EUROPEAN SPALLATION SOURCE

# Standard for remote management of electronics

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# This is work of..

- Rafael A. Baron (initial idea and hardware design)
- Hooman Hassanzadegan (Ethernet Module hardware design)
- Hinko Kocevar (EPICS support)

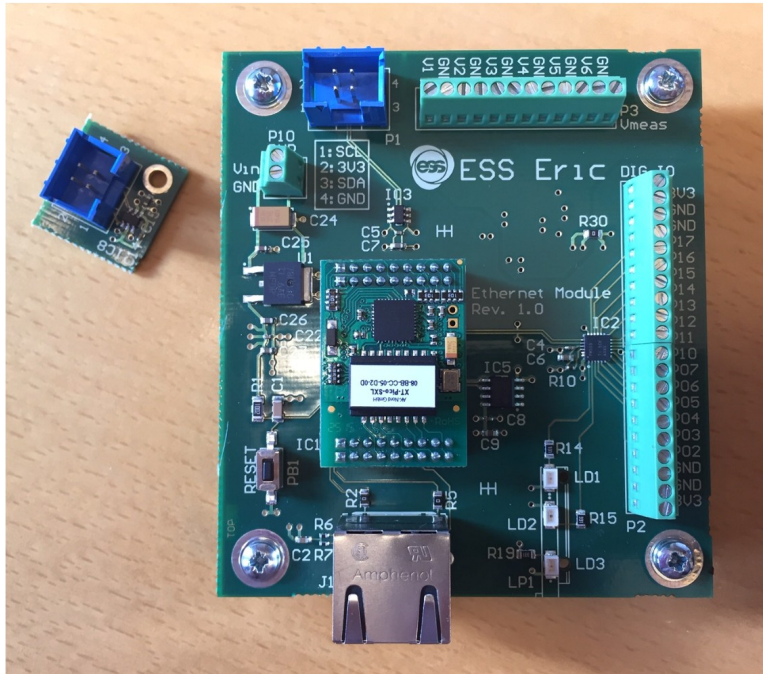
# Purpose of the Ethernet Module

- ESS BI section and RF group are both developing some customized electronics in the form of new units. The Ethernet Module (EM) can then be used to provide network connectivity for these units.
- The EM can measure temperature and voltage from multiple points. Moreover, it provides a general-purpose digital IO port and an EEPROM for storing settings, S/N etc.
- The current EM design is based on the BI and RF interlock requirements.
- The ACCT Interface Units uses the EM for measuring supply voltages and temperatures at various locations within the unit.
- BPM front end shall use the EM for monitoring purposes.
- The EM has been successfully tested at ESS.
- EM shall be proposed to be used in WS front end and LO distribution units.

