Modular Interconnect for Point to Point and Backplane Space Application

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Light weight, high density cable to PCB and cable to cable interconnection

Designed to support data rates up to 10 Gbps

Standard housings are based on 4 and 8 bay configurations

Standard materials include aluminum and conductive composite for housings with gold over nickel for space

Alternate plating options under evaluation include nickel only and unplated (conductive composite only) – dependent on environmental and EMI/RFI performance requirements
## Rugged Embedded System Connector Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>ELARA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ruggedness</td>
<td>Hyperboloid</td>
</tr>
<tr>
<td>High Speed (&gt;6.25 Gbps)</td>
<td>10.0 GBPS + min</td>
</tr>
<tr>
<td>High Density Cable Contacts</td>
<td>Yes</td>
</tr>
<tr>
<td>Modularity</td>
<td>Yes</td>
</tr>
<tr>
<td>Interchangeable Modules</td>
<td>Yes</td>
</tr>
<tr>
<td>Low Mass</td>
<td>Yes</td>
</tr>
<tr>
<td>Efficient RF Cable Assembly</td>
<td>Yes</td>
</tr>
<tr>
<td>Space Qualified Materials</td>
<td>Yes</td>
</tr>
<tr>
<td>PCB Termination</td>
<td>Multiple Options</td>
</tr>
</tbody>
</table>

### ELARA 8 Twinax Module Comparison

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass</td>
<td>~28 g</td>
</tr>
<tr>
<td>Width</td>
<td>29.1 mm</td>
</tr>
<tr>
<td>Height</td>
<td>14.5 mm</td>
</tr>
<tr>
<td>Total Length</td>
<td>41.2 mm</td>
</tr>
<tr>
<td>Modules Currently Available</td>
<td>Twinax, 4x5A Power, 10 contact signal, Fiber Optic</td>
</tr>
<tr>
<td>Modules Currently Space Qualified</td>
<td>All planned Family approach which enables future flexibility</td>
</tr>
<tr>
<td>Twinax Cable Supported (Dimensions)</td>
<td>28 AWG Cable (3mm x 2mm) ~50% less mass than the 24 AWG cable, yet higher insertion loss</td>
</tr>
</tbody>
</table>
EPXB/38999/ELARA Contact Density Comparison

**EPXB**
- 5 shells #2 with 2*48 contacts
  - Total contacts: 480
  - Total surface: 96.90 * 91.80
  - = 8895.42 mm²
  - Gives 18.53 mm²/contact
  - 33% Increase / contact

**D38999**
- 4 shells #23 with 100 contacts
  - Total contacts: 400
  - Total surface: 96.00 * 96.00
  - = 9216 mm²
  - Gives 23.04 mm²/contact
  - 65% Increase / contact

**ELARA**
- 14 ELARA 8-ways with 40 contacts
  - Total contacts: 560
  - Total Surface: 88.7 * 88.1
  - = 7814.47 mm²
  - Gives 13.95 mm²/contact

*Highest density per contact with superior performance*
**ELARA - Modular Interconnect**

### Features
- Highly configurable - 3U connector
- Modules – Twinax, Dual Twinax, 10 pin Mixed Signal, 4 Pin Power, MT Ferrule Single and Multi-mode, 50 Ω Coaxial
- Aluminum, Conductive Composite and Composite shell materials
- Reverse gender - pins protected by insulator, scoop proof sockets
- Low outgassing materials
- Micro - Hyperboloid contact technology
- Ultra High Density

### Benefits
- Weight savings
- Ultra low mating force
- Withstands high shock and vibration space environments
- EMI Shielding for -70 dB attenuation at 10 GHz – Aluminum
- EMI Shielding for -65 dB attenuation at 10 GHz - Composite
- Solderless PCB Termination

### Designed to exceed the requirements of
- ESCC 3401
- ESCC 3402
- ECSS-Q-ST-70C
- ECSS-Q-ST-70-02
- ECSS-Q-ST-70-08C
- ECSS-Q-ST-70-38C
- ECSS-Q-70-71

### Applications
- Backplane architecture
- Point to point Cable Space AGE architecture
ELARA Modules

- **Development Plan**
  - 4 Bay In-line Plug and Receptacle
    - Aluminum Housing or Carbon filled LCP Housing (Molded)
  - 8 Bay In-line Plug and Receptacle
    - Aluminum Housing or Carbon filled LCP Housing (Molded)
    - Straight and Right Angle PCB mount modules (4 and 8 Bay)
  - Target Launch: December 2018

- **High Speed Twinax & Split Quadrax**
- **10-Way Signal & 5-Way Signal**
- **Fiber Optic configuration**
- **MT Ferrule**
- **Copper configuration**

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**smurth interconnect**

*bringing technology to life*
Module Insert Configurations – Developed or In Process

1. **Contact Qualification Complete**
   - Split Quadrax – Two Twinax Cables in a Common Contact Assembly (100 Ω each pair)
   - Twinax – Discrete Twinax with Two / Bay (100 Ω)

2. **In Qualification**
   - Power Module - 4 x 5 A Contacts
   - Mid-power Module - 5 x 3 A Contacts
   - Low Speed Signal - 10 x 1.5 A contacts

