

Repair Manual

Keysight 3.5 mm and Type-N Slotless Contact

Notices

© Keysight Technologies, Inc.
2001-2021

No part of this manual may be reproduced in any form or by any means (including electronic storage and retrieval or translation into a foreign language) without prior agreement and written consent from Keysight Technologies, Inc. as governed by United States and international copyright laws.

Trademark Acknowledgements

Manual Part Number

85052-90070

Publication Date

February 2021

Edition 1

Supersedes: September 2014

Published in USA

Keysight Technologies Inc.
1400 Fountaingrove Parkway
Santa Rosa, CA 95403

Warranty

THE MATERIAL CONTAINED IN THIS DOCUMENT IS PROVIDED "AS IS," AND IS SUBJECT TO BEING CHANGED, WITHOUT NOTICE, IN FUTURE EDITIONS. FURTHER, TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, KEYSIGHT DISCLAIMS ALL WARRANTIES, EITHER EXPRESS OR IMPLIED WITH REGARD TO THIS MANUAL AND ANY INFORMATION CONTAINED HEREIN, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. KEYSIGHT SHALL NOT BE LIABLE FOR ERRORS OR FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES IN CONNECTION WITH THE FURNISHING, USE, OR PERFORMANCE OF THIS DOCUMENT OR ANY INFORMATION CONTAINED HEREIN. SHOULD KEYSIGHT AND THE USER HAVE A SEPARATE WRITTEN AGREEMENT

WITH WARRANTY TERMS COVERING THE MATERIAL IN THIS DOCUMENT THAT CONFLICT WITH THESE TERMS, THE WARRANTY TERMS IN THE SEPARATE AGREEMENT WILL CONTROL.

Technology Licenses

The hardware and/or software described in this document are furnished under a license and may be used or copied only in accordance with the terms of such license.

U.S. Government Rights

The Software is "commercial computer software," as defined by Federal Acquisition Regulation ("FAR") 2.101. Pursuant to FAR 12.212 and 27.405-3 and Department of Defense FAR Supplement ("DFARS") 227.7202, the U.S. government acquires commercial computer software under the same terms by which the software is customarily provided to the public.

Accordingly, Keysight provides the Software to U.S. government customers under its standard commercial license, which is embodied in its End User License Agreement (EULA), a copy of which can be found at

<http://www.keysight.com/find/sweula>

The license set forth in the EULA represents the exclusive authority by which the U.S. government may use, modify, distribute, or disclose the Software. The EULA and the license set forth therein, does not require or permit, among other things, that Keysight: (1) Furnish technical information related to commercial computer software or commercial computer software documentation that is not customarily provided to the public; or (2) Relinquish to, or otherwise provide, the government rights in excess of these rights customarily provided to the public to use, modify, reproduce, release, perform,

display, or disclose commercial computer software or commercial computer software documentation. No additional government requirements beyond those set forth in the EULA shall apply, except to the extent that those terms, rights, or licenses are explicitly required from all providers of commercial computer software pursuant to the FAR and the DFARS and are set forth specifically in writing elsewhere in the EULA. Keysight shall be under no obligation to update, revise or otherwise modify the Software. With respect to any technical data as defined by FAR 2.101, pursuant to FAR 12.211 and 27.404.2 and DFARS 227.7102, the U.S. government acquires no greater than Limited Rights as defined in FAR 27.401 or DFAR 227.7103-5 (c), as applicable in any technical data.

Safety Notices

CAUTION

A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, 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.

WARNING

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

1 General Information

Introduction	4
85052-60049	4
85054-60056	4
Equipment Required But Not Supplied	5
Incoming Inspection	5
Precision Slotless Connectors	5
Replaceable Parts	6
Ordering Parts	6
Replacing Documentation	6

2 Repairing a Slotless Contact

Introduction	10
Inspecting a Damaged Slotless Contact	10
Removing a Slotless Contact	12
Inspecting and Cleaning A Center Conductor	17
Inspecting	17
Cleaning	17
Inserting an Inner Contact	17
Testing a Slotless Contact	20
Contacting Keysight Technologies	22

1 General Information

Introduction

This manual documents the use of both the 85052-60049 and the 85054-60056 slotless contact repair kits. Each kit contains the following:

- One 30 ml bottle of alcohol
- Six foam swabs
- One pair of tweezers
- One inner contact removal/insertion tool
- One inner contact testing tool
- One testing weight
- Ten replacement inner contacts

An explanation of precision slotless connectors appears later in this chapter in **“Precision Slotless Connectors” on page 5.**

The following Keysight Technologies publication provides information on proper connector care to maintain quality standards and devices:

- Microwave Connector Care Card (included in this kit)

Or, contact your nearest Keysight Technologies sales office for the customer training course:

- Understanding Connectors Used With Network Analyzers
 - 85050A +24A (on site)
 - 85050A +24D (at Keysight sales office)

85052-60049

Use the 3.5 mm slotless contact repair kit to repair the female contacts on all 3.5 mm precision slotless connectors (PSC). The only exception to this is the precision slotless contacts in the airlines of the 85052C 3.5 mm precision calibration kit. If damaged, these contacts must be repaired at the factory.

