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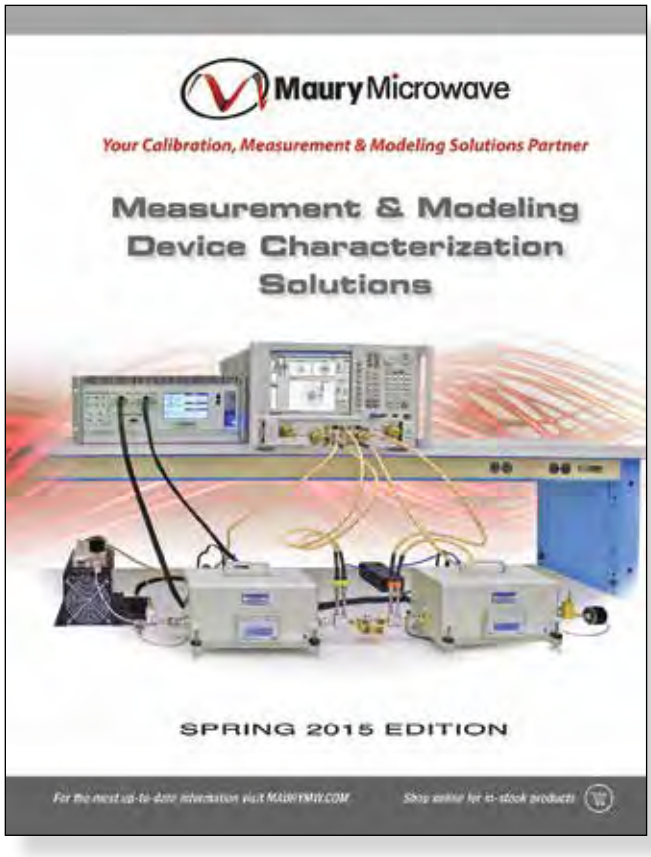
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# Maury Precision Calibration Standards

## *Your Calibration, Measurement & Modeling Solutions Partner!*

## *In This Volume:*

### *Calibration Kits for Vector Network Analyzers*

For precise, accurate calibration of Keysight, Anritsu, Rohde & Schwarz, and other network analyzers from DC to 110 GHz, Maury offers calibration-grade (metrology) cal kits in all popular connector types, in fixed load, sliding load and TRL/LRL configurations.

### *Coaxial & Waveguide Calibration Standards*

The calibration standards provided in Maury calibration-grade cal kits are also available for separate purchase as spares or replacement parts. Maury also makes the world's finest precision and reference air lines, fixed and sliding loads, shorts, opens and precision mismatches.

### *Coaxial Connector Gage Kits*

Maury's analog and digital connector gage kits are offered in 30 gage types and more than 20 kit configurations. These kits provide everything needed to verify the critical interface dimensions of each connector in your test setup. Proper use of these gage kits prevents damage to your test set ports and DUT connectors, while ensuring the best possible electrical performance and most accurate measurements from your test setups.

### *Maury Coax & Waveguide-to-Coax Adapter Solutions*

Maury now offers three lines of precision adapters including ***Test Essentials™ Lab Adapters***, offered at one of the industry's best price/performance ratios, are tailored for daily use in lab or field; ***ColorConnect™ Precision Adapters***, which take advantage of new manufacturing techniques to improved VSWR, thus bridging the gap between laboratory-grade and calibration-grade (metrology) adapters. ColorConnect™ adapters employ the proposed IEEE high-frequency connector/adapter color convention, becoming the first commercially available products to offer immediate and clear indication of mating compatibility; and ***Maury Calibration-Grade (Metrology) Adapters***. Maury calibration-grade (metrology) adapters are known for their quality, durability and repeatability. From 1.85mm to 7-16, and from WR360 to WR10. With the widest variety of precision coaxial and waveguide adapters of any supplier, world-wide, we have the adapter you need, no matter what test setup or application you use.

### *Maury Microwave/RF Cable Assembly Solutions*

Maury's expanded Microwave/RF Cable Assemblies Solutions now include Maury ***Test Port Cable Assemblies*** designed specifically for use with commercial Vector Network Analyzers (VNAs) equipped with calibration-grade metrology NMD connectors; Maury's ***Stability™ Cable Assemblies*** designed specifically for phase-stable and amplitude-stable applications, where excellent measurement repeatability –even after cable flexure– is critical: ***Utility™ Cable Assemblies***, designed for general testing applications, Utility™ cables offer excellent value with their low cost, low insertion loss, excellent return loss, flexibility, and amplitude and phase stability.

### *Thermal and Cryogenic Noise Calibration Systems and Components*

Maury Noise Calibration Systems (NCS) are self-contained, highly accurate sources of RF and microwave noise power that are used wherever noise source accuracy is critical, such as in noise figure and effective input noise temperature measurement, calibration of solid state noise sources, evaluation and verification of earth station receivers, and as radiometer reference sources.





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# General Information

## How To Order Maury Products

Orders may be placed directly with the factory or in care of your nearest Maury sales representative. For orders originating outside the United States, we recommend placing the order through your local Maury sales representative. Maury maintains an extensive network of sales representatives throughout the world. To find your local Maury sales representative use the interactive index on our web site at **maurymw.com/Support/find-sales-rep.php.**

## Pricing and Quotations

Prices for Maury products are those prevailing when an order is placed except when the price is established by formal quotation. Maury Microwave reserves the right to change prices at any time without notice. Price and availability of products with custom or special features must be verified by a valid, formal factory quotation. Maury quotations are valid for a maximum of 30 days. Extensions beyond 30 days can be granted only by the factory.

## Terms of Sale

Domestic terms are net 30 days from the date of invoice for customers with established credit F.O.B. Ontario, California. Please refer to Maury Form 228 for complete terms and conditions. For International sales, please refer to Maury Form 250. Sales to Canada are covered by Maury Form 251. These forms are available on request, or may be found on our web site in PDF format.

## Shipment

All shipments are at the buyer's expense. Shipments are normally made using methods and carriers specified by the customer. In the absence of specific instructions, Maury will ship at our discretion by the most advantageous method. All shipments are F.O.B. the Maury factory in Ontario, California (U.S.A.) and, unless otherwise specified, will be insured at full value at the customer's expense. Shipments are packed to provide ample safety margin against transit damage, and there is no charge for regular packing requirements. Additional charges apply to MILSPEC preservation, packaging, packing and marking.

## Product and Specifications Changes

The information, illustrations and specifications contained in this catalog were current at the time of publication. Maury Microwave is continually striving to upgrade and improve our product offering and therefore, reserves the right to change specifications, designs and models without notice and without incurring any obligation to incorporate new features on products previously sold.

Because products are changed or improved with time, please consult your local Maury representative, or our Sales Department, for current pricing and product information before placing orders.

## Product Selection

Maury representatives and sales office personnel are well qualified to provide assistance in product selection, and current pricing and availability. Our factory applications engineers are ready to assist you with any technical or applications questions you may have.

## Service and Support

***Warranty***

Maury Microwave is highly confident that our products will perform to the high levels that our customers have come to expect. As an expression of that confidence, our products are warranted as noted in the abbreviated warranty statements below. (For a complete statement of the hardware warranty, please see Form 228, Terms and Conditions of Sales. For a complete statement of the software warranty, please see Form 273, Maury License Agreement.)

Maury Microwave hardware products are warranted against defects in material and workmanship for a period of one year after delivery to the original purchaser. If a Maury manufactured hardware product is returned to the factory with transportation prepaid and it is determined by Maury that the product is defective and under warranty, Maury will service the product, including repair or replacement of any defective parts thereof. This constitutes Maury's entire obligation under this warranty.

Maury warrants that, for a period of ninety (90) days following purchase, software products, including firmware for use with and properly installed on a Maury designated hardware product, will operate substantially in accordance with published specifications, and that the media on which the product is supplied is free from defects in material and workmanship. Maury's sole obligation under this warranty is to repair or replace a nonconforming product and/or media, provided Maury is notified of nonconformance during the warranty period. Maury does not warrant that the operation of the product shall be uninterrupted or error-free, nor that the product will meet the needs of your specific application.

The warranty does not apply to defects arising from unauthorized modifications, misuse or improper maintenance of the product. Warranty service is available at our facility in Ontario, California.

***Service Returns***

Repair and calibration services are available for Maury products for as long as replacement parts are available. On some instruments, support services may be available for up to ten years.

## Quality Profile

Maury Microwave Corporation enjoys a well-earned reputation for excellent, technically advanced products that are reliable, meet specifications, and provide a quality appearance. Maintaining and improving this reputation requires adherence to strict quality standards that are set forth in a formal Quality Department Manual. This manual is distributed to all Maury managers, inspectors, and technicians. The Quality Manual can be reviewed by our customers at our facility in Ontario, California.

Our inspection and calibration systems are in accord with MIL-I-45208A and MIL-STD-45662A, respectively. Our overall quality system has been approved through in-house surveys by many of our customers including the U.S. Government. Our laboratory is ANSI/NCSL Z540-1 compliant with traceability to NIST.

***MAURY MICROWAVE CORPORATION IS AN 1SO 9001:2008/AS9100C CERTIFIED COMPANY.***



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# About Maury Microwave

## *Corporate Profile*

Maury and Associates was founded by Mario A. Maury, in Montclair, California on October 15, 1957. With the help of his sons, Mario A. Maury, Jr. and Marc A. Maury, the company earned a solid reputation in the microwave test, measurement and calibration industry. Today, after more than 54 years, we serve our customers as Maury Microwave Corporation. We have are dedicated to the pursuit of quality, and committed to providing the very best in customer service.

## *Markets Served*

Maury Microwave serves all areas of the RF and microwave industry, providing a comprehensive line of automated tuners, microwave components and accessories that operate from DC to 110 GHz. This includes a wide range of test and measurement products used extensively by the wireless communication industry for power and noise characterization of transistors and amplifiers. Our precision calibration solutions are used for test and measurement applications and production testing. Maury also produces system components for ground based and airborne applications such as communications, EW/ECM systems, and radar.

## *Manufacturing Technologies*

Our factory is equipped with the latest 7-axis CNC machines and can handle high volume production as well as high precision, small-quantity manufacturing. We maintain a state-of-the-art microwave laboratory using the latest test equipment and vector network analyzers to support our test and calibration operations. Our in-house manufacturing and testing capabilities allow us to provide products tailored to our customers' specific requirements.

## *Strategic Alliances*

As a leader in the RF and microwave calibration and measurement field, Maury has long been recognized for the accuracy, repeatability, and stability of our products. Agilent Technologies acknowledged this in September, 2001 by inviting Maury Microwave to become a Channel Partner for device characterization solutions. The ongoing success of that relationship led to Maury's current recognition as a Keysight Global Solutions Partner. Maury has strategic alliances with AMCAD Engineering of Limoges, France and Anteverta Microwave B.V., of Delft, Netherlands (see page 18). We also enjoy close business ties with Cascade Microtech of Beaverton, Oregon.

## *Technical Services*

Our extensive knowledge and experience with calibration and measurement requirements provides the expertise necessary for producing high quality products. Maury Calibration and Repair Services are available for every product we make, and are performed in a temperature-controlled environment with the latest in measurement and verification equipment.

## *Products & Technologies*

Maury makes RF and microwave devices that cover a range from DC to 110 GHz, primarily addressing test and measurement applications. Coaxial components are available to 67 GHz in most popular line sizes and we also manufacture waveguide components from WR650 to WR10.



Maury's extensive line of VNA calibration kits also supports Keysight's PNA and ENA series, as well as Rohde and Schwarz ZV series and Anritsu 37000 series and Vector Star network analyzers. Also, new digital connector gage kits are now available in 3.5mm/2.92mm and 2.4mm/1.85mm combination models.




## *Facilities*

Located in the City of Ontario, California, about 40 miles due east of Los Angeles and just north of the San Bernardino Freeway (Interstate 10), our 96,000 square foot facility is within minutes of the Ontario International Airport (ONT). Here, we make the best microwave products in the market.




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# Maury's Strategic Alliances

## *In The Test & Measurement Industry*

***Working Together To Provide The Right Solutions For Your Applications***

## *Keysight Technologies, Inc.*

Keysight's electronic measurement products provide standard and customized electronic measurement instruments and systems, monitoring, management and optimization tools for communications networks and services, software design tools and related services that are used in the design, development, manufacture, installation, deployment and operation of electronics equipment and communications networks and services.

Keysight RF & Microwave test equipment allow Maury's Engineering Experts to provide customer needs with high precision and advanced services (pulsed IV/RF measurements, Load-Pull characterization — CW and pulsed, two-tones, etc.), and are used to support the R&D engineers developing new characterization techniques.

Moreover, as Keysight's solutions partner Maury works closely with Keysight on the development of new applications for the PNA-X which take advantage of its advanced features and extend and enhance its capabilities into high-power, high-speed and 50 ohm environments.

## *Anteverta Microwave*

Anteverta microwave provides pioneering solutions in the fields of device characterization and high performance power amplifier design. We seek to offer the industrial and R&D world with system solutions addressing the most demanding needs in terms of speed, accuracy and multifunctional capabilities.

Anteverta microwave was launched in March 2010 as a spin-off from the Delft University of Technology in The Netherlands. Anteverta microwave was born as the development of a decade of successful research in the fields of large signal device characterization and high efficiency/linearity PA design. In May 2010 Anteverta microwave licensed its products to Maury Microwave Corporation to merge its innovative side with the strengths of the most reliable provider of non-linear characterization systems.

## *AMCAD Engineering*

AMCAD is a provider of new RF & Microwave solutions. Founded in 2004 with Headquarters and Lab in Limoges, France, its founders have brought together a multi-disciplinary and high skilled team.

### *Core Activities:*

Development and provision of solutions and tools for semiconductor professionals, with emphasis on Component Measurements and Modeling, Circuit Design and Systems Behavioral Modeling. AMCAD Products include Advanced Pulsed IV / RF systems and IVCAD data management software. AMCAD's Pulsed IV/RF System is an advanced components characterization system that is essential to semiconductor technology development, device reliability and lifetime testing, and semiconductor device modeling. Its key features include 10A-240V pulse generation, pulse widths down to 200ns, high precision current and voltage measurement, synchronized S2P capabilities to 40 GHz, and self-heating and trapping phenomena characterization; all of which makes it the idea system for modeling a wide range of devices



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# Maury Microwave Corporation
# ISO 9001:2008 — AS9100C Documentation

Maury Microwave Corporation is registered as conforming to ISO 9001:2008 with AS9100C for Design, Manufacturing and Servicing of Microwave Based Measuring and Testing Equipment for the Aerospace, Defense and Wireless Telecom Industries.



EAGLE Registrations Inc.
SERVICE • INTEGRITY • VALUE

ANAB

Certificate No. 3867 (Recertified – January 8, 2015 - 2 Copies)
January 10, 2015 through January 9, 2018

## Certificate of Registration

This is to certify that the Quality Management System of

Maury Microwave
Your Calibration, Measurement & Modeling Solutions Partner

2900 Inland Empire Blvd., Ontario, CA 91764 USA
Site definition: Single

Has been assessed by EAGLE Registrations Inc. and
conforms to the following standard:

**ISO 9001:2008 with AS9100C**

This assessment was performed in accordance with the requirements of AS9104/1:2012
EAGLE Registrations Inc. is accredited under the aerospace Registrar Management Program

Scope of Registration

Design Manufacturing and Servicing of Microwave Based Measuring and Testing Equipment for the Aerospace, Defense and Wireless Telecom Industries.

Chief Technical Officer


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# Calibration and Repair Services



## *Calibration Services*

At Maury Microwave, our commitment to quality doesn't end with the sale of a product. In our state-of-the-art microwave laboratory, we offer both ANSI/NCSL Z540-1 (MIL-STD-45662A) calibration and commercial level calibration services for every product we produce. Our laboratory is ANSI/NCSL Z540-1 ISO 10012-1 compliant with traceability to NIST (National Institute of Standards and Technology).

Each Maury Microwave product is shipped with a certificate of conformance which assures that it has been tested and found to be within operational tolerances. As these products are used, changes can occur which may result in an out-of-tolerance condition. Periodic calibrations are therefore recommended to maintain functional integrity. We are happy to perform the calibrations you need at a reasonable cost.

Please contact our Calibration and Repair – Measurement Services Department to obtain quotations for the specific calibration services you require. Quoted prices will cover the cost of all applicable measurements and include written calibration reports documenting the mechanical and electrical data. If parts are out of tolerance, the cost of repair or replacement will be quoted for your approval prior to the start of any additional work.

It is highly recommended that the following items be maintained on a 12-month re-calibration cycle:

- Calibration Kits
- Verification Kits
- Coaxial Components for Laboratory Use
- Waveguide Components for Laboratory Use
- Automated Tuner Systems
- Noise Calibration Systems (Cryogenic, Thermal and Ambient Terminations) Mechanical Products
- Torque Wrenches
- Connector Gages

## *Repair Services*

Maury products are renown for their ruggedness and long service life, but over time your Maury products may need repair. This may be detected during annual re-calibration and refurbishment. As the original equipment manufacturer, we understand the critical performance criteria of your measurement equipment. When repairs are necessary, we will always provide you with an honest evaluation of each and every Maury part. We will also provide you with options and our best recommendation for restoring your parts to their optimum performance.

***Annual re-calibration and servicing guarantees:***

- Accuracy and Confidence in your Network Analyzer Measurements
- Precision Connector Mating
- Verification of Critical Mechanical and Electrical Specifications
- All Interfaces meet "As New" Mechanical Specifications to Ensure Predictable S-Parameter Performance
- Prolonged Life of Both Maury Measurement Standards and Your Network Analyzers
- Confidence That Your Maury Product Will Be As Precise As When First Delivered
- Refurbishment Done Right and Done Here In Our Factory
- Guaranteed Genuine Maury Parts and Quality
- We Design It, Build It, Calibrate It and Repair It.

***Benefits of Maury Calibration and Repair:***

- Calibration and Repairs Performed Directly By The OEM (No Middleman Delays or Mark-Ups!)
- Complete Confidence In Your Measurements
- Protects Your Costly Network Analyzer Investment
- Maintains Your ANSI/ISO Compliance and NIST Traceability



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# Maury Precision VNA Calibration Kits

## For Fixed Load, Sliding Load and TRL Calibration of Keysight, Rhode & Schwarz and Anritsu VNAs





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# Network Analyzer Calibration Methodologies

## Why do we need to calibrate?

Imperfections exist in even the finest test equipment and, if uncorrected, these imperfections will cause the equipment to yield less than ideal measurements. The basis of network analyzer error correction is the measurement of known electrical standards, such as a through, open circuit, short circuit, and precision load impedance. By calibrating your network analyzer with these standards, you can compensate for its inherent imperfections. The information below addresses some of the most critical factors in VNA calibration, ending with a brief survey of the more widely used calibration methodologies that can be performed with Maury Precision VNA Calibration Kits.

## Calibration Procedures

Calibration procedures include the popular Short-Open-Load or Short-Open-Load-Thru (SOLT) calibration technique, SSLT for waveguide, and Thru-Reflect-Line (TRL).

## Sources and Types of Errors

All measurement systems, including those employing network analyzers, have three types of measurement errors:

- Systematic errors
- Random errors
- Drift errors

Systematic errors are caused by imperfections in the test equipment and test setup. If these errors do not vary over time, they can be characterized through calibration and mathematically removed during the measurement process.

## Error Correction

Vector error correction is the more thorough method of removing systematic errors. This type of error correction requires a network analyzer capable of measuring (but not necessarily displaying) phase as well as magnitude, and a set of calibration standards with known, precise electrical characteristics.

The vector-correction process requires the open, short, load, and sometimes thru calibration standards. The two main types of vector error correction are the one-port and two-port calibrations.

## One-Port Calibration

A one-port calibration can measure and minimize three systematic error terms (directivity, source match, and reflection tracking) from reflection measurements. Three known calibration standards must be measured, such as a Short, Open, and a Load (the load value is usually the same as the characteristic impedance of the test system, generally either 50 or 75 ohm). One-port calibration makes it possible to derive the DUT's actual reflection S-parameters.

## Two-Port Error Correction

Two-port error correction yields the most complete calibration because it accounts for the three major sources of systematic error addressed by one-port calibration at both ports of a two-port DUT. Traditional full two-port calibrations utilize three impedance standards and one transmission standard to define the calibrated reference plane. These standards, typically a Short, Open, Load, and Thru, make up the SOLT calibration kit. The most common Thru used is the test ports connected directly together.

## TRL Calibration

Following SOLT in popularity, the next most common form of two-port calibration is called a Thru-Reflect-Line (TRL) calibration. TRL corrects the same error terms as a SOLT calibration, although it uses different calibration standards.

Other variations of TRL are Line-Reflect-Line (LRL), (LRM) based on Line-Reflect-Match (load) calibration standards or Thru-Reflect-Match (TRM) calibration standards.

In non-coaxial applications such as waveguide, TRL usually achieves better source match and load match corrections than SOLT. While not as commonly used, coaxial TRL can also provide more accuracy than SOLT, but only if very-high quality coaxial transmission lines (such as beadless airlines) are used.

Maury Microwave includes precision beadless air lines in our coaxial TRL calibration kits providing the capability to perform the most accurate calibration possible.

## Why use Sliding Loads?

When performing a SOL, SOLT, or SSLT (waveguide) calibration the impedance standard is the Load. At frequencies above 2 GHz (4 GHz for 2.4mm) sliding loads are more accurate impedance standards. Therefore Sliding Loads will provide a better calibration at higher frequencies. (Reduced directivity error)

A summary of these calibrations is shown below:

## One-port calibration methods

(**SOL**) **S**hort-**O**pen-**L**oad calibration

– Response calibration for measuring VSWR/Return Loss.

(**SSL**) **S**hort-**S**hort-**L**oad calibration

– Calibration for measuring VSWR/Return Loss in waveguide applications

## Two-Port full calibration methods

(**SOLT**) **S**hort-**O**pen-**L**oad-**T**hru

– Full two-port calibration for performing forward and reverse transmission and reflections measurements.

(**SSLT**) **S**hort-**S**hort-**L**oad-**T**hru

– Full two-port calibration for performing forward and reverse transmission and reflections measurements.

(**TRL**) **T**hru-**R**eflect-**L**ine

– Full two-port calibration for performing forward and reverse transmission and reflections measurements.



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# Maury VNA Calibration Kits

## General Information



### *Features*

- *Broad VNA Coverage*
- *Accurate VNA Calibration*
- *DC to 110 GHz*
- *All Popular Coaxial Connector Types and Waveguide Flange Sizes*
- *Fixed Load Kits, Sliding Load Kits, and TRL/LRL Kits are Offered for Most DUT Connector Types*

### *General*

When properly calibrated against known standards, Vector Network Analyzers (VNAs), provide the most accurate means of determining the one- and two-port network characteristics of RF and microwave devices. Calibration effectiveness (a VNA's ability to reduce error terms to negligible values) critically and ultimately depends on the quality and integrity of the calibration standards used.

To help maximize calibration effectiveness, Maury produces a comprehensive line of coaxial and waveguide VNA calibration kits which incorporate accurate, stable, and precise calibration standards for a broad range of VNA models. When properly used, these kits ensure a true evaluation of VNA performance.

Maury kits offer a range of performance and cost options which provide users with choices that are both technically and economically suitable for a variety of intended application.

Coaxial kits are available for testing VNAs fitted with any of the modern, popular connectors, including: 1.85mm, 2.4mm, 2.92mm (K), 3.5mm (also used for SMA testing), Type N, TNC (and AFTNC) and BNC.

Other, less common connector types, such as BZ and ZMA are also available as Special Calibration Kits.

Waveguide kits are available in all common, standard rectangular sizes from WR430 (1.7 to 2.6 GHz) through WR10 (75 to 110 GHz). Maury has also produced kits in less common rectangular size such as WR102 (7 to 11 GHz) and in half-height waveguide. If you require a calibration kit in a nonstandard or rarely used waveguide type please contact our Sales Department.

### *Special Calibration Kits*

Maury frequently configures unique or highly specialized calibration kits based on customer-specified component lists. Whether in coax or waveguide, Maury can provide custom calibration kits to meet your exact needs. Customizing may include special packaging; addition, deletion or substitution of components; single sex coaxial kit configurations; and special waveguide flanges. If your calibration needs are not covered by our standard or expanded kits, our sales department can assist you in defining a special configuration.

#### *Special Packaging*

Most of our calibration kits are housed in foam-lined wooden instrument cases. In some applications, more rugged or specialized packaging may be required. Maury offers special packaging options which include a molded plastic case for “assembly line” use, extremely small cases for single sex coaxial kits, and a briefcase configuration for field use.

#### *Component Changes*

Calibration kits can be configured to include the exact components needed for your VNA calibration. Coax-to-coax and waveguide-to-coax adapters can be changed to meet your interface needs. Reference air lines, sliding loads, gage kits, etc., can also be added or deleted.

#### *Single Sex Coaxial Kits*

Most of Maury's standard or expanded calibration kits include male and female components. Maury also offers single sex kits which are very economical alternatives for production line calibrations that require only a single sex version of a particular connector.

#### *Special Waveguide Flanges*

European designation, half-height or special index pin/bolt pattern waveguide flanges can be incorporated into a special kit. Please provide a flange drawing that describes your special flange when requesting a price quote.

If you do not find a kit to meet your calibration needs, please contact our Sales Department or your local Maury representative for assistance.


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# 1.85mm TRL VNA Calibration Kits

## 7850CK30/31 series

7850CK31

### Features

- *1.85mm Connectors*
- *DC to 67 GHz (Operates to 70 GHz)*
- *Keysight, Rhode & Schwarz and Anritsu VNAs Supported*

### Kit Description

These precision 1.85mm TRL/LRL calibration kits are designed for use with a broad range of vector network analyzers (VNAs) and are used to make error-corrected measurements, from DC to 67 GHz, for devices supplied with 1.85mm connectors. Each kit includes a full complement of calibration standards (shorts, fixed loads and air lines). Three 1.85mm in-series, calibration-grade (metrology), adapters are included in the 7850CK31 kits but are not included in the 7850CK30 kits. All kit components are provided in an attractive foam-lined, wood instrument case.

### Calibration Methods Supported

- *TRM*
  - *– Thru-Reflect-Match (DC to 800 MHz)*
- *TRL*
  - *– Thru-Reflect-Line (800 MHz to 13.0 GHz)*
- *LRL*
  - *– Line-Reflect-Line (13.0 to 67.0 GHz)*

TRL calibration, using Thru, Reflect and Line standards, relies on the characteristic impedance of the air lines (Line). TRL calibration is the most accurate method of measuring devices at low (typically better than 40 dB return loss) and high reflection coefficients.

TRL is typically used as a general term to represent any of these three specific types of calibration (TRM/TRL/LRL). Specifically, these three types of calibration are:

- TRM – Thru, Reflect, Match
- TRL – Thru, Reflect, Line
- LRL – Line, Reflect, Line

TRM is used for low frequencies where a very long air line would be required for the line standard. TRL is used for mid-frequencies where the appropriate line lengths are achievable to reach the 30°–150° phase delay over the frequency band. LRL is used for high frequencies where air line standards become too short to be practical, so the desired delay is achieved as the delta between a reference air line and a longer air line.

7850CK30/31 kits provide all of the calibration standards needed to perform TRL, TRM and LRL calibrations and are specifically configured for use under these three calibration methods. Source match can also be measured using the 3.00cm air line with the short circuit provided.

Key Literature: Maury data sheet 2Z-056.



### Components Included in 7850CK30/31 Kits

| QUANTITY | DESCRIPTION | MODEL |
|---|---|---|
| 1 | 1.85mm female fixed short circuit (0.5cm) | 7846A |
| 1 | 1.85mm male fixed short circuit (0.5cm) | 7847A |
| 1 | 1.85mm female fixed termination | 7831A1 |
| 1 | 1.85mm male fixed termination | 7831B1 |
| 1 | 1.85mm female to male air line (0.96cm) | 7843S0.96 |
| 1 | 1.85mm female to male air line (1.15cm) | 7843S1.15 |
| 1 | 1.85mm female to male air line (3.00) | 7843S3.00 |
| 1* | 1.85mm female to 1.85mm female | 7821A |
| 1* | 1.85mm male to 1.85mm male | 7821B |
| 1* | 1.85mm female to 1.85mm male | 7821C |
| 1 | Torque wrench (8 in. lbs) | 8799A1 |
| 1 | 5/16-inch double end wrench | 8770Z6 |
| 1 | 3/16-inch double end wrench | 7960Z1 |
| 1 | Foam-lined wood instrument case | — |

*These adapters are included in the 7850CK31 kits and are not included in the 7850CK30 kits.

### Recommended Accessories

***A048A Digital Connector Gage Kit***
*(see page 104).*

***8799A1 5/16-inch Precision Torque Wrench (8.0 inch lbs)***
*(see page 106).*

***7821A/B/C 1.85mm In-series Adapters*** *(included in 7850CK31 kits; recommended for 7850CK30 kits. See pages 25 & 112-113.*

***7809A1 & 7809A2 1.85mm NMD test port adapters***
*(see page 111).*



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## COMPONENT SPECIFICATIONS

### Air Lines – Models 7843S0.96, 7843S1.15 & 7843S3.00



Frequency Range . . . . . DC to 67.0 GHz
Electrical Length:
- 7843S0.96 . . . . . 0.96cm
- 7843S1.15 . . . . . 1.15cm
- 7843S3.00 . . . . . 3.00cm

Electrical Length Accuracy. . . . . 0.0005cm
Minimum Return Loss
(excluding connector interface) . . . . . 48 dB
Nominal Impedance . . . . . 50 ohm

### Fixed Shorts - Models 7846A & 7847A



Frequency Range . . . . . DC to 67.0 GHz
Minimum Reflection Coefficient . . . . . 0.98
Nominal Impedance . . . . . 50 ohm
Phase Accuracy . . . . . ±2.0 degrees

### Fixed Terminations - Models 7831A1 & 7831B1



Frequency Range . . . . . DC to 50.0 GHz
Maximum VSWR:
- DC to 1 GHz . . . . . 1.02
- 1 to 10 GHz . . . . . 1.07
- 10 to 26.5 GHz . . . . . 1.10
- 26.5 to 50 GHz . . . . . 1.20

Power Handling . . . . . 0.5 watt CW, 0.25 kW peak
Nominal Impedance . . . . . 50 ohm

### Precision 1.85mm In-series Adapters[1]



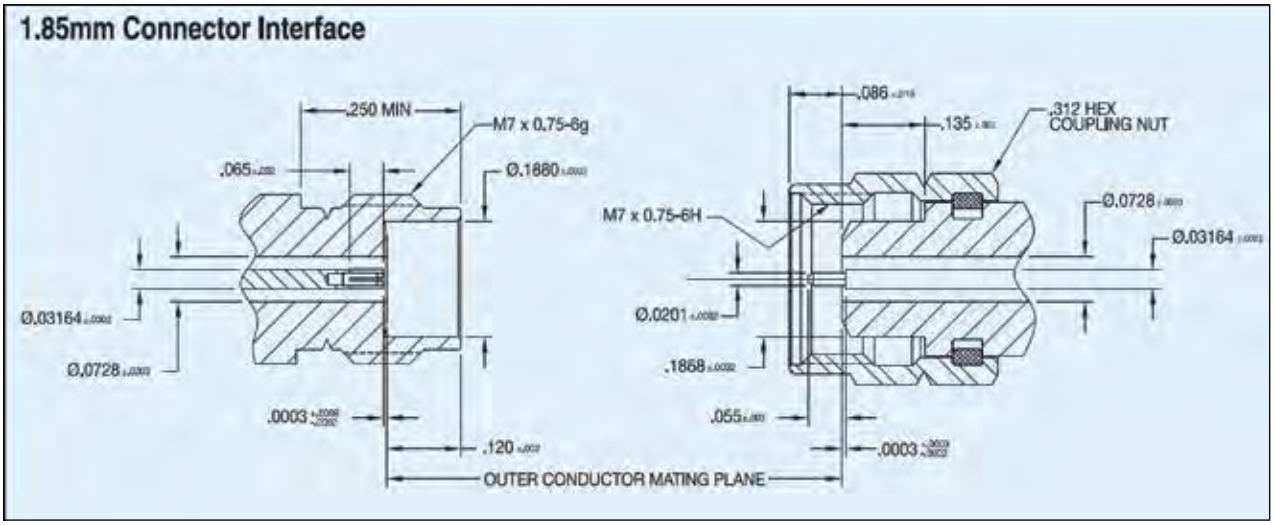
Models 7821A/B/C (1.85mm to 1.85mm)
Frequency Range . . . . . DC to 67.0 GHz
Maximum VSWR:
- DC to 26.5 GHz . . . . . ≤ 1.06
- 26.5 to 40.0 GHz . . . . . ≤ 1.10
- 40.0 to 67.0 GHz . . . . . ≤ 1.15

Nominal Impedance . . . . . 50 ohm

[1] The 7850CK31 calibration kit include one each of the 7821A/B/C adapters. These adapters are not included in the 7850CK30 kits, but may be ordered separately.

## Connector Description

The precision 1.85mm connectors on the components in this kit are miniature, instrument grade, air-interface connectors that operate mode free up to 67 GHz, and comply with IEEE standard 287 general precision connector, instrument grade GPC1.85. For detailed interface specifications please refer to Maury data sheet 5E-089.





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# 2.4mm Fixed Load VNA Calibration Kits

## 7950CK10/11 Series

### Features

- *2.4mm Connectors*
- *DC to 50 GHz*
- *High Performance*
- *Keysight, Rhode & Schwarz and Anritsu VNAs Supported*

### Kit Description

Maury Microwave's precision 2.4mm calibration kits are designed for use with a broad range of vector network analyzers (VNAs). With the components in these kits you can make error-corrected measurements of devices supplied with 2.4mm connectors from DC to 50 GHz. Each kit is supplied with a set of calibration standards; shorts, opens and fixed loads as listed at right. (See page 29 for all Maury 2.4mm cal kit components specifications.)

### Calibration Methods Supported

- *7950CK10/11*
  - *– Fixed Load SOLT (DC–50 GHz)*

7950CK10/11 kits are configured for use in performing one-port SOL (Short-Open-Load) response calibrations (a method used for measuring VSWR/ Return Loss), and full two-port SOLT (Short-Open-Load-Thru) calibration (for performing forward and reverse transmission and reflections measurement).

7950CK11 kits include three 2.4mm in-series adapters for applications that require female/female, male/male, or male/female connections. A wide range of between-series adapters in 2.4mm to other types and special VNA test port adapters (NMD type) are also available by separate order.

### Recommended Accessories

#### *A048A Digital Connector Gage Kit:*

Contains two "thread-on" type, digital gages for measuring female and male contact pin location. These gages provide an easy and accurate way to measure critical linear interface dimensions of 1.85mm and 2.4mm coaxial connectors *(see page 104)*.

#### *8799A1 5/16-in. Precision Torque Wrench (8.0 inch lbs):*

For proper torquing of 1.85mm, 2.4mm, 2.92mm and 3.5mm connections. Factory preset to 8.0 inch lbs to ensure the precise torque needed for optimum repeatability. Employs a "break" design that makes it impossible to over-torque your connections. These torque wrenches are highly recommended for use with 7950CK10/11 kits *(see page 106)*.

#### *7909A1 & 7909A2 2.4mm NMD test port adapters:*

Precision 2.4mm to NMD2.4mm; DC–50.0 GHz. Saves unnecessary wear and tear on your VNA test ports *(see page 149)*.

Key Literature: Maury data sheet 2Z-057.

7950CK11




### Components Included in 7950CK10/11 Kits

| QUANTITY | DESCRIPTION | MODEL |
|---|---|---|
| 1 | 2.4mm female fixed short circuit | 7946A |
| 1 | 2.4mm male fixed short circuit | 7946B |
| 1 | 2.4mm female open circuit termination | 7948A1 |
| 1 | 2.4mm male open circuit termination | 7948B1 |
| 1 | 2.4mm female fixed termination | 7931A1 |
| 1 | 2.4mm male fixed termination | 7931B1 |
| 1* | 2.4mm female to 2.4mm female adapter | 7921A |
| 1* | 2.4mm male to 2.4mm male adapter | 7921B |
| 1* | 2.4mm female to 2.4mm male adapter | 7921C |
| 1 | Foam-lined wood Instrument case | — |

* These adapters are provided in the 7950CK11 kits, but are not included in the 7950CK10 kits.

Maury also offers 2.4mm between series precision adapters and Test Port adapters in the following configurations.

See pages 114-116 for specifications:

- 2.4mm to 2.92mm
- 2.4mm to 3.5mm
- 2.4mm to 7mm
- 2.4mm to Type N
- NMD2.4mm (f) to 1.85mm (m)
- NMD2.4mm (f) to 2.4mm (f/m)
- NMD2.4mm (f)) to NMD2.4mm (m)
- NMD2.4mm (f) to 2.92mm (f/m)
- NMD2.4mm (f) to 3.5mm (f/m)
- NMD2.4mm (f) to 7mm
- NMD2.4mm (f) to Type N (f/m)



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# 2.4mm Sliding Load VNA Calibration Kits

## 7950CK20/21 Series

7950CK21



### Features

- *2.4mm Connectors*
- *DC to 50 GHz*
- *High Performance*
- *Keysight, Rhode & Schwarz and Anritsu VNAs Supported*

### Kit Description

Maury Microwave's precision 2.4mm calibration kits are designed for use with a broad range of vector network analyzers (VNAs). With the components in these kits you can make error-corrected measurements of devices supplied with 2.4mm connectors from DC to 50 GHz. Each kit is supplied with a set of calibration standards; shorts, opens and sliding loads, as listed at right. (See page 29 for all Maury 2.4mm cal kit components specifications.)

### Calibration Methods Supported

- *7950CK20/21*
  - *– Fixed/Sliding Load SOLT (DC–50 GHz)*

7950CK20/21 kits are configured for use in performing one-port SOL (Short-Open-Load) response calibrations (a method used for measuring VSWR/ Return Loss), and full two-port SOLT (Short-Open-Load-Thru) calibration (for performing forward and reverse transmission and reflections measurement).

7950C21 kits include three 2.4mm in-series adapters for applications that require female/female, male/male, or male/female connections. A wide range of between-series adapters in 2.4mm to other types and special VNA test port adapters (NMD type) are also available by separate order.

### Recommended Accessories

***A048A Digital Connector Gage Kit:***

Contains two "thread-on" type, digital gages for measuring female and male contact pin location. These gages provide an easy and accurate way to measure critical linear interface dimensions of 1.85mm and 2.4mm coaxial connectors *(see page 104)*.

***7909A1 & 7909A2 2.4mm NMD test port adapters:***

Precision 2.4mm to NMD2.4mm; DC–50.0 GHz. Saves unnecessary wear and tear on your VNA test ports *(see page 149)*.

Key Literature: Maury data sheet 2Z-057.

### Components Included in 7950CK20/21 Kits

| QUANTITY | DESCRIPTION | MODEL |
|---|---|---|
| 1 | 2.4mm female fixed short circuit | 7946A |
| 1 | 2.4mm male fixed short circuit | 7946B |
| 1 | 2.4mm female open circuit termination | 7948A1 |
| 1 | 2.4mm male open circuit termination | 7948B1 |
| 1 | 2.4mm female fixed termination | 7931A1 |
| 1 | 2.4mm male fixed termination | 7931B1 |
| 1* | 2.4mm female to 2.4mm female adapter | 7921A |
| 1* | 2.4mm male to 2.4mm male adapter | 7921B |
| 1* | 2.4mm female to 2.4mm male adapter | 7921C |
| 1 | 2.4mm female sliding termination | 7935A |
| 1 | 2.4mm male sliding termination | 7935B |
| 1 | Pin depth adjusting tool | 8777S02 |
| 1 | 5/16-inch torque wrench — 8 in. lbs. | 8799A1 |
| 1 | 5/16-inch double end wrench | 8770Z6 |
| 1 | Foam-lined wood Instrument case | — |

* These adapters are provided in the 7950CK21 kits, but are not included in the 7950CK20 kits.

Maury also offers 2.4mm between series precision adapters and Test Port adapters in the following configurations.

See pages 114-116 for specifications:

- 2.4mm to 2.92mm
- 2.4mm to 3.5mm
- 2.4mm to 7mm
- 2.4mm to Type N
- NMD2.4mm (f) to 1.85mm (m)
- NMD2.4mm (f) to 2.4mm (f/m)
- NMD2.4mm (f)) to NMD2.4mm (m)
- NMD2.4mm (f) to 2.92mm (f/m)
- NMD2.4mm (f) to 3.5mm (f/m)
- NMD2.4mm (f) to 7mm
- NMD2.4mm (f) to Type N (f/m)



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# 2.4mm TRL/LRL VNA Calibration Kits

## 7950CK30/31 Series

### Features

- *2.4mm Connectors*
- *DC to 50 GHz*
- *High Performance*
- *Keysight, Rhode & Schwarz and Anritsu VNAs Supported*

### Kit Description

Maury Microwave's precision 2.4mm TRL/LRL calibration kits are designed for use with a broad range of vector network analyzers (VNAs). With the components in these kits you can make error-corrected measurements of devices supplied with 2.4mm connectors from DC to 50 GHz. Each kit is supplied with a set of calibration standards; shorts, opens and fixed loads as listed at right. (See page 29 for all Maury 2.4mm cal kit components specifications.)

### Calibration Methods Supported

- *7950CK30/31*
  - *– TRM/TRL/LRL (DC–50 GHz)*

7950CK30/31 TRL/LRL calibration kits contain all the components needed to perform TRM, TRL and LRL calibrations.

Source match can also be measured using the 6.25cm air line with the short circuit provided.

7950CK31 kits include three 2.4mm in-series adapters for applications that require female/female, male/male, or male/female connections. A wide range of between-series adapters in 2.4mm to other types and special VNA test port adapters (NMD type) are also available by separate order.

### Recommended Accessories

#### *A048A Digital Connector Gage Kit:*

Contains two "thread-on" type, digital gages for measuring female and male contact pin location. These gages provide an easy and accurate way to measure critical linear interface dimensions of 1.85mm and 2.4mm coaxial connectors *(see page 104)*.

#### *7909A1 & 7909A2 2.4mm NMD test port adapters:*

Precision 2.4mm to NMD2.4mm; DC–50.0 GHz. Saves unnecessary wear and tear on your VNA test ports *(see page 149)*.

7950CK31




### Components Included in 7950CK30/31 Kits

| QUANTITY | DESCRIPTION | MODEL |
|---|---|---|
| 1 | 2.4mm female fixed short circuit | 7946A |
| 1 | 2.4mm male fixed short circuit | 7946B |
| 1 | 2.4mm female fixed termination | 7931A1 |
| 1 | 2.4mm male fixed termination | 7931B1 |
| 1* | 2.4mm female to 2.4mm female adapter | 7921A |
| 1* | 2.4mm male to 2.4mm male adapter | 7921B |
| 1* | 2.4mm female to 2.4mm male adapter | 7921C |
| 1 | 2.4mm female to male air line (1.25cm) | 7943S1.25 |
| 1 | 2.4mm female to male air line (1.50cm) | 7943S1.50 |
| 1 | 2.4mm female to male air line (6.25cm) | 7943S6.25 |
| 1 | 5/16-inch torque wrench — 8 in. lbs. | 8799A1 |
| 1 | 3/16-inch double end wrench | 7960Z1 |
| 1 | 5/16-inch double end wrench | 8770Z6 |
| 1 | Foam-lined wood Instrument case | — |

* These adapters are provided in the 7950CK31 kits, but are not included in the 7950CK30 kits.

Maury also offers 2.4mm between series precision adapters and Test Port adapters in the following configurations.

See pages 114-116 for specifications:

- 2.4mm to 2.92mm
- 2.4mm to 3.5mm
- 2.4mm to 7mm
- 2.4mm to Type N
- NMD2.4mm (f) to 1.85mm (m)
- NMD2.4mm (f) to 2.4mm (f/m)
- NMD2.4mm (f)) to NMD2.4mm (m)
- NMD2.4mm (f) to 2.92mm (f/m)
- NMD2.4mm (f) to 3.5mm (f/m)
- NMD2.4mm (f) to 7mm
- NMD2.4mm (f) to Type N (f/m)

Key Literature: Maury data sheet 2Z-057.



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# COMPONENT SPECIFICATIONS For Maury 2.4mm VNA Calibration Kits

## Air Lines – Models 7943S1.25, 7943S1.50 & 7943S6.25



Frequency Range . . . . . DC to 50.0 GHz
Electrical Length:
- 7943S1.25 . . . . . 1.25cm
- 7943S1.50 . . . . . 1.50cm
- 7943S6.25 . . . . . 6.25cm

Electrical Length Accuracy . . . . . 0.0025cm
Minimum Return Loss (excluding connector interface) . .48 dB
Nominal Impedance . . . . . 50 ohm

## Sliding Terminations – Models 7935A & 7935B



Frequency Range (Terminating Element) . . . . 4.0 to 50.0 GHz
Maximum VSWR (Terminating Element):
- 4.0 to 10.0 GHz . . . . . 1.10
- 10.0 to 50.0 GHz . . . . . 1.05

Power Handling . . . . . 0.5 watt CW, 0.5 kW peak
Nominal Impedance . . . . . 50 ohm
Air Line Accuracy (4.0–50.0 GHz) . . . . . 44 dB (Min)
(equivalent return loss of air line impedance)

## Fixed Terminations – Models 7931A1 & 7931B1



Frequency Range . . . . . DC to 50.0 GHz
Maximum VSWR:
- DC to 4.0 GHz . . . . . 1.016
- 4.0 to 50.0 GHz . . . . . 1.15

Power Handling . . . . . 0.5 watt CW, 0.25 kW peak
Nominal Impedance . . . . . 50 ohm

## Fixed Shorts – Models 7946A & 7946B



Frequency Range . . . . . DC to 50.0 GHz
Minimum Reflection Coefficient . . . . . 0.98
Phase Accuracy . . . . . ±2.0 degrees
Nominal Impedance . . . . . 50 ohm

## Open Circuits – Models 7948A1 & 7948B1



Frequency Range . . . . . DC to 50.0 GHz
Minimum Reflection Coefficient . . . . . 0.98
Phase Accuracy . . . . . ±2.0 degrees
Nominal Impedance . . . . . 50 ohm

## Precision 2.4mm Adapters – Models 7921AB/C



Frequency Range . . . . . DC to 50.0 GHz
Maximum VSWR:
- DC to 26.5 GHz . . . . . 1.06
- 26.5 to 40.0 GHz . . . . . 1.10
- 40.0 to 50.0 GHz . . . . . 1.15

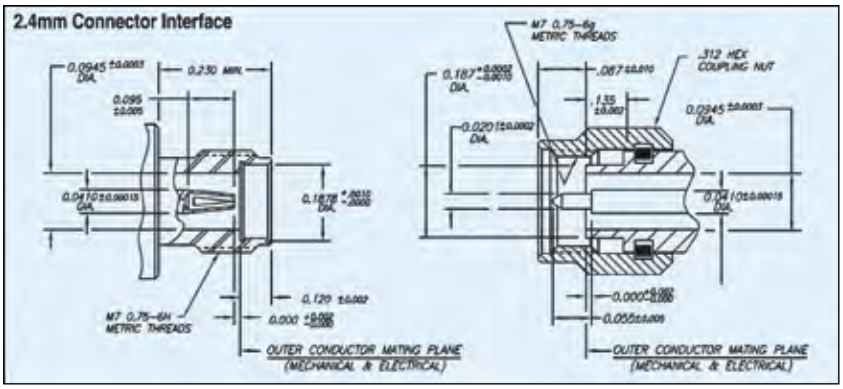
Nominal Impedance . . . . . 50 ohm

(Note: These adapters are included in the 7950CK11/21/31 kits, but are not included in the 7950CK10/20/30 kits.)

## Connector Description

The precision 2.4mm connectors on the components in these kits are miniature, instrument grade, air-interface connectors that operate mode free up to 50 GHz, and comply with IEEE standard 287 general precision connector, instrument grade GPC2.4.

For detailed interface specifications please refer to Maury data sheet 5E-064.





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# 2.92mm Fixed Load VNA Calibration Kits

## 8770CK10/11 Series

8770CK11




### *Features*

- *2.92mm Connectors*
- *DC to 40 GHz*
- *High Performance*
- *Keysight, Rhode & Schwarz and Anritsu VNAs Supported*

### *Kit Description*

Maury Microwave's precision 2.92mm fixed load calibration kits are designed for use with a broad range of vector network analyzers (VNAs). With the components in these kits you can make error-corrected measurements of devices supplied with 2.92mm connectors from DC to 40 GHz. Each kit is supplied with a set of calibration standards; shorts, opens and fixed loads as listed at right. (See page 33 for all Maury 2.92mm cal kit components specifications.)

### *Calibration Methods Supported*

- *8770CK10/11*
  - *– Fixed Load SOLT (DC–40 GHz)*

8770CK10/11 kits are configured for use in performing one-port SOL (Short-Open-Load) response calibrations (a method used for measuring VSWR/ Return Loss), and full two-port SOLT (Short-Open-Load-Thru) calibration (for performing forward and reverse transmission and reflections measurement).

8770CK11 kits include three 2.92mm in-series adapters for applications that require female/female, male/male, or male/female connections. A wide range of between-series adapters in 2.4mm to other types and special VNA test port adapters (NMD type) are also available by separate order.

### *Components Included in 8770CK10/11 Kits*

| QUANTITY | DESCRIPTION | MODEL |
|---|---|---|
| 1 | 2.92mm female fixed short circuit | 8771F1 |
| 1 | 2.92mm male fixed short circuit | 8772F1 |
| 1 | 2.92mm female open circuit termination | 8773A1 |
| 1 | 2.92mm male open circuit termination | 8773B1 |
| 1 | 2.92mm female fixed termination | 8775A2 |
| 1 | 2.92mm male fixed termination | 8775B2 |
| 1* | 2.92mm female to 2.92mm female adapter | 8714A2 |
| 1* | 2.92mm male to 2.92mm male adapter | 8714B2 |
| 1* | 2.92mm female to 2.92mm male adapter | 8714C2 |
| 1 | Foam-lined wood Instrument case | — |

* These adapters are provided in the 8770CK11 kits, but are not included in the 8770CK10 kits.

### *Recommended Accessories*

***A050A Digital Connector Gage Kit:***
Contains two "thread-on" type, digital gages for measuring female and male contact pin location *(see page 104)*.

***8799A1 5/16-in. Precision Torque Wrench (8.0 inch lbs):***
For proper torquing of 1.85mm, 2.4mm, 2.92mm and 3.5mm connections. Factory preset to 8.0 inch lbs to ensure the precise torque needed for optimum repeatability *(see page 106)*.

***8719A & 8719B 2.92mm NMD test port adapters:***
Precision 2.92mm to NMD2.92mm; DC–40.0 GHz *(see page 117)*.

***7909F1 & 7909F2 2.4mm NMD test port adapters:***
Precision NMD2.4mm to 2.92mm; DC–40.0 GHz *(see page 114)*.

Maury 8719A/B and 7909F1/F2 test port adapters are designed to mate with the special ruggedized connectors used on commercial VNA test sets. The precision 2.92mm adapters feature low VSWR with low insertion loss and are of minimum length.

Key Literature: Maury data sheet 2Z-058.



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# 2.92mm Sliding Load VNA Calibration Kits

## 8770CK20/21 Series


8770CK21

### *Features*

- *2.92mm Connectors*
- *DC to 40 GHz*
- *High Performance*
- *Keysight, Rhode & Schwarz and Anritsu VNAs Supported*

### *Kit Description*

Maury Microwave's precision 2.92mm sliding load calibration kits are designed for use with a broad range of vector network analyzers (VNAs). With the components in these kits you can make error-corrected measurements of devices supplied with 2.92mm connectors from DC to 40 GHz. Each kit is supplied with a set of calibration standards; shorts, opens and fixed loads as listed at right. (See page 33 for all Maury 2.92mm cal kit components specifications.)

### *Calibration Methods Supported*

- *8770CK20/21*
  - *– Fixed/Sliding Load SOLT (DC–40 GHz)*

8770CK20/21 kits are configured for use in performing one-port SOL (Short-Open-Load) response calibrations (a method used for measuring VSWR/ Return Loss), and full two-port SOLT (Short-Open-Load-Thru) calibration (for performing forward and reverse transmission and reflections measurement).

8770CK21 kits include three 2.92mm in-series adapters for applications that require female/female, male/male, or male/female connections. A wide range of between-series adapters in 2.4mm to other types and special VNA test port adapters (NMD type) are also available by separate order.

### *Recommended Accessories*

***A050A Digital Connector Gage Kit:***
Contains two "thread-on" type, digital gages for measuring female and male contact pin location *(see page 104)*.

***8719A & 8719B 2.92mm NMD test port adapters:***
Precision 2.92mm to NMD2.92mm; DC–40.0 GHz *(see page 117)*.

***7909F1 & 7909F2 2.4mm NMD test port adapters:***
Precision NMD2.4mm to 2.92mm; DC–40.0 GHz *(see page 114)*.

### *Components Included in 8770CK20/21 Kits*

| QUANTITY | DESCRIPTION | MODEL |
|---|---|---|
| 1 | 2.92mm female fixed short circuit | 8771F1 |
| 1 | 2.92mm male fixed short circuit | 8772F1 |
| 1 | 2.92mm female open circuit termination | 8773A1 |
| 1 | 2.92mm male open circuit termination | 8773B1 |
| 1 | 2.92mm female fixed termination | 8775A2 |
| 1 | 2.92mm male fixed termination | 8775B2 |
| 1* | 2.92mm female to 2.92mm female adapter | 8714A2 |
| 1* | 2.92mm male to 2.92mm male adapter | 8714B2 |
| 1* | 2.92mm female to 2.92mm male adapter | 8714C2 |
| 1 | 2.92mm female sliding termination | 8777A1 |
| 1 | 2.92mm male sliding termination | 8777B1 |
| 1 | Pin depth adjusting tool | 8777S02 |
| 1 | 5/16-inch torque wrench — 8 in. lbs. | 8799A1 |
| 1 | 5/16-inch double end wrench | 8770Z6 |
| 1 | 7/16-inch double end wrench | 8770Z7 |
| 1 | Foam-lined wood Instrument case | — |

* These adapters are provided in the 8770CK21 kits, but are not included in the 8770CK20 kits.

Maury 8719A/B and 7909F1/F2 test port adapters are designed to mate with the special ruggedized connectors used on commercial VNA test sets. The precision 2.92mm adapters feature low VSWR with low insertion loss and are of minimum length.

Key Literature: Maury data sheet 2Z-058.


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# 2.92mm TRL/LRL VNA Calibration Kits

8770CK31

## 8770CK30/31 Series



### *Features*

- *2.92mm Connectors*
- *DC to 40 GHz*
- *High Performance*
- *Keysight, Rhode & Schwarz and Anritsu VNAs Supported*

### *Kit Description*

Maury Microwave's precision 2.92mm TRL/LRL calibration kits are designed for use with a broad range of vector network analyzers (VNAs). With the components in these kits you can make error-corrected measurements of devices supplied with 2.92mm connectors from DC to 40 GHz. Each kit is supplied with a set of calibration standards; shorts, opens and fixed loads as listed at right. (See page 33 for all Maury 2.92mm cal kit components specifications.)

### *Calibration Methods Supported*

- *8770CK30/31*
  - *– TRM/TRL/LRL (DC–40 GHz)*

8770CK30/31 TRL/LRL calibration kits contain all the components needed to perform TRM, TRL and LRL calibrations.

Source match can also be measured using the 6.25cm air line with the short circuit provided.

8770CK31 kits include three 2.4mm in-series adapters for applications that require female/female, male/male, or male/female connections. A wide range of between-series adapters in 2.92mm to other types and special VNA test port adapters (NMD type) are also available by separate order.

### *Components Included in 8770CK30/31 Kits*

| QUANTITY | DESCRIPTION | MODEL |
|---|---|---|
| 1 | 2.92mm female fixed short circuit | 8771F1 |
| 1 | 2.92mm male fixed short circuit | 8772F1 |
| 1 | 2.92mm female fixed termination | 8775A2 |
| 1 | 2.92mm male fixed termination | 8775B2 |
| 1* | 2.92mm female to 2.92mm female adapter | 8714A2 |
| 1* | 2.92mm male to 2.92mm male adapter | 8714B2 |
| 1* | 2.92mm female to 2.92mm male adapter | 8714C2 |
| 1 | 2.92mm female to male air line (5cm) | 8774C5 |
| 1 | 2.92mm female to male air line (5.25cm) | 8774C5.25 |
| 1 | 2.92mm female to male air line (6cm) | 8774C6 |
| 1 | 2.92mm female to male air line (15cm) | 8774C15 |
| 1 | 5/16-inch torque wrench — 8 in. lbs. | 8799A1 |
| 1 | 5/16-inch double end wrench | 8770Z6 |
| 1 | 7/16-inch double end wrench | 8770Z7 |
| 1 | Foam-lined wood Instrument case | — |

* These adapters are provided in the 8770CK31 kits, but are not included in the 8770CK30 kits.

### *Recommended Accessories*

***A050A Digital Connector Gage Kit:***
Contains two "thread-on" type, digital gages for measuring female and male contact pin location *(see page 104)*.

***8719A & 8719B 2.92mm NMD test port adapters:***
Precision 2.92mm to NMD2.92mm; DC–40.0 GHz *(see page 117)*.

***7909F1 & 7909F2 2.4mm NMD test port adapters:***
Precision NMD2.4mm to 2.92mm; DC–40.0 GHz *(see page 114)*.

Maury 8719A/B and 7909F1/F2 test port adapters are designed to mate with the special ruggedized connectors used on commercial VNA test sets. The precision 2.92mm adapters feature low VSWR with low insertion loss and are of minimum length.

Key Literature: Maury data sheet 2Z-058.



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# COMPONENT SPECIFICATIONS For Maury 2.92mm VNA Calibration Kits

## Air Lines – Models 8774C15, 8774C6, 8774C5.25 & 8774C5



Frequency Range . . . . . DC to 40.0 GHz
Electrical Length:
- 8774C15 . . . . . 15cm
- 8774C5 . . . . . 5cm
- 8774C6 . . . . . 6cm
- 8774C5.25. . . . . 5.25cm

Electrical Length Accuracy . . . . . ±0.0025cm
Minimum Return Loss (excluding connector interface) . . 48 dB
Nominal Impedance . . . . . 50 ohm

## Sliding Terminations – Models 8777A1 & 8777B1



Frequency Range . . . . . 4.0 to 40.0 GHz
Air Line Accuracy. . . . . 46 dB min, 4.0 to 40.0 GHz
(equivalent return loss of air line impedance)
Maximum VSWR of Terminating Element:
- 4.0 to 10.0 GHz . . . . . 1.10
- 10.0 to 40.0 GHz . . . . . 1.05

Nominal Impedance . . . . . 50 ohm
Power Handling . . . . . 0.5 watt CW, 0.5 kW peak
Travel . . . . . Greater than 1/2 wavelength at 4 GHz

## Fixed Terminations – Models 8775A2 & 8775B2



Frequency Range . . . . . DC to 40.0 GHz
Maximum VSWR:
- DC to 4.0 GHz . . . . . 1.016
- 4.0 to 40.0 GHz . . . . . 1.12

Power Handling . . . . . 0.5 watt CW, 0.25 kW peak
Nominal Impedance . . . . . 50 ohm

## Fixed Shorts – Models 8771F1 & 8772F1



Frequency Range . . . . . DC to 40.0 GHz
Minimum Reflection Coefficient . . . . . 0.98
Phase Accuracy . . . . . ±2.0 degrees
Nominal Impedance . . . . . 50 ohm

## Open Circuits – Models 8773A1 & 8773B1



Frequency Range . . . . . DC to 40.0 GHz
Minimum Reflection Coefficient . . . . . 0.98
Phase Accuracy . . . . . ±1.5 degrees
Nominal Impedance . . . . . 50 ohm

## Precision 2.92mm Adapters – Models 8714A2/B2/C2



Frequency Range . . . . . DC to 40.0 GHz
Maximum VSWR:
- DC to 4.0 GHz . . . . . 1.05
- 4.0 to 20.0 GHz . . . . . 1.08
- 20.0 to 40.0 GHz . . . . . 1.12

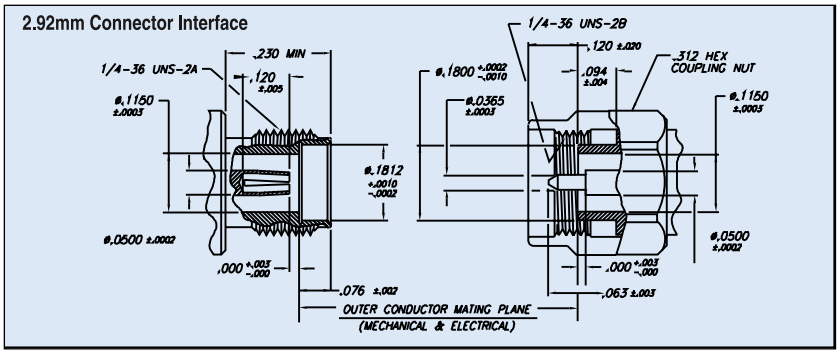
Nominal Impedance . . . . . 50 ohm

(Note: These adapters are included in the 877050CK11/21/31 kits, but are not included in the 8770CK10/20/30 kits.)

## Connector Description

The precision 2.92mm connectors on the components in these kits are miniature, instrument grade, air-interface connectors that operate mode free up to 40 GHz, and comply with IEEE standard 287 general precision connector, instrument grade GPC2.92.

For detailed interface specifications please refer to Maury data sheet 5E-063.





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# 3.5mm Fixed Load VNA Calibration Kits

## 8050CK10/11 Series

8050CK11




### Features

- 3.5mm Connectors
- DC to 26.5 GHz
- High Performance
- Keysight, Rhode & Schwarz and Anritsu VNAs Supported

### Kit Description

Maury Microwave's precision 3.5mm fixed load calibration kits are designed for use with a broad range of vector network analyzers (VNAs). With the components in these kits you can make error-corrected measurements of devices supplied with 3.5mm connectors from DC to 26.5 GHz. Each kit is supplied with a set of calibration standards; shorts, opens and fixed loads as listed at right. (See page 37 for all Maury 3.5mm cal kit components specifications.)

### Calibration Methods Supported

- 8050CK10/11
  - *– Fixed Load SOLT (DC–26.5 GHz)*

8050CK10/11 kits are configured for use in performing one-port SOL (Short-Open-Load) response calibrations (a method used for measuring VSWR/ Return Loss), and full two-port SOLT (Short-Open-Load-Thru) calibration (for performing forward and reverse transmission and reflections measurement).

8050CK11 kits include three 3.5mm in-series adapters for applications that require female/female, male/male, or male/female connections. A wide range of between-series adapters in 3.5mm to other types and special VNA test port adapters (NMD type) are also available by separate order.

### Components Included in 8050CK10/11 Kits

| QUANTITY | DESCRIPTION | MODEL |
|---|---|---|
| 1 | 3.5mm female fixed short circuit | 8046F |
| 1 | 3.5mm male fixed short circuit | 8047F |
| 1 | 3.5mm female open circuit termination | 8048A1 |
| 1 | 3.5mm male open circuit termination | 8048B1 |
| 1 | 3.5mm female fixed termination | 8031A4 |
| 1 | 3.5mm male fixed termination | 8031B4 |
| 1* | 3.5mm female to 3.5mm female adapter | 8021A2 |
| 1* | 3.5mm male to 3.5mm male adapter | 8021B2 |
| 1* | 3.5mm female to 3.5mm male adapter | 8021C2 |
| 1 | Foam-lined wood Instrument case | — |

* These adapters are provided in the 8050CK11 kits, but are not included in the 8050CK10 kits.

### Recommended Accessories

***A050A Digital Connector Gage Kit:***
Contains two "thread-on" type, digital gages for measuring female and male contact pin location *(see page 104)*.

***8799A1 5/16-in. Precision Torque Wrench (8.0 inch lbs):***
For proper torquing of 1.85mm, 2.4mm, 2.92mm and 3.5mm connections. Factory preset to 8.0 inch lbs to ensure the precise torque needed for optimum repeatability *(see page 106)*.

***8009A & 8009B 3.5mm NMD test port adapters:***
Precision 3.5mm to NMD3.5mm; DC–26.5 GHz *(see page 149)*.

***7909B1 & 7909B2 2.4mm NMD test port adapters:***
Precision NMD2.4mm to 3.5mm; DC–26.5 GHz *(see page 149)*.

Maury 8009A/B and 7909B1/B2 test port adapters are designed to mate with the special ruggedized connectors used on commercial VNA test sets. The precision 3.5mm adapters feature low VSWR with low insertion loss and are of minimum length.

Key Literature: Maury data sheet 2Z-059.



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# 3.5mm Sliding Load VNA Calibration Kits

## 8050CK20/21 Series

8050CK21



### *Features*

- *3.5mm Connectors*
- *DC to 26.5 GHz*
- *High Performance*
- *Keysight, Rhode & Schwarz and Anritsu VNAs Supported*

### *Kit Description*

Maury Microwave's precision 3.5mm fixed load calibration kits are designed for use with a broad range of vector network analyzers (VNAs). With the components in these kits you can make error-corrected measurements of devices supplied with 3.5mm connectors from DC to 26.5 GHz. Each kit is supplied with a set of calibration standards; shorts, opens and fixed loads as listed at right. (See page 37 for all Maury 3.5mm cal kit components specifications.)

### *Calibration Methods Supported*

- *8050CK20/21*
  - *– Fixed/Sliding Load SOLT (DC–26.5 GHz)*

8050CK10/11 kits are configured for use in performing one-port SOL (Short-Open-Load) response calibrations (a method used for measuring VSWR/ Return Loss), and full two-port SOLT (Short-Open-Load-Thru) calibration (for performing forward and reverse transmission and reflections measurement).

8050CK11 kits include three 3.5mm in-series adapters for applications that require female/female, male/male, or male/female connections. A wide range of between-series adapters in 3.5mm to other types and special VNA test port adapters (NMD type) are also available by separate order.

### *Recommended Accessories*

***A050A Digital Connector Gage Kit:***
Contains two "thread-on" type, digital gages for measuring female and male contact pin location *(see page 104)*.

***8009A & 8009B 3.5mm NMD test port adapters:***
Precision 3.5mm to NMD3.5mm; DC–26.5 GHz *(see page 149)*.

### *Components Included in 8050CK20/21 Kits*

| QUANTITY | DESCRIPTION | MODEL |
|---|---|---|
| 1 | 3.5mm female fixed short circuit | 8046F |
| 1 | 3.5mm male fixed short circuit | 8047F |
| 1 | 3.5mm female open circuit termination | 8048A1 |
| 1 | 3.5mm male open circuit termination | 8048B1 |
| 1 | 3.5mm female fixed termination | 8031A5 |
| 1 | 3.5mm male fixed termination | 8031B5 |
| 1* | 3.5mm female to 3.5mm female adapter | 8021A2 |
| 1* | 3.5mm male to 3.5mm male adapter | 8021B2 |
| 1* | 3.5mm female to 3.5mm male adapter | 8021C2 |
| 1 | 3.5mm female sliding termination | 8037A |
| 1 | 3.5mm male sliding termination | 8037B |
| 1 | Pin depth adjusting tool | 8777S02 |
| 1 | 5/16-inch torque wrench — 8 in. lbs. | 8799A1 |
| 1 | 7/16-inch double end wrench | 8770Z7 |
| 1 | 5/16-inch double end wrench | 8770Z6 |
| 1 | Foam-lined wood Instrument case | — |

* These adapters are provided in the 8050CK21 kits, but are not included in the 8050CK20 kits.

***7909B1 & 7909B2 2.4mm NMD test port adapters:***
Precision NMD2.4mm to 3.5mm; DC–26.5 GHz *(see page 149)*.

Maury 8009A/B and 7909B1/B2 test port adapters are designed to mate with the special ruggedized connectors used on commercial VNA test sets. The precision 3.5mm adapters feature low VSWR with low insertion loss and are of minimum length.

Key Literature: Maury data sheet 2Z-059.


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# 3.5mm TRL/LRL VNA Calibration Kits

8050CK31

## 8050CK30/31 Series



### *Features*

- *2.92mm Connectors*
- *DC to 40 GHz*
- *High Performance*
- *Keysight, Rhode & Schwarz and Anritsu VNAs Supported*

### *Kit Description*

Maury Microwave's precision 2.92mm TRL/LRL calibration kits are designed for use with a broad range of vector network analyzers (VNAs). With the components in these kits you can make error-corrected measurements of devices supplied with 2.92mm connectors from DC to 40 GHz. Each kit is supplied with a set of calibration standards; shorts, opens and fixed loads as listed at right. (See page 37 for all Maury 2.92mm cal kit components specifications.)

### *Calibration Methods Supported*

- *8770CK30/31*
  - *– TRM/TRL/LRL (DC–40 GHz)*

8770CK30/31 TRL/LRL calibration kits contain all the components needed to perform TRM, TRL and LRL calibrations.

Source match can also be measured using the 6.25cm air line with the short circuit provided.

8770CK31 kits include three 2.4mm in-series adapters for applications that require female/female, male/male, or male/female connections. A wide range of between-series adapters in 2.92mm to other types and special VNA test port adapters (NMD type) are also available by separate order.

### *Recommended Accessories*

***A050A Digital Connector Gage Kit:***
Contains two "thread-on" type, digital gages for measuring female and male contact pin location *(see page 104)*.

***8009A & 8009B 3.5mm NMD test port adapters:***
Precision 3.5mm to NMD3.5mm; DC–26.5 GHz *(see page 149)*.

***7909B1 & 7909B2 2.4mm NMD test port adapters:***
Precision NMD2.4mm to 3.5mm; DC–26.5 GHz *(see page 149)*.

### *Components Included in 8050CK30/31 Kits*

| QUANTITY | DESCRIPTION | MODEL |
|---|---|---|
| 1 | 3.5mm female fixed short circuit | 8046F |
| 1 | 3.5mm male fixed short circuit | 8047F |
| 1 | 3.5mm female fixed termination | 8031A5 |
| 1 | 3.5mm male fixed termination | 8031B5 |
| 1* | 3.5mm female to 3.5mm female adapter | 8021A2 |
| 1* | 3.5mm male to 3.5mm male adapter | 8021B2 |
| 1* | 3.5mm female to 3.5mm male adapter | 8021C2 |
| 1 | 3.5mm female to male air line (5cm) | 8043S5 |
| 1 | 3.5mm female to male air line (5.25cm) | 8043S5.3 |
| 1 | 3.5mm female to male air line (6cm) | 8043S6 |
| 1 | 3.5mm female to male air line (15cm) | 8043S15 |
| 1 | 5/16-inch torque wrench — 8 in. lbs. | 8799A1 |
| 1 | 7/16-inch double end wrench | 8770Z7 |
| 1 | 5/16-inch double end wrench | 8770Z6 |
| 1 | Foam-lined wood Instrument case | — |

* These adapters are provided in the 8050CK31 kits, but are not included in the 8050CK30 kits.

Maury 8009A/B and 7909B1/B2 test port adapters are designed to mate with the special ruggedized connectors used on commercial VNA test sets. The precision 3.5mm adapters feature low VSWR with low insertion loss and are of minimum length.

Key Literature: Maury data sheet 2Z-059.



