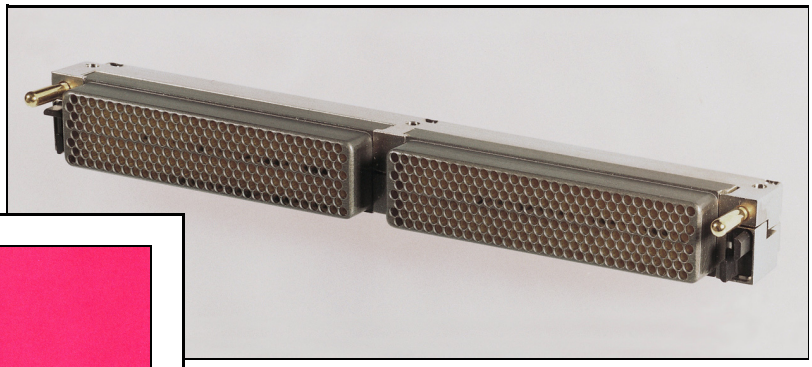
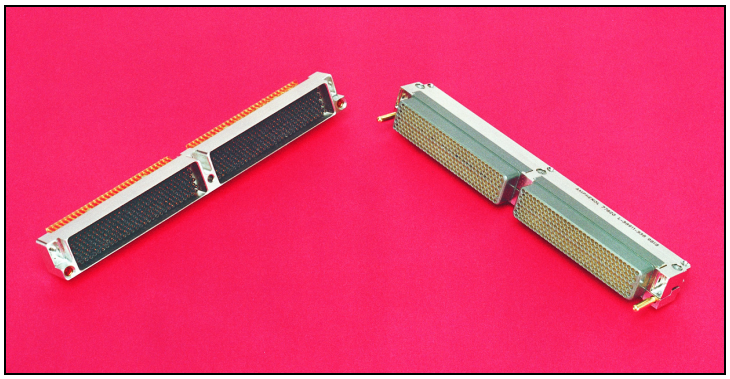
Amphenol® LRM Surface Mount Connectors Reference Guide

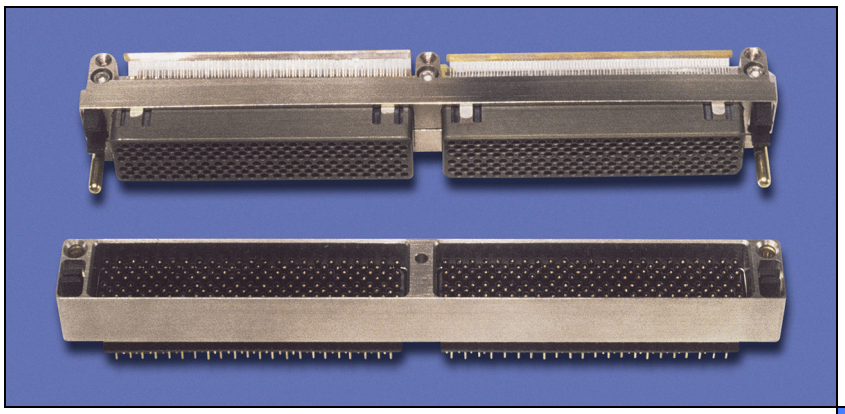
L-2104

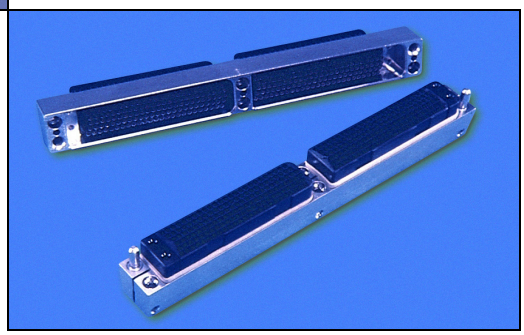
Amphenol meets the high density needs of today's integrated electronic modules with the Line Replaceable Module (LRM) connector family.





High density interconnect systems are offered in chevron, staggered and GEN-X contact patterns. These products represent the evolution of the LRM connector to meet the high density demands of the avionics industry. Each LRM connector utilizes MIL-C-55302 type Bristle® Brush® contacts which provide low mating force, extended service life and stable electrical performance.





GEN-X GRID (top right and left)
472 contacts LRM pattern - .075 inch spacing along the row with .060 inch between rows, offset .0375 inch (mating face)

STAGGERED GRID (middle left)
360 contacts LRM pattern - .100 inch spacing along the row with .050 inch between rows, offset .050 inch (mating face)

CHEVRON GRID (bottom right)
300 contacts LRM pattern - .075 inch spacing along the row with .075 inch between rows, offset .025 inch (mating face)

Amphenol

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If more information is needed concerning the products in this publication, or if you have any special application needs, please contact your nearest Amphenol sales office or Amphenol Aerospace at the address listed below. Ask for publication L-2081, Amphenol® LRM Surface Mount Connectors.

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Telephone: 607-563-5342 (New Products Development Group)
Fax: 607-563-5157
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NOTE:
Some of the connector products in this brochure were formerly known as Bendix® products.
These products are now manufactured and sold under the Amphenol® brand name.
The name “Amphenol” will replace the name “Bendix” on products and literature in the future.

LRM Surface Mount Connectors
with MIL-C-55302 type Bristle® Brush® contacts for integrated avionics packaging

The introduction of high speed integrated circuitry such as VHSIC and MMIC has enabled the Design Engineer to accomplish far more on his printed circuit board than ever before. This, coupled with the emergence of a revolutionary change in avionics packaging - modular avionic architectures - has created the need for a high performance, low insertion force PCB connector with significantly increased contact density.

Designed to meet the high density needs of today's integrated electronic modules, this Straddle Mount connector uses the Amphenol® Bristle Brush Contact which has been proven in military avionics packages and meets the requirements of MIL-C-55302. The low mating force, extended service life and stable electrical performance of the B^3* contact allows this product to provide the high level of performance demanded by today's Line Replaceable Module (LRM) applications.

Amphenol® LRM Surface Connector Features:

Available in Chevron and Staggered Grid Patterns, in SEM "E" and Proprietary Formats.

- **Contact to Board Attachment:**
  - **Module:** Surface mount - Straddle mount with .0375 spacing between leads, with rows of leads on each side of the module
  - **Backplane:** Available with through-hole solder posts or with compliant pins for solderless applications
- **Connector Configurations:**
  - **Chevron Grid:** Six contact rows with 0.075 inch center-to-center contact spacing in each row, 0.075 inch row-to-row spacing with 0.025 inch offset
  - **Staggered Grid:** Eight contact rows with 0.100 inch center-to-center contact spacing in each row, 0.050 inch row-to-row spacing with 0.050 inch offset
  - **GEN-X Grid:** Eight contact rows with 0.075 inch center-to-center contact spacing in each row, 0.060 inch row-to-row spacing with 0.0375 inch offset
- **Polarization:**
  - Insert arrangement controls mating orientation
  - Up to 4096 keying combinations
- **PCB/Heat Sink Accommodations:**
  - A wide range of combinations available
- **Serviceability:**
  - Backplane contacts are front replaceable
- **Low Mating and Unmating Forces**
  - 1.5 oz. per contact (typical)
  - 70% to 90% lower than with conventional pin and socket contacts
- **Temperature Range:**
  - Suitable for vapor phase soldering
  - Normal operating temperature –65°C to +125°C
- **Current Rating:** Consult Amphenol, Sidney, N.Y.
- **Dielectric Withstanding Voltage:**
  - Chevron Grid = 1000 volts at sea level
  - Staggered Grid = 100 volts at sea level (due to incorporation of ESD shield)
  - GEN-X Grid = 100 volts at sea level (due to incorporation of ESD shield)
- **Vibration:** Superior performance under vibration
- **Brush Contact Durability:**
  - 20,000 cycles of mating and unmating
- **Superior Electrical Characteristics:**
  - Redundant current paths
  - Minimized constrictive resistance
  - Uniform current densities
  - Stable time/life contact resistance
  - Gas tight and electrical contact site integrity
- **ESD Protection:**

The Staggered style and the GEN-X style connectors are standard with ESD** protection. These connectors utilize the Faraday Cage principal to shunt electrostatic discharge events to the conductive enclosure on which the connector is mounted, thus never allowing the high voltage, high current discharge event to reside on any contacts. The ESD protected connectors have the same physical envelope as their standard counterparts, and do not require special mounting or terminating techniques. All of the contacts remain fully functional, and electrical characteristics such as capacitance are not effected. See pages 19 and 20 for more information on ESD protection.

- **A Broad Family of LRM Products:**

LRM Surface Mount Connectors are offered in configurations with up to 540 electrical contacts. Other products available in the family are:

- RF module connectors for LRM applications requiring blind mate, radio frequency capability
- High-voltage inserts for LRM power supply applications, designed to control the effects of high voltage at altitude
- Fiber optic configurations for high speed secure communications

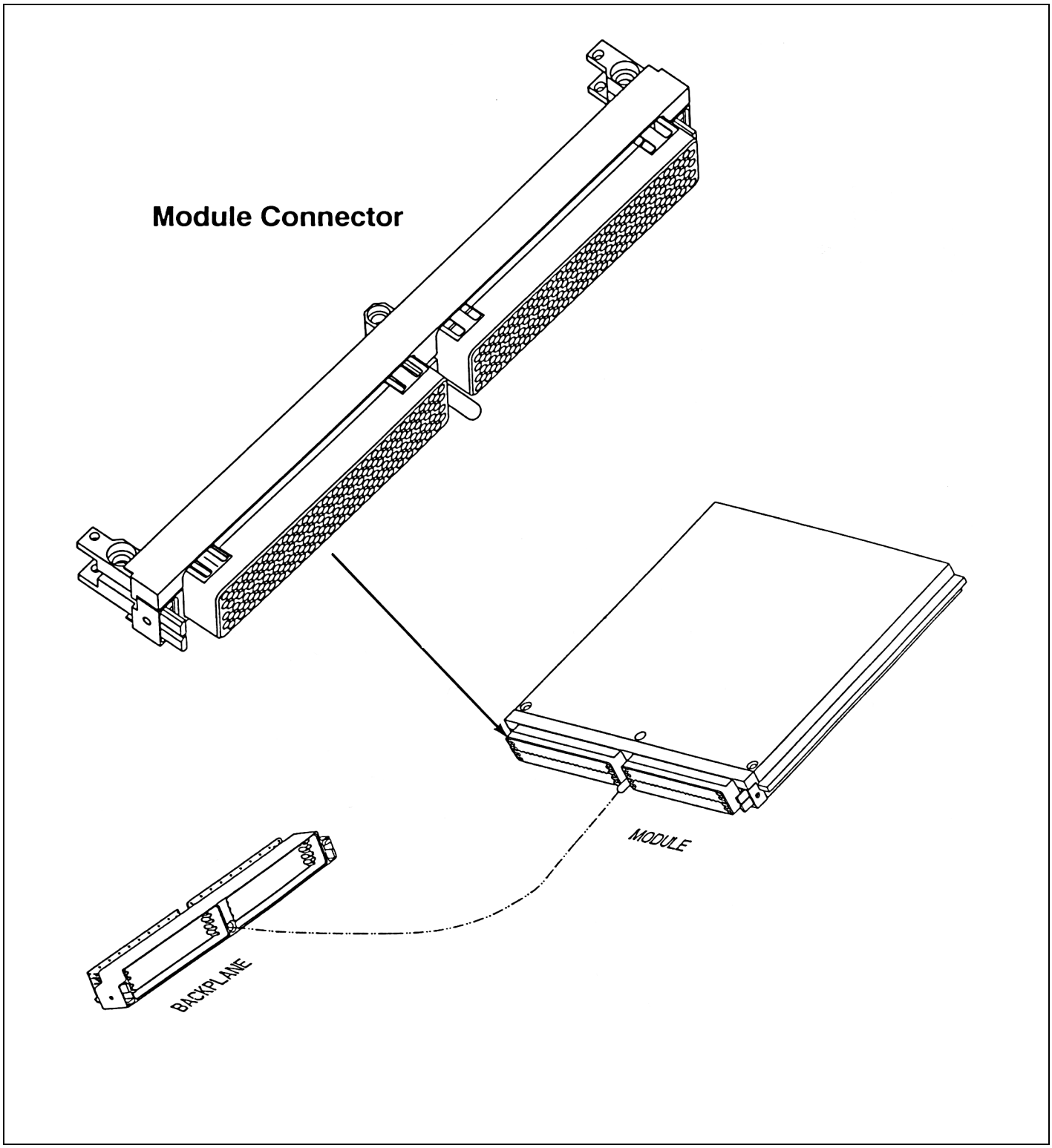
Consult Amphenol, Sidney, NY for further information on these products and any special design applications.

* B^3 = Bristle Brush Bunch

** ESD = Electrostatic Discharge

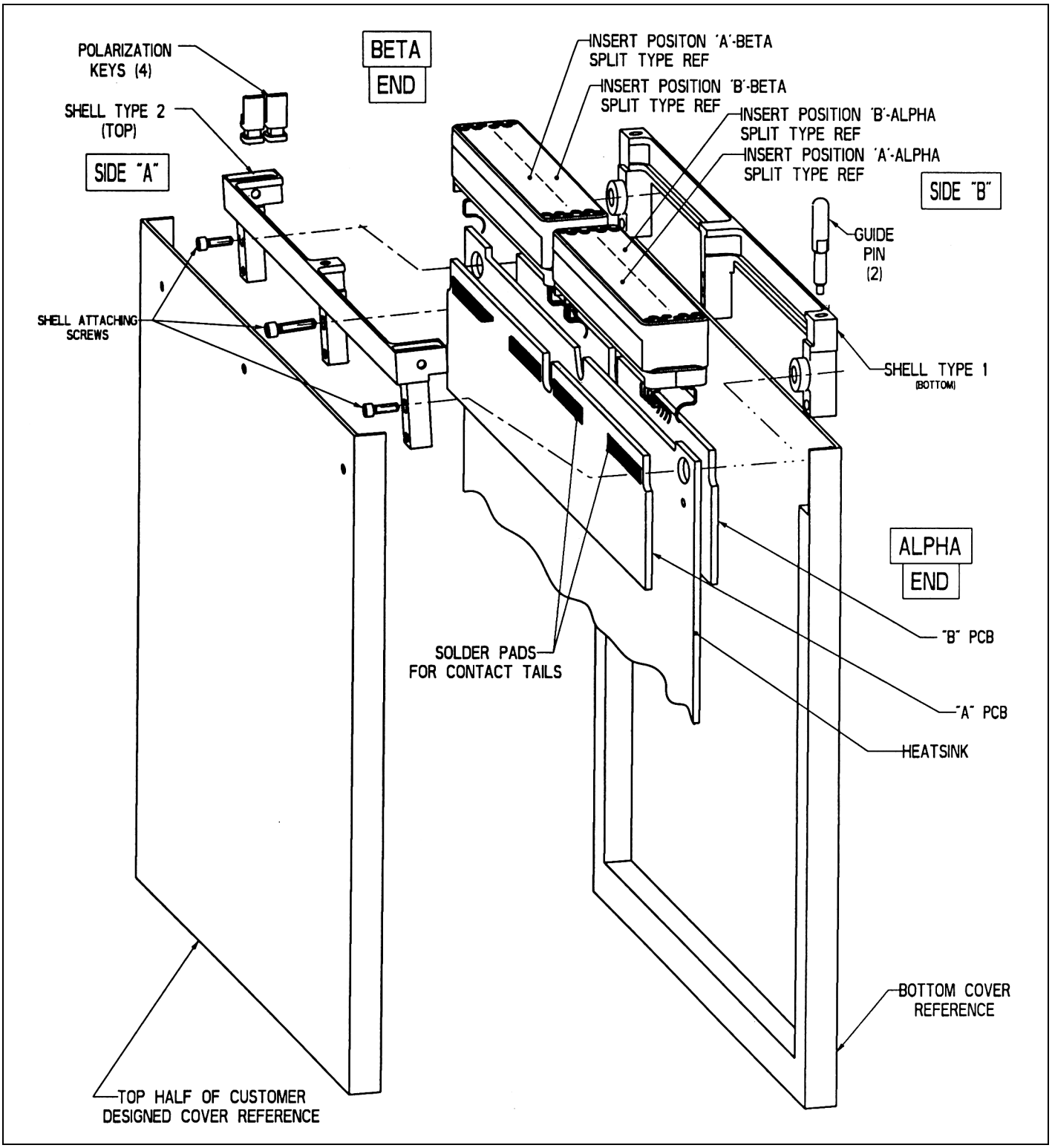
Amphenol®
LRM Module Connector

The following diagram shows how an **LRM Module Connector** may be fitted into systems.



Amphenol®
LRM Module Connector

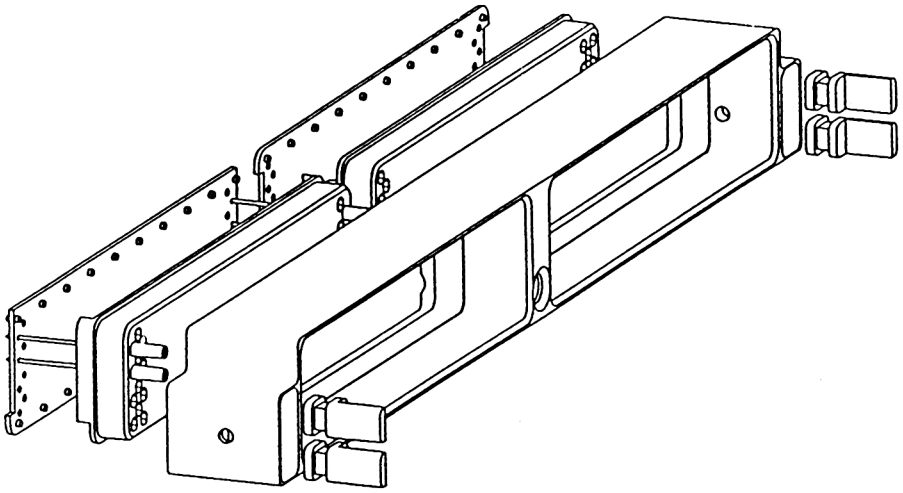
The following is the **LRM Module Connector** identification and naming convention.
The illustration is a double bay module with staggered pattern grid.

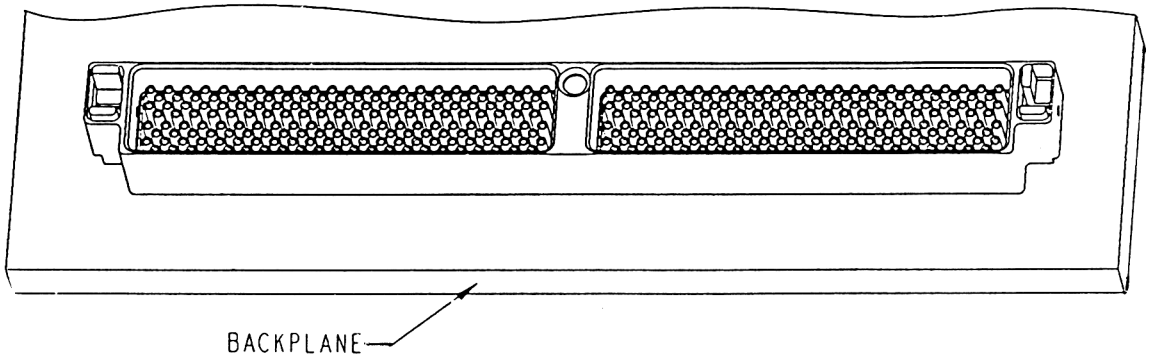


Amphenol®
LRM Backplane Connector

The following diagram shows how an **LRM Backplane Connector** may be fitted into systems.

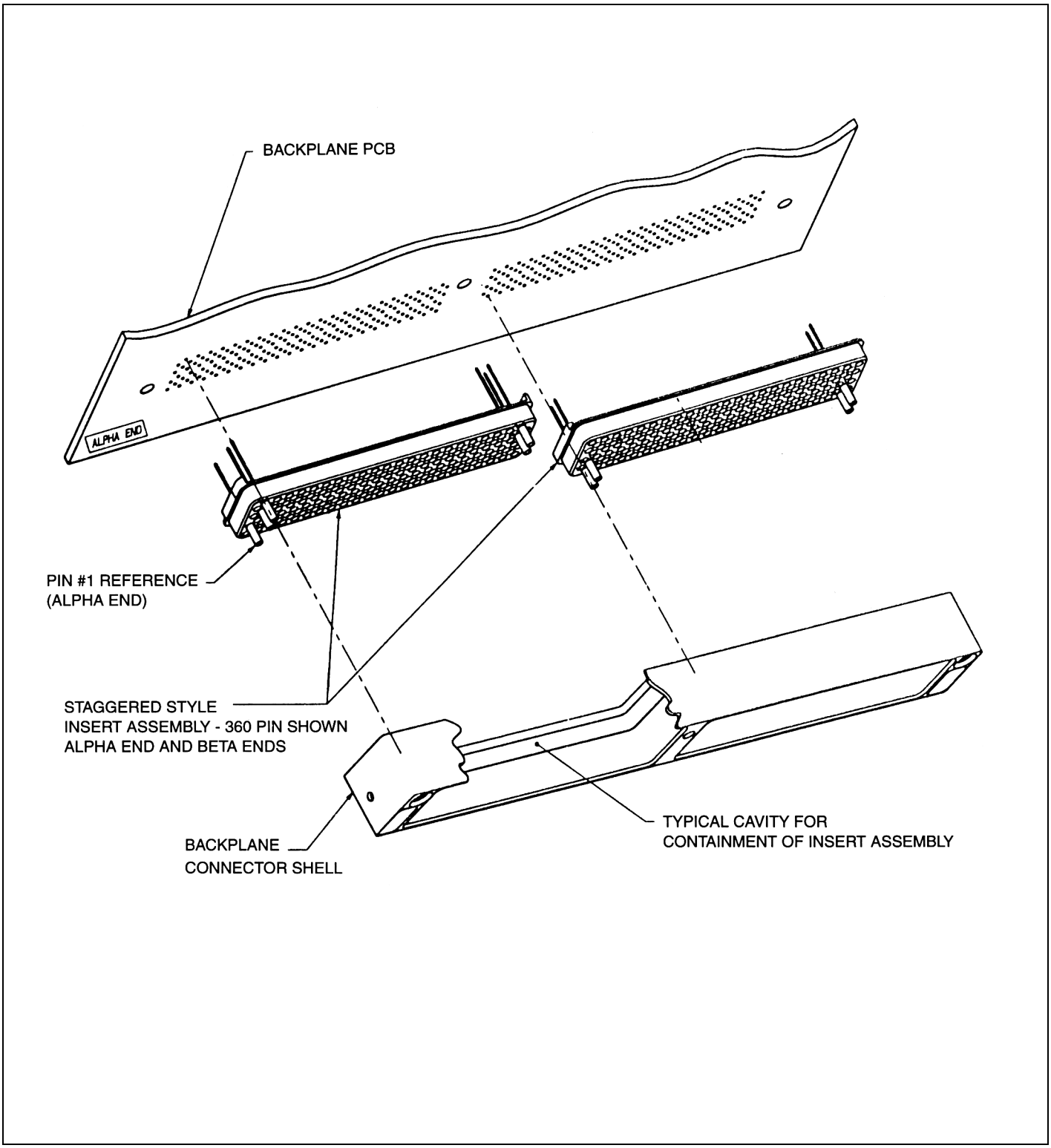
Backplane Connector





Amphenol®
LRM Backplane Connector

The following is the **LRM Backplane Connector** identification and naming convention.
The illustration is a double bay backplane with staggered pattern grid.



Bristle Brush Contacts
advantages, compared to conventional contacts

Brush vs. Conventional Contacts

Brush Contact Innovation

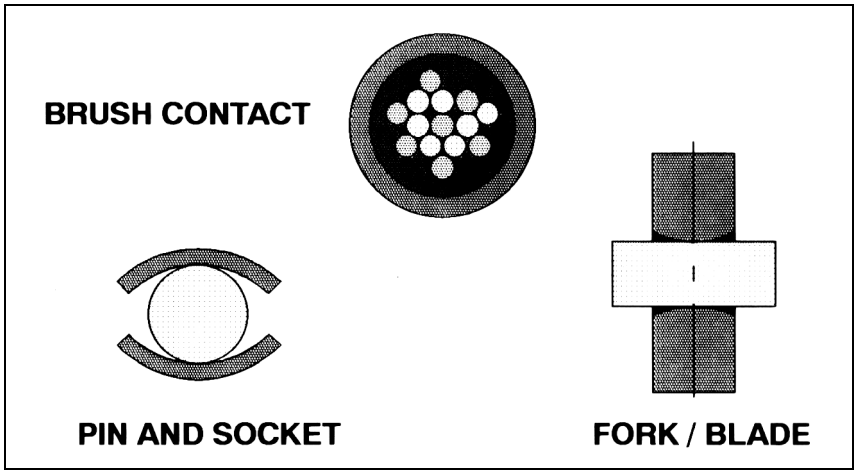
- Multiple contact interfaces
- Very smooth (low friction) interface

Conventional Pin/Socket

- Machined surface finish on both parts
- Higher friction and wear
- Limited number of contact sites

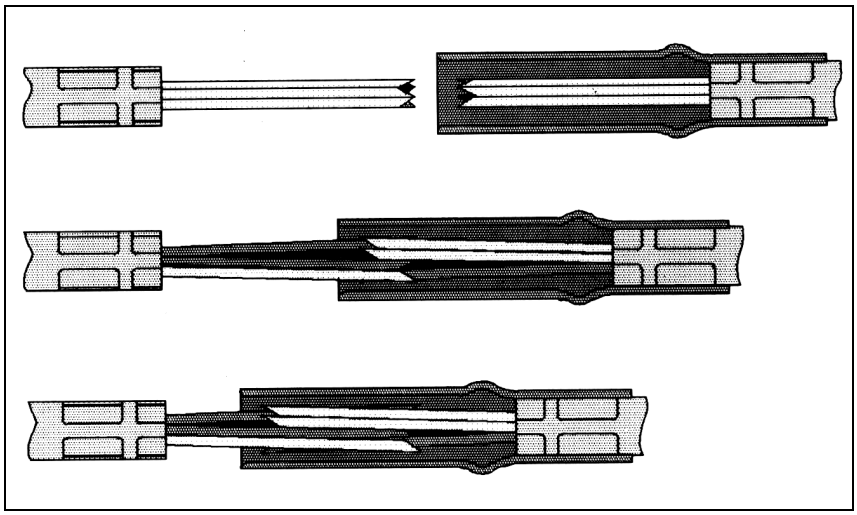
Conventional Fork/Blade

- Sheared surface is part of mating interface - may be sharp or rough
- Limited number of contact sites



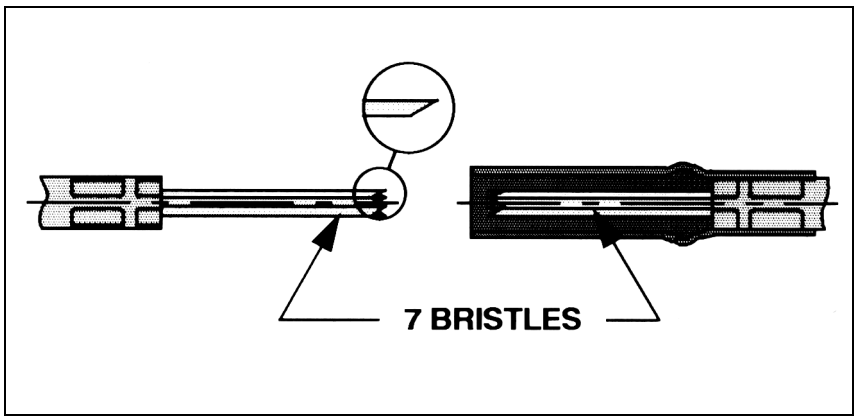
Multiplicity of Independent Contact Sites Provide Multiple Current Paths

- Multiple strands of high tensile strength wire are bundled together to form brush-like contacts. By intermeshing two multi-strand wire bundles, an electrical connection is made.
- Provides redundant current paths, 14 - 70 (points of contact) per mated contact with a gas tight junction



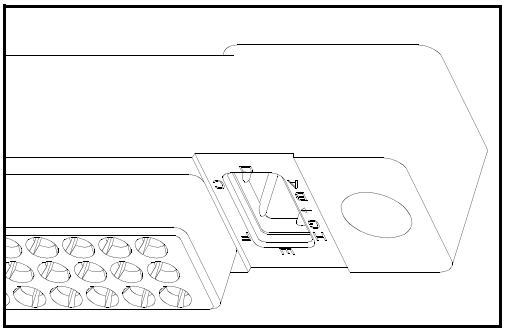
Brush Contact Provides

- Low Mating Force
- Stable Electricals
- Severe Environmental Protection
- High Current Rating
- Long Contact Life
- Dielectric Protection on both Connector Halves
- Overall Cost Effectiveness (Life Cycle Cost)
- Protection against Fretting Corrosion
- Protection against Micro-Arcing



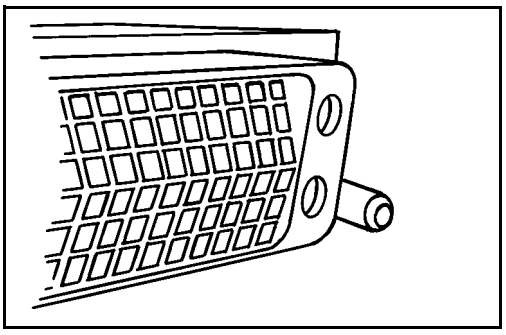
LRM Product Evolution
Amphenol leading the way with new technologies

Amphenol has been committed to keeping up with the ever-changing demands of the rectangular connector marketplace. Starting with the development of the B^3 contact, incorporated into the low mating force PCB connector, and then later the development of the line replaceable module (LRM), Amphenol has led the way in the avionics packaging industry for high quality rectangular products. All of Amphenol's rectangular PCB connectors incorporate the high performance B^3 contact which provides an extended service life (over 20,000 mating/unmating cycles), and the lowest mating forces in the industry. Options for each family include fiber optic, RF and power supply lines. The following shows the product evolution that has led to the newest LRM products offered by Amphenol.



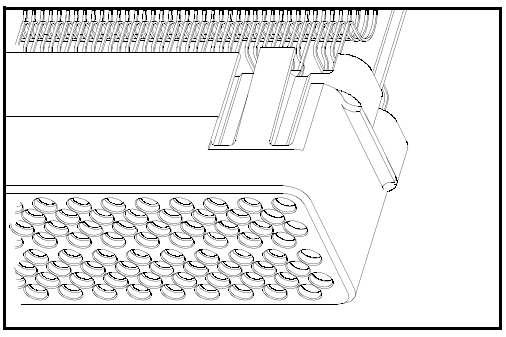
Low Mating Force Connector with Bristle Brush® Contacts

- Developed in the 1980's to provide solutions to problems caused by the high mating and unmating forces of conventional pin and socket contact pairs.
- 4 body styles: mother board (MB), daughter board (DB), PC connector, input/output connector
- Molded of thermoplastic (green) material
- 2, 3 and 4 row configurations, 10 to 100 contacts per row in one contact per row increments
- .100 inch center to center contact spacing, square grid



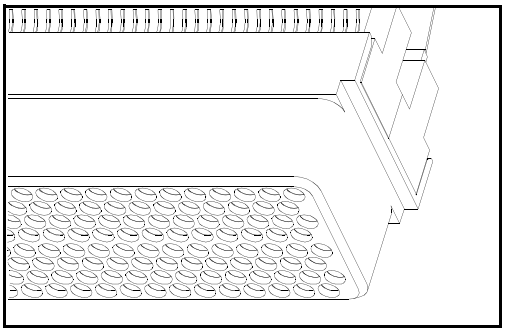
Line Replaceable Module (LRM) Connectors with Chevron Grid

- Developed to meet the avionics packaging requirements for a surface mount, high contact density PCB connector in a SEM-E form factor
- 300 contact pattern grid in 6 rows: 0.075 inch spacing along the row with 0.075 inch between rows, offset 0.025 inch (mating face)



LRM Connectors with Staggered Grid

- Advanced design to provide higher contact density for high speed integrated circuitry such as VHSIC and MMIC, SEM-E and custom form factors
- 360 contact pattern grid in 8 rows: 0.100 inch spacing along the row with 0.050 inch between rows, offset 0.050 inch (mating face)
- Options include polarized shells, accommodation of a wide range of PC board/ heat sink combinations and mother board compliant contacts
- ESD protection and EMI shielding available
- Connector of choice for F-22 Avionics systems



LRM Connectors with GEN-X Grid

- New development for even higher contact density and improved electrical performance, SEM-E and custom form factors
- 472 contact pattern grid in 8 rows: 0.075 inch spacing along the row with 0.060 inch between rows, offset 0.0375 inch (mating face)
- All options and features of 360 pin available including ESD protection

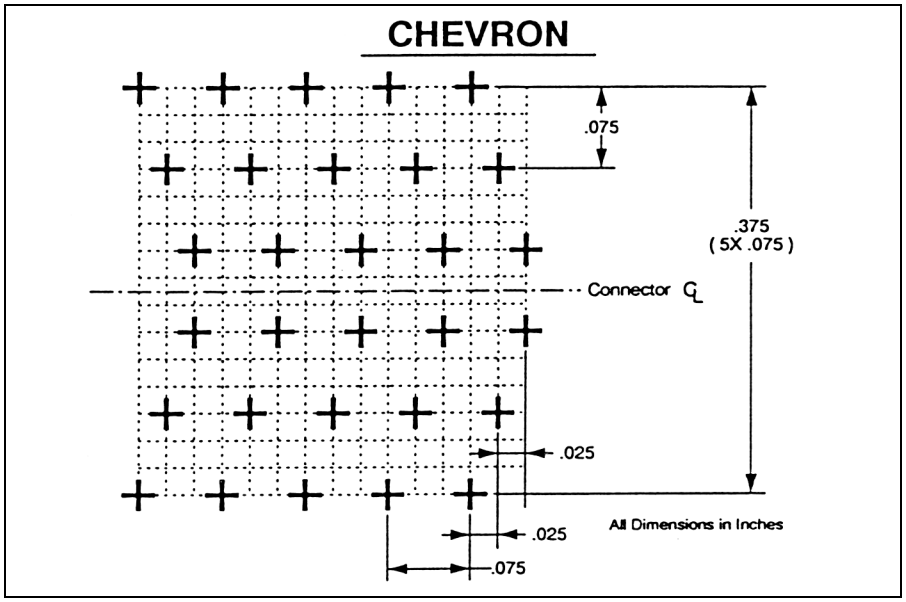
The Future

- 696 contact LRM
- VME and 2mm pitch solutions

Chevron Grid, 300 Contacts
LRM Connectors
contact pattern, materials list, how to order

The LRM Chevron pattern allows for surface mount leads on a .025 inch center line.

The following diagram shows the contact pattern of the chevron grid LRM Connector, .075 inch spacing along the row with .075 inch between rows, offset .025 inch (mating face).



MATERIALS LIST: CHEVRON GRID SERIES LRM CONNECTORS

Material	Description
Shell	Material is aluminum alloy; Finish is electroless nickel, per MIL-C-26074, over copper
Contact Body	Material is copper alloy; Finish is tin per MIL-T-10727 over copper, Tails are finished with tin lead per MIL-P-81728 over copper
Bristles	Material is copper QQ-C-530; Finish is gold, per MIL-G-45204, type II, grade C, Class 00, over nickel
Backplane Sleeve	Material is stainless steel 300 Series, passivated
Guide Pins (LRM 304 and 308 Series)	Material is copper alloy; Finish is nickel
Insert	Material is thermoplastic

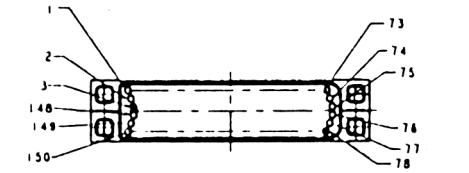
TO ORDER CHEVRON GRID LRM CONNECTORS:

Consult the Amphenol Aerospace, Sidney, NY or your local Amphenol sales representative for availability and part number ordering of Chevron LRM connectors.

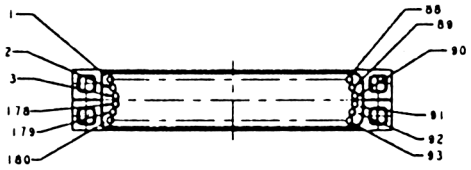
The Chevron pattern LRMs were designed for avionic upgrades, and are available in other configurations such as fiber optic versions, RF modules and Power Supply modules.

Chevron Grid, 300 Contacts
LRM Connectors
insert arrangements

Single Bay Connector
Contact Identification



INSERT ARRANGEMENT SUFFIX 1



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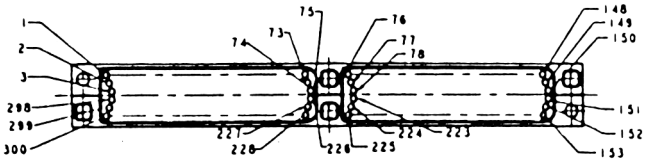
Double Bay Connector
Contact Identification



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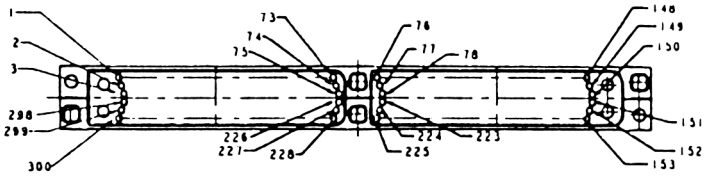

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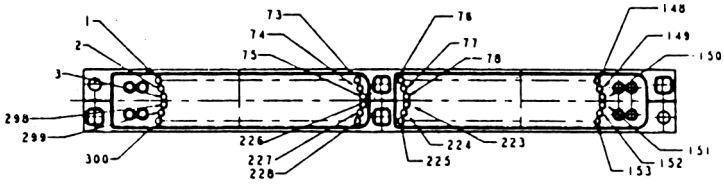

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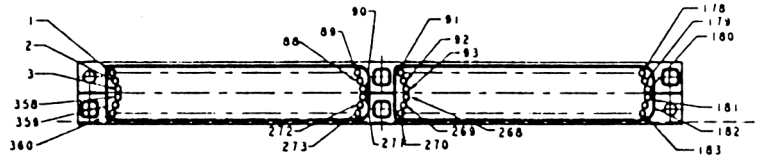
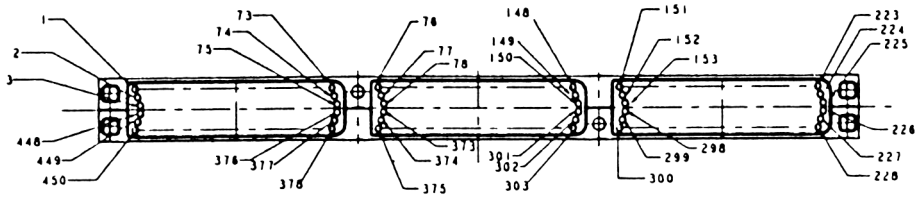


INSERT ARRANGEMENT SUFFIX 6

Triple Bay Connector
Contact Identification



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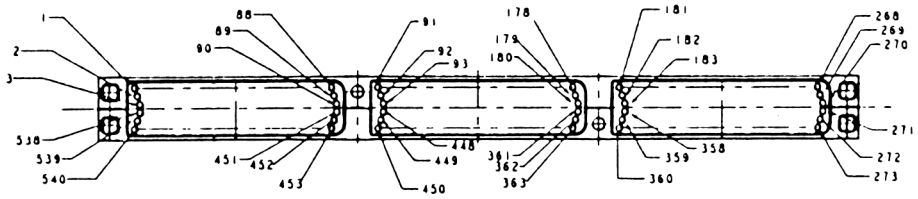


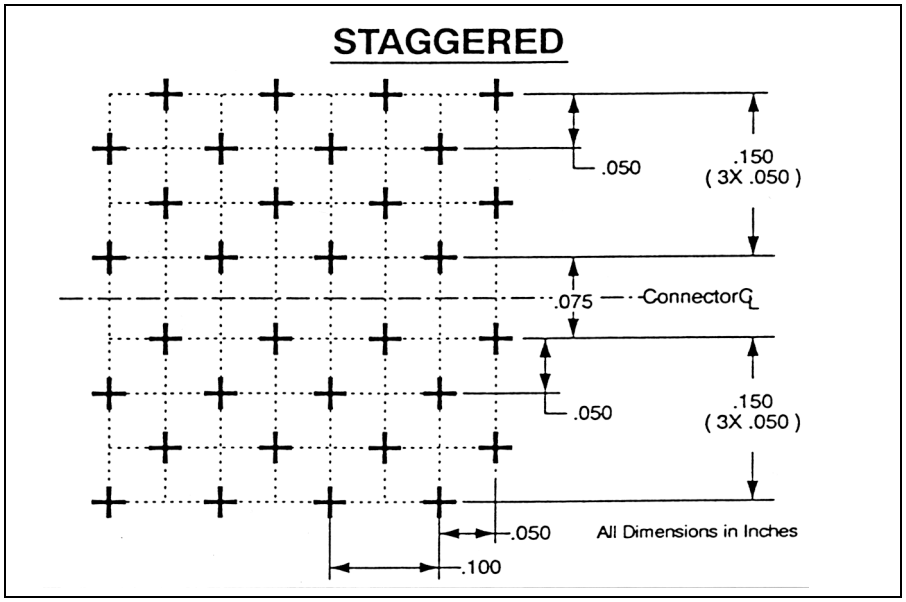
INSERT ARRANGEMENT SUFFIX 8

Staggered Grid, 360 Contacts LRM Connectors

contact pattern, selection criteria

The LRM Staggered pattern allows for surface mount leads on a .025 inch center line.

The following diagram shows the contact pattern of the staggered grid LRM Connector, .100 inch spacing along the row with .050 inch between rows, offset .050 inch (mating face).



The following were the criteria determined for the selection of a connector for the F-16 and the F-22 aircraft:

- **EMI Protection**
- **Durability**
  - **Life of Connector**
- **Reliability**
  - **Fretting Corrosion**
  - **Micro-Arcing**
- **ESD Protection**
- **System Weight**
  - **No need for Rack Dampening**
  - **No need for Board Level ESD Protection**
- **System Cost**
  - **Estimated $4 Billion Savings over Life of F-22 Program**

The Amphenol® LRM Connector with Bristle Brush contacts was superior in the above criteria, as well as meeting other demands of the advanced avionics industry. The Amphenol LRM connector is the only connector that has met the harsher, more demanding applications of these aircraft.

The LRM family of connectors continues to meet the new demands of the avionics industry with additional staggered grid connector products such as LRMs with fiber optics, RF modules and Power Supply modules. Consult Amphenol Aerospace for information on these and LRM custom applications.

Staggered Grid, 360 Contacts LRM Connectors

typical performance, materials list

Table I below identifies the typical electrical, mechanical and environmental performance of an Amphenol® 360 Brush Contact Staggered Grid LRM Connector assembly. This data was program specific and does not reflect actual performance limitations. Table II below provides a materials list for staggered grid LRM connectors.

TABLE I: PERFORMANCE

ELECTRICAL PERFORMANCE

Electrical Parameters	Performance
Current Carrying Capability	10°C temperature rise at 2A and 30°C rise at 3A
Contact Resistance	30 milliohms max. per contact, 25 milliohms max. average
Dielectric Withstanding Voltage at Sea Level	100 VRMS, 60 Hz
Dielectric Withstanding Voltage at Altitude	100 VRMS, 60 Hz at 70,000 ft.
Insulation Resistance	1000 milliohms minimum at 100V d.c.
Electrostatic Discharge Protection	± 25,000V minimum Air and Direct Discharge

MECHANICAL PERFORMANCE

Mechanical Parameters	Performance
Contact Retention (Solder type Backplane Assembly)	Maximum displacement of 0.010" at 1 pound load
Mating and Unmating Forces	Maximum 40.0 pounds mating and unmating
Vibration (Sinusoidal, 20g Peak max.)	No electrical discontinuity >1 µS
Vibration (Random, 11.6g RMS max.	No electrical discontinuity >1 µS
Shock (50g max. shock pulse)	No electrical discontinuity >1 µS
Solderability	Minimum 95% solder coverage
Resistance to Soldering Heat	260°C dip for 10 seconds

ENVIRONMENTAL PERFORMANCE

Environmental Parameters	Performance
Temperature Life	250 Hours at 125°C maximum
Connector Durability	500 cycles mating and unmating
Salt Fog Exposure	48 Hours maximum direct exposure (5% NaCl)
Thermal Shock	500 cycles at +125°C / -65°C
Humidity Exposure	240 Hours at 90 - 98%
Contamination Exposure	Sand and Dust per MIL-STD-202 Method 110
Resistance to Solvents	Boiling Trichlorethylene fumes and solution

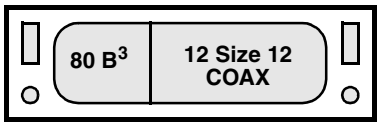
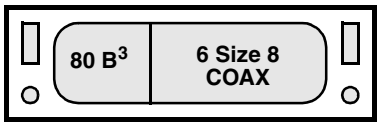
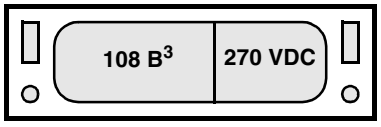
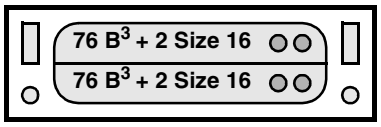
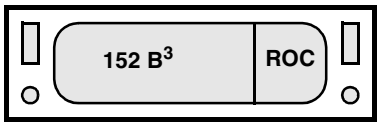
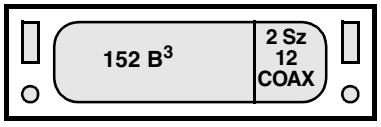
Reference Amphenol Aerospace Engineering Report Number C1-1105

TABLE II: MATERIALS LIST

Material	Description
Brush Wires	Beryllium copper per ASTM B197; finish is Gold per MIL-G-45204, over nickel per QQ-N-290. The exposed ends of the brush wires need not be plated.
Module Contacts	Beryllium copper per UNS C17500; contact body is plated matte tin-lead per ASTM B579; termination end is 60/40 or 63/37 tin-lead dip per QQ-S-571.
Backplane Contacts	Proprietary brass similar to UNS C33500; contact body is plated gold per MIL-G-45204 over nickel per QQ-N-290; termination end is 60/40 or 63/37 tin-lead dip per QQ-S-571; contact sleeve is stainless steel per AMS 5514 with black oxide finish per MIL-C-13924 and conformally coated per MIL-I-46058
Insulators	Polyphenylene Sulfide or Liquid Crystal Polymer per MIL-M-24519
Organizer	Polyphenylene Sulfide or Liquid Crystal Polymer per MIL-M-24519
Shells	Alum Alloy; finish is electroless nickel per AMS 2404
ESD Shields	Alum Alloy; hard coat anodized per MIL-F-14072 with epoxy final coat
Keys	Stainless steel AMS 5640; black anodized per MIL-A-8625
Guide Pins	Beryllium copper alloy per ASTM B196, plated Gold per MIL-G-45204 over nickel per QQ-N-290

Staggered Grid, 360 Contacts
LRM Connectors
typical arrangements, how to order

SINGLE BAY HYBRID ARRANGEMENTS

MODULE	BACKPLANE	
10-507184-1**	10-507186-1**	
10-507184-2**	10-507186-2**	
10-507184-3**	10-507186-3**	
10-507184-4**	10-507186-4**	
10-507184-5**	10-507186-5**	
10-507184-6**	10-507186-6**	
10-507184-7**	10-507186-7**	

Replace ** in desired part number with heat sink and total board package thickness indicators from MODULE suffix chart (pg. 15).

Replace ** in desired part number with termination style and termination stick-out indicators from BACKPLANE suffix chart (pg. 15).

KEY

ROC = "Reliable Optical Connector" (Not supplied with connector. Available from AT&T)

B^3 = Digital contacts (i.e. standard brush)

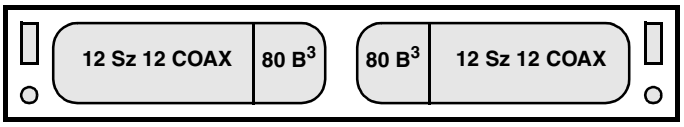
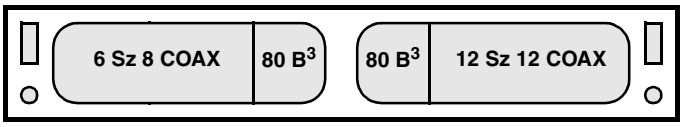
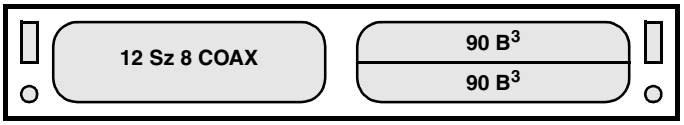
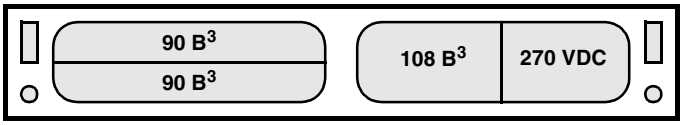
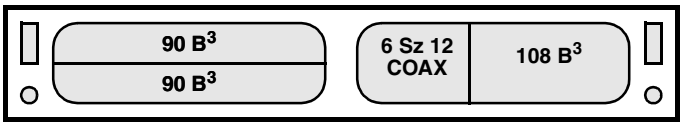
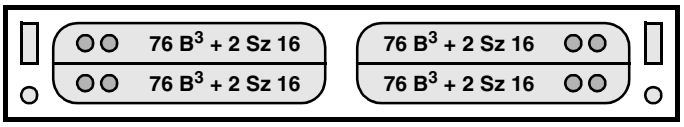
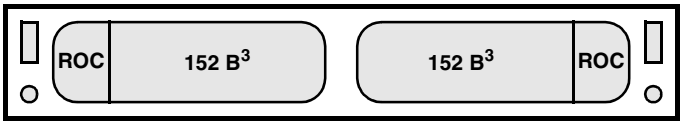
Size 16 cavities will accept:
Fiber optic contacts M29504/1, /2, /14 & /15, or shielded contacts M39029/79 & /80. (Note: these contacts are not supplied with connector and are available from Hughes).

#8 & #12 Blind mate coax available from Amphenol - purchase separately

270 VDC power insert supplied with 2 size 22D MIL-C-38999, Series II power contacts.

Staggered Grid, 360 Contacts
LRM Connectors
typical arrangements, how to order

DOUBLE BAY HYBRID ARRANGEMENTS

MODULE	BACKPLANE	
10-507185-A**	10-507187-A**	
10-507185-B**	10-507187-B**	
10-507185-C**	10-507187-C**	
10-507185-D**	10-507187-D**	
10-507185-E**	10-507187-E**	
10-507185-F**	10-507187-F**	
10-507185-G**	10-507187-G**	

Replace ** in desired part number with heat sink and total board package thickness indicators from MODULE suffix chart (pg. 15).

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KEY

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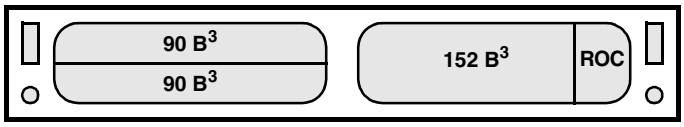
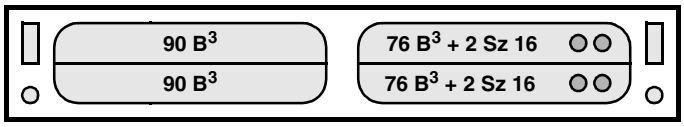
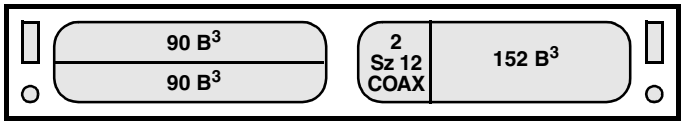
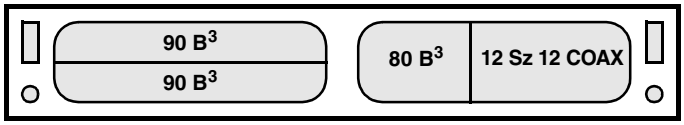
270 VDC power insert supplied with 2 size 22D MIL-C-38999, Series II power contacts.

Staggered Grid, 360 Contacts
LRM Connectors
typical arrangements, how to order

DOUBLE BAY HYBRID ARRANGEMENTS, CONT.

MODULE	BACKPLANE	
10-507185-H**	10-507187-H**	
10-507185-J**	10-507187-J**	
10-507185-K**	10-507187-K**	
10-507185-L**	10-507187-L**	

Replace ** in desired part number with heat sink and total board package thickness indicators from MODULE suffix chart (pg. 15).

Replace ** in desired part number with termination style and termination stick-out indicators from BACKPLANE suffix chart (pg. 15).

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270 VDC power insert supplied with 2 size 22D MIL-C-38999, Series II power contacts.

LRM Hybrid Connectors
part number suffixes

The following charts identify the part number suffixes to be used when ordering Hybrid LRM Connectors. (Refer to preceding pages of Hybrid Arrangements).

HYBRID MODULE SUFFIX CHARTS

HEATSINK THICKNESS

Suffix	Description
1	.125 ± .005
2	.100 ± .005
3	.075 ± .005
4	.062 ± .005
5	.035 ± .005

TOTAL BOARD PACKAGE THICKNESS

Suffix	Description
1	Surface Mount / .090 – .130 Package
2	Surface Mount / .130 – .190 Package
3	Surface Mount / .190 – .250 Package
4	Surface Mount / .060 – .100 Package
5	Surface Mount / .100 – .160 Package
6	Surface Mount / .160 – .220 Package

HYBRID BACKPLANE SUFFIX CHARTS

TERMINATION STYLE

Suffix	Description
1	.021 ± .002 Dia. PCB Tail
2	.016 ± .002 Dia. PCB Tail
3	.012 ± .002 Dia. PCB Tail
4	N/A
5	Compliant

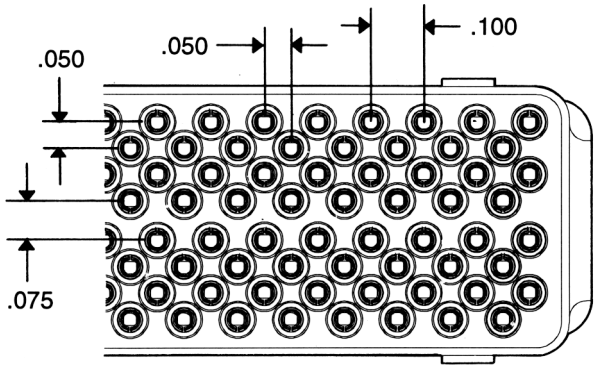
TERMINATION STICKOUT

Suffix	Description
1	.150 ± .020 (PCB)
2	.200 ± .020 (PCB)
3	.250 ± .020 (PCB)
4	.300 ± .020 (PCB)
5	.350 ± .020 (PCB)
6	.400 ± .020 (PCB)
7	.185 ± .020 (PCB)
8	.450 ± .020 (PCB)
9	.500 ± .020 (PCB)
C	.157 ± .020 (Compliant, No Wrap)
D	.217 ± .020 (Compliant, 1 Wrap)
E	.317 ± .020 (Compliant, 2 Wrap)
F	.417 ± .020 (Compliant, 3 Wrap)

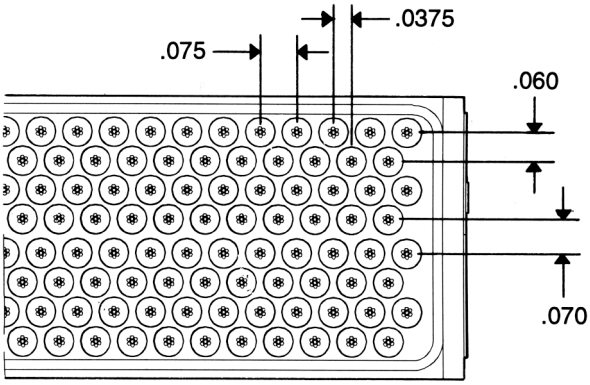
Comparison - Staggered 360 Contact LRM vs. GEN-X 472 Contact LRM

Contact Density

Current Product: Staggered 360 LRM



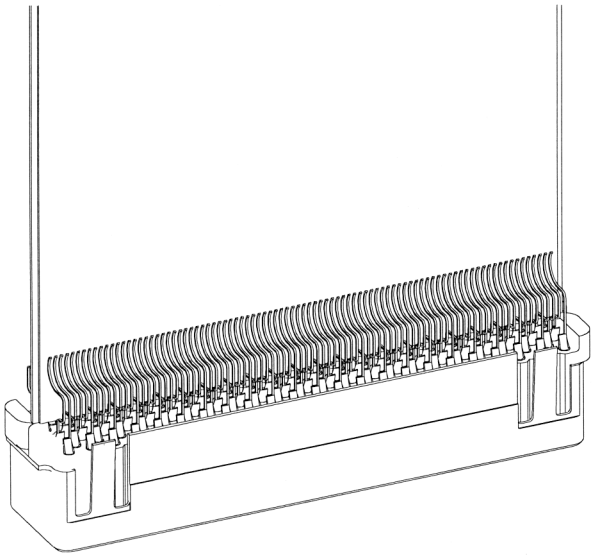
New GEN-X 472 LRM



Tail to Tail Placement

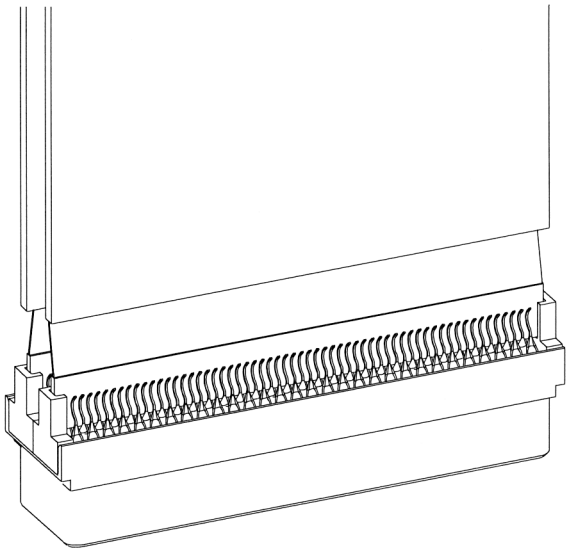
Staggered Grid 360 Contact LRM

0.025 Tail to Tail



GEN-X 472 Contact LRM

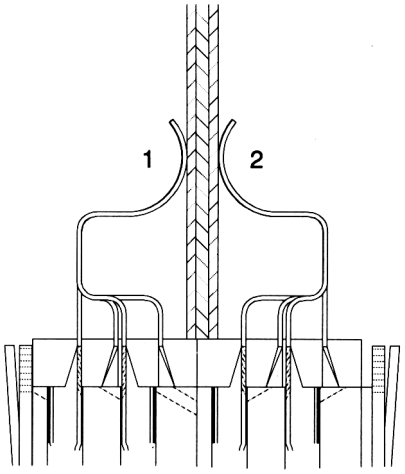
0.0375 Tail to Tail



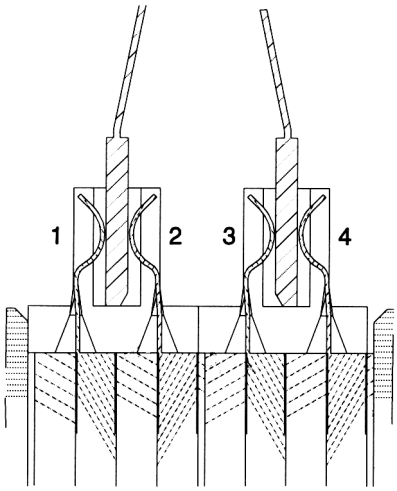
Staggered 360 Contact LRM compared to GEN-X 472 Contact LRM, cont.

Module Termination

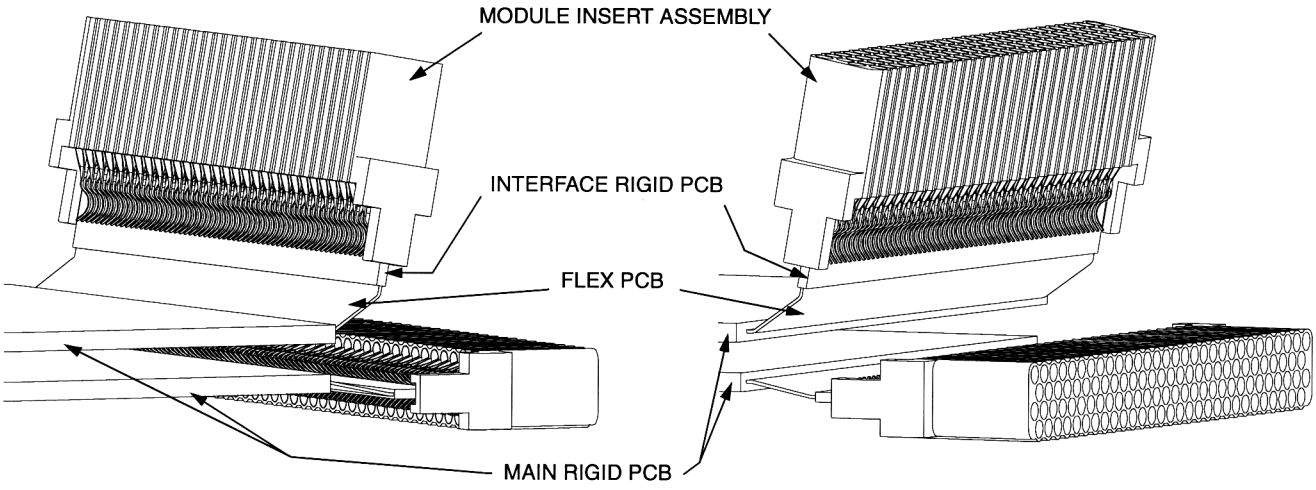
Two Surface Mount Planes for 360 contacts



Four Surface Mount Planes for 472 contacts



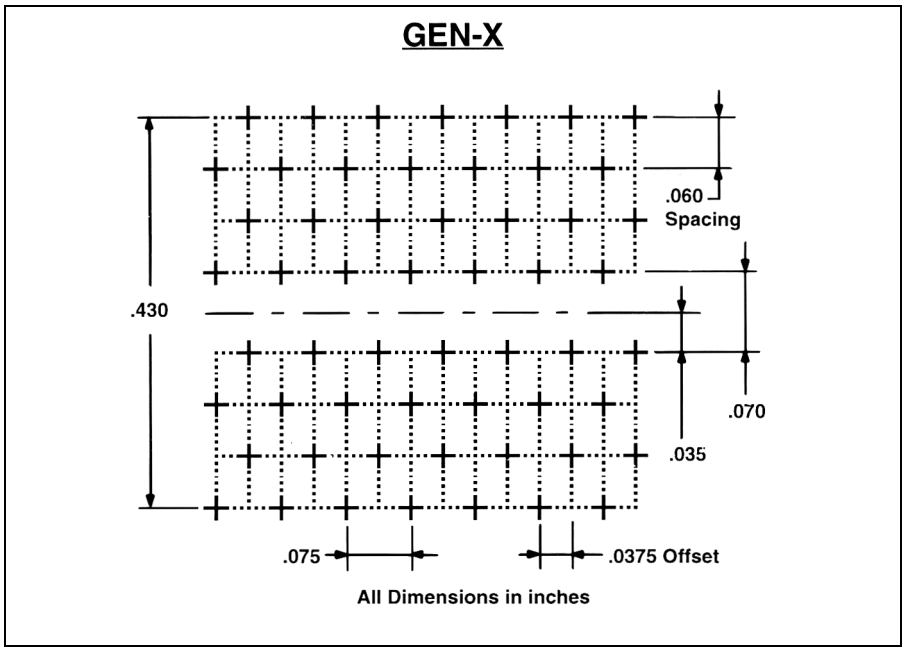
Use of a rigid-flex PCB allows for solderability in manufacturing



GEN-X Grid, 472 Contacts LRM Connectors
contact pattern, how to order

The LRM GEN-X 472 contact pattern allows for surface mount leads on a .035 inch center line.

The following diagram shows the contact pattern of the GEN-X grid LRM Connector, .075 inch spacing along the row with .060 inch between rows, offset .0375 inch (mating face).



TO ORDER GEN-X LRM CONNECTORS:

Consult the Amphenol Aerospace, Sidney, NY or your local Amphenol sales representative for availability and part number ordering of GEN-X LRM connectors. For a material listing for the GEN-X connectors, refer to the same material listing as the staggered grid LRM connectors in this publication.

The 472 GEN-X pattern LRMs were designed for avionic upgrades, and are available in other configurations such as fiber optic versions, RF modules and Power Supply modules.

Amphenol® Electrostatic Discharge (ESD) Protected Connectors

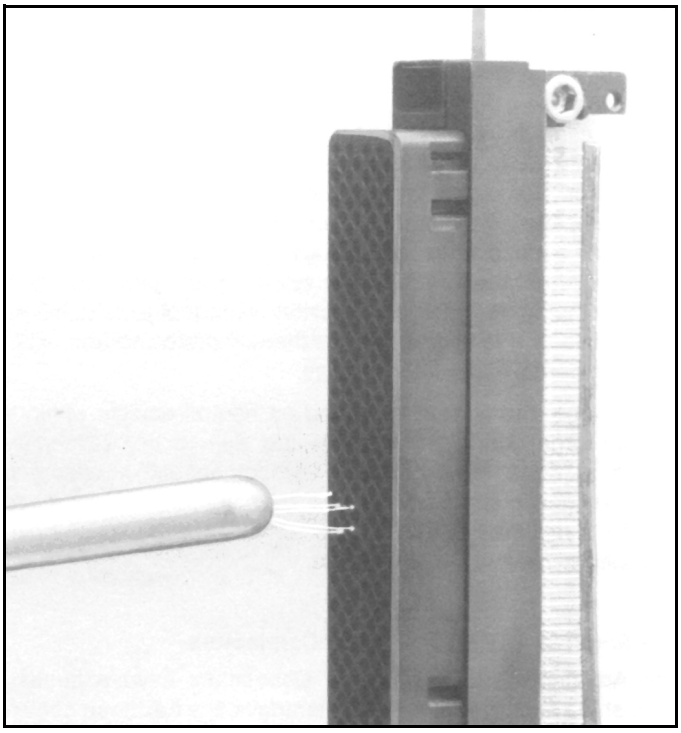
Amphenol has developed cylindrical and rectangular connectors which protect sensitive components from Electrostatic Discharge (ESD) without diodes, varistors, gas tubes, or "experimental" semiconductive materials.

These connectors utilize the Faraday Cage principal to shunt electrostatic discharge events to the conductive enclosure on which the connector is mounted, thus never allowing the high voltage, high current discharge event to reside on any contacts.

The ESD protected connectors have the same physical envelope as their standard counterparts, and do not require special mounting or terminating techniques. All of the contacts remain fully functional, and electrical characteristics such as capacitance are not effected.

Product Features:

- Connector Envelope Identical to Unprotected Design for Most Applications
- Exceeds Protection Requirements of IEC 801-2 and MIL-STD-1686:
  - Ensures that All Components within a Conductive Enclosure will be Subjected to a Maximum of 10V during Electrostatic Discharges between –26 KV and +26 KV
- Voltage Observed on Contacts during ESD Events – <10V (at 1 megohm)
- Current Observed on Contacts during ESD Events – <100 milliamperes (at 2 ohms)
- Response Time – Instantaneous (Voltage and Current are Maximum Values)
- Maximum ESD Voltage – Tested to ±26KV
- No Capacitive Loading
- Eliminates the Need for Discrete Components (such as diodes) and Maximizes Printed Circuit Board Real Estate for Equipment Housed in Conductive Enclosures which require ESD Protection as Free-standing Units
- Operating Voltage of Connectors not Effected for Most Designs
- Pulse Life – Infinite



ESD Testing on LRM Rectangular Connectors (Actual Photo)

What is Electrostatic Discharge (ESD)?

Electrostatic Discharge (ESD) is the rapid transfer of a static electric charge from one body to another. A static electric charge consists of either a surplus or depletion of electrons on a body, which gives that body a potential or voltage relative to ground (or another body). The discharge is extremely fast (less than 1 nanosecond risetime) and the current flow may exceed 100 amps!

Static electricity is normally the result of two materials transferring charges when rubbed or separated, such as shoes scuffing across a dry carpet, or sheets of untreated plastic being separated. This phenomena is commonly referred to as the ***triboelectric effect***.

The voltage developed due to the ***triboelectric effect*** depends on the materials involved, the quantity and type of contact, and relative humidity. In a dry environment a person can accumulate a charge of up to 25 KV! In a moist environment a person's potential is reduced due to the effect of moisture on the insulating properties of materials.

ESD Protected Connectors, cont.

What is a Faraday Cage?

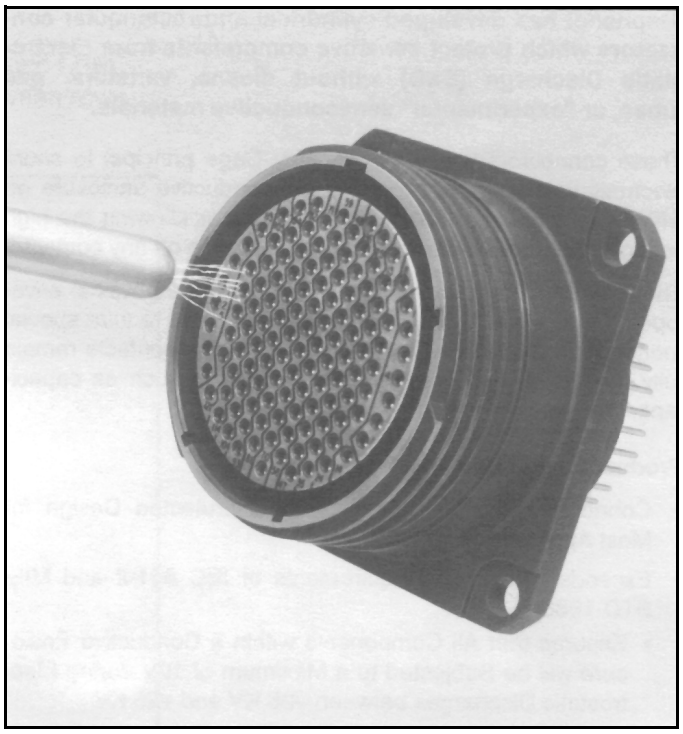
A ***Faraday cage*** is a conductive enclosure. It may be solid in form such as a sheet–metal enclosure, or it may be full of apertures, such as a wire cloth box. When a charge is placed on a faraday cage the electrons which make up the charge, having like polarity, try to position themselves as far as possible from each other. This places the electrons on the outer surface of the enclosure, leaving the inner surface uncharged. The charge on the outer surface does not induce a charge on any neutral object inside of the faraday cage, and therefore does not try to transfer itself onto the internal object. Neutral objects (such as IC's) inside of a faraday cage are thereby protected from ESD activity external to the faraday cage.

The voltage and current observed on neutral objects within a faraday cage during ESD events are due to the secondary effects of ESD. These include Electromagnetic Interference (EMI), magnetic and electrical field coupling. The faraday cage of the Amphenol ESD Protected Connectors has been designed to minimize these effects.

The Amphenol® ESD Protected Connectors

The Amphenol® ESD Protected Connectors have a faraday cage at the mating interface. The faraday cage has been specifically designed to intercept electrostatic discharges from the contacts in the unmated state, while maintaining each contact's isolation when the connector is mated. When the ESD Protected Connectors have been mounted to a conductive enclosure, a faraday cage is created which will protect components located within the enclosure from electrostatic discharges. This eliminates the need for discrete components such as diodes and gas discharge tubes, and saves printed circuit board real estate.

The Amphenol ESD Protected Connectors have been applied to Line Replaceable avionics Modules (LRM) and nuclear missiles, and can be applied to any equipment or system with minimal impact. There are many drop-in replacement ESD Protected connectors for retrofitting existing programs which have conductive enclosures and require ESD protection as free-standing equipment.



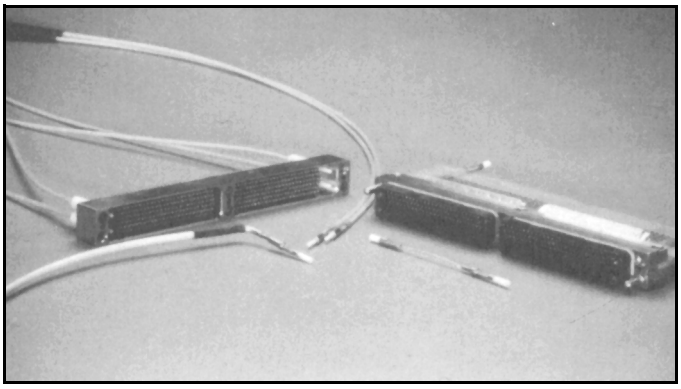
ESD Testing on MIL-C-38999, Series III
Filter Cylindrical Connectors (Actual Photo)

Publication L-2075, "ESD Attenuation Test Procedure for Connectors with Faraday Cage Protective Structures" is available as a reference document to this product data sheet. For technical publication L-2075 or for any further information on ESD Protected Connectors or any of the other products in the broad family of Amphenol Interconnection Products, contact:

Amphenol Corporation
Amphenol Aerospace
40–60 Delaware Ave.
Sidney, New York 13838-1395
Telephone: 607-563-5011
Fax: 607-563-5157

Additional LRM Products

1



Amphenol's LRM Connectors are modular by design, which facilitates custom combinations of digital, fiber optic, RF and power to meet individual customer requirements.

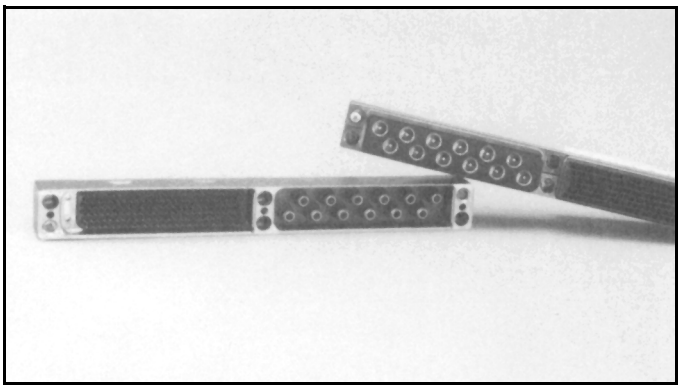
FIBER OPTIC LRM CONNECTORS

1. Fiber optic termini are available packaged in the LRM rectangular connector in the following configurations:

- MIL-T-29504/4, /5, /14 & /15 termini
- Lucent ROC (Robust Optical Connector)
- MT ferrule (2-24 fiber lines per ferrule)

In addition, Amphenol has designed optical backplane interconnect systems capable of providing up to 192 fiber optic lines and 80 digital contacts per LRM (SEM-E format).

2

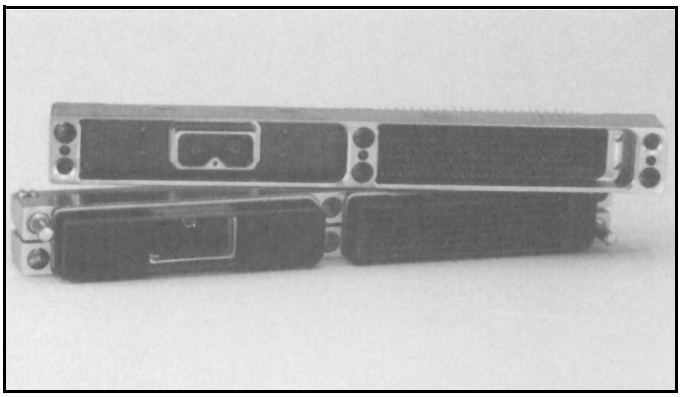


RF MODULES

2. LRM inserts have been designed to accommodate the following RF contacts:

- Size 16 M39029/79 & /80 shielded contacts
- Size 12 coax for DC-2 GHz
- Size 8 coax for DC-32 GHz

3



POWER SUPPLY MODULES

3. Amphenol has designed several custom 270VDC sections which are capable of providing corona-free operation at 100,000 ft. They utilize size 22D contacts and are available in both crimp and compliant pin terminations.