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PowerFactory 2021

Technical Reference

ABB RADS-C

PF2021

POWER SYSTEM SOLUTIONS
MADE IN GERMANY

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Contents

1 Model information

Manufacturer   ABB

Model   RADS-C

Variants   This PowerFactory relay model type models the ABB RADS-C relay which is a protection assembly containing a 3phase differential relay with percentage restrain.

2 General description

The ABB RADS-C protective relay is a static complete phase and earth fault differential protection for generators, motors, reactors, cables or short lines, capacitor banks and busbars. The percentage restraint characteristic provides the required restraint for external faults. The RADS-C relay also has an unrestrained instantaneous function which responds to the total differential current (less any dc component). This will provide redundant operation for severe internal faults.

The ABB RADS-C relay has been modeled using one PowerFactory relay model which includes most of the features available in the relay.

The model implementation has been based on the information available in the relay documentation provided by the manufacturer and freely available [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 two elements modeling two 3 phase CTs; the secondary currents are then measured by two elements modeling the analog filters of the relay.

3.1.1 Available Units

- Two 3 phase current transformers ("Winding 1 Ct" and "Winding 2 Ct" block)

- Two measurement elements ("Measure 1" and "Measure 2" block)

3.1.2 Functionality

The "Winding 1 Ct" and the "Winding 2 Ct" 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 calculate the phase fundamental harmonics using a DFT filter operating over a full cycle.

3.1.3   Data input

The CT secondary rated current (1 or 5 A) value must be set in the measurement elements (*"Nominal current"* parameter).

3.2   Protective elements

A differential element with an ancillary RMS calculation element simulates the relay differential features. All protective functions available in the relay are available also in the PowerFactory relay model.

3.2.1   Available Units

- one 3 phase differential element ("Differential logic" block).

- one measurement element ("Diff RMS meas" block).

3.2.2   Functionality

The following features are available in the differential element ("Differential logic" block):

- Percentage restraint differential with user configurable threshold (available threshold values: 15%, 20%, 25%, 30%).

- Unrestrained differential with user configurable threshold (available threshold values: 5 I_n, 10 I_n, 15 I_n).

The differential element calculates for each phase the average of the currents measured by "Measure 1" and by "Measure 2". The average values are then used to calculate the differential threshold considering a 60% linear percentage restrain.

The measurement element ("Diff RMS meas" block) is used to calculate the RMS value of the differential current. The differential current vector components (or instantaneous values during the EMT simulation) are calculated by the differential element.

3.2.3 Data input

The relationships between the relay settings and the model parameters can be found in the following table (the relay model parameter names are listed between brackets):

Address	Relay Setting	Model block	Model Parameter	Note
	Restrained operate value, I_{sr}	Differential logic	Differential Current base threshold ("Idiff")	
	Unrestrained high speed operate value, I_{su}	Differential logic	Unrestrained Differential threshold ("Idiffunrest")	

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 ("Logic" block).

3.3.2 Functionality

The "Logic" block gets the trip signal coming from the differential element; it operates the relay output contact and the power breaker.

The relay output contact is "OUT1".

3.3.3 Data input

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

4 Features not supported

The three, five or six through-current restraint inputs relay versions are not supported.

Moreover the following approximations have been used:

- The active filters extracting the fundamental harmonic are modeled by digital filters.

- The non linear percentage restrain characteristic is approximated by a linear characteristic (60% slope).

5 References

[1] ABB Relays, S-721 71, Vasteras, Sweden. *Multi-purpose percentage restraint differential protection RADSC 1MRK 509 016-BEN Issued June 2002*, 1999.