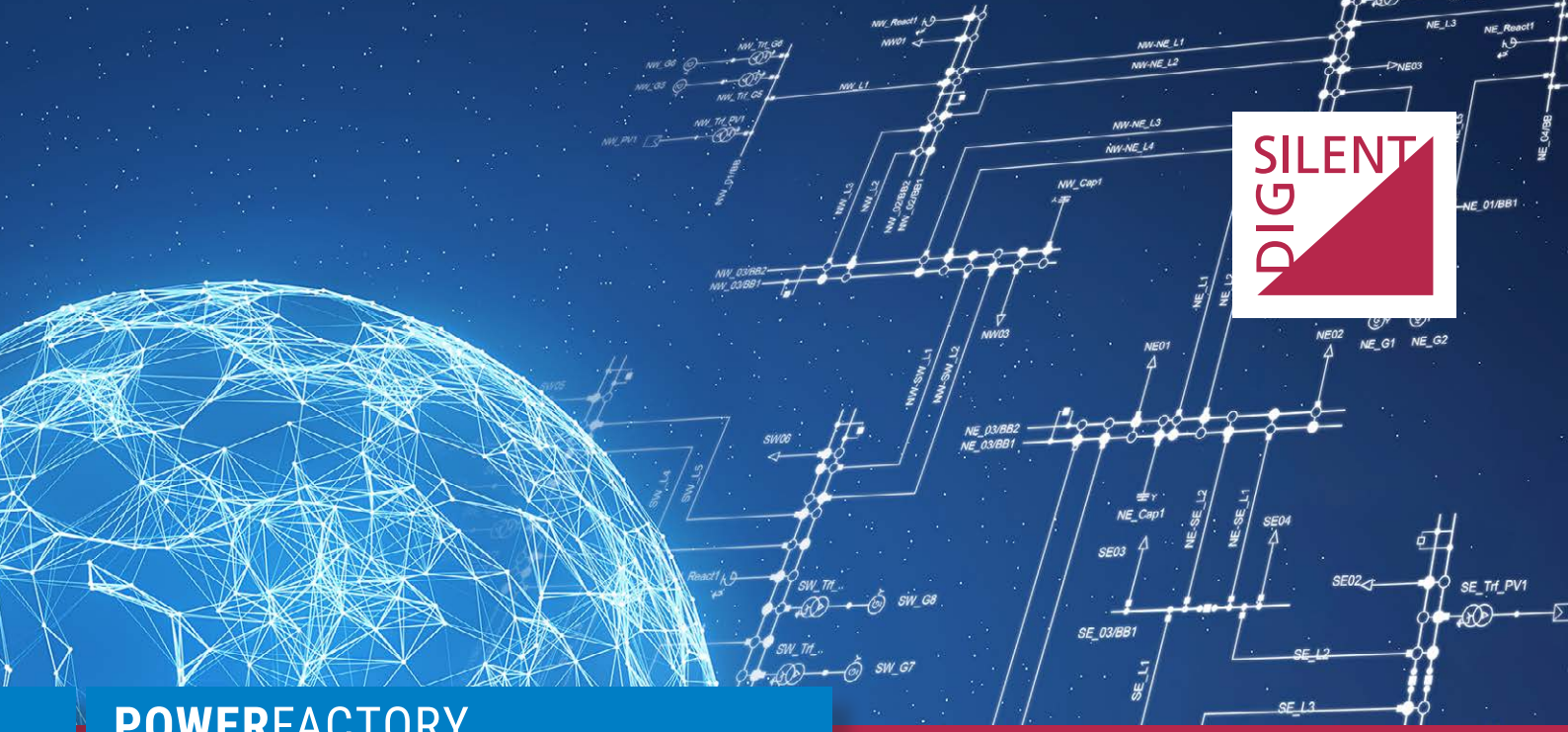

POWERFACTORY

PowerFactory 2021

Technical Reference

Siemens 7UT6xx

PF2021

POWER SYSTEM SOLUTIONS

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1 Model information

Manufacturer Siemens

Model 7UT6xx

Variants The Siemens 7UT6xx PowerFactory relay model can be used to simulate the different firmware versions of the Siemens 7UT612, 7UT613 and 7UT633/635 differential relays. The relay version used to implement the model is Siemens 7UT6xx V4.6 . However please consider that the model has been implemented with a reduced set of the features available in the relays.

