

Parameters

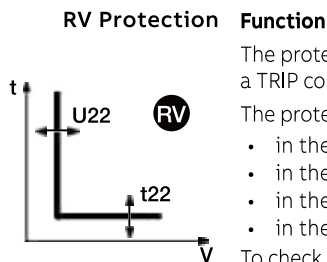
Parameter	Description	Default
Enable	Activates/deactivates the protection and its availability in the parameters menu	OFF
Trip Enable	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
Curve	Allows the operating mode, Step or Lin, to be selected	Scal
Threshold I21	Establishes the value that activates the protection and contributes towards calculating the trip time. The value is given as both absolute value (amperes) and relative value (In) and can be set within the range: 0.6 In to 10 In, in 0.1 In steps	1 In
Threshold U12	It is the voltage that determines the change in trip threshold I21; the behavior differs, depending on the mode selected ⁽¹⁾ The value is given as both absolute value (V) and relative value (Un) and can be set within the range: 0.2 Un to 1 Un in 0.01 Un steps	1 Un
Threshold Uh2	The parameter is shown by the Lin curve and contributes towards I21 trip threshold calculation: • with voltage reading < Uh2 (and ≥ U12), the threshold changes gradually ⁽¹⁾ ; • with voltage reading ≥ Uh2, the threshold is I21. The value is given as both absolute value (V) and relative value (Un) and can be set within the range: 0.2 Un to 1 Un in 0.01 Un steps	1 Un
Threshold Ks2	I21 threshold calculation constant. The value is given as percentage of threshold I21 and can be set within the range: 0.1 I21 to 1 I21, in 0.01 steps	0,6 I21
Time t21	This is the trip time of the protection. The value is given in seconds and can be set within the range: 0.05 s to 30 s, in 0.01 s steps	0.1 s

⁽¹⁾ Trip threshold (depending on the operating curve)

Mode	Voltage reading	Trip threshold
Scal	< U12	Ks2 x I21
	≥ U12	I21
Lin	< U1s	Ks2 x I21
	≥ U12 (e < Uh2)	$((I21 \times (1 - Ks2) \times (U_{mis} - Uh2)) / (Uh2 - U12)) + I21$

Limitations and additional functions

All the parameters described and the block functions are available via USB-C port, Bluetooth Low Energy and system bus (List of additional protections and functions on page 110).



The protection trips if loss of insulation occurs (verification of residual voltage U0); the protection sends a TRIP command if voltage U0 exceeds threshold U22 for longer than t2.

The protection is available:

- in the 3P configuration by activating the presence of external neutral voltage
- in the 3P + N configuration by activating the presence of external neutral voltage
- in the 4P configuration
- in the presence of Ekip Synchrocheck and external V0 configuration

To check and simulate the trip times in relation to all the parameters, please consult:

- summary table of the protections with the operating characteristics (page 191)
- the graph with trip curve (page 192)

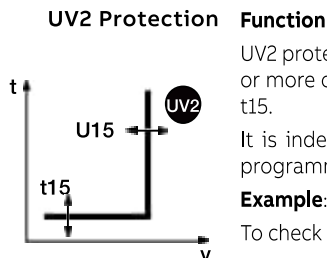
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Parameters

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
<i>Threshold U22</i>	Establishes the value that activates the protection. The value is given as both absolute value (V) and relative value (Un) and can be set within the range: 0.05 Un to 0.5 Un in 0.001 Un steps	0,15 Un
<i>Time t22</i>	This is the trip time of the protection; the value is given in seconds and can be set within a range: 0.05 s to 120 s, in 0.01 s steps	15 s
<i>Reset Time</i>	This is the time the alarm is retained after the protection has quit the alarm condition; it can be useful for keeping the timing activated when the protection is temporarily deactivated. The value is given in seconds and can be set within the range: 0 s to 0.2 s, in 0.02 s steps	0 s

Limitations and additional functions

All the parameters described and the block functions are available via USB-C port, Bluetooth Low Energy and system bus (List of additional protections and functions on page 110).



UV2 protection functions in the same way as UV protection. The protection sends a TRIP command if one or more of the phase-to-phase voltages detected by the unit drops below threshold U15 for longer than t15.

It is independent of UV protection, enabling the thresholds and functions of both protections to be programmed so that different plant solutions can be adopted.

Example: signalling can be configured with UV and the opening command with UV2 or vice versa, or

To check and simulate the trip times in relation to all the parameters, please consult:

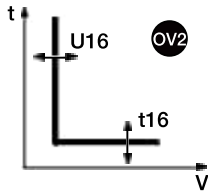
- summary table of the protections with the operating characteristics (page 191)
- the graph with trip curve (page 193)

Parameters

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
<i>Threshold U15</i>	Establishes the value that activates the protection. The value is given as both absolute value (Volts) and relative value (Un) and can be set within the range: 0.05 Un to 1 Un in 0.001 Un steps	0,9 Un
<i>Time t15</i>	This is the trip time of the protection; the value is given in seconds and can be set within a range: 0.05 s to 120 s, in 0.01 s steps	5 s

Limitations and additional functions

All the parameters described and the block functions are available via USB-C port, Bluetooth Low Energy and system bus (List of additional protections and functions on page 110).

OV2 Protection**Function**

OV2 protection functions in the same way as OV protection: the protection sends a TRIP command if one or more line-to-line voltages detected by the unit exceed threshold U16 for longer than t16.

To check and simulate the trip times in relation to all the parameters, please consult:

- summary table of the protections with the operating characteristics (page 191)
- the graph with trip curve (page 193)

Parameters

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
<i>Threshold U16</i>	Establishes the value that activates the protection. The value is given as both absolute value (Volts) and relative value (Un) and can be set within the range: 1 Un to 1.5 Un in 0.001 Un steps	1,05 Un
<i>Time t16</i>	This is the trip time of the protection; the value is given in seconds and can be set within a range: 0.05 s to 120 s, in 0.01 s steps	5 s

Limitations and additional functions

All the parameters described and the block functions are available via USB-C port, Bluetooth Low Energy and system bus (List of additional protections and functions on page 110).

Voltage Stability 2

If all three of the phase to-phase voltages measured by the protection release are beyond the window defined by the monitoring thresholds for the set time, the “Voltage Stability OK” signal is activated on the diagnosis bar.

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Signal source</i>	Defines whether the line-to-line voltages to be checked are those from the internal sockets (Measurement) or from <i>Ekip Synchrocheck</i> , if present. i Note: if <i>Ekip Synchrocheck</i> is set, checking will refer to one single voltage	Meas.
<i>Threshold DOWN</i>	Establishes the lower value of the control band, given as both absolute value (V) and relative value (Un), which can be set within the range: 0.5 Un to 1 Un in 0.001 Un steps	0,9 Un
<i>Threshold UP</i>	Establishes the upper value of the control band, given as both absolute value (V) and relative value (Un), which can be set within the range: 1 Un to 1.5 Un in 0.001 Un steps	1,1 Un
<i>Time</i>	This is the monitoring time that activates the signal; the value is given in seconds and can be set within a range: 0.1 s to 900 s, in 0.1 s steps	30 s

2 - Performance table of Advanced Voltage Protections

- General notes:**
- the performance values given in the next table are valid with ≥ 100 ms trip time, temperature and signals within the operating limits; failure to comply with these limitations could lead to an increase in the tolerances;
 - Ekip Aware sends the TRIP command if the signal read exceeds the threshold for longer than the set time (or the time resulting from the calculation formula)
 - with an inverse time-delay trip curve, the calculation refers to a signal with a constant value throughout the timing: variation of the alarm signal causes a different trip time;
 - the additional notes are given after all the tables.

Protection [ANSI code]	Trip time t_t	Trip threshold tolerance ⁽¹⁾	Trip time tolerance
S2(V) [51V]	$t_t = t_{21}$	$\pm 10 \%$	with $t_{21} \geq 5$ s: ± 100 ms / with $t_{21} < 5$ s: the best between $\pm 10 \%$ and ± 40 ms
RV [59N]	$t_t = t_{22}$	$\pm 10 \%$	with $t_{22} \geq 5$ s: ± 100 ms / with $t_{22} < 5$ s: the best between $\pm 10 \%$ and ± 40 ms
UV2 [27]	$t_t = t_{15}$	$\pm 2 \%$ ⁽²⁾	with $t_{15} \geq 5$ s: ± 100 ms / with $t_{15} < 5$ s: the best between $\pm 10 \%$ and ± 40 ms
OV2 [59]	$t_t = t_{16}$	$\pm 2 \%$ ⁽²⁾	with $t_{15} \geq 5$ s: ± 100 ms / with $t_{15} < 5$ s: the best between $\pm 10 \%$ and ± 40 ms

⁽¹⁾ tolerance values valid with Trip unit at steady state or on with auxiliary power supply, trip time ≥ 100 ms, temperature and signals within operating limits; the tolerances in the table after the notes are applicable if the conditions are not guaranteed

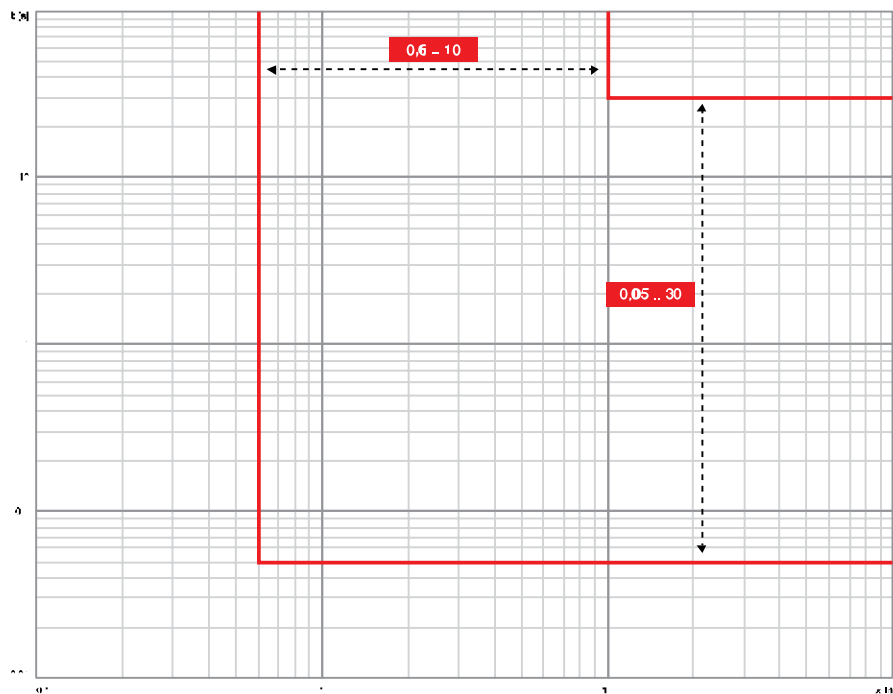
⁽²⁾ the protection release considers 3% hysteresis for quitting alarm condition

