

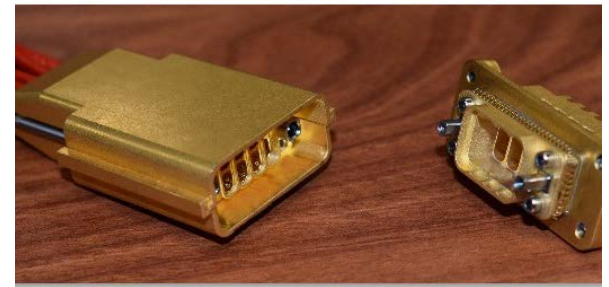
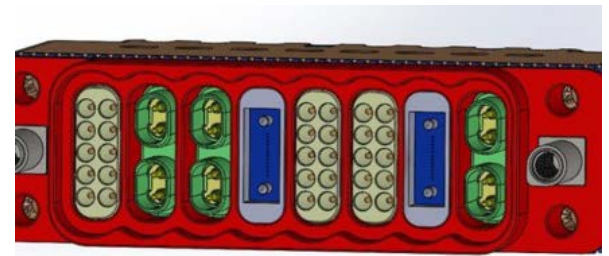
Modular Interconnect for Point to Point and Backplane Space Application

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ELARA - Modular Interconnect

- **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**

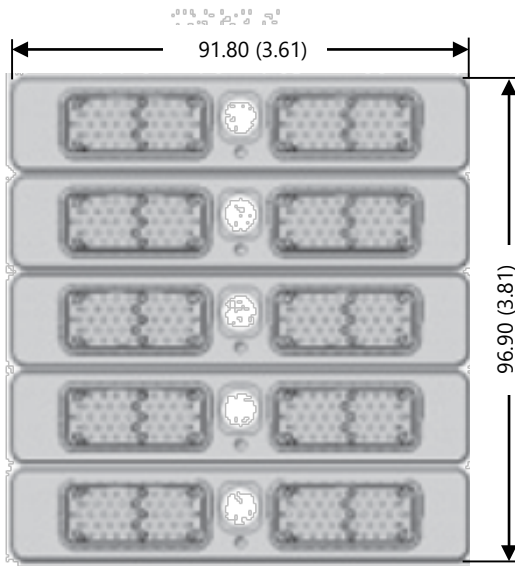


Rugged Embedded System Connector Requirements

Requirement	ELARA
Ruggedness	Hyperboloid
High Speed (>6.25 Gbps)	10.0 GBPS + min
High Density Cable Contacts	Yes
Modularity	Yes
Interchangeable Modules	Yes
Low Mass	Yes
Efficient RF Cable Assembly	Yes
Space Qualified Materials	Yes
PCB Termination	Multiple Options

ELARA 8 Twinax Module Comparison	
Mass	~28 g
Width	29.1 mm
Height	14.5 mm
Total Length	41.2 mm
Modules Currently Available	Twinax, 4x5A Power, 10 contact signal, Fiber Optic
Modules Currently Space Qualified	All planned Family approach which enables future flexibility
Twinax Cable Supported (Dimensions)	28 AWG Cable (3mm x 2mm) ~50% less mass than the 24 AWG cable, yet higher insertion loss

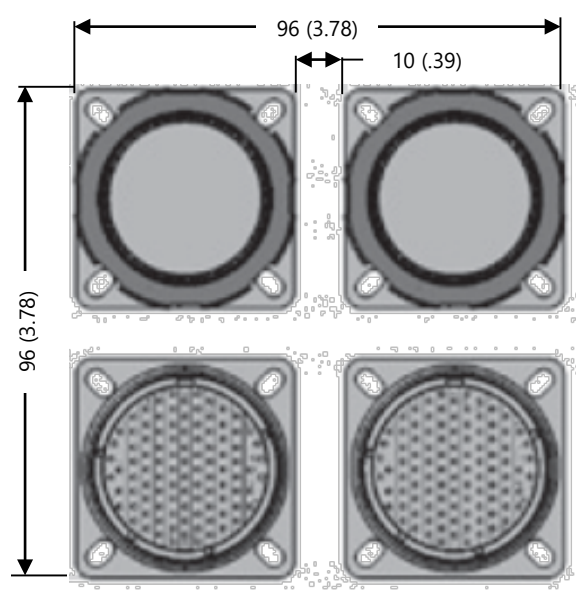
EPXB/38999/ELARA Contact Density Comparison



