

# Defense

Reliable, high performance solutions

Edition 2016/09





Reliable, high performance solutions





Applications	4
Airborne	4
Missile	6
Radar	8
Naval	10
Command and control	12
Vehicles	14
Tactical equipment/submodules	16
Lab testing	18
Radio frequency solutions	20
Microwave cable assemblies	20
Minibend series	34
32071 – high power cable assemblies	42
Eacon – field terminated microwave assembly	46
High flex cables	52
Multiport	54
RF cables	56
LSFH cables	62
RF connectors and adaptors	64
Board-to-board connectors	66
Phase shifters	88
HEMP and lightning protection	90
Antennas	98
Wires and cables	102
Fiber optics solutions	110
All-optical switches	118
RF-over-Fiber	124
System solutions	138
RF cable selection guide	143
Further documentation	145

#### Your partner for system solutions

HUBER+SUHNER is a leading international manufacturer and supplier of components and systems for electrical and optical connectivity. HUBER+SUHNER unites technical and manufacturing expertise in radio frequency, fiber optics and low frequency technologies under one roof and offers a high-quality product range for the defense market.





## Airborne

With extreme environmental changes and load factors up to 10 g, electrical and electronic systems for aircraft require cables and connectors of superior quality. HUBER+SUHNER has many years of experience in the development, production and qualification of cables, connectors and cable systems for airborne applications. Our solutions are used in many systems around the globe and have proven to be reliable and meet the toughest requirements.

### Applications

- Fighter jets
- Helicopters
- UAV
- High altitude airship/aircraft

### Heritage

EUROFIGHTER, MIG platforms, AWACS, C130, E2C-ESM, EA6B, F15, F16, F18, F22, F35, IDECM/ALE-SS, JSTARS, Predator, Tornado, Global Hawk, EP-3, HH-60G, AN/APR-39, NH-90, A400M

### Requirements

- Ultra-low weight and ruggedized solutions
- Small form factor, minimal bend radius (bend-to-the end)





## Microwave cable assemblies

HUBER+SUHNER flexible microwave cable assemblies offer superior electrical and mechanical performance for static and dynamic applications. These assemblies provide optimal performance up to 90 GHz, where stringent electrical requirements are important.

- SUCOFLEX
- Eacon
- Minibend
- Everflex



## Connectors

HUBER+SUHNER is a leading global provider of radio frequency connectors for the transmission of analog and digital signals. In addition to a broad selection of standard connectors for a wide range of different applications, we also develop and manufacture customer-specific solutions.

- BMA
- SMPM-T



## VITA 67

Our VITA 67 is the first high performance true 65 GHz SMPM cable assembly in the market. Thanks to the solderless Minibend bend-to-the-end technology tightest bending radius (0.06"/1.5 mm) is applicable immediately behind the connector. The snap-in captivation method guarantees an easy and quick installation without any tools or loose parts.



## RF-over-Fiber

High density RF connectivity and light-weighting are key elements that are optimally addressed by RF-over-Fiber. With system interconnects often requiring dozens of RF connections between various sensors, antennas and other systems, the HUBER+SUHNER RF-over-Fiber products provide flexibility by ensuring that the solution is easily scalable.





## Missile

The constant motion of a seeker head, coupled with the extreme acceleration and environmental influences, requires the highest performing microwave cable assemblies. HUBER+SUHNER has a unique cable assembly portfolio proven to repeatedly withstand 1 000 000 flexure cycles with minimal degradation. Additionally, Minibend's bend-to-the-end technology offers great flexibility in the tightest space restrictions.

### Applications

- Missile-mounted radars, antennas
- Test benches

### Heritage

AEGIS, Patriot, Erint/Pac 3, Sea Sparrow, Hawk, ESSM, CJR, CREW, RAM, AIM9M, AMRAAM, HARM, ARROW, THAAD, JLENS, CAMM, Meteor

### Requirements

- Excellent flex properties (up to 1 000 000 cycles)
- Low resistance to movement
- Small form factor
- High temperature environment





## Microwave cable assemblies

HUBER+SUHNER flexible microwave cable assemblies offer superior electrical and mechanical performance for static and dynamic applications. These assemblies provide optimal performance up to 90 GHz, where stringent electrical requirements are important.

- Minibend
- SUCOFLEX



## High flex cables

HUBER+SUHNER is a leading global provider of radio frequency connectors for the transmission of analog and digital signals. In addition to a broad selection of standard connectors for a wide range of different applications, we also develop and manufacture customer-specific solutions.

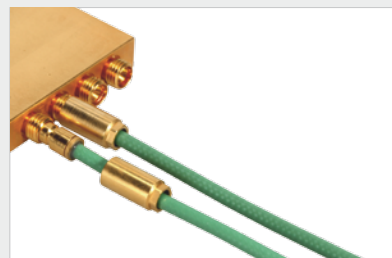
- Everflex
- Multiflex\_53



## Connectors

HUBER+SUHNER is a leading global provider of radio frequency connectors for the transmission of analog and digital signals. In addition to a broad selection of standard connectors for a wide range of applications, customer-specific solutions can also be developed and manufactured.

- SMPM-T
- SMP
- Self-locking connectors



## Power cables

The characteristics of our power cables make them ideal for use in a wide range of applications, where space is at a premium and in harsh environments with high moisture, high temperatures, rapid changes of humidity and where protection against fluids is mandatory.





## Radar

With few exceptions, today's generation of radars employ a phased array or active electronically steered array (AESA) architecture to improve reliability and accuracy, and to allow tracking of multiple targets. HUBER+SUHNER offers a wide range of low loss and phase stable microwave cable assemblies to meet the requirements of today's systems. Miniaturization is a key driver for higher integration and density. Our board-to-board solutions cope with the largest mechanical misalignment and are complemented by our Minibend products. The bend-to-the-end technology enables high integration densities without compromising performance and reliability.

### Applications

- Radars
- T/R modules

### Heritage

3DLERR, GM radar

### Requirements

- Low loss, phase stable cable assemblies
- Small form factor, minimal bend radius (bend-to-the-end)





## Microwave cable assemblies

HUBER+SUHNER flexible microwave cable assemblies offer superior electrical and mechanical performance for static and dynamic applications. These assemblies provide optimal performance up to 90 GHz, where stringent electrical requirements are important.

- Minibend
- SUCOFLEX
- Phase invariant cable assemblies (Minibend CT, < 300 ppm change over temp)



## High flex cables

HUBER+SUHNER is a leading global provider of radio frequency connectors for the transmission of analog and digital signals. In addition to a broad selection of standard connectors for a wide range of applications, customer-specific solutions can also be developed and manufactured.

- MBX
- MMBX
- SMP



## Lightning protectors

HUBER+SUHNER lightning protection products are designed to meet the stringent requirements of the defense and security markets. Both quarter-wave and wideband gas discharge tube (GDT) versions are available for applications up to 18 GHz. An extensive high-voltage impulse laboratory is also available for customer specific design verification.

- 3400 series quarter wave protectors
- Semper self-extinguishing gas capsule protectors



## Fiber optic assemblies

Fiber optic cables support the mobility of the application by reducing both the cable footprint and the overall weight of the solution. This dramatically simplifies and speeds up the installation and maintenance of the system. The use of HUBER+SUHNER's RADOX® technology ensures superior performance in harsh environments. The Q-ODC-12 connects up to 12 fibers in a single mating step, providing both increased flexibility and fast installation.



## RF-over-Fiber

With customers requiring that new solutions and systems combine various technologies, HUBER+SUHNER is able to provide our customers with end-to-end-solutions. The RF-over-Fiber series enables the use of radio frequency and fiber optics in a single system. Application support is available.

- RF-over-Fiber
- LAN-over-Fiber
- GPS-over-Fiber (L1 and L2)





## Naval

HUBER+SUHNER connectors, cable assemblies and protection devices are designed to withstand the harsh environments encountered aboard a ship or submarine. Our designs meet the military requirements for salt fog testing and we can custom design solutions using o-rings and/or glass seals for the most extreme conditions. HUBER+SUHNER uses RADOX® and LSFH (low smoke free of halogen) materials to address the challenging flammability and smoke density requirements inherent in naval applications.

### Applications

- Submarine
- Ship

### Heritage

LAMPSS MKIII, Phalanx, Sidekick, SPY3, Sea Hawk, Zumwalt, NMT, SSEE

### Requirements

- LSFH - low smoke free of halogen
- Corrosion protected and highly dust- and waterproof solutions
- Field mountable with smallest feedthrough

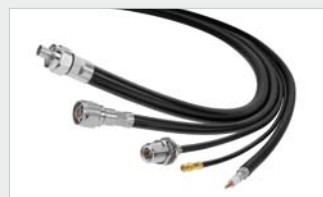




## LSFH cables

HUBER+SUHNER's broad range of low smoke free of halogen (LSFH) cables provide the lowest attenuation, high flexibility and optimal shielding for applications up to 18 GHz. Our RADOX® and LSFH compounds were developed to avoid hazardous fumes in the event of a fire.

- Spuma FR
- Enviroflex
- SUCOFLEX I



## Connectors

In addition to our standard connector portfolio, HUBER+SUHNER can also offer stainless steel configurations to reduce the risk of corrosion under the extreme conditions of naval applications. Additional protection by adding rubber boots or o-rings is also possible, depending upon the interface.



## Lightning protectors/high power limiters

Our high power RF limiter is a multi-stage component, designed to protect the first stage of shipboard equipment by limiting harmful RF power the front-end receiver will see, as well as providing protection from lightning and NEMP pulses. In addition, we offer a broad range of lightning and EMP protection devices to protect sensitive equipment in exposed locations.



## Fiber optic assemblies

HUBER+SUHNER's Q-ODC-12/RADOX® cable assemblies provide a simple and elegant high density interconnect solution for shipborne communication networks. The RADOX® cross-linked jacketing material provides an extended temperature range, resistance against oil/chemicals and UV radiation, and is low-smoke free of halogen, to minimize hazardous fume ingestion in the event of fire.



## RF-over-Fiber

Naval applications have requirements for intra-vessel communication and networking systems, as well as mission-relevant systems. The density of connectivity and the distance between the RF equipment and the receiver systems, make the RF-over-Fiber Series ideal for naval applications. Application support is available.



## Power and data cables

The RADOX® MFH-S cable portfolio meets the most challenging requirements in naval applications for both signal and power transmission. The high abrasion and vibration resistance and small bending radius are key assets for the typically congested environments on ships and submarines. The RADOX® material was developed to avoid hazardous fumes in the event of a fire.





## Command and control

Command and control centers are typically located within mobile shelters or bunker infrastructures and must comply with MIL-STD-188 (or equivalent) shielding specifications. Every point of entry into this type of Faraday cage has a negative impact on the screening effectiveness of the complete system.

HUBER+SUHNER EMP protector designs (coaxial and data line) offer bulkhead feedthrough solutions that guarantee high, long-term screening effectiveness and provide the lowest transfer impedance to protect any sensitive equipment. By using fiber optic cables within a traditional RF or datalink (Ethernet) system, it is possible to position the shelters further from the antennas without sacrificing loss or signal data integrity. Our RF-over-Fiber system provides a significant advantage in terms of safety, overall screening effectiveness, and ease of installation.

In addition to the RF-over-Fiber solution, HUBER+SUHNER can provide all additional connectivity solutions within a shelter.

### Applications

- Mobile shelters
- Bunkers

### Requirements

- High, longterm screening effectiveness
- Immunity against EMI, EMP





## Microwave cable assemblies

HUBER+SUHNER flexible microwave cable assemblies offer superior electrical and mechanical performance for static and dynamic applications. These assemblies provide optimal performance up to 18 GHz, where stringent electrical requirements are important.

- Eacon
- Spuma
- Enviroflex



## Lightning protectors

HUBER+SUHNER lightning protection products are designed to meet the stringent requirements of the defense and security markets. Both quarter-wave and wideband gas discharge tube (GDT) versions are available for applications up to 18 GHz. An extensive high-voltage impulse laboratory is also available for customer specific design verification.

- 3400 series quarter wave protectors
- Semper self-extinguishing gas capsule protectors



## Fiber optic assemblies

The use of FO cables minimizes the cable footprint and the overall weight of the solution, which dramatically simplifies and reduces the time required for both installation and maintenance of the system. Fiber optic technology offers immunity to EMI, EMP and RFI, critical in command and control environments. HUBER+SUHNER's RADOX® technology ensures superior performance in harsh environments.



## RF-over-Fiber

Connectivity and the safety of the control center are key in an antenna remoting system. RF-over-Fiber systems are ideal in command and control centers, since they take advantage of all the benefits - flexibility in installation, proximity of the shelter to the antennas, the harsh environment fiber optic connectors, and the immunity to EMI, EMP and RFI.



## Antennas

HUBER+SUHNER provides broadband antenna solutions for both tactical communication, electronic countermeasure (ECM) and navigational aid. The ruggedized designs ensure system reliability even under the harshest environments, whether mounted on vehicles, man packs or in fixed installations on shelters, masts or containers.



## Databus cables

HUBER+SUHNER databus cables provide reliable solutions for use in high-temperature applications and harsh environmental conditions. Extended temperature range, resistance against UV (sun), oil and other aggressive chemicals are mandatory performance parameters for a reliable communication link.





## Vehicles

Combat vehicles incorporate a wide variety of land based communication equipment operating between 1 MHz and 20 GHz, including navigational aids and jammers, as well as satellite communication hardware. The vast variety of equipment establishes new standards for channel-to-channel isolation requirements, to avoid interferences and to guarantee trouble-free operation of the equipment. HUBER+SUHNER solutions are distinguished by their high shielding performance, robustness and ease of use in the field. Additionally, our EMP protectors are used in many mobile platforms to harden the equipment against LEMP and NEMP, and to provide protection from lightning strikes to the equipment.

### Applications

- Jamming
- Communication
- Navigation

### Requirements

- Wide frequency range for equipment, multiple protection devices
- Field-mountable with minimal points of entry
- High shielding effectiveness to avoid interference



## Microwave cable assemblies

Eacon is a flexible cable and connector solution for high performance field installation. The two piece connector design enables a fast and reliable termination for applications up to 18 GHz. Additional armored options are available to further improve reliability under harsh conditions.



## Lightning protectors

Surge protective device GDT technology provides reliable protection against dangerous surge signals on coaxial lines. This includes all types of interference, e.g. resistive, magnetic field and electric field coupling, which can be caused by lightning strikes (LEMP), switching (SEMP) and other natural or man-made electrical effects such as EMP/HEMP.

- 3400 series quarter wave protectors
- Semper self-extinguishing gas capsule protectors



## Fiber optic assemblies

Fiber optic cables supports the mobility of the application by reducing both the cable footprint and the overall weight of the solution. This dramatically simplifies and speeds up the installation and maintenance of the system. The use of HUBER+SUHNER's RADOX® technology ensures superior performance in harsh environments. The Q-ODC-12 connects up to 12 fibers in a single mating step, providing both increased flexibility and fast installation.



## GPS-over-Fiber

GPS-over-Fiber enables a single GPS signal to be distributed into multiple receiver systems. The small form factor adds significant value within the vehicle with both the conversion modules and FO cable designed to use as little space as possible, while eliminating all forms of (EM and RF) interference.



## Antennas

HUBER+SUHNER provides broadband antenna solutions for vehicle-mount applications for both tactical communication and electronic countermeasure (ECM). The ruggedized designs ensure system reliability even under the harshest environments, mounted on vehicles, man packs or in fixed installations on shelters, mast or containers.

- High power levels (up to 800 W)
- Frequency bands avail. in the range of DC - 10 GHz



## Power distribution cables

HUBER+SUHNER offers single and multi-core cables for power distribution using our patented cross-linked RADOX® material. RADOX® is ideal for use in a wide range of applications, where space is at a premium and where cables are subjected to high temperatures. We also offer some cables that are resistant to both high humidity and motor vehicle fluids, as well as maintaining the small bend radius required in vehicles.







## Tactical equipment/submodules

Integration density continues to increase with new generations of tactical equipment, including portable jammers, software defined radios and microwave submodules. HUBER+SUHNER provides a broad range of standard connectors, adaptors and lightning protectors to meet these requirements, as well as the ability to offer application specific designs. With in-house R+D and machining capabilities, HUBER+SUHNER can develop a custom design and quick-turn verification samples. As one of the leading companies of board-to-board solutions, HUBER+SUHNER offers an extensive array of board-to-board interconnect solutions and can achieve the smallest board-to-board footprint while still achieving outstanding electrical performance.

### Applications

- Mobile jammer units
- Software Defined Radios (SDR)
- RF/Microwave submodules

### Requirements

- High integration density, smaller footprint
- Reliable, hardened equipment (EMP)
- Customer specific options, backplane card mounting



## Microwave cable assemblies

HUBER+SUHNER flexible microwave cable assemblies offer superior electrical and mechanical performance for static and dynamic applications. These assemblies provide optimal performance up to 90 GHz, where stringent electrical requirements are important.

- Minibend



## Board-to-board connectors

Board-to-board connectors are the answer to higher integration and miniaturization, where there is not space for cable assemblies. The MBX/MMBX and SMP/SMPM series offers a wide range of connectors for both board-to-board applications and complex stack-ups with multiple connections in radio module equipment.



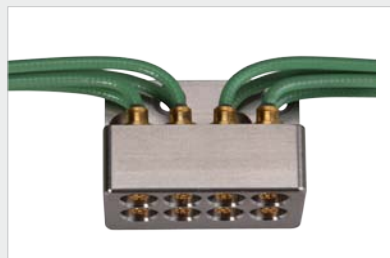
## Connectors

HUBER+SUHNER is a leading global provider of radio frequency connectors and adaptors for the transmission of analog and digital signals. In addition to a broad selection of standard connectors for a wide range of different applications, customer-specific solutions are also developed and manufactured.



## VITA 67

Our VITA 67 is the first high performance true 65 GHz SMPM cable assembly in the market. Thanks to the solderless Minibend bend-to-the-end technology tightest bending radius (0.06"/1.5 mm) is applicable immediately behind the connector. The snap-in captivation method guarantees an easy and quick installation without any tools or loose parts.



## Lightning protectors

Surge protective device GDT technology provides reliable protection against dangerous surge signals on coaxial lines. This includes all types of interference, e.g. resistive, magnetic field and electric field coupling, which can be caused by lightning strikes (LEMP), switching (SEMP) and other natural or man-made electrical effects such as EMP/HEMP. An extensive high-voltage impulse laboratory is also available for customer specific design verification





## Lab testing

Every research and development, test, or quality assurance department that works with RF signals requires precise and repeatable measurements.

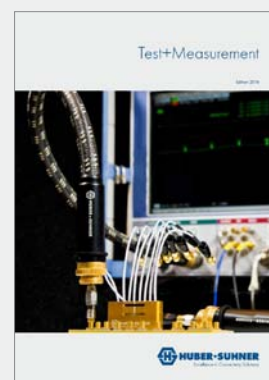
Since the quality of a test configuration is only as strong as the weakest link, HUBER+SUHNER offers a wide range of superior flexible and rugged cable assemblies with excellent amplitude and phase stability and high-precision connectors. In addition, we have a full portfolio of adaptors, resistive terminations and attenuators. Reliable cable assembly and resistive solutions guarantee reduced equipment downtime.

### Applications

- Test labs
- Test benches
- Anechoic chambers

### Requirements

- Lowest loss cable assemblies
- Ruggedized cables to ensure long life
- Broad range of stock assemblies to provide short leadtime







### Microwave cable assemblies

HUBER+SUHNER flexible microwave cable assemblies offer superior electrical and mechanical performance for static and dynamic applications up to 50 GHz. Additional armored options are available for each series to ensure consistent performance even under harsh environmental conditions. Stock assemblies are available to support fast delivery.

- SUCOFLEX 100
- SUCOFLEX 200
- SUCOFLEX 400



### Test leads

HUBER+SUHNER test leads are designed for daily use in component and assembly shops, test labs and high speed digital testing applications. Stock assemblies are available to support fast delivery.

- Sucotest 18 (A)
- Sucotest 26
- Sucotest 40



### Precision adaptors

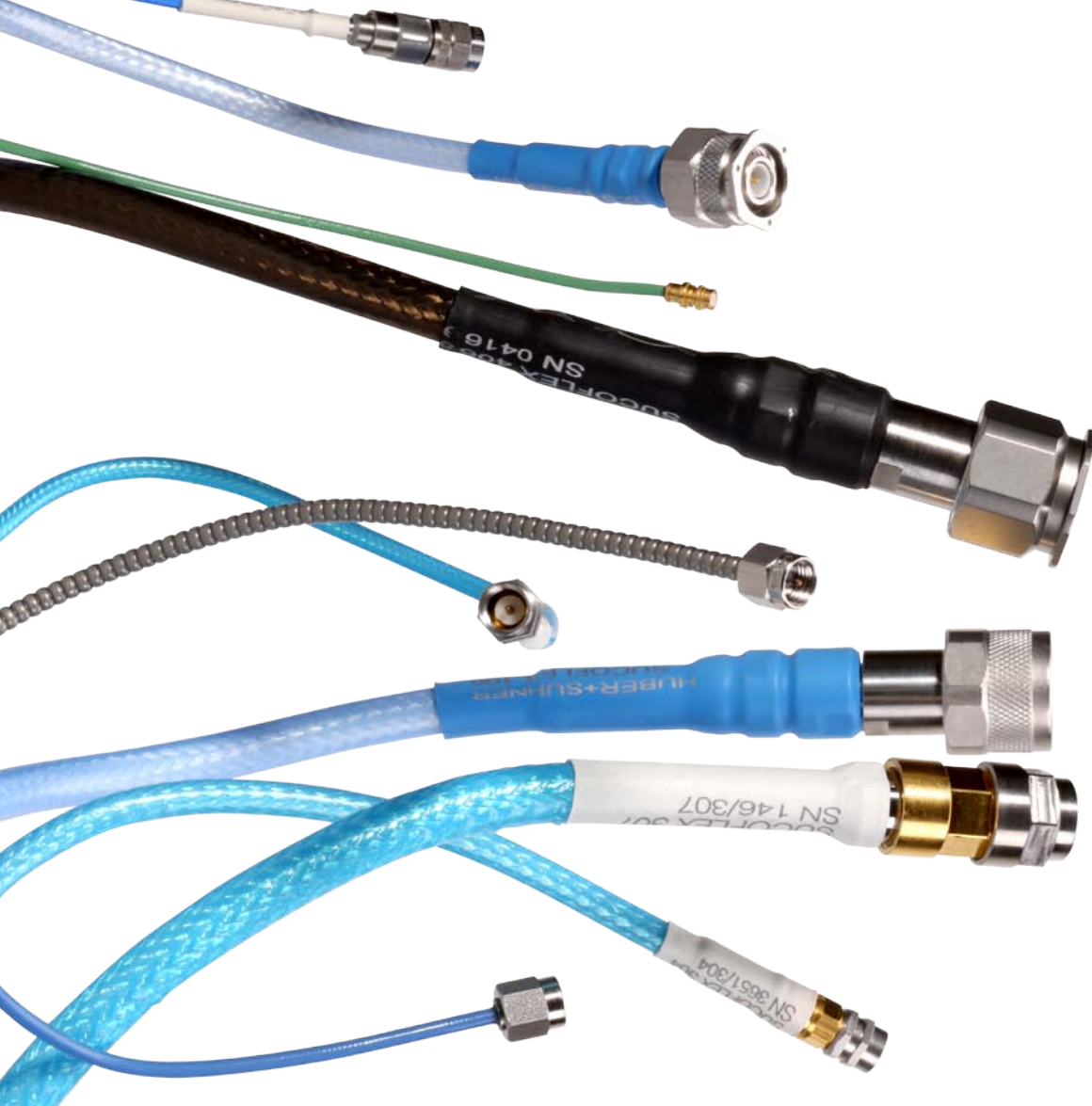
HUBER+SUHNER manufactures a wide range of standard and high-performance adaptors that are ideal for lab and production test applications where measurement accuracy, repeatability, and optimum electrical performance are critical.



### Attenuators, terminations and DC blocks

HUBER+SUHNER offers a comprehensive range of high-quality radio frequency attenuators, terminations and DC blocks for applications up to 18 GHz.





## Microwave cable assemblies

Cables and connectors from the same manufacturer  
 HUBER+SUHNER develops and manufactures coaxial cables and connectors for applications worldwide. Connectors and cables can be optimized for superior electrical performance. We currently offer over 1700 different connector configurations. Demanding customers trust the reliability and quality of HUBER+SUHNER products. These products have been tested to IEC, MIL, CECC and other standards. Our extensive know-how in RF technology enables reliable and competent technical consulting and support. You stand to benefit from a well matched cable and connector range, as well as the vast experience of our engineers.



### Microwave cable assemblies to your specifications

Increase efficiency and productivity in your company by ordering ready-to-use microwave cable assemblies from the specialists. Expert assembly by soldering, clamp or crimp technique and inspection records according to your specifications enable you to order with confidence, whether built to print or from our portfolio of stock assemblies.





## SUCOFLEX 100

The low loss, high performance microwave cable assembly

- For static and dynamic applications up to 50 GHz
- Excellent return loss
- A wide range of connectors is available, including types which feature NWA-specific interfaces, and can be provided with various ruggedizations to protect the assembly against different environmental influences
- Stock assemblies available



## SUCOFLEX 200

The loss revolution for dynamic applications

- For static and dynamic applications up to 40 GHz
- Ultra low loss
- Outstanding phase stability vs. temperature
- Excellent return loss
- Stock assemblies available



## SUCOFLEX 400

The ultra low loss, temperature phase stable microwave cable assemblies

- Best insertion loss on the market up to 26.5 GHz
- High phase stability versus temperature
- Excellent return loss
- Improved system performance from reduced phase change over temperature
- Higher signal integrity due to lower loss



## SUCOFLEX 300

The light-weight, low-loss microwave cable assemblies

- SUCOFLEX 300 series offers consistent outstanding mechanical and electrical performance, stability and reliability up to 40 GHz
- Weight reduction of up to 40 % compared to our conventional products
- Assemblies produced in a clean environment room (class 100)





# SUCOFLEX® 100



SUCOFLEX 100 series flexible microwave cable assemblies offer superior electrical and mechanical performance for static and dynamic applications.

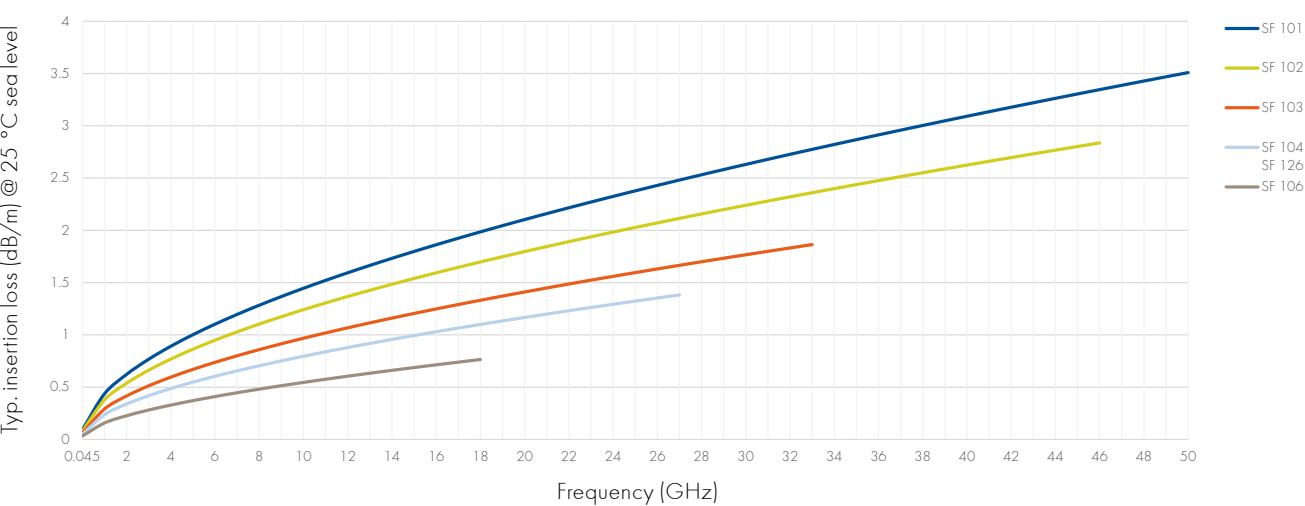
This series is a high-end product designed to provide optimal performance up to 50 GHz, where stringent electrical requirements – in particular stability and low loss – are important. Their mechanical and climate resistance properties surpass those of standard flexible cables. This cable type is ideally suited to test and measurement applications (as test leads) and used in aerospace and defense systems.

## Assembly types

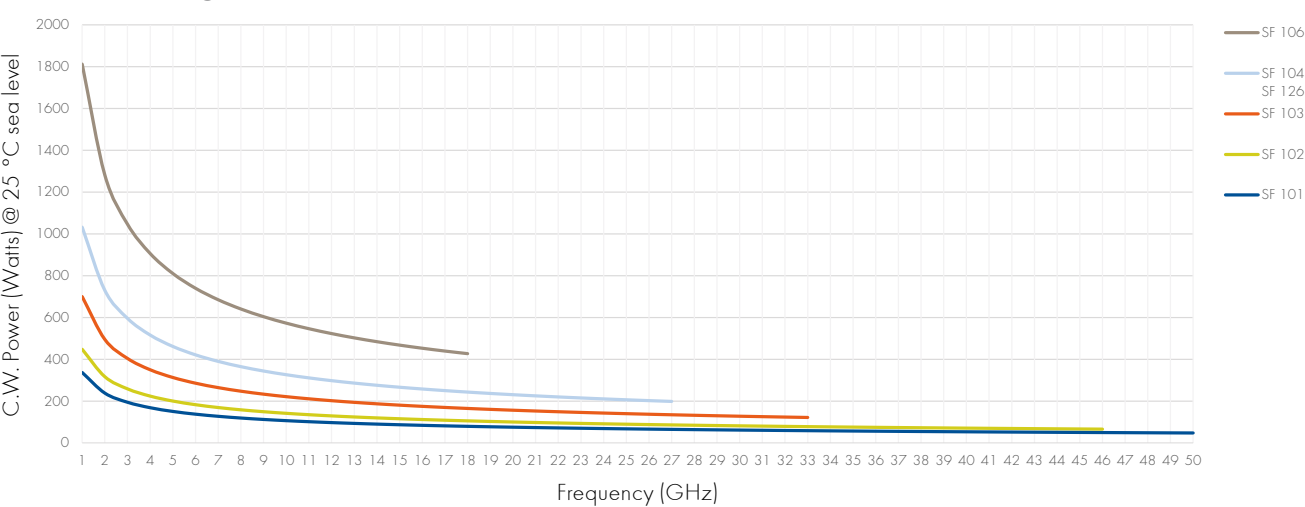
		SUCOFLEX 101	SUCOFLEX 102	SUCOFLEX 103	SUCOFLEX 104	SUCOFLEX 126	SUCOFLEX 106
Max. operating frequency	GHz	50	46	33	26.5	26.5	18
Impedance	Ω	50	50	50	50	50	50
Application		static	static	static	static	dynamic	static
Velocity of propagation	%	77	77	77	77	77	77
Weight	g/m	36	40	53	73	70	142
Min. bending radius static	mm	11	12	13	16	16	24
Min. bending radius repeated	mm	20	20	22	25	25	40
Temperature range	°C	–55 to +125	–55 to +125	–55 to +125	–55 to +125	–55 to +125	–55 to +125
Crush resistance	kN/m	8	8	8	8	8	12
Tensile load	N	100	150	200	250	250	400
Inner conductor		solid wire	solid wire	solid wire	solid wire	stranded	solid wire
Dielectric		LD-PTFE	LD-PTFE	LD-PTFE	LD-PTFE	LD-PTFE	LD-PTFE
Outer conductor		tape/braid	tape/braid	tape/braid	tape/braid	tape/braid	tape/braid
Jacket		FEP	FEP	FEP	FEP	FEP	FEP
Ruggedization		on request	on request	on request	on request	on request	on request
Outer diameter	mm	3.7	4.0	4.6	5.5	5.5	7.9
Screening effectiveness (up to 18 GHz)	dB	> 90	> 90	> 90	> 90	> 90	> 90
Phase stability vs. flexure (360°, diameter 40 mm)	°el/ GHz	< 1.2	< 1.2	< 1.4	< 1.7	< 0.9	< 2.0
Phase stability vs. temperature (–40 to +85 °C)	ppm	< 1500	< 1500	< 1500	< 1500	< 1500	< 1500
Assembly phase matching tolerances	°el/ GHz	± 0.5	± 0.5	± 0.5	± 0.5	± 0.5	± 0.5
Cable attenuation at 25 °C	dB/m	see graph	see graph	see graph	see graph	see graph	see graph
Insertion loss stability vs. bending	dB	± 0.2	± 0.2	± 0.2	± 0.2	± 0.2	± 0.2
Insertion loss stability vs. temperature	%/°C	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Insertion loss stability vs. shaking	dB	± 0.1	± 0.1	± 0.1	± 0.1	± 0.1	± 0.1
Power handling	Watt	see graph	see graph	see graph	see graph	see graph	see graph

# SUCOFLEX® 100 – graphs

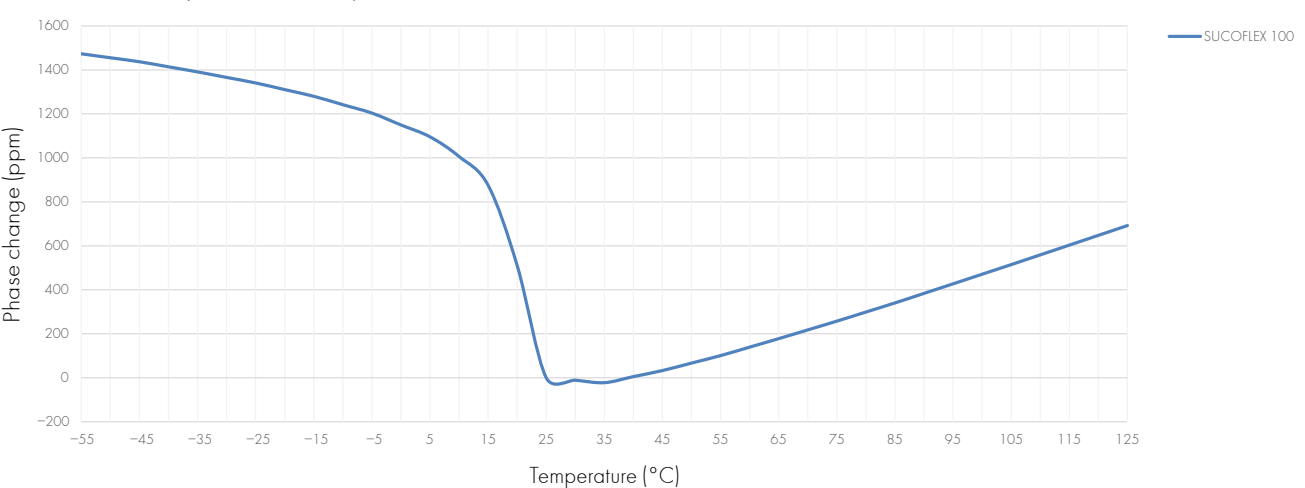
Attenuation (typical values at +25 °C ambient temperature)



Power handling (maximum values at 25 °C ambient temperature and sea level)



Phase stability versus temperature



# SUCOFLEX® 200/400



The tape wrapped SUCOFLEX 200 microwave cable assemblies were specifically developed for high performance and for use in any application where the best insertion loss, highest phase stability versus temperature, excellent return loss and mechanical stability are required.

The SUCOFLEX 400 microwave assembly family was developed for high performance defense, medical, test and measurement technology applications, and when the best insertion loss, highest phase stability versus temperature and excellent return loss are of the utmost importance.

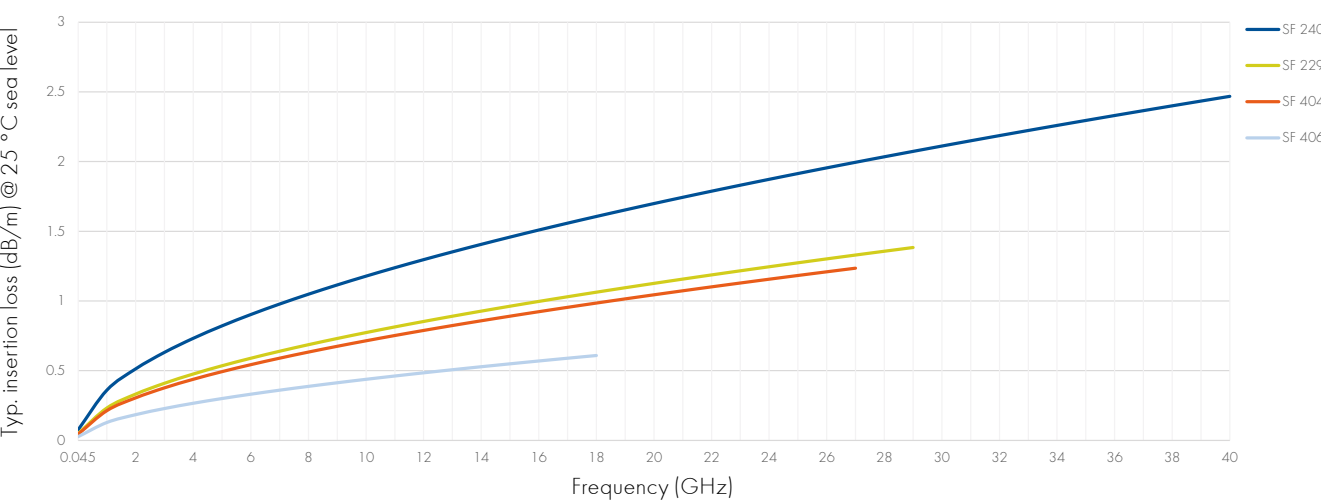
## Assembly types

		SUCOFLEX 229	SUCOFLEX 240	SUCOFLEX 404	SUCOFLEX 406
Max. operating frequency	GHz	29	40	26.5	18
Impedance	Ω	50	50	50	50
Application		static and dynamic	static and dynamic	static	static
Velocity of propagation	%	82	82	89	89
Weight	g/m	61	31	72	145
Min. bending radius static	mm	23	15.2	25	30
Min. bending radius repeated	mm	70	25	35	60
Temperature range on request	°C	-55 to +165 -65 to +200	-55 to +165 -65 to +200	-55 to +125	-55 to +125
Crush resistance	kN/m	–	–	2	6
Tensile load	N	133	133	115	175
Inner conductor		solid wire	solid wire	solid wire	solid wire
Dielectric		PTFE microporous	PTFE microporous	ULD-PTFE	ULD-PTFE
Outer conductor		flat wire braid	flat wire braid	tape/braid	tape/braid
Barrier		tape/braid	tape/braid	–	–
Jacket		FEP	FEP	FEP	FEP
Ruggedization		on request	on request	on request	on request
Outer diameter	mm	5.1	4.2	5.5	8.3
Screening effectiveness (up to 18 GHz)	dB	> 90	> 90	> 90	> 90
Phase stability vs. flexure (360°, diameter 55 mm)	°el/ GHz	< 0.65	< 0.65	< 1.7	< 2.5
Phase stability vs. temperature (-40 to +85 °C)	ppm	< 600	< 600	< 500	< 500
Assembly phase matching tolerances	°el/ GHz	± 0.5	± 0.5	± 0.5	± 0.5
Cable attenuation at 25 °C	dB/m	see graph	see graph	see graph	see graph
Insertion loss stability vs. bending	dB	± 0.2	± 0.2	± 0.1	± 0.1
Insertion loss stability vs. temperature	%/°C	< 0.21	< 0.21	< 0.26	< 0.26
Insertion loss stability vs. shaking	dB	± 0.1	± 0.1	± 0.2	± 0.1
Power handling	Watt	see graph	see graph	see graph	see graph

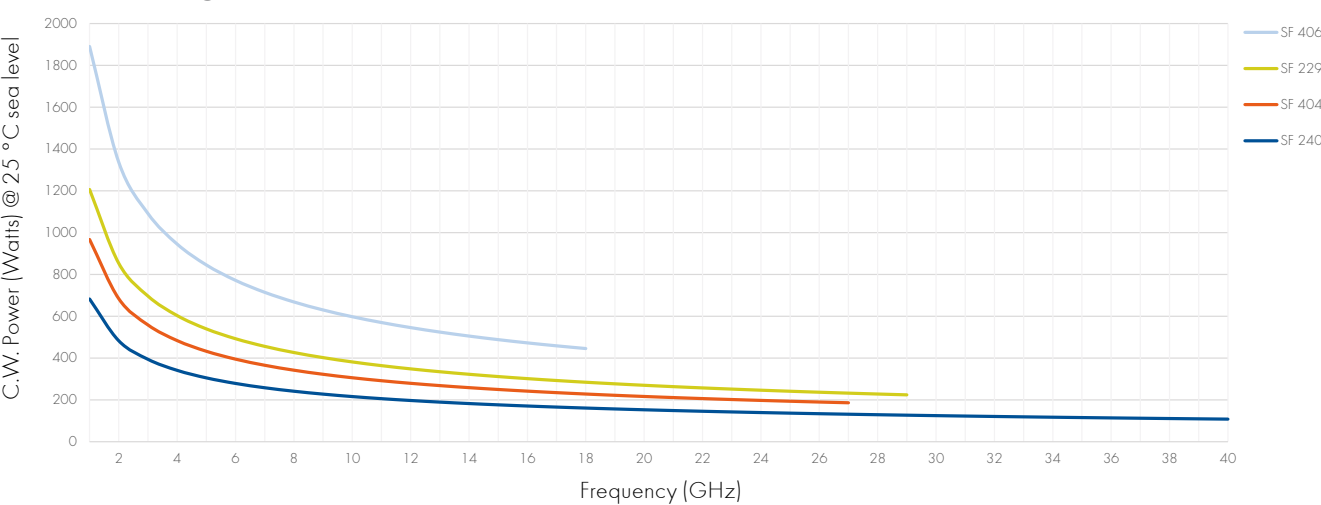


# SUCOFLEX® 200/400 – graphs

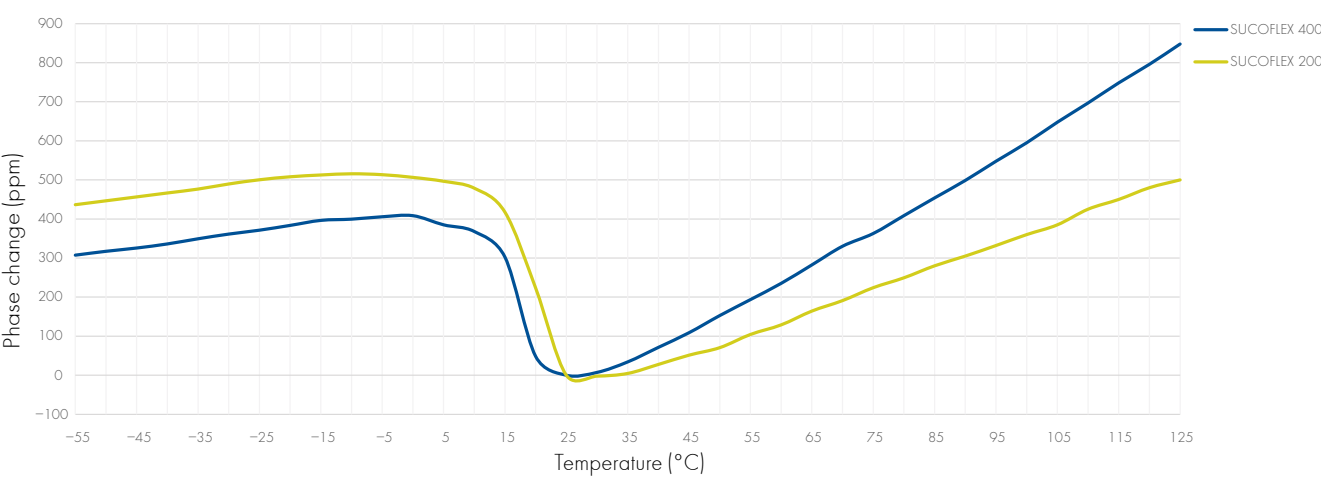
Attenuation (typical values at +25 °C ambient temperature)



Power handling (maximum values at 25 °C ambient temperature and sea level)



Phase stability versus temperature



# SUCOFLEX® 300



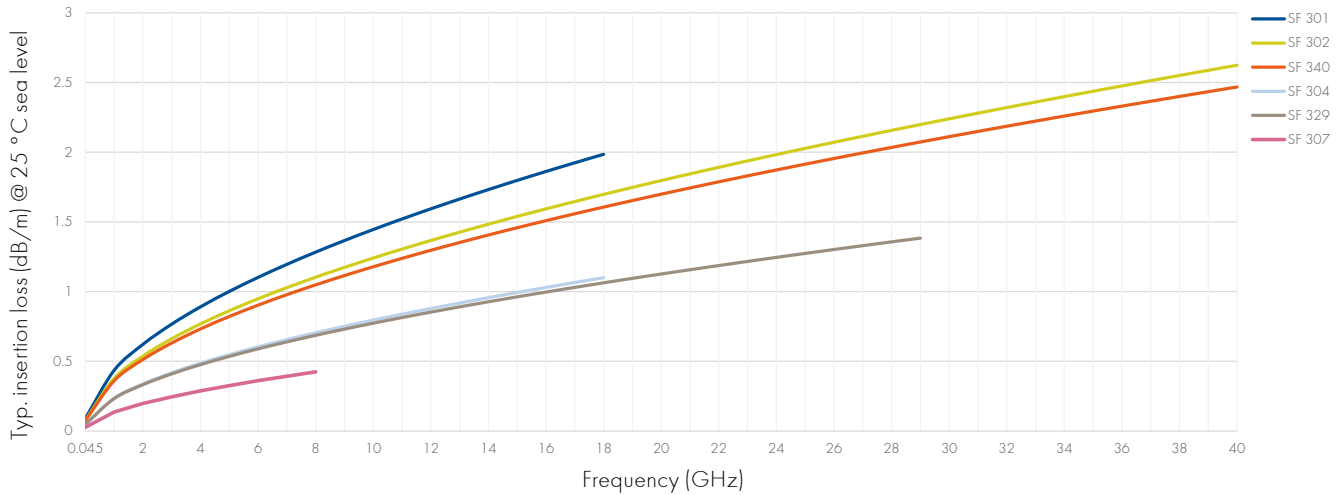
The SUCOFLEX 300 light-weight, low-loss flexible microwave cable assemblies are high-end products designed to meet the stringent needs of space flight systems (e. g. satellites) and aerospace systems (aircraft, helicopters, missiles), which are subjected to extremely severe operating conditions.