# Ethernet Module hardware overview

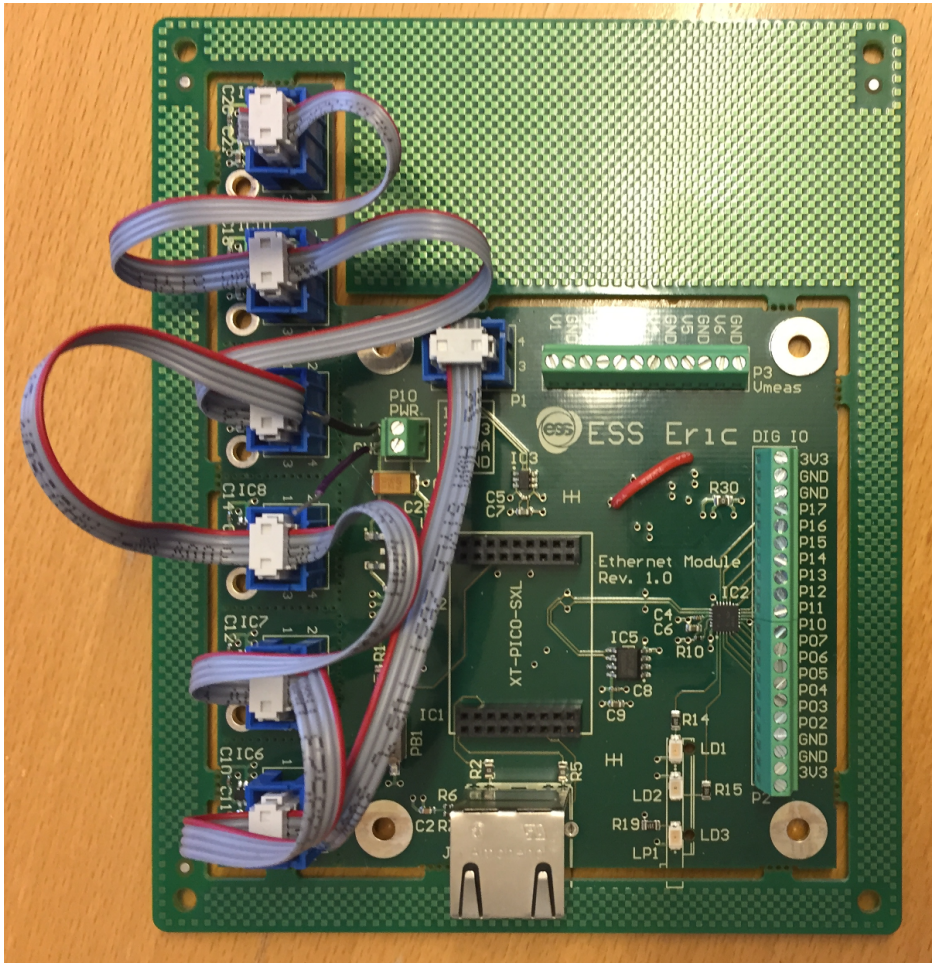
The Ethernet Module hardware provides:

- Network connection (RJ45)
- 1 on-board and 6 external temperature sensors
- Port expander including 14 GPIOs
- 2 on-board and 6 external voltage measurements
- 256 k bytes of EEPROM
- Connection to external devices through I2C bus
- Small form factor
- On-board linear voltage regulator
- Separate power/ground planes for the analog and digital circuitry
- Programmable LEDs



