

Small Junction Box for Photovoltaic Panels

1. SCOPE

This specification contains guidelines for the assembly, installation and fitting of the Small Junction box, and connection parts to customer solar panels.
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2. NOTES

The application of TE Connectivity Small junction boxes on the Solar panel as well as the installation of the Solar panel is not part of the scope of services offered by TE Connectivity. In addition, TE Connectivity does not offer a warranty for Solar boxes with integrated solar cable assemblies if those cable assemblies will be exchanged or unfixed after delivery from TE Connectivity. A cable extension has to be made at the coupling end of the cable (plug connector) and only with TE Connectivity components. If single connectors or solar junction boxes without attached cable are delivered by TE Connectivity, the mounting of the cable is also not in the scope of services offered by TE Connectivity. This is also the case for subsequent mounting of diodes or jumpers. The assembly location and assembly procedure have to agree with JEDEC standard JESD22-114F.

3. APPLICABLE DOCUMENTS

- TE Drawing: 2270285, Small Junction Box
- TE Product Specification: 108-18955, Small Junction Box
108-137077, PV4-S Connector
108-106122, PV4-PM Connector
- TE Application Specification: 114-137077, PV4-S Connector
114-106122, PV4-PM Connector
- TE Model Code Specification: 404-74000-1

4. MODEL CODE

The side-printed model code on the box describes the configuration of the box as well as components used.

For this specification, the junction boxes are marked as follows according specification 404-74000-1:

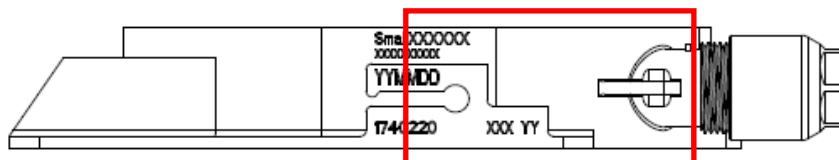


Figure 1: The connection box shown with Model Code (for reference only)

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5. CLEANING PRODUCTS

Cleaning products which can erode the plastics (connector and Junction Box) must not be used. We recommend the use of soft cloths moistened with Isopropyl alcohol for cleaning.



You must not use oils or lubricants of any type or other materials that are not stated in this specification.

6. GENERAL INSTRUCTIONS: HANDLING, SAFETY AND CLEANESS

Any type of exposure to contaminants (dust, humidity etc.) can negatively affect the system with regards to its functions, over the duration of use. This applies especially to the functionality of the connector seals and crimped contact connections. Therefore, during assembly, it is necessary to ensure a careful and clean processing environment.



During storage, transportation and installation, it is necessary to protect the non-inserted contacts against contamination from dust or moisture. Connectors should be protected with the appropriate recommended dust caps prior to being fully connected.*

7. INSTALLATION GUIDELINES FOR JUNCTION BOXES ATTACHMENT TO THE PV MODULE

The following application technical instructions are made as guidelines. These instructions do not excuse the user or installer of the SOLARLOK boxes from independently testing the adhesive tapes or silicone glues to determine the suitability for their proposed assembly process and application.

7.1 Contents

This section describes the gluing of Small connecting boxes onto the rear side of the solar modules with the goal to secure the product in accordance with this specification. This technique may be used on either glass panels or glass/Tedlar panels.

7.2 Assembly aids

Only adhesives approved by TE Connectivity can be used.

Adhesive materials other than those stated under 7.2.1 must be independently tested and verified by the customer at their own responsibility.

7.2.1 Single component silicon adhesive

- Dow Corning Type 895, black, for the rear glass side (No TUV approval)
- Dow Corning Type 744, white, for the rear side of the foil (No TUV approval)
- Dow Corning Solar PV 804, neutral adhesive (see Dow Corning data sheet regarding the suitability for the material of the rear side of the panel), listed in TUV Rheinland certification
- Base coat (primer) (optional), for example General Electric SS 4179 (No TUV approval)

7.2.2 Adhesive foil



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- Double-sided adhesive foils: apply per the valid material manufacturer's instructions for processing.
- The customer should independently test and verify the suitability of using adhesive foils on panel surfaces that are not entirely flat.

