

Test Necessities and Accessories '98

Spectrum Elektrotechnik GmbH is a leading manufacturer of RF and Microwave Components in the Frequency Range of DC to 50.0 GHz. The products are published in eight individual catalogs, showing detailed information and comprehensive data.

Adapters, DC - 50 GHz, 50 Ohms

Coaxial Adapters (In Series and Between Series)
High Power Adapters
Push-On Adapters
Waveguide to Coax Adapters

Microwave Connectors, DC - 50 GHz, 50 Ohms

Blind Mate Connectors
Coaxial Connectors
High Power Connectors
Multi Pin Connectors
Push-On Connectors

Cable Assemblies, DC - 50 GHz, 50 Ohms

ANA Test Cables
Flexible Cable Assemblies
Low Loss Cable Assemblies
Phase Stable Cable Assemblies
Semi Rigid Cable Assemblies (Dia. 0.34" to 1")

Test Necessities and Accessories, DC - 50 GHz, 50 Ohms

Calibration Kits and Cal. Components, Terminations, Gauges, Wrenches
Cable Assemblies with Interchangeable Connectors
Quick Connections: Lockable and NON-Lockable PUSH-Ons
Phase Stable Assemblies, RF - Multipin Connector SQ - 8
Standard Product Specifications: Cable and Connector Specifications,
and Interface Mating Dimensions
Special Products and Services

Components, DC - 50 GHz, 50 Ohms

Coaxial Switches
Coaxial Terminations
DC - Block Connectors
Gain Amplitude Equalizers
Hybrid Housings
Phase Adjusters
Precision Coaxial Terminations
Precision Waveguide Terminations
Special Products and Services:

Adapter Sets, Antennas, Blind Mate Connectors,
Calibration Kits, Custom Connectors/Adapters, Delay Lines,
Detectors, Directional Couplers, Impedance Transformers,
Interface Gauges, Isolators & Circulators, Lightning Surge
Suppressors, Limiters, Phase Stable Assemblies, Precision
Mismatches, Push-Ons, RF-Multipin Connectors SQ-8,
Rotary Joints, Supercomponents, Torque Wrenches.

Quick Connections, 50 Ohms

Blind Mate Connectors
Push - On Adapters
Push - On Connectors
Push - On Cable Assemblies

Components, 75 Ohms

Adapters, Attenuators
Connectors
Switches
Transformers

Machines and Tools

Coax Cable Cutting/Stripping Machines
Flex Cable Cutting/Stripping Machines
Semi-Rigid Cable Bending Machines

A Handbook, just on Necessities, and Accessories, Components that are needed and/or recommended for mechanical inspection and electrical Testing. Some of the Components may also be found in other Catalogs of Spectrum Elektrotechnik GmbH. Showing these Components in this Catalog as well, has been considered inevitable, as the intention was to make this Handbook as complete as even possible in regards to Test Components.

On pages 6 and 7 you will find a Quick Reference Guide, listing the nine Sections and explaining in detail their contents. Chapters one through six are comprising the Test Components, while chapter seven gives an overview about standard cables and connectors that are used with the Test Cables offered, and their Connector Interface Dimensions. chapter eight, Special Products and Services, lists and explains Products, Spectrum Elektrotechnik GmbH has engineered and manufactured for certain programs and applications, as those products were not available at that time, or not as standard from other vendors.

Please always keep in mind that Spectrum Elektrotechnik GmbH is a very innovative Company.

As it is our main goal to improve specification and performance of the products, Spectrum Elektrotechnik GmbH has to reserve the right to change specifications, design and any other information shown in this Handbook at any time without previous notice.

Because of the comprehensive information gathered in this volume, we call it a Handbook, hopefully the Handbook you like to work with best. If you find the time, we would appreciate your personal opinion about this Handbook.

	Page
Company Profile.....	4
Ordering Information.....	5
Quick Reference Guide by Sections.....	6
Section I: Calibration Kits.	9
Open-Short-Load-Through Calibration Kits.....	10
SMP Calibration Kits.....	23
LRL/TRL Kits.....	35
Verification Kits.....	41
Section II: Calibration Components.	45
Open-Short-Loads-Throughlines.....	47
Connector Interface Gauges.....	75
Torque Wrenches.....	89
Thread Limit Gauges.....	93
Instrument Grade Adapters.....	97
- In-Series.....	98
- Between-Series.....	102
- NMD Test Port Adapters.....	113
Section III: Cable Assemblies with Interchangeable Connectors.	153
Section IV: Quick Connections = PUSH-ONs	163
Section V: Phase Stable Cable Assemblies	173
Section VI: RF - Multipin Connector SQ - 8	181
Section VII: Standard Product Specifications	187
Cable Specifications.....	188
Connector Specifications.....	199
Connector Codes.....	203
Interface Mating Dimensions.....	207
Section VIII: Special Products & Services.	231
Adapter Sets.....	234
Antennas.....	236
Blind Mate Connectors.....	238
Charged Device Modelling.....	240
Custom Connectors/Adapters.....	242
Delay Lines.....	244
Detectors.....	246
Directional Couplers.....	248
Impedance Transformers.....	250
Isolators & Circulators.....	252
Lightning Surge Suppressors.....	254
Limiters.....	256
Machines, CNCA-700.....	258
Precision Mismatches.....	260
Rotary Joints.....	262
Supercomponents.....	264
Tools.....	266
Section IX:	269
Glossary.....	270
Part Number Index.....	272
Alphabetical Index.....	280
Sales Representatives.....	283

Spectrum Elektrotechnik GmbH was founded in 1981 and has become a leading supplier of state-of-the-art components used in the RF and Microwave Technology, such as Connectors, Adapters, Cable Assemblies, Phase Shifters, Couplers, Gain Amplitude Equalizers, Terminations, Calibration Kits, etc., etc. In addition, a number of complex and integrated components have been engineered and manufactured for certain programs and to the customers' needs.

Throughout the world, Spectrum Elektrotechnik GmbH has established a reputation as a design, development and manufacturing center. The Company has been recognized as setting standards, introducing new ideas and leading into new technologies.

The Products

The products are used in commercial systems such as Cellular Applications, Radios, SatCom/VSAT, Satellites and Space Applications, Test Centers and Wireless Communication: The products are used in defence applications such as Airborne Radars, Electronic Intelligence, Electronic Warfare, Jamming Systems, Missile Guidance, etc. Whenever RF or Microwave Expertise and Advanced Manufacturing Technologies are needed you will find Spectrum Elektrotechnik GmbH.

Capabilities and Facilities

The departments within the Company have been set up as an intelligent Network, guaranteeing complete in-house control of every operation and procedure, from design, development, manufacturing, assembly and testing.

Spectrum Elektrotechnik GmbH is small enough to react quickly and large enough to handle extensive orders of important programs successfully. This capability enables us to develop, manufacture and test the extensive range of Products meeting the highest standards of quality and performance. Spectrum Elektrotechnik GmbH introduced CAD design centers already in 1984 as well as CAD/CAM work stations to provide data to computer controlled machines. The Company operates the most advanced machines and uses Test Centers to 50.0 GHz from HP and to 40.0 GHz from Wiltron. Manufacturing and Quality Control comply with DIN - ISO 9000, permitting us to meet strict requirements in Commercial, Avionics, Military and Hi-Rel applications. A Final 100% Inspection is standard, Tests include electrical and physical performance, their tolerances, the workmanship, and the compliance to applicable specifications.

Support

An adequate and knowledgeable staff is always available to support the Customers in respect to Applications, Engineering and Sales. The staff acts as a Team, understanding applications, specifications, needs, priorities and problems as well. A net of distributors assures immediate delivery of off-the-shelf products. Authorized technically knowledgeable Representatives will provide immediate assistance to the customers' needs.

Ordering

Please include both, Spectrum Elektrotechnik GmbH part number, and a description of the item(s) ordered. If special features are required, describe them as completely as possible and include an engineering sketch. Orders may be placed directly with the factory in Munich or with any authorized Spectrum Elektrotechnik GmbH Representative. Minimum Factory Order is DM 250.00.

Acceptance of Orders

All orders are subject to acceptance at the discretion of the factory and with an Order Acknowledgment from Spectrum Elektrotechnik GmbH.

Terms

Upon approval of credit, payment is due Net 30 days from date of invoice. Late payments are subject to a 1.5 % monthly charge on past due balances.

Shipments

Spectrum Elektrotechnik GmbH ships via the most expedient reliable carrier. Shipment ex works, Spectrum Elektrotechnik GmbH plant, will be sent freight prepaid and billed unless other prior arrangements are made. Spectrum Elektrotechnik GmbH will use any acceptable method of delivery specifically requested by the customer.

Damaged Materials/Shortages

All orders should be inspected upon receipt for both completeness and receipt of materials in proper condition. All claims for shortages must be made within thirty (30) days after date of shipment of material from Spectrum Elektrotechnik GmbH plant. Title to goods passes to the Buyer upon delivery to the carrier and risk of loss or damage shall thereafter rest with the Buyer. Claims for damage or loss while material is in transit must be made against the carrier by the Buyer.

Warranty

Spectrum Elektrotechnik GmbH warrants products of its manufacture to be free from defects in material and workmanship under conditions of normal use. If, within one year after delivery of the original owner and after prepaid return by the original owner, any Spectrum Elektrotechnik GmbH product is found to be defective, Spectrum Elektrotechnik GmbH shall, at its option, repair or replace said defective item. This warranty does not apply to products which have been disassembled, modified or subjected to conditions exceeding the applicable specifications or ratings.

Cancellation

Cancellation of, or changes to an order acknowledged by Spectrum Elektrotechnik GmbH are accepted only upon terms that protect Spectrum Elektrotechnik GmbH against loss.

Returns

Excess or unused material cannot be returned for credit without factory authorization. Such material is subject to a handling charge of not less than 15 % upon return and inspection of material at the factory. In no case will Spectrum Elektrotechnik GmbH authorize return of material beyond ninety (90) days after shipment from the factory. Credit for returned material is issued by Spectrum Elektrotechnik GmbH only to the original purchaser. Freight charges for returned material is the responsibility of the Buyer.

Defective Material

Claims for defective material or workmanship are subject to verification by Spectrum Elektrotechnik GmbH Quality Control, and must have prior factory authorization. Upon verification, Spectrum Elektrotechnik GmbH reserves the right to repair or replace, as deemed necessary.

Prices / Specifications

Unless otherwise specified, prices quoted are ex works Spectrum Elektrotechnik GmbH plant. Both prices and specifications are subject to modification without prior notice.

Patent and Trademark Indemnity

Buyer agrees at Buyer's expense to protect and defend Seller against any and all claims of patent or trademark infringement arising from Seller's compliance with Buyer's designs or specifications or instruction and to hold Seller harmless from all losses, damages, costs and expenses attributable to any such claim or claims. Seller shall have the right to approve or disapprove counsel designated by Buyer to defend such claims.

Spectrum Elektrotechnik GmbH reserves the right to make design changes without notice on any of its products and without any obligation to make same or similar changes to items previously purchased. In no event does Spectrum Elektrotechnik GmbH assume liability for installation labor or for consequential damages. This warranty is the extent of the obligation or liability assumed by Spectrum Elektrotechnik GmbH with respect to its products, and no other warranty or guarantee is either expressed or implied.

Quick Reference Guide by Sections



Pages	Headline	Content
9 - 43	Section I Calibration Kits	<ul style="list-style-type: none"> • General Introduction to Calibration Kits Page 9 f.f. • Introduction Page 14 • Cal. Kits suggested for Hewlett Packard Page 15 • Cal. Kits suggested for Wiltron ANA Page 19 • SMP Calibration Kits Page 23 • LRL/TRL Calibration Kits Page 35 • Verification Kits Page 41
45 - 151	Section II Calibration Components	<ul style="list-style-type: none"> • Opens-Shorts-Loads & Throughlines Page 47 • Connector Interface Gauges Page 75 • Torque Wrenches Page 89 • Thread Limit Gauges Page 93 • Instrument Grade Adapters Page 97 - In-Series Page 98 - Between-Series Page 102 - NMD Test Port Adapters Page 113 2.4mm Page 121 3.5mm Page 125 7mm Page 129 K* Page 137 N Page 141
153 - 161	Section III Cable Assemblies with Interchangeable Connectors	<ul style="list-style-type: none"> • Introduction Page 154 • Cable Assembly Kits Page 156 • Interchangeable Connector Assemblies Page 158 • Ordering Information Page 160
163 - 172	Section IV Quick Connections = PUSH-ONs	<ul style="list-style-type: none"> • Introduction Page 164 • Handling Information Page 165 • NON-Locking PUSH-ON Connectors Page 166 • Locking PUSH-ON Connectors Page 167 • Cable Selection Chart Page 168 • Ordering Information Page 169 • PUSH-ON Connector Specifications Page 171
173 - 180	Section V Phase Stable Cable Assemblies	<ul style="list-style-type: none"> • Introduction Page 174 • Phase Stable Cable Assemblies Page 176 • Diagrams Page 177 • Connector Selection Chart Page 178 • Ordering Information Page 179

Headline	Content	Pages																																								
Section VI RF - Multipin Connector SQ - 8	<ul style="list-style-type: none">• Introduction Page 182• Technical Data and Outline Drawings Page 184	181 - 186																																								
Section VII Standard Product Specifications	<ul style="list-style-type: none">• Specifications for Cables Types: 10, 14, 16, 17, 18, 22, 40, 42, 43, 100 and 140. Page 187• Connector Specifications Page 199• Connector Codes Page 203• Interface Mating Dimensions Page 207<ul style="list-style-type: none">- Introduction Page 208- Interface Mating Dimensions for: 2.4mm, 3.5mm, 7mm, 7/16, BMA, BNC, C, HN, K*, N, N (75 Ohms), SBX, SBY, SC, SMA, SSMA, SMP, SMP (Test Connector), SPM, TNC (MIL-C-39012), TNC (MIL-C-87104/2) and TNX. Page 209 f.f.	187 - 230																																								
Section VIII Special Products & Services	<table><tr><td>• Introduction</td><td>Page 232</td><td>• Directional Couplers</td><td>Page 248</td></tr><tr><td>• Adapter Sets</td><td>234</td><td>• Impedance Transformers</td><td>250</td></tr><tr><td>• Antennas</td><td>236</td><td>• Isolators & Circulators</td><td>252</td></tr><tr><td>• Blind Mate Connectors</td><td>238</td><td>• Lightning Surge Suppressors</td><td>254</td></tr><tr><td>• Charged Device Comp.</td><td>240</td><td>• Limiters</td><td>256</td></tr><tr><td>• Circulators & Isolators</td><td>252</td><td>• Machines, CNCA-700</td><td>258</td></tr><tr><td>• Couplers</td><td>248</td><td>• Precision Mismatches</td><td>260</td></tr><tr><td>• Custom Conn./Adapters</td><td>242</td><td>• Rotary Joints</td><td>262</td></tr><tr><td>• Delay Lines</td><td>244</td><td>• Supercomponents</td><td>264</td></tr><tr><td>• Detectors</td><td>246</td><td>• Tools</td><td>266</td></tr></table>	• Introduction	Page 232	• Directional Couplers	Page 248	• Adapter Sets	234	• Impedance Transformers	250	• Antennas	236	• Isolators & Circulators	252	• Blind Mate Connectors	238	• Lightning Surge Suppressors	254	• Charged Device Comp.	240	• Limiters	256	• Circulators & Isolators	252	• Machines, CNCA-700	258	• Couplers	248	• Precision Mismatches	260	• Custom Conn./Adapters	242	• Rotary Joints	262	• Delay Lines	244	• Supercomponents	264	• Detectors	246	• Tools	266	231 - 267
• Introduction	Page 232	• Directional Couplers	Page 248																																							
• Adapter Sets	234	• Impedance Transformers	250																																							
• Antennas	236	• Isolators & Circulators	252																																							
• Blind Mate Connectors	238	• Lightning Surge Suppressors	254																																							
• Charged Device Comp.	240	• Limiters	256																																							
• Circulators & Isolators	252	• Machines, CNCA-700	258																																							
• Couplers	248	• Precision Mismatches	260																																							
• Custom Conn./Adapters	242	• Rotary Joints	262																																							
• Delay Lines	244	• Supercomponents	264																																							
• Detectors	246	• Tools	266																																							
Section IX	<ul style="list-style-type: none">• Glossary Page 270• Part Number Index Page 272• Alphabetical Index Page 280• Sales Representatives Page 283	269 - 283																																								

The Phase Adjuster!

DC to 40.0 GHz & 50.0 GHz

VSWR 1.20:1 max.*!

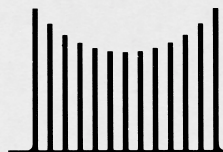
* for P/N LS-P140-KFKM!

Interested?
Please refer to
"The '98 Handbook
Passive Components"



Please ask for our other Products in the Frequency Range of DC to 50.0 GHz:

Adapters, ANA Test Cables, Antennas, Attenuators, Blind Mate Connectors, Circulators, CDM-Components, Coax Switches, Couplers, Custom Components, DC-Block Connectors & Adapters, Gain-Equalizers, Flexible Cable Assemblies, Isolators, Limiters, Mismatches, Multi Pin Connectors, Phase Shifters, Phase Stable Cable Assemblies, Precision Terminations, Push-On Connectors & Adapters, Semi Rigid Cable Assemblies, Waveguide Components, Waveguide to Coax Adapters, etc.



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Section I.1

Calibration Kits

Calibration Kits		9 f.f.
1.	OPEN-SHORT-LOAD -THROUGHLINE KITS	
	a) INFORMATION ON ALL KITS	13
	b) SMP CALIBRATION KIT	23
2.	LRL/TRL <small>Line Reflective Line Through Reflective Line</small> KITS	35
3.	VERIFICATION KITS	41

INTRODUCTION: Vector Network Analyzers are commonly used to accurately determine the RF Characteristics of microwave components. Accurate Testing of microwave circuits means eliminating measurement errors and ensuring repeatable results. This is only possible when the network analyzers can be calibrated with known and true calibration standards. These standards are not to be subjected to any kind of limitations, they must rather be designed to perfection. As Network Analyzers do have the ability to reduce error terms to negligible values, they depend on the quality and integrity of the Calibration Standards.

METHODOLOGY: Two different techniques are commonly known for coaxial calibration, the Open-Short-Load-Through Calibration Method, and the Line Reflective Line (LRL) Calibration Method, also recognized as Through Reflective Line (TRL).

OPEN-SHORT-LOAD-THROUGH CALIBRATION: This method uses as known Standards, Opens, Shorts and Loads. The Load can be either a sliding or a fixed broadband load. The Kits supplied, can be divided into three groups: The **Standard** Calibration Kit, the **Expanded** Calibration Kit, and the **Professional** Calibration Kit. The Instrument Cases for all three of these Calibration Kits are identical. The customer may start with the Standard Calibration Kit and fill the empty spots at a later stage, to end up with an Expanded, or even the Professional Calibration Kit. The Kits, as suggested for **Hewlett Packard** and **Wiltron**, do differ slightly in the number of components supplied, as necessary for the different calibration sequences.

STANDARD OPEN-SHORT-LOAD-THROUGH CALIBRATION KIT: It contains all the components needed for calibration in the subject connector series, Opens, Shorts, Broadband Loads, and the Software Configuration Medium.

EXPANDED OPEN-SHORT-LOAD-THROUGH CALIBRATION KIT: Besides the components supplied with the Standard Calibration Kit, a set of interface gauges for center conductor location dimensions, calibration blocks for zeroing the gauges, wrenches, and a torque wrench are added.

PROFESSIONAL OPEN-SHORT-LOAD-THROUGH CALIBRATION KIT: Additional to the components supplied with the Expanded Calibration Kit, the sets of interface gauges and calibration blocks are completed for measuring further also certain critical outer conductor dimensions. A set of thread limit gauges for checking the connector and coupling nut threads is supplied as well. Four empty spaces can be filled with optional adapters, individually to be specified.

LRL / TRL KIT: The Line Reflective Line (LRL), or Through Reflective Line Methods are using Shorts and two different adapter lengths. Spectrum Elektrotechnik GmbH has developed a complete line of Components, as needed for proper and consistent LRL / TRL calibration. The LRL / TRL Components are true 50 Ohm lines. The adapters are not using any supporting material between center contact and outer conductor. Outer conductors and the sets of center contacts are supplied separately. The set of center contacts contains all lengths as needed for

adjusting the adjacent in-specification connector interfaces that is usually recessed, as allowed, to perfect 50 Ohms lines. So length adjustments of 0.0004 inches (0.01mm) can be achieved, when all center contacts have been purchased. A Center Contact Insertion Tool helps to align and connect the center contact.

The Calibration Kits are delivered with a disc supplying data on the properties of the Kits' components. Kits are available for the Network Analyzers of Hewlett Packard and Wiltron and can be divided into two groups: The **Standard** LRL Calibration Kit, and the **Professional** LRL Calibration Kit. The Instrument Cases for both of these Calibration Kits are identical. The customer may start with the Standard Calibration Kit and fill the empty spots at a later stage, to end up with the Professional Calibration Kit.

STANDARD LRL CALIBRATION KIT: A Calibration Kit contains as a minimum two Shorts (male and female), two Throughlines each (female/female, male/female, male/male) in different lengths and a Disk for the Calibration Characteristics. The Disk is supplied either for the Scalar Network Analyzers of Hewlett Packard, or Wiltron, and is ready to be used.

PROFESSIONAL LRL CALIBRATION KIT: Besides the components, as supplied with the Standard Kit, it also contains Interface Gauges for measuring the center conductor location, Calibration Blocks for those Interface Gauges, and a Torque Wrench.

VERIFICATION KITS: To verify that the network analyzer system is working properly, the measuring of known devices, other than the calibration standards, is a straightforward method. Spectrum Elektrotechnik GmbH is offering Verification Kits that consist of precision airlines and mismatch airlines. Traceable measurement data are shipped with each kit.

TEST CABLES: Vector network analyzers require electrically stable cable assemblies for measurement in very critical areas, such as Phase, Amplitude and VSWR. Cables have to maintain calibration data, even when subjected to bending and twisting which can introduce distorting parameters. The cable assembly needs to be flexible without being flaccid. The Cables of Types 16, 18 and 22, as described in the Phase Stable Cable Assemblies' Section are ideal for this application. One end of the Assembly will usually be terminated with an NMD 2.4mm, 2.9mm, or 3.5mm, 7mm or N connector, as needed for connecting directly with the RF output of the network analyzer. These NMD Connectors are designed with a larger than standard coupling nut for greater stability. The other end of the ANA - Assembly can be terminated with the proper Test Connector, as needed in the setup.

ADAPTERS: Spectrum Elektrotechnik GmbH manufactures a large variety of adapters. Where existing test cables are to be used, between series instrument-grade adapters to those 2.4mm, 2.9mm, 3.5mm, 7mm, or N-type test port or ANA cable connectors are offered. NMD Instrument-Grade Adapters are supplied when the network analyzer test port needs to be changed to another connector series. The NMD Adapters are designed with this larger than standard coupling nut for greater stability.

INTERFACE GAUGES: Checking the interfaces of connectors and adapters upon incoming inspection is not only highly recommended, it is definitely a necessity. Interfaces not meeting specification will not only lead to degraded specification of the components, furthermore these out of specification interfaces may damage the connectors of mating components or ruin the connectors of test equipment. Connector Gauges consist of an especially adapted dial indicator with appropriate bushings and pins that are designed to mate with the specific connector under test. The indicator of each gauge is zero set by a specific master gauge. When engaged to a connector, it measures the specific interface dimension from a reference plane. For every dimension of interest, a special gauge will be offered. This gives the most accurate results, allows easy calibration, fast testing and helps to avoid mistakes. Gauges are available as “Hand Held” or “Thread On”. Faster testing is possible by using the “Hand Held” gauges, the more accurate readings will be achieved from the “Thread On” gauges, as threading on the gauges will perfectly align with the connector. Hand Held means aligning gauge and connector freely, which may allow for mistakes.

TORQUE WRENCHES: Connectors have to be mated and need to be tightened. People who are using nothing but their fingers for tightening, usually undertorque. The electrical performance will vary from tightening to tightening, depending how tired the fingers are. In addition: If the same component gets tested several times and by different people, using for tightening nothing but their fingers, the electrical performance will even vary more, as different torque will be applied, equivalent to the strength of the individual. But the strength does not only depend on the physical ability of the individual, furthermore also to the strength set by the mind. Tightening connectors by hand will result from very loose fits to almost correct fits, but usually always incorrect fits. Tightening connectors by hand is obviously inadequate and not recommendable. People who are using a regular wrench, usually overtorque. Short wrenches may lead to torsional forces that are only a little high, the use of longer wrenches however usually results into applying very high torque. Overtorquing of up to three times has been seen. This will deform the interface of the connectors, proper test results from then on cannot be obtained anymore. For proper test results and long life of the connectors the rules need to be obeyed. For each individual connector series a torque has been specified, a torque that ensures proper mating conditions, repeatable electrical performance and guarantees mechanically a long life of the connectors. Using the Torque Wrench guarantees that the connection is not too loose, it also ensures that the connection is not too tight, preventing possible connector damage and impaired electrical performance. Using the Torque Wrench also assures that all connections are equally tight, each time. No connection at a network analyzer, during calibration and testing of components, should be made without using the proper torque wrench.

THREAD LIMIT GAUGES: Out of limits thread on connectors and adapters can create serious problems and may damage the connectors of mating components or ruin the connectors at the test equipment. Spectrum Elektrotechnik GmbH offers therefore a comprehensive line of thread limit gauges to check the thread on a “GO” / “NO GO” basis. The pitch diameter, pitch angle and number of threads per unit are being examined. A complete Set of gauges consists of two Ring Gauges and one Bolt Gauge.

Section I.1.a

Calibration Kits

Calibration Kits		9 f.f.
1.	OPEN-SHORT-LOAD -THROUGHLINE KITS	
	a) INFORMATION ON ALL KITS	13
	b) SMP CALIBRATION KIT	23
2.	LRL/TRL <small>Line Reflective Line Through Reflective Line</small> KITS	35
3.	VERIFICATION KITS	41

INTRODUCTION: The method uses known Standards, Opens, Shorts and Loads. The Load can be either a sliding or a fixed broadband load. The Kits supplied, can be divided into three groups: The **Standard** Calibration Kit, the **Expanded** Calibration Kit, and the **Professional** Calibration Kit. The Instrument Cases for all three of these Calibration Kits are identical. The customer may start with the Standard Calibration Kit and fill the empty spots at a later stage, to end up with an Expanded, or even the Professional Calibration Kit. The Kits, as suggested for **Hewlett Packard** and **Wiltron**, do differ slightly in the number of components supplied, as necessary for the different calibration sequences.

STANDARD OPEN-SHORT-LOAD-THROUGH CALIBRATION KIT: It contains all the components needed for calibration in the subject connector series, Opens, Shorts, Broadband Loads, and the Software Configuration Medium.

EXPANDED OPEN-SHORT-LOAD-THROUGH CALIBRATION KIT: Besides the components supplied with the Standard Calibration Kit, a set of interface gauges for center conductor location dimensions, calibration blocks for zeroing the gauges, wrenches, and a torque wrench are added.

PROFESSIONAL OPEN-SHORT-LOAD-THROUGH CALIBRATION KIT: Additional to the components supplied with the Expanded Calibration Kit, the sets of interface gauges and calibration blocks are completed for measuring further also certain critical outer conductor dimensions. A set of thread limit gauges for checking the connector and coupling nut threads is supplied as well. Four empty spaces can be filled with optional adapters, individually to be specified.

CALIBRATION KIT COMPONENTS: The most important Components of the Calibration Kits are the Calibration Standards. A Disc will be supplied, carrying data on the properties of the Calibration Standards. The disc is ready to be used on the Vector Network Analyzers of Hewlett Packard and Wiltron.

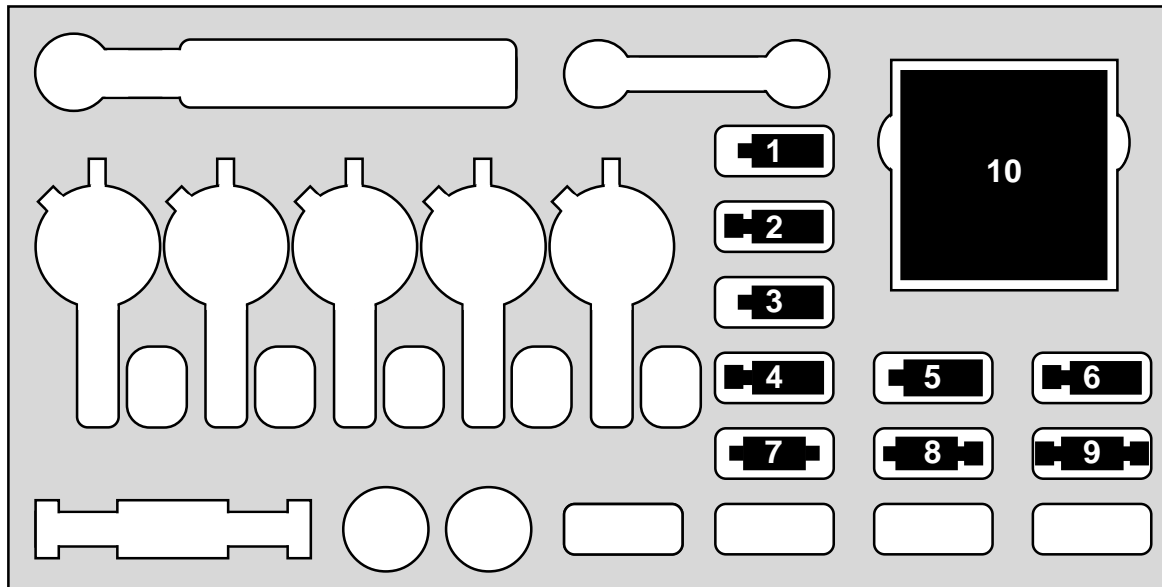
But also other components will be needed during testing and therefore be included in the Kit as well, such as precision adapters, torque wrenches, regular wrenches, as needed for any hex supplied with the components in the calibration kit. A set of precision gauges will be included, for checking the interfaces of the devices before test.

INTERFACE GAUGES: Before testing any device, the interfaces of the connectors have to be checked to ensure that they meet the appropriate specification. Protruding interfaces will damage the mating connector. Interfaces that are recessed below the allowed level will lead to useless test results.

TORQUE WRENCHES: For proper test results and long life of the connectors the rules need to be obeyed. For each individual connector series a torque has been specified, a torque that ensures proper mating conditions, repeatable electrical performance and guarantees mechanically a long life of the connectors. Using a Torque Wrench guarantees that the connection is not too loose, it also ensures that the connection is not too tight, preventing possible connector damage and impaired electrical performance. Using the Torque Wrench also assures that all connections are equally tight, each time.

Suggested for Hewlett Packard ANA

Standard Calibration Kit



The actual layout of the Calibration Kit may differ from the schematic above, it also depends on the connector series and its size. The Instrument Cases for Standard, Expanded and the Professional Kit are same per Connector series. You may start with a Standard Calibration Kit and fill the empty spots at a later stage to end up with an Expanded or even the Professional Calibration Kit.

Description of Equipment Provided

**Suggested for
Hewlett Packard ANA**

Standard Calibration Kit

1: Short female

2: Short male

3: Open Circuit female

4: Open Circuit male

5: Fixed Termination female

6: Fixed Termination male

7: Throughline female-female

8: Throughline female-male

9: Throughline male-male

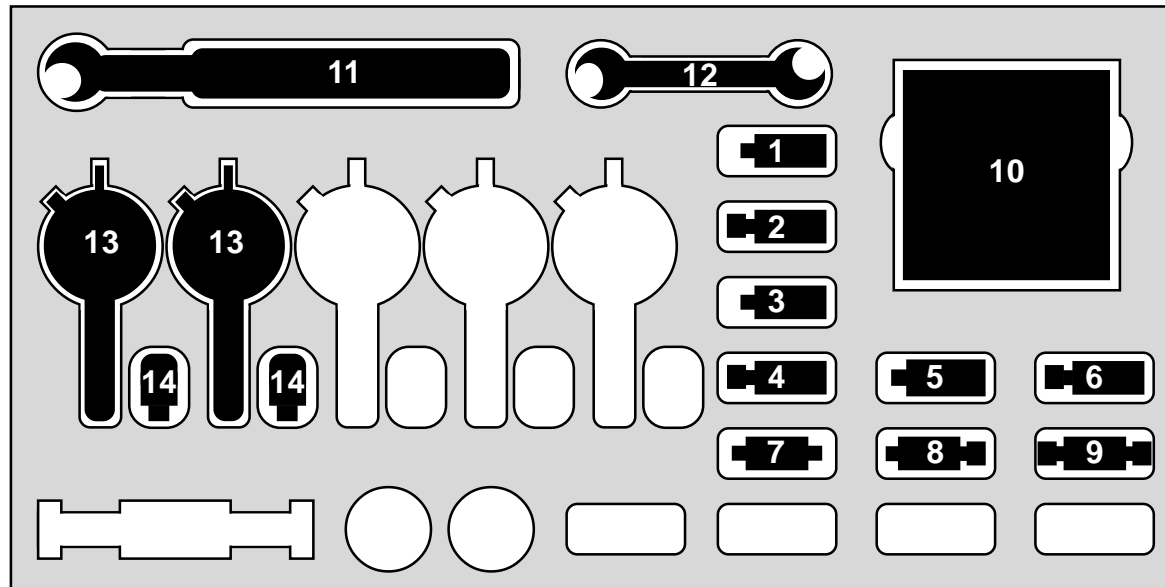
10: Software configuration medium

Instrument case

Operating instructions

Suggested for Hewlett Packard ANA

Expanded Calibration Kit



The actual layout of the Calibration Kit may differ from the schematic above, it also depends on the connector series and its size (this applies also for the No. of Gauges). The Instrument Cases for Standard, Expanded and the Professional Kit are same per Connector series. You may start with a Standard Calibration Kit and fill the empty spots at a later stage to end up with an Expanded or even the Professional Calibration Kit.

Description of Equipment Provided

Suggested for Hewlett Packard ANA

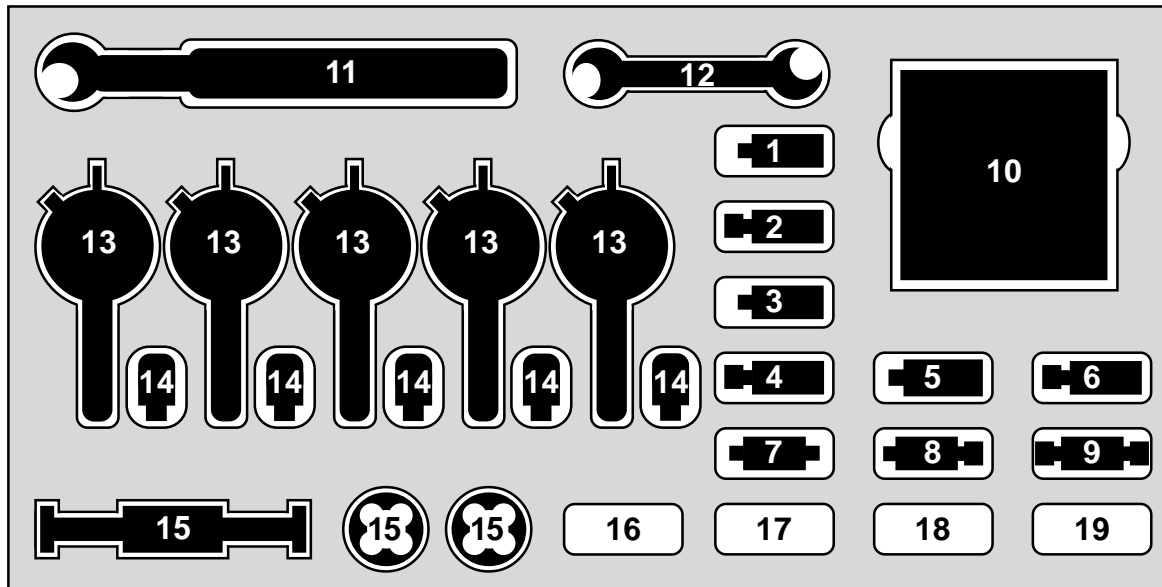
Expanded Calibration Kit

- 1: Short female
- 2: Short male
- 3: Open Circuit female
- 4: Open Circuit male
- 5: Fixed Termination female
- 6: Fixed Termination male
- 7: Throughline female-female
- 8: Throughline female-male
- 9: Throughline male-male

- 10: Software configuration medium
- 11: Torque wrench
- 12: Set of Double ended wrenches
- 13: Set of Interface Gauges for center connector location dimensions*
- 14: Set of Gauge Calibration Blocks
- Instrument case
- Operating instructions

* The resolution is to be specified and whether inch or metric gauges. For details please refer to Section II.2 "Connector Interface Gauges", page 75 f.f.

Suggested for Hewlett Packard ANA Professional Calibration Kit



The actual layout of the Calibration Kit may differ from the schematic above, it also depends on the connector series and its size (this applies also for the No. of Gauges). The Instrument Cases for Standard, Expanded and the Professional Kit are same per Connector series. You may start with a Standard Calibration Kit and fill the empty spots at a later stage to end up with an Expanded or even the Professional Calibration Kit.

Description of Equipment Provided

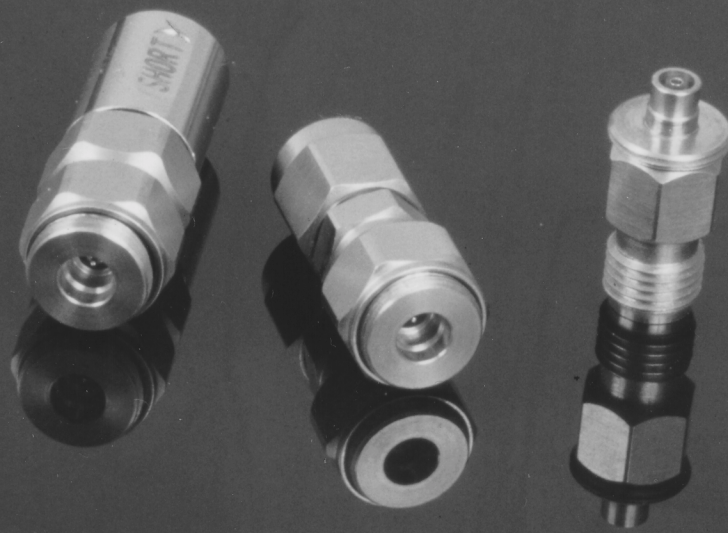
Suggested for Hewlett Packard ANA

Professional Calibration Kit

- | | | | |
|-----|-------------------------------|-----------------|--|
| 1: | Short female | 12: | Set of Double ended wrenches |
| 2: | Short male | 13: | Set of full Interface Gauges for center connector location/outer conductor dimensions* |
| 3: | Open Circuit female | 14: | Set of Gauge Calibration Blocks |
| 4: | Open Circuit male | 15: | Set of Thread Limit Gauges |
| 5: | Fixed Termination female | | Instrument case |
| 6: | Fixed Termination male | | Operating instructions |
| 7: | Throughline female-female | 16, 17, 18, 19: | Optional Adapters to be specified with the order. For details please refer to the specific ordering information. |
| 8: | Throughline female-male | | |
| 9: | Throughline male-male | | |
| 10: | Software configuration medium | | |
| 11: | Torque wrench | | |

* The resolution is to be specified and whether inch or metric gauges. For details please refer to Section II.2 "Connector Interface Gauges", page 75 f.f.

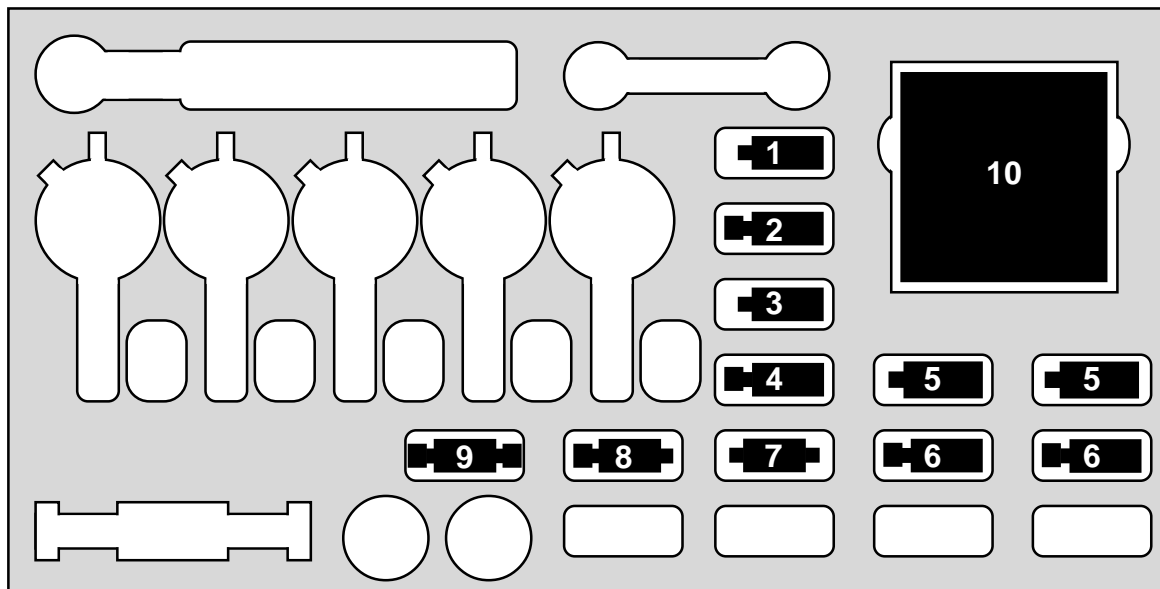
**Are you a Believer?
Or: Can you test your SMP-
Component and Assembly?**



**We make the Calibration Kits,
also for SMPs
Please refer to page 23 f.f.**

Suggested for Wiltron ANA

Standard Calibration Kit



The actual layout of the Calibration Kit may differ from the schematic above, it also depends on the connector series and its size. The Instrument Cases for Standard, Expanded and the Professional Kit are same per Connector series. You may start with a Standard Calibration Kit and fill the empty spots at a later stage to end up with an Expanded or even the Professional Calibration Kit.

Description of Equipment Provided

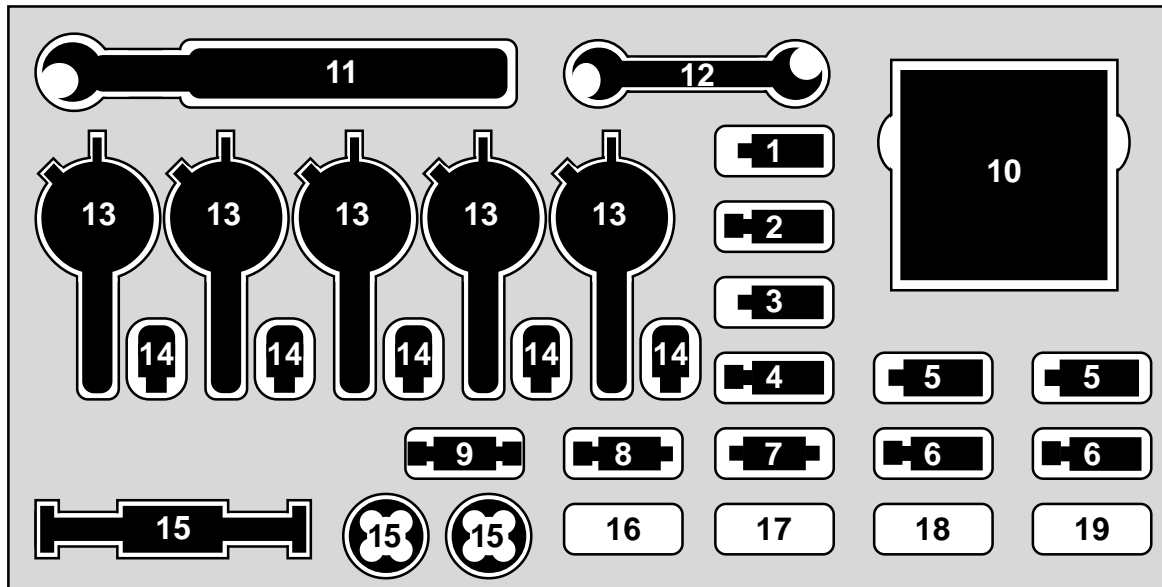
Suggested for Wiltron ANA

Standard Calibration Kit

- | | | | |
|-----------|-----------------------------------|------------|--------------------------------------|
| 1: | Short female | 7: | Throughline female-female |
| 2: | Short male | 8: | Throughline female-male |
| 3: | Open Circuit female | 9: | Throughline male-male |
| 4: | Open Circuit male | 10: | Software configuration medium |
| 5: | 2 Pcs. Terminations female | | Instrument case |
| 6: | 2 Pcs. Terminations male | | Operating instructions |

Suggested for Wiltron ANA

Professional Calibration Kit



The actual layout of the Calibration Kit may differ from the schematic above, it also depends on the connector series and its size (this applies also for the No. of Gauges). The Instrument Cases for Standard, Expanded and the Professional Kit are same per Connector series. You may start with a Standard Calibration Kit and fill the empty spots at a later stage to end up with an Expanded or even the Professional Calibration Kit.

Description of Equipment Provided

**Suggested for
Wilton ANA**

Professional Calibration Kit

- | | |
|-----|-------------------------------|
| 1: | Short female |
| 2: | Short male |
| 3: | Open Circuit female |
| 4: | Open Circuit male |
| 5: | 2 Pcs. Terminations female |
| 6: | 2 Pcs. Terminations male |
| 7: | Throughline female-female |
| 8: | Throughline female-male |
| 9: | Throughline male-male |
| 10: | Software configuration medium |
| 11: | Torque wrench |

- | | |
|-----------------|--|
| 12: | Set of Double ended wrenches |
| 13: | Set of full Interface Gauges for center connector location/outer conductor dimensions* |
| 14: | Set of Gauge Calibration Blocks |
| 15: | Set of Thread Limit Gauges |
| | Instrument case |
| | Operating instructions |
| 16, 17, 18, 19: | Optional Adapters to be specified with the order. For details please refer to the specific ordering information. |

*The resolution is to be specified and whether inch or metric gauges. For details please refer to **Section II.2 “Connector Interface Gauges”**, page 75 f.f.

The **OPEN-SHORT-LOAD-THROUGH CALIBRATION KITS** can be divided into three groups:

The **Standard** Calibration Kit
The **Expanded** Calibration Kit and,
The **Professional** Calibration Kit.

The Instrument Cases for all three of these Calibration Kits are identical. You may start with the Standard Calibration Kit and fill the empty spots at a later stage, to end up with an Expanded, or even the Professional Calibration Kit. The Kits suggested for **Hewlett Packard** and for **Wiltron**, do differ slightly in the number of components supplied, necessary for the different calibration sequences.

The **STANDARD CALIBRATION KIT**: It contains all the components needed for a calibration in the subject connector series, and the software configuration medium.

The **EXPANDED CALIBRATION KIT**: Besides the components supplied with the Standard Calibration Kit, sets of interface gauges for the center conductor location dimensions, calibration block, wrenches, and a torque wrench are added.

The **PROFESSIONAL CALIBRATION KIT**: This Kit contains all the components in the Expanded Kit with the option of Interface Gauges and Calibration Blocks for measuring certain critical outer conductor dimensions. A set of thread limit gauges for checking the connector and coupling nut threads is added as well. Four empty spaces can be filled with optional adapters, individually specified.

GB		-	C	D	E	F	-	H	I	K	L																							
			CD: to be replaced with one of the following numbers/letters for the option required. Calibration Components in this Kit. 24 = 2.4mm 29 = 2.9mm 35 = 3.5mm 70 = 7mm N0 = N SM = SMP			F: Resolution of the Interface Gauges. Please replace F with one of the following letters for the option required. <table><tr><th colspan="2">Resolution</th></tr><tr><td></td><td>mm</td><td></td><td>inches</td></tr><tr><td>H =</td><td>0.005</td><td>J =</td><td>0.0001</td></tr><tr><td>K =</td><td>0.01</td><td>L =</td><td>0.001</td></tr><tr><td>T =</td><td>0.001</td><td colspan="2"></td></tr><tr><td>D =</td><td colspan="3">Digital Gauge 0.01mm/ 0.0005"</td></tr></table> For the Standard Calibration Kit F = 0.		Resolution			mm		inches	H =	0.005	J =	0.0001	K =	0.01	L =	0.001	T =	0.001			D =	Digital Gauge 0.01mm/ 0.0005"				HI: to be replaced with one of the following numbers/letters for the option required. Additional Adapters from Connector Series of Calibration Components: (1 pce. each: f/f, t/m, m/f and m/m). 24 = 2.4mm 29 = 2.9mm 35 = 3.5mm 70 = 7.0mm N0 = N T3 = TNC to MIL-C-39012 T8 = TNC to MIL-C-87104/2 If Adapters, other than to Calibration Connector Series are required, a special Code will be submitted.		KL: Upper Frequency Limit of this Kit. Please replace KL with one of the following numbers for the option required. 06 = 6.0 GHz 12 = 12.4 GHz 18 = 18.0 GHz 26 = 26.5 GHz 35 = 35.0 GHz 40 = 40.0 GHz 50 = 50.0 GHz	
Resolution																																		
	mm		inches																															
H =	0.005	J =	0.0001																															
K =	0.01	L =	0.001																															
T =	0.001																																	
D =	Digital Gauge 0.01mm/ 0.0005"																																	
B: to be replaced with one of the following letters for the option required. S = Standard Kit E = Expanded Kit P = Professional Kit			E: to be replaced with one of the following letters for the option required. Calibration Kit suggested for: H = Hewlett Packard ANA W = Wiltron ANA																															

Section I.1.b

Calibration Kits

Calibration Kits		9 f.f.
1.	OPEN-SHORT-LOAD -THROUGHLINE KITS	
	a) INFORMATION ON ALL KITS	13
	b) SMP CALIBRATION KIT	23
2.	LRL/TRL <small>Line Reflective Line Through Reflective Line</small> KITS	35
3.	VERIFICATION KITS	41

INTRODUCTION: Accurate Testing of microwave circuits means eliminating measurement errors and ensuring repeatable results. This is only possible when the network analyzers can be calibrated with known and true calibration standards. These standards are not to be subjected to any kind of limitations, they must rather be designed to perfection.

THE SMP CONNECTOR: The SMP is a 2.4mm connector, using solid dielectric interface. The female connector utilizes besides a slotted center conductor also a slotted outer conductor, which is unconventional. The female connector is designed to snap into the male connector, which is normally called the "socket".

It is probably safe to say that millions of SMP connectors have been used, some even in critical parts of systems. The SMPs are popular because they are easy to install. Also, they are small, and therefore can be packaged densely, and they do not need to be torqued. Under most circumstances, the retention force of a fully detented pair of connectors is high enough to guarantee proper connection.

THE FACTS: Unfortunately, all of these connectors (or cable assemblies or components terminated with these SMP connectors) could not be tested properly, or have only been tested by using adapters. Using these adapters, electrical tests results are questionable. The test data are always products of the component and the adapter. If an adapter employs compensation gaps, it could help to offset connector problems such as slots, recessed interfaces and untrue 50-Ohm areas. An adapter may also compensate for several dBs if it is matched to a specific connector design. An adapter can also make the test data look worse. The test data of a component may show that the component is electrically out of specification, when it would have been in specification if the adapter had not been used. This may happen especially when connector and adapter are manufactured by different suppliers.

THE PROBLEMS: Designing a Calibration Kit for SMP connectors and not using adapters makes it necessary to redesign the SMP connector for these test components and calibration standards to an extent that uncertainties are completely eliminated. But it always has to be maintained that any standard connector will mate properly with the connectors within the calibration kit.

The Dielectric: The regular SMP connector uses PTFE as dielectric. This dielectric is a very soft material and it is even known for cold flow. It definitely eliminates the traceability of lines, adapters, and connectors and therefore cannot be used for absolute impedance standards. This would result into calibration errors and nil repeatability.

The Slotted Center Conductor: Slotting a line means changing the impedance of that line. The result will be an untrue 50 Ohm area. Corrections can be calculated, compensation by diameter adjustment, or gaps, or both. But fact is that slots, corrections and compensation gaps in short line lengths cannot be separated from each other and therefore also not from any measuring result. Therefore the use of slots and gaps, etc. in test components will bear uncertainties and cannot be recommended.

The Slotted Outer Conductor: The SMP female connector employs in addition also a slotted outer conductor. Again, engineering can calculate compensation as well and try to take care of that mismatch area. But again: the result needs to be tested, it needs to be verified as true and valid. And it needs to be faced again: slots and compensation gaps in short line lengths cannot be separated from each other and any measuring result. Reflections can add or subtract in an uncontrolled manner. Slotted outer conductors are not usable for calibration standards.

The Snap Mechanism: Regular connectors are threaded. Therefore, when coupled, they remain securely in the proper mated position. Thus, components can be characterized precisely, and repeatable tests can be performed, showing identical results. PUSH-ON type connectors are different and much more difficult to test. The male and female connectors simply slide together. Although it is expected that they will end up in a predicted position, and the spring mechanism will lock them up in that position, it cannot be guaranteed. There are mechanical tolerances on all dimensions that can affect performance. If the interfaces of the connectors cannot meet properly, because of those tolerances, or if the interfaces end up in a different position each time (for example, if the insertion and withdrawal forces are inconsistent), the electrical performance will vary during testing.

THE SOLUTION:

Spectrum Elektrotechnik GmbH has developed a whole SMP Calibration System that allows testing SMP connectors with guaranteed repeatability:

The Test Connector Design: The test connectors and adapters have been developed as ideal 50 Ohm lines. The center conductor of the female connector is designed as a seamless tube, loaded with a 0.004" (0.1 mm) slotted center contact, securing contact with the mating pin only at the very end, there where the tubing starts, ensuring a true 50 Ohm design. For the 40 GHz Calibration Kit the center contact is even spring loaded, striving for perfectionism. The outer conductor of the connectors of the calibration components is not slotted as well. This ensures a perfect 50 Ohm line. Instead of PTFE, a different dielectric has been selected. The dielectric constant is close to the one of PTFE, but the disadvantageous properties of PTFE have been eliminated. The material is harder and it stays in place, ensuring true 50 Ohm lines, and traceable and repeatable test results.

To ensure proper and repeatable mating, the SMP Test Connectors employ additional threading. Therefore the Calibration Components can be threaded together during the calibration sequence, ensuring perfect and repeatable mating, avoiding uncertainties that cannot be prevented with pure snap on connectors. On the other hand, the test connectors will mate properly with any standard SMP connector.

The Test Cables: Vector network analyzers require electrically stable cable assemblies for measurement in very critical areas, such as Phase, Amplitude and VSWR. Cables have to maintain calibration data, even when subjected to bending and twisting which can introduce distorting parameters. The cable assembly needs to be flexible without being flaccid. The Cables of Types 16, 18 and 22, as described in the Phase Stable Cable Assemblies' section are ideal for this application. One end of the Assembly will usually be terminated with an NMD 2.4mm, 2.92mm, or 3.5mm, 7mm or N connector, as needed for connecting directly with the RF output of the network analyzer. These NMD Connectors are designed with a larger than standard coupling nut for greater stability. The other end of the ANA - Assembly can be terminated with the proper SMP Test Connector, avoiding any adapter, guaranteeing true and repeatable test results.

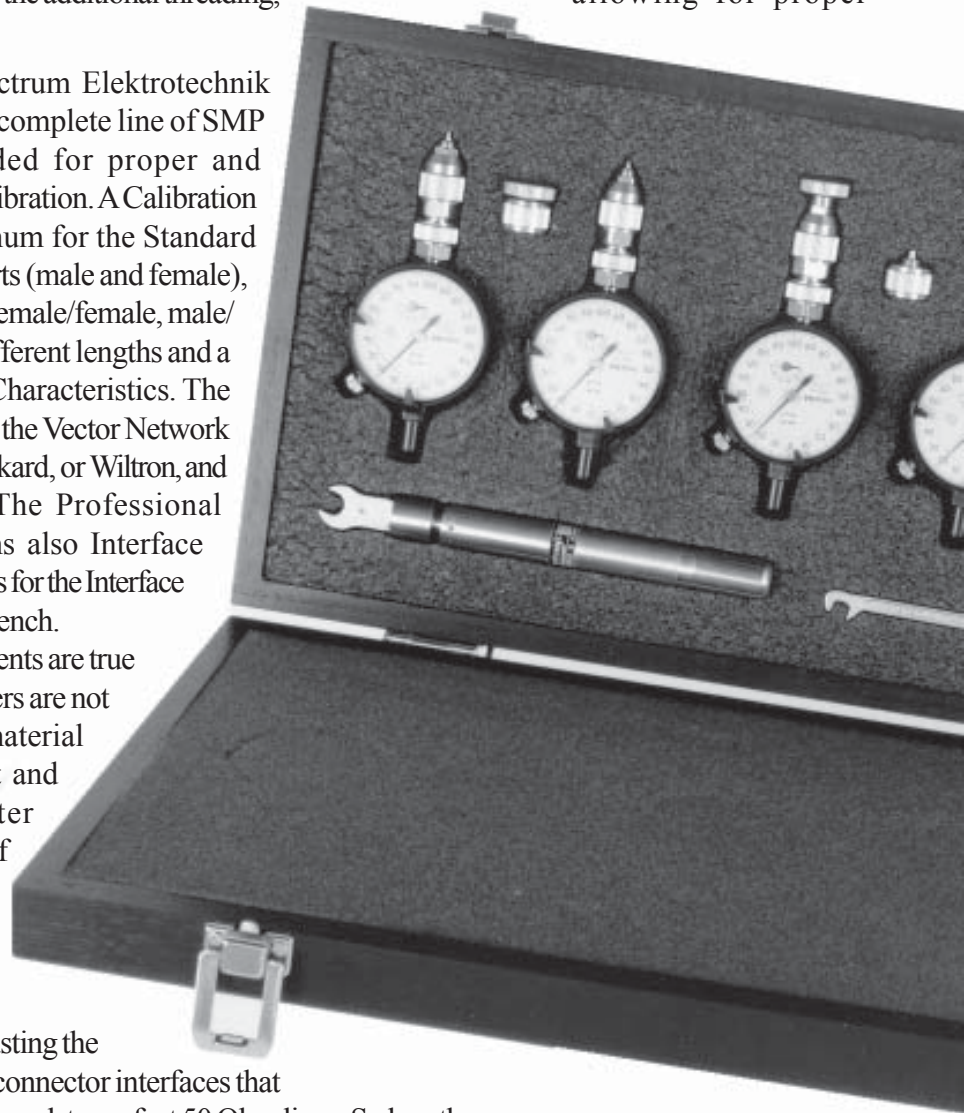
Test Adapters: Regular SMP connectors are made to specifications that allow protruding dielectrics and center conductors. These connectors will damage mating precision connectors. Therefore Spectrum Elektrotechnik GmbH is offering also "Commercial" Adapters, accepting those connectors with protruding interfaces.

Between Series Adapters: Where existing test cables are to be used, Spectrum Elektrotechnik GmbH offers between series instrument-grade adapters to those 2.4mm and 2.9mm test port or cable connectors. The other end of the adapter is supplied with the SMP Test Connector, equipped with the additional threading, allowing for proper calibration.

LRL / TRL KIT: Spectrum Elektrotechnik GmbH has developed a complete line of SMP Components, as needed for proper and consistent LRL / TRL calibration. A Calibration Kit contains as a minimum for the Standard Calibration Kit: two Shorts (male and female), two Throughlines each (female/female, male/female, male/male) in different lengths and a disc for the Calibration Characteristics. The Disc is supplied either for the Vector Network Analyzers of Hewlett Packard, or Wiltron, and is ready to be used. The Professional Calibration Kit contains also Interface Gauges, Calibration Blocks for the Interface Gauges, and a Torque Wrench.

The LRL / TRL Components are true 50 Ohm lines. The adapters are not using any supporting material between center contact and outer conductor. Outer conductors and the sets of center contacts are supplied separately. The set of center contacts contains all lengths as needed for adjusting the adjacent in specification connector interfaces that is usually recessed, as allowed, to perfect 50 Ohm lines. So length adjustments of 0.0004 inches (0.01mm) can be achieved, when all center contacts have been purchased. For details please refer to the LRL / TRL section in this Handbook. The Calibration Kits are supplied with discs that supply data on the properties of the Kits' components. Kits are available for the Network Analyzers of Hewlett Packard and Wiltron. To characterize the Opens, Shorts, and the Loads of the Open-Short-Load-Through Kits, these LRL / TRL Components can perfectly be used.

TEST TOOLS: For proper testing the regular SMP connectors, a variety of tools have been



developed. For testing the SMP right angle connectors an adapter incorporating a bayonet clamp mechanism is offered. As outlined earlier, only snapping the components together may not guarantee the repeatability. The slightest interface gap will contribute to the measurement results. Using the bayonet clamp mechanism will ensure secure fastening and repeatable testing. It guarantees proper and repeatable connection.

A withdrawal fork can serve for easy removal of SMP female connectors and "bullets".

For straight SMP females an Insertion/Holding/Withdrawal tool is supplied.

It threads directly into the test connectors, holding the connector under test in place, ensures repeatability and helps as well for easy removal after testing, and it takes the stress off fragile assemblies.

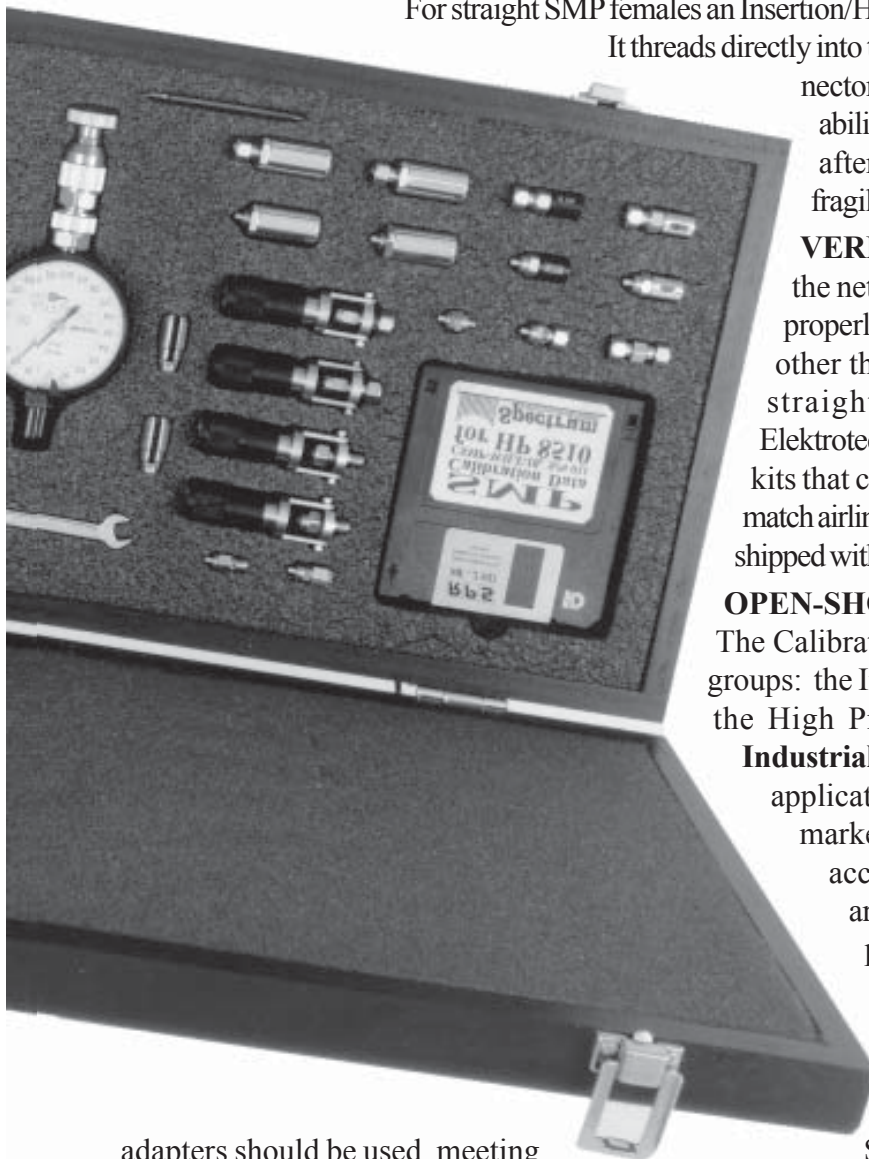
VERIFICATION KITS: To verify that the network analyzer system is working properly, the measuring of known devices, other than the calibration standards, is a straightforward method. Spectrum Elektrotechnik GmbH is offering verification kits that consist of precision airlines and mismatch airlines. Traceable measurement data are shipped with each kit.

OPEN-SHORT-LOAD-THROUGH KIT: The Calibration Kits can be divided into two groups: the Industrial Type Calibration Kit, and the High Precision Calibration Kits. The **Industrial Type Calibration Kit** is used for applications to 18.0 GHz. The Adapters marked "Commercial" are designed to accept all connectors, also those that are made to specifications that allow protruding center contacts.

The **High Precision Calibration Kit** is used for frequency ranges up to 40.0 GHz. With this Kit only precision connectors and Spectrum's SMP Test Connector

adapters should be used, meeting Specification. Connectors manufactured to specifications that are allowing protrusion of the center contacts may ruin the precision components of the High Precision Calibration Kit.

As for other connector series, also for the SMPs the Standard, Expanded and Professional Kits are supplied.



The **OPEN-SHORT-LOAD-THROUGH CALIBRATION KITS** for SMPs can be divided into two groups:

The Industrial Type Calibration Kit High Precision Calibration Kits

The **INDUSTRIAL TYPE CALIBRATION KIT** is used for applications to **18.0 GHz**. The Adapters marked "Commercial" are designed to accept all connectors, also those that are made to specifications that allow protruding center contacts.

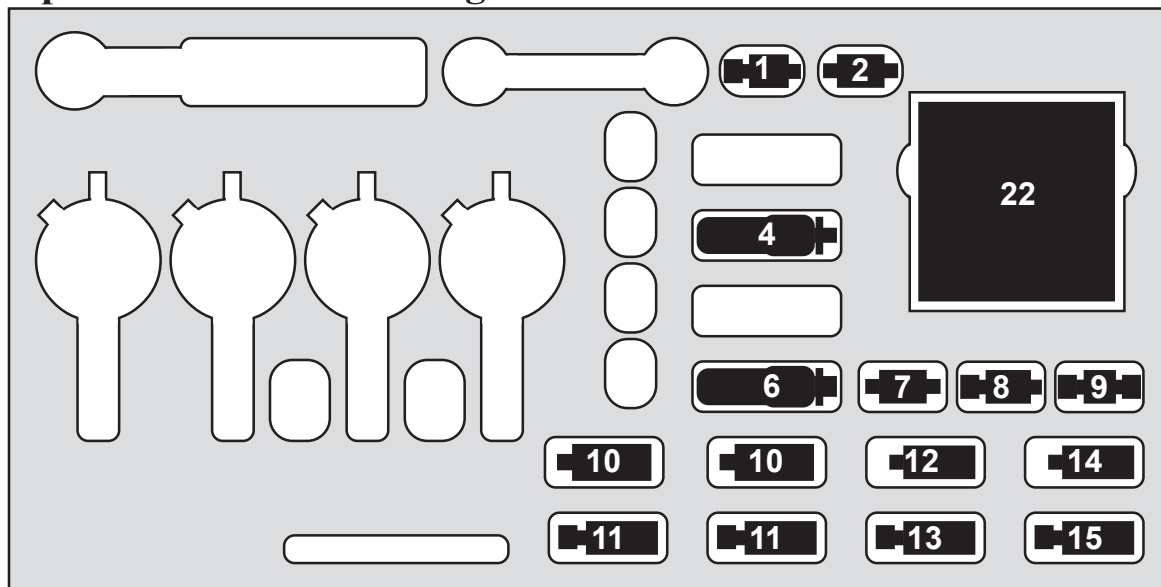
The **HIGH PRECISION CALIBRATION KIT** is used for frequency ranges to **40.0 GHz**. With this Kit only precision connectors and adapters should be used, meeting Spectrum's SMP Connector Specifications. Connectors manufactured to specifications that are allowing protrusion of the center contacts may ruin the precision components of the High Precision Calibration Kit.

The **STANDARD, EXPANDED** and **PROFESSIONAL KITS** are offered within the series **INDUSTRIAL TYPE CALIBRATION KIT** and **HIGH PRECISION CALIBRATION KIT**.

GB		- S		ME		F		- H		I		KL																	
B: to be replaced with one of the following letters for the option required. S = Standard Kit E = Expanded Kit P = Professional Kit				E: to be replaced with one of the following letters for the option required. Calibration Kit suggested for: H = Hewlett Packard ANA W = Wiltron ANA		F: Resolution of the Interface Gauges. Please replace F with one of the following letters for the option required. <table><tr><th colspan="2">Resolution</th></tr><tr><td></td><td>mm</td><td></td><td>inches</td></tr><tr><td>H =</td><td>0.005</td><td>J =</td><td>0.0001</td></tr><tr><td>K =</td><td>0.01</td><td>L =</td><td>0.001</td></tr><tr><td>T =</td><td>0.001</td><td></td><td></td></tr></table> D = Digital Gauge 0.01mm/ 0.0005"		Resolution			mm		inches	H =	0.005	J =	0.0001	K =	0.01	L =	0.001	T =	0.001			HI: to be replaced with one of the following numbers/letters for the option required. Additional Adapters from Connector Series of Calibration Components: (1 pce. each: f/f, f/m, m/f and m/m). 24 = 2.4mm 29 = 2.9mm If Adapters, other than Calibration Connector Series are required, a special Code will be submitted.		KL: To be replaced with the following numbers: 18 = Industrial Type Cal. Kit to 18.0 GHz 40 = High Precision Cal. Kit to 40.0 GHz	
Resolution																													
	mm		inches																										
H =	0.005	J =	0.0001																										
K =	0.01	L =	0.001																										
T =	0.001																												
						For the Standard Calibration Kit F = 0.																							

Open-Short-Load-Through-Kits

Standard Calibration Kit



The actual layout of the Calibration Kit may differ from the schematic above, it also depends on the connector series and its size. The Instrument Cases for Standard, Expanded and the Professional Kit are same per Connector series. You may start with a Standard Calibration Kit and fill the empty spots at a later stage to end up with an Expanded or even the Professional Calibration Kit.

Description of Equipment Provided

Standard Calibration Kit

1:	Precision Adapter SMP-f to S1*	11:	2 Pcs. Precision Standard Terminations SMP-m
2:	Precision Adapter SMP-f to S2*	12:	Precision Standard SMP-Open-f
4:	Comm. Adapter/B.M. ¹⁾ SMP-m to S2*	13:	Precision Standard SMP-Open-m
6:	Comm. Adapter/B.M. ¹⁾ SMP-m to S1*	14:	Precision Standard SMP-Short-f
7:	Throughline SMP-f to SMP-f	15:	Precision Standard SMP-Short-m
8:	Throughline SMP-f to SMP-m	22:	Software Configuration medium
9:	Throughline SMP-m to SMP-m		Instrument case
10:	2 Pcs. Precision Standard Terminations SMP-f		Operating instructions

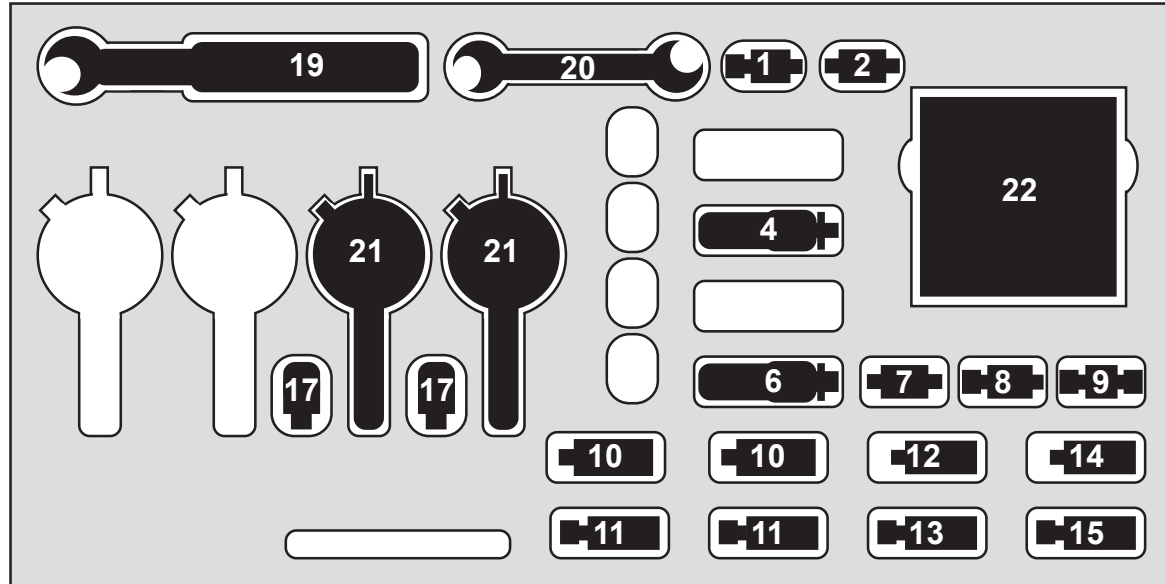
*S1 = 2.4mm-m or 2.9mm-m respectively

*S2 = 2.4mm-f or 2.9mm-f respectively

¹⁾Bayonet Mount, used to hold in place during testing the SMP right angle.

Open-Short-Load-Through-Kits

Expanded Calibration Kit



The actual layout of the Calibration Kit may differ from the schematic above, it also depends on the connector series and its size (this applies also for the No. of Gauges). The Instrument Cases for Standard, Expanded and the Professional Kit are same per Connector series. You may start with a Standard Calibration Kit and fill the empty spots at a later stage to end up with an Expanded or even the Professional Calibration Kit.

Description of Equipment Provided

Expanded Calibration Kit

1:	Precision Adapter SMP-f to S1*	13:	Precision Standard SMP-Open-m
2:	Precision Adapter SMP-f to S2*	14:	Precision Standard SMP-Short-f
4:	Comm. Adapter/B.M. ¹⁾ SMP-m to S2*	15:	Precision Standard SMP-Short-m
6:	Comm. Adapter/B.M. ¹⁾ SMP-m to S1*	17:	Set of Gauge Calibration Blocks
7:	Throughline SMP-f to SMP-f	19:	Torque Wrench
8:	Throughline SMP-f to SMP-m	20:	Set of Double ended wrenches
9:	Throughline SMP-m to SMP-m	21:	Set of full Interface Gauges for center connector location dimensions ²⁾
10:	2 Pcs. Precision Standard Terminations SMP-f	22:	Software Configuration medium
11:	2 Pcs. Precision Standard Terminations SMP-m		Instrument case
12:	Precision Standard SMP-Open-f		Operating instructions

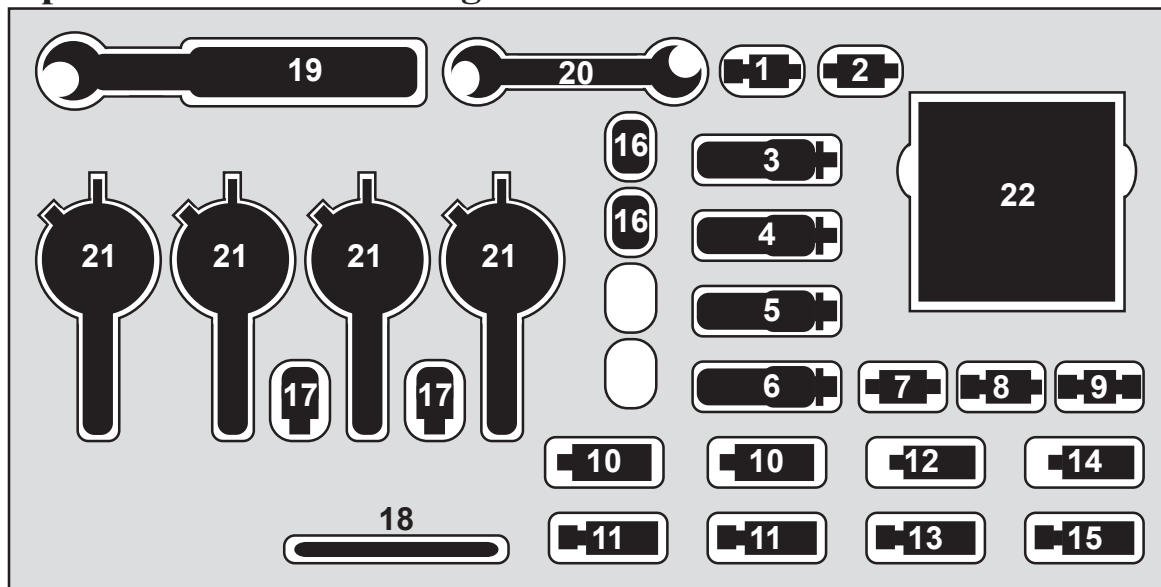
*S1 = 2.4mm-m or 2.9mm-m respectively

*S2 = 2.4mm-f or 2.9mm-f respectively

¹⁾Bayonet Mount, used to hold in place during testing the SMP right angle.

²⁾The resolution is to be specified and whether inch or metric gauges. For details please refer to Section II.2 "Connector Interface Gauges", page 75 f.f.

Open-Short-Load-Through-Kits Professional Calibration Kit



The actual layout of the Calibration Kit may differ from the schematic above, it also depends on the connector series and its size (this applies also for the No. of Gauges). The Instrument Cases for Standard, Expanded and the Professional Kit are same per Connector series. You may start with a Standard Calibration Kit and fill the empty spots at a later stage to end up with an Expanded or even the Professional Calibration Kit.

Description of Equipment Provided Professional Calibration Kit

1:	Precision Adapter SMP-f to S1*	14:	Precision Standard SMP-Short-f
2:	Precision Adapter SMP-f to S2*	15:	Precision Standard SMP-Short-m
3:	Prec. Adapter/B.M. ¹⁾ SMP-m to S2*	16:	Set of I.H.W. ²⁾ Tools for straight connectors
4:	Comm. Adapter/B.M. ¹⁾ SMP-m to S2*	17:	Set of Gauge Calibration Blocks
5:	Prec. Adapter/B.M. ¹⁾ SMP-m to S1*	18:	SMP Withdrawal Tool
6:	Comm. Adapter/B.M. ¹⁾ SMP-m to S1*	19:	Torque Wrench
7:	Throughline SMP-f to SMP-f	20:	Set of Double ended wrenches
8:	Throughline SMP-f to SMP-m	21:	Set of Interface Gauges for center conductor/location dielectric dimensions ³⁾
9:	Throughline SMP-m to SMP-m	22:	Software Configuration medium
10:	2 Pcs. Precision Standard Terminations SMP-f		Instrument case
11:	2 Pcs. Precision Standard Terminations SMP-m		Operating instructions
12:	Precision Standard SMP-Open-f		
13:	Precision Standard SMP-Open-m		

*S1 = 2.4mm-m or 2.9mm-m respectively

*S2 = 2.4mm-f or 2.9mm-f respectively

¹⁾Bayonet Mount, used to hold in place during testing the SMP right angle.

²⁾Insertion / Holding / Withdrawal

³⁾The resolution is to be specified and whether inch or metric gauges. For details please refer to Section II.2 "Connector Interface Gauges", page 75 f.f.

SMP Calibration Kit Details



THE CALIBRATION COMPONENTS:

Spectrum Elektrotechnik GmbH uses a unique system for easy identification of the individual calibration components.

Therefore the Terminations, shorts and opens can easily be identified, at one glance:

-Termination are gold plated

-Shorts are bright nickel plated

-Opens are black anodized

Opens and Shorts are serialized for reason.

Although swapping the components from another set will make only a minor difference:

We consider a minor difference is too much!



THE ADAPTERS:

Besides the regular Adapters supplied, some special adapters are furnished with the SMP Calibration Kit:

A Bayonet Clamp Mechanism is incorporated at some of the adapters for secure fastening and repeatable testing of the right angle SMP female connectors.



SMP - TOOLS:

For straight SMP female connectors, Insertion/Holding/Withdrawal Tools are supplied for different connector lengths. This helps with these tiny connectors. The tools screw directly into the test adapter and hold the connector under test in place. The withdrawal fork serves for easy removal of the SMP female connectors.



THE GAUGES:

Gauges with a variety of Resolutions are available. For specific information please refer to the section II.2 "Connector Interface Gauges", page 75 f.f. Four High Precision Gauges and two Calibration Blocks are supplied with the Professional Calibration Kit. Each of the Gauge are serialized and set for a certain task, marked properly on the back.

- SMP male Center Conductor Gauge
- SMP male Dielectric Gauge
- SMP female Center Conductor Gauge
- SMP female Dielectric Gauge

Precision Gauges are available for most other connector series.



TORQUE WRENCH:

For the especially designed Calibration Components that are employing additional thread, the Torque Wrench should be used to ensure proper coupling and to avoid overtorquing.

The Torque Wrench is set to 0.7 Nm (6.2 inch-pounds).

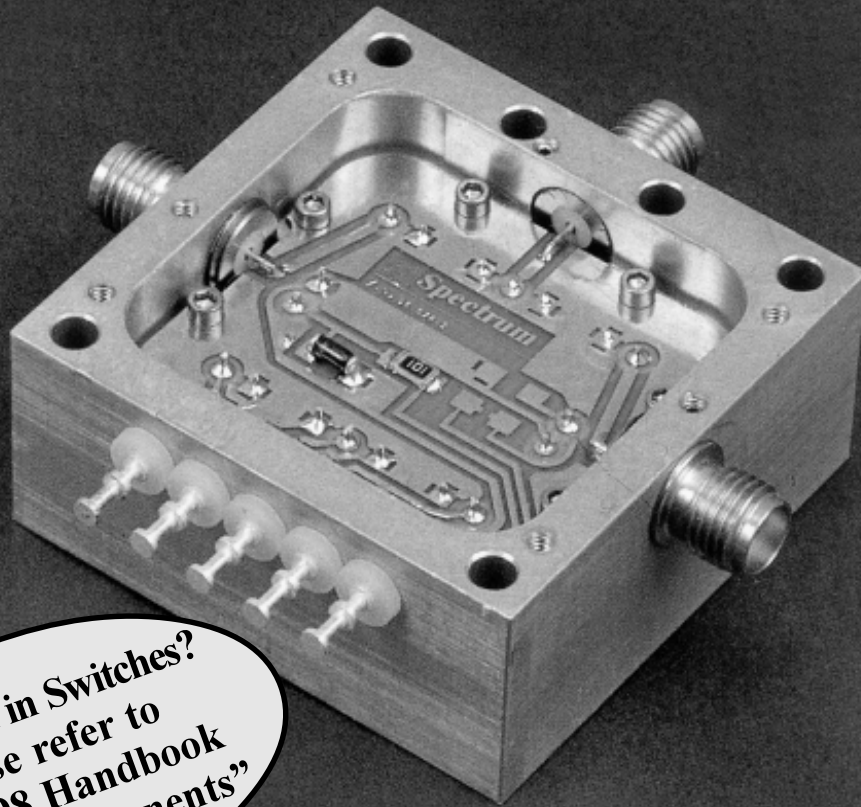
Torque Wrenches are available also for most other connector series.



TEST FIXTURES:

Spectrum Elektrotechnik GmbH offers a variety of test fixtures to allow professional testing in shortest time.

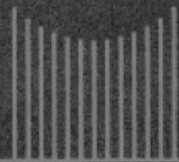
The fixture to the left is used to safely hold in place the Bayonet Mount 2.9mm to SMP Adapter for testing small cable assemblies, that are terminated with an SMP right angle connector.



Interested in Switches?
Please refer to
"The '98 Handbook
Passive Components"

Many boxes look alike! But what a difference when looking inside! What a divergence in performance! Our Designs are state-of-the-art, and they are clean!

Please ask for our Products in the Frequency Range of DC to 50 GHz:
Adapters, ANA Test Cables, Antennas, Attenuators, Blind Mate Connectors, Circulators, CDM-Components, Coax Switches, Couplers, Custom Components, DC-Block Connectors & Adapters, Gain-Equalizers, Flexible Cable Assemblies, Isolators, Limiters, Mismatches, Multi Pin Connectors, Phase Shifters, Phase Stable Cable Assemblies, Precision Terminations, Push-On Connectors & Adapters, Semi Rigid Cable Assemblies, Waveguide Components, Waveguide to Coax Adapters, etc.



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box0296

Section 1.2

Calibration Kits

Calibration Kits		9 f.f.
1.	OPEN-SHORT-LOAD -THROUGHLINE KITS	
	a) INFORMATION ON ALL KITS	13
	b) SMP CALIBRATION KIT	23
2.	LRL/TRL <small>Line Reflective Line Through Reflective Line</small> KITS	35
3.	VERIFICATION KITS	41

INTRODUCTION: The LRL (Line Reflective Line), or TRL (Through Reflective Line) Kits are using a different approach. To calibrate the system a Short is needed and Throughlines of two different lengths. The Throughlines are supposed to be ideal. This means that not only the impedance of 50 Ohms has to be maintained perfectly. Center Contacts are allowed to be recessed within allowed limits. The Center Contacts of the Throughlines are therefore available in different lengths, taking care of the recessed Contacts at the Test Equipment. Therefore for every Outer Conductor of a Throughline a number of Center Contacts are supplied, from "0" Recession/Protrusion to max. Protrusion, equaling the max. allowable Recession of the Test Equipment Connector.

EQUIPMENT PROVIDED: Each Calibration Kit contains as a minimum for the Standard Calibration Kit: two Shorts (male and female), two Throughlines each (female/female, male/female, male/male) in different lengths and a Disc for the Calibration Characteristics. The Disc is supplied either for the Vector Network Analyzers of Hewlett Packard, or Wiltron, and is ready to be used. The Professional Calibration Kit contains also Interface Gauges, Calibration Blocks for the Interface Gauges, and a Torque Wrench.

INTERFACE GAUGES: If you are using a Standard Calibration Kit and did not purchase any Connector Interface Gauges, you should not use the longer Center Contact. If you have Interface Gauges available you should first measure the Recession of the Center Contacts in the Connectors of the Vector Network Analyzer, or if you are using Test Cables, the Recession of the Center Contacts in the connectors of those cable assemblies. Then you should select the correct oversize Center Pin, taking care of the Recession at those Connectors.

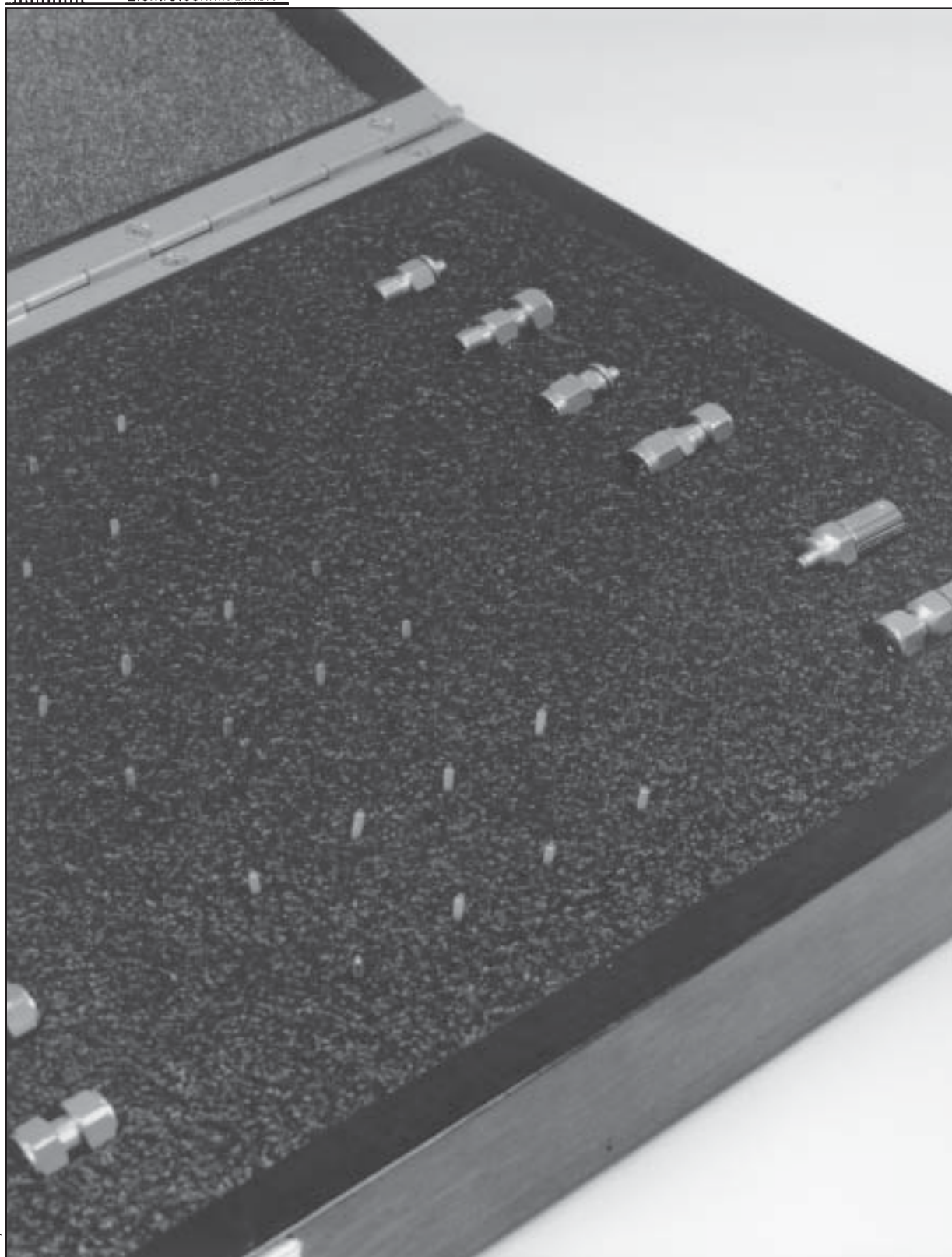
THROUGHLINES: As mentioned earlier, the Throughlines are supplied as outer conductors and different lengths center conductors. To install the Throughlines, please proceed as follows:

1. Measure the Recession of the Test Connectors.
2. Select the appropriate oversize Center Pin (oversize in length).
3. Install the Outer Conductor of the Throughline on one of the Test Connectors.
4. Insert the appropriate Center Conductor into the Outer Conductor of the Throughline, using the especially designed Insertion Tool.
5. Extract the Insertion Tool and connect carefully the second Test Connector.

TORQUE WRENCHES: In order to ensure proper mating of the connectors, it is highly recommended to always use Torque Wrenches. They do not only ensure proper connection of the components but they also help to prevent overtightening, which may damage or degrade the performance of these expensive ideal components.

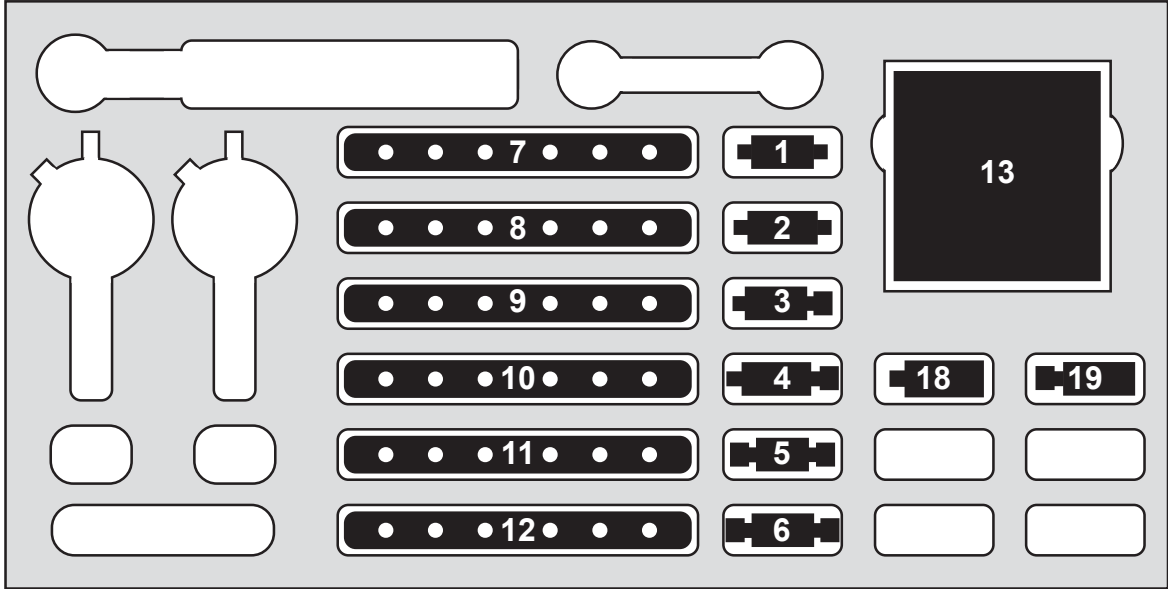
CONNECTORS SERIES: LRL/TRL Calibration Kits are available in the following connector series: 3.5mm, 7mm, K*, N, SMP and TNC.

