HEATWEB



CASE STUDY · HEAT NETWORKS & COMMERCIAL

The BEMS 2.3 controller

Open-source control hardware for heat networks and HVAC

AT A GLANCE

PRODUCT
BEMS 2.3 (Building Energy Efficiency Management Solution) controller

PROGRAMME
SBRI open-source controls project

PROCESSOR
Raspberry Pi CM4 Compute Module

ENCLOSURE
DIN-rail case with LCD display and six buttons

SOFTWARE
Docker, Node-RED and MQTT, open source and licence-free

CERTIFICATION
EMC Directive 2014/30/EU; UKCA planned

The hardware behind our monitoring and control work: an open-source plumbing I/O board, an industrial Raspberry Pi processor and a purpose-designed DIN-rail enclosure, developed, built and CE-certified in our SBRI project and now running on live heat networks and HVAC systems.

The challenge

Monitoring a system is not enough. Heat networks and HVAC plant need their controls adjusted as soon as inefficiencies appear, and operators have obligations such as the Heat Network (Metering and Billing) Regulations.

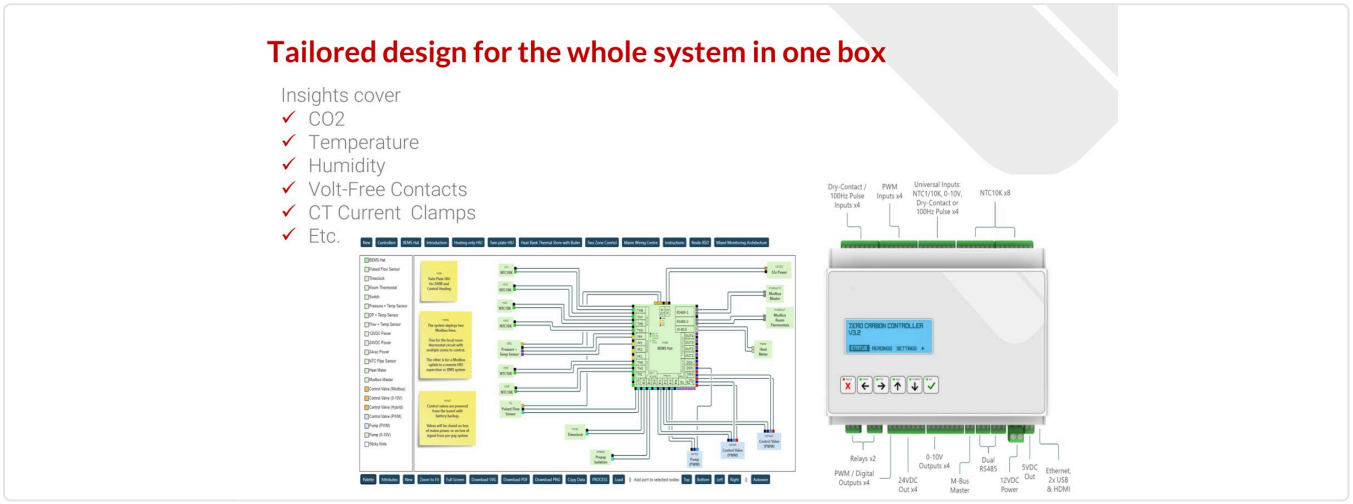
What was missing was a controller that connects to almost every HVAC sensor and device, gives both the data and control, allows remote access, meets the security standards commercial organisations and local authorities require, and makes the data easy to analyse.

What we did

- Designed the plumbing I/O board: 8 NTC inputs, universal and pulse inputs, relay, PWM and 0–10 V outputs, 2 RS485 lines, M-Bus and a battery-backed uninterruptible supply.
- Drove it from a Raspberry Pi CM4 on a base board with USB, Ethernet and display, keeping the board open to other Raspberry Pi models, the BeagleBone and the ESP32.
- Modelled the enclosure in 3D CAD and refined it through 3D-printed prototypes, with a hinged lid, a cooling fan and 4G and WiFi antenna positions.

What we found

- Every PCB developed for the controller was tested and found to comply with the EMC Directive 2014/30/EU: the heating controller, the LCD display and the ESP32 board.
- The same hardware builds into a range: plumbing I/O and BA boards, an EnOcean gateway with wireless sensors, pre-wired application enclosures and control panels.
- Everything that runs on it is open source and licence-free, installed with a single command from GitHub, and the same components run in the controller and in the cloud dashboards.



A tailored design: the whole system wired in one box.

3
PCBs certified to the EMC Directive 2014/30/EU

12 V
single supply, with 24 V, 5 V and 36 V generated on the board

8
dedicated NTC temperature sensor inputs

The outcome

- Installed on live systems including the Excel Centre in London, the National Trust's Stable Yard at Morden Hall and Putney Plaza.
- Running all control on the UK's first CO_2 heat pump heat network, at Swansea University's SHED.
- Used for HIU monitoring from simple mechanical units to RS485 electronic HIUs, including a new hot water HIU built on the controller.

About Heatweb. Heatweb Solutions is a UK provider of engineering support for heat networks and commercial HVAC: monitoring, fault diagnostics, technical compliance, optimisation, commissioning and maintenance.

Talk to an engineer

The full case study: www.heatweb.co.uk/blog/case-study/bems-2-3-controller/

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