## Assembly types

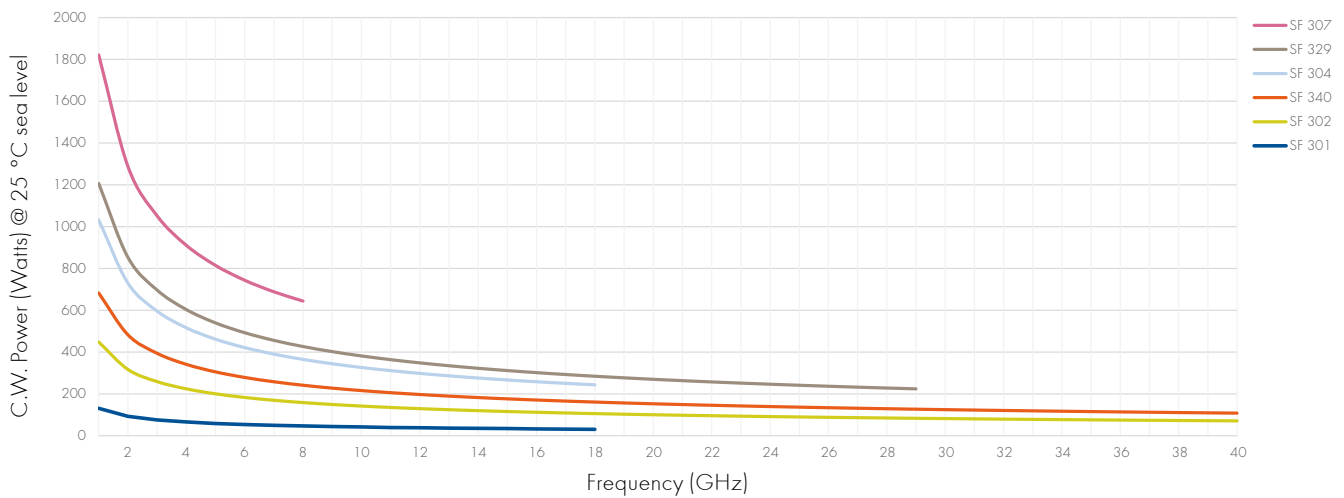
		SUCOFLEX 301	SUCOFLEX 302	SUCOFLEX 304	SUCOFLEX 307	SUCOFLEX 329	SUCOFLEX 340
Max. operating frequency	GHz	18	40	18	8	29	40
Impedance	Ω	50	50	50	50	50	50
Application		static	static	static	static	static	static
Velocity of propagation	%	77	77	77	77	82	82
Weight	g/m	23.9	29	46	133	40	27
Min. bending radius static	mm	15	15	20	50	23	15.2
Min. bending radius repeated	mm	20	30	50	100	70	25
Temperature range	°C	−55 to +125	−55 to +125	−55 to +125	−55 to +150	−65 to +150	−65 to +150
Tensile load	N	100	150	250	340	133	133
Inner conductor		solid wire	solid wire	solid wire	solid wire	solid wire	solid wire
Dielectric		LD-PTFE	LD-PTFE	LD-PTFE	LD-PTFE	PTFE microporous	PTFE microporous
Outer conductor		tape/braid	tape/braid	tape/braid	tape/braid	flat wire braid	flat wire braid
Jacket		ETFE	ETFE	ETFE	ETFE	ECTFE	ECTFE
Ruggedization		on request	on request	on request	on request	on request	on request
Outer diameter	mm	3.5	3.7	5.4	9.0	5.1	4.2
Screening effectiveness (up to 18 GHz)	dB	> 90	> 90	> 90	> 90	> 90	> 90
Phase stability vs. flexure (360°, diameter 40 mm)	°el/ GHz	< 1.5	< 1.5	< 1.5	< 2.0	< 0.65	< 0.65
Phase stability vs. temperature (−40 to +85 °C)	ppm	< 1500	< 1500	< 1500	< 1500	< 1000	< 1000
Assembly phase matching tolerances	°el/ GHz	± 0.5	± 0.5	± 0.5	± 0.5	± 0.5	± 0.5
Cable attenuation at 25 °C	dB/m	see graph	see graph	see graph	see graph	see graph	see graph
Insertion loss stability vs. bending	dB	± 0.2	± 0.2	± 0.1	± 0.1	± 0.2	± 0.2
Insertion loss stability vs. temperature	%/°C	< 0.2	< 0.2	< 0.2	< 0.45	< 0.2	< 0.2
Insertion loss stability vs. shaking	dB	± 0.1	± 0.1	± 0.1	± 0.1	± 0.1	± 0.1
Power handling	Watt	see graph	see graph	see graph	see graph	see graph	see graph
Radiation-gamma	Mrad	100	100	100	100	200	200

# SUCOFLEX® 300 – graphs

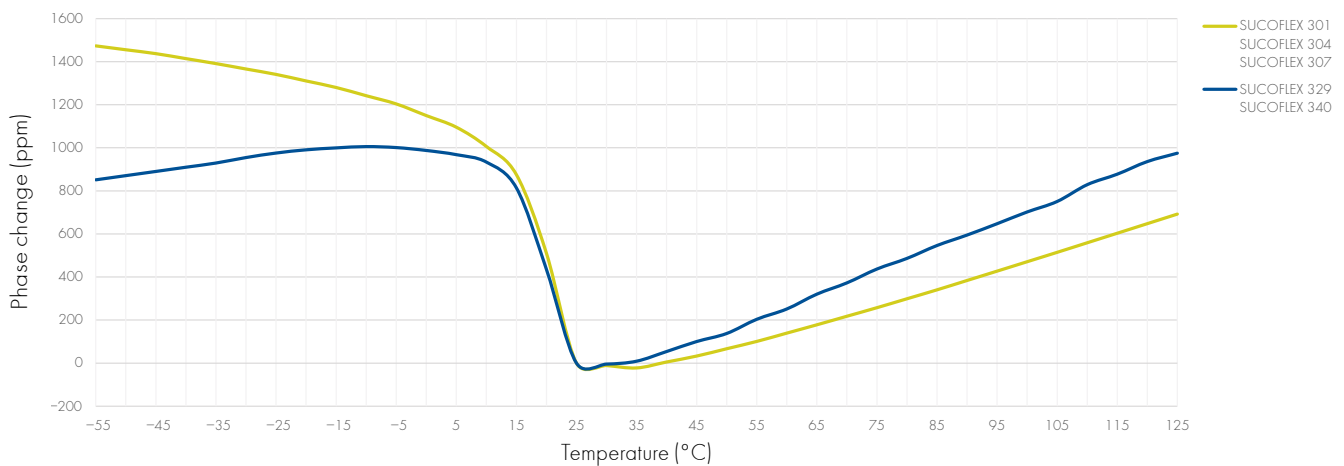
Attenuation (typical values at +25 °C ambient temperature)



Power handling (maximum values at 25 °C ambient temperature and sea level)

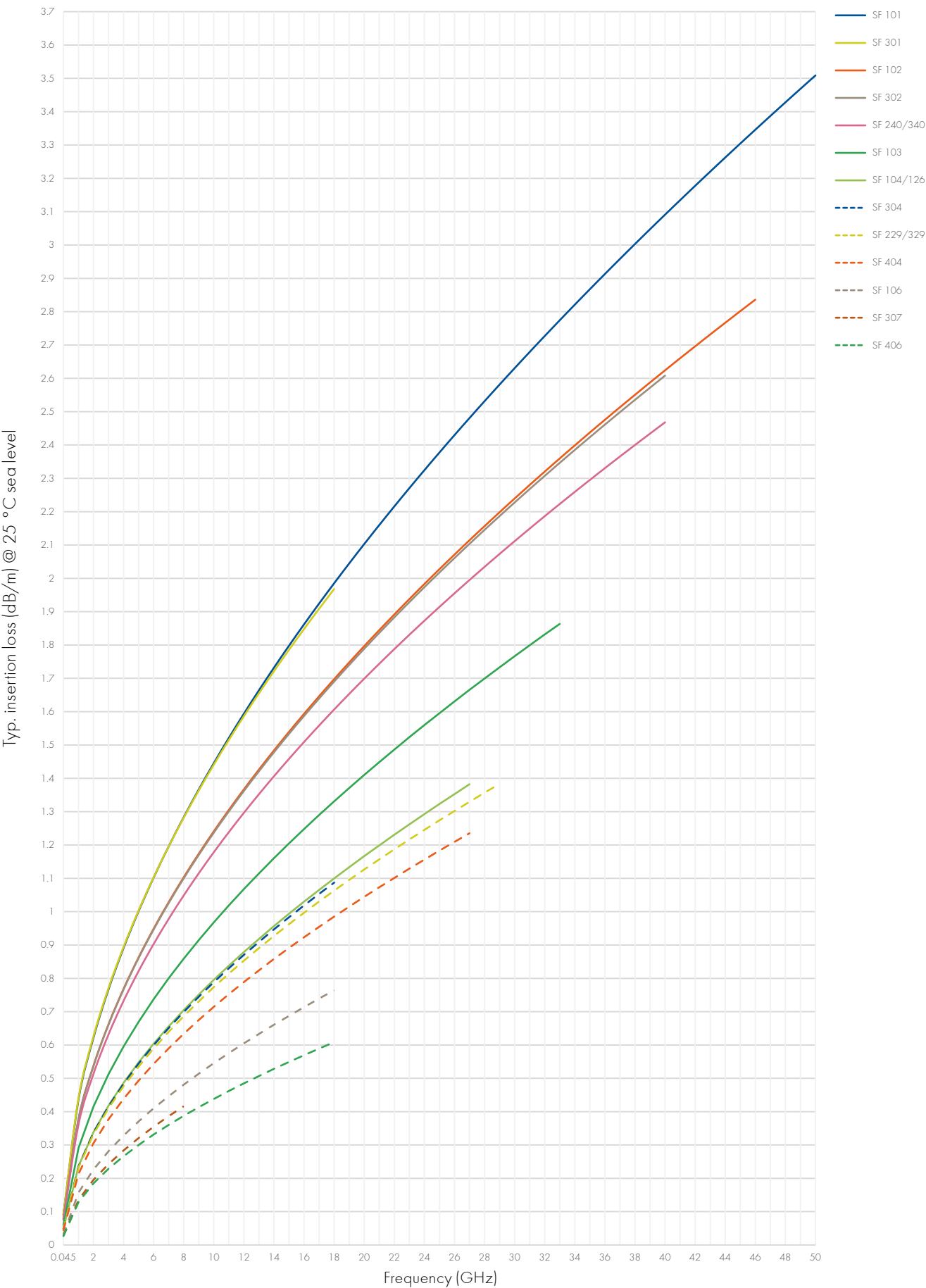


Phase stability versus temperature





# SUCOFLEX® assemblies – insertion loss comparison



# Overview SUCOFLEX® connectors

Cross reference within product range

Outer diameter mm	Cable attenuation at 18 GHz dB/m	Armoring options	Interfaces	BNC	QMA	QN	7/16	BMA	TNC	N	PC7	SMA	PC3.5	SK	PC2.4	Self-lock
			Cables													
3.5	2.0		SUCOFLEX 301									18				
3.7	2.0	A	SUCOFLEX 101									26.5		40	50	
3.7	3.0	A	SUCOFLEX 101 P									26.5		40	50	
3.7	1.9	D	SUCOFLEX 302						18	18		26.5	26.5	40	40	
4.0	1.7	A, D	SUCOFLEX 102					18	18	18		26.5	26.5	40	46	
4.0	1.7		SUCOFLEX 102 I					18	18	18		26.5	26.5	40	46	
4.1	1.6		SUCOFLEX 240									26.5		40		50
4.2	1.6		SUCOFLEX 340									26.5		40		50
4.6	1.3	A, D	SUCOFLEX 103	4				18	18	18	18	18	26.5			
4.6	1.3		SUCOFLEX 103 I	4				18	18	18	18	18	26.5			
5.1	1.1	A	SUCOFLEX 229						18	18		26.5		29		18
5.1	1.1		SUCOFLEX 329						18	18		26.5		29		18
5.4	1.1	D	SUCOFLEX 304						18			18				
5.5	1.1	A, D	SUCOFLEX 104	4	6	6	7.5	18	18	18	18	18	26.5			
5.5	1.1		SUCOFLEX 104 I	4	6	6	7.5	18	18	18	18	18	26.5			
5.5	1.1	A	SUCOFLEX 126	4			7.5	18	18	18	18	18	26.5			
5.5	1.0	A, D	SUCOFLEX 404						18	18		18	26.5			
7.9	0.8	A, D	SUCOFLEX 106			6	7.5		18	18		18				
7.9	1.1	A, D	SUCOFLEX 106 P						18	18		18				
8.2	0.8		SUCOFLEX 106 I			6	7.5		18	18		18				
8.3	0.6	A, D	SUCOFLEX 406						18	18		18				
9.0	-		SUCOFLEX 307						5.5							

All cable assemblies are qualified according to MIL and are available with phase match and/or armoring.

P: Stranded inner conductor for high flexible cable with improved phase variation vs. flexure

I: LSFH jacket (low smoke and free of halogen)



## Self-locking connectors

Refer to page 83 for more information.



# Stock assemblies

## SUCOFLEX® 100

Item no.	Type	Length		Frequency	Max. insertion loss at 25 °C	Max. VSWR	RoHS compliant
		mm	inch	GHz	dB		

### SUCOFLEX\_101

85026753	SF101/PC24m/PC24m/500 mm	500	20	50	2.29	1.44	RoHS 6
----------	--------------------------	-----	----	----	------	------	--------

### SUCOFLEX\_101\_EA (armoured)

85026754	SF101EA/PC24m/PC24m/500 mm	500	20	50	2.29	1.44	RoHS 6
----------	----------------------------	-----	----	----	------	------	--------

### SUCOFLEX\_102

84017146	SF102/SKm/SKm/500 mm	500	20	40	1.76	1.44	RoHS 6
84017149	SF102/SKm/SKm/1000 mm	1000	40	40	3.21	1.44	RoHS 6

### SUCOFLEX\_102\_EA (armoured)

85026755	SF102EA/SKm/SKm/500 mm	500	20	40	1.76	1.44	RoHS 6
85026756	SF102EA/SKm/SKm/1000 mm	1000	40	40	3.21	1.44	RoHS 6

### SUCOFLEX\_104

84017153	SF104/Nm/Nm/500 mm	500	20	18	0.82	1.35	RoHS 6
84016754	SF104/SMAm/SMAm/500 mm	500	20	18	0.82	1.25	RoHS 6
84017154	SF104/PC35m/PC35m/500 mm	500	20	26.5	1.01	1.35	RoHS 6
84017155	SF104/SMAm/Nm/1000 mm	1000	40	18	1.43	1.30	RoHS 6
84017157	SF104/Nm/Nm/1000 mm	1000	40	18	1.43	1.35	RoHS 6
84016755	SF104/SMAm/SMAm/1000 mm	1000	40	18	1.43	1.25	RoHS 6
84017158	SF104/PC35m/PC35m/1000 mm	1000	40	26.5	1.77	1.35	RoHS 6
84017067	SF104/Nm/Nm/1500 mm	1500	59	18	2.03	1.35	RoHS 6
84016756	SF104/SMAm/SMAm/1500 mm	1500	59	18	2.03	1.25	RoHS 6
84017159	SF104/SMAm/Nm/2000 mm	2000	79	18	2.64	1.35	RoHS 6
84017160	SF104/Nm/Nm/2000 mm	2000	79	18	2.64	1.35	RoHS 6
84016757	SF104/SMAm/SMAm/2000 mm	2000	79	18	2.64	1.25	RoHS 6

### SUCOFLEX\_126\_E

85072824	SF126E/SMAm/SMAm/500 mm	500	20	18	0.82	1.25	RoHS 6
85072825	SF126E/SMAm/SMAm/1000 mm	1000	40	18	1.43	1.25	RoHS 6
85072826	SF126E/PC35m/PC35m/1000 mm	1000	40	26.5	1.77	1.35	RoHS 6

### SUCOFLEX\_126\_EA (armoured)

85072828	SF126EA/Nm/Nm/1000 mm	1000	40	18	1.43	1.25	RoHS 6
85072827	SF126EA/SMAm/SMAm/1000 mm	1000	40	18	1.43	1.25	RoHS 6
85072829	SF126EA/Nm/Nf/1500 mm	1500	59	18	2.03	1.25	RoHS 6
85072830	SF126EA/Nm/Nm/1500 mm	1500	59	18	2.03	1.25	RoHS 6



## SUCOFLEX® 200

Item no.	Type	Length		Frequency	Max. VSWR	RoHS comp.
		mm	inch	GHz		
80395241	SF229/SK <sub>m</sub> /SK <sub>m</sub> /36 inch	914	36	29	1.30	RoHS 6
80395242	SF229/SK <sub>m</sub> /SK <sub>m</sub> /48 inch	1219	48	29	1.30	RoHS 6
80395243	SF229/SK <sub>m</sub> /SK <sub>m</sub> /72 inch	1829	72	29	1.30	RoHS 6
80395250	SF229/SM <sub>Am</sub> /SM <sub>Am</sub> /36 inch	914	36	26.5	1.30	RoHS 6
80395251	SF229/SM <sub>Am</sub> /SM <sub>Am</sub> /48 inch	1219	48	26.5	1.30	RoHS 6
80395252	SF229/SM <sub>Am</sub> /SM <sub>Am</sub> /72 inch	1829	72	26.5	1.30	RoHS 6
80395256	SF229/TNC <sub>m</sub> /TNC <sub>m</sub> /36 inch	914	36	18	1.30	RoHS 6
80395257	SF229/TNC <sub>m</sub> /TNC <sub>m</sub> /48 inch	1219	48	18	1.30	RoHS 6
80395258	SF229/TNC <sub>m</sub> /TNC <sub>m</sub> /72 inch	1829	72	18	1.30	RoHS 6
80395253	SF229/N <sub>m</sub> /N <sub>m</sub> /36 inch	914	36	18	1.30	RoHS 6
80395254	SF229/N <sub>m</sub> /N <sub>m</sub> /48 inch	1219	48	18	1.30	RoHS 6
80395255	SF229/N <sub>m</sub> /N <sub>m</sub> /72 inch	1829	72	18	1.30	RoHS 6

## Sucotest 18 (A)

Item no.	Type	Length		Frequency	Max. insertion los at 25 °C	Max. VSWR	ROHS comp.
		mm	inch	GHz			
84002061	ST-18/SM <sub>Am</sub> /SM <sub>Am</sub> /36 inch	914	36	18	< 1.51		
84002060	ST-18/N <sub>m</sub> /N <sub>m</sub> /36 inch	914	36	18	< 1.51		
84004594	ST-18/SM <sub>Am</sub> /N <sub>m</sub> /36 inch	914	36	18	< 1.51		
84003373	ST-18/SM <sub>Am</sub> /SM <sub>Am</sub> /48 inch	1219	48	18	< 1.95		
84003372	ST-18/N <sub>m</sub> /N <sub>m</sub> /48 inch	1219	48	18	< 1.95		
84004006	ST-18/SM <sub>Am</sub> /N <sub>m</sub> /48 inch	1219	48	18	< 1.95		
84004007	ST-18/SM <sub>Am</sub> /SM <sub>Am</sub> /72 inch	1829	72	18	< 2.85		
84004070	ST-18/N <sub>m</sub> /N <sub>m</sub> /72 inch	1829	72	18	< 2.85		
84004595	ST-18/SM <sub>Am</sub> /N <sub>m</sub> /72 inch	1829	72	18	< 2.85		
84013029	ST18A/N <sub>m</sub> /N <sub>m</sub> /1500 mm	1500	59	18	2.74	1.25	RoHS 6
84013030	ST18A/N <sub>m</sub> /N <sub>f</sub> /1500 mm	1500	59	18	2.74	1.25	RoHS 6
84013031	ST18A/N <sub>m</sub> /N <sub>m</sub> /3000 mm	3000	118	18	5.30	1.25	RoHS 6
84013032	ST18A/N <sub>m</sub> /N <sub>f</sub> /3000 mm	3000	118	18	5.30	1.25	RoHS 6
84013033	ST18A/N <sub>m</sub> /716m/1500 mm	1500	59	7.5	1.65	1.29	RoHS 6
84013034	ST18A/N <sub>m</sub> /716f/1500 mm	1500	59	7.5	1.65	1.29	RoHS 6
84013035	ST18A/N <sub>m</sub> /716m/3000 mm	3000	118	7.5	3.18	1.29	RoHS 6
84013036	ST18A/N <sub>m</sub> /716f/3000 mm	3000	118	7.5	3.18	1.29	RoHS 6

## Sucotest 26/40

Item no.	Type	Length		Frequency	Max. insertion loss at 25 °C	Max. VSWR	RoHS compliant
		mm	inch	GHz	dB		
80391541	ST26/SM <sub>Am</sub> /SM <sub>Am</sub> /24 inch	610	24	26.5	1.74	1.45	RoHS 6
80391542	ST26/SM <sub>Am</sub> /SM <sub>Am</sub> /36 inch	914	36	26.5	2.41	1.45	RoHS 6
80391543	ST26/SM <sub>Am</sub> /SM <sub>Am</sub> /48 inch	1219	48	26.5	3.08	1.45	RoHS 6
80391545	ST40/SK <sub>m</sub> /SK <sub>m</sub> /24 inch	610	24	40	2.20	1.50	RoHS 6
80391546	ST40/SK <sub>m</sub> /SK <sub>m</sub> /36 inch	914	36	40	3.03	1.50	RoHS 6
80391547	ST40/SK <sub>m</sub> /SK <sub>m</sub> /48 inch	1219	48	40	3.87	1.50	RoHS 6

# Armoring options

## Type A



Consists of a steel spring (round wire), steel braid and polyurethane (TPU) jacket. Up to +85 °C, this ruggedization offers excellent protection against compression, tension, abrasion and other mechanical forces acting upon the cable.

### Armoring

Surface	TPU
Max. crush resistance	80 kN/m
Torsional stiffness	$8.5 \times 10 \text{ Nm}^2/\text{°}$

### Max. tensile force

Ruggedization	1500 N
Cable connector junction	400 N

## Type B



Consists of a flexible hose of stainless steel. The ruggedization protects the cable against compression, abrasion, mechanical injuries, open fire and hot objects (e.g. soldering irons). The continuous temperature is limited by the cable to +165 °C, and in the immediate proximity of the connectors to the maximum connector temperature.

### Armoring

Surface	stainless steel
Max. crush resistance	80 kN/m
Torsional stiffness	$3.2 \times 10 \text{ Nm}^2/\text{°}$

### Max. tensile force

Ruggedization	1000 N
Cable connector junction	500 N

## Type D



Consists of an aramid yarn braid impregnated with silicon varnish. The ruggedization protects the cable against abrasion and brief high temperatures.

### Armoring

Surface	aramid yarn braiding impregnated with silicon varnish
---------	---

# Jacket options

## Type E

Thermoplastic polyurethane (TPU) jacket for highest flexibility and a low bending moment

## Type I

LSFH jacket (low smoke and free of halogen)

# Qualifications

## Temperature/altitude/humidity

MIL-STD-810C, method 518.1, procedure I

## Thermal shock

MIL-STD-202, method 106, condition B1  
25 cycles, temperature: -54 to 125 °C

## Mechanical shock

MIL-STD-810D, method 516.3, procedure I (half-sine)  
20 g, 6 to 9 ms, 45 Hz cross over frequency

MIL-STD-810, method 516, procedure I (saw-tooth)  
40 g saw-tooth pulse of 11 ms duration  
3 shocks in each of the six directions

## Vibration

MIL-STD-810, method 519.3, procedure I, figure 514.3-1  
(Gunfire)  
26.5 min. with specified vibration profile

MIL-STD-810D, method 514.3, procedure I (random)  
Functional: 0.2 g<sup>2</sup>/Hz  
Endurance: 0.83 g<sup>2</sup>/Hz

MIL-STD-202; method 204, condition G (sinusoidal)  
Acceleration: 30 g  
Frequency range: 10 to 2000 Hz  
Duration: 4 hours in each of three axes

## Acceleration

MIL-STD-810D, method 513.3, procedure II  
27 g, 5 min.  
MIL-STD-810D, method 513.3, procedure I  
50 g, 5 min.

## Chemical resistance

British standard 3G100, part 2, section 3, class A

## Moisture resistance

MIL-STD-202, method 106, 10 day exposure

## Salt fog

MIL-STD-810D, method 509.2  
48 hours exposure to a 5 % solution

## Fungus

MIL-STD-810D, method 508.3

## Sand and dust

Def. Stand. 07-55, part 2, section 4, issue 1  
+35 °C, 3 hours

## Solar radiation

MIL-STD-810, method 505, procedure II



## Minibend series

Minibend is a truly flexible coaxial cable assembly designed for use in low profile, internal, point-to-point interconnections between RF modules within communications systems. Minibend replaces 0.086 inch custom semi-rigid cables with standard flexible cables, eliminating the need for predefined custom lengths and bend configurations. Minibend provides you with a preassembled and tested high performance, cost-effective alternative in a variety of standard lengths and connector configurations.

Minibend R is designed for use in complex, congested environments where higher cable retention force is required. Minibend R's pull strength is more than 70 % greater than standard Minibend. When installed and bent at the minimum bend radius, Minibend R will tolerate multiple 90° rotations at the cable/connector junction. The "R" ruggedization can be added to any Minibend connector style.





### Minibend/Minibend L

Low profile, high performance microwave coaxial cable assemblies

- Frequency range up to 65 GHz (50 GHz Minibend L)
- Triple shielded for high isolation
- Eliminates need for costly and space-consuming right angle connectors
- Direct replacement for 0.086 inch semi-rigid cables
- 30 % reduction in insertion (Minibend L) as compared to the standard Minibend cable



### Microbend/Microbend L

Ultra low profile, high performance, microwave coaxial cable assemblies

- Frequency range up to 90 GHz (85 GHz Microbend L)
- Triple shielded for high isolation
- Direct replacement for 0.047 inch semi-rigid cables
- Guaranteed 10 lbs (45 N) pull force
- 30 % reduction in insertion loss (Microbend L) as compared to the standard Microbend cable



### Mini141

Low profile, high performance ultra low loss microwave cable assemblies

- Frequency range up to 40 GHz
- Triple shielded for high isolation
- Eliminates need for costly right angle connectors
- Direct replacement for 0.141 inch semi-rigid cables



### Minibend CTR (phase invariant)

The minibend CTR phase Invariant cable is developed for phase critical applications requiring precision electrical length connectivity.




- Excellent phase and insertion loss stability over temperature  
< 300 ppm absolute phase change over -55 to +125 °C temperature range
- Outstanding phase stability versus bending phase vs. flexure of 1.0° at 24 GHz
- Revolutionary minibend bend-to-the-end flexibility 5 mm minimum bend radius



# Minibend – series

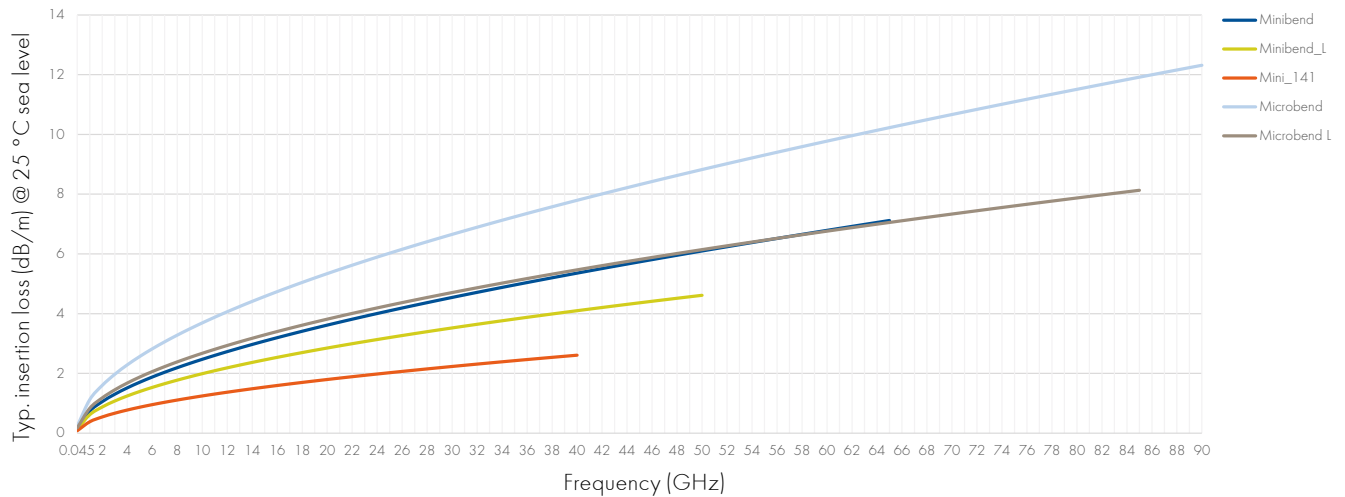
The goal of the Minibend series is to provide the user with incredible flexibility in both the cable assemblies and in application. The cables incorporate numerous elements that give them the smallest bend radii in the industry without compromising isolation, stability or durability. Our connectors complement this series with a patented design that eliminates soldering and strain relief on the cable to allow for the minimum bend radius at the connector. Whether the project requires low loss or low price, high frequency or high isolation, small connectors or small bend radii, our qualified Minibend series of assemblies will exceed your requirements.

- Light weight and low profile
- High isolation from standard triple shielding
- Available with solid or microporous PTFE, or foamed PFA
- Military and aerospace heritage with standard assemblies

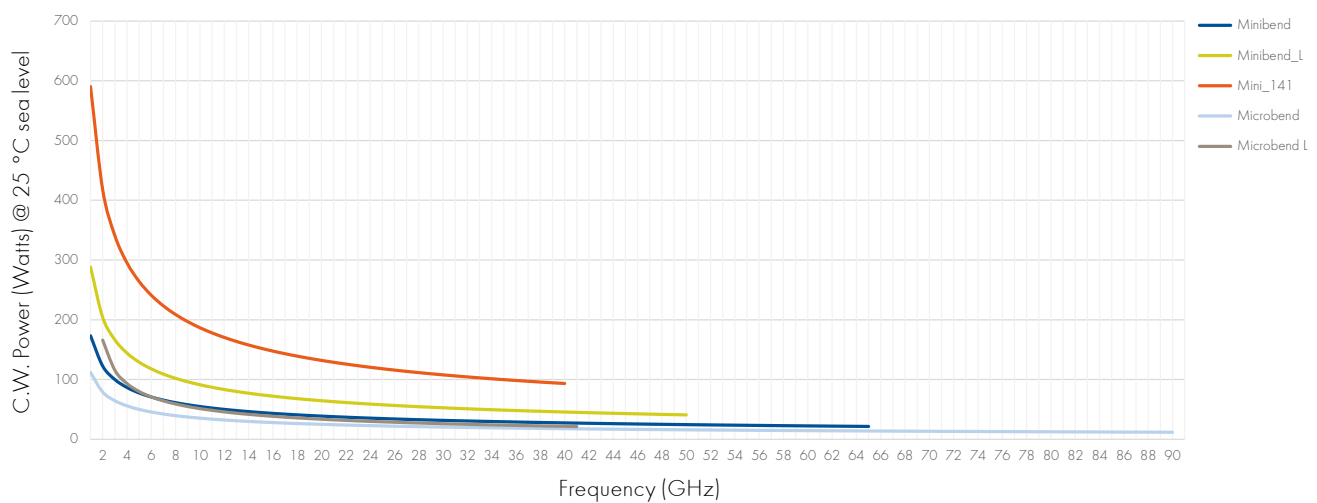
	Minibend	Minibend L	Microbend	Microbend L	Mini141
					
Electrical specifications					
Impedance (nominal)	50 Ω		50 Ω		50 Ω
Operating frequency	DC - 65 GHz		DC - 90 GHz		DC - 40 GHz
Insertion loss variation vs. temperature	< 0.003 °K <sup>-1</sup>		< 0.003 °K <sup>-1</sup>		< 0.0015 °K <sup>-1</sup>
Return loss (min)	-32 dB @ 18 GHz -25 dB @ 40 GHz		-32 dB @ 18 GHz -25 dB @ 40 GHz		-28 dB @ 18 GHz -20 dB @ 40 GHz
RF leakage	100 dB		100 dB		100 dB
Resistance - insulation cable	> 10 <sup>6</sup> MΩ*m		> 10 <sup>6</sup> MΩ*m		> 10 <sup>6</sup> MΩ*m
Withstand voltage - cable assembly (at sea level)	> 2000 V		> 2000 V		> 5000 V
Capacitance	98.4 pF*m <sup>-1</sup>		97.4 pF*m <sup>-1</sup>		89.2 pF*m <sup>-1</sup>
Time delay	4.74 ns*m <sup>-1</sup>		4.74 ns*m <sup>-1</sup>		4.36 ns*m <sup>-1</sup>
Phase variation vs. temperature	< 6000 ppm	< 1500 ppm	< 6000 ppm	< 1500 ppm	< 1500 ppm
Materials and finishes					
Cable center conductor	silver plated OFHC copper		silver plated OFHC copper		silver plated OFHC copper
Cable dielectric	solid PTFE	expanded PTFE	solid PTFE	expanded PTFE	expanded PTFE
Cable shield	silver plated copper flat wire braid		silver plated copper flat wire braid		silver plated copper flat wire braid
Cable binder	aluminum/polyimide laminate tape		aluminum/polyimide laminate tape		aluminum/polyimide laminate tape
Cable braid	stainless steel round wire braid		stainless steel round wire braid		stainless steel round wire braid
Cable jacket	extruded FEP		extruded FEP		extruded FEP
Connector center contacts	beryllium copper, gold plated		beryllium copper, gold plated		beryllium copper, gold plated
Connector insulator	PTFE or Ultem		PTFE or Ultem		PTFE or Ultem
Connector body	stainless steel, passivated or beryllium copper, gold plated		stainless steel, passivated or beryllium copper, gold plated		stainless steel, passivated or beryllium copper, gold plated
Connector nut	stainless steel, passivated or beryllium copper, gold plated		stainless steel, passivated or beryllium copper, gold plated		stainless steel, passivated or beryllium copper, gold plated
Cable mechanics					
Diameter	2.49 mm	2.64 mm	1.91 mm	2.03 mm	3.61 mm
Minimum bending radius - static	5.08 mm	6.4 mm	1.52 mm	5.10 mm	8.38 mm
Minimum bending radius - dynamic	15.24 mm	19.1 mm	4.57 mm	15.20 mm	25.15 mm
Cable retention force	111 N	111 N	45 N	45 N	111 N
Weight	14.6 g*m <sup>-1</sup>	16.4 g*m <sup>-1</sup>	9.2 g*m <sup>-1</sup>	10.4 g*m <sup>-1</sup>	28.5 g*m <sup>-1</sup>

# Minibend – graphs

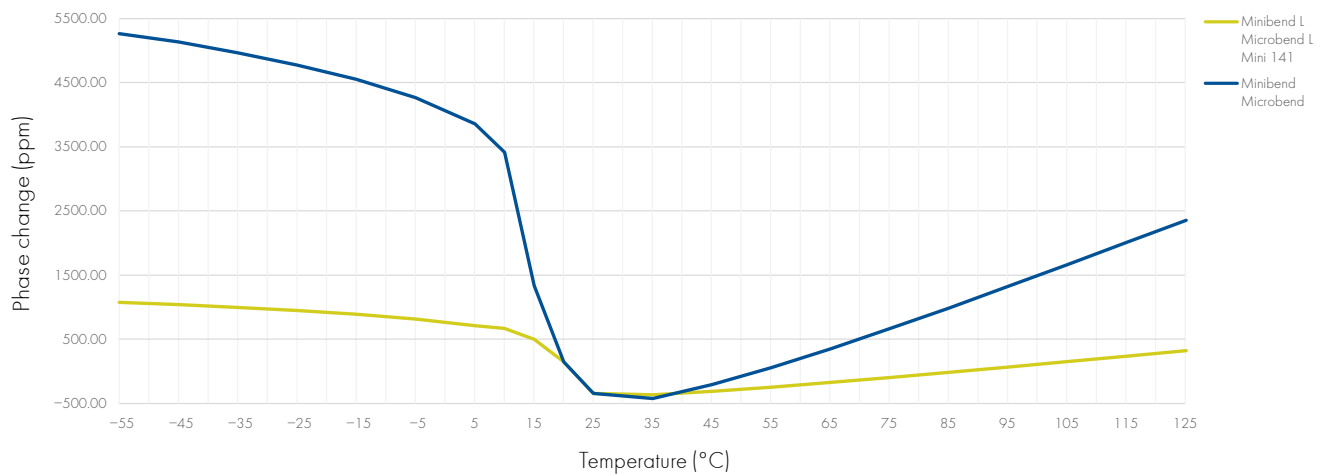
Attenuation (nominal values at +25 °C ambient temperature)



Power handling (maximum values at 25 °C ambient temperature and sea level)



Phase stability versus temperature



# Minibend CTR

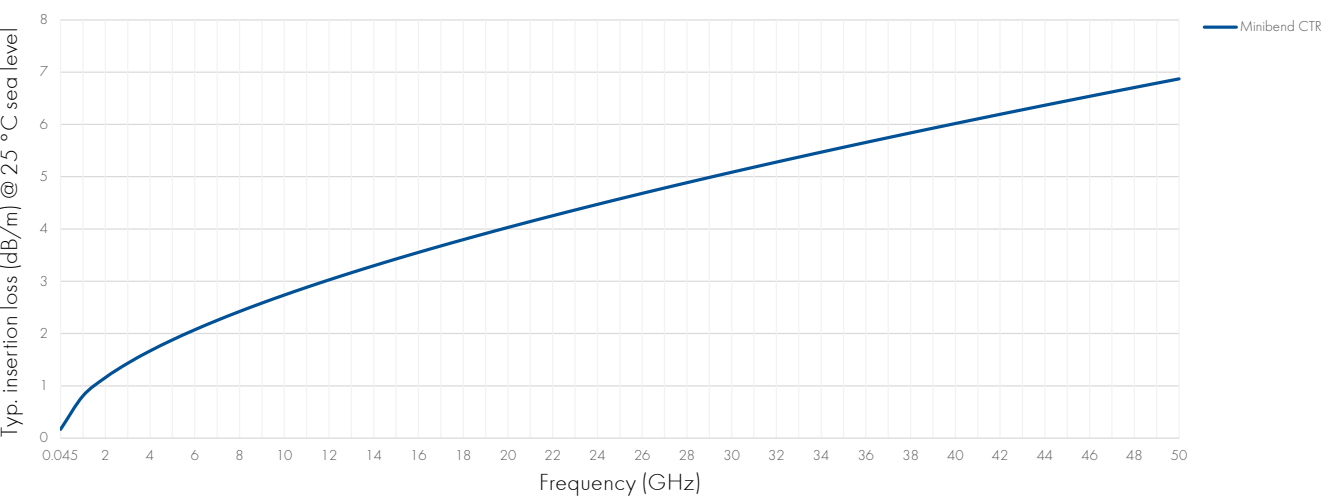
The minibend CTR family of cable assemblies combines the industry-renowned flexibility of HUBER+SUHNER Astrolab's bend-to-the-end connector termination technology with industry leading phase vs. temperature performance to create a stable, reliable, MIL-DTL-17 qualified interconnect solution to satisfy an endless range of customer applications where phase stability is key. The broad selection of connector interfaces offered on minibend CTR cable assemblies ensures that we are able to meet the unique requirements of our customers.

	Minibend CTR
	
Electrical specifications	
Impedance (nominal)	50 $\Omega$
Operating frequency	DC - 50 GHz
Insertion loss variation vs. temperature	< 0.0015 $^{\circ}\text{K}^{-1}$
Return loss (min)	-32 dB @ 18 GHz -25 dB @ 40 GHz
RF leakage	100 dB
Resistance - insulation cable	> 10 <sup>6</sup> M $\Omega$ *m
Withstand voltage - cable assembly (at sea level)	> 2000 V
Capacitance	90.2 pF*m <sup>-1</sup>
Time delay	4.36 ns*m <sup>-1</sup>
Phase variation vs. temperature	< 300 ppm
Materials and finishes	
Cable center conductor	silver plated OFHC copper
Cable dielectric	foamed PFA
Cable shield	silver plated copper flat wire braid
Cable binder	aluminum/polyimide laminate tape
Cable braid	stainless steel round wire braid
Cable jacket	extruded FEP
Connector center contacts	beryllium copper, gold plated
Connector insulator	PTFE or Ultem
Connector body	stainless steel, passivated or beryllium copper, gold plated
Connector nut	stainless steel, passivated or beryllium copper, gold plated
Cable mechanics	
Diameter	2.49 mm
Minimum bending radius - static	5.08 mm
Minimum bending radius - dynamic	15.24 mm
Cable retention force	111 N
Weight	15.6 g*m <sup>-1</sup>

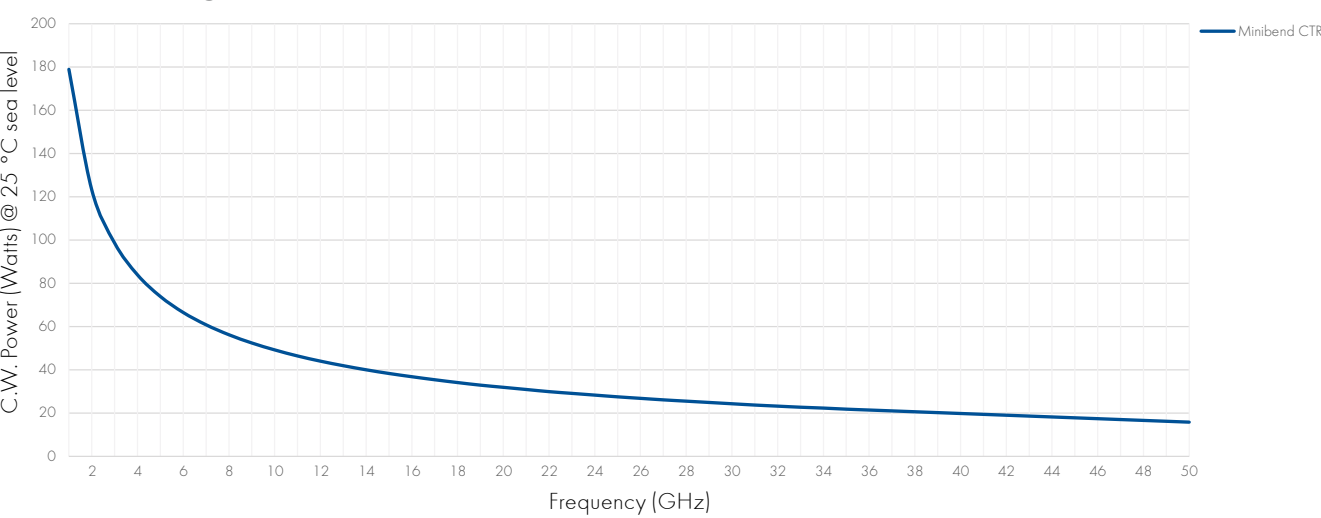


# Minibend CTR - graphs

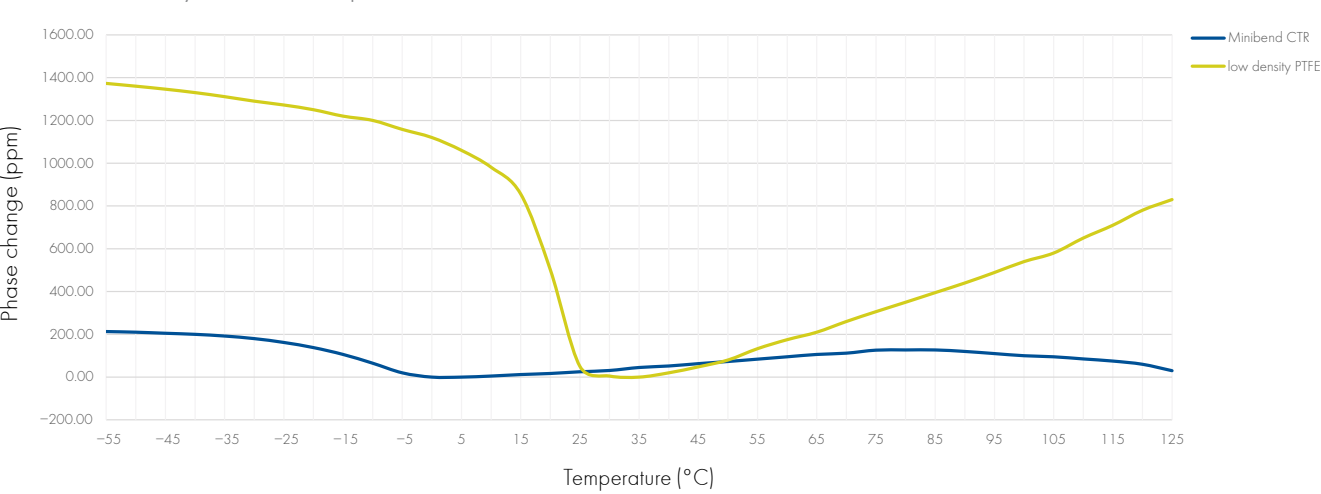
Attenuation (nominal values at +25 °C ambient temperature)



Power handling (maximum values at 25 °C ambient temperature and sea level)



Phase stability versus temperature



# Stock assemblies

Cable	Cable attenuation (nom.) dB/m @ 18 GHz	Outer diameter (mm)	Interface I											Interface II											
			1.85 mm plug, gold plated BeCu contact	2.4/1.85 mm plug	2.4 mm plug, gold plated BeCu contact	2.92 mm plug	SMA plug	SMA plug, fully captivated	SSMA plug	SMP female	SMPM female	SMPM - T female	N plug	ATNC plug	1.85 mm plug, gold plated BeCu contact	2.4/1.85 mm plug	2.4 mm plug, gold plated BeCu contact	2.92 mm plug	SMA plug	SMA plug, fully captivated	SSMA plug	SMP female	SMPM female	SMPM - T female	N plug
Minibend	3.8	2.49					•											•							
Minibend A	3.8	2.49							•											•					
Minibend E	3.8	2.49						•											•						
Minibend K	3.8	2.49				•											•								
Minibend KS	3.8	2.49				•															•				
Minibend KV	3.8	2.49		•													•								
Minibend QG	3.8	2.49			•											•									
Minibend S	3.8	2.49					•														•				
Minibend 2S	3.8	2.49								•											•				
Minibend V	3.8	2.49		•												•									
Minibend VG	3.8	2.49	•												•										
Minibend WR	3.8	2.49					•											•							
Minibend L	2.9	2.64					•											•							
Minibend LS	2.9	2.64					•														•				
Minibend L2S	2.9	2.64								•											•				
Minibend LA	2.9	2.64							•											•					
Microbend R	4.8	1.91					•											•							
Microbend AR	4.8	1.91							•											•					
Microbend KR	4.8	1.91				•											•								
Microbend KMR	4.8	1.91				•																•			
Microbend KMTR	4.8	1.91				•																	•		
Microbend KV	4.8	1.91				•									•										
Microbend MR	4.8	1.91					•															•			
Microbend 2MR	4.8	1.91								•												•			
Microbend MTR	4.8	1.91					•																•		
Microbend 2MTR	4.8	1.91										•											•		
Microbend MVR	4.8	1.91								•					•										
Microbend SR	4.8	1.91					•														•				
Microbend 2SR	4.8	1.91								•											•				
Microbend V	4.8	1.91	•												•										
mini141	1.8	3.61					•											•							
mini141 K	1.8	3.61				•											•								
mini141 N	1.8	3.61											•										•		
mini141 T	1.8	3.61												•										•	
mini141 W	1.8	3.61					•											•							

# Qualifications

The entire Minibend family is certified to the following standards through testing, analysis or similarity.

