RELION® 610 SERIES

Feeder Protection
REF610
Product Guide

Contents

1. Description

REF610 is a feeder protection relay for protection, measuring and supervision of utility and industrial distribution power systems. REF610 is a member of ABB's Relion® protection and control product family and part of its 610 product series. The 610 series includes protection relays for feeder protection, motor protection and general system voltage supervision. The plug-in design of the 610 series protection relays facilitates the commissioning of the switchgear and enables fast and safe insertion and withdrawal of relay plug-in units.

The protection relay is primarily targeted at the protection of incoming and outgoing feeders in distribution substations. REF610 is also used as back-up protection for motors, transformers and generators in utility and industry applications. Further, the 610 series protection relays are suitable for employment in marine and offshore environments.

The numerical feeder protection relays of the 610 series support a wide range of standard communication protocols, among them the IEC 61850, IEC 60870-5-103, DNP3, Modbus, Profibus, LON and SPA communication protocols.

2. Functional overview

Table 1. Functionality

Description	
Protection	
Three-phase overcurrent, low-set stage	•
Three-phase overcurrent, high-set stage	•
Three-phase overcurrent, instantaneous stage	•
Non-directional earth fault, low-set stage	•
Non-directional earth fault, high-set stage	•
Phase discontinuity	•
Three-phase thermal overload for cables	•
Circuit-breaker failure	•
Arc protection, two lens sensors for arc detection	o
Autoreclosing	•
Lockout relay function	•
Condition monitoring	
Trip circuit supervision	•
Trip lockout function	•
Trip counters for circuit-breaker condition monitoring	•
Measurement	
Disturbance recorder	•
Residual current	•
Three-phase current	•
Phase unbalance	•
Thermal level	•

• = Included o = Optional

3. Protection functions

The protection relay offers overcurrent and thermal overload protection, earth-fault and phase-discontinuity protection for cable feeders, and three-pole, multi-shot autoreclose functions for overhead-line feeders.

Enhanced with optional hardware, the protection relay also features two light detection channels enabling arc fault protection of the switchgear, busbar system and cable terminals.

The numerical feeder protection relays of the 610 series support a wide range of standard communication protocols, among them the IEC 61850, IEC 60870-5-103, Modbus, Profibus and DNP3 communication protocols.

