

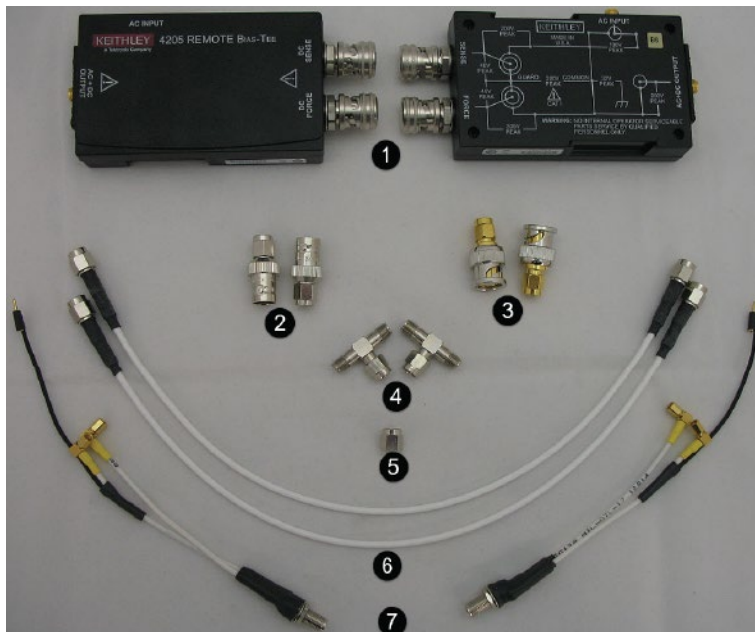
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Instruction sheet

Introduction

The Model 4200-CVU-PWR CVU Power Package enables C-V measurements with a dc voltage bias of up to ± 200 V or 400 V differential (0 V to ± 400 V) and a current output of up to 300 mA.

Figure 1: 4200-CVU-PWR package



The items shipped may vary from items in the picture.

| # | Description | Part number | Quantity |
|---|------------------------------------|-------------|----------|
| 1 | Remote bias tee | 4205-RBT | 2 |
| 2 | SMA male to BNC female adapter | CS-1252 | 2 |
| 3 | SMA male to BNC male adapter | CS-1479 | 2 |
| 4 | SMA tee female-male-female | CS-1391 | 2 |
| 5 | 50 Ω SMA male shorting cap | 011019500 | 1 |
| 6 | SMA plug to SMA plug coaxial cable | CA-406B | 2 |
| 7 | SMA male to SSMC Y cable assembly | CA-426 | 2 |

Using this package, the 4215-CVU Capacitance-Voltage Unit measures the capacitance and either one or two 4200-SMUs or 4215-SMUs are used to supply the dc bias or sweep voltage. The 4200-CVU-PWR is compatible with the 4200A-SCS and 4200-SCS.

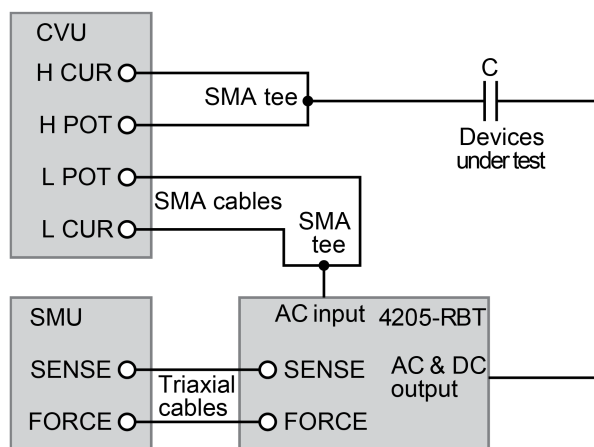


Connect to a device

The voltage output determines if one or two 4205-RBTs are required in the test circuit. For C-V measurements with an applied voltage bias up to ± 200 V, one 4205-RBT is required. For C-V measurements with a voltage differential up to 400 V, two 4205-RBTs are required.

