Testing and Programming the Integrator/ Digitizer Card for the Beam Loss Monitoring System

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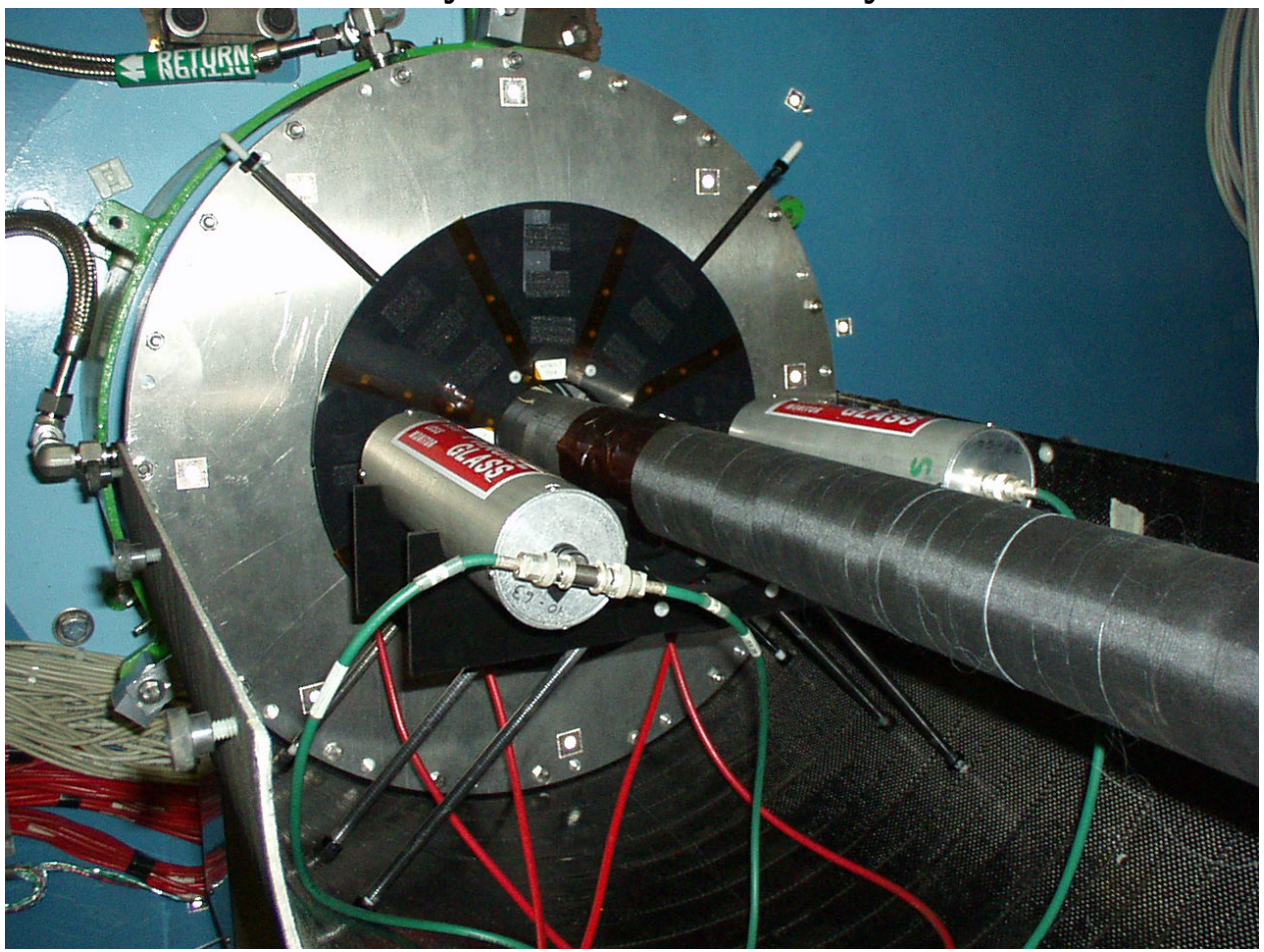
Outline

Introduction

In a perfect system, installing a BLM system would be illogical and unnecessary, however since we do not possess such a machine, it is necessary to install this system.

