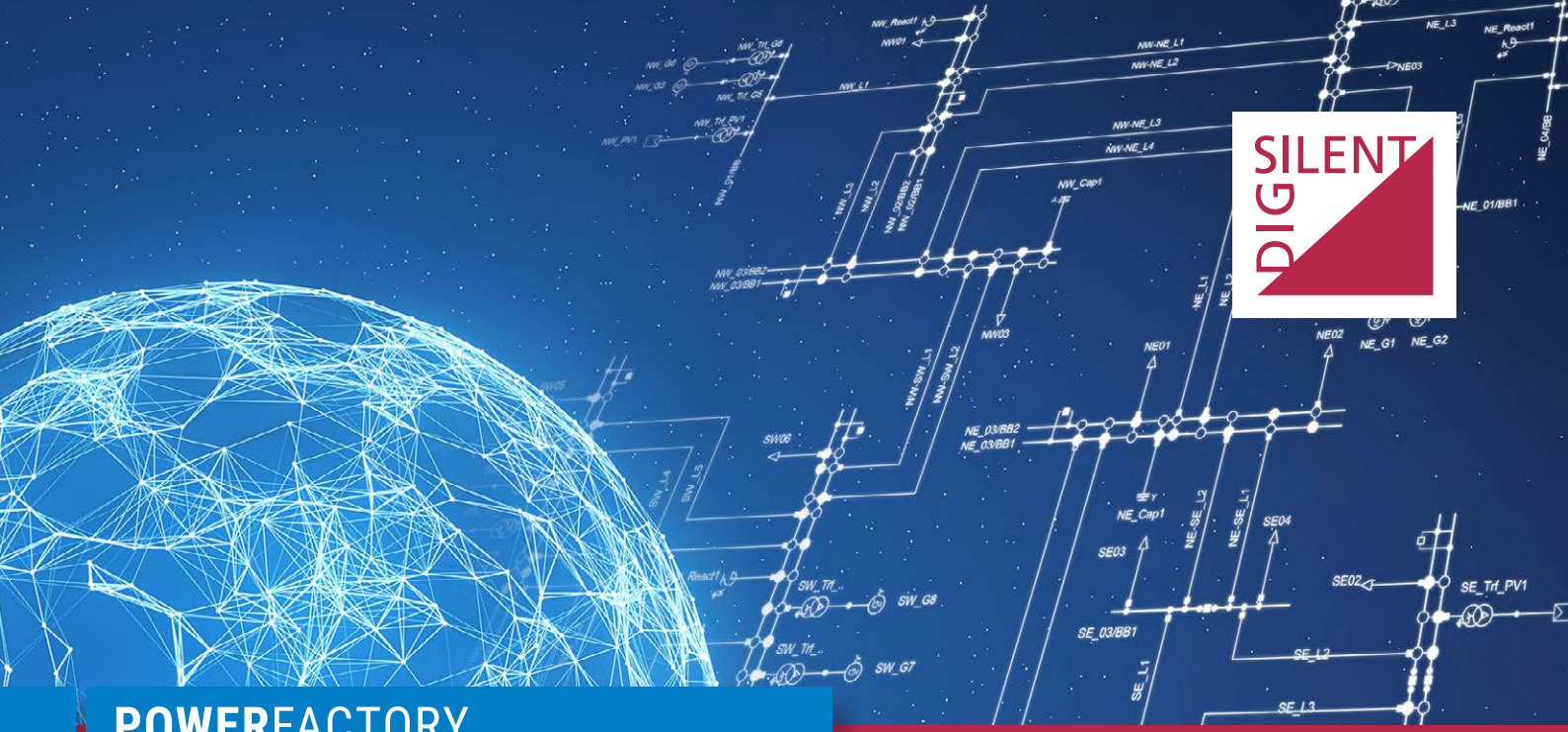

PowerFactory 2021

Technical Reference

Areva P211

PF2021

POWER SYSTEM SOLUTIONS

MADE IN GERMANY

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November 15, 2019
PowerFactory 2021
Revision 924

Contents

1 Model information

Manufacturer Areva

Model P211

Variants This PowerFactory relay models cover the features present in the 302, 401 and 602 version of the Areva P211 relay .

