OV3_ Three-Phase Overvoltage Protection Low-Set Stage (OV3Low) High-Set Stage (OV3High)

Contents

1. Introduction

1.1 Features

- Single-phase, two-phase and three-phase overvoltage protection
- Definite-time (DT) operation
- OV3Low: two inverse-time (IDMT) characteristics
- Voltage measurement with conventional voltage transformers or voltage dividers
- Two alternative measuring principles: the average value of consecutive instantaneous peak-to-peak values of voltages or the numerically calculated fundamental frequency voltages
- Virtual phase-to-phase voltage measurement channels can be used instead of the corresponding analogue measurement channels

1.2 Application

This document specifies the functions of the three-phase overvoltage function blocks OV3Low and OV3High used in products based on the RED 500 Platform. The inverse-time operation is only included in the OV3Low function block.

Faults in the network or a faulty tap changer or voltage regulator of a power transformer may cause abnormal busbar voltages. The function blocks OV3Low and OV3High are designed for the single-phase, two-phase and three-phase overvoltage protection whenever the DT characteristic or, as concerns the low-set stage, the IDMT (Inverse Definite Minimum Time) characteristic is appropriate. Suppression of harmonics is possible.

Table 1 . Protection diagram symbols used in the relay terminal

ABB	IEC	ANSI
OV3Low	3U>	59-1
OV3High	3U>>	59-2

For IEC symbols used in single line diagrams, refer to the manual “Technical Descriptions of Functions, Introduction”, 1MRS750528-MUM.

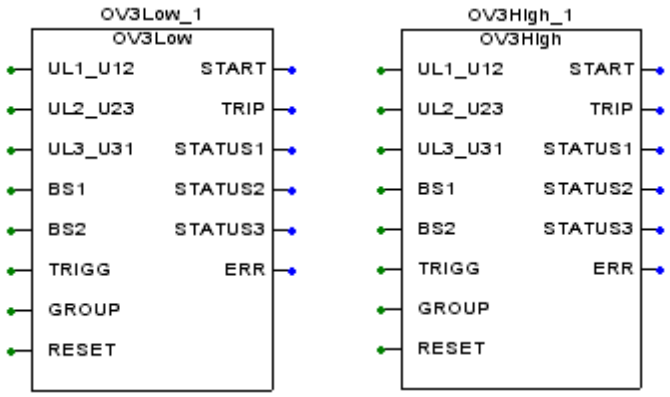

Figure 1. Function block symbols of OV3Low and OV3High

1.3 Input description

Name	Type	Description
UL1_U12	Analogue signal (SINT)	Input for measuring the phase-to-phase voltage U_{12} or the phase-to-earth voltage U_{L1}
UL2_U23	Analogue signal (SINT)	Input for measuring the phase-to-phase voltage U_{23} or the phase-to-earth voltage U_{L2}
UL3_U31	Analogue signal (SINT)	Input for measuring the phase-to-phase voltage U_{31} or the phase-to-earth voltage U_{L3}
BS1	Digital signal (BOOL, active high)	Blocking signal 1
BS2	Digital signal (BOOL, active high)	Blocking signal 2
TRIGG	Digital signal (BOOL, pos. edge)	Control signal for triggering the registers
GROUP	Digital signal (BOOL, active high)	Control input for switching between the setting groups 1 and 2. When GROUP is FALSE, group 1 is active. When GROUP is TRUE, group 2 is active.
RESET	Reset signal (BOOL, pos. edge)	Input signal for resetting the trip signal and registers of OV3Low or OV3High

1.4 Output description

Name	Type	Description
START	Digital signal (BOOL, active high)	Start signal
STATUS1	Digital signal (BOOL, active high)	Status of UL1_U12
STATUS2	Digital signal (BOOL, active high)	Status of UL2_U23
STATUS3	Digital signal (BOOL, active high)	Status of UL3_U31
TRIP	Digital signal (BOOL, active high)	Trip signal
ERR	Digital signal (BOOL, active high)	Signal for indicating a configuration error

2. Description of operation

2.1 Configuration

Voltages can be measured with conventional voltage transformers or voltage dividers. The measuring devices and signal types for analogue channels are selected and configured in a special dialogue box of the Relay Configuration Tool included in the CAP 505 Tool Box. Digital inputs are configured in the same programming environment (the number of selectable analogue inputs, digital inputs and digital outputs depends on the hardware variant).

