RELION® PROTECTION AND CONTROL

REX610

Product Guide

Contents

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1. Description

REX610 is a freely configurable all-in-one protection relay that covers the full range of basic power distribution applications, without forgoing simplicity. The small number of variants translates into easy ordering, setup, use and maintenance. Although rich in functionality, REX610 represents a cost-effective choice. The fully modular hardware, unlocking all available functionality, and continuous access to new developments allow easy and flexible customization, modification and adaptation to changing protection and communication requirements at any time.

REX610 is a member of the renowned Relion® protection and control family of relays, building on ABB's strong heritage of freely configurable multifunctional relays and many proven protection algorithms.

2. Relay hardware

The relay has mandatory and optional slots. A mandatory slot always contains a module but an optional slot may be empty, depending on the composition variant ordered.

Table 1. Module slots

Module	Slot A1	Slot A2	Slot B	Slot C1	Slot C2	Slot D1	Slot D2
AIC2001				o			
AIC2002				o			
AIU2001							o
COM2001		•					
DIO2001			•				
PSU2001	•						

• = Mandatory to have the modules in the slot
o = Optional to have one of the allocated modules in the slot

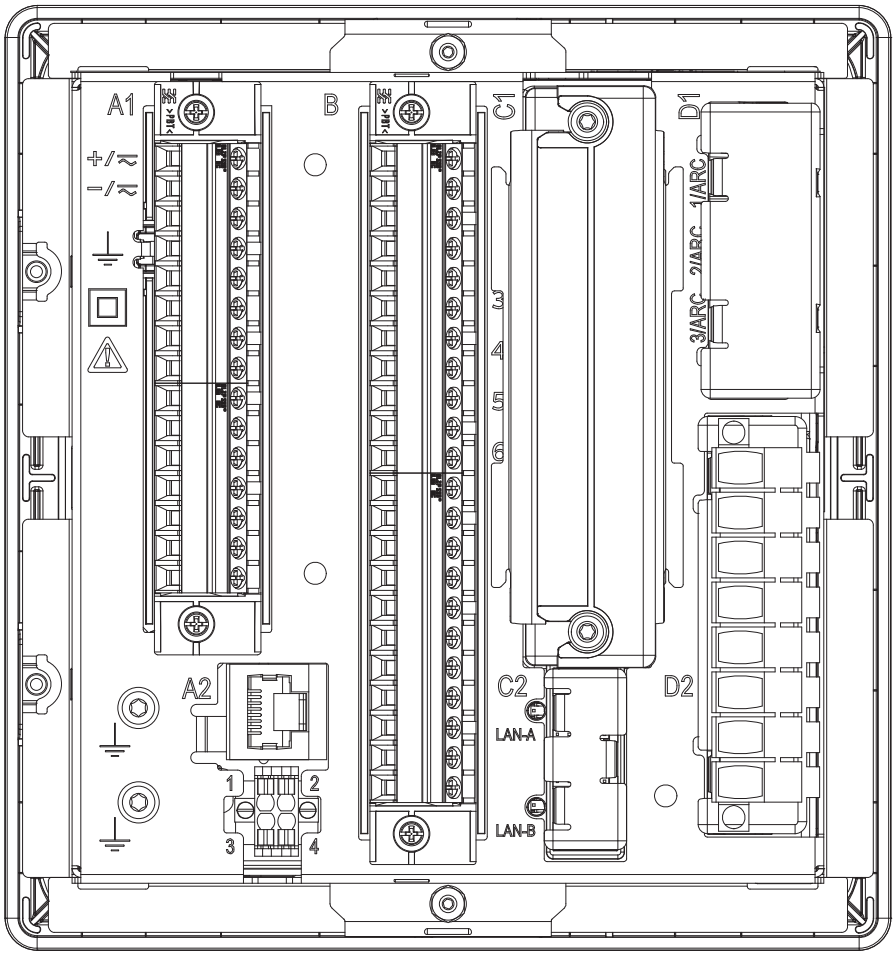

Figure 1. Hardware module slot overview of the REX610 relay

Table 2. Module description

Module	Description
AIU2001	Analog input 4 × VT compression
AIC2001	Analog input 4 × CT compression
AIC2002	Analog input 4 × CT ring lug
PSU2001	24...250 VDC / 48...240 VAC + 2 × PO
DIO2001	Digital I/O 6 × BI + 4 × SO
COM2001	1 × RJ-45 + 1 × RS-485

PO = Power Output
SO = Signal Output

The relay has a nonvolatile memory which does not need any periodical maintenance. The nonvolatile memory stores all events, recordings and logs to a memory which retains data if the relay loses its auxiliary supply.

3. Application

The available functionality of REX610 depends on what modules are installed. If only the current measuring module is installed, it is possible to use functions that only require current to operate.

