SAMPLE SPECIFICATIONS

RED670
RED670 typical functions

The IED shall comprise hardware, time synchronization, monitoring, communication capabilities and other specifications as described in the 1MRG033843_en_Sample_specification_General_specifications_Relion_670 document. For the common protection, control, monitoring functionalities please refer to 1MRG033842_en_Sample_specification_Common_functions_Relion_670 document.

The IED shall support protection and control functionality. Control functionalities are described in 1MRG033840_en_Sample_specification_Bay_control_REC670.

For a complete overview of the functions available in this device, please refer to the Product Guide. For more details about the design of the functions and their applications, please refer to the Technical Manual and the Application Manual respectively.

The functions listed below are most typically specified in RED670, but are available for selection in other types as well, as per the comments under each description.

Only one of the following line differential protection alternatives shall be selected.

**High-speed line differential protection**

The IED shall include line differential protection with four separate CT inputs, applicable to two-ended or three-ended lines.

For a three-ended line configuration, the protection shall be able to apply either a master-master principle or a master-slave principle:

- In a master-slave principle, only one IED has all analog data available and only one IED will perform the tripping decision criteria.
- In a master-master principle, all IEDs at the different ends of the protected zone have all analog data available and will all execute the same tripping decision criteria. For the master-master principle, in the event of losing one of the communication links, protection shall automatically switch to the master-slave principle.

The line differential protection characteristic shall contain three sections, the first of which shall have the constant operating level independent of the bias current, while the other two sections shall have settable slopes. The minimum operating differential current, as well as the section-ends, shall be freely settable.

The line differential protection characteristic shall have a settable temporary threshold level, with a settable time duration to desensitize for transient charging currents during switching on the line.

The line differential protection shall have a settable threshold for unrestrained operation. The unrestrained operation shall depend solely on the differential current exceeding this set limit.

If a substantial amount of the second or fifth harmonic is detected, the restrained operation of the function shall be blocked. The levels of second or fifth harmonic required for blocking the operation shall be settable by the end user.

All calculations and trip decisions shall be performed independently for each phase.
The internal fault detector shall be based on the incremental current principle, where the angle of pure fault current from all line ends is compared. The detection of an internal fault shall be available on the function outputs, so that it can be connected to the disturbance recorder, or connected to binary outputs for test purposes.

Open CT detection shall be available, with the ability to block the operation of line differential protection and provide an alarm about an open CT condition, or to only provide an alarm about the open CT condition while not preventing the line differential protection from operating.

It shall be possible for the line differential protection algorithm to eliminate capacitive charging currents based on the protected circuit capacitances and the measured voltage from local and remote line ends, in order to eliminate false differential currents from the measurement, as well as to prevent unwanted operation of differential protection. The circuit capacitance shall be settable as a parameter. The activation of charging current compensation shall be available on the function outputs, in order to make it available for the disturbance recorder, as well as for indication, for example on LEDs.

Loss of data synchronism detection shall be enabled/disabled with a setting, in order to prevent faulty or incorrect operation of line differential protection, in the event of loss of data synchronism.

It shall be possible for the line differential protection to send a remote trip, settable as a parameter.

For applications where there is no communication between all line ends the link forward feature shall be available.

Remote end communication for transfer of up to 9 analog signals and 192 binary signals in each direction simultaneously using one communication module in each IED shall be available using the IEEE/ANSI C37.94 standard format, with 2 Mbps speed.

This function is available only in RED670.

**Line differential protection for up to five line-ends**

The IED shall include line differential protection with six separate CT inputs, applicable for up to five line-ends.

For applications with more than two line-ends, it shall be possible for the protection to apply a master-master principle or a master-slave principle:

- In a master-slave principle, only one IED has all analog data available and only one IED will perform the tripping decision criteria.
- In a master-master principle, all IEDs at the different ends of the protected zone have all analog data available and will all execute the same tripping decision criteria. For the master-master principle, in the event of losing one of the communication links, protection shall automatically switch to the master-slave principle.

The line differential protection characteristic shall contain three sections, the first of which shall have the constant operating level independent of the bias current, while the other two sections shall have settable slopes. The minimum operating differential current as well as the section-ends shall be freely settable.

The line differential protection characteristic shall have a settable temporary threshold level, with a settable time duration to desensitize for transient charging currents during switching on the line.

The line differential protection shall have a settable threshold for unrestrained operation. The unrestrained operation shall depend solely on the differential current exceeding this set limit.

The line differential protection shall have the possibility of adding time delay to a lower part of the characteristic, which shall be defined by a parameter setting. Time delay shall be settable by a parameter setting, either as inverse characteristic, or as definite time.

If a substantial amount of the second or fifth harmonic is detected, the restrained operation of the function shall be blocked. The levels of second or fifth harmonic required for blocking the operation shall be settable by the end user.

The line differential protection shall have the negative sequence internal/external fault discriminator, with settable operating angle, and with settable minimum required negative sequence current level.

It shall be possible for the line differential protection to calculate and report the negative sequence differential current magnitude, as well as calculate and report the angle between local and remote negative sequence currents.
Open CT detection shall be available, with the ability to block the operation of line differential protection and provide an alarm about an open CT condition, or to only provide an alarm about the open CT condition while not preventing the line differential protection from operating.

The line differential protection shall have an algorithm for charging current compensation, with the possibility of reporting the amount of compensated charging current. The activation of charging current compensation shall be settable by a parameter.

The following specification applies if a line differential protection shall include transformer(s) in-zone:

The line differential protection shall have the capacity to include up to two, two-winding power transformers or one, three-winding power transformer, in the line differential protection zone. All in-zone transformers shall be correctly represented in the algorithm with rated voltage per winding and with vector group compensations. These values shall be settable in the parameter settings. Zero sequence current elimination shall also be available in the parameter settings.

Remote end communication for transfer of up to 3/9 analog signals and 8/192 binary signals in each direction simultaneously using one communication module in each IED shall be available using the IEEE/ANSI C37.94 standard format, with 64 kbps/2 Mbps speed.

In 670 series, this function is available only in RED670.