

# Relay Retrofit Program for SPACOM to REX610

## Installation Manual







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## Conformity



See the REX610 Installation Manual for detailed information on Conformity.

## Safety information



Dangerous voltages can occur on the connectors, even though the auxiliary voltage has been disconnected.



Non-observance can result in death, personal injury or substantial property damage.



Only a competent electrician is allowed to carry out the electrical installation.



National and local electrical safety regulations must always be followed.



The necessary and required earthing connections must be made according to the product guidelines and regulations.



When the plug-in unit has been detached from the case, do not touch the inside of the case. The relay case internals may contain high voltage potential and touching these may cause personal injury.



The protection relay contains components which are sensitive to electrostatic discharge. Unnecessary touching of electronic components must therefore be avoided.



Whenever changes are made in the protection relay, measures should be taken to avoid inadvertent tripping.

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# 1 Introduction

## 1.1 This manual

The installation manual contains instructions on how to install the relay retrofit adapter set together with protection and control relay REX610. The manual provides procedures for mechanical and electrical installation. The chapters are organized in chronological order in which REX610, together with the relay retrofit adapter set, should be installed.

## 1.2 Intended audience

This manual addresses the personnel responsible for installing the product hardware.

The installation and commissioning personnel must have a basic knowledge and certification on handling electronic equipment.

## 1.3 Product documentation

This section describes the product documentation set, document revision history and related documentation.

### 1.3.1 Product documentation set

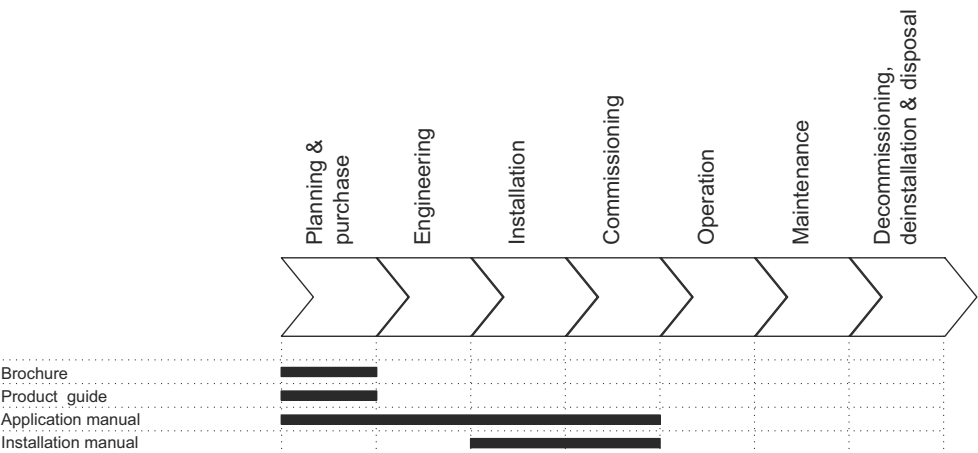


Figure 1: The intended use of documents during the product life cycle

The Installation manual contains instructions on how to install the relay retrofit adapter set together with protection and control relay REX610. The manual provides procedures for mechanical and electrical installation. The chapters are organized in chronological order in which REX610, together with the relay retrofit adapter set, should be installed.

The Application manual contains an overview of Relay Retrofit Program for SPACOM to REX610 and the application description. The manual describes how the program deliverables can be used in the relay retrofit application. The manual also provides information on the retrofit process and the recommendations for the supported relay types. The configuration migration support guidelines provided in the Application manual show the steps composing the process of migrating the existing SPACOM relay configuration and parameters to the replacement relay REX610.

### 1.3.2 Document revision history

Document revision/date	History
A/2022-03-28	First release
B/2023-04-05	Content updated
C/2023-07-10	Content updated

### 1.3.3 Related documentation

Name of the document	Document ID
Relay Retrofit Program for SPACOM to REX610 Product Guide	2NGA001018
Relay Retrofit Program for SPACOM to REX610 Installation Manual	2NGA001017
Relay Retrofit Program for SPACOM to REX610 Application Manual	2NGA001016



See the SPACOM relays and REX610 relay documentation for detailed technical information on the relays. Product series- and product-specific manuals can be downloaded from the ABB website: [www.abb.com/mediumvoltage](http://www.abb.com/mediumvoltage).

## 1.4 Symbols and conventions

### 1.4.1 Symbols



The electrical warning icon indicates the presence of a hazard which could result in electrical shock.



The warning icon indicates the presence of a hazard which could result in personal injury.



The caution icon indicates important information or warning related to the concept discussed in the text. It might indicate the presence of a hazard which could result in corruption of software or damage to equipment or property.



The information icon alerts the reader of important facts and conditions.



The tip icon indicates advice on, for example, how to design your project or how to use a certain function.

Although the warning hazards are related to personal injury, it is necessary to understand that under certain operational conditions, operation of damaged equipment may result in degraded process performance leading to personal injury or death. Therefore, comply fully with all warning and caution notices.

## 1.4.2 Document conventions

A particular convention may not be used in this manual.

- Abbreviations and acronyms are spelled out in the glossary. The glossary also contains definitions of important terms.
- Parameter names are shown in italics.

The function can be enabled and disabled with the *Operation* setting.

- Parameter values are indicated with quotation marks.

The corresponding parameter values are "On" and "Off".

- Input/output messages and monitored data names are shown in Courier font.

When the function starts, the `START` output is set to `TRUE`.

## 2 Environmental aspects

### 2.1 Sustainable development

Sustainability has been taken into account from the beginning of the product design including the pro-environmental manufacturing process, long lifetime, operation reliability and disposing of the protection relay and the relay retrofit adapter set.

The choice of materials and suppliers has been made according to the EU RoHS (2011/65/EU).

**Table 1: Maximum concentration values by weight per homogeneous material**

Substance	Proposed maximum concentration	In %
Lead - Pb	< 1000 ppm (RoHS3)	0.001
Mercury - Hg	< 1000 ppm (RoHS3)	0.001
Cadmium - Cd	< 100 ppm (RoHS3)	0.0001
Hexavalent Chromium Cr (VI)	< 1000 ppm (RoHS3)	0.001
Polybrominated biphenyls - PBB	< 1000 ppm (RoHS3)	0.001
Polybrominated diphenyl ether - PBDE	< 1000 ppm (RoHS3)	0.001

Operational reliability and long lifetime have been ensured with extensive testing during the design and manufacturing processes. Moreover, long lifetime is supported by maintenance and repair services as well as by the availability of spare parts.

Design and manufacturing have been done under a certified environmental system. The effectiveness of the environmental system is constantly evaluated by an external auditing body. We follow environmental rules and regulations systematically to evaluate their effect on our products and processes.

### 2.2 Disposal of a protection relay and the relay retrofit adapter set

Definitions and regulations of hazardous materials are country-specific and change when the knowledge of materials increases. The materials used in this product are typical for electric and electronic devices.

All parts used in this product are recyclable. When disposing of a protection relay or its parts, contact a local waste handler who is authorized and specialized in disposing of electronic waste. These handlers can sort the material by using dedicated sorting processes and dispose the product according to the local requirements.

**Table 2: Materials of the protection relay parts and the relay retrofit adapter set**

Protection relay	Parts	Material
Case / relay retrofit adapter set	Metal plates, parts and screws	Sheet metal: zinc-plated steel Fasteners / ring and washers: stainless steel Securing agent: Tuflok (nylon patch on thread)
	Hard plastic parts	Lexan EXL 9330 (polycarbonate); REACH and RoHS compliant
	Soft plastic parts	Silicone (UL94 HB) Thermoplastic elastomer TPS-SEBS (Dryflex 502350)
	Electronics modules in case	Various
Plug-in unit of protection relay	Electronic plug in modules	Various
	Electronics HMI module	Various
	Hard plastic parts	Lexan EXL 9330 (polycarbonate); REACH and RoHS compliant Lexan EXL 9414T (polycarbonate); REACH and RoHS compliant
	Soft plastic parts	Silicone (UL94 HB) Thermoplastic elastomer TPS-SEBS (Dryflex 500400)
	Wires	PVC and copper
	Metal plates, parts and screws	Sheet metal: zinc-plated steel Self-tapping screws: zinc-plated steel
Package	Box	Cardboard
Attached material	Manuals	Paper

## **3 Unpacking, inspection and storing**

### **3.1 Removing transport packaging**

Delivered products under the Relay Retrofit Program for SPACOM to REX610, namely REX610 protection and control relay and relay retrofit adapter set require careful handling.

See also the REX610 Installation Manual for information related to unpacking, inspection and storing of the protection relay.

1. Examine the delivered products to ensure that they have not been damaged during transport.
2. Remove the transport packaging carefully without force.

### **3.2 Inspecting product and delivery items**

#### **3.2.1 Identifying product**

1. Locate the serial number and the order number of the protection relay from the label on top of the protection relay case.
2. Locate the serial number and the order number from the label on the metal plate of the relay retrofit adapter set.
3. Compare the order numbers of the protection relay and the relay retrofit adapter set with the ordering information to verify that the received products are correct.

#### **3.2.2 Checking delivery items**

Check that all items are included in the delivery in accordance with the delivery documents. Notify ABB immediately if there are any discrepancies in relation to the delivery documents.

#### **3.2.3 Inspecting products**

Products require careful handling before installation on site.

- Check the products to see if any damage occurred during transportation.

### **3.2.4 Returning a product damaged in transit**

If damage has occurred during transport, appropriate actions must be taken against the latest carrier. Please inform the nearest ABB office or representative.

## **3.3 Storing**

If the products are stored before installation, it must be done in the original transport casing in a dry and dust free place.