EPXB

5 shells #2 with 2*48 contacts

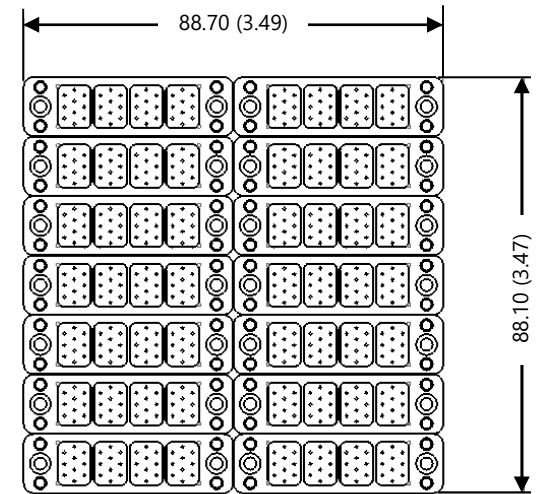
- Total contacts: 480
- Total surface: $96.90 * 91.80$
- = 8895.42 mm^2
- Gives $18.53 \text{ mm}^2/\text{contact}$
- 33% Increase / contact



D38999

4 shells #23 with 100 contacts

- Total contacts: 400
- Total surface: $96.00 * 96.00$
- = 9216 mm^2
- Gives $23.04 \text{ mm}^2/\text{contact}$
- 65% Increase / contact



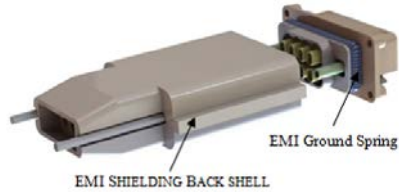
ELARA

14 ELARA 8-ways with 40 contacts

- Total contacts: 560
- Total Surface: $88.7 * 88.1$
- = 7814.47 mm^2
- Gives $13.95 \text{ mm}^2/\text{contact}$