PHASE STABLE CABLE ASSEMBLIES: Spectrum Elektrotechnik GmbH offers a series of Phase Stable Assemblies, fitted at one side with the appropriate NMD connector for direct connection with the Vector Network Analyzers of Hewlett Packard and Wiltron, and with 2.4mm, 3.5mm, K*, SMP, N, TNC, etc. at the other end of the Assembly.



trellipm06

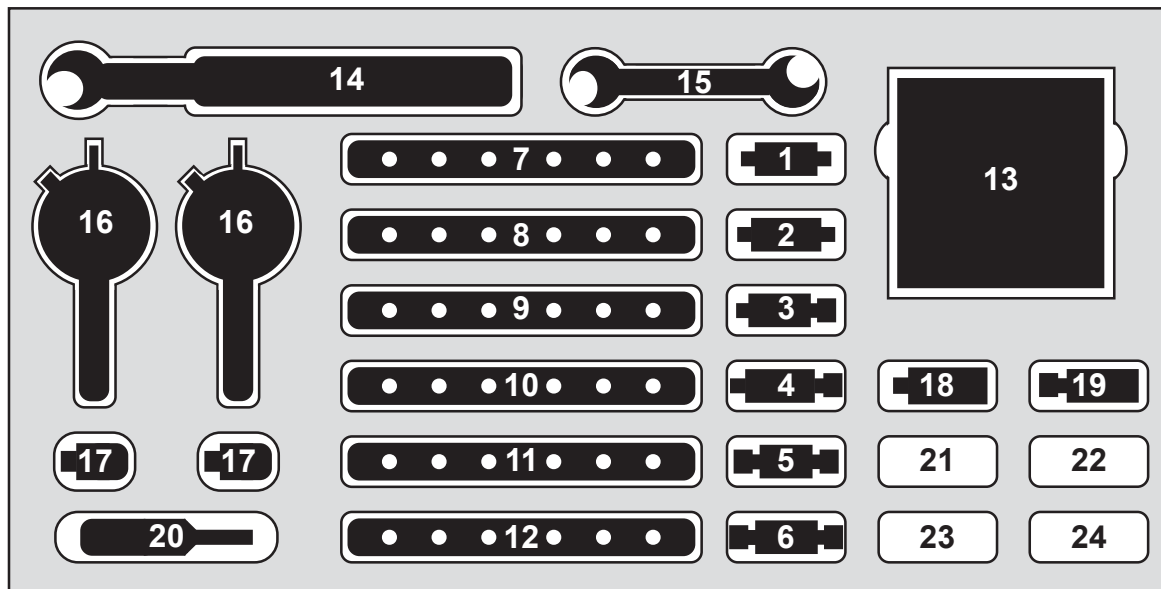
Standard Calibration Kit



The actual layout of the Calibration Kit may differ from the schematic above, it also depends on the connector series and its size. The Instrument Cases for the Standard and Professional Kit are some per Connector series. You may start with a Standard Calibration Kit and fill the empty spots at a later stage to end up with a Professional Calibration Kit.

Description of Equipment Provided		Standard Calibration Kit	
1:	Ideal Outer Conductor for Adapter short, female/female	8:	Set of Ideal Center Conductors for Adapter long, female/female
2:	Ideal Outer Conductor for Adapter long, female/female	9:	Set of Ideal Center Conductors for Adapter short, female/male
3:	Ideal Outer Conductor for Adapter short, female/male	10:	Set of Ideal Center Conductors for Adapter long, female/male
4:	Ideal Outer Conductor for Adapter long, female/male	11:	Set of Ideal Center Conductors for Adapter short, male/male
5:	Ideal Outer Conductor for Adapter short, male/male	12:	Set of Ideal Center Conductors for Adapter long, male/male
6:	Ideal Outer Conductor for Adapter long, male/male	13:	Software Configuration Medium
7:	Set of Ideal Center Conductors for Adapter short, female/female	18:	Short female
		19:	Short male

Professional Calibration Kit



The actual layout of the Calibration Kit may differ from the schematic above, it also depends on the connector series and its size (this applies also for the No. of Gauges). The Instrument Cases for the Standard and Professional Kit are same per Connector series. You may start with a Standard Calibration Kit and fill the empty spots at a later stage to end up with a Professional Calibration Kit.

Description of Equipment Provided Professional Calibration Kit

- | | |
|---|---|
| <p>1: Ideal Outer Conductor for Adapter short, female/female</p> <p>2: Ideal Outer Conductor for Adapter long, female/female</p> <p>3: Ideal Outer Conductor for Adapter short, female/male</p> <p>4: Ideal Outer Conductor for Adapter long, female/male</p> <p>5: Ideal Outer Conductor for Adapter short, male/male</p> <p>6: Ideal Outer Conductor for Adapter long, male/male</p> <p>7: Set of Ideal Center Conductors for Adapter short, female/female</p> <p>8: Set of Ideal Center Conductors for Adapter long, female/female</p> <p>9: Set of Ideal Center Conductors for Adapter short, female/male</p> <p>10: Set of Ideal Center Conductors for Adapter long, female/male</p> | <p>11: Set of Ideal Center Conductors for Adapter short, male/male</p> <p>12: Set of Ideal Center Conductors for Adapter long, male/male</p> <p>13: Software Configuration Medium</p> <p>14: Torque Wrench</p> <p>15: Set of double ended wrenches</p> <p>16: Set of Interface Gauges for center connector location*</p> <p>17: Set of Gauge Calibration Blocks</p> <p>18: Short female</p> <p>19: Short male</p> <p>20: Center Contact Insertion Tool</p> <p>21, 22, 23, 24: Optional Adapters to be specified with the order. For details please refer to the specific ordering information.</p> |
|---|---|

*The resolution is to be specified and whether inch or metric gauges. For details please refer to Section II.2 "Connector Interface Gauges", page 75 f.f.

The **LRL / TRL CALIBRATION KITS** can be divided into two groups: The **Standard Calibration Kit** and The **Professional Calibration Kit**.

The Instrument Cases for both of these Calibration Kits are identical. You may start with the Standard Calibration Kit and fill the empty spots at a later stage, to end up with the Professional Calibration Kit.

The **STANDARD CALIBRATION KIT**: It contains all the components needed for a calibration in the subject connector series, and the software configuration medium. For all the adapters sets of center contacts are supplied, as necessary to build ideal airlines. The different lengths of center contacts are needed to build those ideal airlines, including the mating connectors of the ANA or its cable assemblies. Although these are instrument grade connectors, the center contact may be recessed, as allowed in the applicable connector specification. Using now the correct overlength of the airline center conductor, the recess-gaps at the mating center conductors are filled. With the Standard Calibration Kit, for which connector gauges are not supplied, the overlength center contacts should not be used. It is only proper to use them when the actual recession of the mating connectors has been measured, otherwise the mating connectors can be damaged.

The **PROFESSIONAL CALIBRATION KIT**: Besides the components supplied with the Standard Calibration Kit, sets of interface gauges for the center conductor location dimensions, calibration block, wrenches, and a torque wrench are added. Four empty spaces can be filled with optional adapters, individually specified.

GB	-	C	D	E	F	-	H	I	K	L
B: to be replaced with one of the following letters for the option required. S = Standard Kit P = Professional Kit		CD: to be replaced with one of the following numbers/letters for the option required. ANA Output Conn. or Cable Conn. respectively. 24 = 2.4mm female 29 = 2.9mm female 35 = 3.5mm female 70 = 7mm N0 = N female SM = SMP		E: to be replaced with one of the following letters for the option required. Calibration Kit suggested for: T = Hewlett Packard ANA L = Wiltron ANA	F: Resolution of the Interface Gauges. Please replace F with one of the following letters for the option required.		HI: to be replaced with one of the following numbers/letters for the option required. Additional Adapters from ANA Output Connector Series to one on the following Series: (1 pce. each: f/f, f/m, m/f and m/m). 24 = 2.4mm 29 = 2.9mm 35 = 3.5mm 70 = 7.0mm N0 = N		KL: Upper Frequency Limit of this Kit. Please replace KL with one of the following numbers for the option required. 18 = 18.0 GHz 26 = 26.5 GHz 35 = 35.0 GHz 40 = 40.0 GHz 50 = 50.0 GHz	
					Resolution					
					mm	inches				
					H = 0.005 K = 0.01 T = 0.001	J = 0.0001 L = 0.001				
		D = Digital Gauge 0.01mm/ 0.0005"		If Adapters, other than to Calibration Connector Series are required, a special Code will be submitted.						
For the Standard Calibration Kit F = 0.										

Section 1.3

Calibration Kits

Calibration Kits		9 f.f.
1.	OPEN-SHORT-LOAD -THROUGHLINE KITS	
	a) INFORMATION ON ALL KITS	13
	b) SMP CALIBRATION KIT	23
2.	LRL/TRL <small>Line Reflective Line Through Reflective Line</small> KITS	35
3.	VERIFICATION KITS	41

INTRODUCTION: When purchasing an Open-Short-Load-Through Kit, or a LRL/TRL Kit, Spectrum Elektrotechnik GmbH will assure that the components are in superior condition. But by using the Kit day after day, the components may wear out, or degrade to an unacceptable extent. The Verification Kit is supplied to verify that the Calibration Kit still operates within the limits, or to identify the problems with certain Calibration Components.

EQUIPMENT PROVIDED: Each Verification Kit contains as a minimum one "ideal" air-lines of 50 Ohms, and a Mismatch of 25 Ohms. Both units consist of separate Outer Conductors and Center Conductors.

In the Instrument Case is a certain space available where a Torque Wrench, and a set of single ended wrenches, supplied on separate order, can be fitted.

To install the Airline, or the Mismatch, please proceed as follows:

1. Install the Outer Conductor at one of the Test Connectors.
2. Insert the Center Conductor into the Outer Conductor of the Airline, or the Mismatch, respectively. Please use the especially designed Insertion Tool.
3. Extract the Insertion Tool and connect carefully the second Test Connector.

TORQUE WRENCHES: In order to ensure proper mating of the connectors, it is highly recommended to always use Torque Wrenches. They do not only ensure proper connection of the components, they also help to prevent overtorquing, which may damage or degrade the performance of these expensive "ideal" components.

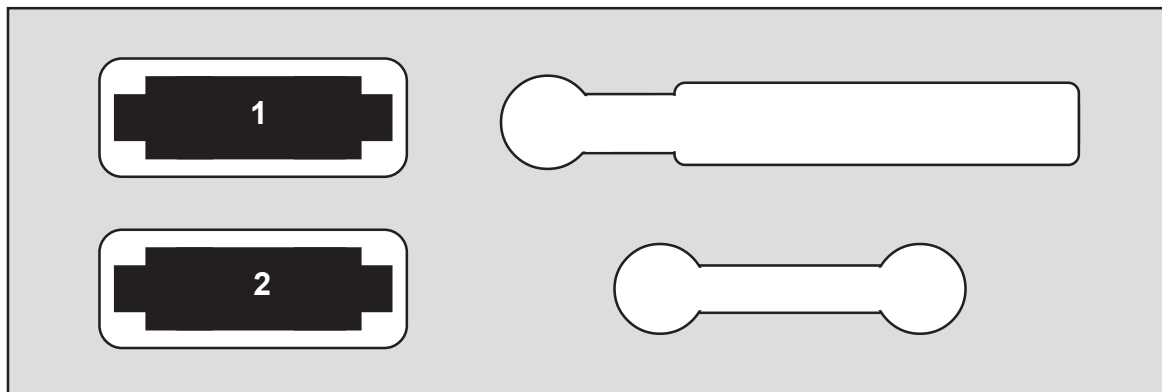
CONNECTOR SERIES: Verification Kits are available in the following connector series: 2.4mm, 2.9mm, 3.5mm, 7mm, N and SMP.

PHASE STABLE CABLE ASSEMBLIES: Spectrum Elektrotechnik GmbH offers a series of Phase Stable Assemblies, fitted at one side with the appropriate NMD connector for direct connection with the Vector Network Analyzers of Hewlett Packard and Wiltron, and with 2.4mm, 3.5mm, K*, SMP, N, etc., males and females at the other end of the Assembly.

Ordering Information for Verification Kits

V	E	-	C	D	E	F
B: to be replaced with one of the following letters for the option required. S = Standard Kit P = Professional Kit			CDEF: to be replaced with one of the following digit number/letter Code, describing Connectors as listed below. 2400 = 2.4mm 2920 = 2.9mm 3500 = 3.5mm 7000 = 7mm N000 = N SMP0 = SMP			

treff.pn6 Date: 02.98



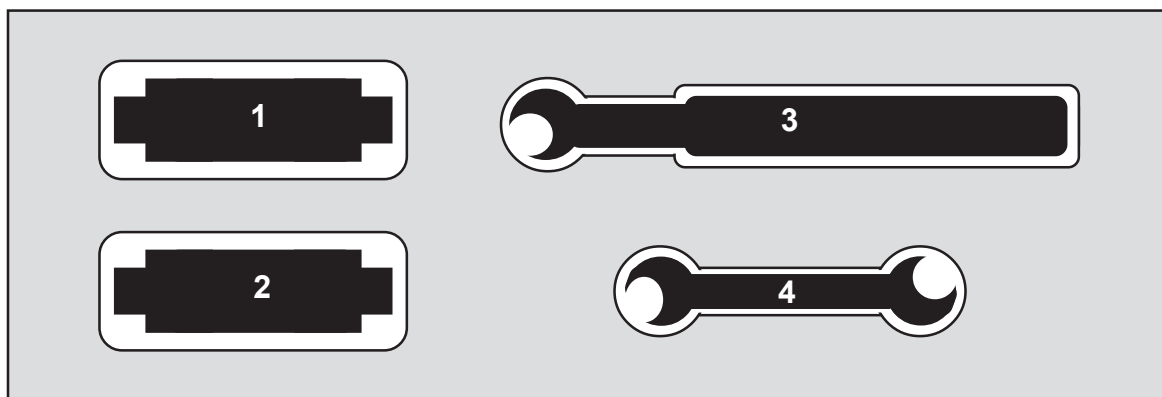
Description of Equipment Provided

Standard Calibration Kit

- 1: Airline 50 Ohms
2: Mismatch 25 Ohms

- Instrument case
Operating instructions

Professional Calibration Kit



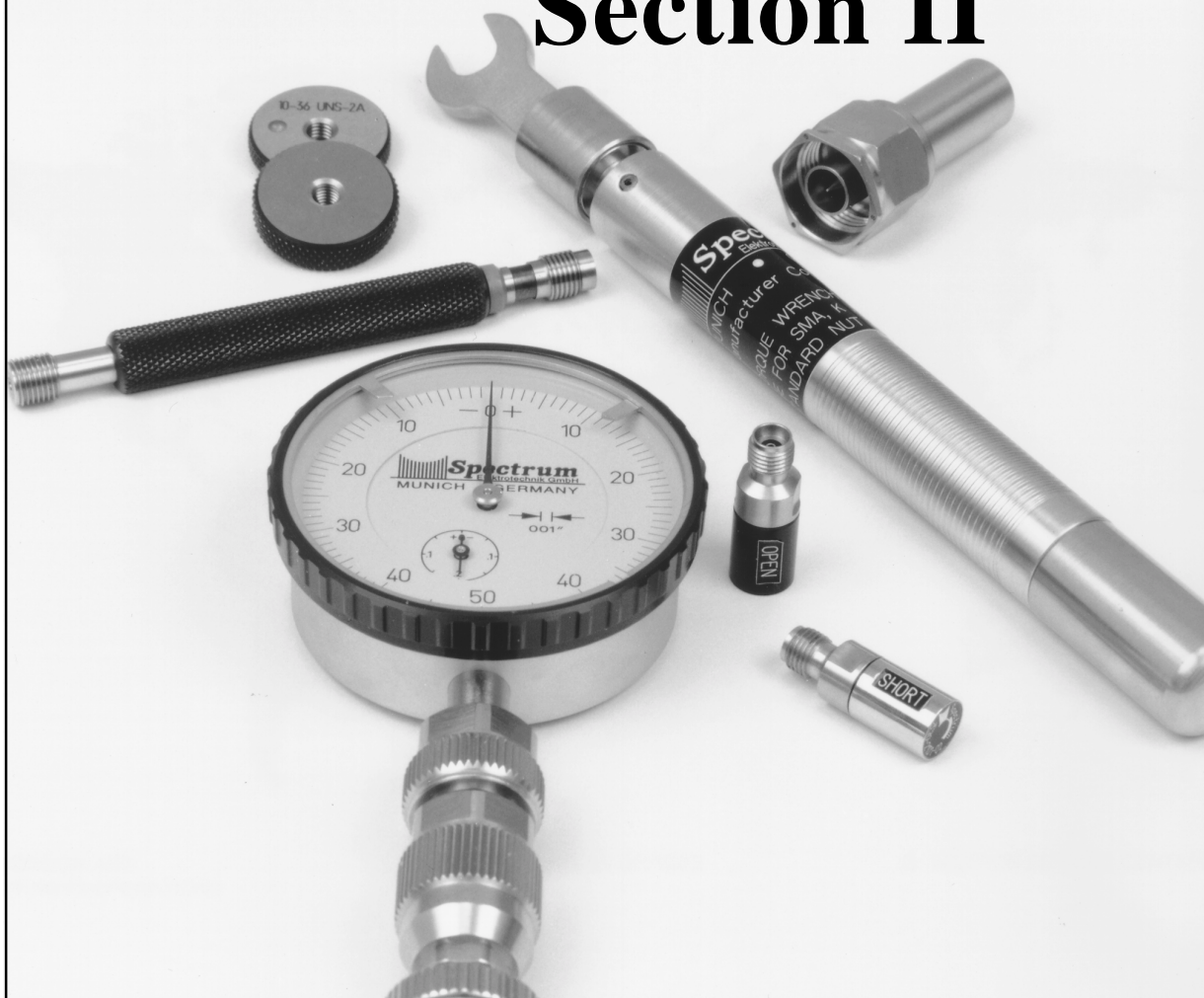
Description of Equipment Provided

Professional Calibration Kit

- 1: Airline 50 Ohms
2: Mismatch 25 Ohms
3: Torque wrench

- 4: Set of Double ended wrenches
Instrument case
Operating instructions

Section II



Calibration Components

1. Opens-Shorts-Loads & Throughlines	47
2. Connector Interface Gauges	75
3. Torque Wrenches	89
4. Thread Limit Gauges	93
5. Instrument Grade Adapters	97

INTRODUCTION: Most commonly as Calibration Components are known the Opens, Shorts, Loads, and the Throughlines. Other necessities, useful before or during the calibration sequence and the testing, are Connector Interface Gauges, Torque Wrenches, Thread Limit Gauges and Instrument Grade Adapters. Spectrum Elektrotechnik GmbH does supply all these components.

OPENS-SHORTS-LOADS-THROUGHLINES: Spectrum Elektrotechnik GmbH offers besides the components, supplied in calibration kits, a variety of Opens, Shorts, Loads and Throughlines that can be purchased individually and are available in most connector series. The Opens and Shorts, not furnished in Kits are not necessarily supplied with the calibration properties of the components. They might be available with the subject data, and even on disc, but this has to be verified with our sales staff, or with engineering .

The new generation calibration components are colour coded. Bright shiny nickel was chosen for the Shorts, easy to remember, as an electrical short circuit would cause bright lightning. Black endcaps were selected for the Opens, as an open electrical circuit is usually rather unexciting, or black. Gold plating was chosen for the Precision Terminations for convenience.

INTERFACE GAUGES: Before connecting any device to the network analyzer, the interfaces of its connectors have to be checked, to ensure that they meet the appropriate specification. Protruding interfaces may damage the mating connectors. Interfaces that are recessed below the allowed dimension will lead to useless test results.

TORQUE WRENCHES: For proper test results and long life of the connectors, the rules need to be obeyed. For each individual connector series a torque has been specified, a torque that ensures proper mating conditions, repeatable electrical performance and guarantees mechanically a long life of the connectors. Using a Torque Wrench guarantees that the connection is not too loose, it also ensures that the connection is not too tight, preventing possible connector damage and impaired electrical performance. Using the Torque Wrench also assures that all connections are equally tight, each time.

THREAD LIMIT GAUGES: Checking the thread of connectors on units under test and the thread of adapters to be used during testing, may avoid ruining expensive calibration components or connectors at test equipment. Out of limits thread may damage the connectors of mating components. Spectrum Elektrotechnik GmbH offers a comprehensive line of thread limit gauges to check the thread on a "GO" / "NO GO" basis.

INSTRUMENT GRADE ADAPTERS: For certain applications adapters are needed, as the test ports of the network analyzer may not have the connector configuration desired, or the appropriate test cable is not available. Spectrum Elektrotechnik GmbH offers a wide variety of in-series and between-series adapters, and test ports adapters, the NMD adapters, which have a larger than standard coupling nut for easy and direct connection with the test port of the network analyzer.

PHASE STABLE CABLE ASSEMBLIES: Spectrum Elektrotechnik GmbH manufactures a series of Phase Stable Assemblies, fitted at one side with the appropriate NMD connector for direct connection with the Scalar Network Analyzers of Hewlett Packard and Wiltron, and with either 2.4mm, 2.9mm, 3.5mm, SMP, N, or TNC, etc., males or females, at the other end of the Assembly. These Cable Assemblies are shown in section V of this Handbook.

Section II.1

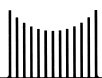


Calibration Components

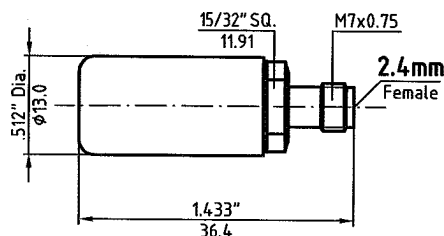
1. Opens-Shorts-Loads & Throughlines	47
2. Connector Interface Gauges	75
3. Torque Wrenches	89
4. Thread Limit Gauges	93
5. Instrument Grade Adapters	97

Selection Chart: Terminations, Opens & Shorts

Calibration Component Type	Sort	Frequency Range	Page
2.4mm	Terminations	DC - 50.0 GHz	49
	Opens		
	Shorts		50
	Throughlines		
3.5mm	Terminations	DC - 35.0 GHz	51
	Opens		
	Shorts		52
	Throughlines		
7mm	Termination	DC - 18.0 GHz	53
	Open		
	Short		54
	Throughlines		
7/16	Terminations	DC - 7.5 GHz	55
	Opens		
	Shorts		56
	Throughlines		
BNC	Terminations	DC - 4.0 GHz	57
	Opens		
	Shorts		58
	Throughlines		
K*	Terminations	DC - 40.0 GHz	59
	Opens		
	Shorts		60
	Throughlines		
N	Terminations	DC - 18.0 GHz	61
	Opens		
	Shorts		62
	Throughlines		
SC	Terminations	DC - 10.0 GHz	63
	Opens		
	Shorts		64
	Throughlines		
SMA	Terminations	DC - 18.0 GHz	65
	Opens		
	Shorts		66
	Throughlines		
SMP Test Components	Terminations	DC - 18.0 GHz and DC - 40.0 GHz	67
	Opens		
	Shorts		68
	Throughlines		
SPM	Terminations	DC - 18.0 GHz	69
	Opens		
	Shorts		70
	Throughlines		
TNC	Terminations	DC - 18.0 GHz	71
	Opens		
	Shorts		72
	Throughlines		
TNX	Terminations	DC - 18.0 GHz	73
	Opens		
	Shorts		74
	Throughlines		



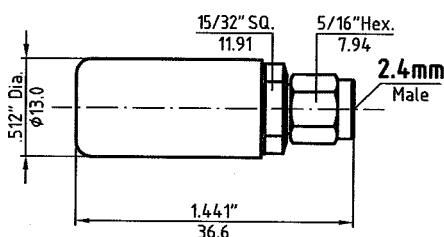
High Precision Coaxial Termination



Connector Body is stainless steel, Cap is gold plated.

2.4mm Female Termination	
Part No.	TE-0050-HF00
Frequency Range	DC - 50.0 GHz
Impedance	50 Ohms
Max. VSWR	1.12 : 1
Max. Average Power	0.5 Watts
Weight in g	25
Temperature Range	-54°C to + 85°C

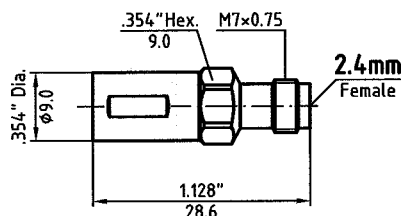
High Precision Coaxial Termination



Connector Body is stainless steel, Cap is gold plated.

2.4mm Male Termination	
Part No.	TE-0050-HM00
Frequency Range	DC - 50.0 GHz
Impedance	50 Ohms
Max. VSWR	1.12 : 1
Max. Average Power	0.5 Watts
Weight in g	26
Temperature Range	-54°C to + 85°C

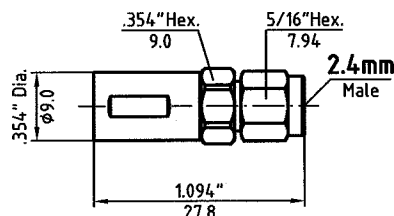
Short/Open Circuit Termination



Short: Connector Body is stainless steel, Cap is nickel plated.
Open: Connector Body is stainless steel, Cap is black anodized.

2.4mm Female Open/Short Circuit Terminations			
Part No.	Description	Frequency Range	Weight (g)
1730-2102-02	Short Circuit	DC - 50.0 GHz	In Development
1740-2102-02	Open Circuit		In Development
Impedance		50 Ohms	
Temperature Range		-54°C to +85°C	

Short/Open Circuit Termination

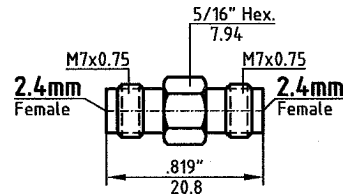


Short: Connector Body is stainless steel, Cap is nickel plated.
Open: Connector Body is stainless steel, Cap is black anodized.

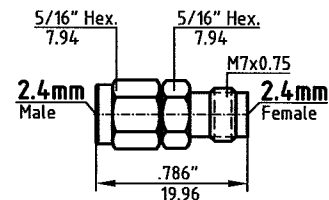
2.4mm Male Open/Short Circuit Terminations			
Part No.	Description	Frequency Range	Weight (g)
1730-1102-02	Short Circuit	DC - 50.0 GHz	In Development
1740-1102-02	Open Circuit		In Development
Impedance		50 Ohms	
Temperature Range		-54°C to +85°C	

Dimensions shown are inches over millimeters. Standard connector parts are made from stainless steel passivated. The housings are made from stainless steel passivated, brass gold plated, brass nickel plated, aluminum anodized, depending on the type of termination or its application.

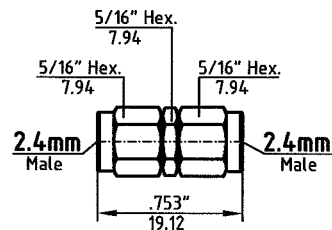
Part - No.	8801-HFHF-02
Connectors	2.4mm-F to 2.4mm-F
Frequency	DC - 50.0 GHz
VSWR max.	1.20 : 1



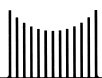
Part - No.	8801-HFHM-02
Connectors	2.4mm-F to 2.4mm-M
Frequency	DC - 50.0 GHz
VSWR max.	1.20 : 1



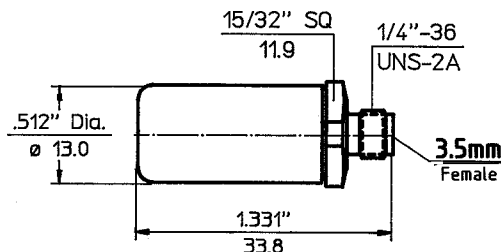
Part - No.	8801-HMHM-02
Connectors	2.4mm-M to 2.4mm-M
Frequency	DC - 50.0 GHz
VSWR max.	1.20 : 1



Adapters with Part Numbers starting **8801** are of same electrical length within the connector series. Dimensions shown are inches over millimeters. Standard connector finish is passivated stainless steel. Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, where applicable.



High Precision Coaxial Terminations

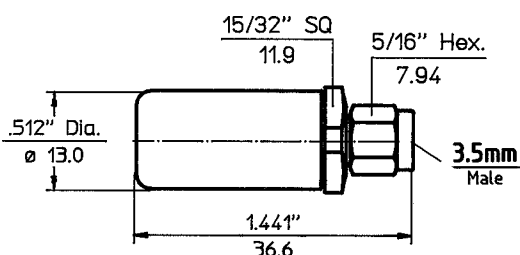


Connector Body is stainless steel, Cap is gold plated.

3.5mm Female HIGH PRECISION TERMINATIONS

Part No.	Frequency Range	VSWR max.	Power (W)
TE-0035-9200	DC - 35.0 GHz	1.10 : 1	0.5 Watts
TE-0026-92P1	DC - 26.5 GHz	1.07 : 1	1 Watt
TE-0004-92P1	DC - 4.0 GHz	1.01 : 1	1 Watt
Impedance		50 Ohms	
Weight in g		24	
Temperature Range		-54°C to +85°C	

High Precision Coaxial Terminations

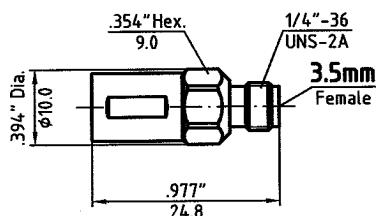


Connector Body is stainless steel, Cap is gold plated.

3.5mm Male HIGH PRECISION TERMINATIONS

Part No.	Frequency Range	VSWR max.	Power (W)
TE-0035-9100	DC - 35.0 GHz	1.10 : 1	0.5 Watts
TE-0026-91P1	DC - 26.5 GHz	1.07 : 1	1 Watt
TE-0004-91P1	DC - 4.0 GHz	1.01 : 1	1 Watt
Impedance		50 Ohms	
Weight in g		25	
Temperature Range		-54°C to +85°C	

Short/Open Circuit Terminations

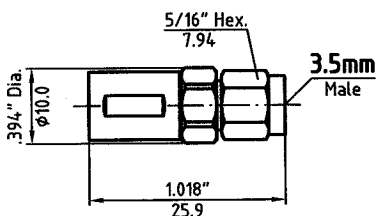


Short: Connector Body is stainless steel, Cap is nickel plated.
Open: Connector Body is stainless steel, Cap is black anodized.

3.5mm Female Open/Short Circuit Terminations

Part No.	Description	Frequency Range	Weight (g)
2130-2102-02	Short Circuit	DC - 26.5 GHz	In Development
2140-2102-02	Open Circuit		In Development
Impedance		50 Ohms	
Temperature Range		-54°C to +85°C	

Short/Open Circuit Terminations

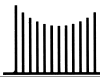


Short: Connector Body is stainless steel, Cap is nickel plated.
Open: Connector Body is stainless steel, Cap is black anodized.

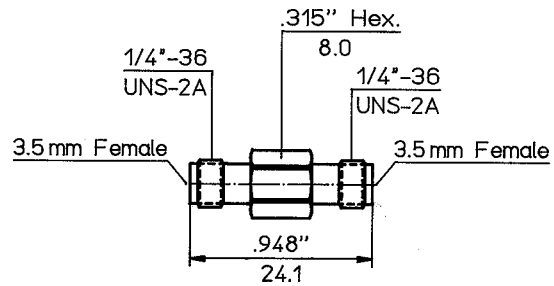
3.5mm Male Open/Short Circuit Terminations

Part No.	Description	Frequency Range	Weight (g)
2130-1102-02	Short Circuit	DC - 26.5 GHz	In Development
2140-1102-02	Open Circuit		In Development
Impedance		50 Ohms	
Temperature Range		-54°C to +85°C	

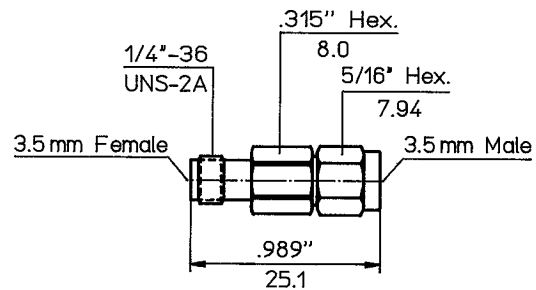
Dimensions shown are inches over millimeters. Standard connector parts are made from stainless steel passivated. The housings are made from stainless steel passivated, brass gold plated, brass nickel plated, aluminum anodized, depending on the type of termination or its application.



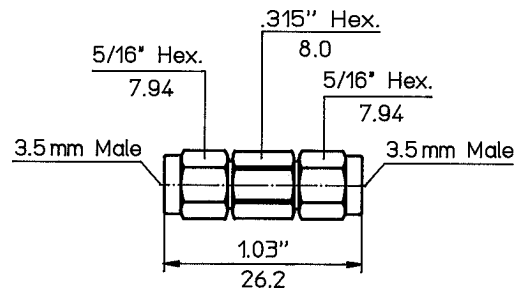
Part - No.	8801-9292-02
Connectors	3.5mm-F to 3.5mm-F
Frequency	DC - 35.0 GHz
VSWR max.	1.15 : 1



Part - No.	8801-9192-02
Connectors	3.5mm-M to 3.5mm-F
Frequency	DC - 35.0 GHz
VSWR max.	1.15 : 1

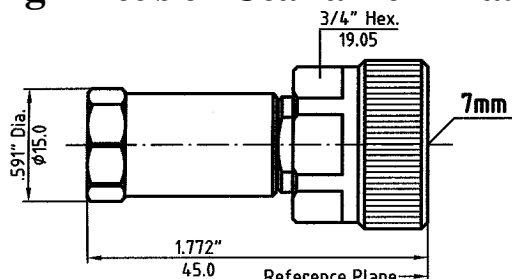


Part - No.	8801-9191-02
Connectors	3.5mm-M to 3.5mm-M
Frequency	DC - 35.0 GHz
VSWR max.	1.15 : 1



Adapters with Part Numbers starting **8801** are of same electrical length within the connector series. Dimensions shown are inches over millimeters. Standard connector finish is passivated stainless steel. Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, where applicable.

High Precision Coaxial Termination

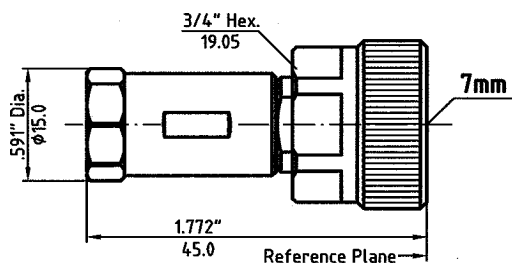


Outer Conductor and Cap are gold plated, coupling nut is stainless steel.

7mm HIGH PRECISION TERMINATION

Part No.	TE-0018-90P1
Frequency Range	DC - 18.0 GHz
Impedance	50 Ohms
Max. VSWR	1.05 : 1
Max. Average Power	1 Watt
Weight in g	58
Temperature Range	-54°C to + 85°C

Short/Open Circuit Termination



Short: Outer Conductor is gold plated, coupling nut is stainless steel, Cap is nickel plated.

Open: Outer Conductor is gold plated, coupling nut is stainless steel, Cap is black anodized.

7mm Open/Short Circuit Terminations

Part No.	Description	Frequency Range	Weight (g)
9030-1101-02	Short Circuit	DC - 18.0 GHz	70
9040-1101-02	Open Circuit		47
Impedance		50 Ohms	
Temperature Range		-54°C to +85°C	

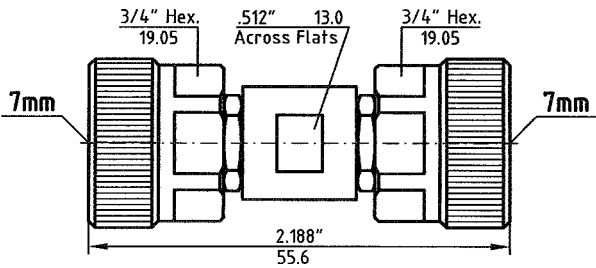
Dimensions shown are inches over millimeters. Standard connector parts are made from stainless steel passivated. The housings are made from stainless steel passivated, brass gold plated, brass nickel plated, aluminum anodized, depending on the type of termination or its application.

7mm Calibration Components, Throughlines



The Center Conductor of the 7 mm Connector is supplied with 4 slots. If you require 6 slots, Part Number changes to: **8001 - 9696 - 03**

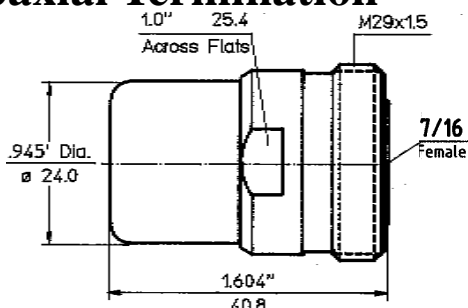
Part - No.	8001-9090-03
Connectors	7mm to 7mm
Frequency	DC - 18.0 GHz
VSWR max.	1.06 : 1



Dimensions shown are inches over millimeters. Standard connector finish is passivated stainless steel. Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, where applicable.

1ceten1.pmf6

Coaxial Termination

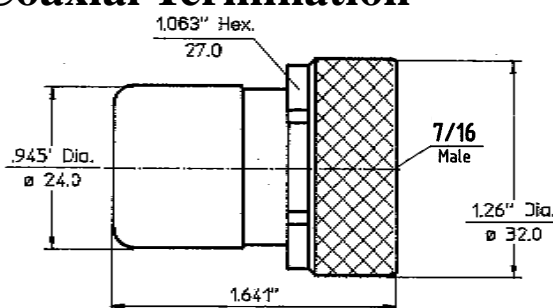


Connector Body is stainless steel, Cap is gold plated.

7/16 Female Termination

Part No.	TE-0010-7601
Frequency Range	DC - 7.5 GHz
Impedance	50 Ohms
Max. VSWR	1.10 : 1
Max. Average Power	1 Watt
Weight in g	118
Temperature Range	-54°C to + 115°C

Coaxial Termination

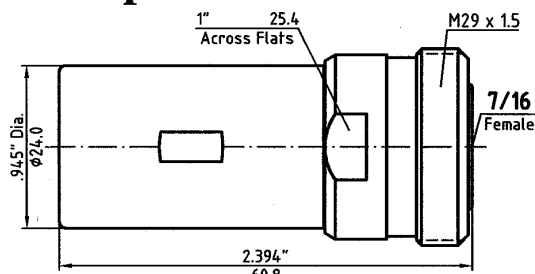


Connector Body is stainless steel, Cap is gold plated.

7/16 Male Termination

Part No.	TE-0010-7501
Frequency Range	DC - 7.5 GHz
Impedance	50 Ohms
Max. VSWR	1.10 : 1
Max. Average Power	1 Watt
Weight in g	123
Temperature Range	-54°C to + 115°C

Short/Open Circuit Terminations

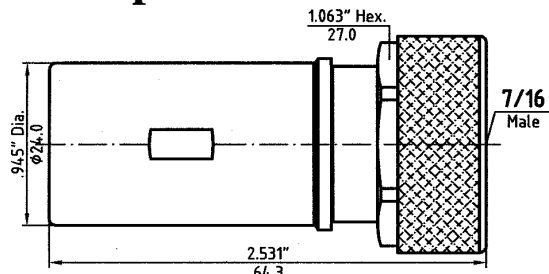


Short : Connector Body is stainless steel, Cap is nickel plated.
Open: Connector Body is stainless steel, Cap is black anodized.

7/16 Female Open/Short Circuit Terminations

Part No.	Description	Frequency Range	Weight (g)
7530-2101-02	Short Circuit	DC - 7.5 GHz	160
7540-2101-02	Open Circuit		75
Impedance		50 Ohms	
Temperature Range		-54°C to +85°C	

Short/Open Circuit Terminations



Short : Connector Body is stainless steel, Cap is nickel plated.
Open: Connector Body is stainless steel, Cap is black anodized.

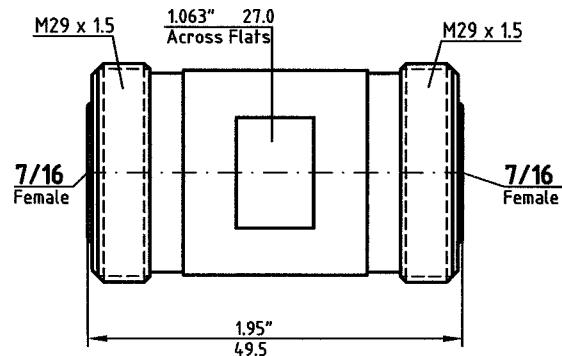
7/16 Male Open/Short Circuit Terminations

Part No.	Description	Frequency Range	Weight (g)
7530-1101-02	Short Circuit	DC - 7.5 GHz	165
7540-1101-02	Open Circuit		80
Impedance		50 Ohms	
Temperature Range		-54°C to +85°C	

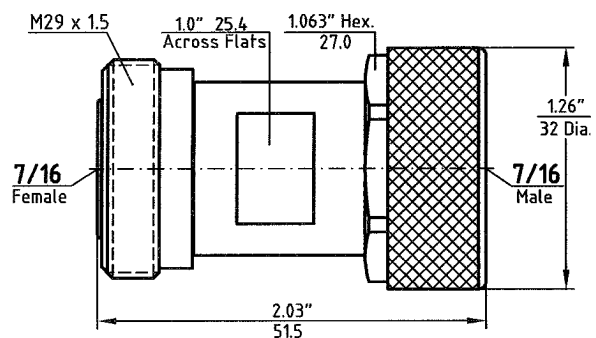
Dimensions shown are inches over millimeters. Standard connector parts are made from stainless steel passivated. The housings are made from stainless steel passivated, brass gold plated, brass nickel plated, aluminum anodized, depending on the type of termination or its application.

Type 7/16 Calibration Components, Throughlines

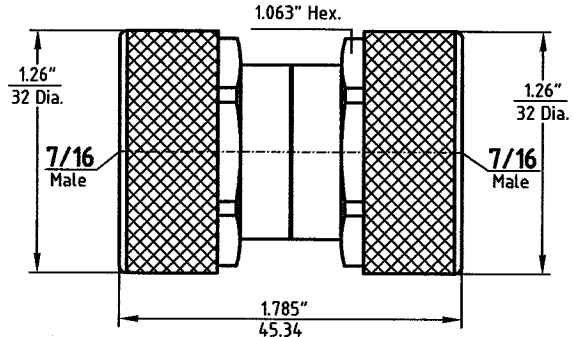
Part - No.	8001-7676-02
Connectors	7/16-F to 7/16-F
Frequency	DC - 7.5 GHz
VSWR max.	$1.06 + 0.005 \times f \text{ (GHz)}$



Part - No.	8001-7576-02
Connectors	7/16-M to 7/16-F
Frequency	DC - 7.5 GHz
VSWR max.	$1.06 + 0.005 \times f \text{ (GHz)}$

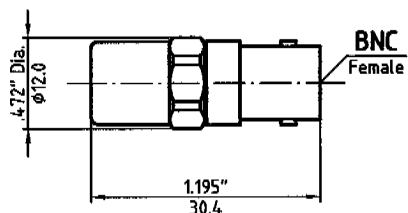


Part - No.	8001-7575-02
Connectors	7/16-M to 7/16-M
Frequency	DC - 7.5 GHz
VSWR max.	$1.06 + 0.005 \times f \text{ (GHz)}$



Dimensions shown are inches over millimeters. Standard connector finish is passivated stainless steel. Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, where applicable.

High Precision Coaxial Termination

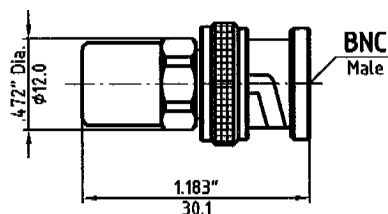


Connector Body is stainless steel, Cap is gold plated.

BNC Female HIGH PRECISION TERMINATION

Part No.	TE-0004-81P1
Frequency Range	DC - 4.0 GHz
Impedance	50 Ohms
Max. VSWR	1.05 : 1
Max. Average Power	1 Watt
Weight in g	14
Temperature Range	-54°C to + 115°C

High Precision Coaxial Termination

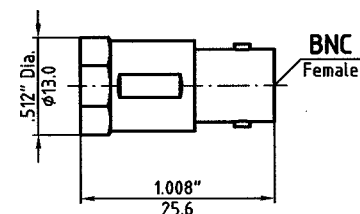


Connector Body is stainless steel, Cap is gold plated.

BNC Male HIGH PRECISION TERMINATION

Part No.	TE-0004-71P1
Frequency Range	DC - 4.0 GHz
Impedance	50 Ohms
Max. VSWR	1.05 : 1
Max. Average Power	1 Watt
Weight in g	19
Temperature Range	-54°C to + 115°C

Short/Open Circuit Termination

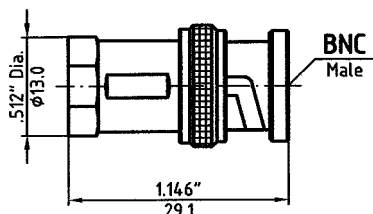


Short : Connector Body is stainless steel, Cap is nickel plated.
Open: Connector Body is stainless steel, Cap is black anodized.

BNC Female Open/Short Circuit Terminations

Part No.	Description	Frequency Range	Weight (g)
4130-2101-02	Short Circuit	DC - 4.0 GHz	10
4140-2101-02	Open Circuit		7
Impedance		50 Ohms	
Temperature Range		-54°C to +85°C	

Short/Open Circuit Termination



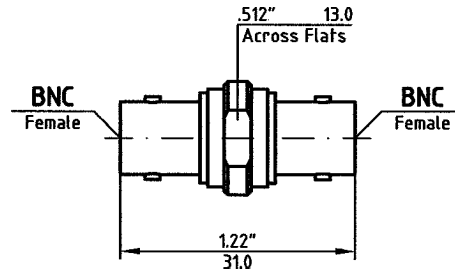
Short : Connector Body is stainless steel, Cap is nickel plated.
Open: Connector Body is stainless steel, Cap is black anodized.

BNC Male Open/Short Circuit Terminations

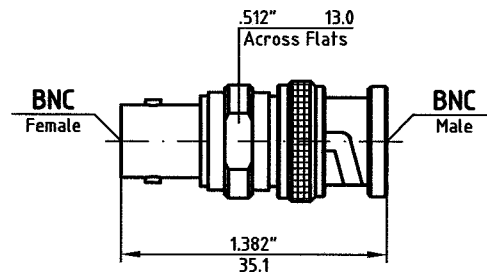
Part No.	Description	Frequency Range	Weight (g)
4130-1101-02	Short Circuit	DC - 4.0 GHz	13
4140-1101-02	Open Circuit		11
Impedance		50 Ohms	
Temperature Range		-54°C to +85°C	

Dimensions shown are inches over millimeters. Standard connector parts are made from stainless steel passivated. The housings are made from stainless steel passivated, brass gold plated, brass nickel plated, aluminum anodized, depending on the type of termination or its application.

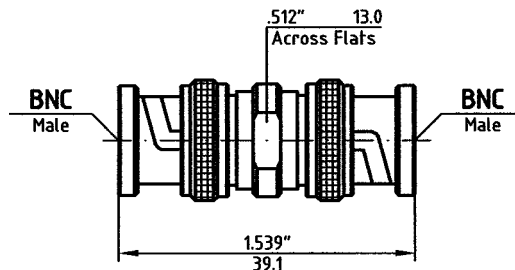
Part - No.	8001-8181-02
Connectors	BNC-F to BNC-F
Frequency	DC - 4.0 GHz
VSWR max.	$1.06 + 0.01 \times f \text{ (GHz)}$



Part - No.	8001-7181-02
Connectors	BNC-M to BNC-F
Frequency	DC - 4.0 GHz
VSWR max.	$1.06 + 0.01 \times f \text{ (GHz)}$

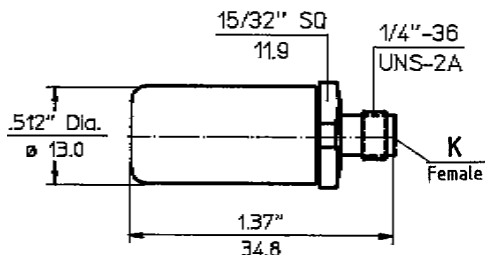


Part - No.	8001-7171-02
Connectors	BNC-M to BNC-M
Frequency	DC - 4.0 GHz
VSWR max.	$1.06 + 0.01 \times f \text{ (GHz)}$



Dimensions shown are inches over millimeters. Standard connector finish is passivated stainless steel. Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, where applicable.

High Precision Coaxial Termination

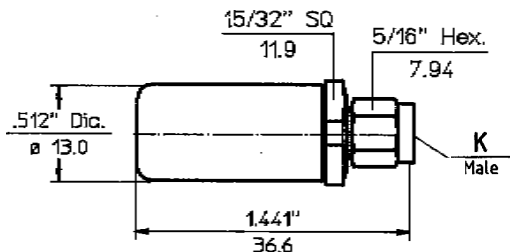


Connector Body is stainless steel, Cap is gold plated.

K* Female HIGH PRECISION TERMINATION

Part No.	TE-0040-KF00
Frequency Range	DC - 40.0 GHz
Impedance	50 Ohms
Max. VSWR	1.10 : 1
Max. Average Power	0.5 Watts
Weight in g	24
Temperature Range	-54°C to + 85°C

High Precision Coaxial Termination

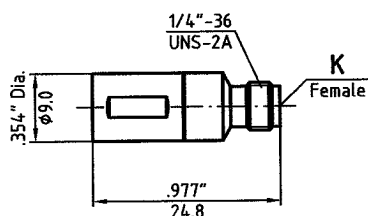


Connector Body is stainless steel, Cap is gold plated.

K* Male HIGH PRECISION TERMINATION

Part No.	TE-0040-KM00
Frequency Range	DC - 40.0 GHz
Impedance	50 Ohms
Max. VSWR	1.10 : 1
Max. Average Power	0.5 Watts
Weight in g	25
Temperature Range	-54°C to + 85°C

Short/Open Circuit Termination

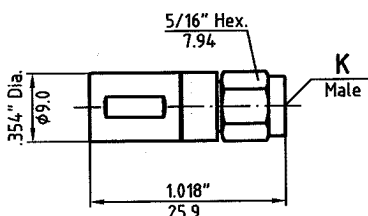


Short : Connector Body is stainless steel, Cap is nickel plated.
Open: Connector Body is stainless steel, Cap is black anodized.

K* Female Open/Short Circuit Terminations

Part No.	Description	Frequency Range	Weight (g)
1530-2101-02	Short Circuit	DC - 40.0 GHz	9
1540-2101-02	Open Circuit		5
Impedance		50 Ohms	
Temperature Range		-54°C to +85°C	

Short/Open Circuit Termination



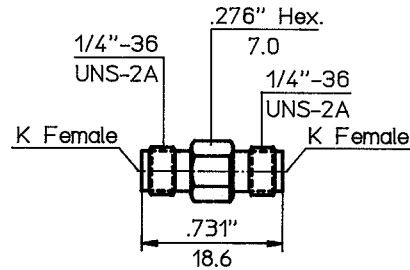
Short : Connector Body is stainless steel, Cap is nickel plated.
Open: Connector Body is stainless steel, Cap is black anodized.

K* Male Open/Short Circuit Terminations

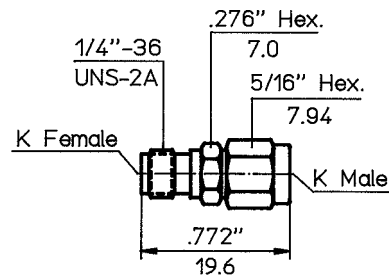
Part No.	Description	Frequency Range	Weight (g)
1530-1101-02	Short Circuit	DC - 40.0 GHz	11
1540-1101-02	Open Circuit		6
Impedance		50 Ohms	
Temperature Range		-54°C to +85°C	

Dimensions shown are inches over millimeters. Standard connector parts are made from stainless steel passivated. The housings are made from stainless steel passivated, brass gold plated, brass nickel plated, aluminum anodized, depending on the type of termination or its application.

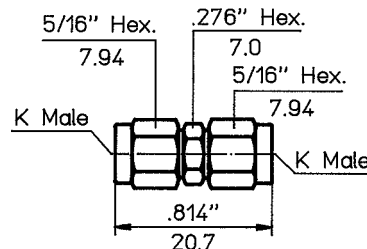
Part - No.	8801-KFKF-02
Connectors	K*-Fem. to K*-Fem.
Frequency	DC - 40.0 GHz
VSWR max.	1.15 : 1



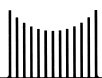
Part - No.	8801-KFKM-02
Connectors	K*-Male to K*-Fem.
Frequency	DC - 40.0 GHz
VSWR max.	1.15 : 1



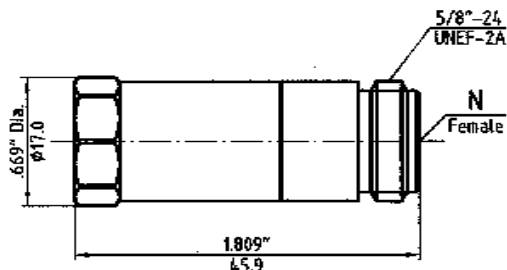
Part - No.	8801-KMKM-02
Connectors	K*-Male to K*-Male
Frequency	DC - 40.0 GHz
VSWR max.	1.15 : 1



Adapters with Part Numbers starting **8801** are of same electrical length within the connector series. Dimensions shown are inches over millimeters. Standard connector finish is passivated stainless steel. Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, where applicable.



High Precision Coaxial Termination

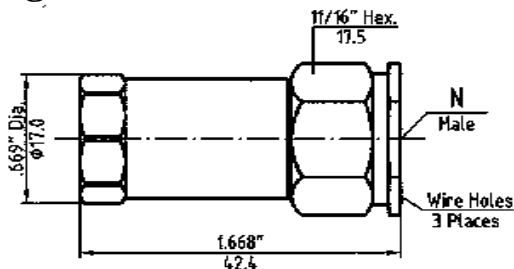


Connector Body is stainless steel, Cap is gold plated.

N Female HIGH PRECISION TERMINATION

Part No.	TE-0018-61P1
Frequency Range	DC - 18.0 GHz
Impedance	50 Ohms
Max. VSWR	1.07 : 1
Max. Average Power	1 Watt
Weight in g	55
Temperature Range	-54°C to + 85°C

High Precision Coaxial Termination

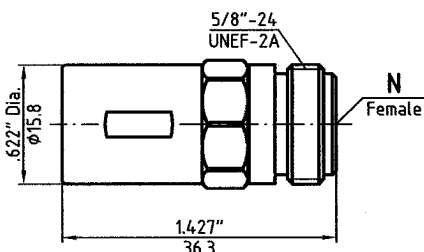


Connector Body is stainless steel, Cap is gold plated.

N Male HIGH PRECISION TERMINATION

Part No.	TE-0018-51P1
Frequency Range	DC - 18.0 GHz
Impedance	50 Ohms
Max. VSWR	1.07 : 1
Max. Average Power	1 Watt
Weight in g	48
Temperature Range	-54°C to + 85°C

Short/Open Circuit Terminations

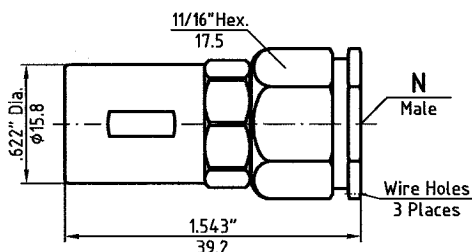


Short : Connector Body is stainless steel, Cap is nickel plated.
Open: Connector Body is stainless steel, Cap is black anodized.

N Female Open/Short Circuit Terminations

Part No.	Description	Frequency Range	Weight (g)
3030-2102-02	Short Circuit	DC - 18.0 GHz	In Development
3040-2102-02	Open Circuit		In Development
Impedance		50 Ohms	
Temperature Range		-54°C to +85°C	

Short/Open Circuit Terminations



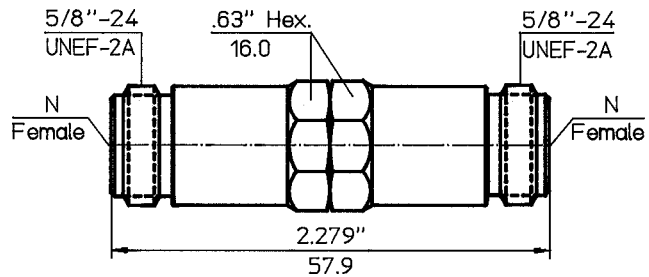
Short : Connector Body is stainless steel, Cap is nickel plated.
Open: Connector Body is stainless steel, Cap is black anodized.

N Male Open/Short Circuit Terminations

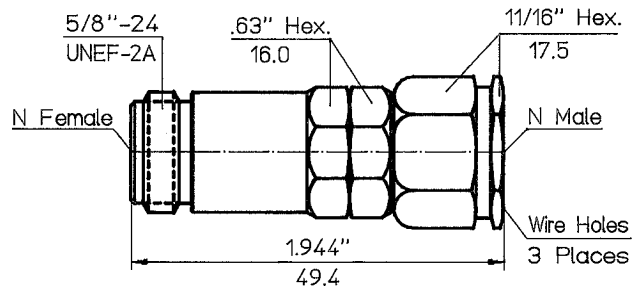
Part No.	Description	Frequency Range	Weight (g)
3030-1102-02	Short Circuit	DC - 18.0 GHz	In Development
3040-1102-02	Open Circuit		In Development
Impedance		50 Ohms	
Temperature Range		-54°C to +85°C	

Dimensions shown are inches over millimeters. Standard connector parts are made from stainless steel passivated. The housings are made from stainless steel passivated, brass gold plated, brass nickel plated, aluminum anodized, depending on the type of termination or its application.

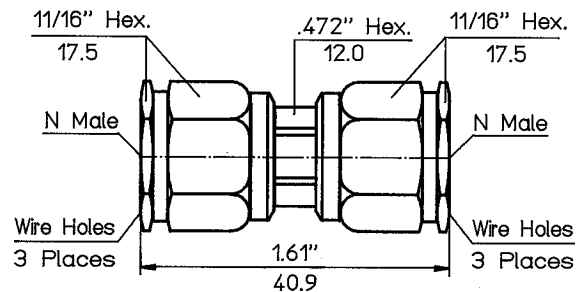
Part - No.	8801-6161-02
Connectors	N-Fem. to N-Fem.
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f \text{ (GHz)}$



Part - No.	8801-5161-02
Connectors	N-Male to N-Fem.
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f \text{ (GHz)}$

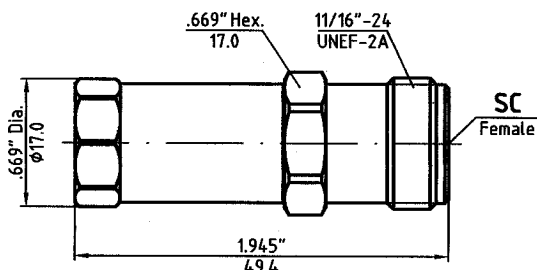


Part - No.	8801-5151-02
Connectors	N-Male to N-Male
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f \text{ (GHz)}$



Adapters with Part Numbers starting **8801** are of same electrical length within the connector series. Dimensions shown are inches over millimeters. Standard connector finish is passivated stainless steel. Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, where applicable.

High Precision Coaxial Termination

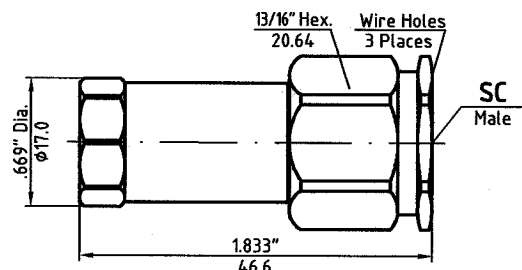


Connector Body is stainless steel.

SC Female HIGH PRECISION TERMINATION

Part No.	TE-0010-79P1
Frequency Range	DC - 10.0 GHz
Impedance	50 Ohms
Max. VSWR	1.15 : 1
Max. Average Power	1 Watt
Weight in g	56
Temperature Range	-54°C to + 115°C

High Precision Coaxial Termination

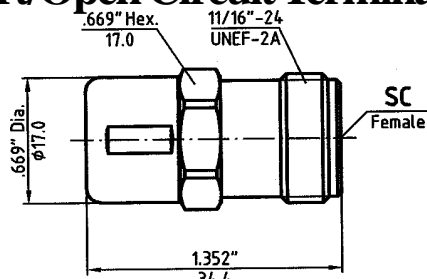


Connector Body is stainless steel.

SC Male HIGH PRECISION TERMINATION

Part No.	TE-0010-80P1
Frequency Range	DC - 10.0 GHz
Impedance	50 Ohms
Max. VSWR	1.15 : 1
Max. Average Power	1 Watt
Weight in g	60
Temperature Range	-54°C to + 115°C

Short/Open Circuit Terminations

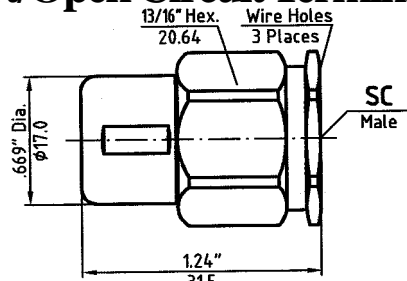


Short: Connector Body is stainless steel, Cap is nickel plated.
Open: Connector Body is stainless steel, Cap is black anodized.

SC Female Open/Short Circuit Terminations

Part No.	Description	Frequency Range	Weight (g)
6030-2101-02	Short Circuit	DC - 10.0 GHz	34
6040-2101-02	Open Circuit		In Development
Impedance		50 Ohms	
Temperature Range		-54°C to +85°C	

Short/Open Circuit Terminations



Short: Connector Body is stainless steel, Cap is nickel plated.
Open: Connector Body is stainless steel, Cap is black anodized.

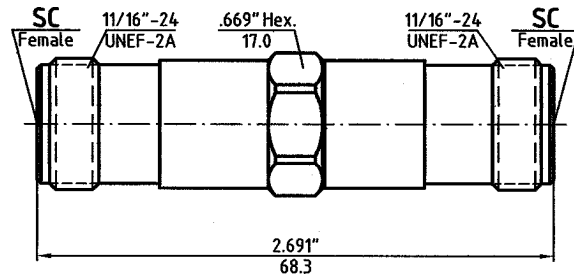
SC Male Open/Short Circuit Terminations

Part No.	Description	Frequency Range	Weight (g)
6030-1101-02	Short Circuit	DC - 10.0 GHz	30
6040-1101-02	Open Circuit		In Development
Impedance		50 Ohms	
Temperature Range		-54°C to +85°C	

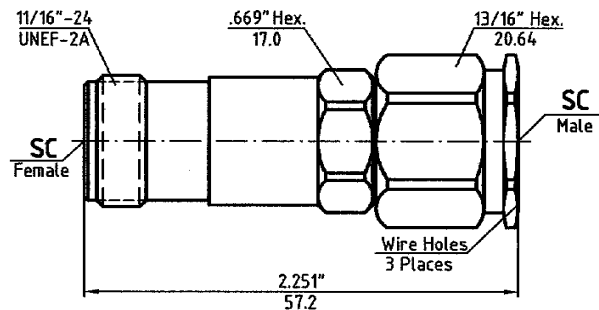
Dimensions shown are inches over millimeters. Standard connector parts are made from stainless steel passivated. The housings are made from stainless steel passivated, brass gold plated, brass nickel plated, aluminum anodized, depending on the type of termination or its application.

Type SC Calibration Components, Throughlines

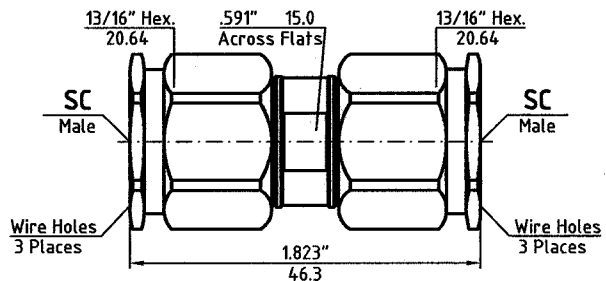
Part - No.	8801-7979-02
Connectors	SC-Fem. to SC-Fem.
Frequency	DC - 10.0 GHz
VSWR max.	$1.05 + 0.01 \times f \text{ (GHz)}$



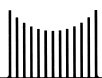
Part - No.	8801-7980-02
Connectors	SC-Fem. to SC-Male
Frequency	DC - 10.0 GHz
VSWR max.	$1.05 + 0.01 \times f \text{ (GHz)}$



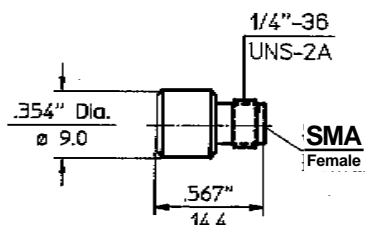
Part - No.	8801-8080-02
Connectors	SC-Male to SC-Male
Frequency	DC - 10.0 GHz
VSWR max.	$1.05 + 0.01 \times f \text{ (GHz)}$



Adapters with Part Numbers starting **8801** are of same electrical length within the connector series. Dimensions shown are inches over millimeters. Standard connector finish is passivated stainless steel. Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, where applicable.



High Precision Coaxial Termination

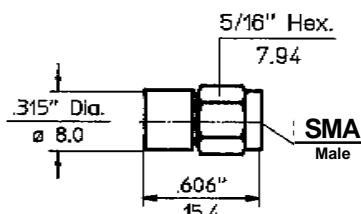


Connector Body and Cap are stainless steel passivated.

SMA Female HIGH PRECISION TERMINATION

Part No.	TE-0020-21P0
Frequency Range	DC - 20.0 GHz
Impedance	50 Ohms
Max. VSWR	1.05 : 1 DC - 12.4 GHz 1.10 : 1 12.4 - 18.0 GHz 1.15 : 1 18.0 - 20.0 GHz
Max. Average Power	0.5 Watts
Weight in g	4
Temperature Range	-54°C to + 115°C

Coaxial Termination

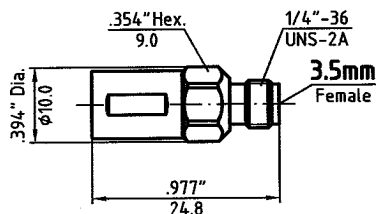


Connector Body and Cap are stainless steel passivated.

SMA Male Termination

Part No.	TE-0020-1100
Frequency Range	DC - 20.0 GHz
Impedance	50 Ohms
Max. VSWR	1.10 : 1
Max. Average Power	0.5 Watts
Weight in g	4
Temperature Range	-54°C to + 85°C

Short/Open Circuit Terminations

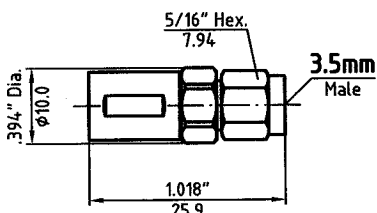


Short: Connector Body is stainless steel, Cap is nickel plated.
Open: Connector Body is stainless steel, Cap is black anodized.

3.5mm Female Open/Short Circuit Terminations

Part No.	Description	Frequency Range	Weight (g)
2130-2102-02	Short Circuit	DC - 26.5 GHz	In Development
2140-2102-02	Open Circuit		In Development
Impedance		50 Ohms	
Temperature Range		-54°C to +85°C	

Short/Open Circuit Terminations



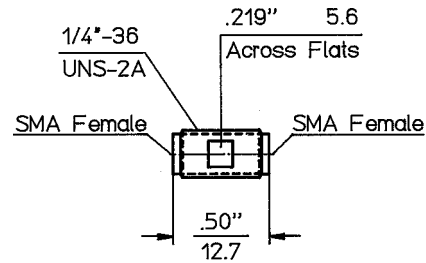
Short: Connector Body is stainless steel, Cap is nickel plated.
Open: Connector Body is stainless steel, Cap is black anodized.

3.5mm Male Open/Short Circuit Terminations

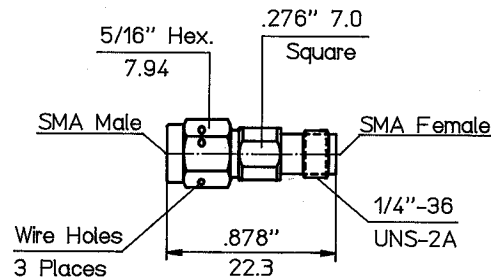
Part No.	Description	Frequency Range	Weight (g)
2130-1102-02	Short Circuit	DC - 26.5 GHz	In Development
2140-1102-02	Open Circuit		In Development
Impedance		50 Ohms	
Temperature Range		-54°C to +85°C	

Dimensions shown are inches over millimeters. Standard connector parts are made from stainless steel passivated. The housings are made from stainless steel passivated, brass gold plated, brass nickel plated, aluminum anodized, depending on the type of termination or its application.

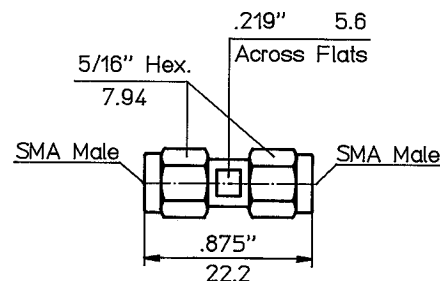
Part - No.	8001-2121-02
Connectors	SMA-F to SMA-F
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f \text{ (GHz)}$



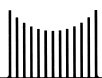
Part - No.	8001-1121-02
Connectors	SMA-M to SMA-F
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f \text{ (GHz)}$



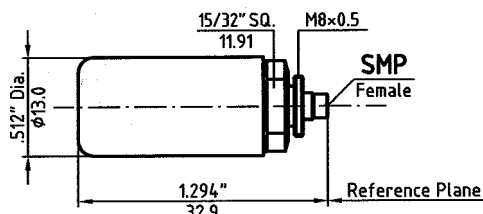
Part - No.	8001-1111-02
Connectors	SMA-M to SMA-M
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f \text{ (GHz)}$



Dimensions shown are inches over millimeters. Standard connector finish is passivated stainless steel. Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, where applicable.



Coaxial Terminations

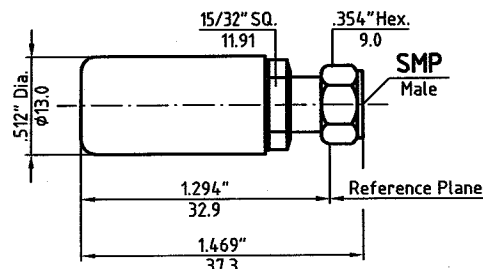


Connector Body is stainless steel, Cap is gold plated.

SMP Test Component Female Terminations

Part No.	Frequency Range	VSWR max.	Power (W)
TE-0018-TP01	DC - 18.0 GHz	1.10 : 1	0.5 Watt
TE-0040-TP01	DC - 40.0 GHz	1.15 : 1	
Impedance		50 Ohms	
Weight in g		23	
Temperature Range		-54°C to +85°C	

Coaxial Terminations

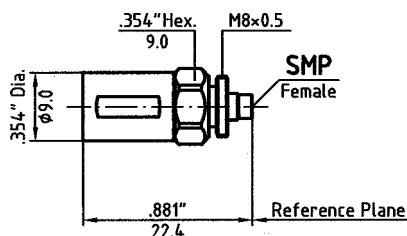


Connector Body is stainless steel, Cap is gold plated.

SMP Test Component Male Terminations

Part No.	Frequency Range	VSWR max.	Power (W)
TE-0018-TJ01	DC - 18.0 GHz	1.10 : 1	0.5 Watt
TE-0040-TJ01	DC - 40.0 GHz	1.15 : 1	
Impedance		50 Ohms	
Weight in g		25	
Temperature Range		-54°C to +85°C	

Short/Open Circuit Terminations

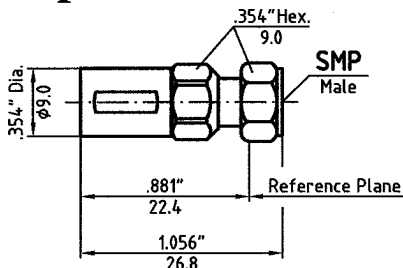


Short: Connector Body is stainless steel, Cap is nickel plated.
Open: Connector Body is stainless steel, Cap is black anodized.

SMP Female Open/Short Circuit Terminations

Part No.	Description	Frequency Range (GHz)	Weight (g)
1130-2101-02	Short Circuit	DC - 18.0	10
1130-2102-02		DC - 40.0	
1140-2102-02	Open Circuit	DC - 18.0	4
1140-2104-02		DC - 40.0	
Impedance		50 Ohms	
Temperature Range		-54°C to +85°C	

Short/Open Circuit Terminations



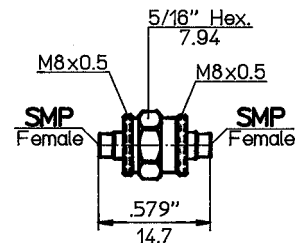
Short: Connector Body is stainless steel, Cap is nickel plated.
Open: Connector Body is stainless steel, Cap is black anodized.

SMP Male Open/Short Circuit Terminations

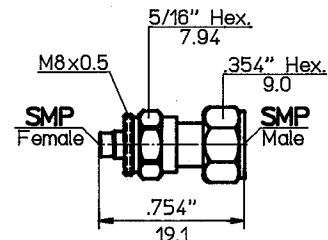
Part No.	Description	Frequency Range (GHz)	Weight (g)
1130-1101-02	Short Circuit	DC - 18.0	12
1130-1102-02		DC - 40.0	
1140-1102-02	Open Circuit	DC - 18.0	7
1140-1104-02		DC - 40.0	
Impedance		50 Ohms	
Temperature Range		-54°C to +85°C	

Dimensions shown are inches over millimeters. Standard connector parts are made from stainless steel passivated. The housings are made from stainless steel passivated, brass gold plated, brass nickel plated, aluminum anodized, depending on the type of termination or its application.

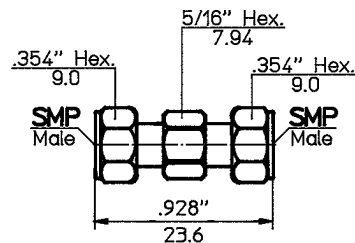
SMP-F to SMP-F		
Part No.	Frequency	VSWR
8801-TPTP-02	DC - 18.0	1.15 : 1
8802-TPTP-02	DC - 40.0	1.2 : 1



SMP-F to SMP-M		
Part No.	Frequency	VSWR
8801-TJTP-02	DC - 18.0	1.15 : 1
8802-TJTP-02	DC - 40.0	1.2 : 1

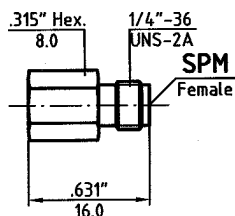


SMP-M to SMP-M		
Part No.	Frequency	VSWR
8801-TJTJ-02	DC - 18.0	1.15 : 1
8802-TJTJ-02	DC - 40.0	1.2 : 1



Adapters with Part Numbers starting **8801** are of same electrical length within the connector series. Dimensions shown are inches over millimeters. Standard connector finish is passivated stainless steel. Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, where applicable.

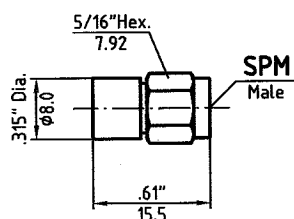
Coaxial Termination



Connector Body and end Cap are stainless steel passivated.

SPM Female Termination	
Part No.	TE-0018-PJ00
Frequency Range	DC - 18.0 GHz
Impedance	50 Ohms
Max. VSWR	1.15 : 1
Max. Average Power	0.5 Watts
Weight in g	5
Temperature Range	-54°C to + 115°C

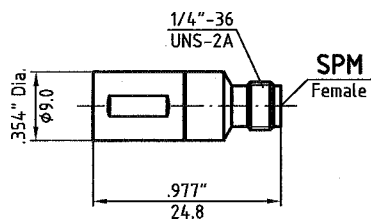
Coaxial Termination



Connector Body and end Cap are stainless steel passivated.

SPM Male Termination	
Part No.	TE-0018-PM00
Frequency Range	DC - 18.0 GHz
Impedance	50 Ohms
Max. VSWR	1.15 : 1
Max. Average Power	0.5 Watts
Weight in g	4
Temperature Range	-54°C to + 115°C

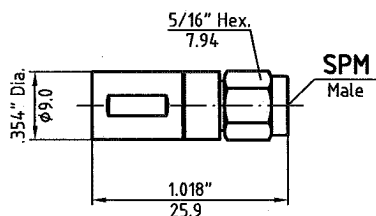
Short/Open Circuit Terminations



Short: Connector Body is stainless steel, Cap is nickel plated.
Open: Connector Body is stainless steel, Cap is black anodized.

SPM Female Open/Short Circuit Terminations			
Part No.	Description	Frequency Range	Weight (g)
2530-2101-02	Short Circuit	DC - 18.0 GHz	In Development
2540-2101-02	Open Circuit		In Development
Impedance		50 Ohms	
Temperature Range		-54°C to +85°C	

Short/Open Circuit Terminations

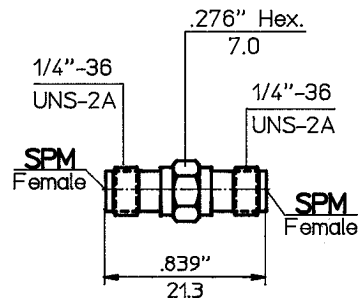


Short: Connector Body is stainless steel, Cap is nickel plated.
Open: Connector Body is stainless steel, Cap is black anodized.

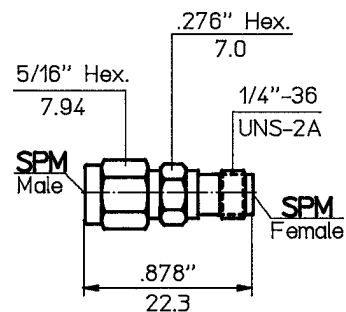
SPM Male Open/Short Circuit Terminations			
Part No.	Description	Frequency Range	Weight (g)
2530-1101-02	Short Circuit	DC - 18.0 GHz	In Development
2540-1101-02	Open Circuit		In Development
Impedance		50 Ohms	
Temperature Range		-54°C to +85°C	

Dimensions shown are inches over millimeters. Standard connector parts are made from stainless steel passivated. The housings are made from stainless steel passivated, brass gold plated, brass nickel plated, aluminum anodized, depending on the type of termination or its application.

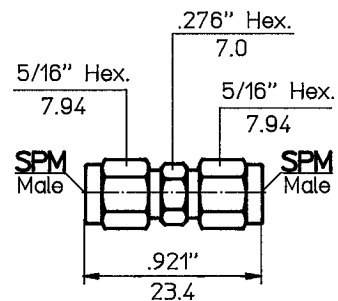
Part - No.	8801-PJPJ-02
Connectors	SPM-F to SPM-F
Frequency	DC - 18.0 GHz
VSWR max.	1.15 : 1



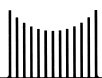
Part - No.	8801-PJPM-02
Connectors	SPM-F to SPM-M
Frequency	DC - 18.0 GHz
VSWR max.	1.15 : 1



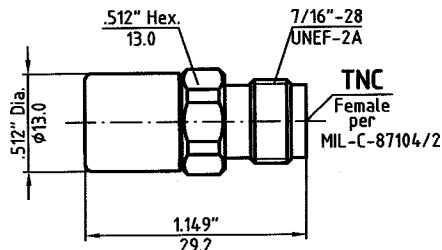
Part - No.	8801-PMPM-02
Connectors	SPM-M to SPM-M
Frequency	DC - 18.0 GHz
VSWR max.	1.15 : 1



Adapters with Part Numbers starting **8801** are of same electrical length within the connector series. Dimensions shown are inches over millimeters. Standard connector finish is passivated stainless steel. Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, where applicable.



High Precision Coaxial Termination

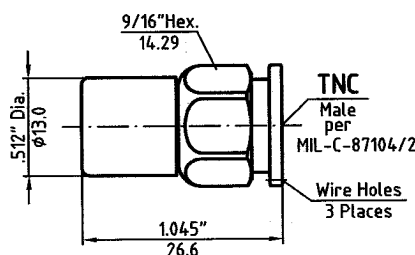


Connector Body is stainless steel, Cap is gold plated.

TNC Female HIGH PRECISION TERMINATION

Part No.	TE-0018-41P1
Frequency Range	DC - 18.0 GHz
Impedance	50 Ohms
Max. VSWR	1.10 : 1
Max. Average Power	1 Watt
Weight	16
Temperature Range	-54°C to + 115°C

High Precision Coaxial Termination

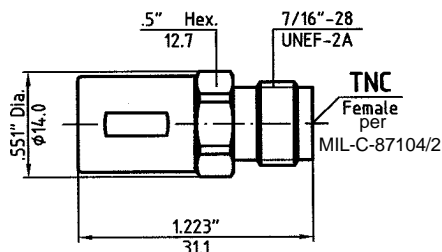


Connector Body is stainless steel, Cap is gold plated.

TNC Male HIGH PRECISION TERMINATION

Part No.	TE-0018-31P1
Frequency Range	DC - 18.0 GHz
Impedance	50 Ohms
Max. VSWR	1.10 : 1
Max. Average Power	1 Watt
Weight	18
Temperature Range	-54°C to + 115°C

Short/Open Circuit Terminations

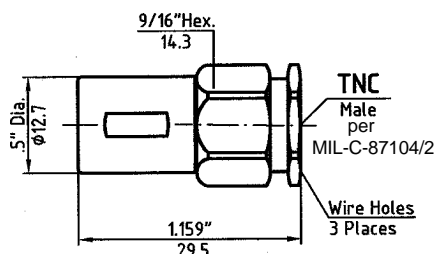


Short: Connector Body is stainless steel, Cap is nickel plated.
Open: Connector Body is stainless steel, Cap is black anodized.

TNC Female Open/Short Circuit Terminations

Part No.	Description	Frequency Range	Weight (g)
4030-2102-02	Short Circuit	DC - 18.0 GHz	In Development
4040-2102-02	Open Circuit		In Development
Impedance		50 Ohms	
Temperature Range		-54°C to +85°C	

Short/Open Circuit Terminations



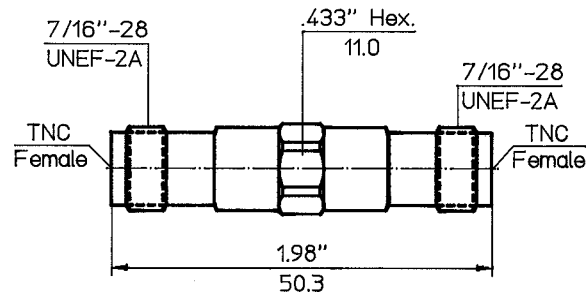
Short: Connector Body is stainless steel, Cap is nickel plated.
Open: Connector Body is stainless steel, Cap is black anodized.

TNC Male Open/Short Circuit Terminations

Part No.	Description	Frequency Range	Weight (g)
4030-1102-02	Short Circuit	DC - 18.0 GHz	In Development
4040-1102-02	Open Circuit		In Development
Impedance		50 Ohms	
Temperature Range		-54°C to +85°C	

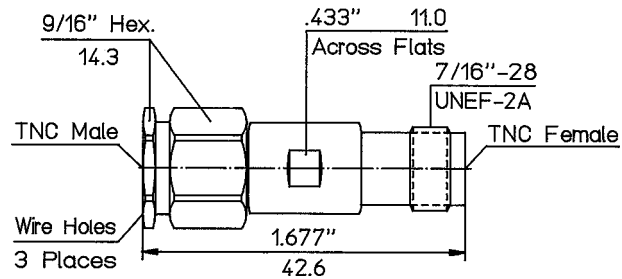
Dimensions shown are inches over millimeters. Standard connector parts are made from stainless steel passivated. The housings are made from stainless steel passivated, brass gold plated, brass nickel plated, aluminum anodized, depending on the type of termination or its application.

Part - No.	8801-4141-02
Connectors	TNC-F to TNC-F
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f \text{ (GHz)}$



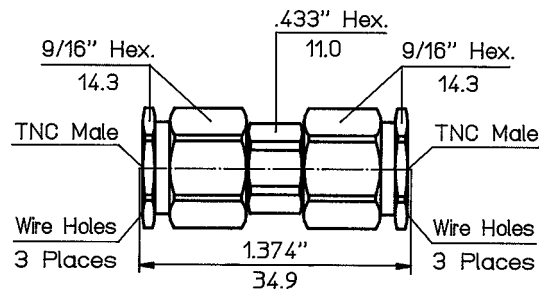
TNC-Interfaces as per MIL-C-87104/2

Part - No.	8801-3141-02
Connectors	TNC-M to TNC-F
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f \text{ (GHz)}$



TNC-Interfaces as per MIL-C-87104/2

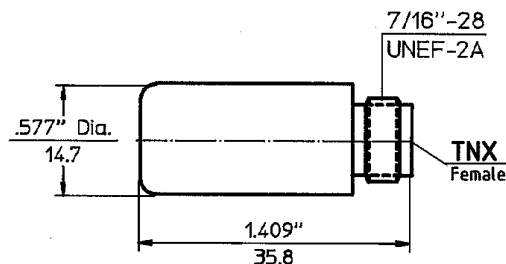
Part - No.	8801-3131-02
Connectors	TNC-M to TNC-M
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f \text{ (GHz)}$



TNC-Interfaces as per MIL-C-87104/2

Adapters with Part Numbers starting **8801** are of same electrical length within the connector series. Dimensions shown are inches over millimeters. Standard connector finish is passivated stainless steel. Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, where applicable.

Coaxial Terminations

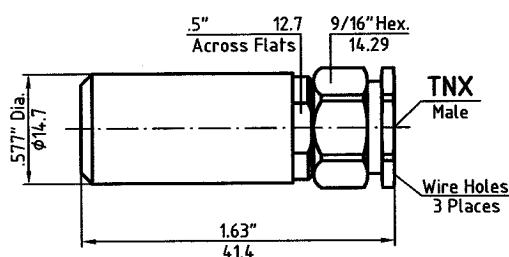


Connector Body and Cap are stainless steel passivated.

TNX Female Termination

Part No.	TE-0018-4900
Frequency Range	DC - 18.0 GHz
Impedance	50 Ohms
Max. VSWR	1.15 : 1
Max. Average Power	1 Watt
Weight in g	33
Temperature Range	-54°C to + 115°C

Coaxial Terminations

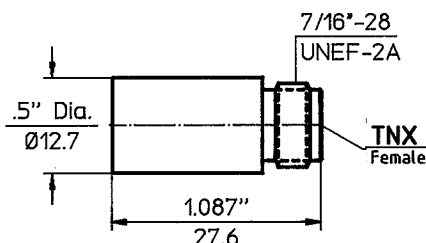


Connector Body and Cap are stainless steel passivated.

TNX Male Termination

Part No.	TE-0018-3900
Frequency Range	DC - 18.0 GHz
Impedance	50 Ohms
Max. VSWR	1.15:1
Max. Average Power	1 Watt
Weight in g	35
Temperature Range	-54°C to + 115°C

Short/Open Circuit Terminations

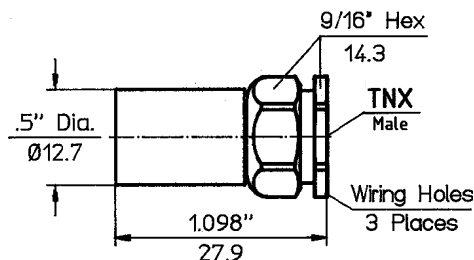


Connector Body and Cap are stainless steel passivated.

TNX Female Open/Short Circuit Terminations

Part No.	Description	Frequency Range	Weight (g)
3930-2101-02	Short Circuit	DC - 18.0 GHz	20
3940-2101-02	Open Circuit		20
Impedance		50 Ohms	
Temperature Range		-54°C to +85°C	

Short/Open Circuit Terminations



Connector Body and Cap are stainless steel passivated.

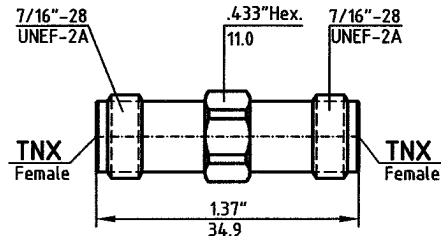
TNX Male Open/Short Circuit Terminations

Part No.	Description	Frequency Range	Weight (g)
3930-1101-02	Short Circuit	DC - 18.0 GHz	22
3940-1101-02	Open Circuit		22
Impedance		50 Ohms	
Temperature Range		-54°C to +85°C	

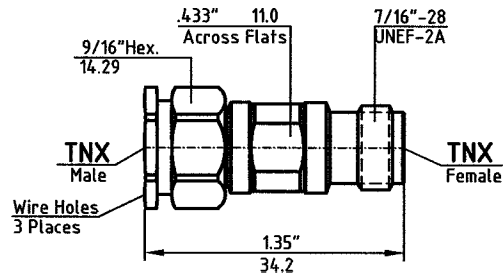
Dimensions shown are inches over millimeters. Standard connector parts are made from stainless steel passivated. The housings are made from stainless steel passivated, brass gold plated, brass nickel plated, aluminum anodized, depending on the type of termination or its application.

Type TNX Calibration Components, Throughlines

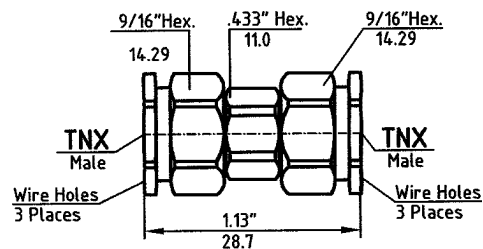
Part - No.	8001-4949-02
Connectors	TNX-F to TNX-F
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f \text{ (GHz)}$



Part - No.	8001-3949-02
Connectors	TNX-M to TNX-F
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f \text{ (GHz)}$



Part - No.	8001-3939-02
Connectors	TNX-M to TNX-M
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f \text{ (GHz)}$



Dimensions shown are inches over millimeters. Standard connector finish is passivated stainless steel. Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, where applicable.

Section II.2



Calibration Components

1. Opens-Shorts-Loads & Throughlines	47
2. Connector Interface Gauges	75
3. Torque Wrenches	89
4. Thread Limit Gauges	93
5. Instrument Grade Adapters	97

INTRODUCTION: Testing the interfaces of connectors and adapters upon incoming inspection is not only highly recommended, it is definitely a necessity. Interfaces not meeting specification will not only lead to degraded specification of the components, furthermore, these out of specification interfaces may damage the connectors of mating components or ruin the connectors of test equipment.

CHECKING THE INTERFACE: Spectrum Elektrotechnik GmbH manufactures a comprehensive line of connector gauges for measuring the critical interface dimensions of coaxial connectors. These connector gauges consist of an especially adapted dial indicator with appropriate bushings and pins that are designed to mate with the specific connector under test. The indicator of each gauge is zero set by a specific master gauge. When engaged to a connector, it measures the specific interface dimension from a specific reference plane. For every dimension of interest, a special gauge will be offered. This gives the most accurate results, allows easy calibration, fast testing and helps to avoid mistakes.

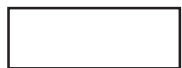
RESOLUTION: A number of gauges are available. The models are shown to the right. The main difference between these four types of gauges is the different resolution as well as the units of measurement: inches or metric. Only the digital gauges can be switched from metric to inch and vice versa.

“HAND-HELD” VERSUS “THREAD-ON”: Most Gauges shown are available as “Hand-Held” or “Thread-On”. The faster testing is possible by using the “Hand-Held” gauges, the more accurate readings will be achieved from the “Thread-On” gauges, as threading on the gauges will perfectly align them with the connector. Hand-Held means aligning gauge and connector freely, which may allow for mistakes.

INTERFACE DIMENSIONS: Complete interface dimensions are shown in section VII.4. of this Handbook. The important measurements are marked clearly for every connector series:



Dimensions, highlighted in an oval shape, are recommended for verification as a minimum. The connector gauges measuring these dimensions are included in the Expanded Calibration Kit and the Professional Kit as well.



Dimensions, highlighted in a rectangular block are recommended for verification in addition to the dimensions highlighted in an oval shape. Checking all these dimensions will guarantee optimum performance of the connectors. The necessary connector gauges to measure all those dimensions are included in the Professional Calibration Kit only.

USING CONNECTOR GAUGES: Select the correct gauge for the connector under test. Inspect the gauge and the appropriate calibration block (master) and make sure that both are in good condition and clean. (Dirt on the gauge or the master will lead to inaccurate measurements and can transfer dirt to the connectors and damage them during gauging). Attach the calibration block carefully to the gauge. Zero the gauge by moving the dial until the gauge pointer reads zero. To verify that the setting is correct and repeatable, remove the calibration block and then attach it a second time.

When testing the connectors, make sure that they are not damaged and clean. When using the “Thread-On” gauges, tighten the connection with the appropriate Torque Wrench only.



Type H: This gauge is available with a resolution of 0.005mm, or 0.0001 inches.



Type K: This gauge is available with a resolution of 0.01mm, or 0.001 inches.

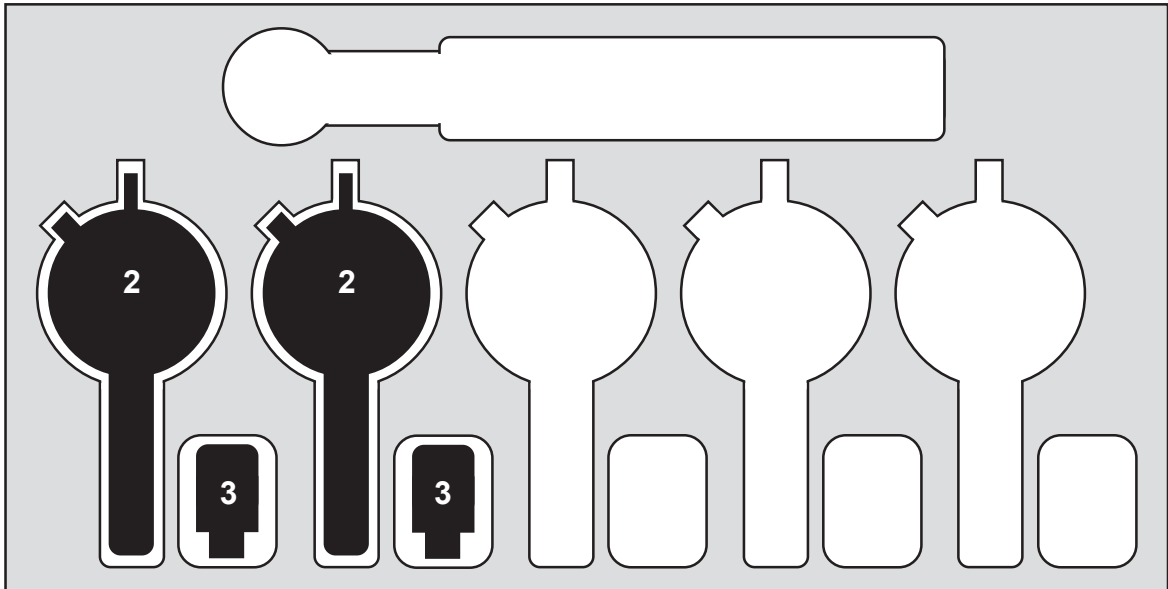


Type D: This gauge employs a digital readout and can be switched from a resolution of 0.01mm to 0.0005 inches.



Type T: This gauge uses a resolution of 0.001 mm and it is available in metric only.

