

PV connectors: proven interchangeability

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Attention to detail builds trust. And trust builds best results – Stäubli Electrical Connectors guarantees high and safe performance as well as reliable operation even in extreme local weather conditions.

With the steady growth of solar power and the increase of PV plants worldwide, a new series of PV modules, suitable for 1500-Volt systems, is on the rise. The higher demand for the latest, '1500 Volt ready' generation of PV connectors from Stäubli Electrical Connectors, raises the question of the interchangeability of the new MC4-Evo 2 with the Original MC4.

Along with the growth of the worldwide demand for energy and the need for replacing fossil fuel energy generation technologies, the renewable energy sector added 176 GW of power generating capacity globally last year, accounting for 72 percent of all power expansion during that period¹.

¹ IRENA: *International Renewable Energy Agency*
<https://www.irena.org/>

Main drivers behind this growth are the trend toward decarbonization and the overall electrification of appliances and industries. Solar energy contributed with more than 60 percent to this rise as it was able to generate a cost-competitive solution in regard to the needs. Important technology innovations and cost reductions accompany and support this market

development that experienced a steady but very fast rise during the last 10 years.

A 1500-Volt PV system design offers investment cost benefits over traditional system designs in large-scale PV plants. This leads to an increase of 1500-Volt systems being implemented during the last couple of years. With this voltage increase, the legal possibilities within the low-voltage directive



are fully exploited, and efficiency can be increased to the maximum possible, including all components such as modules, inverters, cabling and connectors.

Based on this extended application range, Stäubli Electrical Connectors also experienced a higher demand on its latest PV connector line MC4-Evo 2. This connector is the logical further development of the broadly well-known Original MC4 PV connector from Stäubli and is especially designed for the use with 1500 Volt PV technology under all global relevant PV standards.

The MC4-Evo 2 PV connector is internationally certified according to IEC, UL, JET. MC4-Evo 2 is suitable for use in harsh environment such as ammonia and salt mist atmosphere. Further requirements such as IP68 or resistance against UV radiation are

fully met. Like all Stäubli connectors, the MC4-Evo 2 has been thoroughly challenged in company-own extended test sequences and independent third-party certification bodies. Some of these test procedures and criteria go beyond the thresholds given by UL or IEC. This guarantees high and safe performance as well as reliable operation even in extreme local weather conditions, such as high and low temperatures or strong winds, throughout the product's lifetime. The core element within MC4-Evo 2 connectors ensuring safe and loss-free power transmission is the unique Stäubli contact technology MULTILAM.

Stäubli's expertise guarantees reliability

With a proven track record of more than 330 GW of installed PV capacity, amounting to almost 50 percent of the global cumulative PV capacity, Stäubli has more than 25 years

of experience in this field. This long-standing expertise was incorporated in the development and the design of the newer generation of PV connectors: The Stäubli engineers carefully selected the respective materials with regard to performance, safety and quality to provide stable and long-term operation of the PV connectors without showing any signs of corrosive effects or degradation.

Given the situation that the 1500-Volt module technology is more and more well established in the fast-growing PV industry, it is possible that both types of connectors are found within the same PV plant, the Original MC4 as well as the MC4-Evo 2. As recently addressed by James Patterson of the Australian Clean Energy Council (<https://www.ecogeneration.com.au/connector-confusion-highlights-solar-industry-grey-areas/>), there are sometimes



Original MC4 and MC4-Evo 2 from Stäubli Electrical Connectors - for a safe and reliable connection.

uncertainties in the fields, whether a connection between MC4 and MC4-Evo 2 connectors is authorized.

Interchangeability of Stäubli PV connectors

As the manufacturer of both lines of PV connectors, Stäubli has paid attention to the need for interchangeability and confirms that the Original MC4 from Stäubli can be mated with the MC4-Evo 2. This interchangeability between MC4 and MC4 Evo 2 is not only part of Stäubli's manufacturer declaration, it is also part of the compliance documents and certificates according to IEC 62852 and UL 6703. However, at this point it is important to understand that MC4 as well as MC4-Evo 2 are part of a company-owned brand: the connector design belongs entirely to Stäubli and does not represent an industry standard or technical requirement related to the PV market. A very common misunderstanding in the industry is that whatever connector product is called MC4 would conform to the Original MC4 from Stäubli. But there are on the one hand substantial quantities of copycat products on the market, named MC4, and on the other hand the non-awareness that there is only one Original MC4. The one designed and manufactured by Stäubli Electrical Connectors.

Stäubli also grants no design licenses to third parties or similar from the Original MC4. There are many characteristics to distinguish an Original MC4 from Stäubli from a copied product. Two quickly recognizable indications are the color of the O-ring as well as the shape and design of the cap nut. However, if there is an uncertainty about the origin of a connector, Stäubli is always prepared to support users in this matter.

Only mate connectors from the same manufacturer

To ensure the safety of PV plants, it is crucial to know and understand the technical impacts when installing and mating components from different origins. It is also of high importance to follow relevant regulations as well as international and local installation standards. Stäubli strongly supports the local directives that prohibit the coupling of connectors of different manufacturers. Positive examples of such directives can be seen in Australia or Switzerland. In both countries, the national regulations ask for connectors to be of the same brand and product family. Even if

insulator bodies of socket and plug might physically match when mated, there is a strong risk that the two parts do not fulfill their function throughout their life-time.

Environmental influences might affect the live parts inside and lead to safety hazards. Incompatibilities of plastic materials and different quality levels could lead to a damaged connection. When it comes to metallic parts of different origins, it is even of higher complexity. Design and quality of the parts vary heavily between manufacturers.

Different properties, intermetallic phenomena and complex long-term interactions will lead to a damaged connection and a safety hazard in the PV system. Besides being not compliant to the described standards and regulations and a performance loss through massively increased contact resistance in the connection, a severe risk of fire and safety for operators will arise. In the aftermath of a negative event in a PV system, intense and cost-consuming legal issues will have to be resolved as liability questions will have to be answered.

If during installation and commissioning the situation arises to interconnect an Original MC4 connector from Stäubli with an MC4-Evo 2, we can confirm a safe and reliable connection between these two products from Stäubli. This is underlined by third-party certification from UL and TÜV Rheinland. Long-term efficiency, stable grid connection and return on investment of the PV system are again guaranteed by paying close attention to the small details, compatibility and quality requirements of the manufacturers.

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Proven interchangeability of Stäubli PV connectors – Original MC4 can be mated with the MC4-Evo 2.