350 Feeder Protection Relay

Guideform Specification

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## Overview

The feeder protection relay shall provide primary protection for medium voltage distribution feeders. The relay shall be equipped with the following protection functions:

* Volts per Herz (24)
* Synchrocheck (25)
* Positive Sequence Undervoltage (27\_1)
* Phase Undervoltage (27P)
* Auxiliary Undervoltage (27x)
* Directional Power (32)
* Wattmetric Ground Fault (32N)
* Broken Conductor (46BC)
* Thermal Model (49)
* Negative Sequence Instantaneous Overcurrent (50\_2)
* Breaker Failure (50BF)
* Phase Instantaneous Overcurrent (50P)
* Neutral Instantaneous Overcurrent (50N)
* Ground/Sensitive Ground Instantaneous Overcurrent (50G/50SG)
* Negative Sequence Time Overcurrent (51\_2)
* Phase Time Overcurrent (51P)
* Neutral Time Overcurrent (51N)
* Ground/Sensitive Ground Time Overcurrent (51G/51SG)
* Phase Overvoltage (59P)
* Auxiliary Overvoltage (59x)
* Neutral Overvoltage (59N)
* Negative Sequence Overvoltage (59\_2)
* CT Supervision (60CT)
* Neutral Directional Overcurrent (67N)
* Ground/Sensitive Ground Directional Overcurrent (67G/67SG)
* Phase Directional Overcurrent (67P)
* Four Shot Autoreclose (79)
* Underfrequency (81U)
* Overfrequency (81O)
* Cold Load Pickup (CLP)
* Voltage Fuse Failure (VTFF – 60VTS)

The relay shall have a drawout construction to facilitate testing, maintenance and interchange flexibility. The relay shall have a set screw on the drawout handle.

The relay shall operate with three-phase, four-wire connected current transformers.

The relay shall be equipped with Cold Load Pickup which allows automatic or manual blocking or raising of trip settings for a period after the breaker has been closed. This feature adapts the pickup of overcurrent elements to override the higher overload currents resulting from re-energization of feeders after a long period of time.

The relay shall be equipped with an Autoreclose function that can be initiated externally or from overcurrent protection. Up to four reclose operations shall be available, each with a programmable dead time. For each reclose shot, the relay can be programmed to block any overcurrent element.

The relay shall be equipped with an ambient temperature monitor that continuously monitors the temperature that the relay is exposed to. The ambient temperature monitor shall alarm when the device is exposed to extreme temperatures and undesirable conditions such as air-conditioning or station heater failures.

The relay shall be equipped with an Arc Flash detection function that allows fast and secure protection against an arc flash event for a safe working environment.

The feeder protection relay shall have seven (7) output relays. If Arc flash option is selected, then the relay shall have five (5) output relays plus two (2) solid state relays (SSR):

* 2 Form-A with coil monitor
* 5 Form-C (3 Form-C for Arc Flash solution)
* 2 SSR (Arc Flash solution only)

The feeder protection relays shall have ten (10) digital inputs. The digital inputs shall be fully user programmable and have four voltage thresholds.

The relay shall provide complete monitoring and metering functions. These shall include:

* Current: Phasors, RMS Values of per Phase, Neutral Current, Negative Sequence Current.
* Voltage: Phase-to-Phase and Phase-to-Ground, Neutral Voltage, Negative Sequence Voltage, Zero Sequence Voltage, Auxiliary Voltage.
* Power: Active, Reactive, Apparent, Power Factor.
* Frequency
* An event recorder with a record of the last 256 events, time tagged with a resolution of 1ms.
* A Fault recorder which captures measured analog signals at the time of the trip. The Fault Report stores only the last recorded values.
* Waveform capture (oscillography) feature similar to a transient/fault recorder. The oscillography shall capture up to 32 samples per cycle and the digital states.

