

# Winchester Corporate Overview & MIL/AERO Product Focus

October 2013



# Company History

Winchester has a long history of providing leadership in design development and deployment of interconnect technologies and solutions to their customers globally



## Fiber

- Patented Technology – Game Changer
- Broadcast Focused – Rapid Growth
- Custom Hybrid Solutions for Medical & Mil/Aero



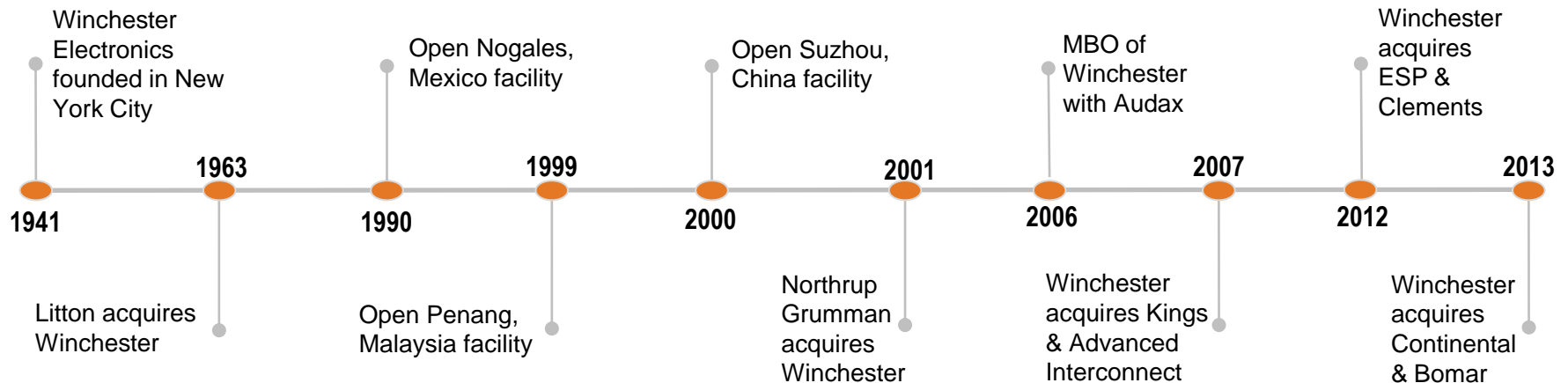
## Connectors

- KINGS®, Cadillac®, CCC®, Bomar® & Winchester Brands
- Highly Engineered – RF and Rugged
- Broad Mil Spec Product Offering



