SPACE PASSIVE COMPONENT DAYS

2nd SPCD - International Symposium

ESA/ESTEC

12-14 October 2016

axon' cable & interconnect

HIGH DATA RATE SOLUTIONS

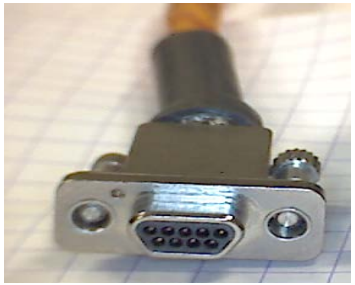
with new cable and connector technologies

Introduction

Status:

Up to now SpaceWire links use the 9 way micro-D connector.

→ There are **no solution** that offer performances required by SpaceWire links specification.



New development:

EMITS from ESA for a new adapted connector started in April 2015 for 24 months

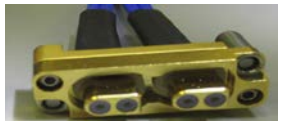
Main activities / topics of the presentation:

1. High data rate background at Axon' cable
2. New SpaceWire adapted connector
3. Cable survey for 100Ω LVDS transmission

1 - High data rate background at Axon' cable

- Long time experience with Mil-Std-1553B Databus for Ariane 5 (1Mb/s)

- AxoMach® family with data rates up to **10 Gb/s** per channel



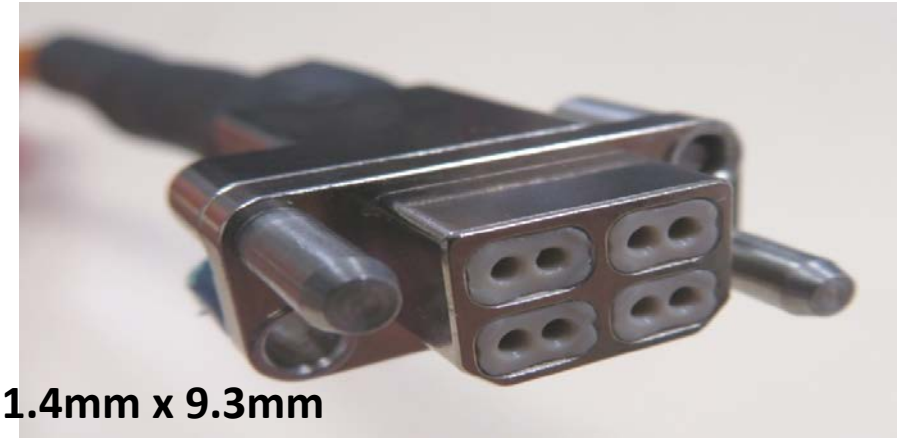
- Adapted to create a SpaceFibre version

- Low mass variant of the classic SpaceWire cable (400Mb/s)

2 - New SpaceWire adapted connector

Connector requirements / specifications :

- Compact : as close as possible as 9 ways micro-D → **CUSTOMERS' PRIORITY**
- 100Ω matched impedance connection
- With improved cable screen terminations to connector (for 360°protection)
- Higher data rate performance (at least 400Mb/s)
- Low crosstalk between ways

