



# ITK Pixel PP1 connectors (update...)

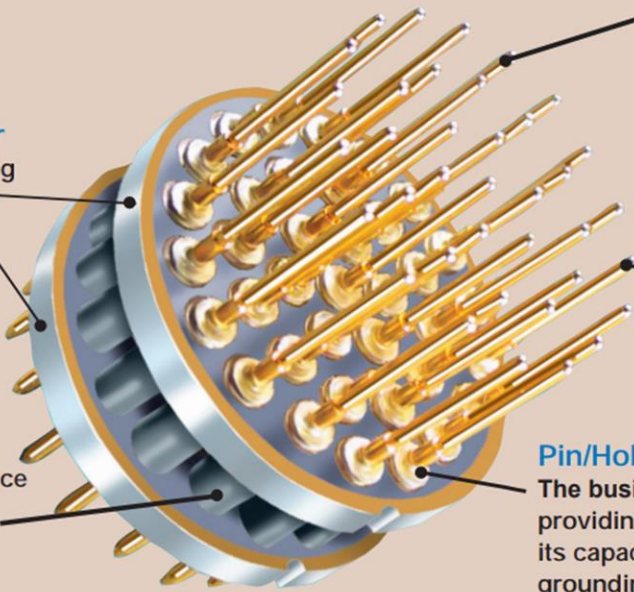
*Presented by Petr Sicho*

# Searching for high density connector with integrated "C array"

## Filter Module Elements

**Multilayer Ceramic Planar Array:** Containing a network of capacitors, feedthrus and ground lines.

**Inductors:** Ferrite Beads to provide inductance and increase insertion loss



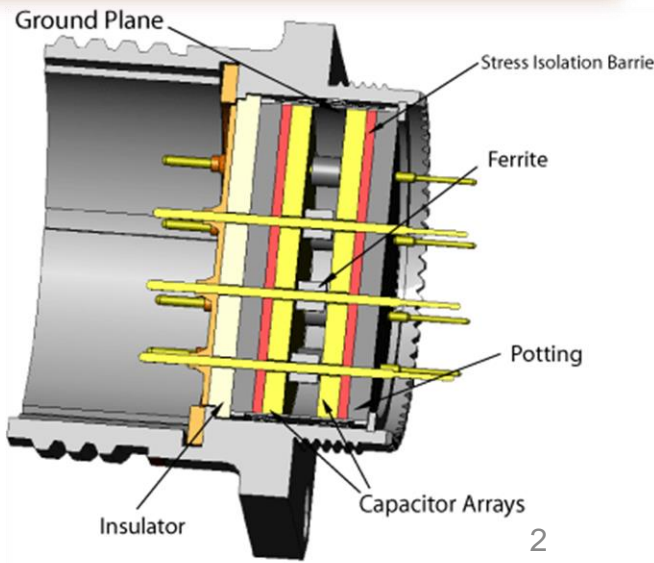
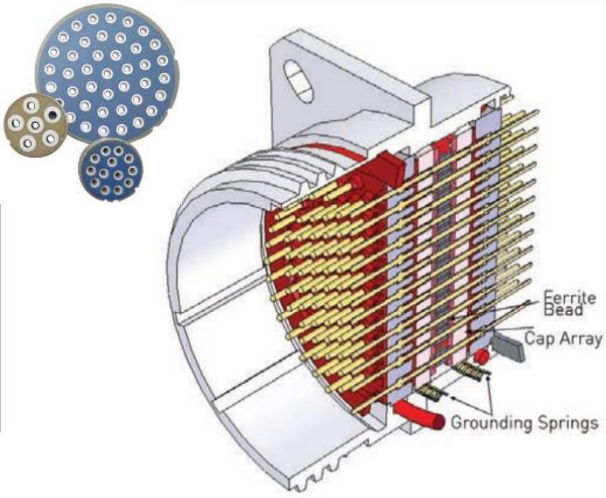
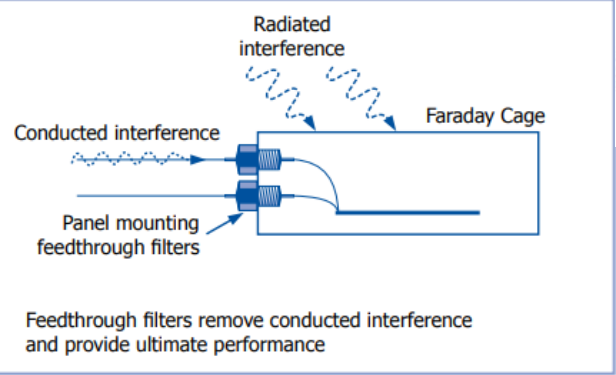
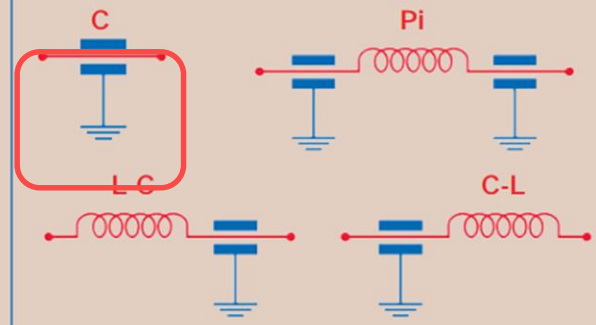
**Contact Types:** Choose from Solder Cup, PC Tail or Piggy-Back Crimp (Consult Factory for PC Tail Length Options).

