



**POWERFACTORY**

# PowerFactory 2021

Technical Reference

GE UR F60

PF2021

**POWER SYSTEM SOLUTIONS**  
MADE IN GERMANY

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## 1 Model information

**Manufacturer** GE

**Model** UR F60

**Variants** The GE UR F60 PowerFactory relay model can be used to model the different firmware versions of the GE UR F60 relay up to revision 5.6x.

## 2 General description

The GE UR F60 is a feeder protection relay with overcurrent, frequency, and voltage protective elements. The GE UR F60 PowerFactory relay model has been implemented trying to simulate the protective functions more commonly used.

The GE UR F60 PowerFactory relay model consists of a main relay model and the following sub relays:

- Phase overcurrent elements (F50/F51)
- Neutral overcurrent elements(F50/51N))
- Ground Overcurrent elements (F50/51G)
- I2 Overcurrent elements (F46)
- Load Encroachment
- Voltage elements (F27/F59)
- Frequency elements (F81)

The main relay contains the measurement and acquisition units, the output logic and all other sub relays.

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

## 3 Supported features

### 3.1 Measurement and acquisition

There are two sets of current transformers and voltage transformers: one associated to the *SRC1* and one associated to the *SRC2* input source. The voltage and the current are measured by four current transformers ("Ct SRC1", "Ct SRC2", "Neutral Ct SRC1" and "Neutral Ct SRC2" blocks) and four voltage transformer ("Vt SRC1", "Vt SRC2", "Auxiliary Vt SRC1", and "Auxiliary Vt SRC2" block). .

Forteen measurement units ("Measurement SRC1 Phasor", "Measurement Delta SRC1", "Measurement Seq SRC1", "Measurement SRC1 RMS", "Measurement SRC2 Phasor", "Measurement

Delta SRC2", "Measurement Seq SRC2", "Measurement SRC2 RMS", "Measurement Neutral SRC 1 Phasor", "Measurement Neutral SRC 1 RMS", "Measurement Neutral SRC 2 Phasor", "Measurement Neutral SRC 2 RMS", "Measurement SRC1 Phasor Vt", and "Measurement SRC2 Phasor Vt" block) are fed by these CTs and the VT. Please notice that separated measurement units calculate the currents using a DFT filter to extract the fundamental phasor magnitude or using a wave integral to compute the total waveform RMS magnitude.

#### 3.1.1 Available Units

- Ct SRC1.
- Ct SRC2.
- Neutral Ct SRC1.
- Neutral Ct SRC2.
- Vt SRC1.
- Vt SRC2.
- Auxiliary Vt SRC1.
- Auxiliary Vt SRC2.
- Measurement SRC1 Phasor.
- Measurement Delta SRC1.
- Measurement Seq SRC1
- Measurement SRC1 RMS.
- Measurement SRC2 Phasor.
- Measurement Delta SRC2.
- Measurement Seq SRC2.
- Measurement SRC2 RMS.
- Measurement Neutral SRC 1 Phasor.
- Measurement Neutral SRC 1 RMS.
- Measurement Neutral SRC 2 Phasor.
- Measurement Neutral SRC 2 RMS.
- Measurement SRC1 Phasor Vt.
- Measurement SRC2 Phasor Vt.

#### 3.1.2 Functionality

The input signals are sampled at 64 samples/cycle; a DFT filter operating over a cycle calculates then the voltage and current values used by the protective elements. Additional measurement elements calculates the current RMS magnitude integrating the current wave. Such RS values can be used for some inverse time overcurrent elements which can be set to work with the current phasor or the current RMS value.

### 3.1.3 Data input

The nominal current and the nominal voltage values MUST be entered in all the measurement units.

## 3.2 Phase overcurrent elements (F50/F51) subrelay

The Phase overcurrent elements (F50/F51) subrelay contains all phase overcurrent elements.

### 3.2.1 Available Units

- Two 3 phase inverse time directional overcurrent elements with voltage restraint ("Phase Toc 1", and "Phase Toc 2" block, the relevant restraint blocks are "V restraint Toc 1", and "V restraint Toc 2").
- Two 3 phase definite time directional overcurrent elements ("Phase loc 1" and "Phase loc 2" block).
- Two 3 phase directional elements ("DirPhase 1" associated to the "Phase Toc 1" and to the "Phase loc 1" block, and "DirPhase 2" associated to the "Phase Toc 2" and to the "Phase loc 2" block) which can be used to control the phase overcurrent blocks.
- Two input and signal source values selectors for the directional elements ("DirPhase Dir1 Source", and "DirPhase Dir2 Source" block).
- Two input and signal source values selectors for the inverse time overcurrent elements ("Phase Toc1 Source/Input", and "Phase Toc2 Source/Input" block).
- Two signal source values selectors for the definite time overcurrent elements ("Phase loc1 Source", and "Phase loc2 Source" block).
- One output element opening the associated breaker ("Output logic" block).

### 3.2.2 Functionality

Please notice that the *input* values for the inverse time elements can be phasors calculated by the measurement DFT filter or RMS magnitude values calculated by the the current wave integration.

The *signal source* (*SRC1* or *SRC2*) can be independently set for each element.

The *input* and the *signal source* of the inverse time elements can be set using the "Phase Toc1 Source/Input", and the "Phase Toc2 Source/Input" block. The *input* and the *signal source* of the directional elements can be set using the "DirPhase Dir1 Source", and the "DirPhase Dir2 Source" block. The *signal source* of the definite time elements can be set using the "Phase loc1 Source", and the "Phase loc2 Source" block. Each inverse time and definite time element can be set with a user configurable resetting time.

A trip block logic associated with the detection of the *Load encroachment* condition can be set in the "Logic" tab page of the "Output Logic" block. The "Output Logic" block input signal carrying the Load encroachment trip signal is *yloadenc*.

The inverse time overcurrent elements support the following trip characteristics:

- "Definite time"

- "IEEE Extremely Inverse"
- "IEEE Very Inverse"
- "IEEE Moderately Inverse"
- "IEC Curve A"
- "IEC Curve B"
- "IEC Curve C"
- "IEC short inverse"
- "IAC Extremely Inverse"
- "IAC Short Inverse"
- "IAC Very Inverse"
- "IAC Inverse"
- "I2t"
- "Recloser Curve" (31 curves)

The phase inverse elements can be used with a voltage restraint feature. The voltage restraint feature can be activated in the "Logic" tab page of the "V restraint Toc1" and of the "V restraint Toc2" block. Set equal to one the "VrestraintON" variable to enable the feature.

