Relion® 611 series

Busbar and Multipurpose Differential Protection and Control REB611 Product Guide

Power and productivity
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Contents

1. Description

REB611 is a dedicated busbar protection IED (intelligent electronic device) designed for phase-segregated short-circuit protection, control, and supervision of single busbars. REB611 is intended for use in high-impedance-based applications within utility substations and industrial power systems. In addition, the IED can be utilized in restricted earth-fault and residual earth-fault applications for the protection of generators, motors, transformers and reactors.

REB611 is a member of ABB's Relion® product family and part of the 611 protection and control product series. The 611 series IEDs are characterized by their compactness and withdrawable-unit design.

The 611 series is designed to offer simplified but powerful functionality intended for most applications. Once the application-specific parameters have been entered, the installed IED is ready to be put into service. The further addition of communication functionality and interoperability between substation automation devices offered by the IEC 61850 standard adds flexibility and value to end users as well as electrical system manufacturers.

2. Standard configuration

REB611 is available in one standard configuration.

To increase the user-friendliness of the IED's standard configuration and to emphasize the IED's simplicity of usage, only the application-specific parameters need setting within the IED's intended area of application.

The standard signal configuration can be altered by LHMI (human-machine interface), WHMI (Web browser-based user interface) or the optional application functionality of the Protection and Control IED Manager PCM600.

Table 1. Standard configuration

Description	Std. conf.
High-impedance differential	A

Table 2. Supported functions

Functionality	Conf. A
Protection[1]	
High-impedance differential protection, instance 1	●
High-impedance differential protection, instance 2	●
High-impedance differential protection, instance 3	●
Non-directional earth-fault protection, low stage, instance 1	●[2]
Non-directional earth-fault protection, high stage, instance 1	●[2]
Circuit breaker failure protection	●
Master trip, instance 1	●
Master trip, instance 2	●
Control	
Circuit-breaker control	●
Supervision	
Trip circuit supervision, instance 1	●
Trip circuit supervision, instance 2	●
CT supervision for high-impedance protection scheme, instance 1	●
CT supervision for high-impedance protection scheme, instance 2	●
CT supervision for high-impedance protection scheme, instance 3	●
Measurement	
Disturbance recorder	●
Three-phase current measurement, instance 1 [3]	●
Residual current measurement, instance 1	●

● = Included

1) The instances of a protection function represent the number of identical function blocks available in a standard configuration.
2) Io selectable by parameter, Io measured as default.
3) In REB611, CMMXU is used for measuring differential phase currents.

3. Protection functions

The IED offers phase-segregated (three phases) high-impedance differential protection and non-directional earth-fault protection for busbars, motors and generators. REB611 also offers high-impedance differential-based restricted earth-fault protection for motors, generators, reactors and power transformers.

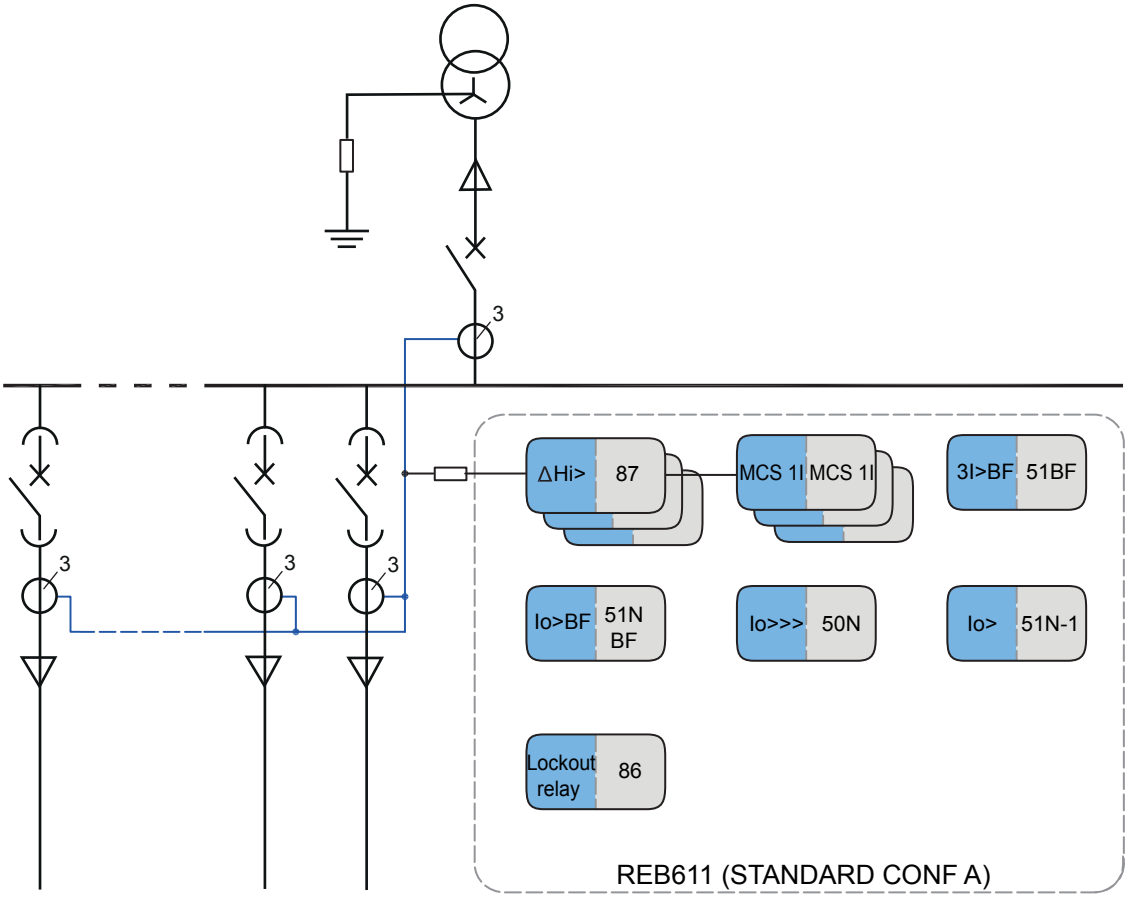


Figure 1. Protection function overview of standard configuration A in a single zone with bus-wire supervision

4. Application

The IED REB611 offers bus-differential protection in a single zone with bus-wire supervision. It also offers the possibility of bus-differential protection over two zones using two REB611 IEDs.

The IED REB611 can be used in the protection of a motor or generator using the combined restricted earth-fault and residual earth-fault protection functionalities. Due to the individuality of the high-impedance protection functions, a single REB611 can be used for restricted earth-fault protection of both the high and low voltage side of a power transformer.

The high-impedance principle for busbar differential protection provides a secure and dependable protection scheme against faults within the measured zone. The high-impedance principle has been used for many years for differential protection due to the capability to manage through-faults also with heavy current transformer (CT) saturation.

The IED REB611's high-impedance protection functions contain built-in blocking functionality, which is provided by the bus-wire supervision functions to restrict faulty operations in case of faults in the measurement circuits.

An additional stand-by (residual) earth-fault protection is provided by the two non-directional earth-fault stages. The stand-by earth-fault protection can be used together with the high-impedance protection functionality to protect motors, generators and transformers against residual earth-faults. The measurements are taken from the earthing point of the protected object.

The residual earth-fault protection can also be used as bus-wire supervision, especially in new or retrofitting applications, where an earth-fault protection function is used for grounding the measurement circuits where short-circuiting or circuit breaks have occurred. The grounding can be done by an external relay.

