

Air traffic control

Reliable and safe solutions

Edition 2019/01



Handle the most difficult routing





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Your partner for system solutions

The HUBER+SUHNER Group is a leading global supplier of components and systems for electrical and optical connectivity. We offer technical expertise in radio frequency technology, fiber optics and low frequency under one roof, thus providing a unique basis for continual innovation focused on the needs of our customers all over the world.



Air traffic control

Air traffic control (ATC) is a service provided by ground-based controllers who direct aircraft on the ground and through controlled airspace. The primary purpose of ATC systems worldwide is to separate aircraft to prevent collisions, to organise and expedite the flow of traffic, and to provide information and other support for pilots. This service can be performed using ground-based infrastructures for air traffic management and guidance, which is owned by civil aviation authorities and managed by air navigation service providers.

This infrastructure, located throughout a given country, can be either an Area Control Center (ACC), whose duty it is to harmonise each aircraft's entrance and exit in order to ensure a consistent traffic flow inside the airways, or airports, whose duty it is to give aircraft the authorisation to take off or land so that a safe distance from all other aircraft is guaranteed. HUBER+SUHNER provides a comprehensive portfolio of cables, connectors, cable assemblies and lightning protectors that meet the key requirements for connection for this market, including:

- Reliability
- Low loss
- Power handling capability
- PIM performance
- Flexibility
- Weather resistance
- On field mountability

Navigational aids

Ground to Air Communication System (G/A/G)

Communication between pilots and air traffic controllers takes place via radio equipment able to work in the frequency range 112-156 MHz (VHF Civil Comms) and/or 225-400 MHz (UHF Military Comms) with 25 kHz and/or 8.33 kHz of channel spacing. The ground installations can be composed of several transceivers which can handle more than 50 frequencies (carriers) independently. Each radio engaged by the controller can transmit a carrier with a nominal RF power of 50 W modulated in analogue or digital mode. For reliability and safety, the system is usually as redundant as possible, meaning that a large number of radios may be needed even for a small airport.

VHF Omnidirectional Radio (VOR)

The VHF Omnidirectional Radio or VOR is a type of short-range radio navigation system for aircraft. It enables aircraft to determine their position and stay on course by receiving radio signals in the frequency range 108-117.950 MHz which are transmitted by a network of fixed ground radio beacons. It represents a modern alternative to NDBs. Unlike NDBs, the VOR transmits two signals: the ground station sends out a master signal, and a highly directional second signal which varies in phase 30 times a second compared to the master.

Marker Beacon (MB)

A Marker Beacon is a particular type of VHF radio beacon used in aviation, usually in conjunction with an Instrument Landing System (ILS), to give pilots a means to determine their position along an established route to a destination, such as a runway. It is situated on the same course/track as the localizer and the runway centreline, 4 to 7 nautical miles before the runway threshold, and transmits a carrier at 75 MHz.

Instrument Landing System (ILS)

The Instrument Landing System consists of two independent sub-systems, one providing lateral guidance (Localizer - LOC) and the other vertical guidance (Glide Slope or Glide Path - GP) to the aircraft that are approaching a runway. In both cases, two different RF signals are transmitted modulated at 90 Hz and 150 Hz respectively. The LOC is normally located beyond the departure end of the runway and generally consists of several pairs of directional antennas working in the frequency range 108.10-111.95 MHz, while the GP is an antenna array situated to one side of the runway touchdown zone and working in the frequency range of 328.6-335.4 MHz.

DME

The Distance Measuring Equipment is a transponder-based radio navigation technology that measures slant range distance by timing the propagation delay of RF radio signals. DME is typically co-located with VORs and its functionality is similar to secondary radars, except in reverse. DME transponders transmit on a channel in the 962-1213 MHz range and receive on a corresponding channel between 1025-1150 MHz.

Non-Directional Beacon (NDB)

A Non-Directional (radio) Beacon is a radio transmitter at a known location. It is used as an aviation or marine navigational aid. The NDB transmits as its identification signal a morse code in the long/medium wave frequency range (190-1750 kHz) in all directions. Due to its operative frequency range, NDB signals follow the curvature of the earth, so they can be received at much greater distances at lower altitudes. The pilot can evaluate his actual position by means of the on-board Automatic Direction Finder (ADF).

1 Ground to Air Communication System (G/A/G)

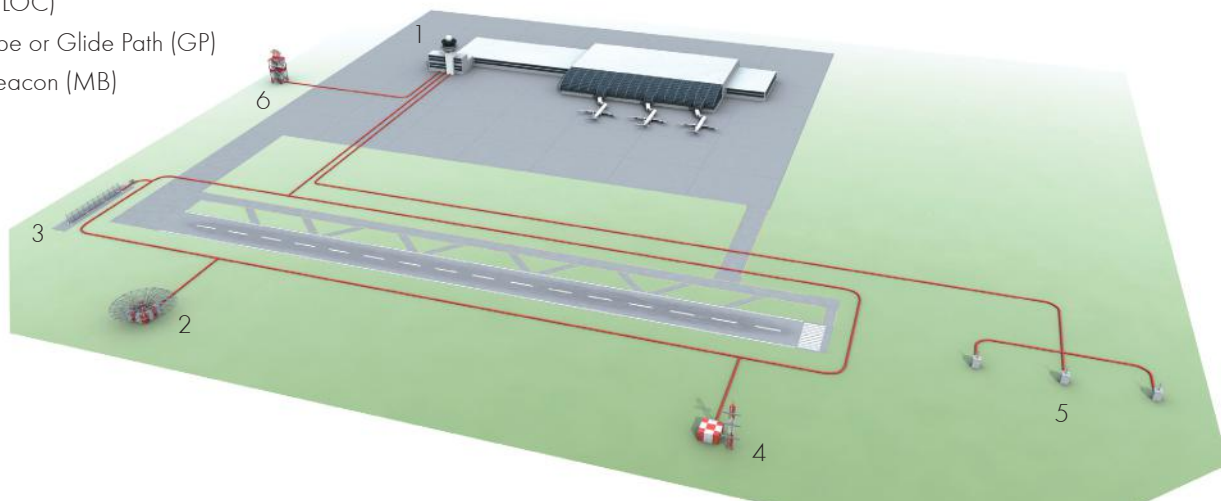
2 VHF Omnidirectional Radio (VOR)

3 Localizer (LOC)

4 Glide Slope or Glide Path (GP)

5 Marker Beacon (MB)

6 Radar



RF cables

HUBER+SUHNER offers a wide range of coaxial cables, developed to meet the highest standards. A balanced range of flexible coaxial cables provide 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 air traffic control applications.

Standard line: high-precision coaxial cable

Our Standard line includes RG coaxial cables to MIL standards, as well as the halogen-free alternatives of the G and GX series, which are mechanically compatible with RG in use.

While the G-series uses LSFH™ (low smoke free of halogen) jacket material, RADOX® additionally offers a higher temperature range, and maximum environmental resistance.

