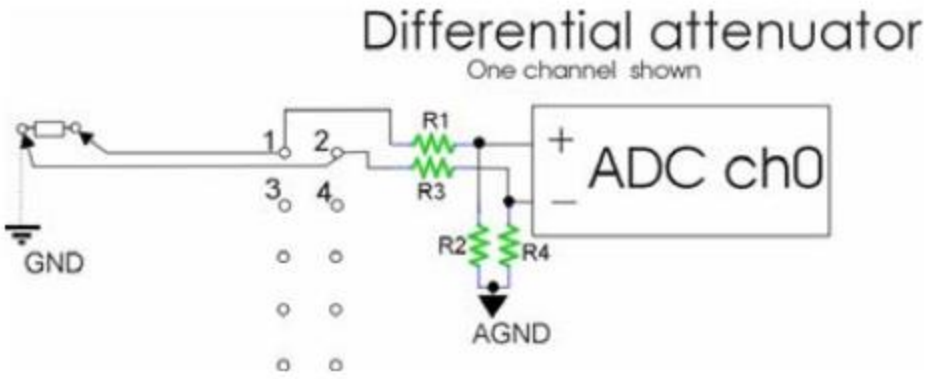
Differential attenuator

Adaptor



Schematic diagram



For increased voltage range

Other sensors

- Pressure, humidity etc.
- If output is voltage, straight forward
  - Consider range.
  - Common mode can be limited.
- If output is current one possibility is to use an inline resistor
  - 4..20 mA with 1Ω resistor → 4..20 mV.
  - (Our current sensors more noisy that voltage sensors)
- Conversion in OPC server or WinCC (better).
- Can be used to monitor voltages on detector.

Easy quick steps

- Prepare your ELMB with the right adaptors.
- Describe the ELMB in WinCC (very quick).
- Generate OPC configuration file (automatic).
- Start OPC server.
- See values coming in.
- Default pt100 adaptors without calibration accurate to 0.1°C

Things to consider

- 64 channels are a lot, but:
  - All have the same range
  - Common mode limited at low ranges
    - -0.15–0.95 V on the three lowest voltage ranges.
    - -2.0–5.0 V in other two.
- Up to 63 ELMBs on a bus.
- Takes 7 s to transmit data from 7 ELMBs on the RICH CAN bus
  - SYNC sent every 10 s.
- High input impedance
  - Disconnecting a connector does not take the voltage to zero.