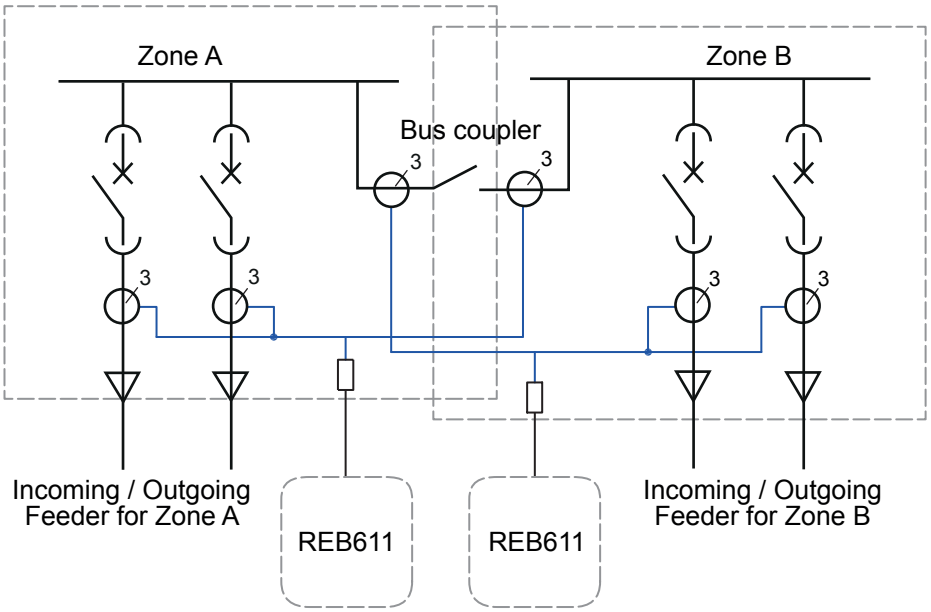


Figure 2. Bus-differential protection covering two zones with two REB611 IEDs

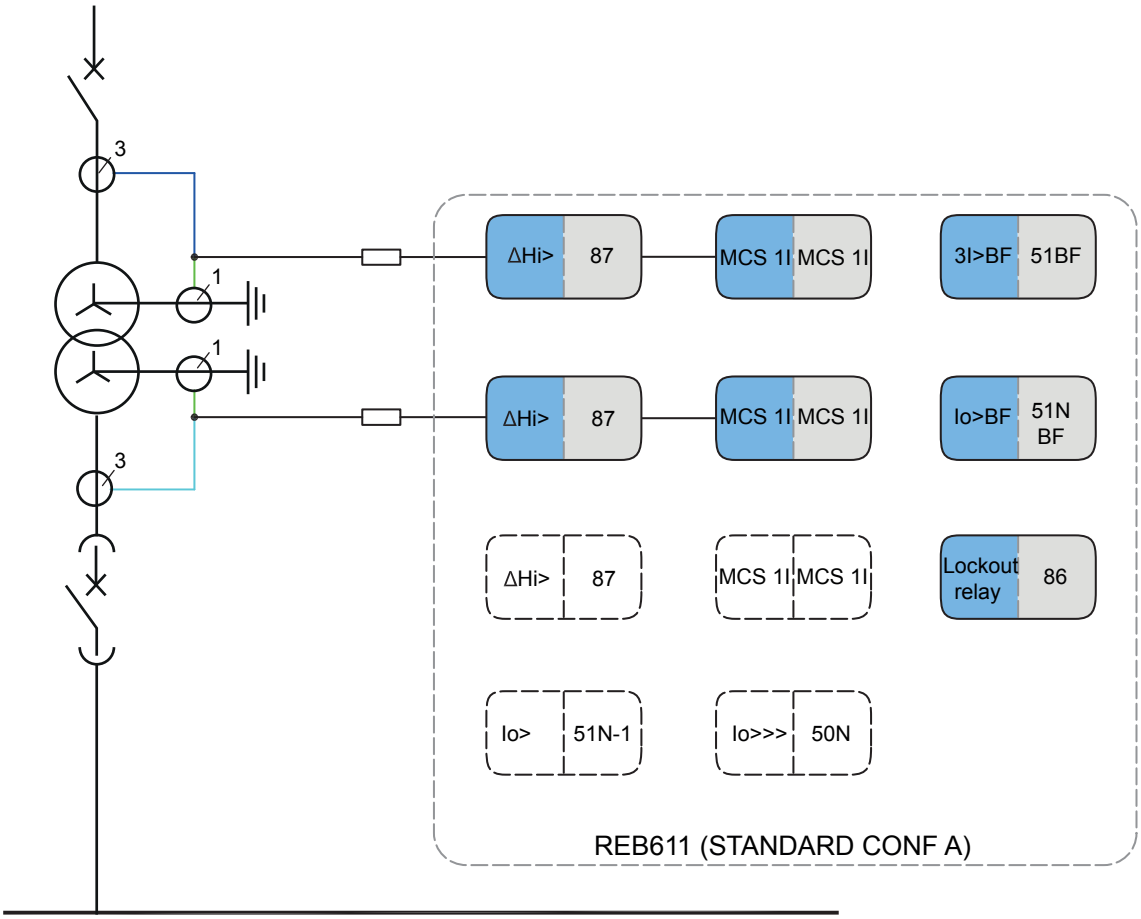


Figure 3. Restricted earth-fault protection of the high and low voltage side of a power transformer

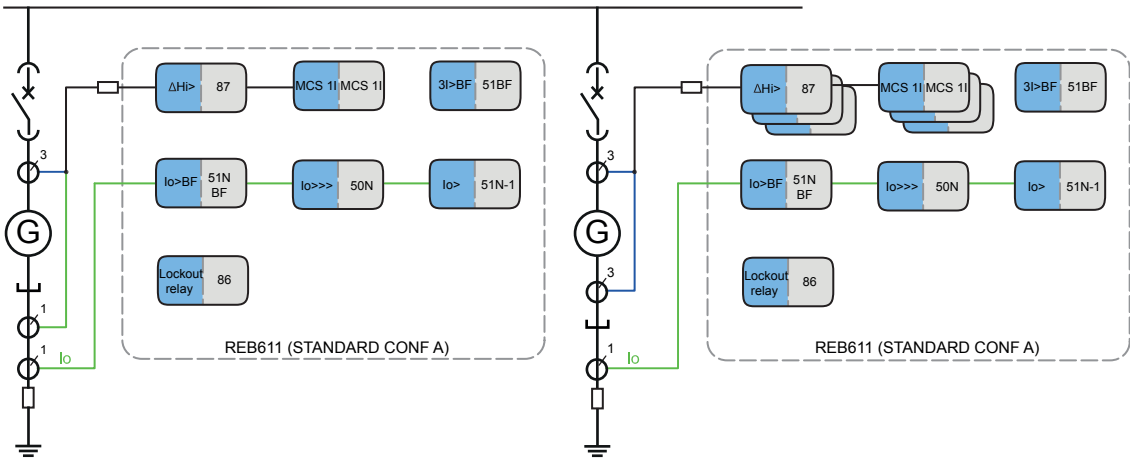


Figure 4. Protection of two generators, one with restricted earth fault and the other with high-impedance differential, both combined with standby earth fault

5. Supported ABB solutions

ABB's 611 series protection and control IEDs together with the COM600 Station Automation device constitute a genuine IEC 61850 solution for reliable power distribution in utility and industrial power systems. To facilitate and streamline the system engineering, ABB's IEDs are supplied with Connectivity Packages containing a compilation of software, IED-specific information and a full IED data model including event and parameter lists. By utilizing the Connectivity Packages, the IEDs can be readily configured via the PCM600 Protection and Control IED Manager and integrated with the COM600 Station Automation device or the MicroSCADA Pro network control and management system.

The 611 series IEDs offer native support for the IEC 61850 standard, including limited binary GOOSE messaging. Compared with traditional hard-wired inter-device signaling, peer-to-peer communication over a switched EthernetLAN offers an advanced and versatile platform for power system protection. The 611 series IED's implementation of the IEC 61850 substation automation standard enables access to some distinctive features that include fast software-based communication, continuous supervision of the integrity of the protection and communication system, and inherent flexibility for reconfiguration and upgrades.

