

Operating and Service Manual HP 86205A Directional Bridge

SERIAL NUMBERS

This manual applies to HP 86205A bridges with serial number 3140A00101 and above. For additional information concerning serial numbers, see "Instruments Covered by this Manual" in "General Information."



HP Part No. 86205-90001
Printed in USA January 1992
Edition 1

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Specifications & Supplemental Characteristics

Table 1-1 lists bridge specifications, which are the performance standards or limits against which you can test the device. Table 1-2 lists supplemental (typical, non-warranted) bridge characteristics.

Accessories

Table 5-1 lists accessories available for use with these bridges.

Instruments Covered By This Manual

Each bridge has a unique serial number. The contents of this manual apply directly to bridges with serial numbers listed on the title page.

Product Description

The HP 86205A is a high performance 50 Ω directional bridge designed for high quality reflection measurements and external source leveling applications over an RF frequency range of 300 KHz to 6 GHz. The bridge achieves a low through loss of 1.5 dB and a high coupling factor of 16 dB. These characteristics make it useful in applications requiring directional couplers, such as power monitoring and closed-loop leveling applications.

Manual Overview

This manual contains information for operating, testing, and servicing the HP 86205A bridge.

General Information



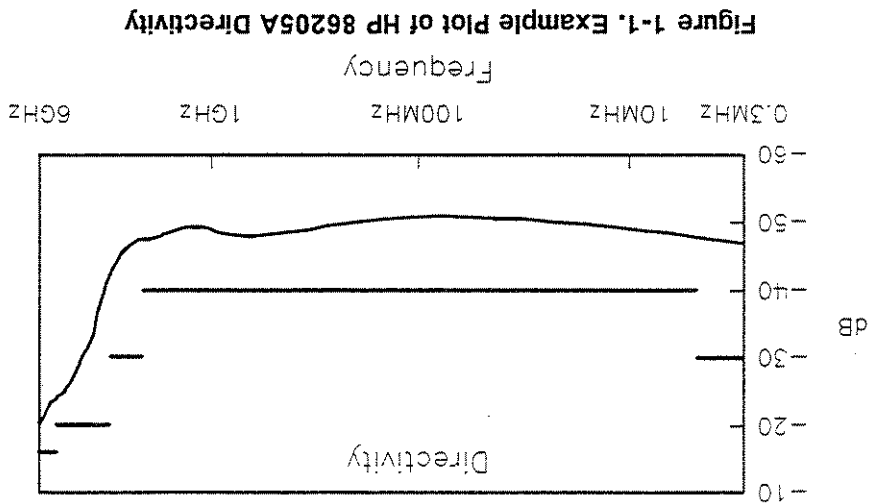
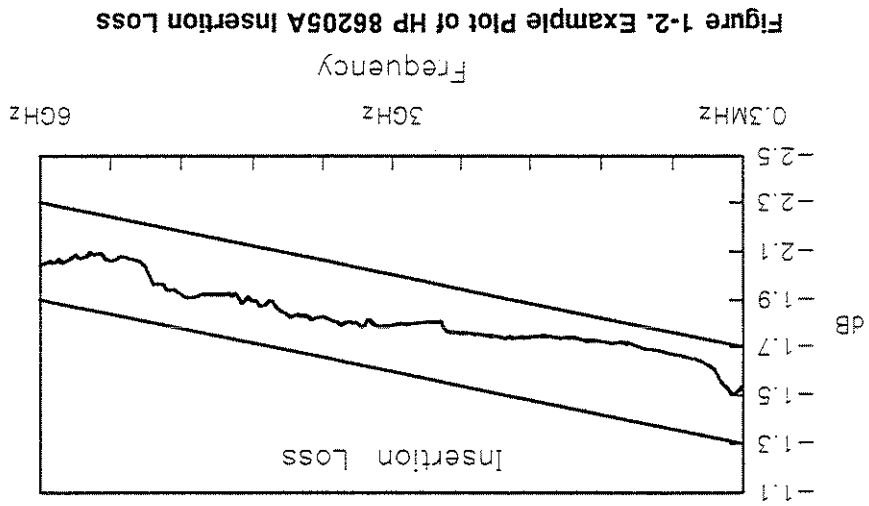
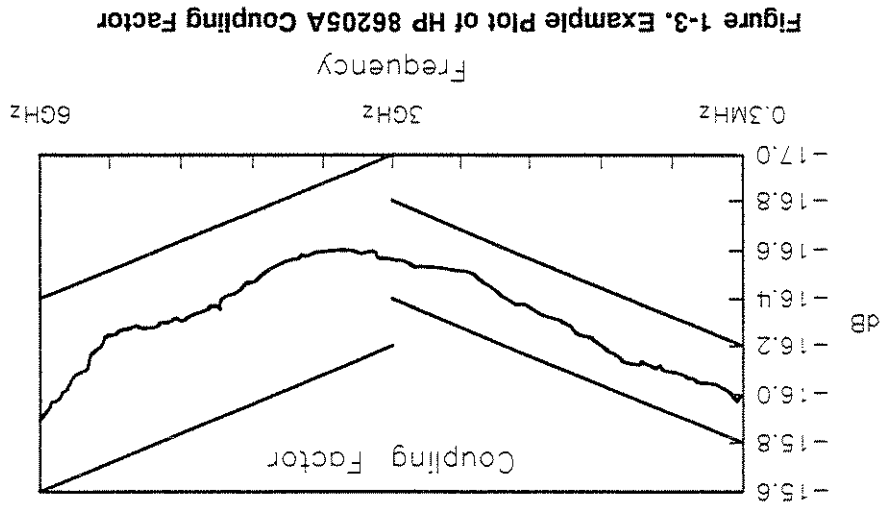
1 Recession refers to a female type-N connector center conductor dimension relative to 0.207 nominal offset.
 2 Before you performance test an HP 86205A bridge, gage all the connectors and enter the results in the test record at the end of "Performance Tests." For descriptive illustrations defining connector tolerances, see the *Microwave Connector Care Manual* (HP part number 08510-90064).