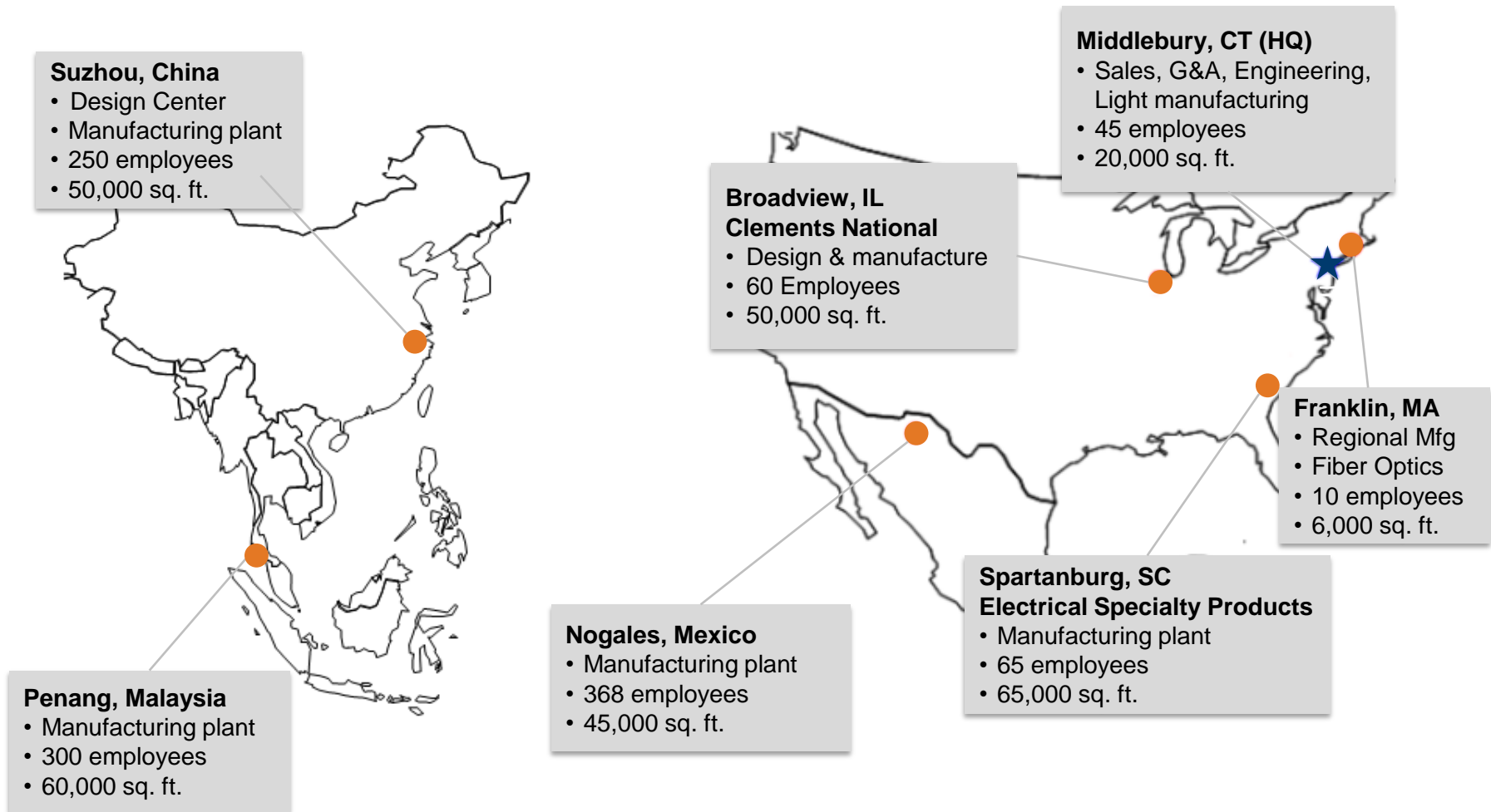
## Cable Assembly

- High Mix / Low Volume
- Global Manufacturing and Supply Chain
- Custom & Differentiated Assemblies



# Global Footprint

## High Mix – Low Volume Factories



1,100 Employees Worldwide

# Winchester Certifications and Memberships

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Certification	Description
AS9100	Aerospace Quality Management System
ISO 13485:2003	Medical Device Quality Management System
IPC/WHMA-A-620 (Class 3)	Requirements and Acceptance Standards for Cable and Wire Harness Assemblies
ISO 9001:2008	Quality Management Systems
OHSAS 18001:2007	Occupational Health and Safety
ISO 14001:2004	Environmental Management System

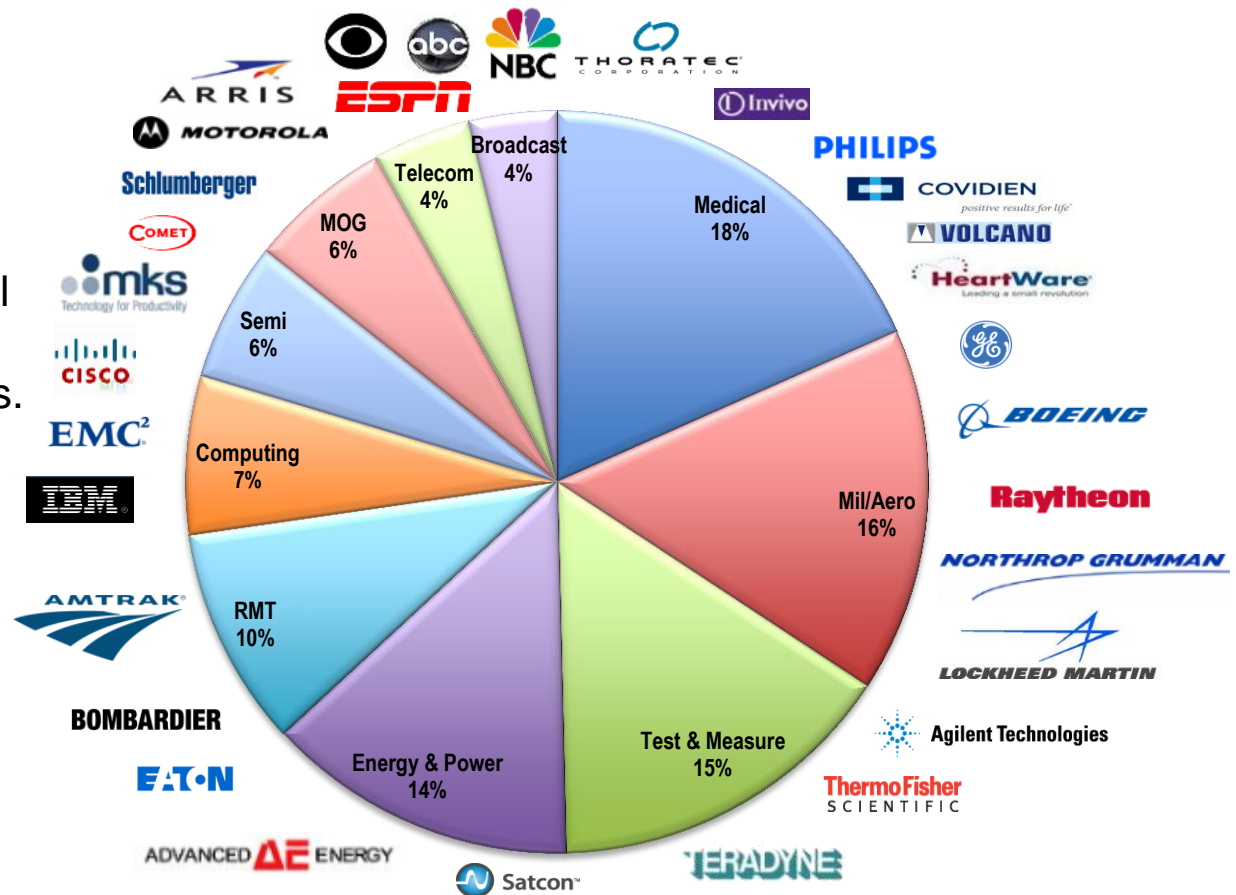
**Winchester supports Class III medical devices and complies with FDA 21 CFR Part 820**



# 2012 Global Sales – Markets & Customers

Winchester designs and manufactures an extensive range of interconnect products, including PCB, RF, and Power connectors as well as value-added cable and electromechanical assemblies.