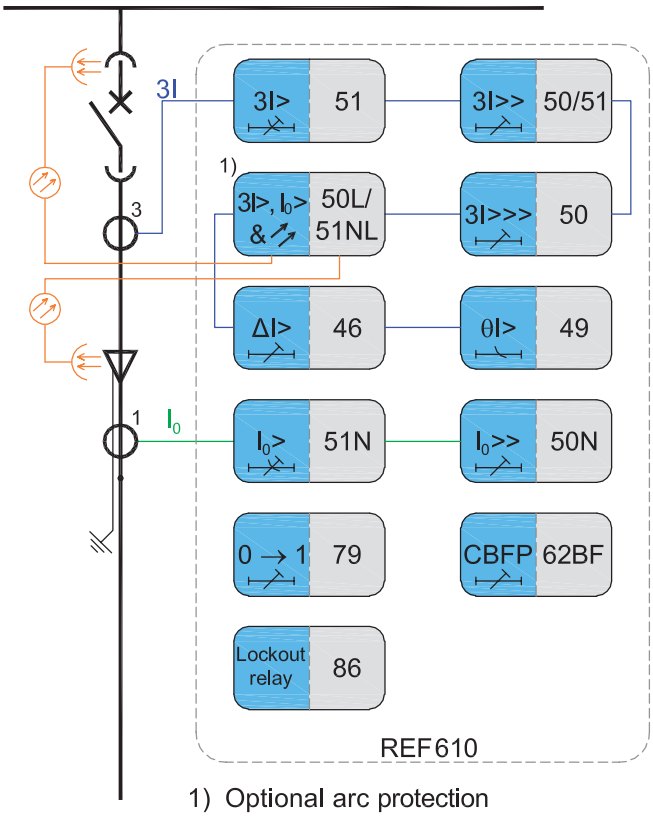


Figure 1. Protection function overview of REF610

4. Application

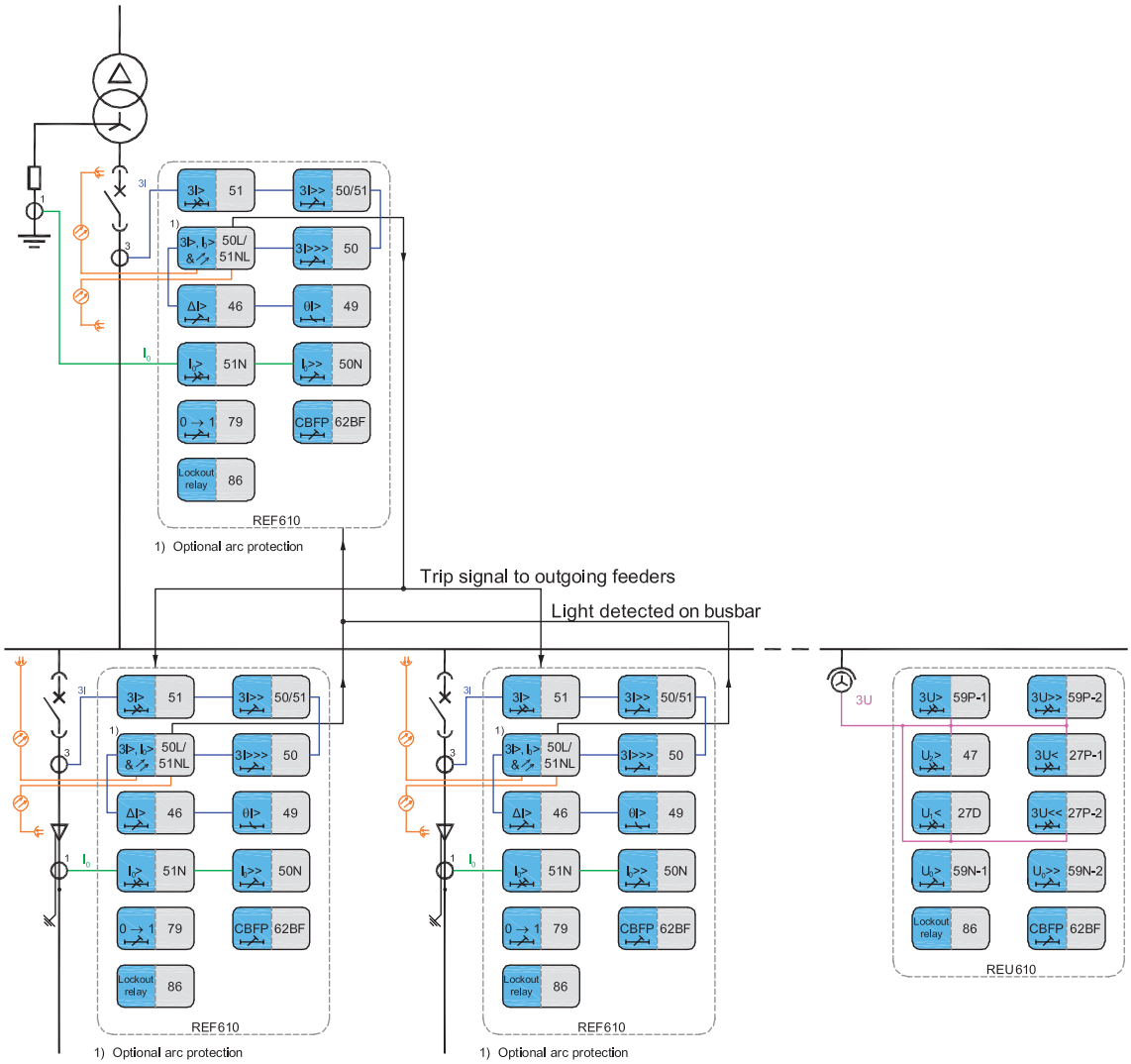


Figure 2. **Substation O/C and E/F protection based on 610 series protection relays. Equipped with an optional hardware module REF610 also provides fast and selective arc fault protection.**

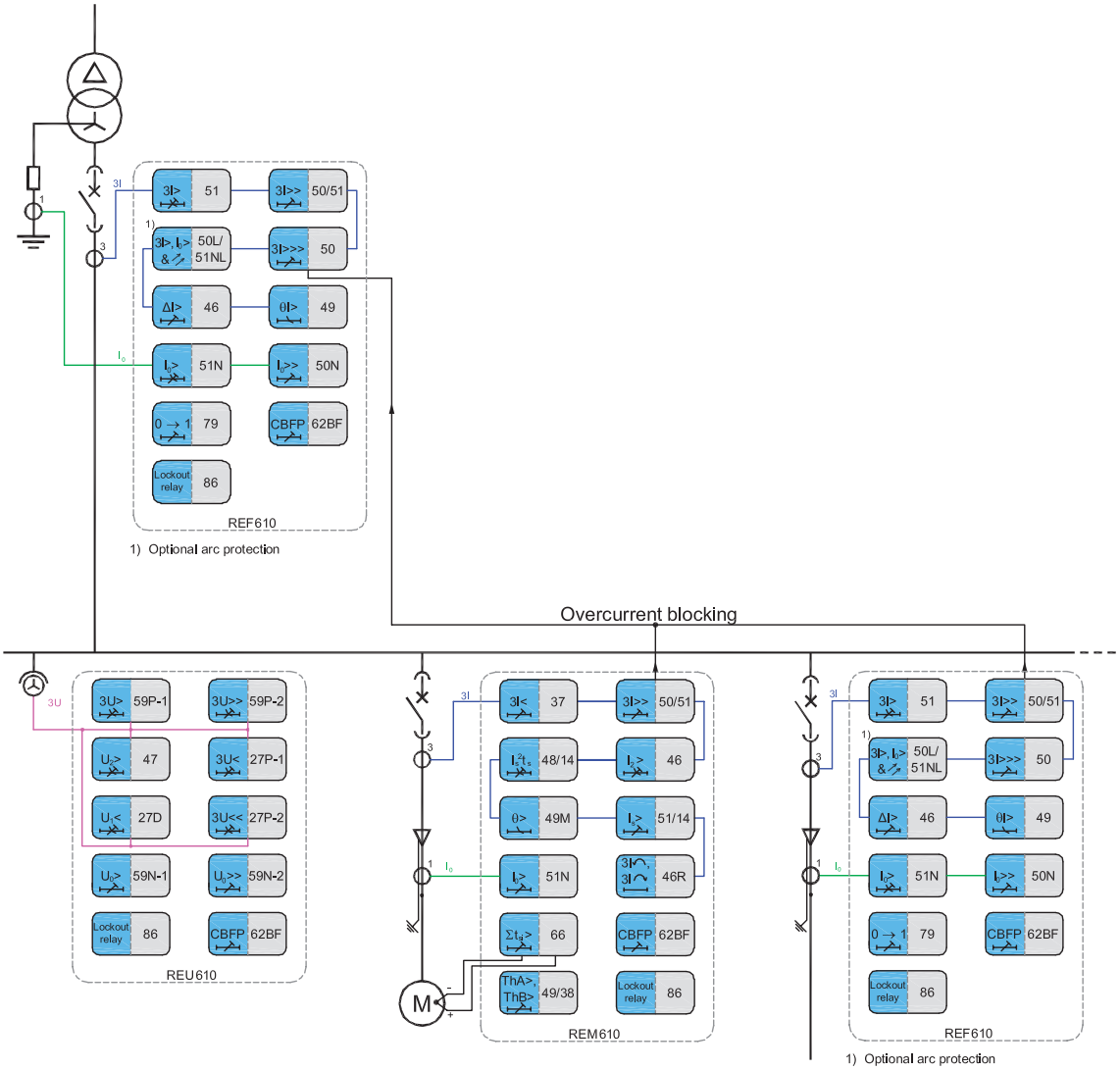


Figure 3. Substation feeder O/C and E/F protection, and substation busbar protection based on 610 series protection relays. The operate time of the busbar protection has been speeded up using the principle of upstream interlocking.

The connection of the CTs to REF610 depends on the available number and types of CTs in the feeder cubicle. Generally an outgoing feeder is equipped with three phase current transformers for high- and low-set overcurrent protection. The residual current for the earth-fault protection can be derived from the three phase currents. It can also be measured with a ring-type cable current transformer, should the outgoing feeder be a cable line and a sensitive earth-fault protection be required.

Should the feeder cubicle be equipped with two phase current transformers, REF610 can still be used for high- and low-set overcurrent protection including phase discontinuity and phase unbalance protection.