85054-60056

Use the Type-N slotless contact repair kit to repair the female contacts on all Type-N precision slotless connectors (PSC).

NOTE

There is no similar contact repair kit for 2.4 mm connectors. The 2.4 mm slotless contact is an integral part of the center conductor and it cannot be replaced.

Equipment Required But Not Supplied

The following items are required, but not supplied with this kit:

- A microscope with $\geq 10\times$ magnification and lighting.
- A source of clean, dry, compressed air or nitrogen.

Incoming Inspection

Refer to **Table 1-1** to verify receipt of all parts in this repair kit.

The foam-lined storage case provides protection for the components in this repair kit during shipping. If the case or components appear damaged, set aside the kit and all packaging materials and contact the nearest Keysight Technologies office listed at the back of this manual.

If either of the following conditions exist, notify your nearest Keysight Technologies office:

- The shipping contents are incomplete.
- There is mechanical damage or a mechanical defect.

Notify the carrier if the shipping container is damaged or the cushioning material shows signs of stress. Keep all shipping material for the carrier's inspection. Keysight Technologies will arrange for repair or replacement of incomplete or damaged shipments without waiting for a settlement from the transportation company.

Precision Slotless Connectors

When properly used, a precision slotless connector should have the same lifespan as a standard slotted connector. Keysight Technologies designed the precision slotless contacts to mate with all connectors within a connector series, but the connectors must meet published interface dimensions.

CAUTION

Mating a connector that does not meet published specifications can damage a precision slotless connector. For this reason, ensure that any device you connect is within its specifications.

Replaceable Parts

Ordering Parts

Table 1-1 lists replacement part numbers. To order a listed part, note the description, part number, and the quantity desired. Telephone or send your order to the nearest Keysight Technologies office (listed at the back of this manual).

Replacing Documentation

The part number for this manual is listed on the title page of this document, and is also listed in **Table 1-1**. Use this number to order extra copies of this manual.

Table 1-1 **Replaceable Parts**

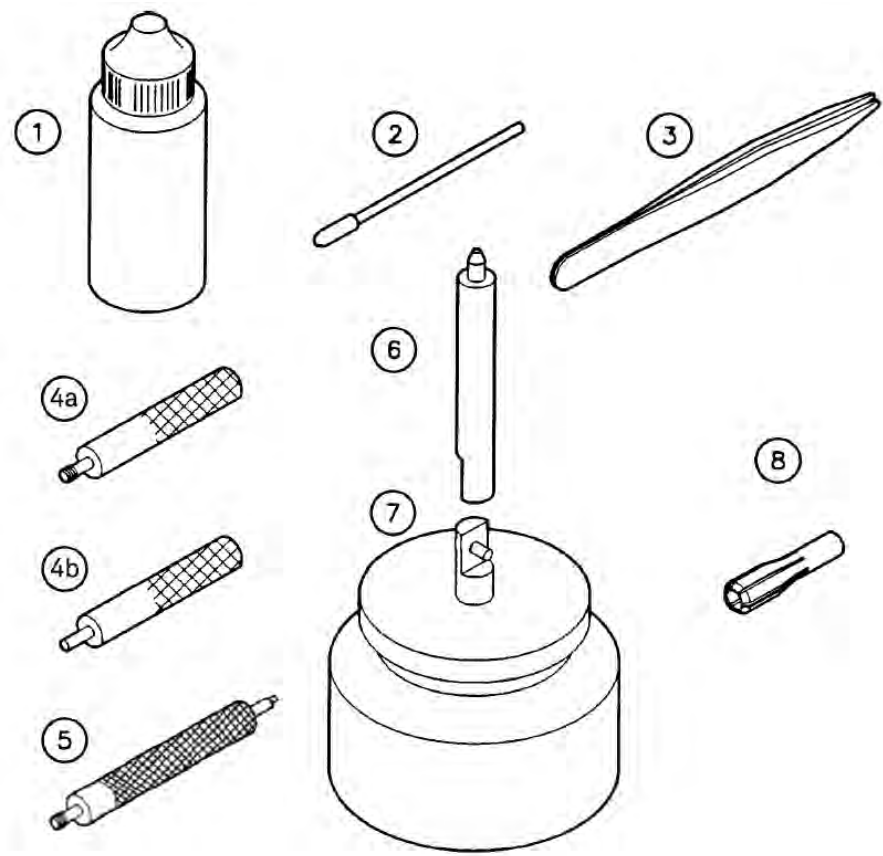
Reference Number	Description	Quantity	Part Number
1	Isopropyl Alcohol	1	8500-5344
2	Foam Swab	6	9301-1243
3	Tweezers	1	8710-1308
4a	Type-N Removal Tool	1	5021-7607
4b	Type-N Insertion Tool	1	5022-0510
5 ^a	3.5 mm Removal/Insertion Tool	1	5022-9143
6	Testing Tool	1	
	3.5 mm		5022-0508
	Type-N		5022-0511
7	Testing Weight	1	5022-0507
8 ^b	Inner Contacts	10	
	3.5 mm		85052-60050
	Type-N		85054-60057
8 ^c	Inner Contacts	1	
	3.5 mm		85052-60051
	Type-N		85054-60058
	Storage Case	1	
	Wooden Box	1	9211-1582
	Foam in Lid	1	5180-8457
	Foam in Bottom	1	5181-5730

Table 1-1 Replaceable Parts

Reference Number	Description	Quantity	Part Number
	Documentation	1	
	Repair manual		85052-90070
	Connector Care Card		08510-90360
	Complete Repair Kit	1	
	3.5 mm		85052-60049
	Type-N		85054-60056

- a. 5022-9143 is an integrated tool with removal and insertion ends.
- b. Same parts as 85052-60051 and 85054-60058 but different quantity.
- c. Same parts as 85052-60050 and 85054-60057 but different quantity.