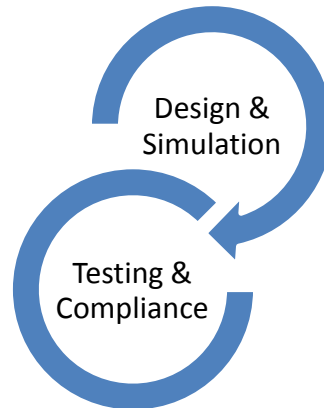
Our products support world-class customers in various high-growth end markets.



Our team of engineers uses highly advanced tools during the design phase to make sure that the parts we design are correct from innovation to application.

Simulation tools and design procedures establish a realistic approach and give the opportunity to accurately predict performance in advance

- *Solidworks* – 3D Modeling and Designing
- *Ansoft HFSS* – Electrical Modeling
- *Ansoft Designer* – Electrical Performance Simulation
- *Ansoft FEM* – Structural Modeling



- World Class In-house Proto Lab
  - Electrical Testing
  - Mechanical Testing
  - Environment Acceleration
- Design for Manufacturing (DFM)

Winchester helps you accelerate through your New Product Development process.



## Products Overview



# Fiber Optic

- Winchester has a wide Fiber Optic products offering
- Supporting multiple market segments – Aerospace and Defense, Broadcast, Medical, Test and Measurement, etc.
- Award Winning Technology
- Design and Manufacturing facility in Franklin, MA



SMPTE 304  
Fiber Tri-Loc® Camera  
Connector



Attenuators

Expanded Beam EL Size 12 and 16 Termini



Cable Assemblies & Hybrid  
Connectors



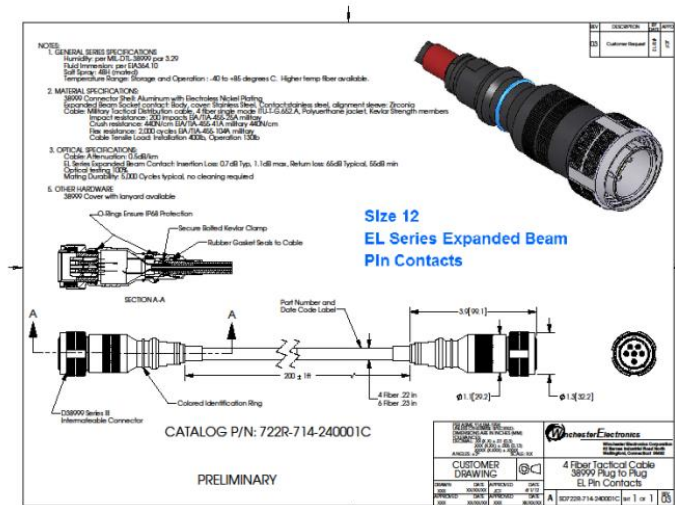
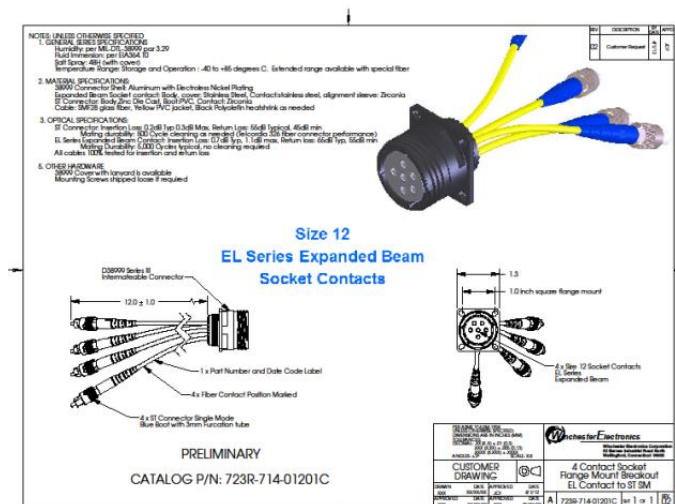
Military qualified  
connectors

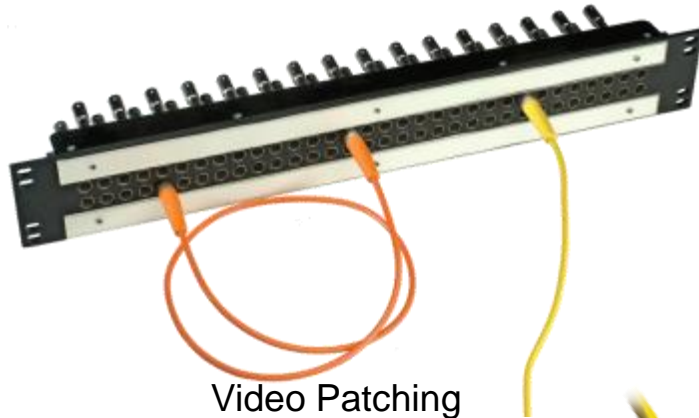


# Expanded Light Interconnect

## Pushing Technology

- Easy push pull or quarter turn mating – discuss needs
- Rugged connector and tubing
- Contacts rated for 1,000+ mating cycles
- No cleaning required for optical contact
- Low cost high performance copper connectivity
- Standard contact form factor
- Flexible fiber and copper arrangements
- Off the shelf components used where possible
- Connector mating cycles – Luminus designed for 100's





Video Patching



Patch Plugs



75 Ohm BNC



Tri-Loc® Camera  
Connectors Series



Standard Video  
Jack



Mid-size Video Jack

Winchester Electronics' KINGS® brand is the leader in high reliability RF interconnects for the aerospace, broadcast, commercial aviation, industrial, medical, military, and telecommunication industries. Exceptional in the manufacture of high-quality audio and video products, Winchester's KINGS® brand is industry-preferred.

