



Rugged board-to-board connectors for harsh applications

Industrial and process automation as well as railroad technology require specific product solutions



Board-to-board connectors for applications in industrial and process automation as well as railroad technology must have a long service life under extreme environmental conditions. The connectors must also be robust against misuse during installation and minimize human error as a factor by allowing for considerable tolerance compensation.

Industrial and process automation as well as railroad technology are among the fields of application for board-to-board connectors requiring specifically tailored product solutions. These must ensure fully reliable functionality including with respect to the following criteria:

- **High shock and vibration loads**
- **Permanent and cyclic temperature loads**
- **Corrosive atmosphere (harmful gas, humidity)**

Due to the increasing integration of functions and the associated increase in the number of signals within electronic devices and the trend toward a modular design, the secure connection of several connectors on one PCB is necessary.

To meet these requirements, ept has developed the Zero8 product family with a robust and innovative plug-in system: ScaleX.

Zero8 product family with ScaleX plug-in system

Commercially available connectors are designed according to the classic female and male multipoint connector concept. The new functional principle involves a gender-neutral plug-in system: Each mating pair has both a blade and spring contact, and contacting is accomplished by means of two contact points.

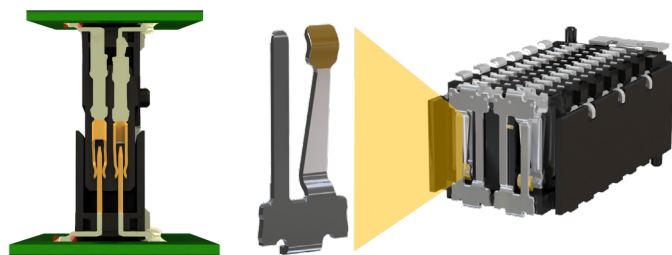


Figure 1:
Classic connection concept -
gender neutral

With the classic female and male multipoint connector concept, a contact point may become disconnected under mechanical load or due to vibration and shock conditions. With ScaleX connection technology, the disconnection of contacts is not possible due to the design; under all conditions, contact between both connection points is always intact.

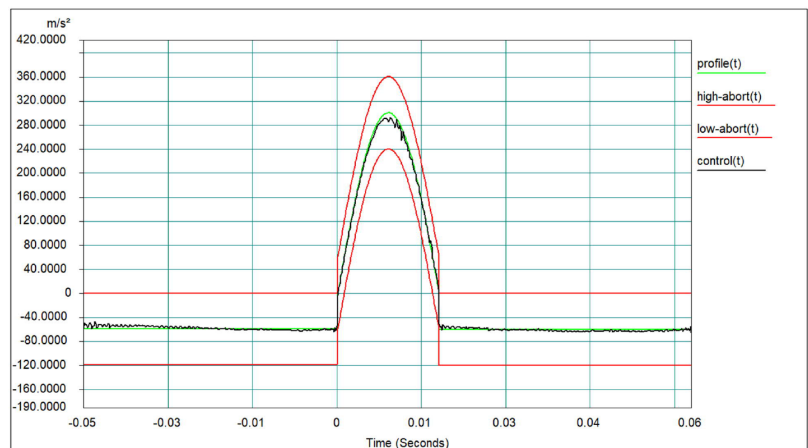
Contacting on homogeneous rolled surface

Unlike conventional systems, contact is prevented from occurring at the non-homogeneous, sharp blanking edge, which would lead to increased frictional wear on the surface. This prevents corrosion of the contacts in a harmful environment and increases the vibration and shock characteristics.

The vibration properties of the Zero8 connectors have been certified for a frequency range of 10–2000 Hz in accordance with the IEC 60068-2-6:2007 standard. The shock properties have been confirmed at an acceleration of 50 G in accordance with IEC 60068-2-27:2008. In addition, the vibration and shock properties have been verified in accordance with railroad standard DIN EN 61373:2011-04.

Figure 2:

Diagram of the shock profile according to DIN EN 61373:2011-04



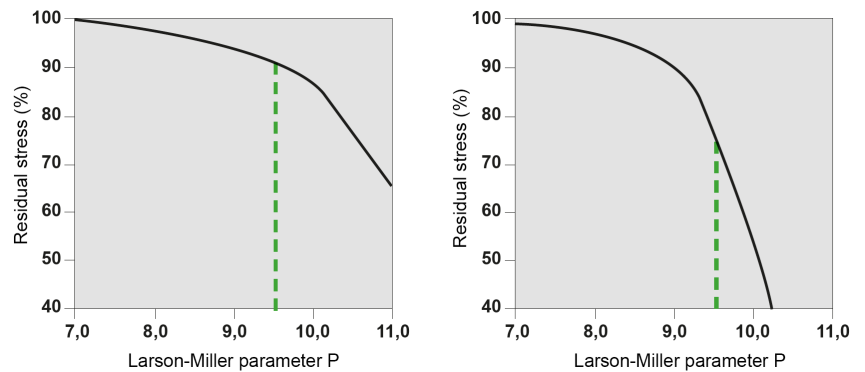
Copper alloy CuNiSi for enhanced spring properties

Instead of the classic CuSn6 material, one with better spring properties was selected as the copper alloy: CuNiSi. Under high temperature loads and with constant temperature cycling, the copper material may loosen up after a certain service life and no longer have the required spring force for a secure connection.

