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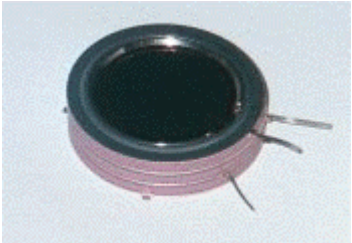
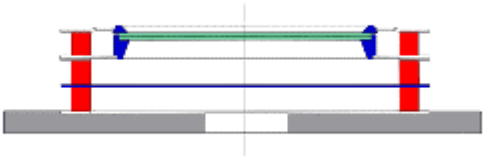
Microchannel Plate Detectors with Single Metal Anode (MCP-MA)



DEL MAR VENTURES Microchannel Plate Detectors MCP-MA series are an open MCP detectors with one or more microchannel plates and a single metal anode. They are intended for time-resolved detection and make use of high-speed response properties of the MCPs. MCP-MA detectors are used for photons and particles detection in vacuum chambers or in the space.

The body of assembly is a metal-ceramic housing. Drawing shows two matched MCPs in V-stack (Chevron) assembly (shown green), which are fixed in place using retainer ring (above MCPs). Metal anode shown blue. Ceramic insulator rings are shown red. Detector can be spot-welded or connected by screws to the support surface (shown grey).



All parts of the assembly are highest quality components. Metal parts are polished to avoid electric discharges. Two MCPs are connected to each other via thin (40 -50 μm) copper or stainless steel foil ring. Direction of channel bias angle in the first MCP is opposite to one in the second MCP (chevron assembly). Typical voltages necessary for a gain of 10^4, resistance and dark current densities of Microchannel Plates are shown in the table below. Each detector is supplied with individual MCP data.

Specifications:

	MCP-MA25	MCP-MA34	MCP-MA46
MCP detector body	metal-ceramic housing		
Effective area ∅, min	18mm	25mm	40mm
MCP type	25-5, 24-10, 25-10 etc.	33-10 or 34-10	46-12
MCP Diameter, mm	24.2 or 24.8	32.8 or 34	46
MCP Thickness, mm	0.46	0.46	0.5
MCP channels pore-pitch, μm	5-6, or 10-12	10 –12	12-15
Typical Gain, (one MCP)	10^4 - 10^4		
(2 stack)	10^6 - 10^7		
(3 stack)	10^8 - 10^9		
Time resolution	< 1ns		
PHD (2 stack assembly)	FWHM/A<120%		
PHD (3 stack assembly)	FWHM/A<80%		
Output	Single metal anode		
Strip current	<20μA		
Outside diameter, mm	30.8	45	60
Detector height	11mm		

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Operation conditions:

Wiring Methods

In general, MCP assemblies can be operated with any electrode (MCP-in, MCP-out or anode) at a ground potential.
(1) Voltage Application
When applying a voltage, do not apply the necessary voltage to the MCP at once. Slowly increase the applied voltage, with maximum 100 V step, until the optimum rating is reached, and verify if the MCP operates properly. In this procedure, also check the dark current by connecting an ammeter to the readout device. If there is an increase in the dark current, which might result from a small discharge, immediately turn off the applied voltage. After some time (depending on the situation) has passed, apply voltage to the MCP again in the same manner as described above. Note that the applied voltage to the MCP should be increased as slowly as possible even after normal operation has been verified.
(2) Applied Voltage
Recommended and maximum applied voltage to MCPs and readout devices are as follows:

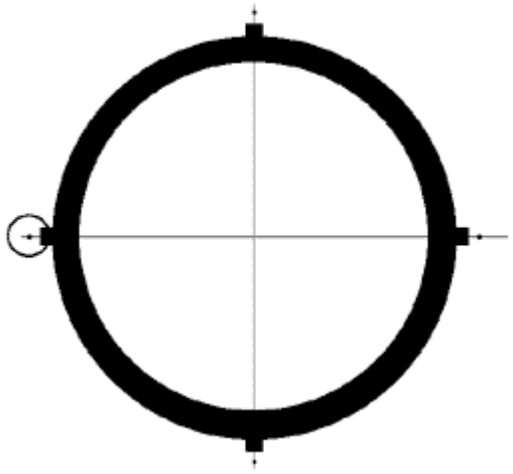
- Between MCP-in and MCP-out: Set this voltage according to the required gain, 700 -1000V per MCP typical, 1100 V maximum, MCP out at positive polarity.
- Between MCP-out and single anode: This is normally set at about 100 - 200 V.

