2001-01-03

PRODUKTINFORMATION

ELFA artikelnr

55-929-02 Koaxkabel Flexiform 401 FJ
55-929-10 Koaxkabel Flexiform 402 FJ
55-929-28 Koaxkabel Flexiform 405 FJ

Habia Cable

Coaxial Cables for Medium-Frequency Applications

Introduction

Telecommunications technology is moving forward rapidly and the need for fast and reliable interactive systems is becoming increasingly important. It is imperative that businesses can rely on being able to communicate efficiently whenever required.

Radio frequency airwaves now have a huge quantity of traffic due to increased mobile communications and this rise is set to increase dramatically. Airwaves are therefore extremely busy and so communications signals are moving up to higher bandwidths, using higher frequencies to transmit data and utilising the medium frequency bands.

Today's cables need better screening and purity of signal because of the higher risk of attenuation or distortion. In addition, there is a strong need for greater improvement of the physical properties such as flexibility, handling and termination. Combined with higher technology in cable materials and manufacturing processes, there is no longer a need to sacrifice physical characteristics for electrical performance.

Habia Cable has developed, together with our successful world-wide telecommunications customer, two new products: Flexiform and Multibend. They have been designed to meet our customer's demands in a world where product innovation is moving forward at a tremendous pace. Habia Cable is committed to developing partnerships for the future and working together into the next century.

Flexiform is a reformable alternative to traditional semi-rigid coaxial cables. Used, for example with circuit boards, where the cable follows a specific path, it can be pulled off a reel and cut to the exact required length, then stripped and formed by hand without the need for special tools. Handling is similar to any standard coaxial cable, which means you can use your existing cut and strip machines.

We have developed a range of Flexiform types, with many additional options available for custom design, including conductor types, screening alternatives and jacket material variations.

Multibend is the completely flexible alternative to semi-rigid coaxial cables. Electrical performance is almost identical. The solid copper tube normally used in a semi-rigid coax is replaced with a wrapped silver-plated copper foil and a braid, giving excellent shielding properties. Multibend is extremely cost effective, eliminating waste lengths traditionally associated with semi-rigids and with minimal performance penalties.

As with Flexiform, there is a range of standard types and many options for custom design. Habia Cable can also provide you with a completely halogen-free version of Multibend.

Both Flexiform and Multibend can be used with all standard types of semi-rigid connectors.

Contents

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Rear Cover: Racal Group Services

Flexiform®

The Reformable Alternative to Semi-Rigid Coaxial Cables

Engineering data

Habia ref	Inner conductor material OD (mm)	Dielectric PTFE OD (mm)	Standard Flexiform Outer Conductor OD (mm)	Flexiform FJ with FEP Outer Jacket OD (mm)	Flexiform HFJ with Zero-Halogen Outer Jacket OD (mm)	Variant of
Flexiform 401	SPC 1,6	5,3	6,4 [0,250]	7,2	7,6	M17/129-00001 M17/129-RG401
Flexiform 402	SCW 0,92	3,0	3,6 [0,141]	4,1	4,6	M17/130-00001 M17/130-RG402
Flexiform 405	SCW 0,51	1,7	2,2 [0,086]	2,6	3,2	M17/133-00001 M17/133-RG405

Note: All figures are nominal unless otherwise specified
SPC = Silver Plated Copper, SCW = Silver Plated Copper Weld.

Features and benefits

- Excellent electrical properties
- Good attenuation
- Easier bending and forming
- Usage of standard semi-rigid connectors
- High temperature range
- Utilise standard cut and strip machinery
- Up to 20 GHz - high operating frequency
- Excellent against crosstalk
- Good flexibility
- Simple mounting
- Outstanding shielding properties

Ease of use

Unique ability to be hand formed.
High degree of shape retention after bending and exhibits no buckling when reformed or flexed.
Routed at the time of installation and able to conform to extremely tight routing.
Eliminates many factors associated with pre-made assemblies.

