

MULTI-CHANNEL HIGH VOLTAGE DISTRIBUTION AND MONITORING SYSTEM FOR LHCb MUON CHAMBERS

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A multi-channel High Voltage Distribution and Monitoring System (HVDM) was designed and constructed for muon chambers produced at PNPI for the LHCb Muon detector. Two options of the system are developed to be used for the chambers. The first one (HVDM_16) allows linear regulation in each distributed channel in a range of 0-3000 V. The second (HVDM_LHCb) one, being radiation hard, allows linear regulation in each distributed channel only within 1000 V.

HVDM block diagram in Fig.1 includes:

1. 36-channel radiation hard Remote Distributors, performing high voltage fan-out from 1 input to 36 outputs, output voltage regulation within 1000 V in 1 V steps, output voltage measurement with 1 V resolution, and output current measurement with 10 nA resolution in $I < 1 \mu\text{A}$, and 100 nA resolution in $I > 1 \mu\text{A}$ range (100 μA max current) for each output. The radiation hardness value is up to 4 krad at 2×10^{12} neutron/cm².

2. 8-channel Master Distributor, performing high voltage fan-out from 1 input to 8 outputs, voltage regulation from 0 to 3000 V in 1 V steps, output voltage measurement with 1 V resolution, and output current measurement with better than 100 nA resolution (1.5 mA max output current) for each output.

3. 16-channel Distributors, performing high voltage fan-out from 1 input to 16 outputs, output voltage regulation from 0 to 3000 V in 1 V steps, output voltage measurement with 1 V resolution, and output current measurement with 10 nA resolution in $I < 1 \mu\text{A}$ and 100 nA resolution in $I > 1 \mu\text{A}$ range (100 μA max current) for each output.

4. Primary High Voltage Power Supply, which can be any industrial rack mounted unit, like Matsusada High Voltage Power Supply, model AV-3*50, whose output regulates in a range from 0 to 3000 V.

5. System Interface/Buffer, providing control and monitoring of the Master and Distributors via the Control/Readout Line. It is implemented as a universal PCI card, compliant to PCI 2.2 specification. Card's buffer memory keeps both voltage setting and actual voltage and current values for each channel.

The HVDM module dimensions comply with the Eurocard (IEC 297 and IEEE 1101) form factor and are 240 mm × 6U for Master and Distributor, and 540 mm × 6U for Remote Distributor. The HVDM design follows that of the high voltage system developed for the CMS EMU CSC in cooperation with the University of Florida (USA).

Figure 2 illustrates design of 36-channel Remote Distributor with each channel served by a plug-in card.

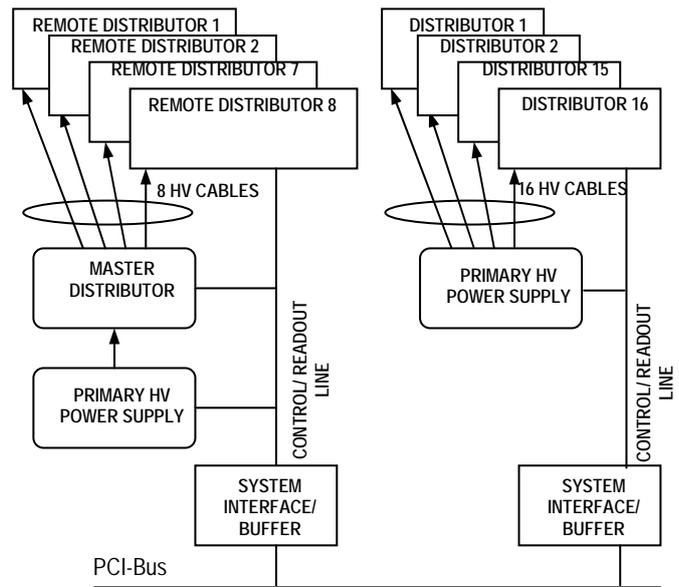


Fig. 1. Block diagram of the HVDM system

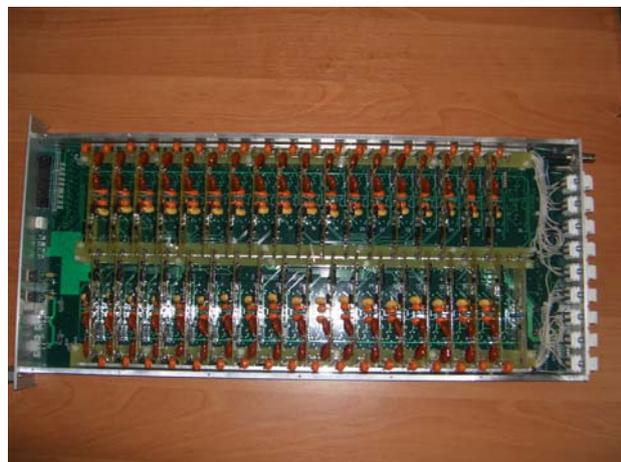


Fig. 2. 36-channel Remote Distributor