Agilent Technologies

911D/E Sliding Load

Operating and Service Manual

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In This Manual…

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Product maintenance agreements and other customer assistance agreements are available for Agilent Technologies products.

For assistance, call your local Agilent Technologies Sales and Service Office (refer to "Service and Support" on page vi).

Service and Support

Any adjustment, maintenance, or repair of this product must be performed by qualified personnel. Contact your customer engineer through your local Agilent Technologies Service Center. You can find a list of local service representatives on the Web at: `http://www.agilent.com/find/assist`

If you do not have access to the Internet, one of these centers can direct you to your nearest representative:

United States (tel) 1 800 452 4844	**Latin America** (tel) (305) 269 7500 (fax) (305) 269 7599	**Canada** (tel) 1 877 894 4414 (fax) (905) 282-6495	**Europe** (tel) (+31) 20 547 2323 (fax) (+31) 20 547 2390
New Zealand (tel) 0 800 738 378 (fax) (+64) 4 495 8950	**Japan** (tel) (+81) 426 56 7832 (fax) (+81) 426 56 7840	**Australia** (tel) 1 800 629 485 (fax) (+61) 3 9210 5947	

Asia Call Center Numbers

Country	Phone Number	Fax Number
Singapore	1-800-375-8100	(65) 836-0252
Malaysia	1-800-828-848	1-800-801664
Philippines	(632) 8426802 1-800-16510170 (PLDT Subscriber Only)	(632) 8426809 1-800-16510288 (PLDT Subscriber Only)
Thailand	(088) 226-008 (outside Bangkok) (662) 661-3999 (within Bangkok)	(66) 1-661-3714
Hong Kong	800-930-871	(852) 2506 9233
Taiwan	0800-047-866	(886) 2 25456723
People's Republic of China	800-810-0189 (preferred) 10800-650-0021	10800-650-0121
India	1-600-11-2929	000-800-650-1101

Safety and Regulatory Information

Review this product and related documentation to familiarize yourself with safety markings and instructions before you operate the instrument. This product has been designed and tested in accordance with international standards.

WARNING

The WARNING notice denotes a hazard. It calls attention to a procedure, practice, or the like, that, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

CAUTION

The **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

Instrument Markings

	When you see this symbol on your instrument, you should refer to the instruments instruction manual for important information.
	This symbol indicates hazardous voltages.
	This symbol indicates that the instrument requires alternating current (ac) input.
	The CE mark is a registered trademark of the European Community. If it is accompanied by a year, it indicates the year the design was proven.
	The C-Tick mark is a registered trademark of the Australian Spectrum Management Community.
	The CSA mark is a registered trademark of the Canadian Standards Association.
1SM1-A	This text indicates that the instrument is an Industrial Scientific and Medical Group 1 Class A product (CISPER 11, Clause 4).

	This symbol indicates that the power line switch is ON.
	This symbol indicates that the power line switch is in STANDBY position.
	This symbol indicates that the power line switch is OFF

Safety Earth Ground

This is a Safety Class I product (provided with a protective earthing terminal). An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power cord, or supplied power cord set. Whenever it is likely that the protection has been impaired, the product must be made inoperative and secured against any unintended operation.

Before Applying Power

Verify that the product is configured to match the available main power source as described in the input power configuration instructions in this manual. If this product is to be powered by autotransformer, make sure the common terminal is connected to the neutral (grounded) side of the ac power supply.

Typeface Conventions

Italics

- Used to emphasize important information:
  Use this software *only* with the Agilent 8494A/B, 8495A/B, 8496A/B.
- Used for the title of a publication:
  Refer to the *Agilent 911D/E Operating And Service Manual*.
- Used to indicate a variable:
  Type `LOAD BIN` *filename*.

`Instrument Display`

- Used to show on-screen prompts and messages that you will see on the display of an instrument:
  The Agilent 8494A/B, 8495A/B, 8496A/B will display the message **`CAL1 SAVED`**.

[Keycap]

- Used for labeled keys on the front panel of an instrument or on a computer keyboard:
  Press **[Return]**.