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# COMPONENT SPECIFICATIONS For Maury 2.92mm VNA Calibration Kits

## Air Lines – Models 8043S15, 8043S6, 8043S5.3 & 8043S5



Frequency Range . . . . . DC to 26.5 GHz
Electrical Length:
- 8043S15 . . . . . 15cm
- 8043S6 . . . . . 6cm
- 8043S5.3 . . . . . 5.3cm
- 8043S5 . . . . . 5cm

Electrical Length Accuracy . . . . . ±0.0025cm
Minimum Return Loss (excluding connector interface) . . . . . 48 dB
Nominal Impedance . . . . . 50 ohm

## Sliding Terminations – Models 8037A & 8037B



Frequency Range . . . . . 2.0 to 34.0 GHz
Maximum VSWR of Terminating Element:
- 2.0 to 4.0 GHz . . . . . 1.09
- 4.0 to 34.0 GHz . . . . . 1.05

Air Line Accuracy. . . . . 50 dB min return loss
(equivalent return loss of air line impedance)
Nominal Impedance . . . . . 50 ohm
Power Handling . . . . . 1.0 watt CW, 1.0 kW peak
Travel . . . . . Greater than 1/2 wavelength at 2.0 GHz

## Precision 3.5mm Adapters – Models 8021A2/B2/C2



Frequency Range . . . . . DC to 34.0 GHz
Maximum VSWR:
- DC to 18.0 GHz . . . . . 1.05
- 18.0 to 26.5 GHz . . . . . 1.08
- 26.5 to 34.0 GHz . . . . . 1.12

Nominal Impedance . . . . . 50 ohm

Note: Adapters are only included in the 8050CK11/21/31 kits

## Fixed Terminations – Models 8031A4 & 8031B4



Frequency Range . . . . . DC to 26.5 GHz
Maximum VSWR:
- DC to 2.0 GHz . . . . . 1.03
- 2.0 to 4.0 GHz . . . . . 1.05
- 4.0 to 18.0 GHz . . . . . 1.10
- 18.0 to 26.5 GHz . . . . . 1.15

Power Handling . . . . . 0.25 watt CW, 0.5 kW peak
Nominal Impedance . . . . . 50 ohm

## Fixed Terminations – Models 8031A5 & 8031B5



Frequency Range . . . . . DC to 26.5 GHz
Maximum VSWR:
- DC to 3.0 GHz . . . . . 1.020
- 3.0 to 6.0 GHz . . . . . 1.032
- 6.0 to 20.0 GHz . . . . . 1.052
- 20.0 to 26.5 GHz . . . . . 1.083

Power Handling . . . . . 0.25 watt CW, 0.5 kW peak
Nominal Impedance . . . . . 50 ohm

## Fixed Shorts – Models 8046F & 8047F



Frequency Range . . . . . DC to 26.5 GHz
Minimum Reflection Coefficient . . . . . 0.98
Phase Accuracy . . . . . ±2.0 degrees
Nominal Impedance . . . . . 50 ohm

## Open Circuits – Models 8048A1 & 8048B1

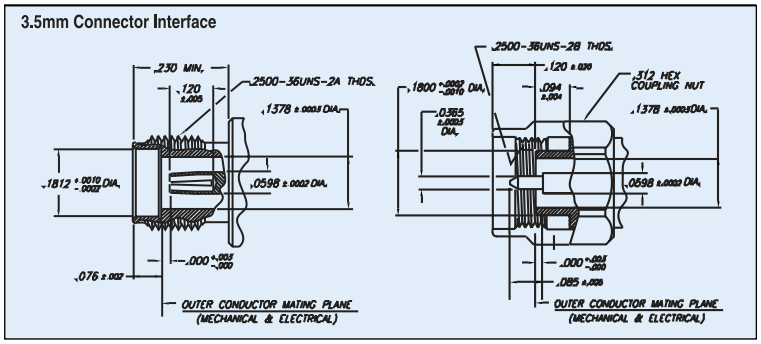


Frequency Range . . . . . DC to 26.5 GHz
Minimum Reflection Coefficient . . . . . 0.98
Phase Accuracy . . . . . ±1.4 degrees
Nominal Impedance . . . . . 50 ohm

## Connector Description

The precision 3.5mm connectors on the components in these kits are miniature, instrument grade, air-interface connectors that operate mode free up to 34 GHz, and comply with IEEE standard 287 general precision connector, instrument grade GPC2.4.

For detailed interface specifications please refer to Maury data sheet 5E-064.





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# 7mm Fixed Load VNA Calibration Kits

## 2650CK10

2650CK10




### *Features*

- *7mm Connectors*
- *DC to 18 GHz*
- *High Performance*
- *Keysight, Rhode & Schwarz and Anritsu VNAs Supported*

### *Kit Description*

Maury Microwave's precision 7mm fixed load calibration kits are designed for use with a broad range of vector network analyzers (VNAs). With the components in these kits you can make error-corrected measurements of devices supplied with 7mm connectors from DC to 18 GHz. Each kit is supplied with a set of calibration standards; shorts, opens and fixed loads as listed at right. (See page 41 for all Maury 7mm cal kit components specifications.)

### *Calibration Method Supported*

- *2650CK10*
  - *– Fixed Load SOLT (DC–18 GHz)*

2650CK10 kits are configured for use in performing one-port SOL (Short-Open-Load) response calibrations (a method used for measuring VSWR/ Return Loss), and full two-port SOLT (Short-Open-Load-Thru) calibration (for performing forward and reverse transmission and reflections measurement).

### *Recommended Accessories*

***A028D Connector Gage Kit:***
One metrology-grade "Thread-on" type, dial indicator style gage for measuring the planar contact location *(see page 105)*.

***2698C2 3/4-inch Precision Torque Wrench (12.0 inch lbs):***
For proper torquing of 7mm, LPC7,Type N, NMD3.5, NMD2.92 NMD2.4 connections. Factory preset to 12.0 inch lbs to ensure the precise torque needed for optimum repeatability *(see page 106)*.

***Ruggedized Test Port Adapters (Available Models):***

***2633C*** – NMD3.5mm female to 7mm

***7909C*** – NMD2.4mm female to 7mm

These NMD2.4 and NMD3.5 test port adapters are designed to mate with the special ruggedized connectors used on commercial VNA test sets. They are calibration-grade (metrology) adapters that feature low VSWR with low insertion loss and are of minimum length *(see page 149)*.

Key Literature: Maury data sheet 2Z-060.

### *Components Included in 2650CK10 Kits*

| QUANTITY | DESCRIPTION | MODEL |
|---|---|---|
| 1 | 7mm fixed short circuit | 2615D3 |
| 1 | 7mm open circuit termination | 2616D3 |
| 1 | 7mm fixed termination | 2610F |
| 1 | Foam-lined wood Instrument case | — |

Maury also offers 7mm between series precision adapters and Test Port adapters in the following configurations:

- NMD1.85mm to 7mm – page 111
- NMD2.4mm to 7mm – page 114
- 2.4mm to 7mm – page 116
- 2.92mm to 7mm – page 119
- NMD3.5mm to 7mm – page 120
- QT3.5mm to 7mm – page 122
- 3.5mm to 7mm – page 123-124
- Type N to 7mm – page 125
- TNC to 7mm – page 125
- AFTNC to 7mm – page 125
- TNCA to 7mm – page 125
- SMA to 7mm – page 125
- BNC (50Ω and 75 Ω) to 7mm – page 125
- HN to 7mm – page 125
- 14mm to 7mm – page 125
- 7/8 EIA to 7mm – page 125
- LCP/OSP to 7mm – page 130
- 7-16 to 7mm – page 133
- Waveguide (WR650-WR62) to 7mm – page 135, 137


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# 7mm Sliding Load VNA Calibration Kits

## 2650CK20

2650CK20



### *Features*

- *7mm Connectors*
- *DC to 18 GHz*
- *High Performance*
- *Keysight, Rhode & Schwarz and Anritsu VNAs Supported*

### *Kit Description*

Maury Microwave's precision 7mm sliding load calibration kits are designed for use with a broad range of vector network analyzers (VNAs). With the components in these kits you can make error-corrected measurements of devices supplied with 7mm connectors from DC to 18 GHz. Each kit is supplied with a set of calibration standards; shorts, opens and fixed loads as listed at right. (See page 41 for all Maury 7mm cal kit components specifications.)

### *Calibration Method Supported*

- *2650CK10*

*– Fixed/Sliding Load SOLT (DC–18 GHz)*

2650CK10 kits are configured for use in performing one-port SOL (Short-Open-Load) response calibrations (a method used for measuring VSWR/ Return Loss), and full two-port SOLT (Short-Open-Load-Thru) calibration (for performing forward and reverse transmission and reflections measurement).

### *Recommended Accessories*

***A028D Connector Gage Kit:***
One metrology-grade "Thread-on" type, dial indicator style gage for measuring the planar contact location *(see page 105)*.

***Ruggedized Test Port Adapters (Available Models):***

***2633C*** – NMD3.5mm female to 7mm

***7909C*** – NMD2.4mm female to 7mm

These NMD2.4 and NMD3.5 test port adapters are designed to mate with the special ruggedized connectors used on commercial VNA test sets. They are calibration-grade (metrology) adapters that feature low VSWR with low insertion loss and are of minimum length *(see page 149)*.

### *Components Included in 2650CK20 Kits*

| QUANTITY | DESCRIPTION | MODEL |
|---|---|---|
| 1 | 7mm fixed short circuit | 2615D3 |
| 1 | 7mm open circuit termination | 2616D3 |
| 1 | 7mm fixed termination | 2610F |
| 1 | 7mm sliding termination | 2517H |
| 1 | 3/4-inch torque wrench — 12 in. lbs. | 2698C2 |
| 1 | Foam-lined wood Instrument case | — |

Maury also offers 7mm between series precision adapters and Test Port adapters in the following configurations:

- NMD1.85mm to 7mm – page 111
- NMD2.4mm to 7mm – page 114
- 2.4mm to 7mm – page 116
- 2.92mm to 7mm – page 119
- NMD3.5mm to 7mm – page 120
- QT3.5mm to 7mm – page 122
- 3.5mm to 7mm – page 123-124
- Type N to 7mm – page 125
- TNC to 7mm – page 125
- AFTNC to 7mm – page 125
- TNCA to 7mm – page 125
- SMA to 7mm – page 125
- BNC (50Ω and 75 Ω) to 7mm – page 125
- HN to 7mm – page 125
- 14mm to 7mm – page 125
- 7/8 EIA to 7mm – page 125
- LCP/OSP to 7mm – page 130
- 7-16 to 7mm – page 133
- Waveguide (WR650-WR62) to 7mm – page 135, 137

Key Literature: Maury data sheet 2Z-060.



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# 7mm TRL/LRL VNA Calibration Kits

## 2650CK30

### *Features*

- *7mm Connectors*
- *DC to 18 GHz*
- *High Performance*
- *Keysight, Rhode & Schwarz and Anritsu VNAs Supported*

### *Kit Description*

Maury Microwave's precision 7mm TRL/LRL calibration kits are designed for use with a broad range of vector network analyzers (VNAs). With the components in these kits you can make error-corrected measurements of devices supplied with 7mm connectors from DC to 18 GHz. Each kit is supplied with a set of calibration standards; shorts, opens and fixed loads as listed at right. (See page 41 for all Maury 7mm cal kit components specifications.)

### *Calibration Methods Supported*

- *2650CK30*
  - *– TRM/TRL/LRL (DC–18 GHz)*

2650CK30 TRL/LRL calibration kits contain the components needed to perform TRM, TRL and LRL calibrations.

Source match can also be measured using the 15cm air line with the short circuit provided.

### *Recommended Accessories*

***A028D Connector Gage Kit:***
One metrology-grade "Thread-on" type, dial indicator style gage for measuring the planar contact location *(see page 105)*.

***Ruggedized Test Port Adapters (Available Models):***

***2633C*** – NMD3.5mm female to 7mm

***7909C*** – NMD2.4mm female to 7mm

These NMD2.4 and NMD3.5 test port adapters are designed to mate with the special ruggedized connectors used on commercial VNA test sets. They are calibration-grade (metrology) adapters that feature low VSWR with low insertion loss and are of minimum length *(see page 149)*.

2650CK30



### *Components Included in 2650CK30 Kits*

| QUANTITY | DESCRIPTION | MODEL |
|---|---|---|
| 1 | 7mm fixed short circuit | 2615D3 |
| 1 | 7mm fixed termination | 2610F |
| 1 | 7mm air line (0.6cm) | 2653L |
| 1 | 7mm air line (3.12cm) | 2653S3.12 |
| 1 | 7mm air line (15cm) | 2653S15 |
| 1 | 3/4-inch torque wrench — 12 in. lbs. | 2698C2 |
| 1 | Foam-lined wood Instrument case | — |

Maury also offers 7mm between series precision adapters and Test Port adapters in the following configurations:

- NMD1.85mm to 7mm – page 111
- NMD2.4mm to 7mm – page 114
- 2.4mm to 7mm – page 116
- 2.92mm to 7mm – page 119
- NMD3.5mm to 7mm – page 120
- QT3.5mm to 7mm – page 122
- 3.5mm to 7mm – page 123-124
- Type N to 7mm – page 125
- TNC to 7mm – page 125
- AFTNC to 7mm – page 125
- TNCA to 7mm – page 125
- SMA to 7mm – page 125
- BNC (50Ω and 75 Ω) to 7mm – page 125
- HN to 7mm – page 125
- 14mm to 7mm – page 125
- 7/8 EIA to 7mm – page 125
- LCP/OSP to 7mm – page 130
- 7-16 to 7mm – page 133
- Waveguide (WR650-WR62) to 7mm – page 135, 137

Key Literature: Maury data sheet 2Z-060.



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# COMPONENT SPECIFICATIONS

## Air Lines – Models 2653S3.12, 2653L & 2653S15



Frequency Range . . . . . DC to 18.0 GHz
Electrical Length:
- 26553S3.12 . . . . . 3.12cm
- 2653L . . . . . 0.69cm
- 2653S15 . . . . . 14.983cm

Electrical Length Accuracy . . . . . ±0.006cm
Return Loss (Min.) – excluding connector interface. . . . 52 dB
Nominal Impedance . . . . . 50 ohm

## Sliding Termination – Model 2517H



Frequency Range . . . . . 2.0 to 18.0 GHz
Maximum VSWR of Terminating Element . . . . . 1.04
Air Line Accuracy. . . . . 52 dB min return loss
(equivalent return loss of air line impedance)
Nominal Impedance . . . . . 50 ohm
Power Handling . . . . . 1.0 watt CW, 5.0 kW peak
Travel . . . . . Greater than 1/2 wavelength at 2.0 GHz

## Fixed Termination – Model 2610F



Frequency Range . . . . . DC to 18.0 GHz
Maximum VSWR:
- DC — 1.0 GHz . . . . . 1.005
- 1.0 — 2.0 GHz . . . . . 1.01
- 2.0 — 8.0 GHz . . . . . 1.03
- 8.0 — 18.0 GHz . . . . . 1.06

Nominal Impedance. . . . . 50 ohm
Power Handling . . . . . 1 watt CW 1 kW peak

## Fixed Short – Model 2615D3



Frequency Range . . . . . DC to 18.0 GHz
Minimum Reflection Coefficient . . . . . 0.995
Phase Accuracy . . . . . ±0.3 degrees
Nominal Impedance . . . . . 50 ohm

## Open Circuit – Model 2616D3

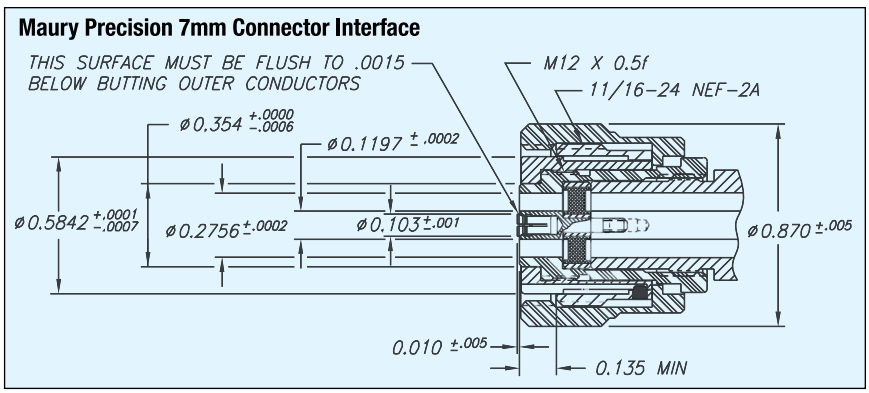


Frequency Range . . . . . DC to 18.0 GHz
Minimum Reflection Coefficient . . . . . 0.995
Phase Accuracy . . . . . ±0.3 degrees
Nominal Impedance . . . . . 50 ohm

## Connector Description

7mm connectors are precision air interface hermaphroditic connectors that are rated from DC to 18 GHz. They have an air line size of 0.1197 inner conductor diameter and a 0.2756 outer conductor diameter. There are basically two configurations; 1) GPC7 (commonly referred to as APC7), which incorporates a bead support and, 2) LPC7A, which is a beadless connector. They comply with IEEE standard 287 for instrument grade general precision connectors (GPC7). See Maury data sheet 5E-060 for complete interface dimensions.

**Maury Precision 7mm Connector Interface**





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# Type N Fixed Load VNA Calibration Kits

8850CK11

## 8850CK10/11 series



### *Features*

- *7mm Connectors*
- *DC to 18 GHz*
- *High Performance*
- *Keysight, Rhode & Schwarz and Anritsu VNAs Supported*

### *Kit Description*

Maury Microwave's precision type N fixed load calibration kits are designed for use with a broad range of vector network analyzers (VNAs). With the components in these kits you can make error-corrected measurements of devices supplied with type N connectors from DC to 18 GHz. Each kit is supplied with a set of calibration standards; shorts, opens and fixed loads as listed at right. (See page 45 for all Maury type N cal kit components specifications.)

### *Calibration Method Supported*

- *8850CK10/11*
  - *– Fixed Load SOLT (DC–18 GHz)*

8850CK10/11 kits are configured for use in performing one-port SOL (Short-Open-Load) response calibrations (a method used for measuring VSWR/ Return Loss), and full two-port SOLT (Short-Open-Load-Thru) calibration (for performing forward and reverse transmission and reflections measurement).

### *Components Included in 8850CK10/11 Kits*

| QUANTITY | DESCRIPTION | MODEL |
|---|---|---|
| 1 | Type N female fixed short circuit | 8806C |
| 1 | Type N male fixed short circuit | 8807C |
| 1 | Type N female open circuit termination | 8809B1 |
| 1 | Type N male open circuit termination | 8810B1 |
| 1 | Type N female fixed termination | 2510A6 |
| 1 | Type N male fixed termination | 2510B6 |
| 1* | Type N female to Type N female adapter | 8828A |
| 1* | Type N male to Type N male adapter | 8828B |
| 1* | Type N female to Type N male adapter | 8828C |
| 1 | Foam-lined wood Instrument case | — |

* These adapters are provided in the 8850CK11 kits, but are not included in the 8850CK10 kits.

### *Recommended Accessories*

#### *A020K Digital Connector Gage Kit:*

Contains two "Thread-on" type, digital gages for measuring female and male contact pin location. They provide an easy and accurate way to measure critical linear interface dimensions of type N coaxial connectors *(see page 105)*.

#### *2698C2 3/4-inch Precision Torque Wrench (12.0 inch lbs):*

For proper torquing of 7mm, LPC7,Type N, NMD3.5, NMD2.92 NMD2.4 connections. Factory preset to 12.0 inch lbs to ensure the precise torque needed for optimum repeatability. Employs a "break" design that makes it impossible to over-torque your connections.

These torque wrenches are highly recommended for use with 8850CK10/11 kits *(see page 106)*.

#### *8829A & 8829B Type N to 3.5mm NMD test port adapters:*

Precision Type N to NMD3.5mm; DC–18.0 GHz. Saves unnecessary wear and tear on your VNA test ports.

*(see page 149)*.

#### *7909D1 & 7909D2 Type N to 2.4mm NMD test port adapters:*

Precision Type N to NMD2.4mm; DC–18.0 GHz. Saves unnecessary wear and tear on your VNA test ports *(see page 149)*.

Key Literature: Maury data sheets 2Z-061.



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# Type N Sliding Load VNA Calibration Kits

8850CK21

## 8850CK20/21 series



### *Features*

- *7mm Connectors*
- *DC to 18 GHz*
- *High Performance*
- *Keysight, Rhode & Schwarz and Anritsu VNAs Supported*

### *Kit Description*

Maury Microwave's precision type N fixed load calibration kits are designed for use with a broad range of vector network analyzers (VNAs). With the components in these kits you can make error-corrected measurements of devices supplied with type N connectors from DC to 18 GHz.

Each kit is supplied with a set of calibration standards; shorts, opens and fixed loads as listed at right. (See page 45 for all Maury type N cal kit components specifications.)

### *Calibration Method Supported*

- *8850CK10/11*

*– Fixed/Sliding Load SOLT (DC–18 GHz)*

8850CK20/21 kits are configured for use in performing one-port SOL (Short-Open-Load) response calibrations (a method used for measuring VSWR/ Return Loss), and full two-port SOLT (Short-Open-Load-Thru) calibration (for performing forward and reverse transmission and reflections measurement).

### *Components Included in 8850CK20/21 Kits*

| QUANTITY | DESCRIPTION | MODEL |
|---|---|---|
| 1 | Type N female fixed short circuit | 8806C |
| 1 | Type N male fixed short circuit | 8807C |
| 1 | Type N female open circuit termination | 8809B1 |
| 1 | Type N male open circuit termination | 8810B1 |
| 1 | Type N female fixed termination | 2510A7 |
| 1 | Type N male fixed termination | 2510B7 |
| 1* | Type N female to Type N female adapter | 8828A |
| 1* | Type N male to Type N male adapter | 8828B |
| 1* | Type N female to Type N male adapter | 8828C |
| 1 | Type N female sliding termination | 2517A02 |
| 1 | 3/4-inch torque wrench — 12.0 in. lbs. | 2698C2 |
| 1 | Foam-lined wood Instrument case | — |

* These adapters are provided in the 8850CK21 kits, but are not included in the 8850CK20 kits.

### *Recommended Accessories*

***A020K Digital Connector Gage Kit:***

Contains two "Thread-on" type, digital gages for measuring female and male contact pin location. They provide an easy and accurate way to measure critical linear interface dimensions of type N coaxial connectors *(see page 105)*.

***8829A & 8829B Type N to 3.5mm NMD test port adapters:***

Precision Type N to NMD3.5mm; DC–18.0 GHz. Saves unnecessary wear and tear on your VNA test ports *(see page 149)*.

***7909D1 & 7909D2 Type N to 2.4mm NMD test port adapters:***

Precision Type N to NMD2.4mm; DC–18.0 GHz. Saves unnecessary wear and tear on your VNA test ports *(see page 149)*.

Key Literature: Maury data sheets 2Z-061.



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# Type N TRL/LRL VNA Calibration Kits

## 8850CK30/31 series

8850CK31



### *Features*

- *7mm Connectors*
- *DC to 18 GHz*
- *High Performance*
- *Keysight, Rhode & Schwarz and Anritsu VNAs Supported*

### *Kit Description*

Maury Microwave's precision type N TRL/LRL calibration kits are designed for use with a broad range of vector network analyzers (VNAs). With the components in these kits you can make error-corrected measurements of devices supplied with type N connectors from DC to 18 GHz. Each kit is supplied with a set of calibration standards; shorts, opens and fixed loads as listed at right. (See page 45 for all Maury type N cal kit components specifications.)

### *Calibration Methods Supported*

- *2650CK30*
  - *– TRM/TRL/LRL (DC–18 GHz)*

8850CK30/31 TRL/LRL calibration kits contain the components needed to perform TRM, TRL and LRL calibrations.

Source match can also be measured using the 15cm air line with the short circuit provided.

### *Components Included in 8850CK30/31 Kits*

| QUANTITY | DESCRIPTION | MODEL |
|---|---|---|
| 1 | Type N female fixed short circuit | 8806G |
| 1 | Type N male offset short circuit | 8807C |
| 1 | Type N female fixed termination | 2510A7 |
| 1 | Type N male fixed termination | 2510B7 |
| 1* | Type N female to Type N female adapter | 8828A |
| 1* | Type N male to Type N male adapter | 8828B |
| 1* | Type N female to Type N male adapter | 8828C |
| 1 | Type N female to Type N male air line (3.12cm) | 2553T3.12 |
| 1 | Type N female to Type N male air line (3.82cm) | 2553T3.82 |
| 1 | Type N female to Type N male air line (15cm) | 2553T15 |
| 1 | 3/4-inch torque wrench — 12.0 in. lbs. | 2698C2 |
| 1 | Foam-lined wood Instrument case | — |

* These adapters are provided in the 8850CK31 kits, but are not included in the 8850CK30 kits.

### *Recommended Accessories*

#### *A020K Digital Connector Gage Kit:*

Contains two "Thread-on" type, digital gages for measuring female and male contact pin location. They provide an easy and accurate way to measure critical linear interface dimensions of type N coaxial connectors *(see page 105)*.

#### *8829A & 8829B Type N to 3.5mm NMD test port adapters:*

Precision Type N to NMD3.5mm; DC–18.0 GHz. Saves unnecessary wear and tear on your VNA test ports *(see page 149)*.

#### *7909D1 & 7909D2 Type N to 2.4mm NMD test port adapters:*

Precision Type N to NMD2.4mm; DC–18.0 GHz. Saves unnecessary wear and tear on your VNA test ports *(see page 149)*.

Key Literature: Maury data sheet 2Z-061.



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# COMPONENT SPECIFICATIONS

## Air Lines – Models 2553T3.12, 2553T3.82 & 2653T15



Frequency Range . . . . . DC to 18.0 GHz
Electrical Length:
2553T3.12. . . . . 3.12cm
2553T3.82 . . . . . 3.816cm
2553T15 . . . . . 14.983cm
Electrical Length Accuracy . . . . . ±0.01cm
Minimum Return Loss (excluding connector interfaces) . . . . 52 dB
Characteristic Impedance (where skin depth is negligible). . . . . 50 ohm + 0.2 ohm

## Sliding Termination – Model 2517A02



Frequency Range . . . . . 1.8 to 18.0 GHz
Maximum VSWR of Terminating Element . . . . . 1.05
Air Line Accuracy. . . . . 54 dB min return loss (equivalent return loss of air line impedance)
Nominal Impedance . . . . . 50 ohm
Power Handling . . . . . 1.0 watt CW, 1.0 kW peak
Travel . . . . . Greater than 1/2 wavelength at 1.8 GHz

## Fixed Terminations – Model 2510A6 & 2510B6



Frequency Range . . . . . DC to 18.0 GHz
Maximum VSWR:
DC to 2.0 GHz . . . . . 1.02
2.0 to 4.0 GHz . . . . . 1.04
4.0 to 18.0 GHz . . . . . 1.06
Nominal Impedance. . . . . 50 ohm
Power Handling . . . . . 1 watt CW, 1 kW peak

## Fixed Terminations – Model 2510A7 & 2510B7



Frequency Range . . . . . DC to 18.0 GHz
Maximum VSWR:
DC to 2.0 GHz . . . . . 1.01
2.0 to 4.0 GHz . . . . . 1.04
4.0 to 18.0 GHz . . . . . 1.12
Nominal Impedance. . . . . 50 ohm
Power Handling . . . . . 1 watt CW, 1 kW peak

## Fixed Shorts – Models 8806G, 8806C & 8807C



Frequency Range . . . . . DC to 18.0 GHz
Minimum Reflection Coefficient . . . . . 0.98
Nominal Impedance . . . . . 50 ohm
Phase Accuracy . . . . . ± 2.0°

## Open Circuits – Models 8809B1 & 8810B1



Frequency Range . . . . . DC to 18.0 GHz
Minimum Reflection Coefficient . . . . . 0.99
Phase Accuracy . . . . . ±2.0°
Nominal Impedance . . . . . 50 ohm

## Precision Type N Adapters – Models 8828A/B/C



Frequency Range . . . . . DC to 18.0 GHz
Maximum VSWR:
DC to 4.0 GHz . . . . . ≤ 1.03
4.0 to 10.0 GHz . . . . . ≤ 1.05
10.0 to 18.0 GHz . . . . . ≤ 1.09
Nominal Impedance . . . . . 50 ohm

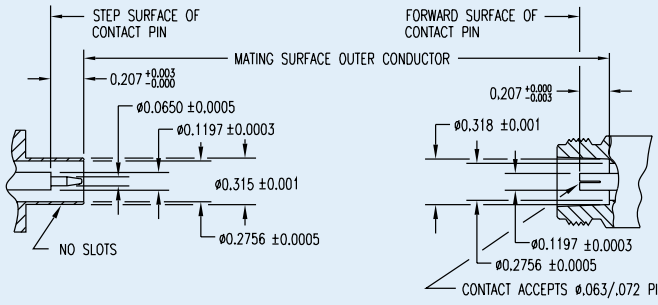
Note: Adapters are only included in the 8850CK11/21/31 kits.

## Connector Description

The precision Type N connectors on the components in these kits are instrument grade, air-interface connectors that are rated for operation from DC to 18.0 GHz, and comply with IEEE standard 287 for instrument grade general precision connectors (GPC Type N).

The connectors are normally made with stainless steel bodies with heat-treated gold-plated beryllium copper contacts. For detailed interface specifications please refer to Maury data sheet 5E-049.

**Type N Connector Interface**





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# 75Ω Type N Fixed Load VNA Calibration Kits

## 8880CK10/11 series




### Features

- *75Ω Type N Connectors*
- *DC to 2.0 GHz*
- *Simple Fixed Load Calibration*
- *Keysight, Rhode & Schwarz and Anritsu VNAs Supported*

### Kit Description

Maury Microwave's precision type N fixed load calibration kits are designed for use with a broad range of vector network analyzers (VNAs). With the components in these kits you can make error-corrected measurements of devices supplied with type N connectors from DC to 18 GHz. Each kit is supplied with a set of calibration standards; shorts, opens and fixed loads as listed at right. (See page 47 for all Maury type N cal kit components specifications.)

### Calibration Method Supported

- *8850CK10/11*
  - *– Fixed Load SOLT (DC–2.0 GHz)*

8880CK10/11 kits are configured for use in performing one-port SOL (Short-Open-Load) response calibrations (a method used for measuring VSWR/ Return Loss), and full two-port SOLT (Short-Open-Load-Thru) calibration (for performing forward and reverse transmission and reflections measurement).

8850CK11 kits include three 75Ω type N in-series adapters for applications that require female/female, male/male, or male/female connections. Other between-series adapters in 75Ω type N to other types are also available by separate order.

### Components Included in 8880CK11 Kits

| QUANTITY | DESCRIPTION | MODEL |
|---|---|---|
| 1 | 75Ω Type N female fixed short circuit | 8884A |
| 1 | 75Ω Type N male fixed short circuit | 8884B |
| 1 | 75Ω Type N female open circuit | 8885A |
| 1 | 75Ω Type N male open circuit | 8885B |
| 1 | 75Ω Type N female fixed termination | 8883A |
| 1 | 75Ω Type N male fixed termination | 8883B |
| 1* | 75Ω Type N female to 75Ω Type N female adapter | 8882A |
| 1* | 75Ω Type N male to 75Ω Type N male adapter | 8882B |
| 1* | 75Ω Type N female to 75Ω Type N male adapter | 8882C |
| 1 | Foam-lined wood Instrument case | — |

* These adapters are provided in the 8880CK11 kits, but are not included in the 8880CK10 kits.

### Recommended Accessories

***A020G 75Ω Dial Indicator Style Connector Gage Kit:***
This kit contains one (1) "push-on" type gages for measuring the female and male contact pin locations for 75Ω type N connectors *(see page 104)*.

***8882 Series Phase Matched 75Ω Adapters:***
These in-series and between series adapters are designed to adapt 75Ω Type N to 50Ω Type N and 75Ω to 50Ω 7mm, 3.5mm and NMD3.5mm. Visit maurymw.com for detailed information *(see page 129)*.

***2698C2 3/4-inch Precision Torque Wrench (12.0 inch lbs):***
For proper torquing of 7mm, LPC7, type N, NMD3.5, NMD2.92 and NMD2.4 connections. Factory preset to 12.0 inch lbs to ensure the precise torque needed for optimum repeatability. Employs a "break" design that makes it impossible to over-torque your connections. These torque wrenches are highly recommended for use with 8880CK10/11 kits *(see page 106)*.

***8882E1/E2 75Ω Type N to 3.5mm NMD 50Ω test port adapters:***
Precision 75Ω Type N to NMD3.5mm; DC–18.0 GHz. Saves unnecessary wear and tear on your VNA test ports *(see page 129)*.

Key Literature: Maury data sheet 2Z-035.



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## COMPONENT SPECIFICATIONS

### Fixed Terminations – Models 8883A and 8883B




Frequency Range . . . . . DC to 2.0 GHz
Maximum VSWR. . . . . 1.01 (46 dB minimum return loss)
Nominal Impedance . . . . . 75 ohm
Power Handling . . . . . 1 watt CW

### Open Circuits – Models 8885A and 8885B



Frequency Range . . . . . DC to 2.0 GHz
Reflection Coefficient . . . . . 0.98 minimum
Phase Accuracy . . . . . ± 2.0 degrees
Nominal Impedance . . . . . 75 ohm

### Fixed Shorts – Models 8884A and 8884B



Frequency Range . . . . . DC to 2.0 GHz
Reflection Coefficient . . . . . 0.98 minimum
Phase Accuracy . . . . . ± 1.0 degree
Nominal Impedance . . . . . 75 ohm

***Warning:* Do not mate a 75 ohm type N connector to a 50 ohm type N connector. Severe damage may result.**

### Precision 75Ω Type N Adapters – Models 8882A, 8882B and 8883C



Frequency Range . . . . . DC to 2.0 GHz
Maximum VSWR . . . . . 1.03
Nominal Impedance . . . . . 75 ohm

(Note: These adapters are included in the 8880CK11 kits, but are not included in the 850CK10 kits.)

## Connector Description

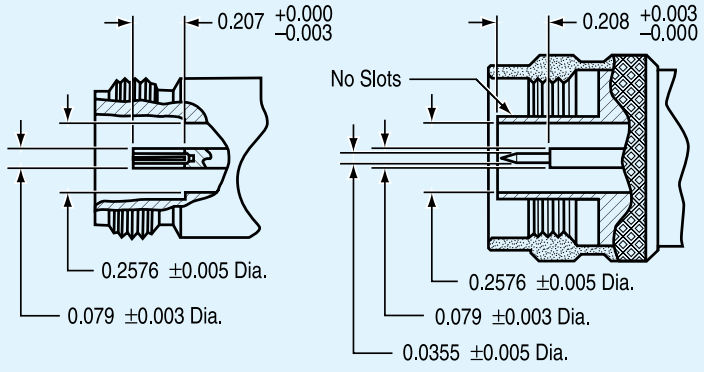
The precision 75Ω Type N connectors on the components in these kits are a precision version developed by Maury Microwave that meets all applicable requirements of IEC169-16.

These connectors exhibit extremely low VSWR and are rated to 2.0 GHz, but can be used at much higher frequencies. The male connectors are provided with 3/4-inch hex coupling nuts to allow for proper torquing to 12.0 inch lbs.

Both male and female connectors are marked with an incised black radial band to provide a visual recognition aide that identifies them as 75 ohm connectors.

For detailed interface specifications please refer to Maury data sheet 5E-054.

**75Ω Type N Connector Interface**





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# TNC Fixed Load and Sliding Load VNA Calibration Kits

## 8650CK10/11 & 8650CK20/21 series

8650CK21



### *Features*

- *TNC Connectors*
- *DC to 18 GHz*
- *High Performance*
- *Keysight, Rhode & Schwarz and Anritsu VNAs Supported*

### *Kit Description*

Maury Microwave's precision TNC fixed load calibration kits are designed for use with a broad range of vector network analyzers (VNAs). With the components in these kits you can make error-corrected measurements of devices supplied with TNC connectors from DC to 18.0 GHz. Each kit is supplied with a set of calibration standards; shorts, opens and fixed loads as listed at right. (See page 49 for all Maury TNC cal kit components specifications.)

### *Calibration Methods Supported*

- *8650CK10/11*
  - *– Fixed Load SOLT (DC–18.0 GHz)*
- *8650CK20/21*
  - *– Fixed/Sliding Load SOLT (DC–18.0 GHz)*

8650CK10/11/20/21 kits are configured for use in performing one-port SOL (Short-Open-Load) response calibrations (a method used for measuring VSWR/ Return Loss), and full two-port SOLT (Short-Open-Load-Thru) calibration (for performing forward and reverse transmission and reflections measurement).

8650CK11/21 kits include three TNC in-series adapters for applications that require female/female, male/male, or male/female connections. A wide range of between-series adapters in AFTNC to other types and special VNA test port adapters (NMD type) are also available by separate order.

### *Recommended Accessories*

***A012E TNC, TNCA, and AFTNC Connector Gage Kit:***
Contains Six metrology-grade "push-on" "universal" type, dial indicator style gage for measuring the contact pin and dielectric interface locations of MIL-STD, IEC and commercial TNC connectors *(see page 105)*.

***2698G1 9/16-inch Torque Wrench — 12.0 Inch lbs:***
For proper torquing of TNC, TNCA and AFTNC and MP6 connections. Factory preset to 12.0 inch lbs to ensure the precise torque needed for optimum repeatability. These torque wrenches are provided with 8650CK20/21 and are highly recommended for use with 8650CK10/11 kits *(see page 106)*.

Key Literature: Maury data sheets 2Z-062.

### *Components Included in 8650CK10/11 Kits*

| QUANTITY | DESCRIPTION | MODEL |
|---|---|---|
| 1 | TNC female fixed short circuit | 8615A |
| 1 | TNC male fixed short circuit | 8615B |
| 1 | TNC female open circuit | 8609B |
| 1 | TNC male open circuit | 8610B |
| 1 | TNC female fixed termination | 332E |
| 1 | TNC male fixed termination | 332F |
| 1* | TNC female to TNC female adapter | 232A11 |
| 1* | TNC male to TNC male adapter | 232B11 |
| 1* | TNC female to TNC male adapter | 232C11 |
| 1 | Foam-lined wood instrument case | — |

* These adapters are provided in the 8650CK11 kits, but are not included in the 8650CK10 kits.

### *Components Included in 8650CK20/21 Kits*

| QUANTITY | DESCRIPTION | MODEL |
|---|---|---|
| 1 | TNC female fixed short circuit | 8615A |
| 1 | TNC male fixed short circuit | 8615B |
| 1 | TNC female open circuit | 8609B |
| 1 | TNC male open circuit | 8610B |
| 1 | TNC female fixed termination | 332E |
| 1 | TNC male fixed termination | 332F |
| 1* | TNC female to TNC female adapter | 232A11 |
| 1* | TNC male to TNC male adapter | 232B11 |
| 1* | TNC female to TNC male adapter | 232C11 |
| 1 | TNC female sliding termination | 452A1 |
| 1 | TNC male sliding termination | 452B1 |
| 1 | 9/16-inch torque wrench — 12 in. lbs. | 2698G1 |
| 1 | 7/16-inch open end wrench | 8770Z7 |
| 1 | Foam-lined wood instrument case | — |

* These adapters are provided in the 8650CK21 kits, but are not included in the 8650CK20 kits.

***8619A & 8619B TNC to 3.5mm NMD test port adapters:***
Precision TNC to NMD3.5mm; DC–18.0 GHz. Saves unnecessary wear and tear on your VNA test ports *(see page 120)*.



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# COMPONENT SPECIFICATIONS

## Sliding Terminations – Models 452A1 & 452B1



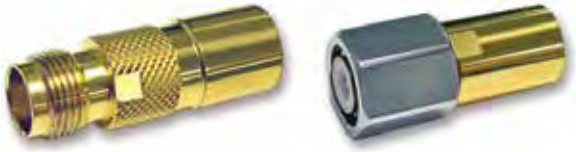
Frequency Range . . . . . 1.8 to 18.0 GHz
Maximum VSWR of Terminating Element . . . . . 1.05
Air Line Accuracy. . . . . 56 dB min return loss
(equivalent return loss of air line impedance)
Nominal Impedance . . . . . 50 ohm
Power Handling . . . . . 5.0 watt CW, 1.0 kW peak
Travel . . . . . Greater than 1/2 wavelength at 2.0 GHz

## Fixed Terminations – Models 332E & 332F




Frequency Range . . . . . DC — 18.0 GHz
Maximum VSWR:
DC — 4.0 GHz . . . . . 1.06
4.0 — 12.0 GHz . . . . . 1.10
12.0 — 18.0 GHz . . . . . 1.15
Nominal Impedance. . . . . 50 ohm
Power Handling . . . . . 1.0 watt CW 1.0 kW peak

## Fixed Short – Models 8615A & 8615B



Frequency Range . . . . . DC to 18.0 GHz
Minimum Reflection Coefficient . . . . . 0.98
Phase Accuracy . . . . . ±5.0°
Nominal Impedance . . . . . 50 ohm

## Open Circuits – Models 8609B & 8610B



Frequency Range . . . . . DC to 18.0 GHz
Minimum Reflection Coefficient . . . . . 0.98
Phase Accuracy . . . . . ±5.0°
Nominal Impedance . . . . . 50 ohm

## Precision TNC Adapters – Models 232A11, 232B11 & 232C11



Frequency Range . . . . . DC to 18.0 GHz
Maximum VSWR:
DC to 4.0 GHz . . . . . 1.06
4.0 to 7.0 GHz . . . . . 1.10
7.0 to 18.0 GHz . . . . . 1.14
Nominal Impedance . . . . . 50 ohm

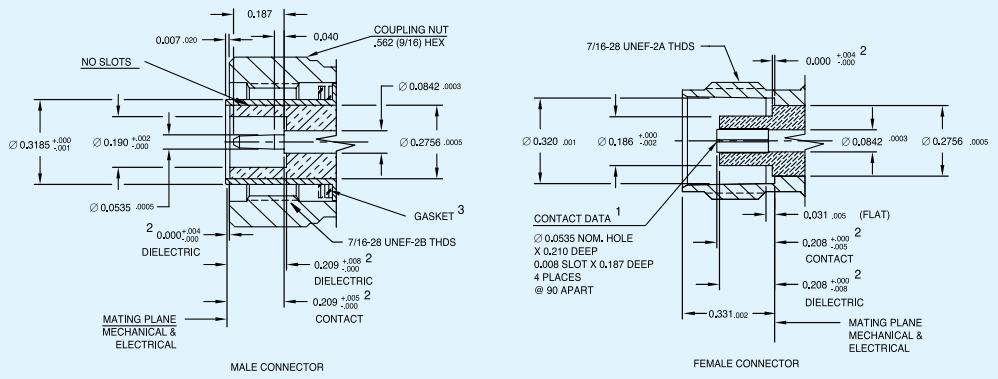
(Note: These adapters are included in the 8650CK11/21 kits, but are not included in the 8650CK10/20 kits.)

## Connector Description

The TNC connectors (MPC/TNC) on the components in this kit are precision stainless steel connectors that mate with most commercially available TNC connectors, and especially with those conforming to MIL-C-39012 and MIL-T-81490. They are low VSWR connectors rated from DC to 18.0 GHz.

For interface specifications see Maury data sheet 5E-053.

**Maury Precision MPC/TNC Connector Interface**




1 The diameter over the slots shall be 0.0842 ± .001 diameter with a 0.0535 ± .00005 diameter x .050 pin inserted in the contact.
2 Dimensions flagged with this note can be inspected with connector gage model A012A only.
3 Gasket can be utilized where weather proofing is required, not normally provided.


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# AFTNC Fixed Load & Sliding Load VNA Calibration Kits

## 8680CK10/11 & 8680CK20/21 series

8680CK21



### Features

- AFTNC Connectors
- DC to 20 GHz
- High Performance
- Keysight, Rhode & Schwarz and Anritsu VNAs Supported

### Kit Description

Maury Microwave's precision AFTNC fixed load calibration kits are designed for use with a broad range of vector network analyzers (VNAs). With the components in these kits you can make error-corrected measurements of devices supplied with AFTNC connectors from DC to 20.0 GHz. Each kit is supplied with a set of calibration standards; shorts, opens and fixed loads as listed at right. (See page 51 for all Maury AFTNC cal kit components specifications.)

### Calibration Methods Supported

- 8680CK10/11
  - – Fixed Load SOLT (DC–20.0 GHz)
- 8680CK20/21
  - – Fixed/Sliding Load SOLT (DC–20.0 GHz)

8680CK10/11/20/21 kits are configured for use in performing one-port SOL (Short-Open-Load) response calibrations (a method used for measuring VSWR/ Return Loss), and full two-port SOLT (Short-Open-Load-Thru) calibration (for performing forward and reverse transmission and reflections measurement).

8680CK11/21 kits include three AFTNC in-series adapters for applications that require female/female, male/male, or male/female connections. A wide range of between-series adapters in AFTNC to other types and special VNA test port adapters (NMD type) are also available by separate order.

### Recommended Accessories

***A012E TNC, TNCA, and AFTNC Connector Gage Kit:***
Contains Six metrology-grade "push-on" "universal" type, dial indicator style gage for measuring the contact pin and dielectric interface locations of MIL-STD, IEC and commercial TNC connectors *(see page 105)*.

***2698G1 9/16-inch Torque Wrench — 12.0 Inch lbs:***
For proper torquing of TNC, TNCA, AFTNC and MP6 connections. Factory preset to 12.0 inch lbs to ensure the precise torque needed for optimum repeatability. These torque wrenches are provided with 8680CK20/21 and are highly recommended for use with 8680CK10/11 kits *(see page 106)*.

Key Literature: Maury data sheet 2Z-062.

### Components Included in 8680CK10/11 Kits

| QUANTITY | DESCRIPTION | MODEL |
|---|---|---|
| 1 | AFTNC female fixed short circuit | 8686A |
| 1 | AFTNC male fixed short circuit | 8687A |
| 1 | AFTNC female open circuit | 8685A |
| 1 | AFTNC male open circuit | 8685B |
| 1 | AFTNC female fixed termination | 8684A |
| 1 | AFTNC male fixed termination | 8684B |
| 1* | AFTNC female to AFTNC female adapter | 8688A |
| 1* | AFTNC male to AFTNC male adapter | 8688B |
| 1* | AFTNC female to AFTNC male adapter | 8688C |
| 1 | Foam-lined wood instrument case | — |

* These adapters are provided in the 8680CK11 kits, but are not included in the 8680CK10 kits.

### Components Included in 8680CK20/21 Kits

| QUANTITY | DESCRIPTION | MODEL |
|---|---|---|
| 1 | AFTNC female fixed short circuit | 8686A |
| 1 | AFTNC male fixed short circuit | 8687A |
| 1 | AFTNC female open circuit | 8685A |
| 1 | AFTNC male open circuit | 8685B |
| 1 | AFTNC female fixed termination | 8684A |
| 1 | AFTNC male fixed termination | 8684B |
| 1* | AFTNC female to AFTNC female adapter | 8688A |
| 1* | AFTNC male to AFTNC male adapter | 8688B |
| 1* | AFTNC female to AFTNC male adapter | 8688C |
| 1 | AFTNC female sliding termination | 8683A |
| 1 | AFTNC male sliding termination | 8683B |
| 1 | 9/16-inch torque wrench — 12 in. lbs. | 2698G1 |
| 1 | 7/16-inch open end wrench | 8770Z7 |
| 1 | Foam-lined wood instrument case | — |

* These adapters are provided in the 8680CK21 kits, but are not included in the 8680CK20 kits.

***8691A & 8691B AFTNC to 3.5mm NMD test port adapters:***

Precision AFTNC to NMD3.5mm; DC–20.0 GHz. Saves unnecessary wear and tear on your VNA test ports *(see page 120)*.



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# COMPONENT SPECIFICATIONS

## Sliding Terminations – Models 8683A & 8683B



Frequency Range . . . . . 2.0 to 20.0 GHz
Maximum VSWR of Terminating Element . . . . . 1.05
Air Line Accuracy. . . . . 56 dB min return loss
(equivalent return loss of air line impedance)
Nominal Impedance . . . . . 50 ohm
Power Handling . . . . . 5.0 watt CW, 1.0 kW peak
Travel . . . . . Greater than 1/2 wavelength at 2.0 GHz

## Fixed Terminations – Models 8684A & 8684B




Frequency Range . . . . . DC — 20.0 GHz
Maximum VSWR:
DC — 4.0 GHz . . . . . 1.04
4.0 — 12.0 GHz . . . . . 1.08
12.0 — 20.0 GHz . . . . . 1.10
Nominal Impedance. . . . . 50 ohm
Power Handling . . . . . 1.0 watt CW 1.0 kW peak

## Fixed Short – Models 8686A & 8687A



Frequency Range . . . . . DC to 20.0 GHz
Minimum Reflection Coefficient . . . . . 0.98
Phase Accuracy . . . . . ±2.0 degrees
Nominal Impedance . . . . . 50 ohm

## Open Circuits – Models 8685A & 8685B



Frequency Range . . . . . DC to 20.0 GHz
Minimum Reflection Coefficient . . . . . 0.98
Phase Accuracy . . . . . ±2.0 degrees
Nominal Impedance . . . . . 50 ohm

## Precision AFTNC Adapters – Models 8688A, 8688B & 8688C



Frequency Range . . . . . DC to 20.0 GHz
Maximum VSWR:
DC to 4.0 GHz . . . . . ≤ 1.04
4.0 to 8.0 GHz . . . . . ≤ 1.08
8.0 to 20.0 GHz . . . . . ≤ 1.12
Nominal Impedance . . . . . 50 ohm

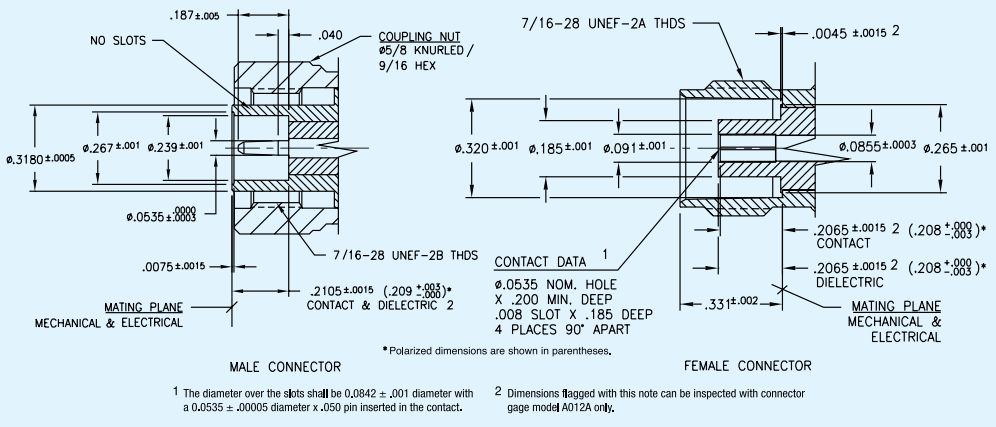
(Note: These adapters are included in the 8680CK11/21 kits, but are not included in the 8680CK10/20 kits.)

## Connector Description

The AFTNC connectors (MPC/AFTNC) on the components in this kit are precision stainless steel connectors that mate with most commercially available AFTNC connectors, and especially with those conforming to MIL-C-39012 and MIL-T-81490. They are low VSWR connectors rated from DC to 20.0 GHz.

For interface specifications see Maury data sheet 5E-056.

**Maury Precision MPC/AFTNC Connector Interface**





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# TNCA Fixed Load & Sliding Load VNA Calibration Kits

## 8670CK10/11 & 8670CK20/21 series

8670CK21



### Features

- *TNC Connectors*
- *DC to 20 GHz*
- *High Performance*
- *Keysight, Rhode & Schwarz and Anritsu VNAs Supported*

### Kit Description

Maury Microwave's precision TNCA fixed load calibration kits are designed for use with a broad range of vector network analyzers (VNAs). With the components in these kits you can make error-corrected measurements of devices supplied with TNCA connectors from DC to 20.0 GHz. Each kit is supplied with a set of calibration standards; shorts, opens and fixed loads as listed at right. (See page 53 for all Maury TNCA cal kit components specifications.)

### Calibration Methods Supported

- *8670CK10/11*
  - *– Fixed Load SOLT (DC–20.0 GHz)*
- *8670CK20/21*
  - *– Fixed/Sliding Load SOLT (DC–20.0 GHz)*

8670CK10/11/20/21 kits are configured for use in performing one-port SOL (Short-Open-Load) response calibrations (a method used for measuring VSWR/ Return Loss), and full two-port SOLT (Short-Open-Load-Thru) calibration (for performing forward and reverse transmission and reflections measurement).

8670CK11/21 kits include three AFTNC in-series adapters for applications that require female/female, male/male, or male/female connections. A wide range of between-series adapters in AFTNC to other types and special VNA test port adapters (NMD type) are also available by separate order.

### Recommended Accessories

***A012E TNC, TNCA, and AFTNC Connector Gage Kit:***
Contains Six metrology-grade "push-on" "universal" type, dial indicator style gage for measuring the contact pin and dielectric interface locations of MIL-STD, IEC and commercial TNC connectors *(see page 105)*.

***2698G1 9/16-inch Torque Wrench — 12.0 Inch lbs:***
For proper torquing of TNC, TNCA, AFTNC and MP6 connections. Factory preset to 12.0 inch lbs to ensure the precise torque needed for optimum repeatability. These torque wrenches are provided with 8670CK20/21 and are highly recommended for use with 8670CK10/11 kits *(see page 106)*.

Key Literature: Maury data sheet 2Z-067.

### Components Included in 8670CK10/11 Kits

| QUANTITY | DESCRIPTION | MODEL |
|---|---|---|
| 1 | TNCA female fixed short circuit | 8676A |
| 1 | TNCA male fixed short circuit | 8677A |
| 1 | TNCA female open circuit | 8675A |
| 1 | TNCA male open circuit | 8675B |
| 1 | TNCA female fixed termination | 8674A |
| 1 | TNCA male fixed termination | 8674B |
| 1* | TNCA female to TNCA female adapter | 8678A |
| 1* | TNCA male to TNCA male adapter | 8678B |
| 1* | TNCA female to TNCA male adapter | 8678C |
| 1 | Foam-lined wood instrument case | — |

* These adapters are provided in the 8670CK11 kits, but are not included in the 8670CK10 kits.

### Components Included in 8670CK20/21 Kits

| QUANTITY | DESCRIPTION | MODEL |
|---|---|---|
| 1 | TNCA female fixed short circuit | 8676A |
| 1 | TNCA male fixed short circuit | 8677A |
| 1 | TNCA female open circuit | 8675A |
| 1 | TNCA male open circuit | 8675B |
| 1 | TNCA female fixed termination | 8674A |
| 1 | TNCA male fixed termination | 8674B |
| 1* | TNCA female to TNCA female adapter | 8678A |
| 1* | TNCA male to TNCA male adapter | 8678B |
| 1* | TNCA female to TNCA male adapter | 8678C |
| 1 | TNCA female sliding termination | 8673A |
| 1 | TNCA male sliding termination | 8673B |
| 1 | 9/16-inch torque wrench — 12 in. lbs. | 2698G1 |
| 1 | 7/16-inch open end wrench | 8770Z7 |
| 1 | Foam-lined wood instrument case | — |

* These adapters are provided in the 8670CK21 kits, but are not included in the 8670CK20 kits.

***8679A & 8679B TNCA to 3.5mm NMD test port adapters:***

Precision TNCA to NMD3.5mm; DC–20.0 GHz. Saves unnecessary wear and tear on your VNA test ports *(see page 120)*.



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# COMPONENT SPECIFICATIONS

## Sliding Terminations – Models 8673A & 8673B



Frequency Range . . . . . 2.0 to 20.0 GHz
Maximum VSWR of Terminating Element . . . . . 1.05
Air Line Accuracy. . . . . 56 dB min return loss
(equivalent return loss of air line impedance)
Nominal Impedance . . . . . 50 ohm
Power Handling . . . . . 5.0 watt CW, 1.0 kW peak
Travel . . . . . Greater than 1/2 wavelength at 2.0 GHz

## Fixed Terminations – Models 8674A & 8674B




Frequency Range . . . . . DC to 20.0 GHz
Maximum VSWR:
DC — 4.0 GHz . . . . . 1.04
4.0 — 8.0 GHz . . . . . 1.08
8.0 — 20.0 GHz . . . . . 1.10
Nominal Impedance. . . . . 50 ohm
Power Handling . . . . . 1.0 watt CW 1.0 kW peak

## Fixed Short – Models 8676A & 8677A



Frequency Range . . . . . DC to 20.0 GHz
Minimum Reflection Coefficient . . . . . 0.98
Phase Accuracy . . . . . ±2.0 degrees
Nominal Impedance . . . . . 50 ohm

## Open Circuits – Models 8675A & 8675B



Frequency Range . . . . . DC to 20.0 GHz
Minimum Reflection Coefficient . . . . . 0.98
Phase Accuracy . . . . . ±2.0 degrees
Nominal Impedance . . . . . 50 ohm

## Precision TNCA Adapters – Models 8678A, 8678B & 8678C



Frequency Range . . . . . DC to 20.0 GHz
Maximum VSWR:
DC to 4.0 GHz . . . . . ≤ 1.04
4.0 to 8.0 GHz . . . . . ≤ 1.08
8.0 to 20.0 GHz . . . . . ≤ 1.12
Nominal Impedance . . . . . 50 ohm

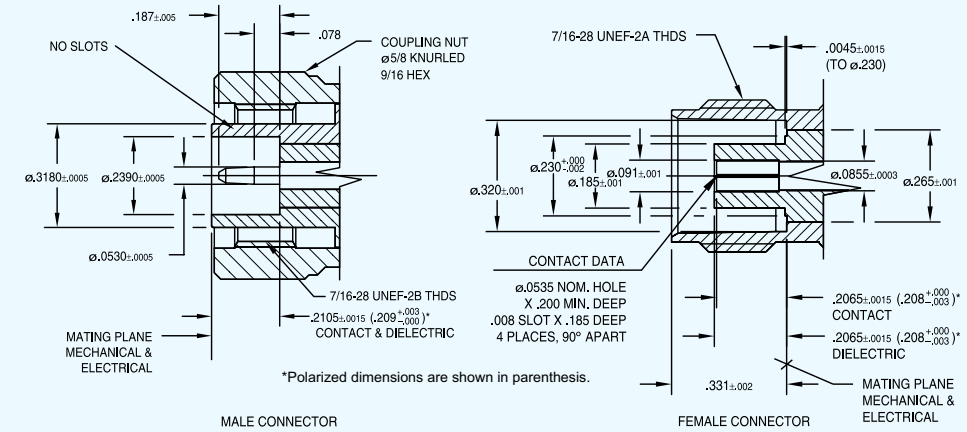
(Note: These adapters are included in the 8670CK11/21 kits, but are not included in the 8670CK10/20 kits.)

## Connector Description

The TNCA connectors (MPC/TNCA) on the components in this kit are precision stainless steel connectors that mate with most commercially available TNCA connectors, and especially with those conforming to MIL-C-39012 and MIL-T-81490. They are low VSWR connectors rated from DC to 20.0 GHz.

For interface specifications see Maury data sheet 5E-058.

**Maury Precision MPC/TNCA Connector Interface**





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# BNC Fixed Load VNA Calibration Kits

## 8550CK10 & 8580CK10 models

### *Features*

- *50Ω or 75Ω BNC Connectors*
- *DC to 10.0 GHz & DC to 12.0 GHz*
- *Simple Fixed Load Calibration*
- *Keysight, Rhode & Schwarz and Anritsu VNAs Supported*

### *Kit Description*

Maury Microwave's precision TNCA fixed load calibration kits are designed for use with a broad range of vector network analyzers (VNAs). With the components in these kits you can make error-corrected measurements of devices supplied with TNCA connectors from DC to 20.0 GHz. Each kit is supplied with a set of calibration standards; shorts, opens and fixed loads as listed at right. (See page 53 for all Maury TNCA cal kit components specifications.)

### *Calibration Method Supported*

- *8670CK10/11*

  *– Fixed Load SOLT (DC–20.0 GHz)*

8550CK10 calibration kits are designed for calibrating Vector Network Analyzers (VNAs) from DC to 10.0 GHz for making 50 ohm measurements of devices with BNC connectors. The 8580CK10 kits are likewise designed for calibrating VNAs that will be used to make measurements of devices with 75Ω BNC connector measurements.

A full complement of calibration standards (opens, shorts and fixed terminations, female and male) are included in both the 8550CK10 and 8580CK10 kits. All components are housed in a foam-lined wooden instrument case. Operating instructions with the calibration standard constants can be downloaded from the Maury website. The instruction manual explains how the cal constants can be keyed in from the VNA's front panel. Optional VNA software, specific to your VNA make and model, is sold separately.

### *Recommended Accessories*

***A012A 50Ω/75Ω Dial Indicator Style Connector Gage Kit:***
This kit contains one (1) "push-on" type gage for measuring the female and male contact pin and dielectric interface locations for 50Ω and 75Ω BNC connectors *(see page 105)*.

***8582D3/D4 Series Phase Matched 75Ω BNC Adapters:***
These between series adapters are designed to adapt 75Ω BNC to 7mm *(see page 125)*.

***2621A1/B1 Series Phase Matched 50Ω BNC Adapters:***
These between series adapters are designed to adapt 50Ω BNC to 7mm. Visit maurymw.com for detailed information *(see page 125)*.

Key Literature: Maury data sheet 2Z-069.

8550CK10



### *Components Included in 8550CK10 Kits*

| QUANTITY | DESCRIPTION | MODEL |
|---|---|---|
| 1 | 50Ω BNC female fixed short circuit | 361N2 |
| 1 | 50Ω BNC male fixed short circuit | 361P2 |
| 1 | 50Ω BNC female open circuit | 371N2 |
| 1 | 50Ω BNC male open circuit | 371P2 |
| 1 | 50Ω BNC female fixed termination | 351A2 |
| 1 | 50Ω BNC male fixed termination | 351B2 |
| 1 | Foam-lined wood instrument case | — |

In-series and between series adapters are available by separate order. Go to maurymw.com for more information.

8580CK10



### *Components Included in 8580CK10 Kits*

| QUANTITY | DESCRIPTION | MODEL |
|---|---|---|
| 1 | 75Ω BNC female fixed short circuit | 8584A1 |
| 1 | 75Ω BNC male fixed short circuit | 8584B1 |
| 1 | 75Ω BNC female open circuit | 8585A1 |
| 1 | 75Ω BNC male open circuit | 8585B1 |
| 1 | 75Ω BNC female fixed termination | 8583A1 |
| 1 | 75Ω BNC male fixed termination | 8583B1 |
| 1 | Foam-lined wood instrument case | — |

In-series and between series adapters are available by separate order. Go to maurymw.com for more information.



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## 50Ω BNC COMPONENT SPECIFICATIONS

### 50Ω Fixed Terminations – Models 351A2 & 351B2




Frequency Range . . . . . DC to 10.0 GHz

Maximum VSWR:

- DC to 2.0 GHz . . . . . 1.04
- 2.0 to 4.0 GHz . . . . . 1.10
- 4.0 to 10.0 GHz . . . . . 1.20

Nominal Impedance . . . . . 50 ohm

Power Handling . . . . . 2.0 watt CW, 1.0 kW peak

### 50Ω Fixed Shorts – Models 361N2 and 361P2



Frequency Range . . . . . DC to 10.0 GHz

Reflection Coefficient . . . . . 0.98 minimum

Phase Accuracy . . . . . ± 5.0 degrees

Nominal Impedance . . . . . 50 ohm

### 50Ω Open Circuits – Models 371N2 and 371P2



Frequency Range . . . . . DC to 12.4 GHz

Reflection Coefficient . . . . . 0.98 minimum

Phase Accuracy . . . . . ± 5.0 degrees

Nominal Impedance . . . . . 50 ohm

***Warning:** Do not mate a 75 ohm BNC connector to a 50 ohm BNC connector. Severe damage may result.*

## 75Ω BNC COMPONENT SPECIFICATIONS

### 75Ω Fixed Terminations – Models 8583A1 & 8583B1




Frequency Range . . . . . DC to 12.0 GHz

Maximum VSWR:

- DC to 2.0 GHz . . . . . 1.02
- 2.0 to 4.0 GHz . . . . . 1.04
- 4.0 to 12.0 GHz . . . . . 1.10

Nominal Impedance . . . . . 75 ohm

Power Handling . . . . . 1 watt CW

### 75Ω Fixed Shorts – Models 8584A1 & 8584B1



Frequency Range . . . . . DC to 12.0 GHz

Reflection Coefficient . . . . . 0.98 minimum

Phase Accuracy:

- DC to 2.0 GHz . . . . . ± 1.0°
- 2.0 to 3.0 GHz . . . . . ± 2.0°
- 3.0 to 12.0 GHz . . . . . ± 6.0°

Nominal Impedance . . . . . 75 ohm

### 75Ω Open Circuits – Models 8585A1 and 8585B1



Frequency Range . . . . . DC to 12.0 GHz

Reflection Coefficient . . . . . 0.98 minimum

Phase Accuracy:

- DC to 2.0 GHz . . . . . ± 1.0°
- 2.0 to 3.0 GHz . . . . . ± 2.0°
- 3.0 to 12.0 GHz . . . . . ± 6.0°

Nominal Impedance . . . . . 75 ohm

## 50Ω BNC Connector Description

Maury BNC series connectors are 50-ohm impedance connectors with two-stud bayonet coupling. These connectors conform to MIL-PRF-39012 (formerly MIL-C-39012). The connectors are normally made with stainless steel bodies and with heat treated gold-plated beryllium copper contacts.

## 75Ω BNC Connector Description

Maury BNC series connectors are 75-ohm impedance connectors with two-stud bayonet coupling. These connectors conform to MIL-PRF-39012 (formerly MIL-C-39012). The connectors are normally made with stainless steel bodies and with heat treated gold-plated beryllium copper contacts.



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# Waveguide VNA Calibration Kits

## 7005E Standard Kits

### *Features*

- *1.12 to 50 GHz*
- *WR650 Through WR22*
- *Fixed and Sliding Load Calibration*
- *Keysight, Anritsu and Rohde & Schwarz VNAs Supported*

K7005E57 WR42



### *Description*

These 7005E Standard Waveguide Calibration Kits are designed to provide accurate calibration of vector network analyzers (VNAs) used for measurements in standard rectangular waveguide from 1.12 to 50 GHz (WR650–WR22). Each kit includes all the components needed for accurate calibration of most VNAs plus a user-specified set of adapters and a high precision sliding termination (in a machined housing) to ensure high effective directivity after calibration. Precision straight sections and a fixed (reference plane) short are also included as verification standards.

### *Flange Description*

The Maury Precision Flanges (MPF) on these components have precision indexing holes and indexing pins for precise mating alignment that maximizes measurement repeatability. They conform to all EIA WR standards for rectangular or round waveguide flanges.

### *Components Included in 7005E Kits*

| QUANTITY | DESCRIPTION | MODEL |
|---|---|---|
| 1 | Fixed (reference plane) short | 344 series |
| 1 | 1/8λ offset short | 340 series |
| 1 | 3/8λ offset short | 340 series |
| 1 | Precision fixed termination | 301 series |
| 1 | High precision sliding termination | 314 series |
| 1 | Straight section (rectangular) | 101/2 series |
| 1 | Flange hardware (including indexing pin set) | — |
| 1 | VNA software (3.5-inch disk or flash drive) | — |
| 1 | Operating Instructions (manual) | — |
| 1 | Instrument case | — |

Note: Each kit includes a set of user-specified adapters per the ***Ordering Options***.

### *Ordering Options*

To specify waveguide band, test port adapter and VNA software options, add a letter (for the desired bandwidth) to the front of the kit model number and add a two digit number to the end of the kit model number (as shown in the diagram at right). The first digit is the test port adapter option number, and the second is the VNA software option number (from the table below). The diagram shows the waveguide band prefix, kit model number, adapter option and VNA software option numbers to order an "R" band 7005E kit for use with an Keysight PNA.




| WAVEGUIDE BAND (Model Prefix) | FREQUENCY RANGE (GHz) | WAVEGUIDE DESIGNATION (EIA WR NO.) | TEST PORT ADAPTER SET OPTIONS | VNA SOFTWARE OPTIONS | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | KITS W/O SOFTWARE OPTION 0 | ROHDE & SCHWARZ ZVA/B SERIES OPTION 1 | KEYSIGHT ENA SERIES OPTION 2 | KEYSIGHT 8510C OPTION 4 | KEYSIGHT 8719/20/22 OPTION 5 | KEYSIGHT PNA SERIES OPTION 7 | ANRITSU 37000 OPTION 9[1] |
| L | 1.12 – 1.70 | WR650 | 1 | 0 | 1 | 2 | 4 | 5 | 7 | 9 |
| R | 1.70 – 2.60 | WR430 | 1 or 2 | 0 | 1 | 2 | 4 | 5 | 7 | 9 |
| S | 2.60 – 3.95 | WR284 | 1, 2, 3, or 6 | 0 | 1 | 2 | 4 | 5 | 7 | 9 |
| E | 3.30 – 4.90 | WR229 | 1, 2 or 3 | 0 | 1 | 2 | 4 | 5 | 7 | 9 |
| G | 3.95 – 5.85 | WR187 | 1, 2 or 3 | 0 | 1 | 2 | 4 | 5 | 7 | 9 |
| F | 4.90 – 7.05 | WR159 | 1, 2 or 3 | 0 | 1 | 2 | 4 | 5 | 7 | 9 |
| C | 5.85 – 8.20 | WR137 | 1, 2 or 3 | 0 | 1 | 2 | 4 | 5 | 7 | 9 |
| H | 7.05 – 10.0 | WR112 | 1, 2 or 3 | 0 | 1 | 2 | 4 | 5 | 7 | 9 |
| X | 8.20 – 12.4 | WR90 | 1, 2 or 3 | 0 | 1 | 2 | 4 | 5 | 7 | 9 |
| M | 10.0 – 15.0 | WR75 | 1, 2 or 3 | 0 | 1 | 2 | 4 | 5 | 7 | 9 |
| P | 12.4 – 18.0 | WR62 | 1, 2 or 3 | 0 | 1 | 2 | 4 | 5 | 7 | 9 |
| N | 15.0 – 22.0 | WR51 | 3 or 5 | 0 | 1 | 2 | 4 | 5 | 7 | 9 |
| K | 18.0 – 26.5 | WR42 | 3 or 5 | 0 | 1 | 2 | 4 | 5 | 7 | 9 |
| U | 26.5 – 40.0 | WR28 | 4 or 5 | 0 | 1 | — | 4 | 5 | 7 | 9 |
| J | 33.0 – 50.0 | WR22 | 5 | 0 | 1 | — | 4 | 5 | 7 | 9 |

| TEST PORT ADAPTER SET OPTIONS (One of these sets is included in each kit, per user specification.) | |
|---|---|
| | OPTION 0: To order kits with no adapters add a zero after the model number, before the Software Option number. |
| | OPTION 1: 2 ea. waveguide (WG) to 7mm right angle launch (RAL); 1 ea. WG to 7mm end launch (EL). |
| | OPTION 2: 1 ea. WG to 7mm RAL; 2 ea. WG to 7mm EL. |
| | OPTION 3: 1 ea. WG to 3.5mm female RAL; 1 ea. WG to 3.5mm male RAL; 1 ea. WG to 3.5mm EL (NMD3.5f in F-K bands). |
| | OPTION 4: 1 ea. WG to 2.92mm female RAL; 1 ea. WG to 2.92mm male RAL; 1 ea. WG to 2.92mm female EL. |
| | OPTION 5: 1 ea. WG to 2.4mm female RAL; 1 ea. WG to 2.4mm male RAL; 1 ea. WG to 2.4mm female EL (Not included for N band). |
| | OPTION 6: 1 ea. WG to type N female RAL; 1 ea. WG to type N male RAL; 1 ea. WG to type N female EL. |

Key Literature: Maury data sheet 3H-001.

[1] Option 9 software is also fully compatible with the Anritsu Vector Star family of VNAs.



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# Optimized Millimeter Waveguide VNA Calibration Kits

## 7005G Optimized Kits

### *Features*

- *26.5 to 110 GHz*
- *WR28 Through WR10*
- *Fixed and Sliding Load Calibration*
- *Optimized Directivity & Source Match*



U7005G17 WR28

### *Description*

The 7005G kits are high precision kits featuring optimized standards and VNA software, which provide highly accurate calibration (for measurements in rectangular waveguide) of Keysight 8510C. 8719/20/22, 8753, and PNA series, Anritsu 37000 and Vector Star, or Rohde & Schwarz ZV series vector network analyzers (VNAs) equipped with external millimeter waveguide test heads or modules. Kits are available for the Keysight VNAs from 26.5 to 110 GHz, and for the Anritsu 37000/Vector Star family from 33 to 110 GHz. Each kit includes all the components needed for accurate calibration of these VNAs as listed at the right. The high precision sliding terminations included in these kits features machined housings; ensuring high effective directivity after calibration. For kits in WR22 and smaller sizes, these sliding terminations are equipped with a micrometer drive so that load positions can be easily and smoothly set. The precision straight section and fixed (reference plane) shorts in these kits can be used as verification standards. All component flanges have precision indexing holes and removable indexing pins for excellent measurement repeatability. The millimeter waveguide flanges in the WR22 and smaller sizes are of a unique Maury-pioneered design featuring a raised outer rim to prevent the flanges from cocking during connection, which can mate with compatible UG ***/U flanges.

### *Optimized Directivity and Source Match*

All 7005G kits are configured for the Short-Short-Load-Thru (SSLT) calibration method using offset shorts and a sliding termination. The sliding termination housings are calibrated for return loss and then selected for compliance with directivity specification. The offset shorts are calibrated and the calibration coefficients are optimized for compliance with the source match specification. The calibration data is provided in a calibration report supplied with each kit. Since the constants are optimized, the data supplied with each kit is unique to that individual kit.

