

# Cable Selection for Military and Aerospace Applications on the Glenair 38999 Panel-Mount Connector

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## Introduction:

### Samtec's Cabling Solutions

As a global manufacturer of electronic interconnect solutions, Samtec provides a wide range of products such as high-speed board-to-board, cable, micro/rugged, and radio frequency (RF) connectors.

Samtec focuses on serving high-performance military, aerospace, and semiconductor manufacturing industries and provides precision-engineered, future-ready components. This includes a full line of discrete wireline products and standard cable assemblies with thousands of options available for maximum flexibility, and extended capabilities to create a custom solution for design challenges.

### Samtec Solutions from Powell Electronics

Customer-centric service and tailorable solutions are at the core of everything Powell Electronics delivers. Whether clients are choosing from standard off-the-shelf products or need custom solutions, the team provides technologies that fit each project's requirements.

Representatives prioritize meeting customer expectations and keep all parties aligned through every step of the process. With no minimum order quantity, the resources of a large company, and the attentive service of a small one, Powell offers flexibility, reduced risk, fast turnarounds, and the freedom to explore design variations without large production-run commitments.

## Making Connections in Aerospace and Defense

Connectors are critical in aerospace and military missions, enabling communication, engine and flight control, and navigation. They also serve ancillary purposes, such as simplifying electronic product assembly and repair and allowing hassle-free equipment upgrades. To perform reliably, these connectors must be extremely robust, capable of withstanding heat and cold, corrosion, abrasion, and moisture. Samtec's flexible high-speed interconnects and cables, tested through its Severe Environment Testing (SET) initiative and available through Powell, are durable and cost-effective, and integrate seamlessly with military and aerospace navigation, communication, and engine-control systems.

## Technology and Cabling Challenges in Severe Environments

For essential information to flow easily and reliably, military and aerospace cables must not stall or fail during communications, surveillance, or reconnaissance. Extreme temperatures,

moisture, and dust can damage equipment, particularly cables, which may lose conductivity. Extreme cold can turn some materials brittle, making them likelier to break; extreme heat can soften or melt other materials, leading to electrical and electronic short circuits.

Choosing the right cables can mean the difference between mission success or mission failure. Extreme environments also include more than just weather and environmental factors. High-lightning-strike areas and industrial sites with heavy machinery vibrations can produce electromagnetic interference that weakens signal integrity and threatens systems' security and function. Frequent and repeated use, heavy vibrations, and harsh terrain wear mechanically on cable assemblies, sometimes leading to microfractures and shorts. A challenge unique to military and aerospace applications is space-based radiation, the risk of which increases dramatically above 30,000 feet. This radiation can degrade and disrupt electronics and even cause bit flips in a system's memory or programming (turning a 0 to a 1 or vice versa).

To overcome these challenges, military and aerospace cable assemblies must be built with safeguards to meet key specifications.

- **Less weight, more flexibility:** They must be waterproof, light, and flexible for easy movement and consistent function in aviation and portable communications.
- **Fire resistance:** They must be fire-resistant to prevent electrical faults and fires that can threaten aircraft and their passengers.
- **Saltwater and ultraviolet resistance:** They must endure ultraviolet radiation, saltwater exposure, and chemical interactions.
- **Composition:** They must not corrode in harsh, remote environments.

## The Glenair 38999 Panel-Mount Connector

The Glenair 38999 (**Figure 1**) is a rugged, high-performance connector series for aerospace and military cable-to-panel input-output applications. These cylindrical environmental-class plugs, which meet MIL-DTL-38999 military specifications, have receptacles with high-density inserts. They mount on control panels and pair with situation-appropriate cables: cable-to-board, cable-to-cable, and cable-to-panel.

**Figure 1:** Glenair manufactures a wide range of environmental and hermetic class MIL-DTL-38999 Qualified Products List and commercial-type connectors in four series.



Samtec's connector assemblies come in four styles.

- **Series I connectors:** Bayonet coupled connectors that work amid high vibrations.
- **Series II connectors:** Bayonet coupled connectors that work amid low vibrations, moisture, and strong wind.
- **Series III connectors:** These are the most common for military and aerospace applications. They're quick-screw-coupled and work in high temperatures, strong wind, vibration, and moisture.
- **Series IV connectors:** These connectors are breech-lock and lightweight, and handle high vibrations, strong wind, and moisture.

## Choosing the Right Samtec Cable Assembly

The Glenair 38 triple 9, as it's commonly known, is a Defense Department-approved and military-standard connector for use in a wide range of cases. As such, it must be partnered with cables that can help deliver the expected performance and reliability. To achieve that goal, Samtec has developed and offers the **MicroMate™**, **Tiger Eye™**, and **Mini Mate®** cable assemblies for the 38999 panel-mount connector.

