Wires & Cables

TAILORED & OFF-THE-SHELF SOLUTIONS
FOR CHALLENGING MARKETS

axon' cables & connectors

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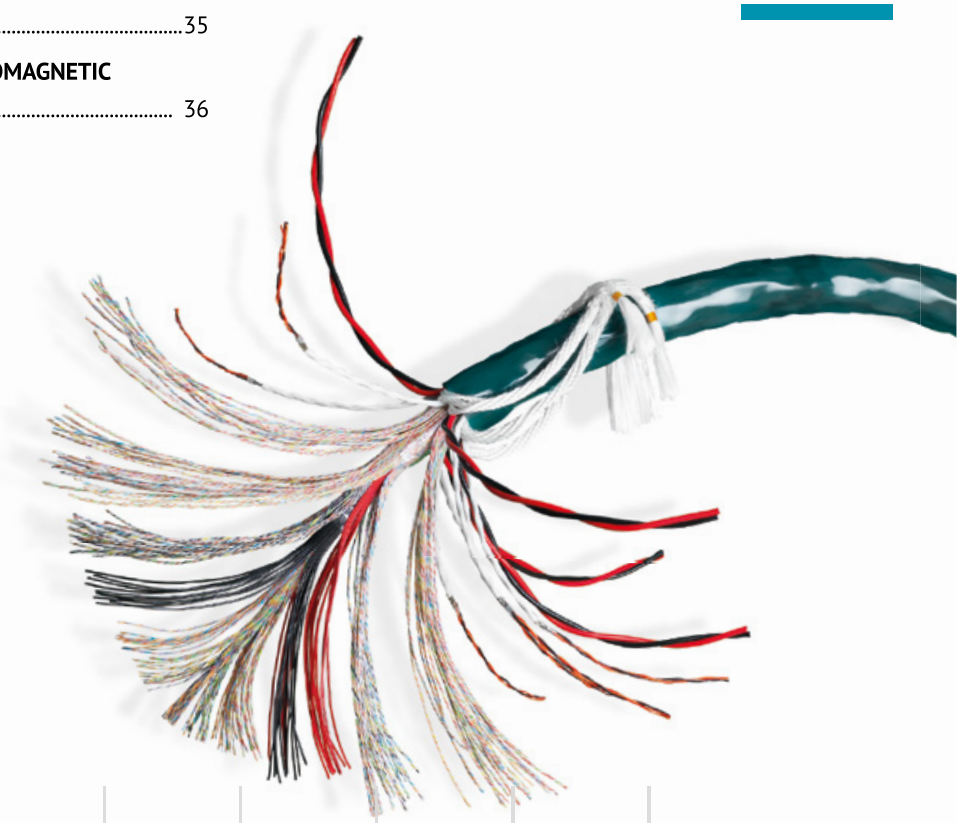
axon' | December 2023

Summary

axon' cables & connectors



Wires & Cables

Headquartered in France, the Axon' group has significant sales and manufacturing footprints in North America, Europe and Asia. The group has in-house expertise in materials including conductor plating, cable insulation, moulding & overmoulding, enabling the company to offer custom-designed cables for many diverse and challenging applications.

Axon' is a WORLDWIDE LEADER in specialist interconnect

axon' cables & connectors

TAILOR-MADE CABLES designed for challenging MARKETS

Designed to be tough

- **Axon' cables are tough! They are engineered, as required, to meet a huge range of electrical, mechanical and environmental challenges, which could include:**
- Signal, power, data transmission, high frequency, high voltage, high data rate.
- Resistance to chemicals, flexion, torsion, EMI, temperature, radiation, moisture/ dust.
- Miniaturisation, weight and space saving.

Industrial equipment, *automation systems and robots, machinery & equipment, heavy industry •*

Electronic equipment •

Medical devices •

Aerospace *flight command or in-flight entertainment •*

Military guidance, *communication or optronic systems •*

Automotive *electronic equipment and diverse sensor systems •* ***Space*** *launchers, satellites and rovers •*

Scientific *research centres •*

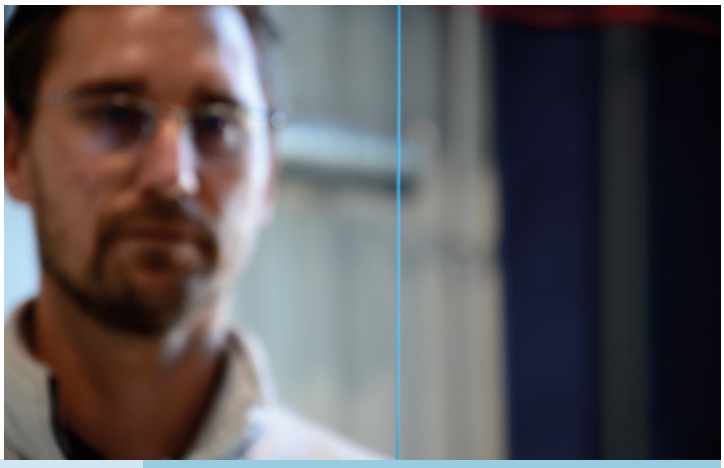
Oil & gas *drilling tools and pipelines •*

Nuclear *or renewable power systems •*

Tough environments

UNTANGLE YOUR TECHNICAL ISSUES WITH AXON'S HIGH PERFORMANCE WIRES

Equipment wires |
for high density cabling



Designed for the transmission of signals or power in numerous applications including box build internal wiring and the wiring of electronic devices, high performance wires made by Axon' are able to resist high temperatures up to **+260°C**.

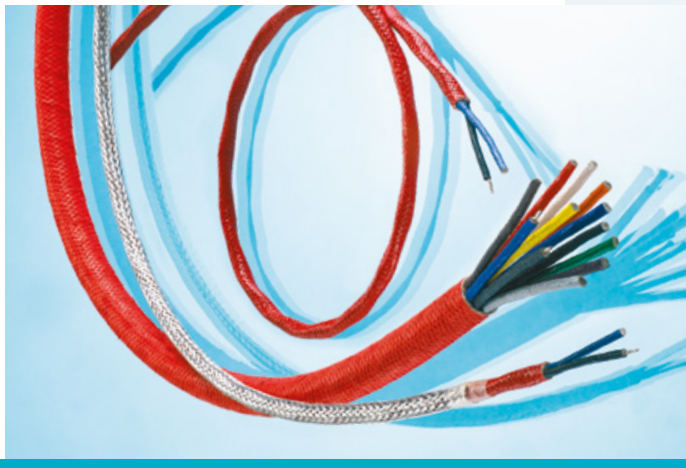
High performance wires insulated with PTFE, L-PTFE, ETFE, FEP, PFA or polyimide

- Resistance to high temperatures: **- 90°C to +260°C** depending on the insulating material.
- Excellent chemical resistance.
- Space and weight savings in high density wiring.
- Excellent dielectric properties & ageing.
- Based on standards including NF (KZ), NEMA and MIL.
- **F**lexible **W**ires (**FW**) for challenging routing in restricted spaces.
- Long length wires for scrap reduction in automated production lines.
- L-PTFE (taped) versions:
  the diameter is up to 20% smaller than standard PTFE wires.

Tough environments

FOR HOTSPOT AREAS

Vibraflame® | the hottest cable yet!



Fire resistant wires & Composite cables

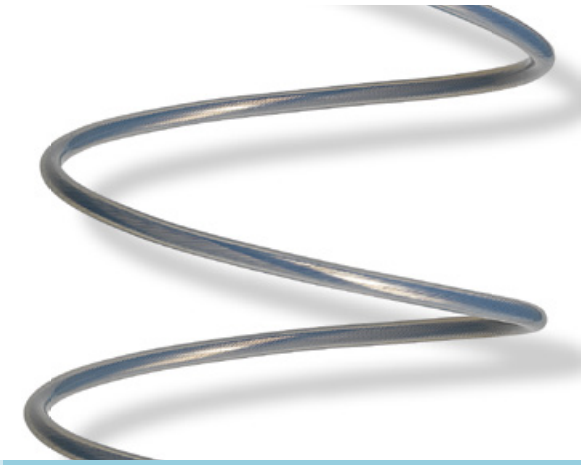
Axon' has developed a range of fire resistant cables named **Vibraflame®** with proven effectiveness over many years.
They are designed for any applications including steel and aluminium plants, oil refineries, glass factories, offshore rigs and in military equipment which require resistance for short durations to extreme temperatures ranging from **-196°C to +1565°C.**

- Maintain electrical circuit integrity at peak temperatures (example: 4 hours in fires exceeding 1050°C).
- Used as power, control, coaxial or power feed cables.
- Heat resistant: **Vibraflame®** cables do not propagate flame and do not contain asbestos.
- Resistant to chemicals, acids and lubricants.
- Axon' Cable also offers extension and compensating cables for thermocouples insulated with **Vibraflame®** insulation able to resist temperatures up to **1050°C.**

Tough environments

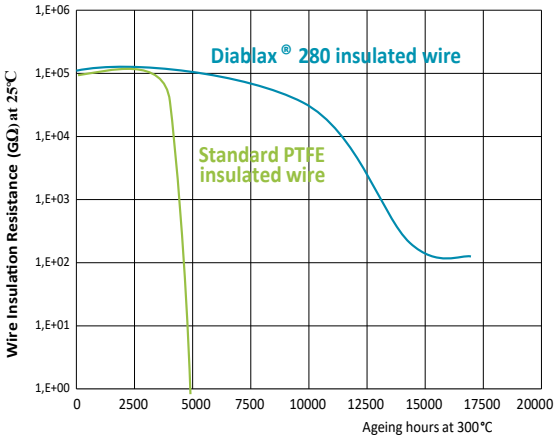
UP TO +280°C

Diablax® |
when even PTFE can't stand the heat ...



