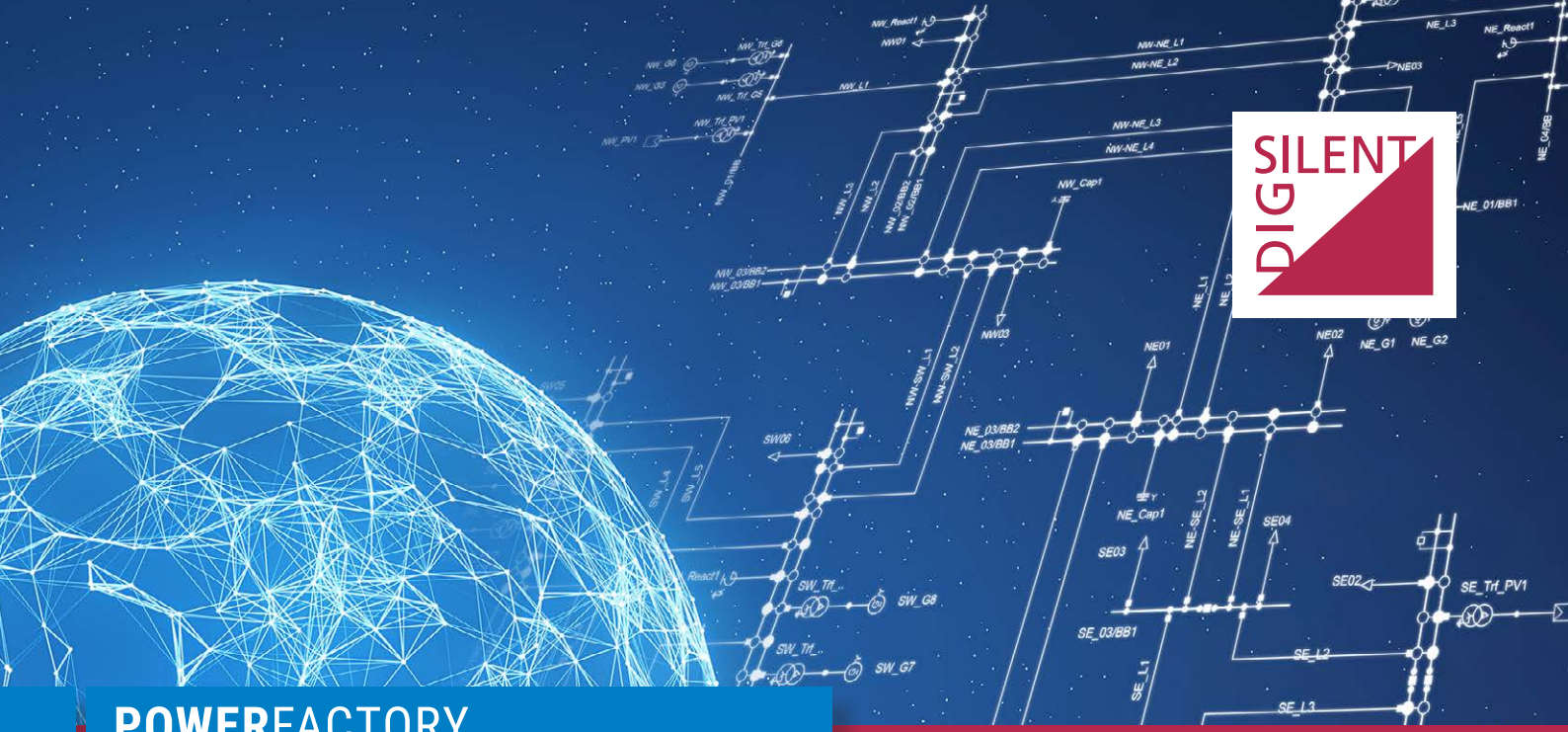

POWERFACTORY

PowerFactory 2021

Technical Reference

Siemens RN25a

PF2021

POWER SYSTEM SOLUTIONS

MADE IN GERMANY

Publisher:
DIgSILENT GmbH
Heinrich-Hertz-Straße 9
72810 Gomaringen / Germany
Tel.: +49 (0) 7072-9168-0
Fax: +49 (0) 7072-9168-88
info@digsilent.de

Please visit our homepage at:
https://www.digsilent.de

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Contents

1 Model information

Manufacturer Siemens

Model RN25a

Variants This PowerFactory relay models can be used to simulate the pilot wire differential Siemens RN25a protective relay.

2 General description

The Siemens RN25a protective relay is a 60 years old project electromechanical pilot wire differential protection based on the well known Merz-Price circulating current system. A summation current transformer at each line end produces a single phase current proportional to the summed three phase currents in the protected line.

The Siemens RN25a relay has been modeled using one PowerFactory relay model which tries to reproduce the behavior of 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 and then summed together; the two resulting single phase currents are measured by two elements modeling the analog filters of the relay.

3.1.1 Available Units

- Two 3 phase current transformers (*"CT1"* and *"CT2"* block).
- Two summation elements (*"Summation transformer local"* and *"Summation transformer remote"* block).
- Two measurement elements (*"Measure 1"* and *"Measure 2"* block).

3.1.2 Functionality

The *"CT1"* and the *"CT2"* 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 simulate a second order low pass analog filter with DC component filter; the time constant is 1 ms.

The summation elements calculate a current using the phase-phase currents and the following formula
$I = 0.86I_{AB} + 1.74I_{BC} + 1.74I_{CA}$

3.1.3 Data input

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

3.2 Protective elements

A differential element simulates the relay differential features.

3.2.1 Available Units

- one single phase magnitude comparator differential element (*”Differential”* block).
- one measurement element (*”Differential RMS”* block).

3.2.2 Functionality

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

- Magnitude comparator differential with user configurable threshold (available threshold values: continuous range from 1 to 2.5 pu).
- Single slope current restraint (fixed at 200 %).

The differential element calculates the magnitude difference vector between the currents measured by *”Measure 1”* and by *”Measure 2”*. The difference vector is then processed by the *”Differential RMS”* block which calculates the RMS value which then is evaluated again by the *”Differential”* block.
A trip is declared when the difference vector is greater than the user configurable differential threshold.

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
	Relaiseinstellung auf	Differential	Differential Current (Itap)	

3.3 Output logic

It represents the output stage of the relay; it is 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 gets the trip signal coming from the differential element; it operates the relay output contact and the power breaker.

The relay output contact is *"yout"*.

3.3.3 Data input

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

4 Features not supported

The following features are not supported:

- Flat differential characteristic when I_1 is greater than 22-24 I_n .

5 References

[1] Siemens, Erlangen. *Leitungsdifferentialschutz RN 25a 1S L2-R/5rt.r25/Ei.*, 1959.