5. Measurement

The protection relay continuously measures the phase currents and the residual current. Further the protection relay calculates the thermal overload of the protected object, the phase unbalance value, the one-minute demand value, the demand value for a specified time frame and the maximum one-minute demand value over a specified time frame.

The values measured can be accessed locally via the user interface on the protection relay's front panel or remotely via the serial communication interface of the protection relay.

6. Disturbance recorder

The protection relay is provided with a built-in battery backed-up digital disturbance recorder for four analog signal channels

and eight digital signal channels. The analog channels can be set to record the curve form of the currents measured. The digital channels can be set to record external or internal relay signals, for example the start or trip signals of protection relay's stages, external blocking or control signals. Any digital relay signal such as a protection start or trip signal, or an external relay control signal can be set to trigger the recording. The recordings are stored in a nonvolatile memory from which the data can be uploaded for subsequent fault analysis.

7. Event recorder

To provide network control and monitoring systems with feeder level event logs, the protection relay incorporates a nonvolatile memory with capacity of storing 100 event codes including the time stamps.The nonvolatile memory retains its data also in case the protection relay temporarily loses its auxiliary supply.The event log facilitates detailed pre- and post-fault analyses of feeder faults and distribution disturbances.

8. Circuit-breaker monitoring

The protection relay constantly monitors the tear and wear of the protected feeder's circuit breaker by using a set of built-in condition monitoring counters. The monitoring counters provide the circuit breaker with operational history data. This data can be used for scheduling preventive maintenance programs for the circuit breaker.

9. 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 its closed and in its open position. It also detects loss of circuit-breaker control voltage.

10. 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.

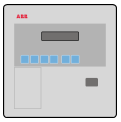
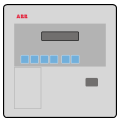
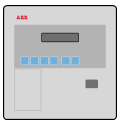
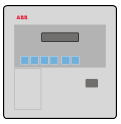
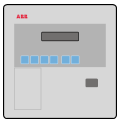
11. Inputs/Outputs

- Four current transformers
- Two digital inputs
- Three additional digital inputs on an optional I/0 module
- Three normally open heavy duty output contacts
- Two change-over signal output contacts
- Three additional signaling contacts on an optional I/O module
- One dedicated IRF contact
- Input/output contacts freely configurable

12. Communication

The protection relays are connected to the fiber-optic communication bus directly or via bus connection modules and gateways. The bus connection module converts the protection relay's electrical signals to optical signals for the communication bus and, vice versa, the communication bus' optical signals to electrical signals for the protection relay.

Table 2. Optional communication modules and protocols

Protocol	Plastic fiber[1)]	Plastic/Glass fiber[1)]	RS-485[1)]	RS-485DNP[1)]	Bus connection modules and gateways
SPA	●	●	●	-	
DNP3	-	-	-	●	
IEC 60780-5-103	●	●	●	-	
Modbus (RTU and ASCII)	●	●	●	-	Protection relay
IEC 61850	●	●	-	-	  Protection relay + SPA-ZC 402
LON	-	-	●	-	  Protection relay + SPA-ZC 102
	●	●	-	-	   Protection relay + SPA-ZC 21 + SPA-ZC 102
Profibus	-	-	●	-	  Protection relay + SPA-ZC 302

1) Optional arc protection

13. Technical data

Table 3. Dimensions

Description	Value	
Width	Frame Case	177 mm 164 mm
Height	Frame Case	177 mm (4U) 160 mm
Depth	Case	149.3 mm
Weight	Protection relay Spare unit	3.5 kg 1.8 kg

Table 4. Power supply

Description	Value	
Type	REF610CxxHxxx	REF610CxxLxxx
U_{aux}rated	U_r= 100/110/120/220/240 V AC U_r= 110/125/220/250 V DC	U_r= 24/48/60 V DC
U_{aux}variation (temporary)	85...110% of U_r (AC)	80...120% of U_r (DC)
	80...120% of U_r (DC)	
Burden of auxiliary voltage supply under quiescent (P_q)/operating condition	<9 W/13 W	
Ripple in the DC auxiliary voltage	Max. 12% of the DC value (at frequency ogf 100 Hz)	
Interruption time in the auxiliary DC voltage without resetting the protection relay	<50 ms at U_{aux} rated	
Time to trip from switching on the auxiliary voltage	<350 ms	
Internal over temperature limit	+100 ºC	
Fuse type	T2A/250 V	

Table 5. Energizing inputs

Description	Value		
Rated frequency	50/60 Hz ±5 Hz		
Rated current, I_n	0.2 A	1 A	5 A
Thermal withstand capability			
• Continuously	0.5 A	4 A	20 A
• For 1 s	20 A	100 A	500 A
• For 10 s	5 A	25 A	100 A
Dynamic current withstand			
• Half-wave value	50 A	250 A	1250 A
Input impedance	<750 mΩ	<100 mΩ	<20 mΩ

Table 6. Measuring range

Description	Value
Measured currents on phases I_{L1}, I_{L2} and I_{L3} as multiples of the rated currents of the energizing inputs	0... 50 × I_n
Earth-fault current as a multiple of the rated current of the energizing input	0... 20 × I_n

Table 7. Digital inputs

Description	Value	
Rated voltage	DI1, DI2	DI3...DI5 (optional)
• REF610CxxHxxx Activating threshold • REF610CxxLxxx Activating threshold	110/125/220/250 V DC Max. 88 V DC (110 V DC -20%) 24/48/60/110/125/220/250 V DC Max. 19.2 V DC (24 V DC -20%)	
• REF610CxxxxHx Activating threshold • REF610CxxxxLx Activating threshold		110/125/220/250 V DC Max. 88 V DC (110 V DC -20%) 24/48/60/110/125/220/250 V DC Max. 19.2 V DC (24 V DC -20%)
Operating range	±20% of the rated voltage	
Current drain	2...18 mA	
Power consumption/input	<0.9 W	

Table 8. Signal output SO1 and optional outputs SO4 and SO5

Description	Value
Rated voltage	250 V AC/DC
Continuous 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 (5 A/3 A/1 A for series connection of SO4 and SO5
Minimum contact load	100 mA at 24 V AC/DC

Table 9. Signal output SO2, optional output SO3 and IRF output

Description	Value
Rated voltage	250 V AC/DC
Continuous carry	5 A
Make and carry for 3.0 s	10 A
Make and carry for 0.5 s	35 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

