

Keysight  
11590B  
Bias Network

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## 11590B Bias Network

### General Information

This Operating and Service Manual contains information required to install, operate and test the 11590B and 11590B Option 001 bias networks. The 11590B is equipped with Type-N female connectors and operates to 12.4 GHz. The 11590B Option 001 is equipped with precision 7 mm connectors and operates to 18.0 GHz.

### Specifications

Instrument specifications are listed in [Table 1](#). These specifications are the performance standards or limits against which the instrument is tested.

**Table 1 Specifications**

Electrical	
<b>Frequency Range</b>	
Standard	0.1 to 12.4 GHz
Option 001	0.1 to 18.0 GHz
<b>Impedance</b>	50 ohms nominal
<b>Port Match (both ports); Minimum Return Loss</b>	
Standard	
0.1 to 1.0 GHz	16 dB
1.0 to 12.4 GHz	19 dB
Option 001	
0.1 to 1.0 GHz	16 dB
1.0 to 12.4 GHz	19 dB
12.4 to 18.0 GHz	14 dB
<b>Insertion Loss; Maximum</b>	
Standard	
0.1 to 1.0 GHz	1.0 dB
1.0 to 12.4 GHz	0.8 dB
Option 001	
0.1 to 1.0 GHz	1.0 dB
1.0 to 12.4 GHz	0.8 dB
12.4 to 18.0 GHz	1.2 dB

**Table 1 Specifications**

<b>Maximum Bias Voltage</b>	100 Vdc
<b>Maximum Bias Current (each bias port)</b>	500 mA
<b>DC Resistance from Bias Port to Output Port at 23 °C (typical)</b>	3.0 ohms
<b>General</b>	
<b>Operating Temperature</b>	0 to 55°C
<b>RF Connectors (non-hermetic)</b>	
Standard	Type-N female
Option 001	Precision 7 mm
<b>Bias Connector (non-hermetic)</b>	BNC female
<b>Net Weight</b>	0.30 kg (0.7 lbs)
<b>Dimensions</b>	
In millimeters	54 x 51 x 28
In inches	2.2 x 2 x 2.1

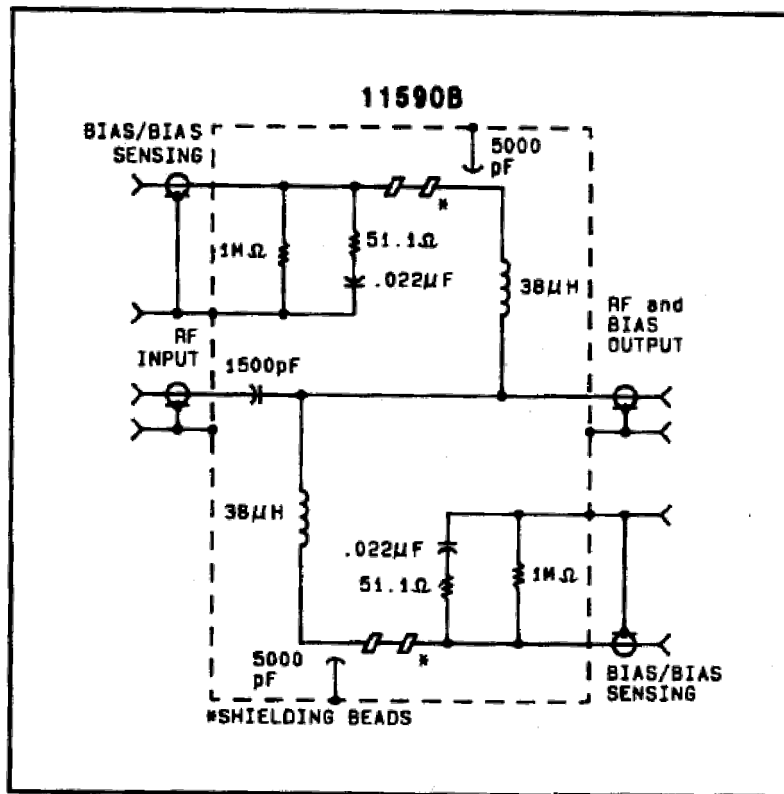
## Description

The 11590B bias network provides a means of supplying dc bias to the center conductor of a coaxial line and thus to a biasable component or device (such as a transistor), while blocking the dc bias from the input RF circuit.

A schematic diagram of the 11590B is shown in [Figure 1](#). The capacitor in the RF input arm acts as a dc block/high pass filter. The vertical arms are identical and act as bias/bias sense arms. Because the BIAS/BIAS SENSING port draws no current (it is connected to a high impedance voltmeter), the voltage measured is identical to the voltage at the RF and Bias Output. To double the maximum current handling capability, both BIAS/BIAS SENSING ports may be used for bias input.

