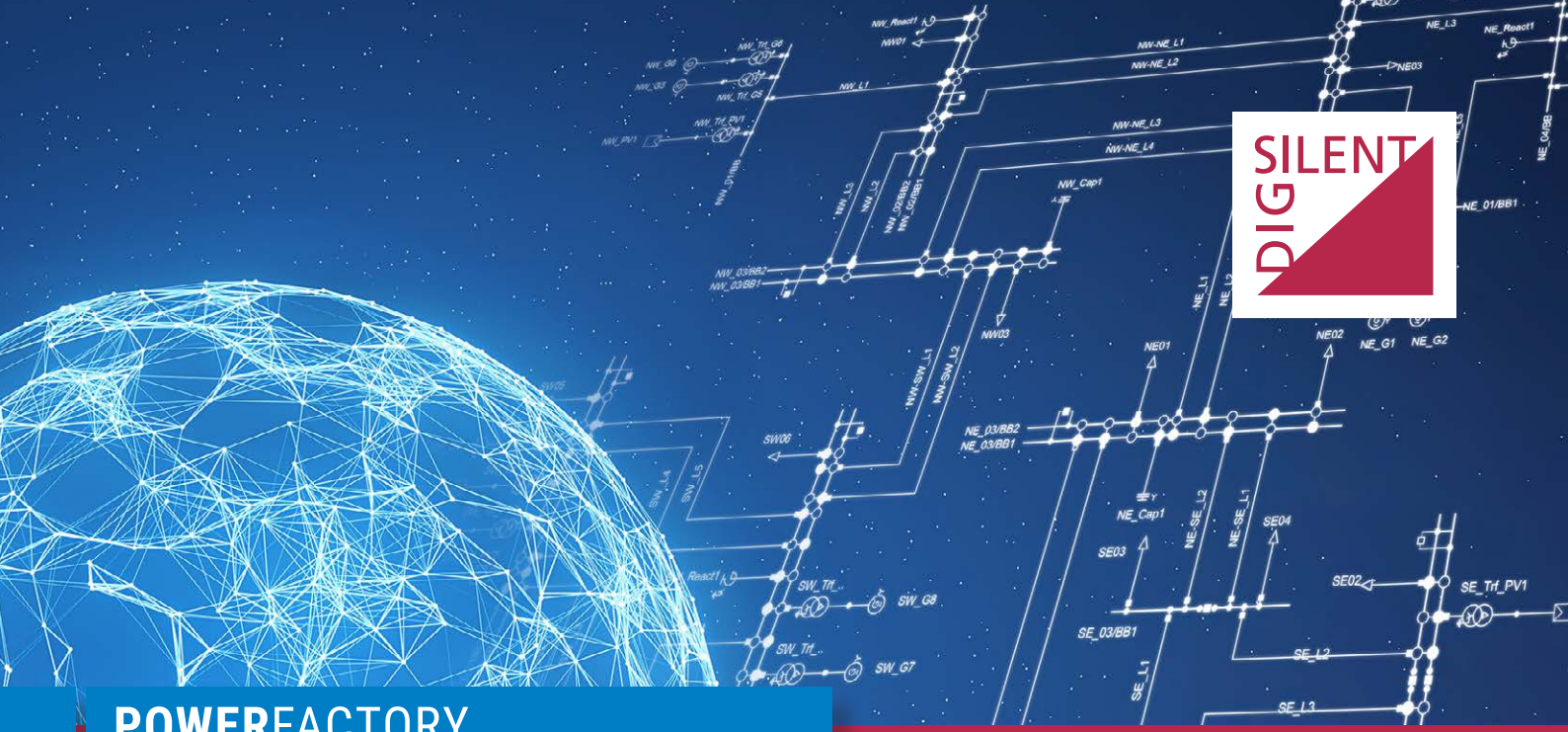

POWERFACTORY

PowerFactory 2021

Technical Reference

Siemens 7SJ61

PF2021

POWER SYSTEM SOLUTIONS

MADE IN GERMANY

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Contents

1 Model information

Manufacturer Siemens

Model 7SJ61

Variants This model can be used to simulate the features present in the Siemens SIPROTEC 7SJ61 protective relays up to firmware version V4.6.

2 General description

The numerical, multi-functional SIPROTEC 7SJ61 is a versatile device designed for protection, control, and monitoring of busbar feeders. For line protection, the device can be used in networks with grounded, low resistance grounded, isolated or compensated neutral point. It is suitable for radial systems with single-end infeed or open ring systems. The device is equipped with motor protection applicable to asynchronous machines of all sizes. Non-directional overcurrent protection (50, 50N, 51, 51N) is the basis of the device. There are two definite time overcurrent protective elements and one inverse time overcurrent protective element for phase currents and ground current. For inverse time overcurrent protective elements, several curves of different standards are provided. Alternatively, user-defined characteristics can be programmed.