### *Components Included in 7005G Kits*

| QUANTITY | DESCRIPTION |
|---|---|
| 2 | Test port adapters |
| 1 | Fixed (reference plane) short (verification standard) |
| 1 | 1/8λ high precision offset short |
| 1 | 3/8λ high precision offset short |
| 1 | Precision fixed termination |
| 1 | High precision sliding termination |
| 1 | Precision straight section (verification standard) |
| 1 | Flange hardware (including the indexing pin set) |
| 1 | Flange tool set |
| 1 | Optimized VNA software (on 3.5" disk, flash drive or cartridge) |
| 1 | Operating Instructions (manual) |
| 1 | Instrument case |

Note: Additional adapters may be ordered separately.

### *Ordering Options*

To specify waveguide band, test port adapter and VNA software options, add a letter (for the desired bandwidth) to the front of the kit model number and add a two digit number to the end of the kit model number (as shown in the diagram at right). The first digit is the test port adapter option number, and the second is the VNA software option number (from the table below). The diagram shows the waveguide band prefix, kit model number, adapter option and VNA software option numbers to order an "U" band 7005G kit for use with an Keysight PNA.




| WAVEGUIDE BAND (Model Prefix) | FREQUENCY RANGE (GHz) | WAVEGUIDE DESIGNATION (EIA WR NO.) | TEST PORT ADAPTERS PROVIDED | VNA SOFTWARE OPTIONS | | | |
|---|---|---|---|---|---|---|---|
| | | | | ROHDE & SCHWARZ ZVA/B SERIES OPTION 1 | KEYSIGHT 8510C OPTION 4 | KEYSIGHT PNA SERIES OPTION 7 | ANRITSU 37000 OPTION 9[1] |
| U | 26.5 – 40.0 | WR28 | 2 U103A1.375 | 11 | 14 | 17 | 19 |
| J | 33.0 – 50.0 | WR22 | 2 J115B1 | 11 | 14 | 17 | 19 |
| V | 50.0 – 75.0 | WR15 | 2 V115C | 11 | 14 | 17 | 19 |
| Y | 60.0 – 90.0 | WR12 | 2 Y115B | 11 | 14 | 17 | 19 |
| Z | 75.0 – 110.0 | WR10 | 2 Z115A | 11 | 14 | 17 | 19 |

1 Option 9 software is also fully compatible with the Anritsu Vector Star family of VNAs.

Key Literature: Maury data sheet 3H-068. For Test Port Adapter specifications see page 149.



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# Millimeter Waveguide VNA Calibration Kits

## 7005M Economy Kits

### *Features*

- *26.5 to 110 GHz*
- *WR28 Through WR10*
- *Fixed or Sliding Load Calibration*
- *SSLT Configured*



V7005M17 WR15

### *Description*

The 7005M series kits are economical, cost effective kits designed to provide accurate calibration (for measurements in rectangular waveguide) of Keysight 8510C. 8719/20/22, 8753, and PNA series, Anritsu 37000, or Rohde & Schwarz ZV series vector network analyzers (VNAs) equipped with external millimeter waveguide test heads or modules. Kits are available for the Keysight VNAs from 26.5 to 110 GHz, and for the Anritsu 37000 from 33 to 110 GHz.

Each kit includes all the components needed for accurate calibration of these VNAs as listed at the right. The 7005M kits come with a precision fixed termination. The precision straight section and fixed (reference plane) short in these kits can be used as verification standards.

All component flanges have precision indexing holes and removable indexing pins for excellent measurement repeatability. The Millimeter waveguide flanges in the WR22 and smaller sizes are of a unique Maury-pioneered design featuring a raised outer rim to prevent the flanges from cocking during connection. These flanges will mate with corresponding UG ( )/U flanges.

### *Components Included in 7005M Kits*

| QTY | DESCRIPTION |
|---|---|
| 1 | Fixed (reference plane) short (calibration and verification standard) |
| 1 | Precision straight section (verification standard) |
| 1 | 1/4λ waveguide straight section (shim) |
| 1 | Precision fixed termination |
| 1 | Flange hardware (including the indexing pin set) |
| 1 | Flange tool set |
| 1 | VNA software (on 3.5" disk or flash drive) |
| 1 | Operating Instructions (manual) |
| 1 | Instrument case |

Note: Additional adapters may be ordered separately.

### *Calibration Method*

The 7005M series kits for the Keysight VNAs are configured for the Short-Short-Load-Load-Thru (SSLLT) calibration method using a fixed short, a fixed precision termination, and a 1/4λ shim.

### *Ordering Options*

To specify the waveguide band, test port adapter and VNA software options you need, add a letter (designating the desired bandwidth) to the front of the kit model number and add a two digit number to the end of the kit model number (as shown in the diagram at right). The first digit is the test port adapter option number, and the second is the VNA software option number (from the table below). The example in the diagram shows the waveguide band prefix, kit model number, adapter option and VNA software option numbers to order an "U" band 7005M kit for use with an Keysight PNA.




| WAVEGUIDE BAND (Model Prefix) | FREQUENCY RANGE (GHz) | WAVEGUIDE DESIGNATION (EIA WR NO.) | TEST PORT ADAPTERS PROVIDED | VNA SOFTWARE OPTIONS | | |
|---|---|---|---|---|---|---|
| | | | | KEYSIGHT 8510C OPTION 14 | KEYSIGHT PNA SERIES OPTION 7 | ANRITSU 37000 OPTION 9[1] |
| U | 26.5 – 40.0 | WR28 | 2 U103A1.375 | 14 | 17 | — |
| J | 33.0 – 50.0 | WR22 | 2 J115B1 | 14 | 17 | 19 |
| V | 50.0 – 75.0 | WR15 | 2 V115C | 14 | 17 | 19 |
| Y | 60.0 – 90.0 | WR12 | 2 Y115B | 14 | 17 | 19 |
| Z | 75.0 – 110.0 | WR10 | 2 Z115A | 14 | 17 | 19 |

1 Option 9 software is also fully compatible with the Anritsu Vector Star family of VNAs.

Key Literature: Maury data sheet 3H-071. For Test Port Adapter specifications see page 149.



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# Waveguide VNA Calibration Kits

## 7006A Economy Kits

### *Features*

- *2.6 to 40 GHz*
- *WR284 Through WR28*
- *Sliding Load Calibration*
- *Keysight, Anritsu and Rohde & Schwarz VNAs Supported*



Q7006A17 WR34

### *Description*

The 7006A Kits are economical, cost-effective kits designed to provide accurate calibration of vector network analyzers (VNAs) that are equipped with 3.5mm or 2.4mm connectors. They are used for making measurements in standard rectangular waveguide from 2.6 to 40 GHz (WR284 to WR28). Each kit includes all the components needed for accurate calibration of most VNAs with a user-specified set of adapters and a precision sliding termination. In addition to these components (listed at right), kits for Anritsu VNAs also include two (2) fixed shorts.

### *Flange Description*

The Maury Precision Flanges (MPF) on these components have precision indexing holes and indexing pins for precise mating alignment that maximizes measurement repeatability. They conform to all EIA WR standards for rectangular or round waveguide flanges.

### *Components Included in 7006A Kits*

| QUANTITY | DESCRIPTION | MODEL |
|---|---|---|
| 1 | Fixed (reference plane) short | 344 series |
| 1 | 1/4λ straight section | 322 series |
| 1 | Precision sliding termination | 313/4 series |
| 1 | WG to NMD 3.5mm female end launch adapter* | 230/3 series |
| 1 | WG to 3.5mm male right angle launch adapter* | 200/10 series |
| 1 | Flange hardware (including the indexing pin set) | — |
| 1 | 3.5-inch data disk with VNA software | — |
| 1 | Operating Instructions (manual) | — |
| 1 | Instrument case | — |

Note: Additional adapters may be ordered separately.

*WR34 and WR28 kits replace these adapters with two 2.4mm female right angle launch adapters.

### *Ordering Options*

To specify the waveguide band, test port adapter and VNA software options you need, add a letter (designating the desired bandwidth) to the front of the kit model number and add a two digit number to the end of the kit model number (as shown in the diagram at right). The first digit is the test port adapter option number, and the second is the VNA software option number (from the table below). The example in the diagram shows the waveguide band prefix, kit model number, adapter option and VNA software option numbers to order an "S" band 7006A kit for use with an Keysight PNA.




| WAVEGUIDE BAND (Model Prefix) | FREQUENCY RANGE (GHz) | WAVEGUIDE DESIGNATION (EIA WR NO.) | TEST PORT ADAPTERS PROVIDED IN KITS | VNA SOFTWARE OPTIONS | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | KITS W/O SOFTWARE OPTION 0 | ROHDE & SCHWARZ ZVA/B SERIES OPTION 1 | KEYSIGHT PNA SERIES OPTION 7 | KEYSIGHT 8510C OPTION 4 | KEYSIGHT 8719/20/22 OPTION 5 | KEYSIGHT PNA SERIES OPTION 7 | ANRITSU 37000 OPTION 9[1] |
| S | 2.60 – 3.95 | WR284 | 1 S230K1 & 1 S200B1 | 0 | 11 | 12 | 14 | 15 | 17 | 19 |
| E | 3.30 – 4.90 | WR229 | 1 E230K1 & 1 E200B1 | 0 | 11 | 12 | 14 | 15 | 17 | 19 |
| G | 3.95 – 5.85 | WR187 | 1 G230K1 & 1 G200B1 | 0 | 11 | 12 | 14 | 15 | 17 | 19 |
| F | 4.90 – 7.05 | WR159 | 1 F230K1 & 1 F200B1 | 0 | 11 | 12 | 14 | 15 | 17 | 19 |
| C | 5.85 – 8.20 | WR137 | 1 C230K1 & 1 C200B1 | 0 | 11 | 12 | 14 | 15 | 17 | 19 |
| H | 7.05 – 10.0 | WR112 | 1 H230K1 & 1 H200B1 | 0 | 11 | 12 | 14 | 15 | 17 | 19 |
| X | 8.20 – 12.4 | WR90 | 1 X230K1 & 1 X200B2 | 0 | 11 | 12 | 14 | 15 | 17 | 19 |
| M | 10.0 – 15.0 | WR75 | 1 M230K1 & 1 M200B2 | 0 | 11 | 12 | 14 | 15 | 17 | 19 |
| P | 12.4 – 18.0 | WR62 | 1 P230K1 & 1 P200B2 | 0 | 11 | 12 | 14 | 15 | 17 | 19 |
| N | 15.0 – 22.0 | WR51 | 1 N230K3 & 1 N200B2 | 0 | 11 | 12 | 14 | 15 | 17 | 19 |
| K | 18.0 – 26.5 | WR42 | 1 K230K6 & 1 N200B8 | 0 | 11 | 12 | 14 | 15 | 17 | 19 |
| Q | 22.0 – 33.0 | WR34 | 2 Q236A1 | 0 | 11 | — | 14 | 15 | 17 | 19 |
| U | 26.5 – 40.0 | WR28 | 2 U236A6 | 0 | 11 | — | 14 | 15 | 17 | 19 |

**NOTE:** To order your kit with no adapters add a "0" (zero) to the model number instead of a "1" before the VNA Software Option Suffix.

[1] Option 9 software is also fully compatible with the Anritsu Vector Star family of VNAs.

Key Literature: Maury data sheet 3H-057A. For Test Port Adapter specifications see page 149.



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# Waveguide TRL VNA Calibration Kits

## 7007H Kits



H7007H17
WR112

### *Features*

- *1.7 to 50 GHz*
- *WR430 Through WR10*
- *Fixed Load Calibration*
- *TRL and SSLT Configured*

### *Description*

The 7007H model series are waveguide kits designed to provide accurate Thru-Reflect-Line (TRL) calibrations of vector network analyzers for measurements in rectangular waveguide at frequencies from 1.7 to 50.0 GHz (WR430 through WR22).

As shown in the adjacent table, the 7007H series calibration kits provide all the necessary devices for an accurate TRL calibration of the appropriate VNA. In addition to TRL calibrations, the 7007H series can also make Short-Short-Load-Thru (SSLT) and offset load calibrations.

All kit component flanges have precision indexing holes for excellent measurement repeatability (indexing pins are provided with the kit).

### *Components Included in 7007H Kits*

| QUANTITY | DESCRIPTION |
|---|---|
| 2 | Waveguide to Coaxial right angle launch test port adapters |
| 1 | Fixed (reference plane) short (verification standard)* |
| 2 | Precision fixed terminations |
| 1 | 1/4λ high precision straight section |
| 1 | Flange hardware (including the indexing pin set) |
| 1 | VNA software (on 3.5" disk or flash drive) |
| 1 | Operating Instructions (manual) |
| 1 | Instrument case |

Note: Additional adapters may be ordered separately.

* Kits for the Anritsu 37000/Vector Star VNAs include two (2) fixed (reference plane) shorts.

### *Ordering Options*

To specify the waveguide band, test port adapter and VNA software options you need, add a letter (designating the desired bandwidth) to the front of the kit model number and add a two digit number to the end of the kit model number (as shown in the diagram at right). The first digit is the test port adapter option number, and the second is the VNA software option number (from the table below). The example in the diagram shows the waveguide band prefix, kit model number, adapter option and VNA software option numbers to order an "R" band 7007H kit for use with an Keysight PNA.




| WAVEGUIDE BAND (Model Prefix) | FREQUENCY RANGE (GHz) | WAVEGUIDE DESIGNATION (EIA WR NO.) | TEST PORT ADAPTERS PROVIDED** | | VNA SOFTWARE OPTIONS | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | QTY | MODEL | KITS W/O SOFTWARE OPTION 0 | ROHDE&SCHWARZ ZVA/B SERIES OPTION 1 | KEYSIGHT ENA SERIES OPTION 2 | KEYSIGHT 8510C OPTION 4 | KEYSIGHT 8719/20/22 OPTION 5 | KEYSIGHT PNA SERIES OPTION 7 | ANRITSU 37000 OPTION 9[1] |
| L | 1.12 – 1.70 | WR650 | 2 | L209A1 (W/G to 7mm) | 0 | 11 | 12 | 14 | 15 | 17 | 19 |
| R | 1.70 – 2.60 | WR430 | 2 | R209A2 (W/G to 7mm) | 0 | 11 | 12 | 14 | 15 | 17 | 19 |
| S | 2.60 – 3.95 | WR284 | 2 | S209C2 (W/G to 7mm) | 0 | 11 | 12 | 14 | 15 | 17 | 19 |
| E | 3.30 – 4.90 | WR229 | 2 | E209C2 (W/G to 7mm) | 0 | 11 | 12 | 14 | 15 | 17 | 19 |
| G | 3.95 – 5.85 | WR187 | 2 | G209C2 (W/G to 7mm) | 0 | 11 | 12 | 14 | 15 | 17 | 19 |
| F | 4.90 – 7.05 | WR159 | 2 | F209C2 (W/G to 7mm) | 0 | 11 | 12 | 14 | 15 | 17 | 19 |
| C | 5.85 – 8.20 | WR137 | 2 | C209C2 (W/G to 7mm) | 0 | 11 | 12 | 14 | 15 | 17 | 19 |
| H | 7.05 – 10.0 | WR112 | 2 | H209D2 (W/G to 7mm) | 0 | 11 | 12 | 14 | 15 | 17 | 19 |
| X | 8.20 – 12.4 | WR90 | 2 | X209D2 (W/G to 7mm) | 0 | 11 | 12 | 14 | 15 | 17 | 19 |
| M | 10.0 – 15.0 | WR75 | 2 | M209D2 (W/G to 7mm) | 0 | 11 | 12 | 14 | 15 | 17 | 19 |
| P | 12.4 – 18.0 | WR62 | 2 | P209D2 (W/G to 7mm) | 0 | 11 | 12 | 14 | 15 | 17 | 19 |
| N | 15.0 – 22.0 | WR51 | 2 | N200A2 (W/G to 3.5mm f) | 0 | 11 | 12 | 14 | 15 | 17 | 19 |
| K | 18.0 – 26.5 | WR42 | 2 | K200A1 (W/G to 3.5mm f) | 0 | 11 | 12 | 14 | 15 | 17 | 19 |
| Q | 22.0 – 33.0 | WR34 | 2 | Q236A1 (W/G to 2.4mm f) | 0 | 11 | — | 14 | 15 | 17 | 19 |
| U | 26.5 – 40.0 | WR28 | 2 | U236A6 (W/G to 2.4mm f) | 0 | 11 | — | 14 | 15 | 17 | 19 |
| J | 33.0 – 50.0 | WR22 | 2 | J236A3 (W/G to 2.4mm f) | 0 | 11 | — | 14 | 15 | 17 | 19 |
| V | 50.0 – 75.0 | WR15 | 2 | V115C Test Port Adapters | 0 | 11 | — | 14 | 15 | 17 | 19 |
| Y | 60.0 – 90.0 | WR12 | 2 | Y115B Test Port Adapters | 0 | 11 | — | 14 | 15 | 17 | 19 |
| Z | 75.0 – 110.0 | WR10 | 2 | Z115A Test Port Adapters | 0 | 11 | — | 14 | 15 | 17 | 19 |

[1] Option 9 software is also fully compatible with the Anritsu Vector Star family of VNAs.

** Indicate adapter option 0 (zero) to order kits without adapters.

Key Literature: Maury data sheet 3H-080. For Test Port Adapter specifications see page 149.



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# VNA Calibration Kit Components Finder

Use the chart below to find the page(s) in this catalog which have information about Maury VNA Calibration Kit Components

## Cal Kit Components Information Finder

| Connector Type | • Fixed Terminations | • Sliding Terminations | • Fixed Flush & Fixed Offset Shorts | • Sliding Shorts | • Opens | • Air Lines (Beadless) | • Air Lines (Bead Supported) | • Precision Mismatches | • Two-Port Mismatch Sets | • Two-Port Mismatch Standards | • Two-Port Standards Sets | • Connector Gage Kits * | • Torque Wrenches |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| • 1.85mm | 64 | 74 | 78 | | 91 | 92 | | | | | | 104-105 | 106 |
| • 2.4mm | 64 | 74 | 79 | | 91 | 93 | | 98 | 100 | | | 104-105 | 106 |
| • 2.92mm | 65 | 74 | 79 | 88 | 91 | 93 | | 98 | 100 | | | 104-105 | 106 |
| • 3.5mm | 65 | 74, 76 | 80 | 88 | 91 | 94 | 94 | 98 | 100 | | 84 | 104-105 | 106 |
| • 7mm | 66 | 75, 76 | 81 | 88, 81 | 91 | 95 | 95 | 98 | 99-100 | | 85 | 105 | 106 |
| • Type N (50 ohm) | 66 | 75, 76 | 82 | 88, 81 | 91 | 96 | 96 | 98 | 99-100 | | | 104-105 | 106 |
| • Type N (75 ohm) | 67 | | 85 | | 91 | | | | | | | 105 | 106 |
| • C | 68 | | 85 | | | | | | | | | 105 | |
| • HN | 68 | | 85 | | | | | | | | | | |
| • SC | 68 | | 85 | | | | | | | | | 105 | 106 |
| • BNC (50 ohm) | 68 | | 85 | | 91 | | | | | | | 105 | |
| • BNC (75 ohm) | 67 | | 85 | | 91 | | | | | | | 105 | |
| • TNC | 69 | 75 | 82 | | 91 | | | 99 | 99 | | | 105 | 106 |
| • AFTNC | 69 | 75 | 83 | | 91 | | | | | | | 105 | 106 |
| • TNCA | 69 | 75 | 83 | | 91 | | | | | | | 105 | 106 |
| • SMA | | 75 | | 89 | | | | | | | | 105 | 106 |
| • OSP™ | 70 | | 84 | | 91 | | | | | | | 105 | 106 |
| • 14mm (GR 900 Equiv.) | 71 | 75 | 84 | | | 97 | | 99 | | | | 105 | 106 |
| • 7-16 | 71 | | 85 | | 91 | 97 | | | | | | 105 | 106 |
| • Waveguide Components | 72 | 77 | 86, 87 | 90 | | | | | | 101 | | | |

* Maury also offers connector gages and gage kits for ZMA/BZ and Multiport connectors. Digital gages and gage kits are available for 1.85mm/2.4mm and 2.92mm (K)/3.5mm connectors. See their listings on page 104-105.



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# Maury Cal Kit Components
## General Information

### *Fixed Terminations*

Maury fixed terminations are precision "fixed" loads that are used to introduce known VSWR into 50 ohm transmission systems. They are available in various frequency ranges with specific VSWR maximums, and are designed for general laboratory use, or as calibration standards for performing $Z_0$ calibrations (especially at low frequencies) on network analyzers (VNAs).

### *Sliding Terminations*

Maury sliding terminations ("sliding loads") consist of a precision, movable, tapered termination in a highly accurate, air dielectric transmission line. They are basic tools for making precision microwave measurements, such as "load separation", in which the reflection from the terminating element can be separated from that of the test device. Load separation using sliding loads is a key element in the calibration of VNAs. The technique is also used to measure the reflection from two-port devices (particularly "non-insertable" devices like waveguide-to-coax adapters) and to measure the directivity of directional couplers.

Maury's sliding terminations are available in metrology grade and high precision units with integral, dedicated connectors; precision units which permit changing the sex of the connector within the same connector series; and modular instruments which permit changing the connector type.

### *Fixed Flush and Fixed Offset Shorts*

Fixed flush and fixed offset shorts are used to establish reference planes in transmission systems and as calibration standards for VNAs. Shorts with an offset of 2.498cm are often used to evaluate the calibration effectiveness of a VNA.

The shorting plane of fixed flush shorts is at the connector reference plane or at some offset established by another component, (typically an open). The shorting plane of some fixed offset shorts can also be relative to that established by another short with a nominal zero offset.

### *Sliding Shorts*

A sliding short is a movable short circuit termination in a precision air line which is used in laboratory measurement applications, such as establishing a reference plane in a transmission system, as tuning elements in the development of microwave components (mixers, amplifiers, etc.), and in tuning high precision CW reflectometer systems. They are also important as calibration standards for calibrating VNAs, PNAs, and ENAs, when they are to be used for measuring highly reflective devices.

Maury coaxial sliding shorts feature a precision transmission structure (air line), consistent low noise contacts on the inner and outer conductors, and a precision connector. Maury sliding shorts are available as modular units with interchangeable connectors, high precision devices with dedicated connectors, and rugged general purpose units.

### *Opens*

Shielded, coaxial open circuit terminations (opens) are used in calibrating VNAs. Their function is to provide a nominal 180° phase offset from a compatible reference short circuit over a broad range of frequencies.

Shielding the open essentially eliminates radiation losses; but creates a residual frequency-sensitive capacitance. An accurate knowledge of the open circuit effective capacitance is essential to an accurate calibration of the analyzer.

Maury opens are characterized for effective capacitance versus frequency by means of a fourth order polynomial curve fit, and the nominal capacitance coefficients are provided with each unit. We offer several innovative designs that improve the consistency and repeatability of the capacitance coefficients, resulting in improved effective source match of calibrated VNAs.

### *Air Lines (Beaded and Beadless)*

Precision or reference air lines are air-dielectric transmission lines with highly accurate dimensions that can be used as fundamental impedance standards and to establish reference positions in measurement and calibration applications.

Maury air lines are available with both bead supported and beadless connectors. Beadless lines offer better impedance and electrical length accuracies and lower VSWR, while beaded lines offer greater convenience.

### *Precision Mismatches and Mismatch Air Line Sets*

Maury precision standard mismatches are fixed terminations that can be used to calibrate swept reflectometers, verify network analyzer calibration, establish impedance references in TDR measurements, and have other general laboratory uses. They are made with thin film resistors and a unique grounding method that ensures stable operation. Calibration data is provided for all units at 1 GHz intervals from 2 GHz to the applicable upper frequency limit.

Maury mismatch air line sets are two-port, 1/4λ VSWR standards consisting of coaxial air lines with precision outer conductors, beadless connectors, and a set of inner conductors with increasing diameters. They produce accurately known reflection coefficents, which are directly calculable from and traceable to air line dimensions. These sets are extremely stable and easy to use in many applications. Their simple geometry allows direct calculation of reflection, loss, transfer and group delay characteristics, making them ideally suited for checking the performance and accuracy of VNAs.

### *Connector Gage Kits*

Maury's connector gage kits provide an easy to use, direct reading, self-checking, and accurate way to measure the critical linear interface dimensions of most coaxial connectors. Their use helps ensure the best electrical performance and accuracy of your test instruments and DUTs, and allows you to avoid serious damage to their connectors.


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# Precision Fixed Terminations

## General Information




### *Fixed Terminations*

A precision fixed termination (or load) consists of an immovable, (fixed) termination which, when mated to the end of a transmission line or cable, absorbs nearly all of the signal energy traveling toward it. An ideal "matched" condition exists when a termination with an impedance value of $Z_0$, is connected to the end of a transmission line or cable that also has a characteristic impedance of $Z_0$. Such an ideal "matched" condition (one with no mismatch between the termination and its mated line or cable) is critical if a voltage standing wave ratio (VSWR) of 1.0:1 is to be achieved in a system with a 50 or 75 ohm impedance value. Simply put, the more closely the 1.0:1 ratio is approached, the more accurate the measurements that can be made from a system.

Maury precision fixed terminations are designed to exacting specifications and are as close to the ideal impedance as it is mechanically possible to make them. The following pages (63 through 72) provide detailed information about the various types of precision fixed terminations offered by Maury. Most are normally sold as components of Maury VNA calibration kits, but may also be purchased separately as replacement parts or spares.


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# Precision Fixed Terminations

## 1.85mm (7831/32 series) and 2.4mm (7931 series)

### *Features*

- *Low VSWR*
- *DC to 67 GHz (1.85mm)*
- *DC to 50 GHz (2.4mm)*
- *Mating Compatible to Each Other*

### *Description*

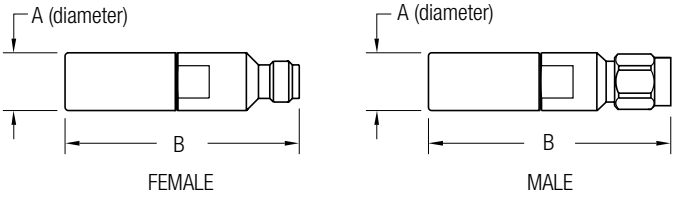
The 7831/32 and 7931 model series fixed terminations, which have 1.85mm and 2.4mm connectors respectively, are precision low VSWR terminations suited to a wide variety of general purpose and precision laboratory applications. Depending on the frequency range and required calibration effectiveness of your network analyzer (VNA or PNA), specific models can be used for full or lowband one-port $Z_0$ calibration and full two-port isolation calibration. The 1.85mm and 2.4mm mini-connectors used on these terminations are mating compatible with each other.

### *Connector Descriptions*

The precision 1.85mm connectors on the 7831A1/B1 and the 7832A/B are miniature, instrument grade, air-interface connectors that operate mode free up to 67 GHz, and comply with IEEE standard 287 general precision connector, instrument grade GPC1.85.

The precision 2.4mm connectors on the 7931A1/B1 are miniature, instrument grade, air-interface connectors that operate mode free up to 50 GHz, and comply with IEEE standard 287 general precision connector, instrument grade GPC2.4.

### *Dimensions – Inches (cm)*




Unless otherwise noted, all dimensions are in inches and centimeters (cm).

| TYPE | MODEL | A | B | MODEL | A | B |
|---|---|---|---|---|---|---|
| 1.85mm | 7831A1 | 0.36 (0.91) | 1.46 (3.71) | 7831B1 | 0.36 (0.91) | 1.50 (3.81) |
| 1.85mm | 7832A | 0.28 (0.71) | 2.39 (6.07) | 7832B | 0.28 (0.71) | 2.29 (5.82) |
| 2.4mm | 7931A1 | 0.36 (0.91) | 1.46 (3.71) | 7931B1 | 0.36 (0.91) | 1.50 (3.81) |

[1] Precision 1.85mm per Maury data sheet 5E-089.

[2] Precision 2.4mm per Maury data sheet 5E-064.




### *Available Models*

| MODEL FEMALE | MODEL MALE | FREQUENCY RANGE (GHz) | MAXIMUM VSWR | CONNECTOR TYPE |
|---|---|---|---|---|
| 7831A1 | 7831B1 | DC – 1.0<br>1.0 – 10.0<br>10.0 – 26.5<br>26.5 – 50.0 | 1.02<br>1.07<br>1.10<br>1.20 | 1.85mm |
| 7832A | 7832B | 10.0 – 67.0 | 1.10 | |
| 7931A1 | 7931B1 | DC – 4.0<br>4.0 – 50.0 | 1.016<br>1.15 | 2.4mm |

### *Specifications*

Frequency Range, VSWR . . . . . (See Available Models chart)
Power Rating . . . . . 0.5 watt CW, 0.25 kW peak
Nominal Impedance. . . . . 50 ohm
Connectors:
7831 series . . . . . 1.85mm [1]
7832 series . . . . . 1.85mm [1]
7931 series . . . . . 2.4mm [2]
Size . . . . . (See Dimensions)


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# Precision Fixed Terminations

## 2.92mm (K) (8775 series) and 3.5mm (8031 series)

### *Features*

- *Low VSWR*
- *DC to 40 GHz (2.92mm)*
- *DC to 34 GHz (3.5mm)*
- *Mates with SMA & Each Other*







### *Description*

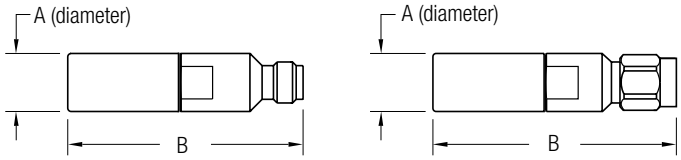
The 8775 and 8031 model series fixed terminations, which have 2.92mm and 3.5mm connectors respectively, are precision low VSWR terminations suited to a wide variety of general purpose and precision laboratory applications. Depending on the frequency range and required calibration effectiveness of your network analyzer (VNA or PNA), specific models can be used for full or lowband one-port $Z_0$ calibration and full two-port isolation calibration. The 2.92mm (K) and 3.5mm connectors used on these terminations are mating compatible with each other, and with SMA connectors.

### *Connector Descriptions*

The precision 2.92mm (or K) connectors on the 8775 model series are precision miniature 2.92mm air line interface connectors that operate mode free to 40 GHz. They have a mechanically compatible interface that mates with SMA and 3.5mm connectors. This interface was originally introduced by Maury in 1974 as the MPC3 connector and was reintroduced as the K connector by Wiltron in 1984.

The 3.5mm connectors on the 8031 model series are air interface connectors that are mating compatible with SMA and K (2.92mm) connectors. They have an air line size of 0.0598 (inner diameter) and 0.1378 (outer diameter).

### *Dimensions – Inches (cm)*




Unless otherwise noted, all dimensions are in inches and centimeters (cm).

| TYPE | MODEL | A | B | MODEL | A | B |
|---|---|---|---|---|---|---|
| 2.92mm | 8775A2 | 0.36 (0.91) | 1.46 (3.71) | 8775B2 | 0.36 (0.91) | 1.50 (3.81) |
| 3.5mm | 8031A( ) | 0.36 (0.91) | 1.46 (3.71) | 8031B( ) | 0.36 (0.91) | 1.50 (3.81) |

[1] Precision 2.92mm (K) per Maury data sheet 5E-063.

[2] Precision 3.5mm per Maury data sheet 5E-062.

### *Available Models*

| MODEL FEMALE | MODEL MALE | FREQUENCY RANGE (GHz) | MAXIMUM VSWR | CONNECTOR TYPE |
|---|---|---|---|---|
| 8775A2 | 8775B2 | DC – 4.0 | 1.016 | 2.92mm [1] |
| | | 4.0 – 40.0 | 1.15 | |
| 8031A2 | 8031B2 | DC – 4.0 | 1.05 | 3.5mm [2] |
| | | 4.0 – 12.0 | 1.10 | |
| | | 12.0 – 18.0 | 1.15 | |
| | | 18.0 – 26.5 | 1.20 | |
| | | 26.5 – 34.0 | 1.25 | |
| 8031A4 | 8031B4 | DC – 2.0 | 1.03 | 3.5mm [2] |
| | | 2.0 – 4.0 | 1.05 | |
| | | 4.0 – 18.0 | 1.10 | |
| | | 18.0 – 26.5 | 1.15 | |
| 8031A5 | 8031B5 | DC – 3.0 | 1.02 | 3.5mm [2] |
| | | 3.0 – 6.0 | 1.032 | |
| | | 6.0 – 20.0 | 1.052 | |
| | | 20.0 – 26.5 | 1.083 | |

### *Specifications*

Frequency Range, VSWR . . . . . (See Available Models chart)

Power Rating . . . . . 0.5 watt CW, 0.25 kW peak

Nominal Impedance. . . . . 50 ohm

Connectors:

8775 series . . . . . 2.92mm (K) [1]

8031 series . . . . . 3.5mm [2]

Size . . . . . (See Dimensions)



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# Precision Fixed Terminations

## 7mm (2610 series) and Type N (2510 series)




### Features

- *Low VSWR*
- *DC to 18 GHz*

### Description

The 2610 and 2510 series fixed terminations (utilizing 7mm and type N connectors respectively) are precision, broadband, low VSWR terminations suited to a wide variety of general purpose and precision laboratory applications. Depending upon the frequency range and required calibration effectiveness of a vector network analyzer (VNA or PNA), specific models can be used for full or lowband one-port $Z_0$ calibration and full two-port isolation calibration.

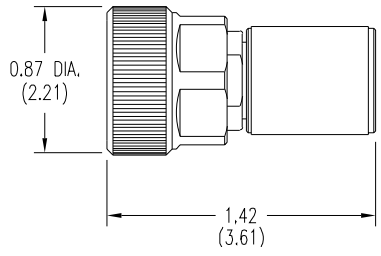
### Connector Descriptions

The 7mm connectors on the 2610 series terminations are precision air interface hermaphroditic connectors that are rated from DC to 18 GHz. They have an air line size of 0.1197 inner diameter and a 0.2756 outer diameter.

The connectors on the 2510 series terminations are Maury precision stainless steel type N connectors that mate with most of the precision type N connectors commonly used today, including those complying with MIL-C-39012 and MIL-T-81490. They are low VSWR connectors rated from DC to 18 GHz.

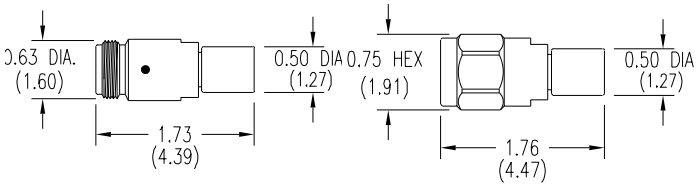
### Dimensions – Inches (cm)

***7mm***




2610

***Type N***




2510 Female  2510 Male

Key Literature: Maury data sheet 2C-003, 2C-005, 5E-049, and 5E-060.

### Available Models

| MODEL FEMALE | MODEL MALE | FREQUENCY RANGE (GHz) | MAXIMUM VSWR | CONNECTOR TYPE |
|---|---|---|---|---|
| 2610C | | DC – 4.0 | 1.04 | 7mm [1] |
| | | 4.0 – 18.0 | 1.08 | |
| 2610D | | DC – 18.0 | 1.04 | 7mm [1] |
| 2610F | | DC – 1.0 | 1.005 | 7mm [1] |
| | | 1.0 – 2.0 | 1.01 | |
| | | 2.0 – 8.0 | 1.03 | |
| | | 8.0 – 18.0 | 1.06 | |
| 2510A4 | 2510B4 | DC – 4.0 | 1.04 | Type N [2] |
| | | 4.0 – 12.0 | 1.10 | |
| | | 12.0 – 18.0 | 1.15 | |
| 2510A5 | 2510B5 | DC – 4.0 | 1.04 | Type N [2] |
| | | 4.0 – 18.0 | 1.10 | |
| 2510A6 | 2510B6 | DC – 2.0 | 1.02 | Type N [2] |
| | | 2.0 – 4.0 | 1.04 | |
| | | 4.0 – 18.0 | 1.06 | |
| 2510A7 | 2510B7 | DC – 2.0 | 1.01 | Type N [2] |
| | | 2.0 – 4.0 | 1.04 | |
| | | 4.0 – 18.0 | 1.12 | |
| 2510A8 | 2510B8 | DC – 3.0 | 1.01 | Type N [2] |
| | | 3.0 – 6.0 | 1.02 | |

### Specifications

Frequency Range, VSWR . . . . . (See Available Models chart)

Power Rating . . . . . 1 watt CW, 1 kW peak

Nominal Impedance. . . . . 50 ohm

Connectors:

2610 series . . . . . 7mm [1]

2510 series . . . . . Type N [2]

Size . . . . . (See Dimensions)

[1] Precision 7mm per Maury data sheet 5E-060.

[2] Precision stainless steel type N per Maury data sheet 5E-049.



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# Precision Fixed Terminations

## Type N 75 ohm (8883 series) and BNC 75 ohm (8583 series)

### *Features*

- *Low VSWR*
- *Type N – DC to 2 GHz;*
- *BNC – DC to 12 GHz*

### *Description*

The 8883 series and 8583 series fixed terminations are precision, low VSWR, 75 ohm terminations equipped with type N and BNC connectors, respectively. These terminations are suited to a wide variety of general purpose and precision laboratory applications; however, their primary usage is for 75 ohm reference $Z_0$ calibration of network analyzers at frequencies up to 2.0 GHz (for Type N) or 12.0 GHz (for BNC). All Maury 75 ohm components are identifiable by a black ring encircling the body of the component. 75 ohm connectors should never be mated to their 50 ohm counterparts as doing so could result in damage to the 75 ohm female connector and/or poor, or erratic electrical performance.

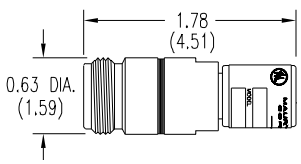
### *Connector Description*

The type N 75 ohm connectors on the components in the 8883 series are a precision version of type N 75 ohm connectors, developed by Maury, which meets all applicable requirements of IEC169-16. They exhibit extremely low VSWR, and although specified to 2.0 GHz, they can be used at much higher frequencies. The male connectors are provided with a 3/4" hex coupling nut so the junctions can be properly torqued to 12 in. lbs.

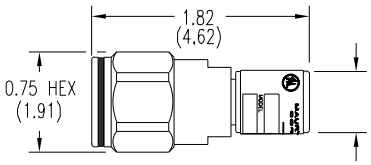
The BNC connectors on the 8583 series terminations are precision miniature coaxial connectors featuring a quick disconnect bayonet locking coupling mechanism. The connector body is fabricated from solid brass finished with nickle plating. The center conductor is beryllium-plated copper, supported by teflon beads. They are rugged, lightweight connectors that are negligibly affected by temperature and humidity.

### *Dimensions – Inches (cm)*

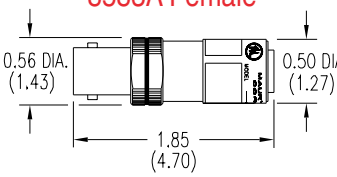
8883A Female



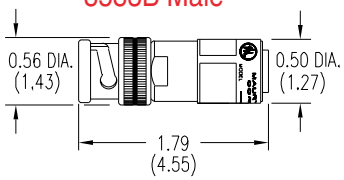

8883B Male




8583A Female




8583B Male




Key Literature: Maury data sheet 2Z-036.







### *Specifications*

Model 8883A – Female type N 75 ohm fixed termination

Model 8883B – Male type N 75 ohm fixed termination

Frequency Range . . . . . DC – 2.0 GHz

Maximum VSWR . . . . . 1.01

Power Rating . . . . . 1 watt CW

Nominal Impedance. . . . . 75 ohm

Connectors:

8883A . . . . . Precision 75 ohm type N female [1]

8883B . . . . . Precision 75 ohm type N male [1]

Size . . . . . (see Dimensions)

Model 8583A1 – Female BNC 75 ohm fixed termination

Model 8583B1 – Male BNC 75 ohm fixed termination

Frequency Range . . . . . DC to 12.0 GHz

Maximum VSWR:

DC to 2.0 GHz . . . . . 1.02

2.0 to 4.0 GHz . . . . . 1.04

4.0 to 12.0 GHz . . . . . 1.10

Nominal Impedance . . . . . 75 ohm

Power Handling . . . . . 1 watt CW

Connectors:

8583A . . . . . Precision 75 ohm BNC female

8583B . . . . . Precision 75 ohm BNC male

Size . . . . . (see Dimensions)



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# Precision Fixed Terminations

## HN, SC and BNC
## (335, 336, and 351 series)

### *Features*

- *Low VSWR*
- *DC to 10 GHz*




### *Description*

Maury produces these four series of low power, general purpose terminations which are designed to operate from DC to 8 or DC to 10 GHz. They are useful in a variety of airborne systems and laboratory applications where low VSWR broadband termination is required.

These compact, lightweight, rugged terminations are available with HN, SC and BNC connectors. Most are sufficiently well matched for low frequency VNA $Z_0$ calibrations and all can be used for isolation calibrations within the appropriate frequency range.

### *Connector Descriptions*

The HN connectors on the 335 series terminations are medium size high voltage connectors with a screw type coupling mechanism and overlapping dielectrics for longer breakdown paths.

The SC connectors on the 336 series terminations are threaded versions of the C connector and are designed for use in severe environments, where vibration and shock are present.

The BNC connectors on the 351 series terminations are 50 ohm impedance connectors with two-stud bayonet coupling. They conform to MIL-C-39012 and are normally made with stainless steel bodies with heat treated, gold-plated beryllium copper contacts.

### *Available Models*

| MODEL FEMALE | MODEL MALE | FREQUENCY RANGE (GHz) | MAXIMUM VSWR | CONNECTOR TYPE |
|---|---|---|---|---|
| 335A | 335B1 | DC – 1.0 | 1.05 | HN [1] |
| | | 1.0 – 4.0 | 1.10 | |
| | | 4.0 – 8.0 | 1.20 | |
| 336A | 336B1 | DC – 1.0 | 1.03 | SC [1] |
| | | 1.0 – 4.0 | 1.07 | |
| | | 4.0 – 10.0 | 1.12 | |
| 351A2 | 351B2 | DC – 2.0 | 1.04 | BNC |
| | | 2.0 – 4.0 | 1.10 | |
| | | 4.0 – 10.0 | 1.20 | |

### *Dimensions – Inches (cm)*

| TYPE | MODEL | DIAMETER INCHES | DIAMETER (CM) | LENGTH INCHES | LENGTH (CM) |
|---|---|---|---|---|---|
| HN Female | 335A | 0.750 | (1.905) | 1.770 | (4.496) |
| HN Male | 335B1 | 0.875 | (2.223) | 1.955 | (4.966) |
| SC Female | 336A | 0.760 | (1.930) | 1.925 | (4.889) |
| SC Male | 336B1 | 0.790 | (2.007) | 1.835 | (4.661) |
| BNC Female | 351A2 | 0.570 | (1.448) | 1.520 | (3.861) |
| BNC Male | 351B2 | 0.570 | (1.448) | 1.435 | (3.645) |

### *Specifications*

Frequency Range, VSWR . . . . . (See Available Models chart)

Power Rating:

HN and SC . . . . . 1 watt CW, 1 kW peak

BNC . . . . . 2 watt CW, 1 kW peak

Nominal Impedance. . . . . 50 ohm

Size . . . . . (See Dimensions)

Key Literature: Maury data sheet 2C-004, 2C-005.

[1] Precision stainless steel connector per Maury data sheet 5E-051.

[2] Precision stainless steel SC per Maury data sheet 5E-050.



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# Precision Fixed Terminations

## TNC (332 series), AFTNC (8684 series) and TNCA (8674 series)







### *Features*

- *Low VSWR*
- *DC to 20 GHz*

### *Description*

These TNC, AFTNC, and TNCA units are precision, broadband, low VSWR fixed terminations suited to a variety of general purpose and precision laboratory applications. Depending upon the frequency range and required calibration effectiveness of a vector network analyzer (VNA) specific models can be used for full or low-band one-port $Z_0$ calibration and full two-port, isolation calibration.

### *Connector Description*

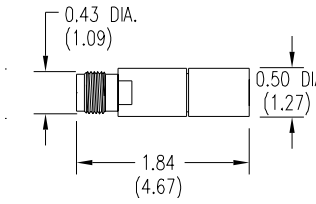
Maury TNC connectors (MPC/TNC) on the are precision stainless steel connectors that mate with MIL-C-39012 and MIL-T-81490 connectors. These low VSWR connectors rated from DC to 18.0 GHz.

Maury AFTNC connectors fully comply with the requirements of MIL-C-87104/2. The male connector utilizes a solid outer conductor configuration to provide consistent measurement results. Connector bodies are fabricated from stainless steel for strength and durability. These connectors were developed using optimized HFSS simulation to provide extremely low VSWR, and they are rated to 20 GHz.

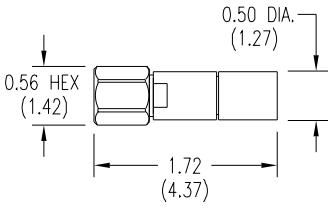
Maury TNCA connectors fully comply with the requirements of MIL-STD 348A. The male connector utilizes a solid outer conductor configuration to provide consistent measurement results. Connector bodies are fabricated from stainless steel for strength and durability.

### *Dimensions – Inches (cm)*

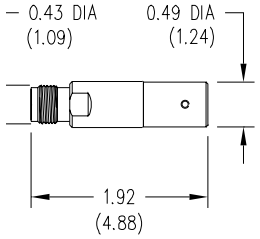
332A Female



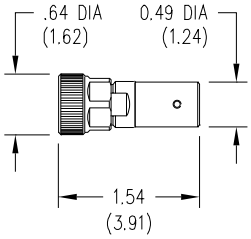

332B Male




8684A & 8674A Female




8684B & 8674B Male




1 Precision TNC per Maury data sheet 5E-053.

2 Precision TNC MIL-C-87104/2 per Maury data sheet 5E-056.

### *Available Models*

| MODEL FEMALE | MODEL MALE | FREQUENCY RANGE (GHz) | MAXIMUM VSWR | CONNECTOR TYPE |
|---|---|---|---|---|
| 332A | 332B | DC – 4.0<br>4.0 – 12.0<br>12.0 – 18.0 | 1.10<br>1.15<br>1.20 | TNC [1] |
| 332E | 332F | DC – 4.0<br>4.0 – 12.0<br>12.0 – 18.0 | 1.06<br>1.10<br>1.15 | TNC [1] |
| 332G | 332H | DC – 2.0<br>2.0 – 4.0 | 1.02<br>1.05 | TNC [1] |
| 332A3 | 332B3 | DC – 3.0<br>3.0 – 6.0 | 1.02<br>1.04 | TNC [1] |
| 332A8 | 332B8 | DC – 3.0<br>4.0 – 13.5 | 1.03<br>1.06 | TNC [1] |
| 332A5 | 332B5 | DC – 12.0<br>12.0 – 18.0 | 1.25<br>1.10 | TNC [1] |
| 8684A | 8684B | DC – 4.0<br>4.0 – 12.0<br>12.0 – 18.0 | 1.04<br>1.08<br>1.10 | AFTNC [2] |
| 8674A | 8674B | DC – 4.0<br>4.0 – 12.0<br>12.0 – 18.0 | 1.04<br>1.08<br>1.10 | TNCA [3] |

### *Specifications*

Frequency Range, VSWR . . . . . See chart
Power Rating . . . . . 1 watt CW, 1 kW peak
Impedance . . . . . 50 ohm (nominal)
Connectors:
332 series . . . . . TNC [1]
8684 series . . . . . AFTNC [2]
8674 series . . . . . TNCA [3]
Size . . . . . (see Dimensions)

3 Precision TNC MIL-STD 348A per Maury data sheet 5E-058.



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# Precision Fixed Terminations

## LCP/OSP™ (8783 series)

### *Features*

- *Low VSWR*
- *DC to 18 GHz*

### *Description*

The 8783 series fixed terminations are equipped with Maury LCP/OSP™ connectors, which are precision, broadband, low VSWR terminations suited to a wide variety of general purpose and precision laboratory applications. Their unique coupling mechanism is an improvement on the original OSP™ design that significantly enhances the performance of these connectors (see Connector Description below). Depending upon the frequency range and required calibration effectiveness of your VNA, PNA, or ENA, specific models can be used for full or lowband one-port $Z_0$ calibration and full two-port, isolation calibration.

### *Connector Description*

The connectors on these components are Maury precision LCP/OSP™ connectors that are mating compatible with standard OSP™ and Dynawave/Dynamate™ series blind-mate connectors. They are low VSWR connectors rated from DC to 18 GHz. A unique feature of these connectors is their use of a positive (thread-on) coupling system which permits mating with the use of a calibrated torque wrench to enhance the repeatability and electrical performance of the connection. For interface specifications on these connectors, please refer to Maury data sheet 5E-065.



8783A 8783B

### *Specifications*

Model 8783A female LCP/OSP™ fixed termination

Model 8783B male LCP/OSP™ fixed termination

Frequency Range . . . . . DC to 18.0 GHz

Maximum VSWR:

DC to 1.0 GHz . . . . . 1.03

1.0 to 6.0 GHz . . . . . 1.05

6.0 to 18.0 GHz . . . . . 1.08

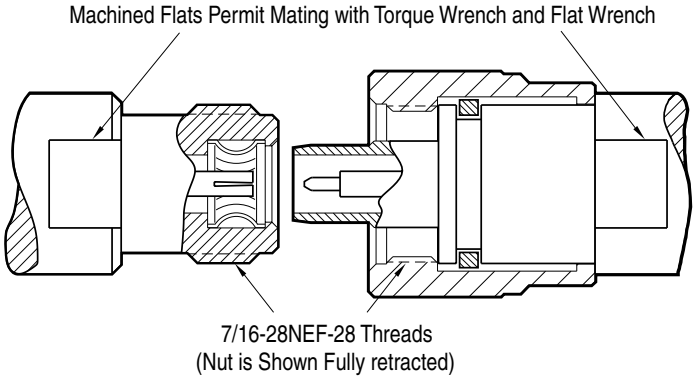
Power Rating . . . . . 1 watt CW, 0.5 kW peak

Reference Impedance. . . . . 50 ohm (nominal)

Connectors . . . . . .LCP/OSP™

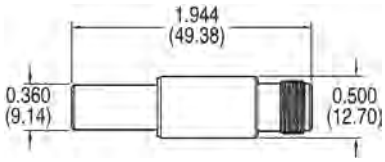
Size . . . . . (see Dimensions)

### *Maury OSP™ Improvements*

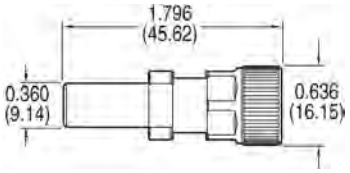



### *Dimensions – Inches (cm)*

8783A Female




8783B Male






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# Precision Fixed Terminations

## 14mm – GR900 Equivalent (2410A)



2410A

### Features

- *Low VSWR*
- *DC to 8.5 GHz*

### Description

The 2410A fixed termination is equipped with the Maury MPC14 connector, a precision 14mm connector. The 2410A is a broadband, low VSWR termination suited to a wide variety of general purpose and precision laboratory applications. Within its frequency range this termination can be used for full or lowband one-port $Z_0$ calibration and full two-port, isolation calibration.

### Connector Description

The MPC14 precision 14mm connector is essentially equivalent to, and mating compatible with, GR900 type connectors. It features an improved hex knurl coupling nut and an improved center conductor inner contact (model 2481A). The coupling nut has a 1.00 inch hex for accurate tightening with a torque wrench, and the knurled knob provides a positive grip for finger tightening.

### Dimensions – Inches (cm)

See the diagram at right.

### Specifications

Model 2410A Precision 14mm Fixed Termination

Frequency Range . . . . . DC to 8.5 GHz

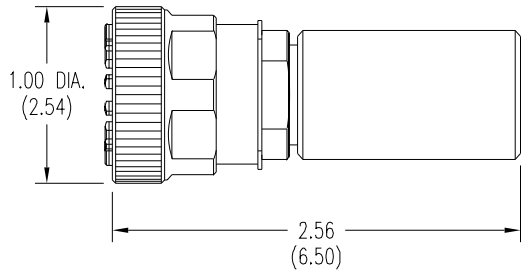
Maximum VSWR: . . . . . 1.005 + 0.004 GHz

Power Rating . . . . . 3 watts CW, 1 kW peak

Reference Impedance . . . . . 50 ohm (nominal)

Connector . . . . . 14mm (MPC14)

Size . . . . . (see diagram below)




# Precision Fixed Terminations

## 7-16 (2710 Series)



2710A 2710B

### Features

- *Low VSWR*
- *DC to 7.5 GHz*

### Description

The 2710 series fixed terminations are precision, broadband, low VSWR terminations suited to a wide variety of general purpose and precision laboratory applications. Within their frequency range they can be used for full band one-port $Z_0$ calibration and full two-port isolation calibration.

### Connector Description

The 7-16 connectors found on the components in these kits are rugged, calibration grade connectors that exceed the requirements for IEC169-4 reference grade and BSEN122190 grade 0 specifications. They feature a thicker dielectric bead to eliminate deflection, retracted threads on the female connector to eliminate the need to apply excessive torque during calibration and test, and tighter tolerance control than called for in the IEC and BSEN specifications to reduce uncertainties.

### Specifications

Model 2710A Female Precision 7-16 Fixed Termination

Model 2710B Male Precision 7-16 Fixed Termination

Frequency Range . . . . . DC to 7.5 GHz

Maximum VSWR:

DC to 4.0 GHz . . . . . 1.02

4.0 to 7.5 GHz . . . . . 1.03

Power Rating . . . . . 3 watts CW, 1 kW peak

Reference Impedance . . . . . 50 ohm (nominal)

Connector . . . . . Precision 7-16

Size in inches (cm):

2710A . . . . . 1.142 (2.901) max dia., 2.758 (7.005) length

2710B . . . . . 1.311 (3.330) max. dia. 3.068 (7.793) length



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# Precision Fixed Terminations

## Waveguide (301 series)

### *Features*

- *Low VSWR*
- *1.12 to 110 GHz*
- *Moderate Power Handling*

### *Description*

The 301 series low power waveguide fixed terminations are precision, low VSWR terminations suited to a wide variety of general purpose and precision laboratory applications. They can be used for full band one-port calibration and full two-port, isolation calibration.

### *Waveguide Flange Description*

The waveguide flanges used on these terminations are Maury Precision Flanges (MPF) in rectangular, or round configurations. MPF flanges have precision indexing holes and removable indexing pins for excellent measurement repeatability. The millimeter waveguide flanges in the WR22 and smaller sizes are of a unique Maury-pioneered design featuring a raised outer rim to prevent the flanges from cocking during connection. These flanges will mate with corresponding UG ( )/U flanges. (See pages 141-144 for flange details.)




### *Available Models*

| MODEL | FREQUENCY RANGE (GHz) | VSWR (Maximum) | EIA WR NUMBER | EQUIVALENT FLANGE | POWER RATING | | LENGTH | |
|---|---|---|---|---|---|---|---|---|
| | | | | | AVE. (W) | PEAK (kW) | inches | (cm) |
| L301A | 1.12 — 1.20<br>1.20 — 1.70 | 1.040<br>1.025 | 650 | CPR-650F | 25.0 | 10.0 | 19.5 | (49.53) |
| R301A | 1.70 — 1.90<br>1.90 — 2.60 | 1.025<br>1.020 | 430 | UG435/U | 12.0 | 5.0 | 14.8 | (37.6) |
| D301A | 2.20 — 3.30 | 1.025 | 340 | CPR340F | 5.0 | 2.0 | 9.8 | (24.9) |
| S301A | 2.60 — 3.95 | 1.025 | 284 | UG584/U | 5.0 | 2.0 | 10.4 | (26.4) |
| E301F | 3.30 — 4.90 | 1.020 | 229 | CPR229F | 5.0 | 2.0 | 7.4 | (18.8) |
| G301 | 3.95 — 5.85 | 1.020 | 187 | UG149A/U | 5.0 | 2.0 | 6.4 | (16.3) |
| F301C | 4.90 — 7.05 | 1.020 | 159 | CPR159F | 3.0 | 1.0 | 5.8 | (14.7) |
| C301 | 5.85 — 8.20 | 1.020 | 137 | UG344/U | 2.5 | 1.0 | 5.2 | (13.2) |
| H301A | 7.05 — 10.00 | 1.015 | 112 | UG51/U | 2.0 | 1.0 | 5.0 | (12.7) |
| X301A | 8.20 — 12.40 | 1.015 | 90 | UG39/U | 1.0 | 1.0 | 5.0 | (12.7) |
| M301A | 10.00 — 15.00 | 1.020 | 75 | MPF75 | 1.0 | 1.0 | 5.0 | (12.7) |
| P301A | 12.40 — 18.00 | 1.020 | 62 | UG419/U | 1.0 | 1.0 | 4.0 | (10.2) |
| N301 | 15.00 — 22.00 | 1.025 | 51 | MPF51 | 0.5 | 0.2 | 3.1 | (07.9) |
| K301 | 18.00 — 26.50 | 1.025 | 42 | UG595/U | 0.5 | 0.2 | 2.8 | (07.1) |
| U301 | 26.50 — 40.00 | 1.025 | 28 | UG599/U | 0.5 | 0.2 | 2.2 | (05.6) |
| J301A | 33.00 — 50.00 | 1.040 | 22 | UG383[1] | 0.5 | 0.1 | 1.6 | (04.1) |
| V301B | 50.00 — 75.00 | 1.025 | 15 | UG385[1] | 0.3 | 0.05 | 1.5 | (03.8) |
| Y301 | 60.00 — 90.00 | 1.030 | 12 | UG387/U | 0.2 | 0.03 | 1.5 | (03.8) |
| Z301B | 75.00 — 110.00 | 1.030 | 10 | UG387[1] | 0.2 | 0.03 | 1.5 | (03.8) |

[1] Units are supplied with Maury precision flanges (MPF) which mate with the UG flanges shown.



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# Sliding Terminations

## General Information



A sliding termination (or sliding load) consists of a precision, movable, tapered termination in a highly accurate, air dielectric transmission line. These instruments are basic tools for making precision microwave measurements, and are particularly useful in the following applications:

**Load Separation:** A general application measurement in which the reflection from the terminating element can be separated from that of the test device. Load separation using sliding loads is a key element in the calibration of vector network analyzers (VNAs). The technique is also used in the measurement of the reflection from two-port devices, particularly "non-insertable", (e.g., waveguide-to-coax adapters, and the directivity of directional couplers). Maury sliding terminations make it possible to measure test device reflection in extremely small increments that would normally be masked by the reflections from the termination.

**50 ohm Fixed Termination:** The low VSWR inherent in Maury sliding terminations make them excellent for use as fixed terminations in 50 ohm systems.

---

Maury manufactures sliding terminations which offer a range of performance and convenience features. These include metrology grade, high precision units with integral, dedicated connectors; precision units which permit the sex of the connector to be changed within the same connector series; and true, modular instruments which permit changing the connector type or sex.

**Metrology grade sliding terminations** provide the highest level of accuracy, stability and repeatability when used as impedance standards for calibrating vector network analyzers. They feature integral connectors, flush set adjustment, and thermal isolation.

**Dedicated connector sliding terminations** are capable of handling higher power than is typical of metrology grade sliding terminations. Their defining characteristic is that they feature connectors of a single type, and (in sexed connectors) of a single, non-interchangable, sex.

**Modular sliding terminations** are provided with a range of interchangable connectors, permitting the user to change the connector type and sex of the sliding termination as needed.

Most Maury sliding termination VNA calibration kits include metrology grade sliding terminations. These sliding terminations are also available individually as replacement parts for the calibration kits. Dedicated connector and Modular models are likewise available as individual instruments, and in some cases as boxed sets. The following pages (73-77) provide detailed descriptions and specifications for all of the coaxial and waveguide sliding terminations offered by Maury.



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# Sliding Terminations — Metrology Grade

## 2.4mm, 2.92mm and 3.5mm

### *Features*

- *Integral Connectors*
- *"Flush Set" Adjustment*
- *"Pull Back" Mechanism & Lock*
- *Thermal Isolation*
- *Enhanced Air Line Accuracy*




### *Description*

These metrology grade sliding terminations achieve a high level of accuracy, stability and repeatability when used as impedance standards for calibrating vector network analyzers (VNAs) and in other critical, precision measurement applications.

They feature seamless, integral, beadless (air dielectric) connectors that provide an extremely accurate impedance reference, and an external jacket that enhances thermal stability by insulating the transmission line.

When used with "thread-on" connector gages, a "flush set" mechanism allows users to adjust the center conductor to achieve a coplanar inner and outer conductor interface at the connector mating plane. A "pull back" mechanism automatically locks the center conductor to a previously set flush condition, making it easy to return to flush condition from any other position.

These terminations are available individually, with female or male connectors, or in boxed sets with one each of both sexes, per the ***Specifications*** chart (below).

### *Specifications*

| MODEL | CONNECTOR TYPE | FREQUENCY RANGE & MAXIMUM VSWR [1] | AIR LINE ACCURACY [2] | POWER HANDLING |
|---|---|---|---|---|
| 7935A | 2.4mm female | 4.0 GHz — 10.0 GHz, 1.10 | 42 dB (4.0 — 50.0 GHz) | 0.5 watts CW, 0.5 kW peak |
| 7935B | 2.4mm male | 10.0 GHz — 50.0 GHz, 1.05 | | |
| 7935C | 2.4mm boxed set (1 ea. 7935A female and 7935B male) [3] | | | |
| 8777A1 | 2.92mm (K) female | 4.0 GHz — 10.0 GHz, 1.10 | 46 dB (4.0 — 40.0 GHz) | 0.5 watts CW, 0.5 kW peak |
| 8777B1 | 2.92mm (K) male | 10.0 GHz — 40.0 GHz, 1.05 | | |
| 8777C1 | 2.92mm (K) boxed set (1 ea. 8777A1 female and 8777B1 male) [3] | | | |
| 8037A | 3.5mm female | 2.0 GHz — 4.0 GHz, 1.09 | 50 dB (4.0 — 34.0 GHz) | 1.0 watts CW, 1.0 kW peak |
| 8037B | 3.5mm male | 4.0 GHz — 34.0 GHz, 1.05 | | |
| 8037C | 3.5mm boxed set (1 ea. 8037A female and 8037B male) [3] | | | |
| 2608C | 7mm (LPC7) | 1.8 GHz — 18.0 GHz, 1.035 | 62 dB | 1.0 watt CW, 1.0 kW peak |
| 8834A | Type N female | 2.0 GHz — 18.0 GHz, 1.04 | 54 dB | |
| 8834B | Type N male | | | |
| 8834C | Type N boxed set (1 ea. 8834A female and 8834B male) [3] | | | |

[1] Maximum VSWR (50 ohm reference) of the terminating element alone.

[2] Equivalent return loss of the air line impedance (50 ohm reference).

[3] Supplied in a foam-lined wood instrument case.



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# Sliding Terminations — Precision Dedicated Connectors

## 7mm (LPC7A), Type N, TNC, AFTNC, TNCA, SMA and 14mm (LPC14)

### *Features*

- *Dedicated (Non-Interchangeable) Precision Connectors*
- *Low Reflection*
- *Greater than 1/2-λ Travel at Lowest Frequency*




### *Description*

These sliding terminations feature dedicated connectors. Those with sexed connectors (e.g., type N), are available in two models; one each with female and male connectors. Except as noted, the terminating elements are capable of handling higher power than typical laboratory sliding loads.

TNC and SMA terminations are precision air lines with low-reflection transformers to the dielectrically loaded connectors. Their air dielectric connectors and movable center conductors permit precision setting of the connector interface condition, using an appropriate connector gage.

### *Specifications*

Frequency Range . . . . . .See chart
VSWR (terminating element) . . . . . .See chart
Power Rating . . . . . .See chart
Nominal Impedance . . . . . .50 ohm
Air Line Accuracy . . . . . .See chart
Travel . . . . . >1/2 wavelength at lowest rated frequency
Connectors . . . . . .See chart

Note: Wood instrument cases are provided with many of these units or are available as optional accessories.

### *Available Models*

| MODEL | CONNECTOR TYPE | FREQUENCY RANGE & MAXIMUM VSWR [1] | AIR LINE ACCURACY [2] | POWER HANDLING |
|---|---|---|---|---|
| 2517H | LPC7A [3] | 2.0 GHz — 18.0 GHz, 1.04 | 52 dB | 1.0 watt CW, 5.0 kW peak |
| 453A1 | Type N female [4] | 1.8 GHz — 18.0 GHz, 1.05 | 56 dB | 5.0 watt CW, 1.0 kW peak |
| 453B1 | Type N male [4] | | | |
| 493A | Type N female [4] | 0.9 GHz — 18.0 GHz, 1.10 | | |
| 493B | Type N male [4] | 1.8 GHz — 18.0 GHz, 1.05 | | |
| 452A1 | TNC female [5] | 1.8 GHz — 18.0 GHz, 1.05 | | |
| 452B1 | TNC male [5] | | | |
| 487A | SMA female [6] | 0.9 GHz — 1.8 GHz, 1.10 | | |
| 487B | SMA male [6] | 1.8 GHz — 18.0 GHz, 1.05 | | |
| 8683A | AFTNC female [7] | 2.0 GHz — 4.0 GHz, 1.04 | | |
| 8683B | AFTNC male [7] | 4.0 GHz — 20.0 GHz, 1.05 | | |
| 8673A | TNCA female [8] | 2.0 GHz — 4.0 GHz, 1.04 | | |
| 8673B | TNCA male [8] | 4.0 GHz — 20.0 GHz, 1.05 | | |
| 2408A1 | LPC14 [9] | 0.9 GHz — 1.5 GHz, 1.08<br>1.5 GHz — 2.0 GHz, 1.04<br>2.0 GHz — 8.5 GHz, 1.03 | 64 dB | 2.0 watts CW, 2.0 kW peak |

[1] Maximum VSWR (50 ohm reference) of the terminating element alone.

[2] Equivalent return loss of the air line impedance (50 ohm reference).

[3] Air interface connector per Maury data sheet 5E-061 with a spring-loaded, self-centering, center pin that mates with standard 7mm connectors.

[4] Precision stainless steel type N per Maury data sheet 5E-049.

[5] Precision stainless steel TNC per ES-2047.

[6] Precision stainless steel SMA per MIL-C-39012.

[7] Precision TNC MIL-C-87104/2 per Maury data sheet 5E-056.

[8] Precision TNCA MIL-STD 348A per Maury data sheet 5E-058.

[9] Movable center conductor permits setting of connector interface conditions.



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# Sliding Terminations — Modular Connectors

## 3.5mm, 7mm (LPC7) and Type N




### *Features*

- *Interchangeable Precision Connectors*
- *Greater than 1/2-λ Travel at Lowest Frequency*
- *Broadband, Low-Reflection*

### *Description*

These precision sliding terminations have interchangeable precision, beadless connectors, eliminating the need for separate loads for different connector sexes or types as noted in the chart below. The 8035A has a single center conductor and interchangeable female and male center contacts and connector bodies. The 2507 and 2517A02 are true modular instruments provided with interchangeable LPC7 and type N (female and male) connectors. Precision adapters for other connectors (including SC, HN, and BNC) are also available as options.

The 8035A is characterized by highly accurate, 50 ohm air line impedance and low terminating element VSWR. The 2507 and 2517A02 are high precision, movable, low-reflection, broadband terminations.

In all of the models listed below, the travel of the movable loads is at least 1/2 wavelength (at the lowest rated frequency) so that frequencies within the rated phase range of the load reflection can be reversed and separated from other in-system reflections. The connectors are beadless (air dielectric), and the movable center conductors can be set to the correct connector interface conditions with the aid of an appropriate connector gage.

All three models are provided in foam-lined wooden instrument cases.

### *Specifications*

Frequency Range . . . . . See chart

VSWR (terminating element) . . . . . See chart

Power Rating . . . . . See chart

Nominal Impedance . . . . . 50 ohm

Air Line Accuracy . . . . . See chart

Travel . . . . . >1/2 wavelength at lowest rated frequency

Connectors . . . . . See chart

Center Conductor . . . . . Silver plated stainless steel

Accessories (provided) . . . . . Wood Instrument case and operating instructions

### *Available Models*

| MODEL | CONNECTOR TYPE(S) | FREQUENCY RANGE & MAXIMUM VSWR [1] | AIR LINE ACCURACY [2] | POWER HANDLING |
|---|---|---|---|---|
| 8035A | 3.5mm [3] | 2.0 GHz — 4.0 GHz, 1.09 (<1.06 typ)<br>4.0 GHz — 34.0 GHz, 1.05 (<1.03 typ) | 44 dB | 1.0 watt CW, 1.0 kW peak |
| 8784E | LCP/OSP [4] | 2.0 GHz — 4.0 GHz, 1.09 (<1.06 typ)<br>4.0 GHz — 18.0 GHz, 1.05 (<1.03 typ) | 44 dB | 1.0 watt CW, 1.0 kW peak |
| 2507 | Beadless LPC7 [5]<br>Type N female [6]<br>Type N male [6] | 0.9 GHz — 1.5 GHz, 1.08<br>1.5 GHz — 2.0 GHz, 1.05<br>2.0 GHz — 18.0 GHz, 1.03 | 56 dB | 1.0 watt CW, 5.0 kW peak |
| 2517A02 | Beadless LPC7 [5]<br>Type N female [6]<br>Type N male [6] | 1.8 GHz — 18.0 GHz, 1.05 | 54 dB | 1.0 watt CW, 1.0 kW peak |

1 Maximum VSWR (50 ohm reference) of the terminating element alone.

2 Equivalent return loss of the air line impedance (50 ohm reference).

3 See Maury data sheet 5E-062 for interface specifications.

4 Precision LCP/OPS™ per Maury data sheet 5E-065.

5 Air interface connector per Maury data sheet 5E-061 with a spring-loaded, self-centering, center pin that mates with standard 7mm connectors.

6 Precision stainless steel type N per Maury data sheet 5E-049.



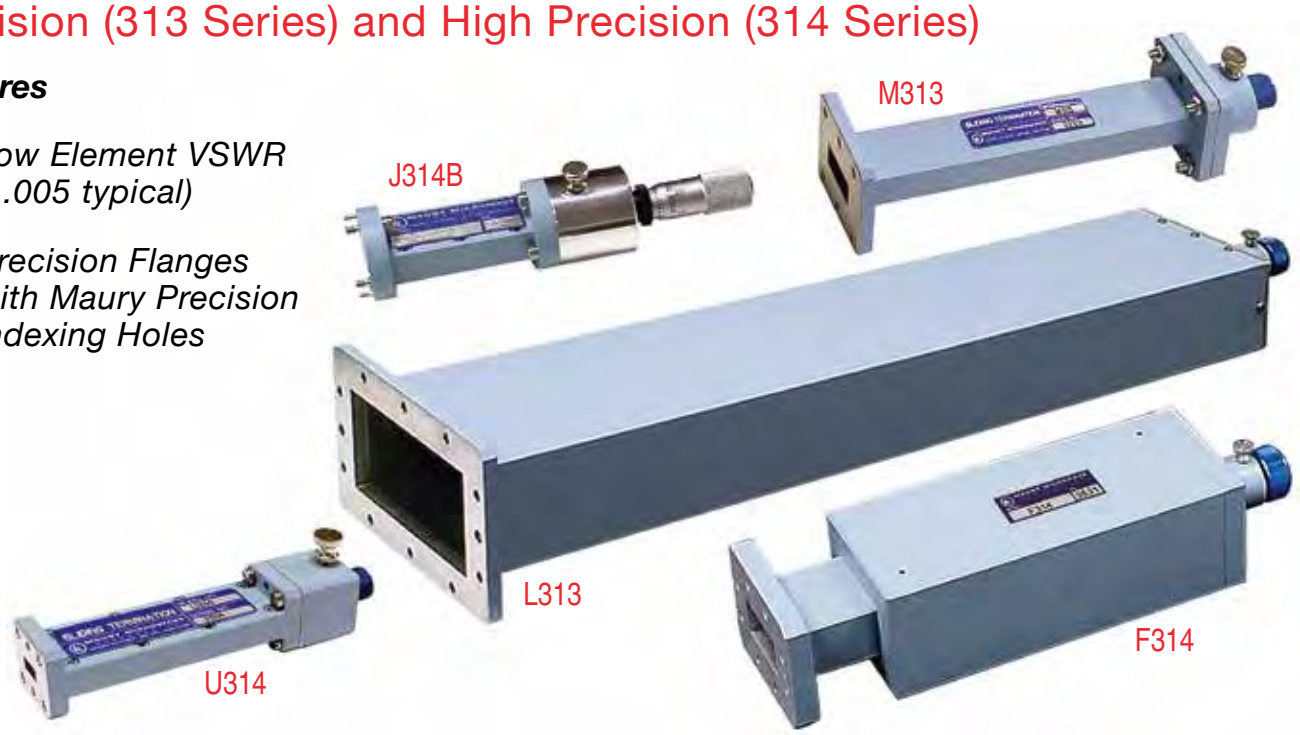
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# Sliding Terminations — Waveguide

## Precision (313 Series) and High Precision (314 Series)

### *Features*

- *Low Element VSWR (1.005 typical)*
- *Precision Flanges with Maury Precision Indexing Holes*




### *Description*

These precision sliding terminations are ideal for use as impedance standards for VNA calibration, and are included in many of the VNA calibration kits offered by Maury. They feature a typical effective return loss greater than 45 dB (313 series) or greater than 50 dB (314 series). Element travel in both series is greater than 1/2 waveguide wavelength (at the lowest rated frequency) so that effective frequencies within the rated phase range of the load reflection can be reversed and separated from other in-system reflections.

