

RTB615

Technical Manual





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This product complies with the directive of the Council of the European Communities on the approximation of the laws of the Member States relating to electromagnetic compatibility (EMC Directive 2014/30/EU) and concerning electrical equipment for use within specified voltage limits (Low-voltage directive 2014/35/EU). This conformity is the result of tests conducted by ABB in accordance with the product standards of the IEC 60255 series.

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 trained and qualified persons are allowed to connect and operate RTB615.



National and local electrical safety regulations must always be followed.



The frame of RTB615 has to be carefully earthed using a separate PE connection point available on the RTB615 front plate.



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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Section 1 Introduction

1.1 This manual

The RTB615 technical manual contains general information about the features of Relion® Test Box RTB615, presenting the different parts of the device and giving examples how to take advantage of the test box in different applications.

1.2 Intended audience

This manual addresses system engineers and installation and commissioning personnel, who use technical data during engineering, installation and commissioning, and in normal service.

The system engineer must have a thorough knowledge of protection systems, protection equipment, protection functions and the configured functional logic in the protection relays. The installation and commissioning personnel must have a basic knowledge in handling electronic equipment.

1.3 Product documentation

1.3.1 Product documentation set

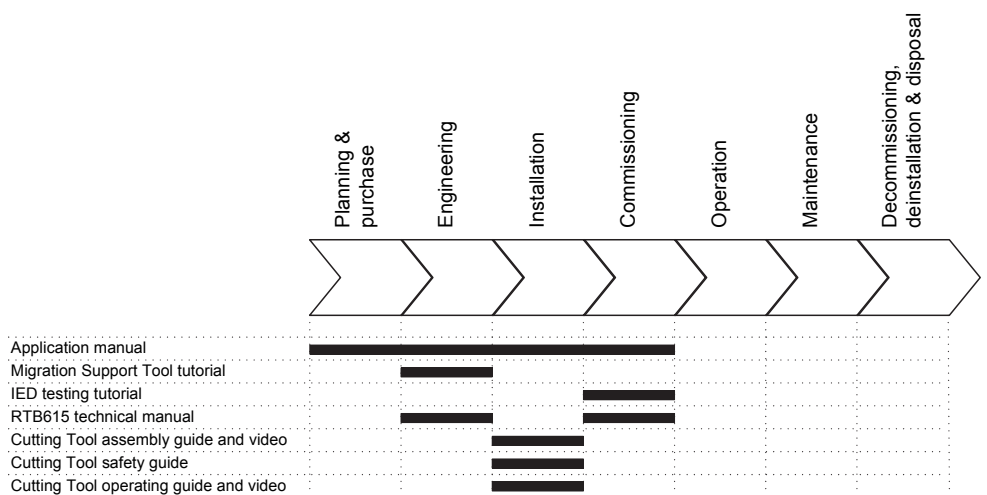


Figure 1: The intended use of documents during the product life cycle

The application manual contains the Relay Retrofit Program overview and the application descriptions. The manual describes how the program deliverables can be used in the relay retrofit applications. The manual also provides information on the retrofit process and the recommendations for each supported relay type.

Migration Support Tool tutorial shows the steps composing the process from collecting the existing relay parameter values to migrating those to the replacement IED settings.

IED testing tutorial illustrates the use of test templates in the Omicron Test Universe environment.

The RTB615 technical manual contains general information about the features of Relion® Test Box RTB615, presenting the different parts of the device and giving examples how to take advantage of the test box in different applications.

Cutting tool assembly guide and video illustrate how the cutting tool is prepared for operation.

Cutting tool safety guide contains safety recommendations to the user.

Cutting tool operating guide and video contain instructions on how to operate the tool during relay retrofit.

1.3.2

Document revision history

Document revision/date	History
A/2014-04-23	First release
B/2019-07-03	Content updated



Download the latest documents from the ABB Web site
<http://www.abb.com/mediumvoltage>.

1.3.3

Related documentation



See the 615 series documentation for detailed technical information on the IED. Product series- and product-specific manuals can be downloaded from the ABB Website
<http://www.abb.com/substationautomation>.

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 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`.

Section 2 Relion Test Box RTB615

RTB615 is a test box for 615 series plug-in units. The 615 series IED can be withdrawn from its original case and inserted to RTB615 for testing. The test box supports periodical IED testing and commissioning of new or retrofit installations. It can also be used for demonstration or training purposes and as a support during the engineering phase. All the IED's analog inputs and binary input and output interfaces are readily available on the RTB615 front plate to connect to the secondary injection device, for example, Omicron or Megger.