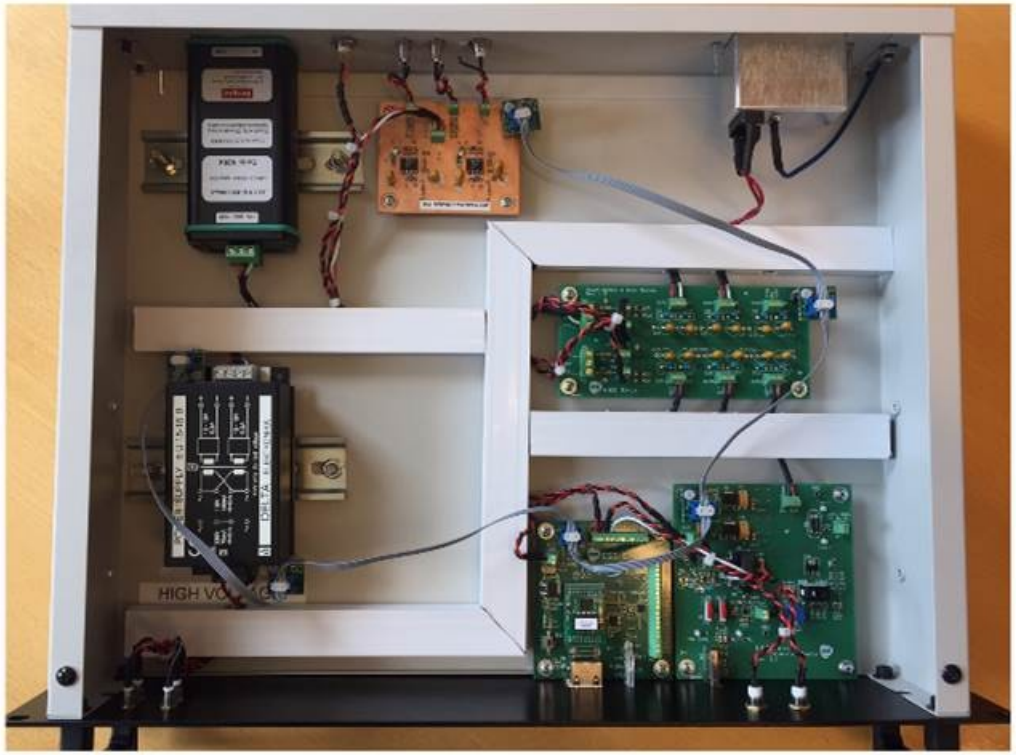
# Ethernet Module usage

Standalone



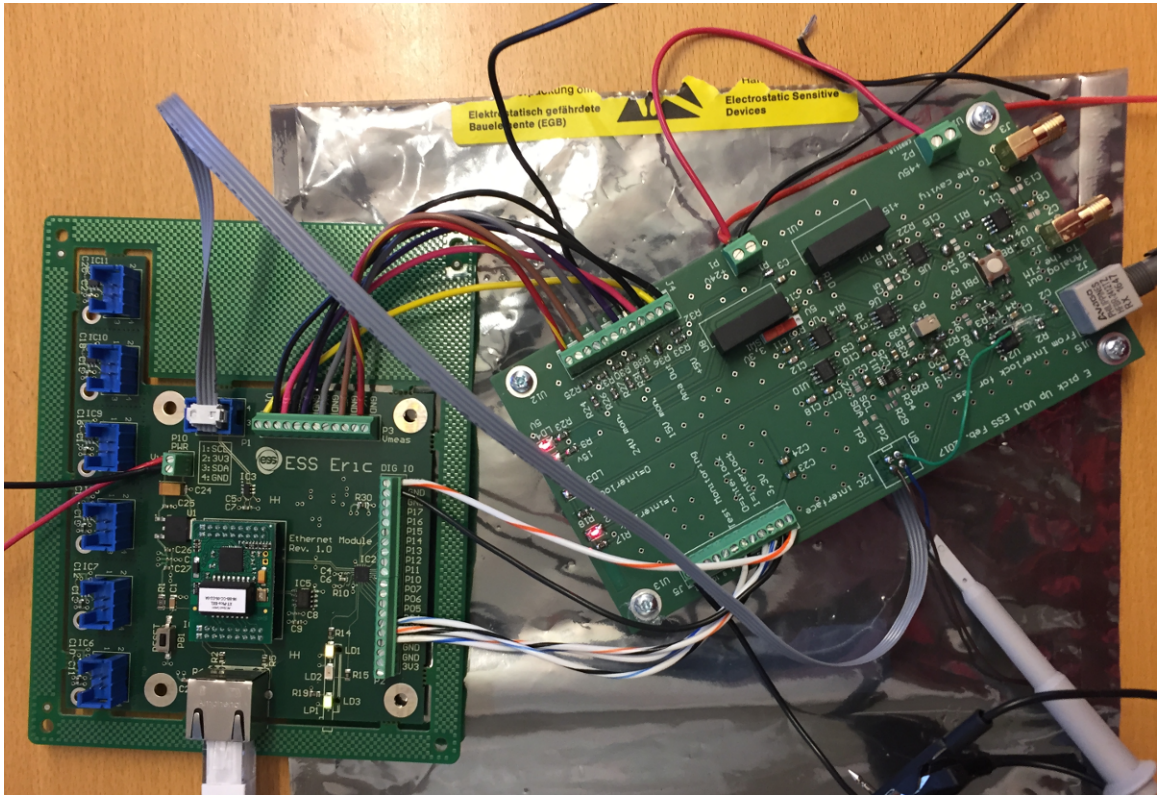
# Ethernet Module usage

BCM front end



# Ethernet Module usage

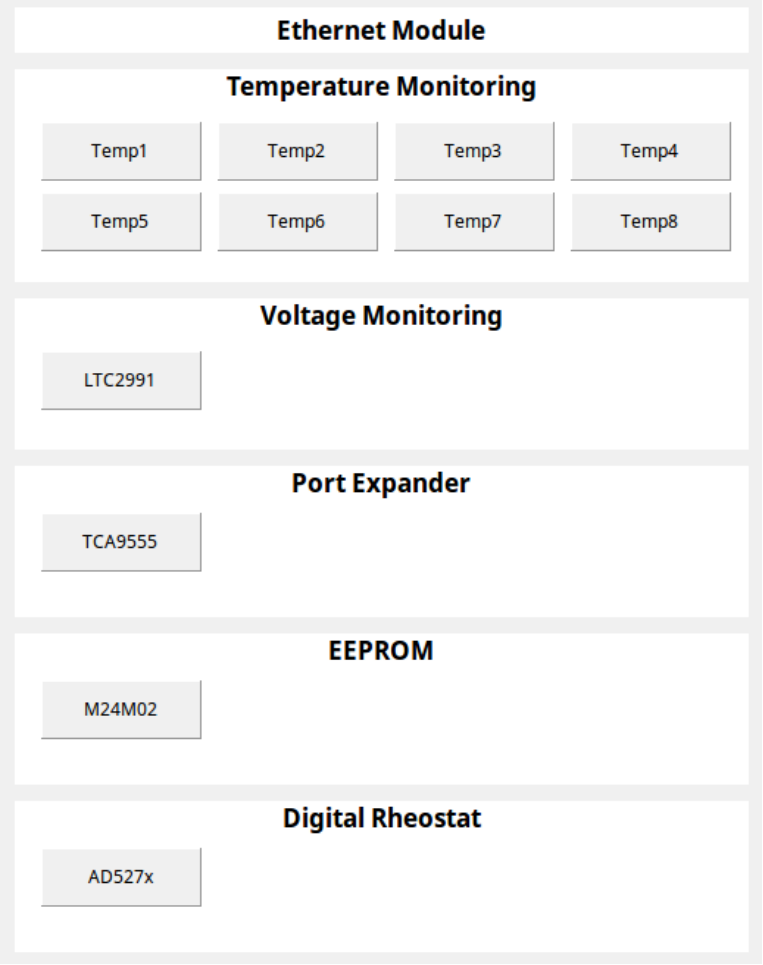
RF pin diode and E pick up



# Ethernet Module software overview

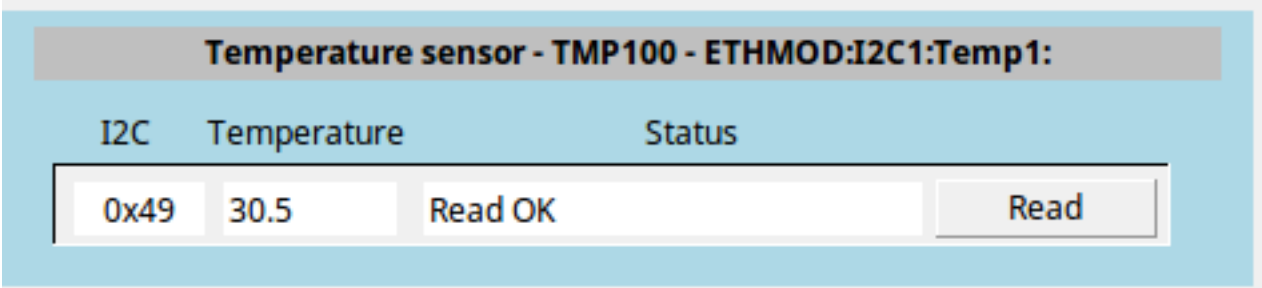
EPICS support for Ethernet Module allows:

- Remote control of the Ethernet Module
- Based on EPICS asynPortDriver
- Configurable number of devices
- Readout of all attached temperature sensors
- Control of port expander GPIO pin direction and level
- Readout of all measured voltages  conversion factor and offset
- Reading and writing to EEPROM
- Controlling digital rheostat