High precision
RG standard
Halogen-free options

	RG	G	GX
Dielectric material	PE	PE	PEX
Jacket material	PVC	LSFH™	RADOX®
Halogen free	-	✓	✓
Low smoke	-	✓	✓
Flame retardancy	-	✓✓	✓✓
Temperature range	✓	✓	✓✓
Weather resistance	✓✓	✓✓	✓✓

Outer diameter (in mm)	RG	G	GX
3	RG_174_A/U	G_02262	GX_02272
5	RG_58_C/U	G_03262-01	GX_03272
5.5	RG_223_/U	G_03262_D	GX_03272_D-06
10	RG_213_/U	-	GX_07272
11	RG_214_/U RG_214 hiflex	G_07262_D	GX_07272_D



PE	Polyethylene
SPE	Foamed polyethylene
SPEX	Foamed polyethylene, radiation cross-linked
PTFE	Polytetrafluoroethylene
PVC	Polyvinyl chloride
FEP	Fluorethylenepropylene copolymer
LSFH™	Low smoke and halogen free
RADOX®	Cross-linked jacket material

Performance line: high-temperature coaxial cable

The PTFE/FEP cables from our RG series are designed for applications at up to 200 °C and are characterised by low losses especially at high frequencies.

The cables in the ENVIROFLEX® family do not contain fluorine plastics either 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	✓✓✓	✓✓

Outer diameter (in mm)	RG	G
2	RG_178_B/U K_01252_D	EF_178 EF_178_D
3	RG_316_/U K_02252_D	EF_316 EF_316_D
5	RG_400_/U	EF_400
5	RG_142_B/U	EF_142
10	RG_393_/U	EF_393

Temperature range
High performance
RG standard



Foam line: flexible, low-loss cable

The 3 product series SPUMA, S and SX provide lowest attenuation, high flexibility and optimal shielding. The S series with LSFH™ jacket material and the radiation cross-linked SX series with the RADOX® jacket also offer extremely high flame protection.

	SPUMA	SPUMA-FR & S	SX
Dielectric material	SPE	SPE	SPEX
Jacket material	PE	LSFH™	RADOX®
Halogen free	✓	✓	✓
Low smoke	-	✓	✓
Flame retardancy	-	✓✓	✓✓
Temperature range	✓	✓	✓✓
Weather resistance	✓✓	✓✓	✓✓

Outer diameter (in mm)	SPUMA	SPUMA-FR & S	SX
3	-	S_02162_B	-
4.5	SPUMA_195	S_03262_B-61	SX_03272_B-60
6	SPUMA_240	S_04162_B-60	SX_04172_B-60
10	SPUMA_400	SPUMA_400-FR-01	-
15	SPUMA_600	-	-

Low loss
Excellent shielding
High flexibility



Standard line – high precision coaxial cables

RG series

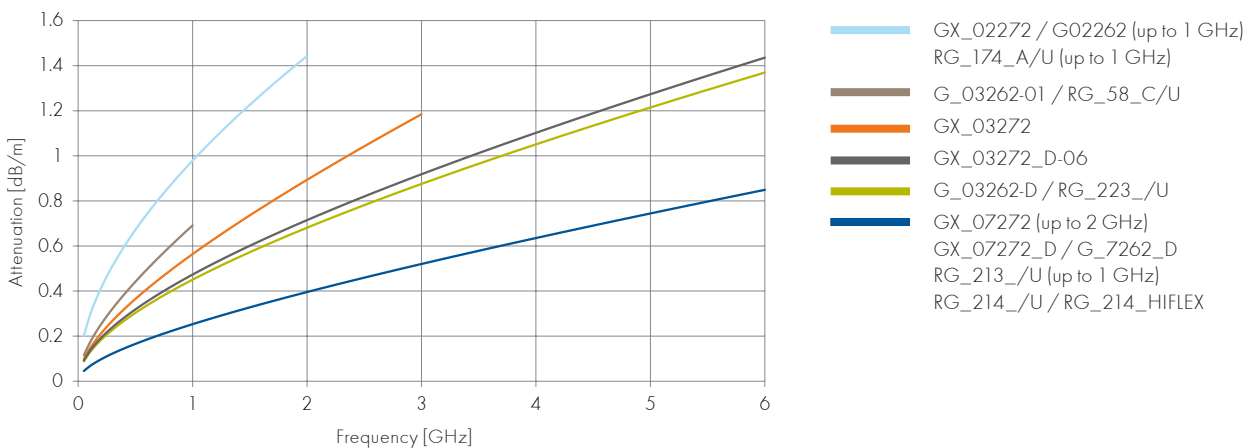
Cable type	Item no.	Impedance [Ω]	Freq. [GHz]	Inner conductor	Dielectric	Braid construction	Jacket	Diameter [mm]
RG_174_A/U	22511579	50	1	strand-07	PE	single screen	PVC	2.8
RG_58_C/U	22510015	50	1	strand-19	PE	single screen	PVC	4.95
RG_223_/U	22510072	50	6	wire	PE	double screen	PVC	5.4
RG_213_/U	22510052	50	1	strand-07	PE	single screen	PVC	10.3
RG_214_/U	22510057	50	6	strand-07	PE	double screen	PVC	10.8
RG_214_HIFLEX	22512156	50	6	strand-19	TPO	double screen	PVC	10.8

G series

Cable type	Item no.	Impedance [Ω]	Freq. [GHz]	Inner conductor	Dielectric	Braid construction	Jacket	Diameter [mm]
G_02262	22510862	50	1	strand-07	PE	single screen	LSFH™	2.8
G_03262-01	22512108	50	1	strand-19	PE	single screen	LSFH™	4.95
G_03262_D	22511812	50	6	wire	PE	double screen	LSFH™	5.4
G_07262_D	22512085	50	6	strand-07	PE	double screen	LSFH™	10.8

