Installation Manual
SMA I/O MODULE
MD.IO-40 (PC-PWC.BG1)

SMA
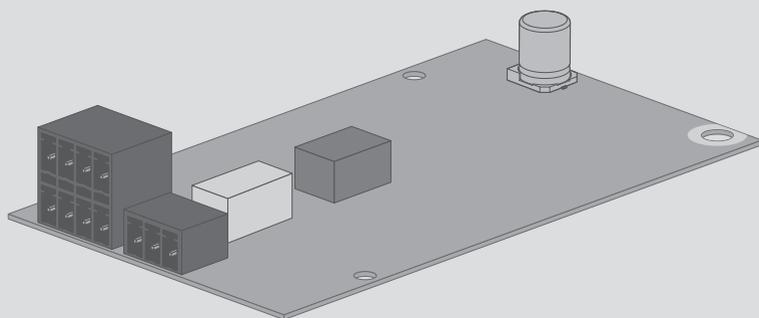
Table of Contents

1 Information on this Document

1.1 Validity

This document is valid for the SMA I/O Module (MD.IO-40) with assembly designation "PC-PWC.BG1" from hardware version A1.

1.2 Target Group

The tasks described in this document must only be performed by qualified persons. Qualified persons must have the following skills:

- Registered qualification for electrically qualified persons, level 1 and 2
- Knowledge of how an inverter works and is operated
- Training in how to deal with the dangers and risks associated with installing and using electrical devices and installations
- Training in the installation and commissioning of electrical devices and installations
- Knowledge of the applicable standards and directives
- Knowledge of and compliance with this document and all safety information

1.3 Symbols

Symbol	Explanation
⚠ DANGER	Indicates a hazardous situation which, if not avoided, will result in death or serious injury
⚠ WARNING	Indicates a hazardous situation which, if not avoided, can result in death or serious injury
⚠ CAUTION	Indicates a hazardous situation which, if not avoided, can result in minor or moderate injury
NOTICE	Indicates a situation which, if not avoided, can result in property damage
i	Information that is important for a specific topic or goal, but is not safety-relevant
☐	Indicates a requirement for meeting a specific goal
☑	Desired result
✖	A problem that might occur

1.4 Typographies

Typography	Use	Example
bold	• Display texts • Elements on a user interface • Terminals • Elements to be selected • Elements to be entered	• The value can be found in the field **Energy**. • Select **Settings**. • Enter **10** in the field **Minutes**.
>	• Connects several elements to be selected	• Select **Settings > Date**.
[**Button**] [**Key**]	• Button or key to be selected or pressed	• Select [**Next**].

1.5 Nomenclature

Complete designation	Designation in this document
SMA I/O modules	Module, product
PV system	PV system

2 Safety

2.1 Intended Use

The SMA I/O Module is a module with 6 digital inputs and 1 digital output operating as a multifunction relay. The SMA I/O Module enables the implementation of grid management services for up to 12 SMA inverters in a network with the same system password. The SMA I/O Module must be installed in one SMA inverter. For the implementation of grid management services, the SMA I/O Module receives the specifications of the grid operator via a ripple control receiver. The SMA I/O Module transmits the specifications of the grid operator via Speedwire network to a maximum of 11 further SMA inverters. The multifunction relay can be configured for various operating modes. The multifunction relay can, for example, be used for switching fault indicators on and off.

The SMA I/O Module may only be installed in the following SMA inverters:

- STP 50-40 (Sunny Tripower CORE1)
- STP 50-JP-40 (Sunny Tripower CORE1-JP)

The inverter still complies with the standard after the product has been installed.

Use this product only in accordance with the information provided in the enclosed documentation and with the locally applicable standards and directives. Any other application may cause personal injury or property damage.

Alterations to the product, e.g. changes or modifications, are only permitted with the express written permission of SMA Solar Technology AG. Unauthorized alterations will void guarantee and warranty claims and in most cases terminate the operating license. SMA Solar Technology AG shall not be held liable for any damage caused by such changes.

