

OPERATING AND MAINTENANCE MANUAL FOR PRECISION TERMINATIONS

1. INTRODUCTION

This manual describes the 28 series 50-ohm terminations and the 29 series offset-reference terminations. It provides specifications, performance verification instructions, and a list of precautions the user should observe when using terminations.



Figure 1. Model 28K50 50 Ohm Termination and Model 28NF50-2 50 Ohm Termination

2. DESCRIPTION

The 28 series terminations consist of precision resistors housed in Type N, GPC-7, WSMA, K, V and W1 precision-connector bodies. The 29 series are precision terminations housed in GPC-7, WSMA and K bodies that produce a 15 or 20 dB reflection of radio and microwave frequency energy.

3. SPECIFICATIONS

Table 1 provides performance specifications for the 28 series terminations, and Table 2 provides specifications for the 29 series offset terminations.

4. PRECAUTIONS

Anritsu terminations are high-quality, precision laboratory instruments and should receive the same care afforded other such instruments. 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 termination 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.** Before mating, measure the pin depth (Figure 2) of the device that will mate with the termination, using a pin depth gauge (Figure 3) or equivalent. Based on terminations returned for repair, destructive pin depth of mating connectors is the major cause of failure in the field. When the termination is mated with a connector having a destructive pin depth, damage will likely occur to the termination. (A destructive pin depth has a center pin that is too long in respect to the connector's reference plane.)

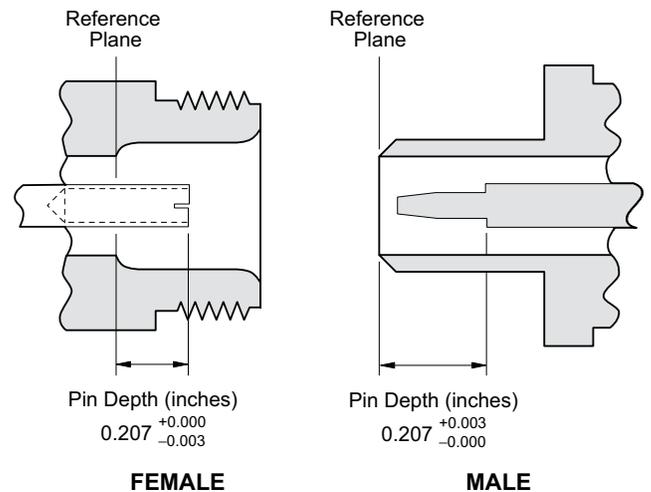


Figure 2. N Connector Pin Depth Definition

Table 1. Performance Specifications for 28 Series Precision Terminations

All Models: Max. Input Power: 0.5 watts (+27 dBm) Characteristic Impedance is 50 Ohms			
Model	Frequency Range (GHz)	Test Port Connector	SWR
28N50-3	DC to 8	N Male	1.03
28NF50-3		N Female	
28N50-2	DC to 18	N Male	1.02 Max.
28NF50-2		N Female	
28A50	DC to 18	GPC-7	1.01 + 0.001F (F in GHz)
28A50-1			1.01 + 0.001F, 1.02 Max. (F in GHz)
28S50-1	DC to 26.5	WSMA Male	1.020 to 18.5 GHz 1.153 to 26.5 GHz
28SF50-1	DC to 26.5	WSMA Female	1.020 to 18.5 GHz 1.153 to 26.5 GHz
28K50	DC to 40	K Male	1.040 to 18.5 GHz 1.070 to 26.5 GHz 1.135 to 40 GHz
28KF50		K Female	
K210	DC to 40	K Male	1.106 to 18 GHz 1.253 to 40 GHz
V210	DC to 65	V Male	1.120 to 18 GHz 1.253 to 26.5 GHz 1.329 to 40 GHz 1.432 to 65 GHz
28V50C	DC to 67	V Male	1.018 to 26 GHz 1.030 to 20 GHz 1.050 to 50 GHz 1.080 to 65 GHz 1.100 to 67 GHz
28VF50C		V Female	
28W50	DC to 110	W1 Male	1.046 to 20 GHz 1.058 to 65 GHz 1.330 to 110 GHz
28WF50		W1 Female	

Table 2. Performance Specifications for 29 Series Offset-Reference Terminations

All Models: Max. Input Power: 0.25 watts (+24 dBm)			
Model	Frequency Range (GHz)	Test Port Connector	Return Loss (dB)
29A50-20	DC to 18	GPC-7	20 ± 0.5 to 1 GHz 20 ± 1.0 to 4 GHz 20 ± 1.5 to 18 GHz
29S50-20	DC to 26.5	WSMA Male	20 ± 1.5 to 18.5 GHz 20 ± 2.5 to 26.5 GHz
29SF50-20	DC to 26.5	WSMA Female	20 ± 1.5 to 18.5 GHz 20 ± 2.5 to 26.5 GHz
29K50-15	DC to 40	K Male	15 ± 1.5 to 18.5 GHz 15 ± 2.5 to 26.5 GHz 15 ± 3.5 to 40 GHz
29KF50-15	DC to 40	K Female	15 ± 1.5 to 18.5 GHz 15 ± 2.5 to 26.5 GHz 15 ± 3.5 to 40 GHz