### *Available Models*

| FREQUENCY RANGE (GHz) | EIA WR NUMBER | EQUIVALENT FLANGE | MAXIMUM ELEMENT VSWR | POWER HANDLING WATTS (w) | PRECISION MODEL & MAX. HOUSING VSWR | | HIGH PRECISION MODEL & MAX. HOUSING VSWR [1] | |
|---|---|---|---|---|---|---|---|---|
| 1.7 — 2.6 | 430 | UG435/U | 1.01 [2] | 8.0 | R313A | 1.01 | R314 | 1.005 |
| 2.2 — 3.3 | 340 | CPR340F | 1.01 | 7.0 | D313A | 1.01 | — | — |
| 2.6 — 3.95 | 284 | UG584/U | 1.01 | 6.0 | S313A | 1.01 | S314 | 1.005 |
| 3.3 — 4.9 | 229 | CPR229F | 1.01 | 5.0 | E313F | 1.01 | E314 | 1.005 |
| 3.95 — 5.85 | 187 | UG149A/U | 1.01 | 5.0 | G313 | 1.01 | G314 | 1.005 |
| 4.90 — 7.05 | 159 | CPR159F | 1.01 | 4.0 | F313C | 1.01 | F314 | 1.005 |
| 5.85 — 8.2 | 137 | UG344/U | 1.01 | 3.0 | C313 | 1.01 | C314 | 1.005 |
| 7.05 — 10.0 | 112 | UG51/U | 1.01 | 2.0 | H313 | 1.01 | H314 | 1.005 |
| 8.2 — 12.4 | 90 | UG39/U | 1.01 | 2.0 | X313 | 1.012 | X314 | 1.005 |
| 10.0 — 15.0 | 75 | MPF75 | 1.01 | 1.5 | M313 | 1.013 | M314 | 1.006 |
| 12.4 — 18.0 | 62 | UG419/U | 1.01 | 1.0 | P313A | 1.015 | P314 | 1.006 |
| 15.0 — 22.0 | 51 | MPF51 | 1.01 | 0.5 | N313 | 1.025 | N314 | 1.008 |
| 18.0 — 26.5 | 42 | UG595/U | 1.01 | 0.5 | K313 | 1.02 | K314 | 1.01 |
| 22.0 — 33.0 | 34 | UG1530/U [3] | 1.015 | 0.5 | — | — | Q314A | 1.01 |
| 26.5 — 40.0 | 28 | UG599/U | 1.015 | 0.5 | U313 | 1.025 | U314 | 1.015 |
| 33.0 — 50.0 | 22 | UG383 [3] | 1.02 | 0.5 | — | — | J314A | 1.015 |
| 50.0 — 75.0 | 15 | UG385/U [3] | 1.02 | 0.5 | — | — | V314B | 1.015 |
| 60.0 — 90.0 | 12 | UG387/U [3] | 1.025 | 0.5 | — | — | Y314B | 1.015 |
| 75.0 — 110.0 | 10 | UG387/U [3] | 1.025 | 0.5 | — | — | Z314B | 1.015 |

[1] Housings are machined.

[2] 1.02 maximum at 1.7 to 2.1 GHz.

[3] Units are provided with Maury MPF series flanges with index holes which mate with the UG flanges shown.



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# Fixed Flush and Fixed Offset Shorts

## General Information

Fixed flush and fixed offset short circuit terminations (shorts) are used to establish reference planes in transmission systems and as key elements in the calibration of vector network analyzers (VNAs). Offset shorts can be used for banded calibrations of VNA. Those with the longest offset are often used to evaluate the calibration effectiveness of a VNA by measuring the effective source match after calibration.

In general, the shorting plane of fixed flush shorts is at the connector reference plane, and at some predetermined offset in offset shorts. The shorting plane of some fixed offset shorts can also be relative to a reference offset established by another short. (e.g.: the 8046 and 8047 series shown on page 80).

Many of the shorts listed in this section are components of the Maury VNA calibration kits described on pages 24 through 55 of this catalog. Others are available as supplements to the components in these kits. In all cases, the specification "Phase Accuracy" is defined in this section as phase deviation from a nominal unit.



# 1.85mm Precision Fixed Offset Shorts

## Model Series 7846 (female) and 7847 (male)

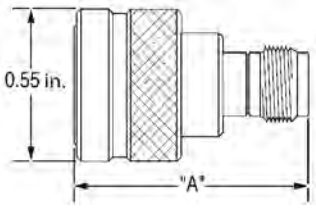
### *Description*

These fixed offset shorts are designed to perform short, short, short (SSS) calibrations on VNAs equipped with 1.85mm test port connectors, including the Keysight PNA series. The 7846A and 7647A are sold as primary components of Maury's 7850 and 7860 series VNA calibration kits; the other models are also included in the 7850A calibration kits as offset shorts which are offset relative to the 7846A and 7847A. All series 7846 and 7847 models may also be purchased separately as replacement parts or spares.

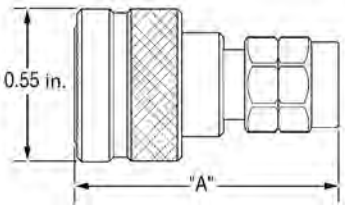
### *Specifications*

Frequency Range . . . . . DC to 67.0 GHz [1]
Minimum Reflection Coefficient . . . . . 0.98
Nominal Impedance . . . . . 50 ohm
Phase Accuracy [2] . . . . . ± 4.0°

### *Reference Dimensions*




7846A/B/C/D




7847A/B/C/D

[1] Operates to 70 GHz.

[2] Phase accuracy is phase deviation from a nominal unit.



7846A 7847A

### *Available Models*

| MODEL | SEX | "A" DIMENSION | | OFFSET LENGTH | |
|---|---|---|---|---|---|
| | | INCHES | (CM) | INCHES | (CM) |
| 7846A [3] | female | 0.980 | (2.4384) | 0.1968 [3] | (0.4999) |
| 7846B | female | 1.022 | (2.5451) | 0.2386 | (0.6060) |
| 7846C | female | 1.052 | (2.6213) | 0.2690 | (0.6833) |
| 7846D | female | 1.096 | (2.7330) | 0.3125 | (0.7938) |
| 7847A [3] | male | 0.945 | (2.4003) | 0.1968 [3] | (0.4999) |
| 7847B | male | 0.987 | (2.5070) | 0.2386 | (0.6060) |
| 7847C | male | 1.017 | (2.5832) | 0.2690 | (0.6833) |
| 7847D | male | 1.061 | (2.6949) | 0.3125 | (0.7938) |

[3] Reference shorts and reference offset lengths for these two model series. The relative offset length of other models in each series is derived by subtracting their offset lengths (shown in this table) from the offset length of their appropriate reference short (i.e., 7846A or 7846B).



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# 2.4mm Precision Fixed Offset Shorts

## Models 7946A (female) and 7946B (male)

### Description

These fixed offset shorts are used to establish the reference plane of calibration for vector network analyzers with 2.4mm test port connectors, including the Keysight PNA series. They are sold as part of Maury's 7950 and 7960 series VNA calibration kits, or may be purchased separately as replacement parts or spares.



7946A 7946B

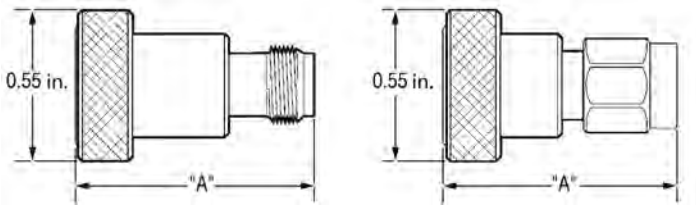
### Specifications

Frequency Range . . . . . DC to 50.0 GHz
Minimum Reflection Coefficient . . . . . 0.98
Nominal Impedance . . . . . 50 ohm
Phase Accuracy . . . . . ± 2.0°

### Available Models

| MODEL | SEX | "A" DIMENSION | | OFFSET LENGTH | |
|---|---|---|---|---|---|
| | | INCHES | (CM) | INCHES | (CM) |
| 7946A | female | 0.830 | (2.1082) | 0.2 | (0.508) |
| 7946B | male | 0.797 | (2.0244) | 0.2 | (0.508) |

### Reference Dimensions




7946A 7946B

# 2.92mm Precision Fixed Offset Shorts

## Model Series 8771 (female) and 8772 (male)

### Description

These fixed offset shorts mate with the 2.92mm (K) test port connectors on various vector network analyzers, including the Keysight PNA series. The 8771F1 and 8772F1 are reference shorts which are sold as part of Maury's 8770 and 8760 series VNA calibration kits, but may also be purchased separately as replacement parts or spares. The other models in these series are also sold separately as calibration kit accessories.

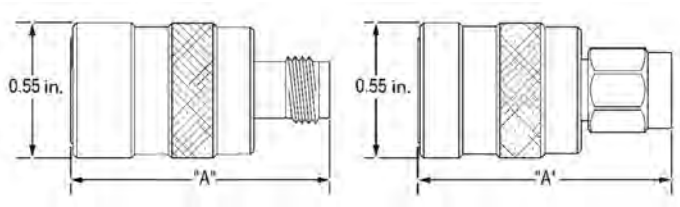


8771F1 8772F1

### Specifications

Frequency Range . . . . . DC to 40.0 GHz
Minimum Reflection Coefficient . . . . . 0.98
Nominal Impedance . . . . . 50 ohm
Phase Accuracy . . . . . ± 2.0°

### Reference Dimensions




8771F1 8772F1

### Available Models

| MODEL | SEX | "A" DIMENSION | | OFFSET LENGTH | | 1/4- λ FREQ (GHz) |
|---|---|---|---|---|---|---|
| | | INCHES | (CM) | INCHES | (CM) | |
| 8771A1 | female | 1.856 | (4.7142) | 1.1803 | (2.9980) | 3.0 |
| 8771B1 | female | 1.364 | (3.4646) | 0.6885 | (1.7488) | 6.0 |
| 8771C1 | female | 1.162 | (2.9515) | 0.4862 | (1.2349) | 10.2 |
| 8771D1 | female | 1.080 | (2.7432) | 0.4040 | (1.0262) | 14.24 |
| 8771E1 | female | 1.005 | (2.5527) | 0.3295 | (0.8369) | 22.24 |
| 8771F1[1] | female | 0.873 | (2.2174) | 0.1970 [1] | (0.5004) | REF |
| 8772A1 | male | 1.897 | (4.8184) | 1.1803 | (2.9980) | 3.0 |
| 8772B1 | male | 1.405 | (3.5687) | 0.6885 | (1.7488) | 6.0 |
| 8772C1 | male | 1.203 | (3.0556) | 0.4862 | (1.2349) | 10.2 |
| 8772D1 | male | 1.121 | (2.8473) | 0.4040 | (1.0262) | 14.24 |
| 8772E1 | male | 1.046 | (2.6568) | 0.3295 | (0.8369) | 22.24 |
| 8772F1[1] | male | 0.914 | (2.3216) | 0.1970 [1] | (0.5004) | REF |

[1] Reference shorts and reference offset lengths for these two model series. The relative offset length of other models in each series is derived by subtracting their offset lengths (show in this table) from the offset length of their appropriate reference short (i.e., 8771F1 or 8772F1).


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# 3.5mm Precision Fixed Offset Shorts

## Model Series 8046 (female) and 8047 (male)

### Description

These shorts mate with the 3.5mm test port connectors on various VNAs, including the Keysight PNA series. The "F" models are reference shorts and are sold as part of Maury's 8050 and 8060 series VNA calibration kits; the other models are offset relative to the 8046F and 8047F, and are sold separately as supplemental parts for those VNA calibration kits.

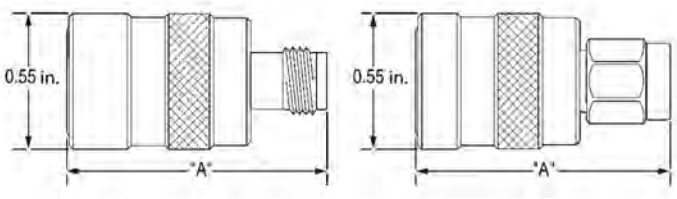


8046A 8047A

### Specifications

Frequency Range . . . . . DC to 34.0 GHz
Minimum Reflection Coefficient . . . . . 0.98
Nominal Impedance . . . . . 50 ohm
Phase Accuracy . . . . . ± 2.0°

### Reference Dimensions




8046 8047

### Available Models

| MODEL | SEX | "A" DIMENSION | | OFFSET LENGTH | | 1/4-λ FREQ (GHz) |
|---|---|---|---|---|---|---|
| | | INCHES | (CM) | INCHES | (CM) | |
| 8046A | female | 1.856 | (4.7142) | 1.1803 | (2.9980) | 3.0 |
| 8046B | female | 1.364 | (3.4646) | 0.6885 | (1.7488) | 6.0 |
| 8046C | female | 1.162 | (2.9515) | 0.4862 | (1.2349) | 10.2 |
| 8046D | female | 1.080 | (2.7432) | 0.4040 | (1.0262) | 14.24 |
| 8046E | female | 1.005 | (2.5527) | 0.3295 | (0.8369) | 22.24 |
| 8046F [1] | female | 0.873 | (2.2174) | 0.1970 [1] | (0.5004) | REF |
| 8047A | male | 1.897 | (4.8184) | 1.1803 | (2.9980) | 3.0 |
| 8047B | male | 1.405 | (3.5687) | 0.6885 | (1.7488) | 6.0 |
| 8047C | male | 1.203 | (3.0556) | 0.4862 | (1.2349) | 10.2 |
| 8047D | male | 1.121 | (2.8473) | 0.4040 | (1.0262) | 14.24 |
| 8047E | male | 1.046 | (2.6568) | 0.3295 | (0.8369) | 22.24 |
| 8047F [1] | male | 0.914 | (2.3216) | 0.1970 [1] | (0.5004) | REF |

[1] Reference shorts and reference offset lengths for these two model series. The relative offset length of other models in each series is derived by subtracting their offset lengths (shown in this table) from the offset length of their appropriate reference short (i.e., 8046F or 8047F).

# 3.5mm/SMA Reference Fixed Flush Shorts

## Models 360D (female) and 360B (male)

### Description

These true coplanar, reference plane shorts mate with the 3.5mm, SMA and 2.92mm (K) test port connectors on various VNAs, including the Keysight PNA series. The 360D has a return loss of less than 0.2 dB with a phase offset of less than 2 degrees. The 360D and 360B are sold as supplemental parts for use with Maury's 8050 and 8060 series VNA calibration kits.



360D 360B

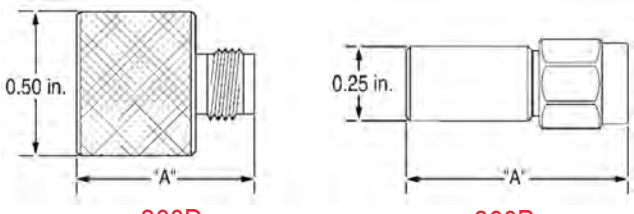
### Specifications

Frequency Range . . . . . DC to 26.5 GHz (usable to 40 GHz)
Minimum Reflection Coefficient . . . . . 0.99
Nominal Impedance . . . . . 50 ohm
Phase Accuracy . . . . . ± 2.0°

### Available Models

| MODEL | SEX | DIMENSION "A" | | OFFSET LENGTH | |
|---|---|---|---|---|---|
| | | INCHES | (CM) | INCHES | (CM) |
| 360D | female | 0.700 | (1.1780) | 0 | (0) |
| 360B | male | 0.610 | (1.5494) | 0 | (0) |

### Reference Dimensions




360D 360B



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# 7mm Precision Reference Fixed Flush Shorts

## Model Series 2615

### *Description*

These true coplannar, reference fixed shorts are designed to terminate an APC7 connector at its mating plane, and are used to establish a reference plane in systems as well as in loss measurements. 2615A3 is a flat face/flat plane short, 2615B3 includes a collet contact to support the inner conductor of series 2653 reference air lines, and 2615D3 has a precision hole (for the same purpose) in place of the collet contact. Two of these shorts are included in Maury 7mm VNA calibration kits; 2615D3 is a component of 2650 series kits , and 2515B3 is a component of 2660 series kits. All of the models shown here are also sold separately as replacement parts or spares.




### *Specifications*

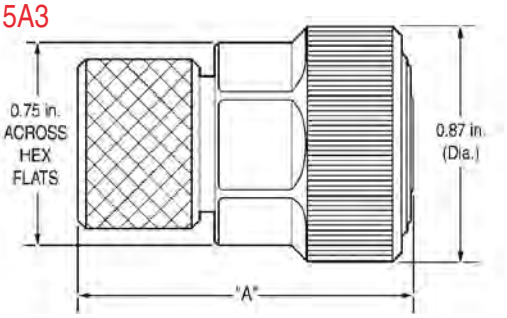
Frequency Range . . . . . DC to 18.0 GHz
Minimum Reflection Coefficient . . . . . 0.995
Nominal Impedance . . . . . 50 ohm
Phase Accuracy . . . . . ± 0.3°

### *Available Models*

| MODEL | "A" DIMENSION | | OFFSET LENGTH | |
|---|---|---|---|---|
| | INCHES | (CM) | INCHES | (CM) |
| 2615A3 | 1.250 | (3.1750) | 0 | (0) |
| 2615B3 | 1.250 | (3.1750) | 0 | (0) |
| 2615D3 | 1.250 | (3.1750) | 0 | (0) |

### *Dimensions – Inches (CM)*

2615A3




# 7mm Precision Fixed Offset Shorts

## Model Series 2649

### *Description*

These very low loss fixed offset shorts are offset electrically from the reference plane of the APC7 connector established by 2615 series flush shorts. The offset length is held to ±0.0025cm. A set of four (2649A/B/C/D) in a foam-lined wood instrument case can be ordered as model 2649R.




### *Specifications*

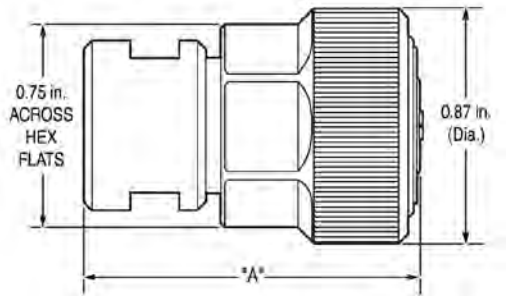
Frequency Range . . . . . DC to 18.0 GHz
Minimum Reflection Coefficient . . . . . 0.98
Nominal Impedance . . . . . 50 ohm
Phase Accuracy . . . . . ± 2.0°

### *Available Models*

| MODEL FREQ | "A" DIMENSION | | RELATIVE OFFSET LENGTH [1] | | 1/4-λ |
|---|---|---|---|---|---|
| | INCHES | (CM) | INCHES | (CM) | (GHz) |
| 2649A | 1.583 | (4.0208) | 0.9833 | (2.4976) | 3.00 |
| 2649B | 1.091 | (2.7711) | 0.4915 | (1.2484) | 6.00 |
| 2649C | 1.250 | (3.1750) | 0.2892 | (0.7346) | 10.20 |
| 2649D | 1.250 | (3.1750) | 0.2070 | (0.5258) | 14.24 |

[1] Relative to the 0 (zero) offset of the 2615 series.

### *Reference Dimensions*




2649C

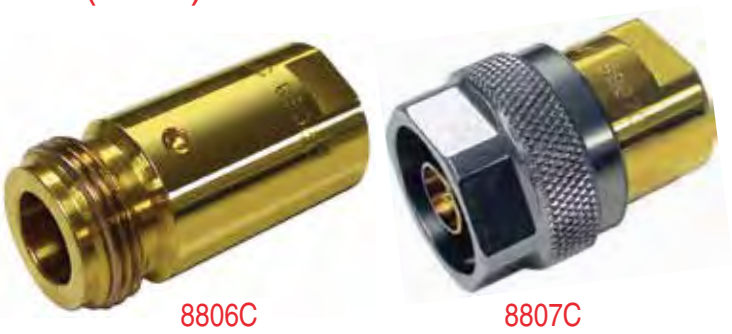

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# Type N Precision Fixed Offset Shorts

## Model Series 8806 (female) and 8807 (male)

### *Description*

These very low loss fixed offset shorts are offset electrically from the reference plane of the type N connector. The 8806C and 8807C are included as components of Maury's 8850 and 8860 VNA calibration kits. The 8806G is also included in the 8860 kit for use in TRL calibrations. The other models in these series may be purchased separately to complement those included in the kits.

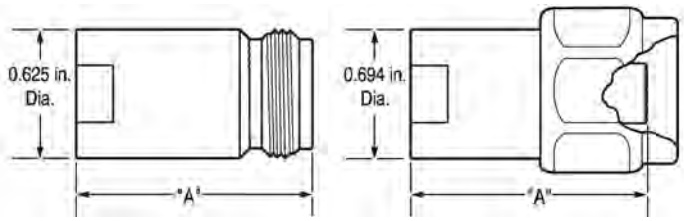


8806C 8807C

### *Specifications*

Frequency Range . . . . . DC to 18.0 GHz
Minimum Reflection Coefficient . . . . . 0.98
Nominal Impedance . . . . . 50 ohm
Phase Accuracy . . . . . ± 2.0°

### *Reference Dimensions*




8806C 8807C

### *Available Models*

| MODEL | SEX | "A" DIMENSION | | OFFSET LENGTH | |
|---|---|---|---|---|---|
| | | INCHES | (CM) | INCHES | (CM) |
| 8806A | female | 1.942 | (4.9327) | 0.9833 | (2.498) |
| 8806B | female | 1.451 | (3.6855) | 0.4915 | (1.248) |
| 8806C | female | 1.248 | (3.1699) | 0.2892 | (0.735) |
| 8806D | female | 1.166 | (2.9616) | 0.2070 | (0.526) |
| 8806G [1] | female | 1.456 | (3.6982) | 0.4972 | (1.263) |
| 8807A | male | 1.791 | (4.5491) | 1.1913 | (3.026) |
| 8807B | male | 1.300 | (3.3020) | 0.6995 | (1.777) |
| 8807C [1] | male | 1.097 | (2.7864) | 0.4972 | (1.263) |
| 8807D | male | 1.015 | (2.5781) | 0.4150 | (1.054) |

[1] 8806G and 8807C are matched (have the same electrical length) for use in TRL calibrations.

# TNC [1] Precision Fixed Offset Shorts

## 8606, 8607, and 8615 Series

### *Description*

These very low loss fixed offset shorts are offset electrically from the reference plane of the TNC connector. The offset length is held to ±0.005cm.

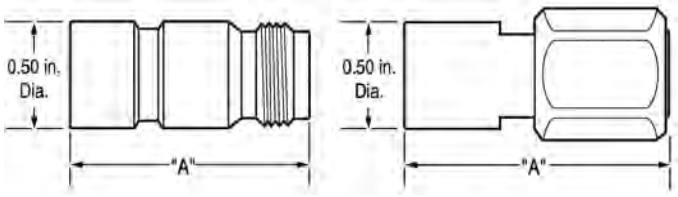


8615A 8615B

### *Specifications*

Frequency Range . . . . . DC to 18.0 GHz
Minimum Reflection Coefficient . . . . . 0.98
Nominal Impedance . . . . . 50 ohm
Phase Accuracy . . . . . ± 5.0°

### *Reference Dimensions*




8606A 8607A

[1] Precision TNC per Maury Data Sheet 5E-053.

### *Available Models*

| MODEL | SEX | "A" DIMENSION | | OFFSET LENGTH | | 1/4- λ FREQ (GHz) |
|---|---|---|---|---|---|---|
| | | INCHES | (CM) | INCHES | (CM) | |
| 8615A [2] | female | 1.431 | (3.6347) | 0.5000 [2] | (1.2700) | REF |
| 8606A | female | 2.123 | (5.3824) | 1.1920 | (3.0277) | 3.00 |
| 8606B | female | 1.777 | (4.5136) | 0.8460 | (2.1488) | 6.00 |
| 8606C | female | 1.635 | (4.1529) | 0.7035 | (1.7869) | 10.20 |
| 8606D | female | 1.577 | (4.0056) | 0.6455 | (1.6396) | 14.25 |
| 8615B [2] | male | 1.300 | (3.3020) | 0.7000 [2] | (1.7780) | REF |
| 8607A | male | 1.992 | (5.0597) | 1.1820 | (3.0023) | 3.00 |
| 8607B | male | 1.646 | (4.1808) | 0.8360 | (2.1234) | 6.00 |
| 8607C | male | 1.504 | (3.8202) | 0.6935 | (1.7615) | 10.20 |
| 8607D | male | 1.446 | (3.6728) | 0.6355 | (1.6142) | 14.25 |

[2] Reference shorts and reference offset lengths for these two model series. The relative offset length of other models in each series is derived by subtracting their offset lengths (show in this table) from the offset length of their appropriate reference short (i.e., 8615A or 8615B).



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# AFTNC[1] Precision Fixed Offset Shorts

## Models 8686A (female) and 8687A (male)

### Description

These fixed offset shorts are reference plane shorts that are used to establish reference planes in transmission systems and as key elements in the calibration of vector network analyzers (VNA), including the Keysight PNA series. They are sold as part of Maury's 8680A and 8680B series VNA calibration kits, or may be purchased separately as replacement parts or spares.

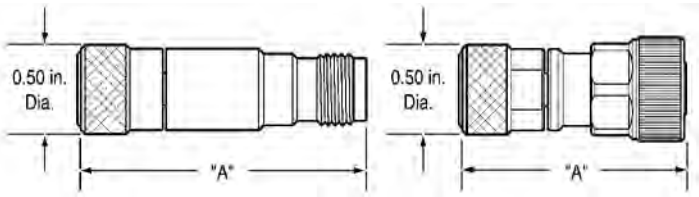


8686A 8687A

### Specifications

Frequency Range . . . . . DC to 20.0 GHz
Minimum Reflection Coefficient . . . . . 0.98
Nominal Impedance . . . . . 50 ohm
Phase Accuracy . . . . . ± 2.0°

### Reference Dimensions




8686A 8687A

### Available Models

| MODEL | SEX | "A" DIMENSION | | OFFSET LENGTH | |
|---|---|---|---|---|---|
| | | INCHES | (CM) | INCHES | (CM) |
| 8686A | female | 1.744 | (4.4298) | 0.9833 | (2.498) |
| 8687A | male | 1.366 | (3.4964) | 0.4915 | (1.248) |

1 Precision AFTNC per MIL-C-87104/2 per Maury data sheet 5E-056.

# TNCA[2] Precision Fixed Offset Shorts

## Models 8676A (female) and 8677A (male)

### Description

These fixed offset shorts are reference plane shorts that are used to establish reference planes in transmission systems and as key elements in the calibration of vector network analyzers (VNA), including the Keysight PNA series. They are sold as part of Maury's 8670A and 8670B series VNA calibration kits, or may be purchased separately as replacement parts or spares.

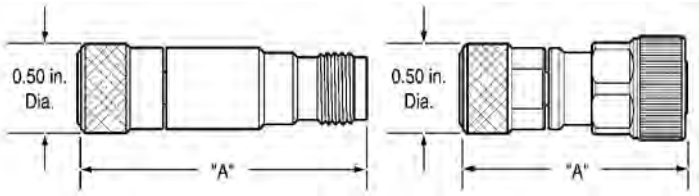


8676A 8677A

### Specifications

Frequency Range . . . . . DC to 18.0 GHz
Minimum Reflection Coefficient . . . . . 0.98
Nominal Impedance . . . . . 50 ohm
Phase Accuracy . . . . . ± 2.0°

### Reference Dimensions




8676A 8677A

### Available Models

| MODEL | SEX | "A" DIMENSION | | OFFSET LENGTH | |
|---|---|---|---|---|---|
| | | INCHES | (CM) | INCHES | (CM) |
| 8676A | female | 1.744 | (4.4298) | 0.9833 | (2.498) |
| 8677A | male | 1.366 | (3.4964) | 0.4915 | (1.248) |

2 Precision TNCA per MIL-STD 328A per Maury data sheet 5E-058.


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# 14mm Precision Reference Fixed Flush Shorts

## Model Series 2415

### Description

These true coplanar, reference fixed flush shorts are designed to terminate an 14mm connector at its mating plane, and are used to establish a reference plane in systems as well as in loss measurements. 2415A1 is a flat face/flat plane short, 2415B1 includes a collet contact to support the inner conductor of series 2453 reference air lines, and 2415D1 has a precision hole (for the same purpose) in place of the collet contact. The 2415D1 is included as a component of Maury's 2450 VNA calibration kits. The other models in these series may be purchased separately to complement those included in the kits.

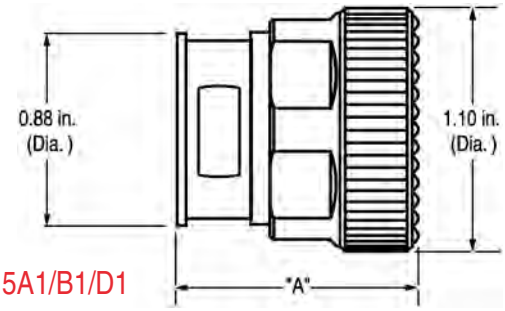


2415A1 2415B1 2415D1

### Specifications

Frequency Range . . . . . DC to 8.5 GHz
Minimum Reflection Coefficient . . . . . 0.995
Nominal Impedance . . . . . 50 ohm
Connector . . . . . 14mm (mating compatible with GR900)
Phase Accuracy . . . . . ± 0.2°

### Reference Dimensions




2415A1/B1/D1

### Available Models

| MODEL | "A" DIMENSION | | OFFSET LENGTH | |
|---|---|---|---|---|
| | INCHES | (CM) | INCHES | (CM) |
| 2415A1 | 1.00 | (2.45) | 0.00 | (0.00) |
| 2415B1 | 1.00 | (2.45) | 0.00 | (0.00) |
| 2415D1 | 1.00 | (2.45) | 0.00 | (0.00) |

# LCP/OSP™ Fixed Offset Shorts

## Model Series 8781

### Description

These fixed offset shorts are used to establish reference planes in transmission systems and as key elements in the calibration of vector network analyzers (VNA), including the Keysight PNA series. They are sold as part of Maury's 8780 series VNA calibration kits, or may be purchased separately as replacement parts or spares.

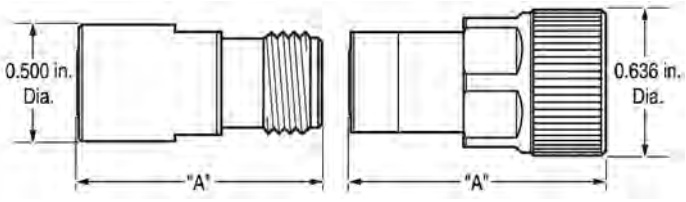


8781A 8781B

### Specifications

Frequency Range . . . . . DC to 18.0 GHz
Minimum Reflection Coefficient . . . . . 0.98
Nominal Impedance . . . . . 50 ohm
Phase Accuracy . . . . . ± 2.0°

### Reference Dimensions




8781A 8781B

### Available Models

| MODEL | SEX | "A" DIMENSION | | OFFSET LENGTH | |
|---|---|---|---|---|---|
| | | INCHES | (CM) | INCHES | (CM) |
| 8781A | female | 1.050 | (2.6670) | 0.3270 | (0.8306) |
| 8781B | male | 1.103 | (2.8016) | 0.3270 | (0.8306) |


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# 7-16 Precision Fixed Offset Shorts

## Model Series 2714

### Description

The 2714A and 2714B are precision 7-16 fixed offset shorts designed to operate from DC to 7.5 GHz. These shorts establish a measurement plane of 2.00cm offset from the connector reference plane for compatibility with the companion 2716 series opens. See page 91.

### Specifications

Frequency Range . . . . . DC to 7.5 GHz
Minimum Reflection Coefficient . . . . . 0.99
Nominal Impedance . . . . . 50 ohm
Phase Accuracy . . . . . DC to 4.0 GHz = ± 0.60°
4.0 to 7.5 GHz = ± 0.85°

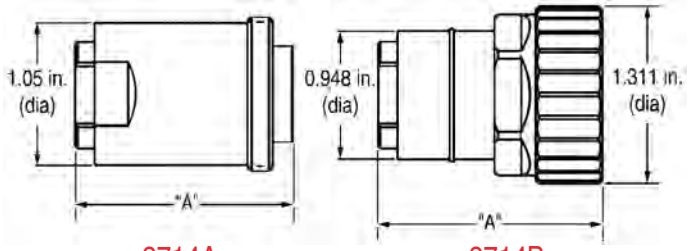
### Available Models

| MODEL | SEX | "A" DIMENSION | | OFFSET LENGTH | |
|---|---|---|---|---|---|
| | | INCHES | (CM) | INCHES | (CM) |
| 2714A | female | 1.707 | (4.3358) | 0.7897 | (2.006) |
| 2714B | male | 1.777 | (4.5136) | 0.7897 | (2.006) |
| 2714C | female | 2.886 | (7.3304) | 1.9680 | (4.999) |
| 2714D | male | 2.955 | (7.5057) | 1.9680 | (4.999) |



2714A 2714B

### Reference Dimensions




2714A 2714B

# General Purpose Fixed Offset Shorts

### Description

The defining characteristic of this class of fixed offset shorts is their suitability for general purpose vector network analyzer (VNA) calibration, where the reference plane (or an offset established by another component) has a wider range of tolerance than would be desirable for high precision, metrology grade calibrations.



361N2



361P2

### Specifications

| MODEL | CONNECTOR TYPE | FREQUENCY RANGE (GHz) | | |
|---|---|---|---|---|
| 8884A | Type N 75 ohm female | DC | — | 2.0 |
| 8884B | Type N 75 ohm male | | | |
| 8445A | HN female | DC | — | 8.0 |
| 8445B1 | HN male | | | |
| 8455A | SC female | DC | — | 10.0 |
| 8455B1 | SC male | | | |
| 361N2 | BNC female | DC | — | 12.4 |
| 361P2 | BNC male | | | |
| 8584A1 | BNC 75 ohm female | DC | — | 12.0 |
| 8584B1 | BNC 75 ohm male | | | |


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# Waveguide Fixed Flush Shorts

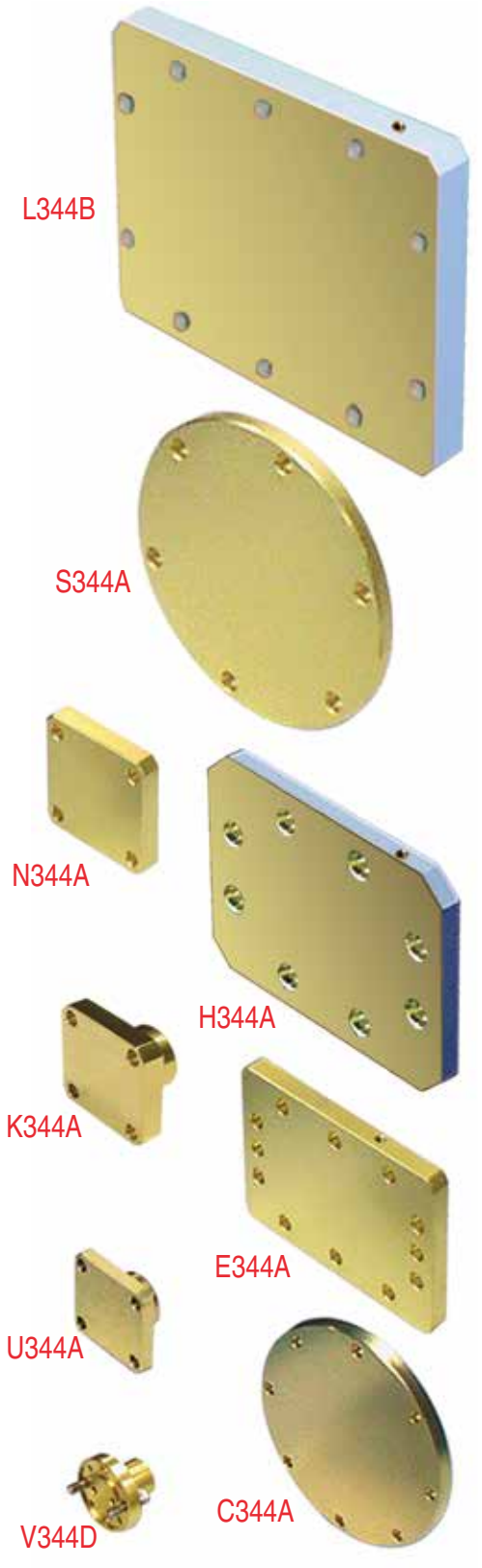
## Model Series 344

### *Description*

These machined fixed shorts are designed to terminate round or rectangular waveguide connectors at the mating plane. They are used to establish a reference plane in systems and in making loss measurements. They are flat face/flat plane shorts that cover frequencies from 1.12 to 110.0 GHz. They may be ordered with user-specified flanges; with or without Maury precision indexing holes. These shorts are included as components of Maury's 7005/6/7 series VNA calibration kits as listed on pages 56–60. They may also be purchased separately as spare or replacement parts for these kits.

### *Available Models*

| MODEL | MATES WITH EQUIVALENT FLANGE | EIA WR NUMBER | FREQUENCY RANGE (GHz) |
|---|---|---|---|
| L344B | CPR650F | 650 | 1.12 — 1.7 |
| R344B | CPR430F / UG435A/U | 430 | 1.7 — 2.6 |
| D344B | CPR340F | 340 | 2.2 — 3.3 |
| S344A | UG53/U | 284 | 2.6 — 3.95 |
| S344B | CPR284F | | |
| S344C | CMR284 | | |
| E344B | CPR229F | 229 | 3.3 — 4.9 |
| E344C | CMR229 | | |
| G344A | UG149A/U | 187 | 3.95 — 5.85 |
| G344B | CPR187F | | |
| G344C | CMR187 | | |
| F344B | CPR159F | 159 | 4.9 — 7.05 |
| F344C | CMR159 | | |
| C344A | UG344/U | 137 | 5.85 — 8.2 |
| C344B | CPR137F | | |
| C344C | CMR137 | | |
| H344A | UG51/U | 112 | 7.05 — 10.0 |
| H344B | CPR112F | | |
| H344C | CMR112 | | |
| X344A | UG39/U | 90 | 8.2 — 12.4 |
| X344B | CPR90F | | |
| X344C | CMR90 | | |
| M344A | MPF75 | 75 | 10.0 — 15.0 |
| P344A | UG419U | 62 | 12.4 — 18.0 |
| N344A | MPF51 | 51 | 15.0 — 22.0 |
| K344A | UG595/U | 42 | 18.0 — 26.5 |
| K344D | UG425/U | | |
| K344E | UG595/U [1] | 42 | 18.0 — 26.5 |
| [3] | — | 34 | 22.0 — 33.0 |
| U344A | UG599/U | 28 | 26.5 — 40.0 |
| [3] | UG381/U | | |
| [3] | UG383/U | 22 | 33.0 — 50.0 |
| [3] | — | 19 | 40.0 — 60.0 |
| V344D | UG385/U | 15 | 50.0 — 75.0 |
| V344E | UG385/U [2] | 15 | 50.0 — 75.0 |
| [4] | UG387U | 12 | 60.0 — 90.0 |
| [4] | — | 10 | 75.0 — 110.0 |




[1] Same as K344D with index holes.
[2] Same as V344D with index holes.
[3] Use K344D.
[4] Use V344D.


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# Waveguide Fixed Offset Shorts

## Model Series 340



### *Description*

Offset shorts with 1/8 and 3/8 wavelength offsets are considered one of the more accurate means of obtaining a 180° phase difference in waveguide. Using these single-piece devices will reduce the number of flange interfaces during calibration. This helps to maintain an essentially constant magnitude of current flow across the calibration plane.

The chart below lists the offset shorts available from Maury. Those in rectangular guide are nominally 1/8 and 3/8 wavelength offset at a frequency near the waveguide band center. These will not be the exact band center as the frequency is chosen to equalize the phase differences at the band edges.

### *Available Models*

| BAND | EIA WR NUMBER | FREQUENCY RANGE (GHz) | MODEL | OFFSET (cm) | DELAY (ps) [1] |
|---|---|---|---|---|---|
| L | WR650 | 1.12 — 1.7 | L340A1 | 3.581 | 119.488 |
| | | | L340A3 | 10.744 | 358.497 |
| R | WR430 | 1.7 — 2.6 | R340F1 | 2.336 | 77.946 |
| | | | R340F3 | 7.010 | 233.904 |
| S | WR284 | 2.6 — 3.95 | S340B1 | 1.524 | 50.852 |
| | | | S340B2 | 4.572 | 152.555 |
| E | WR229 | 3.3 — 4.9 | E340B3 | 1.359 | 45.346 |
| | | | E340B4 | 4.077 | 136.038 |
| G | WR187 | 3.95 — 5.85 | G340B1 | 1.026 | 34.235 |
| | | | G340B3 | 3.078 | 102.704 |
| F | WR159 | 4.9 — 7.05 | F340C1 | 0.815 | 27.194 |
| | | | F340C3 | 2.446 | 81.616 |
| C | WR137 | 5.85 — 8.2 | C340F1 | 0.686 | 22.890 |
| | | | C340F3 | 2.058 | 68.670 |
| H | WR112 | 7.05 — 10.0 | H340B1 | 0.571 | 19.067 |
| | | | H340B3 | 1.714 | 57.191 |
| HS | WR102 | 7.0 — 11.0 | HS340A | 0.558 | 16.684 |
| | | | HS340B | 1.676 | 55.923 |
| X | WR90 | 8.2 — 12.4 | X340B1 | 0.483 | 16.116 |
| | | | X340B3 | 1.448 | 48.316 |
| M | WR75 | 10.0 — 15.0 | M340C1 | 0.396 | 13.213 |
| | | | M340C3 | 1.189 | 39.674 |
| P | WR62 | 12.4 — 18.0 | P340A1 | 0.352 | 11.745 |
| | | | P340A2 | 1.055 | 35.202 |
| N | WR51 | 15.0 — 22.0 | N340A | 0.267 | 8.909 |
| | | | N340B | 0.800 | 26.694 |
| K | WR42 | 18.0 — 26.5 | K340A1 | 0.251 | 8.365 |
| | | | K340A2 | 0.752 | 25.095 |
| U | WR28 | 26.5 — 40.0 | U340B | 0.150 | 5.005 |
| | | | U340C | 0.450 | 15.015 |
| J | WR22 | 33.0 — 50.0 | J340A1 | 0.120 | 4.007 |
| | | | J340B1 | 0.360 | 12.022 |
| V | WR15 | 50.0 — 75.0 | V340A1 | 0.080 | 2.669 |
| | | | V340A3 | 0.240 | 8.008 |
| Y | WR12 | 60.0 — 90.0 | Y340A1 | 0.067 | 2.245 |
| | | | Y340A3 | 0.202 | 6.729 |
| Z | WR10 | 75.0 — 110.0 | Z340A1 | 0.054 | 1.802 |
| | | | Z340A3 | 0.162 | 5.405 |

[1] Offset delay is calculated without consideration for the dispersive effect of waveguide, that is, assuming the short is in air dielectric coaxial line. This conforms to the convention established for Keysight network analyzers. Anritsu analyzers use the actual mechanical offset in centimeters.



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# Sliding Shorts

## General Information

A sliding short is a movable short circuited termination in a precision air line which is used in a variety of laboratory measurement applications. These devices are used to establish a reference plane in a transmission system, as tuning elements in the development of microwave components (mixers, amplifiers, etc.), and tuning high precision CW reflectometer systems. An important application is the calibration of vector network analyzers (VNA). The use of a sliding short for such a calibration is particularly effective when the VNA is to be used for the measurement of highly reflective devices.

The primary criteria for a quality coaxial sliding short are a) a precision transmission structure (air line), b) consistent low noise contacts on the inner and outer conductors and c) a precision connector. Maury manufactures coaxial sliding shorts with a range of performance and operational convenience features. Among the classes available are modular units with interchangeable connectors, high precision devices with dedicated connectors, and rugged general purpose units.

# Modular Sliding Shorts

## Models 2508A, 2518A, 8036A, 8779A, and 8779B

### *Features*

- *Broad Frequency Range*
- *Precision Air Lines*
- *Interchangeable Connectors*




### *Description*

The 2508A, 2518A, and 8036A sliding shorts are true modular instruments. These units are provided with interchangeable connector bodies and center conductors so that measurements may be made in type N (female or male), or 7mm with the 2508A and 2518A, or 3.5mm (female or male) with the 8036A.

The connectors used on these units are air-dielectric (beadless) and the center conductor is movable; therefore, with the aid of an appropriate connector gage, the center pin of the connector can be set to the desired interface condition.

### *Specifications*

Frequency Range . . . . . See Available Models Chart

VSWR (excluding transmission line loss):

2.92mm . . . . . 4.0 to 18.0 GHz, 100:1
18 to 26.5 GHz, 75:1
26.5 to 40.0 GHz, 50:1

3.5mm . . . . . 2.0 to 18.0 GHz, 100:1
18 to 26.5 GHz, 75:1
26.5 to 34.0 GHz, 50:1

7mm . . . . . 2.0 to 18 GHz, 100:1

Type N . . . . . 2.0 to 18 GHz, 100:1

Impedance . . . . . 50 ohm ±0.3%

Travel . . . . . > 1/2-λ at the lowest rated frequency

### *Available Models*

| MODEL | FREQUENCY RANGE (GHz) | CONNECTOR | AIR LINE ACCURACY [1] |
|---|---|---|---|
| 2508A | 0.9 – 18.0 | LPC7 [2], Type N female and male | 56 dB |
| 2518A | 1.8 – 18.0 | | |
| 8036A | 2.0 – 34.0 | 3.5mm female and male | 44 dB |
| 8779A1 | 4.0 – 20.0 | 2.92mm female | 42 dB |
| | 20.0 – 40.0 | | 40 dB |
| 8779B1 | 4.0 – 20.0 | 2.92mm male | 42 dB |
| | 20.0 – 40.0 | | 40 dB |

[1] Equivalent return loss of the air line impedance (50 ohm ref.)

[2] Air interface connector with a spring loaded, self-centering center pin that mates with standard 7mm connectors.



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# Sliding Shorts
## High Precision

### *Features*

- *0.9 to 18.0 GHz*
- *Precision Air Lines*
- *Dedicated Connectors*




### *Description*

These models are movable shorts with dedicated connectors in precision air lines. The inherent low reflection and accurate transmission line of these instruments, coupled with efficient beryllium copper inner and outer conductor contacting fingers, provide an excellent short circuit. The travel of the shorting plane of these instruments is at least 1/2 wavelength at the lowest rated frequency to permit reversal of the reflection phase.

### *Specifications*

Frequency Range . . . . . See Available Models Chart
VSWR (excluding transmission line loss) . . . . . 100:1 minimum
Impedance . . . . . 50 ohm ±0.3%
Travel . . . . . > 1/2 wavelength at the lowest rated frequency

### *Available Models*

| MODEL | FREQ. RANGE (GHz) | CONNECTOR | AIR LINE ACCURACY [1] |
|---|---|---|---|
| 1959A | 1.8 – 18.0 | SMA (f) | 56 dB |
| 1959B | | SMA (m) | |
| 2604A | 0.9 – 18.0 | 7mm | |

1 Equivalent return loss of the air line impedance (50 ohm ref.)

# General Purpose Sliding Shorts
## Model Series 1909 and 1978

### *Specifications*

Frequency Range . . . . . See Available Models Chart
Impedance . . . . . 50 ohm
Travel . . . . . 1/2 wavelength at the lowest rated frequency
Connectors . . . . . See Available Models Chart

### *Available Models*

| MODEL | FREQ. RANGE (GHZ) | CONNECTOR | SHORT TRAVEL (IN.) | LENGTH CLOSED (IN.) |
|---|---|---|---|---|
| 1909A1<br>1909A2 | 0.2 – 0.5 | SMA (f)<br>SMA (m) | 30.0 | 32.6 |
| 1909B1<br>1909B2 | 0.4 – 1.0 | SMA (f)<br>SMA (m) | 15.0 | 17.6 |
| 1909C1<br>1909C2 | 0.8 – 4.0 | SMA (f)<br>SMA (m) | 7.5 | 10.1 |
| 1909D1<br>1909D2 | 2.0 – 12.0 | SMA (f)<br>SMA (m) | 3.0 | 5.6 |
| 1978A1<br>1978A2 | 0.2 – 0.5 | Precision N (f)<br>Precision N (m) | 30.0 | 32.6 |
| 1978B1<br>1978B2 | 0.4 – 1.0 | Precision N (f)<br>Precision N (m) | 15.0 | 17.6 |
| 1978C1<br>1978C2 | 0.8 – 4.0 | Precision N (f)<br>Precision N (m) | 7.5 | 10.1 |
| 1978D1<br>1978D2 | 2.0 – 12.0 | Precision N (f)<br>Precision N (m) | 3.0 | 5.6 |





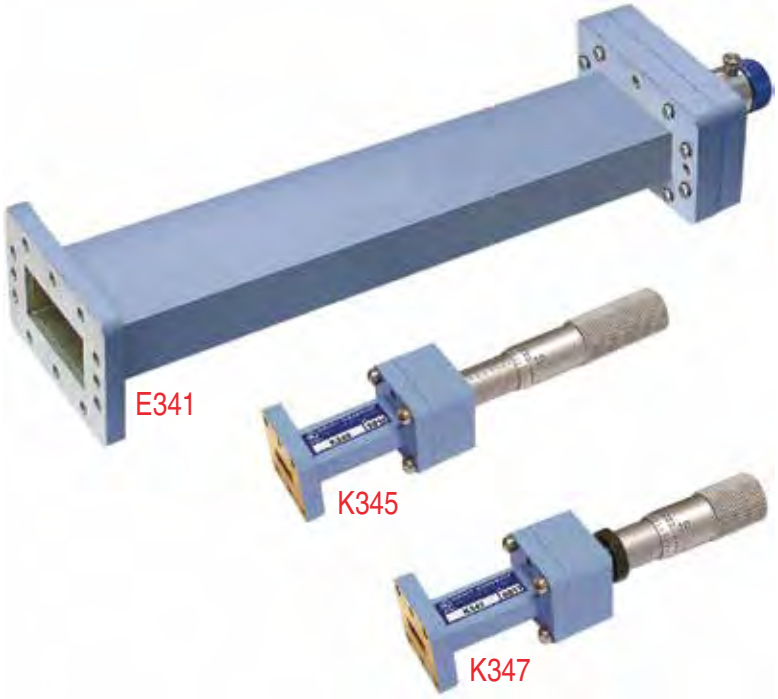
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# Waveguide Sliding Shorts

## Series 341, 345 and 347

### *Description*

Maury waveguide sliding shorts are convenient, low loss, movable shorts for use in a variety of microwave techniques. They can be used with waveguide tees as a variable shunt for tuning or impedance matching applications and they are a necessary device for tuning high performance tuned reflectometer systems. They are valuable for establishing a reference impedance for the calibration and error analysis of waveguide measurement systems. Maury offers three grades of waveguide sliding shorts; series 341, featuring an un-calibrated sliding shaft with a position lock (called an "un-calibrated drive"; series 345, featuring a 0.001-inch resolution micrometer drive (or "calibrated drive"); and series 347 high precision drive, featuring a sliding shaft with a position lock for rapid adjustment, plus a 0.001-inch resolution micrometer for fine adjustment.




### *Available Models*

| MODEL | DRIVE TYPE | EIA WR NUMBER | FREQUENCY RANGE (GHz) | | | EQUIVALENT FLANGE |
|---|---|---|---|---|---|---|
| R341B | Un-calibrated | 430 | 1.7 | — | 2.6 | CPR430F |
| S341 | Un-calibrated | 284 | 2.6 | — | 3.95 | UG53/U |
| E341B | Un-calibrated | 229 | 3.3 | — | 4.9 | CPR229F |
| G341 | Un-calibrated | 187 | 3.95 | — | 5.85 | UG149A/U |
| F341B | Un-calibrated | 159 | 4.90 | — | 7.05 | CPR159F |
| C345 | Calibrated | 137 | 5.85 | — | 8.2 | UG344/U |
| H345 | Calibrated | 112 | 7.05 | — | 10.0 | UG51/U |
| X345 | Calibrated | 90 | 8.2 | — | 12.4 | UG39/U |
| M345 | Calibrated | 75 | 10.0 | — | 15.0 | MPF75 |
| P345 | Calibrated | 62 | 12.4 | — | 18.0 | UG419/U |
| K345 | Calibrated | 42 | 18.0 | — | 26.5 | UG595/U |
| U345 | Calibrated | 28 | 26.5 | — | 40.0 | UG599/U |
| S347 | High Precision | 284 | 2.6 | — | 3.95 | UG53/U |
| C347 | High Precision | 137 | 5.85 | — | 8.2 | UG344/U |
| H345 | High Precision | 112 | 7.05 | — | 10.0 | UG51/U |
| X347A | High Precision | 90 | 8.2 | — | 12.4 | UG39/U |
| M347 | High Precision | 75 | 10.0 | — | 15.0 | MPF75 |
| P347 | High Precision | 62 | 12.4 | — | 18.0 | UG419/U |
| K347 | High Precision | 42 | 18.0 | — | 26.5 | UG595/U |
| U347 | High Precision | 28 | 26.5 | — | 40.0 | UG599/U |
| J347A | High Precision | 22 | 33.0 | — | 50.0 | UG383/U |


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# Opens

## General Information

Shielded, coaxial opens are used in the calibration of vector network analyzers to provide a nominal 180° phase offset from a compatible reference short over a wide range of frequencies.

At these frequencies, open circuit terminations are inherently imperfect. Shielding the open essentially eliminates radiation loss, but creates a residual frequency-sensitive capacitance. An accurate knowledge of the open's effective capacitance is essential to an accurate calibration of the analyzer.

Maury opens are characterized for effective capacitance versus frequency by means of a fourth order polynomial curve fit, and the nominal capacitance coefficients are provided with each unit. We offer several innovative designs that improve the consistency and repeatability of the open's capacitance coefficients resulting in improved effective source match of the calibrated VNA [1].

One design (seen in the 14mm and 7mm models shown below) uses a beadless captivated dielectric rod in place of the center conductor contact. This rod depresses the spring-loaded contact of the test port connector so that it is flush with the outer conductor mating plane. This creates highly accurate, precisely repeatable open circuit conditions which improve the calibration effectiveness and measurement accuracy of the open.



Another design (seen in most of the sexed models listed below) uses a center contact that is captivated and set at the factory to be essentially flush with the outer conductor mating plane, thereby eliminating dependence on test port connector tolerances and adding a high degree of performance consistency to the open.

The 371N1/P1, 8585A/B, and 8885A/B models are designed for limited frequency ranges as determined by their connector types. Models 8885A and 8885B have shielded shells without center conductors or supporting dielectric rods.

In all cases, the specification "Phase Accuracy" is defined as phase deviation from a nominal unit.

### *Specifications and Available Models*

| MODEL | SEX | CONNECTOR TYPE | FREQUENCY RANGE (GHZ) | NOMINAL IMPEDANCE | PHASE ACCURACY | MINIMUM REFLECTION COEFFICIENT |
|---|---|---|---|---|---|---|
| 7948A1<br>7948B1 | female<br>male | 2.4mm | DC – 50.0 | 50 ohm | ±2.0° | 0.98 |
| 8773A1<br>8773B1 | female<br>male | 2.92mm (K) | DC – 40.0 | 50 ohm | ±1.5° | 0.98 |
| 8048A1<br>8048B1 | female<br>male | 3.5mm | DC – 26.5 | 50 ohm | ±1.4° | 0.98 |
| 2616D3 | — | 7mm | DC – 18.0 | 50 ohm | ±3.0° | 0.995 |
| 8809B1<br>8810B1 | female<br>male | Type N | DC – 18.0 | 50 ohm | ±2.0° | 0.99 |
| 8609B<br>8610B | female<br>male | TNC | DC – 18.0 | 50 ohm | ±5.0° | 0.98 |
| 8685A<br>8685B | female<br>male | AFTNC | DC – 20.0 | 50 ohm | ±2.0° | 0.98 |
| 8675A<br>8675B | female<br>male | TNCA | DC – 20.0 | 50 ohm | ±2.0° | 0.98 |
| 8782A<br>8782B | female<br>male | OSP™ | DC – 18.0 | 50 ohm | ±2.0° | 0.99 |
| 371N2<br>371P2 | female<br>male | BNC | DC – 12.4 | 50 ohm | ±5.0° | 0.98 |
| 2416D1 | — | 14mm (GR900) | DC – 8.5 | 50 ohm | ±0.2° | 0.997 |
| 2716A<br>2716B | female<br>male | 7-16 | DC – 7.5 | 50 ohm | DC – 4.0 = ±1.00°<br>4.0 – 7.5 = ±1.25° | 0.99 |
| 8585A1<br>8585B1 | female<br>male | BNC | DC – 12.0 | 75 ohm [2] | DC – 2.0 = ±1.0°<br>2.0 – 3.0 = ±2.0°<br>3.0 – 12.0 = ±6.0° | 0.98 |
| 8885A<br>8885B | female<br>male | Type N | DC – 4.0 | 75 ohm [2] | ±1.0° | 0.98 |

[1] See Maury data sheet 5C-027.

[2] The 8585 and 8885 series opens are for use in 75 ohm calibrations only, and should never be mated to 50 ohm connectors, as this will damage to the 75 ohm female center conductor contact, and would produce an unreliable, unstable electrical connection.



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# Precision Air Lines

## General Information

Coaxial air lines are air-dielectric transmission lines with highly accurate dimensions that can be used as fundamental impedance standards in measurement and calibration applications, and may also be used to establish reference positions for measurements.

Maury offers air lines with bead supported and/or beadless connectors in a variety of popular types including, 1.85mm, 2.4mm, 2.92mm (K), 3.5mm, 7mm, type N, 14mm, and 7-16.

Bead supported air lines offer greater convenience and easier connections (the center conductor is automatically aligned by the dielectric bead for easy connection); beadless air lines offer better impedance and electrical length accuracies, as well as lower VSWR (the center conductor floats free in the air line body, and the male connector nut is retractable to facilitate insertion of the center conductor contact before the thread- on connection tightened.

The photos at the right (above) show end views of two type N air lines. On the left is a model 2503F (representing Maury's bead supported design) and on the right is a model 2553T5 (representing Maury's beadless design). The low-loss dielectric bead in the 2503F keeps the center conductor precisely centered in the body of the air line. The photo on the right shows how the unsupported center conductor of the 2553T5 has shifted to the left, and floats freely in the air line body until it is connected at both ends. The beadless design is a true "air" line in that it does not include any discontinuities caused by having the center conductor supported by dielectric beads.



Bead-Supported  Unsupported (air dielectric)

Beadless air lines are often used as "sample holders" where samples of various materials can be inserted in the air line and measured to determine the material's dielectric properties.

Specifications given for the air line models in this section include the odd 1/4-λ frequency rating. This rating indicates the frequencies at which the electrical length is an odd multiple of a 1/4 wavelength where n = zero or an integer.

# 1.85mm Beadless Air Lines

## Model Series 7843

### *Features*

- *DC to 67.0 GHz (Operates to 70.0 GHz)*
- *Virtually Reflectionless*
- *1.85mm Connectors*



7843S3.00

7843S1.15

7843S0.96

### *Description*

These reference air lines are beadless 1.85mm coaxial transmission lines which are held to extremely tight tolerances to provide a highly accurate 50 ohm impedance standard. They are rated for a frequency range from DC to 67 GHz and are virtually reflectionless. Fabricated from beryllium copper, they are gold-plated to prevent tarnishing.

### *Specifications*

Frequency Range . . . . . DC to 67.0 GHz
Electrical Length . . . . . See Available Models Chart
Electrical Length Accuracy . . . . . 0.0025cm
Minimum Return Loss (excluding connector interface) . . . 48 dB
Nominal Impedance . . . . . 50 ohm

### *Available Models*

| MODEL | CONNECTORS | ELECTRICAL LENGTH (cm) | ODD 1/4-WAVELENGTH FREQUENCY (GHz) | |
|---|---|---|---|---|
| 7843S0.96 | 1.85mm female to male | 0.96 | (2n + 1) | 7.8 |
| 7843S1.15 | 1.85mm female to male | 1.15 | (2n + 1) | 6.5 |
| 7843S3.00 | 1.85mm female to male | 3.00 | (2n + 1) | 2.5 |


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# 2.4mm Beadless Air Lines
## Model Series 7943




### *Features*

- *DC to 50.0 GHz*
- *Virtually Reflectionless*
- *2.4mm Connectors*

### *Description*

The Maury 7943 series reference air lines are beadless 2.4mm coaxial transmission lines which are held to extremely tight tolerances to provide a highly accurate 50 ohm impedance standard utilizing precision 2.4mm connectors These air lines are fabricated from beryllium copper and are gold plated for low loss and to prevent tarnishing.

### *Specifications*

Frequency Range. . . . . DC to 50 GHz (usable to 54 GHz)
Minimum Return Loss (excluding connector interfaces) . . 48 dB
Electrical Length . . . . . See Available Models Chart
Electrical Length Accuracy . . . . . ±0.0025cm
Nominal Impedance . . . . . 50 ohm

### *Available Models*

| MODEL | CONNECTORS | ELECTRICAL LENGTH (cm) | ODD 1/4-WAVELENGTH FREQUENCY (GHz) |
|---|---|---|---|
| 7943G | 2.4mm female to male | 4.997 | (2n + 1) 1.5 |
| 7943H | 2.4mm female to male | 2.997 | (2n + 1) 2.5 |
| 7943S1.25 | 2.4mm female to male | 1.25 | (2n + 1) 6.0 |
| 7943S1.50 | 2.4mm female to male | 1.50 | (2n + 1) 5.0 |
| 7943S6.25 | 2.4mm female to male | 6.25 | (2n + 1) 1.2 |

# 2.92mm Beadless Air Lines
## Model Series 8774




### *Features*

- *DC to 40.0 GHz*
- *Virtually Reflectionless*
- *2.92mm Connectors*

### *Description*

The 8774C series female to male and 8774B series male to male reference air lines are beadless precision 2.92mm coaxial transmission lines which are held to extremely tight tolerances to provide a highly accurate 50 ohm impedance standard, utilizing precision 2.92mm connectors. Fabricated from beryllium copper, these air lines are gold plated for low loss and to prevent tarnishing.

### *Specifications*

Frequency Range. . . . . DC to 40 GHz
Minimum Return Loss (excluding connector interfaces) . . 48 dB
Electrical Length . . . . . See Available Models Chart
Electrical Length Accuracy . . . . . ±0.0025cm
Nominal Impedance . . . . . 50 ohm

### *Available Models*

| MODEL | CONNECTORS | ELECTRICAL LENGTH (cm) | ODD 1/4-WAVELENGTH FREQUENCY (GHz) |
|---|---|---|---|
| 8774C15 | 2.92mm female to male | 14.990 | (2n + 1) 0.50 |
| 8774C7.5 | 2.92mm female to male | 7.495 | (2n + 1) 1.00 |
| 8774C6 | 2.92mm female to male | 6.000 | (2n + 1) 1.25 |
| 8774C5.25 | 2.92mm female to male | 5.250 | (2n + 1) 1.43 |
| 8774C5 | 2.92mm female to male | 4.997 | (2n + 1) 1.50 |
| 8774C3 | 2.92mm female to male | 2.998 | (2n + 1) 2.50 |
| 8774B15 | 2.92mm male to male | 14.990 | (2n + 1) 0.50 |
| 8774B7.5 | 2.92mm male to male | 7.495 | (2n + 1) 1.00 |
| 8774B6.8 | 2.92mm male to male | 6.795 | (2n + 1) 1.10 |


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# 3.5mm Beadless Air Lines

## Model Series 8043

### *Features*

- *DC to 26.5 GHz*
- *Virtually Reflectionless*
- *Precision 3.5mm Connectors*




8043S15

### *Description*

The 8043S series female to male and 8043M series male to male reference air lines are beadless, precision, coaxial 3.5mm transmission lines which are held to extremely tight tolerances to provide a highly accurate 50 ohm impedance standard. Fabricated from beryllium copper, they are gold-plated to prevent tarnishing, with a special stainless steel coupling nut on the male connectors that can be retracted for ease of assembly. All units are equipped with machined flats to permit the use of torque wrenches for proper mating.

### *Specifications*

Frequency Range. . . . . DC to 26.5 GHz
Minimum Return Loss (excluding connector interfaces) . . 48 dB
Electrical Length . . . . . See Available Models Chart
Electrical Length Accuracy . . . . . ±0.0025cm
Nominal Impedance . . . . . 50 ohm

### *Available Models*

| MODEL | CONNECTORS | ELECTRICAL LENGTH (cm) | ODD 1/4-WAVELENGTH FREQUENCY (GHz) |
|---|---|---|---|
| 8043S15 | 3.5mm female to male | 14.990 | (2n+1) 0.50 |
| 8043S10 | 3.5mm female to male | 9.993 | (2n+1) 0.75 |
| 8043S7.5 | 3.5mm female to male | 7.495 | (2n+1) 1.00 |
| 8043S6 | 3.5mm female to male | 6.000 | (2n+1) 1.25 |
| 8043S5.3 | 3.5mm female to male | 5.298 | (2n+1) 1.41 |
| 8043S5 | 3.5mm female to male | 4.997 | (2n+1) 1.50 |
| 8043M10 | 3.5mm male to male | 9.993 | (2n+1) 0.75 |
| 8043M7.2 | 3.5mm male to male | 7.195 | (2n+1) 1.04 |
| 8043M6.8 | 3.5mm male to male | 6.795 | (2n+1) 1.10 |

# 3.5mm Bead Supported Air Lines

## Model Series 8042

### *Features*

- *DC to 18.0 GHz*
- *Virtually Reflectionless*
- *Precision 3.5mm Connectors*



8042E

### *Description*

The 8042 series precision air lines utilize 3.5mm connectors in which the center conductor is supported by a low-loss dielectric bead. The air lines are fabricated from gold-plated, copper alloys to prevent tarnishing.

### *Specifications*

Frequency Range. . . . . DC to 18.0 GHz
VSWR (typical) . . . . . <1.004 + 0.0035$f$(GHz)
Electrical Length . . . . . See Available Models Chart
Electrical Length Accuracy . . . . . ±0.02cm
Nominal Impedance . . . . . 50 ohm

### *Available Models*

| MODEL | CONNECTORS | ELECTRICAL LENGTH (cm) | ODD 1/4-WAVELENGTH FREQUENCY (GHz) |
|---|---|---|---|
| 8042C | 3.5mm female to male | 14.990 | (2n+1) 0.50 |
| 8042D | 3.5mm female to male | 9.993 | (2n+1) 0.75 |
| 8042E | 3.5mm female to male | 7.495 | (2n+1) 1.00 |
| 8042G | 3.5mm female to male | 4.997 | (2n+1) 1.50 |


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# 7mm Beadless Air Lines

## Model Series 2653



2653S3.12

### Features

- *DC to 18.0 GHz*
- *Virtually Reflectionless*
- *LPC7 Connectors*

### Description

The 2653 series reference air lines are beadless, virtually reflectionless, coaxial 7mm air lines. Spring-loaded tips on the ends of the center conductors mate with standard 7mm connectors.

### Specifications

Frequency Range. . . . . DC to 18.0 GHz
VSWR:
DC to 3.0 GHz . . . . . <1.002 + 0.001$f$ (GHz)
3.0 to 18.0 GHz . . . . . <1.005 maximum
Electrical Length . . . . . See Available Models Chart
Electrical Length Accuracy . . . . . ±0.005cm
Characteristic Impedance
(where skin depth is negligible) . . . . . 50 + 0.1 ohm [1]

1 Impedance = 49.987 ohms based on nominal dimensions and tolerances of the conductors, and the equation: $Z = 59.939 \log_e D/d$, D = I.D. inner conductor, d = O.D. outer conductor.

2 Beadless 7mm connector that mates with standard precision 7mm.

### Available Models

| MODEL | CONNECTORS | ELECTRICAL LENGTH (CM) | ODD 1/4-λ FREQUENCY (GHZ) | |
|---|---|---|---|---|
| 2653L | 7mm (LPC7) [2] | 0.693 | (2n + 1) | 10.81 |
| 2653S3 | 7mm (LPC7) [2] | 2.9969 | (2n + 1) | 2.50 |
| 2653S3.12 | 7mm (LPC7) [2] | 3.12 | (2n + 1) | |
| 2653S4 | 7mm (LPC7) [2] | 3.994 | (2n + 1) | 1.875 |
| 2653S5 | 7mm (LPC7) [2] | 4.994 | (2n + 1) | 1.50 |
| 2653S6 | 7mm (LPC7) [2] | 5.993 | (2n + 1) | 1.25 |
| 2653S7.5 | 7mm (LPC7) [2] | 7.493 | (2n + 1) | 1.00 |
| 2653S9.2 | 7mm (LPC7) [2] | 9.239 | (2n + 1) | 0.81 |
| 2653S10 | 7mm (LPC7) [2] | 9.988 | (2n + 1) | 0.75 |
| 2653S15 | 7mm (LPC7) [2] | 14.983 | (2n + 1) | 0.50 |
| 2653S20 | 7mm (LPC7) [2] | 19.980 | (2n + 1) | 0.375 |
| 2653S30 | 7mm (LPC7) [2] | 29.969 | (2n + 1) | 0.25 |

### 7mm Beadless Air Line Kits

Sets of 2653S air lines are available as kits in attractive, foam-lined wood cases; 2653K2 has 1 each 2653S3, 2653S5, 2653S6, 2653S7.5, 2653S10 & 2653S15. Kit 2653K3 adds 1 each 2653S20, & 2653S30 to the air lines in kit 2653K2.

# 7mm Bead Supported Air Lines

## Model Series 2603



2603F

### Features

- *DC to 18.0 GHz*
- *Virtually Reflectionless*
- *Precision 7mm Connectors*

### Description

The 2603 precision air lines are 7mm coaxial line sections with 7mm connectors[3] in which the center conductor is supported by a low-loss dielectric bead. The air lines are held to extremely close tolerances to provide an accurate 50 ohm impedance standard, and are fabricated from copper alloys with a gold-flash protective coating (except those over 15cm which have a silver-layered stainless steel center conductor to eliminate sag).

### Specifications

Frequency Range. . . . . DC to 18.0 GHz
VSWR . . . . . <1.004 + 0.003$f$ (GHz)
Electrical Length . . . . . See Available Models Chart
Electrical Length Accuracy . . . . . ±0.015cm
Characteristic Impedance
(where skin depth is negligible) . . . . . 50 + 0.12 ohm

3 Precision 7mm connector per Maury data sheet 5E-060.

### Available Models

| MODEL | CONNECTORS | ELECTRICAL LENGTH (cm) | ODD 1/4-λ FREQUENCY (GHz) | |
|---|---|---|---|---|
| 2603A | Precision 7mm [3] | 29.979 | (2n + 1) | 0.25 |
| 2603B | Precision 7mm [3] | 19.986 | (2n + 1) | 0.375 |
| 2603C | Precision 7mm [3] | 14.990 | (2n + 1) | 0.50 |
| 2603D | Precision 7mm [3] | 9.993 | (2n + 1) | 0.75 |
| 2603E | Precision 7mm [3] | 7.495 | (2n + 1) | 1.00 |
| 2603F | Precision 7mm [3] | 5.996 | (2n + 1) | 1.25 |
| 2603G | Precision 7mm [3] | 4.997 | (2n + 1) | 1.50 |

### 7mm Bead Supported Air Line Kits

Sets of 2603 air lines are also supplied as kits; 2603K is a set of 6 airlines consisting of 1 each 2653A, 2603B, 2603C, 2603D, 2603E, and 2603G. 2603L is a set of 7 air lines consisting of all those included in 2603K plus 1 each 2603F. Both kits are supplied in attractive, foam-lined wood cases.


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# Type N Beadless Air Lines

## Model Series 2553




### *Features*

- *DC to 18.0 GHz*
- *Virtually Reflectionless*
- *Beadless Type N Connectors*

### *Description*

The 2553T series reference air lines utilize beadless type N connectors which are integral to the air lines, thereby producing extremely low reflection transmission lines. The complete air lines (inner and outer conductor) are fabricated from gold-plated, low-loss copper alloys.

