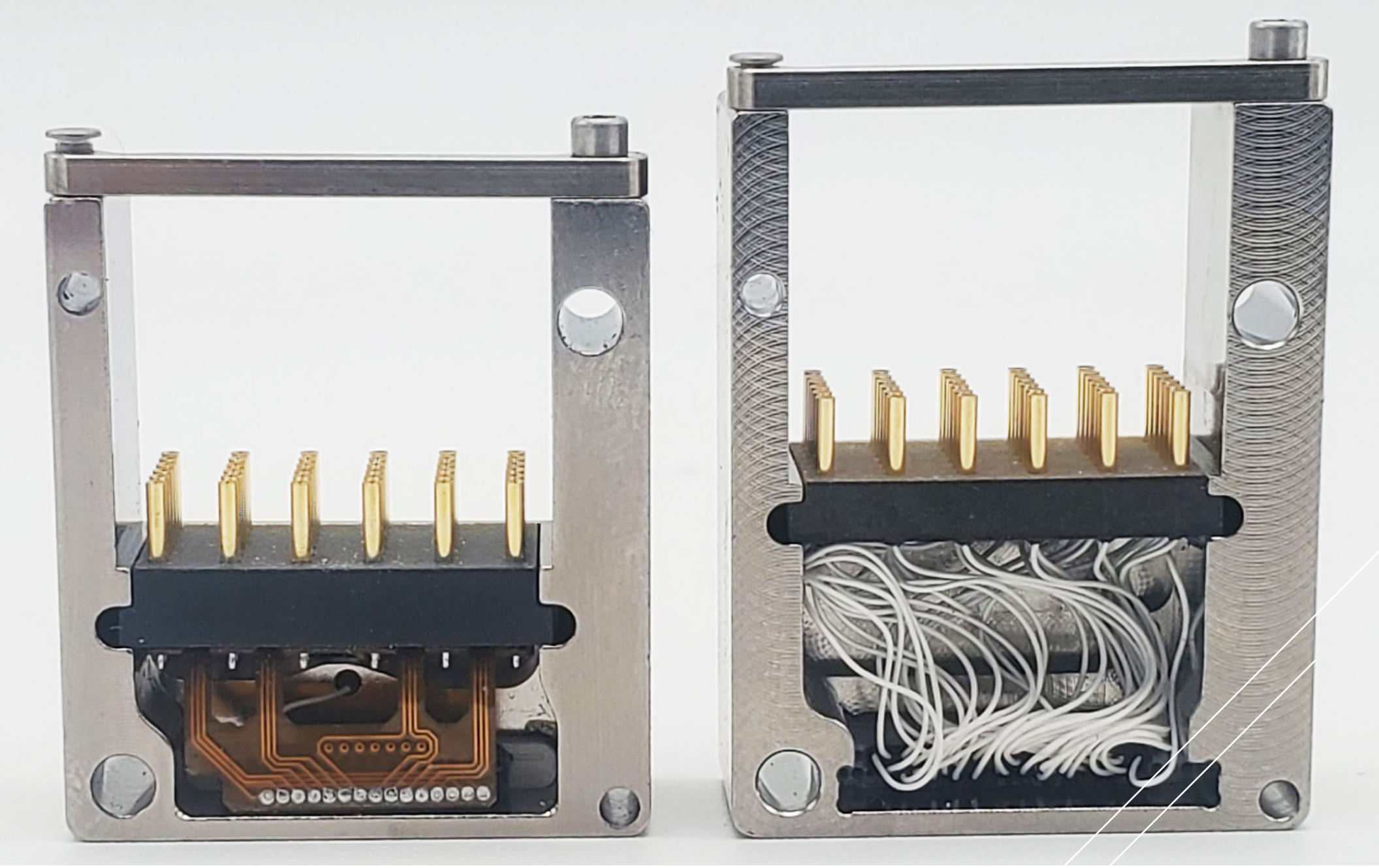


OMNETICS
CONNECTOR CORPORATION

The Difference Between **Flex and Wired Interconnect**

BY SALEEM KHAWAJA

Virtually every electric or electronic product—from a pacemaker or hearing aid to a shipyard crane or oil-well equipment—requires interconnect assemblies. You can find a wide variety of connectors to help make up these assemblies, including Micro-D and Nano-D connectors, Micro Strip and Nano Strip connectors, and circular connectors, all available in a variety of pin configurations.

