

# SERIES 560-7XXX AND 5400-71XXX RF DETECTORS OPERATION AND MAINTENANCE MANUAL

## 1. INTRODUCTION

This manual provides descriptions and specifications for ANRITSU Series 560-7XXX and 5400-71XXX RF Detectors (Figure 1). It also contains procedures for field replacement of detector diodes in the model 5400-71B50 and 5400-71B75 RF detectors and most of the Series 560-7XXX RF detectors.

## 2. GENERAL DESCRIPTION

The ANRITSU Series 560-7XXX and 5400-71XXX RF Detectors use zero-biased Schottky diodes and have a measurement range of  $-55$  dBm to  $+16$  dBm.

The detectors are used with the Model 56100A and 562 Scalar Network Analyzers and with Series 541XXA, 540XXA, and 54XXA Scalar Measurement Systems for making coaxial transmission loss or gain and power measurements. The detectors are also used with the Site Master and Cable Mate Series Personal SWR/RL and Fault Location Testers for making power measurements.



**Figure 1.** Typical Series 560-7XXX and 5400-71XXX RF Detectors

## 3. PERFORMANCE SPECIFICATIONS

Performance specifications for the Series 560-7XXX and 5400-71XXX RF Detectors are listed in Table 1 on page 2.

## 4. PRECAUTIONS FOR USE OF RF DETECTORS

ANRITSU RF Detectors are high-quality, precision laboratory instruments and should receive the same care and respect afforded such instruments. Follow the precautions listed below when handling or connecting these devices. Complying with these precautions will guarantee longer component life and less equipment downtime due to connector or device failure. Also, such compliance will ensure that RF Detector failures are not due to misuse or abuse—two failure modes not covered under the ANRITSU warranty.

**a. Beware of Destructive Pin Depth of Mating Connectors.** Based on RF components returned for repair, destructive pin depth of mating connectors is the major cause of failure in the field. When an RF component connector is mated with a connector having a destructive pin depth, damage will usually occur to the RF component connector. A destructive pin depth is one that is too long in respect of the reference plane of the connector (Figure 2, page 3).

The center pin of a precision RF component connector has a precision tolerance measured in mils ( $1/1000$  inch). The mating connectors of various RF components may not be precision types. Consequently, the center pins of these devices may not have the proper depth. The pin depth of DUT connectors should be measured to assure compatibility before attempting to mate them with RF Detector connectors. An ANRITSU Pin Depth Gauge (Figure 3, page 3), or equivalent, can be used for this purpose.