Standard Gauge Kit



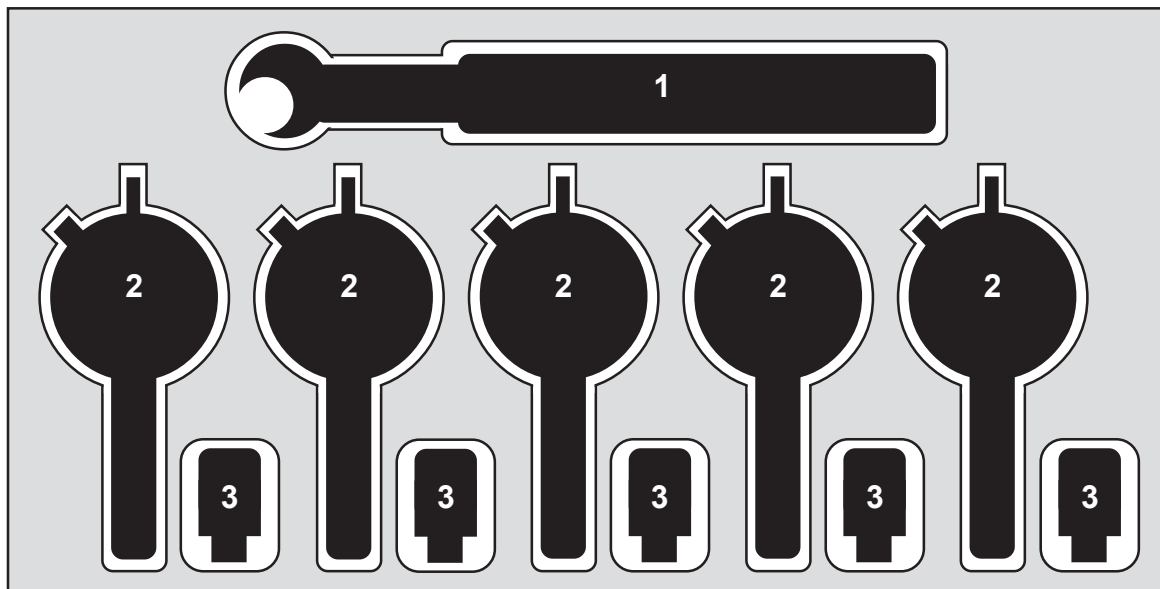
The actual layout and/or filling of the Instrument Case may differ from the schematic above. It depends on the size of the connector series, the number of gauges that are advisable for that connector series, and whether it is a Standard, or a Professional Kit. The layout of the Instrument Case itself for the Standard and the Professional Kits are identical. This is very advantageous, as someone can start with the Standard Kit, and fill the empty spots at a later stage to expand to the Professional Kit. Each instrument Case contains a space where the appropriate Torque Wrench can be fitted.

Description of Equipment Provided

Standard Gauge Kit

2:	Set of Connector Interface Gauges	Instrument case
3:	Set of Gauge Calibration Blocks	Operating instructions

Professional Gauge Kit



The actual layout and/or filling of the Instrument Case may differ from the schematic above. It depends on the size of the connector series, the number of gauges that are advisable for that connector series, and whether it is a Standard, or a Professional Kit. The layout of the Instrument Case itself for the Standard and the Professional Kits are identical. This is very advantageous, as someone can start with the Standard Kit, and fill the empty spots at a later stage to expand to the Professional Kit. Each Professional Kit contains already the appropriate Torque Wrench.

Description of Equipment Provided

Professional Gauge Kit

- 1:** Torque Wrench
- 2:** Set of Connector Interface Gauges
- 3:** Set of Gauge Calibration Blocks

Instrument case
Operating instructions

INFORMATION ON HOW TO ORDER CONNECTOR GAUGES: Spectrum Elektrotechnik GmbH has set up an easy to use part number system. The customer can compose his part number, describing completely the Connector Interface Gauge Kit, he is ordering. The table below explains the system and describes the possible alternatives.

THE MEASUREMENT: The Letter **B** identifies the units of the dial readings, which either can be in millimeters or inches.

THE CONNECTOR SERIES: The four letters **CDEF** are used to recognize the connector series, the Kit is needed for. Please replace these four letters by the code used for identifying the connector series, as listed below.

THE KIT: The letter **H** is to be replaced by the letter **S** when a Standard Kit is ordered, and by the letter **P**, when the Professional Kit is specified.

THE TYPE OF GAUGES: The Gauges are usually available as "Hand Held" or "Thread On". The faster testing is possible by using the "Hand Held" gauges, the more accurate readings will be achieved from the "Thread On" gauges, as threading on the gauges will perfectly align them with the connector. Hand Held means aligning gauge and connector freely, which may allow for mistakes. The letters **JK** are to be replaced by **HH**, when Hand Held Gauges are specified, and with **MG**, when Thread On Gauges are needed.

THE RESOLUTION: The letter **L** has to be replaced by the code that is used to identify the resolution. Resolutions of 0.01mm to 0.001mm, and 0.001 inches to 0.0001 inches are available. For the appropriate letter coding please refer to the table below.

GB		CDEF				H		JK		L																																							
<p>B: to be replaced with the letter I or M according to the units of measurement of the gauge required.</p> <p>I = Inch M = Metric</p>		<p>CDEF: to be replaced with one of the following digit number/letter Code, describing Connectors as listed below.</p> <table><tr><td>2400 = 2.4mm</td><td>SBY0 = SBY</td></tr><tr><td>3500 = 3.5mm</td><td>SC00 = SC</td></tr><tr><td>7000 = 7mm</td><td>SMA0 = SMA</td></tr><tr><td>7160 = 7/16</td><td>SSMA = SSMA</td></tr><tr><td>BMA0 = BMA</td><td>SMP0 = SMP</td></tr><tr><td>BNC0 = BNC</td><td>SMPT = SMP Test Connector</td></tr><tr><td>C000 = C</td><td>SPM0 = SPM</td></tr><tr><td>HN00 = HN</td><td>TNC3 = TNC per MIL-C-39012</td></tr><tr><td>2920 = K*</td><td>TNC8 = TNC per MIL-C-87104/2</td></tr><tr><td>N000 = N</td><td></td></tr><tr><td>N750 = N 75Ω</td><td></td></tr><tr><td>SBX0 = SBX</td><td>TNX0 = TNX</td></tr></table>				2400 = 2.4mm	SBY0 = SBY	3500 = 3.5mm	SC00 = SC	7000 = 7mm	SMA0 = SMA	7160 = 7/16	SSMA = SSMA	BMA0 = BMA	SMP0 = SMP	BNC0 = BNC	SMPT = SMP Test Connector	C000 = C	SPM0 = SPM	HN00 = HN	TNC3 = TNC per MIL-C-39012	2920 = K*	TNC8 = TNC per MIL-C-87104/2	N000 = N		N750 = N 75Ω		SBX0 = SBX	TNX0 = TNX	<p>H: to be replaced with one of the following letters for the option required.</p> <p>S = Standard Kit P = Professional Kit</p>		<p>JK: to be replaced with the letters HH or MG according to the type of gauge required.</p> <p>HH = Hand Held MG = "Thread-On"</p>		<p>L = Resolution</p> <table><tr><th></th><th>mm</th><th>inches</th></tr><tr><td>H =</td><td>0.005</td><td>0.0001</td></tr><tr><td>K =</td><td>0.01</td><td>0.001</td></tr><tr><td>T =</td><td>0.001</td><td>-</td></tr><tr><td>D =</td><td colspan="2">Digital Gauge 0.01mm/ 0.0005"</td></tr></table>		mm	inches	H =	0.005	0.0001	K =	0.01	0.001	T =	0.001	-	D =	Digital Gauge 0.01mm/ 0.0005"	
2400 = 2.4mm	SBY0 = SBY																																																
3500 = 3.5mm	SC00 = SC																																																
7000 = 7mm	SMA0 = SMA																																																
7160 = 7/16	SSMA = SSMA																																																
BMA0 = BMA	SMP0 = SMP																																																
BNC0 = BNC	SMPT = SMP Test Connector																																																
C000 = C	SPM0 = SPM																																																
HN00 = HN	TNC3 = TNC per MIL-C-39012																																																
2920 = K*	TNC8 = TNC per MIL-C-87104/2																																																
N000 = N																																																	
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	mm	inches																																															
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K =	0.01	0.001																																															
T =	0.001	-																																															
D =	Digital Gauge 0.01mm/ 0.0005"																																																

Connector Interface Gauges

Connector Type	Dial Resol. (inches)	Dial Resol. (mm)	Instrument Case Model No.	Type of Gauge	No. of Gauges	Measuring			For Interface Mating Dimensions please refer to page:
						Fem. & Male Contact Interface Locations	Additional Dim. on Female Connector	Additional Dim. on Male Connector	
2.4mm	yes		GI-2400-SHHK	Hand-held	2	yes			209
			GI-2400-PHHK		4		.1201" (3.05mm)	.536" (1.36mm)	
		yes	GM-2400-SHHK	Hand-held	2	yes			209
			GM-2400-PHHK		4		.1201" (3.05mm)	.536" (1.36mm)	
	yes		GI-2400-SMGK	"Thread-On"	2	yes			209
			GI-2400-PMGK		4		.1201" (3.05mm)	.536" (1.36mm)	
		yes	GM-2400-SMGK	"Thread-On"	2	yes			209
			GM-2400-PMGK		4		.1201" (3.05mm)	.536" (1.36mm)	
3.5mm	yes		GI-3500-SHHK	Hand-held	2	yes			210
			GI-3500-PHHK		4		.076" (1.93mm)	Center Pin .1" (2.54mm)	
		yes	GM-3500-SHHK	Hand-held	2	yes			210
			GM-3500-PHHK		4		.076" (1.93mm)	Center Pin .1" (2.54mm)	
	yes		GI-3500-SMGK	"Thread-On"	2	yes			210
			GI-3500-PMGK		4		.076" (1.93mm)	Center Pin .1" (2.54mm)	
		yes	GM-3500-SMGK	"Thread-On"	2	yes			210
			GM-3500-PMGK		4		.076" (1.93mm)	Center Pin .1" (2.54mm)	
7mm	yes		GI-7000-SHHK	Hand-held	1	Planar contact location			211
		yes	GM-7000-SHHK	Hand-held	1	Planar contact location			211
	yes		GI-7000-SMGK	"Thread-On"	1	Planar contact location			211
		yes	GM-7000-SMGK	"Thread-On"	1	Planar contact location			211

Connector Interface Gauges

Connector Type	Dial Resol. (inches)	Dial Resol. (mm)	Instrument Case Model No.	Type of Gauge	No. of Gauges	Measuring			For Interface Mating Dimensions please refer to page:
						Fem. & Male Contact Interface Locations	Additional Dim. on Female Connector	Additional Dim. on Male Connector	
7/16 As per DIN 47223	yes		GI-7160-SHHK	Hand-held	2	yes			212
			GI-7160-PHHK		5		.255" (6.47mm)	.247" (6.27mm) .315" (8.0mm)	
	yes		GM-7160-SHHK	Hand-held	2	yes			212
			GM-7160-PHHK		5		.255" (6.47mm)	.247" (6.27mm) .315" (8.0mm)	
	yes		GI-7160-SMGK	"Thread-On"	2	yes			212
			GI-7160-PMGK		5		.255" (6.47mm)	.247" (6.27mm) .315" (8.0mm)	
	yes		GM-7160-SMGK	"Thread-On"	2	yes			212
			GM-7160-PMGK		5		.255" (6.47mm)	.247" (6.27mm) .315" (8.0mm)	
BMA	yes		GI-BMA0-SHHK	Hand-held	2	yes			213
		yes	GM-BMA0-SHHK	Hand-held	2	yes			213
BNC As per MIL-C-39012 (IEC 169-2)	yes		GI-BNC0-SHHK	Hand-held	2	yes			214
			GI-BNC0-PHHK		5		.198" (5.03mm) .006" (.15mm)	.22" (5.59mm)	
	yes		GM-BNC0-SHHK	Hand-held	2	yes			214
			GM-BNC0-PHHK		5		.198" (5.03mm) .006" (.15mm)	.22" (5.59mm)	
C As per MIL-C-39012 (IEC 169-7)	yes		GI-C000-SHHK	Hand-held	2	yes			215
			GI-C000-PHHK		5		.007" (.18mm) .309" (7.85mm)	.309" (7.85mm)	
	yes		GM-C000-SHHK	Hand-held	2	yes			215
			GM-C000-PHHK		5		.007" (.18mm) .309" (7.85mm)	.309" (7.85mm)	

Connector Interface Gauges

Connector Type	Dial Resol. (inches)	Dial Resol. (mm)	Instrument Case Model No.	Type of Gauge	No. of Gauges	Measuring			For Interface Mating Dimensions please refer to page:
						Fem. & Male Contact Interface Locations	Additional Dim. on Female Connector	Additional Dim. on Male Connector	
HN	yes		GI-HN00-SHHK	Hand-held	2	yes			216
			GI-HN00-PHHK		3			.020" (.51mm) .008" (.20mm)	
		yes	GM-HN00-SHHK	Hand-held	2	yes			216
			GM-HN00-PHHK		3			.020" (.51mm) .008" (.20mm)	
	yes		GI-HN00-SMGK	"Thread-On"	2	yes			216
			GI-HN00-PMGK		3			.020" (.51mm) .008" (.20mm)	
		yes	GM-HN00-SMGK	"Thread-On"	2	yes			216
			GM-HN00-PMGK		3			.020" (.51mm) .008" (.20mm)	
As per MIL-C-3643									
K* (2.9mm)	yes		GI-2920-SHHK	Hand-held	2	yes			217
			GI-2920-PHHK		4		.076" (1.93mm)	.0615" (1.56mm)	
		yes	GM-2920-SHHK	Hand-held	2	yes			217
			GM-2920-PHHK		4		.076" (1.93mm)	.0615" (1.56mm)	
	yes		GI-2920-SMGK	"Thread-On"	2	yes			217
			GI-2920-PMGK		4		.076" (1.93mm)	.0615" (1.56mm)	
		yes	GM-2920-SMGK	"Thread-On"	2	yes			217
			GM-2920-PMGK		4		.076" (1.93mm)	.0615" (1.56mm)	

Connector Interface Gauges

Connector Type	Dial Resol. (inches)	Dial Resol. (mm)	Instrument Case Model No.	Type of Gauge	No. of Gauges	Measuring			For Interface Mating Dimensions please refer to page:
						Fem. & Male Contact Interface Locations	Additional Dim. on Female Connector	Additional Dim. on Male Connector	
N As per MIL-C-39012	yes		GI-N000-SHHK	Hand-held	2	yes			218
			GI-N000-PHHK		4		.359" (9.12mm)	.003" (.08mm)	
		yes	GM-N000-SHHK	Hand-held	2	yes			218
			GM-N000-PHHK		4		.359" (9.12mm)	.003" (.08mm)	
	yes		GI-N000-SMGK	"Thread-On"	2	yes			218
			GI-N000-PMGK		4		.359" (9.12mm)	.003" (.08mm)	
		yes	GM-N000-SMGK	"Thread-On"	2	yes			218
			GM-N000-PMGK		4		.359" (9.12mm)	.003" (.08mm)	
	yes		GI-N750-SHHK	Hand-held	2	yes			219
			GI-N750-PHHK		4		.359" (9.12mm)	.059" (1.50mm)	
N 75 Ohms		yes	GM-N750-SHHK	Hand-held	2	yes			219
			GM-N750-PHHK		4		.359" (9.12mm)	.059" (1.50mm)	
	yes		GI-N750-SMGK	"Thread-On"	2	yes			219
			GI-N750-PMGK		4		.359" (9.12mm)	.059" (1.50mm)	
		yes	GM-N750-SMGK	"Thread-On"	2	yes			219
			GM-N750-PMGK		4		.359" (9.12mm)	.059" (1.50mm)	
SBX	yes		GI-SBX0-SHHK	Hand-held	2	yes			220
			GI-SBX0-PHHK		4		.248" (6.3mm)	.244" (6.2mm)	
		yes	GM-SBX0-SHHK	Hand-held	2	yes			220
			GM-SBX0-PHHK		4		.248" (6.3mm)	.244" (6.2mm)	

Connector Interface Gauges

Connector Type	Dial Resol. (inches)	Dial Resol. (mm)	Instrument Case Model No.	Type of Gauge	No. of Gauges	Measuring			For Interface Mating Dimensions please refer to page:	
						Fem. & Male Contact Interface Locations	Additional Dim. on Female Connector	Additional Dim. on Male Connector		
SBY	yes		GI-SBY0-SHHK	Hand-held	2	yes			221	
			GI-SBY0-PHHK		4		.089" (2.25mm)	.085" (2.15mm)		
		yes	GM-SBY0-SHHK	Hand-held	2	yes			221	
			GM-SBY0-PHHK		4		.089" (2.25mm)	.085" (2.15mm)		
SC	yes		GI-SC00-SHHK	Hand-held	2	yes			222	
			GI-SC00-PHHK		6		.007" (.18mm) .309" (7.85mm)	.309" (7.85mm) .040" (1.015mm)		
		yes	GM-SC00-SHHK	Hand-held	2	yes			222	
			GM-SC00-PHHK		6		.007" (.18mm) .309" (7.85mm)	.309" (7.85mm) .040" (1.015mm)		
	yes		GI-SC00-SMGK	"Thread-On"	2	yes			222	
			GI-SC00-PMGK		6		.007" (.18mm) .309" (7.85mm)	.309" (7.85mm) .040" (1.015mm)		
	As per MIL-C-39012	yes		GM-SC00-SMGK	"Thread-On"	2	yes			222
				GM-SC00-PMGK		6		.007" (.18mm) .309" (7.85mm)	.309" (7.85mm) .040" (1.015mm)	
	SMA	yes		GI-SMA0-SHHK	Hand-held	4	yes	Dielectric Location		223
				GI-SMA0-PHHK		6		.076" (1.93mm)	.10" (2.54mm)	
		yes	GM-SMA0-SHHK	Hand-held	4	yes	Dielectric Location		223	
			GM-SMA0-PHHK		6		.076" (1.93mm)	.10" (2.54mm)		
yes			GI-SMA0-SMGK	"Thread-On"	4	yes	Dielectric Location		223	
			GI-SMA0-PMGK		6		.076" (1.93mm)	.10" (2.54mm)		
As per MIL-C-39012		yes		GM-SMA0-SMGK	"Thread-On"	4	yes	Dielectric Location		223
				GM-SMA0-PMGK		6		.076" (1.93mm)	.10" (2.54mm)	

Connector Interface Gauges

Connector Type	Dial Resol. (inches)	Dial Resol. (mm)	Instrument Case Model No.	Type of Gauge	No. of Gauges	Measuring			For Interface Mating Dimensions please refer to page:
						Fem. & Male Contact Interface Locations	Additional Dim. on Female Connector	Additional Dim. on Male Connector	
SSMA	yes		GI-SSMA-SHHK	Hand-held	4	yes	Dielectric Location		224
		yes	GM-SSMA-SHHK	Hand-held	4	yes	Dielectric Location		224
	yes		GI-SSMA-SMGK	"Thread-On"	4	yes	Dielectric Location		224
		yes	GM-SSMA-SMGK	"Thread-On"	4	yes	Dielectric Location		224
SMP As per DESC94007 and DESC94008	yes		GI-SMP0-SHHK	Hand-held	3	yes	Dielectric Location		225
		yes	GM-SMP0-SHHK	Hand-held	3	yes	Dielectric Location		225
SMP Test Connector	yes		GI-SMPT-SHHK	Hand-held	4	yes	Dielectric Location		226
		yes	GM-SMPT-SHHK	Hand-held	4	yes	Dielectric Location		226
	yes		GI-SMPT-SMGK	"Thread-On"	4	yes	Dielectric Location		226
		yes	GM-SMPT-SMGK	"Thread-On"	4	yes	Dielectric Location		226
SPM	yes		GI-SPM0-SHHK	Hand-held	4	yes	Dielectric Location		227
			GI-SPM0-PHHK		6		.072" (1.83mm)	.01" (0.25mm)	
		yes	GM-SPM0-SHHK	Hand-held	4	yes	Dielectric Location		227
			GM-SPM0-PHHK		6		.072" (1.83mm)	.01" (0.25mm)	
	yes		GI-SPM0-SMGK	"Thread-On"	4	yes	Dielectric Location		227
			GI-SPM0-PMGK		6		.072" (1.83mm)	.01" (0.25mm)	
		yes	GM-SPM0-SMGK	"Thread-On"	4	yes	Dielectric Location		227
			GM-SPM0-PMGK		6		.072" (1.83mm)	.01" (0.25mm)	

Connector Type	Dial Resol. (inches)	Dial Resol. (mm)	Instrument Case Model No.	Type of Gauge	No. of Gauges	Measuring			For Interface Mating Dimensions please refer to page:
						Fem. & Male Contact Interface Locations	Additional Dim. on Female Connector	Additional Dim. on Male Connector	
TNC	yes		GI-TNC3-SHHK	Hand-held	2	yes			228
			GI-TNC3-PHHK		6		.006" (.15mm) .198 (5.03mm)	.2155" (5.474mm) .006" (.15mm)	
		yes	GM-TNC3-SHHK	Hand-held	2	yes			228
			GM-TNC3-PHHK		6		.006" (.15mm) .198 (5.03mm)	.2155" (5.474mm) .006" (.15mm)	
	yes		GI-TNC3-SMGK	"Thread-On"	2	yes			228
			GI-TNC3-PMGK		6		.006" (.15mm) .198 (5.03mm)	.2155" (5.474mm) .006" (.15mm)	
		yes	GM-TNC3-SMGK	"Thread-On"	2	yes			228
			GM-TNC3-PMGK		6		.006" (.15mm) .198 (5.03mm)	.2155" (5.474mm) .006" (.15mm)	
	As per MIL-C-39012								
	TNC	yes		GI-TNC8-SHHK	Hand-held	2	yes		
GI-TNC8-PHHK				6		.0045" (.115mm) .2065 (5.245mm)		.0075" (.19mm) .2105" (5.347mm)	
		yes	GM-TNC8-SHHK	Hand-held	2	yes			229
			GM-TNC8-PHHK		6		.0045" (.115mm) .2065 (5.245mm)	.0075" (.19mm) .2105" (5.347mm)	
yes			GI-TNC8-SMGK	"Thread-On"	2	yes			229
			GI-TNC8-PMGK		6		.0045" (.115mm) .2065 (5.245mm)	.0075" (.19mm) .2105" (5.347mm)	
		yes	GM-TNC8-SMGK	"Thread-On"	2	yes			229
			GM-TNC8-PMGK		6		.0045" (.115mm) .2065 (5.245mm)	.0075" (.19mm) .2105" (5.347mm)	
As per MIL-C-87104/2									

Connector Interface Gauges

Connector Type	Dial Resol. (inches)	Dial Resol. (mm)	Instrument Case Model No.	Type of Gauge	No. of Gauges	Measuring			For Interface Mating Dimensions please refer to page:
						Fem. & Male Contact Interface Locations	Additional Dim. on Female Connector	Additional Dim. on Male Connector	
TNX	yes		GI-TNX0-SHHK	Hand-held	2	yes			230
			GI-TNX0-PHHK		5		.23" (5.84mm)	.002" (.05mm) .0855" (2.17mm)	
		yes	GM-TNX0-SHHK	Hand-held	2	yes			230
			GM-TNX0-PHHK		5		.23" (5.84mm)	.002" (.05mm) .0855" (2.17mm)	
	yes		GI-TNX0-SMGK	"Thread-On"	2	yes			230
			GI-TNX0-PMGK		5		.23" (5.84mm)	.002" (.05mm) .0855" (2.17mm)	
		yes	GM-TNX0-SMGK	"Thread-On"	2	yes			230
			GM-TNX0-PMGK		5		.23" (5.84mm)	.002" (.05mm) .0855" (2.17mm)	

Section II.3



Calibration Components

1. Opens-Shorts-Loads & Throughlines	47
2. Connector Interface Gauges	75
3. Torque Wrenches	89
4. Thread Limit Gauges	93
5. Instrument Grade Adapters	97

INTRODUCTION: Connectors have to be mated and need to be tightened. Some people do it by hand, some use a regular wrench, some use a Torque Wrench.

TIGHTENING BY HAND: People who are using nothing but their fingers for tightening, usually undertorque. The electrical performance will vary from tightening to tightening, depending how tired the fingers are. In addition: If the same component is tested several times and by different people using only their fingers for tightening, the electrical performance will even vary more, as different torque will be applied, equivalent to the strength of the individual. But strength does not only depend on the physical ability of the individual, but also one's perception of what constitutes proper torque. Tightening connectors by hand will result from very loose fits to almost correct fits, but usually always incorrect fits. Tightening connectors by hand is obviously inadequate and not recommendable.

USING A REGULAR WRENCH: The ones who are using a regular wrench, usually overtorque. Short wrenches may lead to torsional forces that are only a little high, the use of longer wrenches however usually results into applying very high torsion. Overtorquing of up to three times has been seen. This will deform the interface of the connectors, proper test results from then on cannot be obtained anymore.

USING THE TORQUE WRENCH: For proper test results and long life of the connectors the rules need to be obeyed. For each individual connector series a torque has been specified, a torque that ensures proper mating conditions, repeatable electrical performance and guarantees mechanically a long life of the connectors. Using the Torque Wrench guarantees that the connection is not too loose, it also ensures that the connection is not too tight, preventing possible connector damage and impaired electrical performance. Using the Torque Wrench also assures that all connections are equally tight, each time.

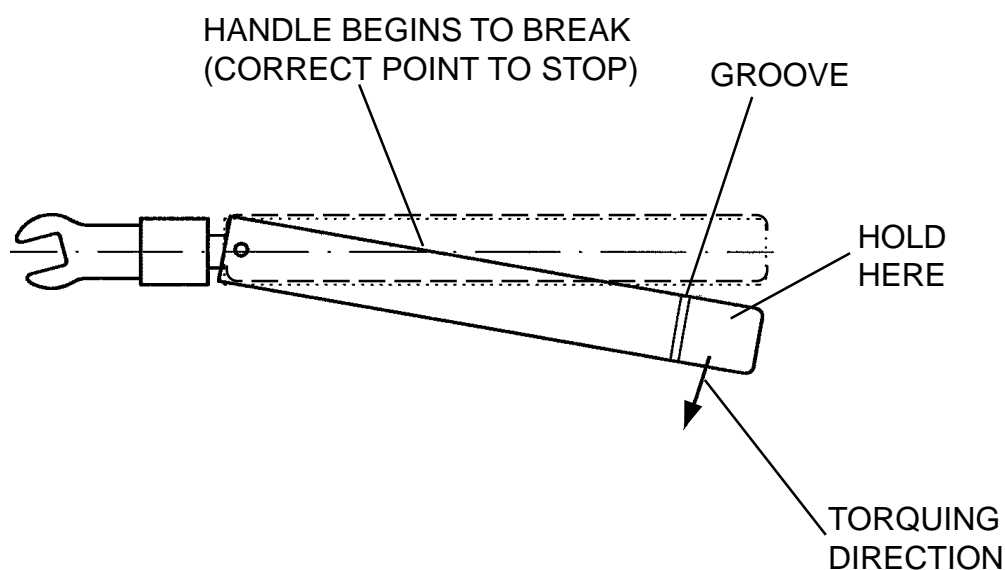
OPERATING THE TORQUE WRENCH: Hold the Torque Wrench always at the same point near the end of the handle. Apply force perpendicular to the Wrench, in a plane parallel to the outer conductor mating planes of the connectors. Rotate the connector nut only when tightening the connector. Use an open-end wrench to keep the body of the mating connector from turning, if it is not a fixed test port connector. Position the wrenches within 90° of each other before applying force.

Avoid pivoting the Wrench on your thumb or other fingers, and do not twist the Wrench relative to the outer conductors mating plane of the connectors. This would result into applying an additional and unknown amount of torque to the connection.

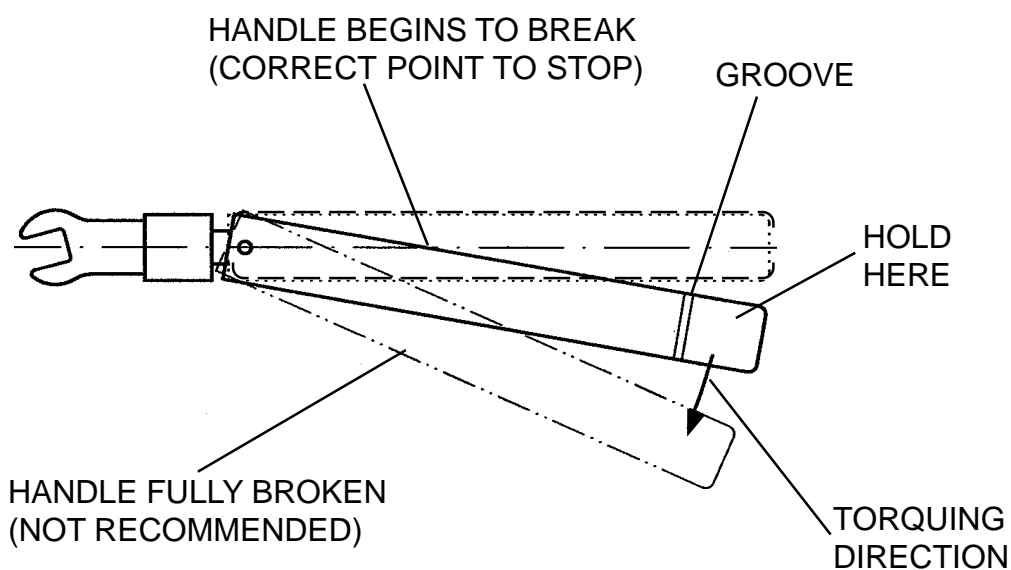
DIFFERENT TORQUE WRENCHES: Spectrum Elektrotechnik GmbH manufactures two different types of Torque Wrenches for most of the connector series:

The Wrench with only the Break Point: The Wrench is employing a "Break Point", when the specific torque has been reached. But having heard and felt the Break, a further torquing would be possible. This Wrench has been designed for people that are sensitive and very conscientious (Torque Wrenches are Series: WE-D.....).

The Torque Wrench that breaks completely: For the smaller connector series that can suffer most from overtorquing, this Wrench has been designed that "Fully Breaks". After the Break Point has been reached, it almost moves freely in an angle of 90° (Series WE-B.....).



**Torque Wrenches, Model Nos. WE-D.....
employing only the “Break Point”.**



**Torque Wrenches, Model Nos. WE-B.....
These Wrenches break completely.**

Torque Wrenches



Connector Type	Remarks	Torque Wrench "Break Point" Model No.	Torque Wrench "Fully Breaks" Model No.	Wrench Size (inches)	Wrench Size (mm)	Preset Torque (in./lbs.)	Preset Torque (Ncm)
2.4mm		WE - D108	WE - B108	5/16"	7.94	9.0	100
2.4mm	Maxi Nut	WE - D117	WE - B117	9/16"	14.29	9.0	100
3.5mm		WE - D100	WE - B100	5/16"	7.94	8.0	90
3.5mm	Maxi Nut	WE - D103	WE - B103	9/16"	14.29	8.0	90
7mm		WE - D107	WE - B107	3/4"	19.05	16.0	180
HN		WE - D116	WE - B116	7/8"	22.2	16.0	180
K* (2.9mm)		WE - D100	WE - B100	5/16"	7.94	8.0	90
K* (2.9mm)	Maxi Nut	WE - D103	WE - B103	9/16"	14.29	8.0	90
N		WE - D101	WE - B101	11/16"	17.46	13.0	150
N		WE - D105	WE - B105	3/4"	19.05	13.0	150
NMD 2.4		WE - D115	WE - B115	3/4"	19.05	9.0	100
NMD 2.9		WE - D114	WE - B114	3/4"	19.05	8.0	90
NMD 3.5		WE - D114	WE - B114	3/4"	19.05	8.0	90
SC		WE - D111	WE - B111	13/16"	20.60	13.0	150
SMA		WE - D100	WE - B100	5/16"	7.94	8.0	90
SMA	Maxi Nut	WE - D103	WE - B103	9/16"	14.29	8.0	90
SSMA		WE - D106	WE - B106	1/4"	6.35	5.0	55
SMP	Calibration Components	WE - D109	WE - B109	.354"	9.0	6.2	70
SPM		WE - D113	WE - B113	5/16"	7.94	8.0	90
TNC		WE - D102	WE - B102	9/16"	14.29	13.0	150
TNX		WE - D112	WE - B112	9/16"	14.29	23.0	260
Spectrum's Interchangeable Connector		WE - DE01	WE - BE01	9/16"	14.29	35.4	400

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Section II.4



Calibration Components

1. Opens-Shorts-Loads & Throughlines	47
2. Connector Interface Gauges	75
3. Torque Wrenches	89
4. Thread Limit Gauges	93
5. Instrument Grade Adapters	97

INTRODUCTION: It is wise to check the thread of connectors and adapters upon incoming inspection. Out of limits thread can create serious problems and may damage the connectors of mating components or ruin the connectors at the test equipment.

Spectrum Elektrotechnik GmbH offers a comprehensive line of thread limit gauges to check the thread on a “GO” / “NO GO” basis.

RING GAUGE: The Gauge is used to check the thread of the female connector.

GO GAUGE: With this Gauge the pitch diameter, pitch angle and number of threads per unit are being examined. The gauge needs to thread on easily up to the very end of the threaded area, without having any force applied.

NO GO GAUGE: It must thread on no more than two revolutions. If the gauge does thread on, and without being forced, more than two revolutions, then the thread is below the allowable minimum limit, the thread pitch diameter is too small.

BOLT GAUGE: The gauge is used to check the coupling nut thread of the male connector.

GO GAUGE: The Gauge examines the pitch diameter, pitch angle and number of threads per unit. It needs to thread in easily, up to the very end of the threaded area of the coupling nut, without the need to have any force applied.

NO GO GAUGE: It must thread into the coupling nut no more than two revolutions. If the gauge does thread in without being forced, more than two revolutions, then the thread is above the allowable maximum limit, the thread pitch diameter is too big.

SET OF GAUGES: A complete Set consists of two Ring Gauges and one Bolt Gauge and is supplied in an instrument case. The Gauges are available for each of the connector series, as listed to the right.

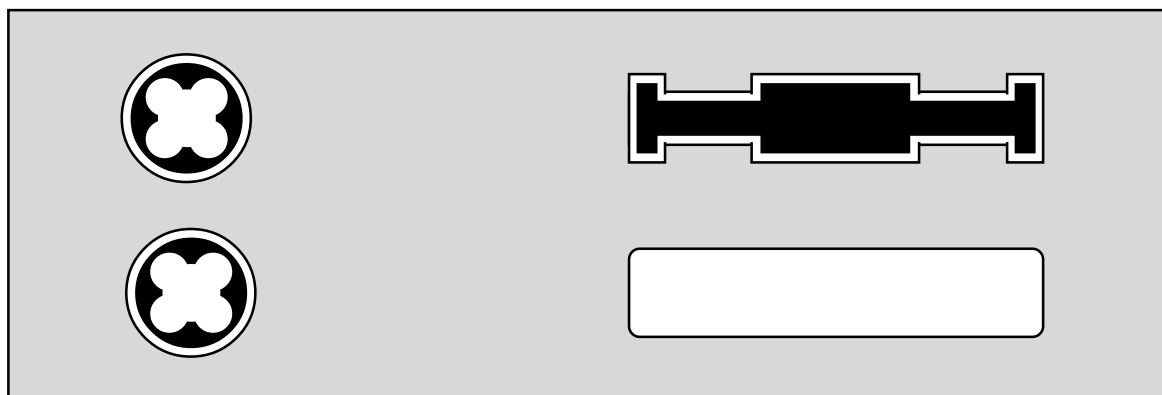
TERMINOLOGY:

ISO METRIC THREAD: The thread is marked with the letter “M” for metric. The diameter and the pitch are in millimeters. The pitch is the distance from a point on the thread to a corresponding point on the adjacent thread. Example: M 7 x 0.75 has a 7mm diameter and threads which measure 0.75mm from one point to its corresponding point.

PITCH DIAMETER: The pitch diameter is defined as the diameter of a cylinder that passes through the thread profile to make the width of the thread ridge and thread groove equal on both sides of the thread and parallel to its axis. The Pitch diameter is the primary control and reference datum for measuring threads.

TREAD DIMENSIONS: It determines first the kind of thread, either Unified Inch Thread or ISO Metric Thread and involves then functional size and pitch, and pitch diameter, including angle, lead and chamfer.

UNIFIED INCH THREAD: The thread is characterized by the diameter and the number of threads per inch. Example: 1/4”- 36 UNS has a 0.25” diameter and 36 threads per inch.



The actual layout and/or filling of the Instrument Case may differ from the schematic above. It depends on the sizes of the connectors and their threads, which results necessarily into the physical dimensions of the gauges. Some connectors are using the same thread, therefore these connector series can be checked with the same set of thread limit gauges. The table below shows in detail: threads, connector series and part numbers of the complete instrument cases. Additionally the model numbers of spare parts are listed, as no gauge may last forever, or needs to be replaced because it was damaged by mistake.

Thread	Connector	Instrument Case Part Number	Spare Parts		
			"Go" Ring Gauge P/N	"No-Go" Ring Gauge P/N	Bolt Gauge P/N
M9 x 0.5	1.8/5.6	LG-M900-0500	GG-M900-0500	NG-M900-0500	BG-M900-0500
M 7	2.4mm	LG-M700-0750	GG-M700-0750	NG-M700-0750	BG-M700-0750
1/4" 36 UNS	3.5mm, K*, SMA, SPM	LG-Z250-36NS	GG-Z250-36NS	NG-Z250-36NS	BG-Z250-36NS
11/16" 24 UNEF	7mm, SC	LG-Z175-24EF	GG-Z175-24EF	NG-Z175-24EF	BG-Z175-24EF
M29 x 1.5	7/16	LG-M290-1500	GG-M290-1500	NG-M290-1500	BG-M290-1500
3/4" 20 UNEF	HN	LG-Z750-20EF	GG-Z750-20EF	NG-Z750-20EF	BG-Z750-20EF
5/8" 24 UNEF	N	LG-Z159-24EF	GG-Z159-24EF	NG-Z159-24EF	BG-Z159-24EF
0.19" 36 UNS	SSMA	LG-Z190-36NS	GG-Z190-36NS	NG-Z190-36NS	BG-Z190-36NS
7/16" 28 UNEF	TNC, TNX	LG-Z111-28EF	GG-Z111-28EF	NG-Z111-28EF	BG-Z111-28EF

wrench.png

Thread Specifications



Connector Type	Thread	Pitch	Bolt Thread Dimensions in mm					Nut Thread Dimensions in mm				
			Outer Diameter		Thread Pitch Diameter		Inner Diameter max.	Outer Diameter min.	Thread Pitch Diameter		Inner Diameter	
			max.	min.	max.	min.			min.	max.	min.	max.
1.8/5.6	M9 x 0.5	.500	8.980	8.874	8.655	8.57	8.367	9.000	8.675	8.787	8.459	8.599
2.4mm	M 7	0.750	6.978	6.838	6.491	6.391	6.058	7.000	6.513	6.645	6.188	6.378
3.5mm	1/4" 36 UNS	0.706	6.327	6.187	5.867	5.791	5.563	6.350	5.892	5.994	5.598	5.766
7mm	11/16" 24 UNEF	1.058	17.432	17.249	16.744	16.642	16.134	17.462	16.774	16.906	16.307	16.561
7/16	M29 x 1.5	1.500	28.968	28.732	27.994	27.844	27.128	29.000	28.026	28.226	27.376	27.676
HN	3/4" 20 UNEF	1.270	19.017	18.811	18.191	18.080	17.643	19.050	18.225	18.369	17.678	17.958
K*	1/4" 36 UNS	0.706	6.327	6.187	5.867	5.791	5.563	6.350	5.892	5.994	5.588	5.766
N	5/8" 24 UNEF	1.058	15.845	15.662	15.156	15.055	14.547	15.875	15.187	15.319	14.732	14.986
SC	11/16" 24 UNEF	1.058	17.432	17.249	16.744	16.642	16.134	17.462	16.774	16.906	16.307	16.561
SMA	1/4" 36 UNS	0.706	6.327	6.187	5.867	5.791	5.563	6.350	5.892	5.994	5.588	5.766
SSMA	0.19" 36 UNS	0.706	4.803	4.663	4.345	4.270	4.039	4.826	4.369	4.468	4.064	4.242
SPM	1/4" 36 UNS	0.706	6.327	6.187	5.867	5.791	5.563	6.350	5.892	5.994	5.588	5.766
TNC	7/16" 28 UNEF	0.907	11.085	10.919	10.495	10.404	9.972	11.112	10.523	10.640	10.135	10.338
TNX	7/16" 28 UNEF	0.907	11.085	10.919	10.495	10.404	9.972	11.112	10.523	10.640	10.135	10.338

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Section II.5.a

Calibration Components

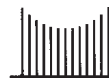
1. Opens-Shorts-Loads & Throughlines		47
2. Connector Interface Gauges		75
3. Torque Wrenches		89
4. Thread Limit Gauges		93
5.	Instrument Grade Adapters	
	a. In-Series <small>Adapters, starting the Part Number with 88xx are Phase Matched within the Series.</small>	97
	b. Between Series	101
	c. NMD Test Port Adapters	113

2.4mm	8801-HFHF-02 8801-HFHM-02 8801-HMHM-02					
3.5mm		8801-9191-02 8801-9192-02 8801-9292-02				
7mm			8001-9090-03 8001-9696-03+ (+ Center Conductor with 6 slots)			
7/16				8001-7575-02 8001-7576-02 8001-7676-02		
BNC					8001-7171-02 8001-7181-02 8001-8181-02	
K* 2.9mm						8801-KFKF-02 8801-KFKM-02 8801-KMKM-02
N						
SC						
SMA						
SMP-T¹⁾	1) = SMP Test Connector					
SPM						
TNC						
TNX						
	2.4mm	3.5mm	7mm	7/16	BNC	K* 2.9mm

Reference Table

In-Series Adapters, 50 Ohms

Adapters, starting the Part Number with
88xx are Phase Matched within the Series.



Spectrum
Elektrotechnik GmbH

							2.4mm
							3.5mm
							7mm
							7/16
							BNC
							K* 2.9mm
8801-5151-02 8801-5161-02 8801-6161-02							N
	8801-7979-02 8801-7980-02 8801-8080-02						SC
		8001-1111-02 8001-1121-02 8001-2121-02					SMA
			8801-TJTJ-02 8802-TJTJ-02 8801-TJTP-02 8802-TJTP-02 8801-TPTP-02 8802-TPTP-02		1) = SMP Test Connector		SMP-T ¹⁾
				8801-PJPJ-02 8801-PJPM-02 8801-PMPM-02			SPM
					8801-3131-02 8801-3141-02 8801-4141-02		TNC
			1) = SMP Test Connector			8001-3939-02 8001-3949-02 8001-4949-02	TNX
N	SC	SMA	SMP-T ¹⁾	SPM	TNC	TNX	

In-Series Adapters



Adapter Type		To:	Phase Matched	Part Number	Frequency Range (GHz)	VSWR (max.)	Length		
							(in.)	(mm)	
2.4mm	female	2.4mm-f	yes	8801-HFHF-02	DC - 50.0	1.20 : 1	.819"	20.8 mm	
				8801-HFHM-02			.786"	19.96mm	
	male	2.4mm-m		8801-HMHM-02			.753"	19.12mm	
3.5mm	female	3.5mm-f	yes	8801-9292-02	DC - 35.0	1.15 : 1	.948"	24.1 mm	
				8801-9192-02			.989"	25.1 mm	
	male	3.5mm-m		8801-9191-02			1.03"	26.2 mm	
7mm	--	7mm	--	8001-9090-03 8001-9696-03 ¹⁾	DC - 18.0	1.06 : 1	2.188"	55.6 mm	
7/16	female	7/16-f	no	8001-7676-02	DC - 7.5	1.06 + 0.005 x f (GHz)	1.95"	49.5 mm	
				8001-7576-02			2.03"	51.5 mm	
	male	7/16-m		8001-7575-02			1.785"	45.34mm	
BNC	female	BNC-f	no	8001-8181-02	DC - 4.0	1.06 + 0.01 x f (GHz)	1.22"	31.0 mm	
				8001-7181-02			1.382"	35.1 mm	
	male	BNC-m		8001-7171-02			1.539"	39.1 mm	
K*	female	K*-f	yes	8801-KFKF-02	DC - 40.0	1.15 : 1	.731"	18.6 mm	
				8801-KFKM-02			.772"	19.6 mm	
	male	K*-m		8801-KMKM-02			.814"	20.7 mm	
N	female	N-f	yes	8801-6161-02	DC - 18.0	1.06 + 0.005 x f (GHz)	2.279"	57.9 mm	
				8801-5161-02			1.944"	49.4 mm	
	male	N-m		8801-5151-02			1.61"	40.9 mm	
SC	female	SC-f	yes	8801-7979-02	DC - 10.0	1.05 + 0.01 x f (GHz)	2.691"	68.3 mm	
				8801-7980-02			2.251"	57.2 mm	
	male	SC-m		8801-8080-02			1.823"	46.3 mm	
SMA	female	SMA-f	no	8001-2121-02	DC - 18.0	1.06 + 0.005 x f (GHz)	.50"	12.7 mm	
				8001-1121-02			.878"	22.3 mm	
	male	SMA-m		8001-1111-02			.875"	22.2 mm	
SMP-T Test Connector	female	SMP-f	yes	8801-TPTP-02	DC - 18.0	1.15 : 1	.579"	14.7 mm	
				8802-TPTP-02	DC - 40.0	1.20 : 1			
				8801-TJTP-02	DC - 18.0	1.15 : 1			
	male	SMP-m		8802-TJTP-02	DC - 40.0	1.20 : 1	.754"	19.1 mm	
				8801-TJTJ-02	DC - 18.0	1.15 : 1			
				8802-TJTJ-02	DC - 40.0	1.20 : 1			
SPM	female	SPM-f	yes	8801-PJPJ-02	DC - 18.0	1.15 : 1	.839"	21.3 mm	
				8801-PJPM-02			.878"	22.3 mm	
	male	SPM-m		8801-PMPM-02			.921"	23.4 mm	
TNC	female	TNC-f	yes	8801-4141-02	DC - 18.0	1.06 + 0.005 x f (GHz)	1.98"	50.3 mm	
				8801-3141-01			1.677"	42.6 mm	
	male	TNC-m		8801-3131-02			1.374"	34.9 mm	
TNX	female	TNX-f	no	8001-4949-02	DC - 18.0	1.06 + 0.005 x f (GHz)	1.37"	34.9 mm	
				8001-3949-02			1.35"	34.2 mm	
	male	TNX-m		8001-3939-02			1.13"	28.7 mm	

Adapters, starting the Part Number with 88xx are Phase Matched within the Series.

Section II.5.b

Calibration Components		
1. Opens-Shorts-Loads & Throughlines		47
2. Connector Interface Gauges		75
3. Torque Wrenches		89
4. Thread Limit Gauges		93
5.	Instrument Grade Adapters	
	a. In-Series <small>Adapters, starting the Part Number with 88xx are Phase Matched within the Series.</small>	97
	b. Between Series	101
	c. NMD Test Port Adapters	113

1.4/4.4											
1.8/5.6											
2.4mm											
3.5mm											
7mm											
7/16											
BMA											
BNC											
C											
HN											
K*											
N											
SBX											
SBY											
SC											
SMA											
SMP											
SMP-T											
SPM											
TNC											
TNX											
	1.4/4.4	1.8/5.6	2.4mm	3.5mm	7mm	7/16	BMA	BNC	C	HN	K*

Reference Table

Between-Series Adapters, 50 Ohms

Adapters, starting the Part Number with 88xx are Phase Matched within the Series.



										1.4/4.4
										1.8/5.6
										2.4mm
										3.5mm
										7mm
										7/16
										BMA
										BNC
										C
										HN
										K*
										N
										SBX
										SBY
										SC
										SMA
										SMP
										SMP-T
										SPM
										TNC
										TNX

Between - Series Adapters



Adapter Type		To:	Part Number	Frequency Range (GHz)	VSWR (max.)	Length	
						(in)	(mm)
1.4/4.4	--	N-f	8002-0361-02	DC - 18.0	1.07 + 0.01 x f (GHz)	1.558"	39.58mm
			8001-0361-02			1.559"	39.6 mm
		N-m	8001-0351-02			1.39"	35.3 mm
			8002-0351-02				
1.8/5.6	female	BNC-f	8001-0481-05	DC - 4.0	1.06 + 0.01 x f (GHz)	1.012"	25.7 mm
		BNC-m	8001-0471-05			1.169"	29.7 mm
	male	BNC-f	8001-0781-05			1.122"	28.5 mm
		BNC-m	8001-0771-05			1.28"	32.5 mm
2.4mm	female	3.5mm-f	8801-HF92-02	DC - 35.0	1.15 : 1	.988"	25.1 mm
		3.5mm-m	8801-HF91-02			1.031"	26.2 mm
	male	3.5mm-f	8801-HM92-02			.957"	24.3 mm
		3.5mm-m	8801-HM91-02			1.0"	25.4 mm
	female	7mm	8001-HF90-02+	DC - 18.0	1.06 : 1	1.415"	35.9 mm
	male		8001-HM90-02+			1.382"	35.1 mm
	female	K*-f	8801-HFKF-02	DC - 40.0	1.15 : 1	.776"	19.7 mm
		K*-m	8801-HFKM-02			.815"	20.7 mm
	male	K*-f	8801-HMKF-02			.74"	18.8 mm
		K*-m	8801-HMKM-02			.783"	19.9 mm
	female	N-f	8001-HF61-02	DC - 18.0	1.06 + 0.005 x f (GHz)	1.228"	31.2 mm
		N-m	8001-HF51-02			1.24"	31.5 mm
	male	N-f	8001-HM61-02			1.268"	32.2 mm
		N-m	8001-HM51-02			1.28"	32.5 mm
3.5mm	female	2.4mm-f	8801-HF92-02	DC - 35.0	1.15 : 1	.988"	25.1 mm
		2.4mm-m	8801-HM92-02			.957"	24.3 mm
	male	2.4mm-f	8801-HF91-02			1.031"	26.2 mm
		2.4mm-m	8801-HM91-02			1.0"	25.4 mm
	female	7mm	8003-9092-02+	DC - 18.0	1.06 : 1	1.268"	32.2 mm
	male		8003-9091-02+			1.376"	34.95 mm
	female	K*-f	8801-KF92-02	DC - 35.0	1.15 : 1	.945"	24.0 mm
		K*-m	8801-KM92-02			.988"	25.1mm
	male	K*-f	8801-KF91-02			.988"	25.1 mm
		K*-m	8801-KM91-02			1.028"	26.1 mm
	female	N-f	8002-6192-02	DC - 18.0	1.06 + 0.005 x f (GHz)	1.228"	31.2 mm
		N-m	8002-5192-02			1.24"	31.5 mm
	male	N-f	8002-6191-02			1.268"	32.2 mm
		N-m	8002-5191-02			1.28"	32.5 mm
	female	TNX-f	8001-4992-02	DC - 18.0	1.06 + 0.01 x f (GHz)	1.414"	35.92mm
		TNX-m	8001-3992-02			1.2"	30.5 mm
	male	TNX-f	8001-4991-02			1.49"	37.9 mm
		TNX-m	8001-3991-02			1.335"	33.9 mm

Adapters, starting the Part Number with 88xx are Phase Matched within the Series.

+ The Center Conductor of the 7mm Connector is supplied with 4 slots. If you require 6 slots, code changes from 90 to 96.

Adapter Type		To:	Part Number	Frequency Range (GHz)	VSWR (max.)	Length	
						(in)	(mm)
7mm	--	2.4mm-f	8001-HF90-02+	DC - 18.0	1.06 : 1	1.415"	35.9 mm
		2.4mm-m	8001-HM90-02+			1.382"	35.1 mm
		3.5mm-f	8003-9092-02+			1.343"	34.1 mm
		3.5mm-m	8003-9091-02+			1.376"	34.95mm
		C-f	8801-8990-02+	DC - 10.0	1.06 + 0.01 x f (GHz)	2.06"	52.2 mm
		C-m	8801-8890-02+			1.79"	45.5 mm
		K*-f	8801-KF90-02+	DC - 18.0	1.06 : 1	1.371"	34.8 mm
		K*-m	8801-KM90-02+			1.412"	35.9 mm
		N-f	8801-6190-02+			2.047"	52.0 mm
		N-m	8801-5190-02+			1.711"	43.47mm
		SC-f	8001-7990-02+	DC - 10.0	1.06 + 0.01 x f (GHz)	1.665"	42.3 mm
		SC-m	8001-8090-02+			1.76"	44.8 mm
		SMA-f	8001-2190-02+	DC - 18.0	1.06 : 1	1.3"	33.0 mm
		SMA-m	8001-1190-02+			1.36"	34.5 mm
		SMP-f	8001-MP90-02+		1.10 : 1	1.197"	30.4 mm
		SMP-m	8001-MJ90-02+			1.479"	36.7 mm
			8002-MJ90-02+				
			8003-MJ90-02+				
			8004-MJ90-02+				
		SMP-f Test Connector	8801-TP90-02+			1.20"	30.4 mm
		SMP-m Test Connector	8801-TJ90-02+			1.37"	34.8 mm
		TNC-f	8002-4190-02+			1.926"	48.9 mm
		TNC-m	8003-3190-02+			2.038"	51.77mm
		TNX-f	8001-4990-02+			1.339"	34.0 mm
		TNX-m	8001-3990-02+			1.46"	37.1 mm
7/16	female	N-f	8001-6176-02	DC - 7.5	1.06 + 0.005 x f (GHz)	1.596"	40.5 mm
		N-m	8001-5176-02			1.66"	42.2 mm
	male	N-f	8001-6175-02			1.632"	41.45mm
		N-m	8001-5175-02			1.634"	41.5 mm
	female	SBX-f	8001-XF76-02			1.761"	44.7 mm
		SBX-m	8001-XM76-02			1.528"	38.8 mm
	male	SBX-f	8001-XF75-02			1.809"	46.0 mm
		SBX-m	8001-XM75-02			1.564"	39.7 mm
	female	SBY-f	8001-YF76-02			1.642"	41.7 mm
		SBY-m	8001-YM76-02			1.735"	44.0 mm
	male	SBY-f	8001-YF75-02			1.674"	42.5 mm
		SBY-m	8001-YM75-02			1.768"	44.9 mm

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Between - Series Adapters

Adapter Type		To:	Part Number	Frequency Range (GHz)	VSWR (max.)	Length	
						(in)	(mm)
BMA	female	N-f	8001-BW61-02	DC - 18.0	1.06 + 0.005 x f (GHz)	1.167"	29.65mm
		N-m	8001-BW51-02			1.24"	31.5 mm
	male	N-f	8001-BM61-02			1.268"	32.2 mm
		N-m	8001-BM51-02			1.28"	32.5 mm
	female	SMA-f	8801-BW21-02			.909"	23.1 mm
		SMA-m	8801-BW11-02			.953"	24.2 mm
	male	SMA-f	8801-BM21-02			.713"	18.1 mm
		SMA-m	8801-BM11-02			.756"	19.2 mm
BNC	female	1.8/5.6-f	8001-0481-05	DC - 4.0	1.06 + 0.01 x f (GHz)	1.012"	25.7 mm
		1.8/5.6-m	8001-0781-05			1.122"	28.5 mm
	male	1.8/5.6-f	8001-0471-05			1.169"	29.7 mm
		1.8/5.6-m	8001-0771-05			1.28"	32.5 mm
	female	N-f	8001-6181-02			1.496"	38.0 mm
		N-m	8001-5181-02			1.54"	39.1 mm
	male	N-f	8001-6171-02			1.484"	37.7 mm
		N-m	8001-5171-02			1.53"	38.8 mm
	female	SMA-f	8001-2181-02		1.06 + 0.005 x f (GHz)	1.024"	26.0 mm
		SMA-m	8001-1181-02			1.135"	28.8 mm
	male	SMA-f	8001-2171-02			1.043"	26.5 mm
		SMA-m	8001-1171-02			1.155"	29.3 mm
	female	TNC-f	8001-4181-02	DC - 4.0	1.06 + 0.01 x f (GHz)	1.173"	29.8 mm
		TNC-m	8001-3181-02			1.398"	35.5 mm
	male	TNC-f	8001-4171-02			1.193"	30.3 mm
		TNC-m	8001-3171-02			1.41"	35.8 mm
C	female	7mm	8801-8990-02+	DC - 10.0	1.06 + 0.01 x f (GHz)	2.06"	52.2 mm
	male	7mm	8801-8890-02+			1.79"	45.5 mm
	female	N-f	8801-6189-02		1.05 + 0.01 x f (GHz)	2.375"	60.32mm
		N-m	8801-5189-02			2.039"	51.8 mm
	male	N-f	8801-6188-02			2.103"	53.42mm
		N-m	8801-5188-02			1.768"	44.9 mm
HN	female	N-f	8001-6168-02	DC - 8.0	1.07 + 0.01 x f (GHz)	1.772"	45.0 mm
		N-m	8001-5168-02			1.443"	36.6 mm
	male	N-f	8001-6169-02			1.52"	38.6 mm
		N-m	8001-5169-02			1.671"	42.4 mm
K*	female	2.4mm-f	8801-HFKF-02	DC - 40.0	1.15 : 1	.776"	19.7 mm
		2.4mm-m	8801-HMKF-02			.74"	18.8 mm
	male	2.4mm-f	8801-HFKM-02			.815"	20.7 mm
		2.4mm-m	8801-HMKM-02			.783"	19.9 mm

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Adapter Type		To:	Part Number	Frequency Range (GHz)	VSWR (max.)	Length			
						(in)	(mm)		
K*	female	3.5mm-f	8801-KF92-02	DC - 35.0	1.15 : 1	.945"	24.0 mm		
		3.5mm-m	8801-KF91-02			.988"	25.1 mm		
	male	3.5mm-f	8801-KM92-02			.988"	25.1 mm		
		3.5mm-m	8801-KM91-02			1.028"	26.1 mm		
	female	7mm	8801-KF90-02+	DC - 18.0	1.06 : 1	1.371"	34.8 mm		
	male		8801-KM90-02+			1.412"	35.9 mm		
	female	N-f	8001-KF61-02	DC - 18.0	1.06 + 0.005 x f (GHz)	1.268"	32.2 mm		
		N-m	8001-KF51-02			1.24"	31.5 mm		
	male	N-f	8001-KM61-02			1.268"	32.2 mm		
		N-m	8001-KM51-02			1.28"	32.5 mm		
	female	SMP-f	8001-KFMP-02	DC - 40.0	1.20 : 1	.655"	16.63mm		
			SMP-m			8001-KFMJ-02	.764"	19.4 mm	
		8002-KFMJ-02				.765"	19.42mm		
		8003-KFMJ-02							
		8004-KFMJ-02							
	male	SMP-f	8001-KMMP-02			.696"	17.68mm		
			SMP-m					8001-KMMJ-02	.806"
		8002-KMMJ-02							
		8003-KMMJ-02							
		8004-KMMJ-02							
	female	SMP-f Test Connector	8801-KFTP-02	DC - 18.0	1.10 : 1	.655"	16.63mm		
		SMP-m Test Connector	8801-KFTJ-02			.830"	21.07mm		
	male	SMP-f Test Connector	8801-KMTP-02			.696"	17.68mm		
		SMP-m Test Connector	8801-KMTJ-02			.871"	22.12mm		
N	female	1.4/4.4	8002-0361-02	DC - 18.0	1.07 + 0.01 x f (GHz)	1.558"	39.58mm		
			8001-0361-02			1.559"	39.6 mm		
	male		8001-0351-02			1.39"	35.3 mm		
			8002-0351-02						
	female	2.4mm-f	8001-HF61-02	DC - 18.0	1.06 + 0.005 x f (GHz)	1.228"	31.2 mm		
		2.4mm-m	8001-HM61-02			1.268"	32.2 mm		
	male	2.4mm-f	8001-HF51-02			1.24"	31.5 mm		
		2.4mm-m	8001-HM51-02			1.28"	32.5 mm		

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I:caene2.pm6 Date: 03-98

Between - Series Adapters



Adapter Type		To:	Part Number	Frequency Range (GHz)	VSWR (max.)	Length	
						(in)	(mm)
N	female	3.5mm-f	8002-6192-02	DC - 18.0	1.06 + 0.005 x f (GHz)	1.228"	31.2 mm
		3.5mm-m	8002-6191-02			1.268"	32.2 mm
	male	3.5mm-f	8002-5192-02			1.24"	31.5 mm
		3.5mm-m	8002-5191-02			1.28"	32.5 mm
	female	7mm	8801-6190-02+		1.06 : 1	2.047"	52.0 mm
	male		8801-5190-02+			1.711"	43.47mm
	female	7/16-f	8001-6176-02	DC - 7.5	1.06 + 0.005 x f (GHz)	1.596"	40.5 mm
		7/16-m	8001-5176-02			1.66"	42.2 mm
	male	7/16-f	8001-6175-02			1.632"	41.45mm
		7/16-m	8001-5175-02			1.634"	41.5 mm
	female	BMA-f	8001-BW61-02	DC - 18.0		1.167"	29.65mm
		BMA-m	8001-BW51-02			1.24"	31.5 mm
	male	BMA-f	8001-BM61-02			1.268"	32.2 mm
		BMA-m	8001-BM51-02			1.28"	32.5 mm
	female	BNC-f	8001-6181-02	DC - 4.0	1.06 + 0.01 x f (GHz)	1.496"	38.0 mm
		BNC-m	8001-6171-02			1.484"	37.7 mm
	male	BNC-f	8001-5181-02			1.54"	39.1 mm
		BNC-m	8001-5171-02			1.53"	38.8 mm
	female	C-f	8801-6189-02	DC - 10.0	1.05 + 0.01 x f (GHz)	2.375"	60.32mm
		C-m	8801-6188-02			2.103"	53.42mm
	male	C-f	8801-5189-02			2.039"	51.8 mm
		C-m	8801-5188-02			1.768"	44.9 mm
	female	HN-f	8001-6168-02	DC - 8.0	1.07 + 0.01 x f (GHz)	1.772"	45.0 mm
		HN-m	8001-6169-02			1.52"	38.6 mm
	male	HN-f	8001-5168-02			1.443"	36.6 mm
		HN-m	8001-5169-02			1.671"	42.4 mm
	female	K*-f	8001-KF61-02	DC - 18.0	1.06 + 0.005 x f (GHz)	1.268"	32.2 mm
		K*-m	8001-KM61-02			1.268"	32.2 mm
	male	K*-f	8001-KF51-02			1.24"	31.5 mm
		K*-m	8001-KM51-02			1.28"	32.5 mm
	female	SBX-f	8001-XF61-02	DC - 8.0	1.06 + 0.01 x f (GHz)	1.626"	41.3 mm
		SBX-m	8001-XM61-02			1.417"	36.0 mm
	male	SBX-f	8001-XF51-02			1.76"	44.7 mm
		SBX-m	8001-XM51-02			1.55"	39.4 mm
	female	SBY-f	8001-YF61-02	DC - 12.0	1.03 + 0.01 x f (GHz)	1.268"	32.2 mm
		SBY-m	8001-YM61-02			1.358"	34.5 mm
	male	SBY-f	8001-YF51-02			1.429"	36.3 mm
		SBY-m	8001-YM51-02			1.52"	38.6 mm

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Adapter Type		To:	Part Number	Frequency Range (GHz)	VSWR (max.)	Length	
						(in)	(mm)
N	female	SC-f	8001-6179-02	DC - 10.0	1.05 + 0.01 x f (GHz)	1.933"	49.1 mm
		SC-m	8001-6180-02			2.039"	51.8 mm
	male	SC-f	8001-5179-02			1.451"	36.8 mm
		SC-m	8001-5180-02			1.9"	48.26mm
	female	SMA-f	8005-2161-02	DC - 18.0	1.06 + 0.005 x f (GHz)	1.226"	31.14mm
		SMA-m	8004-1161-02			1.268"	32.2 mm
	male	SMA-f	8002-2151-02			1.24"	31.5 mm
		SMA-m	8002-1151-02			1.28"	32.5 mm
	female	TNC-f	8001-4161-02			1.24"	31.5 mm
		TNC-m	8001-3161-02			1.457"	37.0 mm
	male	TNC-f	8001-4151-02			1.331"	33.8 mm
		TNC-m	8001-3151-02			1.496"	38.0 mm
	female	TNX-f	8001-4961-02			1.25"	31.7 mm
		TNX-m	8001-3961-02			1.33"	33.9 mm
	male	TNX-f	8001-4951-02			1.297"	33.0 mm
		TNX-m	8001-3951-02			1.37"	34.9 mm
SBX	female	7/16-f	8001-XF76-02	DC - 7.5	1.06 + 0.005 x f (GHz)	1.761"	44.7 mm
		7/16-m	8001-XF75-02			1.809"	46.0 mm
	male	7/16-f	8001-XM76-02			1.528"	38.8 mm
		7/16-m	8001-XM75-02			1.564"	39.7 mm
	female	N-f	8001-XF61-02	DC - 8.0	1.06 + 0.01 x f (GHz)	1.626"	41.3 mm
		N-m	8001-XF51-02			1.76"	44.7 mm
	male	N-f	8001-XM61-02			1.417"	36.0 mm
		N-m	8001-XM51-02			1.55"	39.4 mm
	female	SMA-f	8001-XF21-02	DC - 8.0	1.06 + 0.005 x f (GHz)	1.543"	39.2 mm
		SMA-m	8001-XF11-02			1.587"	40.3 mm
	male	SMA-f	8001-XM21-02			1.335"	33.9 mm
		SMA-m	8001-XM11-02			1.378"	35.0 mm
SBY	female	7/16-f	8001-YF76-02	DC - 7.5	1.06 + 0.005 x f (GHz)	1.642"	41.7 mm
		7/16-m	8001-YF75-02			1.674"	42.5 mm
	male	7/16-f	8001-YM76-02			1.735"	44.0 mm
		7/16-m	8001-YM75-02			1.768"	44.9 mm
	female	N-f	8001-YF61-02	DC - 12.0	1.03 + 0.01 x f (GHz)	1.268"	32.2 mm
		N-m	8001-YF51-02			1.429"	36.3 mm
	male	N-f	8001-YM61-02			1.358"	34.5 mm
		N-m	8001-YM51-02			1.52"	38.6 mm
	female	SMA-f	8001-YF21-02		1.06 + 0.005 x f (GHz)	1.146"	29.1 mm
		SMA-m	8001-YF11-02			1.189"	30.2 mm
	male	SMA-f	8001-YM21-02			1.236"	31.4 mm
		SMA-m	8001-YM11-02			1.28"	32.5 mm

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Between - Series Adapters

Adapter Type		To:	Part Number	Frequency Range (GHz)	VSWR (max.)	Length	
						(in)	(mm)
SC	female	7mm	8001-7990-02+	DC - 10.0	1.06 + 0.01 x f (GHz)	1.665"	42.3 mm
	male		8001-8090-02+			1.76"	44.8 mm
	female	N-f	8001-6179-02		1.05 + 0.01 x f (GHz)	1.933"	49.1 mm
		N-m	8001-5179-02			1.451"	36.8 mm
	male	N-f	8001-6180-02			2.039"	51.8 mm
		N-m	8001-5180-02			1.9"	48.26mm
SMA	female	7mm	8001-2190-02+	DC - 18.0	1.06 : 1	1.3"	33.0 mm
	male		8001-1190-02+			1.36"	34.5 mm
	female	BMA-f	8801-BW21-02		1.06 + 0.005 x f (GHz)	.909"	23.1 mm
		BMA-m	8801-BM21-02			.713"	18.1 mm
	male	BMA-f	8801-BW11-02			.953"	24.2 mm
		BMA-m	8801-BM11-02			.756"	19.2 mm
	female	BNC-f	8001-2181-02	DC - 4.0		1.024"	26.0 mm
		BNC-m	8001-2171-02			1.043"	26.5 mm
	male	BNC-f	8001-1181-02			1.135"	28.8 mm
		BNC-m	8001-1171-02			1.155"	29.3 mm
	female	N-f	8005-2161-02	DC - 18.0		1.226"	31.14mm
		N-m	8002-2151-02			1.24"	31.5 mm
	male	N-f	8004-1161-02			1.268"	32.2 mm
		N-m	8002-1151-02			1.28"	32.5 mm
	female	SBX-f	8001-XF21-02	DC - 8.0		1.543"	39.2 mm
		SBX-m	8001-XM21-02			1.335"	33.9 mm
	male	SBX-f	8001-XF11-02			1.587"	40.3 mm
		SBX-m	8001-XM11-02			1.378"	35.0 mm
	female	SBY-f	8001-YF21-02	DC - 12.0		1.146"	29.1 mm
		SBY-m	8001-YM21-02			1.236"	31.4 mm
	male	SBY-f	8001-YF11-02			1.189"	30.2 mm
		SBY-m	8001-YM11-02			1.28"	32.5 mm
	female	SPM-f	8801-PJ21-02	DC - 18.0		.776"	19.71mm
		SPM-m	8801-PM21-02			.798"	20.3 mm
	male	SPM-f	8801-PJ11-02			.785"	19.93mm
		SPM-m	8801-PM11-02			.933"	23.7 mm
	female	TNC-f	8001-2141-02			1.146"	29.1 mm
		TNC-m	8001-2131-02			1.0"	25.4 mm
	male	TNC-f	8001-1141-02			1.256"	31.9 mm
		TNC-m	8001-1131-02			1.11"	28.2 mm
	female	TNX-f	8001-2149-02			1.378"	35.0 mm
		TNX-m	8001-2139-02			1.164"	29.56mm
	male	TNX-f	8001-1149-02			1.276"	32.4 mm
		TNX-m	8001-1139-02			1.276"	32.4 mm

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Adapter Type		To:	Part Number	Frequency Range (GHz)	VSWR (max.)	Length	
						(in)	(mm)
SMP	female	7mm	8001-MP90-02+	DC - 18.0	1.10 : 1	1.197"	30.4 mm
	male		8001-MJ90-02+			1.479"	36.7 mm
			8002-MJ90-02+				
			8003-MJ90-02+				
			8004-MJ90-02+				
	female	K*-f	8001-KFMP-02	DC - 40.0	1.20 : 1	.655"	16.63mm
	male		8001-KFMJ-02			.764"	19.4 mm
			8002-KFMJ-02			.765"	19.42mm
			8003-KFMJ-02				
			8004-KFMJ-02				
	female	K*-m	8001-KMMP-02	DC - 40.0	1.20 : 1	.696"	17.68mm
	male		8001-KMMJ-02			.806"	20.47mm
			8002-KMMJ-02				
			8003-KMMJ-02				
			8004-KMMJ-02				
SMP Test Connector	female	7mm	8801-TP90-02+	DC - 18.0	1.10 : 1	1.20"	30.4 mm
	male		8801-TJ90-02+			1.37"	34.8 mm
	female	K*-f	8801-KFTP-02			.655"	16.63mm
		K*-m	8801-KMTP-02			.696"	17.68mm
	male	K*-f	8801-KFTJ-02			.830"	21.07mm
		K*-m	8801-KMTJ-02			.871"	22.12mm
SPM	female	SMA-f	8801-PJ21-02	DC - 18.0	1.06 + 0.005 x f (GHz)	.776"	19.71mm
		SMA-m	8801-PJ11-02			.785"	19.93mm
	male	SMA-f	8801-PM21-02			.798"	20.3 mm
		SMA-m	8801-PM11-02			.933"	23.7 mm
TNC	female	7mm	8002-4190-02+	DC - 18.0	1.10 : 1	1.926"	48.9 mm
	male		8003-3190-02+			2.038"	51.77mm
	female	BNC-f	8001-4181-02	DC - 4.0	1.06 + 0.01 x f (GHz)	1.173"	29.8 mm
		BNC-m	8001-4171-02			1.193"	30.3 mm
	male	BNC-f	8001-3181-02			1.398"	35.5 mm
		BNC-m	8001-3171-02			1.41"	35.8 mm
	female	N-f	8001-4161-02	DC - 18.0	1.06 + 0.005 x f (GHz)	1.24"	31.5 mm
		N-m	8001-4151-02			1.331"	33.8 mm
	male	N-f	8001-3161-02			1.457"	37.0 mm
		N-m	8001-3151-02			1.496"	38.0 mm
	female	SMA-f	8001-2141-02	DC - 18.0	1.06 + 0.005 x f (GHz)	1.146"	29.1 mm
		SMA-m	8001-1141-02			1.256"	31.9 mm
	male	SMA-f	8001-2131-02			1.0"	25.4 mm
		SMA-m	8001-1131-02			1.11"	28.2 mm

Adapters, starting the Part Number with 88xx are Phase Matched within the Series.

+ The Center Conductor of the 7mm Connector is supplied with 4 slots. If you require 6 slots, code changes from **90** to **96**.

Between - Series Adapters

Adapter Type		To:	Part Number	Frequency Range (GHz)	VSWR (max.)	Length	
						(in)	(mm)
TNX	female	3.5mm-f	8001-4992-02	DC - 18.0	1.06 + 0.01 x f (GHz)	1.414"	35.92mm
		3.5mm-m	8001-4991-02			1.49"	37.9 mm
	male	3.5mm-f	8001-3992-02			1.2"	30.5 mm
		3.5mm-m	8001-3991-02			1.335"	33.9 mm
	female	7mm	8001-4990-02+		1.10 : 1	1.339"	34.0 mm
	male		8001-3990-02+			1.46"	37.1 mm
	female	N-f	8001-4961-02		1.06 + 0.005 x f (GHz)	1.25"	31.7 mm
		N-m	8001-4951-02			1.297"	33.0 mm
	male	N-f	8001-3961-02			1.33"	33.9 mm
		N-m	8001-3951-02			1.37"	34.9 mm
	female	SMA-f	8001-2149-02			1.378"	35.0 mm
		SMA-m	8001-1149-02			1.276"	32.4 mm
	male	SMA-f	8001-2139-02			1.164"	29.56mm
		SMA-m	8001-1139-02			1.276"	32.4 mm

Adapters, starting the Part Number with 88xx are Phase Matched within the Series.

+ The Center Conductor of the 7mm Connector is supplied with 4 slots. If you require 6 slots, code changes from **90** to **96**.



Section II.5.c

NMD	2.4mm
Test	3.5mm
Port	7mm
Adapters	K*
	N

II. Calibration Components				
1. Opens-Shorts-Loads & Throughlines		47		
2. Connector Interface Gauges		75		
3. Torque Wrenches		89		
4. Thread Limit Gauges		93		
5.	Instrument Grade Adapters			
	a. In-Series		97	
	b. Between Series		101	
	c.	NMD Test Port Adapters		113
		1. 2.4mm		121
		2. 3.5mm		125
		3. 7mm		129
		4. K* (2.9mm)		137
5. N		141		

- 1.4/4.4
- 2.4mm
- 3.5mm
- 7mm
- 7/16
- BMA
- BNC
- C
- HN
- K*
- N
- SBX
- SBY
- SC
- SMA
- TNC
- TNX

port.png

2.4mm NMD		Page 122	Page 122	Page 123					
3.5mm NMD		Page 126	Pages 126 - 127	Page 127					
7mm		Page 130	Pages 130 - 131					Page 131	
K* NMD		Page 138	Page 138	Page 139					
N NMD	Page 142	Page 142	Page 143	Page 143	Page 144	Page 144	Page 145	Page 145	Page 146
	1.4/4.4	2.4mm	3.5mm	7mm	7/16	BMA	BNC	C	HN

Reference Table

Test Port Adapters, 50 Ohms



Page 123	Page 124								2.4mm NMD
Page 128	Page 128								3.5mm NMD
Page 132	Page 132		Page 133	Page 133	Pages 134 - 135	Page 136	Page 136		7mm
Page 139	Page 140								K* NMD
Page 146	Pages 147 - 148	Page 148	Page 149	Page 149	Page 150		Page 150	Page 151	N NMD
K*	N	SBX	SBY	SC	SMA	SMP	TNC	TNX	

Test Port Adapters suggested for Hewlett Packard ANA



Test Port Adapters suggested for Hewlett Packard Network Analyzers						
FROM Hewlett Packard Network Analyzer		TO (Connector Type)	Part Number	Frequency Range (GHz)	VSWR (max.)	Length
Test Port Connector 2.4mm NMD Additional Information on page 121 f.f.		2.4mm - f	8001-HFH2-02	DC - 50.0	1.20 : 1	.819" 20.8mm
		2.4mm - m	8001-HMH2-02			.787" 20.0mm
		3.5mm - f	8001-H292-02	DC - 35.0	1.15 : 1	.989" 25.12mm
		3.5mm - m	8001-H291-02			1.031" 26.2mm
		7mm	8001-H296-02	DC - 18.0	1.06 : 1	1.415" 35.94mm
		K* - f	8001-H2KF-02	DC - 40.0	1.15 : 1	.775" 19.7mm
		K* - m	8001-H2KM-02			.816" 20.73mm
		N - f	8001-H261-02	DC - 18.0	1.06 + 0.005 x f (GHz)	1.228" 31.2mm
		N - m	8001-H251-02			1.24" 31.5mm
Test Port Connector 3.5mm NMD Additional Information on page 125 f.f.		2.4mm - f	8001-HFH3-02	DC - 35.0	1.15 : 1	.989" 25.12mm
		2.4mm - m	8001-HMH3-02			.956" 24.28mm
		3.5mm - f	8001-H392-02	DC - 26.5		.947" 24.06mm
			8002-H392-02	DC - 35.0		.947" 24.06mm
		3.5mm - m	8001-H391-02	DC - 26.5		.989" 25.11mm
			8002-H391-02	DC - 35.0		.989" 25.11mm
		7mm	8001-H396-02	DC - 18.0	1.06 : 1	1.268" 32.2mm
		K* - f	8001-H3KF-02	DC - 35.0	1.15 : 1	.945" 24.0mm
		K* - m	8001-H3KM-02			.986" 25.05mm
		N - f	8001-H361-02	DC - 18.0	1.06 + 0.005 x f (GHz)	1.228" 31.2mm
		N - m	8001-H351-02			1.24" 31.5mm

Test Port Adapters suggested for Hewlett Packard Network Analyzers						
FROM Hewlett Packard Network Analyzer		TO (Connector Type)	Part Number	Frequency Range (GHz)	VSWR (max.)	Length
	7mm Additional Information on page 129 f.f.	2.4mm - f	8001-HF96-02	DC - 18.0	1.06 : 1	1.415" 35.9mm
		2.4mm - m	8001-HM96-02			1.382" 35.1mm
		3.5mm - f	8003-9296-02			1.268" 32.2mm
		3.5mm - m	8003-9196-02			1.376" 34.95mm
		3.5mm - f	8001-9296-02		1.15 : 1	1.343" 34.1mm
		3.5mm - m	8001-9196-02			1.453" 36.9mm
		C - f	8001-8996-02	DC - 10.0	1.06 + 0.01 x f (GHz)	2.06" 52.2mm
		C - m	8001-8896-02			1.79" 45.5mm
		K* - f	8001-KF96-02	DC - 18.0	1.06 : 1	1.371" 34.8mm
		K* - m	8001-KM96-02			1.412" 35.9mm
		N - f	8002-6196-02			2.047" 52.0mm
		N - m	8002-5196-02			1.711" 43.47mm
		SC - f	8001-7996-02	DC - 10.0	1.06 + 0.01 x f (GHz)	1.665" 42.3mm
		SC - m	8001-8096-02			1.76" 44.8mm
		SMA - f	8001-2196-02	DC - 18.0	1.06 : 1	1.3" 33.0mm
		SMA - m	8001-1196-02			1.36" 34.5mm
		SMP - f	8001-MP96-02		1.10 : 1	1.197" 30.4mm
		SMP - m	8001-MJ96-02			1.479" 36.7mm
			8002-MJ96-02			
			8003-MJ96-02			
			8004-MJ96-02			
		SMP -f Test Port Connector	8001-TP96-02			1.181" 30.0mm
		SMP - m Test Port Connector	8001-TJ96-02			1.354" 34.4mm
		TNC - f	8002-4196-02			1.926" 48.9mm
		TNC - m	8003-3196-02			2.038" 51.77mm
		TNX - f	8001-4996-02			1.339" 34.0mm
		TNX - m	8001-3996-02			1.46" 37.1mm

Test Port Adapters suggested for Hewlett Packard ANA



Test Port Adapters suggested for Hewlett Packard Network Analyzers					
FROM Hewlett Packard Network Analyzer	TO (Connector Type)	Part Number	Frequency Range (GHz)	VSWR (max.)	Length
	Test Port Connector NMD Additional Information on page 141 f.f.	1.4/4.4	8001-ND03-02	1.07 + 0.01 x f (GHz)	1.39" 35.3mm
		2.4mm - f	8001-HFND-02	1.06 + 0.005 x f (GHz)	1.24" 31.5mm
		2.4mm - m	8001-HMND-02		1.28" 32.5mm
		3.5mm - f	8001-ND92-02		1.24" 31.5mm
		3.5mm - m	8001-ND91-02		1.28" 32.5mm
		7mm	8001-ND96-02	1.06 : 1	1.711" 43.47mm
		7/16 - f	8001-ND76-02	DC - 7.5	1.66" 42.2mm
		7/16 - m	8001-ND75-02		1.634" 41.5mm
		BMA - f	8001-BWND-02	DC - 18.0	1.24" 31.5mm
		BMA - m	8001-BMND-02		1.28" 32.5mm
		BNC - f	8001-ND81-02	DC - 4.0	1.54" 39.1mm
		BNC - m	8001-ND71-02		1.53" 38.8mm
		C - f	8001-ND89-02	DC - 10.0	2.039" 51.8mm
		C - m	8001-ND88-02		1.768" 44.9mm
		HN - f	8001-ND68-02	DC - 8.0	1.443" 36.6mm
		HN - m	8001-ND69-02		1.671" 42.4mm
		K* - f	8001-KFND-02	DC - 18.0	1.24" 31.5mm
		K* - m	8001-KMND-02		1.28" 32.5mm
			8001-ND61-02		1.398" 35.5mm
		N - f	8090-ND61-02		1.555" 39.5mm
			8091-ND61-02		1.06" 26.9mm
		N - m	8001-ND51-02	1.06 + 0.005 x f (GHz)	1.61" 40.9mm
			8091-ND51-02		1.11" 28.2mm
		SBX - f	8001-NDXF-02	DC - 8.0	1.76" 44.7mm
		SBX - m	8001-NDXM-02		1.55" 39.4mm
		SBY - f	8001-NDYF-02	DC - 12.0	1.429" 36.3mm
		SBY - m	8001-NDYM-02		1.52" 38.6mm

Test Port Adapters suggested for Hewlett Packard ANA

Test Port Adapters suggested for Hewlett Packard Network Analyzers						
FROM Hewlett Packard Network Analyzer		TO (Connector Type)	Part Number	Frequency Range (GHz)	VSWR (max.)	Length
Test Port Connector NMD Additional Information on page 141 f.f.		SC - f	8001-ND79-02	DC - 10.0	1.05 + 0.01 x f (GHz)	1.793" 45.6mm
		SC - m	8001-ND80-02			1.9" 48.26mm
		SMA - f	8001-ND21-02	DC - 18.0	1.06 + 0.005 x f (GHz)	1.24" 31.5mm
		SMA - m	8001-ND11-02			1.28" 32.5mm
		TNC - f	8001-ND41-02			1.331" 33.8mm
		TNC - m	8001-ND31-02			1.496" 38.0mm
		TNX - f	8001-ND49-02			1.297" 33.0mm
		TNX - m	8001-ND39-02			1.37" 34.9mm

Test Port Adapters suggested for Wiltron ANA

Test Port Adapters suggested for Wiltron Network Analyzers						
FROM Wiltron Network Analyzer		TO (Connector Type)	Part Number	Frequency Range (GHz)	VSWR (max.)	Length
Test Port Connector for K* NMD Additional Information on page 137 f.f.		2.4mm - f	8001-HFWI-02	DC - 40.0	1.15 : 1	.775" 19.68mm
		2.4mm - m	8001-HMWI-02			.742" 18.84mm
		3.5mm - f	8001-WI92-02	DC - 35.0		.945" 24.0mm
		3.5mm - m	8001-WI91-02			.986" 25.05mm
		7 mm	8001-WI96-02	DC - 18.0	1.06 : 1	1.371" 34.82mm
		K* - f	8001-KFWI-02	DC - 40.0	1.15 : 1	.731" 18.56mm
		K* - m	8001-KMWI-02			.772" 19.61mm
		N - f	8001-WI61-02	DC - 18.0	1.06 + .005 x f (GHz)	1.228" 31.2mm
		N - m	8001-WI51-02			1.24" 31.5mm



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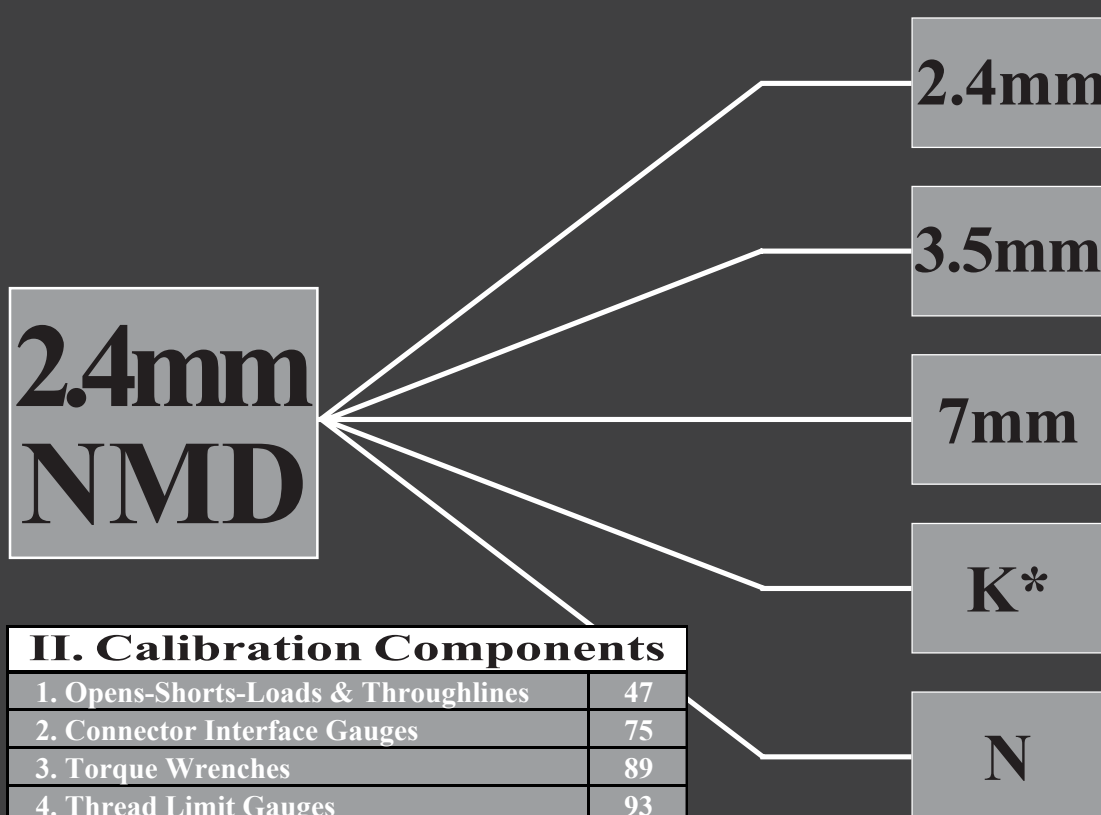
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Section II.5.c.1

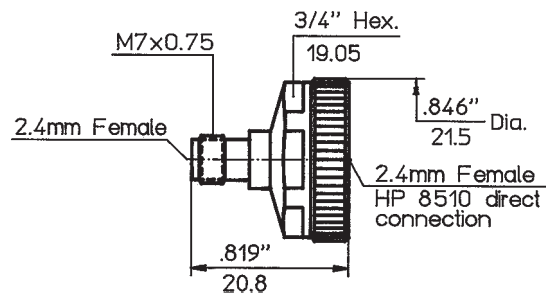


II. Calibration Components				
1. Opens-Shorts-Loads & Throughlines			47	
2. Connector Interface Gauges			75	
3. Torque Wrenches			89	
4. Thread Limit Gauges			93	
5.	Instrument Grade Adapters			
	a. In-Series		97	
	b. Between Series		101	
	c.	NMD Test Port Adapters		113
		1. 2.4mm		121
		2. 3.5mm		125
		3. 7mm		129
		4. K* (2.9mm)		137
		5. N		141

port1.png

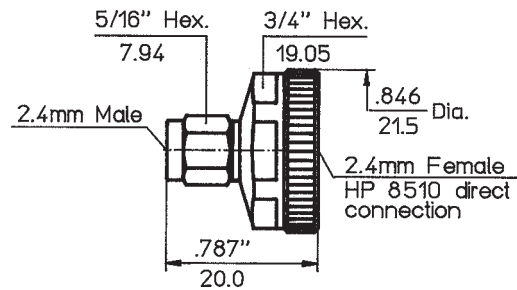
Type 2.4mm NMD Test Port Adapters

Part - No.	8001-HFH2-02
Connectors	2.4mm-F to 2.4mm-F
Frequency	DC - 50.0 GHz
VSWR max.	1.20 : 1



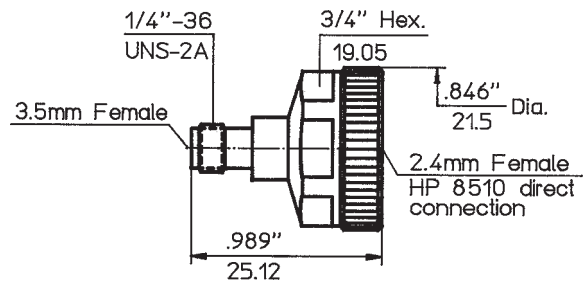
for direct connection with HP8510

Part - No.	8001-HMH2-02
Connectors	2.4mm-F to 2.4mm-M
Frequency	DC - 50.0 GHz
VSWR max.	1.20 : 1



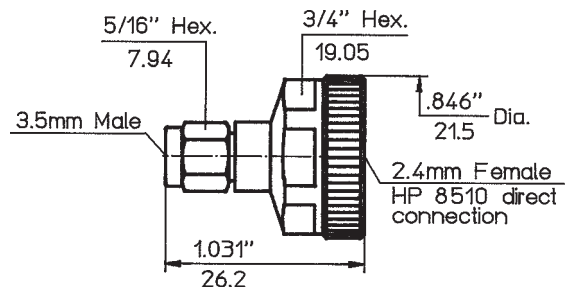
for direct connection with HP8510

Part - No.	8001-H292-02
Connectors	2.4mm-F to 3.5mm-F
Frequency	DC - 35.0 GHz
VSWR max.	1.15 : 1



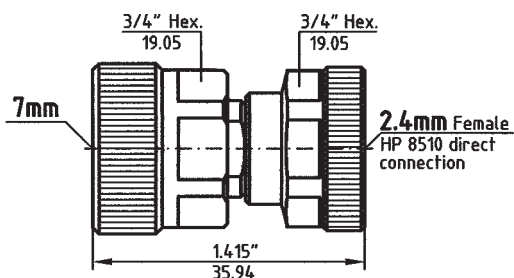
for direct connection with HP8510

Part - No.	8001-H291-02
Connectors	2.4mm-F to 3.5mm-M
Frequency	DC - 35.0 GHz
VSWR max.	1.15 : 1



for direct connection with HP8510

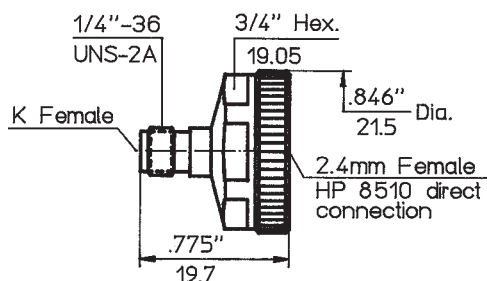
Dimensions shown are inches over millimeters. Standard units have stainless steel finish (last two digits of the P/N are -02). Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, as applicable.



for direct connection with HP8510

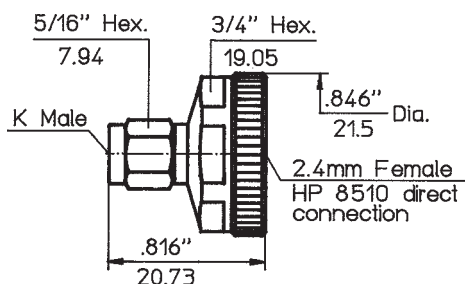
The Center Conductor of the 7 mm Connector is supplied with 6 slots.

Part - No.	8001-H296-02
Connectors	2.4mm-F to 7mm
Frequency	DC - 18.0 GHz
VSWR max.	1.06 : 1



for direct connection with HP 8510

Part - No.	8001-H2KF-02
Connectors	2.4mm-F to K*-Fem.
Frequency	DC - 40.0 GHz
VSWR max.	1.15 : 1



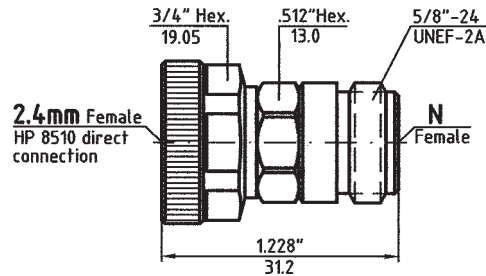
for direct connection with HP 8510

Part - No.	8001-H2KM-02
Connectors	2.4mm-F to K*-Male
Frequency	DC - 40.0 GHz
VSWR max.	1.15 : 1

Dimensions shown are inches over millimeters. Standard units have stainless steel finish (last two digits of the P/N are -02). Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, as applicable.