{Softkey}

- Used for simulated keys that appear on an instrument display:
  Press ***{Prior Menu}***.

`User Entry`

- Used to indicate text that you will enter using the computer keyboard; text shown in this typeface must be typed *exactly* as printed:
  Type `LOAD PARMFILE`
- Used for examples of programming code:

```
#endif // ifndef NO_CLASS
```

`Path Name`

- Used for a subdirectory name or file path:
  Edit the file *`usr/local/bin/sample.txt`*

Computer Display

- Used to show messages, prompts, and window labels that appear on a computer monitor:
  The **Edit Parameters** window will appear on the screen.
- Used for menus, lists, dialog boxes, and button boxes on a computer monitor from which you make selections using the mouse or keyboard:
  Double-click **EXIT** to quit the program.

Overview

This operating and service manual provides information for the Agilent 911D/E sliding loads. The Agilent 911D/E each have a single APC-3.5 male connector.

Description

The coaxial sliding load and mismatch are movable, low reflection loads used to make precision microwave measurements. By moving the load, its reflection can be separated from the other reflections in the system. This technique allows you to measure the directivity of coaxial directional couplers and the residual standing wave ratio (SWR) of coaxial slotted lines. The sliding mismatch is mechanically similar to the sliding load except that its reflection is somewhat higher so that a known mismatch can be introduced into a system for calibration. The reflection is between 23 dB and 28 dB over the frequency range from 3 to 26.5 GHz.

The sliding load contains a hollow cylindrical iron-bearing plastic load element that surrounds the center conductor. The gradual tapering of the load element enables it to absorb the applied RF energy.

The load element can be moved within the instrument body at least one-half of a wavelength at the lowest rated frequency (3 GHz). Some applications may require that the load element be moved in precise steps. There are 6 marks scribed along the body of the load. Use these marks for optimum calibration of the vector network analyzer.

Specifications

Instrument specifications are listed in Table 1. The specifications are the performance standards, or limits, against which the instrument may be tested.

Table 1 Specifications

Specified Information	**Agilent 911D Load**	**Agilent 911E Load**
Connector type	APC 3.5	APC 3.5
Connector sex	Male	Female
Frequency range	3 to 26.5 GHz (usable to 33 GHz)	3 to 26.5 GHz (usable to 33 GHz)
Load stability (plus connector and air line)		
3 to 20 GHz	<0.004	<0.004
20 to 26.5 GHz	<0.004	<0.004
Power rating		
Average	1 W	1 W
Peak	I kW	1 kW
Load element travel	Half of a wavelength at 3.0 GHz (5 cm minimum)	
Dimensions		
Length	25.6 cm (10.1 in)	25.6 cm (10.1 in)
Weight	120 g (4.25 oz)	120 g (4.25 oz)

Environment

Keep the environments where the instrument is to be used or stored and shipped within the following conditions.

Parameter	**Equipment Operation**	**Equipment Storage and Shipping**
Temperature	+15 °C to +35 °C (or network analyzer operating temperature range, whichever is less)	-40 °C to +70 °C
Relative Humidity	<80% relative humidity at 40 °C	<90% relative humidity at 40 °C
Altitude	<4,570 m (15,000 ft)	<15,300 m (50,000 ft)

Handling Precautions and Inspection

Handling Precautions

Do not drop or otherwise mechanically damage the instrument. Do not remove the center conductor unnecessarily since bowing the center conductor causes the SWR to change. The instrument should be kept in its original carrying case when it is not being used. The case helps prevent dust from forming on the center conductor. Dust can become abrasive and can interfere with the load performance capability.

Initial Inspection

Check the shipping container and cushioning materials for damage. Carefully examine the contents for possible damage incurred during shipment. Check the contents received with the packing list to verify the shipment is complete.

If the contents are incomplete or damaged, or the instrument fails its electrical performance test (use the procedures in your network analyzer's operating and service manual), notify an Agilent Technologies Sales and Service Office engineer. In addition, notify the carrier and retain the shipping materials for the carrier's inspection.