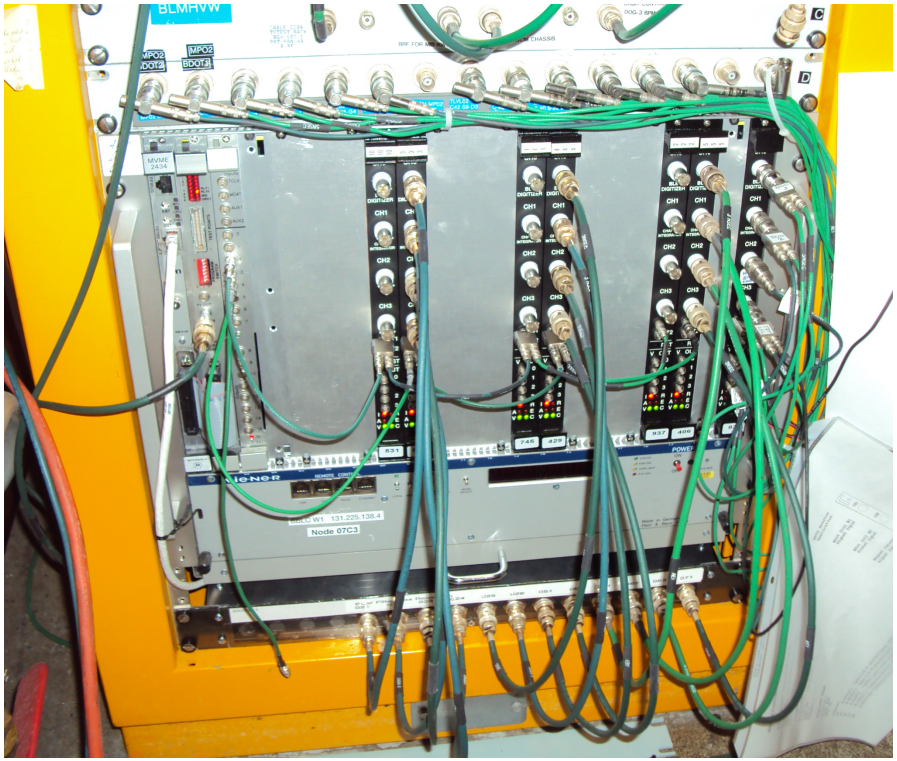


BLM @ Fermilab

Ion Chamber

- Nickel Electrodes
- 110cm^3 Argon gas
- Calibration: 70nC/Rad

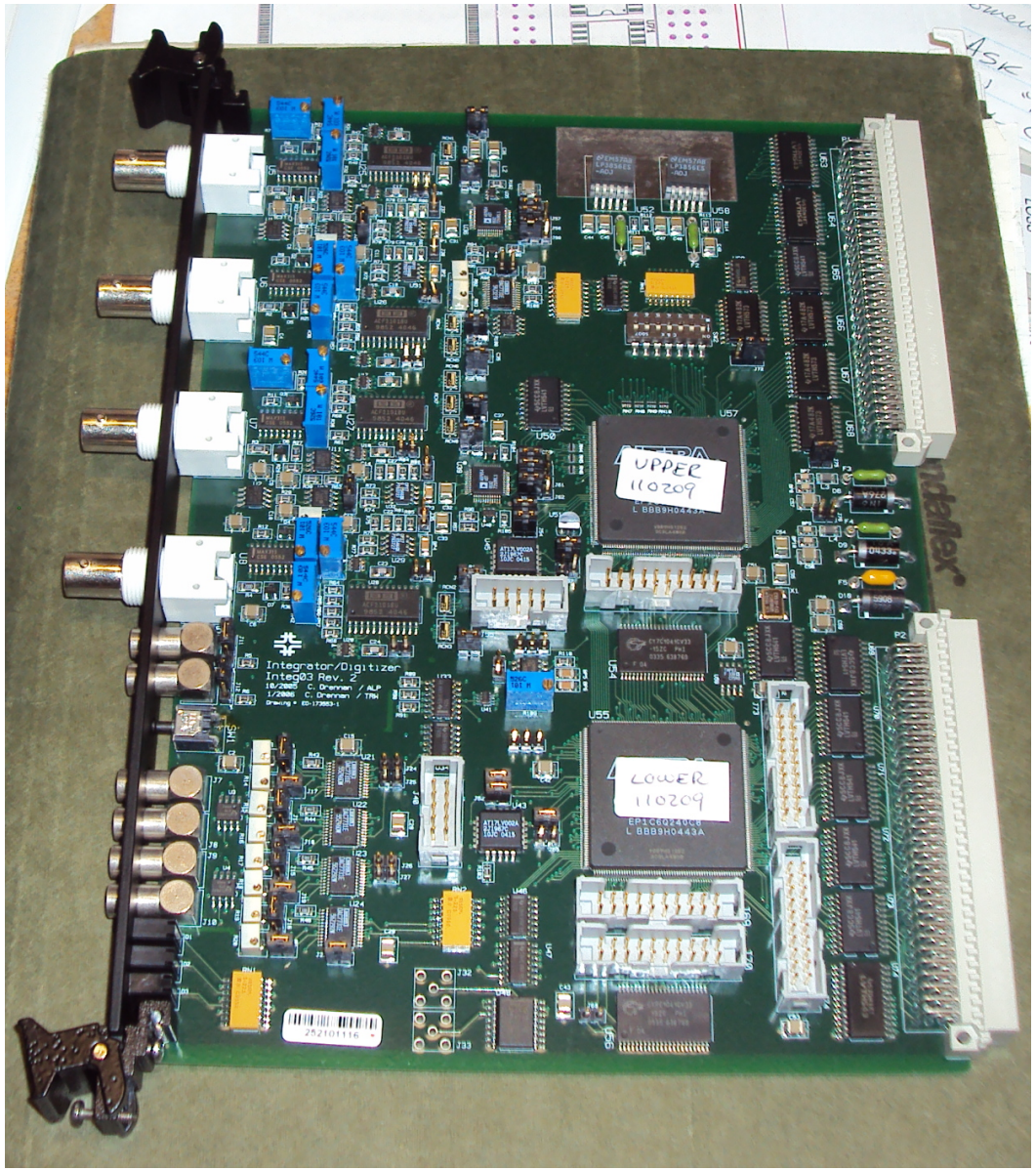
VME crate