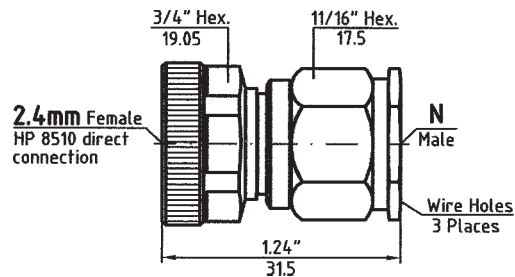
Type 2.4mm NMD Test Port Adapters

Part - No.	8001-H261-02
Connectors	2.4mm-F to N-Fem.
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f(\text{GHz})$



for direct connection with HP8510

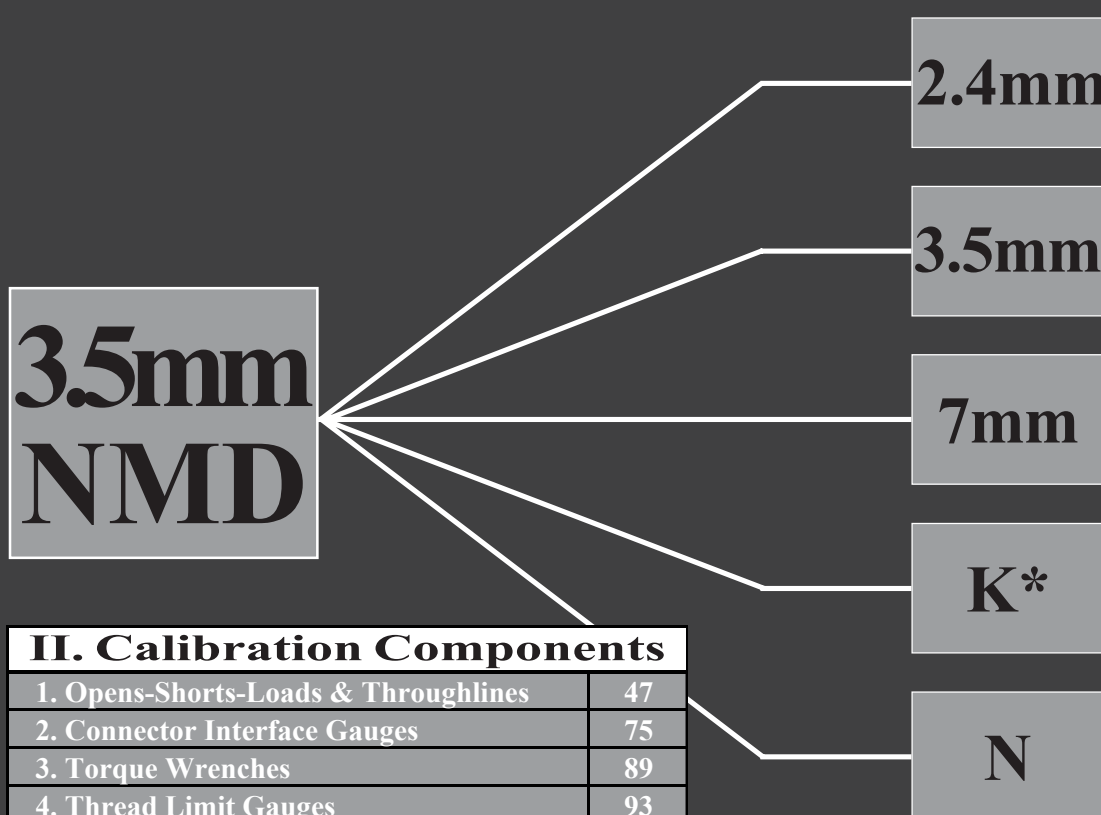
Part - No.	8001-H251-02
Connectors	2.4mm-F to N-Male
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f(\text{GHz})$



for direct connection with HP8510

Dimensions shown are inches over millimeters. Standard units have stainless steel finish (last two digits of the P/N are -02). Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, as applicable.

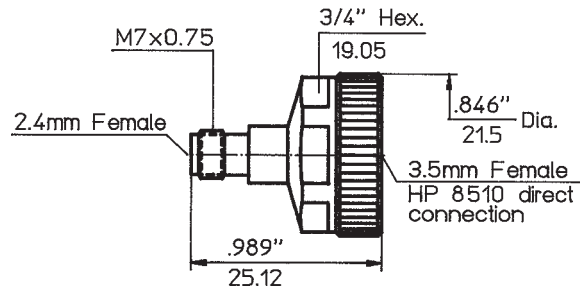
Section II.5.c.2



II. Calibration Components				
1. Opens-Shorts-Loads & Throughlines			47	
2. Connector Interface Gauges			75	
3. Torque Wrenches			89	
4. Thread Limit Gauges			93	
5.	Instrument Grade Adapters			
	a. In-Series		97	
	b. Between Series		101	
	c.	NMD Test Port Adapters		113
		1. 2.4mm		121
		2. 3.5mm		125
		3. 7mm		129
		4. K* (2.9mm)		137
		5. N		141

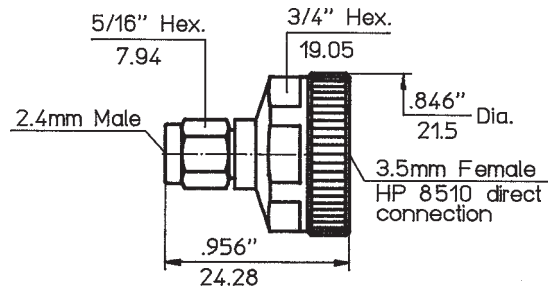
Type 3.5mm NMD Test Port Adapters

Part - No.	8001-HFH3-02
Connectors	3.5mm-F to 2.4mm-F
Frequency	DC - 35.0 GHz
VSWR max.	1.15 : 1



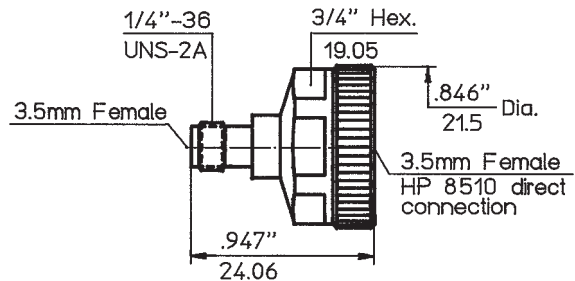
for direct connection with HP8510

Part - No.	8001-HMH3-02
Connectors	3.5mm-F to 2.4mm-M
Frequency	DC - 35.0 GHz
VSWR max.	1.15 : 1



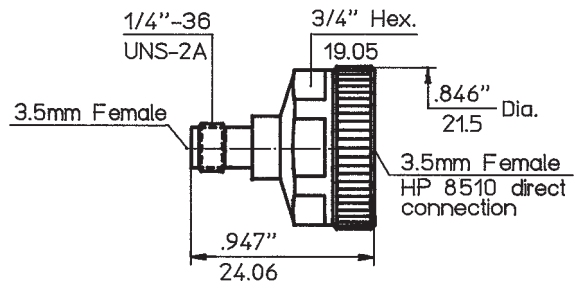
for direct connection with HP8510

Part - No.	8001-H392-02
Connectors	3.5mm-F to 3.5mm-F
Frequency	DC - 26.5 GHz
VSWR max.	1.15 : 1



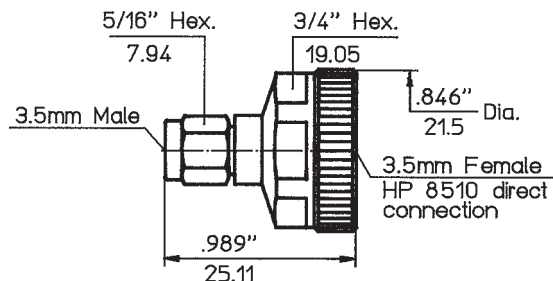
for direct connection with HP8510

Part - No.	8002-H392-02
Connectors	3.5mm-F to 3.5mm-F
Frequency	DC - 35.0 GHz
VSWR max.	1.15 : 1



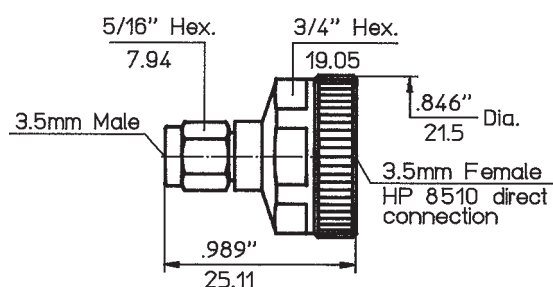
for direct connection with HP8510

Dimensions shown are inches over millimeters. Standard units have stainless steel finish (last two digits of the P/N are -02). Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, as applicable.



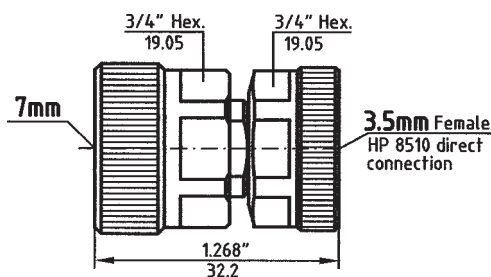
for direct connection with HP8510

Part - No.	8001-H391-02
Connectors	3.5mm-F to 3.5mm-M
Frequency	DC - 26.5 GHz
VSWR max.	1.15 : 1



for direct connection with HP8510

Part - No.	8002-H391-02
Connectors	3.5mm-F to 3.5mm-M
Frequency	DC - 35.0 GHz
VSWR max.	1.15 : 1



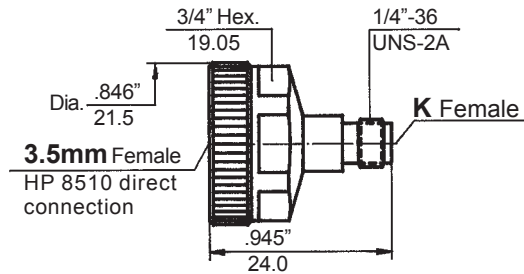
for direct connection with HP8510

The Center Conductor of the 7 mm Connector is supplied with 6 slots.

Part - No.	8001-H396-02
Connectors	3.5mm-F to 7mm
Frequency	DC - 18.0 GHz
VSWR max.	1.06 : 1

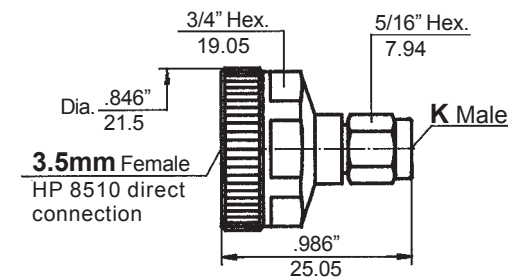
Type 3.5mm NMD Test Port Adapters

Part - No.	8001-H3KF-02
Connectors	3.5mm-F to K*-Fem.
Frequency	DC - 35.0 GHz
VSWR max.	1.15 : 1



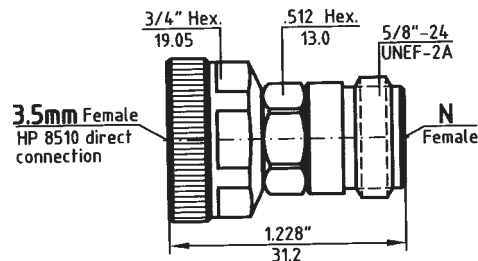
for direct connection with HP8510

Part - No.	8001-H3KM-02
Connectors	3.5mm-F to K*-Male
Frequency	DC - 35.0 GHz
VSWR max.	1.15 : 1



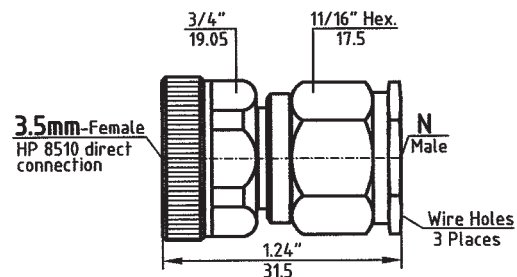
for direct connection with HP 8510

Part - No.	8001-H361-02
Connectors	3.5mm-F to N-Fem.
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f(\text{GHz})$



for direct connection with HP8510

Part - No.	8001-H351-02
Connectors	3.5mm-F to N-Male
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f(\text{GHz})$



for direct connection with HP8510

Dimensions shown are inches over millimeters. Standard units have stainless steel finish (last two digits of the P/N are -02). Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, as applicable.

Section II.5.c.3

**7mm
NMD**

2.4mm

3.5mm

C

K*

N

SC

SMA

SMP

TNC

TNX

II. Calibration Components

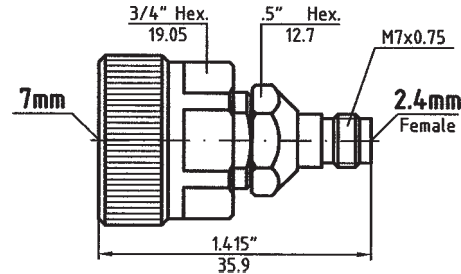
1. Opens-Shorts-Loads & Throughlines		47
2. Connector Interface Gauges		75
3. Torque Wrenches		89
4. Thread Limit Gauges		93
5.	Instrument Grade Adapters	
	a. In-Series	97
	b. Between Series	101
	NMD Test Port Adapters	
	1. 2.4mm	121
	2. 3.5mm	125
	3. 7mm	129
	4. K* (2.9mm)	137
	5. N	141

port1.png

Type 7mm NMD Test Port Adapters

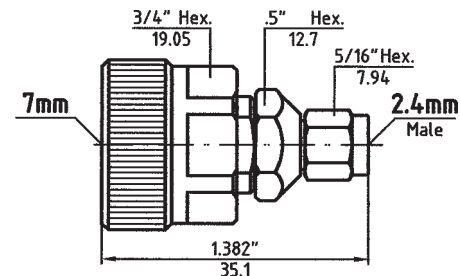
The Center Conductor of the 7 mm Connector is supplied with 6 slots.

Part - No.	8001-HF96-02
Connectors	7mm to 2.4mm-F
Frequency	DC - 18.0 GHz
VSWR max.	1.06 : 1



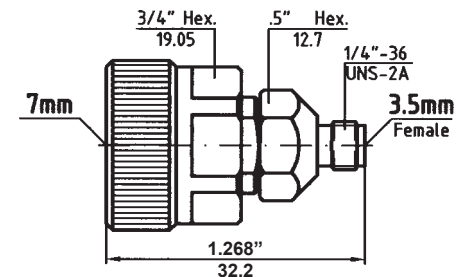
The Center Conductor of the 7 mm Connector is supplied with 6 slots.

Part - No.	8001-HM96-02
Connectors	7mm to 2.4mm-M
Frequency	DC - 18.0 GHz
VSWR max.	1.06 : 1



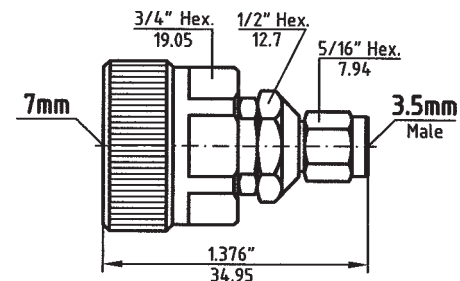
The Center Conductor of the 7 mm Connector is supplied with 6 slots.

Part - No.	8003-9296-02
Connectors	7mm to 3.5mm-F
Frequency	DC - 18.0 GHz
VSWR max.	1.06 : 1

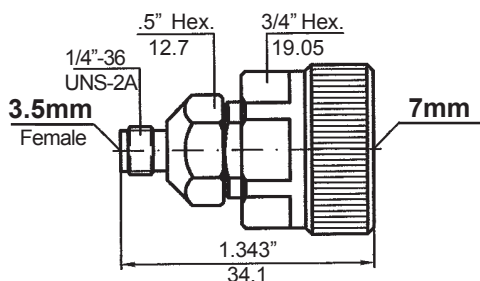


The Center Conductor of the 7 mm Connector is supplied with 6 slots.

Part - No.	8003-9196-02
Connectors	7mm to 3.5mm-M
Frequency	DC - 18.0 GHz
VSWR max.	1.06 : 1

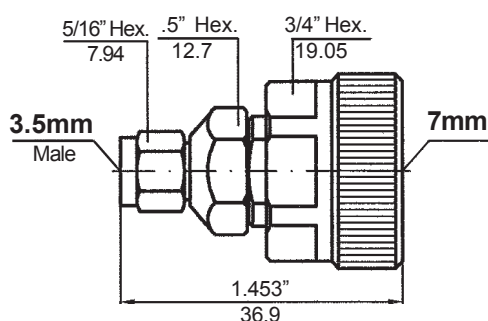


Dimensions shown are inches over millimeters. Standard units have stainless steel finish (last two digits of the P/N are -02). Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, as applicable.



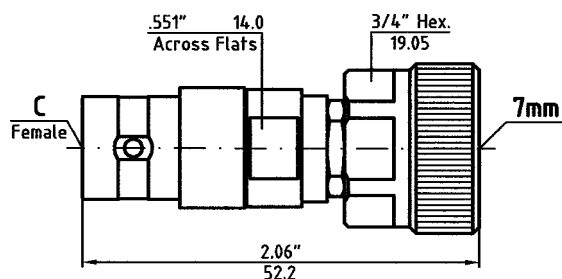
The Center Conductor of the 7 mm Connector is supplied with 6 slots.

Part - No.	8001-9296-02
Connectors	7mm to 3.5mm-F
Frequency	DC - 18.0 GHz
VSWR max.	1.15 : 1



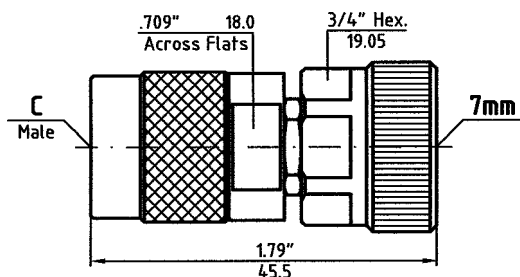
The Center Conductor of the 7 mm Connector is supplied with 6 slots.

Part - No.	8001-9196-02
Connectors	7mm to 3.5mm-M
Frequency	DC - 18.0 GHz
VSWR max.	1.15 : 1



The Center Conductor of the 7 mm Connector is supplied with 6 slots.

Part - No.	8001- 8996 - 02
Connectors	7mm to C-Female
Frequency	DC - 10.0 GHz
VSWR max.	1.06 + 0.01 x f (GHz)



The Center Conductor of the 7 mm Connector is supplied with 6 slots.

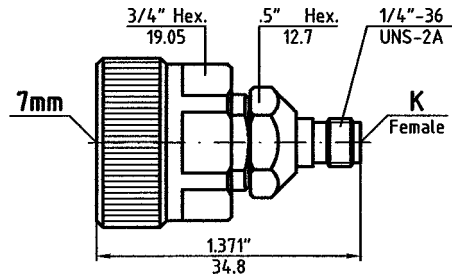
Part - No.	8001- 8896 - 02
Connectors	7mm to C-Male
Frequency	DC - 10.0 GHz
VSWR max.	1.06 + 0.01 x f (GHz)

Dimensions shown are inches over millimeters. Standard units have stainless steel finish (last two digits of the P/N are -02). Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, as applicable.

Type 7mm NMD Test Port Adapters

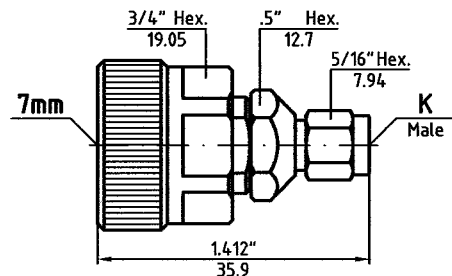
The Center Conductor of the 7 mm Connector is supplied with 6 slots.

Part - No.	8001-KF96-02
Connectors	7mm to K*-Female
Frequency	DC - 18.0 GHz
VSWR max.	1.06 : 1



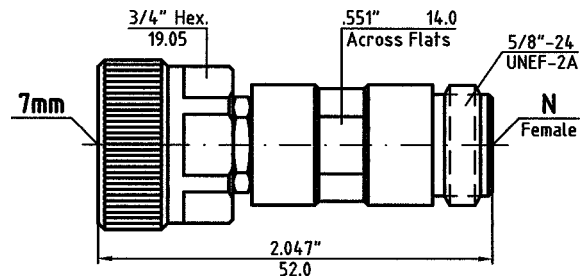
The Center Conductor of the 7 mm Connector is supplied with 6 slots.

Part - No.	8001-KM96-02
Connectors	7mm to K*-Male
Frequency	DC - 18.0 GHz
VSWR max.	1.06 : 1



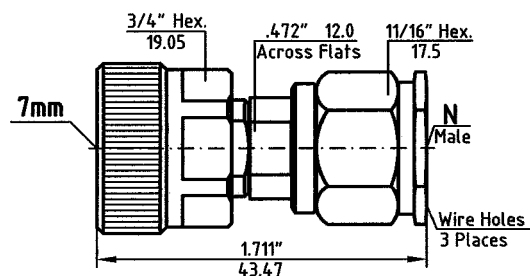
The Center Conductor of the 7 mm Connector is supplied with 6 slots.

Part - No.	8002-6196-02
Connectors	7mm to N-Female
Frequency	DC - 18.0 GHz
VSWR max.	1.06 : 1

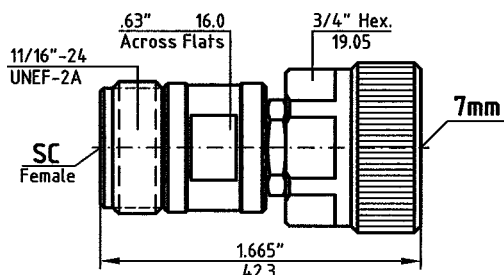


The Center Conductor of the 7 mm Connector is supplied with 6 slots.

Part - No.	8002-5196-02
Connectors	7mm to N-Male
Frequency	DC - 18.0 GHz
VSWR max.	1.06 : 1

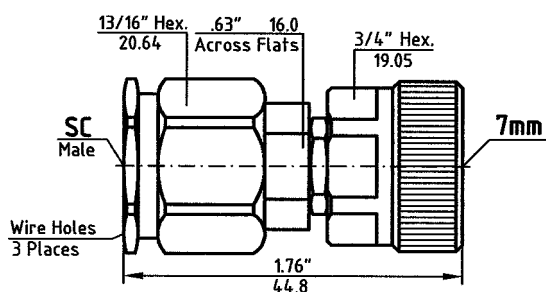


Dimensions shown are inches over millimeters. Standard units have stainless steel finish (last two digits of the P/N are -02). Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, as applicable.



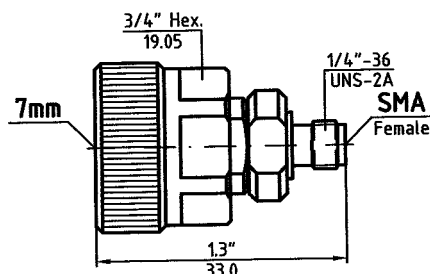
The Center Conductor of the 7 mm Connector is supplied with 6 slots.

Part - No.	8001- 7996 - 02
Connectors	7mm to SC-Female
Frequency	DC - 10.0 GHz
VSWR max.	$1.06 + 0.01 \times f(\text{GHz})$



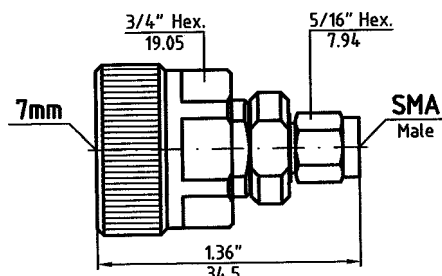
The Center Conductor of the 7 mm Connector is supplied with 6 slots.

Part - No.	8001- 8096 - 02
Connectors	7mm to SC-Male
Frequency	DC - 10.0 GHz
VSWR max.	$1.06 + 0.01 \times f(\text{GHz})$



The Center Conductor of the 7 mm Connector is supplied with 6 slots.

Part - No.	8001- 2196 - 02
Connectors	7mm to SMA-F
Frequency	DC - 18.0 GHz
VSWR max.	1.06 : 1



The Center Conductor of the 7 mm Connector is supplied with 6 slots.

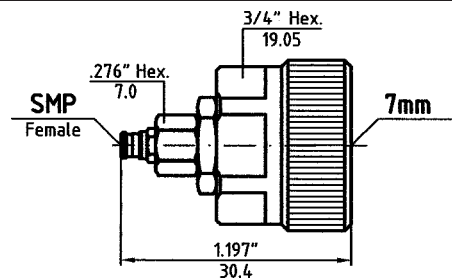
Part - No.	8001- 1196 - 02
Connectors	7mm to SMA-M
Frequency	DC - 18.0 GHz
VSWR max.	1.06 : 1

Dimensions shown are inches over millimeters. Standard units have stainless steel finish (last two digits of the P/N are -02). Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, as applicable.

Type 7mm NMD Test Port Adapters

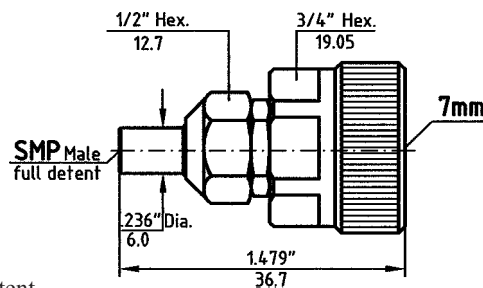
The Center Conductor of the 7 mm Connector is supplied with 6 slots.

Part - No.	8001-MP96-02
Connectors	7mm to SMP-F
Frequency	DC - 18.0 GHz
VSWR max.	1.10 : 1



The Center Conductor of the 7 mm Connector is supplied with 6 slots.

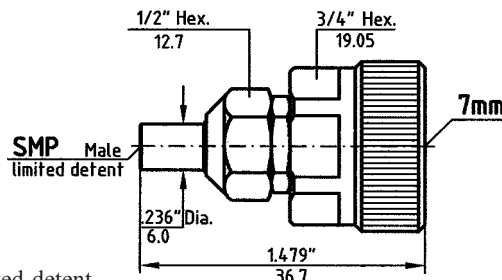
Part - No.	8001-MJ96-02
Connectors	7mm to SMP-M
Frequency	DC - 18.0 GHz
VSWR max.	1.10 : 1



Full detent

The Center Conductor of the 7 mm Connector is supplied with 6 slots.

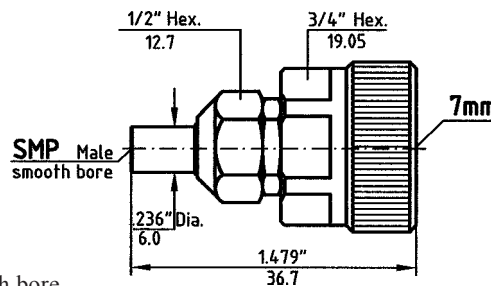
Part - No.	8002-MJ96-02
Connectors	7mm to SMP-M
Frequency	DC - 18.0 GHz
VSWR max.	1.10 : 1



Limited detent

The Center Conductor of the 7 mm Connector is supplied with 6 slots.

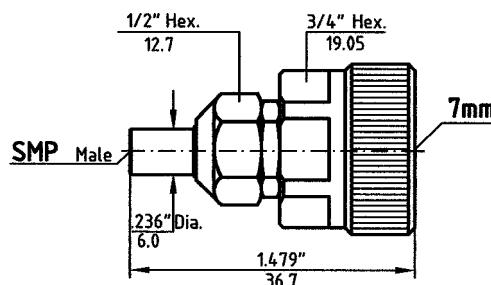
Part - No.	8003-MJ96-02
Connectors	7mm to SMP-M
Frequency	DC - 18.0 GHz
VSWR max.	1.10 : 1



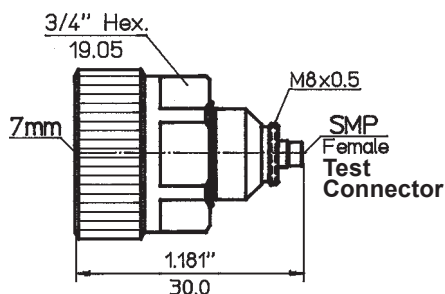
Smooth bore

The Center Conductor of the 7 mm Connector is supplied with 6 slots.

Part - No.	8004-MJ96-02
Connectors	7mm to SMP-M
Frequency	DC - 18.0 GHz
VSWR max.	1.10 : 1

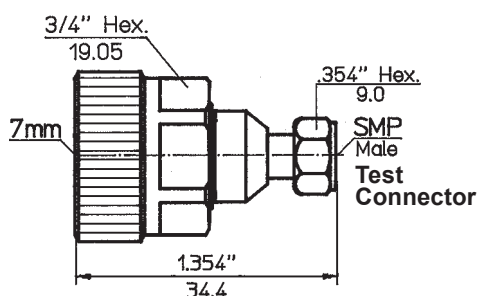


Dimensions shown are inches over millimeters. Standard units have stainless steel finish (last two digits of the P/N are -02). Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, as applicable.



The Center Conductor of the 7 mm Connector is supplied with 6 slots.

Part - No.	8001-TP96-02
Connectors	7mm to SMP-F
Frequency	DC - 18.0 GHz
VSWR max.	1.10 : 1



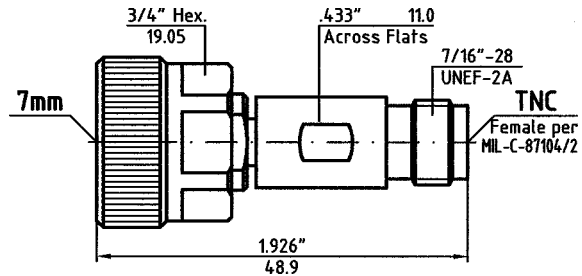
The Center Conductor of the 7 mm Connector is supplied with 6 slots.

Part - No.	8001-TJ96-02
Connectors	7mm to SMP-M
Frequency	DC - 18.0 GHz
VSWR max.	1.10 : 1

Type 7mm NMD Test Port Adapters

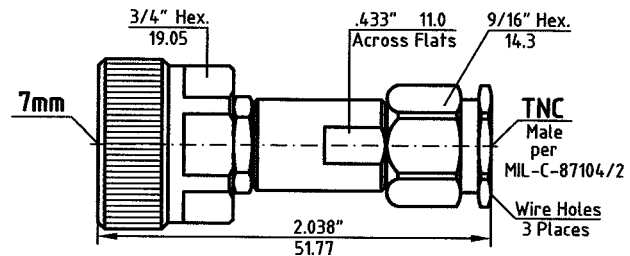
The Center Conductor of the 7 mm Connector is supplied with 6 slots.

Part - No.	8002-4196-02
Connectors	7mm to TNC-F
Frequency	DC - 18.0 GHz
VSWR max.	1.10 : 1



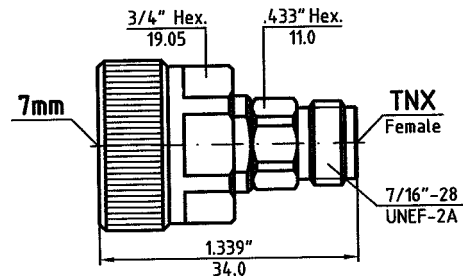
The Center Conductor of the 7 mm Connector is supplied with 6 slots.

Part - No.	8003-3196-02
Connectors	7mm to TNC-M
Frequency	DC - 18.0 GHz
VSWR max.	1.10 : 1



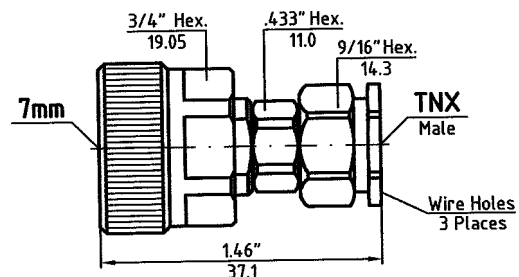
The Center Conductor of the 7 mm Connector is supplied with 6 slots.

Part - No.	8001-4996-02
Connectors	7mm to TNX-F
Frequency	DC - 18.0 GHz
VSWR max.	1.10 : 1



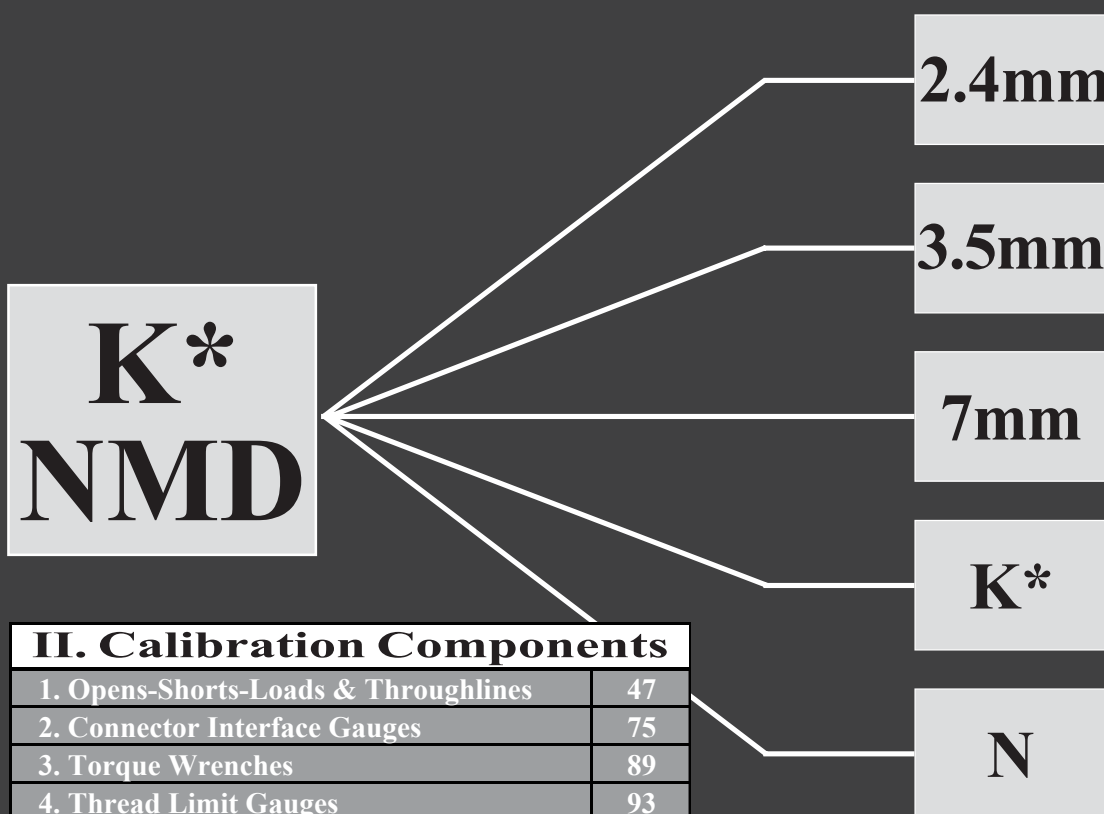
The Center Conductor of the 7 mm Connector is supplied with 6 slots.

Part - No.	8001-3996-02
Connectors	7mm to TNX-M
Frequency	DC - 18.0 GHz
VSWR max.	1.10 : 1



Dimensions shown are inches over millimeters. Standard units have stainless steel finish (last two digits of the P/N are -02). Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, as applicable.

Section II.5.c.4

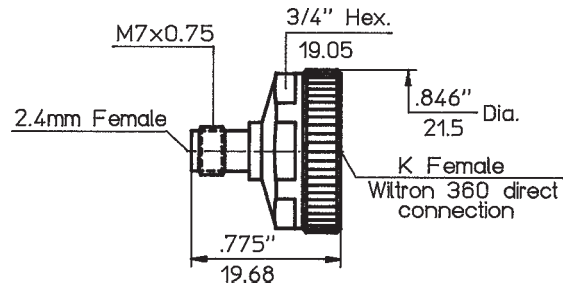


II. Calibration Components				
1. Opens-Shorts-Loads & Throughlines			47	
2. Connector Interface Gauges			75	
3. Torque Wrenches			89	
4. Thread Limit Gauges			93	
5.	Instrument Grade Adapters			
	a. In-Series		97	
	b. Between Series		101	
	c.	NMD Test Port Adapters		113
		1. 2.4mm		121
		2. 3.5mm		125
		3. 7mm		129
		4. K* (2.9mm)		137
		5. N		141

port1.png

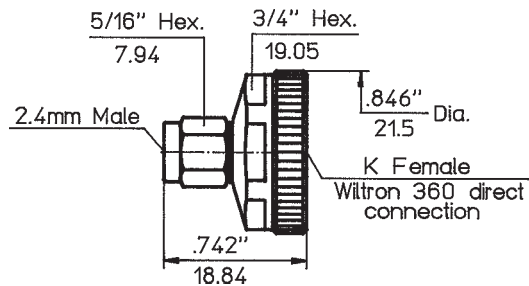
Type K* NMD Test Port Adapters

Part - No.	8001-HFWI-02
Connectors	K*-F-NMD to 2.4mm-F
Frequency	DC - 40.0 GHz
VSWR max.	1.15 : 1



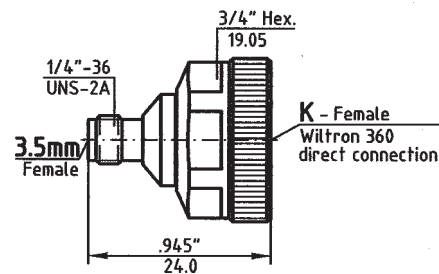
for direct connection with Wiltron 360

Part - No.	8001-HMWI-02
Connectors	K*-F-NMD to 2.4mm-M
Frequency	DC - 40.0 GHz
VSWR max.	1.15 : 1



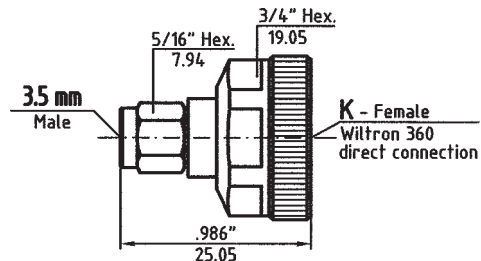
for direct connection with Wiltron 360

Part - No.	8001-WI92-02
Connectors	K*-F-NMD to 3.5mm-F
Frequency	DC - 35.0 GHz
VSWR max.	1.15 : 1



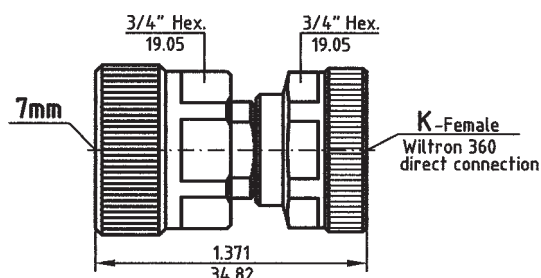
for direct connection with Wiltron 360

Part - No.	8001-WI91-02
Connectors	K*-F-NMD to 3.5mm-M
Frequency	DC - 35.0 GHz
VSWR max.	1.15 : 1



for direct connection with Wiltron 360

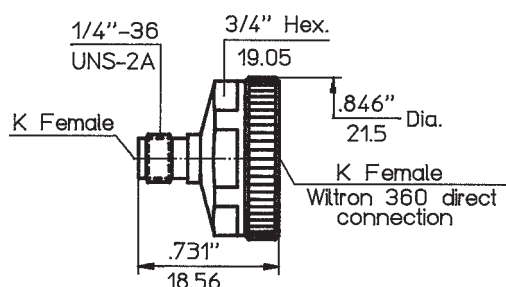
Dimensions shown are inches over millimeters. Standard units have stainless steel finish (last two digits of the P/N are -02). Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, as applicable.



for direct connection with Wiltron 360

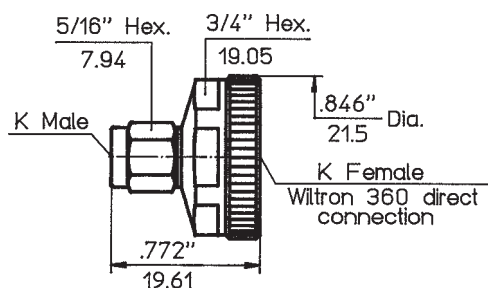
The Center Conductor of the 7 mm Connector is supplied with 6 slots.

Part - No.	8001-WI96-02
Connectors	K*-F-NMD to 7mm
Frequency	DC - 18.0 GHz
VSWR max.	1.06 : 1



for direct connection with Wiltron 360

Part - No.	8001-KFWI-02
Connectors	K*-F-NMD to K*-Fem.
Frequency	DC - 40.0 GHz
VSWR max.	1.15 : 1



for direct connection with Wiltron 360

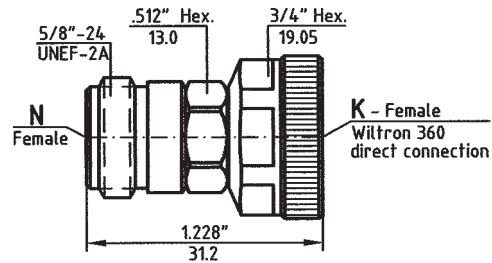
Part - No.	8001-KMWI-02
Connectors	K*-F-NMD to K*-Male
Frequency	DC - 40.0 GHz
VSWR max.	1.15 : 1

port1.png

Dimensions shown are inches over millimeters. Standard units have stainless steel finish (last two digits of the P/N are -02). Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, as applicable.

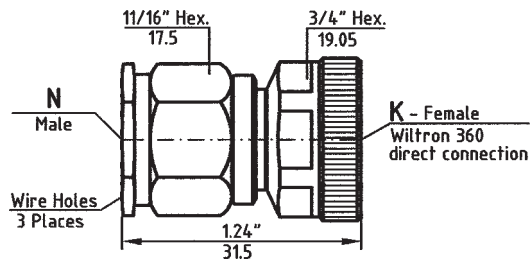
Type K* NMD Test Port Adapters

Part - No.	8001-WI61-02
Connectors	K*-F-NMD to N-Fem.
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f(\text{GHz})$



for direct connection with Wiltron 360

Part - No.	8001-WI51-02
Connectors	K*-F-NMD to N-Male
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f(\text{GHz})$



for direct connection with Wiltron 360

Dimensions shown are inches over millimeters. Standard units have stainless steel finish (last two digits of the P/N are -02). Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, as applicable.

Section II.5.c.5



1.4/4.4

2.4mm

3.5mm

7mm

7/16

BMA

BNC

C

HN

K*

N

SBX

SBY

SC

SMA

TNC

TNX

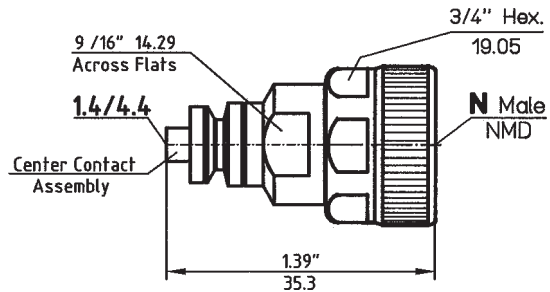
II. Calibration Components

1. Opens-Shorts-Loads & Throughlines		47
2. Connector Interface Gauges		75
3. Torque Wrenches		89
4. Thread Limit Gauges		93
5.	Instrument Grade Adapters	
	a. In-Series	97
	b. Between Series	101
	c.	NMD Test Port Adapters 113
		1. 2.4mm 121
		2. 3.5mm 125
		3. 7mm 129
		4. K* (2.9mm) 137
	5. N 141	

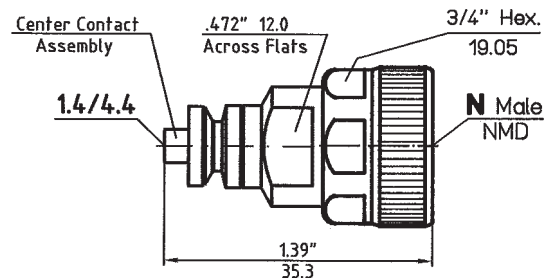
port2.png

Type N NMD Test Port Adapters

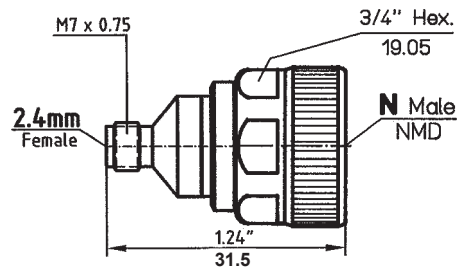
Part - No.	8001-ND03-02
Connectors	N-M-NMD to 1.4/4.4
Frequency	DC - 18.0 GHz
VSWR max.	$1.07 + 0.01 \times f \text{ (GHz)}$



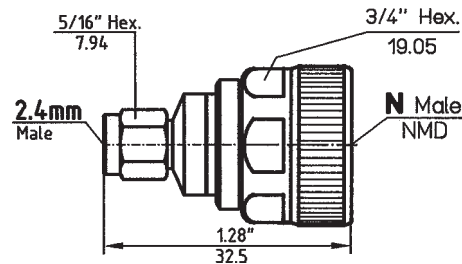
Part - No.	8002-ND03-02
Connectors	N-M-NMD to 1.4/4.4
Frequency	DC - 18.0 GHz
VSWR max.	$1.07 + 0.01 \times f \text{ (GHz)}$



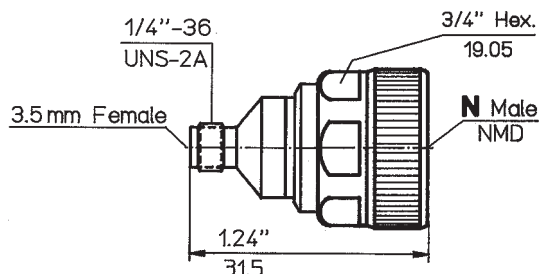
Part - No.	8001-HFND-02
Connectors	N-M-NMD to 2.4mm-F
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f \text{ (GHz)}$



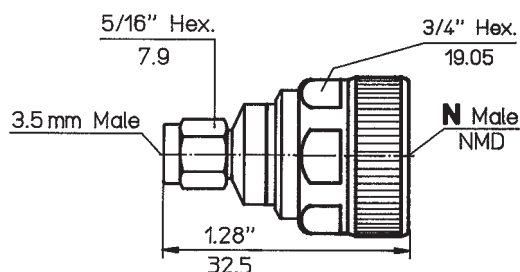
Part - No.	8001-HMND-02
Connectors	N-M-NMD to 2.4mm-M
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f \text{ (GHz)}$



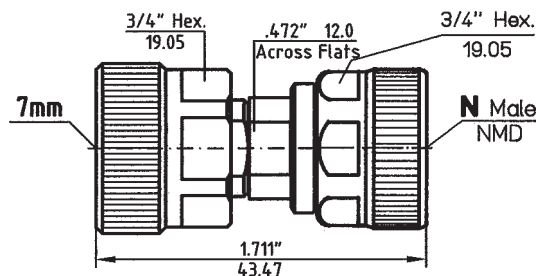
Dimensions shown are inches over millimeters. Standard units have stainless steel finish (last two digits of the P/N are -02). Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, as applicable.



Part - No.	8001-ND92-02
Connectors	N-M-NMD to 3.5mm-F
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f \text{ (GHz)}$



Part - No.	8001-ND91-02
Connectors	N-M-NMD to 3.5mm-M
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f \text{ (GHz)}$

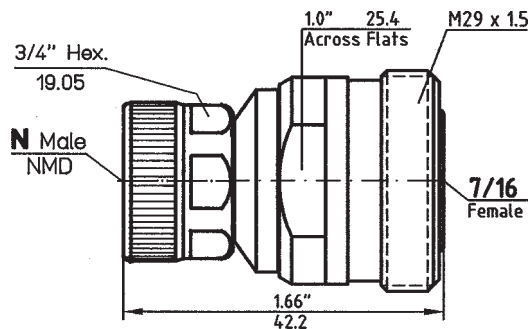


Part - No.	8001-ND96-02
Connectors	N-M-NMD to 7mm
Frequency	DC - 18.0 GHz
VSWR max.	1.06 : 1

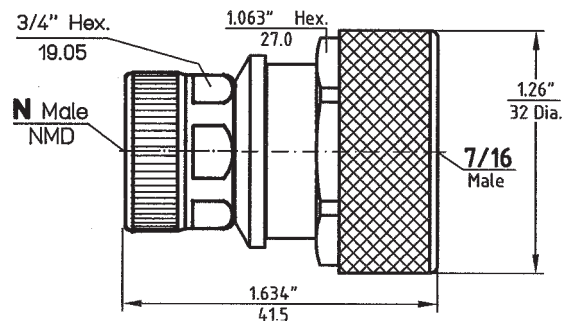
Dimensions shown are inches over millimeters. Standard units have stainless steel finish (last two digits of the P/N are -02). Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, as applicable.

Type N NMD Test Port Adapters

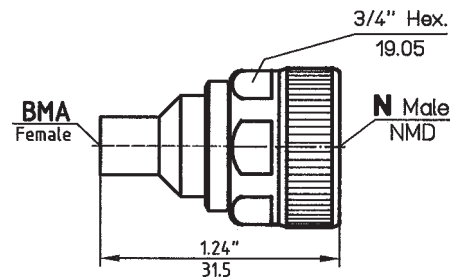
Part - No.	8001-ND76-02
Connectors	N-M-NMD to 7/16-Fem.
Frequency	DC - 7.5 GHz
VSWR max.	$1.06 + 0.005 \times f(\text{GHz})$



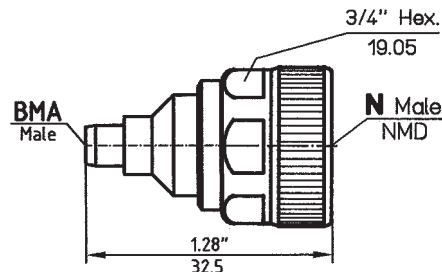
Part - No.	8001-ND75-02
Connectors	N-M-NMD to 7/16-Male
Frequency	DC - 7.5 GHz
VSWR max.	$1.06 + 0.005 \times f(\text{GHz})$



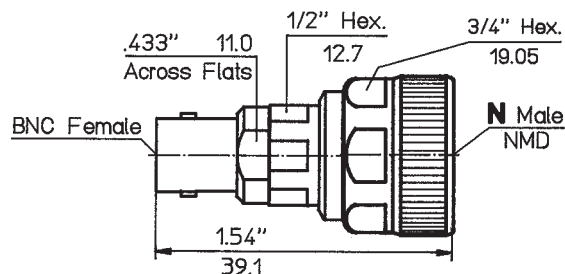
Part - No.	8001-BWND-02
Connectors	N-M-NMD to BMA-F
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f(\text{GHz})$



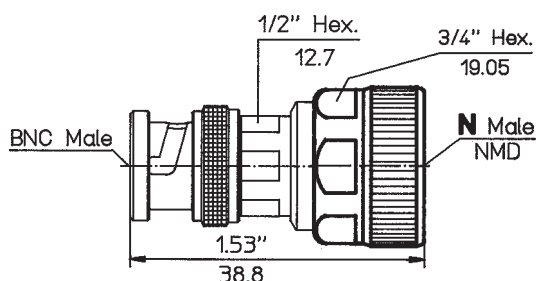
Part - No.	8001-BMND-02
Connectors	N-M-NMD to BMA-M
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f(\text{GHz})$



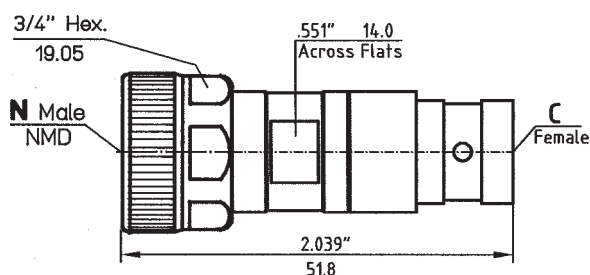
Dimensions shown are inches over millimeters. Standard units have stainless steel finish (last two digits of the P/N are -02). Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, as applicable.



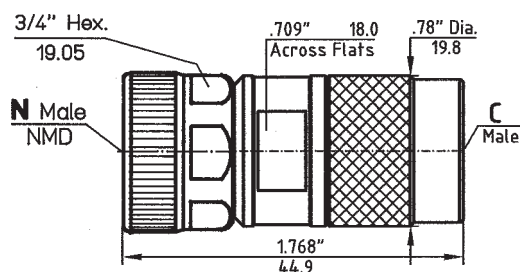
Part - No.	8001-ND81-02
Connectors	N-M-NMD to BNC-F
Frequency	DC - 4.0 GHz
VSWR max.	$1.06 + 0.01 \times f \text{ (GHz)}$



Part - No.	8001-ND71-02
Connectors	N-M-NMD to BNC-M
Frequency	DC - 4.0 GHz
VSWR max.	$1.06 + 0.01 \times f \text{ (GHz)}$



Part - No.	8001-ND89-02
Connectors	N-M-NMD to C-Fem.
Frequency	DC - 10.0 GHz
VSWR max.	$1.05 + 0.01 \times f \text{ (GHz)}$

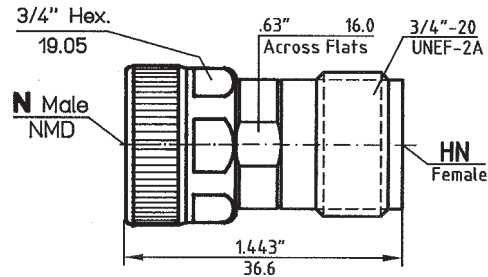


Part - No.	8001-ND88-02
Connectors	N-M-NMD to C-Male
Frequency	DC - 10.0 GHz
VSWR max.	$1.05 + 0.01 \times f \text{ (GHz)}$

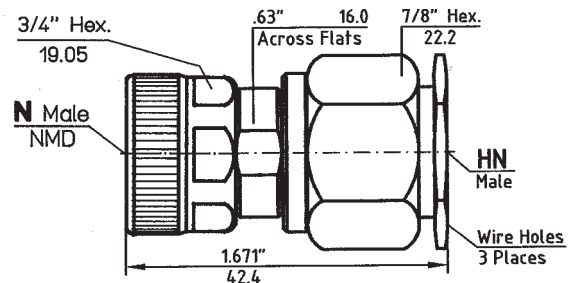
Dimensions shown are inches over millimeters. Standard units have stainless steel finish (last two digits of the P/N are -02). Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, as applicable.

Type N NMD Test Port Adapters

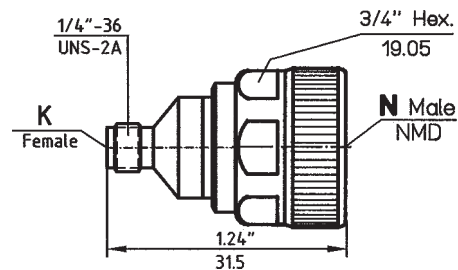
Part - No.	8001-ND68-02
Connectors	N-M-NMD to HN-Fem.
Frequency	DC - 8.0 GHz
VSWR max.	$1.07 + 0.01 \times f(\text{GHz})$



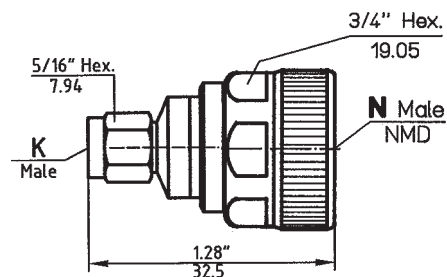
Part - No.	8001-ND69-02
Connectors	N-M-NMD to HN-Male
Frequency	DC - 8.0 GHz
VSWR max.	$1.07 + 0.01 \times f(\text{GHz})$



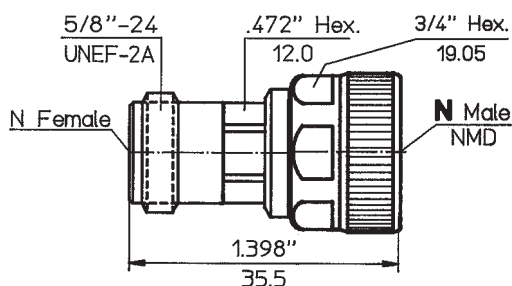
Part - No.	8001-KFND-02
Connectors	N-M-NMD to K*-Female
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f(\text{GHz})$



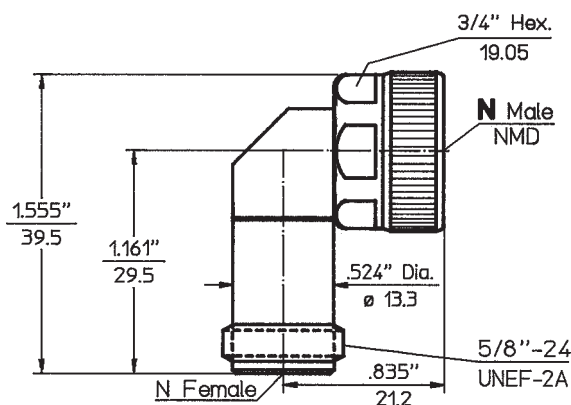
Part - No.	8001-KMND-02
Connectors	N-M-NMD to K*-Male
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f(\text{GHz})$



Dimensions shown are inches over millimeters. Standard units have stainless steel finish (last two digits of the P/N are -02). Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, as applicable.

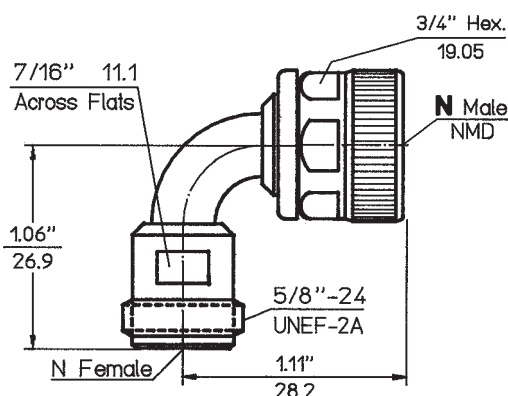


Part - No.	8001-ND61-02
Connectors	N-M-NMD to N-Female
Frequency	DC - 18.0 GHz
VSWR max.	1.06 + 0.005 x f (GHz)



Right Angle

Part - No.	8090-ND61-02
Connectors	N-M-NMD to N-Female
Frequency	DC - 18.0 GHz
VSWR max.	1.15 : 1



Radius Right Angle

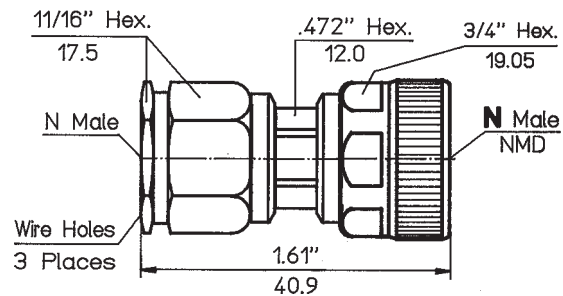
Part - No.	8091-ND61-02
Connectors	N-M-NMD to N-Female
Frequency	DC - 18.0 GHz
VSWR max.	1.20 : 1

port2.png

Dimensions shown are inches over millimeters. Standard units have stainless steel finish (last two digits of the P/N are -02). Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, as applicable.

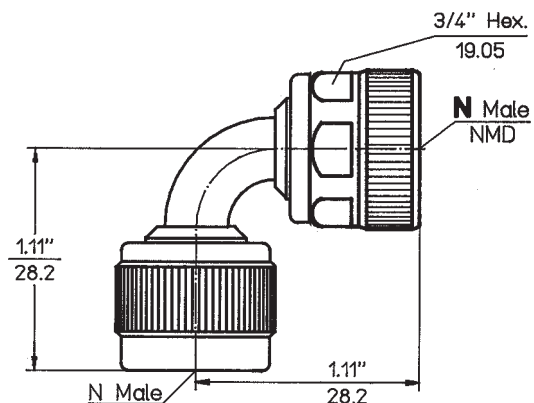
Type N NMD Test Port Adapters

Part - No.	8001-ND51-02
Connectors	N-M-NMD to N-Male
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f(\text{GHz})$

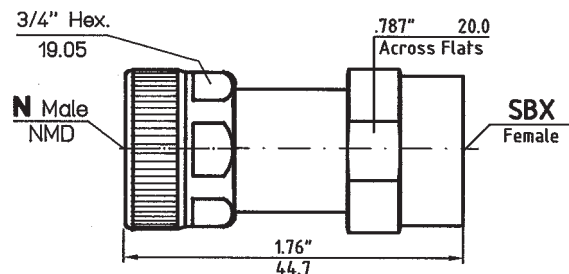


Part - No.	8091-ND51-02
Connectors	N-M-NMD to N-Male
Frequency	DC - 18.0 GHz
VSWR max.	1.20 : 1

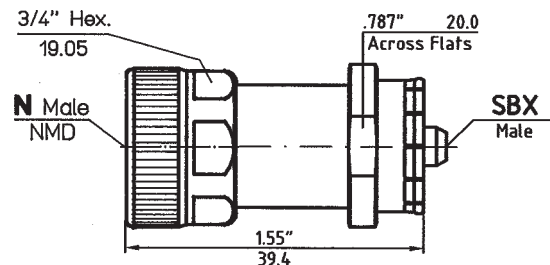
Radius Right Angle



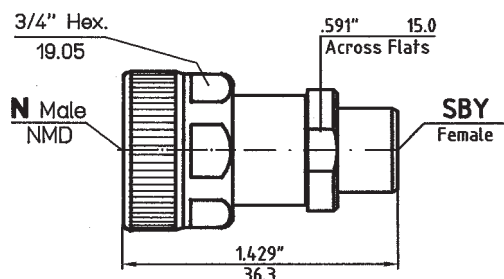
Part - No.	8001-NDXF-02
Connectors	N-M-NMD to SBX-Fem.
Frequency	DC - 8.0 GHz
VSWR max.	$1.06 + 0.01 \times f(\text{GHz})$



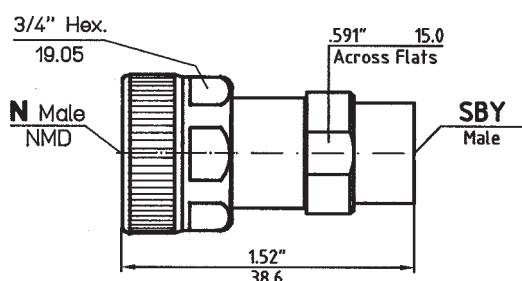
Part - No.	8001-NDXM-02
Connectors	N-M-NMD to SBX-Male
Frequency	DC - 8.0 GHz
VSWR max.	$1.06 + 0.01 \times f(\text{GHz})$



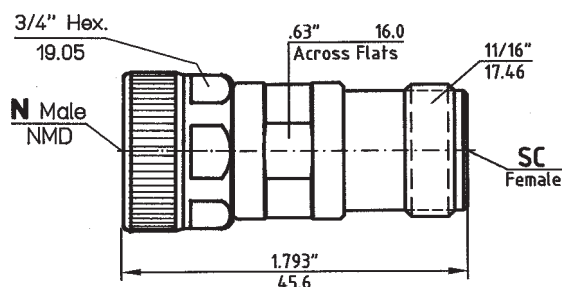
Dimensions shown are inches over millimeters. Standard units have stainless steel finish (last two digits of the P/N are -02). Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, as applicable.



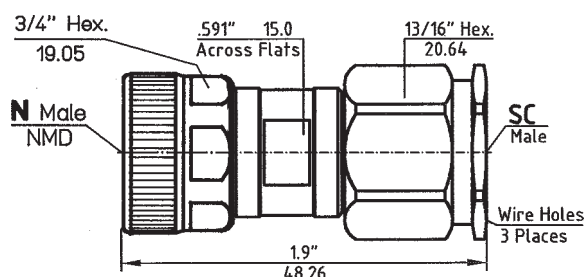
Part - No.	8001-NDYF-02
Connectors	N-M-NMD to SBY-Fem.
Frequency	DC - 12.0 GHz
VSWR max.	$1.03 + 0.01 \times f \text{ (GHz)}$



Part - No.	8001-NDYM-02
Connectors	N-M-NMD to SBY-Male
Frequency	DC - 12.0 GHz
VSWR max.	$1.03 + 0.01 \times f \text{ (GHz)}$



Part - No.	8001-ND79-02
Connectors	N-M-NMD to SC-Female
Frequency	DC - 10.0 GHz
VSWR max.	$1.05 + 0.01 \times f \text{ (GHz)}$

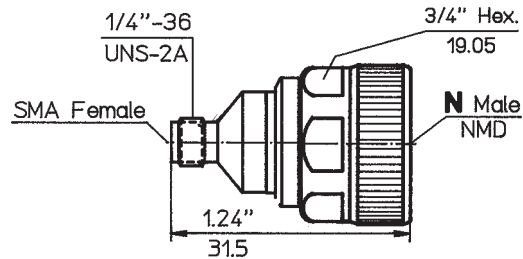


Part - No.	8001-ND80-02
Connectors	N-M-NMD to SC-Male
Frequency	DC - 10.0 GHz
VSWR max.	$1.05 + 0.01 \times f \text{ (GHz)}$

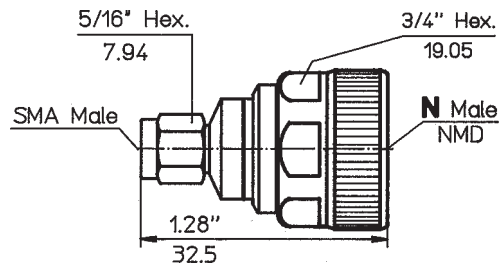
Dimensions shown are inches over millimeters. Standard units have stainless steel finish (last two digits of the P/N are -02). Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, as applicable.

Type N NMD Test Port Adapters

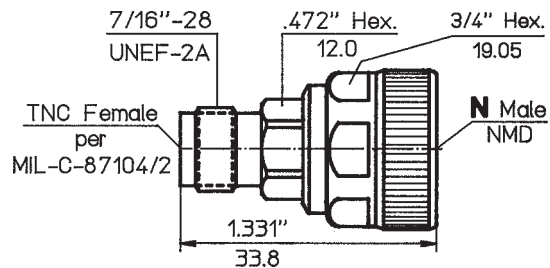
Part - No.	8001-ND21-02
Connectors	N-M-NMD to SMA-Fem.
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f(\text{GHz})$



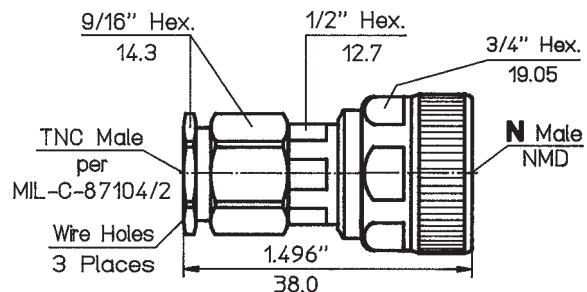
Part - No.	8001-ND11-02
Connectors	N-M-NMD to SMA-Male
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f(\text{GHz})$



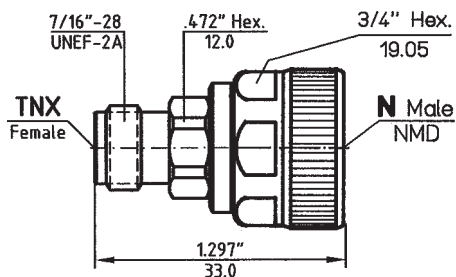
Part - No.	8001-ND41-02
Connectors	N-M-NMD to TNC-Fem.
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f(\text{GHz})$



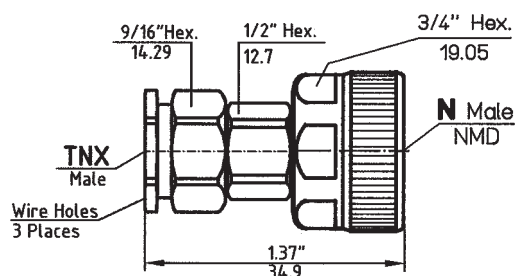
Part - No.	8001-ND31-02
Connectors	N-M-NMD to TNC-Male
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f(\text{GHz})$



Dimensions shown are inches over millimeters. Standard units have stainless steel finish (last two digits of the P/N are -02). Interfaces are per MIL-C 39012, MIL-C-87104/2, MIL-C-3643, MIL-STD-348, IEC-169-7, IEC-457-2, DIN 47 223, DIN 47 226, DIN 47 298, as applicable.



Part - No.	8001-ND49-02
Connectors	N-M-NMD to TNX-Fem.
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f \text{ (GHz)}$



Part - No.	8001-ND39-02
Connectors	N-M-NMD to TNX-Male
Frequency	DC - 18.0 GHz
VSWR max.	$1.06 + 0.005 \times f \text{ (GHz)}$

Phase Shifters

**Interested?
Please refer to
"The '98 Handbook
Passive Components"**

Available Connectors:

2.4mm

3.5mm

7mm

K*

N

SMA

TNC

DC - 2.0 GHz

DC - 12.0 GHz

DC - 18.0 GHz

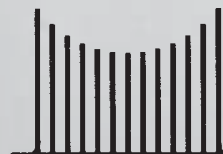
DC - 26.5 GHz

DC - 40.0 GHz

DC - 50.0 GHz

Please ask for our other Products in the Frequency Range of DC to 50.0 GHz:

Adapters, ANA Test Cables, Antennas, Attenuators, Blind Mate Connectors, Circulators, CDM-Components, Coax Switches, Couplers, Custom Components, DC-Block Connectors & Adapters, Gain-Equalizers, Flexible Cable Assemblies, Isolators, Limiters, Mismatches, Multi Pin Connectors, Phase Shifters, Phase Stable Cable Assemblies, Precision Terminations, Push-On Connectors & Adapters, Semi Rigid Cable Assemblies, Waveguide Components, Waveguide to Coax Adapters, etc.



Spectrum
Elektrotechnik GmbH

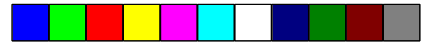
80905 Munich, Germany

P.O. Box 45 05 33

Fax (89) 354-804-90

Telephone: (89) 354-804-0

* 'K' Connector is a trademark of Wiltron Company.

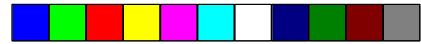


Section III



Cable Assemblies with Interchangeable Connectors (Field Replaceable Connectors)

I:\cablex4.ppt6



Assemblies with Interchangeable Connectors



INTRODUCTION: To ensure accurate testing and optimum system performance, the cable assemblies of test stations are always calibrated with the system. One certain cable set will be used, fitted with certain connectors.

It happens then eventually, that a component would need to be included into the test, showing a different connector configuration. Adding a between-series adapter might be an alternative, but would change the electrical length of the setup. Consequence is then usually to change to different test cables, employing the connectors needed, and calibrating the system again.

Or it occurs that a certain test result is doubted, as it is too bad, or too good. Recalibrating the system and retesting is usually the only alternative.

THE SOLUTION: The answer is the Cable Assembly using Interchangeable Connectors. A Primary Connector Unit is fitted to the cable, accepting those Interchangeable Connector Series. As the Interchangeable Connector Heads have similar electrical performance and are of same electrical length, they can be changed during testing. If the performance of a Connector Head is questionable, it can be exchanged in no time, and the test results can be compared. A cable assembly can be supplied with the Primary Connector Unit, on one, or both ends. In no time the Interchangeable Connectors can be put on, as needed for the application. Basic Connector Units have been developed for the Phase Stable ANA Test Cables of Types 18 and 22, and as well as for a variety of other Test Cables Spectrum Elektrotechnik GmbH is offering, such as the cables of Types 10, 14 17, 100 and 140.

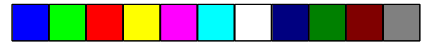
The Interchangeable Connector Heads are available in most popular connector series, such as 7mm, N, SMA and TNC. All these connector heads of the different connector series are of the same electrical length (except the short Nf).

SPECIFYING THE CABLE ASSEMBLY: For your Cable Assembly you need to specify the Type of cable, as listed on page 187 f.f.. You have to decide then about the connector configuration. You may choose to have the Primary Connector Unit terminated on both ends, or you may decide to have the Primary Connector Unit for the Interchangeable Connectors only on one end and a regular connector on the other side. The codes for regular connectors are listed on page 203 f.f..

General ordering information is shown on page 160.

THE CABLE ASSEMBLY KIT: Normally the Cable assembly with Interchangeable Connectors is supplied in an instrument case, as a Standard Kit, or the Professional Kit. It contains also a number of Interchangeable Connectors and a torque wrench. Additional empty spots can be filled with connector heads on separate order, as needed in the individual application.

CUSTOM PRODUCTS: Spectrum Elektrotechnik GmbH is a very innovative company. Our engineers are constantly designing new products, or modifying existing products to customers' requests. Therefore catalogs never will be complete. If you do not find exactly what you need in our catalogs, please contact our sales or engineering department.



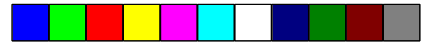
Assemblies with Interchangeable Connectors



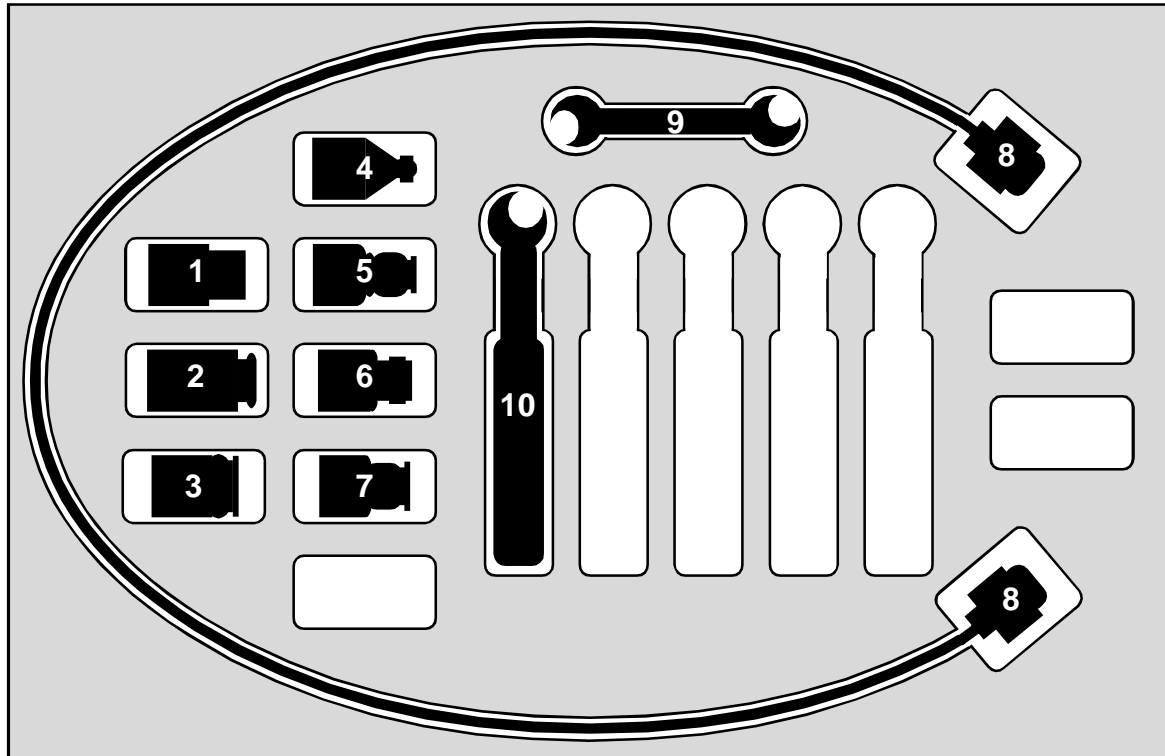
I:\cable4.ppt6

Spectrum Elektrotechnik GmbH P.O. Box 45 05 33, 80905 Munich, Germany Tel. (89) 354 804-0, Fax (89) 354 804-90 (Country Code: 49)

155



Assemblies with Interchangeable Connectors

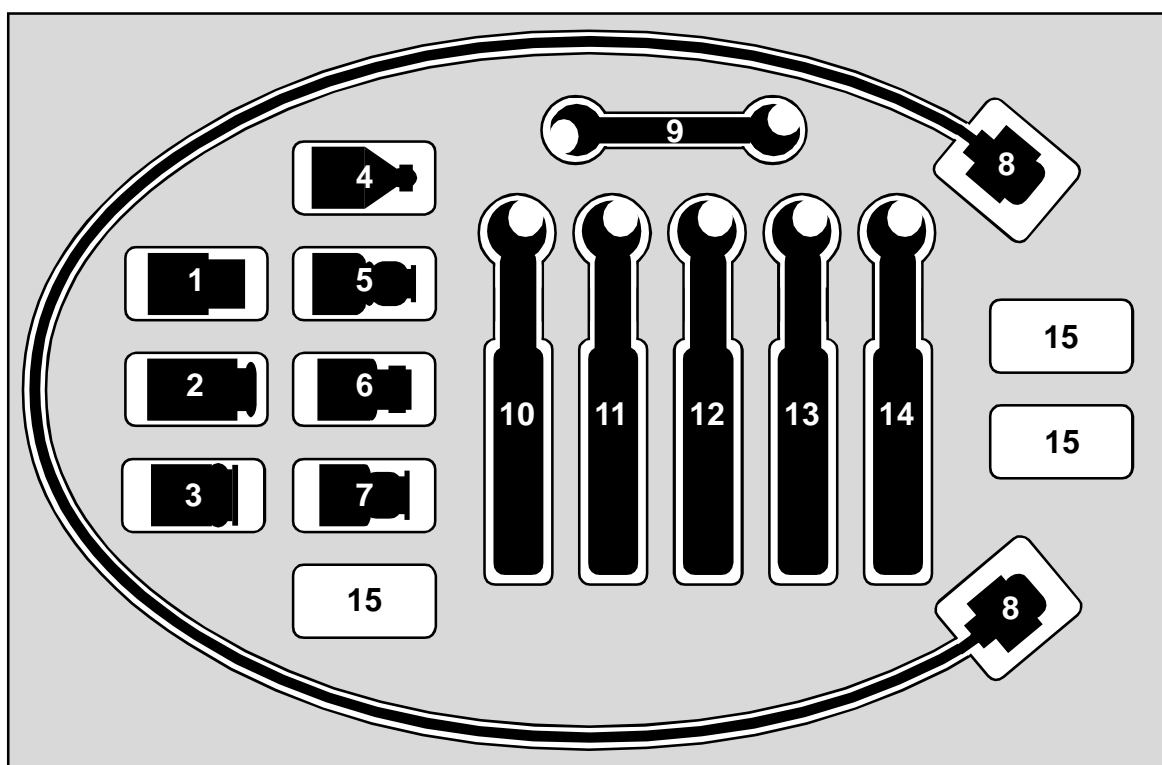


Cable Assembly Kit using Interchangeable Connectors.

Description of Equipment Provided

Standard Kit

- | | |
|---|---|
| 1: Interchangeable Connector 7mm
P/N 9015-E110-02 | 7: Interchangeable Connector TNC m
P/N 4015-E110-02 |
| 2: Interchangeable Connector N f
P/N 3015-E210-02 | 8: 2 Pcs. Primary Connector supplied
with the Cable Assembly |
| 3: Interchangeable Connector N m
P/N 3015-E110-02 | 9: Double Ended Wrench |
| 4: Interchangeable Connector SMA f
P/N 2015-E210-02 | 10: Torque Wrench for Interchangeable
Connectors
Size: 9/16", P/N: WE - DE01 |
| 5: Interchangeable Connector SMA m
Maxi Nut
P/N 2015-E110-02 | Instrument case |
| 6: Interchangeable Connector TNC f
P/N 4015-E210-02 | |



Cable Assembly Kit using Interchangeable Connectors.

Description of Equipment Provided

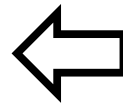
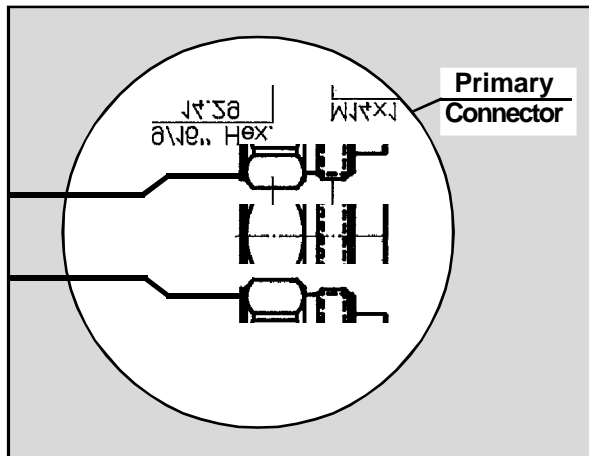
Professional Kit

- | | |
|---|---|
| 1: Interchangeable Connector 7mm
P/N 9015-E110-02 | 10: Torque Wrench for Interchangeable
Connectors
Size: 9/16", P/N: WE - DE01 |
| 2: Interchangeable Connector N f
P/N 3015-E210-02 | 11: Torque Wrench for 7mm
Size: 3/4", P/N: WE - D107 |
| 3: Interchangeable Connector N m
P/N 3015-E110-02 | 12: Torque Wrench for N
Size: 3/4", P/N: WE - D105 |
| 4: Interchangeable Connector SMA f
P/N 2015-E210-02 | 13: Torque Wrench for SMA w/Maxi Nut
Size: 9/16", P/N: WE - D103 |
| 5: Interchangeable Connector SMA m
Maxi Nut
P/N 2015-E110-02 | 14: Torque Wrench for TNC
Size: 9/16", P/N: WE - D102 |
| 6: Interchangeable Connector TNC f
P/N 4015-E210-02 | 15: Optional Additional Interchangeable
Connectors |
| 7: Interchangeable Connector TNC m
P/N 4015-E110-02 | Instrument case |
| 8: 2 Pcs. Primary Connector supplied
with the Cable Assembly | |
| 9: Double Ended Wrench | |

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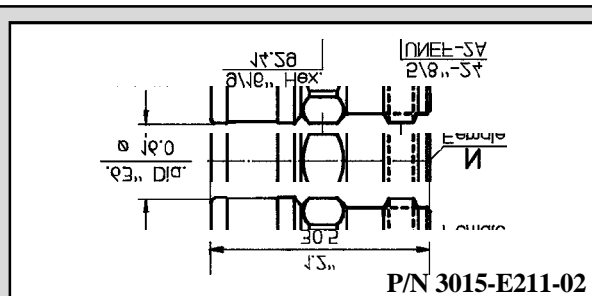
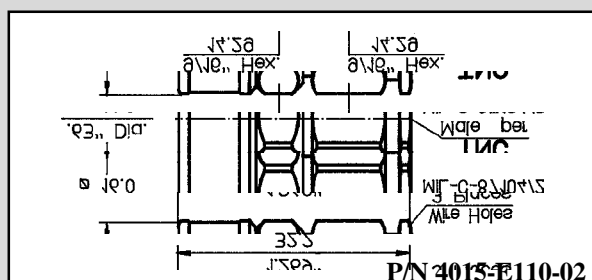
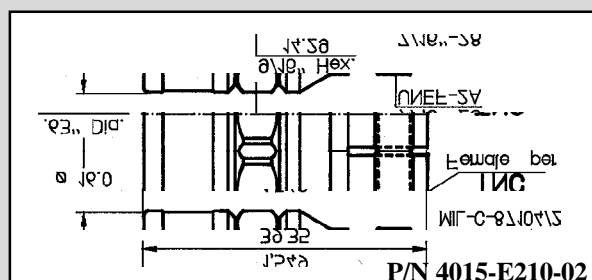
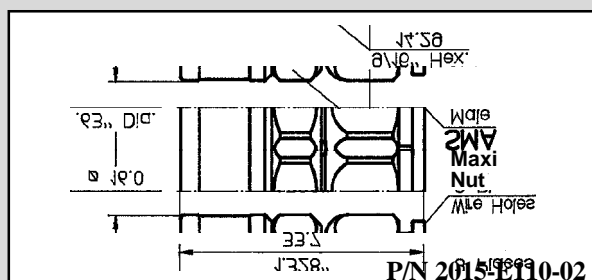
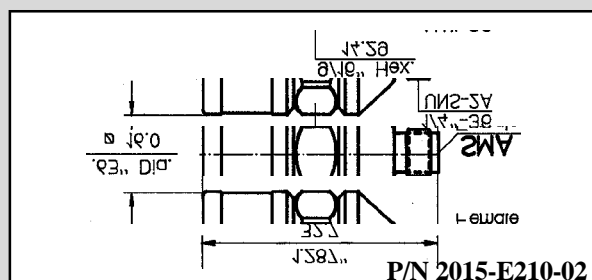
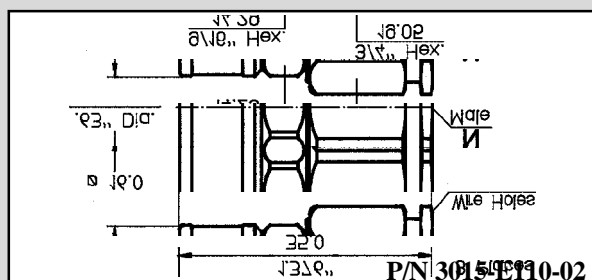
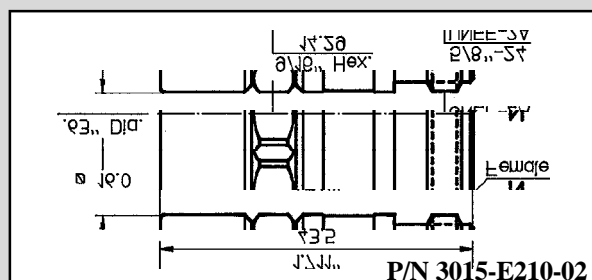
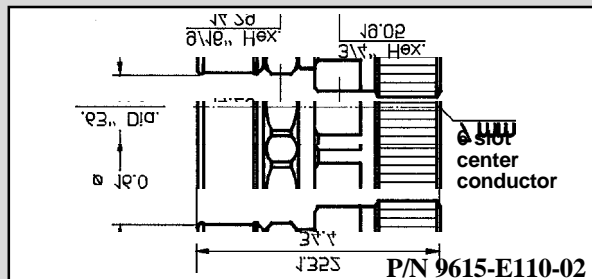
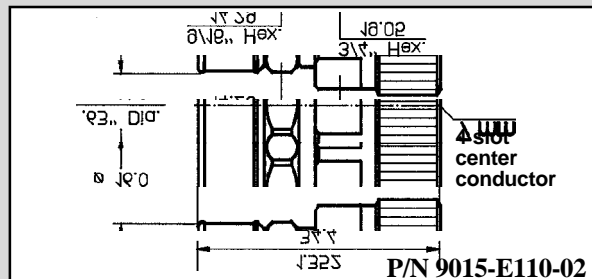
Assemblies with Interchangeable Connectors



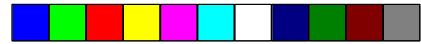
**Primary Connector Unit
for Interchangeable
Connector Series
as supplied with the
cable assembly.**

Type	Sex	Description	Remarks	Connector of equal Electrical Length	Code	Part Number	Finish
7mm	--	straight	4 equally spaced Contact slots	YES	E90	9015-E110-02	passivated Stainless Steel
			6 equally spaced Contact slots	YES	E96	9615-E110-02	
N	Male	straight		YES	E51	3015-E110-02	passivated Stainless Steel
	Female			YES	E61	3015-E210-02	
			Short version	NO	E62	3015-E211-02	
SMA	Male	straight	Maxi-Nut	YES	E11	2015-E110-02	passivated Stainless Steel
	Female			YES	E21	2015-E210-02	
TNC	Male	straight		YES	E31	4015-E110-02	passivated Stainless Steel
	Female			YES	E41	4015-E210-02	

Interchangeable Connectors of Identical Electrical Lengths



**N female straight
Short Version**



Interchangeable Assembly Kit

Ordering Information



INFORMATION ON HOW TO ORDER AN INTERCHANGEABLE CONNECTOR ASSEMBLY KIT:

Spectrum Elektrotechnik GmbH has set up an easy to use part number system. The customer can compose his part number, describing completely the kit he is ordering. The table below explains the system and describes the possible alternatives.

THE KIT: Normally the Cable assembly with Interchangeable Connectors is supplied in an instrument case, as a Standard Kit, or the Professional Kit. It contains also a number of Interchangeable Connectors, and a torque wrench. Additional empty spots can be filled with connector heads on separate order, as needed in the individual application. The letter **T** identifies the type of Kit being ordered. Replacing **T** by **S** means ordering the Standard Kit, **P** stands for the Professional Kit, **C** is used when a custom compiled Kit is ordered.

THE CABLE: The three letters **ABC** are used to identify the cable by its code. The cable code does not necessarily have to be of three digits, it also can be two digits only.

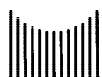
THE ARMORING: For strenuous applications or harsh environment, armoring of the cable may be needed. A variety of armors are available as standard, as outlined in "The '97 Handbook Cable Assemblies". The Customer may replace the **D** in the part number with the code for the armour requested, or he may rely on Spectrums suggestions by replacing the **D** with a temporary code **'A'**. Spectrum will then change that temporary code **'A'** with the appropriate code, describing the armor recommended. For no armour, a **'Blank'** will be used.

THE LENGTH: The letters **EFGH** are describing the length of the cable in millimeters, from reference plane to reference plane of the connectors. For lengths longer than 9999mm (10m), three digits with a leading **'d'** are used to identify the length in decimeters (dm).

Example: for a cable length of 30 meters the length code will be **'d300'**.

THE CONNECTORS: Both ends of the assembly will be terminated with the Primary Unit, as necessary to connect with the Interchangeable Connector Heads. The Interchangeable Connector Heads are available in most popular connector series, such as 7mm, N, SMA and TNC. All these connector heads of the different connector series are of the same electrical length (exception: the short Nf).

R	T	-	A	B	C	D	-	E	F	G	H
T: to be replaced with one of the following letters for the option required. S = Standard Kit P = Professional Kit C = Custom Kit			ABC: to be replaced with the following two or three digit numbers respectively, for the Cable required. Cable Code 10 = Cable Type 10 14 = Cable Type 14 18 = Cable Type 18 22 = Cable Type 22 40 = Cable Type 40 42 = Cable Type 42 100 = Cable Type 100 140 = Cable Type 140 For details on the cables, please refer to Section VII.1, pages 187 - 198.			D: to be replaced in the part number with the code for the armor requested, or rely on Spectrums' suggestions by replacing the 'D' with an 'A'. Spectrum will then change the temporary code 'A' with the appropriate code.			EFGH: to be replaced with the length of the cable. Measurements are taken from the reference plane of one connector to the opposite one.		



Spectrum
Elektrotechnik GmbH

**Ordering
Information**

Assemblies with Interchangeable Connectors

INFORMATION ON HOW TO ORDER INTERCHANGEABLE CONNECTOR ASSEMBLIES:

The customer may order only an assembly, instead of ordering the whole Kit with interchangeable connectors. The table below explains the system and describes the possible alternatives for composing the part number of the cable assembly.

THE CABLE: The three letters **ABC** are used to identify the cable by its code. The cable code does not necessarily have to be of three digits, it also can be two digits only.

THE ARMORING: For strenuous applications or harsh environment, armoring of the cable may be needed. A variety of armors are available as standard, as outlined in "The '97 Handbook Cable Assemblies". The Customer may replace the **D** in the part number with the code for the armour requested, or he may rely on Spectrum's suggestions by replacing the **D** with a temporary code **A**. Spectrum will then change that temporary code **A** with the appropriate code, describing the armor recommended. For no armor, a **Blank** will be used.

THE LENGTH: The letters **EFGH** are describing the length of the cable in millimeters, from reference plane to reference plane of the connectors. For lengths longer than 9999mm (10m), three digits with a leading **d** are used to identify the length in decimeters (dm).

Example: For a cable length of 30 meters the length code will be **d300**.

THE CONNECTORS: The letters **PU** stand for 'Primary Unit'. They identify that one end of the cable assembly is terminated with the Primary Connector Unit, as necessary to connect with the Interchangeable Connector Heads. The letters **MNO** are to be replaced with the two or three digit code, identifying the connector configuration at the other end of the cable assembly. This end may be terminated with a standard connector. For that connector code, please refer to pages 205 f.f. If this end of the cable assembly is supposed to be supplied with a Push-On Connector, locking or non-locking, please refer to pages 163 f.f. If a Primary Unit for Interchangeable connectors is required, then replace **MNO** simply by **PU**.

A	B	C	D	-	E	F	G	H	-	P	U	-	M	N	O				
ABC: to be replaced with the following two or three digit numbers respectively, for the Cable required. Cable Code 10 = Cable Type 10 14 = Cable Type 14 18 = Cable Type 18 22 = Cable Type 22 40 = Cable Type 40 42 = Cable Type 42 100 = Cable Type 100 140 = Cable Type 140 For details on the cables, please refer to Section VII.1, pages 187 - 198.				D: to be replaced in the part number with the code for the armor requested, or rely on Spectrums' suggestions by replacing the 'D' with an 'A'. Spectrum will then change the temporary code 'A' with the appropriate code.				EFGH: to be replaced with the length of the cable. Measurements are taken from the reference plane of one connector to the opposite one.				PU: Primary Unit for Interchangeable Connector Series.				MNO: for the standard Connector configuration, please fill in the two or three number/letter Code, describing the Connector. Please refer to pages 203 - 206. If Push-On Connector is required here as well, please use Codes on pages 166-167.			

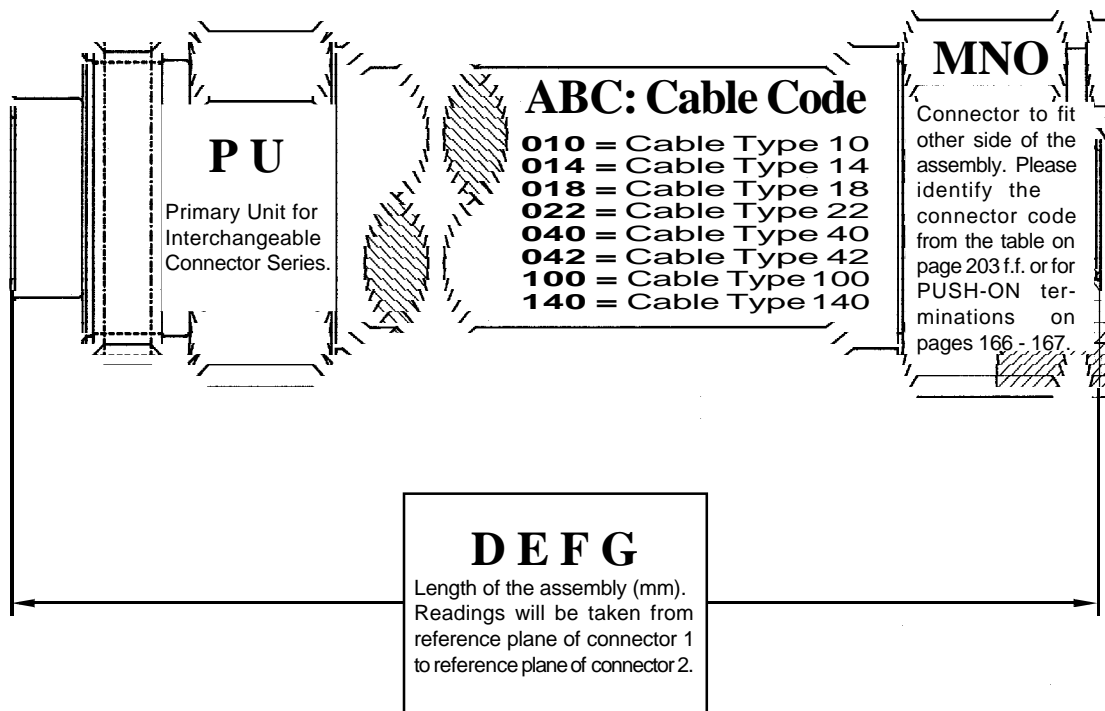
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Ordering Details:

The Part Number Sequence is:

ABCD-EFGH-PU-MNO



Please refer to page 161 for further explanations on the part number sequence.

For cable assemblies, made to customer specification, or complying to special requirements, the company will issue a special part number.