To make C-V measurements with an applied voltage bias up to ± 200 V, connect one SMU (source-measure unit), one 4215-CVU (capacitance-voltage unit), and one 4205-RBT to the device, as shown in the next figure. The SMU sources the dc voltage and the CVU measures the capacitance of the device under test (DUT). The 4205-RBT allows coupling of the ac signals from the CVU and the dc signal from the SMU.

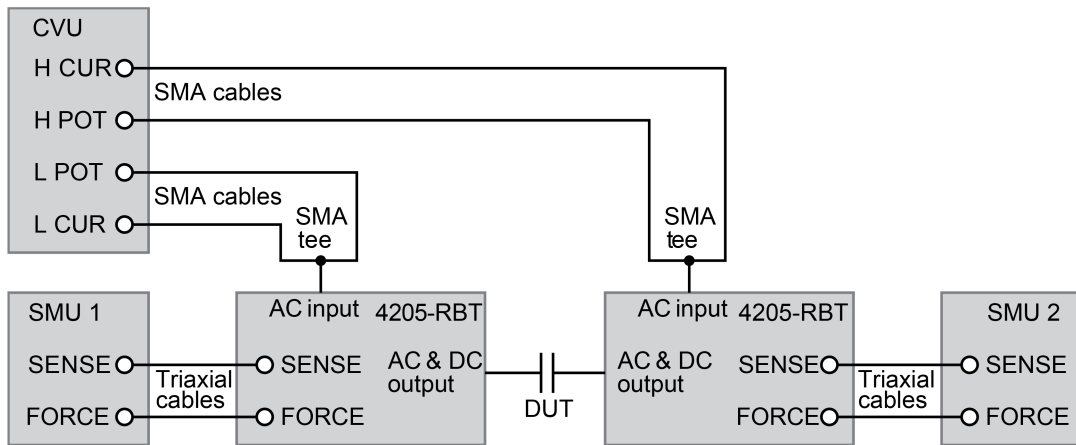
Figure 2: Connections for C-V measurements with applied voltage bias up to ± 200 V



In this setup, you can connect either the CVL1 (LPOT and LCUR) or CVH1 (HPOT and HCUR terminals) to the ac input of the 4205-RBT. By default, the ac ammeter is connected to the CVL1.

To make C-V measurements with a voltage differential up to 400 V, two 4205-RBTs and two 4200-SMUs or 4210-SMUs are required, in addition to the 4215-CVU (see the following figure). In this configuration, you connect SMU 1 and the CVL1 (LPOT and LCUR) terminals of the 4215-CVU through one 4205-RBT to one side of the device. Connect the other side of the device through a second 4205-RBT to both SMU 2 and the CVH1 (HPOT and HCUR) terminals of the 4215-CVU. This setup allows 400 V differential measurements, for example, 0 V to 400 V, -100 V to 300 V, or -400 V to 0 V.

Figure 3: Connections for CV measurements with a voltage differential of 400 V



Control high-voltage measurements using software

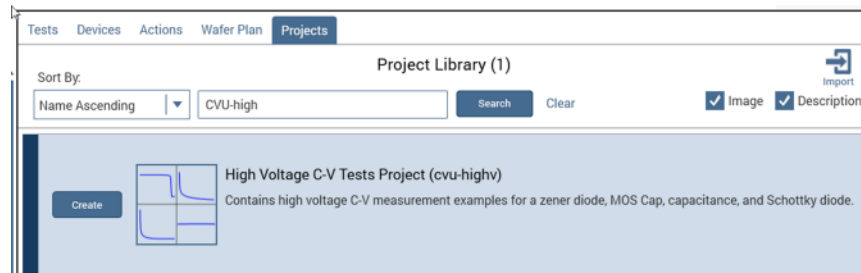
The `hivcvulib` user library contains two modules, `SweepV` and `CvsT`, that allow you to make high voltage C-V measurements. If one 4205-RBT is used, the `SweepV` module allows you to sweep a dc voltage across the DUT using the SMU and measure the capacitance using the 4215-CVU. If two 4205-RBTs are used with the `SweepV` module, one SMU is used to sweep the dc voltage and the other SMU is used to apply an offset dc bias.

