

# **User's and Service Guide**

## **Agilent Technologies 85052B 3.5 mm Calibration Kit**

This manual applies to 85052B calibration kits with serial number prefix 3106A.



**Agilent Part Number: 85052-90077**

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## Calibration Kit Overview

The Agilent 85052B 3.5 mm calibration kit is used to calibrate Agilent network analyzers up to 26.5 GHz for measurements of components with 3.5-mm connectors.

### Kit Contents

The 85052B calibration kit includes the following items:

- calibration kit storage case
- user's and service guide
- offset opens and shorts, broadband loads and sliding load terminations
- 3.5 mm gage sets
- three 3.5 mm adapters
- 5/16 in, 90 N-cm (8 in-lb) torque wrench
- centering bead (for gaging 3.5 mm sliding loads)
- open-end wrench

Refer to [Table 6-1 on page 6-2](#) and [Table 6-2 on page 6-4](#) for a complete list of kit contents and their associated part numbers.

For measurement convenience, the kit also contains three 3.5 mm adapters. The adapters are primarily intended for use in measuring non-insertable devices, but can also be used as a connector saver.

### Broadband Loads

The broadband loads are metrology-grade terminations that have been optimized for performance up to 26.5 GHz. The rugged internal structure provides for highly repeatable connections. A distributed resistive element on sapphire provides excellent stability and return loss.

### Offset Opens and Shorts

The offset opens and shorts are built from parts that are machined to the current state-of-the-art in precision machining.

The offset short's inner conductors have a one-piece construction, common with the shorting plane. The construction provides for extremely repeatable connections.

The offset opens have inner conductors that are supported by a strong, low-dielectric constant plastic to minimize compensation values.

Both the opens and shorts are constructed so that the pin depth can be controlled very tightly, thereby minimizing phase errors. The lengths of the offsets in the opens and shorts are designed so that the difference in phase of their reflection coefficients is approximately 180 degrees at all frequencies.

### Adapters

Like the other devices in the kit, the adapters are built to very tight tolerances to provide

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## **2 Specifications**

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## Environmental Requirements

**Table 2-1 Environmental Requirements**

Parameter	Limits
Temperature	
Operating <sup>a</sup>	+20 °C to +26 °C
Storage	-40 °C to +75 °C
Error-corrected range <sup>b</sup>	± 1 °C of measurement calibration temperature
Relative humidity	Type tested at 95%, 40 °C (non-condensing)

- a. The temperature range over which the calibration standards maintain conformance to their specifications.
- b. The allowable network analyzer ambient temperature drift during measurement calibration and during measurements when the network analyzer error correction is turned on. Also, the range over which the network analyzer maintains its specified performance while correction is turned on.

### Temperature—What to Watch Out For

Changes in temperature can affect electrical characteristics. Therefore, the operating temperature is a critical factor in performance. During a measurement calibration, the temperature of the calibration devices must be stable and within the range shown in [Table 2-1](#).

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**IMPORTANT** Avoid unnecessary handling of the devices during calibration because your fingers are a heat source.

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## Mechanical Characteristics

Mechanical characteristics such as center conductor protrusion and pin depth are *not* performance specifications. They are, however, important supplemental characteristics related to electrical performance. Agilent Technologies verifies the mechanical characteristics of the devices in the kit with special gaging processes and electrical testing. This ensures that the device connectors do not exhibit any center conductor protrusion or improper pin depth when the kit leaves the factory.

“Gaging Connectors” on page 3-6 explains how to use gages to determine if the kit devices have maintained their mechanical integrity. Refer to Table 2-2 on page 2-4 for typical and observed pin depth limits.