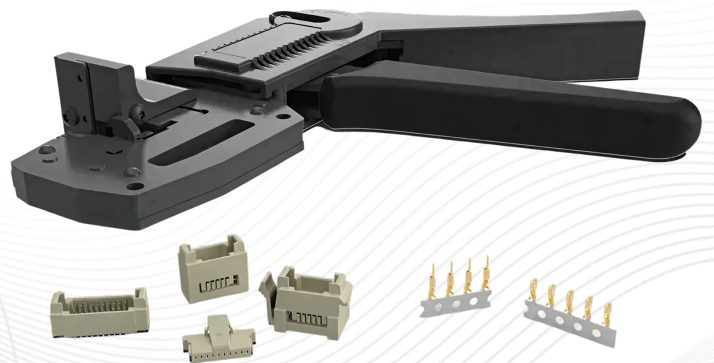
### MicroMate™ 0.0394-Inch (1 Millimeter) Pitch Systems

These discrete wire systems feature crimp-style dual-leaf contacts to connect reliably in cable-to-board, cable-to-cable, and cable-to-panel (**Figure 2**). The panel-mount version fits 0.033-inch–0.09-inch panel thickness. This small size makes MicroMate™ ideal for pairing with the Glenair 38999 and for other aviation or aerospace applications with strict size, weight, and power restrictions.

The dual-crimp connects create two points of contact: one to secure wire insulation and guard against pulling and vibrations, and one to secure wire strands for optimal electrical conductivity. All systems include rugged positive latching to help ensure retention and are available in socket or terminal (single or double row) with wire options including PVC (economical, everyday use) or Teflon™ fluoropolymer wire (high-temp or chemically harsh environments). Full cable assemblies are also available.

**Figure 2:** The tooling accessory and components (ISS1, ISD1/CC09; IST1, IDT1, ISP1, IDP1/TC37) of the MicroMate™ pitch systems.

Source: [Powell](#)



## Tiger Eye™ Discrete Wire Systems

Tiger Eye™ high-cycle, high-reliability connector systems are Samtec’s most rugged, rated to 1,000+ mating cycles in 0.8-mm, 1.27-mm and 2-mm pitches. The heat-treated beryllium copper contacts on the Tiger Eye™ (**Figure 3**) have redundant contact points and adapt to board-to-board, discrete wire and insulation displacement contact cable systems. Shrouded header connectors enclose male pins on the Tiger Eye™, cutting the risk of shocks, electrical shorts, or premature failure and shielding the pins from dust and accidental contact when they’re installed or handled. This helps them work better and last longer.



**Figure 3:** Available Tiger Eye™ components offer build-it-yourself design and application flexibility. Source: [Powell](#)

## Mini Mate® 0.1-Inch (2.54-mm) Pitch Systems

These discrete wire cables and connectors feature individually shrouded contacts, allowing for two to 50 positions. They have keyed polarization, 20 to 30 American Wire Gauge (AWG) PVC or Teflon™ fluoropolymer wire, and deliver up to 4.8 amps in harsh environments.

Teflon™ fluoropolymer resins make cables flexible, allowing them to operate under high temperatures, withstand moisture or harsh chemicals, and avoid cracking from stress. The Teflon™ wire also minimizes signal interference and energy loss so cables perform their best in electronic systems. Polarizing and keying prevents mating mismatches. Polarization allows mating in only one orientation, while its keying uses blanking pins and notches to keep pins properly aligned. All Mini Mate® pitch systems (**Figure 4**) also include rugged metal or plastic latches to help ensure a secure connection. Full cable assemblies are also available.



**Figure 4:** The available Mini Mate® pitch systems components (IPD1/CC79L/ CC79R) and tooling provide application flexibility. Source: [Powell](#)

## Tested for Durability and Reliability

To ensure durability in harsh environments, all three assemblies series have been subjected to and have passed Samtec's SET Initiative, which includes, but is not limited to, tests for dielectric withstanding voltage at altitude and amid electrostatic discharge, temperature shock, and extreme mechanical vibration, and interconnect systems temperature cycling and humidity resistance. This means MicroMate™, Tiger Eye™, and Mini Mate®, have undergone and passed qualification testing for:

**Extended product life:** Evaluates contact resistance and 10-year mixed flowing gas exposure using sulfur dioxide, chlorine, hydrogen sulfide, and nitrogen dioxide for 14 days

**Temperature and humidity:** Tests at 100% relative humidity with 250 mating/unmating cycles over 10 days at +25°C--+64°C

**Connectivity and shock:** Measures connectors for thermal shock, low-level contact resistance, humidity, and mating/unmating forces

**Dielectric withstand voltage:** Ensures no electrical arcs, including altitude chamber tests simulating 70,000 feet

**Electrostatic discharge (ESD):** Exposes connectors to 5, 10, and 15 kilovolts (10 times each) followed by visual inspection

**Temperature cycling and thermal shock:** Tested at -55°C--+85°C for 100 cycles (30-minute dwell), then -65°C--+125°C for 500 cycles (30-minute dwell)

**Non-operating class temperature:** Tested for low-level contact resistance at -55°C--+105°C (100 cycles) and -65°C--+125°C (100 cycles), with retesting after each exposure

**Mechanical shock and random vibration:** Standard vibration and shock tests to measure connector performance



## About the Severe Environment Testing Initiative

Samtec's SET Initiative gauges durability and operability for commercial off-the-shelf plug-in assemblies. Tests involve severe shock, vibration, heat, cold, and humidity. Passing SET tests ensure that cable assemblies for military-aerospace missions and automotive, industrial, and medical applications will save money, enmesh with larger systems, and work reliably above and beyond regular industry standards. Samtec tests its connectors on three levels and developed the initiative's standards using VITA 47.0 through 47.3. VITA 47 standards. The SET Initiative is a safety, quality, and construction gauge for commercial-off-the-shelf plug-ins for mobile uses.

