

**Microprocessor Capacitor Bank Relaying Controls, For
Pole-Mounted, Three-Phase Capacitor Banks, For 7.2 kV
Delta or 14.4 kV Solidly-Grounded Wye Systems**

Revised 08/2022

Specification

1.0 SCOPE

This specification covers the requirements for a control and sensing system for use in a three-phase switched capacitor bank shunt connection to a standard distribution system in either a 7.2 kV ungrounded delta or 14.4 kV solidly-grounded wye configuration at 60 Hz.

2.0 APPLICABLE PUBLICATIONS AND STANDARDS

The controls shall comply with the applicable provisions of the latest NEMA, IEEE, ANSI, and IEC standards relating to capacitors. Applicable standards include:

- 2.1. IEEE Std 18 – Standard for Shunt Power Capacitors
- 2.2. IEEE 1036 – Guide for Application of Shunt Power Capacitors
- 2.3. IEEE Std. C37.99 – Guide for the Protection of Shunt Capacitor Banks

3.0 PRODUCT REQUIREMENTS

3.1. General

The capacitor bank controller and sensors shall conform to the requirements of the standards referenced in Section 2.0 and the specifications herein, for use in the described application in Section 1.0.

3.2. Make and Model

Controllers as specified shall be provided by ValQuest. Controllers from other suppliers shall be considered provided that the proposal provides a complete set of descriptive bulletins, specifications, instructions, and references. Sensors shall be compatible for use with the selected controller and all of its requirements.

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3.3. **Specifications and Features**

- 3.3.1. The Controllers shall have the following features and functionality for use on the 14.4 kV solidly-grounded wye system.
 - 3.3.1.1. 120 VAC control power input.
 - 3.3.1.2. Three phase line current inputs by means of a line current sensors (0 – 10 volt range).
 - 3.3.1.3. Three phase voltage inputs by means of line sensors (0 – 10 volt range).
 - 3.3.1.4. Controllers shall be suitable for measuring, processing, and calculating control functions for both solidly-grounded wye systems and ungrounded delta systems.
 - 3.3.1.5. Capacitors connected to ungrounded delta systems shall be wired as ungrounded wye.
 - 3.3.1.6. Communications support via DNP3 shall be provided through Ethernet RJ45 connector, or optically isolated DB-9 connector.
 - 3.3.1.7. The control shall include the following control modes: Voltage, VAR, Schedule, Temperature, Current, Remote I/O.
 - 3.3.1.8. A trip-close switch for manual operation.
 - 3.3.1.9. Independent operation mode switches: Manual Switch, Remote Switch, Automatic Switch.
 - 3.3.1.10. Data Storage in non-volatile memory recording: operation history, trending, and change in voltage before and after operation.
 - 3.3.1.11. USB port for connection to the application software tool for programming.
 - 3.3.1.12. Licensed copy of software required for programming, entering settings, and viewing metering data.
 - 3.3.1.13. System firmware and user configuration shall be maintained in flash memory so not to be lost during power interruptions.
 - 3.3.1.14. Each controller shall be provided with a physical and electronic copy of the instruction manual.
 - 3.3.1.15. Controller shall utilize “Zero Voltage Crossing” software and capabilities in order to actuate the switches in such a way that the capacitors become

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energized at the zero-crossing of the distribution voltage waveform in order to minimize current and voltage disturbances on the system caused by the switching of the capacitor bank.

- 3.3.1.16. The controller shall be housed in a single enclosure suitable for wet and dusty locations. The housing shall be suitable for pole mounting.
- 3.3.1.17. The controller shall include a single, multi-conductor control cable, 50' in length, to connect the controller to the capacitor rack mounted junction box. The cable shall carry all necessary connections between the controller and the required equipment necessary for the installation.
- 3.3.1.18. All outside connections on the housing shall be weatherproof.
- 3.3.2. The Controllers for the 7.2 kV ungrounded delta system shall have the same features and functionality as those described in 3.3.1. with the following exceptions.
 - 3.3.2.1. One phase line current input by means of a line current sensor (0 – 10 volt range).
 - 3.3.2.2. Voltage inputs by means of one (1) 7200 V – 120 V, two busing, control power transformer.
- 3.3.3. The sensors shall have the following features and functionality.
 - 3.3.3.1. For installations on 14.4 kV grounded-wye systems: Three (3) 15 kV, 95 kV BIL, line post sensors shall be utilized for each capacitor bank installation, capable of measuring both line current and voltage.
 - 3.3.3.2. For installations on 7.2 kV ungrounded-delta systems: One (1) 15 kV, 95 kV BIL, line post sensors shall be utilized for each capacitor bank installation, capable of measuring line current only. One (1) control power transformer shall be used for voltage sensing. The control power transformer shall be two

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(2) bushing unit, 7200 V primary voltage, 120 V secondary voltage, 60:1 ratio, 1,500 VA minimum units.

- 3.3.3.3. Voltage outputs from the line post sensors shall be Low Energy Analog (LEA) outputs. The ratio shall be 1400:1.
- 3.3.3.4. Current outputs shall be Low Energy Analog (LEA) outputs. The selected ratio shall be 600A:10V.
- 3.3.3.5. Line sensors shall be ANSI Gray #70.
- 3.3.3.6. Line sensors shall be capable of mounting directly atop a standard wood utility pole crossarm.
- 3.3.3.7. Line sensors shall have a 20 foot output cable provided.
- 3.3.3.8. Line sensors shall be capable of supporting conductors up to and including 556.5 kcmil ACSR.
- 3.3.3.9. Line sensor secondaries must be capable of being open-circuited without sustaining damage.
- 3.3.3.10. Each line sensor shall be marked with the date of manufacturer, the manufacturer's name, and the model number.
- 3.3.3.11. For installations on 14.4 kV grounded-wye systems, a neutral CT shall be included. The selected CT ratio shall be coordinated to with the selected controller to provide a suitable output for the controller's acceptable input range.

3.4. **Nameplate**

The control cabinet shall be provided with a securely attached stainless steel nameplate containing the below information, which follows the IEEE standard requirements:

- a) Manufacturer's catalog number
- b) Manufacturer's serial number
- c) Manufacture date

4.0 TESTING

Certified test reports substantiating compliance with the Standards listed in Section 2.0 shall be furnished upon request.