- **Diablax®** insulated wires and cables are dedicated to applications requiring continuous long-term operating temperatures up to **280°C** combined with excellent electrical characteristics (high voltage, dielectric strength, high frequency, insulation resistance, dielectric constant ...) and/or high chemical resistance.
- Continuous long-term operating temperature: **Diablax®** can be used up to 280°C for more than 20000 hours (over 2 years).
- For high temperatures, the use of NPC conductor is required.
- Excellent dielectric properties.
- Cryogenic applications : - 250°C.
- From small to medium wire sizes: 28AWG to 04AWG.
- As flexible as PTFE insulated wires.
- Outstanding resistance to chemicals.
- RoHS and REACH compliant.

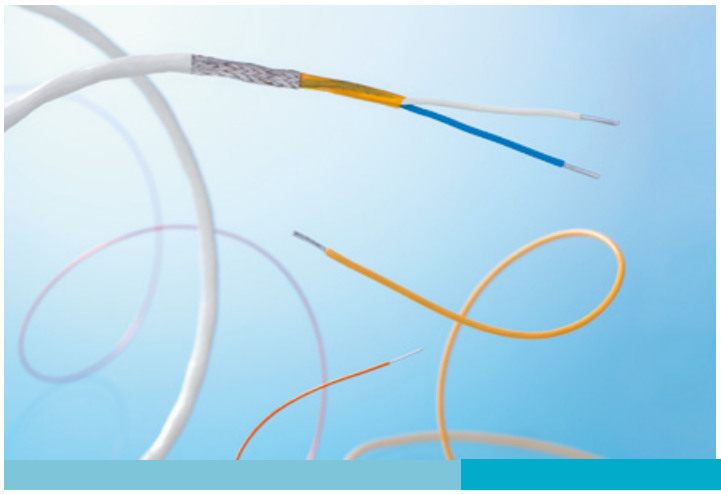
INSULATION RESISTANCE OF PTFE AND DIABLAX® 280 INSULATED WIRES AFTER ACCELERATED THERMAL AGEING AT 300°C



Tough environments

SAFE AND TOUGH!

Halogen free wires & cables



Halogen free wires and cables are designed to avoid propagation of fire and emission of toxic fumes in case of fire in enclosed spaces, such as armoured vehicles, civil or military ships, submarines, underground buildings, public places, industrial facilities, buildings, trains or subways.

	Insulation family	POLIAX™	NEUTRAX™	Polyimide
	Thermal Rating	150°C	200°C	250°C
IEC 60754-1	Halogen-Free	✓	✓	✓
IEC 60332-1	Flame Retardant	✓	✓	✓
IEC 60754-2	Low Smoke toxicity	✓	✓	✓
IEC 61034-2	Low Smoke density	✓	✓	✓

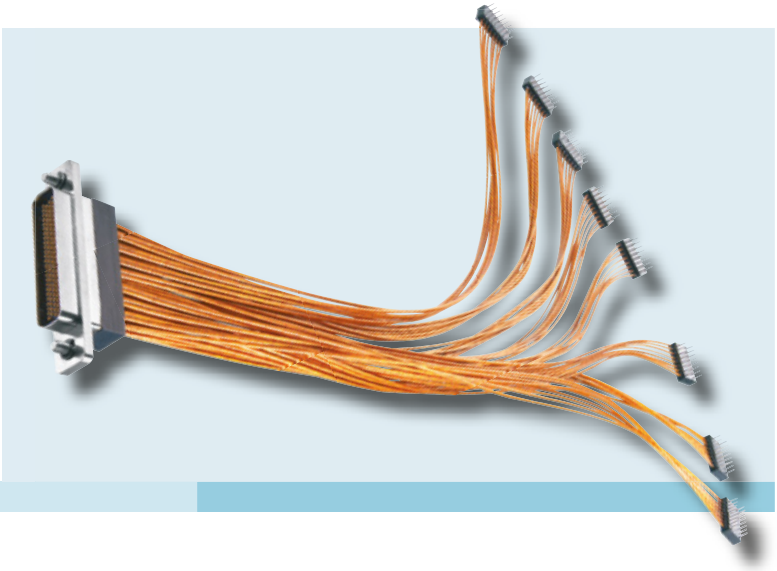
Single wires, shielded cables or multi-core cables jacketed with Axon' special compounds

- Halogen-Free (IEC 60754-1).
- Flame retardant, no propagation of fire and flame (IEC 60332-1).
- Low smoke density to limit visibility problems (IEC 61034-2, NF X 10-702, NF F16-101).
- Low or no emission of toxic and corrosive fumes to save people and equipment (IEC 60754-2, NF X 70-100).
- Very good resistance to chemicals and radiation.
- Operating temperatures ranging from -270°C to +260°C depending on the insulating material (axon' compounds including Poliax™, Neutrax™, thermoplastic elastomers and polyimide-based insulations).
- Very good electrical performance.

Tough environments

FOR APPLICATIONS WITH MULTIPLE CHALLENGES

Axorad™ |
Radiation resistant wires & cables



Radiation resistance combined with high or low temperatures, extreme mechanical stress, and miniaturisation, in standard or inert atmosphere, these are challenges for which **Axorad™** wires and cables are designed.
They can be used as power, instrumentation, control, and sensor cables in nuclear plants, in particle detectors, accelerators or scientific devices.
They are also used in satellites and defence systems including submarines.

- Wires, multi-core wires, coaxial cables and custom-designed cables jacketed with radiation resistant materials including Axon' special compounds.
- Resistance to radiation up to **70 MGy** [(1)].
- Excellent resistance to high (+250°C) or low temperature (-270°C).
- Able to withstand high mechanical stresses.
- Halogen free solutions available.

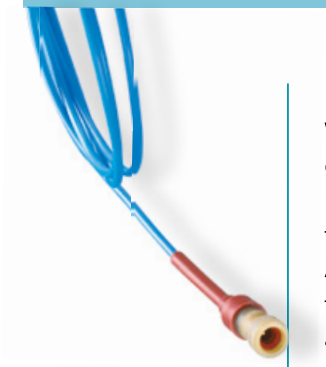
Note

[(1)] Radiation doses are typically expressed either in MRad (1 million Rad) or MGy (1 million Gray): 1 MGy = 100 MRad

Tough environments

CABLES TO SPARK THE INTEREST ...

High voltage wires & cables | High performance for challenging applications



When high voltage is combined with flexibility, miniaturization, or temperature constraints, Axon' Cable offers custom designed wires and cables. They can be used as instrumentation cables, power cables or heating wires for research centres, energy industries, defence and aerospace.

Numerous solutions of tailor-made high voltage wires for harsh applications including:

- Vacuum and ultra-vacuum applications: low outgassing.
- Cryogenic temperatures (down to -270°C).
- Very high temperatures (up to 280°C).
- Radiation (Total Ionizing Dose up to **70 MGy** [1]).
- Continuous long length cables.
- High mechanical resistance.
- Very long lifetime (> 25 years).

Axovolt® miniature high voltage wires up to 22 kV and cable assemblies up to 12 kV

- High performance & small size (down to 1.28 mm dia.).
- Resistance to high temperature (125°C), moisture and pressure.
- Qualified for aeronautics applications (up to 21000 m).
- ITAR-Free.

