

Test Plan

ATLAS Calorimeter First Level Trigger- Timing Control Module

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Atlas Level-1 Calorimeter Trigger

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1 General Notes

These tests will be used both as part of module-acceptance tests on receipt of TCMs from manufacture, and also later, as part of the procedure to diagnose faults and confirm that repaired modules are fully functional. Each TCM should be subjected to all of the tests in this document. The tests should be carried out by a test engineer in the RAL ESS laboratory.

These tests are designed to identify any physical faults in a TCM, such as broken PCB tracks or poor solder joints. Some of the CANbus functions are still under development, particularly the interface to the external ATLAS Detector Control System. Programmable devices on the TCM will have all of their interfaces tested, but not all of their internal functionality. CANbus functional tests will be added when the DCS architecture has been agreed.

All data and address values shown in this document are given as hexadecimal numbers, unless stated otherwise.

2 The Tests

2.1 Solder bridges

Set solder bridges to define module ID B as follows:

Bit	Descriptive Name
0-7	Module Serial number = unique, incremental number
8-11	Hardware Revision Number = 2

2.2 Crate Preparation

1. If using a 9U VME crate, attach a TCM auxiliary backplane to the rear of the J0 connectors. The backplane should have the lab test switch fitted to allow the crate number to be changed, as described in TCM spec section 3.2.4.

2.3 Power

2. Check for shorts between +5V and GND
3. Power up the module.
4. Check for smoke.
5. Measure the power supplies and check that they are in spec ($\pm 5\%$).
6. Confirm power LEDs are illuminated.
7. Confirm that the Crate number is displayed.

2.4 Boundary Scan

Boundary scan the JTAG chains on the TCM. This will test the board for shorts and broken connections (although not at full operating frequency).

2.5 Configuring the CPLDs

The MaxPlusII to configure Altera 7128 CPLD devices.

2.6 TTC Clock Distribution

8. Set up the TTC system in a suitable 6U crate. A L1A is not required.
9. Check that the TTC LED is not lit.
10. Attach TTC fibre to the TCM
11. Check that the TTC LED is now lit
12. Connect a scope to the front panel TTC monitor point, observe that 80 MHz encoded TTC signal is present with a.c.-coupled NIM levels.
13. Using a differential probe, confirm that 20 copies of the TTC encoded signal are present with PECL levels on backplane connectors listed in Spec appendix A and B. Since these signals are not terminated at the receiving end, amplitudes will be double PECL levels.
14. Disconnect the TTC fibre

2.7 VME Access

1. Insert the module into an appropriate 9U crate (custom backplane or VME64 backplane).
2. Read the following VME registers and check that they return the expected values.
Module ID Register A should return 3195
Module ID Register B should return the serial number and hardware revision number.
3. Verify that the TCM Board Select LED, labelled BS, lights up temporarily as each VME access is made.
4. Perform a VME scan of all addresses in the crate, verify that only the expected addresses (TCM internal addresses plus computer-VME memory) respond.

2.8 VME Status Register

1. Set the crate number to 1. Read the VME Status Register. Check that all bits are clear except for the crate number.
2. Repeat with the crate number set to all other possible values.
3. Insert the TTC fibre. Check that the TTC Optical link active bit is set.

2.9 VME Test Register

1. Write and read back all possible values to Test Register 1, using D16 access.
2. Write and read back all possible values to Test Register 2, using D16 access.
3. If this is a TCM-VME, write and read back all bits one at a time, using D32 access

2.10 VME memory tests

1. Disable the Canbus controller by setting bit 1 in the control register.
2. Write a walking-ones pattern to the whole CAN memory , using VME D16 mode.
Read back the pattern.
3. Repeat for the following 15 cyclic variations of the pattern
4. For TCM-VME only, write a walking-one pattern to the whole CAN memory, using VME D32 mode. Read back the pattern.
5. Enable the Can controller

2.11 VMEbus LEDs

These tests require an additional module in the crate, capable of responding to VME bus cycles. The display is checked using cycles directed at this test module, and to the TCM itself.

1. Issue a VME cycle to an unoccupied address in the crate, verify that BERRLED lights briefly.
2. Reset the crate CPU, and check that the SYSRESET LED lights briefly.
3. Issue a VME read cycle to legal addresses in the TCM and to the test module, and check that the BBSY, DTACK, and AS LEDs light briefly.
4. Issue a VME write cycle to legal addresses in the TCM and the test module, and check that the WRITE LED lights briefly.

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5. If working with a TCM-VME, issue a 32-bit read operation to the TCM and the test modules, and check that the LWORD LED lights briefly.
6. Issue a repeated series of 16 walking-ones writes at around 1Hz to the TCM test register and to the test module. Verify that both the VME D0-D15 and the Hex display show the incrementing pattern.
7. If working with a TCM-VME, extend this pattern to 32 bits.
8. Issue VME reads sequentially to all addresses in the CAN memory at around 1Hz, verify that the VME address line display increments as expected. Verify that the upper address bits are correct.

2.12 CAN Microcontroller

2.12.1 Programming, Memory and CANbus Interfaces

A diagnostic firmware load is used to check these interfaces.

1. Connect a bridging connector between the external and internal CAN test points on the front panel.
2. Set the jumper to put the CAN microcontroller into program mode.
3. Connect the module front panel programming socket to the test computer.
4. Start the Accemic software on the test computer.
5. Within Accemic, open the system preferences and change the microcontroller type to MB90F594.
6. Within Accemic, press the Download Diagnostic Program button
7. On the front panel of the TCM, press the microcontroller reset button to initiate the download operation.
8. After Accemic shows that the download has completed, remove the TCM jumper
9. Press the microcontroller reset switch on the front panel of the TCM.
10. Within Accemic, press the Connect To Target button.
11. Within Accemic, press the State Of Processor button.
12. Check that Accemic now displays the following port data for the microprocessor:
Port 8 should have the value 05 (the TCM module type)
The least-significant nibble of Port 7 should show the crate number.
13. Using the VME computer, set the CAN disable bit in the control register. Fill the VME memory with all zeros, and read back to check.
14. Clear the VME disable bit.
15. Read the VME memory. This should now contain a sequence of four rams 0-255.

2.12.2 CAN controller reset test

The CANbus diagnostic code stops after writing the memory. It reruns after a reset.

1. Using the VME computer. Fill the VME memory with all zeros, and read back to check.
2. Write a 1 to the CAN reset bit in the control register, then write zero..
3. Read the VME memory. This should again contain a sequence of four rams 0-255.
4. Disconnect the external-to internal CANbus test cable.

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2.12.3 Operational Internal and External CANbus test

1. Insert the TCM into a crate with VME computer and at least one processor module with CANbus interface.
2. Connect test computer with TCM Labview software to the external CANbus connector.
3. Using the Accemic software as above, load the Monitor Program into the microcontroller.
4. On the Labview display, check that the processor module registers as present and that its voltages are displayed.

An evaluation copy of the Accemic software is now available from www.accemic.com. RAL ID hold a commercial copy.