## Cable qualification

- MIL-DTL-17

## Connector qualification

- MIL-PRF-39012
- MIL-PRF-31031 (SMP)

## Cable assembly qualification

- MIL-PRF-55427

## Space qualification

- MIL-STD-1547
- NASA EEE-INST-002
- ESA 3902
- ESA 3402

## Thermal shock

- MIL-STD-202, method 107, test condition A, 1000 cycles, with cable bent at min. bend radius

## Mechanical shock

- MIL-STD-202, method 213, 12 000 g peak
- MIL-STD-883, method 2002, 1500 g peak

## Sinusoidal vibration

- MIL-STD-202, method 204, 28 g peak

## Random vibration

- MIL-STD-202, method 214, 46.3 g rms
- MIL-STD-883, method 2026, 16.4 g rms

## Acceleration

- MIL-STD-883, method 2001, 3000 g peak

## Moisture resistance

- MIL-STD-202, method 106

## Corrosion

- MIL-STD-202, method 101, test condition B



## 32071 – High power cable assemblies

The 32071 cable assembly offers incredible benefits to not only withstand extreme temperature and high altitude conditions, but also provide outstanding performance at high power levels. Based on its Fluoroloy® loaded connectors we can guarantee up to 500 W CW power at 150 °C under vacuum.

In addition, HUBER+SUHNER provides a comprehensive array of Fluoroloy® loaded panel connectors and feed-throughs for high power applications. Fluoroloy® has a higher dielectric constant (as compared to standard Teflon dielectric), but also a higher rate of thermal conductivity. This provides a more effective and efficient transfer of the heat generated at the center conductor, thus increasing the power handling capability of the connector. Fluoroloy® dielectric is available as an option on all of our connector types, should the power levels of the application require it.



# 32071 – High power, low loss microwave cable assemblies



## Product description

Boa-flex II cables utilize a microporous PTFE dielectric for low loss with minimal phase change due to temperature changes and flexure. Typical velocity is 77 % of the speed of light. All offer very low loss and are extremely stable with flexure.

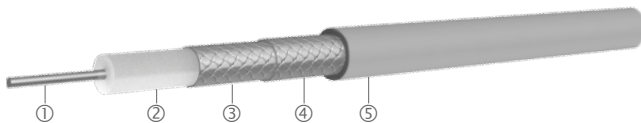
## Product features

- Impedance 50  $\Omega$
- Applicable up to 14 GHz
- Low density PTFE for superior electrical performance
- Helical wrapped outer conductor for increased electrical performance
- Exceptional phase and insertion loss stability with flexure
- Excellent phase vs. temperature characteristics
- Preferred for phase matching and tracking applications

## Recommended connectors

32071	TNC, N, SC
	Others available

## Construction



Cable	Inner conductor ①	Dielectric ②	Outer conductor ③	Outer braid ④	Outer braid ⑤	Outer diameter
						mm
32071	CuAg strand	PTFE microporous	CuAg tape	CuAg	FEP, translucent amber	9.5

## Technical data

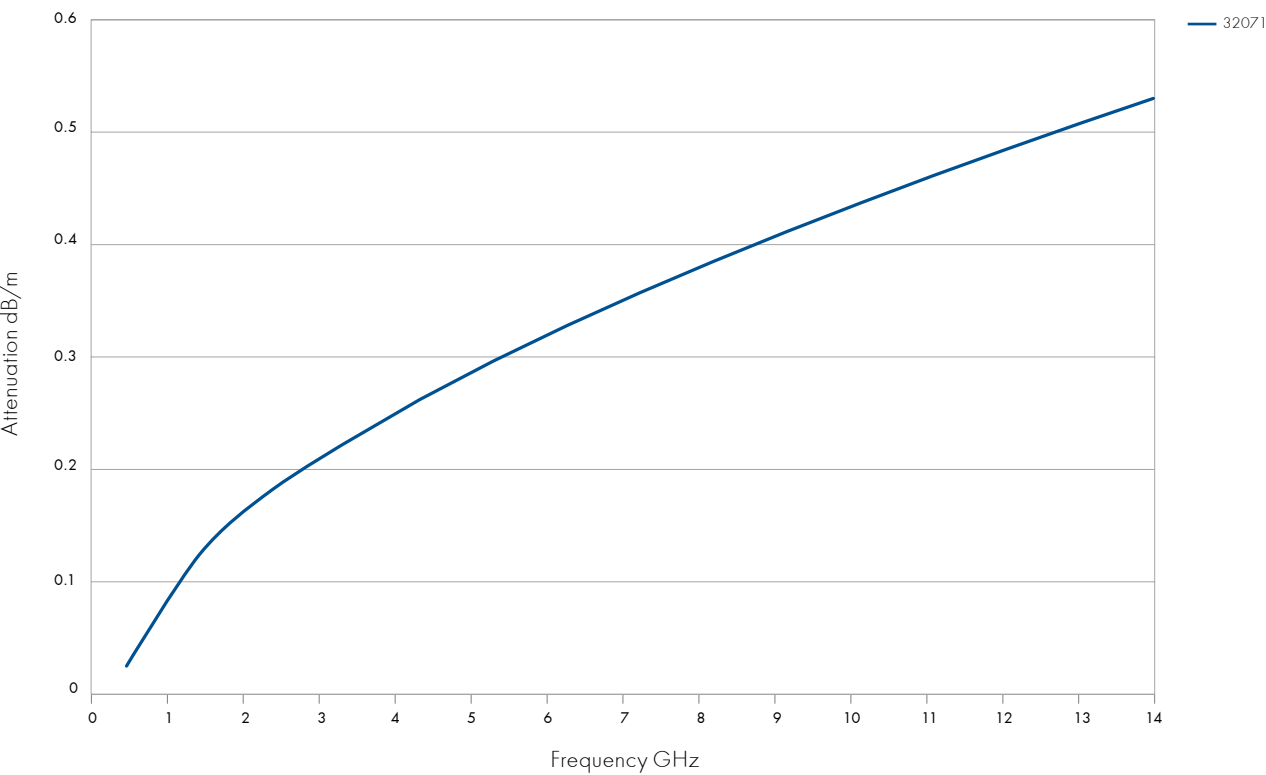
Cable	Item no.	Max. operating frequency	Velocity of propagation	Weight	Min. bending radius		Temperature range
		GHz	%	g/m	static mm	repeated mm	°C
32071	80310956	14	77.8	208.3	50.8	101.6	-55 to +200

## Available connectors

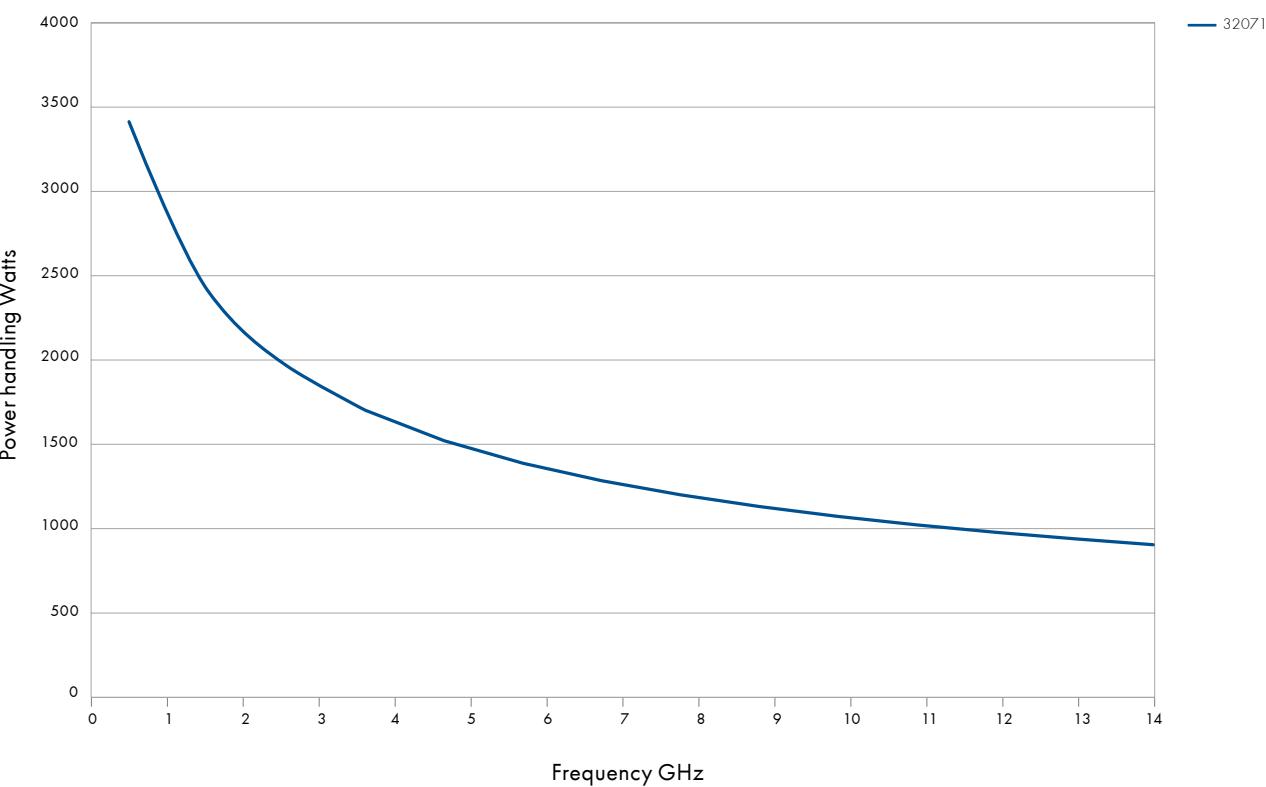
Connector	Series, pattern	HUBER+SUHNER type	Cable	Operating frequency	Item no.
				GHz	
TNC	straight cable plug	29614-32-71	32071	10.0	80318585
N	straight cable plug	29602-32-71		12.4	80318491
	straight cable jack	29601-32-71		12.4	80318466
	straight bulkhead cable jack	29636-32-71		12.4	80340623
SC	straight cable plug	29608-32-71		10.0	80318547

# 32071 - graphs

Attenuation (nominal values at +25 °C ambient temperature)



Power handling (maximum values at 25 °C ambient temperature and sea level)



## 32071 – high power connectors and adaptors



### 29396G-ELPV

- Hermetic TNC jack to TNC jack bulkhead adaptor
- Positively vented and pre-potted
- Frequency range up to 10 GHz
- Designed for high power and multipaction-free applications



### 29713-46ELPV

- Panel mount TNC jack connector
- Integrated heat sink for high power handling capability
- Positively vented and pre-potted
- Frequency range up to 2.2 GHz
- Designed for high power and multipaction-free applications





## Eacon – field terminated microwave assembly

Eacon stands for EASY CONnection – a simple cable and connector solution for a flexible and fast field-termination of microwave cable assemblies without compromising high performance. The new field-terminated microwave cables and connectors are light weight and water ingress protected up to IP68 and support frequencies up to 18 GHz with a wide assortment of connector options.

### Features

- Waterproof IP68
- Low loss
- Usable up to 18 GHz
- Impedance 50  $\Omega$
- Extremely reliable
- Tool kit available

### Benefits

- Easy and fast assembly – only two connector parts
- Field terminated
- Cut to length
- Narrow outer diameter for easy installation and pulling cable through bulkheads
- More added value for customers



# Eacon – easy connector termination



## Mounting kit

A step-by-step assembly instruction together with a complete tool set reassures a simple and quick assembly procedure.



## Cable preparation/stripping

The Eacon cable is prepared/stripped with a pre-aligned tool. Within 3 turns the cable is cut and ready.



## Connector positioning

The cable entry is pushed onto the cable and positioned right at the end of the jacket.



## Folding back the braid

Folding back the braid reassures a good retention force and a high shielding effectiveness.



## Cleaning and checking

Any foreign object debris (FOD) should be avoided on the prepared cable reassuring the specified return and insertion loss values are met.



## Final assembly


The selected interface is mounted onto the prepared cable entry and tightened with a torque wrench. This ensures a high retention force and ingress protection up to IP68.

## Assembly instruction video

All step-by-step instructions and the instruction video can be found on our website.



# Eacon – cable types

		Eacon_2C	Eacon_4C	Eacon_6C
Cable construction				
Item no.		84116378	84048293	84116403
NATO Stock Number (NSN)			6145-17-124-813	
Max. operating frequency	GHz	18	18	18
Application		static	static	static
Velocity of propagation	%	77	77	77
Weight	g/m	35	77	150
Min. bending radius static	mm	12	16	24
Min. bending radius repeated	mm	20	25	40
Temperature range	°C	–55 to +200	–55 to +200	–55 to +200
Tensile load	N	100	180	180
Crush resistance	kN/m	8	8	8
Inner conductor		wire	wire	wire
Dielectric		LD-PTFE	LD-PTFE	LD-PTFE
Outer conductor		tape/braid	tape/braid	tape/braid
Jacket		FEP, white	FEP, white	FEP, white
Outer diameter	mm	3.75	5.50	7.70
Screening effectiveness (up to 18 GHz)	dB	> 90	> 90	> 90
Phase stability vs. flexure, 360°, diameter 55 mm (2C, 4C), 85 mm (6C)	°el/GHz	< 1.2	< 1.7	< 2.0
Phase stability vs. temperature (–40 to +85 °C )	ppm	< 1500	< 1500	< 1500
Cable attenuation at 25 °C	dB/m	see graph	see graph	see graph
Power handling	watt	see graph	see graph	see graph
Smoke index		naval engineering standard 711 and ASTM-B 622-92 (140 °F for 24 hours, conditioned @ 73 °F and 50 % relative humidity)	naval engineering standard 711 and ASTM-B 622-92 (140 °F for 24 hours, conditioned @ 73 °F and 50 % relative humidity)	naval engineering standard 711 and ASTM-B 622-92 (140 °F for 24 hours, conditioned @ 73 °F and 50 % relative humidity)
Solar radiation		MIL-STD-810, method 505, procedure II	MIL-STD-810, method 505, procedure II	MIL-STD-810, method 505, procedure II
Flammability		MIL-C-87104, paragraph 4.6.4.8  FAR, Part 25, App. F	MIL-C-87104, paragraph 4.6.4.8  FAR, Part 25, App. F	MIL-C-87104, paragraph 4.6.4.8  FAR, Part 25, App. F
Chemical resistance		British Standard 3G100, Part 2, Section 3, Class A	British Standard 3G100, Part 2, Section 3, Class A	British Standard 3G100, Part 2, Section 3, Class A
Fungus		MIL-STD-810, Method 508.3	MIL-STD-810, Method 508.3	MIL-STD-810, Method 508.3
RoHS (2002/95/EC)		compliant	compliant	compliant



## Additional options



D-Armour (silicon impreg-  
nated aramid free of halogen)



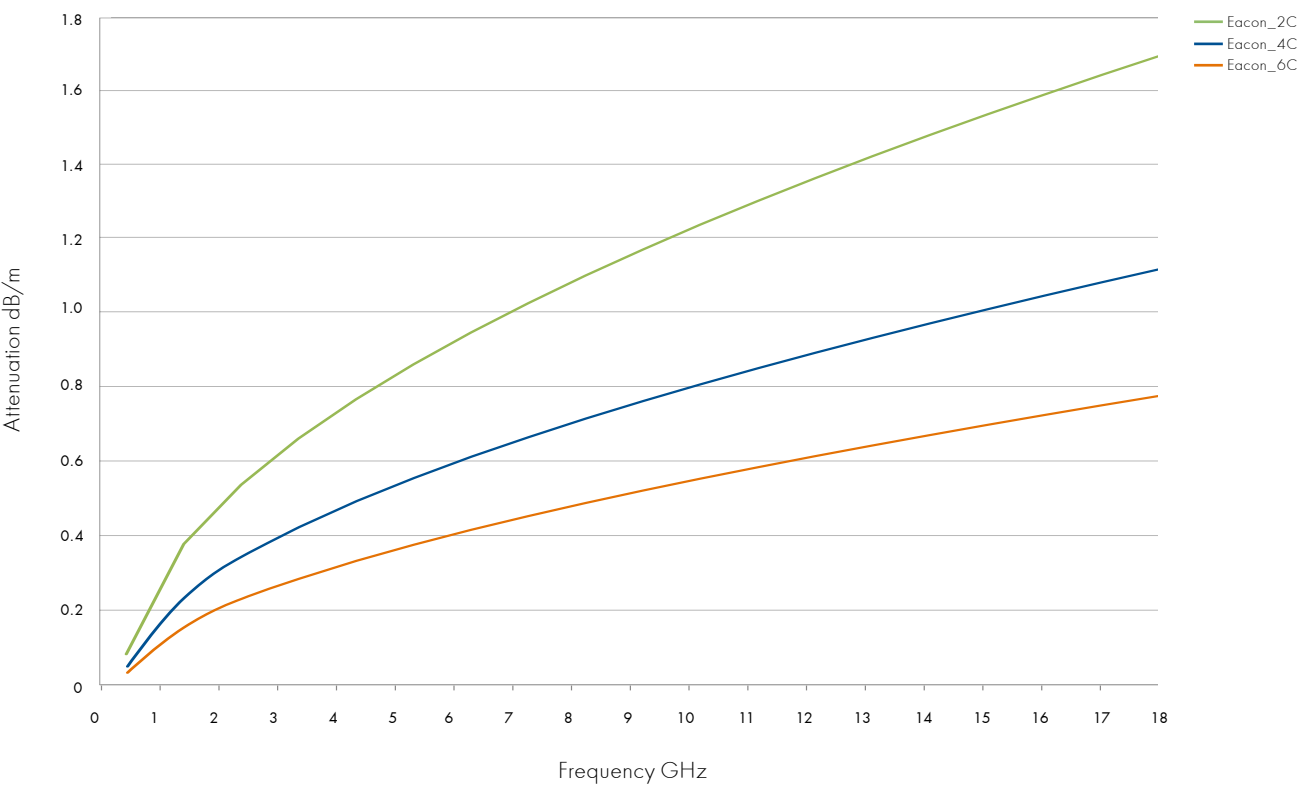
Colored jacket



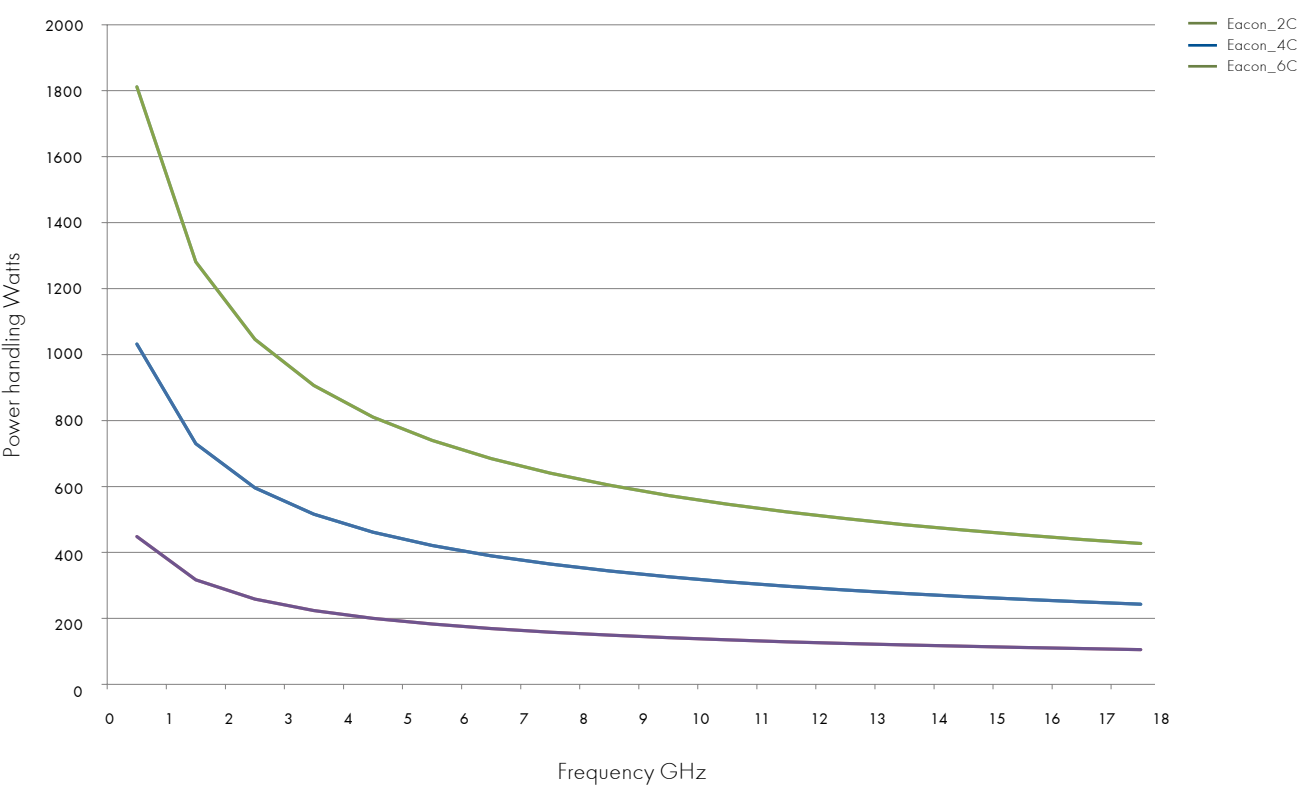
LSFH jacket  
(low smoke free of halogen)

# Eacon - graphs

Attenuation (nominal values at +25 °C ambient temperature)



Power handling (maximum values at +25 °C ambient temperature and sea level)



## Eacon – available connector types

Connector	Series, pattern	HUBER+SUHNER type	NATO Stock Numbers (NSN)	Item no.	Eacon_2C	Eacon_4C	Eacon_6C	Typical VSWR			
								4 GHz	6 GHz	11 GHz	18 GHz
BNC	Straight cable plug	11_BNC-50-4-33/12_NE	5935-17-124-8139	84139633		•		1.15			
	Right angle cable plug	16_BNC-50-4-14/12_NE	5935-17-124-8140	84146122		•		1.30			
	Straight cable plug	11_BNC-50-6-83/12_NE		85077736			•	1.15			
	Right angle cable plug	16_BNC-50-6-3/12_NE		85077740			•	1.30			
	Straight cable jack	21_BNC-50-6-5/12_NE		85077745			•	1.15			
	Bulkhead cable jack	24_BNC-50-6-1/12_NE		85077750			•	1.15			
N	Straight cable plug	11_N-50-4-19/12_NE	5935-17-124-8142	84070286		•			1.12	1.35	1.40
	Straight cable plug	11_N-50-6-19/12_NE		85074230			•		1.12	1.15	
	Right angle cable plug	16_N-50-4-13/12_NE	5935-17-124-8143	84070287		•			1.12	1.15	1.25*
	Right angle cable plug	16_N-50-6-14/12_NE		85074231			•		1.18	1.25	
	Straight cable jack	21_N-50-6-7/12_NE		85077747			•		1.12	1.15	
	Bulkhead cable jack	24_N-50-4-13/12_NE		85005806		•			1.12		1.17
	Bulkhead cable jack	24_N-50-6-3/12_NE		85077425			•		1.12	1.15	
	Straight panel cable jack, flange mount	25_N-50-4-8/122_NE	5935-17-124-8144	84070288		•			1.12		1.17
QMA	Straight cable plug	11_QMA-W50-4-4/19_NE		84121825		•			1.12		
SMA	Straight cable plug	11_SMA-50-2-76/199_NE		85074234	•				1.13		1.30
	Straight cable plug	11_SMA-50-4-101/199_NE	5935-17-124-8145	84070289		•			1.12		1.15
	Straight cable plug	11_SMA-50-6-2/12_NE		85077738			•		1.12	1.25	1.35
	Right angle cable plug	16_SMA-50-2-20/199_NE		85074235	•				1.12	1.35	
	Right angle cable plug	16_SMA-50-4-165/199_NE	5935-17-124-8147	84070290		•			1.12	1.45	
	Right angle cable plug	16_SMA-50-6-1/12_NE		85077744			•		1.18	1.35	1.40
	Straight cable jack	21_SMA-50-6-1/12_NE		85077748			•		1.12	1.25	1.35
TNC	Straight cable plug	11_TNC-50-4-23/12_NE	5935-17-124-8148	84070283		•			1.12	1.30	
	Straight cable plug	11_TNC-50-6-8/12_NE		85074232			•		1.09	1.22	
	Right angle cable plug	16_TNC-50-4-101/12_NE	5935-17-124-8149	84070284		•			1.12	1.30	
	Right angle cable plug	16_TNC-50-6-12/12_NE		85074233			•		1.17	1.35	
	Bulkhead cable jack	24_TNC-50-6-3/12_NE		85077423			•		1.12	1.22	
	Straight panel cable jack, flange mount	25_TNC-50-4-18/12_NE	5935-17-124-8150	84070285		•			1.12	1.20	
	Straight cable jack	21_TNC-50-6-4/12_NE		85077749			•		1.12	1.22	
C	Straight cable plug	11_C-50-6-2/12_NE		85077737			•		1.12	1.25	
	Right angle cable plug	16_C-50-6-2/12_NE		85077743			•		1.18	1.35	
SC	Straight cable plug	11_SC-50-6-1/12_NE		80392483			•		•	•	
	Right angle cable plug	16_SC-50-6-1/12_NE		80392484			•		•	•	
	Bulkhead cable jack	24_SC-50-6-1/12_NE		80392485			•		•	•	
HN	Straight cable plug	11_HN-50-6-1/12_NE		80392480			•	•			
	Right angle cable plug	16_HN-50-6-1/12_NE		80392481			•	•			
	Bulkhead cable jack	24_HN-50-6-1/12_NE		80392482			•	•			

\*(up to 15 GHz)

# Eacon – tool kits



Assembly tool kits for all connectors, used with Eacon 2C/4C/6C cables (with additional space for other auxiliary tools and spare parts).

## Combined Eacon 2C/4C/6C assembly tool kit

HUBER+SUHNER type	Item no.	Content	Size
74_Z-0-0-647	85075222	all tools, needed to assemble Eacon 2C/4C/6C	395 × 315 × 100 mm/15.5 × 12.4 × 3.9 in.

## Eacon 2C assembly tool kit

HUBER+SUHNER type	Item no.	Content	Size
74_Z-0-0-645	85075220	all tools, needed to assemble Eacon 2C	395 × 315 × 100 mm/15.5 × 12.4 × 3.9 in.

Pos.	HUBER+SUHNER type	Item no.	Description	Comment
1	74_Z-0-0-12	22642718	metal saw	-
2	74_Z-0-0-13	22644241	replacement of saw blade	please order separately (not incl. in the toolbox)
3	74_Z-0-0-475	84079191	torque wrench 8 mm (4 Nm)	please check the torque from time to time
4	74_Z-0-0-474	84078907	trim tool	-
5	74_Z-0-0-638	85075218	stripping tool Eacon 2C	-
6	74_Z-0-0-563	84079618	blades cartridge for stripping tool 74_Z-0-0-638	please order separately (not incl. in the toolbox)
7	74_Z-0-0-639	85075217	cone	5 pcs.
8	74_Z-0-0-641	85075213	fixation tool for cutting	-

## Eacon 4C assembly tool kit

HUBER+SUHNER type	Item no.	Content	Size
74_Z-0-0-606	84074447	all tools, needed to assemble Eacon 4C	395 × 315 × 100 mm/15.5 × 12.4 × 3.9 in.

Pos.	HUBER+SUHNER type	Item no.	Description	Comment
1	74_Z-0-0-12	22642718	metal saw	-
2	74_Z-0-0-13	22644241	replacement of saw blade	please order separately (not incl. in the toolbox)
3	74_Z-0-0-475	84079191	torque wrench 8 mm (4 Nm)	please check the torque from time to time
4	74_Z-0-0-474	84078907	trim tool	-
5	74_Z-0-0-473	84079184	stripping tool Eacon 4C	-
6	74_Z-0-0-563	84079618	blades cartridge for stripping tool 74_Z-0-0-473	please order separately (not incl. in the toolbox)
7	74_Z-0-0-642	85075214	fixation tool for cutting	-

## Eacon 6C assembly tool kit

HUBER+SUHNER type	Item no.	Content	Size
74_Z-0-0-646	85075221	all tools, needed to assemble Eacon 6C	395 × 315 × 100 mm/15.5 × 12.4 × 3.9 in.

Pos.	HUBER+SUHNER type	Item no.	Description	Comment
1	74_Z-0-0-12	22642718	metal saw	-
2	74_Z-0-0-13	22644241	replacement of saw blade	please order separately (not incl. in the toolbox)
3	74_Z-0-0-480	84079190	torque wrench 12 mm (5 Nm)	please check the torque from time to time
4	74_Z-0-0-474	84078907	trim tool	-
5	74_Z-0-0-640	85075219	stripping tool Eacon 6C	-
6	74_Z-0-0-564	84079619	blades cartridge for stripping tool 74_Z-0-0-640	please order separately (not incl. in the toolbox)
7	74_Z-0-0-643	85075215	fixation tool for cutting	-





## High flex cables

High flex cable assemblies have repeatedly endured 1 000 000 flexure cycles with minimal electrical and mechanical degradation. All incorporate a flat wire outer conductor and a microporous dielectric for low loss and a tight woven stainless steel outer braid for improved resistance to crushing, bending and kinking. All cables were designed for use in ultra-durable, high flexure applications such as gimbaled radars, antennas and installations where the cable assembly must endure multiple tight bends.

### Main benefits

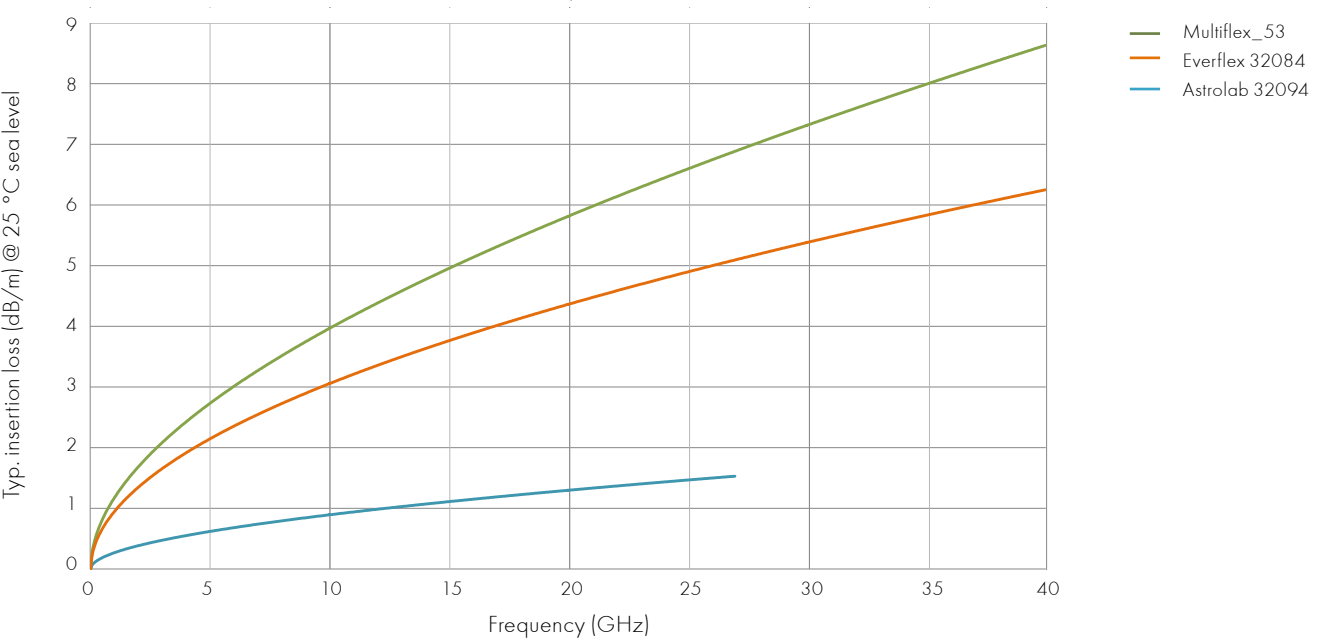
- Excellent flex properties
- Low resistance to movement
- High-shielding effectiveness

Waiver: While the information presented has been carefully compiled to the best of our present knowledge, it is not recommended to design-in such a product before checking with our specialists. High flex applications are very unique and driven by extreme mechanical requirements. Therefore, our specialists will support you in choosing the correct parameters to make your application a success from the beginning. Please contact our local sales organization for further information on our products.

# High flex cables

	Multiflex 53	Astrolab 32094	Everflex 32084
			
Flexure	> 50 000	> 200 000	> 1 million
Operating frequency (cable)	100 GHz	27 GHz	40 GHz
Velocity of propagation	70 %	77 %	76 %
Impedance	50 Ω	50 Ω	50 Ω
Outer diameter	1.74 mm	5.3 mm	2.2 mm
Weight (g/m)	10 g/m (0.67 lbs/100 ft)	61 g/m (4.1 lbs/100 ft)	11 g/m (0.70 lbs/100 ft)
Interfaces	SSMA, SMA, SK (2.9 mm), MMPX	SMA, TNC, N, 3.5 mm, 7 mm	SMA, SSMA, 2.9 mm, SMP, 2.4 mm
Temperature range	−55 to +125 °C	−65 to +200 °C	−65 to +200 °C

Attenuation (nominal values at +25 °C ambient temperature)





## Multiport

In most modern applications restricted space requires high packing density and reduced weight, while data rates increase and rigorous safety standards require the highest quality and reliability. Multiport solutions offer unequalled advantages – especially in the field and under rough environmental conditions.

- One stop for low frequency, high frequency and fiber optic Multiport solutions
- "Plug & play" for durable and reliable connectivity solutions
- Space saving and easy to install
- Reduces mounting time and increases system reliability

### Multiport connectors MIL-DTL-38999, series III

- Spring RF contact – vibration resistant including high frequency range of DC – 18 GHz
- Qualified BMA blind mate coaxial contact – interface according to MIL-STD-348/321
- Easy mounting to meet IP68 sealing requirements with a quick screw coupling connector
- Different coding schemes to avoid reverse polarization issues
- Excellent crosstalk performance between channels
- High performance microwave connection based on SUCOFLEX® and Multiflex microwave cable assemblies

# Multiport



## Custom specific design

Multiport solutions are specifically designed according to your requirements. Each solution is unique and a vast portfolio of connectors with different styles and codings, earthing shells, shielding braids, rugged outer jackets and breakouts are available:

- Multiport connector/backshells:  
standard aluminum, composite, titanium, stainless steel and bronze
- Connector style: jamnut receptacle, square flange receptacle, plug
- Additional braids, jackets, breakouts, armors available
- Size 8 insert designed-in for BMA connectors acc. MIL-STD-348/321
- Other size inserts (size 12, 16, 20) on request

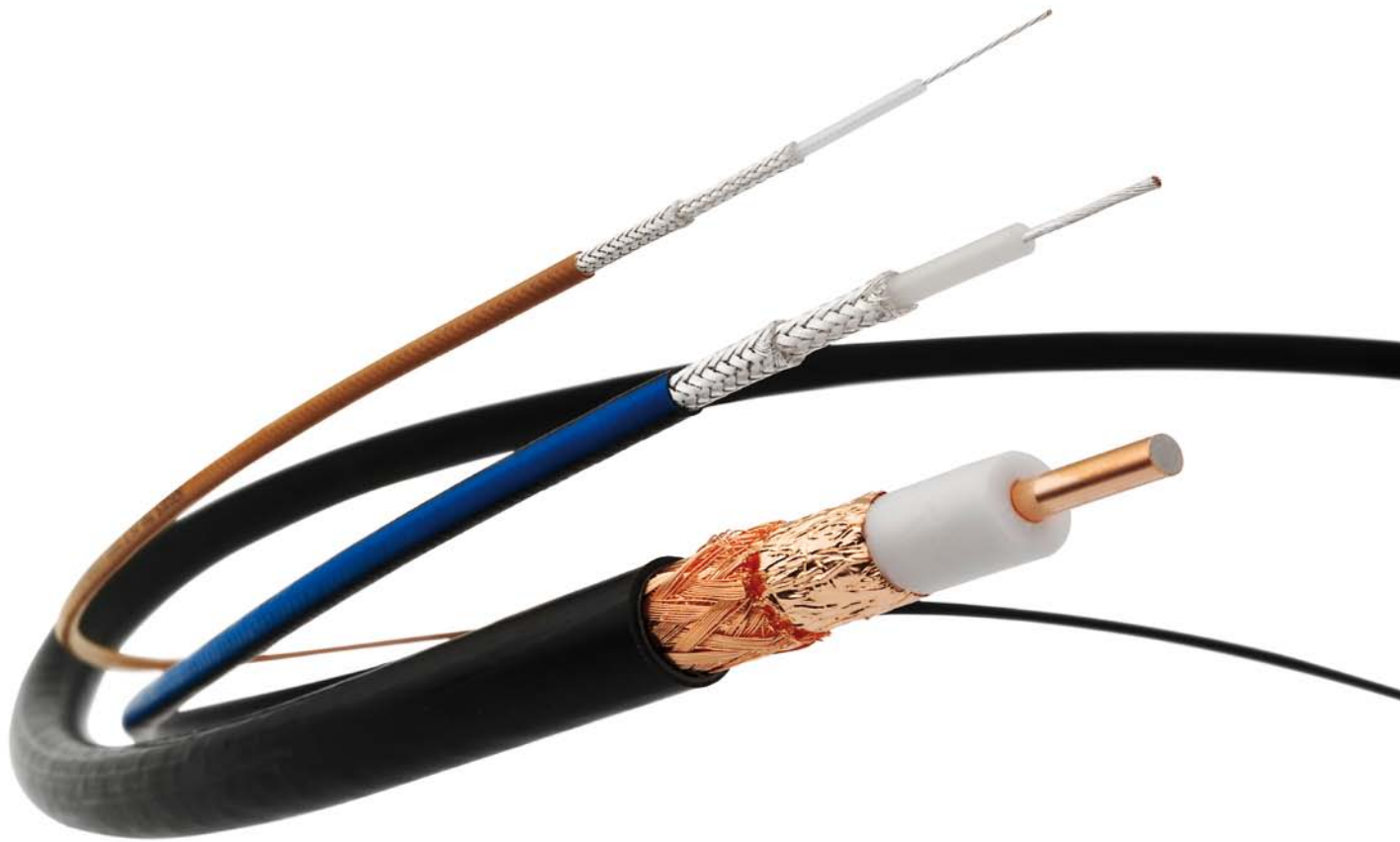
## Harsh environment proved design

- IP68 sealed solutions
- Salt spray: MIL-STD-1344 (48 to 2000 hours)
- Connector endurance: min. 500 cycles

## BMA contacts

Electrical features	
Impedance	50 $\Omega$
Frequency range	DC - 18 GHz
Dielectric withstanding voltage	1.5 kVrms, 50 Hz (at sea level)
Insulation resistance	$\geq 5000 \text{ M}\Omega$
Contact resistance	Center contact: $\leq 2 \text{ m}\Omega$ Outer contact: $\leq 2 \text{ m}\Omega$
VSWR (typical values - DC 18GHz)	$\leq 1.02 + 0.005 f \text{ [GHz]}$ mated connector
Average power (at sea level and room temperature)	< 250 Watt, @ 3 GHz, < 220 Watt, @ 6 GHz < 180 Watt, @ 10 GHz, < 120 Watt, @ 18 GHz
RF leakage interface only (fully mated)	$\geq 90 \text{ dB f [GHz]}$
Climatic features	
Temperature range	-65 to +175 °C
Thermal shock	MIL-STD-202, method 107, condition B
Resistance to moisture	MIL-STD-202, method 106
Resistance to fluid	Gasoline, mineral and synthetic hydraulic fluid, mineral and synthetic lubrication, cleaning and de-icing fluid, extinguishing and cooling fluid.
Corrosion	MIL-STD-202, method 101, condition B
Vibration	MIL-STD-202, method 204, condition D
Shock	MIL-STD-202, method 213, condition I

High performance microwave solution based on SUCOFLEX® and Multiflex microwave cable assemblies. Check the cable selection guide in the back of this catalog for further details on available cable types.



## RF cables

HUBER+SUHNER offers a broad assortment of coaxial cables, developed to meet the highest standards. A wide range of flexible coaxial cables provides the best performance for demanding applications. Our premium quality cables have excellent electrical and mechanical properties and are used globally in various applications to meet the highest demands. Comprehensive, professional support in conjunction with our comprehensive product range makes HUBER+SUHNER a leading provider of radio frequency solutions in defense applications.

### RG/Enviroflex

- Temperature range
- High performance
- RG standard

### Spuma series

- High precision
- Excellent shielding
- Halogen-free options





## RG/Enviroflex series



The PTFE/FEP cables from our RG series are designed for applications up to 200 °C and are characterized by low loss, especially at high frequencies. The cables in the HUBER+SUHNER Enviroflex family do not contain fluorine plastics in the dielectric or in the jacket and thus provide a robust and environmentally friendly option

	RG	Enviroflex
Dielectric material	PTFE	SPEX
Jacket material	FEP	RADOX®
Halogen free	-	✓
Low smoke	✓	✓
Flame retardancy	Not flammable	✓✓
Temperature range	✓✓✓	✓✓
Weather resistance	✓✓✓	✓✓
<b>Outer diameter (in mm)</b>		
2	RG_178_B/U	EF_178, EF_178_D
3	RG_316_/U	EF_316, EF_316_D
5	RG_400_/U	EF_400
5	RG_142_B/U	EF_142
10	RG_393_/U	EF_393

## Spuma series



The Spuma family provides the lowest attenuation, high flexibility and optimal shielding. The LSFH jacket material offer extremely high flame protection, whereas the Spuma-HT line offers great loss performance at an extended temperature range of up to 150 °C.