Cost effective

A great advantage is the ability to simply shape or route the cable by hand and connect the assembly, eliminating the lead-time associated with pre-formed semi-rigid assemblies.
No special forming tools, no additional assembly costs.
No special packaging and shipping requirements.
Long lengths delivered on standard spools.
Significant cost advantages over semi-rigid coax - with minimal performance penalty.

Custom design

Standard Flexiform types supplied without a jacket.
Jacket options include fluoropolymer or halogen-free, cross-linked or flame-retardent.
Standard jacket colour is blue.
All other coaxial types can also be manufactured using the same process (ie Flexiform 179)
Other colours and conductor materials are available on request. Please ask for details.
All types can be supplied with non-magnetic (SPC) conductor, if required.
All types can be supplied with an extra copper foil under the braid, if required.

Connectors

Standard semi-rigid connectors (solder or crimp) can be used on all types above.

Note: All figures are nominal unless otherwise specified

Typical Applications
RF & microwave test equipment
Portable hand sets
Cabinet systems
Antenna applications
Radar equipment

For even better performance, all Flexiform types can be manufactured with an extra copper foil under the braid.

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Flexiform®

The Reformable Alternative to Semi-Rigid Coaxial Cables

Type:
Flexiform 401

Engineering data

Cable design

Centre conductor . . . . silver-plated copper wire, non magnetic
Dielectric . . . . . solid extruded PTFE
Outer conductor . . . tin-soaked copper braid, Coverage 100%

Electrical data

Impedance . . . . . 50 Ohms
Capacitance . . . . . 94 pF/m
Velocity of signal propagation 70%
Signal delay . . . . . 4,8 ns/m
Working voltage, maximum. . . . . 3000V RMS
Attenuation, nominal. . . . . see graph right
Power, nominal. . . . . see graph right
Suitable for frequencies . . . . . up to 20 GHz
Shielding effectiveness . . . . . typically <-130 dB/m

General data

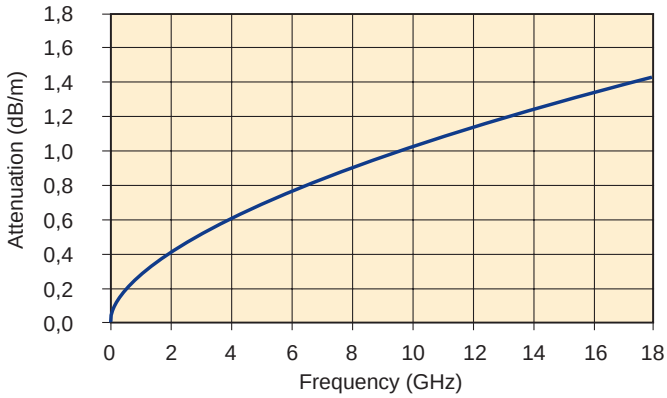
Flammability, passes. . . . . IEC 60 332-3
Minimum bend radius
single bend 40mm
multiple bends. 120mm

Connectors

Connector. . . . . as semi-rigid M17/129-RG401

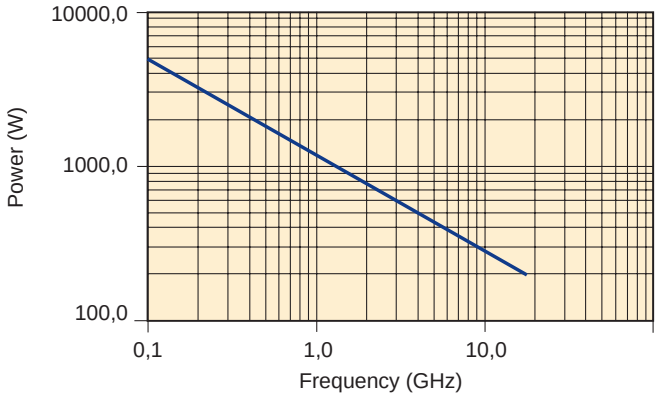
Cable Attenuation

Nominal values @ +25°C ambient temperature



Average Power

Ambient temperature 40°C at sea level & VSWR1.0



Additional information

Flexiform 401 (Standard):

