Relion® 611 series

Feeder Protection and Control REF611 Product Guide

Power and productivity for a better world™

Contents

1. Description

REF611 is a dedicated feeder IED(intelligent electronic device) designed for the protection, control, measurement and supervision of utility substations and industrial power systems including radial, looped and meshed distribution networks with or without distributed power generation. REF611 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 configurations

REF611 is available in two alternative standard configurations.

To increase the user friendliness of the IED's standard configurations 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 configurations

Description	Std. conf.
Non-directional overcurrent and directional earth-fault protection	A
Non-directional overcurrent and non-directional earth-fault protection	B

Table 2. Supported functions

Functionality	A	B
Protection[1)2)]		
Three-phase non-directional overcurrent protection, low stage, instance 1	●	●
Three-phase non-directional overcurrent protection, high stage, instance 1	●	●
Three-phase non-directional overcurrent protection, high stage, instance 2	●	●
Three-phase non-directional overcurrent protection, instantaneous stage, instance 1	●	●
Non-directional earth-fault protection, low stage, instance 1	-	●[3)]
Non-directional earth-fault protection, low stage, instance 2	-	●[3)]
Non-directional earth-fault protection, high stage, instance 1	-	●[3)]
Non-directional earth-fault protection, instantaneous stage	-	●[3)]
Directional earth-fault protection, low stage, instance 1	●[3)]	-
Directional earth-fault protection, low stage, instance 2	●[3)]	-
Directional earth-fault protection, high stage	●[3)]	-
Transient/intermittent earth-fault protection	●[4)]	-
Non-directional (cross-country) earth-fault protection, using calculated Io	●[5)]	-
Negative-sequence overcurrent protection, instance 1	●	●
Negative-sequence overcurrent protection, instance 2	●	●
Phase discontinuity protection	●	●
Residual overvoltage protection, instance 1	●	-
Residual overvoltage protection, instance 2	●	-
Residual overvoltage protection, instance 3	●	-
Three-phase thermal protection for feeders, cables and distribution transformers	●	●
Circuit-breaker failure protection	●	●
Three-phase inrush detector	●	●
Master trip, instance 1	●	●
Master trip, instance 2	●	●
Control		
Circuit-breaker control	●	●
Auto-reclosing	o	o
Supervision		
Trip circuit supervision, instance 1	●	●
Trip circuit supervision, instance 2	●	●
Measurement		
Disturbance recorder	●	●
Three-phase current measurement, instance 1	●	●

Table 2. Supported functions, continued

Functionality	A	B
Sequence current measurement	●	●
Residual current measurement, instance 1	●	●
Residual voltage measurement	●	-

● = Included,○ = Can be ordered as option

1) Note that all directional protection functions can also be used in non-directional mode.
2) The instances of a protection function represent the number of identical function blocks available in a standard configuration.
3) Io selectable by parameter, Io measured as default.
4) Io measured is always used.
5) Io selectable by parameter, Io calculated as default.

3. Protection functions

The IED offers non-directional overcurrent and thermal overload protection as well as directional and non-directional earth-fault protection. The IED also features sensitive earth-fault protection, phase discontinuity protection, transient/intermittent earth-fault protection, residual overvoltage protection, positive-sequence undervoltage and negative-sequence overvoltage protection.

As an additional option, the IED offers three-phase multi-shot auto-reclose functions for overhead line feeders.