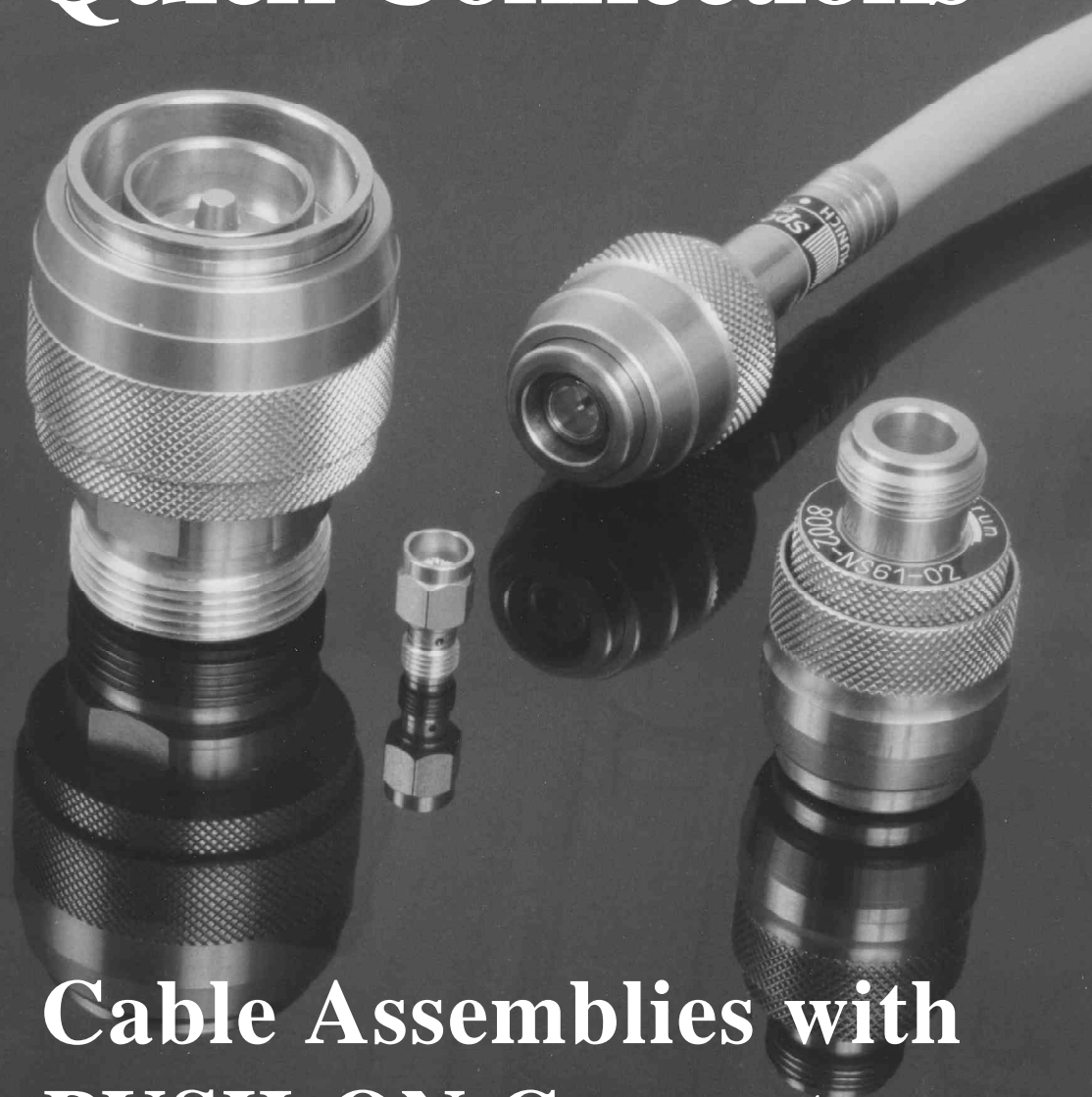
Ordering Example: The cable assembly of Type '22' shall have the length of 75 cm (length is measured from interface to interface). It shall be terminated with a Primary Unit and an N male connector (code from page 205).

ABC = cable code = 22 - DEFG = length in mm = 0750 - PU and LMN are the connectors = PU and 61.

Part Number for the cable assembly in this example: 22 - 0750 - PU - 61.

Section IV

Quick Connections

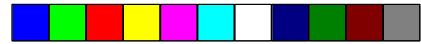


Cable Assemblies with PUSH-ON Connectors

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Spectrum Elektrotechnik GmbH P.O. Box 45 05 33, 80905 Munich, Germany Tel. (89) 354 804-0, Fax (89) 354 804-90 (Country Code: 49)

163



Assemblies with Push-On Connectors



INTRODUCTION: In various applications, especially with test stations, repetitive testing needs to take place. Hundreds, or sometimes even thousands of components have to be tested. Using regular connectors, this means threading on the connector, tightening and torquing, then loosening and disconnecting. This is a very time consuming process, which in most cases is even longer than the electrical test cycle. In applications where only a simple "go/no go" test has to be performed, the time needed for connecting and disconnecting may be ten times longer than the actual test time.

THE SOLUTION: The Push-On Connectors and Connector Savers were developed to eliminate all the time consuming tightening, torquing and loosening of the connectors during test. The Push-On connector slides directly onto any standard female connector of the same series, allowing quick and easy connection and disconnection.

THE LOCKING PUSH-ON: The Push-On connector is a male connector, and looks almost like a regular male connector, but does not employ thread in the coupling nut, and the coupling nut does not turn. To connect, the lock nut is only to be pushed forward. When released, three bolts are locking the connector safely onto the female thread. To disconnect the lock nut has to be pushed forward again, and kept in that position.

THE NON-LOCKING PUSH-ON: The connector does not contain any locking mechanism. A spring finger outer conductor is holding the connector in place. The forces needed for pushing on / pulling off the connector from its mating connector correspond directly to the insertion force / withdrawal force of the spring finger outer conductor. The non-locking Push-On is liked at test stations, where short tests are performed, where data are taken while the hand is still on the connector.

CONNECTORS AVAILABLE: 50 Ohms Push-On Connectors are available in series 7/16, N, SMA and TNC. For 75 Ohms the Push-Ons were designed in series N and F. Some of the connectors are available in different versions, such as lockable and non lockable, or for the N-"Double D" connectors, as being used on test equipment, having flats on two sides in parallel and along the thread.

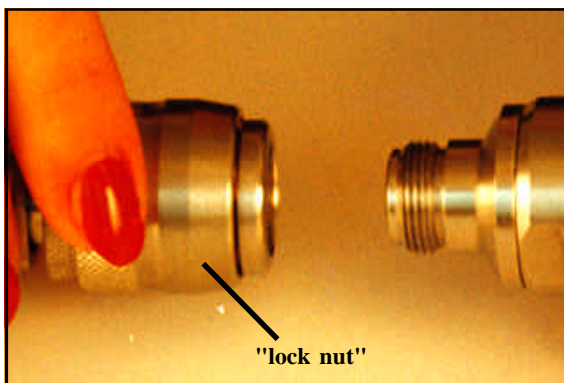
CABLE ASSEMBLIES: Cable assemblies can be terminated directly with Push-On Connectors. For certain RG-Cables the customer may purchase the Push-On Connectors and he can then terminate the assemblies himself using standard tools. Assemblies, using Spectrum's special cable, are only available completely terminated, as special tooling is required. On pages 187 - 198 all the cables are listed that can currently be fitted with Push-On connectors. But please always keep in mind that Spectrum Elektrotechnik GmbH is a very innovative company. Our engineers are constantly designing new products, or modifying existing products to customers' requests. Therefore, the catalogs never will be complete.

CABLE ASSEMBLY PROCEDURES: For those RG-Cables the customer may purchase the Push-On Connectors for making his own assembly. Cable assembly procedures are listed in "The '98 Handbook Quick Connections", or "The '98 Handbook Microwave Connectors".

PUSH-ON ADAPTERS: If you want to use your existing standard cable assemblies, you can turn them into Assemblies with Push-On Connectors, by using Push-On Adapters. The standard female of the Push-On Adapter threads into the male connector of your assembly.



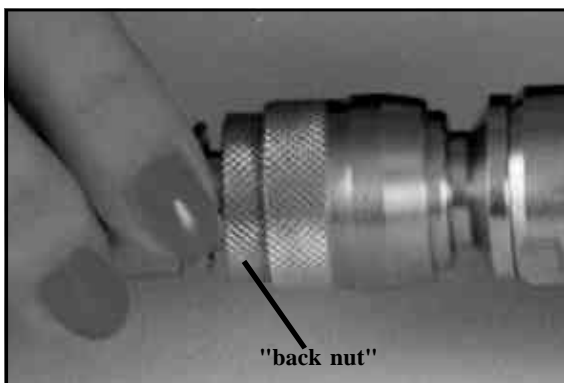
Lockable PUSH-ONS, Handling Information



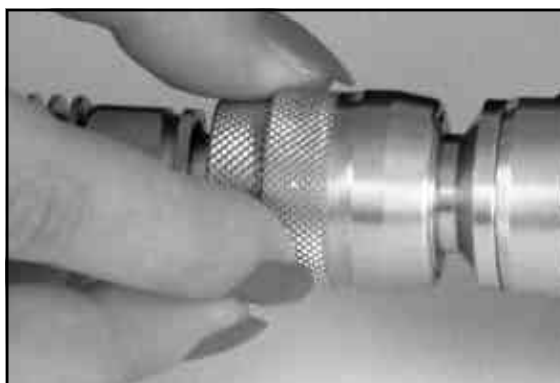
1. Place your fingers at the knurls of the "lock nut".



2. Push "lock nut" forward and engage the Push-On end of the adapter with the mating standard female. Ensure that back nut is released.



3. For operation in an ensured locking mode, push "back nut" onto "lock nut" and tighten.



4. To unlock: When "back nut" is in an unlocked mode, push "lock nut" forward and stop reverse movement by setting your fingers down onto the "back nut".



5. Pull the Push-On off.

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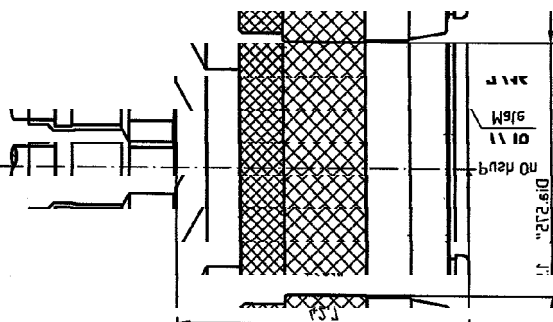
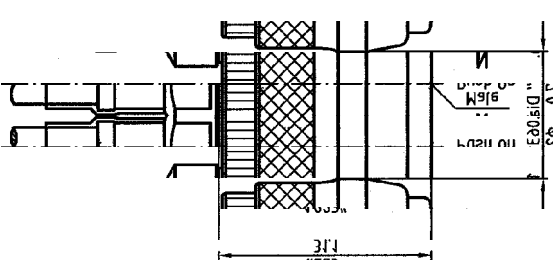
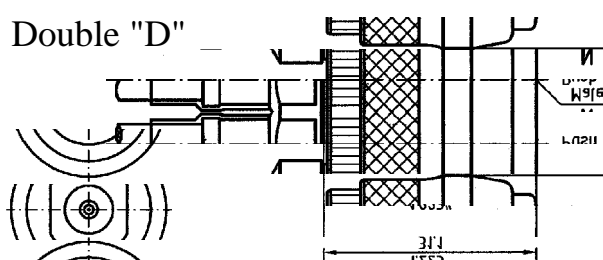
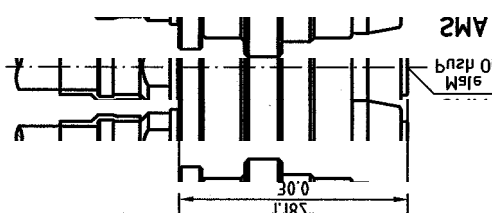
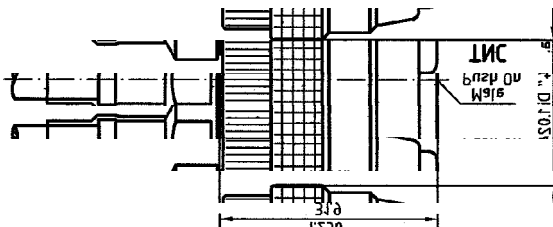
NON-Locking PUSH-ON Connectors

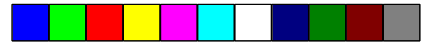


Connector Code	Connector Body Material	Description	Outline
7N	passivated Stainless Steel	7/16 Push-On NON-Locking	
7NB	Brass, Silver Plated for lower Intermodulation Products		
NN	passivated Stainless Steel	N Push-On NON-Locking	
NNB	Brass, Silver Plated for lower Intermodulation Products		
SM	passivated Stainless Steel	SMA Push-On NON-Locking	
TN	passivated Stainless Steel	TNC Push-On NON-Locking	



Locking PUSH-ON Connectors

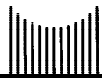
Connector Code	Connector Body Material	Description	Outline
7S	passivated Stainless Steel	7/16 Push-On Locking	
7SB	Brass, Silver Plated for lower Intermodulation Products		
NS	passivated Stainless Steel	N Push-On Locking	
NSB	Brass, Silver Plated for lower Intermodulation Products		
NDS	passivated Stainless Steel		Double "D" 
NDB	Brass, Silver Plated for lower Intermodulation Products		
SML	passivated Stainless Steel	SMA Push-On Locking	
TS	passivated Stainless Steel	TNC Push-On Locking	



Assemblies with Push-On Connectors



Cable Selection Chart												
Frequency in (GHz) → 1 2 3 4 8 12.4 15 18 26.5 30 40 50												
Band		L	S		C	X		KU		K	KA	
Cable Type		Operational Range →										
Increasing Insertion Loss ↓	14 Page 189	(Dia. 7.4mm).								20.0 GHz		
	140 Page 198	(Dia. 7.4mm).								20.0 GHz		
	10 Page 188	(Dia. 7.0mm).								26.5 GHz		
	100 Page 197	(Dia. 5.2mm).								26.5 GHz		
	18 Page 192	ANA-Cable (Dia. 6.0mm).								26.5 GHz		
	22 Page 193	ANA-Cable (Dia. 9.2mm).								26.5 GHz		
	42 Page 195	RG-142B/U (Dia. 4.95mm).						12.4 GHz				
	40 Page 194	RG-400/U (Dia. 4.95mm).						12.4 GHz				
	17 Page 191	(Dia. 2.7mm).								18.0 GHz		
	Connector Selection Charts					Regular Connectors					Pages 203 - 206	
PUSH - ON Connectors						Pages 166 - 167						



Spectrum
Elektrotechnik GmbH

Ordering Information Assemblies with Push-On Connectors

GENERAL INFORMATION ON HOW TO ORDER THE PUSH ON ASSEMBLIES:

Spectrum Elektrotechnik GmbH has set up an easy to use part number system. The customer can compose his part number, describing completely the component he is ordering. The table below explains the system and describes the possible alternatives.

THE CABLE: The three letters **ABC** are used to identify the cable by its code. The cable code does not necessarily have to be of three digits, it also can be two digits only.

THE ARMORING: For strenuous applications or harsh environment, armoring of the cable may be needed,. A variety of armors are available as standard, as outlined in "The '97 Handbook Cable Assemblies". The Customer may replace the **D** in the part number with the code for the armor requested, or he may rely on Spectrums' suggestions by replacing the **'D'** with a temporary code **'A'**. Spectrum will then change that temporary code **'A'** with the appropriate code, describing the armor recommended.

THE LENGTH: The letters **EFGH** are describing the length of the cable in millimeters, from reference plane to reference plane of the connectors.

THE CONNECTORS: The letters **JKL** and **MNO** are to be replaced with the two or three digit codes identifying the connector configuration. One end of the cable assembly is usually supplied with a Push-On Connector, either in locking, or non locking configuration. The locking mechanism is preferred where the cable assembly is connected to the device under test and has to remain there safely for some time. For short term testing, when the assembly is only connected for seconds, the non-locking Push-On Connector may be chosen. The other end of the assembly is normally supplied with a regular connector. For the code please refer to page 203 f.f.. The assembly also can be fitted with a second Push-On Connector, if needed.

A B C D				-	E F G H				-	J K L				-	M N O			
<p>ABC: to be replaced with the following two or three digit numbers respectively, for the Cable required.</p> <p>Cable Code</p> <p>10 = Cable Type 10 14 = Cable Type 14 18 = Cable Type 18 22 = Cable Type 22 40 = Cable Type 40 42 = Cable Type 42 100 = Cable Type 100 140 = Cable Type 140</p> <p>For details on the cables, please refer to Section VII.1, pages 187 - 198.</p>					<p>D: to be replaced in the part number with the code for the armor requested, or rely on Spectrums' suggestions by replacing the 'D' with an 'A'. Spectrum will then change the temporary code 'A' with the appropriate code.</p>					<p>EFGH: to be replaced with the length of the cable. Measurements are taken from the reference plane of one connector to the opposite one.</p>					<p>JKL: to be replaced with the following two or three digit number/letter Code, describing the Push-On Connectors as listed below.</p>			
					<p>Push-On NON-Locking</p> <p>7N = 7/16 Push-On NON-Locking 7NB = 7/16 Push-On NON-Locking NN = N Push-On NON-Locking NNB = N Push-On NON-Locking SM = SMA Push-On NON-Locking TN = TNC Push-On NON-Locking</p>					<p>Push-On Locking</p> <p>7S = 7/16 Push-On Locking 7SB = 7/16 Push-On Locking NS = N Push-On Locking NSB = N Push-On Locking NDS = N Push-On Locking NDB = N Push-On Locking SML = SMA Push-On Locking TS = TNC Push-On Locking</p>					<p>MNO: for the standard Connector configuration, please fill in the two or three number/letter Code, describing the Connector. Please refer to pages 205 - 206.</p> <p>If Push-On Connector is required here as well, please use Codes on pages 166-167.</p>			



Assemblies with Push-On Connectors

Ordering
Information



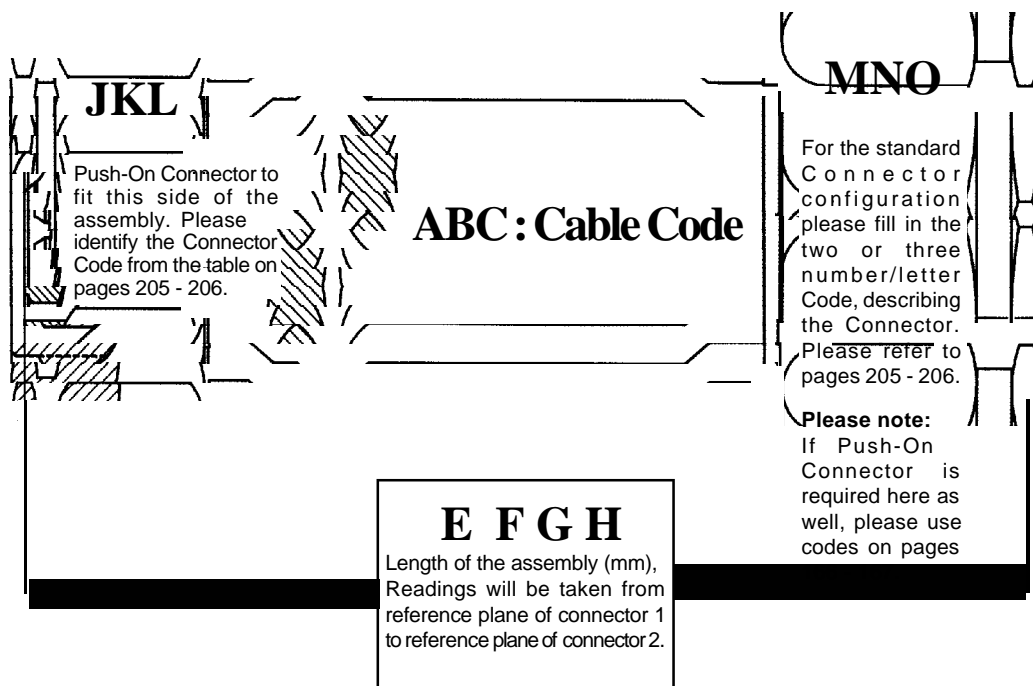
Spectrum
Elektrotechnik GmbH

Purchasing Information on Quick Connecting Assemblies

Ordering Details:

The Part Number Sequence is:

ABCD-EFGH-JKL-MNO



For cable assemblies, made to customer specification, or complying to special requirements, the company will issue a special part number.

Ordering Example: The cable assembly of Type '18' shall have the length of 80 cm. It shall be terminated with 'TNC PUSH-ON locking' (Code from page 167) and 'SMA female' - (Code from Page 206). Length is from interface to interface.
ABC = cable code = 18 / EFGH = length in mm = 0800 / JKL and MNO are the connectors = TS and 21.

Part Number for the cable assembly in this example: 18 - 0800 - TS - 21.

The specifications below are general specifications for all PUSH-ON connectors. Specifications in the following table are recommended for any procurement documents or drawings. In the event of any conflict, these specifications shall govern. The Push-ON Connectors were developed to eliminate the time consuming lightening, torquing and loosening of connectors during test. The connector slides directly onto any Female of the same connector style, allowing quick connecting and disconnecting. Its mechanism locks safely onto the standard thread of the Female connector.

GENERAL

Standard Materials	STEEL corrosion resistant 1.4305 per DIN 17440 (QQ-S-764, class 303 or ASTM-A-582-80). ALUMINUM AlMg4.5Mn per DIN 1725, AlMgSi0.5 per DIN 1725, AlMgSi1 per DIN 1725 (6061-T6 per QQ-A-225/8). BRASS CuZn39Pb3 per DIN 17660 (QQ-B-626, half hard). COPPER BERYLLIUM 33-25 CuBe2Pb H per DIN 17666 (QQ-C-530). TFE Fluorocarbon per DIN 52900 (MIL-P-19468 and L-P403). SILICONE RUBBER per DIN 3771 (MIL-R-5847 and ZZ-R-765, Class II B,) Grade 50 - 75. BORRUM NITRITE Dielectric for high power applications per inhouse specification.
Finish for COPPER BERYLLIUM STAINLESS STEEL ALUMINUM BRASS VARIOUS	Center Contacts shall be gold plated to a minimum thickness of .00005 inch (1.27 µm) in accordance with MIL-G-45204, Type II, Grade C. shall be passivated per QQ-P-35. Conductive Parts shall have an iridited finish per MIL-C-5541. Other parts, such as Coupling Nuts and Back-Bodies shall be anodized per MIL-A-8625. .00003 inch (0.8 µm) min. gold plating per MIL-G-45204, or nicle plating per QQ-N-190, as specified. Imoloy .0001 inch (2.5 µm) min. plating, consisting of 55% Copper / 20% Zinc / 25% Tin (on special request).
Design	The design shall be such that the outline dimensions in this catalog are met. In addition, the assembled connector shall meet the interface dimensions.

ELECTRICAL

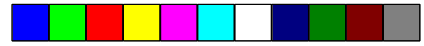
	7/16	N	SMA	TNC
Frequency Range	DC to 7.5 GHz	DC to 18.0 GHz	DC to 26.5 GHz	DC to 18.0 GHz
Insulation Resistance	Not less than 1.000 megaohms.	Not less than 5.000 megaohms.	Not less than 5.000 megaohms.	Not less than 5.000 megaohms.
Voltage Standing Wave Ratio (VSWR)	1.10 : 1	1.15 : 1	1.15 : 1 (DC - 18.0 GHz) 1.20 : 1 (18.0 - 26.5 GHz)	1.15 : 1
Contact Resistance	1.0 milliohms max.	1.0 milliohms max.	3.0 milliohms max.	1.0 milliohms max.
Dielectric Withstanding Voltage	3000 VRMS, 60 Hz	2500 VRMS, 60 Hz	1500 VRMS, 60 Hz	2500 VRMS, 60 Hz
RF High Potential Withstanding Voltage	4000 VRMS @ a 5 MHz	1500 VRMS @ a 5 MHz	1000 VRMS @ a 5 MHz	1500 VRMS @ a 5 MHz
RF Leakage	-90 dB max. to 3.0 GHz -80 dB max to 7.5 GHz	-90 dB max. to 3.0 GHz -75 dB max to 18.0 GHz	-80 dB max. to 3.0 GHz -65 dB max to 26.5 GHz	-90 dB max. to 3.0 GHz -65 dB max to 18.0 GHz
Insertion Loss	0.15 dB max. at 7.5 GHz	0.2 dB max. at 18.0 GHz	0.3 dB max. at 18.0 GHz	0.2 dB max. at 18.0 GHz
Impedance	50 Ohms Nominal	50 Ohms Nominal	50 Ohms Nominal	50 Ohms Nominal
Corona Level Voltage	2800 Volts @ 0 ft.	500 Volts @ 70,000 ft.	250 Volts @ 70,000 ft.	500 Volts @ 70,000 ft.

MECHANICAL

Connector Durability	500 mating cycles min.	500 mating cycles min.	500 mating cycles min.	500 mating cycles min.
Temperature	-55°C to +155°C	-65°C to +100°C	-65°C to +165°C	-65°C to +100°C
Force to Engage and Disengage	Not applicable.	Not applicable.	Shall not exceed 2 inch pounds (0.226 Nm)	Shall not exceed 2-4 inch pounds (0.452-0.678Nm)
Longitudinal Force max.	Not applicable.	Shall not exceed 6 inch-pounds (0.678 Nm).	Not applicable.	Not applicable.

ENVIRONMENTAL

Corrosion (Salt Spray)	Specification MIL-STD-202, Method 101, Test Condition B. The salt solution shall be 5%.
Vibration	Specification MIL-STD-202, Method 204, Test Condition D.
Shock	Specification MIL-STD-202, Method 213, Test Condition I.
Thermal Shock	Specification MIL-STD-202, Method 107, Test Condition B, except high temperature shall be + 200°C.
Moisture Resistance	Specification MIL-STD-202, Method 106. Step 7b (vibration) shall be omitted. Insulation resistance shall be 200 megohms min. within 5 minutes of removal from humidity.



Push-ONs



**For
PUSH-ON
Connectors
please refer to
"The '98
Handbook
Quick
Connections".**



**For
PUSH-ON
Adapters
please refer to
"The '97
Handbook
Adapters".**



Section V

Phase Stable Assemblies

INTRODUCTION: Vector network analyzers require electrically stable cable assemblies for measurement in very critical areas, such as Phase, Amplitude and VSWR. Cables have to maintain calibration data, even when subjected to bending and twisting which can introduce distorting parameters. The cable assembly needs to be flexible without being flaccid.

THE SOLUTION: Spectrum's automatic network analyzer test cable assemblies do meet all the requirements. These reliable test cables offer significant advantages when compared with standard test cables.

The Cables of Types 18 and 22 are very similar. The only difference is that Type 22 is armored, using a silicone jacketed fabric interwoven stainless steel spring. The flexibility of the cable can be compared with regular test cable assemblies. The operating frequency is recommended to 26.5 GHz.

The cable of Type 16 works to 50.0 GHz. It is a semi rigid type cable, armored with a silicone jacketed fabric interwoven stainless steel spring. The cable is a little bit on the stiffer side. But this is highly appreciated for several applications, especially when series of components have to be tested and when it is welcome that the connectors of the cable assembly remain closely in the connecting position.

The cable assemblies of Types 16 and 22 will withstand a pull of 22 pounds and are crush resistant to 880 pounds/square inch without degradation.

CABLE ASSEMBLY CONNECTORS: One end of the Assembly will usually be terminated with an NMD 2.4mm, 3.5mm, or K* connector, as needed for connecting directly with the RF output of the network analyzer. These NMD Connectors are designed with a larger than standard coupling nut for greater stability.

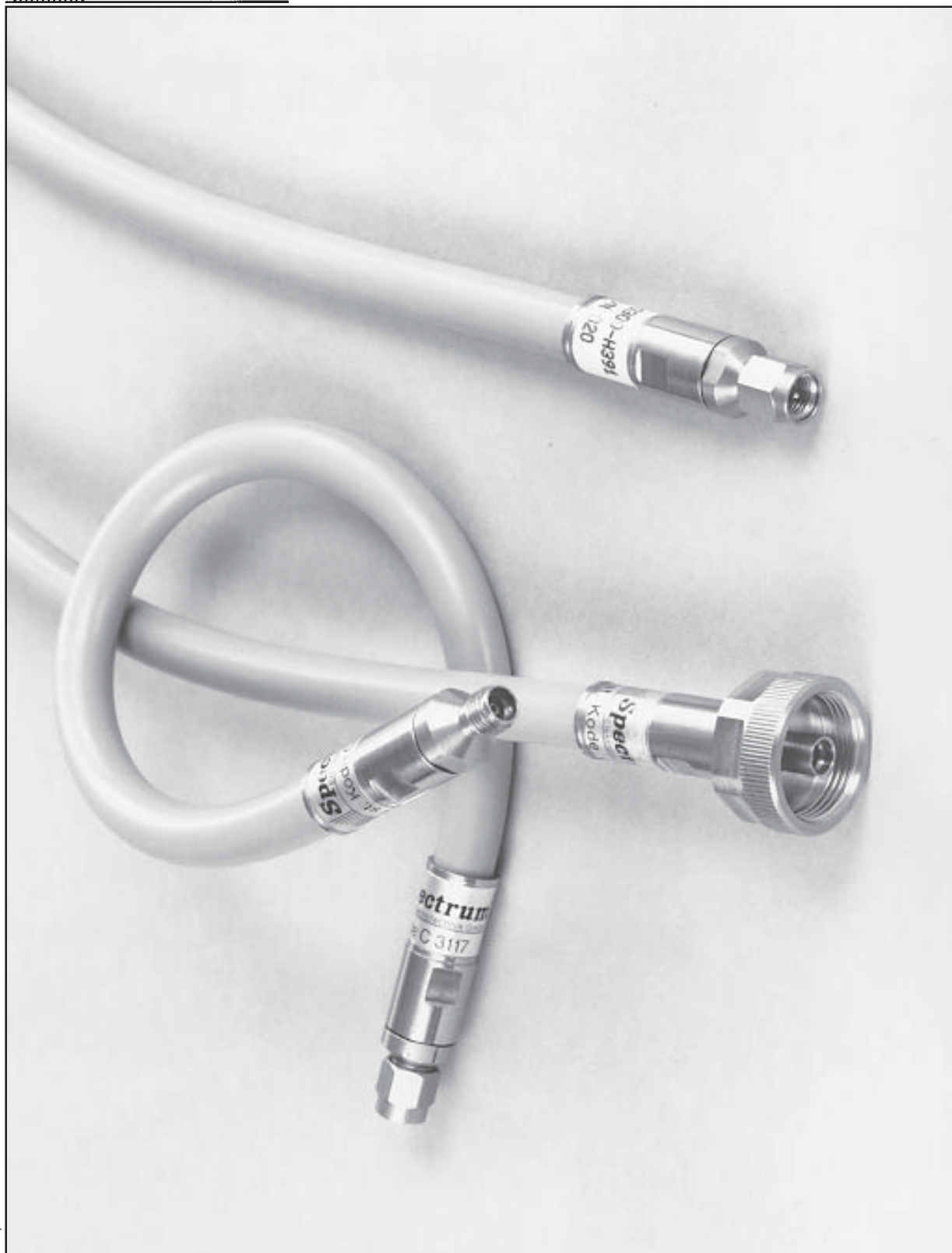
The other end of the ANA - Assembly may be terminated with any of the connectors, as needed in the customers test application, mating in direct connection with the device under test, such as 2.4mm, 3.5mm, 7mm, N, SMA, SPM, TNC, etc. As a large variety of connectors are available, adapters are not necessary and the test setup becomes simple and trustworthy. Sensitive tests can be performed, most accurate testing accomplished.

CABLE ASSEMBLY LENGTHS: The cable assemblies can be manufactured in almost any length, up to 6 meters (20ft.).

PREFERRED ASSEMBLIES: All necessary materials and piece parts will be carried in stock, helping to facilitate fast delivery. Cable assemblies of the most popular lengths, e.g. 45 cm. (17.7") and 60 cm. (2.36"), terminated with preferred connector styles, such as 2.4mm and 3.5mm for the Hewlett-Packard 8510 and K* for Wiltron 360, will be available, in most cases, within a few days of order placement.

THE CABLE ASSEMBLY KIT: ANA Cable Assemblies can be supplied in an instrument case. It normally contains beside the assemblies a torque wrench, or torque wrenches, as needed for the different connector styles, hex, and torques required.

CUSTOM PRODUCTS: Spectrum Elektrotechnik GmbH is a very innovative company. Our engineers are constantly designing new products, or modifying existing products to customers' requests. Therefore catalogs never will be complete. If you do not find exactly what you need in our catalogs, please contact our sales or engineering department.



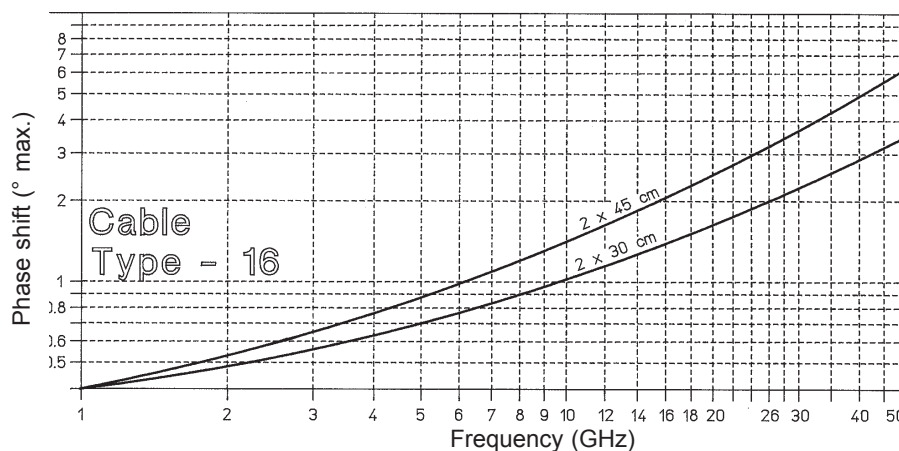
phase: pm 6

Phase Stable Cable Assemblies

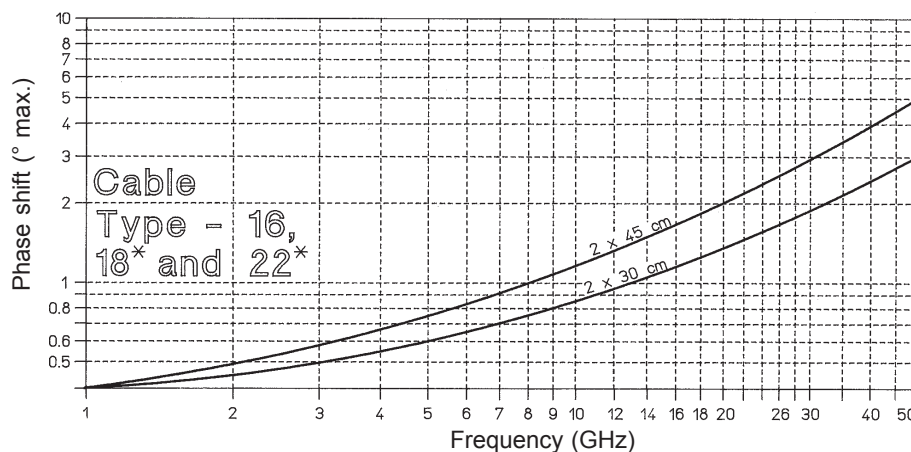


Cable Code		16	18	22
Frequency Range		50.0 GHz	26.5 GHz	26.5 GHz
Cable Outer diameter		9.2 mm. (.36")	6.0 mm. (.24")	9.2 mm. (.36")
Mechanical length		custom-made up to 6m	custom made up to 6m	custom made up to 6m
Electrical length		~ 1.44 x mechan. length	~1.36 x mechan. length	~1.36 x mechan. length
Bend radius min.		6 cm. (2.36")	6 cm. (2.36")	6 cm. (2.36")
Pull resistance		10 kg. (22 pounds)	2 Kg. (4.4 pounds)	10 kg. (22 pounds)
Crush resistance		62 kg./cm² (880 psi)	16 kg./cm² (225 psi)	62 kg./cm² (880 psi)
Return loss, min. /Assembly 2.4mm connectors		17 dB up to 50.0 GHz	20 dB up to 26.5 GHz	20 dB up to 26.5 GHz
3.5mm connectors		20 dB up to 26.5 GHz		
7mm connectors		20 dB up to 18.0 GHz	20 dB up to 18.0 GHz	20 dB up to 18.0 GHz
K* connectors		20 dB up to 40.0 GHz	20 dB up to 26.5 GHz	20 dB up to 26.5 GHz
N connectors		20 dB up to 18.0 GHz	20 dB up to 18.0 GHz	20 dB up to 18.0 GHz
SMA connectors				
TNC connectors				
Return loss stability		40 dB min.	40 dB min.	40 dB min.
Phase stab., 2 x 45 cm. assies manual flexing/torque		Please see also Diagrams on page 177. 5.0° max. @ 40.0 GHz	Please see also Diagrams on page 177. 4.0° max. @ 26.5 GHz	Please see also Diagrams on page 177. 4.0° max. @ 26.5 GHz
Straight vs. 90° bend		4.0° max. @ 40.0 GHz	2.5° max. @ 26.5 GHz	2.5° max. @ 26.5 GHz
Straight after 3 x 90° bends		3.0° max. @ 40.0 GHz	2.0° max. @ 26.5 GHz	2.0° max. @ 26.5 GHz
Amplitude stab., 2 x 45 cm. assies manual flexing/torque		<0.05dB @ 40.0 GHz	-	-
Straight vs. 90° bend		<0.05dB @ 40.0 GHz	<0.05dB @ 26.5 GHz	<0.05dB @ 26.5 GHz
Straight after 3 x 90° bends		<0.05dB @ 40.0 GHz	<0.05dB @ 26.5 GHz	<0.05dB @ 26.5 GHz
Insertion Loss / m (39.37")	1.0 GHz	0.65	0.40	0.40
	10.0 GHz	2.50	1.34	1.34
	18.0 GHz	3.60	1.80	1.80
	26.5 GHz	4.50	2.20	2.20
	40.0 GHz	5.70	-	-
	50.0 GHz	6.60	-	-

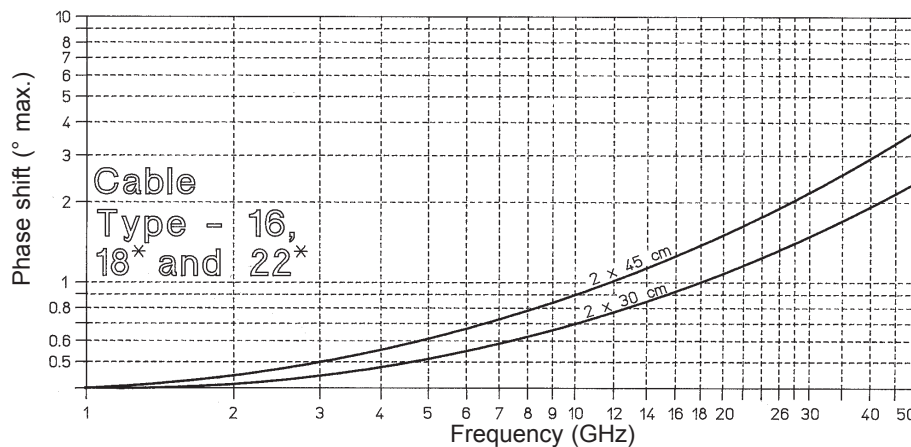
Phase Stability, with
manual flexing/ torque



Phase Stability, measured
when flexed from straight
position to a 90° bend



Phase Stability measured
in straight position
after three 90° bends



Diagrams: Three different criteria were determined to demonstrate the max. phase shift of the cables at ambient temperature. Tests were performed on pairs of cables, so that the total lengths of the assemblies under test were always 60 cm and 90 cm respectively.

* Cable Types 18 and 22: max. operating Frequency: 26.5 GHz.

Phase Stable Cable Assemblies

Connector Selection Chart



Type	Frequency	Sex	Description	Remarks	Connector Code	Finish
2.4 mm	DC - 50.0 GHz1)	Male	straight		HM	passivated Stainless Steel
				Maxi Nut	M2	
				The H2M and H2 developed at Spectrum, have larger than standard coupling threads for greater stability. The connectors are used on test ports, test port adapters, and test port cables.	H2M	
		Female			H2	
					HF	
3.5 mm	DC - 26.5 GHz	Male	straight		91	passivated Stainless Steel
				Maxi-Nut	M3	
				The H3M and H3 developed at Spectrum, have larger than standard coupling threads for greater stability. The connectors are used on test ports, test port adapters, and test port cables.	H3M	
		Female			H3	
					92	
7 mm	DC - 18.0 GHz	--	straight, 4 equally spaced Contact slots	90	passivated Stainless Steel	
			straight, 6 equally spaced Contact slots	96		
K*	DC - 40.0 GHz1)	Male	straight		KM	passivated Stainless Steel
				Maxi-Nut	MK	
				The WIM and WI developed at Spectrum, have larger than standard coupling threads for greater stability. The connectors are used on test ports, test port adapters, and test port cables.	WIM	
		Female			WI	
					KF	
N	DC - 18.0 GHz	Male	straight		51	passivated Stainless Steel
				PUSH-ON, NON-locking	NN	
				PUSH-ON, locking	NDS	
		NS				
		Female		61		
SMA	DC - 18.0 GHz	Male	straight		11	passivated Stainless Steel
				Maxi-Nut	MA	
				PUSH-ON, NON-locking	SM	
		PUSH-ON, locking		SML		
		Female		21		
TNC	DC - 18.0 GHz	Male	straight		31	passivated Stainless Steel
				PUSH-ON, NON-locking	TN	
				PUSH-ON, locking	TS	
		Female		41		

1) DC - 26.5 GHz for Cable Type 18 and 22.

INFORMATION ON HOW TO ORDER PHASE STABLE CABLE ASSEMBLIES:

Spectrum Elektrotechnik GmbH has set up an easy to use part number system. The customer can compose his part number, describing completely the component he is ordering. The table below explains the system and describes the possible alternatives.

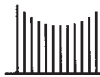
THE CABLE: The two letters **AB** are used to identify the cable by its code. Three different cables are available, recognized by their cable codes 16, 18 and 22. For the specifications of the different cables, please refer to page 187 f.f. and the data sheets in section VII.3 "Standard Product Specifications", starting on page 203.

THE LENGTH: The letters **EFGH** are describing the length of the cable in millimeters, from reference plane to reference plane of the connectors.

THE ARMORING: Cable assemblies of Types 16 and 22 are armored as standard. They will withstand a pull of 22 pounds and are crush resistant to 880 pounds per inch square without any degradation.

THE CONNECTORS: A large variety of connectors are available for these Phase Stable Cable Assemblies. The letters **JKL** and **MNO** are to be replaced with the two or three digit codes, identifying the desired connector configuration. For the description of the connectors and their codes, please refer to pages 203 - 206.

A B		- E F G H				- J K L			- M N O		
AB: to be replaced with the following two or three digit numbers respectively, for the Cable required. Cable Code 16 = Cable Type 16 18 = Cable Type 18 22 = Cable Type 22 For details on the cables, please refer to Section VII.1, pages 187 - 198.		EFGH: to be replaced with the length of the cable. Measurements are taken from the reference plane of one connector to the opposite one.				JKL: to be replaced with the two or three digit number/letter Code, describing the Connectors as listed on the left.			MNO: to be replaced with the two or three digit number/letter Code, describing the Connectors as listed on the left. If Push-On Connector is required here as well, please use Code on pages 166 to 167.		

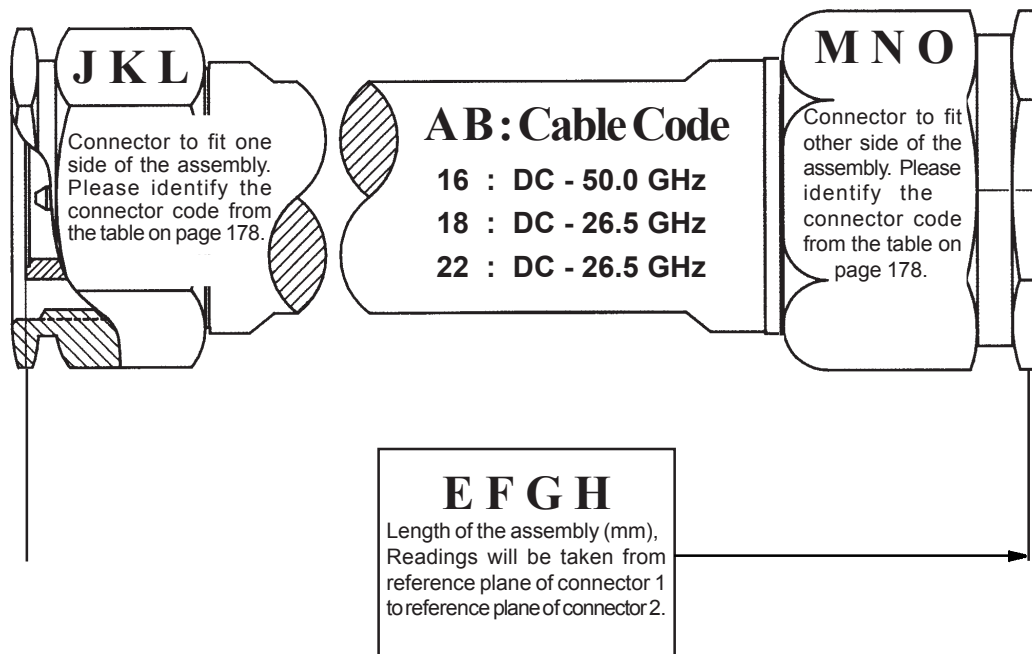


Purchasing Information on Phase Stable Assemblies

Ordering Details:

The Part Number Sequence is:

AB - EFGH - JKL -MNO



For cable assemblies, made to customer specification, or complying to special requirements, the company will issue a special part number.

Ordering Example: The cable assembly of Type '16' shall have the length of 65 cm. It shall be terminated with '3.5mm' - female and 'K*' - male connectors (length is from interface to interface).
 AB = cable code = 16 - EFGH = length in mm = 0650 - JKL and MNO are the connectors = 92 and KM.

Part Number for the cable assembly in this example: 16 - 0650 - KM - 92.

Section VI

RF-Multipin Connector SQ-8

1 caten 5 pm06

INTRODUCTION: In various applications it is necessary to connect and disconnect several microwave links. This may happen when testing high frequency systems: four,.... eight, or even more microwave cables need to be connected.

But not only test stations need the connection of several coaxial high frequency cable assemblies. Helicopters and other aircrafts are equipped with equipment that is needed during flight and normally then taken out again after the completed mission.

Using cable assemblies that are terminated with regular connectors, this means threading on the connectors, tightening and torquing, then later loosening and disconnecting again. This is a very time consuming process, which in some cases may even be longer than the test cycle. In any case valuable time is wasted by making connections and disconnections.

THE SOLUTION: Spectrum's new 'SQ-8' Multipin connector incorporates EIGHT NEW GENERATION precision microwave connectors. The advantage of being able to connect and disconnect eight microwave links simultaneously is one of its major benefits. The 'SQ-8' is blind mating and automatically locks the individual links into place by using a standard housing per MIL-C-38999, series III, shell size 21. The need for a torque wrench, and the difficulties sometimes experienced with mating miniature connectors in confined space, is eliminated.

FIELD REPLACEABLE ASSEMBLIES: Although designed and constructed with reliability and performance foremost in mind, every individual microwave assembly within the component is field replaceable. Everyone of these cable assemblies can be exchanged or replaced in minimum time, by the simple task of engaging or disengaging a bayonet catch. Should one of the assemblies used in the 'SQ-8' get physically damaged, it can be replaced in no time.

When using the 'SQ-8' Multipin Connector, the design, manufacture, and servicing of RF and microwave systems and test equipments is made infinitely easier. Electrically, the individual RF connector inserts offer an excellent performance, and are comparable, and in some cases better than those exhibited by standard microwave connectors.

THE CABLES: The 'SQ-8' Multipin Connector is available for Spectrum's Type 43 cable with normal deliveries. Additional designs have been completed to accommodate a variety of other cable types. These include cable diameters from 3mm to 5mm, from ultra flexible to extremely rugged, electrically phase stable and very low loss. 'SQ-8' Connectors for those cables will become available upon demand. Spectrum Elektrotechnik GmbH is a very innovative company, engineering products exactly to the customers' needs.

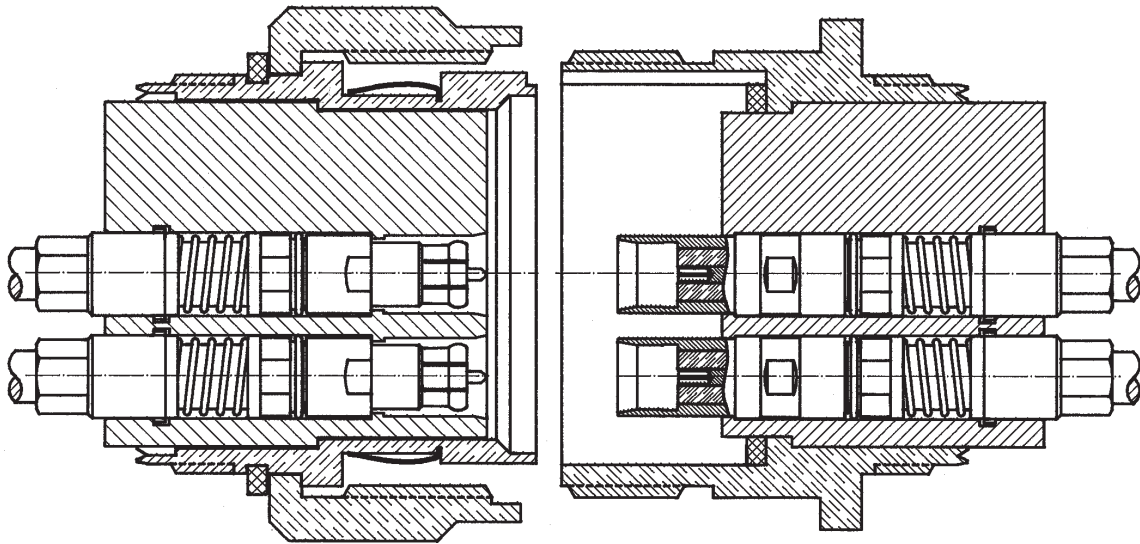
FUTURE DESIGNS: The 'SQ-8' may be the fore runner of a series of NEW MULTIPIN CONNECTOR developments. Other choices of outer body shell styling with different number of microwave inserts may become of interest in certain applications. Frequencies up to 50.0 GHz, and above, with combinations of RF-Inserts and regular pins will be engineered and made available, as they become necessary. Shell sizes, other than offered currently may be needed, or shells to newer configurations can be designed and engineered exactly to the customers' requirements.



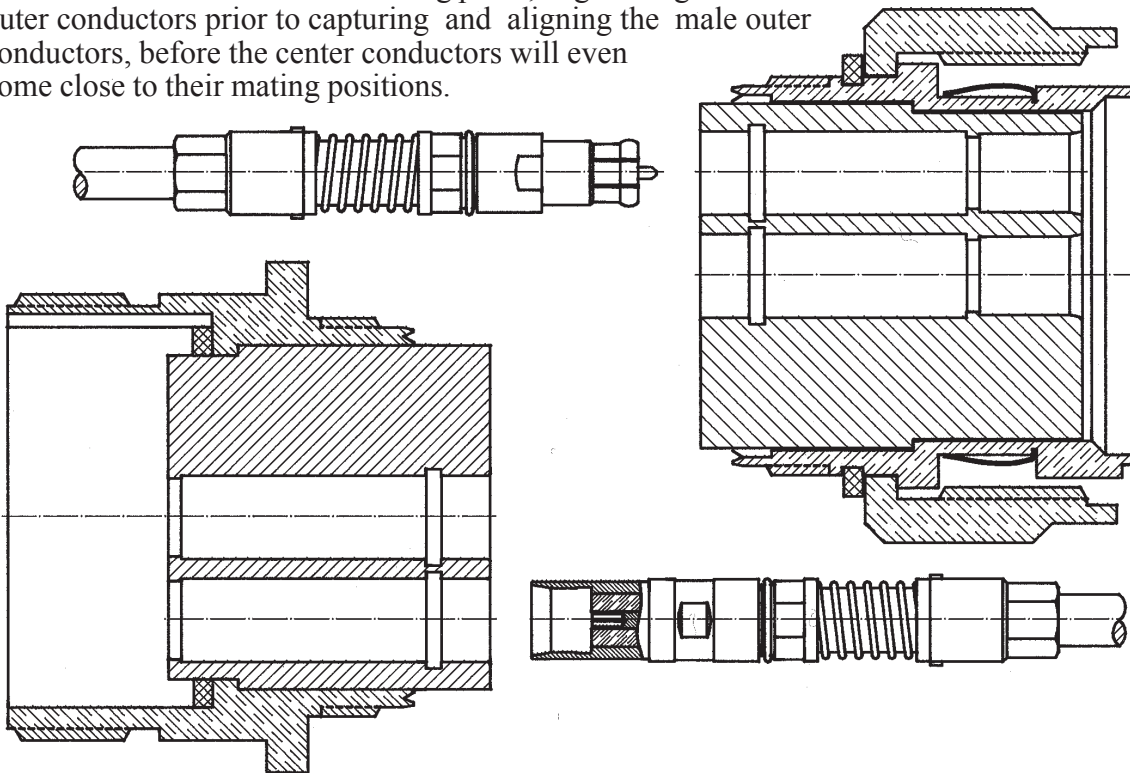
THE INTERFACES: When you have eight microwave connections per interface, it has to be ensured that all the connectors are self aligning easily. This guarantees that the connection is made successfully, each time, without the need for additional force during mating. The male inserts at the SQ-8 are designed to be recessed below the reference plane of the SQ-8. Thus the center pins of the inserts are well protected. The outer conductor of the female insert does protrude above the reference plane of the SQ-8. During the mating process the female outer conductor will catch first the mating plane, align automatically all eight female outer conductors prior to capturing the male outer conductors, aligning them, before the center conductors will meet.

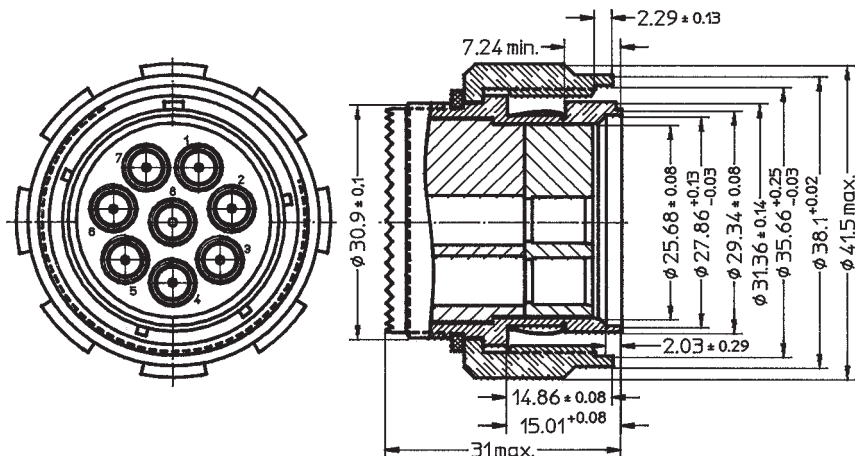
THE INSERTS: All the inserts, used in the SQ-8, are spring loaded for blind mating/self alignment purposes, and they are equipped with a bayonet catch. Therefore every cable assembly can be replaced in minimum time by simply engaging/disengaging the bayonet catch.

RF-Multipin Connector SQ-8



The cross section view demonstrates the perfect engineering that has been leading to the success of the SQ-8: Every cable assembly terminated with an SQ-8 Insert can be replaced in minimum time by simply engaging/disengaging a bayonet catch. The inserts are spring loaded for blind mating / self alignment purposes. The outer conductor of the female insert does protrude above the reference plane of the SQ-8. During the mating process the female outer conductors will catch first the mating plane, align all eight female outer conductors prior to capturing and aligning the male outer conductors, before the center conductors will even come close to their mating positions.

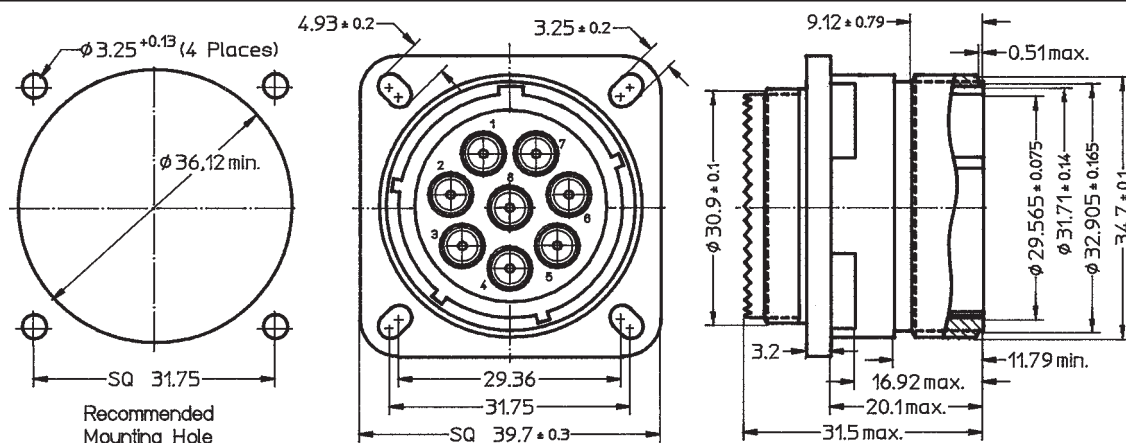




**RF-Multipin
Connector
SQ-8**

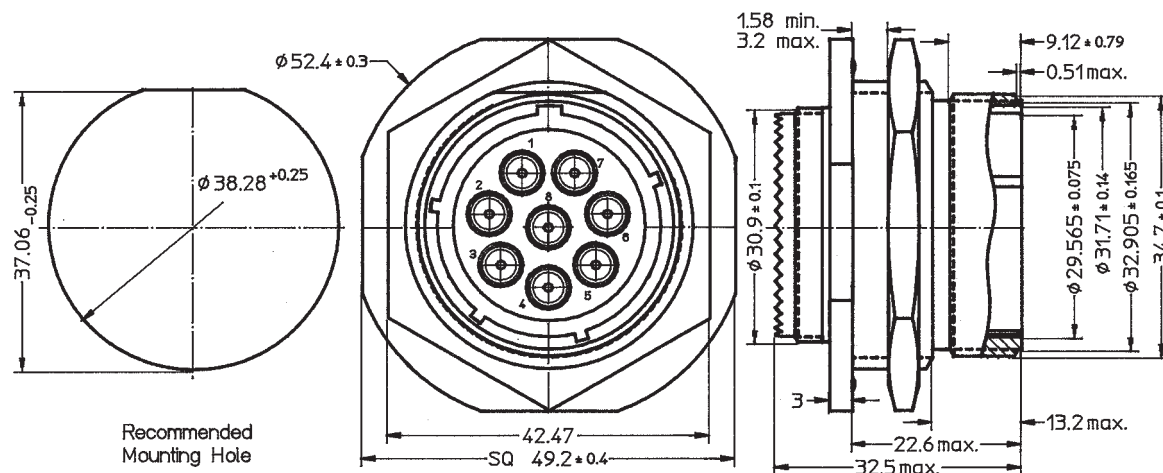
SQ-8 MALE Cable Connector

P/N: SQ-8MLE



SQ-8 4 - Hole Flange Mount Jack

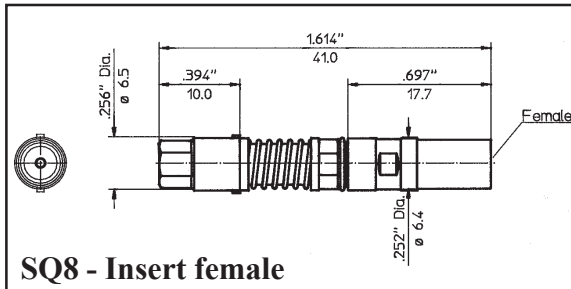
P/N: SQ-8FMJ



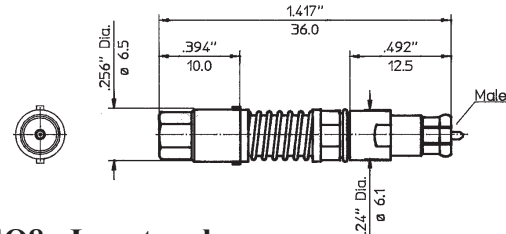
SQ-8 Bulkhead Feedthrough Jack

P/N: SQ-8BFJ

RF-Multipin Connector SQ-8



SQ8 - Insert female



SQ8 - Insert male

SPECIFICATIONS OF THE SQ - 8 INSERTS

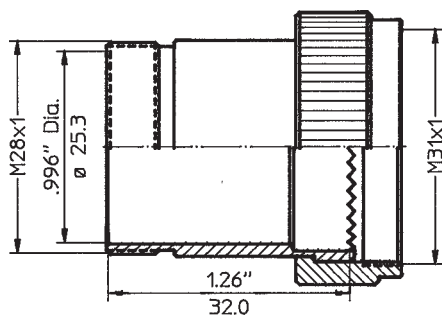
ELECTRICAL

Frequency Range	DC - 24.0 GHz min., DC - 40.0 GHz optional.
Insulation Resistance	The insulation resistance shall not be less than 5,000 megohms.
Voltage Standing Wave Ratio (VSWR)	$1.02 + .005 * f \text{ (GHz)}$
Contact Resistance	The center contact resistance drop shall not exceed 3.0 milliohms and the outer contact resistance drop shall not exceed 2.0 milliohms.
Dielectric Withstanding Voltage	The magnitude of the test voltage shall be 1,000 volts rms at sea level.
RF High Potential Withstanding Voltage	The RF high potential withstanding voltage is 670 volts rms at 5 MHz. Leakage is not applicable.
RF Leakage	- (100 - f (GHz)) dB
Insertion Loss	(.03 SQT(f(GHz))) dB

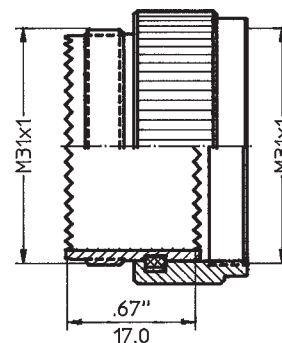
MECHANICAL

Connector Durability	The connector is to be tested and its mating connector shall be subjected to 500 insertions and withdrawal cycles at 12 cycles per minute max. The connector shall show no evidence of mechanical failure and the connector shall meet the mating characteristic requirements.
Cable Retention Force	60 pounds (267 N) min., without stress relief.
Coupling Nut Retention Force	Not applicable.
Force to Engage and Disengage	Not applicable.
Longitudinal Force max.	Longitudinal force is not applicable.
Mating Characteristics	Applicable to Females only: oversize pin .0372 inch (.945 mm) max. dia., .045 inch (1.14 mm) deep; insertion force 3 lbs. (13.34 N) max. with .037 inch (.94 mm) min. dia. pin; withdrawal force 1.00 oz (.278 N) min. with .0355 inch (.90 mm) max. dia. pin.
Recommended Mating Torque	Not applicable.

BACK BODIES



SQ-8 Standard Back Body



SQ-8 Adapter Back Body

Section VII.1

Standard Product Specifications

1. Cable Specifications	187
2. Connector Specifications	199
3. Connector Codes	203
4. Interface Mating Dimensions	207

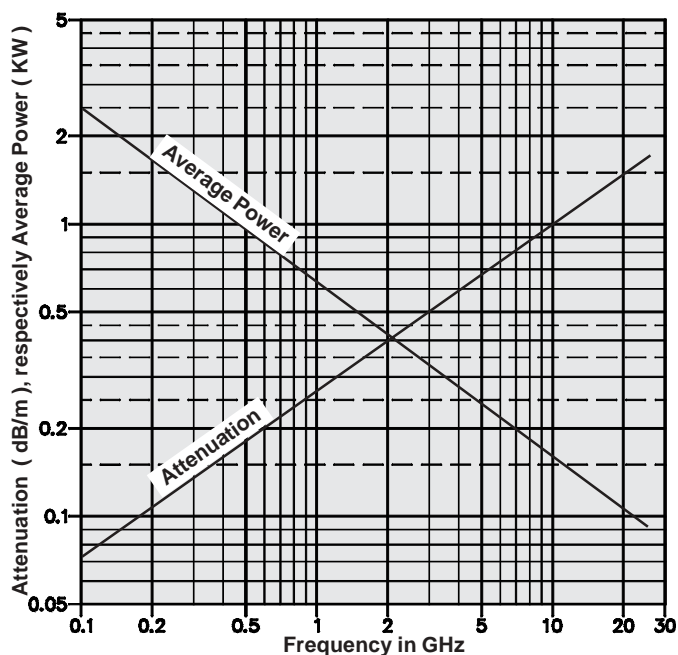
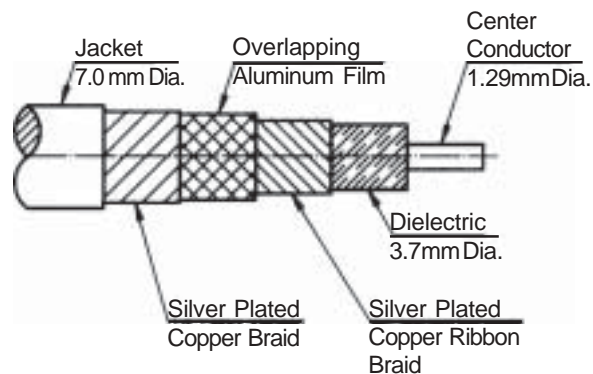
Cable - Type 10

DC - 26.5 GHz

SPECIFICATION		Type 10
Cable Code		10
Frequency Range		DC 26.5 GHz
Outer Diameter in mm		7.0*
Impedance in Ohms at Sea Level and +25°C		50 ± 1
Velocity in %, ± 2%		75
Capacitance in pF/m		87
Dielectric Strength (60 Hz) in KV rms		5.0
Max. Operating Voltage at Sea Level, in KV rms, 60 Hz		1.0
Nominal Insertion Loss in dB/m vs. Frequency	0.5 GHz	0.18
	2.0 GHz	0.40
	5.0 GHz	0.63
	10.0 GHz	0.97
	18.0 GHz	1.35
Nominal CW-Power in Watts, vs. Frequency, at Sea Level and + 20°C	0.5 GHz	950
	2.0 GHz	421
	5.0 GHz	244
	10.0 GHz	162
	18.0 GHz	114
26.5 GHz		91
RF - Leakage at 18.0 GHz		- 100 dBC
Operating Temperature Range		-54°C to +110°C
Outer Conductor Construction		Silver Plated Copper Braid, Overlapping Aluminum Film, Silver Plated Copper Braid
Outer Jacket		PTFE with add. Polyolefin Jacket*
Dielectric Dia. in mm		3.7
Dielectric Material		Low Density PTFE
Dielectric Constant		1.8
Center Conductor Material		Copper, Silver Plated
Center Conductor Dia. in mm		1.29
Weight in Gramms/Meter		69
Minimum Bend Radius, Inside, Static (mm)		26
Minimum Bend Radius, Inside, Dynamic (mm)		60

Characteristics:

- Performance to 26.5 GHz, when terminated with K* or 3.5mm connectors (mating with SMA).
- Meeting the very highest Quality Standard, as needed in military applications.
- Procurement for completely terminated assemblies, fully tested. The test documentation for VSWR and Insertion Loss will be supplied with the cable assembly.
- Available connectors: 1.4/4.4, 2.4mm, 3.5mm, 7mm, 7/16, HN, K*, N, SBX, SBY, SC, SMA, SPM and TNC.
- For Connector Code details please refer to page 203 f.f.
- Additional useful information can be derived from: "The '97 Handbook Cable Assemblies".

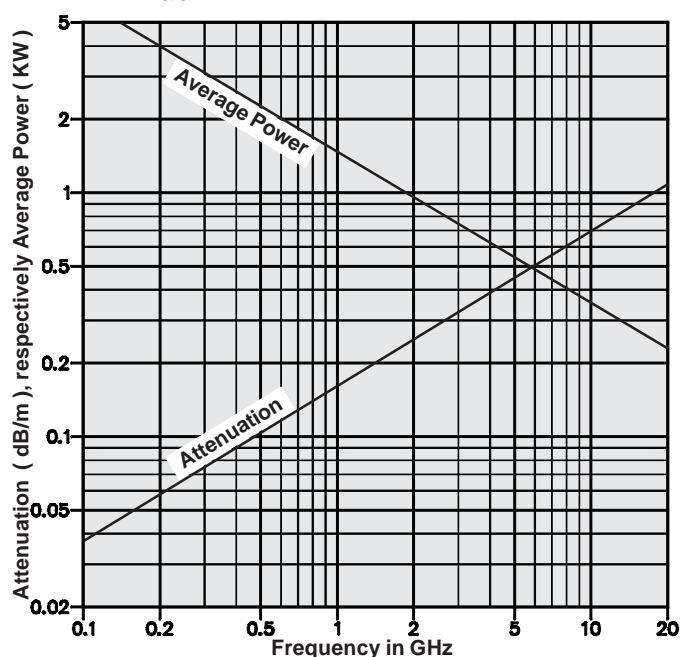
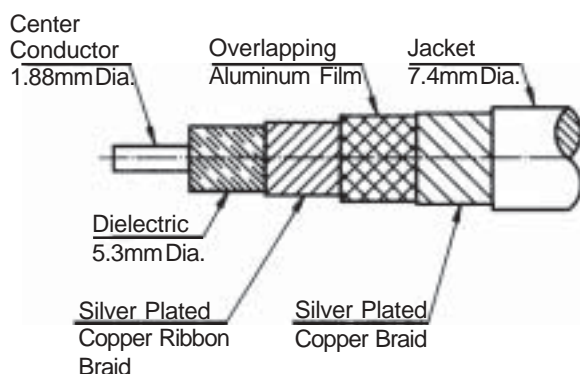


Characteristics:

- Excellent Performance to 20.0 GHz
- Very Rugged Construction.
- Meeting the very highest Quality Standard, as needed in military applications.
- Procurement for completely terminated assemblies, fully tested. The test documentation for VSWR and Insertion Loss will be supplied with the cable assembly.
- Available connectors: 3.5mm, 7mm, 7/16, HN, N, SC, SMA, and TNC.
- For Connector Code details please refer to page 203 f.f.
- Additional useful information can be derived from: "The '97 Handbook Cable Assemblies".

Cable - Type 14

DC - 20.0 GHz



SPECIFICATION		Type 14
Cable Code		14
Frequency Range		DC 20.0 GHz
Outer Diameter in mm		7.4
Impedance in Ohms at Sea Level and +25°C		50 ± 1
Velocity in %, ± 2%		76
Capacitance in pF/m		87
Dielectric Strength (60 Hz) in KV rms		6.0
Max. Operating Voltage at Sea Level, in KV rms, 60 Hz		1.5
Nominal Insertion Loss in dB/m vs. Frequency	0.5 GHz	0.13
	2.0 GHz	0.29
	5.0 GHz	0.49
	10.0 GHz	0.72
	18.0 GHz	1.00
	20.0 GHz	1.08
Nominal CW-Power in Watts, vs. Frequency, at Sea Level and + 20°C	0.5 GHz	2200
	2.0 GHz	967
	5.0 GHz	561
	10.0 GHz	372
	18.0 GHz	263
	20.0 GHz	230
RF - Leakage at 18.0 GHz		-100 dBC
Operating Temperature Range		-54°C to +110°C
Outer Conductor Construction		Silver Plated Copper Braid, Overlapping Aluminum Film, Silver Plated Copper Braid
Outer Jacket		PTFE
Dielectric Diameter in mm		5.3
Dielectric Material		Low Density PTFE
Dielectric Constant		1.7
Center Conductor Material		Copper, Silver Plated
Center Conductor Dia. in mm		1.88
Weight in Gramms/Meter		118
Minimum Bend Radius, Inside, Static (mm)		38
Minimum Bend Radius, Inside,		80

Cable - Type 16

ANA - Cable

Ultimate Performance to DC - 50.0 GHz

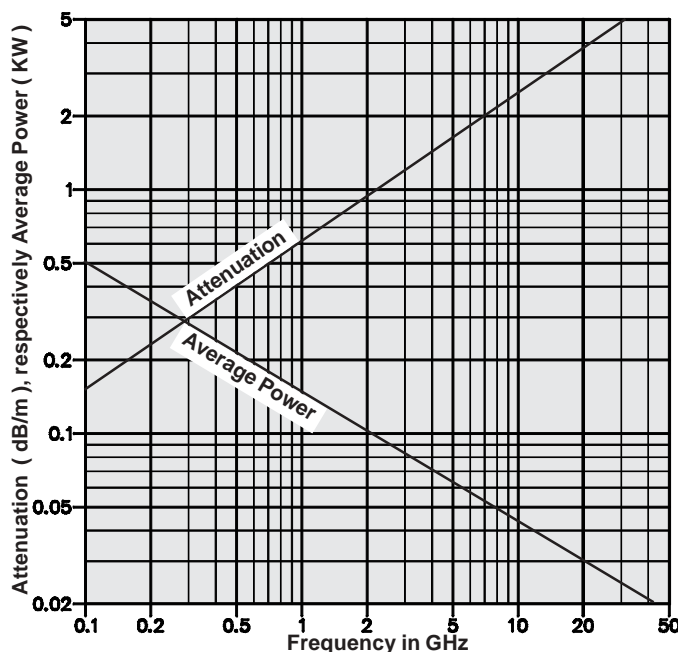
Characteristics:

- Performance to 50.0 GHz
- Excellent Flexibility.
- Procurement for completely terminated assemblies, fully tested. The test documentation for VSWR and Insertion Loss will be supplied with the cable assembly.
- Available connectors: 2.4mm, 3.5mm, 7mm, K*, N, SMA and TNC.
- For Connector Code details please refer to page 203 f.f.
- Additional useful information can be derived from: "The '97 Handbook Cable Assemblies".

SPECIFICATION		Type 16
Cable Code		16
Frequency Range		DC 50.0 GHz
Outer Diameter in mm		9.2
Impedance in Ohms at Sea Level and +25°C		50 ± 1.5
Velocity in %, ± 2%		69.5
Capacitance in pF/m		95.1
Dielectric Strength (60 Hz) in KV rms		2.5
Max. Operating Voltage at Sea Level, in KV rms, 60 Hz		1.5
Nominal Insertion Loss in dB/m vs. Frequency	1.0 GHz	0.65
	10.0 GHz	2.50
	18.0 GHz	3.60
	26.5 GHz	4.50
	40.0 GHz	5.70
	50.0 GHz	6.60
Nominal CW-Power in Watts, vs. Frequency, at Sea Level and + 20°C	1.0 GHz	152
	10.0 GHz	45
	18.0 GHz	32
	26.5 GHz	27
	40.0 GHz	21
	50.0 GHz	18
RF - Leakage at 18.0 GHz		-110 dBC
Operating Temperature Range		-54°C to +125°C
Outer Jacket		Stainless Steel Armor, Silicone Jacketed
Dielectric Material		PTFE
Dielectric Constant		2.0
Center Conductor Material		Stainless Steel Silver Plated
Weight in Gramms/Meter		153
Minimum Bend Radius, Inside,		60

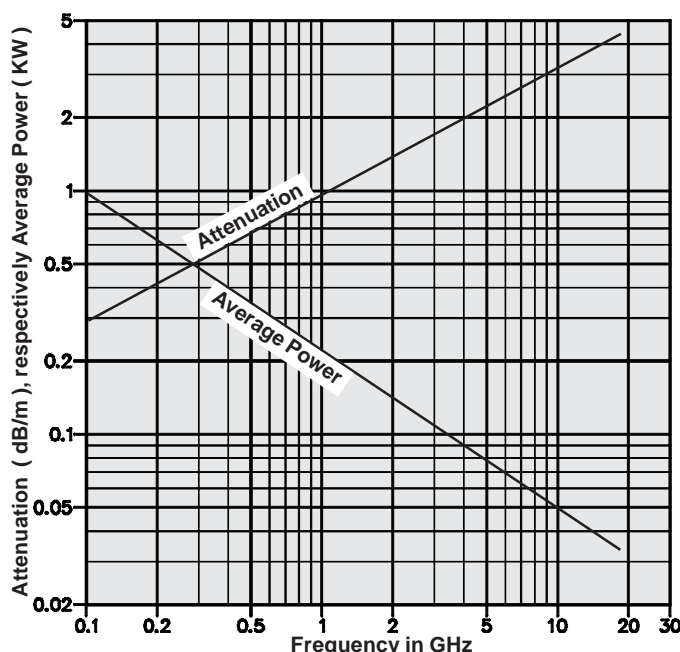
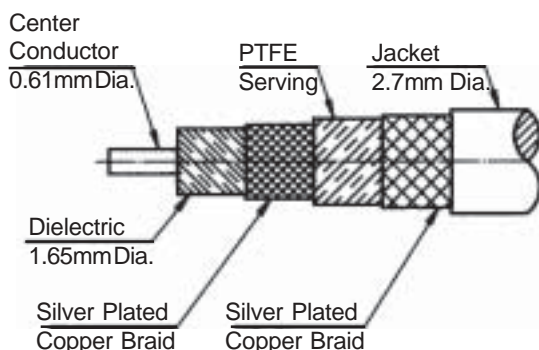
The Cable of Type 16 is phase stable, designed for electrical testing at the Vector Network Analyzers of HP and Wiltron. It operates to 50 GHz when supplied with 2.4mm connectors.

One end of the Assembly is usually terminated with a "special" 2.4mm, 2.9mm, or 3.5mm, NMD connector. These connectors are designed with a larger than standard coupling nut for greater stability, mating directly with the RF ports of the Network Analyzers. The other end of the ANA - Assembly may be terminated with any of the connectors available and needed in the customers test application, mating in direct connection with the device under test. By eliminating expensive adapters the test setup becomes simple and trustworthy.



Characteristics:

- Performance to 18.0 GHz.
- Small Diameter.
- Almost no Spring Back; the cable is like Woolen Yarn.
- Better System Performance because of nearly no mechanical interference.
- Procurement for completely terminated assemblies, fully tested. The test documentation for VSWR and Insertion Loss will be supplied with the cable assembly.
- Available connectors: 1.4/4.4, 3.5mm, BMA, K*, N, SMA and TNC.
- For Connector Code details please refer to page 203 f.f.
- Additional useful information can be derived from: "The '97 Handbook Cable Assemblies".



Cable - Type 17

Flexible as Woolen Yarn

DC - 18.0 GHz

SPECIFICATION		Type 17
Cable Code		17
Frequency Range		DC 18.0 GHz
Outer Diameter in mm		2.7
Impedance in Ohms at Sea Level and +25°C		50 ± 2
Velocity in %, ± 2%		76
Capacitance in pF/m		85
Dielectric Strength (60 Hz) in KV rms		2.0
Max. Operating Voltage at Sea Level, in KV rms, 60 Hz		0.6
Nominal Insertion Loss in dB/m vs. Frequency	0.5 GHz	0.64
	2.0 GHz	1.30
	4.0 GHz	1.90
	8.0 GHz	2.67
	12.4 GHz	3.40
	18.0 GHz	4.20
Nominal CW-Power in Watts, vs. Frequency, at Sea Level and + 20°C	0.5 GHz	320
	2.0 GHz	140
	4.0 GHz	90
	8.0 GHz	58
	12.4 GHz	46
	18.0 GHz	36
RF - Leakage at 18.0 GHz		-90 dBC
Operating Temperature Range		-54°C to +90°C
Outer Conductor Construction		2x Silver Plated Copper Braid
Outer Jacket		PTFE
Dielectric Diameter in mm		1.65
Dielectric Material		Low Density PTFE
Dielectric Constant		1.7
Center Conductor Material		Copper, Silver Plated
Center Conductor Dia. in mm		0.61
Weight in Gramms (Meter)		20
Minimum Bend Radius, Inside, Static (mm)		6.0
Minimum Bend Radius, Inside, Dynamic (mm)		35.0

Cable - Type 18

ANA - Cable

DC - 26.5 GHz

Characteristics:

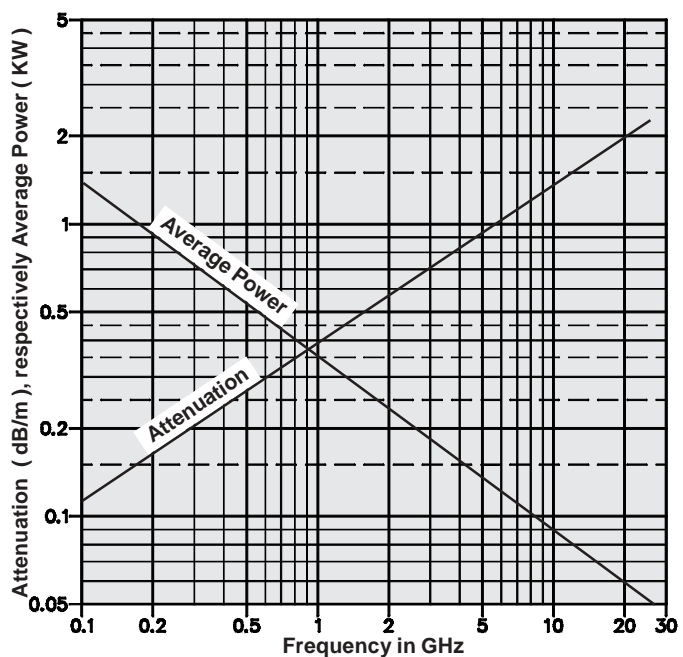
- Performance to 26.5 GHz with 2.4mm. Also when terminated with K* or 3.5 mm connectors (mating with SMA).
- Rugged Construction.
- Short delivery; certain lengths with preferred connector styles may be in stock.
- Procurement for completely terminated assemblies, fully tested. The test documentation for VSWR and Insertion Loss will be supplied with the cable assembly.
- Available connectors: 2.4mm, 3.5mm, 7mm, K*, N, SMA, SMP and TNC.
- For Connector Code details please refer to page 203 f.f.
- Additional useful information can be derived from: "The '97 Handbook Cable Assemblies".

The Cable of Type 18 is phase stable, designed for electrical testing at the Vector Network Analyzers of HP and Wilttron. It operates to 26.5 GHz when supplied with connectors of styles 2.4 mm, 2.9mm, or 3.5mm.

One end of the Assembly is usually terminated with a "special" 2.4mm, 2.9mm, or 3.5mm, NMD connector. These connectors are designed with a larger than standard coupling nut for greater stability, mating directly with the RF ports of the Network Analyzers.

The other end of the ANA - Assembly may be terminated with any of the connectors available and needed in the customers test application, mating in direct connection with the device under test. By eliminating expensive adapters the test setup becomes simple and trustworthy.

SPECIFICATION		Type 18
Cable Code		18
Frequency Range		DC - 26.5 GHz
Outer Diameter in mm		6.0
Impedance in Ohms at Sea Level and +25°C		50 ± 2
Velocity in %, ± 2%		72
Capacitance in pF/m (nominal)		92.5
Dielectric Strength (60 Hz) in KV rms		6.0
Max. Operating Voltage at Sea Level, in KV rms, 60 Hz		3.0
Nominal Insertion Loss in dB/m vs. Frequency	1.0 GHz	0.40
	10.0 GHz	1.34
	18.0 GHz	1.80
	26.5 GHz	2.20
Nominal CW-Power in Watts, vs. Frequency, at Sea Level and + 20°C	1.0 GHz	350
	10.0 GHz	85
	18.0 GHz	60
	26.5 GHz	50
RF - Leakage at 1.0 GHz		-90 dBC
Operating Temperature Range		-55°C +125°C
Outer Jacket		PTFE
Dielectric Material		Low Density PTFE
Dielectric Constant		1.9
Center Conductor Material		Silver Plated Copper Clad Steel
Weight in Gramms/Meter		66
Minimum Bend Radius, Inside, Static (mm)		51
Minimum Bend Radius, Inside		

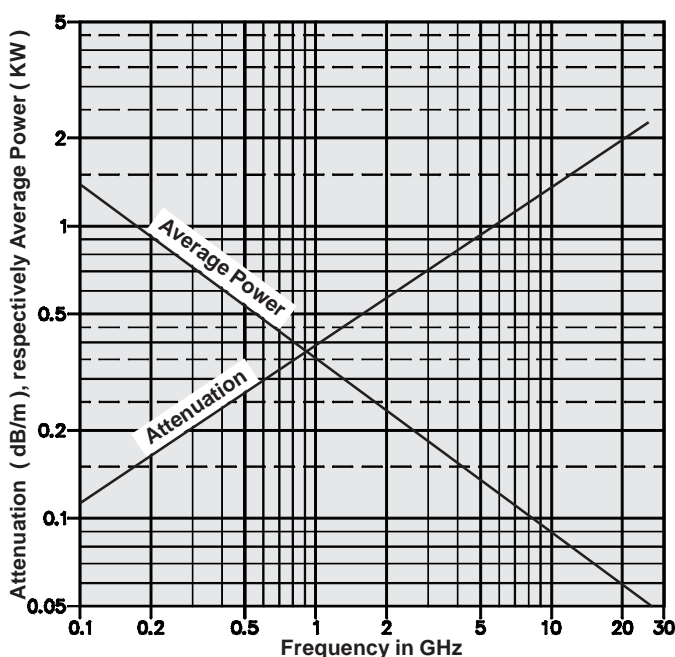


Characteristics:

- Performance to 26.5 GHz with 2.4mm. Also when terminated with K* or 3.5 mm connectors (mating with SMA).
- Rugged Construction.
- Procurement for completely terminated assemblies, fully tested. The test documentation for VSWR and
- Insertion Loss will be supplied with the cable assembly.
- Available connectors: 2.4mm, 3.5mm, 7mm, K*, N, SMA, SMP and TNC.
- For Connector Code details please refer to page 203 f.f.
- Additional useful information can be derived from: "The '97 Handbook Cable Assemblies".

The Cable of Type 22 is phase stable, designed for electrical testing at the Vector Network Analyzers of HP and Wiltron. It is similar to the cable of type 18, but armoured for harsh environment. It operates to 26.5 GHz when supplied with connectors of styles 2.4 mm, 2.9mm, or 3.5mm.

One end of the Assembly is usually terminated with a "special" 2.4mm, 2.9mm, or 3.5mm, NMD connector. These connectors are designed with a larger than standard coupling nut for greater stability, mating directly with the RF ports of the Network Analyzers. The other end of the ANA - Assembly may be terminated with any of the connectors available and needed in the customers test application, mating in direct connection with the device under test. By eliminating expensive adapters the test setup becomes simple and trustworthy.



Cable - Type 22

ANA - Cable

DC - 26.5 GHz

SPECIFICATION		Type 22
Cable Code		22
Frequency Range		DC - 26.5 GHz
Outer Diameter in mm		9.2
Impedance in Ohms at Sea Level and +25°C		50 ± 2
Velocity in %, ± 2%		72
Capacitance in pF/m (nominal)		92.5
Dielectric Strength (60 Hz) in KV rms		6.0
Max. Operating Voltage at Sea Level, in KV rms, 60 Hz		3.0
Nominal Insertion Loss in dB/m vs. Frequency	1.0 GHz	0.40
	10.0 GHz	1.34
	18.0 GHz	1.80
	26.5 GHz	2.20
Nominal CW-Power in Watts, vs. Frequency, at Sea Level and + 20°C	1.0 GHz	350
	10.0 GHz	85
	18.0 GHz	60
	26.5 GHz	50
RF - Leakage at 1.0 GHz		-90 dBC
Operating Temperature Range		-55°C +125°C
Outer Jacket		Stainless Steel Armor Silicone Jacketed
Dielectric Material		Low Density PTFE
Dielectric Constant		1.9
Center Conductor Material		Silver Plated Copper Clad Steel
Weight in Gramms/Meter		174
Minimum Bend Radius, Inside, Static (mm)		51
Minimum Bend Radius Inside		

Cable - Type 40

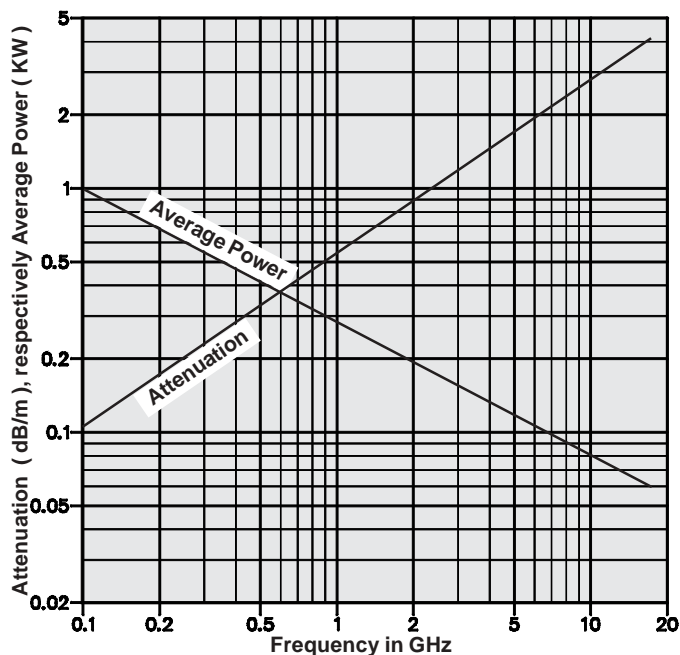
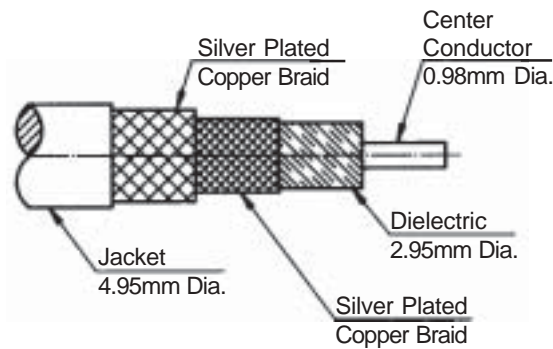
RG - 400/U

DC - 12.4 GHz

SPECIFICATION		Type 40
Cable Code		40
Frequency Range		DC 12.4 GHz
Outer Diameter in mm		4.95
Impedance in Ohms at Sea Level and +25°C		50 ± 2
Velocity in %, ± 2%		69.5
Capacitance in pF/m		105
Dielectric Strength (60 Hz) in KV rms		5.0
Max. Operating Voltage at Sea Level, in KV rms, 60 Hz		1.4
Nominal Insertion Loss in dB/m vs. Frequency	0.5 GHz	0.34
	2.0 GHz	0.87
	4.0 GHz	1.40
	8.0 GHz	2.24
	12.4 GHz	3.00
	18.0 GHz	4.00
Nominal CW-Power in Watts, vs. Frequency, at Sea Level and + 20°C	0.5 GHz	400
	2.0 GHz	192
	4.0 GHz	132
	8.0 GHz	92
	12.4 GHz	75
	18.0 GHz	60
RF - Leakage at 18.0 GHz		-80 dBC
Operating Temperature Range		-54°C to +110°C
Outer Conductor Construction		2x Silver Plated Copper Braid
Outer Jacket		PTFE
Dielectric Diameter in mm		2.95
Dielectric Material		PTFE
Dielectric Constant		2.0
Center Conductor Material		Stranded Silver Plated Copper wire
Center Conductor Construction		19 x 0.20 mm
Center Conductor Dia. in mm		0.98
Weight in Gramms/Meter		74
Minimum Bend Radius, Inside, Static (mm)		40

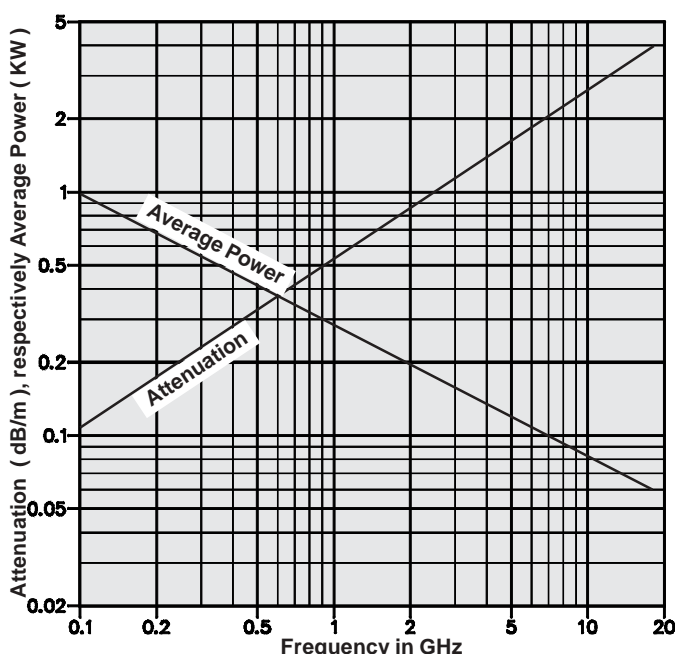
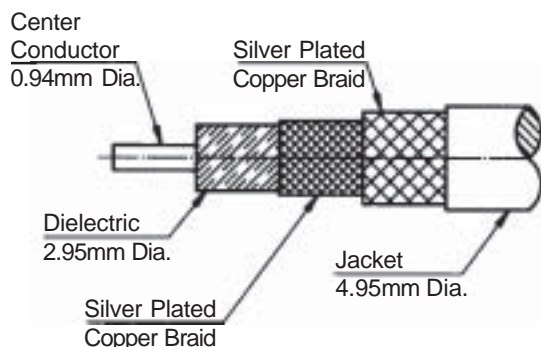
Characteristics:

- Performance to 12.4 GHz, degraded Performance to 18.0 GHz.
- Almost identical to RG-142/U, with the exception of the center conductor: RG-400/U has a stranded center conductor.
- Usage in Commercial Applications where price is of utmost importance.
- Procurement for the raw cable only, or completely terminated assemblies, 100% tested in VSWR and Insertion Loss.
- Available connectors: 1.8/5.6, BNC, N, SMA and TNC.
- For Connector Code details please refer to page 203 f.f.
- Additional useful information can be derived from: "The '97 Handbook Cable Assemblies".



Characteristics:

- Performance to 12.4 GHz, degraded Performance to 18.0 GHz.
- Almost identical to RG-400/U, with the exception of the center conductor: RG-142/U has a solid center conductor.
- Usage in Commercial Applications where price is of utmost importance.
- Procurement for the raw cable only, or completely terminated assemblies, 100% tested in VSWR and Insertion Loss.
- Available connectors: 1.8/5.6, BNC, N, SMA and TNC.
- For Connector Code details please refer to page 203 f.f.
- Additional useful information can be derived from: "The '97 Handbook Cable Assemblies".