### 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):

Address	Relay Setting	Model block	Model setting	Note
5900	Phase Time Overcurrent 1 Function	Phase Toc 1	Out of Service (out-serv)	in the "Dip Settings" tab page. Select <i>On</i> to use <i>SRC2</i> in the "Dip Settings" tab page. Select <i>On</i> to use the RMS integral
5901	Phase Time Overcurrent 1 Signal Source	Phase Toc1 Source/Input	S2 (S2)	
5902	Phase Time Overcurrent 1 Input	Phase Toc1 Source/Input	RMS (RMS)	
5903	Phase Time Overcurrent 1 Pickup	Phase Toc 1	Current Setting (Ipset)	
5904	Phase Time Overcurrent 1 Curve	Phase Toc 1	Characteristic (pcharac)	
5905	Phase Time Overcurrent 1 Multiplier	Phase Toc 1	Time Dial (Tpset)	
5906	Phase Time Overcurrent 1 Reset	Phase Toc 1	Reset Delay (resetT)	
5907	Phase Time Overcurrent 1 Voltage Restraint	V restraint 1	VrestraintON (VrestraintON)	To disable the voltage restraint set VrestraintON = 0 in the "Logic" tab page
5910	Phase Time Overcurrent 2 Function	Phase Toc 2	Out of Service (out-serv)	in the "Dip Settings" tab page. Select <i>On</i> to use <i>SRC2</i> in the "Dip Settings" tab page. Select <i>On</i> to use the RMS integral
5911	Phase Time Overcurrent 2 Signal Source	Phase Toc2 Source/Input	S2 (S2)	
5912	Phase Time Overcurrent 2 Input	Phase Toc2 Source/Input	RMS (RMS)	
5913	Phase Time Overcurrent 2 Pickup	Phase Toc 2	Current Setting (Ipset)	



### 3 Supported features

Address	Relay Setting	Model block	Model setting	Note
5914	Phase Time Overcurrent 2 Curve	Phase Toc 2	Characteristic (pcharac)	To disable the voltage restraint set VrestraintON = 0 in the "Logic" tab page
5915	Phase Time Overcurrent 2 Multiplier	Phase Toc 2	Time Dial (Tpset)	
5916	Phase Time Overcurrent 2 Reset	Phase Toc 2	Reset Delay (resetT)	
5917	Phase Time Overcurrent 2 Voltage Restraint	V restraint 2	VrestraintON (VrestraintON)	
5A00	Phase Instantaneous Overcurrent 1 Function	Phase loc 1	Out of Service (out-serv)	in the "Dip Settings" tab page. Select <i>On</i> to use <i>SRC2</i>
5A01	Phase Instantaneous Overcurrent 1 Signal Source	Phase loc1 Source	S2 (S2)	
5A02	Phase Instantaneous Overcurrent 1 Pickup	Phase loc 1	Current Setting (Ipset)	
5A03	Phase Instantaneous Overcurrent 1 Delay	Phase loc 1	Time Dial (Tpset)	
5A04	Phase Instantaneous Overcurrent 1 Reset Delay	Phase loc 1	Reset Delay (resetT)	in the "Dip Settings" tab page. Select <i>On</i> to use <i>SRC2</i>
5A10	Phase Instantaneous Overcurrent 2 Function	Phase loc 2	Out of Service (out-serv)	
5A11	Phase Instantaneous Overcurrent 2 Signal Source	Phase loc2 Source	S2 (S2)	
5A12	Phase Instantaneous Overcurrent 2 Pickup	Phase loc 2	Current Setting (Ipset)	
5A13	Phase Instantaneous Overcurrent 2 Delay	Phase loc 2	Time Dial (Tpset)	in the "Dip Settings" tab page. Select <i>On</i> to use <i>SRC2</i>
5A14	Phase Instantaneous Overcurrent 2 Reset Delay	Phase loc 2	Reset Delay (resetT)	
7260	Phase Directional Overcurrent 1 Function	DirPhase 1	Out of Service (out-serv)	
7261	Phase Directional Overcurrent 1 Source	DirPhase Dir1 Source	S2 (S2)	
7263	Phase Directional Overcurrent 1 ECA	DirPhase 1	Max Torque Angle (mtau)	"Voltage Polarizing" tab page
7264	Phase Directional Overcurrent 1 Pol V Threshold	DirPhase 1	Polarizing voltage (upolu)	"Voltage Polarizing" tab page
7270	Phase Directional Overcurrent 2 Function	DirPhase 2	Out of Service (out-serv)	in the "Dip Settings" tab page. Select <i>On</i> to use <i>SRC2</i>
7271	Phase Directional Overcurrent 2 Source	DirPhase Dir2 Source	S2 (S2)	
7273	Phase Directional Overcurrent 2 ECA	DirPhase 2	Max Torque Angle (mtau)	
7274	Phase Directional Overcurrent 2 Pol V Threshold	DirPhase 2	Polarizing voltage (upolu)	

### 3.3 Neutral overcurrent elements(F50/51N)) subrelay

The Neutral overcurrent elements(F50/51N))subrelay contains all neutral overcurrent elements.

#### 3.3.1 Available Units

- Two neutral inverse time directional overcurrent elements ("Neutral Toc 1", and "Neutral Toc 2" block).
- Two neutral definite time directional overcurrent elements ("Neutral loc 1" and "Neutral loc 2" block).
- Four neutral directional elements ("DirNeutral 1 Fwd", and "DirNeutral 1 Rev" associated to the "Neutral Toc 1" and to the "Neutral loc 1" block, and "DirNeutral 2 Fwd", and "DirNeutral 2 Rev" associated to the "Neutral Toc 2" and to the "Neutral loc 2" bloc) which can be used to control the neutral overcurrent blocks.
- Two input and signal source values selectors for the directional elements ("DirNeutral 1 Source", and "DirNeutral 2 Source" block).
- Two input and signal source values selectors for the inverse time overcurrent elements ("Neutral Toc1 Source/Input", and "Neutral Toc2 Source/Input" block).
- Two signal source values selectors for the definite time overcurrent elements ("Neutral loc1 Source", and "Neutral loc2 Source" block).
- Two auxiliary logic blocks ("DirNeutral 1 K In", and "DirNeutral 2 K In" block).
- One output element opening the associated breaker ("Output logic" block).

#### 3.3.2 Functionality

Please notice that the *input* values for the inverse time elements can be phasors calculated by the measurement DFT filter or RMS magnitude values calculated by the the current wave integration. The neutral current is in both case calculated as summ of the phase currents.

The *signal source* (*SRC1* or *SRC2*) can be independently set for each element.

