

FUNCTION BLOCK DESCRIPTION

Negative-sequence overvoltage protection function

ANSI 47, IEC U2>



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PROTECTION, AUTOMATION AND
CONTROL FOR POWER INDUSTRY



VERSION INFORMATION

VERSION	DATE	MODIFICATION	COMPILED BY
1.0	2014-08-19	First edition	Petri
2.0	2024-10-10	New design, new chapters, 2.10 system version added, IEC61850 info added	Saina, Erdős

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1 Application

The definite time negative sequence overvoltage protection function measures three voltages and calculates the negative sequence component. If the negative sequence component is above the level defined by parameter setting, then a start signal is generated.

1.1 Mode of operation

The function generates a start signal. The general start signal is generated if the negative sequence voltage component is above the level defined by parameter setting value.

The function generates a trip command only if the time delay has expired and the parameter selection requires a trip command as well.

The function can be disabled by parameter setting or by an external signal, edited by the graphic logic editor.

1.2 Operating characteristics

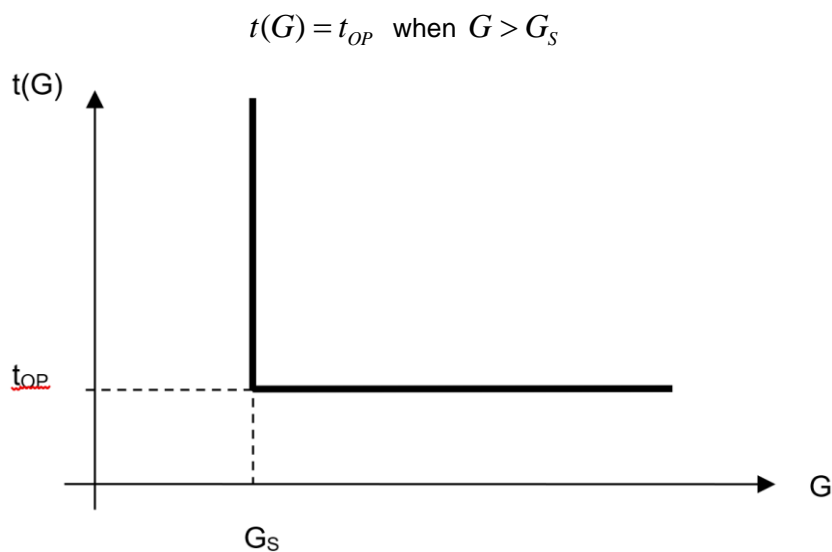


Figure 1-1 Negative sequence overvoltage definite time characteristic

where

t_{OP} (seconds)	theoretical operating time if $G > G_S$, fix, according to the parameter setting,
G	measured value of the characteristic quantity, Fourier base harmonic of the negative sequence voltage component,
G_S	setting value of the characteristic quantity.

1.3 Structure of the negative sequence definite time overvoltage protection algorithm

Figure 1-2 shows the structure of the negative sequence definite time overvoltage protection (TOV47) algorithm.