Table 10. Power outputs PO1, PO2 and PO3

Description	Value
Rated voltage	250 V AC/DC
Continuous 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 (PO1 with both contacts connected in series)	5 A/3 A/1 A
Minimum contact load	100 mA at 24 V AC/DC
Trip-circuit supervision (TCS)[1]:	
• Control voltage range	20...265 V AC/DC
• Current drain through the supervision circuit	~1.5 mA
• Minimum voltage over a contact	20 V AC/DC (15...20 V)

1) Only PO1

Table 11. Data communication interfaces

Interface	Protocol	Cable	Data transfer rate
Front	SPA bus protocol	Optical connection (infrared) via the front communication cable (1MRS050698)	9.6 or 4.8 kbps (9.6 kbps with front communication cable)

Table 12. Lens sensor and optical fiber for arc protection

Description	Value
Fiber-optic cable including lens	1.5 m, 2.0 m or 3.0 m
Normal service temperature range of the lens	-40...+100°C
Maximum service temperature range of the lens, max 1 h	+140°C
Minimum permissible bending radius of the connection fiber	100 mm

Table 13. Enclosure class of the flush-mounted protection relay

Description	Value
Front side	IP 54 Category 2
Rear side, top of the protection relay	IP 40
Rear side, connection terminals	IP 20

Table 14. Environmental conditions

Description	Value
Recommended service temperature range (continuous)	-10...+55ºC
Humidity	<95% RH
Limit temperature range (short-term)	-40...+70ºC
Transport and storage temperature range	-40...+85ºC according to IEC 60068-2-48
Atmospheric pressure	86...106 kPa

Table 15. Environmental tests

Description	Reference
Dry heat test (humidity <50%)	According to IEC 60068-2-2
Dry cold test	According to IEC 60068-2-1
Damp heat test, cyclic (humidity >93%)	According to IEC 60068-2-30

Table 16. Electromagnetic compatibility tests

Description	Type test value	Reference
EMC immunity test level meets the requirements listed below		
1 MHz burst disturbance test, class III		IEC 60255-22-1, IEC 61000-4-18
• Common mode	2.5 kV	
• Differential mode	1.0 kV	
Electrostatic discharge test, class IV		IEC 61000-4-2, IEC 60255-22-2 and ANSI C37.90.3-2001
• For contact discharge	8 kV	
• For air discharge	15 kV	
Radio frequency interference tests		
• Conducted, common mode	10 V (rms), f = 150 kHz...80 MHz	IEC 61000-4-6 and IEC 60255-22-6
• Radiated, amplitude-modulated	10 V/m (rms), f = 80...2700 MHz	IEC 61000-4-3 and IEC 60255-22-3
• Radiated, pulse-modulated	10 V/m, f = 900 MHz	ENV 50204 and IEC 60255-22-3
Fast transient disturbance tests		IEC 60255-22-4 and IEC 61000-4-4
• Power outputs, energizing inputs, power supply	4 kV	
• I/O ports	2 kV	
Surge immunity test		IEC 61000-4-5 and IEC 60255-22-5
• Power outputs, energizing inputs, power supply	4 kV, line-to-earth 2 kV, line-to-line	
• I/O ports	2 kV, line-to earth 1 kV, line-to-line	
Power frequency (50 Hz) magnetic field	300 A/m continuous	IEC 6100-4-8
Power frequency immunity test:		IEC 60255-22-7 and IEC 61000-4-16
REF610CxxHxxx and REF610CxxxxHx	Class A	
• Common mode • Differential mode	300 V rms 150 V rms	
REF610CxxLxxx and REF610CxxxxLx	Class B	
• Common mode • Differential mode	300 V rms 100 V rms	
Voltage dips and short interruptions	30%/10 ms 60%/100 ms 60%/1000 ms >95%/5000 ms	IEC 61000-4-11
Electromagnetic emission tests		EN 55011
• Conducted, RF-emission (Mains terminal)		EN 55011, class A, IEC 60255-25
• Radiated RF-emission		EN 55011, class A, IEC 60255-25
CE compliance		Complies with the EMC directive 2009/108/EC and LV directive 2006/95/IEC

Table 17. Insulation tests

Description	Type test value	Reference
Dielectric tests • Test voltage	 2 kV, 50 Hz, 1 min	IEC 60255-5
Impulse voltage test • Test voltage	 5 kV, unipolar impulses, waveform 1.2/50 µs, source energy 0.5 J	IEC 60255-5
Insulation resistance measurements • Isolation resistance	 >100 MΩ, 500 V DC	IEC 60255-5

Table 18. Mechanical tests

Description	Reference	Requirement
Vibration tests (sinusoidal)	According to IEC 60255-21-1	Class I
Shock and bump test	According to IEC 60255-21-2	Class I

Protection functions

Table 19. Three-phase overcurrent protection (I>, I>>, I>>>)

Feature	Stage I>	Stage I>>	Stage I>>>
Set start value, I>, I>> and I>>>			
• at definite-time characteristic	0.30...5.00 x I_n	0.50...35.0 x I_n	0.50...35.0 x I_n
• at IDMT characteristic	0.30...2.50 x I_n [1)]		
Start time, typical	55 ms	30 ms	30 ms
Time/current characteristic			
• definite-time operate time, t>, t>> and t>>>	0.05...300 s	0.04...300 s	0.04...300 s
• IDMT according to IEC 60255-3	Extremely inverse Very inverse Normal inverse Long-time inverse		
Time multiplier, k	0.05...1.00		
• Special type of IDMT characteristic	RI-type inverse RD-type inverse (RXIDG)		
Time multiplier, k	0.05...1.00		
• IDMT according to IEEE C37.112	Extremely inverse Very inverse Inverse		
Time dial, n	1...15		
Resetting time, maximum	50 ms [2)]	50 ms	50 ms
Retardation time, typical	30 ms	30 ms	30 ms
Set resetting time, t >	0.05...2.50 s		
Drop-off/pick-up ratio, typical	0.96	0.96	0.96
Operate time accuracy			
• at definite-time characteristic	±2% of the set operate time or ±25 ms	±2% of the set operate time or ±25 ms	±2% of the set operate time or ±25 ms
• at IDMT characteristic according to IEC 60255-3 accuracy class index E	5		
• at IDMT characteristic according to IEEE C37.112	±7% of the calculated operate time		
• at RI-type characteristic	±7% of the calculated operate time		
• at RD-type characteristic (RXIDG)	±7% of the calculated operate time		
Operation accuracy			
• 0.3...0.5 x I_n	±5% of the set start value		
• 0.5...5.0 x I_n	±3% of the set start value	±3% of the set start value	±3% of the set start value
• 5.0...35.0 x I_n		±3% of the set start value	±3% of the set start value