Size, Weight, and Turnaround-Time Differences

When it comes to interconnecting the connectors, you have choices to make. Wired interconnect has been the go-to approach over the years, but flex solutions now offer key advantages with respect to size, weight, manufacturing turnaround time, quality, and reliability. In your product development efforts, give careful consideration to the trade offs between flex and wired interconnect implementations.

Many projects get started using a wired connector approach. During the prototyping stage, your wiring requirements might change. Beginning with a wired solution saves you the cost of a re-spin on a flex circuit when the inevitable revisions do occur.

During the prototype stage, you also might be able to create a wired interconnect in-house, avoiding the turnaround time that a prototype flex solution would impose.

Keep in mind, most manufacturing and military specifications require the use of proper crimp tooling. If you need to meet such specs and do not have the proper crimping tools in house, you will need to engage a vendor even for wire assemblies, or you could buy connectors with solder cups that can accept your wires.

Omnetics is participating in a project that involves the design of a connector system for a crash dummy and that highlights the differences between wired and flex approaches. In this application, the connector system carries sensor data off the crash dummy to an external data acquisition system for analysis. The interconnect required a connector bridge between a 36-contact Micro connector and 36-contact Nano connector at a right angle.

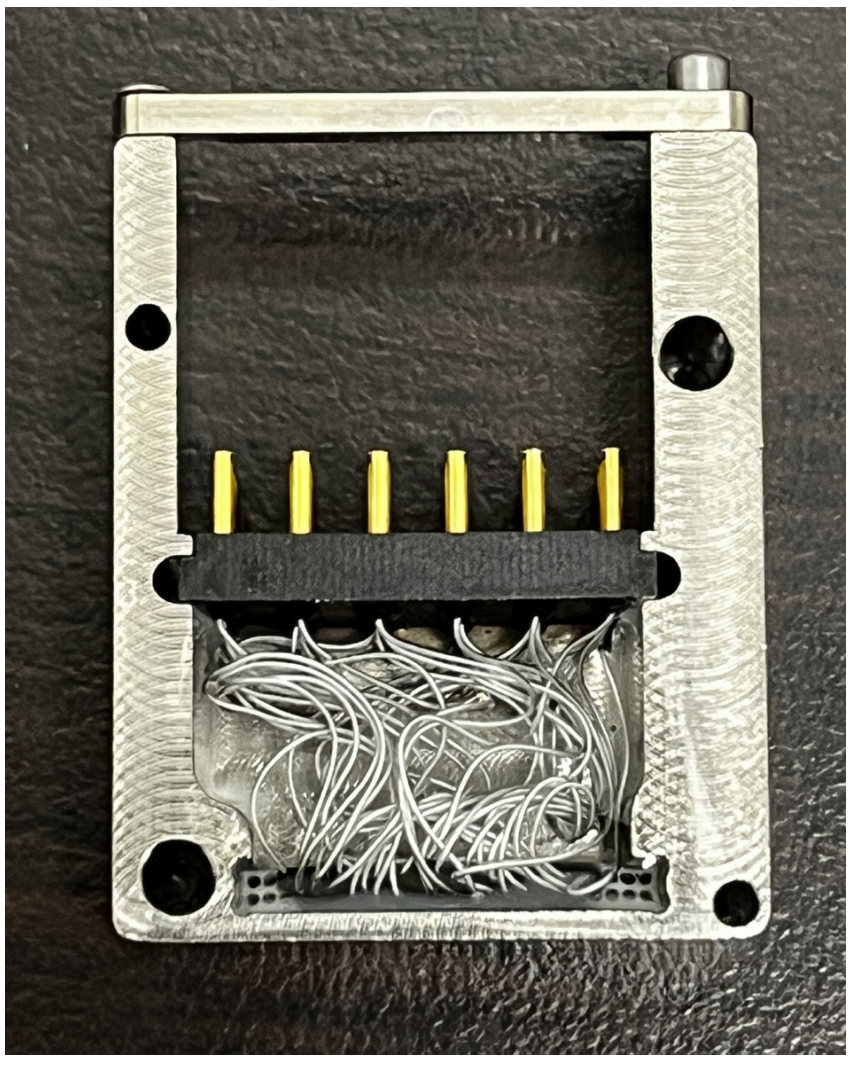


FIGURE 1. THIS MICRO TO NANO BRIDGE INCLUDES 36 ONE-IN. WIRES.

Beginning with a Wired Approach

The design began with a wired approach. The connector bridge initially was made up of 36 one-in. wires, resulting in a total of three feet of wire packed into a very compact space (Figure 1). For the quantities the customer required, crimping and loading those wires took several days. In addition, the connections were not in a straightforward pin 1 to pin 1, pin 2 to pin 2, etc., configuration. That further complicated the fabrication process and increased the probability of misconnections during the manual manufacturing process. All told, completing the Micro to Nano contact wiring for 150 connectors took three days.

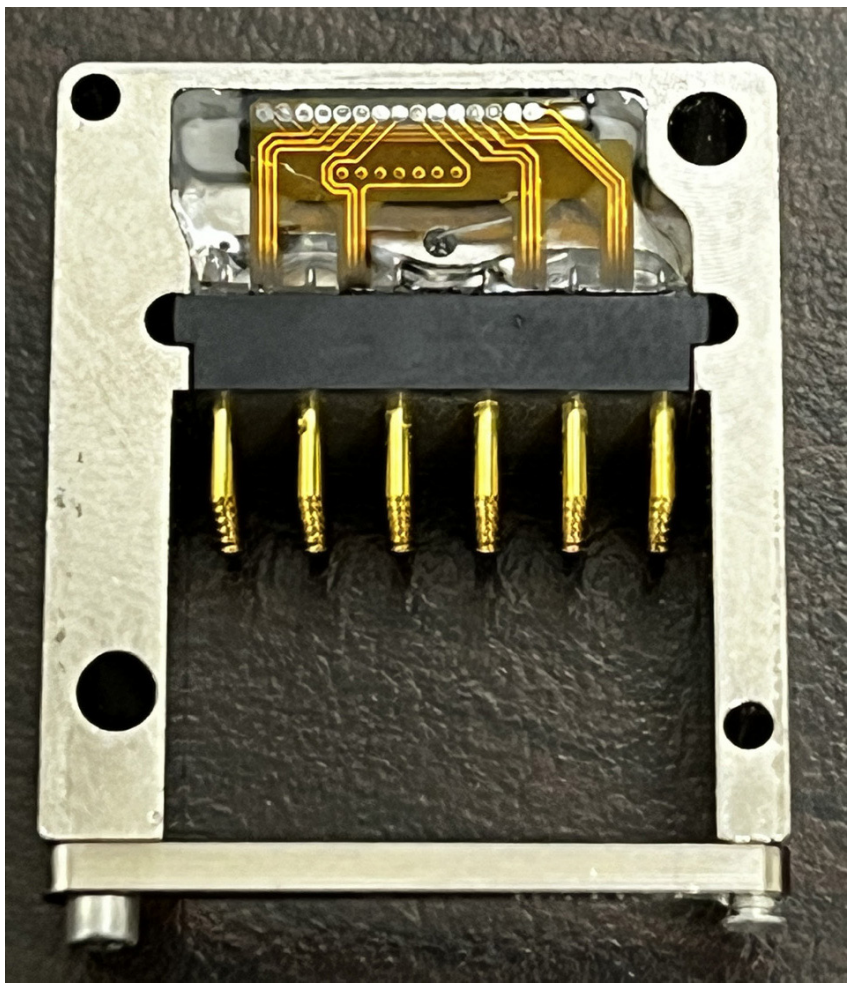
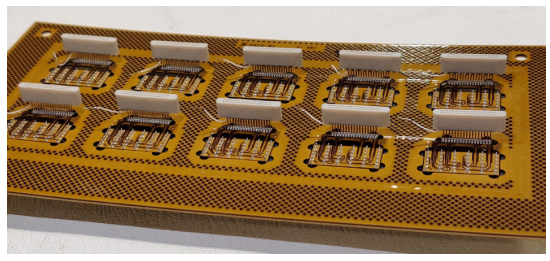