	Spuma	Spuma-FR	Spuma-UF	Spuma-HT
Dielectric material	SPE	SPE	SPE	PTFE
Jacket material	PE	LSFH	TPU	FEP
Halogen free	✓	✓	-	-
Low smoke	-	✓	-	-
Flame retardancy	-	✓✓	-	not flammable
Temperature range	✓	✓	✓	✓✓✓
Weather resistance	✓✓	✓✓	✓✓	✓✓✓
<b>Outer diameter (in mm)</b>				
5	Spuma_195	Spuma_195-FR-01	-	-
6	Spuma_240	Spuma_240-FR-01	Spuma_240-UF	Spuma_240-HT
10	Spuma_400	Spuma_400-FR-01	Spuma_400-UF	Spuma_400-HT
13	-	Spuma_500-FR-01	-	-
15	Spuma_600	-	-	Spuma_600-HT

## RG series

Cable type	Item no.	Impe- dance (Ω)	Freq. (GHz)	Inner conductor	Dielectric	Braid construction	Jacket	Diameter (mm)
RG_178_B/U	22510043	50	1	strand-07	PTFE	single screen	FEP	1.80
RG_316_/U	22510079	50	3	strand-07	PTFE	single screen	FEP	2.50
RG_400_/U	22510080	50	6	strand-19	PTFE	double screen	FEP	4.95
RG_142_B/U	22510037	50	6	wire	PTFE	double screen	FEP	4.95
RG_393_/U	22511430	50	6	strand-07	PFA	double screen	FEP	9.90

## Enviroflex series

Cable type	Item no.	Impe- dance (Ω)	Freq. (GHz)	Inner conductor	Dielectric	Braid construction	Jacket	Diameter (mm)
Enviroflex_178	23010656	50	3	strand-07	SPEX*	single screen	RADOX®	1.84
Enviroflex_178_D	23030426	50	6	strand-07	SPEX*	double screen	RADOX®	2.45
Enviroflex_316	23009565	50	3	strand-07	SPEX*	single screen	RADOX®	2.54
Enviroflex_316_D	22512281	50	6	strand-07	SPEX*	double screen	RADOX®	3.16
Enviroflex_400	22512280	50	6	strand-19	SPEX*	double screen	RADOX®	5.00
Enviroflex_142	22512168	50	6	wire	SPEX*	double screen	RADOX®	5.00
Enviroflex_393	22512282	50	6	strand-07	SPEX*	double screen	RADOX®	10.05

## Spuma series

Cable type	Item no.	Impe- dance (Ω)	Freq. (GHz)	Inner conductor	Dielectric	Braid construction	Jacket	Diameter (mm)
Spuma_195	84151727	50	6	wire	SPE**	tape/braid	PE	4.95
Spuma_195-FR-01	85021562	50	6	wire	SPE**	tape/braid	LSFH	4.95
Spuma_240	84151737	50	6	wire	SPE**	tape/braid	PE	6.15
Spuma_240-FR-01	85021563	50	6	wire	SPE**	tape/braid	LSFH	6.15
Spuma_240-UF	84318337	50	3	strand-07	SPE**	tape/braid	TPU	6.17
Spuma_240-HT	85076426	50	6	wire	PTFE	tape/braid	FEP	5.21
Spuma_400	84102703	50	6	wire	SPE**	tape/braid	PE	10.25
Spuma_400-FR-01	84132035	50	6	wire	SPE**	tape/braid	LSFH	10.25
Spuma_400-FR-75	85022187	75	3	wire	SPE**	tape/braid	LSFH	10.25
Spuma_400-UF	85068966	50	3	strand-07	SPE**	tape/braid	TPU	10.25
Spuma_400-HT	85076427	50	6	wire	PTFE	tape/braid	FEP	9.40
Spuma_500-FR-01	85021564	50	6	wire	SPE**	tape/braid	LSFH	12.78
Spuma_600	84151738	50	6	wire	SPE**	tape/braid	PE	14.99
Spuma_600-HT	85076428	50	6	wire	PTFE	tape/braid	FEP	14.38

\*SPEX: foamed Polyethylene cross-linked

\*\* SPE: foamed Polyethylene

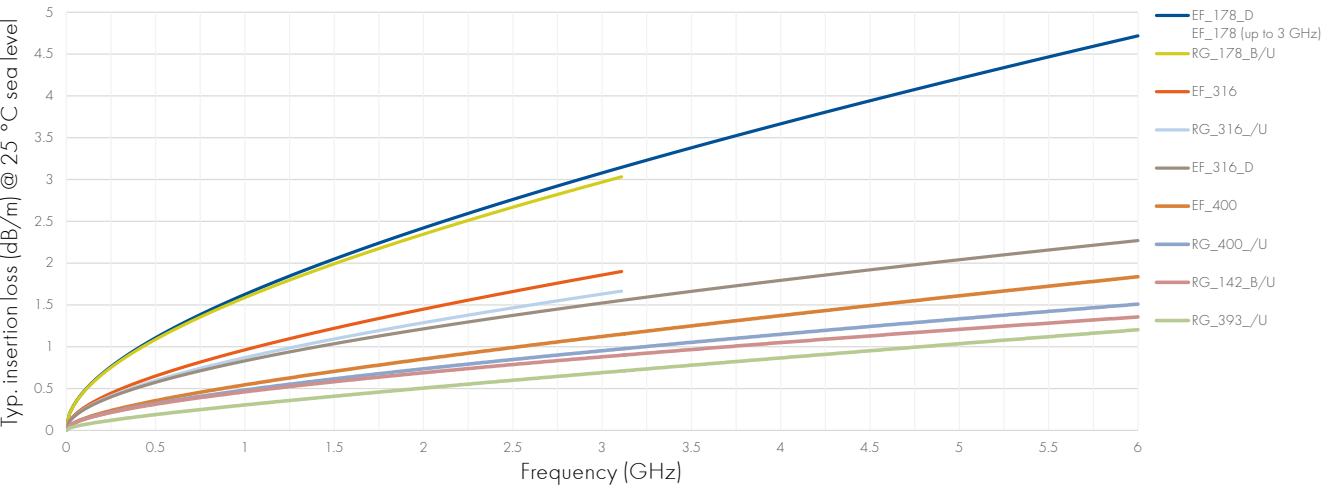
Temperature range (°C)	Attenuation @ 1 GHz (dB/m)	Attenuation @ 3 GHz (dB/m)	Attenuation @ 6 GHz (dB/m)	Screening effectiveness	Bending static (mm)	Bending repeated (mm)	Cable group
-65 to +165	1.62	-	-	> 40 dB (up to 1 GHz)	10	18	U1
-65 to +165	0.87	1.63	-	> 38 dB (up to 1 GHz)	15	25	U2
-65 to +165	0.48	0.95	1.51	> 81 dB (up to 6 GHz)	30	50	U11
-65 to +165	0.46	0.88	1.36	> 85 dB (up to 6 GHz)	30	50	U9
-65 to +165	0.3	0.69	1.20	> 81 dB (up to 6 GHz)	60	100	U33

Temperature range (°C)	Attenuation @ 1 GHz (dB/m)	Attenuation @ 3 GHz (dB/m)	Attenuation @ 6 GHz (dB/m)	Screening effectiveness	Bending static (mm)	Bending repeated (mm)	Cable group
-40 to +105	1.63	3.11	-	> 40 dB (up to 3 GHz)	5	20	U1
-40 to +105	1.63	3.08	4.72	> 60 dB (up to 6 GHz)	5	20	X1
-40 to +105	0.97	1.86	-	> 38 dB (up to 1 GHz)	5	30	U2
-40 to +105	0.89	1.75	2.77	> 80 dB (up to 6 GHz)	5	30	U4
-40 to +105	0.57	1.08	1.65	> 70 dB (up to 6 GHz)	10	40	U11
-40 to +105	0.54	1.07	1.7	> 75 dB (up to 5 GHz)	25	50	U9
-40 to +105	0.29	0.65	1.11	> 78 dB (up to 3 GHz)	30	100	U33

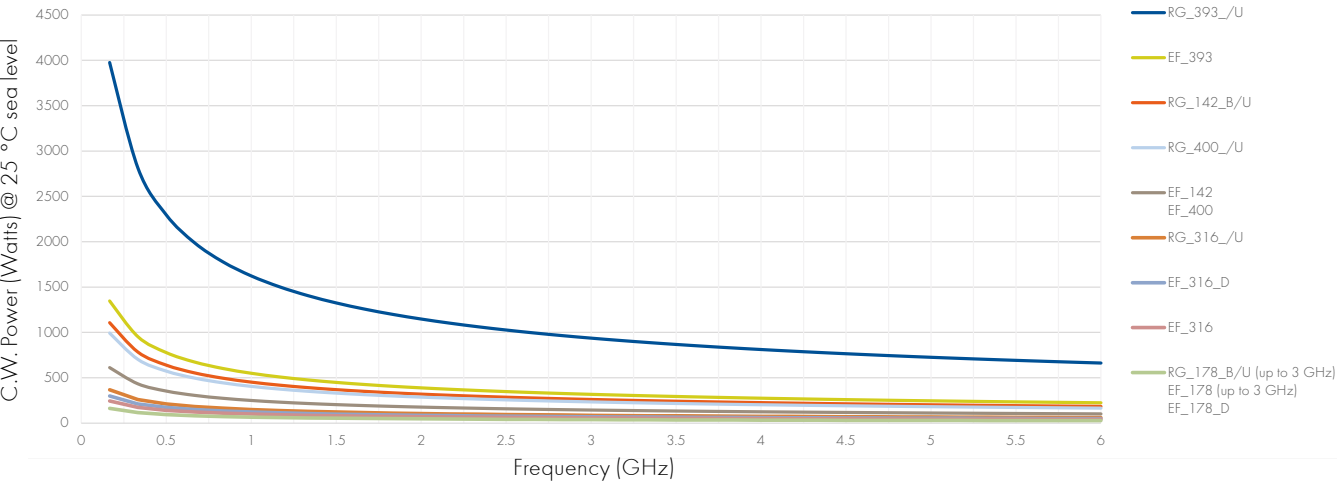
Temperature range (°C)	Attenuation @ 1 GHz (dB/m)	Attenuation @ 3 GHz (dB/m)	Attenuation @ 6 GHz (dB/m)	Screening effectiveness	Bending static (mm)	Bending repeated (mm)	Cable group
-40 to +85	0.39	0.69	1.00	> 90 dB (up to 6 GHz)	12.5	50	X27
-40 to +85	0.39	0.69	1.00	> 90 dB (up to 6 GHz)	12	50	X27
-40 to +85	0.26	0.47	0.68	> 90 dB (up to 6 GHz)	19	60	X28
-40 to +85	0.26	0.47	0.68	> 90 dB (up to 6 GHz)	19	63	X28
-40 to +85	0.42	0.85	-	> 90 dB (up to 3 GHz)	14	53	X34
-55 to +150	0.28	0.50	0.74	> 90 dB (up to 6 GHz)	25	50	-
-40 to +85	0.13	0.24	0.35	> 90 dB (up to 6 GHz)	25	100	U30
-40 to +85	0.13	0.24	0.35	> 90 dB (up to 6 GHz)	25	100	U30
-40 to +85	0.14	0.25	-	> 90 dB (up to 3 GHz)	25	100	X33
-40 to +85	0.17	0.30	-	> 90 dB (up to 3 GHz)	25	100	X34
-55 to +150	0.14	0.27	0.40	> 90 dB (up to 6 GHz)	44	101	-
-40 to +85	0.10	0.19	0.29	> 90 dB (up to 6 GHz)	31	127	X31
-40 to +85	0.09	0.16	0.24	> 90 dB (up to 6 GHz)	38	152	X29
-55 to +150	0.10	0.17	0.25	> 90 dB (up to 6 GHz)	44	101	X37

# RG/Enviroflex series – graphs

Attenuation (nominal values at +25 °C ambient temperature)



Power handling (maximum values at 25 °C ambient temperature and sea level)

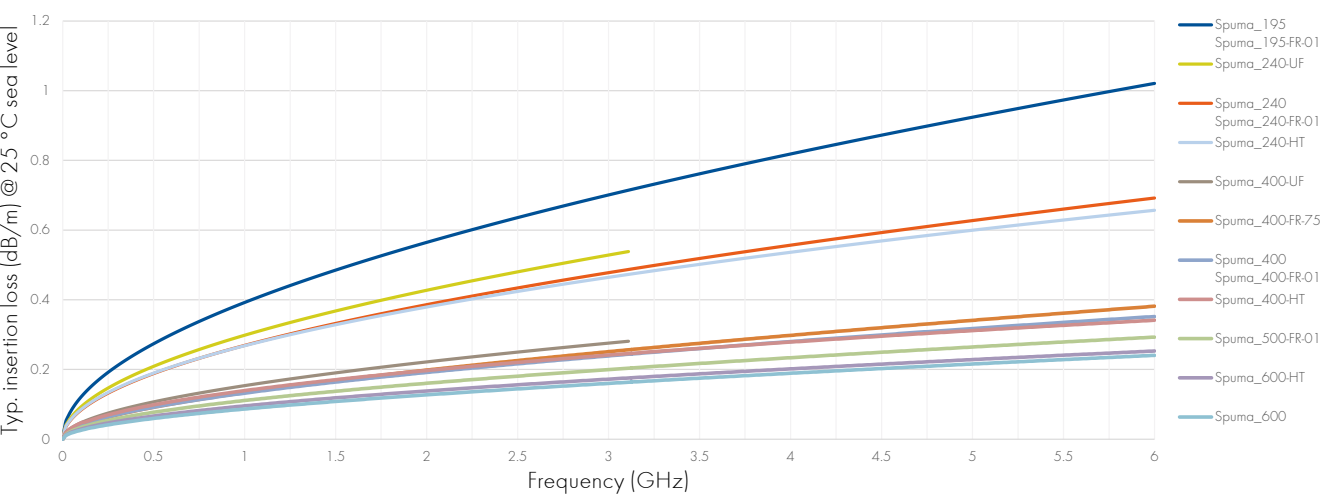


Connector availability

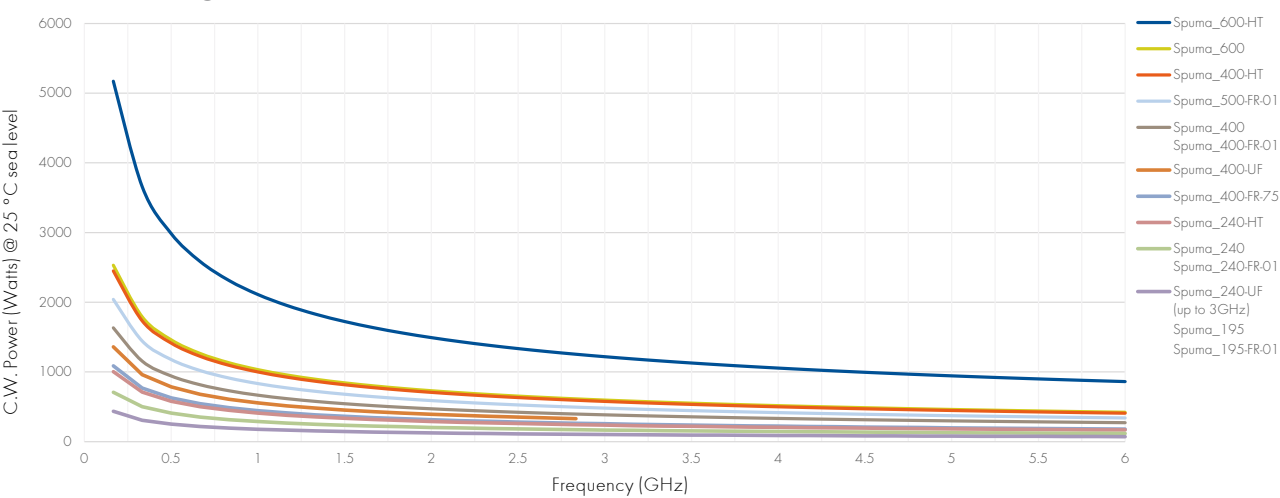
Interfaces		SMA				TNC				N				BNC				QN				QMA			
Cables	cable group	male straight	male right angle	female straight	female bulkhead	male straight	male right angle	female straight	female bulkhead	male straight	male right angle	female straight	female bulkhead	male straight	male right angle	female straight	female bulkhead	male straight	male right angle	female straight	female bulkhead	male straight	male right angle	female straight	female bulkhead
RG_178_B/U	U1	•	•		•	•			•					•		•	•				•				•
RG_316_/U	U2	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•			•	•			•
RG_400_/U	U11	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•			•	•		•
RG_142_B/U	U9	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•			•	•		•
RG_393_/U	U33					•				•	•	•	•	•	•			•	•			•	•		•
EF_178	U1	•	•		•	•			•					•		•	•				•				•
EF_178_D	X1	•			•													•			•				•
EF_316	U2	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•				•	•		•
EF_316_D	U4	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•			•	•		•
EF_400	U11	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•			•	•		•
EF_142	U9	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•			•	•		•
EF_393	U33					•				•	•	•	•	•	•			•	•			•	•		•

# Spuma series – graphs

Attenuation (nominal values at +25 °C ambient temperature)



Power handling (maximum values at 25 °C ambient temperature and sea level)



Connector availability

Interfaces		SMA				TNC				N				BNC				QN				QMA			
Cables	cable group	male straight	male right angle	female straight	female bulkhead	male straight	male right angle	female straight	female bulkhead	male straight	male right angle	female straight	female bulkhead	male straight	male right angle	female straight	female bulkhead	male straight	male right angle	female straight	female bulkhead	male straight	male right angle	female straight	female bulkhead
Spuma_195	X27	•	•			•	•		•	•	•	•													
Spuma_195-FR-01	X27	•	•			•	•		•	•	•	•													
Spuma_240	X28	•	•	•		•	•	•	•	•	•	•	•	•	•		•	•	•		•		•	•	
Spuma_240-FR-01	X28	•	•	•		•	•	•	•	•	•	•	•	•	•		•	•	•		•		•	•	
Spuma_400	U30	•	•			•	•	•	•	•	•	•	•	•	•			•	•		•				
Spuma_400-FR-01	U30	•	•			•	•	•	•	•	•	•	•	•	•			•	•		•				
Spuma_400-FR-75	X33																•								
Spuma_500-FR-01	X31									•	•	•													
Spuma_600	X29									•	•														



## LSFH cables

The need for low smoke free of halogen cables and cable assemblies is driven by an increasing awareness of the industry to prevent toxic fume ingestion in the event of a fire. Especially in applications where space is limited or a fast evacuation is impossible, low smoke free of halogen cables are a must.

HUBER+SUHNER offers a broad range of cables. Our RADOX® and LSFH materials meet truly challenging flammability and smoke density requirements.

- RADOX® – increased temperature range, resistance against oil, chemicals and UV
- Ultra low loss
- Good flexibility, low bending moment
- Extended frequency range up to 46 GHz

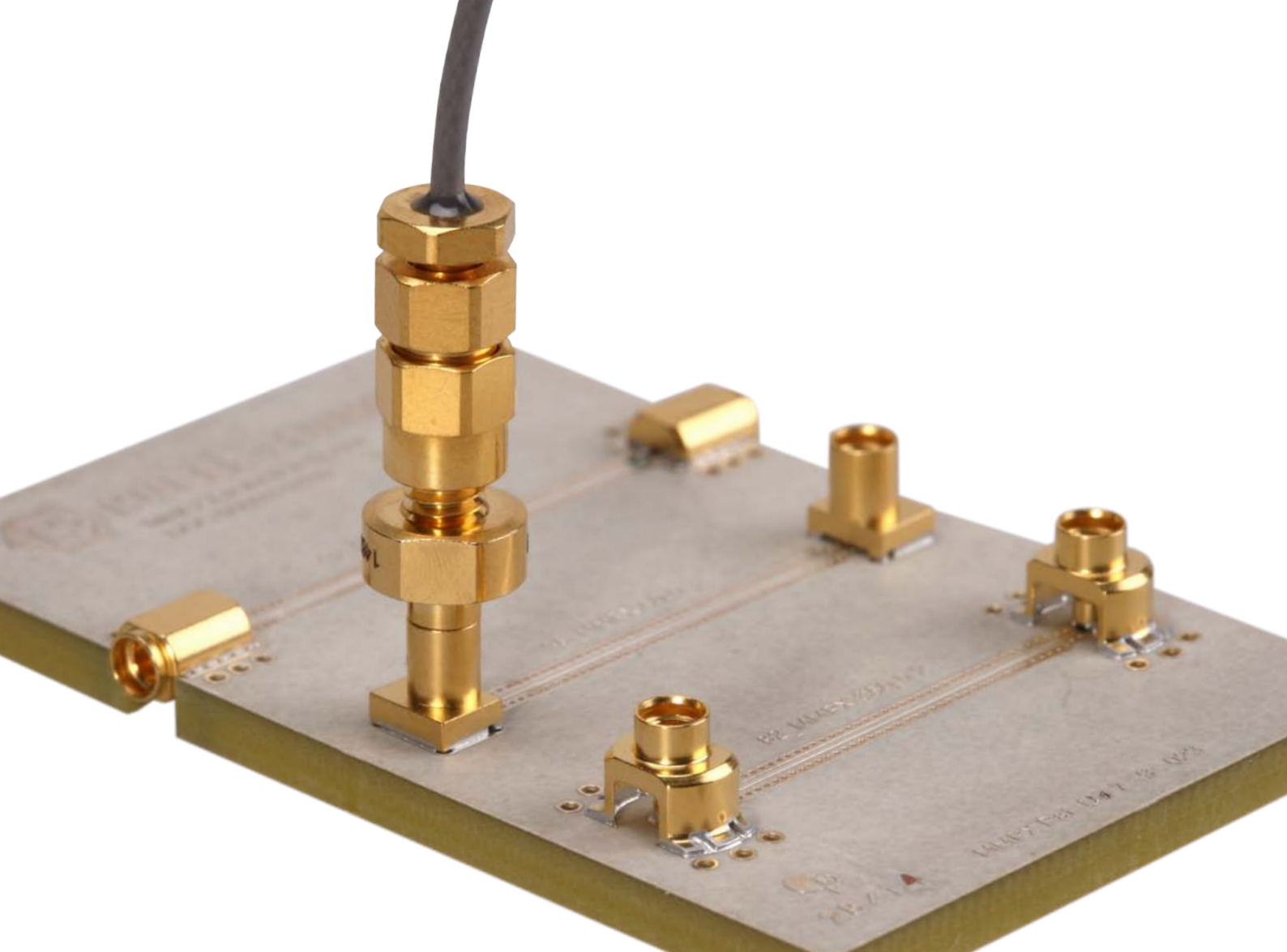


## LSFH cables

Cable type	Item no.	Impedance (Ω)	Frequency (GHz)	Diameter (mm)	Temperature range (°C)	Halogen free IEC 60754-1/-2	Flammability
Enviroflex_178	23010656	50	3	1.84	-40 to +105	✓	✓
Enviroflex_178_D	23030426	50	6	2.45	-40 to +105	✓	✓
Enviroflex_316	23009565	50	3	2.54	-40 to +105	✓	✓
Enviroflex_316_D	22512281	50	6	3.16	-40 to +105	✓	✓
Enviroflex_400	22512280	50	6	5.00	-40 to +105	✓	✓
Enviroflex_142	22512168	50	6	5.00	-40 to +105	✓	✓
Enviroflex_393	22512282	50	6	10.05	-40 to +105	✓	✓
Spuma_195-FR-01	85021562	50	6	4.95	-40 to +85	✓	✓
Spuma_240-FR-01	85021563	50	6	6.15	-40 to +85	✓	✓
Spuma_400-FR-01	84132035	50	6		-40 to +85	✓	✓
Spuma_400-FR-75	85022187	75	3	10.25	-40 to +85	✓	✓
Spuma_500-FR-01	85021564	50	6	12.75	-40 to +85	✓	✓
Sucoform_86-LSFH	22512147	50	40	3.20	-40 to +85	Jacket only	UL 1581 § 1100 IEC 60332-2
Sucoform_141-LSFH	22512148	50	33	4.60	-40 to +85	Jacket only	UL 1581 § 1100 IEC 60332-2
Eacon_6CI-010	84145046	50	18	8.20	-40 to +85	Jacket only	UL 1581 § 1100 IEC 60332-2

## LSFH Microwave cable assemblies

Cable type	Item no.	Impedance (Ω)	Frequency (GHz)	Diameter (mm)	Temperature range (°C)	Halogen free IEC 60754-1/-2	Flammability
SUCOFLEX_102_I	-	50	46	4	-40 to +85	Jacket only	IEC 60332-1
SUCOFLEX_103_I	-	50	33	4.8	-40 to +85	Jacket only	IEC 60332-1
SUCOFLEX_104_I	-	50	26.5	6.6	-40 to +85	Jacket only	IEC 60332-1
SUCOFLEX_106_I	-	50	18	8.4	-40 to +85	Jacket only	IEC 60332-1



## RF connectors and adaptors

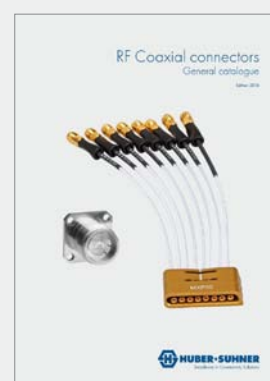
HUBER+SUHNER is a leading global provider of RF connectors, adapters and resistive components. We offer a wide range of standard connectors and application specific solutions. With our experience, product knowledge and application know-how we support customers with application specific solutions.













Within the standard connector series of SMP, SMPM, SMPM-T, MXP, SMA, BNC, TNC, N and others, we provide a comprehensive range of connectors for different applications.

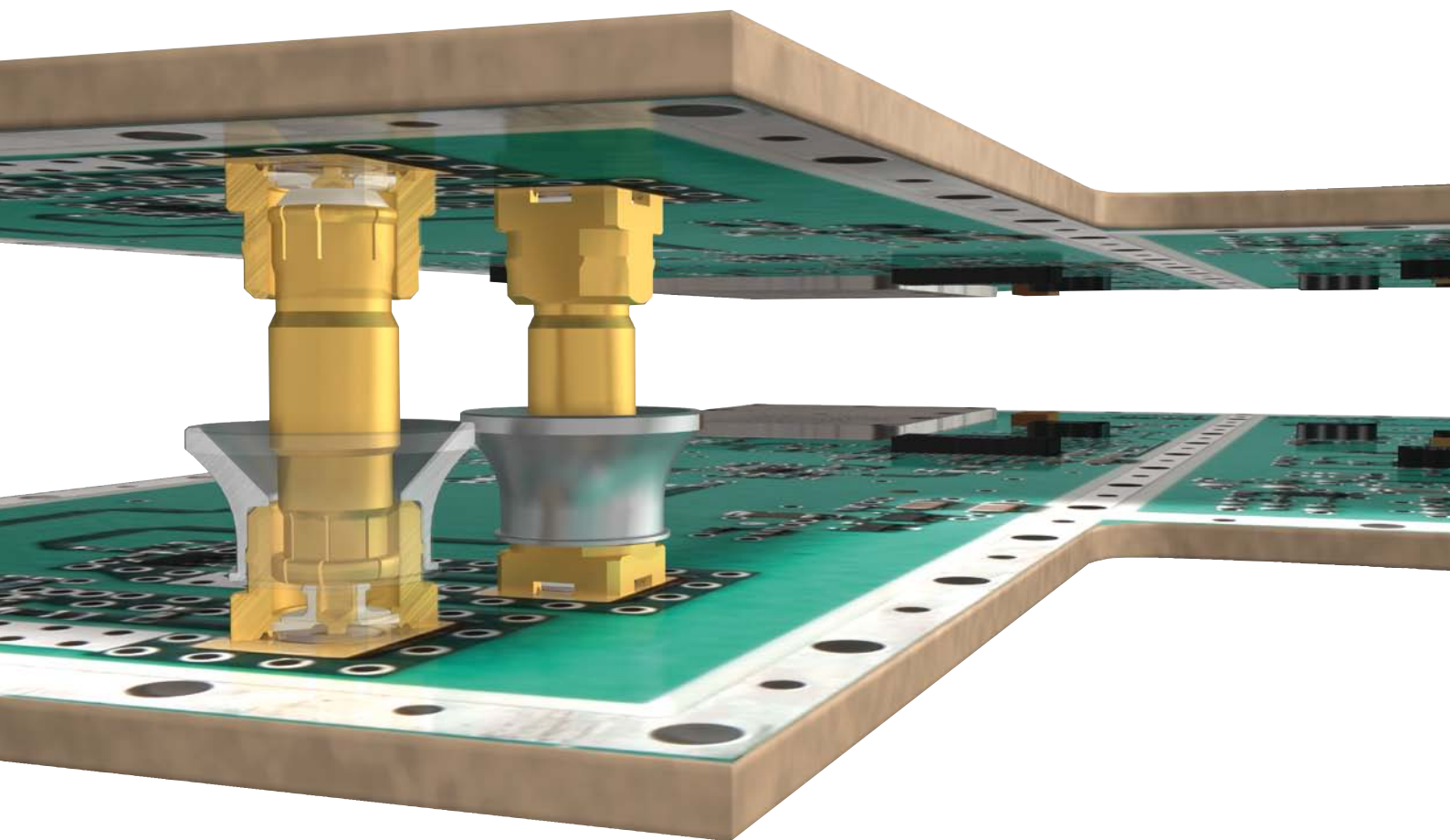
We constantly refine our product portfolio with new and innovative solutions. HUBER+SUHNER has established market standards with board-to-board connectivity solutions such as MMBX and MBX and with connectors with quick-lock mating mechanisms like QMA, XQMA, QN, and XQN.

Additionally HUBER+SUHNER supports its customers worldwide with application engineers to assist customers in production selection. The success of HUBER+SUHNER can be attributed to our high quality products, design-in support and expertise in RF Technology. We are your partner for RF connectivity solutions.

Please find more product details in our RF coaxial connectors catalog.



Series	Coupling mechanism	Frequency range	Picture
BNC	bayonet	4 GHz	
MBX	slide-on	6 GHz	
MCX	snap-on	6 GHz	
MMCX	snap-on	6 GHz	
7/16	screw-on	7.5 GHz	
C	screw-on	11 GHz	
TNC	screw-on	11 GHz	
QN XQN	quick-lock – waterproof IP68 quick-lock – salt and ice protection	11 GHz	
4.3-10	screw-on/snap-on	12 GHz	
MMBX	snap-on	15 GHz	
N	screw-on	18 GHz	
QMA XQMA	quick-lock	18 GHz	
BMA	slide-on	18 GHz/26.5 GHz	
SMA	screw-on (intermateable with PC3.5 and SK)	18 GHz/26.5 GHz	
PC 3.5 (3.5 mm)	screw-on (intermateable with SMA and SK)	26.5 GHz	
SK (2.92 mm)	screw-on (intermateable with PC3.5 and SMA)	40 GHz	
SSMA	screw-on	40 GHz	
SMP	snap-on	40 GHz	
Self-locking connectors	screw-on	up to 40 GHz	
PC 2.4 (2.4 mm)	screw-on	50 GHz	
PC 1.85 (1.85 mm)	screw-on	67 GHz	
SMPM/SMPM-T	snap-on/screw-on	67 GHz	
VITA 67	slide-on	67 GHz	



## Board-to-board connectors

### Lower cost

Direct board-to-board connections with compensating misalignment (**axial float  $\pm 1.2$  mm**) not only save costs compared to cable connections but also allow larger tolerances on all other components.

### Miniaturization

HUBER+SUHNER board-to-board connectors provide the smallest **board-to-board distance (6.7 mm)** in class. This enables smaller designs with less weight and provide much more space on the PCB.

### Reliable connection

Due to the unique **fully automated production** process and 100 % interface control highest quality requirements, capacity and flexibility can be achieved.

### High output power and excellent RF performance

HUBER+SUHNER board-to-board connectors can handle very high power requirements (**260 W**) in a module environment where high ambient temperatures are a given.

This opens new possibilities for module designs without active cooling. Thanks to the unique ball joint design the connectors provide **excellent return loss** values over the complete floating range combined with **outstanding RF shielding** performance.

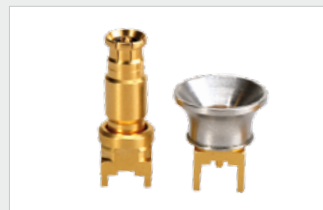
### Secure mating

With blind mateability and the largest connecting range in class, very fast module assemblies are possible.



## MBX

- Very high axial float – best in class
- High output power
- Excellent return loss values
- Smallest board-to-board distances in class
- DC to 6 GHz



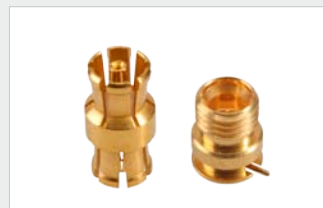
## MMBX

- Very high frequencies (DC to 15 GHz)
- Very good return loss values
- Smallest board-to-board distances in class



## SMPPM

- Ultra high frequency range (DC to 65 GHz)
- MIL-STD-348 qualified
- Various detent options
- Custom ganged connection options available
- Smallest pitch distance and envelope
- Smallest board-to-board distances
- True 65 GHz board-to-board solution

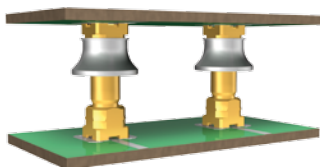


## SMP

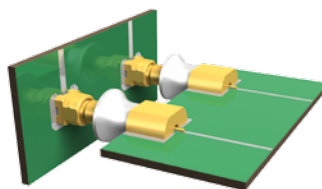
- Ultra high frequency range (DC to 40 GHz)
- MIL-STD-348 qualified
- Various detent options
- Rugged and reliable
- Most widely used board-to-board connector in the market
- Small board-to-board distances



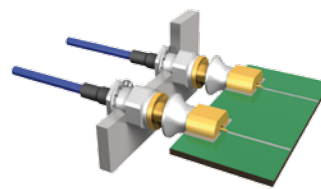
## Applications



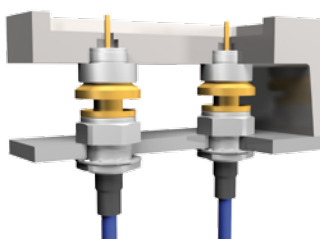
Board-to-board connection



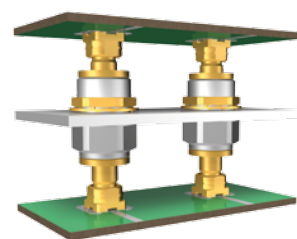
Board-to-board connection right angle



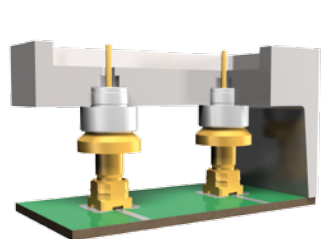
Board-to-panel connection right angle



Panel-to-panel connection



Board-to-board through a panel



Board-to-panel connection (filter)

# Technical data of MBX and MMBX B-to-B connectors

Electrical data	MBX	MMBX
	Requirements	
Impedance	50 Ω	
Frequency range	DC - 6 GHz	DC - 15 GHz
Dielectric withstanding voltage (at sea level)	1 kV rms, 50 Hz	
Working voltage (at sea level)	≤ 330 V rms, 50 Hz	
Insulation resistance	≥ 1 GΩ	
Contact resistance - center contact - outer contact	≤ 5 mΩ ≤ 2.5 mΩ	≤ 5 mΩ ≤ 1 mΩ
Return loss (typical values for a board-to-board connection (measured on board))	26 dB @ 2.5 GHz/19 dB @ 6 GHz	26 dB @ 2.5 GHz/25 dB @ 6 GHz
RF-leakage (interface only)	≥ 70 dB (DC - 6 GHz)	≥ 70 dB (DC - 6 GHz) ≥ 60 dB (6 to 12.4 GHz)
Power	typical 240 W at 2.4 GHz at room temperature	
Mechanical data	Requirements	
Engagement force (slide-side)	≤ 15 N/3.4 lbs	
Disengagement force (slide-side)	≤ 15 N/3.4 lbs	
Durability (mating cycles)	100	
Axial float (misalignment)	± 1.2 mm	± 0.3 mm
Radial float (misalignment)	depending on the adapter ± 0.6 mm (at 13 mm board-to-board distance) ± 1.0 mm (≥ 18 mm board-to-board distance)	depending on the adapter ± 0.4 mm (at 6.7 mm board-to-board distance) ± 0.8 mm (≥ 11.65 mm board-to-board distance)
Environmental data	Test conditions	
Temperature range	-55 to +155 °C/-67 to +311 °F	
Climatic category	55/155/10	55/155/21
Thermal shock	MIL-STD-202, method 107 G, condition B1	
Moisture resistance	MIL-STD-202, method 106 F	
Corrosion	MIL-STD-202, method 101, condition B	
Vibration	MIL-STD-202, method 204 D, condition A	
Mechanical shock	MIL-STD-202, method 213 B, condition B	-
Processing data	Requirements	
Adherent to the print - shearing - pulling (vertical to PCB)	≥ 150 N/33.7 lbs. ≥ 150 N/33.7 lbs.	
Material data MBX/MMBX		
Connector parts	Material	Plating
Center contact	brass/bronze/copper-beryllium alloy	SUCOPRO® gold plating
Outer contact	brass/bronze	SUCOPRO® gold plating
Body	brass	SUCOPRO® gold plating
Insulators	LCP/PTFE/PFA	
Funnel	brass/PA	SUCOPLATE®

Performance listed is typical. Individual part configuration may vary. Contact HUBER+SUHNER for more information and specifications.



# Technical data of SMP and SMPM B-to-B connectors

Electrical data	SMP	SMPM
	Requirements	
Impedance	50 $\Omega$	50 $\Omega$
Frequency range	DC to 40 GHz	DC to 65 GHz
Contact resistance	center conductor 6.0 milliohms max. outer conductor 2.0 milliohms max.	center conductor 6.0 milliohms max. outer conductor 2.0 milliohms max.
DWV	500 Vrms at sea level	335 Vrms at sea level
Insulation resistance	5000 megaohms min.	5000 megaohms min.
Corona levels	190 Vrms at 70 000 ft	125 Vrms at 70 000 ft
RF high potential	325 Vrms at 5 MHz	200 Vrms at 5 MHz
RF leakage	80 dB max. @ 3 GHz 65 dB max. @ 3 to 26.5 GHz	80 dB max. @ 3 GHz 65 dB max. @ 3 to 26.5 GHz
Magnetic permeability	< 2 $\mu$	< 2 $\mu$
VSWR	1.20:1 to 18.0 GHz 1.35:1 to 26.5 GHz	1.1:1 to 26.5 GHz 1.3:1 to 65 GHz
Insertion loss	0.06 $\sqrt{f}$ in GHz (non-hermetic connectors) 0.12 $\sqrt{f}$ in GHz (hermetic connectors)	0.05 + 0.04 $\sqrt{f}$ in GHz (non-hermetic connectors) 0.12 $\sqrt{f}$ in GHz (hermetic connectors)
Mechanical data	Requirements	
Center contact retention	1.5 lbs (6.672 N) min. (captivated designs)	1.5 lbs (6.672 N) min. (captivated designs)
Durability	100 cycles min. into a full detent shroud 500 cycles min. into a limited detent shroud 1000 cycles min. into a smooth bore shroud	100 cycles min. into a full detent shroud 1000 cycles min. into a smooth bore shroud
Force to engage	SMP full detent – 15 lbs (66.723 N) max. SMP limited detent – 10 lbs (44.482 N) max. SMP smooth bore – 2 lbs (8.896 N) max.	SMPM full detent – 3.5 lbs (15.569 N) typical SMPM smooth bore – 1.5 lbs (6.672 N) typical
Force to disengage	SMP full detent – 5 lbs (22.241 N) min. SMP limited detent – 2 lbs (8.896 N) min. SMP smooth bore – 0.5 lbs (2.224 N) min.	SMPM full detent – 5 lbs (22.241 N) typical SMPM smooth bore – 1.5 lbs (6.672 N) typical
Radial misalignment	standard – $\pm 0.25$ mm / 0.010 in. min. float mount – $\pm 0.76$ mm / 0.030 in. min.	–
Axial misalignment	standard – 0.25 mm / 0.010 in. min. float mount – 1.27 mm / 0.050 in. min.	–
Environmental data	Test conditions	
Temperature range	–65 to +165 °C	–65 to +165 °C
Climatic category	MIL-STD-202, method 107, condition B	MIL-STD-202, method 107, condition B
Thermal shock	MIL-STD-202, method 106	MIL-STD-202, method 106
Moisture resistance	MIL-STD-202, method 101, condition B	MIL-STD-202, method 101, condition B
Corrosion	MIL-STD-202, method 204, 28 g peak	MIL-STD-202, method 204, 28 g peak
Vibration	MIL-STD-202, method 214, condition K-I, 46.3 g	MIL-STD-202, method 214, condition K-I, 46.3 g
Mechanical shock	MIL-STD-202, method 213, 12 000 g peak	MIL-STD-202, method 213, 12 000 g peak

Performance listed is typical. Individual part configuration may vary. Contact HUBER+SUHNER for more information and specifications.

# Design guide

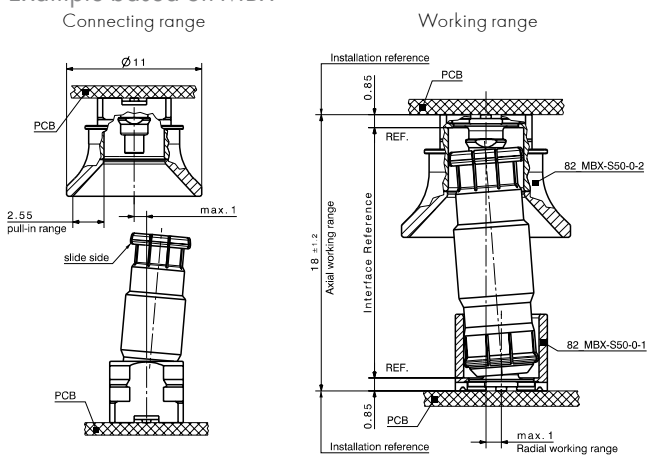
## Working range (axial and radial) – mated board connector

In mated condition, the two connecting parts have to be aligned within the dimension given for the axial and radial working range. Unlike the MMBX interface, the tilt of the adapter can be limited with the MBX. The great advantage of this feature is that there now is a constant working range with different adapter lengths and thus the same standard funnel for the connecting parts can be used.

## Connecting range – unmated board connector

The two connecting parts need to be aligned within the connecting range when mating. In order to guarantee a blind mateable connection, the tilted adapter will be guided by the funnel of the opposite connector. The connecting range therefore depends on the adapter and the pull-in range (size of the funnel).

### Example based on MBX



## Recommendation

HUBER+SUHNER recommends using guiding pins to align the boards within the connecting range and working range as well as distance holders to maintain the axial misalignment within the working range.

HUBER+SUHNER provides an outline drawing for every application with the relevant mechanical dimensions that need to be considered when designing-in our board-to-board solutions. 3D step files are available on [www.hubersuhner.com](http://www.hubersuhner.com)

## Test boards

### MBX/MMBX test boards

Measurement of return loss (RL) and insertion loss (IL) of a MBX/MMBX board-to-board test board.



### MBX/MMBX reference boards

Reference board to identify the insertion loss (IL) of the board-to-board connection itself.




## Series MBX

### Straight PCB jacks (female), surface mount type SMT

Picture	HUBER+SUHNER type	Item no.	Soldering pad
	82_MBX-S50-0-1/111_N	84104680	ML 173
	82_MBX-S50-0-2/113_N	84104681	

### Straight adaptors

Picture	HUBER+SUHNER type	Item no.	Board-to-board distance	Adaptor length
	32_MBX-50-0-1/111_N	84104690	13 mm/0.512 in.	9.7 mm/0.382 in.
	32_MBX-50-0-2/111_N	84104691	18 mm/0.709 in.	14.7 mm/0.579 in.
	32_MBX-50-0-3/111_N	84104692	28 mm/1.012 in.	24.7 mm/0.972 in.


Adaptors with other lengths available upon request.

### Straight PCB jacks (female), through hole type THT


Picture	HUBER+SUHNER type	Item no.	Soldering pad
	82_MBX-50-0-3/111_N	84104683	ML 174
	82_MBX-50-0-4/113_N	84104684	

## Series MMBX

### Straight PCB jacks (female), surface mount type SMT


Picture	HUBER+SUHNER type	Item no.	Soldering pad	Pull-in range
	82_MMBX-S50-0-1/111_N	23001785	ML 122	0.65 mm/0.0256 in. *
	82_MMBX-S50-0-3/111_N	23015527		0.95 mm/0.0374 in.
	82_MMBX-S50-0-13/111_N	84032435		1.80 mm/0.0709 in.

### Straight adaptors

	HUBER+SUHNER type	Item no.	Board-to-board distance	Adaptor length	Min. pull-in range
	32_MMBX-50-0-1/111_N	23001749	6.7 mm/0.264 in.	4.8 mm/0.189 in.	0.65 mm/0.026 in. *
	32_MMBX-50-0-12/111_N	84004734	8.0 mm/0.315 in.	6.0 mm/0.236 in.	0.95 mm/0.037 in.
	32_MMBX-50-0-4/111_N	23010564	10.0 mm/0.394 in.	8.0 mm/0.315 in.	1.80 mm/0.071 in.
	32_MMBX-50-0-13/111_N	84031096	12.0 mm/0.472 in.	10.0 mm/0.417 in.	1.80 mm/0.071 in.
	32_MMBX-50-0-5/111_N	84026915	14.0 mm/0.551 in.	12.0 mm/0.472 in.	1.80 mm/0.071 in.
	32_MMBX-50-0-10/111_N	23034946	15.0 mm/0.591 in.	13.0 mm/0.512 in.	1.80 mm/0.071 in.

\* only suitable pull-in-range

### Straight PCB jacks (female), through hole type THT

Picture	HUBER+SUHNER type	Item no.	Mounting hole	Pull-in range
	82_MMBX-50-0-2/111_N	23001788	ML 15	0.65 mm/0.0256 in.
	82_MMBX-50-0-4/111_N	23013667		0.95 mm/0.0374 in.
	82_MMBX-50-0-14/111_N	84032421		1.80 mm/0.0709 in.


