

# 2015

## 3 Reasons to Use Machined Pin Receptacles in Your Connector Design



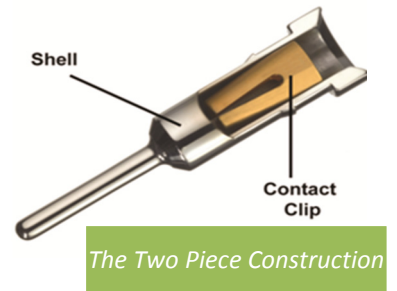
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In the components business, and especially with connectors, price can often be the determining factor as to what product the manufacturer uses. And for a great many mass-market products and applications, the low-cost off-the-shelf, one-piece stamped receptacle fits the bill. The price is right, the performance is adequate. That's why billions of these components are sold every year.

At the other end of the spectrum are products and applications for which the performance and quality standards are much higher because the cost and consequences of failure are much greater. These include medical, military, industrial monitoring devices, safety equipment and other applications considered critical. In these instances, because of its superior quality and performance, the design team should instead consider the improvements in reliability, precision and versatility that may be achieved by specifying a machined pin receptacle

Sometimes referred to as PCB sockets, micro-plugs or connector jacks, machined pin receptacles are known for their reliability and versatility. The two piece construction combination of a precision-machined outer shell and stamped internal finger contact clip provide the flexibility, quality and reliability designers demand for mission-critical applications.

So while price plays a major role in most product designs, there are times when price takes a back seat to other factors. In many cases these factors will dictate the use of machined pin receptacles.



In this white paper we examine several of these factors and highlight three reasons for considering a machined pin receptacle in your next design.

1. **Use machined pin receptacles for making reliable, robust connections in critical applications** – Simply put, when life is on the line, failure is not an option. Medical devices, industrial monitoring devices, safety equipment and defense and aerospace electronics are depended upon every single day. Think implantable insulin devices, defibrillators, medicine delivery pumps and pacemakers. Think night vision goggles, military-grade two-way radios, cockpit controls, and gas detectors. These applications often require a highly reliable connector or pin/receptacle combination that is unique to the equipment and can endure the rigors of the environments to which they are subjected.



Most importantly, critical applications call for machined pin receptacles because a machined receptacle – fitted with a stamped, multi-finger contact that provides an interface with redundant points of contact and a gas-tight connection – delivers vastly superior performance. These contacts maintain their normal and characteristic forces even after extended exposure to shock, vibration and environmental changes. They will function reliably to a

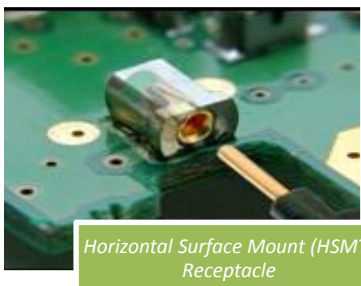
minimum of 1,000 insertion/extraction cycles and usually many more depending upon mating pin size, shape and finish. All while exhibiting no electrical discontinuity greater than 1 micro second when subjected to 10-2000 HZ, 15G vibration, or 50G of shock.

**CASE IN POINT:** A manufacturer of aircraft instrumentation had for years used a stamped beam contact to connect several different components performing various dashboard signal functions. One function related to indicator lights. Primarily because of metal fatigue due to temperature changes, and shock and vibration, these stamped connectors were wearing out. As a result, pilots were getting an error light when there really wasn't an issue, and vice versa. The manufacturer substituted the stamped connector with machined pin receptacles and tested it. The new component proved to be a successful solution and is now being used in production.

2. **Use machined pin receptacles for greater precision, versatility and flexibility in design** – Many connector manufacturers, especially those manufacturing medical cables and interconnects, rely on the precision of machined receptacles for use in their assembly processes, such as insert molding, press-fit or ultrasonic welding.

These processes demand precision-machined contacts to ensure that the diameters, and sometimes lengths, are controlled to very tight tolerances. Otherwise, these manufacturers may find it difficult to achieve the proper fit between the pin and the housing, which can lead to flashing and other assembly issues. With machining, critical tolerances can be held to  $\pm.0005''$  or better, ensuring a proper fit every time.

As discussed earlier, machined pin receptacles are fitted with an internal beryllium copper contact which allows them to have a wide mating lead acceptance range. Traditional stamped receptacle and socket products have a fairly tight range of  $.004''$ . Machined pin receptacles can have a much greater range, generally  $.010''$ , and, in some cases, up to  $.020''$ . This can be extremely valuable when the mating lead diameter varies greatly due to manufacturing tolerances or component changes.