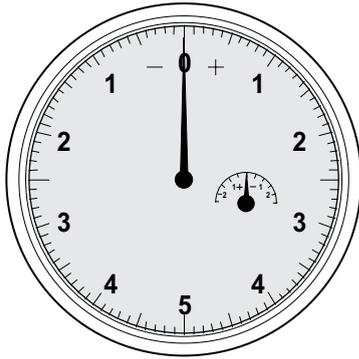


Figure 3. Pin Depth Gauge Scale

The center pin of termination connectors has a precision pin depth tolerance. Connectors on test devices that mate with terminations may not be precision types and 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 (Table 3) in the “+” region of the gauge (Figure 3), the center pin is too long. Mating under this condition will likely damage the termination 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.

Table 3. Terminations Pin-Depth

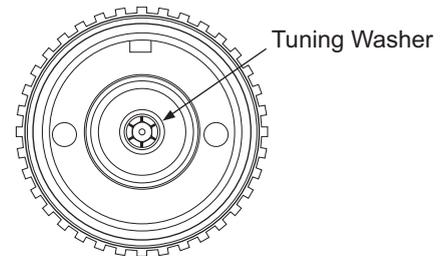
Port / Conn. Type	Pin Depth (Inch)
GPC-7	0.000 -0.003
N Male	0.207 0.000 +0.003
N Female	0.207 0.000 -0.003
WSMA Male	-0.0025 -0.0035
WSMA Female	0.0000 -0.0010
K Male	0.000
K Female	-0.003
V Male	0.000
V Female	-0.002
W1 Male	0.0000
W1 Female	-0.0012

b. Avoid Over Torquing Connectors. Over torquing connectors is destructive; it may damage the connector center pin. See Table 4 for torque recommendations.

Table 4. Torque Wrench Recommendations

Conn. Type	Torque Wrench Model #	Torque Spec (in-lbs)	Open End Wrench Model #
GPC-7	01-200	12	NA
N			
SMA / 3.5 mm	01-201	8	01-204
K (2.92 mm)			
V (1.85 mm)			
W1 (1 mm)	01-504	4	01-505

c. Do Not Disturb Tuning Washers on Connector Center Pins. The center conductor on some terminations contains a small 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.*



Note:

The tuning washer is shown on a GPC-7 connector. A similar washer may be installed on any Anritsu precision connectors.

Figure 4. Tuning Washer on GPC-7 Connector

d. Avoid Applying Excessive Power. The 28 series terminations have a maximum power rating of 0.5 watts. The 29 series, 20 dB offset terminations are rated at 0.25 watts. Applying power levels beyond these values, for even short durations, can damage the termination resistor.

e. Avoid Mechanical Shock. Terminations 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, they require careful handling.

f. **Keep Termination Connectors Clean.** The precise geometry that makes the termination's high performance possible can be disturbed by dirt and other contamination adhering to connector interfaces. When not in use, keep the termination connectors covered.

Connector Cleaning

Over time the outer conductor mating interface will build up a layer of dirt and metal chips that can severely degrade the connector's electrical and mechanical performance. The build up also tends to increase the coupling torque which can damage the mating interface. The cleaning of connectors is essential for maintaining good electrical performance. The connectors should be checked for cleanliness before making any measurements (or calibration). The cleaning procedure is listed below:

Required Items:

1. Low pressure compressed air (solvent free)
2. Lint-free cotton swabs
3. Isopropyl alcohol
4. Microscope

Cleaning Procedure:

1. Remove loose particles on the mating surfaces and threads etc. using low-pressure compressed air.
2. The threads of the connector should be cleaned with a cotton swab. When the connector threads are clean, the connections can be hand-tightened to within a half a turn of the proper torque.
3. Clean mating plane surfaces using alcohol on cotton swabs (Figure 5). Pay close attention to the size of the cotton swab. Use only enough solvent to clean the surface. Use the least possible pressure to avoid damaging connector surfaces. Do not spray solvents directly on to connector surfaces or use contaminated solvents.

g. **Maintenance.** Anritsu recommends that no maintenance other than cleaning be attempted by the customer. The termination should be returned to Anritsu for repair and/or service when needed.