The Siemens 7SJ61 relay has been modeled using four PowerFactory relay models:

- 7SJ61_1A_1A EF (phase and ground rated current equal to 1 A).
- 7SJ61_1A_SEF (phase and ground rated current equal to 1 A, earth fault element sensitive setting ranges).
- 7SJ61_5A_5A EF (phase and ground rated current equal to 5 A).
- 7SJ61_5A_SEF (phase and ground rated current equal to 5 A, earth fault element sensitive setting ranges).

They include the main phase, ground and negative sequence overcurrent protective elements available in the relay.
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 currents flowing in the power system are converted by an element which simulates a 3 phase CT; the secondary currents are then measured by an element which models the digital filter of the relay.

3.1.1 Available Units

- One 3 phase current transformer (”Ct-3p” block).
- One 3 phase measurement element (”MeasPhase” block).

3.1.2 Functionality

The ”Ct-3p” block represents an ideal CT. 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 values are sampled by the ”MeasPhase” block at 16 samples/cycle. The values are processed by a digital filter, integrating the samples over a cycle, which then calculates the voltage and current RMS values used by the protective elements.

3.1.3 Data input

No manual data input is required. Please use the relay model which supports the setting ranges for the connected 3 phase Ct rated current and core Ct rated current.

3.2 Protective elements

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

3.2.1 Available Units

- One 3 phase inverse time overcurrent element (”Ip 51” block).
- Two 3 phase definite time overcurrent elements (”I> 50_1”, and ”I>> 50_2” block).
- One ground current inverse time overcurrent element (”Iep 51N” block).
- Two ground current definite time overcurrent elements (”Ie> 50N_1”, and ”Ie>> 50N_2” block).
- One sensitive ground current inverse time overcurrent element (”Iep 51N” block).
- Two sensitive ground current definite time overcurrent elements (”Ie> 50N_1”, and ”Ie>> 50N_2” block).
- One negative sequence current inverse time overcurrent element (”I2p 46 TOC” block).
- Two negative sequence current definite time overcurrent elements (”I2> 46_1”, and ”I2>> 46_2” block).
- One thermal image element (”Overload 49” block).

3.2.2 Functionality

The phase and the ground inverse time overcurrent elements (”Ip 51” and ”Iep 51N” block) support the following trip characteristics:

- IEC Normal Inverse (”IEC 255-3 inverse” item).
- IEC Very Inverse (”IEC 255-3 very inverse” item).
- IEC Extremely Inverse (”IEC 255-3 extremely inverse” item).
- IEC Long Time Inverse (”IEC 255-3 long inverse” item).
- ANSI/IEEE Inverse (”ANSI/IEEE inverse” item).
- ANSI/IEEE Short inverse (”ANSI/IEEE short inverse” item).
- ANSI/IEEE Long inverse (”ANSI/IEEE long inverse” item).
- ANSI/IEEE Moderately inverse (”ANSI/IEEE moderately inverse” item).
- ANSI/IEEE Very inverse (”ANSI/IEEE very inverse” item).
- ANSI/IEEE Extremely inverse (”ANSI/IEEE extremely inverse” item).
- ANSI/IEEE Definite inverse (”ANSI/IEEE definite inverse” item).
- Definite time.

The sensitive ground time overcurrent element (”Ieep 51Ns” block) supports the following trip characteristics:

- User defined.
- Definite time.
- Log Inverse A.
- Log Inverse B.

The *User defined* trip characteristic is defined by up to 23 current and time value couples which can be set by the user. The trip characteristic definition is unique for any instance of the Siemens 7SJ61 relay model and be found in the *TCCs* folder contained inside the *7SJ61* relay model object.

The negative sequence inverse time overcurrent element (”I2p 46 TOC” block) supports the following trip characteristics:

- ANSI/IEEE Inverse (”ANSI/IEEE inverse” item).
- ANSI/IEEE Moderately inverse (”ANSI/IEEE moderately inverse” item).
- ANSI/IEEE Very inverse (”ANSI/IEEE very inverse” item).
- ANSI/IEEE Extremely inverse (”ANSI/IEEE extremely inverse” item).
- IEC Normal Inverse (”IEC 255-3 inverse” item).
- IEC Very Inverse (”IEC 255-3 very inverse” item).
- IEC Extremely Inverse (”IEC 255-3 extremely inverse” item).
- Definite time.

