

# Feeder Protection REF615

## Product Guide



## 16. Technical data

### Dimensions

Width	frame	177 mm,
	case	164 mm
Height	frame	177 (4U)
	case	160 mm
Depth	case	155 mm
Weight	relay	3.5 kg
	spare unit	1.8 kg

### Power Supply

Type:	Type 1	Type 2
$U_{aux}$ nominal	100, 110, 120, 220, 240 V AC, 50 and 60 Hz 48, 60, 110, 125, 220, 250 V DC	24, 30, 48, 60 V DC
$U_{aux}$ variation	38...110% of $U_n$ (38...264 V AC) 80...120% of $U_n$ (38.4...300 V DC)	50...120% x $U_n$ (12...72 V DC)
Start-up threshold		19.2 V DC (24 V DC * 80%)
Burden of auxiliary voltage supply under quiescent (Pq)/operating condition	<8.4 W/13 W	
Ripple in the DC auxiliary voltage	Max 12% of the DC value (at frequency of 100 Hz)	
Maximum interruption time in the auxiliary DC voltage without resetting the relay	50 ms at $U_{aux}$ rated	
Fuse type	T4 A/250 V	

### Energizing inputs

Rated frequency		50/60 Hz ± 5 Hz	
Current inputs	Rated current, $I_n$	0.2/1 A <sup>1)</sup>	1/5 A <sup>2)</sup>
	Thermal withstand capability: <ul style="list-style-type: none"> <li>• Continuously</li> <li>• For 1 s</li> <li>• For 10 s</li> </ul>	4 A 100 A 25 A	20 A 500 A 100 A
	Dynamic current withstand: <ul style="list-style-type: none"> <li>• Half-wave value</li> </ul>	250 A	1250 A
	Input impedance	<100 mΩ	<20 mΩ
Voltage input	Rated voltage	100 V/ 110 V/ 115 V/ 120 V (Parametrization)	
	Voltage withstand: <ul style="list-style-type: none"> <li>• Continuous</li> <li>• For 10 s</li> </ul>	2 x $U_n$ (240 V) 3 x $U_n$ (360 V)	
	Burden at rated voltage	<0.05 VA	

1) Residual current

2) Phase currents

### Binary inputs

Operating range	±20 % of the rated voltage
Rated voltage	24...250 V DC
Current drain	2...18 mA
Power consumption/input	<0.9 W
Threshold voltage	18...176 V DC

### Signal outputs

Rated voltage	250 V AC/DC
Continuous carry	5 A
Make and carry for 3.0 s	8 A
Make and carry 0.5 s	10 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

<b>IRF relay change over - type signal output relay</b>	
Rated voltage	250 V AC/DC
Continuous contact carry	5 A
Make and carry for 3.0 s	8 A
Make and carry 0.5 s	10 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

### Heavy-duty output relays

<b>Double-pole power relay with trip-circuit supervision function</b>	
Rated voltage	250 V AC/DC
Continuous contact carry	8 A
Make and carry for 3.0 s	15 A
Make and carry 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
Trip-circuit supervision: <ul style="list-style-type: none"> <li>Control voltage range</li> <li>Current drain through the supervision circuit</li> <li>Minimum voltage over the TCS contact</li> </ul>	20...250 V AC/DC ~1.5 mA 20 V AC/DC (15...20 V)

<b>Single-pole power output relays</b>	
Rated voltage	250 V AC/DC
Continuous contact carry	8 A
Make and carry for 3.0 s	15 A
Make and carry 0.5 s	30 A
Breaking capacity when the control-circuit time constant L/R<40 ms, at 48/110/220 V DC	5 A/3 A/1 A
Minimum contact load	100 mA at 24 V AC/DC

### Lens sensor and optic fiber for arc protection

Fibre-optic cable including lens	1.5 m, 3.0 m or 5.0 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 fibre	100 mm