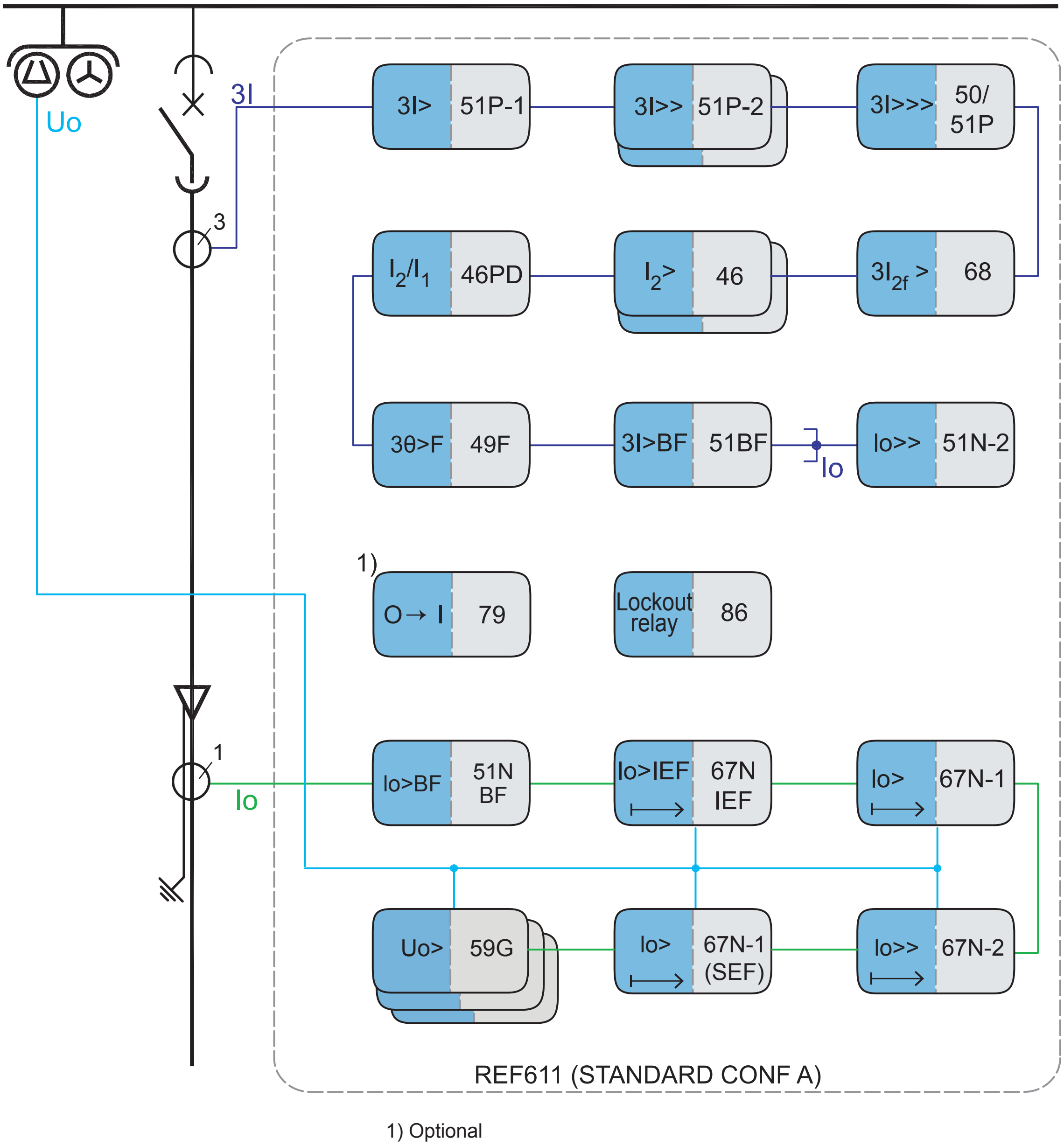

Figure 1. Protection function overview of standard configuration A

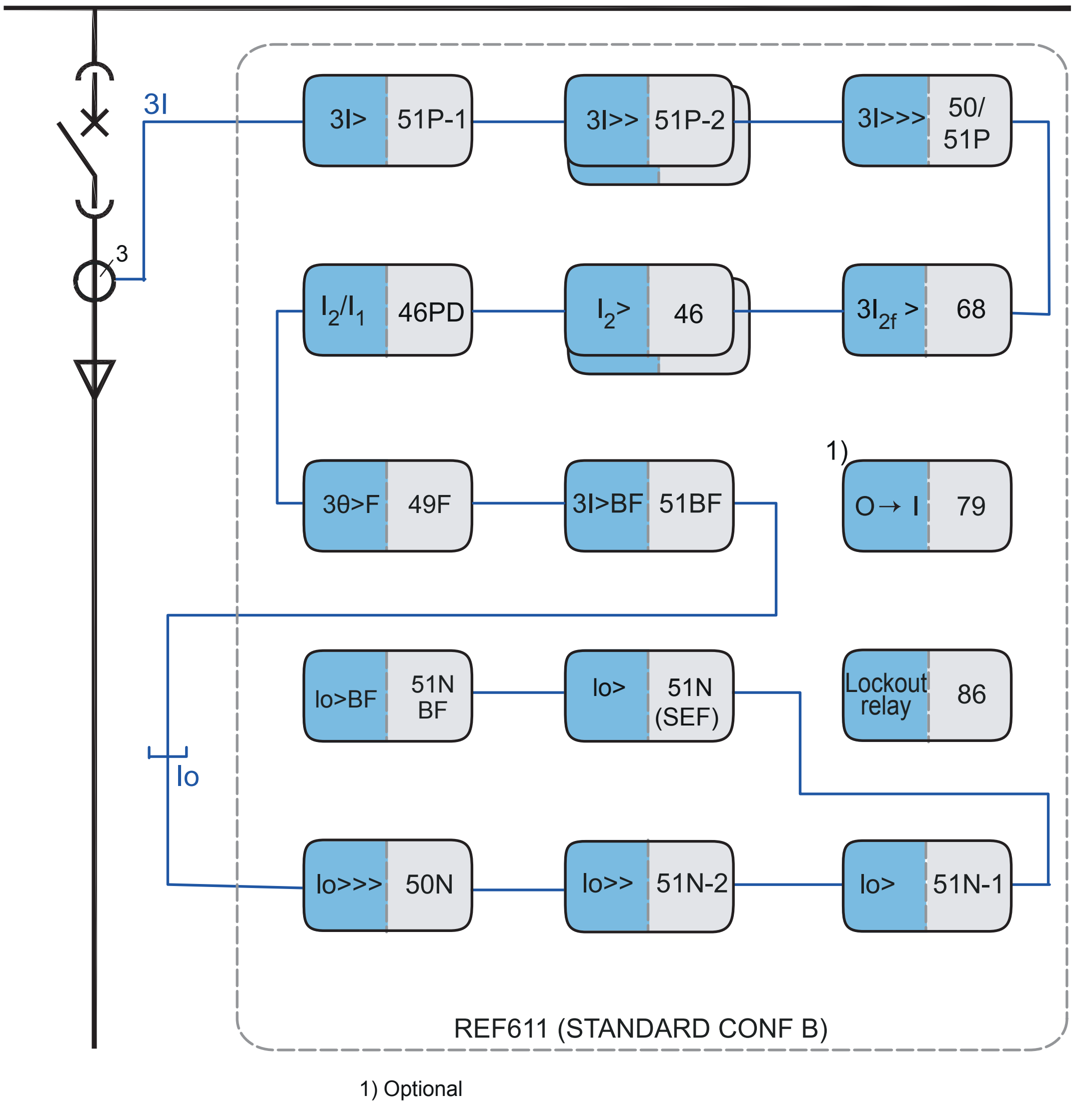

Figure 2. Protection function overview of standard configuration B

4. Application

The feeder protection IEDREF611 can be supplied either with directional or non-directional earth-fault protection. Directional earth-fault protection is mainly used in isolated neutral or compensated networks, whereas non-directional earth-fault protection is intended for directly or low impedance earthed neutral networks. The IED can also be used for protection of ring-type and meshed distribution networks, as well as radial networks containing distributed power generation.

The standard configuration A offers directional earth-fault protection, if the outgoing feeder is equipped with phase current transformers, a core-balance current transformer and residual voltage measurement. The residual current calculated from the phase currents can be used for double (cross country) earth-fault protection. The IED also features transient/intermittent earth-fault protection.

The standard configuration B offers non-directional earth-fault protection for outgoing feeders equipped with phase current transformers. The residual current for the earth-fault protection is derived from the phase currents. When applicable, the core balance current transformers can be used for measuring the residual current, especially when sensitive earth-fault protection is required.