7.3 Equipment

The recommended adhesive is typically provided in cartridges. Refer to supplier's application instructions for adhesive applicator and application.

7.4 Supporting products for assembly and safety

- Guns for spraying from the cartridge
- Gloves, soft and clean cloths
- Cleaning product isopropyl alcohol
- Spatula, brush
- Weight, for example a piece of metal with an approximate weight of 1kg

7.5 Approved components by TÜV Rheinland

- TE Connectivity diode F1200D 108-106119
- TE Connectivity diode SL1110B 108-2444
- TE Connectivity diode SL1200B
- TE Connectivity diode SL1515B 108-106133
- TE Connectivity connector: PV4-S1b40 (b= M(ale) or F(emale)) TÜV Rheinland cert.: R 60148776
- TE Connectivity connector: PV4-S0b40 (b= M(ale) or F(emale)) TÜV Rheinland cert.: R 60148776
- Stäubli Electrical Connectors AG: PV-KBT4/xy-UR & PV-KST4/xy-UR
- TE Connectivity, cable PN 2270245-x, 4 mm2 (12 AWG), TÜV Rheinland cert.: R 50504531 & R 50504536. Type designation: SLKC1B4.
- TE Connectivity, cable PN 2270260-x, 4 mm2 (12 AWG), TÜV Rheinland cert.: R 50504531 & R 50504536. Type designation: SLKC0B4.
- TE Connectivity, cable PN 2270245-x, 4 mm2 (12 AWG), TÜV Rheinland cert.: R 50504531 & R 50504536. Type designation: SLKC1B4.
- TE Connectivity, cable PN 2270260-x, 4 mm2 (12 AWG), TÜV Rheinland cert.: R 50504531 & R 50504536. Type designation: SLKC0B4.
- Kunshan Byson Electronics Co., Ltd., cable PN 6352D, 4 mm2 (10 AWG), TÜV Rheinland cert R50404890 & R50357489.
- Changshu JHOSIN Communication Technology Co., Ltd., cable PN DPN4012A09_REV.A/6, 4 mm2 (10 AWG), TÜV Rheinland cert R50413335 & R50325448.
- Krempel backsheet AKASOL® PTL 3 HR 1000V
- DUNMORE backsheet DUNSOLAR DS 475
- DUNMORE backsheet DUNSOLAR DS 450
- DUNMORE backsheet DUNSOLAR DS 375
- Dow Corning Type PV804

8. SAFETY INSTRUCTIONS

Before beginning the junction box attachment process, obtain, review and follow the manufacturer's material safety information.

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The use of appropriate gloves and eye protection is required throughout the attachment process. Ensure adequate ventilation at all times during the attachment process. Refrain from eating, drinking or smoking in the vicinity. Do Not expose to open flames.

When working with silicone adhesive:

- Avoid contact with eyes. If eye contact occurs, rinse for a period of 15 minutes and seek medical help.
- Avoid prolonged contact with skin.

9. FINAL ASSEMBLY USING SINGLE COMPONENT SILICON ADHESIVE

9.1 Preparation

Place the photovoltaic panel face down on the work table. The attachment area of the photovoltaic panel must be dry, oil/fat-free and free of any dust, oil and contaminants. Thoroughly clean the attachment area with a clean, lightly moistened Isopropyl alcohol soft cloth (e.g. moistened using a dosing unit). Further auxiliary or other cleaning agents are not permitted. Use of any other cleaning agents has to be specified and tested by the customer. The attachment area must be free from condensation and moisture.

To improve adherence, junction boxes may be treated with primer. The attachment area should be thoroughly covered with primer by using a small spatula brush. The specification from the supplier of the primer has to be followed.

Bend the photovoltaic panel foil tabs so that they extend perpendicular from the plane of the panel.