### *Specifications*

Frequency Range . . . . . DC to 18.0 GHz
VSWR (conservatively rated) . . . . . <1.004 + 0.001$f$ (GHz)
Electrical Length . . . . . See Available Models Chart
Electrical Length Accuracy . . . . . ±0.01cm
Characteristic Impedance
(where skin depth is negligible) . . . . . 50 + 0.2 ohm [1]

[1] Impedance = 49.987 ohms based on nominal dimensions and tolerances of the conductors, and the equation: $Z = 59.939 \log_e D/d$, D = I.D. inner conductor, d = O.D. outer conductor.

### *Available Models*

| MODEL | CONNECTORS | ELECTRICAL LENGTH (cm) | ODD 1/4-WAVELENGTH FREQUENCY (GHz) | |
|---|---|---|---|---|
| 2553T30 | Type N female to male [2] | 29.969 | (2n + 1) | 0.25 |
| 2553T20 | Type N female to male [2] | 19.986 | (2n + 1) | 0.375 |
| 2553T15 | Type N female to male [2] | 14.983 | (2n + 1) | 0.50 |
| 2553T10 | Type N female to male [2] | 9.988 | (2n + 1) | 0.75 |
| 2553T7.5 | Type N female to male [2] | 7.493 | (2n + 1) | 1.00 |
| 2553T6 | Type N female to male [2] | 5.993 | (2n + 1) | 1.25 |
| 2553T5 | Type N female to male [2] | 4.994 | (2n + 1) | 1.50 |
| 2553T3.82 | Type N female to male [2] | 3.816 | (2n + 1) | 1.96 |
| 2553T3.12 | Type N female to male [2] | 3.123 | (2n + 1) | 2.40 |
| 2553T3 | Type N female to male [2] | 2.9969 | (2n + 1) | 2.50 |

### *Type N Beadless Air Line Kits*

The 2553K is a kit consisting of six reference air lines from the chart above supplied in an attractive foam-lined wood instrument case.

[2] Beadless precision type N connectors, one female and one male.

# Type N Bead Supported Air Lines

## Model Series 2503



### *Features*

- *DC to 18.0 GHz*
- *Virtually Reflectionless*
- *Precision Type N Connectors*

### *Description*

The 2503 series precision air lines utilize stainless steel type N connectors in which the center conductor is supported by a low-loss dielectric bead. The air lines (inner and outer conductor) are fabricated from gold-plated, low-loss copper alloys.

### *Specifications*

Frequency Range . . . . . DC to 18.0 GHz
VSWR . . . . . <1.03 + 0.003$f$ (GHz)
Electrical Length . . . . . See Available Models Chart
Electrical Length Accuracy . . . . . ±0.02cm
Characteristic Impedance
(where skin depth is negligible) . . . . . 50 + 0.2 ohm

[3] Precision stainless steal type N per Maury data sheet 5E-049.

### *Available Models*

| MODEL | CONNECTORS | ELECTRICAL LENGTH (cm) | ODD 1/4-WAVELENGTH FREQUENCY (GHz) | |
|---|---|---|---|---|
| 2503A | Type N female to male [3] | 29.979 | (2n + 1) | 0.25 |
| 2503B | Type N female to male [3] | 19.986 | (2n + 1) | 0.375 |
| 2503C | Type N female to male [3] | 14.990 | (2n + 1) | 0.50 |
| 2503D | Type N female to male [3] | 9.993 | (2n + 1) | 0.75 |
| 2503E | Type N female to male [3] | 7.495 | (2n + 1) | 1.00 |
| 2503F | Type N female to male [3] | 5.996 | (2n + 1) | 1.25 |
| 2503G | Type N female to male [3] | 4.997 | (2n + 1) | 1.50 |

### *Type N Bead Supported Air Line Kits*

Air lines kits, model 2503K (consisting of one each 2503A, C, D, E, G) and model 2503L (consisting of one each 2503A, B, C, D, E, F, G) are available and are supplied in an attractive foam-lined wood instrument case.


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# 14mm Beadless Air Lines

## Model Series 2453

### Features

- *DC to 8.5 GHz*
- *Virtually Reflectionless*
- *LPC14 Connectors* [1]

### Description

The 2453 series are beadless, virtually reflectionless, coaxial 14mm reference air lines with spring-loaded tips on the ends of the inner conductor to mate with 14mm connectors [2]. VSWR is <1.006 at 8.5 GHz. The lines are fabricated from beryllium copper and are gold-plated to prevent tarnishing.

### Specifications

Frequency Range. . . . . DC to 8.5 GHz
VSWR . . . . . <1.001 + 0.0005$f$ (GHz)
Electrical Length . . . . . See Available Models Chart
Electrical Length Accuracy . . . . . ±0.005cm
Characteristic Impedance
(where skin depth is negligible) . . . . . 50 + 0.05 ohm [2]

### Available Models

| MODEL | CONNECTORS | ELECTRICAL LENGTH (cm) | ODD 1/4-WAVELENGTH FREQUENCY (GHz) | |
|---|---|---|---|---|
| 2453A | Precision 14mm [2] | 29.979 | (2n + 1) | 0.25 |
| 2453B | Precision 14mm [2] | 19.986 | (2n + 1) | 0.375 |
| 2453C | Precision 14mm [2] | 14.990 | (2n + 1) | 0.50 |
| 2453D | Precision 14mm [2] | 9.993 | (2n + 1) | 0.75 |
| 2453E | Precision 14mm [2] | 7.495 | (2n + 1) | 1.00 |
| 2453F | Precision 14mm [2] | 5.996 | (2n + 1) | 1.25 |
| 2453G | Precision 14mm [2] | 4.997 | (2n + 1) | 1.50 |
| 2453H | Precision 14mm [2] | 2.998 | (2n + 1) | 2.50 |

### 14mm Beadless Air Line Kits

The 2453K is a kit consisting of one (each) of 2453C, D, E, F, G and H, from the chart above, supplied in an attractive foam-lined wood instrument case.

# 7-16 Beadless Air Lines

## Model Series 2735A

### Features

- *DC to 7.5 GHz*
- *Virtually Reflectionless*
- *Precision 7-16 Connectors*

### Description

The 2735A series are beadless, virtually reflectionless, coaxial 7-16 reference air lines. The lines are fabricated from beryllium copper and are gold-plated to prevent tarnishing.

### Specifications

Frequency Range. . . . . DC to 7.5 GHz
VSWR . . . . . <1.004 + 0.0035$f$ (GHz)
Electrical Length . . . . . See Available Models Chart
Electrical Length Accuracy . . . . . ±0.005cm
Characteristic Impedance . . . . . 50 + 0.05 ohm

[1] A precision beadless 14mm connector that mates with GR900 connectors.
[2] Impedance = 49.987 ohms based on nominal dimensions and tolerances of the conductors, and the equation: $Z = 59.939 \log_e D/d$, D = I.D. inner conductor, d = O.D. outer conductor.

### Available Models

| MODEL | CONNECTORS | ELECTRICAL LENGTH (cm) | ODD 1/4-WAVELENGTH FREQUENCY (GHz) | |
|---|---|---|---|---|
| 2735A30 | 7-16 female to male | 29.979 | (2n + 1) | 0.25 |
| 2735A7.5 | 7-16 female to male | 7.495 | (2n + 1) | 1.00 |
| 2735A6.0 | 7-16 female to male | 5.996 | (2n + 1) | 1.25 |

### 7-16 Precision Air Line Kits

The 2735K kits consist of the reference air lines listed in the chart above provided in an attractive foam-lined wood instrument case. (See Maury data sheet 2Z-041A for test port adapter options.)





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# Precision Mismatches

## General Information

Precision standard mismatches are fixed coaxial terminations, which are used to introduce a known VSWR into a 50 ohm transmission system. These mismatches are extremely useful in a wide variety of applications and are quick and easy to use. They can be used to calibrate swept reflectometers, verify network analyzer calibration, establish impedance references in TDR measurements, etc.

Maury standard mismatches are quality constructed using thin film resistors and a unique grounding method that ensures stable operation. For ease of identification, the VSWR value of the mismatch is engraved on the end cap. Calibration data is provided for all units.

The standard units in this section are fitted with 2.4mm, 2.92mm, 3.5mm, 7mm, type N, TNC, and 14mm connectors. Please consult with our sales staff for application assistance. The units are also available as sets or kits packaged in foam-lined wood instrument cases. (See page 100.)




# Precision Mismatches

## 2.4mm, 2.92mm & 3.5mm Connectors

### *2.4mm Standard Mismatches*

***Models 7933A1/A2 and 7933B1/B2***

### *Specifications*

Frequency Range . . . . . DC to 50.0 GHz
Nominal VSWR . . . . . See Available Models Chart
VSWR Accuracy . . . . . See Available Models Chart
Calibration Data Provided . . . . . VNA data 2.0 to 50.0 GHz
Nominal Calibration Impedance Reference . . . . . 50 ohm
Power Handling . . . . . 0.5 W average, 0.5 kW peak

### *2.92mm Standard Mismatches*

***Models 8778A1/A2 and 8778B1/B2***

### *Specifications*

Frequency Range . . . . . DC to 40.0 GHz
Nominal VSWR . . . . . See Available Models Chart
VSWR Accuracy . . . . . See Available Models Chart
Calibration Data Provided . . . . . VNA data 2.0 to 40.0 GHz
Nominal Calibration Impedance Reference . . . . . 50 ohm
Power Handling . . . . . 0.5 W average, 0.5 kW peak

### *3.5mm Standard Mismatches*

***Models 8033A1/A2/A3 and 8033B1/B2/B3***

### *Specifications*

Frequency Range . . . . . DC to 26.5 GHz
Nominal VSWR . . . . . See Available Models Chart
VSWR Accuracy . . . . . See Available Models Chart
Calibration Data Provided . . . . . VNA data 2.0 to 26.5 GHz
Nominal Calibration Impedance Reference . . . . . 50 ohm
Power Handling . . . . . 0.5 W average, 0.5 kW peak

### *2.4mm Available Models*

| MODEL | | NOMINAL VSWR | ACCURACY (GHz) | |
|---|---|---|---|---|
| FEMALE | MALE | | DC – 12.0 | 12.0 – 50.0 |
| 7933A1.10 | 7933B1.10 | 1.10 | ±0.08 | +0.13 –0.10 |
| 7933A1.20 | 7933B1.20 | 1.20 | ±0.09 | ±0.13 |
| 7933A1.30 | 7933B1.30 | 1.30 | ±0.09 | ±0.17 |
| 7933A1.50 | 7933B1.50 | 1.50 | ±0.10 | ±0.20 |
| 7933A1.75 | 7933B1.75 | 1.75 | ±0.12 | ±0.22 |
| 7933A2.00 | 7933B2.00 | 2.00 | ±0.14 | ±0.25 |

### *2.92mm Available Models*

| MODEL | | NOMINAL VSWR | ACCURACY (GHz) | |
|---|---|---|---|---|
| FEMALE | MALE | | DC – 12.0 | 12.0 – 40.0 |
| 8778A1.10 | 8778B1.10 | 1.10 | ±0.08 | +0.13 –0.10 |
| 8778A1.15 | 8778B1.15 | 1.15 | ±0.08 | ±0.13 |
| 8778A1.20 | 8778B1.20 | 1.20 | ±0.08 | ±0.13 |
| 8778A1.25 | 8778B1.25 | 1.25 | ±0.08 | ±0.13 |
| 8778A1.30 | 8778B1.30 | 1.30 | ±0.09 | ±0.17 |
| 8778A1.50 | 8778B1.50 | 1.50 | ±0.10 | ±0.20 |
| 8778A1.75 | 8778B1.75 | 1.75 | ±0.12 | ±0.22 |
| 8778A2.00 | 8778B2.00 | 2.00 | ±0.14 | ±0.25 |

### *3.5mm Available Models*

| MODEL | | NOMINAL VSWR | ACCURACY (GHz) | |
|---|---|---|---|---|
| FEMALE | MALE | | DC – 12.0 | 12.0 – 26.5 |
| 8033A1.10 | 8033B1.10 | 1.10 | ±0.06 | ±0.08 |
| 8033A1.20 | 8033B1.20 | 1.20 | ±0.07 | ±0.10 |
| 8033A1.30 | 8033B1.30 | 1.30 | ±0.08 | ±0.12 |
| 8033A1.50 | 8033B1.50 | 1.50 | ±0.09 | ±0.17 |
| 8033A1.75 | 8033B1.75 | 1.75 | ±0.11 | ±0.19 |
| 8033A2.00 | 8033B2.00 | 2.00 | ±0.12 | ±0.22 |
| 8033A2.50 | 8033B2.50 | 2.50 | ±0.13 | ±0.23 |
| 8033A3.00 | 8033B3.00 | 3.00 | ±0.15 | ±0.25 |


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# Precision Mismatches

## 7mm, Type N, TNC and 14mm Connectors




### 7mm Standard Mismatches

***Models 2611A/B/C/D/E/F/G***

### Specifications

Frequency Range . . . . . DC to 18.0 GHz
Nominal VSWR . . . . . See Available Models Chart
VSWR Accuracy . . . . . See Available Models Chart
Calibration Data Provided . . . . . 2.0 to 18.0 GHz
Nominal Calibration Impedance Reference . . . . . 50 ohm
Power Handling . . . . . 1 W average, 1 kW peak

### Type N Standard Mismatches

***Models 2561A/B/C/D/E/F/G and 2562A/B/C/D/E/F***

### Specifications

Frequency Range . . . . . DC to 18.0 GHz
Nominal VSWR . . . . . See Available Models Chart
VSWR Accuracy . . . . . See Available Models Chart
Calibration Data Provided . . . . . 2.0 to 18.0 GHz
Nominal Calibration Impedance Reference . . . . . 50 ohm
Power Handling . . . . . 1 W average, 1 kW peak

### TNC [1] Standard Mismatches

***Models 8611C/D/E/G and 8612G***

### Specifications

Frequency Range . . . . . DC to 18.0 GHz
Nominal VSWR . . . . . See Available Models Chart
VSWR Accuracy . . . . . See Available Models Chart
Calibration Data Provided . . . . . 2.0 to 18.0 GHz
Nominal Calibration Impedance Reference . . . . . 50 ohm
Power Handling . . . . . 1 W average, 1 kW peak

### 14mm Standard Mismatches

***Model 2411E***

### Specifications

Frequency Range . . . . . DC to 8.5 GHz
Nominal VSWR . . . . . See Available Models Chart
VSWR Accuracy . . . . . See Available Models Chart
Calibration Data Provided . . . . . 2.0 to 8.5 GHz
Nominal Calibration Impedance Reference . . . . . 50 ohm
Power Handling . . . . . 1 W average, 1 kW peak

### 7mm Available Models

| MODEL | NOMINAL VSWR | ACCURACY (GHz) | | | RESISTANCE (OHMS) |
|---|---|---|---|---|---|
| | | DC – 8.0 | 8.0 – 12.4 | 12.4 – 18.0 | |
| 2611A | 1.05 | ±0.05 | ±0.05 | +0.07 −0.05 | 47.6 |
| 2611B | 1.10 | ±0.05 | ±0.05 | ±0.07 | 45.5 |
| 2611C | 1.20 | ±0.05 | ±0.06 | ±0.09 | 41.7 |
| 2611D | 1.30 | ±0.05 | ±0.07 | ±0.10 | 38.5 |
| 2611E | 1.50 | ±0.06 | ±0.08 | ±0.15 | 33.3 |
| 2611F | 1.75 | ±0.08 | ±0.10 | ±0.17 | 28.6 |
| 2611G | 2.00 | ±0.10 | ±0.12 | ±0.20 | 25.0 |

### Type N Available Models

| MODEL | | NOMINAL VSWR | ACCURACY (GHz) | | | RESISTANCE (OHMS) |
|---|---|---|---|---|---|---|
| FEMALE | MALE | | DC – 8.0 | 8.0 – 12.4 | 12.4 – 18.0 | |
| 2561A | 2562A | 1.05 | ±0.05 | ±0.05 | +0.08 −0.05 | 47.6 |
| 2561B | 2562B | 1.10 | ±0.06 | ±0.06 | ±0.08 | 45.5 |
| 2561C | 2562C | 1.20 | ±0.06 | ±0.07 | ±0.10 | 41.7 |
| 2561D | 2562D | 1.30 | ±0.06 | ±0.08 | ±0.12 | 38.5 |
| 2561E | 2562E | 1.50 | ±0.08 | ±0.09 | ±0.17 | 33.3 |
| 2561F | 2562F | 1.75 | ±0.10 | ±0.11 | ±0.19 | 28.6 |
| 2561G | 2562G | 2.00 | ±0.12 | ±0.12 | ±0.22 | 25.0 |

### TNC [1] Available Models

| MODEL | | NOMINAL VSWR | ACCURACY (GHz) | | RESISTANCE (OHMS) |
|---|---|---|---|---|---|
| FEMALE | MALE | | DC – 10.0 | 10.0 – 18.0 | |
| 8611C | 8612C | 1.20 | ±0.08 | ±0.15 | 41.7 |
| 8611D | 8612D | 1.30 | ±0.09 | ±0.15 | 38.5 |
| 8611E | 8612E | 1.50 | ±0.10 | ±0.18 | 33.3 |
| 8611F | 8612F | 1.75 | ±0.13 | ±0.20 | 28.6 |
| 8611G | 8612G | 2.00 | ±0.15 | ±0.25 | 25.0 |

### 14mm Available Model

| MODEL | NOMINAL VSWR | ACCURACY (GHz) | | | RESISTANCE (OHMS) |
|---|---|---|---|---|---|
| | | DC – 1.0 | 1.0 – 4.0 | 4.0 – 8.5 | |
| 2411B | 1.10 | ±0.02 | ±0.03 | ±0.04 | 55 |
| 2411C | 1.20 | ±0.03 | ±0.04 | ±0.05 | 60 |
| 2411D | 1.30 | ±0.04 | ±0.05 | ±0.06 | 65 |
| 2411E | 1.50 | ±0.05 | ±0.06 | ±0.07 | 75 |

1 Precision TNC per Maury Data Sheet 5E-053.


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# Precision Mismatches

## Mismatch Sets

Maury offers standard mismatches in sets containing a selection of mismatch values including the nominal matched load (typically, 1.05 VSWR). These sets, available with 7mm, type N female or male, 3.5mm, 2.92mm, 2.4mm, and TNC connectors, are packaged in foam-lined wooden instrument cases. Each mismatch is provided with an individual calibration report.




2562L

### *2.4mm, 2.9mm, and TNC Mismatch Sets*

Please consult our Sales Department for availability of mismatch sets with TNC, 2.92mm and 2.4mm connectors.

### *3.5mm Mismatch Sets*

The 8033K mismatch set is made up of all six each female and male of the 3.5mm mismatches from 1.10 through 2.00 VSWR. The set is packaged in a foam-lined wooden instrument case, and each mismatch value is provided with an individual calibration report.

### *7mm and Type N Mismatch Sets*

Two types of sets are offered in these connector styles: sets with model suffix "L" contain one each of four mismatch values – a nominally matched load, 1.20, 1.50 and 2.00 VSWR. Sets with the model suffix "M" contain one each of all mismatch values indicated on page 99. The basic model designations are: 2611L/M, 7mm; 2561L/M, type N female; 2562L/M, type N male. For example: 2562L describes a mismatch set with type N male connectors containing the four mismatches noted above.




2611M

### *Special Kits*

Custom mismatch kits, combining different connector types and values, can be configured. Please consult our Sales Department and reference model 9476(x).

### *Instrument Cases*

Standard mismatches in the various connector styles and mismatch values are available as individual units. Should you wish to purchase individual units and configure a custom set, Maury can offer the following foam-lined wood instrument cases to provide suitable laboratory storage.

| | |
|---|---|
| 2611S1 | houses 4 units |
| 2611S2 | houses 8 units |
| 2611S3 | houses 12 units |
| 8650Z1 | houses 24 units |



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# Waveguide Two-Port Mismatch Standard Sets

## 322A Series


G322A

### *Features*

- *Two-Port Calculable Standards*
- *Reduced Height 1.00, 1.10, 1.25, 1.50, 2.00 VSWR Spacers*
- *1/4 λ at Midband*

### *Description*

These 322 series models are two-port calculable waveguide standard sets. The sets consist of five reduced height spacers which provide an accurately known VSWR which is directly calculable from the mechanical dimensions. The spacers are fabricated from aluminum and are provided with precision indexing holes for excellent flange alignment. Indexing pins and mounting hardware are also provided. The sets are packaged in foam-lined wood instrument cases.

The standards in these sets are extremely stable and easy to use for a variety of calibration applications. Their simple geometry allows direct calculation of reflection, loss, transfer and group delay characteristics and makes them ideally suited for quickly checking the performance and accuracy of automated network analyzers.

To order the 1.00 VSWR shim by itself, please add "1.00" to the model number. (Example: X322A1.00)

### *Available Models*

| MODEL | FREQUENCY RANGE (GHz) | EIA WR NUMBER | EQUIVALENT FLANGE | 1/4-λ FREQUENCY (GHZ) | LENGTH INCHES | (CM) | WAVEGUIDE TOLERANCE | PS DELAY WITH AIR DIELECTRIC |
|---|---|---|---|---|---|---|---|---|
| R322A | 1.7 — 2.6 | 430 | CPR430F | 2.112 | 1.840 | (4.6736) | ±0.005 | 155.9444 |
| S322A | 2.6 — 3.95 | 284 | UG584/U | 3.221 | 1.198 | (3.0429) | ±0.004 | 101.5334 |
| E322A | 3.3 — 4.9 | 229 | CPR229F | 4.042 | 0.948 | (2.4079) | ±0.003 | 80.34527 |
| G322A | 3.95 — 5.85 | 187 | UG149A/U | 4.826 | 0.807 | (2.0498) | ±0.002 | 68.39518 |
| F322A | 4.90 — 7.05 | 159 | CPR159F | 5.906 | 0.642 | (1.6307) | ±0.002 | 54.41104 |
| C322A | 5.85 — 8.2 | 137 | UG344/U | 6.960 | 0.539 | (1.3691) | ±0.0015 | 45.68154 |
| H322A | 7.05 — 10.0 | 112 | UG51/U | 8.438 | 0.447 | (1.1354) | ±0.0010 | 37.88432 |
| X322A | 8.2 — 12.4 | 90 | UG39/U | 10.129 | 0.382 | (0.9703) | ±0.0010 | 32.37541 |
| M322A | 10.0 — 15.0 | 75 | MPF75 [1] | 12.322 | 0.311 | (0.7899) | ±0.0010 | 26.35799 |
| P322A | 12.4 — 18.0 | 62 | UG419/U | 15.030 | 0.253 | (0.6426) | ±0.0008 | 21.44236 |
| N322A | 15.0 — 22.0 | 51 | MPD51 | 18.249 | 0.209 | (0.5309) | ±0.0008 | 17.71325 |
| K322A | 18.0 — 26.5 | 42 | UG595/U | 21.941 | 0.175 | (0.4445) | ±0.0005 | 14.83167 |
| U322A | 26.5 — 40.0 | 28 | UG599/U | 32.693 | 0.118 | (0.2997) | ±0.0005 | 10.00078 |
| J322A | 33.0 — 50.0 | 22 | MPF22 [1] | 40.824 | 0.0946 | (0.2403) | ±0.0005 | 8.017576 |
| V322A | 50.0 — 75.0 | 15 | MPF15 [1] | 61.518 | 0.0630 | (0.1600) | ±0.00025 | 5.339401 |
| Y322A | 60.0 — 90.0 | 12 | MPF12 [1] | 73.772 | 0.0529 | (0.1344) | ±0.00025 | 4.483402 |
| Z322A | 75.0 — 110.0 | 10 | MPF10 [1] | 91.221 | 0.0424 | (0.1077) | ±0.00025 | 3.593501 |

[1] Provided with Maury "MPF" precision type flanges with indexing holes.



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# Two-Port Mismatch Air Line Standards (Individual Units and Sets)

## General Information

Mismatch air line sets are two-port, 1/4-λ VSWR standards consisting of coaxial air lines employing a design that features a precision outer conductor with beadless connectors and a set of inner conductors with increasing diameters. The inner conductors produce accurately known reflection coefficients which are directly calculable from and traceable to the air line dimensions [1].

Air line standard sets are extremely stable and easy to use for a variety of applications. Their simple geometry allows direct calculation of reflection, loss, transfer and group delay characteristics, making them ideally suited for checking the performance and accuracy of network analyzers. The sets described here utilize beadless connectors and rely on the mating connectors for center conductor support.



# 3.5mm Two-Port Mismatch Air Line Standards

## Model 8044S15 & 8044S60

### *Features*

- *DC to 26.5 GHz*
- *Separated Step Discontinuity*
- *Beadless 3.5mm Connectors*




8044S60

### *Description*

Maury offers the 8044S15 and the 8044S60 as individual two-port mismatch standards in 3.5mm line size and connector type. A key design feature of these units is that the step discontinuity is separated from the connector interface for better accuracy [2].

Both models also feature a precision outer conductor with beadless 3.5mm connectors, and a stepped center conductor. The center conductors are designed to produce an accurately known VSWR which is directly calculable from the mechanical dimension.

### *Specifications*

Frequency Range. . . . . DC to 26.5 GHz

VSWR:

Γ = 0.15 . . . . . 1.350 ± 0.025

Γ = 0.60 . . . . . 4.00 ± 0.25

Reference Impedance . . . . . 50 ohm

Nominal Overall Electrical Length . . . . . 10cm

Nominal Mismatch Section Electrical Length . . . . . 7.5cm

Odd 1/4-λ Frequencies . . . . . 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25 GHz

[1] Beatty, R.W., "Calculated and Measured S11, S21, and Group Delay for Simple Types of Coaxial and Rectangular Waveguide 2-port Standards", NBS Technical Note No. 657, Dec. 1974.

[2] Maury, M.A. Jr., and Simpson, G.R., "Two-Port Verification Standards iin 3.5mm and 7mm for Vector Automatic Network Analyzers", Microwave Journal, June 1984; pp. 101-110.



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# 7mm Two-Port Mismatch Air Line Standard Sets

## Model 2654A



### *Features*

- *DC to 18.0 GHz*
- *Beadless LPC7 Connectors*

### *Description*

The 2654A Beadless Mismatch Air Line Set was designed for use in coaxial systems employing 7mm connectors. The air line connectors are beadless LPC7 connectors that mate with standard 7mm connectors, and rely on the mating connector for center conductor support.

Each set consists of:

A) One (1) outer conductor.

B) Five (5) inner conductors (see specification for corresponding VSWR values).

C) A foam-lined, wood instrument case for protection and storage.

### *Specifications*

Frequency Range. . . . . DC to 18.0 GHz

Nominal Impedance . . . . . 49.987 for 1.00 VSWR

Mismatch Values (VSWR) . . . . . 1.00, 1.10, 1.25, 1.50, 2.00 (based on nominal impedance)

Electrical Length . . . . . 7.495cm

Odd 1/4-λ Frequencies . . . . . .1, 3, 5, 7, 9, 11, 13, 15, 17 GHz

# 7mm Two-Port Mismatch Air Line Standard Sets

## Model 2654B




### *Features*

- *DC to 18.0 GHz*
- *Beadless LPC7(F) Connectors*

### *Description*

The Maury 2654B precision air line standard set contains calculable two-port 7mm coaxial air lines [1]. These standards are provided with the step discontinuity separated from the connector interface for better accuracy [2].

The set consists of a precision outer conductor with beadless 7mm connectors and three center conductors. Each center conductor has a different diameter to produce an accurately known VSWR which is directly calculable from the mechanical dimension. They employ self-centering, spring-loaded pins to allow connection easily without tools.

Also available are the Maury 2654S15 and 2654S60 which are individual two-port standards with $\Gamma$ = 0.15 and 0.60, respectively.

[1] Beatty, R.W., "Calculated and Measured S11, S21, and Group Delay for Simple Types of Coaxial and Rectangular Waveguide 2-port Standards", NBS Technical Note No. 657, Dec. 1974.

### *Specifications*

Frequency Range. . . . . DC to 18.0 GHz

VSWR:

$\Gamma$ = 0 . . . . . 1.005 maximum

$\Gamma$ = 0.15 . . . . . 1.350 ± 0.025

$\Gamma$ = 0.60 . . . . . 4.00 ± 0.25

Reference Impedance . . . . . 50 ohm

Nominal Overall Electrical Length . . . . . 10cm

Nominal Mismatch Section Electrical Length . . . . . 7.5cm

Odd 1/4-λ Frequencies . . . . . .1, 3, 5, 7, 9, 11, 13, 15, 17 GHz

[2] Maury, M.A. Jr., and Simpson, G.R., "Two-Port Verification Standards in 3.5mm and 7mm for Vector Automatic Network Analyzers", Microwave Journal, June 1984; pp. 101-110.



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# Connector Gages and Connector Gage Kits

## General Information

### *Features*

- *Direct Reading, Self-Checking*
- *Accurate, Easy to Use*
- *Digital and/or Dial Indicator Styles*



A048A 1.85mm/2.4mm Digital Connector Gage Kit

A048A (Female) and A048B (Male) Digital Gages with Master Blocks (Enlarged)

### *Description*

Maury connector gage kits provide an easy and accurate way to measure critical linear interface dimensions of most coaxial connectors. Each kit consist of gages with specially adapted indicators, and the bushings and pins needed to mate with specified connectors. Master setting gages are used to adjust the dial indicators (or digital indicators) to zero, before push-on or thread-on gages are mated with connectors to measure the distance from a given interface (male shoulder, etc.) to the outer conductor mating plane. The table below lists available models. Additional information is found in the referenced data sheets.

### *Why You Need Connector Gages*

The Importance of checking the critical mechanical dimensions of your coaxial connectors before mating cannot be overstated. Superior electrical performance depends on making sure all the coaxial connectors in you test setup are operating within their specified tolerances. Pin depth and position of the center conductors are especially critical in that regard.

If the male and female contacts are recessed beyond tolerance they will exhibit a "gap-fit" connection when mated. This causes significant reduction of electrical performance.

If the male and female contacts protrude beyond their specified tolerances they will exhibit an "interference-fit" when mated. This will also degrade electrical performance, with adverse effects on measurement accuracy, and may result in catastrophic damage to the center connectors and contacts.

Since 1962 Maury Microwave has been designing connector gage kits that provide the best method of checking pin depth and position in all the most popular coaxial connector types. Today these include digital gage kits in 1.85mm/2.4mm and 2.92mm/3.5mm connector types, and dial-indicator gage kits in 1.85mm/2.4mm, 2.92mm/3.5mm, 7mm, type N (in 50 ohm and 75 ohm models), BNC, TNC, AFTNC, TNCA, SMA, OSP™, 14mm, 7-16, SMP/GPO™, Multiport, and ZMA/BZ connector types.

All Maury connector gage kits are designed for superior durability, stability and repeatability. Each kit includes at least one connector gage with the master gage block or blocks necessary to ensure the accuracy of the gages. Kits are available as metrology-grade thread-on designs or hand-held push-on designs.

### *Available Models - Digital Indicator Style*

| CONNECTOR TYPE | DIAL RESOLUTION (INCHES) | MODEL | DESCRIPTION | DATA SHEET |
|---|---|---|---|---|
| 1.85mm/2.4mm | 0.001mm/ 0.00004 in. | A048A | Two “thread-on” metrology grade digital gages measure female and male contact pin locations. | 2Y-048 |
| 2.92mm (K) or 3.5mm | 0.001mm/ 0.00004 in. | A050A | Two “thread-on” metrology grade digital gages measure female and male contact pin locations. | 2Y-049 |
| Type N | 0.0001mm/ 0.00004 in. | A020K | Two “thread-on” metrology grade digital gages measure type N female and male connectors, sliding loads, airlines, two-port standards, VNA test port adapters, etc. | 2Y-032 |

[1] OSP™ (the Omni-Spectra designation) is a trademark of M/A-Com.

[2] GPO™ is a trademark of the Gilbert Engineering Co., Inc.



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A007A Type N Push-On Connector Gage Kit



A020D Type N Thread-On Connector Gage Kit

## *Available Models - Dial Indicator Style*

| CONNECTOR TYPE | DIAL RESOLUTION (INCHES) | MODEL | DESCRIPTION | DATA SHEET |
|---|---|---|---|---|
| 2.92mm (K) or 3.5mm | 0.00025 | A034B | Two “push-on” gages measure female and male contact pin interface locations. | 2Y-020 |
| 2.92mm (K) or 3.5mm | 0.0001 | A034E | Two metrology grade “thread-on” gages measure female and male contact pin interface locations. | 2Y-020A |
| 2.4mm/1.85mm | 0.0001 | A035E | Two metrology grade “thread-on” gages measure female and male contact pin interface locations. | 2Y-022A |
| 7mm | 0.0001 | A028 | One “push-on” gage measures planar contact location. | 2Y-005 |
| 7mm | 0.0001 | A028D | One “thread-on” metrology grade gage measures planar contact location. | 2Y-005A |
| N | 0.001 | A007A | One “push-on” gage measures female and male contact pin location. | 2Y-002 |
| N | 0.00025 | A020A | One “push-on” gage measures female and male contact pin location. | 2Y-003 |
| N | 0.0001 | A020D | Two metrology grade “thread-on” gages measure female and male contact pin interface locations. | 2Y-003A |
| N (75 ohms) | 0.0001 | A020G | One “push-on” gage measures female and male contact pin location of 75 ohm type N connectors. | 2Y-003G |
| N, BNC, TNC, C or SC | 0.00025 | A025A | One “push-on” gage measures female and male contact pin location. | 2Y-016 |
| BNC or TNC | 0.0005 | A012A | One “push-on” gage measures female and male contact pin and dielectric interface locations. | 2Y-009 |
| AFTNC, TNC or TNCA | 0.0001 | A012E | Six “push-on” “universal” gages measure all contact pin and dielectric interface locations of all MIL-STD, IEC and commercial TNC connectors. | 2Y-028 |
| SMA | 0.0005 | A027 | Two “push-on” gages measure female and male contact pin interface locations. | 2Y-004 |
| SMA | 0.0005 | A027A | Four “push-on” gages measure female and male contact pin and dielectric interface locations. | 2Y-004 |
| SMA | 0.0005 | A027G | Two “push-on” gages measure female contact pin and dielectric interface locations. | 2Y-004 |
| SMA | 0.0005 | A027M | Three “push-on” gages measure standard male contact pin and dielectric interface locations, and the stepless 0.085-inch male pin dimension. | 2Y-004 |
| OSP™ [1] | 0.00025 | A039C | One “push-on” gage measures female and male contact pin location. | 2Y-026 |
| 14mm (GR900) | 0.0001 | A024 | One “push-on” gage measures planar contact location of 14mm and 7mm connectors. | 2Y-006 |
| 7-16 | 0.0001 | A041A | One “push-on” gage measures female and male contact pin location. | 2Y-027 |
| SMP/GPO™ [2] | 0.0005 | A042A | Three “push-on” gages measures SMP connectors’ contact pin and dielectric interface locations. | 2Y-031 |
| Multiport | 0.0001 | A045A | Six “push-on” gages measures multiport connectors’ contact pin and dielectric locations. | 2Y-029 |
| ZMA/BZ | 0.0001 | A046A | Six “push-on” gages measures ZMA and BZ connectors’ contact pin and dielectric locations. | 2Y-030 |

[1] OSP™ (the Omni-Spectra designation) is a trademark of M/A-Com.

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# Torque Wrenches
## All Models




### *Description*

Maury's torque wrenches are recommended for tightening coaxial connectors in order to obtain optimum repeatability and prolong connector life. They employ a "break" design so it is impossible to over-torque a coupled junction, and torque can be applied in either direction. Each Maury torque wrench is factory preset to the proper in. lbs for tightening its coaxial connector type, and the color coded handles make it easy to select the correct wrench from your toolbox at a glance.

Maury torque wrenches are included in many of our VNA calibration kits, and can be ordered separately by the model numbers listed in the chart below. If the wrench you need isn't shown in this chart, please contact our Sales Department or your local Maury representative for assistance.

Note: The models shown are delivered in a non-calibrated state unless calibration is requested at the time they are ordered. Maury highly recommends annual re-calibration of these torque wrenches to ensure their continued ability to properly tighten connections. Torque wrenches that are subject to heavy use should have their calibration checked more frequent.

### *Available Models*

| Model | For Use With Connector | Wrench Size (Inches) | Preset Torque (in.lbs.) | Handle Color[6] |
|---|---|---|---|---|
| 2498T1 | MPC14, LPC14[1] | 1.0 HEX | 12 ±0.8 | BLUE |
| 2698C2 | 7mm, LPC7, N[2], NMD3.5, NMD2.92, NMD2.4 | 0.75 HEX | 12 ±0.8 | BLUE |
| 2698G1 | TNC[3], MPC6 | 0.562 HEX | 12 ±0.8 | BLUE |
| 2698H1 | LPC/OSP™[4] | 0.562 HEX | 8±0.5 | RED |
| 2698J1 | SC | 0.812 HEX | 12 ±0.8 | BLUE |
| 2698K1 | 7-16 | 1.062 HEX | 20 ±1.2 | GREEN |
| 8799A1[5] | 3.5mm, 2.92mm, 2.4mm, 1.85mm | 0.312 HEX | 8 ±0.5 | RED |
| 8799D1 | SMA, OSM | 0.312 HEX | 5 ±0.3 | BLACK |
| 8799E1 | OSSM, MPC8 | 0.250 HEX | 5 ±0.3 | BLACK |

1 MPC14 and LPC14 connectors are precision 14mm connectors that are essentially the same a s GR900 connectors and are supplied with 1.0 hex nuts.

2 Precision N connectors supplied with 3/4 hex nuts.

3 Precision TNC connectors supplied with 9/16 hex nuts.

4 Precision LPC/OSP™ per Maury data sheet 5E-065. OSP is a M/A Com Omni-Spectra designation.

5 WARNING: Do Not Use on SMA connectors. Damage can result.

6 Unless otherwise marked on nameplate, handle color represents torque value: blue = 12 in. lbs., red = 8 in. lbs., black = 5 in. lbs., gold = 20 in. lbs.


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# Coaxial-to-Coaxial Adapter Finder

## The chart below shows the page(s) in this catalog which describe Maury's Coaxial-to-Coaxial Adapters

| Coaxial-to-Coaxial Connectors<br>Side A \ Side B | • NMD1.85mm | • 1.85mm | • NMD2.4mm | • 2.4mm | • NMD2.92mm (K) | • 2.92mm (K) | • NMD3.5mm | • 3.5mm | • QT3.5mm™ | • 3.5mm Panel Mount | • SMA | • 7mm | • Type N (50 ohm) | • Type N (75 ohm) | • LCP/OSP™ | • TNC | • TNCA | • AFTNC | • BNC (50 ohm) | • HN, SC | • 14mm (GR 900) | • 7-16 | • EIA 7/8 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| • NMD1.85mm | 111 | 111 | 111 | | 111 | 111 | | 111 | | | | 111 | 111 | | | | | | | | | | |
| • 1.85mm | 111 | 112 | | 112 | | 112 | | 112 | | | | | | | | | | | | | | | |
| • NMD2.4mm | 111 | | 114 | 114 | 114 | 114 | | 114 | 122 | | | 114 | 114 | | | | | | | | | | |
| • 2.4mm | | 112 | 114 | 115 | | 115 | | 115 | | | | 115 | 115 | | | | | | | | | | |
| • NMD2.92mm (K) | 111 | | 114 | | 117 | 117 | | | | | | | | | | | | | | | | | |
| • 2.92mm (K) | 111 | 112 | 114 | 115 | 117 | 118 | | | | | | 119 | 119 | | | | | | | | | | |
| • NMD3.5mm | | | | | | | 120 | 120 | 122 | 124 | | 120 | 120 | 129 | | 120 | | 120 | | | | | |
| • 3.5mm | 111 | 112 | 114 | 115 | | | 120 | 121 | | | | 123 | 123 | 129 | 130 | 123 | 123 | 123 | 123 | | | 133 | |
| • QT3.5mm™ | | | 122 | | | | 122 | | | | | 122 | 122 | | | | | | | | | | |
| • 3.5mm Panel Mount | | | | | | | 124 | | | | | 124 | 124 | | | | | | | | | | |
| • SMA | | | | | | | | | | | | 125 | 128 | | | | | | | | | | |
| • 7mm | 111 | | 114 | 115 | | 119 | 120 | 123 | 122 | 124 | 125 | 125 | 125 | 129 | 130 | 125 | 125 | | 125 | 125 | 125 | 133 | 125 |
| • Type N (50 ohm) | 111 | | 114 | 115 | | 119 | 120 | 123 | 122 | 124 | 128 | 125 | 127 | 129 | 130 | 128 | | 128 | 128 | 128 | | 133 | |
| • Type N (75 ohm) | | | | | | | 129 | 129 | | | | 129 | 129 | 129 | | | | | | | | | |
| • LCP/OSP™ | | | | | | | | 130 | | | | 130 | 130 | | | | | | | | | | |
| • TNC | | | | | | | 120 | 123 | | | | 125 | 128 | | | 131 | | | | | | | |
| • TNCA | | | | | | | | 123 | | | | 125 | | | | | 131 | | | | | | |
| • AFTNC | | | | | | | 120 | 123 | | | | 125 | | | | | | 131 | | | | | |
| • BNC (50 ohm) | | | | | | | | 123 | | | | 125 | 128 | | | | | | | | | | |
| • HN, SC | | | | | | | | | | | | 125 | 128 | | | | | | | | | | |
| • 14mm (GR 900) | | | | | | | | 132 | | | | 125 | 132 | | | | | | | | | 132 | 132 |
| • 7-16 | | | | | | | | 133 | | | | 133 | 133 | | | | | | | | 132 | 133 | |
| • EIA 7/8 | | | | | | | | | | | | 125 | | | | | | | | | 132 | | |

### *Also in this Section*

- Waveguide-to-Coaxial Adapters are listed on pages 134-135 (Right Angle Launch models) and pages 136-137 (End Launch models).
- Space Qualified Waveguide-to-Coaxial Adapters (see page 138).
- Waveguide Flange Adapters (see page 140).
- Waveguide Transmission Lines & Test Port Adapters (see page 139).
- Waveguide Flange Information, Specifications and Hole Patterns (see pages 141-144).
- Test Port Cable Assemblies (see page 148).
- Recommended Test Port Adapters (see page 149).
- Stability™ Microwave/RF Cable Assemblies (see pages 150-151).
- ColorConnect™ Precision Attenuators (see pages 158-159).
- Stub Tuners (see page 156).
- Noise Calibration Systems and Components (see pages 160-172).


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# Precision Adapters, Cables, Connectors, Waveguide Components and Noise Calibration Systems

## General Information

### *Coaxial Adapters*

Maury Microwave produces three lines of in-series and between-series coax-to-coax adapters including industry-standard ***Calibration-Grade (Metrology) Adapters***, available in all precision laboratory measurement connector types (1.85mm, 2.4mm, 2.92mm (K), 3.5mm, 7mm, 14mm, etc.) and all common systems connectors (type N, TNC, etc.); with two new ***Test Essentials™*** lines of ***Laboratory Adapters*** and ***ColorConnect™ Adapters***. Maury also manufactures coaxial adapters in other less common connector series not shown in this catalog. For specific configurations not covered in these pages, please contact our Sales Department for assistance.



### *Waveguide-to-Waveguide Adapters*

Maury produces waveguide-to-waveguide adapters, transitions, and straight transmission line sections in all popular EIA waveguide sizes. Units from R through P bands are normally aluminum construction with irridite finish; K band and above are copper alloy with a plated finish. All units are painted with highly durable paint.

Maury also produces waveguide devices in millimeter sizes from 26.5 through 110 GHz (WR28 to WR10), large waveguides (WR430), and in many less common configurations such as: flat guide, reduced height, round, etc. Maury can provide waveguide to waveguide adapters with any flange type, material or finish you require. Consult us on your specific requirement.





### *Waveguide-to-Coaxial Adapters*

Maury's comprehensive line of precision end launch and right-angle launch waveguide-to-coaxial adapters provide a convenient and reliable transition between most popular EIA waveguide sizes and a wide range of precision coaxial connector types. In most cases the waveguide flanges used are Maury Precision Flanges (MPF) that incorporate a pattern of precision index holes and matching pins to ensure proper mating alignment and connection repeatability. Space qualified adapters with specialized coatings or for Aerospace applications are also available.



### *Test Port Adapters*

Maury Test port adapters are specifically designed to mate with the special ruggedized connectors used on commercial VNA test sets, such as those used on Keysight PNA series VNAs and Anritsu 37000 series VNAs. Maury's test port adapters can convert those connectors to other coaxial connector or waveguide types. Using Maury test port adapters as connector savers can yield significant cost savings in terms of reduced VNA down time and lower repair costs.

### *Precision Connectors*

All of the connectors used on Maury adapters are mating compatible with connectors conforming to the applicable MIL-C or MIL-T and industry-standard specifications. However, most Maury connectors are manufactured to even more exacting requirements.

Maury also offers a limited selection of precision connectors with integral or removable panel mount flanges, a series of micro-strip connectors designed for mounting on miniature micro-strip packages, and tool kits for use in performing precision assembly or disassembly of Maury precision connectors.



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## *Stability™ and Utility™ Microwave/RF Cable Assemblies*




Maury Microwave's Stability™ series sets the standard for high-performance ruggedized microwave/RF cable assemblies. For phase-stable and amplitude-stable applications, these cables offer excellent measurement repeatability even after cable flexure. With a ruggedized, durable construction, Stability™ will outlast and outperform other assemblies resulting in a reduced total cost-of-test. Stability's™ light weight, superior flexibility and small form factor make it ideal for daily use with VNA's, test instruments, bench-top testing and ATE systems. Stability™, the phase stable cable of choice.

Maury Microwave's Utility™ series sets the standard for high-end all-purpose test and measurement cable assemblies. Designed for general testing applications, Utility™ offers excellent value with its low cost, low insertion loss, excellent return loss, flexibility, and amplitude and phase stability. Utility™ is the ideal interconnection for reliable and repeatable measurements when mated with test instruments including bench-top testing, on-wafer characterization and ATE systems.

Both Maury's Stability™ and Utility™ cable assemblies are now part of the ColorConnect™ family! Complete product details available in Maury data sheet 2Z-004 and 2Z-005.

## *Noise Calibration Systems*



Maury Noise Calibration Systems (NCS) are self-contained, highly accurate sources of RF and microwave noise power that are used wherever noise source accuracy is critical. Examples are: receiver noise measurements, such as noise figure and effective input noise temperature; calibration of solid state noise sources; evaluation and verification of earth station receivers; and as radiometer reference sources.

## *Cryogenic Terminations (Cold Loads)*



Maury cryogenic terminations are liquid nitrogen cooled loads which provide accurately known noise power at a well matched output port. Used with ambient and/or thermal terminations and a noise figure meter, these terminations provide cold reference temperatures needed for highly accurate noise figure or effective input noise temperature measurements. Because of the accuracy of their noise output, cryogenic terminations are often used as a noise standard for calibration of solid state noise generators.

## *Thermal Terminations (Hot Loads)*



Maury thermal terminations are low-mismatch, heated loads in a precisely controlled thermal environment, which provide and accurately known noise power. Used with ambient and/or cryogenic terminations and a noise figure meter, these terminations provide the hot termination temperature needed for highly accurate noise figure or effective input noise temperature measurements. Because of the accuracy of the noise output, thermal terminations are often used as a noise standard for calibration of solid state noise generators.

## *Coaxial and Waveguide Ambient Terminations*

Maury ambient terminations are room temperature noise sources consisting of stable terminations in massive copper housings that provide thermal stability and reduce the effects of thermal transients.

## *Noise Components & Accessories*

Maury offers a wide range of calibrated adapters and adapter sets that are used with the MT7118J cryogenic termination and the MT7108B thermal termination to adapt the precision 7mm output port to other coaxial series or to waveguide at specific frequencies. They are calibrated for VSWR and insertion loss to allow their input noise temperature to be calculated.


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# Calibration-Grade (Metrology) Adapters

## General Information



### *Connecting With Confidence*

Test and measurement data is only as good as the system used to generate it. Good test and measurement systems rely on high-performance precision adapters to ensure proper connection between system components – connections that ensure the accuracy, repeatability, and reliability of component performance. Over the last four-and-a-half decades, Maury has earned a reputation as a leading producer of high quality, precision adapters. Today, Maury offers adapters with a wider variety of connector types and combinations than any other manufacturer.

Maury adapters feature low reflection at the interface and dielectric support, negligible electromagnetic interference, excellent connection repeatability,rugged durability, and are guaranteed to perform reliably within their specifications even after multiple connection/disconnection cycles.

When you consider the relative ease of incorporation into system designs and applications, and the value versus life-cycle cost inherent in every Maury adapter, it is easy to understand their popularity. Engineers, designers and technicians alike know that with Maury adapters they can have the highest confidence in their component connections.

The following paragraphs describe the major categories of Maury's precision adapter line.

### *In-Series and Between-Series Adapters*

Maury Microwave's comprehensive line of in-series and between-series coaxial adapters are available for all precision laboratory measurement connectors – 1.85mm, 2.4mm, 2.92mm (K), 3.5mm, 7mm, 14mm, 7-16, etc.; all common systems connectors – type N, TNC, etc.; and several special purpose connector series such as EIA 7/8 rigid line connectors. Most of these are available as components of Maury's VNA calibration kits or as kit options, and are also sold separately, as auxiliary components, spares, or replacement parts.

Maury also manufactures adapters in other less common connector series not shown in this catalog. If you have a specific need and don't find a solution in these pages, please contact our Sales Department for assistance.

### *Phase Matched Adapters*

Phase matched adapters are used in two-port VNA calibrations when the devices have same sex input and output connectors that must be tested. Through connection for calibration is made using adapters with female and male connectors. One adapter is then replaced to permit mating to the test device. With phase matched adapters, this can be done without significantly degrading the VNA error correction capability. Phase matched in-series and between-series adapters are noted as such in the following pages.

### *Ruggedized Test Port Adapters*

Maury Test port adapters are specifically designed to mate with the special ruggedized connectors used on commercial VNA test sets, such as those used on Keysight PNA series VNAs and Anritsu 37000 series VNAs. Maury's test port adapters can convert those connectors to other coaxial or waveguide connector types. Using Maury test port adapters as connector savers can yield significant cost savings in terms of less VNA down time and repair costs.



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# NMD1.85mm Test Port Adapters

## 7809 Series

### *Features*

- *Low VSWR*
- *DC to 67 GHz (Usable to 70 GHz)*
- *Protects VNA Test Ports*
- *Ruggedized for Long Life*

### *Description*

Maury's 7809 series NMD1.85mm adapters are precision, low VSWR adapters designed to connect directly to the male 1.85mm NMD-style test ports on certain Keysight test sets and VNA models (including those in the PNA series). They are fully compatible with the VNA test ports, and adapt to precision 1.85mm, 2.4mm, 2.92mm, 3.5mm, 7mm, and type N connectors. Maury test port adapters provide the best possible connection between the VNA and other precision cables and devices. Their rugged construction provides for long life and highly stable, highly repeatable connections. The 7809A1/A2 and 7809K models also act as test port savers, by absorbing the wear and tear that would otherwise affect the test port; preventing costly repairs and eliminating downtime.

### *Connector Description*

The NMD1.85mm female connectors on Maury 7809 series adapters are miniature, instrument grade, air-interface connectors. Rated for operate up to 67 GHz, they are usable up to 70 GHz. They comply with IEEE standard 287 general precision connector, instrument grade GPC1.85. For interface specifications please refer to Maury data sheet 5E-089.




### *Available Models*

| MODEL | CONNECTORS SIDE A | CONNECTORS SIDE B | FREQUENCY RANGE (GHz) AND MAXIMUM VSWR | NOMINAL IMPEDANCE | INSERTION LENGTH INCHES | INSERTION LENGTH (CM) |
|---|---|---|---|---|---|---|
| 7809A1 | NMD1.85mm female [1] | 1.85mm female [3] | DC — 26.5 ≤ 1.10 | 50 ohm | 0.993 | (2.52) |
| 7809A2 | NMD1.85mm female [1] | 1.85mm male [3] | 26.5 — 40.0 ≤ 1.15 | 50 ohm | 0.993 | (2.52) |
| 7809K | NMD1.85mm female [1] | NMD1.85mm male [1] | 40.0 — 67.0 ≤ 1.20 | 50 ohm | 1.133 | (2.88) |
| 7809G | NMD1.85mm female [1] | NMD2.4mm male [2] | DC — 26.5 ≤ 1.10 | 50 ohm | 1.142 | (2.90) |
| 7809H | NMD2.4mm female [2] | NMD1.85mm male [1] | 26.5 — 40.0 ≤ 1.15<br>40.0 — 50.0 ≤ 1.20 | 50 ohm | 1.317 | (3.35) |
| 7809F1 | NMD1.85mm female [1] | 2.92mm female [5] | DC — 20.0 ≤ 1.10 | 50 ohm | 1.072 | (2.72) |
| 7809F2 | NMD1.85mm female [1] | 2.92mm male [5] | 20.0 — 40.0 ≤ 1.16 | 50 ohm | 1.072 | (2.72) |
| 7809B1 | NMD1.85mm female [1] | 3.5mm female [6] | DC — 10.0 ≤ 1.06 | 50 ohm | 1.085 | (2.76) |
| 7809B2 | NMD1.85mm female [1] | 3.5mm male [6] | 10.0 — 20.0 ≤ 1.10<br>20.0 — 34.0 ≤ 1.12 | 50 ohm | 1.085 | (2.76) |
| 7809C | NMD1.85mm female [1] | 7mm [7] | DC — 4.0 ≤ 1.05<br>4.0 — 12.0 ≤ 1.07<br>12.0 — 18.0 ≤ 1.10 | 50 ohm | 1.206 | (0.47) |
| 7809D1 | NMD1.85mm female [1] | Type N female [8] | DC — 4.0 ≤ 1.08 | 50 ohm | 1.145 | (2.91) |
| 7809D2 | NMD1.85mm female [1] | Type N male [8] | 4.0 — 12.0 ≤ 1.12<br>12.0 — 18.0 ≤ 1.14 | 50 ohm | 1.504 | (3.82) |

[1] NMD1.85mm per Maury data sheet 5E-085.
[2] NMD2.4mm per Maury data sheet 5E-083.
[3] Precision 1.85mm per Maury data sheet 5E-089.
[4] Precision 2.4mm per Maury data sheet 5E-064.
[5] Precision 2.92mm (K) per Maury data sheet 5E-063.
[6] Precision 3.5mm per Maury data sheet 5E-062.
[7] Precision 7mm per Maury data sheet 5E-060.
[8] Precision type N per Maury data sheet 5E-049.

Key Literature: Maury data sheet 2B-074.


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# 1.85mm Between-Series Adapters

## Models 7824A/B/C/D, 7826A/B/C/D and 7827A/B/C/D

### *Description*

The precision adapters in these model series are designed to allow devices with 1.85mm connectors to mate with devices and cables bearing 2.4mm, 2.92mm, or 3.5mm connectors. When properly mated, they provide a low VSWR connection with low insertion loss and high repeatability. Made of highly durable materials, these adapters are ideal for use in laboratory and production environments where frequent connect/ disconnect cycles occur.

These adapters are **phase matched within each model series**, so that they may be easily interchanged for VNA measurement of non-insertable devices. Outline dimensions are shown on page 113.

*2.4mm*



7824A 7824B 7824C 7824D

*2.92mm*



7826A 7826B 7826C 7826D

*3.5mm*



7827A 7827B 7827C 7827D

### *1.85mm Connector Description*

The precision 1.85mm connectors on these adapters are miniature, instrument grade, air-interface connectors that are rated for operation from DC to 67 GHz, but may be used up to 70 GHz. They comply with IEEE standard 287 for instrument grade general precision connectors (GPC1.85).

### *Available Models*

| MODEL | ADAPTS SIDE A | ADAPTS SIDE B | FREQUENCY RANGE (GHz) AND MAXIMUM VSWR | NOMINAL IMPEDANCE | INSERTION LENGTH INCHES | INSERTION LENGTH (CM) |
|---|---|---|---|---|---|---|
| 7824A | 1.85mm female [1] | 2.4mm female [2] | DC — 26.5 ≤ 1.06 | 50 ohm | 0.75 | (1.905) |
| 7824B | 1.85mm female [1] | 2.4mm male [2] | 26.5 — 40.0 ≤ 1.10 | 50 ohm | 0.75 | (1.905) |
| 7824C | 1.85mm male [1] | 2.4mm female [2] | 40.0 — 67.0 ≤ 1.15 | 50 ohm | 0.75 | (1.905) |
| 7824D | 1.85mm male [1] | 2.4mm male [2] | | 50 ohm | 0.75 | (1.905) |
| 7826A | 1.85mm female [1] | 2.92mm female [3] | DC — 4.0 ≤ 1.05 | 50 ohm | 0.657 | (1.669) |
| 7826B | 1.85mm female [1] | 2.92mm male [3] | 4.0 — 20.0 ≤ 1.08 | 50 ohm | 0.657 | (1.669) |
| 7826C | 1.85mm male [1] | 2.92mm female [3] | 20.0 — 40.0 ≤ 1.12 | 50 ohm | 0.657 | (1.669) |
| 7826D | 1.85mm male [1] | 2.92mm male [3] | | 50 ohm | 0.657 | (1.669) |
| 7827A | 1.85mm female [1] | 3.5mm female [4] | DC — 4.0 ≤ 1.05 | 50 ohm | 0.657 | (1.669)) |
| 7827B | 1.85mm female [1] | 3.5mm male [4] | 4.0 — 26.5 ≤ 1.08 | 50 ohm | 0.657 | (1.669) |
| 7827C | 1.85mm male [1] | 3.5mm female [4] | 26.5 — 34.0 ≤ 1.12 | 50 ohm | 0.657 | (1.669) |
| 7827D | 1.85mm male [1] | 3.5mm male [4] | | 50 ohm | 0.657 | (1.669) |

# 1.85mm In-Series Adapters

## Models 7821A/B/C

### *Available Models*

7821A 7821B 7821C

| MODEL | ADAPTS SIDE A | ADAPTS SIDE B | FREQUENCY RANGE (GHz) AND MAXIMUM VSWR | NOMINAL IMPEDANCE | INSERTION LENGTH INCHES | INSERTION LENGTH (CM) |
|---|---|---|---|---|---|---|
| 7821A | 1.85mm female [1] | 1.85mm female [1] | DC — 26.5 ≤ 1.06 | 50 ohm | 0.75 | (1.905) |
| 7821B | 1.85mm male [1] | 1.85mm male [1] | 26.5 — 40.0 ≤ 1.10 | 50 ohm | 0.75 | (1.905) |
| 7821C | 1.85mm female [1] | 1.85mm male [1] | 40.0 — 67.0 ≤ 1.15 | 50 ohm | 0.75 | (1.905) |

[1] Precision 1.85mm per Maury data sheet 5E-089.
[2] Precision 2.4mm per Maury data sheet 5E-064.
[3] Precision 2.92mm per Maury data sheet 5E-063.
[4] Precision 3.5mm per Maury data sheet 5E-062.

Key Literature: Maury data sheet 2B-070, 2B-071, 2B-072, 2B-073.



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# 1.85mm Adapter Dimensions (Inches)

## Models 7824A/B/C/D, 7826A/B/C/D and 7827A/B/C/D

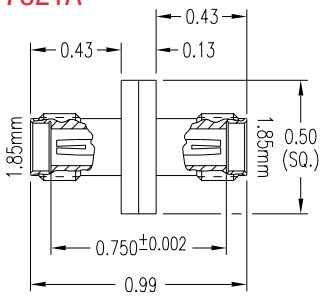
### *7821A/B/C series*

### *7824A/B/C/D series*

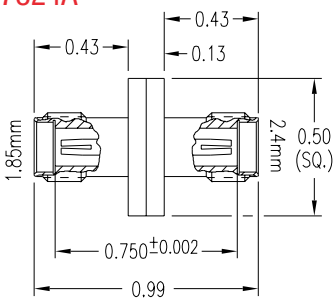
### *7826A/B/C/D series*

### *7827A/B/C/D series*

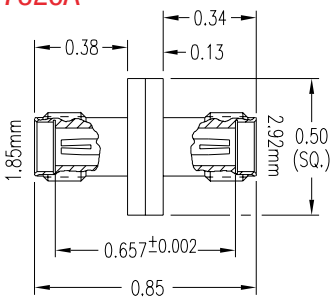
7821A



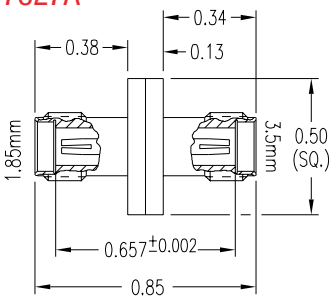

7824A



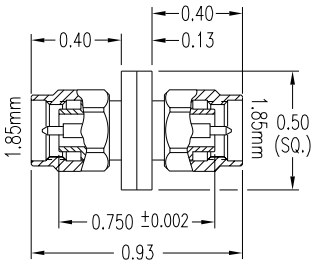

7826A



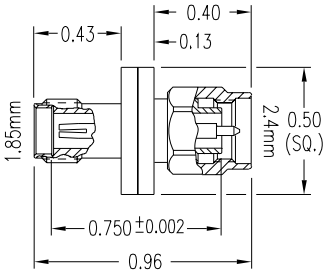

7827A



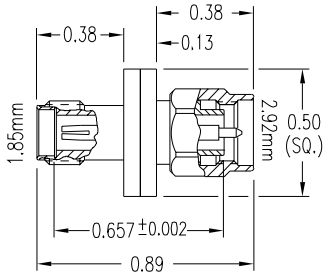

7821B



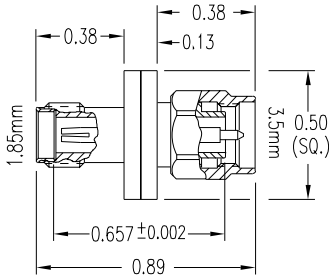

7824B



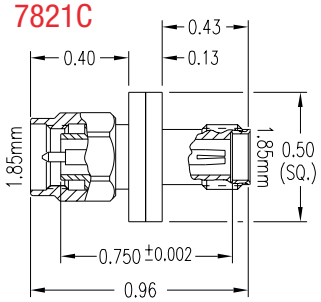

7826B



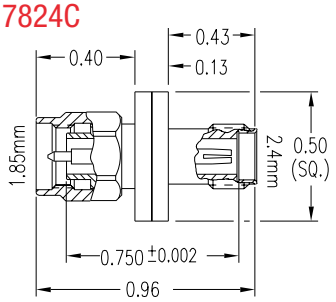

7827B



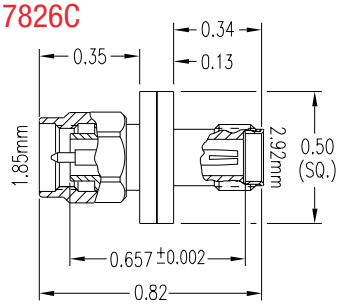

7821C



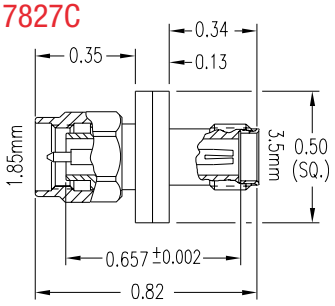

7824C



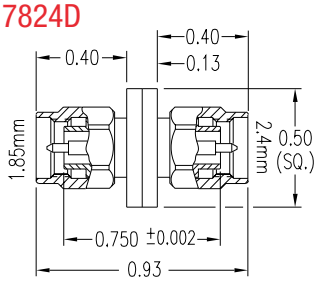

7826C



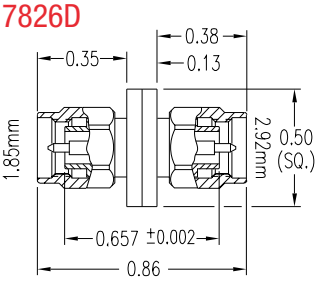

7827C



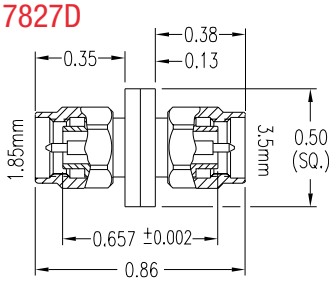

7824D




7826D




7827D






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# NMD2.4mm Test Port Adapters

## 7809H and 7909 Series

### *Features*

- *Low VSWR*
- *DC to 50 GHz*
- *Protects VNA Test Ports*
- *Ruggedized for Long Life*

### *Description*

Maury's 7909 series NMD2.4mm adapters are precision, low VSWR adapters designed to connect directly to the NMD-style 2.4mm male test ports on certain Keysight test sets and VNA models (including those in the PNA series). They are fully compatible with the VNA test ports, and adapt to precision 2.4mm 2.92mm, 3.5mm, 7mm or type N connectors. Maury test port adapters provide the best possible connection between the VNA and other precision cables and devices. Their rugged construction provides for long life and highly stable, highly repeatable connections. The 7909A1/A2 and 7909K models also act as test port savers, by absorbing the wear and tear that would otherwise affect the test port; preventing costly repairs and eliminating downtime.

### *Connector Description*

The NMD2.4mm female connectors on Maury 7909 series adapters are miniature, instrument grade, air-interface connectors., rated for operate up to 50 GHz. They comply with IEEE standard 287 general precision connector, instrument grade GPC2.4.) For interface specifications please refer to Maury data sheet 5E-082. The NMD male connectors are mateable to NMD female connectors via external threads, and can also mate to non-NMD connectors via internal threads.




### *Available Models*

| MODEL | ADAPTS SIDE A | ADAPTS SIDE B | FREQUENCY RANGE (GHz) AND MAXIMUM VSWR | NOMINAL IMPEDANCE | INSERTION LENGTH INCHES | INSERTION LENGTH (CM) |
|---|---|---|---|---|---|---|
| 7809H | NMD2.4mm female [1] | NMD1.85mm male [2] | DC — 26.5 ≤ 1.10<br>26.5 — 40.0 ≤ 1.15<br>40.0 — 50.0 ≤ 1.20 | 50 ohm | 1.317 | (3.35) |
| 7909A1 | NMD2.4mm female [1] | 2.4mm female [3] | | 50 ohm | 1.24 | (3.15) |
| 7909A2 | NMD2.4mm female [1] | 2.4mm male [3] | | 50 ohm | 1.27 | (3.23) |
| 7909K | NMD2.4mm female [1] | NMD2.4mm male [1] | | 50 ohm | 1.317 | (3.35) |
| 7909F1 | NMD2.4mm female [1] | 2.92mm female [5] | DC — 20.0 ≤ 1.10<br>20.0 — 40.0 ≤ 1.16 | 50 ohm | 1.291 | (3.279) |
| 7909F2 | NMD2.4mm female [1] | 2.92mm male [5] | | 50 ohm | 1.291 | (3.279) |
| 7909J | NMD2.4mm female [1] | NMD2.92mm male [4] | | 50 ohm | 1.247 | (3.17) |
| 7909B1 | NMD2.4mm female [1] | 3.5mm female [6] | DC — 10.0 ≤ 1.06<br>10.0 — 20.0 ≤ 1.10<br>20.0 — 34.0 ≤ 1.14 | 50 ohm | 1.06 | (2.70) |
| 7909B2 | NMD2.4mm female [1] | 3.5mm male [6] | | 50 ohm | 1.02 | (2.60) |
| 7909H | NMD2.4mm female [1] | NMD3.5mm male [4] | | 50 ohm | 1.317 | (3.35) |
| 7909C | NMD2.4mm female [1] | 7mm [7] | DC — 4.0 ≤ 1.05<br>4.0 — 12.0 ≤ 1.07<br>12.0 — 18.0 ≤ 1.10 | 50 ohm | 2.04 | (5.18) |
| 7909D1 | NMD2.4mm female [1] | Type N female [8] | DC — 4.0 ≤ 1.08<br>4.0 — 12.0 ≤ 1.12<br>12.0 — 18.0 ≤ 1.14 | 50 ohm | 1.28 | (3.25) |
| 7909D2 | NMD2.4mm female [1] | Type N male [8] | | 50 ohm | 1.64 | (4.17) |

[1] NMD2.4mm per Maury data sheet 5E-082.
[2] NMD1.85mm per Maury data sheet 5E-085.
[3] Precision 2.4mm per Maury data sheet 5E-064.
[4] NMD3.5mm per Maury data sheet 5E-083.
[5] Precision 2.92mm (K) per Maury data sheet 5E-063.
[6] Precision 3.5mm per Maury data sheet 5E-062.
[7] Precision 7mm per Maury data sheet 5E-060.
[8] Precision type N per Maury data sheet 5E-049.

Key Literature: Maury data sheet 2B-049, 2B-049A, 2B-050, 2B-051, 2B-052, 2B-053.


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# 2.4mm In-Series Adapters

## Models 7921A/B/C/D/E




### Description

Maury precision 2.4mm in-series adapters are low VSWR and low loss devices that operate from DC to 50 GHz. The models 7921A, B and C offer combinations for in-series adapting and are phase matched, making them ideal for use in precision measurement applications. These adapters are minimum length and feature a square-flanged body for ease of connecting that also prevents them from rolling off flat surfaces. They are useful as "test port savers" when used with automated network analyzers such as the Keysight 8510, etc. The models 7921D and E are bulk-head and panel mount feed-thru adapters respectively, and are designed for instrumentation applications.

### Specifications

Frequency Range . . . . . DC – 50 GHz

Maximum VSWR . . . . . DC – 26.5 GHz, 1.06

26.5 – 40.0 GHz, 1.10

40.0 – 50.0 GHz, 1.15

Impedance . . . . . 50 ohm

Connectors . . . . . 2.4mm per Maury data sheet 5E-064

### Available Models

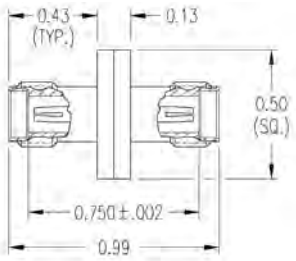
| MODEL | ADAPTS SIDE A | ADAPTS SIDE B | INSERTION LENGTH INCHES | INSERTION LENGTH (CM) |
|---|---|---|---|---|
| 7921A | 2.4mm female [1] | 2.4mm female [1] | 0.75 | (1.905) |
| 7921B | 2.4mm male [1] | 2.4mm male [1] | 0.75 | (1.905) |
| 7921C | 2.4mm female [1] | 2.4mm male [1] | 0.75 | (1.905) |
| 7921D | 2.4mm female [1] | 2.4mm female [1] | 0.86 | (2.18) |
| 7921E | 2.4mm female [1] | 2.4mm female [1] | 0.86 | (2.18) |

[1] Precision 2.4mm per Maury data sheet 5E-064.

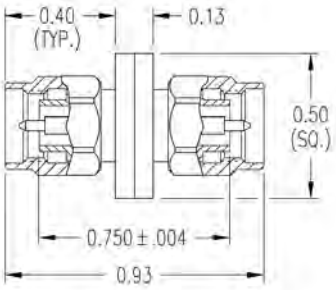
Key Literature: Maury data sheet 2B-001.

### Dimensions – Inches

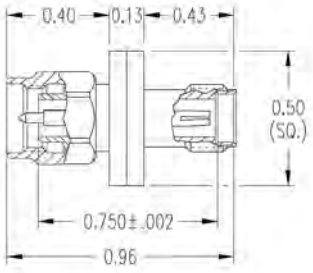
7921A



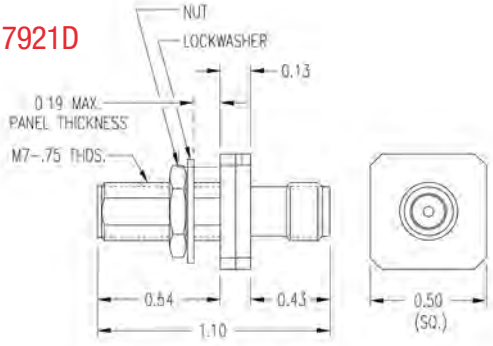

7921B



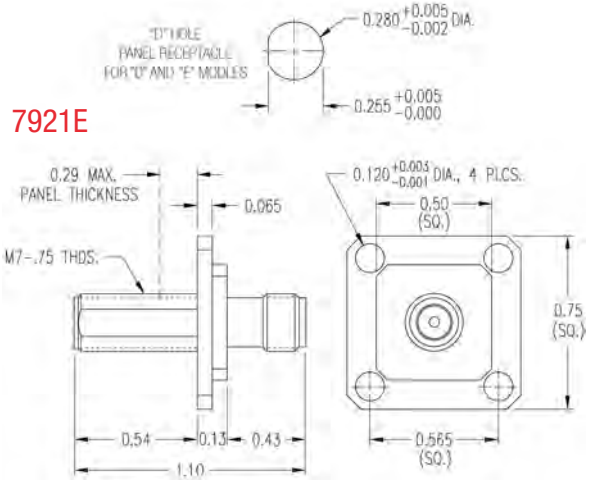

7921C




7921D




7921E






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# 2.4mm Between-Series Adapters

## Models 7926A/B/C/D, 7927A/B/C/D, 7922A/B and 7923A/B/C/D

### Description

The precision adapters in these model series are designed to allow devices with 2.4mm connectors to mate with devices and cables bearing 2.92mm, 3.5mm, 7mm or Type N connectors. When properly mated, they provide a low VSWR connection with low insertion loss and high repeatability. Made of highly durable materials, these adapters are ideal for use in laboratory and production environments where frequent connect/ disconnect cycles occur.