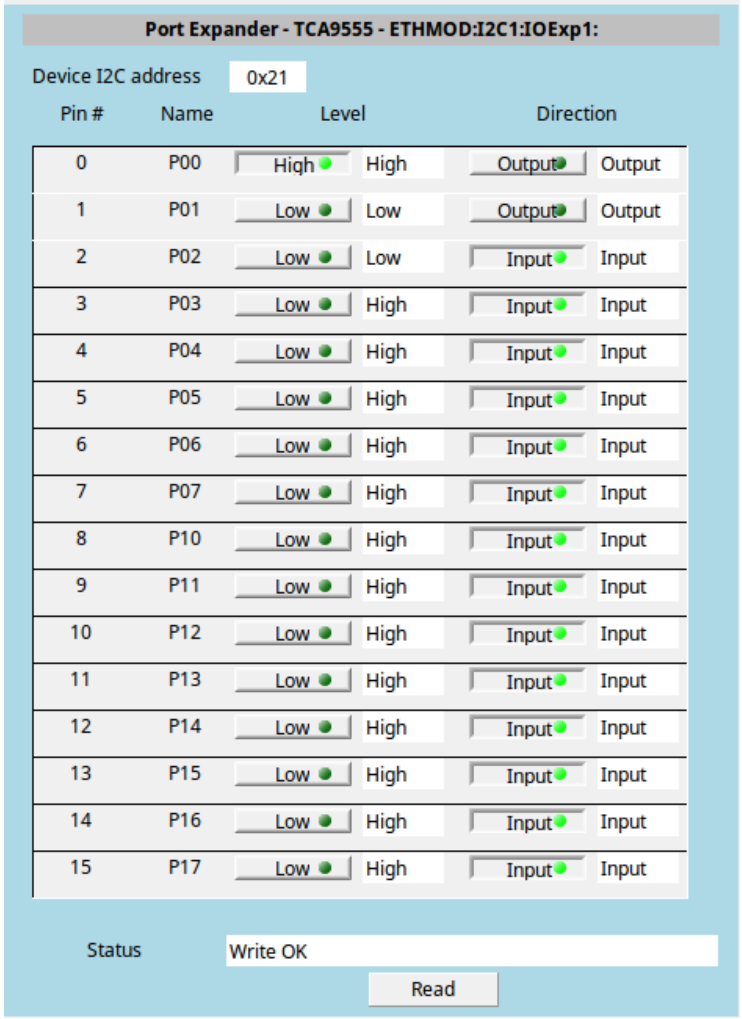
# Ethernet Module temperatures

- Readout of up to 7 temperature sensors
- One sensor is on-board
- Up to 6 additional sensors can be scattered inside the chassis



