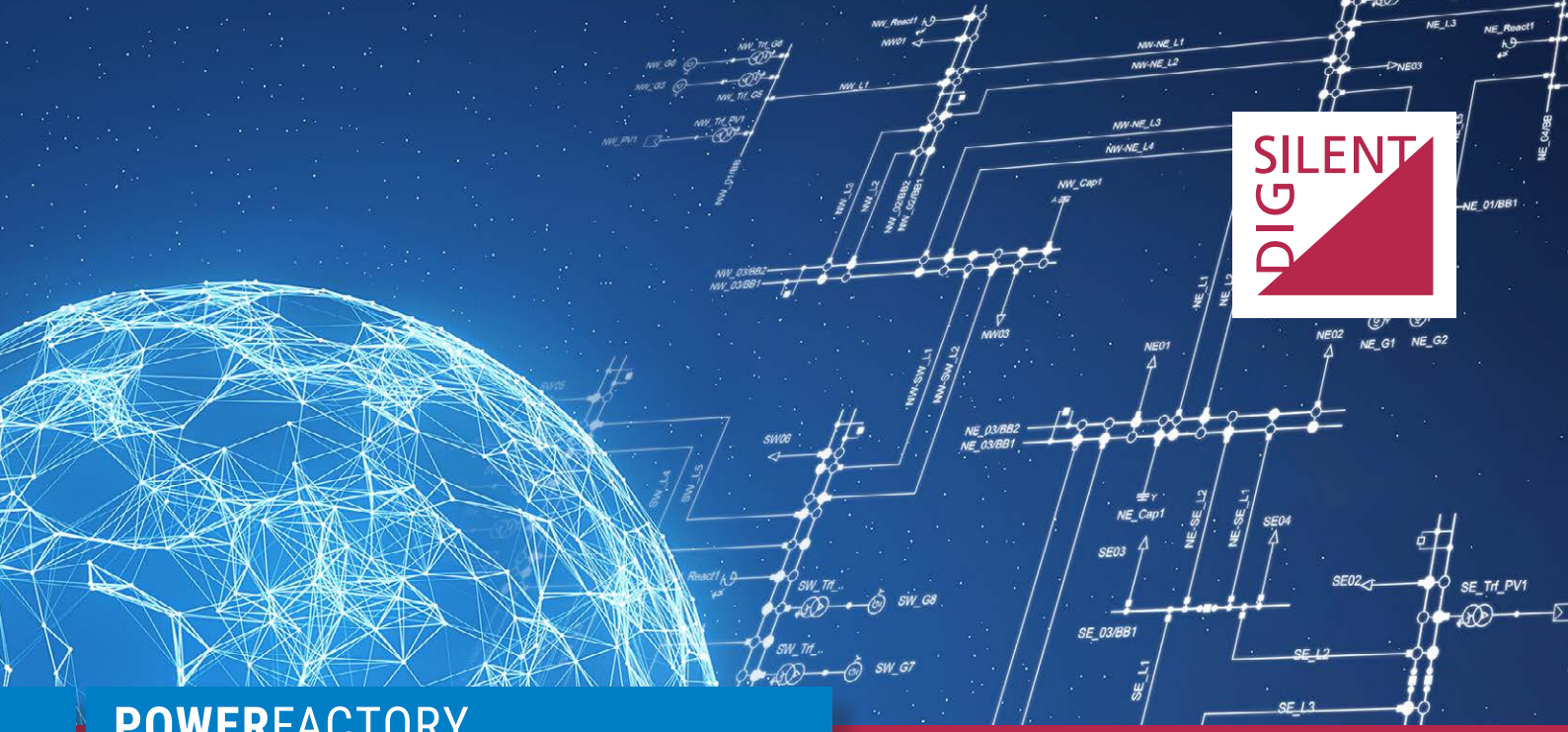

POWERFACTORY

PowerFactory 2021

Technical Reference

ABB REJ 527

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POWER SYSTEM SOLUTIONS

MADE IN GERMANY

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Contents

1 Model information

Manufacturer ABB

Model REJ 527

Variants The ABB REJ 527 PowerFactory relay model simulates the features present in the REJ 527B 411BAA and in the REJ 527B 418BAA relay (Software revision V235).