**Contact Material:** Gold Plated Copper Alloy.

**Pin/Hole Intersection:** The business-end of the filter, providing each contact with its capacitance value and grounding.

### Filter Types

- C** Single capacitor with low self inductance
- LC, CL** Single capacitor combined with an inductive element
- Pi** Dual capacitors with a single inductive element positioned between.



# LEMO-5F – should be still considered or not?

- Response from LEMO representative: *“For the moment we do not have any sort of filter array modules available. We are again working on it internally and will come back to you if we can propose you an eventual solution”*
- Price of LEMO connectors is competitive as CERN has likely very special conditions...
  - ~110Eur/piece - socket type including pins (nSQP order directly at LEMO)
  - **Mating pair** price could be now for ~**260Eur** if larger quantity ordered directly at LEMO, via Mouser it could be ~440Eur (50pc quotation)
  - Total quantity: ~400 connectors (LV and HV matting pairs) giving total price of **100kEur**



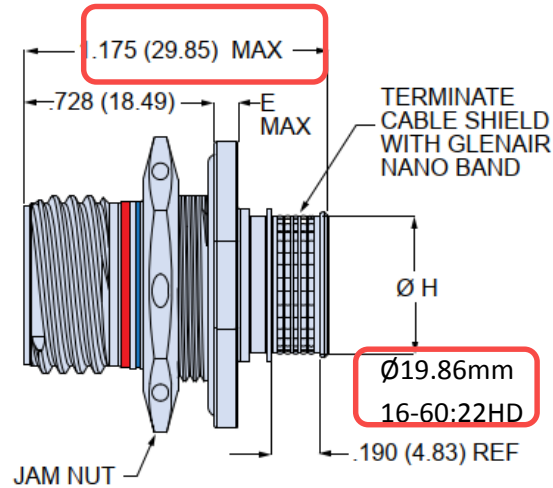
# Axon HD connectors

- Response from Axon representative: *“We do have experience with filtered connectors using planar capacitors, but only in rectangular shape. For circular it’s much more complicated since the distance between individual contacts and the ground varies, and we have no heritage in this”*
- Axon is focused mainly on development of micro-D connectors, therefore they proposed us only micro-D connectors in filtered version (2x37 or 2x31 or 2 x 25 pins). Combo type with mixed pins size is also available (up to 20A). Not sure if such connectors would be useful for us..
- Connector cost and max withstanding voltage was not communicated...
- Axon is interested in cable assembly and is able to provide radiation hard and flexible raw cable (up to 600Mrad)..

# Glenair 806 - Filtered HD jam nut receptacle (PP1 socket)



Standard version

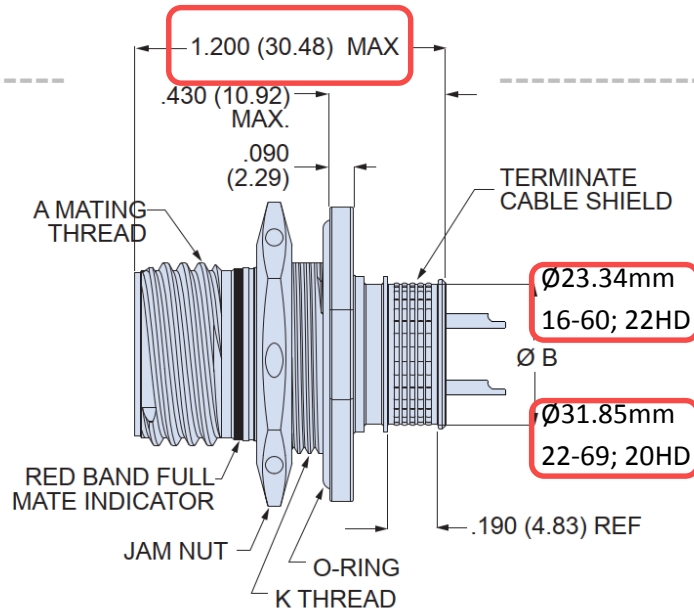


## Standard "Mighty Mouse series 806 connector" (Glenair)

- 1800Vac/7,5A #20HD layout up to 92pins
- 1300Vac/5A #22HD layout up to 186pins
- Crimped pins possible



Filtered version



## Filtered "Mighty Mouse series 240-806 connector" (Glenair)

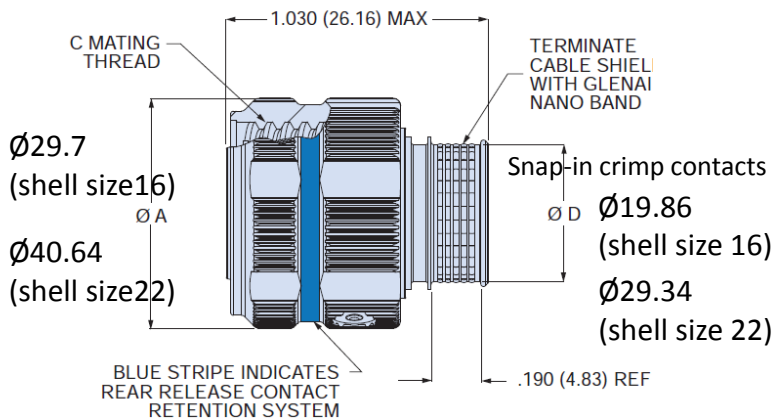
- 300Vdc/5A (#20HD pins)
- 300Vdc/3A (#22HD pins)
- #20HD 22-69 layout (LV)
- #22HD 16-60 layout (HV)
- Only solder/PC tails pins (to be confirmed)