FIGURE 2. THE FLEX IMPLEMENTATION PROVIDES ADVANTAGES FOR THE CRASHDUMMY APPLICATION.

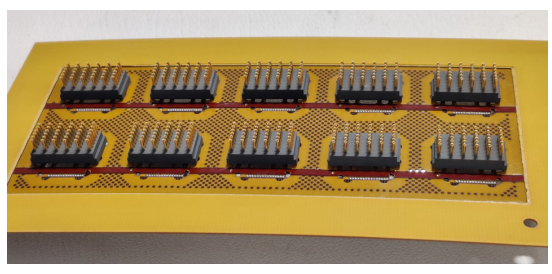
Eliminating Wiring Errors, Speeding Fabrication with Flex

For the crash dummy application, a flex implementation provided compelling advantages (Figure 2). Unlike the wired approach, flex is not subject to manual wiring errors, and it arrives from the vendor 100% tested for continuity and resistance.

In addition, unlike a wired assembly, flex is compatible with standard electronic-product fabrication processes, including through-hole technology pin-in-paste reflow soldering and vapor-phase soldering. For the crash dummy application, Omnetics uses pin-and-paste to solder the through-hole connectors at the same time the surfacemount connectors are soldered. Figure 3a and 3b show the front and back of a flex panel of 10 flex connectors before singulation. Figure 3c shows both sides of the individual terminated flex circuit after singulation.



(A)



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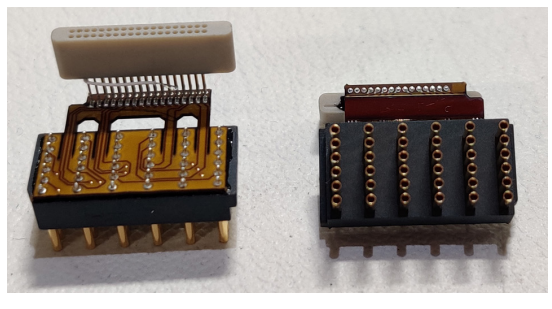

(C)

FIGURE 3. STANDARD FABRICATION PROCESSES SIMULTANEOUSLY SOLDER A PANEL OF THROUGH-HOLE (A) AND SURFACE-MOUNT (B) CONNECTORS BEFORE THEY ARE EXCISED INTO INDIVIDUAL TERMINATED FLEX CIRCUITS (C).

