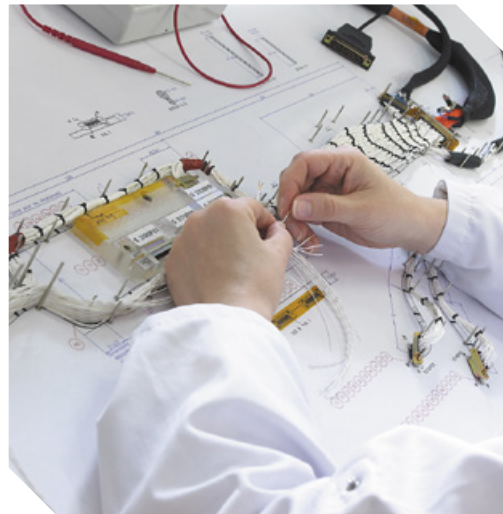
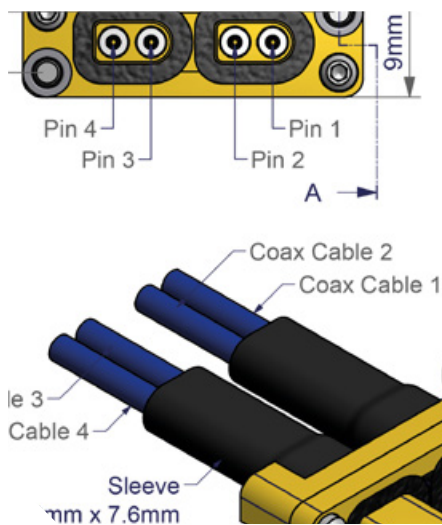


EXPERTISE

STUDIES



INTEGRATION



EXPERTISE

Technical services in Cabling Engineering

CABLING ENGINEERING

The growing need in cabling engineering:

Cabling generally represents less than 2% of the total cost of a system, whether it is an airplane, a helicopter, a drone or even a train. Nevertheless cabling is a major and recurring problem which appears systematically during the final phases of developing a complex system, generating additional and significant non-budgeted costs in order to complete the project. Why?

In order to manage the complexities of large system design, they are divided up into modules, and these modules are allocated to teams often situated in different geographical areas. At the end of the project the modules need to be interconnected, necessitating cabling. And it is at this point the discovery is often made that the necessary interfacing has not been sufficiently studied.

The complexity of large systems has grown, and will continue to grow. The generalisation of 48 Volts in the automotive industry is accelerating the development of mechatronics and allows us to predict that 80% of innovations in our future electric or hybrid cars will involve electronics, and therefore cabling. The improvement of safety in aircraft, the evolving robotisation of systems in hostile environments, the replacement of hydraulic controls by electric equivalents, all this will lead to additional complexity of modules and the need to design interfaces which are both high performance and easy to integrate.

For these reasons AXON' offers you the services of their technical Cabling Engineering teams:

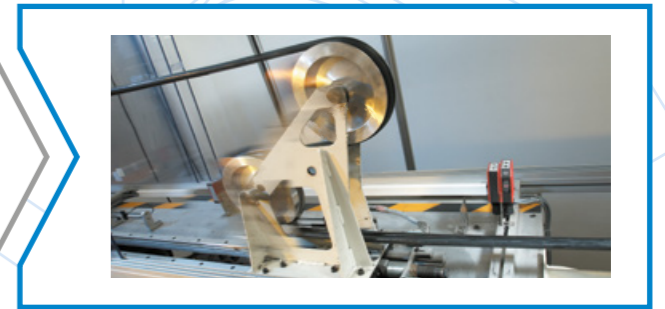
- During the Engineering Development phase.
- And for the Integration phase.

This brochure is intended to give you some insight into the added value that AXON' has been bringing for decades to its key customers.