Figure 1-1 Replaceable Parts



2 Repairing a Slotless Contact

Introduction

If you suspect a problem with the slotless contact, make a visual inspection to determine if there is damage. As you use a connector, dirt and metal particles can accumulate in and around the slotless contact. In extreme cases this accumulation can render the contact non-functional. Often, simply cleaning the contact fixes the problem.

This chapter provides procedures on how to clean both the inner contact and the center conductor, how to reinstall the inner contact, and how to test for functionality. Also provided is a procedure on how to replace the inner contact.

Repairing a damaged slotless contact is a six-step process:

1. **Gage the connector.** Because connector mechanical tolerances can be very precise (on the order of a few hundredths of microinches), even a perfectly clean, unused connector can cause trouble if it is mechanically out of specification. If the pin depth is out of specification, the connector is damaged beyond the capabilities of this repair kit, and the device must be repaired or replaced by Keysight Technologies.

CAUTION

Never use an out-of-specification connector.

2. Under $\geq 10\times$ magnification, inspect the connector to determine the damage.
3. Remove the damaged inner contact.
4. Inspect the center conductor. If it is undamaged, clean it.
5. Install the replacement inner contact.
6. Test the slotless contact.

Inspecting a Damaged Slotless Contact

Inspect the contact under $\geq 10\times$ magnification to define the problem. Usually you can make the repair without disassembling the device to which the precision slotless contact is attached.

Inspect the slotless contact to see if any of the following conditions exist:

- The inner contact has one or more fingers bent inward or crushed, preventing proper contact to the male pin (see **Figure 2-1**).

If so, go to **step 1** of “**Removing a Slotless Contact**”.

- The inner contact has one or more fingers broken (see **Figure 2-2**).

If so, go to **step 2** of “**Removing a Slotless Contact**”.

Repairing a Slotless Contact
Inspecting a Damaged Slotless Contact

- The inner contact is pushed inside the center conductor and will not make contact with the mating connector's male pin (see **Figure 2-3**).
If so, go to **step 3** of **“Removing a Slotless Contact”**.
- The end of the center conductor is dented or scraped near where it touches the inner contact (see **Figure 2-4**).
If so, the slotless contact may be damaged beyond the capabilities of this repair kit, and the device must be repaired or replaced by Keysight Technologies.

