High speed links
High speed links

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Space applications

High speed data links offered by Axon’ Cable are designed to be used in spacecraft for different applications including:

- Satellite and launcher (platform) cabling:
  - Connection between the mast of the launcher and the control system
  - Spacecraft communication network
  - Driver technology compatibility: LVDS (Low Voltage Differential Signaling)
- High Data Rate payloads:
  - Interconnection of high definition imagery sensors in satellites
  - Synthetic aperture radar and hyperspectral optical instruments
  - Driver technology compatibility: CML (Current Mode Logic)

Which Axon’ solutions for which data rate?

<table>
<thead>
<tr>
<th>PROTOCOL</th>
<th>DATA RATE</th>
<th>UP TO 1 MB/S</th>
<th>UP TO 400 MB/S</th>
<th>UP TO 3 GB/S</th>
<th>UP TO 10 GB/S</th>
</tr>
</thead>
<tbody>
<tr>
<td>SpaceWire</td>
<td>9-way Micro-D (Standard cable: ESCC3902 003 variant 01 and 02) or low mass cable (ESCC3902 004 variant 01) or MicroMach® for higher electrical performances (XTalk / EMI / signal integrity)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>SpaceFibre, WizardLink</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>MicroMach® &amp; AxoMach® SpaceFibre</td>
</tr>
<tr>
<td>TT-Ethernet</td>
<td>MicroMach® (also suited to CAT6A and other Ethernet protocols)*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>RS 422 / RS 485 / CAN</td>
<td>D-Sub &amp; Micro-D connectors, 120 Ω twisted shielded pairs, ESCC3902 002 Variant 21 to 30 (100 or 120 Ω shielded pairs),</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>BUS 1553</td>
<td>D-Sub &amp; ACB1 connectors, Bus couplers, ACB1 Triaxial connectors</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*: Compatible with the following standards:
- 10BASE-T
- 100BASE-TX
- 100BASE-T4
- 100BASE-T
- ATM-25
- ATM-51
- 2.5GBASE-T
- ATM-155

- 5GBASE-T
- 10GBASE-T
- 100VG-AnyLan
- TR-4
- TR-16 Active
- TR-16 Passive
SpaceWire links: reliable data transmission

- Based on LVDS spacecraft communication system to ECSS-E-ST-50-12C
- Data transfer up to 400 Mb/s while maintaining a wide working margin
- Low skew, crosstalk and signal attenuation
- Robust cable

Signal integrity

AXON’ digital data transmission bus assemblies which meet the MIL-STD-1553 standard are used for military and aeronautic applications, and have also been integrated within the space environment for over 10 years.

In addition to bus harnesses which ensure the connection between on-board devices, SpaceWire links make possible the transfer of up to 400Mb/s while maintaining a wide working margin, thanks to the use of CELLOFLON®, expanded PTFE developed by AXON’.

The ESCC 3902/003 and 3902/004 qualified cable and ESCC 3401/029 EPPL2 connectors and accessories manufactured by AXON’ protect the integrity of LVDS signals (Low Voltage Differential Signalling) provided by the devices. The cabling has been optimised in order to minimise any mismatching and crosstalk between lines.

A test report validates every SpaceWire link. The electrical performance, which depends on the transmission speed, can be shown with an eye pattern which includes characteristics such as signal jitter. AXON’ can generate and analyse high speed signals up to 40 Gb/s in base band and for Ethernet applications.

Engineering Model or Flight Model designs

AXON’ can offer several designs for Engineering Models (EM) or Flight Models (FM) on request. For custom Lab test harnesses, for example, AXON’ can offer lightweight design configurations for a more cost effective solution (such as a one piece connector and backshell system).

Environmental characteristics

Radiation: up to 400MRad with ESCC 3902/004 Low Mass SpW cable (Static use).
AXON® 28AWG SpaceWire cable qualified to **ESCC 3902/003 variant 01** (AXON® part number: P532242) consists of 4 shielded twisted pairs covered by an overall shield and outer jacket, as shown in the specification.

1 - **CELLOFLON®** expanded PTFE filler
   - Diameter: 1.00 mm nom.

2 - **4 x 100 Ω 28AWG BUS Lines**
   - CONDUCTOR AWG 2807
     - Stranded silver plated copper alloy 2 μm.
     - 7 x 0.127 mm strands.
     - Diameter: 0.38 mm nominal.
     - Cross section: 0.089 mm² nominal.
     - Resistance: 23 Ω/100 m nominal.
   - DIELECTRIC: CELLOFLON® expanded PTFE
     - Colour: blue / white.
   - BRAIDED SHIELD
     - Material: silver plated copper 2.5 μm.
     - Strand diameter: 0.079 mm.
   - JACKET
     - Material: extruded PFA.
     - Diameter: 2.37 mm nominal.
     - Colour: white.

3 - **CELLOFLON®** expanded PTFE tape

4 - **Braided shield**
   - Material: silver plated copper 2.5 μm.
   - Strand diameter: 0.102 mm.

5 - **Outer jacket**
   - Material: PFA.
   - Colour: white.

**MAIN CHARACTERISTICS**
- Outer diameter: 7.5 mm maximum.
- Weight: 85 g/m maximum.
- Operating temperature: -200 / +180°C.
- Impedance (between wires): 100 Ω (±6 Ω) at 400 MHz.
CONSTRUCTION

AXON® 26AWG SpaceWire cable qualified to ESCC 3902/003 variant 02 (AXON® part number: P544806) consists of 4 shielded twisted pairs covered by an overall shield and outer jacket, as shown in the specification.

1 - CELLOFLON® expanded PTFE filler
   - Diameter: 1.40 mm nominal.

2 - 4 x 100 Ω 26AWG BUS Lines
   CONDUCTOR AWG 26/7
   - Stranded silver plated copper alloy 2 μm.
   - 7 x 0.160 mm strands.
   - Diameter: 0.48 mm nominal.
   - Cross section: 0.141 mm² nominal.
   - Resistance: 14 Ω/100 m nominal.
   DIELECTRIC: CELLOFLON® expanded PTFE.
   - Colour: blue / white.
   BINDER
   BRAIDED SHIELD
   - Material: silver plated copper 2.5 μm.
   - Strand diameter: 0.079 mm.
   JACKET
   - Material: extruded PFA.
   - Diameter: 3.05 mm nominal.
   - Colour: white.

3 - CELLOFLON® expanded PTFE tape

4 - Braided shield
   - Material: silver plated copper 2.5 μm.
   - Strand diameter: 0.102 mm.