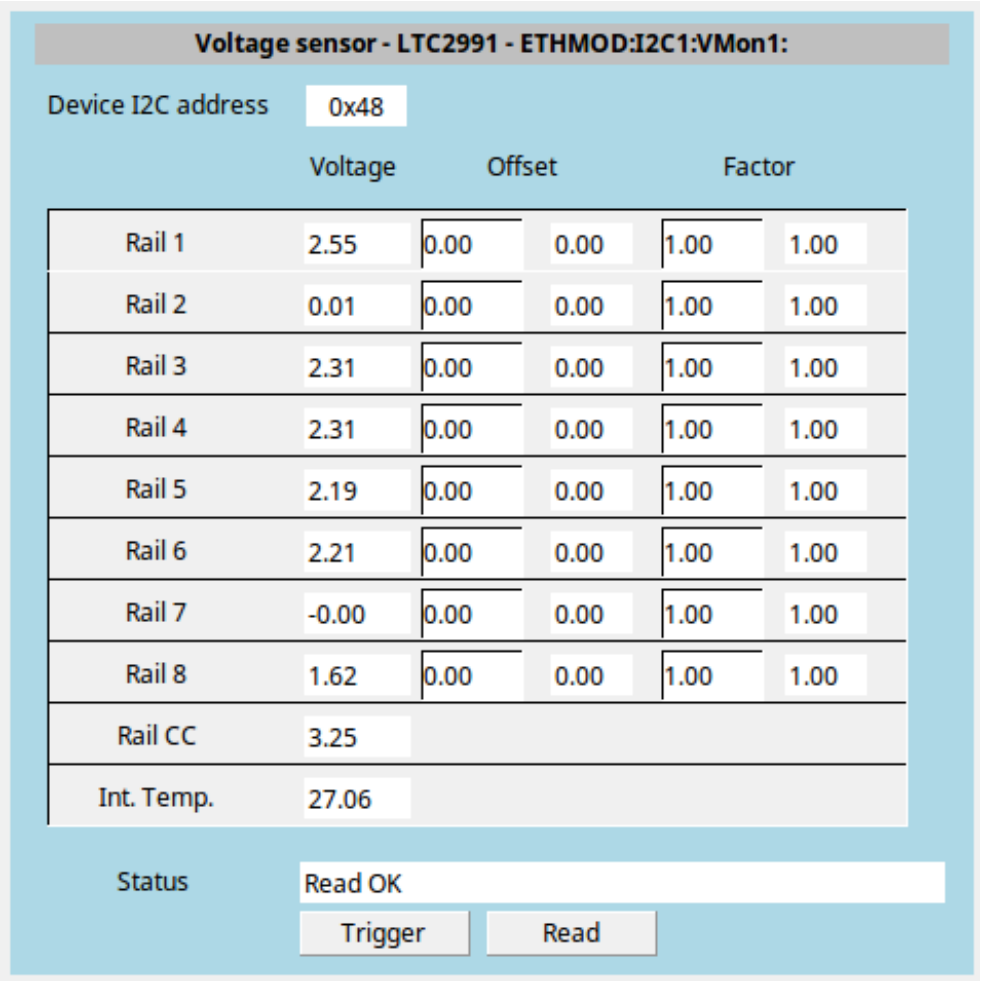
# Ethernet Module GPIO

- Control of port expander GPIO pin direction and level
- Individual GPIO pin can be either input or output
- When set to output user can control the level of the individual GPIO



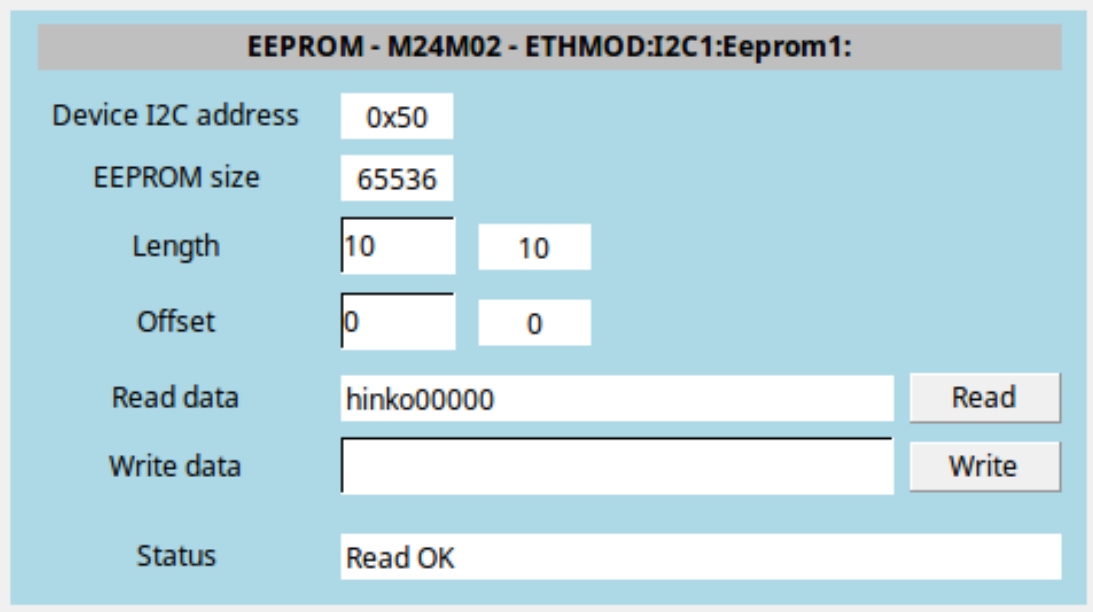
# Ethernet Module voltages

- Readout of up to 6 voltages (Rail 1 - 6)
- Fixed on-board 3.3 V and monitoring voltage (Rail 7 & 8)
- Includes internal temperature and detected Vcc (Rail CC & Int. Temp.)



# Ethernet Module EEPROM

- EEPROM can be written to and read from
- Can be used for serial number of the unit Ethernet Module is installed in
- Or for storing arbitrary application specific data (calibration factors)



# Ethernet Module rheostat

- Control of digital rheostat (resistor)
- Used in RF application
- Example of adding external I²C device to the Ethernet Module