

PROTON DETECTOR - MAST M9 CAMPAIGN - ELECTRICAL DESIGN REVIEW

4.2: Electrical Design Review

- EDR Written Information
 - Pierre Avila, Omar Leon, Ramona Perez, Scott Y. Allan
- EDR Powerpoint Presentation
 - Ramona Perez
- Drawings
 - Adrianna Angulo, Scott Y. Allan, Ramona Perez

4.2.1 Basic Safety Requirements

- Overall block diagram
 - PD Cable Block Diagram attached
- Designer under CDM regulations
 - Ramona Perez, Werner Boeglin
- Class of equipment
 - Class I
- Listing of hazards or risk assessments/precautions
 - 50V power supply with needed SHV output connection.
 - No cable connections should contact metal surfaces.
- Precautions
 - 50V Power Supply: Power on at beginning of the day and power off at the end of the day.
 - Preamplifiers: Wait 5 minutes after powering down the whole electronic system before disconnecting the preamplifiers.
 - The active area of the detectors is never to be touched!
- CE Marked
 - Model 2003BT Silicon Surface Barrier Detector Preamplifier
 - Specifications sheet attached
 - Canberra 2111 Timing Filter Amplifier
 - Specifications sheet attached
 - National Instruments PCI-5105 8-Channels
 - Specifications sheet attached
 - Computer
 - Specifications sheet attached
- Will modifications and/or conditions of use invalidate CE marking?
 - No

4.2.2 Earthing Requirements

- Earthing point discussion needed
 - To avoid ground loops we want to keep our detectors isolated from the MAST RP body and earthed at the MD05 Power Distribution Unit M/014/90/014

- PD Design currently electrically isolates all detectors from the RP body with PEEK 1000
- Breakdown voltage of PEEK insulator is 43.2kV/mm (dielectric strength: 24kV/mm or 24MV/m, thickness: 1.8mm)
- Scott Y Allan comment: The RP earth may be different to your cubicle earth but I think we can keep these separate. I think the screens of your coaxial cables in your probe head will need to be earthed through a single cable, which we have in the RP shaft. I've attached a cable drawing from one of our other probe heads to show how this is done.
- Size of conductor – potential fault current/ physical strength
 - The maximum current generated by the amplifier if it short circuits to the earth is 80mA at 24V.

4.2.3 Documentation (Technical Construction File)

- Design calculations relating to electrical safety (Cable Ratings: refer to 4.2.6 Cable sizes & Types)
- AC supply point, available vs. required capacity interlocked/non-interlocked
 - The MD05 cubicle to be used is an existing cubicle which has the AC power points
 - Scott Y Allan has the Electrical Drawing for the MD05 cubicle
- Allocation of plant & cable numbers
 - CCFE's Drawing Office will allocate cable numbers when they copy the PD Cable Block Diagram into their computer system
- Cable schedules
 - See PD Cable Block Diagram
- Drawings
 - PD Cable Block Diagram attached
 - PD Sequence Diagram attached
 - MD05 Electrical Drawing provided by Scott Y Allan
- Test and commissioning schedules to the extent these affect safety
 - During the equipment installation
- Maintenance requirements
 - None unless damage has been done

4.2.4 Cable Routing

- Tray work is to be done by CCFE employees
- Type of cable and adequacy of electrical and mechanical protection
 - Insulating wrap to be used on cable connections to prevent metallic contact.
 - See 4.2.6 Cable size & type.

4.2.5 Control Requirements

- I/O requirements
 - During a total power up, the ADNACO box must be powered on before the computer.
 - During a total power down process, the computer must be turned off before the ADNACO box.
- Signal conditioning

- Preamplifier
 - Specifications sheet attached
- Amplifier
 - Specifications sheet attached
- Ferrite cores
 - Specifications sheet attached
- Remote control
 - Probe will need to be moved radially
 - Probe will need to be rotated manually (+/- 10 degrees)
- Interfaces
 - A remote connection over the network to our computer is needed to control our data acquisition software, digitizer, and computer
- Timing and sequence diagrams
 - PD Data Collection Sequence Diagram attached
- Data collection
 - SIGNAL → DETECTOR → PREAMPLIFIER → AMPLIFIER → DIGITIZER → COMPUTER
 - Data transferred from the digitizer to the computer upon receiving a trigger signal from MAST DATAC

4.2.6 Power Requirements

- Electrical design under CDM regulations
 - Clarification needed
- Supply rating (Voltages & Current)
 - Power Estimates
 - ADNACO box: 300W
 - Computer: 330W
 - Amplifier: 1.3W - 2W
 - Preamplifier: 100mW - 360mW
 - 50V Power Supply unit: 100W
- Interlocked/ non-interlocked
 - MD05 cubicle is not PASS interlocked
- Circuit allocation
 - See Electrical Drawing for MD05 cubicle provided by Scott Y Allan
- Means of isolation
 - System can be isolated by shutting off power to the MD05 cubicle
- Internally generate voltages and earthing arrangements
 - See Cable Block Diagram
- Cable size & type
 - LMR195 coaxial cables, 50 Ohm
 - Specifications sheet attached
 - 5106C multi-conductor cable
 - Specifications sheet attached
 - Adnaco-FC1 multi-mode LC-LC duplex fiber optic cable
 - Specifications sheet attached

- Kapton insulated coaxial cables, 50 Ohm
 - Specifications sheet attached
- IEC 60320 power cables