GX series

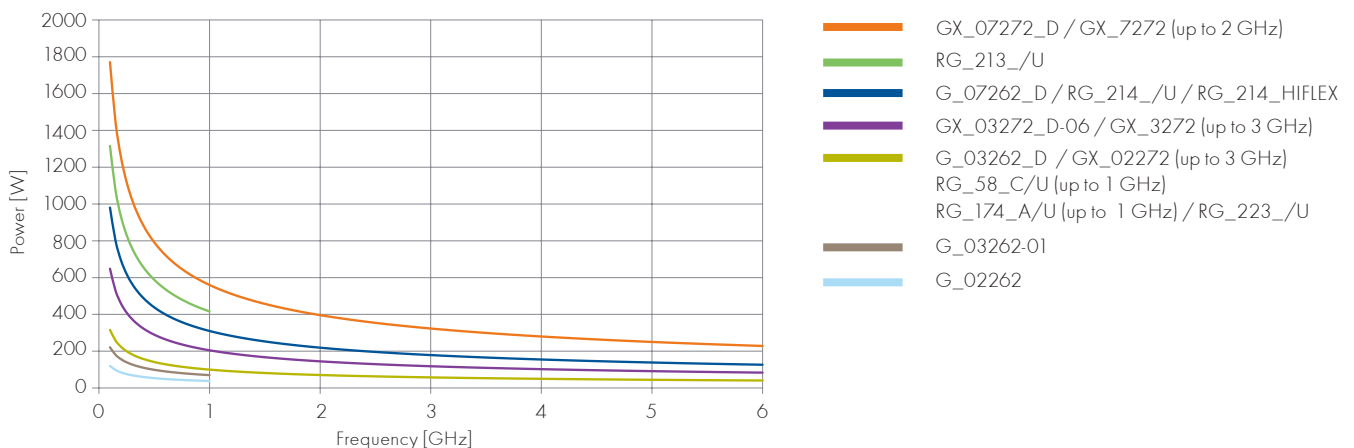
Cable type	Item no.	Impedance [Ω]	Freq. [GHz]	Inner conductor	Dielectric	Braid construction	Jacket	Diameter [mm]
GX_02272	22510833	50	2	strand-07	PEX	single screen	RADOX®	2.8
GX_03272	22510959	50	3	strand-19	PEX	single screen	RADOX®	4.95
GX_03272_D-06	22511592	50	6	wire	PEX	double screen	RADOX®	5.4
GX_07272	22510708	50	2	strand-07	PEX	single screen	RADOX®	10.3
GX_07272_D	22511171	50	6	strand-08	PEX	double screen	RADOX®	10.8



Temperature range	Attenuation @100MHz [dB/m]	Attenuation @200MHz [dB/m]	Attenuation @ 400MHz [dB/m]	Screening effectiveness	Bending static [mm]	Bending repeated [mm]	Cable group
-25 °C - +85 °C	0.26	0.38	0.55	> 40 dB (up to 1 GHz)	15	28	U2
-25 °C - +85 °C	0.17	0.25	0.38	> 38 dB (up to 1 GHz)	25	50	U7
-25 °C - +85 °C	0.13	0.18	0.27	> 85 dB (up to 1 GHz)	30	54	U9
-25 °C - +85 °C	0.06	0.08	0.12	> 40 dB (up to 1 GHz)	50	100	U29
-25 °C - +85 °C	0.07	0.10	0.15	> 71 dB (up to 1 GHz)	55	108	U32
-25 °C - +85 °C	0.07	0.10	0.14	> 70 dB (up to 1 GHz)	15	60	U32

Temperature range	Attenuation @100MHz [dB/m]	Attenuation @200MHz [dB/m]	Attenuation @ 400MHz [dB/m]	Screening effectiveness	Bending static [mm]	Bending repeated [mm]	Cable group
-40 °C - +85 °C	0.26	0.38	0.55	> 40 dB (up to 1 GHz)	15	28	U2
-40 °C - +85 °C	0.17	0.25	0.38	> 38 dB (up to 1 GHz)	25	50	U7
-40 °C - +85 °C	0.13	0.18	0.27	> 85 dB (up to 1 GHz)	30	54	U9
-40 °C - +85 °C	0.06	0.08	0.12	> 40 dB (up to 1 GHz)	50	100	U29

Temperature range	Attenuation @100MHz [dB/m]	Attenuation @200MHz [dB/m]	Attenuation @ 400MHz [dB/m]	Screening effectiveness	Bending static [mm]	Bending repeated [mm]	Cable group
-25 °C - +85 °C	0.26	0.38	0.55	> 40 dB (up to 1 GHz)	15	28	U2
-25 °C - +85 °C	0.17	0.25	0.38	> 38 dB (up to 1 GHz)	25	50	U7
-25 °C - +85 °C	0.13	0.18	0.27	> 85 dB (up to 1 GHz)	30	54	U9
-25 °C - +85 °C	0.06	0.08	0.12	> 40 dB (up to 1 GHz)	50	100	U29
-25 °C - +85 °C	0.07	0.10	0.15	> 71 dB (up to 1 GHz)	55	108	U32



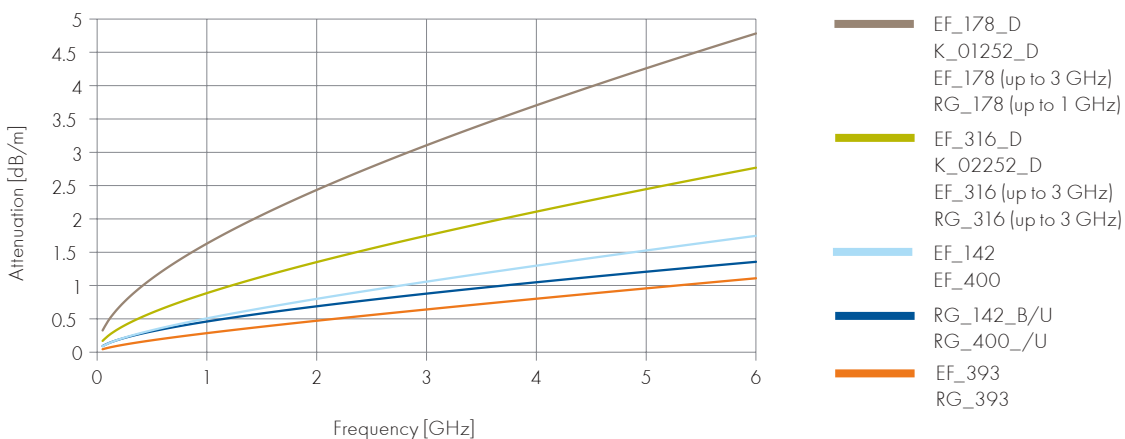
Performance line – high temperature coaxial cables

RG series

Cable type	Item no.	Impedance [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
K_01252_D	22610061	50	6	strand-07	PTFE	double screen	FEP	2.4
RG_316_/U	22510079	50	3	strand-07	PTFE	single screen	FEP	2.50
K_02252_D	22510218	50	6	strand-07	PTFE	double screen	FEP	3
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