Max Input Power: +25 dBm Max Input Voltage: port 1 or port 2 30 VDC 0 VDC Max Input Current: 1 amp DC Connector Recession: ¹ 0.204 in to 0.207 in ² Weight: net 0.57 kg (1.3 lbs) 1.80 kg (4.0 lbs) shipping Dimensions: 160W x 93H x 23D (mm) 6.3W x 3.7H x 1D (in)	Nominal Through Loss: 1.5 dB +0.1 dB/GHz Through Loss Deviation: ±0.2 dB from nominal Nominal Coupling Factor: 16 dB +0.15 dB/GHz 1 MHz to 3 GHz 16.5 dB -0.2 dB/GHz 3 GHz to 6 GHz Coupling Factor Deviation: ±0.2 dB from nominal 1 MHz to 3 GHz ±0.4 dB from nominal 3 GHz to 6 GHz
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Table 1-2. HP 86205A Supplemental Characteristics

Connector: 50Ω Precision Type-N female Frequency Range: 300 kHz to 6 GHz Directivity: 25 ±5°C >30 dB 300 kHz to 5 MHz >18 dB typical 3 to 5 GHz >40 dB 5 MHz to 2 GHz >16 dB typical 5 to 6 GHz >30 dB 2 GHz to 3 GHz >20 dB typical 3 to 5 GHz >23 dB 300 kHz to 2 GHz Port Match:	>16 dB typical 5 to 6 GHz >20 dB typical 3 to 5 GHz >30 dB 2 GHz to 3 GHz >40 dB 5 MHz to 2 GHz >16 dB typical 5 to 6 GHz >30 dB 300 kHz to 5 MHz >18 dB typical 3 to 5 GHz >20 dB 2 to 3 GHz >23 dB 300 kHz to 2 GHz
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Table 1-1. HP 86205A Specifications



Initial Inspection

1. Check the shipping container and packaging material for damage.
 2. Check the shipment for completeness.
 3. Check the connectors and bridge body for mechanical damage.
 4. Check the bridge electrically.
Refer to the "Performance Tests" chapter for procedures that check the bridge electrically.
- If any of the following conditions exist, notify your nearest Hewlett-Packard office:
- incomplete shipment
 - mechanical damage or defect
 - failed electrical test
- If you find damage or signs of stress to the shipping container or the cushioning material, keep them for the carrier's inspection. Hewlett-Packard does not wait for a claim settlement before arranging for repair or replacement.

