

OPERATION AND MAINTENANCE MANUAL FOR AIR LINES

1. INTRODUCTION

This manual describes the Model 18 and 19 Series Air Lines (Figure 1). It provides specifications, performance verification instructions, and a list of precautions the user should observe when using air lines.

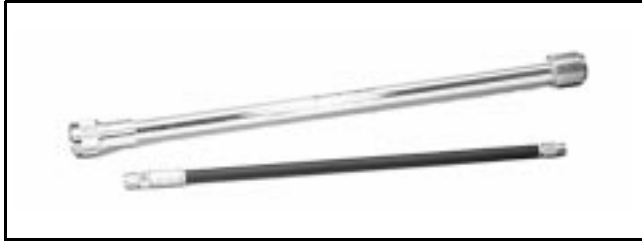


Figure 1. Models 18A50 and 19S50 Air Lines

2. DESCRIPTION

The 18 and 19 series air lines are precision-machined metal tubes containing a center conductor surrounded by an air dielectric. They are used as impedance standards, and as delay lines for measuring return loss using the ANRITSU precision return loss technique. This technique is described in

ANRITSU Application Note AN54100A-2, *Precision Return Loss Measurements*.

3. SPECIFICATIONS

Table 1 provides air line performance specifications.

4. PRECAUTIONS

ANRITSU 18 and 19 series air lines are high-quality, precision laboratory devices and should receive the same care and respect afforded such devices. Complying with the following precautionary notes will guarantee longer component life and less equipment downtime due to connector failure. Also, such compliance will ensure that RF component failures are not due to misuse or abuse—two failure modes not covered under the ANRITSU warranty.

- a. **Beware of Destructive Pin Depth on Mating Connectors.** Measure the pin depth (Figure 2) of the connector that mates with the RF component, *before* mating. Use a ANRITSU Pin Depth Gauge (Figure 3) or equivalent. Based on RF components returned for repair, destructive pin depth on mating connectors is the major cause of failure in the field. When an RF component

Table 1. Performance Specifications

Model	Frequency Range (GHz)	Test Port Connector	Beaded Port Connector	SWR	Diameter (mm)	Length (cm)
18A50*	0.5 to 18	GPC-7	GPC-7	1.003 (Test Port) 1.020 (Beaded End)	7	30
18N50	0.5 to 18	N Male	GPC-7	1.006	7	30
18NF50		N Female				
19S50	0.8 to 26.5	WSMA Male	WSMA Male	1.006 to 18 GHz 1.010 to 26.5 GHz	3.5	25
19SF50		WSMA Female				
19K50	0.8 to 40	K Male	K Male	1.020	2.9	15
19KF50		K Female				

* A Model 21A-1 Short is required for use with the Model 18A50 in a 5600-P1 Accuracy Enhancement Test System. This short has a colletted GPC-7 connector.



connector is mated with a connector having a destructive pin depth, damage will likely occur to the RF component connector. (A destructive pin depth has a center pin that is too long in respect to the connector's reference plane.)

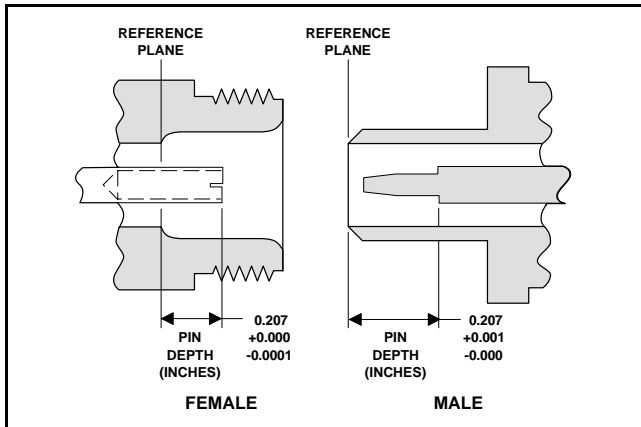


Figure 3. N Connector Pin Depth Definition

The center pin on an RF component connector has a precision tolerance measured in mils (1/1000 inch), whereas connectors on test devices that mate with RF components may not be precision types. Their pins may not have the proper depth. *They must be measured before mating to ensure suitability.* When gauging pin depth, if the test device connector measures out of tolerance in the “+” region (Table 2), the center pin is too long. Mating under this condition will likely damage the RF component connector. On the other hand, if the test device connector measures out of tolerance in the “-” region, the center pin is too short. While this will not cause any damage, it will result in a poor connection and a consequent degradation in performance.