When the analogue channels and digital inputs have been selected and configured in the dialogue box, the inputs and outputs of the function block can be configured on a graphic worksheet of the configuration tool. Digital inputs are connected to the boolean inputs of the function block and in the same way, the outputs of the function block are connected to the output signals.

Voltage measurement channels are connected to the UL1_U12, UL2_U23 and UL3_U31 inputs of the function block. The following voltages can be connected to each input:

Input name	Measured voltage
UL1_U12	UL1, UL1b, U12, U12b, U12s or U12bs
UL2_U23	UL2, UL2b, U23, U23b, U23s or U23bs
UL3_U31	UL3, UL3b, U31, U31b, U31s or U31bs

All analogue inputs has to be connected. If single or two-phase protection is required, one of the voltage channels must be connected to multiple inputs of the function block. This can be done only with phase-to-phase voltage channels.

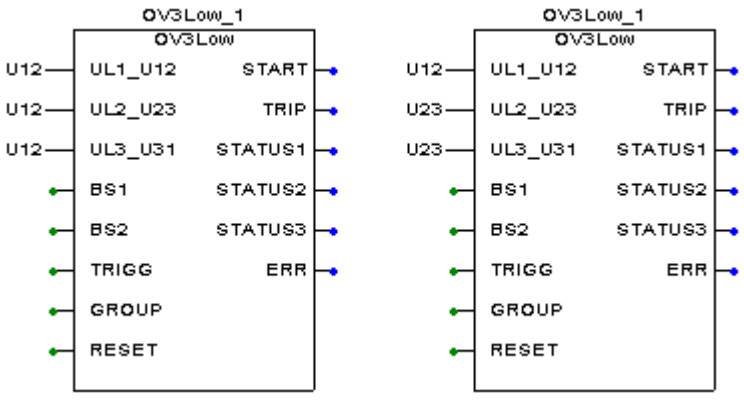

Figure 2 Connection examples when only one or two phase-to-phase voltages are available

If phase voltages are connected to the function block, the control parameter "Measuring mode" has to be in position Mode 3. Phase-to-phase voltages are derived from phase voltages within the function block as follows:

U12 = UL1 - UL2

U23 = UL2 - UL3

U31 = UL3 - UL1

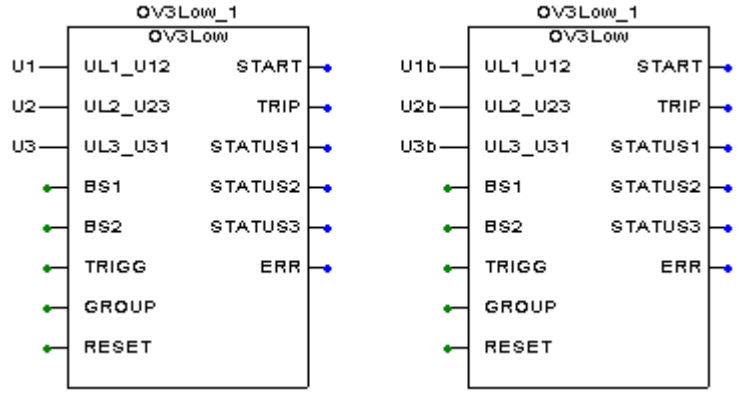

Figure 3 Connections when phase voltages are connected directly to the function block

Note that when phase-to-phase voltages are derived numerically in the function block, only the fundamental frequency measurement can be used: peak-to-peak measurement is not available (see section 2.2 Measuring mode).

Numerical formulation of phase-to-phase voltages can be done outside the function block as well. In this case virtual phase-to-phase voltage channels are connected to the function block. Both measuring modes 1 or 2 can now be used. Single or two-phase protection can be achieved similarly as in Figure 2.

