FUNCTION BLOCK DESCRIPTION

Loss-of-load (undercurrent) protection function

ANSI 37, IEC I<

PROTECTA HUNGARY

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PROTECTION, AUTOMATION AND CONTROL FOR POWER INDUSTRY

VERSION INFORMATION

VERSION	DATE	MODIFICATION	COMPILED BY
1.0	2010-11-11	First edition	Petri
2.0	2025-08-20	New design, new chapters, graphical analogue inputs added, IEC61850 info added	Papik, Erdős, Ádám

CONTENTS

USED SYMBOLS

Additional information

Useful information for settings.

Important part for proper usage.

1 Operation principle

The loss-of-load (undercurrent) protection function operates when the current decreases below a predetermined value.

This protection function can be applied to fan or pump drives, where the flowing media provides cooling for the motor itself. If this cooling stops, the motor must not remain in operation. In these cases, the protection against low load after a given time delay disconnects the motor from the power supply.

It can also stop a motor in case of a failure in a mechanical transmission (e.g. conveyor belt).

A time delay may be required after the start of the function to prevent operation during transients of the power systems.

The advantage of this function is its simplicity: no voltage measurement is needed, no power calculations are performed. The operation is based on phase currents only.

1.1 Operation of the loss-of-load (undercurrent) protection algorithm

The function starts if the current is between the start current as upper limit, defined by the “Start Current” parameter and the minimal current as lower limit, defined by the “Idle Current” parameter. These limit values are given in percent of the rated current of the protected object. This is defined by the “InMotor/InCT“ parameter. This parameter is also given as a percentage of the device rated input current.

The function operates in all three phases individually, but the general start signal output (GenSt) is generated if the conditions are satisfied in all three phases.

At starting, a time counter is triggered. The function generates a trip command if the time delay defined by the “Time Delay” parameter expires.

The timers operate in all three phases individually, but the general trip command (GenTr) is output if the timers expire in all three phases.

The **inputs** of the loss-of-load protection function are

- the Fourier basic components of three phase currents,
- binary input,
- parameters.

The **outputs** of the loss-of-load protection function are

- the general start status signal,
- the general trip command.

2 Overview

The function block of the loss-of-load (undercurrent) protection function is shown in Figure 2-1. This block shows all binary input and output status signals that are applicable in the graphic equation editor.

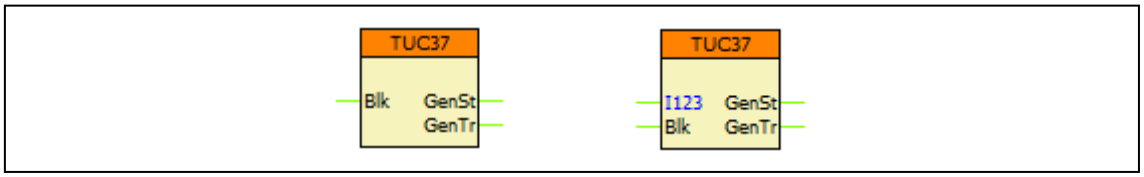

Figure 2-1 The function block of the loss-of-load (undercurrent) protection function

2.1 Settings

2.1.1 Parameters

The parameters are listed as they are seen on the local or remote HMI.

Table 2-1 Parameters of the loss-of-load (undercurrent) function

TITLE	DIM	RANGE	STEP	DEFAULT	EXPLANATION
Operation	-	Off, On	-	Off	Enabling the function by choosing the characteristics.
Start Signal Only	-	FALSE, TRUE	-	FALSE	Select FALSE to generate trip command
InMotor/InCT	%	20 – 150	1	100	Ratio of the rated current of the protected object and that of the current input of the device
Start Current	%	20 – 100	1	40	Start current related to the rated current of the protected object, below which the function operates
Idle Current	%	1 – 20	1	10	Minimal current related to the rated current of the protected object, above which the function operates
Time Delay	msec	60 – 60000	1	100	Time delay for the trip command

2.2 Function I/O

This section describes briefly the analogue and digital inputs and outputs of the function block.