Any use of the product other than that described in the Intended Use section does not qualify as the intended use.

The enclosed documentation is an integral part of this product. Keep the documentation in a convenient place for future reference and observe all instructions contained therein.

The type label must remain permanently attached to the product.

All components must remain within their permitted operating ranges at all times.

The product must only be used in countries for which it is approved or released by SMA Solar Technology AG and the grid operator.

2.2 Safety Information

This section contains safety information that must be observed at all times when working on or with the product.

To prevent personal injury and property damage and to ensure long-term operation of the product, read this section carefully and observe all safety information at all times.

⚠ DANGER

Danger to life due to high voltages of the PV array

When exposed to sunlight, the PV array generates dangerous DC voltage, which is present in the DC conductors and the live components of the inverter. Touching the DC conductors or the live components can lead to lethal electric shocks.

- Prior to performing any work on the inverter, always disconnect the inverter from voltage sources on the AC and DC sides as described in the inverter manual. When doing so, note that even if the DC load-break is switched off, there will be dangerous direct voltage present in the DC conductors of the inverter.

NOTICE

Damage to seals on the enclosure lids in subfreezing conditions

If you open the enclosure lids when temperatures are below freezing, the enclosure seals can be damaged. This can lead to moisture entering the inverter.

- Only open the enclosure lids if the ambient temperature is not below -5°C

- If a layer of ice has formed on the seal of the lid when temperatures are below freezing, remove it prior to opening the enclosure lids (e.g. by melting the ice with warm air). Observe the applicable safety regulations.

NOTICE

Damage to the inverter or product due to electrostatic discharge

Touching electronic components can cause damage to or destroy the inverter or the product through electrostatic discharge.

- Ground yourself before touching any component.

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3   Scope of Delivery

Check the scope of delivery for completeness and any externally visible damage. Contact your distributor if the scope of delivery is incomplete or damaged.
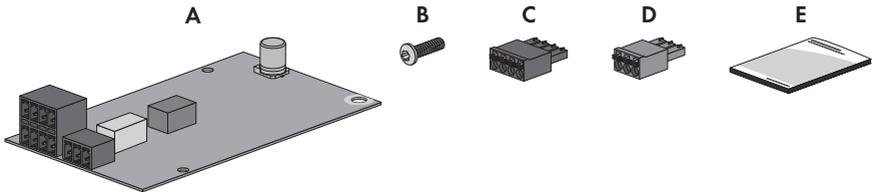
Figure 1: Components included in the scope of delivery

Position	Quantity	Designation
A	1	Module of device type "PC-PWC.BG1"
B	1	Fastening screw (M5, TX 25)
C	2	4-pole plug
D	1	Three-pole plug
E	1	Quick reference guide for commissioning

4 Product Description

4.1 SMA I/O modules

The SMA I/O Module is a module with 6 digital inputs and 1 digital output operating as a multifunction relay. The SMA I/O Module enables the implementation of grid management services for up to 12 SMA inverters in a network with the same system password. The SMA I/O Module must be installed in one SMA inverter. For the implementation of grid management services, the SMA I/O Module receives the specifications of the grid operator via a ripple control receiver. The SMA I/O Module transmits the specifications of the grid operator via Speedwire network to a maximum of 11 further SMA inverters. The multifunction relay can be configured for various operating modes. The multifunction relay can, for example, be used for switching fault indicators on and off.

Design of the module
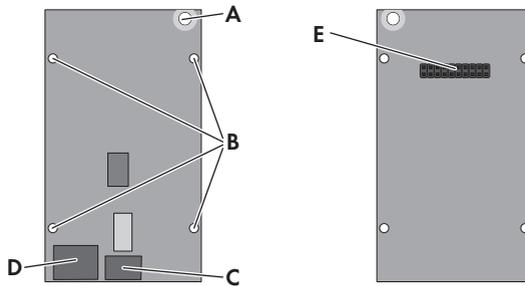
Figure 2: Design of the module

Position	Designation	Explanation
A	–	Opening for the fastening screw
B	–	Openings for the guide pins of the communication assembly
C	**OUTPUT**	Multifunction Relay Connection
D	**INPUT**	Terminals for ripple control receiver
E	–	Connector strip on the back of the module for connection to the communication assembly in the inverter

4.2   Type Label

The type label clearly identifies the product. The type label is located on the front of the product.

