1. Capacitor Bank Controllers (CBCs)

1.1. The Capacitor Bank Control (CBC) shall be designed to control utility distribution capacitor banks by oil switch or vacuum switch. The control shall have the ability to operate independently using site measurement values or remotely by wireless communications. In addition, if communication is lost the CBC is to provide a backup failsafe operational mode using the site measurement values. The control must also have the ability for three-phase monitoring and can report each individual phase voltage, VARs, current and power factor.

1.2. Operational modes:

1.2.1. VAR
1.2.2. Voltage
1.2.3. Current
1.2.4. Time
1.2.5. Temperature
1.2.6. Thresholds from the sensor inputs
1.2.7. Remote
1.2.8. Backup communication lost

1.3. HMI

1.3.1. Shall have the following independent operation mode switches:

1.3.1.1. Manual switch
1.3.1.2. Remote switch
1.3.1.3. Automatic switch

1.3.2. Shall have a readable four line LCD Display

1.3.3. Shall have a Trip (Green) and Close (Red) buttons

1.3.4. Bank State indicators

1.3.4.1. Trip (Green)
1.3.4.2. Close (Red)

1.3.5. The control shall visually display on the LCD and by illumination of an LED any delay timers which may inhibit a control action. (trip, close, reclose)

1.3.6. The control shall visually display when the motor relay switches are being driven.

1.3.7. Shall visually indicate an alarm(s) by illumination of an LED and user can view alarms on LCD

1.3.8. Shall visually indicate when an alarm(s) or operation threshold(s) are tracking via LED illumination and the user can view the event being tracked on the LCD

1.3.9. An indicator that AC Power is present

1.3.10. Shall have Neutral Current Lockout Reset button

1.3.11. Shall have a ten key pad for ease of programming, entering settings, and viewing metering data

1.3.12. A USB port for connection to the application software tool for programming

1.4. Communications ports

1.4.1. Pluggable RS-232 or Serial Port
1.4.2. Pluggable Ethernet Port
1.4.3. Power Over Ethernet PoE. IEEE 802.3AT
1.4.4. USB for local application software tool connection
1.4.5. When communications cards are present the CBC shall have a 12 volts 3 amp power supply to power a cellular modem or a radio.

1.5. Protocol

1.5.1. Shall support DNP3 Level 2

1.6. Communication Loss Capabilities

1.6.1. When the CBC-8000 control loses communications it shall have the ability to revert to a stand-alone operational mode utilizing site measurement values

1.6.2. These communications backup modes include, voltage, VAR, time, temperature, and current from the sensor inputs

1.6.3. The control shall have a backup communications timer, a valid communications messages or time sync’s will reinstate the timer

1.7. Two-way capabilities:

1.7.1. To remotely Trip or Close the bank

1.7.2. The ability to remotely modify the programming in the CBC-8000 control

1.7.3. Support Class 0, 1, 2, and 3 scanning

1.7.4. The control shall provide unsolicited report by exception of events

1.7.5. Firmware upgrades

1.7.6. Remotely retrieve Data logs

1.7.7. The control shall report via unsolicited messaging for state change

1.7.8. The control can report via unsolicited messaging for when the control is tracking voltage, VAR, voltage, current, temperature, or neutral current fault condition.

1.7.9. The control shall provide an unsolicited report of the reason the control did not execute a trip or close command due to local site measurements.

1.7.10. A direct SCADA Override which maintains the bank tripped or closed until the time reaches the SCADA release time or until the operator releases override.