1) As the maximum measured current is 50 × I_n, a predefined current setting of 2.5 x In is used for the operate time calculation at IDMT mode of operation, if the set start value is greater than 2.5 x I_n. This will speed up the operation of the protection relay making the operate time shorter than the theoretical IDMT curve would imply. However, the stage always starts according to the set start value.
2) Resetting time of the trip signal

Table 20. Non-directional earth-fault protection (I_0>, I_0>>)

Feature	Stage I_0>	Stage I_0>>
Set start value, I_0> and I_0>>		
• At definite-time characteristic	1.0...100% I_n	5.0...800% In
• At IDMT characteristic	1.0...100% I_n [1)]	
Start time, typical	60 ms	50 ms
Time/current characteristic		
• Definite time operate time, t_0> and t_0>>	0.05...300 s	0.05...300 s
• IDMT according to IEC 60255-3	Extremely inverse Very inverse Normal inverse Long-time inverse	
Time multiplier, k_0	0.05...1.00	
• Special type of IDMT characteristic	RI-type inverse RD-type inverse	
Time multiplier, k_0	0.05...1.00	
• IDMT according to IEEE C37.112	Extremely inverse Very inverse Inverse	
Time dial, n_0	1...15	
Resetting time, maximum	50 ms [2)]	50 ms
Retardation time, typical	30 ms	30 ms
Set resetting time, t_{0r}>	0.05...2.50 s	
Drop-off/pick-up ratio, typical	0.96	0.96
Operate time accuracy		
• At definite-time characteristic	±2% of the set operate time or ±25 ms	±2% of the set operate time or ±25 ms
• At IDMT characteristic according to IEC 60255-3 accuracy class index E	5	
• At IDMT characteristic according to IEEE C37.112	±7% of the calculated operate time	
• At RI-type characteristic	±7% of the calculated operate time	
• At RD-type characteristic (RXIDG)	±7% of the calculated operate time	
Operation accuracy		
• 1.0...10.0% I_n	±5% of the set start value +0.05% I_n	±5% of the set start value +0.05% I_n
• 10.0...100% I_n	±3% of the set start value	±3% of the set start value
• 100...800% I_n		±3% of the set start value

1) As the maximum measured current is 50 × I_n, a predefined current setting of 2.5 x I_n is used for the operate time calculation at IDMT mode of operation, if the set start value is greater than 2.5 x I_n. This will speed up the operation of the protection relay making the operate time shorter than the theoretical IDMT curve would imply. However, the stage always starts according to the set start value.
2) Resetting time of the trip signal.

Table 21. Three-phase thermal overload protection for cables (θ>)

Feature	Value
Set full load current, I_θ	0.30...1.50 x I_n
Set alarm level, θ_a>	50...100%
Trip level, θ_t>	100%
Time constant, τ	1...200 min
Operate time accuracy I/I_θ >1.2	±2% of the set operate time or ±1 s

Table 22. Phase discontinuity protection (ΔI>)

Feature	Value
Set start value, ΔI> at definite-time characteristic	10...100% ΔI =(I_{max}-I_{min})/I_{max}*100%
Start time, typical	100 ms
Time/current characteristics definite time operate time, tΔ>	1...300 s
Resetting time, maximum	70 ms
Drop-off/pick-up ratio, typical	0.90
Operate time accuracy	
• At definite-time characteristic	±2% of the set operate time or ±75 ms
Operation accuracy	
• 10...100%	±3% of the set start value and ±1 unit

Table 23. Arc protection (ARC)

Feature	Value
Stage ARC	
Set trip value ArcI>	0.5...35.0 x I_n
Operate time	< 15 ms [1)]
$ArcI_0$>	5.0...800% I_n
Operate time	< 17 ms [1)]
Resetting time	30 ms
Operation accuracy	±7% of the set start value
LightSensor>	
Activation time of LightSensor>	< 15 ms
Resetting time	20 ms

1) Applies only if a signal output contact (SO1...5) is used. If a power output contact (PO1...3) is used, 2...3 ms will be added. It is used only for alarm purposes.

Table 24. Autoreclose function (O → I)

Feature	Value
Trigger pulse	Any start/trip signal
Number of shots	0...3
CB closing time	0.1...10 s
Start delay of stage I>	0...300 s
Start delay of stage I_0>	0...300 s
Reclaim time	3...300 s
Cutout time	0.1...300 s
Dead time of shot 1	0.1...300 s
Dead time of shot 2	0.1...300 s
Dead time of shot 3	0.1...300 s
Operate time accuracy	±2% of the set time and ±25 ms

Table 25. Circuit-breaker failure protection (CBFP)

Feature	Value
Set operate time	0.10...60.0 s
Phase-to phase voltage threshold for external triggering of the CBFP:	
• Pick-up/drop-off	0.08/0.04 x I_n

14. Mounting methods

Using the appropriate mounting accessories, the standard relay case for the 610 series relays can be flush mounted, semi-flush mounted or wall mounted. The flush mounted and wall mounted relay cases can also be mounted in a tilted position (25°) by using special accessories.

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

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

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

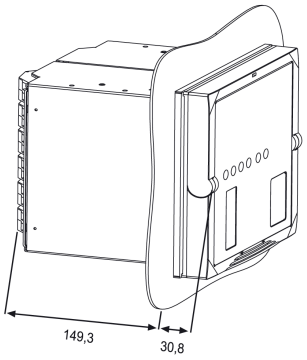


Figure 4. Flush mounting

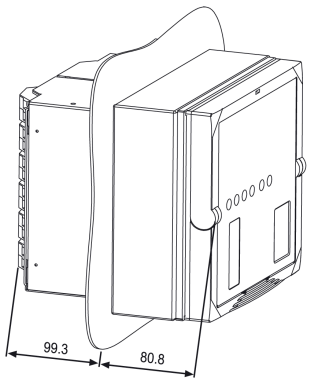


Figure 5. Semi-flush mounting

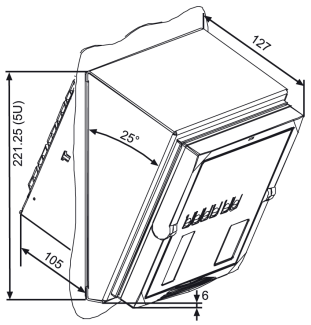


Figure 6. Semi-flush mounting in a 25º angle

15. Relay case and plug-in unit

As a safety measure, the relay cases for the current measuring protection relays are provided with automatically acting contacts for short-circuiting the CT secondaries, when a relay plug-in unit is withdrawn from the relay case. In addition, the relay case is provided with a mechanical coding system to prevent the current measuring relay plug-in units from being inserted into a case for a voltage protection relay unit and vice versa, that is the relay cases are associated to a certain type of relay plug-in unit.