### Security / Change History Report

The relay must comply with NERC CIP security reporting requirements and provide traceability. The relay must maintain a history of the last changes made to the configuration, including modifications to settings and firmware upgrades. A summary history of the last ten sessions and a list the last 100 specific setting changes made must be recorded and stored in non-volatile memory. The report must be available to be saved and printed in PDF format.

Security Setting Reports must include the following information:

* Dates and times of setting changes
* MAC address of user making setting changes
* Listing of modified changes
* How setting changes were made: Keypad, Front USB port, Ethernet & Rear Serial Port

### User Interfaces

User interfaces shall include the following:

* A 4 x 20-character LCD display, and navigation keys
* Indicator LEDs on the front panel which shall provide a quick visual indication of status
* A front panel USB serial port that shall provide easy computer access. The communications protocol shall be Modbus RTU
* One rear RS485 port. The communications protocol shall be Modbus RTU
* An optional RJ45 & MTRJ Fiber Optic Ethernet port shall be provided to allow 10BaseT Ethernet connectivity to Local or Wide Area Networks. The communications protocol shall support Modbus TCP
* An optional Dual MTRJ Fiber Optic Ethernet port shall be provided to allow 100MB Multi-mode Ethernet connectivity to Local or Wide Area Networks. The communications protocol shall support Modbus TCP,
* The relay shall support the following communication protocols:
* Modbus RTU
* Modbus TCP/IP
* IEC 61850 GOOSE
* IEC 61850
* DNP 3.0
* IEC 60870-5-104
* IEC 60870-5-103
* PRP & HSR (IEC 62439-3), Daisy chain and Link Loss Alert (LLA) only in redundancy options.
* OPC-UA
* The Protection Relay shall have an IRIG-B input to allow time synchronization using a GPS clock over a wide area network.
* The IRIG-B input shall support both AM and DC time synchronization with an auto detect feature that removes the requirement of manual selection.
* The Protection Relay shall have support for IEEE 1588 Precision Time Protocol (PTP) to synchronize the time between different nodes on an Ethernet network and it is used when very precise time synchronization is required.
* The relay shall be capable of being set by Windows-based, Easy to use, Setup graphical terminal interface
* To make the data acquisition more efficient, the feeder relay shall provide a User Definable Memory Map, which shall allow a remote computer to read up to 125 nonconsecutive data registers by using one Modbus packet. The User Definable Memory Map shall be programmed to join any memory map address to one in the block of consecutive User Map locations, so that they can be accessed by means of these consecutive locations. The User Definable area shall have two sections:
* A Register Index area containing 125 Actual Values registers
* A Register area containing the data located at the addresses in the Register Index

The relay must be capable of being programmed through a Windows based software program that is capable of the following:

1. The software program will operate in the following fashion

a. Request system data from user through display screens.

b. Generate settings file

c. Review settings with user with the option to disable any configured settings that are not required

d. Provide PDF report outlining the settings that have been generated

e. Report and Settings file to be saved in user-selectable location

2. The setup software shall also allow the user to program the relay via a ‘Quick Setup’ feature.

a. This Quick Setup function shall be a single page screen.

### Automation

The Protection Relay shall have programmable automation functions to allow the user to build simple logic.

1. The logic must include 16 (sixteen) logic elements
2. The logic elements can be programmable using the state of any contact, virtual or remote input or an output operand from protection or control elements.
3. The logic provides for assigning up to three triggering inputs in an ‘AND/OR’ gate for the logic element operation and up to three blocking inputs in an ‘AND/OR’ gate for defining a block signal.
4. Pickup and dropout timers shall be available for delaying the logic element operation and reset respectively.

To help extend product life, and to protect the feeder relay from hostile and harsh environments including moisture, temperature variations, salt spray, organic attack (fungus), and aggressive chemicals and vapors, the product manufacturer shall provide an optional harsh environment conformal coating.

For more information on this product visit the GE Multilin Web Site for a product brochure at:

<http://www.gegridsolutions.com/multilin/catalog/350.htm>