The customizable graphical display of the Web browser-based HMI of COM600 presents a single-line diagram feature that is especially useful for the 611 series IEDs because of the limited size of the LHMI. Further, the WHMI of COM600 offers an overview of the whole substation, including IED-specific single-line diagrams, thus enabling convenient information accessibility.

To enhance personnel safety, the WHMI also enables remote access to substation devices and processes. Furthermore, COM600 can be used as a local data warehouse for technical documentation of the substation and for network data collected by the IEDs. The collected network data facilitates extensive reporting and analyzing of network fault situations using the data and event handling features of COM600.

The data historian can be used for accurate process performance monitoring by following process and equipment performance calculations with real-time and history values. Better understanding of the process behaviour by joining time-based process measurements with production and maintenance events helps the user to understand the process dynamics.

COM600 also features gateway functionality providing seamless connectivity between the substation IEDs and network-level control and management systems such as MicroSCADA Pro and System 800xA.

Table 3. Supported ABB solutions

Product	Version
Station Automation COM600	3.4 or later
MicroSCADA Pro	9.2 SP2 or later
System 800xA	5.0 Service Pack 2

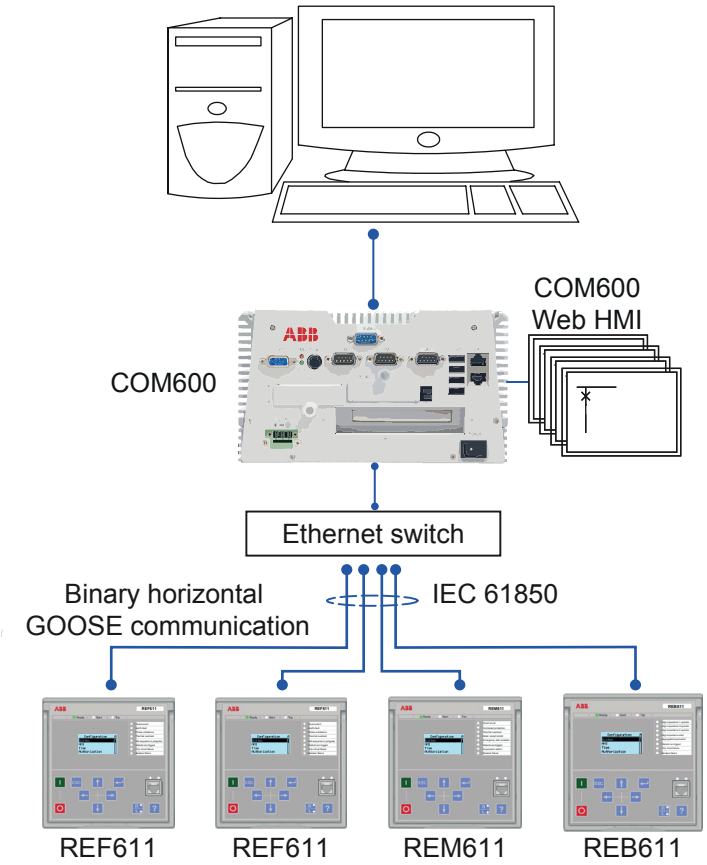


Figure 5. Power system example using 611 series IEDs, COM600 and MicroSCADA pro or System 800xA

6. Control

The IED offers control of one circuit breaker or contactor with dedicated push buttons for opening and closing. Control is achieved via the IED's LHMI or a remote system (for example, the Protection and Control IED Manager COM600).

By default, the IED is equipped with a single input interlocking scheme. For the creation of additional interlocking schemes, secured object control (SOC), blocking-based protection schemes or external tripping, binary GOOSE messaging can be used.

These additional protection and control schemes required by specific applications are configured using the LHMI, the WHMI and the optional application functionality of PCM600. The LHMI and the WHMI can be utilized for signal configuration, while the PCM600 is required for the configuration of the GOOSE messaging.

7. Measurement

The IED continuously measures the high-impedance and neutral currents.

The measured values can be accessed locally via the user interface on the IED front panel or remotely via the communication interface of the IED. The values can also be accessed locally or remotely using the WHMI.

8. Disturbance recorder

The IED is provided with a disturbance recorder with preconfigured analog and binary channels.

The analog channels can be set to record either the waveform or the trend of the currents and residual voltage measured. The analog channels can also be set to trigger the recording function when the measured values fall below or exceed the set values.

The binary signal channels can be set to start a recording on the rising or the falling edge of the binary signal or both. The binary channels are preconfigured to record IED-specific signals, for example the start or trip signals of the IED stages, or external blocking or control signals. All available preconfigured binary signals can be set to trigger the recordings.

Additionally, the disturbance recorder contains the status of the active setting group.

The recorded information is stored in a non-volatile memory and can be uploaded for subsequent fault analysis.

For additional information regarding the preconfigured analog and binary channels, see the standard configuration section in the application manual.

9. Event log

To collect sequence-of-events (SoE) information, the IED incorporates a non-volatile memory with a capacity of storing up to 512 events with associated time stamps. The non-volatile memory retains its data also in case the IED temporarily loses its auxiliary supply. The event log facilitates detailed pre- and post-fault analyses of feeder faults and disturbances. The increased capacity to process and store data and events in the IED offers the prerequisites to support the growing information demand of future network configurations.

The SoE information can be accessed locally via the user interface on the IED front panel or remotely via the communication interface of the IED. The information can further be accessed, either locally or remotely, using the Web browser-based user interface.

10. Recorded data

The IED has the capacity to store the records of the 32 latest fault events. The records enable the user to analyze the most recent power system events.

Each record includes current, residual voltage and angle values, start times of the protection blocks, time stamp, and so on.

The fault recording can be triggered by the start signal or the trip signal of a protection block, or by both.

The available measurement modes include DFT, RMS and peak-to-peak. In addition, the maximum demand current with time stamp is recorded separately. By default, the records are stored in the non-volatile memory of the device.

11. Trip circuit supervision and measurement circuit supervision

The trip circuit supervision (TCS) continuously monitors the availability and operability of the trip circuit. It provides two open-circuit monitoring functions that can be used to monitor the circuit breaker’s control signal circuits. The supervision function of the TCS also detects the loss of circuit breaker control voltage.

The measurement circuit supervision function of the IED constantly monitors the performance of the current transformer. This is done by utilizing the phase-segregated CT supervision function.

12. Self-supervision

The IED’s built-in self-supervision system continuously monitors the state of the IED hardware and the operation of the IED software. The operator is alerted when any fault or malfunction is detected.

A permanent IED fault blocks the protection functions to prevent incorrect operation.

13. Access control

To protect the IED from unauthorized access and to maintain information integrity, the IED is provided with a four-level, role-based authentication system with administrator-programmable individual passwords for the viewer, operator, engineer and administrator

levels. The access control applies both locally and remotely to the front panel user interface, the Web browser-based user interface and PCM600.

14. Inputs and outputs

The IED is equipped with three phase-segregated differential current inputs and one residual-current input. The differential current inputs and the residual-current inputs are rated 1/5 A, that is, the inputs allow connection of either 1 A or 5 A secondary current transformers. The optional residual-current input 0.2/1 A is normally used in applications requiring sensitive earth-fault protection and featuring core-balance current transformers.

The rated currents of the analog inputs can be selected in the IED software. In addition, the binary input threshold (18…176 V DC) can be selected by adjusting the IED's parameter settings.

All binary input and output contacts are pre-configured according to the two standard configurations available, but can be easily reconfigured by setting application-based parameters using the signal configuration functionality of the LHMI and WHMI.

See the Input/output overview table and the terminal diagrams for more information about the IED's inputs and outputs.

