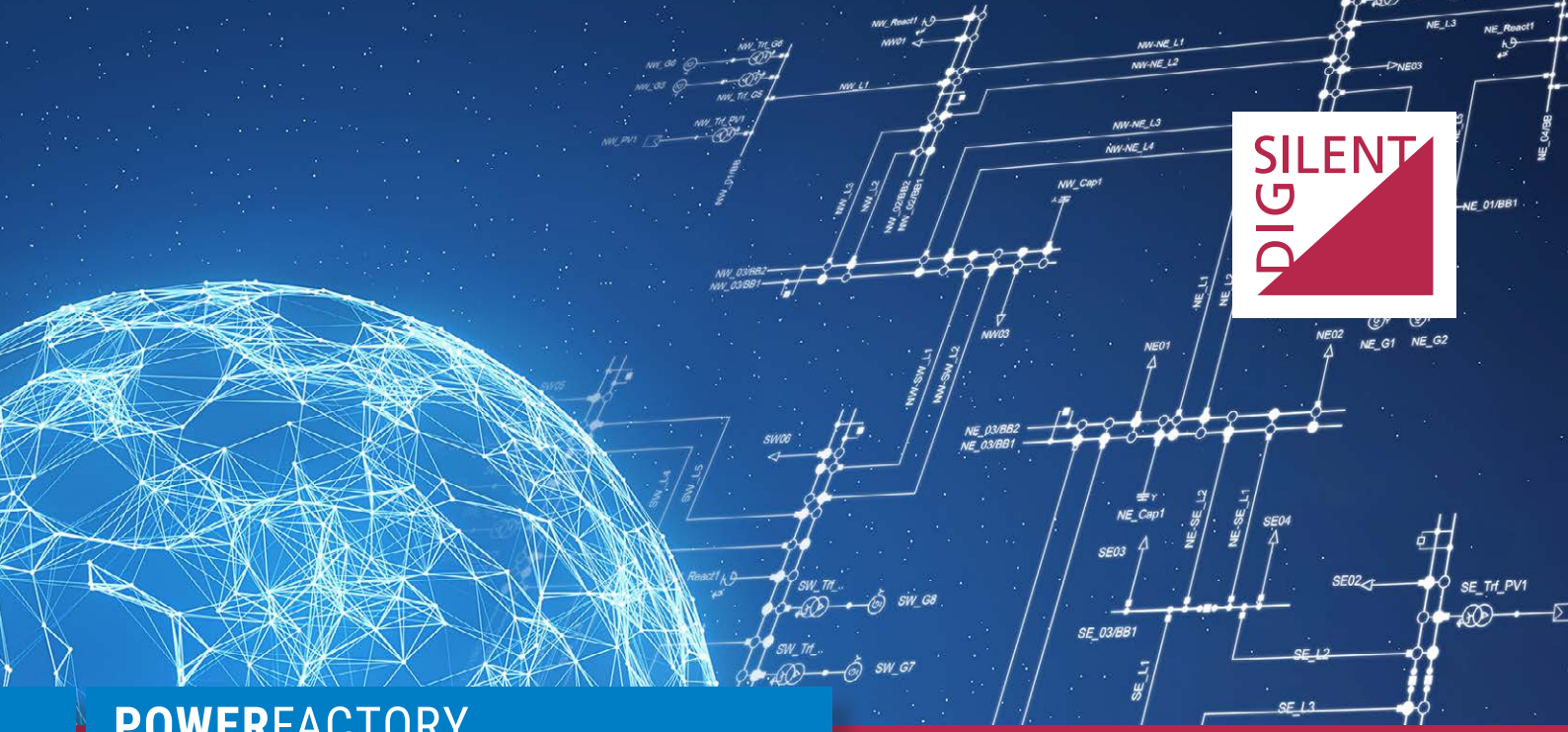

POWERFACTORY

PowerFactory 2021

Technical Reference

Schneider SEPAM 10

PF2021

POWER SYSTEM SOLUTIONS

MADE IN GERMANY

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1 Model information

Manufacturer Schneider

Model SEPAM 10

Variants The Schneider SEPAM 10 PowerFactory relay model simulates the protective features present in the Schneider SEPAM 10 relay models(firmware version 2.0).