A —— PC-PWC.BG1
B —— XXXXX
C —— XX

Figure 3: Design of the type label

Position	Explanation
A	Device type
B	Serial number
C	Hardware version

You will require the information on the type label to use the product safely and when seeking customer support from Service (see Section 9 "Contact", page 23).

5   Mounting

5.1   Mounting position
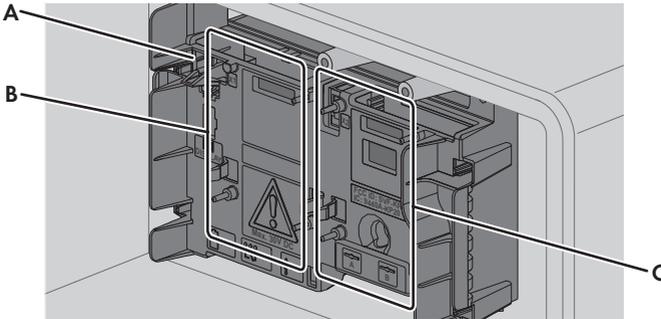
Figure 4: Communication assembly in the inverter with mounting position for the module

Position	Designation
A	Communication assembly
B	Module slot **M1** *
C	Module slot **M2**

* Production resources SMA Solar Technology AG recommends using module slot **M1** for the module.

5.2   Installing the Module

ⓘ **Maximum number of modules of the same device type per inverter**

You can only use a maximum of one SMA I/O module per inverter.

Procedure:

1.   ⚠ **DANGER**

    Danger to life due to high voltages of the PV array

    When exposed to sunlight, the PV array generates dangerous DC voltage, which is present in the DC conductors and the live components of the inverter. Touching the DC conductors or the live components can lead to lethal electric shocks.

    • Prior to performing any work on the inverter, always disconnect the inverter from voltage sources on the AC and DC sides as described in the inverter manual. When doing so, note that even if the DC load-break is switched off, there will be dangerous direct voltage present in the DC conductors of the inverter.

2. Remove the enclosure lid of the DC Connection Unit. Unscrew all screws with a Torx screwdriver (TX 25) and remove the enclosure lid carefully forward.

3. Set the screws and the enclosure lid aside and store safely.

4. Install the module at the desired mounting location. Perform the following steps:

- Guide the three guide pins on the communication assembly through the holes in the module. The holes in which the guide pins must be inserted depend on the mounting location.
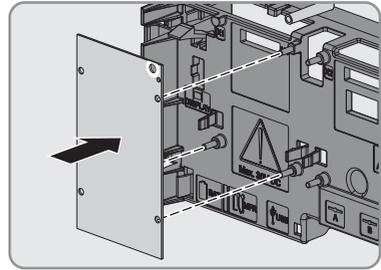
- Carefully push the module down on the upper edge and on the connection sockets until it audibly snaps into both side locking tabs of the communication assembly. The plug on the back of the module is automatically pushed into the socket terminal strip of the communication assembly.
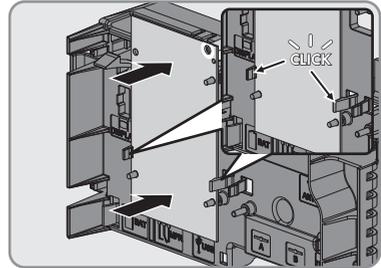
5. Screw tight the fastening screw with a Torx screwdriver (TX 25) on the module (torque: 1.5 Nm). This additionally fixes the module in place and grounds it in the inverter enclosure.
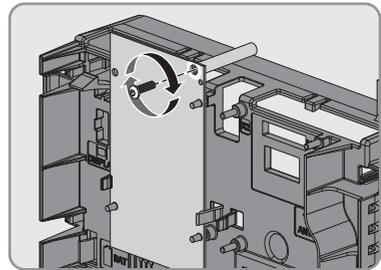
6   Connection

6.1   Cable Requirements

| i | **UV resistance of connection cables**

> Connection cables to be laid outdoors must be UV-resistant or routed in a UV-resistant cable channel.