**Degree of protection of flush-mounted relay**

Front side	IP 54
Top of the relay	IP 40
Rear side, connection terminals	IP 20

**Environmental conditions and tests**

<b>Environmental conditions</b>	
Operating temperature range	-25...+55°C (continuous)
Short-time service temperature range	-40...+85°C (<16h) Note: Degradation in MTBF and HMI performance outside the temperature range of -25...+55°C
Relative humidity	<93%, non-condensing
Atmospheric pressure	86...106 kPa
Altitude	up to 2000 m
Transport and storage temperature range	-40...+85°C

<b>Environmental tests</b>	
Dry heat test (humidity <50%)	According to IEC 60068-2-2 Test values: • 96 h at +55°C • 16 h at +85°C
Cold test	According to IEC 60068-2-1 Test values: • 96 h at -25°C • 16 h at -40°C
Damp heat test, cyclic	According to IEC 60068-2-30 Test values: • 6 cycles at +25...55°C, humidity 93...95%
Storage test	According to IEC 60068-2-48 Test values: • 96 h at -40°C • 96 h at +85°C

**Electromagnetic compatibility tests**

The EMC immunity test level meets the requirements listed below:	
1 MHz burst disturbance test, class III:  • Common mode • Differential mode	According to IEC 61000-4-18 and IEC 60255-22-1, level 3 2.5 kV 1.0 kV
Electrostatic discharge test  • Contact discharge • Air discharge	According to IEC 61000-4-2, IEC 60255-22-2, level 3 6 kV 8 kV

*(continued)*

<p>Radio frequency interference tests:</p> <ul style="list-style-type: none"> <li>• Conducted, common mode</li> <li>• Radiated, amplitude-modulated</li> <li>• Radiated, pulse-modulated</li> </ul>	<p>According to IEC 61000-4-6 and IEC 60255-22-6, level 3 10 V (emf), <math>f = 150 \text{ kHz} \dots 80 \text{ MHz}</math>  According to IEC 61000-4-3 and IEC 60255-22-3, level 3 10 V/m (rms), <math>f=80 \dots 1000 \text{ MHz}</math> and <math>f=1.4 \dots 2.7 \text{ GHz}</math>  According to the ENV 50204 and IEC 60255-22-3, level 3 10 V/m, <math>f=900 \text{ MHz}</math></p>
<p>Fast transient disturbance tests:</p> <ul style="list-style-type: none"> <li>• Signal outputs, binary inputs, IRF</li> <li>• Other ports</li> </ul>	<p>According to IEC 61000-4-4 and IEC 60255-22-4, class B  2 kV  4 kV</p>
<p>Surge immunity test:</p> <ul style="list-style-type: none"> <li>• Binary inputs</li> <li>• Communication</li> <li>• Other ports</li> </ul>	<p>According to IEC 61000-4-5 and IEC 60255-22-5, level 4/3  2 kV, line-to-earth, 1kV, line-to-line  1 kV, line-to-earth  4 kV, line-to-earth, 2 kV, line-to-line</p>
<p>Power frequency (50 Hz) magnetic field:</p> <ul style="list-style-type: none"> <li>• Continuous</li> </ul>	<p>According to IEC 61000-4-8, level 5  300 A/m</p>
<p>Power frequency immunity test:</p> <ul style="list-style-type: none"> <li>• Common mode</li> <li>• Differential mode</li> </ul>	<p>According to IEC 60255-22-7, class A  300 V rms  150 V rms</p>
<p>Voltage dips and short interruptions</p>	<p>According to IEC 61000-4-11  30%/10 ms  60%/100 ms  60%/1000 ms  &gt;95%/5000 ms</p>
<p>Electromagnetic emission tests:</p> <ul style="list-style-type: none"> <li>• Conducted, RF emission (mains terminal)  0.15...0.50 MHz</li> <li>• Radiated RF emission  0...230 MHz</li> <li>• Radiated RF emission  230...1000 MHz</li> </ul>	<p>According to the EN 55011, class A and IEC60255-25  &lt; 79 dB(<math>\mu\text{V}</math>) quasi peak  &lt; 66 dB(<math>\mu\text{V}</math>) average  &lt; 73 dB(<math>\mu\text{V}</math>) quasi peak  &lt; 60 dB(<math>\mu\text{V}</math>) average  &lt; 40 dB(<math>\mu\text{V}/\text{m}</math>) quasi peak, measured at 10 m distance  &lt; 47 dB(<math>\mu\text{V}/\text{m}</math>) quasi peak, measured at 10 m distance</p>