2 General description

The SIPROTEC 7UT6 differential protection relays are used for fast and selective fault clearing of short-circuits in transformers of all voltage levels and also in rotating electric machines like motors and generators, for short lines and busbars. The protection relay can be parameterized for use with three-phase and single-phase transformers. In addition to the differential function, a backup overcurrent protection for 1 winding/ star point is integrated in the relay. Optionally, a low or high-impedance restricted earth-fault protection, a negativesequence protection and a breaker failure protection can be used. 7UT613 and 7UT633 feature 4 voltage inputs. With this option an overvoltage and undervoltage protection is available as well as frequency protection, reverse / forward power protection, fuse failure monitor and overexcitation protection.

The Siemens 7UT6xx relays has been modeled using two PowerFactory relay models; the following relay models are available:

- 7UT6xx 1A
- 7UT6xx 5A

Each relay model consists of a main relay and two sub relays:

- Overcurrent.
- Voltage and frequency.

The main relays includes the measurement and acquisition elements, the differential feature, with harmonic restraint and vector group/ratio compensation, a restricted earth fault element, the output logic and two sub relays, one containing the overcurrent and the thermal image elements and one containing the over/undervoltage and the frequency elements.

The model implementation has been based on the information available in the relay documentation provided by the manufacturer and freely available [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 six elements modeling six 3 phase CTs, by two elements modeling two single phase CTs and by an element modeling a 3phase VT; the 3 phase secondary currents are then measured by eighteen elements modeling the digital filters of the relay, other elements measure the neutral current and the additional single phase current input, measure the 3 phase-ground voltages and calculates the 3 phase-phase voltages.

3.1.1 Available Units

- Six 3 phase current transformers (”Wd_1 Ct”, ”Wd_2 Ct”, ”Wd_3 Ct”, ”Wd_4 Ct”, ”Wd_5 Ct” and ”Wd_6 Ct” block).
- Two single phase current transformers (”Wd_1 Ct-3I0” and ”Single phase Ct” block).
- One three phase voltage transformer (”Vt” block).
- One 3 phase current and voltage measurement element (”Measure 1” block).
- Seventeen 3phase current measurement elements (”Meas_1 2nd H”, ”Meas_1 5th-H”, ”Measure 2”, ”Meas_2 2nd H”, ”Meas_2 5th-H”, ”Measure 3”, ”Meas_3 2nd H”, ”Meas_3 5th-H”, ”Measure 4”, ”Meas_4 2nd H”, ”Meas_4 5th-H”, ”Measure 5”, ”Meas_5 2nd H”, ”Meas_5 5th-H”,”Measure 6”, ”Meas_6 2nd H” and ”Meas_6 5th-H” block).
- Two single phase measurement elements (”Neutral measurement” and ”Single phase measurement” block).
- One 3phase voltage measurement element (”Measure 1 Delta” block).

3.1.2 Functionality

The ”Wd_1 Ct”, the ”Wd_2 Ct”, the ”Wd_3 Ct”, the ”Wd_4 Ct”, the ”Wd_5 Ct”, the ”Wd_6 Ct”, the ”Single phase Ct” and the ”Wd_1 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 input currents are sampled at 16 samples/cycle.

The measurement blocks calculate the harmonic components of the currents using a DFT filter operating over a full cycle.

The 3phase voltage measurement element (”Measure 1 Delta” block) calculates the phase-phase voltages which, depending upon the relay settings, can be used by the over/under voltage elements instead of the phase-ground voltages.

There are three measurement elements for each 3 phase CT, each of them is extracting an unique harmonic :