☐ Number of conductors:
For connecting the ripple control receiver: at least five insulated conductors
For connecting to the multifunction relay: at least two insulated conductors
Tip: You can use one common cable with at least seven insulated conductors to connect both the ripple control receiver and the multifunction relay

☐ Conductor cross-section: 0.5 mm² to 0.75 mm²

☐ Maximum cable length: 100 m

6.2   Preparing the Connection Cable

Always proceed as follows to prepare each connection cable for connection to multipole terminal blocks.

Procedure:

1. Strip 40 mm of cable sheath from the end of the connection cable to which the multipole terminal block is to be attached. Make sure that no pieces of cable are dropped into the inverter.

2. Strip off 6 mm of the conductor insulation from each of the required connection cable conductors (see Section 6.1 "Cable Requirements", page 13).

3. Trim unneeded insulated conductors of the connection cable flush with the cable sheath.

4. Push one bootlace ferrule onto each stripped insulated conductor up to the stop, if necessary.

6.3   Inserting the Cables

Additionally required material (not included in the scope of delivery):

☐ Connection cable (see Section 6.1 "Cable Requirements", page 13)

Procedure:

1. Make sure that the inverter has been disconnected and is secured against reconnection (see the inverter manual).

2. Remove the swivel nut from the cable gland for the communication cable.

3. Thread the swivel nut over the cable.

4. Remove the two-hole cable support sleeve from the cable gland.

5. Remove the sealing plug from one of the enclosure openings of the two-hole cable support sleeve and insert the cable into the enclosure opening.

6. Press the two-hole cable support sleeve with the cable into the cable gland and guide the cable to the communication assembly in the DC Connection Unit. Ensure that any unused enclosure openings of the two-hole cable support sleeve are sealed with sealing plugs.

7. Tighten the swivel nut on the cable gland hand-tight. This will secure the cable.

6.4 Connecting the Ripple Control Receiver

6.4.1 Connecting the Ripple Control Receiver

The digital signals for the specifications to the grid management services are transmitted to the **INPUT** terminal of the module. Up to six control signals can be transmitted.

Additionally required material (not included in the scope of delivery):

☐ 1 ripple control receiver

Requirements:

☐ The ripple control receiver must be technically suitable for connection to the digital inputs (see Section 8 "Technical Data", page 22).

☐ The connection cable must be prepared for connection to the multipole plug (see Section 6.2 "Preparing the Connection Cable", page 13).

☐ The connection cable must be inserted through the cable gland into the inverter (see Section 6.3 "Inserting the Cables", page 13).

Pin assignment:
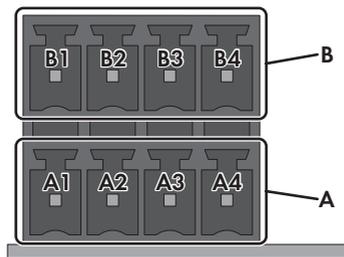
Figure 5: Pin assignment for terminal **INPUT**

Pin row	Pin	Assignment	Explanation
A	A1	24 V	Voltage supply output
	A2	IN	Input for ripple control signal 0
	A3	IN	Input for ripple control signal 1
	A4	IN	Input for ripple control signal 2

Pin row	Pin	Assignment	Explanation
B	B1	24 V	Voltage supply output
	B2	IN	Input for ripple control signal 3
	B3	IN	Input for ripple control signal 4
	B4	IN	Input for ripple control signal 5