Horizontal Surface Mount (HSMT)  
Receptacle

The versatility and flexibility of machined receptacles is further evidenced by the numerous ways they can be used to accomplish various other objectives. For instance, in making board-to-board connections there are multiple receptacle design styles suitable for robust/power applications on  $.100''$  pitch or greater, as well as for fine pitch down to  $.8$  mm, for low-level, high-speed signal transmission. In addition, SMT and HSMT options offer added design flexibility, allowing I/O and component

connectivity to be fully integrated with SMT circuit board production.

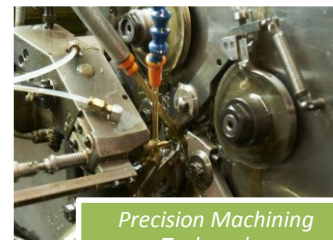
As a final note on versatility and flexibility, machined pin receptacles offer the design engineer dual-connection (solder cup or crimp barrel) capabilities from a single component. In this setup a manufacturer can plug a component or PCB in the “receptacle” end while soldering or crimping a wire in the other end.

These are just a few examples where machined pins and receptacle contacts offer the engineer exceptional versatility and flexibility in meeting design and performance objectives.

3. **Use machined pin receptacles to cut costs and save time when prototyping –**

Precision-turning technology makes low-volume prototyping fast, easy and cost effective. In fact, the cost savings of prototyping using precision-turning technology compared to that of prototyping a stamped part are substantial. Consider that initial tooling costs for building a stamping die can range from a few thousand dollars for simple designs, to tens of thousands of dollars or more for more complex designs. Factor in that it can take as long as two to three months to get the tooling from concept to production. Additional modifications can be costly as well, and can result in longer lead times to get to the final production item. All of this could result in delays in getting your product to market, putting you at a significant competitive disadvantage.

In contrast, using CNC or Swiss precision-turning technology, an efficient supplier should be able to work out a design and prototype your part in a few weeks – in some cases even less. Tooling costs are minimal and pricing for the prototyped components can be quite reasonable. And, of course, if the prototype needs to be modified, that can be done quickly and easily. In addition, since the majority of changes can be handled with modifications to cam sets and/or programs, there is little impact on cost as compared to manufacturing partial or whole die sections.



**CASE IN POINT:** A manufacturer of power equipment needed to pass more current without a significant rise in temperature. The receptacles the customer had been using were made of standard brass but the manufacturer wanted to see if a tellurium copper receptacle shell would achieve its objectives. Consequently, they ordered a prototype. The new receptacles conducted electricity more efficiently and kept the temperature to an acceptable level. After the initial run, the manufacturer went on to buy hundreds of thousands of these receptacles and experienced continued excellence in performance.

## **Summary**

The products being designed today, and the electronics and electronic components that power them, are always evolving. Design engineers are faced with the challenge of designing products quickly and efficiently while accommodating ever-increasing demands for power, signal, and board real estate requirements. For a great many of these products, and for any product performing a mission critical function, the machined pin receptacle warrants strong consideration. Its reliability, versatility and flexibility make it a wise design choice for a wide array of connector systems across a broad spectrum of industries. Below is a listing of some of the features and characteristics that have compelled designers to specify machined pin receptacles in their applications.

- Robust, two-piece construction consisting of a precision-machined outer shell and stamped internal beryllium copper contact
- Selection of shell materials - brass, phosphor bronze or tellurium copper – as required
- Receptacle shell geometries machined to address a variety of termination styles and applications
- Shell and contact are individually plated as required
- Wide mating lead diameter acceptance range
- Low contact resistance
- Gas-tight connection and mating interface
- Selection of higher or lower force contacts for the majority of mating pin sizes
- Options available for high temperature applications via beryllium nickel contacts
- High mechanical life without degradation of insertion/withdrawal force
- Excellent performance under shock and vibration

## **About Stephen Capitelli**

Stephen has a BSEE from the Pratt Institute and is currently the Manager of Product Engineering at Mill-Max Mfg. Corp. He has more than 20 years of experience in the electronics industry designing connectors for PC board applications. He has worked with countless suppliers helping them to source the exact connector for their interconnect requirements.

## **About Mill-Max Manufacturing**

Founded in 1971, Mill-Max Mfg. Corp. is the leading U.S. manufacturer of machined interconnect components with a vertically integrated manufacturing facility headquartered at 190 Pine Hollow Rd., Oyster Bay, NY 11771. Its full product line includes spring-loaded connectors, SIP, DIP, PGA and BGA sockets, board-to-board interconnects and pin headers, surface mount and custom products, PCB pins and receptacles, solder terminals, wrapost receptacles and terminals. The company's complete manufacturing facility includes engineering, tooling, primary and secondary machining, stamping, plating, injection molding, and assembly.