Figure 2-1 Finger bent in or crushed

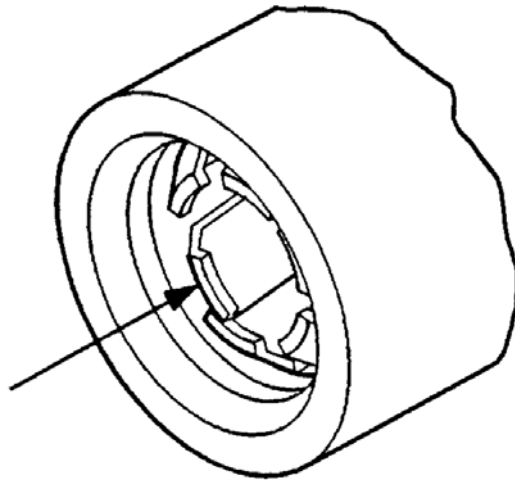


Figure 2-2 Broken inner contact

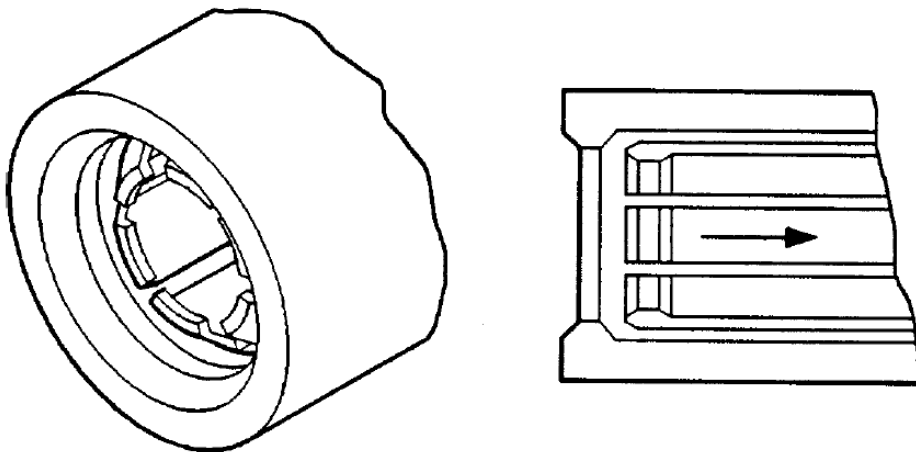


Figure 2-3 Inner contact pushed inside

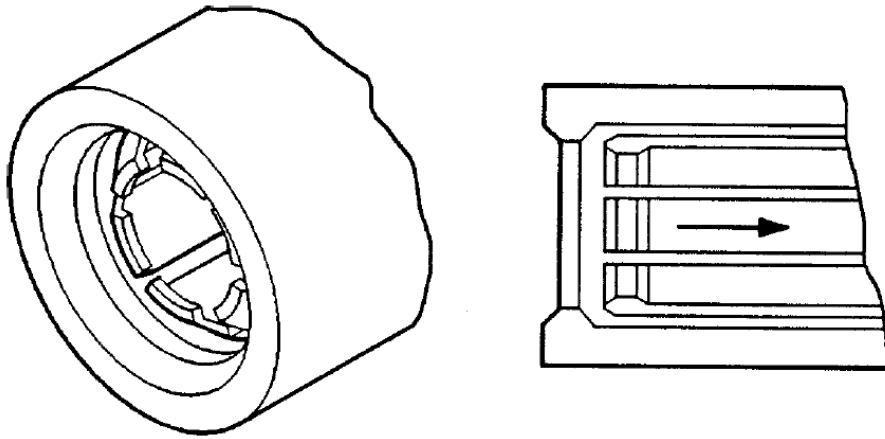
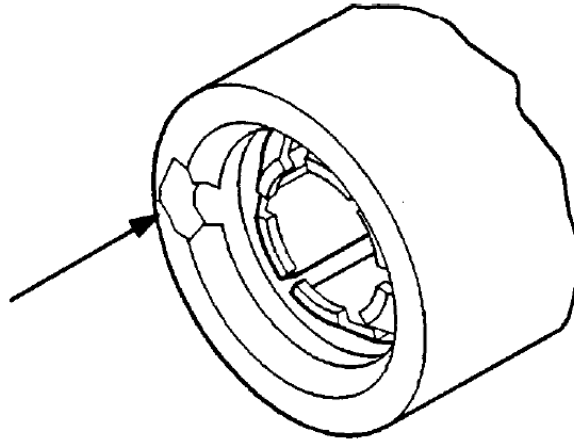


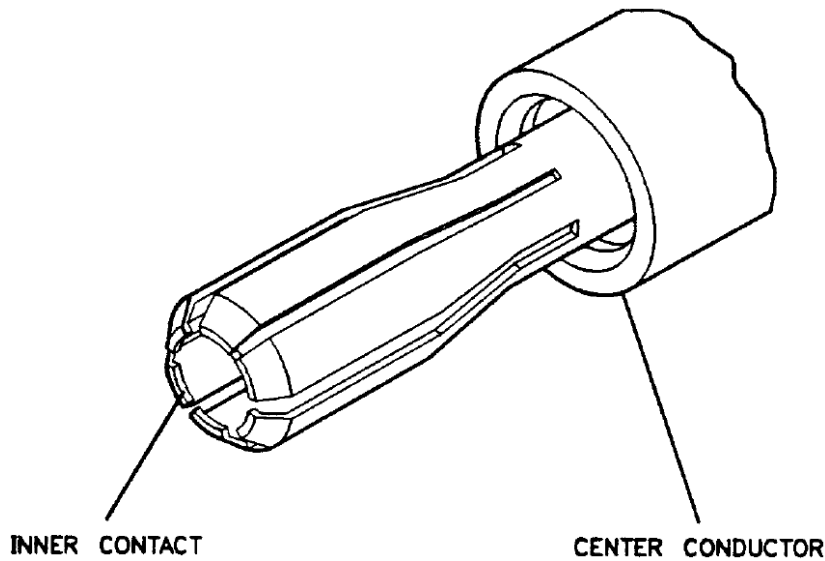
Figure 2-4 Damaged center conductor



Removing a Slotless Contact

1. If one or more of the inner contact's fingers are bent inward or crushed, you must straighten or remove those fingers before you remove the entire inner contact. **Figure 2-5** shows both the inner contact and the center conductor.

Figure 2-5 Inner contact and center conductor



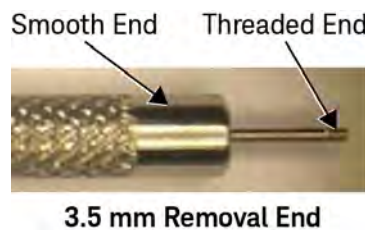
- a. Under magnification, carefully try to insert the removal tool (see [Figure 2-6](#)).
- b. If the damaged fingers prevent you from inserting the tool, use the tweezers provided to either move aside or remove the damaged fingers (see [Figure 2-7](#)).

CAUTION

Avoid damaging the center conductor, which houses the inner contact. Do not touch the tweezers to anything but the damaged inner contact. Do not, under any circumstances, use anything to squeeze or clamp on to the center conductor that might cause damage.

CAUTION

Unlike Type-N tool, 3.5 mm tool has integrated both removal and insertion ends into one tool. Before using 3.5 mm removal/insertion tool check the correct end to use to avoid damage on inner contact.



