

Overview

The Keithley Instruments Model 4200-PRB-C (Figure 1, below) is an adapter cable that allows connection of various 4200 instruments with some types of DC probe manipulators. The input end of the cable has a single female SMA and the other end is split into two gold SSMC plugs (female connectors). One SSMC has the pulse signal and the other is the shield or ground. The black wire, with integrated connector, is used to connect to the shield of another 4200-PRB-C cable.

Figure 1
4200 Pulse SMA to SSMC Adapter

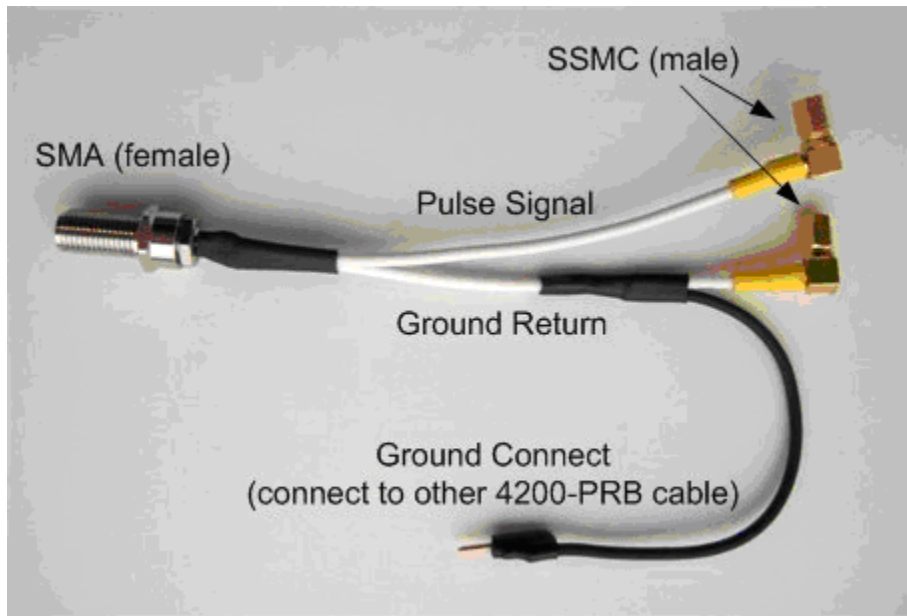
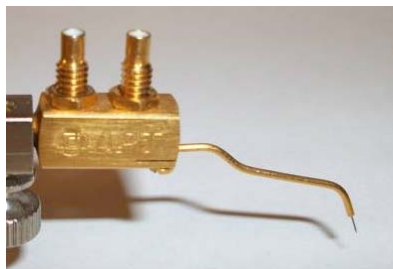


Figure 2 shows an example of a probe needle holder that has two SSMC-style connectors to support Kelvin cabling.

Figure 2
SSMC probe needle holder



The Model 4200-PRB-C is included with the following models:

- Model 4220-PGU Dual Channel Pulse Generator
- Model 4225-PMU Dual Channel Ultra-Fast I-V Module
- Model 4200-CVU-PROBER-KIT Prober Accessory for 4200-CVU
- Model 4200-CVU-PWR C-V Power Pack
- Model 4200-PIV-A Pulse IV Package (using Model 4200 Remote Bias Tees)
- Model 4200-PIV-Q Pulse IV Package, Q-point

4200-PRB-C Schematic

There are two main functions of the SSMC adapter cable:

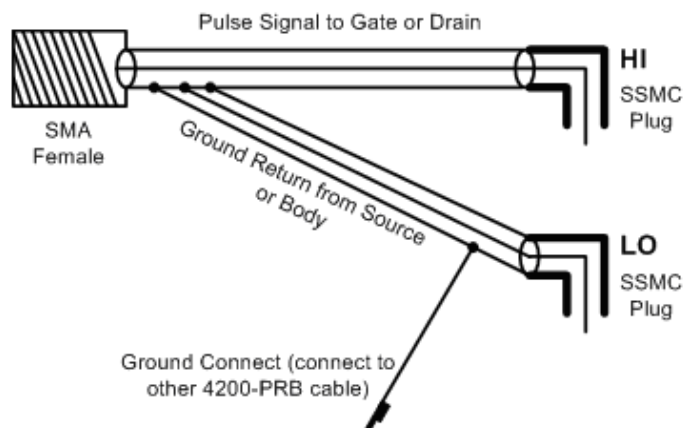
1. Provide electrical connection from SMA on the test instrument to the SSMC probe tip connectors.
2. Provide a local, high frequency ground for the low-side connection.