2.2.1 Analogue inputs

Graphic Analogue inputs ***(only from firmware version 2.10.2.3010 and up)***

The sources of the analogue inputs are defined by the user, applying the graphic equation editor (*Logic Editor*). Parts written in **bold** are seen on the left side of the function block in the Logic editor.

The function uses the following analogue signals as inputs:

Table 2-2 Analogue input signals of the loss-of-load (undercurrent) protection function

ANALOGUE INPUT SIGNAL	SIGNAL TITLE	EXPLANATION
TUC37_**I123**_AnIn_	3phase current	Input for three-phase currents

The applied analogue connectors must be identical to the analogue input type (i.e. voltage to voltage input etc.), Invalid connections are not allowed.

2.2.2 Analogue outputs (measurements)

The function has no analogue inputs.

2.2.3 Binary input signals (graphed output statuses)

The conditions of the inputs are defined by the user, applying the graphic equation editor (logic editor). The part written in **bold** is seen on the function block in the logic editor.

Table 2-3 The binary input status signals of the loss-of-load (undercurrent) function

BINARY INPUT SIGNAL	EXPLANATION
TUC37_**Blk**_GrO_	The programmed True state of this input disables the operation of the function

2.2.4 Binary output signals (graphed input statuses)

The binary output status signals of the loss-of-load (undercurrent) protection function. Parts written in **bold** are seen on the function block in the logic editor.

Table 2-4 The binary output status signals of the loss-of-load (undercurrent) protection function

BINARY OUTPUT SIGNALS	SIGNAL TITLE	EXPLANATION
TUC37_**GenSt**_Grl_	General Start	Starting of the function
TUC37_**GenTr**_Grl_	General Trip	Trip command of the function

2.2.5 On-line data

Visible values on the on-line data page:

Table 2-5 The displayed on-line data of the loss-of-load (undercurrent) function

SIGNAL TITLE	DIMENSION	EXPLANATION
General Start	Off, On	Starting of the function
General Trip	Off, On	Trip command of the function
Current input assignment	-	*Status of the graphical analogue input (if exists) (Complete if OK, Missing if not connected)*

2.2.6 Events

The following events are generated in the event list, as well as sent to SCADA according to the configuration.

Table 2-6 Events of the loss-of-load (undercurrent) function

EVENT	VALUE	EXPLANATION	IEC61850 DATA ATTRIBUTES
General Start	Off, On	General start of loss-of-load (undercurrent) protection function	F1PTUC1STStr
General Trip	Off, On	General trip command of the loss-of-load (undercurrent) protection function	F1PTUC1STOp

2.3 Technical data

Table 2-7 Technical data of the loss-of-load (undercurrent) function

FUNCTION	VALUE	ACCURACY
Current accuracy	20 – 2000% of In	±1% of In
Reset ratio at idle current	0.95 0.70	
Operating time accuracy		±5% or ± 15 ms whichever is greater
Minimum operating time	<60 ms	
Reset time	<60 ms	

2.3.1 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 testing, otherwise there will be no physical trip on the relay.

Additional notes for Graphic Analogue inputs *(only from firmware version 2.10.2.3010 and up):*

Starting from the firmware version **2.10.2.3010**, the majority of the function blocks can be updated to be equipped with graphic analogue inputs which **allow the user to assign the functions’ analogue inputs by applying the graphic equation editor**.

The analogue connections of these functions can be checked by examining the source that is connected to their inputs (just like examining the source of a logic signal).

These functions must be placed in the Logic Editor and their graphic analogue inputs must be connected to make them operate. If a connection is intact, the online status of the corresponding analogue input will show “Complete”. If it is missing, the status will be “Missing” and the function will not operate.

Note that these graphical inputs do not exist in the earlier firmware/function versions! Checking and modifying the analogue assignments in these cases are done by using the EuroCAP Software Configuration menu.