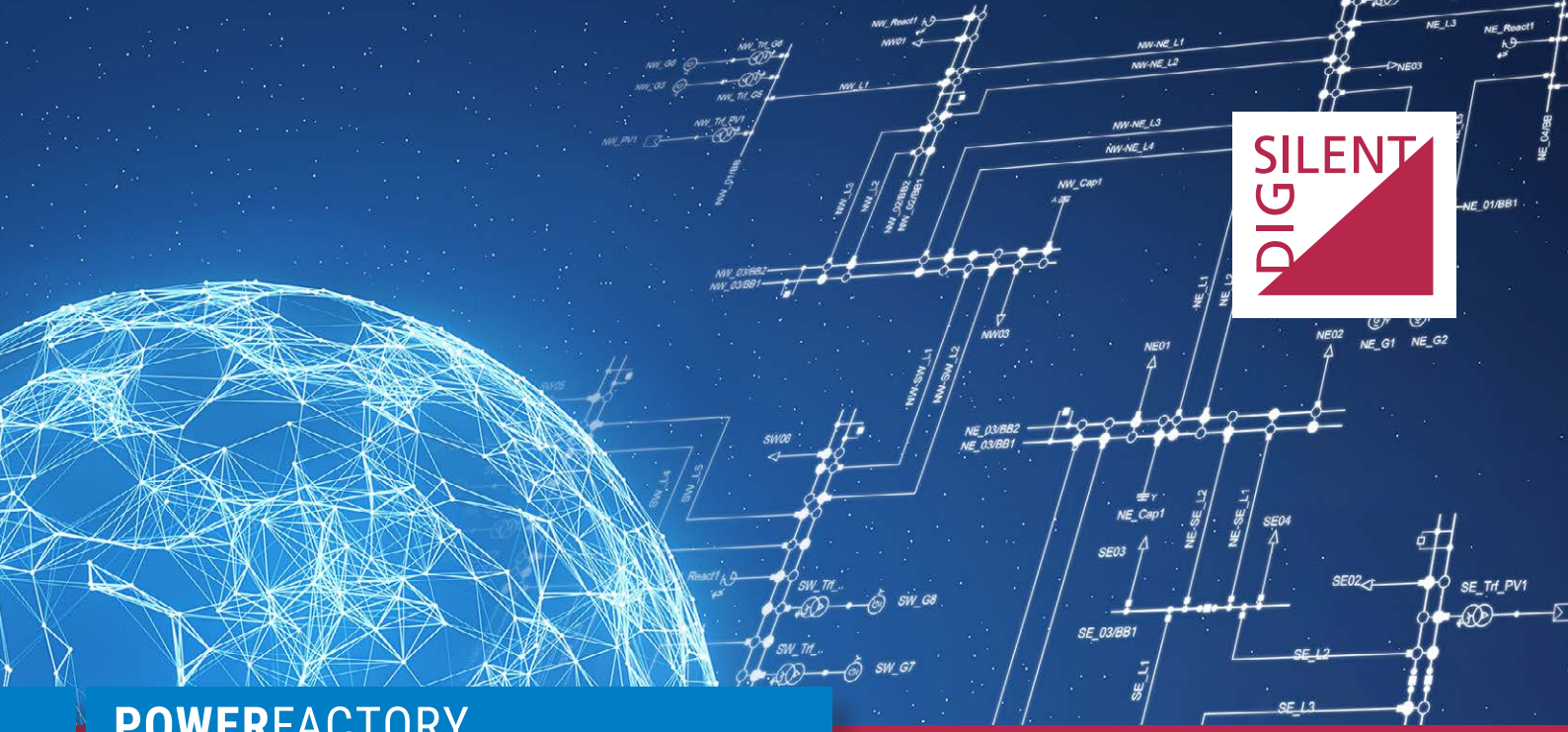

POWERFACTORY

PowerFactory 2021

Technical Reference

ZIV 8ZLS

PF2021

POWER SYSTEM SOLUTIONS

MADE IN GERMANY

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1 Model information

Manufacturer ZIV

Model 8ZLS

Variants The ZIV 8ZLS PowerFactory relay model can be used to simulate the ZIV 8ZLS relay. However please consider that the model has been implemented with a reduced set of the features available in the relays.

2 General description

The ZLS terminal is an IED designed to provide fast, safe and reliable protection for all types of faults between phases and between phase and ground, in transmission, sub-transmission, and distribution lines. The terminal is equipped with four reversible zones.

The ZIV 8ZLS PowerFactory relay model consists of a main relay and four sub relays, one for each quadrilateral element:

- Quadrilateral Zone 1.
- Quadrilateral Zone 2.
- Quadrilateral Zone 3.
- Quadrilateral Zone 4.