# Anritsu

**Table 1. 560-7XXX and 5400-71XXX RF Detectors Performance Specifications**

| Model        | Frequency Range  | Impedance | Return Loss   | Input Connector | Frequency Response  |
|--------------|------------------|-----------|---|-----------------|---|
| 560-7A50     | 0.01 to 18 GHz   | 50Ω       | 15 dB, <0.04 GHz<br>22 dB, <8 GHz<br>17 dB, <18 GHz   | GPC-7           | ±0.5 dB, 18 GHz   |
| 560-7N50B    | 0.01 to 20 GHz   | 50Ω       | 15 dB, <0.04 GHz<br>22 dB, <8 GHz<br>17 dB, <18 GHz<br>14 dB, <20 GHz                                       | N(m)            | ±0.5 dB, <18 GHz<br>±1.25 dB, <20 GHz   |
| 560-7S50B    | 0.01 to 20 GHz   | 50Ω       | 15 dB, <0.04 GHz<br>22 dB, <8 GHz<br>17 dB, <18 GHz<br>14 dB, <20 GHz                                       | WSMA(m)         | ±0.5 dB, <18 GHz<br>±1.25 dB, <20 GHz   |
| 560-7S50-2   | 0.01 to 26.5 GHz | 50Ω       | 15 dB, <0.04 GHz<br>22 dB, <8 GHz<br>17 dB, <18 GHz<br>14 dB, <26.5 GHz                                     | WSMA(m)         | ±0.5 dB, <18 GHz<br>±1.25 dB, <26.5 GHz   |
| 560-7K50     | 0.01 to 40 GHz   | 50Ω       | 12 dB, <0.04 GHz<br>22 dB, <8 GHz<br>17 dB, <18 GHz<br>15 dB, <26.5 GHz<br>14 dB, <32 GHz<br>13 dB, <40 GHz | K(m)            | ±0.5 dB, <18 GHz<br>±1.25 dB, <26.5 GHz<br>±2.2 dB, <32 GHz<br>±2.5 dB, <40 GHz |
| 560-7VA50    | 0.01 to 50 GHz   | 50Ω       | 12 dB, <0.04 GHz<br>19 dB, <20 GHz<br>15 dB, <40 GHz<br>10 dB, <50 GHz                                      | V(m)            | ±0.8 dB, <20 GHz<br>±2.5 dB, <40 GHz<br>±3.0 dB, <50 GHz                        |
| 5400-71B50   | 0.001 to 1.5 GHz | 50Ω       | 20dB  | BNC(m)          | ±0.2 dB, <1.5 GHz   |
| 5400-71B75   | 0.001 to 1.5 GHz | 75Ω       | 20 dB   | BNC(m)          | ±0.2 dB, <1.5 GHz   |
| 5400-7N50    | 0.001 to 3 GHz   | 50Ω       | 26 dB   | N(m)            | ±0.2 dB, <1 GHz<br>±0.3 dB, <3 GHz  |
| 5400-71N75   | 0.001 to 3 GHz   | 75Ω       | 26 dB, <2 GHz<br>20 dB, <3 GHz  | N(m)            | ±0.2 dB, <1 GHz<br>±0.3 dB, <3 GHz  |
| 5400-71N75L* | 0.005 to 1.2 GHz | 75Ω       | 24 dB   | N(m)            | ±0.2 dB, <1 GHz<br>±0.5 dB, <1.2 GHz  |

**All Models:**

*Maximum Input Power:* 100mW (+20 dBm)

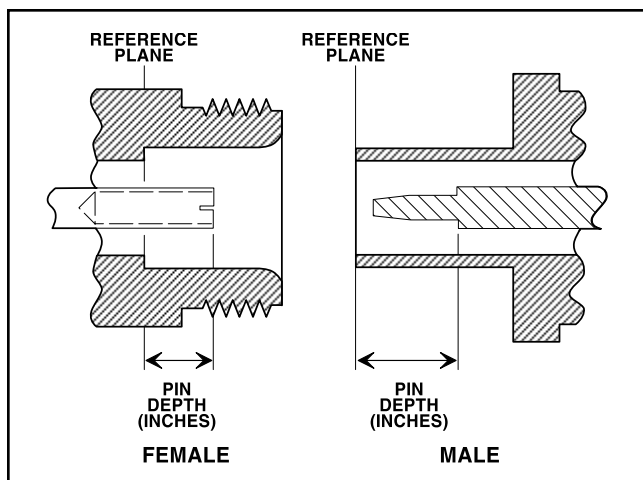
*Cable Length:* 122 cm (4 ft)

*Dimensions:* 7.6 x 2.9 x 2.2 cm (3 x 1-1/8 x 7/8 in.)

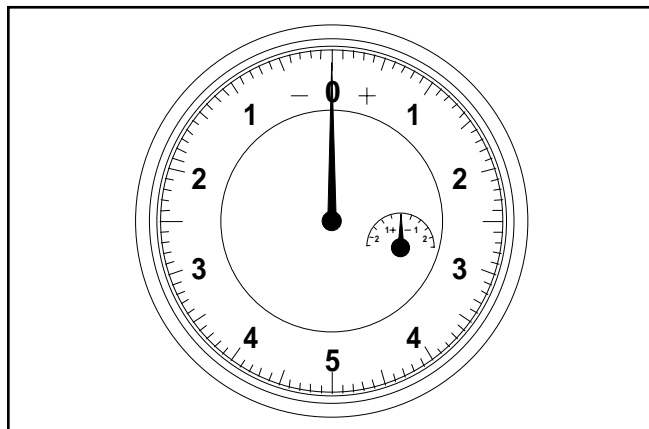
*Weight:* 170g (6 oz)

\* The input of the 5400-71N75L is limited to extend the damage level to 1W (+30 dBm)

The limit begins compression at 10 dBm <0.05 GHz, 15 dBm <1 GHz, or 20 dBm <1.2 GHz



**Figure 2.** N Connector Pin Depth Definition



**Figure 3.** Pin Depth Gauge

If the measured connector is out of tolerance in the “+” region, the center pin is too long (see Table 2). Mating under this condition will likely damage the precision RF Detector connector. If the test device connector measures out of tolerance in the “-” region, the center pin is too short. This will not cause damage, but it will result in a poor connection and a consequent degradation in performance.