The SSMC Adapter cable is appropriate for on-wafer pulse IV testing of nominally DC structures. It is *not* appropriate for higher frequency devices. There is no hard upper frequency limit due to the effect of device impedance, test instrument output impedance, device layout, and probe configuration. In general, any device that has a F_T much above 1 GHz could oscillate when using a DC probe connection scheme and the 4200-PRB cables. Also, if the device has an RF layout (G-S-G), these adapter cables and DC probe manipulators will most likely be insufficient.

As shown in Figure 3, one of the two SSMC cables has a black ground lead to provide a high-frequency ground connection for a probe pin. This allows for testing of 2-pin devices (using a single 4200-PRB-C), or 3 or 4-terminal devices (using two 4200-PRB-C cables).

Figure 3

4200-PRB-C Schematic



Compatible Probe Holders

The 4200-PRB-C is compatible for on-wafer device testing using the SSMC-style probe tip (example shown in Figure 2):

- Cascade DCM-2xx DC probe manipulators (see Table 1)
- Suss Microtec probe manipulators (see Table 2)
- Signatone SCA-50 coaxial probes
- Any probe interconnect with SSMC connectors near the probe tip
- American Probe & Technologies:
 - o 73APT series coax probe
 - o 73APT-100K Kelvin Probe
 - o 74CJ series coaxial probe holder

See Table 1 for details on compatible Cascade products and Table 2 for compatible Suss products.

Table 1
Cascade Microtech Positioners compatible with the Model 4200-PRB-C

Probe Station	Positioner	Arm	Holder/Needle
Summit Series	DCM-205 DCM-210 DCM-320 DCM-400 MS1 series when used with the 115-596 DCP probe mount Summit E/W RF positioners when used with the 104-030K DCP probe mount Summit N/S RF positioners when used with the 104-856K DCP probe mount	All DCP Probe Mounts with dual mini-triax connectors	DCP-HTR DCP-105R DCP-115R DCP-150R DCP-150K-25 DCP-150K-50
M150 Series	DCM-205 DCM-210 DCM-320	All DCP Probe Mounts with dual mini-triax connectors 143-450 DCP Probe Mount	
Elite 300 Series	MS1 series when used with the 141-800 DCP probe mount DCM200/300 series when used with the 139-370 DCP probe mount	All DCP Probe Mounts with dual mini-triax connectors	

Table 2
Suss Microtech Positioners compatible with the Model 4200-PRB-C

Probe Station Type	Positioner	Arm	Holder/Needle
ProbeShield (PA200/300)	PROBEHEAD PH110HF Part # B00-118480	PROBE ARM PH110/PH150 FOR ADVANCED COAX PROBE/PROBESHIELD® Part # B50-144866	PROBE HOLDER/ TIP AP&T / KELVIN Part Num K00-67045 REPLACEMENT TIP FOR AP&T PROBE KELVIN / 1 TIP / 5 PCS. Part # K00-67055
PA200/PM8/PM5/EP4/ Generic	PROBEHEAD PH110HF Part # B00-118480	FRONT PLATE DC PH110HF Part # B50-133838 PROBE ARM PH120/PH150 / FLEX FOR AP&T-PROBES Part # B50-116272	PROBE HOLDER/ TIP AP&T / KELVIN Part Num K00-67045 REPLACEMENT TIP FOR AP&T PROBE KELVIN / 1 TIP / 5 PCS. Part # K00-67055
Other Vendors Probe Stations	PROBEHEAD PH110HF Part # B00-118480	FRONT PLATE DC PH110HF Part # B50-133838 PROBE ARM PH120/PH150 / FLEX FOR AP&T-PROBES Part # B50-116272	PROBE HOLDER/ TIP AP&T / KELVIN Part # K00-67045 REPLACEMENT TIP FOR AP&T PROBE KELVIN / 1 TIP / 5 PCS. Part # K00-67055

WARNING The procedures contained in this document are intended for use by qualified personnel only. Do not perform these procedures unless qualified to do so. Failure to recognize and observe normal safety precautions could result in personal injury or death.

