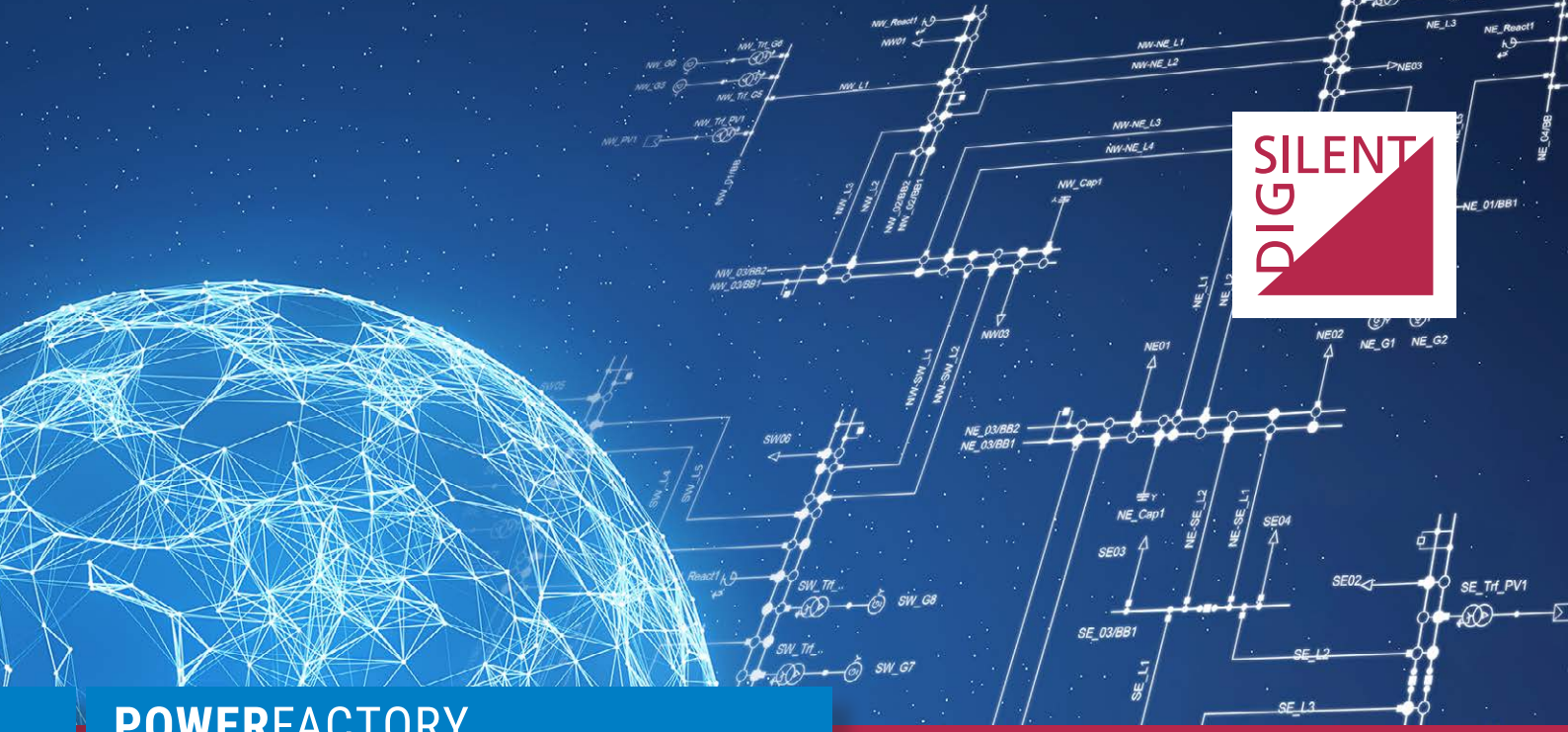

PowerFactory 2021

Technical Reference

Alstom LFCB

PF2021

POWER SYSTEM SOLUTIONS

MADE IN GERMANY

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Contents

1 Model information

Manufacturer Alstom

Model LFCB

Variants These PowerFactory relay models can be used to simulate the Alstom LFCB 102 and LFCB 103 digital differential relays.

