

PRESS RELEASE

4-Pair Power over Ethernet: Contact Quality is Decisive

RJ45 contacts reach their physical limits / Critical case: Disconnecting under load / Constructive measures prevent quality defects and signal losses

By Matthias Gerber, Market Manager LAN Cabling at R&M

Wetzikon, January 28, 2016. Miniature lightning display: This would be one way of describing the spark formation that occurs when a live contact is opened. To use Power over Ethernet (PoE) as an example, this could happen when the LAN connector is pulled out during operation. In terms of physics, the effect can be explained using the inductances on the current path: The current does not suddenly change, it simply wants to continue flowing. For those who are not electrical engineers, we can use another example: An inert mass can be accelerated with caution using a fragile object, but if the object is to be used to bring it to a sudden standstill, this leads to fragmentation.

In principle, sparks may also occur during connection, if the contacts bounce before creating a permanent connection. With Power over Ethernet, this is prevented because the supplying device "negotiates" with the terminal equipment to be supplied. The electronic power supply uses resistance measurement to determine if the terminal device requires PoE at all, and if so, to which power class it belongs. Only then does the corresponding current start to flow. With the new 4-Pair Power over Ethernet (4PPoE), with a power of up to 100 W, this power level can reach up to one ampere per twisted pair.

The active equipment electronics, however, are unable to anticipate when someone will pull out the LAN connector. In this case, the disconnection takes place under load, which leads to a breaking spark (Image 1). An extremely hot plasma is produced in the vicinity, which can damage both the nearby connector and the socket contact.

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Under the microscope, this "loss of contact material" appears in the form of an actual crater.

During reconnection, the contact is restored. However, the contact quality and the resulting data transmission reliability are no longer ensured. It is possible to ensure that the LAN electrical supply is shut down before disconnecting, by following the operating instructions. However, in practice, there is always someone who will simply pull out the connector.

Manufacturers such as R&M use constructive measures to tackle this problem. R&M designed the RJ45 connector contacts and the gold-coated spring-loaded contacts of the connection modules in such a way that the breaking points lie far outside the nominal contact area. This means that when connected, they do not interrupt data transmission. The contact's gold coating ensures a low level of contact resistance and, as a result, minimal dissipation in the connection: It does not grow hot. R&M therefore recommends that all planners and installers working with PoE-compatible networks also watch out for these kinds of issues that do not necessarily appear in the manufacturer's data sheet.

R&M has extensively researched the effects of PoE on the plug connectors, in particular the damage caused by spark formation, and co-authored an IEC technical report on this subject (IEC TC48B: "The effects of engaging and separating under electrical load on connector interfaces used in Power over Ethernet (PoE) applications"). This document introduces the concept of the nominal contact area. During the connection process, the contact point moves between A and B along the surface of the contacts from the first contact point (connection/separation area) to the end contact point (nominal contact area). These two areas are separated by the grinding zone (Image 2). In other words, the zone in which the contact is broken and in which the sparking may occur must be separated from the zone in which the contact between the connector and the socket is created in normal operation (nominal contact area).

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Research showed that modular RJ45 connectors typically fulfill this requirement and comply with the standard IEC 60603-7. As a result of flexibility in implementation, however, this is not always guaranteed. It is therefore up to the manufacturer to ensure that this requirement is fulfilled through a specific contact design. The special design of the contacts used with R&M's RJ45 sockets ensures the largest possible distance between the separation area and the nominal contact area, both at the socket and the connector.

The IEC 60512-99-1 standard introduced a testing procedure that can check the PoE-compatibility of RJ45 connectors. A further document is set to describe a test that checks the suitability of connector systems for future 4PPoE variants. This document is currently being drawn up by the IEC TC48B committee. In order to ensure a PoE-compatible RJ45 connection, both the IEC 60603-7-x (in the corresponding category) and the IEC 60512-99-1 must be specified. This must be taken into account during planning, operation, and maintenance of a structured cabling solution.

In the White Paper "4PPoE – Parameters for Network Planning," R&M provides information on the physical backgrounds that must be considered when working with cabling for PoE applications. R&M's "Power over Ethernet" website provides network planners and installers with practical tips and tools, such as the "PoE Calculator":
<http://www.rdm.com/de/co/produkte/power-over-ethernet.aspx>

About R&M

R&M (Reichle & De-Massari AG) is a world leader in the manufacture of future-proof products and systems for communication and data networks. Pioneering connectivity solutions are produced in close collaboration with certified partners for the LAN, Public and Telecom Networks, and Data Center sectors. The core values of the Swiss family company are innovation, quality, and customer focus. Further information can be found at www.rdm.com

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Images

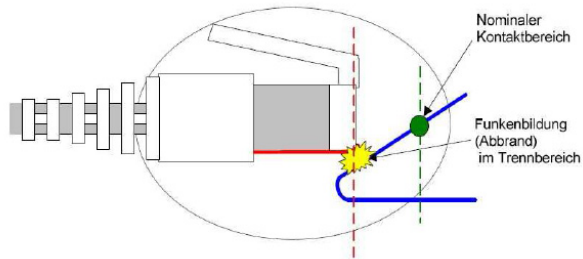


Image 1: RJ45 connector contact with a connection module spring-loaded contact. Well-designed models ensure the nominal contact area is not too close to the first/last contact point. Diagram: R&M

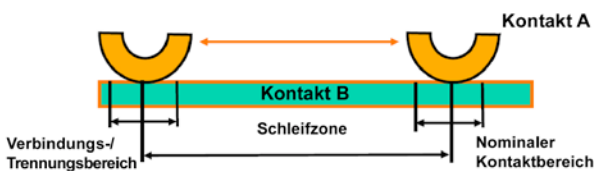


Image 2: The layout of the nominal contact area. Diagram: R&M

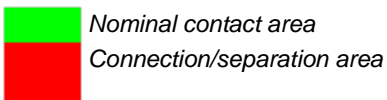
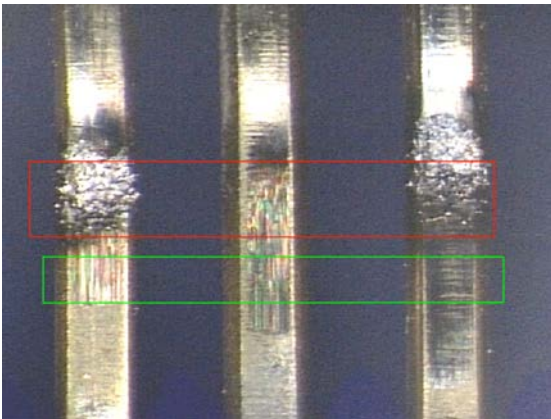


Image 3: Example of a good contact design that ensures the damage does not affect the contact zone (no overlapping of nominal contact area and connection/separation area). Photos: R&M