1 General Information

Calibration Kit Overview

The Agilent 85032F type-N 50 Ω calibration kit is used to calibrate Agilent network analyzer systems for measurements of components with type-N connectors up to 9 GHz. The standards in this calibration kit allow you to perform simple 1- or 2-port calibrations.

This manual describes the 85032F calibration kit and provides replacement part numbers, specifications, and procedures for using, maintaining and troubleshooting the kit.

NOTE This manual assumes you practice proper connector care. For information, refer to Chapter 3,"Use, Maintenance, and Care of the Devices." Also refer to the "Principles of Microwave Connector Care – Quick Reference Card," located in the back of this manual.

Kit Contents

The 85032F type-N calibration kit contains the following:

- offset opens and shorts, and broadband load terminations with both male and female connectors
- disk that contains the calibration constants of the devices in this kit

Broadband Loads

The broadband loads are metrology-grade, 50 ohm terminations that have been optimized for performance up to 9 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 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.

Calibration Definitions

The calibration kit must be selected and the calibration definitions for the devices in the kit installed in the network analyzer prior to performing a calibration. Refer to your network analyzer user's guide for instructions on selecting the calibration kit and performing a calibration.

The calibration definitions can be:

- resident within the analyzer
- loaded from the provided disk
- entered from the front panel

Installation of the Calibration Definitions

The calibration definitions for the kit may be permanently installed in the internal memory or hard disk of the network analyzer.

If the calibration definitions for the kit are not permanently installed in the network analyzer, they must be manually entered. Refer to your network analyzer user's guide for instructions.

Options

There are several optional adapters available for the 85032F. See Table 6-1 on page 6-3 for further information.

Equipment Required but Not Supplied

Connector gage sets, optional adapters, open-end wrenches and various connector cleaning supplies are *not* included with this calibration kit. These or similar items are recommended to ensure the successful operation of this calibration kit. Refer to Table 6-2 on page 6-4 for ordering information.

2 Specifications

Environmental Requirements

Table 2-1 Environmental Requirements

Parameter	Limits
Operating temperature[a]	+20 °C to +26 °C (+68 °F to +79 °F)
Error-corrected temperature range[b]	±1 °C of measurement calibration temperature
Storage temperature	–40 °C to +75 °C (–40 °F to +167 °F)
Altitude	
Operation	< 4,500 meters (≈15,000 feet)
Storage	< 15,000 meters (≈50,000 feet)
Relative humidity	Always Non-Condensing
Operation	0 to 80% (26 °C maximum dry bulb)
Storage	0 to 95%

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.

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

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 this 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 3-7 explains how to use gages to determine if the kit devices have maintained their mechanical integrity. (Refer to Table 2-3 on page 2-4 for *typical* and *observed* pin depth limits).

Table 2-2 Mechanical Characteristics

Dimension	Typical Value
Inside diameter of outer conductor	7.0000 ±0.0076 mm
Outside diameter of center conductor	3.0404 ±0.0051 mm

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. Some coaxial connectors (such as 2.4 mm and 3.5 mm) are designed to have these planes nearly flush. Type-N connectors, however, are designed with a pin depth offset of approximately 5.26 mm (0.207 inch), not permitting these planes to be flush. The male center conductors are recessed by the offset value while the female center conductors compensate by protruding the same amount. This offset necessitates redefining of pin depth with regard to protrusion and recession.

Protrusion refers to a male type-N connector center conductor having a pin depth value less than 5.26 mm (0.207 inch), or female type-N connector center conductor having a pin depth value greater that 5.26 (0.207 inch).

Recession refers to a male type-N connector center conductor having a pin depth value greater than 5.26 mm (0.207 inch), or female type-N connector center conductor having a pin depth value less than 5.26 (0.207 inch).

The pin depth value of each calibration device in this 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 this kit take into account the effect of pin depth on the device's performance. Table 2-3 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 in type-N connectors.

NOTE The gages intended for measuring the type-N connectors compensate for the designed offset of 5.26 mm (0.207 inch). Therefore, protrusion and recession readings will be in relation to a *zero* reference plane (as if the inner and outer conductor planes were intended to be flush). Gage readings can be directly compared with the *observed* values listed in Table 2-3.

