

uCal™ Universal VNA Calibration Module

DATA SHEET

MODELS:

- UC26-35 26.5 GHz uCal with 3.5mm connectors
- UC18-7 18 GHz uCal with 7mm connectors
- UC18-N 18 GHz uCal with Type N connectors



The Importance of VNA Calibration

Calibration of a Vector Network Analyzer (VNA) is essential to ensure accurate and reliable measurements of network parameters, such as S-parameters, over the desired frequency range. A VNA calibration kit is used in this process because it provides known and precise reference standards to correct for systematic errors introduced by the measurement system, cables, and connectors. Calibrating a VNA is performed to:

ELIMINATE SYSTEMATIC ERRORS

- Directivity: Corrects for imperfections in the directional coupler.
- Source Match: Compensates for mismatch at the VNA source port.
- Load Match: Corrects for mismatch at the measurement port.
- Reflection Tracking: Adjusts for errors in reflected signal measurements.
- Transmission Tracking: Compensates for errors in signal transmission paths.

Calibration ensures that these systematic errors are accounted for and removed, improving measurement accuracy.

ESTABLISH A REFERENCE PLANE

Calibration defines the reference plane at the measurement ports (the plane where the DUT—Device Under Test—is connected). This ensures that the VNA measurements reflect the DUT's characteristics without being influenced by the cables or connectors leading to the device.

COMPENSATE FOR CONNECTOR AND CABLE EFFECTS

Real-world cables and connectors have losses, mismatches, and other imperfections. Calibration accounts for these, so the VNA measures only the DUT's response.

Universal VNA Calibration Modules

Universal VNA Calibration Modules (uCal) simplify and expedite the calibration process of a Vector Network Analyzer (VNA) by automating the use of calibration standards, reducing human error, and providing accurate results without manual intervention.

A uCal contains a set of precisely defined and integrated calibration standards, each standard individually characterized with measurement uncertainty and stored on the uCal's onboard memory. The uCal is equipped with electronic switches to select and connect the appropriate calibration standard to the VNA, thereby enabling rapid transitions between standards without physically disconnecting or reconnecting cables, reducing the chances of human-induced errors like improper torque or connector wear.



A uCal includes an integrated characterized transmission line that functions as a verification device. By comparing measured results against its precisely known reference data, users can confirm calibration accuracy, identify setup issues, and ensure long-term confidence in measurement integrity.

Communication with the VNA

uCal connects to the VNA via USB control interfaces.

Calibration coefficients for each standard are pre-programmed into uCal and communicated to the VNA, either directly (for VNAs that directly support uCal) or through Insight.

Calibration Process

Using Insight, the uCal performs the calibration in several automated steps:

1. The VNA directs the uCal to switch to the open standard and measures the response.
2. It then switches to the short standard and measures the response.
3. Next, it switches to the load standard and performs another measurement.
4. Finally, it connects the through standard to measure the transmission response.
5. Based on these measurements and the known parameters of the standards, the VNA, or Insight, calculates and applies error correction to the measurement system.

User Interface

The process is controlled through Insight, providing a guided and user-friendly calibration routine, compatible with most VNA makes and models. Users only need to connect the uCal to the VNA ports, and the rest is handled automatically.

Advantages include

- Speed: Calibration is faster since there is no need to manually connect and disconnect standards.
- Accuracy: Eliminates errors caused by manual handling, such as connector inconsistencies and improper torquing.
- Ease of Use: Minimal user interaction is required, making calibration simpler and more accessible.
- Reliability: Reduces wear and tear on VNA ports and connectors, prolonging their lifespan.
- Consistency: Provides repeatable results across multiple calibration sessions and users.