9.2 Adhesive application procedure

The silicon adhesive needs only to be applied to a small peripheral area on the bottom of the junction box. Before applying the adhesive, it is recommended that the junction box cover be opened to ease later attachment to the photovoltaic panel. A 10 mm – 20 mm wide band of adhesive applied to the recess area is adequate. During this process, ensure that the silicon bead is continuous and free of gaps. If desired, the silicon bead may be smoothed with the small spatula to ensure a uniform and gap free surface.



Touching or handling of the diodes or the bridging elements during the pressing of the box is not permitted. Mechanical stressing of diodes or bridging elements can cause their destruction and thereby the malfunction of the panel.

To attach the junction box to the photovoltaic panel, thread the foil tabs through the openings in the bottom of the junction box. Make sure the junction box is properly oriented in a horizontal position before firmly placing the junction box into its final position on the photovoltaic panel. At this point, the 1kg metal weight can be applied to the top of the junction box to ensure adequate adhesive coverage. If desired, use the spatula to smooth any excess silicon that may have extruded out of the joint. Using a clean cloth, remove any excess adhesive drips that may have occurred during assembly. Keep the photovoltaic module assembly in the horizontal position until full cure is obtained.

A full cure requires 20 hours at room temperature before the photovoltaic module can be connected and tested

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10. WIRING THE JUNCTION BOX

10.1 Tab connections

The tabs exiting the photovoltaic panel are terminated to the tab connectors as shown in Figure 2 below:

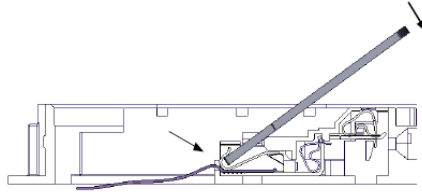


Figure 2

Using a TE Connectivity opening tool, lever the spring clamp until it is open to allow tab insertion. The width of the tab cannot exceed 8 mm. If the tab exceeds this width, it can be folded over onto itself to reduce the width so long as the maximum thickness does not exceed 1.5 mm.

All terminal blocks can be opened at once using tool PN 1740969-2.

11. ASSEMBLING DIODES AND JUMPERS



When replacing a diode, the marking of the new diode (including the letter) must exactly correspond with the existing installed diode.

TE Connectivity Small junction box offers the user a number of jumper and interconnection options. By utilizing various combinations of jumpers and diodes, a number of photovoltaic panel configurations can be realized. Termination of jumpers and diodes is accomplished by inserting the component leads into the spring clip openings of each rail. The maximum opening of these clips is 2.5mm x 2.1mm. The use of solid leads is required.

Recommended diode and jumper dimensions:

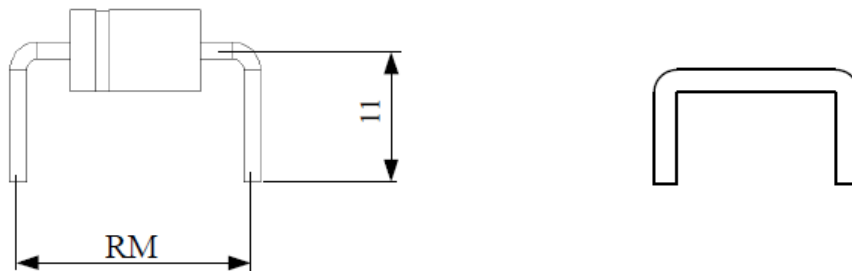


Fig. 3

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Recommended bend locations for various jumper positions shown in the Table 2 and Figure 4:

RM_1	RM_2
20.8 mm	45.8 mm

Table 2: Contact Spacing

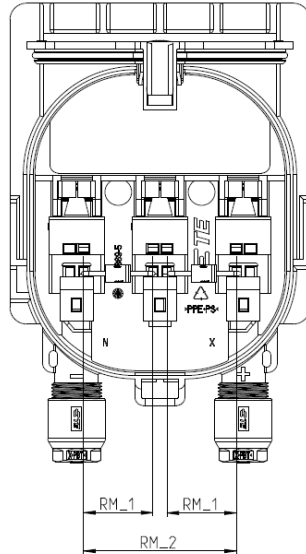


Figure 4

To terminate the diodes or jumpers, a TE Connectivity tool is inserted vertically down to open a window in the spring clip, as shown in figure 5 and 6. The diode or jumper lead is inserted into the open spring clip window. Removal of the tool will allow the clip to close and terminate the lead. The spring clips can be opened in pairs by using a special assembly aid tool PN 0-1579007-5, which can be obtained from TE Connectivity.