2 General description

The Sepam series 10 family of protection relays is designed for the protection and operation of MV/LV utility substations and electrical distribution networks in industrial installations. It comprises three models suitable for normal protection applications involving current metering:

- Sepam series 10 N, for earth fault protection.
- Sepam series 10 B, for phase overcurrent, earth fault and thermal overload protection.
- Sepam series 10 A, for phase overcurrent, earth fault and thermal overload protection, which may require logic inputs and a communication port.

The PowerFactory Schneider SEPAM 10 relay model is a monolithic models and simulate most of the protective features available in the relays including the $2nd$ *harmonic blocking* and the *In rush detection* feature. The setting ranges which are entered in the relay model are the ranges present in the relay *Standard version*.

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

3 Supported features

3.1 Measurement and acquisition

It represents the interface between the power system and the relay protective elements.

The phase 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 three 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” block).
- One neutral current transformer (”Core Ct” block).
- One 3 phase measurement element (”Meas. Phase” block).
- One 3phase 2^{nd} harmonic measurement element (”Meas. Phase 2nd harmonic” block).
- One single phase neutral current measurement element (”Meas. Earth” block).

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

- *phase blocking input* controlling the *I> IDMT I> DT I>> IDMT I>> DT I>>>* block
- *grnd blocking input* controlling the *I0> IDMT I0> DT I0>>* block

3.1.2 Functionality

The ”Ct” and the ”Core Ct” 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 input current and voltage values are sampled by the ”Measure Ph” and the ”Measure Seq” block at 20 samples/cycle. The values are processed by a DFT filter, operating over a cycle, which then calculates the voltage and current RMS values used by the protective elements.

3.1.3 Data input

The CT secondary rated current (1 or 5 A) value must be set in the ”Meas. Phase”, in the ”Meas. Earth” and in the ”Meas. Phase 2nd harmonic” block.

If no core CT is available please select the 3 phases CT also in the ”Core Ct” 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.

3.2.1 Available Units

- Two 3 phase inverse time elements (”I> IDMT” and ”I>> IDMT” block).
- Three 3 phase time defined element (”I> DT”, ”I>> DT”, and ”I>>>” block).
- One earth current inverse time elements (”I0> IDMT” block).
- Two earth current time defined element (”I0> DT”, ”I0>>” block).
- One thermal image element (”49RMS” block).

3.2.2 Functionality

Each relay inverse time overcurrent element is represented in the model by a couple of blocks: one *TOC* and one *IOC* block. Indeed each inverse time overcurrent element can be set in the relay to use one of the available inverse characteristics or a definite time trip characteristic with a different current threshold range. The protective element in the relay is unique therefore only one between the *TOC* (enabling an inverse characteristic) and the *IOC* (implementing a time definite characteristic) can be enabled at the same time. The block couples are:

- I> IDMT and I> DT
- I>> IDMT and I>> DT
- I0> IDMT and I0> DT

The inverse time overcurrent elements (”I> IDMT”, ”I>> IDMT” and ”I0> IDMT” block) support the following trip characteristics:

- SIT/A IEC standard inverse
- VIT/B IEC very inverse
- LTI/B IEC long-time inverse
- EIT/C IEC extremely inverse
- MI/D IEEE moderately inverse
- VI/E IEEE very inverse
- EI/F IEEE extremely inverse
- RI

A delayed reset characteristic is available for the any IEEE or IEC tripping characteristic and can be enabled or disabled by the user.

The relationship between current and time values for the ”SIT/A IEC standard inverse”, the ”VIT/B IEC very inverse”, the ”LTI/B IEC long-time inverse” and the ”EIT/C IEC extremely inverse” characteristic complies with the IEC 60255-3 standards. The ”MI/D IEEE moderately inverse”, the ”VI/E IEEE very inverse”, and the ” EI/F IEEE extremely inverse” characteristic complies with the ANSIIEEE C37.112 standards. The ”RI” characteristic is a special characteristic which is used mainly in combination with existing mechanical relays.

In rush detection Inside the relay model has been implemented the *In rush detection* feature using the appearance (I more than 10%) disappearance (I below 5%) of the phase currents. The time logic present in the relay is simulated in detail in the model. It can be configured to block the protective elements or to increase the trip thresholds.

2^{nd} **harmonic blocking** The ground elements can be blocked when the current 2^{nd} harmonic content is greater than a given (fixed) threshold.