UC26-35

26.5 GHZ UCAL WITH 3.5MM CONNECTORS

Specifications

Frequency50 MHz - 26.5 GHz
Connectors3.5mm

Configuration..... UCFF-CC-GG
FF.....26 (26.5 GHz)
CC35 (3.5mm)
GG.....MM (male-male)
.....MF (male-female)
.....FF (female-female)



UC18-7

18 GHZ UCAL WITH 7MM CONNECTORS

Specifications

Frequency50 MHz - 18 GHz
Connectors7mm

Configuration..... UCFF-CC-GG
FF.....18 (18 GHz)
CC7 (7mm)
GG.....XX (genderless)



	50 MHz to 500 MHz	0.5 GHz to 2 GHz	2 GHz to 20 GHz	20 GHz to 26.5 GHz
Directivity	40 dB	41 dB	38 dB	38 dB
Source Match	38 dB	38 dB	38 dB	35dB
Tracking	0.08 db	0.08 dB	0.1 dB	0.1 dB

	50 MHz to 500 MHz	0.5 GH to 2 GHz	2 GHz to 18 GHz
Directivity	40 db	41 dB	35 dB
Source Match	38 dB	38 dB	38 dB
Tracking	0.08 db	0.08 dB	0.1 dB

UC18-N

18 GHZ UCAL WITH TYPE N CONNECTORS

Specifications

Frequency50 MHz - 18 GHz
ConnectorsType N

Configuration..... UCFF-CC-GG
FF.....18 (18 GHz)
CCN (Type N)
GG.....MM (male-male)
.....MF (male-female)
.....FF (female-female)

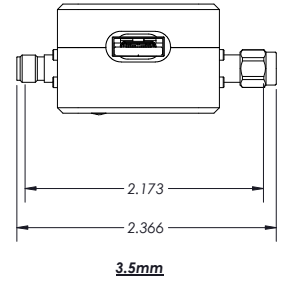
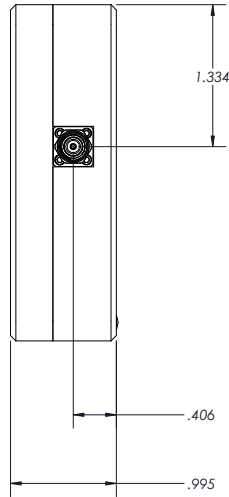
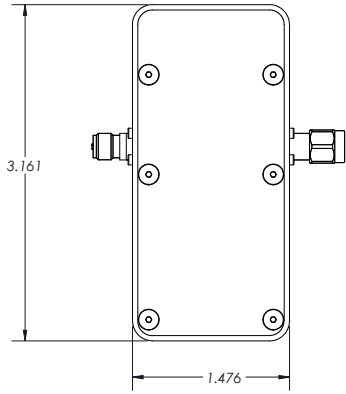


	50 MHz to 500 MHz	0.5 GHz to 2 GHz	2 GHz to 18 GHz
Directivity	40 dB	41 dB	38 dB
Source Match	38 dB	38 dB	38 dB
Tracking	0.08 dB	0.08 dB	0.1 dB

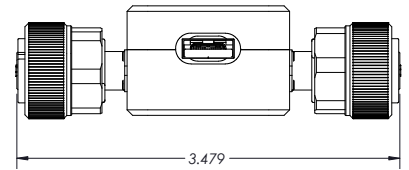
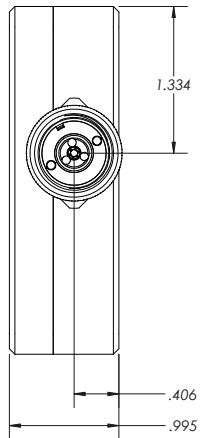
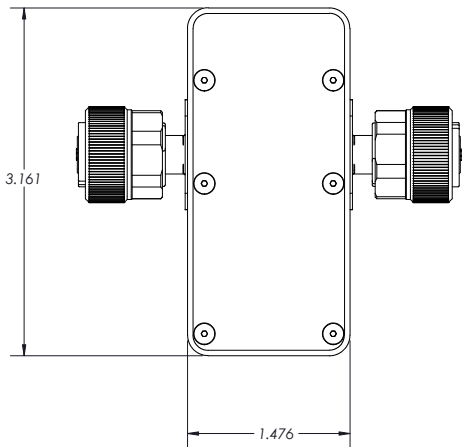
Dimensions