Packaging Materials

Original shipping containers should be retained in the event the instrument needs to be returned to the factory. Materials identical to those used are available for purchase through an Agilent Technologies Sales and Service Office. When returning instruments to the factory, include a completed service tag. The tag should state the type of service needed, your address, the instrument model number and its serial number. Mark the container *FRAGILE* to assure careful handling. Refer to the instrument by model number and serial number in any correspondence.

Principles of Operation

The sliding load is used to determine the magnitude of reflection due to the load, and the magnitude of fixed reflections due to the system. By moving the load element, the reflection from the load can be separated from other reflections in the system. This enables quantities such as the directivity of coaxial directional couplers or residual SWR of coaxial slotted lines to be measured.

The load connector and body have a fixed reflection that must be considered when making measurements. The magnitude of the load element's reflection does not change with position of the load, however, the phase does change. The phase determines how the load element's reflection combines vectorially with the fixed reflection of the system. By sliding the load element, all phase combinations of the system's fixed reflections with the load element's reflection are obtained. As the load element is moved, its reflection vector rotates in a circle about the tip of the system's connector and transmission line vector (see Figure 1). The load element reflection error can be eliminated and extremely small reflection quantities can be measured.

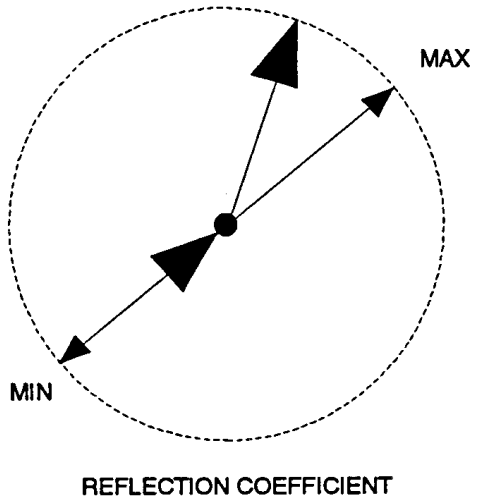

Figure 1 Reflection Coefficient Vector Relationship

Connecting the Load

Check that the mating-plane surfaces and center conductors are clean and free of grit. To connect the load and ensure that the center conductor and conductor body are making good contact, refer to Figure 2 and proceed as follows.