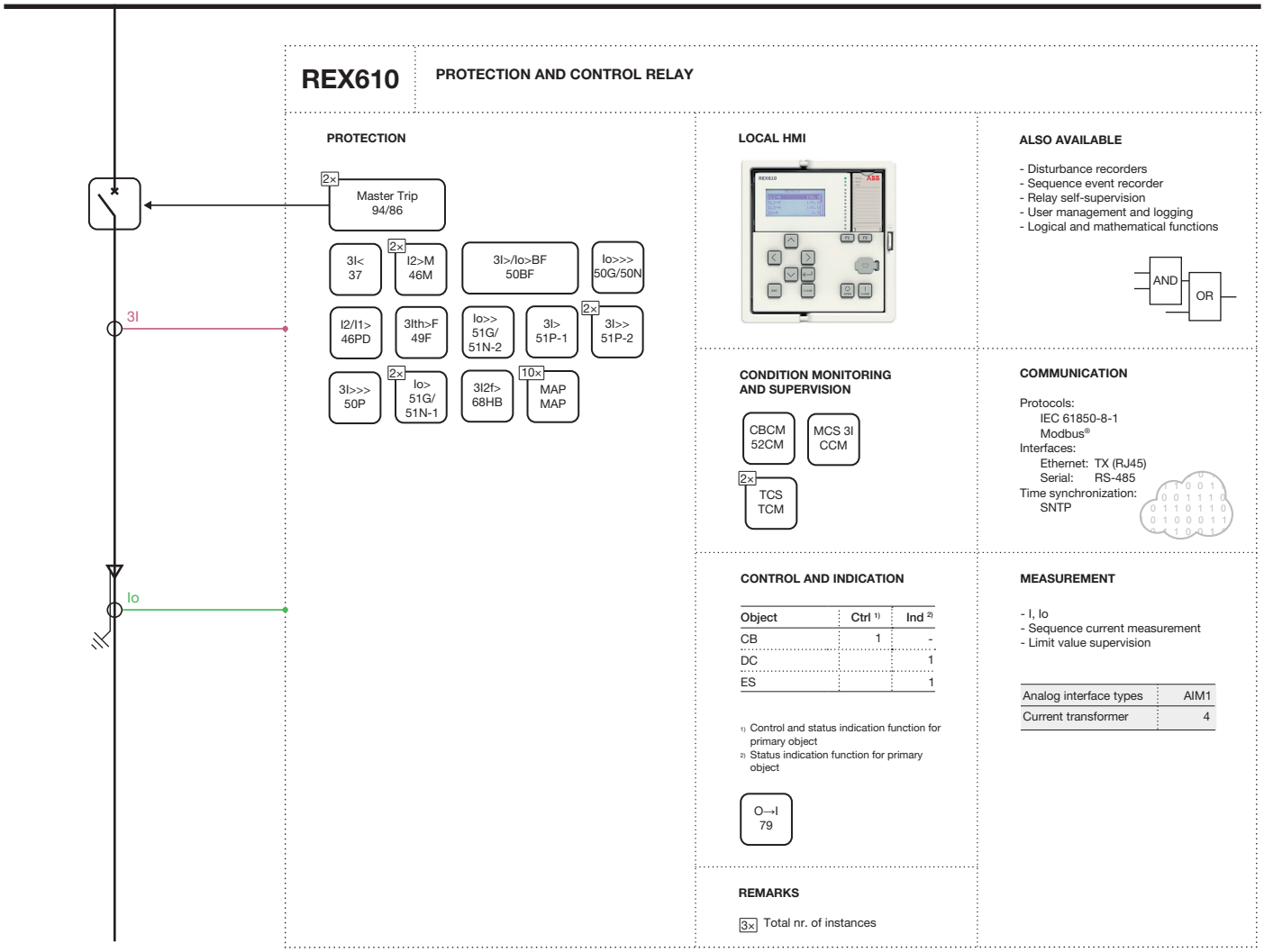

Figure 2. REX610 with CT module installed

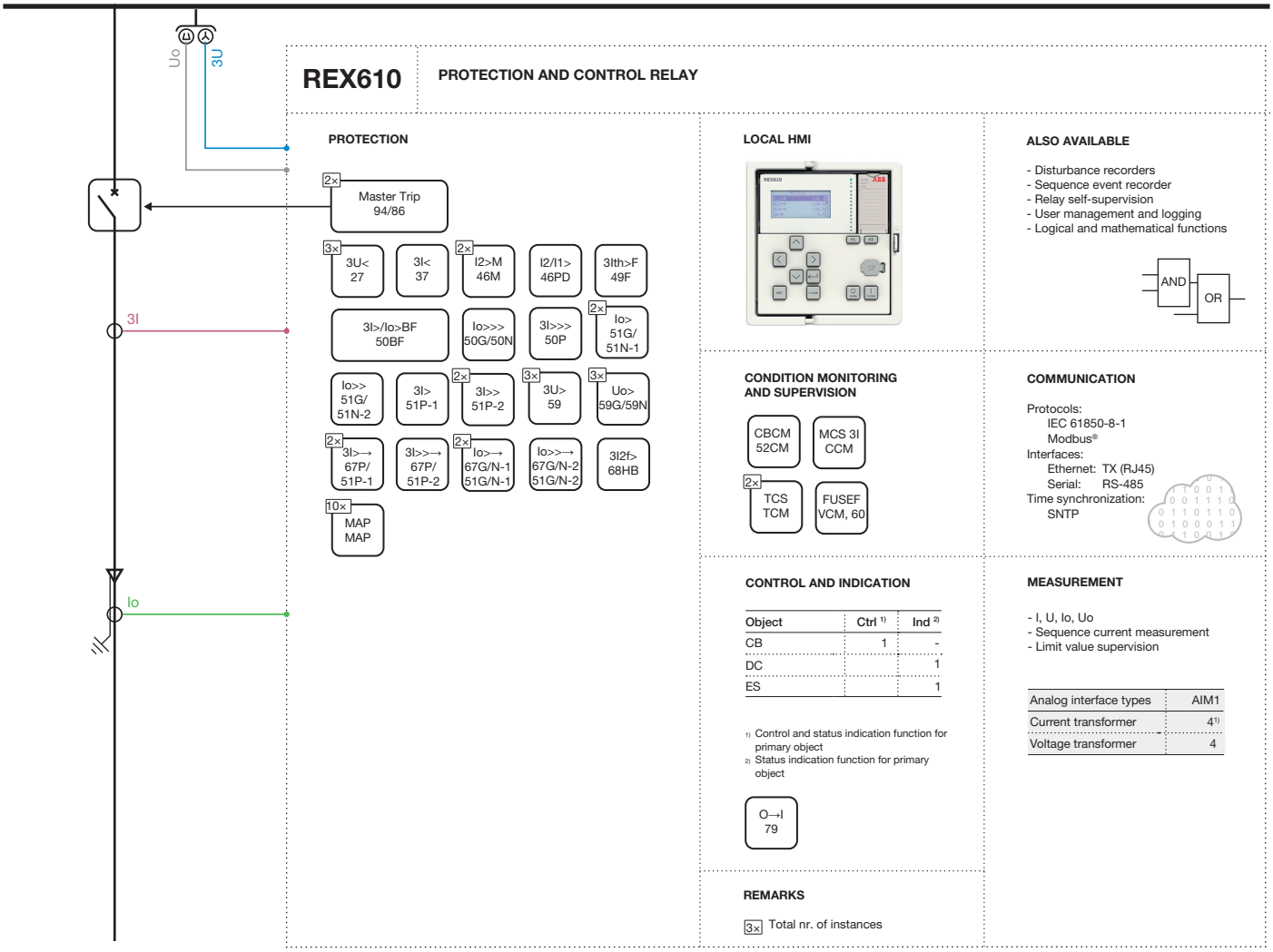

Figure 3. REX610 with CT and VT modules installed

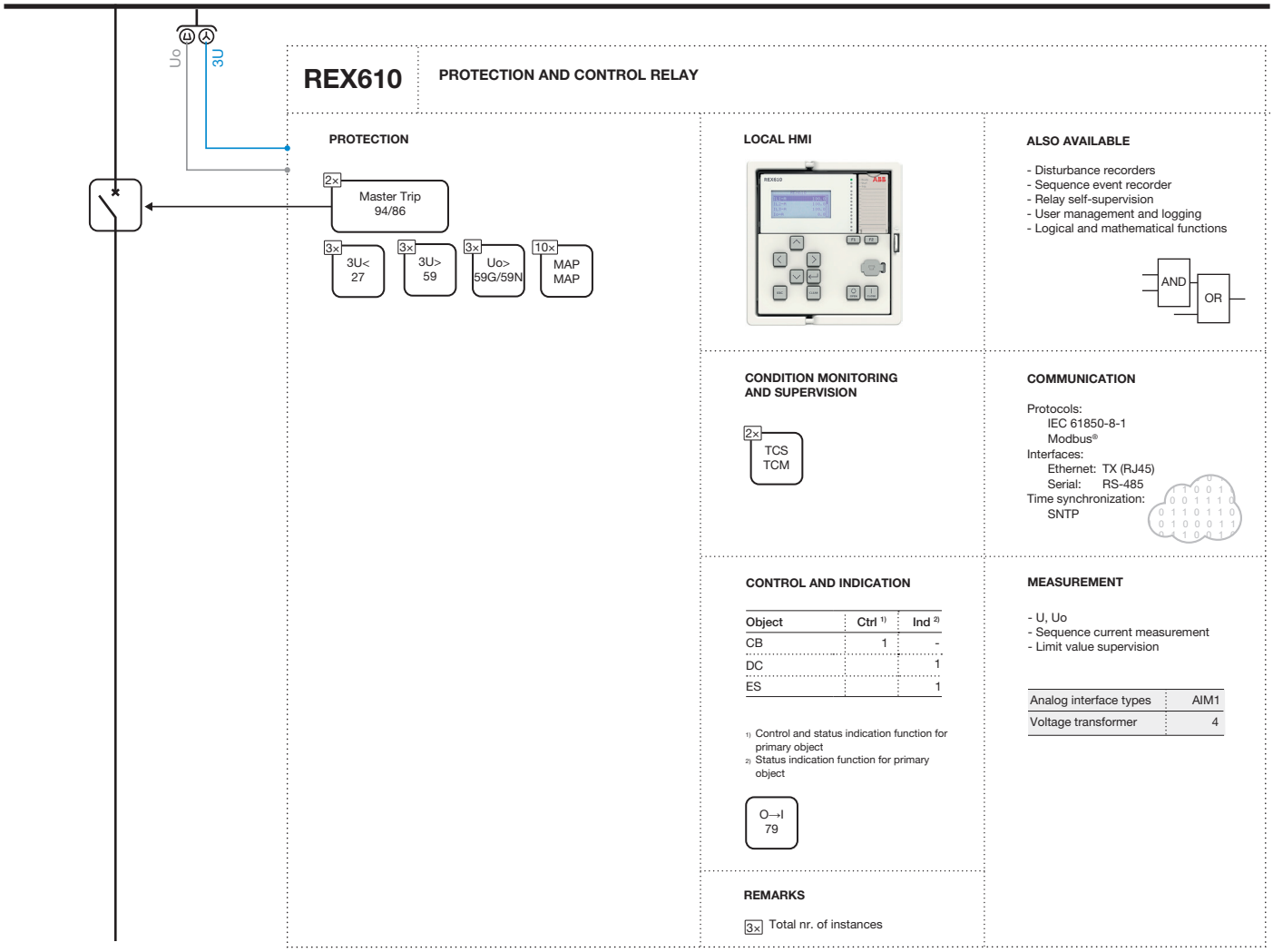

Figure 4. REX610 with VT module installed

4. Control

REX610 integrates functionality for controlling a circuit breaker via the LHMI or by means of remote controls. Additionally, the relay includes a disconnector position indication block and an earthing switch position indication block that can be used with a disconnector and an earthing switch that are only manually controlled.

Interlocking schemes required by the application are configured using Signal Matrix or Application Configuration in PCM600. REX610 includes an autoreclosing function with up to five programmable autoreclosing shots of desired type and duration.

5. Measurements

The base functionality of the REX610 relay contains a number of basic measurement functions for current, voltage and symmetrical components of currents. These measurement functions can be freely connected to the measured secondary quantities available in the relay. The measurements are available locally on the HMI and can be accessed remotely via communication.

6. Disturbance recorder

The protection relay is provided with a disturbance recorder featuring up to 8 analog and 32 binary signal channels. The analog channels can be set to record the waveform of the currents and voltages measured and they can trigger the recording function when the measured value falls below or exceeds the set values.

The binary signal channels can be set to start a recording either on the rising or the falling edge of the binary signal or on both. By default, the binary channels are set to record external or internal relay signals, for example, the start or trip signals of the relay stages, or external blocking or control signals. Binary relay signals, such as protection start and trip signals, or an external relay control signal via a binary input can be set to trigger the recording. Recorded information is stored in a nonvolatile memory and can be uploaded for subsequent fault analysis.

7. Event log

To collect sequence-of-events information, the relay has a nonvolatile memory capable of storing 1024 events with the associated time stamps. The event log facilitates detailed pre- and post-fault analyses of feeder faults and disturbances. The considerable capacity to process and store data and events in the relay supports the growing information demand of future network configurations.

The sequence-of-events information can be accessed either via the LHMI or remotely via the communication interface of the relay.

