PowerFactory 2021

Technical Reference

Siemens R3Z24

Contents

1 Model information

Manufacturer   Siemens

Model   R3Z24

Variants   The Siemens R3Z24 PowerFactory relay model can be used to simulate the Siemens R3Z24 relay.

2 General description

The Siemens R3Z24 PowerFactory relay model has been implemented trying to simulate the distance protection features.

The relay contains the measurement and acquisition units, the output logic, the overcurrent starting logic, and the distance trip logic.

The model implementation has been based on the information available in the relay manuals [1] [2] [3].

3 Supported features

3.1 Measurement and acquisition

The phase voltages and currents are measured by one current transformer (*"Ct"* block) and by one voltage transformer *"Vt"* block).
The measurement unit (*"Measurement"* block) is fed by the CT and the VT.

3.1.1 Available Units

- One 3 phases Ct (*"Ct"* block).

- One 3 phases Vt (*"Vt"* block).

- One 3 phases measurement element (*"Measurement"* block).

3.1.2 Functionality

The CT and the VT provide the current and the voltage instantaneous values measured at the relay position that are sampled at 20 samples/cycle by the *"Measurement Seq"* block where a FFT (Fast Fourier Transform) filter operating over a cycle calculates then the voltage and current phasor values used by directional element. The FFT filter calculates the phase and voltage from the fundamental harmonic to the 16th harmonic.

3.1.3   Data input

The nominal current and the nominal voltage values MUST be entered in the *"Measurement"* block.

3.2   Directional element

3.2.1   Functionality

The *"Directional angles"* block performs an active power calculation. The forward direction is declared when the calculated power is greater than zero.

3.2.2   Available Units

- One 3 phases Pcosϕ directional element (*"Dir"* block).

3.2.3   Data input

The relay input configuration can be set in the model using the *Tripping Direction* (*"idir"* parameter) combo box in the *"Dir"* dialog.

3.3   Protective elements

The Siemens R3Z24 relay models simulate four impedance offset elements with directional characteristic distance protection. Two delayed backup trips triggered by the starting element and by the starting element and the directional element are also available.

3.3.1   Available Units

- Four impedance offset distance elements (*"Schritte 1"*, *"Schritte 1b"*, *"Schritte 2"*, and *"Schritte 3"* block).

- Five timers (*"Zeit 1"*, *"Zeit 2"*, *"Zeit 3"*, *"Zeit 4"*, and *"Zeit 5"* block).

- One starting element (*"7RC64"* block).

- One directional element (*"Dir"* block).

- One polarizing block (*"Polarizing"* block).

3.3.2   Functionality

The starting element is a pure overcurrent starting logic with double starting threshold for the phase currents and the earth current. The distance elements implement four impedance zone calculating the impedance as V/I. A timer is associated to each impedance zone. The *"Zeit 4"* timer starts when a fault has been detected in the forward direction, the *"Zeit 5"* timer starts when a fault has been detected. All ranges have no steps and any value can be set in the allowed range.

3.3.3   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	Range	Note
	7RC64 IM	7RC64-RA14	Earth Current, 3I0 (*"Ie"*)	0.4-0.8 pu	
	RA14	7RC64-RA14	CurrentI>>	1-4 pu	
	K, C1 x[1],C3[1], ϕ[1]	Schritte[1]	Replica Impedance (Zm)	0.05-64 Ω	
			Offset Impedance (Zoff)	0.05-64 Ω	
			Offset Angle (roffang)	270-360	
	t1	T1	Time Setting (*"Tdelay"*)	0-7.4 s; disabled	
	t2	T2	Time Setting (*"Tdelay"*)	0-7.4 s; disabled	
	t3	T3	Time Setting (*"Tdelay"*)	0-7.4 s; disabled	
	t4	T4	Time Setting (*"Tdelay"*)	0-7.4 s; disabled	
	t5	T5	Time Setting (*"Tdelay"*)	0-7.4 s; disabled	

The *Replica Impedance*, the *Offset Impedance*, the *Offset Angle* values for each distance zone must be manually calculated using the *K*, the *C1* , the *C3*, and the ϕ relay settings. Please consider that the relay model operates only a input data check using the minimum and the maximum allowed value.

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[1]x = 1,2,3,4

3.4   Output logic

The output logic is implemented by the *"Output Logic"* block located in the main relay.

3.4.1   Available Units

- Output Logic

3.4.2   Functionality

The *"Output Logic"* block is operating the breaker.

3.4.3   Data input

No user input is required to configure the output logic feature.

Please disable the *"Output Logic"* block located in the main relay to disable the relay model ability to open the power circuit.

4 References

[1] Siemens, Erlagen, Germany. *Siemens Distanzschutz R3Z24 Technische Angaben 4 TS 12 R B2 4445 TS Rel 4177 B1. 1-21*, 1960.

[2] Siemens, P. O. Box 48 06, D-90026 Nurnberg, Germany. *Distanzschutz fur Hoch- und Hochstspannungsnetze, Distanzschutz 7SL93(R1Z23b), 7SL94(R1Z24b), 7SL96(R3Z24b), 7SL97(R3Z27)*, 1970.

[3] Siemens, P. O. Box 48 06, D-90026 Nurnberg, Germany. *Siemens Distanzschutz R3Z24 Maschinenlesbare Bezeichnung: 7SL96 Technische Angaben*, 1970.