**b. Avoid Over Torquing Connectors.** Over torquing connectors is destructive; it may damage the connector center pin. Finger-tight is usually sufficient for Type N connectors. *Always* use a connector torque wrench (8 inch-pounds) when tightening GPC-7, WSMA, K, or V type connectors. *Never* use pliers to tighten connectors.

**c. Avoid Mechanical Shock.** RF Detectors are designed to withstand years of normal bench

**Table 2.** Allowable Device Under Test (DUT) Connector Pin Depth

| DUT Connector Type         | ANRITSU Gauging Set Model | Pin Depth (inches)    | Pin Depth Gauge Reading |
|----------------------------|---------------------------|-----------------------|-------------------------|
| N-Male<br>N-Female         | 01-163                    | .207 -0.000<br>+0.030 | 207 +0.000<br>-0.030    |
| GPC-7                      | 01-161                    | +0.000<br>-0.030      | Same as<br>Pin Depth    |
| WSMA-Male<br>WSMA-Female   | 01-162                    | -0.000<br>-0.010      | Same as<br>Pin Depth    |
| SMA-Male,<br>SMA-Female    | 01-162                    | -0.000<br>-0.010      | Same as<br>Pin Depth    |
| 3.5 mm-Male<br>3 mm-Female | 01-162                    | -0.000<br>-0.010      | Same as<br>Pin Depth    |
| K-Male,<br>K-Female        | 01-162                    | +0.000<br>-0.010      | Same as<br>Pin Depth    |

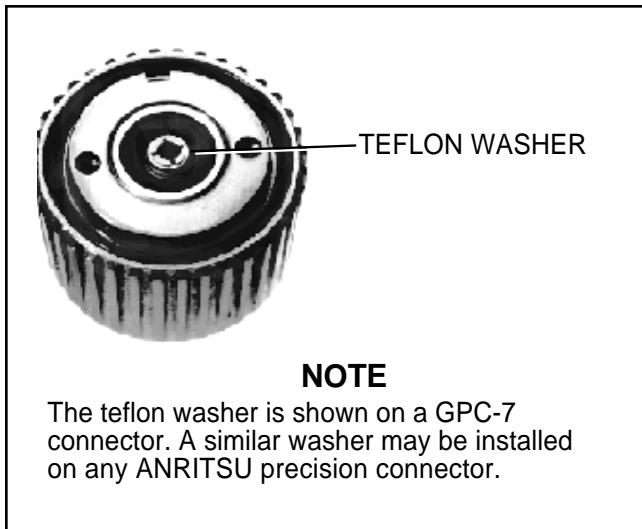
handling. However, do not drop or otherwise treat them roughly. Mechanical shock will significantly reduce their service life.

**d. Avoid Applying Excessive Power.** The Series 560-7XXX and 5400-71XXX RF Detectors are rated at +20 dBm (100 mW) maximum input power. Exceeding this input power level, even for short durations, will permanently damage their internal components.

**e. Do Not Disturb Teflon Tuning Washers on Connector Center Pins.** The center conductor of many RF component connectors contains a small teflon tuning washer that is located near the point of mating (Figure 4, page 4). This washer compensates for minor impedance discontinuities at the interface. *Do not disturb this washer.* The location of this washer is critical to the performance of the RF component.

**f. Keep Connectors Clean.** The precise geometry that makes possible the RF component’s high performance can be easily disturbed by dirt or other contamination adhering to connector interfaces. When not in use, keep the connectors covered.

To clean the connector interfaces, use a clean cotton swab that has been *dampened* with denatured alcohol. Figure 5, page 4 illustrates the cleaning of male and female connectors.