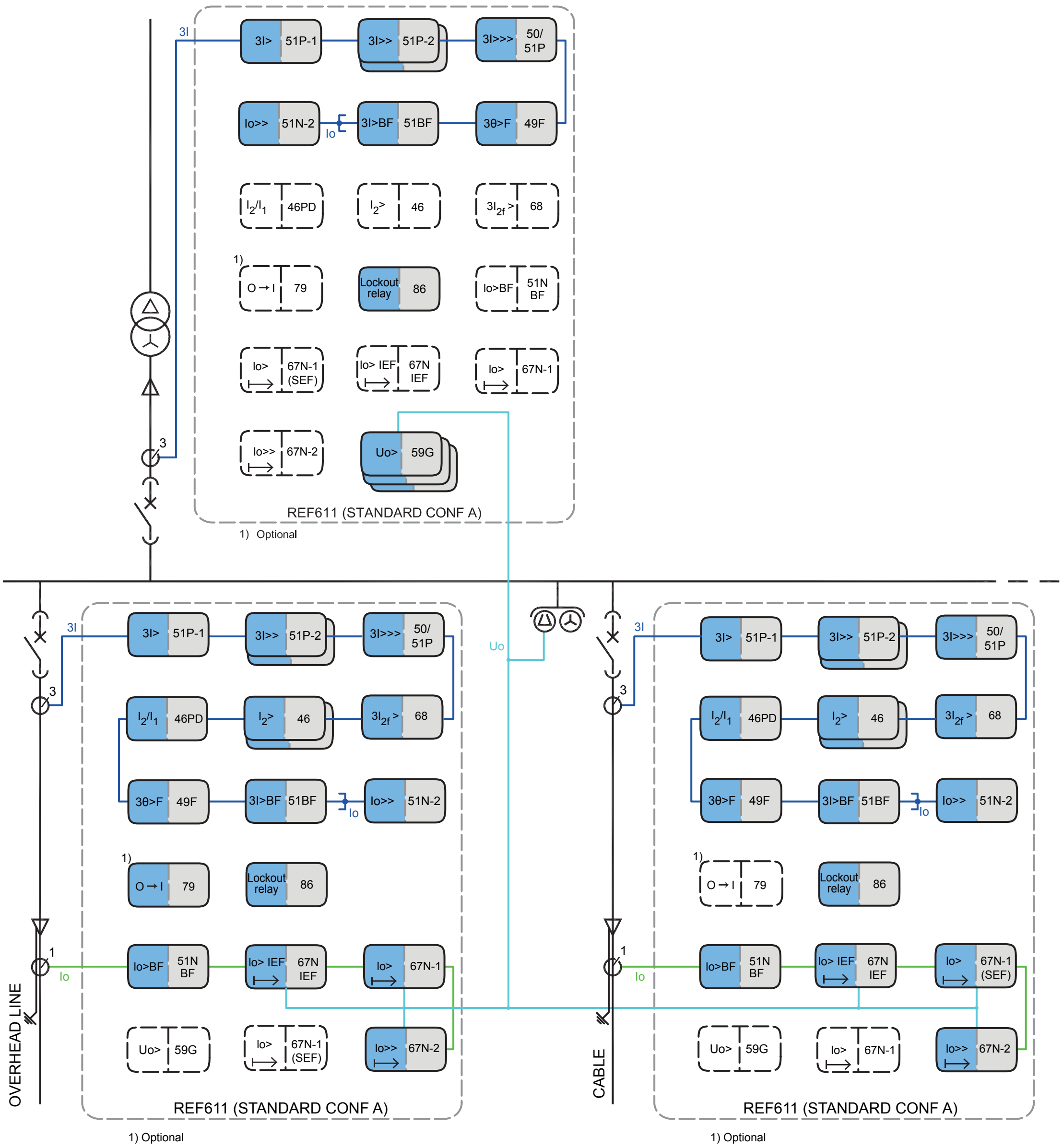

Figure 3. Substation O/C and E/F protection using the standard configuration A. The incoming feeder includes the residual overvoltage protection for the substation. The outgoing feeder uses directional earth-fault protection with the optional autoreclosing functionality for the overhead line as shown. The protection functions not used are uncolored and indicated with a dashed block outline.