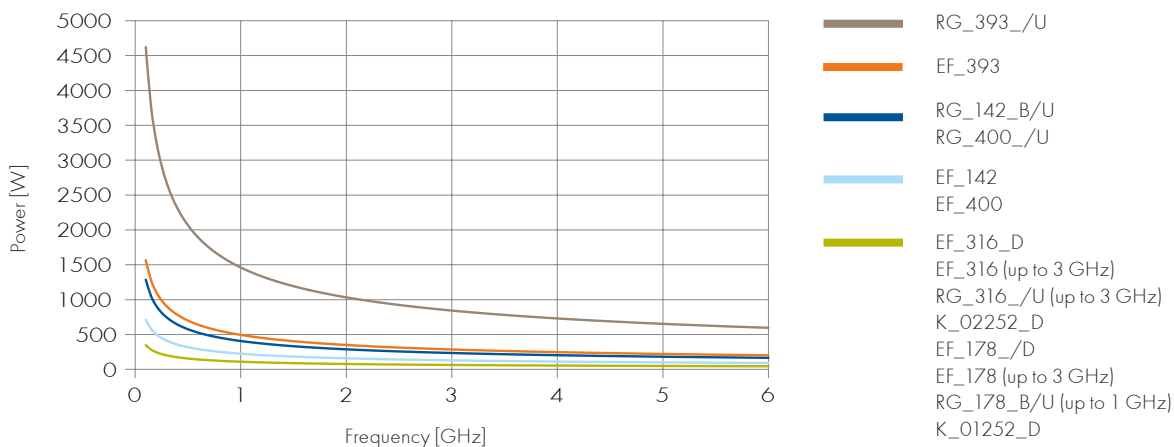
ENVIROFLEX®

Cable type	Item no.	Impedance [Ω]	Freq. [GHz]	Inner conductor	Dielectric	Braid construction	Jacket	Diameter [mm]
EF_178	23010656	50	3	strand-07	SPEX	single screen	RADOX®	1.84
EF_178_D	23030426	50	6	strand-07	SPEX	double screen	RADOX®	2.45
EF_316	23009565	50	3	strand-07	SPEX	single screen	RADOX®	2.54
EF_316_D	22512281	50	6	strand-07	SPEX	double screen	RADOX®	3.16
EF_400	22512280	50	6	strand-19	SPEX	double screen	RADOX®	5.00
EF_142	22512168	50	6	wire	SPEX	double screen	RADOX®	5.00
EF_393	22512282	50	6	strand-07	SPEX	double screen	RADOX®	10.05



Temperature range	Attenuation @100MHz [dB/m]	Attenuation @200MHz [dB/m]	Attenuation @ 400MHz [dB/m]	Screening effectiveness	Bending static [mm]	Bending repeated [mm]	Cable group
-65 °C - +165 °C	0.47	0.67	0.98	> 40 dB (up to 1 GHz)	10	18	U1
-65 °C - +165 °C	0.44	0.65	0.96	> 80dB (up to 6 GHz)	15	24	X1
-65 °C - +165 °C	0.25	0.37	0.53	> 38 dB (up to 1 GHz)	15	25	U2
-65 °C - +165 °C	0.26	0.38	0.55	> 80dB (up to 6 GHz)	18	30	U4
-65 °C - +165 °C	0.13	0.19	0.28	> 81 dB (up to 6 GHz)	30	50	U11
-65 °C - +165 °C	0.13	0.19	0.28	> 85 dB (up to 6 GHz)	30	50	U9
-65 °C - +165 °C	0.07	0.10	0.16	> 81 dB (up to 6 GHz)	60	100	U33

Temperature range	Attenuation @100MHz [dB/m]	Attenuation @200MHz [dB/m]	Attenuation @ 400MHz [dB/m]	Screening effectiveness	Bending static [mm]	Bending repeated [mm]	Cable group
-40 °C - +105 °C	0.47	0.67	0.98	> 40 dB (up to 3 GHz)	5	20	U1
-40 °C - +105 °C	0.47	0.67	0.98	> 60 dB (up to 6 GHz)	5	20	X1
-40 °C - +105 °C	0.25	0.37	0.53	> 38 dB (up to 1 GHz)	5	30	U2
-40 °C - +105 °C	0.24	0.35	0.52	> 80 dB (up to 6 GHz)	5	30	U4
-40 °C - +105 °C	0.14	0.21	0.31	> 70 dB (up to 6 GHz)	10	40	U11
-40 °C - +105 °C	0.13	0.19	0.29	> 75 dB (up to 5 GHz)	25	50	U9
-40 °C - +105 °C	0.07	0.10	0.15	> 78 dB (up to 3 GHz)	30	100	U33



Foam line – flexible, low loss cables

SPUMA series

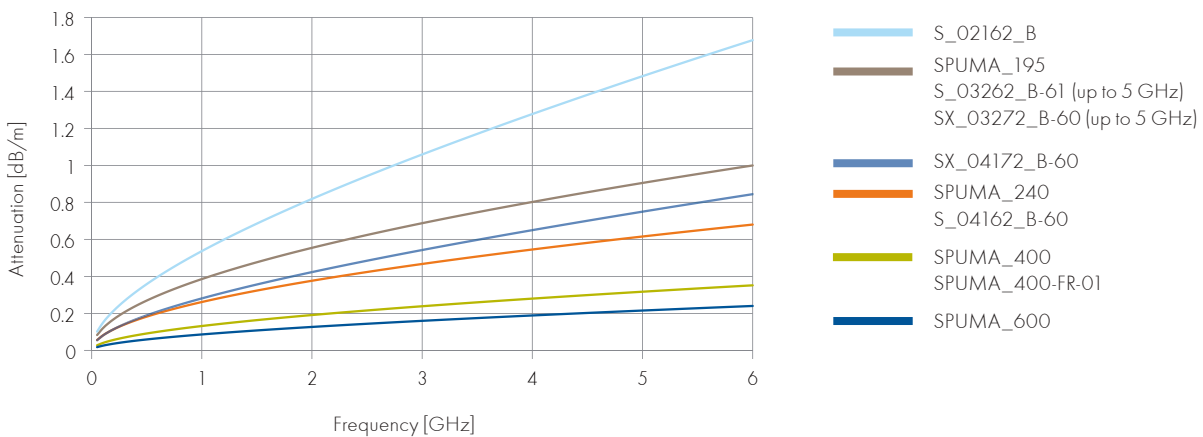
Cable type	Item no.	Impe- dance [Ω]	Freq. [GHz]	Inner conductor	Dielectric	Braid construction	Jacket	Diameter [mm]
SPUMA_195	84151727	50	6	wire	SPE	tape / braid	PE	4.95
SPUMA_240	84151737	50	6	wire	SPE	tape / braid	PE	6.15
SPUMA_400	84102703	50	6	wire	SPE	tape / braid	PE	10.25
SPUMA_600	84151738	50	6	wire	SPE	tape / braid	PE	14.99

SPUMA-FR and S series

Cable type	Item no.	Impe- dance [Ω]	Freq. [GHz]	Inner conductor	Dielectric	Braid construction	Jacket	Diameter [mm]
S_02162_B	22512310	50	6	strand-07	SPE	tape / braid	LSFH™	3.15
S_03262_B-61	84078137	50	5	wire	SPE	tape / braid	LSFH™	4.50
S_04162_B-60	84023780	50	6	wire	SPE	tape / braid	LSFH™	5.50
SPUMA_400-FR-01	84132035	50	6	wire	SPE	tape / braid	LSFH™	10.25