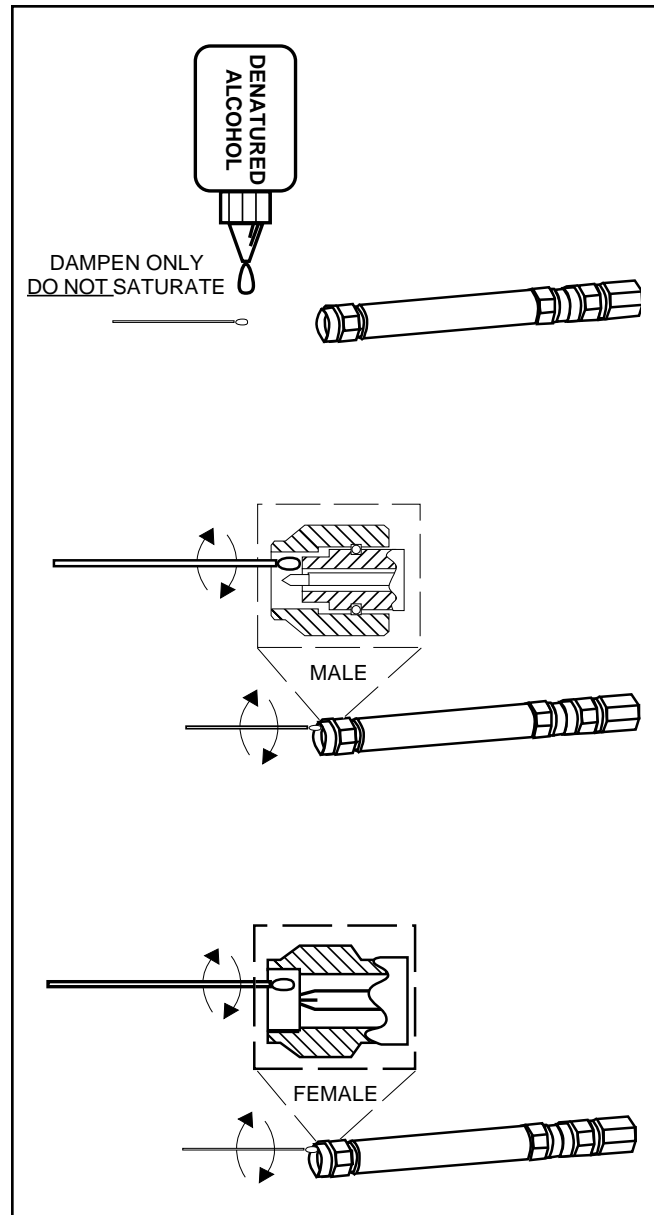
**Figure 4.** Tuning Washer on GPC-7 Connector

**NOTE**

Most cotton swabs are too large to fit in the smaller connector types. In these cases it is necessary to peel off most of the cotton and then twist the remaining cotton tight. Be sure that the remaining cotton does not get stuck in the connector. Cotton swabs of the appropriate size can be purchased through a medical-laboratory-type supply center.

The following are some important tips on cleaning connectors:

- Use only denatured alcohol as a cleaning solvent.
- Do not use excessive amounts of alcohol as prolonged drying of the connector may be required.
- Never put lateral pressure on the center pin of the connector.
- If installed, do not disturb the teflon washer on the center conductor pin.
- Verify that no cotton or other foreign material remains in the connector after cleaning it.
- If available, use compressed air to remove foreign particles and to dry the connector.
- After cleaning, verify that the center pin has not been bent or damaged.



**Figure 5.** Cleaning Male and Female Connectors

**5. DETECTOR DIODE REPLACEMENT**

RF Detector models 5400-71B50 and 5400-71B75 are equipped with field-replaceable detector diodes; the series 560-7XXX RF Detectors, except for model 560-7VA50, are equipped with field-replaceable detector diode modules. Paragraph 5.1 provides a procedure for replacing defective diodes in the models 5400-71B50 and 5400-71B75; paragraph 5.2 provides a procedure for replacing detector diode modules in series 560-7XXX RF Detectors.

Table 3 provides the diode/diode module part number for each RF detector model containing a field-replaceable detector diode or diode module.