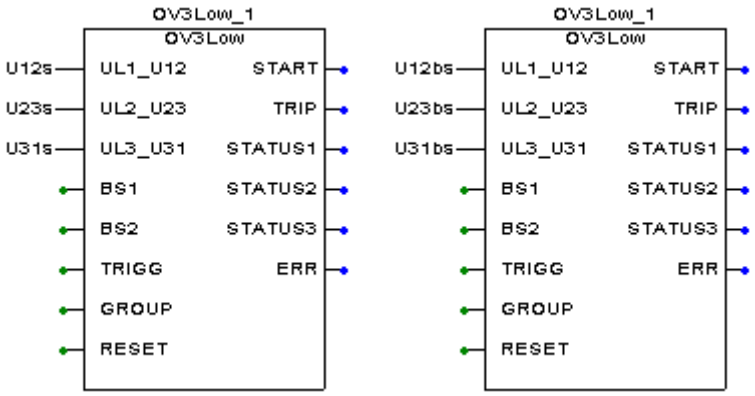

Figure 4 Connection examples when virtual phase-to-phase voltages are used

2.2 Measuring mode

When phase-to-phase voltages are measured, the function block operates on two alternative measuring principles: the average value of consecutive instantaneous peak-to-peak values of voltages or the numerically calculated fundamental frequency voltage. The measuring mode is selected with either an MMI parameter or a serial communication parameter as follows:

Measuring mode	Voltage types measured	Measuring principle
Mode 1	Phase-to-phase voltages	Peak-to-peak measurement
Mode 2	Phase-to-phase voltages	Fundamental frequency measurement
Mode 3	Phase-to-earth voltages	Fundamental frequency measurement

With both the measuring principles, the operation is insensitive to the DC component and the operation accuracy is defined in the frequency range f/f_n=0.95...1.05. In peak-to-peak measurement, the harmonics of the voltages are not suppressed, whereas in fundamental frequency measurement the harmonics suppression is at least -50 dB at f = n x f_n, where n = 2, 3, 4, 5...

2.3 Operation criteria

If at least one phase-to-phase voltage measured by the function block exceeds the set start voltage, the module delivers the START signal. When the function block starts, the START signal and the STATUS_ output signal of the specific phase-to-earth or phase-to-phase voltage are set to TRUE. Should the overvoltage situation exceed the preset definite operate time or, at the inverse-time operation of OV3Low, the time determined by the level of the measured voltage, the function block operates. At the inverse-time operation, two different sets of voltage/time curves, A and B, are available. The delay of the heavy-duty output relay is included in the total operate time. In operation, the TRIP signal is set to TRUE.

The DT or IDMT timer is allowed to run only if the blocking signal BS1 is inactive, i.e. its value is FALSE. When the signal becomes active, i.e. its value turns to TRUE, the timer will be stopped (frozen).

When the blocking signal BS2 is active, the TRIP signal cannot be activated. The TRIP signal can be blocked by activating the BS2 signal until the function block drops off.

2.3.1 Operation hysteresis and reset ratio

The “Oper. hysteresis” control parameter can be set to adjust the level of a comparator. The operation hysteresis affects the reset ratio. If the hysteresis is set to 3%, for example, the reset ratio of an overvoltage function block (OV3_) will be 0.97. On the other hand, the same setting for an undervoltage function block (UV3_) will lead to the reset ratio of 1.03. Furthermore, an absolute operation hysteresis of 0.005 per unit is included. The absolute hysteresis affects the reset ratio when a low start voltage setting is used. For example, if the start voltage setting is 0.2 x Un and the operation hysteresis is set to 2%, the reset ratio would normally be 0.98 (OV_) or 1.02 (UV_). Due to the absolute hysteresis, however, the reset ratio will be 0.975 (OV_) or 1.025 (UV_).