SX series

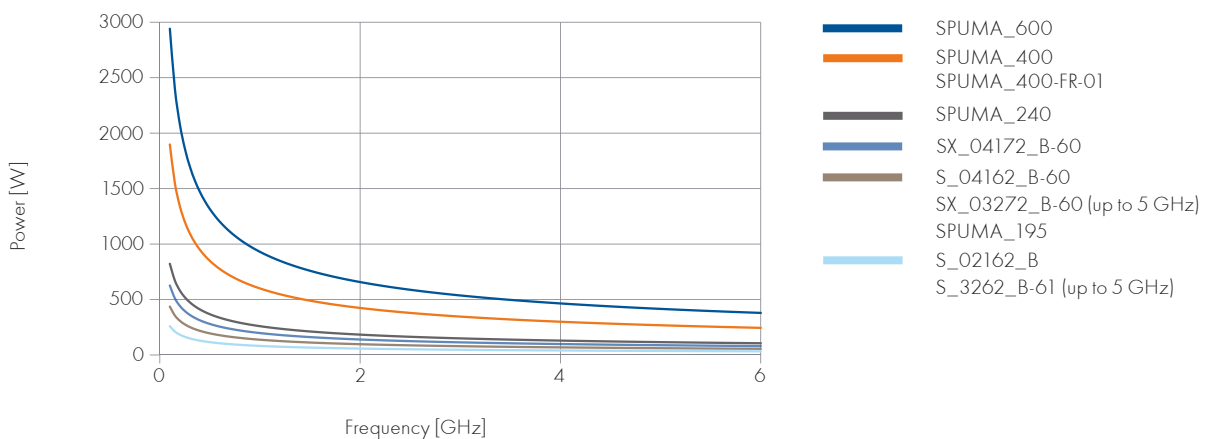
Cable type	Item no.	Impe- dance [Ω]	Freq. [GHz]	Inner conductor	Dielectric	Braid construction	Jacket	Diameter [mm]
SX_03272_B-60	84010513	50	5	wire	SPEX	tape / braid	RADOX®	4.5
SX_04172_B-60	84026748	50	6	wire	SPEX	tape / braid	RADOX®	5.5



Temperature range	Attenuation @100MHz [dB/m]	Attenuation @200MHz [dB/m]	Attenuation @ 400MHz [dB/m]	Screening effectiveness	Bending static [mm]	Bending repeated [mm]	Cable group
-40 °C - +85 °C	0.12	0.17	0.24	> 90 dB (up to 6 GHz)	12.5	50	X27
-40 °C - +85 °C	0.08	0.11	0.16	> 90 dB (up to 6 GHz)	19.0	60	X28
-40 °C - +85 °C	0.04	0.06	0.08	> 90 dB (up to 6 GHz)	25.0	100	U30
-40 °C - +85 °C	0.03	0.04	0.05	> 90 dB (up to 6 GHz)	38.0	152	X29





Temperature range	Attenuation @100MHz [dB/m]	Attenuation @200MHz [dB/m]	Attenuation @ 400MHz [dB/m]	Screening effectiveness	Bending static [mm]	Bending repeated [mm]	Cable group
-40°C - +85°C	0.15	0.21	0.32	> 80 dB (up to 6 GHz)	16	30	S9
-40°C - +85°C	0.10	0.15	0.21	> 90 dB (up to 2 GHz)	15	40	X7
-40°C - +85°C	0.08	0.11	0.16	> 80 dB (up to 2.2 GHz)	25	60	X9
-40°C - +85°C	0.04	0.06	0.08	> 90 dB (up to 6 GHz)	25	100	U30

Temperature range	Attenuation @100MHz [dB/m]	Attenuation @200MHz [dB/m]	Attenuation @ 400MHz [dB/m]	Screening effectiveness	Bending static [mm]	Bending repeated [mm]	Cable group
-40 °C - +105 °C	0.11	0.15	0.22	> 85 dB (up to 2 GHz)	20	40	X7
-40 °C - +105 °C	0.08	0.11	0.17	> 80 dB (up to 2.2 GHz)	25	60	X9



RF connectors

Cable	Group	7/16				BNC				N			
		11	16	21	24	11	16	21	24	11	16	21	24
GX_02272	U2					•	•	•	•	•		•	•
GX_03272	U7					•	•	•	•	•	•	•	•
GX_03272_D-06	U9	•	•			•	•	•	•	•	•	•	•
GX_07272	U29	•		•		•	•		•	•	•	•	•
GX_07272_D	U32	•	•	•		•	•			•	•	•	•
RG_178_B/U	U1					•		•	•				
K_01252_D	X1												
RG_316_/U	U2					•	•	•	•	•		•	•
K_02252_D	U4					•	•	•	•	•	•	•	•
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_195	X27									•	•		
SPUMA_240	X28	•				•				•	•	•	•
SPUMA_400	U30	•	•		•					•	•	•	•
SPUMA_600	X29	•								•	•		
S_02162_B	S9									•			•
S_03262_B-61	X7										•		
S_04162_B	X9	•	•		•	•				•/R	•	•	•
S_04162_B-60	X9	•	•		•	•				•/R	•	•	•
SX_03272_B-60	X7										•		
SX_04172_B-60	X9	•	•		•	•				•/R	•	•	•

QMA				QN				SMA				TNC			
															
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•	•		•	•	•		•	•/R	•/R	•/R	•	•	•	•	•
				•	•		•					•			
	•	•		•	•		•	•	•			•/R	•		•/R
				•	•		•	•	•			•/R	•	•	•/R
•	•		•					•	•						
•	•				•				•						
•	•	•	•	•	•		•	•/R	•	•	•	•/R	•	•	•/R
•	•	•	•	•	•		•	•/R	•	•	•	•/R	•	•	•/R
•	•				•				•						
•	•	•	•	•	•		•	•/R	•	•	•	•/R	•	•	•/R

•/R = Reverse
R = Reverse

QMA

HUBER+SUHNER QMA coaxial connectors are according to QLF standard and available with 50 Ω impedance. The QMA connectors are return loss optimized for frequencies up to 6 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 a very similar performance to the SMA, but in addition it offers an easier, faster and safer coupling operation, helping customers to save significantly time during production. QMA connectors are also available as waterproof version and are compatible with QLF standard.

- Easy to mate 10 times faster than with threaded SMA
- Increased reliability
- 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 as there is no need for wrench clearance
- Excellent electrical performance
- Consistent VSWR performance enables to replace standard



XQMA

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

QN

HUBER+SUHNER QN coaxial connectors are available with 50 Ω impedance. The frequency range extends to 11 GHz, depending on the connector and cable type, however most of the QN connectors are return loss optimised 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, helping the customers to save significantly time during production of their systems.