The `CvsT` module provides capacitance measurements as a function of time at a user-specified dc bias. You can also use this module with either one or two 4205-RBTs. With one 4205-RBT and one SMU, capacitance measurements can be made with up to 200 V dc bias. With two 4205-RBTs and two SMUs, capacitance measurements can be made up to 400 V dc bias.

These modules are preconfigured in a project. On the 4200A-SCS, the project is the **High Voltage C-V Tests Project (cvu-highv)**. In the 4200A project, the tests that are based on `SweepV` are `hvcv-zener`, `hvcv-moscap`, `200vsweep`, and `400vsweep`. The test that is based on `CvsT` is `200vbias`. On the 4200-SCS, the project is **CVU_highV**.

If you are using a 4200A-SCS, you can search Project Library in Clarius to find the project, as shown in the following figure.

Figure 4: Search for the cvu-highv project



If you are using a 4200-SCS, you can find the project at the following location:

C:\S4200\kiuser\Projects_CV

These projects use both the *SweepV* and *CvsT* modules to make measurements on devices.

You can also open the *SweepV* and *CvsT* modules in a project using a user test module (UTM) On the 4200A-SCS, you can create user modules by selecting **Custom Test** from the Test Library.

To create a user module:

1. Choose **Select**.
2. In the Test Library, select **Custom Test**.
3. Select **Choose a test from the pre-programmed library (UTM)**.
4. Drag the test to the project tree.
5. Select **Configure**.
6. In the Test Settings pane, under User Libraries, select *hivcvulib*.
7. In the User Modules list, select *CvsT* or *SweepV*.

More detail about the 4200-CVU-PWR

For more information about using the 4200-CVU-PWR with a 4200A-SCS, go to The Learning Center or tek.com/keithley and search for the document named *Using the 4200-CVU-PWR C-V Power Package to Make High Voltage and High Current C-V Measurements with the Model 4200A-SCS Parameter Analyzer*.

For more information about using the 4200-CVU-PWR with a 4200-SCS, go to tek.com/keithley and search for the document *Using the Model 4200-CVU-PWR C-V Power Package to Make High Voltage and High Current C-V Measurements with the Model 4200-SCS Semiconductor Characterization System*.

The following safety precautions should be observed before using this product and any associated instrumentation. Although some instruments and accessories would normally be used with nonhazardous voltages, there are situations where hazardous conditions may be present.

This product is intended for use by personnel who recognize shock hazards and are familiar with the safety precautions required to avoid possible injury. Read and follow all installation, operation, and maintenance information carefully before using the product. Refer to the user documentation for complete product specifications.

If the product is used in a manner not specified, the protection provided by the product warranty may be impaired.

The types of product users are:

Responsible body is the individual or group responsible for the use and maintenance of equipment, for ensuring that the equipment is operated within its specifications and operating limits, and for ensuring that operators are adequately trained.

Operators use the product for its intended function. They must be trained in electrical safety procedures and proper use of the instrument. They must be protected from electric shock and contact with hazardous live circuits.

Maintenance personnel perform routine procedures on the product to keep it operating properly, for example, setting the line voltage or replacing consumable materials. Maintenance procedures are described in the user documentation. The procedures explicitly state if the operator may perform them. Otherwise, they should be performed only by service personnel.

Service personnel are trained to work on live circuits, perform safe installations, and repair products. Only properly trained service personnel may perform installation and service procedures.