Measurements are in inches

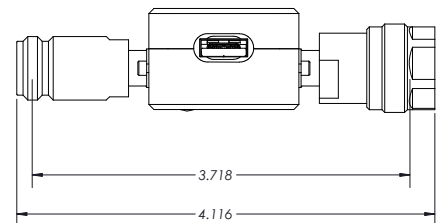
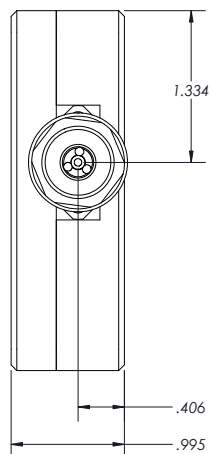
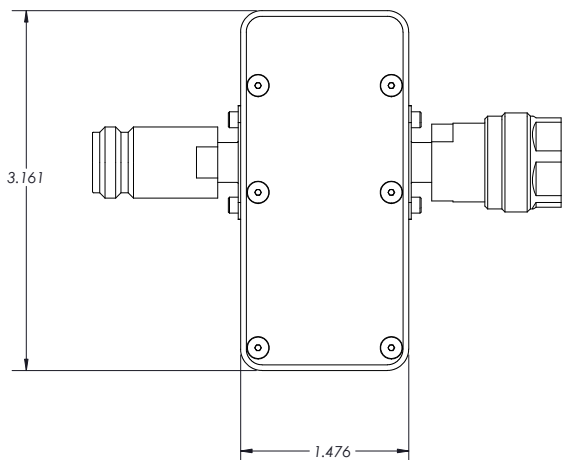
3.5mm



7mm



Type N



Recommended Accessories

Insight

Accurate calibration and measurement are the foundation of trustworthy VNA results. Maury's Insight software simplifies calibration, validation, visualization, and uncertainty analysis across most commercial VNAs. With guided workflows, users avoid common mistakes, validate calibrations with confidence, and quantify measurement uncertainty in real time. Insight ensures consistent results across teams and labs, empowering better decisions and higher confidence in every measurement.

Insight is the primary interface between the uCal and commercial VNAs, for models that do not directly support uCal. With Insight, users can use uCal with modern and legacy VNAs alike.

Verification Kits

Validation is the most important step in ensuring trustworthy VNA measurements. Maury verification kits provide a definitive way to confirm calibration accuracy by comparing user-measured data to factory-characterized standards. Available for 1-port and 2-port calibration validation, these kits detect errors that traditional airline checks may miss, helping you avoid costly mistakes and repeat calibrations. Using verification kits ensures confidence in your results and protects the integrity of your test process.

Torque wrenches

Consistent connector tightness is critical for repeatable, reliable measurements and longer connector life. Maury torque wrenches use a "break" design to prevent over-torquing, ensuring every connection is tightened to the correct specification. Color-coded handles make it easy to select the right tool, reducing setup errors and protecting valuable test ports and cables. Regular use helps maintain measurement accuracy while minimizing costly connector damage.

Connector Gage Kits

Connector gage kits are essential for ensuring that coaxial connectors meet critical mechanical tolerances before mating. Incorrect pin depth or misaligned contacts can cause poor electrical performance, unreliable measurements, or even permanent connector damage. Maury's gage kits provide quick, accurate, and repeatable measurements across all common connector types, helping you maintain measurement accuracy and protect valuable test equipment.

Metrology adapters

Maury metrology adapters provide the highest accuracy when connecting precision coaxial components. Available as both in-series and between-series, these phase-matched adapters are engineered for minimal electrical length difference and extremely low VSWR. By ensuring consistent, repeatable connections across different connector families, they safeguard measurement integrity and help extend the useful life of calibration kits and test equipment.



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