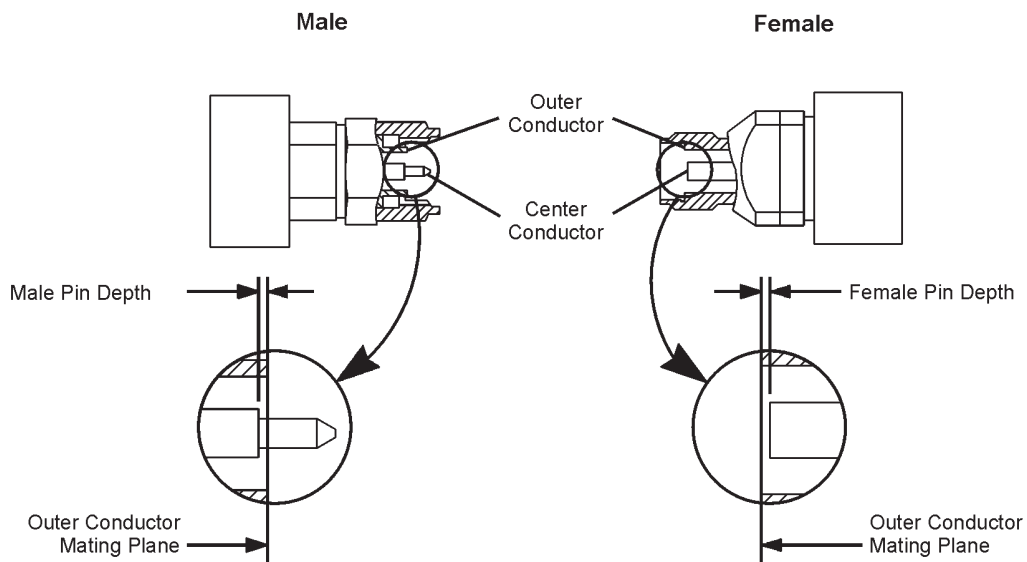
### Pin Depth

Pin depth is the distance the center conductor mating plane differs from being flush with the outer conductor mating plane. See Figure 2-1. The pin depth of a connector can be in one of two states: either protruding or recessed.

**Protrusion** is the condition in which the center conductor extends beyond the outer conductor mating plane. This condition will indicate a positive value on the connector gage.

**Recession** is the condition in which the center conductor is set back from the outer conductor mating plane. This condition will indicate a negative value on the connector gage.

**Figure 2-1 Connector Pin Depth**



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## Mechanical Characteristics

The pin depth value of each calibration device in the kit is not specified, but is an important mechanical parameter. The electrical performance of the device depends, to some extent, on its pin depth. The electrical specifications for each device in the kit take into account the effect of pin depth on the device's performance. Table 2-2 lists the typical pin depths and measurement uncertainties, and provides observed pin depth limits for the devices in the kit. If the pin depth of a device does not measure within the *observed* pin depth limits, it may be an indication that the device fails to meet electrical specifications. Refer to Figure 2-1 for a visual representation of proper pin depth (slightly recessed).

**Table 2-2 Pin Depth Limits**

Device	Typical Pin Depth	Measurement Uncertainty <sup>a</sup>	Observed Pin Depth Limits <sup>b</sup>
Opens	0 to -0.0127 mm 0 to -0.00050 in	+0.0064 to -0.0064 mm +0.00025 to -0.00025 in	+0.0064 to -0.0191 mm +0.00025 to -0.00075 in
Shorts	0 to -0.0127 mm 0 to -0.00050 in	+0.0041 to -0.0041 mm +0.00016 to -0.00016 in	+0.0041 to -0.0168 mm +0.00016 to -0.00066 in
Fixed loads	-0.0025 to -0.0254 mm -0.0001 to -0.0010 in	+0.0041 to -0.0041 mm +0.00016 to -0.00016 in	+0.0016 to -0.0295 mm +0.00006 to -0.00116 in
Adapter	-0.0025 to -0.0254 mm -0.0001 to -0.0010 in	+0.0041 to -0.0041 mm +0.00016 to -0.00016 in	+0.0016 to -0.0295 mm +0.00006 to -0.00116 in
Sliding loads	0 to -0.0076 mm 0 to -0.00030 in	+0.0041 to -0.0041 mm +0.00016 to -0.00016 in	+0.0041 to -0.0117 mm +0.00016 to -0.00046 in

- a. Approximately +2 sigma to -2 sigma of gage uncertainty based on studies done at the factory according to recommended procedures.
- b. Observed pin depth limits are the range of observation limits seen on the gage reading due to measurement uncertainty. The depth could still be within specifications.