Observe the environmental requirements stated in the technical manual of REX610.



## 4 Mounting

### 4.1 Checking environmental conditions and mounting space

The mechanical and electrical environmental conditions at the installation site must be within the limits described in the REX610 Technical Manual.

- Avoid installation in dusty, damp places.

Avoid places susceptible to rapid temperature variations, powerful vibrations and shocks, surge voltages of high amplitude and fast rise time, strong induced magnetic fields or similar extreme conditions.

- Check that sufficient space is available.

Sufficient space is needed at the front and rear of the protection relay together with the relay retrofit adapter set to allow access to wires and optical fibers. Sufficient space also allows to provide adequate ventilation to the protection relay and enables maintenance and future modifications.

- Ensure that the flush-mounted protection relays together with relay retrofit adapter set can be added and replaced without excessive dismantling.



Make sure that the ventilation holes are not blocked at any side of the installed protection relay case.

### 4.2 Required tools

- T20 Torx (and PH2 for older versions) for removing the protective earthing of the SPACOM relay
- T25 Torx screwdriver for detaching the fixing parts of the existing SPACOM relay
- T10 Torx screwdriver for mounting the case



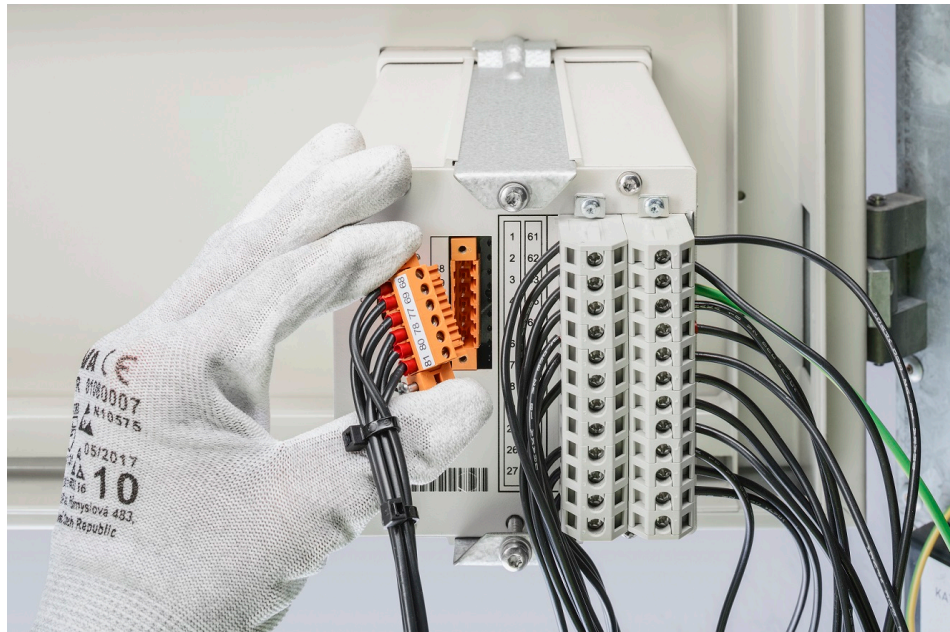
Only use adjustable torque screwdrivers.

### 4.3 Detaching the SPACOM relay and preparing the installation of relay retrofit adapter set



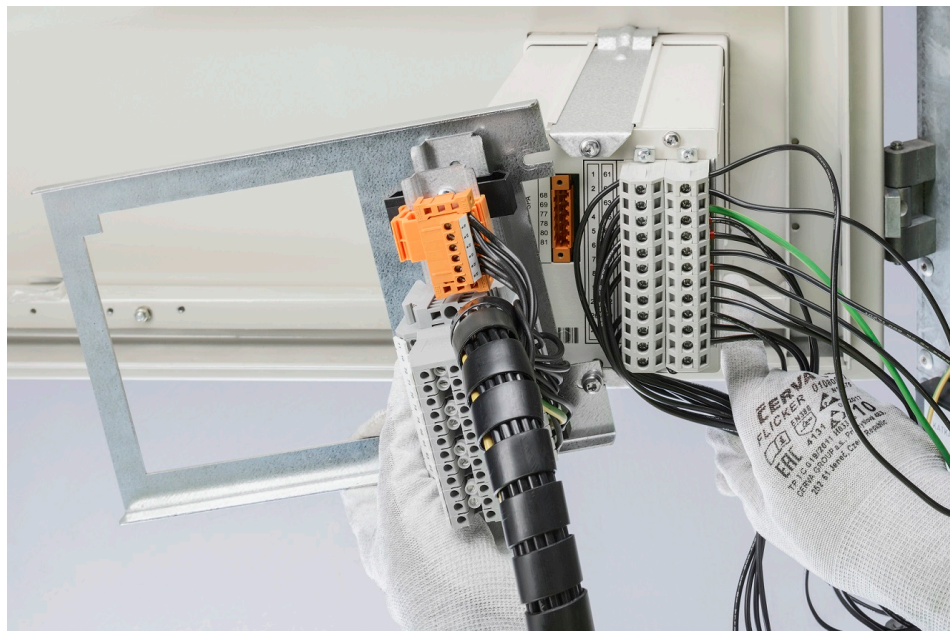
The work to retrofit the SPACOM relay can begin when the necessary safety procedures have been done at the site. The auxiliary voltage must be disconnected before detaching the SPACOM relay from the panel door. It is recommended to inspect relay wiring first for any discrepancies.

1. Remove the orange color terminal set, wherever applicable, from the existing SPACOM relay.



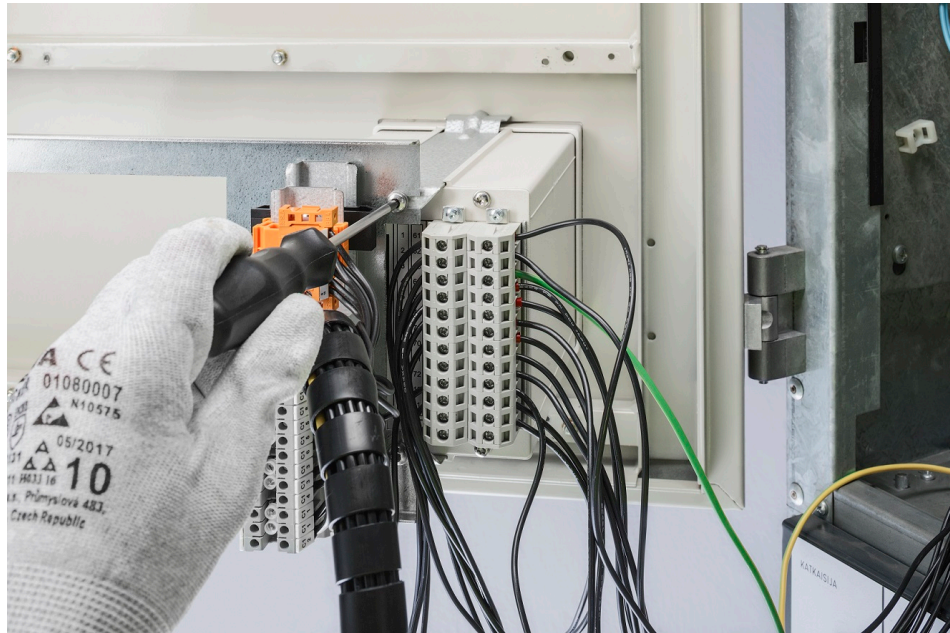
*Figure 2: Removing the orange color terminal set*

2. Loosen the fixing screw of the SPACOM relay to temporarily mount the retrofit adapter set by using the holes that are open on one side on the metal plate.



*Figure 3: Temporary mounting of the relay retrofit adapter set to the SPACOM relay*

3. Tighten the fixing screws of the SPACOM relay after inserting the relay retrofit adapter set assembly.



*Figure 4: Tightening the fixing screws of the SPACOM relay*

4. Remove the secondary wires from the existing SPACOM relay and connect them to the corresponding terminals of the relay retrofit adapter set.

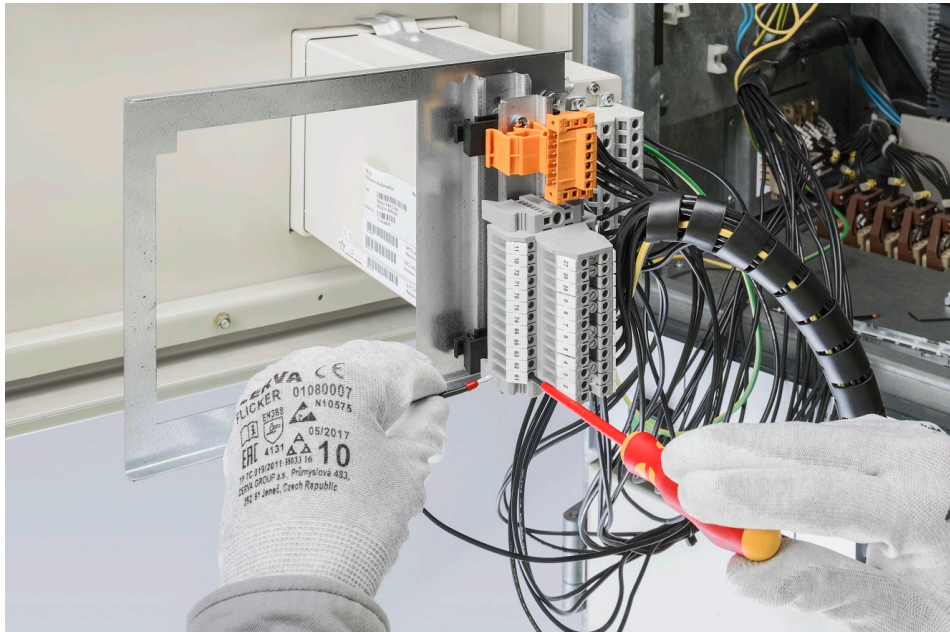
The relay retrofit adapter set is marked on the top based on the existing SPACOM relay terminal numbers so that the user can remove the secondary wires from the existing SPACOM relay and connect them to the corresponding terminals of the relay retrofit adapter set.