A vertical arm is comprised of a series inductance and shunt capacitance which act together as a low pass filter. The ferrite beads and R-C filter decouple the power supply from the RF section and help to reduce the possibility of inductance related oscillation.

Figure 1 Schematic Diagram



11590\_020\_001

## Installation

### Initial Inspection

Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. Procedures for checking electrical performance are given under "PERFORMANCE TESTS". If the contents are incomplete, if there is mechanical damage or defect, or if the 11590B bias network does not pass the Performance Tests, notify Keysight Technologies – see "Contacting Keysight" on page 8. If the shipping container is damaged, or the cushioning material shows signs of stress, notify the carrier as well as Keysight. Keep the shipping materials for the carrier's inspection. The Keysight office will arrange for repair or replacement at Keysight's option without waiting for claim settlement.

### Preparation For Use

**Interconnections** The 11590B bias network is connected in line with the device to be biased. The bias is applied through either BIAS/BIAS SENSING port, and is sensed through the other BIAS/BIAS SENSING port.

**Mating Connectors** The mating connectors for Type-N connectors are the opposite gender Type-N connectors. Precision 7 mm connectors (Option 001) are genderless.

## Operating Environment

The instrument may be operated in environments within the following limits:

Temperature	0° to +55°C
Humidity	Up to 95%
Altitude	Up to 7625 meters (25,000 feet)

The instrument should be protected from temperature and humidity conditions which cause condensation within the instrument.

## Storage and Shipment

The instrument may be stored in environments within the following limits:

Temperature	-40°C to +75°C
Humidity	Up to 95%
Altitude	Up to 7625 meters (25,000 feet)

The instrument should be protected from temperature and humidity conditions which cause condensation within the instrument.

## Packaging

**Tagging for Service** If the instrument is being returned to Keysight for service, attach a tag indicating the type of service required, return address, and model number. See [“Contacting Keysight” on page 8](#).

**Original Packaging** Containers and materials identical to those used in factory packaging are available through Keysight offices. Mark the container FRAGILE to ensure careful handling.

**Other Packaging** The following general instructions should be used for re-packing with commercially available materials:

1. Wrap the instrument in heavy paper or plastic (If shipping to a Keysight office or service center, attach a tag as explained previously).
2. Use a strong shipping container.
3. Use a thick layer of shock absorbing material 70 to 100 mm (3 to 4 inches) thick around all sides of the instrument to provide firm cushioning and prevent movement inside the container.
4. Seal the shipping container securely.
5. Mark the shipping container FRAGILE to ensure careful handling.
6. In any correspondence, refer to the instrument by model number and full serial number.

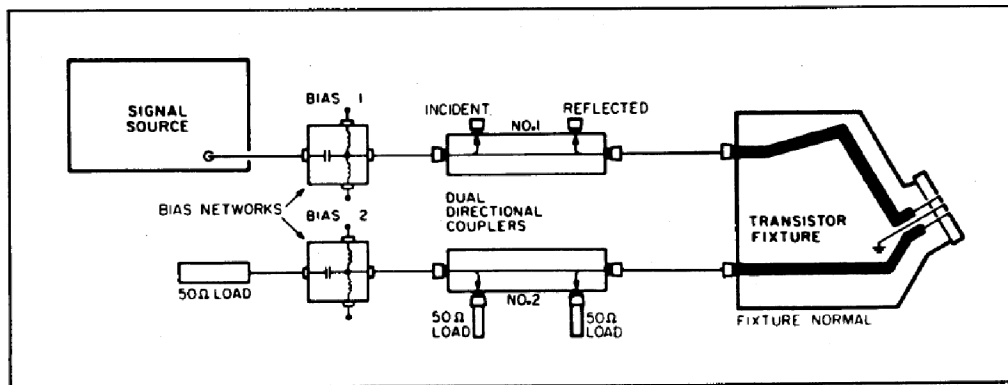
## Operation

### Operating Instructions

Figure 2 shows the Keysight 11590B bias network connected in a typical measurement setup. Many other applications are possible but not shown because the general method of setup and operation is the same.

The 11590B contains an in-line filter which will help prevent inductance related oscillations. However, to eliminate the possibility of oscillation with bipolar transistors, it is recommended that the 11635A bias decoupling network be used with the 11590B.

**Figure 2 Typical Measurement Setup**



11590\_020\_002

## Performance Tests

The procedures in this section tests the electrical performance of the 11590B using the specifications of Table 1 as performance standards.

### Test Record

Results of the performance tests may be tabulated on the Test Record at the end of the procedures.

