This article originally appeared on engineering.com on November 7, 2023.

Better Connectors Can Boost Manufacturers' Efficiency and Safety

By optimizing wire-to-wire and wire-to-board connections, assembly teams can prevent costly connector mating mishaps.

TTI has sponsored this post.

Wires are the arteries of the electronic world. Hidden from view, the complex tangles of wired connections are what keep the electrons flowing in our increasingly smart products.

So how can manufacturers make sure those connections are correct—and stay that way?

The risk of mating error rises as assembly teams fall under pressure to mate more connections more quickly. Not only can this lead to mis-mating and defective products, it also puts an unergonomic burden on operators who could succumb to fatigue or injury.

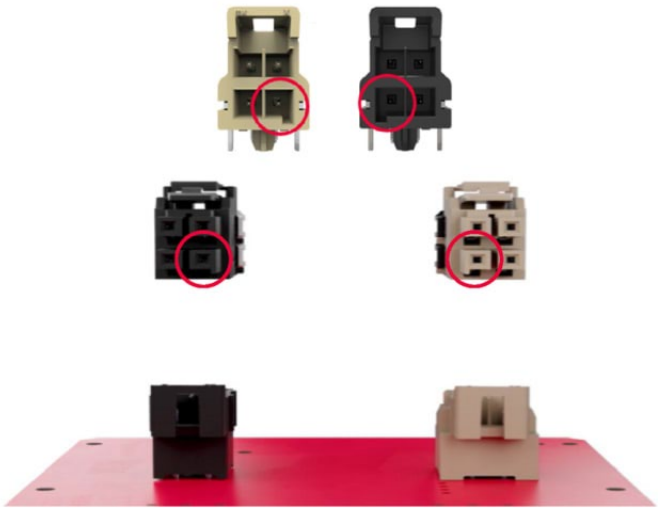
Traditional connector markings and wire colors aren't fool proof, and they aren't enough to keep up with the new demands on operators. But new connector innovations like mechanical keying, color coding, Terminal Position Assurance (TPA) and low mating force can help assembly teams avoid mating mishaps while improving efficiency and safety.

The key to proper mating

When there are a lot of connectors to keep track of overall and with some connectors having the same position sizes and mating interfaces, it's easy to make a mating mistake. Wire-to-wire or wire-to-board connections could be mismatched, improperly oriented or insecurely fastened. Such mistakes can have serious consequences, up to and including end-product failures that leave manufacturers liable.

Thankfully, there are some simple strategies to reduce and even eliminate error. Mechanical keying is one of them. This refers to a connector that's molded specifically to allow one—and only one—type of mated connection.

"Keying really provides that error proofing of making sure that the wrong receptacle can't go to the wrong header," Jim Connors, business development manager at connector provider Molex, told Engineering.com.



An example of mechanical keying shown with Molex Nano-Fit power connectors. (Image: Molex.)

While keying provides a safeguard against mis-mating, assembly operators might still have a tough time finding the right pair. That's a big problem for manufacturing anything beyond low volume production. Color coded connectors can solve

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it, giving operators an immediate visual guide for what to mate where. In tandem, keyed and color coded connectors ensure the correct connection can be made efficiently every time.

"We work closely with customers on the number of keys and colors they need," Connors says. Molex provides a number of connector solutions that are both keyed and color coded—some with up to nine options for each, so even the most complex arrays can be designed for easy assembly.

Color coding in the Molex wire-to-board and wire-to-wired connectors. (Image: Molex.)

Even with all the receptacles and headers in their proper place, there's still no guarantee that the connection has been made securely. Manufacturers that need that extra peace of mind can find it with Terminal Position Assurance (TPA).

"Terminal Position Assurance is a secondary optional piece that can be put on the housing after contact insertion to make sure that that contact is fully seated in place," Connors explains.

Think of it like a deadbolt on a closed door. TPA is an extra mechanism that won't lock in place on the housing unless the contacts are fully seated in the housing. Not only does this offer the operator assurance that they've done their job properly, it also ensures that the contacts will not back out later on in the manufacturing assembly process, in testing, in shipping, or in the operation of the product.

"It can be basically an insurance policy to make sure that contact is fully seated and aligned properly," Connors says.

Though it's slightly more expensive and requires one additional part for assembly, TPA is an increasingly popular option for critical applications where the consequences of contact backouts / connector failure are worse than the added costs.

Making an ergonomic connection

As assembly teams are tasked with making ever more connections, it's important to prioritize their comfort and safety. Assembly operators continuously work their hands and fingers, often dealing with small parts that may be hard to access comfortably. All this can leave the operator fatigued. Worse, it can leave them with injuries, like tendonitis and carpal tunnel syndrome, that result from poor ergonomics. Under these conditions, mistakes and assembly times can easily multiply.

Again, proper connectors can offer a simple solution. Reducing the force required to make connections reduces the strain on assembly teams.

"We're trying to offer a lower mating force contact… to provide for more effective and efficient assembly of those connectors," Connors says. Molex offers several connectors with tin plating, which Connors says enables up to a 40% lower mating force than a standard contact. Some connectors even have a gold plating, which lowers the mating force even further.

Certain Molex connectors, such as the Nano-Fit series, provide both tin and gold plating options, though most manufacturers limit the use of gold plating due to its higher cost. Connors says that Molex is exploring ways to minimize that cost while retaining the advantage of gold's low mating force for future products.

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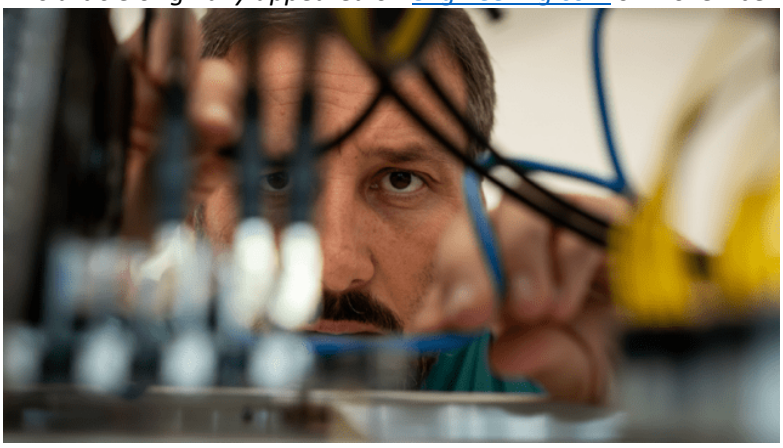

Connectors with a low mating force help ensure operators can work safely and efficiently. (Image: Molex.)

Another helpful connector improvement is to ensure operators have ergonomic push points that they can use when making connections. Molex looks for ways to eliminate sharp edges on the connector housing. It also designs locations on connector features that operators can easily grip with their fingers "so they can actually grab the connector and mate it easier on a regular basis," Connors says.

The importance of the right connection

Wires are an inescapable part of nearly every manufactured product. By optimizing connector design, manufacturers can improve the accuracy, efficiency and safety of their assembly teams. Ultimately, better connectors make for happier employees and better end products.

"With the dense growth of electronics in a wide variety of applications, we're trying to figure out how we can solve this for the future," Connors says. "So adding colors, adding keys, making sure that there's error-proof assembly, and making it more effective and efficient for the operator."

To learn more about Molex connectors, visit TTI.