Performance guaranteed in all operating conditions

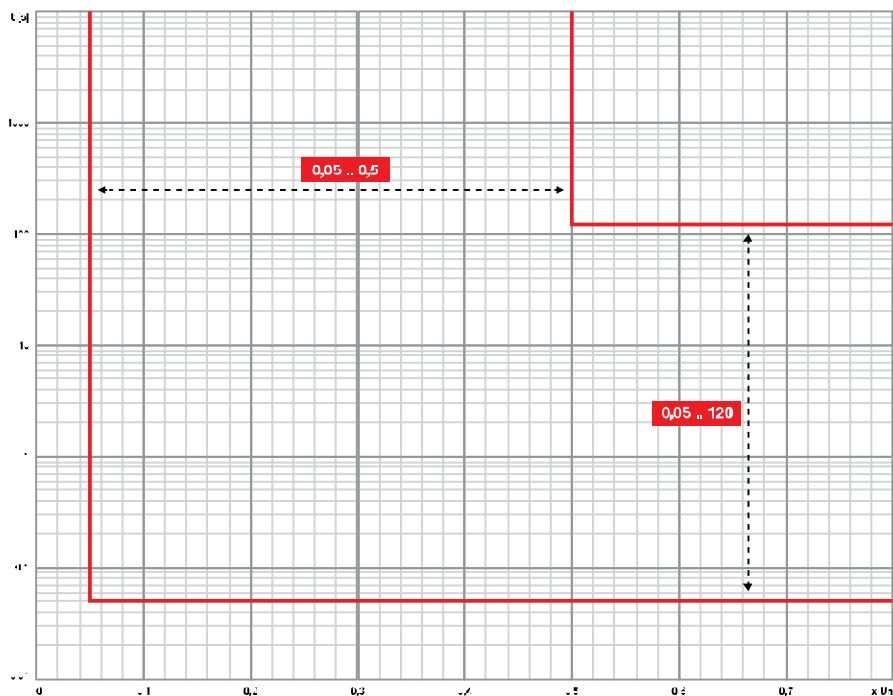
Protection	Trip threshold tolerance	Trip time tolerance
S2(V)	--	$\pm 20 \%$
RV	$\pm 10 \%$	$\pm 20 \%$; in the case of single-phase self-supply: the highest between $\pm 20 \%$ and 30 ms
UV2	--	$\pm 20 \%$
OV2	--	$\pm 20 \%$

3 - Advanced Voltage protection curves

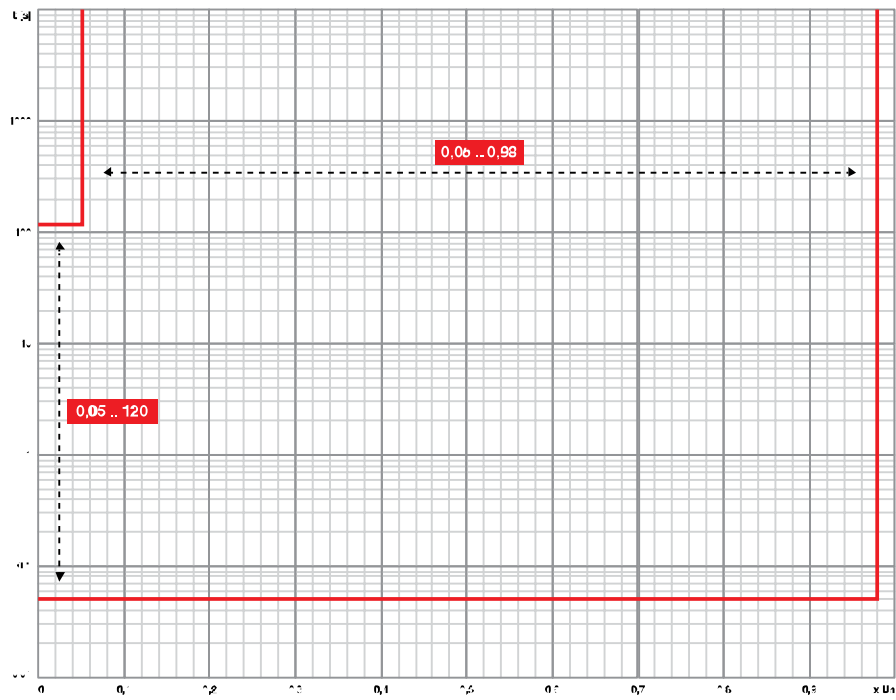
Function S2(V)



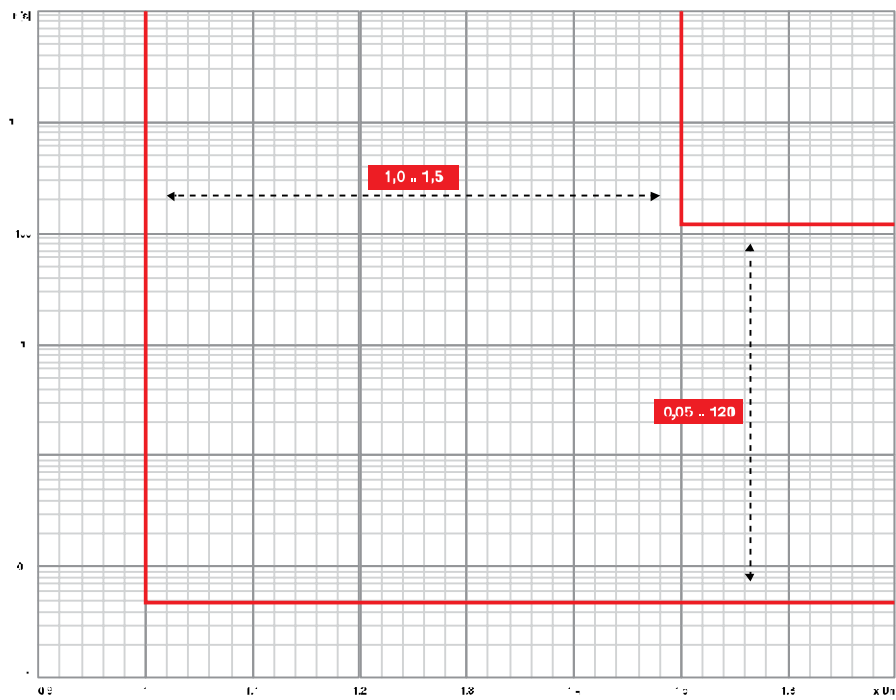
Function RV



Function UV2



Function OV2



4 - Settings of Advanced Current Protections

Settings	The Advanced Voltage Protections digital upgrade does not enable the presence of any additional parameter in the Settings display menu. The available parameters are all described and available in the Protections chapter.
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5 - Advanced Voltage Protection test

Test	The Advanced Current Protections digital upgrade does not enable the presence of any additional test command in the Test display menu. Ekip Connect has a Test Protections section where the presence of voltage alarm signals can be simulated and the times and trips of certain protections in the package can be checked.
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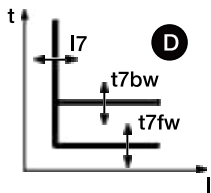
6 - Advanced Voltage Protection default

Default	All the protections in the package are supplied in the OFF configuration by default.
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Directional Current Protection

1 - Directional Current Protection

D Protection Overview



D protection is available if the Directional Current Protections digital upgrade is installed.

The protection parameters can be checked and configured via all remote connection systems.

In addition, the main protection parameters are available on display in the Protections menu and their presence can be checked in the Info menu.

Function

D protection is very similar to S protection, with the additional capability of recognizing the direction of the current during a fault.

The current direction allows the user to find out whether the fault is on the supply side or load side of the device controlled by Ekip Aware.

In ring type distribution systems, D protection allows the distribution section in which the fault has occurred to be identified and disconnected without affecting the rest of the installation (using zone selectivity).

Depending on the direction of the fault, if the current of one or more phases exceeds threshold I_7 (I_{7fw} or I_{7bw}) for longer than time t_7 (t_{7fw} or t_{7bw}), the protection activates and sends a TRIP command.

The **fault direction** is established by comparing the **detected fault current** with the **reference direction**.

i **NOTE:** the reference direction is calculated considering the set value of the power flow direction and the phase sequence (cyclic direction of the phases):

Phase sequence (set)	Power flow (set)	Phase sequence (detected)	Reference direction (forward direction)
123	High-->Low	123	High-->Low
123	Bottom --> Top	123	Bottom --> Top
123	High-->Low	321	Bottom --> Top
123	Bottom --> Top	321	High-->Low
321	High-->Low	123	Bottom --> Top
321	Bottom --> Top	123	High-->Low
321	High-->Low	321	High-->Low
321	Bottom --> Top	321	Bottom --> Top

To check and simulate the trip times in relation to all the parameters, please consult:

- the summary table of the protections with the calculation formulas (page 198);
- the graph with trip curve (page 199).

Parameters

The following parameters are available on display in the *Protections - Advanced* menu:

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	ON
<i>Threshold I7 Fw</i>	Establishes the value that activates the protection with forward direction. The value is given as both absolute value (amperes) and relative value (I_n) and can be set within the range: 0.6 I_n to 10 I_n , in 0.1 I_n steps	2 I_n
<i>Threshold i7 Bw</i>	Establishes the value that activates the protection with backward direction. The value is given as both absolute value (amperes) and relative value (I_n) and can be set within the range: 0.6 I_n to 10 I_n , in 0.1 I_n steps	2 I_n
<i>Time t7 Fw</i>	This is the trip time in the case of forward direction. The value is given in seconds and can be set within the range: 0.1 s to 0.8 s, in 0.01 s steps	0,2 s

Continued on the next page

Parameter	Description	Default
<i>Time t7 Bw</i>	This is the trip time in the case of backward direction. The value is given in seconds and can be set within the range: 0.1 s to 0.8 s, in 0.01 s steps	0,2 s
<i>Zone Selectivity⁽¹⁾</i>	Activates/deactivates the function and selectivity time availability on the display.  IMPORTANT: configure selectivities S, S2, I, RELT, MCR, G, Gext and MDGF OFF to ensure that selectivity D functions correctly	OFF
<i>Selectivity time Fw⁽¹⁾</i>	This is the trip time of the protection with the zone selectivity function activated, forward direction and selectivity input Fw not present. The value is given in seconds and can be set within the range: 0.1 s to 0.8 s, in 0.01 s steps	0,13 s
<i>Selectivity time Bw⁽¹⁾</i>	This is the trip time of the protection with the zone selectivity function activated, backward direction and selectivity input Bw not present. The value is given in seconds and can be set within the range: 0.1 s to 0.8 s, in 0.01 s steps	0,13 s
<i>StartUp enable</i>	Activates/deactivates the function and availability of the associated parameters on the display	OFF
<i>StartUp Threshold Fw⁽²⁾</i>	Protection threshold valid during Startup time, in the conditions in which the function is activated and with forward current direction ⁽²⁾ . The value is given as both absolute value (amperes) and relative value (In) and can be set within the range: 0.6 In to 10 In, in 0.1 In steps	2 In
<i>StartUp Threshold Bw⁽²⁾</i>	Protection threshold valid during Startup time, in the conditions in which the function is activated and with backward current direction. The value is given as both absolute value (amperes) and relative value (In) and can be set within the range: 0.6 In to 10 In, in 0.1 In steps	2 In
<i>StartUp Time⁽²⁾</i>	This is the time for which the StartUp threshold remains activated and is calculated from the moment the activation Threshold is exceeded The value is given in seconds and can be set within the range: 0.1 s to 30 s, in 0.01 s steps	0.1 s
<i>Direction Min Angle</i>	Ekip Aware calculates the phase displacement angle between active and apparent power measured: when phase displacement exceeds the set Direction Min Angle parameter, the unit considers the fault direction to have been identified. The value is given in degrees and can be set within a range of 15 values from 3.6° to 69.6°	3,6 °

⁽¹⁾ details on page 197⁽²⁾ details on page 113**Limitations and additional functions**

All the parameters described above are available via USB-C port, BLE and system bus, as well as some further ones: block functions, Startup th.on ProgStatusD, Trip only Forward and Trip only Backward.

