

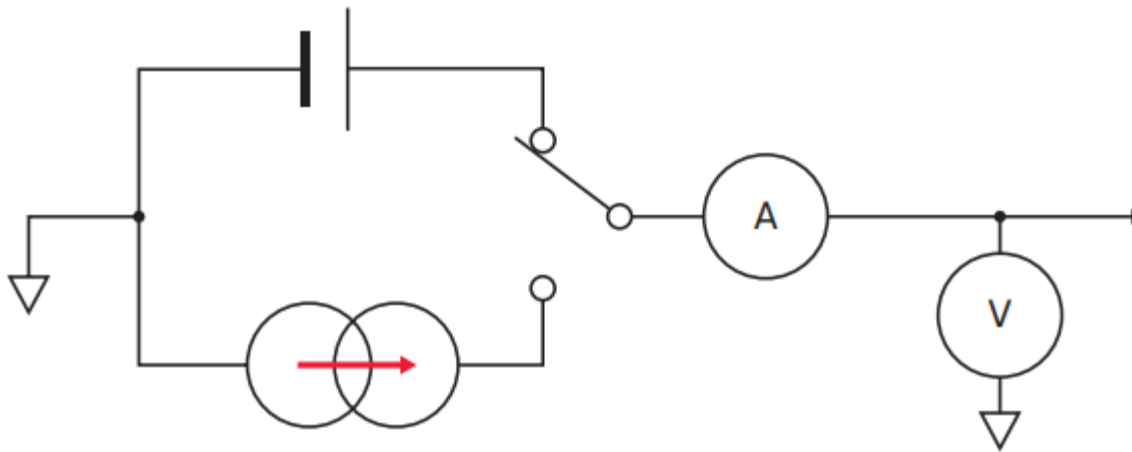
Parametric measurements (DC component characterisation)

Parametric testing

- parametric testers were developed in the 80s as successors to analog curve tracers
- parametric testing is very important during the whole life cycle – from development to production
- DC measurements of various electronic components:
 - diodes, transistors, resistors, capacitors, ...
- current-voltage (IV) or capacitance-voltage (CV) characteristics are typically measured
 - two-terminal or multi-terminal measurements (transistors)
- high-power measurements (high current / high voltage) are typically done in pulse mode

Parametric testing

- the basis of all parametric testers are precision DC sources (SMU – source measurement unit)
 - combination of a precise voltage or current source and simultaneous current and voltage measurement
 - continuous or pulsed mode (pulsed mode offers higher output power and limits the heating of measured components)



SMUs

- measuring sources (SMU) are very versatile instruments:
 - precision voltage and current source
 - continuous, pulsed, sweeps (lin/log), arbitrary waveform
 - electronic load (SMUs are four-quadrant)
 - voltmeter
 - ammeter (active regulation for zero voltage across the input)
 - resistance meter (using internal voltage source and ammeter)
 - voltage typically up to 210 V
 - all of this on two or even more isolated channels

Keysight B2900B series



Keysight B2900B series

- B2901B, B2902B, B2911B, B2912B
 - general SMUs
- B2985B, B2987B
 - high-resistance / small current meters
- B2981B, B2983B
 - small current meters

Keysight B291xB - general SMUs

- 1 or 2 channels, multiple-instrument synchronization
- local/remote sense; can use triaxial cabling for low current measurements
- **100 nV/10 fA** resolution; up to **210 V/3 A (10,5 A pulsed)**
- simple front-panel or remote operation
 - **BenchVue** – basic version for free
 - **PW9251A Quick IV Measurement Software** – free basic sw
 - **EasyEXPERT group+**
 - advanced software – meas. configuration, results analysis
 - can be used with other instruments – B150xA, E526xA, E5270B

