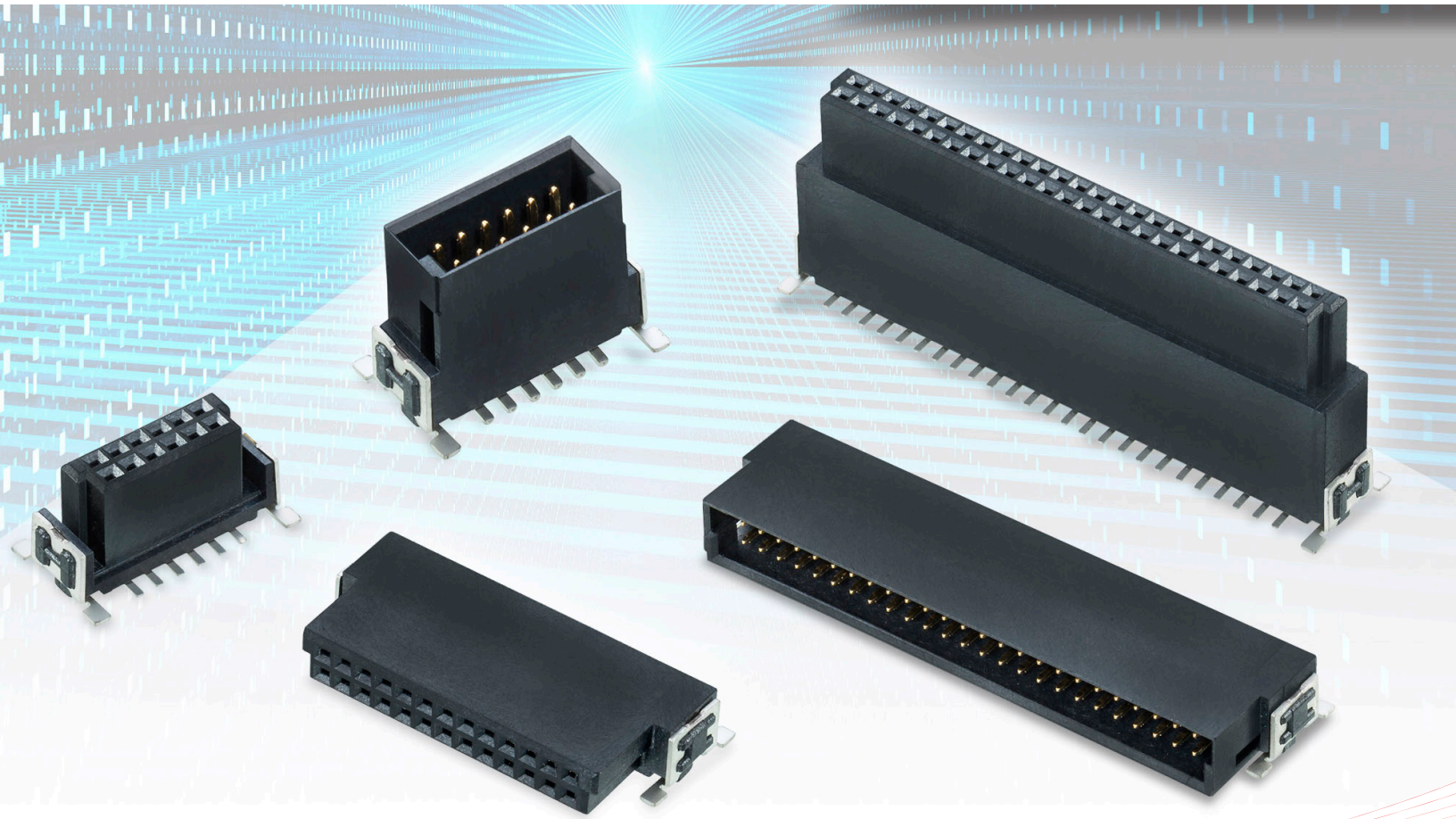
Rugged Connectors
for Durable Industrial Use

What is a rugged connector?