Circuitry overview:
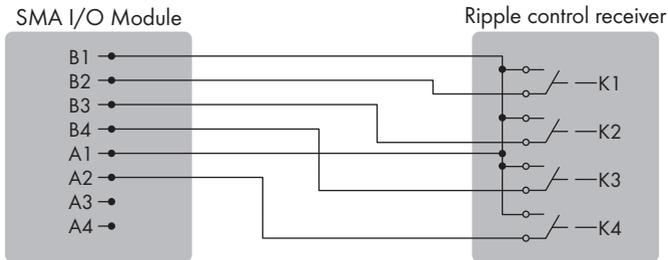
Figure 6: Connection of a Ripple Control Receiver

⚠ DANGER

Danger to life due to electric shock caused by incorrect connection of the ripple control receiver

Incorrect connection of the ripple control receiver can result in grid voltage on the inverter enclosure.

- Do not connect the insulated conductors of the connection cable to the line conductors of the ripple control receiver.
- When connecting, ensure that no bridge is being used in the ripple control receiver.

Procedure:

1. Connect the connection cable to the ripple control receiver (see the manual from manufacturer). Trim the unused insulated conductors up to the cable sheath and write down the conductor colors of the required insulated conductors.

2. Connect the connection cable to the four-pole plug:

   - Depending on the ripple control receiver and the pin assignment in terminal **INPUT**, identify the conductor entries that are required for connecting the connection cable. The voltage supply (24 V) only needs to be connected once.

   - Release the required conductor entries using a screwdriver and insert the insulated conductors into the conductor entries. Make sure that the noted conductor colors correspond to the pin assignment of the connection **INPUT**.

3. Insert the four-pole plug at terminal **INPUT** into the desired pin row.

4. If needed, make more connections on the module (see Section 6.4.2 "Use of the Ripple Control Receiver for further Inverters", page 16).

5. If no further connections are required on the module, close the inverter and commission it (see the inverter manual).

6. Configure the digital inputs via the installation assistant of the inverter user interface (see the inverter manual for login information and for how to start the installation assistant)

6.4.2   Use of the Ripple Control Receiver for further Inverters

You can use the signal from one ripple control receiver for a maximum of twelve inverters. To this end, you must only equip one of the inverters in the PV system with the module. This inverter forwards the signals of the ripple control receiver via communication signal via LAN or WLAN to the other inverters in the PV system. For this, all inverters must be located in the same local network and have the same PV system password.

6.5   Multifunction Relay Connection

6.5.1   Connection to the Multifunction Relay

i **Operating modes and connection option**

The operating modes and connection options of the multifunctional relay on the module are identical to the operating modes and connection options of the multifunctional relay on the communication assembly of the inverter. For more information see the inverter manual at www.SMA-Solar.com.

Requirements:

☐ You must select the connection option depending on the desired function of the multifunction relay (see inverter manual).

☐ The contactors must be technically suitable for connection to the multifunction relay (see Section 8 "Technical Data", page 22).

☐ The remote terminal must be technically suitable for connection to the multifunction relay (see Section 8 "Technical Data", page 22).

☐ The connection cable must be prepared for connection to the multipole plug (see Section 6.2 "Preparing the Connection Cable", page 13).

☐ The connection cable must be inserted through the cable gland into the inverter (see Section 6.3 "Inserting the Cables", page 13).
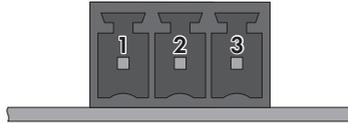
Figure 7: Pin assignment for terminal **OUTPUT**

Pin	Explanation
1	Make contact
2	Change-over contact
3	Break contact

Procedure:

> ⚠ **DANGER**
>
> **Danger to life due to electric shock caused by incorrect connection to the multifunction relay**
>
> The multifunction relay is designed for a maximum switching voltage of 30 V_{DC}. When connecting a remote terminal with higher voltage, there is a risk of lethal electric shock.
>
> - Pay attention to the maximum switching voltage of 30 V_{DC} when making the connection.