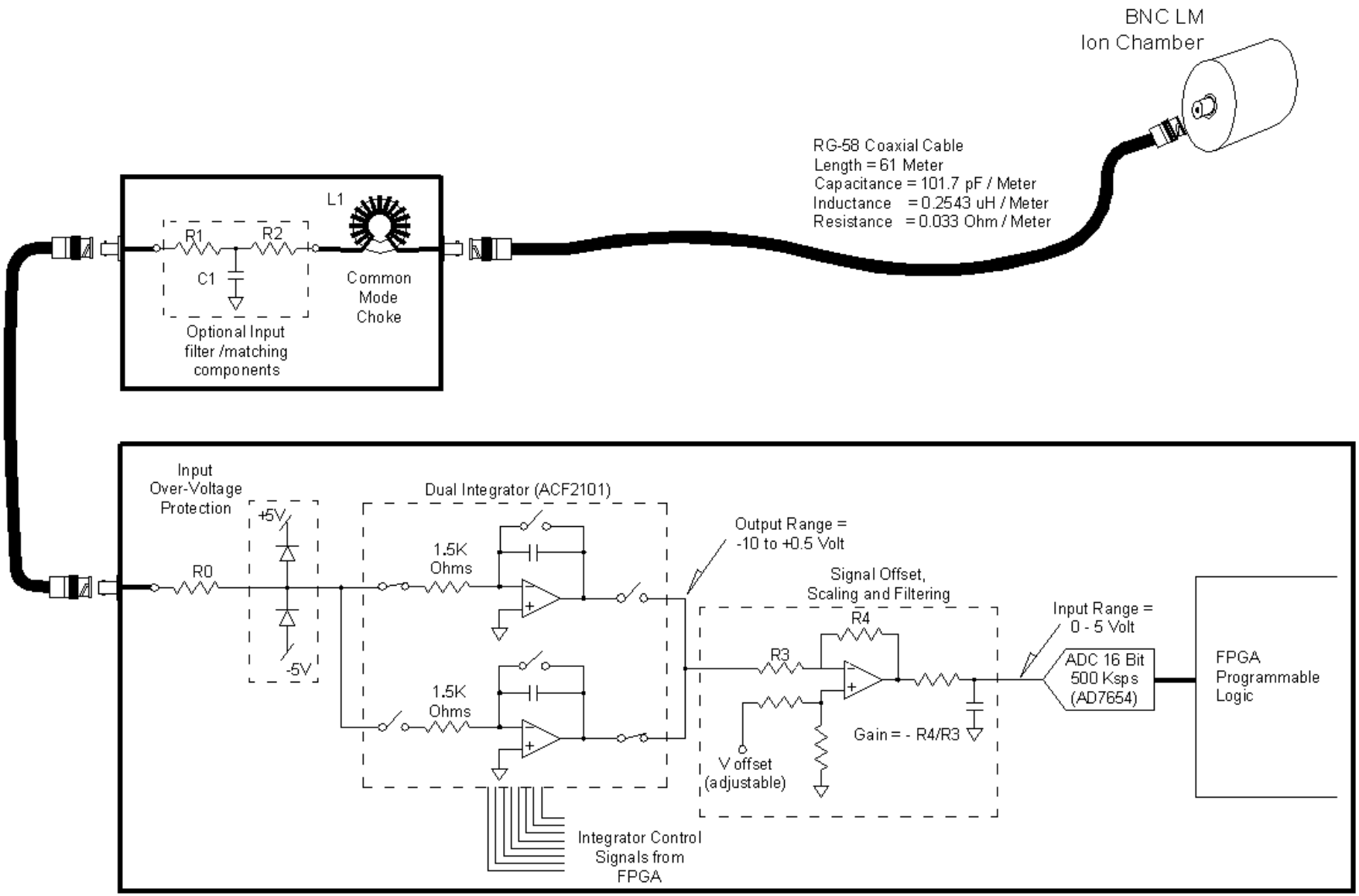
- Control Card
- Timing Card
- Abort Card
- High Voltage Card
- Digitizer Card

Outline

4 Channel Integrator/ Digitizer



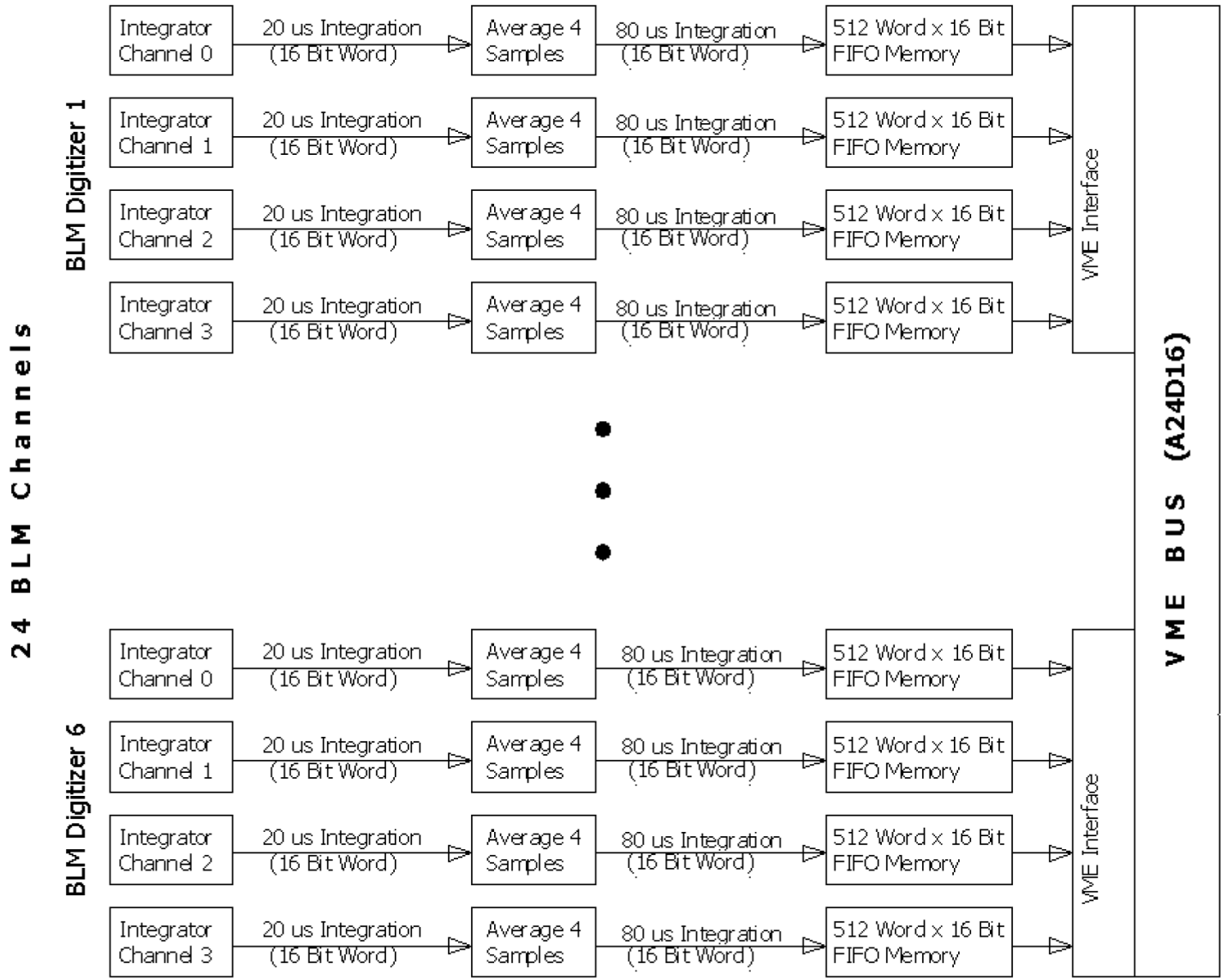
How does it work?