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



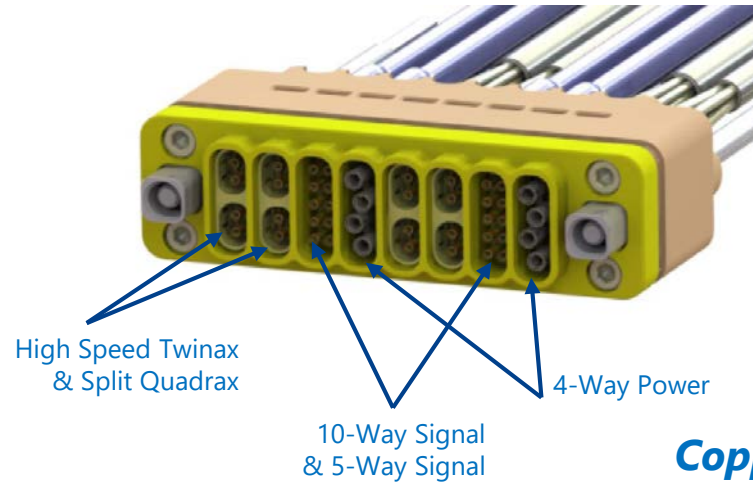
Applications

- Backplane architecture
- Point to point Cable Space AGE architecture

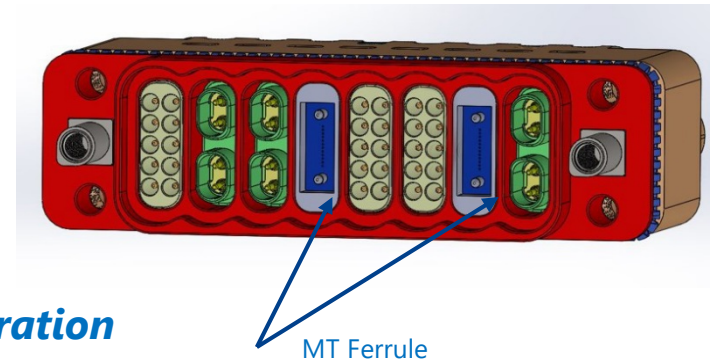
ELARA Modules

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



Copper configuration



Fiber Optic configuration

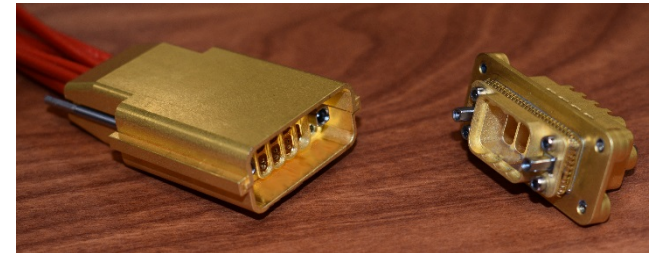
Module Insert Configurations – Developed or In Process

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

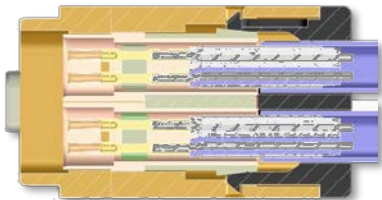
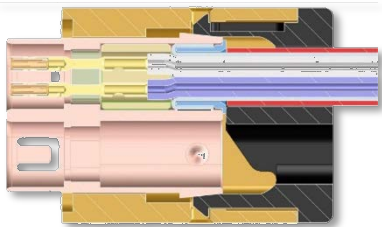


3. In Development

- MT Fiber Optic Ferrule - up to a 12 fiber single mode ribbon
- MT Fiber Optic Ferrule - up to 12 fiber multi-mode ribbon
- 50 Ω Coaxial Module



Split Quadrax and Discrete Twinax Module Qualification



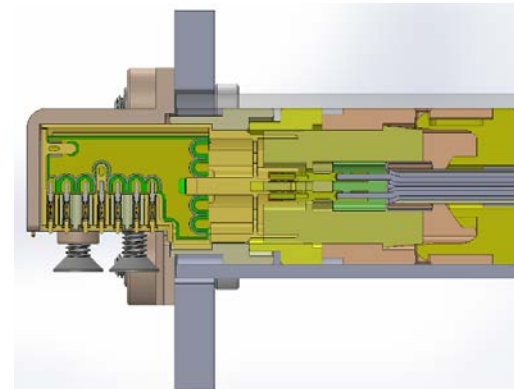
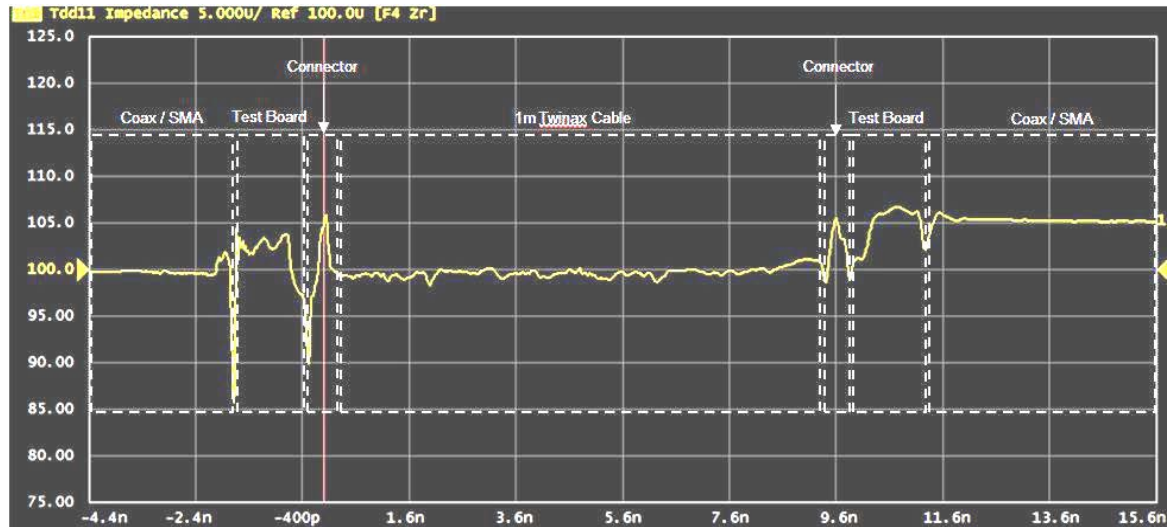
Group	Test Description	Result	Group	Test Description	Result
1	Mechanical and Climatic		3	Assembly Integrity and Plating	
	Sinusoidal Vibration (20g / 10-2,000 Hz)	Pass		High Temperature Storage (150°C for 1,000 hours)	Pass
	Random Vibration (20g RMS / 20-2,000 Hz)	Pass		Mating and Unmating Forces (≤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

