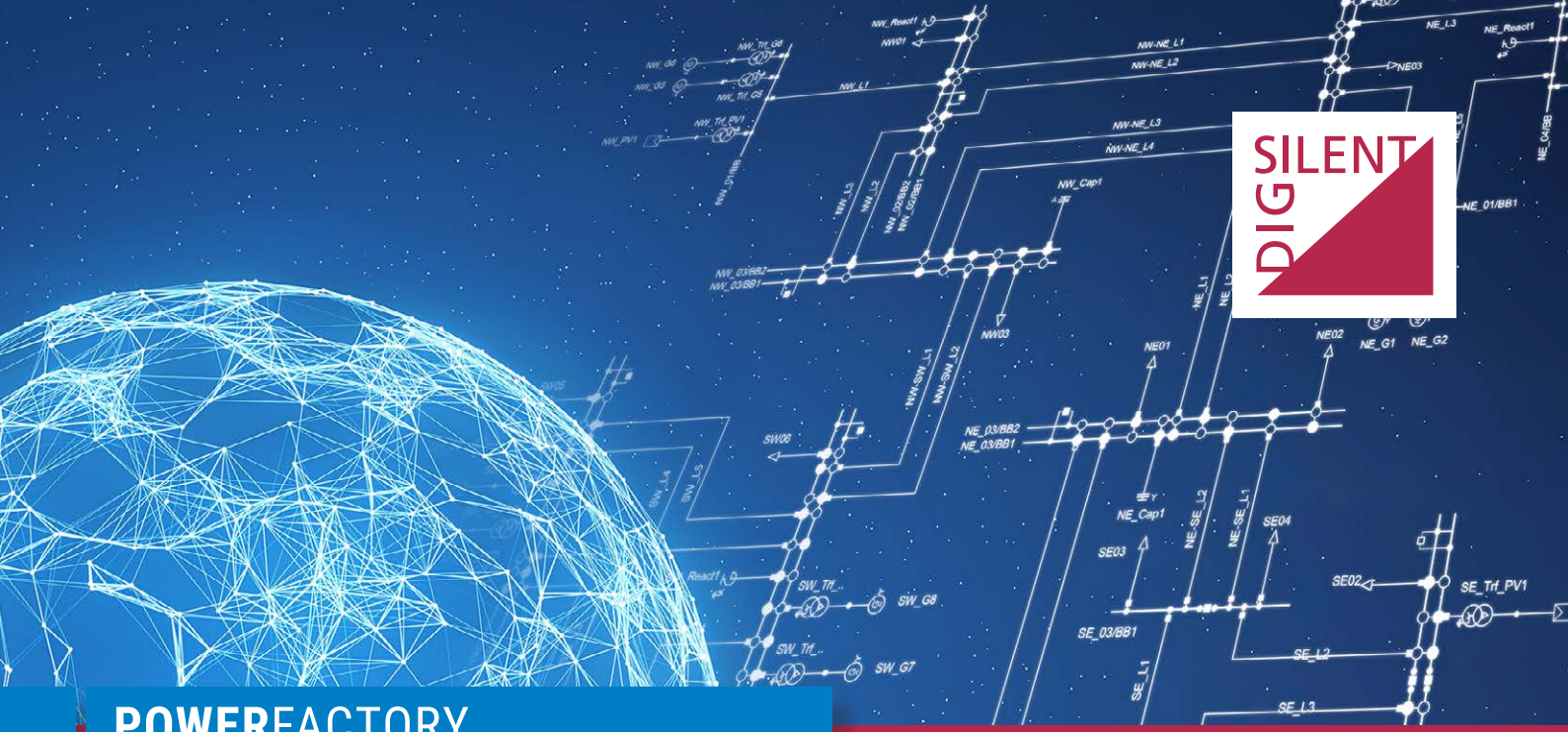

PowerFactory 2021

Technical Reference

AEG PS 462

PF2021

POWER SYSTEM SOLUTIONS

MADE IN GERMANY

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Contents

1 Model information

Manufacturer AEG

Model PS 462

Variants This PowerFactory relay model simulates a reduced set of the features present in the 310, 411, 412, and 610 firmware versions of the AEG PS 462 relay .

2 General description

The AEG PS 462 time-overcurrent protection device is used for selective short-circuit protection, ground fault protection and overload protection in medium- and high-voltage systems. The systems can be operated as impedance-grounded, resonant grounded or isolated-neutral systems. The multitude of functions incorporated into the protection devices enable the user to cover a wide range of applications in the protection of cable and line sections, transformers and motors.// The PS 462 time-overcurrent protection device is a four-pole (A, B, C, N) measurement relay with definite-time overcurrent protection, three stages, phase-selective, inverse-time overcurrent protection, single-stage, phase-selective, auto-reclosing control, motor protection with thermal overload protection, unbalance protection, switch on to fault protection and circuit breaker failure protection.