The wiring of the instrument transformer (CTs and VTs) is also pre-wired. The user can decide to disconnect it at site and connect it directly to the REX610 relay.



*Figure 5: Removing the secondary wires from the existing SPACOM relay*



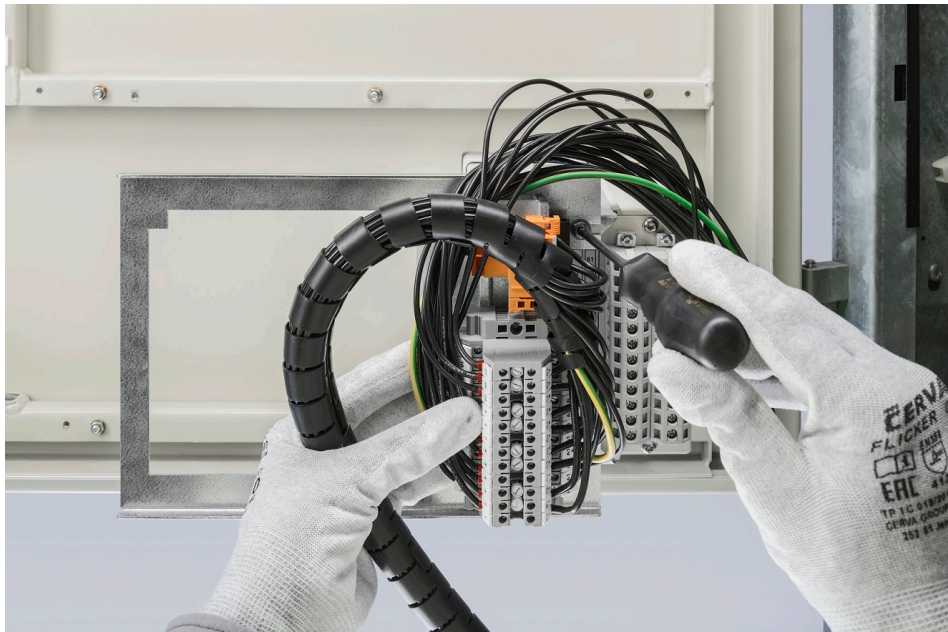


*Figure 6: Connecting the wire to the corresponding terminal of the relay retrofit adapter set by following the terminal numbering*



*Figure 7: Connecting all wires to the corresponding terminal of the relay retrofit adapter set by following the terminal numbering*

5. After the re-wiring is completed, loosen the fixing screw, remove the relay retrofit adapter set assembly and put it aside.



*Figure 8: Loosening the fixing screws of SPACOM relay and detaching the retrofit adapter set*

6. Loosen the fixing screws of the SPACOM relay, detach the fixing parts and take the existing SPACOM relay out of the panel cutout.



*Figure 9: Loosening the fixing screws of SPACOM relay and detaching the fixing parts*





Figure 10: Taking out the SPACOM relay from the existing location

## 4.4 Flush mounting REX610 and mounting the relay retrofit adapter set



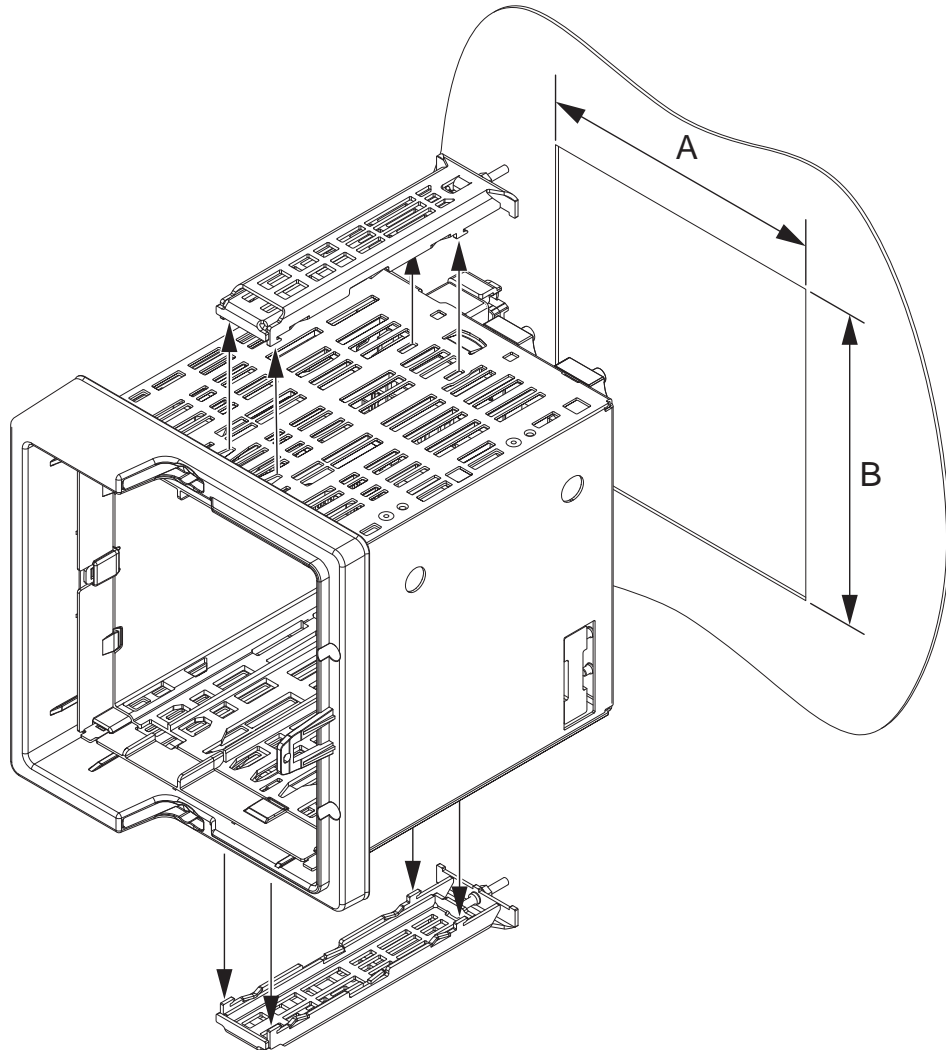
Refer to the REX610 Installation Manual for the detaching and installing the plug-in unit part from the REX610.

All the mounting elements are integrated in the protection relay.

Requirements for installation of the REX610 protection and control relay:

- Panel cutout of  $129.0 \pm 1 \times 139.0$  mm ( $5.0787 \pm 0.03937 \times 5.4724$  in)
- Depth behind the panel 163.6 mm (6.4409 in)

1. Loosen the clamp screws from the top and bottom of the case.
2. Detach the fixing clamp assembly.



*Figure 11: Detaching the fixing clamp assembly*

A	$129.0 \pm 1 \text{ mm}$ ( $5.0787 \pm 0.03937 \text{ in}$ )
B	$139.0 \text{ mm}$ ( $5.4724 \text{ in}$ )



3. Mount the REX610 to the panel cutout.

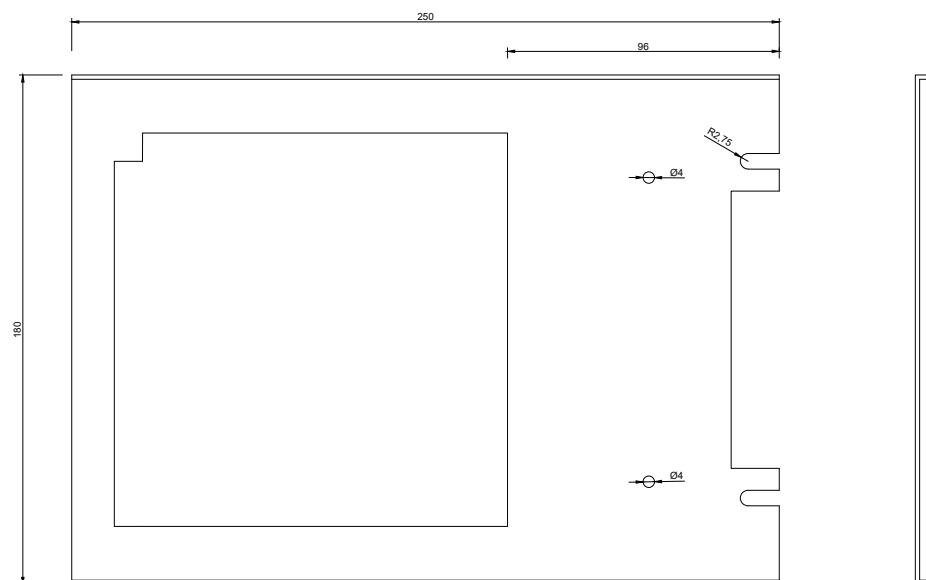
As the mechanical dimensions of the SPACOM 100 series relays and the REX610 are the same, the existing SPACOM relay panel cutout does not need any modifications. The REX610, together with the relay retrofit adapter set, can be mounted on the switchgear panel door at the same place as the SPACOM relay.