Table 4. Input/output overview

Standard configuration	Analog inputs		Binary inputs/outputs	
	CT	VT	BI	BO
A	4	-	4	6

15. Communication

For application specific situations where communication between IEDs and remote systems are needed, the 611 series IEDs also support IEC 61850 and Modbus® communication protocols. Operational information and controls are available through these protocols. Some communication functionality, for example, horizontal communication between the IEDs, is only enabled by the IEC 61850 communication protocol.

The IEC 61850 communication implementation supports monitoring and control functionality. Additionally, parameter settings and disturbance and fault records can be accessed using the IEC 61850 protocol. Disturbance records are available to any Ethernet-based application in the standard COMTRADE file format. The IED supports simultaneous event reporting to five different clients on the station bus.

The IED can send binary signals to other IEDs (so-called horizontal communication) using the IEC 61850-8-1 GOOSE (Generic Object Oriented Substation Event) profile. Binary GOOSE messaging can, for example, be employed for protection and interlocking-based protection schemes. The IED meets the GOOSE performance requirements for tripping applications in distribution substations, as defined by the IEC 61850 standard.

The IED offers an optional second Ethernet bus to enable the creation of a self-healing Ethernet ring-type topology. The communication module including three RJ-45 ports is used when the whole substation bus is based on CAT5 STP cabling.

The self-healing Ethernet ring solution enables a cost-efficient communication loop controlled by a managed switch with rapid spanning tree protocol (RSTP) support. The managed switch controls the consistency of the ring, routes the data and corrects the data flow in case of a communication disturbance. The IEDs in the ring topology act as unmanaged switches forwarding unrelated data traffic. The self-healing Ethernet ring solution avoids single point of failure concerns and improves the reliability of the communication.

All communication connectors, except for the front port connector, are placed on integrated

optional communication modules. The IED can be connected to Ethernet-based communication systems via the RJ-45 connector (100Base-TX) or the fibre-optic LC connector (100Base-FX). If connection to a serial bus is required, the 10-pin RS-485 screw terminal can be used.

Modbus implementation supports RTU, ASCII and TCP modes. Besides standard Modbus functionality, the IED supports retrieval of time-stamped events, changing the active setting group and uploading of the latest fault records. If a Modbus TCP connection is used, five clients can be connected to the IED simultaneously.

When the IED uses the RS-485 bus for the serial communication, both two- and four-wire connections are supported. Termination and pull-up/down resistors can be configured with jumpers on the communication card. External resistors are not needed.

The IED supports the following time synchronization methods with a time-stamping resolution of 1 ms:

Ethernet-based:
- SNTP (Simple Network Time Protocol)

With special time synchronization wiring:
- IRIG-B (Inter-Range Instrumentation Group - Time Code Format B)

In addition, the IED supports time synchronization via the Modbus protocol.

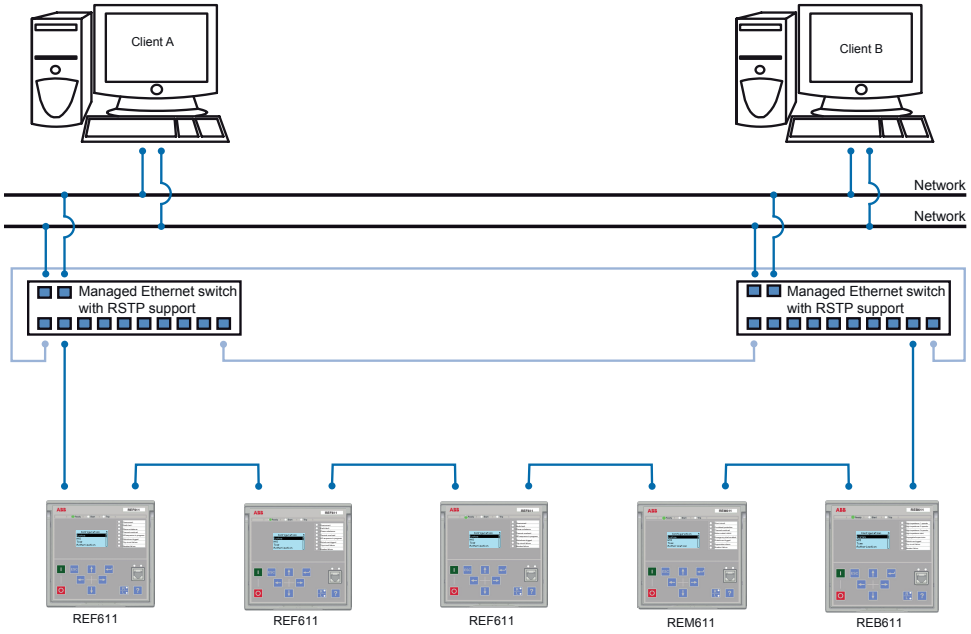


Figure 6. Self-healing Ethernet ring solution

Table 5. Supported station communication interfaces and protocols

Interfaces/protocols	Ethernet		Serial
	100BASE-FX	10/100BASE-TX	RS-485
IEC 61850	•	•	-
MODBUS RTU/ASCII	-	-	•
MODBUS TCP/IP	•	•	-

• = Supported

16. Technical data

Table 6. Dimensions

Description	Value	
Width	Frame	177 mm
	Case	164 mm
Height	Frame	177 mm (4U)
	Case	160 mm
Depth		201 mm (153 + 48 mm)
Weight	Complete IED	4.1 kg
	Plug-in unit only	2.1 kg

Table 7. Power supply

Description	Type 1	Type 2
U_{aux}nominal	100, 110, 120, 220, 240 V AC 50 and 60 Hz	24, 30, 48, 60 V DC
	48, 60, 110, 125, 220, 250 V DC	
Maximum interruption time in the auxiliary DC voltage without resetting the IED	50 ms at $U_n$rated	
U_{aux}variation	38...110% of U_n (38...264 V AC)	50...120% of U_n (12...72 V DC)
	80...120% of U_n (38.4...300 V DC)	
Start-up threshold		19.2 V DC (24 V DC * 80%)
Burden of auxiliary voltage supply under quiescent (P_q)/ operating condition	DC < 12.0 W (nominal)/< 18.0 W (max.) AC < 16.0 W (nominal)/< 21.0 W (max.)	DC < 12.0 W (nominal)/< 18.0 W (max.)
Ripple in the DC auxiliary voltage	Maximum 15% of the DC value (at frequency of 100 Hz)	
Fuse type	T4A/250 V	

Table 8. Energizing inputs

Description		Value	
Rated frequency		50/60 Hz	
Current inputs	Rated current, I_n	0.2/1 A[1)]	1/5 A[2)]
	Thermal withstand capability:		
	• Continuously	4 A	20 A
	• For 1 s	100 A	500 A
	Dynamic current withstand:		
	• Half-wave value	250 A	1250 A
	Input impedance	< 100 mΩ	< 20 mΩ

1) Ordering option for residual current input
2) Residual current and/or phase current

Table 9. Binary inputs

Description	Value
Operating range	±20% of the rated voltage
Rated voltage	24...250 V DC
Current drain	1.6...1.9 mA
Power consumption	31.0...570.0 mW
Threshold voltage	18...176 V DC
Reaction time	3 ms

Table 10. Signal output X100: SO1

Description	Value
Rated voltage	250 V AC/DC
Continuous contact carry	5 A
Make and carry for 3.0 s	15 A
Make and carry for 0.5 s	30 A
Breaking capacity when the control-circuit time constant L/R<40 ms	1 A/0.25 A/0.15 A
Minimum contact load	100 mA at 24 V AC/DC (2.4 VA)

Table 11. Signal outputs and IRF output

Description	Value
Rated voltage	250 V AC/DC
Continuous contact carry	5 A
Make and carry for 3.0 s	10 A
Make and carry 0.5 s	15 A
Breaking capacity when the control-circuit time constant L/R<40 ms, at 48/110/220 V DC	1 A/0.25 A/0.15 A
Minimum contact load	100 mA at 24 V AC/DC (2.4 VA)