5 - Outer jacket
   - Material: PFA.
   - Colour: blue

MAIN CHARACTERISTICS
- Outer diameter: 9.00 mm maximum.
- Weight: 115 g/m maximum.
- Operating temperature: -200 / +180°C.
- Impedance (between wires): 100 Ω (±6 Ω) at 400 MHz.
Test and measurements

- Eye pattern measurements (up to 10 Gb/s),
  - Jitter measurements,
  - Eye height and width,
  - Q factor,
  - Skew.

- TDR (Time Domain Reflectometry) analysis,
  - Impedance analysis,
  - Skew.

- BER test (Bit Error Rate),
  - PRBS (Pseudo Random Binary Sequence) generation and analysis.

Connection

For either cable size (AWG26 or AWG28), there are two possibilities to connect the link to the PCB:
- Pigtail whose wires are soldered to the PCB.
- Special 9 way CBR connector (each line has the same electrical length to reduce the skew between one another).
Low Mass solutions

Weight saving: a key issue in space

- AXON has developed Low Mass SpaceWire cable specifically for SpaceWire applications, which is uniquely qualified to ESCC3902/004. The cable assembly is terminated with ESCC 3401/029 EPPL 2 Micro-D connectors. Low Mass SpaceWire is 50% lighter than standard SpaceWire.
- The Ultra Low Mass Coax Link, based on AXON’s coaxial cable expertise, is almost 30% lighter still, and is significantly smaller and even more flexible. It is not ESA endorsed for the SpaceWire protocol, but may still be interesting for certain applications.

Main characteristics

<table>
<thead>
<tr>
<th></th>
<th>Classic SpaceWire cable ESCC 3902.003.01</th>
<th>Low Mass SpaceWire cable ESCC 3902.004.01</th>
<th>Ultra Low Mass Coax Link with overall shield</th>
<th>Ultra Low Mass Coax Link without overall shield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass (g/m)</td>
<td>85 max.</td>
<td>42 max.</td>
<td>32.5 max.</td>
<td>30 max.</td>
</tr>
<tr>
<td>Overall Ø (mm)</td>
<td>7 max.</td>
<td>6.5 max.</td>
<td>4.5 max.</td>
<td>4.2 max.</td>
</tr>
<tr>
<td>Static bend radius</td>
<td>45</td>
<td>25</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>Dynamic bend radius</td>
<td>60</td>
<td>30</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>Impedance (Ω)</td>
<td>100 ±6</td>
<td>100 ±6</td>
<td>2x50 ±2</td>
<td>2x50 ±2</td>
</tr>
<tr>
<td>Capacitance (pF)</td>
<td>&lt; 50</td>
<td>&lt; 50</td>
<td>&lt; 48</td>
<td>&lt; 48</td>
</tr>
<tr>
<td>- intra pair</td>
<td>&lt; 90</td>
<td>&lt; 90</td>
<td>&lt; 97</td>
<td>&lt; 97</td>
</tr>
<tr>
<td>- inter pair</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resistance DC (Ω/m)</td>
<td>0.23</td>
<td>0.23</td>
<td>0.90</td>
<td>0.90</td>
</tr>
<tr>
<td>Intra pair skew (ps/m)</td>
<td>&lt; 80</td>
<td>&lt; 50</td>
<td>&lt; 20</td>
<td>&lt; 20</td>
</tr>
<tr>
<td>Inter pair skew (ps/m)</td>
<td>&lt; 130</td>
<td>&lt; 100</td>
<td>&lt; 20</td>
<td>&lt; 20</td>
</tr>
<tr>
<td>Average α (dB/m)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ø1 GHz</td>
<td>-1.5</td>
<td>-1.4</td>
<td>-2.6</td>
<td>-2.6</td>
</tr>
<tr>
<td>Cable length</td>
<td>4.5 m max.*</td>
<td>4.6 m max.*</td>
<td>2.3 m max.*</td>
<td>2.3 m max.*</td>
</tr>
<tr>
<td>(for -6 dB atten.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*: for a 400 Mb/s data rate

With long experience in space wiring and a mastery of many advanced cabling technologies, AXON has designed two new solutions to lighten traditional high speed links: The Low Mass SpaceWire and the Ultra Low Mass Coax Link.

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CABLES & HARNESSES FOR SPACE APPLICATIONS - www.axon-cable.com
Low Mass 28AWG SpaceWire cable

Making use of AXON’s CELLOFLON® expanded PTFE, alveolar a-PTFE dielectrics and AXON’s patented AXALU® silver plated aluminium shields, the new Low Mass SpaceWire cable saves almost half the weight compared to conventional SpaceWire cable constructions.

CONSTRUCTION
AXON’s Low Mass 28AWG SpaceWire cable according to the ESCC 3902/004.01 requirements (AXON part number: P551259) consists of 4 shielded twisted pairs covered by an overall shield and outer jacket, as shown in the specification.

1 - CELLOFLON® expanded PTFE filler
- Diameter: 1.35 mm nom.

2 - 4 x 100 Ω 28AWG BUS Lines
CONDUCTOR AWG 2819
- Stranded silver plated copper alloy (2 μm minimum).
- 19 x 0.079 mm strands.
- Diameter: 0.395 mm nominal.
- Cross section: 0.093 mm² nominal.
- Resistance: 23 Ω/100 m nominal.
DIELECTRIC: Alveolar PTFE.
- Colour: blue / white.
INNER BRAIDED SHIELD
- Material: silver plated aluminium (2 μm minimum).
- Strand diameter: 0.079 mm.

3 - Braided shield (in electrical contact with the inner braided shields)
- Material: silver plated aluminium (2 μm minimum).
- Strand diameter: 0.100 mm.

4 - Outer jacket
- Material: Expanded PTFE tape (CELLOFLON®) under a Polyimide tape.

MAIN CHARACTERISTICS
- Outer diameter: 6.5 mm maximum.
- Bend radius: 25 mm minimum for fully static applications.
- Weight: 42 g/m maximum.
- Operating temperature: -100 / +150°C.
- Impedance (between wires of a pair): 100 Ω (±6 Ω) at 400 MHz.
- All inner shields are in contact with overall shield.

MAIN ADVANTAGES COMPARED TO THE ESCC3902/003 VARIANT 01
- Smaller bend radius (routing made easier)
- Approximately half the weight
- Reduced intra-pair and inter-pair skew
- Improved resistance to radiation (evaluation performed up to 300 Mrad)
Part list

1 - Low Mass SpaceWire cable (P551259)
2 - Micro-D plug connector (MDSA209P000B: 9 ways / high phosphorous nickel plated)
3 - High phosphorous nickel plated backshell and stainless steel 2-56 UNC-2A fastners
4 - Marking sleeve

Cable shield connection: All shields are terminated to the shell of the Micro-D connectors. Alternatively, the shields can also be connected to pin 3 at both ends on request.