Keysight B298xB series

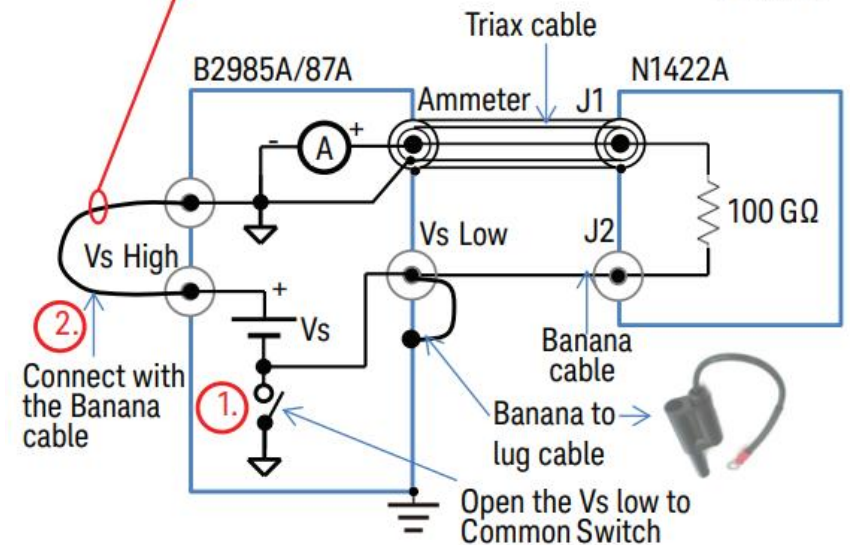
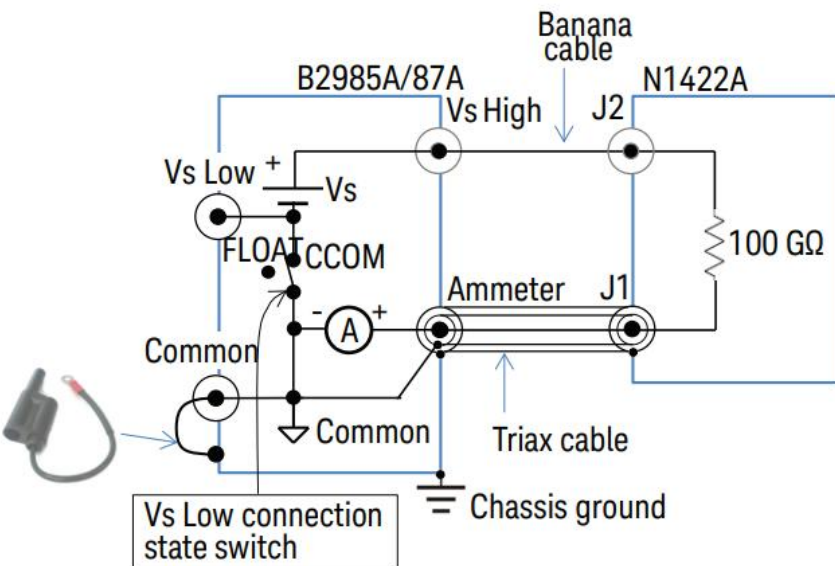
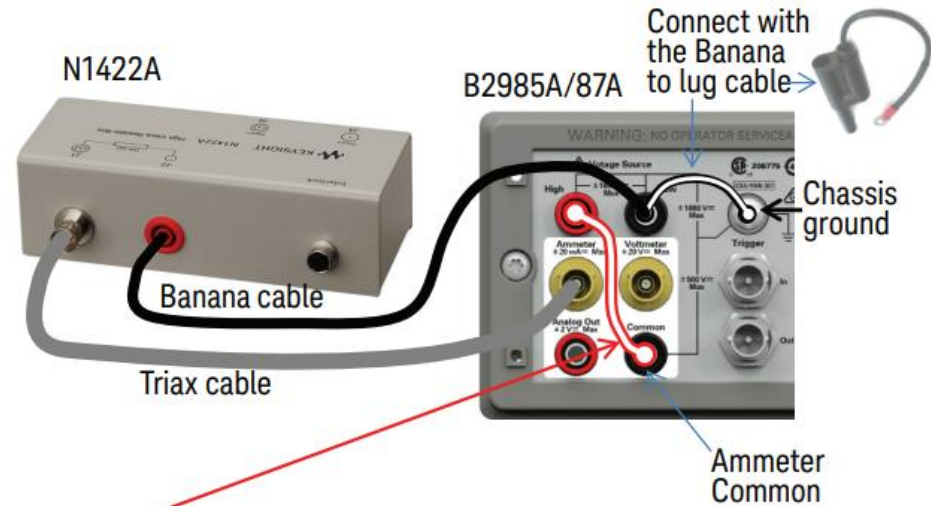
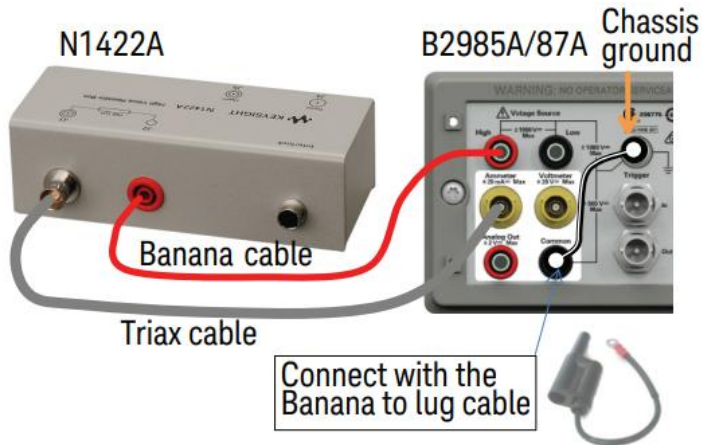
- B2985B / B2987B
 - these models contain a high voltage supply (up to 1000 V)
 - measurement of ultra-low currents (lowest range 2 pA) and large resistances (up to 1 PΩ)
 - can be used for example to measure resistance of dielectrics
 - using a special fixture N1424A/B/C
- B2981B / B2983B
 - these models are without the internal voltage supply; can be used as precise ultra-low current meters
- B2987B and B2983B models have rechargable battery