### Straight PCB jacks (female), edge mount

Picture	HUBER+SUHNER type	Item no.	Mounting hole
	92_MMBX-S50-0-12/111_N	84019159	ML 147

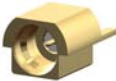
Please find broader product range and details on our website or in our RF coaxial connectors general catalogue.

## Series SMP


### Straight PCB plugs (male)

Picture	HUBER+SUHNER type	Item no.	Detent	Operating frequency	Packaging
	81_SMP-S50-0-L1/111_NE	80377946	limited detent	DC - 40 GHz	single
	81_SMP-S50-0-S1/111_NE	80377947	smooth bore	DC - 40 GHz	single

### Edge mount PCB plugs (male)

Picture	HUBER+SUHNER type	Item no.	Detent	Operating frequency	Packaging
	91_SMP-50-0-L1/111_NE	80377833	limited detent	DC - 40 GHz	single
	91_SMP-50-0-S1/111_NE	80377835	smooth bore	DC - 40 GHz	single

### Adaptor/bullet jack/jack (female/female)


Picture	HUBER+SUHNER type	Item no.	Packaging	Adaptor length
	31_SMP-50-0-5/111_NE	80377837	single	8.76 mm/0.345 in.
	31_SMP-50-0-6/111_NE	80377836	single	19.30 mm/0.760 in.

### Straight panel mount receptacle (male)

Picture	HUBER+SUHNER type	Item no.	Detent	Pin length	Packaging
	12_SMP-50-0-S1/119_NE	80378538	catchers mitt	0.062"/1.57 mm additional length on request	single

## Series SMPM

### Adaptor jack/jack (female/female)

Picture	HUBER+SUHNER type	Item no.	Packaging	Adaptor length
	29981-A2F1	80372056	single	5.33 mm/0.210 in.
	29981-A2F2	80363712	single	12.7 mm/0.500 in.
	29981-A2F3	80376811	single	6.45 mm/0.254 in.

Please find broader product range and details on our website or in our RF coaxial connectors general catalogue.

# Microminiature connectors



## SMP

HUBER+SUHNER SMP connectors provide a robust, proven and fully compatible plug-in solution for applications up to 40 GHz. HUBER+SUHNER SMP connectors have been MIL-SPEC qualified for defense and space flight hardware. The design of the interface and materials provide true compatibility as well as guaranteed mechanical performance with all MIL-STD-348 SMP connectors in the market over the mating life of the connector.



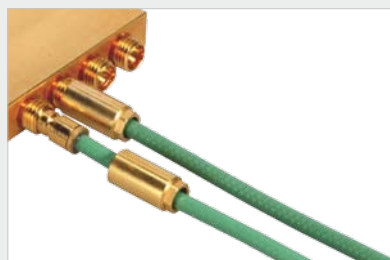
## SMMPM

HUBER+SUHNER Astrolab SMMPM connectors offer unrivaled miniaturization and performance for RF applications up to 65 GHz. HUBER+SUHNER Astrolab SMMPM connectors are MIL-SPEC qualified for defense and space flight applications. Along with the unique bend-to-the-end microbend style cable connectors, HUBER+SUHNER Astrolab offers a large portfolio of different PCB mount SMMPM connectors that have been designed with optimized PCB trace launch geometries to offer a complete interconnect design solution from "wire-to-trace".



## SMMPM-T

The SMMPM-T is the smallest threaded open source connector on the market. Its unique and innovative combination of a MILSTD-348 SMMPM female interface connector together with a retractable threaded nut provides an integrated solution offering unprecedented electrical and mechanical performance. The SMMPM-T handles high density requirements with a connector centerline-to-centerline spacing of just 5 mm (0.20 in) while offering unmatched electrical stability at frequencies up to 65 GHz in even the harshest operating environments.



## VITA 67

HUBER+SUHNER VITA 67 is the first high-density and true high-performance 65 GHz coaxial interconnect system on the market. Incorporating the solderless Minibend bend-to-the-end technology tightest bending radius (0.06"/1.5 mm) immediately behind the connector, the snap-in captivation method guarantees quick, easy and precise installations without tool or loose parts. VITA 67 is designed for side-by-side implementation with VITA 46 and VITA 66 hardware. It can be assembled with diameter 0.086" and smaller cable types.




## SMP – technical data

Electrical data		Requirements
Impedance		50 $\Omega$
Frequency range		DC to 40 GHz
Contact resistance		center conductor 6.0 milliohms max. outer conductor 2.0 milliohms max.
DWV		500 Vrms at sea level
Insulation resistance		5000 megaohms min.
Corona levels		190 Vrms at 70 000 ft
RF high potential		325 Vrms at 5 MHz
RF leakage		80 dB max. at 3 GHz 65 dB max. at 3 to 26.5 GHz
Magnetic permeability		< 2 $\mu$
VSWR		1.2:1 to 18 GHz 1.35:1 to 26.5 GHz 1.5:1 to 40 GHz
Insertion loss		0.06 $\sqrt{f}$ in GHz (non-hermetic connectors) 0.12 $\sqrt{f}$ in GHz (hermetic connectors)
Mechanical data		Requirements
Center contact retention		1.5 lbs (6.672 N) min. (captivated designs)
Durability		100 cycles min. into a full detent shroud 500 cycles min. into a limited detent shroud 1000 cycles min. into a smooth bore shroud
Force to engage		SMP full detent – 15 lbs (66.723 N) max. SMP limited detent – 10 lbs (44.482 N) max. SMP smooth bore – 2 lbs (8.896 N) max.
Force to disengage		SMP full detent – 5 lbs (22.241 N) min. SMP limited detent – 2 lbs (8.896 N) min. SMP smooth bore – 0.5 lbs (2.224 N) min.
Radial misalignment		standard – $\pm 0.25$ mm/0.010 in. min. float mount – $\pm 0.76$ mm/0.030 in. min.
Axial misalignment		standard – 0.25 mm/0.010 in. min. float mount – 1.27 mm/0.050 in. min.
Environmental data		Requirements
Temperature range		–65 to +165 °C
Thermal shock		MIL-STD-202, method 107, condition B
Moisture resistance		MIL-STD-202, method 106
Corrosion		MIL-STD-202, method 101, condition B
Sine vibration		MIL-STD-202, method 204, 28 g peak
Random vibration		MIL-STD-202, method 214, condition K-I, 46.3 g
Shock		MIL-STD-202, method 213, 12 000 g peak
Material data		
Cable and shroud connectors	Material	Plating
Body	beryllium copper per ASTM B- 196 or brass per QQ-B-626	SUCOPRO gold plate
	#303 SS per ASTM A- 582	passivated per SAE-AMS-2700
Contact	beryllium copper per ASTM B-196	SUCOPRO gold plate
Dielectric	PTFE per ASTM D-1710, type I, grade 1 or Torlon™ per ASTM D-5204	–
Ferrule	brass per ASTM B-135	SUCOPRO gold plate

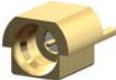


## Series SMP – PCB mount connectors

### Straight PCB plugs (male)


Picture	HUBER+SUHNER type	Item no.	Detent	Operating frequency	Packaging
	81_SMP-S50-0-L1/111_NE	80377946	limited detent	DC - 40 GHz	single
	81_SMP-S50-0-S1/111_NE	80377947	smooth bore	DC - 40 GHz	single

### Edge mount PCB plugs (male)


Picture	HUBER+SUHNER type	Item no.	Detent	Operating frequency	Packaging
	91_SMP-50-0-L1/111_NE	80377833	limited detent	DC - 40 GHz	single
	91_SMP-50-0-S1/111_NE	80377835	smooth bore	DC - 40 GHz	single

## Series SMP – cable connectors

### SMP female connector – straight

Picture	Cable types	Part no.	Item no.	Typ. return loss
	Multiflex_86	21_SMP-50-2-1/111_NE	80390557	DC - 20 GHz: 29 dB
	Sucoform_86			20 - 30 GHz: 27 dB
	Semirigid_86			30 - 40 GHz: 20 dB

### SMP female connector – right angle

Picture	Cable types	Part no.	Item no.	Typ. return loss	
	Multiflex_86	26_SMP-50-2-2/111_NE	80377839	DC - 20 GHz:	25 dB
	Sucoform_86			20 - 26.5 GHz:	20 dB
	Semirigid_86			26.5 - 30 GHz:	15 dB
				26.5 - 40 GHz:	10 dB

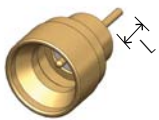
## SMPM – technical data

Electrical data		Requirements
Impedance		50 $\Omega$
Frequency range		DC to 65 GHz
Contact resistance		center conductor 6.0 milliohms max. outer conductor 2.0 milliohms max.
DWV		335 Vrms at sea level
Insulation resistance		5000 megaohms min.
Corona levels		125 Vrms at 70 000 ft
RF high potential		200 Vrms at 5 MHz
RF leakage		80 dB max. at 3 GHz 65 dB max. at 3 to 26.5 GHz
Magnetic permeability		< 2 $\mu$
VSWR		1.1:1 to 26.5 GHz 1.3:1 to 65 GHz
Insertion loss		0.05 + 0.04 $\sqrt{f}$ in GHz (non-hermetic connectors) 0.12 $\sqrt{f}$ in GHz (hermetic connectors)
Mechanical data		Requirements
Center contact retention		1.5 lbs (6.672 N) min. (captivated designs)
Durability		100 cycles min. into a full detent shroud 1000 cycles min. into a smooth bore shroud
Force to engage		SMPM full detent – 3.5 lbs (15.569 N) typical SMPM smooth bore – 1.5 lbs (6.672 N) typical
Force to disengage		SMPM full detent – 5 lbs (22.241 N) typical SMPM smooth bore – 1.5 lbs (6.672 N) typical
Environmental data		Requirements
Temperature range		–65 to +165 °C
Thermal shock		MIL-STD-202, method 107, condition B
Moisture resistance		MIL-STD-202, method 106
Corrosion		MIL-STD-202, method 101, condition B
Sine vibration		MIL-STD-202, method 204, 28 g peak
Random vibration		MIL-STD-202, method 214, condition K-I, 46.3 g
Shock		MIL-STD-202, method 213, 12 000 g peak
Material data		
Cable and shroud connectors	Material	Plating
Body and contact	beryllium copper per ASTM B-196	gold plate per ASTM B-488, code C, type II over nickel plate per SAE-AMS-QQ-N-290, type 1
Dielectric	PTFE per ASTM D-1710, type I, grade 1 or Torlon™ per ASTM D-5204	-
Shroud	#303 SS per ASTM A-582	passivated per SAE-AMS-2700






Contact HUBER+SUHNER for more information and specifications by part number.

# SMPM – series

## Hermetic male shrouds

Picture	HUBER+SUHNER type	Item no.	"L"	End option	Detent
			mm/in		
	29972H1-2-030S	80376464	0.762/0.030	square	full
	29972H1-2-050S	80376465	1.270/0.050	square	full
	29972H1-2-060S	80395460	1.524/0.060	square	full
	29972H1-2-070S	80395461	1.778/0.070	square	full
	29972H1-2-090S	80395462	2.286/0.090	square	full
	29972H1-4-030S	80395463	0.762/0.030	square	smooth bore
	29972H1-4-050S	80395464	1.270/0.050	square	smooth bore
	29972H1-4-060S	80395465	1.524/0.060	square	smooth bore
	29972H1-4-070S	80395466	1.778/0.070	square	smooth bore
	29972H1-4-090S	80395467	2.286/0.090	square	smooth bore

## PCB mount male connectors

	HUBER+SUHNER type	Item no.	Detent
	29972S1-2-001	80367473	full
	29972S1-4-001	80367474	smooth bore
	29972SM-2-001	80367475	full
	29972SM-4-001	80367476	smooth bore
	29972T1-2-155	80395469	full
	29972T1-4-155	80395470	smooth bore
	29976CB7-2-4	80374382	full
	29976CB7-4-4	80395468	smooth bore
	29972CB2-2-002	80376772	full
	29972CB2-4-002	80376773	smooth bore


## SMPM-T – technical data

Electrical data		Requirements
Impedance		50 $\Omega$
Frequency range		DC to 67 GHz
Contact resistance		center conductor 6.0 milliohms max. outer conductor 2.0 milliohms max.
DWV		335 Vrms at sea level
Insulation resistance		5000 megaohms min.
Corona levels		125 Vrms at 70 000 ft.
RF high potential		200 Vrms at 5 MHz
RF leakage		80 dB max. at 3 GHz 65 dB max. at 3 to 26.5 GHz
Magnetic permeability		< 2 $\mu$
VSWR		1.1:1 to 26.5 GHz 1.3:1 to 65 GHz
Insertion loss		0.05 + 0.04 $\sqrt{f}$ in GHz (non-hermetic connectors) 0.12 $\sqrt{f}$ in GHz (hermetic connectors)
Mechanical data		Requirements
Center contact retention		1.5 lbs (6.672 N) min. (captivated designs)
Durability		100 cycles min. into a full detent shroud 1000 cycles min. into a smooth bore shroud
Force to engage		SMPM full detent – 3.5 lbs (15.569 N) typical SMPM smooth bore – 1.5 lbs (6.672 N) typical
Force to disengage		SMPM full detent – 5 lbs (22.241 N) typical SMPM smooth bore – 1.5 lbs (6.672 N) typical
Environmental data		Requirements
Temperature range		–65 to +165 °C
Thermal shock		MIL-STD-202, method 107, condition B
Moisture resistance		MIL-STD-202, method 106
Corrosion		MIL-STD-202, method 101, condition B
Sine vibration		MIL-STD-202, method 204, 28 g peak
Random vibration		MIL-STD-202, method 214, condition K-1, 46.3 g
Shock		MIL-STD-202, method 213, 12 000 g peak
Material data		
Cable and shroud connectors	Material	Plating
Body and contact	Beryllium copper per ASTM B-196	gold plate over nickel plate per SAE-AMS-QN-N-290, type 1
Dielectric	PTFE or Torlon™ or Ultem™	–


Contact HUBER+SUHNER for more information and specifications by part number.

# SMPM-T – series




## Hermetic male shrouds

Picture	Part number	Item no.	Interface	Contact type	Contact length (L)
	29976H1-2-060S	80362701	full detent	square	1.52 mm/0.06 in.
	29976H1-2-090S	80362703	full detent		2.28 mm/0.09 in.
	29976H1-4-060S	80362705	smooth bore		1.52 mm/0.06 in.
	29976H1-4-090S	80362707	smooth bore		2.28 mm/0.09 in.




## Panel mount male connectors

Picture	Part number	Item no.	Interface
	29976TSP-2-005	80370422	full detent SMPM-T male
	29976TSP-4-005	80374421	smooth bore SMPM-T male

## PCB mount male connectors

Picture	Part number	Item no.	Interface
	29976S1-2-140	80362694	full detent
	29976S1-4-140	80362695	smooth bore
	29976RA-2-001	80374263	full detent
	29976RA-4-001	80374264	smooth bore
	29976T1-2-155	80366706	full detent
	29976T1-4-155	80372345	smooth bore

## PCB mount male connectors

Picture	Part number	Item no.	Interface
	29976BM-2-001	80320230	full detent
	29976BM-4-001	80320231	smooth bore
	29976BM-2-002	80362690	full detent
	29976BM-4-002	80362691	smooth bore
	29976BM-2-004	80366009	full detent
	29976BM-4-004	80363975	smooth bore

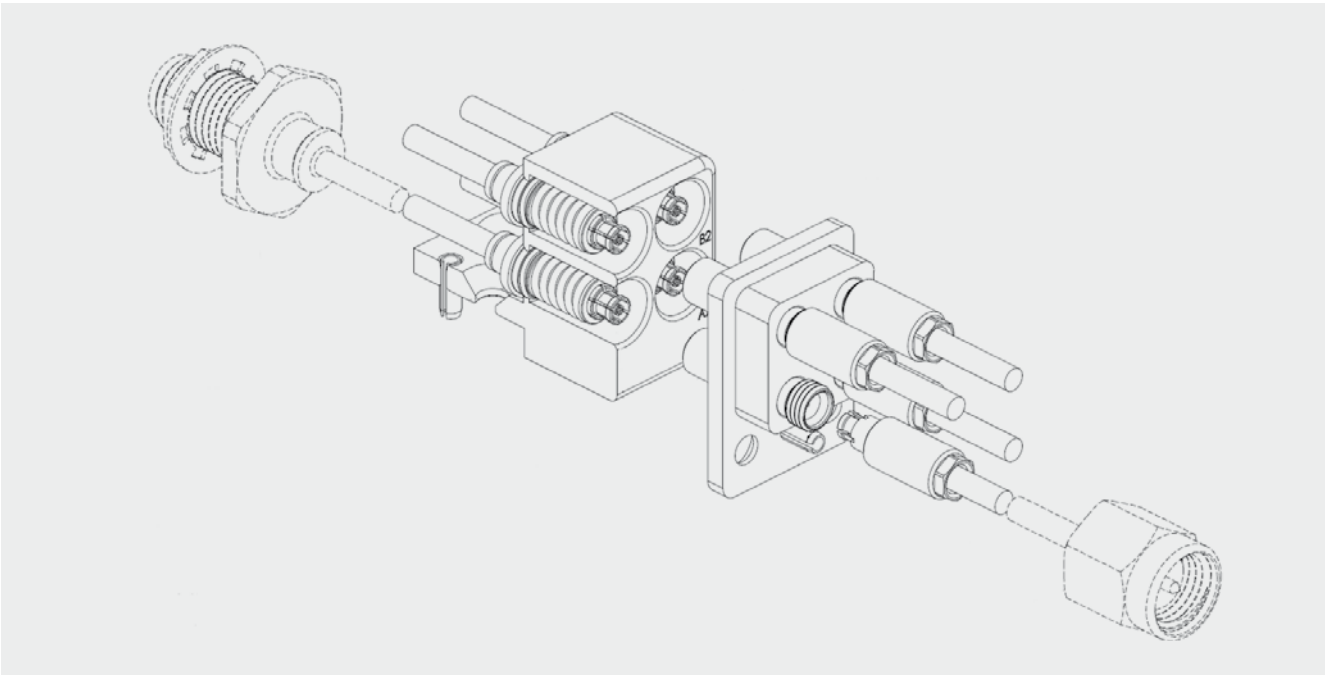
## VITA 67 (SMPM)– technical data

Electrical data		Requirements
Impedance		50 $\Omega$
Frequency range		DC to 65 GHz
Contact resistance		center conductor: 6.0 milliohms max outer conductor: 2.0 milliohms max
DWV		335 Vrms
Insulation resistance		5 000 megaohms min.
Corona levels		125 Vrms at 70 000 ft
RF high potential		200 Vrms at 5 MHz
RF leakage		SHF (3 to 30 GHz): 100 dB min. VHF/UHF (30 MHz to 3 GHz): 120 dB min. HF (3 to 30 MHz): 140 dB min.
Magnetic permeability		< 2 $\mu$
VSWR		1.1:1 to 26.5 GHz 1.3:1 to 65 GHz
Insertion loss		0.05 + 0.04 $\sqrt{f}$ in GHz
Mechanical data		Requirements
Center contact retention		1.5 lbs (6.672 N) min
Durability		1000 cycles min. (smooth bore)
Force to engage		1.5 lbs. (6.672 N) typical
Force to disengage		1.5 lbs (6.672 N) typical
Environmental data		Requirements
Temperature range		–65 to +155 °C
Thermal shock		MIL-STD-202-107, test condition B
Moisture resistance		MIL-STD-202-106
Corrosion		MIL-STD-202-101, test condition B
Sine vibration		MIL-STD-202-204, 28 g peak
Random vibration		MIL-STD-202-214, test condition K-1, 46.3 g
Shock		MIL-STD-202-213, 12 000 g peak
Material data		
Cable and shroud connectors	Material	Plating
Body and contact	beryllium copper	gold over nickel
Dielectric	PTFE	–
Housing	passivated stainless steel	–

Contact HUBER+SUHNER for more information and specifications by part number.



# VITA 67 – series



## Standard VITA parts

Picture	Version	Module type	No. of positions	Part. no	Item no.	Cable size
	VITA 67.1	daughter card	4	29981-DCM4	80391306	0.047"   0.086"
		backplane*	4	29989-MBM4	80396360	0.047"
		backplane*	4	29989-MBM4-86	80379468	0.086"
	VITA 67.2	daughter card	8	29981-DCM8	80391307	0.047"   0.086"
		backplane*	8	29989-MBM8	80379226	0.047"
		backplane*	8	29989-MBM8-86	80379469	0.086"

\* Backplane connector blocks are SMPM and SMPM-T compatible

## VITA tools

HUBER+SUHNER VITA 67 connector blocks utilize a snap-in captivation method of the SMPM connector allowing for "one-and-done" installation of the cable assembly into the connector block without the use of any tools and easily-misplaced loose parts as competitors solutions. De-mating the connector from the block requires the use of a single-motion plunger tool to engage the snap ring and free the connector.

Picture	Tool	Description	Item no.
	Removal tool	AT-2377-DCM1	80378115
	Insertion tool	AT-2377-DCM2	80378196

# VITA 67 – series

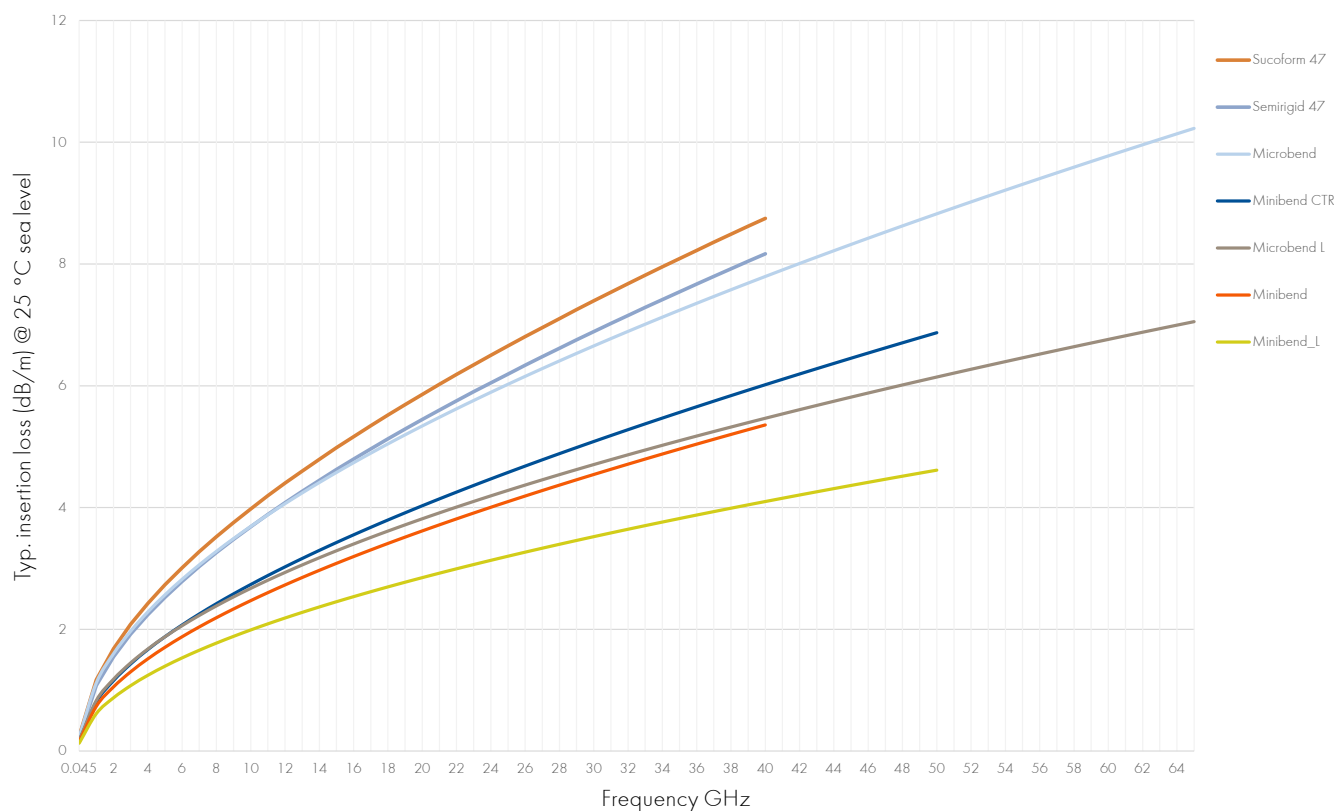
## Available cables

Cable type	Outer diameter (mm)	Bend radius static (mm)	Frequency range (GHz)	Features/benefits
Microbend	1.96	1.52	90	Bend-to-the end
Microbend L	1.96	5.10	90	Bend-to-the end/low loss
Minibend	2.50	5.08	65	Bend-to-the end
Minibend L	2.64	5.08	50	Bend-to-the end/low loss
Minibend CTR	2.49	5.08	50	Bend-to-the end < 300 PPM phase change over temperature
Sucoform 47	1.20	3.18	40	Smallest diameter available
Semirigid 47	1.20	3.18	67	Smallest diameter available

For connectors (A and B referred in the assembly drawing) all connectors are available according:

- Minibend series: refer to page 34
- All other cables according RF connector catalogue or based on the connector overview on page 65

## Attenuation (nominal values at +25 °C ambient temperature)



# Self-locking connectors

The HUBER+SUHNER self-locking solution is a simple and easy to use connector that eliminates the need for lockwire/safety wire that can lead to potential FOD in an aircraft. The anti-rotation microwave connector maintains the required torque to ensure the connector interface remains fully engaged throughout the operational profile that the aircraft may experience.

Our solution features a lock-collar mechanism that once engaged prevents rotation of the coupling nut. This design results in time savings during the initial cable assembly installation by eliminating lockwires and the associated equipment necessary to install it. The size and weight of these connector assemblies are similar with standard connectors and maintains full function in harsh and/or high vibration environments.

Electrical data	TNC series	PC2.4 series
		
Interface	TNC	PC2.4
Impedance	50 Ω	50 Ω
Frequency range	DC to 18 GHz	DC to 50GHz
DWV	1.5 kV rms, 50 Hz (depending on cable)	400 kV rms
Working voltage (at sea level) - Unmated	500 V rms, 50 Hz (depending on cable)	250 Vrms
Insulation resistance	$\geq 5 \times 10^3 \text{ M}\Omega$	$\geq 5 \times 10^3 \text{ M}\Omega$
Contact resistance - Center contact - Outer contact	$\leq 1.5 \text{ m}\Omega$ $\leq 1 \text{ m}\Omega$	$\geq 1.4 \text{ m}\Omega$ $\geq 1 \text{ m}\Omega$
Mechanical data		
Center contact retention	46 to 69 Ncm/4.1 to 6.1 in lbs	67 N-cm/6.0 in lbs
Coupling nut retention force	$\geq 450 \text{ N}/101.2 \text{ lbs}$	$\geq 450 \text{ N}/101.2 \text{ lbs}$
Contact captivation	$\geq 27 \text{ N}/6.1 \text{ lbs}$	$\geq 26.7 \text{ N}/6 \text{ lbs}$
Durability	$\geq 500$	$\geq 500$
Environmental data		
Temperature range	-65 to +165 °C	-55 to +125 °C
Thermal shock	MIL-STD-202, method 107, condition B	MIL-STD-202, method 107
Vibration	MIL-STD-202, method 204, condition B	MIL-STD-202, method 204, condition B
Shock	MIL-STD-202, method 213, condition G	MIL-STD-202, method 213, condition G

## Available standard parts

Cable type	TNC straight	PC2.4 straight
SUCOFLEX 229 (D)	•	
SUCOFLEX 240 (D)		•
SUCOFLEX 329 (D)	•	
SUCOFLEX 340 (D)		•

Please refer to the microwave cable assembly section for more information on SUCOFLEX 200/300 – page 24/26  
Contact HUBER+SUHNER for more information and specifications by part number and in the event additional configurations are required.

## QMA/QMA-W50

HUBER+SUHNER QMA coaxial connectors comply with the QLF standard and are available with 50  $\Omega$  impedance. The QMA connectors are return loss optimized for frequencies up to 18 GHz. The interface is based on the SMA dimension, but instead of a threaded coupling mechanism, a new snap-lock mechanism is used. The QMA interface has very similar performance to the SMA, but it offers an easier, faster and safer coupling operation, which helps customers save significant time during production or installation. QMA connectors are also available in a waterproof version (IP68) and are compatible with the QLF standard.



- Easy to mate, 10 times faster than with threaded SMA
- Increased reliability, waterproof IP68 (QMA-W50)
- No torque or tooling required
- 360° rotatable interface
- Easy routing of cable assembly without mechanical stress or electrical performance degradation
- Higher packing density
- Size equivalent to SMA, but space saving (no torque wrench required)
- Excellent electrical performance
- Consistent VSWR performance enables easily replacement



### XQMA (QMA eXtreme, waterproof IP68)

In addition to the outstanding qualities of the quick lock connector QMA, this advanced version has some extra advantages such as protection from corrosion in a salty atmosphere and from freezing in the event of high humidity and low temperature.

## QN

HUBER+SUHNER QN coaxial connectors are available with 50  $\Omega$  impedance. The frequency range extends to 11 GHz, depending on the connector and cable type, however most of the QN connectors are return loss optimized for frequencies up to 6 GHz. The interface is based on the inner dimensions of the N connector but instead of a threaded coupling mechanism a snap-lock mechanism is used. The QN interface has a very similar performance to N, but in addition it offers an easier, faster and safe coupling operation, which helps customers save significant time during production or installation of their systems.



- Cycle time improvement for making RF connections (10 times faster to mount than threaded connectors)
- No torque or tooling required
- Higher packaging density
- Free-rotating connection when mated (cable torsion relief)
- Eliminates loosening problems associated with threaded connectors
- Same performance as N
- Best intermodulation



### XQN (QN eXtreme, waterproof IP68)

Besides the outstanding qualities of the quick lock connector QN, this advanced version has some extra advantages such as protection from corrosion in a salty atmosphere and from freezing in case of high humidity and low temperature.

# Customized connectors – service and support

HUBER+SUHNER offers a professional design-in service for board connector footprints. By the use of three dimensional electromagnetic field simulators the optimal performance of the HUBER+SUHNER board connectors is provided to the customer.

Customized and optimized PCB footprints

HUBER+SUHNER provides comprehensive design data collections to their customers:

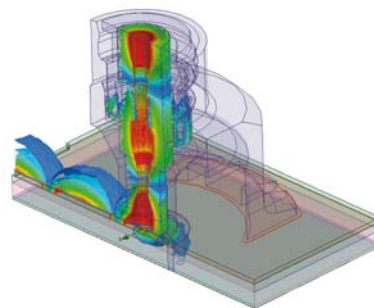
## 3D files

For the exchange of CAD models between various CAD systems, HUBER+SUHNER provides 3D files in IGS or STEP data format.

Comprehensive design data

## S-parameter files

Measured S-parameters of the HUBER+SUHNER components are available on request, offering the customers the possibility to include these components into their electrical simulations.



## Application notes

Many application notes and technical design guidelines for the HUBER+SUHNER solutions are available on request.

Although our standard assortment is broad, there are customer requirements which require a unique solution. Thanks to our design and manufacturing capabilities and years of RF experience, HUBER+SUHNER is the ideal partner when customized solutions are required.

Non standard connectors



We offer a broad range of different platings ideally suited for your specific need. In addition to the standard gold and silver-platings we have additional platings with superior performance:

- SUCOPRO – the gold plating of the future (minimizes gold-embrittlement)
- SUCOPLATE – the outdoor plating
- Black silver/black chrome – camouflage or non-reflective for tactical equipment

Plating technology



HUBER+SUHNER has a team of specialists supporting your application. We have more than 25 years of experience within the industry and have successfully participated in many programs. Capitalize on our broad knowledge of connectors, cables, cable assemblies and EMPs.

Application engineering

# Adaptors


HUBER+SUHNER manufactures a wide range of adaptors in various configurations such as within series or between series, straight or angled designs and some with panel mount features. They are classified according to their typical intended applications, each of which requires specific properties.

+

Standard adaptors

- Wide range of different configurations
- Appropriate materials
- Most common interfaces available
- Accurate transitions

- Effective and reliable interconnection solutions
- IP68 rated




+

Precision adaptors

- Precision interfaces
- Excellent electrical performance
- Premium base materials and platings

- For precision laboratory measurements
- High repeatability and accuracy




+

Low PIM adaptors

- Outstanding low intermodulation performance
- Excellent electrical contacts
- Non-magnetic materials

- High reliability
- Repeatable intermodulation measurements




+

Hermetically sealed adaptors

- Glass-fired seal
- 100 % tested
- Wide temperature range

- Hermetically sealed feed-thru
- Leakage rate: 10-8 Torr l/sec




+

MIL approved adaptors

- Materials, finishes and performance per MIL-PRF-55339
- Interfaces according to MIL-STD-348
- Extensive portfolio of configurations

- Extensive flight heritage in aircraft and satellite applications
- Precision measurement performance




+

Customer specific adaptors

Adaptors can be designed according to your application specific requirements:

- Between/in-series adaptors
- Stainless steel, beryllium copper, brass materials
- Gold, passivated, SUCOPRO®, SUCOPLATE® platings



# Adaptors – portfolio overview

		SMPM-T		MMBX		MMCX		MCX		MMPX		SMPM		PC 1.85		SMP		PC 2.4		SK (2.92 mm standard)		PC 3.5		SMA		QMA		N	
		Plug	Jack	Plug	Jack	Plug	Jack	Plug	Jack	Plug	Jack	Plug	Jack	Plug	Jack	Plug	Jack	Plug	Jack	Plug	Jack	Plug	Jack	Plug	Jack	Plug	Jack	Plug	Jack
SMPM-T	Plug																			•	•								
	Jack																												
MMBX	Plug																							•	•				
	Jack																							•	•		•		
MMCX	Plug					•																		•	•				
	Jack						•																	•	•				
MCX	Plug							•															•	•	•	•			
	Jack								•														•	•	•	•			
MMPX	Plug														•						•								
	Jack																				•								
SMPM	Plug											•									•								
	Jack																				•								
PC 1.85	Plug														•						•								
	Jack																				•								
SMP	Plug																			•	•								
	Jack																			•	•								
PC 2.4	Plug																			•	•								•
	Jack																			•	•							•	
SK 2.92 mm standard	Plug	•									•	•	•							•	•								
	Jack	•									•	•	•							•	•								
PC 3.5	Plug							•	•												•	•				•	•	•	•
	Jack							•	•												•	•				•	•	•	•
SMA	Plug			•	•	•	•	•	•															•	•		•	•	•
	Jack			•	•	•	•	•	•															•	•		•	•	•
QMA	Plug					•	•														•	•		•	•	•	•		•
	Jack																				•	•		•	•	•	•		
N	Plug																				•	•		•	•	•	•		
	Jack																				•	•		•	•	•	•		

Standard adaptors

Precision adaptors





## Phase shifter

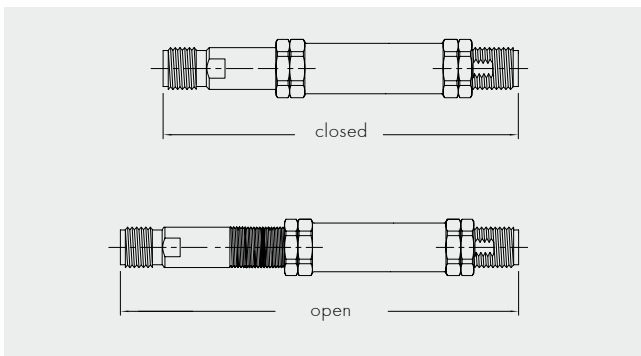
The phase shifter product family is designed for use in electronic systems where precision adjustment and tuning of transmission line electrical lengths are required. The phase shifter, or line trimmer, is designed to allow precise in-line phase change while maintaining constant VSWR and Insertion Loss performance values.

The construction of the phase shifters incorporates fine gauge threads for precise tuning accuracy at a resolution of less than 0.1 degrees. A variety of interfaces and phase adjustment ranges are available with operation up to 26 GHz.

These passive devices have proven successful in aerospace and satellite programmes with flight heritage in both North America and Europe.

# Phase shifter – portfolio

Type	Interfaces		Frequency range (GHz)		Total $\Delta\Phi$		VSWR		Dimension (mm)		Dimension (inch)	
	1	2	min	max.	min	max.	min	max.	closed	open	closed	open
40002C	SMA plug	SMA plug	0.1	4.0	4°	160°	1.05:1	1.28:1	108.71	143.00	4.28	5.63
40003C	SMA plug	SMA jack	0.1	4.0	4°	160°	1.05:1	1.28:1	105.66	139.95	4.16	5.51
40004C	SMA jack	SMA jack	0.1	4.0	4°	160°	1.05:1	1.28:1	103.38	137.67	4.07	5.42
40019C	N plug	TNC jack	0.1	4.0	4°	160°	1.15:1	1.35:1	117.86	152.15	4.64	5.99
40020C	TNC jack	TNC jack	0.1	4.0	4°	160°	1.15:1	1.35:1	129.79	164.08	5.11	6.46
40002A	SMA plug	SMA plug	0.5	8.0	35°	570°	1.08:1	1.25:1	159.00	218.44	6.26	8.60
40003A	SMA plug	SMA jack	0.5	8.0	35°	570°	1.08:1	1.25:1	155.96	215.39	6.14	8.48
40004A	SMA jack	SMA jack	0.5	8.0	35°	570°	1.08:1	1.25:1	153.67	213.11	6.05	8.39
40006A	N plug	N jack	0.5	8.0	33°	538°	1.08:1	1.25:1	164.34	220.47	6.47	8.68
40007A	N jack	N jack	0.5	8.0	33°	538°	1.08:1	1.25:1	163.07	219.20	6.42	8.63
40002B	SMA plug	SMA plug	8.0	18.0	97°	219°	1.25:1	1.40:1	58.42	68.58	2.30	2.70
40003B	SMA plug	SMA jack	8.0	18.0	97°	219°	1.25:1	1.40:1	53.37	65.58	2.18	2.58
40004B	SMA jack	SMA jack	8.0	18.0	97°	219°	1.25:1	1.40:1	52.07	62.23	2.05	2.45
40005B	N plug	N plug	8.0	18.0	102°	230°	1.25:1	1.40:1	73.91	84.58	2.91	3.33
40006B	N plug	N jack	8.0	18.0	102°	230°	1.25:1	1.40:1	73.15	83.82	2.88	3.30
40007B	N jack	N jack	8.0	18.0	102°	230°	1.25:1	1.40:1	68.83	79.50	2.71	3.13
40011B	N jack	SMA plug	8.0	18.0	92°	208°	1.25:1	1.40:1	60.71	70.36	2.39	2.77
40004D	SMA jack	SMA jack	8.0	26.0	146°	474°	1.25:1	1.37:1	56.90	72.90	2.24	2.87
40004E	SMA jack	SMA jack	8.0	26.0	146°	474°	1.25:1	1.37:1	56.90	72.90	2.24	2.87



## Environmental qualification levels:

Thermal shock:	MIL-STD-202, Method 107, 100 cycles, -55/+125 °C
Sine vibration:	MIL-STD-202, Method 204, 21 g peak
Random vibration:	MIL-STD-202, Method 214, 26.1 g rms
Mechanical shock:	MIL-STD-202, Method 213, 750 g peak.



## HEMP and lightning protection

Four decades of experience in developing and manufacturing coaxial- and data line-HEMP and LEMP protectors are the foundation of our current EMP protector portfolio and have made HUBER+SUHNER a first stop for protection solutions in defense applications. HUBER+SUHNER offers protection components for land-based, airborne and naval tactical communications as well as for navigation, radar and electronic warfare applications.

Our products are designed to meet the stringent requirements of the defense and security markets. An extensive high-voltage impulse laboratory is available to verify our designs in accordance with the valid lightning, surge and HEMP standards.

HUBER+SUHNER holds groundbreaking patents in the field of coaxial lightning and HEMP protection, such as the automatically suppressing surge arrestor (Semper).

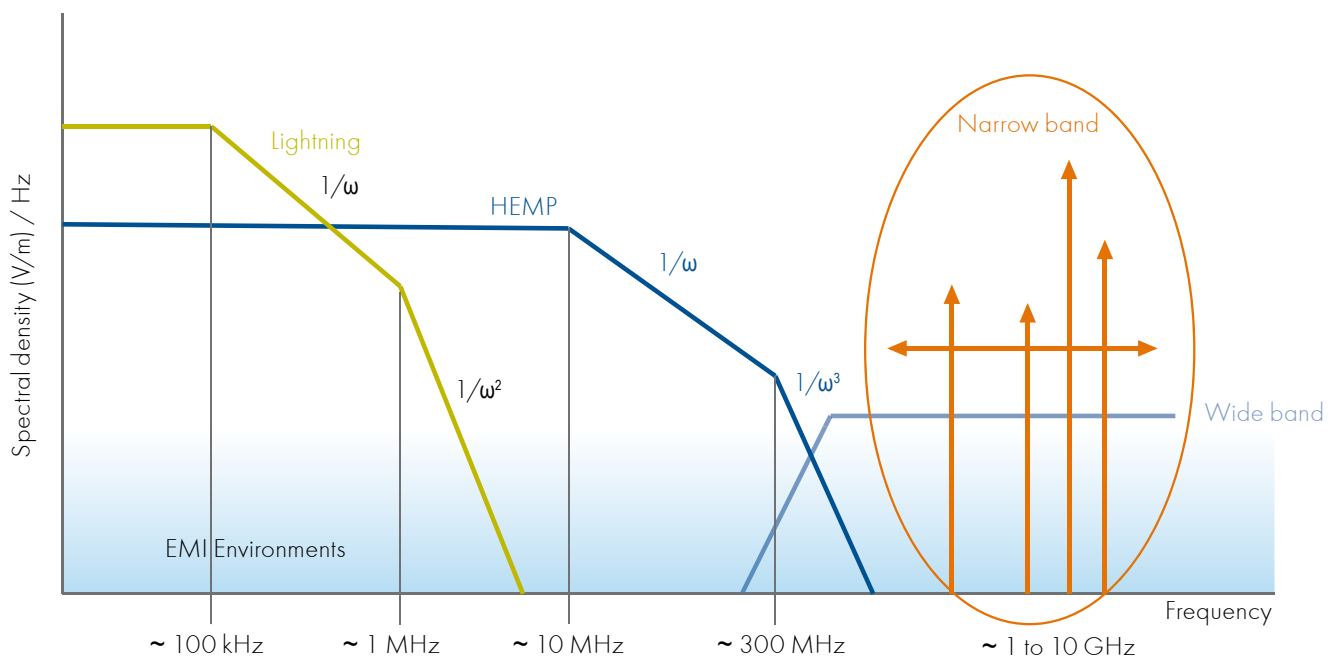
Many of our products are referenced by the NATO Maintenance and Supply Agency (NAMSA).



# Threat scenario in defense applications

The threat mechanisms by which high level energy surges are generated can be separated into the two groups of natural occurrences and man-made energy surges. The natural phenomenon of lightning (LEMP) has been extensively investigated. Cloud-earth or earth-cloud flashes with currents up to 400 kA are generated as soon as the electrical field strength exceeds 100 kV/m. Good lightning protectors shall be capable of handling large currents without being degraded. The frequency content of lightning goes up to  $\approx 1$  MHz. Man-made surges can be unintentional when they originate from high power switching of electric engines or intentional when they are created by specific weapons, radar equipment or high power communication transmitters. The three categories of intentional created surges are:

- The HEMP or high altitude electromagnetic pulse. Its interference mechanism derives from Gamma radiation generated during a nuclear explosion at high altitude. This radiation displaces electrons from the molecules in the upper atmosphere (Compton Effect) which causes the high level HEMP/ NEMP (nuclear EMP) pulse. Such high altitude nuclear explosion can affect a huge area, several hundreds of kilometers in diameter, on the earth. HEMP/NEMP protectors shall be capable of diverting fast pulses (ns rise times) on a path with minimal inductance to ground. The HEMP pulse has significant spectral components up to  $\approx 300$  MHz.
- The HPM/UWB pulse. Meanwhile several non- nuclear mechanisms have been developed that produce even faster effects than the HEMP. The technique of using fast pulse generators that receive their energy either from conventional TNT explosions or from large capacitors (Marx generator) built into bombs (E bombs) or missiles is well known. The frequency content of Ultra wideband pulses (UWB) ranges from 500 MHz to 5 GHz. High power microwave sources (HPM) generate narrow band signals extending from 1 to 10 GHz. Protectors against HPM and UWB signals must be capable to react within pico-seconds.
- Radar pulse streams and other transmitters with high continuous or pulsed power are a threat for any sensitive RF receivers on board of vessels and airplanes. Classic examples are jets landing on an aircraft carrier or signal exploitation hardware on warships. Protection components which limit the received signals to a non-hazardous level are demanded in this scenario.



- Lightning: significant spectral components up to  $\sim 1$  MHz
- HEMP: significant spectral components up to  $\sim 300$  MHz
- Wide band (e.g. UWB/SP): extending  $> 500$  MHz to  $5$  GHz
- Narrow band (e.g. HPM/HiRF): extending from  $\sim 1$  to  $10$  GHz
- EMI environments

# Lightning protection – product overview



## Gas discharge tube protectors with exchangeable GDTs

"Series 3401/3402" (standard versions)

For applications with RF and DC components on the antenna line the standard GDT lightning/EMP protectors feature DC continuity and large bandwidth. Most HUBER+SUHNER GDT protector designs provide excellent performance in the NEMP application as well. For specific applications internally DC-blocked GDT protectors are available.



