

# HARWIN

## SEVEN CONSIDERATIONS TO FUTUREPROOF CONNECTOR SELECTION

### IN INDUSTRIAL AND EMBEDDED SYSTEMS

The nature of industrial and embedded systems has changed significantly in recent years with equipment afforded less space and operating with tighter tolerances under harsher conditions. These factors, coupled with the increased data volumes from the rise of IoT, mean the integrity and durability of data connectors have in many cases become critical.

What hasn't changed, however, are the strict cost pressures these systems are created in.

As such, the choice of connectors is a vital consideration in system design and one that needs to fit not only today's needs but – given the rapid evolution happening in these sectors – also takes into consideration future needs too.

Here John Feaster, Product Manager, BBi Connectors from the connector specialist Harwin examines seven key considerations related to data connectors that system developers need to take into account in order to future-proof applications without blowing the budget.



## 1 - VIBRATION

Industrial environments are now increasingly characterized by machinery operating in closer proximity than would previously be the case. This means that today's monitoring and automation systems are exposed to greater levels of vibration, particularly from motors and other heavy equipment.

Connectors must be able to withstand these conditions to maintain reliability and while historically the nature of the equipment (especially when cost was also factored in) meant such concerns were not seen as critical, vibration resistance is rarely a luxury that can be overlooked.

High-reliability (HRI) connectors do exist – for example Harwin's Datamate – and these are able to remain operational in even the most extreme environments. However, these are also often beyond the price constraints of most industrial and embedded systems.

However, for many connector developers that have undertaken the process of developing such ranges, the learnings gained, and techniques implemented in the development of these HRI devices are making their way down to industrial connectors too.

As an example, Harwin's Kontrol range of connectors is designed for high vibrational stress and components are tested to withstand 20G for 12 hours. Features like shrouded pins and secure latching mechanisms can also help in maintaining a secure connection in the presence of vibration.

