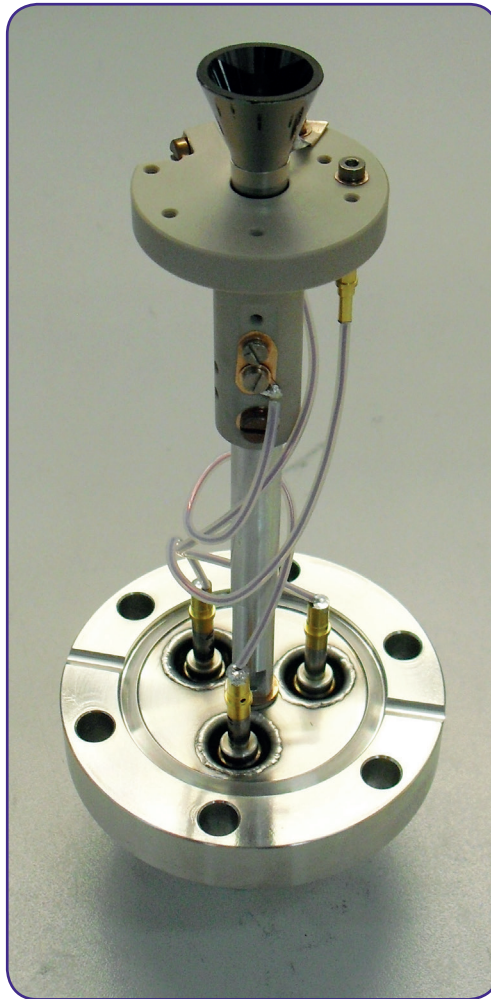


# CEM 4230 Detector Setup



## Manual



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CEM 4230 Detector Setup  
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# 2 Introduction

## 2.1 General Information

This manual is intended to assist users in the installation, operation and maintenance of Release Version 1.1 of the CEM 4230 Megaspaltron Detector Setup.

## 2.2 Safety Instructions



Please read this manual carefully before performing any electrical or electronic operations and strictly follow the safety rules given within this manual.

The following symbols appear throughout the manual:



The “note symbol” marks text passages, which contain important information/hints about the operation of the detector. Follow this information to ensure a proper functioning of the detector.



The “caution symbol” marks warnings, which are given to prevent an accidentally damaging of the detector or the readout system. Do NOT ignore these warnings and follow them strictly. Disregarding these warnings may cause permanent damage to the system and is not covered by the device warranty.



The “high voltage symbol” marks warnings, given in conjunction with the description of the operation/use of high voltage supplies and/or high voltage conducting parts. Hazardous voltages are present, which can cause serious or fatal injuries. Therefore only persons with the appropriate training are allowed to carry out the installation, adjustment and repair work.

## 3 Installation

### 3.1 Initial Inspection

Visual inspection of the system is required to ensure that no damage has occurred during shipping. Should there be any signs of damage, please contact SURFACE CONCEPT immediately. Please check the delivery according to the packing list (see **Table 1**) for completeness.

- CEM 4230 Detector Setup in transport container (delivered under Argon atmosphere)

Table 1: Packing list for the CEM 4230 Detector Setup.

### 3.2 Installation

#### 3.2.1 Mounting the CEM

The CEM is mounted to a transport container which is filled with Argon atmosphere. To install the CEM into your vacuum chamber, proceed as follows:



Figure 1: A CEM assembly mounted to the transport container and after removal.

- Open the plastic bag containing the transport container. 1x Wall Power Supply (5V/3A)
- Remove the three pairs of nuts and screws holding the CEM.
- Carefully remove the CEM assembly by pulling the flange upwards. The cables and the CEM mount may touch the opening, but do not rotate the assembly before the CEM funnel has fully cleared the opening.
- Remove the viton gasket. Again, touching the cables or CEM mount with the gasket is not a problem, but keep away from the CEM funnel.



The funnel at the front of the CEM should be protected from exposure to particle contamination. While transporting the CEM outside the container keep the funnel pointing downwards or inside a suitable container. Larger particles can be removed by carefully using tweezers.

- Install the CEM by placing a copper gasket on the base flange and inserting the CEM assembly into an appropriate DN40CF flange opening. Take care not to touch the walls or other obstacles with the CEM funnel and do not pinch the cables between the flange edges.
- After installation of the CEM assembly, evacuate the chamber. This is a high-pressure channeltron, do not perform bakeout.
- At this point, you can perform some basic resistance checks, **see Chapter 4.1**.
- Keep the transport container in case the CEM must be sent back for repair or modification. It can also be used for storing the detector temporarily when not installed in a vacuum chamber.