- ”Measure 1” (fundamental value of the current converted by ”Wd_1 Ct”).
- ”Meas_1 2nd H” (2^{nd} harmonic of the current converted by ”Wd_1 Ct”).
- ”Meas_1 5th-H” (5^{th} harmonic of the current converted by ”Wd_1 Ct”).
- ”Measure 2” (fundamental value of the current converted by ”Wd_2 Ct”).
- ”Meas_2 2nd H” (2^{nd} harmonic of the current converted by ”Wd_2 Ct”).
- ”Meas_2 5th-H” (5^{th} harmonic of the current converted by ”Wd_2 Ct”).
- ”Measure 3” (fundamental value of the current converted by ”Wd_3 Ct”).
- ”Meas_3 2nd H” (2^{nd} harmonic of the current converted by ”Wd_3 Ct”).
- ”Meas_3 5th-H” (5^{th} harmonic of the current converted by ”Wd_3 Ct”).
- ”Measure 4” (fundamental value of the current converted by ”Wd_4 Ct”).
- ”Meas_4 2nd H” (2^{nd} harmonic of the current converted by ”Wd_4 Ct”).
- ”Meas_4 5th-H” (5^{th} harmonic of the current converted by ”Wd_4 Ct”).
- ”Measure 5” (fundamental value of the current converted by ”Wd_5 Ct”).
- ”Meas_5 2nd H” (2^{nd} harmonic of the current converted by ”Wd_5 Ct”).
- ”Meas_5 5th-H” (5^{th} harmonic of the current converted by ”Wd_5 Ct”).
- ”Measure 6” (fundamental value of the current converted by ”Wd_6 Ct”).
- ”Meas_6 2nd H” (2^{nd} harmonic of the current converted by ”Wd_6 Ct”).
- ”Meas_6 5th-H” (5^{th} harmonic of the current converted by ”Wd_6 Ct”).

3.1.3 Data input

No user input is required but the relay model version with the secondary rated value which matches the CT rated current must be used.

3.2 Main relay protective elements

A differential element with an ancillary RMS calculation element simulates the relay differential features. A restricted earth fault element with a separated RMS calculation element is also available.

3.2.1 Available Units

- One 3 phase differential element (”Diff.Prot” block).
- Six current adapters for the differential element (”Wd_1 Adapt”, ”Wd_2 Adapt”, ”Wd_3 Adapt”,”Wd_4 Adapt”,”Wd_5 Adapt” and ”Wd_6 Adapt” block).
- One differential current measurement element (”Diff RMS meas” block, ancillary to the differential element).
- One restricted earth fault differential element (”REF Prot” block).
- One restricted earth fault differential current measurement element (”REF RMS meas” block, ancillary to the restricted earth fault element).
- One restricted earth fault calculation element (”REF Irestrain” block).

3.2.2 Functionality

Differential :

The following features are available in the differential element (”Diff.Prot” block):

- Double bias current percentage restraint differential with user configurable differential threshold and user configurable restraint slopes and slopes thresholds.
- Unrestrained differential with user configurable threshold.
- User configurable time delay (shared by both differentials).
- 2^{nd} harmonic restraint of the first differential with user configurable threshold.
- 5^{th} harmonic restraint of the first differential with user configurable threshold.

The current adapters get the vector values and the RMS values measured by the measurement blocks and recalculate them taking care of the different CT ratios, voltage levels and CT winding connections.

The differential element calculates for each phase the scalar summation of the currents returned by the adapters. Such values are then used to calculate the differential threshold considering the user configurable double bias current percentage restraint.

The zero sequence current can be removed using the *”Remove Earth Current”* checkbox (*”iremovel0 parameter”*) in the current adapters.

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.

The harmonic restrain uses the 2^{nd} and the 5^{th} harmonic.

Restricted Earth Fault :

The REF(Restricted Earth Fault) feature is comparing the neutral current with the zero sequence current measured by the ”Wd_1 Ct” CT.

The following features are available in the restricted earth fault element (”REF Prot” block):

- Single bias current percentage restraint differential with user configurable differential threshold and user configurable restraint slope.
- User configurable time delay.

The restricted earth fault element evaluate the neutral current and the trip threshold value is function of

- the single bias current percentage restraint characteristic.
- the angle between the zero sequence current calculated using the phase currents and the neutral current.
- the ratio between the zero sequence current calculated using the phase currents and the neutral current.

The stabilization or restraining current is calculated by the ”REF Irestrain” block with the following formula:

$$I_{stab} = k(|3I0' - 3I0"| - |3I0' + 3I0"|)$$

This value is used by the ”REF Prot” block to calculate the restricted earth fault differential threshold considering the user configurable single bias current percentage restraint.