The *input* and the *signal source* of the inverse time elements can be set using the "Neutral Toc1 Source/Input", and the "Neutral Toc1 Source/Input" block. The *input* and the *signal source* of the directional elements can be set using the "DirNeutral 1 Source", and the "DirNeutral 2 Source" block. The *signal source* of the definite time elements can be set using the "Neutral loc1 Source", and the "Neutral loc2 Source" block. Each inverse time and definite time element can be set with a user configurable resetting time.

A trip block logic associated with the detection of the *Load encroachment* condition can be set in the "Logic" tab page of the "Output Logic" block. The "Output Logic" block input signal carrying the Load encroachment trip signal is *yloadenc*.

The inverse time overcurrent elements support the following trip characteristics:

- "Definite time"
- "IEEE Extremely Inverse"
- "IEEE Very Inverse"
- "IEEE Moderately Inverse"

### 3 Supported features

- "IEC Curve A"
- "IEC Curve B"
- "IEC Curve C"
- "IEC short inverse"
- "IAC Extremely Inverse"
- "IAC Short Inverse"
- "IAC Very Inverse"
- "IAC Inverse"
- "I<sub>2t</sub>"
- "Recloser Curve" (31 curves)

#### 3.3.3 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):

Address	Relay Setting	Model block	Model setting	Note
5B00	Neutral Time Overcurrent 1 Function	Neutral Toc 1	Out of Service (out-serv)	in the "Dip Settings" tab page. Select <i>On</i> to use <i>SRC2</i> in the "Dip Settings" tab page. Select <i>On</i> to use the RMS integral
5B01	Neutral Time Overcurrent 1 Signal Source	Neutral Toc1 Source/Input	S2 (S2)	
5B02	Neutral Time Overcurrent 1 Input	Neutral Toc1 Source/Input	RMS (RMS)	
5B03	Neutral Time Overcurrent 1 Pickup	Neutral Toc 1	Current Setting (Ipset)	
5B04	Neutral Time Overcurrent 1 Curve	Neutral Toc 1	Characteristic (pcharac)	
5B05	Neutral Time Overcurrent 1 Multiplier	Neutral Toc 1	Time Dial (Tpset)	
5B06	Neutral Time Overcurrent 1 Reset	Neutral Toc 1	Reset Delay (resetT)	in the "Dip Settings" tab page. Select <i>On</i> to use <i>SRC2</i> in the "Dip Settings" tab page. Select <i>On</i> to use the RMS integral
5B10	Neutral Time Overcurrent 2 Function	Neutral Toc 2	Out of Service (out-serv)	
5B11	Neutral Time Overcurrent 2 Signal Source	Neutral Toc2 Source/Input	S2 (S2)	
5B12	Neutral Time Overcurrent 2 Input	Neutral Toc2 Source/Input	RMS (RMS)	
5B13	Neutral Time Overcurrent 2 Pickup	Neutral Toc 2	Current Setting (Ipset)	
5B14	Neutral Time Overcurrent 2 Curve	Neutral Toc 2	Characteristic (pcharac)	
5B15	Neutral Time Overcurrent 2 Multiplier	Neutral Toc 2	Time Dial (Tpset)	in the "Dip Settings" tab page. Select <i>On</i> to use <i>SRC2</i>
5B16	Neutral Time Overcurrent 2 Reset	Neutral Toc 2	Reset Delay (resetT)	
5C00	Neutral Instantaneous Overcurrent 1 Function	Neutral loc 1	Out of Service (out-serv)	
5C01	Neutral Instantaneous Overcurrent 1 Signal Source	Neutral loc1 Source	S2 (S2)	
5C02	Neutral Instantaneous Overcurrent 1 Pickup	Neutral loc 1	Current Setting (Ipset)	
5C03	Neutral Instantaneous Overcurrent 1 Delay	Neutral loc 1	Time Dial (Tpset)	

### 3 Supported features

Address	Relay Setting	Model block	Model setting	Note
5C04	Neutral Instantaneous Overcurrent 1 Reset Delay	Neutral loc 1	Reset Delay (resetT)	in the "Dip Settings" tab page. Select <i>On</i> to use <i>SRC2</i>
5C10	Neutral Instantaneous Overcurrent 2 Function	Neutral loc 2	Out of Service (out-serv)	
5C11	Neutral Instantaneous Overcurrent 2 Signal Source	Neutral loc2 Source	S2 (S2)	
5C12	Neutral Instantaneous Overcurrent 2 Pickup	Neutral loc 2	Current Setting (Ipset)	
5C13	Neutral Instantaneous Overcurrent 2 Delay	Neutral loc 2	Time Dial (Tpset)	
5C14	Neutral Instantaneous Overcurrent 2 Reset Delay	Neutral loc 2	Reset Delay (resetT)	
7280	Neutral Directional Overcurrent 1 Function	DirNeutral 1	Out of Service (out-serv)	in the "Dip Settings" tab page. Select <i>On</i> to use <i>SRC2</i>
7281	Neutral Directional Overcurrent 1 Source	DirNeutral Source	S2 (S2)	
7283	Neutral Directional Overcurrent 1 Forward ECA	DirNeutral 1 Fwd	Max Torque Angle (mtau)	"Voltage Polarizing" tab page
		DirNeutral 1 Rev	Max Torque Angle (mtau)	"Voltage Polarizing" tab page
7284	Neutral Directional Overcurrent 1 Forward Limit Angle	DirNeutral 1 Fwd	Angle Operating Sector (phisec)	"Voltage Polarizing" tab page
7285	Neutral Directional Overcurrent 1 Forward Pickup	DirNeutral 1 Fwd	Operating Current (curopu)	
7286	Neutral Directional Overcurrent 1 Reverse Limit Angle	DirNeutral 1 Rev	Angle Operating Sector (phisec)	"Voltage Polarizing" tab page
7287	Neutral Directional Overcurrent 1 Reverse Pickup	DirNeutral 1 Rev	perating Current (curopu)	
7290	Neutral Directional Overcurrent 2 Function	DirNeutral 2	Out of Service (out-serv)	in the "Dip Settings" tab page. Select <i>On</i> to use <i>SRC2</i>
7291	Neutral Directional Overcurrent 2 Source	DirNeutral Source	S2 (S2)	
7293	Neutral Directional Overcurrent 2 Forward ECA	DirNeutral 2 Fwd	Max Torque Angle (mtau)	"Voltage Polarizing" tab page
		DirNeutral 2 Rev	Max Torque Angle (mtau)	"Voltage Polarizing" tab page
7294	Neutral Directional Overcurrent 2 Forward Limit Angle	DirNeutral 2 Fwd	Angle Operating Sector (phisec)	"Voltage Polarizing" tab page
7295	Neutral Directional Overcurrent 2 Forward Pickup	DirNeutral 2 Fwd	Operating Current (curopu)	
7296	Neutral Directional Overcurrent 2 Reverse Limit Angle	DirNeutral 2 Rev	Angle Operating Sector (phisec)	"Voltage Polarizing" tab page
7297	Neutral Directional Overcurrent 2 Reverse Pickup	DirNeutral 2 Rev	perating Current (curopu)	

### 3.4 Ground Overcurrent elements (F50/51G) subrelay

The Ground Overcurrent elements (F50/51G) subrelay contains all ground overcurrent elements.