The default setting of the parameter, which is 4%, is recommended. A lower hysteresis setting may lead to repetitive starting of protection. Therefore, the deviation from the nominal frequency and the total harmonic distortion (THD) of the network should be carefully studied when using a setting lower than the default value, since these factors affect the measurement accuracy. If a low hysteresis setting is used, the following is recommended:

Network condition	Recommended action
Low deviation from the nominal frequency	Use fundamental frequency measurement (Mode 2&3)
High deviation from the nominal frequency but low THD	Use peak-to-peak measurement (Mode 1)
High deviation from the nominal frequency and high THD	Increase the operation hysteresis setting

Figure 5 below clarifies the effect of the “Oper. hysteresis” parameter. The start voltage of overvoltage protection is set to 1.1 x Un and that of undervoltage protection to 0.9 x Un. Both protection functions have the same setting of 4% for the “Oper. hysteresis” parameter.

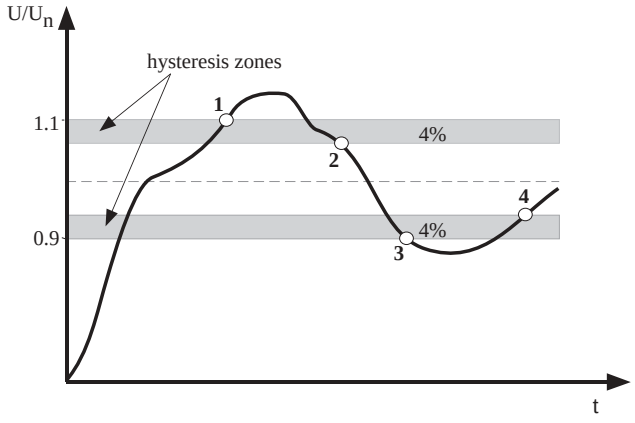

Figure 5. Principal of the operation hysteresis of voltage protection: 1)Overvoltage protection starts 2)The start of overvoltage protection is reset

3)Undervoltage protection starts 4)The start of undervoltage protection is reset

2.4 IDMT type operation of OV3Low

At the inverse-time characteristic, the operate time will the shorter, the more the voltage deviates from the set start voltage. The relationship between time and voltage can be expressed as follows:

$$t = \frac{ka}{\left(b\frac{U-U>}{U>}-0.5\right)^{p}}+c$$,where

- t operate time in seconds
- k adjustable time multiplier
- U measured voltage
- U> set start voltage
- a constant 480
- b constant 32
- c constant 0.035
- p constant (see the table below)

In the IDMT mode of operation, the integration of the operate time of the overvoltage function block does not start until the voltage exceeds the set start value by 6%. The operate time accuracy stated in the technical data applies when the voltage exceeds the set value by 10%.

The overvoltage function block includes two selectable inverse-time characteristics, curve A and curve B. The degree of inversity is determined by the factor p as follows:

Characteristic	p (constant)
A	2
B	3

(For a graphical presentation of the curves, refer to the manual “Technical Descriptions of Functions, Introduction”.)

The parameter “Operation mode” is used for selecting the desired operate time characteristic.

2.5 Setting groups

Two different groups of setting values, group 1 and group 2, are available for the function block. Switching between the two groups can be done in the following three ways:

1 Locally via the control parameter “Group selection”[1)] of the MMI

2 Over the communication bus by writing the parameter V2[1)]

3 By means of the input signal GROUP when allowed via the parameter “Group selection” (i.e. when V2 = 2[1)]).

[1)] Group selection (V2): 0 = Group 1; 1 = Group 2; 2 = GROUP input

The control parameter “Active group” indicates the setting group valid at a given time.

2.6 Test mode

The digital outputs of the function block can be activated with separate control parameters for each output either locally via the MMI or externally via the serial communication. When an output is activated with the test parameter, an event indicating the test is generated.

The protection functions operate normally while the outputs are tested.

2.7 START and TRIP outputs

The output signal START is always pulse-shaped. The minimum pulse width of the corresponding output signal is set via a separate parameter on the MMI or on serial communication. If the start situation is longer than the set pulse width, the START signal remains active until the start situation is over. The output signal TRIP may be non-latching or latching. When the latching mode has been selected, the TRIP signal remains active until the output is reset even if the operation criteria have reset.

2.8 Resetting

The TRIP output signal and the registers can be reset either with the RESET input or over the serial bus or the local MMI.