The measurement element (”REF RMS meas” block) is used to calculate the RMS value of the restricted earth fault differential current. The restricted earth fault 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):

Differential :

Address	Relay Setting	Model block	Model Parameter	Note
1201	DIFF PROT.	Diff.Prot	Out of Service (outserv)	
1206	INRUSH 2.HARM.	Diff.Prot	Disable harmonic blocking (harmblockdisable)	In the ”Harmonic blocking” tab page, shared with 1207
1207	RESTR. n.HARM.	Diff.Prot	Disable harmonic blocking (harmblockdisable)	In the ”Harmonic blocking” tab page, shared with 1206
1221	I-DIFF>	Diff.Prot	Differential Current base threshold (Idiff)	
1226A	T I-DIFF>	Diff.Prot	Time Setting (Tset)	In the model unique parameter shared with 1236A

Address	Relay Setting	Model block	Model Parameter	Note
1231	I-DIFF>>	Diff.Prot	Unrestrained Differential threshold (Idiffunrest)	
1236A	T I-DIFF>>	Diff.Prot	Time Setting (Tset)	In the model unique parameter shared with 1236A
1241A	SLOPE 1	Diff.Prot	Restrain Percentage 1 (Irestepercent1)	
1242A	BASE POINT 1	Diff.Prot	Restraint Current 1st Threshold (Ipset1)	
1243A	SLOPE 2	Diff.Prot	Restrain Percentage 2 (Irestepercent2)	
1244A	BASE POINT 2	Diff.Prot	Restraint Current 2nd Threshold (Ipset2)	
1271	2. HARMONIC	Diff.Prot	2nd Harmonic blocking threshold (H2threshold)	In the "Harmonic blocking" tab page
1276	n. HARMONIC	Diff.Prot	5th Harmonic blocking threshold (H5threshold)	In the "Harmonic blocking" tab page
1278A	IDIFFmax n.HM	Diff.Prot	Harm blocking disabling threshold(hblckdisthr)	In the "Harmonic blocking" tab page

Current adapters :

Address	Relay Setting	Model block	Model Parameter	Note
311	UN-PRI SIDE 1	Wd_1 Adapt	Nominal Terminal Line-Line Voltage (LLVolt)	
312	SN SIDE 1	Wd_1 Adapt	Current Transformer Ratio (CTratio)	= SN SIDE 1 / ($\sqrt{3}*$UN-PRI SIDE 1)
314	CONNECTION S1	Wd_1 Adapt	Current Transformer Connection (icontype)	
321	UN-PRI SIDE 2	Wd_2 Adapt	Nominal Terminal Line-Line Voltage (LLVolt)	
322	SN SIDE 2	Wd_2 Adapt	Current Transformer Ratio (CTratio)	= SN SIDE 2 / ($\sqrt{3}*$UN-PRI SIDE 2)
324	CONNECTION S2	Wd_2 Adapt	Current Transformer Connection (icontype)	
325	VECTOR GRP S2	Wd_2 Adapt	Transformer Group (trasfgroup)	
331	UN-PRI SIDE 3	Wd_3 Adapt	Nominal Terminal Line-Line Voltage (LLVolt)	
332	SN SIDE 3	Wd_3 Adapt	Current Transformer Ratio (CTratio)	= SN SIDE 3 / ($\sqrt{3}*$UN-PRI SIDE 3)
334	CONNECTION S3	Wd_3 Adapt	Current Transformer Connection (icontype)	
335	VECTOR GRP S3	Wd_3 Adapt	Transformer Group (trasfgroup)	
341	UN-PRI SIDE 4	Wd_4 Adapt	Nominal Terminal Line-Line Voltage (LLVolt)	
342	SN SIDE 4	Wd_4 Adapt	Current Transformer Ratio (CTratio)	= SN SIDE 4 / ($\sqrt{3}*$UN-PRI SIDE 4)
344	CONNECTION S4	Wd_4 Adapt	Current Transformer Connection (icontype)	
345	VECTOR GRP S4	Wd_4 Adapt	Transformer Group (trasfgroup)	
351	UN-PRI SIDE 5	Wd_5 Adapt	Nominal Terminal Line-Line Voltage (LLVolt)	
352	SN SIDE 5	Wd_5 Adapt	Current Transformer Ratio (CTratio)	= SN SIDE 5 / ($\sqrt{3}*$UN-PRI SIDE 5)
354	CONNECTION S5	Wd_5 Adapt	Current Transformer Connection (icontype)	
355	VECTOR GRP S5	Wd_5 Adapt	Transformer Group (trasfgroup)	
361	UN-PRI SIDE 6	Wd_6 Adapt	Nominal Terminal Line-Line Voltage (LLVolt)	
362	SN SIDE 6	Wd_6 Adapt	Current Transformer Ratio (CTratio)	= SN SIDE 6 / ($\sqrt{3}*$UN-PRI SIDE 6)
364	CONNECTION S6	Wd_6 Adapt	Current Transformer Connection (icontype)	
365	VECTOR GRP S6	Wd_6 Adapt	Transformer Group (trasfgroup)	
1211A	DIFFw.IE1-MEAS	Wd_1 Adapt	Remove Earth Current (iremovel0)	1 if DIFFw.IE1-MEAS =NO
1212A	DIFFw.IE2-MEAS	Wd_2 Adapt	Remove Earth Current (iremovel0)	1 if DIFFw.IE2-MEAS =NO
1213A	DIFFw.IE3-MEAS	Wd_3 Adapt	Remove Earth Current (iremovel0)	1 if DIFFw.IE3-MEAS =NO
1214A	DIFFw.IE4-MEAS	Wd_4 Adapt	Remove Earth Current (iremovel0)	1 if DIFFw.IE4-MEAS =NO
1215A	DIFFw.IE5-MEAS	Wd_5 Adapt	Remove Earth Current (iremovel0)	1 if DIFFw.IE5-MEAS =NO
1216A	DIFFw.IE3phMEAS	Wd_6 Adapt	Remove Earth Current (iremovel0)	1 if DIFFw.IE1-MEAS =NO