- Cycle time improvement for making RF connections (10 times faster to mount than threaded connectors)
- No torque 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

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

Coaxial connectors 4.3-10

HUBER+SUHNER as a leading global supplier of RF product is an active partner of a developing group designated to provide an innovative solution for the telecom market. The new 4.3-10 connector system is designed to meet the rising performance needs of mobile network equipment and at the same time reducing its size supporting the ongoing space reduction requirements. The interface design has been filed to IEC and has the potential to become the standard connector system for the above mentioned market.

This new interface offers very low PIM performance together with weight and compactness advantages. A key feature of this connector is the separation of electrical from mechanical plane, which implies a lower coupling torque and the possibility of offering the connector plug with screw, hand screw and quick lock design, thus simplifying the installation effort and offering for all mechanisms a very high electrical performance.

- High density module design
 - Due to the smaller flange and compactness
 - Type 2, 3 minimum pitch 25.4 mm (no torque wrench)
- Light weight modules
 - Due to low weight components and the possibility of designing modules with thinner wall thickness (no torque or small torque required)
 - Bulkhead solutions possible
- Flexibility in connector choice
 - Due to the 3 different plug design
- Reliable electrical performance
 - The separation of electrical and mechanical planes results in easier installation possibilities



Feeder assemblies

Field mountable assemblies

HUBER+SUHNER filed mountable solutions consider mainly HUBER+SUHNER SUCOFEED cables, that guarantee optimal shielding, low attenuation, low VSWR, excellent intermodulation performance and flexibility for handling and installation on sites, in combination of HUBER+SUHNER QUICK-FIT connectors, the worldwide approved N and 7/16 connectors for foam dielectric corrugated copper tube cables.

Cable Features:

- Low attenuation design available
- High power capability
- High shielding effectiveness
- UV-resistant
- Guaranteed performance up to 3 GHz

Connector Features:

- Excellent RF performance
- Low, stable and reproducible PIM (Passive Intermodulation Product), typically -165 dBc
- Safe assembly process, in-field termination with reproducible electrical performance
- Quick and easy assembly, 2 main connector parts, 4 steps in less than 4 minutes
- High IP rating, IP 68



LISCA

LISCA cable assemblies are specially developed for applications where low VSWR and low attenuation combined with low intermodulation products are required. The excellent performance is achieved by utilizing corrugated SUCOFEED cables with low intermodulation designed connectors and a controlled assembly process with HUBER+SUHNER solder technology. This product line is designed to provide optimal performance up to 4 GHz.

- Excellent RF performance
- Low attenuation
- Low, stable intermodulation products
- Moisture protection IP68



Cable type	Filed mountable	LISCA assemblies
1/4"	-	•
3/8"	-	•
1/2" HF	QUICK-FIT	•
1/2"	QUICK-FIT	•
7/8"	QUICK-FIT	-

Lisca 4.3-10 Feeder



Interface key specifications		Requirements
RL/IL	DC - 4 GHz 4 - 6 GHz	≥ 36 dB ≥ 32 dB
Power		500 W @ 2 GHz @ 90 °C
Screening efficiency	type 1	≥ 110 dB @ DC to 6 GHz
	type 2, 3	≥ 90 dB @ DC to 3 GHz
PIM		-166 dBc @ 2 x 43 dBm -160 dBc @ 2 x 46 dBm
Water tightness (interface, mated)		IP68 (@ 25 m, 1 hour)

Besides our existing LISCA portfolio following configurations can be ordered:

		Example:	LIS-C9 F-11	431X-16	431X-02000-51
		Product name			
SUCOFEED_1/4_HF	C5	Cable type			
SUCOFEED_3/8_HF	C7				
SUCOFEED_1/2_HF	C9				
SUCOFEED_1/2	C12				
Flame retardant: F PE: no indication					
Straight male	11	Pattern of connector	1		
Right angle male	16				
Straight female	21	Pattern of connector		2	
4.3-10	Type 1 431X Type 2 431Y Type 3 431Z	Connector interface		1	2
		Assembly length in mm			
Jumper performance code	example: 51	Technical performance			

Other products with 4.3-10 are available on request.

Lightning protectors

To protect air traffic control equipment from the destructive effects of lightning, operators of instrument landing systems (ILS) traditionally use gas discharge tube (GDT) protection technology.

In aeronautical applications, availability and reliability are of utmost importance. It is for this reason that HUBER+SUHNER has introduced an attractive lightning protector portfolio that can handle higher lightning currents than traditional GDT protectors and reduces residual energy at the output of the protecting device to only a fraction of that performed by the GDT protectors. This new technology is called the "quarter-wave shorting stub" principle.



GDT protectors vs. quarter-wave shorting stub designs

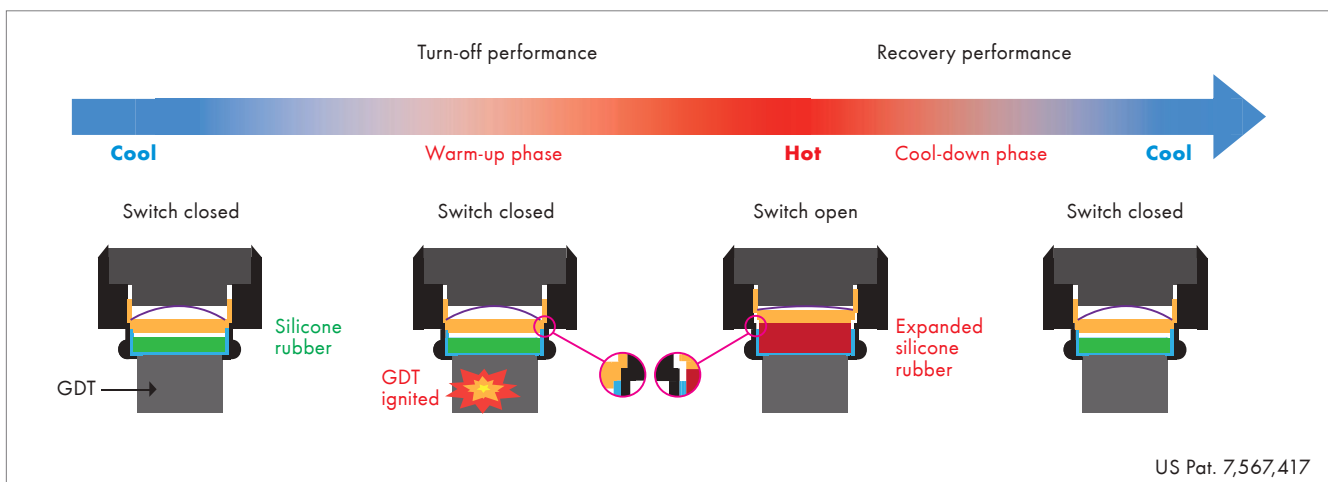
Comparison of key parameters between the traditional gas discharge tube technology of series 3401 and the new and improved designs of series 3400 and 3407.