The operation indicators, latched trip signal and recorded data can be reset as follows:

	Operation indicators	Latched trip signal	Recorded data
RESET input of the function block [1)]		X	X
Parameter F062V013 for OV3Low[1)]		X	X
Parameter F063V013 for OV3High[1)]		X	X
General parameter F001V011 [2)]	X		
General parameter F001V012 [2)]	X	X	
General parameter F001V013 [2)]	X	X	X
Push-button C [2)]	X		
Push-buttons C + E (2 s) [2)]	X	X	
Push-buttons C + E (5 s) [2)]	X	X	X

[1)] Resets the latched trip signal and recorded data of the particular function block.
[2)] Affects all function blocks.

3. Parameters and events

3.1 General

- Each function block has a specific channel number for serial communication parameters and events. The channel for OV3Low is 62 and that for OV3High 63.
- The data direction of the parameters defines the use of each parameter as follows:

Data direction	Description
R, R/M	Read only
W	Write only
R/W	Read and write

- The different event mask parameters (see section “Control settings”) affect the visibility of events on the MMI or on serial communication (LON or SPA) as follows:

Event mask 1 (FxxxV101/102)	SPA / MMI (LON)
Event mask 2 (FxxxV103/104)	LON
Event mask 3 (FxxxV105/106)	LON
Event mask 4 (FxxxV107/108)	LON

For example, if only the events E3, E4 and E5 are to be seen on the MMI of the relay terminal, the event mask value 56 (8 + 16 + 32) is written to the “Event mask 1” parameter (FxxxV101).

In case a function block includes more than 32 events, there are two parameters instead of e.g. the “Event mask 1” parameter: the parameter “Event mask 1A” (FxxxV101) covers the events 0...31 and “Event mask 1B”(FxxxV102) the events 32...63.

3.2 Setting values

3.2.1 Actual settings

OV3Low

Parameter	Code	Values	Unit	Default	Data direction	Explanation
Operation mode	S1	0 ... 3 [1)]	-	1	R/M	Selection of operation mode and inverse-time characteristic
Start voltage	S2	0.10...1.60	x Un	1.10	R/M	Start voltage
Operate time	S3	0.05...300.00	s	0.05	R/M	Operate time in DT mode
Time multiplier	S4	0.05...1.00	-	0.05	R/M	Time multiplier in IDMT mode

[1)]Operation mode 0 = Not in use; 1 = Definite time; 2 = A curve; 3 = B curve

OV3High

Parameter	Code	Values	Unit	Default	Data direction	Explanation
Operation mode	S1	0 or 1 [1)]	-	1	R/M	Selection of operation mode
Start voltage	S2	0.10...1.60	x Un	1.10	R/M	Start voltage
Operate time	S3	0.05...300.00	s	0.05	R/M	Operate time in DT mode

[1)]Operation mode 0 = Not in use; 1 = Definite time

3.2.2 Setting group 1

OV3Low

Parameter	Code	Values	Unit	Default	Data direction	Explanation
Operation mode	S41	0 ... 3 [1)]	-	1	R/W	Selection of operation mode and inverse-time characteristic
Start voltage	S42	0.10...1.60	x Un	1.10	R/W	Start voltage
Operate time	S43	0.05...300.00	s	0.05	R/W	Operate time in DT mode
Time multiplier	S44	0.05...1.00	-	0.05	R/W	Time multiplier in IDMT mode

[1)]Operation mode 0 = Not in use; 1 = Definite time; 2 = A curve; 3 = B curve

OV3High

Parameter	Code	Values	Unit	Default	Data direction	Explanation
Operation mode	S41	0 or 1 [1)]	-	1	R/W	Selection of operation mode
Start voltage	S42	0.10...1.60	x Un	1.10	R/W	Start voltage
Operate time	S43	0.05...300.00	s	0.05	R/W	Operate time in DT mode

[1)]Operation mode 0 = Not in use; 1 = Definite time

3.2.3 Setting group 2

OV3Low

Parameter	Code	Values	Unit	Default	Data direction	Explanation
Operation mode	S71	0 ... 3 [1)]	-	1	R/W	Selection of operation mode and inverse-time characteristic
Start voltage	S72	0.10...1.60	x Un	1.10	R/W	Start voltage
Operate time	S73	0.05...300.00	s	0.05	R/W	Operate time in DT mode
Time multiplier	S74	0.05...1.00	-	0.05	R/W	Time multiplier in IDMT mode