SHELL STYLE 07  
JAM NUT RECEPTACLE  
NANOBAND PLATFORM, SOLDER CUP CONTACTS



# Glenair 806 series

- Glenair representatives contacted in order to get customized version of mighty mouse 806 (see previous slide), limited voltage rating of filtered version could be showstopper for HV lines..
- Price? Still waiting Glenair response... Mouser is likely the only distributor of Glenair connectors in Europe but their price is usually quite high (also for LEMO);
- 806-020-ME12-26SMA socket connector 12/26 (shell size/#pins) is offered by Mouser for 860Eur/pc and plug 840Eur (quoted for 10pc, no C filters!)
- It hard to assume price bellow **1500,-Eur/mating pair** for larger shell (16-60) with EMI filters inside - Total **600kEur** or more (estimated - to be confirmed..)
- Plug connector with “nut” only
- Radiation hardness???

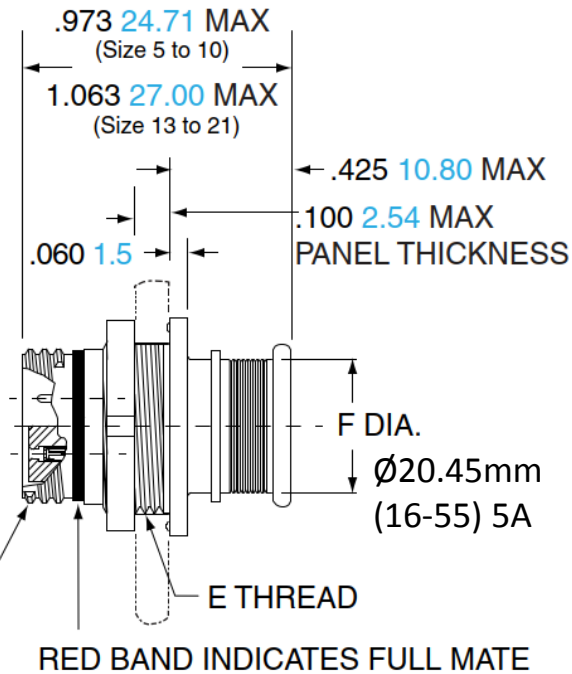
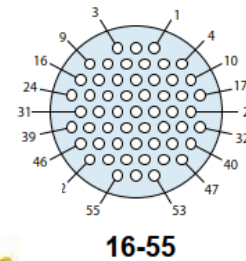
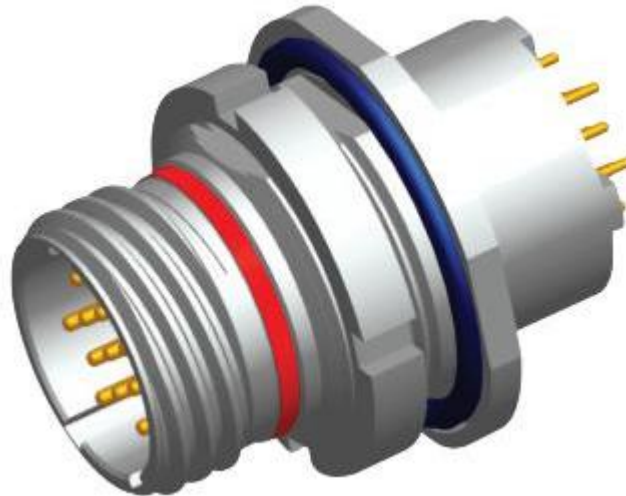


# Amphenol 2M800x series connectors

2M801-009-07

2M801-009-07ZNU16-55

- Jam nut mount
- shell size: 16
- # of pins: 55
- Pin size: #23 (5A)
- Only ~25g
- 1 piece ordered at Farnell