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
	I> tripping curve	I> IDMT	Out of Service(outserv)	Disable the model blocks when the relay setting is *OFF* enable "I> DT" and disable
		I> DT	Out of Service(outserv)	"I> IDMT" when is *DT*, disable "I> DT" and enable "I> IDMT" when is not *DT*
	I> set point	I> IDMT	Current Setting (Ipset)	
		I> DT	Current Setting (Ipset)	
	I> tripping curve	I> IDMT	Characteristic (pcharac)	
	I> Time Delay	I>> IDMT	Time Dial (Tpset)	
		I>> DT	Time Dial (Tpset)	
	I>> tripping curve	I>> IDMT	Out of Service(outserv)	Disable the model blocks when the relay setting is *OFF* enable "I>> DT" and disable
		I>> DT	Out of Service(outserv)	I>> IDMT" when is *DT*, disable "I>> DT" and enable "I>> IDMT" when is not *DT*
	I>> set point	I>> IDMT	Current Setting (Ipset)	
		I>> DT	Current Setting (Ipset)	
	I>> tripping curve	I>> IDMT	Characteristic (pcharac)	
	I>> Time Delay	I>> IDMT	Time Dial (Tpset)	
		I>> DT	Time Dial (Tpset)	
	I>>> tripping curve	I>>>	Out of Service(outserv)	Disable the model block when the relay setting is *OFF*
	I>>> set point	I>>>	Pickup Current (Ipset)	
	I>>> Time Delay	I>>>	Time Setting (Tset)	
	Io> tripping curve	Io> IDMT	Out of Service(outserv)	Disable the model blocks when the relay setting is *OFF* enable "Io> DT" and disable
		Io> DT	Out of Service(outserv)	"Io> IDMT" when is *DT*, disable "Io> DT" and enable "Io> IDMT" when is not *DT*
	Io> set point	Io> IDMT	Current Setting (Ipset)	
		Io> DT	Current Setting (Ipset)	
	Io> tripping curve	Io> IDMT	Characteristic (pcharac)	
	Io> Time Delay	Io>> IDMT	Time Dial (Tpset)	
		Io>> DT	Time Dial (Tpset)	
	Io>> tripping curve	Io>>	Out of Service(outserv)	Disable the model block when the relay setting is *OFF*
	Io>> set point	Io>>	Pickup Current (Ipset)	
	Io>> Time Delay	Io>>	Time Setting (Tset)	
	Thermal Overload Protection Activity	49RMS	Out of Service(outserv)	

Address	Relay Setting	Model block	Model setting	Note
	Thermal Overload Protection Tripping set point	49RMS	Current Setting (Ipset)	
	Thermal Overload Protection trip threshold	49RMS	Current Setting (Ipset)	
	Thermal Overload Protection Time constant T	49RMS	Time Dial (Tpset)	

In rush detection The *In rush detection* feature can be configurated using the variables present in the in the ”Logic” tab page of the ”CLPU Phase” block and of the ”CLPU Ground” block.

The blocking feature can be enabled setting equal to ”1” the ”BLOCK” variable .

The setpoint increase can be controled setting the”multiplier” variable” in the ”Logic” tab page of the ”CLPU Ground” block. ”multiplier” equal to 1 disables the feature.

Which protective elements must be affected by the inrush detection can be set using the ”IM”, the ”IMM” and the ”IMMM” variable inside ”CLPU Phase” and the ”I0M” and the ”I0MM” variable inside ”CLPU Ground”: when such variables are equal to ”1” the *In rush detection* feature operates a block or a setpoint increase; a value equal to ”0” means that the relevant protective element will not be affected.

The ”Tclpu” time delay setting can be set using the ”Time setting” variable of the ”Tclpu” block.

2^{nd} **harmonic blocking** The 2^{nd} harmonic blocking can be enabled setting equal to 1 the *H2RES* parameter in the ”Logic” tab page of the ”CLPU Ground” block .

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 trip logic is implemented by the ”Output Logic” block.

The relay trip output signal is ”yout”.

3.3.2 Functionality

The ”Output Logic” block collects the trip signals coming from the overcurrent protective elements and, when any protective element trips, operates the power breaker and the ”yout” relay output contact.

3.3.3 Data input

To disable the relay model ability to open the power circuit breaker simply disable the ”Output Logic” block.

4 Features not supported

The following features are not supported:

- Trip circuit supervision.

5 References

[1] Schneider Electric, Esslinger Strasse 7, 70771 Leinfelden-Echterdingen, Germany. *Sepam Series 10 Electrical Network Protection Reference Manual 03/2009 SEPED307003*, 2009.