Cable - Type 42

RG - 142B/U

DC - 12.4 GHz

SPECIFICATION		Type 42
Cable Code		42
Frequency Range		DC 12.4 GHz
Outer Diameter (mm)		4.95
Impedance in Ohms at Sea Level and +25°C		50 ± 2
Velocity in %, ± 2%		69.5
Capacitance in pF/m		105
Dielectric Strength (60 Hz) in KV rms		5.0
Max. Operating Voltage at Sea Level, in KV rms, 60 Hz		1.4
Nominal Insertion Loss in dB/m vs. Frequency	0.5 GHz	0.34
	2.0 GHz	0.87
	4.0 GHz	1.40
	8.0 GHz	2.24
	12.4 GHz	3.00
Nominal CW-Power in Watts, vs. Frequency, at Sea Level and + 20°C	18.0 GHz	4.00
	0.5 GHz	400
	2.0 GHz	192
	4.0 GHz	132
	8.0 GHz	92
	12.4 GHz	75
	18.0 GHz	60
RF - Leakage at 18.0 GHz		-80 dBC
Operating Temperature Range		-54°C to +110°C
Outer Conductor Construction		2x Silver Plated Copper Braid
Outer Jacket		PTFE
Dielectric Diameter in mm		2.95
Dielectric Material		PTFE
Dielectric Constant		2.0
Center Conductor Material		Silver Plated Copperweld Steel
Center Conductor Construction		1 x 0.94 mm
Center Conductor Dia. in mm		0.94
Weight in Gramms/Meter		69
Minimum Bend Radius, Inside, Static (mm)		40

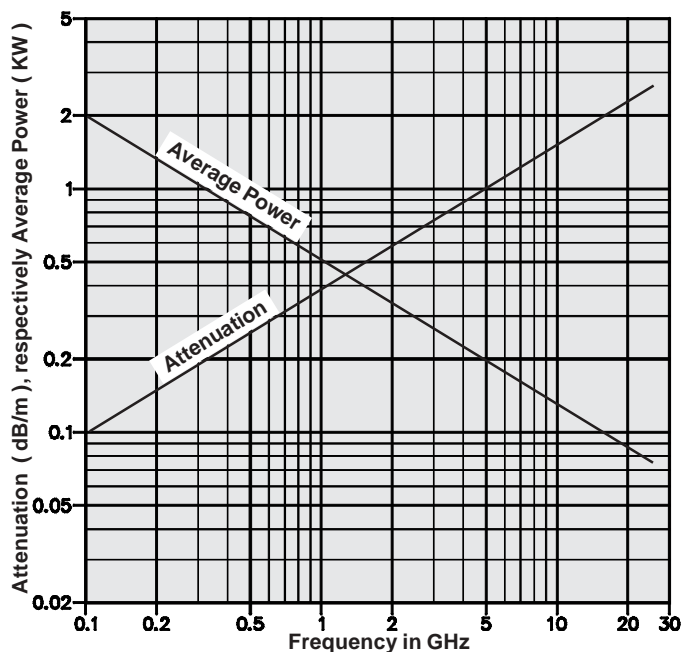
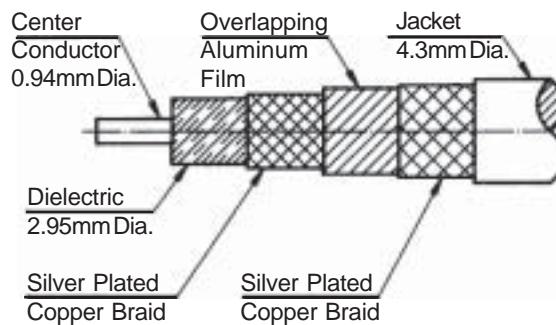
Cable - Type 43

DC - 26.5 GHz

SPECIFICATION		Type 43
Cable Code		43
Frequency Range		DC 26.5 GHz
Outer Diameter in mm		4.3
Impedance in Ohms at Sea Level and +25°C		50 ± 2
Velocity in %, ± 2%		72
Capacitance in pF/m		79
Dielectric Strength (60 Hz) in KV rms		5.0
Max. Operating Voltage at Sea Level, in KV rms, 60 Hz		0.7
Nominal Insertion Loss in dB/m vs. Frequency	0.5 GHz	0.28
	2.0 GHz	0.61
	4.0 GHz	0.85
	8.0 GHz	1.28
	12.4 GHz	1.70
	18.0 GHz	2.10
Nominal CW-Power in Watts, vs. Frequency, at Sea Level and + 20°C	0.5 GHz	800
	2.0 GHz	340
	4.0 GHz	220
	8.0 GHz	150
	12.4 GHz	120
	18.0 GHz	90
26.5 GHz		75
RF - Leakage at 18.0 GHz		-90 dBC
Operating Temperature Range		-54°C to +110°C
Outer Conductor Construction		Silver Plated Copper, Aluminium Film, Silver Plated Copper
Outer Jacket		PTFE
Dielectric Diameter in mm		2.95
Dielectric Material		Low Density PTFE
Dielectric Constant		1.9
Center Conductor Material		Copper, Silver Plated
Center Conductor Dia. in mm		0.94
Weight in Gramms/Meter		45
Minimum Bend Radius, Inside, Static (mm)		40
Minimum Bend Radius, Inside,		100

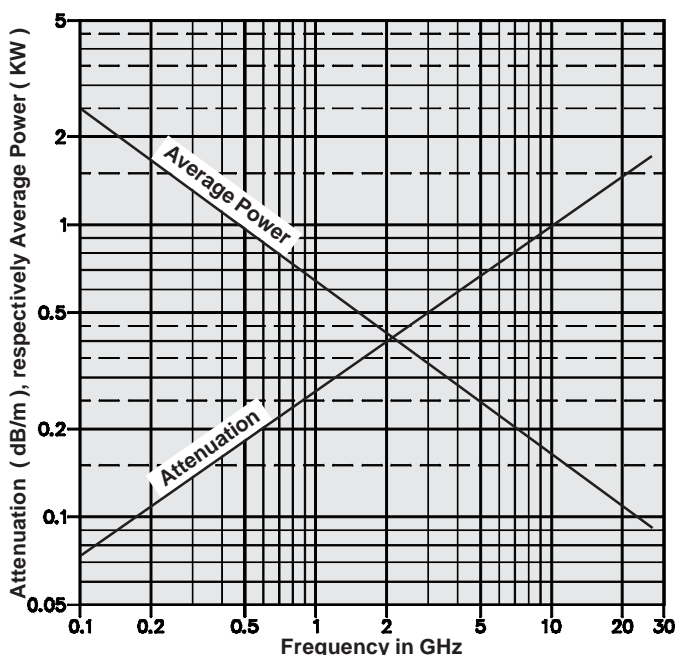
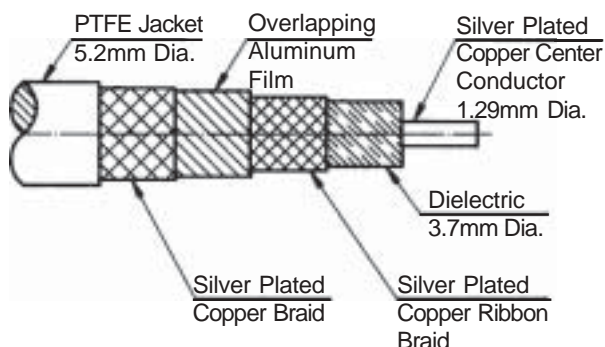
Characteristics:

- Performance to 26.5 GHz, when terminated with K* or 3.5mm connectors (mating with SMA).
- Procurement for completely terminated assemblies, fully tested. The test documentation for VSWR and Insertion Loss will be supplied with the cable assembly.
- Available connectors: 1.4/4.4, 2.4mm, 3.5mm, 7mm, 7/16, HN, K*, N, SBX, SBY, SC, SQ8, SMA, SPM and TNC.
- For Connector Code details please refer to page 203 f.f.
- Additional useful information can be derived from: "The '97 Handbook Cable Assemblies".



Characteristics:

- Performance to 26.5 GHz, when terminated with K* or 3.5 mm connectors (mating with SMA).
- Rugged Construction.
- Short delivery; certain lengths with preferred connector styles may be in stock.
- The cable used most; significant price advantage over other similar products.
- Procurement for completely terminated assemblies, fully tested. The test documentation for VSWR and Insertion Loss will be supplied with the cable assembly.
- Available connectors: 1.4/4.4, 2.4mm, 3.5mm, 7mm, 7/16, HN, K*, N, SBX, SBY, SC, SMA, SPM and TNC.
- For Connector Code details please refer to page 203 f.f.
- Additional useful information can be derived from: "The '97 Handbook Cable Assemblies".



Cable - Type 100

Low Loss, Low Cost

High Performance

DC - 26.5 GHz

SPECIFICATION		Type 100
Cable Code		100
Frequency Range		DC 26.5 GHz
Outer Diameter in mm		5.2
Impedance in Ohms at Sea Level and +25°C		50 ± 1
Velocity in %, ± 2%		75
Capacitance in pF/m		87
Dielectric Strength (60 Hz) in KV rms		6.0
Max. Operating Voltage at Sea Level, in KV rms, 60 Hz		1.5
Nominal Insertion Loss in dB/m vs. Frequency	0.5 GHz	0.18
	2.0 GHz	0.40
	5.0 GHz	0.63
	10.0 GHz	0.97
	18.0 GHz	1.35
	26.5 GHz	1.70
Nominal CW-Power in Watts, vs. Frequency, at Sea Level and + 20°C	0.5 GHz	950
	2.0 GHz	421
	5.0 GHz	244
	10.0 GHz	162
	18.0 GHz	114
	26.5 GHz	91
Peak-Power, 10% Duty Cycle		4 x CW-Power
RF - Leakage at 18.0 GHz		- 100 dBC
Operating Temperature Range		-54°C to +110°C
Outer Conductor Construction		Copper Ribbon Braid, Overlapping Aluminum Film, Silver Plated Copper Braid
Outer Jacket		PTFE
Dielectric Diameter in mm		3.7
Dielectric Material		Low Density PTFE
Dielectric Constant		1.8
Center Conductor Material		Copper, Silver Plated
Center Conductor Dia. in mm		1.29
Weight in Gramms/Meter		69
Minimum Bend Radius, Inside, Static (mm)		26
Minimum Bend Radius, Inside,		60

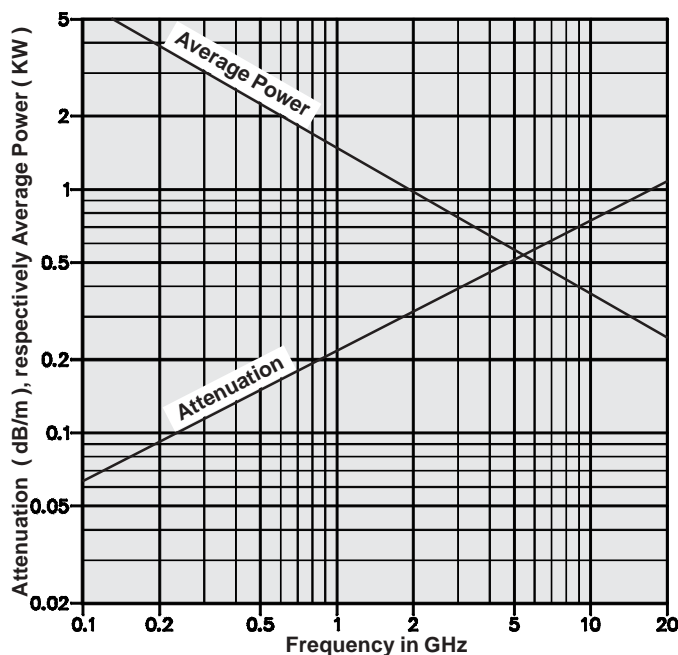
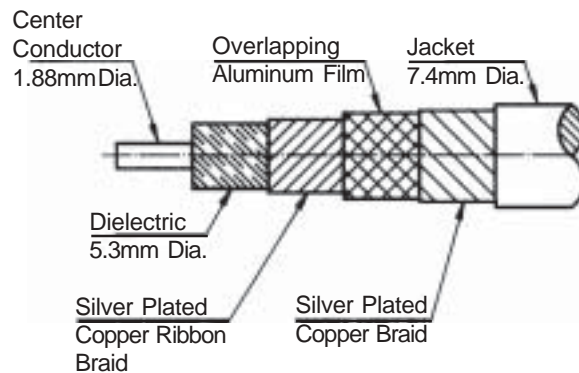
Cable - Type 140

DC - 20.0 GHz

Characteristics:

- Excellent Performance to 20.0 GHz
- Rugged Construction.
- Procurement for completely terminated assemblies, fully tested. The test documentation for VSWR and Insertion Loss will be supplied with the cable assembly.
- Available connectors: 3.5mm, 7mm, 7/16, HN, N, SBX, SBY, SMA, SC, and TNC.
- For Connector Code details please refer to page 203 f.f.
- Additional useful information can be derived from: "The '97 Handbook Cable Assemblies".

SPECIFICATION		Type 140
Cable Code		140
Frequency Range		DC 20.0 GHz
Outer Diameter in mm		7.4
Impedance in Ohms at Sea Level and +25°C		50 ± 1
Velocity in %, ± 2%		83
Capacitance in pF/m		87
Dielectric Strength (60 Hz) in KV rms		6.0
Max. Operating Voltage at Sea Level, in KV rms, 60 Hz		1.5
Nominal Insertion Loss in dB/m vs. Frequency	0.5 GHz	0.15
	2.0 GHz	0.32
	5.0 GHz	0.53
	10.0 GHz	0.75
	18.0 GHz	1.05
	20.0 GHz	1.14
Nominal CW-Power in Watts, vs. Frequency, at Sea Level and + 20°C	0.5 GHz	2200
	2.0 GHz	967
	5.0 GHz	561
	10.0 GHz	372
	18.0 GHz	263
	20.0 GHz	245
RF - Leakage at 18.0 GHz		-100 dBC
Operating Temperature Range		-54°C to +110°C
Outer Conductor Construction		Silver Plated Copper Braid, Overlapping Aluminum Film, Silver Plated Copper Braid
Outer Jacket		PTFE
Dielectric Diameter in mm		5.3
Dielectric Material		Low Density PTFE
Dielectric Constant		1.4
Center Conductor Material		Copper, Silver Plated
Center Conductor Dia. in mm		1.88
Weight in Grams/Meter		118
Minimum Bend Radius, Inside, Static (mm)		38
Minimum Bend Radius, Inside,		80



Section VII.2



Standard Product Specifications

1. Cable Specifications	187
2. Connector Specifications	199
3. Connector Codes	203
4. Interface Mating Dimensions	207













Connector Specifications (Example)



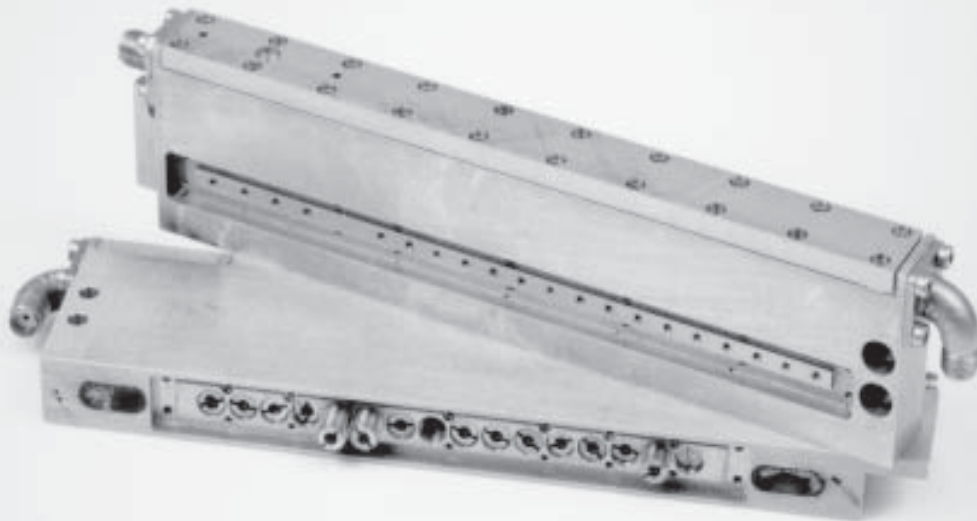
The specifications below are general specifications for connectors. Specific Data for VSWR, Insertion loss, R.F. leakage etc., are available from the factory upon request. Specifications in the following table are recommended for any procurement documents or drawings. In the event of any conflict between these specifications and other documentation, these specifications shall govern. These specifications are subject to change according to the latest revision.

REQUIREMENT		GENERAL SPECIFICATIONS
GENERAL		
Standard Materials		STEEL corrosion resistant 1.4305 per DIN 17440 (QQ-S-764, class 303 or ASTM-A-582-80). ALUMINUM AlMg4.5Mn per DIN 1725, AlMgSi0.5 per DIN 1725, AlMgSi1 per DIN 1725 (6061-T6 per QQ-A-225/8). BRASS CuZn39Pb3 per DIN 17660 (QQ-B-626, half hard). COPPER BERYLLIUM 33-25 CuBe2Pb H per DIN 17666 (QQ-C-530). TFE Fluorocarbon per DIN 52900 (MIL-P-19468 and L-P403). SILICONE RUBBER per DIN 3771 (MIL-R-5847 and ZZ-R-765, Class II B,) Grade 65 - 75. BORRIUM NITRITE Dielectric for high power applications per inhouse specification.
Finish for	COPPER BERYLLIUM STAINLESS STEEL ALUMINUM BRASS VARIOUS	Center Contacts shall be gold plated to a minimum thickness of .00005 inch (1.27 µm) in accordance with MIL-G-45204, Type II, Grade C. shall be passivated per QQ-P-35. Conductive Parts shall have an iridited finish per MIL-C-5541. Other parts, such as Coupling Nuts and Back-Bodies shall be anodized per MIL-A-8625. .00003 inch (0.8 µm) min. gold plating per MIL-G-45204, or nicle plating per QQ-N-190, as specified. Imoloy .0001 inch (2.5 µm) min. plating, consisting of 55% Copper / 20% Zinc / 25% Tin (on special request).
Design		The design shall be such that the outline dimensions in this catalog are met. In addition, the assembled connector shall meet the interface dimensions.
ELECTRICAL		
Frequency Range Insulation Resistance Voltage Standing Wave Ratio (VSWR) Contact Resistance Dielectric Withstanding Voltage RF High Potential Withstanding Voltage RF Leakage Insertion Loss		Please refer to the appropriate data sheet as shown in: "The '97 Handbook Adapters" and "The '98 Handbook Microwave Connectors".
MECHANICAL		
Connector Durability Cable Retention Force Coupling Nut Retention Force Force to Engage and Disengage Longitudinal Force max. Mating Characteristics Recommended Mating Torque		Please refer to the appropriate data sheet as shown in: "The '97 Handbook Adapters" and "The '98 Handbook Microwave Connectors".
ENVIRONMENTAL		
Corrosion (Salt Spray) Vibration Shock Thermal Shock Moisture Resistance		Specification MIL-STD-202, Method 101, Test Condition B. The salt solution shall be 5%. Specification MIL-STD-202, Method 204, Test Condition B. Specification MIL-STD-202, Method 213, Test Condition 1. Specification MIL-STD-202, Method 107, Test Condition B, except high temperature shall be + 200°C. Specification MIL-STD-202, Method 106. Step 7b (vibration) shall be omitted. Insulation resistance shall be 200 megohms min. within 5 minutes of removal from humidity.

All the connectors manufactured and used by Spectrum Elektrotechnik GmbH, if not specified differently in the order, will meet the following standard specifications:

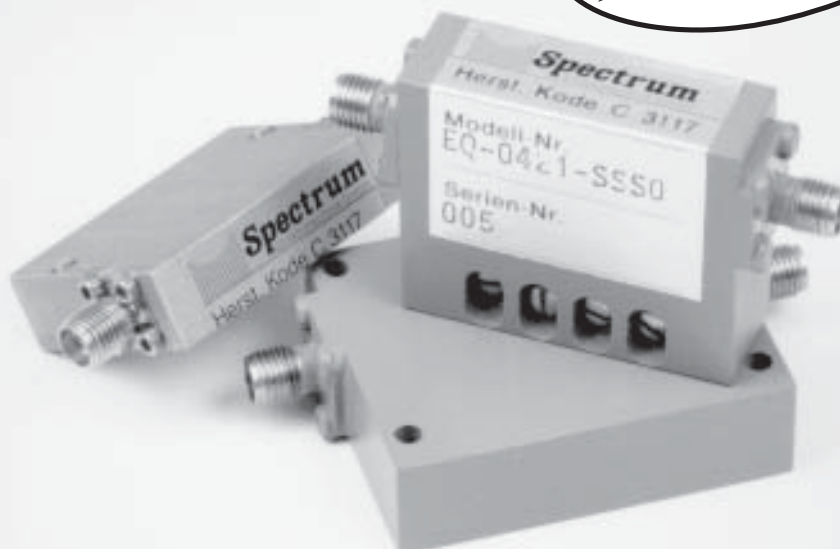
1.4/4.4	DIN 47298
1.8/5.6	DIN 47226
2/5.5	 Spectrum Specifications
2.4mm	 Spectrum Specifications
3.5mm	 Spectrum Specifications
7mm	IEC 457-2
7/16	DIN 47223
BMA	 Spectrum Specifications
BNC	MIL-C-39012 (IEC 169-2)
C	MIL-C-39012 (IEC 169-7)
HN	MIL-C-3643
K*	 Spectrum Specifications
N	MIL-C-39012
N 75 Ohms	 Spectrum Specifications
SBX	 Spectrum Specifications
SBY	 Spectrum Specifications
SC	MIL-C-39012
SMA	MIL-C-39012
SSMA	 Spectrum Specifications
SMB	MIL-C-39012
SMC	MIL-C-39012
SMP	DESC 94007 and DESC 94008
SMP Test Connector	 Spectrum Specifications
SPM	 Spectrum Specifications
TNC	MIL-C-39012 or MIL-C-87104/2
TNX	 Spectrum Specifications

The Specifications listed above are available upon request. The Specifications are also shown in full detail in "The '97 Handbook Adapters", and "The '98 Handbook Microwave Connectors". The Handbooks can be supplied free of charge. Connectors that do not meet the appropriate specifications can ruin the mating connectors, test sets, etc.



Gain Amplitude Equalizers

Please refer to
"The '98 Handbook
Passive Components"



Section VII.3

Standard Product Specifications

1. Cable Specifications	187
2. Connector Specifications	199
3. Connector Codes	203
4. Interface Mating Dimensions	207

INTRODUCTION: Spectrum Elektrotechnik GmbH has set up an easy to use part number system. The customer can compose his part number, describing completely the component he is ordering. The table below explains the system and describes the possible alternatives.

THE CONNECTORS: The six letters **JKL** and **MNO** in the part number, as shown in the part number system below, are to be replaced with the two or three digit codes, identifying the connector configuration. The possible connector configurations and its codes are listed on the next two pages, identifying a large variety of connectors. If you require these connectors at your cable assembly, then just simply replace the letters **JKL** and **MNO** with their appropriate code. The code does not necessarily have to be of three digits, it also can be two digits only. Besides regular connectors you may require one or both ends of the cable assembly to be supplied with **Push-On Connectors**, either in locking, or non locking configuration. The Push-On with locking mechanism is preferred where the cable assembly is connected to the device under test and has to remain there safely for some time. For short term testing, when the assembly is only connected for seconds, the non-locking Push-On Connector may be chosen. For additional information on **Push-Ons** please refer to pages 163 f.f.

If you require **Interchangeable Connectors** on one or both ends of the cable assembly, it needs to be supplied with the **Primary Unit** 'PU' on those ends. In no time the Interchangeable Connectors of the required series, male or female, can be mounted then, as needed for the application. **Primary Units** have been developed for the Phase Stable ANA Test Cable of Type 22, and as well as for a variety of other Test Cables Spectrum Elektrotechnik GmbH is offering, such as the cables of Types 10, 14 17, 100 and 140. The Interchangeable Connector Heads are available in most popular connector series, such as 7mm, N, SMA and TNC. All these connector heads, although of different connector series, are of the same electrical length (exception: the short Nf). For additional Information please refer to pages 153 f.f.

If you are specifying a **Phase Stable Cable** assembly, and you require one end of the assembly to be terminated with an NMD 2.4mm, 2.9mm, 3.5mm, or N. Please refer to page 173 f.f. for additional information and the appropriate connector code.

THE CABLE: The first three letters in the part number, **ABC**, are used to identify the cable by its code. The cable code does not necessarily have to be of three digits, it also can be two digits only. Some cables are listed on pages 187 f.f. Full data on those cables and additional information on other cables, armouring, etc. can be obtained from "The '97 Handbook Cable Assemblies".

THE ARMORING: For strenuous applications or harsh environment, armoring of the cable may be needed. A variety of armors are available as standard, as outlined in "The '97 Handbook Cable Assemblies". The Customer may replace the **D** in the part number with the code for the armor requested, or he may rely on Spectrum's suggestions by replacing the '**D**' with a temporary code '**A**'. Spectrum will then change that temporary code '**A**' with the appropriate code, describing the armor recommended.

THE LENGTH: The letters **EFGH** are describing the length of the cable in millimeters, from reference plane to reference plane of the connectors. For lengths longer than 9999mm (10m), three digits with a leading '**d**' are used to identify the length in decimeters (dm). Example: for a cable length of 30 meters the length code will be 'd300'.

A B C D				-	E F G H				-	J K L			-	M N O		
Cable Code					Length					Connector Code				Connector Code		
				Armor-ing												

Type	Sex	Description	Remarks	Code	Finish
1.4/4.4	Connector	straight		03	silver plated Brass
1.8/5.6	Male	straight		07	gold plated Brass
		Right Angle		05	
	Female	straight		04	
		Right Angle		06	
2/5.5	Male	Right Angle		02	anodized aluminum
2.4 mm	Male	straight	Maxi-Nut	HM	passivated Stainless Steel
			NMD	M2	
		2-Hole Flange Mount		H2M	
				HN	
	Female	straight	HP-direct connection	HF	
		Bulkhead Feedthrough		H2	
		2-Hole Flange Mount		HB	
		4-Hole Flange Mount		HF2	
3.5 mm	Male	straight	Maxi-Nut	91	passivated Stainless Steel
			NMD	M3	
				H3M	
		straight		92	
	Female	direct Connection	HP-direct connection	H3	
		Bulkhead Feedthrough		92B	
		2-Hole Flange Mount		922	
		4-Hole Flange Mount		924	
7 mm	Connector	straight, 4 equally spaced Contact slots	Interchangeable Connector	E90	passivated Stainless Steel
				90	
		straight, 6 equally spaced Contact slots	Interchangeable Connector	E96	
				96	
7/16	Male	straight	PUSH-ON, Locking	7SB	silver plated Brass
				7S	passivated Stainless Steel
			PUSH-ON, NON-Locking	7N	silver plated Brass
				7NB	silver plated Brass
	Female	straight		75	passivated Stainless Steel
		Bulkhead Feedthrough		76	
		4-Hole Flange Mount		753	
				754	
BMA	Male	Bulkhead Feedthrough		BM	passivated Stainless Steel
		2-Hole Flange Mount		BF	
	Female	Bulkhead Feedthrough		BB	
		straight		BW	
BNC	Male	straight		71	nickel plated Brass
	Female			81	
C	Male	straight		88	passivated Stainless Steel
	Female			89	
HN	Male	straight		69	passivated Stainless Steel
		Right Angle		67	
	Female	straight		68	
K*	Male	straight	Regular length	KM	passivated Stainless Steel
			Maxi-Nut	MK	
			Short	KMS	
			NMD	WIM	
	Female	straight	Wiltron direct connection	KF	
		Bulkhead Feedthrough		WI	
		2-Hole Flange		KFB	
		4-Hole Flange		KF2	
N	Male	straight	PUSH-ON, Locking	NSB	silver plated Brass
			PUSH-ON, NON-Locking	NNB	
			PUSH-ON, Locking, Double "D"	NDB	
				NDS	
			PUSH-ON, Locking	NS	
			PUSH-ON, NON-Locking	NN	
			Hexagonal Knurl Nut	510	
				51	
			Interchangeable Connector	E51	
			High Power	51H	
	Female	Right Angle		55	passivated Stainless Steel
		straight		61	
		straight, Short version	Interchangeable Connector	E61	
		straight		E62	
			High Power	61H	
			straight	63	
		Bulkhead Feedthrough	Right Angle	5A	
				5B	
SBX	Male	straight		65	passivated Stainless Steel
	Female			5C	
SBY	Male	straight		XM	passivated Stainless Steel
	Female			XF	
	Male			YM	passivated Stainless Steel
	Female			YF	

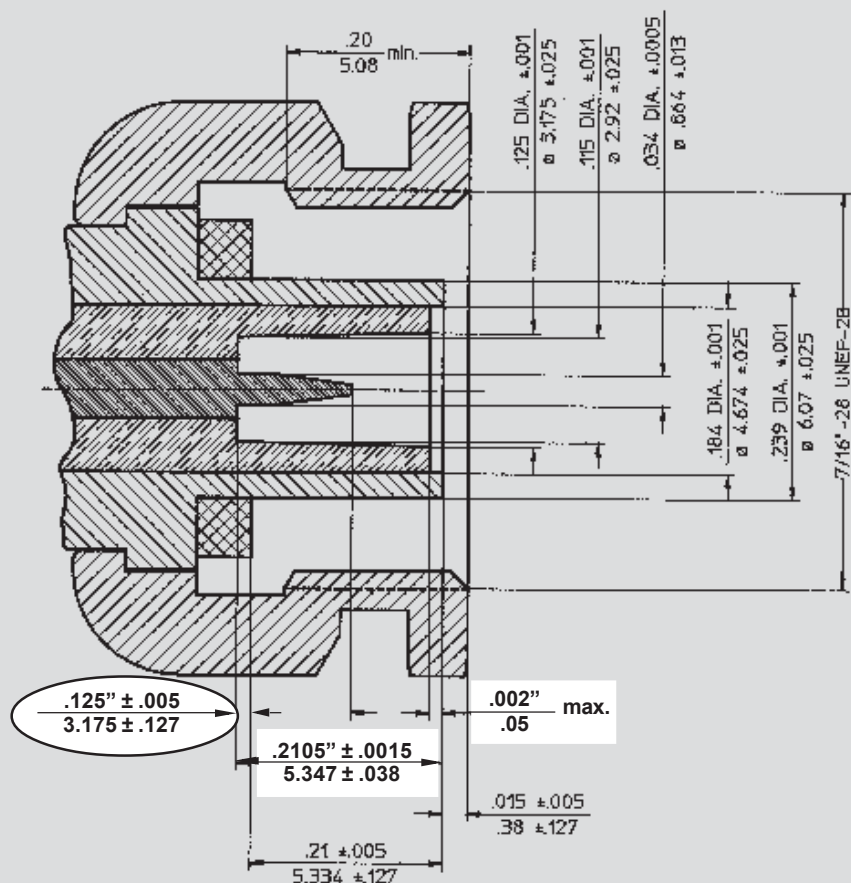
interface pm6

Connector Selection Chart 50 Ω



Type	Sex	Description		Remarks	Code	Finish	
SC	Male	straight			80	passivated Stainless Steel	
		Right Angle			77		
		straight		High Power	80H		
	Female	straight			79		
		Bulkhead Feedthrough			78		
straight		High Power	79H				
SMA	Male	straight		Across Flats	1S	passivated Stainless Steel	
				Maxi-Nut	MA		
				PUSH-ON, NON-Locking	SM		
				PUSH-ON, Locking	SML		
				Phase Adjustable	PH		
				Regular	11		
				Interchangeable Connector	E11		
				Short	11S		
				Short	10S		
				Regular	10		
				Low Cost	101		
					14		
			15				
		Right Angle	DC-12.0 GHz	Regular (w/o wire holes)	151	passivated Stainless Steel	
				Short (w/o wire holes)	152		
				Long (w/o wire holes)	153		
				Regular (with wire holes)	154		
				Short (with wire holes)	155		
				Long (with wire holes)	156		
	Long			17L			
	Radius Right Angle		DC - 25.0 GHz	17	gold plated Stainless Steel		
				16			
	Female	straight		DC - 18.0 GHz	20	passivated Stainless Steel	
				Interchangeable Connector	E21		
		Bulkhead Feedthrough		DC - 18.0 GHz	23	gold plated Stainless Steel	
		4-Hole Flange Mount			22		
					24		
					25		
					27		
		2-Hole Flange Mount			26	gold plated Stainless Steel	
		Right Angle		Regular	18R	passivated Stainless Steel	
				Long	18L		
		Radius Right Angle		DC - 25.0 GHz	28	gold plated Stainless Steel	
					19	pass. Stainless Steel	
	SMB	Male	straight		DC - 4.0 GHz	MB	gold plated Brass
		Female				FB	
	SMC	Male	straight		DC - 10.0 GHz	MC	gold plated Brass
			Right Angle			CW	
		Female	straight			FC	
	SMP Test Connector	Male	straight		DC - 40.0 GHz	TMJ	passivated Stainless Steel
Female					TMP		
SMP	Male	straight		DC - 40.0 GHz	MJ	passivated Stainless Steel	
	Female	straight			MP		
		Right Angle		DC - 18.0 GHz	MPR		
SPM	Male	straight			PM	passivated Stainless Steel	
	Female	straight			PJ		
		Bulkhead Feedthrough			PGF		
		2-Hole Flange Mount			PG2		
		4-Hole Flange Mount			PG4		
SSMA	Male	straight			SSM	passivated Stainless Steel	
	Female				SSF		
TNC	Male	straight		PUSH-ON, Locking	TS	passivated Stainless Steel	
				PUSH-ON, NON-Locking	TN		
					31		
				Interchangeable Connector	E31		
			High Power	31H			
		Right Angle			35	gold plated Stainless Steel	
	Female	straight			40		passivated Stainless Steel
					41		
				Interchangeable Connector	E41		
			High Power	41H			
Bulkhead Feedthrough			43				
4-Hole Flange Mount		straight	45	gold plated Stainless Steel			
			44				
		Radius Right Angle		46			
TNX	Male	straight			39	passivated Stainless Steel	
	Female				49		

Section VII.4



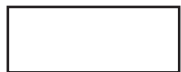
Standard Product Specifications

1. Cable Specifications	187
2. Connector Specifications	199
3. Connector Codes	203
4. Interface Mating Dimensions	207

Complete interface dimensions of the connectors are shown in this chapter. The important measurements are marked clearly for every connector series:



Dimensions, highlighted in an oval shape, are recommended for verification as a minimum. The connector gauges measuring these dimensions are included in the Expanded Calibration Kit and the Professional Kit as well.



Dimensions, highlighted in a rectangular shape are recommended for verification in addition to the dimensions highlighted in an oval shape. Checking all these dimensions will guarantee optimum performance of the connectors. The necessary connector gauges to measure all those dimensions are included in the Professional Calibration Kit only.

Testing the interfaces of connectors and adapters upon incoming inspection is not only highly recommended, it is definitely a necessity. Interfaces not meeting specification will lead to degraded specification of the components. In addition: These out of specification interfaces may damage the connectors of mating components or ruin the connectors of the test equipment.

Spectrum Elektrotechnik GmbH manufactures a comprehensive line of connector gauges for measuring the critical interface dimensions of coaxial connectors. These connector gauges consist of an especially adapted dial indicator with appropriate bushings and pins that are designed to mate with the specific connector under test. The indicator is zero set by a calibration block (master). When engaged to a connector, it measures the specific interface dimension from a reference plane.

For every dimension of interest, a special gauge is offered. This gives the most accurate results, allows easy calibration, fast testing and helps to avoid mistakes.

A number of gauges are available. The main difference between the gauges is in the resolution, and the units of measurement, inches, or metric. Only the digital gauges can be switched from metric to inch and vice versa. Normally the Connector Gauges are supplied in an instrument case that protects them from getting damaged. In the box, there is also space for the appropriate torque wrench, which can be supplied on a separate order.

Dimensions shown are inches over millimeters.

Frequency: DC - 50 GHz min.

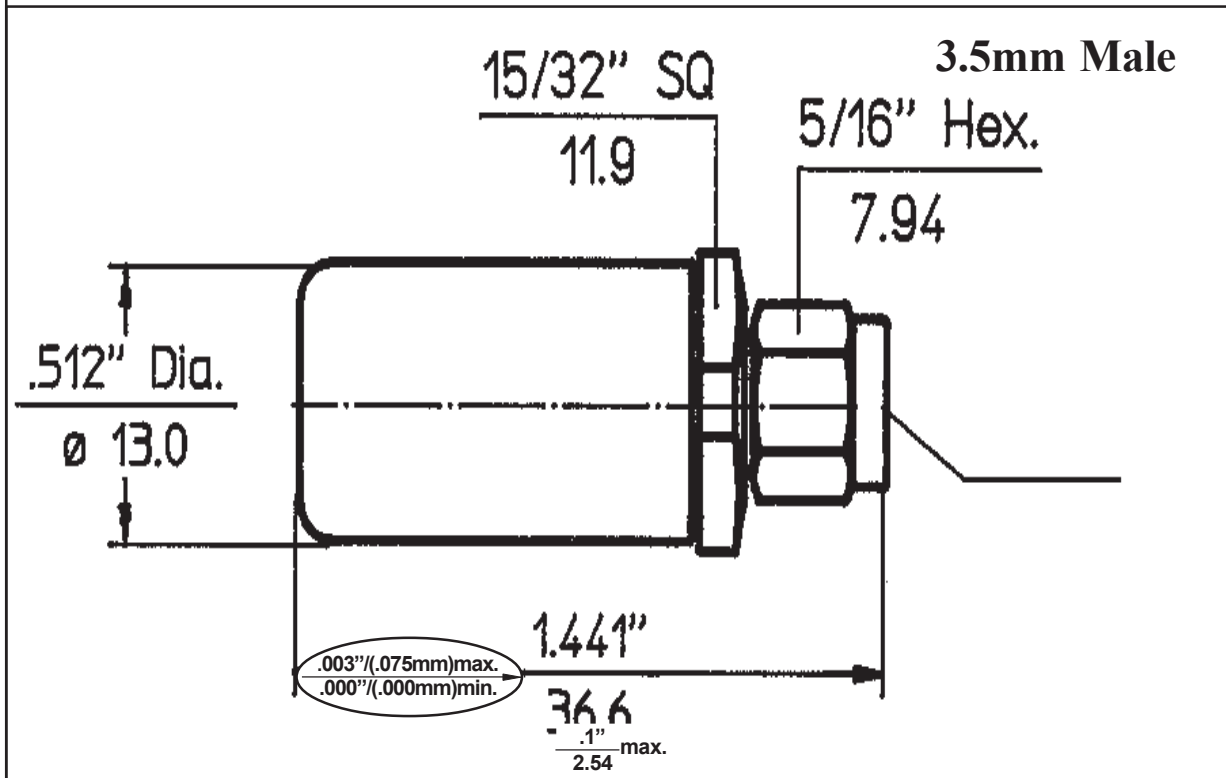
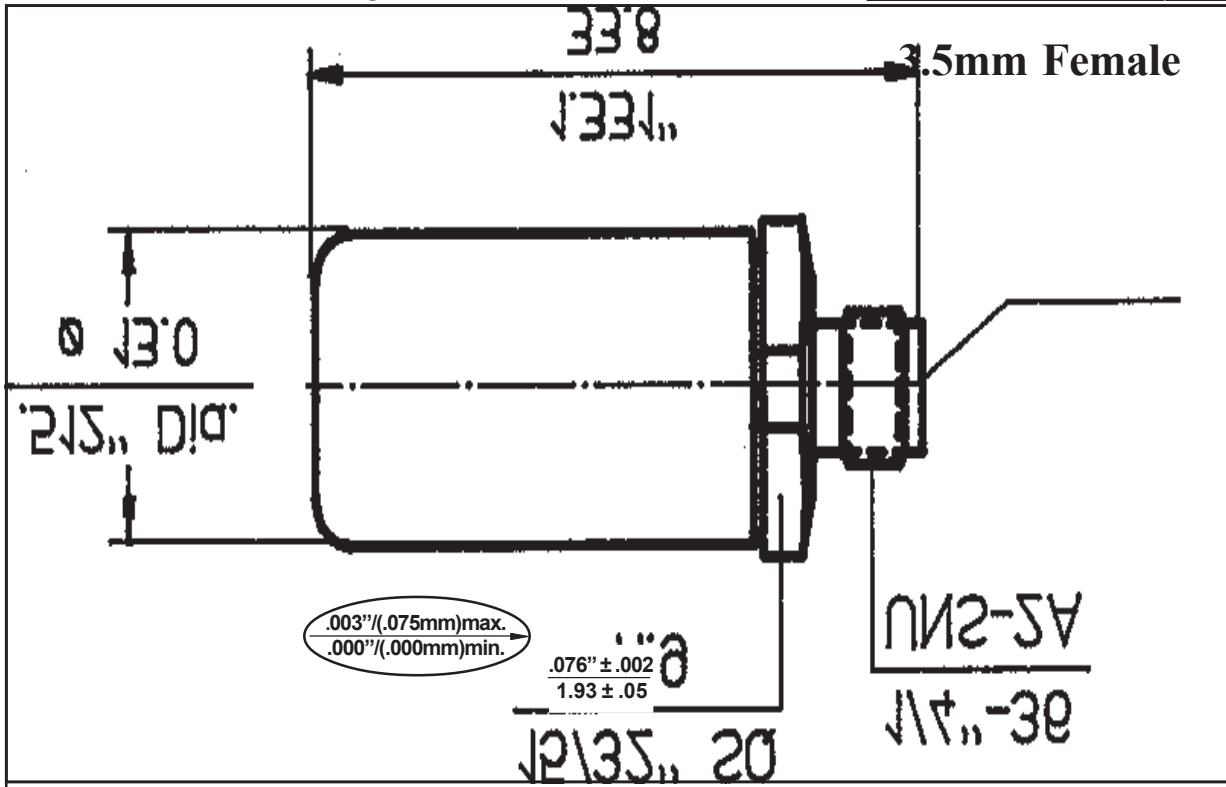
Technical drawing of a cross-section of a mechanical part. The drawing includes the following dimensions and features:

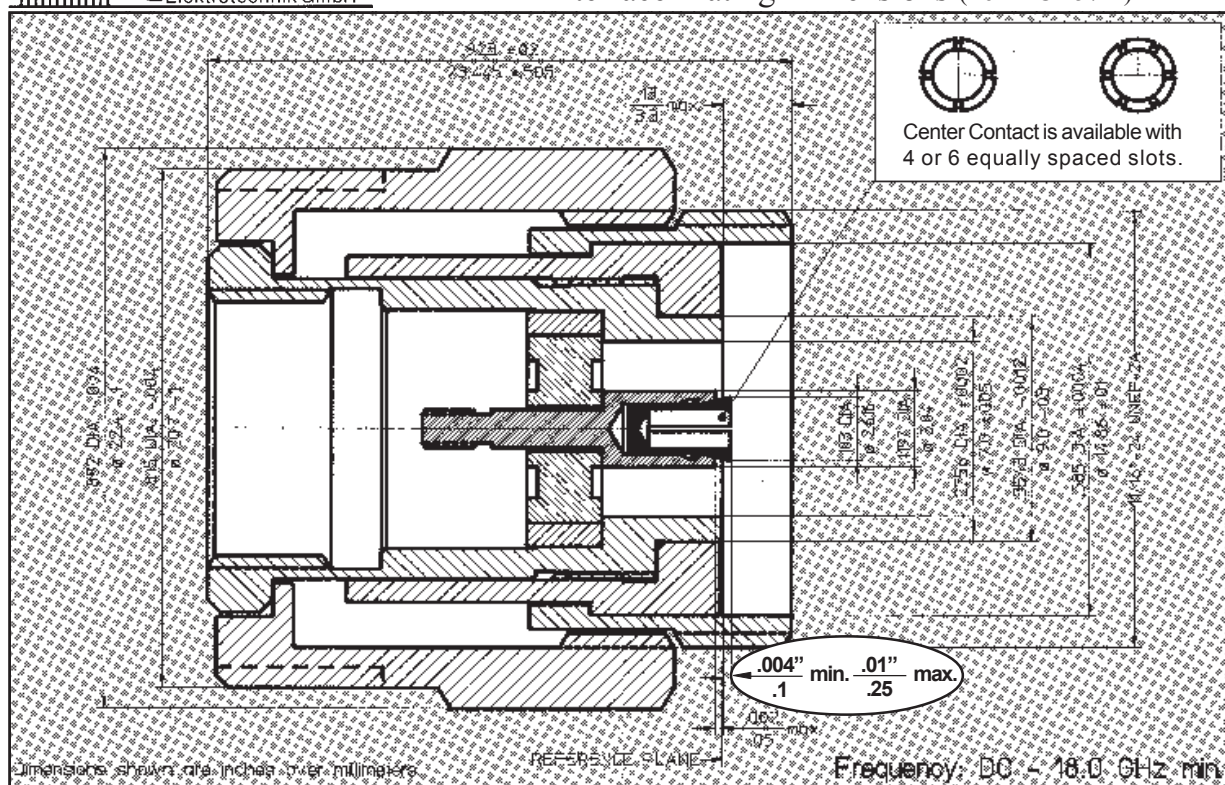
- Top Dimensions:**
 - Overall width: 1.772 ± 0.063 inches (45.1 ± 1.6 mm)
 - Left side width: 1.139 ± 0.012 inches (29.3 ± 0.3 mm)
 - Right side width: 0.637 ± 0.053 inches (16.1 ± 1.4 mm)
- Internal Features:**
 - Two rectangular features with cross-hatching on the left side.
 - A central horizontal slot with a width of 0.536 ± 0.0032 inches (13.6 ± 0.08 mm).
 - A central horizontal slot with a width of 0.475 ± 0.005 inches (12.0 ± 0.13 mm).
- Right Side Dimensions:**
 - Overall height: 2.595 ± 0.073 inches (65.9 ± 1.9 mm)
 - Slot height: 0.945 ± 0.024 inches (24.0 ± 0.6 mm)
 - Slot width: 0.475 ± 0.005 inches (12.0 ± 0.13 mm)
 - Slot depth: 0.17 ± 0.005 inches (4.3 ± 0.13 mm)
 - Slot width: 0.17 ± 0.005 inches (4.3 ± 0.13 mm)
 - Slot depth: 0.17 ± 0.005 inches (4.3 ± 0.13 mm)
- Bottom Dimensions:**
 - Overall width: 1.772 ± 0.063 inches (45.1 ± 1.6 mm)
 - Left side width: 1.139 ± 0.012 inches (29.3 ± 0.3 mm)
 - Right side width: 0.637 ± 0.053 inches (16.1 ± 1.4 mm)
- Reference Plane:** A horizontal line labeled "REFERENCE PLANE" is shown at the bottom of the part.
- Material:** The part is made of a material with a tensile strength of 179 MPa (25.9 ksi).

Dimensions shown are inches over millimeters.

Frequency: DC ~ 50 GHz min.

3.5mm Interface Mating Dimensions



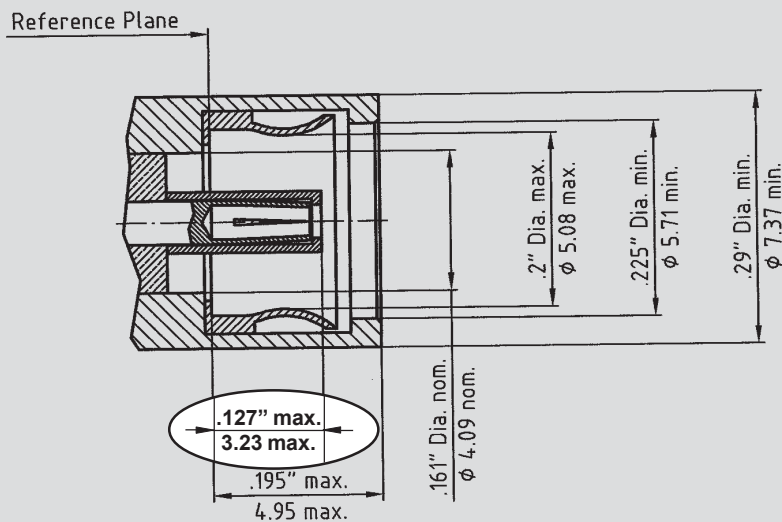


[illegible]

Frequency: DC – 7.5 GHz min.

Frequency: DC - 7.5 GHz min.

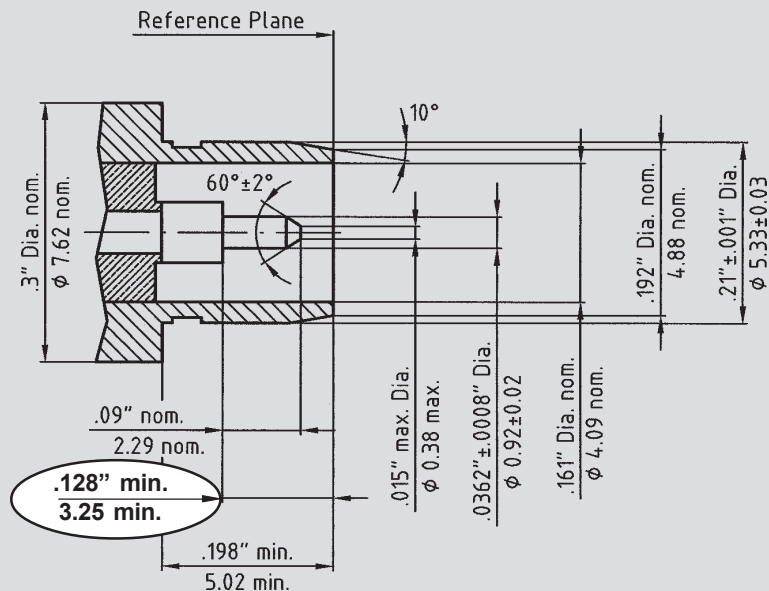
BMA Female



Dimensions shown are inches over millimeters.

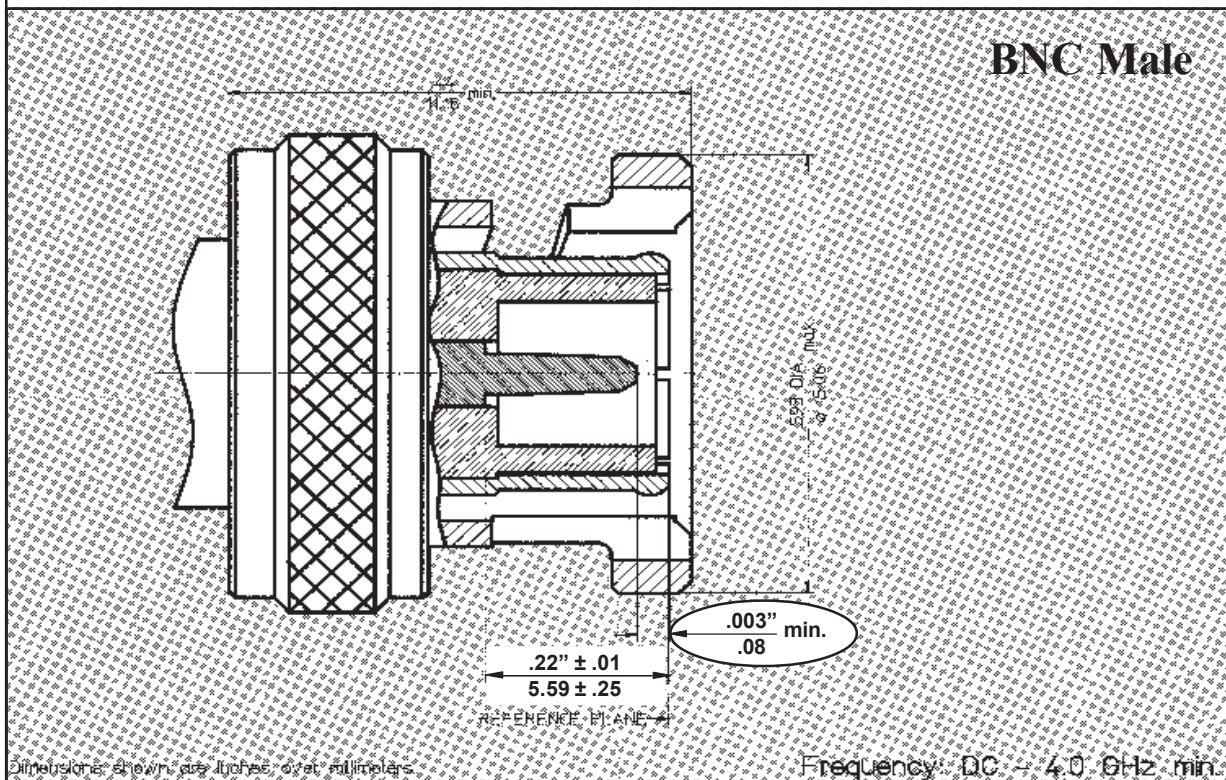
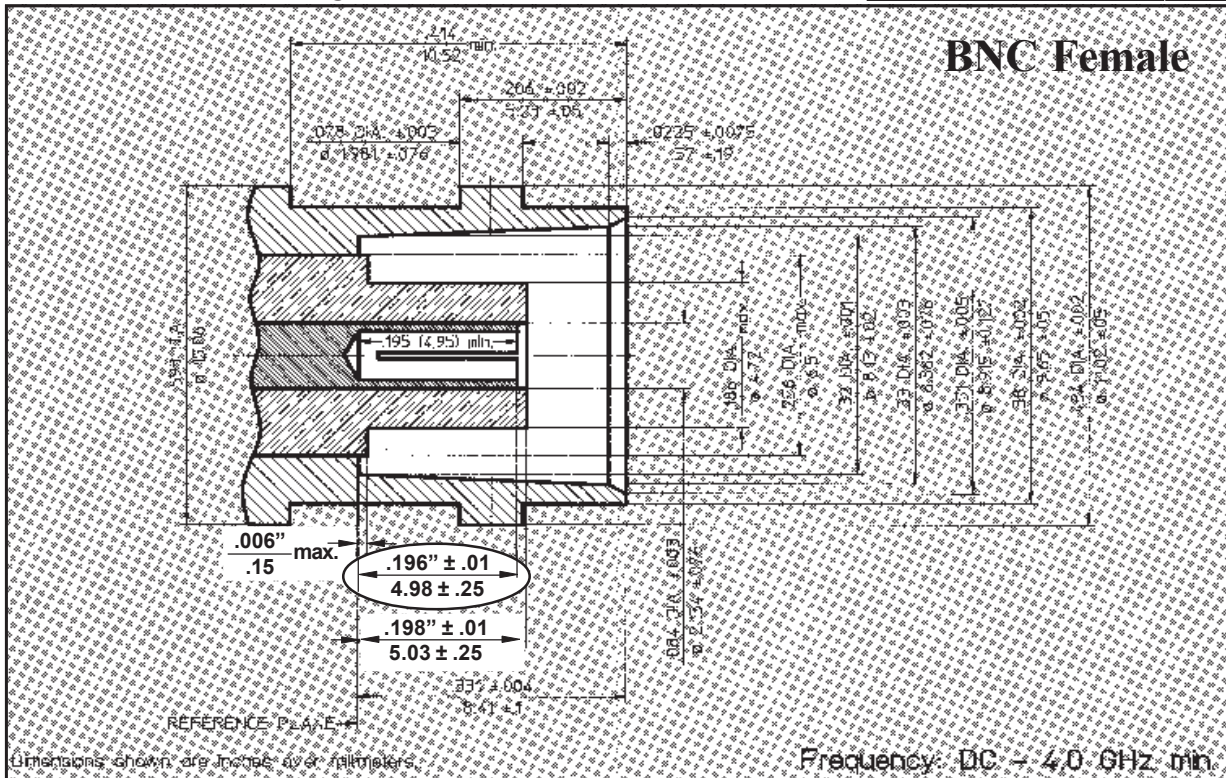
Frequency: DC - 22.0 GHz min.

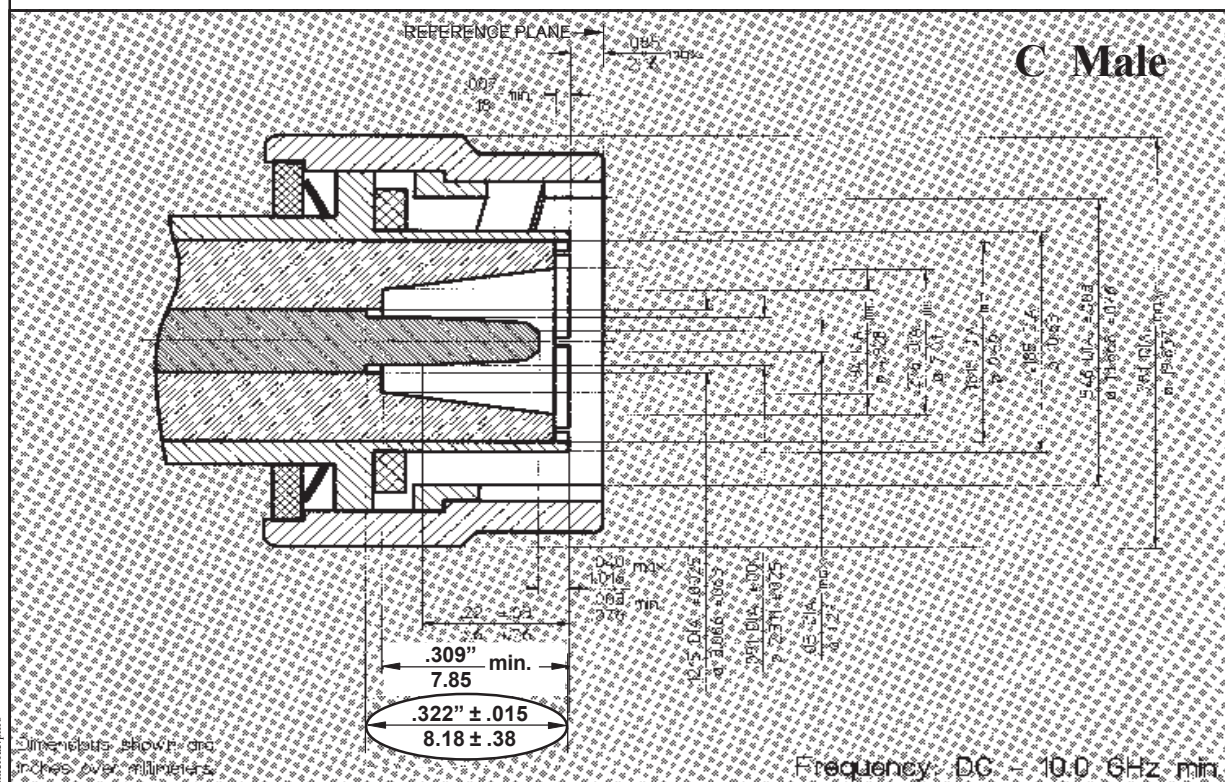
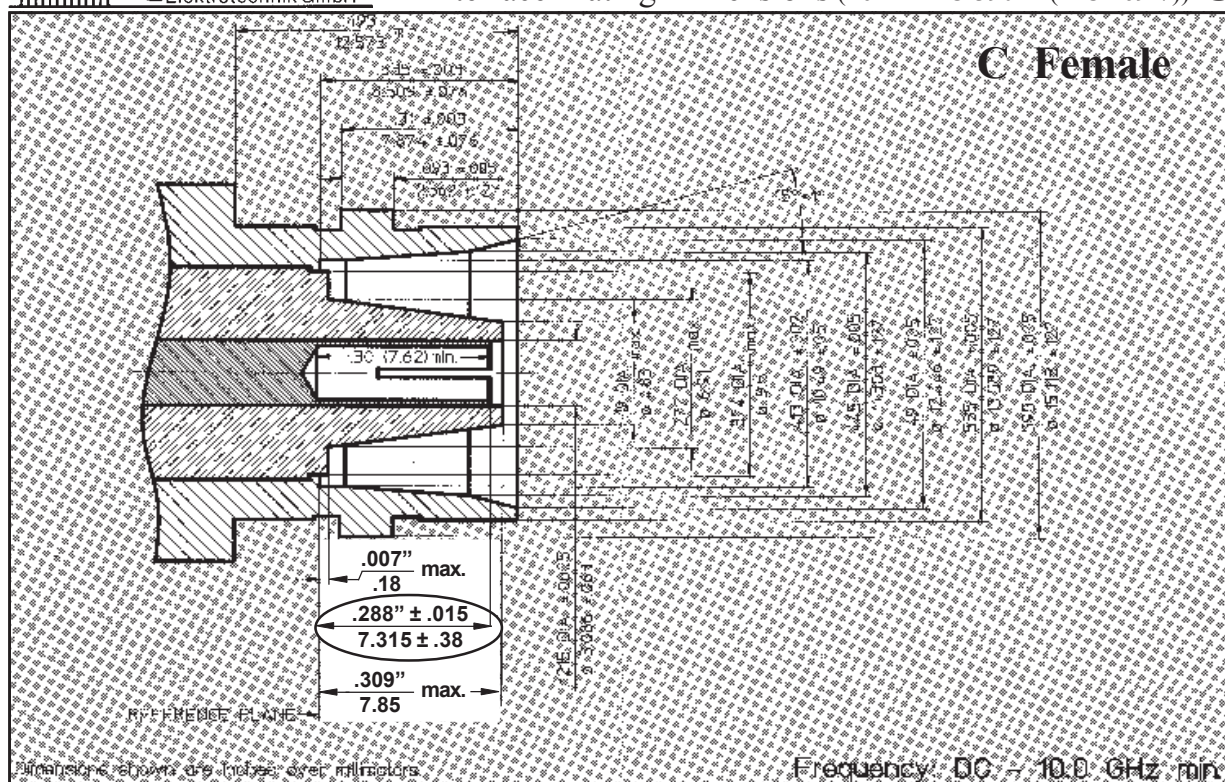
BMA Male



Dimensions shown are inches over millimeters.

Frequency: DC - 22.0 GHz min.





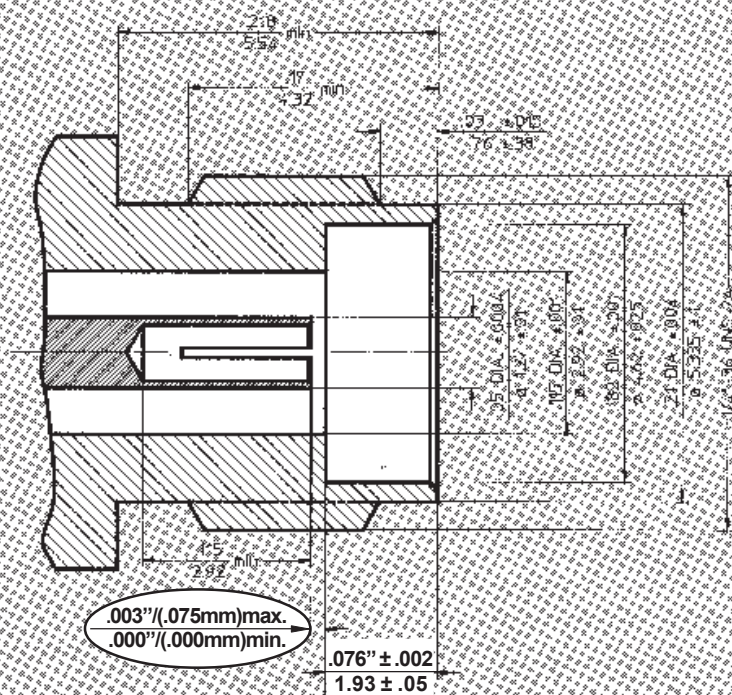
[illegible]

Frequency: DC - 8.0 GHz min.

[illegible]

Frequency: DC – 8.0 GHz min.

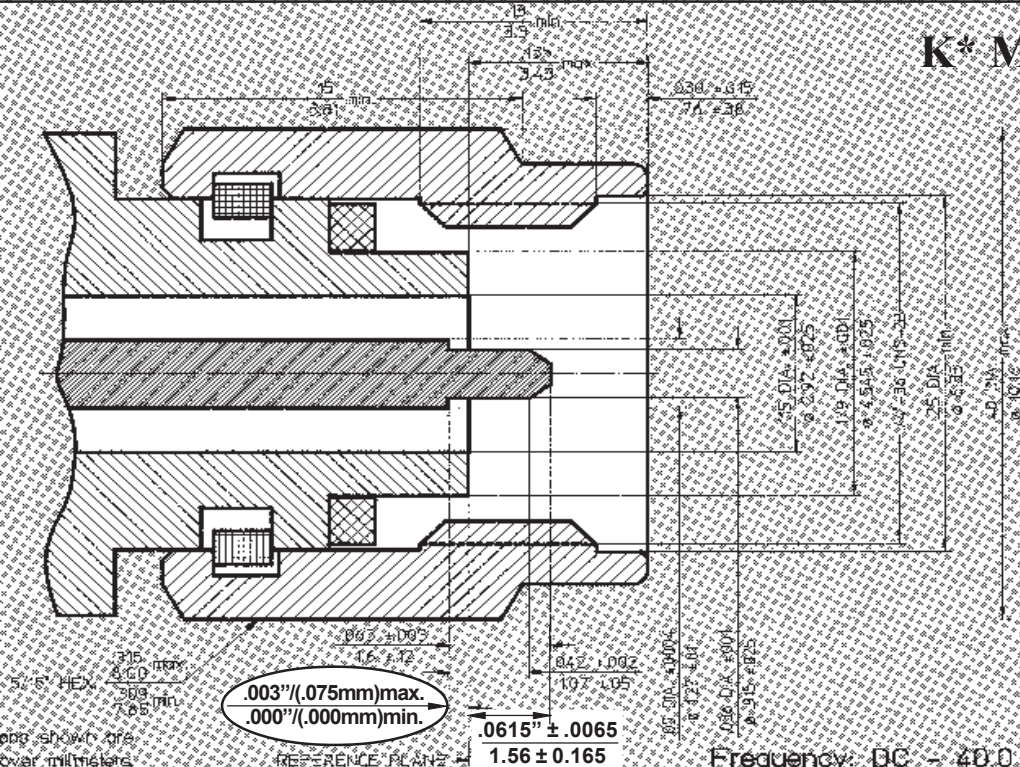
K* Female



Dimensions shown are inches over millimeters.

Frequency: DC ~ 40.0 GHz min

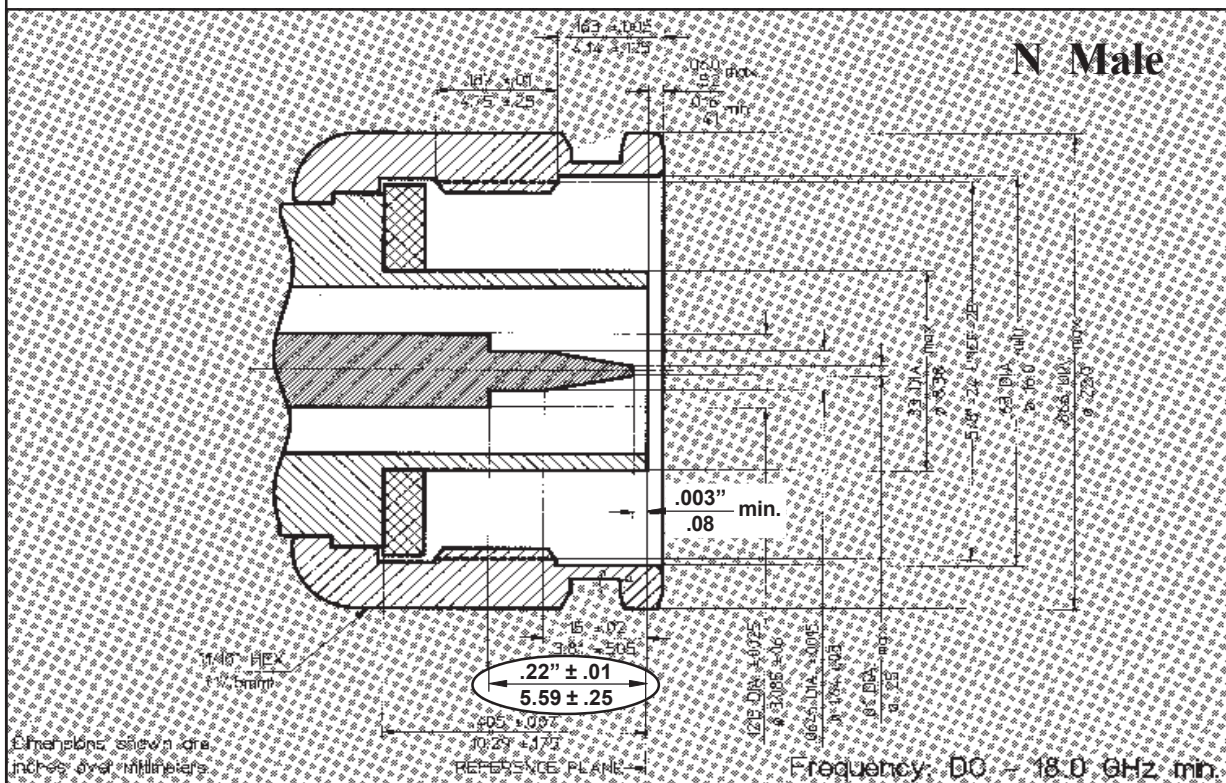
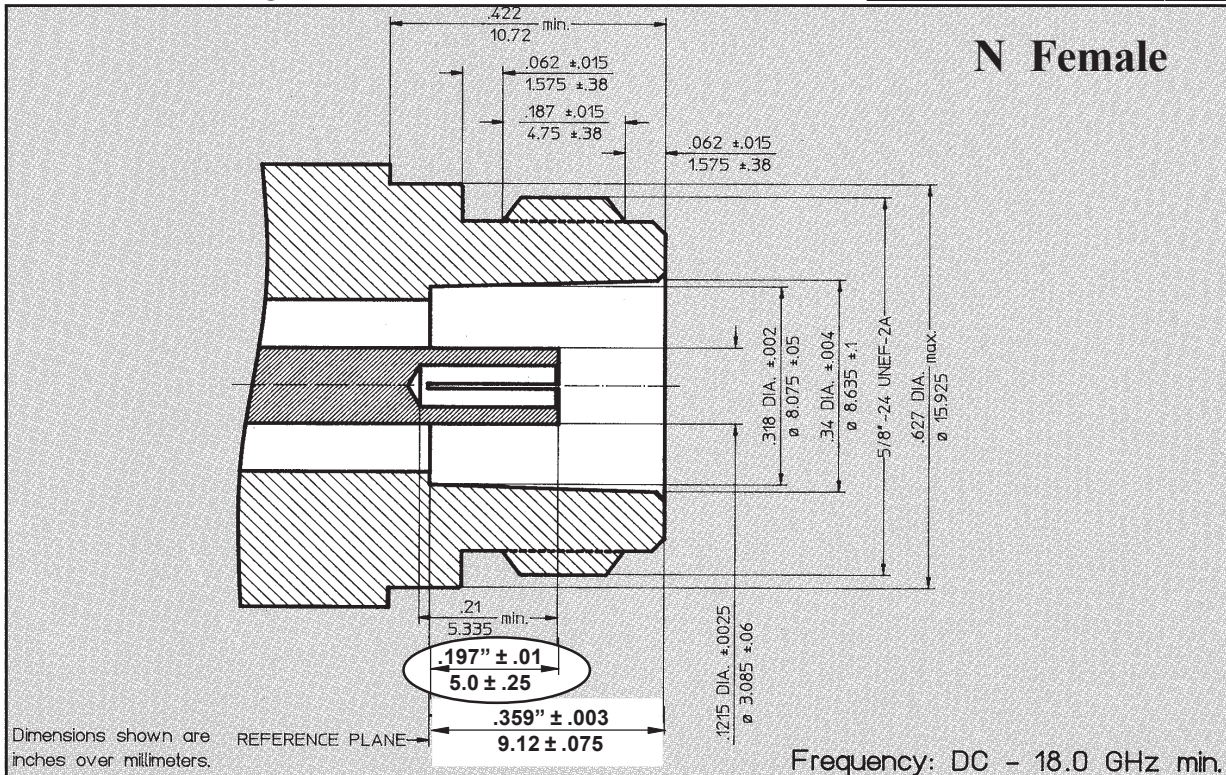
K* Male



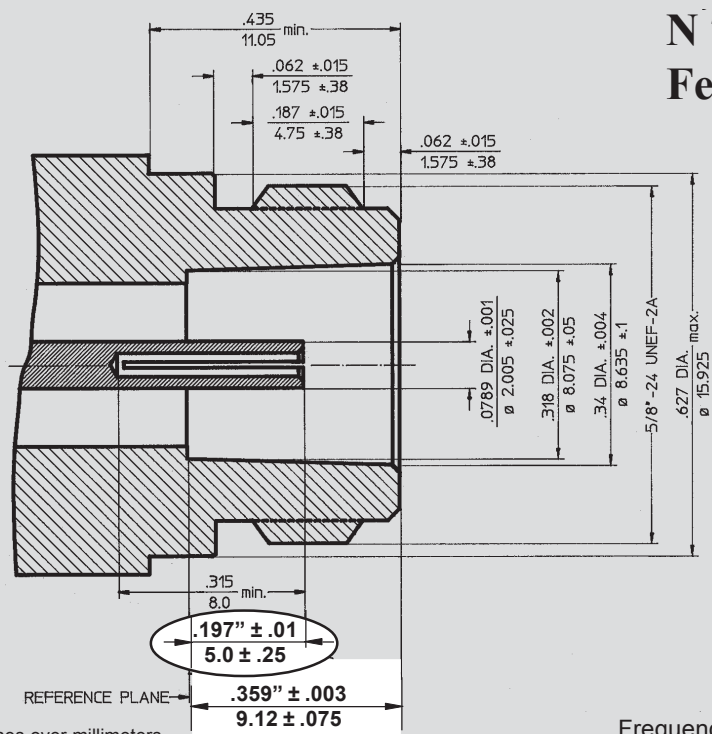
Dimensions shown are
inches over millimeters

Frequency: DC - 40.0 GHz min.

N Interface Mating Dimensions (Per MIL-C-39012)



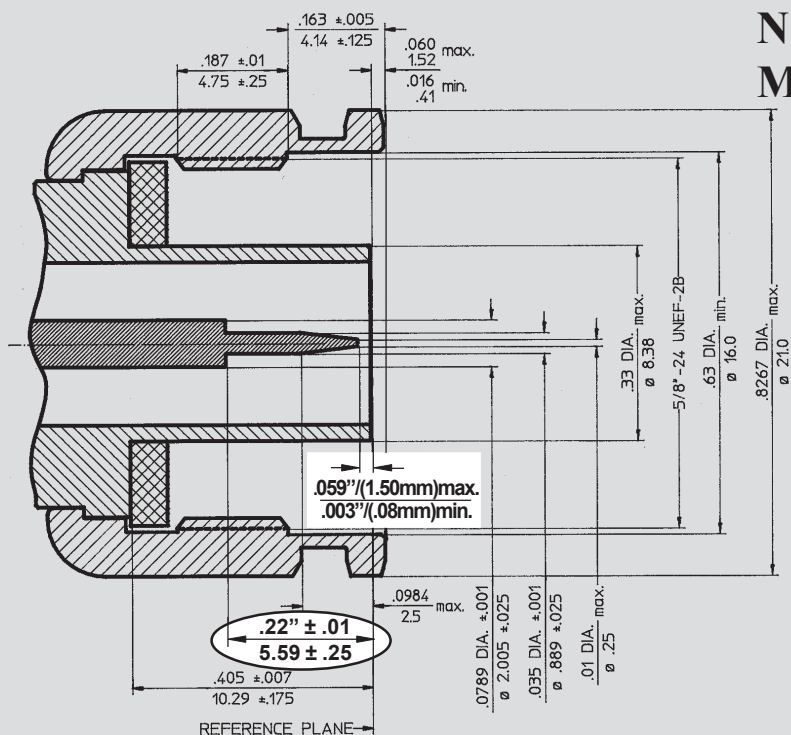
N 75 Ohms Female



Dimensions shown are inches over millimeters.

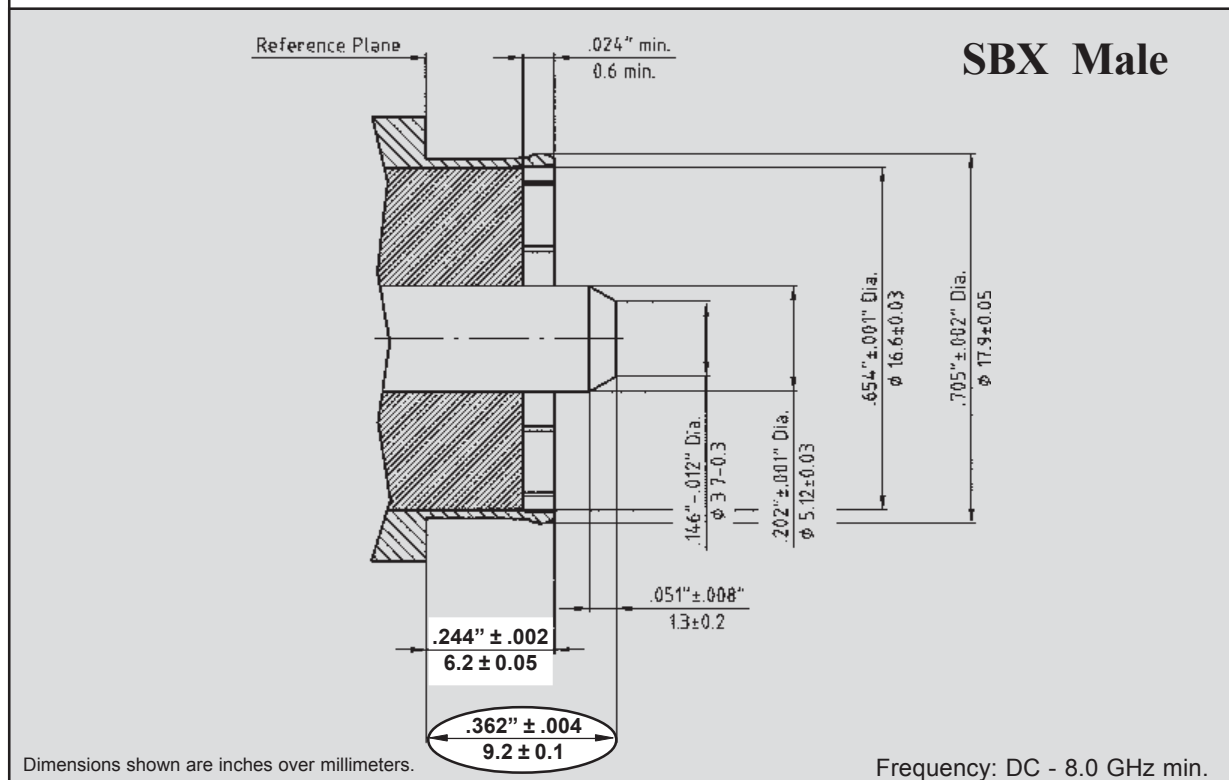
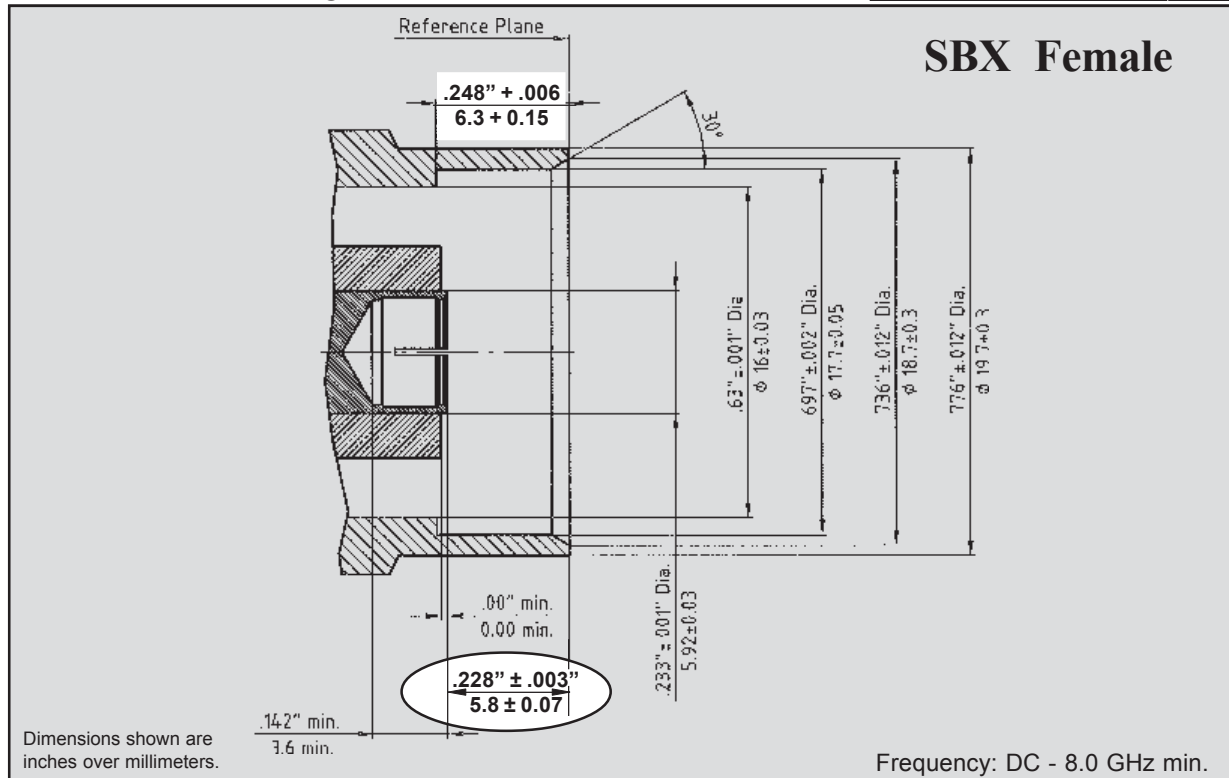
Frequency: DC - 1.5 GHz min.

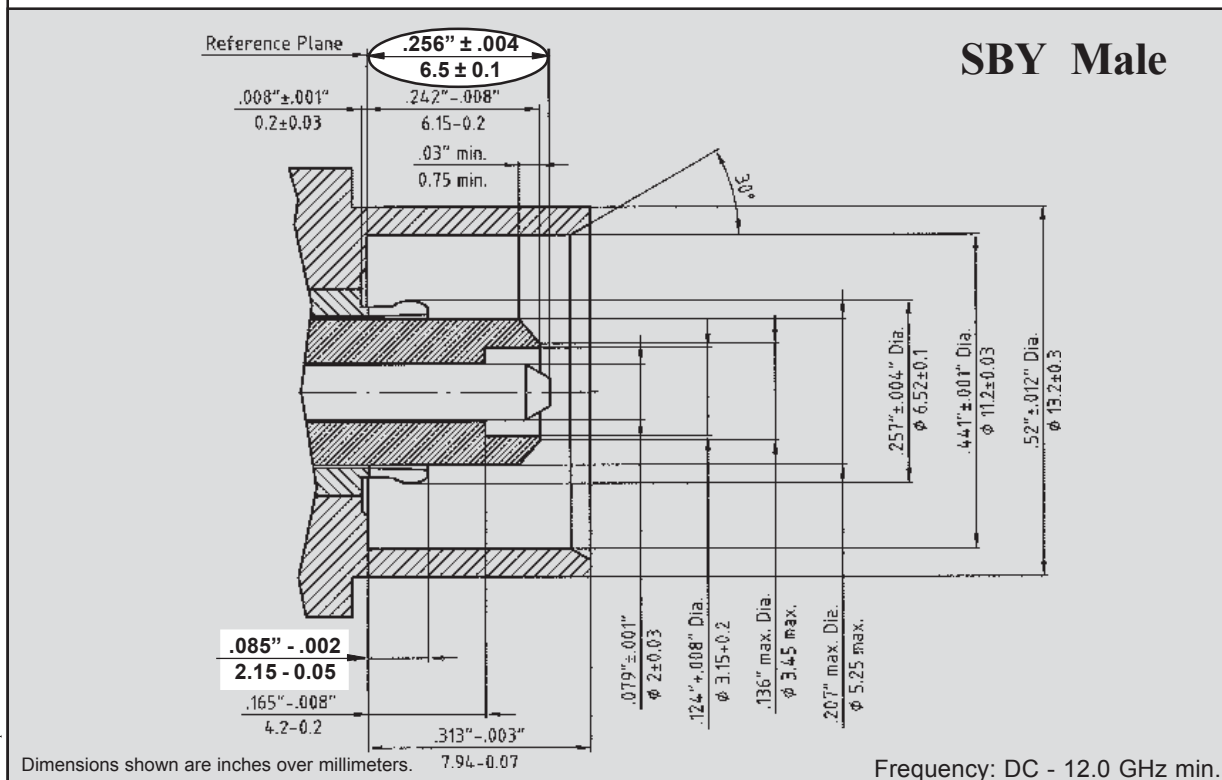
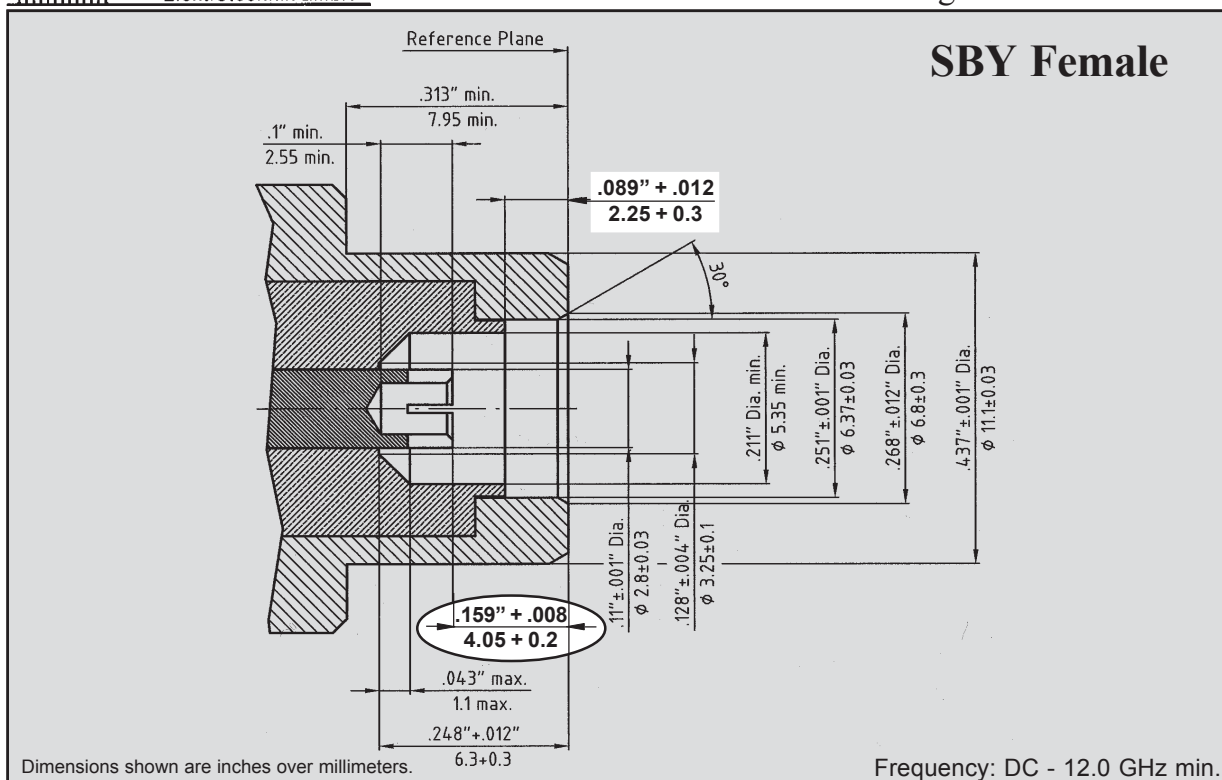
N 75 Ohms Male



Dimensions shown are inches over millimeters.

Frequency: DC - 1.5 GHz min.





Technical drawing of a mechanical part with dimensions in inches and millimeters. The drawing includes a cross-section view of a part with a central hole and a reference plane.

Dimensions (inches and millimeters):

- Top horizontal dimensions: $.493 \pm .002$, $18.58 \pm .45$, $.25$, 6.35 , $.062 \pm .010$, $1.575 \pm .38$, $.195 \pm .009$, $4.955 \pm .127$.
- Left vertical dimension: $.36$, 9.14 full.
- Internal hole dimensions: $.30$, 7.62 min., $.19$ DIA. max., $.03$ DIA. max., $.272$ DIA. max., $.059$ max., $.374$ DIA. max., $.035$.
- Right vertical dimensions: $.15$, 3.81 full, $.15$ DIA. $\pm .002$, $.03$ DIA. $\pm .005$, $.45$ DIA. $\pm .008$, $.12$ DIA. $\pm .009$, $.05$ DIA. max., $.06$ DIA. max.
- Bottom horizontal dimensions: $.007$ max., $.18$, $.288 \pm .015$, $7.315 \pm .38$, $.309$ max., 7.85 .
- Reference plane: REFERENCE PLANE.
- Bottom right dimensions: $.1215$ DIA. $\pm .0025$, $.03$ DIA. max.

Frequency: DC - 10.0 GHz min

Technical drawing of a mechanical part, likely a valve or actuator, showing a cross-section and side view with dimensions in inches and millimeters.

Dimensions (Inches / Millimeters):

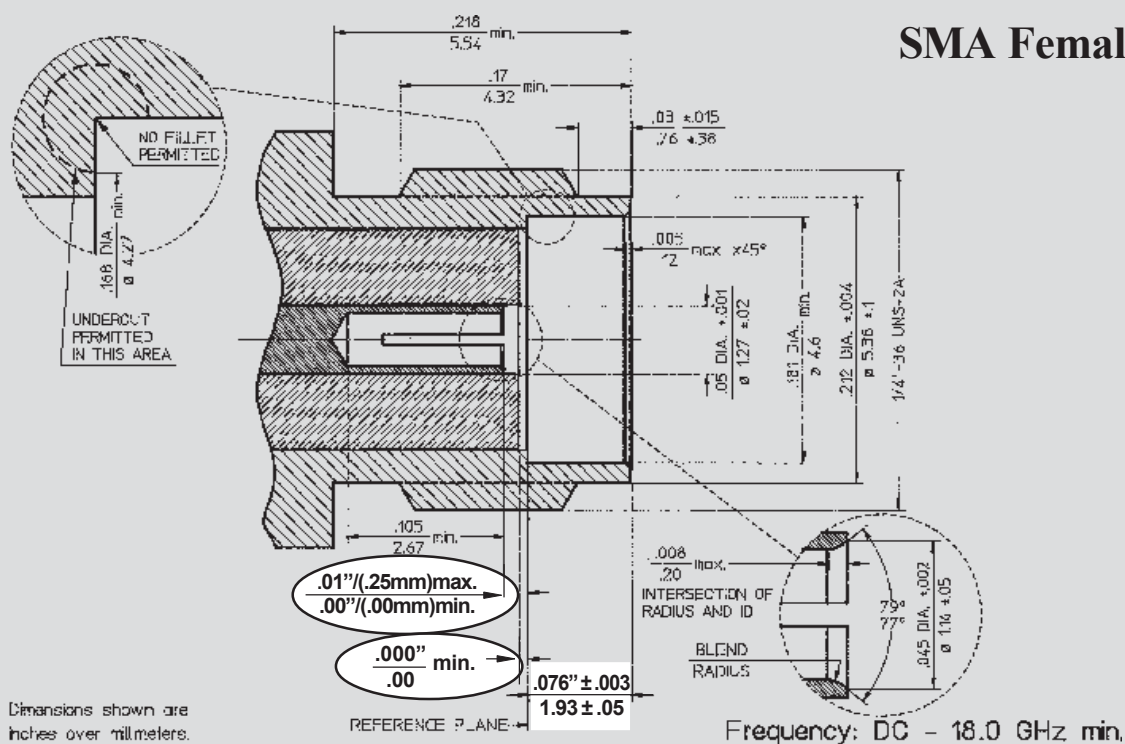
- Top horizontal dimension: 2.16 ± 0.035 / $55 \pm .017$
- Top left horizontal dimension: 2.5 / 6.35
- Top right horizontal dimension: 0.55 ± 0.03 / $14 \pm .76$
- Internal vertical dimension: $.007$ / $.18$ min.
- Bottom left horizontal dimension: 0.03 / 2.54 min.
- Bottom left horizontal dimension: 2.21 ± 0.07 / $56 \pm .007$
- Bottom left horizontal dimension: $.309$ min. / 7.85
- Bottom left horizontal dimension: $.322 \pm 0.15$ / $8.18 \pm .38$
- Bottom right horizontal dimension: $.040$ / (1.015mm) max.
- Bottom right horizontal dimension: $.003$ / $(.075\text{mm})$ min.
- Bottom right horizontal dimension: 2.75 DIA. / $\phi 3.085$
- Bottom right horizontal dimension: 0.91 DIA. / $\phi 2.21$
- Bottom right horizontal dimension: 0.5 DIA. / $\phi 1.27$
- Bottom right horizontal dimension: 2.76 DIA. / $\phi 70.3$
- Bottom right horizontal dimension: 3.77 DIA. / $\phi 95.95$
- Bottom right horizontal dimension: 0.16 DIA. DIFF. ZONE
- Bottom right horizontal dimension: 2.06 DIA. / $\phi 51.8$

Frequency: DC - 10.0 G

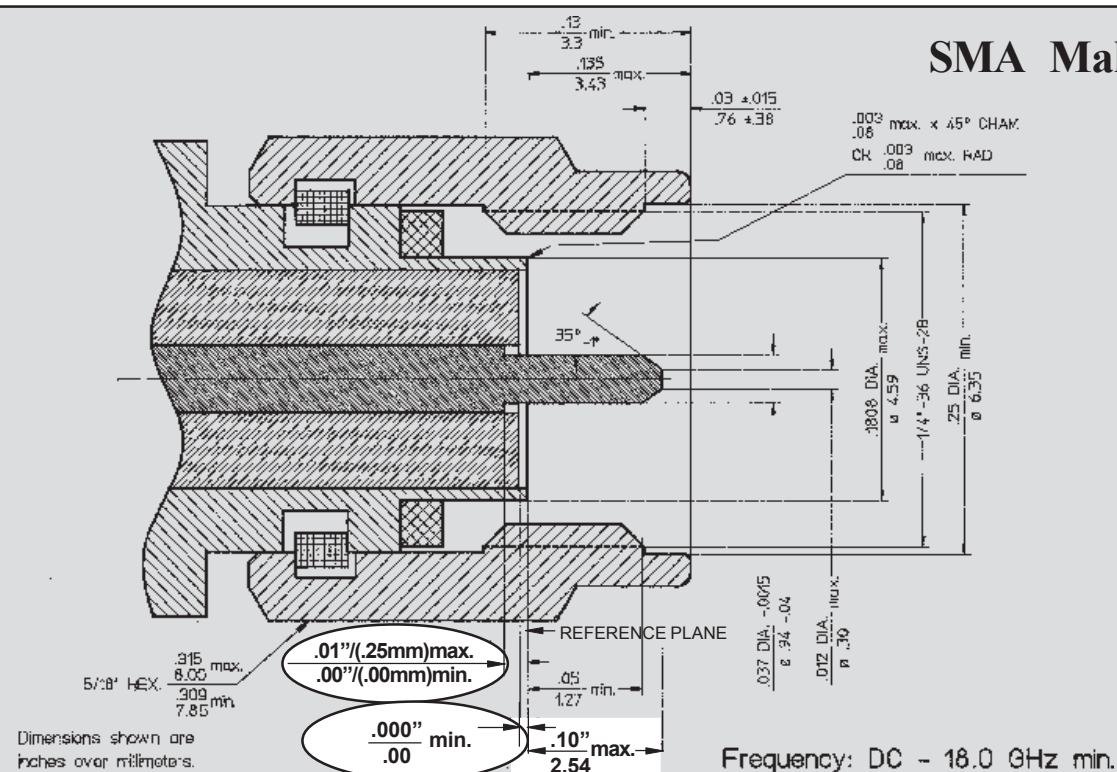
REFERENCE PLANE

Frequency: DC - 10.0 GHz min.