	Series 3401	Series 3400	Series 3407
	GDT technology	$\lambda/4$ shorting stub technology	$\lambda/4$ shorting stub technology with high pass filter
Lightning current handling capability (8/20 μ s)	20 kA multiple 30 kA single	50 kA multiple	50 kA multiple
Residual peak voltage Input pulse: 4 kV (1.2/50 μ s) 2 kA (8/20 μ s)	650 V (peak)	< 20 V	< 15 V
Residual energy Input pulse: 4 kV (1.2/50 μ s) 2 kA (8/20 μ s)	350 μ J	< 5 μ J	< 1 μ J

SEMPER™ - self-extinguishing gas discharge tube protector

The patented SEMPER™ concept impressively enhances the safety and reliability of the well-known gas discharge tube (GDT) protector principle. It eliminates the risk of the gas discharge tube "holding on" due to DC line powering or high RF signals, which render the system inoperable and can destroy the GDT.

The SEMPER™ invention is based on a mechanical resettable thermo-switch which is integrated into the GDT protector's capsule holder.



SEMPER™ functionality

Lightning protectors for ILS

Gas discharge tube (GDT) protectors

NDBs, Marker beacons, VOR-, Localizer-, Glide Path- and communication- equipment can be protected by means of series 3401 and 3402 GDT protectors. If you decide to use GDT technology, we recommend choosing SEMPER™ products which are identified in the following table by the suffix «-EX»

Application		H+S type	Frequency range of the component [MHz]	Interface	Mounting	RL min.	IL max.
Abbreviation	Frequencies					[dB]	[dB]
NDB	190-1750 kHz	3401.17.A*	DC - 1000	N - female / female	bulkhead MH12	26	0.1
MB	75 MHz	3401.17.C*	DC - 1000	N - male / female	bulkhead MH12	26	0.1
VOR, LOC	108-11795 MHz	3401.17.0048-EX*	DC - 1000	N - female / female	bulkhead MH12	24	0.1
GP	328-336 MHz	3401.17.0057-EX*	DC - 1000	N - male / female	bulkhead MH12	24	0.1
COM	117975-137 MHz						
DME	962-1213 MHz	3402.17.A*	DC - 2500	N - female / female	bulkhead MH25	20	0.2
		3402.17.C*	DC - 2500	N - male / female	bulkhead MH25	20	0.2
		3402.17.0072-EX*	DC - 2500	N - female / female	bulkhead MH25	20	0.2
		3402.17.0076-EX*	DC - 2500	N - male / female	bulkhead MH25	20	0.2

* 230V GDT included * GDT not included

Quarter-wave shorting stub protectors

If you want to build the most reliable ATC system possible, we highly recommend selecting quarter-wave shorting stub protectors from the following list. These products guarantee multiple lightning current handling capability of 50 kA (8/20 μs) and feature much lower residual voltage and energy when compared with GDT protectors. We offer products that can handle several applications within their operating bandwidths.

Application		H+S type	Frequency range of the component [MHz]	Interface	Mounting	RL min.	IL max.
Abbreviation	Frequencies					[dB]	[dB]
MB	75 MHz	3407.17.0022	74-180	N - female / female	bulkhead MH74 or M8	20	0.15
VOR; LOC	108-11795 MHz						
COM	117975-137 MHz						
GP	328-336 MHz	3407.17.0023	220-450	N - female / female	bulkhead MH74 or M8	20	0.1
		3407.17.0053	320-512	N - male / female	bulkhead MH12 or M8	20	0.2
MB	75 MHz	3407.17.0088	74-420	N - male / female	bulkhead MH74 or M8	23	0.15
VOR; LOC	108-11795 MHz						
GP	328-336 MHz						
COM	117975-137 MHz						
DME	962-1213 MHz	3400.17.0385	950-1450	N - female / female	bulkhead MH25 or M8	20	0.1

The products that appear in blue type in the above list represent the latest design of our quarter-wave shorting stub protectors. With its wide bandwidth of 74-420 MHz, it can be used to protect Marker Beacon-, VOR-, Localizer-, Glide Path- and communication- equipment. These protectors offer clear technical advantages, which result in higher system reliability.



3407.17.0089, N female - N female



Radar equipment

Radar is an object-detection system that uses radio waves to determine the range, altitude, direction, or speed of objects. The radar beam would follow a linear path in a vacuum, but in reality it follows a somewhat curved path in the atmosphere because of the variation of the refractive index of air. The maximum range of a conventional radar can be limited by a number of factors:

- Line of sight, which depends on height above ground. This means that without a direct line of sight, the path of the beam is blocked.
- Signal noise is an internal source of random variations in the signal, which is generated by all electronic components.
- Radar systems must overcome unwanted signals in order to focus only on the actual targets of interest. These unwanted signals may originate from internal and external sources, both passive and active.
- Radar jamming refers to radio frequency signals originating from sources outside the radar, transmitting in the radar's frequency and thereby masking targets of interest. Jamming may be intentional, as in the case of an electronic warfare tactic, or unintentional, as in the case of friendly forces, operating equipment that transmits using the same frequency range.



Primary radar

A primary radar sends radar signals into the surrounding airspace and receives its reflections. Electronic and mathematical support systems allow it to fade out the echoes that are created by the topology (hills etc.), such that only moving reflections (flying objects) are shown on the screen. The primary radar (ASR) works in the frequency range between 2200-2900 MHz. The rated pulse power is specified up to 25 kW.

Secondary radar

A secondary radar consists of an interrogator and a transponder. The transponder, which receives the interrogator's signal, replies automatically with application-specific information. The interrogator is situated on the ground and the transponder is part of the on-board navigation equipment. This application is known as Secondary Surveillance Radar (SSR). It is used by the air traffic controller to collect information about the airplanes that cannot be identified with the primary radar. Such information includes the cruising altitude and the plane's identity. The SSR works in the frequency range between 1030-1090 MHz with signal power between 150 W-1500 W.



Surface movement radar

A surface movement radar is used by air traffic controllers to detect aircraft and vehicles on the surface of an airport. It may also be used at night and during low visibility to monitor the movement of aircraft and vehicles. The SMR uses a carrier frequency in X-Band (9 GHz) or in Ku-band (15-17 GHz). Higher-resolution SMR operate between 92-96 GHz.

Weather radar.

A weather surveillance radar (WSR) is a type of radar used to locate precipitation, calculate its motion, and estimate its type (rain, snow, hail etc.). These radars send directional pulses of microwave radiation, on the order of a microsecond long, using a cavity magnetron or klystron tube connected by a waveguide to a parabolic antenna. The wavelengths of 1 - 10 cm are approximately ten times the diameter of the droplets or ice particles of interest, because rayleigh scattering occurs at these frequencies. This means that part of the energy of each pulse will bounce off these small particles, back in the direction of the radar station.

SUCOFLEX® 100 – assemblies

SUCOFLEX 104 / 126

SUCOFLEX 104, 104P(E) cables have been designed to provide solutions where it's important to have excellent electrical and mechanical performances up to 26.5 GHz. They are also fully qualified according to the MIL norms. The assembly's configuration is extremely flexible due to a wide range of connector interfaces and different ruggedisation types for the cable.