D protection (if available and enabled) can be configured with 2 further parameters:

- Trip only Forward: if activated, D protection only manages open commands if the forward direction is detected;
- Trip only Backward: if activated, D protection only manages open commands if the backward direction is detected.

faults in the opposite direction are only handled as alarm information.

The block functions and Startup th on ProgStatusD are described in section List of additional protections and functions on page 110.

Notes

- activation of D directional protection automatically activates the alarm that monitors phase sequence (which can also be excluded and activated in the manual mode): note how, in the case of a cyclic sequence of phases that differs from the set value, in the event of a fault the directional protection inverts the reference direction with respect to the expected direction; details of the phase sequence protection are available on page 180
- in the case of small overcurrents, the behavior of the directional protection is influenced by the type of load: to prevent the direction of the fault current from being incorrectly interpreted in the case of capacitive loads, it is advisable for the setting of that protection to be made on the basis of real fault conditions and not overloads

D zone selectivity Protection Foreword

The function, which can be activated for D protection if available and enabled, allows devices belonging to the same installation, including Ekip Aware, to be connected to each other so as to optimize trip management in the case of D protection.

It is especially useful in ring and grid type systems where, besides the zone, it is essential to also define the direction of the power flow that supplies the fault.

The function allows the devices to be coordinated so that, if a fault occurs:

- the device nearest to the fault trips;
- the other devices are blocked for a programmable time.



IMPORTANT:

- **connection can be made between ABB devices that have the zone selectivity function**
- **disable the zone selectivities of protections S, S2, I, RELT, MCR, G, Gext and MDGF to correctly use the selectivity D function**

Characteristics

Ekip Aware has five selectivity connections, located on the upper terminal box of the CB:

Name	Type	Description	Name for D
Szi	Input	Forward direction selectivity input	DFin
Szo	Output	Forward direction selectivity output	DFout
Gzi	Input	Backward direction selectivity input	DBin
Gzo	Output	Backward direction selectivity output	DBout
Szc	Common	Common connection of selectivity network	SZc

Configuration

To correctly configure selectivity D in a ring system:

1. Connect the zone selectivity outputs of each device (example: DFin) to the selectivity input of the same direction as the device immediately after (example: DFout).
2. Connect all the Szc of devices in the same network together.

Logic table

The table includes all cases in which, with zone selectivity enabled in the device, an alarm condition occurs or a zone selectivity signal is received from another device.

The Forward output is activated if the **fault direction** coincides with the **reference direction** otherwise, if it is in the opposite direction, the Backward output is activated (page 195)

Fault direction	Condition	DFin	DBin	DFout	DBout	Tripping time	Remarks
Forward	If < I7 Fw	0	x	0	x	No TRIP	Device not in alarm status
Backward	If < I7 Bw	x	0	x	0		
Forward	If < I7 Fw	1	x	1	x	No TRIP	The device is not in the alarm status, but sends the selectivity signal received to the output of the reference direction
Backward	If < I7 Bw	x	1	x	1		
Forward	If > I7 Fw	0	x	1	x	t7 Fw sel	The device is in the alarm status and is the first to detect the fault: trips within time t7 Fw sel or t7 Bw sel
Backward	If > I7 Bw	x	0	x	1	t7 Bw sel	
Forward	If > I7 Fw	1	x	1	x	t7 Fw	The device is in the alarm status but is not the first to detect the fault: trips within time t7 Fw (or t7 Bw)
Backward	If > I7 Bw	x	1	x	1	t7 Bw	

x = Any input/output state (0 or 1)

0 = Input not activated / Output not activated

1 = Input activated / Output activated



IMPORTANT: when zone selectivity is active and the direction of the fault cannot be established, the unit trips by considering the first threshold to be exceeded between I7 Fw and I7 Bw, without activating any output (DFout or DBout).; if both the thresholds have been exceeded (for example, if they have been set with the same value), the unit trips after the shortest time between t7 Fw and t7 Bw.

2 - Directional Current Protection performance table

- General notes:**
- the performance values given in the next table are valid with ≥ 100 ms trip time, temperature and signals within the operating limits; failure to comply with these limitations could lead to an increase in the tolerances;
 - Ekip Aware sends the TRIP command if the signal read exceeds the threshold for longer than the set time (or the time resulting from the calculation formula)
 - with an inverse time-delay trip curve, the calculation refers to a signal with a constant value throughout the timing: variation of the alarm signal causes a different trip time;
 - the additional notes are given after all the tables.

Performance

Protection [ANSI code]	Trip time t_t	Trip threshold tolerance ⁽¹⁾	Trip time tolerance
D [67]	$t_t = t7$	with $I_f \leq 6 I_n$: $\pm 7\%$ / with $I_f > 6 I_n$: $\pm 10\%$	with $t7 \geq 400$ ms: ± 40 ms / with $t7 < 400$ ms: ± 20 ms and $\pm 10\%$, whichever is the highest

Startup

Protection [ANSI code]	Trip time t_t	Trip threshold tolerance ⁽¹⁾	Trip time tolerance
D StartUp	$t_t = t7$ startup	$\pm 10\%$	The best between $\pm 10\%$ and 40 ms

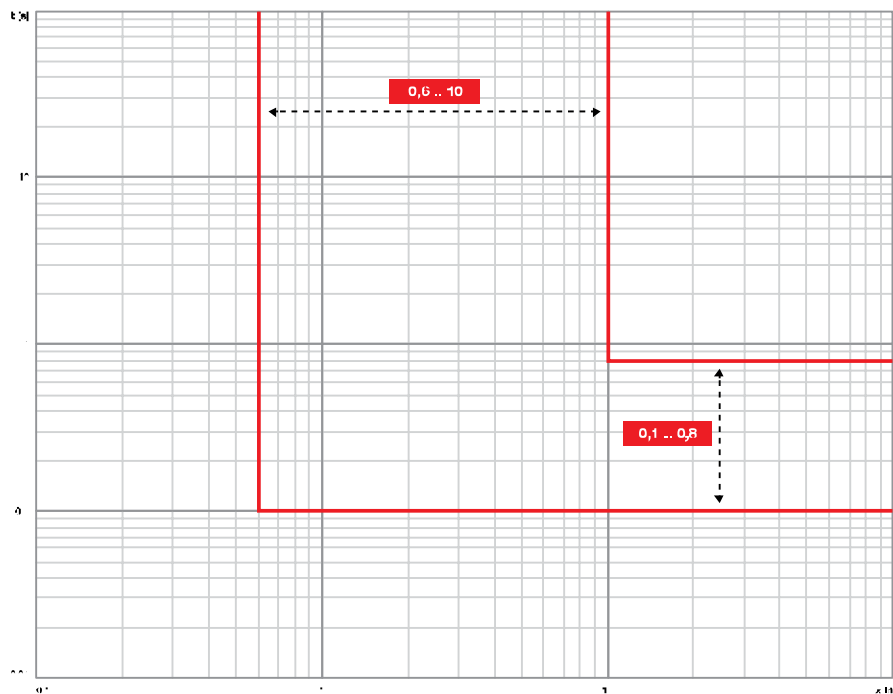
⁽¹⁾ tolerance values valid with Trip unit at steady state or on with auxiliary power supply, trip time ≥ 100 ms, temperature and signals within operating limits; the tolerances in the table after the notes are applicable if the conditions are not guaranteed

Performance guaranteed in all operating conditions

Protection	Trip threshold tolerance	Trip time tolerance
D	--	$\pm 20\%$

3 - Directional Current Protection curves

Function D



4 - Directional Current Protection settings

Settings	The Directional Current Protection digital upgrade does not enable the presence of any additional parameter in the Settings display menu (the Power flow parameter is also available with just the Measurements package). The available parameters are all described and available in the Protections chapter.
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5 - Directional Current Protection test

Test	The Directional Current Protection digital upgrade does not enable the presence of any additional test command in the Test display menu. Ekip Connect has a Test Protections section where the presence of current or voltage alarm signals can be simulated and the times and trips of the D protection can be checked.
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6 - Directional Current Protection default

Default	D protection is supplied in the OFF configuration by default.
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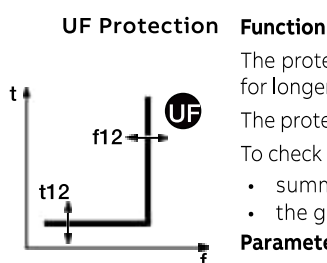
Frequency Protections

1 - Frequency Protections

Overview The following protections are available when the Frequency Protections digital upgrade is present:

Name	Type of protection	Page
UF	Minimum frequency	201
OF	Maximum frequency	202
UF2	Minimum frequency	202
OF2	Maximum frequency	203
ROCOF	Rapid frequency variations	204
Frequency Stability	Frequency threshold check	205
Frequency Stability 2	Frequency threshold check	205

The parameters of every protection can be checked and configured via all remote connection systems. In addition, the presence of all of them can be checked in the Info menu, on display.



The protection sends a TRIP command if the grid frequency read by the unit drops below threshold f12 for longer than t12.

The protection excludes itself if the maximum value of the line-to-line voltage is less than 30 V.

To check and simulate the trip times in relation to all the parameters, please consult:

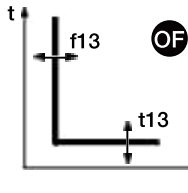
- summary table of the protections with the operating characteristics (page 206)
- the graph with trip curve (page 207)

Parameters

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
<i>Threshold f12</i>	Establishes the value that activates the protection. The value is given as both absolute value (Hertz) and relative value (Fn) and can be set within the range: 0.9 Fn to 1 Fn in 0.001 Fn steps	0,9 Fn
<i>Time t12</i>	This is the trip time of the protection; the value is given in seconds and can be set within a range: 0.06 s to 300 s, in 0.01 s steps	3 s

Limitations and additional functions

All the parameters described and the block functions are available via USB-C port, Bluetooth Low Energy and system bus (List of additional protections and functions on page 110).

OF Protection**Function**

The protection sends a TRIP command if the grid frequency read by the unit exceeds threshold f_{13} for longer than t_{13} .

The protection excludes itself if the maximum value of the line-to-line voltage is less than 30 V.