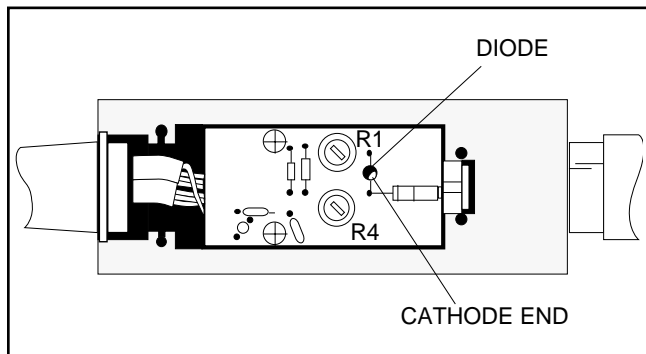
**Table 3.** 560-7XXX and 5400-71XXX RF Detector Diode/Diode Module Part Numbers

| RF Detector Model | Diode or Diode Module Part Number |
|-------------------|-----------------------------------|
| 5400-71B50        | 10-21                             |
| 5400-71B75        | 10-88                             |
| 5400-71N50        | Factory Replacement Only          |
| 5400-71N75        | Factory Replacement Only          |
| 560-7A50          | A7219A                            |
| 560-7N50B         | C24441                            |
| 560-7S50B         | C24441                            |
| 560-7S50-2        | A7219B                            |
| 560-7K50          | ND19393                           |
| 560-7VA50         | Factory Replacement Only          |

**NOTE**

RF Detector Models 5400-71N50, 5400-71N75, and 560-7VA50 do not have field-replaceable detector diodes. Contact your local ANRITSU Service Center for assistance.

**a. Required Adjustments** Whenever the detector diode (or diode module) of the RF detector is replaced, the two potentiometers that are part of the RF detector PCB subassembly (Figures 6 (below) and 9 (page 6)) must be readjusted. The potentiometer readjustment is done after the de-



**Figure 6.** Model 5400-71B50 and 5400-71B75 RF Detectors Housing Layout Diagram

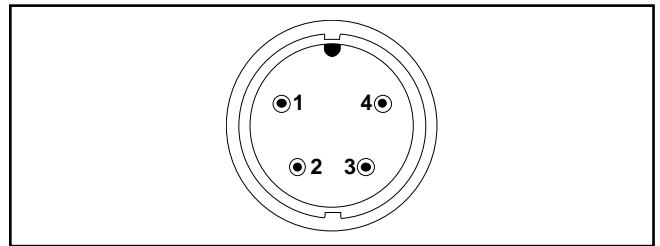
fective diode is removed, but before the replacement diode is installed.

**b. Test Equipment Required** The detector diode replacement procedures require a digital multimeter (DMM) that has a display resolution of at least 3-1/2 digits (John Fluke Model 8840A, or equivalent).

**5.1. Detector Diode Replacement for the Model 5400-71B50 and 5400-71B75 RF Detectors**

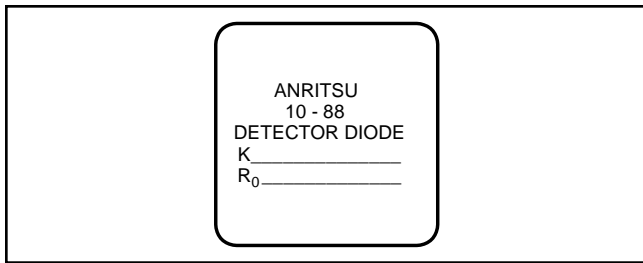
The model 5400-71B50 and 5400-71B75 RF Detectors are equipped with a field-replaceable detector diode. To replace, proceed as follows:

1. Unfasten the four detector housing top cover retaining screws. Remove the top cover.
2. Unplug the defective diode (Figure 6) from the PCB subassembly and remove.
3. Set the potentiometer R1 full clockwise (maximum resistance).
4. Connect the DMM leads between pins 1 and 2 of the RF detector cable connector (Figure 7). Measure the resistance value, which is the maximum resistance of R1 (approximately 40.5 KΩ is typical). Record this value; it will hereafter be referred to as “R<sub>T</sub>”.