# Connectors

RF – Mil/Aero & Industrial

Winchester Electronics manufactures a wide variety of standard RF connectors. Standard catalog connectors include: BMA, BNC, C Series, K-Loc®, MCX, MMCX, QC-N Series, QC-SMA™, SC Series, SMA, SMB, TNC Series, TRB Series, TRT Series.



The Winchester Electronics Quick Connect family was designed to take the labor and space constraints out of system designs. With a push/pull style of mating, connections have never been easier.



**BMA**



**BNC**



**MMCX**



**K-Loc®**



**MCX**



**C-Series**



**SC Series**



**N-Series**



**TRT**



**SMB**



**TRB**



**SMA**

# Connectors

## Multi-Pin

Rack and Panel / Blind Mate  
Connectors for Military and  
Industrial Applications



Comprehensive line of press-fit  
PCB D-Subminiature  
connectors for backplane  
applications with C-Press®  
compliant pin technology.

Combination D-Subminiature  
connectors provide packaging  
solutions including RF, Power,  
and Signal within standard D  
shell sizes and insert  
configurations.



Winchester's RF Modular Board Mount  
Compliant Platform 75 Ohm modular  
RF Blind Mate interconnection system



# Connectors

Clements *Cadillac*® Brand

The recent acquisition of Clements National Company, with its *Cadillac*® brand product line, has broadened our market base to include Rail/Mass Transit and Marine Oil & Gas.



Heavy-duty coupling nut for severe service applications

Sure grip protective molded coupling nuts are available in various colors

Durable polyurethane black finish for transit environments



MCO Micro power Series, quick mating, single pin connector



MCO Threaded Series, multi-pin control connector

**Cadillac**®

WINCHESTER  
ELECTRONICS



# REVERSE BAYONET CONNECTORS

## MIL-C-5015 INSERT CONFIGURATIONS

### ➤ FEATURES and BENEFITS

- Derived from the threaded series to provide faster coupling
- Improved anti-vibration resistance
- Bayonet pins are protected inside the coupling nut
- 120° fast coupling and uncoupling
- Audible and visible tactile mating
- IP67 environmental protection
- High number of mating cycles
- Crimp and solder contact designs silver or gold plated
- Thermocouple, PCB, Coax and fiber optic contacts available
- Expanded beam sizes #12 awg and #16 awg and size #12 plastic fiber contacts available
- Maximum current ratings 22 amp – 245 amp



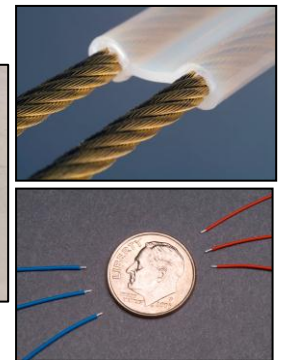
# Cable Assemblies

Winchester's cable assembly operations manufacture a wide variety of custom RF cable assemblies to customers in the industrial, medical, military, and telecommunications industries.



Included are flexible, semi-rigid, conformable, over-mold, ribbon, wire harness, heavy gauge power cable, multi-cord power cords, and jacketed cable assemblies.

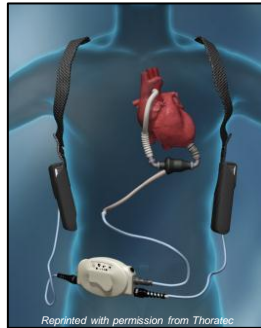
Leveraging a range of connections (crimp, solder IDC) and capabilities from over-molding to laser wire & cable processing.



# Cable Assemblies

## Market Applications Examples

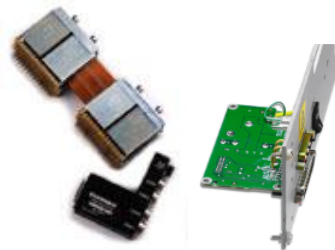
Class-III Medical  
Life Sustaining



Military Mobile  
Communications



Data Center – Heavy Gage Cabling



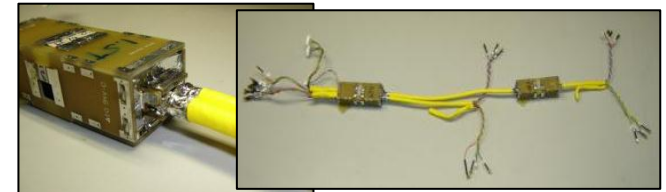
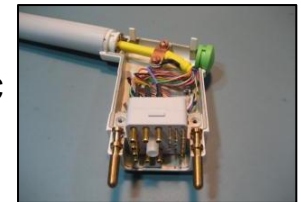
New Energy  
Harnesses



Mechanical  
Sub-Assemblies



Medical  
Non-Magnetic  
for MRI





Military and Commercial Aerospace Capabilities



# Military & Aerospace Product Experience

Winchester Electronics is strongly established in the military and commercial aerospace market as a valued supplier to several major manufacturer's worldwide.