To check and simulate the trip times in relation to all the parameters, please consult:

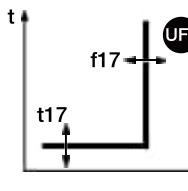
- summary table of the protections with the operating characteristics (page 206)
- the graph with trip curve (page 207)

Parameters

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
<i>Threshold f_{13}</i>	Establishes the value that activates the protection. The value is given as both absolute value (Hertz) and relative value (F_n) and can be set within the range: 1 F_n to 1.1 F_n in 0.001 F_n steps	1,1 F_n
<i>Time t_{13}</i>	This is the trip time of the protection; the value is given in seconds and can be set within a range: 0.06 s to 300 s, in 0.01 s steps	3 s

Limitations and additional functions

All the parameters described and the block functions are available via USB-C port, Bluetooth Low Energy and system bus (List of additional protections and functions on page 110).

UF2 Protection**Function**

UF2 protection functions in the same way as UF protection: the protection sends a TRIP command if the grid frequency read by the unit drops below threshold f_{17} for longer than t_{17} .

It is independent of UF protection, thus thresholds and functions of the two protections can be programmed so as to take advantage of different plant solutions (example: signaling with UF and open command with UF2 or vice versa, or both for signaling or tripping).

The protection excludes itself if the maximum value of the line-to-line voltage is less than 30 V.

To check and simulate the trip times in relation to all the parameters, please consult:

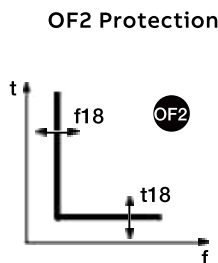
- summary table of the protections with the operating characteristics (page 206)
- the graph with trip curve (page 207)

Parameters

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
<i>Threshold f_{17}</i>	Establishes the value that activates the protection. The value is given as both absolute value (Hertz) and relative value (F_n) and can be set within the range: 0.9 F_n to 1 F_n in 0.001 F_n steps	0,9 F_n
<i>Time t_{17}</i>	This is the trip time of the protection; the value is given in seconds and can be set within a range: 0.06 s to 300 s, in 0.01 s steps	3 s

Limitations and additional functions

All the parameters described and the block functions are available via USB-C port, Bluetooth Low Energy and system bus (List of additional protections and functions on page 110).



Function

OF2 protection functions in the same way as OF protection: the protection sends a TRIP command if the grid frequency read by the unit exceeds threshold f18 for longer than t18.

It is independent of OF protection, thus thresholds and functions of the two protections can be programmed so as to take advantage of different plant solutions (example: signaling with OF and open command with OF2 or vice versa, or both for signaling or tripping).

The protection excludes itself if the maximum value of the line-to-line voltage is less than 30 V.

To check and simulate the trip times in relation to all the parameters, please consult:

- summary table of the protections with the operating characteristics (page 206)
- the graph with trip curve (page 207)

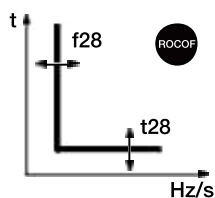
Parameters

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
<i>Threshold f18</i>	Establishes the value that activates the protection. The value is given as both absolute value (Hertz) and relative value (Fn) and can be set within the range: 1 Fn to 1.1 Fn in 0.001 Fn steps	1,1 Fn
<i>Time t18</i>	This is the trip time of the protection; the value is given in seconds and can be set within a range: 0.06 s to 300 s, in 0.01 s steps	3 s

Limitations and additional functions

All the parameters described and the block functions are available via USB-C port, Bluetooth Low Energy and system bus (List of additional protections and functions on page 110).

ROCOF Protection Function



ROCOF protection protects against rapid frequency variations: the protection sends a TRIP command if the frequency changes faster than control variation f_{28} set in the unit for longer than t_{28} .

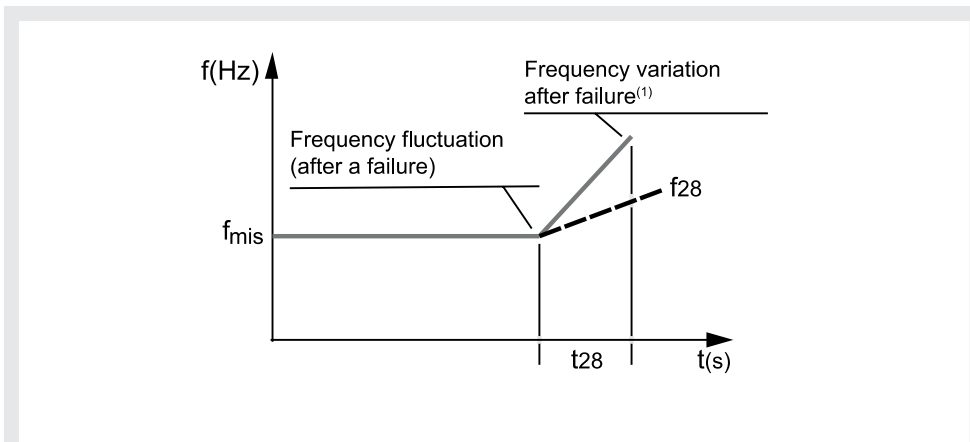


Figure 183

⁽¹⁾ example with positive linear variation of the higher frequency of the set f_{28} value; the protection also manages negative variations

The protection excludes itself if the maximum value of the line-to-line voltage is less than 30 V.

To check and simulate the trip times in relation to all the parameters, please consult:

- summary table of the protections with the operating characteristics (page 206)
- the graph with trip curve (page 208)

Parameters

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
<i>Threshold f_{28}</i>	establishes the maximum admissible frequency variation rate over time; the protection trips if this rate is exceeded. The value is given as absolute value (Hz/s) F_n and can be set within the range: 0.4 Hz/s to 10 Hz/s in 0.2 Hz/s steps	0,6 Hz/s
<i>Trip Direction</i>	Establishes whether the protection monitors an increase (Up), a decrease (Down) or both variations (Up and Down)	Up or Down
<i>Time f_{28}</i>	This is the trip time of the protection; the value is given in seconds and can be set within a range: 0.06 s to 300 s, in 0.01 s steps	0,5 s

Limitations and additional functions

All the parameters described and the block functions are available via USB-C port, Bluetooth Low Energy and system bus (List of additional protections and functions on page 110).

Frequency Stability If the frequency measured by the protection release is beyond the window defined by the monitoring thresholds for the set time, the “Frequency Stability OK” signal is activated on the diagnosis bar.

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates monitoring of the parameters and their availability in the menu	OFF
<i>Signal source</i>	Defines whether the frequencies of the line-to-line voltages to be checked are those from the internal sockets (Measurement) or from <i>Ekip Synchrocheck</i> , if present. i Note: if <i>Ekip Synchrocheck</i> is set, checking will refer to one single voltage	Meas.
<i>Threshold DOWN</i>	Establishes the lower limit value of the control band, given as both absolute value (Hertz) and relative value (Fn), which can be set within the range: 0.9 Fn to 1 Fn in 0.001 Fn steps	0,998 Fn
<i>Threshold UP</i>	Establishes the higher value of the control band, given as both absolute value (Hertz) and relative value (Fn), which can be set within range: 1 Fn to 1.1 Fn in 0.001 Fn steps	1,002 Fn
<i>Time</i>	This is the monitoring time that activates the signal; the value is given in seconds and can be set within the range: 0.1 s to 900 s, in 0.1 s steps	30 s

Frequency Stability 2 If the frequency measured by the protection release is beyond the window defined by the monitoring thresholds for the set time, the “Frequency Stability OK” signal is activated on the diagnosis bar.

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates monitoring of the parameters and their availability in the menu	OFF
<i>Signal source</i>	Defines whether the frequencies of the line-to-line voltages to be checked are those from the internal sockets (Measurement) or from <i>Ekip Synchrocheck</i> , if present. i Note: if <i>Ekip Synchrocheck</i> is set, checking will refer to one single voltage	Meas.
<i>Threshold DOWN</i>	Establishes the lower limit value of the control band, given as both absolute value (Hertz) and relative value (Fn), which can be set within the range: 0.9 Fn to 1 Fn in 0.001 Fn steps	0,998 Fn
<i>Threshold UP</i>	Establishes the higher value of the control band, given as both absolute value (Hertz) and relative value (Fn), which can be set within range: 1 Fn to 1.1 Fn in 0.001 Fn steps	1,002 Fn
<i>Time</i>	This is the monitoring time that activates the signal; the value is given in seconds and can be set within the range: 0.1 s to 900 s, in 0.1 s steps	30 s

2 - Performance table of Frequency Protections

- General notes:**
- the performance values given in the next table are valid with ≥ 100 ms trip time, temperature and signals within the operating limits; failure to comply with these limitations could lead to an increase in the tolerances;
 - Ekip Aware sends the TRIP command if the signal read exceeds the threshold for longer than the set time (or the time resulting from the calculation formula)
 - with an inverse time-delay trip curve, the calculation refers to a signal with a constant value throughout the timing: variation of the alarm signal causes a different trip time;
 - the additional notes are given after all the tables.

Performance

Protection [ANSI code]	Trip time t_t	Trip threshold tolerance ⁽¹⁾	Trip time tolerance
UF [81L] / UF2 [87L]	$t_t = t_{12}$ (t17)	$\pm 1\%$ ⁽²⁾	with $t_{12} \leq 5$ s: ± 100 ms / with $t_{12} < 5$ s: the best between $\pm 10\%$ (min = 30 ms) and ± 40 ms
OF [81H] / OF2 [87H]	$t_t = t_{13}$ (t18)	$\pm 1\%$ ⁽²⁾	with $t_{13} \geq 5$ s: ± 100 ms / with $t_{13} < 5$ s: the best between $\pm 10\%$ and ± 40 ms
ROCOF [81R]	$t_t = t_{28}$	$\pm 10\%$ ⁽³⁾	the best between $\pm 20\%$ and 200 ms

⁽¹⁾ tolerance values valid with protection release at steady state or on with auxiliary power supply, trip time ≥ 100 ms, temperature and signals within operating limits; the tolerances in the table after the notes are applicable if the conditions are not guaranteed

⁽²⁾ tolerance valid for frequencies within range: $f_n \pm 2\%$. A $\pm 5\%$ tolerance is applicable for off range frequencies