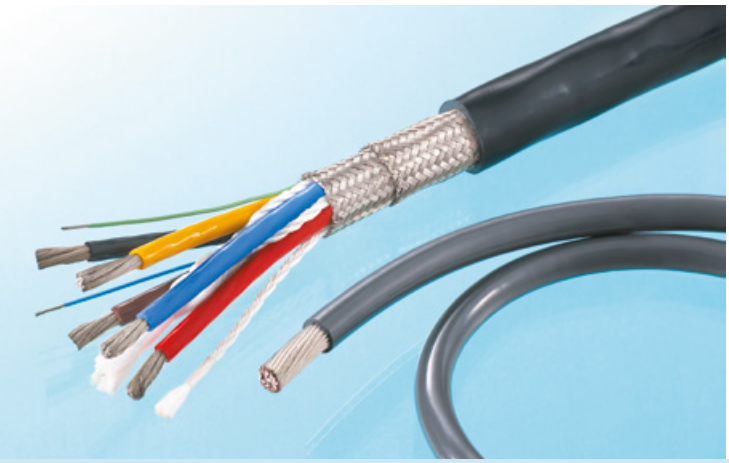
Note

[1] Radiation doses are typically expressed either in MRad (1 million Rad) or MGy (1 million Gray): 1 MGy = 100 MRad

Tough environments

POWER DISTRIBUTION

Flexforce® cables | Powerful and flexible



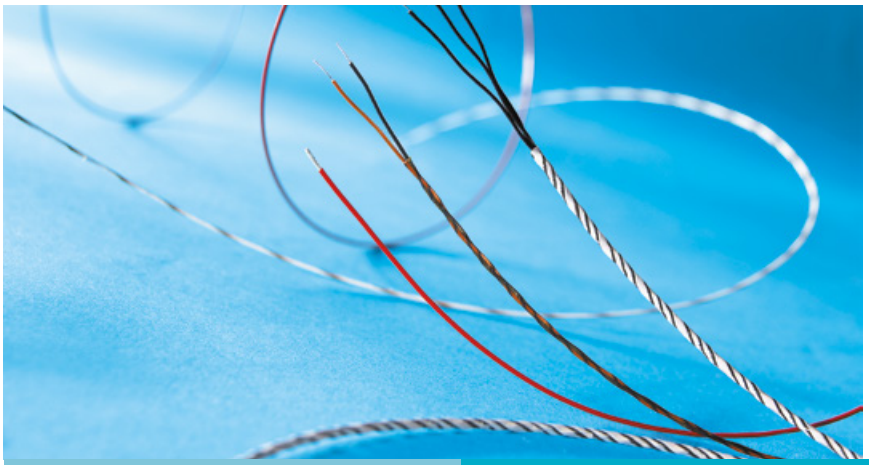
High current carrying capacity and flexibility required? Severe temperature, chemical and mechanical resistance needed in a reduced space? Easy to install, **Flexforce®** flexible power cables are designed to meet the most demanding applications including armoured vehicles and radar systems. **Flexforce®** cables can be used in static or dynamic applications.

- Cables made with extra-flexible tin plated copper conductors: flexibility levels better than IEC 228 class 6.
- High current carrying capacity (example: 330 Amps for a 50 mm² **Flexforce®** at 30°C).
- Temperature range: from -90°C to +200°C depending on the material.
- Halogen-free version available up to +125°C.
- Excellent resistance to abrasion and cut-through resistance.
- Resistance to engine fluids and chemicals.
- Operating voltage: 600 VAC, 1000 VAC, depending on the construction. Higher voltage ratings on request.
- Can be terminated with lugs or connectors.

Space grade wires & cables

TO INFINITY AND BEYOND

Lightweight and resistant wires



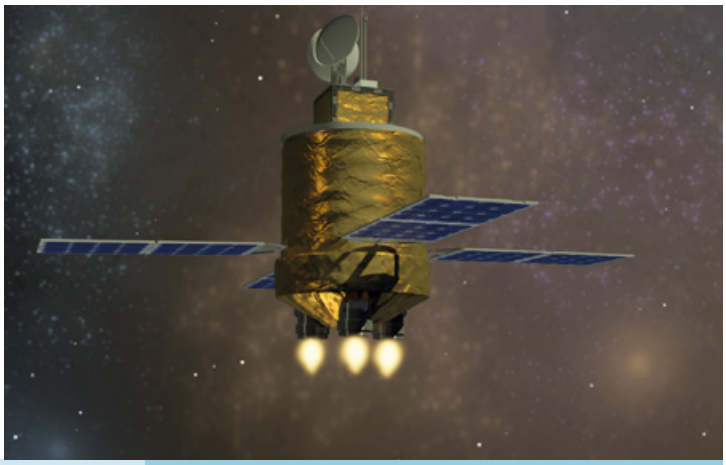
Involved in countless space projects in orbit, Axon' offers a large range of wires for traditional or **NewSpace** projects. They are designed for the internal cabling of electronic boxes for all orbit and planetary exploration profiles ; for cryogenic applications, launchers, satellites and mega-constellations.

- MIL-Aero based wires adapted and tested/qualified for NewSpace needs.
  Flight Heritage on-board satellite mega constellations.
- ESA cables in compliance with ESA/ESCC 3901 and ESCC 3902 standards:
  from single core hook-up wires to coaxial cables and data bus cables.
- Axon' s large range of ESA spec cables includes: | Low frequency, 600 V, electrical wires & cables | Coaxial cables | SpaceWire cables | Composite cables made with ESCC wires. |
- Small or large quantities delivery.
- Excellent radiation resistance.
- Non-flammable.
- Resistance to most chemicals.
- Thermocouple extension wires: | Used to test the thermal behaviour of satellites in vacuum chambers | Made with vacuum compatible materials including bare copper, constantan and FEP. |
- **Axalu®** silver plated aluminium wires: | 50 % to 60% weight saving in comparison with copper conductors | Data transmission and battery power distribution in satellites. |
- QPL list for Axon' interconnect solutions:
  https://escies.org/webdocument/showArticle?id=135&groupid=6

Space grade wires & cables

POWER AND WEIGHT SAVING

Cables for satellite electrical propulsion



Power cables developed with the support of the European Space Agency [1].

- Resistant to high temperatures :
  - From -100°C to max. +280°C for static applications.
  - From min -50°C to max +120°C for dynamic applications.
- Operating voltage up to 5 kV DC.
- Radiation resistance up to 200 Mrad [2].
- Maximum operating current up to 12A.

Custom-designed cables

- Depending on the electrical propulsion technology used, challenging requirements can vary a lot from one mission to another, which requires in-depth study of customers' requirements.

Tailor-made solutions are adapted to the specific application taking into account mission-critical parameters including:

- Total radiation dose.
- Low and high temperature.
- Operating voltage.
- Voltage frequency.
- Flexibility.

Flight heritage:

- Specific orbits (LEO, GEO,etc).

Notes

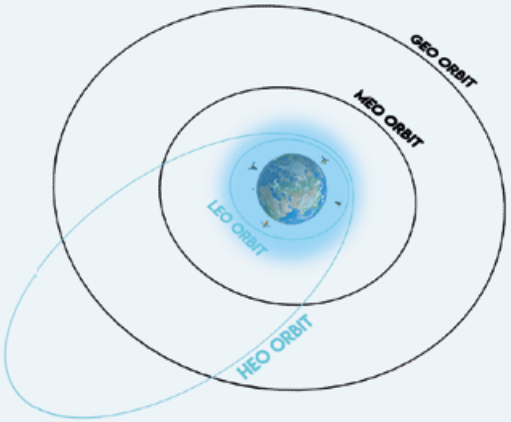
[1] ESA ITTAO1524507NLSFE

[2] Radiation doses are typically expressed either in MRad (1 million Rad) or MGy (1 million Gray): 1 MGy = 100 MRad

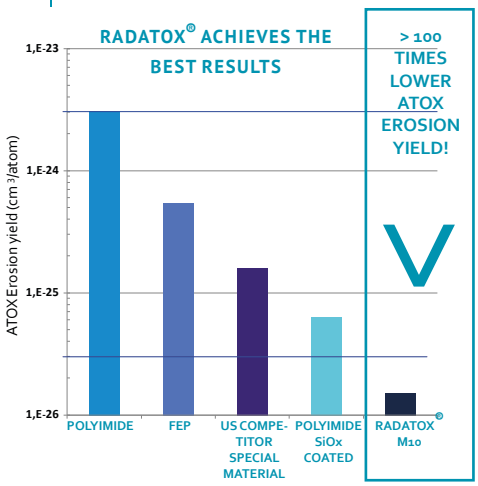
Space grade wires & cables

FACING DOWN THE EXTRATERRESTRIAL THREAT

Radatox® | Wires and cables resistant to atomic oxygen



In order to limit the effects of Atomic Oxygen (ATOX) in Low Earth Orbit (LEO) which erodes and damages materials including polymer insulated wires and cables, Axon' Cable has developed a new electrical insulation system called **Radatox®**.

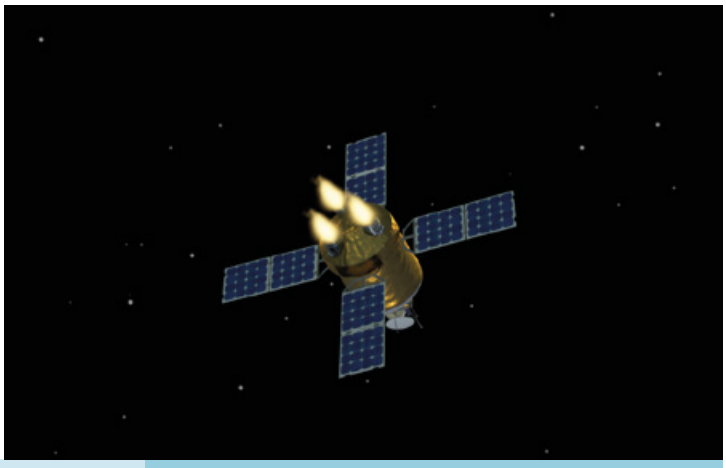


- 10 times more resistant to ATOX compared to FEP, PFA, PTFE.
- 100 times more ATOX-resistant than polyimides.
- Radiation resistant (≥ 200Mrad).
- 40% mass saving compared to solutions such as FEP, PFA or PTFE.
- Twice as flexible as polyimide tapes with similar thickness.
- Easy to strip.
- ITAR-free.
- Proven by independent laboratories to have superior ATOX performance.