1.7.11. The control shall have configurable point mapping to reduce communications traffic.

1.8. Capacitor Controller Requirements

1.8.1. The input voltage of the control is auto-ranging from 85 to 265 Vac and it operates on both 50 and 60 Hz systems

1.8.2. The CBC-8000 control shall have input line fuse protection

1.8.3. The CBC-8000 control shall run diagnostics at power up and have continuous error checking

1.8.4. The control shall have an open Door Alarm switch to reports the state of the door. Open or Closed.

1.9. System firmware and user configuration will be maintained in flash memory so not to be lost during power interruptions

1.9.1. CBC-8000 control shall have a real-time clock to maintain time stamps and accurate time if power is lost

1.9.2. CBC-8000 control shall support Daylight Savings time

1.9.3. True RMS Line Voltage with a +/- .25 accuracy

1.10. Parameters

1.10.1. Over voltage(OV)/Under voltage(UV) voltage thresholds in settable .1 volt increments

1.10.2. Independent OV & UV track timers

1.10.3. The control shall have a programmable random track time generator which applies an additional randomized tracking time to the independent OV/UV tracking times. By enabling the random track timer, each CBC-8000 control on the substation and feeder have unique OV/UV track times, which will reduce voltage hunting events.

1.10.4. Secondary Emergency voltage threshold limits

1.10.4.1. Emergency under voltage and Emergency over-voltage override close thresholds in .1 volt increments
1.10.4.2. User settable Emergency OV/UV track timer
1.10.5. Independent conservation voltage reduction (CVR) OV/UV settable thresholds
1.10.6. VAR Control with user settable VAR targets and track timer
1.10.7. VAR operation must detect and report reverse power flow
1.10.8. The control must be able to detect and report harmonic total harmonic distortion (THD) and odd harmonics up to the 13th harmonic.
1.10.9. Bank Operation Confirmation: When three-phase voltage and current sensors are present, the control must have the ability to confirm and validate the successful operation of each of the three capacitor banks. The control will log and report the status of each of the three phases of the capacitors, as operation passed or failed, upon the completion of the control operation.
1.10.10. Operation counter
   1.10.10.1. CBC-8000 control shall have a maximum daily operations limit. If the control number is violated the control has a lockout feature. However, during this lockout state, the controller shall still allow manual operations so that maintenance personnel can run any tests and remote commands.
   1.10.10.2. The CBC-8000 control maximum counter shall have the ability to be reset by a remote command.
1.10.11. The CBC-8000 control shall optionally have the ability to detect neutral current imbalance. Supplier shall provide a split core current sensor for detection of neutral current.
1.10.12. The CBC-8000 control shall have the ability to detect and report voltage phase unbalance as defined in ANSI standard C84.1-2011.
   1.10.12.1. Shall include Unbalance voltage percentage, Phase A-B, B-C, and C-A voltages and phase angle.
1.10.13. Adaptive voltage algorithm (Delta Voltage). At the time of control action the CBC-8000 control shall determine if the action would cause a voltage violation. If it is determined that it would the action would be aborted.
   1.10.13.1. The CBC-8000 control shall allow the utility to select the number of voltage change samples (from 1 to 8) due to past control actions to calculate the average delta voltage used in the adaptive voltage algorithm. The counter is reset, or cleared, daily at midnight.
1.10.14. Adaptive Kvar algorithm. At the time of control action, the CBC-8000 control shall determine if the action would cause a Kvar violation. If it is determined that it would, the action would be aborted.
1.10.15. The CBC-8000 control shall have a minimum of a 30 Amp relay
   1.10.15.1. The relay drive time is user settable in 1 second intervals up to 4 minutes and 15 seconds
1.10.16. The CBC-8000 control shall include a temperature sensor for automatic operation and that can be used as a backup operation mode in the event communications are lost

1.11. Data Logs
   1.11.1. The CBC-8000 control shall have the following data logging capabilities.
      1.11.1.1. A Sequence of Events (SOE) data log which allow users to select items which are alarmed upon when an event or alarm is active.
      1.11.1.2. A Data Profiler data log which users can select a time interval to log user selected items.
      1.11.1.3. A Communications Debug data log which can record all incoming and outgoing communication traffic.