Except for the 7923 series, these adapters are phase matched within each model series, so that they may be easily interchanged for VNA measurement of non-insertable devices.

*2.92mm* 7926A 7926B 7926C 7926D



*3.5mm* 7927A 7927B 7927C 7927D



### 2.4mm Connector Description

The precision 2.4mm connectors on these adapters are miniature, instrument grade, air-interface connectors that are rated for operation from DC to 50 GHz. They comply with IEEE standard 287 for instrument grade general precision connectors (GPC2.4).

*7mm* 7922A 7922B



*Type N* 7923A 7923B 7923C 7923D



### Available Models

| MODEL | ADAPTS SIDE A | ADAPTS SIDE B | FREQUENCY RANGE (GHz) AND MAXIMUM VSWR | NOMINAL IMPEDANCE | INSERTION LENGTH INCHES | INSERTION LENGTH (CM) |
|---|---|---|---|---|---|---|
| 7926A | 2.4mm female [1] | 2.92mm female [2] | DC — 4.0 ≤ 1.05 | 50 ohm | 0.65 | (1.65) |
| 7926B | 2.4mm female [1] | 2.92mm male [2] | 4.0 — 20.0 ≤ 1.08 | 50 ohm | 0.65 | (1.65) |
| 7926C | 2.4mm male [1] | 2.92mm female [2] | 20.0 — 40.0 ≤ 1.12 | 50 ohm | 0.65 | (1.65) |
| 7926D | 2.4mm male [1] | 2.92mm male [2] | | 50 ohm | 0.65 | (1.65) |
| 7927A | 2.4mm female [1] | 3.5mm female [3] | | 50 ohm | 0.657 | (1.669) |
| 7927B | 2.4mm female [1] | 3.5mm male [3] | DC — 18.0 ≤ 1.06 | 50 ohm | 0.657 | (1.669) |
| 7927C | 2.4mm male [1] | 3.5mm female [3] | 18.0 — 26.5 ≤ 1.08 | 50 ohm | 0.657 | (1.669) |
| 7927D | 2.4mm male [1] | 3.5mm male [3] | 26.5 – 34.0 ≤ 1.12 | 50 ohm | 0.657 | (1.669) |
| 7922A | 2.4mm female [1] | 7mm [4] | DC — 4.0 ≤ 1.03 | 50 ohm | 1.28 | (3.25) |
| 7922B | 2.4mm male [1] | 7mm [4] | 4.0 — 12.0 ≤ 1.07<br>12.0 — 18.0 ≤ 1.08 | 50 ohm | 1.28 | (3.25) |
| 7923A | 2.4mm female [1] | Type N female [5] | | 50 ohm | 1.22 | (3.10) |
| 7923B | 2.4mm female [1] | Type N male [5] | DC — 4.0 ≤ 1.07 | 50 ohm | 1.58 | (4.02) |
| 7923C | 2.4mm male [1] | Type N female [5] | 4.0 — 18.0 ≤ 1.12 | 50 ohm | 1.20 | (3.05) |
| 7923D | 2.4mm male [1] | Type N male [5] | | 50 ohm | 1.56 | (3.96) |

[1] Precision 2.4mm per Maury data sheet 5E-064.
[2] Precision 2.92mm per Maury data sheet 5E-063.
[3] Precision 3.5mm per Maury data sheet 5E-062.
[4] Precision 7mm per Maury data sheet 5E-060.
[5] Precision type N per Maury data sheet 5E-049.

Key Literature: Maury data sheet 2B-008.



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# NMD2.92mm Test Port Adapters

## 8719 Series

### Features

- *Low VSWR*
- *DC to 40 GHz*
- *Protects VNA Test Ports*
- *Ruggedized for Long Life*







### Description

Maury's 8719 series NMD2.92mm adapters are precision, low VSWR adapters designed to connect directly to the NMD-style 2.92mm male test ports on certain Keysight test sets and VNA models (including those in the PNA series). They are fully compatible with the VNA test ports, and adapt to precision 2.4mm or 2.92mm (K) connectors. Maury test port adapters provide the best possible connection between the VNA and other precision cables and devices. Their rugged construction provides for long life and highly stable, highly repeatable connections. The 8719A/B and 8719F models also act as test port savers, by absorbing the wear and tear that would otherwise affect the test port; preventing costly repairs and eliminating downtime.

### Connector Description – NMD2.92mm

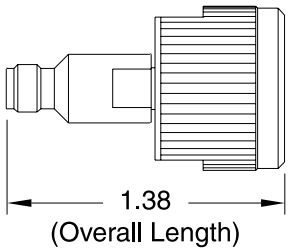
The NMD2.92mm connectors on Maury 8719 series adapters are ruggedized test-port connectors used for stable connection to a network analyzer. The female connector is only mateable to NMD male connectors via external threads on the male nut. The NMD male connectors are mateable to NMD female connectors via external threads, and can also mate to non-NMD connectors (2.92mm, SMA, or 3.5mm) via internal threads.

### Connector Description – 2.92mm (K)

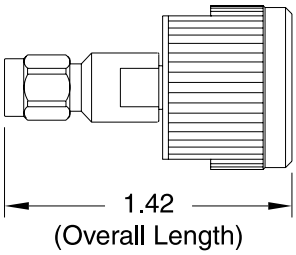
The K connectors on 8719A/B adapters are precision miniature 2.92mm air-interface connectors that are rated for operation from DC to 40 GHz. They have a mechanically compatible interface that mates with SMA and 3.5mm connectors. The K connector was originally introduced by Maury in 1974 as the MPC3 connector and re-introduced by Wiltron in 1984 as the K connector. They comply with IEEE standard 287 general precision connector, instrument grade (GPC2.92).

### Dimensions – Inches (cm)

8719A




8719B




### Available Models

| MODEL | ADAPTS SIDE A | ADAPTS SIDE B | FREQUENCY RANGE (GHz) AND MAXIMUM VSWR | NOMINAL IMPEDANCE | INSERTION LENGTH INCHES | INSERTION LENGTH (CM) |
|---|---|---|---|---|---|---|
| 8719A | NMD2.92mm female [1] | 2.92mm (K) female [2] | DC — 4.0 ≤ 1.05 | 50 ohm | 1.23 | (3.12) |
| 8719B | NMD2.92mm female [1] | 2.92mm (K) male [2] | 4.0 — 20.0 ≤ 1.08 | 50 ohm | 1.23 | (3.12) |
| 8719F | NMD2.92mm female [1] | NMD2.92mm male [1] | 20.0 — 40.0 ≤ 1.12 | 50 ohm | 1.28 | (3.25) |
| 8719E | NMD2.92mm female [1] | NMD2.4mm male [3] | DC — 20.0 ≤ 1.08<br>20.0 — 40.0 ≤ 1.12 | 50 ohm | 1.44 | (3.66) |

**Note:** See 7809F on page 111 for NMD1.85mm female to 2.92mm (K) test port adapters or 7909F on page 114 for NMD2.4mm to 2.92mm (K) test port adapters.

[1] NMD2.92mm per Maury data sheet 5E-083. [2] Precision 2.92mm (K) per Maury data sheet 5E-063. [3] NMD2.4mm per Maury data sheet 5E-082.

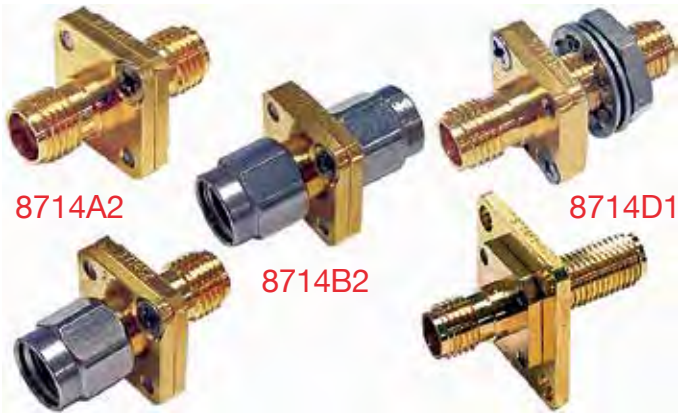
Key Literature: Maury data sheet 2B-004.



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# 2.92mm (K) In-Series Adapters

## Models 8714A2/B2/C2/D1/E1




### Description

Maury precision 2.92mm (K) in-series adapters are low VSWR and low loss devices that operate from DC to 40 GHz. The models 8714A2, B2 and C2 offer all combinations for adapting and are ideal for using with precision measurement applications. These adapters are minimum length, phase matched and feature a square-flange body for ease of connecting and prevents rolling off tables. They are useful as "test port savers" when used with vector network analyzers such as the Keysight 8510, etc. The 8714D1 and 8714E1 are bulkhead and panel mount feedthru adapters respectively, designed for instrumentation applications.

### Specifications

Frequency Range . . . . . DC – 40 GHz

Maximum VSWR . . . . . DC - 4.0 GHz, 1.05

4.0 - 20.0 GHz, 1.08

20.0 - 40.0 GHz, 1.12

Impedance . . . . . 50 ohm

Connectors . . . . . 2.92mm (K) per Maury data sheet 5E-063

### Available Models

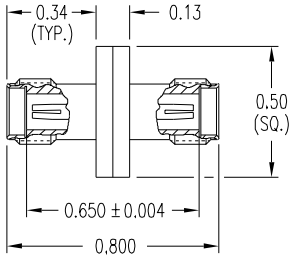
| MODEL | ADAPTS SIDE A | ADAPTS SIDE B | INSERTION LENGTH INCHES | INSERTION LENGTH (CM) |
|---|---|---|---|---|
| 8714A2 | 2.92mm female[1] | 2.92mm female[1] | 0.65 | (1.65) |
| 8714B2 | 2.92mm male[1] | 2.92mm male[1] | 0.65 | (1.65) |
| 8714C2 | 2.92mm female[1] | 2.92mm male[1] | 0.65 | (1.65) |
| 8714D1 | 2.92mm female[1] | 2.92mm female[1] | 0.85 | (2.15) |
| 8714E1 | 2.92mm female[1] | 2.92mm female[1] | 0.85 | (2.15) |

[1] Precision 2.92mm per Maury data sheet 5E-063.

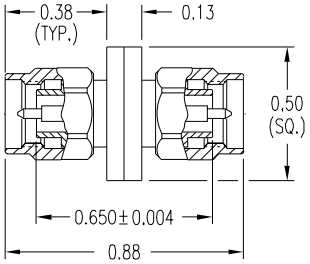
Key Literature: Maury data sheet 2B-003.

### Dimensions – Inches (cm)

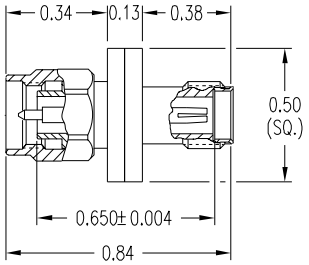
8714A2



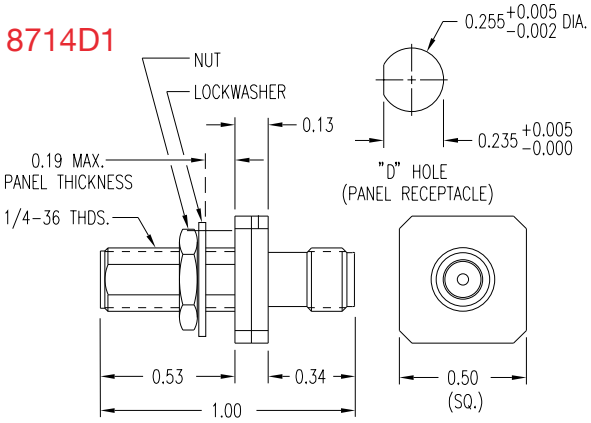

8714B2



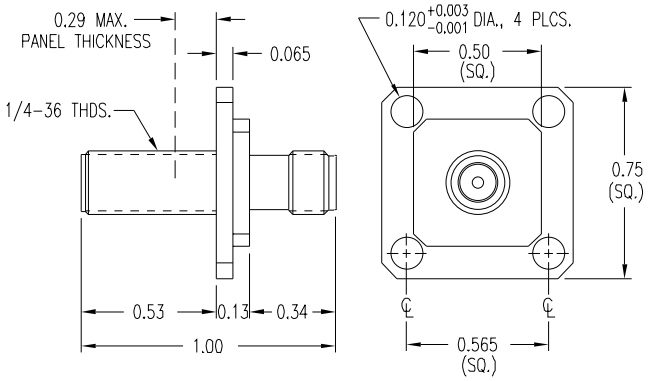

8714C2




8714D1




8714E1






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# 2.92mm Between-Series Adapters

Models 8723A/B/C/D and 8725A/B




## Description

The precision adapters in these model series are designed to allow devices with 2.92mm connectors to mate with devices and cables bearing 7mm or Type N connectors. When properly mated, they provide a low VSWR connection with low insertion loss and high repeatability. Made of highly durable materials, these adapters are ideal for use in laboratory and production environments where frequent connect/ disconnect cycles occur.

The 8725A and 8725B adapters are phase matched to each other so that they may be easily interchanged for network analyzer measurement of non-insertable devices.

## Connector Description – 2.92mm (K)

The K connectors on 8719A/B adapters are precision miniature 2.92mm air-interface connectors that are rated for operation from DC to 40 GHz. They have a mechanically compatible interface that mates with SMA and 3.5mm connectors. The K connector was originally introduced by Maury in 1974 as the MPC3 connector and re-introduced by Wiltron in 1984 as the K connector. They comply with IEEE standard 287 general precision connector, instrument grade (GPC2.92).

## Type N Connector Description

The precision type N connectors on these adapters are instrument grade, air-interface connectors that are rated for operation from DC to 18 GHz. They comply with IEEE standard 287 for instrument grade general precision connectors (GPC Type N). The connectors are normally made with stainless steel bodies with heat treated gold-plated beryllium copper contacts.

## 7mm Connector Description

Maury precision 7mm connectors are miniature, instrument grade, air-interface connectors rated for operation from DC to 18 GHz. They comply with IEEE standard 287 for instrument grade general precision connectors (GPC7). They are normally made with gold-plated beryllium copper bodies and have a six-slot heat treated gold-plated beryllium copper center conductor contact for improved repeatability and durability. See Maury data sheet 5E-060 for interface dimensions.

## Available Models

| MODEL | ADAPTS SIDE A | ADAPTS SIDE B | FREQUENCY RANGE (GHz) AND MAXIMUM VSWR | NOMINAL IMPEDANCE | INSERTION LENGTH INCHES | INSERTION LENGTH (CM) |
|---|---|---|---|---|---|---|
| 8723A | 2.92mm female [1] | Type N female [2] | DC — 4.0 ≤ 1.07<br>4.0 — 12.0 ≤ 1.10<br>12.0 – 18.0 ≤ 1.15 | 50 ohm | 1.614 | (4.099) |
| 8723B | 2.92mm female [1] | Type N male [2] | | 50 ohm | 1.914 | (5.014) |
| 8723C | 2.92mm male [1] | Type N female [2] | | 50 ohm | 1.614 | (4.099) |
| 8723D | 2.92mm male [1] | Type N male [2] | | 50 ohm | 1.914 | (5.014) |
| 8725A | 2.92mm female [1] | 7mm [3] | DC — 4.0 ≤ 1.05<br>4.0 — 12.0 ≤ 1.07<br>12.0 — 18.0 ≤ 1.10 | 50 ohm | 1.67 | (4.24) |
| 8725B | 2.92mm male [1] | 7mm [3] | | 50 ohm | 1.67 | (4.24) |

[1] Precision 2.92mm per Maury data sheet 5E-063.

[2] Precision type N per Maury data sheet 5E-049.

[3] Precision 7mm per Maury data sheet 5E-060.

Key Literature: Maury data sheet 2B-042, 2B-043.



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# NMD3.5mm Test Port Adapters

## 2433A1, 2633C, 8009, 8619, 8679, 8691 and 8829 Series

### *Features*

- *Low VSWR*
- *DC to 18, 20 or 26.5 GHz*
- *Protects VNA Test Ports*
- *Ruggedized for Long Life*




### *Description*

Maury's NMD3.5mm adapters are precision, low VSWR adapters designed to connect directly to the NMD-style 3.5mm male test ports on certain Keysight test sets and VNA models (including those in the PNA series). They are fully compatible with the VNA test ports, and adapt to precision 3.5mm 7mm TYPE N, TNC, AFTNC, or 14mm connectors. Maury test port adapters provide the best possible connection between the VNA and other precision cables and devices. Their rugged construction provides for long life and highly stable, highly repeatable connections. The 8009A/B and 8009F models also act as test port savers, by absorbing the wear and tear that would otherwise affect the test port; preventing costly repairs and eliminating downtime.

### *Connector Description*

The NMD3.5mm female connectors on Maury test port adapters are miniature, instrument grade, air-interface connectors., rated for operate up to 18, 20 or 26.5 GHz, according to the range of the adapted connector type. For interface specifications please refer to Maury data sheet 5E-084. The NMD male connectors on 8009F units are mateable to NMD female connectors via external threads, and can also mate to non-NMD connectors via internal threads.

### *Available Models*

| MODEL | ADAPTS SIDE A | ADAPTS SIDE B | FREQUENCY RANGE (GHz) AND MAXIMUM VSWR | NOMINAL IMPEDANCE | INSERTION LENGTH INCHES | INSERTION LENGTH (CM) |
|---|---|---|---|---|---|---|
| 8009A | NMD3.5mm female [1] | 3.5mm female [2] | DC — 18.0 ≤ 1.08<br>18.0 — 26.5 ≤ 1.12 | 50 ohm | 1.45 | (3.68) |
| 8009B | NMD3.5mm female [1] | 3.5mm male [2] | | 50 ohm | 1.49 | (3.79) |
| 8009F | NMD3.5mm female [1] | NMD3.5mm male [1] | | 50 ohm | 1.49 | (3.79) |
| 2633C | NMD3.5mm female [1] | 7mm [3] | DC — 18.0 ≤ $1.018 + 0.003f$ | 50 ohm | 1.78 | (4.53) |
| 8829A | NMD3.5mm female [1] | Type N female [4] | DC — 6.0 ≤ 1.04<br>6.0 — 18.0 ≤ 1.08 | 50 ohm | 2.04 | (5.18) |
| 8829B | NMD3.5mm female [1] | Type N male [4] | | 50 ohm | 2.20 | (5.59) |
| 8619A | NMD3.5mm female [1] | TNC female [5] | DC — 3.5 ≤ 1.06<br>3.5 — 7.0 ≤ 1.10<br>7.0 — 18.0 ≤ 1.16 | 50 ohm | 2.05 | (5.21) |
| 8619B | NMD3.5mm female [1] | TNC male [5] | | 50 ohm | 2.00 | (5.08) |
| 8691A | NMD3.5mm female [1] | AFTNC female [6] | DC — 4.0 ≤ 1.04<br>4.0 — 20.0 ≤ 1.10 | 50 ohm | 1.92 | (4.88) |
| 8691B | NMD3.5mm female [1] | AFTNC male [6] | | 50 ohm | 1.54 | (3.91) |
| 8679A | NMD3.5mm female [1] | TNCA female [7] | DC — 4.0 ≤ 1.04<br>4.0 — 20.0 ≤ 1.10 | 50 ohm | 1.92 | (4.88) |
| 8679B | NMD3.5mm female [1] | TNCA male [7] | | 50 ohm | 1.54 | (3.91) |
| 2433A1 | NMD3.5mm female [1] | 14mm [8] | DC — 8.5 ≤ $1.01 + 0.008f$ | 50 ohm | 2.32 | (5.89) |

[1] NMD3.5mm per Maury data sheet 5E-084.
[2] Precision 3.5mm per Maury data sheet 5E-062.
[3] Precision 7mm per Maury data sheet 5E-060.
[4] Precision type N per Maury data sheet 5E-049.
[5] Precision TNC per Maury data sheet 5E-053.
[6] Precision AFTNC per Maury data sheet 5E-056.
[7] Precision TNC MIL-STD 348A per Maury data sheet 5E-068.
[8] Precision 14mm per Maury data sheet 5E-068.

Key Literature: Maury data sheet 2B-049, 2B-049A, 2B-050, 2B-051, 2B-052, 2B-053.


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# 3.5mm In-Series Adapters

## Models 8021A/B/C/D/E/M/N/P/K/L




### *Description*

These precision 3.5mm adapters are low VSWR and low loss models that operate from DC to 34 GHz. The 8021A2/B2/C2 series are designed for in-series adapting and are phase matched, making them ideal for use in precision measurement applications. They are minimum length and feature a square-flanged body to prevent them from rolling off flat surfaces. They serve as "test port savers" when used with network analyzers such as the Keysight PNA-X, etc.

Several designs are available for instrumentation applications: 8021D1 is a bulkhead feedthru model, 8021E1 is a panel mount model, and 8021K1/L1 are bull-nose panel mount adapters. The 8021M/N/P series are slim-line 3.5mm models for use in tight spaces where minimal clearance exists around the test port.

### *Available Models*

| MODEL | ADAPTS | | INSERTION LENGTH | |
|---|---|---|---|---|
| | SIDE A | SIDE B | INCHES | (CM) |
| 8021A2 | 3.5mm female[1] | 3.5mm female[1] | 0.65 | (1.65) |
| 8021B2 | 3.5mm male[1] | 3.5mm male[1] | 0.65 | (1.65) |
| 8021C2 | 3.5mm female[1] | 3.5mm male[1] | 0.65 | (1.65) |
| 8021D1 | 3.5mm female[1] | 3.5mm female[1] | 0.85 | (2.15) |
| 8021E1 | 3.5mm female[1,2] | 3.5mm female[1,2] | 0.85 | (2.15) |
| 8021M | 3.5mm female[1] | 3.5mm female[1] | 0.915 | (2.41) |
| 8021N | 3.5mm female[1] | 3.5mm female[1] | 0.915 | (2.41) |
| 8021P | 3.5mm female[1] | 3.5mm male[1] | 0.915 | (2.41) |
| 8021K1 | 3.5mm male[1] | 3.5mm female[1] | 1.456 | (3.70) |
| 8021L1 | 3.5mm female[1] | 3.5mm female[1] | 1.456 | (3.70) |

[1] Precision 3.5mm per Maury data sheet 5E-062.
[2] Panel mount feedthru.

Key Literature: Maury data sheet 2B-021.

### *Specifications*

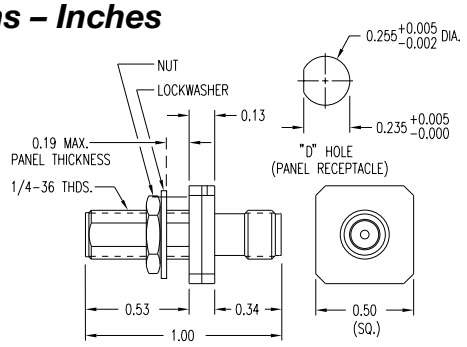
Frequency Range . . . . . DC – 34 GHz

| Maximum VSWR: | 8021A2/B2/C2//M/N/P | 8021D1/E1/K1/L1 |
|---|---|---|
| DC – 18 GHz | 1.05 | 1.07 |
| 18 – 26.5 GHz | 1.08 | 1.10 |
| 26.5 – 34.0 GHz | 1.12 | 1.14 |

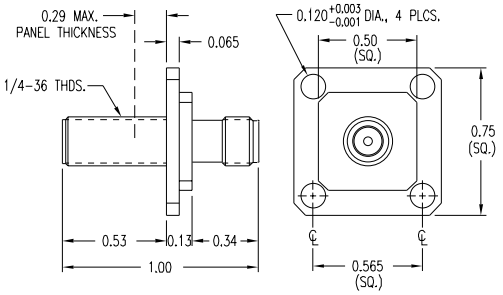
Impedance . . . . . 50 ohm
Connectors . . . . . 3.5mm per Maury data sheet 5E-062

### *Dimensions – Inches*

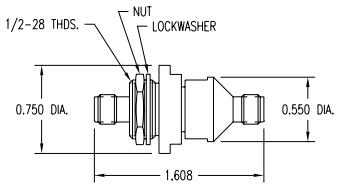
8021D1



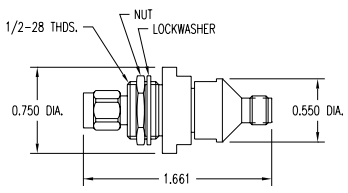

8021E1




8021K1




8021L1





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# 3.5mm (QT3.5mm™) Quick Test Adapters

## 8006 Series (U.S. Patent No. 6,210,221)

### *Features*

- *Quick, Easy Push-On/Pull-Off Design*
- *Designed for Durability and Long Life (3,000 Connect/Disconnect Cycles)*
- *Excellent Repeatability/Low VSWR*
- *Guide Sleeve Design for Automated applications*



8006E1 No Nut | 8006E11 3/8" Nut | 8006E21 9/16" Nut | 8006Q1 Guide Sleeve

### *Description*

The QT3.5mm™ male connector incorporates a quick connect design that provides for a push-on/pull-off capability that mates with any commercially available SMA, 3.5mm, and 2.92mm female connectors. The optional quick 1-1/2 turn twist nut combines the best of both worlds allowing quick connect or disconnect with the increased accuracy of a thread-on connector. In addition to the no nut and quick turn nut designs, a guide sleeve configuration is available to provide a self-aligning capability required in automated test stations.

The push-on connector offers excellent repeatability and long life making these adapters ideal for use in a production environment. The nut can also be torqued to 8 in. lbs making them suitable for test port applications where a calibration is required. The connectors come in four configurations: no nut, a 3/8" diameter nut, a 9/16" diameter nut, and a guide sleeve configuration.

### *Repeatability**

| MODE | DC — 18 GHz | 18 — 26.5 GHz |
|---|---|---|
| Push-On | > 40 dB | > 40 dB |
| Torqued to 8 in. lbs | > 50 dB | > 50 dB |
| Hand Torqued | > 50 dB | > 50 dB |

*Repeatability is based on a minimum of 3,000 connect/disconnect cycles.

### *Available Models*

| MODEL | ADAPTS SIDE A | SIDE B | FREQUENCY RANGE (GHz) | MAXIMUM VSWR (GHz) |
|---|---|---|---|---|
| 8006B1<br>8006B11<br>8006B21 | QT3.5mm™ (m) with no nut<br>QT3.5mm™ (m) with 3/8" diameter nut<br>QT3.5mm™ (m) with 9/16" diameter nut | 7mm | DC — 18.0 | DC — 4.0 ≤ 1.04<br>4.0 — 18.0 ≤ 1.08 |
| 8006C1<br>8006C11<br>8006C21 | QT3.5mm™ (m) with no nut<br>QT3.5mm™ (m) with 3/8" diameter nut<br>QT3.5mm™ (m) with 9/16" diameter nut | NMD3.5mm (f) | DC — 26.5 [1] | DC — 16.0 ≤ 1.08<br>16.0 — 26.5 ≤ 1.12 |
| 8006E1<br>8006E11<br>8006E21 | QT3.5mm™ (m) with no nut<br>QT3.5mm™ (m) with 3/8" diameter nut<br>QT3.5mm™ (m) with 9/16" diameter nut | 3.5mm (f) | DC — 26.5[1] | DC — 16.0 ≤ 1.05<br>16.0 — 26.5 ≤ 1.08 |
| 8006F1<br>8006F11<br>8006F21 | QT3.5mm™ (m) with no nut<br>QT3.5mm™ (m) with 3/8" diameter nut<br>QT3.5mm™ (m) with 9/16" diameter nut | 3.5mm (m) | DC — 26.5[1] | DC — 16.0 ≤ 1.05<br>16.0 — 26.5 ≤ 1.08 |
| 8006G1<br>8006G11<br>8006G21 | QT3.5mm™ (m) with no nut<br>QT3.5mm™ (m) with 3/8" diameter nut<br>QT3.5mm™ (m) with 9/16" diameter nut | Type N (f) | DC — 18.0 | DC — 4.0 ≤ 1.05<br>4.0 — 18.0 ≤ 1.08 |
| 8006H1<br>8006H11<br>8006H21 | QT3.5mm™ (m) with no nut<br>QT3.5mm™ (m) with 3/8" diameter nut<br>QT3.5mm™ (m) with 9/16" diameter nut | Type N (m) | DC — 18.0 | DC — 14.0 ≤ 1.05<br>4.0 — 18.0 ≤ 1.08 |
| 8006K1<br>8006K11<br>8006K21 | QT3.5mm™ (m) with no nut<br>QT3.5mm™ (m) with 3/8" diameter nut<br>QT3.5mm™ (m) with 9/16" diameter nut | NMD2.4mm (f) | DC — 26.5[1] | DC — 16.0 ≤ 1.08<br>16.0 — 26.5 ≤ 1.12 |
| 8006Q1 | QT3.5mm™ (m) guide sleeve | 3.5mm (f) | DC — 26.5[1] | DC — 16.0 ≤ 1.05<br>16.0 — 26.5 ≤ 1.08 |

[1] Slightly reduced VSWR specifications to 34 GHz.



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# 3.5mm Between-Series Adapters

## 8022, 8023, 8025, 8682, 8672 & 8028 Series




### Description

These precision adapters are used to connect 3.5mm devices to cables or devices with the connector types listed below. Low VSWR, low insertion loss and high repeatability, make these rugged, highly durable adapters ideal for use wherever frequent connect/disconnect cycles occur. Most are phase matched within their model series.

### 3.5mm Connector Description

Rated from DC to 34 GHz, the precision 3.5mm miniature, air-interface connectors on these adapters comply with IEEE standard 287 for instrument grade general precision connectors (GPC3.5). See Maury data sheet 5E-062 for interface dimensions.

### 7mm Connector Description *(see page 125)*

Rated from DC to 18 GHz, these precision miniature, air-interface connectors comply with IEEE standard 287 for instrument grade general precision connectors (GPC7). See Maury data sheet 5E-060 for interface dimensions.

### Type N Connector Description *(see page 126)*

Rated from DC to 18 GHz, these precision miniature, air-interface connectors comply with IEEE standard 287 for instrument grade general precision connectors (GPC Type N). Maury data sheet 5E-049 for interface dimensions.

### BNC Connector Description

Rated from DC to 10 GHz, Maury BNC series connectors conform to MIL-C-39012. The two-stud bayonet coupling connectors are normally made with stainless steel bodies with heat treated gold plated beryllium copper contacts.

### TNC Connector Descriptions *(see page 131)*

Maury offers three precision TNC connector designs. See Maury data sheet 5E-058 for interface dimensions.

### Available Models

| MODEL | ADAPTS | | FREQUENCY RANGE (GHZ) AND MAXIMUM VSWR | NOMINAL IMPEDANCE | INSERTION LENGTH | |
|---|---|---|---|---|---|---|
| | SIDE A | SIDE B | | | INCHES | (CM) |
| 8022A1 | 3.5mm female [1] | 7mm | DC – 4.0 ≤ 1.04<br>4.0 – 18.0 ≤ 1.08 | 50 ohm | 1.67 | (4.24) |
| 8022B1 | 3.5mm male [1] | 7mm | | | | |
| 8022A2 | 3.5mm female [1] | 7mm [2] | | | | |
| 8022B2 | 3.5mm male [1] | 7mm [2] | | | | |
| 8022S | 3.5mm female [1] | 7mm [3] | | | 1.22 | (3.10) |
| 8022T | 3.5mm male [1] | 7mm [3] | | | | |
| 8023A | 3.5mm female [1] | Type N female | DC – 4.0 ≤ 1.065<br>4.0 – 18.0 ≤ 1.13 | 50 ohm | 1.62 | (4.11) |
| 8023B1 | 3.5mm female [1] | Type N male | | | | |
| 8023C | 3.5mm male [1] | Type N female | | | | |
| 8023D1 | 3.5mm male [1] | Type N male | | | | |
| 8025A1 | 3.5mm female [1] | TNC female | DC – 4.0 ≤ 1.04 (< 1.03 typ)<br>4.0 – 8.0 ≤ 1.14 (< 1.07 typ)<br>8.0 – 18.0 ≤ 1.20 (< 1.15 typ) | 50 ohm | 1.61 | (4.10) |
| 8025B1 | 3.5mm female [1] | TNC male | | | | |
| 8025C1 | 3.5mm male [1] | TNC female | | | | |
| 8025D1 | 3.5mm male [1] | TNC male | | | | |
| 8682A | 3.5mm female [1] | AFTNC female | DC – 4.0 ≤ 1.04<br>4.0 – 12.0 ≤ 1.06<br>12.0 – 20.0 ≤ 1.08 | 50 ohm | 1.34 | (3.40) |
| 8682B | 3.5mm female [1] | AFTNC male | | | 1.29 | (3.28) |
| 8682C | 3.5mm male [1] | AFTNC female | | | 1.34 | (3.40) |
| 8682D | 3.5mm male [1] | AFTNC male | | | 1.29 | (3.28) |
| 8672A | 3.5mm female [1] | TNCA female | DC – 4.0 ≤ 1.04<br>4.0 – 12.0 ≤ 1.06<br>12.0 – 20.0 ≤ 1.08 | 50 ohm | 1.34 | (3.40) |
| 8672B | 3.5mm female [1] | TNCA male | | | 1.29 | (3.28) |
| 8672C | 3.5mm male [1] | TNCA female | | | 1.34 | (3.40) |
| 8672D | 3.5mm male [1] | TNCA male | | | 1.29 | (3.28) |
| 8028A | 3.5mm female [1] | BNC female | DC – 4.0 ≤ 1.10<br>4.0 – 10.0 ≤ 1.20 | 50 ohm | 2.00 | (5.08) |
| 8028B | 3.5mm female [1] | BNC male | | | 1.91 | (4.85) |
| 8028C | 3.5mm male [1] | BNC female | | | 2.00 | (5.08) |
| 8028D | 3.5mm male [1] | BNC male | | | 1.91 | (4.85) |

[1] Precision 3.5mm per Maury data sheet 5E-062. These 3.5mm connectors are mating compatible with SMA or 2.92mm (K) connectors.

[2] High Precision 7mm test port interface with enhanced performance in VNA applications.

[3] 8022S and 8022T feature low VSWR and ultra-low insertion loss from DC to 18.0 GHz. Designed for optimal match and loss performance. See data sheet 2B-022E.

Key Literature: Maury data sheets 2B-022, 2B-022D, 2B-022E, 2B-017, 2B-017A, 2B-025, and 2B-028.



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# 3.5mm Between-Series Panel Mount Adapters

## Models 8022N/P, 8023P1/P2, 8023T1/T2, 8009D/E/E1

### Description

The 8022N/P and 8023P/T models are precision panel mount adapters designed for use in OEM applications, special test fixtures, and custom instrumentation designs. These models adapt 3.5mm female or male connectors to 7mm or type N female or male connectors. When properly mated, they provide a low VSWR connection with low insertion loss and high repeatability. Made of highly durable materials, these adapters are ideal for use in laboratory and production environments where frequent connect/disconnect cycles occur.

The 8009D/E/E1 are NMD3.5mm panel mount adapters designed for use in applications where the highest repeatability is critical. They adapt precision 3.5mm connectors to NMD3.5mm male connectors, and are mateable to non-NMD SMA, 2.92mm (K) and 3.5mm connectors via internal threads. The center conductors are supported by two dielectric beads for exceptional stability and long life. These models are rated for operation from DC to 26.5 GHz.

### 3.5mm Connector Description

Maury precision 3.5mm connectors on these adapters are miniature, instrument grade, air-interface connectors that are rated for operation from DC to 34 GHz. They comply with IEEE standard 287 for instrument grade general precision connectors (GPC3.5).

### 7mm Connector Description

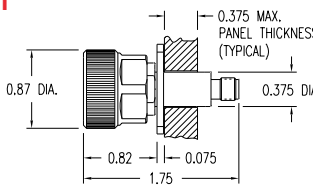
Maury precision 7mm connectors are miniature, instrument grade, air-interface connectors rated for operation from DC to 18 GHz. They comply with IEEE standard 287 for instrument grade general precision connectors (GPC7). They are normally made with gold-plated beryllium copper bodies and have a six-slot heat treated gold-plated beryllium copper center conductor contact for improved repeatability and durability. See Maury data sheet 5E-060 for interface dimensions.

### Type N Connector Description

The precision type N connectors on these adapters are instrument grade, air-interface connectors that are rated for operation from DC to 18 GHz. They comply with IEEE standard 287 for instrument grade general precision connectors (GPC Type N). The connectors have stainless steel bodies with heat treated gold-plated beryllium copper contacts.

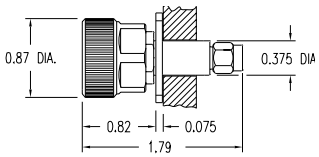


8022N



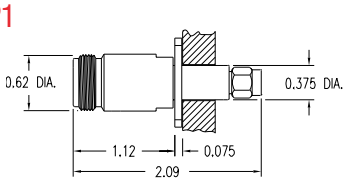



8022P



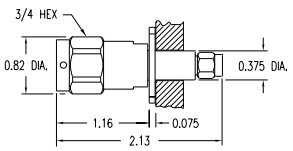



8023P1



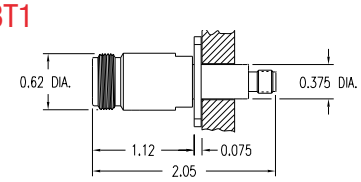


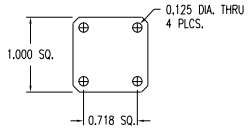

8023P2





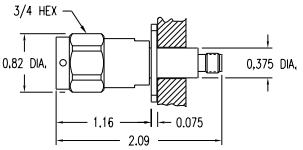

8023T1



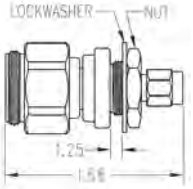

Flange Layout (8022/23)

8023T2

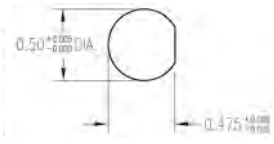



8009D






Recommended Mounting Hole (8009D)




### Available Models

| MODEL | ADAPTS SIDE A | ADAPTS SIDE B | FREQUENCY RANGE (GHz) AND MAXIMUM VSWR | NOMINAL IMPEDANCE | INSERTION LENGTH INCHES | INSERTION LENGTH (CM) |
|---|---|---|---|---|---|---|
| 8022N | 3.5mm female | 7mm | DC — 4.0 ≤ 1.04 | 50 ohm | 1.670 | (4.24) |
| 8022P | 3.5mm male | 7mm | 4.0 — 18.0 ≤ 1.08 | 50 ohm | 1.670 | (4.24) |
| 8023P1 | 3.5mm male | Type N female | DC — 4.0 ≤ 1.065 | 50 ohm | 1.611 | (4.09) |
| 8023P2 | 3.5mm male | Type N male | 4.0 — 18.0 ≤ 1.13 | 50 ohm | 1.972 | (5.01) |
| 8023T1 | 3.5mm female | Type N female | DC — 4.0 ≤ 1.065 | 50 ohm | 1.615 | (4.10) |
| 8023T2 | 3.5mm female | Type N male | 4.0 — 18.0 ≤ 1.13 | 50 ohm | 1.976 | (5.02) |
| 8009D | 3.5mm male | NMD3.5mm male | DC — 18.0 ≤ 1.06 | 50 ohm | 1.455 | (3.69) |
| 8009E | 3.5mm male | NMD3.5mm male | 18.0 — 26.5 ≤ 1.10 | 50 ohm | 1.455 | (3.69) |
| 8009E1 | 3.5mm male | NMD3.5mm male | | 50 ohm | 1.455 | (3.69) |

Key Literature: Maury data sheets 2B-022C, 2B-017A and 2B-034B.



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# 7mm Between-Series Adapters

## Series 2633, 2606, 2607, 2617, 2621, 2622, 2624, 2625, 2657, 8692 & 8696




### *Description*

Maury offers an extensive line of precision 7mm adapters in all common laboratory and systems connector types. 7mm adapters are also available for special purpose connections such as EIA rigid line connectors. Female and male adapters in the same connector series are phase matched for VNA applications. See pages 114 –123 for 7mm to 2.4mm, 2.92mm, and 3.5mm adapters.

### *7mm Connector Description*

Maury precision 7mm connectors are miniature, instrument grade, air-interface connectors rated for operation from DC to 18 GHz. They comply with IEEE standard 287 for instrument grade general precision connectors (GPC7). They are normally made with gold-plated beryllium copper bodies and have a six-slot heat treated gold-plated beryllium copper center conductor contact for improved repeatability and durability. See Maury data sheet 5E-060 for interface dimensions.

### *Available Models*

| MODEL | ADAPTS SIDE A | ADAPTS SIDE B | FREQUENCY RANGE (GHz) AND MAXIMUM VSWR | NOMINAL IMPEDANCE | INSERTION LENGTH INCHES | INSERTION LENGTH (CM) |
|---|---|---|---|---|---|---|
| 2633A | 7mm "female" [1] | 7mm [1] | DC — 18.0 ≤ 1.004 + 1.003$f$ | 50Ω | 1.62 | (4.24) |
| 2606C | 7mm [1] | Type N female [2] | DC — 4.0 ≤ 1.03 | 50Ω | 1.51 | (3.84) |
| 2606D | 7mm [1] | Type N male [2] | 4.0 — 9.0 ≤ 1.04<br>9.0 — 18.0 ≤ 1.07 | 50Ω | 1.51 | (3.84) |
| 2622A1 | 7mm [1] | TNC female [3] | DC — 4.0 ≤ 1.05 | 50Ω | 1.68 | (4.26) |
| 2622B | 7mm [1] | TNC male [3] | 4.0 — 18.0 ≤ 1.15 | 50Ω | 1.55 | (3.94) |
| 8692A | 7mm [1] | AFTNC female [4] | DC — 4.0 ≤ 1.04 | 50Ω | 1.88 | (4.78) |
| 8692B | 7mm [1] | AFTNC male [4] | 4.0 — 18.0 ≤ 1.06 | 50Ω | 1.82 | (4.62) |
| 8696A | 7mm [1] | TNCA female [5] | DC — 4.0 ≤ 1.04 | 50Ω | 1.88 | (4.78) |
| 8696B | 7mm [1] | TNCA male [5] | 4.0 — 18.0 ≤ 1.06 | 50Ω | 1.82 | (4.62) |
| 2625A | 7mm [1] | SMA female [6] | DC — 4.0 ≤ 1.05<br>4.0 — 10.0 ≤ 1.08 | 50Ω | 1.67 | (4.24) |
| 2625B | 7mm [1] | SMA male [6] | 10.0 — 18.0 ≤ 1.15 | 50Ω | 1.67 | (4.24) |
| 2621A1 | 7mm [1] | BNC female | DC — 4.0 ≤ 1.06 | 50Ω | 2.16 | (5.48) |
| 2621B1 | 7mm [1] | BNC male | 4.0 — 10.0 ≤ 1.15 | 50Ω | 2.07 | (5.25) |
| 8582D1 | 7mm [1] | BNC 75Ω female | DC — 2.0 ≤ 1.50 (Typ.) | 50Ω /75Ω | 2.06 | (5.23) |
| 8582D2 | 7mm [1] | BNC 75Ω male | DC — 2.0 ≤ 1.50 (Typ.) | 50Ω /75Ω | 2.06 | (5.23) |
| 8582D3 | 7mm [1] | BNC 75Ω female | DC — 12.0 ≤ 1.60 (Typ.) | 50Ω /75Ω | 2.06 | (5.23) |
| 8582D4 | 7mm [1] | BNC 75Ω male | DC — 12.0 ≤ 1.60 (Typ.) | 50Ω /75Ω | 2.06 | (5.23) |
| 2657A | 7mm [1] | HN female [7] | DC — 4.0 ≤ 1.05 | 50Ω | 3.00 | (7.62) |
| 2657B | 7mm [1] | HN male [7] | 4.0 — 8.5 ≤ 1.12 | 50Ω | 2.70 | (6.86) |
| 2624A | 7mm [1] | SC female [8] | DC — 4.0 ≤ 1.06 | 50Ω | 2.36 | (5.99) |
| 2624B1 | 7mm [1] | SC male [8] | 4.0 — 8.0 ≤ 1.09<br>8.0 — 10.0 ≤ 1.12 | 50Ω | 2.22 | (5.64) |
| 2607A1 | 7mm [1] | 14mm (GR900) | DC — 8.5 ≤ 1.004 + 1.004$f$ | 50Ω | 2.01 | (5.10) |
| 2617 | 7mm [1] | 7/8 EIA | DC — 1.0 ≤ 1.02<br>1.0 — 2.0 ≤ 1.05<br>2.0 — 3.0 ≤ 1.10<br>3.0 — 4.0 ≤ 1.15 | 50Ω | 2.68 | (6.81) |

1 7mm per Maury data sheet 5E-060.
2 Precision type N per Maury data sheet 5E-049.
3 Precision TNC per Maury data sheet 5E-053
4 Precision TNC MIL-C-87104/2 per Maury data sheet 5E-056.
5 Precision TNC MIL-STD 348A per Maury data sheet 5E-058.
6 Precision stainless steel per MIL-C-39012.
7 Precision stainless steel HN per Maury data sheet 5E-051.
8 Precision stainless steel SC per Maury data sheet 5E-050.

Key Literature: Maury data sheets 2B-022, 2B-022D, 2B-017, 2B-017A, 2B-025, 2B-028, and 2B-030.


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# Type N In-Series Adapters (50 ohm) – Phase Matched
## 8828 Series

### Description

The 8828 precision type N in-series adapters feature extremely low VSWR with low insertion loss, and are phase matched (having the same electrical insertion length) so they may be readily interchanged in network analyzer measurement applications. They are constructed with aluminum bodies. Connector bodies are made from stainless steel, and the center conductors are made from gold plated, heat treated beryllium.

### Connector Description

The Maury type N connectors on these adapters are precision, miniature, instrument grade, air-interface connectors, rated for operation from DC to 18 GHz. They comply with IEEE standard 287 for instrument grade general precision connectors (GPC Type N), and meet most applicable interface requirements of MIL-C-39012/1 (see footnote 2, in Figure 1 below) and they meet all applicable interface requirements of MIL-C-39012/2. The connectors will mate properly with MIL-C-71, MIL-C-39012, MIL-T-81490 and most other semi-precision type N connectors. The male connectors are provided with a 0.75-inch hex coupling nut so they can be properly torqued to 12 in. lbs. The connectors have stainless steel bodies with heat treated gold-plated beryllium copper contacts.

### Specifications

Frequency Range . . . . . DC – 18 GHz

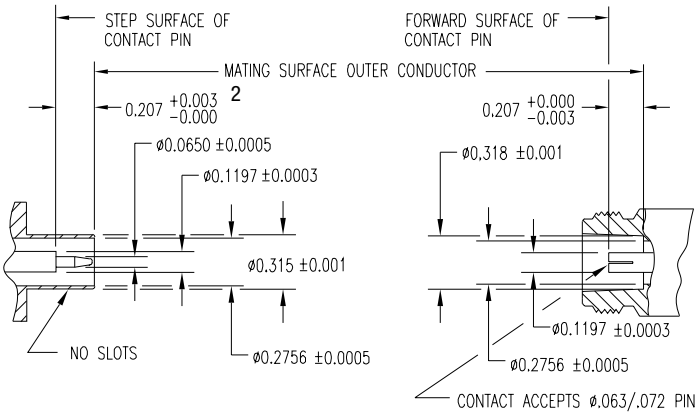
Maximum VSWR . . . . . DC – 4.0 GHz, 1.03 (<1.02 typical)
4.0 – 10.0 GHz, 1.05 (<1.03 typical)
10.0 – 18.0 GHz, 1.09 (<1.06 typical)

Impedance . . . . . 50 ohm

Insertion Loss . . . . . 0.08 dB + 0.01 dB$f$ (GHz)

### Interface Dimensions – Inches

Figure 1 – Contact Pin Location




2 This dimension is .210 minimum on MIL-C-39012/1.

Key Literature: Maury data sheet 2B-029.




### Available Models

| MODEL | ADAPTS SIDE A | ADAPTS SIDE B | INSERTION LENGTH INCHES | INSERTION LENGTH (CM) |
|---|---|---|---|---|
| 8828A | Type N female [1] | Type N female [1] | 2.50 | (6.35) |
| 8828B | Type N male [1] | Type N male [1] | 2.50 | (6.35) |
| 8828C | Type N female [1] | Type N male [1] | 2.50 | (6.35) |

[1] Precision type N per Maury data sheet 5E-049.

### Dimensions – Inches

Figure 2 – 8828A

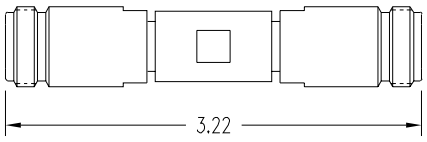



Figure 3 – 8828B

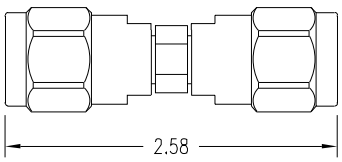
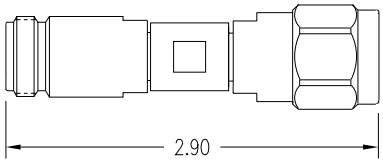



Figure 4 – 8828C





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# Type N In-Series Adapters (50 ohm)

## 8801 and 8803 Series

### Description

The 8801 beadless (air dielectric) adapters, and the 8803 bead-supported adapters both have precision type N connectors that exhibit low VSWR and low insertion loss from DC to 18 GHz. They are useful in a variety of VNA measurement applications or in general laboratory use. Two kits are available; the 8801K and 8801L; each including a selection of these adapters in a wood instrument case. (See "Available Models" below for kit contents.)



8801K
Type N
Adapter Kit

### Connector Description

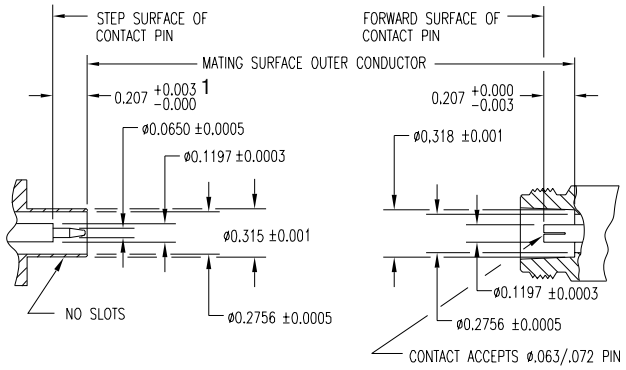
The Maury type N connectors on these adapters are precision, miniature, instrument grade, air-interface connectors, rated for operation from DC to 18 GHz. They comply with IEEE standard 287 for instrument grade general precision connectors (GPC Type N), and most applicable interface requirements of MIL-C-39012/1 (see footnote 1, in Figure 1 below). They also meet all applicable interface requirements of MIL-C-39012/2, and will mate properly with MIL-C-71, MIL-C-39012, MIL-T-81490 and most other semi-precision type N connectors. The male connectors are provided with a 0.75-inch hex coupling nut so they can be properly torqued to 12 in. lbs. The connectors have stainless steel bodies with heat treated gold-plated beryllium copper contacts.

### Specifications

Frequency Range . . . . . DC – 18 GHz
Maximum Insertion Loss:
DC – 4.0 GHz . . . . . 8801 ≤ 0.07 dB; 8803 ≤ 0.1 dB
4.0 – 10.0 GHz . . . . . 8801 ≤ 0.10 dB; 8803 ≤ 0.15 dB
10.0 – 18.0 GHz . . . . . 8801 ≤ 0.15 dB; 8803 ≤ 0.25 dB
Dielectric . . . . . .8801 – Beadless; 8803 – Teflon Bead

### Dimensions – Inches

Figure 1 – Contact Pin Location




1 This dimension is .210 minimum on MIL-C-39012/1.

### Dimensions – Inches

Figure 2 – 8801A/8803A

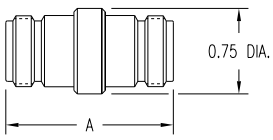



Figure 3 – 8801B/8803B

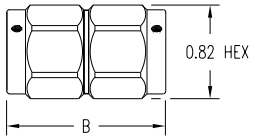
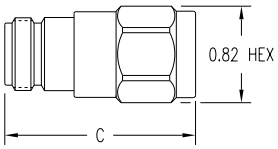



Figure 4 – 8801C/8803C




### Available Models

| MODEL | ADAPTS SIDE A | ADAPTS SIDE B | FREQUENCY RANGE (GHz) AND MAXIMUM VSWR | NOMINAL IMPEDANCE | INSERTION LENGTH INCHES | INSERTION LENGTH (CM) |
|---|---|---|---|---|---|---|
| 8801A | Type N female [2] | Type N female [2] | DC — 4.0 ≤ 1.03 | 50 ohm | 0.657 | (1.67) |
| 8801B | Type N male [2] | Type N male [2] | 4.0 — 10.0 ≤ 1.08 | 50 ohm | 1.302 | (3.31) |
| 8801C | Type N female [2] | Type N male [2] | 10.0 — 18.0 ≤ 1.10 | 50 ohm | 1.237 | (3.14) |
| 8803A | Type N female [2] | Type N female [2] | DC — 4.0 ≤ 1.05 (<1.03 typ) | 50 ohm | 0.836 | (2.12) |
| 8803B | Type N male [2] | Type N male [2] | 4.0 — 10.0 ≤ 1.08 (<1.05 typ) | 50 ohm | 1.729 | (4.39) |
| 8803C | Type N female [2] | Type N male [2] | 10.0 — 18.0 ≤ 1.12 (<1.08 typ) | 50 ohm | 1.282 | (3.25) |
| 8803D [3] | Type N female [2] | Type N female [2] | | 50 ohm | 0.836 | (2.12) |
| 8801K | Kit consisting of one each 8801A, 8801B, 8803A and 8803B. | | | | | |
| 8801L | Kit consisting of one each of all models listed above, except the 8803D. | | | | | |

2 Precision type N per Maury data sheet 5E-049.
3 This is a precision pressurized bulkhead feed thru adapter similar to UG30/U. Outline drawing available on request.

Key Literature: Maury data sheet 2B-010.


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# Type N Between-Series Adapters (50 ohm)

## Model Series 8694, 8697, 8816, 8817, 8820, and 8821

### *Description*

Maury precision type N between-series adapters are designed for general purpose laboratory use and high precision measurement applications. They exhibit low VSWR and low insertion loss across the frequency range of the adapted connector, and are built to the same rigorous quality standards as the type N in-series adapters listed on the preceding pages.

### *Type N Connector Description*

See page 125 for a description of Maury type N connectors. See also Maury data sheet 5E-049 for interface dimensions.



8816A 8816C 8817B 8820C

### *Available Models*

| MODEL | ADAPTS SIDE A | ADAPTS SIDE B | FREQUENCY RANGE (GHz) AND MAXIMUM VSWR | NOMINAL IMPEDANCE | INSERTION LENGTH INCHES | INSERTION LENGTH (CM) |
|---|---|---|---|---|---|---|
| 8816A | Type N female [2] | SMA female [3] | DC — 4.0 ≤ 1.05<br>4.0 — 10.0 ≤ 1.10<br>10.0 — 18.0 ≤ 1.16 | 50 ohm | 1.59 | (4.04) |
| 8816B | Type N female [2] | SMA male [3] | | | 1.59 | (4.04) |
| 8816C | Type N male [2] | SMA female [3] | | | 1.95 | (4.95) |
| 8816D | Type N male [2] | SMA male [3] | | | 1.95 | (4.95) |
| 8817A | Type N female [2] | TNC female [4] | DC — 4.0 ≤ 1.065<br>4.0 — 8.0 ≤ 1.10<br>8.0 — 12.0 ≤ 1.12<br>12.0 — 18.0 ≤ 1.14 | | 1.17 | (2.97) |
| 8817B | Type N female [2] | TNC male [4] | | | 1.50 | (3.81) |
| 8817C | Type N male [2] | TNC female [4] | | | 1.53 | (3.89) |
| 8817D | Type N male [2] | TNC male [4] | | | 1.86 | (4.72) |
| 8694A | Type N female [2] | AFTNC female [5] | DC — 4.0 ≤ 1.04<br>4.0 — 8.0 ≤ 1.06<br>8.0 — 18.0 ≤ 1.08 | | 1.82 | (4.63) |
| 8694B | Type N female [2] | AFTNC male [5] | | | 1.77 | (4.48) |
| 8694C | Type N male [2] | AFTNC female [5] | | | 2.18 | (5.54) |
| 8694D | Type N male [2] | AFTNC male [5] | | | 2.13 | (5.90) |
| 8697A | Type N female [2] | TNCA female [6] | DC — 4.0 ≤ 1.04<br>4.0 — 8.0 ≤ 1.06<br>8.0 — 18.0 ≤ 1.08 | | 1.82 | (4.63) |
| 8697B | Type N female [2] | TNCA male [6] | | | 1.77 | (4.48) |
| 8697C | Type N male [2] | TNCA female [6] | | | 2.18 | (5.54) |
| 8697D | Type N male [2] | TNCA male [6] | | | 2.13 | (5.90) |
| 8821A1 [1] | Type N female [2] | BNC female | DC — 4.0 ≤ 1.08<br>4.0 — 10.0 ≤ 1.20 | | 2.10 | (5.33) |
| 8821B1 [1] | Type N female [2] | BNC male | | | 2.01 | (5.11) |
| 8821C1 [1] | Type N male [2] | BNC female | | | 2.46 | (6.25) |
| 8821D1 [1] | Type N male [2] | BNC male | | | 2.37 | (6.02) |
| 8820A | Type N female [2] | HN female [7] | DC — 4.0 ≤ 1.08<br>4.0 — 8.5 ≤ 1.12 | | 1.93 | (4.90) |
| 8820B1 | Type N female [2] | HN male [7] | | | 2.64 | (6.71) |
| 8820C | Type N male [2] | HN female [7] | | | 2.39 | (6.07) |
| 8820D1 | Type N male [2] | HN male [7] | | | 2.00 | (5.08) |

[1] 8821A1/B1 and 8821C1/D1 are phase matched pairs.
[2] Precision type N per Maury data sheet 5E-049.
[3] Precision stainless steel SMA per MIL-C-39012.
[4] Precision stainless steel TNC per Maury data sheet 5E-053.
[5] Precision TNC per MIL-C-87104/2 per Maury data sheet 5E-056.
[6] Precision TNC per MIL-STD 348A per Maury data sheet 5E-058.
[7] Precision stainless steel HN per Maury data sheet 5E-051.

Key Literature: Maury data sheets 2B-006B, 2B-016, 2B-011, 2B-045, 2B-056, 2B-057 and 2B-058.



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# Type N Adapters (75 ohm) – Phase Matched

## 8882 Series

### Description

The 8882 type N 75 ohm adapters are manufactured with a precision version of the Maury type N interface. To help prevent the inadvertent mating of these 75 ohm adapters to 50 ohm type N connectors, a black band is incised into these adapters on the male coupling nut, or just behind the female coupling threads. 75 ohm N center conductors are smaller than 50 ohm versions, so mating a 50 ohm male to a 75 ohm female will destroy the female contact. Mating a 75 ohm male to a 50 ohm female will result in a poor electrical connection.

These adapters are phase matched (having the same electrical insertion length) within their series so they may be readily interchanged in network analyzer measurement applications, and for accurate measurement of non-insertable devices.

### Connector Description

Maury type N, 75 ohm connectors are a precision version of the Maury type N interface which meets all applicable requirements of IEC169-16. They exhibit extremely low VSWR and although rated to 2.0 GHz, they can be used at much higher frequencies. The male connectors are provided with a 0.75-inch hex coupling nut so they can be properly torqued to 12 in. lbs. See Maury data sheet 5E-054 for interface dimensions.

### Specifications

Frequency Range . . . . . DC – 2.0 GHz

Maximum VSWR:

8882A/B/C . . . . . 1.03

All 75 ohm to 50 ohm models . . . . . 1.5 (75/50 ohm) typical
(calibrated out during the measurement calibration process)

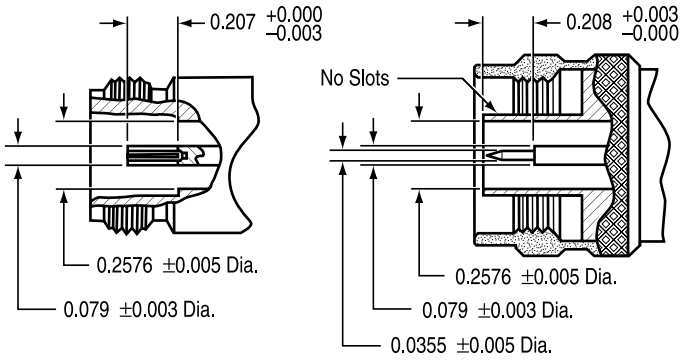
Nominal Impedance . . . . . 75 ohm



8882E1 8882E2 8882G11 8882F22

### Interface Dimensions

Contact Pin Location




### Available Models (In-Series)

| MODEL | ADAPTS SIDE A | ADAPTS SIDE B | INSERTION LENGTH INCHES | INSERTION LENGTH (CM) |
|---|---|---|---|---|
| 8882A | Type N (F) 75 Ω [1] | Type N (F) 75 Ω [1] | 2.768 | (7.0307) |
| 8882B | Type N (M) 75 Ω [1] | Type N (M) 75 Ω [1] | 2.768 | (7.0307) |
| 8882C | Type N (F) 75 Ω [1] | Type N (M) 75 Ω [1] | 2.768 | (7.0307) |

[1] Precision Type N - 75 ohm per Maury data sheet 5E-054.
[2] NMD3.5mm per Maury data sheet 5E-084.
[3] Precision 3.5mm per Maury data sheet 5E-062.

### Available Models (Between-Series)

| MODEL | ADAPTS SIDE A | ADAPTS SIDE B | INSERTION LENGTH INCHES | INSERTION LENGTH (CM) |
|---|---|---|---|---|
| 8882E1 | NMD3.5mm (F) 50 Ω [2] | Type N (F) 75 Ω [1] | 1.003 | (2.5476) |
| 8882E2 | NMD3.5mm (F) 50 Ω [2] | Type N (M) 75 Ω [1] | 1.603 | (4.0716) |
| 8882G11 | Type N (F) 75 Ω [1] | 3.5mm (F) 50 Ω [3] | 1.748 | (4.4399) |
| 8882G12 | Type N (F) 75 Ω [1] | 3.5mm (M) 50 Ω [3] | 1.748 | (4.4399) |
| 8882G21 | Type N (M) 75 Ω [1] | 3.5mm (F) 50 Ω [3] | 1.748 | (4.4399) |
| 8882G22 | Type N (M) 75 Ω [1] | 3.5mm (M) 50 Ω [3] | 1.748 | (4.4399) |
| 8882D1 | Type N (F) 75 Ω [1] | 7mm 50 Ω [4] | 2.277 | (5.7836) |
| 8882D2 | Type N (M) 75 Ω [1] | 7mm 50 Ω [4] | 2.277 | (5.7836) |
| 8882F11 | Type N (F) 75 Ω [1] | Type N (F) 50 Ω [5] | 2.634 | (6.6904) |
| 8882F12 | Type N (F) 75 Ω [1] | Type N (M) 50 Ω [5] | 2.634 | (6.6904) |
| 8882F21 | Type N (M) 75 Ω [1] | Type N (F) 50 Ω [5] | 2.634 | (6.6904) |
| 8882F22 | Type N (M) 75 Ω [1] | Type N (M) 50 Ω [5] | 2.634 | (6.6904) |

[4] Precision 7mm per Maury data sheet 5E-060.
[5] Precision type N per Maury data sheet 5E-049.

Key Literature: Maury data sheet 2B-031.


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# LPC/OSP™ Between-Series Adapters

## 8787 Series

### Description

The LPC/OSP™[1] adapters are designed to provide a precisely repeatable mated interface for calibration purposes and for test of production components which use the standard OSP™[2] series blind-mate connectors.

Interface dimensions of the connectors are tightly controlled. A hexagonal coupling nut on the male connector, allows torquing to 8 in/lb with a calibrated torque wrench to further improve the repeatability of a mated pair. Both the female and male connectors are fully mating compatible with the standard OSP™ series and with Dynawave's Dynamate™ series 3 blind-mate connectors.

Most adapters in the same series are phase matched and may be interchanged for VNA measurement of non-insertable devices.

### 3.5mm Connector Description

The Maury precision 3.5mm connectors on these adapters are miniature, instrument grade, air-interface connectors that are rated for operation from DC to 34 GHz. They comply with IEEE standard 287 for instrument grade general precision connectors (GPC3.5).

### 7mm Connector Description

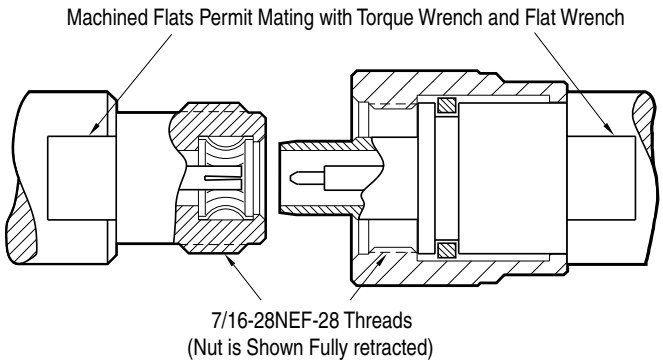
Maury precision 7mm connectors are miniature, instrument grade, air-interface connectors rated for operation from DC to 18 GHz. They comply with IEEE standard 287 for instrument grade general precision connectors (GPC7). They are normally made with gold-plated beryllium copper bodies and have a six- slot heat treated gold-plated beryllium copper center conductor contact for improved repeatability and durability. See Maury data sheet 5E-060 for interface dimensions.

### Type N Connector Description

The Maury type N connectors on these adapters are precision, miniature, instrument grade, air-interface connectors, rated for operation from DC to 18 GHz. They comply with IEEE standard 287 for instrument grade general precision connectors (GPC Type N), and meet most applicable interface requirements of MIL-C-39012/1 (see Note 7, below) and they meet all applicable interface requirements of MIL-C-39012/2. The connectors will mate properly with MIL-C-71, MIL-C-39012, MIL-T-81490 and most other semi-precision type N connectors. The male connectors are provided with a 0.75-inch hex coupling nut so they can be properly torqued to 12 in. lbs. The connectors have stainless steel bodies with heat treated gold-plated beryllium copper contacts.




### Maury Improved LCP/OSP™ Interface




### Available Models

| MODEL | ADAPTS SIDE A | ADAPTS SIDE B | FREQUENCY RANGE (GHz) AND MAXIMUM VSWR | NOMINAL IMPEDANCE | INSERTION LENGTH INCHES | INSERTION LENGTH (CM) |
|---|---|---|---|---|---|---|
| 8787Q | LPC/OSP™ female [1] | 3.5mm female [4] | | 50 ohm | 1.50 | (3.81) |
| 8787R | LPC/OSP™ female [1] | 3.5mm male [4] | DC — 4.0 ≤ 1.04 | 50 ohm | 1.50 | (3.81) |
| 8787S | LPC/OSP™ male [1] | 3.5mm female [4] | 4.0 — 18.0 ≤ 1.08 | 50 ohm | 1.50 | (3.81) |
| 8787T | LPC/OSP™ male [1] | 3.5mm male [4] | | 50 ohm | 1.50 | (3.81) |
| 8787G | LPC/OSP™ female [1] | 7mm [5] | DC — 4.0 ≤ 1.04 | 50 ohm | 2.10 | (5.32) |
| 8787H | LPC/OSP™ male [1] | 7mm [5] | 4.0 — 18.0 ≤ 1.08 | 50 ohm | 2.10 | (5.32) |
| 8787J | LPC/OSP™ female [1] | Type N male [6] | DC — 4.0 ≤ 1.065 | 50 ohm | 2.40 | (6.08) |
| 8787K | LPC/OSP™ male [1] | Type N male [6] | 4.0 — 18.0 ≤ 1.13 | 50 ohm | 2.40 | (6.08) |

[1] Precision LCP/OSP™ per Maury data sheet 5E-065.
[2] OSP™ is a trademark of M/A-Com, Inc.
[3] Dynamate™ is a trademark of Dynawave, Inc.
[4] Precision 3.5mm per Maury data sheet 5E-062.
[5] Precision 7mm per Maury data sheet 5E-060.
[6] Precision type N per Maury data sheet 5E-049.
[7] This dimension is .210 minimum on MIL-C-39012/1.

Key Literature: Maury data sheets 2B-022C, 2B-017A and 2B-034B.


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# TNC In-Series Adapters

## 232, 8688 & 8678 Series

### *Description*

Because TNC interfaces vary from maker to maker, compatibility must be verified before connectors of different specification types are mated. Mating different specification types degrades electrical performance and risks damage to connector interfaces. Maury application note 5A-031 discusses the most common TNC connectors and compatibility issues that arise if specification types are mixed. See also Maury data sheet 5E-057A to check the compatibility of your TNC connectors.

### *TNC Connector Descriptions*

***Maury offers three precision TNC connector designs:***

***MPC/TNC –*** Precision TNC connectors that mate with most commercially available TNC connectors and specifically with MIL-C-39012/26/27 test connectors or MIL-T-81490 connectors. This design is used in the 232A11/B11/C11 models and – with some modifications – in the 232A2/B2/C2 models.

Models 232A11/B11/C11 are designed per the Maury 5E-053 interface standard and are intended for general purpose precision test applications. These adapters are recommended for use with dielectrically loaded TNC interfaces. Because they are ideal for use in VNA application these adapters are provided in Maury 8650CK series VNA calibration kits (see pages 48-49).

Models 232A2/B2/C2 are designed per the Maury 5E-053A interface standard; an improved MPC/TNC version that is mating compatible with all common military and IEC specification TNC connectors. This includes MIL-STD-348A standard and test connectors (which replace MIL-C-39012 connectors), MIL-T-81490, and IEC 169-17 G0 and G2 connectors.

All 232 series adapters exhibit low VSWR when properly mated and are usable to 18 GHz.

***AFTNC –*** Fully compliant with MIL-C-87104/2 "AFTNC" design standards. Mating dimensions are tightly controlled to ensure low VSWR from DC to 20 GHz. In this design, the male connector utilizes a solid outer conductor configuration to provide consistent measurement results.




For long life and reliability, connector bodies are fabricated from solid stainless steel, with gold-plated, heat treated beryllium copper contacts. See Maury data sheet 5E-056 for interface dimensions.

This design is used in the 8688A/B/C in-series adapters (listed below). For optimum performance, models 8688A/B/C should only be used with other MIL-C-87104/2 connectors.

***TNCA –*** Fully compliant with MIL-STD 348A with tightly controlled interface dimensions to ensure low VSWR from DC to 20 GHz. This design is used in the 8678A/B/C in-series adapters listed below. In the 8678A/B/C models, the male connector utilizes a solid outer conductor configuration to provide consistent measurement results. When properly mated, these adapters exhibit low VSWR from DC to 20 GHz. When mated to TNC connectors governed by other specifications, reduced performance can be expected. Connector bodies are made from stainless steel, and contacts are made from gold-plated, heat treated beryllium copper to ensure long life and reliability. See Maury data sheet 5E-058 for interface dimensions.