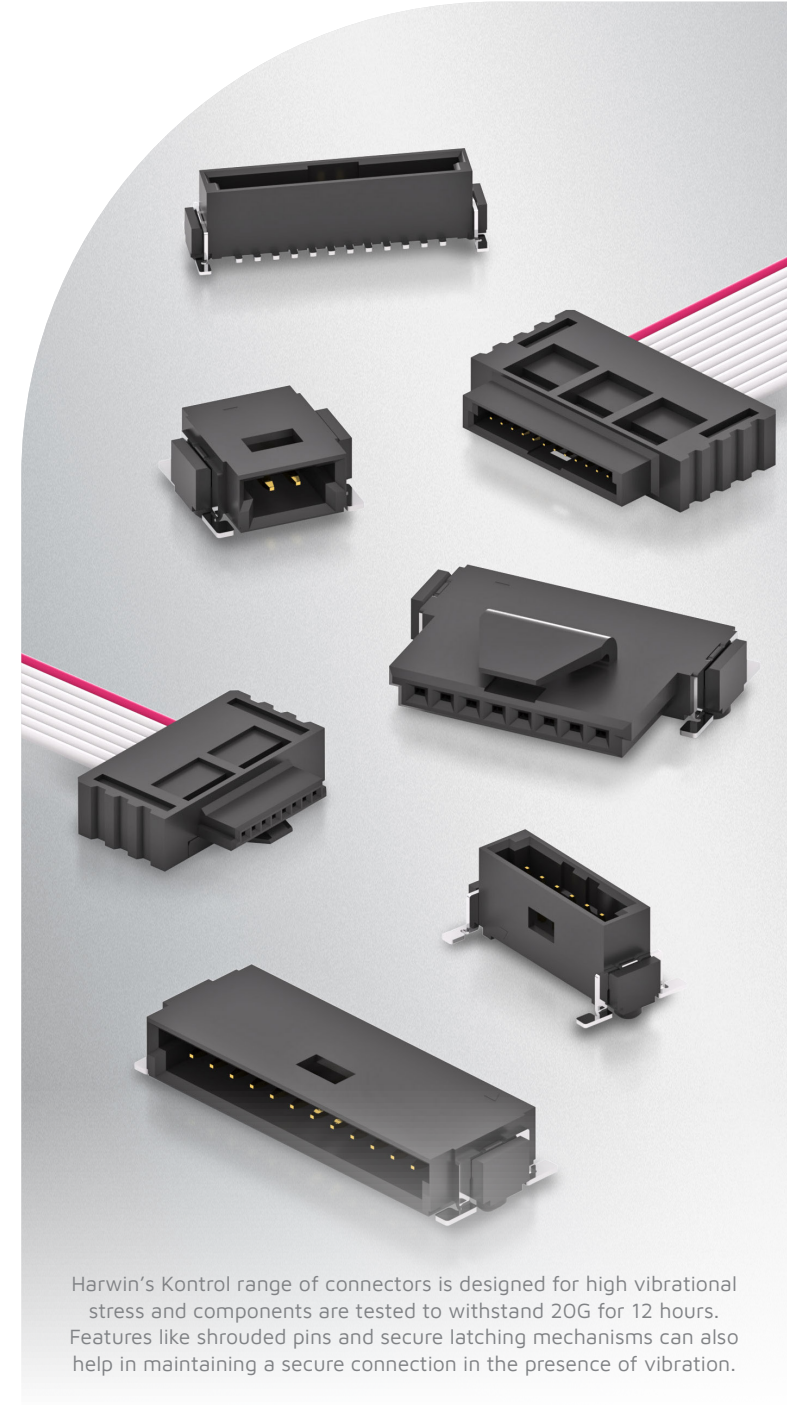
## 2 - SIZING

As touched on, space in modern systems has become premium. The trend is towards miniaturization, with a drive to pack more functionality into smaller spaces. This creates a demand for connectors that are smaller, with a lower profile. Additionally, this trend also applies to the pitch of the connectors, enabling more connections in a smaller connector.

Like vibration resistance, the techniques developed to miniaturize the high-end systems are also working their way down to industrial connectors.

However, while miniaturization remains vital, smaller connectors is not the only way to achieve this and designers need to consider the overall system, for example can the number of pins required be reduced?

Alternatively, mixed layout and hybrid connectors offer another way to shrink the design at the system level, combining power and signal options into a single unit and thereby reducing the total number of required connectors.



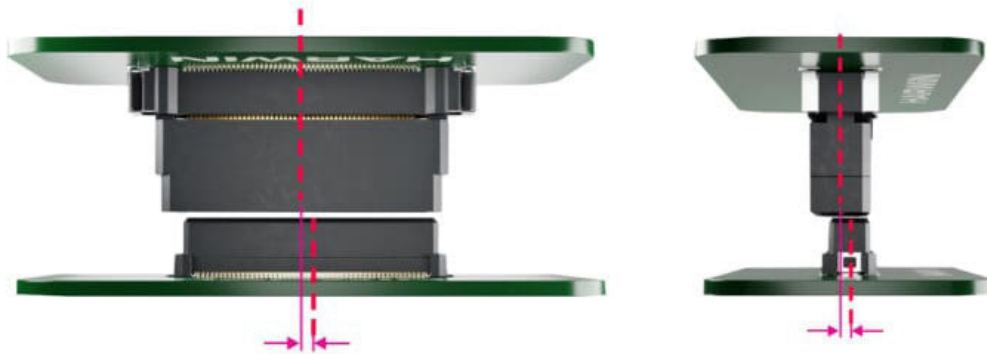
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### 3 - DESIGN COMPLEXITY

At this point, it should be noted that the use of smaller connectors that have minimal pitches can demand higher accuracy on the PCB manufacturing and lead to increased failure if not perfectly aligned – especially when multiple matings cycles will be undertaken (see below).

By reducing the total number of connectors on a board, we reduce the risk of misalignment of a single connector pair and therefore increase the tolerance afforded to the design.

This isn't the only way to solve this problem, and recent advances have led to the creation of floating connector ranges that build in additional tolerances while also combining power and signal connectors on a single unit. For example, Harwin launched its [floating connector range, Flecto](#), in March 2024, and these fine-pitch, high-pin-count board-to-board connectors are able to withstanding up to  $\pm 0.5\text{mm}$  misalignment in both the X and Y axes to give greater alignment tolerance alongside high-speed data transmission, mixed signal and power options.



A new generation of floating connectors are enabling misalignment to enable greater manufacturing tolerances in the X and Y axes – shown is Harwin's Flecto floating connector, which enables up to  $\pm 0.5\text{mm}$  of misalignment



## 4 - ELECTROMAGNETIC INTERFERENCE (EMI)

As equipment is placed more closely on a factory floor, and as more (and more complex) electronic systems are introduced to these industrial settings, the risk of electromagnetic interference (EMI) also increases, which will disrupt the operation of sensitive electronics and affect signal integrity.