Both analog and binary signals of the IED, and additional test switches and indication LEDs are available in the front panel of RTB615. The IED being tested can be energized using internal power supply or an external 48 V DC power supply. RTB615 does not support the physical connections available at the IED's communication card, including possible arc protection interfaces, nor testing of them.

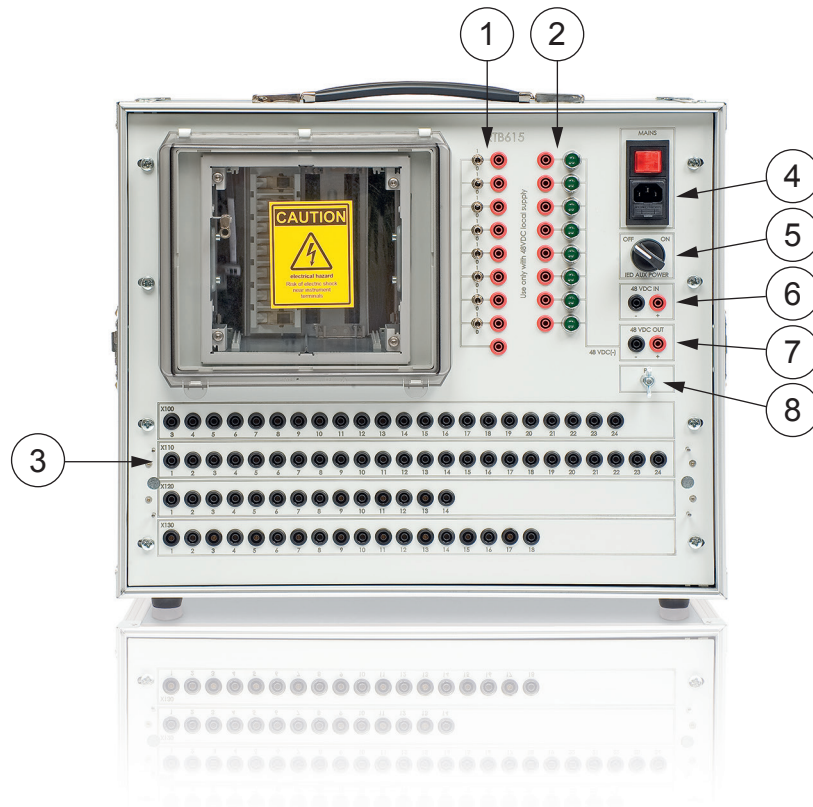


Figure 2: Front view of the Relion Test Box RTB615

- 1 Test switches
- 2 Indication LEDs
- 3 IED I/O interface terminals X100, X110, X120 and X130
- 4 Main power switch and mains wall plug connector
- 5 IED auxiliary power supply switch
- 6 48 V DC IN terminal
- 7 48 V DC OUT terminal
- 8 Protective earth (PE) terminal

2.1 Supported 615 series IEDs

RTB615 can be used with selected IEC 615 series IED variants, excluding RED615. Additionally, the REF615, REM615, RET615, REU615 and REV615 IED variants where the hardware slot X130 is in use are not supported. The 615 series IED versions

having sensor inputs (instead of conventional CTs and VTs), 5 VT inputs, RTD/mA inputs or maximum number of binary inputs are not supported.

Due to mechanical interface reasons between 615 plug-in units and RTB615, only 615 series Ver.3.0 (D) onwards is supported. See the 615 installation manual for information on detaching and installing the plug-in unit.



Composition change notification is shown on the LHMI after inserting plug-in unit to the case. Press the ESC button on the IED to continue working.



Inserting a non-compatible 615 plug-in unit into RTB615 results in an IRF situation with the IED.

Table 1: *Example of significant digits in the order code*

Determinative digits in the 18 character order code																		
Digit	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Order code	H	B	M	A	A	C	A	B	N	B	A	1	A	B	N	1	1	E

Table 2: *615 series IED order codes compatible with RTB615*

3rd digit	5th digit	6th digit	7th digit	8th digit	18th digit
F	A	A	A	A	D or later
F	A	B	A	A	D or later
F	A	A	A	C	D or later
F	A	B	A	C	D or later
F	A	A	F	G	D or later
F	A	B	A	C	D or later
F	A	B	F	G	D or later
F or M	A	C	A	B	D or later
F or M	A	C	A	D	D or later
F or M	A	D	A	B	D or later
F or M	A	D	A	D	D or later
T or V	B	A	B	A	D or later
V	B	A	F	D	D or later
M or U	C	A	A	H	D or later
M	C	B	A	H	D or later
M	C	A	F	D	D or later
M	C	B	F	D	D or later

2.2 IED analog and binary interfaces

All the IED’s analog input, binary input and output interfaces are available on the RTB615 front plate, to connect to the secondary injection and testing device. The connections can be done using standard banana type insulated connectors. The marking of the interfaces correspond to the markings of 615 series case rear connections and the related IED connection drawings.