**Insulation and mechanical tests**

<b>Insulation tests</b>	
Dielectric tests:	According to IEC 60255-5
• Test voltage	2 kV, 50 Hz, 1 min 500 V, 50 Hz, 1min, communication
Impulse voltage test:	According to IEC 60255-5
• Test voltage	5 kV, unipolar impulses, waveform 1.2/50 $\mu$ s, source energy 0.5 J 1 kV, unipolar impulses, waveform 1.2/50 $\mu$ s, source energy 0.5 J, communication
Insulation resistance measurements	According to IEC 60255-5
• Isolation resistance	>100 M $\Omega$ , 500 V DC
Protective bonding resistance	According to IEC 60255-27
• Resistance	<0.1 $\Omega$ (60 s)

<b>Mechanical tests</b>	
Vibration tests (sinusoidal)	According to IEC 60255-21-1, class 2
Shock and bump test	According to IEC 60255-21-2, class 2

**EMC compliance**

Complies with the EMC directive 2004/108/EC	
Standards	EN 50263 (2000), EN 60255-26 (2007)

**Product safety**

Complies with the LV directive 2006/95/EC	
Standards	EN 60255-27 (2005), EN 60255-6 (1994)

**RoHS compliance**

Complies with the RoHS directive 2002/95/EC	
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**Data communication for front interface**

Front interface:
• TCP/IP protocol
• Standard CAT 5 Ethernet cable
• 10 MBits/s

**Protection functions****Three-phase non-directional overcurrent protection (PHxPTOC)**

Operation accuracy	Depending on the frequency of the current measured: $f_n \pm 2\text{Hz}$			
	PHLPTOC	$\pm 1.5\%$ of the set value or $\pm 0.002 \times I_n$		
	PHHPTOC and PHIPTOC	$\pm 1.5\%$ of set value or $\pm 0.002 \times I_n$ (at currents in the range of $0.1 \dots 10 \times I_n$ ) $\pm 5.0\%$ of the set value (at currents in the range of $10 \dots 40 \times I_n$ )		
Start time <sup>1) 2)</sup>		Minimum	Typical	Maximum
	PHIPTOC: $I_{\text{Fault}} = 2 \times \text{set Start value}$	16 ms	19 ms	23 ms
	$I_{\text{Fault}} = 10 \times \text{set Start value}$	11 ms	12 ms	14 ms
	PHHPTOC and PHLPTOC: $I_{\text{Fault}} = 2 \times \text{set Start value}$	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	$\pm 1.0\%$ of the set value or $\pm 20$ ms			
Operate time accuracy in inverse time mode	$\pm 5.0\%$ of the theoretical value or $\pm 20$ ms <sup>3)</sup>			
Suppression of harmonics	RMS: No suppression DFT: -50dB at $f = n \times f_n$ , where $n = 2, 3, 4, 5, \dots$ Peak-to-Peak: No suppression P-to-P+backup: No suppression			

1) *Measurement mode* = default (depends on stage), current before fault =  $0.0 \times I_n$ ,  $f_n = 50$  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

3) Maximum *Start value* =  $2.5 \times I_n$ , *Start value* multiples in range of 1.5 to 20



**Three-phase non-directional overcurrent protection (PHxPTOC) main settings**

Parameter	Function	Value (Range)	Step
Start value	PHLPTOC	0.05...5.00 x I <sub>n</sub>	0.01
	PHHPTOC	0.10...40.00 x I <sub>n</sub>	0.01
	PHIPTOC	0.10...40.00 x I <sub>n</sub>	0.01
Time multiplier	PHLPTOC	0.8...10.0	0.05
	PHHPTOC	0.05...15.00	0.05
Operate delay time	PHLPTOC	40...200000 ms	10
	PHHPTOC	40...200000 ms	10
	PHIPTOC	40...200000 ms	10
Operating curve type <sup>1)</sup>	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 please refer to the Operating characteristics table at the end of the Technical data chapter