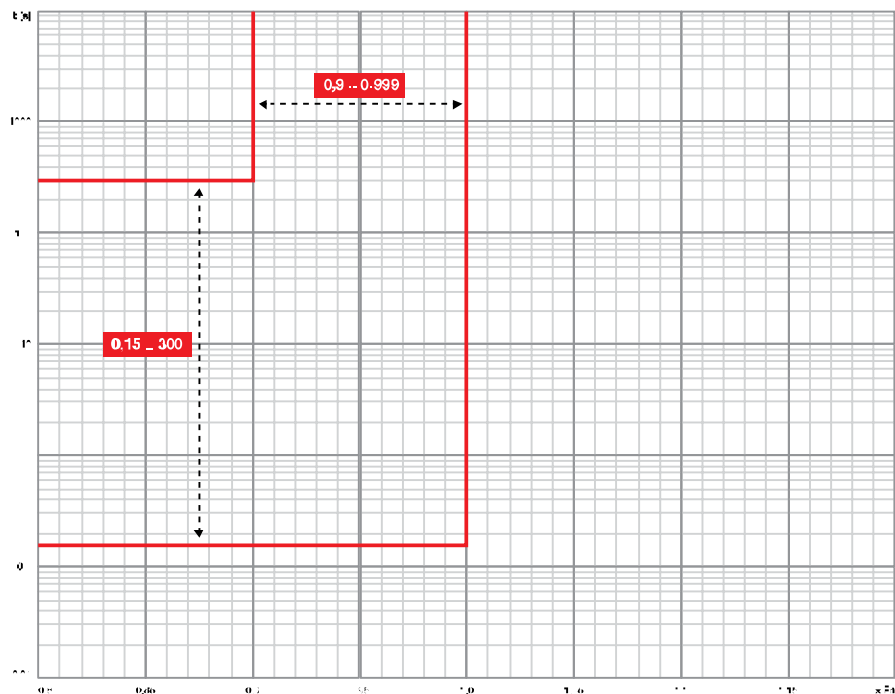
⁽³⁾ $\pm 20\%$ for threshold 0.4 Hz / s

Performance guaranteed in all operating conditions

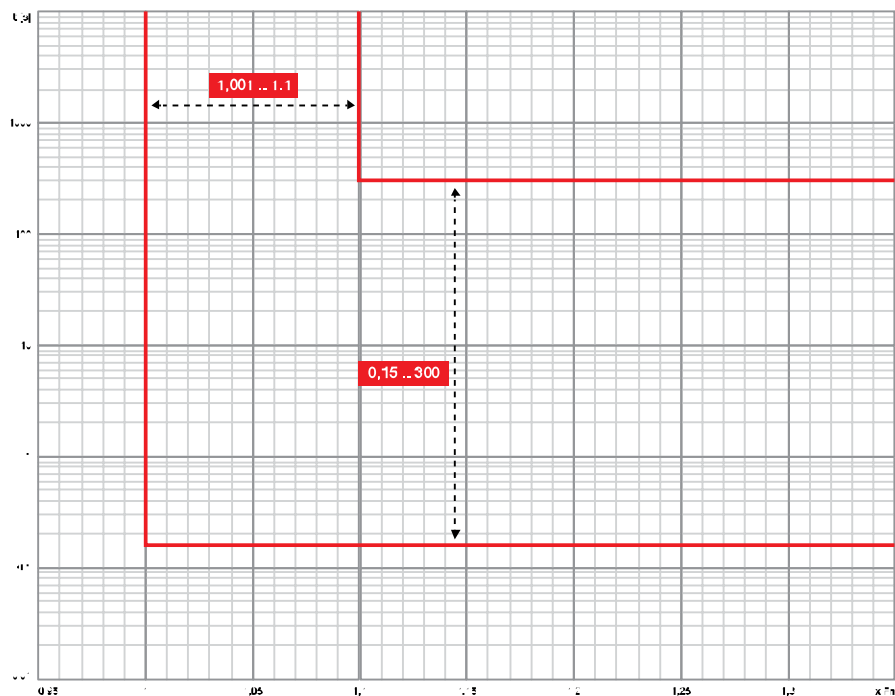
Protection	Trip threshold tolerance	Trip time tolerance
UF / UF2	$\pm 2\%$	$\pm 20\%$
OF / OF2	$\pm 2\%$	$\pm 20\%$
ROCOF	--	$\pm 20\%$

3 - Frequency protection curves

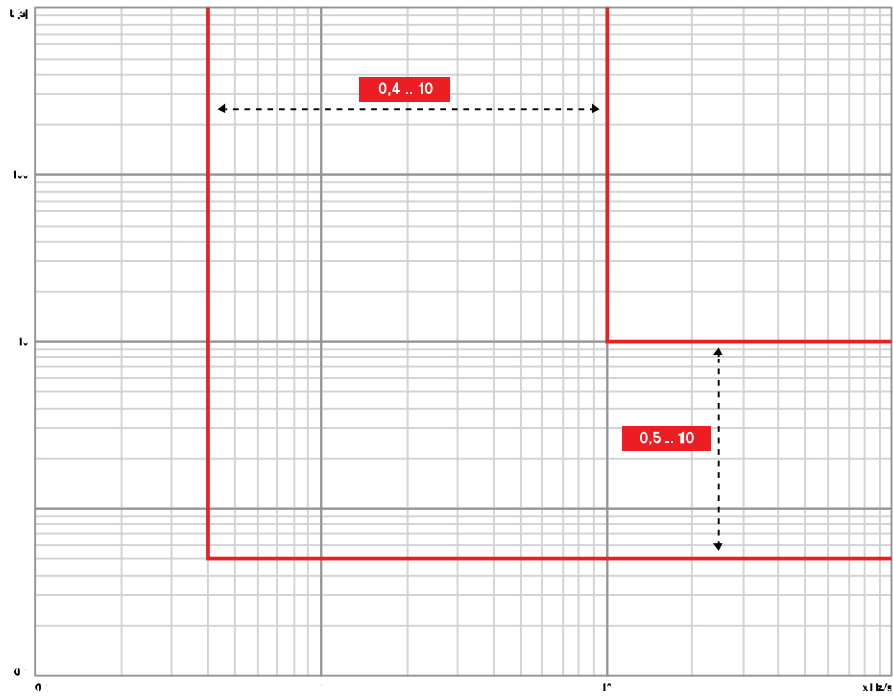
Function UF \ Function UF2



Function OF \ Function OF2



Function ROCOF



4 - Frequency protections settings

Settings	The Frequency Protections digital upgrade does not enable the presence of any additional parameter in the Settings display menu. The available parameters are all described and available in the Protections chapter.
-----------------	--

5 - Frequency Protections test

Test	The Frequency Protections digital upgrade does not enable the presence of any additional test command in the Test display menu. Ekip Connect has a Test Protections section where the presence of voltage alarm signals can be simulated and the times and trips of certain protections in the package can be checked.
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6 - Frequency protections default

Default	All the protections in the package are supplied in the OFF configuration by default.
----------------	--

Power Protections

1 - Power Protections

Overview The following protections are available when the Power Protections digital upgrade is installed.

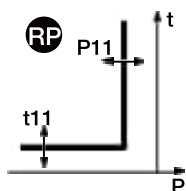
Name	Type of protection	Page
RP	Reverse active power	210
OQ	Maximum reactive power	211
OP	Active overpower	211
UP	Active underpower	212
RQ	Reverse reactive power	212
CosΦ	Minimum cosφ	213

The parameters of every protection can be checked and configured via all remote connection systems. In addition, CosΦ monitoring can be activated, via display, in the Protections menu and the presence of all can be checked in the Info menu.



WARNING! The Power flow parameter affects the sign of the powers and power factor values measured by the unit. Power flow must be properly configured and verified on the basis of your installation to ensure that all the protections of the Power Protections digital upgrade function correctly

RP Protection Function



The protection sends a TRIP command if the reverse total active power exceeds threshold P11 for longer than t1.

To check and simulate the trip times in relation to all the parameters, please consult:

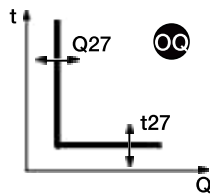
- summary table of the protections with the operating characteristics (page 214)
- the graph with trip curve (page 215)

Parameters

Parameter	Description	Default
Enable	Activates/deactivates the protection and its availability in the parameters menu	OFF
Trip Enable	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
Threshold P11	Establishes the value that activates the protection. The value is given as both absolute value (kW) and relative value (Sn) and can be set within the range: -0.05 Sn to -1 Sn in 0.001 Sn steps i NOTE: the threshold expressed in Sn is preceded by the “-” sign to indicate that inverse power is involved	-0,1 Sn
Time t11	This is the trip time of the protection; the value is given in seconds and can be set within a range: 0.05 s to 120 s, in 0.01 s steps	10 s

Limitations and additional functions

All the parameters described and the block functions are available via USB-C port, Bluetooth Low Energy and system bus (List of additional protections and functions on page 110).

OQ Protection**Function**

The protection sends a TRIP command if one or more of the reactive power values detected by the unit exceed threshold Q27 for longer than t27.

To check and simulate the trip times in relation to all the parameters, please consult:

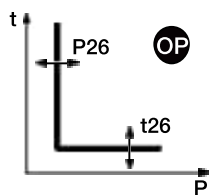
- summary table of the protections with the operating characteristics (page 214)
- the graph with trip curve (page 215)

Parameters

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
<i>Threshold Q27</i>	Establishes the value that activates the protection. The value is given as both absolute value (kVAR) and relative value (Sn) and can be set within the range: 0.4 Sn to 2 Sn in 0.001 Sn steps	1 Sn
<i>Time t27</i>	This is the trip time of the protection; the value is given in seconds and can be set within a range: 0.5 s to 100 s, in 0.5 s steps	1 s

Limitations and additional functions

All the parameters described and the block functions are available via USB-C port, Bluetooth Low Energy and system bus (List of additional protections and functions on page 110).

OP Protection**Function**

The protection sends a TRIP command if one or more of the active power values detected by the unit exceed threshold P26 for longer than t26.

To check and simulate the trip times in relation to all the parameters, please consult:

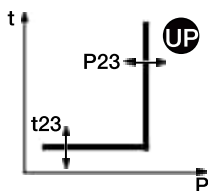
- summary table of the protections with the operating characteristics (page 214)
- the graph with trip curve (page 216)

Parameters

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
<i>Threshold P26</i>	Establishes the value that activates the protection. The value is given as both absolute value (kW) and relative value (Sn) and can be set within the range: 0.4 Sn to 2 Sn in 0.001 Sn steps	1 Un
<i>Time t26</i>	This is the trip time of the protection; the value is given in seconds and can be set within a range: 0.5 s to 100 s, in 0.5 s steps	1 s

Limitations and additional functions

All the parameters described and the block functions are available via USB-C port, Bluetooth Low Energy and system bus (List of additional protections and functions on page 110).

UP Protection Function

The protection sends a TRIP command if one or more of the active power values detected by the unit drop below threshold P23 for longer than t23.

The protection is active also for negative (reverse) active power, but is independent from the RP protection (Reverse active power protection).

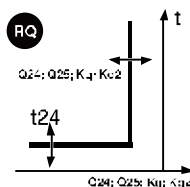
To check and simulate the trip times in relation to all the parameters, please consult:

- summary table of the protections with the operating characteristics (page 214)
- the graph with trip curve (page 216)

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
<i>Threshold P23</i>	Establishes the value that activates the protection. The value is given as both absolute value (kW) and relative value (Sn) and can be set within the range: 0.1 Sn to 1 Sn in 0.001 Sn steps	1 Sn
<i>Time t23</i>	This is the trip time of the protection; the value is given in seconds and can be set within a range: 0.5 s to 100 s, in 0.5 s steps	1 s
<i>StartUp enable</i>	Activates/deactivates the function and availability of the StartUp Time parameter in the menu	OFF
<i>StartUp Time</i>	This is the time for which the threshold remains disabled and is calculated from the moment the activation Threshold is exceeded. The value is given in seconds and can be set within the range: 0.1 s to 30 s, in 0.01 s steps	0.1 s

Limitations and additional functions

All the parameters described and the block functions are available via USB-C port, Bluetooth Low Energy and system bus (List of additional protections and functions on page 110).

