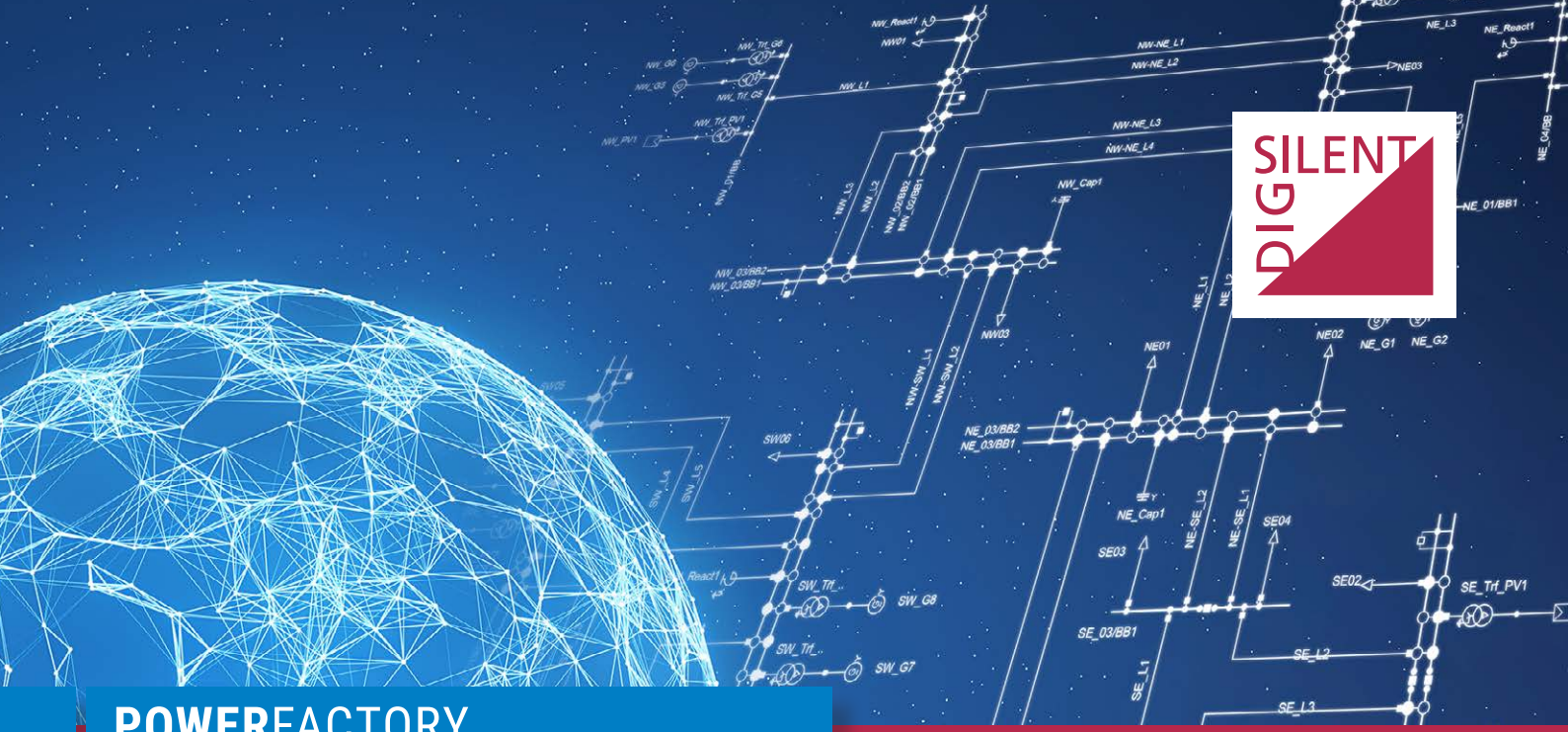

PowerFactory 2021

Technical Reference

Alstom PSEL 3000

PF2021

POWER SYSTEM SOLUTIONS

MADE IN GERMANY

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Contents

1 Model information

Manufacturer Alstom

Model PSEL 3000

Variants These PowerFactory relay models can be used to simulate the different versions (3.01,3.02,3.03,3.05,3.07,3.11,3.12,3.13,3.15,3.17)of the Alstom PSEL 3000 distance relays. Please consider that 3.05,3.07, 3.15,3.17 have a directional feature which is not currently present in these relay models.
The ability to model the different Alstom PSEL 3000 versions can be summarized in the following table (see also 1.2.1 of [1]):

PSEL 3	X	Y	Z	Status
	Any	Any	1	Modeled
	Any	Any	2	Modeled
	Any	Any	3	Modeled
	Any	Any	5	Not fully modeled
	Any	Any	7	Not fully modeled

2 General description

The Alstom PSEL 3000 protection relays are backup distance relays for phase-phase faults. An additional residual overpower relay element and a capacitive voltage transformers monitoring feature are also available.

The Alstom PSEL 3000 relays have been modeled with the following relay models:

- PSEL 3000 1A
- PSEL 3000 5A

Please notice that the models listed above are identical except that for the measurement rated current and the impedance settings ranges.

The model implementation has been based on the information available in the relay documentation provided by RTE [1] [2].

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 the *"Ct"* current transformer which models the set of 3 phase current transformers; the voltages are converted by the *"Vt"* voltage transformer which again models a set of 3 voltage transformers. The secondary currents and voltages are then measured by two measurement elements which simulate the analog filters of the relay.