**Skew inter pair**: 0.1 ns/m maximum. / **Skew intra pair**: 0.05 ns/m maximum.

Depending on the required frequency and data rate, this assembly can be up to 10 meters long without exceeding the 6 dB attenuation limit. This limit is measured at the 5th harmonic of the fundamental equivalent frequency of the LVDS signal (250MHz for 100Mb/s; 500MHz for 200Mb/s or 1GHz for 400Mb/s). The real requirement is to be outside the mask (see above). Please contact us for more details.

Test and measurements

- **Eye pattern measurements** (up to 10 Gb/s): Jitter measurements, Eye height and width, Q factor and Skew.
- **TDR (Time Domain Reflectometry) analysis**: Impedance analysis and Skew.
- **BER test** (Bit Error Rate): PRBS (Pseudo Random Binary Sequence) generation and analysis.
- **Crosstalk**
Ultra Low Mass Coax Link

The **Ultra Low Mass Coax Link** based on AXON' coaxial cable expertise, is almost 30% lighter than the already very light Low Mass SpaceWire cable. This radical solution is significantly smaller and more flexible than the conventional twisted pair approach and exceeds the performance requirements for high speed serial data links compared to twisted pair cables. Although these links meet all SpaceWire performance requirements, because they are based on coaxial, rather than twisted pair constructions they are not formally endorsed by ESA for SpaceWire use.

At the customer’s discretion, however, they can prove an interesting option for applications where installation space and mass budgets are extremely limited, or particularly where an alternative protocol to SpaceWire is in use.

**Important:** Potential users of this solution must ensure for themselves that the cable is compatible with their application.

**CONSTRUCTION**

AXON’s Ultra Low Mass Coax Link (AXON’ part numbers: P551260 for the version without overall shield and P547585 for the version with) consists of 8 coaxial cables stranded around a filler and outer tape, as shown in the specification.

1. CELLOFLON® expanded PTFE filler
   - Diameter: 1.70 mm nominal.
2. 8 x 50 Ω SM50 Coaxial cables
   - CONDUCTOR AWG 3407
   - Stranded silver plated copper alloy (2 μm).
   - 7 x 0.063 mm strands.
   - Diameter: 0.187 mm nominal.
   - Cross section: 0.020 mm² nominal.
   - Resistance: 90.9 Ω/100 m nominal.
3. DIELECTRIC: PTFE
   - Colour: white.
4. BRAIDED SHIELD
   - Material: silver plated copper (2.5 μm).
   - Strand diameter: 0.063 mm.
5. JACKET
   - Material: extruded PFA.
   - Colour: white.
6. CELLOFLON® expanded PTFE tape (on P551260 only)
7. Braided shield (on P547585 only)
8. Polymide tape (single layer on P551260, double layer on P547585)

**MAIN CHARACTERISTICS**

- Outer diameter: 4.20 mm maximum (4.50 mm with overshield).
- Bend radius: 6 mm minimum for fully static applications.
- Weight: 30 g/m maximum (32.5 g/m with overshield).
- Operating temperature: -100 / +150°C.
- Impedance (between wires of a pair): 8x50 Ω at 400 MHz.

**MAIN ADVANTAGES COMPARED TO THE ESCC 3902/003 VARIANT 01**

- Smaller bend radius (routing made easier)
- More than half the weight saving
- Reduced intra-pair and inter-pair skew
- Improved resistance to radiation

Note: The maximum length is shorter due to a higher attenuation.

*Ultra Low Mass Coax Links can be terminated with 9 way Micro-D connectors (such as are employed on SpaceWire and Low Mass SpaceWire links) or ultra miniature 15 way Nano-D connectors, suitable for applications where the connector interface area is extremely limited.*
**Part list**

1. Ultra Low Mass Coax cable (P551260 or P547585)
2. Micro-D plug connector (MDSA209P000B: 9 ways / high phosphorous nickel plated)
3. High phosphorous nickel plated backshell and stainless steel 2-56 UNC-2A fastners
4. Marking sleeves

**ESCC 3902.003/01**

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>Ultra Low Mass Coax cable with overall shield</th>
<th>Ultra Low Mass Coax cable without overall shield</th>
</tr>
</thead>
<tbody>
<tr>
<td>P532242</td>
<td>P547585</td>
<td>P551260</td>
</tr>
<tr>
<td>WEIGHT</td>
<td>85 g/m</td>
<td>37.5 g/m max.</td>
</tr>
<tr>
<td>DIAMETER</td>
<td>7 mm max.</td>
<td>4.5 mm max.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.2 mm max.</td>
</tr>
</tbody>
</table>

**Cable shield connection**: All coaxial shields are terminated to the shell of both connectors.

**Skew inter pair**: 0.1 ns/m maximum. / **Skew intra pair**: 0.02 ns/m maximum.

Depending on the required frequency and data rate, this assembly can be up to 4 meters long without exceeding the 6 dB attenuation limit. This limit is measured at the 5th harmonic of the fundamental equivalent frequency of the LVDS signal (250MHz for 100Mb/s; 500MHz for 200Mb/s or 1GHz for 400Mb/s). The real requirement is to be outside the mask (see above). Please contact us for more details.

**Test and measurements**

- **Eye pattern measurements (up to 10 Gb/s)**: Jitter measurements, Eye height and width, Q factor and Skew.
- **TDR (Time Domain Reflectometry) analysis**: Impedance analysis and Skew.
- **BER test (Bit Error Rate)**: PRBS (Pseudo Random Binary Sequence) generation and analysis.
- **Crosstalk**
Part list

1 - Ultra Low Mass Coax cable (P551260 or P547585)
2 - Nano-D plug connector (ND2A215P000B: 15 ways / nickel plated)
3 - Nickel plated backshell and stainless steel 0-80 UNF fasteners
4 - Marking sleeves

**ESCC**

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>Ultra Low Mass Coax cable with overall shield</th>
<th>Ultra Low Mass Coax cable without overall shield</th>
</tr>
</thead>
<tbody>
<tr>
<td>P532242</td>
<td>P547585</td>
<td>P551260</td>
</tr>
<tr>
<td>WEIGHT</td>
<td>85 g/m max.</td>
<td>37.5 g/m max.</td>
</tr>
<tr>
<td>DIAMETER</td>
<td>7 mm max.</td>
<td>4.5 mm max.</td>
</tr>
</tbody>
</table>

**Cable shield connection:** All coaxial shields are terminated to the shell of both connectors. **Skew inter pair:** 0.1 ns/m maximum. **Skew intra pair:** 0.02 ns/m maximum.

Depending on the required frequency and data rate, this assembly can be up to 4 meters long without exceeding the 6 dB attenuation limit. Please contact us for more details.