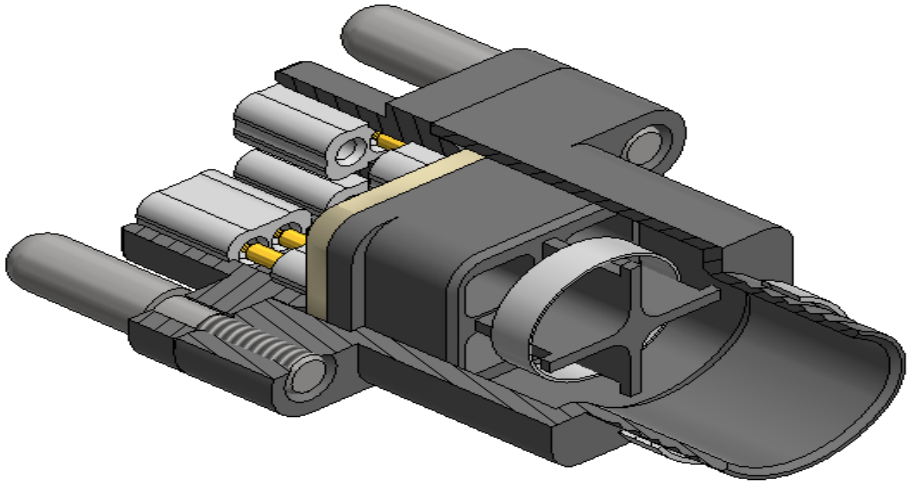


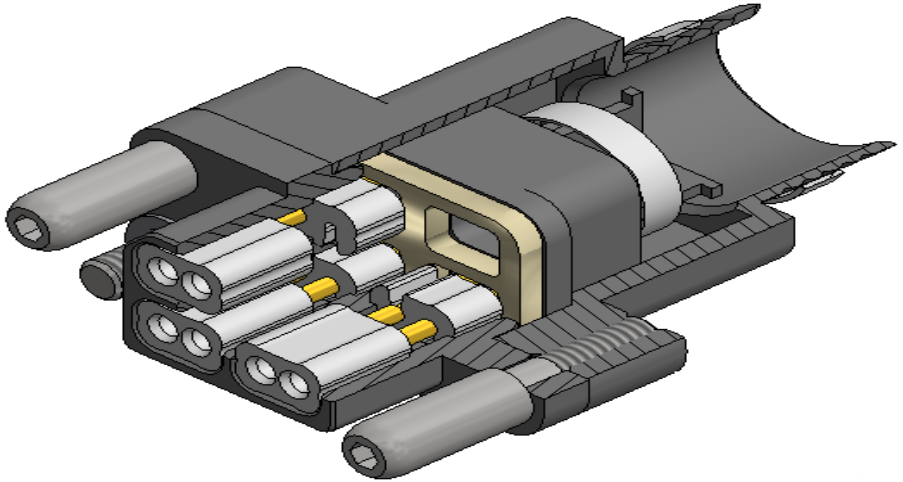
Dimensions: 21.4mm x 9.3mm

2 - New SpaceWire adapted connector

aXiform insert + metallic band:

→ ensures a solid electrical contact by maintaining a degree of pressure over the 4 cable braids

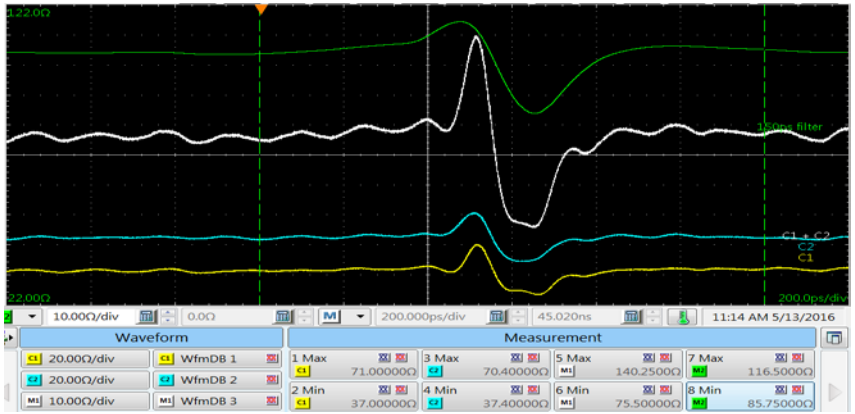
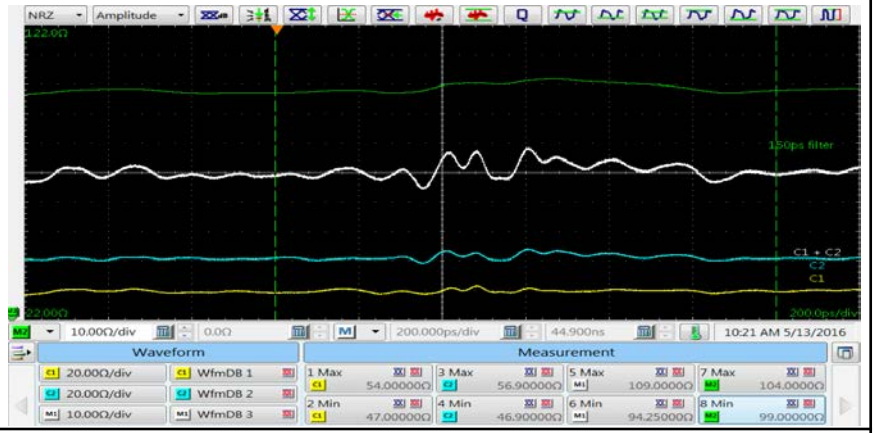