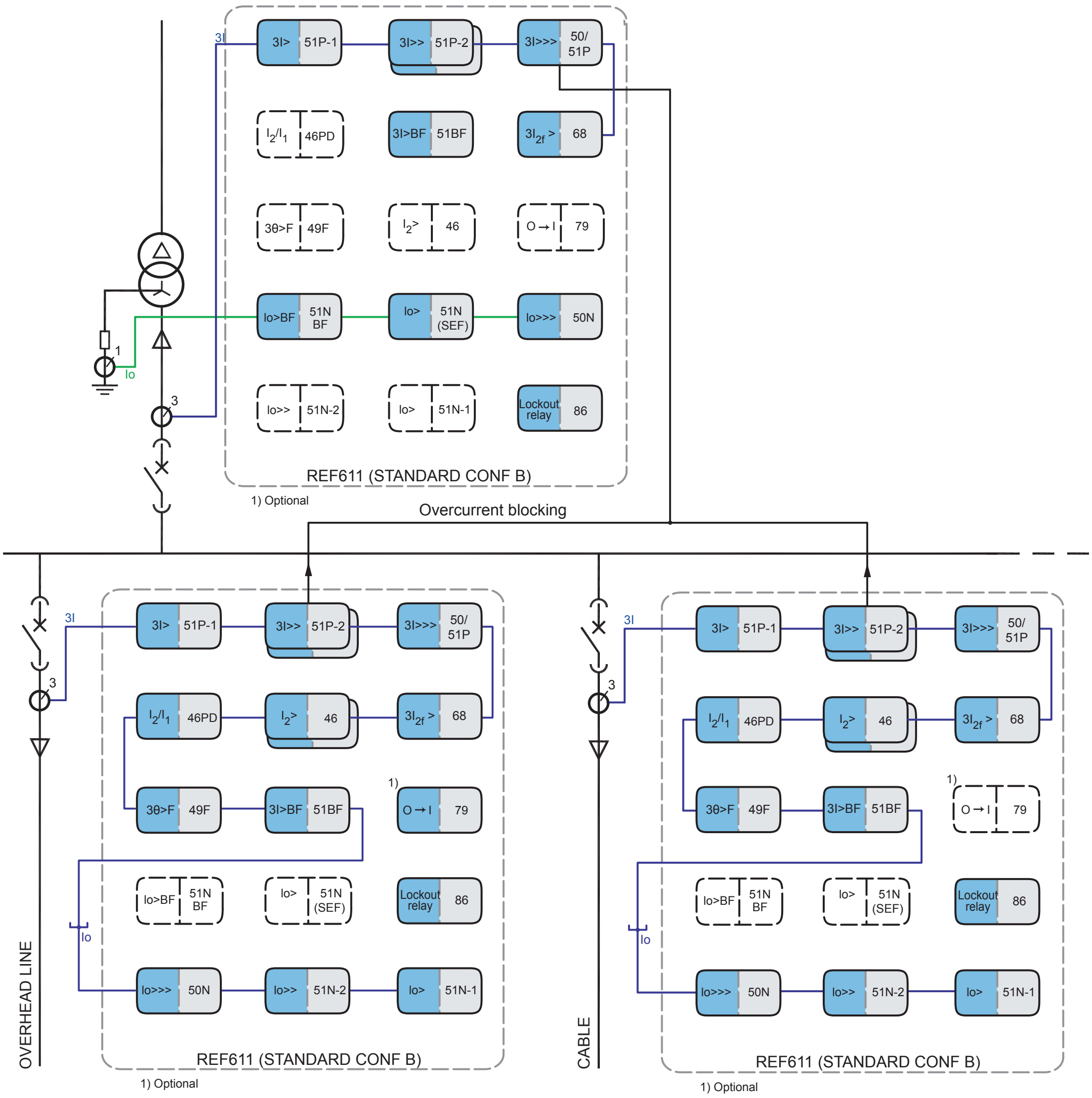

Figure 4. Substation O/C and non-directional E/F protection using the standard configuration B. The busbar protection is based on the interlocking principle, where the start of the O/C protection of the outgoing feeder sends a blocking signal to the instantaneous O/C stage of the incoming feeder. In the absence of the blocking signal, the O/C protection of the incoming feeder clears the internal switchgear (busbar) fault. The protection functions not used are uncolored and indicated with a dashed block outline.

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

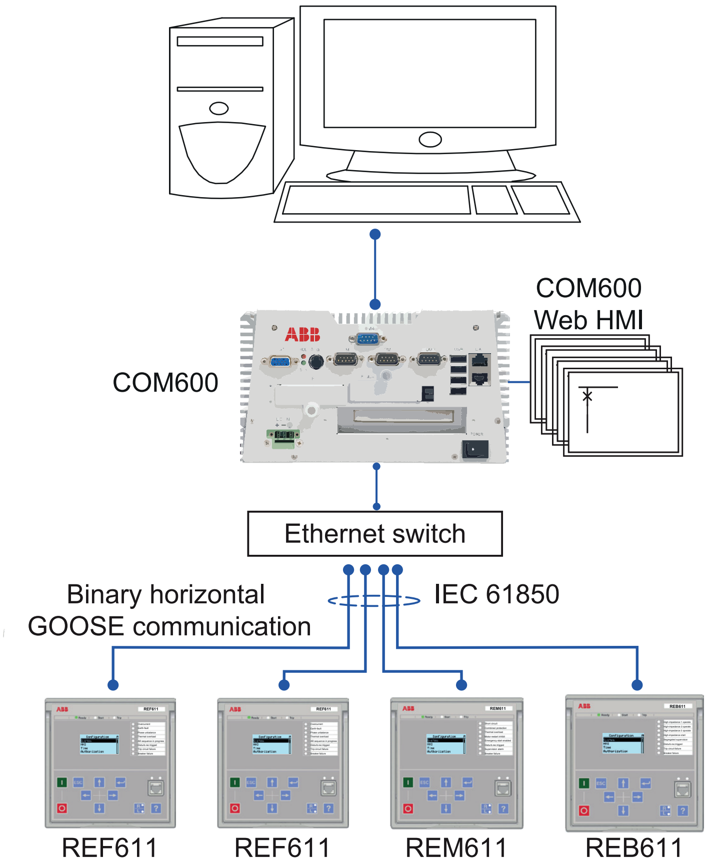

Figure 5. Power system example using 611 series IEDs, COM600 and MicroSCADA pro or System 800xA

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 phase currents, the neutral current and the residual voltage (standard configuration A).

In addition, the IED calculates the symmetrical components of the currents and the maximum current demand value over a user-selectable preset time frame.

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 (standard configuration A) 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

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.

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

Depending on the standard configuration selected, the IED is equipped with three phase-current inputs and one residual-current input for non-directional earth-fault protection, or in the case of directional earth-fault protection, also with a residual voltage input.

The phase-current inputs are rated 1/5 A. Two optional residual-current inputs are available: 1/5 A or 0.2/1 A. The 0.2/1 A input is normally used in applications requiring sensitive earth-fault protection and featuring core-balance current transformers. The residual voltage input covers the rated voltages (60...210 V).

The rated currents and voltages 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 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 or 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	1	3 (9)[1)]	6 (9)[1)]
B	4	-	4 (10)[1)]	6 (9)[1)]

1) With optional binary I/O module ( )

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. Limited 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.

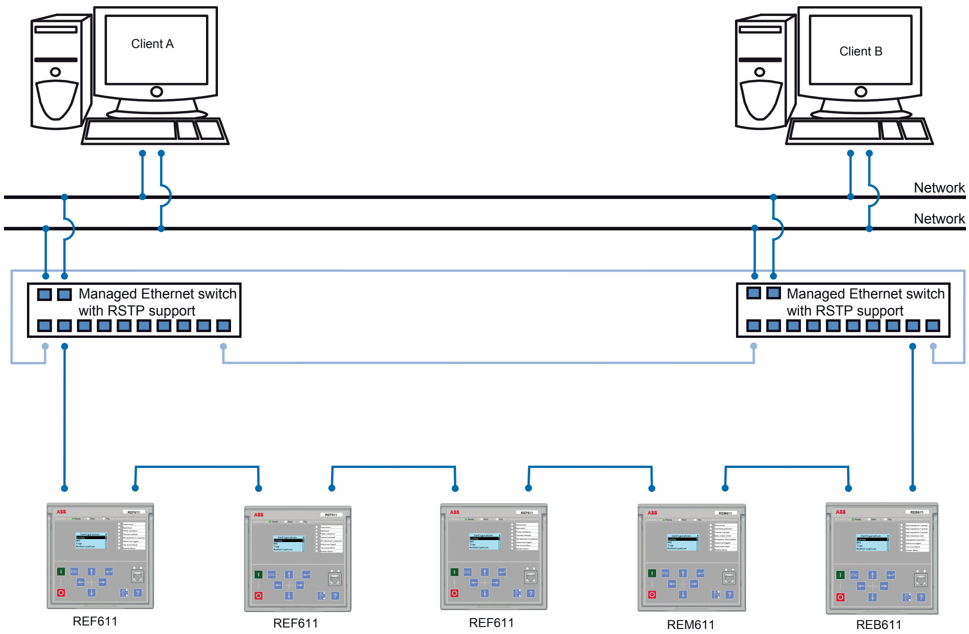

Figure 6. Self-healing Ethernet ring solution

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 • For 1 s	 4 A 100 A	 20 A 500 A
	Dynamic current withstand: • Half-wave value	 250 A	 1250 A
	Input impedance	< 100 mΩ	< 20 mΩ
Residual voltage input	Rated voltage	60...210 V AC	
	Voltage withstand: • Continuous • For 10 s	 2 x U_n (240 V AC) 3 x U_n (360 V AC)	
	Burden at rated voltage	< 0.05 VA	