Make sure diodes and jumpers are fully inserted into the clips as deeply as possible in order to avoid direct contact with the lid.

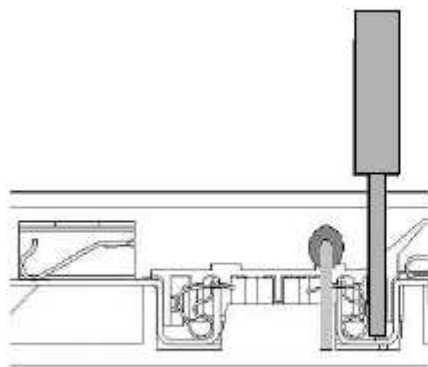


Fig. 5

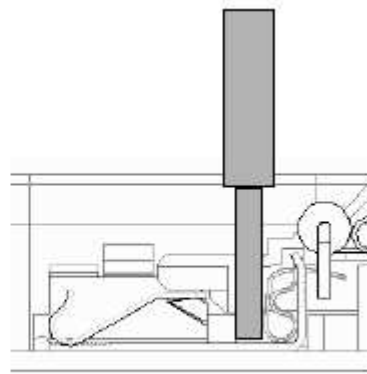
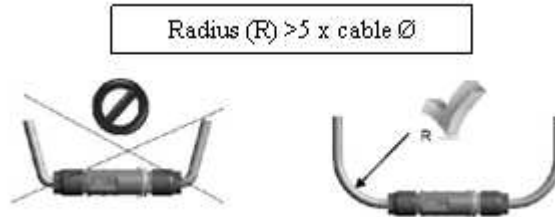


Fig. 6

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12. CABLE ROUTING

The cable must not be bent or crushed on the direct exit of the cable screw joint. A minimum bending radius $R \geq 5 \times$ cable diameter must be maintained. The cable must be routed in a way that tensile stress on the conductor or connections is prevented.



13. DIRECT CABLE ATTACHMENT TO THE JUNCTION BOX



In order to ensure protection against electrical shock, the junction box MUST be disconnected from all external power sources while installing the cables! DO NOT CONNECT UNDER ELECTRICAL LOAD! DO NO CONNECT OR DISCONNECT UNDER LOAD!



In case of replacement of cables or components or of assembling / disassembling of the cable entry gland, new pinch rings and seals have to be used. If a visible deformation appears at the clamping area of the cable, the cable end needs to be trimmed to remove the deformed area.

A direct cable connection can be made to the direct connect junction box using (max. 4mm²) the cable termination spring clips in the junction box. In the manner shown below, direct connection of the cable (4 mm² / AWG 12) can be accommodated. The sealing grommet can accommodate insulation diameters up to 7.8 mm.

Use only wires released by TE Connectivity as detailed in Table 7, Section 4.4.

To ensure proper termination, cable insulation should be stripped detailed as shown in Figure 7 and Table 3.



Figure 7

Table 3

X	Box	x-PN-y
11mm±1mm	3-rail Small Box	All series

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On multi-stranded conductors, it is recommended to use conductor sleeves (for metrical cable/dual rated UL crimping tool PN 734641-2; conductor sleeves for 4mm² acc. DIN 46228/1 for non-insulated ferrules) or at least, twist the strand bundle to ensure all strands are captured in the spring clip. To open the spring clip window for the cable, a special tool, PN 1579007-2, is inserted vertically into the window as seen in Figure 8. The cable can be inserted through the opened window into the clip. The release of the spring terminates the cable as shown in Figure 8 and 9.