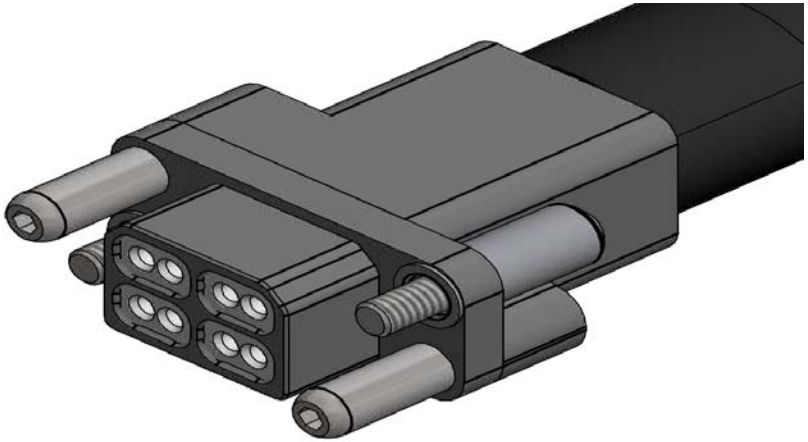
2 - Preliminary Electrical Results

(Test performed on a 1m length LowMass cable variant)

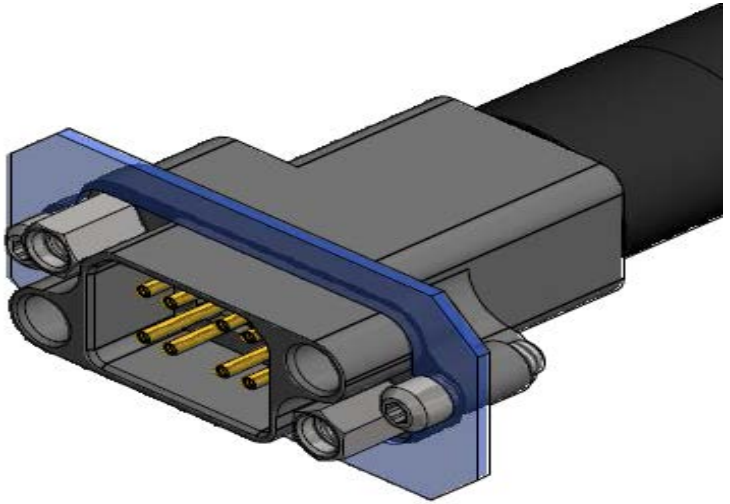
- Ground contact between Male & Female bodies **< 5 mΩ**.
- Crosstalk Next/Fext **< -50 dB** up to 2 GHz
- Return loss **< -20 dB** up to 1 GHz
- Eye pattern: up to **4Gb/s** with respect to the SpaceWire mask.
- Characteristic impedance:

Micro-D connector	New SpaceWire connector
	
White curve: 76Ω to 140Ω (20GHz) Green curve: 86Ω to 116Ω (5GHz)	White curve: 94Ω to 109Ω (20GHz) Green curve: 99Ω to 104Ω (5GHz)