Space grade wires & cables

PROTECTION OF ELECTRONIC DEVICES

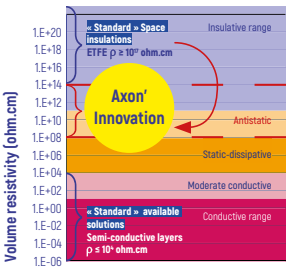
«Smart» antistatic wires & cables



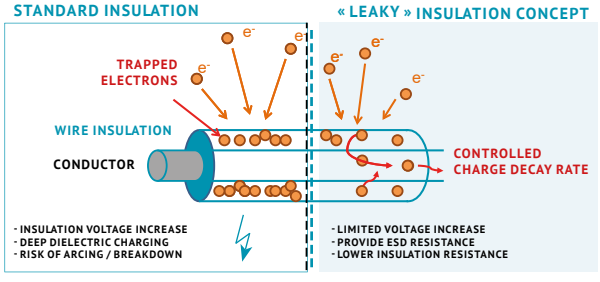
Axon' Cable has developed with ESA support an innovative range of low voltage antistatic cables resistant to electrostatic discharges which will then contribute to the **protection of electronic devices** in spacecraft.

- Innovative range of anti-static wires made with "controlled leakage" insulating materials able to dissipate the electrostatic discharges through the central conductor.
- Anti-static wires with volume resistivity in the range of 10^7 to 10^{15}ohm.cm.
- Good electrical insulating material which prevents ESD.
- Good mechanical performance in compliance with ESCC 3901/012.
- No grounding issues : easy integration.
- Cable design based on the requirements defined in the following space charging standards : ESA ECSS-E-ST-20-06C,NASA-HDBK-4002, JAXA-JERG-2-211A.
- Electrical, mechanical and thermal tests performed based on ESCC3901 specifications.

ESD-TYPE CLASSIFICATION OF INSULATION MATERIALS



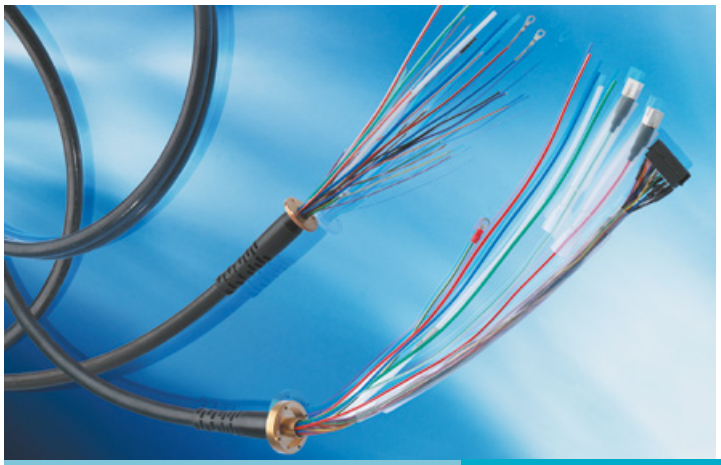
AXON' INNOVATIVE SOLUTION



Hybrid cables

TO YOUR SPECIFICATIONS

Tailor-made round cables



Resistance to flexing, torsion, vibration, shock, abrasion, space saving, high temperature, resistance to chemicals, radiation, sterilisation, fire, electrical performance and electromagnetic compatibility.

The list of potential requirements is extensive. As are the cable solutions that Axon' engineers can offer!

Formed in 1965, Axon' has gained an enviable range of capabilities:

- Solid, stranded or multi-stranded precision conductors.
- Fluorinated materials (PTFE, FEP, ETFE, PFA).
- Hybrid round cables can be made with twisted pairs, shielded wires, flexible wires, power cables, coaxial cables, fibre optic cables and tubes.
- Halogen free solutions.
- Radiation resistant materials.
- Sterilisable insulating and jacketing materials (PVC, silicone, polyurethane, thermoplastic elastomers).
- Spiral cables characterised by memory and extension coefficient suited for the application.
- Small, medium and high volumes.
- **Long length cables** suited for automated production lines.

Hybrid cables

TO YOUR NEEDS

Tailor-made flat-form cables

Excellent flexlife and robustness! These are the qualities of **hybrid flat or ribbon cables** manufactured by Axon' Cable. They are designed for equipment with a reduced cabling space. This is an ideal solution for automation systems and robots.

- Hybrid ribbon cables can be offered with twisted pairs, feeder wires, signal cables, flexible wires, PTFE or polyurethane (PU) tubes.
- Laminated ribbon cables jacketed with materials including FEP, ETFE, PFA, PVC, polyurethane (TPU), thermoplastic elastomers (TPE).
- **Flextrack®** laminated flat cables insulated with **Celloflon®** (PTFE) for high flex applications including pick and place equipment.
- Lightweight.
- No particle emissions.
- Low outgassing.
- Excellent resistance to chemicals, solvents and high temperatures together with repeated flexions.
- Low bend radius and high flexlife.
- Shaped cables for challenging routing.

At the speed of light!

CHALLENGING ENVIRONMENTS

Axopt® |
Optical fibre cables

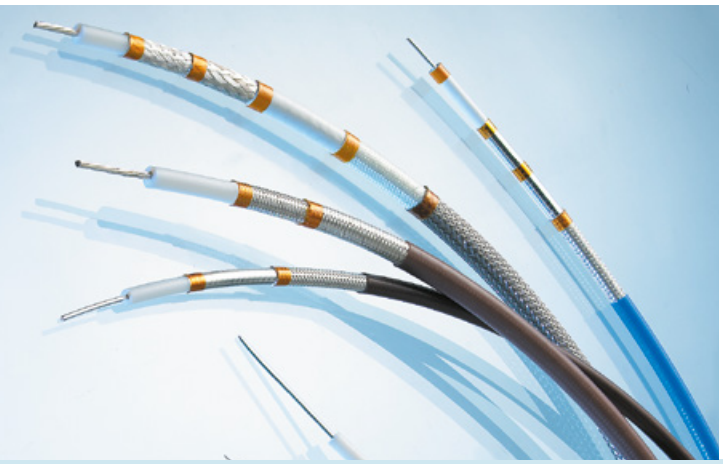
Weight saving, immunity to electromagnetic interference and capable of high data rates, these are the qualities of **Axopt®** optical fibre cables designed for challenging applications including defence and avionics.

Axon' optic fibre cables range includes:

- Single fibre optic cables, multimode 50/125 1.8 mm, ARINC-802 qualified, multimode 62.5/125 1.8 mm, single mode 9/125 1.8 mm.
- Custom-designed hybrid cables made with multifibre cables and electrical wires depending on the application.
  - Tight structure for a safer and better connection.
  - Tensile strength: > 200 N.
  - UV laser marking.
  - Operating temperature: -60°C to +135°C.
  - Very low shrinkage allowing very stable performance after cabling.
  - Easy cable stripping.
  - ITAR-free.

Signal integrity

Coaxial cables



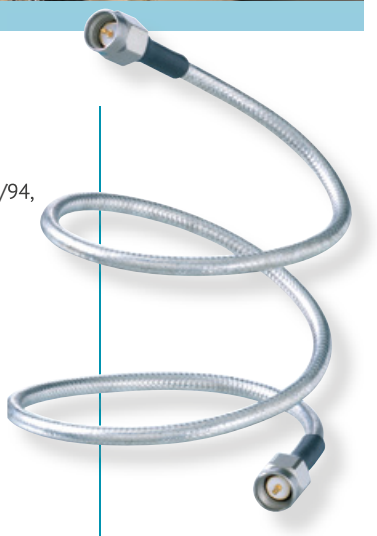
Coaxial cables are designed for the transmission of signals with minimum distortion and attenuation while preventing the reception of outside interference. In order to meet the most demanding requirements including aerospace, military equipment and medical devices, Axon' offers different types of coaxial cables including:

- Single or double screened coaxial cables.
- Coaxial cables according to MIL-C-17 (RG), M17/93 (KX21), M17/94, M17/95, M17/113 (KX22), M17/128, etc.
- Triaxial cables, low noise and subminiature cables.
- Hand formable coaxial cable:
  - Easy installation: no tooling required.
  - Fully compatible with coaxial connectors.
  - Up to 18 GHz.