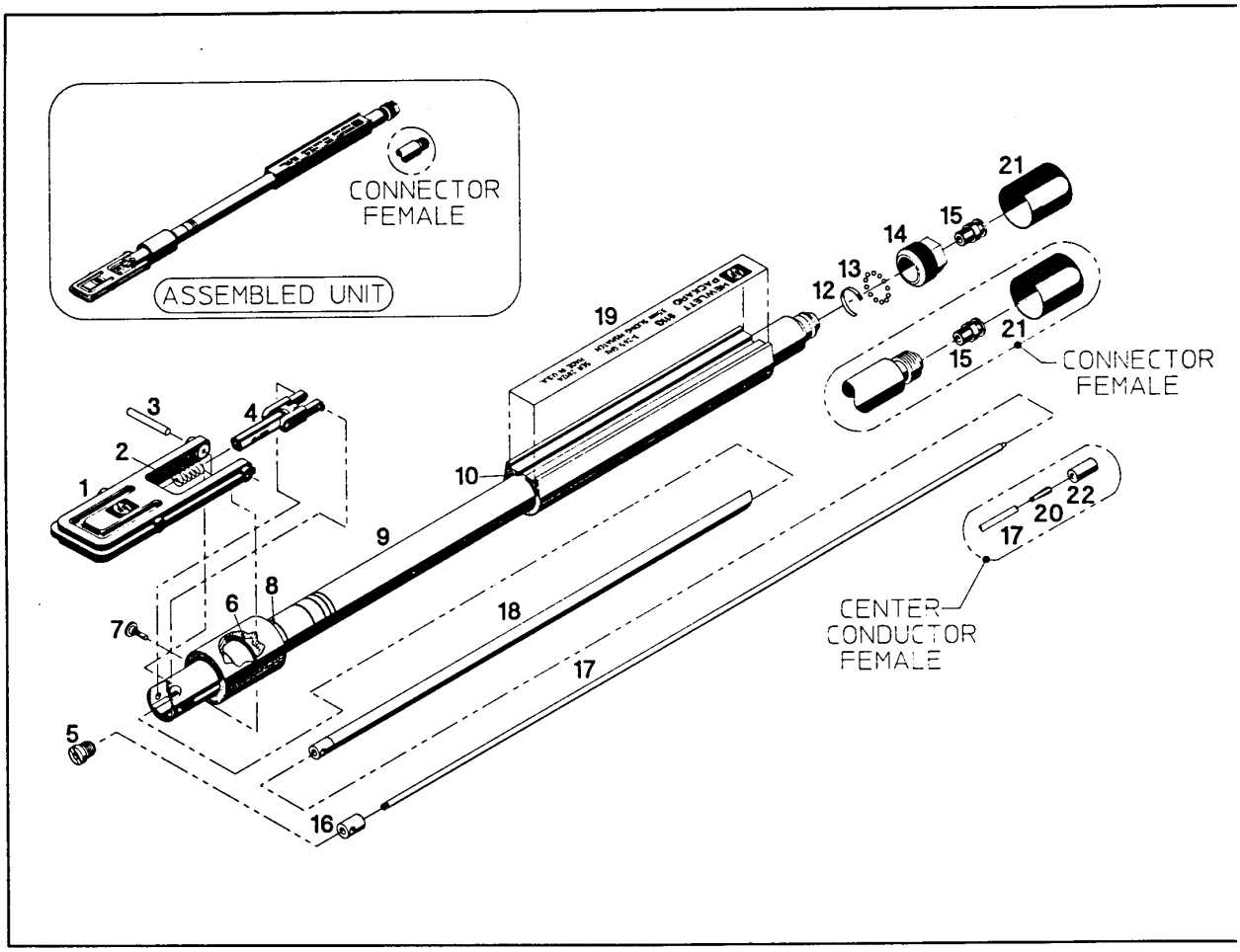

Figure 2 Illustrated Parts Breakdown

1. For Agilent 911E use a 3.5 mm female pin-depth gage (Agilent part number 11752-60021), and a torque wrench set to 8 inch-pounds (0.9N-m). Set the pin depth to 0.000 inch protrusion.

   For Agilent 911D use a 3.5 mm male pin depth-gage (Agilent part number 11752-60020), and a torque wrench set to 8 inch-pounds. Use a centering bead (Agilent part number 85052-20057) to set the pin-depth to 0.000 inch protrusion.

2. Release the lock (1) and mate the center conductor pin (17) firmly against the mating connector's center-conductor pin.

CAUTION

Keep the center conductors of the two connectors aligned. Misalignment causes damage to the female center conductor pin.

3. Thread on the coupling nut. Use a torque wrench set to 8 inch-pounds (0.9 N-m) and torque the connector bodies.
4. After ensuring the center conductor pins are correctly mated, latch the lock (1).

   Periodically inspect and clean the load's center and outer conductor surfaces at the reference plane for wear and debris.

Disconnecting the Load

CAUTION

Avoid damaging the center conductor. Keep the center conductor in locked position while you disconnect the load.

Avoid damage to the swivel assembly. To lock the center conductor while the load is disconnected, you must first make sure to pull the handle back completely, before setting the handle down into the locked position.

Performance Tests

Verification of instrument performance over its specifications is achieved by measuring the network analyzer's system directivity. Refer to the operating manual of the network analyzer under calibration for the directivity performance test.

Adjustments

The center conductor in the instrument may be adjusted for connector pin depth. Use a pin-depth gage as specified in “Connecting the Load” on page -5. Once the pin-depth is set, lock the center conductor and adjust the set screw beneath the lock handle. Use a torque wrench set to 8 inch-pounds (0.9 N-m).

