1. GENERAL

1.1 Product Data

.1 Submit product data in accordance with Section 16010 – Electrical General Requirements.

.2 Indicate dimensions and connection details.

2. PRODUCTS

2.1 Microprocessor Based Metering Equipment

.1 Power System Analyzer and Meter

.1 Where indicated on the drawing, provide a digital line Power Quality Meter and Analyzer device. The Analyzer and meter shall be UL, CSA, and CUL listed and meet ANSI C12.20 (0.5%) energy revenue metering accuracy standard.

.2 The metering equipment shall provide direct reading metered or calculated values of the items listed below and shall auto range between units, kilounits and megaunits for all metered values. The device shall be capable of displaying the frequency distribution in graphic form and shall be capable of displaying the Waveform in graphic form. The device shall be capable of displaying multiple parameters at once, including four (4) user-configurable custom screens, displaying any seven (7) of the parameters listed.

.1 AC current (amperes) in A, B, and C phase, 3-phase average, Neutral (N) and Ground (G) (provide neutral and ground current transformer). Accuracy +/- 0.2%.

.2 AC voltage (volts) for A-B, B-C and C-A, phase average, A-N, B-N and C-N, average phase to N, and N to G. Accuracy +/- 0.2%.

.3 Real Power (Watts), Reactive Power (vars), Apparent Power (VA), Real Energy (WH), Reactive Energy (VARH), Apparent Energy (VAH) for each phase and system. Accuracy +/- 0.4%. Forward/Reverse indication shall be provided.

.4 Frequency (Hertz) Accuracy +/- 0.4%.

.5 Demand values for System Current (Amperes), System Real Power (Watts), System Reactive Power (vars), and System Apparent Power (VA).

.6 Power Factor for both Displacement and Apparent.

.7 Percent Total Harmonic Distortion (THD) for all Currents and Voltages.

.8 K-Factor, Transformer Derating Factor, and Crest Factor.

.3 This device shall provide the following advanced analysis features:

.1 Onboard logging capability, including the ability to log a total of 24 parameters with intervals ranging from 0.13 seconds (every 8 cycles) to twice a week (5,040 minutes). Four separate trends shall be available.

.2 Trend Analysis Screens displaying the minimum and maximum values for each metered value, with all parameters time stamped to 10 millisecond resolution.

.3 Time-of-use metering capability to store energy usage data for time-of-use revenue metering.

.4 Demand Analysis Screens displaying present demand and peak demands for phase currents and power. Peak demands shall display time and date stamped to within 10 millisecond resolution. Demand Window Selection for metered demand values shall be selectable as a fixed or sliding window, a synch, pulse initiation, or a communication system initiation.

.5 Harmonic Analysis Screens shall be capable of being function key triggered to capture a high-speed waveform of two (2) cycles of data sampled at 128 samples per cycle, simultaneously recording all currents and voltages. Data captured shall include the magnitude and the direction of the harmonic source from 1st through the 50th harmonic.

.6 Event/Alarm Analysis Screens shall display data recorded for up to ten (10) event/alarm conditions. For each event/alarm a description of the event/alarm, date, and time of event/alarm shall be recorded (10 mS resolution).

.7 The metering equipment shall be capable of transmitting all data at time of the event via Modbus communications to a personal computer for creating and displaying wave forms.

.8 The meter shall have the ability to store the last 504 meter events in non-volatile memory. Each event will be date and time stamped with 10 millisecond accuracy. The meter shall provide the ability to view the events via the local display or via Modbus communications.

.9 Event/Alarm Condition Levels shall be capable of being triggered by up to 7 of any of 61 conditions when the programmed threshold is exceeded. All shall have programmable time delays from 0.1 to 60 seconds except voltage disturbance, which shall be programmable from 0 to 3,600 cycles.

.4 This metering equipment shall be capable of receiving the following inputs:

.1 Instrument Transformers: Input ranges of this device shall accommodate external current transformers with ranges from 10,000/5 through 5/5 amperes. Provide external current transformers for each phase, neutral and ground circuit with rating as indicated on the drawing or sized for incoming service or associated feeder. The unit shall be capable of overranging up to eight (8) times nominal current rating. Provide fused external potential transformers for up to 500 kV.

.2 Control Power: The device shall also be capable of being supplied from a separate control power source with input range of 100 to 240V AC.

.3 Dry Contacts: Three (3) dry discrete input contacts shall be capable of being monitored, which may be programmed by the user to perform any of the following functions. The status of the input contacts shall be locally displayable and accessible through the communications port.

.1 Trigger an Event/Alarm Analysis including Harmonic Analysis information for display on the device and information for Waveform Analysis and display at a personal computer.

.2 Act as a synchronizing pulse input to synchronize demand windows with a utility provided synchronizing pulse.

.3 Actuate a relay output.

.4 Reset a relay output, peak demand, Minimum/Maximum, or Event Analysis records.

.5 Furnish Relay Output Contacts with four (4) Form C (NO/NC) relay output contacts which shall be capable of being independently programmed for the following functions:

.1 Act as a kWH, kVARH, or kVAH pulse initiator output.

.2 Actuate on one (1) or more Event/Alarm conditions, including discrete inputs and Communication Command signal.

.6 Furnish one (1) 4 to 20 mA analog input and four (4) 4 to 20 mA outputs.

.7 The device shall be fully programmable from the faceplate, including alarm relay and power quality (e.g., harmonic distortion) settings. Programming shall be password protected.

2.2 Medium Voltage Protective relays

.1 Relays for phase time overcurrent, instantaneous overcurrent and ground fault protection, ANSI 50/51, 50/51G, or 50/51N, shall be incorporated into a single device.