Components of the Module

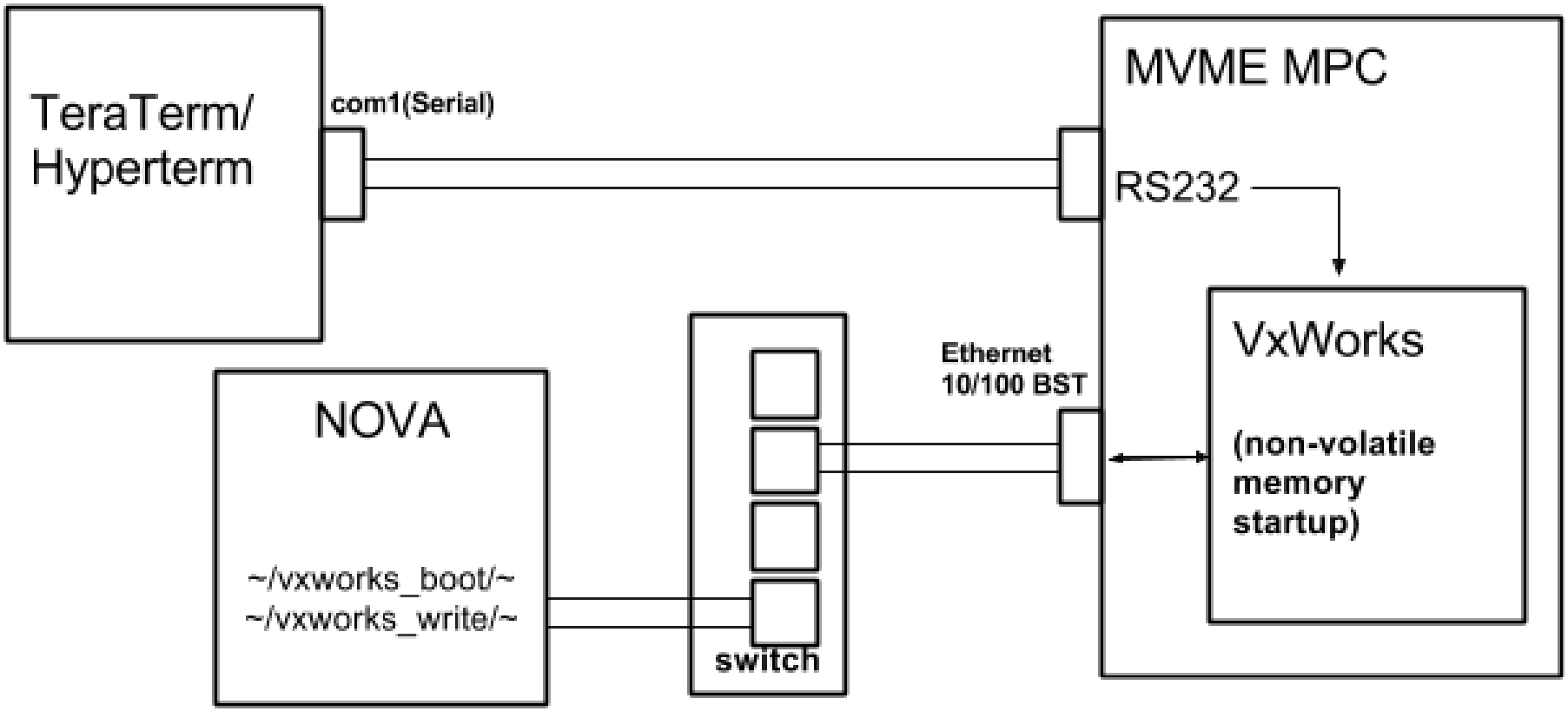
- Dual Integrator, integration for 20 μs,
- Analog to Digital Converter(ADC) produces a 16 bit word (1 bit≈15.26fC),
- Sum 4 sets of 20μs integration samples to get a 80μs sum,
- Divide the 80 μs sums by 4 to get 16 bit word,
- Data Acquisition for 40 ms produces 500 samples/cycle,
- 500 samples written to FIFO,
- Samples transferred over the VME bus for analysis.