#### 3.4.1 Available Units

- Two neutral inverse time directional overcurrent elements ("Neutral Toc 1", and "Neutral Toc 2" block).
- Two 3 neutral definite time directional overcurrent elements ("Neutral loc 1" and "Neutral loc 2" block).
- Two input and signal source values selectors for the inverse time overcurrent elements ("Neutral Toc1 Source/Input", and "Neutral Toc2 Source/Input" block).
- Two signal source values selectors for the definite time overcurrent elements ("Neutral loc1 Source", and "Neutral loc2 Source" block).
- One output element opening the associated breaker ("Output logic" block).

#### 3.4.2 Functionality

The ground overcurrent elements are not directional.

Please notice that the *input* values for the inverse time elements can be phasors calculated by the measurement DFT filter or RMS magnitude values calculated by the the current wave integration. The ground current is in both case measured by the "Neutral Ct SRC1" or by the "Neutral Ct SRC2"CT (depending up on the active *signal source*). The *signal source* (SRC1 or SRC2) can be independently set for each element.

The *input* and the *signal source* of the inverse time elements can be set using the "Ground Toc1 Source/Input", and the "Ground Toc1 Source/Input" block. The *signal source* of the definite time elements can be set using the "Ground loc1 Source", and the "Ground loc2 Source" block. Each inverse time and definite time element can be set with a user configurable resetting time.

A trip block logic associated with the detection of the *Load encroachment* condition can be set in the "Logic" tab page of the "Output Logic" block. The "Output Logic" block input signal carrying the Load encroachment trip signal is *yloadenc*.

The inverse time overcurrent elements support the following trip characteristics:

- "Definite time"
- "IEEE Extremely Inverse"
- "IEEE Very Inverse"
- "IEEE Moderately Inverse"
- "IEC Curve A"
- "IEC Curve B"
- "IEC Curve C"
- "IEC short inverse"
- "IAC Extremely Inverse"
- "IAC Short Inverse"

### 3 Supported features

- "IAC Very Inverse"
- "IAC Inverse"
- "I2t"
- "Recloser Curve" (31 curves)

#### 3.4.3 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):

Address	Relay Setting	Model block	Model setting	Note
5D00	Ground Time Overcurrent 1 Function	Ground Toc 1	Out of Service (out-serv)	in the "Dip Settings" tab page. Select <i>On</i> to use <i>SRC2</i>
5D01	Ground Time Overcurrent 1 Signal Source	Ground Toc1 Source/Input	S2 (S2)	
5D02	Ground Time Overcurrent 1 Input	Ground Toc1 Source/Input	RMS (RMS)	
5D03	Ground Time Overcurrent 1 Pickup	Ground Toc 1	Current Setting (Ipset)	
5D04	Ground Time Overcurrent 1 Curve	Ground Toc 1	Characteristic (pcharac)	
5D05	Ground Time Overcurrent 1 Multiplier	Ground Toc 1	Time Dial (Tpset)	
5D06	Ground Time Overcurrent 1 Reset	Ground Toc 1	Reset Delay (resetT)	in the "Dip Settings" tab page. Select <i>On</i> to use the RMS integral
5D10	Ground Time Overcurrent 2 Function	Ground Toc 2	Out of Service (out-serv)	
5D11	Ground Time Overcurrent 2 Signal Source	Ground Toc2 Source/Input	S2 (S2)	
5D12	Ground Time Overcurrent 2 Input	Ground Toc2 Source/Input	RMS (RMS)	
5D13	Ground Time Overcurrent 2 Pickup	Ground Toc 2	Current Setting (Ipset)	
5D14	Ground Time Overcurrent 2 Curve	Ground Toc 2	Characteristic (pcharac)	
5D15	Ground Time Overcurrent 2 Multiplier	Ground Toc 2	Time Dial (Tpset)	in the "Dip Settings" tab page. Select <i>On</i> to use the RMS integral
5D16	Ground Time Overcurrent 2 Reset	Ground Toc 2	Reset Delay (resetT)	
5E00	Ground Instantaneous Overcurrent 1 Function	Ground loc 1	Out of Service (out-serv)	in the "Dip Settings" tab page. Select <i>On</i> to use <i>SRC2</i>
5E01	Ground Instantaneous Overcurrent 1 Signal Source	Ground loc1 Source	S2 (S2)	
5E02	Ground Instantaneous Overcurrent 1 Pickup	Ground loc 1	Current Setting (Ipset)	
5E03	Ground Instantaneous Overcurrent 1 Delay	Ground loc 1	Time Dial (Tpset)	
5E04	Ground Instantaneous Overcurrent 1 Reset Delay	Ground loc 1	Reset Delay (resetT)	
5E10	Ground Instantaneous Overcurrent 2 Function	Ground loc 2	Out of Service (out-serv)	
5E11	Ground Instantaneous Overcurrent 2 Signal Source	Ground loc2 Source	S2 (S2)	in the "Dip Settings" tab page. Select <i>On</i> to use <i>SRC2</i>
5E12	Ground Instantaneous Overcurrent 2 Pickup	Ground loc 2	Current Setting (Ipset)	
5E13	Ground Instantaneous Overcurrent 2 Delay	Ground loc 2	Time Dial (Tpset)	

### 3 Supported features

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Address	Relay Setting	Model block	Model setting	Note
5E14	Ground Instantaneous Overcurrent 2 Reset Delay	Ground loc 2	Reset Delay (resetT)	

### 3.5 I2 Overcurrent elements (F46) subrelay

The I2 Overcurrent elements (F46)subrelay contains all negative sequence overcurrent elements.

#### 3.5.1 Available Units

- Two negative sequence inverse time directional overcurrent elements ("I2 Toc 1", and "I2 Toc 2" block).
- Two negative sequence definite time directional overcurrent elements ("I2 loc 1" and "I2 loc 2" block).
- Four negative sequence directional elements ("DirNegSeq 1 Fwd", and "DirNegSeq 1 Rev" associated to the "I2 Toc 1" and to the "I2 loc 1" block, and "DirNegSeq 2 Fwd", and "DirNegSeq 2 Rev" associated to the "I2 Toc 2" and to the "I2 loc 2" bloc) which can be used to control the negative sequence overcurrent blocks.
- Two input and signal source values selectors for the directional elements ("DirNegSeq 1 Source", and "DirNegSeq 1 Source" block).
- Two input and signal source values selectors for the inverse time overcurrent elements ("I2 Toc1 Source", and "I2 Toc2 Source" block).
- Two signal source values selectors for the definite time overcurrent elements ("I2 loc1 Source", and "I2 loc2 Source" block).
- Two auxiliary logic blocks ("DirNegSeq 1 K In", and "DirNegSeq 2 K In" block).
- One output element opening the associated breaker ("Output logic" block).