**Figure 7.** RF Detector Cable Connector Pin Layout

5. Obtain the “K” value from the replacement diode container level (Figure 8, page 6).
6. Compute the set value for R1 as follows:
 
$$R_{1_{set}} = K \times R_T$$
7. Adjust R1 counterclockwise until the DMM indicates the R<sub>1set</sub> value calculated in step 6.
8. Connect the DMM leads between pin 3 of the RF detector cable connector and the cable shield.
9. Obtain the “R<sub>0</sub>” value from the replacement diode container label (Figure 8, page 6).



**Figure 8.** Replacement Diode Container Label

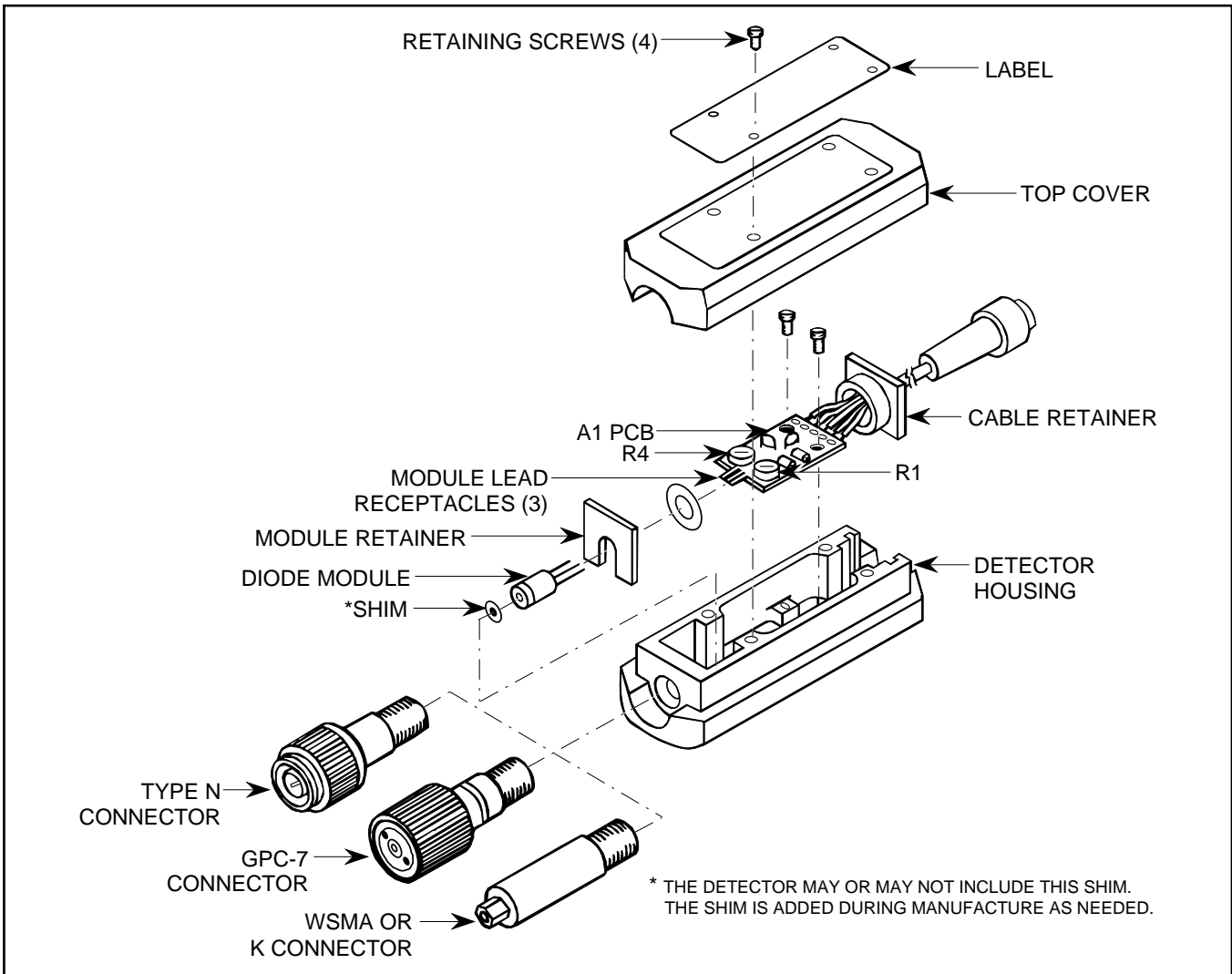
10. Adjust R4 until the DMM indicates the "R<sub>0</sub>" value. Disconnect the DMM.
11. Orient the cathode end (white dot) of the replacement diode as shown in Figure 6 (white dot towards centerline of the detector PCB subassembly). Insert the diode into the socket of the PCB subassembly.