[1)]Operation mode 0 = Not in use; 1 = Definite time; 2 = A curve; 3 = B curve

OV3High

Parameter	Code	Values	Unit	Default	Data direction	Explanation
Operation mode	S71	0 or 1 [1)]	-	1	R/W	Selection of operation mode
Start voltage	S72	0.10...1.60	x Un	1.10	R/W	Start voltage
Operate time	S73	0.05...300.00	s	0.05	R/W	Operate time in DT mode

[1)]Operation mode 0 = Not in use; 1 = Definite time

3.2.4 Control settings

Parameter	Code	Values	Unit	Default	Data direction	Explanation
Measuring mode	V1	0 ... 2 [1]	-	0	R/W	Selection of measuring mode
Group selection	V2	0 ... 2 [2]	-	0	R/W	Selection of the active setting group
Active group	V3	0 or 1 [3]	-	0	R/M	Active setting group
Start pulse	V4	0...1000	ms	0	R/W	Minimum pulse width of START signal
Trip signal	V5	0 or 1 [4]	-	0	R/W	Selection of latching feature for TRIP output
Trip pulse	V6	40...1000	ms	40	R/W	Minimum pulse width of TRIP
Oper. hysteresis	V7	1.0…5.0	%	4.0	R/W	Operation hysteresis
Reset registers	V13	1=Reset	-	0	W	Resetting of latched trip signal and registers
Test START	V31	0 or 1 [5]	-	0	R/W	Testing of START
Test TRIP	V32	0 or 1 [5]	-	0	R/W	Testing of TRIP
Event mask 1	V101	0...1023	-	15	R/W	Event mask 1 for event transmission (E0 ... E9)
Event mask 2	V103	0...1023	-	15	R/W	Event mask 2 for event transmission (E0 ... E9)
Event mask 3	V105	0...1023	-	15	R/W	Event mask 3 for event transmission (E0 ... E9)
Event mask 4	V107	0...1023	-	15	R/W	Event mask 4 for event transmission (E0 ... E9)

[1] Measuring mode 0 = Mode 1; 1 = Mode 2; 2 = Mode 3
[2] Group selection 0 = Group 1; 1 = Group 2; 2 = GROUP input
[3] Active group 0 = Group 1; 1 = Group 2
[4] Trip signal 0 = Non-latching; 1 = Latching
[5] Test START 0 = Do not activate; 1 = Activate

3.3 Measurement values

3.3.1 Input data

Parameter	Code	Values	Unit	Default	Data direction	Explanation
Voltage UL1_U12	I1	0.00...2.00	x Un	0.00	R/M	Phase-to-phase voltage U_{12} or phase-to earth voltage U_{L1}
Voltage UL2_U23	I2	0.00...2.00	x Un	0.00	R/M	Phase-to-phase voltage U_{23} or phase-to earth voltage U_{L2}
Voltage UL3_U31	I3	0.00...2.00	x Un	0.00	R/M	Phase-to-phase voltage U_{31} or phase-to earth voltage U_{L3}
Input BS1	I4	0 or 1 [1)]	-	0	R/M	Block signal BS1
Input BS2	I5	0 or 1 [1)]	-	0	R/M	Block signal BS2
Input TRIGG	I6	0 or 1 [1)]	-	0	R/M	Signal for triggering the registers
Input GROUP	I7	0 or 1 [1)]	-	0	R/M	Signal for switching between the groups 1 and 2
Input RESET	I8	0 or 1 [1)]	-	0	R/M	Signal for resetting the output signals and registers of OV3Low or OV3High

[1)]Input 0 = Not active; 1 = Active

3.3.2 Output data

Parameter	Code	Values	Unit	Default	Data direction	Explanation
Output START	O1	0 or 1 [1)]	-	0	R/M	Status of start signal
Output TRIP	O2	0 or 1 [1)]	-	0	R/M	Status of trip signal

[1)]Output 0 = Not active; 1 = Active

3.3.3 Recorded data

3.3.3.1 General

The information required for later fault analysis is recorded when the function block starts or trips, or when the recording function is triggered via the external TRIGG input.