Figure 2-1 Connector Pin Depth

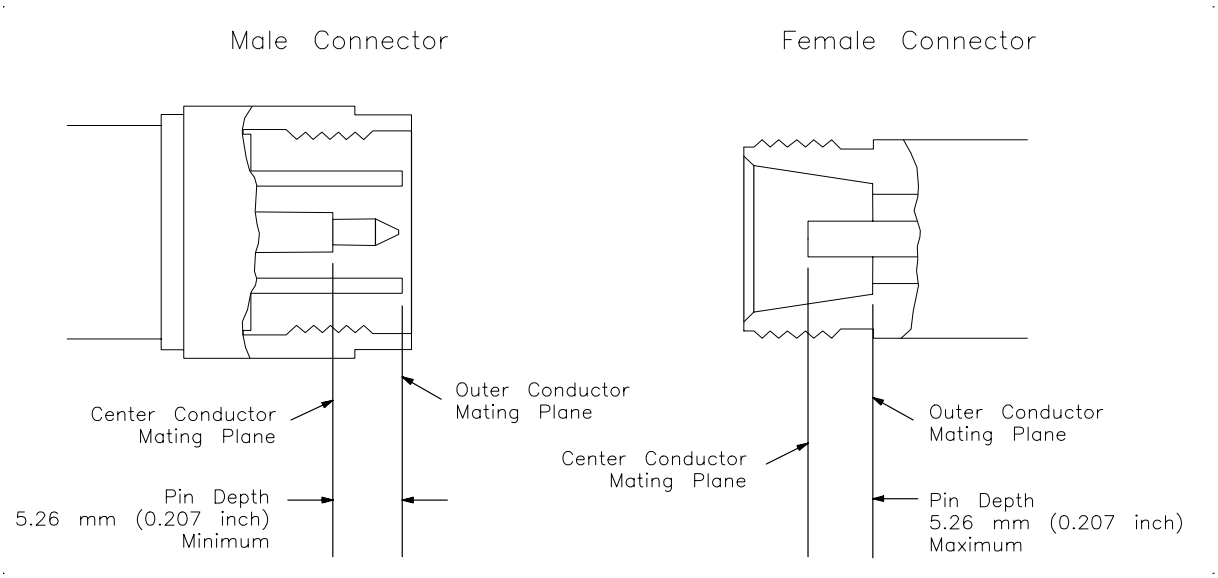

Table 2-3 Pin Depth Limits

Device	Typical Pin Depth	Measurement Uncertainty[a]	Observed Pin Depth Limits
Opens	0 to –0.0127 mm (0 to –0.0005 in)	+0.0038 to –0.0038 mm (+0.00015 to –0.00015 in)	+0.0038 to –0.0165 mm (+0.00015 to –0.00065 in)
Shorts	0 to –0.0127 mm (0 to –0.0005 in)	+0.0038 to –0.0038 mm (+0.00015 to –0.00015 in)	+0.0038 to –0.0165 mm (+0.00015 to –0.00065 in)
Fixed Loads	0 to –0.0508 mm (0 to –0.002 in)	+0.0038 to –0.0038 mm (+0.00015 to –0.00015 in)	+0.0038 to –0.0546 mm (+0.00015 to –0.00215 in)

a. Approximately +2 sigma to –2 sigma of gage uncertainly based on studies done at the factory using the 85054-60049 gages kit (same as kit gages) according to recommended procedures.

NOTE When measuring pin depth, the measured value (resultant average of three or more measurements) is *not* the true value. Always compare the measured value with the *observed* pin depth limits in Table 2-3 to evaluate the condition of device connectors.

Electrical Specifications

The electrical specifications in Table 2-4 apply to the devices in your calibration kit when connected with an Agilent precision interface.

Table 2-4 Electrical Specifications

Device	Frequency (GHz)	Parameter	Specification
Broadband Loads	DC to ≤2	Return Loss	≥48 dB (≤0.00398ρ)
(male and female)	>2 to ≤3	Return Loss	≥45 dB (≤0.00562ρ)
	>3 to ≤6	Return Loss	≥40 dB (≤0.010ρ)
	>6 to ≤9	Return Loss	≥38 dB (≤0.0126ρ)
Adapters[a]	DC to ≤9	Return Loss	≥38 dB (≤0.0126ρ)
Offset Opens[b]	DC to ≤3	Deviation from Nominal	±0.65°
(male and female)	>3 to ≤9	Phase	±1.00°
Offset Shorts[b]	DC to ≤3	Deviation from Nominal	±0.65°
(male and female)	>3 to ≤9	Phase	±1.00°

a. Specifications apply to Options 100, 200, and 300 only.
b. The specifications for the opens and shorts are given as allowed deviation from the nominal model as defined in the standard definitions. Refer to Table A-7 through Table A-9.

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 This Kit" on page 4-2 for more information.