The main relay contains the measurement and acquisition units, the output logic, the mho elements and the sub relays.

The ZIV 8ZLS PowerFactory relay model has been implemented trying to simulate the distance protective functions. The voltage and overcurrent elements are not modeled in this version of the relay model.

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

3 Supported features

3.1 Measurement and acquisition

The voltage and the current are measured locally by one three phase current transformer (”Phase Ct” block), and by one three phase voltage transformer (”Phase Vt” block).

Three measurement units (”Measurement”, ”Measurement Delta”, and ”Measurement Sequence” block) are fed by this CT and this VT.

3.1.1 Available Units

- One three phase current transformers (”Phase Ct” block).
- One three phase voltage transformer (”Phase Vt” block).
- One three phase measurement element calculating both the current and voltage values (”Measurement” block).
- One three phase measurement element calculating the phase to phase current values(”Measurement Delta” block).
- One three phase measurement element calculating the current and voltage sequence values (”Measurement Sequence” block).

3.1.2 Functionality

The input current and voltage values are sampled at 20 samples/cycle. The average values are processed by a DFT filter, operating over a cycle, which then calculates the voltage and current values used by the protective elements.

The ”Measurement Delta” block calculates the current phase-phase values used by starting elements elements (”Forward supervision two-phase”, and ”Reverse supervision two-phase” block).

3.1.3 Data input

The nominal current value MUST be entered in all measurement blocks. The nominal voltage value must be entered in the ”Measurement”, and in the ”Measurement Sequence” block.

3.2 Quadrilateral Zone 1-4 subrelays

The *Quadrilateral Zone 1-4* sub relays are identical and simulate the four ground quadrilateral characteristics. Each characteristic is modeled by 2 reactive and two resistive blinders with and additional directional logic.

3.2.1 Available Units

- Two 3 phase resistive blinder elements(”Resistive Limit Forward”, and ”Resistive Limit Reverse” block).
- Two 3 phase reactive blinder elements(”Reach Fwd”, and ”Reach Reverse” block).
- One timer(”Time Delay” block).
- One directional element (”Directional” block).
- Five logic elements (”X Fwd Reach logic”, ”X Rev Reach logic”, ”Trip logic”, ”Sup logic”, and ”Const” block).

3.2.2 Functionality

The quadrilateral characteristic is implemented by blinder which uses different polarizing quantities: the reactive blinders are polarized with the negative sequence current. The ”Reach Forward”, and ”Reach Reverse” block act as user interface, the angle difference between the operating and the polarizing vector is calculated by the ”X Fwd Reach logic” and the ”X Rev Reach logic” block. The ”Sup logic” block combines the starting signals with the directional signals and provides the supervision signals to the blinders and ”Trip logic” block. The ”Trip logic” block combines together the trip signals of the four blinders and set the final trip signal of the quadrilateral logic; to declare the trip condition all blinders must trip and the phase supervision signals coming from the ”Sup logic” block must allow the trip. The ”Const” block is simply an auxiliary digital block which provides to the ”X Fwd Reach logic” and the ”X Rev Reach logic” block the conventional values for the trip/no trip condition.

3.2.3 Data input

The relationships between the relay settings of the *Quadrilateral characteristic Zone x* (where x = 1,2,3,4 indeed the relationships for the settings of the Zone 1, 2,3,and 4 follow an identical logic) 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 setting	Note
	Zone x direction	Directional	Tripping Direction (idir)	
	Zone x reach	Reach Fwd	Reactance (X)	
	Zone 1 resistive limit	Resistive Limit Forward	Resistance (R)	
	Zone 2 time delay, ground fault	Time Delay	Time Setting (Tdelay)	Unique timer for both phase and ground
	Zone 2 time delay, phase fault	Time Delay	Time Setting (Tdelay)	Unique timer for both phase and ground

3.3 Main relay

ZIV 8ZLS PowerFactory main scheme contains the polarizing, the mho protective elements, the su brelays which models the quadrilateral elements and the starting elements used by both the mho and the quadrilateral protective functions.

3.3.1 Available Units

- One polarizing element (”Polarizing” block).
- Four mho elements (”Z1Mho”, ”Z2Mho”, ”Z3Mho”, and ”Z4Mho” block).
- Eleven logic elements (”Start1Logic”, ”Start2Logic”, ”Start3Logic”, ”Start4Logic”, ”Z1LoopSel”, ”Z2LoopSel”, ”Z3LoopSel”, ”Z4LoopSel”, ”FwdStartLogic”, ”RevStartLogic”, and ”Const” block).
- Two calculation elements (”I2PhCalc”, and ”U1PhCalc” block)

3.3.2 Functionality

The main relays contains the following features

- Accordingly to the fault direction and type selection of the correct starting threshold and signal.
- Polarizing calculation.
- Mho elements logic.
- Whole relay tripping logic.