On Board Processing



Outline

Communication with the Board



Introduction to FPGAs

FPGA (Field Programmable Gate Array)

Two FPGAs employed:

Upper/ INTEG

· manages sequencing and readout of integrator channels

· performs scaling and averaging of readings

Lower/ SUMS

· DAC analog outputs

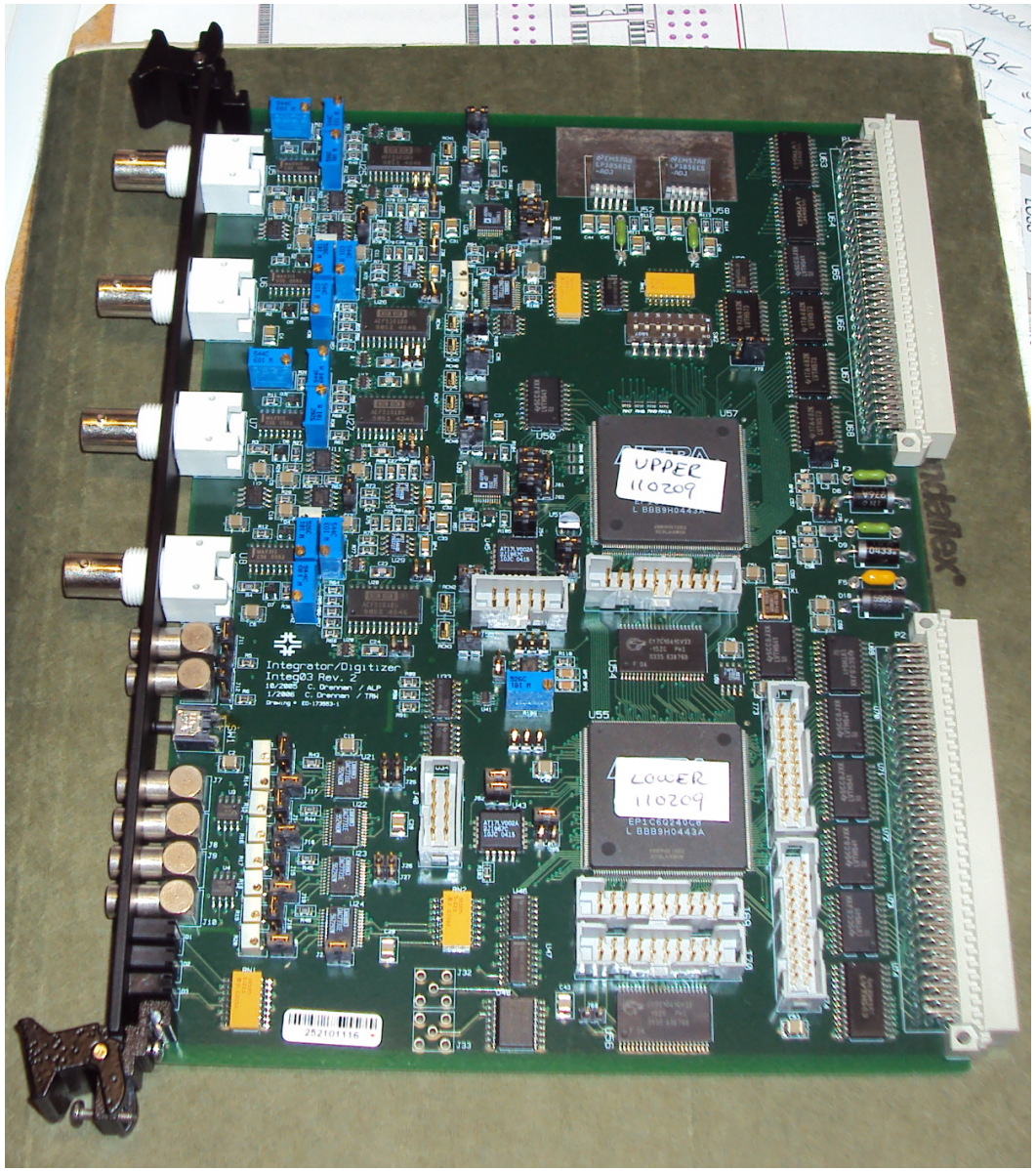
FPGAs manufactured by Altera.

Code written and manufactured using Quartus (*.pof).

A *.bst file created using ATMEL programming system.