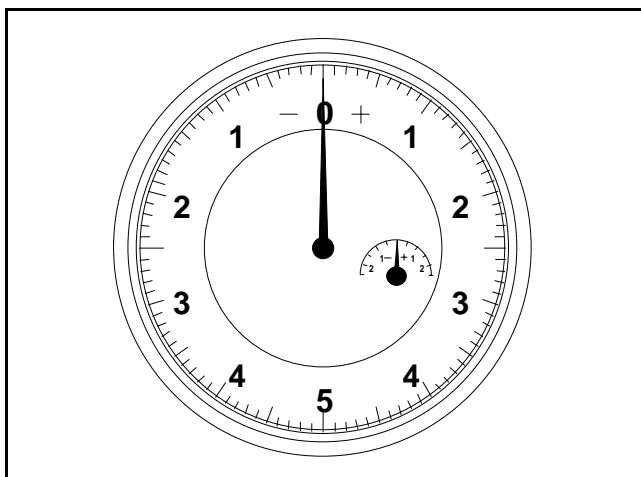


Figure 2. Pin Depth Gauge

Table 2. RF Connector Pin Depth

Series	Port/ Connector Type	Pin Depth (Mils)	ANRITSU Gauge Reading
18A50	Beaded GPC	+0.000 -0.003	Same As Pin Depth
	Beadless GPC	+0.0000 -0.0006	
18N50	Beaded GPC	+0.000 -0.003	207 +0.000 -0.001
	Beadless N	207 -0.000 +0.001	
	Beadless NF	207 -0.000 +0.001	
19S50	Beaded WSMA	-0.003±0.0007	Same As Pin Depth
	Beadless WSMA	-0.003±0.0005	
19SF50	Beaded WSMA	-0.003±0.0007	Same As Pin Depth
	Beadless WSMA	-0.0005 ±0.0005	
19K50 19KF50	Beaded K	0.000 to -0.003	Same As Pin Depth
	Beadless K	0.000 to -0.001	

- b. Avoid Over Torquing Connectors.** Over torquing connectors is destructive; it may damage the connector center pin. Finger-tight is usually sufficient, especially on Type N connectors. *Never* use pliers to tighten connectors.
- c. Do Not Disturb Teflon Tuning Washers On Connector Center Pins.** The center conductor on many RF component connectors contains a small teflon tuning washer located near the point of mating (interface) (Figure 4). This washer compensates for minor impedance discontinuities at the interface. The washer's location is critical to the RF component's performance. *Do not disturb it.*
- d. Avoid Mechanical Shock.** RF components are designed to withstand years of normal bench handling. However, do not drop or otherwise treat them roughly. They are laboratory-quality devices and, like other such devices, require careful handling. All air lines are shipped from the factory in sturdy, wooden boxes containing foam padding. These boxes should be used to store the air line when it is not in use.
- e. Keep Air Line Connectors Clean.** The precise geometry that makes the RF component's high performance possible can be easily disturbed by dirt and other contamination adhering to connector interfaces. When not in use, keep

the connectors covered. Refer to paragraph 7 for cleaning instructions.

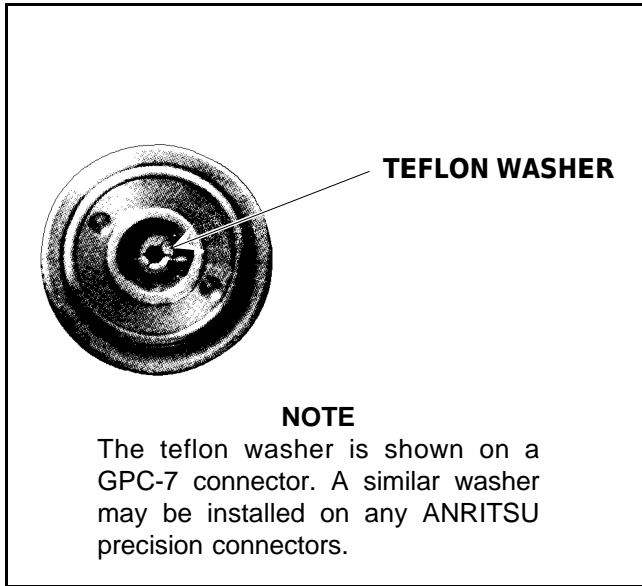


Figure 4. Tuning Washer on GPC-7 Connector

5. OPERATION

The 18 and 19 series air lines are equipped with a beadless connector on one end and a beaded connector on the other. The beadless connector is used at the measurement end to provide a connection with minimum reflection.

The beaded end connects to the test port of the SWR Autotester or bridge and holds the center conductor captive. The beaded end also fixes the plane of reference at the beadless end. A typical test setup for using the air line to measure return loss is shown in Figure 4.

Operation with an air line requires an awareness of the following:

19S50 and 19SF50: Use one of the compensating washers packaged with the air line when mating the air line with the termination. The WSMA connectors on these components have been designed for measuring SMA connectors. When two WSMA connectors are mated together, they require a washer for pin-depth compensation of the center conductors.