Jacket. . . . . none
OD. 6,4mm
Weight, nominal 110kg/km
Operating temperature. . . . . -40 to +125°C

Flexiform 401 FJ

Jacket . . . . . FEP, Blue
OD. 7,2mm
Weight, nominal 130kg/km
Operating temperature. . . . . -40 to +125°C

Flexiform 401 HFJ

Jacket . . . . . halogen-free, Blue
. . . . . cross-linked and flame-retardent
OD. 7,6mm
Weight, nominal 130kg/km
Operating temperature. . . . . -30 to +105°C

Delivered on standard spools in long lengths, giving less waste than semi-rigids.

Custom design

All MIL types of coaxial cables can be manufactured using the Flexiform method or process.

Flexiform can be manufactured with an extra copper foil under the braid.

Different types of outer jacket are also available.
Please ask for details.

For even better performance, all Flexiform types can be manufactured with an extra copper foil under the braid.

Note: All figures are nominal unless otherwise specified

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Flexiform®

Type:
Flexiform 402

The Reformable Alternative to Semi-Rigid Coaxial Cables

Engineering data

Cable design
Centre conductor . . . . . silver-plated copper-clad steel wire
Dielectric . . . . . solid extruded PTFE
Outer conductor . . . tin-soaked copper braid, Coverage 100%

Electrical data
Impedance . . . . . 50 Ohms
Capacitance . . . . . 94 pF/m
Velocity of signal propagation 70%
Signal delay . . . . . 4,8 ns/m
Working voltage, maximum . . . . . 2500V RMS
Attenuation, nominal . . . . . see graph right
Power, nominal . . . . . see graph right
Suitable for frequencies . . . . . up to 20 GHz
Shielding effectiveness . . . . . typically <-130 dB/m

General data
Flammability, passes . . . . . IEC 60 332-3
Minimum bend radius
single bend 10mm
multiple bends 40mm

Connectors
Connector . . . . . as semi-rigid M17/130-RG402

Additional information

Flexiform 402 (Standard):
Jacket . . . . . none
OD 3,6mm
Weight, nominal 44kg/km
Operating temperature . . . . . -40 to +125°C

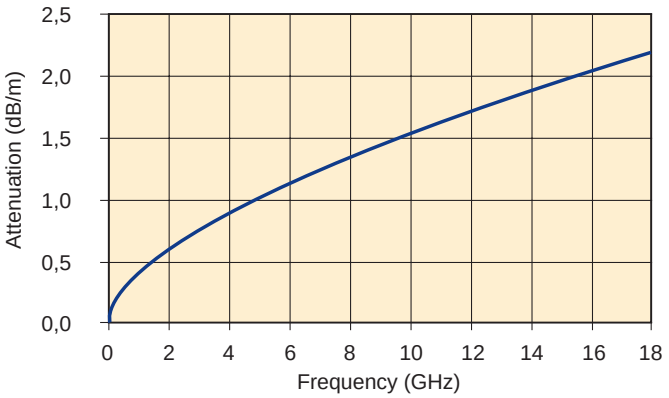
Flexiform 402 FJ
Jacket . . . . . FEP, Blue
OD 4,1mm
Weight, nominal 52kg/km
Operating temperature . . . . . -40 to +125°C

Flexiform 402 HFJ
Jacket . . . . . halogen-free, Blue
. . . . . cross-linked and flame-retardent
OD 4,6mm
Weight, nominal 53kg/km
Operating temperature . . . . . -30 to +105°C