Table 12. Double-pole power output relays with TCS function

Description	Value
Rated voltage	250 V AC/DC
Continuous contact carry	8 A
Make and carry for 3.0 s	15 A
Make and carry for 0.5 s	30 A
Breaking capacity when the control-circuit time constant L/R<40 ms, at 48/110/220 V DC (two contacts connected in series)	5 A/3 A/1 A
Minimum contact load	100 mA at 24 V AC/DC (2.4 VA)
Trip-circuit supervision (TCS):	
• Control voltage range	20...250 V AC/DC
• Current drain through the supervision circuit	~1.5 mA
• Minimum voltage over the TCS contact	20 V AC/DC (15...20 V)

Table 13. Single-pole power output relays

Description	Value
Rated voltage	250 V AC/DC
Continuous contact carry	5 A
Make and carry for 3.0 s	15 A
Make and carry for 0.5 s	30 A
Breaking capacity when the control-circuit time constant L/R<40 ms, at 48/110/220 V DC	1 A / 0.25 A / 0.15 A
Minimum contact load	100 mA at 24 V AC/DC (2.4 VA)

Table 14. Front port Ethernet interfaces

Ethernet interface	Protocol	Cable	Data transfer rate
Front	TCP/IP protocol	Standard Ethernet CAT 5 cable with RJ-45 connector	10 MBits/s

Table 15. Station communication link, fibre-optic

Connector	Fibre type[1)]	Wave length	Max. distance	Permitted path attenuation[2)]
LC	MM 62.5/125 µm glass fibre core	1300 nm	2 km	< 8 dB

1) (MM) multi-mode fibre, (SM) single-mode fibre
2) Maximum allowed attenuation caused by connectors and cable together

Table 16. IRIG-B

Description	Value
IRIG time code format	B004, B005[1)]
Isolation	500 V 1 min
Modulation	Unmodulated
Logic level	TTL Level
Current consumption	2...4 mA
Power consumption	10...20 mW

1) According to 200-04 IRIG -standard

Table 17. Degree of protection of flush-mounted IED

Description	Value
Front side	IP 54
Rear side, connection terminals	IP 20

Table 18. Environmental conditions

Description	Value
Operating temperature range	-25...+55ºC (continuous)
Short-time service temperature range	-40...+85ºC (< 16 h)[1)2)]
Relative humidity	< 93%, non-condensing
Atmospheric pressure	86...106 kPa
Altitude	Up to 2000 m
Transport and storage temperature range	-40...+85ºC

1) Degradation in MTBF and HMI performance outside the temperature range of -25...+55ºC
2) For IEDs with an LC communication interface the maximum operating temperature is +70ºC

Table 19. Environmental tests

Description	Type test value	Reference
Dry heat test (humidity < 50%)	• 96 h at +55ºC • 16 h at +85ºC	IEC 60068-2-2
Cold test	• 96 h at -25ºC • 16 h at -40ºC	IEC 60068-2-1
Change of temperature test	• 5 cycles (3 h + 3 h) at 25°C…+55°C	IEC 60068-2-14
Damp heat test, cyclic	• 6 cycles (12 h + 12 h) at +25°C…+55°C, humidity > 93%	IEC 60068-2-30
Storage test	• 96 h at -40ºC • 96 h at +85ºC	IEC 60068-2-2 IEC 60068-2-1

Table 20. Electromagnetic compatibility tests

Description	Type test value	Reference
1 MHz/100 kHz burst disturbance test:		IEC 61000-4-18 IEC 60255-22-1, class III IEEE C37.90.1-2002
• Common mode	2.5 kV	
• Differential mode	2.5 kV	
3/10/30 MHz burst disturbance test:		IEC 61000-4-18
• Common mode	2 kV	
Electrostatic discharge test:		IEC 61000-4-2 IEC 60255-22-2 IEEE C37.90.3-2001
• Contact discharge	8 kV	
• Air discharge	15 kV	
Radio frequency interference tests:		
	10 V (rms) f=150 kHz...80 MHz	IEC 61000-4-6 IEC 60255-22-6, class III
	10 V/m (rms) f=80...2700 MHz	IEC 61000-4-3 IEC 60255-22-3, class III
	10 V/m f=900 MHz	ENV 50204 IEC 60255-22-3, class III
	20 V/m (rms) f=80...1000 MHz	IEEE C37.90.2-2004
Fast transient disturbance tests:		IEC 61000-4-4 IEC 60255-22-4 IEEE C37.90.1-2002
• All ports	4 kV	
Surge immunity test:		IEC 61000-4-5 IEC 60255-22-5
• Communication	2 kV, line-to-earth	
• Other ports	4 kV, line-to-earth 2 kV, line-to-line	
Power frequency (50 Hz) magnetic field:		IEC 61000-4-8
• Continuous • 1...3 s	300 A/m 1000 A/m	
Pulse magnetic field immunity test	1000 A/m	IEC 61000-4-9
Damped oscillatory magnetic field immunity test	100 A/m	IEC 61000-4-10
Voltage dips and short interruptions	30%/10 ms 60%/100 ms 60%/1000 ms > 95%/5000 ms	IEC 61000-4-11

Table 20. Electromagnetic compatibility tests, continued

Description	Type test value	Reference
Power frequency immunity test: • Common mode • Differential mode	Binary inputs only 300 V rms 150 V rms	IEC 61000-4-16 IEC 60255-22-7, class A
Emission tests: • Conducted 0.15...0.50 MHz 0.5...30 MHz • Radiated 30...230 MHz 230...1000 MHz	 < 79 dB (µV) quasi peak < 66 dB (µV) average < 73 dB (µV) quasi peak < 60 dB (µV) average < 40 dB (µV/m) quasi peak, measured at 10 m distance < 47 dB (µV/m) quasi peak, measured at 10 m distance	EN 55011, class A IEC 60255-25

Table 21. Insulation tests

Description	Type test value	Reference
Dielectric tests • Test voltage	 2 kV, 50 Hz, 1 min 500 V, 50 Hz, 1 min, communication	IEC 60255-5 and IEC 60255-27
Impulse voltage test • Test voltage	 5 kV, 1.2/50 µs, 0.5 J 1 kV, 1.2/50 µs, 0.5 J, communication	IEC 60255-5 and IEC 60255-27
Insulation resistance measurements • Isolation resistance	 > 100 MΩ, 500 V DC	IEC 60255-5 and IEC 60255-27
Protective bonding resistance • Resistance	 < 0.1 Ω, 4 A, 60 s	IEC 60255-27

Table 22. Mechanical tests

Description	Reference	Requirement
Vibration tests (sinusoidal)	IEC 60068-2-6 (test Fc) IEC 60255-21-1	Class 2
Shock and bump test	IEC 60068-2-27 (test Ea shock) IEC 60068-2-29 (test Eb bump) IEC 60255-21-2	Class 2
Seismic test	IEC 60255-21-3	Class 2

Table 23. Product safety

Description	Reference
LV directive	2006/95/EC
Standard	EN 60255-27 (2005) EN 60255-1 (2009)

Table 24. EMC compliance

Description	Reference
EMC directive	2004/108/EC
Standard	EN 50263 (2000) EN 60255-26 (2007)

Table 25. RoHS compliance

Description
Complies with RoHS directive 2002/95/EC

Protection functions

Table 26. High-impedance differential protection (HIPDIF)

Characteristic		Value		
Operation accuracy		Depending on the frequency of the current measured: f_n ±2 Hz		
		±1.5% of the set value or ±0.002 x In		
Start time[1)2)]		Minimum	Typical	Maximum
	IFault = 2.0 x set Start value	12 ms	16 ms	24 ms
	IFault= 10 x set Start value	10 ms	12 ms	14 ms
Reset time		< 40 ms		
Reset ratio		Typical 0.96		
Retardation time		< 35 ms		
Operate time accuracy in definite time mode		±1.0% of the set value or ±20 ms		