**Test and measurements**

- **Eye pattern measurements (up to 10 Gb/s):** Jitter measurements, Eye height and width, Q factor and Skew.
- **TDR (Time Domain Reflectometry) analysis:** Impedance analysis and Skew.
- **BER test (Bit Error Rate):** PRBS (Pseudo Random Binary Sequence) generation and analysis.
- **Crosstalk**
As data rates and EMI requirements increase, Axon introduces MicroMach®, an impedance matched high speed connector, initially developed for optimized SpaceWire performance, but which can also be used for other protocols such as SpaceFibre, Wizardlink, & TT-Ethernet.

Higher performance

- Compact,
- Matched 100 Ω impedance pairs: excellent continuity of signal,
- Low crosstalk between ways,
- Enjoy a robust EMC design, providing protection for both the cable and the equipment,
- Is capable of data rates well in excess of typical SpaceWire performance - up to 3 Gb/s.

Electrical Characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Specification</th>
</tr>
</thead>
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<td>Max. Operating Data Rate</td>
<td>3 Gb/s</td>
</tr>
<tr>
<td>Mating / unmating forces</td>
<td>MF &lt; 25N&lt;br&gt;3N &lt; UF &lt; 25N</td>
</tr>
<tr>
<td>Shield resistance</td>
<td>11 mΩ/m</td>
</tr>
<tr>
<td>Mated shell conductivity</td>
<td>5 mΩ</td>
</tr>
<tr>
<td>Characteristic impedance</td>
<td>90Ω &lt; ZC &lt; 110Ω</td>
</tr>
<tr>
<td>Crosstalk FEXT and NEXT</td>
<td>&lt;-50dB up to 1 GHz</td>
</tr>
<tr>
<td>Shielding effectiveness</td>
<td>&lt;-80dB up to 1 GHz</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>3902/003 SpaceWire AWG26</th>
<th>3902/003 SpaceWire AWG28</th>
<th>3902/004 Low Mass SpaceWire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intra-pair Skew</td>
<td>Max. 80 ps/m</td>
<td>Max. 80 ps/m</td>
<td>Max. 50 ps/m</td>
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<tr>
<td>Inter-pair Skew</td>
<td>Max. 130 ps/m</td>
<td>Max. 130 ps/m</td>
<td>Max. 100 ps/m</td>
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<tr>
<td>Insertion Loss</td>
<td></td>
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<tr>
<td>Up to 1.5 GHz</td>
<td>-2.25 dB/m</td>
<td>-2.95 dB/m</td>
<td>-2.95 dB/m</td>
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<tr>
<td>Up to 3 GHz</td>
<td>-3.70 dB/m</td>
<td>-7.90 dB/m</td>
<td>-4.90 dB/m</td>
</tr>
<tr>
<td>Up to 4.5 GHz</td>
<td>-5.00 dB/m</td>
<td>-6.65 dB/m</td>
<td>-6.65 dB/m</td>
</tr>
</tbody>
</table>
Mechanical characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum cable weight</td>
<td></td>
</tr>
<tr>
<td>- SpaceWire, AWG26 (ESCC 390200302)</td>
<td>- 115g/m max.</td>
</tr>
<tr>
<td>- SpaceWire, AWG28 (ESCC 390200301)</td>
<td>- 85 g/m max.</td>
</tr>
<tr>
<td>- Low Mass SpaceWire, AWG28 (ESCC 390200401)</td>
<td>- 42 g/m max.</td>
</tr>
<tr>
<td>Mating force</td>
<td>&lt; 25 N</td>
</tr>
<tr>
<td>Demating force</td>
<td>3 N &lt; demating force &lt; 25 N</td>
</tr>
<tr>
<td>Operating and storage temperature</td>
<td>-55°C to +125°C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ESCC Standard</th>
<th>Connector</th>
<th>Nom. Weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cable mount connectors</td>
<td></td>
</tr>
<tr>
<td>3409-002</td>
<td>01 &amp; 02</td>
<td>9.5 g</td>
</tr>
<tr>
<td></td>
<td>03 &amp; 04</td>
<td>9 g</td>
</tr>
<tr>
<td></td>
<td>PCB connectors</td>
<td></td>
</tr>
<tr>
<td>3401-095</td>
<td>01</td>
<td>4.5 g</td>
</tr>
<tr>
<td></td>
<td>02</td>
<td>5 g</td>
</tr>
<tr>
<td></td>
<td>03</td>
<td>5.5 g</td>
</tr>
<tr>
<td></td>
<td>Saver connectors</td>
<td></td>
</tr>
<tr>
<td>3401-096</td>
<td>01</td>
<td>7.5 g</td>
</tr>
</tbody>
</table>

Wiring

When ordering a MicroMach assembly for normal SpaceWire use or as a primary SpW test cable, indirect (or "crossover") wiring should be selected. Typically, this is most likely to be with a male to male link.

Contact linking for indirect wiring

<table>
<thead>
<tr>
<th>Variant</th>
<th>Connector</th>
<th>Pin numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESCC 3409-002 codes 01 or 02</td>
<td>1st connector, e.g. code 01 or 02 (male)</td>
<td>1 2 3 4 5 6 7 8</td>
</tr>
<tr>
<td></td>
<td>2nd connector, e.g. code 01 or 02 (male)</td>
<td>3 4 1 2 7 8 5 6</td>
</tr>
</tbody>
</table>

However, if ordering a MicroMach SpaceWire Extension cable, to extend the length of an existing MicroMach SpaceWire cable, for example, when entering a TVAC chamber, direct wiring should be, to avoid negating the crossover effect. Typically, this may be with a female to male link.

Contact linking for direct wiring

<table>
<thead>
<tr>
<th>Variant</th>
<th>Connector</th>
<th>Pin numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESCC 3409-002 codes 01 &amp; 03 or 02 &amp; 04</td>
<td>1st connector, e.g. code 01 or 02 (female)</td>
<td>1 2 3 4 5 6 7 8</td>
</tr>
<tr>
<td></td>
<td>2nd connector, e.g. code 01 or 02 (male)</td>
<td>1 2 3 4 5 6 7 8</td>
</tr>
</tbody>
</table>

Signals

Pin / socket 1: Dout-
Pin / socket 5: Sout-
Pin / socket 2: Dout+
Pin / socket 6: Sout+
Pin / socket 3: Din-  
Pin / socket 7: Sin-
Pin / socket 4: Din+  
Pin / socket 8: Sin+
MICROMACH® cable mount connectors

- EMI seals: conductive silicone based rubber
- Shrinkable strain relief: fluoropolymer

**Materials:**
- Housing and shield termination: 25.4μm minimum high phosphorus nickel plating on aluminium alloy
- Insert: PEEK
- Contact: 1.27μm gold over 1.27μm nickel plating on copper alloy
- Hardware: Stainless steel