A dry atmosphere/rough vacuum is recommended in both cases. **See Chapter 5.1** for additional information.



- **High-Pressure channeltron assembly: Do not perform bakeout when using the standard mount.**
- **Maximum operating temperature: 70 °C**
- **Maximum ambient pressure with high voltage applied: < 1E-3 mbar**



The CEMs should be kept under vacuum or in protective atmosphere if possible. Alternatively use a dry atmosphere. Water contamination may change gain characteristics over time. The best long term storage environment is an oil free vacuum in the 10E-2 mbar range or better. The transport container is not designed for a long term storage of the CEMs.

## 3.2.2 Cabling and High Voltage

The general connection scheme of the CEM 4230 Detector Setup including its CEM decouple box is shown in **Figure 2**. The components shown greyed out are additional possibilities for further pulse processing. Those devices are not part of the CEM 4230 Detector Setup.

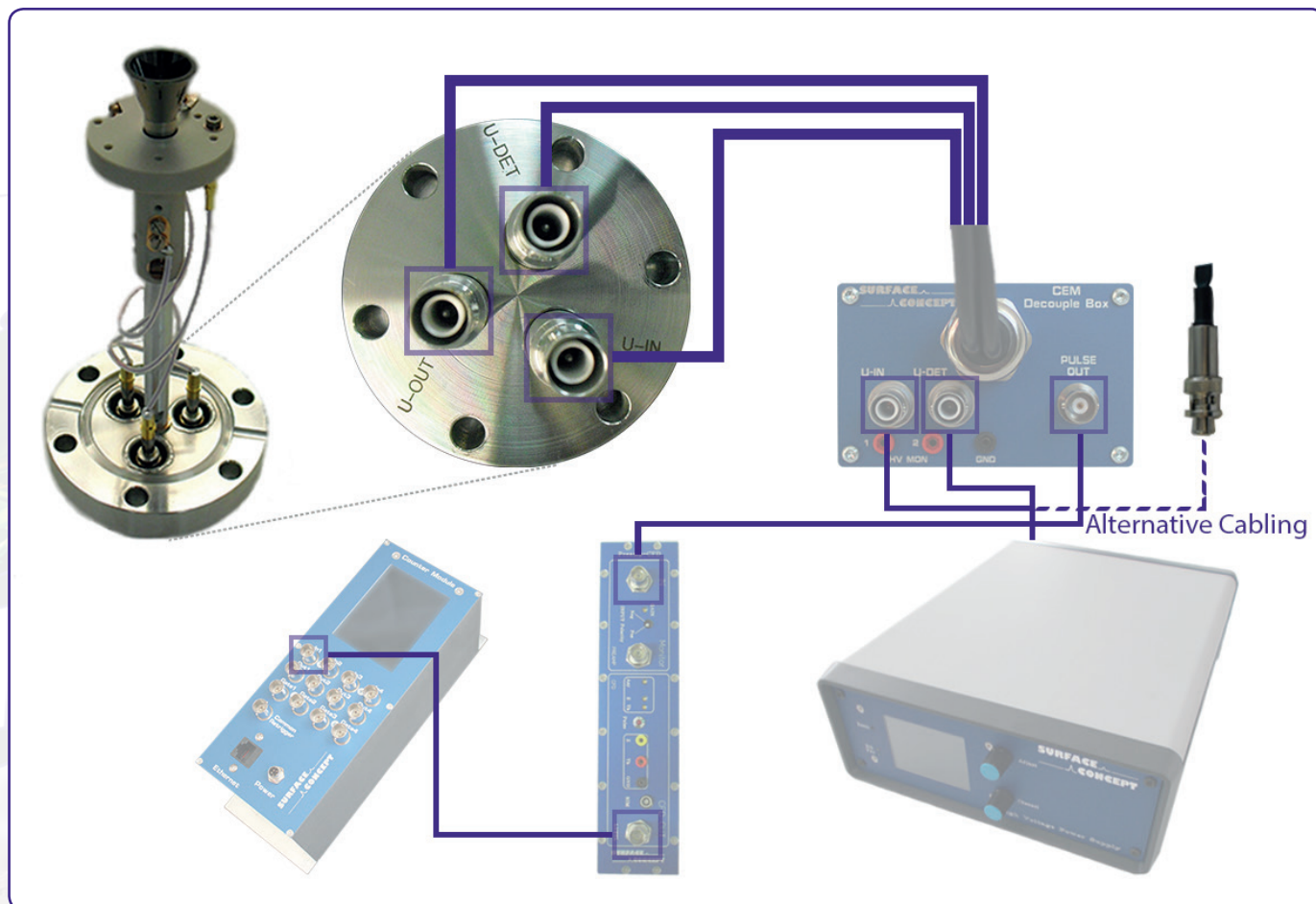


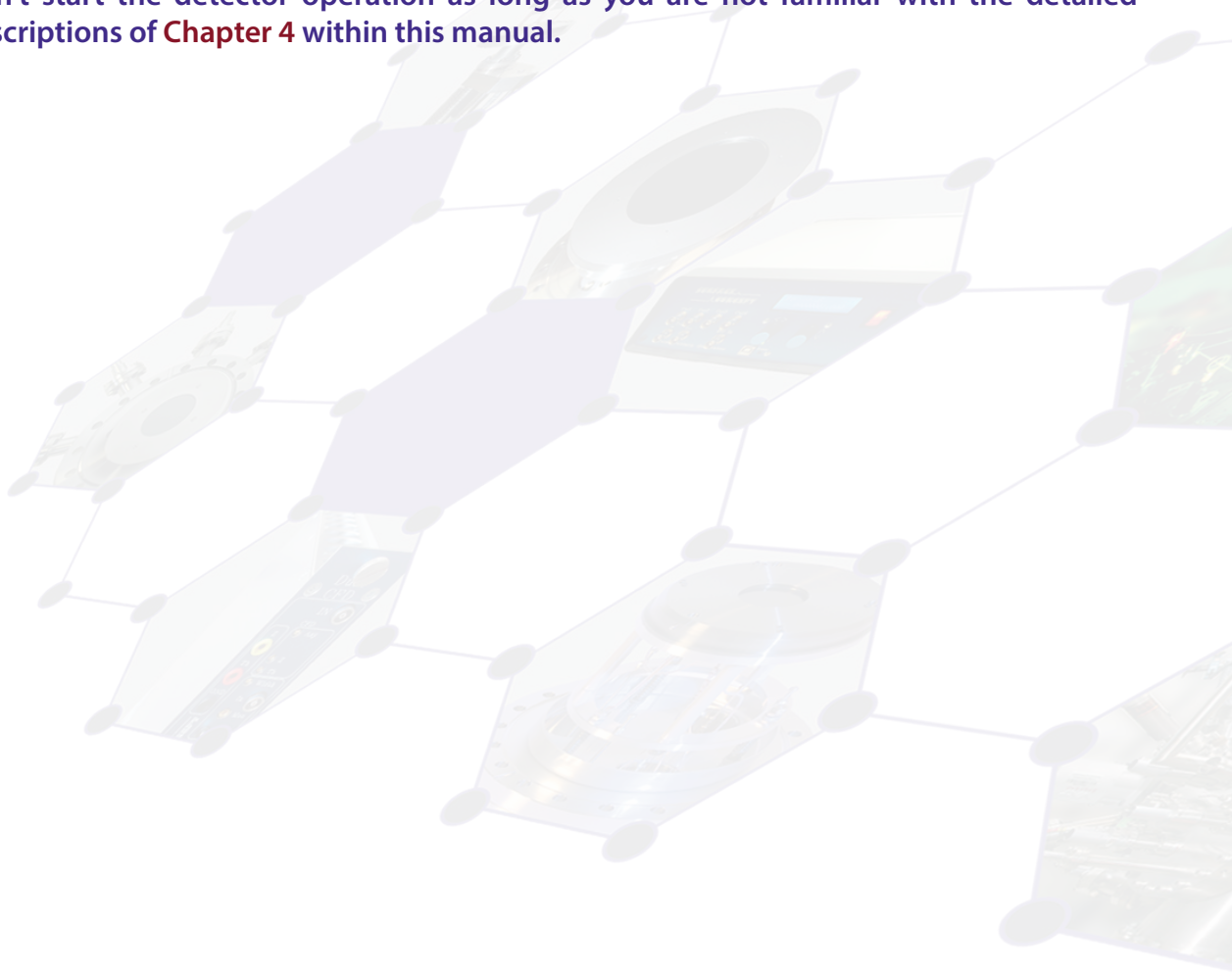
Figure 2: Possible connection scheme of the CEM 4230 Detector Setup.

- Connect any HV Supply to the 3 SHV feedthroughs of the CEM base flange.
- Connect any HV Supply to the “U-DET” SHV connector of the decoupling box.
- In case of using a Surface Concept CEM Decoupling Box, mount the CEM Decoupling Box to the flange of the CEM and connect the 3 SHV cables of the decoupling box to the 3 SHV feedthroughs of the CEM flange.
- Terminate the “U-IN” SHV connector of the decoupling box with a SHV termination plug or by a defined reference potential.
- “Pulse Out” is the signal output for the CEM pulses. The corresponding connector type is BNC with a 50 Ohm terminated signal line.