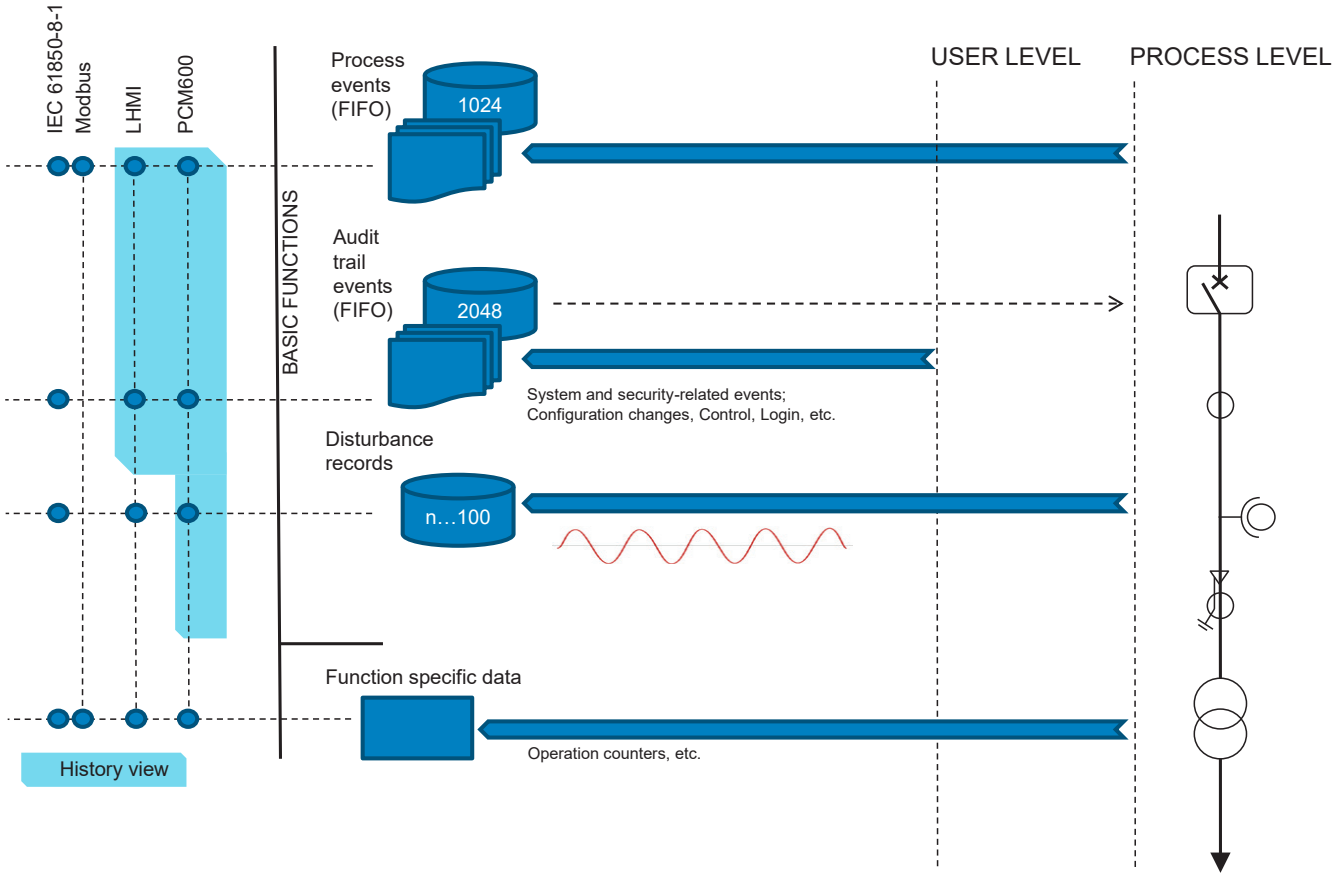

Figure 5. Event recording

8. Trip circuit supervision

The trip circuit supervision continuously monitors the availability and operability of the trip circuit. It provides open-circuit monitoring both when the circuit breaker is in closed and in open position. It also detects loss of circuit-breaker control voltage.

9. Self-supervision

The relay's built-in self-supervision system continuously monitors the state of the relay hardware and the operation of the relay software. Any fault or malfunction detected is used for alerting the operator.

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

10. Access control and cybersecurity

Cybersecurity measures are implemented to secure safe operation of the protection and control functions. The relay supports these measures with configuration hardening capabilities, encrypted communication, security event logging and user access control.

The relay supports role-based user authentication and authorization. All user activity is logged as security events to an audit trail in a nonvolatile memory. The nonvolatile memory does not need battery backup or regular component exchange to maintain the memory storage. File transfer uses communication encryption protecting the data in transit. Also, the communication link between the relay configuration tool PCM600 and the relay is encrypted. All rear communication ports and optional protocol services can be activated according to the required system setup.

User accounts can be managed by PCM600.

11. Station communication

Operational information and controls are available through a wide range of communication protocols including IEC 61850 and Modbus®. Full communication capabilities, for example,

horizontal communication between the relays, are only enabled by IEC 61850.

The IEC 61850 protocol is a core part of the relay as the protection and control application is fully based on standard modelling. The relay supports Edition 2 version of the standard. With Edition 2 support, the relay has the latest functionality modelling for substation applications and the best interoperability for modern substations.

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

The relay can send binary and analog signals to other devices using the IEC 61850-8-1 GOOSE (Generic Object Oriented Substation Event) profile. Binary GOOSE messaging can, for example, be used for protection and interlocking-based protection schemes. The relay also supports the sending and receiving of analog values using GOOSE messaging. Analog GOOSE messaging enables easy transfer of analog measurement values over the station bus, thus facilitating, for example, the sending of measurement values between the relays when controlling transformers running in parallel.

The relay can be connected to Ethernet-based communication systems in a station bus using the RJ-45 connector (100Base-TX). If connection to a serial bus is required, the RS-485 communication port can be used.

Modbus implementation supports RTU and TCP modes. Besides standard Modbus functionality, the relay supports retrieval of time-stamped events and changing the active setting group. If a Modbus TCP connection is used, three clients can be connected to the relay simultaneously. Further, Modbus serial and Modbus TCP can be used in parallel, and, if required, both IEC 61850 and Modbus can be run simultaneously.

When the relay uses the RS-485 bus for the serial communication, two-wire connections are supported. Termination and pull-up/down resistors can be configured with a jumper on the power supply card so that external resistors are not needed.

Table 3. Time synchronization methods supported by the relay

Methods	Time-stamping resolution
SNTP (Simple Network Time Protocol)[1)]	1 ms

1) Ethernet-based

Table 4. Supported station communication interfaces and protocols

Interfaces/Protocols	Ethernet	Serial
	100BASE-TX RJ-45	RS-485
IEC 61850-8-1	•	-
MODBUS RTU	-	•
MODBUS TCP/IP	•	-

• = Supported

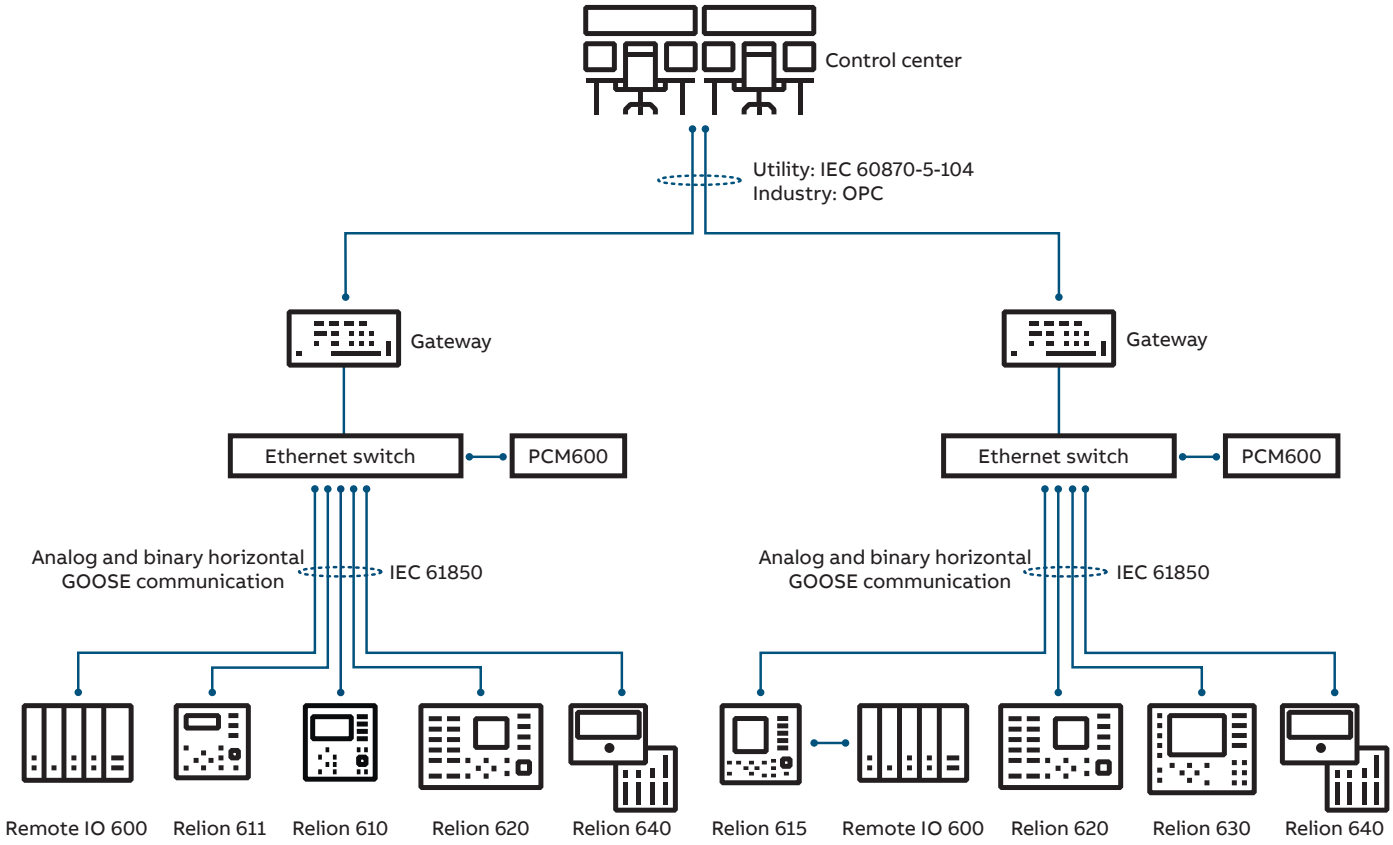

Figure 6. Communication example using Relion relays

12. Technical data

Table 5. Dimensions

Description	Value	
Width	Frame	149.5 mm (5.8858 in)
	Case	127.5 mm (5.0196 in)
Height	Frame	159.5 mm (6.2795 in)
	Case	155.5 mm (6.1220 in)
Depth		202.8 mm (163.6 mm + 39.2 mm) (7.9842 in)
Weight	Protection relay with the four separate connectors	2.5 kg (5.5 lbs)