The Larson-Miller parameter can be used to determine the residual stress dependent on time and temperature load: At an internal device temperature of 85 °C, the copper material may reach a temperature of up to 115 °C under the defined rated current. The Larson-Miller parameter of 9.5 is equivalent to 3 years of temperature stress at 115 °C.

In the case of contact material CuNiSi, a residual stress of more than 90 % remains after this thermal load, whereas in the case of classic CuSn6, a residual stress of just 75 % remains.

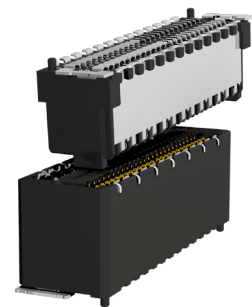
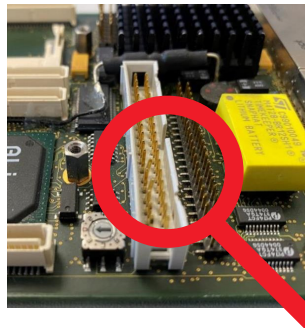
Figure 3:
Thermal stress relaxation
Larson-Miller parameter CuNiSi
- CuSn6



Contact protection according to the Koshiri concept

The contacts are arranged protected in the insulator material according to the Koshiri concept, thus preventing deformation of the contacts during installation. With the classic male and female multipoint connector concept, incorrect operation during installation is one of the biggest causes of faults. This can lead to enormous costs if the entire assembly has to be scrapped or the connector replaced in a costly rework process.

Figure 4:
Classic male multipoint
connector - deformed contacts
due to incorrect operation /
contact protection Zero8



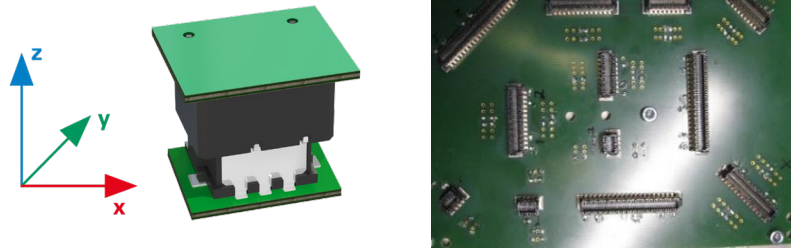
High tolerance compensation including in mated state

In addition to the high tolerance compensation during installation, the ScaleX connection concept also ensures optimum tolerance compensation in the mated state of 0.4 mm in the x and y directions, and up to 2.3 mm in the Z direction. This also allows the installation of multiple connectors on one PCB.

ept has verified 500 mating cycles with 12 connectors on one printed circuit board according to DIN EN 60512-9-1:2010-12 in an accredited laboratory.

Figure 5:

Tolerance compensation in mated state / test board with 12 Zero8 connectors

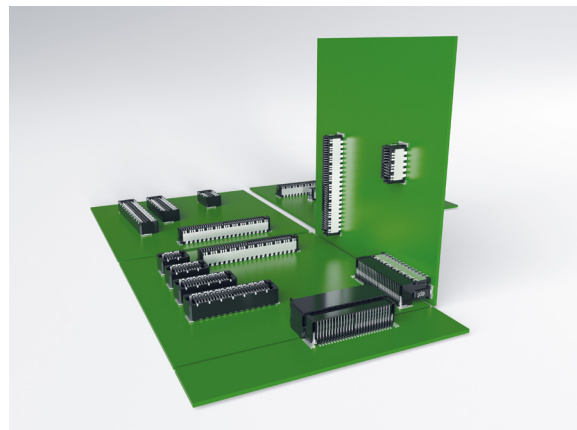


The ept Zero8 product family for demanding industrial applications

The Zero8 product family from ept has been specially developed for demanding industrial applications, offering maximum scalability: Developers can customize types, stack heights and pole counts to meet their individual requirements. Socket and plug are currently available in mid-profile and low-profile versions and will also be available in high-profile and angled versions in the future. Due to the different heights, Zero8 connectors can be used to achieve board spacings from 6.00 mm to 21.00 mm - the number of poles requestable can vary between 12 to 80.

Figure 6:

Zero8 product family



But that's not all. Hardware developers also have a choice when it comes to shielding. Both sides of the connector pair with or without shielding? Or even just one side with shielding? The decision is up to the developer - all Zero8 connectors are in any case compatible with each other and can be freely combined, whether with or without shielding.

Written by: Martin Adamczyk, Product Manager; Irina Lew, Head of Marketing; ept GmbH