The terminals 1 and 2 in the terminal row X100 are not available in the front plate. In the IED, these terminals are connected to the power supply module. For powering up the IED, see the specific section in this document.



The interface row marked with “X130” is a reservation for future needs. The IED versions where X130 hardware slot is used are not supported by RTB615.

The RTB615 connections towards secondary injection and testing device can be done in the same way as if the IED plug-in unit would be in its original case within the installation. Relevant circuit diagrams concerning the actual installation should be used to determine analog signals injection terminals and polarities as well as the expected binary input and output signals and corresponding terminals.

2.3 Masking plates

Masking plates are available for certain IED product variants of the Ver.4.0 FP1 release as an additional feature of RTB615. The masking plate is applied on the top of the terminal rows and it exposes only those signals which are relevant to the specific IED variant. The masking plate also provides references and functional names for the expected signal types.

Table 3: *RTB615 and accessories*

Item	Description	Order Code
Relion Test Box RTB615 (including masking plates)		2RCA031791
RTB615 masking plate	REF615 #BFCACAB#####1E and #BFCADAB#####1E	2RCA032077
RTB615 masking plate	REM615 #BMAACAD#####1E	2RCA032078

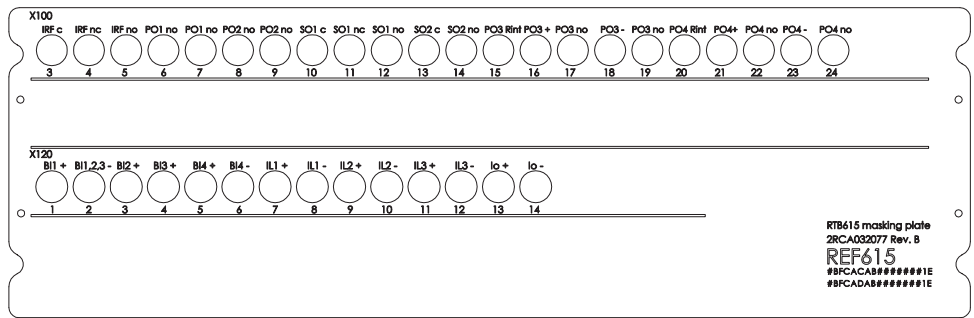


Figure 3: RTB615 masking plate for REF615

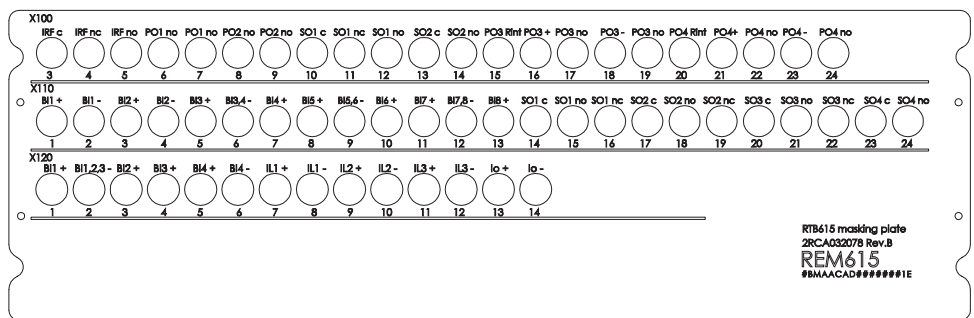


Figure 4: RTB615 masking plate for REM615

2.4 Test switches

RTB615 is equipped with eight switch controlled general purpose binary output terminals. They can be wired to the IED binary input terminals to simulate process signals connected to the IED.



The IED’s binary inputs' threshold voltage level has to be set according to the used voltage level. The parameter is found in the LHMI menu **Configuration/I/O modules/Common settings/Threshold Voltage**.

2.5 Indication LEDs

RTB615 is equipped with eight general purpose indication LEDs with connection terminals. LEDs can be wired to any binary output terminal of the IED to indicate the concerned binary output status. Driving voltage positive pole (+ side) for the indication LEDs has to be taken from RTB615’s internal 48 V DC source marked as

48 VDC OUT. The indication LEDs' negative pole (- side) is permanently connected to this source.

2.6 Power supply

RTB615 can be powered up using the mains connection or using an external 48 V DC supply, for example, from the secondary injection (test) device. In case the mains connection is used, the supply rating has to be 100...240 V AC and 50...60 Hz. [Figure 5](#) shows the RTB615 internal connections in detail. DUT refers to IED plug-in unit under test.