Table 6. Power supply

Description	Value
Nominal auxiliary voltage U_n	24...250 ⎓ (V DC) 48...240 ∼ (V AC)
Maximum interruption time in the auxiliary DC voltage without resetting the relay	50 ms at U_n
Auxiliary voltage variation	85...110% (AC)
	80...120% (DC)
Start-up threshold	U_n (minimum)
Burden of auxiliary voltage supply under quiescent (P_q)/operating condition	9 W (P_q) 19 W/40 VA (P_{max})
Ripple in the DC auxiliary voltage	<15%
Fuse type	4A 250 ∼ (V AC) fast (+UL DC rated)

Table 7. Energizing inputs

Description		Value	
Rated frequency		50/60 Hz	
Current inputs	Rated current, I_n	1 A	5 A
	Thermal withstand:		
	• Continuous	4 A	20 A
	• For 1 s	100 A	500 A
	Dynamic current withstand:		
	• Half sine wave	250 A	1250 A
	Input impedance	<100 mΩ	<20 mΩ
Voltage inputs	Rated voltage	57...250 ∼ (V AC)	
	Voltage withstand:		
	• Continuous	500 ∼ (V AC)	
	• For 10 s	750 ∼ (V AC)	
	Burden at rated voltage	<0.5 VA	

Table 8. Binary inputs

Description	Value
Operating range	24...250 ⎓ (V DC) 48...240 ∼ (V AC)
Rated voltage	80...120% (DC) 85...110% (AC)
Current drain	Typically 1.6...1.9 mA <2.5 mA
Power consumption	<0.5 W
Threshold voltage, pick-up	Programmable 18...176 ⎓ (V DC) 38...168 ∼ (V AC)
Threshold voltage, drop-off	Programmable 16...176 ⎓ (V DC) 34...168 ∼ (V AC)
Reaction time	<6 ms[1)]
Burden	<0.5 W / 2 VA

1) REX610 cycle time is 5 ms

Table 9. Signal output relays (SO1)

Description		Value
Rated voltage		250 V AC/DC
Continuous contact carry current		5 A
Mechanical endurance	Unloaded operation	10000 cycles
Electrical endurance	Closing operations	1000 cycles
	Opening operations	1000 cycles
Making limits	Limiting making capacity (inductive)	300 W at L/R = 40 ms for DC or p.f. = 0.4 for AC
	Make and carry (resistive) for 3.0 s	15 A (3 s On, 15 Off)
	Make and carry (resistive) for 0.5 s	30 A (0.5 s On, 15 s Off)
Breaking limits	Limiting breaking capacity ≤48 V	1 A at L/R = 40 ms for DC or p.f. = 0.4 for AC
	Limiting breaking capacity 110 V	0.25 A at L/R = 40 ms for DC or p.f. = 0.4 for AC
	Limiting breaking capacity 220 V	0.15 A at L/R = 40 ms for DC or p.f. = 0.4 for AC
Minimum contact load		100 mA

Table 10. IRF and signaling outputs other than SO1

Description		Value
Rated voltage		250 V AC/DC
Continuous contact carry current		5 A
Mechanical endurance	Unloaded operation	10000 cycles
Electrical endurance	Closing operations	1000 cycles
	Opening operations	1000 cycles
Making limits	Limiting making capacity (inductive)	300 W at L/R = 40 ms for DC or p.f. = 0.4 for AC
	Make and carry (resistive) for 3.0 s	10 A (3 s On, 15 Off)
	Make and carry (resistive) for 0.5 s	15 A (0.5 s On, 15 s Off)
Breaking limits	Limiting breaking capacity ≤48 V	1 A at L/R = 40 ms for DC or p.f. = 0.4 for AC
	Limiting breaking capacity 110 V	0.25 A at L/R = 40 ms for DC or p.f. = 0.4 for AC
	Limiting breaking capacity 220 V	0.15 A at L/R = 40 ms for DC or p.f. = 0.4 for AC
Minimum contact load		10 mA

Table 11. Tripping output relays (Double-pole power output relays with TCS function)

Description		Value
Rated voltage		250 V AC/DC
Continuous contact carry current		8 A
Mechanical endurance	Unloaded operation	10000 cycles
Electrical endurance	Closing operations	1000 cycles
	Opening operations	1000 cycles
Making limits	Limiting making capacity (inductive)	1000 W at L/R = 40 ms for DC or p.f. = 0.4 for AC
	Make and carry (resistive) for 3.0 s	15 A (3 s On, 15 Off)
	Make and carry (resistive) for 0.5 s	30 A (0.5 s On, 15 s Off)
Breaking limits	Limiting breaking capacity ≤48 V (inductive), two contacts connected in series	5 A at L/R = 40 ms for DC or p.f. = 0.4 for AC
	Limiting breaking capacity 110 V (inductive), two contacts connected in series	3 A at L/R = 40 ms for DC or p.f. = 0.4 for AC
	Limiting breaking capacity 220 V (inductive), two contacts connected in series	1 A at L/R = 40 ms for DC or p.f. = 0.4 for AC
Minimum contact load		100 mA

Table 12. Serial interface

Type	Location	Connector
RS-485	Rear	1=B, 2=A, 3=GND, 4=capacitive shield

Table 13. USB interface, HMI

Type	Location	Connector	Rate
USB, type B	Front	USB 1.x / USB 2.0 compatible	240 Mbits/s (max.)

Table 14. Ethernet interface

Cable	Protocol	Location	Rate
Standard Ethernet CAT 5 STP cable with RJ-45 connector (shielded)	TCP/IP	Rear	100 Mbits/s

Table 15. Degree of protection of the protection relay

Description	Value
Front side	IP 54
Left and right side	IP 20
Top and bottom	IP 20
Case inside[1)]	IP 20

1) Plug-in unit removed

Table 16. Environmental conditions

Description	Value
Operating temperature range	-40...+70ºC
Short-time service temperature range	-40...+85ºC
Relative humidity	5...95% (EN60255)
Atmospheric pressure	86...106 kPa (test reference/EN60255)
Altitude	<2000 m (EN60255)
Transport and storage temperature range	-40...+85ºC

Table 17. Electromagnetic compatibility tests

Description	Type test value	Reference
1 MHz/100 kHz burst disturbance test		IEC 61000-4-18 IEC 60255-26, class III IEEE C37.90.1-2012
• Common mode	2.5 kV	
• Differential mode	2.5 kV	
3 MHz, 10 MHz and 30 MHz burst disturbance test		IEC 61000-4-18
• Common mode	2.5 kV	
Electrostatic discharge test		IEC 61000-4-2 IEC 60255-26 IEEE C37.90.3-2001
• Contact discharge	8 kV	
• Air discharge	15 kV	
Radio frequency interference test		
• Conducted RF	10 V (rms) f = 150 kHz...80 MHz	IEC 61000-4-6 IEC 60255-26, class III
• Radiated RF	10 V/m (rms) f = 80...2700 MHz	IEC 61000-4-3 IEC 60255-26, class III
	20 V/m f = 900 MHz	ENV 50204
	20 V/m (rms) f = 80...1000 MHz	IEEE C37.90.2-2004
Fast transient disturbance test		IEC 61000-4-4 IEC 60255-26 IEEE C37.90.1-2002
• Communication	2 kV	
• Other ports	4 kV	
Surge immunity test		IEC 61000-4-5 IEC 60255-26
• Communication	4 kV, line-to-earth	
• Other ports	4 kV, line-to-earth 2 kV, line-to-line	
Power frequency (50 Hz) magnetic field immunity test		IEC 61000-4-8
• Continuous • 1...3 s	300 A/m 1000 A/m	
Pulse magnetic field immunity test	1000 A/m 6.4/16 µs	IEC 61000-4-9
Damped oscillatory magnetic field immunity test		IEC 61000-4-10

Table 17. Electromagnetic compatibility tests, continued

Description	Type test value	Reference
• Continuous and 2 s	Current oscillation frequency: 100 kHz and 1 MHz Current rise time: 75 ns Repetition frequency: 40 Hz (100 Hz) and 400 Hz (1 MHz) Polarity of first half period: Positive and Negative	
Voltage dips and short interruptions	30%/10 ms 60%/100 ms 60%/1000 ms >95%/5000 ms	IEC 61000-4-11
Power frequency immunity test	Binary inputs only	IEC 61000-4-16 IEC 60255-26, class A
• Common mode	300 V rms	
• Differential mode	150 V rms	
Emission tests		EN 55011, class A IEC 60255-26 CISPR 11 CISPR 22
• Conducted		
0.15...0.50 MHz	<79 dB (µV) quasi peak <66 dB (µV) average	
0.5...30 MHz	<73 dB (µV) quasi peak <60 dB (µV) average	
• Radiated		
30...230 MHz	<40 dB (µV/m) quasi peak, measured at 10 m distance	
230...1000 MHz	<47 dB (µV/m) quasi peak, measured at 10 m distance	
1…3 GHz	<76 dB (µV/m) peak <56 dB (µV/m) average, measured at 3 m distance	
3…6 GHz	<80 dB (µV/m) peak <60 dB (µV/m) average, measured at 3 m distance	

Table 18. Safety-related tests

Description	Type test result	Reference
Overvoltage category	III	IEC 60255-27
Pollution degree	3	IEC 60255-27
Insulation class	Class I	IEC 60255-27
Dielectric tests	2 kV, 50 Hz, 1 min 500 V, 50 Hz, 1 min, communication	IEC 60255-27 IEEE C37.90-2005
Impulse voltage test	5 kV, 1.2/50 µs, 0.5 J 1 kV, 1.2/50 µs, 0.5 J, communication	IEC 60255-27 IEEE C37.90-2005
Insulation resistance measurements	>100 MΩ, 500 V DC	IEC 60255-27
Maximum temperature of parts and materials	Tested	IEC 60255-27
Flammability of insulating materials, components and fire enclosures	OK	IEC 60255-1 IEC 60255-27
Single-fault condition	OK	IEC 60255-1 IEC 60255-27