#### 3.5.2 Functionality

The *signal source* (*SRC1* or *SRC2*) can be independently set for each element.

The *signal source* of the directional elements can be set using the "DirNegSeq 1 Source", and the "DirNegSeq 2 Source" block. The *signal source* of the definite time elements can be set using the "I2 loc1 Source", and the "I2 loc2 Source" block. Each inverse time and definite time element can be set with a user configurable resetting time.

A trip block logic associated with the detection of the *Load encroachment* condition can be set in the "Logic" tab page of the "Output Logic" block. The "Output Logic" block input signal carrying the Load encroachment trip signal is *yloadenc*.

#### 3.5.3 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
6300	Negative Sequence Time Overcurrent 1 Function	I2 Toc 1	Out of Service (outserv)	in the "Dip Settings" tab page. Select <i>On</i> to use <i>SRC2</i>
6301	Negative Sequence Time Overcurrent 1 Signal Source	I2 Toc1 Source	S2 (S2)	
6302	Negative Sequence Time Overcurrent 1 Pickup	I2 Toc 1	Current Setting (Ipset)	
6303	Negative Sequence Time Overcurrent 1 Curve	I2 Toc 1	Characteristic (pcharac)	



### 3 Supported features

Address	Relay Setting	Model block	Model setting	Note
6304	Negative Sequence Time Overcurrent 1 Multiplier	I2 Toc 1	Time Dial (Tpset)	in the "Dip Settings" tab page. Select <i>On</i> to use <i>SRC2</i>
6305	Negative Sequence Time Overcurrent 1 Reset	I2 Toc 1	Reset Delay (resetT)	
6310	Negative Sequence Time Overcurrent 2 Function	I2 Toc 2	Out of Service (outserv)	
6311	Negative Sequence Time Overcurrent 2 Signal Source	I2 Toc2 Source	S2 (S2)	
6312	Negative Sequence Time Overcurrent 2 Pickup	I2 Toc 2	Current Setting (Ipset)	
6313	Negative Sequence Time Overcurrent 2 Curve	I2 Toc 2	Characteristic (pcharac)	
6314	Negative Sequence Time Overcurrent 2 Multiplier	I2 Toc 2	Time Dial (Tpset)	
6315	Negative Sequence Time Overcurrent 2 Reset	I2 Toc 2	Reset Delay (resetT)	
6400	Negative Sequence Instantaneous Overcurrent 1 Function	I2 loc 1	Out of Service (outserv)	in the "Dip Settings" tab page. Select <i>On</i> to use <i>SRC2</i>
6401	Negative Sequence Instantaneous Overcurrent 1 Signal Source	I2 loc1 Source	S2 (S2)	
6402	Negative Sequence Instantaneous Overcurrent 1 Pickup	I2 loc 1	Current Setting (Ipset)	
6403	Negative Sequence Instantaneous Overcurrent 1 Delay	I2 loc 1	Time Dial (Tpset)	
6404	Negative Sequence Instantaneous Overcurrent 1 Reset Delay	I2 loc 1	Reset Delay (resetT)	
6410	Negative Sequence Instantaneous Overcurrent 2 Function	I2 loc 2	Out of Service (outserv)	
6411	Negative Sequence Instantaneous Overcurrent 2 Signal Source	I2 loc2 Source	S2 (S2)	
6412	Negative Sequence Instantaneous Overcurrent 2 Pickup	I2 loc 2	Current Setting (Ipset)	
6413	Negative Sequence Instantaneous Overcurrent 2 Delay	I2 loc 2	Time Dial (Tpset)	in the "Dip Settings" tab page. Select <i>On</i> to use <i>SRC2</i>
6414	Negative Sequence Instantaneous Overcurrent 2 Reset Delay	I2 loc 2	Reset Delay (resetT)	
72A0	Negative Sequence Directional Overcurrent 1 Function	DirNegSeq 1	Out of Service (outserv)	
72A1	Negative Sequence Directional Overcurrent 1 Source	DirNegSeq Source	S2 (S2)	
72A3	Negative Sequence Directional Overcurrent 1 Forward ECA	DirNegSeq 1 Fwd	Max Torque Angle (mtau)	
72A4	Negative Sequence Directional Overcurrent 1 Forward Limit Angle	DirNeutral 1 Rev	Max Torque Angle (mtau)	
		DirNegSeq 1 Fwd	Angle Operating Sector (phiseq)	
72A5	Negative Sequence Directional Overcurrent 1 Forward Pickup	DirNegSeq 1 Fwd	Operating Current (curopu)	
72A6	Negative Sequence Directional Overcurrent 1 Reverse Limit Angle	DirNegSeq 1 Rev	Angle Operating Sector (phiseq)	"Voltage Polarizing" tab page
72A7	Negative Sequence Directional Overcurrent 1 Reverse Pickup	DirNegSeq 1 Rev	perating Current (curopu)	

### 3 Supported features

Address	Relay Setting	Model block	Model setting	Note
Negative Sequence 72B0	Negative Sequence Directional Overcurrent 2 Function	DirNegSeq 2	Out of Service (outserv)	
72B1	Negative Sequence Directional Overcurrent 2 Source	DirNegSeq Source	S2 (S2)	in the "Dip Settings" tab page. Select <i>On</i> to use <i>SRC2</i>
72B3	Negative Sequence Directional Overcurrent 2 Forward ECA	DirNegSeq 2 Fwd	Max Torque Angle (mtau)	"Voltage Polarizing" tab page
		DirNegSeq 2 Rev	Max Torque Angle (mtau)	"Voltage Polarizing" tab page
72B4	Negative Sequence Directional Overcurrent 2 Forward Limit Angle	DirNegSeq 2 Fwd	Angle Operating Sector (phisec)	
72B5	Negative Sequence Directional Overcurrent 2 Forward Pickup	DirNegSeq 2 Fwd	Operating Current (curopu)	"Voltage Polarizing" tab page
72B6	Negative Sequence Directional Overcurrent 2 Reverse Limit Angle	DirNegSeq 2 Rev	Angle Operating Sector (phisec)	
72B7	Negative Sequence Directional Overcurrent 2 Reverse Pickup	DirNegSeq 2 Rev	perating Current (curopu)	"Voltage Polarizing" tab page

## 3.6 Voltage elements (F27/F59) subrelay

The Voltage elements (F27/F59) subrelay contains all over and undervoltage elements.