3. **In Development**
   - MT Fiber Optic Ferrule - up to a 12 fiber single mode ribbon
   - MT Fiber Optic Ferrule - up to 12 fiber multi-mode ribbon
   - 50Ω Coaxial Module
### Split Quadrax and Discrete Twinax Module Qualification

#### Qualification Completed Successfully

<table>
<thead>
<tr>
<th>Group</th>
<th>Test Description</th>
<th>Result</th>
<th>Group</th>
<th>Test Description</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mechanical and Climatic</td>
<td>Pass</td>
<td>3</td>
<td>Assembly Integrity and Plating</td>
<td>Pass</td>
</tr>
<tr>
<td></td>
<td>Sinusoidal Vibration (20g / 10-2,000 Hz)</td>
<td>Pass</td>
<td>High Temperature Storage (150°C for 1,000 hours)</td>
<td>Pass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Random Vibration (20g RMS / 20-2,000 Hz)</td>
<td>Pass</td>
<td>Mating and Unmating Forces (≤ 120 N)</td>
<td>Pass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mechanical Shock (50g / 11ms)</td>
<td>Pass</td>
<td>Electrical Test (IR, DWV, VSWR, IL)</td>
<td>Pass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bump (40g / 6ms)</td>
<td>Pass</td>
<td>Mated Shell Conductivity (≤ 2.5 mV)</td>
<td>Pass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dry Heat &amp; IR (125°C for 2 hours - IR 100MΩ)</td>
<td>Pass</td>
<td>Rated Current (Contact Resistance)</td>
<td>Pass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Damp Heat (25 to 55°C to 95% RH)</td>
<td>Pass</td>
<td>Contact Retention (&gt;10N &lt;25N max. 0.3mm shift)</td>
<td>Pass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cold Test (-55°C for 2 hours)</td>
<td>Pass</td>
<td>Insert Retention (In Shell)</td>
<td>Pass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low Air Pressure (50V @ 33,000m pressure)</td>
<td>Pass</td>
<td>4</td>
<td>High Temperature Measurement</td>
<td>Pass</td>
</tr>
<tr>
<td></td>
<td>Damp Heat Accelerated (25 to 55°C to 95% RH)</td>
<td>Pass</td>
<td>High Temperature Measurement (125°C IR ≥ 100MΩ)</td>
<td>Pass</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Rapid Change in Temperature (-55°C to 150°C)</td>
<td>Pass</td>
<td>All Groups (Pre and Post Test Group)</td>
<td>Pass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Electrical Test (IR, DWV, VSWR, IL)</td>
<td>Pass</td>
<td>Pre Mating and Unmating Forces (≤ 120 N)</td>
<td>Pass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Contact Retention (&gt;10N &lt;25N max. 0.3mm shift)</td>
<td>Pass</td>
<td>Pre/POST Electrical Test (IR, DWV, VSWR, IL)</td>
<td>Pass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mating and Unmating Forces (≤ 120 N)</td>
<td>Pass</td>
<td>Pre Near / Far End Cross Talk (NEXT/FEXT) ≤ 4%</td>
<td>Pass</td>
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<tr>
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<td>Electrical Test (IR, DWV, VSWR, IL)</td>
<td>Pass</td>
<td></td>
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<tr>
<td></td>
<td>Endurance (500 cycles w/ Savers - 100 wo Savers)</td>
<td>Pass</td>
<td>EMI - Shielding Effectiveness -65dB to 10GHz</td>
<td>Pass</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mating and Unmating Forces (≤ 120 N)</td>
<td>Pass</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mated Shell Conductivity (≤ 2.5 mV)</td>
<td>Pass</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Return Loss (≤-10dB @ 6.25 GHz)</td>
<td>Pass</td>
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Electrical Performance

**TDR**

- Connector impedance 90Ω to 105Ω
- The low value is due to the pin field capacitance on the test board and the high value is due to the inductance of the connector contact
High Speed electrical performance of the connection system is further enhanced by a cable to cable application, rather than a cable to PCB termination.
EMI / RFI Protection

EMI

Target Attenuation
-65 dB @ 10 GHz

EMI Shielding Backshell

EMI Ground Spring
Measured Shielding Effectiveness

- **EMI – Shielding Effectiveness to date**

  ![Shielding Effectiveness Graph](image)

  - **Frequency 4 to 8 GHz**
  - **Minimum Shielding Effectiveness -73 dB**

  ![Shielding Effectiveness Graph](image)

  - **Frequency 8 to 10 GHz**
  - **Minimum Shielding Effectiveness -68 dB**
  - **-70 dB expected with a revised bulkhead EMI gasket**
Summary

- ELARA modular connector systems has been demonstrated to meet the high speed signal integrity (based on S Parameter measurement, Impedance and Eye Pattern) and environmental performance for space applications.
- The connector system has the flexibility to meet the needs of various interconnection requirements including DTP applications and SpaceWire transmission.
- High density of contact packaging.
- The additional modules under development will ensure that high speed electrical transmission, low speed signal, power, and fiber optic data are fully supported for space applications.
- Higher Signal Data Rates demand a partnership at the system level.