Qualification Completed Successfully

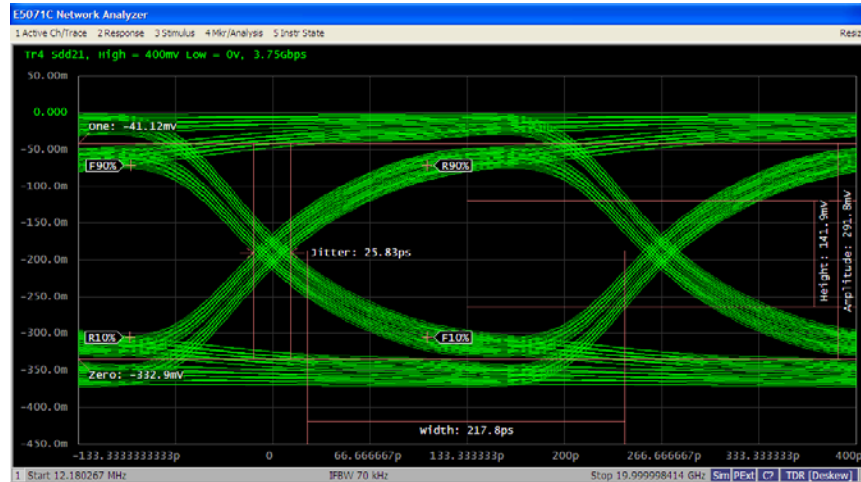
Electrical Performance

TDR

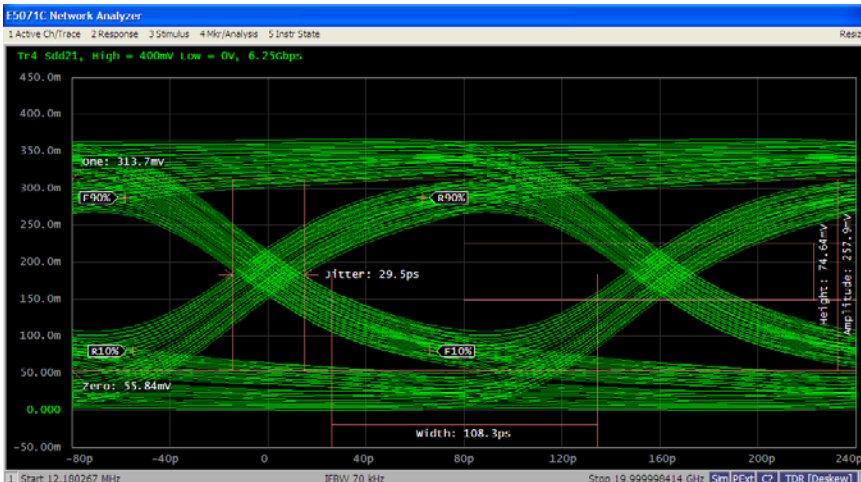
- Connector impedance 90Ω to 105Ω
- The low value is due to the pin field capacitance on the test board and the high value is due to the inductance of the connector contact



