ALBA High Voltage Splitter - power distribution to ion pumps

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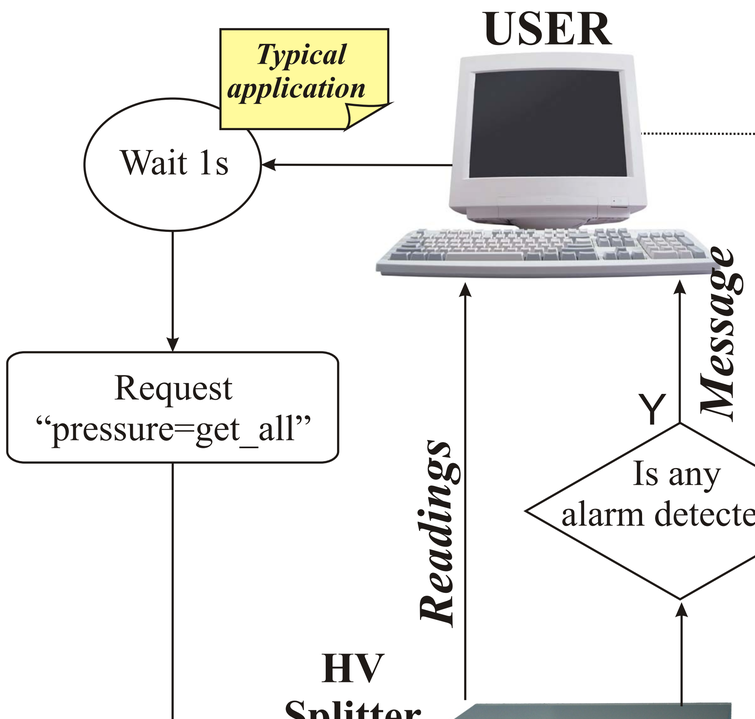
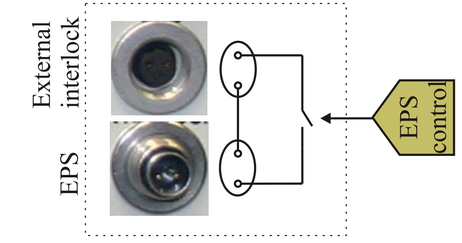
High Voltage Splitter (HVS) is an equipment designed in Alba that allows a high voltage (HV) distribution (up to +7kV) from one ion pump controller up to eight ion pumps. The current drawn by each splitter channel is measured independently inside a range from 10nA up to 10mA with 5% accuracy, those measurements are a base for vacuum pressure calculations. A relation, current-pressure depends mostly on the ion pump type, so different tools providing the full calibration flexibility have been implemented. Splitter settings, status and recorded data are accessible over a 10/100 Base-T Ethernet network, none the less a local (manual) control was implemented mostly for service purposes. The device supports also additional functions as a HV cable interlock, pressure interlock output cooperating with the facility's Equipment Protection System (EPS), programmable pressure warnings/alarms and automatic calibration process based on an external current source.



The project development and tests took around one year, and first units were applied in first vacuum installation of the booster. From that point on, HVS-s have been fully working for more than 2 years also supplying the storage ring, front ends and linac. In total, 83 units were installed which made HVS a key instrument in Alba vacuum system.
Full implementation flexibility, complete integration to Alba's TANGO based control system, diagnostic purposes and cost efficiency make this project a great solution and improvement of synchrotron technologies.

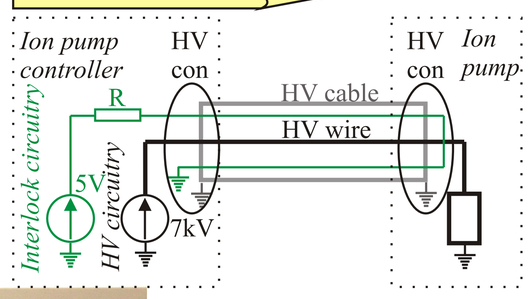
An exceptional vacuum loss scenario is indicated with the dry contact EPS output. As this trigger shuts down the accelerator, a redundant activation mechanism has been implemented.