Keysight B298xB series



Keysight B298xB series

- floating/grounded resistance measurement configuration:



Keysight B298xB series

- N1424A/B/C fixture for material resistance measurement:



Keysight B1500A measuring system



Keysight B1500A measuring system

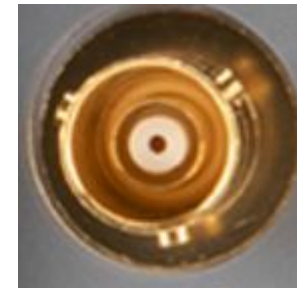
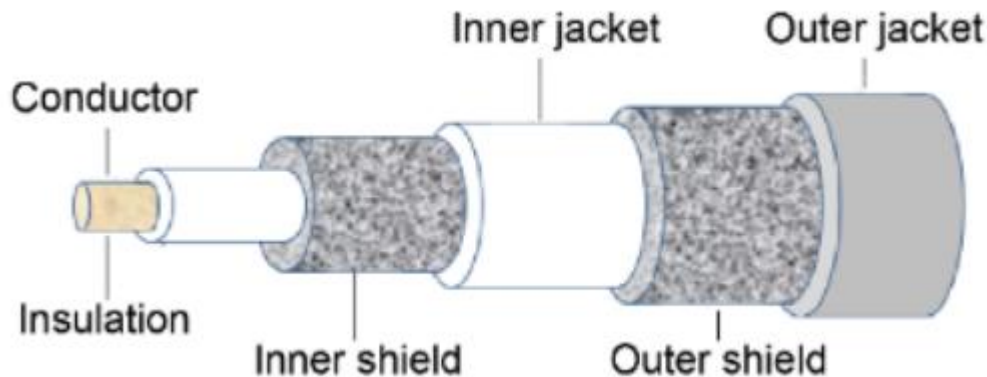
- advanced modular system for component characterisation
 - multiple types of SMU modules + external extension units for high voltage/current measurement
- voltage from μV up to 10 kV, current from nA up to 1,5 kA
- pulse measurements (min 10 μs)
- possibility of an automated temperature testing (-50 to +250 °C)
- capacitance measurement with DC bias of up to 3 kV
- EasyEXPERT software is included