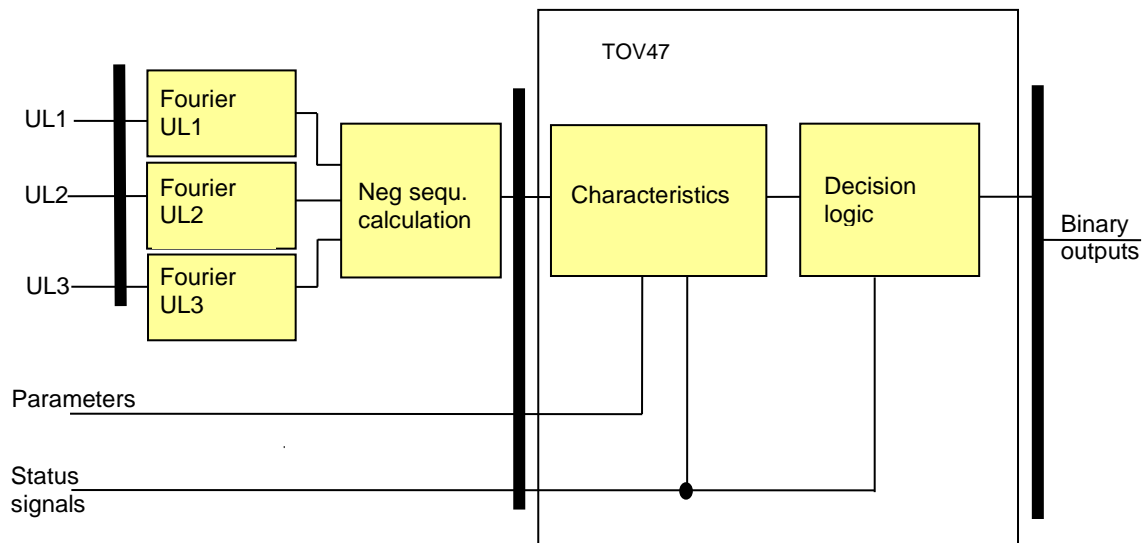


Figure 1-2 Structure of the negative sequence definite time overvoltage protection algorithm

The **inputs** are

- the RMS value of the negative sequence fundamental Fourier component, calculated using the sampled three phase voltages,
- parameters,
- status signals.

The **outputs** are

- the binary output status signals.

The **software modules** of the definite time overvoltage protection function:

Fourier calculations

These modules calculate the fundamental Fourier components of the phase voltages individually (not part of the TOV47 function).

Neg sequ. calculation

This module calculates the negative sequence fundamental Fourier component (not part of the TOV47 function).

Characteristics

This module calculates the required time delay based on the Fourier components of the negative sequence voltage component.

Decision logic

The decision logic module combines the status signals to generate the trip command of the function.

The descriptions that follow explain the details of the individual components.

1.4 The Fourier calculation (Fourier)

These modules calculate the fundamental Fourier components of the phase voltages individually. They are not part of the TOV47 function; they belong to the preparatory phase.

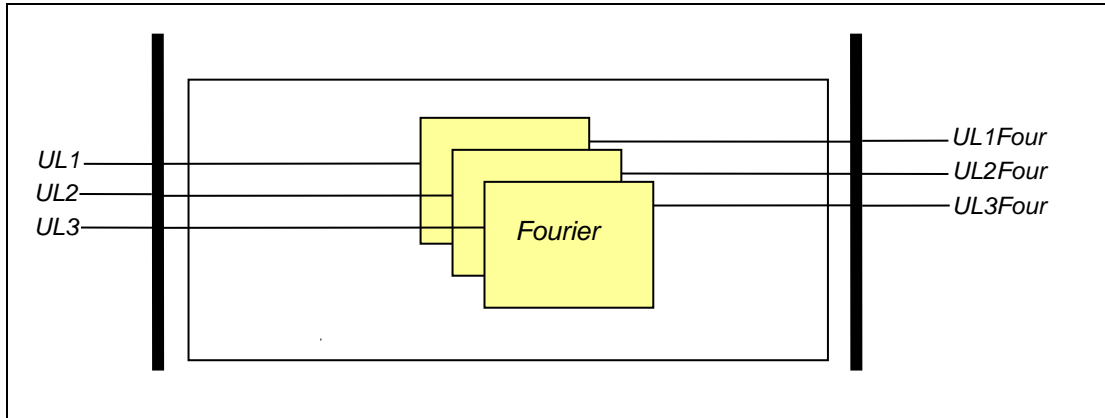


Figure 1-3 Schema of the Fourier calculation

The **inputs** are the sampled values of the three phase voltages (UL1, UL2, UL3)

The **outputs** are the RMS values of the fundamental Fourier components of the analyzed voltages (UL1Four, UL2Four, UL3Four).

1.5 The negative sequence component calculation (Neg sequ. calculation)

This module calculates the negative sequent fundamental Fourier component. This is not part of the TOV47 function; it belongs to the preparatory phase.