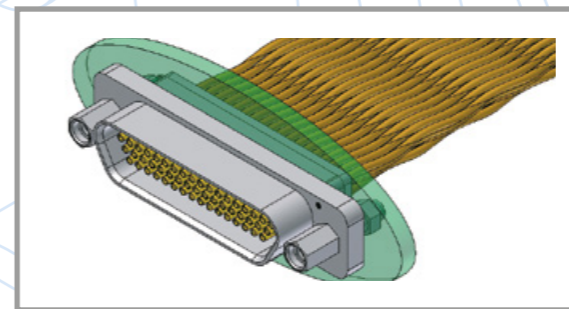
Joseph Puzo
CEO



ADVANTAGES OF CO-DESIGN WITH AXON' TEAMS



Mould-flow modelling, EMI & flex-life simulation



Space saving, Optimised EMI protection



Routing optimisation and customer integration


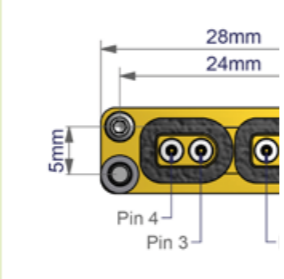
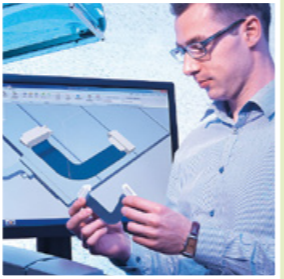


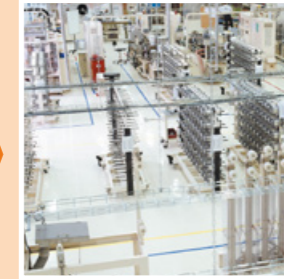


Supply Chain optimisation, quality control

AXON' TECHNICAL EXPERTISE : STUDIES & INTEGRATION

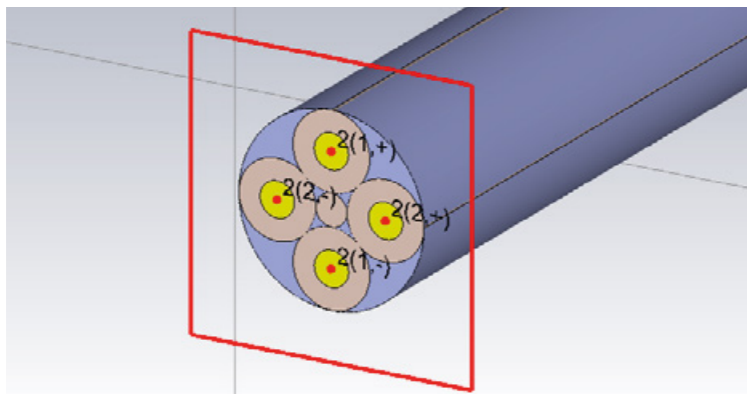
Cabling can be a major and recurring problem towards the end of a system design process. In response to this problem, AXON' can offer you the assistance of its technical teams to accompany you during the different phases of your projects.