## Self-extinguishing GDT protectors (Semper)

The HUBER+SUHNER Semper design guarantees safe extinguishing of the GDT under high RF power or with additional DC components on the antenna line. By retrofitting standard GDTs with the Semper GDT existing installations can be upgraded. The Semper technology is a true improvement to the standard gas tube technology and increases reliability and lifetime of GDT protectors.



## True broadband GDT protectors

"Series 3406"

SlimLine GDT protectors feature high return loss in the frequency band between DC and 6 GHz. This design is best suited for point to point and WLAN equipment.



## Hybrid/low PIM/high power GDT protectors

"Series 3409"

This patented technology features low passive intermodulation at extremely high continuous and peak instantaneous power (up to 25 kW PIP).



## Bias-T/DC injectors with integrated lightning protector

"Series 3410"

Bias-T's, used to "feed-in" or "pick-off" DC voltage into or from antenna feeder cables, provide the operating voltage for active electronics installed on the mast (mast head amplifiers, etc.)



## Hybrid GDT fine protectors

"Series 3403"

For very sensitive DC powered receivers such as those used in GPS installations, the hybrid GDT fine protectors with integrated transient voltage suppressor diodes guarantee lowest residual pulse energy. HUBER+SUHNER fine protectors feature DC continuity.




+

### Quarter-wave shorting stub protectors

"Series 3400"

HUBER+SUHNER quarter-wave shorting stub protectors perform best lightning parameters with excellent RF specifications within limited bandwidth. A ratio of 4:1 between lowest and highest frequency of the frequency band is achievable by still meeting high return loss. For specific applications internally DC-blocked quarter-wave shorting stub protectors are also available.




+

### Filter protectors

"Series 3407"

LC or LCL band pass filter technologies allow an increase in bandwidth to ratios larger than 4:1 in a compact mechanical design, hence they are an alternative to quarter-wave shorting stub protectors. LC or LCL filter protectors are internally DC-blocked.




+



### Data line protectors

"Series 3414" (twisted pair, ethernet)

Our CAT 5 and CAT6 (Gigabit )data line protectors are "Power Over Ethernet" compatible and available as IP68 rated robust components for outdoor applications (i.e. back-haul microwave links) or in IP20 specified housings for indoor installations (i.e. data processing centers).




## Semper – self-extinguishing gas discharge tube protector

The patented Semper™ concept enhances the safety and reliability of the well-known gas discharge tube (GDT) protector principle impressively. It eliminates the risk of gas discharge tube "hold on" due to DC line powering or high RF signals which will render the system inoperable and can destroy the GDT. The Semper™ invention is based on a mechanical resettable thermo-switch which is integrated within the GDT protectors capsule holder.

Turn-off performance

Recovery performance

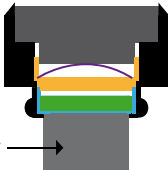


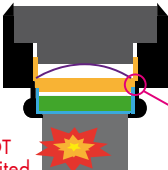
Switch closed

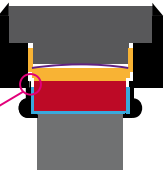
Switch closed

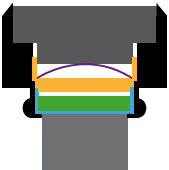
Switch open

Switch closed









Silicone rubber

GDT ignited

Expanded silicone rubber

Semper functionality

US Pat. 7,567,417

## Gas discharge tube (GDT) protectors

This technology features bandwidths from DC - 6 GHz and can handle surge currents up to 30kA. GDT technology allows DC voltage on the center conductor. By selecting the correct GDT these products can be used in applications with transmit power up to 1 kW CW. For applications with higher power please consult the factory. A special version of this technology is represented by the self-extinguishing GDT protector (Semper). GDT technology provides reliable protection against natural and man-made surges.

Picture	HUBER+SUHNER type	Freq. range (MHz)	Connectors	Mounting	RL min. (dB)	IL max. (dB)	IP rating
	3401.01.A	DC - 300 300 - 1000	BNC (f) - BNC (f)	MH12	26 19	0.1 0.1	IP20
	3401.01C	DC - 1000	BNC (m) - BNC (f)	MH12	26 19	0.1 0.1	IP20
	3401.02.A	DC - 400 400 - 1000	BNC (f) - BNC (f)/75 Ω	MH12	20 15	0.1 0.2	IP20
	3401.26.A	DC - 300 300 - 1000	TNC (f) - TNC (f)	MH12	26 19	0.1 0.1	IP64
	3401.26.C	DC - 300 300 - 1000	TNC (m) - TNC (f)	MH12	26 19	0.1 0.1	IP20
	3401.26.0012-EX**	DC - 1000	TNC (f) - TNC (f)	MH12	19	0.1	IP64
	3401.17.A	DC - 1000	N (f) - N (f)	MH12	26	0.1	IP65
	3401.17.C	DC - 1000	N (m) - N (f)	MH12	26	0.1	IP65
	3401.17.K	DC - 1000	N (f) - N (f)	MH12	26	0.1	IP66
	3401.17.0048-EX **	DC - 1000	N (f) - N (f)	MH12	24	0.1	IP65
	3401.17.0057-EX **	DC - 1000	N (m) - N (f)	MH12	24	0.1	IP65
	3401.17.0056 ****	DC - 1000	N (m) - N (f)	MH12	26.4	0.1	IP67
	3402.17.A	DC - 2500	N (f) - N (f)	MH25	20	0.2	IP65
	3402.17.C	DC - 2500	N (m) - N (f)	MH25	20	0.2	IP65
	3402.17.K	DC - 1000 1000 - 2500	N (f) - N (f)	MH25	26 20	0.1 0.2	IP66
	3402.17.0033 ***	DC - 2500	N (f) - N (f)	MH25	20	0.2	IP65
	3402.17.0072-EX **	DC - 2500	N (f) - N (f)	MH25	20	0.2	IP65
	3402.17.0076-EX **	DC - 2500	N (m) - N (f)	MH25	20	0.2	IP65
	3402.17.3001	DC - 2000 2000 - 3000	N (f) - N (f)	MH25	26 20	0.2 0.3	IP67
	3402.17.3002	DC - 2000 2000 - 3000	N (m) - N (f)	MH25	26 20	0.2 0.3	IP67
	3402.18.A	DC - 1500 1500 - 2000	N (f) - N (f)/ 75 Ω	MH25	16.5 15.5	0.2 0.2	IP65
	3402.26.0002	DC - 2500	TNC (f) - TNC (f)	MH25	20	0.2	IP65
	3402.26.0004	DC - 2500	TNC (m) - TNC (f)	MH25	20	0.2	IP65
	3402.26.0006-EX *	DC - 2500	TNC (f) - TNC (f)	MH25	20	0.2	IP65
	3402.26.3001	DC - 1000 1000 - 3000	TNC (f) - TNC (f)	MH170	26 20	0.2 0.3	IP65
	3402.27.0001	DC - 1500 1500 - 2000	TNC (f) - TNC (f)/75 Ω	MH25	16.5 15.5	0.2 0.2	IP65
	3406.17.0009	DC - 5600 5600 - 5800 5800 - 6000	N (f) - N (f)	MH24	20 18.5 15	0.2	IP65
	3406.17.0012	DC - 5600 5600 - 5800 5800 - 6000	N (m) - N (f)	MH24	20 18.5 15	0.2	IP65
	3406.26.0010	DC - 2000	TNC (m) - TNC (f)	MH4	20	0.2	IP65
	3406.00.0030	DC - 3000	N (f) - SMA (f)	5/8-4UNEF	20	0.2	IP65


\* Semper GDT 9071.99.0648 (90 V) integrated  
 \*\* Semper GDT 9071.99.0647 (230 V) integrated

\*\*\* GDT 9071.99.0547 (230 V) integrated  
 \*\*\*\* GDT 9071.99.0550 (470 V) integrated




## Quarter wave shorting stub and LC-filter protectors

$\lambda/4$  shorting stub technology can handle extremely high surge currents and features very low residual energy. No DC voltage is allowed on the center pin. Bandwidths with a ratio of 4:1 can be realized. Depending on the selected interface they can be used in applications up to 5 kW CW.

Picture	HUBER+SUHNER type	Freq. range (MHz)	Connectors	Mounting	RL min. (dB)	IL max. (dB)	IP rating
	3407.17.0022	74 - 180	N (f) - N (f)	MH74	20	0.15	IP66
	3407.17.0088	74 - 420	N (m) - N (f)	MH74	23	0.15	IP67
	3407.17.0089	74 - 420	N (f) - N (f)	MH74	23	0.15	IP67
	3407.17.0023	220 - 450	N (m) - N (f)	MH74	20	0.1	IP65
	3407.17.0053	320 - 512	N (m) - N (f)	MH12	20	0.2	IP65
	3400.17.0388	380 - 512	N (m) - N (f)	MH74	20	0.1	IP65
	3400.17.0254	1000 - 1100	N (f) - N (f)	MH12	20	0.1	IP65
	3400.17.0385	950 - 1450	N (f) - N (f)	MH25	20	0.1	IP65
	3400.17.0247	2400 - 3600	N (m) - N (f)	MH50	20	0.15	IP67
	3400.17.0410	2000 - 6000	N (f) - N (f)	screw M8	20	0.2	IP65
	3400.17.0235	5000 - 7000	N (f) - N (f)	MH25	20	0.25	IP65
	3400.17.0380	6000 - 18000	N (f) - N (f)	MH69	20	0.3	IP65

## Hybrid GDT fine protectors


For sensitive DC powered electronics such as GPS receivers the Hybrid GDT fine protector with integrated suppressor diodes guarantees lowest residual pulse energy.

Picture	HUBER+SUHNER type	Freq. range (MHz)	Connectors	Mounting	RL min. (dB)	IL max. (dB)	IP rating
	3403.17.0050	650 - 2500	N (f) - N (f) /15 V	MH119	20.8	0.5	IP65
	3403.17.0051*	806 - 2500	N (m) - N (f) /15 V	M6/2 x Ø 4.2	20.8	0.5	IP65
	3403.17.0075	800 - 2500	N (f) - N (f) /6 V	MH12	26.4	0.3	IP67

\* HEMP optimized

## High power limiter


Limiters are multi-stage hybrid components which reduce harmful RF power at its input to a defined power level at the output. The special feature of the presented high power limiter is that it is not only limiting but at the same time it is capable of protecting against lightning- and NEMP pulses.

Picture	HUBER+SUHNER type	Freq. range (MHz)	Connectors	Mounting	RL min. (dB)	IL max. (dB)	IP rating
	9078.17.0013	0.1 - 32 MHz	N (f) - N (f)	MH12	18	0.5	IP67
	9078.17.0014	0.1 - 32 MHz	N (f) - N (f)	MH12	20	0.7	IP67
	9078.17.0015	0.1 - 50 MHz	N (f) - N (f)	MH12	20	0.7	IP67

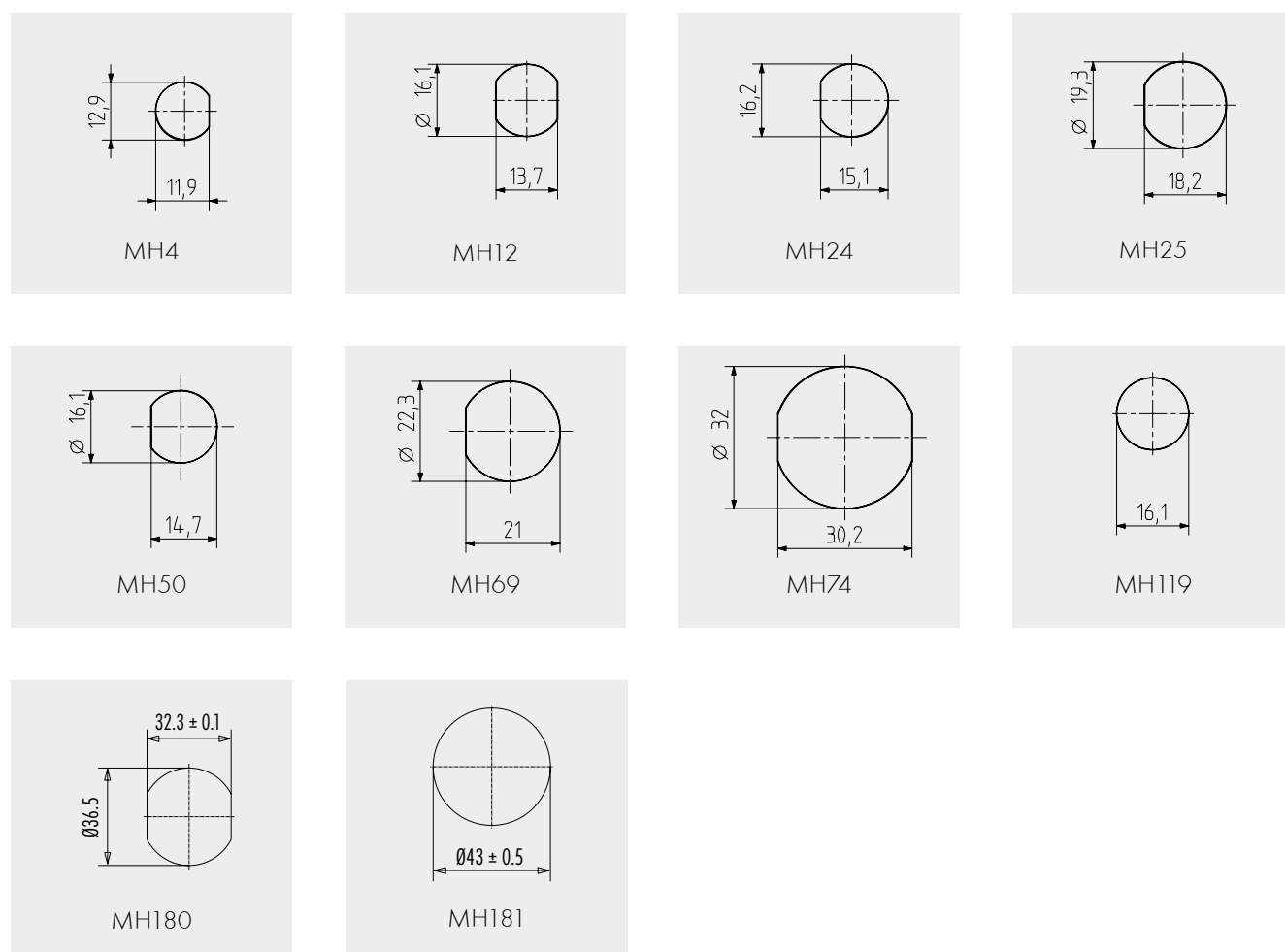
HUBER+SUHNER type	RF average power	RF peak power	Limiting threshold	Surge current handling capability	Residual pulse energy (LEMP) 2 kA; 8/20 µs/4 kV; 1.2/50 µs	Residual pulse energy (NEMP) 6 kV; 5/200 ns	Response time
9078.17.0013	≤ 25 W ≤ 44 dBm	≤ 5 kW ≤ 67 dBm	10 - 12.6 W 40 - 41 dBm	10 kA (8/20 µs)	300 µJ	30 µJ	< 100 ns
9078.17.0014	≤ 25 W ≤ 44 dBm	≤ 1 kW ≤ 60 dBm	4 mW 6 dBm	10 kA (8/20 µs)	200 µJ	-	< 2 ns
9078.17.0015	≤ 25 W ≤ 44 dBm	≤ 1 kW ≤ 60 dBm	16 mW 12 dBm	10 kA (8/20 µs)	200 µJ	-	< 2 ns

# Data line protectors

Data line protectors for twisted pair applications are available as Cat 4, 5 and 6. We offer IP20 designs for indoor usage and ruggedized IP68 protectors.

Picture	HUBER+SUHNER type	Ethernet	Connectors	Mounting	Frequency (MHz)	Data rate (Mbps)	IP rating
	3414.99.0003	Cat5 (class D)	RJ45	screw	100	1000	IP20
	3414.99.0008	Cat5 (class D)	RJ45	clamp	100	1000	IP68
	3414.99.0009	Cat5 (class D)	RJ45	MH180	100	1000	IP68
	3414.99.0021	Cat6 (class E)	RJ45	DIN Rail	250	1000	IP20
	3414.99.0022	Cat6 (class E)	RJ45	clamp	250	1000	IP68
	3414.99.0024	Cat4 (class C)	D38999/24FA35SN	MH181	20	16	IP68
HUBER+SUHNER type							
9073.99.0002	RJ45 plug kit, field assembly for 3414.99.0009						
9073.99.0004	protective cap for data line protector 3414.99.0009						
9073.99.0003	protective cap for RJ45 plug kit 9073.99.0002						

## Mounting holes



# NATO registered surge protective devices (EMP/HEMP)

NATO stock no. (NSN)	HUBER+SUHNER type	Description
5920-12-325-4220	3401.01.A	50 Ω, 1 GHz, BNC(f) - BNC(f)
5920-17-106-6384		
5935-99-110-3099		
5920-12-310-6281	3401.01.F	50 Ω, 1 GHz, BNC(f) - BNC(f), GDT holder with chain
1450-23-113-7610	3401.02.A	75 Ω, 0.4 GHz, BNC(f) - BNC(f)
5920-12-338-0883		
5920-99-147-6582	3401.170045	50 Ω, 1 GHz, , N(f) - N(f), 350 V GDT included
5820-99-726-4346	3401.17.A	50 Ω, 1 GHz, , N(f) - N(f)
5920-01-565-8254		
5920-14-516-6621		
5920-17-100-7884		
5920-66-127-4034		
5920-01-485-4062	3401.17.C	50 Ω, 1 GHz, N(m) - N(f)
5920-01-545-4178		
5920-12-321-2510	3401.17.K	50 Ω, 1 GHz, , N(f) - N(f), GDT holder with chain
5920-25-134-3502	3401.18.A	75 Ω, 1 GHz, N(f) - N(f)
5920-01-596-7066	3401.26.A	50 Ω, 1 GHz, TNC(f) - TNC(f)
5920-17-113-6448		
5920-66-138-2463		
5920-25-144-6357	3401.27.A	75 Ω, 0.4 GHz, TNC(f) - TNC(f)
5920-99-297-6617	3402.00.0043	50 Ω, 2.5 GHz, 4/11(f) - N(f), GDT holder with chain
5920-99-665-6391	3402.00.0044	50 Ω, 2.5 GHz, 4/11(f) - N(m), GDT holder with chain
5920-01-615-2087	3402.170043	50 Ω, 2.5 GHz, N(m) - N(f)
5920-01-421-4919	3402.17.A	50 Ω, 2.5 GHz, N(f) - N(f)
5920-17-105-4779		
5920-99-773-3078		
5920-01-461-3214	3402.17.C	50 Ω, 2.5 GHz, N(m) - N(f)
5920-12-330-1428		
5920-12-332-5482	3402.17.K	50 Ω, 2.5 GHz, N(f) - N(f), GDT holder with chain
5920-01-570-0497	3406.00.0012	50 Ω, 3 GHz, N(f) - SMA(f), GDT fix installed
5920-01-494-8295	3407.17.0023	50 Ω, 220 to 450 MHz, N(f) - N(f)
5920-99-776-5629	9071.99.0052	gas discharge tube, 900 V, 8 × 8 mm together with holder
5820-99-202-8264	9071.99.0053	gas discharge tube, 1200 V, 8 × 8 mm together with holder
5920-12-356-2329	9071.99.0054	gas discharge tube, 1500 V, 8 × 8 mm together with holder
5920-12-356-2540	9071.99.0447	gas discharge tube with holder, 230 V
5920-01-576-2146	9071.99.0448	gas discharge tube with holder, 90 V
5920-12-356-2327		
5920-12-356-2328	9071.99.0451	gas discharge tube with holder, 600 V
5920-14-542-1015		
5920-01-597-6253	9071.99.0547	gas discharge tube with holder, 230 V
5920-01-565-8253	9071.99.0548	gas discharge tube with holder, 470 V
5920-01-565-8255	9071.99.0550	gas discharge tube with holder, 90 V
5895-01-624-3840	9078.17.0013	limiter, 50 Ω, 0.1 to 32 MHz

The NATO Stock Number (NSN) is a 13 digit number and is divided into 3 parts:

- **The first part** (4 digits): is the NATO Supply Classification Code and relates the item to the group and class of similar items:  
e.g. 5920: 59 for Electrical and Electronic Equipment Components and 5920 Fuses, Arrestors, Absorbers and Protectors.
- **The middle part** (2 digits): indicates the NCB assigning the NSN:  
country code: e.g. 00/01 for US, 12 for Germany, 13 for Belgium, 14 for France, 15 for Italy, 17 for Netherlands, 23 for Greece, 33 for Spain, 66 for Australia, 99 for UK
- **The final part** (7 digits): of the NSN does not have inherent significance. However, the number is assigned to one and to only one item of supply within the codifying country.



## Antennas

The emerging need for interoperability in communications, jamming and timing and positioning presents tremendous challenges for military applications. Traditional communication systems have been independently designed without the bandwidth, power, or interoperability needed for today's applications. Advanced communications require integration of legacy capability with new waveforms and platforms.

HUBER+SUHNER offers a broad range of antennas for a multitude of applications in communications, jamming and timing and positioning. Our antennas cover a broad frequency range from 1 MHz up to 6 GHz supporting all communication bands, allowing for a seamless transition between legacy and future requirements. While offering a small and compact footprint, our antennas still provide exceptional performance levels and are designed to meet harsh environment conditions.

- Low profile/shark fin design
- Broad frequency range
- High power capability
- Rugged design
- Customer-specific adaptations



## GPS antennas

The GPS L1/L2 antennas are ideally suited for exterior installations on roofs or mounting poles as well as mounting brackets. Our antennas contain large selective patch antennas and an RF band pass filter that attenuates cellular and radar frequency ranges in order to minimize interferences and blocking effects.



## Vehicle antennas

HUBER+SUHNER's wideband vehicle antennas (380 to 6000 MHz) are an essential part of today's sophisticated RF systems used in tactical communication and electronic countermeasure (ECM) applications. Designed to provide maximum performance and durability, the HUBER+SUHNER vehicle antennas are the best choice for installations on all types of vehicles as well as for fixed installations.



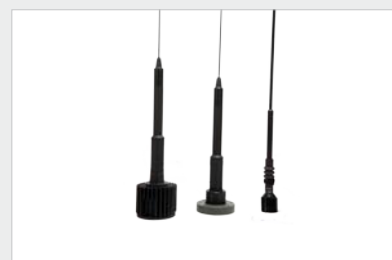
## SENCITY Shield

The SENCITY Shield product line was specifically developed to meet today's challenging requirements for ECM missions in military and security applications. The low profile/shark fin design ensures low visibility while still providing exceptional electrical performance in terms of horizontal gain and high power capabilities.



## UHF/VHF antennas

Additionally, HUBER+SUHNER offers a broad range of additional UHF/VHF antennas suited for communication and electronic countermeasure applications. Contact your local HUBER+SUHNER representative for more information.



GPS antennas

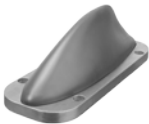

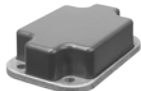

Electrical data	GPS antenna L1	GPS antenna L1+L2
		
Frequency range	typ. 1575.42 MHz min./max. 1565 to 1613 MHz	L1 typ. 1589 MHz min./max. 1565 to 1613 MHz  L2 typ. 1235 MHz min./max. 1218 to 1253 MHz
Impedance	50 Ω	50 Ω
VSWR	1.5	1.5
Peak gain	low gain module: 20 dBi high gain module: 25 dBi	20 dBi
Power supply	3 to 5 VDC	3 to 5 VDC
Mechanical and environmental properties		
Dimensions	76 × 21 mm	76 × 21 mm
Weight	0.13 kg	0.13 kg
Radome material	PA6	PA6
Radome color	black/green/other on request	black/green/other on request
Operating temperature range	−40 to +85 °C	−40 to +85 °C
Waterproof	IP69	IP69
Cable pig tail	RG174/straight SMA	RG174/straight SMA

GPS splitter






This device makes it possible to use a single GPS referencing antenna for synchronization of systems, increasing capacity without increasing the need for additional GPS antennas or cabling requirements.

## Vehicle antennas

Antennas	Type	Frequency (MHz)	Gain (dBi)	Power (W)	Requirements	
				@ 25 °C/sea level	Dimensions (mm)	Weight (kg)
	1399.99.0120	698 to 960 1710 to 2170 2400 to 2700 3400 to 3700 4900 to 5935	5 5 7 9.5 8	up to 500 W CW	100 × 90 × 256	1.000
	1399.17.0094	698 to 960 1710 to 2170 2400 to 2700 3400 to 3700 4900 to 5875	4 4 8 7.5 7.5	up to 1000 W CW	100 × 153 × 256	1.600
	1399.99.0037	690 to 960 1700 to 2200 2400 to 2500 1500 to 1700 2500 to 2700	5 5 5 6 6	on request	100 × 40 × 145	0.530
	1399.99.0222	690 to 960 1700 to 2200 2500 to 2700 2400 to 2500 5100 to 6000	5 8 8 8 8	up to 250 W CW	103 × 82 × 353	1.500

## SENCITY Shield

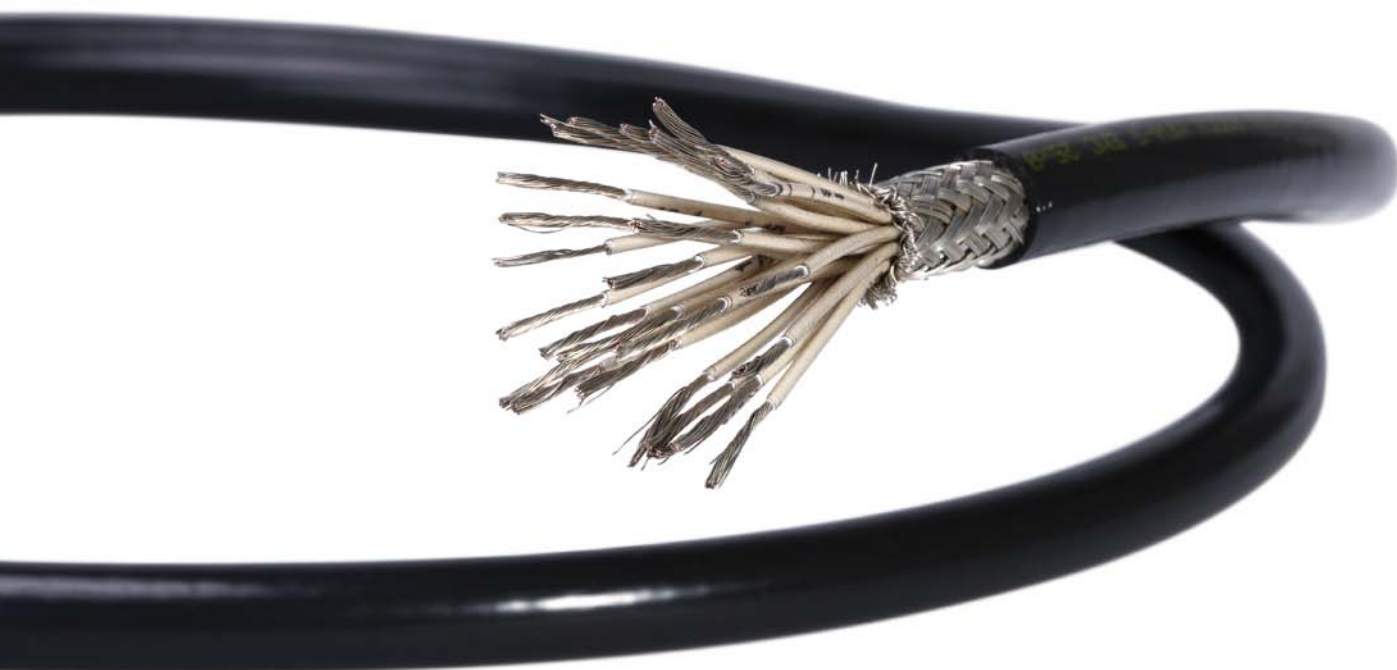
Antennas	Type	Frequency (MHz)	Gain (dBi)	Power (W)	Requirements	
				@ 25 °C/sea level	Dimensions (mm)	Weight (kg)
	1399.17.0030 Mag mount	694 to 960 1350 to 1710 1710 to 2700 2700 to 3400 3400 to 4900 4900 to 6000	3.5 6 6 7.5 7.5 8	up to 400	119 × 102 × 276	1.75
	1399.17.0050 Mag mount	694 to 960 1350 to 1710 1710 to 2700 2700 to 3400 3400 to 4900 4900 to 6000	4.5 6 6 6.5 8 8	up to 400	120 × 105 × 316	2.25
	1399.17.0051	694 to 960 1350 to 1710 1710 to 2700 2700 to 3400 3400 to 4900 4900 to 6400	5 6 6.5 9 8 8	up to 500	75 × 78 × 313	1.20

## Service: Painted antennas



Our antennas can be ordered with an additional painting service in order to match the exact color of your equipment. Please contact HUBER+SUHNER for more details.



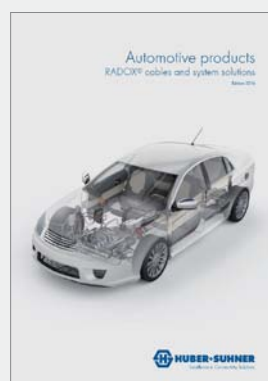


## Wires and cables

HUBER+SUHNER develops and produces high grade solutions that are suitable for the most extreme environment conditions. They can be installed in very tight spaces and will satisfy even the most stringent demands. HUBER+SUHNER is the professional partner in the development and production of system solutions which incorporate all of our knowledge and engineering expertise.

RADOX® single core and multi core cables were developed and produced for high grade defense solutions.

- Wide temperature range
- Fixed and mobile applications
- Small overall diameter
- Flexible and rugged
- Light-weight and space saving solutions
- Chemical and mechanical resistance





## RADOX® MFH-S

The extensive RADOX® MFH-S cable portfolio meets the most challenging requirements in naval applications. The cables are suited to support both signal and power transmission. The high abrasion and vibration resistance and a very small bending radius are a key asset for congested environments on ships or submarines. The RADOX® material was developed to avoid hazardous fumes in the event of a fire



## VG/MIL cables

HUBER+SUHNER has a wide product range of different wires according to the MIL and VG standard used extensively throughout industry. These applications include commercial wiring avionics, aircraft, helicopters, ships, trains, offshore platforms and high performance military electronics or wherever there is a demand for reliable performance under extreme conditions.



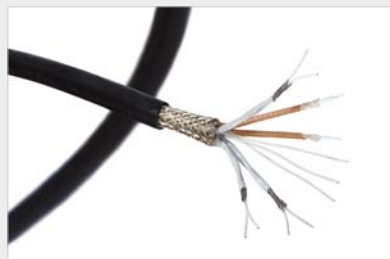
## Power distribution cables

The characteristics of these RADOX cables make them ideal for use in a wide range of applications, where space is at a premium and where cables are subjected to high temperatures. Even high humidity levels and motor vehicle fluids do not negatively affect the lifetime of the cables.



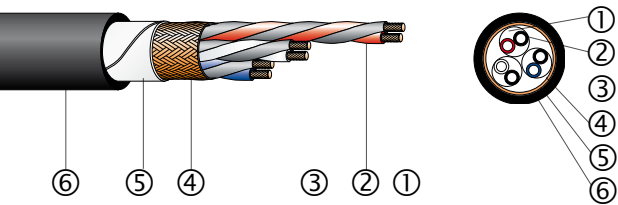
## Data cables

The broad range of different data cable is based on our extensive expertise in data communication with electron-beam-cross-linked material technology. The databus cables provide reliable solutions for use in high-temperature applications and harsh environmental conditions. Extended temperature range, resistance against UV (sun), oil and other aggressive chemicals are mandatory performance parameters for a reliable communication link.



# RADOX® MFH-S

MFH-S      Multi cores and twisted pairs screened and unscreened



- Ozone, hydrolysis, chemical resistant
- Weatherproof
- Easy to process
- Leight weight
- Wide operating temperature range
- Halogen free
- Flame retardant

**Application**  
 For fixed installations in dry, damp or wet locations, inside and outside of ships, industrial equipment, defense equipment, buses, other vehicles and railway rolling stock.

Composition of cable	
① Center (if necessary)	RADOX filler
② Cores type	MA14; RADOX TI301 (145 °C/20 000 hours)
Conductor	stranded tin plated copper, acc. to EN 60228, class 5
Core colors	optional with pair screen and drain wire
③ Fillers (optional)	see table
④ EMV screening	RADOX
⑤ Separator	optimized tin plated copper braid, optical coverage: ≥ 85 %
⑥ Sheath	textile yarn
	RADOX elastomer S FH (SHF 2; SHF mud NEK 606)
	Color black and blue

Technical data	
Voltage rating U <sub>0</sub> /U	600/1000 V AC
Test voltage	3500 V AC
Temperature range	-50 up to +145 °C
Min. bending radius	static      ≤ 12 mm      3 × cable-dia.
	≥ 12 mm      4 × cable-dia.
	dynamic    > 12 mm      5 × cable-dia.
	> 12 mm      6 × cable-dia.

Fire tests		
Flame propagation:		
Vertial of a single cable	EN 50265-2-1, IEC 60332-1	
Content of halogen acid gas	EN 50267-2-1, IEC 60754-1	0 mg/g
Fire protection in rolling stock:		
Level of protection	DIN 5510	Level 1 – 4
Hazard level	EN 45545	HL1 – HL3

Approvals		
GERMANISCHER LLOYD	certificate no. 43159-02 HH	
DNV	certificate no. E-12873	TAP DNV 827.11
NEK 606	mud resistant	NEK TS 606, 4.1
ABS (American Bureau of Shipping)	certificate no. 15-GD1369103-PDA	

# RADOX® MFH-S

Extract from our delivery programme

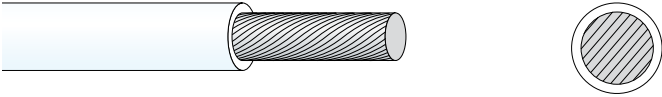
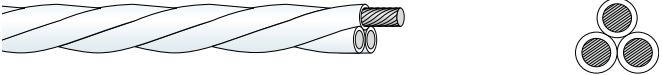
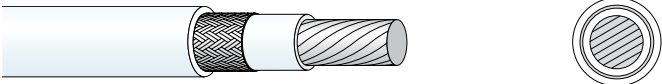
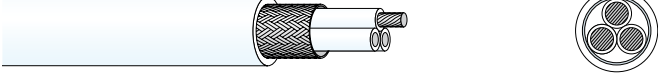
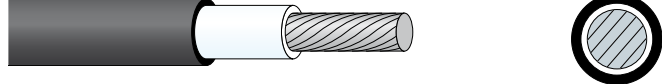
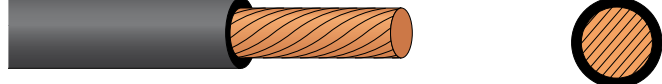
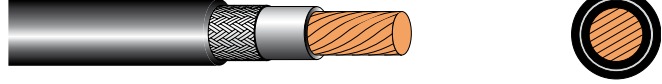
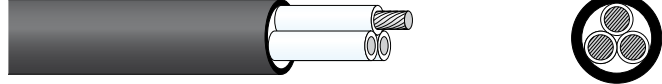
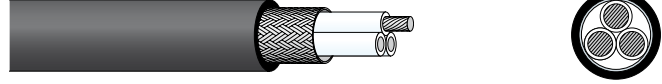
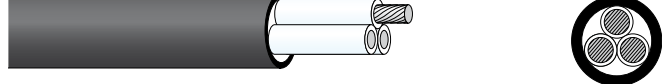
## Multi cores

Cross section n × mm <sup>2</sup>	R <sub>20</sub> IEC 60228 max. Ω/km	Overall screen cross section mm <sup>2</sup>	Cable Ø mm	Core colors	Weight nom. kg/100 m
3 × 0.5	40.1	2.11	5.75 ± 0.3	bk, bu, bn	6.4
5 × 0.75	26.7	2.9	7.35 ± 0.3	bk, bu, bn, gy, light blu	10.9
7 × 0.75	26.7	3.43	8.35 ± 0.3	bk, bu, bn, gy, light blu, wh, og	14.1
12 × 0.75	26.7	3.96	9.55 ± 0.3	wh num	18.8
25 × 0.75	26.7	5.94	12.9 ± 0.4	wh num	33.6
37 × 0.75	26.7	9.98	14.8 ± 0.4	wh num	50.0
50 × 0.75	26.7	11.64	17.1 ± 0.5	wh num	64.8
3 × 1.5	13.7	2.9	7.45 ± 0.3	bk, bu, bn	11.8
5 × 1.5	13.7	3.96	8.9 ± 0.3	bk, bu, bn, gy, light blu	16.8
7 × 1.5	13.7	4.0	10.1 ± 0.4	bk, bu, bn, gy, light bu, wh, og	21.7
12 × 1.5	13.7	5.55	11.9 ± 0.4	wh num	31.4
3 × 2.5	8.21	2.9	8.6 ± 0.3	bk, bu, bn	15.6
5 G 2.5	26.7	4.36	10.5 ± 0.4	gnye, bu, bn, bk, gy	23.7
19 × 2.5	8.21	10.9	17.9 ± 0.5	wh num	73.4
3 × 4	4.8	3.7	9.8 ± 0.3	bk, bu, bn	22.0
4 × 4	5.09	5.22	13.0 ± 0.4	bu, bn, bk, bk	29.7
3 × 6	3.2	4.22	11.3 ± 0.4	bk, bu, bn	30.1
8 × 2.5 und 2 × 0.75	26.7	9.98	15.3 ± 0.5	wh num	47.7

## Twisted pairs

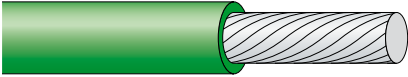

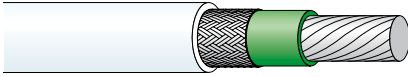









Cross section n × mm <sup>2</sup>	R <sub>20</sub> IEC 60228 max. Ω/km	Overall screen cross section mm <sup>2</sup>	Cable Ø mm	Core colors	Weight nom. kg/100 m
2 × 0.5	40.1	2.11	5.55 ± 0.3	bk, bu	5.8
2 × 2 × 0.5	40.1	2.38	7.9 ± 0.3	bk, bu, bn, gy	10.1
2 × (2 × 0.5)	40.1	3.17	8.3 ± 0.3	bk, bu, bn, gy	12.0
5 × 2 × 0.5	40.1	3.96	9.75 ± 0.3	wh num	16.4
7 × 2 × 0.5	40.1	4.75	11.8 ± 0.4	wh num	22.8
14 × 2 × 0.5	40.1	9.98	14.1 ± 0.4	wh num	34.8
14 × (2 × 0.5)	40.1	9.98	15.5 ± 0.5	wh num	45.5
4 × 2 × 0.75	26.7	3.96	10.0 ± 0.3	wn num	16.4
4 × (2 × 0.75)	26.7	4.75	10.5 ± 0.3	wh num	21.3
8 × 2 × 0.75	26.7	9.98	11.6 ± 0.4	wn num	24.5
12 × 2 × 0.75	26.7	9.98	15.6 ± 0.5	wh num	43.9
12 × (2 × 0.75)	26.7	11.64	17.1 ± 0.5	wh num	54.0
19 × 2 × 0.75	26.7	11.64	18.3 ± 0.5	wh num	60.4
8 × (2 × 1.5)	13.7	13.86	19.5 ± 0.5	wh num	72.4
16 × (2 × 1.5)	13.7	16.63	24.0 ± 0.5	wh num	122.2
2 × 4	5.09	3.7	10.8 ± 0.4	bk, bu	18.6
2 × 2 × 2.5	8.21	5.55	13.7 ± 0.4	bk, bu, bn, gy	28.7
2 × (2 × 2.5)	8.21	5.15	13.9 ± 0.4	bk, bu, bn, gy	33.0
2 × 2 × 4	4.8	9.98	16.6 ± 0.5	bk, bu, bn, gy	46.8
2 × 6	3.2	4.36	10.7 ± 0.4	bk, bu	24.4
2 × 2 × 6	3.2	13.3	18.9 ± 0.5	bk, bu, bn, gy	58.9

# VG cables

Description	Construction
Part no. 20 of cable construction Type A Single core insulated wire, 600 V, rated temperature up to +150 °C	
Part no. 21 of cable construction Type E Multicore insulated wire, open stranded 600 V, rated temperature up to +150 °C	
Part no. 22 of cable construction Type C Single core insulated wire, screened with sheath 600 V, rated temperature up to +150 °C	
Part no. 23 of cable construction Type F Cable, screened 600 V, rated temperature up to +150 °C	
Part no. 24 of cable construction Type K Single core insulated wire, with sheath 600 V, rated temperature up to +150 °C	
Part no. 25 of cable construction Type G Single core insulated wire, high flexible 600 V, rated temperature up to +150 °C	
Part no. 26 of cable construction Type H Single core insulated wire, high flexible, screened, with sheath 600 V, rated temperature up to +150 °C	
Part no. 27 of cable construction Type B Cable 600 V, rated temperature up to +150 °C	
Part no. 28 of cable construction Type A Cable, double screen 600 V, rated temperature up to +150 °C	
Part no. 28 of cable construction Type D Cable, screened 600 V, rated temperature up to +150 °C	








Please find more product details in our "Wires and cables for industrial applications" catalog.

# MIL cables

Description	Construction	
MIL 5932 A1  Single core 600 V, rated up to +150 °C		
MIL 5932 E1  Single core, screened 600 V, rated up to +150 °C		
MIL 5932 E2  screened pairs 600 V, rated up to +150 °C		
MIL 4412 A1  Single core, dual insulated 600 V, rated up to +150 °C		
MIL 4412 E1  Single core, dual insulated, screened 600 V, rated up to +150 °C		
MIL 4412 E2  screened pairs 600 V, rated up to +150 °C		

Constructions and dimensions acc. to MIL-W-22759
 Please find more product details in our "Wires and cables for industrial applications" catalog.

# Power distribution cables

Description	Construction
<p>RADOX® anticapillary (single insulation)</p> <p>Single core, 1 to 10mm<sup>2</sup> 600 V, rated up to +150 °C</p>	
<p>RADOX® anticapillary (double insulation)</p> <p>Single core, 1 to 6 mm<sup>2</sup> 600 V, rated up to +150 °C</p>	
<p>RADOX® 155 battery cable, flexible (FLR41X or FLR91X)</p> <p>Single core, thin wall, 10 to 150mm<sup>2</sup> 600 V, rated up to +150 °C</p>	
<p>RADOX® Elastomer S battery cable, high flex (FLR33X)</p> <p>Single core, thin wall, 10 to 150 mm<sup>2</sup> 600 V/1000 V, rated up to +150 °C</p>	
<p>RADOX® Elastomer S battery cable, flex (FL33X)</p> <p>Thick wall Single core, 10 to 150 mm<sup>2</sup> 600 V/1000 V, rated up to +150 °C</p>	
<p>RADOX® screened battery cable (FLRXC33X-1x__T150)</p> <p>Single core, 10 to 150 mm<sup>2</sup> 600 V/1000 V, rated up to +150 °C</p>	
<p>RADOX screened multicore cable</p> <p>multi core: 2 to 5 conductors 600 V/1000 V, rated up to +150 °C</p>	

Please find more product details in our "Automotive products" catalog.



# RADOX® Databus cables



## RADOX® Milcat 7

- High speed data transmission 600 Mhz at 100 Ohm
- Resistance to acid, alkali, mud and weathering
- Can be fitted with M12 connectors

### Applications

- Fixed and mobile installations
- Gigabit Ethernet for tough industrial environments



## RADOX® Milcat 5e

- Cat5e performance
- Temperature resistant to -40 °C
- Very good wear resistance
- Flame-resistant

### Applications

- Military communication
- Extended possible uses: UV-resistance renders suitable for outdoor use
- Tough industrial environments



## RADOX® Marine Cat 5e

- Cat5e performance
- DNV tested
- Extremely robust design
- Wear, pressure and vibration-resistant
- Flame, oil and mud-resistant to NEK606

### Applications

- Data transmission to ships' diesel engines
- Industrial environments where robust design and fluid resistance are required



## RADOX® Databus 120 Ω

- CAN technology
- GL tested
- Largely resistant to acids, oil and other chemical media

### Applications

- Databus communication in ships
- Can be installed in dry and wet areas

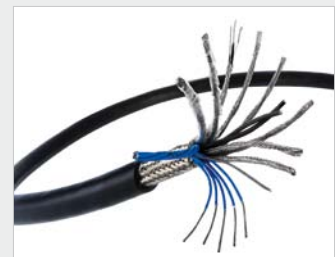


## RADOX® MFH-S B Multipair

- Interference-resistant signal and data transmission
- DNV and ABS tested
- Temperature range from -50 to +145 °C
- Flame, oil and mud resistant to NEK606
- Flame resistant to IEC60332-1-2 and IEC606332-3-22

### Applications

- Indoor and outdoor installations
- Fixed and moving installations
- Ship building, offshore or other industrial applications with particularly high requirements





## Fiber optics

HUBER+SUHNER offers a broad range of fiber optic cabling solutions for communication that meet the requirements of the defense ground and naval applications. Mobile systems have to be compact, light, robust and resistant to environment influences. On ships only halogen free and self-extinguishing cables are installed to give the highest protection to personnel and equipment in the event of fire.

The components as well as the assemblies are tested extensively in HUBER+SUHNER's test laboratory and in external labs. The tests are performed according to international and military standards. Typical tests are

- Thermal tests: temperature cycling, humidity, shock
- Mechanical tests: tension, bending, crush, impact, vibration, durability
- Fire tests: fire propagation, circuit integrity, smoke density, toxic gases
- Ingress resistance: water and dust tightness
- Fluid resistance: water, oils, fuels, solvents, acids



## Connectors

HUBER+SUHNER offers a wide range of fiber optic connectors optimized for both indoor and outdoor applications. Customer-specific connectors are also available in addition to a comprehensive standard product portfolio. All fiber optic connectors meet the highest mechanical and thermal specifications.