RQ Protection Function

RQ protection protects against reactive power reversal; the threshold can be adjusted on the basis of the active power.

The protection sends a TRIP command when inverse reactive power enters the TRIP area, as determined by the protection parameters and power value readings, for longer than t24.

Adjustment of constants Kq and Kq2 allows the trip threshold of the protection (determined by the intersection of the two TRIP areas, whose limits depend on the parameters configured in the unit) to be changed.

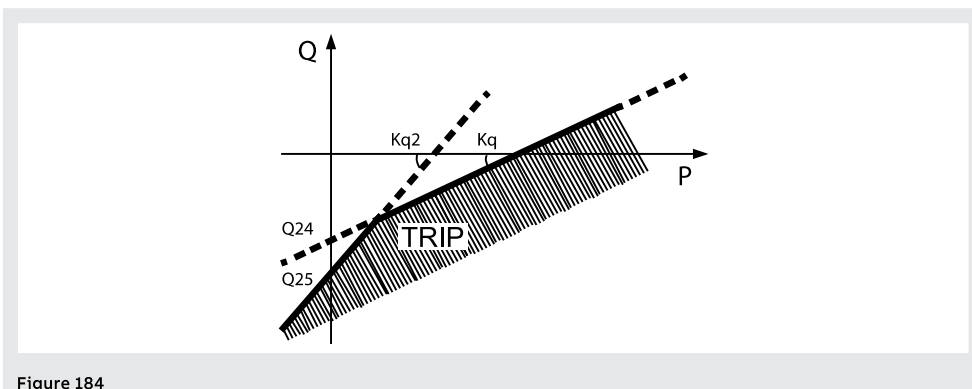


Figure 184

To check and simulate the trip times in relation to all the parameters, please consult:

- summary table of the protections with the operating characteristics (page 214)
- the graph with trip curve (page 216)

Continued on the next page

Parameters

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
<i>Threshold Kq</i>	Defines the gradient of the line relating to threshold Q24. The value is given as absolute value (slope of the line) and can be set within the range: -2 to 2 in 0.01 steps	-2
<i>Threshold -Q24</i>	This is the reactive power required to define the trip line and relative TRIP area. The value is given as both absolute value (kVAR) and relative value (Sn) and can be set within the range: 0.1 Sn to 1 Sn in 0.001 Sn steps  NOTE: the threshold expressed in Sn is not preceded by the “-” sign, but should still be understood as inverse reactive power	0,1 Sn
<i>Threshold Kq2</i>	Defines the gradient of the line relating to threshold Q25. The value is given as absolute value (slope of the line) and can be set within the range: -2 to 2 in 0.01 steps	2
<i>Threshold -Q25</i>	Defines the reactive power value at which the protection trips and is required for the purpose of defining the relative TRIP area The value is given as both absolute value (kVAR) and relative value (Sn) and can be set within the range: 0.1 Sn to 1 Sn in 0.001 Sn steps  NOTE: the threshold expressed in Sn is not preceded by the “-” sign, but should still be understood as inverse reactive power	0,11 Sn
<i>Time t24</i>	This is the trip time of the protection; the value is given in seconds and can be set within a range: 0.5 s to 100 s, in 0.1 s steps	100 s
<i>Threshold Vmin</i>	It is the minimum voltage for activation of the protection. If a there is at least one line-to-line voltage present below the Vmin threshold, the protection is not active. The value is given as both absolute value (V) and relative value (Un) and can be set within the range: 0.5 Un to 1.2 Un in 0.01 Un steps	0.5 Un

Limitations and additional functions

Ekip Aware accepts parameters in accordance with the following limitations: $Q24 < Q25$ and $Kq < Kq2$.

All the parameters described and the block functions are available via USB-C port, Bluetooth Low Energy and system bus (List of additional protections and functions on page 110).

CosΦ Protection The protection activates an alarm when the total cosφ value drops below the set threshold.
Total cosφ is calculated as ratio between total active power and total apparent power.

Parameters

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and availability of the threshold in the menu	OFF
<i>Threshold</i>	Defines the value that activates the protection; can be set within the range: 0.5 to 0.95 in 0.01 steps	0,95

2 - Performance table of Power Protections

- General notes:**
- the performance values given in the next table are valid with ≥ 100 ms trip time, temperature and signals within the operating limits; failure to comply with these limitations could lead to an increase in the tolerances;
 - Ekip Aware sends the TRIP command if the signal read exceeds the threshold for longer than the set time (or the time resulting from the calculation formula)
 - with an inverse time-delay trip curve, the calculation refers to a signal with a constant value throughout the timing: variation of the alarm signal causes a different trip time;
 - the additional notes are given after all the tables.

Performance

Protection [ANSI code]	Trip time t_t	Trip threshold tolerance ⁽¹⁾	Trip time tolerance
UP [32LF]	$t_t = t_{23}$	$\pm 10 \%$	with $t_{23} \geq 5$ s: ± 100 ms / with $t_{23} < 5$ s: the best between $\pm 10 \%$ and ± 40 ms
OP [32OF]	$t_t = t_{26}$	$\pm 10 \%$	with $t_{26} \geq 5$ s: ± 100 ms / with $t_{26} < 5$ s: the best between $\pm 10 \%$ and ± 40 ms
RQ [40 o 32R]	$t_t = t_{24}$	$\pm 10 \%$	with $t_{24} \geq 5$ s: ± 100 ms / with $t_{24} < 5$ s: the best between $\pm 10 \%$ and ± 40 ms
OQ [32OF]	$t_t = t_{27}$	$\pm 10 \%$	with $t_{27} \geq 5$ s: ± 100 ms / with $t_{27} < 5$ s: the best between $\pm 10 \%$ and ± 40 ms
RP [32R]	$t_t = t_{11}$	$\pm 10 \%$	with $t_{11} \geq 5$ s: ± 100 ms / with $t_{11} < 5$ s: the best between $\pm 10 \%$ and ± 40 ms

Startup

Protection [ANSI code]	Trip time t_t	Trip threshold tolerance ⁽¹⁾	Trip time tolerance
UP StartUp	$t_t = t_{23}$ startup	$\pm 10 \%$	with $t_{23} \geq 5$ s: ± 100 ms / with $t_{23} < 5$ s: the best between $\pm 10 \%$ and ± 40 ms

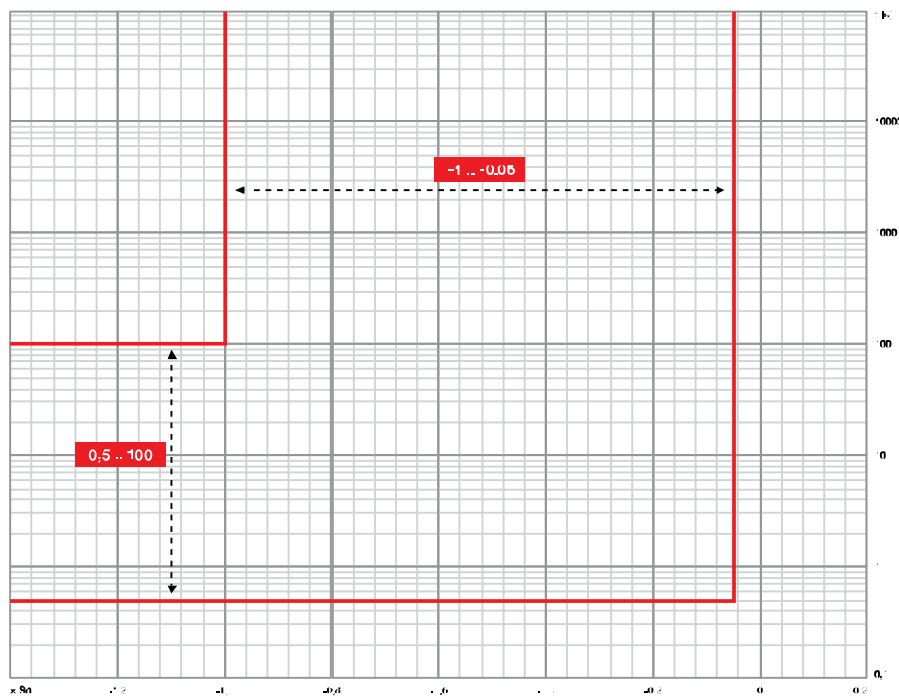
⁽¹⁾ tolerance values valid with protection release at steady state or on with auxiliary power supply, trip time ≥ 100 ms, temperature and signals within operating limits; the tolerances in the table after the notes are applicable if the conditions are not guaranteed

Performance guaranteed in all operating conditions

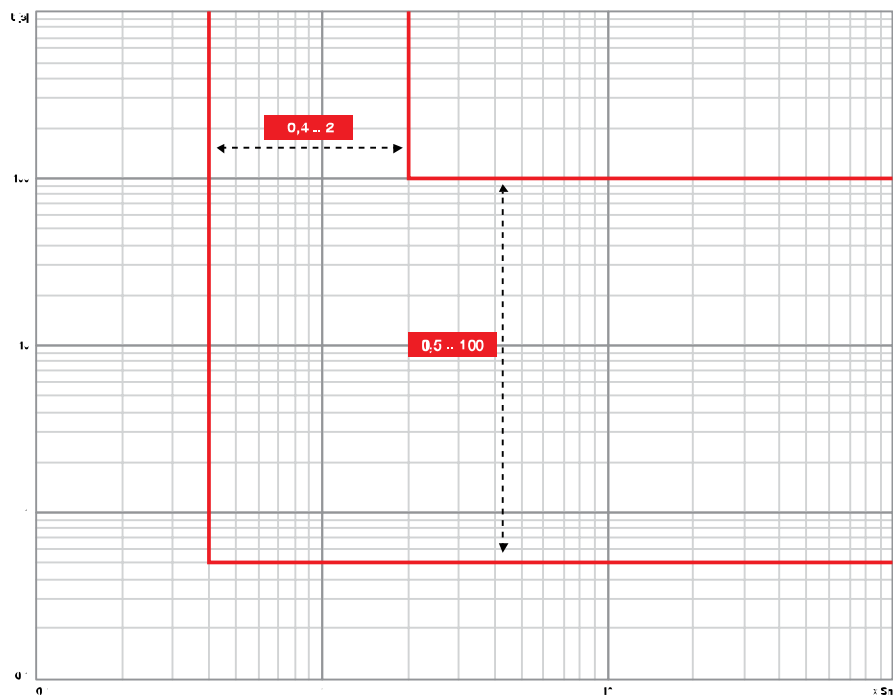
Protection	Trip threshold tolerance	Trip time tolerance
UP	--	$\pm 20 \%$
OP	--	$\pm 20 \%$
RQ	--	$\pm 20 \%$
OQ	--	$\pm 20 \%$
RP	--	$\pm 20 \%$