Model 4200-SCS Documentation

The Model 4200-SCS includes manuals, white papers, application notes, and specifications. Access to these files, mostly PDFs, is from the Complete Reference icon in the upper left corner of the 4200 desktop (see Figure 4). This icon opens up Internet Explorer to the 4200-SCS Complete Reference web page.

Figure 4
4200 Complete Reference Icon



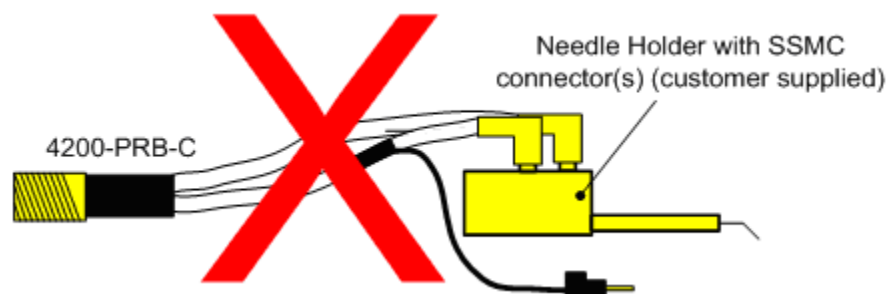
Connection instructions for Keithley models

WARNING When using the 4200-PRB-C with the Model 4200-SCS, make sure to disable the Model 4200-SCS high-voltage output to prevent potential exposure to high voltage. Disabling the interlock will prevent voltages greater than 42V from being output. To disable Model 4200-SCS high voltage, remove the interlock plug on the back of the system.

As shown in the schematic (Figure 3), the two cables in the adapter are not the same. The end with the ground connection (LO in Figure 3) has the center pin of the SSMC connector connected to the shield (ground). Do not connect both of the SSMC connectors of the 4200-PRB-C to the same probe tip (see Figure 5).

The incorrect connections shown in Figure 5 will result in the signal shorted to the shield (ground) and not allow the signal to reach the probe pin. It shows both SSMC connectors from a single adapter connected to the two SSMC connectors on a single probe needle holder.

Figure 5
Incorrect use of the 4200-PRB-C



Model 4200-PIV-A: Pulse IV option

One probe pin is required for each pad on the DUT. Since the 4200-PIV-A is used for testing transistors, either three or four probes are typically required (requiring a pair of 4200-PRB-C cables).

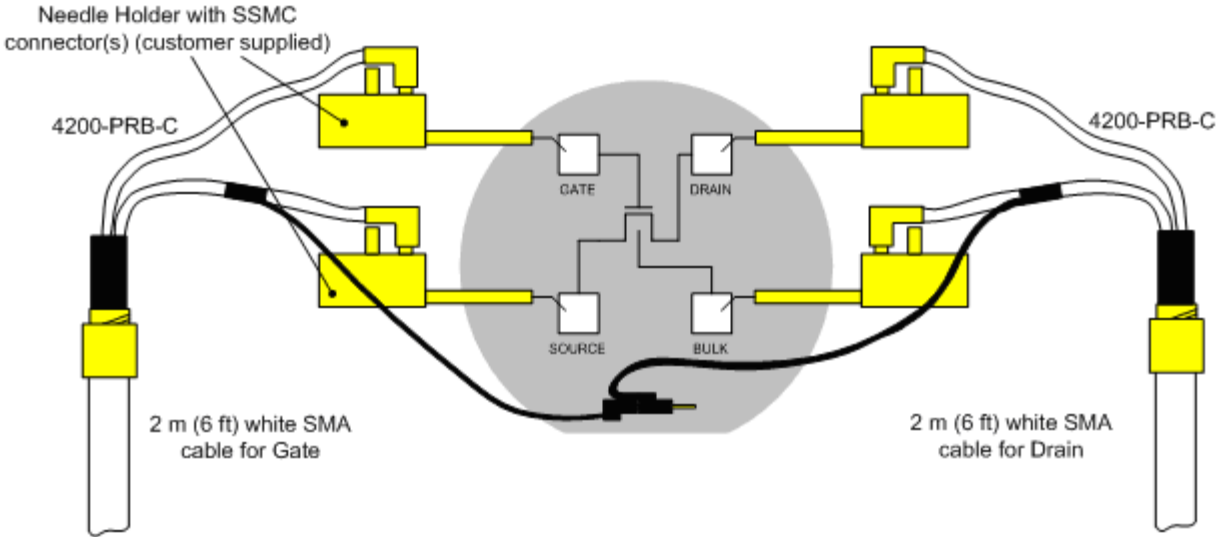
In the case of RF G-S-G pad layout, do not use the 4200-PRB-C adapter cables. Use the shorter SMA cables supplied with the 4200-PIV-A package to connect directly from the 4200-RBT to the RF manipulator.