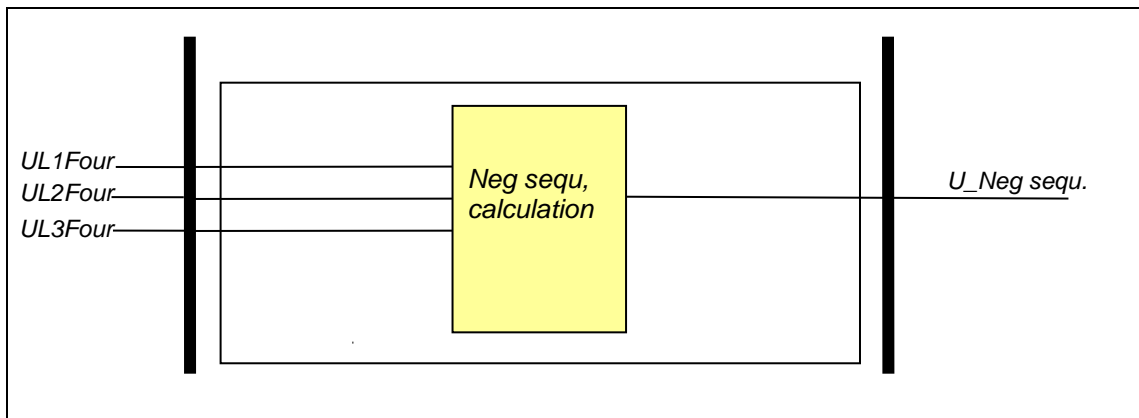


Figure 1-4 Schema of the negative sequence component calculation

The **inputs** are the RMS values of the fundamental Fourier components of the analyzed voltages (UL1Four, UL2Four, UL3Four).

The **output** is the RMS value of the negative sequence fundamental Fourier component voltage (U_Neg sequ.).

1.6 The definite time characteristics (Characteristics)

This module decides the stating of the function based on the negative sequence Fourier component voltage and it counts the time delay. The time delay is defined by the parameter setting, if the voltage is above the threshold value.

The **inputs** are the RMS value of the negative sequence fundamental Fourier component (U_{neg} sequ.) and parameters.

The internal **outputs** are the status signals. These indicate the started state and the generated trip command if the time delay determined by the setting is expired.

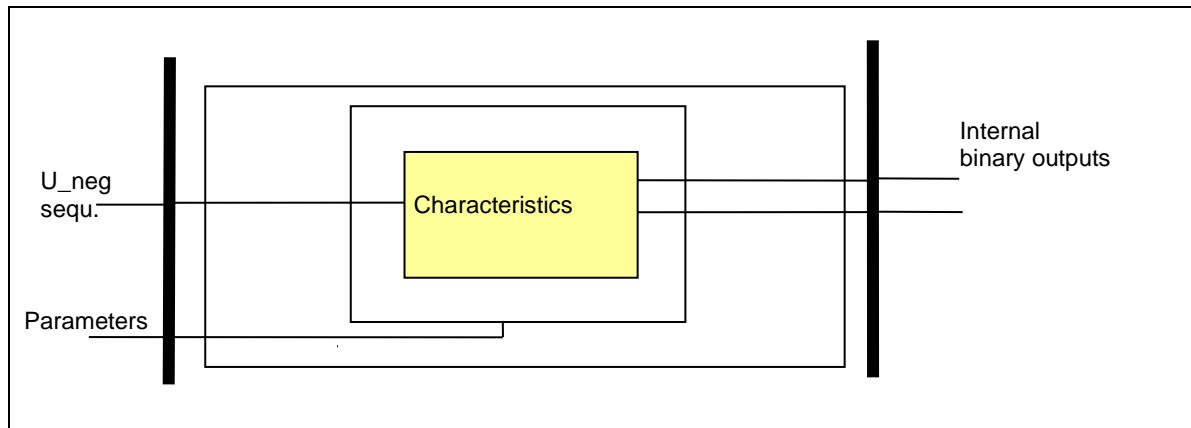


Figure 1-5 Schema of the definite time characteristic calculation

Table 1-1 The integer parameter of the neg. sequence overvoltage protection function

TITLE	DIM	RANGE	STEP	DEFAULT	EXPLANATION
Start Voltage	%	2 – 40	1	30	Voltage level setting. If the voltage is above the setting value, the function generates a start signal

Table 1-2 The timer parameter of the neg. sequence overvoltage protection function

TITLE	DIM	RANGE	STEP	DEFAULT	EXPLANATION
Time Delay	ms	50 – 60000	1	100	Time delay of the overvoltage protection function

The internal **binary output status signals** of the three-phase definite time overvoltage protection function are listed in Table 1-3 below.