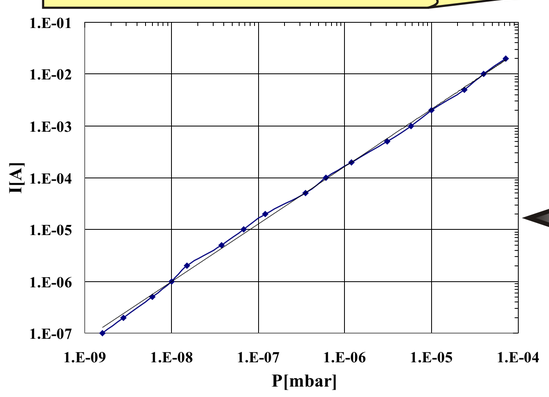
Ch1	Ch2	Ch3	Ch4	Ch5	Ch6	Ch7	Ch8
	X	X					X

EPS alarm configuration example

HV cable internal diagram



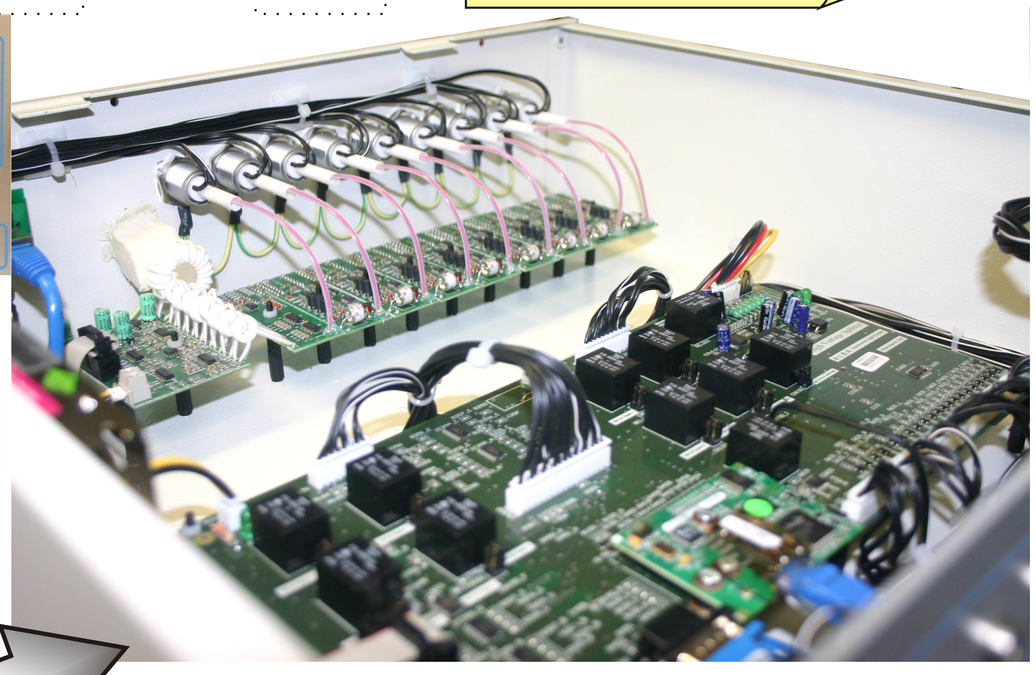
25lps noble diode ion pump, Uconst=7kV



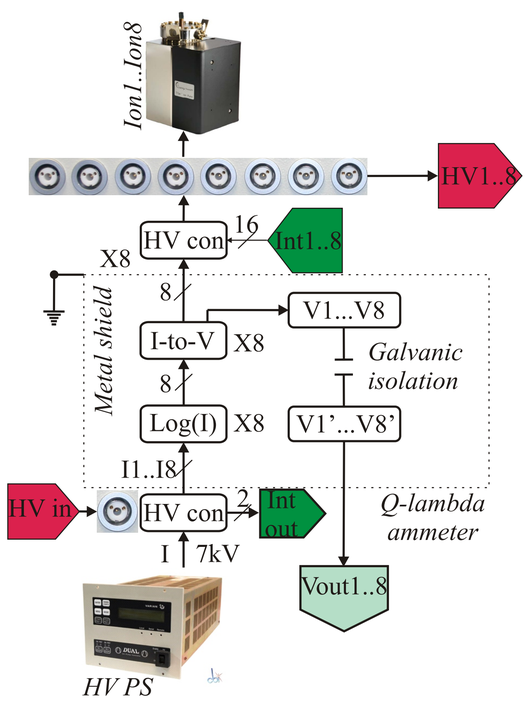
$$P\,[\mathrm{mbar}] = \frac{0.08778 * \frac{5600}{Voltage\,[\mathrm{V}]} * Cal_{Factor} * I\,[\mathrm{A}]}{IonPump_{Speed}\,[\mathrm{l/s}]}$$