Restricted earth fault :

Address	Relay Setting	Model block	Model Parameter	Note
1301	REF PROT.	REF Prot	Out of Service (outserv)	
1311	I-REFF>	REF Prot	Differential Current base threshold (Idiff)	
1312A	T I-REF>	REF Prot	Time Setting (Tset)	
1313A	SLOPE	REF Prot	Restrain Percentage 1 (Irestepercent1)	

3.3 Overcurrent subrelay

3.3.1 Available Units

- One 3phase thermal image element (”Thermal overload” block).
- One 3phase inverse time overcurrent element (”Ip” block).
- Two 3phase definite time overcurrent elements (”I>” and ”I>>” block).
- One ground inverse time overcurrent element (”3I0p” block).
- Two ground definite time overcurrent elements (”3I0>” and ”3I0>>” block).
- One residual inverse time overcurrent element (”IEp” block).
- Two residual definite time overcurrent elements (”IE>” and ”IE>>” block).
- Two single phase definite time overcurrent elements (”1Phase I>” and ”1Phase I>>” block).
- One negative sequence inverse time overcurrent element (”I2p” block).
- Two negative sequence definite time overcurrent elements (”I2>” and ”I2>>” block).

3.3.2 Functionality

Identical sets of protective elements are available in the model for the phase overcurrent protection, the ground overcurrent protection, the residual overcurrent and the negative sequence overcurrent protection. Each set consists of one inverse time element and two definite time elements. Moreover one thermal image element and two definite time single phase overcurrent elements are available.

The inverse time overcurrent elements (”Ip”, ”3I0p”, ”IEp” and ”I2p” block) support the following inverse characteristics:

- ANSI Definite Inverse.
- ANSI Extremly Inverse.
- ANSI Inverse.
- ANSI Long Time Inverse.
- ANSI Moderately Inverse.
- ANSI Short Inverse.
- ANSI Very Inverse.
- Definite Time.
- IEC Extremely Inverse.
- IEC Long Inverse.
- IEC Normal Inverse.
- IEC Very Inverse.

The inverse time trip characteristic equations comply with the IEC 60255-3 and the IEEE standard equations. The thermal image element (”Thermal overload” block) models an element using the IEC 60255-8 equation.