### 3.6.1 Available Units

- Two 3phase time inverse characteristic undervoltage elements ("Phase undervoltage 1", and "Phase undervoltage 2", "Phase Undervoltage 1 Mode Source", "Phase Undervoltage 2 Mode Source", "Phase undervoltage 1 Minimum Voltage", and "Phase undervoltage 2 Minimum Voltage" block)
- One three phase time defined characteristic overvoltage element with delayed reset ("Phase overvoltage", "Phase Overvoltage Mode Source", and "Phase overvoltage reset delay" block)
- Three zero sequence time inverse characteristic overvoltage elements with delayed reset("Neutral Overvoltage 1 Source", "Neutral overvoltage 1", "Neutral overvoltage 1 reset delay", "Neutral Overvoltage 2 Source", "Neutral overvoltage 2", "Neutral overvoltage 2 reset delay", "Neutral Overvoltage 3 Source", "Neutral overvoltage 3" and "Neutral overvoltage 3 reset delay" block)
- Three negative sequence time defined characteristic overvoltage elements with delayed reset("Negative Sequence Overvoltage 1 Source", "Negative Sequence overvoltage 1", "Negative Sequence overvoltage 1 reset delay", "Negative Sequence Overvoltage 2 Source", "Negative Sequence overvoltage 2", "Negative Sequence overvoltage 2 reset delay", "Negative Sequence Overvoltage 3 Source", "Negative Sequence overvoltage 3" and "Negative Sequence overvoltage 3 reset delay" block)
- One auxiliary time defined characteristic overvoltage element with delayed reset ("Auxiliary Overvoltage", "Auxiliary Overvoltage Source", and "Auxiliary Overvoltage Minimum Voltage" block).
- One auxiliary inverse characteristic undervoltage element with delayed reset ("Auxiliary Undervoltage", "Auxiliary Undervoltage Source", and "Auxiliary Undervoltage Minimum Voltage" block).
- One output block opening the associated breaker ("Output logic" block)

### 3.6.2 Functionality

All the over/undervoltage elements available in the relay have been implemented in the model. The phase undervoltage elements support the following trip characteristics:

- Inverse
- Definite

The neutral overvoltage elements support the following trip characteristics:

- Definite
- FlexCurve A
- FlexCurve B

### 3 Supported features

- FlexCurve C

Each undervoltage element can be set to use the phase-phase voltages or the phase-ground voltages; a minimum activation threshold is available as well.

Each overvoltage element can set with a user definable reset time. The voltage signal source (*SRC1* or *SRC2*) can be set for each voltage element.

#### 3.6.3 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
7000	Phase Undervoltage 1 Function	Phase Undervoltage 1	Out of Service (out-serv)	in the "Dip Settings" tab page. Select <i>On</i> to use <i>SRC2</i>
7001	Phase Undervoltage 1 Signal Source	Phase Undervoltage 1 Source	S2 (S2)	
7002	Phase Undervoltage 1 Pickup	Phase Undervoltage 1	Input Setting (Ipset)	
7003	Phase Undervoltage 1 Delay	Phase Undervoltage 1	Time Dial (Tpset)	
7004	Phase Undervoltage 1 Curve	Phase Undervoltage 1	Characteristic (pcharac)	
7005	Phase Undervoltage 1 Minimum Voltage	Phase Undervoltage 1 Minimum Voltage	Pickup Voltage (Uset)	in the "Dip Settings" tab page. Select <i>On</i> to use <i>SRC2</i>
7013	Phase Undervoltage 2 Function	Phase Undervoltage 2	Out of Service (out-serv)	
7014	Phase Undervoltage 2 Signal Source	Phase Undervoltage 2 Source	S2 (S2)	
7015	Phase Undervoltage 2 Pickup	Phase Undervoltage 2	Input Setting (Ipset)	
7016	Phase Undervoltage 2 Delay	Phase Undervoltage 2	Time Dial (Tpset)	
7017	Phase Undervoltage 2 Curve	Phase Undervoltage 2	Characteristic (pcharac)	in the "Dip Settings" tab page. Select <i>On</i> to use <i>SRC2</i>
7018	Phase Undervoltage 2 Minimum Voltage	Phase Undervoltage 2 Minimum Voltage	Pickup Voltage (Uset)	
7040	Phase Overvoltage 1 Function	Phase Overvoltage	Out of Service (out-serv)	
7041	Phase Overvoltage 1 Signal Source	Phase Overvoltage Source	S2 (S2)	
7042	Phase Overvoltage 1 Pickup	Phase Overvoltage	Input Setting (Ipset)	
7043	Phase Overvoltage 1 Delay	Phase Overvoltage	Time Dial (Tpset)	in the "Dip Settings" tab page. Select <i>On</i> to use <i>SRC2</i>
7044	Phase Overvoltage 1 Reset Delay	Phase Overvoltage Reset Delay	Time Setting (resetT)	
7F00	Neutral Overvoltage 1 Function	Neutral Overvoltage 1	Out of Service (out-serv)	
7F01	Neutral Overvoltage 1 Signal Source	Neutral Overvoltage 1 Source	S2 (S2)	
7F02	Neutral Overvoltage 1 Pickup	Neutral Overvoltage 1	Input Setting (Ipset)	
7F03	Neutral Overvoltage 1 Delay	Neutral Overvoltage 1	Time Dial (Tpset)	in the "Dip Settings" tab page. Select <i>On</i> to use <i>SRC2</i>
7F04	Neutral Overvoltage 1 Reset Delay	Neutral Overvoltage 1 Reset Delay	Time Setting (resetT)	
7F08	Neutral Overvoltage 1 Curve	Neutral Overvoltage 1	Characteristic (pcharac)	
7F10	Neutral Overvoltage 2 Function	Neutral Overvoltage 2	Out of Service (out-serv)	