*Figure 12: Mounting the REX610 relay to the existing panel cutout*

4. Insert the relay retrofit adapter set around the REX610 relay from the back side of the panel door.

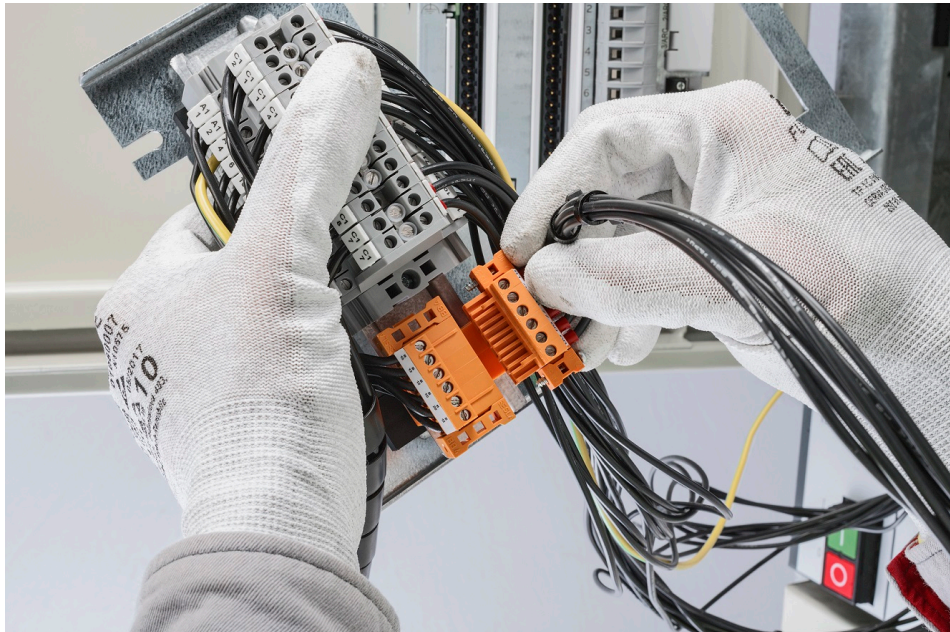
Depending on the space available around the relay, it is possible to insert the mounting assembly of the relay retrofit adapter set in four different directions; terminal set located on the top of the relay, down to the relay, on the left side, or on the right side.



*Figure 13: Dimensions of the mounting plate of the retrofit adapter set*



Existing SPACOM relay's BIO terminal secondary wiring set is possible to reuse on the corresponding pre-wired terminals. Note that if the relay retrofit adapter set will be inserted on the left side of the relay, this existing terminal set needs to be insert at this point.



*Figure 14: Reusing the existing SPACOM relay's orange color BIO terminal secondary wiring*



*Figure 15: Deciding the correct direction of the relay retrofit adapter set installation*

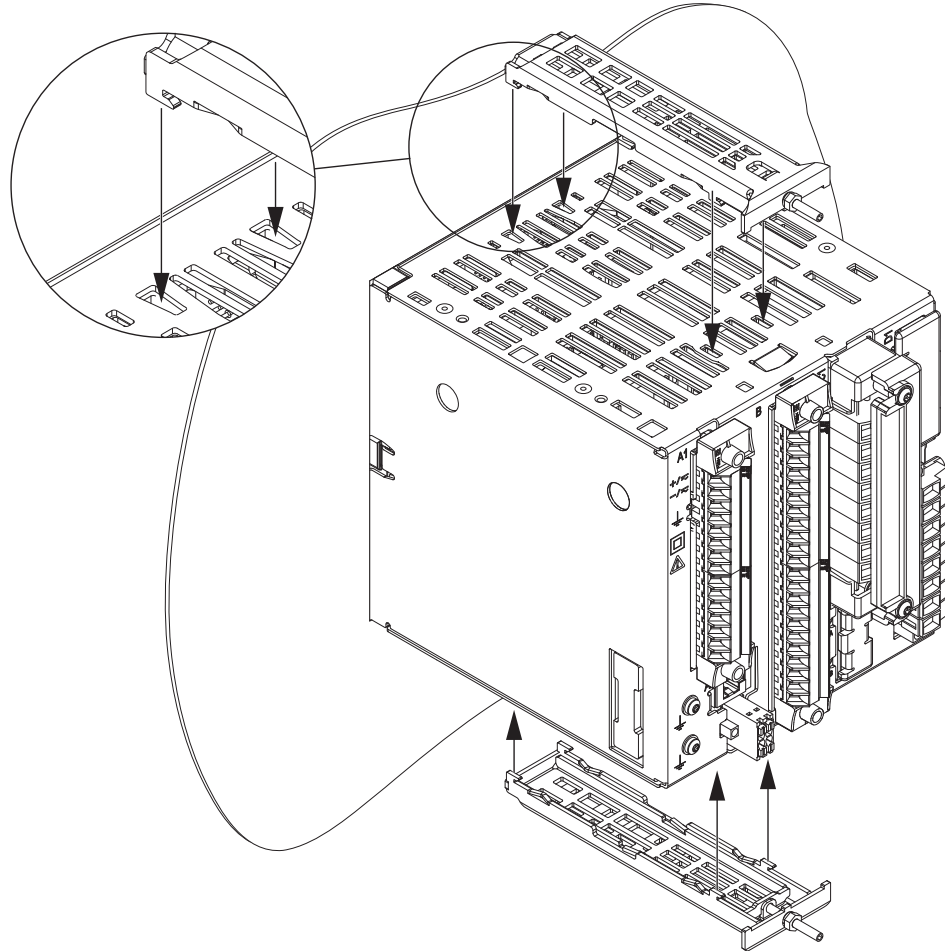


*Figure 16: Inserting the relay retrofit adapter set around the REX610 relay (for example purposes only)*



5. Mount the fixing clamp assembly back on to the case.

Relay retrofit adapter set can be installed with the same mounting arrangement as the REX610.



*Figure 17: Mounting the fixing clamp assembly*

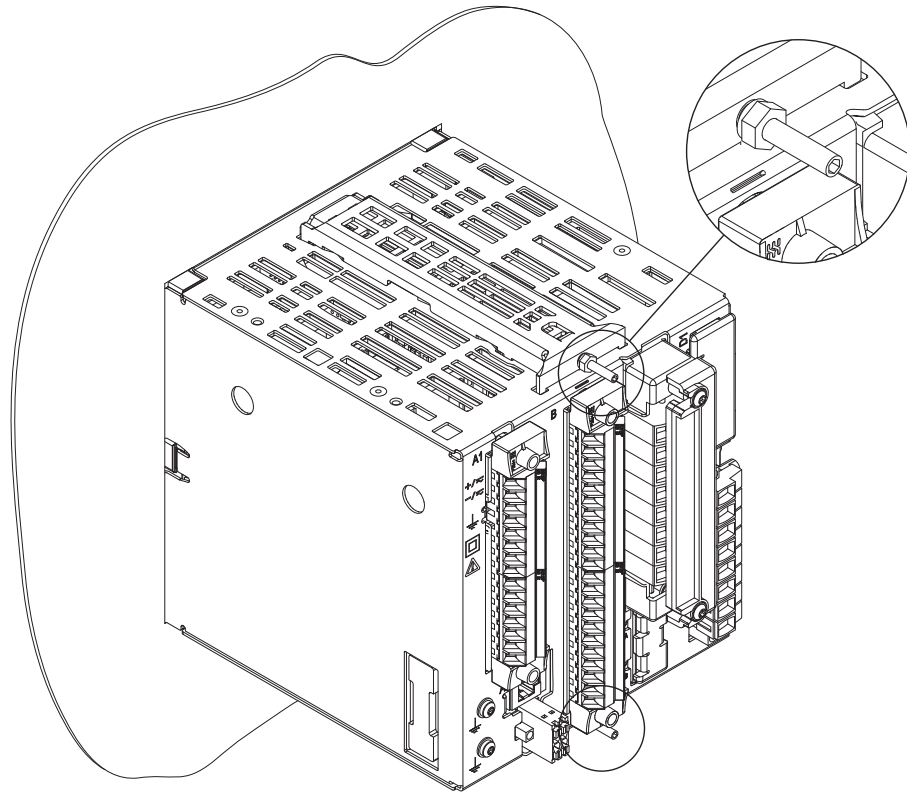


*Figure 18: Mounting the fixing clamp assembly together with the relay retrofit adapter set*

6. Tighten the M3 (1.5 mm Allen key) screws to secure the case.



The allowed range for the fixing screws' tightening torque is  $0.7 \pm 10\%$  Nm ( $0.5162 \pm 10\%$  ft lb).



*Figure 19: Tightening the M3 screw*

7. Install the plug-in unit into the case.



There is a protective film on the top side of the protection relay. It prevents debris from falling inside the unit when the electrical wiring is installed. Remove the protective film before energizing the protection relay.

## 5 Connecting

### 5.1 Required tools

Use a flat-blade screwdriver when handling the CT/VT terminals.

**Table 3: Required tools**

Terminal	Slotted screw (part of the terminal)	Screwdriver blade	
		Width	Thickness
CT (C1)	M3	ø3.5 mm (0.1377 in)	Max. ø0.6 mm (0.02362 in)
VT (D2)	M2.5	ø3.0 mm (0.1181 in)	Max. ø0.5 mm (0.1968 in)

### 5.2 Connecting the functional earthing



The earth lead must be at least 1.5 mm<sup>2</sup> (AWG 16). If the earth lead is long, the cross section of the wire must be increased.



Use a fine copper wire as the earth lead.