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 type1)	Wave length	Max. distance	Permitted path attenuation2)
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. Three-phase non-directional overcurrent protection (PHxPTOC)

Characteristic		Value		
Operation accuracy		Depending on the frequency of the current measured: f_n ±2 Hz		
	PHLPTOC	±1.5% of the set value or ±0.002 x I_n		
	PHHPTOC and PHIPTOC	±1.5% of 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 [1)2)]		Minimum	Typical	Maximum
	PHIPTOC: I_{Fault} = 2 x set *Start value* I_{Fault} = 10 x set *Start value*	16 ms 11 ms	19 ms 12 ms	23 ms 14 ms
	PHHPTOC and PHLPTOC: 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 [3)]		
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 P-to-P+backup: No suppression		

1) Set *Operate delay time* = 0.02 s, *Operate curve type* = IEC definite time, *Measurement mode* = default (depends on stage), current before fault = 0.0 x In, fn = 50 Hz, fault current in one phase 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
3) Includes the delay of the heavy-duty output contact

Table 27. Three-phase non-directional overcurrent protection (PHxPTOC) main settings

Parameter	Function	Value (Range)	Step
Start value	PHLPTOC	0.05...5.00 x I_n	0.01
	PHHPTOC	0.10...40.00 x I_n	0.01
	PHIPTOC	1.00...40.00 x I_n	0.01
Time multiplier	PHLPTOC	0.05...15.00	0.05
	PHHPTOC	0.05...15.00	0.05
Operate delay time	PHLPTOC	40...200000 ms	10
	PHHPTOC	40...200000 ms	10
	PHIPTOC	20...200000 ms	10
Operating curve type[1)]	PHLPTOC	Definite or inverse time Curve type: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19	
	PHHPTOC	Definite or inverse time Curve type: 1, 3, 5, 9, 10, 12, 15, 17	
	PHIPTOC	Definite time	

1) For further reference, see the Operating characteristics table at the end of the Technical data chapter.

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	±1.5% 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 1)2)		Minimum	Typical	Maximum
	EFIPTOC: I_{Fault} = 2 x set *Start value* I_{Fault} = 10 x set *Start value*	16 ms 11 ms	19 ms 12 ms	23 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 3)		
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) *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
2) Includes the delay of the signal output contact
3) 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	1.00...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[1)]	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) For further reference, see the Operating characteristics table at the end of the Technical data chapter.

Table 30. Directional earth-fault protection (DEFxPDEF)

Characteristic		Value		
Operation accuracy		Depending on the frequency of the current measured: f_n ±2 Hz		
	DEFLPDEF	Current: ±1.5% of the set value or ±0.002 x I_n Voltage ±1.5% of the set value or ±0.002 x U_n Phase angle: ±2°		
	DEFHPDEF	Current: ±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) Voltage: ±1.5% of the set value or ±0.002 x U_n Phase angle: ±2°		
Start time 1)2)		Minimum	Typical	Maximum
	DEFHPDEF I_{Fault} = 2 x set *Start value*	42 ms	44 ms	46 ms
	DEFLPDEF I_{Fault} = 2 x set *Start value*	61 ms	64 ms	66 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 3)		
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) Set *Operate delay time* = 0.06 s, *Operate curve type* = IEC definite time, *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
2) Includes the delay of the signal output contact
3) Maximum *Start value* = 2.5 x I_n, *Start value* multiples in range of 1.5 to 20

Table 31. Directional earth-fault protection (DEFxPDEF) main settings

Parameter	Function	Value (Range)	Step
Start value	DEFLPDEF	0.010...5.000 x I_n	0.005
	DEFHPDEF	0.10...40.00 x I_n	0.01
Directional mode	DEFLPDEF and DEFHPDEF	1=Non-directional 2=Forward 3=Reverse	
Time multiplier	DEFLPDEF	0.05...15.00	0.05
	DEFHPDEF	0.05...15.00	0.05
Operate delay time	DEFLPDEF	60...200000 ms	10
	DEFHPDEF	40...200000 ms	10
Operating curve type[1)]	DEFLPDEF	Definite or inverse time Curve type: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19	
	DEFHPDEF	Definite or inverse time Curve type: 1, 3, 5, 15, 17	
Operation mode	DEFLPDEF and DEFHPDEF	1=Phase angle 2=IoSin 3=IoCos 4=Phase angle 80 5=Phase angle 88	

1) For further reference, see the Operating characteristics table at the end of the Technical data chapter.

Table 32. Transient/intermittent earth-fault protection (INTRPTEF)

Characteristic	Value
Operation accuracy (Uo criteria with transient protection)	Depending on the frequency of the current measured: f_n ±2 Hz
	±1.5% of the set value or ±0.002 x Uo
Operate time accuracy	±1.0% of the set value or ±20 ms
Suppression of harmonics	DFT: -50 dB at f = n x f_n, where n = 2, 3, 4, 5

Table 33. Transient/intermittent earth-fault protection (INTRPTEF) main settings

Parameter	Function	Value (Range)	Step
Directional mode	INTRPTEF	1=Non-directional 2=Forward 3=Reverse	-
Operate delay time	INTRPTEF	40...1200000 ms	10
Voltage start value (voltage start value for transient EF)	INTRPTEF	0.01...0.50 x Un	0.01
Operation mode	INTRPTEF	1=Intermittent EF 2=Transient EF	-
Peak counter limit (min. requirement for peak counter before start in IEF mode)	INTRPTEF	2...20	-

Table 34. Residual overvoltage protection (ROVPTOV)