## **Standard and Customized RF MIL-AERO Products**

- Largest offering of QPL connectors in the marketplace
- Broad product range covering the full frequency spectrum
- Solutions for high reliability
- Custom materials to solve complex problems in critical applications

## **Unique Technical Capabilities**

- DLA (Defense Logistics Agency) qualified lab for MIL-SPEC A, B & C testing (full environmental, mechanical and electrical capabilities)
- In-depth analytical processes to provide the performance required, including HFSS (High Frequency Simulation Software) and FEM (structural modeling)

SERIES	CABLE	SIZE	COUPLING	IMPEDANCE	FREQUENCY	VOLTAGE RATING
20 KV	Coaxial	Standard	Bayonet	Non-Constant	-	20 KV DC
10 KV	Coaxial	Standard	Bayonet	Non-Constant	-	10 KV DC
C	Coaxial	Standard	Bayonet	50 Ohms	0 to 11 GHz	1000 VRMS
SC	Coaxial	Standard	Threaded	50 Ohms	0 to 11 GHz	1000 VRMS
N	Coaxial	Standard	Threaded	50 Ohms	0 to 11 GHz	1000 VRMS
HN	Coaxial	Standard	Threaded	50 Ohms	0 to 4 GHz	1500 VRMS
UHF	Coaxial	Standard	Threaded	Non-Constant	0 to 500 MHz	500 Volts Peak
TNC	Coaxial	Miniature	Threaded	50 Ohms	0 to 11 GHz	500 VRMS
BNC	Coaxial	Miniature	Bayonet	50/75 Ohms	0 to 4 GHz	500 VRMS
SHV	Coaxial	Miniature	Bayonet	Non-Constant	0 to 300 MHz	3500 VRMS
MHV	Coaxial	Miniature	Bayonet	Non-Constant	0 to 500 MHz	3500 VRMS
K-Loc®	Coaxial	Miniature	Positive-Lock	50 Ohms	-	500 VRMS
TRB/TRT	Triaxial / Twinaxial	Miniature	Bayonet/Threaded	Non-Constant	0 to 500 MHz	400 VRMS
SMA	Coaxial	Sub-Miniature	Threaded	50 Ohms	0 to 18 GHz	500 VRMS
SDB	Twinaxial	Sub-Miniature	Bayonet/Threaded	Non-Constant	0 to 500 MHz	400 VRMS

SERIES	CABLE	SIZE	COUPLING	IMPEDANCE	FREQUENCY	VOLTAGE RATING
<b>N</b>	Coaxial	Standard	Threaded	50 Ohms	0 to 11 GHz	1000 VRMS
<b>BNC</b>	Coaxial	Miniature	Bayonet	50 Ohms	0 to 4 GHz	500 VRMS
<b>TNC</b>	Coaxial	Miniature	Threaded	50 Ohms	0 to 11 GHz	500 VRMS
<b>SMA</b>	Coaxial	Sub-Miniature	Threaded	50 Ohms	0 to 18 GHz	500 VRMS
<b>BMA</b>	Coaxial	Sub-Miniature	Snap-On	50 Ohms	0 to 18 GHz	500 VRMS
<b>QMA</b>	Coaxial	Sub-Miniature	Snap-On	50 Ohms	0 to 6 GHz	500 VRMS
<b>QC-SMA+</b>	Coaxial	Sub-Miniature	Positive Lock	50 Ohms	0 to 18 GHz	500 VRMS
<b>SMB</b>	Coaxial	Sub-Miniature	Snap-On	50 Ohms	0 to 4 GHz	335 VRMS
<b>SMC</b>	Coaxial	Sub-Miniature	Threaded	50 Ohms	0 to 10 GHz	335 VRMS
<b>MCX</b>	Coaxial	Sub-Miniature	Snap-On	50 Ohms	0 to 6 GHz	335 VRMS
<b>MMCX</b>	Coaxial	Sub-Miniature	Snap-On	50 Ohms	0 to 6 GHz	250 VRMS
<b>SMP</b>	Coaxial	Sub-Miniature	Snap-On	50 Ohms	0 to 40 GHz	335 VRMS
<b>SMPM</b>	Coaxial	Micro-Miniature	Snap-On	50 Ohms	0 to 65 GHz	250 VRMS

## MIL-PRF-39012

- Coaxial connectors: SMA, BNC, TNC, N and C interfaces.
- More than 600 approved part numbers.
- Configurations include straight and right-angle cable connectors, receptacles, hermetic connectors and dust caps.



## MIL-PRF-49142

- Triaxial connectors: TRB (bayonet coupling) and TRT (threaded coupling).
- 75 approved parts.

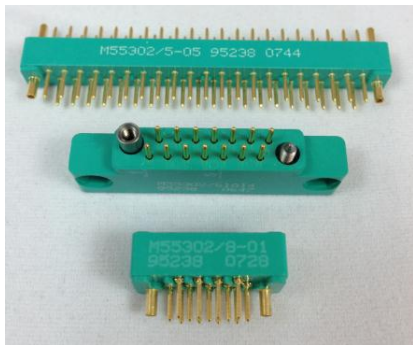


## MIL-PRF-55339

- Coaxial adapters: BNC, TNC, N and C interfaces.
  - Within and between series
- 26 approved parts.



M55302



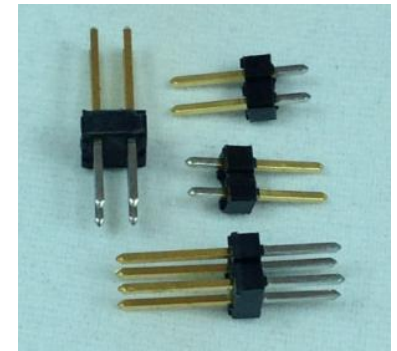
M28748



M39029



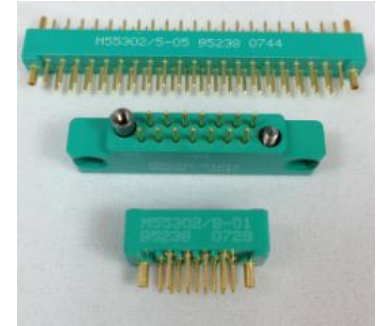
DESC Headers





PCB right angle and straight thru pin and socket connectors designed for use with single, double, and multi-layered board to board applications.