1. Loosen the upper functional earth screw (T10) to connect a separate earth protection lead.

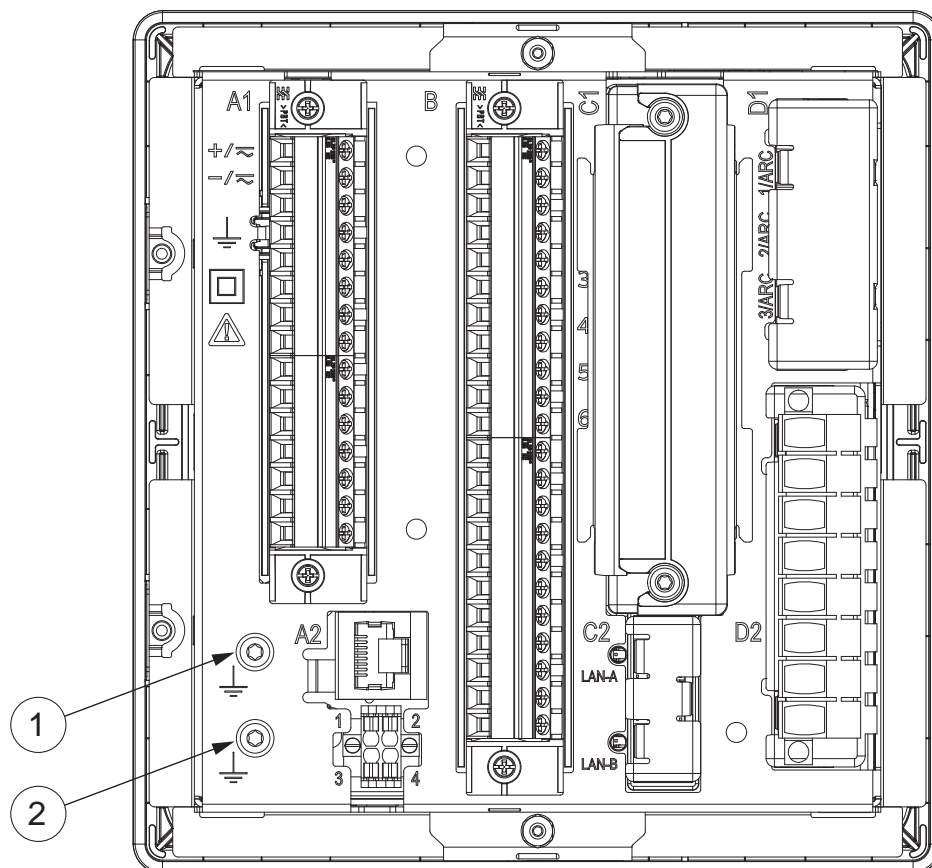


Figure 20: Locating the functional earth screw

- 1 Upper functional earth screw
- 2 Lower functional earth screw



The earth lead should be as short as possible but extra length is required for door mounting.



Each protection relay must have its own earth lead connected to the earth circuit connector.

2. Connect the earth lead to the earth bar.

Use either a stripped wire screwed between a washer cup and the functional earth screw or a ring lug.



Select a suitable ring lug to fit under the M3 screw.

3. Tighten the functional earth screw.

The allowed tightening torque is  $0.75 \text{ Nm} \pm 10\%$  ( $0.55 \text{ ft lb} \pm 10\%$ ).

4. Use the lower functional screw to earth the RS-485 shield wire in the RS-485 cable when hard earth shielding is required.



To avoid earth loops, another capacitive coupled earth pin (pin-4) of RS-485 can be used to connect the cable shield to another RS-485 connected relay on the same bus.



Shielded Ethernet cables are recommended.

5. Support the earth lead so that it cannot break or weaken.

Be aware of the mechanical, chemical, and electrochemical environment.



For additional information, refer to the REX610 Installation Manual.

## 5.3

### Connecting the relay retrofit adapter set to REX610

Connect the pre-wired A1 and B terminals to the REX610 relay after installing the relay retrofit adapter set mounting assembly on the back side of the REX610 protection and control relay.



The allowed tightening torque for the wire clamp is 0.40...0.50 Nm (0.2950...0.3687 ft lb).



Check the terminal diagrams of REX610 from the REX610 Installation and Technical Manuals.

1. Connect the pre-wired terminals A1 and B to the REX610 relay.



Figure 21: Connecting the pre-wired terminals to REX610

Table 4: Pre-wired terminals from SPAJ 110/111/131/135 C to connector A1

REX610		SPAJ 110/111/131/135 C		Wiring description
Terminal	Description	Terminal	Terminal	
A1:1	Uaux+	61	Uaux+	A1:1 (61)
A1:2	Uaux-	62	Uaux-	A1:2 (62)
A1:3	-	-	-	A1:3
A1:4	Functional Earth (FE2)	PE	Protective earth terminal	A1:4 (PE)
A1:5	-	-	-	A1:5
A1:6	PO1	65	TRIP1	A1:6 (65 ) <sup>1</sup>
A1:7	PO1	-	-	A1:7 <sup>1</sup>
A1:8	PO1	-	-	A1:8 <sup>2</sup>
A1:9	PO1	-	-	A1:9 <sup>2</sup>
A1:10	PO1	66	TRIP1	A1:10 (66)
A1:11	PO2	68	TRIP2	A1:11 (68) <sup>3</sup>
A1:12	PO2	-	-	A1:12 <sup>3</sup>
A1:13	PO2	-	-	A1:13 <sup>4</sup>
A1:14	PO2	-	-	A1:14 <sup>4</sup>
A1:15	PO2	69	TRIP2	A1:15 (69)

<sup>1</sup> Terminals are wired together

<sup>2</sup> Terminals are wired together

<sup>3</sup> Terminals are wired together

<sup>4</sup> Terminals are wired together

**Table 5: Pre-wired terminals from SPAJ 110/111/131/135 C to connector B**

REX610		SPAJ 110/111/131/135 C		Wiring description
Terminal	Description	Terminal	Terminal	
B:1	BI1	10	EXTERNAL CONTROL	B:1 (10)
B:2	BI1/BI2 Com	11	EXTERNAL CONTROL	B:2 (11)
B:3	BI2	-	-	B:3
B:4	BI3	-	-	B:4
B:5	BI3/BI4 Com	-	-	B:5
B:6	BI4	-	-	B:6
B:7	BI5	-	-	B:7
B:8	BI5/BI6 Com	-	-	B:8
B:9	BI6	-	-	B:9
B:10	SO1	-	-	B:10
B:11	SO1 (NC)	-	-	B:11
B:12	SO1 (NO)	-	-	B:12
B:13	SO2	75	START 2	B:13 (75) <sup>5</sup>
B:14	SO2 (NC)	73	START 2 (NC)	B:14 (73) <sup>5</sup>
B:15	SO2 (NO)	74	START 2 (NO)	B:15 (74) <sup>5</sup>
B:16	IRF	72	IRF	B:16 (72)
B:17	IRF	71	IRF	B:17 (71)
B:18	IRF	70	IRF	B:18 (70)
B:19	CSO1	77	START 1	B:19 (77)
B:20	CSO1	78	START 1	B:20 (78)
B:21	CSO2	80	SIGNAL 1	B:21 (80)
B:22	CSO2	81	SIGNAL 1	B:22 (81)

**Table 6: Pre-wired terminals from SPAJ 140/141/142 C to connector A1**

REX610		SPAJ 140/141/142 C		Wiring description
Terminal	Description	Terminal	Terminal	
A1:1	Uaux+	61	Uaux+	A1:1 (61)
A1:2	Uaux-	62	Uaux-	A1:2 (62)
A1:3	-	-	-	A1:3
A1:4	Functional Earth (FE2)	63	Earth	A1:4 (63)
A1:5	-	-	-	A1:5
A1:6	PO1	65	TRIP	A1:6 (65) <sup>6</sup>
A1:7	PO1	-	-	A1:7 <sup>6</sup>
A1:8	PO1	-	-	A1:8 <sup>7</sup>

*Table continues on the next page*

<sup>5</sup> SPAJ 131 C not in use

<sup>6</sup> Terminals are wired together

<sup>7</sup> Terminals are wired together

REX610		SPAJ 140/141/142 C		Wiring description
Terminal	Description	Terminal	Terminal	
A1:9	PO1	-	-	A1:9 <sup>7</sup>
A1:10	PO1	66	TRIP	A1:10 (66)
A1:11	PO2	74	START 1	A1:11 (74) <sup>8</sup>
A1:12	PO2	-	-	A1:12 <sup>8</sup>
A1:13	PO2	-	-	A1:13 <sup>9</sup>
A1:14	PO2	-	-	A1:14 <sup>9</sup>
A1:15	PO2	75	START 1	A1:15 (75)

**Table 7: Pre-wired terminals from SPAJ 140/141/142 C to connector B**

REX610		SPAJ 140/141/142 C		Wiring description
Terminal	Description	Terminal	Terminal	
B:1	BI1	10	EXTERNAL CONTROL	B:1 (10)
B:2	BI1/BI2 Com	11	EXTERNAL CONTROL	B:2 (11)
B:3	BI2	-	-	B:3
B:4	BI3	-	-	B:4
B:5	BI3/BI4 Com	-	-	B:5
B:6	BI4	-	-	B:6
B:7	BI5	-	-	B:7
B:8	BI5/BI6 Com	-	-	B:8
B:9	BI	-	-	B:9
B:10	SO1	-	-	B:10
B:11	SO1 (NC)	-	-	B:11
B:12	SO1 (NO)	-	-	B:12
B:13	SO2	80	SIGNAL 1	B:13 (80)
B:14	SO2 (NC)	-	-	B:14
B:15	SO2 (NO)	81	SIGNAL 1	B:15 (81)
B:16	IRF	72	IRF	B:16 (72)
B:17	IRF	71	IRF	B:17 (71)
B:18	IRF	70	IRF	B:18 (70)
B:19	CSO1	68	SIGNAL 2	B:19 (68)
B:20	CSO1	69	SIGNAL 2	B:20 (69)
B:21	CSO2	77	START 2	B:21 (77)
B:22	CSO2	78	START 2	B:22 (78)

