1. Introduction.

The racks which will contain the EUROGAM Data Acquisition Electronics are, because of the high heat loadings, inter-cooled by water cooled heat exchangers. The air is internally recirculated by a system of fan trays, and the heat generated by the electronics taken away by demineralised water [1]. In order to ensure that the system is functioning correctly, the air flow and air temperature need to be continuously monitored. This note describes a proposal, based upon developments for the ZEUS cooling system at DESY, for the environmental monitoring of the racks. The monitoring of crate voltages and currents is not included in this proposal, this will be the subject of a further note.

2. Requirements.

The fans which move the column of air around the rack are of two types; recirculating fans which are mounted at the tops of the racks and which direct the air, via ducts in the sides of the racks, back to the bottom; and booster fans, which, in the absence of any fans built into the crates themselves, assist in maintaining the speed of the air column through the water cooled heat exchangers.

It is desirable to know if any of these fans fail, since this could cause local ‘hot spots’ in the electronics which would be difficult to detect by globally measuring the air column temperature. To this end, each individual fan is fitted with a sensor to detect a drop in air pressure caused by the fan failing.

In addition, the temperature of the air column will be measured at one point, at the top of the rack, to give an early indication of any potentially catastrophic overheating conditions, caused for example by failure of the cooling water supply.

3. Implementation.

Referring to Figure 1, within each fan unit (recirculating or booster, but not fans such as those built in to the VME crates or the LeCroy High Voltage mainframes) is a fan failure detector circuit, the output of which controls individual LED’s on the unit’s front panel to show the state of each fan. The same circuit also provides an encoded output to the 1 U deep ‘Rack Control’ module at the top of the rack via a fan failure monitor bus.This encoded output has three states for each fan unit; these states are:

a. All fans working

b. Any one fan not working

c. All fans not working

The Rack Control module uses a microcontroller, the 68HC11, to communicate via a multi-drop inter-rack monitor bus with a VME Rack Monitor bus driver/receiver. The 68HC11 is controlled by firmware in an on board EEPROM, and it includes an ADC which is used to convert the output of a sensor monitoring the air temperature within the recirculating fan unit. When interrogated by the controlling CPU (an MVME 147) in the VME monitor crate, each Rack Controller will return a word showing the status of the fans and air temperature within the addressed rack. The MVME 147 can then pass this status information to the users/operators via its Ethernet port.

4. <u>Status.</u>

The fan failure detectors and encoders are built and tested, and are being fitted to the fan units. The Rack Control module has been designed at Rutherford for the ZEUS experiment and details of it are awaited. The Rack Monitor driver/receiver module has also been designed at Rutherford, but it will be overly complex for EUROGAM, since ZEUS will have some 160 racks to monitor. Circuits for the driver/receiver will therefore be obtained from Rutherford with a view to building a simplified module for EUROGAM use.

References

1. 'Crates, racks, power supplies and cooling'. EUROGAM EDOC029

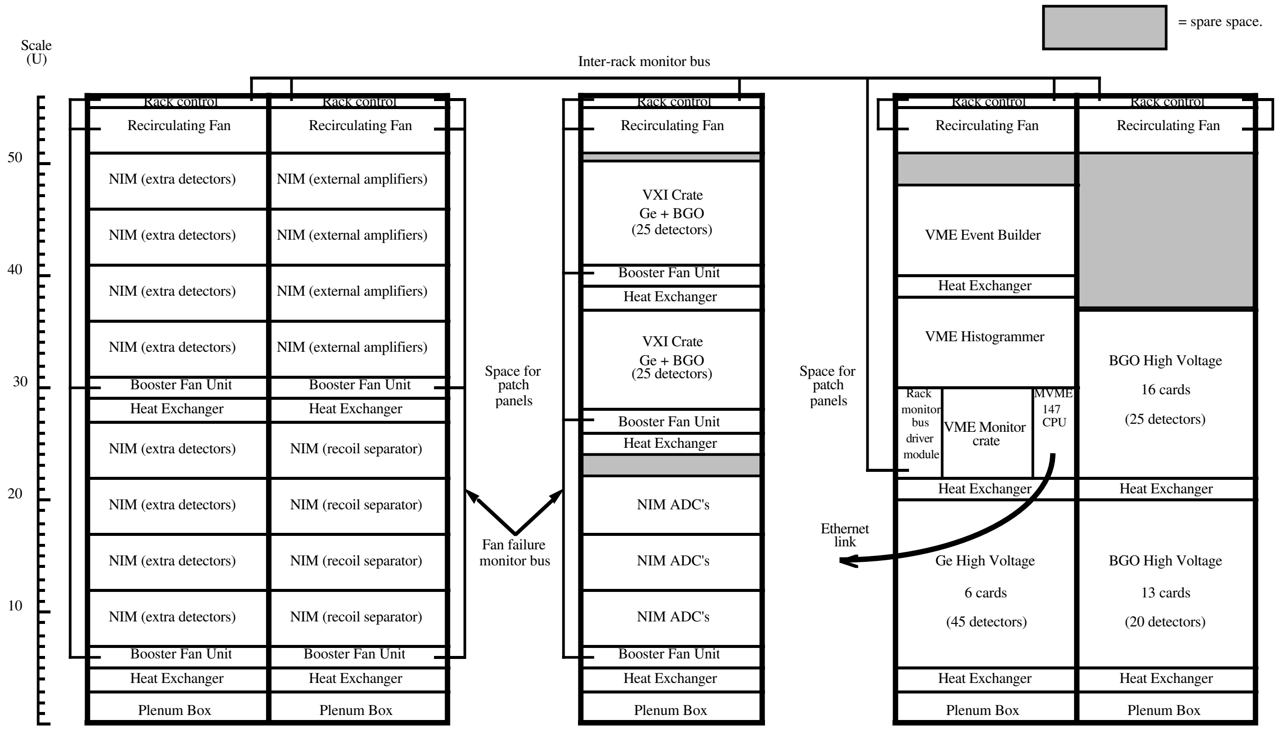

Figure 1
Layout for EUROGAM electronics phase 1. Includes external amplifiers

G. McPherson
3 Dec. 1990