Operation

Overview

This chapter includes the following information on the HP 86205A directional bridge:

- bridge operation
- bridge features
- operating precautions
- measurement configurations

Bridge Operation

Table 2-1 and Figure 2-1 illustrate the bridge operation. The table shows the port orientation in a reflection measurement and in a power monitoring or leveling configuration. The figure identifies the paths and ports of the bridge and shows the electrical characteristics of each path.

Table 2-1.
Port Orientation
with Corresponding Application

Port Number	Reflection Measurement	Power Monitoring/Leveling
	1	Test Port
2	Input Port	Output
3	Coupled	Coupled
Application		

The HP 86205A operates over an RF frequency range of 300 kHz to 6 GHz and has excellent directivity for high quality reflection measurements. Additionally, the bridge has a very low insertion loss of 1.5 dB which means more power to the device under test; this is especially important in the measurement of high power solid state amplifiers and TWTs. The bridge also features a ± 0.2 dB flatness from the nominal 16 dB coupled arm. This capability is valuable in external leveling applications where a power meter or diode detector is used to level the power remotely from the source. Power variations are then minimized, which is important when measuring input-sensitive devices.

DC bias may be applied to a DUT through the main arm of the bridge. (**DO NOT** apply bias to the coupled port of the bridge.) Threaded mounting holes (3.5 mm x 0.5 mm) are located under prepunched holes in the model number label, as shown in

Bridge Features

- frequency range from 300 kHz to 6 GHz
- high directivity
- insertion loss of 1.5 dB (nominal)
- coupled arm flatness of ± 0.2 dB from nominal