1) Measurement mode = default (depends on stage), current before fault = 0.0 x In, fn = 50 Hz, fault current with nominal frequency injected from random phase angle, results based on statistical distribution of 1000 measurements
2) Includes the delay of the signal output contact

Table 27. High-impedance differential protection (HIPDIF) main settings

Parameter	Values (Range)	Unit	Step	Default	Description
Operate value	1...200	%In	1	5	Operate value, percentage of the nominal current
Minimum operate time	20...300000	ms	10	20	Minimum operate time

Table 28. Non-directional earth-fault protection (EFxPTOC)

Characteristic		Value		
Operation accuracy		Depending on the frequency of the current measured: f_n ±2 Hz		
	EFLPTOC	±1.5% of the set value or ±0.002 x I_n		
	EFHPTOC and EFIPTOC[1)]	±1.5% of the set value or ±0.002 x I_n (at currents in the range of 0.1…10 x I_n) ±5.0% of the set value (at currents in the range of 10…40 x I_n)		
Start time [2)3)]		Minimum	Typical	Maximum
	EFIPTOC: I_{Fault} = 2 x set *Start value*	16 ms	19 ms	23 ms
	EFIPTOC: I_{Fault} = 10 x set *Start value*	11 ms	12 ms	14 ms
	EFHPTOC and EFLPTOC: I_{Fault} = 2 x set *Start value*	22 ms	24 ms	25 ms
Reset time		< 40 ms		
Reset ratio		Typical 0.96		
Retardation time		< 30 ms		
Operate time accuracy in definite time mode		±1.0% of the set value or ±20 ms		
Operate time accuracy in inverse time mode		±5.0% of the theoretical value or ±20 ms [4)]		
Suppression of harmonics		RMS: No suppression DFT: -50 dB at f = n x f_n, where n = 2, 3, 4, 5,… Peak-to-Peak: No suppression		

1) Function not included.
2) *Measurement mode* = default (depends on stage), current before fault = 0.0 x I_n, f_n = 50 Hz, earth-fault current with nominal frequency injected from random phase angle, results based on statistical distribution of 1000 measurements
3) Includes the delay of the signal output contact
4) Maximum *Start value* = 2.5 x I_n, *Start value* multiples in range of 1.5 to 20

Table 29. Non-directional earth-fault protection (EFxPTOC) main settings

Parameter	Function	Value (Range)	Step
Start value	EFLPTOC	0.010...5.000 x I_n	0.005
	EFHPTOC	0.10...40.00 x I_n	0.01
	EFIPTOC [1]	1.00...40.00 x I_n	0.01
Time multiplier	EFLPTOC	0.05...15.00	0.05
	EFHPTOC	0.05...15.00	0.05
Operate delay time	EFLPTOC	40...200000 ms	10
	EFHPTOC	40...200000 ms	10
	EFIPTOC	20...200000 ms	10
Operating curve type[2]	EFLPTOC	Definite or inverse time Curve type: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19	
	EFHPTOC	Definite or inverse time Curve type: 1, 3, 5, 9, 10, 12, 15, 17	
	EFIPTOC	Definite time	

1) Function not included.
2) For further reference, see the Operating characteristics table at the end of the Technical data chapter.

Table 30. Circuit breaker failure protection (CCBRBRF)

Characteristic	Value
Operation accuracy	Depending on the frequency of the current measured: f_n ±2 Hz
	±1.5% of the set value or ±0.002 x I_n
Operate time accuracy	±1.0% of the set value or ±20 ms

Table 31. Circuit breaker failure protection (CCBRBRF) main settings

Parameter	Function	Value (Range)	Step
Current value (Operating phase current)	CCBRBRF	0.05...1.00 x I_n	0.05
Current value Res (Operating residual current)	CCBRBRF	0.05...1.00 x I_n	0.05
CB failure mode (Operating mode of function)	CCBRBRF	1=Current 2=Breaker status 3=Both	-
CB fail trip mode	CCBRBRF	1=Off 2=Without check 3=Current check	-
Retrip time	CCBRBRF	0...60000 ms	10
CB failure delay	CCBRBRF	0...60000 ms	10
CB fault delay	CCBRBRF	0...60000 ms	10

Table 32. Operation characteristics

Parameter	Values (Range)
Operating curve type	1=ANSI Ext. inv. 2=ANSI Very. inv. 3=ANSI Norm. inv. 4=ANSI Mod inv. 5=ANSI Def. Time 6=L.T.E. inv. 7=L.T.V. inv. 8=L.T. inv. 9=IEC Norm. inv. 10=IEC Very inv. 11=IEC inv. 12=IEC Ext. inv. 13=IEC S.T. inv. 14=IEC L.T. inv 15=IEC Def. Time 17=Programmable 18=RI type 19=RD type
Operating curve type (voltage protection)	5=ANSI Def. Time 15=IEC Def. Time 17=Inv. Curve A 18=Inv. Curve B 19=Inv. Curve C 20=Programmable 21=Inv. Curve A 22=Inv. Curve B 23=Programmable

Measurement functions

Table 33. Three-phase current measurement (CMMXU)

Characteristic	Value
Operation accuracy	Depending on the frequency of the current measured: f_n ±2 Hz
	±0.5% or ±0.002 x I_n (at currents in the range of 0.01...4.00 x I_n)
Suppression of harmonics	DFT: -50 dB at f = n x f_n, where n = 2, 3, 4, 5,… RMS: No suppression

Table 34. Residual current measurement (RESCMMXU)

Characteristic	Value
Operation accuracy	Depending on the frequency of the current measured: f/f_n = ±2 Hz
	±0.5% or ±0.002 x I_n at currents in the range of 0.01...4.00 x I_n
Suppression of harmonics	DFT: -50 dB at f = n x f_n, where n = 2, 3, 4, 5,… RMS: No suppression

Supervision functions

Table 35. CT supervision for high-impedance protection scheme (HZCCRDIF)

Characteristic	Value
Operation accuracy	Depending on the frequency of the current measured: fn ±2 Hz
	±1.5% of the set value or ±0.002 x In
Reset time	< 40 ms
Reset ratio	Typical 0.96
Retardation time	< 35 ms
Operate time accuracy in definite time mode	±1.0% of the set value or ±20 ms

Table 36. CT supervision for high-impedance protection scheme (HZCCRDIF) main settings

Parameter	Values (Range)	Unit	Step	Default	Description
Start value	1.0...100.0	%In	0.1	10.0	Start value, percentage of the nominal current
Alarm delay time	100...300000	ms	10	3000	Alarm delay time
Alarm output mode	1=Non-latched 3=Lockout			3=Lockout	Select the operation mode for alarm output

17. Local HMI

The IED is equipped with a four-line liquid crystal display (depending on the chosen font and language, more or fewer lines might be visible). The display is designed for entering parameter settings of the protection and control functions. It is also suited for remotely controlled substations where the IED is only occasionally accessed locally via the front panel user interface.

The display offers front-panel user interface functionality with menu navigation and menu views. Depending on the standard configuration, the IED displays the related measuring values.

The LHMI includes a push button (L/R) for local/remote operation of the IED. When the IED is in the local mode, the IED can be operated only by using the local front panel user interface. When the IED is in the remote mode, the IED can execute commands sent from a remote location. The IED supports the remote selection of the local/remote mode via a binary input. This feature facilitates, for example, the use of an external switch at the substation to ensure that all IEDs are in the local mode during maintenance work and that the circuit breakers cannot be operated remotely from the network control center.