- Use any analogue pulse processing devices (e.g. the Surface Concept 1Channel Preamplifier/ CFD) for the processing of the analogue CFD pulses.
- Use any digital counter or time resolved measurement device (e.g. the Surface Concept 4 Channel Counter or the Surface Concept Time-to-Digital Converter) for pulse recognition/ counting and/ or time resolved measurements. Connect any HV Supply to the 3 SHV feedthroughs of the CEM base flange.



**Finish the complete cabling before any HV supplies and/ or pulse processing devices are turned on and any software is started. Also, close the software and turn off any connected devices, especially any high voltage before performing any changes to the cabling. Don't start the detector operation as long as you are not familiar with the detailed descriptions of **Chapter 4** within this manual.**





# 4 Operation of the CEM

## 4.1 “Start Up” Procedure for First Time Operation

Mistakes, which lead to wrong measurement results or damage the CEM can happen very easily while taking the system into operation. Therefore it is strongly advised to read the following sections completely beforehand and to strictly follow all advices given.

  
**Note**

Due to gain degradation it will become necessary to increase the operating voltage from time to time.

### 4.1.1 Basic Checks

We recommend this procedure when taking the system into operation the first time and after every venting.

- Remove any cables/plugs from the feedthrough flange if connected.
- Use a multimeter to check the resistance between each of the three HV inputs “U-IN”, “U-OUT” and “U-DET” on the CEM assembly and between any of the three inputs “U-IN”, “U-OUT”, “U-DET” and ground. The only measurable resistance should be between R(U-IN/U-OUT) of several 10 MOhm, of R(U-IN/U-DET) of several 10 MOhm and of R(U-OUT/ R-DET) of 1 MOhm. All resistances towards ground should be infinite (> 2 GOhm).
- Reconnect the cabling and finish it as described in chapter 3, if not already done.
- Turn on the power for all devices.



Ion gauges and ion pump are both sources for electrons and ions. Ion pumps can also be a source for X-rays. They can produce so many particles/X-rays that a CEM is in complete overload, even when not facing the particle source directly. This will wear out the CEM very fast. Turn off ion pumps and ion gauges before turning on the high voltage.

- Switch on any HV supply.
- If possible, watch the vacuum pressure while increasing the high voltage; turn the voltages back, if an unusual increase is observed in the pressure (indicator for high voltage sparking).
- Increase the voltage step wise up with around 400 V per minute to the operation voltage of the CEM. It is given in the specification sheet of the detector.



High voltage sparks may seriously damage the detector. Observe the chamber pressure carefully every time the high voltage is turned on. Switch off the high voltage immediately in case of a temporary pressure rise by an order of magnitude or more. This indicates high voltage sparking.



If sparking occurs, turn down the high voltage immediately and wait some time (up to 5 min.). Check for shorts, start the “Start-Up” procedure again with and increase voltage in small steps. Turn off the high voltage completely, stop the procedure and call SURFACE CONCEPT for further assistance, if it is not possible to reach the operation voltage without sparking.

- After finishing the previous steps with a satisfying result, you may now start carefully with a charged particle or light source observing the detector output.



Turn off the high voltage, close the software and turn off the controller before performing any changes of the cabling.

## 4.2 Standard Operating Procedure

Use this procedure later on for all operations when the detector has already been operated in vacuum before and has not been vented in between.

- Connect the CEM 4230 Detector Setup as described in chapter 3.
- Be sure that the vacuum pressure at the detector is below the specified maximum operating pressure.
- Turn off all sources for electrons, ions, light or X-rays that might hit the detector.
- Turn on the power for all devices.
- Switch on any HV supply.
- If possible, watch the vacuum pressure while increasing the high voltage; turn the voltages back, if an unusual increase is observed in the pressure (indicator for high voltage sparking).
- Increase the voltage step wise up in a couple of minutes to the operation voltage of the CEM. It is given in the specification sheet of the detector.
- Switch on your charged particle or light source observing the detector output.