The PowerFactory AEG PS 462 relay model is a monolithic model and simulates a subset of the protective features available in the relay.

The model implementation has been based on the information available in the relay technical brochure and manual [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 a block which simulates the 3 phase CT and by a block which models a single phase CT detecting the earth current; the secondary currents are then measured in the relay model by two elements which simulate the digital sampling of the relay.

3.1.1 Available elements and input signals

The *Measurement and acquisition* feature consists of the following elements:

- One 3 phase current transformer (”Ct-3P” block).
- One single phase current transformer (”Ct-3I0” block).
- One 3 phase measurement element (”Measure Ph” block).
- One single phase measurement element (”Measure 3I0” block).

The following relay input signals are available to block the protective elements:

- *BlockIrefP* controlling *IrefP*
- *BlockI>* controlling *I>*
- *BlockI>>* controlling *I>>*
- *BlockI>>>* controlling *I>>>*
- *BlockIrefN* controlling *IrefN*
- *BlockIn>* controlling *In>*
- *BlockIn>>* controlling *In>>*
- *BlockIn>>>* controlling *In>>>*
- *BlockIrefneg* controlling *IrefNeg*
- *BlockI2>* controlling *I2>*
- *BlockI2>>* controlling *I2>>*

3.1.2 Functionality

The ”Ct-3P” and the ”Ct-3I0” 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 ”Measure Ph” and the ”Measure 3I0” block measure the currents sampling the input waves at 20 samples/cycles. The RMS values are calculated with a rectangular integration over a full cycle.

The input signals can be used to simulate the *reverse interlocking* feature.

3.1.3 Data input

The CT secondary rated current (1 or 5 A) value must be set in the ”Measure Ph” and in the ”Measure 3I0” block.

If no core CT is available please select the 3 phases CT also in the ”Ct-3I0” slot: the earth current will be calculated assuming that an Holmgreen’s connection of the phases is used.

3.2 Protective elements

A set of inverse time and definite time overcurrent elements is modeling the relay protective functions. All the inverse characteristics available in the relay are available in the inverse time model blocks. The breaker failure feature is also modeled.

3.2.1 Available Units

Overcurrent elements

- One 3-phase non-directional inverse time characteristic overcurrent element(”IrefP” block).
- Three 3-phase non-directional definite time overcurrent protection elements (”I>”, ”I>>” and ”I>>>” block).
- One residual non-directional inverse time characteristic overcurrent element(”IrefN” block).
- Three residual non-directional definite time overcurrent protection elements (”In>”, ”In>>” and ”In>>>” block).
- One negative sequence non-directional inverse time characteristic overcurrent element(”IrefNeg” block).
- Two negative sequence non-directional definite time overcurrent protection elements (”I2>” and ”I2>>” block).

Breaker failure

- One timer element (”TimerCBF” block).
- One logic element (”StartLogic” block).

3.2.2 Functionality

Overcurrent elements The inverse time overcurrent elements (”IrefP”, ”IrefN” and ”IrefNeg” block) support the following trip characteristics:

- 0 Definite time
- 1 Standard inverse
- 2 Very inverse
- 3 Extremly inverse
- 4 Long time inverse
- 5 Moderately inverse
- 6 Very inverse
- 7 Extremly inverse
- 8 Normally inverse

- 9 Short inverse
- 10 Long inverse
- 11 RI inverse
- 12 RXIDG

The relationship between current and time values for the ”1 Standard inverse”, the ”2 Very inverse”, the ”3 Extremly inverse” and the ”4 Long Time Inverse” characteristic complies with the IEC 60255-3 standards. The ”5 Moderately inverse”, the ”6 Very inverse”, the ”7 Extremly inverse”, the ”8 Normally inverse”, the ”9 Short inverse” and the ”10 Long inverse” characteristic complies with the ANSIIEEE C37.112 standards. The ”RI inverse” and the ”RXIDG” characteristic are special characteristics which are used mainly in combination with existing mechanical relays. The ”0 Definite time” characteristic is a time constant characteristic which allow to define the DTOC relay operation mode.

Breaker failure The logic element (”Starting” block) is collecting the starting signals of the overcurrent elements. The input signals are combined by an OR logic and the resulting signal is sent to the timer element (”TimerCBF” block) together with the relay trip output signal. When both signals are *on* for a time longer than the time set in the timer element, a breaker failure condition is declared.