> **NOTICE**
>
> **Minimum switching current required to prevent surface corrosion of the relay contacts**
>
> Surface corrosion can impair the functionality of the multifunction relay. In order to prevent surface corrosion of the relay contacts, a minimum current must flow over the relay at the moment of switching.
>
> - If the relay does not switch a load but only a control signal, make sure that a minimum switching current of 10 mA flows over the relay at the 10 V switching moment.

1. Connect the connection cable to the remote terminal (see the remote terminal manual). Trim the unused insulated conductors up to the cable sheath and write down the conductor colors.

2. Connect the connection cable to the three-pole plug:
   - Depending on the remote terminal and the pin assignment on the terminal **OUTPUT** identify the conductor entries that are required for connecting the connection cable.
   - Release the required conductor entries using a screwdriver and insert the insulated conductors into the conductor entries. Make sure that the noted conductor colors correspond to the pin assignment on the terminal **OUTPUT**.

3. Insert the three-pole plug into the pin row in terminal **OUTPUT**.

4. If no further connections are required on the module, close the inverter and commission it (see the inverter manual).

5. Change the operating mode of the multifunction relay, if required (see Section 6.5.2 "Changing the Operating Mode of the Multifunction Relay", page 18).

6.5.2   Changing the Operating Mode of the Multifunction Relay

| i | **Changing the operating mode with two existing multifunction relays**

For inverters with an internal multifunction relay on the communication module and an additional multifunction relay on an SMA I/O module, the operating mode can be changed separately for each multifunction relay. The parameters of the internal multifunction relay are marked with [**A**] on the inverter user interface. The parameters of the multifunction relay on the SMA I/O module are marked with [**B**].

The default operating mode of the multifunction relay is **Fault indication (FltInd)** . If you decide to use another operating mode and have established the correct electrical connection for this operating mode and the associated connection variant, you will have to change the operating mode of the multifunction relay and make other settings, if necessary.

Procedure:

1. Activate the user interface of the inverter (see the inverter manual).

2. Log in as **Installer** or **User**.

3. Call up the menu **Device Parameters**.

4. Select [**Edit parameters**].

5. In the parameter group **Device > Multifunction relay > Operating mode** select the parameter **Operating mode of multifunction relay** or **Mlt.OpMode** and set the desired operating mode.

6. Once you have set the operating mode **Self-consumption** or **SelfCsmp**, you can configure other settings:

   • In the parameter group **Device > Multifunction relay > Self-consumption > Minimum On power** select the parameter **Minimum On power for MFR self-consumption** or **Mlt.MinOnPwr** and set the desired value. This will configure the power threshold from which a load is to be activated.

   • In the parameter group **Device > Multifunction relay > Self-consumption > Minimum power On time** select the parameter **Minimum power On time, MFR self-consumption** or **Mlt.MinOnPwrTmm** and set the desired value. This will configure the minimum time for which the power must have exceeded the minimum switch-on power threshold in order to trip activation of the load.

   • In the parameter group **Device > Multifunction relay > Self-consumption > Minimum On power** select the parameter **Minimum On time for MFR self-consumption** or **Mlt.MinOnTmm** and set the desired value. This will configure the minimum time for which the load remains activated.

7. If you have set the operating mode **Control via communication** or **ComCtl**, in the parameter group **Device > Multifunction relay > Control via communication > Status** select the parameter **Status of MFR with control via communication** or **Mlt.ComCtl.Sw** and set the desired value. This determines whether the multifunction relay can be controlled via a communication product.

8. If you have set the operating mode **Battery bank** or **BatCha**, make further settings:

   • In the parameter group **Device > Multifunction relay > Battery bank > Minimum On power** select the parameter **Minimum On power for MFR battery bank** or **Mlt.BatCha.Pwr** and set the desired value. This will configure the power threshold from which the battery is to be charged.