3.2.3 Data input

The relationships between the relay settings and the model parameters can be found in the following table:

Address	Relay Setting	Model block	Model setting	Note
112	Charac. Phase	Ip 51	Out of Service (outserv)	When *Disabled* in the model put the block out of service
		Ip 51	Characteristic (pcharac)	
113	Charac. Ground	Iep 51N	Out of Service (outserv)	When *Disabled* in the model put the block out of service
		Iep 51N	Characteristic (pcharac)	
131	51N IEC CURVE	Ieep 51Ns	Characteristic (pcharac)	
131	51N ANSI CURVE	Ieep 51Ns	Characteristic (pcharac)	
140	46	I2p 46 TOC	Out of Service (outserv)	When *Disabled* in the model put the block out of service
		I2p 46 TOC	Characteristic (pcharac)	
142	49	Overload 49	Out of Service (outserv)	
1201	FCT 50/51	Ip 51	Out of Service (outserv)	
		I> 50_1	Out of Service (outserv)	
		I>> 50_2	Out of Service (outserv)	
1202	50-2 PICKUP	I>> 50_2	Current Pickup (Ipsetr)	
1203	50-2 DELAY	I>> 50_2	Time Setting (Tset)	
1204	50-1 PICKUP	I> 50_1	Current Pickup (Ipsetr)	
1205	50-1 DELAY	I> 50_1	Time Setting (Tset)	
1207	51 PICKUP	Ip 51	Current Setting (Ipsetr)	
1208	51 TIME DIAL	Ip 51	Time Dial (Tpset)	
1209	51 TIME DIAL	Ip 51	Time Dial (Tpset)	
1211	51 IEC CURVE	Ip 51	Characteristic (pcharac)	
1212	51 ANSI CURVE	Ip 51	Characteristic (pcharac)	
1301	FCT 50N/51N	Iep 51N	Out of Service (outserv)	
		Ie> 50N_1	Out of Service (outserv)	
		Ie>> 50N_2	Out of Service (outserv)	
1302	50N-2 PICKUP	Ie>> 50N_2	Current Pickup (Ipsetr)	
1303	50N-2 DELAY	Ie>> 50N_2	Time Setting (Tset)	
1304	50N-1 PICKUP	Ie> 50N_1	Current Pickup (Ipsetr)	
1305	50N-1 DELAY	Ie> 50N_1	Time Setting (Tset)	
1307	51N PICKUP	Iep 51N	Current Setting (Ipsetr)	
1308	51N TIME DIAL	Iep 51N	Time Dial (Tpset)	
1309	51N TIME DIAL	Iep 51N	Time Dial (Tpset)	
1311	51N IEC CURVE	Iep 51N	Characteristic (pcharac)	
1312	51N ANSI CURVE	Iep 51N	Characteristic (pcharac)	
3101	Sens. Gnd Fault	Iep 51N	Out of Service (outserv)	
		Iee> 50Ns_1	Out of Service (outserv)	
		Iee>> 50Ns_2	Out of Service (outserv)	
3113	50N-2 PICKUP	Iee>> 50Ns_2	Current Pickup (Ipsetr)	
3114	50N-2 DELAY	Iee>> 50Ns_2	Time Setting (Tset)	
3117	50N-1 PICKUP	Iee> 50Ns_1	Current Pickup (Ipsetr)	
3118	50N-1 DELAY	Iee> 50Ns_1	Time Setting (Tset)	
3119	51N PICKUP	Ieep 51Ns	Current Setting (Ipsetr)	
3120	51N TIME DIAL	Ieep 51Ns	Time Dial (Tpset)	
3120	51N TIME DIAL	Ieep 51Ns	Time Dial (Tpset)	
4001	FCT 46	I2p 46 TOC	Out of Service (outserv)	
4002	46-2 PICKUP	I2>> 46_2	Current Pickup (Ipsetr)	
4003	46-2 DELAY	I2>> 46_2	Time Setting (Tset)	

Address	Relay Setting	Model block	Model setting	Note
4004	46-1 PICKUP	I2> 46_1	Current Pickup (Ipsetr)	
4005	46-1 DELAY	I2> 46_1	Time Setting (Tset)	
4006	46 IEC CURVE	I2p 46 TOC	Characteristic (pcharac)	
4007	46 ANSI CURVE	I2p 46 TOC	Characteristic (pcharac)	
4008	46 PICKUP	I2p 46 TOC	Current Setting (Ipsetr)	
4009	46 TIME DIAL	I2p 46 TOC	Time Dial (Tpset)	
4010	46 TIME DIAL	I2p 46 TOC	Time Dial (Tpset)	
4201	FCT 49	Overload 49	Out of Service (outserv)	
4202	49 K-FACTOR	Overload 49	Current Setting (Ipsetr)	
4203	TIME CONSTANT	Overload 49	Time Dial (Tpset)	
4207	Kt-FACTOR	Overload 49	Reset Delay (ResetT)	

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 collects the trip signals coming from the protective elements and operates the relay output contact. The only available output contact is *Trip*.

3.3.3 Data input

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

4 Features not supported

The following features are not supported:

- 50 1Ph-1 and 50 1Ph-2 element.
- Dynamic pickup values.
- Disk emulation reset.
- Cold Load pickup.
- 2^{nd} harmonic blocking.
- Start inhibit for motors (66/68).
- Motor starting protection(48).
- Automatic reclosing (79).

5 References

[1] Siemens AG, Wittelsbacherplatz 2, 80333 Munich, Germany. *SIPROTEC Multi-functional Protective Relay with Bay Controller7SJ61 V4.6 Manual C53000-G1140-C118-8*, 2004.