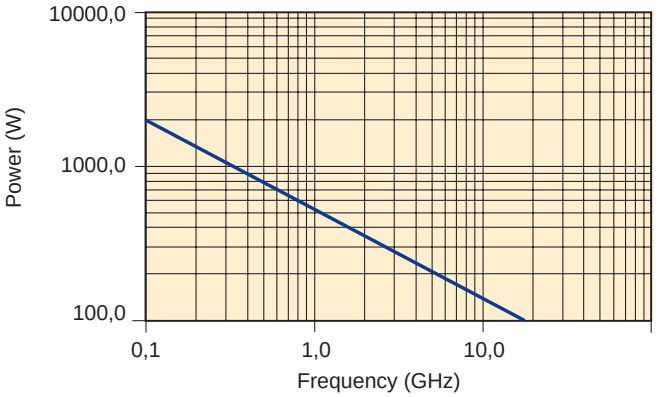
Delivered on standard spools in long lengths, giving less waste than semi-rigids.

Note: All figures are nominal unless otherwise specified

Cable Attenuation
Nominal values @ +25°C ambient temperature



Average Power
Ambient temperature 40°C at sea level & VSWR1.0



Custom design
All MIL types of coaxial cables can be manufactured using the Flexiform method or process.

Flexiform can be manufactured with a non-magnetic SPC conductor, with an extra copper foil under the braid.

Different types of outer jacket are also available.
Please ask for details.

For even better performance, all Flexiform types can be manufactured with an extra copper foil under the braid.

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Type:
Flexiform 405

Engineering data

Cable design

Centre conductor . . . . . silver-plated copper-clad steel wire
Dielectric . . . . . solid extruded PTFE
Outer conductor . . . tin-soaked copper braid, Coverage 100%

Electrical data

Impedance . . . . . 50 Ohms
Capacitance . . . . . 94 pF/m
Velocity of signal propagation 70%
Signal delay . . . . . 4,8 ns/m
Working voltage, maximum. . . . . 1500V RMS
Attenuation, nominal. . . . . see graph right
Power, nominal. . . . . see graph right
Suitable for frequencies . . . . . up to 20 GHz
Shielding effectiveness . . . . . typically <-130 dB/m

General data

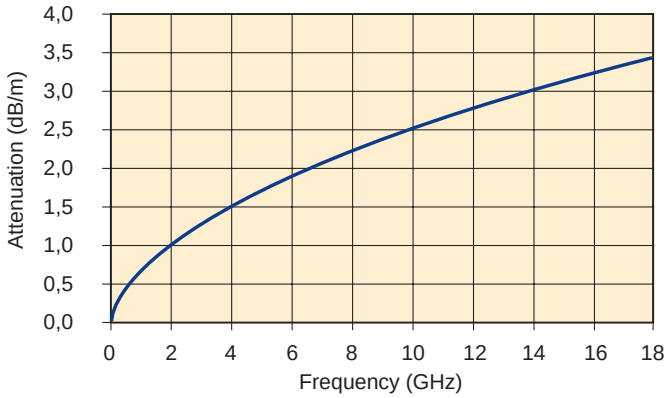
Flammability, passes. . . . . IEC 60 332-3
Minimum bend radius
single bend 6mm
multiple bends. 25mm

Connectors

Connector. . . . . as semi-rigid M17/133-RG405

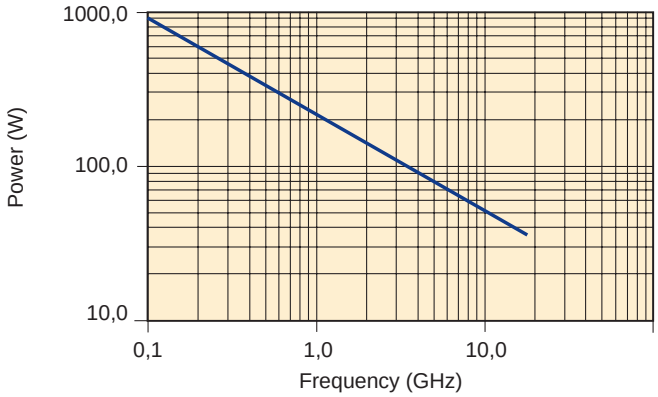
Cable Attenuation

Nominal values @ +25°C ambient temperature



Average Power

Ambient temperature 40°C at sea level & VSWR1.0



Additional information

Flexiform 405 (Standard):

