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## SEL-351 RELAY GUIDEFORM SPECIFICATION SHEET

Protection, control, and monitoring for substations and transmission lines will be provided as an integrated microprocessor-based relay package. This package must contain four separate current inputs and four separate voltage inputs for ac current and voltage measurements. This package must also provide a minimum of six configurable opto-isolated control inputs and seven configurable programmable output contacts as well as one self-test alarm contact. Options must be available to increase the contact I/O count. The output contacts must be rated for tripping duty per IEEE C37.90 standards and provide ordering options for high current interrupting capability. The programmable outputs must be flexible and support AND, OR, and INVERT Boolean operations of internal relay elements and logic outputs.

### Standard Protective Functions Include:

- Phase TOC (51P, 51A, 51B, 51C), ground TOC (51G), and neutral TOC (51N) elements with IEEE and IEC curve selections to provide 2 levels of phase and ground/neutral TOC protection.
- Six levels of Instantaneous phase (50P), ground (50G), and neutral (50N) elements.
- Ordering options for Sensitive neutral ground TOC element (*or* sensitive earth fault - SEF) (51N) with a 0.005-1.500 A setting range.
- Negative-sequence TOC element (51Q).
- Six levels of negative-sequence instantaneous elements (50Q).
- Phase directional element with positive sequence polarizing memory for three-phase faults (32P) that can be used to polarize the phase TOC or instantaneous overcurrent elements.
- Ground directional element that automatically selects between negative sequence voltage, zero-sequence voltage, or traditional neutral current polarization (32G).
- Two levels of single phase overvoltage and single phase undervoltage elements (59/27).
- One level of Sequence overvoltage elements
- Load encroachment logic for phase TOC and instantaneous element supervision.
- Six voltage controlled underfrequency or overfrequency elements (81).
- Six independent setting groups.
- Cold load pickup logic.
- Sequence coordination.

### Standard Metering Functions Include:

- Single- and three-phase real and reactive power (MW and MVAR).
- Single- and three-phase real and reactive directional energy (MWh, MVARh).
- Single- and three-phase power factor (PF).

### Metering Accuracy:

- $V_A, V_B, V_C, V_S$ :  $\pm 0.1\%$  (33.5 - 150 V; wye-connected)

- Voltage magnitudes and angles:  $V_A, V_B, V_C$ , and  $V_S$ .
- Current magnitudes and angles:  $I_A, I_B, I_C, I_G$ , and  $I_N$ .
- System frequency and station battery voltage monitoring.
- Demand Ammetering (current): phase, negative-sequence, residual, and ground.

### Standard Monitoring and Control Functions Include:

- Programmable four shot internal reclosing function with shot and reclose state indication.
- Sync. element that can be combined with bus and line voltage elements for reclose qualifications.
- Maximum and minimum log for  $I_A, I_B, I_C, I_G, I_N, V_A, V_B, V_C, V_S, 3\phi$  MW and MVAR.
- Interrupting contact wear monitor that can be referenced to manufacturer's data or published standards.
- No fewer than 15 of the latest event reports containing voltage and current measurements, contact inputs and output status, fault location, and relay element conditions. Record formats displaying 4 and 16 samples per cycle shall be available. Nonvolatile memory storage.
- A sequence of events recorder (SER) consisting of the 512 latest time-tagged events. Nonvolatile memory storage.
- Three EIA-232 serial ports, one located on the front panel, two on the back panel that support ASCII text communication to allow relay setting entry via PC based terminal emulation package.
- One 4 wire isolated EIA-485 serial port located on the back panel.
- Optional DNP 3.0 Level 2 protocol with bit-mapping.
- IRIG-B time synchronization input with battery backed clock to retain the time during deenergization.
- Front-panel 2 line by 16 character LCD display for local numeric setting and interrogation.
- Trip and close circuit monitoring.

$V_{AB}, V_{BC}, V_{CA}, V_S: \pm 0.3\%$  (33.5 - 260 V; delta-connected)  
 $I_A, I_B, I_C: \pm 0.1\%$  and  $\pm 1$  mA (0.5 - 10 A) (5 A nominal)  
 $\pm 0.1\%$  and  $\pm 0.2$  mA (0.1 - 2 A) (1 A nominal)