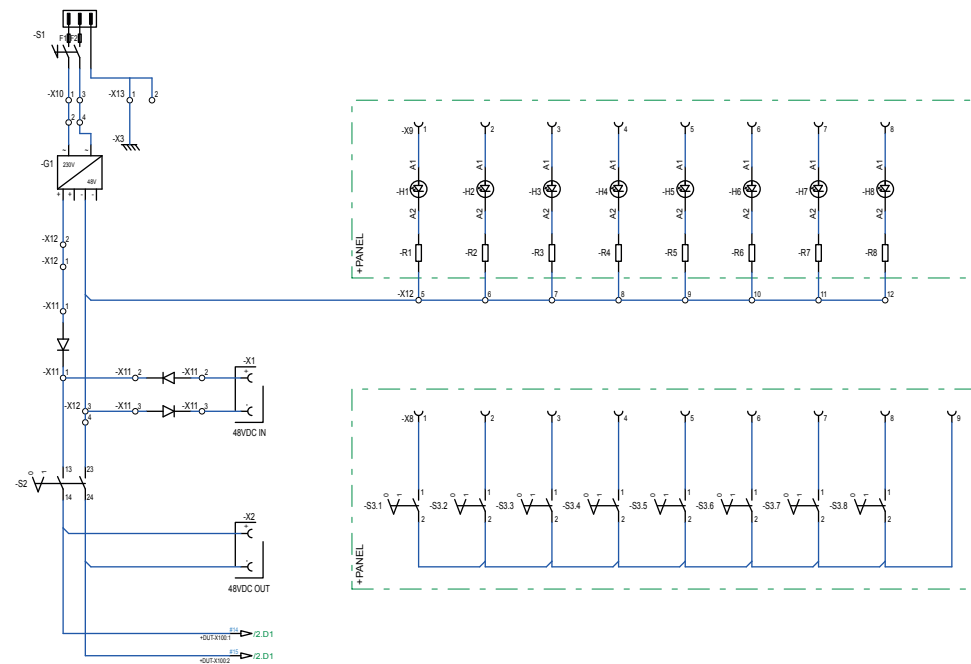


Figure 5: RTB615 internal connections concerning power supply circuits

Table 4: *RTB615 power supply connectors and selection switch*

	Connector	Description
	MAINS switch S1	100...240 V AC, 50...60 Hz, wall plug and the main switch for an in-built AC/DC converter. Fuses F1 and F2 for the mains connection can be found under the plastic hatch below the wall plug.
	IED AUX POWER switch S2	Switch for powering up the inserted IED plug-in unit. Powers up also the 48 V DC OUT connectors
	48 VDC IN connectors X1	Input connectors for an external 48 V DC power supply
	48 VDC OUT connectors X2	48 V DC output to supply the indication LEDs and test switches
	PE connector X13:2	Protective earth connection point

Section 3 Application examples

The basic functionality of the replacement IED can be easily verified in the project laboratory before entering the site. The same functionality can be tested at the site using the RTB615 test box, thus reducing the amount of tests to be carried out when the 615 series plug-in unit is inserted to its original case and installed. By using the XRIO-based test templates for replacement, IEDs together with the secondary test devices RTB615 and Omicron considerably simplifies and speeds up the testing.

Retrofit program provides testing templates for specific IED models which replace the existing relays. These templates are verified by ABB together with migrated configuration from existing relay.

Benefits of RTB615 are quite similar for all applications. The test box provides a convenient interface to access plug-in unit's hardware interfaces and an easy way to energize the IED. This helps planning and preparing easily reproducible test sequences at office. Tests can be automated by predefining relay characteristics, tolerances and trigger conditions and using the test templates to adapt the setting values for each IED being tested.



The final trip test (operating the circuit breaker) should always be done while the IED is inserted to its original case as a part of the installation.



Current and voltage transformers' correct phasing, ratio and circuit conductivity have to be checked while the IED plug-in unit is inserted to the original case as a part of the installation.

Following paragraphs give some examples how RTB615 can be utilized in different use cases.

3.1 Testing under the Relay Retrofit Program

The basic functionality of the replacement IED can be verified in the project laboratory before entering the site. The same functionality can be tested at the site using RTB615, thus reducing the amount of tests to be carried out when the 615 series plug-in unit is inserted to its original case and installed. Using XRIO-based test templates for replacement IEDs with the secondary test devices RTB615 and Omicron simplifies and speeds up the testing.

RTB615 enables IED plug-in unit testing in parallel to the panel wiring and IED case installation work. This allows two persons to work simultaneously without disturbing each other in the process.