3 - Power protection curves

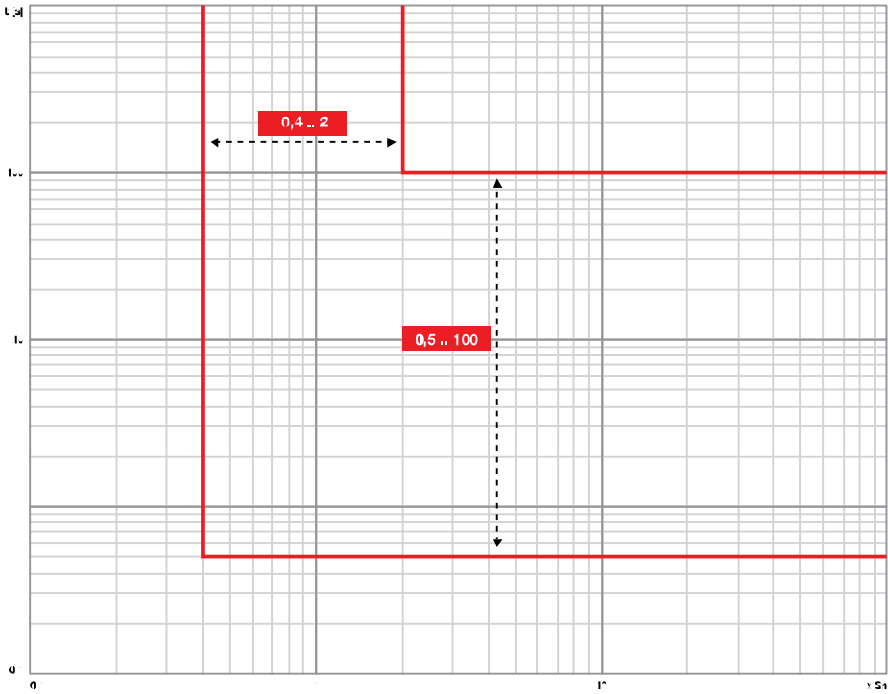
Function RP



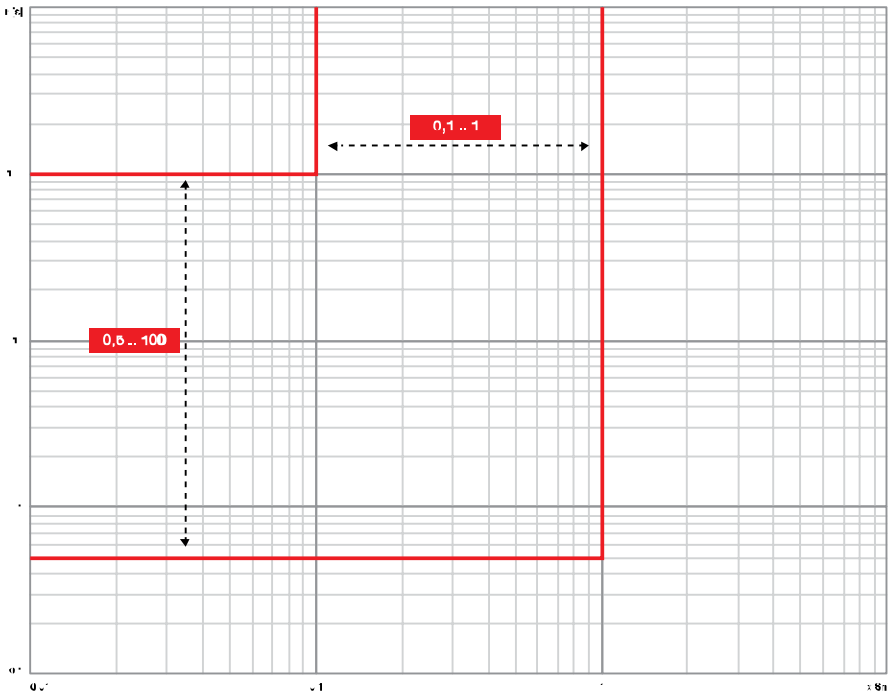
Function OQ

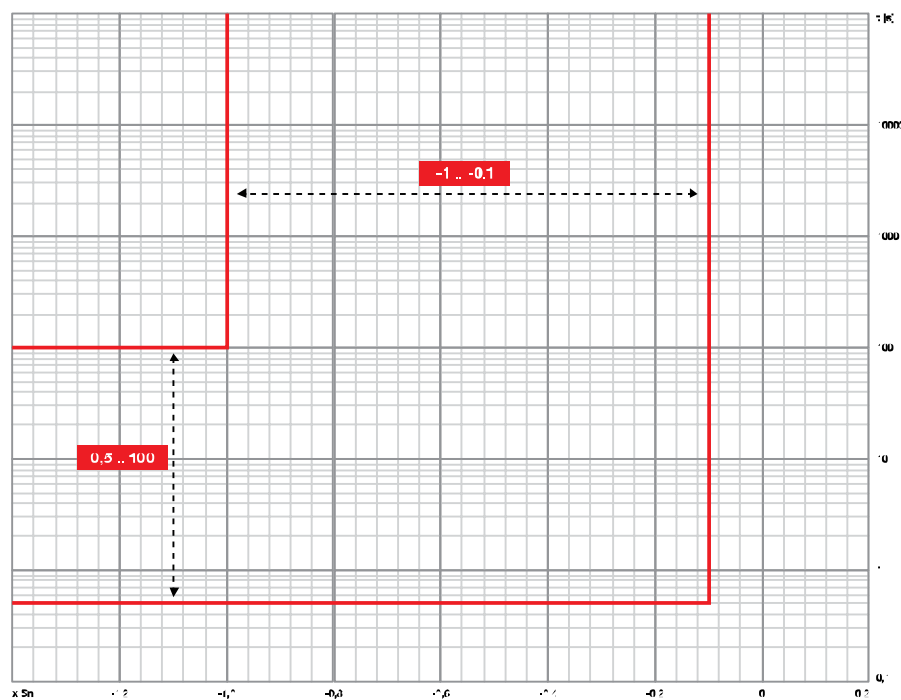


Function OP



Function UP





4 - Power Protection settings

Settings	The Power Protections digital upgrade does not enable the presence of any additional parameter in the Settings display menu. The available parameters are all described and available in the Protections chapter.
-----------------	--

5 - Power Protection test

Test	The Power Protections digital upgrade does not enable the presence of any additional test command in the Test display menu. Ekip Connect has a Test Protections section where the presence of voltage alarm signals can be simulated and the times and trips of certain protections in the package can be checked.
-------------	---

6 - Default of Power Protections

Default	All the protections in the package are supplied in the OFF configuration by default.
----------------	--

Dual Setting Protections

1 - Protections

Overview If the Dual Settings Protections digital upgrade is installed, the function of the same name can be activated to obtain two different protection configurations.

The configurations, called Set A and Set B:

- are alternatives to each other
- changing around is managed by events that can be programmed by the user



IMPORTANT: if the change set conditions are available but high priority alarms are also present (protection timing or temperatures off range), change set is inhibited until the alarms disappear.

Access and activation The function can be checked and configured via display from all remote connection systems. The parameters are available on display in the *Settings-Configuration-Protection Set* menu:

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the function. If the function is OFF, the set used via trip unit is always Set A	OFF
<i>Select set</i>	Defines the main set of protections, activated without there being any further conditions (e.g. the change Set event). The parameter normally remains: Set A	Set A



NOTE: If the software package is present but the function is disabled, the Protections menus still displays the two Set pages even if only the first (Set A) is activated.

The remote connection systems include an additional parameter called “Set Change ignores High Priority Alarms”. If activated, the protection release ignores high priority alarms, which would normally block set change. The parameter is disabled, by default.

Configuration The event that leads to set changing from A to B can be programmed in the “Activate SET B” section of the “Functions” page of Ekip Connect:

Parameter	Description	Default
<i>Function</i>	Event or several events (up to eight in the logic AND or OR configuration) that lead to set changing from A to B. The Custom configuration can be programmed via Ekip Connect.	Deactivated
<i>Delay</i>	This is the minimum time the expected event must be present in order to activate change Set; the value is given in seconds and can be set within a range: 0 s to 100 s, in 0.1 s steps	0 s



IMPORTANT: if the default set selected is B, the change set function will have no effect (the protection release will continue to remain in the Set B configuration)

Display When the digital upgrade Dual Setting Protection is present:

- An additional intermediate selection option where you can choose the set you want to access (Set A, Set B) is available in the Protections page, before the list of protections
- presence of the “---” package is available in the Info page
- the icon dedicated to the Set used by the protection release is provided at the top right of the HOME page

Icon	Description
	Grey lettering, function not enabled; set in use: Set A
	White lettering, function enabled and activated; set in use: Set A
	White lettering, function enabled and activated; set in use: Set B

Triple Setting Protections

1 - Protections

Overview If the Triple Settings Protections digital upgrade is installed, the function of the same name can be activated to obtain three different protection configurations.

The configurations, called Set A, Set B and Set C:

- are alternatives to each other
- changing around is managed by events that can be programmed by the user



IMPORTANT:

- If both set B and C change-around conditions are present, priority is always given to changing to set B
- if set changing conditions are available but high priority alarms are also present (protection timing or temperatures off range) set changing is inhibited until the alarms disappear

Access and activation The function can be checked and configured via display from all remote connection systems. The parameters are available on display in the *Settings-Configuration-Protection Set* menu:

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the function. If the function is OFF, the set used via trip unit is always Set A	OFF
<i>Select set</i>	Defines the main set of protections, activated without there being any further conditions (e.g. the change Set event). The parameter normally remains: Set A	Set A



NOTE: If the software package is present but the function is disabled, the Protections menus still displays the two Set pages even if only the first (Set A) is activated.

The remote connection systems include an additional parameter called “Set Change ignores High Priority Alarms”. If activated, the protection release ignores high priority alarms, which would normally block set change. The parameter is disabled, by default.

Configuration The two events that lead to set changing to B (“Activate SET B” section) and set changing to A (“Activate SET C” section) can be programmed in the “Functions” page of Ekip Connect.

Both sections have two parameters:

Parameter	Description	Default
<i>Function</i>	Event or several events (up to eight, in AND or OR logic configuration) that lead to set changing. The Custom configuration can be programmed via Ekip Connect	Deactivated
<i>Delay</i>	This is the minimum time the expected event must be present in order to activate change Set; the value is given in seconds and can be set within a range: 0 s to 100 s, in 0.1 s steps	0 s



NOTE: If the selected default set is B or C, the correlated change set function will have no effect (e.g. if the Default Set is C, the Activate SET C function will not work)

- Display** If the Triple Settings Protections digital upgrade is installed:
- an additional intermediate selection option where you can choose the set you want to access (Set A, Set B, Set C) is available in the Protections page, before the list of protections
 - presence of the “---” package is available in the Info page
 - the icon dedicated to the Set used by the protection release is provided at the top right of the HOME page

Icon	Description
	Grey lettering, function not enabled; set in use: Set A
	White lettering, function enabled and activated; set in use: Set A
	White lettering, function enabled and activated; set in use: Set B
	White lettering, function enabled and activated; set in use: Set C

CB Internal Temperature Control protection

1 - CB Internal Temperature Control protection

Overview



Access and parameters

When the CB Internal Temperature Control (CB T) protection package is present, you can always activate the protection of the same name to access the CB in the event of temperature rise.