Small in size and weight; ruggedly constructed; suitable for use in airborne, ground systems, and commercial applications.



### Competitors



AbelConn, LLC



# Continental Product Overview

## M55302 Connectors

PN	CCC	AirBorn	IEH Corp	Incon	AbelConn		PN	CCC	AirBorn	IEH Corp	Incon	AbelConn
M55302/1-03 thru -05	X						M55302/55	X	X	X	X	
M55302/2-03 thru -05	X						M55302/56	X	X	X	X	
M55302/4-01 thru -06	X				X		M55302/57	X	X	X	X	
M55302/5-01 thru -06	X						M55302/59	X				
M55302/6-01 thru -06	X				X		M55302/60	X	X	X	X	
M55302/7- 01 thru -05	X				X		M55302/61	X	X	X	X	
M55302/8- 01 thru -05	X				X		M55302/62	X	X	X	X	
M55302/16 -01 thru -21	X						M55302/63	X	X	X	X	
M55302/17 -01 thru -63	X						M55302/64	X	X	X	X	
M55302/18 -01 thru -21	X						M55302/65, /66	X	X		X	
M55302/21 -01 thru -02	X		X	X			M55302/138	X	X	X	X	
M55302/22 -01 thru -03	X		X	X			M55302/139	X	X	X	X	

M28748 Connectors are rectangular, rack and panel, electrical connectors, with non-removable solder type contacts, and removable crimp type contacts, intended for use in electronic and electrical equipment.



### Approved QPL Products

M28748/1

M28748/2

M28748/3

M28748/4

M28748/5

M28748/6

M28748/7

M28748/8

M28748/13

M28748/14



### Competitors



Mil-Spec	CCC Series	WEC Series	Gender	Contact Size
M28748/1	250-16	MRA	M	#16 or .062"
M28748/2	250-16	MRA	F	#16 or .062"
M28748/3	25	MRAC	M	#16 or #20
M28748/4	25	MRAC	F	#16 or #20
M28748/5	20	MRE	M	#20 or .040"
M28748/6	20	MRE	F	#20 or .040"
M28748/7	MM-22	UMI/SRE	M	#22 or .030"
M28748/8	MM-22	CUMI/SRE	F	#22 or .030"
M28748/13	MMM	N/A	M	#22 or .030"
M28748/14	MMM	N/A	F	#22 or .030"

M39029 contacts are removable crimp, solderless wrap, and solder type electrical contacts for use in connectors and other electric and electronic components.

Ideal for commercial applications where field replacement of contacts is required.

### MIL-SAE-AS-39029 CONTACTS

M39029/34-271

M39029/34-272

M39029/34-273

M39029/34-440

M39029/35-274

M39029/35-275

M39029/35-276

M39029/35-441



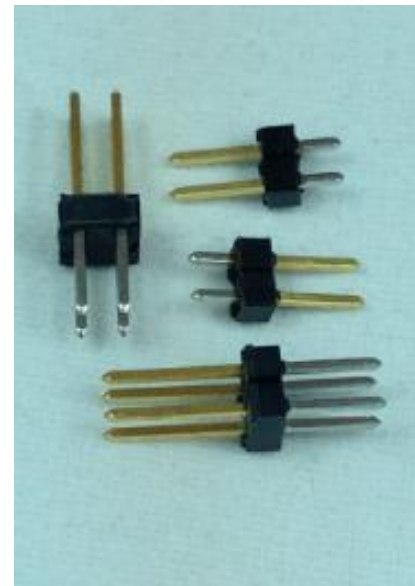
### Competition



### 86098, 86101, 86102, 89402 - DESC Header Series

- Contact size: .025" Square Posts
- Centerline: .100"
- Current Rating: 3 Amps
- PCB Terminations: Straight & Right Angle Solder Tail, Surface Mount
- Single Row Straight Thru: 1 - 40 positions (86101)
- Single Row Right Angle: 1 - 40 positions (86098)
- Double Row Straight Thru: 2 - 80 positions (89402)
- Double Row Right Angle: 2 - 80 positions (86102)

Applications:  
Printed Circuit Board



# Connector Development Overview

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At the core of our product development strategy is listening to and understanding the needs of our customers, which is summarized in the following list of Connector Design Trends:

- Small, high-frequency RF connectors
- Improved mechanical coupling on RF Connectors
- Application specific materials
- Higher Frequency versions of standard size RF Connectors
- Small, low-power, custom machined contacts

# Small, High Frequency RF Connectors

50 Ohm

## SMP Sub Miniature RF Connectors

Sub Miniature high frequency RF connectors featuring a push-on interface

Operating Frequency:

DC to 40 GHz

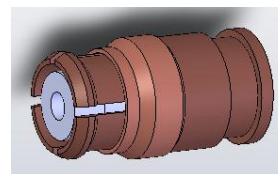
DC to 26.5 GHz (Right Angle Connectors)

Used in high density PCB or Cable-to-PCB applications.

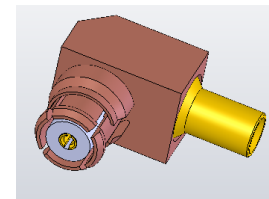
PCB applications use two Jack PCB connectors joined by a Plug Bullet Adapter.

