

Technical Note DS05_TN001_090130

Ion Chambers

Module: Connections

Sensor Connection Techniques

Description

1. General

Around the world there are two different methods used for connecting ionization chambers to an electrometer. These methods are called **floated input technology** and **grounded input technology**.

The main difference between both systems is the way in which the polarization voltage is supplied to the ionization chamber. The grounded input clamps the electrometer amplifier on ground potential and provides the polarization voltage to the outer chamber wall. The floated input clamps the outer chamber wall on ground potential and provides the polarization voltage through the inner (collecting) electrode. Therefore the electrometer amplifier is on polarization potential and needs an isolating amplifier to provide analogue output. The extremely low current initiated inside the chamber by radiation forces the use of high sophisticated guarding techniques in order to make the entire system (chamber, cable, connectors and amplifier) usable in clinical routine.

2. Floated Input

The floated input technology allows a consistent triaxial conception of electrometer input, cable and sensor and therefore facilitates the construction of chambers with sophisticated EMC shielding. The chamber wall is on ground and therefore the entire chamber and cable system is properly shielded. No protective sleeve is needed. This consequent shielding system provides extremely low noise operation. The outer shield of the triax cable is on ground. Standard triax connectors (either bayonet or threaded) can be used.

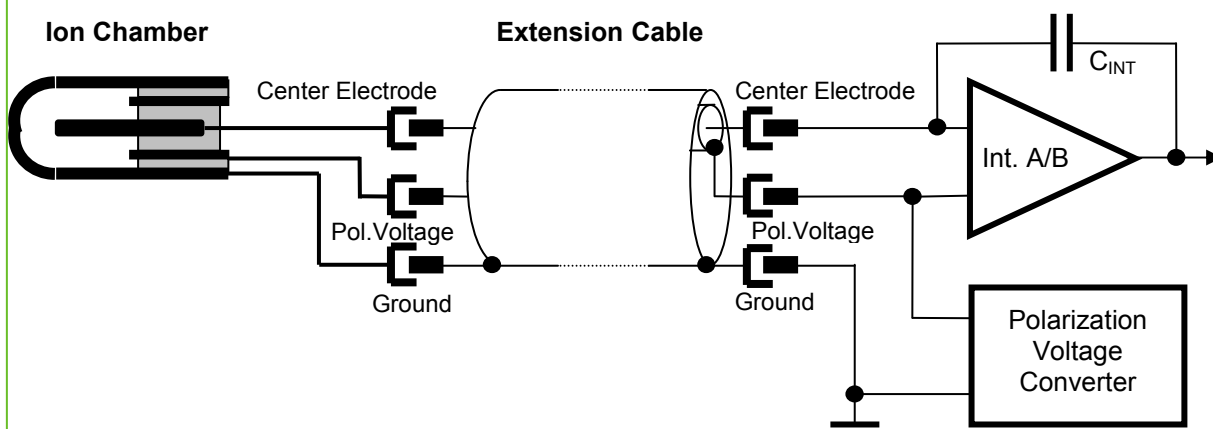


Fig. 1.

3. Grounded Input

With the grounded input technology, typically all electrical components inside the electrometer are on ground potential. On the other hand, the construction of cables and sensors is more demanding, because of the following reasons: First, the chamber wall is on polarization voltage and an additional isolating sleeve is necessary to protect from electrical hazard and leakage current, especially when used in water. Second, as the chamber wall is not grounded, RF noise may enter into the chamber and cause problems under all RF operated particle accelerators. Third, if a triax cable is used, the connectors become very complicated because inside the connectors inner and outer shielding must be crossed to get the outer shell of the connector on ground level. The same occurs inside the chamber if a conductive (metal) chamber body has to be grounded.

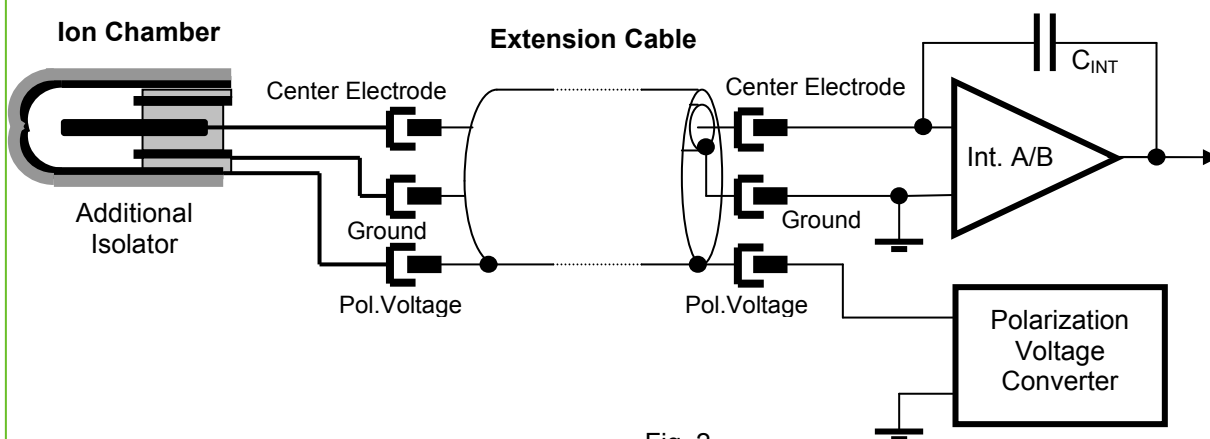


Fig. 2.

4. Compatibility

Floated and grounded input technologies are basically incompatible to each other.

If you would connect a chamber / cable designed for grounded input circuitry to an electrometer circuit using floated input technology by means of an adapter, this adapter will either short-circuit the polarization voltage or put the outer shell of the connector on polarization potential. Even worse is the case when any metal part of the chamber body will be on polarization voltage which causes undefined shielding and leakage current conditions. This would ignore all basic rules of electrical safety, and breaks applicable national and international laws and regulations such as the Medical Device Act.

If you would connect a chamber / cable designed for floated input circuitry to an electrometer circuit using grounded input technology, you would face the problem that the polarization voltage must be supplied through the chamber wall (since by definition the inner electrode is on ground potential). Consequently, all conductive parts of the cable or chamber are connected to polarization voltage. The negative effects described above are increased by the fact that the unprotected conductive chamber wall or entrance window (in addition to the hazards) could produce faulty dosimetry readings due to leakage currents in the relatively high impedance and high sensitive area of thin windows resp. conductive plastic chamber bodies. This can only be resolved by isolating the conductive chamber body against the water using an isolating sleeve, which can cause the problem that the chamber would not fit into the chamber holder anymore.



In case of any further questions, please contact us under:

IBA Dosimetry GmbH
Service Department
Bahnhofstrasse 5
DE-90592 Schwarzenbruck
Germany

Service hotline:
phone: +49 9128 607 38
fax: + 49 9128 607 10
mailto: service@iba-group.com