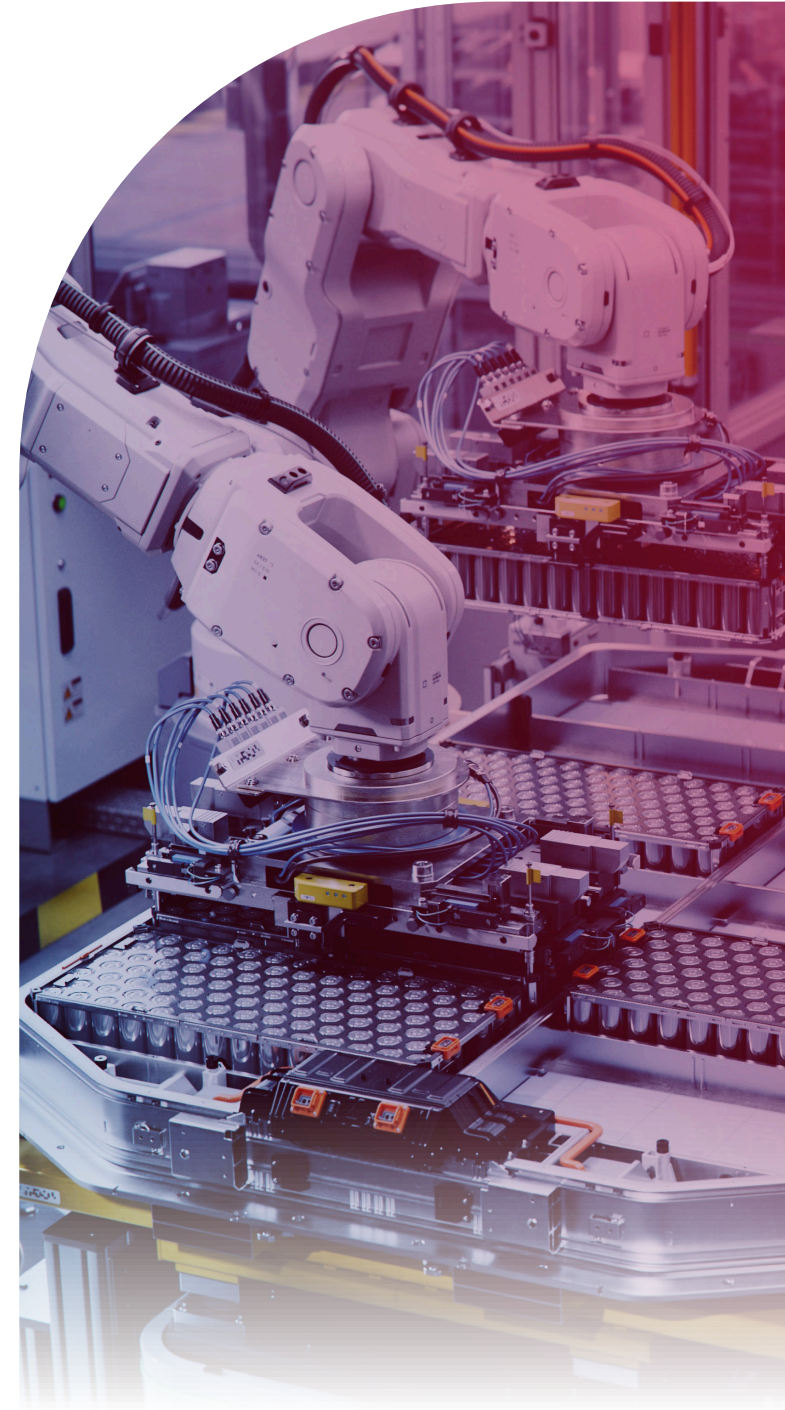
In order to futureproof systems, designers need to consider the future environment in which these systems will operate and the noisy EMI environment in which they'll work, taking steps to mitigate not only current but future EMI levels they will encounter.

It may be that the layout permits a standard board-to-board connector, such as Kontrol, to be used, however designers can also consider the use of backshells and braided cable assemblies to mitigate future EMI.

## 5 - DATA RATES

With the rise of the industrial IoT, modern applications now require higher data transfer rates, and this will continue to rise. The data being generated therefore needs to be thought about, be it through the implementation of higher data rate connectors, or through the introduction of edge processing to reduce the data being transmitted.

Either way, designers should not only consider what their future data transmission requirements will be, but also (because the data rate achieved is based on the circuit layout, not just the connector) verify the stated performance of a connector in the specific layout being implemented.



## 6 - MATING CYCLES (DURABILITY)

Another trend that needs to be considered is the increased number of mating cycles that these connectors are now needing to undergo.

Designers should calculate the likely rate / number of matings that will be required during the life and determine if a standard commodity connector is suitable, or if a dedicated HRI model is needed.

It should be said that, like for vibration resistance, techniques developed for HRI ranges – which can undergo exceptionally high levels of mating and unmating – are making their way into lower-priced connector ranges from the more advanced connector suppliers.

For example, Harwin's Kontrol range of connectors are rated to 500 mating cycles, which is very high for an industrial component.

## 7 - SUPPLY CHAIN RELIABILITY

Finally, designers should consider the supply chain in order to future proof systems. For example, many developers are already putting in place dual sourcing of components.

But on supply chain reliability a trend that is once again rearing its head and that is trustability of the supplier. Recent years have seen a rise in counterfeit and low-quality parts being misleadingly sold, as well as a number of websites listing products and "taking orders" for stock they don't have and never will.

When placing orders, customers need to be careful not to fall victim to scams and we recommend steps are put in place to verify the relationships between the component manufacturers and the distribution partners actually exist. In short, seek to work with reputable distributors.

Like many, Harwin uses a franchised distribution model with ECIA standards in place to prevent fraudulent or counterfeit parts, for example listing [distribution partners listed on the website](#) as well as on [TrustedParts.com](#) and any company that claims to be a partner that isn't on these lists should be avoided.