CAUTION

When connecting any air line to a DUT, always turn the coupling nut, rather than the DUT or air line. To do otherwise loosens the center pin on the air line, causing a change in pin depth and a consequent degradation in the air line's performance.

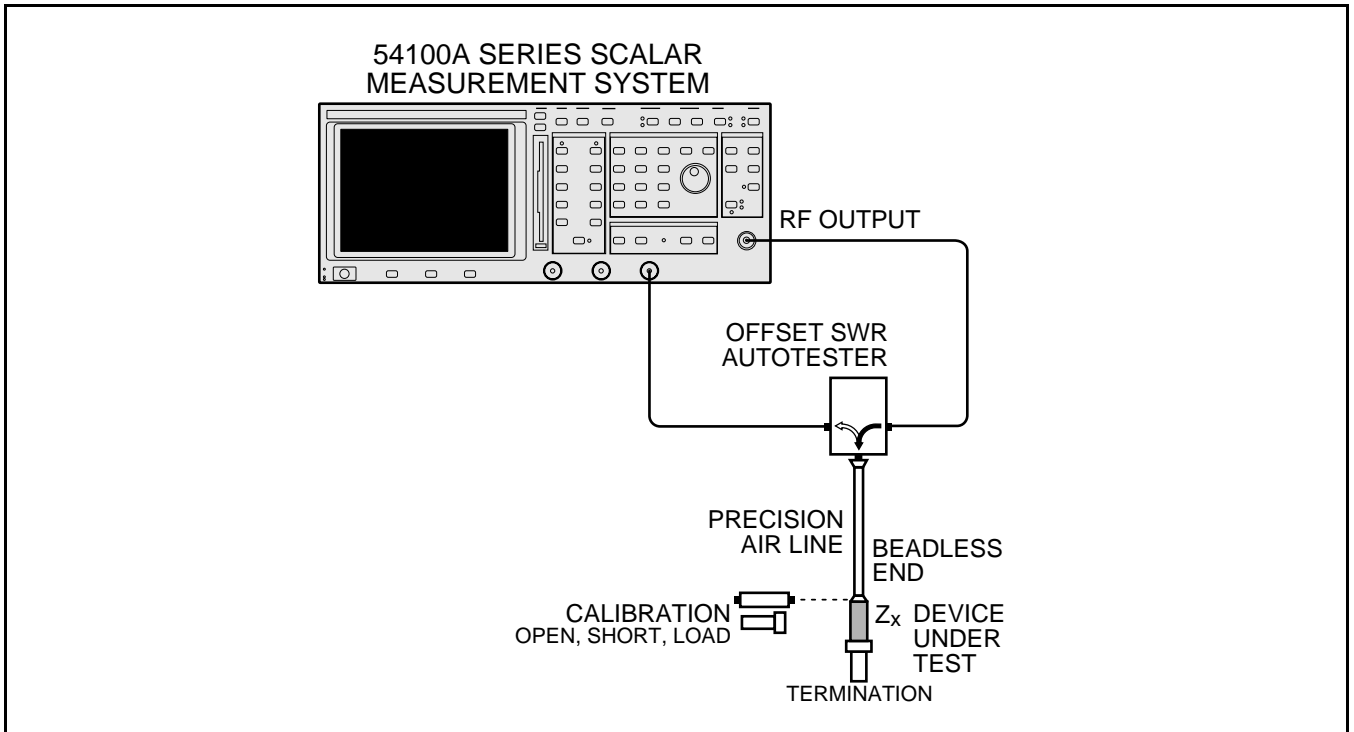


Figure 5. Typical Test Setup for Measuring Return Loss Using an Air Line

6. PERFORMANCE VERIFICATION

Performance verification consists of measuring the pin depth on the air line connectors. Gauging sets for measuring the pin depth of the 18 and 19 series air lines are available from ANRITSU. Table 3 provides a listing that correlates each air line type with its appropriate gauging set. Instructions for gauging the air line connectors are provided with the gauging set.

Table 3. Available Gauging Sets

Model	Connector Type	Gauging Set Model
18A50	GPC-7	01-161
18N50	N Male	01-163
18NF50	N Female	
19S50	WSMA Male	01-162
19SF50	WSMA Female	
19K50	K Male	01-162
19KF50	K Female	

7. MAINTENANCE

ANRITSU recommends that no maintenance other than cleaning be attempted by the customer. The air line should be returned to ANRITSU for repair and/or service when needed.

To clean the connector interfaces, use alcohol and a clean, damp, cotton swab.

CAUTION

If installed, do not disturb the teflon washer on the center conductor.