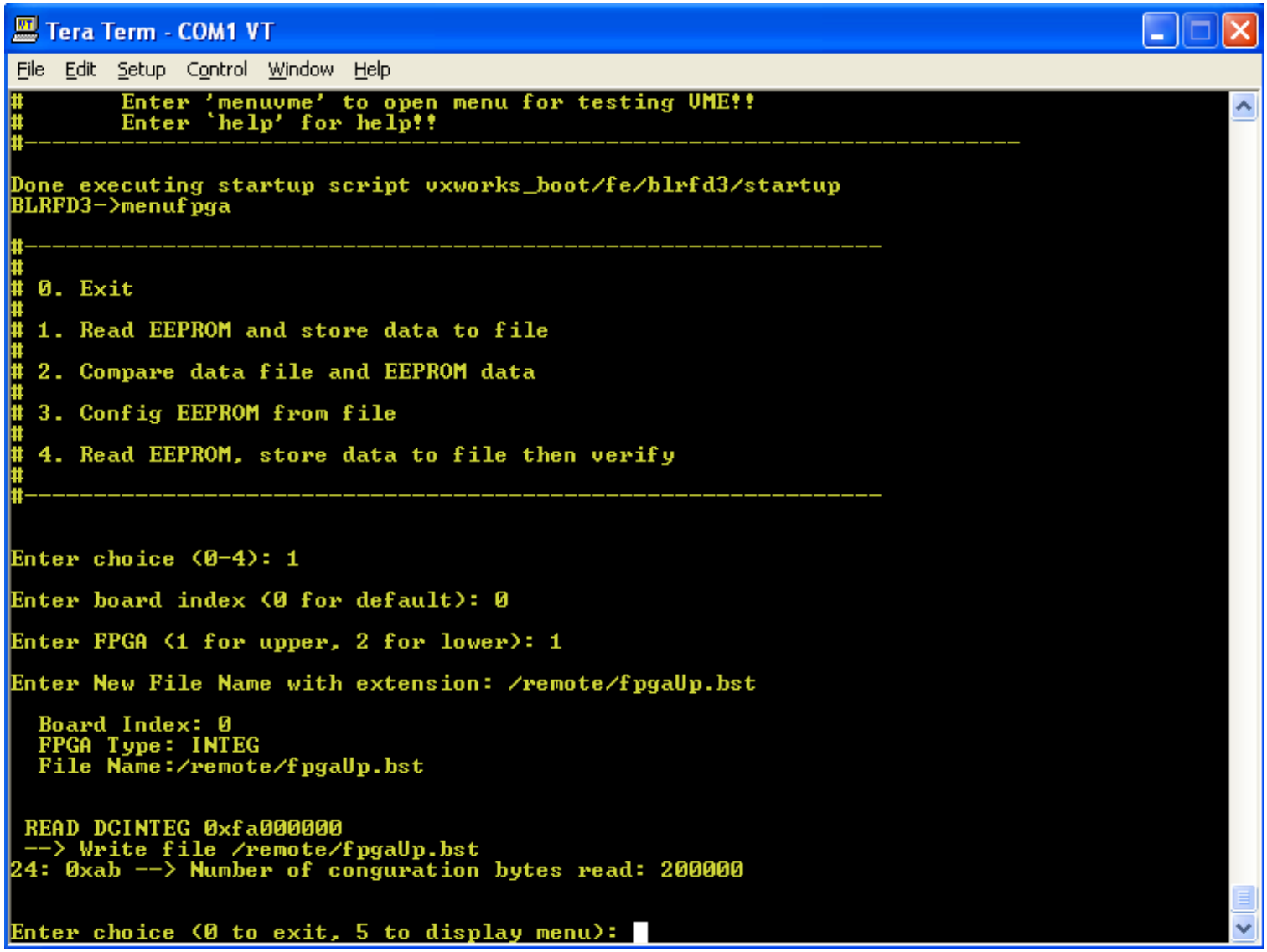
FPGA configured from the EEPROM device at each power up.