3.3.3 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 setting	Note
2001	I O/C	I>>	Out of service (outserv)	
		I>	Out of service (outserv)	
		Ip	Out of service (outserv)	
2011	I>>	I>>	Pickup Current (Ipsetr)	
2013	T I>>	I>>	Time Setting (Tset)	
2014	I>	I>	Pickup Current (Ipsetr)	
2016	T I>	I>	Time Setting (Tset)	
2022	Ip	Ip	Current Setting (Ipsetr)	
2023	T Ip	Ip	Time Dial(Tpset)	IEC curve time dial
2024	D Ip	Ip	Time Dial(Tpset)	IEEE curve time dial
2026	IEC CURVE	Ip	Characteristic(pcharac)	
2027	ANSI CURVE	Ip	Characteristic(pcharac)	
2201	3I0 O/C	3I0>>	Out of service (outserv)	
		3I0>	Out of service (outserv)	
		3I0p	Out of service (outserv)	
2211	3I0>>	3I0>>	Pickup Current (Ipsetr)	
2213	T 3I0>>	3I0>>	Time Setting (Tset)	
2214	3I0>	3I0>	Pickup Current (Ipsetr)	
2216	T 3I0>	3I0>	Time Setting (Tset)	
2222	3I0p	3I0p	Current Setting (Ipsetr)	
2223	T 3I0p	3I0p	Time Dial(Tpset)	IEC curve time dial
2224	D 3I0p	3I0p	Time Dial(Tpset)	IEEE curve time dial
2226	IEC CURVE	3I0p	Characteristic(pcharac)	
2227	ANSI CURVE	3I0p	Characteristic(pcharac)	
2401	IE O/C	IE>>	Out of service (outserv)	
		IE>	Out of service (outserv)	
		IEp	Out of service (outserv)	
2411	IE>>	I>>	Pickup Current (Ipsetr)	
2413	T IE>>	I>>	Time Setting (Tset)	
2414	IE>	I>	Pickup Current (Ipsetr)	
2416	T IE>	I>	Time Setting (Tset)	
2422	IEp	IEp	Current Setting (Ipsetr)	
2423	T IEp	IEp	Time Dial(Tpset)	IEC curve time dial
2424	D IEp	IEp	Time Dial(Tpset)	IEEE curve time dial
2426	IEC CURVE	IEp	Characteristic(pcharac)	
2427	ANSI CURVE	IEp	Characteristic(pcharac)	
2701	1Phase O/C	1Phase I>>	Out of service (outserv)	
		1Phase I>	Out of service (outserv)	
2702	1Phase>>	1Phase I>>	Pickup Current (Ipsetr)	
2704	T 1Phase>>	1Phase I>>	Time Setting (Tset)	
2705	1Phase>	1Phase I>	Pickup Current (Ipsetr)	
2707	T 1Phase>	1Phase I>	Time Setting (Tset)	
4001	UNBALANCE LOAD	I2>>	Out of service (outserv)	
		I2>	Out of service (outserv)	
		I2p	Out of service (outserv)	
4011	I2>>	I2>>	Pickup Current (Ipsetr)	
4013	T I2>>	I2>>	Time Setting (Tset)	
4014	I2>	I2>	Pickup Current (Ipsetr)	
4016	T I2>	I2>	Time Setting (Tset)	
4022	I2p	I2p	Current Setting (Ipsetr)	

Address	Relay Setting	Model block	Model setting	Note
4023	T I2p	I2p	Time Dial(Tpset)	IEC curve time dial
4024	D I2p	I2p	Time Dial(Tpset)	IEEE curve time dial
4026	IEC CURVE	I2p	Characteristic(pcharac)	
4027	ANSI CURVE	I2p	Characteristic(pcharac)	
4201	THERM. OVERLOAD	Thermal overload	Out of service (outserv)	
4202	K-FACTOR	Thermal overload	Current Setting (Ipsetr)	
4203	TIME CONSTANT	Thermal overload	Time Dial(Tpset)	

3.4 Voltage and frequency subrelay

3.4.1 Available Units

- One over frequency element (”f>” block).
- Three under frequency elements (”f<”, ”f<< ”, and ”f<<<” block).
- Undervoltage element controlling the frequency elements (”U min” block).
- Two overvoltage elements (”Uphph>” , ”Uphph>>” when the phase-phase voltages are used, ”Uphe>” , ”Uphe>>” when the phase-ground voltages are used).
- Two undervoltage elements (”Uphph<” , ”Uphph<< ” when the phase-phase voltages are used, ”Uphe<” , ”Uphe<< ” when the phase-ground voltages are used).
- Two over excitation elements (”U/f>” and ”U/f>>” block).

3.4.2 Functionality

The overfrequency element and the three underfreqency elements can be blocked by a minimum voltage threshold element. The set consisting of two 3 phase overvoltage and two 3phase undervoltage elements is duplicated: one set is fed by the phase-phase voltages , one set is fed by the phase-ground voltages; only one set, accordingly with the value of the ”VALUES” (address 5318A) relay parameter, can be active at the same time.

The V/Hz value is calculated by the ”V/Hz calculator” block.