### 3 Supported features

Address	Relay Setting	Model block	Model setting	Note
7F11	Neutral Overvoltage 2 Signal Source	Neutral Overvoltage 2 Source	S2 (S2)	in the "Dip Settings" tab page. Select <i>On</i> to use <i>SRC2</i>
7F12	Neutral Overvoltage 2 Pickup	Neutral Overvoltage 2	Input Setting (Ipset)	
7F13	Neutral Overvoltage 2 Delay	Neutral Overvoltage 2	Time Dial (Tpset)	
7F14	Neutral Overvoltage 2 Reset Delay	Neutral Overvoltage 2 Reset Delay	Time Setting (resetT)	
7F18	Neutral Overvoltage 2 Curve	Neutral Overvoltage 2	Characteristic (pcharac)	
7F20	Neutral Overvoltage 3 Function	Neutral Overvoltage 3	Out of Service (out-serv)	in the "Dip Settings" tab page. Select <i>On</i> to use <i>SRC2</i>
7F21	Neutral Overvoltage 3 Signal Source	Neutral Overvoltage 3 Source	S2 (S2)	
7F22	Neutral Overvoltage 3 Pickup	Neutral Overvoltage 3	Input Setting (Ipset)	
7F23	Neutral Overvoltage 3 Delay	Neutral Overvoltage 3	Time Dial (Tpset)	
7F24	Neutral Overvoltage 3 Reset Delay	Neutral Overvoltage 3 Reset Delay	Time Setting (resetT)	
7F28	Neutral Overvoltage 3 Curve	Neutral Overvoltage 3	Characteristic (pcharac)	in the "Dip Settings" tab page. Select <i>On</i> to use <i>SRC2</i>
64A0	Negative Sequence Overvoltage 1 Function	Negative Sequence Overvoltage 1	Out of Service (out-serv)	
64A1	Negative Sequence Overvoltage 1 Signal Source	Negative Sequence Overvoltage 1 Source	S2 (S2)	
64A2	Negative Sequence Overvoltage 1 Pickup	Negative Sequence Overvoltage 1	Input Setting (Ipset)	
64A3	Negative Sequence Overvoltage 1 Delay	Negative Sequence Overvoltage 1	Time Dial (Tpset)	
64A4	Negative Sequence Overvoltage 1 Reset Delay	Negative Sequence Overvoltage 1 Reset Delay	Time Setting (resetT)	in the "Dip Settings" tab page. Select <i>On</i> to use <i>SRC2</i>
64B0	Negative Sequence Overvoltage 2 Function	Negative Sequence Overvoltage 2	Out of Service (out-serv)	
64B1	Negative Sequence Overvoltage 2 Signal Source	Negative Sequence Overvoltage 2 Source	S2 (S2)	
64B2	Negative Sequence Overvoltage 2 Pickup	Negative Sequence Overvoltage 2	Input Setting (Ipset)	
64B3	Negative Sequence Overvoltage 2 Delay	Negative Sequence Overvoltage 2	Time Dial (Tpset)	
64B4	Negative Sequence Overvoltage 2 Reset Delay	Negative Sequence Overvoltage 2 Reset Delay	Time Setting (resetT)	in the "Dip Settings" tab page. Select <i>On</i> to use <i>SRC2</i>
64C0	Negative Sequence Overvoltage 3 Function	Negative Sequence Overvoltage 3	Out of Service (out-serv)	
64C1	Negative Sequence Overvoltage 3 Signal Source	Negative Sequence Overvoltage 3 Source	S2 (S2)	
64C2	Negative Sequence Overvoltage 3 Pickup	Negative Sequence Overvoltage 3	Input Setting (Ipset)	
64C3	Negative Sequence Overvoltage 3 Delay	Negative Sequence Overvoltage 3	Time Dial (Tpset)	
64C4	Negative Sequence Overvoltage 3 Reset Delay	Negative Sequence Overvoltage 3 Reset Delay	Time Setting (resetT)	in the "Dip Settings" tab page. Select <i>On</i> to use <i>SRC2</i>
7F30	Auxiliary Overvoltage 1 Function	Auxiliary Overvoltage	Out of Service (out-serv)	
7F31	Auxiliary Overvoltage 1 Signal Source	Auxiliary Overvoltage Source	S2 (S2)	

### 3 Supported features

Address	Relay Setting	Model block	Model setting	Note
7F32	Auxiliary Overvoltage 1 Pickup	Auxiliary Overvoltage	Input Setting (Ipset)	in the "Dip Settings" tab page. Select <i>On</i> to use <i>SRC2</i>
7F33	Auxiliary Overvoltage 1 Pickup Delay	Auxiliary Overvoltage	Time Dial (Tpset)	
7F34	Auxiliary Overvoltage 1 Reset Delay	Auxiliary Overvoltage Reset Delay	Time Setting (resetT)	
7F60	Auxiliary Undervoltage 1 Function	Auxiliary Undervoltage	Out of Service (out-serv)	
7F61	Auxiliary Undervoltage 1 Signal Source	Auxiliary Undervoltage Source	S2 (S2)	
7F62	Auxiliary Undervoltage 1 Pickup	Auxiliary Undervoltage	Input Setting (Ipset)	
7F63	Auxiliary Undervoltage 1 Delay	Auxiliary Undervoltage	Time Dial (Tpset)	
7F64	Auxiliary Undervoltage 1 Curve	Auxiliary Undervoltage	Characteristic (pcharac)	
7F65	Auxiliary Undervoltage 1 Minimum Voltage	Auxiliary Undervoltage Minimum Voltage	Pickup Voltage (Uset)	

### 3.7 Frequency elements (F81) subrelay

The Frequency elements (F81) subrelay contains all over and under frequency elements.

#### 3.7.1 Available Units

- Six under frequency elements. Each element consists of the following blocks:
  - An under voltage limit block ("UnderFreq z<sup>1</sup> MinVolt")
  - An under current limit block ("UnderFreq z<sup>1</sup> MinAmp")
  - An under frequency block ("UnderFreq z<sup>1</sup>")
  - A block implementing a delayed reset ("UnderFreq z<sup>1</sup> reset delay")
  - A calculation and a measurement block ("UFz<sup>1</sup> Meas switch" and "Meas Freq UFz<sup>1</sup>")
- Four over frequency elements. Each element consists of the following blocks:
  - An over frequency block ("OverFreq y<sup>2</sup>")
  - A block implementing a delayed reset ("OverFreq y<sup>2</sup> reset delay")
- Four Frequency rate of change elements. Each element consists of the following blocks:
  - An under voltage limit block ("Freq Rate z<sup>1</sup> Ov Supv")
  - An under current limit block ("Freq Rate z<sup>1</sup> Oc Supv")
  - A under frequency limit block ("Freq Rate z<sup>1</sup> Min Frequency")
  - A over frequency limit block ("Freq Rate z<sup>1</sup> Max Frequency")
  - A frequency rate of change element ("Freq Rate z<sup>1</sup>")
  - A block implementing a delayed reset ("Freq Rate z<sup>1</sup> reset delay")
  - A logic block ("Freq Rate z<sup>1</sup> Logic")

#### 3.7.2 Functionality

**Under frequency elements** The under frequency elements are using by default the voltage signals to measure the frequency. When the voltage is smaller than the voltage threshold inserted in the "UnderFreq x5 MinVolt" block the current signals are used to measure the frequency. If also the current is smaller than the threshold inserted in the "UnderFreq x5 MinAmp" block the element is blocked. Each element has a frequency threshold and a trip delay and can be set with a user configurable reset delay ("UnderFreq x5 reset delay" block).