A pair of 4200-PRB-C cables is supplied with the 4200-PIV-A package. These cables are used to provide a pair of HI and a pair of LO signal paths to DC probe tips. In addition, each Y cable has a third conductor which is a ground tap used to connect both LO paths together. Connecting the two LO paths is important to minimize impedance mismatch and minimize the loop area, which contributes to inductance and reduces pulse shape quality. Typically, these signal paths are as follows and are shown in Figure 6 for a 4-terminal device:

HI from Adapter 1 to Gate
LO from Adapter 1 to Source
HI from Adapter 2 to Drain
LO from Adapter 2 to Substrate
LO Tap from Adapter 1 to LO Tap from Adapter 2

conductor which is a ground tap, used to connect both LO paths together. Connecting the two LO paths is important to minimize impedance mismatch and minimize the loop area, which contributes to inductance and reduces pulse shape quality.

Figure 7
PIV-Q connections for 4-terminal device



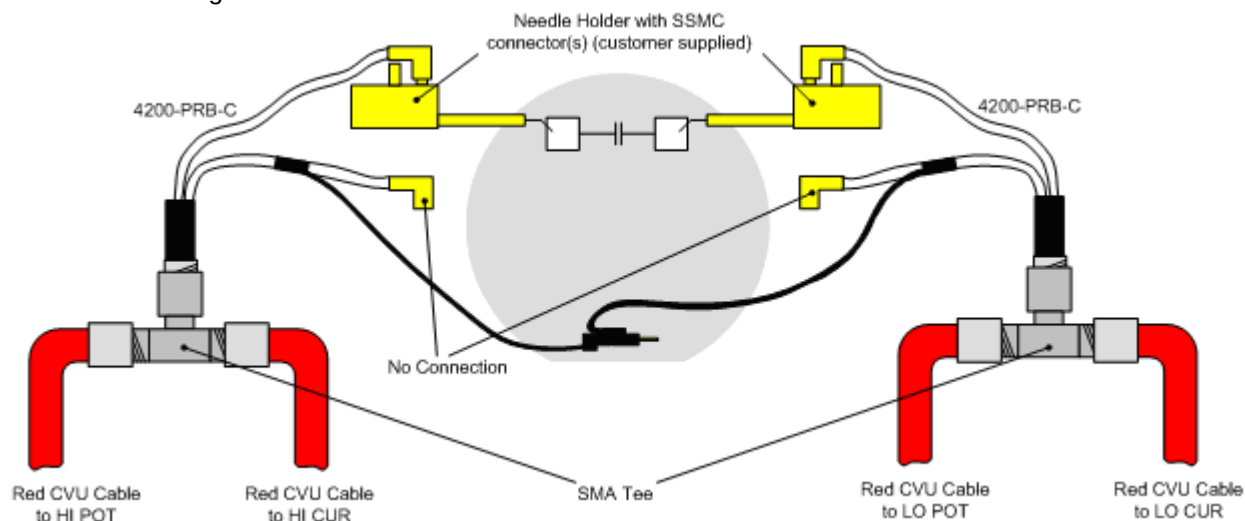
To use the 4200-PRB-C with the 4200-SCS and the 4200-PIV-Q package:

1. Set up and connect the 4200-SCS. For 4200-SCS set up, refer to the 4200-SCS Quick Start Guide and 4200-SCS Reference Manual.
2. Set up and connect the 4200-PIV-Q. For 4200-PIV-Q set up, refer to the 4200 PIV-Q Pulse Measurements App Note, found in the Applications Notes sidebar of the 4200 Complete Reference web page. The document name is "Model 4200-PIV-Q Pulse Measurements for Compound Semiconductor and LDMOS Transistors."
3. Prepare the probe connection by disconnecting any existing cables from the SSMC connectors on the needle holders.
4. Continue setup by connecting a 4200-PRB-C cable to the 2 m (6-foot) SMA cable from the back of the 4200. Refer to Figure 7. Don't forget to connect the black shield jumpers to each other as shown in Figure 7.
5. Finish setup by verifying connections and running DC and/or Pulse IV tests using the 4200 project QPulseIV-Complete. Information about this project is also in the PIV-Q Applications Note.

4200-CVU-PROBER-KIT: Prober Accessory Kit for 4210-CVU

The CVU prober kit includes longer CVU (red SMA coax) cables and various adapters: Triax to BNC, Triax barrels, BNC barrels, BNC to SMA, SMA Tees. These adapters assist in connecting the 4200-CVU instrument card to a variety of probe manipulators. In addition, there are two (2) 4200-PRB-C adapter cables. The CVU card has both POT and CUR connections for both the HI and LO, for a total of four connectors. Therefore there are four of each of the adapters and cables to allow for full force and sense signal routing up to the probe manipulator connection. There are two PRB cables because each cable supports both signal and ground, so a pair can support 2, 3 or 4-terminal devices. Figure 8 shows connections for a 2-terminal capacitor. It is also possible to connect one or both of the unused ground connections to probe manipulators to support 3 or 4-terminal devices. See Figure 7 for a similar connection to a 4-terminal device using the 4200-PRB cables.

Figure 8
Connections using the CVU-PROBER-KIT



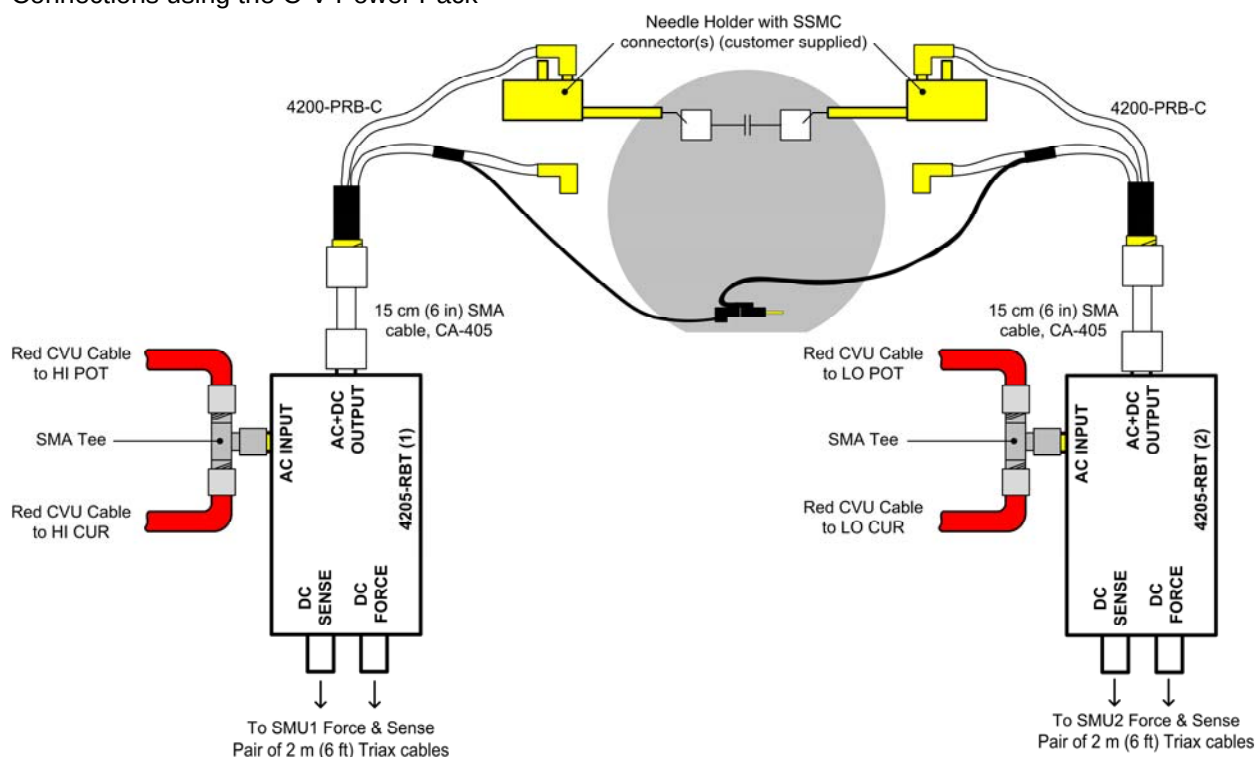
To use the 4200-PRB-C along with the 4200-SCS and the 4200-CVU-PROBER-KIT:

1. Set up and connect the 4200-SCS. For 4200-SCS set up, refer to the 4200-SCS Quick Start Guide and 4200-SCS Reference Manual.
2. Set up and connect to the 4210-CVU (Section 15, 4200 Reference Manual). The 4200 Reference Manual can be found on the main page of the 4200 Complete Reference web page.
3. Prepare the probe connection by disconnecting any existing cables from the SSMC connectors on the probe needle holders.
4. Continue setup by connecting the red SMA cables from CVU HI POT and HI CURR to one SMA Tee. Connect the red SMA cables from CVU LO POT and LO CUR to a second SMA Tee.
5. Connect each SMA Tee to a 4200-PRB-C adapter cable. Refer to Figure 8. Don't forget to connect the black shield jumpers to each other as shown in Figure 8.
6. Finish setup by verifying connections and performing initial verification (Confidence Check, Section 15 of the 4200 Reference Manual) or basic measurements (Section 3, 4200 User's Manual).

Model 4200-CVU-PWR: C-V Power Pack

This package for the 4200-SCS with the 4210-CVU enable C-V measurements with a DC voltage bias of up to $\pm 200V$ or $400V$ differential (0 to $\pm 400V$). It includes bias tees, adapters and two 4200-PRB-C adapter cables. Figure 9 shows connections for using the C-V Power Pack.

Figure 9
Connections using the C-V Power Pack



To use the 4200-PRB-C along with the 4200-SCS and the 4200-CVU-PWR Kit:

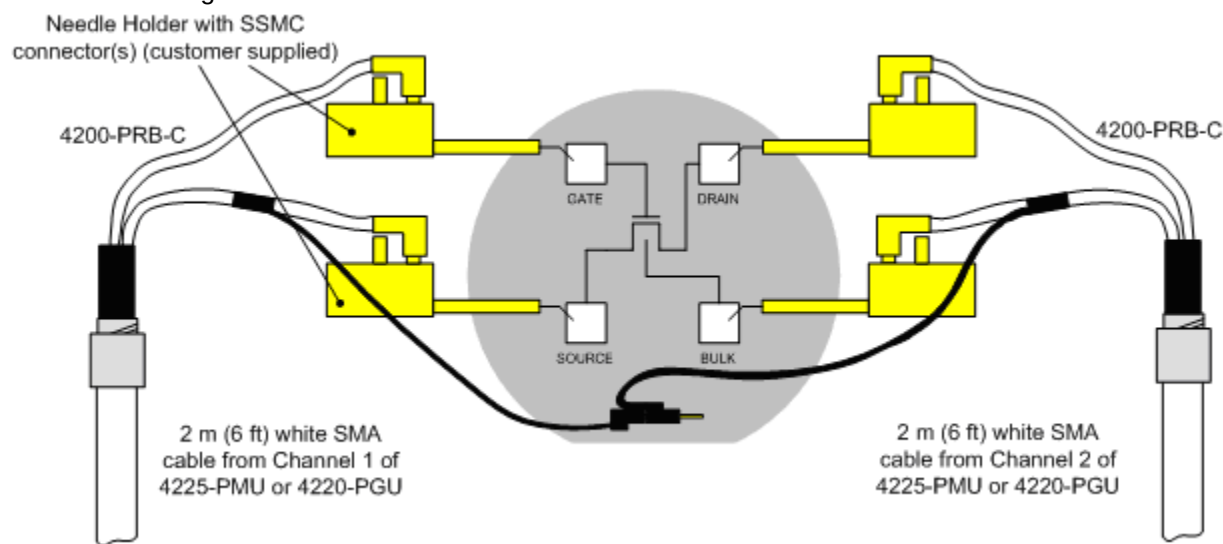
1. Set up and connect the 4200-SCS. For 4200-SCS set up, refer to the 4200-SCS Quick Start Guide and 4200-SCS Reference Manual.
2. Set up and connect to the 4210-CVU (Section 15, 4200 Reference Manual). The 4200 Reference Manual can be found on the main page of the 4200 Complete Reference web page.
3. Make connections for the CVU Power kit by referring to the applications note "Using the Model 4200-CVU-PWR C-V Power Package..", found on the Applications page of the 4200-SCS Complete Reference web page.
4. Prepare the probe connection by disconnecting any existing cables from the SSMC connectors on the probe needle holders.
5. Connect each 4205-RBT to a 4200-PRB-C adapter cable using the short SMA cable. Refer to Figure 9. Don't forget to connect the black shield jumpers to each other as shown in Figures 9. Routing the signal through additional adapters or switches is not supported.
6. Finish setup by verifying connections and following the remainder of the applications note.