- c. After you move or remove the damaged inner contact fingers and can insert the inner contact removal tool, go to [step 3](#).

Figure 2-6 Inserting the removal tool

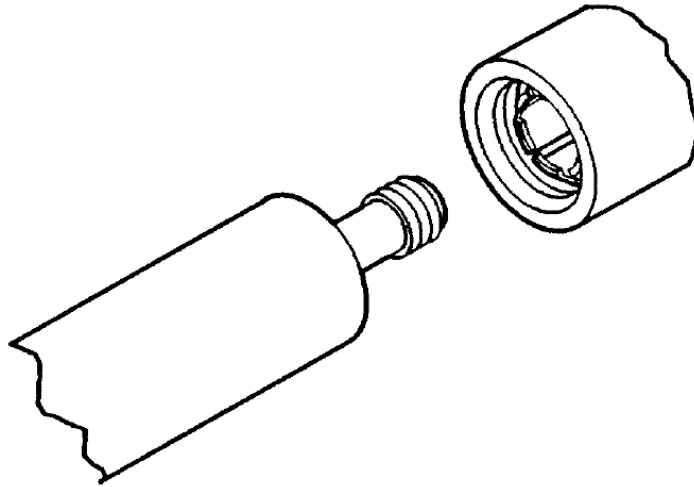
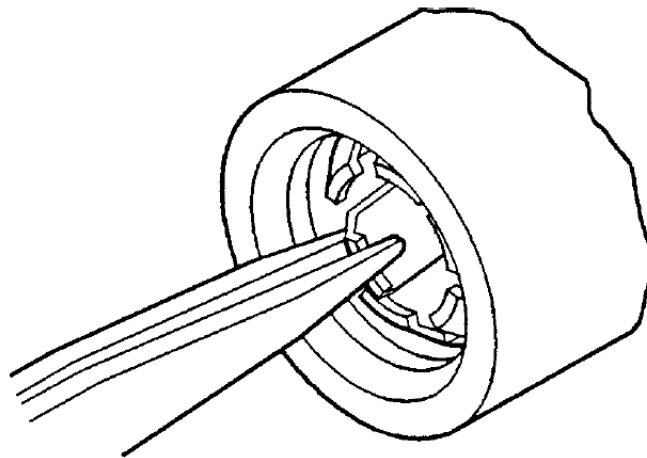


Figure 2-7 Moving a damaged finger



2. If one or more of the inner contact's fingers are broken, you must remove that finger before you remove the entire inner contact:
 - a. Under magnification, look down inside the inner contact and locate the broken finger or fingers.

The fingers may have already fallen out. If so, continue with **step 3**.
 - b. If you can see the broken fingers inside the inner contact, turn the device upside down and gently tap on it (see **Figure 2-8**).

Using this gentle tapping, try to force the broken fingers to drop out or at least move forward far enough so that you can remove them with the tweezers (see **Figure 2-9**). Do not, under any circumstances, use anything other than gentle tapping.

- c. After you remove the broken inner contact fingers and can carefully insert the inner contact removal tool, go to **step 3**.

Figure 2-8 Freeing a broken contact finger

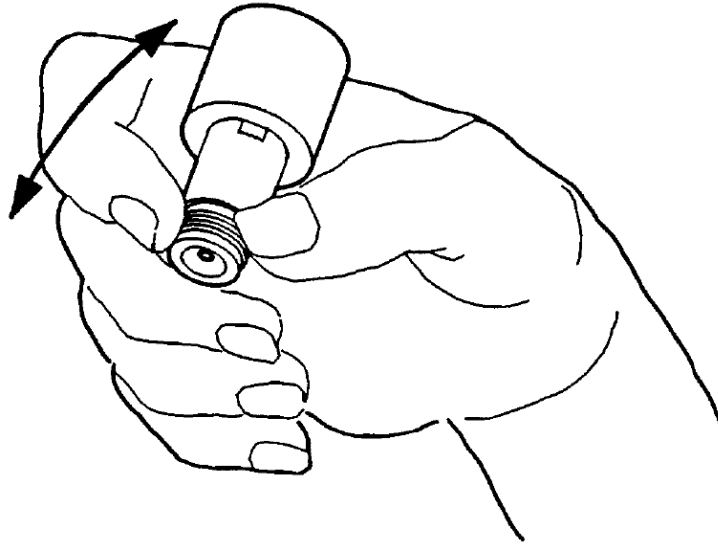
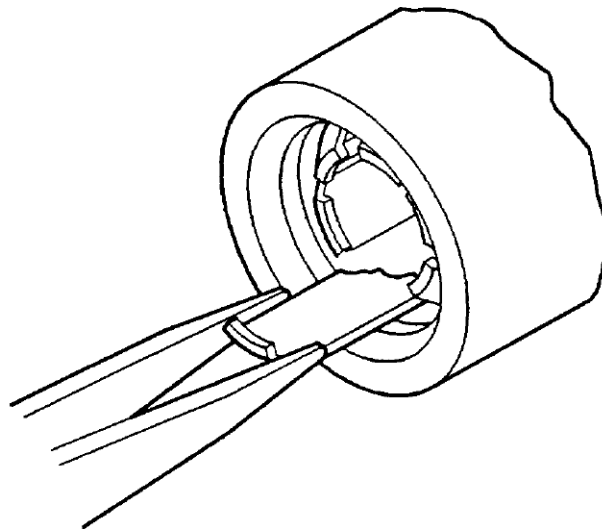


Figure 2-9 Removing a broken contact finger



3. If the inner contact is pushed inward and no longer makes contact with the mating connector's male pin, you must remove and replace the inner contact:
 - a. Under magnification, insert the removal tool into the damaged contact far enough so that it touches the bottom of the inside of the inner contact.
 - b. Turn the tool clockwise to engage the tool coupling thread with the thread on the inside of the contact (see **Figure 2-10**).