Figure 2-1. HP 86205A Bridge Ports and Measurement Paths

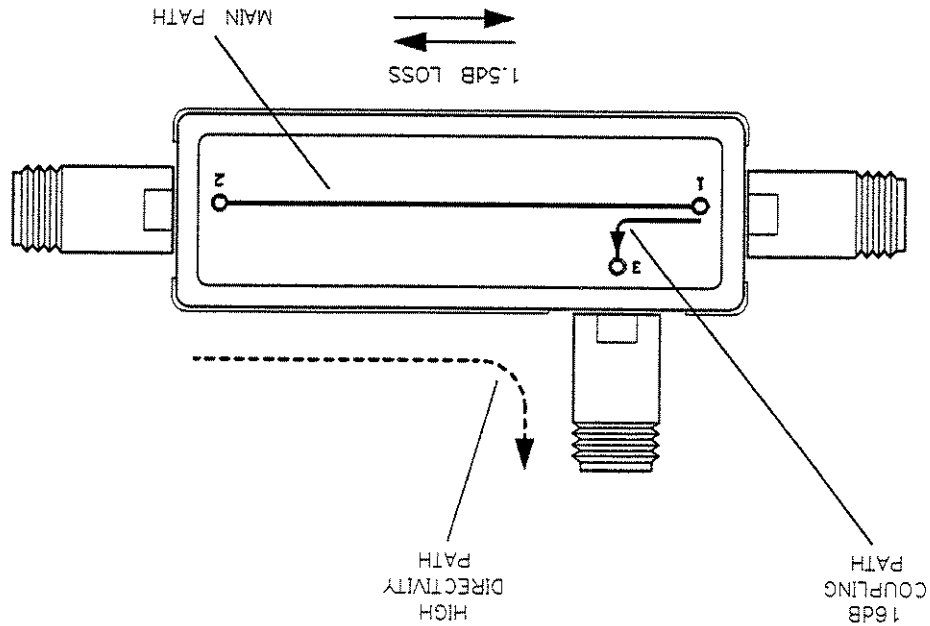


Figure 2-2. Location of Threaded Mounting Holes

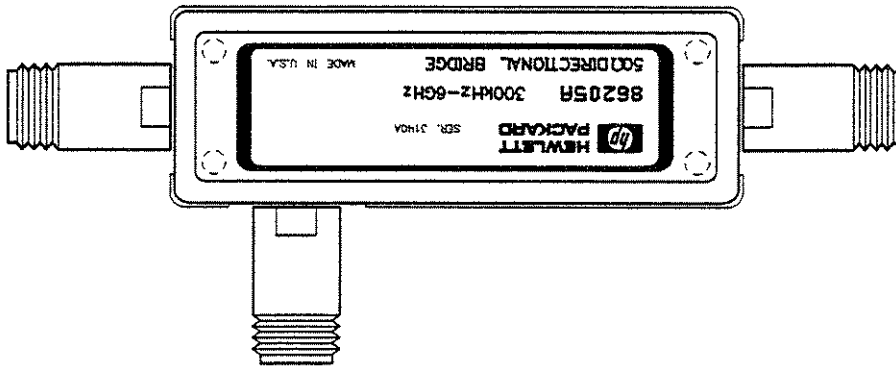


Figure 2-2. Since the bridge package is brass, appropriate caution must be taken to avoid damaging the threaded holes.

Operating Precautions

- Read and observe all cautions.
- Tighten the bridge connectors with fingers only.
- If you must use a wrench, use a torque wrench set at 9.2 cm·kg (12 lb·in).

Cautions



Electrostatic discharge (ESD) can damage the highly sensitive microcircuits in this device; an ESD as low as 1000V can destroy your bridge.

ESD damage occurs most often as you connect or disconnect a device. Use the bridge at a static-safe workstation and wear a grounding strap. *Never* touch the input connector center contacts, or the contact pins of a connecting cable.

Do *not* apply more than +25 dBm RF CW power, or more than 1 amp DC or 0 VDC to port 3 or 30 VDC to port 1 or 2 of the bridge. Higher current/power/voltage can electrically damage the bridge.

Before you connect a cable to the bridge, always discharge the cable's center conductor static electricity to instrument-ground.

Do not drop the bridge or subject it to mechanical shock.

Measurement Configurations

This section shows the HP 86205A directional bridge in the following configurations:

- remote reflection measurement using the HP 8711 network analyzer
- vector impedance measurement using two bridges and the HP 8753 network analyzer
- external power leveling with or without a controller
- reflection measurement using a spectrum analyzer and tracking generator

Remote Reflection Measurement Configuration

You can use remote sensing in applications where your DUT is not easily accessible. For example: when measuring the reflection coefficient of an antenna that is located on a tower.

To Set Up the Measurement

1. Connect the equipment as shown in Figure 2-3.

The cable length from the analyzer source to the bridge does not affect directivity, but may affect source match. However, you may put an attenuator between the cable and bridge to improve source match.

Connect the DUT either directly to the bridge or as close as possible.

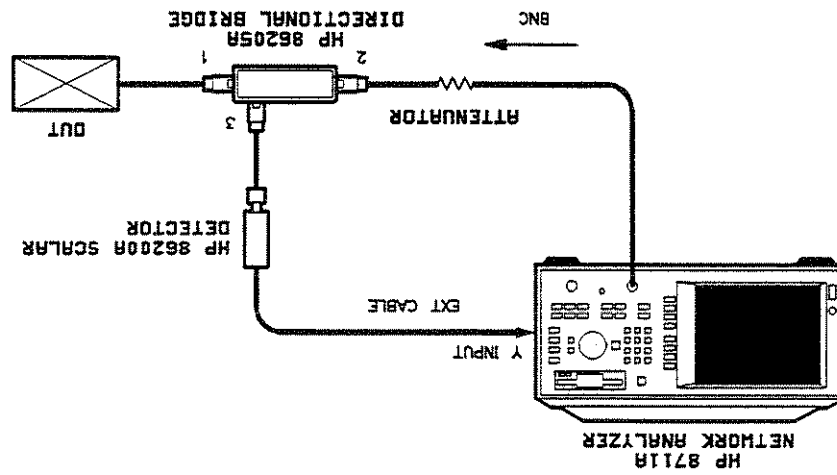
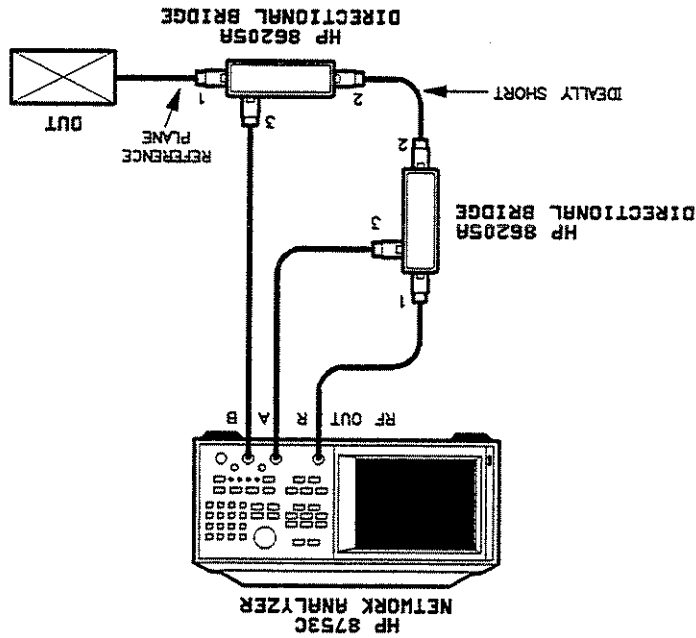