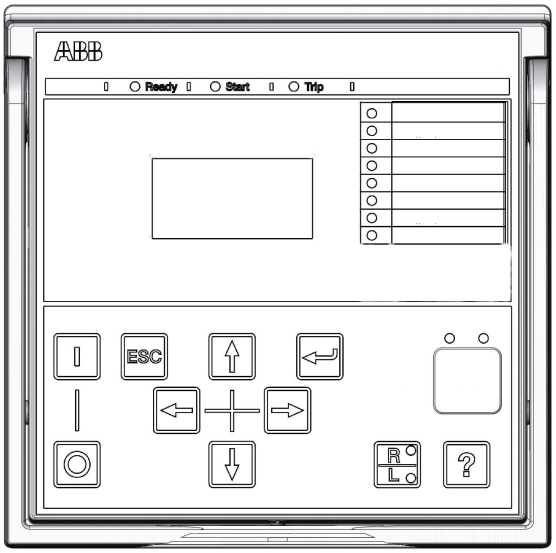


Figure 7. Front panel of 611 series IEDs

18. Mounting methods

Using appropriate mounting accessories, the standard IED case for the 611 series IED can be flush mounted, semi-flush mounted or wall mounted. The flush mounted and wall mounted IED cases can also be mounted in a tilted position (25°) using special accessories.

Further, the IEDs can be mounted in any standard 19” instrument cabinet by means of 19” mounting panels available with cut-outs for one or two IEDs. Alternatively, the IED can be mounted in 19” instrument cabinets using 4U Combiflex equipment frames.

For routine testing purposes, the IED cases can be equipped with test switches, type RTXP 18, which can be mounted side by side with the IED cases.

Mounting methods:

- Flush mounting
- Semi-flush mounting
- Semi-flush mounting in a 25° tilt
- Rack mounting
- Wall mounting
- Mounting to a 19" equipment frame
- Mounting with a RTXP 18 test switch to a 19" rack

Panel cut-out for flush mounting:

- Height: 161.5 ±1 mm
- Width: 165.5 ±1 mm

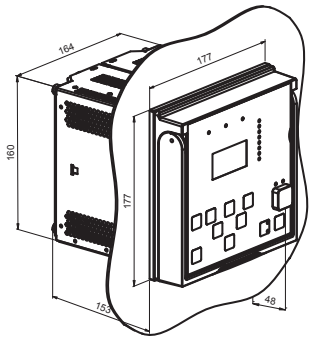


Figure 8. Flush mounting

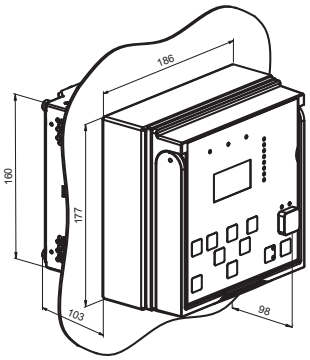


Figure 9. Semi-flush mounting

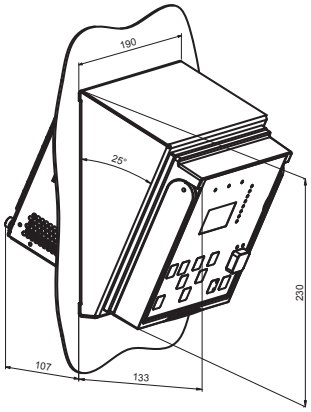


Figure 10. Semi-flush with a 25° tilt

19. IED case and IED plug-in unit

For safety reasons, the IED casings of the current measuring IEDs are equipped with automatic operating contacts that short-circuit the current transformer secondary circuits when the IED unit is withdrawn from its case. The IED casing is also equipped with a mechanical coding system that prevents current measuring IED units from being inserted into voltage measuring IED casings and vice versa, that is, the IED casings are assigned to a certain type of IED plug-in unit.

20. Selection and ordering data

The IED type and serial number label identifies the protection IED. The label is placed above the LHMI on the upper part of the plug-in unit. An order number label is placed on the side of the plug-in unit as well as inside the case. The order number consists of a string of codes generated from the IED's hardware and software modules.

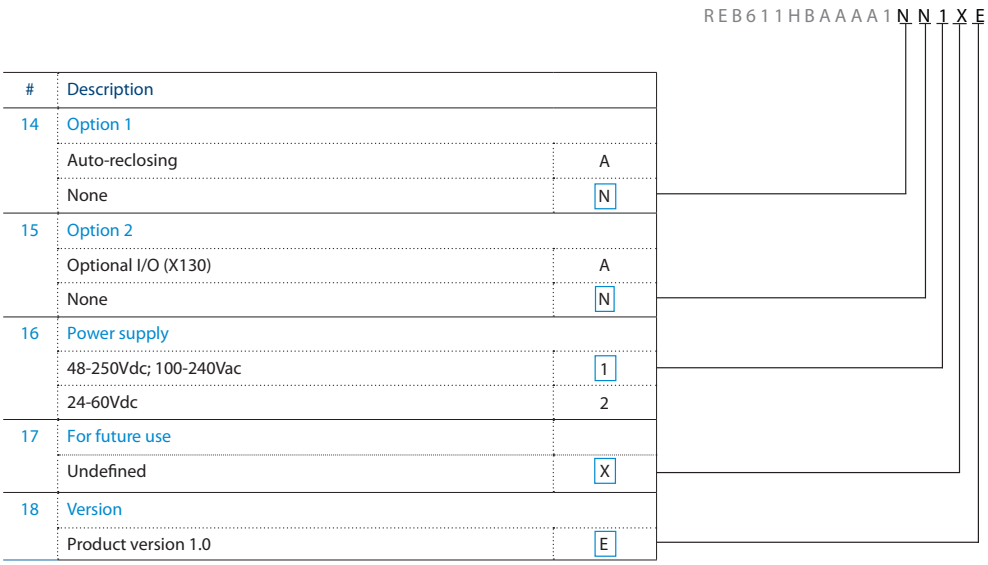
Use the ordering key information to generate the order number when ordering complete IEDs.

R E B 6 1 1 H B A A A A 1 N N 1 X E

#	Description	
1-2	Product	
	Relay	RE
3	Main application	
	Busbar and multipurpose differential protection and control	B
4-6	IED series	
	611 series IED	611
7	IED casing and test switches	
	Complete relay	H
	Complete relay with test switch installed and wired in 19" cover plate	K
	Complete relay with test switch installed and wired for Combifex rack mounting	L
8	Standard	
	IEC	B
	CN	C

R E B 6 1 1 H B A A A A 1 N N 1 X E

#	Description	
9	Standard configuration	
	High impedance differential	A
10	AIM I_0	
	1A / 5A	A
	0.2A / 1A	B
11	Communication module	
	Ethernet 100Base FX (LC)	A
	Ethernet 100Base TX (RJ45)	B
	RS485 (including IRIG-B)	C
	Ethernet 100Base TX (3*RJ45)	D
	None	N
12	Communication protocols	
	IEC61850	A
	Modbus	B
13	Language	
	English	1
	English and Chinese	2



#	Description	
14	Option 1	
	Auto-reclosing	A
	None	N
15	Option 2	
	Optional I/O (X130)	A
	None	N
16	Power supply	
	48-250Vdc; 100-240Vac	1
	24-60Vdc	2
17	For future use	
	Undefined	X
18	Version	
	Product version 1.0	E

Example code: REB611HBAAAA1NN1XE

Your ordering code:

Digit (#)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
Code																		

Figure 11. Ordering key for complete IEDs

21. Accessories and ordering data

Table 37. Mounting accessories

Item	Order number
Semi-flush mounting kit	1MRS050696
Wall mounting kit	1MRS050697
Inclined semi-flush mounting kit	1MRS050831
19” rack mounting kit with cut-out for one IED	1MRS050694
19” rack mounting kit with cut-out for two IEDs	1MRS050695
Mounting bracket for one IED with test switch RTXP in 4U Combiflex (RHGT 19” variant C)	2RCA022642P0001
Mounting bracket for one IED in 4U Combiflex (RHGT 19” variant C)	2RCA022643P0001
19” rack mounting kit for one IED and one RTXP18 test switch (the test switch is not included in the delivery)	2RCA021952A0003
19” rack mounting kit for one IED and one RTXP24 test switch (the test switch is not included in the delivery)	2RCA022561A0003

22. Tools

The IED is delivered as a pre-configured unit. The default parameter setting values can be changed from the front-panel user interface, the Web browser-based user interface (WHMI) or PCM600 in combination with the IED-specific Connectivity Package.