2 General description

The MiCOM P211 relay is made for motor application. It is designed for a wide range of protection, supervision and control functions relating to motor applications. Thanks to the many technical features and cost efficient design, P211 can be used both in medium voltage and in low voltage applications, specifically where communication facilities are required. Three versions of the MiCOM P211 relay can be ordered: *A*,*B* and *C*. Please notice that the *A* version doesn't include the "Earth fault overcurrent Io>" element.

The PowerFactory Areva P211 relay models are monolithic models and simulate most of the protective elements available in the relay. The models include the measurement and acquisition elements, the thermal image elements, the overcurrent/undercurrent protection elements, the loss of phase, the prolonged start, the motor stall protection and the output logic. The following model version are available:

- P211 0.37-0.75A
- P211 0.75-1.5A
- P211 1.5-3.0A
- P211 10.0-20.0A
- P211 20-40A
- P211 3.0-6.0A
- P211 40-80A
- P211 5.0-10.0A

Please notice that the only difference between these versions is the range of the motor nominal current *IB* setting ("I>" block, *Current Setting* parameter). No model subversions are available for the *A*,*B* and *C* relay versions.

The model implementation has been based on the information available in the relay manual [1] [2] [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 simulating the 3 phase CT and by a block simulating a single phase CT measuring the earth current; the secondary currents are then measured by one element modeling the digital sampling of the relay.

3.1.1 Available Units

- One 3 phase current transformer (”Ct-3P” block).
- One single phase current transformer (”Ct-3I0” block).
- One 3 phase measurement element (”Measure” block).

The following relay input signals are available and can be used in the output block user configurable logic (see 3.3.2):

- *S1S2*
- *T1T2*
- *V1*
- *V2*

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” block measures the currents sampling the input waves at 20 samples/cycles. The RMS values are calculated with a rectangular integration over a full cycle.

Please notice that in the Areva P211 relay the ”V1” and ”V2” relay input signals are available only in the *C* version.

3.1.3 Data input

The CT secondary rated current (1 or 5 A) value must be set in the ”Measure” block (*Nominal Current* setting).

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 thermal image, definite time overcurrent/undercurrent elements, loss of phase, too long starting and motor stall protection is modeling the relay protective functions.

3.2.1 Available Units

- One three-phase thermal image element(”I>” block).
- One three-phase non-directional definite time overcurrent element (”I>>” block).
- One three-phase under current element (”I<” block).
- One earth fault non-directional definite time element(”Io>” block).
- One negative sequence overcurrent element (”Unbalance” block).
- One loss of phase element (”Loss of phase”, ”Loss of phase detector” and ”Loss of phase Logic” block).
- One too long starting element (”Prolonged start/stall Current Set”, ”Prolonged start/stall Tistart”, ”Start detector”, ”Prolonged start logic” and ”Negate 1” block).
- One stall protection (”Prolonged start/stall Current Set”, ”Prolonged start/stall Tistall” and ”Prolonged stall logic” block).

3.2.2 Functionality

Overcurrent elements :

The thermal image element (”I>” block) supports the standard IEC 60255-8 class 10 characteristic.

Please notice that the earth fault definite element is not present in the *A* version of the relay. If an Areva P211 *A* version relay is simulated the element must be disabled manually.

Loss of phase The loss of phase element uses in the ”Loss of phase detector” block a 2% I_n current threshold to detect the open phase condition. The ”Loss of phase Logic” block, when at least one phase current is smaller than 2% I_n , sends a trip command to the ”Loss of phase” block which acts as time delay.

Prolonged start The start condition is detected by the ”Prolonged start logic” block which get the trip signal of the ”Start detector” block, acting as under current element and the trip signal of the ”Prolonged start/stall Current Set” block which is an overcurrent element with current threshold modeling the *Prolonged start or stall Current Set* relay setting. The ”Start detector’ block has a 90 ms reset delay. To declare a start condition both the ”Start detector” and the ”Prolonged start/stall Current Set” trip signals must be on. It means that a start condition is declared if the current values jump from a value smaller than the ”Start detector” block 2% I_n current threshold to a value greater than the ”Prolonged start/stall Current Set” block current threshold in less than 90 ms. The ”Prolonged start/stall Tistart” block adds to the logic the delay represented in the relay by the *Time Delay for prolonged start* setting.

Motor stall The *Motor stall* protection is active only if the no start condition has been detected. For this reason the *Motor stall* logic is controlled by the ”Prolonged start logic” block. The *Motor stall* current threshold is shared with the *Prolonged start* logic and can be set in the ”Prolonged start/stall Current Set” block. The ”Prolonged start/stall Tistall” block adds to the logic the delay represented in the relay by the ”Time Delay for stall or locked rotor” setting.