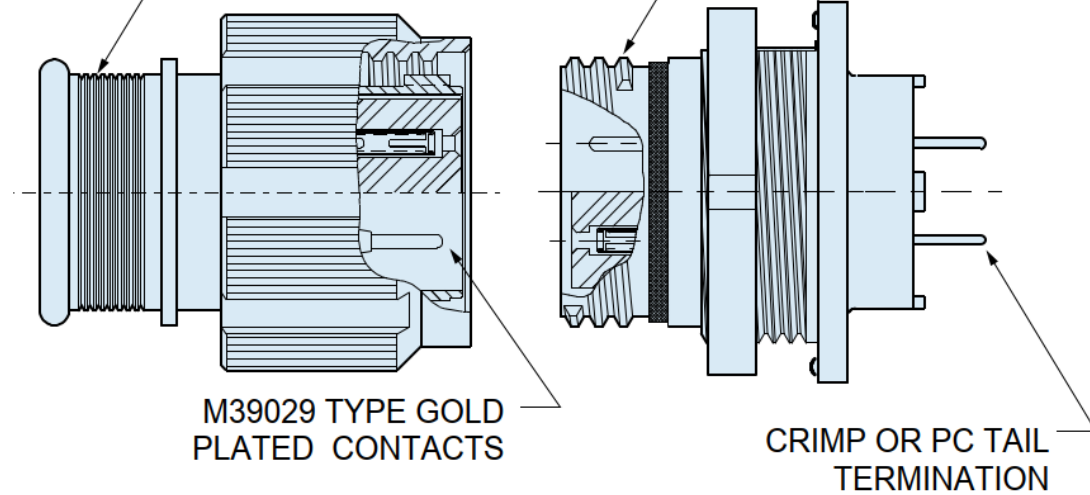


- Amphenol recommends their 2M80x series (miniature and light version of MIL-DTL-38999) – exists in “push-pull” or “bayonet” or “dual-start Acme threaded” version (picture above)
- Planar C array can be integrated in all versions, 1000VDC should not be problem(!)
- Radiation resistance?? Waiting Amphenol’s statement..
- Price? Amphenol socket connector 2M801-009-07ZNU16-55 (shell 16, 55 pins picture above) at Mouser costs 140Eur (plug 160Eur) – without filter array, total quantity of matting pairs could cost **120kEur** (quoted for 10pc only)

# Amphenol 2M801-xxxx

INTEGRAL SHIELD  
TERMINATION AND  
MOLDING PLATFORM

DOUBLE-START ACME  
MATING THREADS



## 2M801 MATERIALS AND FINISHES

Shells	Aluminum Alloy or Stainless Steel
Contacts	Copper Alloy, gold plated
Insulators	Polyphenylene Sulfide (PPS)
Contact Retention	Beryllium Copper Alloy
Grommet, Interfacial Seal, O-Ring	Fluorosilicone Rubber

~200Mrad



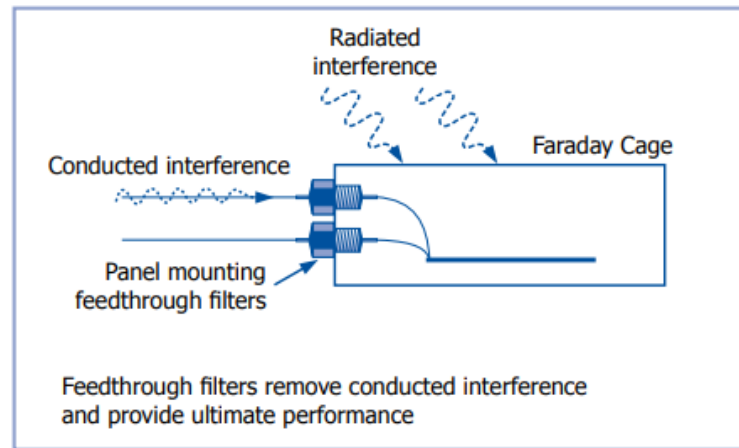
# What we can conclude and what next?

- In order to move ahead with connector selection we have to freeze PP1 services and PP1 layout meaning number of connector types, number of lines, wire gauges and then provide specification to suppliers along with asking for appropriate solution.
- Both Glenair and Amphenol can provide circular HD connectors with filtering capacitor planar arrays. Such connectors are considered as customized and are not available online via distributors military/aeronautical applications.
- Total cost? Just first estimation for price indication done for non-filtered versions (for filtered versions a quotation has to be requested). LEMO and Amphenol is fairly the same price, Glenair is significantly more expensive even if their connectors look similar as Amphenol ones and the cost difference should be understood.
- Radiation hardness information was requested – waiting for data
- Operation in magnetic field should be also checked..
- In addition to Amphenol and Glenair also Souriau (France) was contacted, but no feedback so far. They have also filtered version (basically the same product range)

# Backup slides

# EMI filters at Pixel patch panels

- As we share common Faraday cage with Strips we have to adopt their rather strict shielding and grounding rules as Strips are more sensitive to EMI
- In principle we should use filter at each connector pin (each wire) entering Faraday cage at PP1



- Ceramic feedthrough capacitor with low self inductance. It shunts high frequency noise to ground..
- We assume 10nF at PP1 entry..