<sup>8</sup> Terminals are wired together<sup>9</sup> Terminals are wired together

**Table 8: Pre-wired terminals from SPAJ 144 C to connector A1**

REX610		SPAJ 144 C		Wiring description
Terminal	Description	Terminal	Terminal	
A1:1	Uaux+	61	Uaux+	A1:1 (61)
A1:2	Uaux-	62	Uaux-	A1:2 (62)
A1:3	-	-	-	A1:3
A1:4	Functional Earth (FE2)	63	Earth	A1:4 (63)
A1:5	-	-	-	A1:5
A1:6	PO1	65	TS2	A1:6 (65) <sup>10</sup>
A1:7	PO1	-	-	A1:7 <sup>10</sup>
A1:8	PO1	-	-	A1:8 <sup>11</sup>
A1:9	PO1	-	-	A1:9 <sup>11</sup>
A1:10	PO1	66	TS2	A1:10 (66)
A1:11	PO2	74	TS1	A1:11 (74) <sup>12</sup>
A1:12	PO2	-	-	A1:12 <sup>12</sup>
A1:13	PO2	-	-	A1:13 <sup>13</sup>
A1:14	PO2	-	-	A1:14 <sup>13</sup>
A1:15	PO2	75	TS1	A1:15 (75)

**Table 9: Pre-wired terminals from SPAJ 144 C to connector B**

REX610		SPAJ 144C		Wiring description
Terminal	Description	Terminal	Terminal	
B:1	BI1	10	EXTERNAL CONTROL	B:1 (10)
B:2	BI1/BI2 Com	11	EXTERNAL CONTROL	B:2 (11)
B:3	BI2	-	-	B:3
B:4	BI3	-	-	B:4
B:5	BI3/BI4 Com	-	-	B:5
B:6	BI4	-	-	B:6
B:7	BI5	-	-	B:7
B:8	BI5/BI6 Com	-	-	B:8
B:9	BI6	-	-	B:9
B:10	SO1	-	-	B:10
B:11	SO1 (NC)	-	-	B:11
B:12	SO1 (NO)	-	-	B:12

*Table continues on the next page*

<sup>10</sup> Terminals are wired together

<sup>11</sup> Terminals are wired together

<sup>12</sup> Terminals are wired together

<sup>13</sup> Terminals are wired together

REX610		SPAJ 144C		Wiring description
Terminal	Description	Terminal	Terminal	
B:13	SO2	80	SS2	B:13 (80)
B:14	SO2 (NC)	-	-	B:14
B:15	SO2 (NO)	81	SS2	B:15 (81)
B:16	IRF	72	IRF	B:16 (72)
B:17	IRF	71	IRF	B:17 (71)
B:18	IRF	70	IRF	B:18 (70)
B:19	CSO1	68	SS3	B:19 (68)
B:20	CSO1	69	SS3	B:20 (69)
B:21	CSO2	77	SS1	B:21 (77)
B:22	CSO2	78	SS1	B:22 (78)

**Table 10: Pre-wired terminals from SPAU 110/121/130 C and SPAS 120 C to connector A1**

REX610		SPAU 110/121/130 C and SPAS 120 C		Wiring description
Terminal	Description	Terminal	Terminal	
A1:1	Uaux+	61	Uaux+	A1:1 (61)
A1:2	Uaux-	62	Uaux-	A1:2 (62)
A1:3	-	-	-	A1:3
A1:4	Functional Earth (FE2)	PE	Protective earth terminal	A1:4 (PE)
A1:5	-	-	-	A1:5
A1:6	PO1	65	TRIP1	A1:6 (65) <sup>14</sup>
A1:7	PO1	-	-	A1:7 <sup>14</sup>
A1:8	PO1	-	-	A1:8 <sup>15</sup>
A1:9	PO1	-	-	A1:9 <sup>15</sup>
A1:10	PO1	66	TRIP1	A1:10 (66)
A1:11	PO2	68	TRIP2	A1:11 (68) <sup>16</sup>
A1:12	PO2	-	-	A1:12 <sup>16</sup>
A1:13	PO2	-	-	A1:13 <sup>17</sup>
A1:14	PO2	-	-	A1:14 <sup>17</sup>
A1:15	PO2	69	TRIP2	A1:15 (69)

<sup>14</sup> Terminals are wired together

<sup>15</sup> Terminals are wired together

<sup>16</sup> Terminals are wired together

<sup>17</sup> Terminals are wired together

**Table 11: Pre-wired terminals from SPAU 110/121/130 C and SPAS 120 C to connector B**

REX610		SPAU 110/121/130 C and SPAS 120 C		Wiring description
Terminal	Description	Terminal	Terminal	
B:1	BI1	10	EXTERNAL CONTROL	B:1 (10)
B:2	BI1/BI2 Com	11	EXTERNAL CONTROL	B:2 (11)
B:3	BI2	-	-	B:3
B:4	BI3	-	-	B:4
B:5	BI3/BI4 Com	-	-	B:5
B:6	BI4	-	-	B:6
B:7	BI5	-	-	B:7
B:8	BI5/BI6 Com	-	-	B:8
B:9	BI6	-	-	B:9
B:10	SO1	-	-	B:10
B:11	SO1 (NC)	-	-	B:11
B:12	SO1 (NO)	-	-	B:12
B:13	SO2	75	START 2	B:13 (75) <sup>18</sup>
B:14	SO2 (NC)	73	START 2 (NC)	B:14 (73) <sup>18</sup>
B:15	SO2 (NO)	74	START 2 (NO)	B:15 (74) <sup>18</sup>
B:16	IRF	72	IRF	B:16 (72)
B:17	IRF	71	IRF	B:17 (71)
B:18	IRF	70	IRF	B:18 (70)
B:19	CSO1	77	START 1	B:19 (77)
B:20	CSO1	78	START 1	B:20 (78)
B:21	CSO2	80	SIGNAL 1	B:21 (80)
B:22	CSO2	81	SIGNAL 1	B:22 (81)

**Table 12: Pre-wired terminals from SPAM 150 C (NO) to connector A1**

REX610		SPAM 150 C (NO)		Wiring description
Terminal	Description	Terminal	Terminal	
A1:1	Uaux+	61	Uaux+	A1:1 (61)
A1:2	Uaux-	62	Uaux-	A1:2 (62)
A1:3	-	-	-	A1:3
A1:4	Functional Earth (FE2)	63	Earth	A1:4 (63)
A1:5	-	-	-	A1:5
A1:6	PO1	65	TRIP	A1:6 (65) <sup>19</sup>
A1:7	PO1	-	-	A1:7 <sup>19</sup>
A1:8	PO1	-	-	A1:8 <sup>20</sup>

*Table continues on the next page*

<sup>18</sup> SPAU 130 C not in use

<sup>19</sup> Terminals are wired together



REX610		SPAM 150 C (NO)		Wiring description
Terminal	Description	Terminal	Terminal	
A1:9	PO1	-	-	A1:9 <sup>20</sup>
A1:10	PO1	66	TRIP	A1:10 (66)
A1:11	PO2	74	RESTART ENABLE	A1:11 (74) <sup>21</sup>
A1:12	PO2	-	-	A1:12 <sup>21</sup>
A1:13	PO2	-	-	A1:13 <sup>22</sup>
A1:14	PO2	-	-	A1:14 <sup>22</sup>
A1:15	PO2	75	RESTART ENABLE	A1:15 (75)



SPTU 48R2 and SPTU 240R2 contact 65-66 is normally open.

**Table 13: Pre-wired terminals from SPAM 150 C (NO) to connector B**

REX610		SPAM 150 C (NO)		Wiring description
Terminal	Description	Terminal	Description	
B:1	BI1	10	EXTERNAL CONTROL	B:1 (10)
B:2	BI1/BI2 Com	11	EXTERNAL CONTROL	B:1 (11)
B:3	BI2	-	-	B:3
B:4	BI3	-	-	B:4
B:5	BI3/BI4 Com	-	-	B:5
B:6	BI4	-	-	B:6
B:7	BI5	-	-	B:7
B:8	BI5/BI6 Com	-	-	B:8
B:9	BI6	-	-	B:9
B:10	SO1	-	-	B:10
B:11	SO1 (NC)	-	-	B:11
B:12	SO1 (NO)	-	-	B:12
B:13	SO2	80	PRIOR ALARM SIGNAL 2	B:13 (80)
B:14	SO2 (NC)	-	-	B:14
B:15	SO2 (NO)	81	PRIOR ALARM SIGNAL 2	B:15 (81)
B:16	IRF	72	IRF	B:16 (72)
B:17	IRF	71	IRF	B:17 (71)
B:18	IRF	70	IRF	B:18 (70)
B:19	CSO1	68	SIGNAL 1	B:19 (68)
B:20	CSO1	69	SIGNAL 1	B:20 (69)
B:21	CSO2	77	START PRIOR ALARM	B:21 (77)
B:22	CSO2	78	START PRIOR ALARM	B:22 (78)

<sup>20</sup> Terminals are wired together

<sup>21</sup> Terminals are wired together

<sup>22</sup> Terminals are wired together

**Table 14: Pre-wired terminals from SPAM 150 C (NC) to connector A1**

REX610		SPAM 150 C (NC)		Wiring description
Terminal	Description	Terminal	Description	
A1:1	Uaux+	61	Uaux+	A1:1 (61)
A1:2	Uaux-	62	Uaux-	A1:2 (62)
A1:3	-	-	-	A1:3
A1:4	Functional Earth (FE2)	63	Earth	A1:4 (63)
A1:5	-	-	-	A1:5
A1:6	PO1	-	-	A1:6
A1:7	PO1	-	-	A1:7
A1:8	PO1	-	-	A1:8
A1:9	PO1	-	-	A1:9
A1:10	PO1	-	-	A1:10
A1:11	PO2	74	RESTART ENABLE	A1:11 (74) <sup>23</sup>
A1:12	PO2	-	-	A1:12 <sup>23</sup>
A1:13	PO2	-	-	A1:13 <sup>24</sup>
A1:14	PO2	-	-	A1:14 <sup>24</sup>
A1:15	PO2	75	RESTART ENABLE	A1:15 (75)



SPTU 48R3 and SPTU 240R3 contact 65-66 is normally closed.

