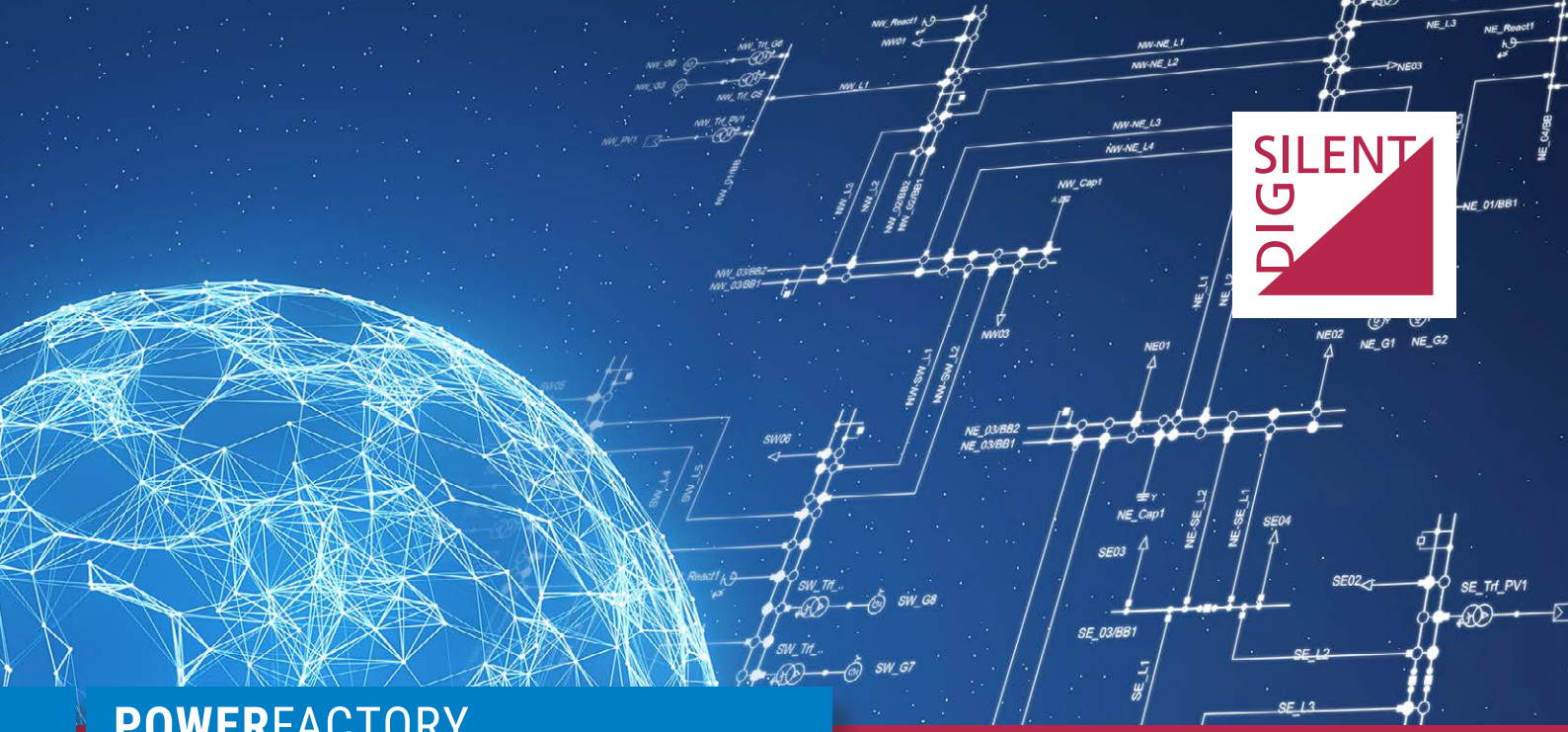

POWERFACTORY

PowerFactory 2021

Technical Reference

AEG PS 431

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

November 15, 2019
PowerFactory 2021
Revision 924

Contents

1 Model information

Manufacturer AEG

Model PS 431

Variants This PowerFactory relay model covers the features present in the 302, 401 and 602 version of the AEG PS 431 relay .

2 General description

The AEG PS 431 time-overcurrent protection devices are used for selective short-circuit protection in high-voltage networks. The networks can be operated with impedance neutral grounding, with resonant grounding or with an isolated neutral. The AEG PS 431 time-overcurrent protection device is a four-pole (A, B, C, N) measurement relay with phase-selective phase current timer stage with DTOC and IDMT characteristics, time-lag high set phase current timer stage, residual current timer stage with DTOC and IDMT characteristics, time-lag high set residual current timer stage, tripping matrix and circuit-breaker failure protection.

The PowerFactory AEG PS 431 relay model is a monolithic model and simulate most of the protective elements available in the relay.