Performance may be verified using either a vector or scalar network analyzer setup. Errors due to directivity, source match, and return loss of the "opposite port" termination (and detector match in a scalar system) will add uncertainties to your measurement. The most accurate method uses an error corrected instrument. However, a scalar system will give acceptable results depending on the quality of the components.

The following general instructions apply to both vector and scalar network analyzers.

### Return Loss Of Input and Output Ports (Port Match)

1. Connect the equipment for a standard reflection measurement.
2. Calibrate the system with the appropriate standards.
3. Connect the appropriate instrument port of the 11590B to the test port. Terminate the opposite port of the 11590B with a 50 ohm load.



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**NOTE** The Return Loss of the load should be at least 20 dB better than the desired measurement value.

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4. Measure the port match. The specifications are as follows:

**Port Match (both ports) – Minimum Return Loss**

Standard

0.1 to 1.0 GHz 16 dB

1.0 to 12.4 GHz 19 dB

Option 001

0.1 to 1.0 GHz 16 dB

1.0 to 12.4 GHz 19 dB

12.4 to 18.0 GHz 14 dB

**Insertion Loss**

1. Connect the equipment for a standard insertion loss measurement.
2. Calibrate the system with a through line.
3. Replace the through line with the 11590B.
4. Measure the insertion loss. The specifications are as follows:

**Insertion Loss – Maximum**

Standard

0.1 to 1.0 GHz 1.0 dB

1.0 to 12.4 GHz 0.8 dB

Option 001

0.1 to 1.0 GHz 1.0 dB

1.0 to 12.4 GHz 0.8 dB

12.4 to 18.0 GHz 1.2 dB

**Adjustments**

There are no mechanical or electrical adjustments on the 11590B bias network.

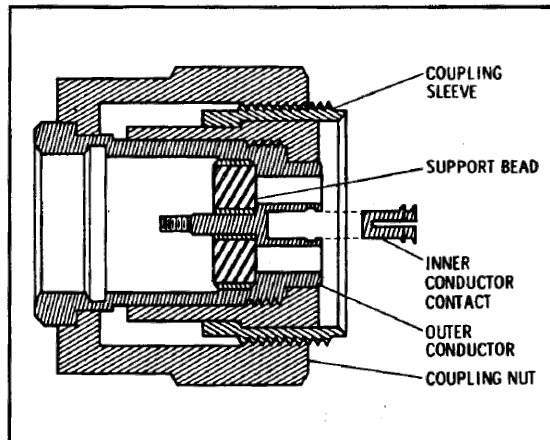
## Replacement Parts

### Inner Conductor Contact; Option 001

The center conductor collet (**Figure 3**) in the precision 7 mm connector, Keysight part number 1250-0907, may be replaced using a special extractor tool, Keysight part number 5060-0370. Examine the collet with a magnifying glass to determine if it is damaged. The collet must be free of burrs and the prongs must be equally spaced. If the collet needs to be replaced, perform the following procedure:

1. Place the instrument so that the connector faces down.
2. Tap the connector lightly on the outside ring and the center conductor collet should protrude slightly.
3. Compress the handle of the collet extractor tool, causing the jaws to expand, and insert the tool into the precision 7 mm connector.
4. Release the compression on the extractor tool, allowing the jaws of the tool to close on the center conductor collet. Pull the tool straight out from the connector without twisting. The collet will come out of the connector with the tool. Do not reuse the extracted collet.
5. To install a new center conductor collet, push the collet into the center conductor until it snaps into place. No special tool is required for this operation.

**Figure 3 Precision 7 mm Connector**



11590\_020\_003

## Service

There are no serviceable parts in the 11590B bias network.

## Test Record

Specifications Tested	Step	Test Cond. (GHz)	Limit (dB)	Result (dB)
<b>Port Match (Return Loss)</b>				
Standard	39	0.1 to 1.0	$\geq 16$	
		1.0 to 12.4	$\geq 19$	
Option 001	39	0.1 to 1.0	$\geq 16$	
		1.0 to 12.4	$\geq 19$	
		12.4 to 18.0	$\geq 14$	
<b>Insertion Loss</b>				
Standard	40	0.1 to 1.0	$\leq 1.0$	
		1.0 to 12.4	$\leq 0.8$	
Option 001	40	0.1 to 1.0	$\leq 1.0$	
		1.0 to 12.4	$\leq 0.8$	
		12.4 to 18.0	$\leq 1.2$	

## Contacting Keysight

Assistance with test and measurement needs and information on finding a local Keysight office are available on the Web at:

[www.keysight.com/find/assist](http://www.keysight.com/find/assist)

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**NOTE** In any correspondence or telephone conversation, refer to the Keysight product by its model number and full serial number. With this information, the Keysight representative can determine whether your product is still within its warranty period.

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