3.2.3 Data input

The relationships between the relay settings and the model parameters can be found in the following tables (the relay model parameter names are listed between brackets):

Address	Relay Setting	Model block	Model setting	Note
17000	DTOC I>	I>	Pickup Current (Ipset)	
17004	DTOC tI>	I>	Time Setting (Tset)	
17001	DTOC I>>	I>>	Pickup Current (Ipset)	
17006	DTOC tI>>	I>>	Time Setting (Tset)	
17002	DTOC I>>>	I>>>	Pickup Current (Ipset)	
17007	DTOC tI>>>	I>>>	Time Setting (Tset)	
17003	DTOC IN>	In>	Pickup Current (Ipset)	
17008	DTOC tIN>	In>	Time Setting (Tset)	
17009	DTOC IN>>	In>>	Pickup Current (Ipset)	
17010	DTOC tIN>>	In>>	Time Setting (Tset)	
17018	DTOC IN>>>	In>>>	Pickup Current (Ipset)	
17019	DTOC tIN>>>	In>>>	Time Setting (Tset)	
17096	IDMT: Enabled USER	IrefP	Out of Service(outserv)	
		IrefNeg	Out of Service(outserv)	
		IrefN	Out of Service(outserv)	
72050	IDMT: Iref,P	IrefP	Current Setting (Ipset)	
72056	IDMT: Characteristic P	IrefP	Characteristic (pcharac)	
72053	IDMT: Factor kt,P	IrefP	Time Dial (Tpset)	
72051	IDMT: Iref,neg	IrefNeg	Current Setting (Ipset)	
72057	IDMT: Characteristic neg	IrefNeg	Characteristic (pcharac)	
72054	IDMT: Factor kt,neg	IrefNeg	Time Dial (Tpset)	
72052	IDMT: Iref,N	IrefN	Current Setting (Ipset)	
72058	IDMT: Characteristic N	IrefN	Characteristic (pcharac)	
72055	IDMT: Factor kt,N	IrefN	Time Dial (Tpset)	
18090	I2>: Enabled USER	I2>	Out of Service(outserv)	

Address	Relay Setting	Model block	Model setting	Note
		I2>>	Out of Service(outserv)	
18091	I2> : Ineg>	I2>	Pickup Current (Ipset)	
18092	I2> : tIneg>	I2>	Time Setting (Tset)	
18093	I2>> : Ineg>>	I2>>	Pickup Current (Ipset)	
18094	I2>> : tIneg>>	I2>>	Time Setting (Tset)	

Breaker failure :

Address	Relay Setting	Model block	Model setting	Note
22080	CBF Enabled User	TimerCBF	Out of Service (outserv)	
11067	t_{CBF}	TimerCBF	Time Setting (Tdelay)	

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 elements and relay output signals

The following elements are part of the *Output logic* feature:

- one overcurrent elements trip element ("TripLogic" block).
- one breaker failure trip element ("CBFLogic" block).

The following relay output signals are available:

- "TripCmd1"
- "TripCmd2"
- "startIP" (3 phase elements start signal, single start signals combined by an OR boolean operator)
- "startIn" (residual elements start signal, single start signals combined by an OR boolean operator)
- "startIneg" (negative sequence elements start signal, single start signals combined by an OR boolean operator)
- "Starting"
- "youtCBF"

3.3.2 Functionality

The "TripLogic" block collects the trip signals coming from the overcurrent protective elements and operates the "TripCmd1" and the "TripCmd2" relay output contact. The "TripLogic" block output contacts are "TripCmd1" and "TripCmd2". By default only "TripCmd1" trips the power breaker but the trip logic can be modified in the "Logic" tab page of the "TripLogic" block.

The "CBFLogic" block gets the breaker failure logic trip commands and operates the "youtCBF"relay output contact. The "CBFLogic" block output contact is "yout".

The "Starting" relay output signal is the "StartLogic" output signal and is *on* when at least one overcurrent element has started (current greater than its trip threshold).

3.3.3 Data input

To disable the relay model ability to open the power circuit breaker simply disable the ”TripLogic” and the ”CBFLogic” block.

4 Features not supported

The following features are not supported:

- User configurable *Tripping Matrix and Latch* (any overcurrent protective element trips the relay).
- Overcurrent element dynamic threshold.
- Inverse elements delayed reset.
- Overload protection.
- Reclosing feature.
- Differential feature.
- Logic for heavy starting and protection with blocked rotor.
- Start-up frequency monitoring and reclosure blocking.
- Start-up number monitoring.
- Protection against low load.
- *Measuring Circuit Monitoring*.

Please notice that time setting ranges with different step size e.g. tIN>> 0.01-9.99 s (step size = 0.01 s) and for tIN>> 10.0-99.9 s (step size = 0.1 s) are modeled with the full range and smallest step size -> tIN>> 0.01-99.9 s (step size = 0.01s)

5 References

[1] ALSTOM Energietechnik GmbH, Protection and Control Unit, Lyoner Straβe 44-48,D-60528 Frankfurt P.O. Box 710143, D-60491 Frankfurt Germany. *PS 462 PS 482 Time-Overcurrent Protection Device AFSV.06.057910499EN TiPDF*.

[2] ALSTOM Energietechnik GmbH, Protection and Control Unit, Lyoner Straβe 44-48,D-60528 Frankfurt Postfach 71 01 07, D-60491 Frankfurt Germany. *Time-Overcurrent Protection Device PS 462 Version -301 -401 -601 88462-301-401-601 / AFSV.12.05820 EN*.