Table 1-3 The internal binary output status signals of the function

BINARY OUTPUT SIGNALS	SIGNAL TITLE	EXPLANATION
Start	Start	Starting of the function
Trip	Trip	Trip command of the function

1.7 The decision logic (Decision logic)

The decision logic module combines the internal status signals, Boolean and binary parameters to generate the trip command of the function.

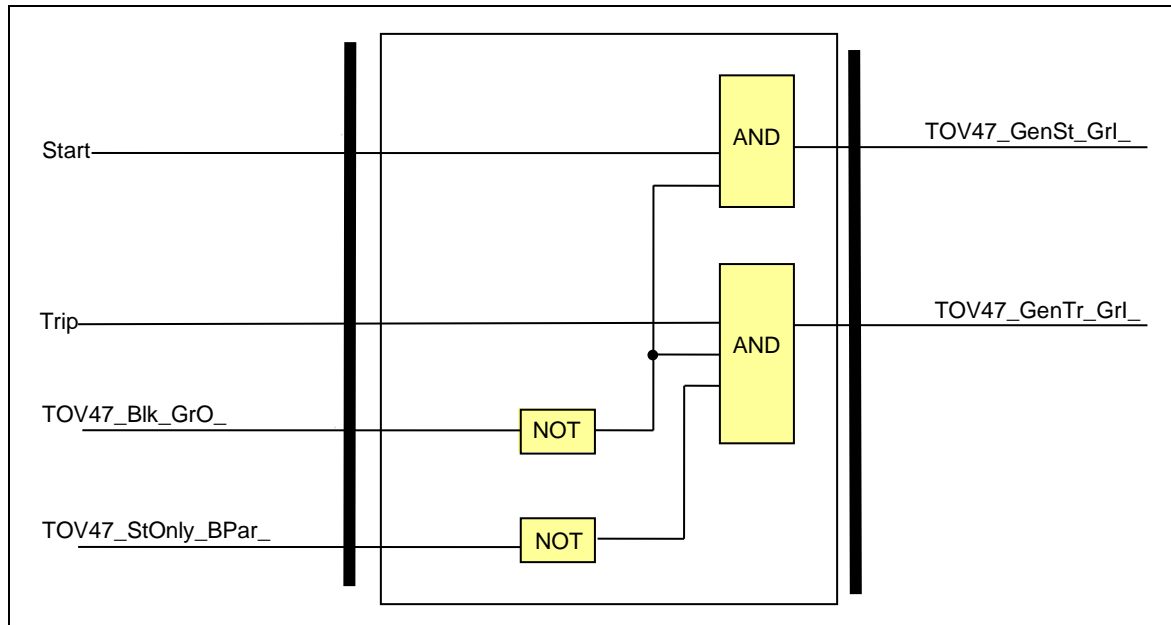


Figure 1-6 The decision logic scheme of the negative sequence definite time overvoltage protection function

The **boolean parameter** of the negative sequence definite time overvoltage protection function is shown in Table 1-4 below.

Table 1-4 The boolean parameter of the neg. sequence overvoltage protection function

TITLE	DIM	RANGE	STEP	DEFAULT	EXPLANATION
Start Signal Only	-	TRUE, FALSE	-	FALSE	Enabling start signal only

The negative sequence overvoltage protection function has a binary input signal, which serves the purpose of disabling the function. **The conditions of disabling are defined by the user, applying the graphic equation editor.**

Table 1-5 The binary input signal of the neg. sequence overvoltage protection function

BINARY INPUT SIGNALS	EXPLANATION
TOV47_Blk_GrO_	Output status of a graphic editor defined by the user to disable the negative sequence definite time overvoltage protection function

Binary output status signals

Table 1-6 The binary output signals of the neg. sequence overvoltage protection function

BINARY OUTPUT SIGNALS	SIGNAL TITLE	EXPLANATION
TOV47_GenSt_GrI_	General Start	General start signal
TOV47_GenTr_GrI_	General Trip	General trip command