## Cables

HUBER+SUHNER offers a broad selection of different fiber optic cables used in a wide range of indoor and outdoor applications and optimized for stationary and mobile use. All cable types are developed for maximum capacity and tested extensively according to international standards.



## Assemblies/cable systems

HUBER+SUHNER is the leading supplier of harsh environment fiber optic interfaces. Our expertise in developing ruggedized assemblies means that they can be installed in the most demanding environments where factors such as extreme temperatures, vibrations and humidity create challenges to overcome. The ODC for example, is easy-to-install and was developed to meet the requirements of its surroundings.



## Backpack

HUBER+SUHNER fiber optic backpacks consist out of a modular system. This enable us to provide customer specific solutions to meet mission specific requirements and allow an easy and fast deployment of temporary fiber optic links suitable to withstand extreme environmental conditions.



## Fiber management systems

HUBER+SUHNER supports all products that enable the deployment of future-proof and easy-to-install fiber management for temporary camp installations. Our fiber management solutions are a key enabler for C4ISTAR shelter installation and a flexible mission-based adaptation.



## Waveform Division Multiplexing (WDM)

We offer all types of optical muxes, ranging from simple Wideband WDM over Coarse WDM to Dense WDM. In order to combine the different WDM grids and/or cascade several muxes we must also provide the matching WDM bandsplitters



# Connectors for harsh environment

Technical data	Q-ODC	Q-ODC-12	ODC®-2/ODC®-4	EBC	TFOCA/TFOCA II®
					
Technology	full ceramic 1.25 mm ferrule and sleeve	plastic ferrule (PPS)	full ceramic 1.25 mm ferrule and sleeve	hermaphroditic expanded beam	hermaphroditic expanded beam
Number of fibers	2	≤ 12	2/4	2/4	2/4/6/12
Protection class	IP67	IP68	IP68	IP67	IP67
Fiber types	singlemode and multimode	singlemode and multimode	singlemode and multimode	singlemode and multimode	singlemode and multimode
Operating temperature <sup>1)</sup>	-40 to +85 °C	-40 to +85 °C	-40 to +85 °C	-46 to +85 °C	-46 to +85 °C
Mating durability	200 <sup>2)</sup>	100 <sup>2)</sup>	1000 <sup>2)</sup>	3000	2000 (multimode) 1000 (singlemode)
Mechanical performance	tensile load 450 N plug ≤ 30 N socket	tensile load 500 N plug ≤ 30 N socket	tensile load 800 N plug ≤ 30 N socket	tensile load 1500 N 500 free falls from 1.2 m height	tensile load 1500 N 500 free falls from 1.2 m height
Protection cap	snap-on	snap-on	screwed	screwed	screwed

<sup>1)</sup> depending on cable type

<sup>2)</sup> with repeated cleaning

<sup>3)</sup> further cable types are available

## Fiber optic cables

	Cable type	Weight (kg/km)	Number of fibers	Jacket Ø (mm)	Jacket material
	Mobile field cables	24	2	5.6	TPU
	Rugged minicord breakout cables	28	2	6.0	TPU
	Simplex cables with tight tube	3	1	0.6	TPU
	Jellyfree - dry block glass-armoured multi-fiber loose tube cables 7.0 mm	96	2 to 24	7.0	LSFH
	OptiPack cable	8.3	12	3.0	LSFH
	Glass-armoured riser cables with 2 tubes	26 35	2 2	4.8 5.5	LSFH LSFH
	Glass-armoured riser cables with 4 fibers	33	4	5.5	LSFH
	Rolling stock fiber optic cable RADOX® with 4 fibers	191	4	9.6	LSFH
	Rolling stock fiber optic cable RADOX® with 2 fibers	53	2	7.0	LSFH

# Fiber optic assemblies

HUBER+SUHNER can configure robust assemblies to meet customer requirements from our wide range of connectors and patch cables.



## ODC assemblies

- Robust ODC industrial connectors
- Protected end faces
- Safe installation – blind mating
- Dustproof and watertight
- For harsh environmental conditions

### Applications

- Connecting access points in buildings or outdoors
- Control cabinet cabling



## Q-ODC-12 link cable assemblies

- Standard Q-ODC-12 (m/f) connectors
- Various lengths
- Rodent protection, UV resistant, robust
- Compatible with all Q-ODC-12 interfaces

### Applications

- MLUSC connection cable
- Connection cable from the control room to the control cabinets with modular expansion



## Robust cable assemblies

- With all typical fiber types
- Standard connectors incl. SFF
- For harsh environmental condition

### Applications

- Connecting access points in buildings
- Control cabinet cabling



## Patch cables

- Simplex and duplex
- Standard connectors incl. SFF
- Connector types with automatic protective caps

### Applications

- Connecting fiber fan-out modules and access points in distribution boxes
- Distribution enclosure patches



## Customer specific assemblies

- Broad range of connectors: EBC, TFOCA (II), 38999
- Various lengths
- Rodent protection, UV resistant, robust
- MIL approved cables

### Applications


- Tactical network installations
- Backpack cables



# Fiber optic cable systems

A variety of cable systems can be configured to meet customer requirements. Pre-terminated cable systems offer the following advantages:

- Can be installed directly and quickly, immediately operational
- No splicing or connector assembly required on site
- Cost savings thanks to simple and time-saving installation
- Little expertise required





## MASTERLINE Ultimate

- Pre-terminated "plug & play" solution
- Robust connector head with 6 or 12 Q-ODC jacks
- Rodent protection and UV-resistant
- Simple, time-saving installation

### Applications

- Control cabinet cablings in and between buildings
- For connecting distribution boxes
- For connecting access points on masts or in buildings







## MASTERLINE Extreme

- Featuring robust ODC industrial connectors
- Safe installation – blind mating
- Water- and dust-tight for use in tough environmental conditions
- Hybrid version with power conductor available

### Applications

- Control cabinet cablings in and between buildings
- For connecting distribution boxes
- For connecting access points on masts



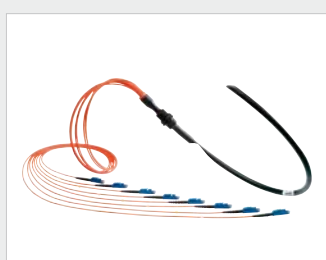



## MASTERLINE Classic

- Strong cable support
- Wide operating temperature range
- Dust- and water-tight pull-in hose for protecting fan-out cables
- With standard connectors

### Applications

- Control cabinet cablings in and between buildings
- For connecting distribution boxes and cabinets
- For cabling communication networks






## Mobile cable systems

- Easy storage of cable assemblies
- Assemblies with multi-pole connectors
- MASTERLINE Mobile with standard connectors and removable protective sheaths
- Both cable ends accessible

### Applications

- Temporary connections





# Fiber optic fiber management systems

Practical and compact modules support the professional fanning out of fibers to connection and fan-out points.

+	<div data-bbox="161 468 352 506">MDR module</div> <div data-bbox="161 517 549 669"> <ul style="list-style-type: none"> <li>• Space saving</li> <li>• Mounted on DIN rail (35 mm)</li> <li>• Splice/patch and patch variants</li> <li>• Angled couplings for optimal patch cable connections</li> </ul> </div> <div data-bbox="638 499 783 528">Applications</div> <div data-bbox="638 533 1031 591"> <ul style="list-style-type: none"> <li>• Fiber fan-out in control cabinets and distribution boxes</li> </ul> </div>	
+	<div data-bbox="161 790 496 826">Wall-mounted housings</div> <div data-bbox="161 835 574 990"> <ul style="list-style-type: none"> <li>• Various sizes (Optibox)</li> <li>• For splicing and/or patching</li> <li>• Multiple cable inputs and outputs</li> <li>• High level of dust- and water-tightness</li> <li>• Smart fiber management</li> </ul> </div> <div data-bbox="638 835 783 864">Applications</div> <div data-bbox="638 869 1002 958"> <ul style="list-style-type: none"> <li>• For connecting cable segments</li> <li>• Branch point to access points</li> <li>• For use in buildings and outdoors</li> </ul> </div>	
+	<div data-bbox="161 1108 430 1144">Cable terminations</div> <div data-bbox="161 1153 609 1308"> <ul style="list-style-type: none"> <li>• Housings for splicing and patching</li> <li>• For 19" cabinets</li> <li>• Easy installation</li> <li>• Casing also available for housing fan-out cables in cable systems</li> </ul> </div> <div data-bbox="659 1153 804 1182">Applications</div> <div data-bbox="659 1187 1031 1276"> <ul style="list-style-type: none"> <li>• Fiber fan-out in control cabinets, distribution boxes and distribution cabinets</li> </ul> </div>	
+	<div data-bbox="161 1426 413 1464">Distribution boxes</div> <div data-bbox="161 1471 612 1565"> <ul style="list-style-type: none"> <li>• High fiber density</li> <li>• Optimum access to fibers and connectors</li> <li>• Modular assembly for future expansion</li> </ul> </div> <div data-bbox="659 1471 804 1500">Applications</div> <div data-bbox="659 1505 1024 1630"> <ul style="list-style-type: none"> <li>• For connecting and branching cable segments</li> <li>• For connecting access points</li> <li>• For use in buildings and outdoors</li> </ul> </div>	
+	<div data-bbox="161 1744 477 1783">Distribution enclosures</div> <div data-bbox="161 1789 630 1944"> <ul style="list-style-type: none"> <li>• Optimum access to fibers and connectors</li> <li>• Splice and patch-only modules and splice/patch modules</li> <li>• Modular assembly for gradual expansion</li> <li>• Professional fiber and cable supports</li> </ul> </div> <div data-bbox="659 1789 804 1818">Applications</div> <div data-bbox="659 1823 1038 1881"> <ul style="list-style-type: none"> <li>• Fiber distribution in communication network nodes</li> </ul> </div>	

# Wavelength Division Multiplexing (WDM)

HUBER+SUHNER has specialized on optical wavelength division multiplexing. We offer all types of optical muxes, ranging from simple Wideband WDM over Coarse WDM to Dense WDM. To be able to combine the different WDM grids and/or cascade several muxes we have provide the matching WDM bandsplitters. There is no grid that we do not serve, so of course we as well offer the muxes that power high-speed multi-lambda transceivers and we are happy to customize our muxes to your specific grids applied in your sensing application.



## CWDM COLOR cubes

Coarse Wavelength Division Multiplexing (CWDM) is an excellent choice for increasing bandwidth capacity while keeping costs down. The COLOR cube family, based on standard Thin Film Filter (TFF) technology with a proprietary packaging, offers you smallest component dimensions combined with an outstanding performance and reliability.



## Bandsplitter COLOR-Cubes

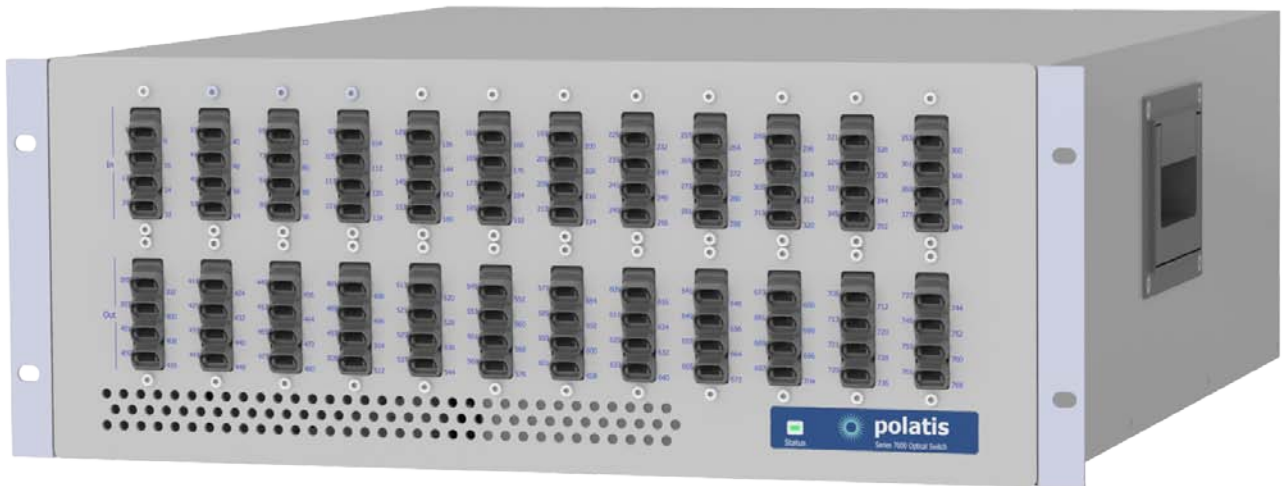
HUBER+SUHNER provides a great variety of hi-isolation bandsplitters, based on Thin Film Filters (TFF): Simple Wideband WDMs which create two channels at 1310 and 1550 nm, each with a bandwidth up to 100 nm. Or different CWDM bandsplitters for CWDM upgrades and extensions from e.g. 4 channels to 8 channels. Here, an important characteristic is the number of skipped (not-useable) channels, reaching from 0 to 2 channels



## DWDM COLOR cubes

While we use our patented packaging and assembly technology for the wider WDM grids, we as well rely on classical cascading of 3-ports assembled into modules for the narrow DWDM grids. We can supply any combinations and channel amounts, ranging from 400 to 50 GHz, please, contact us for further configurations.





## All-optical switches

HUBER+SUHNER Polatis is the leading provider of all-optical switches, enabling low latency, fully transparent connections between optical fibers without requiring conversion between optical and electrical signals to offer much greater flexibility and energy efficiency. The patented DirectLight® optical switch technology connects fibers with the best possible optical performance. The modular, strictly non-blocking optical switch platform scales from 4 × 4 to 384 × 384 ports, applying class-leading performance to provide dynamic connectivity for government, data center, test, telecommunications and video networks.

Polatis all-optical switches are time-proven in mission-critical government, aerospace and defense applications, with key features that enable systems integrators to deliver the secure, scalable, reliable, manageable and cost-effective optical cross-connect capabilities that government agencies require for both digital and analogue communications networks.

## System components

<p><b>Series 1000</b></p> <ul style="list-style-type: none"> <li>• Benchmark optical performance</li> <li>• Rich user interface functionality</li> <li>• Single sided N-fibre variants available</li> <li>• Verizon NEBS 3+ certified</li> </ul>	<p><b>Series 3000</b></p> <ul style="list-style-type: none"> <li>• DirectLight Multimode System</li> <li>• Supports 50/125 and 62.5/125 multimode fiber</li> <li>• Available in <math>N \times N</math>, <math>M \times N</math> configurations NETCONF</li> </ul>	<p><b>Series 6000 Lite</b></p> <ul style="list-style-type: none"> <li>• Compact 1RU physical size</li> <li>• Energy efficient, low power, fanless</li> <li>• Redundant hot swap NIC + PSU</li> <li>• SDN enabled with OpenFlow and NETCONF</li> </ul>
<p><b>Series 6000</b></p> <ul style="list-style-type: none"> <li>• Low insertion loss/superior optical specs</li> <li>• Carrier class interfaces</li> <li>• Available in <math>N \times N</math> and <math>M \times N</math> configurations</li> <li>• Single sided variants available</li> </ul>	<p><b>Series 6000 PSS</b></p> <ul style="list-style-type: none"> <li>• Compact 1+1 optical layer protection</li> <li>• Up to 16 services in 1RU, &lt; 25 W</li> <li>• Pre-configured, drop in APS system</li> <li>• Automatic LOS protection and restoration</li> </ul>	<p><b>Series 7000</b></p> <ul style="list-style-type: none"> <li>• Superior optical specs</li> <li>• <math>N \times N</math> and <math>M \times N</math> configurations</li> <li>• SDN enabled carrier-class interfaces</li> <li>• Low power, resilient architecture</li> </ul>

## Applications



### RF-over-Fiber

HUBER+SUHNER Polatis' switches enable government agencies to use optical fiber to eliminate copper coaxial cabling, copper based patch panels, and large footprint RF switches to distribute RF signals within buildings, satellite ground terminals, mobile command shelters, land, sea and airborne platforms and test ranges.

› [page 122](#)



### Data center/cyber security

The HUBER+SUHNER Polatis optical switch can be seamlessly integrated with software-defined network management and orchestration agents, allowing commissioning, change, or upgrade of optical resources with just a few mouse clicks.

› [page 123](#)

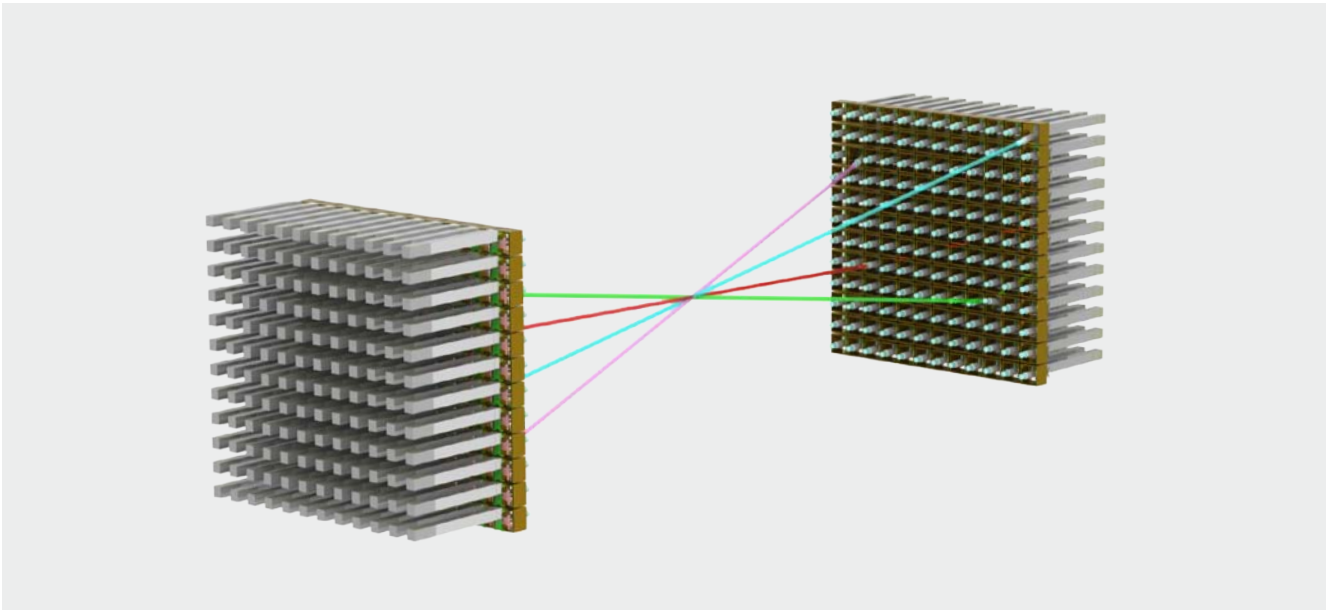


### Remote software-defined test access

Unlike many traditional optical solutions, a HUBER+SUHNER Polatis optical switch enables seamless, centralized test equipment integration and enables agencies to leverage expensive test equipment across their optical infrastructure. Furthermore, the high performance of the HUBER+SUHNER Polatis optical switch ensures that test data is accurate, reliable and repeatable.

› [page 123](#)

# Technology



Polatis' highly reliable piezoelectric Directlight® beam-steering technology sets the industry standard for lowest optical loss and highest performance. With more than a billion port-hours accumulated on deployed units, the Polatis technology platform delivers a broad range of class-leading all-optical matrix switch products into demanding applications.

At the core of Polatis optical switches is our patented DirectLight beam-steering technology that makes connections using compact piezoelectric actuators to align collimated beams of light from opposing arrays of input and output fibers with minimal loss, distortion or interference between paths. Alignment is maintained using feedback from integrated position sensors to ensure connection stability over time, temperature and external disturbances. Switching occurs completely independently of the power level, color or direction of light on the path, enabling pre-provisioning of dark fiber and avoiding concatenation of switching delays across mesh or multi-stage switched optical networks. Polatis optical switches are fully non-blocking and available in sizes from 4x4 to 384 × 384.

## Key features

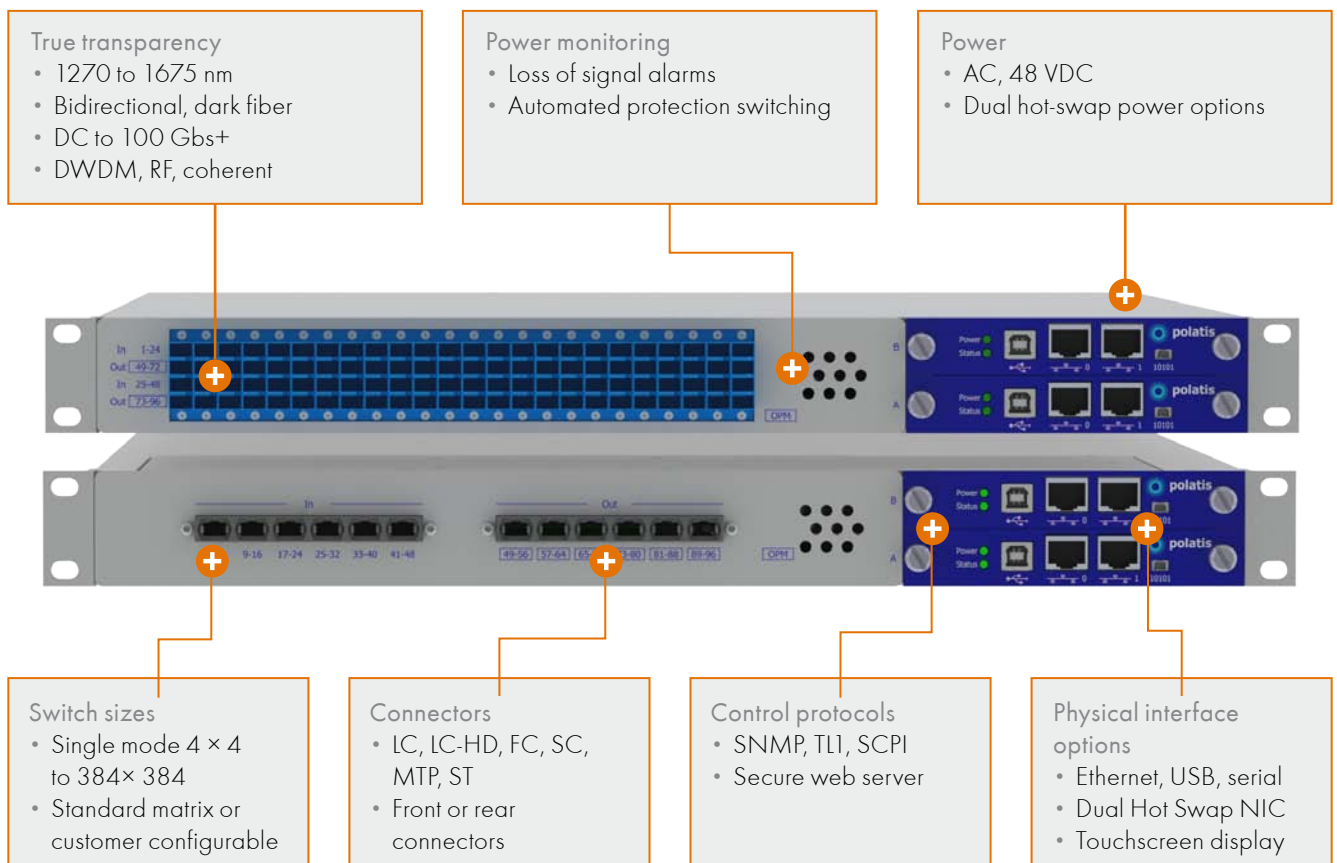
- DirectLight® free-space optical switch technology connects fibers with the best possible optical performance
- Lowest loss all-optical cross-connect – typical 1dB IL
- Excellent connection repeatability and stability
- Modular platform scales from 4 × 4 thru 384 × 384 and beyond
- Dual-sided (M × N) and single-sided (M-fibre) variants
- True transparent dark-fibre switch connections are independent of protocol, bitrate, light colour, direction or power level
- Robust against shock, vibration, thermal environments
- Optical power monitoring enables variable attenuation and M:N optical layer mesh protection switching

## Product overview

Product	Matrix size	Technology	Optional functions	
Series 1000	4 × 4 to 32 × 32 32-fiber	DirectLight™ Singlemode	OPM APS VOA	<ul style="list-style-type: none"> <li>Benchmark optical performance</li> <li>Rich user interface functionality</li> <li>Single sided N-fibre variants available</li> <li>Verizon NEBS 3+ certified</li> </ul>
Series 3000	4 × 4 to 16 × 16	DirectLight™ Multimode	OPM APS VOA	<ul style="list-style-type: none"> <li>Supports 50/125 and 62.5/125</li> <li>Multimode fiber</li> <li>Available in N × N, M × N configurations</li> <li>Touchscreen</li> </ul>
Series 6000 Lite	Up to 48 × 48	DirectLight™ Singlemode	OPM APS VOA	<ul style="list-style-type: none"> <li>Compact 1RU physical size</li> <li>Energy efficient, low power, fanless</li> <li>Redundant hot swap NIC and PSU</li> <li>SDN enabled with OpenFlow and NETCONF</li> </ul>
Series 6000	48 × 48 to 192 × 192 192-fiber	DirectLight™ Singlemode	OPM APS VOA	<ul style="list-style-type: none"> <li>Low insertion loss/superior optical specs</li> <li>Carrier class interfaces (SNMP, TL1, etc.)</li> <li>Available in NxN and MxN configurations</li> <li>Single sided N-fibre variants available</li> <li>SDN enabled with OpenFlow and NETCONF</li> </ul>
Series 6000 PSS	4, 8 or 16 Rx/Tx line pairs Protection services	DirectLight™ Singlemode		<ul style="list-style-type: none"> <li>Compact 1+1 optical layer protection</li> <li>Up to 16 services in 1RU, &lt; 25 watts</li> <li>Pre-configured, drop in APS system</li> <li>Automatic LOS protection and restoration</li> </ul>
Series 7000	208 × 208 to 384 × 384	DirectLight™ Singlemode	OPM APS VOA	<ul style="list-style-type: none"> <li>Superior optical specs</li> <li>NxN and MxN configurations</li> <li>SDN enabled carrier-class interfaces</li> <li>Low poer, resilient architecture</li> </ul>

OPM: Optical power monitor/APS: Automatic protection switching/VOA: Variable optical attenuation

## Configuration options





# Applications



## RF-over-Fiber

Distribution of RF signals over fiber has been established since the mid 1980's for cable TV, government and defence related applications. The well-documented benefits of distributing RF signals through optical fibers rather than coaxial copper cable include greatly reduced electromagnetic interference and susceptibility, smaller and less expensive cables with lower attenuation, better RF link noise performance and longer cable runs.

HUBER+SUHNER Polatis all-optical switches have found significant applications in RF distribution systems for flexible provisioning and protection of fiber links and terminal equipment. Performance differentiators of the Polatis optical switch technology include ultra-low optical loss, typically below 1 dB; modulation-free dark fiber connectivity, low crosstalk and polarization dependence, high signal security and low optical back reflection.

HUBER+SUHNER Polatis' switches enable government agencies to use optical fiber to eliminate copper coaxial cabling, copper based patch panels, and large footprint RF switches to distribute RF signals within buildings, satellite ground terminals, mobile command shelters, land, sea and airborne platforms and test ranges. Using fiber optics for RF distribution allows systems to support secure communications across Secure Compartmented Information Facility (SCIF) boundaries.



## Data center and cyber security

Traditional fiber optic distribution systems rely on manual intervention to provision connections. Automation of the fiber infrastructure to create a software-defined optical network eliminates the delay, error and uncertainty of manual provisioning and removes a potential weak link in the information security structure. Using the Polatis dynamic fiber cross-connects, government agencies can reduce service provisioning and upgrade timescales and manual service intervention requirements by up to 90 %.

The Polatis optical switch can be seamlessly integrated with software-defined network management and orchestration agents, allowing commissioning, change, or upgrade of optical resources with just a few mouse clicks. Automated provisioning not only reduces the potential for human error, it also eliminates the handling of fibers and connectors, significantly increasing the life of the fiber plant and improving system return on investment.



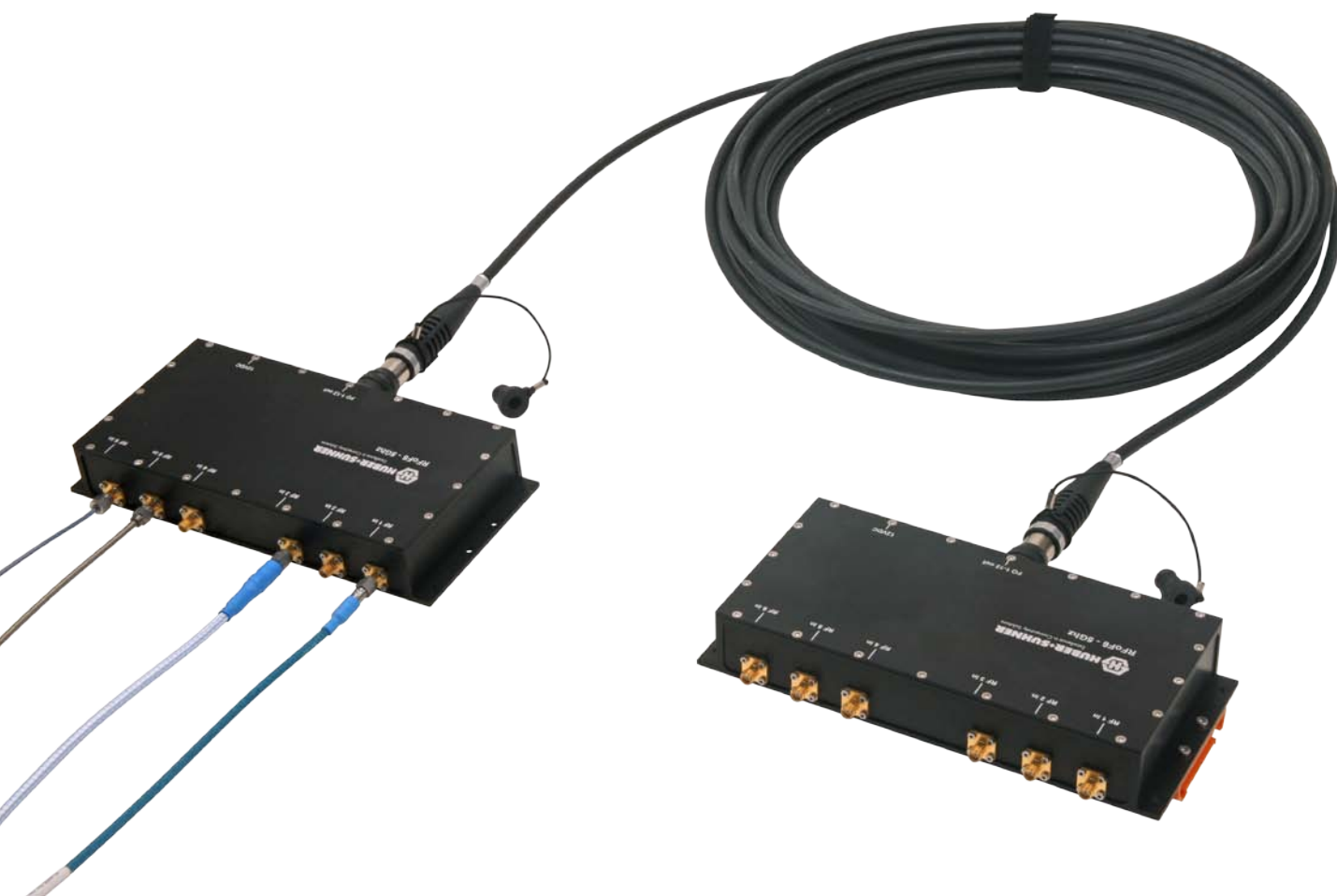
## Remote software-defined test access

Unlike many traditional optical solutions, a HUBER+SUHNER Polatis optical switch enables seamless, centralized test equipment integration. Using Polatis enables agencies to leverage expensive test equipment across their optical infrastructure to:

- Reconfigure and partition system connectivity on demand between multiple users
- Improve network reliability and availability through more rapid fault isolation and remediation
- Coordinate fault location with an up-to-date database to ensure that the right network resources are rapidly repaired
- Perform maintenance and service restoration on a fiber-by-fiber basis, without impact to other fibers or services

Furthermore, the high performance of the Polatis optical switch ensures that test data is accurate, reliable and repeatable. HUBER+SUHNER Polatis' ability to incorporate real-time tests into the fabric of the optical network improves not only the reliability of the communications infrastructure; it also drives down operational costs through "one-stop" system testing. And, by improving fault isolation and remediation, on-site maintenance requirements (and their costs) are drastically reduced.





## RF-over-Fiber series (RFoF, GPSoF and LANoF)

The market is evolving at a significant pace. With customers requiring that new systems combine various technologies, HUBER+SUHNER has positioned itself to be able to provide customers with end-to-end hybrid solutions.

The RF-over-Fiber series enables the use of radio frequency and fiber optics in a single system. With these two core technologies, HUBER+SUHNER is using its vast experience and expertise to deliver best-in-class technology conversion modules.

HUBER+SUHNER's RF-over-Fiber series consists of three product lines; RF-over-Fiber (RFoF), GPS-over-Fiber (GPSoF) and LAN-over-Fiber (LANoF).

The main advantages that RF-over-Fiber systems have over traditional RF system are that they:

- allow for greater distances between the RF source and the RF receiver system
- are immune to EMI and RFI
- are immune to EMP
- are more difficult to intercept ("tap")
- are lighter in weight

## System components

<div><div></div><div>+</div></div> <h3>RF-over-Fiber (RFoF)</h3> <ul style="list-style-type: none"><li>• 1 MHz to 20 GHz</li><li>• Simplex and duplex systems</li><li>• Fully configurable</li></ul>	<div><div></div><div>+</div></div> <h3>GPS-over-Fiber (GPSoF)</h3> <ul style="list-style-type: none"><li>• L1 and L2 bands</li><li>• Multiport receivers</li><li>• 1PPS and 10 MHz</li></ul>	<div><div></div><div>+</div></div> <h3>LAN-over-Fiber (LANoF)</h3> <ul style="list-style-type: none"><li>• Gigabit connectivity</li><li>• "Field LAN" ruggedized</li><li>• Up to 20 km per link</li></ul>
--	--	---

## Applications



### Shelters

Highly mobile and deployed in harsh environments, connectivity as well as the safety of the command center are key aspects of RF-over-Fiber within an antenna remoting system. The use of fiber optic cables makes it possible to position the shelters further away from the antennas and contributes to high mobility.

› page 133



### Vehicles

GPS-over-Fiber enables a single GPS signal to be distributed into multiple receiver systems. The small form factor adds significant value within the vehicle with both the conversion modules and fiber optic cable designed to use as little space as possible.

› page 134



### SATCOM

In SATCOM applications, RF-over-Fiber enables communication between satellites and control centers. The communication link is created by connecting the antenna to the control center. RF-over-Fiber supports both fixed earth installations as well as mobile applications.

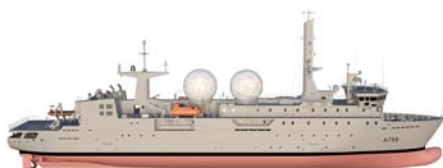
› page 135



### Aircraft

High density RF connectivity with a significantly reduced cable footprint is key to the success of the HUBER+SUHNER airframe solution. Weight reduction and cost optimization are achieved by using less material as well as speeding up the installation and maintenance processes.

› page 136

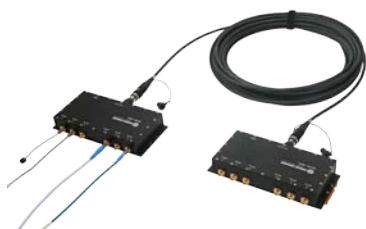


### Naval Vessels

RF-over-Fiber within naval applications covers both communication systems on the vessel as well as antenna systems relevant to missions. The use of RF-over-Fiber and LAN-over-Fiber ensures ruggedized end-to-end solutions on all communication platforms.

› page 137

# RF-over-Fiber



Driven by a philosophy of providing high density RF connectivity, while significantly reducing cable footprints. HUBER+SUHNER's single mode, simplex and duplex systems are both flexible and perfect for harsh environments. Flexibility is achieved by providing customers with a wide range of options when it comes to inter-connectivity, while the scalability of the systems enables an unlimited RF connectivity density.

The use of HUBER+SUHNER's renowned components, such as RADOX and Q-ODC-12, ensures that the system can be deployed in any environment and with a significantly smaller cable footprint.

The standard RFoF modules are available in 1, 6 and 12 ports and cover a wide frequency range of 1 MHz to 20 GHz. The systems are capable of covering distances of up to 100 km and are perfect for applications requiring secure, low loss, light-weight and high-density connectivity.

RF-over-Fiber		# of RF ports				Key technical parameters/features									
Item	Item description	1	3	6	12	Simplex	Duplex	Frequency MHz		Gain flatness*	Noise figure*	SFDR*	OIP3*	Single-mode	Max. link distance**
								from	to						
85073881	RFoF1 - 3 GHz (TX)	•				•		1	3000	< 1.5	15	100	20	•	100
85073882	RFoF1 - 3 GHz (RX)	•				•		1	3000	< 1.5	15	100	20	•	100
85073883	RFoF1 - 3 GHz (TRM)	•					•	1	3000	< 1.5	15	100	20	•	100
85071061	RFoF6 - 3 GHz (TX)			•		•		1	3000	< 1.5	15	100	20	•	100
85071062	RFoF6 - 3 GHz (RX)			•		•		1	3000	< 1.5	15	100	20	•	100
85071063	RFoF12 - 3 GHz (TX)				•	•		1	3000	< 1.5	15	100	20	•	100
85071064	RFoF12 - 3 GHz (RX)				•	•		1	3000	< 1.5	15	100	20	•	100
85071065	RFoF3 - 3 GHz (TRM)		•				•	1	3000	< 1.5	15	100	20	•	100
85071066	RFoF6 - 3 GHz (TRM)			•			•	1	3000	< 1.5	15	100	20	•	100
85065392	RFoF6 - 6 GHz (TX)			•		•		300	6000	< 1.5	20	100	10	•	100
85065393	RFoF6 - 6 GHz (RX)			•		•		300	6000	< 1.5	20	100	10	•	100
85074581	RFoF6 - 6 GHz LN (TX)			•		•		300	6000	< 0.7	7	105	10	•	100
85074578	RFoF6 - 6 GHz LN (RX)			•		•		300	6000	< 0.7	7	105	10	•	100
85065394	RFoF12 - 6 GHz (TX)				•	•		300	6000	< 1.5	20	100	10	•	100
85065395	RFoF12 - 6 GHz (RX)				•	•		300	6000	< 1.5	20	100	10	•	100
85071630	RFoF3 - 6 GHz (TRM)		•				•	300	6000	< 1.5	20	100	10	•	100
85071631	RFoF6 - 6 GHz (TRM)			•			•	300	6000	< 1.5	20	100	10	•	100
85072903	RFoF1 - 20 GHz (TX)	•				•		200	20 000	< 1.0	45	100	28	•	100
85072904	RFoF1 - 20 GHz (RX)	•				•		200	20 000	< 1.0	45	100	28	•	100
85076291	RFoF1 - 20 GHz (TRM)	•					•	200	20 000	< 1.0	45	100	28	•	100
85077808	RFoF1 - 20 GHz LN (TX)	•				•		200	20 000	< 1.0	8	105	25	•	100
85077809	RFoF1 - 20 GHz LN (RX)	•				•		200	20 000	< 1.0	8	105	25	•	100

\* Typical value(s)

\*\* Real link distances are dependent on the application/environment.

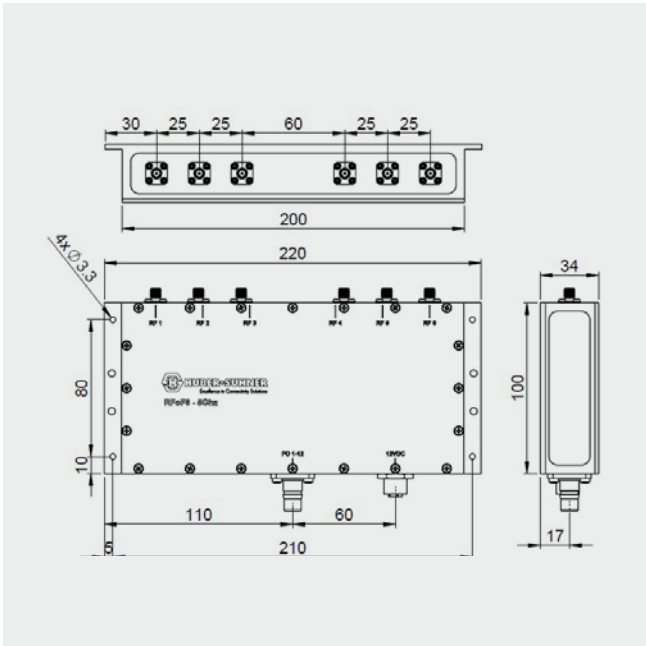
# Datasheet RFoF6 – 3 GHz

Electrical data		Value			Remarks
		minimal	typical	maximal	
Frequency range	MHz	1		3000	3 dB bandwidth
Gain	dB	6	10	14	
Gain flatness	dB/100 MHz		< 1.5		
Noise figure	dB	12	15	25	
Spurious-free dynamic range	dB Hz <sup>2/3</sup>		100		
Max. input at 1dB compression	dBm		+0		
Max. input power for no damage	dBm		+15		
VSWR (input and output)	dB		< 1.8		
OIP3	dBm		+20		
Time delay	Ns		12		
Supply voltage transmitter	VDC	+11	+12	+16	max. 750 mA
Supply voltage receiver	VDC	+11	+12	+16	max. 500 mA
Temperature range	operating °C	–40		+85	
	storage °C	–40		+85	
RF input impedance	Ω	50			

Optical Data		Value			Remarks
		minimal	typical	maximal	
Fiber optic connectors		Q-ODC 12			
Fiber		Single mode fiber 9/125 µm			
Fiber power loss	dB/km		0.4		
Optical power in fiber	mW	3	6	10	
Side mode suppression ratio	dB	30	40		

Mechanical Data		Value			Remarks
		minimal	typical	maximal	
Module weight	kg	1.1			transmitter and receiver
Module dimensions	mm	220 × 100 × 34			transmitter and receiver
RF connectors		QMA/SMA female			

All specifications at 25 °C case temperature Tc, unless otherwise specified



# GPS-over-Fiber (GPSoF)



Our GPSoF modules are focused on distributing a single GPS signal into multiple receiver systems. This approach ensures that signal data, such as time synchronization into separate, yet connected, systems is always the same. Standard GPSoF systems include both single and multiport solutions; and accommodate both L1 and L2 bands.

In addition to the GPSoF modules, HUBER+SUHNER also provides a Time and Frequency Standard (TFS) module. This module uses 1PPS to ensure that time synchronization is still possible in the event of a loss of GPS signal. The pulse is synchronized to the average of the GPS signal. The module also provides a 10 MHz electrical output, which is used for reference signaling. The small form factor of the GPSoF modules ensures that the systems are ideal for both fixed and mobile applications, where space may be limited.

GPS-over-Fiber		# of RF ports		Key technical parameters/features										
Item	Item description	1	4	Simplex	Frequency MHz		Gain flatness*	Noise figure*	SFDR*	OIP3*	1PPS	10 MHz	Single-mode	Max. link distance**
					from	to								
85065409	GPSoF1 - 1.5 GHz (TX)	•		•	1565	1615	< 2.0	14	100	7			•	100
85065397	GPSoF1 - 1.5 GHz (RX)	•		•	1565	1615	< 2.0	14	100	7			•	100
85065809	GPSoF4 - 1.5 GHz (RX)		•	•	1565	1615	< 2.0	14	100	7			•	100
85072905	GPSoF1 - 1.5 GHz (TX) L1+L2	•		•	1218	1615	< 2.0	14	100	7			•	100
85072906	GPSoF1 - 1.5 GHz (RX) L1+L2	•		•	1218	1615	< 2.0	14	100	7			•	100
85072907	GPSoF4 - 1.5 GHz (RX) L1+L2		•	•	1218	1615	< 2.0	14	100	7			•	100
85072918	TFS1.10	•		•	1218	1615	N/A	N/A	N/A	N/A	•	•	•	100
85072919	GPSoF4+ (RX)		•	•	1218	1615	<2.0	14	100	7	•	•	•	100

\* Typical value(s)

\*\* Real link distances are dependent on the application/environment.

