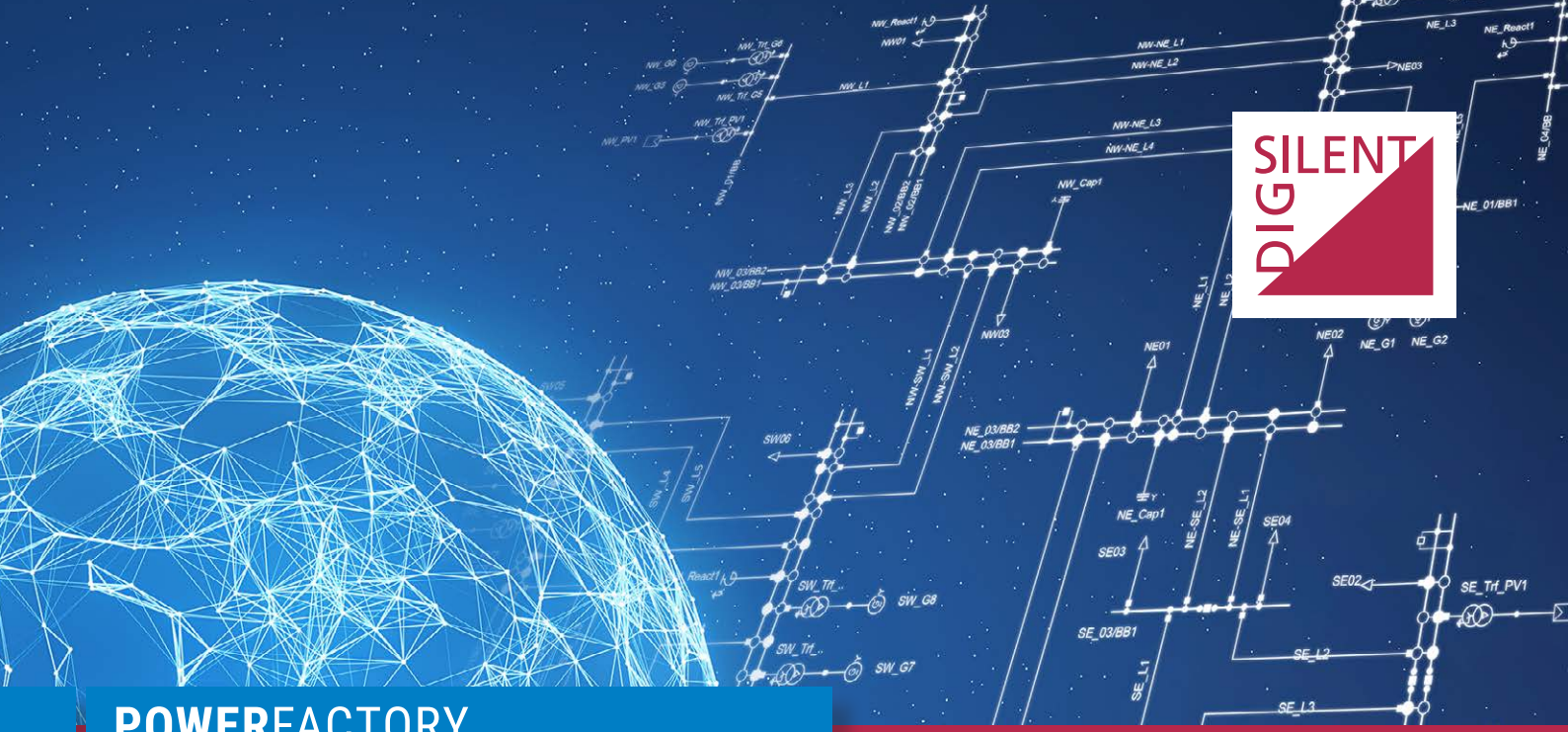

PowerFactory 2021

Technical Reference

Alstom MBCH

PF2021

POWER SYSTEM SOLUTIONS

MADE IN GERMANY

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May 6, 2019
PowerFactory 2021
Revision 892

Contents

1 Model information

Manufacturer Alstom

Model MBCH

Variants These PowerFactory relay models can be used to simulate the Alstom MBCH 12, 13 and 16 static differential relays. However please consider that the models have been implemented with a reduced set of the features available in the relays.

2 General description

The Alstom MBCH 12, 13 and 16 are high-speed, single phase, biased differential relays suitable for the protection of two- or three-winding power transformers, autotransformers, or generator transformer units. Up to six biased current inputs can be provided to cater for power transformers with more than two windings and/or more than one circuit-breaker controlling each winding, as in 'mesh' or 'one and a half circuit breaker' bus bar arrangements.

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

- MBCH 12 (two current inputs)
- MBCH 13 (three current inputs)
- MBCH 16 (six 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 single phase CTs; the secondary currents are then measured by a measurement element for each CT which is modeling the analog filter of the relay.

3.1.1 Available Units

- MBCH 12
  - Two single phase current transformers ("Winding 1 Ct" and "Winding 2 Ct" block)

  - Two measurement elements (”Measure 1” and ”Measure 2” block)
- MBCH 13
  - Three single 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)
- MBCH 16
  - Six single phase current transformers (”Winding 1 Ct”, ”Winding 2 Ct”, ”Winding 3 Ct” ,”Winding 4 Ct”, ”Winding 5 Ct” and ”Winding 6 Ct” block)
  - Six measurement elements (”Measure 1”, ”Measure 2”, ”Measure 3”, ”Measure 4”, ”Measure 5” and ”Measure 6” block)

3.1.2 Functionality

The ”Winding 1 Ct” and the ”Winding 2 Ct” block (and ”Winding 3 Ct”, ”Winding 4 Ct”, ”Winding 5 Ct”, ”Winding 6 Ct” in the model types where they are available) 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 measurement blocks simulate a second order low pass analog filter with DC component filter; the time constant is 1 ms.

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: 10%, 20%, 30%, 40%, 50% I_n).
- Dual slope percentage bias restraint characteristic.

The differential element calculates the average of the currents measured by ”Measure 1” and by ”Measure 2” (and by ”Winding 3 Ct”, ”Winding 4 Ct”, ”Winding 5 Ct”, ”Winding 6 Ct” in the model types where they are available) . The average value is then used to calculate the differential threshold considering a a double bias characteristic with 20% linear restraint up to I_n and 80% above I_n.

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
	Minimum basic setting Biased feature	Differential	Differential Current base threshold (”Idiff”)	

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

- One output element (”Logic” block).

3.3.2 Functionality

The ”Logic” block gets the trip signal coming from the differential element; it operates the relay output contact and the power breaker.

The relay output contact is ”OUT1”.

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:

- Magnetising inrush restraint.
- Transformer over-excitation.
- Unrestrained differential threshold (High-set feature).

5 References

[1] ALSTOM T&D Protection & Control Ltd, St Leonards works, Stafford ST17 4LX England. *Type MBCH 12, 13, 16 Biased Differential Protection for Transformers, Generators and Generator Transformers R-6070K*, 1998.

[2] ALSTOM T&D Protection & Control Ltd, St Leonards works, Stafford ST17 4LX England. *Service Manual Type MBCH Biased Differential Relay R-8017G*, 1999.