2 General description

The directional or non-directional earth-fault relay ABB REJ 527 is intended for earth-fault protection in medium voltage distribution networks but can also be used for protection of generators, motors and transformers.

The ABB REJ 527 relay has been modeled using one PowerFactory ABB REJ 527 relay model which includes any protective element available in the relay.

The PowerFactory ABB REJ 527 relay model consists of the measurement and acquisition units, the protective elements, the start situation detection logic, the breaker failure feature and the output logic.

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

3 Supported features

3.1 Measurement and acquisition

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

The primary current is measured by one current transformer (”Ct” block), the primary voltage by one voltage transformer (”Vt” block). Please notice that the voltage transformer must provide directly the zero sequence voltage. One measurement unit (”Measure” block) is fed by this CT and this VT.

3.1.1 Available Units

- one 3 phases or single phase current transformer (’Ct” block).
- one 3phases/single phase voltage transformer (”Vt” block).
- one single phase measurement element (”Measure” block).

3.1.2 Functionality

The ”Ct” block represents an ideal CT. Using the CT default configuration the current at the primary side is 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 signals are sampled in the relay model at 20 samples/cycle; a DFT filter operating over a cycle calculates the current values used by the protective elements. Please notice that no info is available in the manual about the sampling rate. For this reason an implementation common in many protective relays has been used.

3.1.3 Data input

Please notice that the CT secondary nominal current and the VT secondary nominal voltage value must be entered in the measurement unit.

3.2 Protective elements

A set of inverse time and definite time overcurrent elements is modeling the relay earth overcurrent protective functions. The inverse characteristics available in the relay are available as well in the inverse time model block.

3.2.1 Available Units

- One directional/non directional ground current inverse/definite time overcurrent element (”I0>” and ”I0> (def time)” block).
- One directional/non directional ground current definite time overcurrent element (”I0>>” block)
- Three zero sequence overvoltage time defined elements (”Uob>”, ”Uo>” and ”Uo>>” block). When enabled the ”Uob>” block is blocking the earth fault overcurrent elements.

3.2.2 Functionality

The PF model contains all the protective elements available in the relay. The inverse time overcurrent elements support the following trip characteristics:

- Definite time.
- IEC ”Extremely inverse”.
- IEC ”Very inverse”.
- IEC ”Normal inverse”.
- IEC ”Long time inverse”.

- ”RI Inverse time”.
- ”RD Inverse time”.

3.2.3 Data input

Please enable the ”I0>” block and disable the ”I0> (def time)” block if an inverse trip characteristic should be used in the first ground element. Vice versa disable the ”I0>” block and enable the ”I0> (def time)” block if the definite time trip characteristic should be used in the first ground element. Please notice that by default when a new relay instance is created the ”I0>” block is disabled.