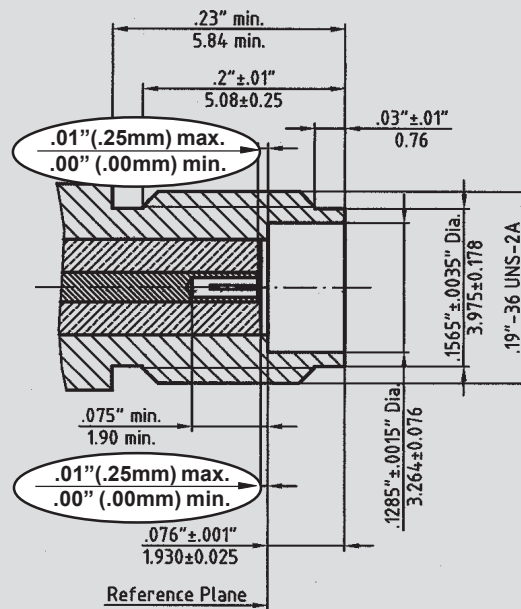
SMA Female



SMA Male



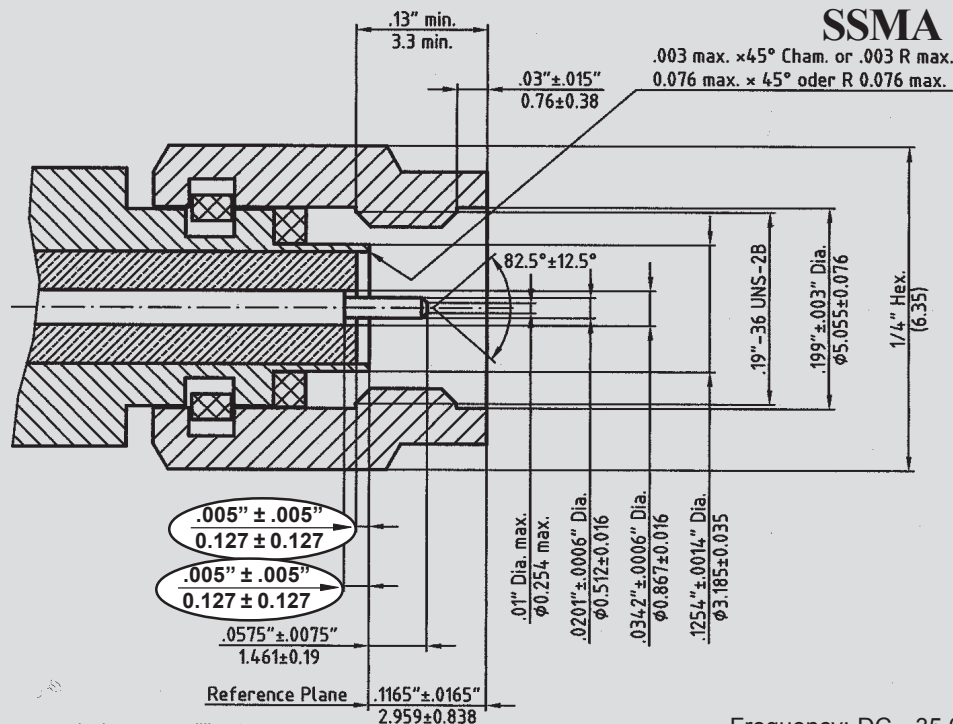
SSMA Female



Dimensions shown are inches over millimeters.

Frequency: DC - 35.0 GHz min.

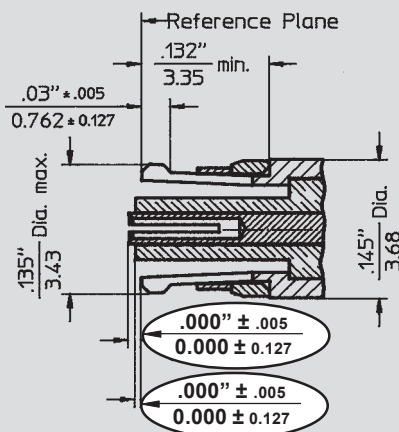
SSMA Male



Dimensions shown are inches over millimeters.

Frequency: DC - 35.0 GHz min.

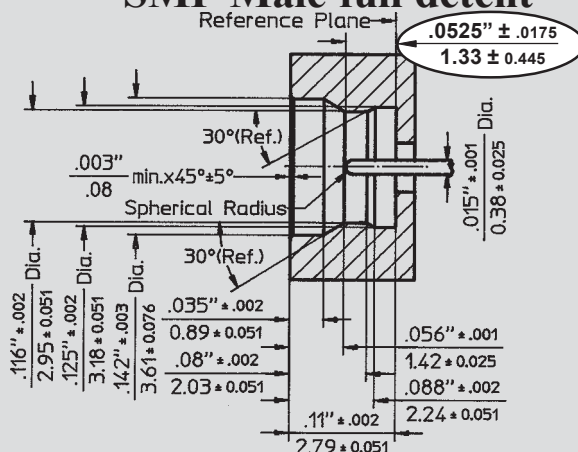
SMP Female



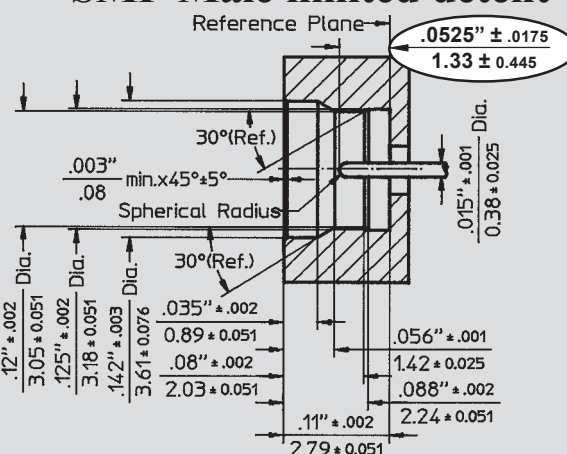
Dimensions shown are inches over millimeters.

Frequency: DC - 40.0 GHz min.

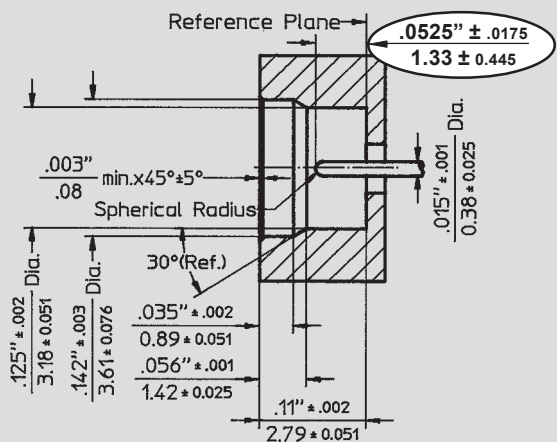
SMP Male full detent



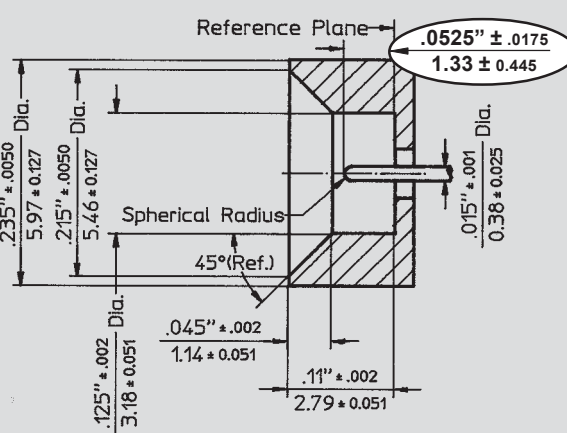
SMP Male limited detent



SMP Male smooth bore

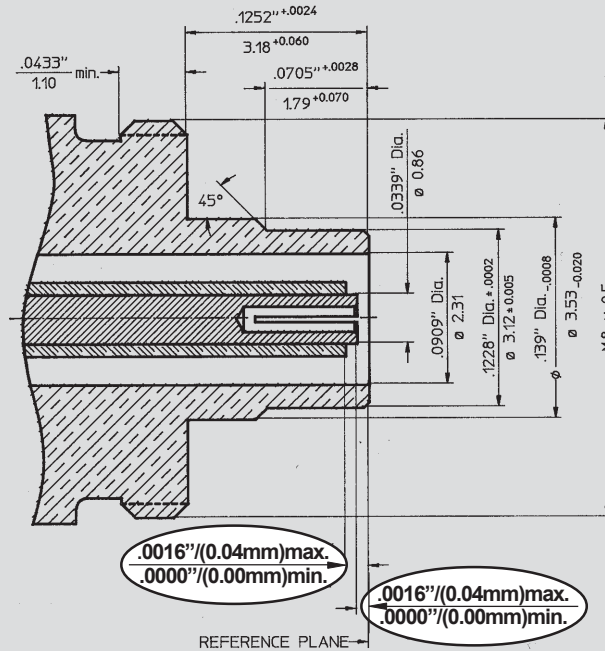


SMP Male



interface.pn6

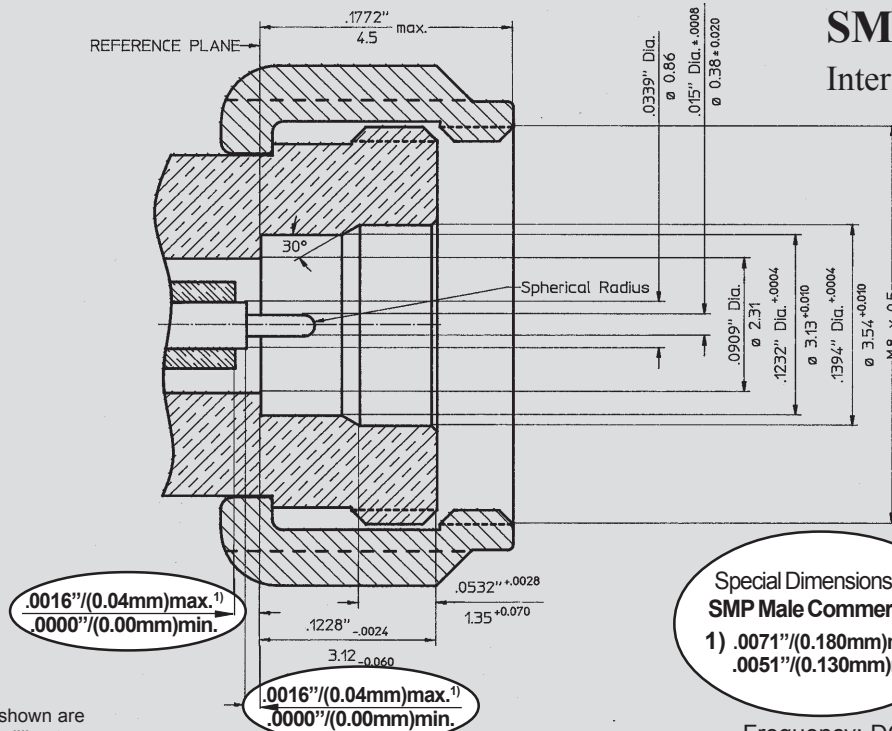
SMP Female Interface



Dimensions shown are inches over millimeters.

Frequency: DC - 40.0 GHz min.

SMP Male Interface Precision

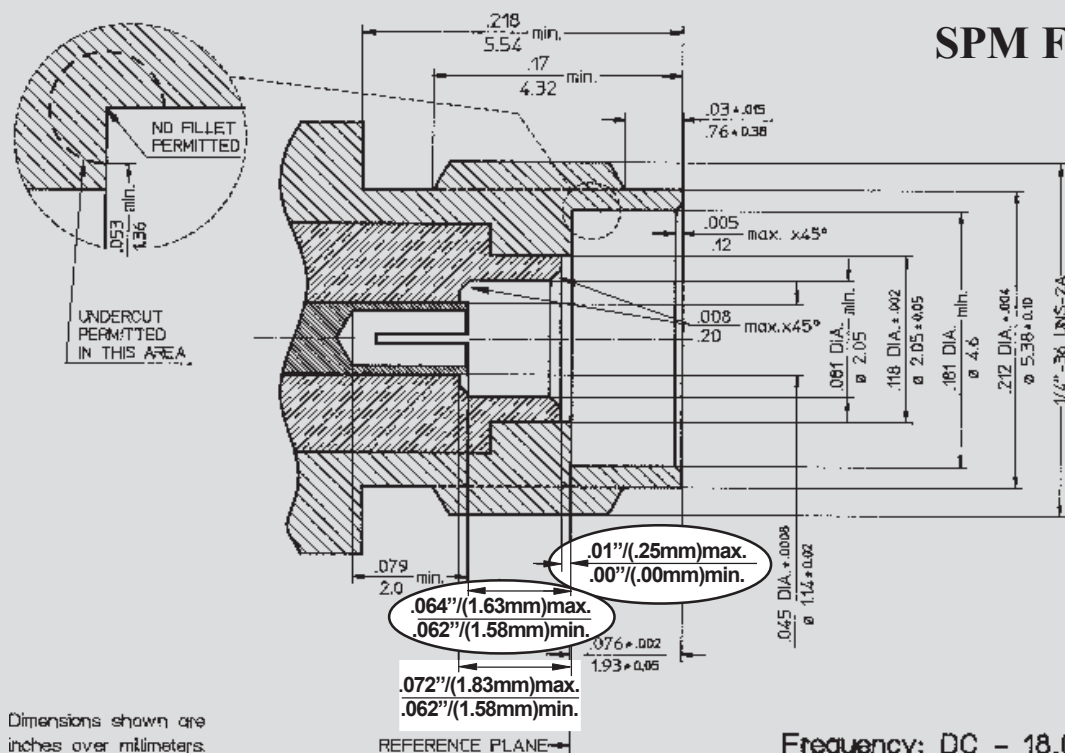


Dimensions shown are inches over millimeters.

Special Dimensions for
SMP Male Commercial
1) $.0071''/(0.180\text{mm})\text{max.}$
 $.0051''/(0.130\text{mm})\text{min.}$

Frequency: DC - 40.0 GHz min.

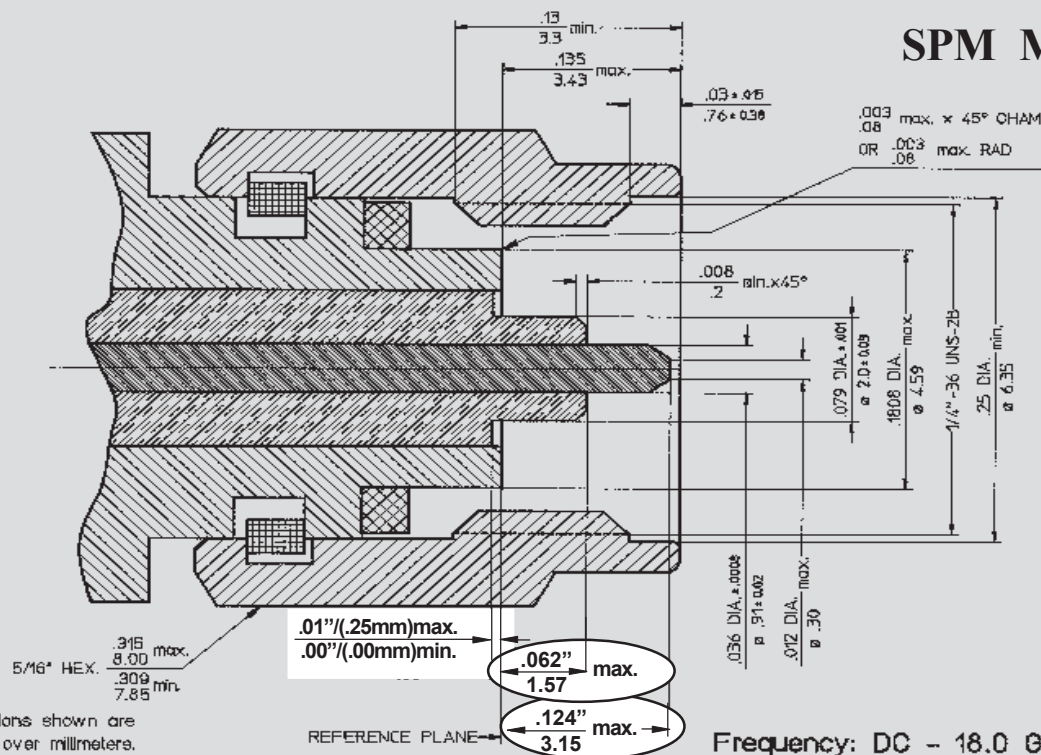
SPM Female



Dimensions shown are
inches over millimeters.

Frequency: DC - 18.0 GHz min.

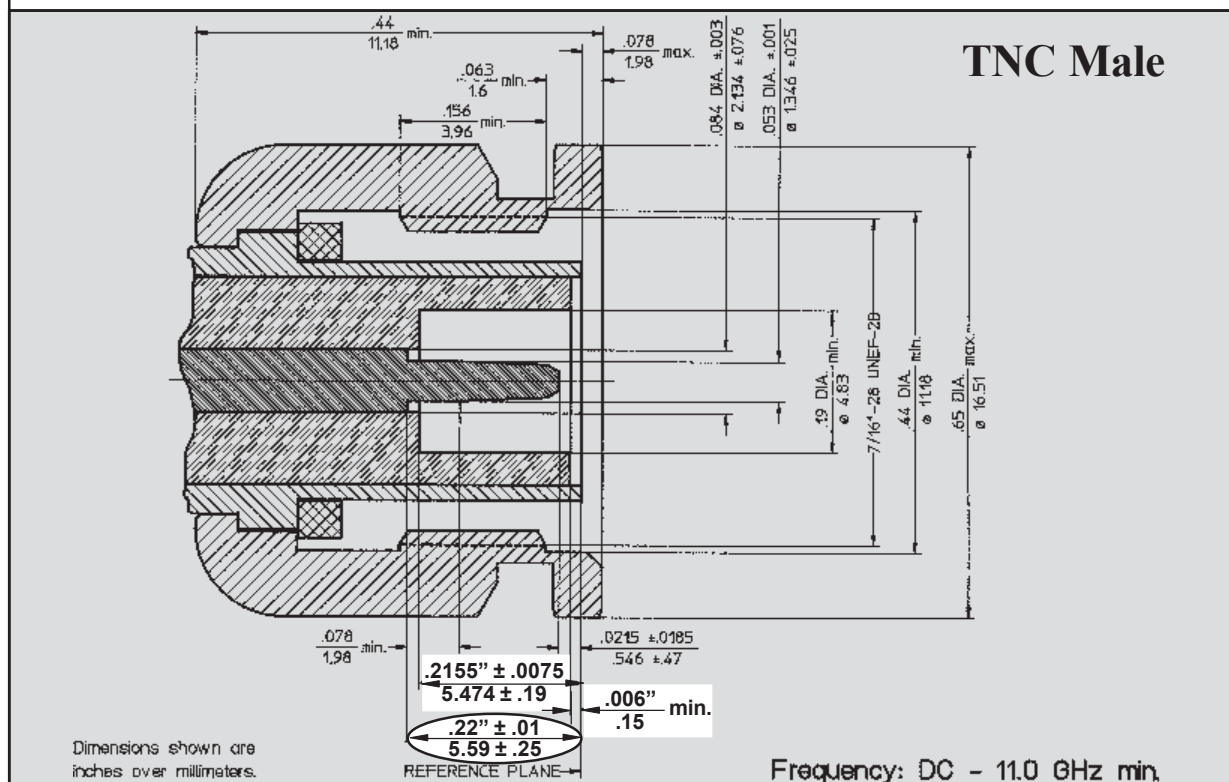
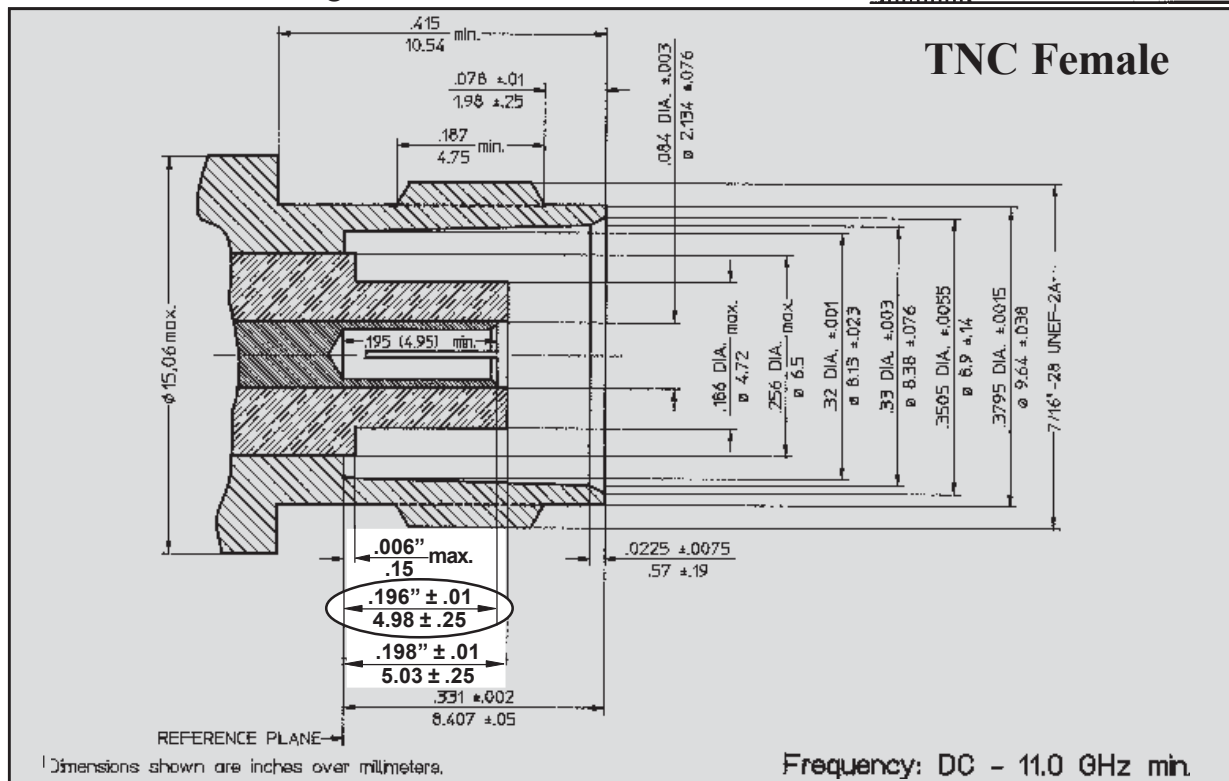
SPM Male

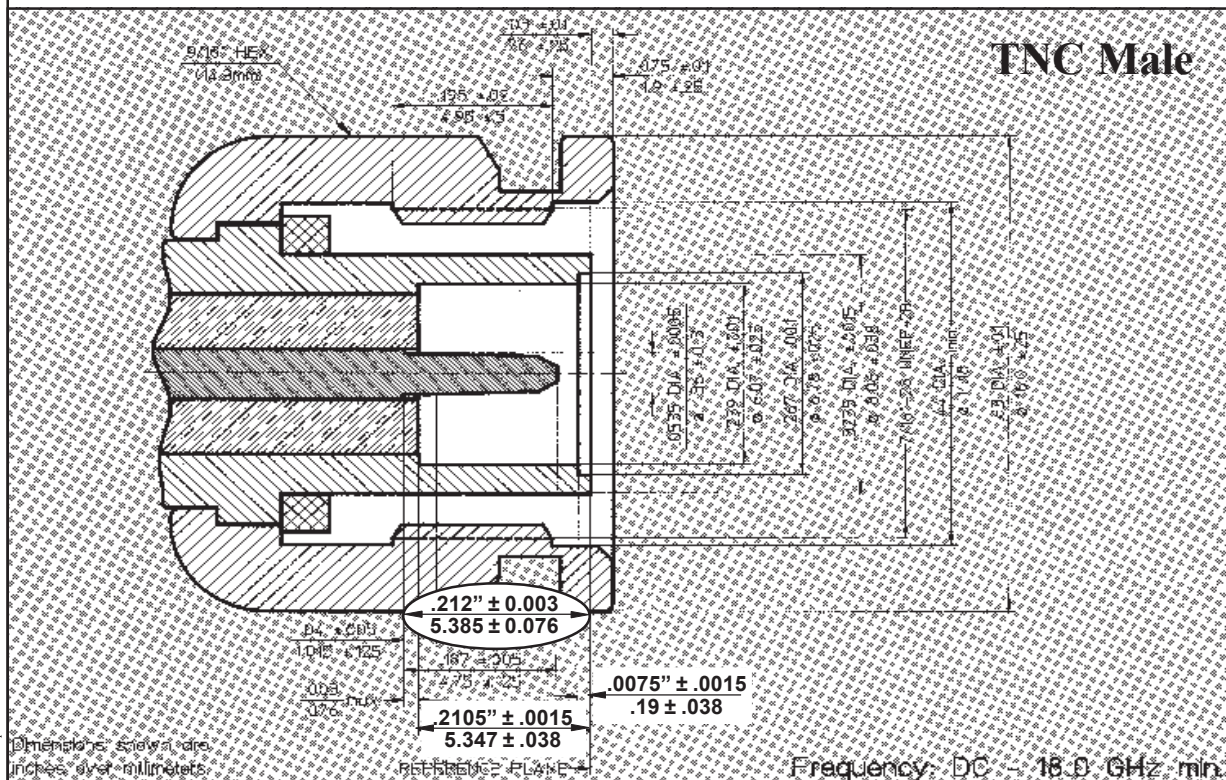


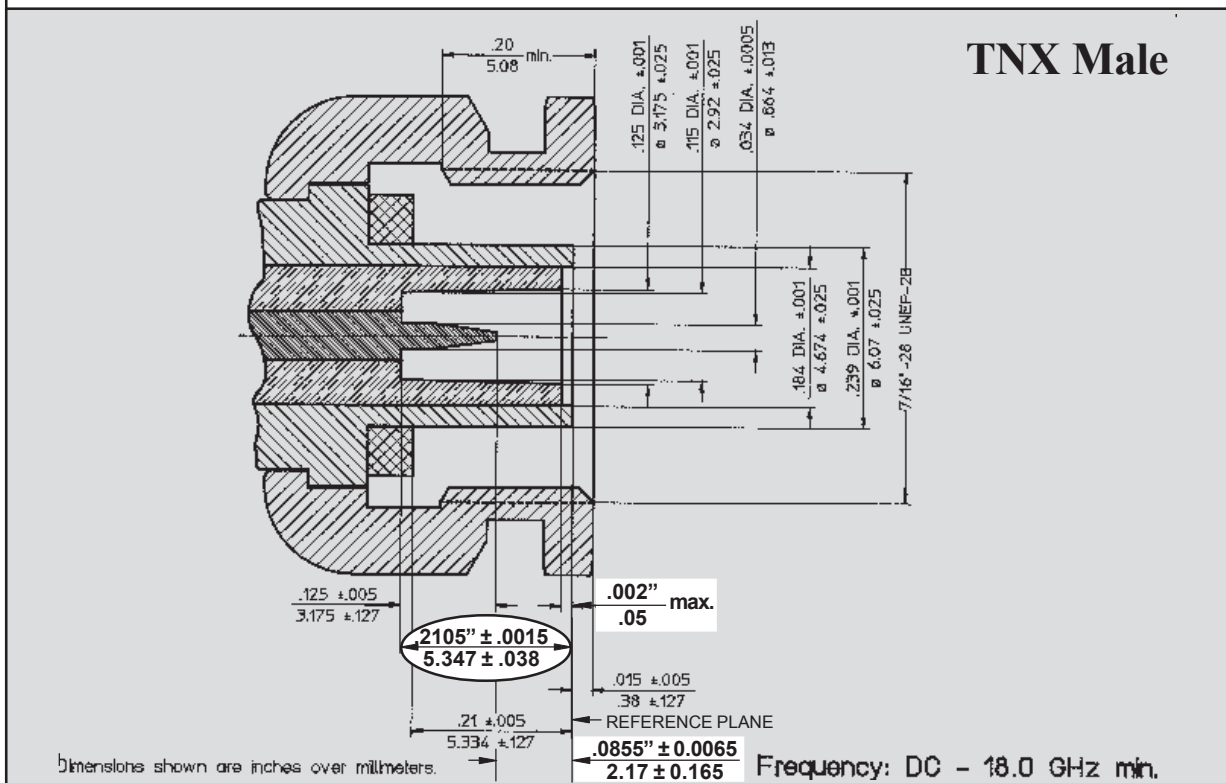
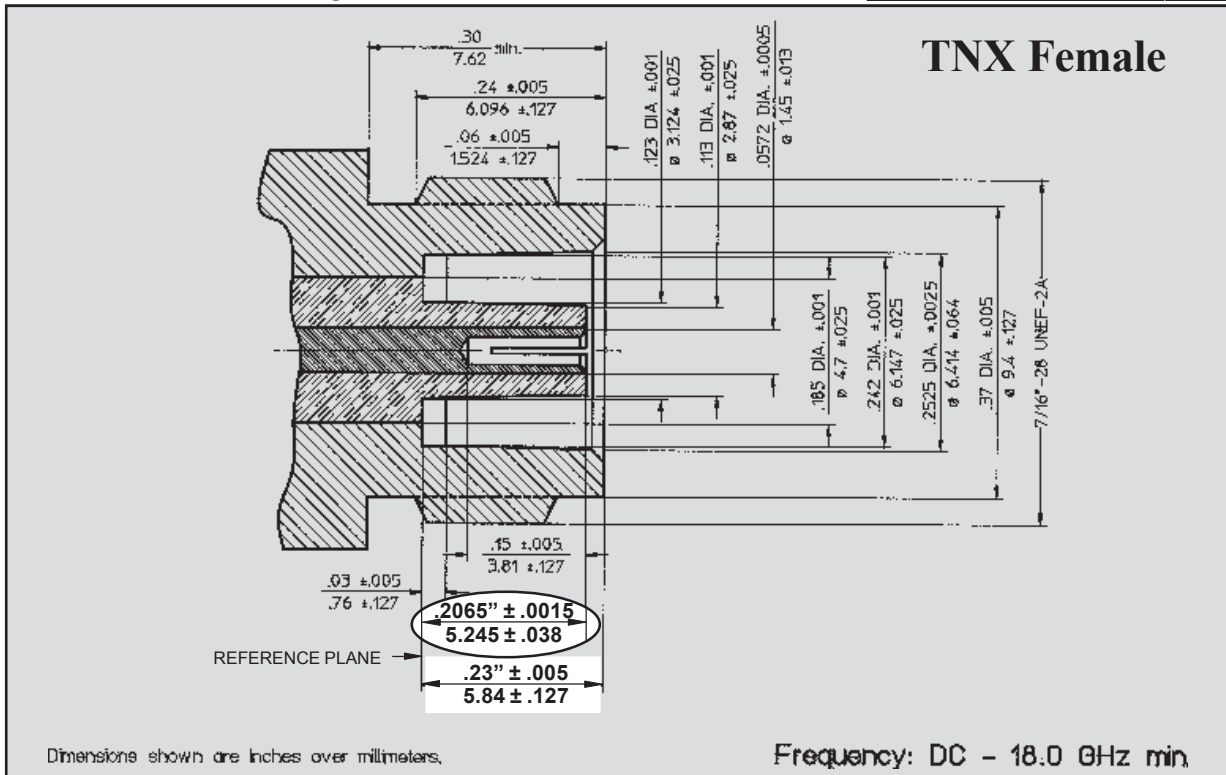
Dimensions shown are inches over millimeters.

Frequency: DC - 18.0 GHz min.

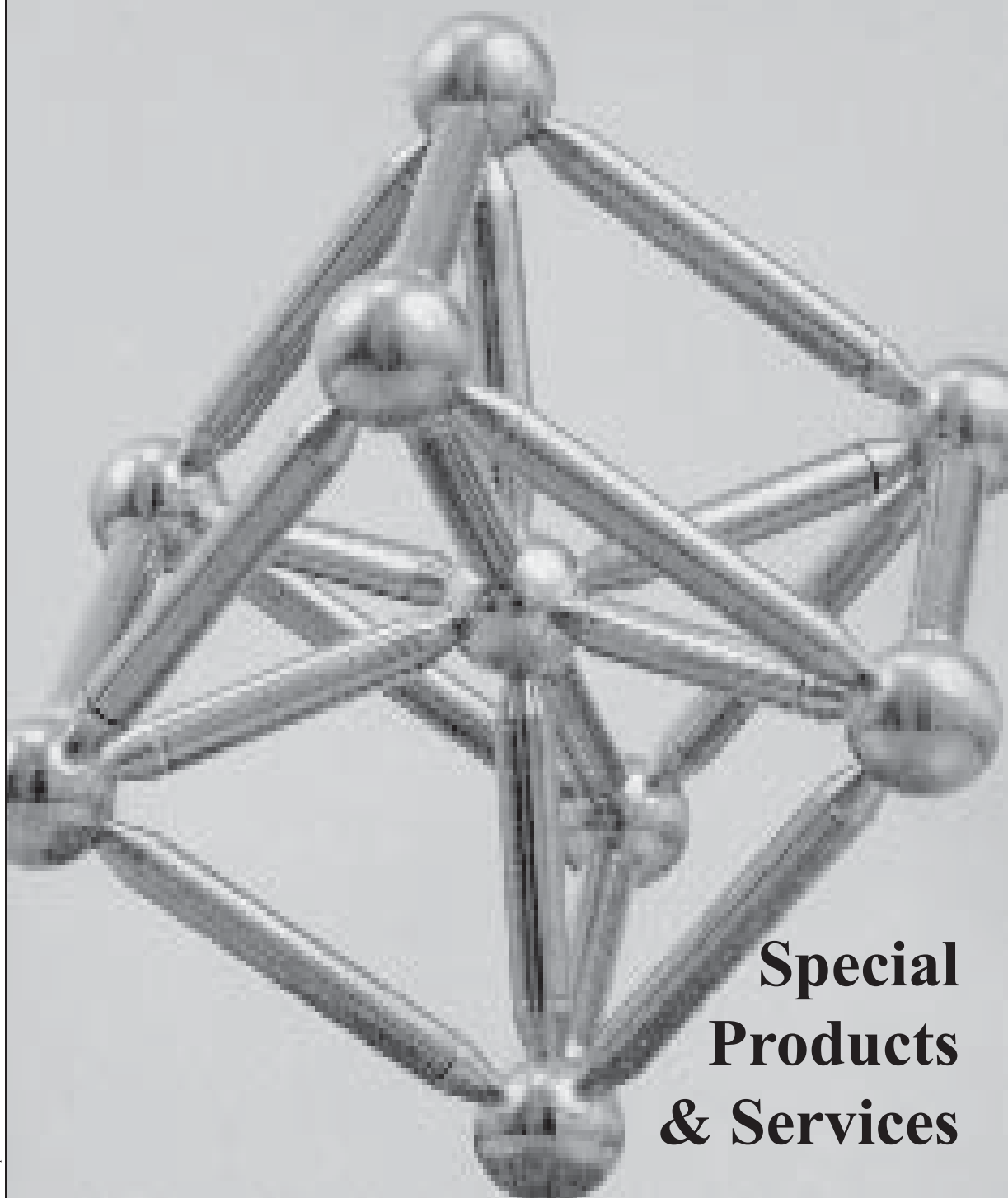
TNC Interface Mating Dimensions (Per MIL-C-39012)







Section VIII



**Special
Products
& Services**

1.04.01.06 pm06

Design and Engineering: Spectrum Elektrotechnik GmbH is a very innovative Company. It employs a strong and successful team of experienced engineers. If your application requires a product that is not available as standard, Spectrum Elektrotechnik GmbH is the Company to contact. Our engineers are ready and willing and capable to listen to your problem and they will try their best to propose something that will fit your needs perfectly. There is also a possibility that we may have solved already a similar problem for somebody else and that we have a solution available, almost off the shelf.

Following a few examples of areas where our engineering staff has proposed and designed and manufactured hardware to the customers requirements, or has developed successfully Products to widen and strengthen our Product Range:

The Cable Assembly Group: Designing and manufacturing of Low Loss Cable Assemblies, Extra Light Weight Assemblies, Phase & Amplitude Matched Cable Assemblies, High Velocity and Thermal Stable Dielectrics, Delay Lines, etc.

The Connector Group: Designing and manufacturing successfully new Connector Series, e.g. of Types SBX, SBY and SPM, connectors that were not available at all with the physical and electrical performance as needed for specific programs.

Adapters for special applications were designed to fit exactly the customer's needs, mechanically and electrically.

A whole new Product Line was developed and successfully introduced to the market: the PUSH-ON Connectors and Adapters for series 3.5mm, K*, SMA, N and TNC, using 50 Ohms impedance, and for F, N and TNC as well, using 75 Ohms impedance.

The Component Group: Besides the Standard Product Lines, Spectrum Elektrotechnik GmbH offers Engineering and Manufacturing Services, to design and manufacture Components exactly to Customer's Specification. Whatever cannot be found in anybody else's catalog, Spectrum Elektrotechnik GmbH is definitely worthwhile to contact. There is even always a possibility that a similar product has already been designed for somebody else.

The Table to the right shows the areas where Spectrum Elektrotechnik GmbH has successfully designed and manufactured products to customers' specifications. On pages 234 through 267 detailed information will be given on these components.

Process Engineering: This Group has been developing tools and machines that are needed in manufacturing but were not available on the market as standard. Currently the design, manufacturing and testing of an Automatic Cable Cutting and Stripping Machine has been completed and the machine has been introduced to the market as CNCA-700.

Quick Response Manufacturing: The Quick Response Manufacturing is another good example for the commitment to providing excellent Customer Service. The Quick Response Group was implemented to react immediately to customers' needs. Sometimes Products will be shipped within 24 hours. All Products manufactured in the Quick Response Area will meet the same Quality Standards as all the other products, they are submitted to the same inspection.

Product	Please refer to page(s):
Adapter Sets	234 - 235
Antennas	236 - 237
Blind Mate Connectors	238 - 239
Charged Device Modelling	240 - 241
Circulators & Isolators	252 - 253
Couplers	248 - 249
Custom Connectors/Adapters	242 - 243
Delay Lines	244 - 245
Detectors	246 - 247
Directional Couplers	248 - 249
Impedance Transformers	250 - 251
Isolators & Circulators	252 - 253
Lightening Surge Suppressors	254 - 255
Limiters	256 - 257
Machines, CNCA-700 Cable Cutting & Stripping Machine	258 - 259
Precision Mismatches	260 - 261
Rotary Joints	262 - 263
Supercomponents	264 - 265
Tools	266 - 267

Adapter Sets



Spectrum Elektrotechnik GmbH offers a standard range of precision adapter sets. Each set comprises a commonly used grouping of series and inter-series adapters. Each adapter within any set is 100% tested, and ensures low reflection and optimum phase performance over its full frequency range. To enable the user to maintain these quality adapters in pristine condition, they are supplied in a nicely finished wooden case.

Customers can also specify adapters for their own custom compiled sets. For details please call your Spectrum Representative.

Between Series Kit 7mm, consisting of the following Precision Adapters: **SET7-MINI-S1**

1 Adapter straight	7 mm to 2.4 mm-Female:	P/N 8001-HF90-02
1 Adapter straight	7 mm to 2.4 mm-Male:	P/N 8001-HM90-02
1 Adapter straight	7 mm to K*-Female:	P/N 8001-KF90-02
1 Adapter straight	7 mm to K*-Male:	P/N 8001-KM90-02
1 Adapter straight	7 mm to 3.5-Female:	P/N 8001-9092-02
1 Adapter straight	7 mm to 3.5-Male:	P/N 8001-9091-02
1 Adapter straight	7 mm to SMA-Female:	P/N 8001-2190-02
1 Adapter straight	7 mm to SMA-Male:	P/N 8001-1190-02

Between Series Kit Type N, consisting of the following Precision Adapters: **SETN-MINI-S1**

1 Adapter straight	N-Fem. to 3.5 mm-Fem.:	P/N 8002-6192-02
1 Adapter straight	N-Fem. to 3.5 mm-Male:	P/N 8002-6191-02
1 Adapter straight	N-Male to 3.5 mm-Fem.:	P/N 8002-5192-02
1 Adapter straight	N-Male to 3.5 mm-Male:	P/N 8002-5191-02
1 Adapter straight	N-Female to SMA-Fem.:	P/N 8001-2161-02
1 Adapter straight	N-Female to SMA-Male:	P/N 8001-1161-02
1 Adapter straight	N-Male to SMA-Fem.:	P/N 8002-2151-02
1 Adapter straight	N-Male to SMA-Male:	P/N 8002-1151-02

Between Series Kit 7mm, consisting of the following Precision Adapters: **SET7-MINI-S2**

2 Adapter straight	7 mm to 3.5-Female:	P/N 8003-9092-02
2 Adapter straight	7 mm to 3.5-Male:	P/N 8003-9091-02
2 Adapter straight	7 mm to SMA-Female:	P/N 8001-2190-02
2 Adapter straight	7 mm to SMA-Male:	P/N 8001-1190-02

Between Series Kit BNC, consisting of the following Precision Adapters: **SETB-TSMA-S1**

1 Adapter straight	BNC-Fem. to SMA-Fem.:	P/N 8001-2181-02
1 Adapter straight	BNC-Fem. to SMA-Male:	P/N 8001-1181-02
1 Adapter straight	BNC-Male to SMA-Fem.:	P/N 8001-2171-02
1 Adapter straight	BNC-Male to SMA-Male:	P/N 8001-1171-02

Between Series Kit 7mm, consisting of the following Precision Adapters: **SET7-TNCN-S1**

2 Adapter straight	7 mm to TNC-Female:	P/N 8002-4190-02
2 Adapter straight	7 mm to TNC-Male:	P/N 8002-3190-02
2 Adapter straight	7 mm to N-Female:	P/N 8001-6190-02
2 Adapter straight	7 mm to N-Male:	P/N 8001-5190-02

In-Series Kit Type SMA, consisting of the following Precision Adapters: **SETS-TSMA-S1**

1 Adapter straight	SMA-Fem. to SMA-Fem.:	P/N 8001-2121-02
1 Adapter straight	SMA-Fem. to SMA-Male:	P/N 8001-1121-02
1 Adapter straight	SMA-Male to SMA-Male:	P/N 8001-1111-02
1 Adapter radius angle	SMA-Fem. to SMA-Fem.:	P/N 8091-2121-02
1 Adapter radius angle	SMA-Fem. to SMA-Male:	P/N 8091-1121-02
1 Adapter radius angle	SMA-Male to SMA-Male:	P/N 8091-1111-02

Between Series Kit 7mm, consisting of the following Precision Adapters: **SET7-UNIV-S1**

1 Adapter straight	7 mm to 3.5 mm-Female:	P/N 8001-9092-02
1 Adapter straight	7 mm to 3.5 mm-Male:	P/N 8001-9091-02
1 Adapter straight	7 mm to SMA-Female:	P/N 8001-2190-02
1 Adapter straight	7 mm to SMA-Male:	P/N 8001-1190-02
1 Adapter straight	7 mm to TNC-Female:	P/N 8002-4190-02
1 Adapter straight	7 mm to TNC-Male:	P/N 8002-3190-02
1 Adapter straight	7 mm to N-Female:	P/N 8001-6190-02
1 Adapter straight	7 mm to N-Male:	P/N 8001-5190-02

In-Series Kit, Type N, consisting of the following Precision Adapters: **SETN-TYPN-S1**

2 Adapter straight	N-Female to N-Female:	P/N 8001-6161-02
2 Adapter straight	N-Female to N-Male:	P/N 8001-5161-02
2 Adapter straight	N-Male to N-Male:	P/N 8001-5151-02

Between Series Kit N-TNC, consisting of the following Precision Adapters: **SETN-TTNC-S1**

2 Adapter straight	N-Female to TNC Fem.:	P/N 8001-4161-02
2 Adapter straight	N-Female to TNC Male:	P/N 8001-3161-02
2 Adapter straight	N-Male to TNC Female:	P/N 8001-4151-02
2 Adapter straight	N-Male to TNC Male:	P/N 8001-3151-02

In-Series Kit Type TNC, consisting of the following Precision Adapters: **SETT-TTNC-S1**

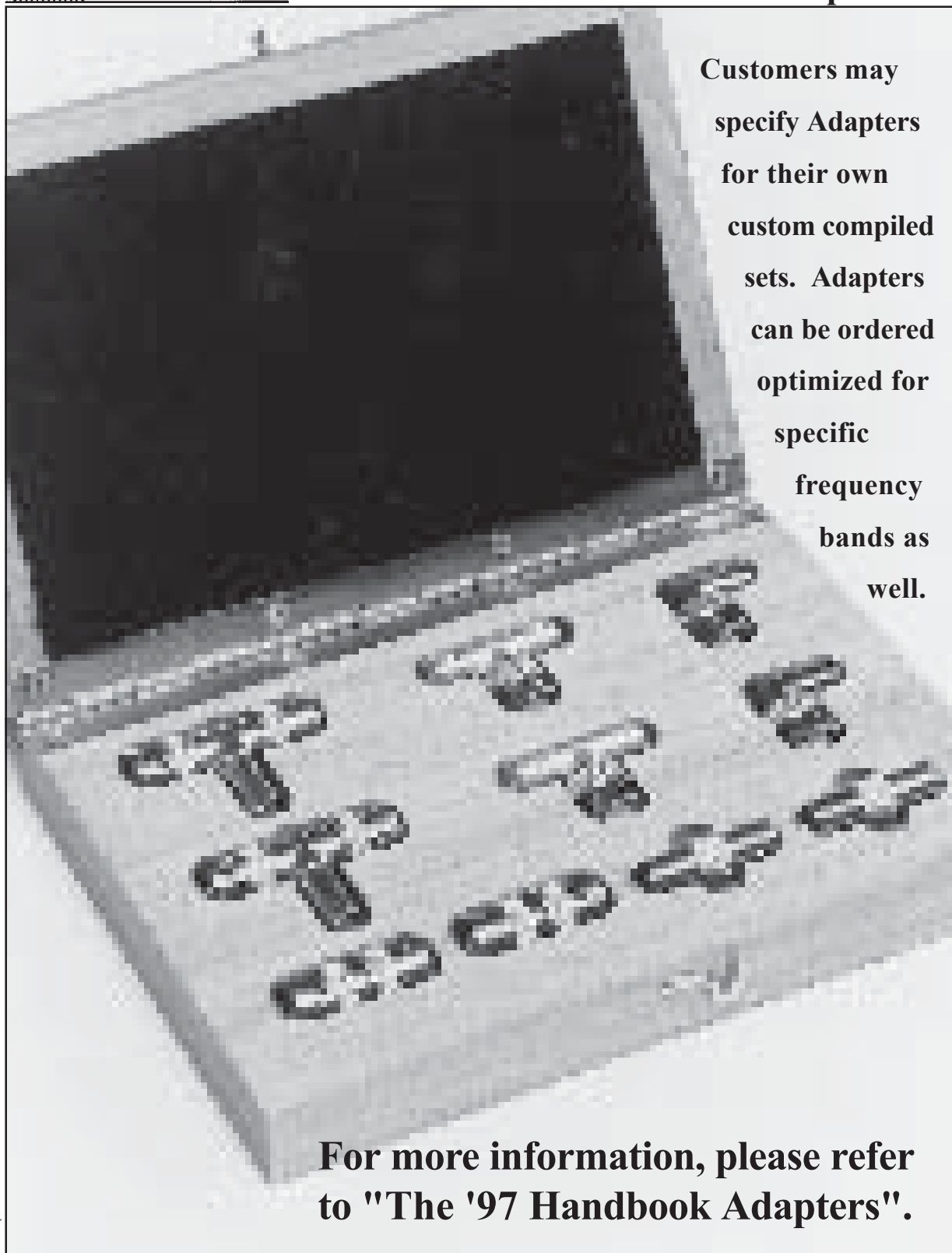
2 Adapter straight	TNC-Fem. to TNC Fem.:	P/N 8001-4141-02
2 Adapter straight	TNC-Fem. to TNC Male:	P/N 8001-3141-02
2 Adapter straight	TNC-Male to TNC Male:	P/N 8001-3131-02

Between Series Kit TNC-SMA, consisting of the following Precision Adapters: **SETT-TSMA-S1**

2 Adapter straight	TNC Fem. to SMA-Fem.:	P/N 8001-2141-02
2 Adapter straight	TNC Fem. to SMA-Male:	P/N 8001-1141-02
2 Adapter straight	TNC Male to SMA-Fem.:	P/N 8001-2131-02
2 Adapter straight	TNC Male to SMA-Male:	P/N 8001-1131-02

How to order your Personal Set:

Please use the temporary P/N: SET-PERS, and specify all the Adapters you want to include in your Set. The individual Kit will be showing your name plate, identifying your own compiled Set.



Customers may specify Adapters for their own custom compiled sets. Adapters can be ordered optimized for specific frequency bands as well.

For more information, please refer to "The '97 Handbook Adapters".

INTRODUCTION: Antennas are employed to couple electromagnetic energy between free space propagation and the energy received or transmitted as a guided wave by a radar system. Antenna dimensions of several wavelengths may be needed to confine an adequate amount of energy.

Application: Most antennas are used to serve as both, transmitters and receivers of microwave systems. Most systems require an antenna that tends to concentrate the transmitted energy into a small solid angle, or to receive energy from a specific direction.

Antenna Gain: The ability of an antenna to concentrate energy in a particular direction or to be more sensitive to energy incident from a specific direction is described in terms of the antenna gain. Denoted only as the gain, the exact definition would be the power gain of an antenna, which includes losses associated with the antenna, such as ohmic and RF heating.

Antenna Radiation Pattern: The spatial distribution of energy when plotted on a relative basis is called the antenna radiation pattern and it is a measure of the power per unit area, also called the power pattern. When measuring the unit per solid angle in a given direction, it is called the radiation intensity pattern.

Average Power Handling: This is the maximum allowable power to which the antenna can be subjected to without suffering permanent damage.

Connectors: Antennas can be supplied with almost any connector or waveguide configuration, supposing that frequency range and power level are within the connector/waveguide limits.

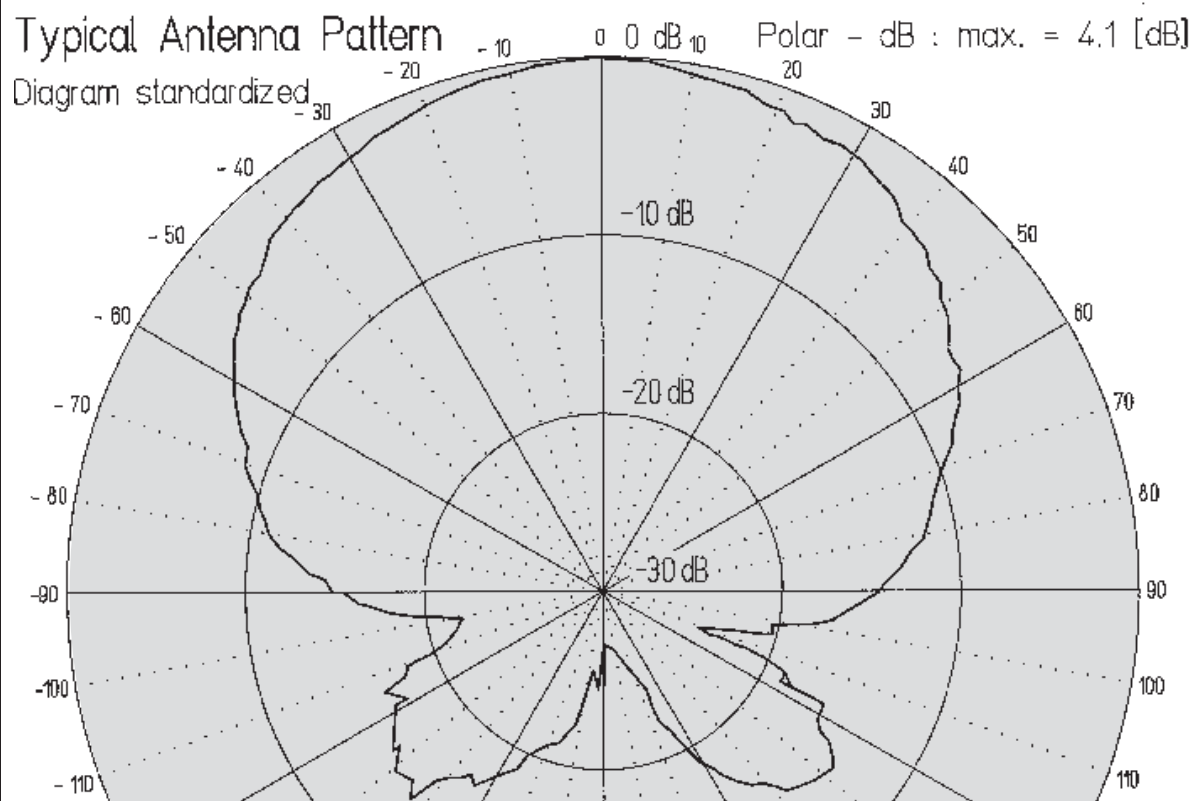
Custom Designs: Spectrum Elektrotechnik GmbH has been supplying only antennas that are designed to special requirements. At the time being the company does not compete with standard products that are available from various suppliers.

Frequency and Bandwidth: The frequency and bandwidth depend on many parameters, the type and physical structure, dimensions and materials of the antenna, the gain, beam width, polarization, radome, material, shape, etc.

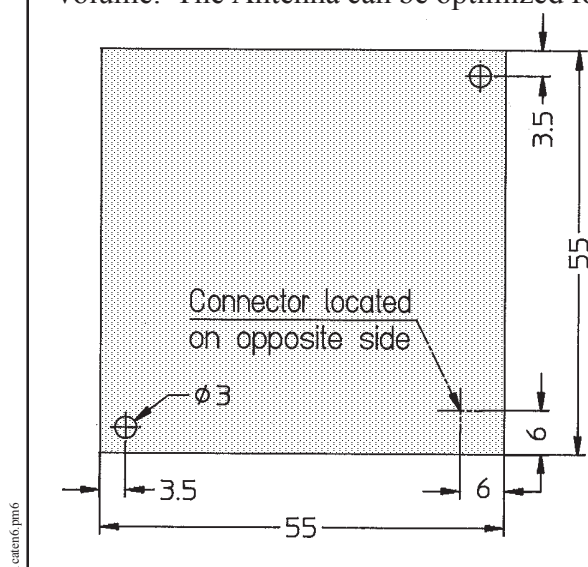
Operating Temperature Range: The temperature range is usually very wide, especially for outdoor applications.

Polarization: The direction of the polarization is defined as the direction of the electric field vector. The principal planes of the antenna pattern are associated with a linearly polarized component of the electric field and are commonly designated as horizontal or vertical polarizations, so that the antenna patterns are specified as being either horizontal or vertical patterns. For circular polarization the electric field rotates at a frequency equal to the frequency of the propagating wave, e.g. right handed when the direction of rotation of the electric-field vector is clockwise when viewed as a receding wave away from the antenna.

VSWR: VSWR is the ratio of the reflected signal and the incident signal, when looking into the antenna from system side. The VSWR for receive and transmit of an antenna may be different.



The Planar Antenna has been designed for OEM - Applications and is operating in the 2.4 GHz Band. The small dimensions and the rugged construction of the device are ideally suited for all applications regarding Wireless Telecommunication such as LAN, PBXs, PCS, PCN, Laptops, etc. The unique design utilizes a board construction that allows lowest cost at high volume. The Antenna can be optimized for any frequency in the ISM band.



Specification	
Model-No. AN-2424-21	
Frequency Range	2.45 GHz
Antenna Gain	3.5 dBi
Polarization	linear
Dimensions	55mm * 55mm
Connector	SMA female

INTRODUCTION: Regular connectors have to be aligned properly for mating purposes. Whenever the connecting parts are fully visible, there is no problem in alignment. But putting connectors together, without seeing and feeling them, is usually a challenge and always almost impossible, if they are not designed for such purpose.

With Blind Mate Connectors there is at least one of the two mating connectors designed to move or shift in location for self aligning, proper and safe mating purposes.

Frequency: Blind Mate Connectors do usually operate over a wide frequency range. But the bigger the connector series, the lower the upper frequency limit becomes, as known by the law of physics. The SBX works to 8.0 GHz, and it can take a tremendous lot of power. The SBY operates safely to 12.0 GHz, the BMA to 18.0 GHz, and the SMP to 40.0 GHz.

VSWR: VSWR is the ratio of the reflected signal and the incident signal, caused by reflections and discontinuities within the circuit, as no design is perfect, and manufacturing tolerances do not allow perfect devices anyway. But it is the fact that the Blind Mate Connection has a much lower VSWR, compared to the VSWR as seen on most cable assemblies.

Operating Temperature Range: The standard temperature range is normally specified from -54°C to +125°C. Depending on the application, the temperature range can be widened by using special design techniques and selecting appropriate materials and dielectrics.

Average Power Handling: This is the maximum allowable CW power to which the unit can be subjected to without suffering permanent damage.

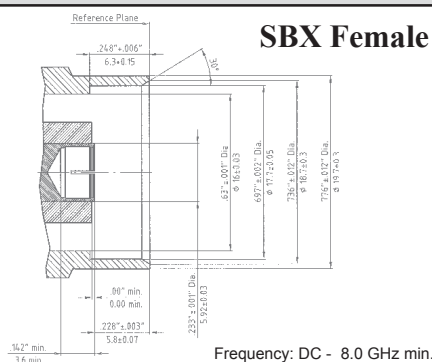
Standard Connectors: The complete line of Blind Mate Connectors will be shown in the "The '98 Handbook Quick Connections". "The '97 Handbook Adapters" lines out a number of in-series and between-series adapters and references complete dimensions of the interfaces.

Custom Designs: Spectrum Elektrotechnik GmbH will always be designing and supplying connectors to suit particular requirements, such as low VSWR, unique mechanical outline, unusual mounting, better power dissipation, characteristic impedance other than 50 Ohms, rough environment, etc., etc. If a special unit is needed, it is recommended to contact our sales force or the engineering department, as there is always a good chance that a similar problem was already solved for somebody else, or only a minor change is needed to an existing design in order to meet the new requirement.

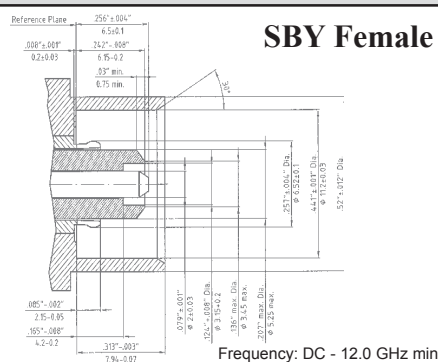
Applications: Blind Mate Connectors are used to interconnect components, replacing cable assemblies. The advantages are: lower cost, less insertion loss and a more rugged construction. Blind mate connectors are often used on the back of drawers as well.

Blind Mate Connectors are advanced connections for the newer systems.

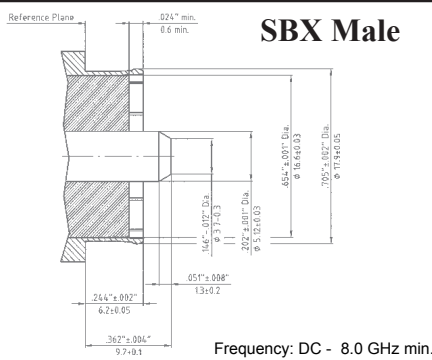
Full details, interface mating dimensions and product information are shown in : "The '97 Handbook Adapters",
"The '98 Handbook Quick Connections" and
"The '98 Handbook Microwave Connectors" .



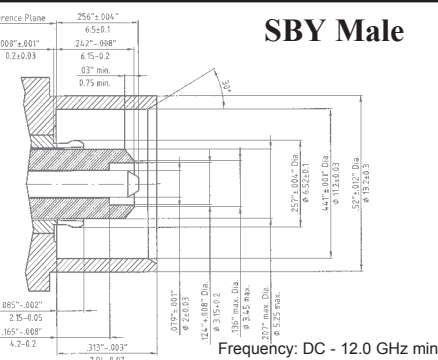
Frequency: DC - 8.0 GHz min.



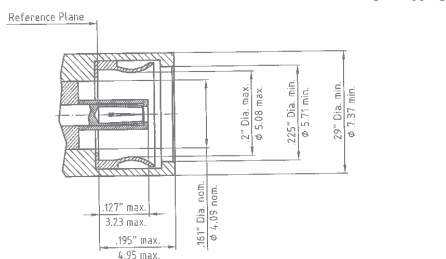
Frequency: DC - 12.0 GHz min.



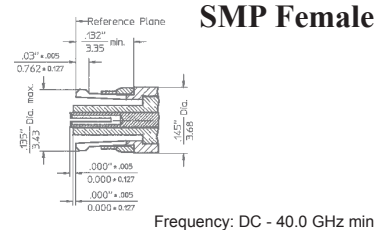
Frequency: DC - 8.0 GHz min.



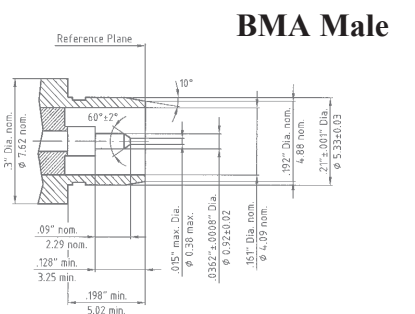
Frequency: DC - 12.0 GHz min.



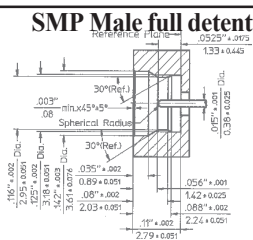
Frequency: DC - 22.0 GHz min.



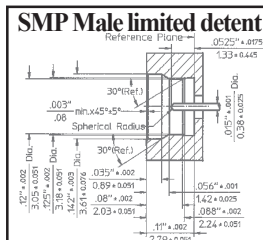
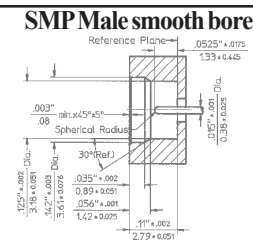
Frequency: DC - 40.0 GHz min.

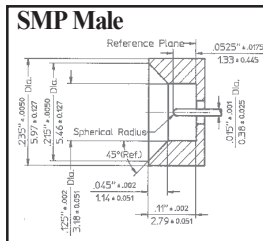


Frequency: DC - 22.0 GHz min.



SMP Male smooth bore

**SMP Male**



Page 10 of 10

INTRODUCTION: Microelectronic products, semiconductor devices, are used in almost any kind of equipment. These devices may suffer from electronic discharge damage. This can occur, when a device acquires charge through some triboelectric process and then abruptly touches grounded objects. Discharge damage also may occur, when charged personnel is touching grounded devices. To avoid the human body discharge, considerable effort has been made by employing wrist straps, static dissipative flooring, or avoiding human handling completely. But ICs may even already suffer from transportation. Often they are packaged in plastic shipping tubes, made from PVC (Polyvinyl Chloride). Left untreated, the material acts like a charge generator. PVC must be dipped in antistatic solution, but the coating deteriorates with age and wear.

CDM MODELLING: In order to find out how safe the semiconductor devices are and what kind of stress, or electronic discharge the semiconductor products can take, test methods were needed to be developed. For simulating controlled discharge at semiconductor devices, a special method, the Charged Device Modelling (CDM) became known.

THE CDM SIMULATOR: At a standard charged device modelling simulator the device under test is placed on dielectric, charged by a power supply and discharged through a 1 Ohm resistor that serves to sample the discharge current. The process is then monitored via an oscilloscope, connected to a parallel transmission line. The parasitic inductance, associated with the 1 Ohm resistor, is critical to the proper operation of the circuit.

THE DISC RESISTOR: The problem of parasitic inductances can be avoided or at least minimized by its geometrical shape that is most beneficial to the circuit. If a disc resistor is used, the current flows radially. By mounting the disc resistor on a coaxial line of same dimensions a CDM (Charged Device Modelling) test can be performed by simply connecting the protruding center conductor of the coaxial line with the device that has been charged.

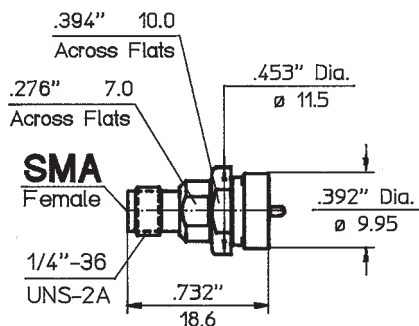
CALIBRATION: For calibration purposes the coaxial probe needs a mating receptacle. It must connect to a device that accommodates the protruding center conductor of the probe. The structure of the probe/mating receptacle must maintain a perfect 50 Ohm transmission line, with the only exception of the small area where the 1 Ohm resistor is placed.

THE HARDWARE: Spectrum Elektrotechnik GmbH has designed and manufactured a probe that has a standard SMA female connector at one end, and therefore can easily connect to standard transmission lines with SMA connectors. The other side of the unit is equipped with a replaceable center conductor and has a narrow cylindrical area for the 1 Ohm resistor. The replaceable center conductor is of utmost importance, as damages at the center conductor, resulting from arcing when discharging devices, are unavoidable.

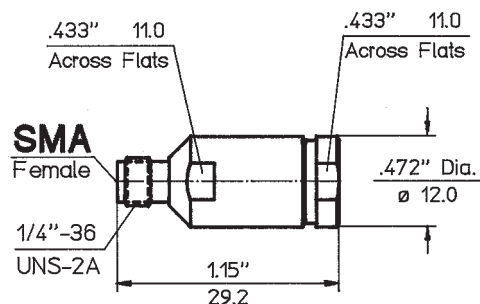
The mating device for calibration purposes accommodates the protruding center conductor of the probe and maintains a perfect 50 Ohm line, with the exception of the area where the one Ohm resistor has been placed. The SMA connector at the other end allows again for connection with standard 50 Ohm transmission lines.

The mounting plate is necessary to accommodate the probe safely in order to mount it on a positioner for accurate placement in relation to the device to be discharged.

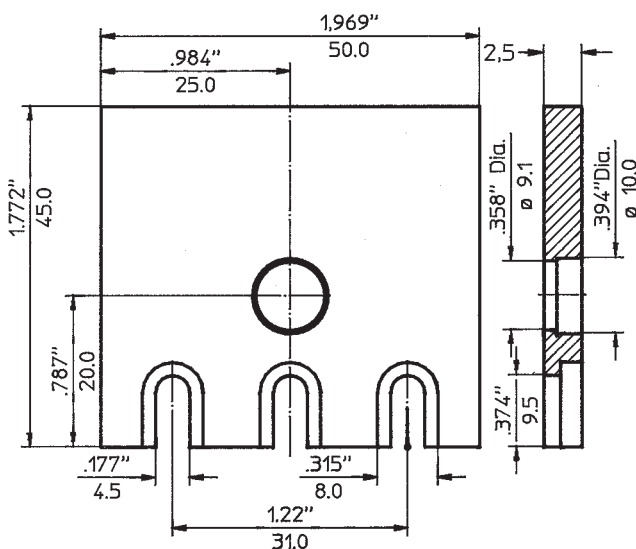
CUSTOM PRODUCTS: The CDM Components are custom products, developed to one customers' needs. Spectrum Elektrotechnik GmbH is a very innovative company. Our engineers are constantly designing new products, or modifying existing products to customers' requests. Therefore our catalogs never will be complete. If you do not find exactly what you need in our catalogs, or other catalogs, please contact our sales or engineering department.



CDM* - Probe
P/N 8001-S001-02



CDM* - Probe Test Adapter
P/N 8001-S002-02



Mounting Plate for CDM* Probe
P/N 8001-S003-00

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INTRODUCTION: Spectrum Elektrotechnik GmbH offers a large variety of standard Connectors and Adapters, as shown in "The '97 Handbook Adapters " and " The '98 Handbook Microwave Connectors ".

In many applications a standard component will not fit perfectly, or maybe it cannot be used at all. It would be needed a little bit shorter or longer, or narrower, or wider, or would have to meet special electrical requirements, such as higher power or better return loss, oretc.,

Applications: Special Connectors and Adapters are needed in state-of-the-art systems. These systems are following design criteria that are quite different to the standard scheme.

Mechanically they may be more compact, and of lighter weight, therefore cannot use some existing designs. Electrically these systems are to be of superior performance, therefore they have to meet specifications that are almost impossible, needing components to be engineered to excellence, and in detail.

Frequency: The frequency for custom designed connectors and adapters ranges is from DC to 50.0 GHz. For this frequency range complete test equipment is available.

Connector Types: Besides the connectors, meeting the standard interface specifications, such as MIL-Standards, DIN- or IEC- Specifications, Spectrum Elektrotechnik GmbH has been designing, manufacturing and introducing to the market successfully new Connector Series of Types **SBX**, **SBY** and **SPM**, connectors that were not available at all with the physical and electrical performance, as needed for applications in certain programs.

Additionally, a whole new Product Line was designed: the **PUSH-ON** Connectors and Adapters, being available in **50 Ohms** impedance for Series **7/16**, **SMA**, **N** and **TNC**. In **75 Ohms** impedance **PUSH-ON** Connectors of styles **F** and **N** were developed.

Spectrum Elektrotechnik GmbH is open for almost any engineering task. If none of the existing designs can be used, experienced engineering staff is available to develop the component that will meet exactly the requirements.

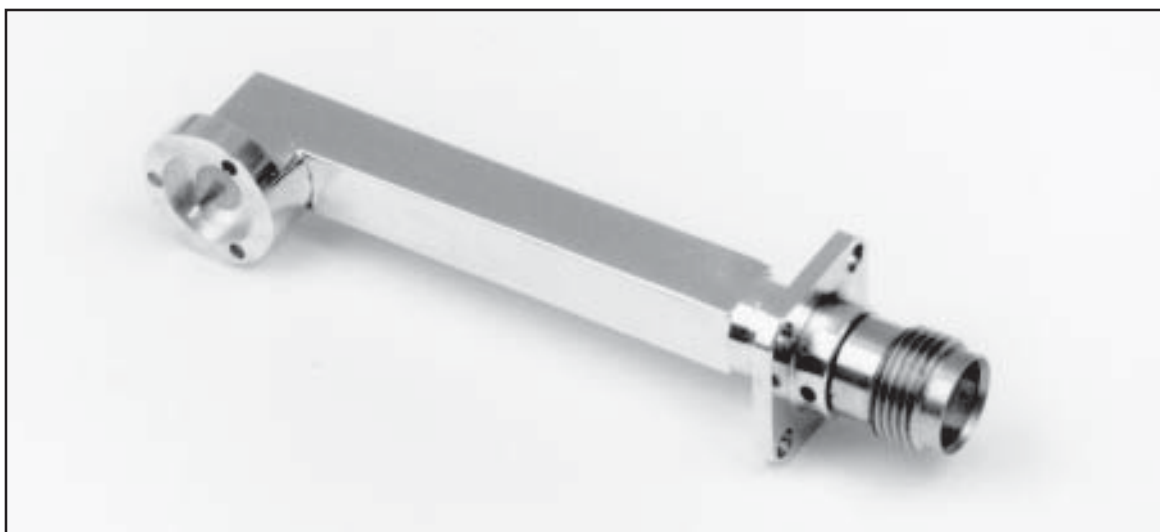
Operating Temperature Range: The normal operating temperature ranges from -54°C to $+115^{\circ}\text{C}$. For certain programs however, connectors and adapters were designed, allowing a much wider environmental temperature range.

Successful performance has been achieved at lowest temperatures of 20 K, in programs where the components in receivers, used for exploring the universe, are being cooled down to those temperatures because of noise level reasons.

In other programs the opposite was needed, environmental temperatures above 200°C . Using special design techniques and dielectrics, also these requirements were met.

VSWR: VSWR is the ratio of the reflected signal and the incident signal.

Spectrum Elektrotechnik GmbH has designed for several programs connectors and adapters showing lowest VSWR. Especially with high power components, reflections are unwanted, as the reflected power will be transformed into heat, causing even higher temperatures and consequently limiting the performance, especially when already operating at higher environmental temperatures.



These special adapters were designed to replace a semi rigid cable of 0.250" diameter. There was a major problem with the cable assembly: it could not be manufactured with repeatable performance, as the cable is quite big in diameter for its short length, therefore difficult to bend. Soldering connectors to such a short assembly is extremely difficult in addition. Using newest complex CNC machinery the outer conductor of the replacing mitre angled adapter was machined in one piece. Designing and developing components using state-of-the-art manufacturing features, results in outstanding mechanical designs with superior electrical performance at higher frequencies.



The special connector above was developed to hook up directly to an aerial, a long whip antenna, as used on radio equipment of vehicles. For achieving superior electrical performance, it incorporates a matching circuit in the connector body. A special quick connection/disconnection mechanism was developed for this special unit.

Microwave delay devices are designed and manufactured to meet delay requirements in frequency ranges from UHF through KA-Band. Several techniques are used to achieve the delays. It is the responsibility of the design engineer to decide about the best method for delaying the signals in his particular application. The decision depends on the frequency range, the delay needed, the VSWR, the suppression of undesired signals, the size of the device and its form, and last but not least the price of the device will be an important factor.

The coaxial delay line is the classical device. The length of the delay line can easily be calculated from the propagation delay of the signal within the coaxial cable and the delay needed. Other advantages are the good electrical performance of the professional delay line, the usually fast availability and the attractive price. Disadvantages are in some cases the large size and the high insertion loss, especially for longer delays at higher frequencies.

Spectrum Elektrotechnik GmbH offers a wide variety of coaxial delay lines. All the designs use Semi-Rigid Cable, from very small diameters, such as 0.047" up to diameters of 0.250", for certain applications even bigger. The Semi-Rigid Cables are using either Solid Dielectric, or Low Density Dielectric. The advantage of the Low Density Dielectric is lower insertion loss, a wider temperature range and better performance over temperature.

All Delay Lines are made to the customer specifications: a specific delay that is needed in the applications, a minimum attenuation, a maximum return loss, a minimum change over temperature, a certain mechanical configuration and for an environment that often only allows the best.

Delay Lines Packaging Options

The delay line can be packaged in a number of different ways, such as:

- **An especially designed housing:** It can be made of any kind of material, although mostly used is excavated aluminum.
- **19" Rack Mounting:** This is common for larger delay lines, or for applications in laboratories or test sets.
- **Spool Mounting:** This is an economical way of packaging, using a spool as supporting and mounting fixture.
- **Free Coils:** This is definitely the most inexpensive packaging, winding the delay line in a free coil and then using either tape, plastic or stainless steel ties, or just solder, to hold the delay line together.

The following Table can be used as a quick reference. Comparing the data of the different cables listed in attenuation, diameter, length and weight will allow a fast decision about which cables may be suited best in a specific application.

Dielectric	Cable P/N	Code	Outer Diameter	Attenuation dB (10 GHz)			Phase Stability	Min. Bend Radius (mm)	Length (Nom.) (m)			Weight (grs)		
				/10ns	/50ns	/100ns			/10ns	/50ns	/100ns	/10ns	/50ns	/100ns
Low Density	421-307	05	0.085"	5.00	24.9	49.8		15.2	2.33	11.6	23.3	54	272	544
	422-700-3	-	0.085"	4.20	21.1	43.3		15.0	2.43	12.2	24.3	50	250	501
	421-069	-	0.116"	3.10	15.5	31.0	Best	17.80	2.35	11.7	23.5	82	408	816
	421-298	98	0.141"	2.40	12.0	24.0	Best	25.4	2.43	12.2	24.3	100	499	998
	422-900-3	141L	0.141"	2.24	11.2	22.4		25.4	2.43	12.2	24.3	102	508	1017
	421-336	36	0.250"	1.12	5.6	11.2	Best	50.8	2.40	12.0	24.0	327	1633	3266
	421-281	81	0.250"	1.12	5.6	11.2	Best	50.8	2.40	12.0	24.0	181	907	1814
Solid	RG-405 421-086	89	0.086"	5.22	26.10	52.2	Note "A"	5.1	2.12	10.6	21.2	45	226	454
	RG-402 421-669	69	0.141"	2.92	14.60	29.2	Note "A"	8.9	2.12	10.6	21.2	100	499	998
	RG-401 421-252	52	0.250"	1.80	9.0	18.0	Note "A"	12.7	2.12	10.6	21.2	318	1588	3175
	421-250	50	0.250"	1.80	9.0	18.0		12.7	2.12	10.6	21.2	315	1575	3150

* "A" - At higher temperatures, 21 to 120 degrees C, microporous PTFE dielectric Cable has only slightly better phase response than solid PTFE dielectric cable. However, from 21°C to -50°C microporous cable displays far superior phase response.

Quick Response Manufacturing

The Quick Response Manufacturing is another good example for the commitment to providing excellent Customer Service. The Quick Response Group was implemented to react immediately to customers' needs. Sometimes Products will be shipped within 24 hours. All Products manufactured in the Quick Response Area will meet the same Quality Standard as all the other products, they are submitted to the same inspection criteria, they are tested with the same procedures as used on standard products.

INTRODUCTION: Detectors are needed to monitor power levels of microwave signals or to identify modulation wave shapes, using one of three different semiconductor types: Tunnel Diodes, Biased Schottky Diodes and Zero Bias Schottky Diodes.

Tunnel Diode Detectors: Excellent sensitivity at zero bias, good VSWR and flat response over multi-octave bands can be named to describe the semiconductor. Tunnel detectors are preferred for CW and pulse detection at higher pulse repetition rate. They are suitable for narrow and fast pulse processing, have excellent temperature stability and are ideal for DC coupled applications. They are also used in DLVAs (direct log video amplifiers).

Schottky Detectors: These devices have excellent sensitivity at optimum bias, and operate in an extended dynamic range of 20 dBm. They show moderate temperature stability and they are typically used for power monitoring and threshold circuits, as with AC coupled DLVAs as well.

Zero Bias Schottky Detectors: They do have good sensitivity at zero bias with an extended dynamic range. Zero Bias Schottky Detectors are very suitable for applications in power monitoring applications and in instrumentation as well.

Applications: Detectors are needed during monitoring, test and measurement, they also can be integrated in components and they are used in systems applications as well.

Connectors: Detectors are available with a large variety of connectors, meeting the appropriate standard interface specifications, such as MIL-Standards, DIN- or IEC-Specifications, etc.

Custom Designs: Spectrum Elektrotechnik GmbH has been designing and supplying special detectors to suit particular requirements in flatness, sensitivity, leakage, lower output capacitance, mechanical outline, mounting, special connector requirements, rough environment, etc., etc.

Dynamic Range: It covers the input power range from the minimum power, which is defined by the TSS, and the maximum power, which will cause the diode to burn out.

Frequency and Bandwidth: The detectors of Spectrum Elektrotechnik GmbH are designed to operate in frequency ranges of 500 MHz to 26.5 GHz. For certain applications, units may be tuned for certain criteria in narrower bands.

Flatness: The logarithmic ratio of the maximum to the minimum output voltage of the detector with constant input power over the whole specified frequency range is called the Flatness.

$$\text{Flatness (dB)} = 10 \log (U_{\text{max}}/U_{\text{min}})$$

K Factor: The min. ratio of output voltage versus the RF input power is specified as the Output Voltage Sensitivity. Measured is the output voltage at an open circuit with a known RF input power.

Operating Temperature Range: The temperature range applies from -54°C to +115°C for Schottky Detectors and -54°C to +125°C for Tunnel Detectors. Storage temperature will be -54°C to +125°C for all devices.

Output Voltage Sensitivity: The ratio of output voltage versus the RF input power is specified as the Output Voltage Sensitivity. Measured is the output voltage at an open circuit with a known RF input power.

Peak Power Handling: This is the maximum allowable Peak power to which the unit can be subjected to without suffering permanent damage, or without changing permanently the specified characteristics of the device. Regular Tunnel detectors can usually withstand a CW power of 17 dBm, Schottky detectors 20 dBm.

Polarity: In general detectors can be supplied with positive video output and with negative video output as well.

Square Law Range: The range where the video output power remains proportional to the square of the input signal power.

Survival Power: This is the maximum allowable peak power at 25°C, 1 microsecond pulse and 0.1% duty to which the unit can be subjected to without suffering permanent damage.

TSS: Tangential Signal Sensitivity is the amount of power required to produce an output pulse of an amplitude, which is sufficient to raise the noise fluctuation by an amount equal to the average noise level.

VSWR: The Voltage Standing Wave Ratio is measured at the signal input port of the detector.

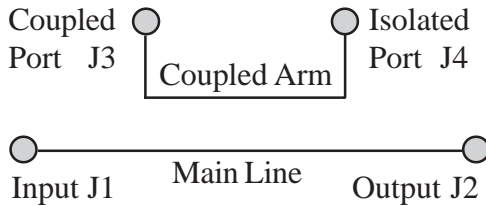
Video Bandwidth: This is the bandwidth of the video modulated signal.

Video Capacitance: The capacitance, which can be measured in parallel to the video output of the detector.

Video Resistance: The resistance which can be measured at the video output of the detector.



INTRODUCTION: Directional Couplers are Four Port devices. The design uses the coupling between two transmission lines. The distance between the main line where the energy is propagating through, and the coupling arm is a function of the energy coupled. All ports of the couplers are matched to 50 Ohms impedance.



Theoretically, the Power transmitted into port J1 is partially coupled into port J3. At port J2 the remaining power will be received. In reality however, the components behave differently: Injected Power into port J1, minus Coupled Power at Port J3, minus Insertion Loss of the Circuit, minus power reflected into port J4, equals the Output Power at port J2. An ideal coupler, would not receive power at port J4.

Main Line: The RF-Circuit between the input and output ports is called the Main Line.

Coupled Line: The transmission line into which the main signal is coupled, is called the Coupled Line. Normally one port of the coupled line is terminated with a 50 Ohms load.

Frequency: The Coupling Characteristics are limited over finite frequency bands. Using creative ideas, Spectrum Elektrotechnik GmbH has designed Directional Couplers for higher power applications, operating over wider frequency ranges of more than one octave.

Coupling: The coupled power can be 40 dB below the power introduced into the main arm, depending on the specification. It varies with frequency at a limited amount. But the variation, or ripples can usually be optimized very well.

$$\text{Coupling (dB)} = -10 \log (P_3/P_1)$$

Insertion Loss: Every transmission line will cause loss, as energy will be dissipating into the circuit. A good design will offer good trade off between size of the component and its loss.

$$\text{Insertion Loss (dB)} = -10 \log (1-P_3/P_1)$$

Directivity: The power ratio between isolated port and coupled port is called Directivity. Ideal would be no power at Port 4, resulting in infinite Directivity, but in actual the isolated port never will become completely power free.

$$\text{Directivity (dB)} = -10 \log (P_4/P_3)$$

Isolation: The power ratio between port 4 and port 1 is called Isolation. Isolation is also another term to measure reflections into port 4.

$$\text{Isolation (dB)} = -10 \log (P_4/P_1)$$

$$\text{Isolation (dB)} = \text{Coupling (dB)} + \text{Directivity (dB)}$$

VSWR: Every microwave component shows reflections and discontinuities within the circuit, as no design can be perfect, and manufacturing tolerances do not allow perfect designs anyway. coupled port reduces the directivity by an amount, equal to the return loss of the mismatches.

$$\text{Return Loss (dB)} = -10 \log ((VSWR-1)/(VSWR+1))^2$$



**High Power Directional Coupler, used
in an L - Band Radar Application.**

INTRODUCTION: Impedance Transformers are passive linear coaxial components used to transform 50 Ohms impedance levels to 75 Ohms impedance levels or vice versa.

Application: Impedance Transformers are mainly used to connect components and measurement systems of different impedances. Signal sources and test systems using 50 Ohms impedances are mostly used. Some test systems may even be only available with 50 Ohms impedance. Employing an Impedance Transformer means that these 50 Ohms systems can be used for testing 75 Ohms components.

Resistance Network Impedance Transformers: These components are using a resistor network to transform from 75 Ohms to 50 Ohms or vice versa. As the resistors need to be small for integration into the coaxial circuit, and because of little reflections, the component is only specified for low power, normally 0.5 Watts, or even less. The operating frequency is only to a few hundred MHz, e.g. DC to 200 MHz. The insertion loss is high. Often the component is designed to have a voltage insertion loss of 10 dB.

Multiple Quarterwave Impedance Transformers: The unit consists of multiple sections of quarterwave length, properly cascaded for optimum performance and broad band properties. The operating bandwidths may be to 3.0 GHz with a max. insertion loss of 5 dB, an average power of 2 Watts and a peak power of 2 KW.

Inductive Impedance Transformers: These components consist of two windings, linked by a mutual magnetic field. The relationship between impedance of input and output depends on the ratio of the number of windings between primary and secondary coil. These components have low loss, but are only usable at lower frequencies. Normally the design is not used at all in coaxial Impedance Transformers.

Average Power Handling: This is the maximum allowable CW power to which the unit can be subjected to without suffering permanent damage.

Connectors: Impedance Transformers can be fitted with a number of connector styles. Of special interest are: N(50 Ohms) to N(75 Ohms), BNC(50 Ohms) to BNC(75 Ohms), TNC(50 Ohms) to TNC(75 Ohms), and 1.8/5.6 to 1.6/5.6. For special applications also units can be offered with different connector styles at the input and output.

Custom Designs: Spectrum Elektrotechnik GmbH has been designing and supplying special Impedance Transformers to suit particular requirements, such as certain bandwidths, unique mechanical outline, unusual mounting or special connector requirements, etc., etc.

Frequency and Bandwidth: As 75 Ohms systems are usually designed to operate at lower frequencies, there seems to be no need for Impedance Transformers operating at higher frequencies. Depending on the designs, Impedance Transformers may operate up to a few hundred MHz, only some are designed for frequencies to 3.0 GHz.

High Reliability Components: Impedance Transformers can also be supplied to Customers High Reliability Specifications, environmental, military or governmental requirements, and/or to customer test procedures.

Impedance Transformers for other impedances: Basically a unit for any impedance transformation needed, can be designed. Depending on the operating frequency and bandwidth, the appropriate design will be chosen for low development cost.

Insertion Loss: This is the amount of power lost through the Impedance Transformer under matched conditions.

One dB Bandwidth: This is the frequency range over which the insertion loss variation is less than 1 dB, referenced to the midband insertion loss.

Operating Temperature Range: The temperature ranges from -54°C to $+125^{\circ}\text{C}$, or even wider, depending on the application.

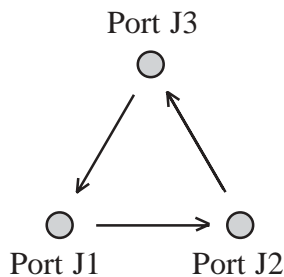


Peak Power Handling: This is the maximum allowable power to which the unit can be subjected to without suffering permanent damage, or without changing permanently the specified characteristics of the device. The peak power is transmitted at a certain pulse width and pulse repetition rate.

Standard Products: Although a number of products have been supplied to customers' orders, a standard product line on Impedance Transformers has not been designed yet. But there is a possibility that the product required has been designed already or that a design, very close to the requirement exists. Therefore please check your requirements with our sales force, or our engineering staff.

VSWR: VSWR is the ratio of the reflected signal and the incident signal. It is desired that the Impedance Transformers have little reflections. In reality, the units will show some reflections and discontinuities within the circuit, as no design is perfect, and manufacturing tolerances do not allow perfect designs anyway.

INTRODUCTION: Isolators and Circulators are usually three port devices, and they are used to force the microwave energy into one direction only. The typical junction Circulator consists of a stripline circuit, sandwiched between two ferrite discs or triangles, an upper and a lower ground plane, magnetically biased by permanent magnets located outside the ground planes. In a Circulator, the magnetic field, applied through the vertical axis of the assembly, results into a circulation of the microwave energy from one port to the other, depending on where the energy is coming from.



Microwave energy entering the device from port J1 is directed to port J2. Energy entering from port J2, is directed to port J3. Signals entering from port J3, are directed to port J1, etc. If one of the ports is terminated into a 50 Ohms load, the device becomes an Isolator. Signals then only can pass the unit with low loss in one direction, and only with high loss in the reverse direction. If e.g. port J3 is terminated into a 50 Ohms line, microwave energy only can pass the device with low loss from port J1 to port J2. An Isolator is used to "isolate" microwave

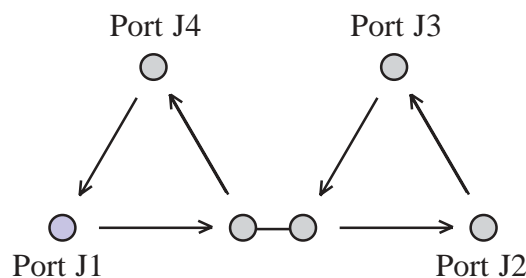
components from each other, or to protect units to receive damages by working into an open or short circuit. The output of an oscillator is usually protected by an isolator.

Frequency and Bandwidth: Coaxial and microstrip circulators and isolators operate either in the bias region above resonance or below resonance. Above-resonance circuits are usually used for smaller bandwidths and higher power designs, while below-resonance circuits achieve wider bandwidths. Theoretically, the above-resonance circuits have no lower frequency limit.

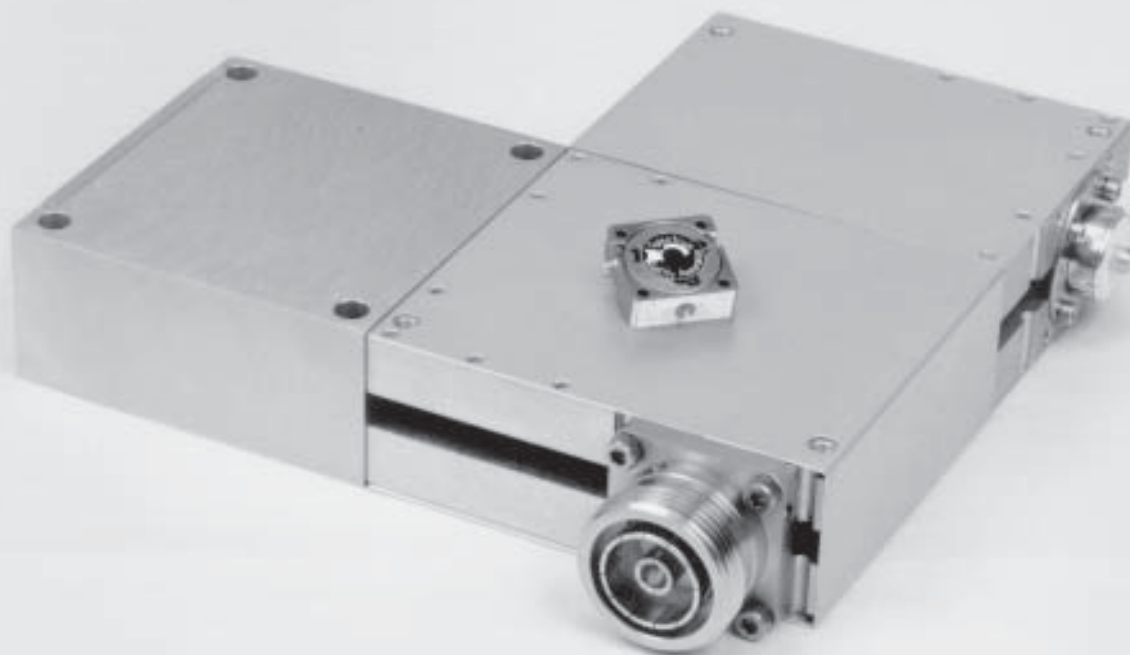
Operating Temperature: The performance depends on the magnetic field, applied to saturate the ferrite material. Temperature compensated magnets and ferrites need to be used where wide temperature ranges are required. Internal heaters can be installed, where temperature range and ferrite material do not allow other compensation.

Input VSWR: The input VSWR is a function of the VSWR of the other ports. At an isolator the higher output VSWR will cause reflected energy towards the terminated port, where it will be attenuated by the value of the isolation, and the balance is reflected back to the input, increasing the input VSWR.

Four Port Devices: Four Port Circulators and Isolators are used where higher directivity is needed. An Isolator would have the ports J3 and J4 terminated. In the schematic to the left,



microwave energy is forced from port J1 to J2, or from port J3 to port J4, when crossing two ferrite junctions. The high isolation only applies when two ferrite junctions have been crossed, here between ports J2 and J1 with ports J3 and J4 terminated with matched loads.



**Designing Components to
Customer Specifications!**

**Circulators for High Power Applications vs.
Smallest Devices for Employment as "Drop In".**

Icomp08.ppt6

INTRODUCTION: Lightning has potential damaging effects on electronic equipment. Therefore modern equipment usually incorporates surge suppressors in the RF path in order to protect the equipment.

Spectrum Elektrotechnik GmbH has developed several types of lightning surge suppressors. They were engineered especially for the cellular communications industry. The designs are usually employing in the connector or the adapter a built-in fuse. But it has to be noted that the surge suppressor needs maintenance and replacement as soon as it has done its job of protection.

Another method for protecting the circuits against lightning, is the use of quarter wave stub devices. They have the advantage of being maintenance free, offer high attenuation and effectively a short circuit to incoming pulses outside the operating frequency. On the other hand they have the big disadvantage of needing to be tuned by the stub length to the center frequency, the equipment is working at, and have an operating bandwidth which is very narrow and usually only in the range of only +/- 70 MHz around the center frequency.