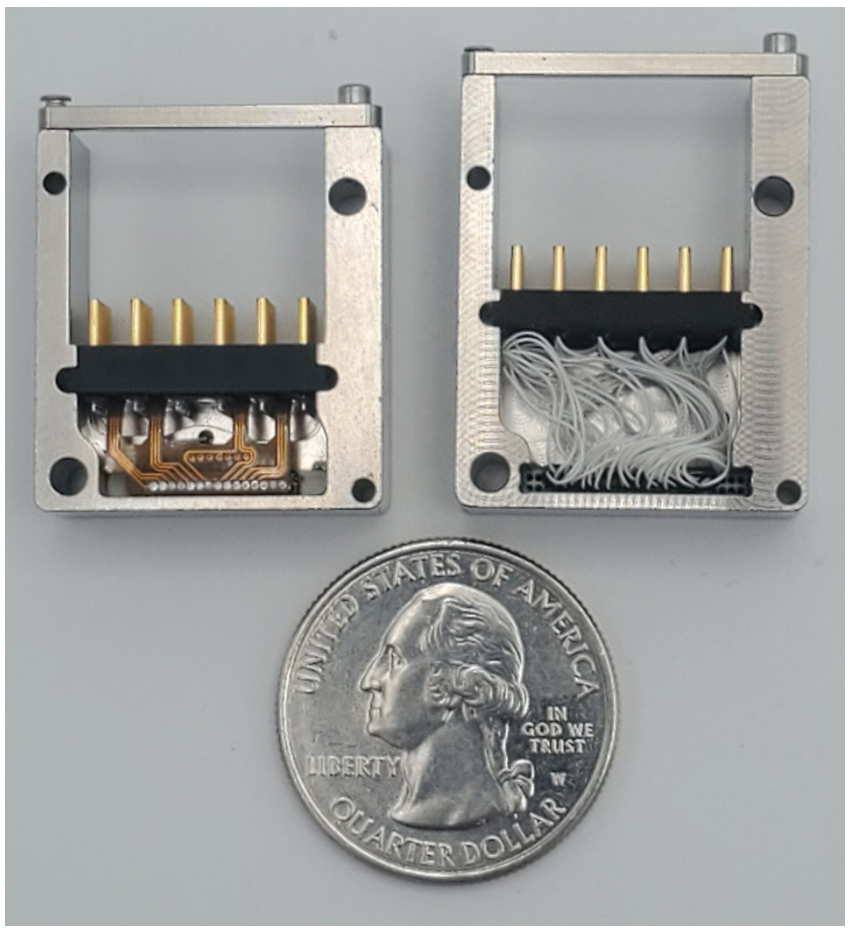

FIGURE 4. THE FLEX SOLUTION (LEFT) IS MORE COMPACT THAN THE WIRED IMPLEMENTATION (RIGHT).

Flex Saves Space Compared to a Wired Solution

Flex also facilitates form factor reduction due to the minimal spacing between traces. In addition, flex differs from a wired implementation in that flex permits the use of smaller housings because flex takes up less space within the housing. Smaller housings not only save space in the end application but also require less machining.

Figure 4 shows the space savings that the flex solution provides for the crash dummy connector assembly in contrast with the wired version. The height of the assembly with flex on the left is about a quarter of an inch shorter than the wired version on the right. In addition, the flex part is 13% lighter than the wired part.

The crash dummy connector employs a Nano housing that accommodates both surface-mount and through-hole fabrication. The Micro side uses through-hole technology, and both the Nano and Micro connectors can be soldered to the flex in a single operation. Use of the flex approach cut the time to fabricate 150 connector assemblies from three days to half a day.

Consider Temperature, Strength Differences

You should take several factors into account for your connector applications. Temperature is key. Many operating environments, such as found in the oil and gas industry, require operating temperature ranges to 200° C and higher, and you can specify flex circuits that tolerate such temperatures. Although companies can build cables with insulating jackets that withstand 200° C, flex can be your most reliable, cost-effective choice.

Strength is another factor to take into consideration. Wire has higher tensile strength than flex, but tensile strength is not of particular importance in an application such as the crash dummy. More important is strain relief, which you can obtain by specifying overmolding for both wired and flexbased connector assemblies.

Conclusion

A choice between a wired or flex implementation often presents itself in the design of electronic products and systems. If you are building a system—a large test station, for example—that will require only a few dozen connector assemblies over its lifetime, a wired approach might suffice. But if you require hundreds of the assemblies per month, wired versions can become cost-prohibitive because of the manual labor and long fabrication time needed to build them. In such cases, a flex assembly that can be fabricated using standard soldering processes can become the clear favorite. Even if you do not require high volumes, you may choose flex for its other advantages, such as light weight, small form factor, and tolerance for shock and vibration. When purchasing connector assemblies, look for a vendor with expertise in both flex and wired cable assemblies. Such a vendor will work with you to make sure you understand the flex vs. wired trade-offs with respect to cost, turnaround time, electrical performance specs, and reliability metrics related to temperature, shock and vibration, and corrosive environments. Omnetics will work with you to identify the optimal solution for aviation, industrial, medical, military, petroleum, and space applications.