With the following characteristics

- Very low losses.
- Limitation of outside interference.
- Weight and space saving.
- High temperature resistance.

All Axon' coaxial cables can be integrated into custom- designed hybrid cables.



Signal integrity

SPACE SAVING

Picocoax® | Miniature coaxial cables

Miniaturisation and quality of signal transmission are key issues for manufacturers of test equipment, cameras, sensors and medical devices.

In order to meet these challenges, Axon' Cable manufactures a full range of flexible and **miniature coaxial cables** (36AWG to 46AWG) called **Picocoax®**.

- Composite cables made with bundles of 18 to 256 (or more on request) **Picocoax®** (called **Multipicocoax®**).
- Hybrid cables with **Picocoax®** wires, twisted pairs, shielded wires, flexible wires, power cables or tubes able to transmit power, signals and fluids.

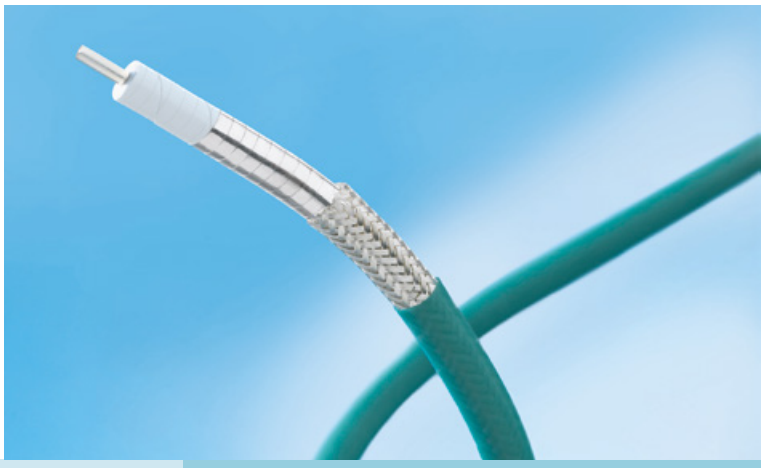
Picocoax® miniature coaxial cables are insulated with:

- High performance dielectric materials including FEP or **Celloflon®** (Axon' porous PTFE).
- The use of **Celloflon®** enables the manufacture of lighter, smaller, more flexible coaxial cables with improved electrical characteristics.
- Good compromise between small diameter (e.g 0.20 mm) and capacitance of 50 or 100 pF/m.
- Very good electrical characteristics: low dielectric constant.
- High flexibility.
- Miniature coaxial wires can be welded directly onto a PCB.

Signal integrity

30% WEIGHT SAVING

Lightweight coaxial cables



Designed for the cabling of aircraft and helicopters, **lightweight coaxial cables** manufactured by Axon' are **30 % lighter** than the EN4604-007 aeronautics standards and qualified to EN4604-009. Made with materials including aluminium, alveolar PTFE and **Cello-flon®** (porous PTFE patented by Axon') and optimized for weight saving, they have excellent mechanical and electrical performance.

- Frequency up to 18 GHz for the connected versions.
- Excellent attenuation values (15 dB for 100 m at 1 GHz).
- Low dielectric constant (1.3 depending on the product).
- Temperature rating: -55°C to +180°C. (good crush resistance).
- Can be terminated with standard coaxial connectors (N, TNC, SMA, others).

Microwave coaxial cables

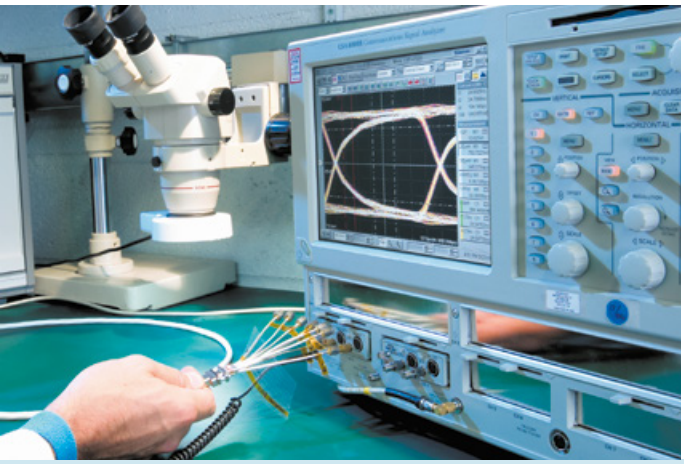
Suitable for either ground-based or on-board radar, for avionics, defence or space applications, Axon' Cable has developed an extensive range of microwave cables terminated with coaxial connectors.
The company's engineers are focused on optimizing the assemblies for the customer's specific frequency.

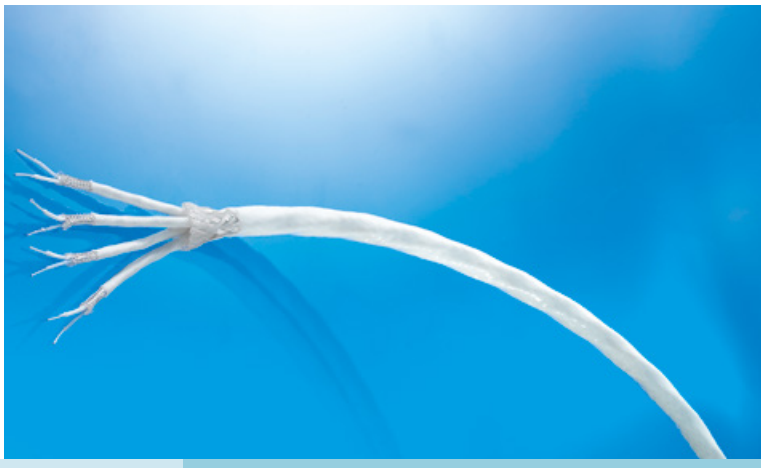
- Frequency up to 50 GHz for the standard range but can be higher depending on customer's application.
- Excellent insertion- and return loss.
- Very flexible versions for highy repetitive bending in dynamic applications.
- Versions made with additional mechanical protection for challenging environments.
- Radiation resistance for space versions.
- Easy installations.
- Axon' microwave cable assemblies can be easily integrated into hybrid harnesses.

Signal integrity

HIGH DATA RATES IN HARSH ENVIRONMENTS ? NOT A PROBLEM ...

High speed cables





Vertically integrated, Axon' Cable is able to optimise the design of both conductor and insulation materials to deliver high speed cables capable of coping with severe conditions. High temperature, weight saving, mechanical resistance, are just a few examples. Axon' engineers use a range of simulation tools to optimise electrical, mechanical & environmental performance.

A large range of customized solutions made with in-house materials including:

- Conductor, PTFE and thermoplastic insulating materials depending on the temperature (from -55°C/+125°C or -90°C +200°C).
- EMI optimised.
- Low mass with aluminium silver plated shielding for space applications.
- Radiation resistant : up to 300 Mrad[1] (space applications).
- High speed cables can be supplied as cable assemblies terminated with market leading high data rate connectors developed by Axon'.

AXON' HIGH SPEED CABLES ARE OPTIMIZED FOR PROTOCOLS INCLUDING:

USB	RS422 RS485	IEEE1394	CAN	LVDS	Fibre Channel	Ethernet /TT-Ethernet (cat 5, cat 6a, Cat8): from 1 Gb/s to 40 Gb/s	SpaceWire 400 Mb/s	Wizarlink 10 Gb/s	SpaceFibre 10 Gb/s

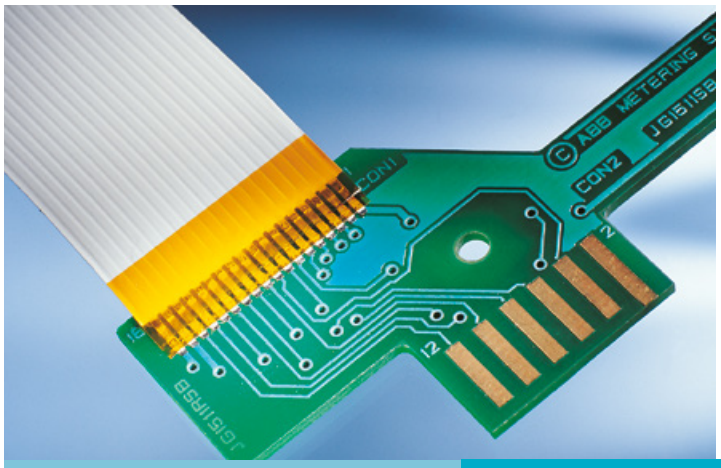
Note

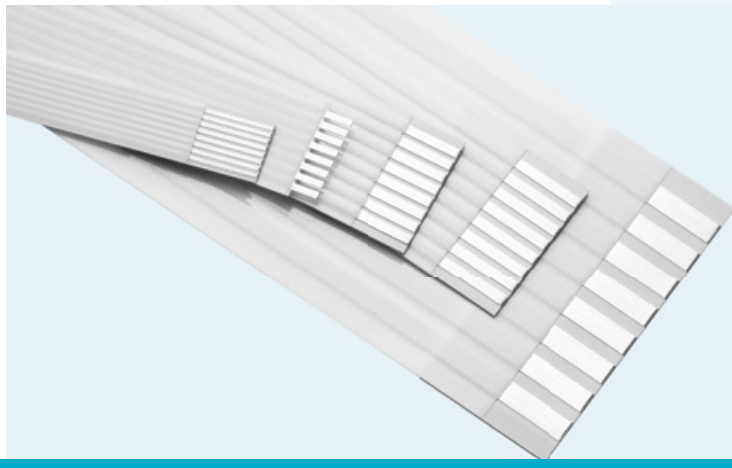
[1] Radiation doses are typically expressed either in MRad (1 million Rad) or MGy (1 million Gray): 1 MGy = 100 MRad