**MicroMach® AWG26 Male In-line Plug**
ESCC 3409/002 - CONNECTOR CODE 01 (see details page E-22)

**MicroMach® AWG28 Male In-line Plug**
ESCC 3409/002 - CONNECTOR CODE 02 (see details page E-22)

**MicroMach® AWG26 Female Panel Mount Jack**
ESCC 3409/002 - CONNECTOR CODE 03 (see details page E-23)

Dimensions in mm. All ESCC specifications are subject to change. Please refer to https://escies.org for latest specifications.
MicroMach® AWG28 Female Panel Mount Jack
ESCC 3409/002 - CONNECTOR CODE 04 (see details page E-23)

Dimensions in mm. All ESCC specifications are subject to change. Please refer to https://escies.org for latest specifications.
MICROMACH® panel mount connectors

**Materials:**
- Housing and shield termination: 25.4μm minimum high phosphorus nickel plating on aluminium alloy
- Insert: PEEK
- Contact: 1.27μm gold over 1.27μm nickel plating on copper alloy
- Hardware: Stainless steel

**Mechanical:**
- Torque screw-nut: 0.35 N.m
- Nuts and washers are included
- Jackpost diameter: 2-56-UNC-2B

---

**MicroMach® Female Edge PCB SMT Panel Mount**
ESCC 3401/095 - VARIANT 01 (see details page E-24)

PCB Terminations: Copper alloy, silver plated 2 μm minimum

---

**MicroMach® Female Wired PCB Panel Mount**
ESCC 3401/095 - VARIANT 02 (see details page E-24)

PCB Terminations: Unshielded twisted pair, 100Ω with PTFE dielectric core and silver plated annealed copper center conductor

---

**MicroMach® Female Flex PCB Panel Mount**
ESCC 3401/095 - VARIANT 03 (see details page E-25)

PCB Terminations: Flexible PCB with Copper / Polyimide coverlays (2 layers with metalized holes) and full ground plane.
MICROMACH®
connector saver

- EMI seals: conductive silicone based rubber

Materials:
- Housing and shield termination: 25.4μm minimum high phosphorus nickel plating on aluminium alloy
- Insert: PEEK
- Contact: 1.27μm gold over 1.27μm nickel plating on copper alloy
- Hardware: Stainless steel

MicroMach® Saver
ESCC 3401/096 - VARIANT 01 (see details page E-25)
Detailed MICROMACH® connector specifications

**MicroMach® AWG26 Male, In-line Plug**

ESCC 3409/002 - CONNECTOR CODE 01

Dimensions in mm. All ESCC specifications are subject to change. Please refer to https://escies.org for latest specifications.

**MicroMach® AWG28 Male, In-line Plug**

ESCC 3409/002 - CONNECTOR CODE 02

Dimensions in mm. All ESCC specifications are subject to change. Please refer to https://escies.org for latest specifications.
MicroMach® AWG26 Female Panel Mount Jack
ESCC 3409/002 - CONNECTOR CODE 03

MicroMach® AWG28 Female Panel Mount Jack
ESCC 3409/002 - CONNECTOR CODE 04

Dimensions in mm. All ESCC specifications are subject to change. Please refer to https://escies.org for latest specifications.
MicroMach® Female Edge PCB SMT Panel Mount
ESCC 3401/095 - VARIANT 01

Dimensions in mm. All ESCC specifications are subject to change. Please refer to https://escies.org for latest specifications.
MicroMach® Female Flex PCB Panel Mount
ESCC 3401/095 - VARIANT 03

Dimensions in mm. All ESCC specifications are subject to change. Please refer to https://escies.org for latest specifications.

MicroMach® Saver
ESCC 3401/096 - VARIANT 01
Faster data transmission

Aimed, for example, at the interconnection of high definition imagery sensors in satellites these links present the following main advantages:

- Transmission of high data rates: 10 Gb/s up to 40 Gb/s,
- Signal integrity: skew < 10 ps per mated pair,
- Low mismatching: differential characteristic impedance 100 Ω (±10 Ω),
- Low crosstalk better than -35 dB at 10 GHz,
- Improved EMC behavior: shielding effectiveness for 1 m link < -60 dB up to 10 GHz,
- Space saving: about half the width of a standard SMA connector for the same number of contacts.

Construction

AXOMACH® high data rate links are made with:

- Microwave coaxial cables
- And different connector types: AXOMACH® inline version, panel mount, SMD or saver connectors as well as SMA panel mount connectors

A procurement specification is available on request. This document following ESCC format details the rating, physical and electrical characteristics, test & inspection data for AXON® space grade high data rate AXOMACH® series connectors and links.

On the following pages each component of this high data rate link will be described in detail.
Microwave coaxial cable

SC25SP
AXON® part number: P840563
Cable suitable for termination to AxoMach® inline connectors, PCB connectors, SMA connectors.

**CONDUCTOR**
- Silver plated copper (Ag 2μm).
- AWG 2401.
- Area 0.205 mm².
- Resistance: 10 Ω/100 m.

**DIELECTRIC**
- Extruded CELLOFLON® (expanded PTFE).
- Colour: natural.
- Nominal diameter: 1.51 mm.

**SHIELDING**
Silver plated copper tape.

**SEPARATING TAPE**
Polyimide.

**SHIELDING**
Silver plated copper braid (Ag 2μm).

**JACKET**
- PFA.
- Colour: blue.

**MAIN CHARACTERISTICS**
- Nominal outer diameter: 2.50 mm.
- Maximum weight: 17 g/m.
- Nominal impedance: 50 Ω.
- Nominal capacitance: 87 pF/m.
- Temperature rating: -65°C to +150°C.
- Maximum attenuation:
  - 0.70 dB/m at 1 GHz.
  - 1.55 dB/m at 5 GHz.
  - 2.20 dB/m at 10 GHz.
  - 3.05 dB/m at 18 GHz.
- Velocity of propagation: > 76%.
QUASI-FLEX® hand-formable semi-rigid substitute

SH22SW
AXON® part number: P540264
Cable connected to a PCB connector on one side and welded to the equipment PCB on the other side.

CONDUCTOR
- Solid conductor.
- Silver plated copper clad steel (Ag 2μm).
- Nominal diameter: 0.51 mm.

DIELECTRIC
- Extruded PTFE.
- Nominal diameter: 1.65 mm.

SHIELDING
Tin soaked silver plated copper braid (space quality defined by ECSS-Q-10-71 A).