2 Negative Sequence Overvoltage Protection Function Overview

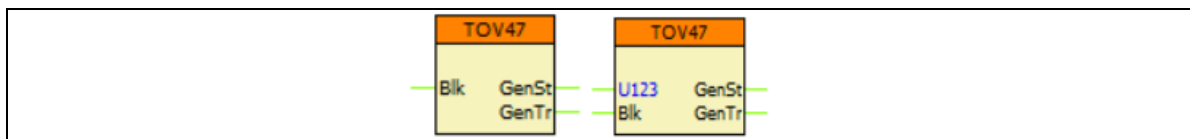


Figure 2-1 Graphic appearance of the neg. seq. overvoltage protection function block

2.1 Settings

2.1.1 Parameters

Table 2-1 Parameters of the function

TITLE	DIM	RANGE	STEP	DEFAULT	EXPLANATION
Operation	-	On, Off	-	Off	Enabling the function
Start Signal Only	-	TRUE, FALSE	-	FALSE	Enabling start signal only
Start Voltage	%	2 – 40	1	30	Voltage level setting. If the voltage is above the setting value, the function generates a start signal
Time Delay	ms	50 – 60000	1	100	Time delay of the overvoltage protection function

2.2 Function I/O

2.2.1 Analogue inputs

For configurations running on firmware version 2.10.2.3010 and above, i.e. with graphical analogue signals Table 2-2 below shows the analogue inputs. Parts written in **bold** are seen on the left side of the function block in the logic editor.

Table 2-2 The graphical analogue input signals of the neg. seq. overvoltage protection function

ANALOGUE INPUT SIGNALS	TITLE	EXPLANATION
TOV47_ U123 _AnIn_	3phase voltage	Input for sampled values of the 3-Phase voltages

2.2.2 Analogue outputs

There are no analogue outputs for this function block.

2.2.3 Binary input signals (graphed output statuses)

The **binary input status signals** of the neg. seq. overvoltage protection function are listed in Table 2-3. Parts written in **bold** are seen on the function block in the logic editor.

Table 2-3 The binary input status signals of the neg. seq. overvoltage protection function

BINARY INPUT SIGNALS	SIGNAL TITLE	EXPLANATION
TOV47_ Blk _GrO_	Blk	Signal for blocking the function

2.2.4 Binary output signals (graphed input statuses)

The **binary output status signals** of the neg. seq. overvoltage protection function are listed in Table 2-4. Parts written in **bold** are seen on the function block in the logic editor.

Table 2-4 The binary output status signals of the neg. seq. overvoltage protection function

BINARY OUTPUT SIGNALS	SIGNAL TITLE	EXPLANATION
TOV47_ GenSt _Grl_	General Start	General start signal
TOV47_ GenTr _Grl_	General Trip	General trip command

2.2.5 Online data

The following values are visible in the *online data* page:

Table 2-5 Online data of the neg. seq. overvoltage protection function block

SIGNAL TITLE	DIMENSION	EXPLANATION
General Start	-	General start signal
General Trip	-	General trip command
<i>Voltage input assignment</i>	-	<i>Status of the graphical analogue input (if exists) (Complete if OK, Missing if not connected)</i>

2.2.6 Events

The following events are generated in the event list as well as sent to the SCADA

Table 2-6 Events of the neg. seq. overvoltage protection function block

EVENT	VALUE	EXPLANATION	IEC 61850 DATA ATTRIBUTE
General Start	on, off	General start signal	F1PTOV\$ST\$Str
General Trip	on, off	General trip command	F1PTOV\$ST\$Op

2.3 Technical data

Table 2-7 Technical data of the neg. seq. overvoltage protection function

FUNCTION	VALUE	ACCURACY
Pick-up starting accuracy		< ± 0,5 %
Blocking voltage		< ± 1,5 %
Reset time	60 ms	
U> → Un	50 ms	
U> → 0		
Operate time accuracy		< ± 20 ms
Drop-off ratio		± 0.5 %
Minimum operate time	50 ms	

2.4 Notes for Testing

Normally in the EuroProt+ devices the trip contacts are assigned to the Trip Logic function block, and not to the protection function blocks. Because of this, the testing personnel must make sure that the Trip Logic is switched on ('Operation' parameter is set to other than 'Off') before starting the tests, otherwise there will be no physical trip on the relay.