There is, however, a universal relay case available, which is not associated to a certain plug-in unit type. When a relay plug-in unit is plugged into such a relay case for the first time, the relay case automatically adapts to that particular protection relay type, that is the short-circuiting contacts are activated as well as the mechanical blocking system. Hereafter, the relay case is permanently associated to a certain protection relay type.

16. Selection and ordering data

When ordering protection relays and/or accessories, please specify the following information: order number, HMI language set number and quantity. The order number identifies the protection relay type and hardware and is labelled on the marking strip under the lower handle of the protection relay.

Use the ordering key information in Figure 7 to generate the order number when ordering complete protection relays.

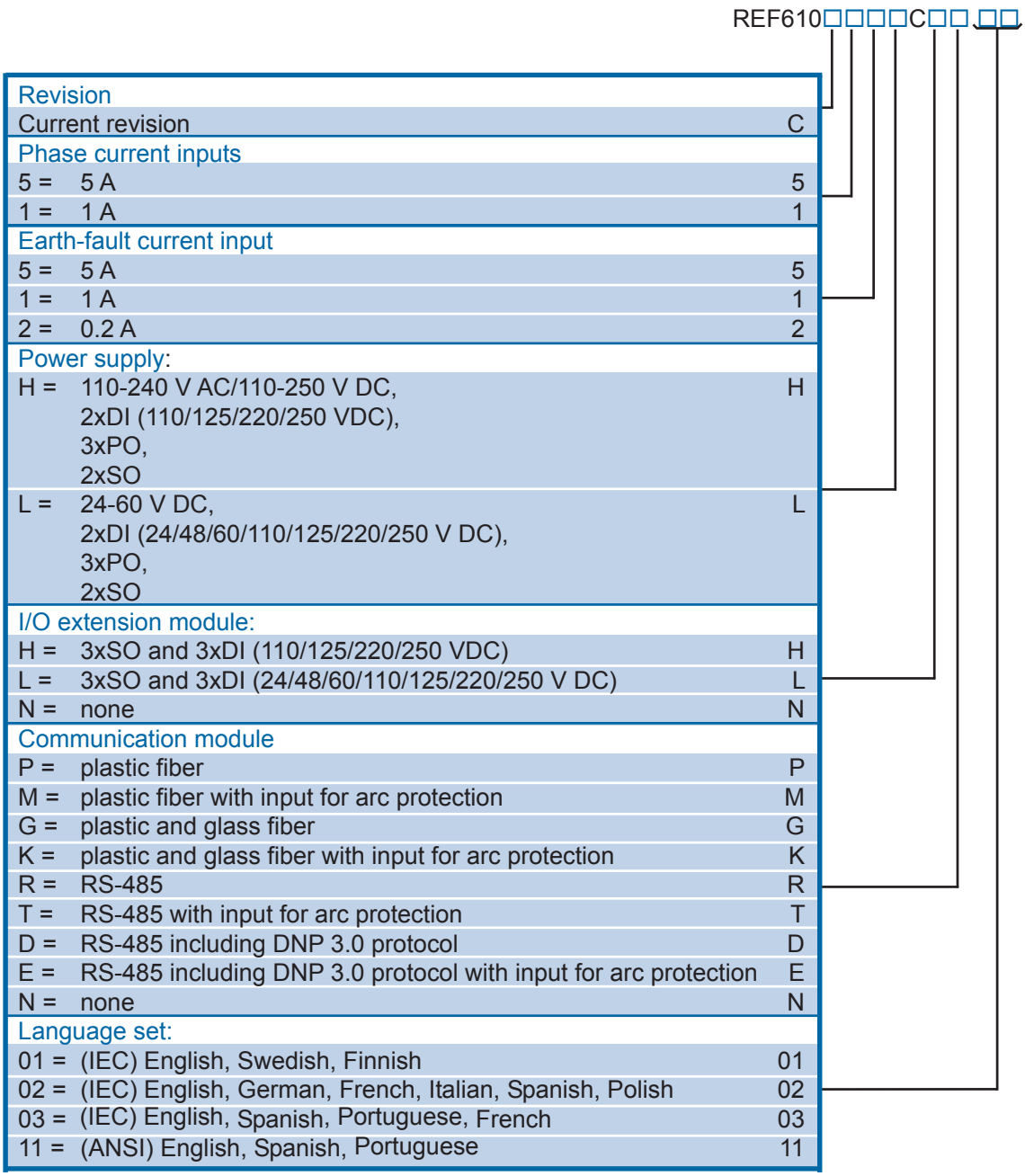
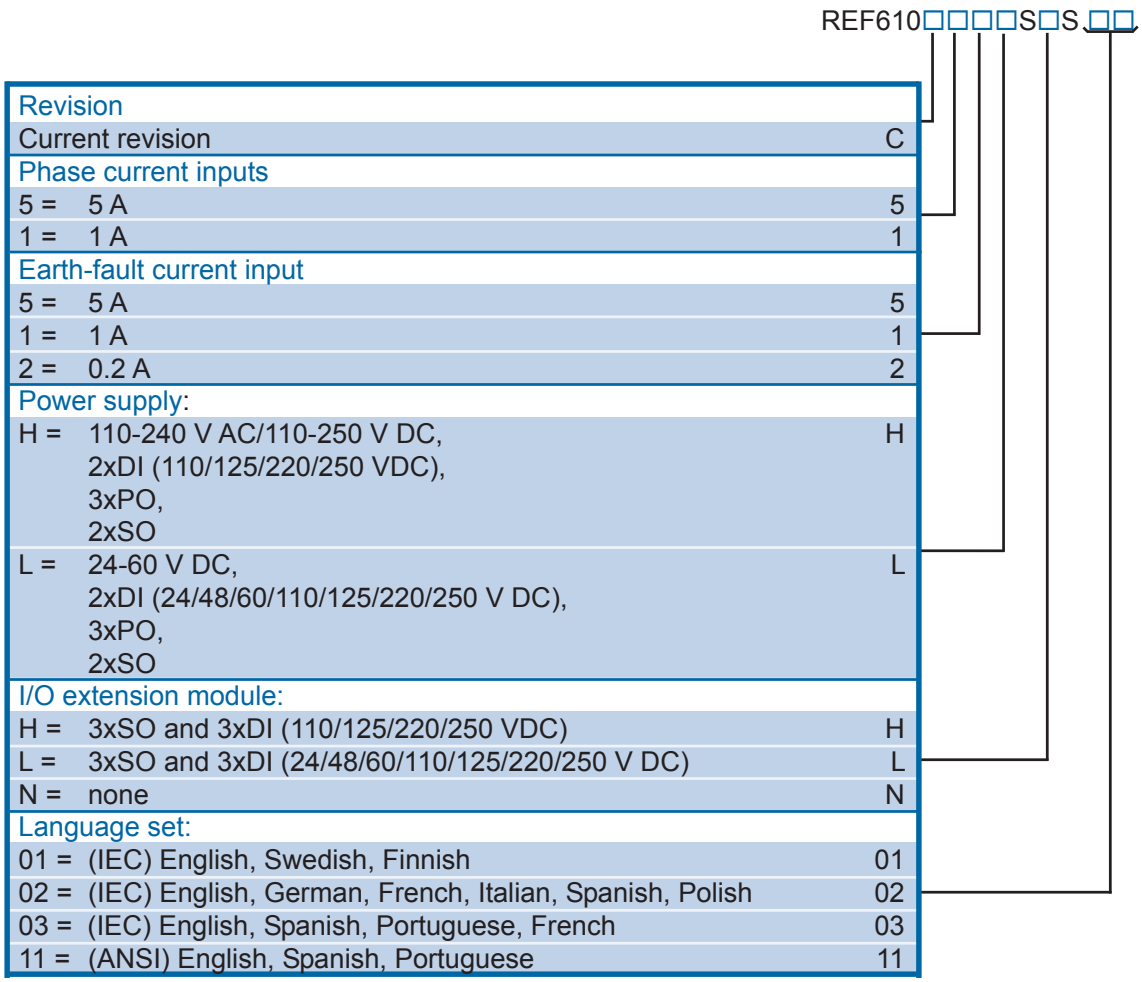