A rugged connector is a connector designed to withstand more than a static, stable environment. It might have to contend with a variety of environmental conditions. These is no specific definition of a rugged connection, but typical factors include:

- Vibration
- Physical Knocks
- Exposure to Heat or Cold
- Inaccurate and/or repeated mating

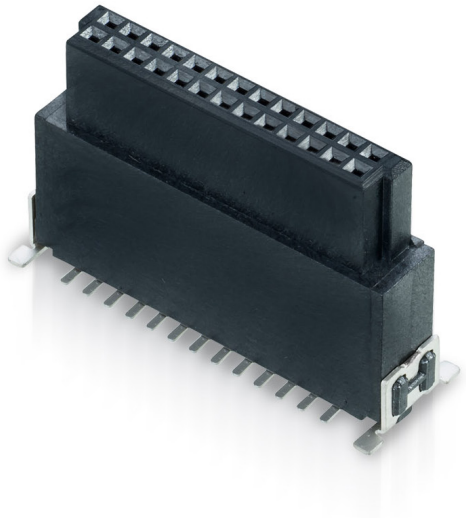
Your application will determine how crucial, and how extreme, these factors are likely to be. Often military and aerospace applications demand more extreme ruggedness. Unfortunately, products designed for these markets come with a price to match their extreme requirements. Industrial applications, such as factory machinery, also require a certain level of ruggedness, but not as extreme – and commercial expectations are also much tighter.



HARWiN

An example of an industrial connector

Harwin's Archer Kontrol is an excellent example of this type of connector. It is rugged enough for industrial use but also commercially viable. This system is designed to address each of the factors highlighted above, and we'll cover these points in more detail to help with your choice of the right connection.



Vibration

Think of a piece of factory automation – often lots of moving parts, all generating movement within the machinery itself. Vibration is a constant issue for almost all equipment outside of the office area.

Vibration is bad for your mated connectors because it can cause the mating surfaces to become temporarily disconnected. Female (socket) connectors with two points of contact are more desirable in these conditions, so that one surface of the contact stays in contact with the male pin.

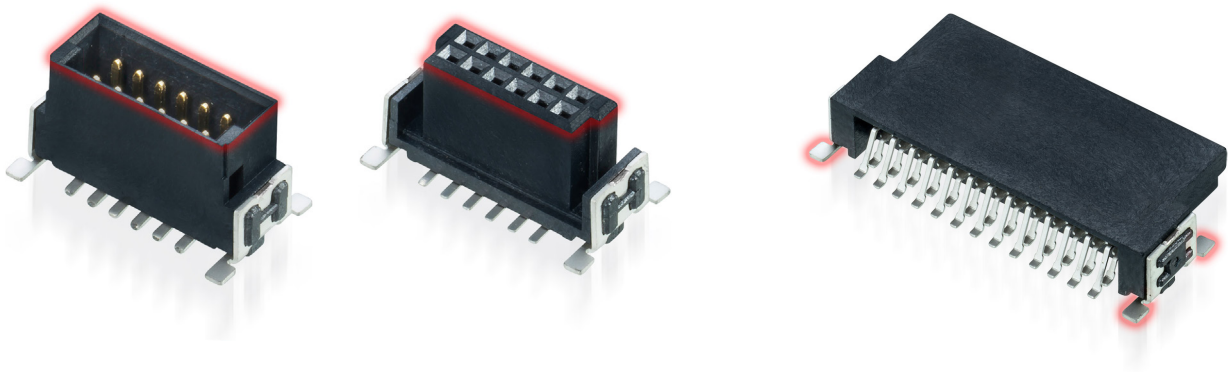
Look for a connector tested to an industry-recognized standard (such as EIA-364-28D, condition IV) which requires the products to show no electrical discontinuity within a 12-hour test period. During the test, the mated products are subjected to vibration frequencies cycling from 10 to 2000Hz, over an amplitude of 1.52mm. The acceleration on the connectors is 196m/s^2, equivalent to 20G (20 times the force of gravity).

Although this is a laboratory test, it is a good indicator of the typical vibration levels found within industrial applications.

Physical Knocks

Accidental damage can happen at any time during the life of an electronic device. It could be on initial build, regular maintenance, or even whilst in service if the electronics are not fully enclosed. Although we've not tried driving a fork-lift into the side of the product, it will resist smaller bumps. Both male and female connectors are designed to fully shroud the contacts, in both mated and un-mated conditions. Both contact designs also have the ends of the contacts recessed behind the front face, so anything placed on the top surface does not touch the contacts.

For soldering to the PCB, both male and female connectors are fitted with strain relief surface mount hold-downs. These "feet" add to the area of surface mount pads soldered to the PCB, which increases the amount of force required to pull the connector off the PCB. It's important that the soldering method used gives good strong SMT solder connections to these hold-downs as well as the contacts.