The temperatures are detected by the protection release by means of temperature sensors inside the CB.

Function configuration can be checked via all remote connection systems.

Taking Ekip Connect as a reference, you can access the protection parameters in the “A Parameters” subpage (and “B Parameters” and “C Parameters” subpages if the Dual or Triple Setting digital upgrade are installed), of the “Protection Parameters” page, “Temperature rise” section.

Parameter	Description	Default
Trip activation	Activates/deactivates the function. If the function is ON, a trip command is sent in the case of OFF for faulty temperature pre-defined by ABB.	OFF

In addition, package presence can be checked in the Info menu, on display.

Limitations This function can only be requested when the CB is ordered. The protection is activated in the presence of auxiliary power supply, with CB closed and in the absence of current protection alarms.

Signalling and information The protection release trips when an alarm threshold is exceeded and sends a signal to the diagnostic bar or to the dedicated address of all remote connection systems if a prealarm threshold is exceeded.

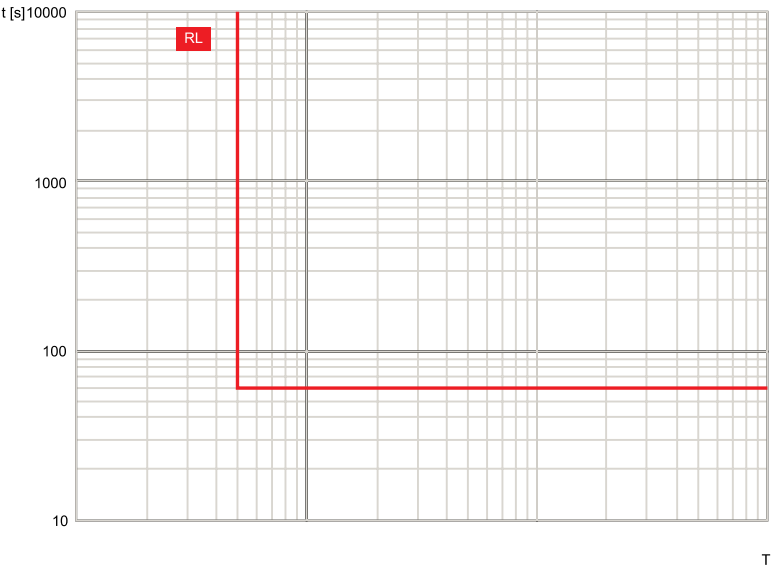
Both thresholds are pre-defined by ABB on the basis of the CB model and cannot be changed.

Information about the internal temperature sensors (SW version, s/n, state of connection, alarm due to threshold having been exceeded) is available from all remote connection systems; considering Ekip Connect as a reference, the information is available on the *Modules - Internal Temperature Sensors 1* page and, with CB model E6.3, on the *Modules - Internal Temperature Sensors 2* page.

 **IMPORTANT: the information about the alarms is valid when the connection is not in the error state.**

CB Internal Temperature Control protection curve Trip time is 60 s from the moment the temperature threshold is exceeded.

The temperature threshold value is fixed and reserved.



Predictive Maintenance on-premise

1 - Predictive Maintenance on-premise

Overview If the Predictive Maintenance on-premise package is present, you can activate the function of the same name, which provides the state of health of the CB so that maintenance can be planned in the best way. Depending on different parameters and measurements, the function returns three indicators about the state of health, which automatically update runtime.

- Health Index, in percentage value, from 100% (healthy circuit-breaker) to 0% (low state of health)
- Next Maintenance Date, indicates the forecast date for the next maintenance.
- End of life, indicates the forecast date of circuit-breaker end of life.

The three indicators are forecasts based on parameters and measurements recorded by the circuit-breaker. The information they provide is useful for planning maintenance which, if performed at regular intervals, enables partial or full recovery of the indicators.

Access The parameters of the function and the state of health indicators are available via all remote connection systems; the indicators are also available on the trip unit display, in the Diagnostic Health Index page (for Health Index parameters) and Diagnostic Maintenance page (for Next Maintenance Date and End of Life). In addition, package presence can be checked in the Info menu, on display.

Operation Proceed as follows to activate the function:

1. Make sure that system configuration is correct (see "limitations" paragraph)
2. Enter CB installation date in Trip unit
3. Configure function data
4. Activate Predictive Maintenance on-premise function



IMPORTANT: The function is not retroactive, this means that it is crucial for the installation date entered to be the one measured at the time of entry. Correct state of health calculation is not guaranteed if different dates are entered (prior to that of the trip unit clock).

After maintenance during the course of life of the circuit-breaker:

5. Select the maintenance alert/s from among those available (MNT, not RES, SMC, SBA, SBC, SMT, SMO, SCO, SPC, SRD, SSP) and save the parameter in the trip unit
6. Reset maintenance

Data and dimensions The indicators are calculated on the basis of the following input data:

1. Date of last maintenance
2. State of wear of contacts (100% - 0%)
3. Number of operations
4. Working temperatures
5. Rated current
6. Number of poles
7. Number of specific operations
8. Estimated life with installation at 440V and 690V, and relevant reference voltage used
9. Rated current class
10. Signalling of maintenance done (MNT, not RES, SMC, SBA, SBC, SMT, SMO, SCO, SPC, SRD, SSP)

As well as the data, there are certain runtime measured quantities:

- Rms current of each phase (from internal current sensors)
- Vibrations (from Ekip Signalling 4T)
- Umidity (from Ekip Signalling 4T)
- Temperature of poles (from internal temperature sensors)
- Ambient temperature (from Ekip Signalling 4T)

Parameters Taking Ekip Connect as a reference, the protection parameters can be accessed in the “Diana” page:

Parameter	Description	Default
Diana Status	Activates/deactivates the function.	OFF
Service Data MNT	Parameter for confirming problem-solving maintenance (generic)	Disabled
Service Data NOT RES	Parameter for confirming non-problem-solving maintenance	Disabled
Service Data SMC	Parameter for confirming maintenance or replacement of springs	Disabled
Service Data SBA	Parameter for confirming maintenance or replacement of opening coils (at least one among YO, YO2, YO Sense, YO2 Sense, depending on CB configuration)	Disabled
Service Data SBC	Parameter for confirming maintenance or replacement of closing coils (at least one among YC, YC2, YC Sense, YC2 Sense, depending on CB configuration)	Disabled
Service Data SMT	Parameter for confirming maintenance or replacement of undervoltage coils (at least one among YU, YU2, YU Sense, YU2 Sense, depending on CB configuration)	Disabled
Service Data SMO	Parameter for confirming maintenance or replacement of spring charging motor	Disabled
Service Data SCO	Parameter for confirming maintenance or replacement of opening operating mechanism	Disabled
Service Data SPC	Parameter for confirming arc chute contact cleaning	Disabled
Service Data SRD	Parameter for confirming adjustment of contacts in the arc chute (clearance between contacts)	Disabled
Service Data SSP	Parameter for confirming the number of completely replaced poles	0 poles

Continued on the next page

Parameter	Description	Default
Life at 440	Icu Current @440V i NOTE: differs from the Icu @440V parameter used by the CB for the Cto.Cto protections, must be configured with the same value (see Catalog)	150
Life at 690	Icu Current @690V i NOTE: differs from the Icu @440V parameter used by the CB for the Cto.Cto protections, must be configured with the same value (see Catalog)	100
Height Above Ground	Height from ground level at which CB is installed	0
Number of poles	Number of poles of CB	3
Voltage used	System voltage configured i NOTE: differs from the "Rated voltage" parameter, must be configured with the same value	440
Nominal current class	Rated current class defined as three levels: • level 1 less than 50% of load • level 2 within the range of 50 to 80% of load • level 3 over 80% of total current load Depending on the selection made, if all the current sensors are disconnected and the measurement is not available, the severity level will be based on the severity level calculated by using the nominal current as a parameter	≥50%, ≤80%
Number of Op specified	Total number of permitted operations of the CB (based on 2 registers)	10000

Limitations The protection requires the presence of internal temperature sensors (which can only be ordered when the CB is being ordered) and Ekip Signalling 4T.
Protection is activated in the presence of auxiliary power supply.
The maximum value of the "Next Maintenance Date" indicator is three and a half years.

Signalling and information The remote connection systems include information about the internal temperature sensors, such as SW version, s/n, state of connection, alarm due to the threshold having been exceeded.
Ekip Connect displays this information on the "Modules - Internal Temperature Sensors 1" page and, with CB model E6.3, on the "Modules - Internal Temperature Sensors 2" page.



IMPORTANT: the information about the alarms is valid when the connection is not in the error state.

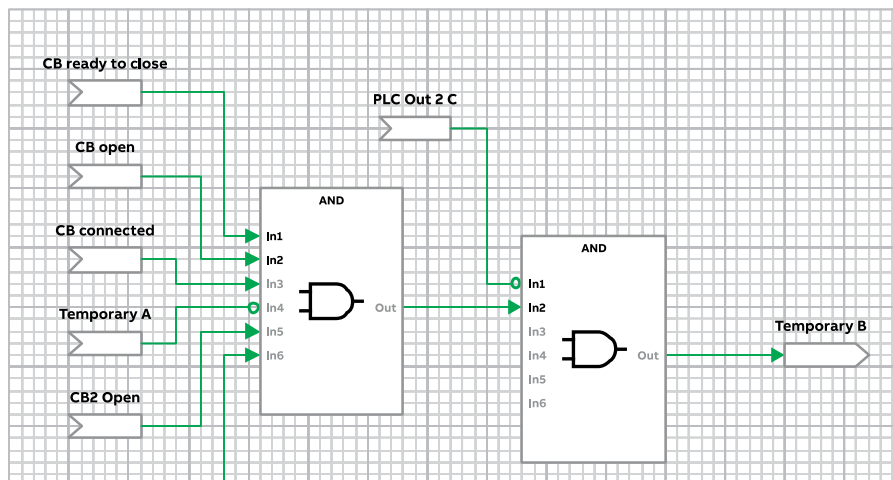
Custom Logics

1 - Protections

Overview The Custom Logic function can be activated if the Custom Logic package is present. The Custom Logic function is useful for creating advanced customized logics for the purpose of managing inputs and outputs.

Compared to the conventional programmable logic controllers, use of the interface reduces programming time and the need for additional cabling.

The user can create more or less complex layouts with one or more devices, where the state of the digital Inputs (ON / OFF) is processed by different logic functions which return digital Outputs to suit one's configuration requirements.



Start To access the area dedicated to the Custom Logics, just open Ekip Connect, access the “Tools” menu and select the “Custom Logics” push-button.



Programming and uploading Access to the “Custom Logics” area and Custom Logic programming do not require connection to the Trip unit and can also be carried out Offline; in addition, you can also create your project in the absence of the Custom Logic SW package.

On the other hand, connection to the Trip unit via USB-C and the presence on this of the Custom Logic SW package are mandatory for uploading and downloading the Custom Logic configuration.