Space saving

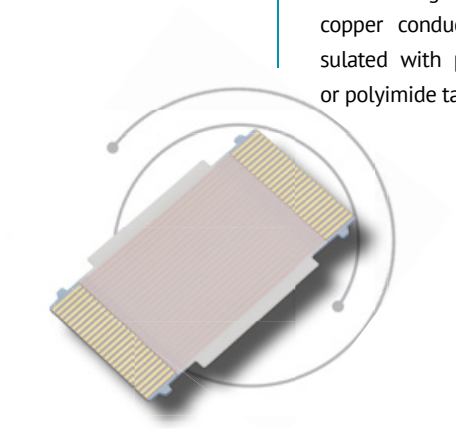
BOARD-TO-BOARD CONNECTION

Flat flexible cables





Designed for board to-board interconnections in electronic systems, **Axojump™** Flat Flexible Cables are made up of flat tin or gold plated copper conductors insulated with polyester or polyimide tapes.



- From 0.30 mm pitch for extreme space saving up to 2.54 mm pitch; custom pitches also possible.
- Extremely small dimensions: low profile, narrow width, fine pitch.
- Easy and fast installation: time saving and cost reduction.
- **Tin alloy** or **gold** coating on the stripped end can be offered to reduce or guarantee the absence of whiskers.
- Shielded versions for EMI protection.
- Excellent flexibility and flexlife: over 70 million cycles for the ultra-flexible version (10 mm bend radius).
- **Custom-designed** versions with folds, shields, notches, punching, slitting or marking.
- Temperature use: 105°C or 125°C.

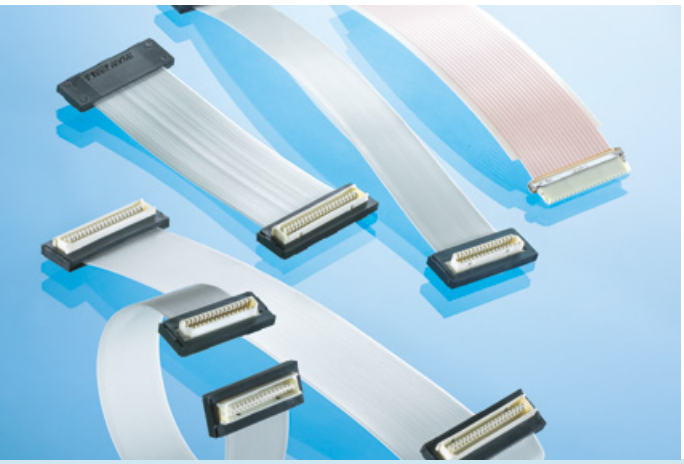
Type of connection

- ZIF/LIF connectors with or without mechanical locking systems.
- Hot bar or reflow soldering.

Space saving

BOARD-TO-DISPLAY

FDC-Flat Display Connections |
Board-to-display



100 Ω FLAT FLEXIBLE CABLE

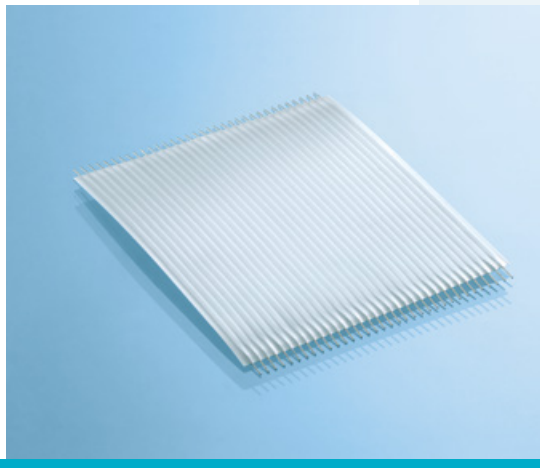
Designed for board to display interconnections, **FDC-Flat Display Connections** consist of Flat Flexible Cables and connectors including DF-9, DF-19, FI-SE and Fi-X. Ready to plug, they are designed for displays or HD displays in any application including consumer electronics, industrial equipment, and infotainment systems in cars or aircraft.

- Available in 0.50 mm, 1.00 mm and 1.25 mm pitches.
- Ready-to-plug solution.
- Space saving.
- Excellent flexlife and flexibility.
- Foldable for easy integration mounting.
- Shielded versions available.
- Mate-able with ZIF connectors.
- Excellent high speed transmission with **FDC100™** version (100 Ω flat flex cable). >= 2 Gbps for LVDS (depending on cable length).

Space saving

BOARD TO BOARD CONNECTOR & POWER TRANSMISSION

Round-end Flat Cables



Axostrip™ is a range of Round-end Flat Cables (RFC) which can be soldered or inserted to achieve **board to board inter-connections.**
Made up of tin plated copper insulated with polyester, polyimide or aramid tape, they are designed to transmit power.

- Power transmission (3A).
- High resistance to bending and vibration.
- Easy and fast integration.
- Lower purchasing costs:
  RFC are wave-soldered with other components.
- High degree of flexibility.

2 possible types of ends

ROUND CONDUCTORS ON BOTH ENDS	ROUND CONDUCTORS ON ONE END & FLAT CONDUCTORS ON THE OTHER END
LOWER PRODUCTION COSTS AS NO CONNECTORS ARE REQUIRED	THIS DISMOUNTABLE VERSION IS COMPATIBLE WITH ZIF CONNECTORS

Space saving

POWER TRANSMISSION

Bulk flat flexible Cables

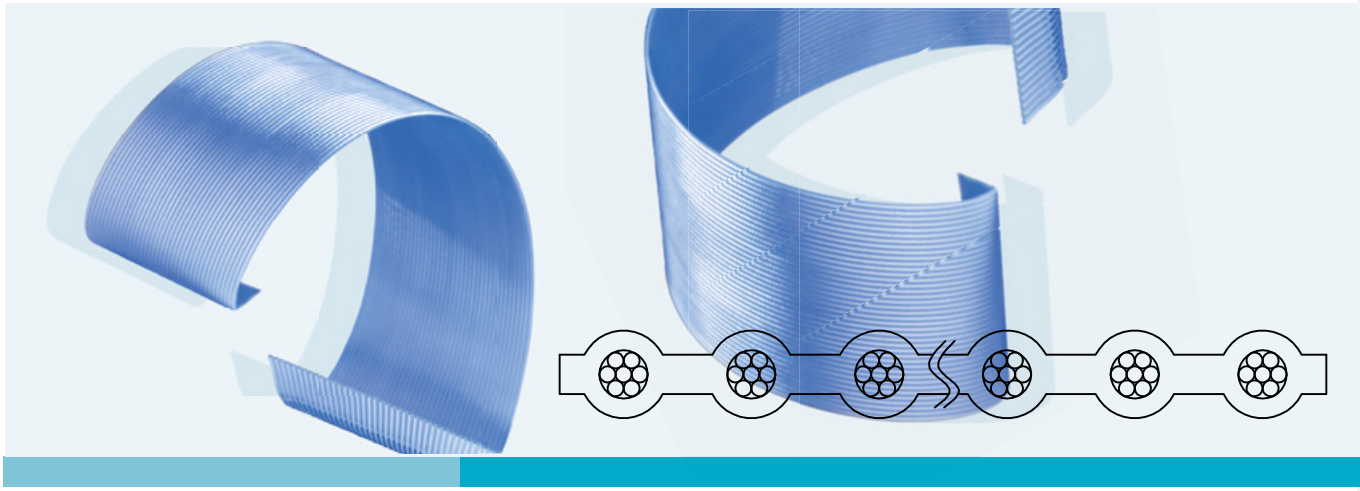
Bulk flat flexible cables Flexlink® can be installed in switch rotary connectors (SRC) for Airbag systems, printers and computers for consumer electronics, used for special machines or board-to-board connections.
They are supplied on the reel or as ready-to-use harnesses for any application where flexibility and space reduction are required.

- Power transmission (8 A for example).
- Excellent flexibility.
- Space saving.
- Bulk flat flex cables can be cut to length as required.
- Compatible with most standard crimp contacts.
- Low width FFC can be punched to facilitate positioning.
- **Picoline®** low margin cables to save space and reduce cable friction noise, inside the airbag® SRC cassette.
- Temperature rating: 105°C or 200°C .