4 Channel Integrator/ Digitizer



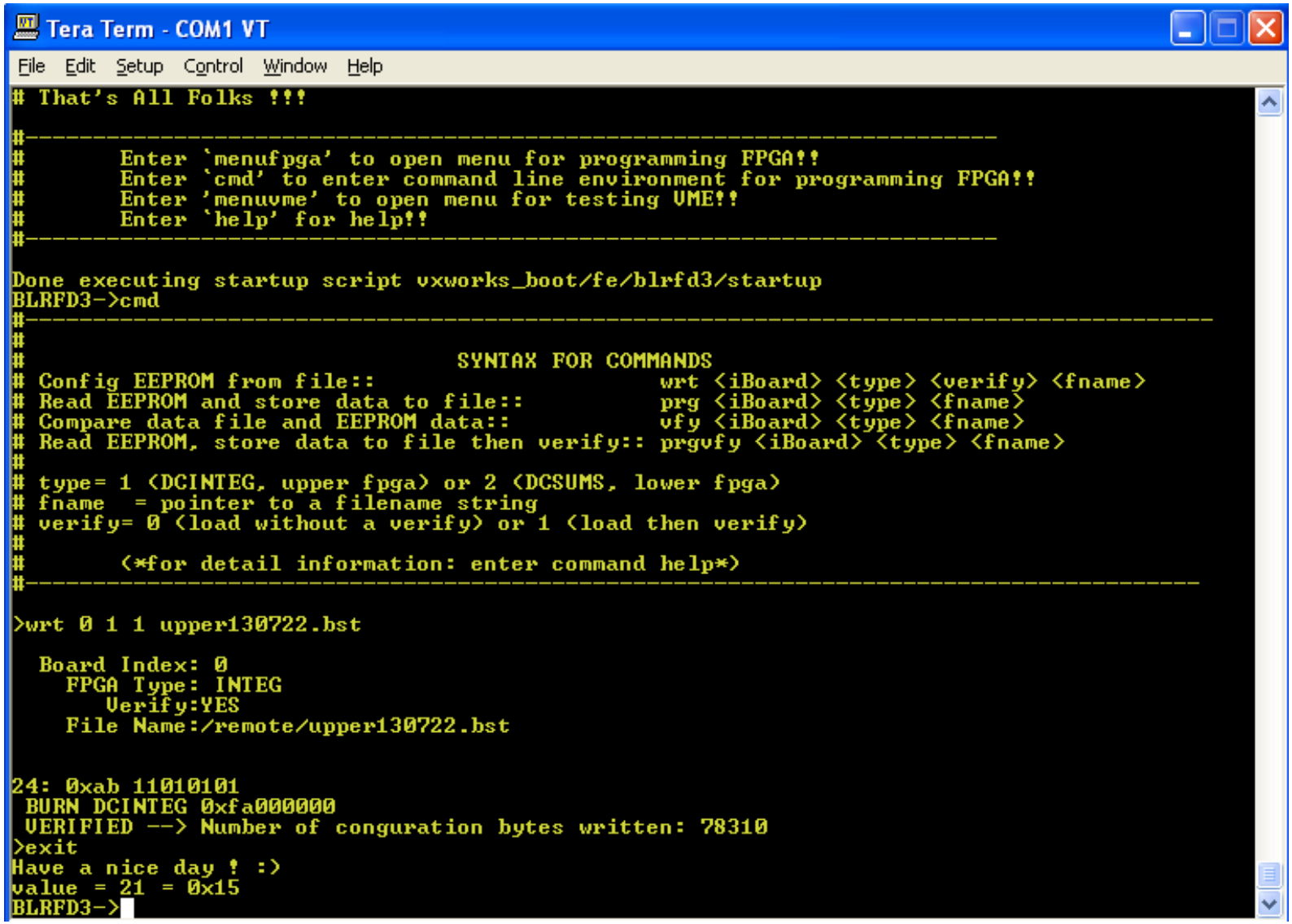
Programming the FPGA

Menu Mode



Programming the FPGA

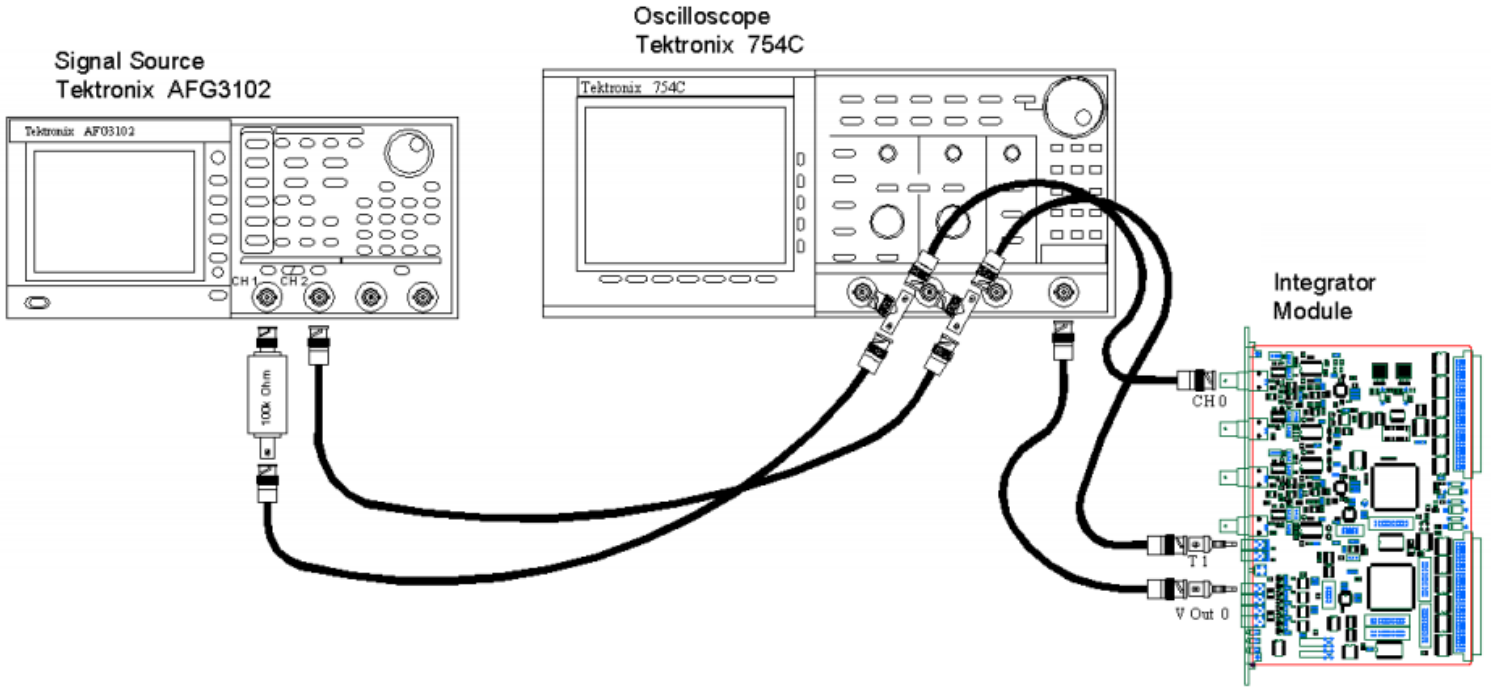
Command Line Mode



Outline

Testing the Digitizer Card

Test with External Pulse



Testing the Digitizer Card

Test DAC (Digital to Analog Converter)

- Send analog signal from the Board
- Turn off all external input
  DIP switch and Registers employed to work with code
- Write certain values to registers at certain address to send commands
  example: write 0xff00 to register at address offset 0x01034 turns off FP input and turns on DAC input
- Data acquisition method is same
- Compare FIFO data to test DAC settings to evaluate Integrator and Digitizer