The data of the last three events are stored in Recorded data 1…3, beginning from Recorded data 1. These registers are updated in a cyclical manner, where the values of the most recent event overwrite the oldest recorded data. If the recorded data has been reset or the relay has been restarted, the first event is again stored in Recorded data 1.

3.3.3.2 Date and time

The time stamp indicates the rising edge of the START, TRIP or TRIGG signal.

3.3.3.3 Duration

In the DT mode of operation the duration of the start situation is recorded as a percentage of the set operate time and, as concerns OV3Low, in the IDMT mode of operation as a percentage of the calculated operate time.

3.3.3.4 Voltages

If the function block trips, the voltage values are updated at the moment of tripping, i.e. on the rising edge of the TRIP signal. At external triggering, the voltage values are updated at the moment of triggering i.e. on the rising edge of the input signal TRIGG. If the function block starts but does not trip, the voltage values captured one fundamental cycle (20 ms at rated frequency 50 Hz) after the beginning of the start situation will be recorded. So, the values of the phase-to-phase voltages U_{12}, U_{23} and U_{31} are always recorded at the same moment, as multiples of the rated voltage U_n.

3.3.3.5 Status data

The status data of the input signals BS1 and BS2 as well as the “Active group” parameter are recorded at the moment of triggering. The “Active group” parameter indicates the setting group valid for the recorded data.

3.3.3.6 Priority

The priority of the recording function is the following:

1 Tripping

2 Starting

3 External triggering,

which means that if the function block has started, it will neglect an external triggering request.

3.3.3.7 Recorded data 1

Parameter	Code	Values	Unit	Default	Data direction	Explanation
Date	V201	YYYY-MM-DD	-	-	R/M	Recording date
Time	V202	hh:mm:ss.000	-	-	R/M	Recording time
Duration	V203	0.0...100.0	%	0.0	R/M	Duration of start situation
Voltage UL1_U12	V204	0.00...2.00	x Un	0.00	R/M	Filtered value of U_{12} or U_{L1}
Voltage UL2_U23	V205	0.00...2.00	x Un	0.00	R/M	Filtered value of U_{23} or U_{L2}
Voltage UL3_U31	V206	0.00...2.00	x Un	0.00	R/M	Filtered value of U_{31} or U_{L3}
BS1	V207	0 or 1 [1)]	-	0	R/M	Status of BS1 input
BS2	V208	0 or 1 [1)]	-	0	R/M	Status of BS2 input
Active group	V209	0 or 1 [2)]	-	0	R/M	Active setting group

[1)]BS_ 0 = Not active; 1 = Active
[2)]Active group 0 = Group 1; 1 = Group 2

3.3.3.8 Recorded data 2

Parameter	Code	Values	Unit	Default	Data direction	Explanation
Date	V301	YYYY-MM-DD	-	-	R/M	Recording date
Time	V302	hh:mm:ss.000	-	-	R/M	Recording time
Duration	V303	0.0...100.0	%	0.0	R/M	Duration of start situation
Voltage UL1_U12	V304	0.00...2.00	x Un	0.00	R/M	Filtered value of U_{12} or U_{L1}
Voltage UL2_U23	V305	0.00...2.00	x Un	0.00	R/M	Filtered value of U_{23} or U_{L2}
Voltage UL3_U31	V306	0.00...2.00	x Un	0.00	R/M	Filtered value of U_{31} or U_{L3}
BS1	V307	0 or 1 [1)]	-	0	R/M	Status of BS1 input
BS2	V308	0 or 1 [1)]	-	0	R/M	Status of BS2 input
Active group	V309	0 or 1 [2)]	-	0	R/M	Active setting group