Eye Pattern Performance



Eye Pattern at 3.75 Gbps (Jitter 25.83 ps)

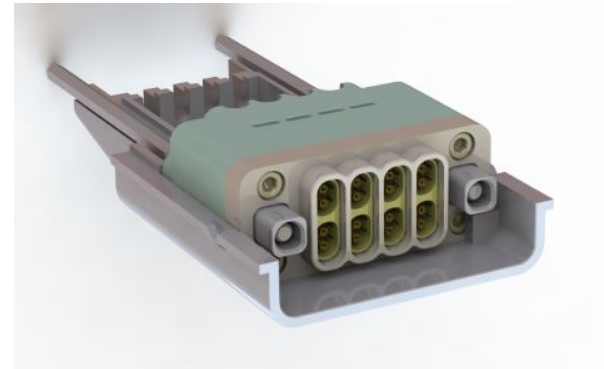


Eye Pattern at 6.25 Gbps (Jitter 29.5 ps)

High Speed electrical performance of the connection system is further enhanced by a cable to cable application, rather than a cable to PCB termination

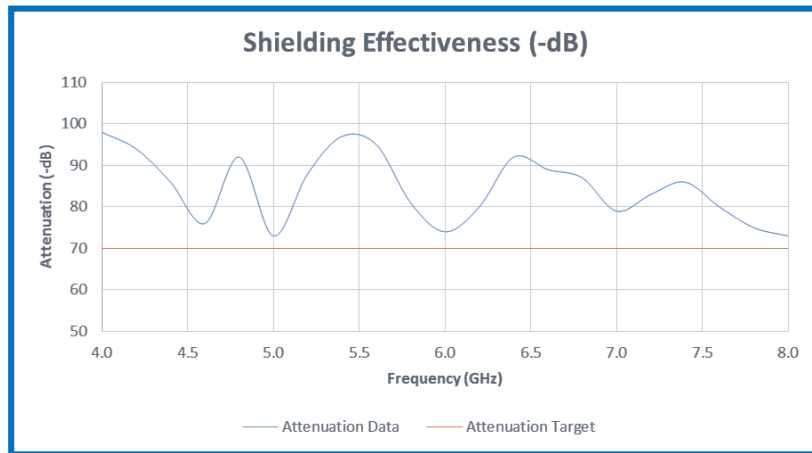
EMI

Target Attenuation
-65 dB @ 10 GHz

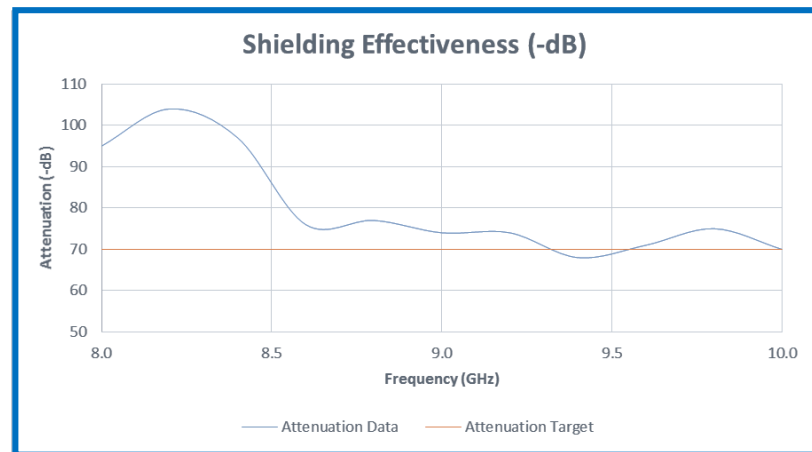


Measured Shielding Effectiveness

■ EMI – Shielding Effectiveness to date



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



- 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**



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