LEAN ENGINEERING EXPERTISE

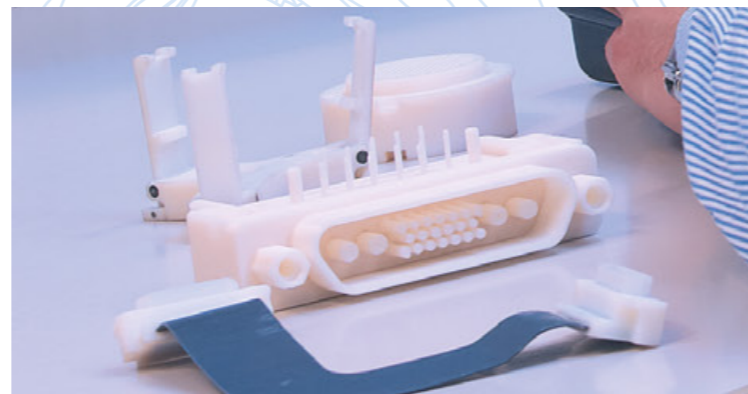
<p>1 IDEA <i>Upstream studies / pre-design</i></p>  <p>Example of AXON' added value Provide a <u>global view</u> of available interconnect technologies.</p>	<p>2 CONCEPT <i>Co-design</i></p>  <p>Example of AXON' added value <u>Simulation</u>. Predictive modelling of flex-life, EMI performance, mould-flow analysis and more.</p>	<p>3 PROTOTYPING <i>Validation by rapid prototyping</i></p>  <p>Example of AXON' added value Production-representative 3D mock-ups produced <u>rapidly</u>. Prototype CNC machining centre.</p>	<p>4 PRODUCT-IONISATION <i>Product / Process studies</i></p>  <p>Example of AXON' added value <u>Anticipation</u> of productionisation issues. Creation of the product / process.</p>	<p>5 PRE-SERIES <i>Ramp-Up</i></p>  <p>Example of AXON' added value <u>Reliability</u>. Optimisation of interconnect assembly machines.</p>	<p>6 VOLUME PRODUCTION <i>Continuous improvement</i></p>  <p>Example of AXON' added value <u>Productivity improvements</u>. Implementation of Lean Manufacturing.</p>
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LEAN MANUFACTURING EXPERTISE

Simulation



3D Printing



Integration / Training



AXON' Tests & Qualifications

The AXON' control laboratories have at their disposal a wide variety of in-house test equipment to validate the different components:

- Signal transmission:

- Time domain: Jitter (RMS, PP) / Skew (same pair, between pairs) / Eye opening / TD Cross Talk, ISI, BER.
- Frequency domain: Crosstalk (FEXT, NEXT) / Insertion loss / Return Loss / Attenuation / Polarity (phase).

- Electrical characteristics:

Automatic continuity and insulation testing / Dielectric strength / Current flow / Capacitance, Inductance / Transfer impedance (shield efficiency).

- Climatic characteristics:

Resistance to salt spray / Accelerated ageing / Endurance at temperature / Ovens in order to operate «burn-out» and minimize the global outgassing of the assembly.

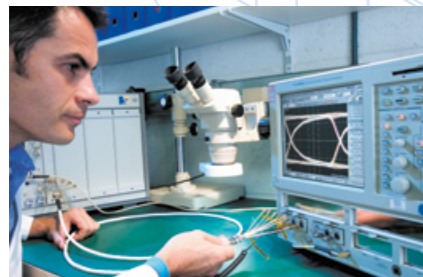
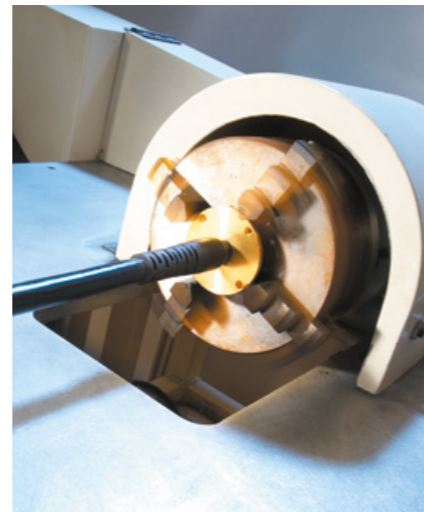
- Dimensions:

High sensitivity video equipment to control dimensions of miniature components / X-ray machine to control inside moulded or potted assemblies which cannot be dismantled.

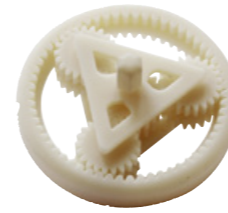
- Mechanical characteristics:

Vibration / Shock / Acceleration.

Our Research & Process department can design and manufacture any custom control tools to suit your needs.



AXON' Additive Manufacturing



Additive Manufacturing is a process consisting of depositing successive layers of material one on top of the other to form a 3D object.