Read our white paper to learn more about Samtec's SET Initiative.

## How to Select the Right Samtec Connection to a Glenair 38999

The Glenair 38999 plugs' size, shape and pin count will determine which Samtec wire assemblies are the best match. Because Glenair 38999 plugs come in different sizes and have different-sized pins, including larger ones for power, smaller ones for signals, Samtec wire assemblies can accommodate multiple pins in multiple configurations for easy integration into any form factor and system.

To better secure electrical ties amid the shocks and vibrations of military and aerospace missions, several Samtec wire assemblies feature screw-down and latch connections. The following steps can help you select the right connection:

1. Select the Glenair 38999 connector you will be using. You need to do this to determine the number and size of the pins you will be connecting to. Note that the size of the Glenair 38999 pins defines the wire gauges that you can use, and there may be multiple sizes on a single connector (e.g., larger ones for power and smaller ones for signals).
2. Based on the size(s) of the desired AWG, use the chart in **Table 1** to select the appropriate Samtec product.
3. Consider the form factor on the cable end opposite the Glenair 38999 connection. Most often, customers look for the smallest form factor that they can use given their wire gauge and the number of pins.
4. Determine other selection criteria including the level of retention. (For example, for military-aerospace applications good retention requires metal screw-downs or metal latches).

Note that multiple Samtec products may be identified as needed during steps 2 through 4

as there can be multiple wire gauges and even multiple wire bundles routing to different locations.

**Table 1:** Specifications for the MicroMate™, Tiger Eye™, and Mini Mate® pitch and wiring systems.

MicroMate™	Tiger Eye™	Mini Mate®
(.0394-inch) 1-mm Pitch Systems	0.80-mm, 1.27-mm, and 2-mm Pitch Discrete Wire Systems	.100-inch (2.54-mm) Pitch Systems
<ul style="list-style-type: none"> <li>• Cable-to-board, cable-to-cable and cable-to-panel</li> <li>• Low profile design down to 3.2 mm</li> <li>• 28 and 30 AWG wire options in PVC or Teflon™ fluoropolymer wire</li> <li>• Up to 40 total crimp-style dual-leaf contacts</li> <li>• Socket or terminal, single or double row</li> <li>• Rugged positive latching for increased retention</li> <li>• Vertical and right-angle mating headers</li> <li>• Full cable assemblies also available</li> </ul>	<ul style="list-style-type: none"> <li>• 24–32 AWG in PVC or Teflon™ fluoropolymer wire; color coded wire available</li> <li>• Single or double ended assemblies</li> <li>• Up to 100 total positions</li> <li>• Shrouded, polarized, and keyed for more rugged applications</li> <li>• Retention latching option for higher withdrawal forces</li> <li>• Optional screw-downs</li> <li>• Full cable assemblies also available</li> </ul>	<ul style="list-style-type: none"> <li>• Individually shrouded contacts</li> <li>• 2–50 total positions</li> <li>• Single and double row</li> <li>• 20–30 AWG PVC or Teflon™ fluoropolymer wire; color coded available</li> <li>• Keyed polarization</li> <li>• Rugged metal or plastic latching</li> <li>• Vertical or right-angle mating header</li> <li>• Sealed version on roadmap for harsh environments</li> <li>• Full cable assemblies also available</li> </ul>

## Conclusion: Securely Connecting the Future of Aerospace and Defense

The right cables mean that communication, navigation, and control systems work as intended and can increase success rates for aerospace and military missions. Severe environment-tested and certified Samtec connectors work reliably in harsh environments, minimize failure risk, and save money long term. Using such heavily tested products instills confidence in engineers and end users.

Samtec and Powell are devoted to helping military and aerospace missions succeed. By partnering, the companies offer a reliable, accessible supply of rugged cable assemblies for Glenair 38999 plugs, including:

- High-quality products that have passed SET
- Full cable assemblies that competitors do not offer

- A full line of discrete wire products including standard cable assemblies with thousands of options available for maximum flexibility
- Customization that can also extend capabilities or meet any design challenge

Securely connect the future of aerospace and defense and experience the benefits of the Samtec and Powell partnership.

## Resources and Next Steps

Visit [www.powell.com](http://www.powell.com) or email a Powell representative at [samtecinfo@powell.com](mailto:samtecinfo@powell.com) to learn more about the Samtec-Powell SET Initiative and how Samtec cable assemblies can elevate your systems.

**Contact an Expert Today!**

### Explore Our Solutions:

- [Military and Aerospace Connectors and Product Applications](#)
- [Samtec Discrete Wire Solutions | Powell Electronics](#)
- [Samtec SET Initiative Whitepaper](#)
- [MIL-DTL-38999 Series I, II, III, and IV Cylindrical Connectors - Glenair](#)