

Contents	Page
1 OVERCURRENT PROTECTION	2
1.1 Application.....	2
1.2 Measuring principle	2
1.3 Design	2
1.4 Setting.....	3
1.5 Testing	4
1.6 Technical data	5
1.7 Appendix	6
1.7.1 Terminal diagrams	6
1.7.2 Signal list.....	7
1.7.3 Setting table.....	8

1 OVERCURRENT PROTECTION

1.1 Application

The overcurrent protection (ITOC) function serves as a built-in local back-up function to the main protection functions.

Its mode of operation is selectable between the following modes:

- not in operation at all
- operates all the time as independent protection function
- it operates as a back-up protection function when the main protection function is out of operation for different reasons, e.g. when operation of the distance protection is blocked by the fuse failure protection.

1.2 Measuring principle

The current measuring elements within one of the built in digital signal processors measure continuously the currents in all three phases and the residual current $3I_0$ and compare them with the set values $I_{>}$ for the phase currents and $I_{N>}$ for the residual current. A recursive Fourier filter filters the current signals, and a separate trip counter prevents high overreaching of the measuring elements. The following signals will get their logical values equal to 1 if the measured current exceeds the pre-set value:

- ITOCL1 if the phase L1 current will be greater than the set value $I_{>}$
- ITOCL2 if the phase L2 current will be greater than the set value $I_{>}$
- ITOCL3 if the phase L3 current will be greater than the set value $I_{>}$
- ITOCN if the residual current $3I_0$ will be greater than the set value $I_{N>}$

1.3 Design

Fig. 1 presents a simplified block diagram of the ITOC function.

Presence of the ITOC-BLKTR binary signal on one of the binary inputs will always block the operation of the ITOC function. The function will also not operate if the operation set Off. In this case logical signals Back-up and Independ will have their logical values equal to zero.

Setting of the operation mode to independent operation makes possible to the ITOC function to be active all the time. When operating in the back-up mode, the function will be active only if the input ITOC-VTSZ will have its logical value equal to 1.

Two independent timers delay the appearance of the corresponding output logical signals ITOC-TRIPP for the phase measuring elements and ITOC-TRIPN for the earth-fault measuring element respectively.

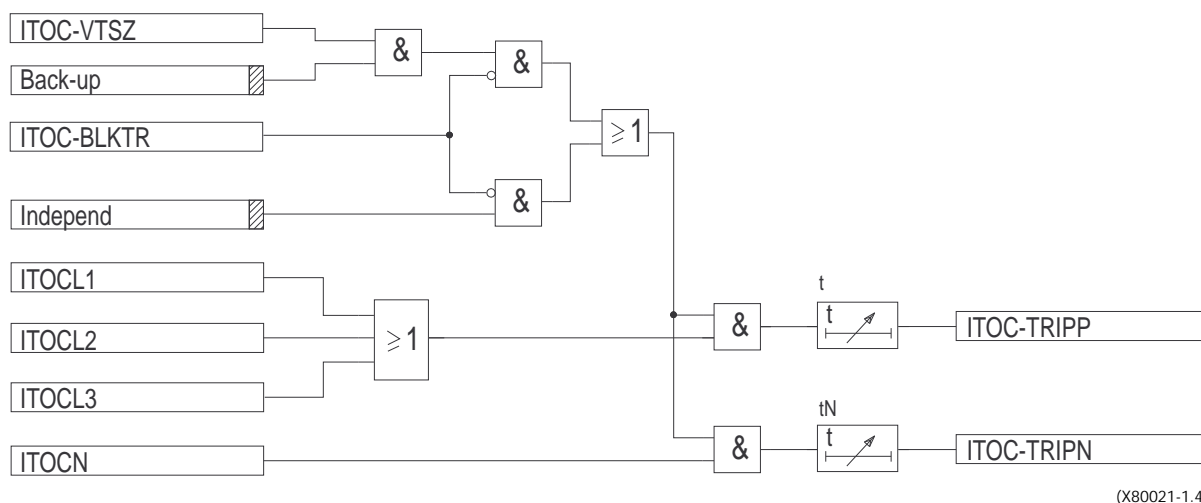


Fig. 1 Simplified block diagram of the overcurrent protection function

The appendix to this description of the ITOC function brings the following information:

- A simplified terminal diagram of the ITOC function
- A terminal diagram for the ITOC function
- A description of the connection and production signals for the ITOC function
- A table of the setting parameters for the ITOC function

1.4 Setting

The setting of the parameters for the ITOC function takes place under the menu:

Settings

Functions

Group n

TimeOverCurr

The setting of the operating value for the overcurrent phase measuring elements $I>$ must be higher than the maximum expected load current in the protected feeder. It is necessary to consider an additional margin of at least 10% to the declared inaccuracy of the current instrument transformers and measuring elements.