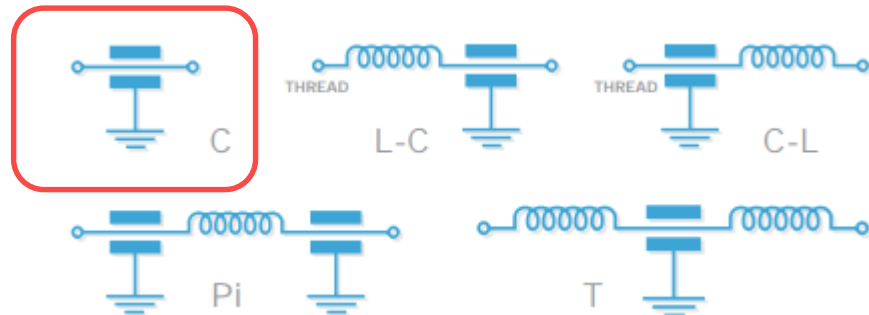








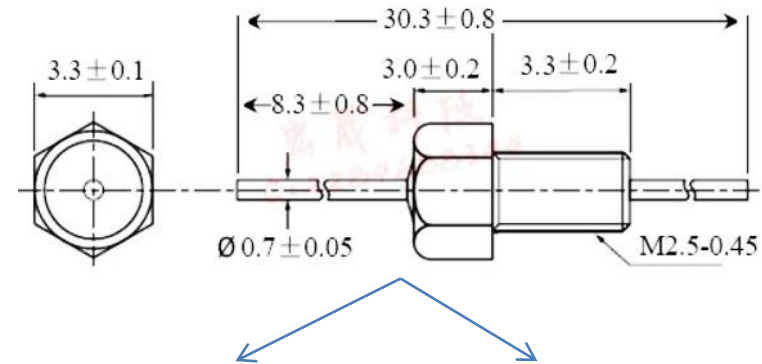


Image	Mouser Part No	Mfr. Part No.	Mfr.	Description		Availability	Pricing (EUR)
							
 <a href="#">🔍 Enlarge</a>	654-0100907ZNU1655SA	2M80100907ZNU1655SA	Amphenol Aerospace	Circular MIL Spec Connector M801 55C 55#23 SKT RECP OM  <a href="#">Learn More</a>	<a href="#">Datasheet</a>	Non-stocked	1: 172,49 € 5: 151,66 € 10: 141,73 €
 <a href="#">🔍 Enlarge</a>	654-801009071655SA	801-009-07ZNU16-55SA	Glenair	Circular MIL Spec Connector RECEPT BAND PLATFORM JAM NUT SKT  <a href="#">Learn More</a>	<a href="#">Datasheet</a>	25 Factory Stock Available <a href="#">More Info Available</a>	10: 466,53 € 25: 460,31 €



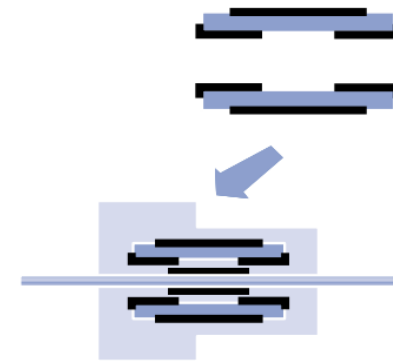
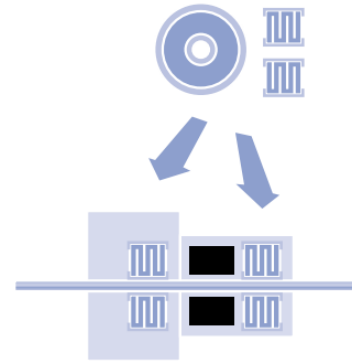
# Panel Mount Feed Through Capacitor (EMI Low Pass Filter)

- Example:
- 1.Capacitance :10000pF (Tolerance : +80%,-20%)
- 2.Rated Current :7A
- 3.Working Voltage :50VDC
- 4.Dielectric Withstanding Voltage:150VDC
- 5.Insulation Resistance:>10000M Ohms
- 6.Dissipation Factor:< 3.0%
- 7.Temp. range:-55-+125°C
- 8. Installation: Screw
- 9.Thread Size:M2.5X0.45mm
- 10.Material N or S
- 11.Part Number (10000pF) RTF-76-023-M2.5
- 12. M2.5 (Dimension in mm)

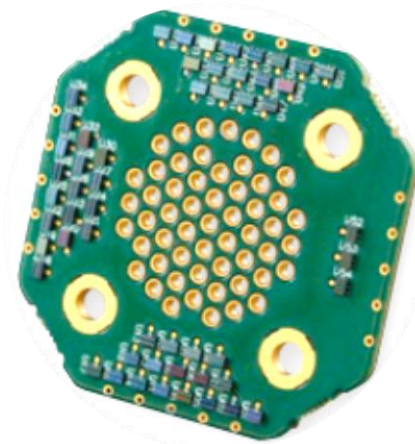


Multilayer discoidal capacitor

Tubular capacitor



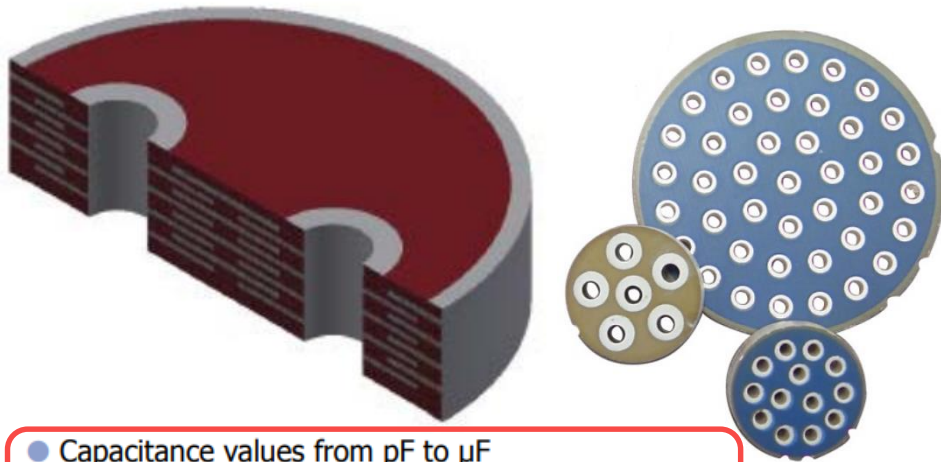
EMI SMD diodes  
around  
connector pins?



# EMI filter arrays

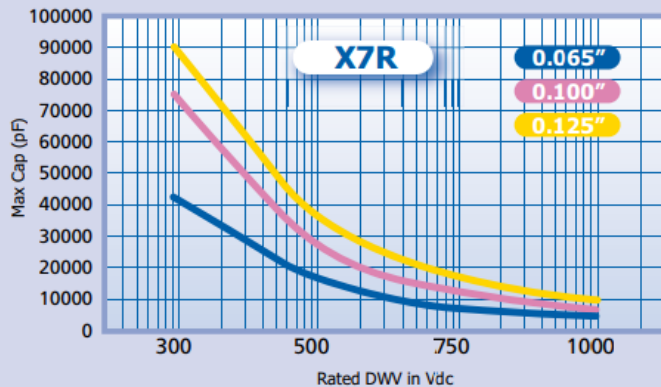
- There are two types of high density capacitor arrays:

## Multilayer planar array

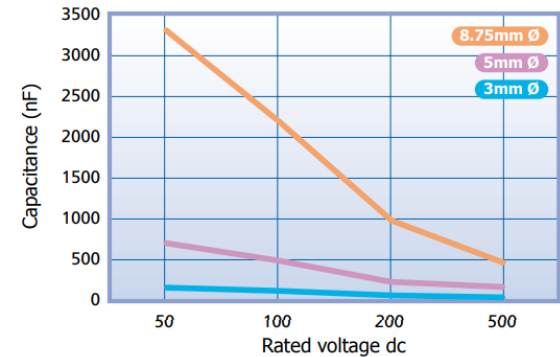
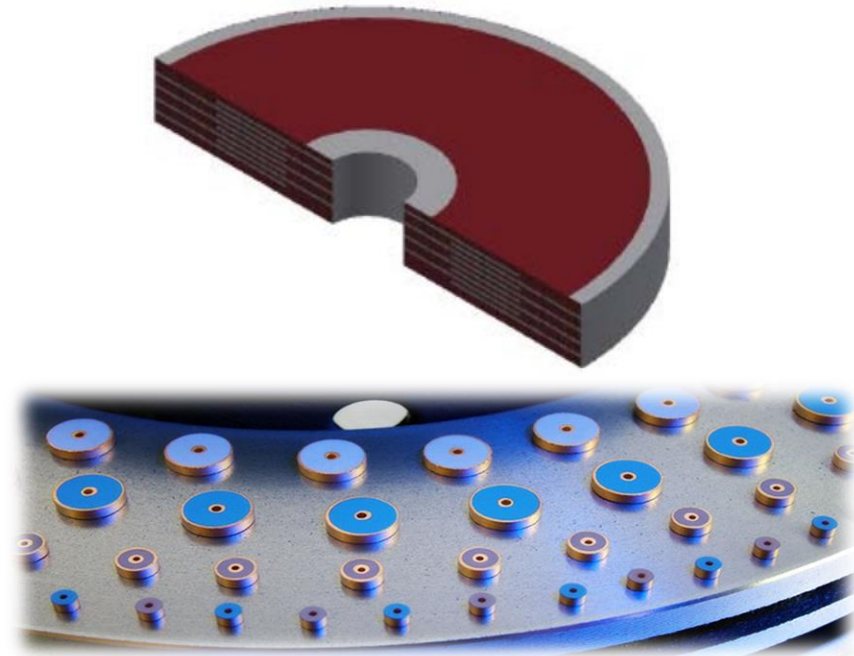


- Capacitance values from pF to  $\mu\text{F}$
- High voltage capability - DWV (Dielectric Withstand Voltage) to 10kV