Table 19. Mechanical tests

Description	Type test result	Reference
Vibration tests (sinusoidal)	Class 1	IEC 60068-2-6 (test Fc) IEC 60255-21-1
Shock and bump test	Class 1	IEC 60068-2-27 (test Ea shock) IEC 60068-2-29 (test Eb bump) IEC 60255-21-2
Seismic test	Class 2	IEC 60255-21-3
Drop test	OK	IEC 60068-2-31 ISTA 1A
Mechanical durability test • 200 withdrawals and insertions of the plug-in unit	OK	IEEE C37.90-2005

Table 20. Environmental tests

Description	Type test value	Reference
Dry heat test	• 96 h at +70°C • 16 h at +85°C[1)]	IEC 60068-2-2 IEC60255-1 IEEE C37.90-2005
Dry cold test	• 96 h at -40°C • 16 h at -40°C	IEC 60068-2-1 IEC60255-1 IEEE C37.90-2005
Damped heat cyclic test	• 6 cycles (12 h + 12 h) at +25…+55°C, humidity >93%	IEC 60068-2-30 IEC60255-1
Change of temperature test	• 6 cycles (3 h + 3 h) at -40...+70°C	IEC 60068-2-14 IEC60255-1
Storage test	• 96 h at -40°C • 96 h at +85°C	IEC 60068-2-1 IEC 60068-2-2 IEC60255-1 IEEE C37.90-2005
Damp heat steady state test	10 days at +40°C, 93% RH	IEC 60068-2-78 IEC60255-1
Air quality test	H2S - 10 ppb NO2 - 200 ppb CL2 - 10 ppb SO2 - 200 ppb Temperature - 25°C Relative humidity - 75% Duration - 21 days	IEC 60068-2-60

1) For relays with an LC communication interface, the maximum operating temperature is +70°C.

Table 21. Product safety

Description	Reference
LV directive	EMC Directive 2014/30/EU Low Voltage Directive 2014/35/EU RoHS Directive 2015/863/EU
Standard	EN 60255-27 (2014) EN 60255-1 (2009)

Table 22. EMC compliance

Description	Reference
EMC directive	2014/30/EU
Standard	EN 60255-26 (2013)

Table 23. RoHS compliance

Description
Complies with RoHS Directive 2011/65/EU and the amended EU Directive 2015/863/EU

Protection functions

Table 24. Three-phase non-directional overcurrent protection (PHxPTOC)

Characteristic		Value		
Operation accuracy	PHLPTOC	Depending on the frequency of current measured: f_n ±2 Hz		
		±1.5% of the set value or ±0.002 × I_n 1) ±1.5% of the set value or ±0.007 × I_n 2)		
	PHHPTOC and PHIPTOC	±1.5% of the set value or ±0.002 × I_n 1) ±1.5% of the set value or ±0.007 × I_n 2) (at currents in the range of 0.1…10 × I_n) ±5% of the set value (at currents in the range of 10…40 × I_n)		
Start time 3)4)		Minimum	Typical	Maximum
	PHIPTOC: I_{Fault} = 2 × set *Start value* I_{Fault} = 10 × set *Start value*	12ms 8 ms	20 ms 13 ms	38 ms 31 ms
	PHHPTOC and PHLPTOC: I_{Fault} = 2 × set *Start value*	25 ms	35 ms	48 ms
Reset time		Typically 40 ms		
Reset ratio		Typically 0.96		
Retardation time		<45 ms		
Operate time accuracy in definite time mode		±1.0% of the set value or ±40 ms		
Operate time accuracy in inverse time mode		±5.0% of the theoretical value or ±50 ms 5)		
Suppression of harmonics		RMS: No suppression DFT: -50 dB at f = n × f_n, where n = 2, 3, 4, 5,… Peak-to-Peak: No suppression P-to-P+backup: No suppression		

1) *Measurement mode* = "RMS", "DFT" and "Peak-Peak" mode with CT secondary >0.2 A
2) *Measurement mode* = "Peak-to-peak", CT Secondary <0.2 A
3) *Measurement mode* = default (depends on the stage), current before fault = 0.0 × I_n, f_n = 50 Hz, fault current in one phase with nominal frequency injected from random phase angle, results based on statistical distribution of 1000 measurements
4) Includes the delay of the signal output contact (SO)
5) Maximum *Start value* = 2.5 × I_n, *Start value* multiples in the range of 1.5...20

Table 25. Three-phase non-directional overcurrent protection (PHxPTOC) main settings

Parameter	Function	Value (Range)	Step
Start value	PHLPTOC	0.05...5.00 × I_n	0.01
	PHHPTOC	0.10...40.00 × I_n	0.01
	PHIPTOC	1.00...40.00 × I_n	0.01
Time multiplier	PHLPTOC and PHHPTOC	0.05...15.00	0.01
Operate delay time	PHLPTOC and PHHPTOC	40...300000 ms	10
	PHIPTOC	20...300000 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 Operation characteristics table

Table 26. Three-phase directional overcurrent protection (DPHxPDOC)

Characteristic		Value		
Operation accuracy	DPHLPDOC	Depending on the frequency of the measured current: f_n ±2 Hz		
		Current: ±1.5% of the set value or ±0.002 × I_n[1)] ±1.5% of the set value or ±0.007 × I_n[2)] Voltage: ±1.5% of the set value or ±0.002 × U_n Phase angle: ±2°		
	DPHHPDOC	Current: ±1.5% of the set value or ±0.002 × I_n[1)] ±1.5% of the set value or ±0.007 × I_n[2)] (at currents in the range of 0.1…10 × I_n) ±5.0% of the set value (at currents in the range of 10…40 × I_n) Voltage: ±1.5% of the set value or ±0.002 × U_n Phase angle: ±2°		
Start time[3)4)]		Minimum	Typical	Maximum
	I_{Fault} = 2 × set *Start value*	28 ms	35 ms	42 ms
Reset time		Typically 40 ms		
Reset ratio		Typically 0.96		
Retardation time		<45 ms		
Operate time accuracy in definite time mode		±1.0% of the set value or ±40 ms		
Operate time accuracy in inverse time mode		±5.0% of the theoretical value or ±50 ms[5)]		
Suppression of harmonics		DFT: -50 dB at f = n × f_n, where n = 2, 3, 4, 5,…		

1) *Measurement mode* = "RMS", "DFT" and "Peak-Peak" mode with CT secondary >0.2 A
2) *Measurement mode* = "Peak-to-peak", CT Secondary <0.2 A
3) *Measurement mode* and *Pol quantity* = default, current before fault = 0.0 × I_n, voltage before fault = 1.0 × U_n, f_n = 50 Hz, fault current in one phase with nominal frequency injected from random phase angle, results based on statistical distribution of 1000 measurements
4) Includes the delay of the signal output contact
5) Maximum *Start value* = 2.5 × I_n, *Start value* multiples in range of 1.5...20

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

Parameter	Function	Value (Range)	Step
Start value	DPHLPDOC	0.05...5.00 × I_n	0.01
	DPHHPDOC	0.10...40.00 × I_n	0.01
Time multiplier	DPHxPDOC	0.05...15.00	0.01
Operate delay time	DPHxPDOC	40...300000 ms	10
Directional mode	DPHxPDOC	1 = Non-directional 2 = Forward 3 = Reverse	-
Characteristic angle	DPHxPDOC	-179...180°	1
Operating curve type[1)]	DPHLPDOC	Definite or inverse time Curve type: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19	
	DPHHPDOC	Definite or inverse time Curve type: 1, 3, 5, 9, 10, 12, 15, 17	

1) For further reference, see the Operating characteristics table

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 × I_n		
	EFHPTOC and EFIPTOC	±1.5% of the set value or ±0.002 × I_n (at currents in the range of 0.1…10 × I_n) ±5.0% of the set value (at currents in the range of 10…40 × I_n)		
Start time [1)2)]		Minimum	Typical	Maximum
	EFIPTOC: I_{Fault} = 2 × set *Start value* I_{Fault} = 10 × set *Start value*	 22 ms 13 ms	 27 ms 18 ms	 37 ms 34 ms
	EFHPTOC and EFLPTOC: I_{Fault} = 2 × set *Start value*	20 ms	30 ms	42 ms
Reset time		Typically 40 ms		
Reset ratio		Typically 0.96		
Retardation time		<45 ms		
Operate time accuracy in definite time mode		±1.0% of the set value or ±40 ms		
Operate time accuracy in inverse time mode		±5.0% of the theoretical value or ±50 ms [3)]		
Suppression of harmonics		RMS: No suppression DFT: -50 dB at f = n × f_n, where n = 2, 3, 4, 5,… Peak-to-Peak: No suppression		

1) *Measurement mode* = default (depends on the stage), current before fault = 0.0 × I_n, f_n = 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 (SO)
3) Maximum *Start value* = 2.5 × I_n, *Start value* multiples in the range of 1.5...20

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

Parameter	Function	Value (Range)	Step
Start value	EFLPTOC	0.010...5.000 × I_n	0.005
	EFHPTOC	0.10...40.00 × I_n	0.01
	EFIPTOC	1.00...40.00 × I_n	0.01
Time multiplier	EFLPTOC and EFHPTOC	0.05...15.00	0.01
Operate delay time	EFLPTOC and EFHPTOC	40...300000 ms	10
	EFIPTOC	20...300000 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 Operation characteristics table

Table 30. Directional earth-fault protection (DEFxPDEF)