Vacuum requirements

A system pressure better than $6.5*10^{-4}$ Pa ($5*10^{-6}$ Torr) is necessary for proper operation. The MCP detector has to be degassed before applying the maximum voltage. Because the MCP is operated with a high voltage of about 1 kV per stage, a relatively high degree of vacuum must be required. If the MCP is operated at a deficient vacuum, not only will the noise increase due to the ion generation in the channels, but also the lifetime may be shortened. In the worst case, the MCP may be damaged by discharge. Therefore, it is recommended that the MCP be operated at a degree of vacuum as high as possible. When using a new MCP, it is recommended that before applying a voltage to it, the system be evacuated at a pressure of $6.5*10^{-4}$ Pa ($5*10^{-6}$ Torr) or below for more than 24 hours. If the evacuation time is short or the degree of vacuum is deficient, a discharge may occur.

MCP-MA detectors mounting

MCP-MA assembly has four electrodes: MCP-in, MCP-out, Metal Anode and Base or Mounting Electrode. 3mm thick ceramic rings insulate electrodes from each other. Mounting electrode is insulated from the anode so that it can sit directly on a flange.



Mounting electrode is shown on a picture. It has four small fins 2mm*1.5mm that can be used to fix detector on the standard metal flange or on any other support substrate.

All metal electrodes as well as insulating ceramic rings have the same outside diameter.
The outside dimensions of detectors are as following:
MCP-MA34 OD 45mm, height 11.3mm
MCP-MA24 OD 30.8mm, height 11.3mm

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Recommended mounting methods:

1. Spot welding of four fins to a customer support base or flange.
2. Using 4 screw M2 or equivalent. Fixing screw holes should be located equidistantly on the diameter of 50mm for MCP-MA34/2 and on diameter 36mm for MCP-MA24/2. Figure above shows four centers of the M2 mounting holes. Standard stainless steel washers OD 5mm or equivalent (only one shown on the picture) can be used to fix detector.

In all mounting arrangements care should be taken about efficient evacuation of all mini volumes created. When mounting a MCP-MA detector on the flange make sure that the internal volume between MCPs and flange can be efficiently evacuated. In order to provide necessary space for detector evacuation we recommend to place thin washers under four fins (between detector and mounting plate or flange). In other words screws should fix fins between two washers - one above and the other below fins.

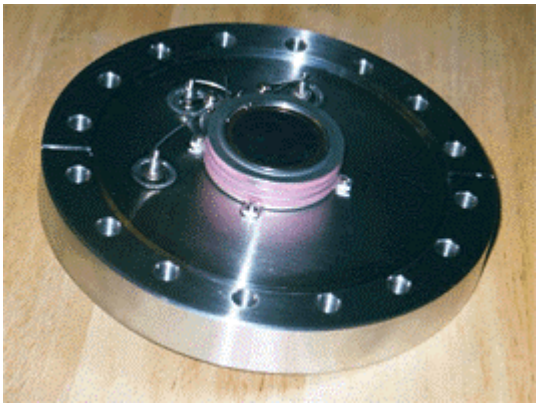

Figure above shows a MCP-MA34 detector mounted on the standard 6" ConFlat vacuum flange by four screws fixing detector fins to the flange. Nuts placed beneath fins provide a gap between detector and flange. This gap allows efficient and safe evacuating of internal detector volumes.

We can supply MCP-MA detector premounted on the custom-made support substrate. For quotation e-mail or fax support substrate drawing.

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