2 - In-line variants



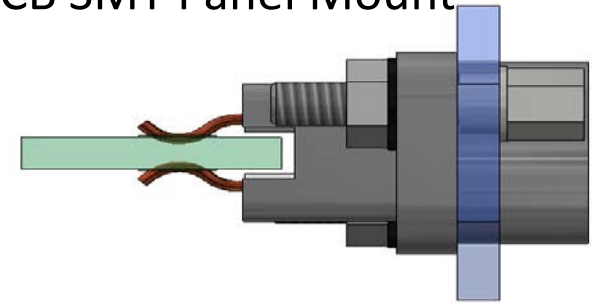
Inline Male

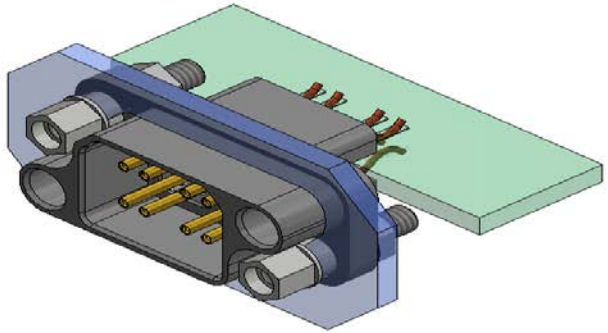


Inline female panel mount

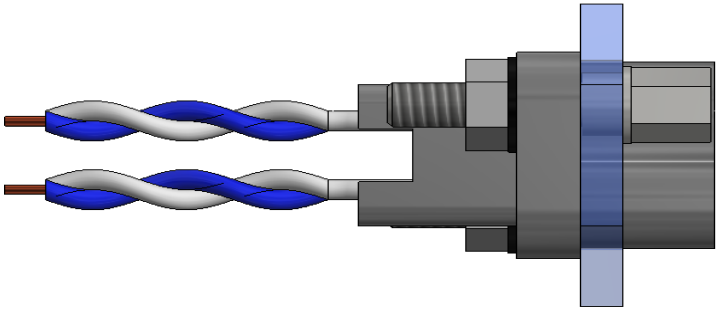
2 - PCB variants

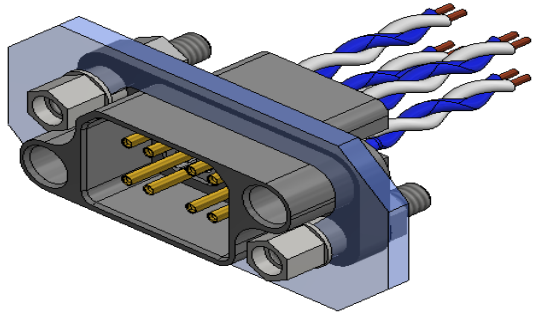
Edge PCB SMT Panel Mount



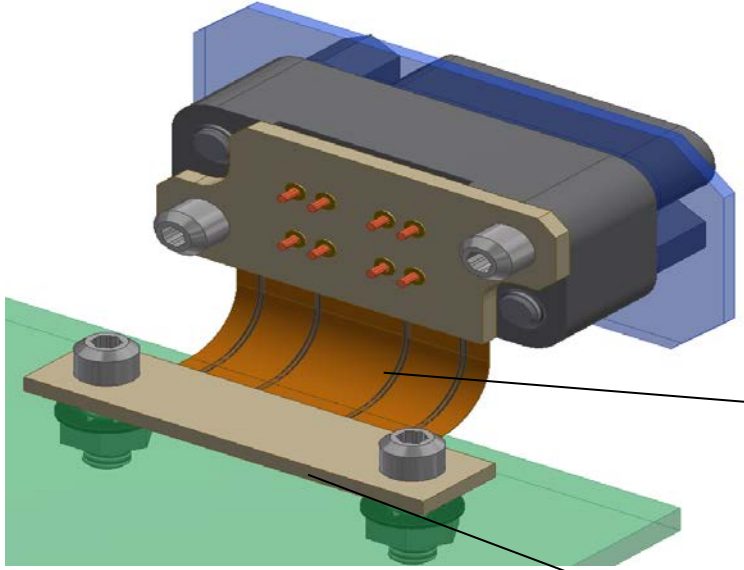


Wired PCB Panel Mount





2 -PCB variants \ Flex PCB Panel Mount



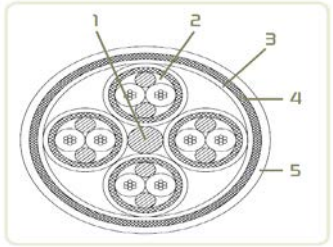
- Compact
- Matched impedance
- Easy to install
- “True” flexible