Jacket. . . . . none
OD. 2,2mm
Weight, nominal 15kg/km
Operating temperature. . . . . -40 to +125°C

Flexiform 405 FJ

Jacket . . . . . FEP, Blue
OD. 2,6mm
Weight, nominal 18kg/km
Operating temperature. . . . . -40 to +125°C

Flexiform 405 HFJ

Jacket . . . . . halogen-free, Blue
. . . . . cross-linked and flame-retardent
OD. 3,2mm
Weight, nominal 21kg/km
Operating temperature. . . . . -30 to +105°C

Delivered on standard spools in long lengths, giving less waste than semi-rigids.

Note: All figures are nominal unless otherwise specified

Custom design

All MIL types of coaxial cables can be manufactured using the Flexiform method or process.

Flexiform can be manufactured with a non-magnetic SPC conductor, with an extra copper foil under the braid.

Different types of outer jacket are also available.
Please ask for details.

For even better performance, all Flexiform types can be manufactured with an extra copper foil under the braid.

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Formulas for Coaxial cables

Characteristic impedance

The term expressing the ratio of voltage to current in a cable of indefinite length and without SWR. For coaxial cables it is called characteristic impedance and measured in ohms (Ω). Usually manufactured in 50, 75 and 95 ohms impedance.

$$Z_0 = \frac{60}{\sqrt{\varepsilon}} \cdot \ln\left(\frac{Dm}{d}\right) \quad \text{or} \quad Z_0 = \frac{3333}{V_p \cdot C} \quad \text{or} \quad Z_0 = \sqrt{\frac{L}{C}} \ [\Omega]$$

Capacitance

Capacitance is the ability to store and release electrical energy from voltage.

$$C = \frac{\varepsilon \cdot 55{,}6}{\ln\left(\frac{Dm}{d}\right)} \quad \text{or} \quad C = \frac{3333 \cdot \sqrt{\varepsilon}}{Z_0} \ [\text{pF/m}]$$

Velocity of propagation

The ratio between the signal speed in a cable and light velocity in vacuum (300,000 km/s). Expressed as a fraction or as a percentage of the speed of light. If the speed of light is 100% in vacuum, the value for solid PTFE is 70%

$$V_p = \frac{1}{\sqrt{\varepsilon}} \quad \text{or} \quad V_p = \frac{3333}{Z_0 \cdot C}$$

Time delay

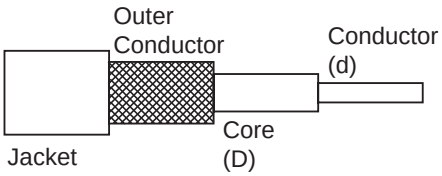
Time delay is the time for the signal to travel a certain distance. For solid PTFE the delay is 4,8 nano seconds per metre. For light in vacuum the delay is 3,3 ns/m.

$$t = 3{,}33 \cdot \sqrt{\varepsilon} \quad \text{or} \quad t = \frac{3333}{Vp} \ [\text{ns/m}]$$

Inductance

Inductance is the ability to store and release electrical energy from current.

$$L = 0{,}2 \cdot \ln\left(\frac{Dm}{d}\right) \ [\mu\text{H/m}]$$



where
D = dielectric core diameter
d1 = diameter of outer conductor wire strand
Dm = D+1,5d1
d = conductor diameter
V_p = velocity of propagation
Z_0 = characteristic impedance
C = capacitance
e = dielectric constant. (2,05 for PTFE)
t = time delay
L = inductance

In any transmission line there is the possibility of the energy being transmitted in a variety of modes depending on the frequency and the construction of the transmission line. The top frequency specified (g) for a coaxial line is the highest frequency that can be used where only the TEM_{∞} mode will be supported.

Custom Design
All coaxial cables can be produced according to individual customer requirements.

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