### *Available Models*

| MODEL | ADAPTS SIDE A | ADAPTS SIDE B | FREQUENCY RANGE (GHz) AND MAXIMUM VSWR | NOMINAL IMPEDANCE | INSERTION LENGTH INCHES | INSERTION LENGTH (CM) |
|---|---|---|---|---|---|---|
| 232A11 | TNC female [1] | TNC female [1] | DC — 4.0 ≤ 1.06 | 50 ohm | 1.35 | (3.43) |
| 232B11 | TNC male [1] | TNC male [1] | 4.0 — 7.0 ≤ 1.10 | 50 ohm | 1.35 | (3.43) |
| 232C11 | TNC female [1] | TNC male [1] | 7.0 — 18.0 ≤ 1.14 | 50 ohm | 1.35 | (3.43) |
| 232A2 | TNC female [2] | TNC female [2] | DC — 4.0 ≤ 1.06 | 50 ohm | 1.35 | (3.43) |
| 232B2 | TNC male [2] | TNC male [2] | 4.0 — 7.0 ≤ 1.10 | 50 ohm | 1.35 | (3.43) |
| 232C2 | TNC female [2] | TNC male [2] | 7.0 — 18.0 ≤ 1.14 | 50 ohm | 1.35 | (3.43) |
| 8688A | AFTNC female [3] | AFTNC female [3] | DC — 4.0 ≤ 1.04 | 50 ohm | 2.10 | (5.33) |
| 8688B | AFTNC male [3] | AFTNC male [3] | 4.0 — 8.0 ≤ 1.08 | 50 ohm | 1.95 | (4.95) |
| 8688C | AFTNC female [3] | AFTNC male [3] | 8.0 — 20.0 ≤ 1.12 | 50 ohm | 2.00 | (5.08) |
| 8678A | TNCA female [4] | TNCA female [4] | DC — 4.0 ≤ 1.04 | 50 ohm | 2.10 | (5.33) |
| 8678B | TNCA male [4] | TNCA male [4] | 4.0 — 8.0 ≤ 1.08 | 50 ohm | 1.95 | (4.95) |
| 8678C | TNCA female [4] | TNCA male [4] | 8.0 — 20.0 ≤ 1.12 | 50 ohm | 2.00 | (5.08) |

[1] Precision TNC per Maury data sheet 5E-053.
[2] Precision TNC per Maury data sheet 5E-053A.
[3] Precision TNC per Maury data sheet 5E-056.
[4] Precision TNCA per Maury data sheet 5E-058.

Key Literature: Maury data sheets 2B-007, 2B-046.


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# 14mm Between-Series Adapters

## 2406, 2407 & 2709 Series; EIA Model 2417B

### *Description*

Maury 14mm coaxial adapters utilize precision air dielectric connectors that are fully mating compatible with, and equivalent to, the GR900BT connector. These connectors are often used in highly critical laboratory applications at frequencies up to 8.5 GHz. They feature improved center conductor inner contacts (model 2481A) and outer connector bodies with a one-inch Hex/Knurl coupling nut for accurate tightening with a calibrated torque wrench. Coupled junctions that are properly tightened with a calibrated torque wrench offer greatly enhanced measurement repeatability and accuracy.

14mm Adapters are offered for precision 3.5mm, type N, 7-16, and 7/8 EIA rigid line connectors. The 3.5mm adapters can also be used for connection to SMA and 2.92mm (the frequency range is limited to 8.5 GHz by the 14mm connector). To adapt from 14mm to 7mm, please see model 2607A1 (page 125).

In addition to coaxial adapters, Maury also offers a full line of components utilizing the 14mm precision interface. Many of these are direct replacements for the original GR models. Please contact our Sales Department for a cross reference to the original GR model numbers. Maury 14mm products also include VNA calibration kits, directional couplers and noise terminations.

### *14mm Connector Description*

Maury precision 14mm connectors are instrument grade, air-interface connectors that are rated for operation from DC to 8.5 GHz. The connectors are normally made with stainless steel bodies with heat treated gold plated beryllium copper contacts. They are also known as GR900 (General Radio) connectors.










### *Available Models*

| MODEL | ADAPTS SIDE A | ADAPTS SIDE B | FREQUENCY RANGE (GHz) AND MAXIMUM VSWR | NOMINAL IMPEDANCE | INSERTION LENGTH INCHES | INSERTION LENGTH (CM) |
|---|---|---|---|---|---|---|
| 2407A1 [1] | 14mm (GR900) [3] | 3.5mm female [4] | DC — 8.5 ≤ 1.020 + 0.008$f$ | 50 ohm | 2.01 | (5.11) |
| 2407B1 [1] | 14mm (GR900) [3] | 3.5mm male [4] | DC — 8.5 ≤ 1.020 + 0.008$f$ | 50 ohm | 2.01 | (5.11) |
| 2406C1 | 14mm (GR900) [3] | Type N female [5] | DC — 8.5 ≤ 1.006 + 0.006$f$ | 50 ohm | 1.95 | (4.95) |
| 2406D1 | 14mm (GR900) [3] | Type N male [5] | DC — 8.5 ≤ 1.006 + 0.006$f$ | 50 ohm | 2.03 | (5.16) |
| 2709A [2] | 14mm (GR900) [3] | 7-16 female [6] | DC — 7.5 ≤ 1.006 + 0.006$f$ | 50 ohm | 1.81 | (4.60) |
| 2709B [2] | 14mm (GR900) [3] | 7-16 male [6] | DC — 7.5 ≤ 1.006 + 0.006$f$ | 50 ohm | 1.81 | (4.60) |
| 2417B | 14mm (GR900) [3] | 7/8 EIA | DC — 5.0 ≤ 1.012 + 0.008$f$ | 50 ohm | 3.04 | (7.72) |

[1] 2407A1 and 2407B1 are phase matched for VNA applications.
[2] 2709A and 2709B are phase matched for VNA applications.
[3] Precision 14mm (GR900) per Maury data sheet 5E-068.
[4] Precision 3.5mm per Maury data sheet 5E-062.
[5] Precision type N per Maury data sheet 5E-049.
[6] Precision 7-16 per Maury data sheet 5E-066.

Key Literature: Maury data sheet 2B-020.


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# 7-16 In-Series and Between-Series Adapters

## 2705, 2706, 2707 and 2712 Series

### *Description*

These adapters are precision 7-16 to 3.5mm, 7mm, type N or 7mm connectors which cover the frequency ranges from DC to 7.5 GHz. They are fabricated from stainless steel and beryllium copper alloy to provide a rugged, long-wearing and highly repeatable interface with very low VSWR. These characteristics make them ideal for use in laboratory measurement environments and in wireless applications.

Adapters in the same model series are phase matched so that they can be readily interchanged for VNA measurement of non-insertable devices.




### *7-16 Connector Description*

The Maury 7-16 interface is designed to provide a standard test interface that is tighter controlled than the grade "0" standard test connectors specified by European Standard EN 122190 and British Standard BSEN 122190. This interface also complies with the requirements of the "Reference Connector" specified in IEC standard publication 169-4 and is designed to be used as a test connector for all devices which use the general purpose 7-16 connector described in all three standards. Recommended torque value when mating these connectors to themselves or to general purpose 7-16 connectors is 20.0 in/lb. (See Maury data sheet 5E-066 for interface dimensions.)




### *Available Models*

| MODEL | ADAPTS SIDE A | ADAPTS SIDE B | FREQUENCY RANGE (GHz) AND MAXIMUM VSWR | NOMINAL IMPEDANCE | INSERTION LENGTH INCHES | INSERTION LENGTH (CM) |
|---|---|---|---|---|---|---|
| 2705A | 7-16 female [1] | 3.5mm female [2] | DC — 7.5 ≤ 1.04 | 50 ohm | 2.45 | (6.21) |
| 2705B | 7-16 female [1] | 3.5mm male [2] | | | | |
| 2705C | 7-16 male [1] | 3.5mm female [2] | | | | |
| 2705D | 7-16 male [1] | 3.5mm male [2] | | | | |
| 2707A | 7-16 female [1] | 7mm [3] | DC — 7.5 ≤ 1.03 | 50 ohm | 2.56 | (6.50) |
| 2707B | 7-16 male [1] | 7mm [3] | | | | |
| 2707C * | 7-16 male [1, 5] | 7mm [3] | | | | |
| 2706A | 7-16 female [1] | Type N female [4] | DC — 7.5 ≤ 1.03 | 50 ohm | 2.86 | (7.26) |
| 2706B | 7-16 female [1] | Type N male [4] | | | | |
| 2706C | 7-16 male [1] | Type N female [4] | | | | |
| 2706D | 7-16 male [1] | Type N male [4] | | | | |
| 2706E * | 7-16 male [1, 5] | Type N female [4] | | | | |
| 2706F * | 7-16 male [1, 5] | Type N male [4] | | | | |
| 2712A | 7-16 female [1] | 7-16 female [1] | DC — 7.5 ≤ 1.025 | 50 ohm | 1.83 | (4.65) |
| 2712B | 7-16 male [1] | 7-16 male [1] | | | | |
| 2712C | 7-16 female [1] | 7-16 male [1] | | | | |

* Special short-face design made to facilitate a proper connect with air lines.

[1] Precision 7-16 per Maury data sheet 5E-066.
[2] Precision 3.5mm per Maury data sheet 5E-062.
[3] Precision 7mm per Maury data sheet 5E-060.
[4] Precision type N per Maury data sheet 5E-049.
[5] Test port adapter for use with precision 7-16 beadless air lines.

Key Literature: Maury data sheet 2B-080, 2B-081, 2B-082 and 2B-083.


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# Waveguide-To-Coaxial Adapters — Right Angle Launch

## WR650–WR22 to 2.4mm, 2.92mm, 3.5mm, SMA, 7mm, Type N, and TNC

### *General Information*

Maury produces a comprehensive lines of waveguide to coaxial adapters. Our adapters set the standards for high precision laboratory test and measurement applications, and for systems applications where accuracy and durability are important. These adapters feature precision index holes and lapped flanges to facilitate proper mating; ensuring that your system will deliver the critical performance demanded by the most exacting measurement tasks.

Maury waveguide to coaxial adapters include right angle and end launch configurations. They are available in all common waveguide sizes, covering frequencies from DC to 50 GHz. They adapt to 2.4mm, 2.92mm, 3.5mm, 7mm, type N, TNC and SMA coaxial connector types.

If you require an adapter not listed in this catalog, please contact our Sales Department or your local Maury representative. Special adapters in large waveguide sizes such as WR975 (0.76 to 1.15 GHz), in uncommon sizes (e.g.: WR102), and in half-height waveguide can also be provided. We can also provide units with less common connectors such as SC, 14mm (GR900) and EIA rigid line (7/8, 1-5/8, etc.). Other special adapters have been built for space flight environments.

### *Description*

Maury right angle launch adapters feature low VSWR and low insertion loss. Except where noted, flanges are in accordance with the listing on page 141. Most of the adapters shown incorporate precision index holes in the flange for precise mating alignment and connection repeatability. Please consult the factory for detailed flange interface information.

### *Specifications*

Frequency Range . . . . . 1.12 – 40.0 GHz (in waveguide bands)

Maximum VSWR . . . . . 1.25 (<1.15 typical)

Flanges . . . . . Cover Type, see page 141

### *VSWR Options*

Improved VSWR is provided on adapters with a numeric suffix to the model number (e.g., X200A2).

| Model Suffix | Maximum VSWR |
|---|---|
| 2 | 1.05 |
| 8 | 1.07 |
| 1 | 1.10 |
| 6 | 1.15 |
| 3 | 1.20 |
| 7 | 1.25 |

Many adapters can be provided with improved VSWR over their full or partial waveguide bands. Our Sales Department will gladly assist you with this and other application specific requirements. Information on specific models such as loss, power handling and dimensions will be provided on request.



Type N
L213A1



7mm
C209D2



7mm
P209D2



3.5mm
N200A2



2.92mm
U211C6



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# Waveguide To Coaxial Adapters — Right Angle Launch

## Available Models

### *Right Angle Launch EIA WR to 2.4mm, 2.92mm and 3.5mm Connectors*

| FREQUENCY RANGE (GHz) | EIA WR NUMBER | MODEL (BY COAXIAL CONNECTOR TYPE) | | | | | |
|---|---|---|---|---|---|---|---|
| | | 2.4mm female | 2.4mm male | 2.92mm female | 2.92mm male | 3.5mm female | 3.5mm male |
| 1.70 – 2.60 | 430 | — | — | — | — | R200A1 | R200B1 |
| 2.20 – 3.30 | 340 | — | — | — | — | — | — |
| 2.60 – 3.95 | 284 | — | — | — | — | S200A1 | S200B1 |
| 3.30 – 4.90 | 229 | — | — | — | — | E200A1 | E200B1 |
| 3.95 – 5.85 | 187 | — | — | — | — | G200A1 | G200B1 |
| 4.90 – 7.05 | 159 | — | — | — | — | F200A1 | F200B1 |
| 5.85 – 8.20 | 137 | — | — | — | — | C200A1 | C200B1 |
| 7.05 – 10.00 | 112 | — | — | — | — | H200A1 | H200B1 |
| 8.20 – 12.40 | 90 | X236A1 | X236B1 | — | — | X200A2 | X200B2 |
| 10.00 – 15.00 | 75 | — | — | — | — | M200A2 | M200B2 |
| 12.40 – 18.00 | 62 | P236A1 | P236B1 | — | — | P200A2 | P200B2 |
| 15.00 – 22.00 | 51 | N236A1 | N236B1 | — | — | N200A2 | N200B2 |
| 18.00 – 26.50 | 42 | K236A1 | K236B1 | — | — | K200A2 | K200B2 |
| 22.00 – 33.00 | 34 | Q236A1 | Q236B1 | — | — | Q200A3 | Q200B3 |
| 26.50 – 40.00 | 28 | U236A6 | U236B6 | U210C6 | U211C6 | U200A1 [1] | U200B1 [1] |
| 33.00 – 50.00 | 22 | J236A3 | J236B3 | — | — | — | — |

### *Right Angle Launch EIA WR to SMA, 7mm, Type N and TNC Connectors*

| FREQUENCY RANGE (GHz) | EIA WR NUMBER | MODEL (BY COAXIAL CONNECTOR TYPE) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | SMA female [2] | SMA male [2] | 7mm | Type N female | Type N male | TNC female | TNC male |
| 1.12 – 1.70 | 650 | — | — | L209A1 | L213A1 | L214A1 | — | — |
| 1.70 – 2.60 | 430 | — | — | R209A2 | R213A2 | R214A2 | — | — |
| 2.20 – 3.30 | 340 | — | — | D209A2 | D213A1 | D214A1 | — | — |
| 2.60 – 3.95 | 284 | — | — | S209D2 | S213D2 | S214D2 | — | — |
| 3.30 – 4.90 | 229 | — | — | E209A2 | E213A2 | E214A2 | — | — |
| 3.95 – 5.85 | 187 | — | — | G209D2 | G213D2 | G214D2 | — | — |
| 4.90 – 7.05 | 159 | — | — | F209A2 | F213A2 | F214A2 | — | — |
| 5.85 – 8.20 | 137 | C210D | C211D | C209D2 | C213D2 | C214D2 | — | — |
| 7.05 – 10.00 | 112 | — | — | H209D2 | H213D2 | H214D2 | — | — |
| 8.20 – 12.40 | 90 | X210D | X211D | X209D2 | X213D2 | X214D2 | — | — |
| 10.00 – 15.00 | 75 | M210D1 | M211D1 | M209D2 | M213D2 | M214D2 | M215D1 | M216D1 |
| 12.40 – 18.00 | 62 | P210D | P211D | P209D2 | P213D2 | P214D2 | — | — |
| 15.00 – 22.00 | 51 | N210D | — | — | — | — | — | — |
| 18.00 – 26.50 | 42 | — | — | — | — | — | — | — |
| 26.50 – 40.00 | 28 | — | — | — | — | — | — | — |

[1] 3.5mm WR28 models are rated to 34 GHz. Use 2.92mm adapters, which are mating compatible, for full band coverage.

[2] Use 3.5mm adapters in bands not covered.



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# Waveguide To Coaxial Adapters — End Launch

## WR430–WR22 to 2.4mm, 2.92mm, 3.5mm, SMA, 7mm, and Type N

### *General Information*

Maury produces a comprehensive lines of waveguide to coaxial adapters. Our adapters set the standards for high precision laboratory test and measurement applications, and for systems applications where accuracy and durability are important. These adapters feature precision index holes and lapped flanges to facilitate proper mating; ensuring that your system will deliver the critical performance demanded by the most exacting measurement tasks.

Maury waveguide to coaxial adapters include right angle and end launch configurations. They are available in all common rectangular waveguide sizes, covering frequencies from DC to 50 GHz. They adapt to 2.4mm, 2.92mm, 3.5mm, 7mm, type N and SMA coaxial connector types.

If you require an adapter not listed in this catalog, please contact our Sales Department or your local Maury representative. Special adapters in large waveguide sizes such as WR975 (0.76 to 1.15 GHz), in uncommon sizes (e.g.: WR102), and in half-height waveguide can also be provided. We can also provide units with less common connectors such as SC, 14mm (GR900) and EIA rigid line (7/8, 1-5/8, etc.). Other special adapters have been built for space flight environments.

### *Description*

Maury end launch adapters feature low VSWR and low insertion loss. Except where noted, flanges are in accordance with the listing on page 141. Most of the adapters shown incorporate precision index holes in the flange for precise mating alignment and connection repeatability. Please contact us for detailed flange interface information.

### *Specifications*

Frequency Range . . . . . 1.7 – 40.0 GHz
(in waveguide bands)

Maximum VSWR . . . . . 1.25 (<1.15 typical) to 18.0 GHz
1.30 (< 1.20 typical) to 50.0 GHz

Flanges . . . . . Cover Type, see page 141

### *VSWR Options*

Improved VSWR is provided on adapters with a numeric suffix to the model number (e.g.,X230A1).

| Model Suffix | Maximum VSWR |
|---|---|
| 2 | 1.05 |
| 8 | 1.07 |
| 1 | 1.10 |
| 6 | 1.15 |
| 3 | 1.20 |
| 7 | 1.25 |

Many adapters can be provided with improved VSWR over their full or partial waveguide bands. Our Sales Department will gladly assist you with this and other application specific requirements. Information on specific models such as loss, power handling and dimensions will be provided on request.



E229A1
WR229-to-7mm



H229A2
WR112-to-7mm



K233B8
WR42 -to-2.92mm
Male



U237A1
WR28 -to-2.4mm
Female



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# Waveguide To Coaxial Adapters — End Launch

## Available Models

### *End Launch EIA WR to 2.4mm, 2.92mm, and 3.5mm Connectors*

| FREQUENCY RANGE (GHz) | EIA WR NUMBER | MODEL (BY COAXIAL CONNECTOR TYPE) | | | | | |
|---|---|---|---|---|---|---|---|
| | | 2.4mm female | 2.4mm male | 2.92mm female | 2.92mm male | 3.5mm female | 3.5mm male |
| 1.70 – 2.60 | 430 | — | — | — | — | — | — |
| 2.60 – 3.95 | 284 | — | — | — | — | — | — |
| 3.30 – 4.90 | 229 | — | — | — | — | E230A1 | E230B1 |
| 3.95 – 5.85 | 187 | — | — | — | — | G230A1 | G230B1 |
| 4.90 – 7.05 | 159 | — | — | — | — | — | — |
| 5.85 – 8.20 | 137 | — | — | — | — | C230A1 | C230B1 |
| 7.05 –10.00 | 112 | — | — | — | — | H230A1 | H230B1 |
| 8.20 –12.40 | 90 | — | — | — | — | X230A1 | X230B1 |
| 10.00 –15.00 | 75 | — | — | — | — | M230A1 | M230B1 |
| 12.40 –18.00 | 62 | — | — | — | — | P230A2 | P230B2 |
| 15.00 –22.00 | 51 | — | — | — | — | N230A3 | N230B3 |
| 18.00 – 26.50 | 42 | K237A2 | K237B2 | K233A8 | K233B8 | K230A6 | K230B6 |
| 22.00 – 33.00 | 34 | Q237A2 | Q237B2 | — | — | — | — |
| 26.50 –40.00 | 28 | U237A1 | U237B1 | U233A1 | U233B1 | U230A7 [1] | U230B7 [1] |
| 33.00 –50.00 | 22 | J237A6 | J237B6 | — | — | — | — |

### *End Launch EIA WR to SMA, 7mm, and Type N Connectors*

| FREQUENCY RANGE (GHz) | EIA WR NUMBER | MODEL (BY COAXIAL CONNECTOR TYPE) | | | | |
|---|---|---|---|---|---|---|
| | | SMA female [2] | SMA male [2] | 7mm | Type N female | Type N male |
| 1.70 – 2.60 | 430 | — | — | R229A1 | R221A | R221B |
| 2.60 – 3.95 | 284 | — | — | S229A1 | S221A1 | S221B1 |
| 3.30 – 4.90 | 229 | — | — | E229A1 | E221A1 | E221B1 |
| 3.95 – 5.85 | 187 | — | — | G229C1 | G221A1 | G221B1 |
| 4.90 – 7.05 | 159 | — | — | F229C1 | F221A1 | F221B1 |
| 5.85 – 8.20 | 137 | — | — | C229A1 | C221A1 | C221B1 |
| 7.05 – 10.00 | 112 | — | — | H229A2 | H221A | H221B |
| 8.20 – 12.40 | 90 | — | — | X229A2 | X221A2 | X221B2 |
| 10.00 – 15.00 | 75 | — | — | M229A2 | M221A2 | M221B2 |
| 12.40 – 18.00 | 62 | P223A | P223B | P229A2 | P221A2 | P221B2 |
| 15.00 – 22.00 | 51 | — | — | — | — | — |
| 22.00 – 33.00 | 34 | — | — | — | — | — |
| 18.00 – 26.50 | 42 | — | — | — | — | — |
| 26.50 –40.00 | 28 | — | — | — | — | — |

[1] 3.5mm WR28 models are rated to 34 GHz. Use 2.92mm adapters, which are mating compatible, for full band coverage.

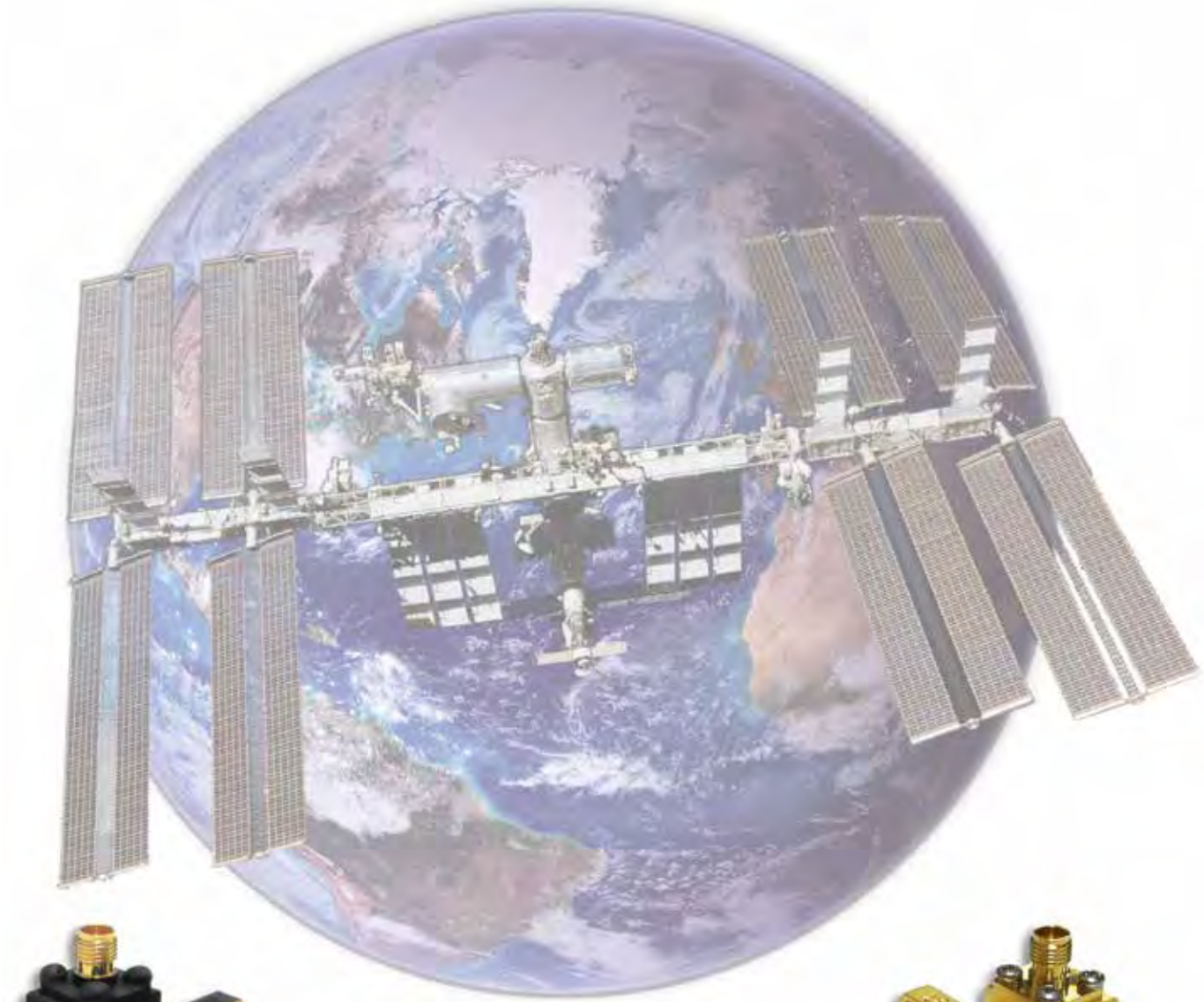
[2] Use 3.5mm adapters in bands not covered.



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# Space Qualified Adapters

Maury Microwave offers an extensive line of precision Space Qualified waveguide-to-coaxial adapters for use in satellite communications and other space applications. Our unique designs, special materials, plating and coating processes, enable us to produce adapters that operate with optimum performance and reliability under the extreme conditions encountered in space. Maury Space Qualified adapters are available in right angle and end launch versions and can be provided in many waveguide size and connector configurations. Weight-saving designs, custom flanges and beadless versions for harsh radiation exposure are also available, with full band or optimized narrow band performance ranges. These adapters can be qualified under Group A/B/C environmental testing, including Thermal Shock, Vibration, Operating Temperature Extremes, and EMI — all tailored to your exact specifications. Please call our Sales Department for more information.





N232P01



N233P01



N233P02



N234P02



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# Waveguide Transmission Lines and Test Port Adapters

## Straight Sections and Transitions

### *Description*

Maury produces waveguide components in many EIA WR sizes. A comprehensive line of standard rectangular products is available in the sizes shown below. They are generally supplied with cover flanges. Units from R through P bands are normally aluminum construction with irridite finish; K band and above are copper alloy with a plated finish. All units are painted with highly durable paint, or other special order finishes. Maury can provide waveguide devices with any flange type, material or finish you require. Special waveguide devices in millimeter sizes from 18 to 110 GHz (WR62 to WR10), large waveguides (WR430), and many special configurations such as: flatguide, reduced height, round, etc. can also be provided.

U103A4







### *Rectangular Transmission Lines*

| MODEL | FREQUENCY RANGE (GHz) | | | LENGTH [1] INCHES | (CM) |
|---|---|---|---|---|---|
| S102A12 [2] | 2.60 | — | 3.95 | 12.00 | (30.5) |
| G102A8 [2] | 3.95 | — | 5.85 | 8.00 | (20.3) |
| C101A8 [3] | 5.85 | — | 8.20 | 8.00 | (20.3) |
| H101A6 [3] | 7.05 | — | 10.00 | 6.00 | (15.2) |
| X101A6 [3] | 8.20 | — | 12.40 | 6.00 | (15.2) |
| M102A6 [2] | 10.00 | — | 15.00 | 6.00 | (15.2) |
| P101A6 [3] | 12.40 | — | 18.00 | 6.00 | (15.2) |
| N102A4 [2] | 15.00 | — | 22.00 | 4.00 | (10.2) |
| K101A4 [3] | 18.00 | — | 26.50 | 4.00 | (10.2) |
| U101A4 [3] | 26.50 | — | 40.00 | 4.00 | (10.2) |
| Q102A4 [2] | 22.00 | — | 33.00 | 4.00 | (10.2) |

### *Millimeter Wave Test Port Adapters (Straight Sections)*

| MODEL | FREQUENCY RANGE (GHz) | | | LENGTH [1] INCHES | (CM) |
|---|---|---|---|---|---|
| U103A1.375 | 26.5 | — | 40.0 | 1.375 | (3.51) |
| J115B1 | 33.0 | — | 50.0 | 1.97 | (5.00) |
| T115B | 40.0 | — | 60.0 | 1.97 | (5.00) |
| V115C | 50.0 | — | 75.0 | 1.50 | (3.81) |
| Y115B | 60.0 | — | 90.0 | 1.97 | (5.00) |
| Z115A | 75.0 | — | 110.0 | 1.375 | (3.51) |

### *Millimeter Waveguide Transmission Lines*

| MODEL | FREQUENCY RANGE (GHz) | | | LENGTH [1] INCHES | (CM) |
|---|---|---|---|---|---|
| J106B [4] | 33.0 | — | 50.0 | 1.96 | (5.0) |
| V106B [4] | 50.0 | — | 75.0 | 1.96 | (5.0) |
| T106B [5] | 40.0 | — | 60.0 | 1.96 | (5.0) |
| Y106B [5] | 60.0 | — | 90.0 | 1.96 | (5.0) |
| Z106B [5] | 75.0 | — | 110.0 | 1.96 | (5.0) |

### *Rectangular to Rectangular Waveguide Stepped Transitions – Overlapping Bands*

| MODEL | FREQUENCY RANGE (GHz) AND MAXIMUM VSWR | | | | EIA WAVEGUIDE SIZES SIDE A | SIDE B | EQUIVALENT FLANGES SIDE A | SIDE B | LENGTH [1] INCHES | (CM) |
|---|---|---|---|---|---|---|---|---|---|---|
| H161C | 8.20 | — | 10.00 | ≤ 1.05 | 112 | 90 | CPR112F | UG39/U | 1.5 | (3.8) |
| X161 | 10.00 | — | 12.40 | ≤ 1.05 | 90 | 75 | UG39/U | MPF75 | 2.4 | (6.1) |
| M161 | 12.40 | — | 15.00 | ≤ 1.05 | 75 | 62 | MPF75 | UG419/U | 2.4 | (6.1) |

[1] Other lengths can be provided. Please specify when ordering.
[2] Aluminum construction.
[3] Brass plated construction.
[4] Precision aluminum straight sections.
[5] To request straight sections made out of solid aluminum, specify band, length, and 104 series.


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# Waveguide Flange Adapters

## In-Band – Minimum Length

### *Description*

Maury series 166 are unique precision waveguide flange adapters for converting flanges from one type to another type in the same waveguide band and introducing a minimum of insertion length. A summary of the basic model types of adapters available in this series may be found in Maury data sheet 3A-166. This data sheet also lists the contents of the specific hardware kit that is supplied with each model type (except K and U bands).

These flange adapters are designed for both laboratory and system applications. They provide a convenient and precise method for converting equipment from one type flange to another for either temporary or permanent installations. Due to the precision manufacturing techniques utilized, the reflection introduced by these adapters is 1.01. Each adapter is provided with special mounting hardware and installation instructions, (except models in K and U bands).




### *Available Models*

| MODEL | ADAPTS SIDE A | ADAPTS SIDE B | FREQUENCY RANGE (GHz) | TYPICAL VSWR | EIA WR NUMBER | OVERALL LENGTH INCHES | OVERALL LENGTH (CM) |
|---|---|---|---|---|---|---|---|
| S166B | CPR284F | UG53/U | 2.60 — 3.95 | 1.01 | 284 | 0.50 | (1.3) |
| E166C | CPR229F | CMR229 | 3.30 — 4.90 | 1.01 | 229 | 0.50 | (1.3) |
| E166D | CMR229 | CPR229 | 3.30 — 4.90 | 1.01 | 229 | 0.50 | (1.3) |
| G166A | UG149A/U | CPR187F | 3.95 — 5.85 | 1.01 | 187 | 0.50 | (1.3) |
| F166C | CPR159 | CPR159 | 4.90 — 7.05 | 1.01 | 159 | 0.75 | (1.9) |
| F166D | CMR159 | CPR159F | 4.90 — 7.05 | 1.01 | 159 | 0.75 | (1.9) |
| C166A | UG344/U | CPR137F | 5.85 — 8.20 | 1.01 | 137 | 0.50 | (1.3) |
| C166B | CPR137F | UG344/U | 5.85 — 8.20 | 1.01 | 137 | 0.50 | (1.3) |
| C166D | CMR137 | CPR137F | 5.85 — 8.20 | 1.01 | 137 | 0.75 | (1.9) |
| C166E | UG344/U | CMR137 | 5.85 — 8.20 | 1.01 | 137 | 0.50 | (1.3) |
| H166A | UG51/U | CPR112F | 7.05 — 10.00 | 1.01 | 112 | 0.50 | (1.3) |
| H166B | CPR112F | UG51/U | 7.05 — 10.00 | 1.01 | 112 | 0.50 | (1.3) |
| H166C | CPR112F | CMR112 | 7.05 — 10.00 | 1.01 | 112 | 0.75 | (1.9) |
| H166D | CMR112 | CPR112F | 7.05 — 10.00 | 1.01 | 112 | 0.75 | (1.9) |
| H166E | UG51/U | CMR112 | 7.05 — 10.00 | 1.01 | 112 | 0.50 | (1.3) |
| H166F | CMR112 | UG51/U | 7.05 — 10.00 | 1.01 | 112 | 0.50 | (1.3) |
| X166A | UG39/U | CPR90F | 8.20 — 12.40 | 1.01 | 90 | 0.50 | (1.3) |
| X166B | CPR90F | UG39/U | 8.20 — 12.40 | 1.01 | 90 | 0.50 | (1.3) |
| X166D | CMR90 | CPR90F | 8.20 — 12.40 | 1.01 | 90 | 0.75 | (1.9) |
| X166E | UG39/U | CMR90 | 8.20 — 12.40 | 1.01 | 90 | 0.50 | (1.3) |
| X166F | CMR90 | UG39/U | 8.20 — 12.40 | 1.01 | 90 | 0.50 | (1.3) |
| K166G | UG595U | UG425U | 18.00 — 26.50 | 1.01 | 42 | 0.50 | (1.3) |
| U166G | UG599/U | UG381/U | 26.50 — 40.00 | 1.01 | 28 | 0.50 | (1.3) |

Key Literature: Maury data sheet 3A-166.



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# Waveguide Flange Information

## Maury Precision Flanges (MPF)

### *Description*

Maury MPF flanges are designed to provide precise mating of flanges when repeated connections are required or in systems where optimum waveguide alignment is critical. Some MPF series flanges also allow mating to more than one type of flange interface, which amplifies their versatility and economy when mating different flange types within a band. Please refer to the "mates with" column in the chart below to see the possible combinations.

MPF flanges are provided on components used in Maury calibration kits or on low VSWR components such as waveguide to coax adapters with VSWR of 1.10 or better.

MPF flanges in WR22 and smaller waveguide (millimeter wave sizes) provide dramatic improvements in connection consistency, repeatability and serviceability versus standard UG flanges, while still maintaining mating compatibility with these older designs (see Maury data sheet 5E-030). As in larger waveguide sizes, these flanges have two precision index holes and slip-fit alignment pins. (Threaded pins may also be installed in the standard four-pin pattern when mating to standard UG flanges.



Both types of pins are removable, making the flange face available for servicing.)

MPF flanges also have a raised outer ring which prevents the mating surfaces from cocking due to uneven torque applied to the flange bolts. To obtain complete technical descriptions, please request the data sheets shown in the Maury Data Sheet column.

NOTE: All Maury MPF flanges have precision index holes. Corresponding slip-fit alignment pins are also available. Together, these ensure precise alignment and repeatable mating in waveguide connections. All Maury waveguide VNA calibration kit components come with MPF flanges. Alignment pins are available separately. See Maury data sheet 3A-996 for details.

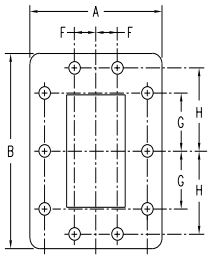
### *Maury Precision Flange Reference Chart*

| BAND | EIA WR NUMBER | MPF DESIGNATION | MATES WITH | MAURY DATA SHEET |
|---|---|---|---|---|
| L | 650 | MPF650 | UG417A/U (without groove) | — |
| R | 430 | MPF430 | UG435/U (without groove) | 5E-016 |
| D | 340 | MPF340 | CPR340F | — |
| S | 284 | MPF284 | UG53/U, UG54A/U, CPR284 | 5E-002 |
| S | 284 | MPF284B | UG53/U, UG54A/U, CPR284, CMR284 | 5E-002A |
| S | 284 | MPF284C | UG53/U, UG54A/U | 5E-002B |
| E | 229 | MPF229 | CPR229, CMR229 | 5E-003 |
| E | 229 | MPF229B | CPR229 | 5E-003A |
| G | 187 | MPF187 | UG149A/U, UG148B/U, CPR187 | 5E-004 |
| G | 187 | MPF187C | UG149A/U, UG148B/U | 5E-004A |
| F | 159 | MPF159 | CPR159, CMR159 | 5E-011 |
| F | 159 | MPF159B | CPR159 | 5E-011A |
| C | 137 | MPF137 | UG344/U, UG343A/U, CPR137 | 5E-005 |
| C | 137 | MPF137C | UG344/U, UG343A/U | 5E-005A |
| H | 112 | MPF112 | UG51/U, UG138/U, CPR112F & G | 5E-001 |
| H | 112 | MPF112B | UG51/U, UG52/U | 5E-001A |
| H | 112 | MPF112C | UG51/U, UG52/U, CMR112 | 5E-001C |
| HS | 102 | MPF102 | UG1493 | 5E-014 |
| X | 90 | MPF90 | UG39/U, UG40A/U, CPR90 | 5E-006 |
| X | 90 | MPF90A | UG39/U, UG40A/U, CMR90 | 5E-006 |
| X | 90 | MPF90B | UG39/U, UG40A/U | 5E-006A |
| M | 75 | MPF75A & B | M3922/70-004 & -005 | 5E-007 |
| P | 62 | MPF62 | UG419/U, UG541A/U | 5E-008 |
| N | 51 | MPF51A & B | M3922/70-010, -011, -012, -022, -023, -024 | 5E-012 |
| N | 51 | MPF51C | Keysight Type, UBR180 | 5E-013 |
| K | 42 | MPF42 | UG595/U, UG596/U | 5E-009 |
| Q | 34 | MPF34 | UG595U, UG596/U, UG1530/U | 5E-019 |
| U | 28 | MPF28 | UG599/U, UG600/U | 5E-010 |
| J | 22 | MPF22 | UG383/U | 5E-030 |
| T | 19 | MPF19 | UG383/U-M | 5E-030 |
| V | 15 | MPF15 | UG385/U | 5E-031 |
| Y | 12 | MPF12 | UG387/U | 5E-031 |
| Z | 10 | MPF10 | UG38&/U-M | 5E-031 |

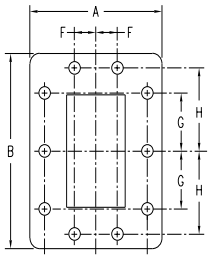

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# Standard Waveguide Flange Specifications

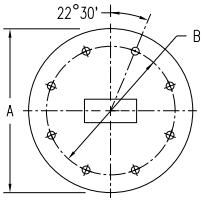
| WR650 | WG6 | R14 |
|---|---|---|
| UG417A/U (without groove) | | |
| Dimensions | inches | mm |
| A | 5.44 | 138.18 |
| B | 8.69 | 220.73 |
| E | 2.31 | 58.69 |
| F | 1.25 | 31.73 |
| G | 2.37 | 60.30 |
| H | 3.94 | 100.00 |
| Hole Dia. | 0.330 [1] | 8.20 |



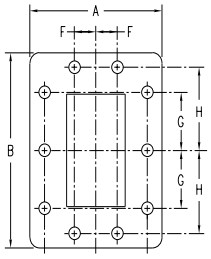

| WR430 | WG8 | R22 |
|---|---|---|
| UG435B/U (without groove) | | |
| Dimensions | inches | mm |
| A | 4.19 | 106.38 |
| B | 6.34 | 161.04 |
| E | 1.72 | 43.69 |
| F | 0.94 | 23.83 |
| G | 1.79 | 45.39 |
| H | 2.79 | 70.99 |
| Hole Dia. | 0.257 [1] | 6.71 |



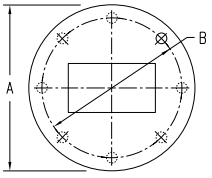

| WR284 | WG10 | R32 |
|---|---|---|
| UG53/U | | |
| Dimensions | inches | mm |
| A | 5.31 | 134.87 |
| B | 4.75 | 120.65 |
| Hole Dia. | 0.257 [1] | 6.50 |



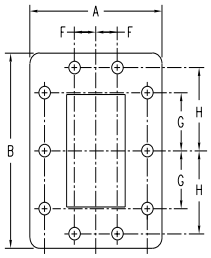

| WR229 | WG11A | R40 |
|---|---|---|
| CPR229F | UDR40 | |
| Dimensions | inches | mm |
| A | 2.76 | 70.20 |
| B | 3.89 | 98.73 |
| E | 1.05 | 26.67 |
| F | 0.50 | 12.70 |
| G | 1.07 | 27.18 |
| H | 1.62 | 41.15 |
| Hole Dia. | 0.257 [1] | 6.50 |



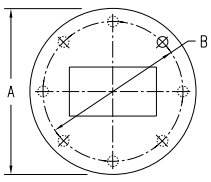

| WR187 | WG12 | R48 |
|---|---|---|
| UG149/U | UAR48 | |
| Dimensions | inches | mm |
| A | 3.64 | 92.33 |
| B | 3.25 | 82.55 |
| Hole Dia. | 0.330 [1] | 5.13 |




| WR159 | WG13 | R58 |
|---|---|---|
| CPR159 | UDR58 | |
| Dimensions | inches | mm |
| A | 2.44 | 61.98 |
| B | 3.18 | 80.77 |
| E | 0.88 | 22.35 |
| F | 0.38 | 9.53 |
| G | 0.50 | 12.70 |
| H | 1.27 | 32.26 |
| Hole Dia. | 0.257 [1] | 6.50 |




| WR137 | WG14 | R70 |
|---|---|---|
| UG344/U | UAR70 | |
| Dimensions | inches | mm |
| A | 3.13 | 79.50 |
| B | 2.75 | 69.85 |
| Hole Dia. | 0.199 [1] | 5.16 |

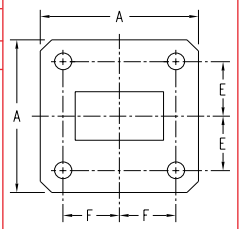



[1] English and metric hole sizes may differ slightly.

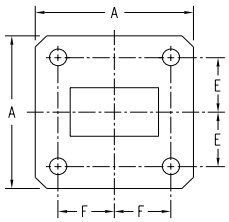

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# Standard Waveguide Flange Specifications

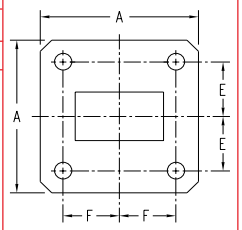
| WR112 | WG15 | R84 |
|---|---|---|
| UG51/U | UBR84 | |
| Dimensions | inches | mm |
| A | 1.875 [1] | 47.90 |
| E | 0.737 | 18.72 |
| F | 0.676 | 17.17 |
| Hole Dia. | 0.169 [2] | 4.255 |



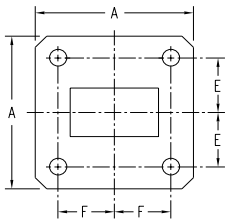

| WR90 | WG16 | R100 |
|---|---|---|
| UG39/U | UBR100 | |
| Dimensions | inches | mm |
| A | 1.625 [1] | 41.40 |
| E | 0.640 | 16.26 |
| F | 0.610 | 15.49 |
| Hole Dia. | 0.169 [2] | 4.255 |



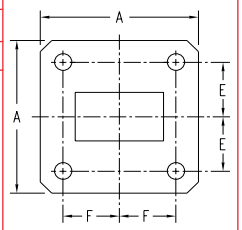

| WR75 | WG17 | R120 |
|---|---|---|
| COM'L | UBR120 | |
| Dimensions | inches | mm |
| A | 1.50 [1] | 38.83 |
| E | 0.561 | 14.25 |
| F | 0.520 | 13.21 |
| Hole Dia. | 0.144 [2] | 4.085 |



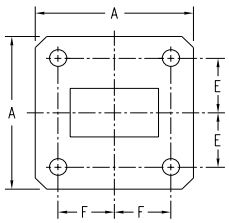

| WR62 | WG18 | R140 |
|---|---|---|
| UG419/U | UBR140 | |
| Dimensions | inches | mm |
| A | 1.31 [1] | 33.30 |
| E | 0.478 | 12.14 |
| F | 0.497 | 12.63 |
| Hole Dia. | 0.144 [2] | 4.085 |



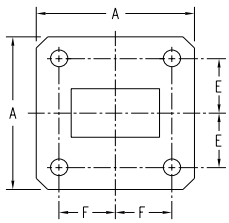

| WR51 | WG19 | R180 |
|---|---|---|
| COM'L | | |
| Dimensions | inches | mm |
| A | 1.31 [1] | 33.27 |
| E | 0.497 [1] | 12.62 |
| F | 0.478 [1] | 12.14 |
| Hole Dia. | 0.144 [2] | 3.658 |




| WR42 | WG20 | R220 |
|---|---|---|
| UG595/U | UBR220 | |
| Dimensions | inches | mm |
| A | 0.875 [1] | 22.23 |
| E | 0.335 | 8.51 |
| F | 0.320 | 8.13 |
| Hole Dia. | 0.116 [2] | 3.07 |




| WR34 | WG21 | R260 |
|---|---|---|
| UG1530 | | |
| Dimensions | inches | mm |
| A | 0.875 [1] | 22.41 |
| E | 0.335 [1] | 8.51 |
| F | 0.320 [1] | 8.13 |
| Hole Dia. | 0.116 [2] | 3.07 |

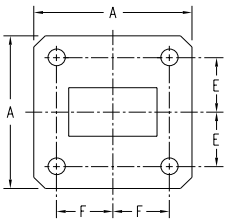



[1] CAUTION: U.S. MIL and commercial flange dimensions differ from IEC flanges.
[2] English and metric hole sizes may differ slightly.

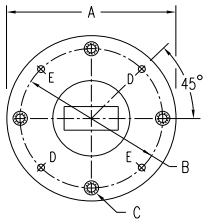

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# Standard Waveguide Flange Specifications

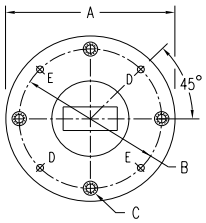
| WR28 | WG22 | R320 |
|---|---|---|
| UG599/U | | |
| Dimensions | inches | mm |
| A | 0.75 | 19.05 |
| E | 0.265 | 6.73 |
| F | 0.250 | 6.35 |
| Hole Dia. | 0.116 | 2.98 |



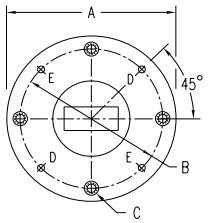

| WR22 | WG23 | R400 |
|---|---|---|
| UG383/U | | |
| Dimensions | inches | mm |
| A | 1.13 | 28.85 |
| B | 0.94 | 23.81 |
| C Holes | 4-40 UNC-2B | |
| D Holes | 0.063 | 1.613 |
| E Dowels | 0.061 | 1.555 |



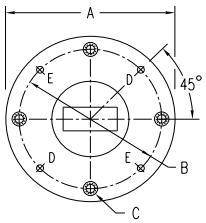

| WR19 | WG24 | R500 |
|---|---|---|
| UG383/U-M | | |
| Dimensions | inches | mm |
| A | 1.13 | 28.85 |
| C Holes | 4-40 UNC-2B | |
| D Holes | 0.063 | 1.613 |
| E Dowels | 0.061 | 1.555 |
| All Holes | 0.938 | 23.81 |



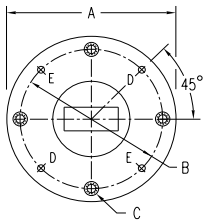

| WR15 | WG25 | R620 |
|---|---|---|
| UG385/U | | |
| Dimensions | inches | mm |
| A | 0.750 | 19.05 |
| B | 0.563 | 14.29 |
| C Holes | 4-40 UNC-2B | |
| D Holes | 0.063 | 1.613 |
| E Dowels | 0.061 | 1.555 |




| WR12 | WG26 | R740 |
|---|---|---|
| UG387/U | | |
| Dimensions | inches | mm |
| A | 0.750 | 19.05 |
| B | 0.563 | 14.29 |
| C Holes | 4-40 UNC-2B | |
| D Holes | 0.063 | 1.613 |
| E Dowels | 0.061 | 1.555 |
| All Holes | 0.563 | 14.29 |




| WR10 | WG27 | R900 |
|---|---|---|
| UG387/U-M | | |
| Dimensions | inches | mm |
| A | 0.750 | 19.05 |
| B | 0.563 | 14.29 |
| C Holes | 4-40 UNC-2B | |
| D Holes | 0.063 | 1.613 |
| E Dowels | 0.061 | 1.555 |
| All Holes | 0.563 | 14.29 |





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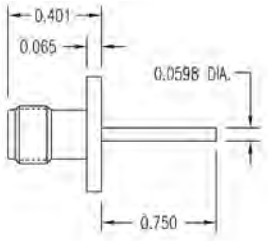
# 3.5mm Panel Mount, Suspended Stripline, and Micro-Strip Launch Connectors

## 8002 and 8004 Series

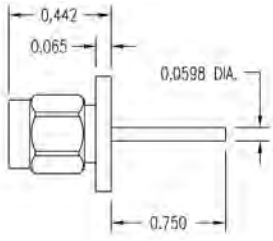
### *Panel Mount Connectors*

The 8002A and 8002B are 3.5mm panel mount connectors in a four-hole mounting configuration. Ordering Option 1 converts these to two-hole mounting. The rear part of the center conductor can be removed for machining and a set of five spare center conductors, 8002C, is available.

8002A Female



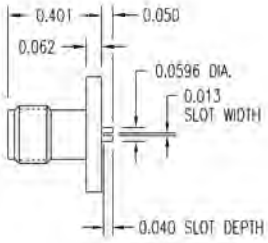

8002B Male



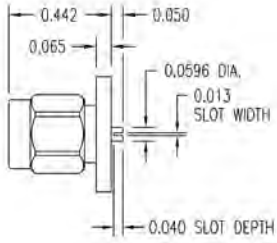

### *Suspended Stripline Connectors*

The 8002D and 8002E are designed for use with suspended stripline circuits utilizing 0.010 thick dielectric with 1/2 ounce copper on both sides (0.012 inch nominal thickness). 8002D and 8002E are provided with the 4-Hole flange configuration only.

8002D Female




8002E Male

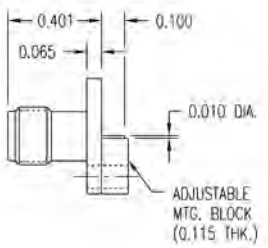



### *Micro-Strip Connectors*

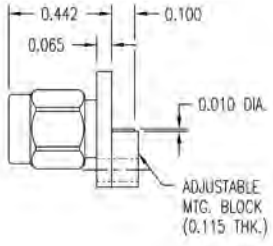
The 8004 series connectors are designed for use with micro-strip circuits and include a transformer from 3.5mm to a 0.01-inch pin diameter launch. Three basic panel mount configurations are available: Mounting Block, Dielectric Feed Thru, and Bushing Feed Thru. Mounting Block and Dielectric Feed Thru versions (8004A, 8004B, 8004C and 8004D) are available in both 4-Hole flange and 2-Hole flange configurations. 8004E and 8004F Bushing Feed Thru versions are only available with the 4-Hole flange.

Mounting Block Configuration

8004A Female

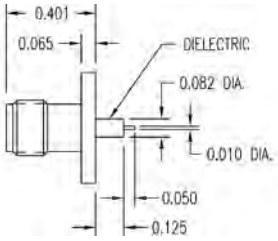



8004B Male

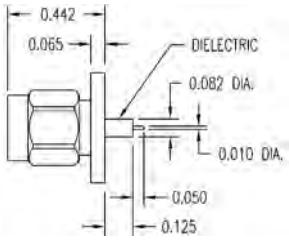



Dielectric Feed Thru Configuration

8004C Female

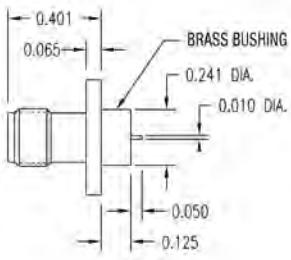



8004D Male

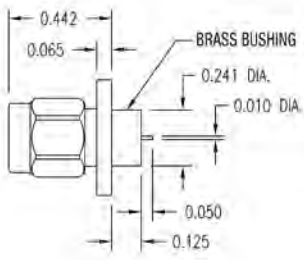



Bushing Feed Thru Configuration

8004E Female




8004F Male

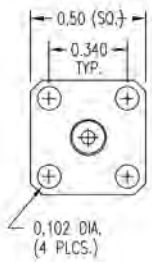



### *Ordering Flange Configurations*

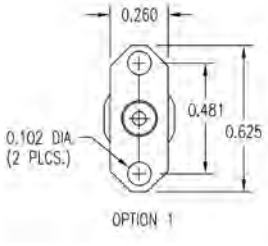
When placing your order be sure to indicate which flange configuration you need. The default configuration is the 4-hole flange, which is standard for all 8002 and 8004 models.

A 2-Hole flange option is available for 8002 and 8004 models except 8002D, 8002E, 8004A, 8004B, 8004E and 8004F. To order connectors with the 2-Hole flange, indicate that you are ordering Option 1 by adding a numeral 1 after the model number.

4-Hole Flange




2-Hole Flange (Option 1)





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ColorConnect™ Maury Microwave

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*(http://www.maurymw.com/store)*

## At-A-Glance Performance Comparison

### *Test Essentials™ Lab Adapters*

Test Essentials™ Lab Adapters have been designed for daily use in microwave/RF labs and production facilities and offer one of the industry's best price/performance ratios. Test Essentials™ Lab Adapters feature excellent electrical performance, rugged construction for durability, repeatable mating and high reliability. Test Essentials™ Lab Adapters are available in SMA, N, 3.5mm, 2.92mm, 2.4mm and 1.85mm in-series and between-series configurations.

### *ColorConnect™ Precision Adapters*

ColorConnect™ Precision Adapters have been designed for lab and field use where quality, performance, ease-of-identification and ease-of-use are critical. New manufacturing techniques have given ColorConnect™ Precision Adapters improved VSWR specifications bridging the gap between calibration-grade metrology adapters and daily-use lab adapters. Following the proposed IEEE high-frequency connector/adapter color convention, ColorConnect™ Precision Adapters are the first commercially available products to offer clear indications of compatibility and intermatability. ColorConnect™ makes it a simple matter to avoid and eliminate damaged equipment, degraded equipment reliability, degraded performance and lengthy maintenance times due to improper mating (and attempted mating) of incompatible adapters. ColorConnect™ Precision Adapters are available in N Type, 3.5mm, 2.92mm, 2.4mm and 1.85mm in-series and between-series.

### *Calibration-Grade (Metrology) Adapters*

Maury Microwave's comprehensive line of calibration-grade (metrology) adapters (see page 107-144) have been designed as an integral part of its renowned Vector Network Analyzer (VNA) Calibration Kits and are also available separately where calibration-grade precision is demanded. In-series and between series coaxial adapters are available for all precision laboratory measurement connectors – 1.85mm, 2.4mm, 2.92mm (K), 3.5mm, 7mm, 14mm, 7-16, etc.; all common systems connectors – type N, TNC, etc.; and several special purpose connector series such as EIA 7/8 rigid line connectors.

## *Maury Coaxial Adapter Solutions*

| Connector 1 | Connector 2 | VSWR | | |
|---|---|---|---|---|
| | | Test Essentials™ | | Metrology |
| | | Lab Adapters | ColorConnect™ Precision Adapters | Calibration-Grade Adapters |
| SMA (F) | SMA (F) | 1.15 | 1.15 | — |
| SMA (M) | SMA (M) | 1.15 | 1.15 | — |
| SMA (M) | SMA (F) | 1.15 | 1.15 | — |
| SMA (F) | N (F) | 1.15 | 1.15 | — |
| SMA (M) | N (M) | 1.15 | 1.15 | — |
| SMA (F) | N (M) | 1.15 | 1.15 | — |
| SMA (M) | N (F) | 1.15 | 1.15 | — |
| N (F) | N (F) | 1.20 | 1.15 | 1.09 |
| N (M) | N (M) | 1.20 | 1.15 | 1.09 |
| N (M) | N (F) | 1.20 | 1.15 | 1.09 |
| 3.5mm (F) | N (F) | 1.15 | 1.14 | 1.13 |
| 3.5mm (M) | N (M) | 1.15 | 1.14 | 1.13 |
| 3.5mm (F) | N (M) | 1.15 | 1.14 | 1.13 |
| 3.5mm (M) | N (F) | 1.15 | 1.14 | 1.13 |
| 3.5mm (F) | 3.5mm (F) | 1.20 | 1.12 | 1.08 |
| 3.5mm (M) | 3.5mm (M) | 1.20 | 1.12 | 1.08 |
| 3.5mm (M) | 3.5mm (F) | 1.20 | 1.12 | 1.08 |
| 2,4mm (F) | 3.5mm (F) | 1.15 | 1.10 | 1.08 |
| 2.4mm (M) | 3.5mm (M) | 1.15 | 1.10 | 1.08 |
| 2.4mm (F) | 3.5mm (M) | 1.15 | 1.10 | 1.08 |
| 2.4mm (M) | 3.5mm (F) | 1.15 | 1.10 | 1.08 |
| 2.92mm (F) | 2.92mm (F) | 1.17 | 1.14 | 1.12 |
| 2.92mm (M) | 2.92mm (M) | 1.17 | 1.14 | 1.12 |
| 2.92mm (M) | 2.92mm (F) | 1.17 | 1.14 | 1.12 |
| 2.4mm (F) | 2.92mm (F) | 1.17 | 1.14 | 1.12 |
| 2.4mm (M) | 2.92mm (M) | 1.17 | 1.14 | 1.12 |
| 2.4mm (F) | 2.92mm (M) | 1.17 | 1.14 | 1.12 |
| 2.4mm (M) | 2.92mm (F) | 1.17 | 1.14 | 1.12 |
| 2,4mm (F) | 2,4mm (F) | 1.22 | 1.17 | 1.15 |
| 2.4mm (M) | 2.4mm (M) | 1.22 | 1.17 | 1.15 |
| 2.4mm (M) | 2.4mm (F) | 1.22 | 1.17 | 1.15 |
| 1.85mm (F) | 1.85mm (F) | 1.30 | 1.20 | 1.15 |
| 1.85mm (M) | 1.85mm (M) | 1.30 | 1.20 | 1.15 |
| 1.85mm (M) | 1.85mm (F) | 1.30 | 1.20 | 1.15 |



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# Two New Maury Coaxial Adapter Solutions

Test Essentials™ Lab Adapters — In-Series




Test Essentials™ ColorConnect™ Adapters — In-Series




## Available Models

| Test Essentials™ Lab Adapters | | | | |
|---|---|---|---|---|
| **Model** | **Connector 1** | **Connector 2** | **Frequency** | **VSWR** |
| TE-A-SMA-FF | SMA Female | SMA Female | DC – 18.0 | 1.15 |
| TE-A-SMA-MM | SMA Male | SMA Male | DC – 18.0 | 1.15 |
| TE-A-SMA-MF | SMA Male | SMA Female | DC – 18.0 | 1.15 |
| TE-A-SMAN-FF | SMA Female | N Female | DC – 18.0 | 1.15 |
| TE-A-SMAN-MM | SMA Male | N Male | DC – 18.0 | 1.15 |
| TE-A-SMAN-FM | SMA Female | N Male | DC – 18.0 | 1.15 |
| TE-A-SMAN-MF | SMA Male | N Female | DC – 18.0 | 1.15 |
| TE-A-N-FF | N Female | N Female | DC – 18.0 | 1.20 |
| TE-A-N-MM | N Male | N Male | DC – 18.0 | 1.20 |
| TE-A-N-MF | N Male | N Female | DC – 18.0 | 1.20 |
| TE-A-35N-FF | 3.5mm Female | N Female | DC – 18.0 | 1.15 |
| TE-A-35N-MM | 3.5mm Male | N Male | DC – 18.0 | 1.15 |
| TE-A-35N-FM | 3.5mm Female | N Male | DC – 18.0 | 1.15 |
| TE-A-35N-MF | 3.5mm Male | N Female | DC – 18.0 | 1.15 |
| TE-A-35-FF | 3.5mm Female | 3.5mm Female | DC – 26.5 | 1.20 |
| TE-A-35-MM | 3.5mm Male | 3.5mm Male | DC – 26.5 | 1.20 |
| TE-A-35-MF | 3.5mm Male | 3.5mm Female | DC – 26.5 | 1.20 |
| TE-A-2435-FF | 2.4mm Female | 3.5mm Female | DC – 26.5 | 1.15 |
| TE-A-2435-MM | 2.4mm Male | 3.5mm Male | DC – 26.5 | 1.15 |
| TE-A-2435-FM | 2.4mm Female | 3.5mm Male | DC – 26.5 | 1.15 |
| TE-A-2435-MF | 2.4mm Male | 3.5mm Female | DC – 26.5 | 1.15 |
| TE-A-292-FF | 2.92mm Female | 2.92mm Female | DC – 40.0 | 1.17 |
| TE-A-292-MM | 2.92mm Male | 2.92mm Male | DC – 40.0 | 1.17 |
| TE-A-292-MF | 2.92mm Male | 2.92mm Female | DC – 40.0 | 1.17 |
| TE-A-24292-FF | 2.4mm Female | 2.92mm Female | DC – 40.0 | 1.17 |
| TE-A-24292-MM | 2.4mm Male | 2.92mm Male | DC – 40.0 | 1.17 |
| TE-A-24292-FM | 2.4mm Female | 2.92mm Male | DC – 40.0 | 1.17 |
| TE-A-24292-MF | 2.4mm Male | 2.92mm Female | DC – 40.0 | 1.17 |
| TE-A-24-FF | 2,4mm Female | 2.4mm Female | DC – 50.0 | 1.22 |
| TE-A-24-MM | 2.4mm Male | 2.4mm Male | DC – 50.0 | 1.22 |
| TE-A-24-MF | 2.4mm Male | 2.4mm Female | DC – 50.0 | 1.22 |
| TE-A-185-FF | 1.85mm Female | 1.85mm Female | DC – 65.0 | 1.30 |
| TE-A-185-MM | 1.85mm Male | 1.85mm Male | DC – 65.0 | 1.30 |
| TE-A-185-MF | 1.85mm Male | 1.85mm Female | DC – 65.0 | 1.30 |

## Available Models

| ColorConnect™ Precision Adapters | | | | |
|---|---|---|---|---|
| **Model** | **Connector 1** | **Connector 2** | **Frequency** | **VSWR** |
| CC-A-SMA-FF | SMA Female | SMA Female | DC – 18.0 | 1.15 |
| CC-A-SMA-MF | SMA Male | SMA Female | DC – 18.0 | 1.15 |
| CC-A-SMA-MM | SMA Male | SMA Male | DC – 18.0 | 1.15 |
| CC-A-N-FF | N Female | N Female | DC – 18.0 | 1.15 |
| CC-A-N-MM | N Male | N Male | DC – 18.0 | 1.15 |
| CC-A-N-MF | N Male | N Female | DC – 18.0 | 1.15 |
| CC-A-35N-FF | 3.5mm Female | N Female | DC – 18.0 | 1.14 |
| CC-A-35N-MM | 3.5mm Male | N Male | DC – 18.0 | 1.14 |
| CC-A-35N-FM | 3.5mm Female | N Male | DC – 18.0 | 1.14 |
| CC-A-35N-MF | 3.5mm Male | N Female | DC – 18.0 | 1.14 |
| CC-A-35-FF | 3.5mm Female | 3.5mm Female | DC – 26.5 | 1.12 |
| CC-A-35-MM | 3.5mm Male | 3.5mm Male | DC – 26.5 | 1.12 |
| CC-A-35-MF | 3.5mm Male | 3.5mm Female | DC – 26.5 | 1.12 |
| CC-A-2435-FF | 2.4mm Female | 3.5mm Female | DC – 26.5 | 1.10 |
| CC-A-2435-MM | 2.4mm Male | 3.5mm Male | DC – 26.5 | 1.10 |
| CC-A-2435-FM | 2.4mm Female | 3.5mm Male | DC – 26.5 | 1.10 |
| CC-A-2435-MF | 2.4mm Male | 3.5mm Fem | DC – 26.5 | 1.10 |
| CC-A-292-FF | 2.92mm Female | 2.92mm Female | DC – 40.0 | 1.14 |
| CC-A-292-MM | 2.92mm Male | 2.92mm Male | DC – 40.0 | 1.14 |
| CC-A-292-MF | 2.92mm Male | 2.92mm Female | DC – 40.0 | 1.14 |
| CC-A-24292-FF | 2.4mm Female | 2.92mm Female | DC – 40.0 | 1.14 |
| CC-A-24292-MM | 2.4mm Male | 2.92mm Male | DC – 40.0 | 1.14 |
| CC-A-24292-FM | 2.4mm Female | 2.92mm Male | DC – 40.0 | 1.14 |
| CC-A-24292-MF | 2.4mm Male | 2.92mm Female | DC – 40.0 | 1.14 |
| CC-A-24-FF | 2,4mm Female | 2,4mm Female | DC – 50.0 | 1.17 |
| CC-A-24-MM | 2.4mm Male | 2.4mm Male | DC – 50.0 | 1.17 |
| CC-A-24-MF | 2.4mm Male | 2.4mm Female | DC – 50.0 | 1.17 |
| CC-A-185-FF | 1.85mm Female | 1.85mm Female | DC – 65.0 | 1.20 |
| CC-A-185-MM | 1.85mm Male | 1.85mm Male | DC – 65.0 | 1.20 |
| CC-A-185-MF | 1.85mm Male | 1.85mm Female | DC – 65.0 | 1.20 |

**Proposed IEEE High-Frequency Connector/Adapter Color Convention**
**(Available with Maury ColorConnect™ Precision Adapters)**





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# Test Port Cable Assemblies

## Series 8944C, 8946C and 8948C



8946C25

## Features

- *For VNA Applications*
- *Ruggedized Test Port Connectors*
- *For Use with 2.4mm, 2.92mm, 3.5mm, and 7mm Test Ports*
- *Coaxial Test Port to Waveguide Adapters Available*

## Description

Maury 8944, 8946 and 8948 series test port cable assemblies and test port adapters replace multiple cables in various connector types with versatile and cost-effective alternatives. These cable assemblies extend the test ports of network analyzers, and have a rugged female and male test port connector at each end. They come in standard lengths of 25 or 38 inches and are extremely flexible while maintaining excellent phase and amplitude stability. The adapters also have a rugged test port connector on one side with a precision 2.4mm, 2.92mm, 3.5mm, 7mm, N, TNC or waveguide connector (EIA WR229 to WR28) on the other side. NMD to NMD adapters are also available. The adapters are sold separately. (See page 149.)

## Available Models – Cable Assemblies

| KIT MODEL | TYPE | CABLE LENGTH INCHES | (CM) | FREQUENCY RANGE (GHz) | CABLE O.D. (NOMINAL) INCHES | (CM) | BEND RADIUS (MINIMUM) INCHES | (CM) | NOMINAL IMPEDANCE |
|---|---|---|---|---|---|---|---|---|---|
| 8946C25 | NMD2.4mm | 25.0 | (63.5) | DC — 50.0 | 0.6 | (1.524) | 2.5 | (6.35) | 50 ohm |
| 8946C38 | NMD2.4mm | 38.0 | (96.5) | | | | | | |
| 8944C25 | NMD3.5mm | 25.0 | (63.5) | DC — 26.5 | 0.6 | (1.524) | 2.5 | (6.35) | 50 ohm |
| 8944C38 | NMD3.5mm | 38.0 | (96.5) | | | | | | |
| 8948C25 | 7mm | 25.0 | (63.5) | DC — 18.0 | 0.6 | (1.524) | 2.5 | (6.35) | 50 ohm |
| 8948C38 | 7mm | 38.0 | (96.5) | | | | | | |

## Specifications (25-in. Length Cables)

Maury 8944, 8946 and 8948 series 25-inch test port cables have the following specifications:

Frequency Range:
- 8946 series . . . . . DC – 50.0 GHz
- 8944 series . . . . . DC – 26.5 GHz
- 8948 series . . . . . DC – 18.0 GHz

Insertion Loss (dB)*
- 8946 series . . . . . Typical: $0.02 + 0.34\sqrt{f} + 0.004f$
  Guaranteed: $0.65 + 0.38\sqrt{f} + 0.006f$
- 8944 & 8948 series . . . . . Typical: $0.02 + 0.19\sqrt{f} + 0.005f$
  Guaranteed: $0.39 + 0.19\sqrt{f} + 0.007f$

Return Loss (dB):
- 8946 series . . . . . 15
- 8944 & 8948 series . . . . . 18

Overall Phase Stability (degrees):* . . . . . Typical: $0.05(f)$
Guaranteed: $0.5 + 0.08(f)$

Overall Amplitude Stability (dB): . . . . . Typical: ≤0.03
Guaranteed: ≤0.08

Return Loss Stability (dB): . . . . . ≥40

## Specifications (38-in. Length Cables)

Maury 8944, 8946 and 8948 series 38-inch test port cables have the following specifications:

Frequency Range:
- 8946 series . . . . . DC – 50.0 GHz
- 8944 series . . . . . DC – 26.5 GHz
- 8948 series . . . . . DC – 18.0 GHz

Insertion Loss (dB):*
- 8946 series . . . . . Typical: $0.02 + 0.52\sqrt{f} + 0.006f$
  Guaranteed: $0.65 + 0.57\sqrt{f} + 0.009f$
- 8944 & 8948 series . . . . . Typical: $0.02 + 0.29\sqrt{f} + 0.007f$
  Guaranteed: $0.39 + 0.29\sqrt{f} + 0.011f$

Return Loss (dB):
- 8946 series . . . . . 15
- 8944 & 8948 series . . . . . 18

Overall Phase Stability (degrees):* . . . . . Typical: $0.10(f)$
Guaranteed: $0.5 + 0.17(f)$

Overall Amplitude Stability (dB): . . . . . Typical: ≤0.05
Guaranteed: ≤0.15

Return Loss Stability (dB): . . . . . ≥40

* $f$ = frequency in GHz.