12. Reinstall the top cover, securing it with the four retaining screws. This completes replacement of the detector diode.

### 5.2. Detector Diode Module Replacement for the Series 560-7XXX RF Detectors

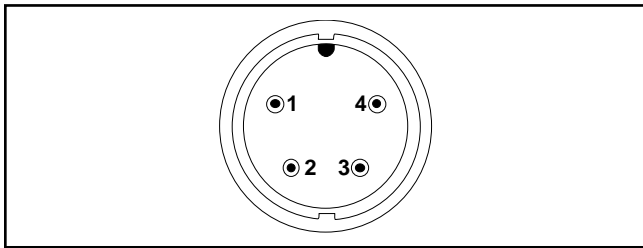
Series 560-7XXX RF Detectors, except for model 560-7VA50, are equipped with a field-replaceable diode module that contains (in addition to the detector diode) a thermistor, a resistor, and two capacitors. To replace, proceed as follows:

1. Unfasten the four detector housing top cover retaining screws. Remove the top cover.
2. Unfasten the two retaining screws that hold down the RF detector PCB subassembly (Figure 9).



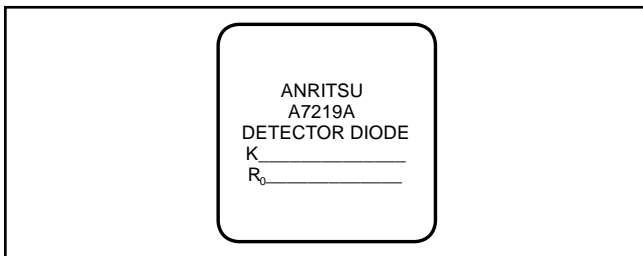
**Figure 9.** Series 560-7XXX RF Detectors, Exploded View

3. Slide the cable retainer out of the RF detector housing assembly. When the cable retainer clears the housing, disconnect the PCB subassembly from the diode module. Remove the spring washer.
4. Remove the fiberglass module retainer from the detector housing. This retainer can be removed by prying it out using a small screwdriver, or by pulling it out using short, round nose pliers.
5. Remove the diode module from the rear of the connector body by pulling it straight out.
6. Connect the DMM leads between pins 1 and 2 of the RF detector cable connector (Figure 10). Measure the resistance value, which is the maximum resistance of R1 (approximately 40.5 KΩ is typical). Record this value; it will hereafter be referred to as “R<sub>T</sub>”.



**Figure 10.** RF Detector Cable Connector Pin Layout

7. Obtain the “K” value from the replacement diode container label (Figure 11).



**Figure 11.** Replacement Diode Module Container Label

8. Compute the set value for R1 as follows:  

$$R_{set} = K \times R_T$$
9. Adjust R1 counterclockwise until the DMM indicates the R<sub>1set</sub> value calculated in step 8.
10. Connect the DMM leads between pin 3 of the RF detector cable connector and the cable shield.
11. Obtain the “R<sub>0</sub>” value from the replacement diode container label and adjust R4 until the DMM indicates this value. Disconnect the DMM.
12. Orient the detector housing normally (Figure 9, page 6). Insert the replacement diode module into the rear of the connector body so that the center lead *is on top*.
13. Orient the spring washer so that the two curved flanges point toward the rear of the detector housing and are positioned horizontally (i.e., 3 o'clock and 9 o'clock positions).
14. Insert fiberglass module retainer between the replacement diode module and the spring washer. push down on the retainer until fully seated.
15. Orient the PCB subassembly normally as shown in Figure 9 and insert it into the detector housing so that the leads from the replacement diode module mate with the connectors on the PCB subassembly.
16. Insert the cable retainer into the slot in the detector housing.
17. Fasten the PCB subassembly into the detector housing using two retaining screws.
18. Reinstall the top cover, securing it with four retaining screws. This completes replacement of the detector diode module.

## 6. ANRITSU Service Centers

Table 4, page 8, provides names and addresses of ANRITSU Service Centers.