Figure 7. Ordering key for complete protection relays

Use the ordering key information in Figure 8 to generate the order number when ordering spare units.



Revision		
Current revision		C
Phase current inputs		
5 =	5 A	5
1 =	1 A	1
Earth-fault current input		
5 =	5 A	5
1 =	1 A	1
2 =	0.2 A	2
Power supply:		
H =	110-240 V AC/110-250 V DC, 2xDI (110/125/220/250 VDC), 3xPO, 2xSO	H
L =	24-60 V DC, 2xDI (24/48/60/110/125/220/250 V DC), 3xPO, 2xSO	L
I/O extension module:		
H =	3xSO and 3xDI (110/125/220/250 VDC)	H
L =	3xSO and 3xDI (24/48/60/110/125/220/250 V DC)	L
N =	none	N
Language set:		
01 =	(IEC) English, Swedish, Finnish	01
02 =	(IEC) English, German, French, Italian, Spanish, Polish	02
03 =	(IEC) English, Spanish, Portuguese, French	03
11 =	(ANSI) English, Spanish, Portuguese	11

Figure 8. Ordering key for spare units

17. Accessories

Table 26. Cables

Item	Order number
Front communication cable	1MRS050698
Cable for optical sensors for arc protection (X.X = length [m])	1MRS120534-X.X

Table 27. Mounting accessories

Item	Order number
Semi-flush mounting kit	1MRS050696
Inclined semi-flush mounting kit	1MRS050831
19” rack mounting kit with cutout for one protection relay	1MRS050694
19” rack mounting kit with cutout for two protection relays	1MRS050695
Surface mounting frame	1MRS050697
Mounting bracket for RTXP 18	1MRS061207
Mounting bracket for 4U high Combiflex equipment frame	1MRS061208

Table 28. Test switches

Item	Order number
Test switch RTXP 18	1MRS050783

Table 29. Optional communication cards

Item	Order number
Plastic fiber	1MRS050889
Plastic fiber with inputs for arc protection	1MRS050890
RS-485	1MRS050892
RS-485 with inputs for arc protection	1MRS050888
Plastic and glass fiber	1MRS050891
Plastic and glass fiber with inputs for arc protection	1MRS050885
RS-485 including DNP3 protocol	1MRS050887
RS-485 including DNP3 protocol and inputs for arc	1MRS050886

Table 30. 610 series universal cases

Item	Order number
Empty universal relay case for 610 series	1MRS050904

18. Tools

Table 31. Configuration and setting tools

Tool	Version
Protection and Control IED Manager PCM600	2.1 or later
REF610 Connectivity Package	2.1 or later
CAP 501 Relay Setting Tool CAP 50	2.4.0-1 or later
CAP 505 Relay Setting Tool CAP 505 v. 2.4.0-1 or later	2.4.0-1 or later
Communication Engineering Tool (CET) for SPA-ZC 40x	1.1.1
Lon Network Tool LNT 505	1.1.1 Add-on 1
Profibus-DPV1/SPA Configuration Tool (PCT)	

Table 32. Supported functions

Function	PCM600[1)]	CAP 501	CAP 505	CET for SPA-ZC 40x[1)]	LNT 505	PCT
Parameter setting	●	●	●	-	-	-
Disturbance handling	●	●	●	-	-	-
Signal monitoring	●	●	●	-	-	-
Disturbance record analysis	●	●	●	-	-	-
Relay configuration templates	●	●	●	-	-	-
Creating/handling projects	●	●	●	-	-	-
IEC 61850 communication configuration	-	-	-	●	-	-
LON communication configuration	-	-	-	-	●	-
Profibus communication configuration	-	-	-	-	-	●