Ideal current-to-pressure conversion - default solution

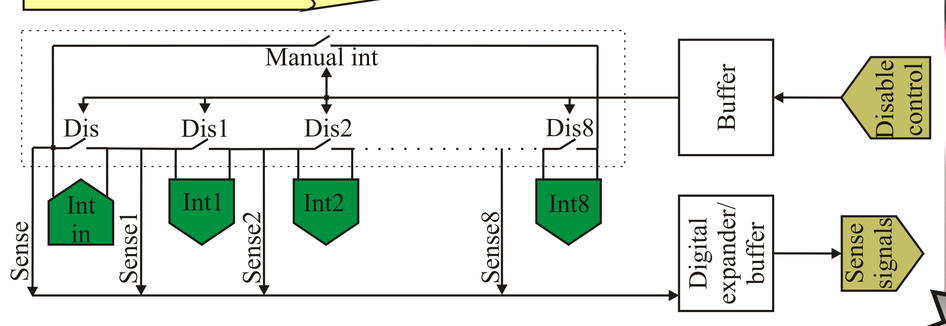
High Voltage Splitter inner part



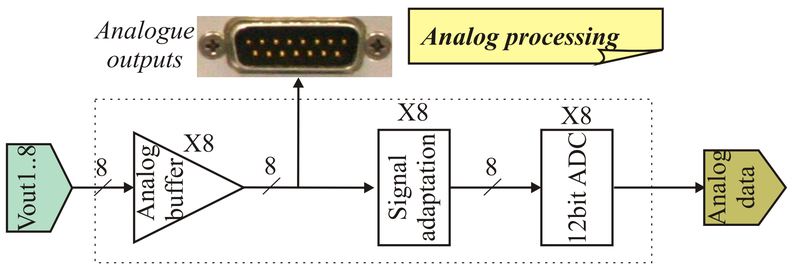
High voltage distribution



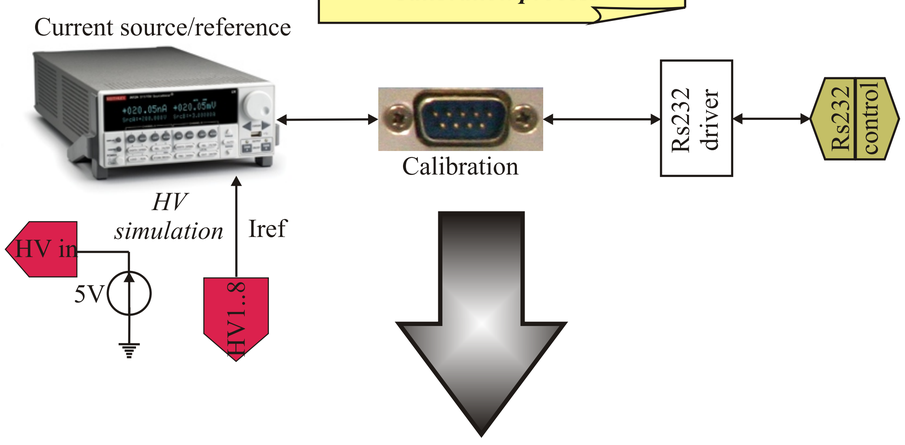
Cable interlock distribution