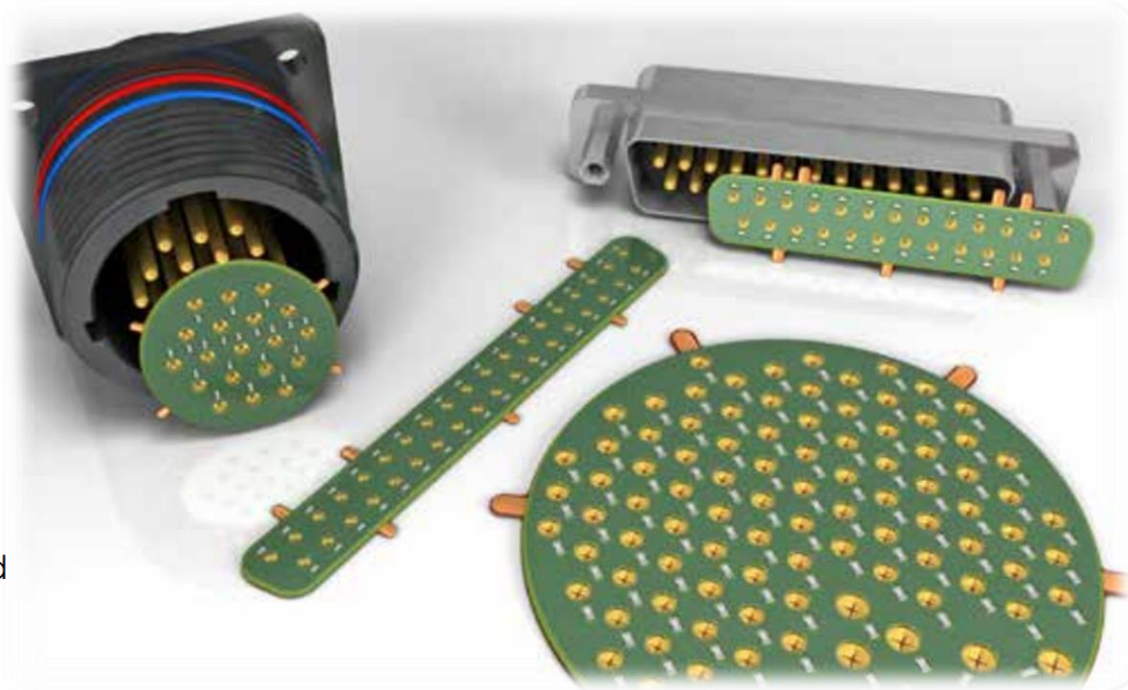
High density circular planforms



## Discoidal multilayer capacitors



# Custom Filter inserts?

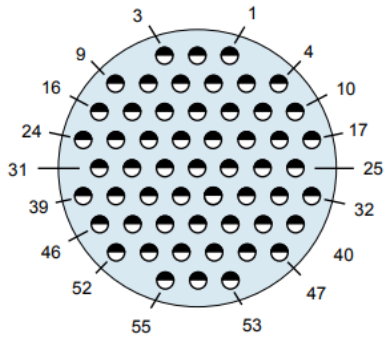


## “Flex” Filter Inserts

- “Drop-in” filter solution for military circular and D-Subminiature connectors
- Chip capacitor filtering with a wide array of capacitances and voltage ratings available
- Simple installation in your *existing* connector
- Cost effective, providing simple and immediate solutions

# Military/aerospace EMI connectors

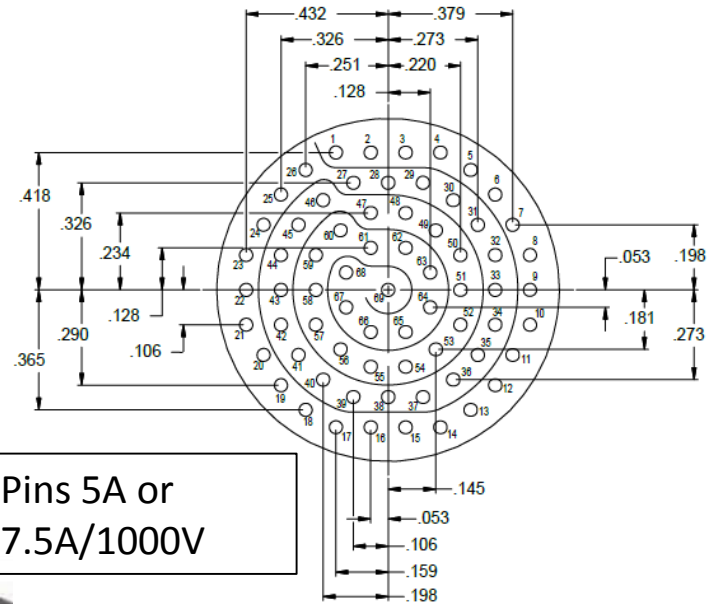
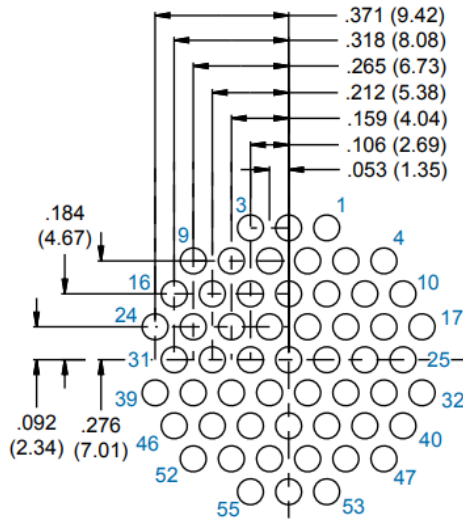
(MIL-DTL-38999 Series - Glenair, Amphenol, Souriau, etc) How about LEMO???