There will always be a certain low value of measured residual current $3I_0$ in the measuring circuits due to the differences in the current instrument transformers. Higher values can be expected on longer lines with a higher operating voltage. The presence of the close untransposed lines, where the zero sequence mutual coupling effect is significant, will additionally increase the apparent residual current measured by the terminal.

Therefore, it is usually necessary to set the operating value of the earth-fault current measuring element $I_{N>}$ at a minimum of 20% of the line nominal current. The setting value must be increased on the longer, untransposed lines and in cases where the zero sequence mutual coupling effect is significant.

The corresponding time delay must be according to the relay co-ordination plan in a whole network.

1.5 Testing

It is necessary to check the operating values of the current measuring elements and corresponding functions during the commissioning as well as during regular maintenance tests. ABB Relays recommends, although it does not absolutely request, the use of a testing equipment of type RTS 21 (FREJA) for purposes of the secondary injection testing.

Before testing, it is necessary to connect the testing equipment according to the valid terminal diagram of the particular REx 5xx terminal. Special attention should be paid to the correct connection of the input and output current terminals, and to the connection of the residual current.

It is necessary to perform the following steps when testing the ITOC function:

- 1.1 Check if the input and output logical signals as presented on the Fig. 1 are configured to the corresponding binary inputs and outputs of the tested terminal. If not, configure them for the testing purposes.
- 1.2 Set the operating mode of the ITOC function to the independent operation.
- 1.3 Set the operating values of the current measuring elements to the desired values and the time delays of timers t and t_N to zero.
- 1.4 Increase slowly the current in one phase until the signal ITOC-TRIPP appears. Record the operating value and compare it with the set value. The result should be within the 5% limits of accuracy with the addition of the accuracy as declared for the used measuring instruments. Disconnect the current.
- 1.5 Repeat the procedure under the previous item in other two phases.
- 1.6 Set the timer t to the selected value and the fault current in one phase to at least 120% of the operating value. Decrease the measured current to zero and connect the time measuring instrument to be stopped by the ITOC-TRIPP signal.
- 1.7 Increase instantaneously the current in one phase and record the operating time.
- 1.8 Repeat the above measuring procedure for the residual current measuring element.

- 1.9 Change the operating mode to Off and increase the measured current to the value higher than the set value for the phase measuring elements. The ITOC function must not operate.
- 1.10 Set the operating mode to Backup and check that the signal FUSE-VTSZ has logical value zero. It is possible to observe it on the local man machine interface (MMI) unit under the sub menu:

Service Report**Logical Signals****FuseFailure**

Increase the measured current to the value higher than the set value for the phase measuring elements. The ITOC function must not operate.

- 1.11 Simulate the operation of the fuse failure function (see the document "Fuse failure function", so that the signal FUSE-VTSZ gets its logical value equal to 1. Increase the measured current to the value higher than the set value for the phase measuring elements. The ITOC function must operate properly. Disconnect the measured voltages and currents.
- 1.12 Re-configure (if necessary) the terminal to the normal operating mode.

1.6 Technical data**Table 1:**

Function	Setting range
Operating current	
phase measuring elements	(10-400)% of I_r in steps of 1
residual measuring elements (only for protections measuring $3I_0$)	(10-200)% of I_r in steps of 1
Time delay	
phase measuring elements	(0-25) s in steps of 0,1
residual measuring elements (only for protections measuring $3I_0$)	(0-25) s in steps of 0,1

1.7 Appendix

1.7.1 Terminal diagrams

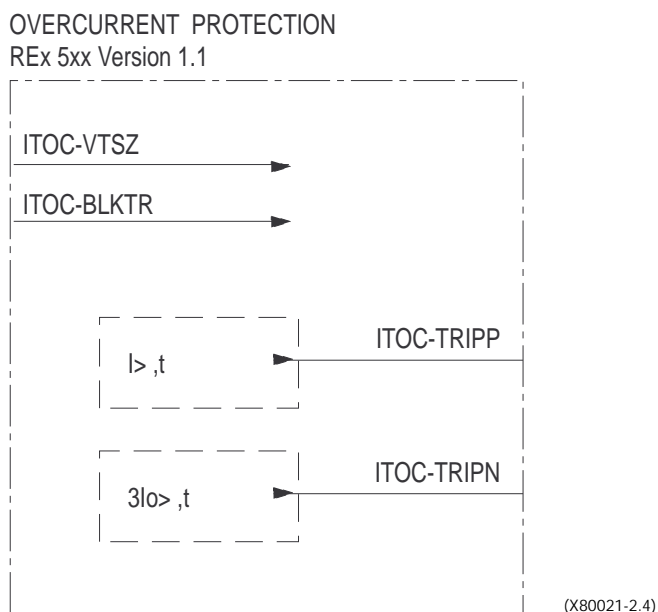


Fig. 2 Simplified terminal diagram of the function.