MAIN CHARACTERISTICS
- Nominal outer diameter: 2.15 mm.
- Approximate weight: 17 g/m.
- Impedance: 50 Ω (± 2 Ω).
- Nominal capacitance: 97 pF/m.
- Temperature rating: -55°C to +125°C.
- Maximum attenuation:
  - 0.70 dB/m at 1 GHz.
  - 1.30 dB/m at 3 GHz.
  - 1.85 dB/m at 6 GHz.
  - 2.45 dB/m at 10 GHz.
  - 3.55 dB/m at 18 GHz.
- Velocity of propagation: > 69%.
AXOMACH®
cable assemblies

- Special 100 Ω (2 x 50) inserts for the transmission line
- EMI gasket / connector to backshell interface seals: conductive silicone base rubber
- Shrinkable strain relief: fluoropolymer

**Materials:**
- Body: gold on aluminium alloy
- Dielectric: PTFE
- Pin contact: gold on copper alloy
- Hardware: stainless steel

### Single way male inline plug

**ESCC 3409/001 - CONNECTOR CODE 01** (see details page E-38)

### Two way male inline plug

**ESCC 3409/001 - CONNECTOR CODE 02** (see details page E-38)

### Four way male inline plug

**ESCC 3409/001 - CONNECTOR CODE 03** (see details page E-39)
Single way female inline jack
ESCC 3409/001 - CONNECTOR CODE 04 (see details page E-39)

Two way female inline jack
ESCC 3409/001 - CONNECTOR CODE 05 (see details page E-40)

Four way female inline jack
ESCC 3409/001 - CONNECTOR CODE 06 (see details page E-40)
Single way female panel mount jack
ESCC 3409/001 - CONNECTOR CODE 07 (see details page E-41)

Two way female panel mount jack
ESCC 3409/001 - CONNECTOR CODE 08 (see details page E-41)

Four way female panel mount jack
ESCC 3409/001 - CONNECTOR CODE 09 (see details page E-42)
Male inline SpaceFibre plug
ESCC 3409/001 - CONNECTOR CODE 10 (see details page E-42)

Female inline SpaceFibre jack
ESCC 3409/001 - CONNECTOR CODE 11 (see details page E-43)

Straight male SMA plug
ESCC 3409/001 - CONNECTOR CODE 17 (see details page E-43)

Female panel mount SpaceFibre jack
ESCC 3409/001 - CONNECTOR CODE 18 (see details page E-44)
AXOMACH® panel mount & SMD connectors

- **Materials**
  - Body: gold on aluminium alloy
  - Dielectric: PTFE
  - Mated contact: gold on copper alloy
  - Hardware: stainless steel

**Single way female panel mount jack**
ESCC 3401/089 - VARIANT 01  (see details page E-45)

**Two way female panel mount jack**
ESCC 3401/089 - VARIANT 02  (see details page E-45)

**Four way female panel mount jack**
ESCC 3401/089 - VARIANT 03  (see details page E-46)
Female panel mount SpaceFibre jack
ESCC 3401/089 - VARIANT 04 (see details page E-46)

Single way female SMD jack
ESCC 3401/089 - VARIANT 05 (see details page E-47)

Two way female SMD jack
ESCC 3401/089 - VARIANT 06 (see details page E-47)
Four way female SMD jack
ESCC 3401/089 - VARIANT 07  (see details page E-48)

Female SMD SpaceFibre jack
ESCC 3401/089 - VARIANT 08  (see details page E-48)
AXOMACH® savers

**Materials:**
- Body: gold on aluminium alloy
- Dielectric: PTFE
- Mated contact: gold on copper alloy
- Hardware: stainless steel

**Single way connector saver**
ESCC 3401/090 - VARIANT 01 (see details page E-49)

**Two way connector saver**
ESCC 3401/090 - VARIANT 02 (see details page E-49)

**Four way connector saver**
ESCC 3401/090 - VARIANT 03 (see details page E-50)

**SpaceFibre connector saver**
ESCC 3401/090 - VARIANT 07 (see details page E-52)
AXOMACH®
blanking plates

Materials:
- Body: gold on aluminium alloy
- Dielectric: PTFE
- Mated contact: gold on copper alloy
- Hardware: stainless steel

Blanking plate for single way connectors
ESCC 3401/090 - VARIANT 04 (see details page E-50)

Blanking plate for two way connectors
ESCC 3401/090 - VARIANT 05 (see details page E-51)

Blanking plate for four way connectors
ESCC 3401/090 - VARIANT 06 (see details page E-51)
Detailed AXOMACH® connector specifications

Single way male inline plug
ESCC 3409/001 - CONNECTOR CODE 01

Dimensions in mm. All ESCC specifications are subject to change. Please refer to https://escies.org for latest specifications.
Four way male inline plug
ESCC 3409/001 - CONNECTOR CODE 03

Dimensions in mm. All ESCC specifications are subject to change. Please refer to https://escies.org for latest specifications.
Two way female inline jack  
ESCC 3409/001 - CONNECTOR CODE 05

Dimensions in mm. All ESCC specifications are subject to change. Please refer to https://escies.org for latest specifications.

Four way female inline jack  
ESCC 3409/001 - CONNECTOR CODE 06

Dimensions in mm. All ESCC specifications are subject to change. Please refer to https://escies.org for latest specifications.
Dimensions in mm. All ESCC specifications are subject to change. Please refer to https://escies.org for latest specifications.
Four way female panel mount jack
ESCC 3409/001 - CONNECTOR CODE 09

Dimensions in mm. All ESCC specifications are subject to change. Please refer to https://escies.org for latest specifications.
**Female inline SpaceFibre jack**  
**ESCC 3409/001 - CONNECTOR CODE 11**

Dimensions in mm. All ESCC specifications are subject to change. Please refer to https://escies.org for latest specifications.

---

**Straight male SMA plug**  
**ESCC 3409/001 - CONNECTOR CODE 17**

Dimensions in mm. All ESCC specifications are subject to change. Please refer to https://escies.org for latest specifications.
Female panel mount SpaceFibre jack
ESCC 3409/001 - CONNECTOR CODE 18

Dimensions in mm. All ESCC specifications are subject to change. Please refer to https://escies.org for latest specifications.
AXOMACH® panel mount & SMD connector specifications

Single way female panel mount connector  
ESCC 3401/089 - VARIANT 01

Two way female panel mount connector  
ESCC 3401/089 - VARIANT 02

Dimensions in mm. All ESCC specifications are subject to change. Please refer to https://escies.org for latest specifications.
Four way female panel mount connector
ESCC 3401/089 - VARIANT 03

Dimensions in mm. All ESCC specifications are subject to change. Please refer to https://escies.org for latest specifications.

Female panel mount SpaceFibre connector
ESCC 3401/089 - VARIANT 04

Dimensions in mm. All ESCC specifications are subject to change. Please refer to https://escies.org for latest specifications.
Single way female SMD connector
ESCC 3401/089 - VARIANT 05

Dimensions in mm. All ESCC specifications are subject to change. Please refer to https://escies.org for latest specifications.