**Table 15: Pre-wired terminals from SPAM 150 C (NC) to connector B**

REX610		SPAM 150 C (NC)		Wiring description
Terminal	Description	Terminal	Description	
B:1	BI1	10	EXTERNAL CONTROL	B:1 (10)
B:2	BI1/BI2 Com	11	EXTERNAL CONTROL	B:2 (11)
B:3	BI2	-	-	B:3
B:4	BI3	-	-	B:4
B:5	BI3/BI4 Com	-	-	B:5
B:6	BI4	-	-	B:6
B:7	BI5	-	-	B:7
B:8	BI5/BI6 Com	-	-	B:8
B:9	BI6	-	-	B:9
B:10	SO1	65	TRIP	B:10 (65)
B:11	SO1 (NC)	66	TRIP (NC)	B:11 (66)
B:12	SO1 (NO)	-	-	B:12
B:13	SO2	80	PRIOR ALARM SIGNAL 2	B:13 (80)

*Table continues on the next page*

<sup>23</sup> Terminals are wired together

<sup>24</sup> Terminals are wired together

REX610		SPAM 150 C (NC)		Wiring description
Terminal	Description	Terminal	Description	
B:14	SO2 (NC)	-	-	B:14
B:15	SO2 (NO)	81	PRIOR ALARM SIGNAL 2	B:15 (81)
B:16	IRF	72	IRF	B:16 (72)
B:17	IRF	71	IRF	B:17 (71)
B:18	IRF	70	IRF	B:18 (70)
B:19	CSO1	68	SIGNAL 1	B:19 (68)
B:20	CSO1	69	SIGNAL 1	B:20 (69)
B:21	CSO2	77	START PRIOR ALARM	B:21 (77)
B:22	CSO2	78	START PRIOR ALARM	B:22 (78)

2. Connect the pre-wired CT/VT wires to the REX610 CT/VT connector by following the markings.

The wiring of the instrument transformers (CTs and VTs) are pre-wired and marked. The user can decide either to use that or to connect the wires directly to the REX610 relay according to the phase order and the connection diagram.

All connections are made on the rear of the case. No soldering is needed. Open the screw-compression type terminals before inserting any wires. The terminals are closed at the time of delivery.



The allowed tightening torque for the compression connector wire clamp is 0.60...0.80 Nm (0.4425...0.5900 ft lb). The allowed tightening torque for the VT connector wire clamp is 0.40...0.50 Nm (0.2950...0.3687 ft lb).



*Figure 22: Connecting the pre-wired CT/VT wires to the REX610 CT/VT connector by following the markings*

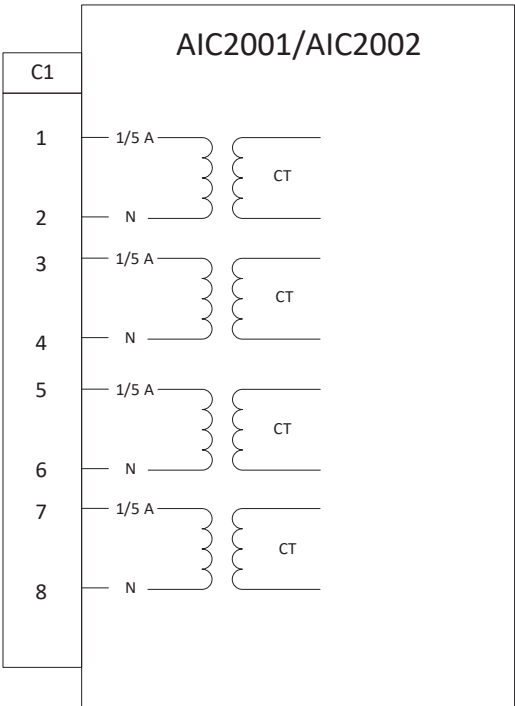


Figure 23: AIC2001/AIC2002 module

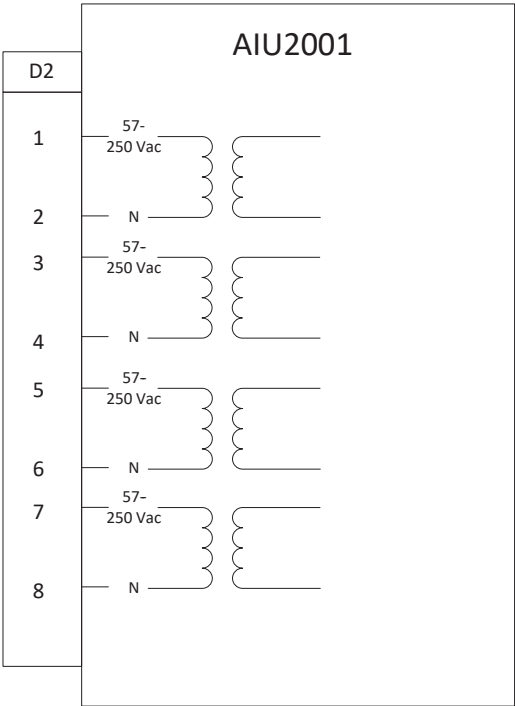


Figure 24: AIU2001 module

**Table 16: Pre-wired terminals from SPAJ 110 C to CT connector of REX610**

REX610		SPAJ 110 C		Wiring description
Terminal	Description	Terminal	Terminal	
C1:1	IL1	-	-	C1:1
C1:2	IL1	-	-	C1:2
C1:3	IL2	-	-	C1:3
C1:4	IL2	-	-	C1:4
C1:5	IL3	26/27	Io, 1A/5A	C1:5 (26/27)
C1:6	IL3	-	-	C1:6 <sup>25</sup>
C1:7	Io	-	-	C1:7 <sup>25</sup>
C1:8	Io	25	Io	C1:8 (25)

**Table 17: Pre-wired terminals from SPAJ 111 C to CT connector of REX610**

REX610		SPAJ 111 C		Wiring description
Terminal	Description	Terminal	Terminal	
C1:7	Io	26/27	Io, 1A/5A	C1:7 (26/27)
C1:8	Io	25	Io	C1:8 (25)

**Table 18: Pre-wired terminals from SPAJ 131 C to CT connector of REX610**

REX610		SPAJ 131 C		Wiring description
Terminal	Description	Terminal	Terminal	
C1:1	IL1	2/3	IL1, 5A/1A	C1:1 (2/3)
C1:2	IL1	1	IL1	C1:2 (1)
C1:3	IL2	5/6	IL2, 5A/1A	C1:3 (5/6)
C1:4	IL2	4	IL2	C1:4 (4)
C1:5	IL3	8/9	IL3, 5A/1A	C1:5 (8/9)
C1:6	IL3	7	IL3	C1:6 (7)

**Table 19: Pre-wired terminals from SPAJ 135 C to CT connector of REX610**

REX610		SPAJ 135 C		Wiring description
Terminal	Description	Terminal	Terminal	
C1:1	IL1	2/3	IL1, 5A/1A	C1:1 (2/3)
C1:2	IL1	1	IL1	C1:2 (1)
C1:3	IL2	-	-	C1:3 (5/6)
C1:4	IL2	-	-	C1:4 (4)
C1:5	IL3	8/9	IL3, 5A/1A	C1:5 (8/9)

*Table continues on the next page*

<sup>25</sup> Terminals are wired together. IL3 and Io inputs are wired in series to make automatic doubling of Io>> operative (multiplication by the INRP HAR -function block).

REX610		SPAJ 135 C		Wiring description
Terminal	Description	Terminal	Terminal	
C1:6	IL3	7	IL3	C1:6 (7)
C1:7	Io	26/27	Io, 1A/5A	C1:7 (26/27)
C1:8	Io	25	Io	C1:8 (25)

**Table 20: Pre-wired terminals from SPAJ 140/141/142 C to CT connector of REX610**

REX610		SPAJ 140/141/142 C		Wiring description
Terminal	Description	Terminal	Terminal	
C1:1	IL1	2/3	IL1, 5A/1A	C1:1 (2/3)
C1:2	IL1	1	IL1	C1:2 (1)
C1:3	IL2	5/6	IL2, 5A/1A	C1:3 (5/6)
C1:4	IL2	4	IL2	C1:4 (4)
C1:5	IL3	8/9	IL3, 5A/1A	C1:5 (8/9)
C1:6	IL3	7	IL3	C1:6 (7)
C1:7	Io	26/27 <sup>26</sup> 27/28 <sup>27</sup>	Io, 5A/1A <sup>26</sup> Io, 1A/0.2A <sup>27</sup>	C1:7 (26/27/28)
C1:8	Io	25	Io	C1:8 (25)