Keysight B1500A measuring system



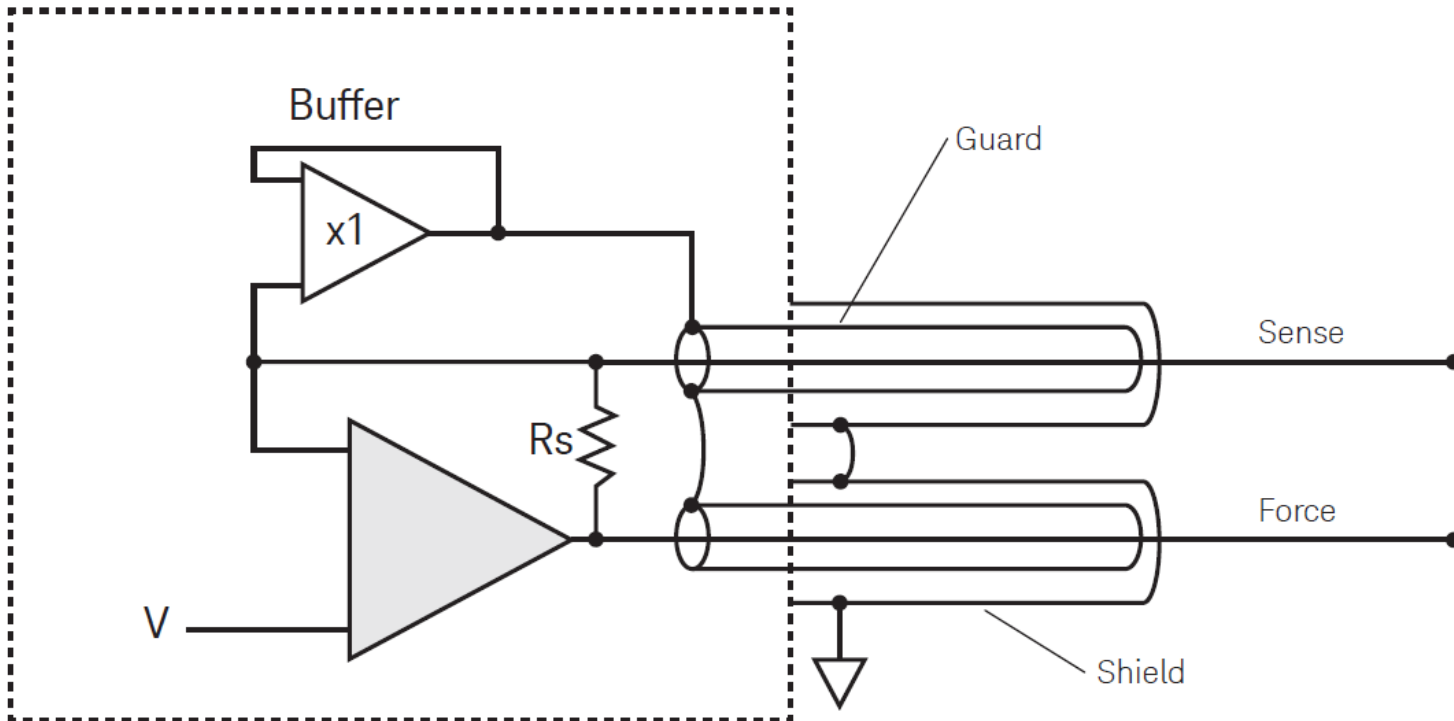
Shielding and guarding

- shielding reduces the influence of external noise
- the purpose of the “guard” (protective terminal) is to eliminate parasitic currents that can introduce errors into sensitive measurements
 - triaxial cables – inner jacket serves as the guard terminal with the potential of the inner conductor; outer jacket as shield