## Electrical Specifications

The electrical specifications in [Table 2-3](#) apply to the devices in your calibration kit when connected with an Agilent precision interface.

**Table 2-3 Electrical Specifications for 85052B 3.5 mm Devices**

Device	Specification	Frequency (GHz)
Broadband loads (male and female)	Return loss $\geq 46$ dB ( $\rho \leq 0.00501$ )	dc to $\leq 2$
	Return loss $\geq 44$ dB ( $\rho \leq 0.00631$ )	$> 2$ to $\leq 3$
	Return loss $\geq 38$ dB ( $\rho \leq 0.01259$ )	$> 3$ to $\leq 8$
	Return loss $\geq 36$ dB ( $\rho \leq 0.01585$ )	$> 8$ to $\leq 20$
	Return loss $\geq 34$ dB ( $\rho \leq 0.01995$ )	$> 20$ to $\leq 26.5$
Sliding loads <sup>a</sup>	Return loss $\geq 44$ dB ( $\rho \leq 0.00631$ )	$> 3$ to $\leq 26.5$
Offset opens <sup>b</sup> (male and female)	$\pm 0.65^\circ$ deviation from nominal	dc to $\leq 3$
	$\pm 1.20^\circ$ deviation from nominal	$> 3$ to $\leq 8$
	$\pm 2.00^\circ$ deviation from nominal	$> 8$ to $\leq 20$
	$\pm 2.00^\circ$ deviation from nominal	$> 20$ to $\leq 26.5$
Offset shorts <sup>b</sup> (male and female)	$\pm 0.50^\circ$ deviation from nominal	dc to $\leq 3$
	$\pm 1.00^\circ$ deviation from nominal	$> 3$ to $\leq 8$
	$\pm 1.75^\circ$ deviation from nominal	$> 8$ to $\leq 20$
	$\pm 1.75^\circ$ deviation from nominal	$> 20$ to $\leq 26.5$
Adapters <sup>c</sup>	Return loss $\geq 30$ dB ( $\rho \leq 0.03162$ )	dc to $\leq 8$
	Return loss $\geq 28$ dB ( $\rho \leq 0.03981$ )	$> 8$ to $\leq 18$
	Return loss $\geq 26$ dB ( $\rho \leq 0.05012$ )	$> 18$ to $\leq 26.5$

a. Assuming proper usage, the specifications for the residual return loss after calibration for the sliding load termination include:

- the quality of the airline portions within the sliding load, combined with
- the effective stability of the sliding element.

Proper usage includes the following practices:

- Connector mating surfaces are clean.
- The changes in slide positioning are NOT done in equal steps since this results in very poor calibration for some portions of the frequency range.
- The center conductor of test port connectors are nominally set back from the outer conductor.

Sliding loads are designed to allow the center conductor to be moved. The position of the sliding load center conductor should be set by a reference block and not positioned flush against the center conductor of the test port.

<See the following page for more footnotes.>

- b. The specifications for the opens and shorts are given as allowed deviation from the nominal model as defined in the standard definitions.
- c. The offset delay value is 94.75 psec.

## **Residual Errors after Calibration**

The 8510 “Specifications and Performance Verification” software can be used to obtain a printout of the residual errors after a calibration has been performed. Refer to the “Specifications and Performance Verification” section of the 8510C *On-Site Service Manual* for information on how to use the software.

## **Certification**

Agilent Technologies certifies that this product met its published specifications at the time of shipment from the factory. Agilent further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology (NIST) to the extent allowed by the institute’s calibration facility, and to the calibration facilities of other International Standards Organization members. See [“How Agilent Verifies the Devices in Your Kit” on page 4-2](#) for more information.