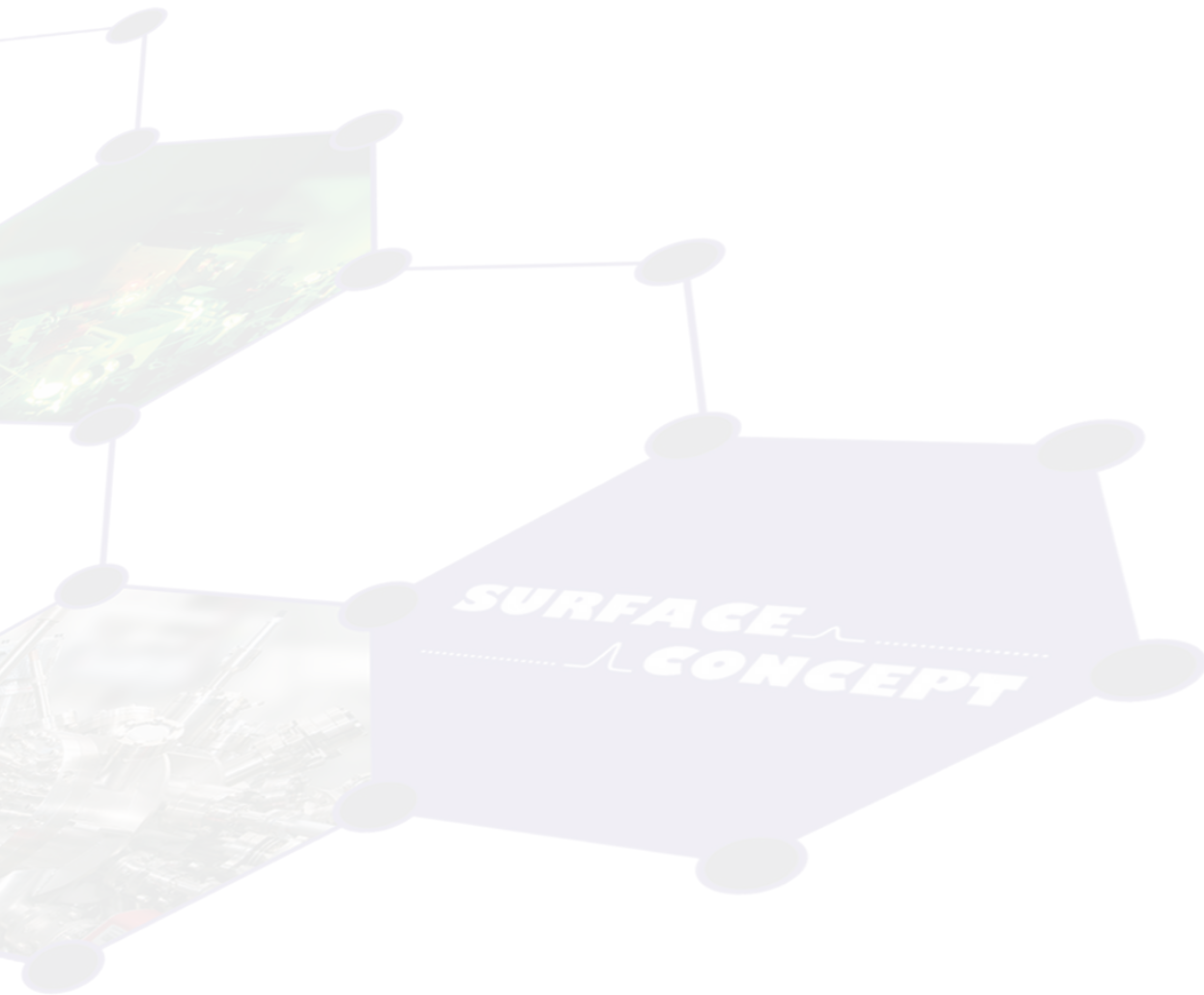


Turn off the high voltage, close the software and turn off the controller before performing any changes of the cabling.

## 4.3 Bake Out Procedure



This high-pressure channeltron assembly is not intended for bake-out.



# 5 Additional Information

## 5.1 Storage

CEMs are comparatively resistant to the repeated aeration of the vacuum chamber. However, when exposed to air over a longer period of time, the binding of moisture leads to a decrease in gain and therefore to a reduction of the lifetime.

For this reason, the CEM assemblies are delivered in a sealed container filled with argon. We recommend not opening the container before the detector is actually required. Alternatively, store the CEMs in argon, dry air or even better, in vacuum.

Water may lead to a reduction in the work function, resulting in a higher gain. During the burn-in after having been stored for a longer period of time, the CEMs may pass through a deep valley of gain until they reach a stable plateau again. This should be considered when setting the applied voltage and the discriminator threshold.

## 5.2 Replacement



**Note**

Contact SURFACE CONCEPT before performing a replacement.

Please contact Surface Concept before performing replacement of any parts. We will provide you with a detailed step by step description.

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