Exposure to Heat or Cold

Although some countries enjoy temperate climate or air-conditioned factories, this is not always the case and even factory machinery can be subject to higher or lower temperatures. Archer Kontrol is rated to an operating range between -55°C and +125°C. Thermal shock testing is carried out to EIA-364-32C Condition III, cycling 10 times and spending 30 minutes at each extreme. It is also tested to EIA-364-17B, Method A, which subjects the connectors to 125°C for 96 hours. In all cases, connectors are visually inspected, and the contact resistance before and after does not exceed 35milliohms.

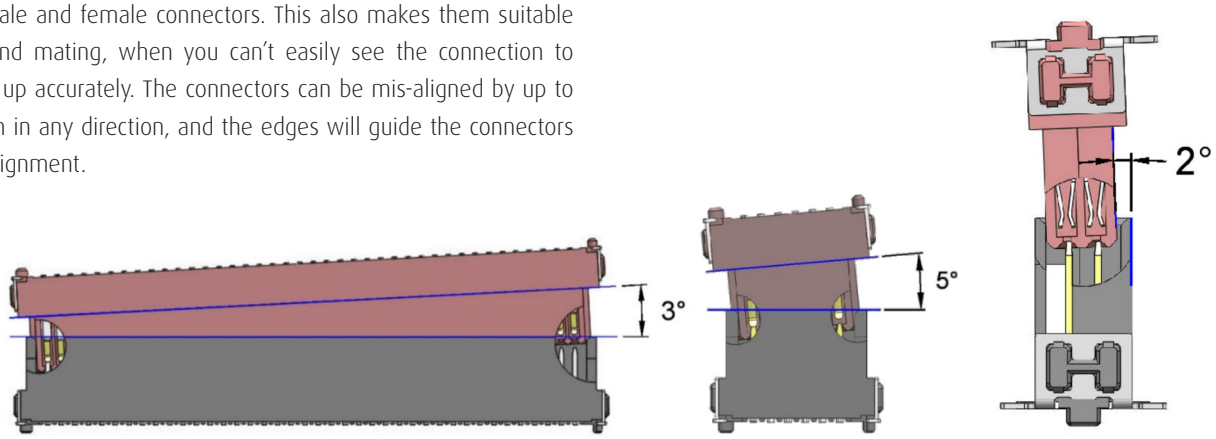
This exceeds the levels normally seen on a basic pin header and socket connection, which is typically rated up to 105°C.

Mating Tolerance

Firstly, let's address the actual number of mating cycles, called durability. This is the minimum number of times that a connector can be mated and unmated. Archer Kontrol is rated to 500 operations – other non-rugged designs might only achieve 30 to 300.

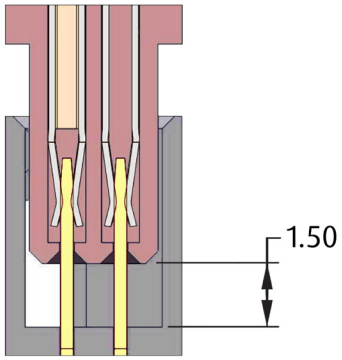
The shrouded design, and the style of contact used, allows for inaccurate or mis-mating. Connectors are guided together into the correct mated position by the design of the leading edges on both the male and female connectors. This also makes them suitable for blind mating, when you can't easily see the connection to line it up accurately. The connectors can be mis-aligned by up to 0.7mm in any direction, and the edges will guide the connectors into alignment.

If you don't quite get the mating straight and vertical, this can cause damage to the contacts. Archer Kontrol will also accommodate angled misalignment, up to 5 degrees along the length and 2 degrees along the width. Again, as the connectors are pushed together, the shrouded design pulls them back into alignment.



These considerations are very useful when modules are replaced or maintained in the field, especially if customers are allowed access to these connectors.

A final feature of the design is that these connectors do not need to be fully mated for full performance. They can be separated by up to 1.5mm, giving more scope in designing board-to-board mating distances. This also compensates for the connectors not being fully mated during servicing or customer intervention.



Should I choose Archer Kontrol?

As with selecting any connector for your design, you first need to understand the important criteria your design must meet – both electrical and environmental. We have a whitepaper that gives an overview of the selection process, to help with your thought process. Once you have chosen your specifications, you then face the task of searching through connector offerings to find one that meets your requirements.

Archer Kontrol is designed with industry in mind, so it's a good place to start your investigations if that's your market. Our Experts are happy and willing to advise on your requirements, give more detail on Archer Kontrol, or suggest other products from the Harwin range if something else is more suitable.

Want to talk to someone?

If you would like to talk to someone about Harwin's product, technical knowledge or documentation, contact one of our Experts for assistance.