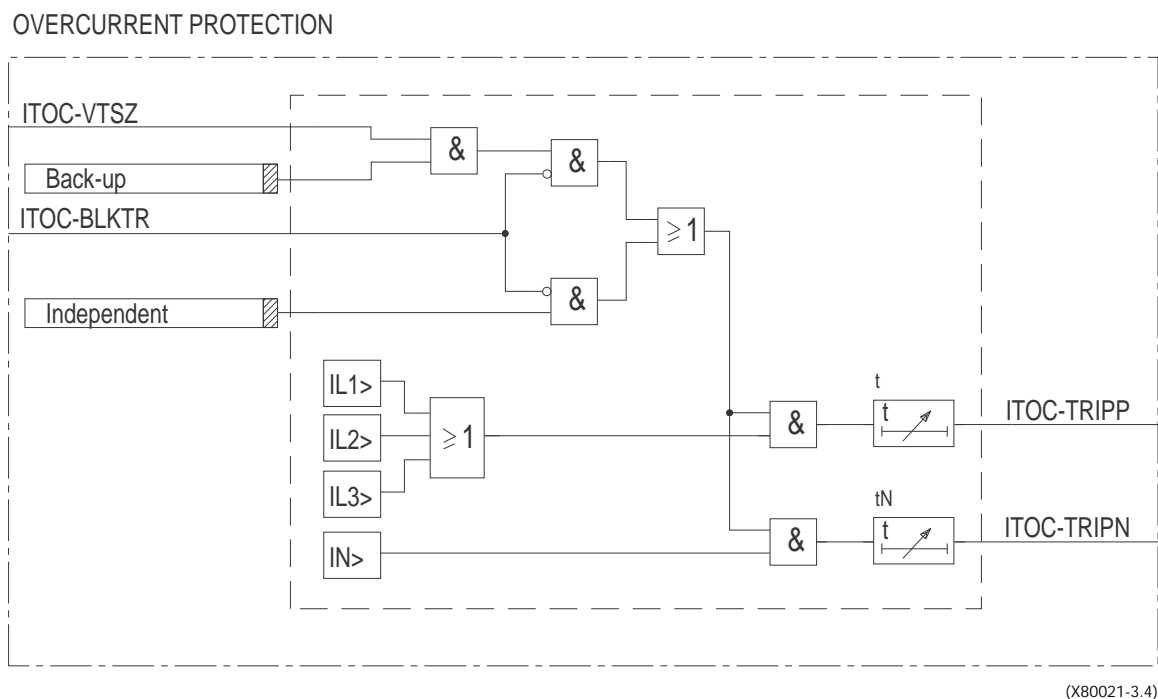


Fig. 3 Terminal diagram of the function.

1.7.2 Signal list

CONNECTIONS:	TO:	SETTING:	DESCRIPTION:
ITOC-BLKTR	BI		Input signal that blocks the operation of the overcurrent protection function
ITOC-VTSZ	BI		Input signal that releases the operation of the overcurrent protection function, when programmed to back-up operation
PRODUCTION:	TO:	SETTING:	DESCRIPTION:
ITOC-TRIPP	TRIP, BO		Operation of the phase overcurrent protection function
ITOC-TRIPN	TRIP, BO		Operation of the earth-fault overcurrent protection function

1.7.3 Setting table

PARAMETER:	SETTING RANGE:	SETTING				DESCRIPTION:
		ACTUAL				
		Group 1	Group 2	Group 3	Group 4	
Operation	Off Backup Independ (10 - 400)% of I _r					Setting of the operating mode
I>	(10 - 400)% of I _r					Operating value of the current measuring elements for phase currents
t	(0,00 - 25,00) s					Set value of a time delay for the operation of the phase current measuring elements
IN>	(10 - 200)% of I _r					Operating value of the current measuring element for residual current
tN	(0,00 - 25,00) s					Set value of a time delay for the operation of the residual current measuring element