- c. Occasionally the inner contact spins with the tool, preventing the tool from engaging. If this happens, apply a small amount axial pressure to the tool and continue to turn it clockwise.
- d. Once the tool is engaged by 2 turns, you can remove the inner contact. Pull the tool and inner contact straight out away from the center conductor (see [Figure 2-11](#)).

CAUTION

Do not damage the center conductor as you remove the inner contact.

- e. Unthread the broken inner contact from the removal tool and discard the contact; it cannot be repaired or reused.

Figure 2-10 Threading the removal tool into the inner contact

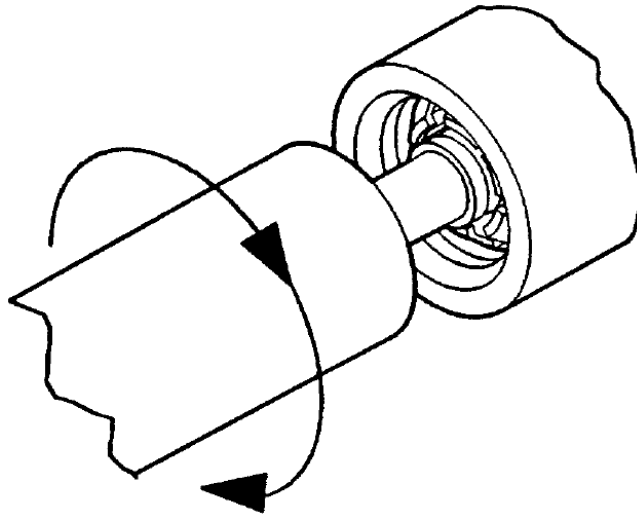
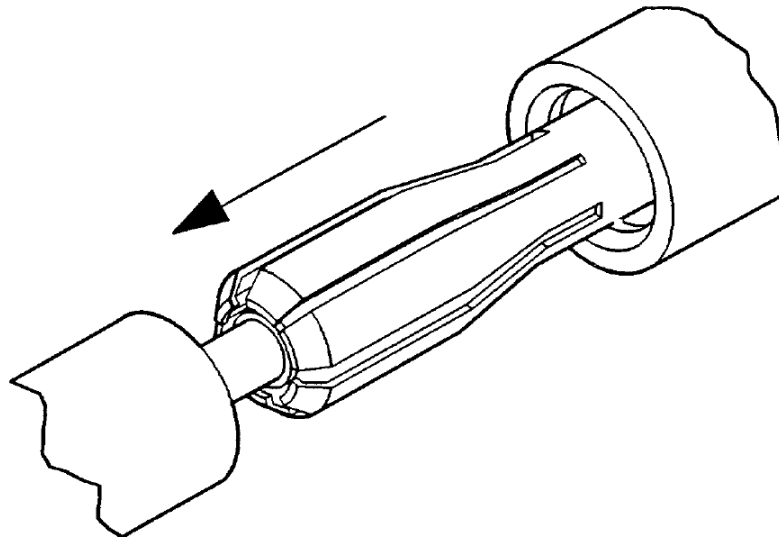


Figure 2-11 Removing the inner contact

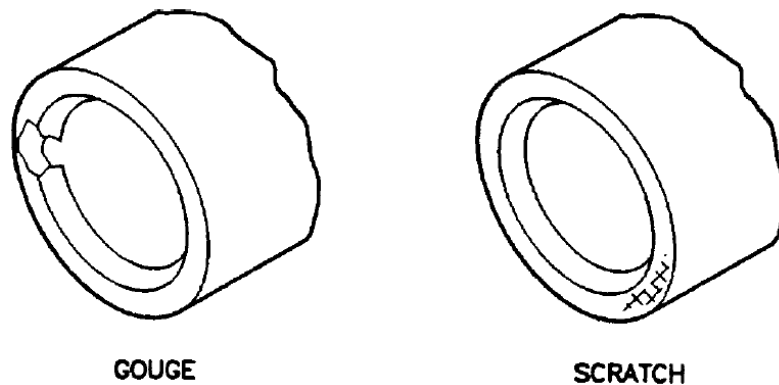


Inspecting and Cleaning A Center Conductor

Inspecting

1. Under magnification, inspect the center conductor for damage.
2. Refer to **Figure 2-12**. Is the center conductor gouged? Does it have any imperfection that would interfere with the insertion of a new inner contact? If so, you must return the device to Keysight Technologies for repair; you cannot repair a center conductor with this kit.
3. If the center conductor is undamaged, or if the damage is too light to affect device performance, clean the center conductor.