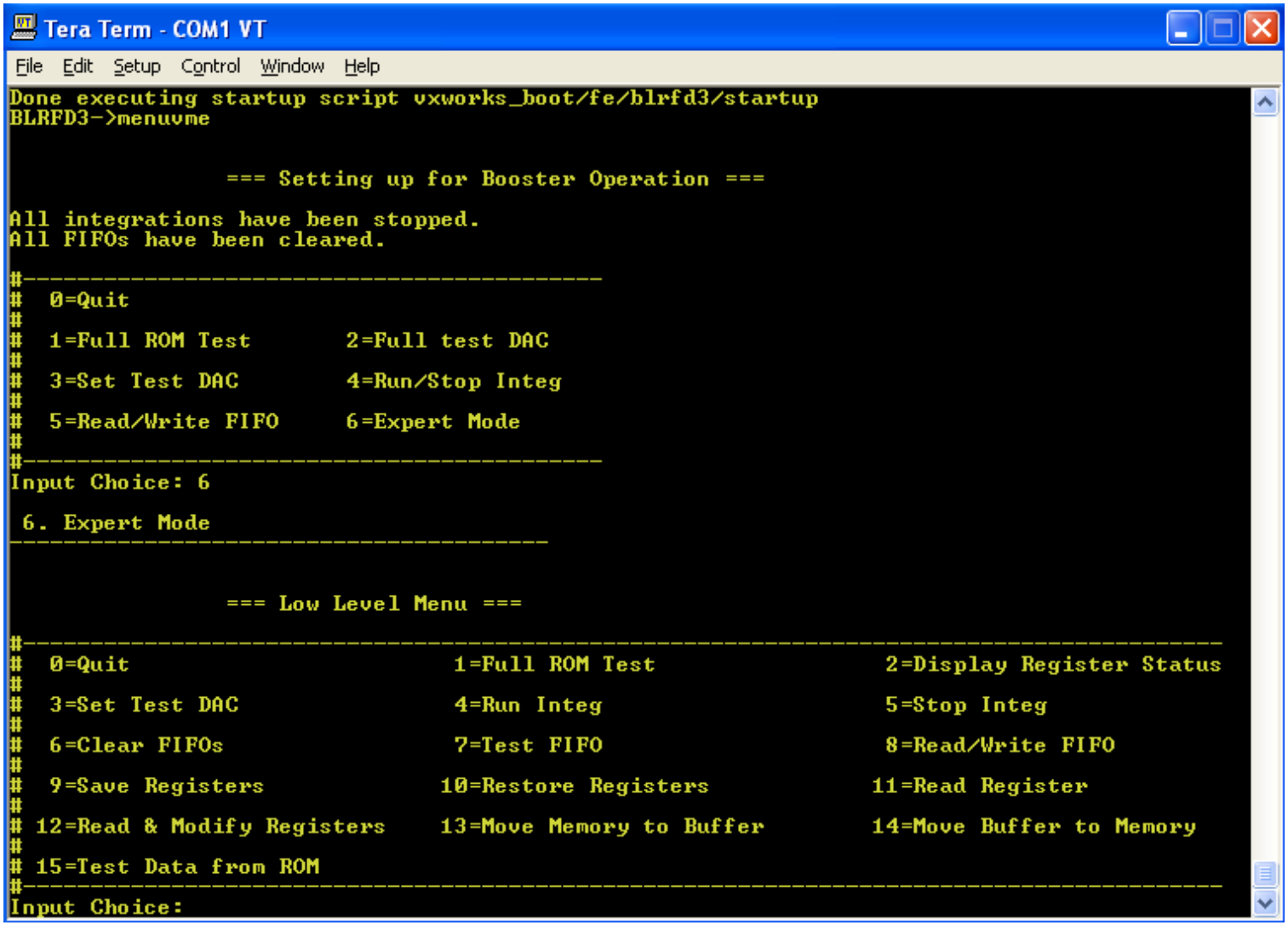
Testing the Digitizer Card

ROM Test

- Fixed values from ROM memory skips integration and digitization and stored to FIFO
- Data stored in FIFO is compared to expected data file computed from the known ROM values

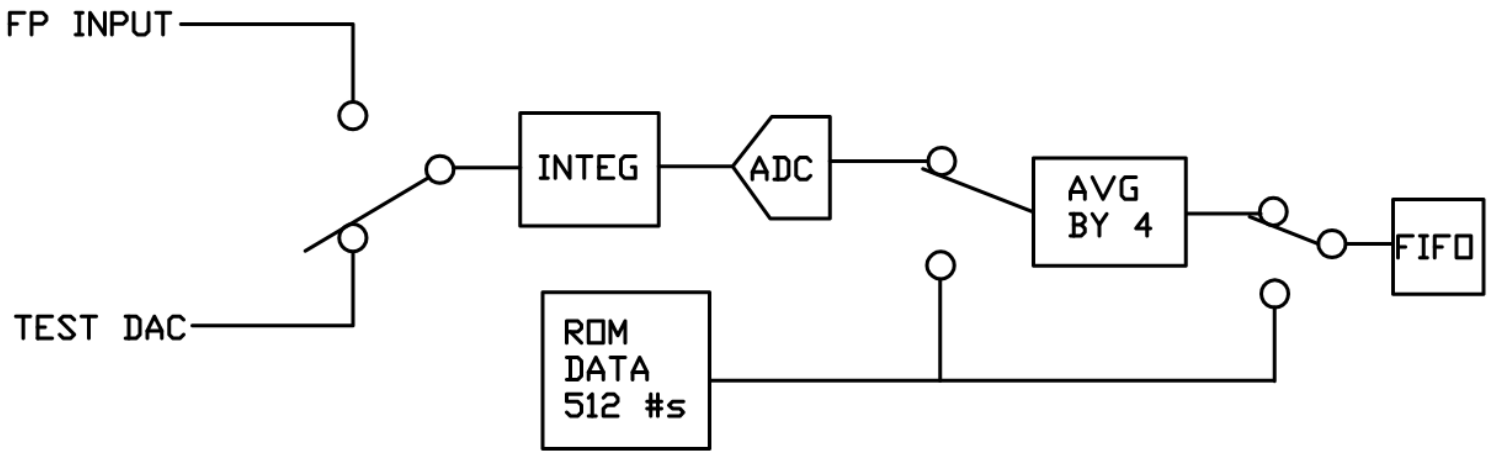
Testing the Digitizer Card

Screenshot of Test



Testing the Digitizer Card

Schematic for Data Acquisition



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Conclusion and Future Work

- built user interface to program the FPGA
- built routines to evaluate the veracity of the module

- build routines to test specific components of the board
- multi-board FPGA programming
- multi-board testing

Acknowledgements

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- Dianne M Engram
- Linda M Diepholz
- Dr. Davenport
- ...entire SIST team

References

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Questions?