The Protection and Control IED Manager PCM600 is available in three different variants, that is PCM600, PCM600 Engineering and PCM600 Engineering Pro. Depending on the chosen variant, PCM600 offers extensive IED configuration functions, such as IED signal configuration and IEC 61850 communication configuration including horizontal GOOSE communication.

When the WHMI is used, the IED can be accessed either locally or remotely using a Web browser (IE 7.0 or 8.0). For security reasons, the WHMI is disabled by default. The interface can be enabled with PCM600 or from the front panel user interface (LHMI). The functionality of the interface can be limited to read-only access by means of PCM600.

The IED connectivity package is a collection of software and specific IED information, which enable system products and tools to connect and interact with the IED. The connectivity packages reduce the risk of errors in system integration, minimizing device configuration and set-up times. Further, the Connectivity Packages for the 611 series IEDs include a flexible update tool for adding one additional LHMI language to the IED's default English HMI language. The update tool is activated using PCM600 and enables multiple updates of the additional HMI language, thus offering flexible means for possible future language updates.

Table 38. Tools

Configuration and setting tools	Version
PCM600	2.4 or later
Web browser-based user interface	IE 7.0 and 8.0
REB611 Connectivity Package	1.0 or later

Table 39. Supported functions

Function	WHMI	PCM600	PCM600 Engineering	PCM600 Engineering Pro
IED parameter setting	●	●	●	●
Saving of IED parameter settings in the IED	●	●	●	●
Signal monitoring	●	●	●	●
Disturbance recorder handling	●	●	●	●
Alarm LED viewing	●	●	●	●
Access control management	●	●	●	●
IED signal configuration (signal matrix)	-	●	●	●
Modbus® communication configuration (communication management)	-	●	●	●
Saving of IED parameter settings in the tool	-	●	●	●
Disturbance record analysis	-	●	●	●
IEC 61850 communication configuration, GOOSE (communication configuration)	-	-	-	●
Phasor diagram viewing	●	-	-	-
Event viewing	●	-	-	-
Saving of event data on the user's PC	●	-	-	-

● = Supported

23. Terminal diagram

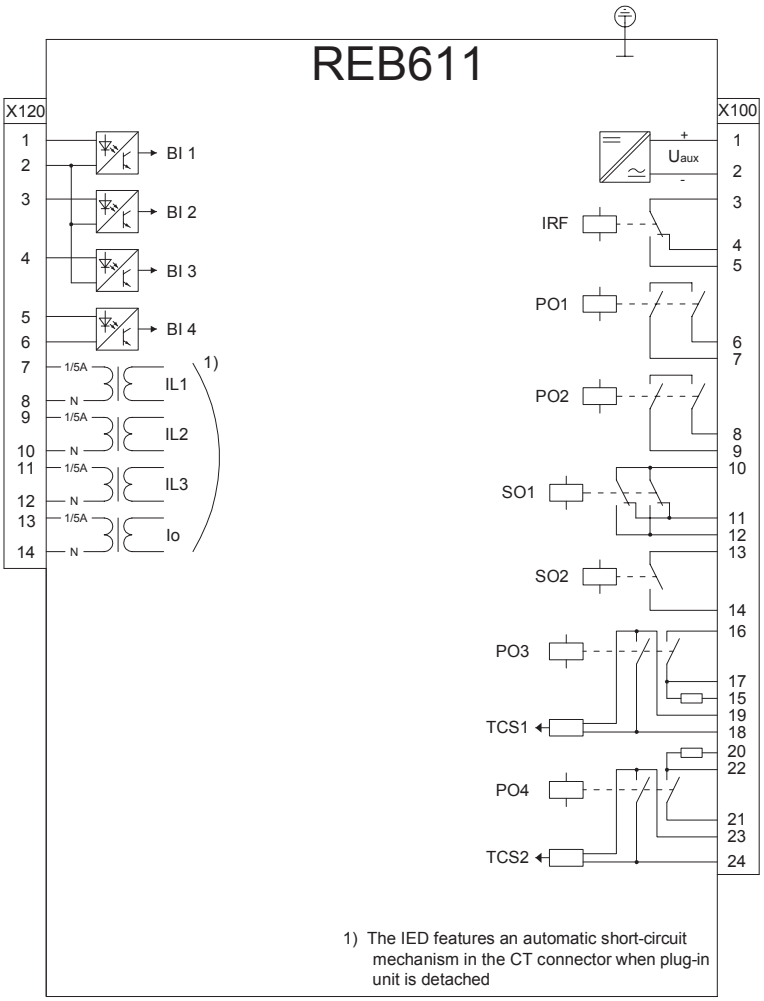


Figure 12. Terminal diagram of standard configuration A

24. References

The www.abb.com/substationautomation portal offers you information about the distribution automation product and service range.

You will find the latest relevant information on the REB611 protection IED on the product page.

The download area on the right hand side of the Web page contains the latest product documentation, such as technical reference manual, installation manual, operators manual, and so on. The selection tool on the Web page helps you find the documents by the document category and language.

The Features and Application tabs contain product related information in a compact format.

25. Functions, codes and symbols

Table 40. REB611 functions, codes and symbols

Function	IEC 61850	IEC 60617	IEC-ANSI
Protection			
High-impedance differential protection, instance 1	HIPDIF1	dHi>(1)	87(1)
High-impedance differential protection, instance 2	HIPDIF2	dHi>(2)	87(2)
High-impedance differential protection, instance 3	HIPDIF3	dHi>(3)	87(3)
Non-directional earth-fault protection, low stage, instance 1	EFLPTOC1	Io> (1)	51N-1 (1)
Non-directional earth-fault protection, high stage, instance 1	EFHPTOC1	Io>> (1)	51N-2 (1)
Circuit breaker failure protection	CCBRBRF1	3I>/Io>BF	51BF/51NBF
Master trip, instance 1	TRPPTRC1	Master Trip (1)	94/86 (1)
Master trip, instance 2	TRPPTRC2	Master Trip (2)	94/86 (2)
Switch groups			
Input switch group [1)]	ISWGAPC	ISWGAPC	ISWGAPC
Output switch group [2)]	OSWGAPC	OSWGAPC	OSWGAPC
Selector switch group [3)]	SELGAPC	SELGAPC	SELGAPC
Control			
Circuit-breaker control	CBXCBR1	I <-> O CB	I <-> O CB
Supervision			
Trip circuit supervision, instance 1	TCSSCBR1	TCS (1)	TCM (1)
Trip circuit supervision, instance 2	TCSSCBR2	TCS (2)	TCM (2)
CT supervision for high-impedance protection scheme, instance 1	HZCCRDIF1	MCS 1I(1)	MCS 1I(1)
CT supervision for high-impedance protection scheme, instance 2	HZCCRDIF2	MCS 1I(2)	MCS 1I(2)
CT supervision for high-impedance protection scheme, instance 3	HZCCRDIF3	MCS 1I(3)	MCS 1I(3)
Measurement			
Disturbance recorder	RDRE1	-	-
Three-phase current measurement, instance 1 [4)]	CMMXU1	3I	3I
Residual current measurement, instance 1	RESCMMXU1	Io	In

1) 10 instances
2) 20 instances
3) 6 instances
4) In REB611, CMMXU is used for measuring differential phase currents.

26. Document revision history

Document revision/date	Product series version	History
A/2011-11-18	1.0	First release

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