Retrofit program provides testing templates for specific IED models replacing old relays. These templates are verified by ABB together with migrated configuration from old relay.

3.1.1 Testing templates

The parameter settings of the existing relay have been migrated into the new replacement IED parameters and configuration during the migration phase. The testing phase target is to verify two issues; the new replacement IED is in full operation condition and the behaviour corresponds to behaviour of the old relay. Specific test templates have been created to support this phase.

Each test template covers a specific existing relay and new IED set-up. The templates are designed to be used by the Omicron Test Universe. The templates support testing of protection features as per the existing relay functionalities. An editable report of the carried out tests is issued at the end of the test sequence.

When the test templates are applied, the Omicron Test Universe guides the user through a semi-automated test sequence. The templates receive the IED settings from the Parameter Setting Tool of PCM600 in XRIO-based format.

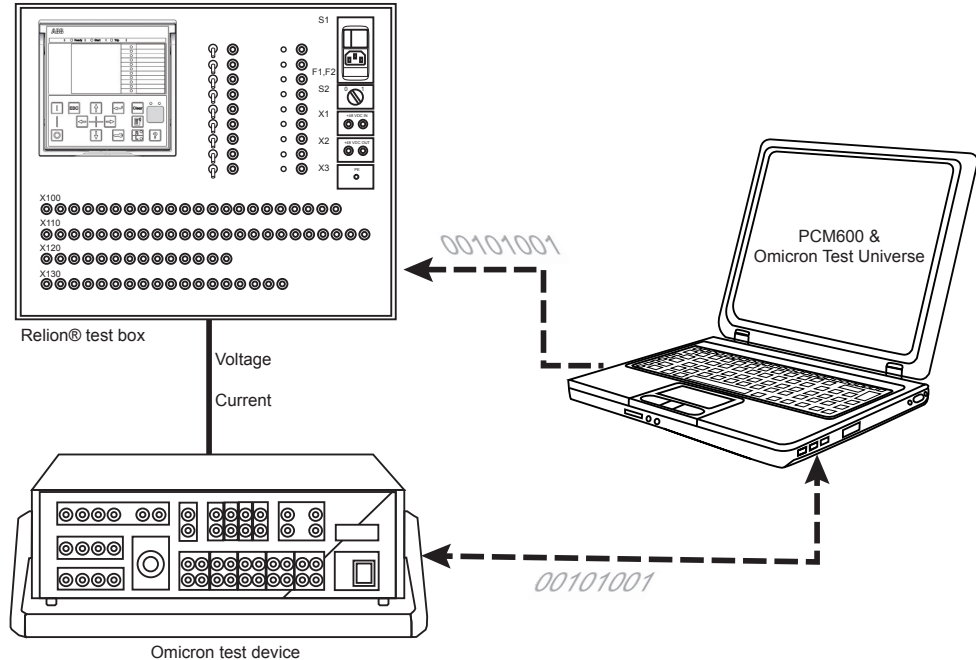


Figure 6: Test system based on RTB615 and Omicron toolset

3.2 Testing and verification during engineering phase

RTB615 helps wiring the signals from test equipment when testing the application configuration during the engineering period.

Test switches and indication LEDs help to simulate process signals when testing the logic IED configuration. The PCM600 Application Configuration tool in online mode together with RTB615 enable many possibilities to test and verify logic.

3.3 Periodical testing

When planning periodical testing, it is assumed that the system is properly and comprehensively commissioned. The scope of the periodical testing usually includes injecting known current and voltage signals to verify measuring accuracy, protection functionality and correct operation of input and output contacts.

RTB615 enables testing without separate test switches or disconnecting terminals inside the installation.

The necessary connections between RTB615 and the secondary testing and injection device need only be prepared for the first test case. Other similar IED plug-in units can be tested using the same connections. This approach speeds up the periodical testing work.

Section 4 Glossary

615 series	Series of numerical protection and control relays for protection and supervision applications of utility substations, and industrial switchgear and equipment
DUT	Device under test
IED	Intelligent electronic device
IRF	1. Internal fault 2. Internal relay fault
LHMI	Local human-machine interface
PCM600	Protection and Control IED Manager
PE	1. Polyethylene 2. Protective earth
RED615	Line differential protection and control relay
REF615	Feeder protection and control relay
REM615	Motor protection and control relay
RET615	Transformer protection and control relay
REU615	Voltage protection and control relay
REV615	Capacitor bank protection and control relay
RTB615	Relion Test Box
RTD	Resistance temperature detector
VT	Voltage transformer
XRIO	eXtended Relay Interface by OMICRON



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