Characteristic		Value		
Operation accuracy		Depending on the frequency of the voltage measured: f_n ±2 Hz		
		±1.5% of the set value or ±0.002 x U_n		
Start time[1)2)]		Minimum	Typical	Maximum
	U_{Fault} = 1.1 x set *Start value*	55 ms	56 ms	58 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		
Suppression of harmonics		DFT: -50 dB at f = n x f_n, where n = 2, 3, 4, 5,…		

1) Residual voltage before fault = 0.0 x U_n, f_n = 50 Hz, residual voltage 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 35. Residual overvoltage protection (ROVPTOV) main settings

Parameter	Function	Value (Range)	Step
Start value	ROVPTOV	0.010...1.000 x U_n	0.001
Operate delay time	ROVPTOV	40...300000 ms	1

Table 36. Negative phase-sequence overcurrent protection (NSPTOC)

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		
Start time [1)2)]		Minimum	Typical	Maximum
	I_{Fault} = 2 x set *Start value* I_{Fault} = 10 x set *Start value*	22 ms 14 ms	24 ms 16 ms	25 ms 17 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		
Operate time accuracy in inverse time mode		±5.0% of the theoretical value or ±20 ms [3)]		
Suppression of harmonics		DFT: -50 dB at f = n x f_n, where n = 2, 3, 4, 5,…		

1) Negative sequence current before fault = 0.0, f_n = 50 Hz, results based on statistical distribution of 1000 measurements
2) Includes the delay of the signal output contact
3) Maximum *Start value* = 2.5 x I_n, *Start value* multiples in range of 1.5 to 20

Table 37. Negative phase-sequence overcurrent protection (NSPTOC) main settings

Parameter	Function	Value (Range)	Step
Start value	NSPTOC	0.01...5.00 x I_n	0.01
Time multiplier	NSPTOC	0.05...15.00	0.05
Operate delay time	NSPTOC	40...200000 ms	10
Operating curve type [1)]	NSPTOC	Definite or inverse time Curve type: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19	

1) For further reference, see the Operating characteristics table at the end of the Technical data chapter.

Table 38. Phase discontinuity protection (PDNSPTOC)

Characteristic	Value
Operation accuracy	Depending on the frequency of the current measured: f_n ±2 Hz
	±2% of the set value
Start time	< 70 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
Suppression of harmonics	DFT: -50 dB at f = n x f_n, where n = 2, 3, 4, 5,…

Table 39. Phase discontinuity protection (PDNSPTOC) main settings

Parameter	Function	Value (Range)	Step
Start value (Current ratio setting I_2/I_1)	PDNSPTOC	10...100%	1
Operate delay time	PDNSPTOC	100...30000 ms	1
Min. phase current	PDNSPTOC	0.05...0.30 x I_n	0.01

Table 40. 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 41. 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 42. Three-phase thermal overload protection for feeders (T1PTTR)

Characteristic	Value
Operation accuracy	Depending on the frequency of the current measured: f_n ±2 Hz
	Current measurement: ±1.5% of the set value or ±0.002 x I_n (at currents in the range of 0.01...4.00 x I_n)
Operate time accuracy[1)]	±2.0% of the theoretical value or ±0.50 s

1) Overload current > 1.2 x Operate level temperature

Table 43. Three-phase thermal overload (T1PTTR) main settings

Parameter	Function	Value (Range)	Step
Env temperature Set (Ambient temperature used when the AmbSens is set to Off)	T1PTTR	-50...100°C	1
Current multiplier (Current multiplier when function is used for parallel lines)	T1PTTR	1...5	1
Current reference	T1PTTR	0.05...4.00 x I_n	0.01
Temperature rise (End temperature rise above ambient)	T1PTTR	0.0...200.0°C	0.1
Time constant (Time constant of the line in seconds)	T1PTTR	60...60000 s	1
Maximum temperature (temperature level for operate)	T1PTTR	20.0...200.0°C	0.1
Alarm value (Temperature level for start (alarm)	T1PTTR	20.0...150.0°C	0.1
Reclose temperature (Temperature for reset of block reclose after operate)	T1PTTR	20.0...150.0°C	0.1
Initial temperature (Temperature raise above ambient temperature at startup)	T1PTTR	-50.0...100.0°C	0.1

Table 44. Three-phase inrush current detection (INRPHAR)

Characteristic	Value
Operation accuracy	At the frequency f = f_n
	Current measurement: ±1.5% of the set value or ±0.002 x I_n Ratio I2f/I1f measurement: ±5.0% of the set value
Reset time	+35 ms / -0 ms
Reset ratio	Typical 0.96
Operate time accuracy	+35 ms / -0 ms

Table 45. Three-phase inrush detection (INRPHAR) main settings

Parameter	Function	Value (Range)	Step
Start value (Ratio of the 2nd to the 1st harmonic leading to restraint)	INRPHAR	5...100%	1
Operate delay time	INRPHAR	20...60000 ms	1

Table 46. 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

Control functions

Table 47. Autoreclosing (DARREC)

Characteristic	Value
Operate time accuracy	±1.0% of the set value or ±20 ms

Measurement functions

Table 48. 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 49. Current sequence components (CSMSQI)

Characteristic	Value
Operation accuracy	Depending on the frequency of the current measured: f/f_n = ±2 Hz
	±1.0% 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,…

Table 50. 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

Table 51. Residual voltage measurement (RESVMMXU)

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

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.