3.4.3 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 setting	Note
4301	OVEREXC. PROT.	U/f>	Out of Service (outserv)	
		U/f>>	Out of Service (outserv)	
4302	U/f >	U/f>	Input Setting (Ipsetr)	
4303	T U/f >	U/f>	Time dial (Tpset)	
4304	U/f >>	U/f>>	Input Setting (Ipsetr)	
4305	T U/f >>	U/f>>	Time dial (Tpset)	
4306	t(U/f=1.05)	V/Hz user defined curve 1	Cell ”Y1”,”2”	Curve defined in the
4307	t(U/f=1.10)	V/Hz user defined curve 1	Cell ”Y1”,”3”	”7UT6xx Tripping
4308	t(U/f=1.15)	V/Hz user defined curve 1	Cell ”Y1”,”4”	Curves” folder located
4309	t(U/f=1.20)	V/Hz user defined curve 1	Cell ”Y1”,”5”	inside the relay type
4310	t(U/f=1.25)	V/Hz user defined curve 1	Cell ”Y1”,”6”	4 user defined curves
4311	t(U/f=1.30)	V/Hz user defined curve 1	Cell ”Y1”,”7”	are available and
4312	t(U/f=1.35)	V/Hz user defined curve 1	Cell ”Y1”,”8”	can be used to set 4
4313	t(U/f=1.40)	V/Hz user defined curve 1	Cell ”Y1”,”9”	sets of V/Hz points
5201	UNDERVOLTAGE	U<	Out of Service (outserv)	
		U<<	Out of Service (outserv)	
5211	U<	U<	Pickup Voltage	
5213	T U<	U<	Time Delay	
5214	U<<	U<<	Pickup Voltage	
5216	T U<<	U<<	Time Delay	

Address	Relay Setting	Model block	Model setting	Note
5301	OVERVOLTAGE	U>	Out of Service (outserv)	
		U>>	Out of Service (outserv)	
5311	U>	U>	Pickup Voltage	
5313	T U>	U>	Time Delay	
5314	U>>	U>>	Pickup Voltage	
5316	T U>>	U>>	Time Delay	
5601	O/U FREQUENCY	f<	Out of Service (outserv)	
		f<<	Out of Service (outserv)	
		f<<<	Out of Service (outserv)	
		f>	Out of Service (outserv)	
5611	f<	f<	Frequency (Fset)	
5612	f<<	f<<	Frequency (Fset)	
5613	f<<<	f<<<	Frequency (Fset)	
5614	f>	f>	Frequency (Fset)	
5641	T f<	f<	Time Delay (Tdel)	
5642	T f<<	f<<	Time Delay (Tdel)	
5643	T f<<<	f<<<	Time Delay (Tdel)	
5644	T f>	f>	Time Delay (Tdel)	
5651	Umin	Umin	Pickup Voltage (Usetr)	

3.5 Output logic

It represents the output stage of the relay; it's the interface between the relay and the power breaker. A set of five relay output contacts is available and can be configured using any custom logic.

3.5.1 Available Units

- One output element (”Logic” block).

3.5.2 Functionality

The ”Logic” block gets the trip signals coming from the differential element, the restricted earth fault element and from the two subrelay; it operates the relay output contacts and the power breaker.

The following output contacts are available:

- OUT1
- OUT2
- OUT3
- OUT4
- OUT5

They are operated by any (differential/restricted earth fault element or subrelay elements) protection element trip. By default the behavior of these output contacts is identical. Any custom relay output logic can be inserted in the ”Logic” tab page of the ”Logic” block.

The relay output contact which operates the breaker is ”OUT1”.

3.5.3 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:

- 2^{nd} restricted earth fault element.
- 3^{rd} harmonic differential restraint.
- Unrestrained differential element independent time delay.
- Differential cross blocking feature.
- Overload element detailed model (calculation method, current & thermal warning stage).
- Dynamic Cold Load Pickup for Time Overcurrent Protection.
- 2^{nd} harmonic restraint for the overcurrent elements.
- Overcurrent inverse time element ”Disk emulation”.
- Reverse Power Protection.
- Forward Power Supervision.
- Circuit Breaker Failure Protection.
- External trip commands.

5 References

[1] Siemens, P. O. Box 48 06, D-90026 Nurnberg, Germany. *SIPROTEC Differential Protection 7UT6x V4.6 Manual C53000-G1176-C230-1*, 1995.