Space saving

SPACE SAVING & HIGH TEMPERATURE

Ribbon cables



When applications require temperature resistance and space saving, flat cables made with round conductors are the solution.
Insulated with FEP or ETFE, these **ribbon** cables can be made with solid or stranded round conductors.
Available in **1.27 mm** and **2.54 mm** pitches, they have also an excellent flexlife.

- Excellent mechanical resistance to abrasion (ETFE insulation) and traction.
- High temperature resistance:
  -90°C to +200°C for FEP insulated flat cables.
  -90°C to +155°C for ETFE insulated flat cables.
- Excellent flexlife.
- Space saving.
- Compatible with IDC connectors.
- Laser weldable.
- UL style 2445 Recognition for round conductor flat cables insulated with FEP (Axon' UL file nr: E45046).

Additional cabling solutions

Cable accessories

Being vertically integrated, Axon' can offer additional cabling solutions to deliver an optimized design for the specific application.

- **Axotresse®** braids - single or double braids designed for manual shielding over small lengths of assembly branches.
- PTFE tubes designed to transport fluids or gas, they can be integrated into hybrid hydro-electrical cables or used in catheters or pipettes.
- PTFE or **Celloflon®** tape (porous PTFE patented by Axon') for cable insulation.
- Large width PTFE tapes for cable insulation.
- PTFE tapes can also be used for membranes.
- PTFE or silicone tubes.

Custom-designed Solutions

As a multi-skilled group, Axon' is able to provide custom-designed wires and cables to meet customers' requirements

Expertise in a number of areas including:

- Metallurgy.
- Plastics technology.
- Electronics.

Grey Matter

- 10% of the turnover is invested in Research & Development.
- Simulation tools: flexlife, shielding efficiency, high frequency.

Co-engineering

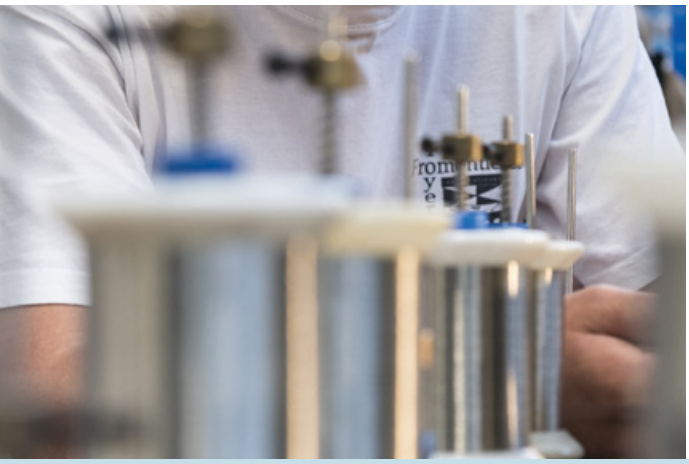
- Idea and co-design: state-of-art design and simulation tools.
- Evaluation.
- Validation of materials.
- Productionisation: Product/ Process studies
  - Design of production tools.
  - In-house test equipment for validation (electrical characteristics, environmental characteristics, mechanical characteristics, dimension, etc).
- Industrialisation: pre-series.
- Production.

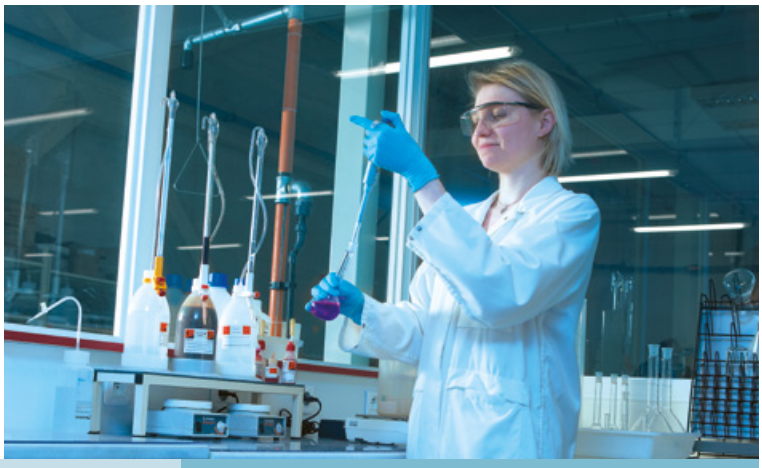
Open innovation

- Cross-over from space or aeronautics technologies towards those of automotive or medical enables Axon' to offer innovations to customers all within an accelerated design cycle time.

Custom-designed solutions

Vertical integration





- Concept
- Co-design
- Simulation

➔ STUDY

- Plating
- Drawing
- Stranding

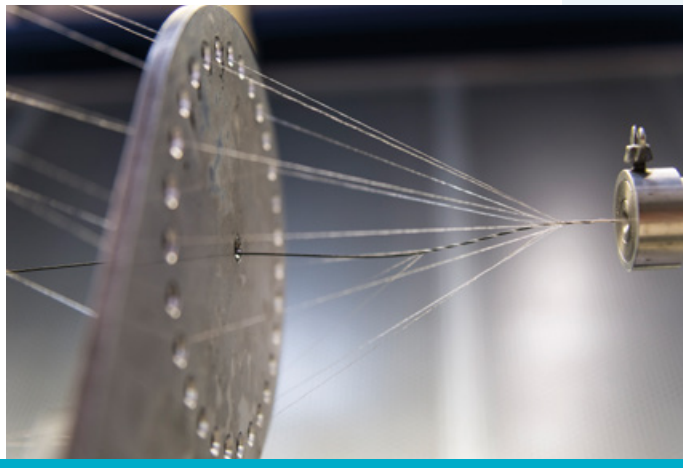
➔ CONDUCTOR

- Insulating (thermoplastic, PTFE or taping)
- Assembling
- Shielding
- Potting
- Jacketing

➔ FLAT OR ROUND CABLES

Custom-designed solutions

Real collaborative Engineering



Once the collaborative design is complete, Axon' has in-house manufacturing and test capabilities for every single process in conductor, wire and cable manufacture. This enables:

- Full control of the production chain.
- Full control of the quality of products and deadlines.
- Time saving.
- Rapid development of fully bespoke cable solutions.

Wires and cable manufacture : Axon' has vertically integrated several technologies including

- Conductor manufacture: plating, drawing and stranding.
- Cable insulation: thermoplastic extrusion, PTFE extrusion and taping.
- Protection against electromagnetic interference: shielding.
- Assembly of hybrid elements.
- The design of manufacturing and test tools.

Custom-designed solutions

State of the art |
In-house conductor manufacture

EXPERTISE in plating

- **Conductors** made with
  - bare copper.
  - silver plated copper.
  - silver plated aluminium (for **Axalu**® wires: space application).
  - tin plated copper.
  - silver plated nickel.
  - nickel plated copper.
  - gold plated copper (for flat flexible cables).
  - special copper alloys.

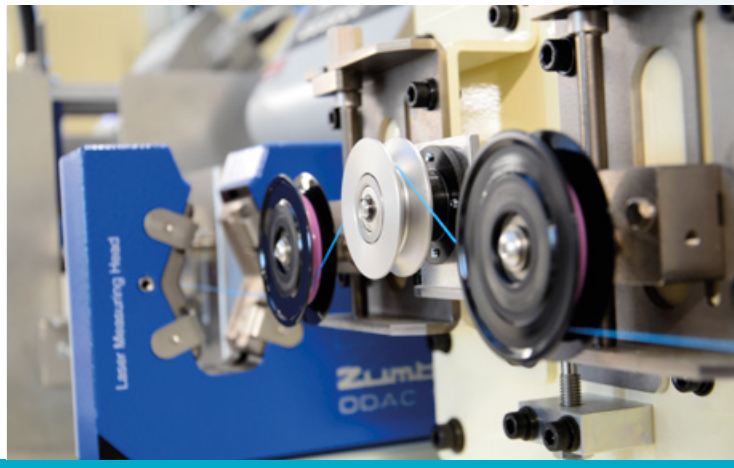
- **Plating** allows to improve :
  - electrical conductivity.
  - solderability.
  - corrosion resistance.
  - oxydation protection.

EXPERTISE in conductor drawing

EXPERTISE in stranding to manufacture more flexible multi- stranded conductors

Custom-designed solutions

Cable jacketing



In-house expertise in thermoplastic extrusion, PTFE extrusion and taping.