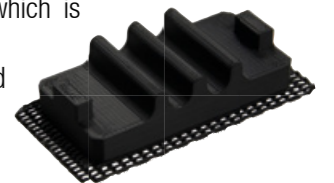
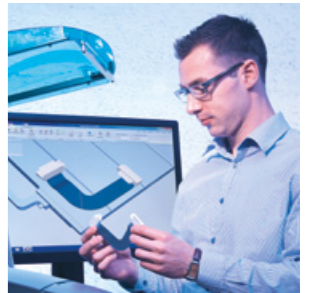
There are numerous applications:

- **Prototyping** in order to validate a technical solution or to verify a space envelope. Customisation.
- **Training** of new employees of customers by producing larger scale models of miniature parts.
- **Rapid creation of tooling** as production aids, such as wiring boards and fixtures. After Sales Service.

Greater reactivity: in order to produce a part of medium complexity, a machinist would take more than a day, and the cost would be significant. With additive manufacturing, the same piece can be produced in less than one hour at very reasonable cost.

Additional technical possibilities:

- Possibility of creating complex parts (gears, bearings, etc) in a single operation, which is impossible using traditional stamping or machining.
- Creation of part in two different materials in a single operation, where previously it would have been necessary to assemble two parts produced separately.

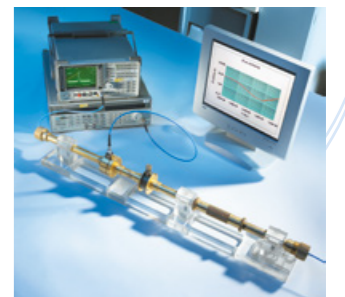


Simulations

Time to Market is all important! When designs are complex with challenging requirements in terms of available space and performance much time can be lost through the iterative process of trial and error – making, fitting, trying out, adjusting and re-making.

With long experience in complex interconnect design and manufacture and an impressive range of **simulation and modelling tools**, AXON' engineers can work collaboratively alongside the customer's own Designers to ensure the final assembly is fully **Designed for Manufacture (DFM)**. Just some examples of such time-saving simulation and modelling capabilities include:

- Coaxial or twisted pair **capacitance and impedance simulation**, to optimise the cable's RF performance,
- **EMC modelling**, for cables and even complete harnesses, to meet customer-specified levels of Transfer Impedance (Zt)
- **Microwave simulation**, allowing high frequency RF connectors to be designed Right First Time,
- SPICE **circuit modelling**, to ensure databus and network topologies are correctly configured from the start,
- **Mould Flow Analysis**, to proactively address potential issues for complex moulds and overmoulds,
- **3D Cable and harness routing**, whereby complete interconnects can be designed for manufacture directly within the customer's own 3D models, using STEP file transfers,
- **Cable flex-life modelling**, involving complex mathematical predictions of real-world flex-life, making it possible to optimise cable materials and construction prior to any manufacture or test.



AXON' Heritage in Cabling Engineering

Some examples of AXON' co-operations during different phases of customer projects.

Phase 1 Idea	Phase 2 Concept	Phase 3 Prototyping	Phase 4 Production- sation	Phase 5 Pre-series	Phase 6 Volume production	Applications
HYDRO-ELECTRIC SENSOR						<u>Industrial Market :</u> Electrical and fluid distribution
LAMINATED FLAT CABLING OF A SEMI-ROTATING SYSTEM						<u>Automotive Market :</u> Energy and signal distribution
POWER DISTRIBUTION SYSTEM						<u>Space Market :</u> Lightweight (Bus bar technology)
FLY-BY-WIRE						<u>Avionics Market :</u> Bus network cabling for flight controls
ELECTRONIC CONTROL SYSTEM						<u>Electronics Market :</u> Self-supporting flexible cable
EMI QUALIFICATION						<u>Defence Market :</u> Performance optimisation of customer systems

Many customers have discovered that by engaging AXON' professional Engineering Services at an early stage in their programme it has allowed them to re-task their own valuable engineering resource onto other key priorities, confident in the knowledge that the interconnect will not only perform as required, but will be designed to be robust and repeatable over the full life of the programme.

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