Characteristic		Value		
Operation accuracy	DEFLPDEF	Depending on the frequency of the measured current: f_n ±2 Hz Current: ±1.5% of the set value or ±0.002 × I_n Voltage: ±1.5% of the set value or ±0.002 × U_n Phase angle: ±2°		
	DEFHPDEF	Current: ±1.5% of the set value or ±0.002 × I_n (at currents in the range of 0.1…10 × I_n) ±5.0% of the set value (at currents in the range of 10…40 × I_n) Voltage: ±1.5% of the set value or ±0.002 × U_n Phase angle: ±2°		
Start time [1)2)]		Minimum	Typical	Maximum
	DEFHPDEF I_{Fault} = 2 × set *Start value*	36 ms	50 ms	88 ms
	DEFLPDEF I_{Fault} = 2 × set *Start value*	40 ms	50 ms	73 ms
Reset time		Typically 40 ms		
Reset ratio		Typically 0.96		
Retardation time		<45 ms		
Operate time accuracy in definite time mode		±1.0% of the set value or ±40 ms		
Operate time accuracy in inverse time mode		±5.0% of the theoretical value or ±50 ms [3)]		
Suppression of harmonics		DFT: -50 dB at f = n × f_n, where n = 2, 3, 4, 5,…		

1) *Measurement mode* = default (depends on the stage), current before fault = 0.0 × 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 × I_n, *Start value* multiples in range of 1.5...20

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

Parameter	Function	Value (Range)	Step
Start value	DEFLPDEF	0.010...5.000 × I_n	0.005
	DEFHPDEF	0.10...40.00 × I_n	0.01
Directional mode	DEFxPDEF	1 = Non-directional 2 = Forward 3 = Reverse	-
Time multiplier	DEFxPDEF	0.05...15.00	0.01
Operate delay time	DEFLPDEF	50...300000 ms	10
	DEFHPDEF	40...300000 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	DEFxPDEF	1 = Phase angle 2 = IoSin 3 = IoCos 4 = Phase angle 80 5 = Phase angle 88	-

1) For further reference, see the Operating characteristics table

Table 32. Three-phase inrush detector (INRPHAR)

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

Table 33. Three-phase inrush detector (INRPHAR) main settings

Parameter	Function	Value (Range)	Step
Start value	INRPHAR	5...100%	1
Operate delay time	INRPHAR	20...60000 ms	1

Table 34. Three-phase thermal protection for feeders, cables and distribution transformers (T1PTTR)

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

1) Overload current > 1.2 × Operate level temperature

Table 35. Three-phase thermal protection for feeders, cables and distribution transformers (T1PTTR) main settings

Parameter	Function	Value (Range)	Step
Time constant	T1PTTR	60...60000 s	1
Current reference	T1PTTR	0.05...4.00 × I_n	0.01
Temperature rise	T1PTTR	0.0...200.0°C	0.1
Env temperature Set	T1PTTR	-50...100°C	1
Alarm value	T1PTTR	20.0...150.0°C	0.1
Maximum temperature	T1PTTR	20.0...200.0°C	0.1
Reclose temperature	T1PTTR	20.0...150.0°C	0.1
Initial temperature	T1PTTR	-50.0...100.0°C	0.1
Current multiplier	T1PTTR	1...5	1

Table 36. Negative-sequence overcurrent protection (NSPTOC)

Characteristic		Value		
Operation accuracy		Depending on the frequency of the measured current: f_n ±2 Hz		
		±1.5% of the set value or ±0.002 × I_n		
Start time [1)2)]		Minimum	Typical	Maximum
	I_{Fault} = 2 × set *Start value*	22 ms	32 ms	52 ms
	I_{Fault} = 10 × set *Start value*	14 ms	24 ms	40 ms
Reset time		Typically 40 ms		
Reset ratio		Typically 0.96		
Retardation time		<45 ms		
Operate time accuracy in definite time mode		±1.0% of the set value or ±40 ms		
Operate time accuracy in inverse time mode		±7.0% of the theoretical value or ±50 ms [3)]		
Suppression of harmonics		DFT: -50 dB at f = n × 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 × I_n, *Start value* multiples in range of 1.5...20

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

Parameter	Function	Value (Range)	Step
Start value	NSPTOC	0.01...5.00 × I_n	0.01
Time multiplier	NSPTOC	0.05...15.00	0.01
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 Operation characteristics table

Table 38. Phase discontinuity / Single phasing protection for motor (PDNSPTOC)

Characteristic	Value
Operate time accuracy	Depending on the frequency of the measured current: f_n ±2 Hz
	±2.5% of the set value
Start time	<80 ms
Reset time	Typically 40 ms
Reset ratio	Typically 0.96
Retardation time	<45 ms
Operate time accuracy in definite time mode	±1.0% of the set value or ±40 ms
Suppression of harmonics	DFT: -50 dB at f = n × f_n, where n = 2, 3, 4, 5,…

Table 39. Phase discontinuity / Single phasing protection for motor (PDNSPTOC) main settings

Parameter	Function	Value (Range)	Step
Start value	PDNSPTOC	10...100%	1
Operate delay time	PDNSPTOC	100...30000 ms	1
Min phase current	PDNSPTOC	0.05...0.30 × I_n	0.01

Table 40. Loss of phase, undercurrent (PHPTUC)

Characteristic	Value
Operation accuracy	Depending on the frequency of the measured current: f_n ±2 Hz
	±1.5% of the set value or ±0.002 × I_n
Start time	Typically <65 ms
Reset time	Typically 40 ms
Reset ratio	Typically 1.04
Retardation time	<45 ms
Operate time accuracy	±1.0% of the set value or ±40 ms

Table 41. Loss of phase, undercurrent (PHPTUC) main settings

Parameter	Function	Value (Range)	Step
Start value	PHPTUC	0.01...1.00 × I_n	0.01
Operate delay time	PHPTUC	50...200000 ms	10
Current block value	PHPTUC	0.00...0.50 × I_n	0.01

Table 42. Three-phase undervoltage protection (PHPTUV)

Characteristic		Value		
Operation accuracy		Depending on the frequency of the measured voltage: f_n ±2 Hz		
		±1.5% of the set value or ±0.002 × U_n		
Start time[1)2)]		Minimum	Typical	Maximum
	U_{Fault} = 0.9 × set *Start value*	58 ms	70 ms	82 ms
Reset time		Typically 40 ms		
Reset ratio		Depends on the set *Relative hysteresis*		
Retardation time		<45 ms		
Operate time accuracy in definite time mode		±1.0% of the set value or ±40 ms		
Operate time accuracy in inverse time mode		±5.0% of the theoretical value or ±50 ms[3)]		
Suppression of harmonics		DFT: -50 dB at f = n × f_n, where n = 2, 3, 4, 5,…		

1) *Start value* = 1.0 × U_n, Voltage before fault = 1.1 × U_n, f_n = 50 Hz, undervoltage in one phase-to-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) Minimum *Start value* = 0.50, *Start value* multiples in range of 0.90...0.20

Table 43. Three-phase undervoltage protection (PHPTUV) main settings

Parameter	Function	Value (Range)	Step
Start value	PHPTUV	0.05...1.20 × U_n	0.01
Time multiplier	PHPTUV	0.05...15.00	0.01
Operate delay time	PHPTUV	60...300000 ms	10
Operating curve type[1)]	PHPTUV	Definite or inverse time Curve type: 5, 15, 21, 22, 23	

1) For further reference, see the Operation characteristics table

Table 44. Three-phase overvoltage protection (PHPTOV)

Characteristic		Value		
Operation accuracy		Depending on the frequency of the measured voltage: f_n ±2 Hz		
		±1.5% of the set value or ±0.002 × U_n		
Start time[1)2)]		Minimum	Typical	Maximum
	U_{Fault} = 1.1 × set *Start value*	18 ms	31 ms	42 ms
Reset time		Typically 40 ms		
Reset ratio		Depends on the set *Relative hysteresis*		
Retardation time		<45 ms		
Operate time accuracy in definite time mode		±1.0% of the set value or ±40 ms		
Operate time accuracy in inverse time mode		±5.0% of the theoretical value or ±50 ms[3)]		
Suppression of harmonics		DFT: -50 dB at f = n × f_n, where n = 2, 3, 4, 5,…		

1) *Start value* = 1.0 × U_n, Voltage before fault = 0.9 × U_n, f_n = 50 Hz, overvoltage in one phase-to-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) Maximum *Start value* = 1.20 × U_n, *Start value* multiples in range of 1.20...2.00

Table 45. Three-phase overvoltage protection (PHPTOV) main settings

Parameter	Function	Value (Range)	Step
Start value	PHPTOV	0.05...1.60 × U_n	0.01
Time multiplier	PHPTOV	0.05...15.00	0.01
Operate delay time	PHPTOV	40...300000 ms	10
Operating curve type[1)]	PHPTOV	Definite or inverse time Curve type: 5, 15, 17, 18, 19, 20	

1) For further reference, see the Operation characteristics table

Table 46. Residual overvoltage protection (ROVPTOV)

Characteristic		Value		
Operation accuracy		Depending on the frequency of the measured voltage: f_n ±2 Hz		
		±1.5% of the set value or ±0.002 × U_n		
Start time[1)2)]		Minimum	Typical	Maximum
	U_{Fault} = 2 × set *Start value*	39 ms	50 ms	64 ms
Reset time		Typically 40 ms		
Reset ratio		Typically 0.96		
Retardation time		<45 ms		
Operate time accuracy		±1.0% of the set value or ±40 ms		
Suppression of harmonics		DFT: -50 dB at f = n × f_n, where n = 2, 3, 4, 5,…		

1) Residual voltage before fault = 0.0 × 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 47. Residual overvoltage protection (ROVPTOV) main settings

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

Table 48. Circuit breaker failure protection (CCBRBRF)

Characteristic	Value
Operation accuracy	Depending on the frequency of the measured current: f_n ±2 Hz
	±1.5% of the set value or ±0.002 × I_n
Operate time accuracy	±1.0% of the set value or ±40 ms
Reset time	Typically 40 ms
Retardation time	<45 ms

Table 49. Circuit breaker failure protection (CCBRBRF) main settings

Parameter	Function	Value (Range)	Step
Current value	CCBRBRF	0.05...2.00 × I_n	0.01
Current value Res	CCBRBRF	0.05...2.00 × I_n	0.01
CB failure trip mode	CCBRBRF	1 = 2 out of 4 2 = 1 out of 3 3 = 1 out of 4	-
CB failure mode	CCBRBRF	1 = Current 2 = Breaker status 3 = Both (AND) -1 = Both (OR)	-
Retrip time	CCBRBRF	0...60000 ms	10
CB failure delay	CCBRBRF	0...60000 ms	10
CB fault delay	CCBRBRF	0...60000 ms	10