Keithley products are designed for use with electrical signals that are measurement, control, and data I/O connections, with low transient overvoltages, and must not be directly connected to mains voltage or to voltage sources with high transient overvoltages. Measurement Category II (as referenced in IEC 60664) connections require protection for high transient overvoltages often associated with local AC mains connections. Certain Keithley measuring instruments may be connected to mains. These instruments will be marked as category II or higher.

Unless explicitly allowed in the specifications, operating manual, and instrument labels, do not connect any instrument to mains.

Exercise extreme caution when a shock hazard is present. Lethal voltage may be present on cable connector jacks or test fixtures. The American National Standards Institute (ANSI) states that a shock hazard exists when voltage levels greater than 30 V RMS, 42.4 V peak, or 60 VDC are present. A good safety practice is to expect that hazardous voltage is present in any unknown circuit before measuring.

Operators of this product must be protected from electric shock at all times. The responsible body must ensure that operators are prevented access and/or insulated from every connection point. In some cases, connections must be exposed to potential human contact. Product operators in these circumstances must be trained to protect themselves from the risk of electric shock. If the circuit is capable of operating at or above 1000 V, no conductive part of the circuit may be exposed.

For maximum safety, do not touch the product, test cables, or any other instruments while power is applied to the circuit under test. ALWAYS remove power from the entire test system and discharge any capacitors before connecting or disconnecting cables or jumpers, installing or removing switching cards, or making internal changes, such as installing or removing jumpers.

Do not touch any object that could provide a current path to the common side of the circuit under test or power line (earth) ground. Always make measurements with dry hands while standing on a dry, insulated surface capable of withstanding the voltage being measured.


For safety, instruments and accessories must be used in accordance with the operating instructions. If the instruments or accessories are used in a manner not specified in the operating instructions, the protection provided by the equipment may be impaired.

Do not exceed the maximum signal levels of the instruments and accessories. Maximum signal levels are defined in the specifications and operating information and shown on the instrument panels, test fixture panels, and switching cards.

Chassis connections must only be used as shield connections for measuring circuits, NOT as protective earth (safety ground) connections.

The **WARNING** heading in the user documentation explains hazards that might result in personal injury or death. Always read the associated information very carefully before performing the indicated procedure.

The **CAUTION** heading in the user documentation explains hazards that could damage the instrument. Such damage may invalidate the warranty.

The **CAUTION** heading with the  symbol in the user documentation explains hazards that could result in moderate or minor injury or damage the instrument. Always read the associated information very carefully before performing the indicated procedure. Damage to the instrument may invalidate the warranty.

Instrumentation and accessories shall not be connected to humans.

Before performing any maintenance, disconnect the line cord and all test cables.

To maintain protection from electric shock and fire, replacement components in mains circuits — including the power transformer, test leads, and input jacks — must be purchased from Keithley. Standard fuses with applicable national safety approvals may be used if the rating and type are the same. The detachable mains power cord provided with the instrument may only be replaced with a similarly rated power cord. Other components that are not safety-related may be purchased from other suppliers as long as they are equivalent to the original component (note that selected parts should be purchased only through Keithley to maintain accuracy and functionality of the product). If you are unsure about the applicability of a replacement component, call a Keithley office for information.

Unless otherwise noted in product-specific literature, Keithley instruments are designed to operate indoors only, in the following environment: Altitude at or below 2,000 m (6,562 ft); temperature 0 °C to 50 °C (32 °F to 122 °F); and pollution degree 1 or 2.

To clean an instrument, use a cloth dampened with deionized water or mild, water-based cleaner. Clean the exterior of the instrument only. Do not apply cleaner directly to the instrument or allow liquids to enter or spill on the instrument. Products that consist of a circuit board with no case or chassis (e.g., a data acquisition board for installation into a computer) should never require cleaning if handled according to instructions. If the board becomes contaminated and operation is affected, the board should be returned to the factory for proper cleaning/servicing.

Safety precaution revision as of June 2018.