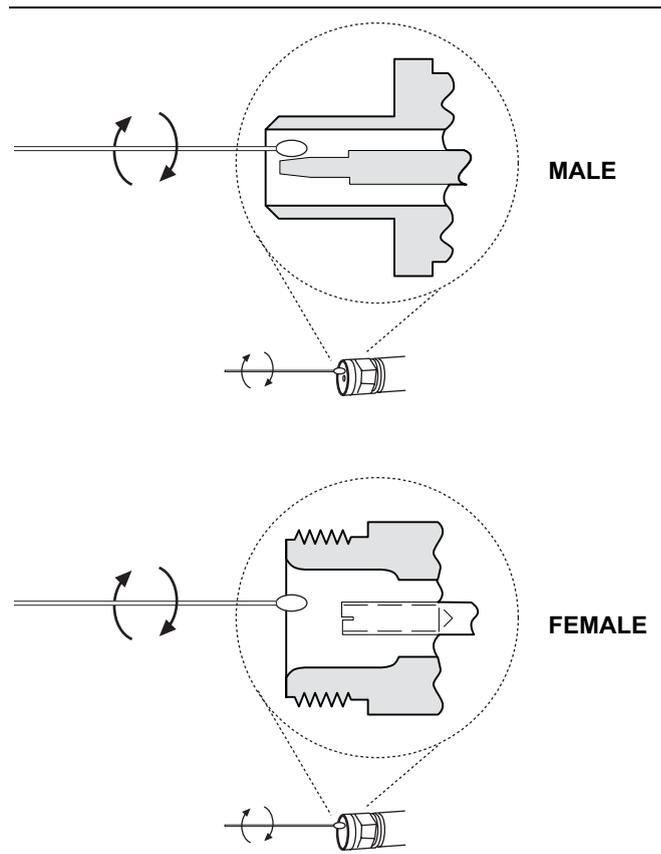


Figure 5. Cleaning Technique Using Cotton Swabs

Caution

If installed, do not disturb the tuning washer on the center conductor. See [paragraph 4c](#).

5. PERFORMANCE VERIFICATION

The performance of precision terminations can be verified using a Vector Network Analyzer (VNA). With proper calibration, measurements are traceable to the National Institute of Standards and Technology (NIST). Table 5 lists the recommended Anritsu calibration kit and calibration type for each termination interface.

Table 5. Recommended Calibration Kit

Termination Interface	Calibration Kit Model Number	Calibration Type
SMA / 3.5 mm	3650-1	Sliding termination
GPC-7	3651-1	Sliding termination
N	3653	SOLT ⁽¹⁾
K	3652-1	Sliding termination
V	3654C	Sliding termination
W1	3656	Offset short ⁽¹⁾

⁽¹⁾Sliding terminations are unavailable for the N and W1 interface.

A sliding termination calibration is recommended in cases when high return loss accuracy is required. While the quality of the termination enters into the error terms of a VNA calibration, it is the directivity that suffers the most if the termination's return loss degrades with increasing frequency as is the case with broadband loads. The directivity after a fixed load calibration is in the 25 dB range at 50 GHz whereas the same calibration done with a sliding load would yield directivity in the 34 dB range. Therefore, when neglecting other sources of error, measuring a 20 dB return loss device in a system having a directivity of 25 dB would have a maximum absolute error of 7.20 dB. The same device measured in a system having a directivity of 34 dB would have a maximum absolute error of 1.95 dB. Clearly, the sliding termination is the better calibration standard when measuring precision terminations.

Refer to the network analyzer operation manual for a complete step-by-step procedure on how to perform a sliding termination calibration.

WARRANTY

Anritsu terminations are warranted against defects in materials and workmanship for one year from the date of shipment. Anritsu's obligation covers repairing or replacing products which prove to be defective during the warranty period. Buyers shall prepay transportation charges for equipment returned to Anritsu for warranty repairs. Obligation is limited to the original purchaser. Anritsu is not liable for consequential damages.

LIMITATION OF WARRANTY

The foregoing warranty does not apply to Anritsu connectors that have failed due to normal wear. Also, the warranty does not apply to defects resulting from improper or inadequate maintenance by the Buyer, unauthorized modification or misuse, or operation outside of the environmental specifications of the product. No other warranty is expressed or implied, and the remedies provided herein are the Buyer's sole and exclusive remedies.

NOTICE

Anritsu Company has prepared this manual for use by Anritsu Company personnel and customers as a guide for the proper installation, operation and maintenance of Anritsu Company equipment and computer programs. The drawings, specifications, and information contained herein are the property of Anritsu Company, and any unauthorized use or disclosure of these drawings, specifications, and information is prohibited; they shall not be reproduced, copied, or used in whole or in part as the basis for manufacture or sale of the equipment or software programs without the prior written consent of Anritsu Company.

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