**Over frequency elements** Each element has a frequency threshold and a trip delay and can be set with a user configurable reset delay ("OverFreq y<sup>4</sup> reset delay" block).

**Frequency rate of change elements** The frequency rate of change elements are controlled by an under frequency threshold and an over frequency threshold, by a minimum voltage threshold and by a minimum current threshold. Each element has a frequency rate of change threshold and a trip delay and can be set with a user configurable reset delay ("Freq Rate x5 reset delay" block).

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<sup>1</sup>z = 1,2,3,4,5,6  
<sup>2</sup>y = 1,2,3,4

### 3.7.3 Data input

**Under frequency elements** 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
7E10	Underfrequency z <sup>3</sup> Function	UnderFreq z <sup>3</sup>	Out of Service (outserv)	The relay settings must be transferred in both model blocks
7E11	Underfrequency z <sup>3</sup> Min Volt/Amp	UnderFreq z <sup>3</sup> MinVolt UnderFreq z <sup>3</sup> MinAmp	Pickup Voltage (Uset) Pickup Current (Ipset)	
7E13	Underfrequency z <sup>3</sup> Pickup	UnderFreq z <sup>3</sup>	Frequency(Fset)	A value smaller than the system rated frequency must be set
7E14	Underfrequency z <sup>3</sup> Delay	UnderFreq z <sup>3</sup>	Time Delay (Tdel)	
7E15	Underfrequency z <sup>3</sup> Reset Delay	UnderFreq z <sup>3</sup> reset delay	Time Setting (Tdelay)	

No user input is required for the "UnderFreq 1 Meas switch" and the "Meas Freq UnderFreq 1" block.

**Over frequency elements** 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
64D0	Overfrequency y <sup>4</sup> Function	OverFreq y <sup>4</sup>	Out of Service (outserv)	
64D3	Overfrequency y <sup>4</sup> Pickup	OverFreq y <sup>4</sup>	Frequency (Fset)	
64D4	Overfrequency y <sup>4</sup> Pickup Delay	OverFreq y <sup>4</sup>	Time Delay (Tdel)	
64D5	Overfrequency y <sup>4</sup> Reset Delay	OverFreq y <sup>4</sup> reset delay	Time Setting (Tdelay)	

No user input is required for the "Meas Freq OverFreq" block.

**Frequency rate of change elements** 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
A900	Frequency Rate of Change y <sup>4</sup> Function	Freq Rate y <sup>4</sup>	Out of Service (outserv)	
A901	Frequency Rate of Change y <sup>4</sup> OC Supervision	Freq Rate y <sup>4</sup>	Oc Supv Pickup Current(Ipset)	
A902	Frequency Rate of Change y <sup>4</sup> Min	Freq Rate y <sup>4</sup>	Min Frequency Frequency (Fset)	
A903	Frequency Rate of Change y <sup>4</sup> Max	Freq Rate y <sup>4</sup>	Max Frequency Frequency (Fset)	
A904	Frequency Rate of Change y <sup>4</sup> PickupP Delay	Freq Rate y <sup>4</sup>	Time Delay (Tdel)	
A905	Frequency Rate of Change y <sup>4</sup> Reset Delay	Freq Rate y <sup>4</sup>	Time Setting (Tdelay)	
A90B	Frequency Rate of Change y <sup>4</sup> Pickup	Freq Rate y <sup>4</sup>	Gradient df/dt (dFset)	
A90C	Frequency Rate of Change y <sup>4</sup> OV Supervision	Freq Rate y <sup>4</sup>	Ov Supv Pickup Voltage(Uset)	

<sup>3</sup>z = 1,2,3,4,5,6

<sup>4</sup>y = 1,2,3,4



No user input is required for the "Meas Freq OverFreq" block.

## 3.8 Load Encroachment subrelay

### 3.8.1 Available Units

- One load encroachment definition zone ("Load Encroachment" block).
- One minimum voltage activation threshold ("Min Voltage" block).
- One trip delay element ("Pickup Delay" block).
- One reset delay element ("Reset Delay" block).
- One polarizing element ("Polarizing" block).
- One auxiliary logic element ("Trip block logic" block).

### 3.8.2 Functionality

The Load Encroachment subrelay define in the R-X plan a load encroachment zone with a minimum voltage activation threshold, an user settable trip and reset delay. This trip signal can be used in the other subrelay "Output Logic" element to inhibit the trip of the other protective functions. The block logic can be defined by the user in the "Logic" tab page of each "Output Logic" block.

### 3.8.3 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
6700	Load Encroachment Function	Load Encroachment	Out of Service (outserv)	
6702	Load Encroachment Minimum Voltage	Min Voltage	Pickup Voltage (Uset)	
6703	Load Encroachment Reach	Load Encroachment	Reach (Reach)	
6704	Load Encroachment Angle	Load Encroachment	Angle (Angle)	
6705	Load Encroachment Pickup Delay	Pickup Delay	Time Setting (Tdelay)	
6706	Load Encroachment Reset Delay	Reset Delay	Time Setting (Tdelay)	

## **3.9 Output logic**

### **3.9.1 Available Units**

The output logic is implemented by the "Output Logic" block located in each subrelay and by the "Output Logic" block located in the main relay.

### **3.9.2 Functionality**

The "Output Logic" block located in the main relay is operating the breaker. Please disable the "Output Logic" block in the main relay to disable the relay model ability to open the power circuit. The signal operating the breaker is "yout". Height additional output signals ("H1" ... "H8") freely configurable are available.

### **3.9.3 Data input**

The configuration of the "H1" ... "H8" output signals can be done in the "Logic" tab page of the "Output Logic" block.

## 4 Features not supported

The following features are not supported:

- Breaker failure.
- Trip bus.
- Sensitive Directional Power.
- High impedance fault detector.
- Syncrocheck.
- Automatic Recloser.
- Two Breaker Control Elements.
- Load encroachment multiple selectable input source (*SRC1* is used)
- Frequency elements multiple selectable input source (*SRC1* is used)

## 5 References

- [1] GE Multilin, 215 Anderson Avenue, Markham - Ontario Canada L6E 1B3. *F60 Feeder Protection System UR Series Instruction Manual F60 Revision: 5.6x Manual P/N: 1601-0093-T1 (GEK-113484)*, 2008.