1.12. Timers
   1.12.1. Auto Trip Delay
   1.12.2. Remote Trip Delay
   1.12.3. Auto Close Delay
   1.12.4. Remote Close Delay
   1.12.5. Bank Reclose Delay
   1.12.6. Motor Switch Driver Timer
1.13. **Power Analysis:** The CBC-8000 control shall support seven sensor inputs which can be used to monitor all three phase voltages, currents, VAR’s, and power factors plus the neutral current sensor

   1.13.1. The CBC-8000 control shall have six (6) sensor inputs for three-phase analysis
   1.13.2. The six (6) sensor inputs must also detect and report voltage, current, including THD and harmonics up to the 13th harmonic
   1.13.3. A seventh sensor input is required for Neutral Current Sensing
   1.13.4. This relates the six sensor inputs for 3 phase analysis
   1.13.5. The ability to average the voltage or current values between 1 and 60 minutes.

1.14. **Software Application tool:** The bidder must offer a software application tool

   1.14.1. The tool shall be able to remotely “over the air” or “locally”:
   1.14.1.1. Allow user to program the control
   1.14.1.2. Trip & Close the control
   1.14.1.3. View status and states
   1.14.1.4. View alarm
   1.14.1.5. Download the Sequence of Events (SOE), the Data Profiler and Communications debug logs
   1.14.1.6. Upgrade the control firmware

2. **TRAINING**

   2.1. Training:
   2.1.1. The vendor shall provide training instruction for the purchaser’s personnel in operation of the controllers. Training shall be conducted by experienced personnel and supported by training aids.
   2.1.2. The vendor shall offer detailed instructions for the purchaser’s engineering and maintenance personnel covering every item of equipment furnished as part of the contract
   2.1.3. The vendor shall offer instructions to describe CBC-8000 control service software for the Utility’s field technicians. CBC-8000 control hardware manuals shall be provided.

3. **SUPPORT, SERVICE and MAINTENANCE, and USER GROUP**

   3.1. Installation – The manufacture shall provide necessary product training to the utility to install and operate the Capacitor Bank Controller. Cost of this service shall be listed separately from the materials list.
   3.2. Service/Maintenance – The vendor shall state recommended modes of maintenance and shall describe preventive maintenance procedures.
   3.3. User Group – The vendor shall advise if it has a User Group that is organized and if it has active annual group meetings.
   3.4. Documentation – The system shall not be considered complete until documentation has been delivered to the utility. The vendor shall furnish two (2) sets of instruction manuals, including installation, operation, and maintenance and troubleshooting procedures.
   3.5. Warranty – All materials shall be warranted for a period of one year from date of installation or 18 months from the date of shipment or whichever comes first, against material defects and workmanship. The warranty shall include parts and labor to repair the defective component at the supplier's facility. The supplier also warrants that all equipment and materials supplied there under are new.

4. **ENVIRONMENTAL REQUIREMENTS**

   4.1. The CBC-8000 control shall be of weatherproof design, capable of operation within an ambient temperature range of -20 degrees to 65 degrees Celsius and a relative humidity from 0% to 95%, noncondensing.

5. **WORKLOAD**

   5.1. All equipment supplied under these contract documents shall be designed for continuous operation, 24 hours per day
6. **TEST EQUIPMENT**
6.1. The vendor shall describe in its proposal and recommend all necessary test equipment for the CBC-8000 control. The vendor shall also provide the service software necessary for the CBC-8000 control.

7. **SURGE WITHSTAND**
7.1. The equipment shall meet the following standards
   7.1.1. IEC 61000-4-2 Electrostatic Discharge
   7.1.2. IEC 61000-4-4 Electrical Fast Transient
   7.1.3. IEC 61000-4-5 Combination Surge
   7.1.4. IEC 61000-4-8 AC Magnetic Fields
   7.1.5. IEC 61000-4-9 Pulsed Magnetic Fields
   7.1.6. IEC 61000-4-12 Ring/Oscillatory Wave

8. **Enclosure**
8.1. Shall be NEMA 4X, IP65 or equivalent rating
8.2. The CBC-8000 control shall offer four or six jaw meter base mounting or the control can be provided in a pole or panel mount configuration.
8.3. Enclosure shall have a locking clasp.
8.4. The CBC-8000 control shall include a ground lug.