Analog processing

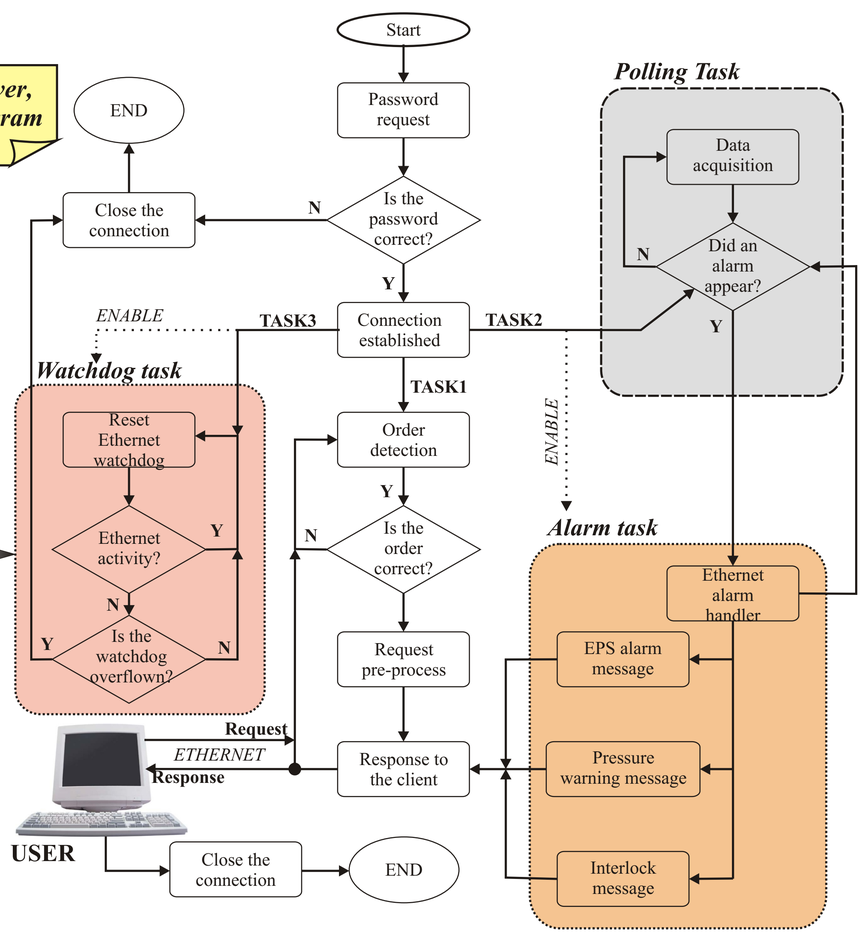


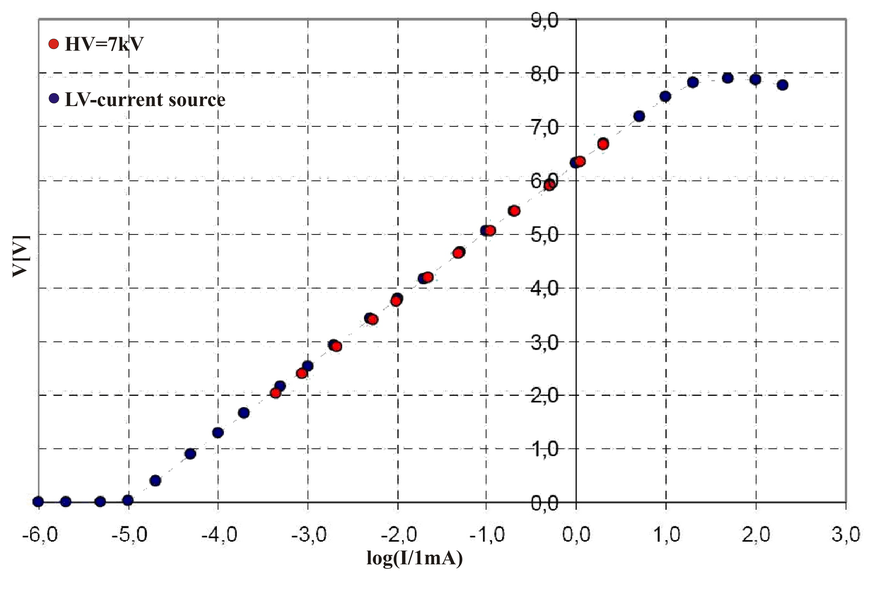
Calibration process



Control unit

Telnet server, block diagram





Current measurements "V=f(I)" under high and low voltage conditions with a Q-Lambda current sensor.