**Table 21: Pre-wired terminals from SPAJ 144 C to CT connector of REX610**

REX610		SPAJ 144 C		Wiring description
Terminal	Description	Terminal	Terminal	
C1:1	IL1	2/3	IL1, 5A/1A	C1:1 (2/3)
C1:2	IL1	1	IL1	C1:2 (1)
C1:3	IL2	5/6	IL2, 5A/1A	C1:3 (5/6)
C1:4	IL2	4	IL2	C1:4 (4)
C1:5	IL3	8/9	IL3, 5A/1A	C1:5 (8/9)
C1:6	IL3	7	IL3	C1:6 (7)
C1:7	Io	26/27	Io, 5A/1A	C1:7(26/27)
C1:8	Io	25	Io	C1:8 (25)

**Table 22: Pre-wired terminals from SPAU 110 C to VT connector of REX610**

REX610		SPAU 110 C		Wiring description
Terminal	Description	Terminal	Terminal	
D2:7	Uo	29/30	Uo, 100V/110V	D2:7 (29/30)
D2:8	Uo	28	Uo	D2:8 (28)

<sup>26</sup> SPAJ 140 C

<sup>27</sup> SPAJ 141 C / SPAJ 142 C

**Table 23: Pre-wired terminals from SPAU 121 C to VT connector of REX610**

REX610		SPAU 121 C		Wiring description
Terminal	Description	Terminal	Terminal	
D2:1	U1	14/15	U1, 100V/110V	D2:1 (14/15)
D2:2	U1	13	U1	D2:2 (13)
D2:3	U2	-	-	D2:3 <sup>28</sup>
D2:4	U2	-	-	D2:4 <sup>28</sup>
D2:5	U3	-	-	D2:5 <sup>29</sup>
D2:6	U3	-	-	D2:6 <sup>29</sup>

**Table 24: Pre-wired terminals from SPAU 130 C to VT connector of REX610**

REX610		SPAU 130 C		Wiring description
Terminal	Description	Terminal	Terminal	
D2:1	U1	14/15	U1, 100V/110V	D2:1 (14/15) <sup>30</sup>
D2:2	U1	13	U1	D2:2 (13) <sup>30</sup>
D2:3	U2	17/18	U2, 100V/110V	D2:3 (17/18)
D2:4	U2	16	U2	D2:4 (16)
D2:5	U3	20/21	U3, 100V/110V	D2:5 (20/21)
D2:6	U3	19	U3	D2:6 (19)

**Table 25: Pre-wired terminals from SPAS 120 C to CT and VT connectors of REX610**

REX610		SPAS 120 C		Wiring description
Terminal	Description	Terminal	Terminal	
C1:7	Io	26/27	Io, 1A/5A	C1:5 (26/27)
C1:8	Io	25	Io	C1:6 (25)
D2:7	Uo	29/30	Uo, 100V/110V	D2:7 (29/30)
D2:8	Uo	28	Uo	D2:8 (28)

**Table 26: Pre-wired terminals from SPAM 150 C (NO) to CT connector REX610**

REX610		SPAJ 150 C (NO)		Wiring description
Terminal	Description	Terminal	Description	
C1:1	IL1	2/3	IL1, 5A/1A	C1:1 (2/3)
C1:2	IL1	1	IL1	C1:2 (1)
C1:3	IL2	5/6	IL2, 5A/1A	C1:3 (5/6)
C1:4	IL2	4	IL2	C1:4 (4)

*Table continues on the next page*

<sup>28</sup> Terminals are wired together

<sup>29</sup> Terminals are wired together

<sup>30</sup> VT connection for the single-phase operation (SG1/1=1, SPCJ3C14)

REX610		SPAJ 150 C (NO)		Wiring description
Terminal	Description	Terminal	Description	
C1:5	IL3	8/9	IL3, 5A/1A	C1:5 (8/9)
C1:6	IL3	7	IL3	C1:6 (7)
C1:7	Io	26/27	Io, 5A/1A	C1:7(26/27)
C1:8	Io	25	Io	C1:8 (25)

**Table 27: Pre-wired terminals from SPAM 150 C (NC) CT connector REX610**

REX610		SPAM 150 C (NC)		Wiring description
Terminal	Description	Terminal	Description	
C1:1	IL1	2/3	IL1, 5A/1A	C1:1 (2/3)
C1:2	IL1	1	IL1	C1:2 (1)
C1:3	IL2	5/6	IL2, 5A/1A	C1:3 (5/6)
C1:4	IL2	4	IL2	C1:4 (4)
C1:5	IL3	8/9	IL3, 5A/1A	C1:5 (8/9)
C1:6	IL3	7	IL3	C1:6 (7)
C1:7	Io	26/27	Io, 5A/1A	C1:7(26/27)
C1:8	Io	25	Io	C1:8 (25)

## 5.4

### Connecting the communication



See the REX610 Installation Manual for detailed information about connecting the communication.

## 5.5

### Energizing the protection relay



See the REX610 Installation Manual for detailed information about energizing the protection relay.



## 6 Removing, repairing and exchanging



See the REX610 Installation Manual for detailed information about removing, repairing and exchanging the protection and control relay.

## 7 Accessories and ordering data

**Table 28: Order codes for Relay Retrofit Program for SPACOM to REX610**

SPACOM relay type to be retrofitted	Order code	Replacement relay REX610 order code <sup>1</sup>
SPAJ 110 C <sup>2</sup>	RRPSPAJ110CREX610	REX6101GA#####
SPAJ 111 C <sup>3</sup>	RRPSPAJ111CREX610	REX6101GA#####
SPAJ 131 C	RRPSPAJ131CREX610	REX6101GA#####
SPAJ 135 C	RRPSPAJ135CREX610	REX6101GA#####
SPAJ 140 C	RRPSPAJ140CREX610	REX6101GA#####
SPAJ 141 C	RRPSPAJ141CREX610	REX6101GA#####
SPAJ 142 C	RRPSPAJ142CREX610	REX6101GA#####
SPAJ 144 C	RRPSPAJ144CREX610	REX6101GA#####
SPAU 110 C	RRPSPAU110CREX610	REX6101G#B#####
SPAU 121 C	RRPSPAU121CREX610	REX6101G#B#####
SPAU 130 C	RRPSPAU130CREX610	REX6101G#B#####
SPAS 120 C	RRPSPAS120CREX610	REX6101GAB#####
SPAM 150 C (NO)	RRPSPAM150NOREX610	REX6101GA#####
SPAM 150 C (NC)	RRPSPAM150NCREX610	REX6101GA#####

<sup>1</sup> The order code for a replacement relay REX610 includes a fixed part in capital letters and a non-fixed part in hashes (#). The non-fixed part can be freely selected when ordering a REX610 relay.

<sup>2</sup> SPAJ110 (SPCJ1C8) high-set stage earth-fault protection function (Io>>) is not fully compatible with REX610. EFxPTOC -function blocks don't have built in an automatic doubling feature. For multiplication, an INRPHAR -function blocking is needed, therefore at least one of the phase current inputs must be connected in series with the Ioinput. Note! INRPHAR blocking is based on 2nd harmonic.

<sup>3</sup> SPAJ111 (SPCJ1C7) low-set stage earth-fault protection function (Io>) is not fully compatible with REX610. The lowest setting value for SPAJ111 is 0.2 %In, the lowest setting value for REX610 (EFLPTOC) is 1.0 %In.

**Table 29: Order codes for parts and accessories for warranty purposes only**

Item	Description	Order code
Relay retrofit adapter set without REX610 relay	Retrofit Adapter Set_RRPSPAJ110CREX610	1VFR100521A0001
Relay retrofit adapter set without REX610 relay	Retrofit Adapter Set_RRPSPAJ111CREX610	1VFR100521A0002
Relay retrofit adapter set without REX610 relay	Retrofit Adapter Set_RRPSPAJ131CREX610	1VFR100521A0003
Relay retrofit adapter set without REX610 relay	Retrofit Adapter Set_RRPSPAJ135CREX610	1VFR100521A0004
Relay retrofit adapter set without REX610 relay	Retrofit Adapter Set_RRPSPAJ140CREX610	1VFR100521A0005
Relay retrofit adapter set without REX610 relay	Retrofit Adapter Set_RRPSPAJ141CREX610	1VFR100521A0006
Relay retrofit adapter set without REX610 relay	Retrofit Adapter Set_RRPSPAJ142CREX610	1VFR100521A0007
Relay retrofit adapter set without REX610 relay	Retrofit Adapter Set_RRPSPAJ144CREX610	1VFR100521A0008
Relay retrofit adapter set without REX610 relay	Retrofit Adapter Set_RRPSPAU110CREX610	1VFR100521A0010
Relay retrofit adapter set without REX610 relay	Retrofit Adapter Set_RRPSPAU121CREX610	1VFR100521A0011
Relay retrofit adapter set without REX610 relay	Retrofit Adapter Set_RRPSPAU130CREX610	1VFR100521A0012
Relay retrofit adapter set without REX610 relay	Retrofit Adapter Set_RRPSPAS120CREX610	1VFR100521A0009
Relay retrofit adapter set without REX610 relay	Retrofit Adapter Set_RRPSPAM150CNOREX610	1VFR100521A0013
Relay retrofit adapter set without REX610 relay	Retrofit Adapter Set_RRPSPAM150CNCREX610	1VFR100521A0014

## 8 Glossary

BIO	Binary input and output
CT	Current transformer
Ethernet	A standard for connecting a family of frame-based computer networking technologies into a LAN
HMI	Human-machine interface
IEC	International Electrotechnical Commission
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
REX610	Numerical protection and control relays for protection and supervision applications of utility substations, and industrial switchgear and equipment
RoHS	Restriction of the use of certain hazardous substances in electrical and electronic equipment
RS-485	Serial link according to EIA standard RS485
UL 94	Standard for safety of flammability of plastic materials for parts in devices and appliances testing
VT	Voltage transformer



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