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 setting	Note
	I0>/In Set start value of stage I0>	Io>	Current Setting (Ipset)	
		Io> (def time)	Current Setting (Ipset)	
	U0>/Un Set start value of stage U0>	Uo>	Pickup Voltage (Uset)	
	t0> Operate time of stage I0>/U0>	Io>	Time Dial (Tpset)	
		Io> (def time)	Time Dial (Tpset)	
		Uo>	Time Delay (Tdel)	
	k> Time multiplier k of stage I0>	Io>	Time Dial (Tpset)	
	I0>>/I Set start value of stage I0>>	Io>>	Pickup Current (Ipset)	
	U0>>/Un Set start value of stage U0>>	Uo>>	Pickup Voltage (Uset)	
	t0>> Operate time of stage I0>>/U0>>	Io>>	Time Settings (Tset)	
		Uo>>	Time Delay (Tdel)	
	U0b>/Un Set start value of stage U0b>	Uob>	Pickup Voltage (Uset)	
	tb> Operate time of stage U0b>	Uob>	Time Delay (Tdel)	
	SGF3/1	Io> dir	Tripping Direction (idir)	”None” in the model when *SGF3/1* is 1
		Io>(def time) dir	Tripping Direction (idir)	”None” in the model when *SGF3/1* is 1
	SGF3/2	Io> dir	Tripping Direction (idir)	”Forward” in the model when *SGF3/2* is 0, ”Reverse” when *SGF3/2* is 1
		Io>(def time) dir	Tripping Direction (idir)	”Forward” in the model when *SGF3/2* is 0, ”Reverse” when *SGF3/2* is 1
	SGF3/3	Io>> dir	Tripping Direction (idir)	”None” in the model when *SGF3/3* is 1
	SGF3/4	Io>> dir	Tripping Direction (idir)	”Forward” in the model when *SGF3/4* is 0, ”Reverse” when *SGF3/4* is 1
	SGF3/5	Io> dir	I, cos(phi) (icosphi)	
		Io>(def time) dir	I, cos(phi) (icosphi)	
	SGF3/6	Io> dir	Angle Operating Sector (phisec)	
		Io>(def time) dir	Angle Operating Sector (phisec)	
	Basic angle (φb) of stage I0>/I0>>	Io>> dir	Max. Torque Angle (mtau)	In the ”Voltage polarizing” tab page

Address	Relay Setting	Model block	Model setting	Note
		Io>(def time) dir	Max. Torque Angle (mtau)	In the ”Voltage polarizing” tab page

3.3 Start situation detection

3.3.1 Available Units

The start situation detection logic is implemented by some overcurrent/undercurrent elements which simulate the start detection logic thresholds (the ”0.12In”, the ”1.25In” and the ”1.5In” block) and by a timer (”Inrushdetector” block) which forces to *on* the *start detection signal* until the current isn't smaller than 1.25 In. The start detection signal is then used by the ”ICalc” block which divides by two the current feeding the ”I>>” element.

3.3.2 Functionality

A start situation is defined as a situation where the phase current rises from a value below 0.12 x I> to a value above 1.5 x I> in less than 60 ms. The start situation ends when the current falls below 1.25 x I>.

3.3.3 Data Input

No data input is required. The feature can be deactivated disabling the ”Inrushdetector” block.

3.4 Breaker failure

3.4.1 Available Units

The Circuit breaker failure protection feature is modeled by the ”CBFP” block and by the ”Min I” block.

3.4.2 Functionality

The ”CBFP” block is a timer which operates the relay model ”PO2” output signal when the earth current is still present after CBFP (relay setting) seconds that the ”PO1” output signal has been activated.

3.4.3 Data Input

Please insert the ”CBFP” relay setting as ”Time setting” of the ”CBFP” block in the PF relay model.

3.5 Output logic

It represents the output stage of the relay; it's the interface between the relay and the power breaker.

3.5.1 Available Units

The output logic is implemented by the "Trip logic" and by the "Output logic" block.

3.5.2 Functionality

The "Output logic" block operates the breaker.

The relay output signal which activate the breaker is "PO1"; the relay output signal "PO2" is also available and is controlled by the breaker failure feature. Please notice that the power breaker is not operated by "PO2".

The output logic can be freely configured by the user in the "Logic" tab page of the "Output logic" block.

Two additional signals are available to simulate the behavior of the starting signals of the earth fault elements: "TStartI0M" represents the starting signal of the "I0>" element, "TStartI0MM" represents the starting signal of the "I0>>" element.

3.5.3 Data input

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

4 Features not supported

- Directional angle correction.
- Directional additional angle.
- Operation characteristic cos φ (please use sin φ_1 with φ_1 = -90°)
- Automatic doubling of the set start value of stage I>>.
- Inverse-time operation of stage I0> inhibited by the start of stage I0>>.

5 References

[1] ABB Ltd Distribution Automation, P.O.box 699, FI-65101 Vaasa , FINLAND. *Directional or Non Directional Earth fault relay RJ527 Technical reference manual Document ID: 1MRS750616-MUM Issued 07.07.1999 Version: C/14.11.2005*, 1999.