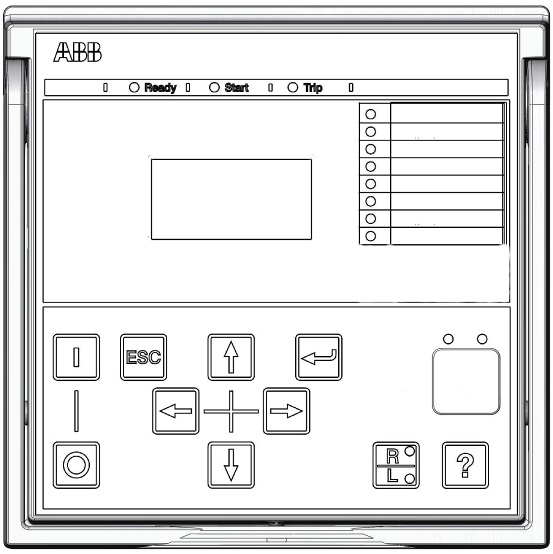

Figure 7. Front panel of 611 series IEDs

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

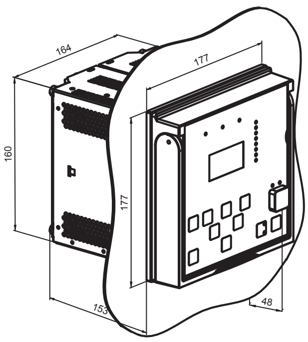

Figure 8. Flush mounting

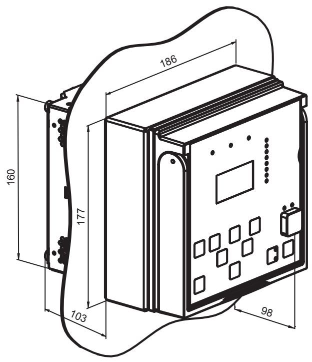

Figure 9. Semi-flush mounting

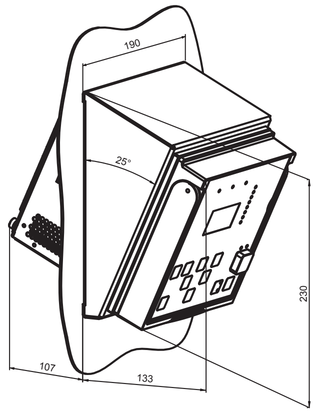

Figure 10. Semi-flush with a 25º tilt

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

#	Description	
1-2	Product	
	Relay	RE
3	Main application	
	Feeder protection and control	F
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 Com - bilfex rack mounting	L
8	Standard	
	IEC	B
	CN	C

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

#	Description	
9	Standard configuration	
	Non-directional O/C and directional E/F	A
	Non-directional O/C and non-directional E/F	B
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

REF611HBAAAA1NN1XE

#	Description	
14	Option 1	
	Auto-recloser	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: REF611HBAAAA1NN1XE

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 52. 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 53. Tools

Configuration and setting tools	Version
PCM600	2.4 or later
Web browser-based user interface	IE 7.0 and 8.0
REF611 Connectivity Package	1.0 or later