[1)]BS_ 0 = Not active; 1 = Active
[2)]Active group 0 = Group 1; 1 = Group 2

3.3.3.9 Recorded data 3

Parameter	Code	Values	Unit	Default	Data direction	Explanation
Date	V401	YYYY-MM-DD	-	-	R/M	Recording date
Time	V402	hh:mm:ss.000	-	-	R/M	Recording time
Duration	V403	0.0...100.0	%	0.0	R/M	Duration of start situation
Voltage UL1_U12	V404	0.00...2.00	x Un	0.00	R/M	Filtered value of U_{12} or U_{L1}
Voltage UL2_U23	V405	0.00...2.00	x Un	0.00	R/M	Filtered value of U_{23} or U_{L2}
Voltage UL3_U31	V406	0.00...2.00	x Un	0.00	R/M	Filtered value of U_{31} or U_{L3}
BS1	V407	0 or 1 [1)]	-	0	R/M	Status of BS1 input
BS2	V408	0 or 1 [1)]	-	0	R/M	Status of BS2 input
Active group	V409	0 or 1 [2)]	-	0	R/M	Active setting group

[1)]BS_ 0 = Not active; 1 = Active
[2)]Active group 0 = Group 1; 1 = Group 2

3.3.4 Events

Code	Weighting coefficient	Default mask	Event reason	Event state
E0	1	1	START signal from 3U> or 3U>> stage	Reset
E1	2	1	START signal from 3U> or 3U>> stage	Activated
E2	4	1	TRIP signal from 3U> or 3U>> stage	Reset
E3	8	1	TRIP signal from 3U> or 3U>> stage	Activated
E4	16	0	BS1 signal of 3U> or 3U>> stage	Reset
E5	32	0	BS1 signal of 3U> or 3U>> stage	Activated
E6	64	0	BS2 signal of 3U> or 3U>> stage	Reset
E7	128	0	BS2 signal of 3U> or 3U>> stage	Activated
E8	256	0	Test mode of 3U> or 3U>> stage	Off
E9	512	0	Test mode of 3U> or 3U>> stage	On

4. Technical data

Operation accuracies	The operation accuracy is ± 2.5 % of the set value when phase-to-earth voltages are connected to the terminal and phase-to-phase values are derived numerically in the terminal. The operation accuracy is ± 1 % of the set value when phase-to-phase voltages are connected directly to the terminal. Above values apply when f/fn = 0.95...1.05
Start time	Injected voltages = 1.1 x start voltage: f/f_n = 0.95...1.05 internal time < 42 ms total time[1] < 50 ms
Reset time	40...1000 ms (depends on the minimum pulse width set for the TRIP output)
Reset ratio	Default 0.96 (range 0.95...0.99) Depends on the value of the “Oper. hysteresis” parameter
Retardation time	Total retardation time when the voltage drops below the start value[2] < 50 ms
Operate time accuracy in definite-time mode	Depends on the frequency of the voltage measured: f/f_n = 0.95...1.05: ± 2% of set value or ± 20 ms[2]
Accuracy class index E in inverse-time mode (OV3Low)	Depends on the frequency of the voltage measured: f/f_n = 0.95...1.05: ± 20 ms[2] or the accuracy appearing when the measured voltage varies ±2.5%
Frequency dependence of the settings and operate times (see above)	Measuring mode — Suppression of harmonics Mode 1 — No suppression Mode 2&3 — -50 dB at f = n x f_n, where n = 2, 3, 4, 5,...
Configuration data	Task execution interval (Relay Configuration Tool): 10 ms at the rated frequency f_n = 50 Hz

[1] Includes the delay of the signal relay
[2] Includes the delay of the heavy-duty output relay

Technical revision history		
Function block	**Technical revision**	**Change**
OV3Low	B	-
	C	- (No change in the manual)
	D	Input names changed: U12 → UL1_U12 U23 → UL2_U23 U31 → UL3_U31 New outputs: STATUS1, STATUS2, STATUS3 Control parameter “Oper. hysteresis” added Setting parameter values changed: Start voltage: 0.80…1.60 → 0.10…1.60 Operate time: 0.05…10.00 → 0.05…300.00 Input data parameter names changed: Voltage U12 → Voltage UL1_U12 Voltage U23 → Voltage UL2_U23 Voltage U31 → Voltage UL3_U31
	E	-
OV3High	B	-
	C	See above: OV3Low D
	D	-