Figure 2-12 Damaged center conductor



Cleaning

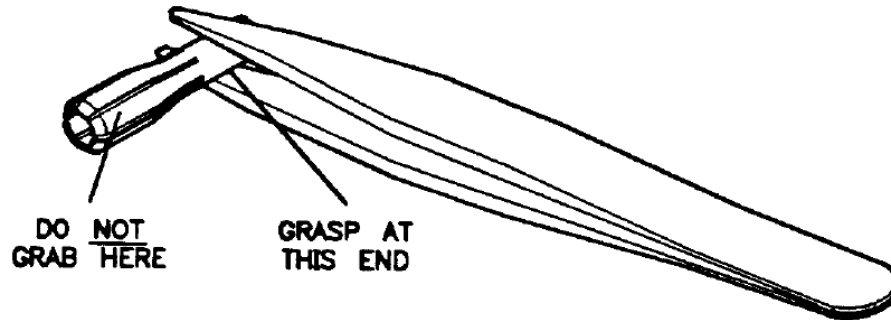
1. Under magnification, look for loose dirt or metal particles.
2. Using the foam swabs and isopropyl alcohol provided in this repair kit, clean the center conductor.
3. Using a source of dry air or nitrogen, blow out the hole in the center conductor; be sure that all the alcohol evaporates.
4. The clean center conductor is now ready for you to insert a new inner contact.

Inserting an Inner Contact

When you install a replacement inner contact, be careful handling the replacement parts. These parts are fragile until they are inside the center conductor; do not squeeze or misuse them in any way.

1. Using the tweezers provided in this kit, carefully pick up a new inner contact by its small-diameter end (away from the fingers, see [Figure 2-13](#)). Do not use excessive pressure. Holding the contact by the fingers will damage it.

Figure 2-13 How to properly hold the inner contact



2. Under magnification, carefully insert the insertion tool into the new inner contact until it hits bottom. Do not use the removal tool (with the threaded end) to insert the inner contact, or you may damage the new inner contact.
3. Let go of the contact with tweezers and slowly insert the contact into the center conductor (see [Figure 2-14](#)). As you install the contact, its fingers compress and the force required to insert it first increases and then decreases. When the insertion force begins to decrease, do not push too hard or you may damage the new inner contact or center conductor.
4. At the point that the contact snaps into place, stop pushing.
5. Carefully withdraw the insertion tool from the inner contact.
6. Under magnification, visually inspect the assembly and make sure the inner contact is properly installed (see [Figure 2-15](#)).

CAUTION

Never apply either lubricant or adhesive to an inner contact.

CAUTION

Unlike Type-N tool, 3.5 mm tool has integrated both removal and insertion ends into one tool. Before using 3.5 mm removal/insertion tool check the correct end to use to avoid damage on inner contact.

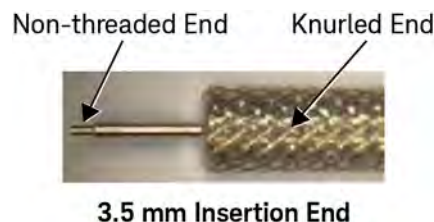


Figure 2-14 Installing a new inner contact

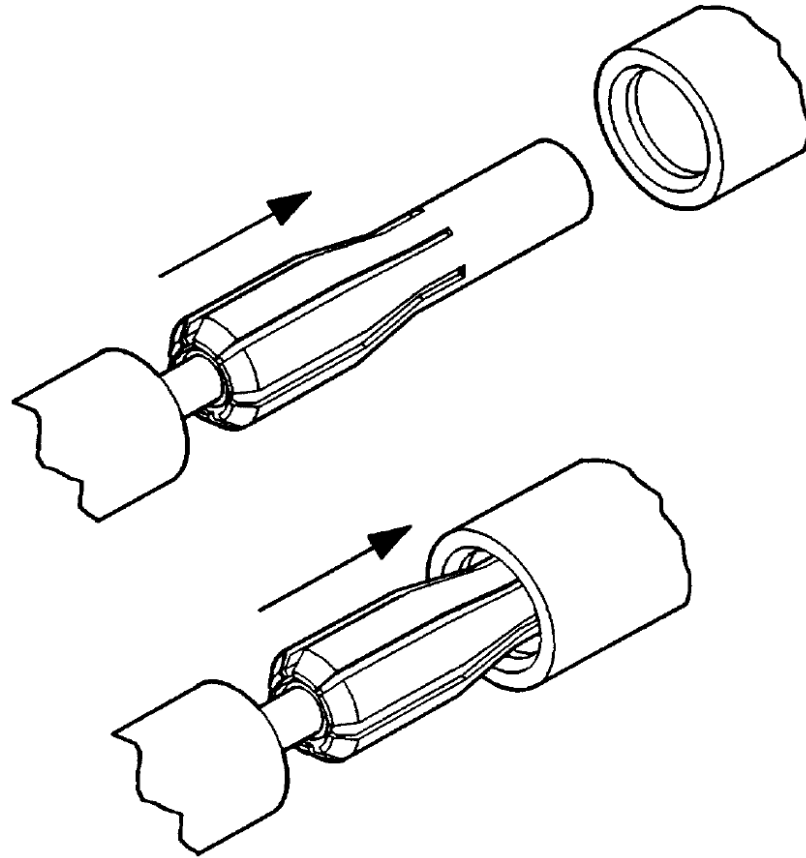
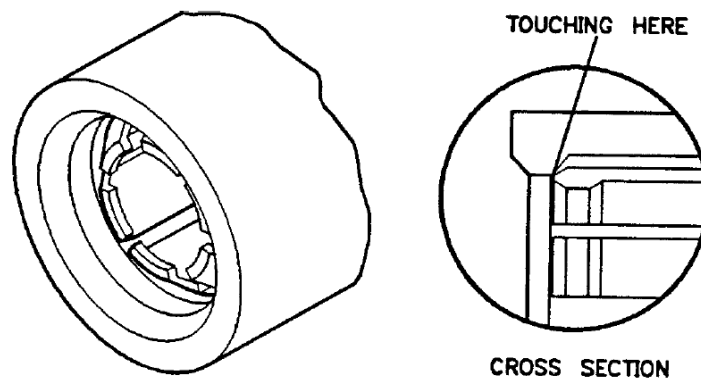