Model 4225-PMU: Ultra Fast I-V Module

Model 4220-PGU: Pulse Generator Unit

The 4225-PMU and 4220-PGU each come with a pair of white SMA cables and two 4200-PRB-C adapter cables. This allows the PMU or PGU, which both have two pulse channels, to connect to two individual 2-terminal devices or to a single 3 or 4-terminal device. Figure 10 shows the connection to a 4-terminal transistor.

Figure 10
Connections using the 4225-PMU or 4220-PGU to test a 4-terminal transistor



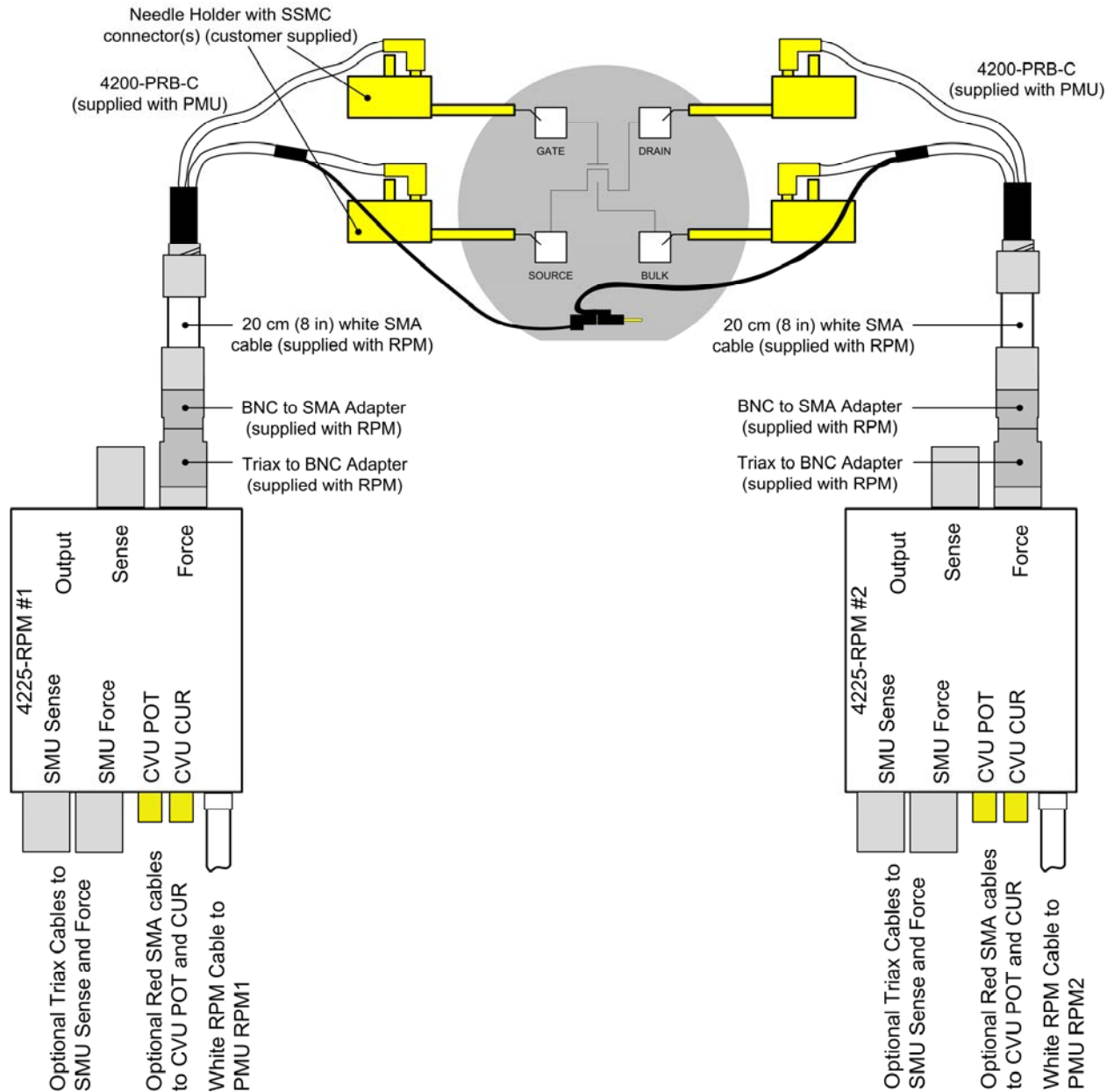
To use the 4200-PRB-C along with the 4200-SCS and the 4225-PMU or 4220-PGU:

1. Set up and connect the 4200-SCS. For 4200-SCS set up, refer to the 4200-SCS Quick Start Guide and 4200-SCS Reference Manual.
2. Set up and connect to the 4225-PMU or 4220-PGU, shown in Section 16 of the 4200-SCS Reference Manual. The 4200 Reference Manual can be found on the main page of the 4200 Complete Reference web page.
3. Prepare the probe connection by disconnecting any existing cables from the SSMC connectors on the probe needle holders.
4. Connect each pulse channel to a 4200-PRB-C adapter cable using the white SMA cable. Refer to Figure 10. Don't forget to connect the black shield jumpers to each other as shown in Figures 10. Routing the signal through additional adapters or switches will degrade pulse performance.
5. Finish setup by verifying connections.

Model 4225-PMU with Model 4225-RPM: Ultra Fast I-V Module with Remote Amplifier/Switch

The 4225-PMU has integrated pulse source and measure. Adding the optional 4225-RPMs provide lower current measure ranges for pulse I-V and switching to allow for CV and SMU tests without re-cabling. Just as with the 4225-PMU alone, the included cables and adapters allow the PMU+RPM to connect to two individual 2-terminal devices or to a single 3 or 4-terminal device. Figure 11 shows the connection to a 4-terminal transistor.

Figure 11
Connections using the 4225-RPM to a 4-terminal transistor



To use the 4200-PRB-C along with the 4200-SCS and the 4225-RPM via the 4225-PMU:

1. Set up and connect the 4200-SCS. For 4200-SCS set up, refer to the 4200-SCS Quick Start Guide and 4200-SCS Reference Manual.
2. Set up and connect to the 4225-PMU and 4225-RPM, shown in Section 16 of the 4200-SCS Reference Manual. The 4200 Reference Manual can be found on the main page of the 4200 Complete Reference web page.
3. Prepare the probe connection by disconnecting any existing cables from the SSMC connectors on the probe needle holders.
4. Connect each RPM output to a 4200-PRB-C adapter cable. Refer to Figure 11 or Section 16 of the Reference Manual. Don't forget to connect the black shield jumpers to each other as shown in Figures 11. Routing the signal through additional adapters or switches will degrade pulse performance.

5. Finish setup by verifying connections and then follow the “Procedure to configure a PMU (with or without RPM) from an ITM as explained in Section 16 of the Reference Manual.