The model implementation has been based on the information available in the relay technical brochures and manual [2] [1] [3].

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:

- *Block I>* controlling *I> IDMT* and *I> DTOC*
- *Block In>* controlling *In> IDMT* and *In> DTOC*

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 three-phase non-directional overcurrent protection with Inverse Definite Minimum Time (IDMT) characteristic element(”I> IDMT” block).
- One three-phase non-directional overcurrent protection with Definite Time(DTOC) characteristic element (”I> DTOC” block).
- One three-phase non-directional overcurrent protection Time-lag (definite time) high set element (”I>>” block).
- One residual non-directional overcurrent protection with Inverse Definite Minimum Time (IDMT) characteristic element(”In> IDMT” block).

- One residual non-directional overcurrent protection with Definite Time(DTOC) characteristic element (”In> DTOC” block).
- One residual non-directional overcurrent protection Time-lag (definite time) high set element (”In>>” block).

Breaker failure

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

3.2.2 Functionality

Overcurrent elements The inverse time overcurrent elements (”I> IDMT” and ”In> IDMT” block) support the following trip characteristics:

- Extremly inverse.
- Long time inverse.
- Normally inverse.
- RI inverse.
- Very inverse.

The relationship between current and time values for the ”Normal Inverse”, ”Very Inverse”, ”Extremely Inverse” and ” Long Time Inverse” characteristic complies with the IEC 60255-3 standards. The ”RI inverse” characteristic is a special characteristic used mainly in combination with existing mechanical relays.

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):

Overcurrent elements :

Address	Relay Setting	Model block	Model setting	Note
1713	IDMT Base current I_B	I> IDMT	Current Setting (Ipset)	
1736	IDMT Characteristic factor	I> IDMT	Time Dial (Tpset)	
1735	IDMT Characteristic type	I> IDMT	Characteristic (pcharac)	
1714	IDMT Base current I_{NB}	In> IDMT	Current Setting (Ipset)	
1739	IDMT Characteristic factor	In> IDMT	Time Dial (Tpset)	
1738	IDMT Characteristic type	In> IDMT	Characteristic (pcharac)	
1700	DTOC Threshold operate value I>	I> DTOC	Pickup Current (Ipset)	
1704	DTOC Delay time $t_{I>}$:	I> DTOC	Time Setting (Tset)	
1701	DTOC Threshold operate value I>>	I>> DTOC	Pickup Current (Ipset)	
1706	DTOC Delay time $t_{I>>}$:	I>> DTOC	Time Setting (Tset)	
1703	DTOC Threshold operate value IN>	In> DTOC	Pickup Current (Ipset)	
1708	DTOC Delay time $t_{IN>}$:	In> DTOC	Time Setting (Tset)	
1709	DTOC Threshold operate value IN>>	In>> DTOC	Pickup Current (Ipset)	
1710	DTOC Delay time $t_{IN>>}$:	In>> DTOC	Time Setting (Tset)	

To enable the DTOC (UMZ) mode disable the ”I> IDMT” and the ”In> IDMT” block and enable the ”I> DTOC” and the ”In> DTOC” block. To enable the IDMT (AMZ) mode enable the ”I> IDMT” and the ”In> IDMT” block and disable the ”I> DTOC” and the ”In> DTOC” block.

Breaker failure :

Address	Relay Setting	Model block	Model setting	Note
1720	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:

- ”Tripping”

- ”youtCBF”

3.3.2 Functionality

The ”TripLogic” block collects the trip signals coming from the overcurrent protective elements and operates the ”Tripping” relay output signal. The ”TripLogic” block output contact is ”yout”.

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

Both ”TripLogic” and ”CBFLogic” operates the power breaker.

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).
- *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] AEG Starkstromanlagen Dresden GmbH, Bereich Schutz- und Schaltanlagenleittechnik System Protection and Control, Konigsbrucker Strasse 124,D - 01099 Dresden P.O. Box 10 03 60, D-01073 Dresden Germany. *AEG T&D PS 431 Time-Overcurrent Protection Device SLTS.06.04185PDF0597EN Ti*.

[2] ALSTOM Energietechnik GmbH, Protection and Control Unit, Lyoner Straβe 44-48,D-60528 Frankfurt Postfach 71 01 07, D-60491 Frankfurt Germany. *PS 431 Time-Overcurrent Protection Device AFSV.06.04186PDF0899EN MM*.

[3] ALSTOM Energietechnik GmbH, Protection and Control Unit, Lyoner Straβe 44-48,D-60528 Frankfurt Postfach 71 01 07, D-60491 Frankfurt Germany. *Uberstromzeitschutzeinrichtung PS 431 Version - 302- 401 - 602 89431-302-401-602 / SLTS.12.04951*.