   • In the parameter group **Device > Multifunction relay > Battery bank > Minimum time before reconnection** select the parameter **Minimum time before reconnection of MFR battery bank** or **Mlt.BatCha.Tmm** and set the desired value. This will configure the minimum time which must elapse after charging the battery before the battery can be charged again.

9. Select [**Save all**] to save the changes.

7   Decommissioning

7.1   Removing the Module

Procedure:

1.
   ⚠ DANGER

   Danger to life due to high voltages of the PV array

   When exposed to sunlight, the PV array generates dangerous DC voltage, which is present in the DC conductors and the live components of the inverter. Touching the DC conductors or the live components can lead to lethal electric shocks.

   - Prior to performing any work on the inverter, always disconnect the inverter from voltage sources on the AC and DC sides as described in the inverter manual. When doing so, note that even if the DC load-break is switched off, there will be dangerous direct voltage present in the DC conductors of the inverter.

2. Remove the enclosure lid of the DC Connection Unit. Unscrew all screws with a Torx screwdriver (TX 25) and remove the enclosure lid carefully forward.

3. Set the screws and the enclosure lid aside and store safely.

4. Remove all connecting terminal plates from the used connection sockets of the module.

5. Loosen the fastening screw on the module using a Torx screwdriver (TX 25).
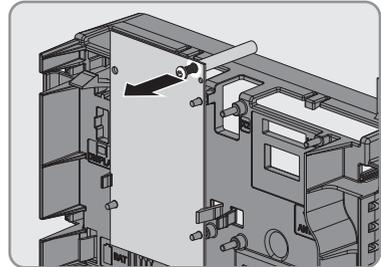
6. Remove the module:
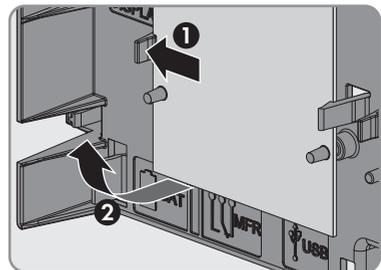
   - Press the right or left locking tab of the communication assembly slightly outwards and pull the module slightly forwards holding the lower end until the module is released from the interlock of the locking tab.

   - Grab the module by the upper and lower edge with one hand.

- Slightly press the second locking tab outwards using the other hand and pull the module slightly forwards on the lower end until the module is released from the interlock of the locking tab.
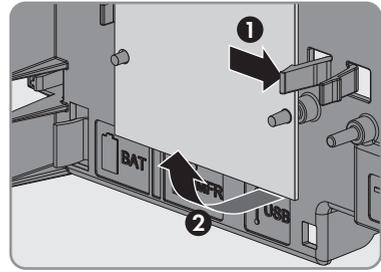
- Remove the module from its slot by pulling it forwards.

7. Remove the swivel nut from the cable gland for the communication cable.

8. Remove the connection cable from the swivel nut and the two-hole cable support sleeve.

9. Close unused enclosure openings of the two-hole cable support sleeve with sealing plugs.

10. Press the cable support sleeve into the two-hole cable gland.

11. Tighten the swivel nut on the cable gland hand-tight.

12. Close the inverter and recommission it, if necessary (see inverter manual).

7.2   Packing the Product for Shipment

- Pack the product for shipping. Use the original packaging or packaging that is suitable for the weight and size of the product.

7.3   Disposing of the Product

- Dispose of the product in accordance with the locally applicable disposal regulations for electronic waste.

