Keysight Technologies

Ion Beam Current Measurement - Product Fact Sheet

B2983A Femto/Picoammeter

B2987A Electrometer/
High Resistance Meter

The Keysight B2980A Series Femto/Picoammeter and Electrometer/ High Resistance Meter Facilitates Stable Ion Beam Adjustment.

This one-pager describes how the B2980A Series Femto/Picoammeter can facilitate the adjustment of ion beam systems (including the cable interfacing) to improve measurement results.

Ion beam technology

Where is ion beam technology used?

Ion beam technology is widely used in engineering, biology, medical science and the physical sciences.

Major applications include:

- Ion implanters used in semiconductor wafer processing.
- Materials research in areas such as superconductivity and mass spectroscopy for materials analysis.
- Marking and destroying chemical materials and cancer cells.

Ion beam calibration is crucial

To insure accurate results, an ion beam should be calibrated before use. During calibration the following parameters are typically calibrated by measuring the ion beam current using an ammeter.

- Ion beam alignment
- Ion beam strength

Key points in the ion beam current measurement

The following are key points to consider when measuring ion beam current.

- The ion beam current is typically very small (in the nanoamp or even picoamp range), so a picoammeter or electrometer is required to make these measurements.
- The ability to display the beam current behavior in real time greatly facilitates the ion beam current adjustment process

The B2980A Series Femto/Picoammeter is the best solution for ion beam current measurement

Key ammeter features

- 2 pA to 20 mA full scale auto-ranging
- Conveniently located front panel measurement navigation key enables quick adjustment of both the manual current range and the measurement speed
- Floating ammeter design allows easy application of a DC bias
- Electrometer versions with built-in DC bias sources are available (B2985A/B2987A)

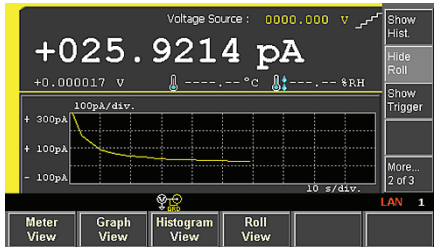
Battery operated versions available

Both the picoammeter and electrometer have battery operated versions (B2983A & B2987A respectively) to improve noise immunity and allow for cord-free operation.

Roll graph view facilitates ion beam adjustment

The B2980A Series' roll graph view can show the time-based behavior of the ion beam current, making it easy to determine how long it takes the beam to stabilize and to optimize the beam current settings.

- The Roll graph's auto-scaling time axis feature means that data is refreshed in real time.
- In addition to Roll view, Graph and Histogram views are also available to help with the ion beam optimization



It is easy to monitor changes in the ion beam current as they occur.

KEYSIGHT TECHNOLOGIES

Unlocking Measurement Insights

B2980A Series Ammeter Ion Beam Collector Connection Examples

Example 1. Connecting to a vacuum chamber with a coaxial BNC

This example shows how to connect a vacuum chamber with a BNC (coaxial) to the ammeter's triaxial input. Figure 1 shows details of the connection scheme between the B2980A Series ammeter and the vacuum chamber. Note that here a BNC vacuum connector is used to connect to the inside of the vacuum chamber.

The B2980A Series ammeter is a floating design with a triaxial input. The center of the triaxial connector goes to the ammeter input and the inner shield connects to the ammeter common. The outer shield of the triaxial connector is connected to the instrument chassis.

As shown in Figure 1, in this example a female triaxial to male BNC adapter (N1254A-104) can be used to connect the ammeter to the vacuum chamber's coaxial BNC.

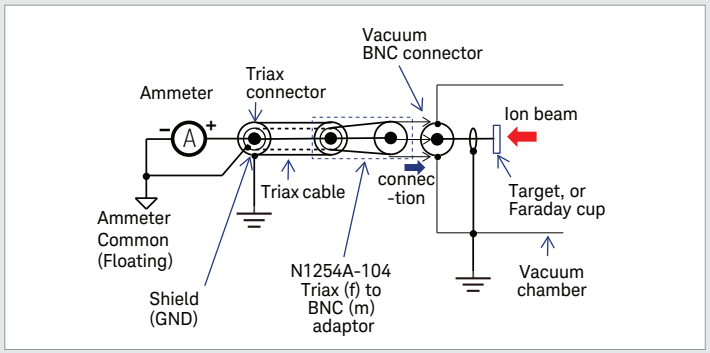


Figure 1.

Example 2. Connecting to a vacuum chamber with a triaxial BNC and applying a DC bias

This example shows how to connect a vacuum chamber with a triaxial BNC to the ammeter's triaxial input and how to also apply a DC bias to the triaxial guard. This scheme can only be used with the B2985A & B2987A electrometers since only they have a built-in voltage source. Figure 2 shows details of the connection scheme between the B2985A/87A ammeter and the vacuum chamber including the built-in DC voltage source. Note that in this case the high side of the voltage source output is connected to the low side of the ammeter which is also connected to the inner shield of the triaxial connector.

This scheme permits the guard connection to be safely biased to high voltages even inside the vacuum chamber, which in-turn limits parasitic leakage currents and improves the accuracy of the low-level ion beam current measurement.

In the case where the ion source is at ground potential, a DC bias can be applied to the ion collector side using the B2985A/87A's built-in voltage source. Note that this configuration can also be used to apply a bias voltage to the collector side even when the ion beam's source is a bias source.

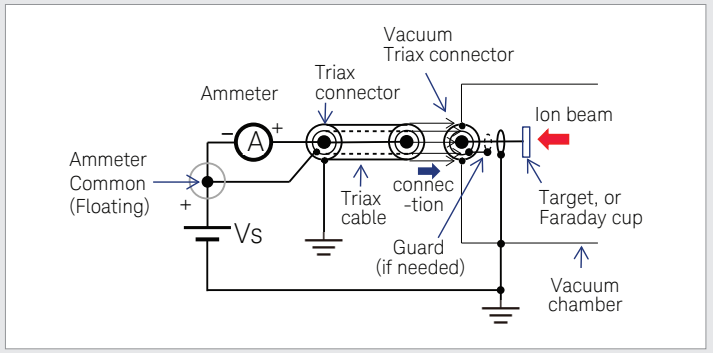


Figure 2.

Key specifications

The following table shows the B2980A Series' key specifications for ion beam current measurement.

Product Number	Measurement Resolution	Current Measurement	Voltage Measurement	Voltage Source	Battery Operation
B2981A	6½ digits	0.01 fA - 20 mA			
B2983A	6½ digits	0.01 fA - 20 mA			✓
B2985A	6½ digits	0.01 fA - 20 mA	1 µV - 20 V	Up to ±1000 V	
B2987A	6½ digits	0.01 fA - 20 mA	1 µV - 20 V	Up to ±1000 V	✓

To learn more please visit:
www.keysight.com/find/b2900a

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