**Applications:** High Speed Optical Networking Equipment, Flow Control Equipment, Radar Systems

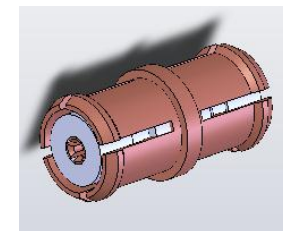
Straight Cable Plug,  
.085" cable



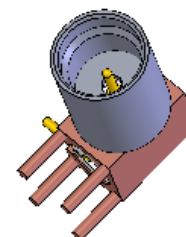
Swept RA Plug,  
.047" cable



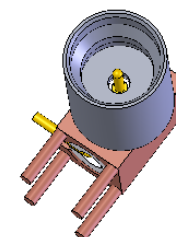
Bullet Adapter



Right Angle PCB Jack,  
Smooth Bore (SB)



Right Angle PCB Jack,  
Full Detent, (FD)





# Small, High Frequency RF Connectors

50 Ohm

## SMPM Micro Miniature RF Connectors

Micro Miniature high frequency RF connectors featuring a push-on interface. Miniaturized version of SMP.

Operating Frequency:

DC to 65 GHz

DC to 40 GHz (Right Angle Connectors)

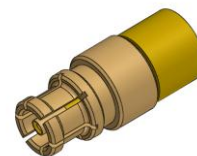
30% smaller than SMP Connectors.

Used in high density PCB or Cable-to-PCB applications.

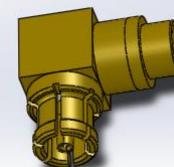
PCB applications use two Jack PCB connectors joined by a plug Bullet Adapter.

**Applications:** High Speed Optical Networking Equipment, RF Power Amplifiers, Radar Systems

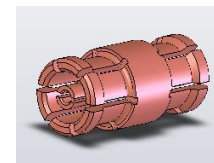
Straight Cable Plug,  
.047" cable



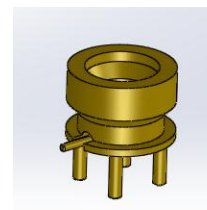
Swept RA Plug,  
.047" cable



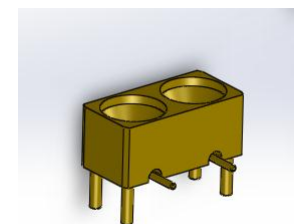
Bullet Adapter



Vertical PCB Jack,  
Smooth Bore (SB)



Vertical PCB Jack, Dual  
Full Detent, (FD)



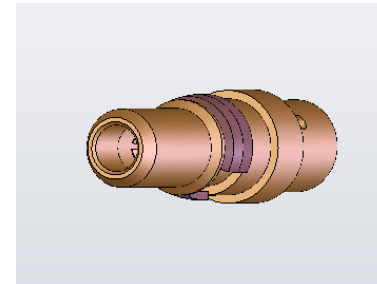
## 117-Series 32 GHz Combo-D RF Contacts

Size 8 High Frequency RF contacts designed for RG 402 (.141') semi-rigid cable. Termination method features point and shoot center contact and soldered outer conductor.

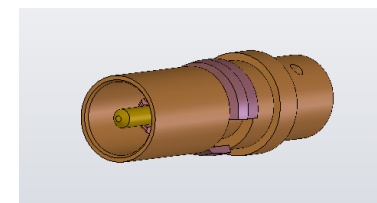
Operating Frequency:  
DC to 32 GHz

**Applications:** Military, Radar systems, Medical

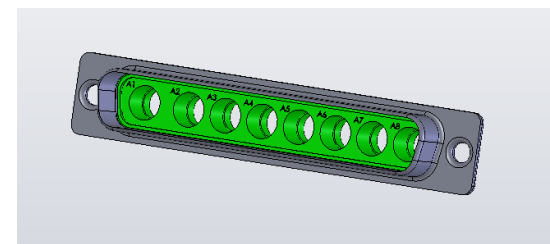
Straight Cable Plug, .141 Cable



Straight Cable Jack, .141 Cable



Combination D-Sub Connector (Reference)



# Improved Mechanical Coupling

50 Ohm

## QCSMA+ Quick Connect SMA Connector

Push-Pull Snap-on SMA Interface is faster and easier to mate than threaded SMA interface.

Eliminates need for torque wrenches.

Backwards compatible to field installed SMA Jacks.

Mates to SMA Jack with thread length of .200 +/- .005

18 GHz

**Applications:** Military, Instrumentation/test & Measurement



Open, unmated state, the shroud is pulled back



Holding onto the shroud, push the QC connector into its mate



Complete mating by pushing the shroud forward

## Anti-Rotation TNC Connectors

Threaded RF Connectors are routinely secured to panels using lockwire to ensure mated connectors do not disengage in high vibration applications.

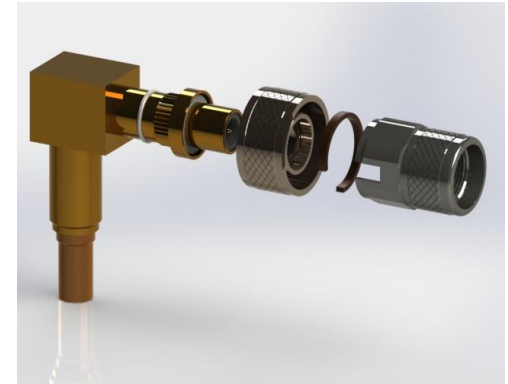
This practice adds cost...Coupling nuts with lockwire holes are more expensive to produce. Installation costs increase as each connector be secured to a panel.