Two way female SMD connector
ESCC 3401/089 - VARIANT 06

Dimensions in mm. All ESCC specifications are subject to change. Please refer to https://escies.org for latest specifications.
**Four way female SMD connector**

ESCC 3401/089 - VARIANT 07

Dimensions in mm. All ESCC specifications are subject to change. Please refer to https://escies.org for latest specifications.

**Female SMD SpaceFibre connector**

ESCC 3401/089 - VARIANT 08

Dimensions in mm. All ESCC specifications are subject to change. Please refer to https://escies.org for latest specifications.
Detailed AXOMACH® accessory specifications

**Single way connector saver**
ESCC 3401/090 - VARIANT 01

Dimensions in mm. All ESCC specifications are subject to change. Please refer to https://escies.org for latest specifications.

**Two way connector saver**
ESCC 3401/090 - VARIANT 02
Four way connector saver
ESCC 3401/090 - VARIANT 03

Blanking plate for single way connectors
ESCC 3401/090 - VARIANT 04

Dimensions in mm. All ESCC specifications are subject to change. Please refer to https://escies.org for latest specifications.
Blanking plate for two way connectors
ESCC 3401/090 - VARIANT 05

Dimensions in mm. All ESCC specifications are subject to change. Please refer to https://escies.org for latest specifications.
SpaceFibre connector saver
ESCC 3401/090 - VARIANT 07

Dimensions in mm. All ESCC specifications are subject to change. Please refer to https://escies.org for latest specifications.
SMA connectors (ESCC3402 QPL)

To connect AXOMACH® links to your devices equipped with SMA plugs or to create panel feedthroughs, AXON® proposes the following ESA qualified SMA connectors:

<table>
<thead>
<tr>
<th>ESCC VARIANT</th>
<th>TECHNICAL CONFIGURATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESCC 3402/001 variant 01</td>
<td>Straight plug, solder type, for semi-rigid cable Ø 2.2 mm.</td>
</tr>
<tr>
<td>ESCC 3402/001 variant 09</td>
<td>Right angle plug, solder type, for semi-rigid cable Ø 2.2 mm.</td>
</tr>
<tr>
<td>ESCC 3402/002 variant 01</td>
<td>Straight jack, solder type, for semi-rigid cable Ø 2.2 mm.</td>
</tr>
<tr>
<td>ESCC 3402/002 variant 09</td>
<td>Straight jack, solder type, rear mounting, 2 holes, flange mounted, for semi-rigid cable Ø 2.2 mm.</td>
</tr>
<tr>
<td>ESCC 3402/002 variant 68</td>
<td>Straight jack, solder type, rear mounting, flange mounted, for semi-rigid cable Ø 2.2 mm.</td>
</tr>
<tr>
<td>ESCC 3402/003 variant 07</td>
<td>Hermetic adaptor, female-female.</td>
</tr>
<tr>
<td>ESCC 3402/003 variant 14</td>
<td>Straight bulkhead adaptor, female-female.</td>
</tr>
</tbody>
</table>

This list is non-exhaustive.

Termination of the connectors

**AXOMACH® panel mount connectors**

This connector can be terminated to a PCB using flat flexible conductors in order to be mechanically decoupled between the PCB and the panel where the connector is mounted. One end of the flat conductor is soldered to the connector lead using high temperature solder or a parallel gap weld procedure. The other end is soldered on PCB tracks by using standard soldering. This termination must be validated and approved depending on the mission environment.

**AXOMACH® cable mount connectors and surface mount connectors**

- Inner conductor is crimped to gold plated copper alloy contacts.
- Cable shield is soldered into the backshell using soft soldering.
- X-Ray inspection is performed on all link terminations.

Transmission measurements are performed on 100% of manufactured links up to 10 Gb/s. The manufacturing and control procedures are maintained in a PID followed by CNES/ESA and reviewed every two years.
Electrical characteristics

Maximum rating for a 1 metre link terminated with two single way cable mount connectors.

<table>
<thead>
<tr>
<th>CHARACTERISTICS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristic impedance (Zc)</td>
<td>90 Ω &lt; Zc &lt; 100 Ω</td>
</tr>
<tr>
<td>Jitter peak (at 1, 3, 5, 6, 8 and 10 Gb/s)</td>
<td>Maximum 20 ps</td>
</tr>
<tr>
<td>Jitter rms (at 1, 3, 5, 6, 8 and 10 Gb/s)</td>
<td>Maximum 5 ps</td>
</tr>
<tr>
<td>Quality factor (Qf) at 1 Gb/s</td>
<td>minimum 20</td>
</tr>
<tr>
<td>Quality factor (Qf) at 3 Gb/s</td>
<td>minimum 15</td>
</tr>
<tr>
<td>Quality factor (Qf) at 5, 6, 8, 10 Gb/s</td>
<td>minimum 10</td>
</tr>
<tr>
<td>Skew (Sk) between coaxial cables</td>
<td>Maximum 20 ps</td>
</tr>
<tr>
<td>Insertion Loss (IL) at 0 to 5 GHz</td>
<td>maximum -1 dB</td>
</tr>
<tr>
<td>Insertion Loss (IL) at 0 to 10 GHz</td>
<td>maximum -2 dB</td>
</tr>
<tr>
<td>Return Loss (RL) at 0 to 5 GHz</td>
<td>maximum -12 dB</td>
</tr>
<tr>
<td>Return Loss (RL) at 0 to 10 GHz</td>
<td>maximum -9 dB</td>
</tr>
<tr>
<td>Crosstalk far end (xTf - 0 to 5 GHz)</td>
<td>Maximum -45 dB</td>
</tr>
<tr>
<td>Crosstalk near end (xTn - 0 to 10 GHz)</td>
<td>Maximum -35 dB</td>
</tr>
<tr>
<td>Time analysis (jitter and quality factor) at room temperature</td>
<td>See table below</td>
</tr>
</tbody>
</table>

EMC: AXOMACH link shielding efficiency
(from 500 MHz to 18 GHz)

Shielding effectiveness for a 1 metre link < -60 dB up to 10 GHz

Time analysis (jitter & quality factor) at room temperature for a 1 metre link with 0.2 m test jig

Which data rate for which length?
This table is a design tool for cable routing and gives indicative values.