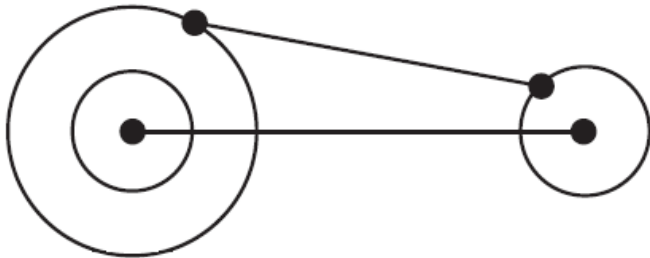
„Guarding“

- most of the B1505A SMUs use two triaxial connectors for connection to the fixture/DUT

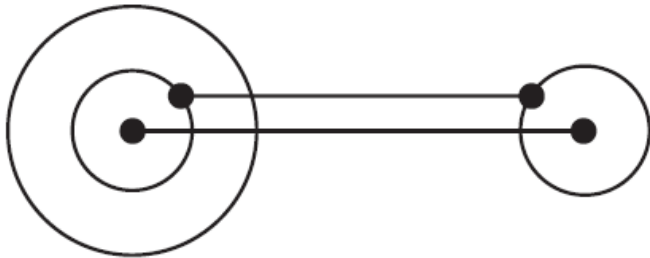


„Guarding“

- in some cases, it might be needed to use an adaptor between triaxial and BNC coaxial connector



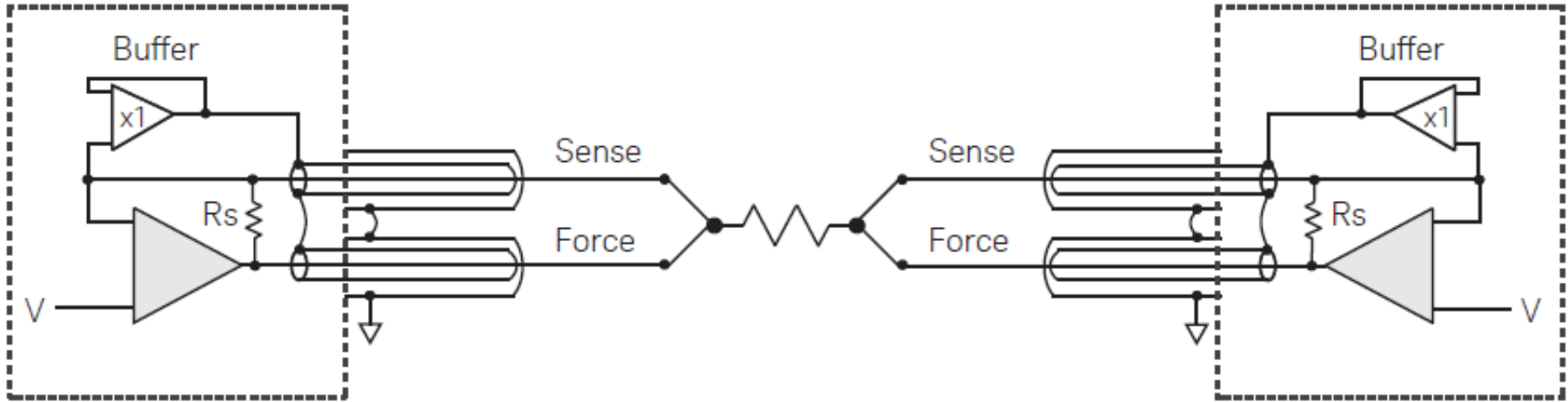
- middle „guard“ conductor is not connected
- simple and safe
- not suitable for low-current measurements



- „guard“ connected to the outer BNC conductor
- can be used for low current measurements
- unsafe – potentially a high voltage on the outer conductor of the BNC
- the outer conductor of the BNC has to be isolated from ground

Four terminal measurements

- probably all SMUs can use four terminal connection – two force and two sense terminals



- for certain special measurements, even four terminal triaxial cables exist:

