

# TUNING FORK AND BLADE CONNECTOR SOLUTIONS

# Amphenol

Backplane Systems



# Amphenol Backplane Systems – Tuning Fork and Blade Connectors

## Amphenol Backplane Systems, The World Leader

Amphenol Backplane Systems (ABS), part of Amphenol Corporation, is the leading producer of high-density, high-reliability system-level packaging solutions for military and aerospace programs. We have over 30 years of experience in the military and aerospace market and our commitment to the industry is exemplified in everything we do.

Solving complex packaging challenges depends on making sure that environmental, mechanical, and electrical factors are all addressed. ABS is able to meet those challenges by taking a value added systems-level approach. ABS tackles problems such as signal integrity, mechanical robustness, and reliability concurrently rather than independently. This approach along with our dedicated Applications Engineering support sets ABS apart from our competition.

### UHD Connector Overview

Amphenol's Ultra High Density (UHD) interconnect is a high-reliability packaging solution for airborne, space, shipboard, and ground-based applications. UHD is presently used in all of these environments and meets the requirements of EIA IS-753, DESC 89065, and IEEE 1101.1 to 1101.9

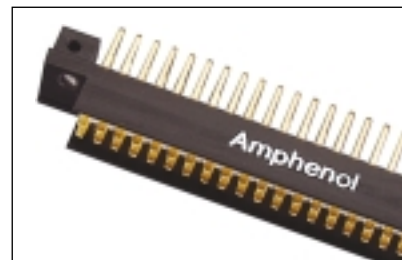
Based on a downsized version of the widely accepted fork-and-blade contact technology, Amphenol's UHD connectors feature up to 396 surface-mount contacts in the SEM-E (Standard Electronic Module) format and up to 556 pins in the 10 SU configurations. The mating backplane connectors feature solderless press-fit tuning fork contacts arranged on a staggered eight-row 0.100" x 0.050" grid.



### NAFI Connector Overview

ABS's initial product offering for military and aerospace applications was the SEM 40-pin NAFI-style interconnect, which we co-developed with the U.S. Navy in the late 1960s. NAFI is an acronym for Naval Avionics Facility – Indianapolis. Together we helped develop the form-factor for interconnecting modules and daughterboards through a central backplane.

NAFI connectors offer design flexibility, adaptable in two, three, four, and five rows of contacts. The mating backplane connectors feature solderless press-fit tuning fork contacts arranged on a 0.100" x 0.100" grid.



### I/O Connector Overview

Cable to backplane Input/Output connectors enable stranded cable terminations to mate with the backplane. They provide a reliable connection of stranded wire cable assemblies to multi-layer printed circuit backplanes.



### In This Catalog

This catalog focuses on Amphenol's UHD, NAFI, and I/O connector solutions. Complete technical specifications and dimensional data on these and other ABS products can be found on our web site:

[www.amphenol-abs.com](http://www.amphenol-abs.com)

### The ABS Web Site Includes:

- Product Drawings
- Materials, Finishes and Operating Characteristics
- Qualifications
- Technical Bulletins
- Signal Integrity Information
- Frequently Asked Questions (FAQs)

Other high-reliability Amphenol Interconnect products are available by accessing [www.amphenol-aerospace.com](http://www.amphenol-aerospace.com).

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## UHD Connector Solutions

Amphenol's Ultra High Density (UHD) interconnect packaging solution combines high interconnect density (80 contacts per linear inch) and design flexibility with proven technologies to meet a wide range of advanced, high-reliability packaging requirements. It is well suited for all military and aerospace programs.

The foundation of the UHD connector is a downsized version of the proven MIL-C-28859 tuning fork and MIL-C-28754 blade contact technologies. The UHD connector packages 396 contacts with two mounting attachments and 372 contacts with three mounting attachments into the SEM-E format, using an eight row 0.100" x 0.050" staggered grid to optimize trace routing through the backplane.

Backplane connectors use solderless compliant press-fit contacts. The module connectors are surface mounted to the module using rigid pin or flex-circuit terminations.

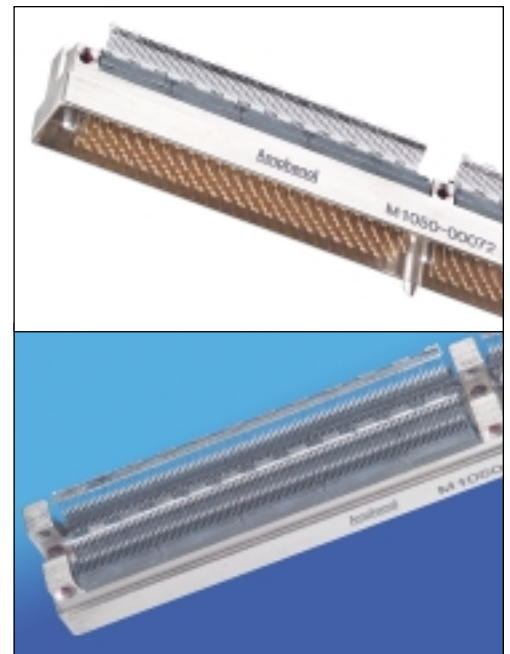
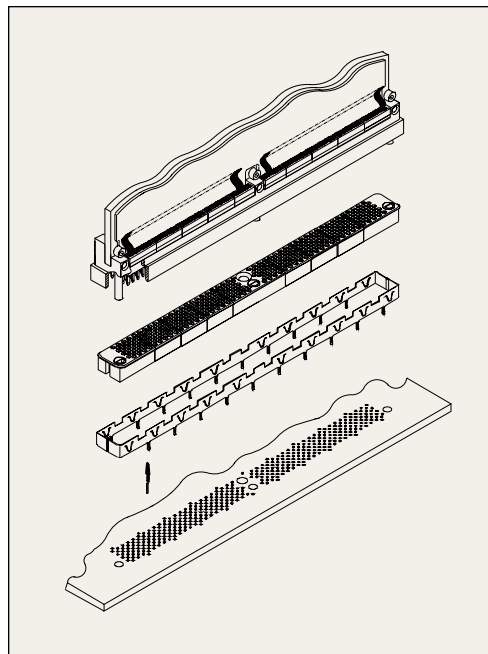
The UHD connector has been designed to provide signal integrity and interconnect density to meet today's advanced system-level requirements while maintaining a robust design.

### UHD OPERATING CHARACTERISTICS

Temperature Range	-65°C to +125°C
Current Rating (individual contact)	2 amps DC at 25 °C
Current Rating (multiple contacts)	1 amp DC at 25 °C
Dielectric Withstanding Voltage (DWV)	600V (RMS) at 60 Hz
Insulation Resistance	1,000 Megohms
Contact Resistance	30 milliohms maximum
Contact-to-Backplane Retention Force	3 lb. minimum
Contact Life (durability)	500 cycles
Contact Engagement Force	2.25 ounce maximum average
Contact Normal Force	1.0N (3.53 ozf) average
Contact Wipe Length	0.053 inch minimum

### UHD 372 Pin Connector SEM-E

- 372 Digital Contacts
- SEM-E Format
- IEEE 1101.4, 1101.7, 1101.9
- DESC 89065-93002
- Rigid or Flex Terminations



## Design Flexibility

Designers faced with unique packaging requirements will appreciate the design flexibility of the UHD connector. A modular approach allows for straightforward incorporation of signal, power, coax, and fiber-optic inserts, as well as EMI shielding, all within the same connector footprint. This modular approach also enables the production of connectors that are longer or shorter than the basic SEM-E format. Several 'standard' configurations are available which represent commonly used variations:

- 372-Pin Digital
- 300-Pin Multipurpose (Fiber-Optic, Coax, Power)
- 296-Pin with 270V Power
- 292-Pin with Coax
- 396-Pin Futurebus+ SEM-E
- 556-Pin Futurebus+ 10 SU

## UHD ENVIRONMENTAL CHARACTERISTICS

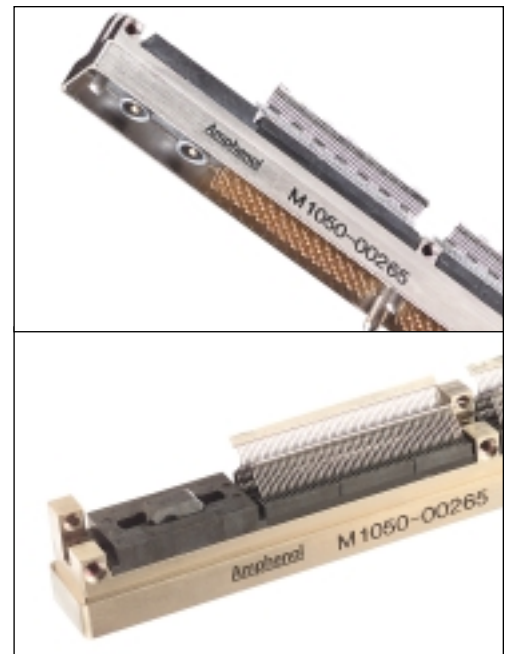
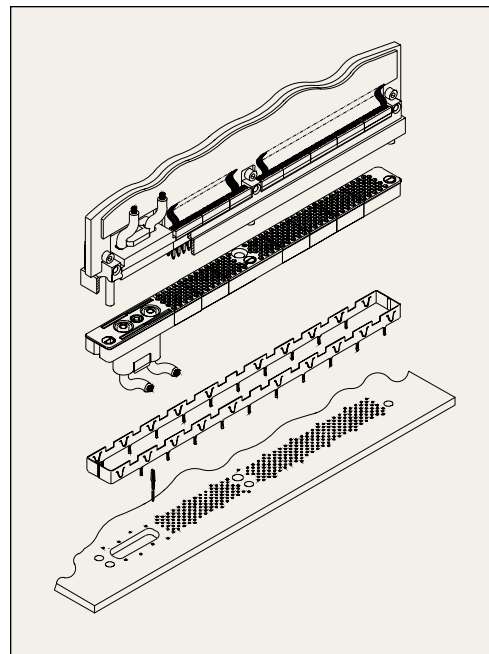
Salt Fog	MIL-STD-810	Method 509, Procedure I
Thermal Shock	MIL-STD-202	Method 107, test condition B
Humidity	MIL-STD-1344	Method 1002
Shock	MIL-STD-202	Method 213, test condition C
Resistance to Solder Heat	EIA-364-56	Procedures 3 and 4
Vibration (sinusoidal)	MIL-STD-202	Method 204, test condition G
Vibration (random)	MIL-STD-202	Method 214, test condition I, letter E

## UHD MODULE CONNECTOR MATERIALS & FINISHES

Frame Material	Aluminum alloy, 6061-T6 per ASTM B241.
Frame Finish	Black anodize per MIL-A-8625, Type II, Class II, or Electroless nickel plate per MIL-C-26074, Class 4.
Contact Material	Brass per ASTM B36, C26000
Contact Finish	0.00005 inch (minimum) gold per MIL-G-45204 over 0.00005-inch (minimum) nickel per QQ-N-290. Solderable per MIL-STD-208
Insulator/Terminal Guide	Polyphenylene Sulfide (PPS), glass-reinforced (40%) per ASTM D4067 or Liquid Crystal Polymer (LCP) per MIL-M-24519.
Flex Circuit	3 ounce 1/2 hard copper per IPC-CF-150/7-CUW7-3SS3 with 0.001-inch polyimide per IPC-FC-231-1, meeting the requirements of MIL-P-50884.
Polarizing Key/Guide Pin Adhesive	Stainless steel, type 303 per ASTM A582, passivated DP-190 Gray (3M Scotch-Weld)

## UHD 296 Pin Connector with 270V Power

- 296 Digital Contacts
- SEM-E Format
- DESC 89065-93006
- Two 270V Power Contacts
- Rigid or Flex Terminations

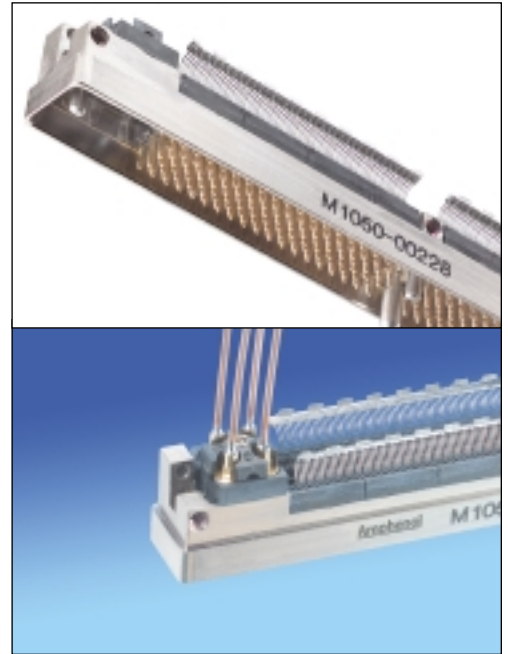
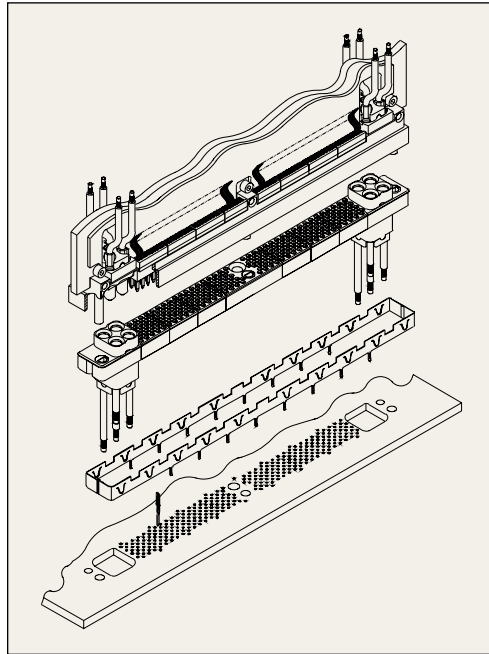


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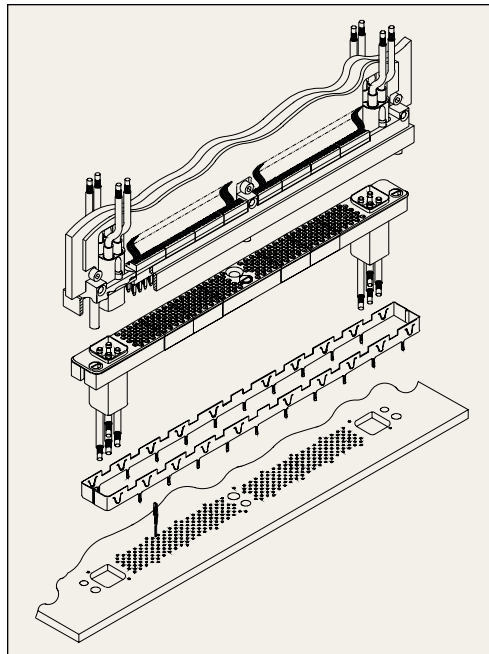
### **UHD 292-Pin Connector With Coax**

- 292 Digital Contacts
- SEM-E Format
- DESC 89065
- 8 Coax Contacts
- Rigid or Flex Terminations
  
- High-Performance Impedance-Matched Contacts: 50 Ohms Nominal at 0-2 GHz
- Integral Guidance Simplifies Use in Blind-Mate Applications
- Easily Incorporated Into the UHD Backplane and Module Connector Assemblies
- Controlled Contact Float Provides Accurate Mating Alignment
- Industry-Standard Hand Crimping Tools



### **UHD 300-Pin Multipurpose Connector**

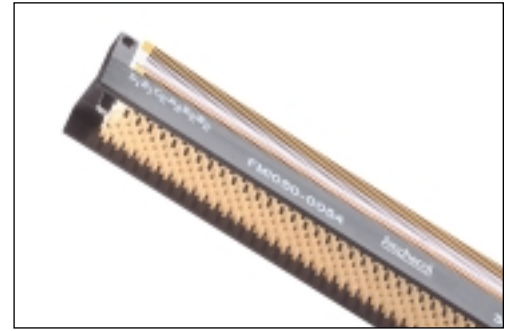
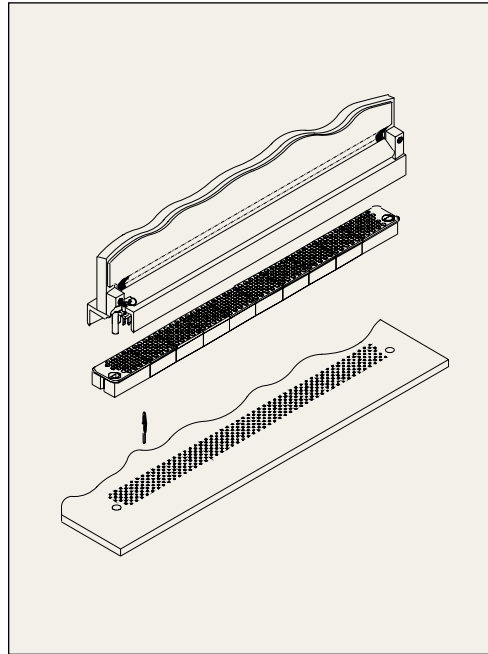
- 300 Digital Contacts
- SEM-E Format
- DESC 89065-93004
- 8 Size-16 M-29504 Fiber Optic, Coax Contacts
- Rigid or Flex Terminations



**Coax, fiber optic and power contact inserts are available in many configurations.**

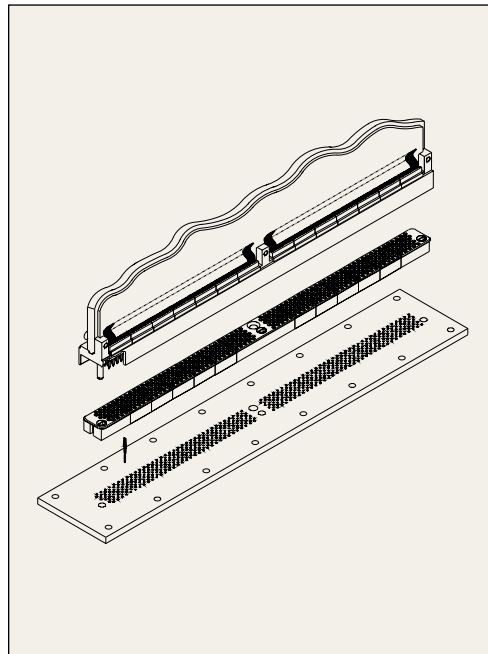
**UHD 396 Pin Connector**  
**Futurebus+ SEM-E**

- 396 Digital Contacts
- SEM-E Format
- EIA /IS-753
- IEEE 1101.4, 1101.7, 1101.9
- Rigid or Flex Terminations



**UHD 556 Pin Connector**  
**Futurebus+ 10-SU**

- 556 Digital Contacts
- 10-SU Format
- EIA /IS-753
- IEEE 1101.3, 1101.8
- Rigid or Flex Terminations



**UHD Backplane Connector**

The UHD series backplane connectors make use of ABS's "Dynamic Retention" compliant press-fit tuning fork contacts for a solderless, gas tight interface with the printed circuit backplane.

**UHD BACKPLANE CONNECTOR MATERIALS & FINISHES**

Contact Material	Beryllium Copper per ASTM B194.
Contact Finish	0.00005 inch (Minimum) gold per MIL-G-45204 over 0.00005-inch (minimum) nickel per QQ-N-290.
Insulator Material	Polyester, glass-reinforced (30%) per MIL-M-24519, Type GPT-30F or Liquid Crystal Polymer (LCP) per MIL-M-24519, Type GLCD. Both are flame-retardant per UL Bulletin 94 V-0.
Polarizing Bushings	Sintered stainless steel per ASTM B582, passivated
EMI Shield Material	Beryllium copper alloy, C17200-TD02 per ASTM B194.
EMI Shield Finish	0.000100/0.000250 inch-thick electroless nickel per MIL-C-26074, Class I.
Adhesive	DP-190 Gray (3M Scotch-Weld)

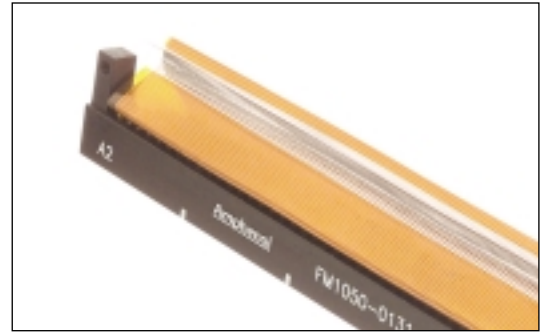
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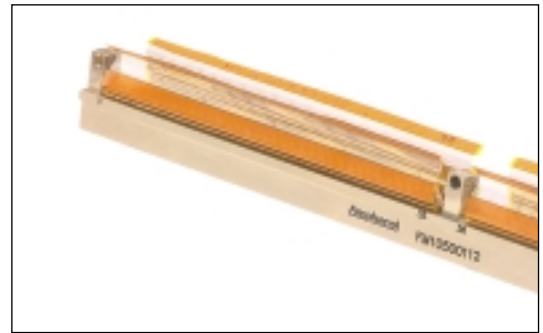
## Why Use UHD?

There are several UHD connectors developed specifically to meet industry standard requirements, however, UHD's modular architecture enables Amphenol to produce connectors containing upwards of 680 contacts. Features such as coax, fiber-optic, power, EMI shielding and accommodations for module covers can be integrated into the UHD connector system. Connector length and body style can be tailored to meet specific needs, with a choice of rigid pin or flex-circuit terminations.

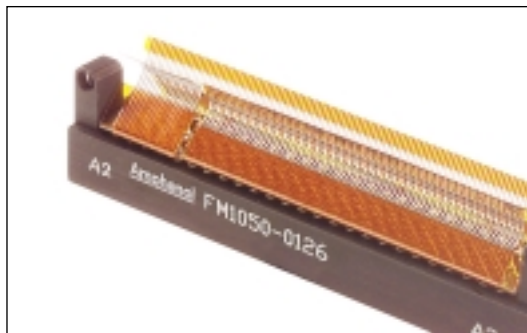
Extender board connector configurations are also available so that customers can have access to probe and test modules that are electrically connected to the backplane.



**396-Pin**



**556-Pin**



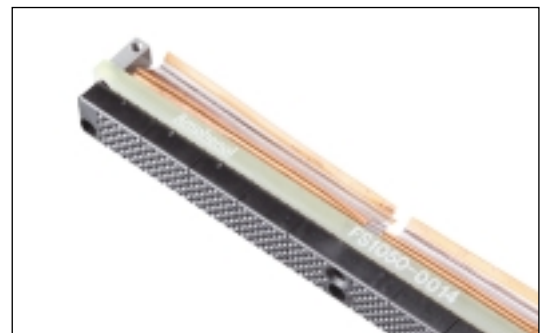
**196-Pin**



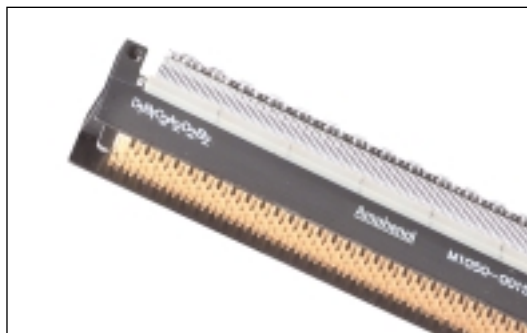
**680-Pin**



**196-Pin**



**372-Pin Extender Card Connector**

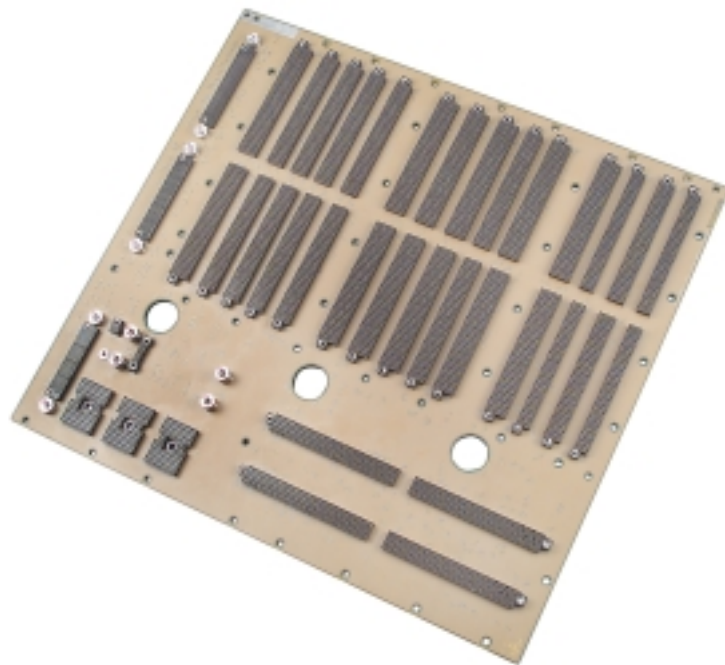


**396-Pin**

## NAFI Connector Solutions

Amphenol's NAFI connector products include multi-row, through-hole solder "blade" and card extender connectors as well as press fit "tuning fork" backplane connectors. As with our other connector products, a high degree of flexibility is possible to meet specific density and layout requirements. Rugged, metal header bodies are custom-machined and include finishes such as anodizing and chromating.

Amphenol's NAFI connector technologies are tested and qualified to MIL-C-28859 and MIL-C-28754. The focal point of Amphenol's NAFI backplane technology is the solderless "eye-of-the-needle" gas tight, press-fit tuning fork contact design. Connector patterns containing multiple rows of contacts are easily produced and can include standard NAFI-style features such as guide pins and D- and V-shaped polarizing keys.



### NAFI ENVIRONMENTAL CHARACTERISTICS

Salt Spray (corrosion)	MIL-STD-1344	Method 1001, Test Condition B
Thermal Shock	MIL-STD-1344	Method 1003, -55C to +125C
Humidity	MIL-STD-810	Method 507, Procedure 1
Physical Shock	MIL-STD-202	Method 213
Vibration (random)	MIL-STD-1344	Method 2005, 10-2000Hz, 15g peak

### NAFI OPERATING CHARACTERISTICS

Temperature Range	-55°C to +125°C
Current Rating (Max)	3 amps (continuous)
Voltage Rating (Min)	1,000 V (RMS) at 60 Hz
Insulation Resistance (Min)	10,000 Megohms
Contact Resistance (Max)	6 milliohms
Contact-to-Backplane Retention Force (Min)	7.5 lb.
Contact Life (durability)	500 cycles
Contact Engagement Force (6 ounce contact available)	2.25 ounce average
Torque Resistance	3 inch-ounces minimum

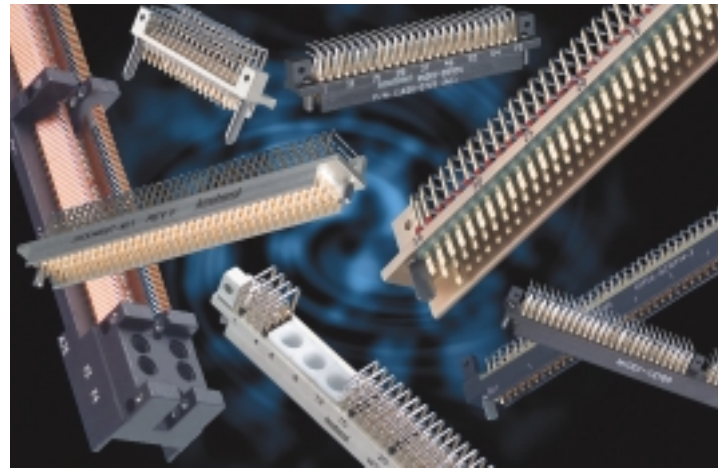
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## M Series NAFI Connectors

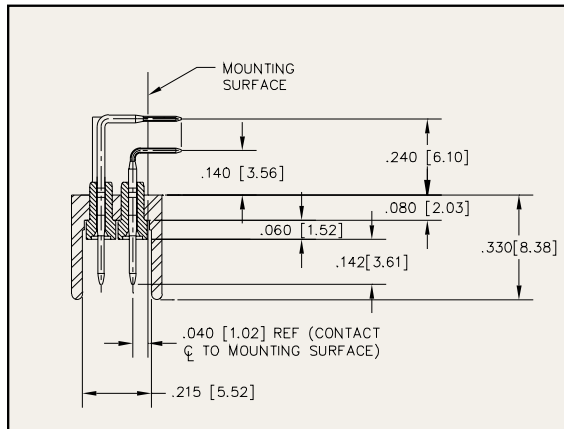
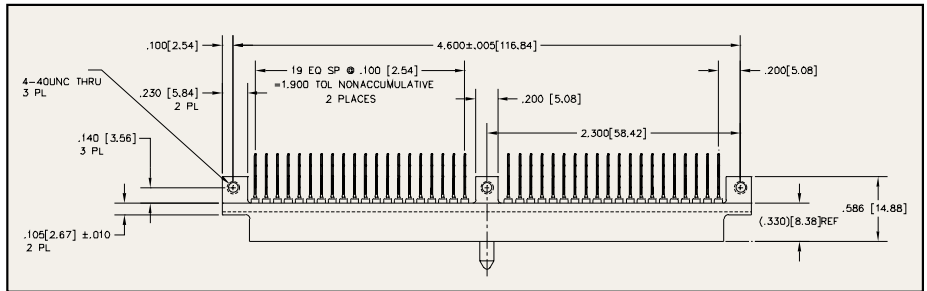
Amphenol's M series male blade connectors are available with two, three, four and five rows of contacts. The aluminum frame is available in many configurations or is custom designed to meet specific customer requirements which can include coax, fiber-optic and power contacts. The gold plated contact tails are solder coated for ease of application to the daughtercard. The blade contacts can be oriented standard (blade parallel to daughtercard) or reverse (blade perpendicular to daughtercard). The components used by Amphenol have been designed to meet the requirements of MIL-C-28754.



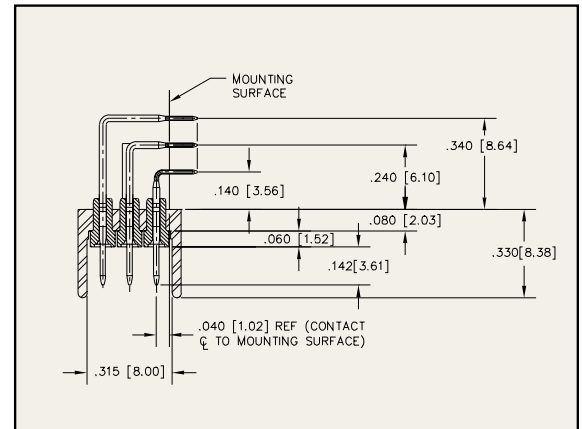
Numerous options are available and a Quick Form Design Guide is available on-line to simplify the selection and specification of this connector.

Complete technical specifications and dimensional data on these and other ABS products can be found on our web site:

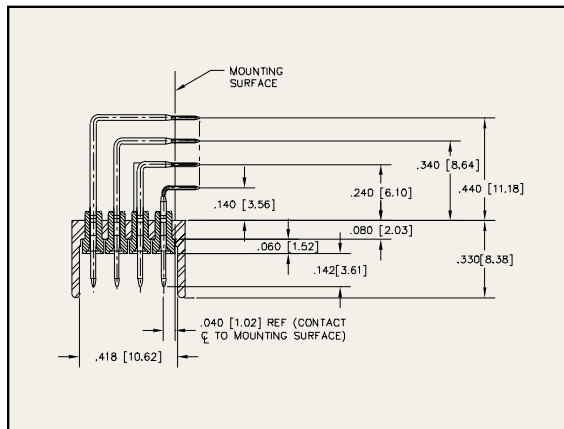
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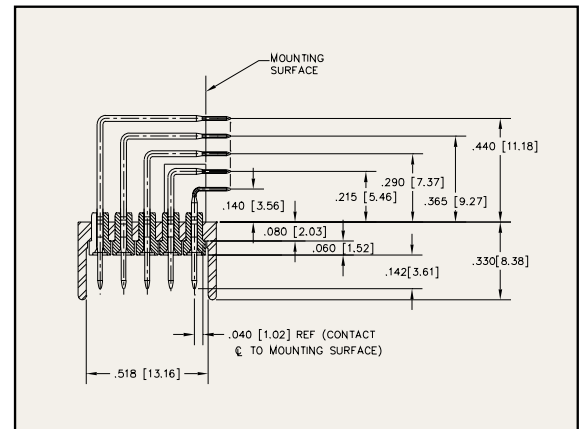
2 Row



3 Row



4 Row



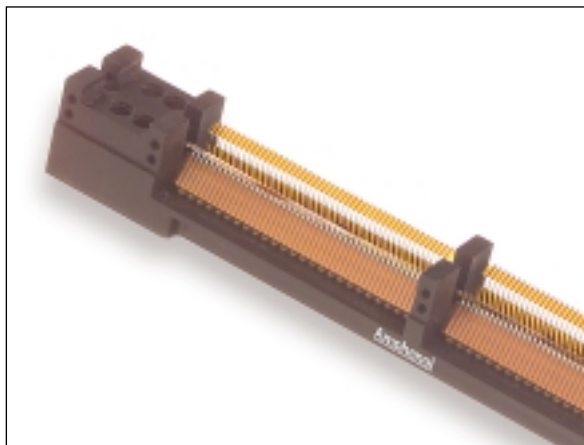
5 Row

## NAFI Flex Connectors FM Series

Amphenol's FM series flexible circuit male blade connectors are designed to meet a wide variety of surface mount module designs. The FM series connectors can be packaged in up to five rows. The standard NAFI interface is maintained while the flexible circuit traces provide the link to the module. The flexible circuit termination allows for hand soldering or various automated surface mount soldering processes. The aluminum frame is available in many configurations or is custom designed to meet specific customer requirements which can include coax, fiber-optic and power contacts.

Complete technical specifications and dimensional data on these and other ABS products can be found on our web site:

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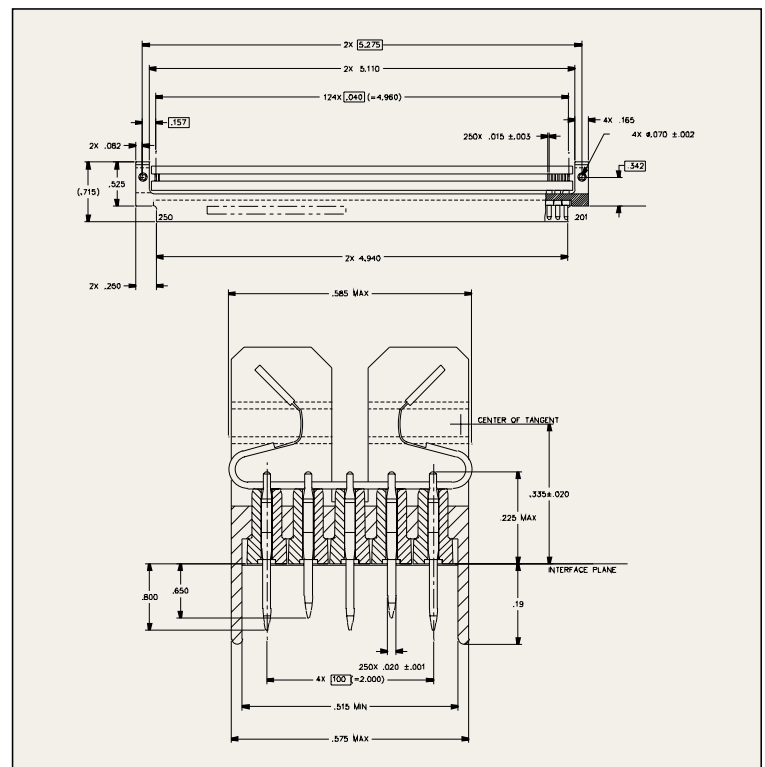


## NAFI MATERIALS AND FINISHES / DAUGHTERCARD CONNECTOR

Frame Material	Aluminum alloy, 6061-T6 per QQ-A-200/8
Frame Finish	Black anodize per MIL-A-8625, Type II, Class II, or Gold or Clear Chromate per MIL-C-5541
Contact Material	Brass per ASTM B36
Contact Finish	0.00005 inch (minimum) gold per MIL-G-45204 over 0.000100-inch (minimum) nickel per QQ-N-290. Solder coated tail 60/40 tin-lead
Insulator Material	Polyphenylene Sulfide (PPS), per MIL-M-24519. High Temperature nylon 6-6 per MIL-M-20693
Flex Circuit	3 ounce 1/2 hard copper per IPC-CF-150/7-CUW7-3SS3 with 0.001-inch polyimide per IPC-FC-231-1, meeting the requirements of MIL-P-50884.
Polarizing Key/Guide Pin	Stainless steel, type 303 per ASTM A582, passivated

## BACKPLANE CONNECTOR

Contact Material	Beryllium Copper per QQ-C-533
Contact Finish	0.000050 inch (Minimum) gold per MIL-G-45204 over 0.000100-inch (minimum) nickel per QQ-N-290.
Insulator Material	Polyester, glass-reinforced (30%) per MIL-M-24519, Type GPT-30F, flame-retardant per UL Bulletin 94 V-0.
Polarizing Bushings	Sintered stainless steel per ASTM B582, Passivated



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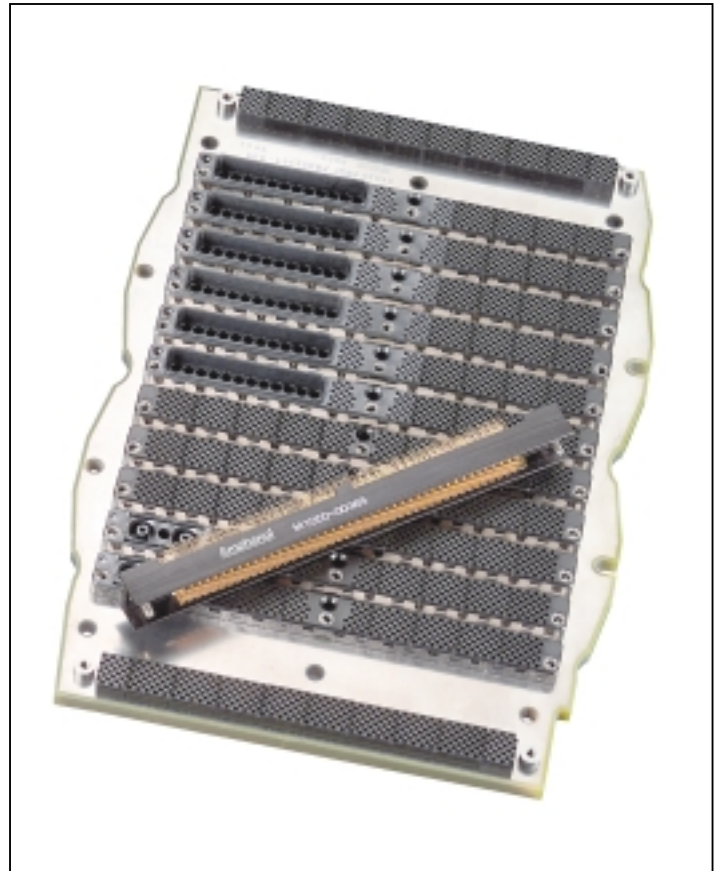
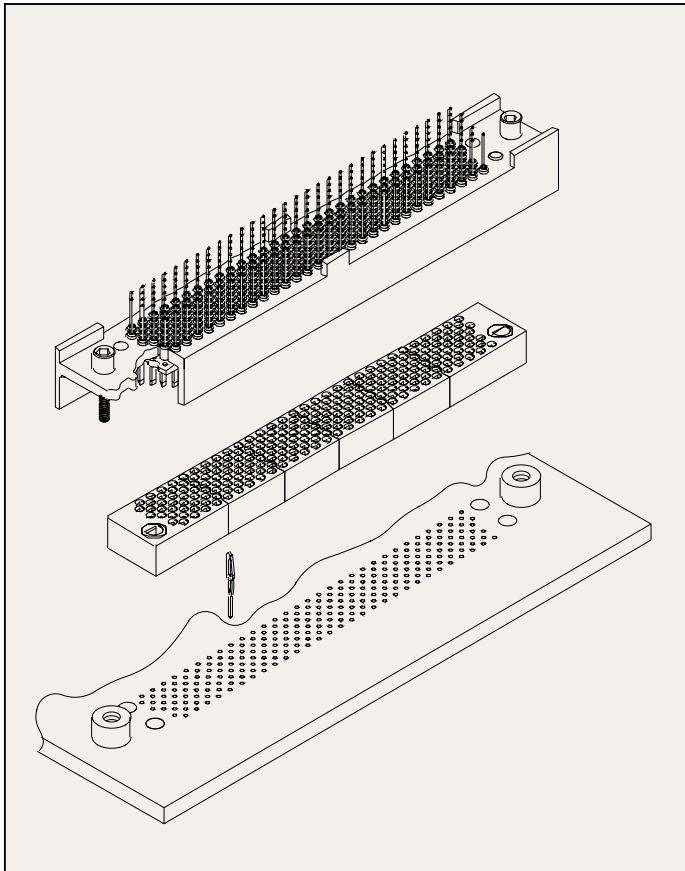
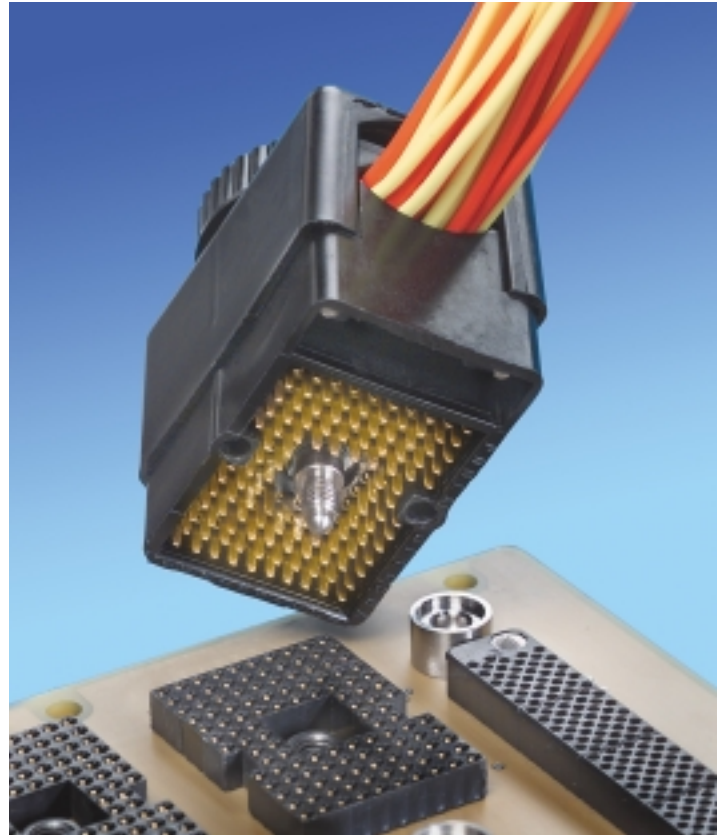
## I/O Solutions

The ABS I/O 100 series of fork-and-blade connectors provide a means of terminating #22-gauge through #26-gauge stranded wire to the backplane. The connectors are available with 24, 36, 40, or 120 crimp-style blade contacts and include captive hardware and polarizing features. The receptacle (tuning fork) connectors can be placed where needed on either side of the backplane.

The UHD interconnect is also available in a stacking configuration useful in board-to-board and rigid-flex applications. The separable interface shares the same 0.050" x 0.100" staggered grid as the standard UHD connector and mates with a corresponding array of tuning fork contacts on the backplane. The male blade stacker can be secured using captive hardware and press-fit threaded bushings on the backplane. A 0.100" x 0.100" stacking solution is also available in the standard NAFI family of connectors.

Complete technical specifications and dimensional data on these and other ABS products can be found on our web site:

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## The Interconnect Solution

The Amphenol Backplane Systems design and production facility in Nashua, New Hampshire comprises over 35,000 square feet of space.

For information about ABS and detailed descriptions of products, please call toll free 888-318-3553 to speak with an Applications Engineer or see us at our web site:

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*Amphenol Backplane Systems, 18 Celina Avenue, Nashua, New Hampshire 03063*

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