This practice also creates FOD (Foreign Object Debris)

Anti-rotation coupling design features a locking collar that when pushed forward secures the coupling nut to the Jack and prevents rotation – which precludes the need for secondary lockwire operation.

Mates with standard TNC connectors.

**Applications:** Commercial Aviation



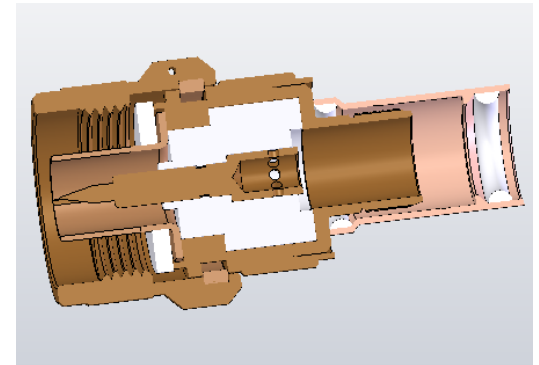
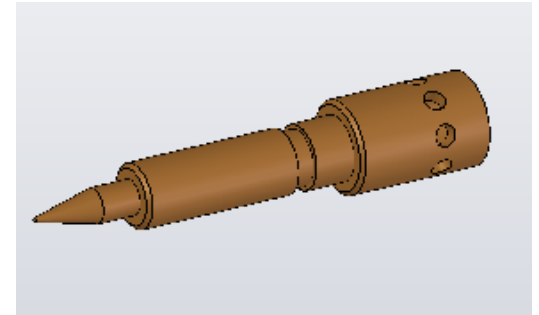
## N Connector to terminate to solid aluminum conductor

Aluminum is a soft, light weight material and It is difficult to obtain a solid, secure crimp as crimped contacts can be moved in place.

We added “cold-flow cavities” (holes) to the center contact to allow the soft aluminum conductor to “cold flow” under crimp compression into the contact to form a homogeneous fusion of aluminum conductor and copper contact yielding a strong, secure, reliable crimp.

**Applications:** Commercial Aviation In-Flight-Entertainment

Center contact with “cold flow Cavities”



## N Connector to terminate to braid with 20% coverage

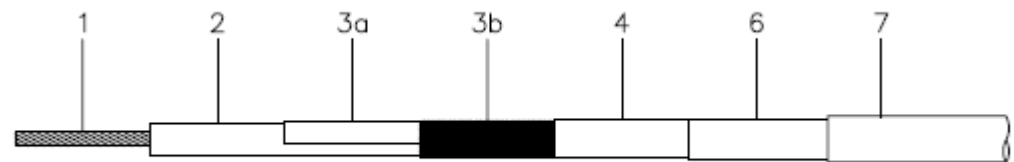
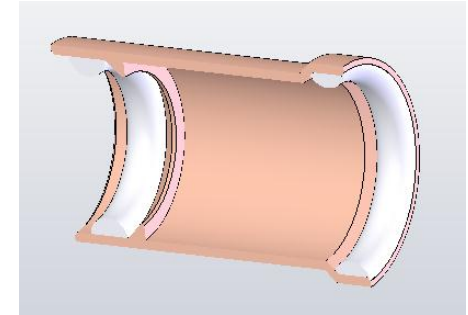
Typical RF cable braid coverage is 95%... Customer needed a connector to terminate to a “leaky feeder” cable with only 20% braid coverage.

Reduced braid coverage made achieving reliable mechanical retention a challenge...Initial designs yielded only 17 lbs. retention force. (below customer requirement).

Solution was to add mechanical retention ring barb inside the crimp sleeve that pierces the cable jacket increasing retention forces to 45 lbs. (meeting customer requirement)

**Applications:** Commercial Aviation In-Flight-Entertainment (IFE)

Internal Barbed Crimped Sleeve



# Higher Frequency Standard Size RF Connectors

50 Ohm

## 18 GHz N, TNC, SMA Connectors

Designed for use on 1801, 2301 and 2801 IW  
Microwave high performance, high frequency, low-loss  
cables

Typical N and TNC Connectors are rated for 11 GHz

VSWR 1.35 for 18 GHz Assemblies (2 Straight Plugs)

Solder / Clamp Termination

**Applications:** Military, Test & Measurement

18 GHz N Connectors



18 GHz TNC Connectors



18 GHz SMA Connectors



## Mini PowerSnap Wire-to-Board Power Terminals

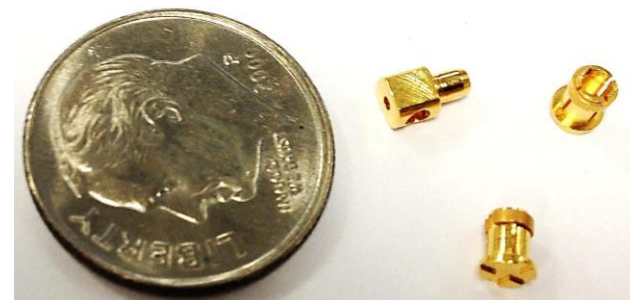
Unique, audible, “Snap-on” coupling mechanism ensures secure, robust connection.

Current Capacity 10 Amps

Small size versus larger pin & socket style connectors

Low profile .265” mated height for vertical PCB socket mated to right angle wire contact

**Applications:** Military, Test & Measurement





Connecting Innovation to Application®

