



ATLAS Muon MDT

MROD Module:

MROD Series Production

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Abstract

This document contains an overview of the MROD series production.

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1 Prototype Results

In total six prototype modules of the latest MROD design have been produced. This prototype series has tested three different MROD configurations on the same PCB: Four prototype modules have 8 input channels and two modules have 6 inputs. One of the 8-channel modules has only one DSP in the MROD output section (as opposed to two output DSPs in all other modules). For the main production 6- and 8-channel modules will be made, probably with a single output DSP only. One type of PCB will serve both MROD configurations.

All six prototype modules underwent extensive tests and perform satisfactorily. Only a small number of minor changes will be made to the PCB before the main production starts. It should be stressed that the two companies which did the prototypes both did an excellent job.

2 Production organization

2.1 Introduction

The MROD production basically consists of three main steps:

1. ordering of components.
2. production of PCBs.
3. assembly of complete MRODs.

It is understood that steps 2 and 3 may be done by either two different companies (as was the case for the prototype series) or a single company. In any case a pre-series of 15 modules will be requested for quality assessment. Treatment of the pre-series shall be identical to that of the full series.

2.2 Ordering of components

The major active components (FPGAs, DSPs, optical components etc.) will be ordered through CERN. Price enquiries are going on. Front panels and stiffener bars will be ordered through NIKHEF. Sufficient S-Link source card daughter boards (the ROLs) are already on stock at NIKHEF. The minor (mostly passive) components such as diodes, resistors, and capacitors are assumed to be supplied by the assembly house.

2.3 Production of PCBs

The MROD PCBs will be produced either by the firm who did the prototype PCBs or by another well reputed firm. PCB production shall include electrical testing of the bare PCBs. Price enquiries are ongoing.

2.4 Assembly of complete MRODs

The assembly will be done by the same firm who assembled the prototype modules or by another firm of good reputation. The mounting of the front panel and the stiffener bar is part of the assembly task. Assembly shall include automatic optical inspection. Price enquiries are ongoing.

3 Testing and reworking

For each production batch, first a small number (typically 3 to 5) of randomly selected modules will be subjected to an initial test procedure where the supply voltages will be turned on manually while monitoring the currents. Once this initial test procedure is passed successfully it will be assumed that the whole batch is O.K. in this respect.

All modules of that batch will subsequently be tested by placing them in a VME crate where they will be connected to the supply voltages when the crate is turned on. In the crate, the modules will be subjected to an automated series of functional tests described elsewhere. After being accepted, all modules will be subject to a one day “burn in” period.

Failure on any of the tests requires further inspection of the board and possibly reworking on some of its components. This may include returning the board to the assembly house.

The testing of the MRODs will in principle be done at NIKHEF. It is estimated that the automated test procedure takes about 20 to 30 minutes per module (including handling etc.). We are still investigating whether part of the tests can be done in parallel, i.e. with a number of modules in a crate simultaneously. We plan to hire students to do most of the routine testing. If the assembly is done close to NIKHEF (in the Netherlands), we may consider to physically move our test equipment to the location of the assembly company.

4 Numbers

The experiment requires the installation of 192 MRODs (28 8-channel and 164 6-channel modules). To this minimum number we add some 10% for “life-time spares”. In addition we add 5% to accommodate for modules which after production fail the acceptance tests and happen to be “beyond repair”. This 5% is a crude estimate based on experience with the CSM (2 failures out of 40). For the components we plan to buy “a few” extra to allow for the occasional replacement.

We propose to produce 220 MRODs: 44 8-channel modules and 176 6-channel modules. Note that an 8-channel module can be a replacement (“spare”) for a 6-channel module but not vice versa. The six prototype modules may also be deployed as spares.

5 Funding

The total cost of the MROD is estimated to lie between CHF 6000 and CHF 7500. The precise number still depending on price negotiations which are ongoing. The total amount is about MCHF 1.4 which fits well within the MoU envelope. The participating institutes (NIKHEF, MPI München, LMU München and Saclay) have made their funds available at CERN (or have pledged to do so soon).

6 Planning

- November 2005: Ordering of active components (mostly through CERN).
- December 16, 2005: Ordering of pre-series PCBs.
- March 1, 2006: Components received.
- March 2006: Assembly of pre-series.
- April 2006: Acceptance tests/quality assessment of pre-series MRODs.
- May 1, 2006: Order of full series PCBs and assembly.
- June/July, 2006: Acceptance tests/reworking of delivered MRODs.
- August 2006: Installation in USA15.

The MROD VME-crates (with a non-standard P3 backplane) will be installed in the USA15 racks well before August 2006 (the P3 backplanes themselves will be mounted in the MROD crates before the installation of these crates).

The crate controllers (Concurrent Technologies VP315/022-96 single board computers) and the TTC Interface Modules (TIMs) will be installed at the same time as the MRODs.

Note that all (17) of the VME-crates and crate controllers have been delivered. The same is true for the 19 P3-backplanes. The delivery of 19 TIMs is imminent.

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