<table>
<thead>
<tr>
<th></th>
<th>0.5 m</th>
<th>1 m</th>
<th>2 m</th>
<th>3 m</th>
<th>4 m</th>
<th>5 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 5 Gb/s</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>6 to 7 Gb/s</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>8 to 10 Gb/s</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Links are measured with CML (Current Mode Logic) driver differential signal amplitude of 600 mVpp (worst case condition) and ±100 mV CML receiver input threshold.
### Mechanical characteristics

<table>
<thead>
<tr>
<th>CHARACTERISTICS</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum cable weight</td>
<td>15 g/m per cable</td>
</tr>
<tr>
<td></td>
<td>30 g/m per way</td>
</tr>
<tr>
<td>Mating force</td>
<td>&lt; 5.6 N (2.8 N per contact)</td>
</tr>
<tr>
<td>Demating force</td>
<td>1 N &lt; demating force &lt; 5.6 N</td>
</tr>
<tr>
<td>Operating and storage temperature</td>
<td>-55°C to +125°C</td>
</tr>
<tr>
<td>Total Mass Loss (TML)</td>
<td>&lt; 1%</td>
</tr>
<tr>
<td>Collected Volatile Condensable Material (CVCM)</td>
<td>&lt; 0.1 %</td>
</tr>
<tr>
<td>Recovered Mass Loss (RML)</td>
<td>&lt; 1%</td>
</tr>
</tbody>
</table>

See A xoMach® weight table on page E-59

### Manufacturing

AXOMACH® components are manufactured and tested in clean room conditions. Cleanliness level: Class ISO 8 = Class 100 000 following FED STD 209E.

AXON™ operators are certified by international space agencies on soldering and crimping process according to ECSS-Q-ST-70-08 & ECSS-Q-ST-70-26. AXON™ is monitored by CNES (French space agency) for AXOMACH® connectors and links manufacturing and controlled according to PID.
Qualification

Environmental, mechanical and endurance testing are performed according to ESCC3401 chart IV.

16 Mated Connector Sets (1)

4 Mated Conn. Sets
- Wiring Para. 9.10
- Vibration Para. 9.11
- Shock or Bump Para. 9.12
- Climatic Sequence Para. 9.13
- Seal Test Para. 9.9
- Plating Thickness (3) Para. 9.14
- Joint Strength (5) Para. 9.15

70 Contact Sets (1)

35 Contact Sets (2)
- Engage/Sep. Forces Para. 9.28
- Solderability Para. 9.31
- Oversize Pin Exclusion Para. 9.29
- Probe Damage Para. 9.30
- Plating Thickness Para. 9.14

35 Contact Sets (6)
- High Temp. Storage Para. 9.21
- Overload Test Para. 9.26
- Corrosion Para. 9.22
- Maintenance Aging (4) Para. 9.27
- Joint Strength (5) Para. 9.15

4 Mated Conn. Sets
- Wiring Para. 9.10
- Rapid Change of Temp. Para. 9.16
- Contact Retention Para. 9.17
- Permanence of Marking Para. 9.19
- Seal Test Para. 9.9
- Joint Strength (5) Para. 9.15

4 Mated Conn. Sets
- Wiring Para. 9.10
- Mating/Unmating Forces Para. 9.20
- High Temp. Storage Para. 9.21
- Insert Retention Para. 9.23
- Seal Test Para. 9.9

4 Mated (4) Conn. Sets
- Wiring Para. 9.10
- High Temp. Measurement Para. 9.25
- Corrosion Para. 9.22
- Joint Strength (5) Para. 9.15

Engage/Sep. Forces Para. 9.28
Solderability Para. 9.31
Oversize Pin Exclusion Para. 9.29
Probe Damage Para. 9.30
Plating Thickness Para. 9.14

Oversize Pin Exclusion Para. 9.29
Probe Damage Para. 9.30
Plating Thickness Para. 9.14
## Compatibility guide

**ESCC 3409 / 001 connector assembly compatibility**

![Connector Diagram]

### Connector code, side A

<table>
<thead>
<tr>
<th>01</th>
<th>02</th>
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CABLES & HARNESSES FOR SPACE APPLICATIONS - www.axon-cable.com
### ESCC 3409 / 001 connector mating compatibility

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## SpaceWire solutions

### Cables

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<thead>
<tr>
<th>Cable Type</th>
<th>Weight (g/m)</th>
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<tbody>
<tr>
<td>Classic 28AWG SpaceWire</td>
<td>85</td>
</tr>
<tr>
<td>Classic 26AWG SpaceWire</td>
<td>115</td>
</tr>
<tr>
<td>Low Mass 28AWG SpaceWire</td>
<td>42</td>
</tr>
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</table>

### Connectors

<table>
<thead>
<tr>
<th>Connector Type</th>
<th>Weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 way male connector (with screwlock and backshell)</td>
<td>about 8 g</td>
</tr>
<tr>
<td>9 way female connector (with screwlock and backshell)</td>
<td>about 8 g</td>
</tr>
<tr>
<td>9 way female CBR connector</td>
<td>about 3 g</td>
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</table>

### MicroMach® Connectors

<table>
<thead>
<tr>
<th>Connector Type</th>
<th>Weight (g)</th>
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</thead>
<tbody>
<tr>
<td>Male in-line connectors</td>
<td>9.5</td>
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<tr>
<td>Female panel mount connectors</td>
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<tr>
<td>Female edge PCB SMT panel mount connector</td>
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<td>Female wired PCB panel mount connector</td>
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<tr>
<td>Female flex PCB panel mount connector</td>
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<tr>
<td>Saver connector</td>
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## Low Mass solutions

### Cables

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>Weight (g/m)</th>
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<tbody>
<tr>
<td>Low Mass 28AWG SpaceWire</td>
<td>42</td>
</tr>
<tr>
<td>Ultra Low Mass Coax cable (with overall shield)</td>
<td>37.5</td>
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<tr>
<td>Ultra Low Mass Coax cable (without overall shield)</td>
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### Connectors

<table>
<thead>
<tr>
<th>Connector Type</th>
<th>Weight (g)</th>
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<tbody>
<tr>
<td>Micro-D connector (with screwlock and backshell)</td>
<td>about 8 g</td>
</tr>
<tr>
<td>Nano-D connector (with screwlock and backshell)</td>
<td>about 2 g</td>
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**AXOMACH® links**

### Cables

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<thead>
<tr>
<th>AXON REFERENCES</th>
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<tr>
<td>SC25SP (Microwave coaxial cable)</td>
<td>17 g/m (34 g/m per way)</td>
</tr>
<tr>
<td>SH22SW (QUASIFLEX hand-formable semi-rigid substitute)</td>
<td>17 g/m (34 g/m per way)</td>
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### Connectors

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<tr>
<th>ESCC REFERENCES</th>
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<tr>
<td>PCB / panel mount connectors</td>
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<tr>
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<td>3401/089 03</td>
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<td>Panel mount connectors</td>
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<td>Male cable mount connectors</td>
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