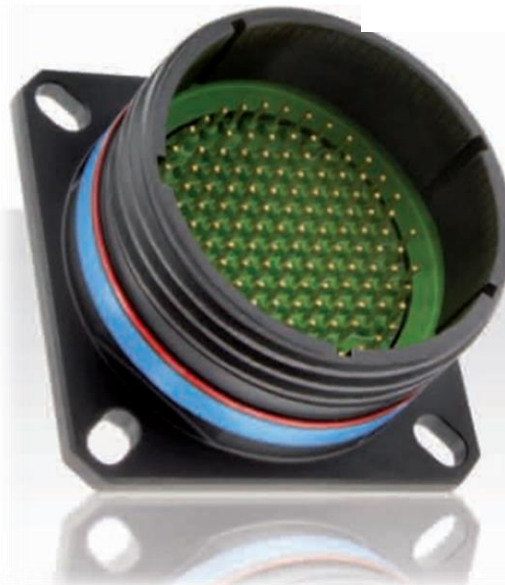
**Insert Arrangement**  
**19-255 21-255**

55 #20HD Contacts  
.028 (0.71) Max. Dia. Tail

- Series 801: **19-255**
- Series 802: **19-255**
- Series 805: **21-255**

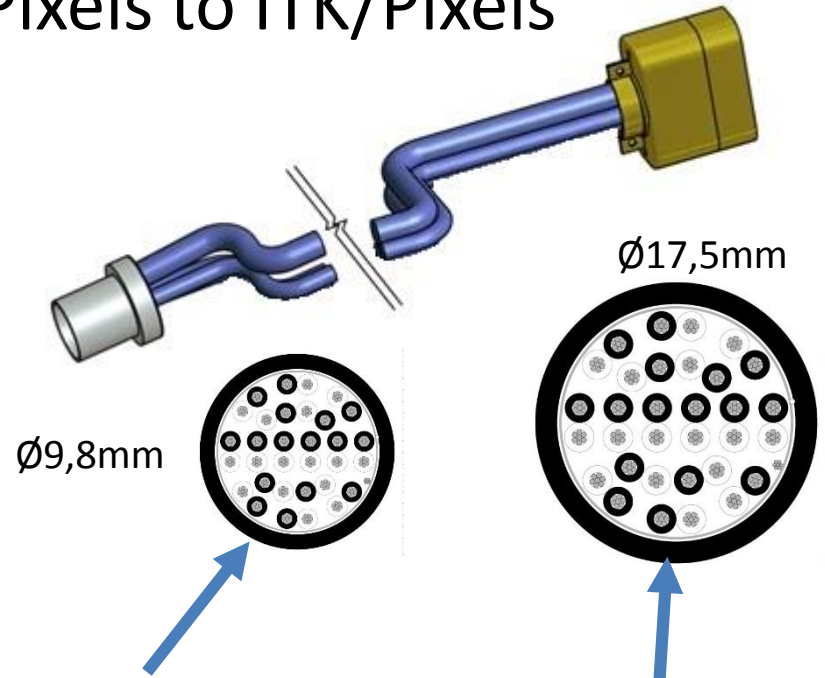
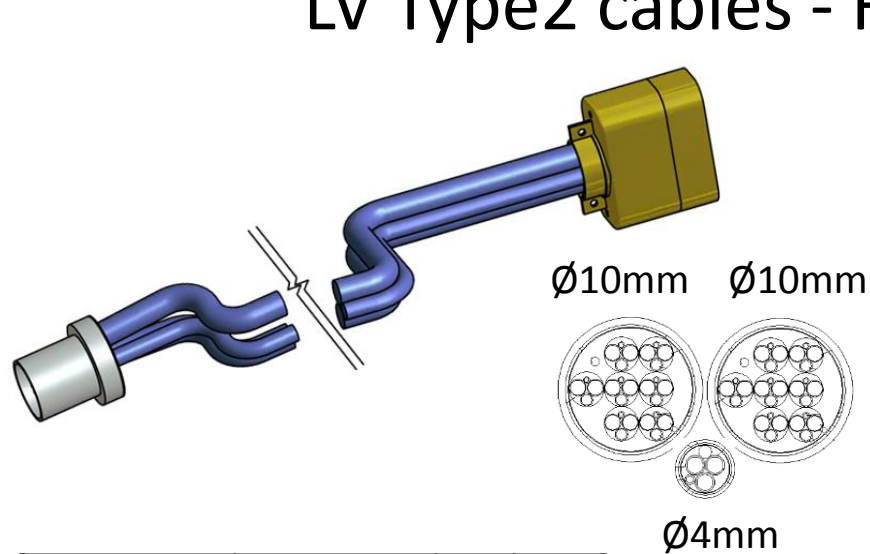


Pins 5A or  
7.5A/1000V





# LV Type2 cables - From Pixels to ITK/Pixels



16 pairs of AWG 24 + 16 pairs of AWG20

- Type 2 cable could be built as a harness of two cables (if we have very flexible cable we can assume just one cable with 32 twisted pairs)
- Includes: **4 LV loops** (4x4 twisted pairs of AWG20)  
**4 Vdcs + 4 Vcan + 4 CAN + 4 Tilock**  
(16 pairs of AWG24)
- → 32 twisted pairs in total needed
- → 64 pins needed (LEMO-5F 66 pin at PP1 and Positronic 66 pin at PP2 end works..)

Vxx 1	Vxx Sense 1	2	1
Vxx_retSense1	Vxx_ret	8	7