Figure 2-3. Remote Directivity Measurement Setup

Figure 2-4. Vector Impedance Measurement Setup



You may connect the analyzer input signal to either the A or B input port. Use an A/R or B/R ratio measurement to improve the source match.



Note

Vector Impedance Measurement Configuration

1. Connect the equipment as shown in Figure 2-4

To Set Up the Measurement

This configuration provides a low-cost custom test system when full 2-port measurements are not needed.

4. Connect the DUT to the bridge and adjust the scale/division under the **DISPLAY** key.
3. With nothing connected to the bridge, make a normalization of the measurement setup by pressing:
 - CAL** **Normalize**
2. Set the parameters on the analyzer to measure with an external detector by pressing:
 - CHAN 1** **Det Options** **Broadband External Y/R***

2. Choose the following parameters on the analyzer:

PRESET

MEAS A/R (or **B/R**) If you connected the analyzer input signal to

the B input port)

MENU POWER then enter the power value and press **X1**

NUMBER OF POINTS then enter the desired number

START then enter the start frequency and press **X1**

STOP then enter the stop frequency and press **X1**

3. Make a measurement calibration by pressing one of the following key sequences:

CAL

Cal Kit N 500

Return Calibrate menu

RESPONSE connect either an open or short calibration device to

the reference plane and press the corresponding **OPEN (F)** or

SHORT (F) key.

or

CAL Calibrate Menu

(for A/R) **S11 1-PORT**

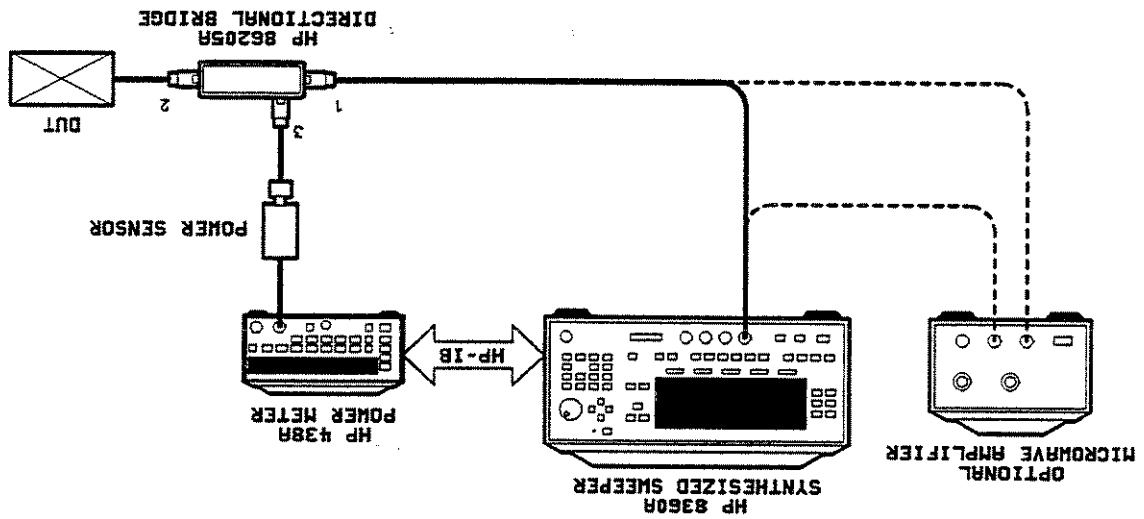
(for B/R) **S22 1-PORT**

Connect an open, short, and load calibration device to the reference plane while pressing the corresponding key for measurement.