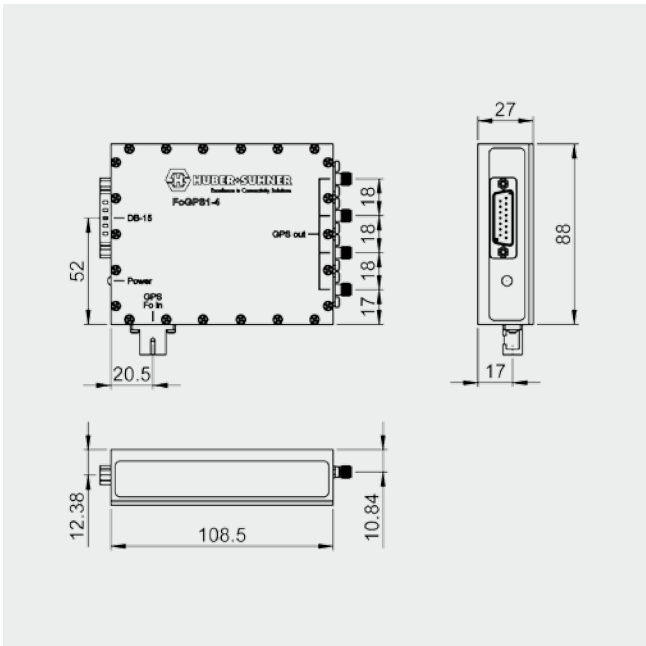
# Datasheet GPSoF - 1.5 GHz (L1+L2)

Electrical data			Value			Remarks
			minimal	typical	maximal	
Frequency range	MHz		1218		1615	
Gain	dB		4	7	10	
Gain flatness	dB/100 MHz			< 2		
Noise figure	dB			14		
Spurious-free dynamic range	dB Hz <sup>2</sup> '3			100		
Max. input at 1 dB compression	dBm			−20		
Max. input power for no damage	dBm			+15		
VSWR (input and output)	dB			< 1.8		
OIP3	dBm			+ 7		
Time Delay	Ns			55		
Supply voltage Vs transmitter	VDC		+12	+12	+15	max. 170 mA
Supply voltage Vs receiver	VDC		+12	+12	+15	max. 100 mA
Temperature range	operating	°C	−40		+85	
	storage	°C	−40		+85	
RF input impedance	Ω		50			

Optical data			Value			Remarks
			minimal	typical	maximal	
Fiber optic connectors			FC/APC			
Fiber			Single mode fiber 9/125 um			
Optical power in fiber	mW		6	8	10	
Side mode suppression ratio	dB		30	40		

Mechanical data		Value			Remarks
Module weight	g	270			transmitter and receiver
Module dimensions	mm	90 × 95 × 23			transmitter and receiver
RF connectors		QMA/SMA female			

All specifications at 25 °C case temperature Tc, unless otherwise specified





# LAN-over-Fiber



With the use of multimedia continuing to increase within the operations landscape (from planning to de-briefing), our modules are focused on providing Gigabit connectivity within challenging environments.

Again, the use of HUBER+SUHNER’s RADOX and Q-ODC-12 components ensure that the exposed portions of the system remain functional within harsh environments, while the inter-connect within a mobile structure (shelter or vehicle) remains robust and functional within environments exposed to, for example, intense vibration.

The standard LANoF modules are available in 1, 6 and 12 ports and can be easily integrated into existing network infrastructures. The LANoF system is particularly well suited to applications that require "field LAN" capabilities for data synchronization, diagnostics, remote identification and software distribution.

LAN-over-Fiber		# of LAN ports			Key technical parameters/features				
Item	Item description	1	6	12	Duplex	Bit rate from	to	Single mode	Max. link distance ** km
						Mbps	Mbps		
85072917	LANoF1 - 1 Gbps	•			•	10	1000	•	20
85065410	LANoF6 - 1 Gbps		•		•	10	1000	•	20
85065411	LANoF12 - 1 Gbps			•	•	10	1000	•	20

\*\* Real link distances are dependent on the application/environment.

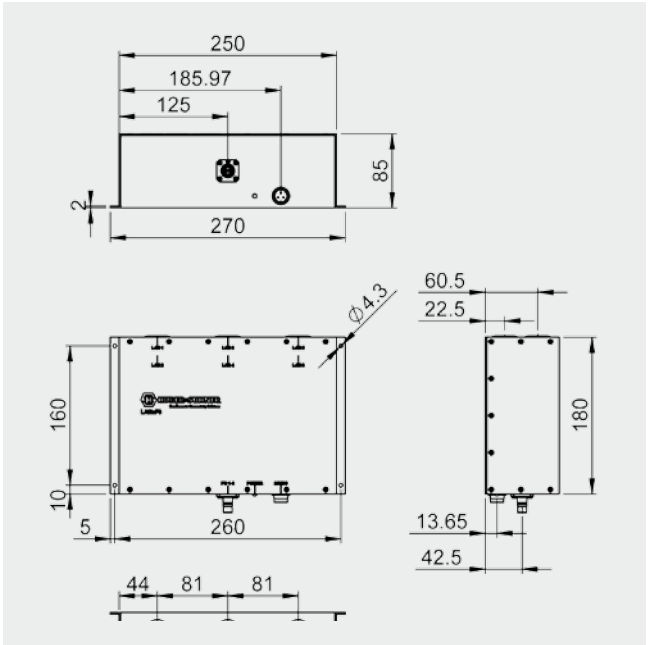
# Datasheet: LAnoF6 – 1 Gbps

Electrical data			Value			Remarks
			minimal	typical	maximal	
Data rate	Mbps		10		1000	
Max. distance	km				20	
Max. optical input power for no damage	dBm			+15		
Supply voltage Vs	VDC		+12	+12	+32	max. 100 mA
Temperature range	operating	°C	0		+70	
	storage	°C	-40		+85	

Optical data			Value			Remarks
			minimal	typical	maximal	
Fiber optic connectors			Q-ODC-12			
Fiber			Single mode fiber 9/125 um			
Fiber power loss	dB/km			0.4		
Optical power in fiber	mW		3	6	10	
Side mode suppression ratio	dB		30	40		

Mechanical data			Value			Remarks
Module weight	kg		1.3			transmitter and receiver
Module dimensions	mm		270 × 150 × 90			transmitter and receiver
LAN connectors			RJ45/M12 P4			

All specifications at 25 °C case temperature Tc, unless otherwise specified



# Customized modules

The modular design of the RF-over-Fiber series products ensures that HUBER+SUHNER is able to provide fast, flexible and cost-effective customizations that meet our customers' application requirements.

## Customized options include

- Small-form factor for applications that have limited space available
- Housings that support the light-weighting requirements of an application
- A combination of RF, GPS and LAN functionality into a single module
- Ruggedization for use in harsh environments (i.e. extreme temperatures, vibration and shock)
- High-density housing for applications that need to limit the amount of hardware within the solution without compromising on connectivity density
- Customer-specific interconnect options (for both RF and FO)
- Rack-mountable housing



### Small form factor

- Housings that support the light-weighting requirements of an application
- Small-form factor for applications that have limited space available



### Combined technologies

- Rack-mountable housing
- A combination of RF, GPS and LAN functionality into a single module



### Ruggedized enclosures

- Rack-mountable and high-density housing
- Ruggedization for use in harsh environments (i.e. extreme temperatures, vibration and shock)



# Key application: Shelters

(Makes use of RFoF, GPSoF and LANoF)

Shelter connectivity perfectly illustrates the benefits of an RF-over-Fiber system. Highly mobile and deployed in harsh environments, connectivity as well as the safety of the control center are key elements of RF-over-Fiber within an antenna remoting system.

The use of FO cables, within a traditional RF system, makes it possible to position the shelters far away from the antennas, while ensuring that the links between the antennas and the shelter remain secure.

The use of FO cables also supports the mobility of the application by reducing the cable footprint as well as light-weighting the solution. This dramatically simplifies and speeds up the installation and maintenance of the system. The use of HUBER+SUHNER's RADOX® technology ensures superior performance in harsh environments. Immunity to EMI, EMP and RFI provide the important finishing touches to this high performing and secure system solution.

In addition to the RF-over-Fiber solution, HUBER+SUHNER offers any additional connectivity requirements within a shelter. Our antennas, lightning protectors and military qualified cable assemblies are well-known and widely used in defense applications worldwide.

## Key benefits

- |                      |   |
|----------------------|---|
| • Safety             | Enables greater distances between the shelter personnel and the RF equipment. |
| • Security           | Immune to EMI and RFI. Lower risk of interception.                            |
| • Better performance | Greater distances covered with very low loss.                                 |
| • Ruggedized         | Designed for use in harsh environments.                                       |
| • Mobility           | Light-weighting and reduction of cable footprint enable rapid deployment.     |



# Key application: Vehicles

(Makes use of GPSoF and LANoF)

RF-over-Fiber is creating new opportunities for cabled solutions within vehicle applications. Highly mobile and exposed to challenging environments, the RF-over-Fiber series is paving the way for the next generation of end-to-end connectivity solutions in this application landscape.

GPS-over-Fiber enables a single GPS signal to be distributed into multiple receiver systems. The small form factor adds significant value within the vehicle with both the conversion modules and FO cable designed to use as little space as possible, while eliminating all forms of (EM and RF) interference.

LAN-over-Fiber facilitates vehicle identification as well as data and software synchronization for vehicles that are deployed in the field. This new "field LAN" capability, based on a ruggedized gigabit FO network is changing the way that media and data is being shared in operations.

## Key benefits

- |                      |  |
|----------------------|--|
| • Mobility           | Reduction of cable footprint enables rapid deployment.             |
| • Form factor        | Small modules and cables ensure easy integration.                  |
| • Better performance | "Field LAN" is a game changer. GPS signal distribution is smarter. |
| • Security           | Immune to EMI/RFI. Lower risk of interception.                     |
| • Ruggedized         | Designed for use in harsh environments.                            |



# Key application: SATCOM

(Makes use of RFoF and LANoF)

In SATCOM applications, RF-over-Fiber enables communication between satellites and control centers. The communication link is created by connecting the antenna to the control center. RF-over-Fiber supports both fixed earth installations as well as mobile applications.

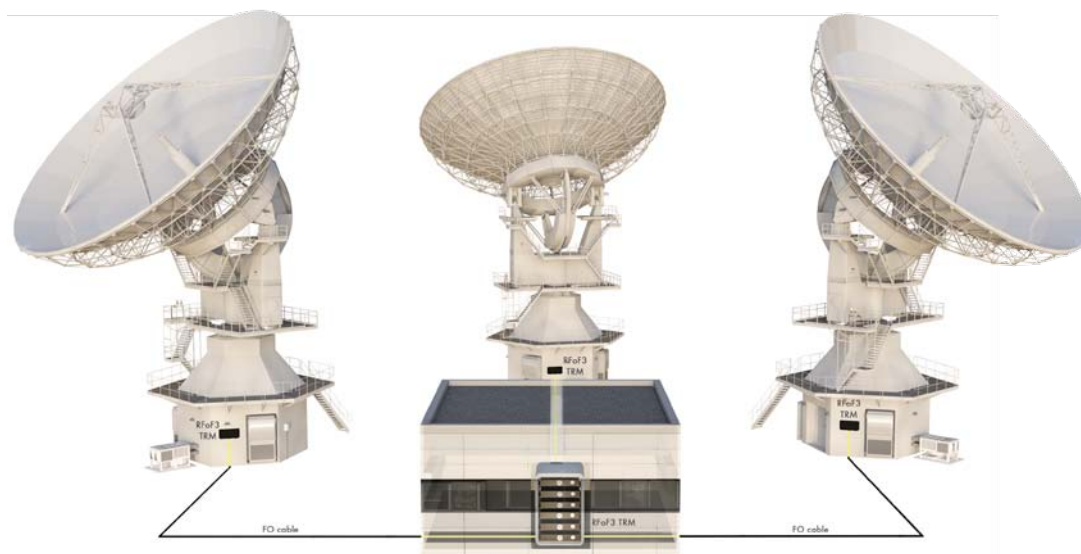
Broad frequency ranges, excellent performance and security are critical aspects that are perfectly addressed by HUBER+SUHNER's RF-over-Fiber products. With single modules that cover the all intermediate frequency (IF) signals as well as the L, S and C bands, HUBER+SUHNER not only meets the frequency range requirements in SATCOM, but also has low noise modules in its portfolio that can be used in noise-sensitive applications. The low noise modules offer a 50 % lower noise figure, from 15 dB to 7 dB (IF signals).

Excellent performance and the security of the SATCOM links are further supported by immunity to EMI, RFI and EMP.

The use of LAN-over-Fiber is growing within the SATCOM applications landscape. Ethernet connectivity for VOIP, VPN connectivity and other data network services are easily integrated into both fixed and mobile infrastructures. Gigabit LAN modules ensure the future-proofing of all SATCOM applications.

## Key benefits

- **Security** Immune to EMI and RFI. Lower risk of interception.
- **Better performance** Greater distances covered, immune to EMP and very low loss.
- **Mobility** Less cable and weight supports rapid deployment in mobile applications.
- **Efficient** Faster and simplified installation and maintenance (key in mobile applications – SNG and VSAT)



# Key application: Aircraft

(Makes use of RFoF)

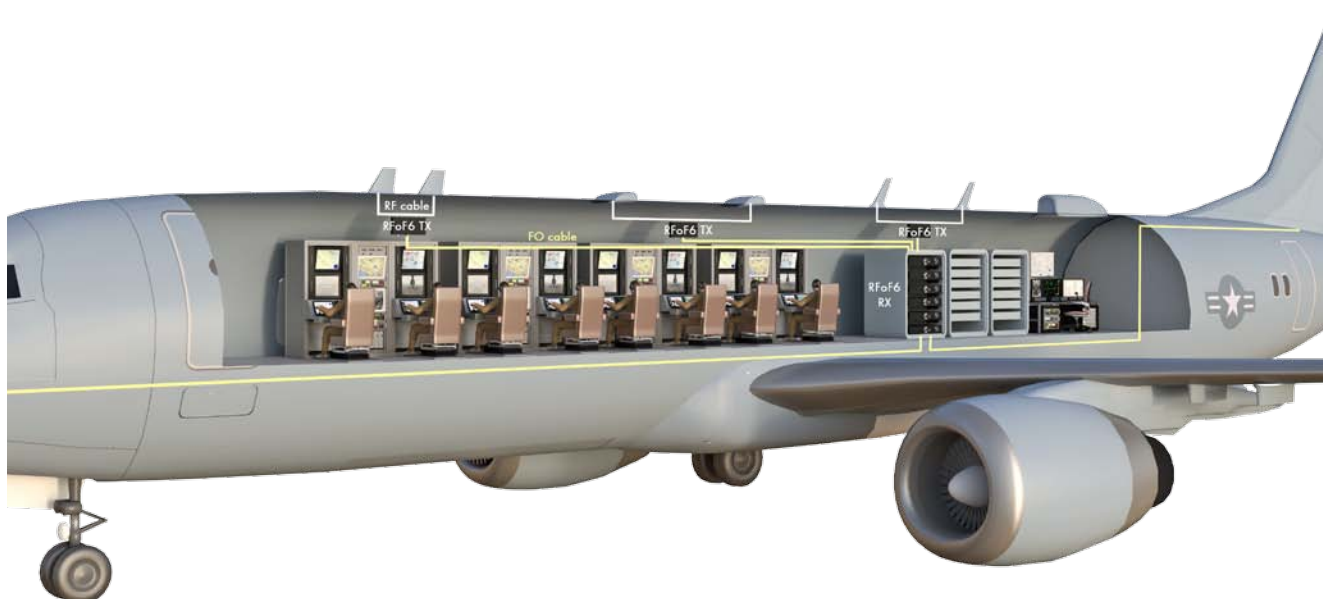
The integration of RF-over-Fiber solutions within airframe applications is growing rapidly. High density RF connectivity and light-weighting are key elements that are optimally addressed by RF-over-Fiber. Often requiring dozens of RF connections between various sensors, antennas and systems, the HUBER+SUHNER RF-over-Fiber products provide flexibility by ensuring that the solution is easily scalable.

For example, the use of five 12 port modules easily covers the requirement of 50 RF connections; and providing reserve capacity for future connectivity increases. The use of five modules means that only five cables are required to cover the entire connectivity demand. This not only significantly decreases the overall cable footprint, but allows for meaningful weight reduction within the aircraft.

The light-weighting of the connectivity solution while retaining optimal performance, allows for the weight to be used elsewhere else in the aircraft or for the total weight of the aircraft to be reduced. The reduction of the weight of the aircraft offers better fuel efficiency, which can either save costs or provides the capability to extend the time and range of a mission.

## Key benefits

- |                      |   |
|----------------------|---|
| • Scalability        | Perfect for applications requiring a high density of RF connectivity. |
| • Better performance | Significantly less loss.  |
| • Efficient          | Less cable means faster and easier installation and maintenance.      |
| • Lightweight        | Saves costs or allows for weight re-distribution.                     |
| • Security           | Immune to EMI and RFI.  |
| • Ruggedized         | Designed for use in airborne conditions.                              |





# Key application: Naval Vessels

(Makes use of RFoF, GPSoF and LANoF)

"A city on the sea", naval applications have both a requirement for intra-vessel communication and networking systems; as well as mission-relevant systems.

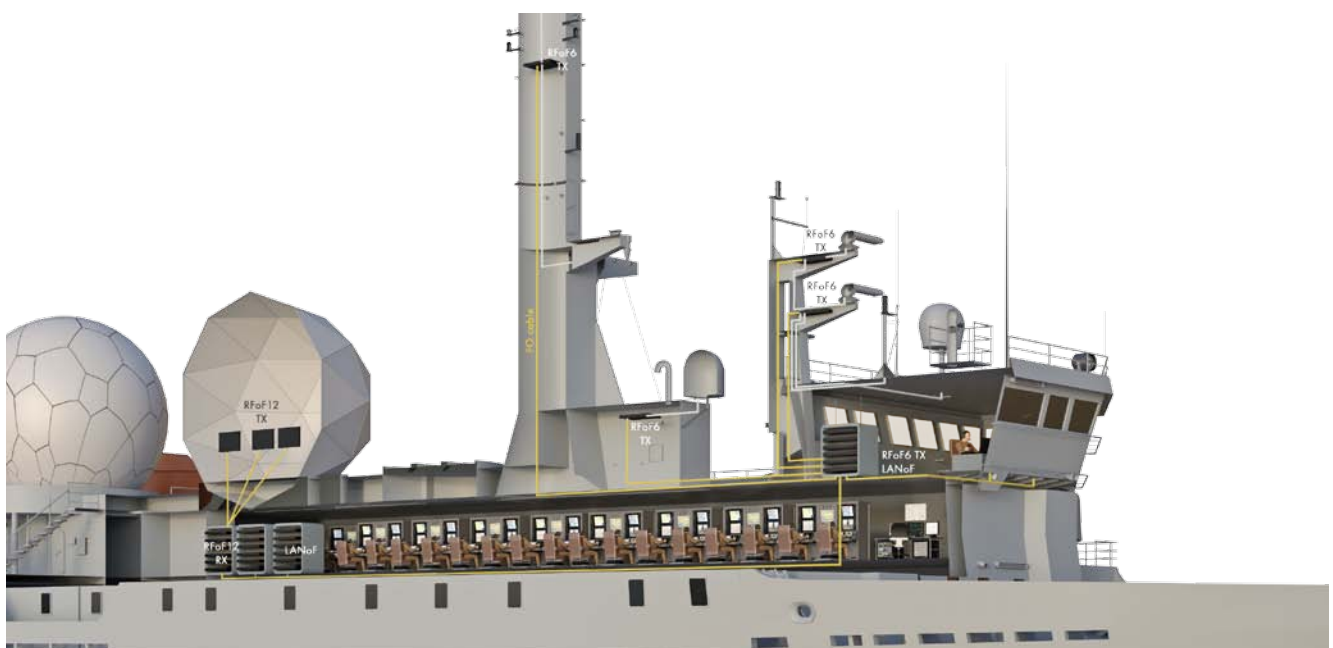
The density of connectivity as well as the distances between the RF equipment and the receiver systems, make the RF-over-Fiber series ideal for naval applications.

The easily scalable RF-over-Fiber products ensure that the RF density requirements are met, while still reducing the overall cable footprint on the vessel. The broad frequency range also ensures that the RF-over-Fiber modules can be used for navigation, INMARSAT, COMINT, ELINT and other antenna systems.

The use of LAN-over-Fiber provides a ruggedized Gigabit FO network on the vessel.

## Key benefits

- |               |   |
|---------------|---|
| • Scalability | Perfect for applications requiring a high density of RF connectivity. |
| • Utility     | Covers both internal and mission-relevant systems.                    |
| • Efficient   | Less cable means faster and easier installation and maintenance.      |
| • Security    | Immune to EMI and RFI.  |
| • Ruggedized  | Designed for use in harsh environments.                               |





## System solutions

### System products

With the market rapidly moving to **combine technologies and to increase connectivity density**, our growing system product portfolios provide the bridges for the delivery of end-to-end solutions.

### Services

HUBER+SUHNER's **global supply chain network and engineering footprint** enables us to provide our customers with a one-stop-stop for their service needs. Our servicing offering includes kitting, painted antennas, sourcing, project management and other value-adding services.

### Sub-systems

**Excellence in engineering and manufacturing** provides the basis for delivering added value to our customers within the sub-systems area. HUBER+SUHNER is **perfectly positioned to deliver hybrid, multi-product and build-to-print solutions**.

### Systems

The nature of systems developments and Implementations requires global **project excellence** along with a focus on delivering solutions instead of components. Our **turn-key solution approach** (which combines project management, solution design capabilities and high performing products) is a key differentiator in this fast-growing area of our business.

# System solutions – examples



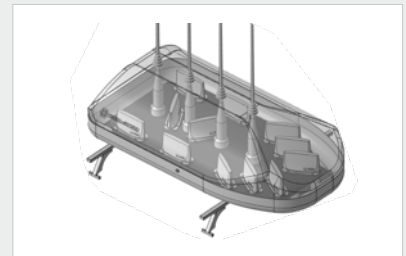
## Cable solutions

With radio frequency, low frequency and fiber optic technologies all core competencies of HUBER+SUHNER, we are able to provide a host of harnessing and hybrid assembly cable solutions.



## Antenna systems

HUBER+SUHNER's extensive range of antennas provides an ideal platform for delivering best-in-class communication and jamming systems. Flexible configuration options that include systems-level testing provide the finishing touches to this fast-growing offering.



## Box builds/mechanical integration

Mechanical integration is a key part of applications that have limited space and that are built into customer-specific sub-systems. HUBER+SUHNER's box build offers additional value by streamlining the integration process, while ensuring superior quality and performance.

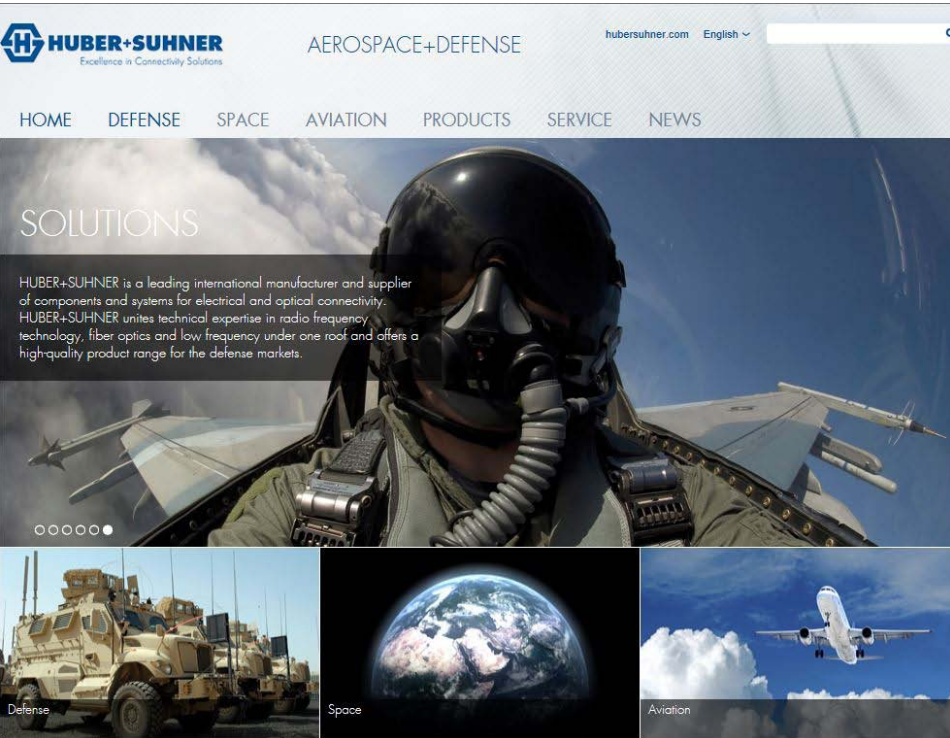


## End-to-end connectivity solutions

Command and control centers require a host of military-grade RF components. HUBER+SUHNER's defense portfolio covers all of the products required for an end-to-end connectivity solution. These include connectors, EMPs, antennas, cable assemblies as well as a host of interface panes, racks and junction boxes.



# Aerospace+Defense Microsite



[aerospacedefense.hubersuhner.com](http://aerospacedefense.hubersuhner.com)



# EMP Calculation Tool



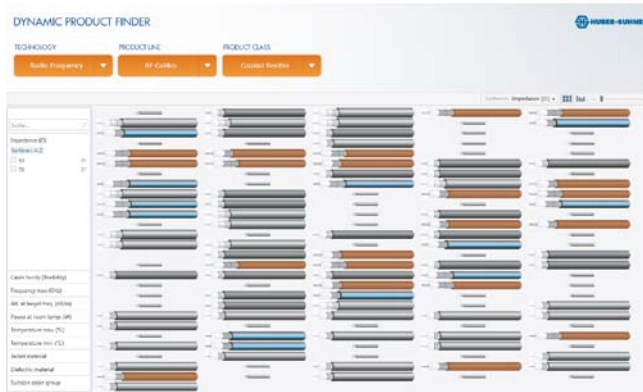
The EMP Protector Tool Box will help you to select the right protector for your specific applications. Furthermore, it allows you to calculate the correct gas capsule size for the GDT series and gives you guidance on the interface power handling capabilities.

[rfcablecalc.hubersuhner.com](http://rfcablecalc.hubersuhner.com)



# Product selection guides

## 1. EVALUATE with our product finder



By using our "product finder" please choose the suitable cable, connector, adaptor, EMP or antenna. You will find this utility on our homepage or with following link:

[products.hubersuhner.com](https://products.hubersuhner.com)

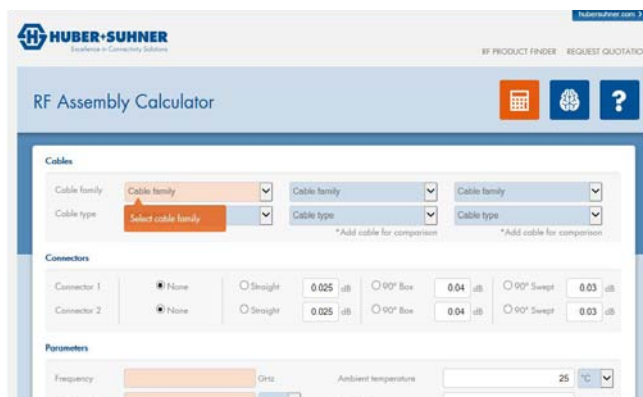
## 2. CONFIGURE with the assembly configurator



By using the "RF assembly configurator" you can define the suitable assembly. You will find this utility on our homepage or with following link:

[rfwebpcf.hubersuhner.com](https://rfwebpcf.hubersuhner.com)

## 3. CALCULATE with the assembly calculator



Define the suitable assembly by using the "RF assembly calculator". You will find this utility on our homepage or with following link:

[fcablecalc.hubersuhner.com](https://fcablecalc.hubersuhner.com)



# RF cable selection guide (US)

Cable type	Outer diameter (inch)	Frequency range (GHz)	VOP (%)	Typ. insertion loss (dB/ft)						CW power (W)		Min. temperature (°C)	Max. temperature (°C)	Min. bending radius (static) (inch)	Weight (lbs/ft)	Dynamic applications	Qualified acc. MIL	Halogen free	Armoring	38999 suitable cable	Cable assembly only
				@ 3 GHz	@ 6 GHz	@ 18 GHz	@ 40 GHz	@ 50 GHz	@ 60 GHz	@ 1 GHz sea level / 25 °C	@ 18 GHz sea level / 25 °C										
SUCOFLEX 101	0.14	50	77	0.259	0.372	0.668	1.036	1.177		337	79	-55	125	0.43	0.024		•		•		•
SUCOFLEX 101 P	0.14	50	77	0.366	0.530	0.994	1.603	1.844		313	74	-55	125	0.43	0.022	•	•		•		•
SUCOFLEX 101 PE	0.14	50	77	0.366	0.530	0.994	1.603	1.844		67	16	-40	85	0.43	0.020	•	•		•		•
SUCOFLEX 102	0.16	46	77	0.223	0.320	0.570	0.881			448	112	-55	125	0.47	0.027				•		•
SUCOFLEX 102 I	0.16	46	77	0.223	0.320	0.570	0.881			273	64	-40	85	0.47	0.024		•	*		•	•
SUCOFLEX 102 D	0.18	46	77	0.223	0.320	0.570	0.881			448	112	-55	125	0.59	0.030		•		•	•	•
SUCOFLEX 103	0.18	33	77	0.174	0.247	0.448				700	165	-55	125	0.51	0.036		•		•	•	•
SUCOFLEX 103 I	0.19	33	77	0.174	0.247	0.448				410	97	-40	85	0.51	0.036		•	*		•	•
SUCOFLEX 103 D	0.20	33	77	0.174	0.247	0.448				700	165	-55	125	0.79	0.042		•		•	•	•
SUCOFLEX 104	0.22	26.5	77	0.140	0.204	0.369				1032	243	-55	125	0.63	0.048		•		•	•	•
SUCOFLEX 104 I	0.26	26.5	77	0.140	0.204	0.369				683	161	-40	85	0.63	0.055		•	*		•	•
SUCOFLEX 104 D	0.24	26.5	77	0.140	0.204	0.369				1032	243	-55	125	0.79	0.050		•		•	•	•
SUCOFLEX 126	0.22	26.5	77	0.140	0.204	0.369				1032	243	-55	125	0.63	0.047	•	•		•		•
SUCOFLEX 126E	0.22	26.5	77	0.140	0.204	0.369				683	161	-40	85	0.63	0.044	•	•		•		•
SUCOFLEX 106	0.31	18	77	0.094	0.140	0.259				1812	427	-55	125	0.94	0.105		•		•		•
SUCOFLEX 106 I	0.32	18	77	0.094	0.140	0.259				793	187	-40	85	0.94	0.096		•	*		•	•
SUCOFLEX 106 D	0.33	18	77	0.094	0.140	0.259				1812	427	-55	125	0.94	0.117		•		•		•
SUCOFLEX 106 P	0.31	18	77	0.137	0.210	0.427				1574	371	-55	125	0.94	0.106	•	•		•		•
SUCOFLEX 229	0.20	29	82	0.134	0.192	0.344				1206	284	-55	165	0.90	0.041	•	•		•	•	•
SUCOFLEX 240	0.16	40	82	0.201	0.287	0.509	0.780			682	161	-55	165	0.33	0.021	•	•		•		•
SUCOFLEX 301	0.14	18	77	0.259	0.372	0.668				131	31	-55	125	0.59	0.106		•		•		•
SUCOFLEX 302 D	0.17	40	77	0.253	0.363	0.646	1.003			448	106	-55	125	0.59	0.022		•		•		•
SUCOFLEX 304 D	0.23	18	77	0.158	0.226	0.405				1032	244	-55	125	1.18	0.038		•		•		•
SUCOFLEX 307	0.35	8.0	77	0.085	0.122					1821	-	-55	150	2.95	0.098		•		•		•
SUCOFLEX 329	0.20	29	82	0.134	0.192	0.344				1206	284	-65	150	0.91	0.028		•				•
SUCOFLEX 340	0.16	40	82	0.201	0.287	0.509	0.780			682	161	-65	150	0.33	0.019		•				•
SUCOFLEX 404	0.22	26.5	89	0.119	0.171	0.311				967	228	-55	125	0.98	0.048		•			•	•
SUCOFLEX 404 D	0.24	26.5	89	0.119	0.171	0.311				967	228	-55	125	1.18	0.055		•		•	•	•
SUCOFLEX 406	0.33	18	89	0.076	0.110	0.204				1890	445	-55	125	1.18	0.097		•		•		•
SUCOFLEX 406 D	0.34	18	89	0.076	0.110	0.204				1890	445	-55	125	1.57	0.104		•		•		•
Eacon 2C	0.15	18	77	0.223	0.320	0.570				395	93	-55	200	0.47	0.026		•		•		
Eacon 4C	0.21	18	77	0.140	0.204	0.369				1032	244	-55	200	0.59	0.048		•		•		
Eacon 6C	0.32	18	77	0.094	0.140	0.259				1582	373	-55	200	0.94	0.096		•		•		
Microbend	0.08	90	70.3	0.669	0.958	1.717	2.648	2.999	3.625	111	26	-55	200	0.06	0.008		•				•
Microbend L	0.08	85	76	0.493	0.700	1.227	1.859	2.087	2.298	-	-	-55	200	0.20	0.010		-				-
Minibend	0.10	65	70.3	0.442	0.640	1.159	1.822	2.047	2.308	173	41	-55	200	0.20	0.010		•				•
Minibend L	0.11	50	76	0.367	0.520	0.918	1.394	1.567		288	68	-55	200	0.20	0.011		•				•
Mini 141	0.14	40	76.3	0.213	0.305	0.549	0.823			590	139	-55	200	0.33	0.021		•				•
Everflex 32084	0.08	40	76	0.598	0.782	1.428	2.108			192	45	-55	200	**	0.007	•	•				•
Multiflex 53	0.07	67	71	0.637	0.917	1.670	2.630	3.165	3.528	34	8	-65	165	**	0.013	•					•
Multiflex 86	0.10	40	71	0.427	0.619	1.143	1.823			159	38	-65	165	0.25	0.014					•	
Multiflex 141	0.16	33	71	0.247	0.363	0.701				424	100	-65	165	0.39	0.030					•	
Sucoform 86	0.08	40	71	0.405	0.597	1.137	1.871			184	43	-65	165	0.24	0.010						
Sucoform 141	0.14	33	71	0.247	0.372	0.747				484	114	-65	165	0.31	0.025						
Semi-rigid 47	0.05	67	69.5	0.658	0.948	1.744	2.778	3.179	3.549	36	9	-40	100	0.13	0.005						
Semi-rigid 86	0.09	67	69.5	0.384	0.568	1.084	1.795	2.080	2.349	148	35	-40	125	0.13	0.015						
Semi-rigid 118	0.12	40	80	0.231	0.333	0.598	0.924			680	160	-40	125	0.38	0.021						
Semi-rigid 141	0.14	33	69.5	0.250	0.381	0.768				512	121	-40	125	0.25	0.035						
Semi-rigid 250	0.25	18	69.5	0.162	0.253	0.549				1593	376	-40	90	0.37	0.106						
Enviroflex_178	0.07	3	71	1.033						67	-	-40	105	0.2	0.004			•			
Enviroflex_178_D	0.10	6	70	1.033	1.582					67	-	-40	105	0.2	0.008			•			
Enviroflex_316	0.10	3	71	0.622						100	-	-40	105	0.2	0.011			•			
Enviroflex_316_D	0.12	6	70	0.585	0.930					122	-	-40	105	0.2	0.014			•			
Enviroflex_400	0.20	6	70	0.369	0.564					250	-	-40	105	0.39	0.040			•			
Enviroflex_142	0.20	6	71	0.360	0.570					250	-	-40	105	0.98	0.040			•			
Enviroflex_393	0.40	6	71	0.213	0.372					550	-	-40	105	1.18	0.121			•			
Spuma_240-HT	0.20	6	76	0.156	0.340					410	-	-55	150	0.99	0.040						
Spuma_400-HT	0.37	6	76	0.088	0.122					1000	-	-55	150	1.75	0.101						
Spuma_600-HT	0.56	6	76	0.058	0.085					2111	-	-55	150	2.75	0.210						
Spuma_195/-FR	0.19	6	80	0.232	0.335					178	-	-40	85	0.49	0.020			•			
Spuma_240/-FR	0.24	6	84	0.155	0.229					288	-	-40	85	0.75	0.034			•			
Spuma_400/-FR	0.40	6	85	0.079	0.118					667	-	-40	85	0.98	0.063			•			
Spuma_500/-FR	0.50	6	86	0.064	0.096					833	-	-40	85	1.34	0.120			•			
Spuma_600	0.59	6	85	0.055	0.079					1033	-	-40	85	1.5	0.134						

\* ISFH only on jacket/dielectric contains fluor (PTFE)

\*\* please ask our local sales rep for additional information

RF cable selection guide (metric)

Cable type	Outer diameter (mm)	Frequency range (GHz)	VOP (%)	Typ. insertion loss (dB/m)						CW power (W)		Min. temperature (°C)	Max. temperature (°C)	Min. bending radius (static) (mm)	Weight (g/m)	Dynamic applications	Qualified acc. MIL	Halogen free	Armoring	38999 suitable cable	Cable assembly only
				@ 3 GHz	@ 6 GHz	@ 18 GHz	@ 40 GHz	@ 50 GHz	@ 60 GHz	@ 1 GHz sea level / 25 °C	@ 18 GHz sea level / 25 °C										
SUCOFLEX 101	3.7	50	77	0.77	1.10	1.99	3.09	3.51		337	79	-55	125	11	36		•		•		•
SUCOFLEX 101 P	3.7	50	77	1.08	1.58	2.96	4.78	5.50		313	74	-55	125	11	33	•	•		•		•
SUCOFLEX 101 PE	3.7	50	77	1.08	1.58	2.96	4.78	5.50		67	16	-40	85	11	30	•	•		•		•
SUCOFLEX 102	4.0	46	77	0.66	0.95	1.70	2.62			448	112	-55	125	12	40		•		•	•	•
SUCOFLEX 102 I	4.0	46	77	0.66	0.95	1.70	2.62			273	64	-40	85	12	36		•	*		•	•
SUCOFLEX 102 D	4.6	46	77	0.66	0.95	1.70	2.62			448	112	-55	125	15	45		•		•	•	•
SUCOFLEX 103	4.6	33	77	0.51	0.74	1.33				700	165	-55	125	13	53		•		•	•	•
SUCOFLEX 103 I	4.8	33	77	0.51	0.74	1.33				410	97	-40	85	13	53		•	*		•	•
SUCOFLEX 103 D	5.1	33	77	0.51	0.74	1.33				700	165	-55	125	20	63		•		•	•	•
SUCOFLEX 104	5.5	26.5	77	0.42	0.60	1.10				1032	243	-55	125	16	73		•		•	•	•
SUCOFLEX 104 I	6.6	26.5	77	0.42	0.60	1.10				683	161	-40	85	16	82		•	*		•	•
SUCOFLEX 104 D	6.1	26.5	77	0.42	0.60	1.10				1032	243	-55	125	20	96		•		•	•	•
SUCOFLEX 126	5.5	26.5	77	0.42	0.60	1.10				1032	243	-55	125	16	70	•	•		•		•
SUCOFLEX 126E	5.5	26.5	77	0.42	0.60	1.10				683	161	-40	85	16	66	•	•		•		•
SUCOFLEX 106	7.9	18	77	0.28	0.41	0.76				1812	427	-55	125	24	142		•		•		•
SUCOFLEX 106 I	8.2	18	77	0.28	0.41	0.76				793	187	-40	85	24	144		•	*			•
SUCOFLEX 106 D	8.3	18	77	0.28	0.41	0.76				1812	427	-55	125	26	175		•		•		•
SUCOFLEX 106 P	7.9	18	77	0.36	0.54	1.06				1574	371	-55	125	24	137	•	•		•		•
SUCOFLEX 229	5.1	29	82	0.41	0.59	1.06				1206	284	-55	165	23	61	•	•		•	•	•
SUCOFLEX 240	4.1	40	82	0.63	0.90	1.61	2.47			682	161	-55	165	8.4	31	•	•		•		•
SUCOFLEX 301	3.5	18	77	0.77	1.10	1.99				131	31	-55	125	15	23.9		•				•
SUCOFLEX 302 D	4.3	40	77	0.66	0.95	1.70	2.62			448	106	-55	125	15	31		•		•		•
SUCOFLEX 304 D	6.0	18	77	0.42	0.60	1.10				1032	244	-55	125	20	56		•		•		•
SUCOFLEX 307	9.0	8.0	77	0.25	0.36	-				1821	-	-55	150	50	133		•				•
SUCOFLEX 329	5.1	29	82	0.41	0.59	1.06				1206	284	-65	150	23	40		•				•
SUCOFLEX 340	4.2	40	82	0.63	0.90	1.61	2.47			682	161	-65	150	8.4	27		•				•
SUCOFLEX 404	5.5	26.5	89	0.38	0.54	0.99				967	228	-55	125	25	72		•		•	•	•
SUCOFLEX 404 D	6.1	26.5	89	0.38	0.54	0.99				967	228	-55	125	30	82		•		•	•	•
SUCOFLEX 406	8.3	18	89	0.23	0.33	0.61				1890	445	-55	125	30	145		•		•		•
SUCOFLEX 406 D	8.8	18	89	0.23	0.33	0.61				1890	445	-55	125	40	155		•		•		•
Eacon 2C	3.8	18	77	0.66	0.95	1.70				395	93	-55	200	12	39		•		•		
Eacon 4C	5.5	18	77	0.42	0.60	1.10				1032	244	-55	200	16	73		•		•		
Eacon 6C	7.7	18	77	0.28	0.41	0.76				1582	373	-55	200	24	148		•		•		
Microbend	2.0	90	70.3	1.97	2.82	5.05	7.79	8.82	9.78	111	26	-55	200	1.50	11.9		•				•
Microbend L	2.0	85	76	1.45	2.06	3.61	5.47	6.14	6.76	-	-	-55	200	-	-		-				-
Minibend	2.5	65	70.3	1.30	1.88	3.41	5.36	6.10	6.79	173	41	-55	200	5.08	14.9		•				•
Minibend L	2.7	50	76	1.08	1.53	2.70	4.10	4.61		288	68	-55	200	6.4	16.4		•				•
Mini 141	3.7	40	76.3	0.67	0.95	1.70	2.61			590	139	-55	200	8.4	31.3		•				•
Everflex 32084	2.4	40	76	1.76	2.30	4.20	6.20			192	45	-55	200	**	10.4	•	•				•
Multiflex 53	1.74	67	71	1.98	2.86	5.20	8.17	9.31	10.37	34	8	-65	165	**	8.5	•					•
Multiflex 86	2.7	40	71	1.32	1.92	3.55	5.67			159	38	-65	165	6	21					•	
Multiflex 141	4.2	33	71	0.73	1.08	2.09				424	100	-65	165	10	45					•	
Sucoform 86	2.1	40	71	1.21	1.78	3.39	5.57			184	43	-65	165	6	15						
Sucoform 141	3.6	33	71	0.73	1.11	2.23				484	114	-65	165	8	38						
Semi-rigid 47	1.2	67	69.5	1.92	2.79	5.13	8.17	9.35	10.44	36	9	-40	100	3.18	7.1						
Semi-rigid 86	2.2	67	69.5	1.13	1.67	3.19	5.28	6.12	6.91	148	35	-40	125	3.18	24						
Semi-rigid 118	3.0	40	80	0.68	0.98	1.76	2.72			680	160	-40	125	9.53	34						
Semi-rigid 141	3.6	33	69.5	0.68	1.04	2.09				512	121	-40	125	6.35	52						
Semi-rigid 250	6.4	18	69.5	0.44	0.69	1.50				1593	376	-40	90	19	158						
Enviroflex_178	1.84	3	71	3.11	-					67	-	-40	105	5	6.5			•			
Enviroflex_178_D	2.45	6	70	3.08	4.72					67	-	-40	105	5	11.2			•			
Enviroflex_316	2.54	3	71	1.86	-					100	-	-40	105	5	16			•			
Enviroflex_316_D	3.16	6	70	1.52	2.27					122	-	-40	105	5	21			•			
Enviroflex_400	5.00	6	70	1.12	1.84					250	-	-40	105	10	60			•			
Enviroflex_142	5.00	6	71	1.06	1.75					250	-	-40	105	30	60			•			
Enviroflex_393	10.05	6	71	0.64	1.11					550	-	-40	105	30	180			•			
Spuma_240-HT	5.21	6	76	0.46	0.66					410	-	-55	150	25.4	60						
Spuma_400-HT	9.40	6	76	0.26	0.36					1000	-	-55	150	44.5	150						
Spuma_600-HT	14.38	6	76	0.17	0.25					2111	-	-55	150	70	310						
Spuma_195/-FR	4.95	6	80	0.70	1.02					178	-	-40	85	12.5	30			•			
Spuma_240/-FR	6.15	6	84	0.48	0.69					288	-	-40	85	19	50			•			
Spuma_400/-FR	10.25	6	85	0.24	0.35					667	-	-40	85	25	94			•			
Spuma_500/-FR	12.78	6	86	0.20	0.29					833	-	-40	85	34	178			•			
Spuma_600	14.99	6	85	0.16	0.24					1033	-	-40	85	38	200						

\* LSFH only on jacket/dielectric contains fluor (PTFE)

\*\* please ask our local sales rep for additional information





# Further documentation



Space  
Market brochure



Aviation  
Market brochure



Test+Measurement  
Market brochure



Air traffic control  
Market brochure



RF coaxial connectors  
General catalogue



Microwave cables and  
assemblies  
General catalogue



RF cables  
General catalogue



Wires + Cables  
General catalogue



Lightning protection  
General catalogue



FO cabling systems  
General catalogue



HUBER+SUHNER AG  
Degersheimerstrasse 14  
9100 Herisau  
Switzerland  
Phone +41 71 353 4111  
Fax +41 71 353 4444  
hubersuhner.com

HUBER+SUHNER Astrolab  
4 Powder Horn Drive  
Warren, New Jersey  
07059-5105 USA  
Phone +1 732-560-3800  
Fax +1 732-560-9570  
astrolab.com

HUBER+SUHNER is certified according to ISO 9001, ISO 14001, AS/EN9100, ISO/TS 16949 and IRIS.

**Waiver**

Fact and figures herein are for information only and do not represent any warranty of any kind.