All the connectors are made of stainless steel in order to improve the robustness of the assemblies in very harsh environments, as well as the number of matings. For applications where it is important to improve either the phase stability (low loss stranded inner conductor) as well as the bending moment, a special version of SUCOFLEX 126E with a polyurethane jacket has been designed.



SUCOFLEX 106 / 118

SUCOFLEX 106 and 118 should be used in applications up to 18GHz where special consideration must be given to low attenuation or high power handling capacity. Wherever phase stability is additionally required a special version has been designed with a low loss stranded inner conductor (SUCOFLEX 118).

As is generally the case for all the cables in the SUCOFLEX 100 series, the assembly configuration is also extremely flexible due to a wide range of connector interfaces and different ruggedisation types for the cable.



Cable	Group	BMA				N				SMA				TNC			
		14	15	24	25	11	16	21	24	11	16	21	24	11	16	21	24
SF_104		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
SF_126		•	•		•	•	•	•	•	•	•	•	•	•	•		•
SF_106		•	•		•	•	•	•	•	•	•	•	•	•	•	•	•
SF_118						•	•	•	•	•		•	•	•	•		

EACON – cables

To suit to the needs of our customers, HUBER+SUHNER has developed this innovative solution. EACON represents a simple, flexible and fast way to assemble microwave cables and connectors in the field without compromising performance. The new field-mountable microwave cable and connectors are light and waterproofed, built for frequencies up to 18 GHz - ready for use in the defence market as well as in the industrial market in general.



Features and benefits

- Waterproof IP 68
- Low loss
- Usable up to 18 GHz
- Extremely reliable
- Assembly tool kit available
- Easy assembly – only two connector parts
- Field mountable
- Allows you to take on-site decisions regarding length and configurations
- Narrowest cable feed thanks to dimensions (assembly after installation)
- More added value for customers

EACON – connectors

Cable	BNC			N			QMA			SMA			TNC			
	11	16	25	11	16	25	11	16	25	11	16	25	11	16	25	
EACON 4C	•	•		•	•	•	•			•	•		•	•	•	
Electrical data																
Impedance	50 Ω			50 Ω			50 Ω			50 Ω			50 Ω			
Frequency range	4 GHz			18.0/15.0 GHz*			6 GHz			18.0/11.0 GHz*			11.0 GHz			
Mechanical data																
Centre contact	plugged			plugged			plugged			plugged			plugged			
Outer contact	clamped			clamped			clamped			clamped			clamped			
Cable retention force	min. 180 N/1 min.			min. 180 N/1 min.			min. 180 N/1 min.			min. 180 N/1 min.			min. 180 N/1 min.			
Environmental data																
Operating temperature	-65°C to +165°C			-65°C to +165°C			-65°C to +165°C			-65°C to +165°C			-65°C to +165°C			
IP rating				IP 68**			IP 68**			IP 68**			IP 68**			
2002/95/EC (RoHS)	compliant			compliant			compliant			compliant			compliant			
Material data																
Centre contact	copper beryllium alloy			copper beryllium alloy			copper beryllium alloy			copper beryllium alloy			copper beryllium alloy			
Outer contact	brass			brass			stainless steel			stainless steel			brass			
Insulator	PTFE			PTFE			PTFE			PTFE			PTFE			
Gasket	MVQ (silicone rubber)						MVQ (silicone rubber)									
Fastening nut	stainless steel			stainless steel			stainless steel			stainless steel			stainless steel			

* 90°

** to be clarified between customer and HUBER+SUHNER

Lightning protectors

Lightning protectors for radar applications used in air traffic control systems

In aeronautical applications, availability and reliability are of the utmost importance. It is for this reason that HUBER+SUHNER has introduced an attractive lightning protector portfolio that can handle higher lightning currents than traditional GDT protectors and reduce the residual energy at the output of the protecting device to only a fraction of that performed by the GDT protectors. This new technology is called the "quarter-wave shorting stub" principle.

All of the listed products below are quarter-wave shorting stub designs, which feature high lightning current handling capability, low residual energy and can handle high RF power.

Application		H+S Type	Frequency range of the component [MHz]	Connectors	Mounting/grounding	RL min.	IL max.
Abbreviation	Frequencies [MHz]					[dB]	[dB]
DME SSR	962-1213 1030-1090	3400.17.0385	950-1450	N - fem./fem.	bulkhead MH25 or M8	20	0.1
SSR	1030-1090	3400.17.0254	1000-1100	N - fem./fem.	bulkhead MH12	20	0.1
SSR ASR	1030 2700-2900	3400.17.0416	1000-1100 2700-2900	N - fem./fem.	bulkhead MH25 or M8	20	0.1
ASR MLS	2700-2900 5031-5091	3400.17.0410	2000-6000	N - male / fem.	M8	20	0.2
MLS	5031-5091	3400.17.0235	5000-7000	N - fem./fem.	bulkhead MH25 or M8	20	0.25

Appendix

LSFH™

Abbreviation for Low Smoke Free Halogene.

LISCA

LISCA cable assemblies are specially developed for applications where low VSWR and low attenuation combined with low intermodulation products are required.

QUICK-LOCK

A snap-on connector interface design with a retractable lock nut, providing a fast connect/disconnect feature.

RADOX®

Trademark of HUBER+SUHNER: for crosslinked, flame-retardant, heat-resistant and halogen-free insulation and jacket materials.

QUICK-FIT

Connectors are designed for the termination of corrugated foam dielectric cables.

SEMPER™

The patented self-extinguishing gas discharge tube protector concept impressively enhances the safety and reliability of the well-known gas discharge tube (GDT) protector principle. The invention is based on a mechanical resettable thermo-switch, which is integrated into the GDT protector's capsule holder.

SPUMA

The SPUMA product family provides flexible and halogen-free cable types and is extremely low loss.

SUCOFEED®

The HUBER+SUHNER trade name for these cables is SUCOFEED. One unique feature of the HUBER+SUHNER QUICK-FIT connectors is their compatibility with most of the cable brands on the market.

SUCOFLEX®

The SUCOFLEX is a high-end product family designed to provide optimal performance, where stringent electrical requirements, in particular stability and low loss, are important. The mechanical and climatic resistance properties exceed those of standard flexible cables.

SUCOPLATE®

A plating material made out of a combination of copper, tin and zinc. Good corrosion and abrasion resistance. Non-magnetic. Registered trademark of HUBER+SUHNER.

VSWR

Abbreviation for Voltage Standing Wave Ratio. The ratio of the maximum to minimum voltage set up along a transmission by reflections.

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HUBER+SUHNER is certified according to EN (AS) 9100, ISO 9001, ISO 14001, ISO/TS 16949 and IRIS.

Waiver

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