4. Connect the DUT to the reference plane and adjust the scale/division under the **SCALE REF** key.

2. Zero and calibrate the power meter/sensor.
3. Enter the appropriate power sensor calibration factors into the power meter. (Can only be done with an HP 438A or 437B.)
4. Enable the power meter/sensor calibration array. For operating information on the power meter refer to its operating manual.
5. Connect the power sensor to the bridge as shown in Figure 2-5.
6. Set up the synthesizer parameters by pressing:

Figure 2-5. External Power Leveling Configuration



1. Connect the equipment as shown in Figure 2-5.

To Set Up the Measurement

The HP 8753 and HP 8625 sources can alternatively be used in this automated measurement configuration. By substituting a frequency counter for the power meter, this configuration can be used for signal monitoring.

External Power Leveling Configuration

The measurement configuration shown in Figure 2-5 provides precision power levels to a remote DUT. With a power meter and bridge, the source power can be monitored and automatically adjusted.

The 16 dB coupling factor is partially compensated by the through loss (1.5 dB) to give a 14.5 dB effective coupling factor (relative to the bridge output port).
 The bridge coupling flatness has as good as 0.1 dB/GHz power level roll-off with ± 0.2 dB error.



Note

Coupling Factor -14.5 (dB(m))

11. Set the coupling factor by pressing:

ALC Leveling Point Extd

10. On the HP 8360, press:

The power produced at the point where the power meter/sensor was disconnected is now calibrated at the frequencies and power level specified above.

FLTNSS ON/OFF (the amber LED should be on)

9. When a message is displayed, indicating the operation is complete, apply the flatness correction array to your measurement setup by pressing:

Mtr Meas Menu Measure Corr All

8. Set the power meter under synthesizer control to perform the sequence of steps necessary to generate the correction information at each frequency point by pressing:

Auto Fill Start and enter the desired start frequency
 Auto Fill Stop and enter the desired stop frequency
 Auto Fill Incr and enter the desired increment frequency
 value

PRIOR

Delete Menu Delete All

MENU Fitness Menu

7. Set up the user flatness correction by pressing:

PRESET
 START then enter the desired start frequency
 STOP then enter the desired stop frequency

7. Press **[MKR]** and position the marker with the front panel knob to measure the return loss at the frequency of interest.
 Terminate the second port of a two-port DUT.

6. Measure the DUT by connecting it to port 1 of the bridge.
 The normalized trace or flat line represents 0 dB return loss.

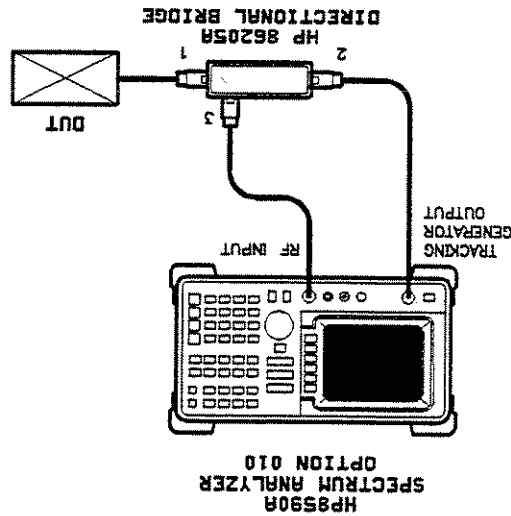
TRACE B CLEAR WRITE B
BLANK B MORE 1 OF 3 NORMALIZE ON
[TRACE]

5. Normalize the trace by pressing:
 4. Replace the DUT with a short circuit.
 3. Set the desired center frequency and span to view the DUT.

AUX CTRL
TRACK GEN SRC PWR ON

2. On the tracking generator, press:

Figure 2-6. Reflection Measurement Setup



1. Connect the equipment as shown in Figure 2-6.

To Set Up the Measurement

This configuration is for portable reflection measurement applications.

Reflection Measurement Configuration

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