

Automated temperature regulation at cryogenic temperatures: iMACRT

A new generation of temperature regulators for cryogenics applications has been designed at the Néel Institute. This new system, iMACRT, is built to a modular autonomous, design around an Ethernet interface, and can regulate temperatures between 10 mK and 300 K. Forty instruments have already been constructed and transfer of the technology to an industrial partner is under way.

The instrument was developed for low temperature experiments in helium, nitrogen and He³-He⁴ dilution refrigerator environments (T<100mK). It consists of three distinct modules:

> The resistance measurement module, MMR3. Three resistors can be monitored simultaneously with a very low noise level, below 1nV/√Hz. The measurement range extends from 1 micro-ohm to 2 Megohms. It uses a AC differential square pulse, four-wire measurement scheme, with three current ranges from 10pA to 10mA. An accuracy of 0.05% can be reached after calibration, with a temperature drift never exceeding 135 ppm/°C. The equipment is particularly adapted to the measurement of germanium, carbon, ruthenium oxide, and Cernox™ thermometers

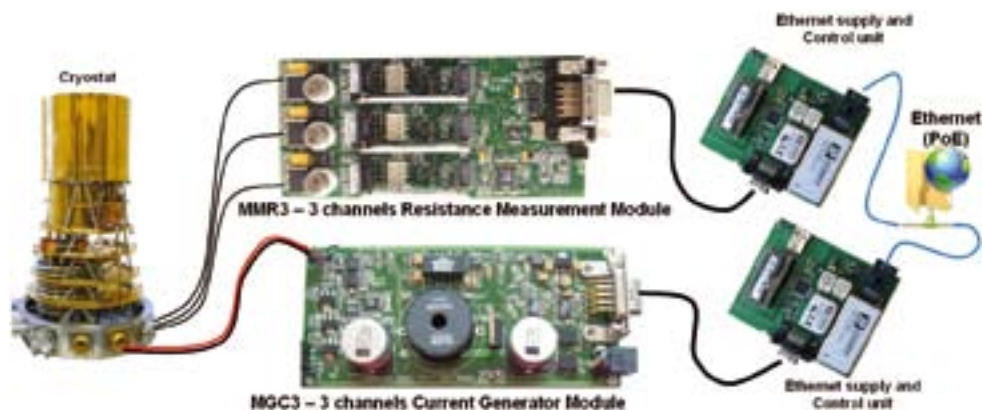
> The current generator module, MGC3. It powers the three temperature regulator channels simultaneously. The temperature controllers are of the Proportional-Integral-Derivative (PID) type and can be operated in automatic or manual mode. The first channel can output up to 9 Watts of power at 25V compliance voltage when powered via PoE (Power over Ethernet) technology. It can provide 50 Watts at 44V compliance voltage if powered by an external power supply. The two other channels can deliver a 20mA output current with a 16 bit resolution. These current sources are protected against open and short circuits and shut down automatically in case of connection loss. Two TTL digital outputs are provided for auxiliary controls.

> The interconnection module, MACRT. This is the Ethernet interface which allows remote control of the two other modules over an Ethernet network.

Technology transfer of this instrument is currently under way with Cryomagnetics (USA) and Cryoconcepts (France).



The MMR3 as seen through the web browser



CONTACT

Olivier EXSHAW

Olivier.Exshaw@grenoble.cnrs.fr

Tel: +33 476 88 10 27