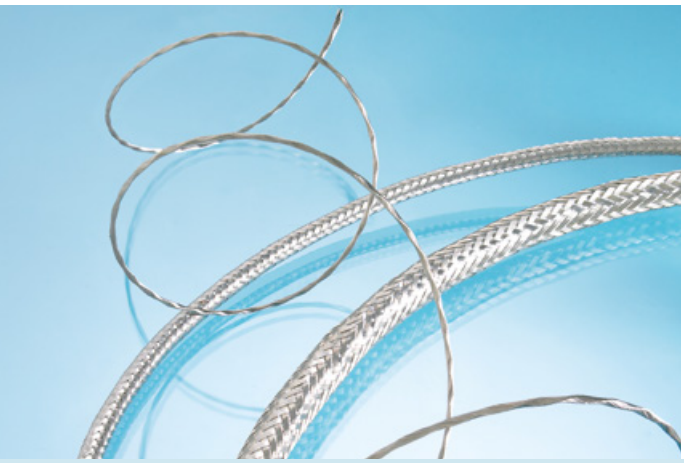
Wire insulation and cable jacketing with a large range of materials including:

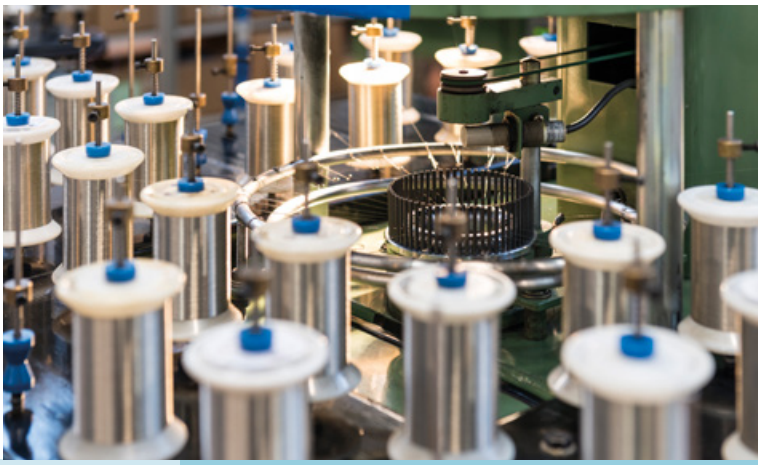
- Fluorinated materials (PTFE,FEP, ETFE, PFA), PEEK, polyimide.
- Special materials and compounds developed by Axon'.
- Tapes including PTFE, **Celloflon®** and polyimide.
- Crosslinked primary wire insulations and jackets.
- Sterilisable materials including medical grade PVC, silicone and polyurethane.
- Halogen free materials.

Long length cables insulated with PTFE or thermoplastic materials for customers' automated processes.

Custom-designed solutions

Protection against electromagnetic interference



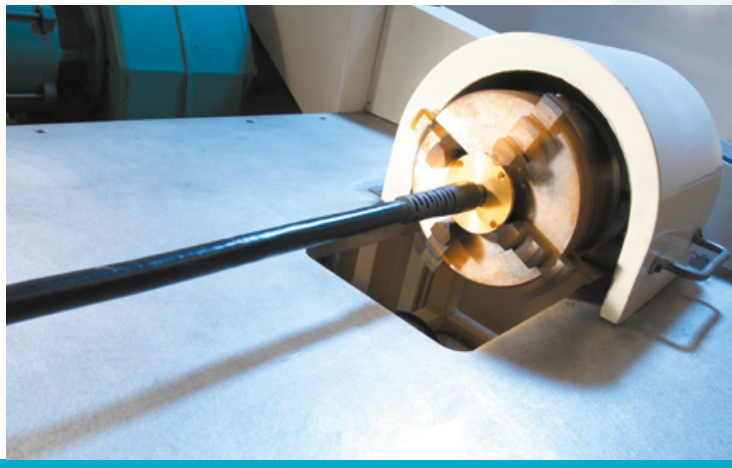


Any electronic system can both disturb and be disturbed by the creation of EMI.
Efficient shielding of wires, cables and harnesses is therefore required.

- Simulation and control tools:
  - Definition of required EMC value during the design phase.
  - Definition of cable shielding configuration.
  - Shield efficiency testing.
- Expertise in shielding techniques: helicoidal shieding, braiding, tapes for round or flat cables.
- Optimisation of bundles, diameters of shielding strands, braiding angles.
- Synthetic fibre, glass fibre for mechanical protection.
- Overbraiding of branches with a continuous shielding.

Test equipment

In-house test capabilities



Because connectors and interconnect solutions often have a hard life, Axon' uses a wide variety of in-house equipment to ensure all products stand up to the most challenging of environments.
For very specific requirements, Axon' Process Development teams are also able to design bespoke equipment and test benches in partnership with the customers.

Physical characteristics

- Meniscograph (IEC 38-2-69) to check solderability of cables and components.
- Scanning Electron Microscopy (SEM).
- Differential Scanning Calorimetry (DSC).
- X-Ray Radiography, with Computed Tomography if needed.
  Residual magnetism test.
- Fourier Transform Infra-Red Spectrometry (FTIR).
- Dynamic Mechanical Analysis (DMA).

Mechanical characteristics

- Resistance to shock, combined flex/torsion, folding, winding, unwinding.
- Resistance to flexlife.
- Vibration equipment and combined vibration/ climatic "shake and bake" tests.
- Tensile tests.

Test equipment

In-house test capabilities

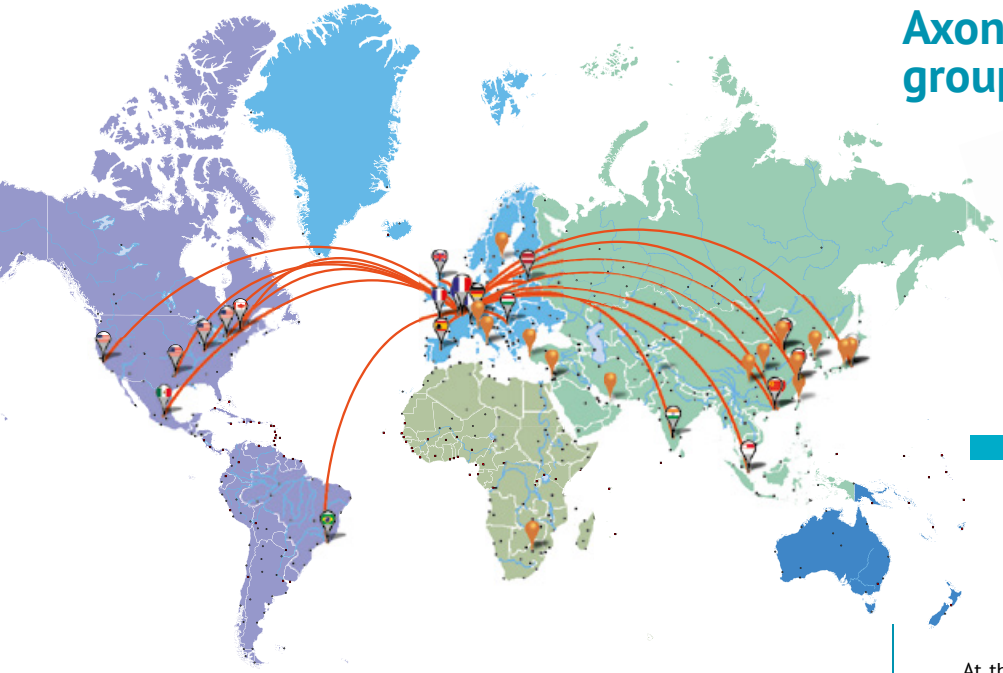
Electrical characteristics

- **DC harnessing**
  - Automatic Test Equipment (ATE) for continuity, insulation resistance, dielectric strength, in 2 wire and 4 wire test options
  - Filter testing: capacitance, inductance.
- **Power and high voltage**
  - High current generator up to 1000A.
  - Partial Discharge tester for high voltage.
- **High frequency**
  - Network analyser for insertion loss, return loss, phase matching.
  - Sampling scope/ TDR up to 50GHz.
- **High data rate**
  - Dedicated test bench for Mil-Std-1553 data bus.
  - Eye pattern test bench.
- **EMI/EMC testing**
  - Transfer impedance test benches.
  - Bit error rate tester.
  - Mode stirred chamber.

Environmental characteristics

- Resistance to salt spray, thermal shock, autoclaving, accelerated ageing, humidity.
- Resistance to oils, decontaminants, sterilization, solvents.
- Resistance to flame.
- 500 bars high pressure water test bench.
- Thermal infrared cameras.

Axon' is closer than you think



Axon' is a medium-sized group with

20

subsidiaries worldwide

The Axon' Group has been developing world-leading interconnect solutions for challenging applications since 1965

At the very beginning, Axon' Cable manufactured high temperature insulated wires. Since then, the group has greatly enlarged its areas of expertise to offer complete solutions to customers:

- Design and manufacture of **wires, cable assemblies,** custom-designed **connectors** with Axon' Cable.
- Design and manufacture of **metal-plastic parts and components** with Axon' Mechatronics and Axon' Nanotec.
- Design and manufacture of **elastomeric components** with Addix.

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PHOTOS: FRED LAURES, BASTIEN GUILBERT, NICKELKROME, AXON'

axon' cables & connectors

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