8 Technical Data

General Data

Mounting location	In the inverter
Voltage supply	Via the inverter

Mechanical Data

Width x height x depth	60 mm x 105 mm x 33 mm

Ambient Conditions for Storage/Transport

Ambient temperature	-40°C to +70°C
Relative humidity, non-condensing	10% to 100%
Maximum height above mean sea level	3000 m

Digital inputs

Quantity	6
Input voltage	24 V_{DC}
Cutoff frequency	30 Hz
Maximum cable length	100 m

Digital outputs (multifunction relay)

Quantity	3
Execution	Potential-free relay contacts
Maximum switching voltage	30 V_{DC}
Maximum switching current	1 A
Minimum switching current	10 mA
Minimum electrical endurance when the maximum switching voltage and maximum switching current are complied with	100000 switching cycles
Bounce time	5 ms
Reset time	5 ms
Maximum cable length	100 m

9 Contact

If you have technical problems with our products, please contact the SMA Service Line. We require the following information in order to provide you with the necessary assistance:

- Inverters:
  - Serial number
  - Firmware version
  - Special country-specific settings (if applicable)
- Module:
  - Serial number
  - Hardware version
- Operating mode of the multifunction relay
- Information on the connected ripple control receiver
- Detailed description of the problem

Danmark Deutschland Österreich Schweiz	SMA Solar Technology AG Niestetal Sunny Boy, Sunny Mini Central, Sunny Tripower: +49 561 9522-1499 Monitoring Systems (Kommunikationsprodukte): +49 561 9522-2499 Fuel Save Controller (PV-Diesel-Hybridsysteme): +49 561 9522-3199 Sunny Island, Sunny Boy Storage, Sunny Backup, Hydro Boy: +49 561 9522-399 Sunny Central, Sunny Central Storage: +49 561 9522-299 SMA Online Service Center: www.SMA-Service.com	Belgien Belgique België Luxemburg Luxembourg Nederland	SMA Benelux BVBA/SPRL Mechelen +32 15 286 730 SMA Online Service Center: www.SMA-Service.com
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		Türkiye	SMA Service Partner DEKOM Ltd. Şti. +90 24 22430605 SMA Online Service Center: www.SMA-Service.com
France	SMA France S.A.S. Lyon +33 472 22 97 00 SMA Online Service Center : www.SMA-Service.com	Ελλάδα Κύπρος	SMA Service Partner AKTOR FM. Αθήνα +30 210 8184550 SMA Online Service Center: www.SMA-Service.com

España Portugal	SMA Ibérica Tecnología Solar, S.L.U. Barcelona +34 935 63 50 99 SMA Online Service Center: www.SMA-Service.com	United Kingdom	SMA Solar UK Ltd. Milton Keynes +44 1908 304899 SMA Online Service Center: www.SMA-Service.com
Italia	SMA Italia S.r.l. Milano +39 02 8934-7299 SMA Online Service Center: www.SMA-Service.com	Bulgaria România Slovenija Hrvatska	SMA Service Partner Renovatio Solar +40 372 756 599 SMA Online Service Center: www.SMA-Service.com
United Arab Emirates	SMA Middle East LLC Abu Dhabi +971 2234 6177 SMA Online Service Center: www.SMA-Service.com	India	SMA Solar India Pvt. Ltd. Mumbai +91 22 61713888
ไทย	SMA Solar (Thailand) Co., Ltd. กรุงเทพฯ +66 2 670 6999	대한민국	SMA Technology Korea Co., Ltd. 서울 +82-2-520-2666
South Africa	SMA Solar Technology South Africa Pty Ltd. Cape Town 08600SUNNY (08600 78669) International: +27 (0)21 826 0600 SMA Online Service Center: www.SMA-Service.com	Argentina Brasil Chile Perú	SMA South America SPA Santiago de Chile +562 2820 2101
Australia	SMA Australia Pty Ltd. Sydney Toll free for Australia: 1800 SMA AUS (1800 762 287) International: +61 2 9491 4200	Other countries	International SMA Service Line Niestetal 00800 SMA SERVICE (+800 762 7378423)

10 EU Declaration of Conformity

within the scope of the EU directives

- Electromagnetic compatibility 2014/30/EU (29.3.2014 L 96/79-106) (EMC)

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SMA Solar Technology AG confirms herewith that the products described in this document are in compliance with the fundamental requirements and other relevant provisions of the above-mentioned directives. The entire EU Declaration of Conformity can be found at www.SMA-Solar.com.

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