Table 50. Multipurpose protection (MAPGAPC)

Characteristic	Value
Operate time accuracy	±1.0% of the set value or ±40 ms

Table 51. Multipurpose protection (MAPGAPC) main settings

Parameter	Function	Value (Range)	Step
Start value	MAPGAPC	-10000.0...10000.0	0.1
Operate delay time	MAPGAPC	0...200000 ms	100
Operation mode	MAPGAPC	1 = Over 2 = Under	-

Table 52. Operation characteristics

Parameter	Value (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 20 = UK rectifier
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 53. Autoreclosing (DARREC)

Characteristic	Value
Operate time accuracy	±1.0% of the set value or ±40 ms

Condition monitoring and supervision functions

Table 54. Fuse failure supervision (SEQSPVC)

Characteristic		Value	
Operate time[1)]	NPS function	U_{Fault} = 1.1 × set *Neg Seq voltage Lev*	<38 ms
		U_{Fault} = 5.0 × set *Neg Seq voltage Lev*	<24 ms
	Delta function	ΔU = 1.1 × set *Voltage change rate*	<35 ms
		ΔU = 2.0 × set *Voltage change rate*	<28 ms

1) Includes the delay of the signal output contact, f_n = 50 Hz, fault voltage with nominal frequency injected from random phase angle, results based on statistical distribution of 1000 measurements

Table 55. Circuit-breaker condition monitoring (SSCBR)

Characteristic	Value
Current measuring accuracy	±1.5% or ±0.002 × I_n (at currents in the range of 0.1…10 × I_n) ±5.0% (at currents in the range of 10…40 × I_n)
Operate time accuracy	±1.0% of the set value or ±40 ms
Travelling time measurement	±11 ms

Table 56. Current circuit supervision (CCSPVC)

Characteristic	Value
Operate time [1)]	<30 ms

1) Including the delay of the output contact

Table 57. Current circuit supervision (CCSPVC) main settings

Parameter	Function	Value (Range)	Step
Start value	CCSPVC	0.05...0.20 × I_n	0.01
Max operate current	CCSPVC	1.00...5.00 × I_n	0.01

Measurement functions

Table 58. Three-phase current measurement (CMMXU)

Characteristic	Value
Operation accuracy	Depending on the frequency of the measured current: f_n ±2 Hz
	±0.6% or ±0.002 × I_n (at currents in the range of 0.01...4.00 × I_n)
Suppression of harmonics	DFT: -50 dB at f = n × f_n , where n = 2, 3, 4, 5,… RMS: No suppression

Table 59. Residual current measurement (RESCMMXU)

Characteristic	Value
Operation accuracy	At the frequency f = f_n
	±0.6% or ±0.002 x I_n (at currents in the range of 0.01...4.00 × I_n)
Suppression of harmonics	DFT: -50 dB at f = n × f_n, where n = 2, 3, 4, 5,… RMS: No suppression

Table 60. Sequence current measurement (CSMSQI)

Characteristic	Value
Operation accuracy	Depending on the frequency of the measured current: f_n ±2 Hz
	±1.0% or ±0.002 × I_n at currents in the range of 0.01...4.00 × I_n
Suppression of harmonics	DFT: -50 dB at f = n × f_n, where n = 2, 3, 4, 5,…

Table 61. Three-phase voltage measurement (VMMXU)

Characteristic	Value
Operation accuracy	Depending on the frequency of the measured voltage: f_n ±2 Hz at voltages in range 0.01…1.15 × U_n
	±0.6% or ±0.002 × U_n
Suppression of harmonics	DFT: -50 dB at f = n × f_n, where n = 2, 3, 4, 5,… RMS: No suppression

Table 62. Residual voltage measurement (RESVMMXU)

Characteristic	Value
Operation accuracy	Depending on the frequency of the measured voltage: f/f_n = ±2 Hz
	±0.6% or ±0.002 × U_n
Suppression of harmonics	DFT: -50 dB at f = n × f_n, where n = 2, 3, 4, 5,… RMS: No suppression

Logging functions

Table 63. Disturbance recorder (common functionality) (RDRE) main settings

Parameter	Function	Value (Range)	Step
Pre-trg length	RDRE	0...100%	1
Record length	RDRE	10...500 cycles	1
Operation mode	RDRE	1 = Overwrite 2 = Saturation	-
Storage rate	RDRE	8=8 samples / cycle 16=16 samples / cycle 32=32 samples / cycle	-

Other functionality

Table 64. Time delay off, eight channels (TOFPAGC)

Characteristic	Value
Operate time accuracy	±1.0% of the set value or ±40 ms

Table 65. Time delay on, eight channels (TONGAPC)

Characteristic	Value
Operate time accuracy	±1.0% of the set value or ±40 ms

13. Local HMI

The relay is available with a small display suited for remotely controlled substations where the relay is only occasionally accessed locally via the front panel user interface. The LCD display offers front-panel user interface functionality with menu navigation and menu views.

REX610 has a setting for local/remote operation of the relay which can be defined from either the LHMI or PCM600. When the relay is in the local mode, it can be operated only by using the local front panel user interface. When the relay is in the remote mode, it can execute commands sent from a remote location. Depending on the relay configuration, the selection of the local/remote mode can be made via a binary input or GOOSE communication. This feature facilitates, for example, the use of an external switch at the substation to ensure that all relays are in the local mode during maintenance work and that the circuit breakers cannot be operated remotely from the network control center.

Figure 7. Display

Table 66. Display

Character size[1)]	Rows in the view	Characters per row
Small, mono-spaced (6 × 12 pixels)	5	20

1) Depending on the selected language

14. Mounting methods

With appropriate mounting accessories, the protection relay case can be flush mounted, rack mounted or wall mounted. The rack mounting kits are available with cutouts for either one or two relays.

Mounting options for the relay:
- Flush mounting
- Rack mounting
- Wall mounting

Panel cutout for flush mounting:
- Height: 139.0 mm (5.4724 in)
- Width: 129.0 ± 1 mm (5.0787 ± 0.03937 in)

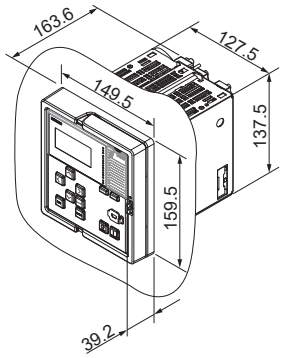

Figure 8. Flush mounting

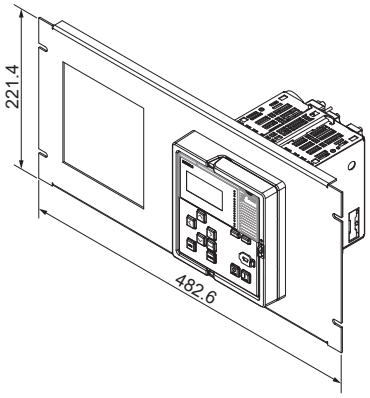

Figure 9. Rack mounting

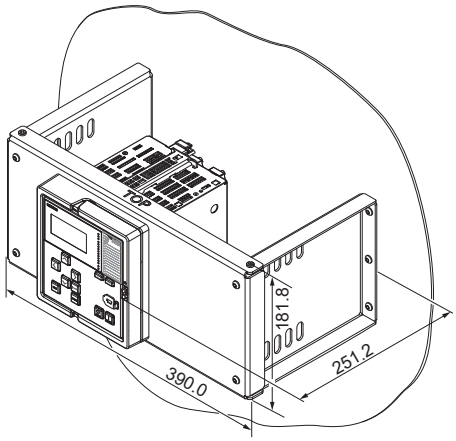

Figure 10. Wall mounting

15. Selection and ordering data

Use ABB Library to access the selection and ordering information and to generate the order number.

Product Selection Tool (PST), a Next-Generation Order Number Tool, supports order creation for ABB's microprocessor-based protection relays with emphasis on, but not exclusively for, the Relion product family. PST is an easy-to-use, online tool always containing the latest product information. The complete order code can be created with detailed specification and the result can be printed and mailed. Registration is required.

16. Modification Sales

Modification Sales is a concept that provides modification support for already delivered relays. Under Modification Sales it is possible to add protection functions by adding a hardware module. The same options are available as when a new relay variant is configured and ordered from the factory: it is possible to add new hardware modules into empty slots or change the type of the existing modules within the slots.

17. Accessories and ordering data

Table 67. Mounting accessories

Item	Order number
Wall mounting kit	2RCA055188A0001
19" rack mounting kit with cutout for one relay	2REA060349A0001
19" rack mounting kit with cutout for two relays	2REA060349A0002

18. Tools

The protection relay is delivered with the correct protection and control functionality included but it needs some engineering to fit in the needed application. The default parameter setting values can be changed from the LHMI or Protection and Control IED Manager PCM600 in combination with the relay-specific connectivity package.

PCM600 offers extensive relay configuration functions. For example, the setting parameters, relay application and IEC 61850 communication, including horizontal GOOSE communication, can be modified with PCM600.

The relay connectivity package is a collection of software and specific relay information which enables system products and tools to connect and interact with the protection relay. The connectivity packages reduce the risk of errors in system integration, minimizing device configuration and setup times.

Further, the connectivity package for REX610 includes a flexible update tool for adding one additional LHMI language and new functionalities to the protection relay. The flexible modification support of the relay enables adding new protection functionalities whenever the protection and control needs are changing.