.2 The relay shall be a solid-state microprocessor-based multifunctional type that operates from the 5 ampere secondary output of current transformers. The relay shall provide ANSI 50/51N protective functions for each of the three (3) phases, and ANSI 50/51N or 50/51G ground fault protection functions as shown on the plans or as determined by the coordination study. The relay shall be true rms sensing of each phase and ground. Ground element shall be capable of being utilized in residual, zero sequence, ground source connection schemes, or deactivated.

.3 The primary current transformer rating being used for phase and ground protection feeding the device shall be programmable for current transformers with primary current ratings from 5 through 5,000 amperes.

.4 Both the phase and ground protection curves shall be independently field-selectable and programmable with or without load. Curves shall be selectable from the following:

IEEE: Moderately inverse, very inverse, extremely inverse

IEC: A, B, C or D

Thermal: Flat, lt, I^2t, I^4t

Thermal curves shall be similar to those on low voltage trip units for close coordination with downstream devices. Selectable short delay pickup and short delay time settings shall also be provided. The phase instantaneous overcurrent trip shall have field-programmable pickup points from 1.0 to 25 times current transformer primary rating or NONE. In addition, a field-selectable (ON or OFF) discriminator circuit shall be included such that when phase instantaneous overcurrent has been programmed to NONE, the discriminator circuit shall protect against currents exceeding 11 times current transformer primary rating, only when the breaker is being closed and shall be deactivated after approximately 8 cycles.

.5 The relay shall be field-configurable to have either of the following function combinations assigned to its two type "a" contacts: 1) one contact assigned ANSI 51 phase and ANSI 51 ground and the other contact assigned ANSI 50 phase and ANSI 50 ground; 2) one contact assigned ANSI 51/50 phase and the other contact assigned 51/50 ground.

.6 The relay shall have a built-in alphanumeric display capable of displaying the following information with metering accuracy of +/- one (1) percent of full scale (I_n) from 0.04 x I_n to 1 x I_n and +/- two (2) percent of full scale (I_n) from 1 x I_n to 2 x I_n:

.1 Individual phase currents.

.2 Ground current.

.3 Cause of trip.

.4 Magnitude and phase of current causing trip.

.5 Phase or ground indication.

.6 Peak current demand for each phase and ground since last reset.

.7 Current transformer primary rating.

.8 Programmed phase and ground set points.

.7 Relay shall have the following features:

.1 Integral manual testing capability for both phase and ground protection function. Testing shall be selectable to either operate contact outputs or not operate output contacts.

.2 Continuous self-testing of internal circuitry.

.3 Unit failure alarm contact for customer use.

.4 Programmable lockout/self reset after trip function.

.5 Programmable set points for device curve selection.

.6 Programmable inputs, such as current transformer ratios.

.7 Access to program and test modes shall be via sealable hinged cover for security.

.8 Relay shall be suitable for operating temperatures from -30 degrees to 55 degrees C. Relay shall be suitable for operating with humidity from 0 to 95% relative humidity (non-condensing).

.9 Relay shall have Modbus communication capability. Relay shall be capable of the following over the communication network:

.1 Ability to transmit all information contained in the relay such as currents, set points, cause of trip, magnitude of trip current, and open-close trip status.

.10 Relay alarm and/or trip contacts shall not change state if power is lost or an undervoltage occurs. These contacts shall only cause a trip upon detection of an overcurrent or fault condition based upon programmed settings. A "protection OFF" alarm shall be provided which is normally energized when the relay is powered and the self-diagnostics indicates the unit is functional. Upon loss of power or relay failure, this alarm relay shall be de-energized providing a failsafe protection OFF alarm.

.11 The relay shall be suitable for operating on control power with a nominal input voltage of 12 to 240V AC 60 Hz. When AC control power schemes are shown on the drawings, in addition to control power transformer or remote control power shown or herein specified, dual-source power supply shall be included.

.12 Provide a dual-source power supply (DSPS) for each relay when operated from standard 120V AC, or, 50/60 Hz, auxiliary control power which is normally connected and available. The DSPS shall operate solely from the breaker main current transformers (CTs) during a fault condition, if the normally connected auxiliary AC voltage is not available. A battery or UPS as power shall not be required for reliable tripping under all fault conditions. The DSPS shall operate anytime there is a fault, even after an extended power outage. When the standard auxiliary power supply is not available, the DSPS shall provide enough power to operate the overcurrent relay in the tripped state with currents greater than 1.8 per unit rated secondary current, 9A with a single-phase current, 1.2 per unit secondary current or 6A with three-phase currents. There shall be no effect on the overcurrent relay trip time accuracy when the DSPS switches from normal AC voltage to fault-current power.

.13 Provide the relay in a drawout case allowing for removal and replacement of the relay unit without disruption of the wiring. The drawout case shall have quick release operation with two-stage disconnect operation. The removal of the relay inner chassis shall disconnect the trip circuits and short the CT secondaries before the unit control power is disconnected. All voltage inputs, discrete inputs and contact outputs shall be disconnected while maintaining

security against false tripping. Upon insertion of the relay inner chassis, the control power connections shall be made before the trip circuits are activated to provide additional security against false tripping. Drawout case terminals shall accommodate a bare wire connection, spade or ring terminals. A spare self-shorting contact on the terminal block shall be available to provide alarm indication and/or tripping of circuit breaker upon removal of the relay from the case.

2.3 Acceptable Manufacturers

.1 Cutler-Hammer – Analyzer – IQ Analyer 6600 or approved equal.

.2 Cutler-Hammer – Protective Relay – DT 3010 or approved equal.

3. EXECUTION

3.1 Installation

.1 Analyzer and protective relay shall be factory installed and connected in designated cubicles.

END OF SECTION