Replacing the Load Element

To replace the iron-bearing plastic load element, use Figure 2 for reference as you follow the procedure below:

Dissemble the Load

1. Spread the tabs on the handle (1) to free it from the spiral pin (3).
2. Pull the handle away from the swivel assembly (4), being careful not to lose the spring (2) from the internal hole in the handle.
3. Squeeze the tabs of the swivel assembly together to free them from the two holes in the end of the handle.
4. Use a small, flat-bladed screwdriver to remove the tuning element (5) from the end of the load element (18). If needed, use a heat-gun to soften the glue securing the tuning element so that it can be removed.
5. Carefully remove the spiral pin (3) from the load body (9).
6. Carefully remove the center conductor (17). Be very careful not to bend and damage the center conductor.
7. Move the sliding load handle (8) toward the handle end of the load assembly.
   a. Use a small posi-drive screwdriver to remove the load screw (7).
   b. Very carefully and gently remove the load element (18) from the body.
   c. Slide the load handle off the end of the body.
   d. If necessary, remove to replace the 0-ring.
8. Clean a dirty load, internally, using a small diameter rod (about 0.035 to 0.040 inches diameter).

NOTE

Hold the load near the collar as you clean it. Do not hold it near the end that has the diagonal cut.

   a. Use compressed air to blow out any dirt inside the load. Be careful not to damage the diagonal cut at the end of the load.
   b. Wrap a bit of cotton around the end of the rod.
   c. Swab the inside of the load with back and forth motions, finally pushing the swab out the end with the aluminum collar.

d. Carefully inspect, and then clean the center conductor with a cotton swab. Be careful not to bend the center conductor.

e. Replace a damaged or worn center conductor.

9. Remove the coupling nut (14) from the 911D.

   a. Remove the retaining ring (12).

   b. Slide the coupling nut back to allow the ball bearings (13) to drop out through the hole in the nut.

   c. After removing all 12 ball bearings, slide the coupling nut off the end of the load body.

Reassemble the Load

1. Insert the load into the handle-end of the body, diagonal cut end first.

   a. Align the hole in the aluminum collar with the long slot in the body.

   b. Move the sliding load handle so that the hole in the handle aligns with the hole in the aluminum collar.

   c. Drop the load screw (7) into the hole in the handle.

   d. Carefully, thread then tighten the screw into the collar. If the screw does not thread into the load collar, damage can result.

2. Move the sliding load handle toward the rear of the load body.

   a. Insert the center conductor (17) into the body and align the hole in the center conductor with the long and short slots in the body.

   b. Insert the spiral pin (3) through the slots and the hole in the end of the center conductor.

3. To complete the reassembly, follow the steps in the disassembly procedure in reverse order.

Replaceable Parts

Table 2 lists the replaceable parts for the load. To order a replaceable part, address your order or inquiry to one of the Agilent Technologies Sales and Service Offices listed at the end of this document.

In your correspondence to the office, include the instrument's model number, the part number needed, and a brief description of the part.

NOTE

In addition you may order the Sliding Load Handle Replacement Kit, Agilent part number 85052-60047.

Table 2 Load Assembly Replaceable Parts

Item Number	Part Number	Description
1	00911-20055	Handle
2	1460-0212	Compression spring
3	1480-0722	Spiral Pin
4	00915-40008	Swivel assembly
4	5021-9682	Plunger-slider load (p/o swivel assembly) (911E)
5	9135-0344	Tuning element
6	0905-1138	O-Ring (0.375 in x 0.500 in)
7	00915-20006	Load screw
8	00911-20055	Sliding-load body
9	00911-20061	Male body (911D)
9	00911-20062	Female body (911E)
10	00911-40005	Extrusions
11	Not Assigned	
12	1250-2078	Retaining ring (911D)
13	1410-0059	Ball BPG Type (911D)
14	5021-7070	Coupling nut (911D)
15	00911-20059	Support plug
16	00911-20063	Center conductor carriage
17	00911-20047	Male center conductor (911D)
17	00911-20049	Female center conductor (911E)

Item Number	Part Number	Description
18	00911-20064	Load element (911D/E)
18	00911-20065	Blunt load element (911E)
19	00911-80009	ID label (911D)
19	00911-80010	ID label (911E)
20	5021-6558	Slotless contact (911E)
21	1401-0200	Protective cover (911D)
21	1401-0202	Protective cover (911E)
22	85052-20057	Centering bead (911E)