Table 68. Tools

Description	Version
PCM600	2.11
REX610 connectivity package	1.0 or later

Table 69. Supported functions

Function	PCM600
Relay parameter setting	•
Saving of relay parameter settings in the relay	•
Signal monitoring	•
Disturbance recorder handling	•
Alarm LED viewing	•
Access control management	•
Relay signal configuration (Signal Matrix)	•
Modbus® communication configuration (communication management)	•
Saving of relay parameter settings in the tool	•
Disturbance record analysis	•
XRIO parameter export/import	•
Application configuration	•
IEC 61850 communication configuration, GOOSE (communication configuration)	•
Event viewing	•
Saving of event data on the user's PC	•

• = Supported

19. Module diagrams

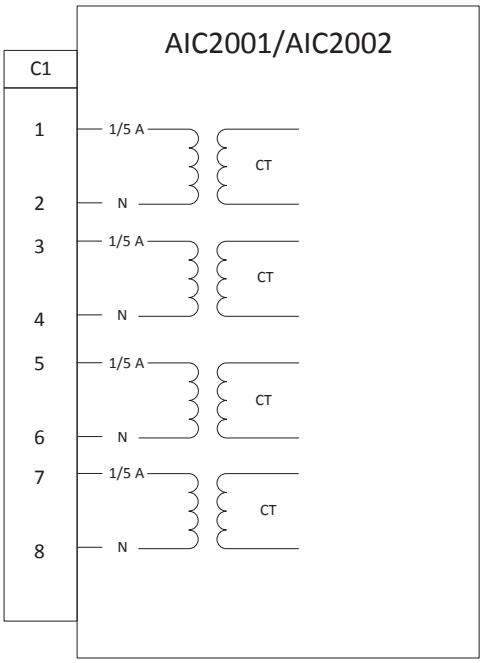

Figure 11. AIC2001/AIC2002 modules

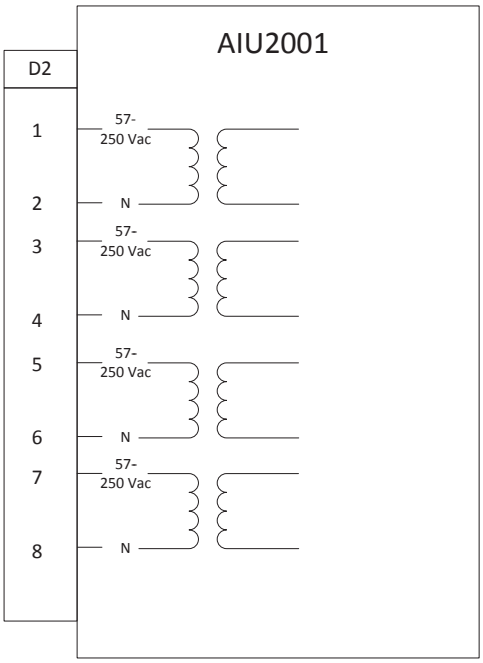

Figure 12. AIU2001 module

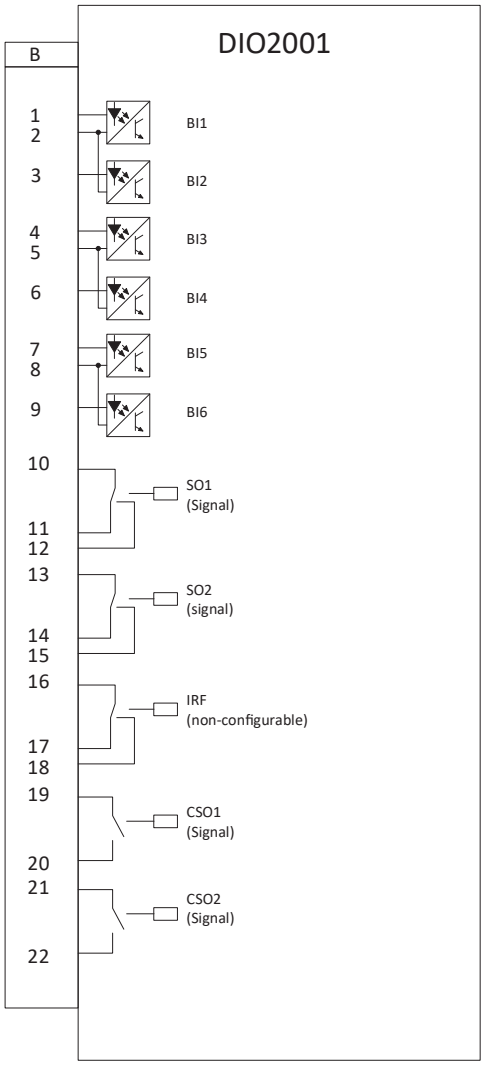

Figure 13. DIO2001 module

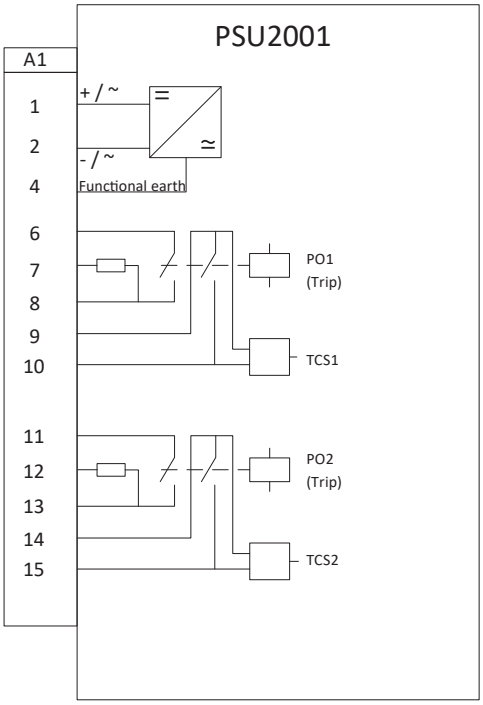

Figure 14. PSU2001 module

20. Certificates

Certificates can be found on the product page.

21. References

The www.abb.com/substationautomation portal provides information on the entire range of distribution automation products and services.

The latest relevant information on the REX610 protection and control relay is found on the product page. Scroll down the page to find and download the related documentation.

22. Functions, codes and symbols

All available functions are listed in the table. All of them may not be applicable to all products.

Table 70. Functions included in the relay

Function	IEC 61850	IEC 60617	IEC-ANSI
Protection			
Three-phase non-directional overcurrent protection, low stage	PHLPTOC	3I>	51P-1
Three-phase non-directional overcurrent protection, high stage	PHHPTOC	3I>>	51P-2
Three-phase non-directional overcurrent protection, instantaneous stage	PHIPTOC	3I>>>	50P
Three-phase directional overcurrent protection, low stage	DPHLPDOC	3I> ->	67P/51P-1
Three-phase directional overcurrent protection, high stage	DPHHPDOC	3I>> ->	67P/51P-2
Non-directional earth-fault protection, low stage	EFLPTOC	Io>	51G/51N-1
Non-directional earth-fault protection, high stage	EFHPTOC	Io>>	51G/51N-2
Non-directional earth-fault protection, instantaneous stage	EFIPTOC	Io>>>	50G/50N
Directional earth-fault protection, low stage	DEFLPDEF	Io> ->	67G/N-1 51G/N-1
Directional earth-fault protection, high stage	DEFHPDEF	Io>> ->	67G/N-1 51G/N-2
Three-phase inrush detector	INRPHAR	3I2f>	68HB
Three-phase thermal protection for feeders, cables and distribution transformers	T1PTTR	3Ith>F	49F
Negative-sequence overcurrent protection	NSPTOC	I2>M	46M
Phase discontinuity / Single phasing protection for motor	PDNSPTOC	I2/I1>	46PD
Loss of phase, undercurrent	PHPTUC	3I<	37
Three-phase undervoltage protection	PHPTUV	3U<	27
Three-phase overvoltage protection	PHPTOV	3U>	59
Residual overvoltage protection	ROVPTOV	Uo>	59G/59N
Circuit breaker failure protection	CCBRBRF	3I>/Io>BF	50BF
Master trip	TRPPTRC	Master Trip	94/86
Multipurpose protection	MAPGAPC	MAP	MAP
Control			
Circuit-breaker control	CBXCBR	I <-> O CB	52
Disconnector position indication	DCSXSWI	I <-> O DC	29DS
Earthing switch position indication	ESSXSWI	I <-> O ES	29GS
Autoreclosing	DARREC	O -> I	79
Condition monitoring and supervision			
Trip circuit supervision	TCSSCBR	TCS	TCM
Fuse failure supervision	SEQSPVC	FUSEF	VCM, 60
Circuit-breaker condition monitoring	SSCBR	CBCM	52CM
Current circuit supervision	CCSPVC	MCS 3I	CCM

Table 70. Functions included in the relay, continued

Function	IEC 61850	IEC 60617	IEC-ANSI
Measurement			
Three-phase current measurement	CMMXU	3I	IA, IB, IC
Residual current measurement	RESCMMXU	Io	IG
Sequence current measurement	CSMSQI	I1, I2, I0	I1, I2, I0
Three-phase voltage measurement	VMMXU	3U	VA, VB, VC
Residual voltage measurement	RESVMMXU	Uo	VG/VN
Traditional LED indication			
Programmable LED control	LED	LED	LED
Logging functions			
Disturbance recorder (common functionality)	RDRE	DR	DFR
Disturbance recorder, analog channels 1…8	A1RADR	A1RADR	A1RADR
Disturbance recorder, binary channels 1...32	B1RBDR	B1RBDR	B1RBDR
Communication protocols			
IEC 61850-8-1 MMS	MMSLPRT	MMSLPRT	MMSLPRT
IEC 61850-8-1 GOOSE	GSELPRT	GSELPRT	GSELPRT
Modbus protocol	MBSLPRT	MBSLPRT	MBSLPRT

23. Document revision history

Document revision/date	Product version	History
A/2022-04-21	1.0	First release
B/2022-04-21	1.0	Content updated

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