3.1.1 Available Units

- One 3 phase current transformer (*"Ct"* block).
- One 3 phase voltage transformer (*"Vt"* block).
- One 3phase measurement element (*"Measurement"* block).
- One phase-phase voltage measurement element (*"Delta Measurement"* block).

3.1.2 Functionality

The *"Ct"* represents an ideal CTs. Using the CT default configuration the currents 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 10 ms.

3.1.3 Data input

The user must selects the 1A or the 5A Alstom PSEL 3000 relay model accordingly with the relay version he is going to simulate. The relay rated voltage must be set using the *Rated Voltage* (*"Unom"* parameter) combo box in the *"Measurement"* and in the *"Delta Measurement"* block dialog.

3.2 Protective elements

The Alstom PSEL 3000 relay models simulate a single quadrilateral phase-phase distance protection, a zero sequence overpower element which aims to detect fault involving the ground and a zero sequence overvoltage element with phase-phase voltage restrain used to detect capacitive voltage transformers faults (*VT supervision*).

3.2.1 Available Units

- A distance quadrilateral element with separated forward and reverse reach values (”PS-Zones*” and ”*PS-T” block).
- A zero sequence overpower element with inverse time trip characteristic (”PW-SR*” and ”*PW-TD” block).
- A residual overvoltage element used for the VT supervision(*"TCT"* block).
- A phase-phase single phase overvoltage element used for the VT supervision(*"TCT Ubc"* block).

3.2.2 Functionality

Distance protection The quadrilateral element allows to insert separated reactance reaches for forward and reverse zone. For each quadrilateral side a vector is generated using the related impedance; the angle between such vector multiplied by the operating current vector and the operating voltage vector must be smaller than 90° to declare the working point as internal to the shape.

Zero sequence overpower The zero sequence power is calculated by the "PW-SR" block which models also the minimum zero sequence current threshold *"Ir"*. The delay due to the *basic time "TB"* and to the time dependent *"TD"* ia calculated by the "PW-TD" block.

VT supervision The capacitive voltage transformers fault detector consists of a zero sequence overvoltage element (*"TCT"* block) and of ph-phase overvoltage element monitoring the phase B-phase C phase-phase voltage. The capacitive voltage transformer fault is declared when the zero sequence voltage is greater than the *"U"* threshold of the *"TCT"* block and the phaseB-phaseC voltage is greater than 80 %U_n.

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	Range	Note
	X1 (K and X)	PS-Zones	+X Reach (*"Xmax"*)	2-256 step 0.5 sec.Ω (1A)	$X1 = 0.2KXC$
					Check if
				0.4-51.2 step 0.1 Ω (5A)	the selected value is available in the relay
	X2 (K2)	PS-Zones	-X Reach (*"Xmin"*)	5-80 step 5 sec.Ω (1A)	
				1-16 step 1 sec.Ω (5A)	
	Rd	PS-Zones	+R Resistance (*"Rmax"*)	10-160 step 10 sec.Ω (1A)	
				2-32 step 2 sec.Ω (5A)	
			-R Resistance (*"Rmin"*)	10-160 step 10 sec.Ω	
				2-32 step 2 sec.Ω (5A)	
	ϕ	PS-Zones	Relay Angle (*"phi"*)	46;47;48;49;52;54;55;	
			-R Angle (*"gamma2"*)	57;62;64;67;70;76;79;	
			-R Angle (*"gamma2"*)	83;86°	
	T	PS-T	Time Setting (*"Tdelay"*)	0-19.8 step 0.02 s	
	Ir	PW-Sr	Operating Current (*"curopu"*)	0.1-1 step 0.1 In	In the *Voltage Polarizing* tab page
	Sr	PW-TD	Input Setting (*"Ipset"*)	0.6 sec VA	Fixed value
	TD (i)	PW-TD	Time Dial (*"Tpset"*)	1-9 step 1	
	TB	PW-TD	Time Shift (*"Tshift"*)	0.1-9.9 step 0.1 s	
	U (TCT)	TCT	Pickup Voltage (*"Uset"*)	0.03-0.08 step 0.01 Un	
	T (TCT)	TCT	Time Delay(*"Tdel"*)	30-450 step 30 s	

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 distance element, the TCT element, and the PW element; it operates the relay output contacts and the power breaker.

The relay output contacts are *"yout"* and *"y_s"*. *"yout"* is the contact operating the breaker, *"y_s"* is a signaling contact and is activated when the residual overpower element starts.

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:

- K and X settings (+X Reach (*"Xmax"*) allows some values which are not available in the relay, see 3.5.1.1 of [1]).
- QMPD module (optional directional module, 2.4.3 of [1]).

5 References

[1] Alstom T&D, GEC ALSTHOM T&D Protection & Controle Service Marketing HT Font de la Banquiére Avenue de Figuiéres 34975 LATTES CEDEX France. *PROTECTION DE SECOURS LIGNE PSEL 3000 Guide de Mise en Service et de Maintenance Version EDF MS/M 6781 EDF*, 1997.

[2] RTE, TE Normandie-Paris / GESCC Pole Etudes Expertises Controle Electrique A l'attention du Gestionnaire National Controle Commande Local 119, rue des trois FONTANOT 92024 NANTERRE CEDEX France. *Guide de mise en service d'une protection complémentaire et de secours ligne PSEL 3003*, 2007.