PowerFactory 2021

Technical Reference

Siemens 7SD600

SILENT
DIG

POWER SYSTEM SOLUTIONS
MADE IN GERMANY

PF2021

Contents

1 Model information

Manufacturer   Siemens

Model   7SD600

Variants   This PowerFactory relay model type simulates the Siemens 7SD600 microprocessor differential relay protection up to the V3.1 firmware version.

2 General description

The numerical current comparison protection 7SD511 is a fast and selective short circuit protection for cables and overhead lines of all voltage levels, irrespective of the method of neutral point connection. It is particularly suited to short lines where, for example, the first zone of a distance protection cannot be set sufficiently short. It can be implemented no matter how short the line. A current transformer, but not a voltage transformer is required at each end of the line. The current comparison protection system requires the installation of one 7SD600 unit and a summation transformer at each end of the line; the two units exchange data by digital signals.

The Siemens 7SD600 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 which model two 3 phase CTs; the secondary currents are summed together and then measured by four elements which simulate the digital filters of the relay.
Please notice that the second single phase transformer ("Wd_2 Ct" block) represents the measurement at the remote end of the line. No data link is modeled and only one Siemens 7SD600 relay model is required to simulate the whole differential arrangement at one side of the line.

3.1.1   Available Units

- Two summation elements ("Sum_1" and "Sum_2" block).

- Two single phase current transformers ("Wd_1 Ct" and "Wd_2 Ct" block).

- Four single phase measurement elements ("Meas_1", "Meas_1_2nd-H", "Meas_2" and "Meas_2_2nd-H" block).

- One single phase measurement element ancillary to the differential element("Diff RMS meas" block).

3.1.2   Functionality

The "Wd_1 Ct", and the "Wd_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 harmonic component using a DFT filter operating over a full cycle. "Meas_1" and "Meas_2" extract the fundamental current harmonic, "Meas_1_2nd-H" and "Meas_2_2nd-H" the 2nd current harmonic.

The "Diff RMS meas" block calculates the RMS value of the differential currents calculated by the differential element.

The summation transformers 4AM4930 are modeled by the two summation elements ("Sum_1" and "Sum_2" block).

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, "Inom" variable).

3.2   Protective elements

A differential element ("Differential" block) simulates the relay differential features. A single phase overcurrent element acts has emergency overcurrent function, another single phase overcurrent element blocks the differential element for currents smaller than an user configurable threshold.

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

- Single phase differential with double percentage bias characteristic (fixed thresholds values at 300% and 500%, fixed slopes equal to 33% to 66%).

- User configurable differential trip delay.

- 2nd harmonic restrain of the differential with user configurable threshold and disabling overcurrent threshold.

All protective functions available in the relay are available also in the PowerFactory relay model.

3.2.1 Available Units

- One single phase differential element ("Differential" block).

- One single phase definite time overcurrent element ("I1>" block).

- One single phase definite time overcurrent element acting as blocking element("I1Rel" block).

- One ancillary logic element ("IE>" block).

3.2.2 Functionality

The differential element calculates the differential current in terms of current vector components (or instantaneous values during the EMT simulation) using the current values measured by "Meas_1" and by "Meas_2" block.

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
1501	DIF.PR	Differential	Out of Service (outserv)	
1503	IDIFF>	Differential	Differential current base threshold (Idiff)	
1510	HARM2	Differential	Disable harmonic blocking (harmblockdisable)	In the "Harmonic blocking" tab page
1511	HARM2	Differential	2nd Harmonic blocking threshold (H2 threshold)	In the "Harmonic blocking" tab page
1512	IHARM2	Differential	Harm blocking disabling threshold (hblckdisthr)	In the "Harmonic blocking" tab page
1523	I1REL.	I1Rel	Pickup Current (Ipsetr)	
1525	T - DLY.	Differential	Time Setting (Tset)	
1701	E.O/C	I1>	Out of Service (outserv)	
1702	I1> EME	I1>	Pickup Current (Ipset)	
1703	T I1>	I1>	Time Setting (Tset)	

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 and the emergency overcurrent function; it operates the relay output contact and the power breaker when at least one trip signal has been activated.

The relay output contact are:

- *OUT1*
- *OUT2*
- *OUT3*
- *OUT4*
- *OUT5*

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

- Transfer Trip function.

- Intertrip function.

- Lockout function.

- Differential current monitoring.

- Spill current feature (10I-SpC and 10-SpC parameter)

5 References

[1] Siemens AG Department of Power Transmission and Distribution Protection and Substation Control Systems, P.O. Box 48 06, D-90026 Nuremberg, Germany. *Numerical line differential protection SIPROTEC 7SD600 V3.1 System Manual Order No. E50417-G1176-C069-A3*, 2000.