● = Supported

1) Requires a connectivity package

19. Terminal diagram

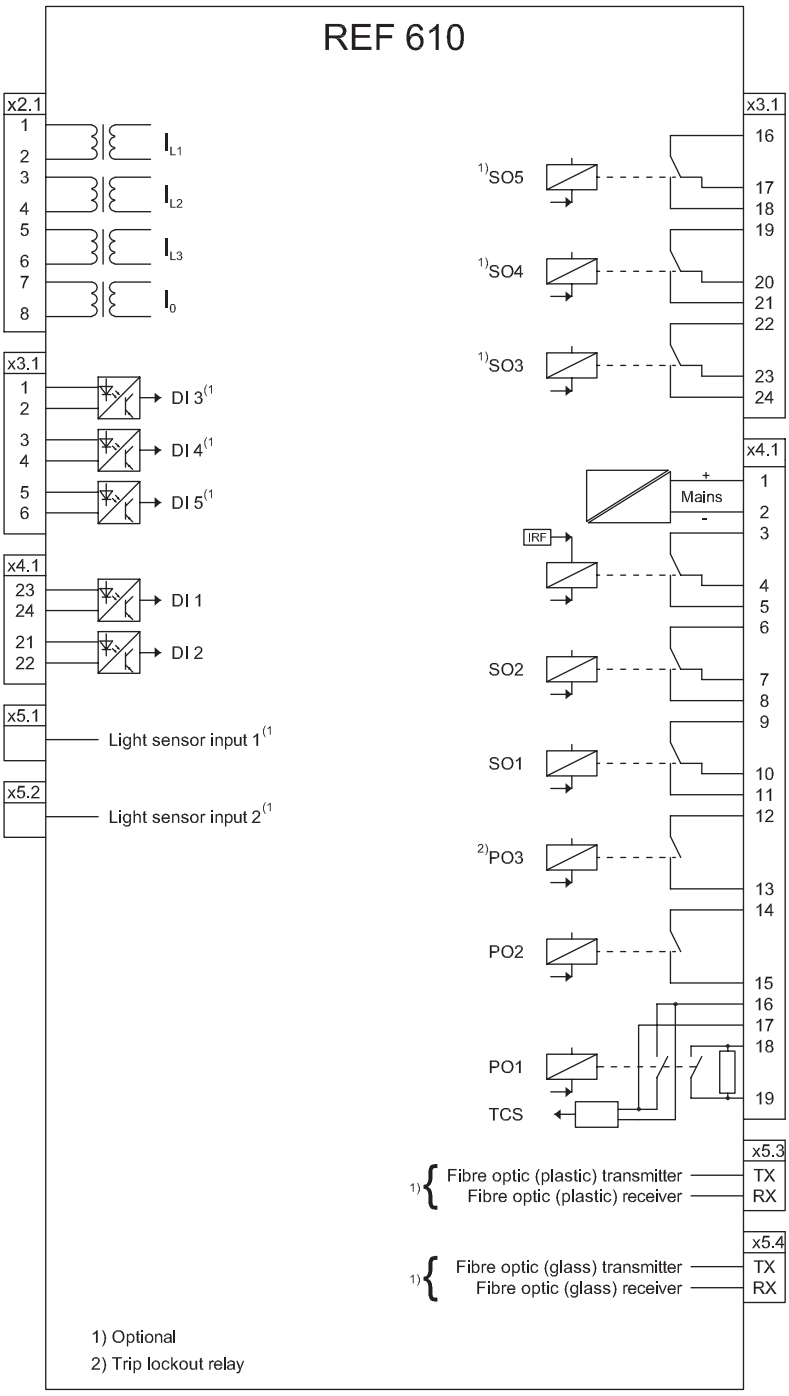


Figure 9. Terminal diagram of REF610

20. Approvals

REF610 has been granted a preliminary EDF approval:

Number EDF R&D H-M2A-2006-02557-FR.

21. Certificates

KEMA has issued a Type test Certificate of Complete type test for the 610 series products. Certificate No. 08-1071, 08-1072 and 08-1073.

DNV (Det Norske Veritas) has issued a Type Approval Certificate for the 610 series protection relays. Certificate No. E-9945. The 610 series protection relays comply with Det Norske Veritas' Rules for Classification of Ships, High Speed & Light Craft and Det Norske Veritas' Offshore Standards.

The ENA (Energy Networks Association) Protection Assessment Panel has issued a Notice of Conformity Certificate to REF610. Notice of Conformity No. 154 Issue: 1, General & Environmental Self Certification Statement No. SC001 Issue B, Functional Assessment Statement(s) No. FA001-05 Issue 1.

Korea Electrical Safety Corporation (KESCO) has issued a KAS V-Check Mark certificate for the 610 series products. Ref. Cert. No. KAS-KESCO-7018-02.

22. 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 REF610 protection relay is found on the product page. Scroll down the page to find and download the related documentation.

23. Functions, codes and symbols

Table 33. Functions included in REF610

Functionality	IEC 60617	IEC-ANSI
Protection		
Three-phase overcurrent, low-set stage	I>	51
Three-phase overcurrent, high-set stage	I>>	50/51
Three-phase overcurrent, instantaneous stage	I>>>	50
Non-directional earth-fault, low-set stage	I_0>	51N
Non-directional earth-fault, high-set stage	I_0>>	50N/51N
Phase discontinuity	∆I>	46
Three-phase thermal overload for cables	Q>	49
Circuit-breaker failure	CBFP	62BF
Arc protection, two lens sensors for arc detection	Arc	50/50NL
Autoreclosing	O -> I	79
Lockout relay function		86
Condition monitoring		
Trip circuit supervision	TCS	TCS
Trip lockout function	TRIP LOCKOUT	TRIP LOCKOUT
Trip counters for circuit-breaker condition monitoring		
Measurement		
Disturbance recorder		
Residual current	I_0	I_n
Three-phase current	L_1, L_2, L_3	I_a, I_b, I_c
Phase unbalance	ΔI	$I_{(unbal)}$
Thermal level	θ	TH LEVEL

24. Document revision history

Document revision/date	Product version	History
A/2007-02-10	A	First release
B/2007-06-04	B	Content updated to correspond to the product version
C/2009-10-30	C	Content updated to correspond to the product version
D/2009-12-14	C	Content updated
E/2010-04-20	C	Order codes corrected
F/2011-11-18	C	Order codes corrected
G/2019-03-14	C	Content updated

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