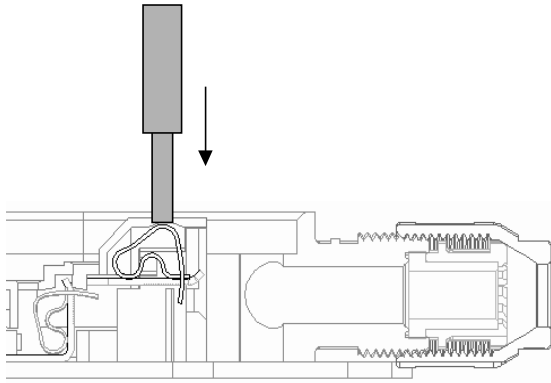


Figure 8

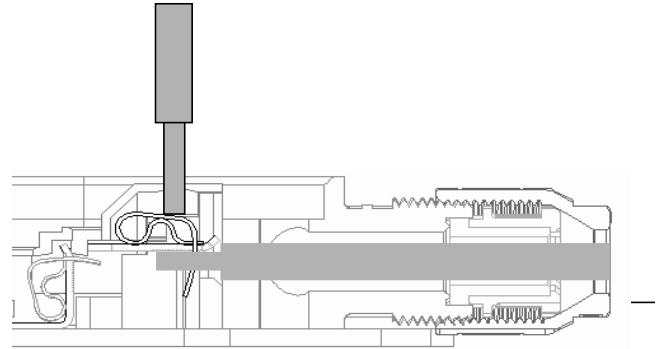


Figure 9

The Connecting boxes, with integrated couplings for cables, are designed for cable diameters from 5.5 mm to 7.8 mm. In relation to the outer diameter of the cable, a suitable pinch ring must be used see Table 4.

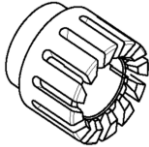
Outer diameter of cable	Pinch ring type
Outer diameter of cable: from 5.5 mm to 7.8 mm	1987981-2 

Table 4

The initial tightening torque is 1.4 ±0.1 Nm. For this, it is recommended to use a slotted socket wrench with wrench size of 13mm.



In case of replacement of cables or components or of assembling / disassembling of the cable entry gland, new pinch rings and seals have to be used. If a visible deformation appears at the clamping area of the cable, the cable end needs to be trimmed to remove the deformed area.

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The proper contacting of the cable by the spring clamp can be controlled via windows in the bottom of the box (see Figure 10) or by measuring the depth of the visible spring clamp in the actuation window (see Figure 11).



Fig 10

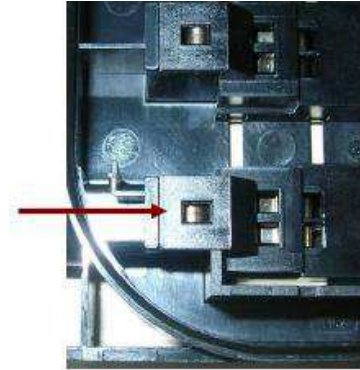


Figure 11

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14. JUNCTION BOX LID ASSEMBLY

14.1 Closing of the junction box

The rear part of the lid is hung onto the casing and is closed, together with the bottom part of the lid, by clicking closed the front side. During this procedure, it is necessary to pay attention that the cover is evenly seated on the bottom part of the casing around the perimeter and that the seal properly placed in the area designated for it. For this purpose, the lid must be pressed in over the entire perimeter.