**Table 4. ANRITSU Service Centers**

**UNITED STATES**

ANRITSU COMPANY  
685 Jarvis Drive  
Morgan Hill, CA 95037-2809  
Telephone: (408) 776-8300  
FAX: 408-776-1744  
COMPANY  
10 Kingsbridge Road  
Fairfield, NJ 07004  
Telephone: (201) 227-8999  
FAX: 201-575-0092

**AUSTRALIA**

ANRITSU PTY. LTD.  
Unit 3, 170 Foster Road  
Mt Waverley, VIC 3149  
Australia  
Telephone: 03-9558-8177  
Fax: 03-9558-8255

**BRAZIL**

ANRITSU ELECTRONICA LTDA.  
Praia de Botafogo, 440, Sala 2401  
CEP22250-040, Rio de Janeiro, RJ, Brasil  
Telephone: 021-28-69-141  
Fax: 021-53-71-456

**CANADA**

ANRITSU INSTRUMENTS LTD.  
215 Stafford Road, Unit 102  
Nepean, Ontario K2H 9C1  
Telephone: (613) 828-4090  
FAX: (613) 828-5400

**CHINA**

BEIJING SERVICE  
CENTER  
Beijing Fortune Building  
416W, 5 Dong San Huan Bei Lu  
Chaoyang qu  
Beijing 100004, China  
Telephone: 011861065909237  
FAX: 011861065909236

**FRANCE**

ANRITSU S.A  
9 Avenue du Quebec  
Zone de Courtaboeuf  
91951 Les Ulis Cedex  
Telephone: 016-44-66-546  
FAX: 016-44-61-065

**GERMANY**

ANRITSU GmbH  
Grafenberger Allee 54-56  
D-40237 Dusseldorf  
Germany  
Telephone: 0211-968550  
FAX: 0211-968555

**INDIA**

MEERA AGENCIES (P) LTD.  
A-23 Hauz Khas  
New Delhi 110 016  
Telephone: 011-685-3959  
FAX: 011-686-6720

**ISRAEL**

TECH-CENT, LTD  
Haarad St. No. 7, Ramat Haahayal  
Tel-Aviv 69701  
Telephone: (03) 64-78-563  
FAX: (03) 64-78-334

**ITALY**

ANRITSU Sp.A  
Roma Office  
Via E. Vittorini, 129  
00144 Roma EUR  
Telephone: (06) 50-22-666  
FAX: (06) 50-22-4252

**JAPAN**

ANRITSU CORPORATION  
1800 Onna Atsugi-shi  
Kanagawa-Prf. 243 Japan  
Telephone: 0462-23-1111  
FAX: 0462-25-8379

**KOREA**

ANRITSU KOREA (AWK)  
#901 Daero Bldg. 26-5  
Yeoido Dong, Youngdeungpo  
Seoul Korea 150 010  
Telephone: 02-782-7156  
FAX: 02-782-4590

**SINGAPORE**

ANRITSU (SINGAPORE) PTE LTD  
3 Shenton Way #24-03  
Shenton House  
Singapore 0106  
Telephone: 2265206  
FAX: 2265207

**SOUTH AFRICA**

ETESCSA  
1st Floor Montrose Place  
Waterfall Park  
Becker Road  
MIDRAND  
SOUTH AFRICA  
Telephone: 011-315-1366  
Fax: 011-315-2175

**SWEDEN**

ANRITSU AB  
Botvid Center  
S-14584  
Stockholm, Sweden  
Telephone: (08) 534-717-00  
FAX: (08) 534-717-30

**TAIWAN**

CO., LTD.  
8F, No. 96, Section 3  
Chien Kuo N. Road  
Taipei, Taiwan, R.O.C.  
Telephone: (02) 515-6050  
FAX: (02) 509-5519

**UNITED KINGDOM**

ANRITSU LTD.  
200 Capability Green  
Luton, Bedfordshire  
LU1 3LU, England  
Telephone: 015-82-41-88-53  
FAX: 015-82-31-303



## NOTES

## NOTES

## **WARRANTY**

The ANRITSU product(s) listed on the title page is (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.

## **TRADEMARK ACKNOWLEDGEMENTS**

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