Flexible PCB with a ground layer and 4 x 100Ω differential impedance

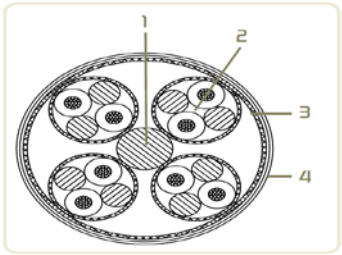
½ metalized holes

3 - Cable survey for 100Ω LVDS transmission

Current cable: 4 x Twisted pairs

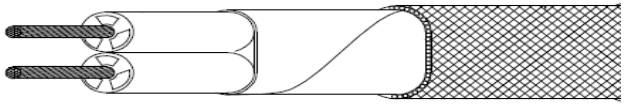


ESCC3902/003



ESCC 3902/004

4 x Parallel pairs

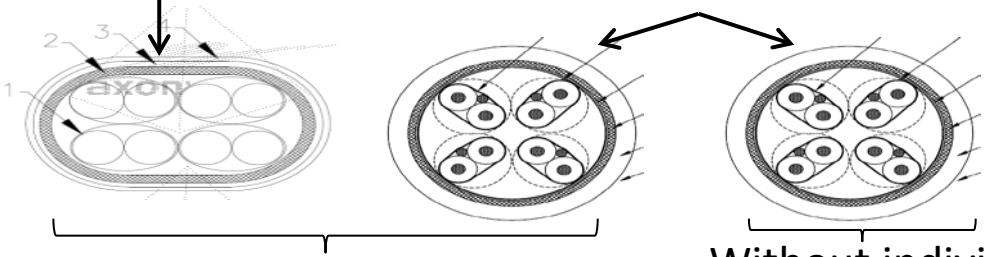


With alveolar insulation

→ Intra pair skew reduction
→ Insertion loss reduction
→ Smaller cable

Parallel assembly

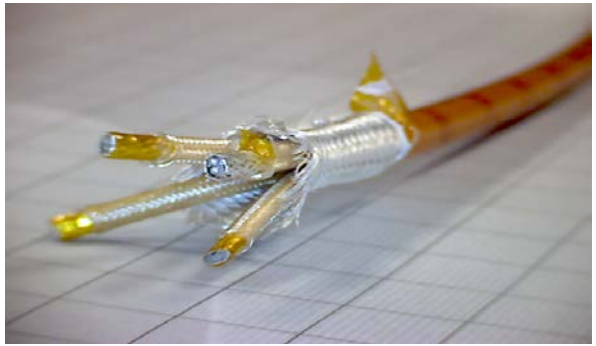
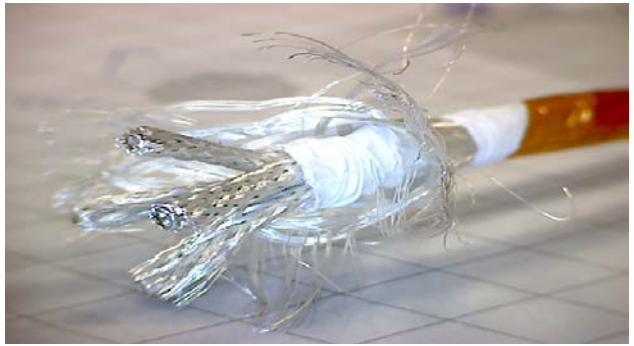
Twisted assembly



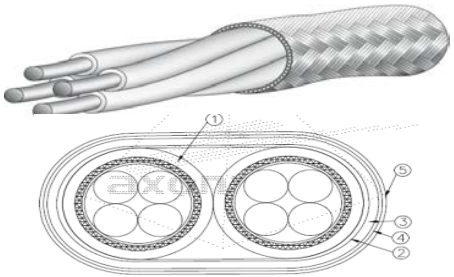
With individual PEEK braid

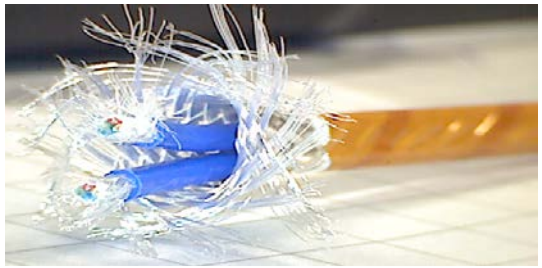
Without individual PEEK braid

3 - Cable survey for 100Ω LVDS transmission

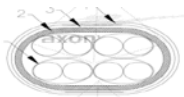
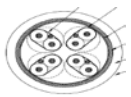
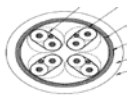
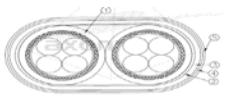
Parallel assembly	Twisted assembly	
		
With individual PEEK braid		Without individual PEEK braid

2 x Quads in parallel





3 - Cable survey for 100Ω LVDS transmission

	ESCC 3902 004 Requirements				
		With individual PEEK braid		Without individual PEEK braid	
S21 (dB/m) 1000Mhz(max)	<1.4	1.19	1.14	1.23	1.39
NEXT Up to 1GHz (dB) (max)	<-50	<-60	<-60	<-60	-31
FEXT up to 1GHz (dB) (max)	<-50	<-60	<-60	<-60	-43
Zc (Ω)	94-106Ω		(only one pair under the criteria)		
Intra pair Skew (ps/m) (max)	<50	<5	<5	<5	7
Inter pair Skew (ps/m) (max)	<100	<5	17	<5	23

Conclusion

In progress :

- Evaluation of the different connector variants with different cables
- Writing of an ESCC specification for harness + ESCC detail specification for connectors (PCB and in-line)

At the end of the project (estimated End 2017) **:**

- A range of connector for in-line, panel mount and PCB version
- ESCC specifications
- CNES PID
- Alternative cables for 100Ω LVDS transmission protocol

New connector + new cables → Axon' strategy to increase data rate capability of the full assembly