Table 54. 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 diagrams

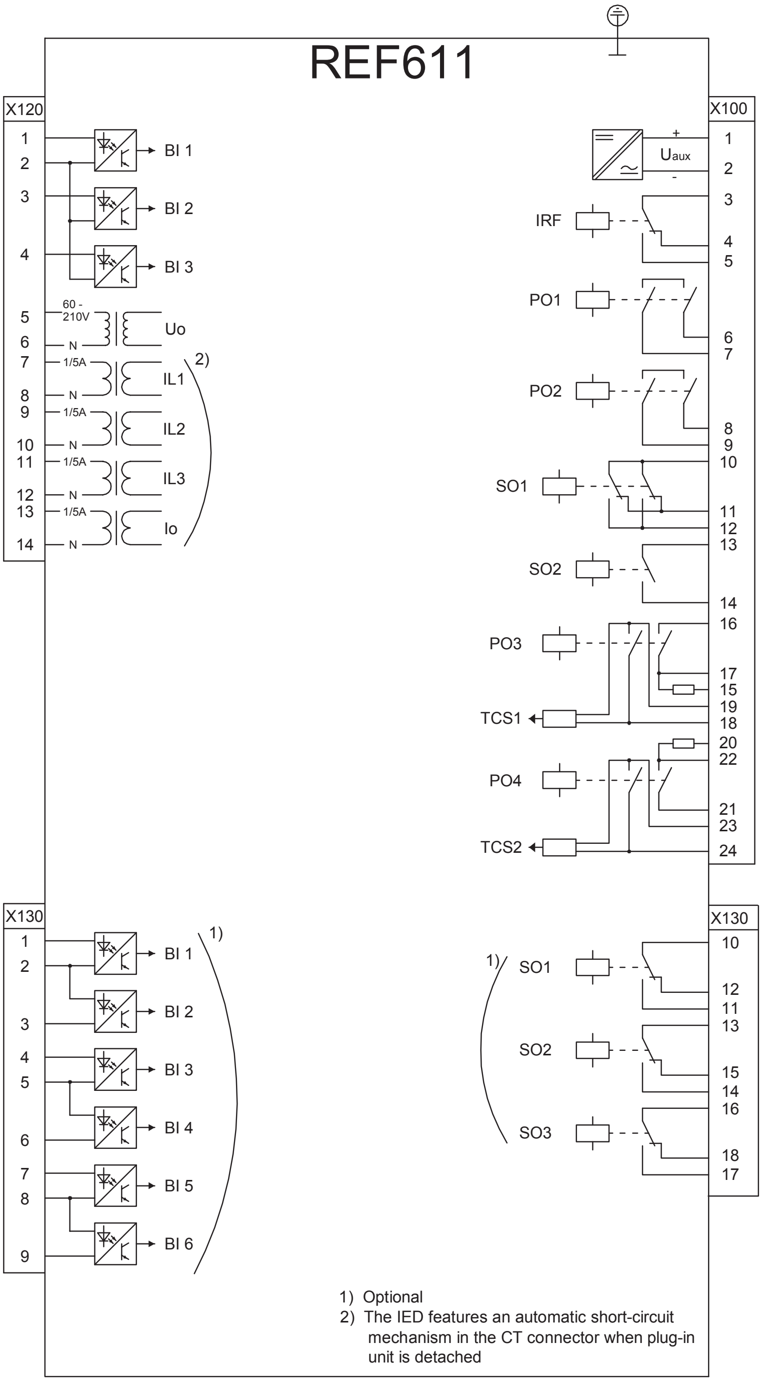

Figure 12. Terminal diagram of standard configuration A

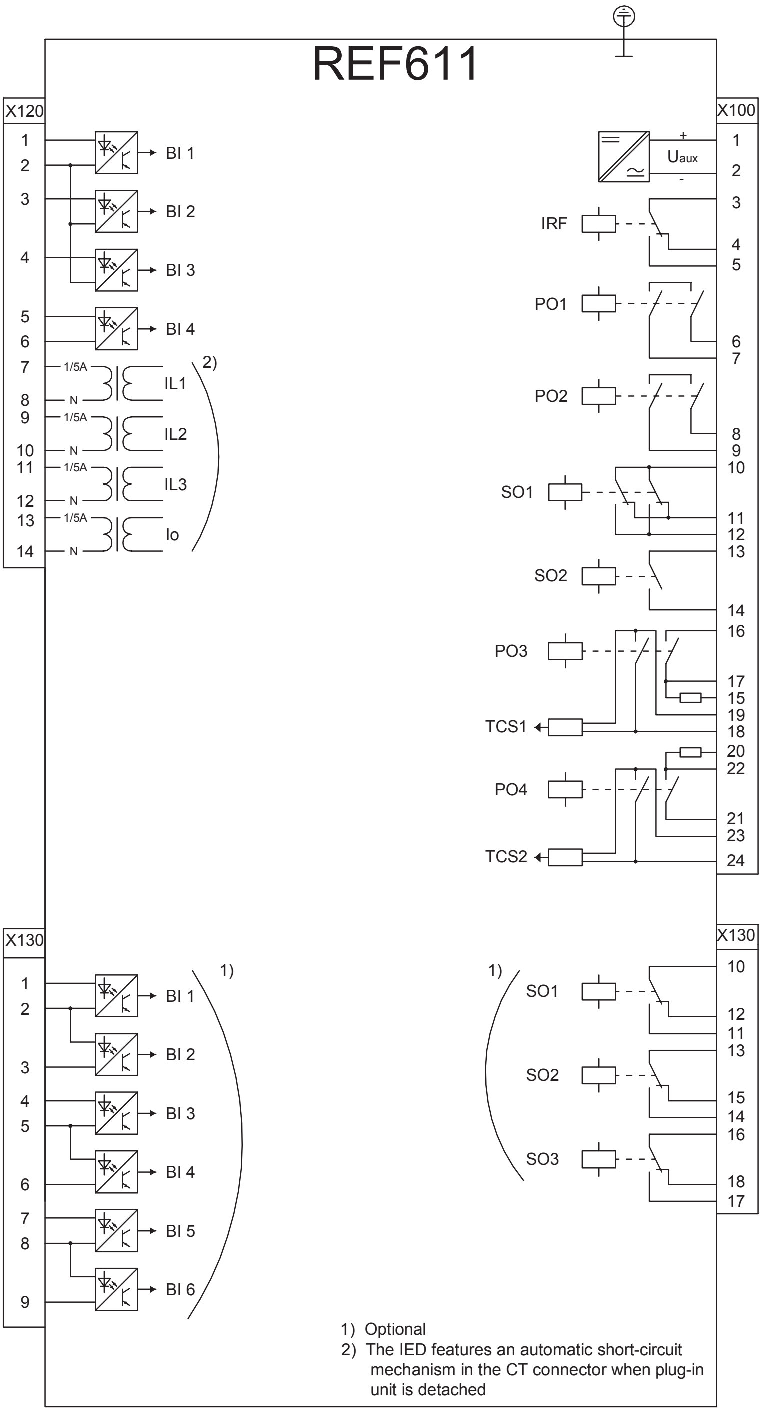

Figure 13. Terminal diagram of standard configuration B

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 REF611 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 55. REF611 functions, codes and symbols

Function	IEC 61850	IEC 60617	IEC-ANSI
Protection			
Three-phase non-directional overcurrent protection, low stage, instance 1	PHLPTOC1	3I> (1)	51P-1 (1)
Three-phase non-directional overcurrent protection, high stage, instance 1	PHHPTOC1	3I>> (1)	51P-2 (1)
Three-phase non-directional overcurrent protection, high stage, instance 2	PHHPTOC2	3I>> (2)	51P-2 (2)
Three-phase non-directional overcurrent protection, instantaneous stage, instance 1	PHIPTOC1	3I>>> (1)	50P/51P (1)
Non-directional earth-fault protection, low stage, instance 1	EFLPTOC1	Io> (1)	51N-1 (1)
Non-directional earth-fault protection, low stage, instance 2	EFLPTOC2	Io> (2)	51N-1 (2)
Non-directional earth-fault protection, high stage, instance 1	EFHPTOC1	Io>> (1)	51N-2 (1)
Non-directional earth-fault protection, instantaneous stage	EFIPTOC1	Io>>>	50N/51N
Directional earth-fault protection, low stage, instance 1	DEFLPDEF1	Io> -> (1)	67N-1 (1)
Directional earth-fault protection, low stage, instance 2	DEFLPDEF2	Io> -> (2)	67N-1 (2)
Directional earth-fault protection, high stage	DEFHPDEF1	Io>> ->	67N-2
Transient / intermittent earth-fault protection	INTRPTEF1	Io> -> IEF	67NIEF
Non-directional (cross-country) earth-fault protection, using calculated Io	EFHPTOC1	Io>> (1)	51N-2 (1)
Negative-sequence overcurrent protection, instance 1	NSPTOC1	I2> (1)	46 (1)
Negative-sequence overcurrent protection, instance 2	NSPTOC2	I2> (2)	46 (2)
Phase discontinuity protection	PDNSPTOC1	I2/I1>	46PD
Residual overvoltage protection, instance 1	ROVPTOV1	Uo> (1)	59G (1)
Residual overvoltage protection, instance 2	ROVPTOV2	Uo> (2)	59G (2)
Residual overvoltage protection, instance 3	ROVPTOV3	Uo> (3)	59G (3)
Three-phase thermal protection for feeders, cables and distribution transformers	T1PTTR1	3Ith>F	49F
Circuit breaker failure protection	CCBRBRF1	3I>/Io>BF	51BF/51NBF
Three-phase inrush detector	INRPHAR1	3I2f>	68
Master trip, instance 1	TRPPTRC1	Master Trip (1)	94/86 (1)
Master trip, instance 2	TRPPTRC2	Master Trip (2)	94/86 (2)

Table 55. REF611 functions, codes and symbols, continued

Function	IEC 61850	IEC 60617	IEC-ANSI
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
Auto-reclosing	DARREC1	O -> I	79
Supervision			
Trip circuit supervision, instance 1	TCSSCBR1	TCS (1)	TCM (1)
Trip circuit supervision, instance 2	TCSSCBR2	TCS (2)	TCM (2)
Measurement			
Disturbance recorder	RDRE1	-	-
Three-phase current measurement, instance 1	CMMXU1	3I	3I
Sequence current measurement	CSMSQI1	I1, I2, I0	I1, I2, I0
Residual current measurement, instance 1	RESCMMXU1	Io	In
Residual voltage measurement	RESVMMXU1	Uo	Vn

1) 10 instances
2) 20 instances
3) 6 instances

26. Document revision history

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

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