2 General description

The Alstom LFCB 102 and 103 protective relays are digital, phase selective, true differential protections for two and three terminal transmission and sub-transmission lines. The relays are an all digital, microprocessor based design for use with modern digital communication systems. Currents are compared on a per phase basis, obviating the biasing problem of the conventional summation current trans-former approach and providing phase selection information for single pole tripping and to identify the fault type. Relays at all ends operate simultaneously providing rapid fault clearance irrespective of whether the fault current is fed from all terminals or from only one line end.

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

- LFCB 102 (two current inputs)
- LFCB 103 (three current inputs)

Please notice that the models listed above are identical except that for the number of current inputs.

The model implementation has been based on the information available in the relay documentation provided by the manufacturer and freely available [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 set of elements modeling the 3phase CTs; the secondary currents are then measured by a measurement element for each CT which is modeling the digital filters of the relay.

3.1.1 Available Units

- LFCB 102
  - Two 3 phase current transformers (”Winding 1 Ct” and ”Winding 2 Ct” block)

  - Two measurement elements (”Measure 1” and ”Measure 2” block)
- LFCB 103
  - Three 3 phase current transformers (”Winding 1 Ct”, ”Winding 2 Ct” and ”Winding 3 Ct” block)
  - Three measurement elements (”Measure 1”, ”Measure 2” and ”Measure 3” block)

3.1.2 Functionality

The ”Winding 1 Ct” and the ”Winding 2 Ct” block (and ”Winding 3 Ct” in the LFCB 103 model type) 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 currents are sampled at 8 samples/cycle. The values are processed by a DFT filter, operating over a cycle, which then calculates the current values used by the differential element.

3.1.3 Data input

The CT secondary rated current (1 or 5 A) value must be set in the measurement elements (*”Nominal current”* parameter).

3.2 Protective elements

A differential element with an ancillary RMS calculation element simulates the relay differential features.

3.2.1 Available Units

- one 3 phase differential element (”Differential” block).
- one measurement element (”Diff RMS meas” block).

3.2.2 Functionality

The following features are available in the differential element (”Differential” block):

- Differential with user configurable threshold (available threshold values from 20% to 200% I_n with step 5% I_n).
- Dual slope percentage bias restraint characteristic with user configurable restraint percentages and 2^{nd} slope threshold.

The differential element calculates the average of the currents measured by ”Measure 1” and by ”Measure 2” (and by ”Winding 3 Ct’ in the LFCB 103 model type). The average value is then

used to calculate the differential threshold considering a double bias characteristic with user configurable restraint percentages and 2^{nd} slope threshold.

The measurement element (”Diff RMS meas” block) is used to calculate the RMS value of the differential current. The differential current vector components (or instantaneous values during the EMT simulation) are calculated by the differential element.

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	Note
	I_{S1}	Differential	Differential Current base threshold (Idiff)	
	K_1	Differential	Restrain Percentage 1 (Irestrpercent1)	
	I_{S2}	Differential	Restraint Current 2nd threshold (Ipset2)	
	K_1	Differential	Restrain Percentage 2 (Irestrpercent1)	

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 Units and Output signals

- One output element (”Logic” block).

The following relay output signals are available:

- OUT1
- OUT2
- OUT3
- OUT4
- OUT5

3.3.2 Functionality

The ”Logic” block gets the trip signal coming from the differential element; it operates the relay output contacts and the power breaker. The signal operating the breaker is ”OUT1”, the other relay output signals are,at the moment, not set.

3.3.3 Data input

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

4 Features not supported

The following features are not supported:

- Intertrip facility.
- Permissive Intertrip facility.
- Romete end data transmission delay (ideal no delay transmission is used).

5 References

[1] ALSTOM T&D Protection & Control Ltd, St Leonards works, Stafford ST17 4LX England. *Service Manual Type LFCB 102 Digital Current Differential Relay R-5905E*, 1998.

[2] ALSTOM T&D Protection & Control Ltd, St Leonards works, Stafford ST17 4LX England. *Type LCFB Digital Current Differential Relay R-4054M*, 1999.