Figure 2-15 Inspecting the installation



Testing a Slotless Contact

After you install a new inner contact, you must test it using the tools provided in this repair kit. This tool was designed to help find improperly installed inner contacts.

1. Using a foam swab and alcohol, clean the testing tool.
2. Under magnification, carefully install the testing tool in the slotless contact assembly (see [Figure 2-16](#)).
3. Repeat [step 2](#), two more times.
4. Inspect the inner contact. If the fingers are damaged, remove and replace the inner contact.
5. Insert the testing tool.
6. With the testing tool inserted, turn the device upside down so that the testing tool hangs by the grip of the slotless contact.
7. Hook the testing weight to the testing tool. If the contact has the proper minimum retention force, it does not lose its grip.
8. Remove the testing weight.
9. Remove the testing tool.
10. Visually inspect the slotless contact.
11. If you see any dirt or metal particles, clean the contact using the alcohol and foam swabs provided in this kit.
12. The clean, precision slotless connector is ready for use.

Figure 2-16 Inserting the testing tool

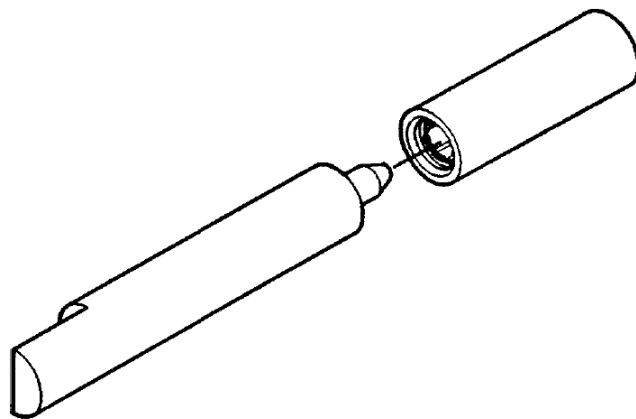
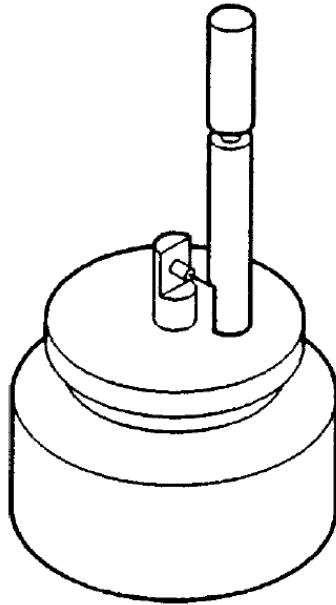


Figure 2-17 Testing the retention force of the contact



Contacting Keysight Technologies

Online assistance: <http://www.keysight.com/find/assist>

Americas

Canada
1 877 894 4414

Latin America
(305) 269 7500

United States
1 800 829 4444

Asia Pacific

Australia
1 800 629 485

China
800 810 0189

Hong Kong
800 938 693

India
1 800 112 929

Japan
0 120 (421) 345

Korea
080 769 0800

Malaysia
1 800 888 848

Singapore
1 800 375 8100

Taiwan
0800 047 866

Thailand
1 800226 008

Europe & Middle East

Austria
43 (0) 1 360 277 1571

Belgium
32 (0) 2 404 93 40

Denmark
45 70 13 15 15

Finland
358 (0) 10 855 2100

France
0825 010 700*
*0.125 Euros/minute

Germany
49 (0) 7031 464 6333

Ireland
1890 924 204

Israel
972-3-9288-504/544

Italy
39 02 92 60 8484

Netherlands
31 (0) 20 547 2111

Spain
34 (91) 631 3300

Sweden
0200-88 22 55

Switzerland
0800 80 53 53

United Kingdom
44 (0) 118 9276201

Other European Countries: <http://www.keysight.com/find/contactus>



This information is subject to change
without notice.

© Keysight Technologies 2000-2021

Edition 1, February 2021



85052-90070

www.keysight.com