

Photon Counter Protection

This circuit have 3 main objectives:

- 1.- Protection of the photomultiplier due to overlight.
- 2.- Protection of the photomultiplier due to overcurrent
- 3.- Protection of the photomultiplier electronics if +24 Volts are not present
- 4.- Protection of the shutter coil if +5 Volts are not present
- 5.- Protection of the shutter coil for electronic or handling malfunction

Maximum photomultiplier counts permitted	3Mcs
Maximum photomultiplier Current	80ma
DC Coil Resistance	7.5ohm

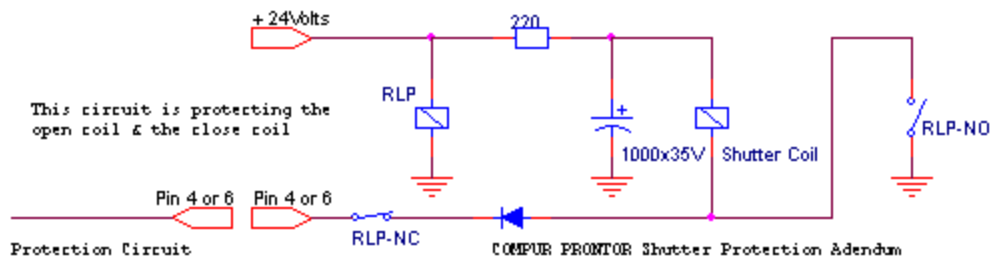
1.- To protect the photomultiplier for maximum counts the circuit have a internal counter made by U3. An internal counter oscillator U4, give a repetitive reset to U3, if the rate of the oscillator U4 is lower than the rate of the phoromultiplier the a pulse (FLSU) that toggle a D type flip flop U2 and a led indicator show a overlight condition. At the same time, the shutter close coil is activated by means of Q2 and open coil is disable by RL1 to avoid is opening. The only way to go out of this condition is to manually activate a reset button located at the front panel of the box.

2.- To protect the photomultiplier from excessive current the circuit made by U6 is looking for the amount of current flowing trough R5 that is the +5 Volts photomultiplier return The comparator circuit (U5) is looking for any increase of the current. When a overcurrent is detected a D type flip flop is toggle and a led indicator is activated. At the same time, the shutter close coil is activated by means of Q2 and open coil is disable by RL1 to avoid its opening. The only way to go out of this condition is to manually activate a reset button located at the front panel of the box.

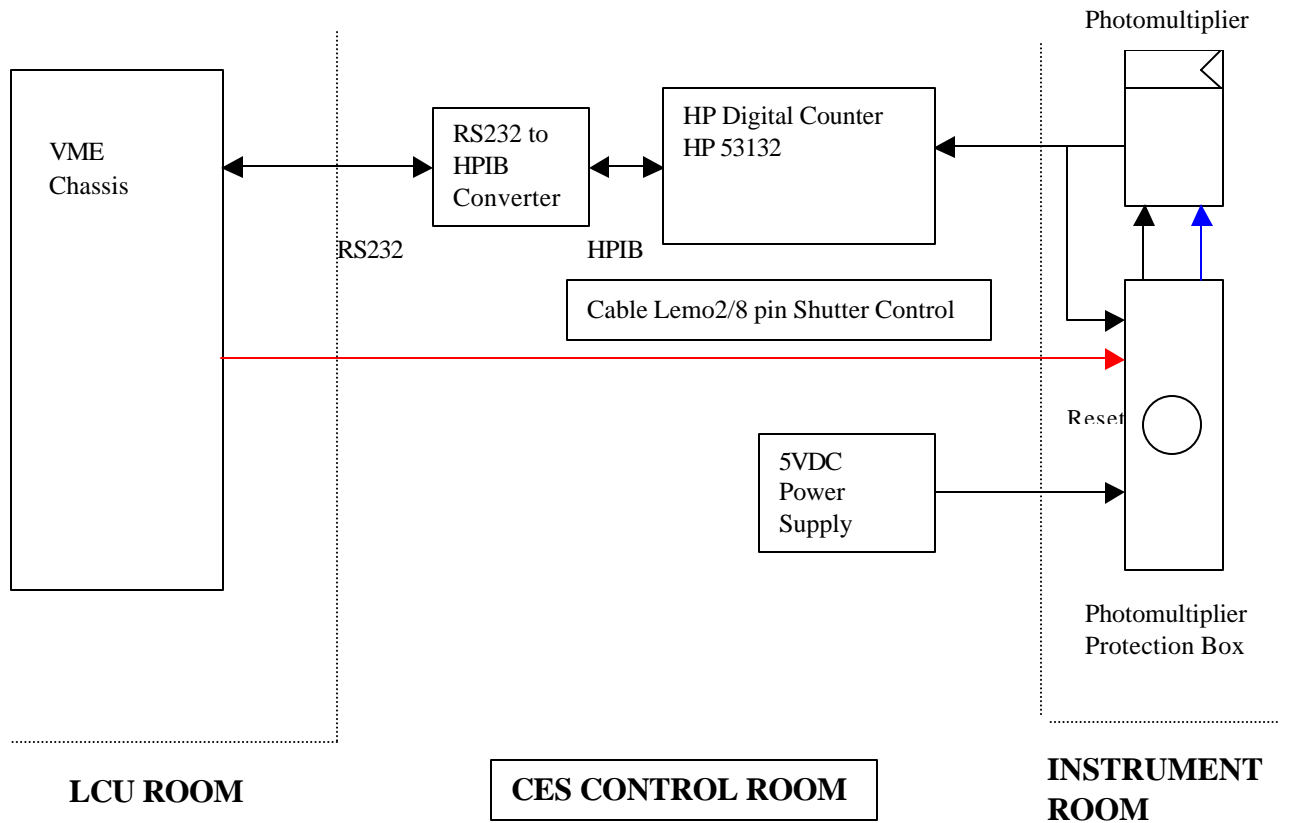
3.- If the +24 Volts power supply fail, the relay RL2 cut the power for the photomultiplier.

4.- When the +5 Volts are out, for any reason, the photomultiplier is protected because its high voltage depends of these voltage. But the coil (7.5ohm over 24 volts) can be burned if the base – emitter resistor of Q1 is not there. The 47 Kohm resistor made a pull up system in order to avoid 24 volts long period application over 7.5 ohm coil.

5.- To be sure that for any reason a long time pulse is applied to one or both the aperture or close coil of the shutter, a extra circuit has been implemented.



How to use the Photon Counter Protection.



Photomultiplier Self Protection.

A protection for the photomultiplier device has been implemented at the CES Instrument Room. This protection is performed by the photomultiplier itself.

Two ways of protection are use, in a redundancy method:

- By measured the current of the Photomultiplier system.
- By pulse counting, that is made looking for a certain amount of pulses as a limit.

In the first case, the limit was set at 80mA, that according the manufacturer information that is reached when the tube is counting its maximum.

In the second case, the limit choose was 3Mpps (3.000.000 Pulse per second), according the manufacturer information that is reached when the tube start to go out of linearity.

Both limits are near one from the other but has been implement in order to have a double protection.

Whenever a limit condition arrives the close coil of the shutter will be activated and the open coil will be disable in order to avoid any future command. The only way to go out of this condition, will be by push a button in the instrument room. The operator will receive in its console a shutter close command.

The system was implemented in that way in order to force the operator to check a possible overlights condition inside the Instrument Room.

In case of problem with the Protection Box, it is possible to go back by change cable Lemo 2/8 pin IN (Red Label) and replaced by de Lemo 2/8 pin OUT (Blue Label).