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# Recommended Test Port Adapters

## Adapter Specifications

### Coaxial to Coaxial Test Port Adapter Specifications

| ADAPTER MODEL | ADAPTS SIDE A | ADAPTS SIDE B | FREQUENCY RANGE AND MAXIMUM VSWR (GHz) | NOMINAL IMPEDANCE | OVERALL LENGTH INCHES | (CM) |
|---|---|---|---|---|---|---|
| 7909A1 [1] | NMD2.4mm female | 2.4mm female | DC — 26.5 ≤ 1.10<br>26.5 — 40.0 ≤ 1.15<br>40.0 — 50.0 ≤ 1.20 | 50 ohm | 1.51 | (3.84) |
| 7909A2 [1] | NMD2.4mm female | 2.4mm male | | 50 ohm | 1.48 | (3.76) |
| 7909B1 | NMD2.4mm female | 3.5mm female | DC — 10.0 ≤ 1.06<br>10.0 — 20.0 ≤ 1.10<br>20.0 — 34.0 ≤ 1.14 | 50 ohm | 1.46 | (3.71) |
| 7909B2 | NMD2.4mm female | 3.5mm male | | 50 ohm | 1.50 | (3.81) |
| 7909C | NMD2.4mm female | 7mm | DC — 4.0 ≤ 1.05<br>4.0 — 12.0 ≤ 1.07<br>12.0 — 18.0 ≤ 1.10 | 50 ohm | 2.16 | (5.49) |
| 7909D1 | NMD2.4mm female | Type N female | DC — 4.0 ≤ 1.08<br>4.0 — 12.0 ≤ 1.12<br>12.0 — 18.0 ≤ 1.14 | 50 ohm | 1.80 | (4.57) |
| 7909D2 | NMD2.4mm female | Type N male | | 50 ohm | 1.84 | (4.67) |
| 7909F1 | NMD 2.4mm female | 2.92mm (K) female | DC — 20.0 ≤ 1.10<br>20.0 — 40.0 ≤ 1.16 | 50 ohm | 1.44 | (3.66) |
| 7909F2 | NMD 2.4mm female | 2.92mm (K) male | | 50 ohm | 1.48 | (3.76) |
| 7909H | NMD 2.4mm female | NMD 3.5mm male | DC — 10.0 ≤ 1.06<br>10.0 — 20.0 ≤ 1.10<br>20.0 — 34.0 ≤ 1.14 | 50 ohm | 1.49 | (3.79) |
| 8009A | NMD 3.5mm female | 3.5mm female | DC — 18.0 ≤ 1.08<br>18.0 — 26.5 ≤ 1.12 | 50 ohm | 1.45 | (3.68) |
| 8009B | NMD 3.5mm female | 3.5mm male | | 50 ohm | 1.49 | (3.79) |
| 2633C | NMD 3.5mm female | 7mm | DC — 18.0 ≤ $1.018 + 0.003f$ | 50 ohm | 1.86 | (4.72) |
| 8829A | NMD 3.5mm female | Type N female | DC — 6.0 ≤ 1.04<br>6.0 — 18.0 ≤ 1.08 | 50 ohm | 2.04 | (5.18) |
| 8829B | NMD 3.5mm female | Type N male | | 50 ohm | 2.20 | (5.59) |
| 2433A1 | NMD 3.5mm female | 14mm (GR900 equiv) | DC — 8.5 ≤ $1.01+0.008f$ | 50 ohm | 2.32 | (5.89) |
| 8022A2 | 3.5mm female | 7mm | DC — 4.0 ≤ 1.04<br>4.0 — 18.0 ≤ 1.08 | 50 ohm | 1.67 | (4.24) |
| 8022B2 | 3.5mm male | 7mm | | 50 ohm | 1.67 | (4.24) |
| 2633A | 7mm | 7mm “female” | DC — 18.0 ≤ $1.004 + 0.003f$ | 50 ohm | 1.62 | (4.12) |
| 2606C | 7mm | Type N female | DC — 4.0 ≤ 1.03<br>4.0 — 9.0 ≤ 1.04<br>9.0 — 18.0 ≤ 1.07 | 50 ohm | 1.51 | (3.84) |
| 2606D | 7mm | Type N male | | 50 ohm | 1.51 | (3.84) |
| 2622A1 | 7mm | TNC female | DC — 4.0 ≤ 1.05<br>4.0 — 18.0 ≤ 1.15 | 50 ohm | 1.68 | (4.26) |
| 2622B | 7mm | TNC male | | 50 ohm | 1.55 | (3.94) |
| 2607A1 | 7mm | 14mm (GR900 equiv) | DC — 8.5 ≤ $1.004 + 0.004f$ | 50 ohm | 2.01 | (5.10) |

### Waveguide to Coaxial Test Port Adapter Specifications

| ADAPTER MODEL | ADAPTS SIDE A | ADAPTS SIDE B | FREQUENCY RANGE AND MAXIMUM VSWR (GHz) | EQUIVALENT FLANGE | OVERALL LENGTH INCHES | (CM) |
|---|---|---|---|---|---|---|
| E230K1 [2] | NMD3.5mm female | EIA WR229 | 3.3 — 4.9 ≤ 1.10 | CPR229F | 3.88 | (9.86) |
| G230K1 [2] | NMD3.5mm female | EIA WR187 | 3.95 — 5.85 ≤ 1.10 | UG149/U | 3.88 | (9.86) |
| F230K1 | NMD3.5mm female | EIA WR159 | 4.9 — 7.05 ≤ 1.10 | CPR159F | 3.40 | (8.64) |
| C230K1 | NMD3.5mm female | EIA WR137 | 8.85 — 8.20 ≤ 1.10 | UG344/U | 3.13 | (7.95) |
| H230K1 | NMD3.5mm female | EIA WR112 | 7.05 — 10.0 ≤ 1.10 | UG51/U | 2.98 | (7.57) |
| X230K1 | NMD3.5mm female | EIA WR90 | 8.2 — 12.4 ≤ 1.10 | UG39/U | 2.73 | (6.93) |
| M230K1 | NMD3.5mm female | EIA WR75 | 10.0 — 15.0 ≤ 1.10 | MPF75 | 2.63 | (6.68) |
| P230K1 | NMD3.5mm female | EIA WR62 | 12.4 — 18.0 ≤ 1.10 | UG419/U | 2.38 | (6.05) |
| N230K3 | NMD3.5mm female | EIA WR51 | 15.0 — 22.0 ≤ 1.20 | MPF51 | 2.00 | (5.08) |
| K230K6 | NMD3.5mm female | EIA WR42 | 18.0 — 26.5 ≤ 1.15 | UG595/U | 1.80 | (4.57) |
| U233E [3] | NMD2.92mm female | EIA WR28 | 26.5 — 40.0 ≤ 1.30 | UG599/U | 1.80 | (4.57) |

[1] 7909A1 and 7909A2 are phase matched for VNA applications.

[2] These Larger waveguide adapters should not be directly connected to test sets without support.

[3] Mates with the special (K) connector provided on Anritsu 360 VNA.



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# Stability™ Maury Microwave — Microwave/RF Cable Assemblies

*Series SC-24, SC-292, SC-35 and SC-N*

## Features and Benefits

- *Amplitude and phase stable with flexure*
- *Reliable and repeatable measurements*
- *Durable, ruggedized, crush-resistant*
- *Longer flex life*
- *Also available in 2.92mm or 3.5mm Low-Profile and Thermal Vacuum configurations.*
- *Available in 90° Swept Angle configurations.*

## Typical Applications

- *Vector network analyzers (VNAs)*
- *RF and microwave instruments*
- *Bench-top testing*
- *Probe station integrations*
- *RF production testing*
- *ATE systems*

## Description

Maury Microwave's Stability™ series sets the standard for high-performance ruggedized cable assemblies. Designed specifically for phase-stable and amplitude-stable applications, Stability™ offers excellent measurement repeatability even after cable flexure. With a ruggedized, durable construction, Stability™ will outlast and outperform other assemblies resulting in a reduced total cost-of-test. Stability's™ light weight, superior flexibility and small form factor make it ideal for daily use with VNA's, test instruments, bench-top testing and ATE systems.

Stability™ cable assemblies are now part of the ColorConnect™ family! Following the proposed IEEE high-frequency connector/adapter color convention, Stability™ cable assemblies are the first commercially available assemblies to offer clear indications of compatibility and intermatability. ColorConnect™ makes it a simple matter to avoid and eliminate damaged equipment, degraded equipment reliability, degraded performance and lengthy maintenance times due to improper mating (and attempted mating) of incompatible interconnects.

## Stability ™ Specifications

| STABILITY™ Cable Type | Frequency | Typical Phase Stability with Flexure | Typical Amplitude Stability with Flexure |
|---|---|---|---|
| SC-185 | 67 GHz | ±8.0° | ±0.08 dB |
| SC-24 | 50 GHz | ±6.0° | ±0.05 dB |
| SC-292 | 40 GHz | ±5.0° | ±0.05 dB |
| SC-35 | 26.5 GHz | ±3.5° | ±0.02 dB |
| SC-N | 18.0 GHz | ±2.0° | ±0.015 dB |

### Typical Configurations

| Part Number | Lengtn* | Connector 1 | Connector 2 | Frequency |
|---|---|---|---|---|
| SC-185-MM-24 | 24 in. | 1.85mm male | 1.85mm male | 67 GHz |
| SC-185-MM-36 | 36 in. | | | |
| SC-185-MM-48 | 48 in. | | | |
| SC-24-MM-24 | 24 in. | 2.4mm male | 2.4mm male | 50 GHz |
| SC-24-MM-36 | 36 in. | | | |
| SC-24-MM-48 | 48 in. | | | |
| SC-292-MM-24 | 24 in. | 2.92mm male | 2.92mm male | 40 GHz |
| SC-292-MM-36 | 36 in. | | | |
| SC-292-MM-48 | 48 in. | | | |
| SC-292-MM-60 | 60 in. | | | |
| SC-292-MM-78 | 78 in. | | | |
| SC-35-MM-24 | 24 in. | 3.5mm male | 3.5mm male | 26.5 GHz |
| SC-35-MM-36 | 36 in. | | | |
| SC-35-MM-48 | 48 in. | | | |
| SC-35-MM-60 | 60 in. | | | |
| SC-35-MM-78 | 78 in. | | | |
| SC-N-MM-24 | 24 in. | N male | N male | 18 GHz |
| SC-N-MM-36 | 36 in. | | | |
| SC-N-MM-48 | 48 in. | | | |
| SC-N-MM-60 | 60 in. | | | |
| SC-N-MM-78 | 78 in. | | | |

* Custom lengths are available by special order.



STABILITY™ SC-292-MM-36
Microwave/RF Cable Assembly



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# Cable Assembly Specifications

## Electrical Properties[1]

| STABILITY™ Cable Type | SC-185 | SC-24 | SC-292 | SC-35 | SC-N |
|---|---|---|---|---|---|
| Maximum Frequency | 67 GHz | 50 GHz | 40 GHz | 26.5 GHz | 18.0 GHz |
| VSWR | 1.40 typ/ 1.50 max | 1.30 typ/ 1.43 max | 1.25 typ/ 1.40 max | 1.25 typ/ 1.35 max | 1.25 typ/ 1.30 max |
| Typical Insertion Loss (cable only) | 1.79 dB/ft | 1.52 dB/ft | 0.84 dB/ft | 0.67 dB/ft | 0.54 dB/ft |
| Impedance (nominal) | 50 ohm | 50 ohm | 50 ohm | 50 ohm | 50 ohm |
| Phase Stability vs Bending[2] | ±8° typ/ ±15.6° max | ±6° typ/ ±11.8° max | ±5° typ/ ±9.5° max | ±3.5° typ/ ±7.0° max | ±2.0° typ/ ±4.5° max |
| Amplitude Stability vs Bending[3] | ±0.08 dB typ/ ±0.10 dB max | ±0.05 dB typ/ ±0.08 dB max | ±0.05 dB typ/ ±0.10 dB max | ±0.02 dB typ/ ±0.04 dB max | ±0.015 dB typ/ ±0.02 dB max |
| Phase Stability vs Temp | <4°/m/GHz (–55 ~+125°C) | | | | |
| Velocity of Propagation | 76% (nominal) | | | | |
| Shielding Effectiveness | >90 dB (DC –18.0 GHz) | | | | |
| Time Delay (nominal) | 1.3ns/ft (4.4ns/m) | | | | |

[1] These specifications also apply to Stability™ Low-Profile (-LP) and Thermal Vacuum (-TVAC) cable assemblies (see page 153).

[2] Per IEC 60966-1, section 8.6, method 1.

[3] Per IEC 60966-1, section 8.4.

## Mechanical/Environmental Properties

| STABILITY™ Cable Type | SC-185, SC-24, SC-292, SC-35 and SC-N | |
|---|---|---|
| Center Conductor Material | Silver-Plated Copper-Clad Steel | |
| Maximum Outer Diameter | SC-292/SC-35/SC-N 0.277 in (7.04mm) | SC-185/SC-24 0.244 (6.20mm) |
| Nominal Weight | 1.61 oz/ft (150g/m) | 1.02 oz/ft (95g/m) |
| Min. Static Bend Radius / Min. Dynamic Bend Radius | 1.0 in. (25.4mm) / 2.0 in. (50.8mm) | |
| Flex Life Cycles [4] | >20,000 | |
| Crush Resistance | >254 lb/inch (44 kN/m) | |
| Operating Temperature Range | –67 ~ +257°F (–55 ~ +125°C) | |
| Fire Resistance [5] | Yes | |
| Abrasion Resistance [6] | Yes | |
| RoHS/REACH | Yes | |

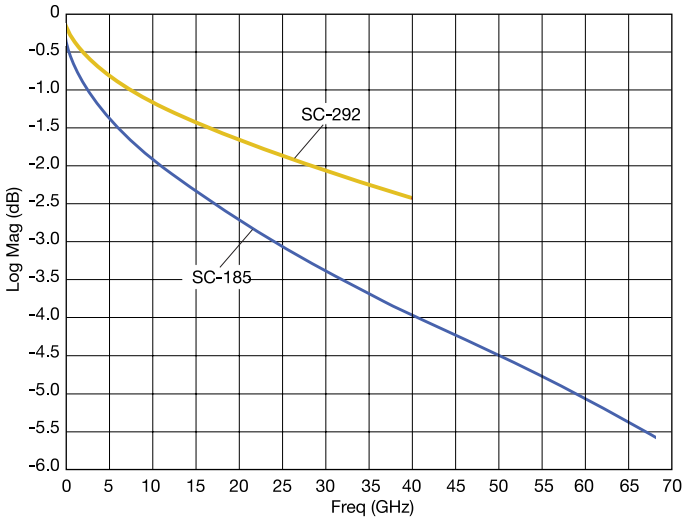
[4] Per IEC 60966-1, section 9.3.

[5] Per MIL-C-87104.

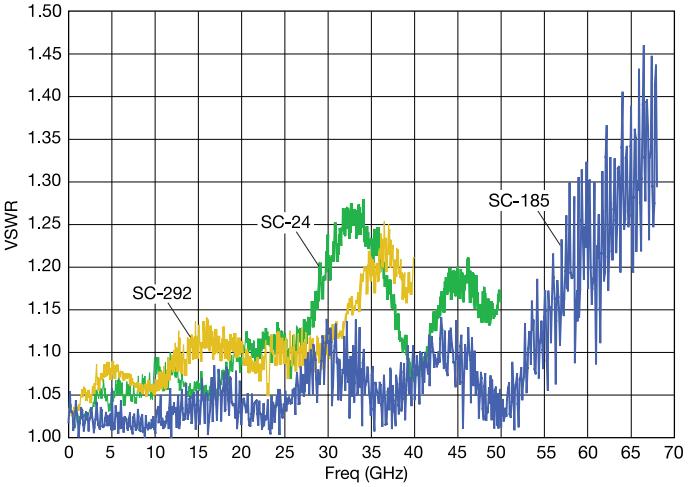
[6] Per SAE AS5756.




## Maury Stability™ 36" Cable Assembly Typical Insertion Loss




## Maury Stability™ 36" Cable Assembly Typical VSWR






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## Stability™ Low-Profile Cable Assemblies (-LP)

Stability™ Low-Profile Cable Assemblies are designed for high-density applications such as switch matrices and PXI/PXIe/AXIe cards, as well as wafer-probe applications where traditional cable assemblies might cause interference due to cable and connector size. Stability™ Low-Profile Cable Assemblies offer the same electrical performance as Stability™ Microwave/RF Cable Assemblies in an configuration that is 44% smaller and 66% lighter, and are available with 3.5mm and 2.92mm connectors.

### *Mechanical/Environmental Properties (-LP)*

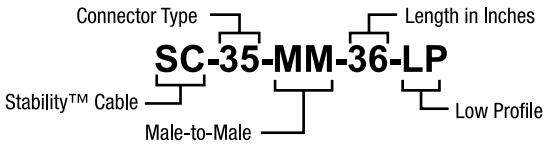
| STABILITY™ Cable Type | SC-292 and SC-35 |
|---|---|
| Center Conductor Material | Silver-Plated Copper-Clad Steel |
| Maximum Outer Diameter | 0.156 in (3.95mm) |
| Nominal Weight | 0.54 oz/ft (50g/m) |
| Minimum Bend Radius | 1.0 in. (25.4mm) |
| Flex Life Cycles[4] | >20,000 |
| Crush Resistance | >23 lb/inch (4kN/m) |
| Operating Temperature Range | –67 ~ +257°F (–55 ~ +125°C) |
| Fire Resistance[5] | Yes |
| RoHS/REACH | Yes |

[4] Per IEC 60966-1, section 9.3. [5] Per MIL-C-87104.




## Ordering Instructions for Stability™ Low Profile (-LP) Cable Assemblies

To specify a Stability™ Low Profile Cable Assembly, add "-LP" at the end of the SC model number, as shown in the example below.



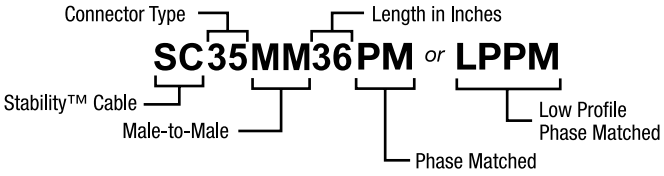

## Stability™ Phase-Matched (PM) Cable Assembly Sets

Stability™ Phase-Matched Cable Assemblies have been designed for applications where strict phase equality between multiple paths are required. Stability™ PM Cable Assemblies are matched within ±0.63 °/GHz and available as sets of two or more assemblies. Stability™ PM Cable Assemblies are offered in both standard and low-profile formats and maintain the mechanical and electrical characteristics of the original assembly. Phase matched assemblies are available with 2.4mm, 2.92mm, 3.5mm and Type-N connectors and in all lengths.



## Ordering Instructions for Stability™ Phase-Matched (PM) Cable Assembly Sets

To specify a Stability™ Phase-Matched Cable Assembly set, add "PM" or "LPPM" at the end of the SC model number, as shown in the example below. "PM" indicates standard configuration Phase-Matched sets; "LPPM" indicates Low Profile configuration, Phase-Matched sets.







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## Stability™ Swept 90° Cable Assemblies (-RT)

Stability™ Swept 90° Cable Assemblies are designed for applications requiring a fixed and stable bend where traditional cable assemblies may be inconvenient. With a bend radius of 1.43 inches and a cable-to-connector length of 3.3 inches, Stability™ Swept 90° Cable Assemblies retain the electrical and mechanical specifications of the traditional assembly while removing stresses related to hand-formed bends. Stability™ Swept 90° Cable Assemblies are built on demand and are available with 2.92mm, 3.5mm and Type-N connectors.

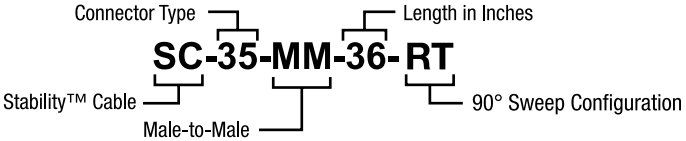




Stability™ Swept 90° Cable Assemblies are available in all the lengths offered for the standard Stability™ Microwave/RF Cable Assemblies.

## Ordering Instructions for Stability™ Swept 90° Cable Assemblies (-RT)

To specify a Stability™ Swept 90° Cable Assembly, add "-RT" at the end of the SC model number, as shown in the example at the right.

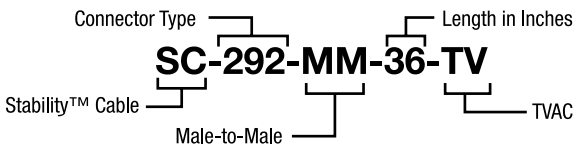



## Stability™ Thermal Vacuum Cable Assemblies (-TV)

Stability™ TVAC Cable Assemblies have been designed for measurements in a thermal vacuum environment for space product testing. TVAC cable assemblies connect components or satellites located in thermal test chambers to systems and instruments outside. Stability™ TVAC Cable Assemblies offer the same electrical and mechanical performance as Stability™ Microwave/RF Cable Assemblies with specialized vented 2.92mm connectors that meet low outgassing requirements of ESA-PSS-01-702 with a TML < 1% and CVCM < 0.1%.

## Ordering Instructions for Stability™ Thermal Vacuum (-TV) Cable Assemblies

To specify a Stability™ Thermal Vacuum Cable Assembly, add "-TV" at the end of the SC model number, as shown in the example at the right.




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Utility™ Maury Microwave

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# Utility™ Microwave/RF Cable Assemblies

***Series UC-N and UC-SMA***

## Typical Applications

- *RF and microwave instruments*
- *Bench-top testing*
- *Probe station integrations*
- *RF production testing*
- *Component/module testing*
- *ATE systems*

## Features and Benefits

- *Excellent Value*
- *Low insertion loss*
- *Reliable and repeatable measurements*
- *Amplitude and phase stable with flexure*
- *High mating-cycle durability*

## Description

Maury Microwave's Utility™ series sets the standard for high-end all-purpose test and measurement cable assemblies. Designed for general testing applications, Utility™ offers excellent value with its low cost, low insertion loss, excellent return loss, flexibility, and amplitude and phase stability. Utility™ is the ideal interconnection for reliable and repeatable measurements when mated with test instruments including bench-top testing, on-wafer characterization and ATE systems.

Utility™ cable assemblies are now part of the ColorConnect™ family! Following the proposed IEEE high-frequency connector/adapter color convention, Utility™ cable assemblies are the first commercially available assemblies to offer clear indications of compatibility and intermatability. ColorConnect™ makes it a simple matter to avoid and eliminate damaged equipment, degraded equipment reliability, degraded performance and lengthy maintenance times due to improper mating (and attempted mating) of incompatible interconnects.



Utility™ UC-N-MM-24 (Left) and UC-SMA-MM-24 (Right) Microwave/RF Cable Assemblies



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# Cable Assembly Specifications

## Electrical Properties

| Utility™ Cable Type | Type N | SMA |
|---|---|---|
| Maximum Frequency | 18.0 GHz | 20.0 GHz |
| VSWR | 1.30 max | 1.25 max |
| Typical Insertion Loss (cable only) | 0.64 dB/ft | |
| Impedance (nominal) | 50 ohm | |
| Phase Stability vs Bending[1] | ±3.0° typ | |
| Amplitude Stability vs Bending[2] | ±0.015 dB typ | |
| Velocity of Propagation | 71% (nominal) | |
| Shielding Effectiveness | >100 dB (DC –18.0 GHz) | |
| Time Delay (nominal) | 1.45ns/ft (4.75ns/m) | |

[1] Per IEC 60966-1, section 8.6, method 1.

[2] Per IEC 60966-1, section 8.4.

## Mechanical/Environmental Properties

| Utility™ Cable Type | Type N and SMA |
|---|---|
| Center Conductor Material | Silver-Plated Copper-Clad Steel |
| Maximum Outer Diameter | 0.190 in (4.81mm) |
| Nominal Weight | 0.65 oz/ft (60g/m) |
| Min. Static Bend Radius/ Min. Dynamic Bend Radius | 1.0 in. (25.4mm)/ 2.0 in. (50.8mm) |
| Flex Life Cycles[3] | >10,000 |
| Crush Resistance | >131 lb/inch (23 kN/m) |
| Operating Temperature Range | –67 ~ +221°F (–55 ~ +105°C) |
| Fire Resistance[4] | Yes |
| RoHS/REACH | Yes |

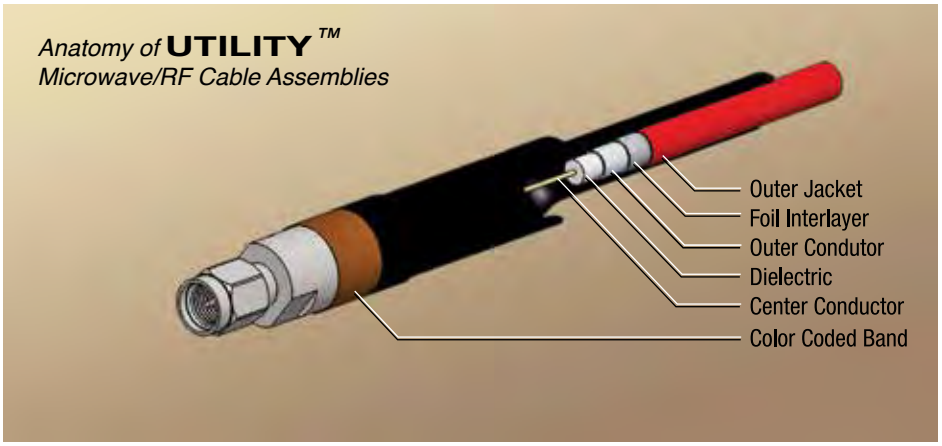
[3] Per IEC 60966-1, section 9.3.

[4] Per MIL-C-87104.

## Available Models

| Part Number | Length[5] | Connector 1 | Connector 2 | Frequency |
|---|---|---|---|---|
| UC-N-MM-24 | 24 in. | N male | N male | 18 GHz |
| UC-N-MM-36 | 36 in. | | | |
| UC-N-MM-48 | 48 in. | | | |
| UC-N-MM-60 | 60 in. | | | |
| UC-N-MM-78 | 78 in. | | | |
| UC-SMA-MM-24 | 24 in. | SMA male | SMA male | 20 GHz |
| UC-SMA-MM-36 | 36 in. | | | |
| UC-SMA-MM-48 | 48 in. | | | |
| UC-SMA-MM-60 | 60 in. | | | |
| UC-SMA-MM-78 | 78 in. | | | |

[5] Custom lengths are available by special order.






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# ColorConnect™ Precision Attenuators

## AT-Series



AT-24-01-03 AT-292-01-03 AT-SMA-01-03

AT-Series Attenuators

## Features

- *Fixed Coaxial Attenuators*
- *Precision 2.4mm, 2.92mm & SMA Male/Female Connectors*
- *Color Coded For Easy Identification*

## Description

Maury Microwave's AT-series of fixed coaxial attenuators are used to reduce the power of a RF, MW or mmW signal without distorting its signal quality/waveform. Attenuators are often used to lower the amplitude of a signal to a measurable level or to protect a measurement instrument from damage. Attenuators are also used to improve matching between components by improving the return loss (twice insertion loss) and effectively reducing the VSWR seen by adjacent components. Key attenuator parameters include attenuation, frequency bandwidth, power handling, VSWR and quality/repeatability of connector.

## ColorConnect™ Color Coding

Maury AT-Series attenuators are part of the ColorConnect™ family. Following the proposed IEEE high-frequency connector/adapter color convention, AT-Series attenuators are the first commercially available attenuators to offer clear indications of compatibility and intermatability. ColorConnect™ makes it a simple matter to avoid and eliminate damaged equipment, degraded equipment reliability, degraded performance and lengthy maintenance times due to improper mating (and attempted mating) of incompatible interconnects.

**Proposed IEEE High-Frequency Connector/Adapter Color Convention**

**(Available with Maury ColorConnect™ Precision Adapters)**

| | |
|---|---|
| BROWN | SMA |
| RED | TYPE N |
| ORANGE | 3.5mm |
| YELLOW | 2.92mm (K) |
| GREEN | 2.4mm |
| BLUE | 1.85mm (V) |

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## Available Models

| Model | Connector 1 | Connector 2 | Frequency Range | Power Handling (W) | Attenuation (dB) | VSWR (max) |
|---|---|---|---|---|---|---|
| AT-SMA-02-03 | SMA male | SMA female | DC – 26.5 | 2 | 3 | 1.5:1 |
| AT-SMA-02-06 | SMA male | SMA female | DC – 26.5 | 2 | 6 | 1.5:1 |
| AT-SMA-02-10 | SMA male | SMA female | DC – 26.5 | 2 | 10 | 1.5:1 |
| AT-SMA-02-20 | SMA male | SMA female | DC – 26.5 | 2 | 20 | 1.5:1 |
| AT-292-01-03 | 2.92mm male | 2.92mm female | DC – 40.0 | 1 | 3 | 1.4:1 |
| AT-292-01-06 | 2.92mm male | 2.92mm female | DC – 40.0 | 1 | 6 | 1.4:1 |
| AT-292-01-10 | 2.92mm male | 2.92mm female | DC – 40.0 | 1 | 10 | 1.4:1 |
| AT-292-01-20 | 2.92mm male | 2.92mm female | DC – 40.0 | 1 | 20 | 1.4:1 |
| AT-24-01-03 | 2.4mm male | 2.4mm female | DC – 50.0 | 1 | 3 | 1.75:1 |
| AT-24-01-06 | 2.4mm male | 2.4mm female | DC – 50.0 | 1 | 6 | 1.75:1 |
| AT-24-01-10 | 2.4mm male | 2.4mm female | DC – 50.0 | 1 | 10 | 1.75:1 |
| AT-24-01-20 | 2.4mm male | 2.4mm female | DC – 50.0 | 1 | 20 | 1.75:1 |


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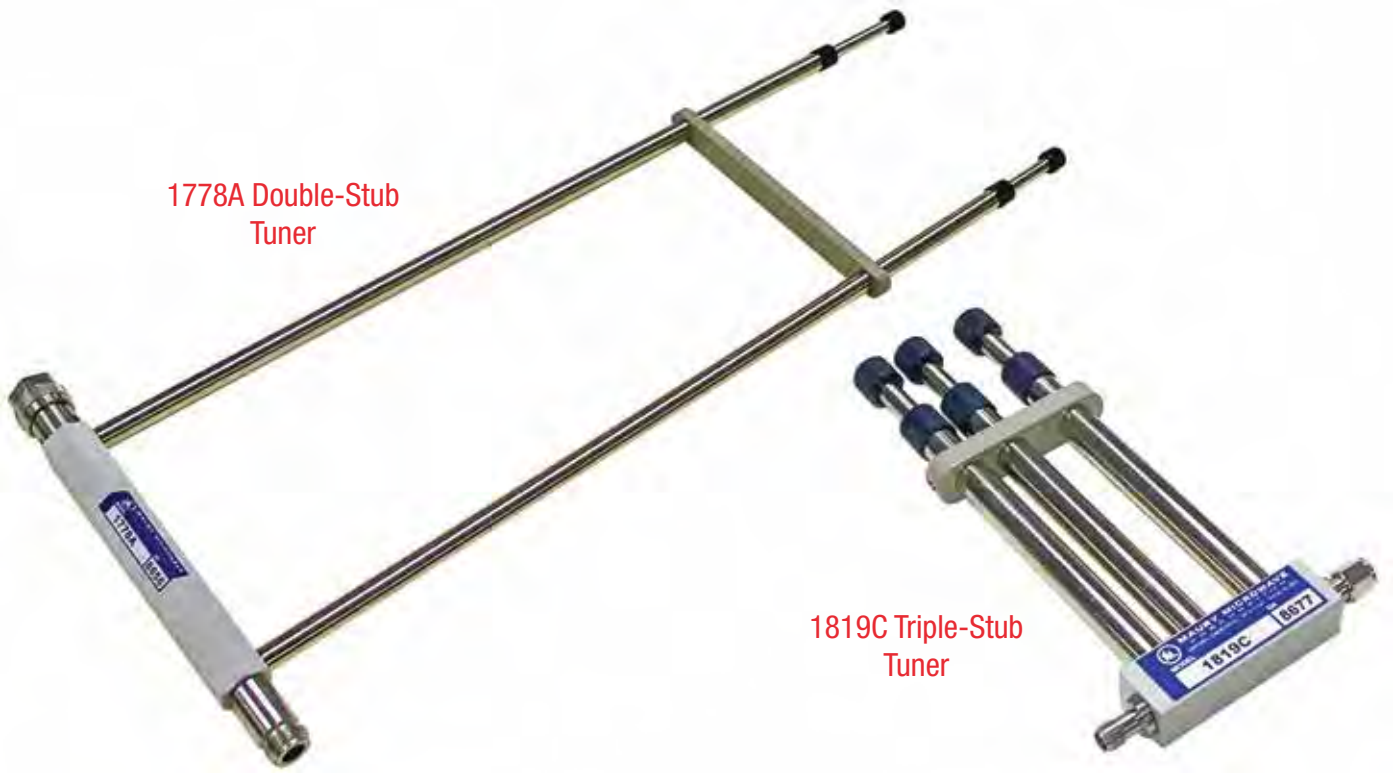
# Coaxial Stub Tuners

## Description

Maury stub tuners are basic laboratory tools used for matching load impedances to provide for maximum power transfer between a generator and a load, and for introducing a mismatch into an otherwise matched system. Typical applications include power and attenuation measurements, tuned reflectometer systems and providing a DC return for single-ended mixers and detectors. Maury stub tuners are available in double- and triple-stub configurations with frequency ranges extending from 0.2 to 18.0 GHz.

Stub tuners work as impedance transformers to introduce a variable shunt susceptance into a coaxial transmission line. They consist of one or more short-circuited, variable length lines (stubs) connected at right angles to the primary transmission line. To provide all possible shunt susceptances, each stub must be movable over 1/2 wavelength at the lowest frequency of operation; therefore, the lower frequency limit of a tuner is determined by the frequency at which the maximum stub travel equals 1/2 wavelength. The upper frequency limit for a stub tuner is established by its connectors.

The inter-stub spacing of multiple-stub tuners determines the range of impedances that can be matched and the ease of tuning. Triple-stub tuners are more convenient to use since tuning sensitivity is relatively independent of stub spacing.




## Available Models

| STUB CONFIGURATION | FREQUENCY RANGE (GHz) | MODEL (BY CONNECTOR TYPE) TYPE N | 7mm | SMA | STUB TRAVEL INCHES | (cm) | STUB SPACING INCHES | (cm) |
|---|---|---|---|---|---|---|---|---|
| DOUBLE-STUB | 0.2 — 0.5 | 1778G | 2612B7 | — | 30.0 | (76.2) | 4.6 | (11.7) |
| | 0.4 — 1.0 | 1778A | 2612B1 | 1719A | 15.0 | (38.1) | 4.6 | (11.7) |
| | 0.8 — 4.0 | 1778B | 2612B2 | 1719B | 7.5 | (19.1) | 2.0 | ( 5.1) |
| | 2.0 — 12.0 | 1778C | 2612B3 | 1719C | 3.0 | ( 7.6) | 0.75 | ( 1.9) |
| | 2.0 — 18.0 | 1778E | — | — | 3.0 | ( 7.6) | 0.5 | ( 1.3) |
| | 4.0 — 18.0 | 1778D | 2612B4 | 1719D | 1.75 | ( 4.4) | 0.5 | ( 1.3) |
| TRIPLE-STUB | 0.2 — 0.5 | 1878G | 2612C7 | — | 30.0 | (76.2) | 4.6 (11.7) / | 2.0 ( 5.1) |
| | 0.4 — 1.0 | 1878A | 2612C1 | 1819A | 15.0 | (38.1) | 4.6 (11.7) / | 2.0 ( 5.1) |
| | 0.8 — 4.0 | 1878B | 2612C2 | 1819B | 7.5 | (19.1) | 1.0 ( 2.5) / | 0.75 ( 1.9) |
| | 2.0 — 18.0 | 1878C | 2612C3 | 1819C | 3.0 | ( 7.6) | 0.75 ( 1.9) / | 0.5 ( 1.3) |
| | 4.0 — 18.0 | 1878D | 2612C4 | 1819D | 1.75 | ( 4.4) | 0.75 ( 1.9) / | 0.5 ( 1.3) |


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# Maury Noise Calibration Systems and Components

## *True Thermal Noise Sources That Provide High Accuracy in a Conceptually Simple Package.*

### *In This Section:*

### *Maury MT7000 Series Noise Calibration Systems*

These Maury Noise Calibration Systems (NCS) are self-contained, highly accurate sources of RF and microwave noise power that are used wherever noise source accuracy is critical. Examples are: receiver noise measurements, such as noise figure and effective input noise temperature; calibration of solid state noise sources; evaluation and verification of earth station receivers; and as radiometer reference sources. (See pages 161).

### *Maury MT7000 Series Waveguide Cryogenic Terminations (Cold Loads) and Maury MT7100 Series Coaxial Cryogenic Terminations (Cold Loads)*

Maury cryogenic terminations are liquid nitrogen cooled loads which provide accurately known noise power at a well matched output port. Used with ambient and/or thermal terminations and a noise figure meter, these terminations provide cold reference temperatures needed for highly accurate noise figure or effective input noise temperature measurements. Because of the accuracy of their noise output, cryogenic terminations are often used as a noise standard for calibration of solid state noise generators. (See pages 163-164.)

### *Maury MT7000 Series Waveguide Thermal Terminations (Hot Loads) and Maury MT7100 Series Coaxial Thermal Terminations (Hot Loads)*

Maury thermal terminations are low-mismatch, heated loads in a precisely controlled thermal environment, which provide and accurately known noise power. Used with ambient and /or cryogenic terminations and a noise figure meter, these terminations provide the hot termination temperature needed for highly accurate noise figure or effective input noise temperature measurements. Because of the accuracy of the noise output, thermal terminations are often used as a noise standard for calibration of solid state noise generators. (See pages 169-172.)

### *Maury Coaxial and Waveguide Ambient Terminations*

Maury ambient terminations are room temperature noise sources consisting of a stable termination in a massive copper housing to provide thermal stability and to reduce the effects of thermal transients. (See page 168.)

### *Noise Components & Accessories*

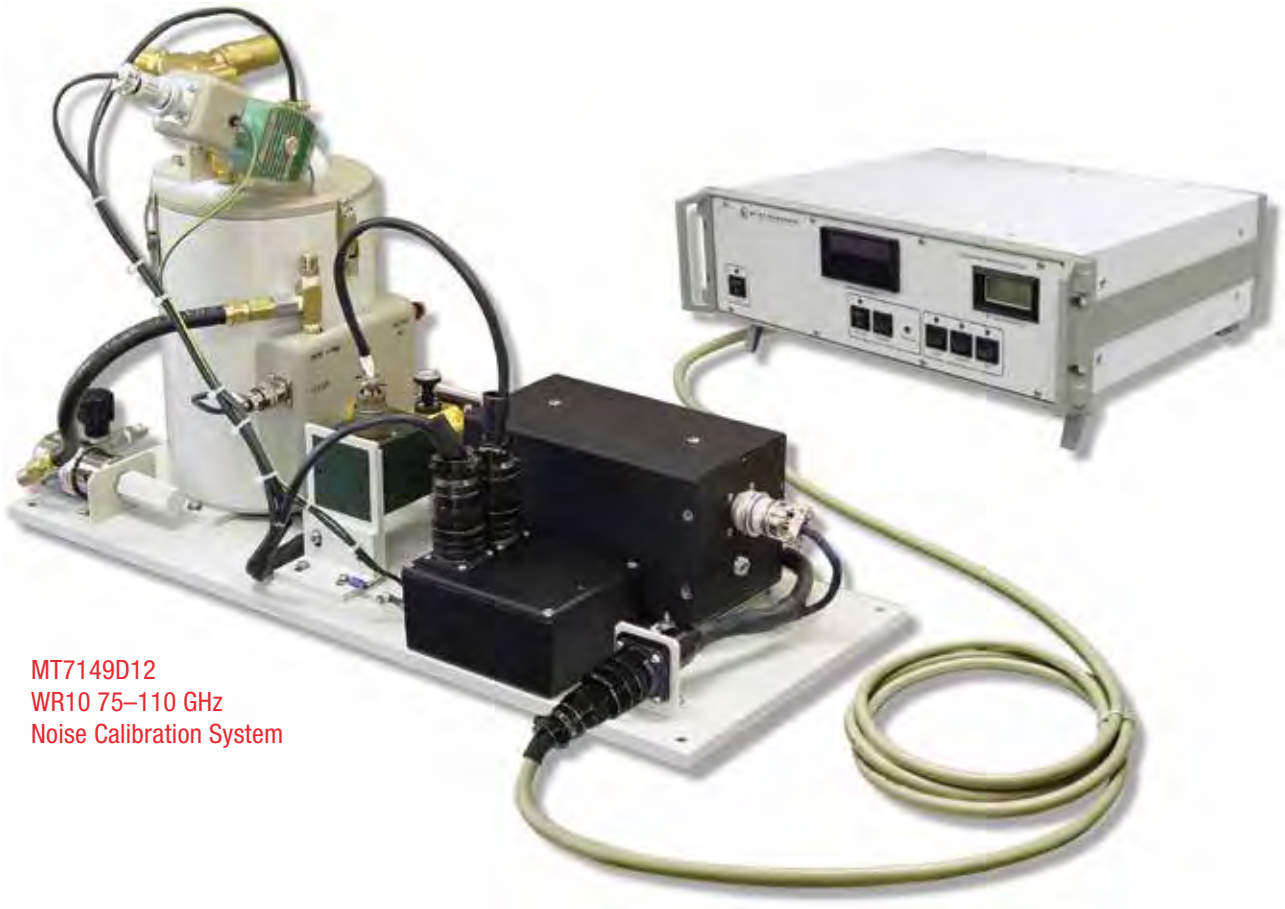
Maury offers a number of accessories to support your Maury Noise Calibration System including a wide range of calibrated adapters and adapter sets that are used with the MT7118J cryogenic termination and the MT7108B thermal termination to adapt the precision 7mm output port to other coaxial series or to waveguide at specific frequencies. They are calibrated for VSWR and insertion loss to allow their input noise temperature to be calculated. (See pages 165 and 172.)





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# Noise Calibration Systems and Components



MT7149D12
WR10 75–110 GHz
Noise Calibration System

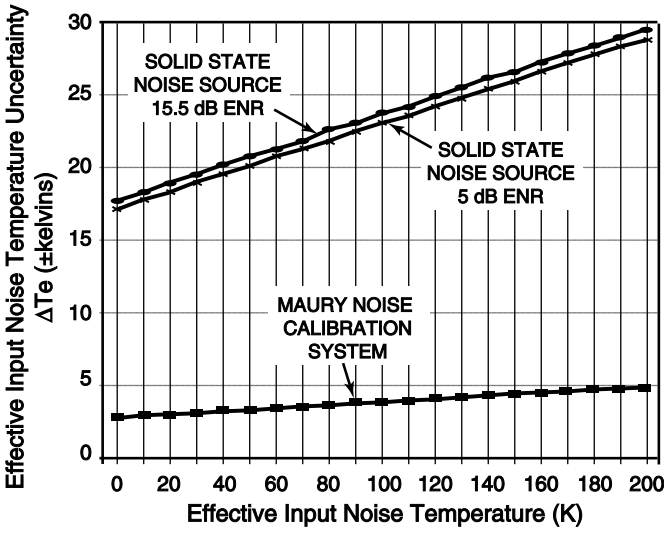
## *Introduction*

The Maury Noise Calibration Systems (NCS) are self-contained, highly accurate sources of RF and microwave noise power. These systems are used wherever noise source accuracy is critical. Examples are: receiver noise measurements such as noise figure and effective input noise temperature; calibration of solid state noise sources; evaluation and verification of earth station receivers; and as radiometer reference sources.

Each NCS consists of two (hot/cold) or three (hot/ambient/cold) thermal noise sources whose outputs can be conveniently switched into a single calibrated output port. This capability makes for a unique combination of accuracy and convenience. The incorporation of the output switch makes the operation of the NCS in a noise performance measurement as convenient as a solid state noise generator – without the accuracy penalty associated with the latter. The plot shown at right illustrates the improvement in accuracy that can be gained by the use of an NCS in a typical measurement application (effective input noise temperature).

The cold noise source is a liquid nitrogen ($LN_2$) cooled termination. A liquid nitrogen level sensor and an automatic fill system maintains the proper nitrogen level. The user must provide a suitable liquid nitrogen reservoir. The cold termination is also pressurized with helium at 2 psi. Pressure is maintained by a regulator that requires 20 psi maximum from an external user-supplied source. Since most helium bottles are pressurized to about 1,000 psi or more, the MT152C pressurizing system is included.

The hot noise source is a heated termination whose temperature is maintained by proportional control to better than ±0.2K by the MT155J controller. Actual temperature is indicated by a digital readout on the controller front panel.





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# Noise Calibration Systems and Components

**(Continued)**



MT155J

The MT155J controller can be located up to 25 feet (7.6 meters) away from the mounting plate.

The NCS consists of three assemblies:

A. A component mounting plate which holds the cryogenic and heated termination assemblies, the hot/cold or hot/ambient/cold remotely controlled relay(s) and output assembly, and the helium pressure regulator. The $LN_2$ level sensor and fill solenoid are mounted on the cover of the dewar flask.

B. The MT155J controller (shown at right) which contains the temperature control circuitry and a digital temperature readout for the thermal termination, the automatic or manual $LN_2$ fill control circuitry and the remote noise temperature output switch.

C. The MT155L control cable, 25 feet in length, which connects the controller to the mounting plate.

Calibration of the hot/cold noise temperatures at the output connector of the NCS is provided at a number of frequencies. Each NCS model is calibrated at specific standard frequencies. Typically, waveguide units will be calibrated at the band edges and the arithmetic center frequency of the waveguide. Coaxial units are generally calibrated at four data points within the frequency range of the connector type. For example, the MT7098J is a dual-load model equipped with a 7mm connectors and transmission lines. Calibration for this unit is provided at 3.95 GHz, 7.5 GHz, 12.4 GHz and 18.0 GHz. (Maury also offers the MT7250 series Noise Calibration Swept Data Module as a tool that allows users to work with other non-standard data points in addition to, or in place of the factory standards.[1]) Note that these noise temperatures are not critical as long as they are accurately known.

## *Typical NCS Models*

The table below shows a some of the more popular NCS available from Maury. Each model is a complete system made up of the appropriate terminations assembled on a mounting plate, the MT155J controller and the interconnecting cable. All dual-load systems shown consist of cold ($LN_2$) and heated terminations. The tri-load system (MT7208J) includes an ambient termination as well. Please consult our Sales Department if you do not see a noise calibration system in this table suitable for your application or if you would like more detailed information on any of these systems.

| Model | Frequency Range (GHz) | Transmission Line | Output Connector Or Flange | Type |
|---|---|---|---|---|
| MT7091B | 10.0 — 12.4 | WR90 | MPF90 [2] | Dual-load |
| MT7093B | 10.0 — 15.0 | WR75 | MPF75B [3] | Dual-load |
| MT7094B | 15.0 — 22.0 | WR51 | MPF51B [3] | Dual-load |
| MT7095J | 18.0 — 26.5 | WR42 | UG595/U | Dual-load |
| MT7096J | 26.5 — 40.0 | WR28 | UG599/U | Dual-load |
| MT7097 | 33.0 — 50.0 | WR22 | UG383/U | Dual-load |
| MT7100J | 50.0 — 75.0 | WR15 | UG385/U | Dual-load |
| MT7149D | 75.0 — 110.0 | WR10 | UG385/U | Dual-load |
| MT7098J | DC — 18.0 | Coaxial | 7mm | Dual-load |
| MT7208J [4] | DC — 18.0 | Coaxial | 7mm | Tri-load |

[1] Maury data sheet 4E-020 provides specifics on the MT7250 series.

[2] Mates with the appropriate military (UG) and CPR flanges.

[3] Mates with most standard military and industrial flanges in this band.

[4] CE certified.



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# Cryogenic Noise Terminations (Cold Loads)



MT7025J with Power Supply and Foam-lined Wood Carrying Case.

## Introduction

Maury cryogenic terminations are liquid nitrogen cooled loads which provide accurately known noise power at a well matched output port. Used with ambient and/or thermal terminations and a noise figure meter, these terminations provide cold reference temperatures needed for highly accurate noise figure or effective input noise temperature measurements. Because of the accuracy of their noise output, cryogenic terminations are often used as a noise standard for calibration of solid state noise generators.

The accuracy achieved by these terminations is possible because they utilize the known temperature of boiling liquid nitrogen as a constant for calculating noise temperature. Because of this, measurements made with these terminations are traceable to the fundamental quantity, temperature and NIST via temperature and network calibration standards.

Each unit is provided with a calibration report which includes VSWR and available output noise temperature data at standard frequencies. Options for additional user-selected frequencies are available (see Maury data sheet 4E-020, which provides specifics for the MT7250 series Noise Calibration Swept Data Module, a software too that allows users to work with non-standard data points in addition to, or in place of the factory standards).

The cryogenic terminations require user-provided liquid nitrogen and dry helium gas at 2 psi. Maury's MT152A pressurization system is available as an optional accessory to regulate the helium pressure (see page 165). The terminations include a heater circuit to prevent frosting on the output connector and to prevent the heat load of the device under test from affecting the output noise temperature.



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# MT7118J 7mm Coaxial Cryogenic Terminations

## DC to 18.0 GHz

### *Features*

- *Accurate Noise Temperature at Specified Calibration Frequencies*
- *Low VSWR Across the Full Frequency Range*
- *Liquid Nitrogen Cooled*
- *Metrology Grade Calibration for Solid State Noise Generators*
- *Low Noise Figure/Temperature Measurements*



MT7118J

## *Description*

The MT7118J cryogenic termination is a liquid nitrogen cooled noise source that provides accurately known noise temperatures at specified calibration frequencies and low VSWR over the full frequency range. It is used for performing accurate noise temperature measurements in 7mm applications such as certification of the noise performance of low noise earth stations. It is also used for general purpose, low noise figure/temperature measurements and calibration of solid state noise generators.

The MT7118J comes with a linear power supply that operates on line voltages of 120 VAC/60 Hz or 240 VAC/50 Hz, while supplying 48 VDC to the device power input.

The MT7118J can be packaged with an extensive complement of options and accessories, including calibrated adapters to other coaxial connector series and waveguide, and user specified calibration frequencies. Our sales staff will be happy to assist in tailoring the best package for your application.

The MT7118J can be optimized for VSWR and input noise temperature over other bandwidths, or with additional calibration points. For calibration at additional or other frequencies see Maury data sheet 4E-020, which covers the maury MT7250 series Noise Calibration Swept Data Module; a software tool that works with Microsoft® Excel® 2003 (or later) to provide an Effective Noise Temperature Interpolator. Please contact our Sales Department for additional information.

Maury also produces an extensive line of precision hot, cold and ambient terminations in both coaxial and waveguide configurations. Our sales staff is ready to assist you in ordering the right noise calibration solution for your applications.

## *Pressurizing System*

Maury cryogenic terminations require helium gas pressurization at 2 psi. The optional MT152A pressurizing system (see page 165) provides the valves, gages, and hardware necessary to connect an external helium gas supply to Maury cryogenic terminations (helium gas supply is not provided).

## *Specifications*

Frequency Range. ..... DC to 18.0 GHz

Maximum VSWR: ..... 1.06, DC to 4.0 GHz
1.10, 4.0 to 12.0 GHz
1.15, 12.0 to 18.0 GHz

Operating Temperature (Load) ..... 77.36°K (liquid N cooled)

Calibration Frequencies & Noise Temperature Uncertainty ..... ±1.5 K

Connector ..... 7mm

Operating Orientation ..... Horizontal

Operating Life ..... 2 hours minimum (one fill)

Dewar Capacity ..... 1 liter

Weight ..... 7 lbs approximate (empty)

Pressurization ..... 2 psi helium gas (external supply)

AC Power ..... 100 to 240 VAC, 47 to 63 Hz
6.0 amps maximum

Accessories (provided) ..... One (1) two meter power cord and a wooden instrument case

Note: For calibration at additional or other frequencies, see the information on Maury's MT7250 series Noise Calibration Swept Data Module software (pages 166 – 167), or consult our Sales Department.



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# Waveguide Cryogenic Terminations

## MT70xx Series




## Features

- *Accurate Noise Temperature at Specified Calibration Frequencies*
- *Low VSWR Across the Full Frequency Range*
- *Liquid Nitrogen Cooled*
- *Metrology Grade Calibration for Solid State Noise Generators*
- *Low Noise Figure/Temperature Measurements*

## Description

Maury offers waveguide cryogenic terminations in several styles and a wide range of waveguide sizes from WR430 through WR15. The table below represents a typical sample of the available terminations.

Waveguide terminations are generally calibrated at three frequencies – high, low and arithmetic center – within the applicable frequency range; however, they can be calibrated at any user-specified frequency within the waveguide band (using Maury MT7250 Noise Calibration Swept Data Module (see pages 166-167). Additional user-specified calibration frequencies are also available as an option.

In addition to liquid nitrogen, these terminations require pressurization with helium gas (not provided) at 2 psi. The MT152A pressurizing system (see page 165) is available to provide proper regulation of the helium supply.

The MT70xx series units come with a universal input power supply that operates on line voltages of 100–240 VAC and 47–63 Hz, while supplying 48 VDC to the device power input.

## Available Model Series (Typical)

| Model | Frequency Range (GHz) | EIA Waveguide Size | VSWR (maximum) |
|---|---|---|---|
| MT7040( ) | 7.05 — 10.0 | WR112 [1, 2] | 1.08 |
| MT7041( ) | 10.0 — 12.4 | WR90 [2] | 1.10 |
| MT7042( ) | 10.0 — 15.5 | WR75 [3] | 1.08 |
| MT7043( ) | 13.0 — 15.0 | WR62 [2] | 1.10 |
| MT7044( ) | 15.0 — 22.0 | WR51 [3] | 1.10 |
| MT7021( ) | 18.0 — 26.5 | WR42 [2] | 1.08 |
| MT7022( ) | 26.5 — 40.0 | WR28 [2] | 1.10 |
| MT7023( ) | 33.0 — 50.0 | WR22 [2] | 1.10 |
| MT7025( ) | 50.0 — 75.0 | WR15 [2] | 1.15 |
| MT7027( ) | 75.0 — 110.0 | WR10 [2] | 1.20 |

## Calibration Uncertainty

| Frequency Range (GHz) | Calibration Uncertainty |
|---|---|
| < 18.0 | ±1.5 K |
| 18.0 — 40.0 | ±1.5 K |
| 40.0 — 50.0 | ±1.8 K |
| 50.0 — 110.0 | ±2.6 K |

1 Flange mates with the applicable CPR flange.
2 Flange mates with the applicable CMR flange.
3 Flange mates with the applicable military (UG) flange.


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# Cryogenic Termination Accessories

## MT152A/C Helium Pressurizing Systems

Maury cryogenic terminations must be supplied with helium gas at about 2 psi to purge contaminants (air, carbon dioxide, etc.) from the coaxial or waveguide transmission line (connecting the cooled termination to the output connector) before the dewar is filled with liquid nitrogen. For stand-alone cryogenic terminations, the MT152A regulates the helium supply by use of a two-stage pressure regulator preset to provide 2 to 3 psi output pressure and a safety pressure relief valve set to 4 psi. These are included with an 8 foot hose and CGA-580 fittings for connecting your helium supply to the termination.

Maury dual-load and tri-load noise calibration systems are provided with the MT152C helium pressurizing system, a modified version of the MT152A, which serves the same purpose.


MT152A

## Calibrated Adapters Sets

Maury offers a wide range of calibrated adapters and adapter sets that are used with the MT7118J cryogenic termination and the MT7108B thermal termination to adapt the precision 7mm output port to other coaxial series or to waveguide at specific frequencies. They are calibrated for VSWR and insertion loss to allow their input noise temperature to be calculated.

The table below lists the available models and calibrated adapter sets. These are also available separately; however, since the use of adapters affects measurement accuracy and limits stability or repeatability in waveguide applications, better accuracy is achieved (and operation of the termination is simpler) when they are purchased and calibrated with your instrument. Maury recommends purchase of your instrument with the connector type or waveguide flange needed. (See also page 172.)

Maury also offers cryogenic and thermal terminations calibrated at user-specified or standard frequencies. Please consult our Sales Department for more information.

## Available Models

| Model | Connector Type | Description [1] | | | | | |
|---|---|---|---|---|---|---|---|
| 8022M | 3.5mm | One (1) each female and male adapter calibrated at 3.95, 7.5, 12.4, and 18.0 GHz. | DC | – | 4.0 | GHz, | 1.04 |
| | | | 4.0 | – | 18.0 | GHz, | 1.08 |
| 2606M | Type N | One (1) each female and male adapter calibrated at 3.95, 7.5, 12.4, and 18.0 GHz. | DC | – | 4.0 | GHz, | 1.03 |
| | | | 4.0 | – | 9.0 | GHz, | 1.04 |
| | | | 9.0 | – | 18.0 | GHz, | 1.07 |
| 2607M | GR900 | One (1) adapter calibrated at 3.95, 7.5, 12.4, and 18.0 GHz. | DC | – | 8.5 | GHz, | 1.04 |
| R229E | WR430 | One (1) w/g to 7mm end launch adapter calibrated at 2.25, 2.295 and 2.388 GHz. | 1.7 | – | 2.6 | GHz, | 1.10 |
| E229D | WR229 | One (1) w/g to 7mm end launch adapter calibrated at 3.7, 3.95 and 4.2 GHz. | 3.7 | – | 4.2 | GHz, | 1.05 |
| F229D | WR159 | One (1) w/g to 7mm end launch adapter calibrated at 4.9, 6.0 and 7.05 GHz. | 4.9 | – | 7.05 | GHz | 1.10 |
| H229D | WR112 | One (1) w/g to 7mm end launch adapter calibrated at 7.5, 8.0, 8.212 and 8.4 GHz. | 7.05 | – | 10.0 | GHz, | 1.05 |
| X229D | WR90 | One (1) w/g to 7mm end launch adapter calibrated at 11.7, 11.95 and 12.2 GHz. | 8.2 | – | 12.4 | GHz, | 1.05 |
| M229D | WR75 | One (1) w/g to 7mm end launch adapter calibrated at 14.0, 14.25 and 14.5 GHz. | 10.0 | – | 15.0 | GHz, | 1.05 |
| P229D | WR62 | One (1) w/g to 7mm end launch adapter calibrated at 12.4, 15.0 and 18.0 GHz. | 12.4 | – | 18.0 | GHz, | 1.05 |

Key literature – Maury data sheet 4A-008A and 4A-008B.



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# Noise Calibration Swept Data Module

## MT7250 SERIES



## Features

- *Multiple Data Points*
- *Effective Noise Temperature Calculator*
- *Effective Noise Temperature Interpolator*
- *Certified Calibration Report Generator*
- *Standard and User-Defined Frequencies*

## Description

Maury cryogenic and thermal terminations, whether stand-alone models or components of Maury noise calibration systems, are calibrated for hot/cold noise temperatures at their output connectors for a number of frequencies. Waveguide units are typically calibrated at specific standard frequencies or data points at the band edges and the arithmetic center frequency of the waveguide. Coaxial units are generally calibrated at four data points within the frequency range the connector type is rated for. Maury offers the MT7250 series Noise Calibration Swept Data Module as a tool that allows users to work with other, non-standard, data points in addition to, or in place of, the factory standards.

The MT7250 series Swept Data Module Software works with Microsoft® Excel® 2003[1] (or later) to give users the ability to generate standardized, or customized, Maury-certified calibration reports for any Maury cryogenic termination, thermal termination or noise calibration system. The data module can be supplied with a new unit at time of purchase, or with a re-certified unit.

## The Effective Noise Temperature Calculator

The Effective Noise Temperature Calculator uses measured loss and actual temperature data to produce Maury-certified calibration reports. These reports are based on a) pre-measured data points (as shown in the table on the page 167), or b) a user-defined or customized set of measured data points, or c) a combination of both.

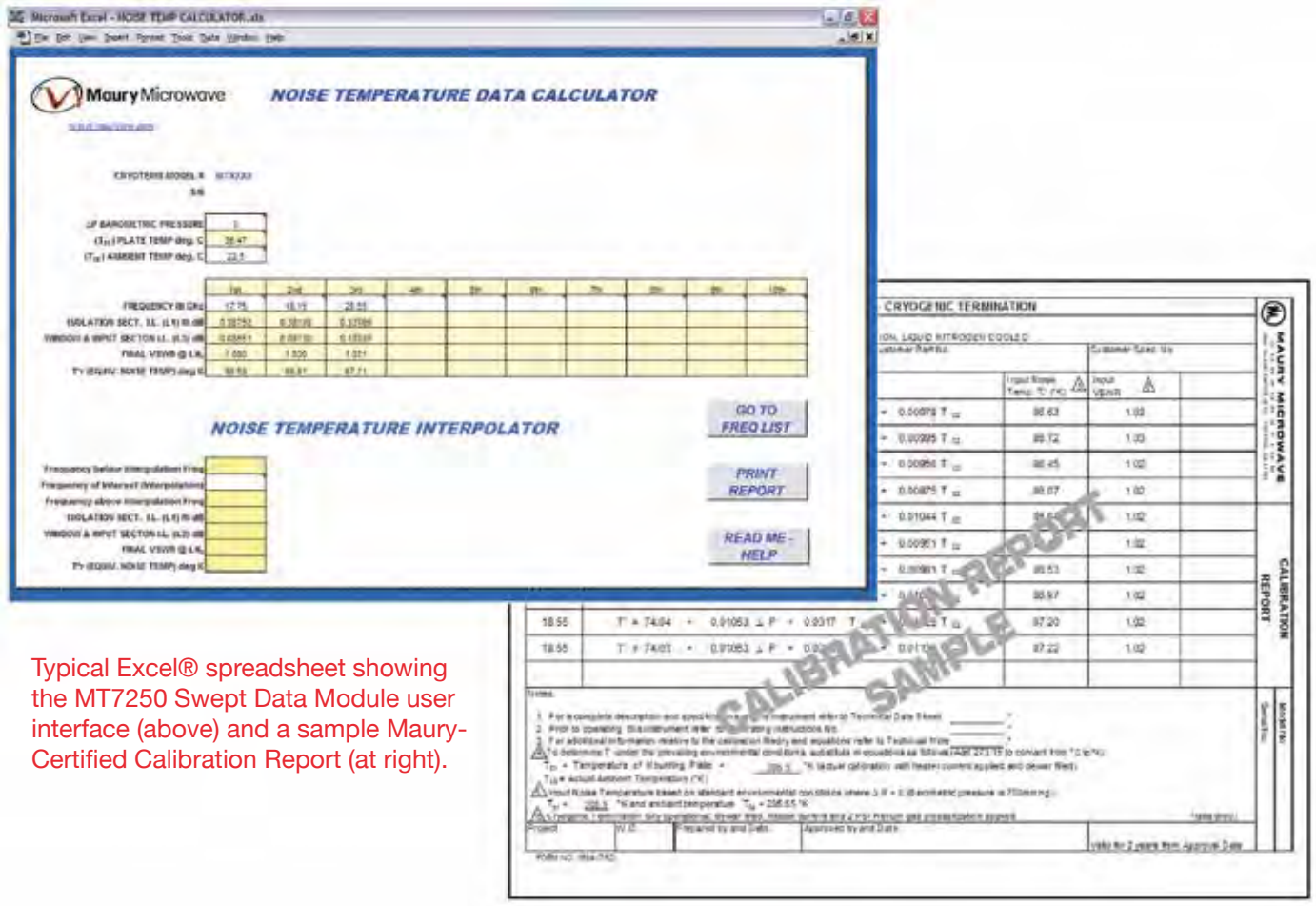
## The Effective Noise Temperature Interpolator

For use as a reference tool, the built-in Effective Noise Temperature Interpolator can be used to generate noise temperatures for non-measured data points within the data band of interest.

[1] Not provided.



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Typical Excel® spreadsheet showing the MT7250 Swept Data Module user interface (above) and a sample Maury-Certified Calibration Report (at right).

## *Standard Pre-Measured Data Points*

| Waveguide or Line | Frequency Band (GHz) | Step Size |
|---|---|---|
| WR51 | 15.0—22.0 | 0.10 |
| WR42 | 18.0—26.5 | 0.10 |
| WR28 | 26.5—40.0 | 0.25 |
| WR22 | 33.0—50.0 | 0.25 |
| WR15 | 50.0—75.0 | 0.50 |
| WR10 | 75.0—110.0 | 0.50 |
| 7mm | 0.2—18.0 | 0.20 |


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# Ambient Terminations




2659A



J309A

## Description

Maury ambient terminations are room temperature noise sources consisting of a stable termination in a massive copper housing to provide thermal stability and to reduce the effects of thermal transients.

These terminations are used as a reference temperature noise source for highly accurate noise figure or effective input noise temperature measurements, as an "on-line" standard for calibrating the operating noise temperature of low noise receiving systems, and in the calibration of solid state noise generators.

Each unit is provided with a direct reading dial thermometer calibrated from -5° to 45°C with better than 0.5° resolution and accuracy. The thermometer receptacle in the housing will also accept a quartz thermometer probe which, when connected to an appropriate unit, will provide for a remote temperature readout.

The units listed below are typical of those available. Please consult the factory for terminations in waveguide sizes, connector types or frequency ranges not shown here.

## Available Models

| Model | Frequency Range (GHz) | VSWR (maximum) | Connector or EIA Waveguide Size |
|---|---|---|---|
| 2459A | DC — 8.5 | 1.02, DC — 1.0<br>1.04, 1.0 — 4.0<br>1.06, 4.0 — 8.5 | 14mm (GR900) |
| 2659A | DC — 18.0 | 1.04, DC — 4.0<br>1.08, 4.0 — 12.0<br>1.10, 12.0 — 18.0 | 7mm |
| R309B | 2.2 — 2.3 | 1.05 | WR430 [1] |
| E309A | 3.7 — 4.2 | 1.05 | WR229 [1] |
| X309A | 8.2 — 12.4 | 1.05 | WR90 [2] |
| M309A | 10.0 — 15.0 | 1.05 | WR75 [3] |
| P309A | 12.4 — 18.0 | 1.05 | WR62 [2] |
| K309B | 21.0 — 23.0 | 1.05 | WR42 [2] |
| J309A | 33.0 — 50.0 | 1.05 | WR22 [2] |
| U309B | 36.0 — 38.0 | 1.05 | WR28 [2] |

1 Flange mates with the applicable CPR flange.
2 Flange mates with the applicable military (UG) flange.
3 Flange mates with most applicable standard military and industrial flanges.


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# Thermal Noise Terminations (Hot Loads)




## *Introduction*

Maury thermal terminations are low-mismatch, heated loads in a precisely controlled thermal environment which provide an accurately known noise power. Used with ambient and/or cryogenic terminations and a noise figure meter, these terminations provide the hot termination temperature needed for highly accurate noise figure or effective input noise temperature measurements. Because of the accuracy of the noise output, thermal terminations are often used as a noise standard for calibration of solid state noise generators.

The accuracy achieved by these terminations is possible because they utilize the proven concept of thermal (Johnson) noise operating in a precision thermal environment provided by the MT151C temperature controller. (The MT151C is a highly stable, proportional temperature controller that is accurately calibrated against NIST-traceable temperature measuring equipment.) This is the same concept used in several national standards laboratories and NIST at the higher microwave frequencies.

The termination and the controller are matched during calibration; therefore, the two instruments must be purchased as a unit. In addition, a line voltage option must be specified. Each unit is provided with a calibration report which includes VSWR and available output noise temperature at specific frequencies.

Options for additional or alternative user-selected frequencies are available. Maury also offers the MT7250 series Noise Calibration Swept Data Module as a tool that allows users to work with non-standard data points in addition to, or in place of the factory standards[1].) Other accessories such as special instrument cases and calibrated adapters to other coaxial series or waveguide are also available.

1 See Maury Data Sheet 4E-020. See also pages 166-167.


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# Coaxial Thermal Termination

## MT7108B




## Description

Maury offers a single thermal noise termination model (the MT7108B), which is equipped with a precision 7mm coaxial output connector, and operates from DC to 18 GHz. This compact, reliable instrument is equally suited for both field measurements and laboratory use. It is generally used to make accurate low noise figure/temperature measurements and for calibration of solid state noise generators. The flexibility and versatility of the MT7108B are enhanced by an extensive selection of options and accessories. These include calibrated adapters to other coaxial connector series and waveguide flanges, and factory calibration at user-specified frequencies. (Maury's MT7250 series Noise Calibration Swept Data Module is offered as a tool that allows users to work with non-standard data points in addition to, or in place of the factory standards[1].)

The MT7108B comes with a MT151C controller, with which it is precisely matched during the initial factory calibration. For accurate performance, these units must be used together. The MT151C's internal proportional controller responds to sensors in physical proximity to the termination and directs the MT7108B's heater circuit to maintain the physical temperature of the termination at 373.1 kelvins (100°C). Heavy insulation of the entire termination assembly minimizes the effects of the external environment. The MT151C's line voltage must be specified at the time of order. This ensures that the MT151C will be properly fuzed and shipped with the appropriate power cable (AC power option 22 for 100/120 VAC, 50/60 Hz, or option 32 for 220/240 VAC, 50/60 Hz).

VSWR and noise temperature data are provided at four frequencies (3.95 GHz, 7.5 GHz, 12.4 GHz and 18.0 GHz). A certified calibration report with traceability to NIST is provided with each unit.

1 See Maury data sheet 4E-020 for details, and pages 166-167 in this volume.
2 Precision 7mm per Maury data sheet 5E-060.

## Specifications

Frequency Range ..... DC to 18 GHz

Nominal Physical Load Temperature.....373.1 K

Load Temperature Stability..... ±0.2 K

VSWR (maximum):

DC to 4 GHz.....1.06
4 to 12 GHz.....1.10
12 to 18 GHz.....1.15

AC Power (User specifies one of two options):

Option 22.....100/120 VAC, 50/60 Hz
Option 32.....220/240 VAC, 50/60 Hz

Noise Temperature Uncertainty ..... ±0.7 K

Connector ..... Precision 7mm [2]

## Accessories Provided

- One (1) MT151C controller
- One (1) MT151P controller cable
- One (1) Instrument case


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# Waveguide Thermal Terminations

## MT70xx Series




## Description

Maury offers waveguide thermal terminations in several styles and a wide range of waveguide sizes, from WR430 through WR10. The chart below represents a typical sample of the available terminations.

Waveguide terminations are generally calibrated at three frequencies – high, low, and arithmetic center – within the applicable frequency range; however, they can be calibrated at any user-specified frequency within the waveguide band. Additional user-specified calibration frequencies are also available as an option. (Maury's MT7250 series Noise Calibration Swept Data Module is offered as a tool that allows users to work with non-standard data points in addition to, or in place of the factory standards[1].) Please contact our Sales Department for more information.

The physical temperature of the waveguide terminations is 350 kelvins with a stability of ±0.2 kelvins. These terminations are calibrated with a specific temperature controller, and the two instruments are provided as a unit. A line voltage option must be specified at the time of order.

## Available Models

| Model | Frequency Range (GHz) | EIA Waveguide Size | Maximum VSWR |
|---|---|---|---|
| MT7005A | 3.7 – 4.2 | WR229 [2] | 1.07 |
| MT7081A | 10.0 – 12.4 | WR90 [3] | 1.10 |
| MT7082A | 10.0 – 15.0 | WR75 [3] | 1.08 |
| MT7009B | 15.0 – 22.0 | WR51 | 1.10 |
| MT7084A | 18.0 – 26.5 | WR42 [3] | 1.08 |
| MT7085A | 26.5 – 40.0 | WR28 [3] | 1.10 |
| MT7086A | 33.0 – 50.0 | WR22 [3] | 1.10 |
| MT7088B | 50.0 – 75.0 | WR15 [3] | 1.20 |
| MT7090J | 75.0 – 110.0 | WR10 [3] | 1.15 |

## Calibration Uncertainty

| Frequency Band (GHz) | Uncertainty (Kelvins) |
|---|---|
| < 18.0 | ±0.70 K |
| 18.0 – 40.0 | ±0.60 K |
| 40.0 – 50.0 | ±0.65 K |
| 50.0 – 110.0 | ±1.00 K |

## Accessories Provided

- One (1) MT151C controller
- One (1) MT151P controller cable
- One (1) Instrument case

1 See Maury data sheet 4E-020 and pages 166-167 in this volume.

2 Flange mates with applicable CPR and CMR flanges.

3 Flange mates with the applicable military (UG) flange.


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# Thermal Terminations – Options and Accessories

## Temperature Controller, MT151C

A temperature controller is provided with each thermal termination. The controller and the termination are calibrated together and are sold as a unit. A line voltage must be specified at the time of order:

- Option 22 ..... 100/120 VAC
- Option 32 ..... 220.240 VAC



MT151C

## Instrument Case

Most Maury heated terminations are supplied in a foam-lined instrument case (like the one shown at below) for convenient handling and storage. Please contact our Sales Department for details.



A typical foam-lined Instrument case with one (1) model MT7090J, one (1) calibrated MT151C Controller and one (1) Operating Manual.

## Calibrated Adapters For Your 7mm Hot and Cold Loads

You can increase the utility of your Maury Cryogenic and Thermal Terminations by using precision adapters to connect the 7mm output port on the termination to other coaxial and waveguide connectors. However, as in any microwave measurement system, adding adapters degrades the accuracy of the data that can be obtained. In the case of waveguide measurement, stability and repeatability will also be degraded by the use of adapters. Therefore, for optimum performance, it is always recommended that a thermal termination with the appropriate output port be used for specific measurement applications.

In situations where adapters must be used, it is critical that the adapters are calibrated so that the critical performance parameters are known and can be calculated into the measurements. Adapters can be calibrated separately, but better accuracy is achieved and operation of the termination is simpler when they are purchased and calibrated with the thermal termination they will be used with.

The table at right shows the adapters and adapter sets that are available from Maury. If you don't see the adapter you need in this table, please contact our Sales Department for assistance.

All of these adapters are calibrated for VSWR and insertion loss so that their input noise temperature can be calculated using Maury technical note TN-011. The adapters are shipped with a test report and operating note. When purchased with a thermal termination, Maury can provide VSWR calibration of these adapters for an additional cost (quoted on request). Please contact our Sales Department for further details.

See page 165 for descriptions of the calibrated adapter sets.



Typical 7mm between-series adapters.

| Model | Maximum VSWR (GHz) | Adapts 7mm to |
|---|---|---|
| 2606M | 1.03, DC–4.0<br>1.04, 4.0–9.0<br>1.07, 9.0–18.0 | Type N (F & M) |
| 8022M | 1.04, DC–4.0<br>1.08, 4.0–18.0 | 3.5mm (F & M) |
| 2607M | $1.004 + 0.004f$ | 14mm |
| R229E | 1.10, 1.7–2.6 | WR430 |
| E229D | 1.05, 3.7–4.2 | WR229 |
| F229D | 1.10, 4.9–7.05 | WR159 |
| H229D | 1.05, 7.05–10.0 | WR112 |
| X229D | 1.05, 8.2–12.4 | WR90 |
| M229D | 1.05, 10.0–15.0 | WR75 |
| P229D | 1.05, 12.4–18.0 | WR62 |



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# Thank You!

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