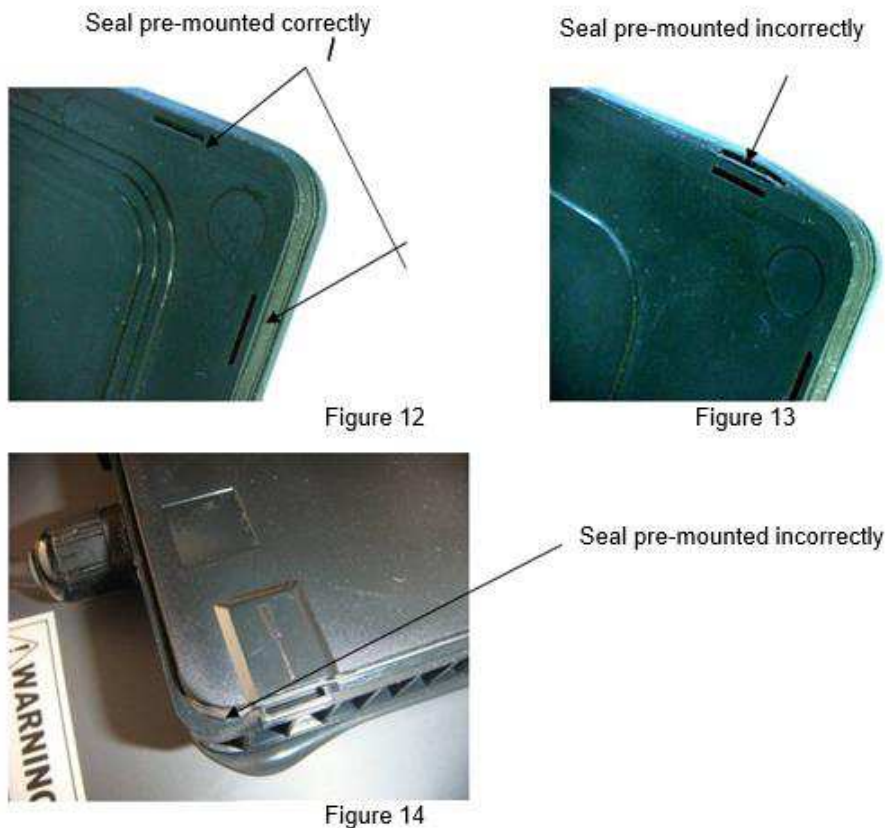


Attention: The junction box should only be opened by authorized and trained personnel!

14.2 Opening of the junction box

A screwdriver with the tip width of 3 - 5 mm is inserted into the pocket by of the front part of the lid. By prying, the lid at the latch hook is released and it can be opened by lifting it up.

The lid seal must be uniform all around, and pressed into the circumferential groove of the lid and inserted in the existing fastening lugs (see Figures 12 and 13). After mounting, the seal must not be sitting out from the box housing (see Figure 14).



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CAUTION: Do not open the junction box while it is under an electrical load. Components within the junction box may be electrically charged and capable of inflicting severe injury or death. Extreme caution should be applied when opening the junction box.

CAUTION: ENSURING OF THE JUNCTION BOX LID – TIGHTNESS to guarantee tightness, make sure the seal is correctly fitted.

For protection against injury by electrical current, the box and the connector must always be completely separated from other sources of voltage during the prefabricating and cannot be connected or disconnected under voltage. All the openings in the casing must be entirely closed.



Unplugged terminal points must be protected against moisture, dust and any environmental pollution. Only clean and dry plugged terminal points fulfill their respective pollution class.



Attention: If a cable or diode has been pulled out of the spring clamp by force, the box has to be replaced.

15. STORAGE

See Product Specification 108-18701, 108-18955, 108-94038 and 108-94064.



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Annex A

Documentation Change Record

Version	Clause	Page	Change Description
A7	Purpose & 1.1	3	Cancel information related to 5-rail box
	1.2 & 1.3	4	Cancel information related to 5-rail box
	2.2.2.1	5	Adding notes
	Table 1	7	Cancel information related to 5-rail box
	Table 3	10	Cancel information related to 5-rail box
	2.5.2	12	Cancel information related to 5-rail box
	2.6	14	Cancel information related to 5-rail box
	3.2.3 order 4	21	Modify the content <i>Initial tightening torque is max. 1.3 +0,2 Nm</i> to <i>Initial tightening torque is 1.0+0,2 Nm for cable 1983530-1 and 1983821-1, and 1.3+0,2 Nm for other cables</i>
	8	30	According to TÜV Rheinland requirement, add the list of product components approved in TÜV Rheinland certification
B	All	All	Removed information on obsoleted parts. Rewritten to include Small junction box information
C	All	All	Removed all reference to 2.5 mm ² cable and associated parts. Added §7.5 Approved components by TÜV Rheinland
C3	All	All	Several updates according TÜV Rheinland request.