

Fermilab - DES 12-Channel CCD Acquisition Board Acceptance Criteria

Revision: 0.0

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Revision History

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1.0 Introduction

This document covers the testing strategy to verify that the FERMILAB-DES 12-Channel CCD Acquisition Board will operate in an acceptable fashion. Basically a method to prove that the board works according to specification. It is assumed that the board has been verified to be functional and has been programmed and tested. All tests described in this document pertain to the latest hardware revision level of the subject board.

The 12-Channel Acquisition board produces the Bias Voltages to operate the CCD, the Video Readback electronics and the CCD temperature monitoring electronics along with a means of communicating with the MEC(Monsoon Engineering Console). The Bias voltages are set using a controllable DAC that is writeable via MEC. The voltage that is generated by the DAC is also monitored on the 12-Channel board with an ADC that is readable via MEC. The Bias voltages are forwarded to a Transition module that filters the voltages and also contains logic that produces the Substrate voltages for the CCD's. The Substrate voltages are produced from one of the Bias voltages that is fanned out via six amplifiers to produce six voltages for 6 CCD's. There are 12-Channels of Video Readback Electronics that are used to process the video signal from 6 CCD's(1/2 of each CCD). The CCD temperature monitoring electronics provide six precise 1ma current source to six resistive temperature device(RTD) that are mounted at six CCD locations. The voltage drop on an RTD is fed back to an instrumentation amplifiers on the 12-Channel board for monitoring, there are 6 channels of RTD electronics on the board to provide temperature monitoring of 6 CCD's.

The Transition board mounts at the rear of the crate in the same slot as the 12-Channel board. The transition board provides a means to fanout the signals from the 12-Channel board to the VIB board via cables. A Fanout board is a test module that was developed to allow for monitoring of the input and output signals that are present on the cables between the Transition module and the VIB board.

The test procedure assumes that the tester is familiar with the use of the MEC (MONSOON Engineering Console) and can execute the required commands.

Video Input Noise monitoring procedure:

The Video Input paths are tested by shorting the Input signals together, the RMS noise is recorded and must be less than 4 counts RMS.

Step 1. Connect the cables from the Transition Module to the Fanout Board. In the middle section of the fanout board place the shorts between the shield connection and the input connection.(Shield “-“ to Input “-“, Shield “+” to Input “+”).

Step 2. Open the MEC and initialize the system.

Step 3. On the MEC console set the Video inputs to Channel 0 and 1.

Step 3. Run the Readout program to produce a noise measurement on the Video Input channels 0 and 1.

Step 4. Record in the Criteria Test spreadsheet for this particular 12-Channel board the noise for channels 0 and 1.

Step 5. Repeat the procedure for all 12 Video Input Channels.

Bias & Substrate monitoring procedure:

The Bias and Substrate Voltages are tested at a 10%, 90% and Typical voltage levels. The level must measure within 2% of it's set value when measured at the Fanout board with a multi-meter. The noise levels are also monitored at each setting and must be less than 4 counts RMS read back via the Video Input path using the MEC. The voltage level read back by the ADC on the 12-Channel using the MEC will also be recorded.

- Step 1. Connect the cables from the Transition Module to the Fanout Board.
- Step 2. On the MEC console set the Video inputs to Channel 3 and 4.
- Step 3. Set the Bias 0 level to the 10% level and update the window. Record the voltage level that is monitored by the ADC. Also record the value for the six Substrate voltages.
- Step 4. Using the multi-meter measure and record the voltage labeled Bias_Filter(1) on the Fanout board. Also measure and record the six VSUB voltages found on the Fanout board. When measuring the voltages the VSUB voltages connect the black lead to the +48V Return pin. When measuring the voltages for the Bias levels connect the black lead to the BIAS_RTN pin.
- Step 5. Remove the Jumper from Video input signals Channel 5. Connect a wire from Bias_Filter(1) to In05+ and a wire from J41 to In05-. Run the program to measure the RMS noise count, record the value in the spreadsheet.
- Step 6. Connect the wires from In05+ and In05- to VSUB1 and J39 respectively. Run the program to measure the RMS noise count, record the value in the spreadsheet.
- Step 7. Repeat for VSUB2 .. VSUB6.
- Step 8. Repeat step 3-7 with Bias 0 level set to 4v.
- Step 9. Repeat step 3-7 with Bias 0 level set to 90% level.
- Step 10. Set the Bias 1 level to 10% level and update the window. Record the value that is monitored by the ADC.
- Step 11. Using the multi-meter measure and record the voltage labeled Bias_Filter(2) on the Fanout board.
- Step 12. Connect a wire from Bias_Filter(2) to In05+ and a wire from J55 to In05-. Run the program to measure the RMS noise count, record the value in the spreadsheet.
- Step 13. repeat 10-12 with the Bias 1 level set to 4v.
- Step 14. repeat 10-12 with the Bias 1 level set to 90% level.

Repeat the 10-14 steps for Bias_Filters(3) to (34), setting the level at the 10%, Typical and 90% maximum values.

CCD Temperature monitoring procedure:

The CCD Temperature monitoring circuitry produces a 1ma current source that is forwarded to the RTD at the CCD. The RTD has a 1000 ohm impedance at 0 degrees celcius and varies with temperature. The precision of the 1ma source is tested on the fanout board by placing 1000 ohm 0.1% resistors in place of the RTDs on the Fanout board.

- Step 1. Measure and record the voltage across the resistors for all 6 channels.
- Step 2. Record the ADC read back for all 6 channels.
- Step 3. Replace the 1000 ohm resitors with 100 ohm resistors and repeat steps 1 and 2.

In the description for these tests, certain conventions are followed to ease comprehension. These conventions and examples of each are presented in Table 1.

Table 1 - Test Description Conventions

Convention	Example	Description
Linux commands that are typed on a PAN xterm window	mecStart	Boldface characters
Commands typed to the MEC command line	<i>ppxSetAVP</i>	<i>Boldface italics</i>
Buttons on the DHE boards or MEC console	<u>>startExp<</u>	<u><i>Bold italics underlined inside > < symbols</i></u>
Designate data values that are returned in the PAN xterm or MEC console window	<i>dir</i>	<i>Italics</i>
Responses from the programs	this is a response	Courier font
Specific board signal names	FBIAS1	BOLDFACE SMALL CAPITALS
MEC attribute names	<i>mcbCodeID</i>	<i>Boldface italics</i>

Required Equipment:

- DHE with programmable power supplies and 8- or 6-slot backplane chassis.
- 12-Channel Transition module
- Fanout Board
- Personal Computer running MS Windows 2000 or Windows XP. The PC must be connected to the network with the \\decapod\MNSN disk mapped into the Windows disk structure. Required programs are MS Word and Xilinx Impact.
- Digital multimeter