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 and undercurrent elements :

Address	Relay Setting	Model block	Model setting	Note
	Base current I_B	I>	Current Setting (Ipsetr)	
	I> Overload Tripping time for I=6xIB	I>	Time Dial (Tpset)	
	I> Overload Latching of thermal trip	I>	Out of Service (outserv)	
	Io> Current Set	Io>	Pickup Current (Ipset)	
	Io> Time Delay	Io>	Time Setting (Tset)	
	Io> Protection Status	Io>	Out of Service (outserv)	
	I>> Current Set	I>>	Pickup Current (Ipset)	
	I>> Time Delay	I>>	Time Setting (Tset)	
	I>> Protection Status	I>>	Out of Service (outserv)	
	I< Current Set	I<	Pickup Current (Ipset)	
	I< Time Delay	I<	Time Setting (Tset)	
	I< Protection Status	I<	Out of Service (outserv)	
	Ph:AS Current Set	Unbalance	Pickup Current (Ipset)	
	Ph:AS Time Delay	Unbalance	Time Setting (Tset)	
	Ph:AS Protection Status	Unbalance	Out of Service (outserv)	

Loss of phase :

Address	Relay Setting	Model block	Model setting	Note
	Ph:Lo Time Delay	Loss of phase	Time Setting (Tdelay)	
	Ph:Lo Protection status:	Loss of phase	Out of Service (outserv)	

Prolonged start :

Address	Relay Setting	Model block	Model setting	Note
	Prolonged start or stall Current Set	Prolonged start/stall Current Set	Pickup Current (Ipset)	Shared with *Motor stall*
	Time Delay for prolonged start	Prolonged start/stall Tistart	Time Setting (Tdelay)	
	Prolonged start or stall Protection status	Prolonged start/stall Tistart	Out of Service (outserv)	

Motor stall :

Address	Relay Setting	Model block	Model setting	Note
	Prolonged start or stall Current Set	Prolonged start/stall Current Set	Pickup Current (Ipset)	Shared with *Prolonged start*
	Time Delay for stall or locked rotor	Prolonged start/stall Tistall	Time Setting (Tdelay)	
	Prolonged start or stall Protection status	Prolonged start/stall Tistall	Out of Service (outserv)	

For any element the *Enabled on alarm* Protection Status can be modeled modifying the default output trip logic (see 3.3.2)

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 breaker trip element (”Trip Logic” block).
- One breaker reclosing element (”Close Circuit Breaker” block).

3.3.2 Functionality

The ”Trip Logic” block collects the trip signals coming from the overcurrent protective elements and operates the ”P1”, ”P3” and ”P4” relay output contacts. ”P1’ operates the power breaker, ”P3” and ”P4” can be used to trigger an alarm signal. Please notice that in the Areva P211 relay the ”P3” and ”P4” relay output signals are available only in the *C* version. The trip logic assigned to the relay output contacts can be modified in the "Logic" tab page of the ”Trip Logic”.

The ’P2’ relay output command is controlled by the ”Close Circuit Breaker” block which gets as input signal the *V1* relay input signal. It simulate the *Close Circuit Breaker* operation mode.

3.3.3 Data input

To disable the relay model ability to open the power circuit breaker simply disable the ”Trip Logic” block. To disable the relay model ability to close the power circuit breaker simply disable the ”Close Circuit Breaker” block.

4 Features not supported

The following features are not supported:

- Alarm thermal stage.
- Threshold for theta forbid start.
- Number of permitted starts.
- Input for PTC sensors.

5 References

[1] Areva T&D, Automation & Information Systems Business, Tour AREVA 1, place Jean Millier 92084 Paris - La Défense, 92084 France. *MiCOM P211 Motor Protection Relay Version 6.G User Manual Publication: P211MnEnV6G.PDF*, 2004.

[2] Schneider Electric, 35 rue Joseph Monier, 92506 Rueil-Malmaison, FRANCE. *MiCOM P211 Feeder Management Relay NRJED111054EN 06-2011*, 2011.

[3] Schneider Electric, 35 rue Joseph Monier, 92506 Rueil-Malmaison, FRANCE. *MiCOM P211 Motor Protection Relay P211/EN M/A31 Software version 7C Technical Manual*, 2011.