Application: Not protecting equipment against lightning strikes and allowing the energy of the surge to enter the equipment is a quite dangerous practice and usually ends up in destroyed equipment.

Lightning surge suppressing devices are therefore likely to be found in most applications, especially when modern systems are being designed. The protection of the equipment of cellular communication base station, connected directly with the antenna is one of the most important criteria.

Good applications for surge suppressors are also the protection of transceivers of radios on vehicles. The arc suppression device is usually built into the input connector at the long whip antenna.

Connectors: Surge Suppression devices are available with a large variety of connectors, such as 7/16, HN, N, SMA, etc., meeting the appropriate standard interface specifications, such as MIL-Standards, DIN- or IEC- Specifications.

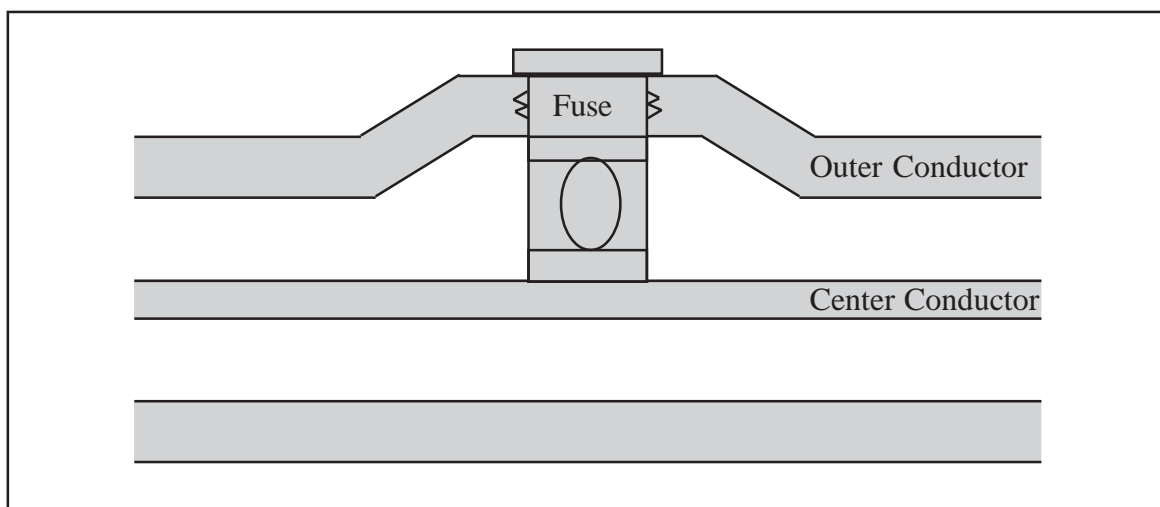
Custom Designs: Designs have been made to suit particular specifications, such as unique mechanical outline, unusual mounting, special electrical requirements, rough environment, etc., etc. Experienced engineers are available and they are interested to hear about the system needs and they are eager to offer solutions that meet exactly the requirements needed in the application.

Frequency: The frequency range for the connectors and adapters being equipped with surge suppression is usually below 3.0 GHz.

Operating Temperature Range: The temperature ranges from -54°C to +125°C, or even wider, depending on the application, the design and the materials used. Engineering can usually offer something that fits perfectly the system use.

Risetime/Voltage: Depending on the design and the type of fuse being incorporated, the devices will trigger in microseconds, or even nanoseconds. The pulse rise time is normally very fast and measured in kV/μs.

VSWR: VSWR is the ratio of the reflected signal and the incident signal. Because of the built in fuse, incorporated in the RF path, electrically the device is not ideal at all anymore. But as the fuse is normally small, compared to the wavelength of the operating frequency, the voltage standing wave ratio is in general still good enough for the application, or in other words: a degradation in VSWR is not noticeable. Corrective actions integrated in the design, will help in addition to keep the reflected signal to a minimum.



Schematic cross section view of a lightning surge suppressor, to demonstrate the structural arrangement between outer conductor, center conductor and fuse.



The picture shows a four hole flange mount adapter with surge suppression, being used between the antenna and the vehicle mount radio equipment.

INTRODUCTION: Limiters are used to protect RF components against excessive incident power levels. The devices are designed and manufactured to meet stringent requirements, mechanically, electrically and environmentally. It is the specialty of Spectrum Elektrotechnik GmbH to design and manufacture devices to meet stringent specifications, electrically, mechanically and environmentally.

Fundamentals: The power limiting circuit consists of a single PIN diode or several diodes, shunted across a transmission line, requiring a dc return in order to achieve proper limiting operation. Low input power passes with the minimum insertion loss of the circuit. Power levels, greater than the threshold level will cause greater insertion loss, resulting in leakage power that the output power of the device remains at constant level.

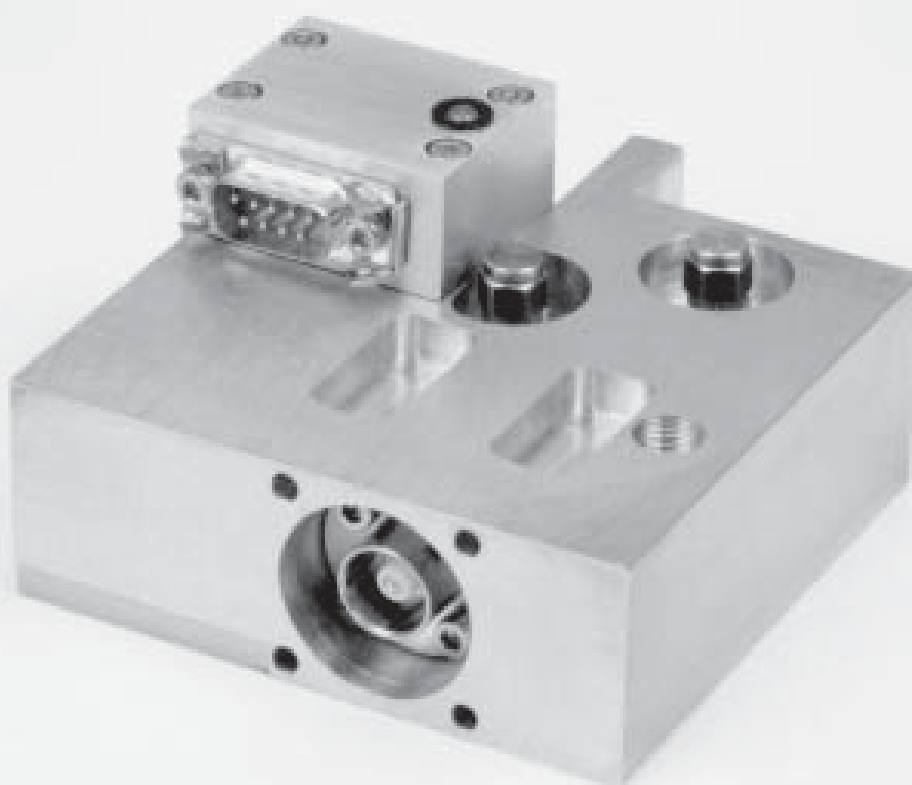
High Power Limiters: In radar applications a limiter is normally installed to protect the receiver against excessive power, caused by unwanted reflections from other nearby radars or objects that accidentally come close to the radar. For normal power levels the limiter will operate like the classic device. But even high power levels arrive, the limiter will act as a reflective unit, protecting the receiver by returning all the power that cannot be absorbed back into the line. To control the reflected power, usually a circulator is installed at the input of the limiter, directing the excessive power to a high power load where it will be absorbed.

Custom Units: Spectrum Elektrotechnik GmbH offers mainly custom designed limiters, special components, using different or an even unique mechanical configuration, special frequency ranges than normally offered, higher power levels, etc. Spectrum Elektrotechnik GmbH is a very innovative company. It employs a strong and successful team of experienced engineers. They will always do their best to propose something that will perfectly fit the requirements.

Frequency and Bandwidth: Limiters have been designed and manufactured to serve multi octave bandwidths, from very low frequencies up to Ku band. Wide operating bandwidths usually apply for low power limiters. The higher the power level becomes, the narrower the bandwidth will be.

Housing and Connector Configuration: Most of the designs, Spectrum Elektrotechnik GmbH can offer, will be engineered exactly to the customer specifications, size and shape of the housing supplied with the necessary connector configuration, providing that the frequency range of the connectors do not limit the frequency range of the application. As Spectrum Elektrotechnik GmbH is manufacturing its own housings and its own connectors, almost every mechanical configuration needed and every connector style preferred may become reality.

VSWR: VSWR is the ratio of the reflected signal and the incident signal. Every microwave component shows reflections and discontinuities within the circuit, as no design is perfect, and manufacturing tolerances do not allow perfect designs anyway.



**High Power Limiter,
built on a Modular Bases,
using the SBY - Connector.**

Phase Stable Assemblies (ANA-Cable Assemblies)



The Cable Assemblies of Series 16, 18 and 22 are Phase Stable Assemblies, designed for the Vector Network Analyzers of HP and Wiltron.

The Cables of Types 18 and 22 operate to 26.5 GHz, while Cable Type 16 works to 50.0 GHz (when supplied with 2.4mm connectors).

One end of the Assembly is usually terminated with a "special" 2.4mm, 3.5mm, or K* connector. These connectors are designed with a larger than standard coupling nut for greater stability, mating directly with the RF ports of the Network Analyzers.

The other end of the ANA - Assembly may be terminated with any of the connectors available and needed in the customers test application, mating in direct connection with the device under test. By eliminating expensive adapters the test setup becomes simple and trustworthy.

The cable assemblies can be manufactured in various lengths up to 6 meters (20ft.). All necessary piece parts will be carried in stock, helping to facilitate fast deliveries.

Cable assemblies of the most popular lengths, e.g. 45 cm. (17.7") and 60 cm. (2.36"), terminated with preferred connector styles, such as 2.4mm and 3.5mm for the Hewlett-Packard 8510 and K* for Wiltron 360, will be available, in most cases, within a few days of order placement.

Note:

For special requirements, the cable can be terminated with almost any connector style. Please call your nearest Spectrum Representant or contact our Marketing or Engineering Staff.

ANA Cable Assembly Characteristics:

Cable Code	16	18	22
Frequency Range	50.0 GHz	26.5 GHz	26.5 GHz
Cable Outer diameter	9.2 mm. (.36")	6.0 mm. (.24")	9.2 mm. (.36")
Mechanical length	custom-made up to 6m	custom made up to 6m	custom made up to 6m
Electrical length	~ 1.44 x mechan. length	~1.36 x mechan. length	~1.36 x mechan. length
Bend radius min.	6 cm. (2.36")	6 cm. (2.36")	6 cm. (2.36")
Pull resistance	10 kg. (22 pounds)	2 Kg. (4.4 pounds)	10 kg. (22 pounds)
Crush resistance	62 kg./cm ² (880 psi)	16 kg./cm ² (225 psi)	62 kg./cm ² (880 psi)
Return loss, min. /Assembly	17 dB up to 50.0 GHz	20 dB up to 26.5 GHz	20 dB up to 26.5 GHz
2.4mm connectors			
3.5mm connectors	20 dB up to 26.5 GHz		
7mm connectors	20 dB up to 18.0 GHz	20 dB up to 18.0 GHz	20 dB up to 18.0 GHz
K* connectors	20 dB up to 40.0 GHz	20 dB up to 26.5 GHz	20 dB up to 26.5 GHz
N connectors	20 dB up to 18.0 GHz	20 dB up to 18.0 GHz	20 dB up to 18.0 GHz
SMA connectors			
TNC connectors			
Return loss stability	40 dB min.	40 dB min.	40 dB min.
Phase stab., 2 x 45 cm. assies manual flexing/torque	Please refer to: "The '97 Handbook Cable Assemblies". 5.0° max. @ 40.0 GHz	Please refer to: "The '97 Handbook Cable Assemblies". 4.0° max. @ 26.5 GHz	Please refer to: "The '97 Handbook Cable Assemblies". 4.0° max. @ 26.5 GHz
Straight vs. 90° bend	4.0° max. @ 40.0 GHz	2.5° max. @ 26.5 GHz	2.5° max. @ 26.5 GHz
Straight after 3 x 90° bends	3.0° max. @ 40.0 GHz	2.0° max. @ 26.5 GHz	2.0° max. @ 26.5 GHz
Amplitude stab., 2 x 45 cm. assies manual flexing/torque	<0.05dB @ 40.0 GHz	-	-
Straight vs. 90° bend	<0.05dB @ 40.0 GHz	<0.05dB @ 26.5 GHz	<0.05dB @ 26.5 GHz
Straight after 3 x 90° bends	<0.05dB @ 40.0 GHz	<0.05dB @ 26.5 GHz	<0.05dB @ 26.5 GHz
Insertion Loss / m (39.37")	1.0 GHz	0.65	0.40
	10.0 GHz	2.50	1.34
	18.0 GHz	3.60	1.80
	26.5 GHz	4.50	2.20
	40.0 GHz	5.70	-
	50.0 GHz	6.60	-



Phase Stable Assemblies

**For complete information please refer to:
" The '97 Handbook Cable Assemblies " or
" The '97 Handbook Test Necessities and Accessories ".**

INTRODUCTION: Mismatches for a 50 Ohms line are terminations which have been designed for terminating lines with a characteristic impedance other than 50 Ohms. For example a termination, designed for reflectionless termination of a 25 Ohms line, will cause a mismatch of 2:1 when used on a 50 Ohms line ($50:25 = 2:1$).

Applications: Mismatches are used as standards of reflections in calibrating reflectometer setups and/or other impedance measurement devices. Mismatches are also used to simulate known impedances other than 50 Ohms, to introduce test conditions in a system and to measure the results that would be encountered, once the actual component is installed in the system.

Mismatch Values: Standard Mismatch Values for a 50 Ohms transmission line are known as 1.25:1, 1.5:1, 2:1, 4:1, etc. For specific applications any mismatch value can be designed.

Frequency Range: The frequency range of the Mismatches depends on the design. Theoretically Mismatches can be designed for almost any frequency range.

Power: Precision Mismatches are usually designed and needed for test and calibration purposes, operating at low power. For other applications units can be supplied as special, engineered exactly to the customers' needs.

VSWR: VSWR is the ratio of the reflected signal and the incident signal. Mismatches are designed to provide reflectionless termination of a line other than 50 Ohms. For the 50 Ohms line however they show a known VSWR over the frequency range specified. The better the design and the lower the manufacturing tolerances, the more constant will the VSWR be over the frequency range.

Connector Configuration: Most of the Mismatches manufactured by Spectrum Elektrotechnik GmbH are available with different connector configurations, providing that the frequency range of the connectors do not limit the frequency range of the application. BNC connectors operate to 4.0 GHz, HN and SBX connectors to 8.0 GHz, C, SC and 1.8/5.6 to 10.0 GHz, TNC (per MIL-C-39012) operate min. to 11.0 GHz (as per MIL-Specification, but this can be extended to 14 or even 16 GHz). SBY work to 12.0 GHz, 2/5.5 connectors operate to 14.0 GHz, SMA, SPM, N, TNC (per MIL-C-87104/2), TNX, BMA and 7mm connectors can be used to 18.0 GHz, 1.4/4.4 to 20.0 GHz, 3.5mm connectors to 26.5 GHz, or respectively to 35.0 GHz. K* and SMP connectors are designed to operate to 40.0 GHz and 2.4mm connectors to 50.0 GHz.

Standard Products: Although a number of products have been supplied to customer orders, a standard product line on Mismatches has not been established yet. But there is a possibility that the product required has been designed already or that a design, very close to the requirement exists. Therefore please check your requirements with our sales force, or our engineering staff.

Custom Designs: Spectrum Elektrotechnik GmbH has been designing and supplying special Mismatches to suit particular requirements, such as wide bandwidths, unique mechanical outline, unusual mounting or special connector requirements, etc., etc.

Operating Temperature Range: It usually ranges from -54°C to $+125^{\circ}\text{C}$, or it is even wider. The temperature range will affect the power handling of the devices.



Spectrum Elektrotechnik GmbH manufactures precision mismatches to customer specifications: To the requested mismatch value, frequency range, power limits, temperature range, connector configuration, mechanical outline, etc., etc.

INTRODUCTION: There are applications where a stationary RF line needs to be connected to a rotating component. The Rotary Joint has been developed to service these needs, translating the electromagnetic energy from a stationary line to a rotating line. As the Rotary Joint is a dynamic device, the electrical performance depends very much on a reliable mechanical design that is engineered for the satisfaction of the dynamic requirements and the RF performance. The electrical specification of the Rotary Joint is not supposed to change over its guaranteed lifetime.

The Coaxial Line Rotary Joint: The device has coaxial input and output terminals and is using a transmission path that is also a coaxial line. For the electromagnetic propagation the TEM mode is used. The unit can usually cover a wide frequency range. The power handling capability is normally only restricted by the power limits of the connectors.

The Waveguide Rotary Joint: This device is using rectangular waveguide for input and output, and for the transmission line itself. The unit operates in the TE₁₀ mode and can provide low VSWR at high power levels. As coupling for the rotation element, normally a noncontacting choke coupling is employed. The frequency band of operation is limited by the waveguide and in addition by the frequency sensitivity of the coupling choke.

The Waveguide to Coaxial Rotary Joint: For Input and output of the device rectangular waveguide is used, while the transmission line path is provided as coaxial line, connecting to the waveguide sections. The modes of operation are TE₁₀ mode in the waveguide sections and TEM in the coaxial path. The operating frequency is limited by the waveguide, the power is limited by the coaxial part.

The Rectangular to Circular Waveguide Rotary Joint: Input and output of the device are provided as rectangular waveguide, the transmission line uses circular waveguide. The modes of operation are the TE₁₀ mode in the rectangular sections and the TM₀₁ mode in the circular waveguide. As coupling for the rotation element, normally a noncontacting choke coupling is used. The frequency band of operation is limited by the waveguide and in addition by the frequency sensitivity of the coupling choke.

Frequency Range: Spectrum Elektrotechnik GmbH has manufactured units in different frequency bands, usually designed exactly to the customers' specifications. Engineering is currently designing Standard Coaxial Rotary Joints for the frequency ranges DC-2.0 GHz, DC-18.0 GHz and DC-26.5 GHz, operating in regular environment.

A rather simple design will meet all the requirements at lower frequency ranges, while only a most precise and state-of-the-art unit can be used at higher frequencies.

Rotary Joint Life: The life expectancy will mainly depend on the lifetime of the ball bearings, seals, and contact junctions. Other parameters that are limiting life, are rotational speed, and external mechanical loading, or pressurizing the unit. Harsh environment, subjecting the rotary joint to vibrations, shock, extremely low or high temperatures, humidity, etc. may further shorten the lifetime. It is therefore of utmost importance to identify in detail the environment the device is supposed to operate in.

VSWR: Every microwave component shows reflections and discontinuities within the circuit, as no design can be perfect, and manufacturing tolerances unfortunately do not allow perfect designs. VSWR is the ratio of the reflected signal and the incident signal. Rotary Joints are also characterized by the tendency of having to use a high number of parts. The tolerances on the dimensions need to be as tight as possible, not only for mechanical purposes, but also for electrical reasons, in order to assure that reflections cannot increase after some time of operation.



Spectrum Elektrotechnik GmbH manufactures coaxial rotary joints to customer specifications: To the specific frequency range, power limits, return loss, insertion loss, temperature range, rotational speed, connector configuration, mechanical outline, etc., etc.

INTRODUCTION: By integrating components, assemblies are engineered that exhibit a number of advantages against the common designs, such as reduced package size at lower cost and superior RF performance. A Supercomponent can achieve a volume reduction of 10 to 1, or even more. Electrically, the integration may result into lower transmission loss, flat attenuation and improved VSWR.

The success on integrated packaging depends on the total understanding and the control of the components that are supposed to be integrated. Spectrum Elektrotechnik GmbH has an extensive capability in a variety of passive and active components.

Modular Packaging: Spectrum Elektrotechnik GmbH has an intensive product capability in devices such as attenuators, limiters, couplers, detectors, filters, power dividers, terminations, etc. By using this specific component experience, Spectrum Elektrotechnik GmbH can produce effectively integrated packages, using stripline or microstrip circuitry.

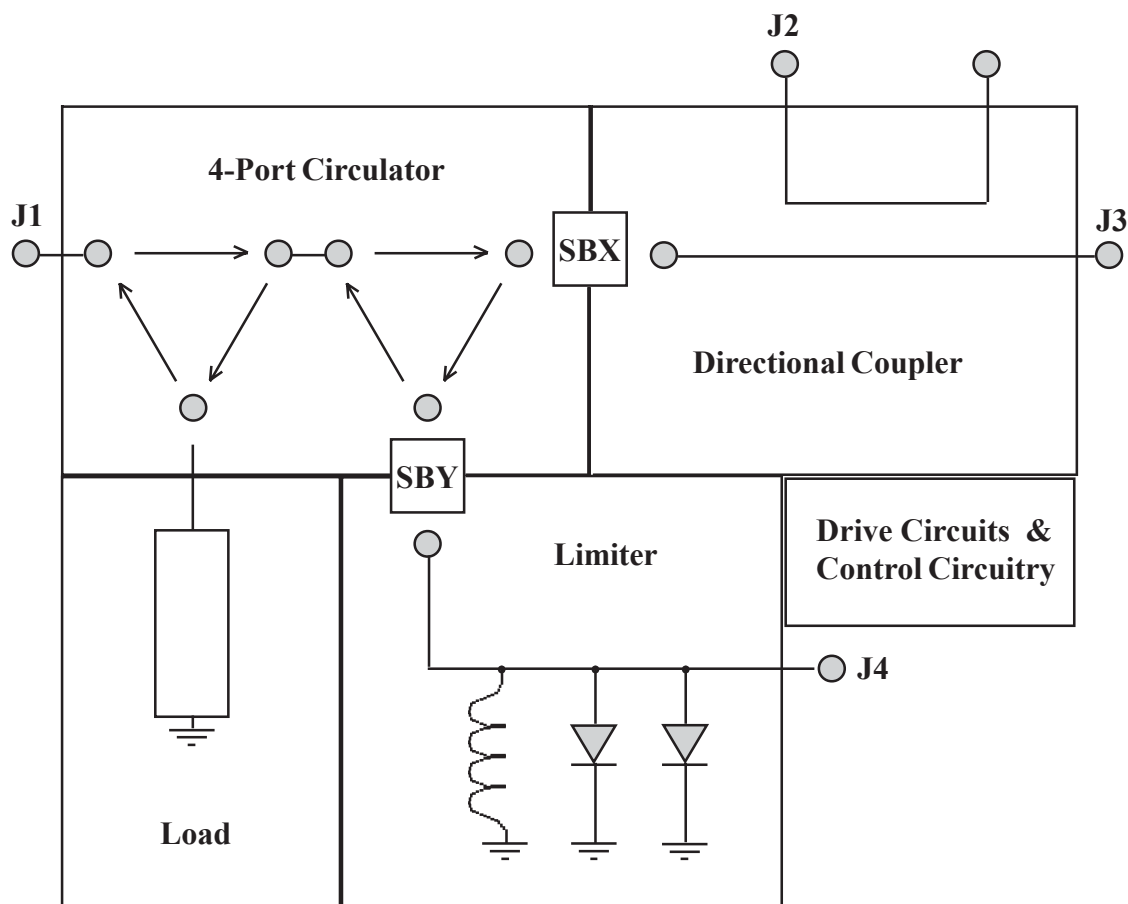
Modular Power Component Packaging : This is a higher level of components integration, in general used for higher power devices. The components or groups of components are usually interconnected by special blind mate connectors, integrated directly into the component housings. Such, the connectors can't even be seen, when the components are connected, providing shortest distance between the components, which is desirable, especially at those high power levels.

Power Interconnections: Spectrum Elektrotechnik GmbH did design and manufacture two completely new connector series, the SBX and SBY, and is offering these now to other manufacturers for modular packaging purposes. Modular Packaging means not only integration, it furthermore reserves the advantage of easy maintainability and replacement of faulty components. Spectrum Elektrotechnik GmbH has been a leader in modular integration of high power components.

Example: A High Power Duplexer in a Radar Program did consist of several individual components: a Circulator, a Load, a Directional Coupler, a Limiter and Drive Circuitry. The Components were mounted to heat sinks and interconnected by cable assemblies.

For the next generation radar Spectrum Elektrotechnik GmbH was awarded the contract for a complete redesign: The modular components were laid out densely and the package was shaped to fit into a small area. All interconnecting cable assemblies were eliminated, and replaced by using the connector series SBX and SBY. A drive circuit was added and accommodated into the limiter housing, together with an over temperature sensor circuit.

In case one of the components becomes defective, or needs to be tested or replaced, only the locking screws have to be unfastened, and the component can be removed, and replaced, within no time.



Schematic of a Super Component, consisting of Circulator, Coupler, Limiter, Load and the necessary Drive and Control Circuitry. The Component is built in a Modular Basis and is using the High Power Blind Mate Connectors of Series SBX and SBY.

Section IX

- **Glossary**
- **Part Number Index**
- **Alphabetical Index**
- **Sales Representatives**

1. Glossary	270
2. Part Number Index	272
3. Alphabetical Index	279
4. Sales Representatives	283

RF Measurement Chart



VSWR 1 + R 1 - R	Reflection Coefficient R	Return Loss (dB)	Relative to Unity Reference			
			X dB Below Reference	Ref + x (dB)	Ref - x (dB)	Ref ± x Pk to Pk Ripple (dB)
∞	1.00	0	0	-6.00	∞	∞
17.40	0.891	1	1	-5.53	19.28	24.81
8.72	0.794	2	2	-5.08	13.74	18.81
5.85	0.708	3	3	-4.65	10.69	15.34
4.42	0.631	4	4	-4.25	8.66	12.91
3.57	0.562	5	5	-3.87	7.18	11.05
3.01	0.501	6	6	-3.53	6.22	9.75
2.61	0.447	7	7	-3.21	5.14	8.35
2.32	0.398	8	8	-2.91	4.41	7.32
2.10	0.355	9	9	-2.64	3.81	6.45
1.92	0.316	10	10	-2.39	3.30	5.69
1.78	0.282	11	11	-2.16	2.88	5.03
1.67	0.251	12	12	-1.95	2.51	4.46
1.58	0.224	13	13	-1.76	2.20	3.96
1.50	0.200	14	14	-1.58	1.93	3.51
1.43	0.178	15	15	-1.42	1.70	3.12
1.38	0.159	16	16	-1.28	1.50	2.78
1.33	0.141	17	17	-1.15	1.32	2.47
1.29	0.126	18	18	-1.03	1.17	2.20
1.25	0.112	19	19	-0.92	1.03	1.96
1.22	0.100	20	20	-0.83	0.92	1.74
1.196	0.0891	21	21	-0.741	0.811	1.552
1.172	0.0794	22	22	-0.644	0.719	1.382
1.152	0.0708	23	23	-0.594	0.638	1.232
1.134	0.0631	24	24	-0.531	0.566	1.098
1.119	0.0562	25	25	-0.475	0.502	0.977
1.107	0.0501	26	26	-0.434	0.446	0.880
1.096	0.0447	27	27	-0.380	0.397	0.777
1.083	0.0398	28	28	-0.338	0.353	0.691
1.074	0.0355	29	29	-0.303	0.314	0.556
1.065	0.0316	30	30	-0.270	0.279	0.549
1.058	0.0282	31	31	-0.242	0.248	0.490
1.052	0.0251	32	32	-0.215	0.221	0.436
1.046	0.0224	33	33	-0.192	0.197	0.389
1.041	0.0200	34	34	-0.172	0.174	0.347
1.036	0.0178	35	35	-0.153	0.156	0.309
1.032	0.0159	36	36	-0.137	0.138	0.275
1.029	0.0141	37	37	-0.122	0.123	0.245
1.026	0.0126	38	38	-0.109	0.110	0.219
1.023	0.0112	39	39	-0.098	0.098	0.196
1.020	0.0100	40	40	-0.086	0.087	0.173
1.0112	0.0056	45	45	-0.049	0.049	0.097
1.0064	0.0032	50	50	-0.028	0.028	0.056
1.0036	0.0018	55	55	-0.016	0.016	0.031
1.0020	0.0010	60	60	-0.0086	0.0086	0.0172

1 centen 10 mm6

To Convert	Into	Multiply by	Conversely Multiply by
Ampere-hours (Ah)	coulombs (C)	3600	2.778×10^{-4}
Celsius (centigrade, °C)	Fahrenheit (°F)		$^{\circ}\text{C} = (^{\circ}\text{F} - 32) / 1.8$
centimeters (cm)	feet (ft)	0.03281	30.48
centimeters (cm)	inches (in)	0.3937	2.54
ergs (erg)	joules (J)	10^{-7}	10^7
Fahrenheit (°F)	Celsius (centigrade, °C)		$^{\circ}\text{F} = ^{\circ}\text{C} * 1.8 + 32$
feet (ft)	centimeters (cm)	30.48	0.03281
feet (ft)	yards (yd)	0.33333	3
gallons, US (gal)	liters (l)	3.785	0.2642
grams (g)	ounces (oz)	0.03527	28.35
horsepower (hp)	kilowatts (kW)	0.745	1.342
inches (in)	centimeters (cm)	2.54	0.3937
inches (in)	feet (ft)	0.08333	12
inch-pounds (inlbf)	newton-meters (Nm)	0.11298	8.8512
joules (J)	ergs (erg)	10^7	10^{-7}
joules (J)	kilowatt-hours (kWh)	2.778×10^{-7}	3.6×10^6
kilograms (kg m/s ²)	kilopond (kp)	0.1020	9.807
kilograms (kg)	pounds (lb)	2.205	0.4536
kilopond (kp)	kilograms (kg m/s ²)	9.807	0.1020
kilopond (Kp)	newtons (N)	9.807	0.1020
kilowatt-hours (kWh)	joules (J)	3.6×10^6	2.778×10^{-7}
kilowatts (kW)	horsepower (hp)	1.342	0.745
liters (l)	gallons, US (gal)	0.2642	3.785
meters (m)	microns [micrometer], (μm)	10^6	10^{-6}
meters (m)	miles [nautical], (nmi)	5.4×10^{-4}	1852
meters (m)	miles [statue], (mi)	6.215×10^{-4}	1609
meters (m)	mils (mil)	3.937×10^{-4}	2.54×10^{-5}
microns [micrometer], (μm)	meters (m)	10^{-6}	10^6
miles [nautical], (nmi)	meters (m)	1852	5.4×10^{-4}
miles [statue], (mi)	meters (m)	1609	6.215×10^{-4}
mils (mil)	meters (m)	2.54×10^{-5}	3.937×10^{-4}
newtons (N)	kilopond (kp)	0.1020	9.807
newtons (N)	ounces [force], (oz)	3.5968	0.2780
newtons (N)	pounds [force], (lbf)	0.2248	4.448
newton-meters (Nm)	inch-pounds (inlbf)	8.8512	0.11298
newton-meters (Nm)	ounce-inches	1.416×10^2	7.062×10^{-3}
ounces (oz)	grams (g)	28.35	0.03527
ounces [force], (oz)	newtons (N)	0.2780	3.5968
ounce-inches	newton-meters (Nm)	7.062×10^{-3}	1.416×10^2
pounds (lb)	kilograms (kg)	0.4536	2.205
pounds [force], (lbf)	newtons (N)	4.448	0.2248
yards (yd)	feet (ft)	3	0.33333

Part Number Index

Part Number	Description	Page(s)
AN-2424-21	Planar ISM Band Antenna	236 - 237
BG-M290-1500	Bolt Gauge Thread M29 x 1.5	95
BG-M700-0750	Bolt Gauge Thread M 7	95
BG-M900-0500	Bolt Gauge Thread M9 x 0.5	95
BG-Z111-28EF	Bolt Gauge Thread 7/16" - 28 UNEF	95
BG-Z159-24EF	Bolt Gauge Thread 5/8" - 24 UNEF	95
BG-Z175-24EF	Bolt Gauge Thread 11/16" - 24 UNEF	95
BG-Z190-36NS	Bolt Gauge Thread 0.19" - 36 UNS	95
BG-Z250-36NS	Bolt Gauge Thread 1/4" - 36 UNS	95
BG-Z750-20EF	Bolt Gauge Thread 3/4" - 20 UNEF	95
GG-M290-1500	"Go" Ring Gauge Thread M29 x 1.5	95
GG-M700-0750	"Go" Ring Gauge Thread M 7	95
GG-M900-0500	"Go" Ring Gauge Thread M9 x 0.5	95
GG-Z111-28EF	"Go" Ring Gauge Thread 7/16" - 28 UNEF	95
GG-Z159-24EF	"Go" Ring Gauge Thread 5/8" - 24 UNEF	95
GG-Z175-24EF	"Go" Ring Gauge Thread 11/16" - 24 UNEF	95
GG-Z190-36NS	"Go" Ring Gauge Thread 0.19" - 36 UNS	95
GG-Z250-36NS	"Go" Ring Gauge Thread 1/4" - 36 UNS	95
GG-Z750-20EF	"Go" Ring Gauge Thread 3/4" - 20 UNEF	95
GI-2400-PHHK	Connector Gauge Kit 2.4mm with 4 Hand-Held Gauges (inches, resolution K)	81
GI-2400-PMGK	Connector Gauge Kit 2.4mm with 4 "Thread-on" Gauges (inches, resolution K)	81
GI-2400-SHHK	Connector Gauge Kit 2.4mm with 2 Hand-Held Gauges (inches, resolution K)	81
GI-2400-SMGK	Connector Gauge Kit 2.4mm with 2 "Thread-on" Gauges (inches, resolution K)	81
GI-2920-PHHK	Connector Gauge Kit 2.9mm with 4 Hand-Held Gauges (inches, resolution K)	83
GI-2920-PMGK	Connector Gauge Kit 2.9mm with 4 "Thread-on" Gauges (inches, resolution K)	83
GI-2920-SHHK	Connector Gauge Kit 2.9mm with 2 Hand-Held Gauges (inches, resolution K)	83
GI-2920-SMGK	Connector Gauge Kit 2.9mm with 2 "Thread-on" Gauges (inches, resolution K)	83
GI-3500-PHHK	Connector Gauge Kit 3.5mm with 4 Hand-Held Gauges (inches, resolution K)	81
GI-3500-PMGK	Connector Gauge Kit 3.5mm with 4 "Thread-on" Gauges (inches, resolution K)	81
GI-3500-SHHK	Connector Gauge Kit 3.5mm with 2 Hand-Held Gauges (inches, resolution K)	81
GI-3500-SMGK	Connector Gauge Kit 3.5mm with 2 "Thread-on" Gauges (inches, resolution K)	81
GI-7000-SHHK	Connector Gauge Kit 7mm with 1 Hand-Held Gauge (inches, resolution K)	81
GI-7000-SMGK	Connector Gauge Kit 7mm with 1 "Thread-on" Gauge (inches, resolution K)	81
GI-7160-PHHK	Connector Gauge Kit 7/16 with 5 Hand-Held Gauges (inches, resolution K)	82
GI-7160-PMGK	Connector Gauge Kit 7/16 with 5 "Thread-on" Gauges (inches, resolution K)	82
GI-7160-SHHK	Connector Gauge Kit 7/16 with 2 Hand-Held Gauges (inches, resolution K)	82
GI-7160-SMGK	Connector Gauge Kit 7/16 with 2 "Thread-on" Gauges (inches, resolution K)	82
GI-BMA0-SHHK	Connector Gauge Kit BMA with 2 Hand-Held Gauges (inches, resolution K)	82
GI-BNC0-PHHK	Connector Gauge Kit BNC with 5 Hand-Held Gauges (inches, resolution K)	82
GI-BNC0-SHHK	Connector Gauge Kit BNC with 2 Hand-Held Gauges (inches, resolution K)	82
GI-C000-PHHK	Connector Gauge Kit C with 5 Hand-Held Gauges (inches, resolution K)	82
GI-C000-SHHK	Connector Gauge Kit C with 2 Hand-Held Gauges (inches, resolution K)	82
GI-HN00-PHHK	Connector Gauge Kit HN with 3 Hand-Held Gauges (inches, resolution K)	83
GI-HN00-PMGK	Connector Gauge Kit HN with 3 "Thread-on" Gauges (inches, resolution K)	83
GI-HN00-SHHK	Connector Gauge Kit HN with 2 Hand-Held Gauges (inches, resolution K)	83
GI-HN00-SMGK	Connector Gauge Kit HN with 2 "Thread-on" Gauges (inches, resolution K)	83
GI-N000-PHHK	Connector Gauge Kit N with 4 Hand-Held Gauges (inches, resolution K)	84
GI-N000-PMGK	Connector Gauge Kit N with 4 "Thread-on" Gauges (inches, resolution K)	84
GI-N000-SHHK	Connector Gauge Kit N with 2 Hand-Held Gauges (inches, resolution K)	84
GI-N000-SMGK	Connector Gauge Kit N with 2 "Thread-on" Gauges (inches, resolution K)	84
GI-N750-PHHK	Connector Gauge Kit N 75 Ohms with 4 Hand-Held Gauges (inches, resolution K)	84
GI-N750-PMGK	Connector Gauge Kit N 75 Ohms with 4 "Thread-on" Gauges (inches, resolution K)	84
GI-N750-SHHK	Connector Gauge Kit N 75 Ohms with 2 Hand-Held Gauges (inches, resolution K)	84
GI-N750-SMGK	Connector Gauge Kit N 75 Ohms with 2 "Thread-on" Gauges (inches, resolution K)	84
GI-SBX0-PHHK	Connector Gauge Kit SBX with 4 Hand-Held Gauges (inches, resolution K)	84
GI-SBX0-SHHK	Connector Gauge Kit SBX with 2 Hand-Held Gauges (inches, resolution K)	84
GI-SBY0-PHHK	Connector Gauge Kit SBY with 4 Hand-Held Gauges (inches, resolution K)	85
GI-SBY0-SHHK	Connector Gauge Kit SBY with 2 Hand-Held Gauges (inches, resolution K)	85
GI-SC00-PHHK	Connector Gauge Kit SC with 6 Hand-Held Gauges (inches, resolution K)	85
GI-SC00-PMGK	Connector Gauge Kit SC with 6 "Thread-on" Gauges (inches, resolution K)	85
GI-SC00-SHHK	Connector Gauge Kit SC with 2 Hand-Held Gauges (inches, resolution K)	85
GI-SC00-SMGK	Connector Gauge Kit SC with 2 "Thread-on" Gauges (inches, resolution K)	85
GI-SMA0-PHHK	Connector Gauge Kit SMA with 6 Hand-Held Gauges (inches, resolution K)	85
GI-SMA0-PMGK	Connector Gauge Kit SMA with 6 "Thread-on" Gauges (inches, resolution K)	85
GI-SMA0-SHHK	Connector Gauge Kit SMA with 4 Hand-Held Gauges (inches, resolution K)	85
GI-SMA0-SMGK	Connector Gauge Kit SMA with 4 "Thread-on" Gauges (inches, resolution K)	85
GI-SSMA-SHHK	Connector Gauge Kit SSMA with 4 Hand-Held Gauges (inches, resolution K)	86
GI-SSMA-SMGK	Connector Gauge Kit SSMA with 4 "Thread-on" Gauges (inches, resolution K)	86
GI-SMP0-SHHK	Connector Gauge Kit SMP with 3 Hand-Held Gauges (inches, resolution K)	86
GI-SMPT-SHHK	Connector Gauge Kit SMP Test Connector with 4 Hand-Held Gauges (inches, resolution K)	86
GI-SMPT-SMGK	Connector Gauge Kit SMP Test with 4 "Thread-on" Gauges (inches, resolution K)	86
GI-SPM0-PHHK	Connector Gauge Kit SPM with 6 Hand-Held Gauges (inches, resolution K)	86
GI-SPM0-PMGK	Connector Gauge Kit SPM with 6 "Thread-on" Gauges (inches, resolution K)	86
GI-SPM0-SHHK	Connector Gauge Kit SPM with 4 Hand-Held Gauges (inches, resolution K)	86
GI-SPM0-SMGK	Connector Gauge Kit SPM with 4 "Thread-on" Gauges (inches, resolution K)	86
GI-TNC3-PHHK	Connector Gauge Kit TNC (MIL-C-39012) with 6 Hand-Held Gauges (inches, resolution K)	87
GI-TNC3-PMGK	Connector Gauge Kit TNC (MIL-C-39012) with 6 "Thread-on" Gauges (inches, resolution K)	87
GI-TNC3-SHHK	Connector Gauge Kit TNC (MIL-C-39012) with 2 Hand-Held Gauges (inches, resolution K)	87
GI-TNC3-SMGK	Connector Gauge Kit TNC (MIL-C-39012) with 2 "Thread-on" Gauges (inches, resolution K)	87

Part Number	Description	Page(s)
GI-TNC8-PHHK	Connector Gauge Kit TNC (MIL-C-87104/2) with 6 Hand-Held Gauges (inches, resolution K)	87
GI-TNC8-PMGK	Connector Gauge Kit TNC (MIL-C-87104/2) with 6 "Thread-on" Gauges (inches, resolution K)	87
GI-TNC8-SHHK	Connector Gauge Kit TNC (MIL-C-87104/2) with 2 Hand-Held Gauges (inches, resolution K)	87
GI-TNC8-SMGK	Connector Gauge Kit TNC (MIL-C-87104/2) with 2 "Thread-on" Gauges (inches, resolution K)	87
GI-TNX0-PHHK	Connector Gauge Kit TNX with 5 Hand-Held Gauges (inches, resolution K)	88
GI-TNX0-PMGK	Connector Gauge Kit TNX with 5 "Thread-on" Gauges (inches, resolution K)	88
GI-TNX0-SHHK	Connector Gauge Kit TNX with 2 Hand-Held Gauges (inches, resolution K)	88
GI-TNX0-SMGK	Connector Gauge Kit TNX with 2 "Thread-on" Gauges (inches, resolution K)	88
GM-2400-PHHK	Connector Gauge Kit 2.4mm with 4 Hand-Held Gauges (metric, resolution K)	81
GM-2400-PMGK	Connector Gauge Kit 2.4mm with 4 "Thread-on" Gauges (metric, resolution K)	81
GM-2400-SHHK	Connector Gauge Kit 2.4mm with 2 Hand-Held Gauges (metric, resolution K)	81
GM-2400-SMGK	Connector Gauge Kit 2.4mm with 2 "Thread-on" Gauges (metric, resolution K)	81
GM-2920-PHHK	Connector Gauge Kit 2.9mm with 4 Hand-Held Gauges (metric, resolution K)	83
GM-2920-PMGK	Connector Gauge Kit 2.9mm with 4 "Thread-on" Gauges (metric, resolution K)	83
GM-2920-SHHK	Connector Gauge Kit 2.9mm with 2 Hand-Held Gauges (metric, resolution K)	83
GM-2920-SMGK	Connector Gauge Kit 2.9mm with 2 "Thread-on" Gauges (metric, resolution K)	83
GM-3500-PHHK	Connector Gauge Kit 3.5mm with 4 Hand-Held Gauges (metric, resolution K)	81
GM-3500-PMGK	Connector Gauge Kit 3.5mm with 4 "Thread-on" Gauges (metric, resolution K)	81
GM-3500-SHHK	Connector Gauge Kit 3.5mm with 2 Hand-Held Gauges (metric, resolution K)	81
GM-3500-SMGK	Connector Gauge Kit 3.5mm with 2 "Thread-on" Gauges (metric, resolution K)	81
GM-7000-SHHK	Connector Gauge Kit 7mm with 1 Hand-Held Gauge (metric, resolution K)	81
GM-7000-SMGK	Connector Gauge Kit 7mm with 1 "Thread-on" Gauge (metric, resolution K)	81
GM-7160-PHHK	Connector Gauge Kit 7/16 with 5 Hand-Held Gauges (metric, resolution K)	82
GM-7160-PMGK	Connector Gauge Kit 7/16 with 5 "Thread-on" Gauges (metric, resolution K)	82
GM-7160-SHHK	Connector Gauge Kit 7/16 with 2 Hand-Held Gauges (metric, resolution K)	82
GM-7160-SMGK	Connector Gauge Kit 7/16 with 2 "Thread-on" Gauges (metric, resolution K)	82
GM-BMA0-SHHK	Connector Gauge Kit BMA with 2 Hand-Held Gauges (metric, resolution K)	82
GM-BNC0-PHHK	Connector Gauge Kit BNC with 5 Hand-Held Gauges (metric, resolution K)	82
GM-BNC0-SHHK	Connector Gauge Kit BNC with 2 Hand-Held Gauges (metric, resolution K)	82
GM-C000-PHHK	Connector Gauge Kit C with 5 Hand-Held Gauges (metric, resolution K)	82
GM-C000-SHHK	Connector Gauge Kit C with 2 Hand-Held Gauges (metric, resolution K)	82
GM-HN00-PHHK	Connector Gauge Kit HN with 3 Hand-Held Gauges (metric, resolution K)	83
GM-HN00-PMGK	Connector Gauge Kit HN with 3 "Thread-on" Gauges (metric, resolution K)	83
GM-HN00-SHHK	Connector Gauge Kit HN with 2 Hand-Held Gauges (metric, resolution K)	83
GM-HN00-SMGK	Connector Gauge Kit HN with 2 "Thread-on" Gauges (metric, resolution K)	83
GM-N000-PHHK	Connector Gauge Kit N with 4 Hand-Held Gauges (metric, resolution K)	84
GM-N000-PMGK	Connector Gauge Kit N with 4 "Thread-on" Gauges (metric, resolution K)	84
GM-N000-SHHK	Connector Gauge Kit N with 2 Hand-Held Gauges (metric, resolution K)	84
GM-N000-SMGK	Connector Gauge Kit N with 2 "Thread-on" Gauges (metric, resolution K)	84
GM-N750-PHHK	Connector Gauge Kit N 75 Ohms with 4 Hand-Held Gauges (metric, resolution K)	84
GM-N750-PMGK	Connector Gauge Kit N 75 Ohms with 4 "Thread-on" Gauges (metric, resolution K)	84
GM-N750-SHHK	Connector Gauge Kit N 75 Ohms with 2 Hand-Held Gauges (metric, resolution K)	84
GM-N750-SMGK	Connector Gauge Kit N 75 Ohms with 2 "Thread-on" Gauges (metric, resolution K)	84
GM-SBX0-PHHK	Connector Gauge Kit SBX with 4 Hand-Held Gauges (metric, resolution K)	84
GM-SBX0-SHHK	Connector Gauge Kit SBX with 2 Hand-Held Gauges (metric, resolution K)	84
GM-SBY0-PHHK	Connector Gauge Kit SBY with 4 Hand-Held Gauges (metric, resolution K)	85
GM-SBY0-SHHK	Connector Gauge Kit SBY with 2 Hand-Held Gauges (metric, resolution K)	85
GM-SC00-PHHK	Connector Gauge Kit SC with 6 Hand-Held Gauges (metric, resolution K)	85
GM-SC00-PMGK	Connector Gauge Kit SC with 6 "Thread-on" Gauges (metric, resolution K)	85
GM-SC00-SHHK	Connector Gauge Kit SC with 2 Hand-Held Gauges (metric, resolution K)	85
GM-SC00-SMGK	Connector Gauge Kit SC with 2 "Thread-on" Gauges (metric, resolution K)	85
GM-SMA0-PHHK	Connector Gauge Kit SMA with 6 Hand-Held Gauges (metric, resolution K)	85
GM-SMA0-PMGK	Connector Gauge Kit SMA with 6 "Thread-on" Gauges (metric, resolution K)	85
GM-SMA0-SHHK	Connector Gauge Kit SMA with 4 Hand-Held Gauges (metric, resolution K)	85
GM-SMA0-SMGK	Connector Gauge Kit SMA with 4 "Thread-on" Gauges (metric, resolution K)	85
GM-SSMA-SHHK	Connector Gauge Kit SSMA with 4 Hand-Held Gauges (metric, resolution K)	86
GM-SSMA-SMGK	Connector Gauge Kit SSMA with 4 "Thread-on" Gauges (metric, resolution K)	86
GM-SMP0-SHHK	Connector Gauge Kit SMP with 3 Hand-Held Gauges (metric, resolution K)	86
GM-SMPT-SHHK	Connector Gauge Kit SMP Test Connector with 4 Hand-Held Gauges (metric, resolution K)	86
GM-SMPT-SMGK	Connector Gauge Kit SMP Test with 4 "Thread-on" Gauges (metric, resolution K)	86
GM-SPM0-PHHK	Connector Gauge Kit SPM with 6 Hand-Held Gauges (metric, resolution K)	86
GM-SPM0-PMGK	Connector Gauge Kit SPM with 6 "Thread-on" Gauges (metric, resolution K)	86
GM-SPM0-SHHK	Connector Gauge Kit SPM with 4 Hand-Held Gauges (metric, resolution K)	86
GM-SPM0-SMGK	Connector Gauge Kit SPM with 4 "Thread-on" Gauges (metric, resolution K)	86
GM-TNC3-PHHK	Connector Gauge Kit TNC (MIL-C-39012) with 6 Hand-Held Gauges (metric, resolution K)	87
GM-TNC3-PMGK	Connector Gauge Kit TNC (MIL-C-39012) with 6 "Thread-on" Gauges (metric, resolution K)	87
GM-TNC3-SHHK	Connector Gauge Kit TNC (MIL-C-39012) with 2 Hand-Held Gauges (metric, resolution K)	87
GM-TNC3-SMGK	Connector Gauge Kit TNC (MIL-C-39012) with 2 "Thread-on" Gauges (metric, resolution K)	87
GM-TNC8-PHHK	Connector Gauge Kit TNC (MIL-C-87104/2) with 6 Hand-Held Gauges (metric, resolution K)	87
GM-TNC8-PMGK	Connector Gauge Kit TNC (MIL-C-87104/2) with 6 "Thread-on" Gauges (metric, resolution K)	87
GM-TNC8-SHHK	Connector Gauge Kit TNC (MIL-C-87104/2) with 2 Hand-Held Gauges (metric, resolution K)	87
GM-TNC8-SMGK	Connector Gauge Kit TNC (MIL-C-87104/2) with 2 "Thread-on" Gauges (metric, resolution K)	87
GM-TNX0-PHHK	Connector Gauge Kit TNX with 5 Hand-Held Gauges (metric, resolution K)	88
GM-TNX0-PMGK	Connector Gauge Kit TNX with 5 "Thread-on" Gauges (metric, resolution K)	88
GM-TNX0-SHHK	Connector Gauge Kit TNX with 2 Hand-Held Gauges (metric, resolution K)	88
GM-TNX0-SMGK	Connector Gauge Kit TNX with 2 "Thread-on" Gauges (metric, resolution K)	88
LG-M290-1500	Instrument Case Thread M29 x 1.5	95
LG-M700-0500	Instrument Case Thread M7	95
LG-M900-0500	Instrument Case Thread M9 x 0.5	95

Part Number Index



Part Number	Description	Page(s)
LG-Z111-28EF	Instrument Case Thread 7/16" - 28 UNEF	95
LG-Z159-24EF	Instrument Case Thread 5/8" - 24 UNEF	95
LG-Z175-24EF	Instrument Case Thread 11/16" - 24 UNEF	95
LG-Z190-36NS	Instrument Case Thread 0.19" - 36 UNS	95
LG-Z250-36NS	Instrument Case Thread 1/4" - 36 UNS	95
LG-Z750-20EF	Instrument Case Thread 3/4" - 20 UNEF	95
NG-M290-1500	"No-Go" Ring Gauge Thread M29 x 1.5	95
NG-M700-0750	"No-Go" Ring Gauge Thread M 7	95
NG-M900-0500	"No-Go" Ring Gauge Thread M9 x 0.5	95
NG-Z111-28EF	"No-Go" Ring Gauge Thread 7/16" - 28 UNEF	95
NG-Z159-24EF	"No-Go" Ring Gauge Thread 5/8" - 24 UNEF	95
NG-Z175-24EF	"No-Go" Ring Gauge Thread 11/16" - 24 UNEF	95
NG-Z190-36NS	"No-Go" Ring Gauge Thread 0.19" - 36 UNS	95
NG-Z250-36NS	"No-Go" Ring Gauge Thread 1/4" - 36 UNS	95
NG-Z750-20EF	"No-Go" Ring Gauge Thread 3/4" - 20 UNEF	95
SET7-MINI-S1	Adapter Set - Between Series Kit 7mm	234
SET7-MINI-S2	Adapter Set - Between Series Kit 7mm	234
SET7-TNCN-S1	Adapter Set - Between Series Kit 7mm	234
SET7-UNIV-S1	Adapter Set - Between Series Kit 7mm	234
SET8-TSMA-S1	Adapter Set - Between Series Kit BNC	234
SETN-MINI-S1	Adapter Set - Between Series Kit Type N	234
SETN-TTNC-S1	Adapter Set - Between Series Kit N-TNC	234
SETN-TYPN-S1	Adapter Set - In-Series Kit Type N	234
SETS-TSMA-S1	Adapter Set - In-Series Kit Type SMA	234
SETT-TSMA-S1	Adapter Set - Between Series Kit TNC-SMA	234
SETT-TTNC-S1	Adapter Set - In-Series Kit Type TNC	234
SQ - 8BFJ	SQ - 8 Bulkhead Feedthrough Jack (RF-Multipin Connector)	185
SQ - 8FMJ	SQ - 8 4 - Hole Flange Mount (RF-Multipin Connector)	185
SQ - 8MLE	SQ - 8 Male Cable Connector (RF-Multipin Connector)	185
SQ - 8	SQ - 8 RF - Insert Female	186
SQ - 8	SQ - 8 RF - Insert Male	186
TE-0004-71P1	High Precision Coaxial Termination BNC Male	57
TE-0004-81P1	High Precision Coaxial Termination BNC Female	57
TE-0004-91P1	High Precision Coaxial Termination 3.5mm Male	51
TE-0004-92P1	High Precision Coaxial Termination 3.5mm Female	51
TE-0010-79P1	High Precision Coaxial Termination SC Female	63
TE-0010-80P1	High Precision Coaxial Termination SC Male	63
TE-0010-7501	Coaxial Termination 7/16 Male	55
TE-0010-7601	Coaxial Termination 7/16 Female	55
TE-0018-TJ01	Coaxial Termination SMP Test Component Male	67
TE-0018-TP01	Coaxial Termination SMP Test Component Female	67
TE-0018-PJ00	Coaxial Termination SPM Female	69
TE-0018-PM00	Coaxial Termination SPM Male	69
TE-0018-31P1	High Precision Coaxial Termination TNC Male	71
TE-0018-3900	Coaxial Termination TNX Male	73
TE-0018-41P1	High Precision Coaxial Termination TNC Female	71
TE-0018-4900	Coaxial Termination TNX Female	73
TE-0018-51P1	High Precision Coaxial Termination N Male	61
TE-0018-61P1	High Precision Coaxial Termination N Female	61
TE-0018-90P1	High Precision Coaxial Termination 7mm	53
TE-0020-1100	Coaxial Termination SMA Male	65
TE-0020-21P0	High Precision Coaxial Termination SMA Female	65
TE-0026-91P1	High Precision Coaxial Termination 3.5mm Male	51
TE-0026-92P1	High Precision Coaxial Termination 3.5mm Female	51
TE-0035-9100	High Precision Coaxial Termination 3.5mm Male	51
TE-0035-9200	High Precision Coaxial Termination 3.5mm Female	51
TE-0040-KF00	High Precision Coaxial Termination K* Female	59
TE-0040-KM00	High Precision Coaxial Termination K* Male	59
TE-0040-TJ01	Coaxial Termination SMP Test Component Male	67
TE-0040-TP01	Coaxial Termination SMP Test Component Female	67
TE-0050-HF00	High Precision Coaxial Termination 2.4mm Female	49
TE-0050-HM00	High Precision Coaxial Termination 2.4mm Male	49
WE - BE01	Torque Wrench "Fully Breaks" for Spectrum's Interchangeable Connector	92
WE - B100	Torque Wrench "Fully Breaks" for Connector Type 3.5mm, K* and SMA	92
WE - B101	Torque Wrench "Fully Breaks" for Connector Type N (Size 11/16")	92
WE - B102	Torque Wrench "Fully Breaks" for Connector Type TNC	92
WE - B103	Torque Wrench "Fully Breaks" for Connector Type 3.5mm, K* and SMA all with Maxi Nut	92
WE - B105	Torque Wrench "Fully Breaks" for Connector Type N (Size 3/4")	92
WE - B106	Torque Wrench "Fully Breaks" for Connector Type SSMA	92
WE - B107	Torque Wrench "Fully Breaks" for Connector Type 7mm	92
WE - B108	Torque Wrench "Fully Breaks" for Connector Type 2.4mm	92
WE - B109	Torque Wrench "Fully Breaks" for Connector Type SMP Calibration Components	92
WE - B111	Torque Wrench "Fully Breaks" for Connector Type SC	92
WE - B112	Torque Wrench "Fully Breaks" for Connector Type TNX	92
WE - B113	Torque Wrench "Fully Breaks" for Connector Type SPM	92
WE - B114	Torque Wrench "Fully Breaks" for Connector Type NMD 2.9mm and NMD 3.5mm	92
WE - B115	Torque Wrench "Fully Breaks" for Connector Type NMD 2.4mm	92
WE - B116	Torque Wrench "Fully Breaks" for Connector Type HN	92
WE - B117	Torque Wrench "Fully Breaks" for Connector Type 2.4mm Maxi Nut	92

Part Number	Description	Page(s)
WE - DE01	Torque Wrench "Break Point" for Interchangeable Connector	92
WE - D100	Torque Wrench "Break Point" for Connector Type 3.5mm, K* and SMA	92
WE - D101	Torque Wrench "Break Point" for Connector Type N (Size 11/16")	92
WE - D102	Torque Wrench "Break Point" for Connector Type TNC	92
WE - D103	Torque Wrench "Break Point" for Connector Type 3.5mm, K* and SMA all with Maxi Nut	92
WE - D105	Torque Wrench "Break Point" for Connector Type N (Size 3/4")	92
WE - D106	Torque Wrench "Break Point" for Connector Type SSMA	92
WE - D107	Torque Wrench "Break Point" for Connector Type 7mm	92
WE - D108	Torque Wrench "Break Point" for Connector Type 2.4mm	92
WE - D109	Torque Wrench "Break Point" for Connector Type SMP Calibration Components	92
WE - D111	Torque Wrench "Break Point" for Connector Type SC	92
WE - D112	Torque Wrench "Break Point" for Connector Type TNX	92
WE - D113	Torque Wrench "Break Point" for Connector Type SPM	92
WE - D114	Torque Wrench "Break Point" for Connector Type NMD 2.9mm and NMD 3.5mm	92
WE - D115	Torque Wrench "Break Point" for Connector Type NMD 2.4mm	92
WE - D116	Torque Wrench "Break Point" for Connector Type HN	92
WE - D117	Torque Wrench "Break Point" for Connector Type 2.4mm Maxi Nut	92
1130-1101-02	Short Circuit Termination SMP Male	67
1130-1102-02	Short Circuit Termination SMP Male	67
1130-2101-02	Short Circuit Termination SMP Female	67
1130-2102-02	Short Circuit Termination SMP Female	67
1140-1102-02	Open Circuit Termination SMP Male	67
1140-1104-02	Open Circuit Termination SMP Male	67
1140-2102-02	Open Circuit Termination SMP Female	67
1140-2104-02	Open Circuit Termination SMP Female	67
1530-1101-02	Short Circuit Termination K* Male	59
1530-2101-02	Short Circuit Termination K* Female	59
1540-1101-02	Open Circuit Termination K* Male	59
1540-2101-02	Open Circuit Termination K* Female	59
1730-1102-02	Short Circuit Termination 2.4mm Male	49
1730-2102-02	Short Circuit Termination 2.4mm Female	49
1740-1102-02	Open Circuit Termination 2.4mm Male	49
1740-2102-02	Open Circuit Termination 2.4mm Female	49
2015-E110-02	Interchangeable Connector SMA Male Maxi Nut	158, 159
2015-E210-02	Interchangeable Connector SMA Female	158, 159
2130-1102-02	Short Circuit Termination 3.5mm Male	51, 65
2130-2102-02	Short Circuit Termination 3.5mm Female	51, 65
2140-1102-02	Open Circuit Termination 3.5mm Male	51, 65
2140-2102-02	Open Circuit Termination 3.5mm Female	51, 65
2530-1101-02	Short Circuit Termination SPM Male	69
2530-2101-02	Short Circuit Termination SPM Female	69
2540-1101-02	Open Circuit Termination SPM Male	69
2540-2101-02	Open Circuit Termination SPM Female	69
3015-E110-02	Interchangeable Connector N Male	158, 159
3015-E210-02	Interchangeable Connector N Female	158, 159
3015-E211-02	Interchangeable Connector N Female Short version	158, 159
3030-1102-02	Short Circuit Termination N Male	61
3030-2102-02	Short Circuit Termination N Female	61
3040-1102-02	Open Circuit Termination N Male	61
3040-2102-02	Open Circuit Termination N Female	61
3930-1101-02	Short Circuit Termination TNX Male	73
3930-2101-02	Short Circuit Termination TNX Female	73
3940-1101-02	Open Circuit Termination TNX Male	73
3940-2101-02	Open Circuit Termination TNX Female	73
4015-E110-02	Interchangeable Connector TNC Male	158, 159
4015-E210-02	Interchangeable Connector TNC Female	158, 159
4030-1102-02	Short Circuit Termination TNC Male	71
4030-2102-02	Short Circuit Termination TNC Female	71
4040-1102-02	Open Circuit Termination TNC Male	71
4040-2102-02	Open Circuit Termination TNC Female	71
4130-1101-02	Short Circuit Termination BNC Male	57
4130-2101-02	Short Circuit Termination BNC Female	57
4140-1101-02	Open Circuit Termination BNC Male	57
4140-2101-02	Open Circuit Termination BNC Female	57
6030-1101-02	Short Circuit Termination SC Male	63
6030-2101-02	Short Circuit Termination SC Female	63
6040-1101-02	Open Circuit Termination SC Male	63
6040-2101-02	Open Circuit Termination SC Female	63
7530-1101-02	Short Circuit Termination 7/16 Male	55
7530-2101-02	Short Circuit Termination 7/16 Female	55
7540-1101-02	Open Circuit Termination 7/16 Male	55
7540-2101-02	Open Circuit Termination 7/16 Female	55
8001-BMND-02	Test Port Adapter BMA Male to N NMD	118, 144
8001-BM51-02	Adapter BMA Male to Adapter N Male (Between Series)	106, 108
8001-BM61-02	Adapter BMA Male to Adapter N Female (Between Series)	106, 108
8001-BWND-02	Test Port Adapter BMA Female to N NMD	118, 144
8001-BW51-02	Adapter BMA Female to Adapter N Male (Between Series)	106, 108
8001-BW61-02	Adapter BMA Female to Adapter N Female (Between Series)	106, 108
8001-HF51-02	Adapter N Male to Adapter 2.4mm Female (Between Series)	104, 107

Part Number Index



Part Number	Description	Page(s)
8001-HF61-02	Adapter 2.4mm Female to N Female	104 - 107
8001-HFH2-02	HP Test Port Adapter 2.4mm Female to 2.4mm Female	116, 122
8001-HFH3-02	HP Test Port Adapter 2.4mm Female to 3.5mm Female	116, 126
8001-HFND-02	Test Port Adapter 2.4mm Female to N NMD	118, 142
8001-HF90-02	Adapter 2.4mm Female to 7mm	104, 105
8001-HF96-02	Test Port Adapter 2.4mm Female to 7mm	117, 130
8001-HFWI-02	Wiltron Test Port Adapter 2.4mm Female to K* Female	119, 138
8001-HMH2-02	HP Test Port Adapter 2.4mm Male to 2.4mm Female	116, 122
8001-HMH3-02	HP Test Port Adapter 2.4mm Male to 3.5mm Female	116, 126
8001-HM51-02	Adapter 2.4mm Male to N Male	104, 107
8001-HM61-02	Adapter 2.4mm Male to N Female	104, 107
8001-HM90-02	Adapter 2.4mm Male to 7mm	104, 105
8001-HM96-02	Adapter 2.4mm Male to 7mm (6 slots)	117, 130
8001-HMND-02	Test Port Adapter 2.4mm Male to N NMD	118, 142
8001-HMWI-02	Wiltron Test Port Adapter 2.4mm Male to K* Female	119, 138
8001-H2KF-02	HP Test Port Adapter 2.4mm Female to K* Female	116, 123
8001-H2KM-02	HP Test Port Adapter 2.4mm Female to K* Male	116, 123
8001-H251-02	HP Test Port Adapter 2.4mm Female to N Male	116, 124
8001-H261-02	HP Test Port Adapter 2.4mm Female to N Female	116, 124
8001-H291-02	HP Test Port Adapter 2.4mm Female to 3.5mm Male	116, 122
8001-H292-02	HP Test Port Adapter 2.4mm Female to 3.5mm Female	116, 122
8001-H296-02	HP Test Port Adapter 2.4mm Female to 7mm	116, 122
8001-H3KF-02	HP Test Port Adapter 3.5mm Female to K* Female	116, 128
8001-H3KM-02	HP Test Port Adapter 3.5mm Female to K* Male	116, 128
8001-H351-02	HP Test Port Adapter 3.5mm Female to N Male	116, 128
8001-H361-02	HP Test Port Adapter 3.5mm Female to N Female	116, 128
8001-H391-02	HP Test Port Adapter 3.5mm Female to 3.5mm Male	116, 127
8001-H392-02	HP Test Port Adapter 3.5mm Female to 3.5mm Female	116, 126
8001-H396-02	HP Test Port Adapter 3.5mm Female to 7mm	116, 127
8001-KFMJ-02	Adapter K* Female to SMP Male	107, 111
8001-KFMP-02	Adapter K* Female to SMP Female	107, 111
8001-KFND-02	Test Port Adapter K* Female to N NMD	118, 146
8001-KFWI-02	Wiltron Test Port Adapter K* Female to K* Female	119, 139
8001-KF51-02	Adapter N Male to K* Female	107, 108
8001-KF61-02	Adapter N Female to K* Female	107, 108
8001-KF96-02	Test Port Adapter K* Female to 7mm	117, 132
8001-KMMJ-02	Adapter K* Male to SMP Male	107, 111
8001-KMMP-02	Adapter K* Male to SMP Female	107, 111
8001-KMND-02	Test Port Adapter K* Male to N NMD	118, 146
8001-KMWI-02	Wiltron Test Port Adapter K* Male to K* Female	119, 139
8001-KM51-02	Adapter N Male to K* Male	107, 108
8001-KM61-02	Adapter N Female to K* Male	107, 108
8001-KM96-02	Test Port Adapter K* Male to 7mm	117, 132
8001-MJ90-02	Adapter SMP Male to 7mm	105, 111
8001-MJ96-02	Test Port Adapter SMP Male to 7mm	117, 134
8001-MP90-02	Adapter SMP Female to 7mm	105, 111
8001-MP96-02	Test Port Adapter SMP Female to 7mm	117, 134
8001-NDXF-02	Test Port Adapter SBX Female to N NMD	118, 148
8001-NDXM-02	Test Port Adapter SBX Male to N NMD	118, 148
8001-NDYF-02	Test Port Adapter SBY Female to N NMD	118, 149
8001-NDYM-02	Test Port Adapter SBY Male to N NMD	118, 149
8001-ND03-02	Test Port Adapter 1.4/4.4 to N NMD	118, 142
8001-ND11-02	Test Port Adapter SMA Male to N NMD	119, 150
8001-ND21-02	Test Port Adapter SMA Female to N NMD	119, 150
8001-ND31-02	Test Port Adapter TNC Male to N NMD	119, 151
8001-ND39-02	Test Port Adapter TNX Male to N NMD	119, 150
8001-ND41-02	Test Port Adapter TNC Female to N NMD	119, 150
8001-ND49-02	Test Port Adapter TNX Female to N NMD	119, 151
8001-ND51-02	Test Port Adapter N Male to N NMD	118, 148
8001-ND61-02	Test Port Adapter N Female to N NMD	118, 147
8001-ND68-02	Test Port Adapter HN Female to N NMD	118, 146
8001-ND69-02	Test Port Adapter HN Male to N NMD	118, 146
8001-ND71-02	Test Port Adapter BNC Male to N NMD	118, 145
8001-ND75-02	Test Port Adapter 7/16 Male to N NMD	118, 144
8001-ND76-02	Test Port Adapter 7/16 Female to N NMD	118, 144
8001-ND79-02	Test Port Adapter SC Female to N NMD	119, 149
8001-ND80-02	Test Port Adapter SC Male to N NMD	119, 149
8001-ND81-02	Test Port Adapter BNC Female to N NMD	118, 145
8001-ND88-02	Test Port Adapter C Male to N NMD	118, 145
8001-ND89-02	Test Port Adapter C Female to N NMD	118, 145
8001-ND91-02	Test Port Adapter 3.5mm Male to N NMD	118, 143
8001-ND92-02	Test Port Adapter 3.5mm Female to N NMD	118, 143
8001-ND96-02	Test Port Adapter N NMD to 7mm	118, 143
8001-S001-02	Charged Device Model - Probe	241
8001-S002-02	Charged Device Model - Probe Test Adapter	241
8001-S003-02	Charged Device Model - Mounting Plate for CDM Probe	241
8001-TJ96-02	Test Port Adapter 7mm to SMP Male Test Connector	117, 135
8001-TP96-02	Test Port Adapter 7mm to SMP Female Test Connector	117, 135
8001-WI51-02	Wiltron Test Port Adapter K* Female to N Male	119, 140

Part Number	Description	Page(s)
8001-WI61-02	Wiltron Test Port Adapter K* Female to N Female	119, 140
8001-WI91-02	Wiltron Test Port Adapter 3.5mm Male to K* Female	119, 138
8001-WI92-02	Wiltron Test Port Adapter 3.5mm Female to K* Female	119, 138
8001-WI96-02	Wiltron Test Port Adapter K* Female to 7mm	119, 139
8001-XF11-02	Adapter SBX Female to SMA Male	109, 110
8001-XF21-02	Adapter SBX Female to SMA Female	109, 110
8001-XF51-02	Adapter SBX Female to N Male	108, 109
8001-XF61-02	Adapter SBX Female to N Female	108, 109
8001-XF75-02	Adapter SBX Female to 7/16 Male	105, 109
8001-XF76-02	Adapter SBX Female to 7/16 Female	105, 109
8001-XM11-02	Adapter SBX Male to SMA Male	109, 110
8001-XM21-02	Adapter SBX Male to SMA Female	109, 110
8001-XM51-02	Adapter SBX Male to N Male	108, 109
8001-XM61-02	Adapter SBX Male to N Female	108, 109
8001-XM75-02	Adapter SBX Male to 7/16 Male	105, 109
8001-XM76-02	Adapter SBX Male to 7/16 Female	105, 109
8001-YF11-02	Adapter SBY Female to SMA Male	109, 110
8001-YF21-02	Adapter SBY Female to SMA Female	109, 110
8001-YF51-02	Adapter SBY Female to N Male	108, 109
8001-YF61-02	Adapter SBY Female to N Female	108, 109
8001-YF75-02	Adapter SBY Female to 7/16 Male	105, 109
8001-YF76-02	Adapter SBY Female to 7/16 Female	105, 109
8001-YM11-02	Adapter SBY Male to SMA Male	109, 110
8001-YM21-02	Adapter SBY Male to SMA Female	109, 110
8001-YM51-02	Adapter SBY Male to N Male	108, 109
8001-YM61-02	Adapter SBY Male to N Female	108, 109
8001-YM75-02	Adapter SBY Male to 7/16 Male	105, 109
8001-YM76-02	Adapter SBY Male to 7/16 Female	105, 109
8001-0351-02	Adapter 1.4/4.4 to N Male	104, 107
8001-0361-02	Adapter 1.4/4.4 to N Female	104, 107
8001-0471-05	Adapter 1.8/5.6 Female to BNC Male	104, 106
8001-0481-05	Adapter 1.8/5.6 Female to BNC Female	104, 106
8001-0771-05	Adapter 1.8/5.6 Male to BNC Male	104, 106
8001-0781-05	Adapter 1.8/5.6 Male to BNC Female	104, 106
8001-1111-02	Throughline SMA Male to SMA Male	66, 99, 100
8001-1121-02	Throughline SMA Male to SMA Female	66, 99, 100
8001-1131-02	Adapter SMA Male to TNC Male	110, 111
8001-1139-02	Adapter SMA Male to TNX Male	110, 112
8001-1141-02	Adapter SMA Male to TNC Female	110, 111
8001-1149-02	Adapter SMA Male to TNX Female	110, 112
8001-1171-02	Adapter BNC Male to SMA Male	106, 110
8001-1181-02	Adapter BNC Female to SMA Male	106, 110
8001-1190-02	Adapter SMA Male to 7mm	105, 110
8001-1196-02	Test Port Adapter SMA Male to 7mm	117, 133
8001-2121-02	Throughline SMA Female to SMA Female	66, 99, 100
8001-2131-02	Adapter SMA Female to TNC Male	110, 111
8001-2139-02	Adapter SMA Female to TNX Male	110, 112
8001-2141-02	Adapter SMA Female to TNC Female	110, 111
8001-2149-02	Adapter SMA Female to TNX Female	110, 112
8001-2171-02	Adapter BNC Male to SMA Female	106, 110
8001-2181-02	Adapter BNC Female to SMA Female	106, 110
8001-2190-02	Adapter SMA Female to 7mm	105, 110
8001-2196-02	Test Port Adapter SMA Female to 7mm	117, 133
8001-3151-02	Adapter N Male to TNC Male	109, 111
8001-3161-02	Adapter N Female to TNC Male	109, 111
8001-3171-02	Adapter BNC Male to TNC Male	106, 111
8001-3181-02	Adapter BNC Female to TNC Male	106, 111
8001-3939-02	Throughline TNX Male to TNX Male	74, 99, 100
8001-3949-02	Throughline TNX Male to TNX Female	74, 99, 100
8001-3951-02	Adapter N Male to TNX Male	109, 112
8001-3961-02	Adapter N Female to TNX Male	109, 112
8001-3990-02	Adapter TNX Male to 7mm	105, 112
8001-3991-02	Adapter TNX Male to 3.5mm Male	104, 112
8001-3992-02	Adapter TNX Male to 3.5mm Female	104, 112
8001-3996-02	Test Port Adapter TNX Male to 7mm	117, 136
8001-4151-02	Adapter N Male to TNC Female	109, 111
8001-4161-02	Adapter N Female to TNC Female	109, 111
8001-4171-02	Adapter BNC Male to TNC Female	106, 111
8001-4181-02	Adapter BNC Female to TNC Female	106, 111
8001-4949-02	Throughline TNX Female to TNX Female	74, 99, 100
8001-4951-02	Adapter N Male to TNX Female	109, 112
8001-4961-02	Adapter N Female to TNX Female	109, 112
8001-4990-02	Adapter TNX Female to 7mm	105, 112
8001-4991-02	Adapter TNX Female to 3.5mm Male	104, 112
8001-4992-02	Adapter TNX Female to 3.5mm Female	104, 112
8001-4996-02	Test Port Adapter TNX Female to 7mm	117, 136
8001-5168-02	Adapter HN Female to N Male	106, 108
8001-5169-02	Adapter HN Male to N Male	106, 108
8001-5171-02	Adapter BNC Male to N Male	106, 108

Part Number Index



Part Number	Description	Page(s)
8001-5175-02	Adapter N Male to 7/16 Male	105, 108
8001-5176-02	Adapter N Male to 7/16 Female	105, 108
8001-5179-02	Adapter N Male to SC Female	109, 110
8001-5180-02	Adapter N Male to SC Male	109, 110
8001-5181-02	Adapter BNC Female to N Male	106, 108
8001-6168-02	Adapter HN Female to N Female	106, 108
8001-6169-02	Adapter HN Male to N Female	106, 108
8001-6171-02	Adapter BNC Male to N Female	106, 108
8001-6175-02	Adapter N Female to 7/16 Male	105, 108
8001-6176-02	Adapter N Female to 7/16 Female	105, 108
8001-6179-02	Adapter N Female to SC Female	109, 110
8001-6180-02	Adapter N Female to SC Male	109, 110
8001-6181-02	Adapter BNC Female to N Female	106, 108
8001-7171-02	Throughline BNC Male to BNC Male	58, 98, 100
8001-7181-02	Throughline BNC Male to BNC Female	56, 98, 100
8001-7575-02	Throughline 7/16 Male to 7/16 Male	58, 98, 100
8001-7576-02	Throughline 7/16 Male to 7/16 Female	56, 98, 100
8001-7676-02	Throughline 7/16 Female to 7/16 Female	56, 98, 100
8001-7990-02	Adapter SC Female to 7mm	105, 110
8001-7996-02	Test Port Adapter SC Female to 7mm	117, 133
8001-8090-02	Adapter SC Male to 7mm	105, 110
8001-8096-02	Test Port Adapter SC Male to 7mm	117, 133
8001-8181-02	Throughline BNC Female to BNC Female	58, 98, 100
8001-8896-02	Test Port Adapter C Male to 7mm	117, 131
8001-8996-02	Test Port Adapter C Female to 7mm	117, 131
8001-9090-03	Throughline 7mm to 7mm	54, 98, 100
8001-9196-02	Test Port Adapter 3.5mm Male to 7mm	117, 131
8001-9296-02	Test Port Adapter 3.5mm Female to 7mm	117, 131
8001-9696-03	Throughline 7mm to 7mm (6 slots)	54, 98, 100
8002-H391-02	HP Test Port Adapter 3.5mm Female to 3.5mm Male	116, 127
8002-H392-02	HP Test Port Adapter 3.5mm Female to 3.5mm Female	116, 126
8002-KFMJ-02	Adapter K* Female to SMP Male	107, 111
8002-KMMJ-02	Adapter K* Male to SMP Male	107, 111
8002-MJ90-02	Adapter 7mm to SMP Male	105, 111
8002-MJ96-02	Test Port Adapter SMP Male to 7mm	117, 134
8002-ND03-02	Test Port Adapter 1.4/4.4 to N NMD	118, 142
8002-0351-02	Adapter 1.4/4.4 to N Male	104, 107
8002-0361-02	Adapter 1.4/4.4 to N Female	104, 107
8002-1151-02	Adapter N Male to SMA Male	109, 110
8002-2151-02	Adapter N Male to SMA Female	109, 110
8002-4190-02	Adapter 7mm to TNC Female	105, 111
8002-4196-02	Test Port Adapter TNC Female to 7mm	136
8002-5191-02	Adapter 3.5mm Male to N Male	104, 108
8002-5192-02	Adapter 3.5mm Female to N Male	104
8002-5196-02	Test Port Adapter N Male to 7mm	117, 132
8002-6191-02	Adapter 3.5mm Male to N Female	104, 108
8002-6192-02	Adapter 3.5mm Female to N Female	104, 108
8002-6196-02	Test Port Adapter N Female to 7mm	132
8003-KFMJ-02	Adapter K* Female to SMP Male	107, 111
8003-KMMJ-02	Adapter K* Male to SMP Male	107, 111
8003-MJ90-02	Adapter SMP Male to 7mm	105, 111
8003-MJ96-02	Test Port Adapter SMP Male to 7mm	117, 134
8003-3190-02	Adapter TNC Male to 7mm	105, 111
8003-3196-02	Test Port Adapter TNC Male to 7mm	136
8003-9091-02	Adapter 7mm to 3.5mm Male	104, 105
8003-9092-02	Adapter 7mm to 3.5mm Female	104, 105
8003-9196-02	Test Port Adapter 3.5mm Male to 7mm	130
8003-9296-02	Test Port Adapter 3.5mm Female to 7mm	130
8004-KFMJ-02	Adapter K* Female to SMP Male	107, 111
8004-KMMJ-02	Adapter K* Male to SMP Male	107, 111
8004-MJ90-02	Adapter SMP Male to 7mm	105, 111
8004-MJ96-02	Test Port Adapter SMP Male to 7mm	117, 134
8004-1161-02	Adapter N Female to SMA Male	109, 110
8005-2161-02	Adapter N Female to SMA Female	109, 110
8090-ND61-02	Test Port Adapter N Female to N NMD	118, 147
8091-ND51-02	Test Port Adapter N Male to N NMD	118, 148
8091-ND61-02	Test Port Adapter N Female to N NMD	118, 147
8801-BM11-02	Adapter BMA Male to SMA Male	106, 110
8801-BM21-02	Adapter BMA Male to SMA Female	106, 110
8801-BW11-02	Adapter BMA Female to SMA Male	106, 110
8801-BW21-02	Adapter BMA Female to SMA Female	106, 110
8801-HFHF-02	Throughline 2.4mm Female to 2.4mm Female	50, 98, 100
8801-HFHM-02	Throughline 2.4mm Female to 2.4mm Male	50, 98, 100
8801-HFKE-02	Adapter 2.4mm Female to K* Female	106
8801-HFKM-02	Adapter 2.4mm Female to K* Male	106
8801-HF91-02	Adapter 2.4mm Female to 3.5mm Male	104
8801-HF92-02	Adapter 2.4mm Female to 3.5mm Female	104
8801-HMHM-02	Throughline 2.4mm Male to 2.4 Male	50, 98, 100
8801-HMKF-02	Adapter 2.4mm Male to K* Female	104, 106

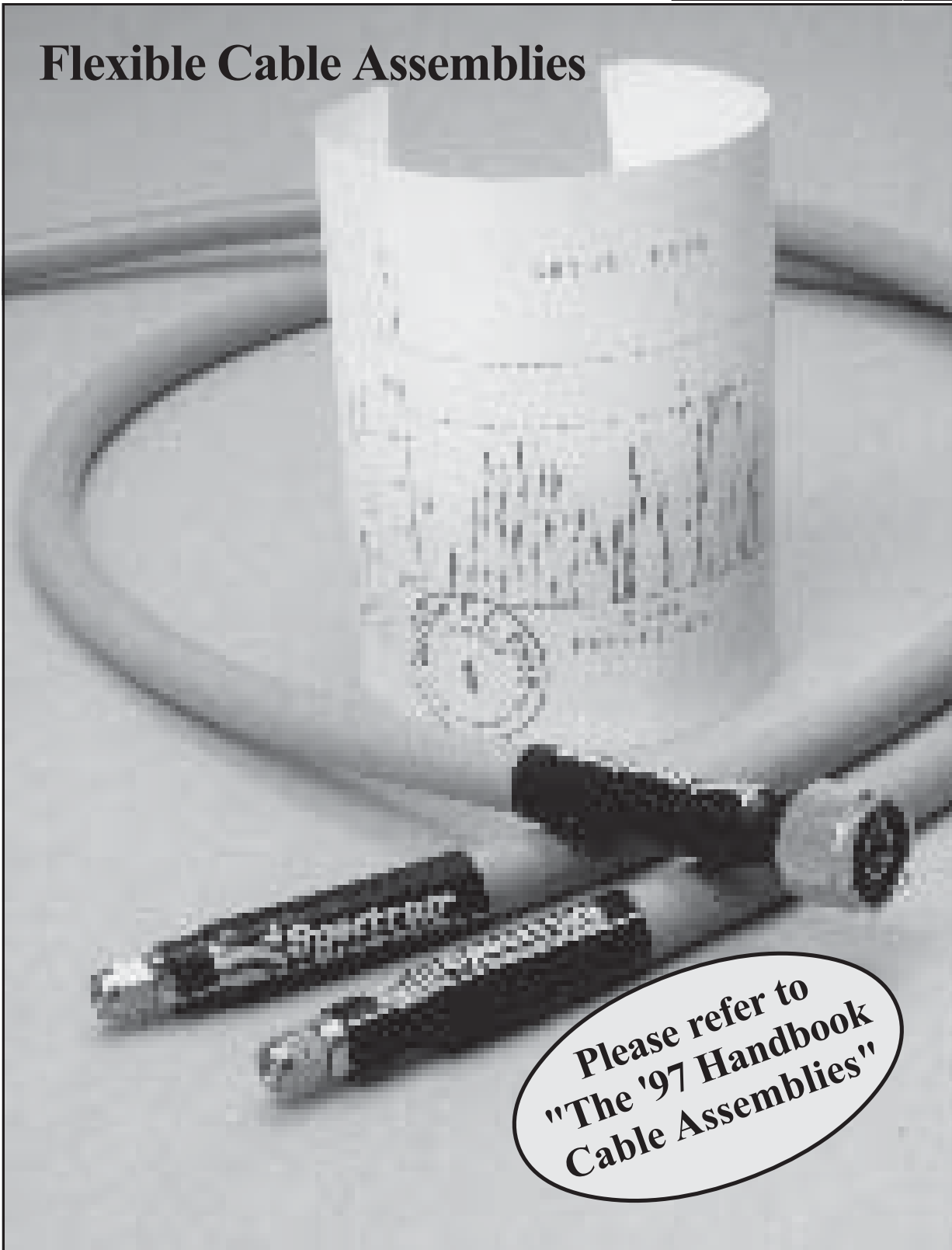
Part Number	Description	Page(s)
8801-HMKM-02	Adapter 2.4mm Male to K* Male	104, 106
8801-HM91-02	Adapter 2.4mm Male to 3.5mm Male	104
8801-HM92-02	Adapter 2.4mm Male to 3.5mm Female	104
8801-KFKF-02	Throughline K* Female to K* Female	60, 98, 100
8801-KFKM-02	Throughline K* Male to K* Female	60, 98, 100
8801-KFTJ-02	Adapter K* Female to SMP Male Test Connector	107, 111
8801-KFTP-02	Adapter K* Female to SMP Female Test Connector	107, 111
8801-KF90-02	Adapter 7mm to K* Female	105, 107
8801-KF91-02	Adapter 3.5mm Male to K* Female	104, 107
8801-KF92-02	Adapter 3.5mm Female to K* Female	104, 107
8801-KF96-02	Adapter 7mm (6 slots) to K* Female	105, 107
8801-KMTJ-02	Adapter K* Male to SMP Male Test Connector	107, 111
8801-KMTP-02	Adapter K* Male to SMP Female Test Connector	107, 111
8801-KM90-02	Adapter 7mm to K* male	105, 107
8801-KM91-02	Adapter 3.5mm Male to K* Male	104, 107
8801-KM92-02	Adapter 3.5mm Female to K* Male	104, 107
8801-KM96-02	Adapter 7mm (6 slots) to K* male	105, 107
8801-KMKM-02	Throughline K* Male to K* Male	60, 98, 100
8801-PJPJ-02	Throughline SPM Female to SPM Female	70, 99, 100
8801-PJPM-02	Throughline SPM Female to SPM Male	70, 99, 100
8801-PJ11-02	Adapter SMA Male to SPM Female	110, 111
8801-PJ21-02	Adapter SMA Female to SPM Female	110, 111
8801-PMPM-02	Throughline SPM Male to SPM Male	70, 99, 100
8801-PM11-02	Adapter SMA Male to SPM Male	110, 111
8801-PM21-02	Adapter SMA Female to SPM Male	110, 111
8801-TJ TJ-02	Throughline Test Component SMP Male to SMP Male	68, 99, 100
8801-TJ TP-02	Throughline Test Component SMP Female to SMP Male	68, 99, 100
8801-TJ90-02	Adapter 7mm to SMP Male Test Connector	105, 111
8801-TP TP-02	Throughline Test Component SMP Female to SMP Female	68, 99, 100
8801-TP90-02	Adapter 7mm to SMP Female Test Connector	105, 111
8801-3131-02	Throughline TNC Male to TNC Male	72, 99, 100
8801-3141-02	Throughline TNC Male to TNC Female	72, 99, 100
8801-4141-02	Throughline TNC Female to TNC Female	72, 99, 100
8801-5151-02	Throughline N Male to N Male	62, 99, 100
8801-5161-02	Throughline N Male to N Female	62, 99, 100
8801-5188-02	Adapter C male to N Male	106, 108
8801-5189-02	Adapter C Female to N Male	106, 108
8801-5190-02	Adapter 7mm to N Male	105, 108
8801-5196-02	Adapter 7mm (6 slots) to N Male	105, 108
8801-6161-02	Throughline N Female to N Female	62, 99, 100
8801-6188-02	Adapter C Male to N Female	106, 108
8801-6189-02	Adapter C Female to N Female	106, 108
8801-6190-02	Adapter 7mm to N Female	105, 108
8801-6196-02	Adapter 7mm (6 slots) to N Female	105, 108
8801-7979-02	Throughline SC Female to SC Female	64, 99, 100
8801-7980-02	Throughline SC Female to SC Male	64, 99, 100
8801-8080-02	Throughline SC Male to SC Male	64, 99, 100
8801-8890-02	Adapter 7mm to C Male	105, 106
8801-8896-02	Adapter 7mm (6 slots) to C Male	105, 106
8801-8990-02	Adapter 7mm to C Female	105, 106
8801-8996-02	Adapter 7mm (6 slots) to C Female	105, 106
8801-9191-02	Throughline 3.5mm Male to 3.5mm Male	52, 98, 100
8801-9192-02	Throughline 3.5mm Male to 3.5mm Female	52, 98, 100
8801-9292-02	Throughline 3.5mm Female to 3.5mm Female	52, 98, 100
8802-TJ TJ-02	Throughline SMP Male to SMP Male Test Component (40.0 GHz)	68, 99, 100
8802-TJ TP-02	Throughline SMP Female to SMP Male Test Component (40.0 GHz)	68, 99, 100
8802-TP TP-02	Throughline SMP Female to SMP Female Test Component (40.0 GHz)	68, 99, 100
9015-E110-02	Interchangeable Connector 7mm with 4 equally spaced Contact slots	158, 159
9030-1101-02	Short Circuit Termination 7mm	53
9040-1101-02	Open Circuit Termination 7mm	53
9615-E110-02	Interchangeable Connector 7mm with 6 equally spaced Contact slots	158, 159

Alphabetical Index

	Page(s)
Assemblies with Interchangeable Connectors	153 - 162
Between Series Adapters	101 - 112
Calibration Components, Terminations, Throughlines	45 - 74
- Type 2.4mm	49 - 50
- Type 3.5mm	51 - 52
- Type 7mm	53 - 54
- Type 7/16	55 - 56
- Type BNC	57 - 58
- Type K*	59 - 60
- Type N	61 - 62
- Type SC	63 - 64
- Type SMA	65 - 66
- Type SMP Test Component	67 - 68
- Type SPM	69 - 70
- Type TNC	71 - 72
- Type TNX	73 - 74
Cable Assemblies with Interchangeable Connectors	153 - 162
- Assemblies with Interchangeable Connectors	158
- Cable Assembly Kit	156 - 157
Cable Specifications for Types:	187 - 198
10, 14, 16, 17, 18, 22, 40, 42, 43, 100 & 140	
Calibration Components, Terminations, Throughlines, Open-Shorts for 2.4mm, 3.5mm, 7mm, 7/16, BNC, K*, N, SC, SMA, SMP (Test Components), SPM, TNC and TNX	
Calibration Kits	9 f.f.
- (LRL)/(TRL)	35 - 40
- SMP	23 - 33
- suggested for Hewlett Packard	15 - 17
- suggested for Wiltron	19 - 21
- Verification Kits	41 - 43
Company Profile	4
Connector Codes	203 - 206
Connector Interface Gauges	75 - 88
Connector Specifications	199 - 201
Field Replaceable Connectors	153 - 162
Instrument Grade Adapters	97 - 112
- In-Series	97 - 100
- Between Series	101 - 112
- NMD Test Port Adapters	113 - 151
suggested for Hewlett Packard ANA	116 - 119
suggested for Wiltron ANA	119
Type 2.4mm	121 - 124
Type 3.5mm	125 - 128
Type 7mm	129 - 136
Type K*	137 - 140
Type N	141 - 151
In-Series Adapters	97 - 100
Interface Gauges	75 - 88
- Ordering Information	80
Interface Mating Dimensions for 2.4mm, 3.5mm, 7mm, 7/16, BMA, BNC, C, HN, K*, N, N (75 Ohms), SBX, SBY, SC, SMA, SSMA, SMP, SMP Test Connector, SPM, TNC (MIL-C-39012), TNC (MIL-C-87104/2), TNX.	207 - 230
Line Reflective Lines (LRL)/Through Reflective Lines (TRL)	35 - 40
- Ordering Information	40
NMD Test Port Adapters	113 - 151
- suggested for Hewlett Packard ANA	116 - 119
- suggested for Wiltron ANA	119
- Type 2.4mm	121 - 124
- Type 3.5mm	125 - 128
- Type 7mm	129 - 136
- Type K*	137 - 140
- Type N	141 - 151

	Page(s)
Open-Short-Load-Through Calibration Kits	14 - 22
Ordering Information	22
- Assemblies with Interchangeable Connectors	161
- Assemblies with PUSH-ON Connectors	169 - 170
- Connector Interface Gauges	80
- General	5
- Interchangeable Assembly Kit	160
- LRL/TRL Calibration Kit	40
- Open-Short-Load-Through Calibration Kits	22
- Phase Stable Cable Assemblies	179
- SMP	22
- Verification Kits	28
Phase Stable Cable Assemblies	173 - 180
- Connector Selection Chart	178
- Diagrams, Phase Stable Cable Assemblies	177
- Ordering Information	179
PUSH-ON Connector Specifications	171
Quick Connections (PUSH - ONs)	163 - 172
- Handling Information	165
- Locking PUSH-ON Connectors	167
- Ordering Information	169 - 170
- Specifications	171
- NON-Locking PUSH-ON Connectors	166
Quick Connections Cable Selection Chart	168
Quick Reference Guide by Sections	6 - 7
RF- Multipin Connector SQ-8	181 - 186
- Specifications	186
Short/Open Circuit Terminations	48 - 74
SMP Calibration Kits	23 - 33
- Kits	29
- Ordering Information	28
Special Products & Services	231 - 267
- Adapter Sets	234 - 235
- Antennas	236 - 237
- Blind Mate Connectors	238 - 239
- Charged Device Modelling	240 - 241
- Circulators & Isolators	252 - 253
- Couplers	248 - 249
- Custom Connectors/Adapters	242 - 243
- Delay Lines	244 - 245
- Detectors	246 - 247
- Directional Couplers	248 - 249
- Impedance Transformers	250 - 251
- Isolators & Circulators	252 - 253
- Lightning Surge Suppressors	254 - 255
- Limiters	256 - 257
- Machines, CNCA-700	258 - 259
- Precision Mismatches	260 - 261
- Rotary Joints	262 - 263
- Supercomponents	264 - 265
- Tools	266 - 267
Test Port Adapters NMD	113 - 151
Thread Limit Gauges	93 - 96
- Types	95
- Thread Specifications	96
Torque Wrenches	89 - 92
- Types	92
Verification Kits	41 - 43
- Calibration Kit	43
- Ordering Information	42

Flexible Cable Assemblies



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