



POWERFACTORY

PowerFactory 2021

Technical Reference

ABB REJ 603

POWER SYSTEM SOLUTIONS
MADE IN GERMANY

F2021

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1 Model information

Manufacturer ABB

Model REJ 603

Variants This family of PowerFactory relay models simulates the features present in the ABB REJ 603 Rev 1 relay.

2 General description

The ABB REJ 603 is a CT-powered microprocessor feeder protection relay mainly designed for the selective short-circuit and earth fault protection of feeders in secondary distribution networks and for protection of transformers in utilities and industries.

The ABB REJ 603 relays have been modeled using four PowerFactory relay models:

- REJ 603-CT2 (for the 15-56 A Is range)
- REJ 603-CT3 (for the 32-112 A Is range)
- REJ 603-CT4 (for the 64-224 A Is range)
- REJ 603-CT5 (for the 128-448 A Is range)

They include any protective element available in the relay.

The model implementation has been based on the information available in the relay manual [1].

3 Supported features

3.1 Measurement and acquisition

It represents the interface between the power system and the relay protective elements. The currents flowing in the power system are converted by an element simulating the 3 phase CT and by an element simulating a single phase CT; the secondary currents are then measured by two elements modeling the digital filter of the relay. An additional 3ph measurement element is connected to the 3phases CT and is extracting the 2nd harmonic component of the phase currents.

3.1.1 Available Units

- one 3ph current transformer ("Ct-3p" block)
- one single phase current transformer ("Ct-3I0" block)

- one 3ph measurement element ("Measure" block)
- one 3ph measurement element calculating the phase current 2nd harmonic ("Measure 2nd harmonic" block)
- one single phase measurement element ("Measure 3I0" block)

3.1.2 Functionality

The "Ct-3p" and the "Ct-3I0" block represent ideal CTs. Using the CT default configuration the current at the primary side are converted to the secondary side using the CT ratio. The CT saturation and/or its magnetizing characteristic are not considered. Please set the "Detailed Model" check box in the "Detailed Data" tab page of the CT dialog and insert the data regarding the CT burden, the CT secondary resistance and the CT excitation parameter if more accurate simulation results are required.

The measurement blocks model the digital sampling of the relay implementing a DFT ("Discrete Fourier Transform") filter using 20 sample /cycle and operating over a full cycle. Please notice that no info is available in the ABB REJ 603 relay manual about the sampling rate or the algorithm used to extract the 2nd harmonic. For this reason an implementation common in many protective relays has been used.

3.1.3 Data input

The relay nominal current value (relay "Is" setting) must be set in the measurement blocks. The CTs must have transformer ratio equal to 1/1.

If no core CT is available please select the 3 phases CT also in the "Ct-3I0" slot: the earth current will be calculated assuming that an Holmgreen's connection of the phases is used.

3.2 Protective elements

A set of inverse time and definite time overcurrent elements is modeling the relay protective functions. The inverse characteristics available in the relay are available as well in the inverse time model blocks.

3.2.1 Available Units

- One 3 phase inverse time overcurrent element ("I>" block)
- One 3 phase definite time overcurrent element ("I>>" block)
- One ground current inverse time overcurrent element ("I0>" block)
- One ground current definite time overcurrent element ("I0>>" block)
- one inrush detection element ("Inrush blocking threshold" block)

3.2.2 Functionality

The PF model contains all the protective elements available in the relay. The inverse time overcurrent elements support the following trip characteristics:

- Definite time
- IEC "Extremely inverse"
- IEC "Very inverse"
- IEC "Normal inverse"
- IEC "Long time inverse"
- "RI Inverse time"
- "HR-Fuse"
- "FR-Fuse"

Please notice as the "FR-Fuse" trip characteristic equation parameters have been calculated to match the curve shape displayed at page 30 of the relay technical references [1].

The current 2nd harmonic component calculated by the "Measure 2nd harmonic" block is send to the "Inrush blocking threshold" which is blocking the protective elements if the 2nd harmonic current is greater than 15% I_n . Please notice as no info is available in the manual regarding the 2nd harmonic current threshold value blocking the other protective elements. A typical value (15% I_n) is at the moment used in the model.

3.2.3 Data input

The relationships between the relay settings and the model parameters can be found in the following table:

Address	Relay Setting	Model block	Model setting	Note
	Low-set phase over-current protection stage pick-up current $I >$	I>	Current Setting	
	Low-set phase over-current protection stage definite time delay $t >$	I>	Time Dial	
	Low-set phase over-current protection stage inverse time characteristic	I>	Characteristic	
	Low-set phase over-current protection stage time multiplier k	I>	Time Dial	
	High-set phase over-current protection stage pick-up current $I >>$	I>>	Pickup Current	
	High-set phase over-current protection stage definite time delay $t >>$	I>>	Time Setting	
	Low-set earth-fault over-current protection stage pick-up current $I >$	I0>	Current Setting	
	Low-set earth-fault over-current protection stage definite time delay $t >$	I0>	Time Dial	
	Low-set earth-fault over-current protection stage inverse time characteristic	I0>	Characteristic	
	Low-set earth-fault over-current protection stage time multiplier k	I0>	Time Dial	
	High-set earth-fault over-current protection stage pick-up current $I >>$	I0>>	Pickup Current	
	High-set earth-fault over-current protection stage definite time delay $t >>$	I0>>	Time Setting	

3.3 Output logic

It represents the output stage of the relay; it's the interface between the relay and the power breaker.

3.3.1 Available Units

- one output element ("Output Logic" block)

3.3.2 Functionality

The "Output Logic" block is collecting the trip signals coming from the protective elements and operating the relay output contact. The output contact is "yout".

3.3.3 Data input

To disable the relay model ability to open the power circuit breaker simply disable the "Output Logic" block.

4 Features not supported

- The transformer inrush detection is not completely supported due to the missing information regarding the detection threshold value used by the relay. At the moment in the model a 15% In threshold is used.

5 References

- [1] ABB Ltd Distribution Automation, Maneja Works, Vadodara - 390 013, India. *User's manual and Technical description Self-Powered Feeder Protection REJ603 1MDU07206-YN Issued: 18.02.2008 Revision: A Product Version 1.0*, 2008.