The four overcurrent starting thresholds of the models match the setting available in the relay; the correct starting signal is selected by the ”FwdStartLogic” and the ”RevStartLogic” block considering the fault direction and the type of fault and sent to the mho and the quadrilateral distance elements.

The polarizing voltage is calculated by the ”Polarizing” block using the voltage values measured with a delay of 2 cycles.

The tripping logic is defined by the ”Output Logic” block (see 3.4).

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 setting	Note
	Zero sequence angle	Polarizing	K0 (K0)	
	K0 Factor (zero sequence compensation)	Polarizing	Angle (phiK0)	
	Forward supervision single-phase element pickup	Forward supervision single-phase	Current I>> (ip2)	

Address	Relay Setting	Model block	Model setting	Note
	Forward supervision two-phase element pickup	Forward supervision two-phase	Current I>> (ip2)	
	Reverse supervision single-phase element pickup	Reverse supervision single-phase	Current I>> (ip2)	
	Reverse supervision two-phase element pickup	Reverse supervision two-phase	Current I>> (ip2)	
	Zone 1 reach	Z1Mho	Replica Impedance (Zm)	
	Zone 2 reach	Z2Mho	Replica Impedance (Zm)	
	Zone 3 reach	Z3Mho	Replica Impedance (Zm)	
	Zone 4 reach	Z4Mho	Replica Impedance (Zm)	
	Positive sequence angle	Z1Mho	Relay Angle (phi)	
		Z2Mho	Relay Angle (phi)	
		Z3Mho	Relay Angle (phi)	
		Z4Mho	Relay Angle (phi)	
	Zone 2 time delay, ground fault	Z2 Phase Time Delay	Time Setting (Tdelay)	
	Zone 2 time delay, phase fault	Z2 Ground Time Delay	Time Setting (Tdelay)	
	Zone 3 time delay, ground fault	Z3 Phase Time Delay	Time Setting (Tdelay)	
	Zone 3 time delay, phase fault	Z3 Ground Time Delay	Time Setting (Tdelay)	
	Zone 4 time delay, ground fault	Z4 Phase Time Delay	Time Setting (Tdelay)	
	Zone 4 time delay, phase fault	Z4 Ground Time Delay	Time Setting (Tdelay)	

3.4 Output logic

The output logic is the interface between the relay and the power system.

3.4.1 Available Units and Signals

The trip logic is implemented by the ”OutputLogic” block located in the main relay.

The purpose of the ”OutputLogic” block is to collect the mho block and the quadrilateral subrelays trip signals and operate the power breaker. It supports the *PUTT* and the *POTT* acceleration trip schemes

The following relay output signals are available:

- yout
- yout_A
- yout_B
- yout_C

The ”yout” signal triggers a 3 phase trip signals, the other signals trigger a single phase trip.

3.4.2 Functionality

The ”OutputLogic” block located in the main relay operates the power breaker when a trip command has been issued by any protective element (Mho elements and Quadrilateral subrelays). The trip logic can be:

- 3 phase
- 2 phase
- single phase

The 2 phase trip is enabled when a 2 phase fault has been detected and the *two_poles_trip* flag has been set equal to *TRIP* in the ”Logic” tab page of the ”OutputLogic” block.
The single phase trip is enabled when a phase-ground fault has been detected and the *single_pole_trip* flag has been set equal to *TRIP* in the ”Logic” tab page of the ”OutputLogic” block. The teleprotection schemes require the connection with another remote relay; they must be enabled setting the *PUTT* and the *POTT* parameter in the ”Logic” tab page of the ”OutputLogic” block.

3.4.3 Data input

Please disable the ”OutputLogic” block in the main relay to disable the relay model ability to open the power circuit. The *POTT*, *PUTT*,*two_poles_trip*, and *single_pole_trip* parameter can be set equal to *TRIP* or to *NOTRIP* in the ”Logic” tab page of the ”OutputLogic” block.

4 Features not supported

4.1 Main features

The following features are not supported:

- Directional Overcurrent Unit.
- Remote Breaker Open Detector.
- Out of Step (OS) Detector.
- Voltage Units.
- Recloser.
- Synchronism Unit.
- Trip & Close Coil Circuit Supervision.

5 References

[1] ZIV GRID AUTOMATION, S.L. Parque Tecnológico, 210 48170 Zamudio - Bizkaia - Spain. *8ZLS-J Distance Protection Instructions Manual BZLS1210Jv00*, 2012.