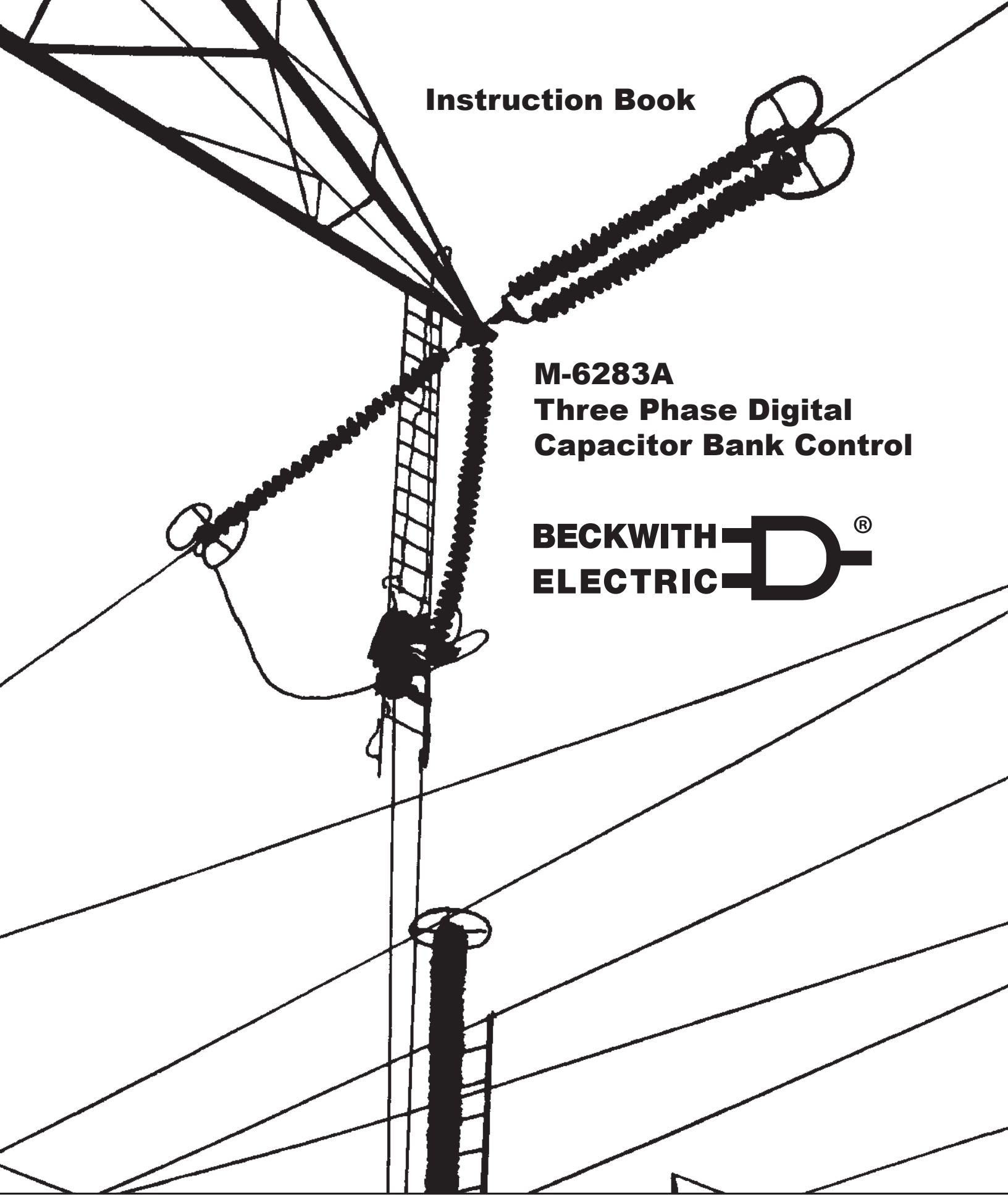
Instruction Book



M-6283A
Three Phase Digital Capacitor Bank Control

BECKWITH ELECTRIC®

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lwIP (lightweight IP) – lwIP is a widely used open-source TCP/IP stack designed for embedded systems.

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Racoon – Racoon is the Internet Key Exchange (IKE) library source code used in IPsec/IKE implementation.

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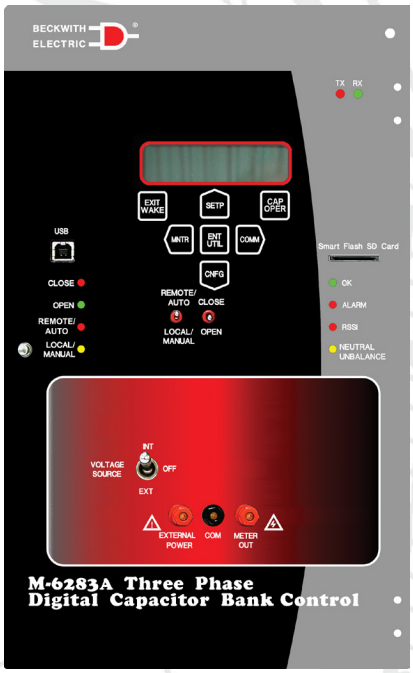
CONTROLS

Three Phase Capacitor Bank Control M-6283A



Three Phase Sensing Digital Capacitor Bank Control for Remote Capacitor Automation, Monitoring and Protection

Control

- Universal control offering automatic Voltage, VAr, Current, Time (seasonality) or Temperature operation with programmable voltage override
- Full three phase voltage and current sensing
- Compatible with traditional VT's, Line Post Sensors and multi-core LPS
- Three phase (Ganged) capacitor switch operation with optional Independent Phase switching
- 8 Setting profiles with programmable automatic or SCADA controlled profile switching
- Patent pending neutral current detection algorithm

Automation/Communications

- Front panel USB port for local programming and data transfer
- Smart Flash SD Card Slot for Quick Uploading of Configurations, Settings, Firmware Upgrades, and Supports Control Cloning
- Flexible Communication Options for Wired or Wireless Networks with two independent serial ports (232, 485, Fiber or Bluetooth)
- Optional full 10/100 Mbps auto-sensing, auto-negotiable true Ethernet (copper or fiber) port with multi-user and multi-protocol support
- Protocols supported include MODBUS, DNP3.0
- Full DNP implementation with support for read/write of digital and analog values, file transfer, multicasting, unsolicited response, monitoring and remote control
- Compatible with most popular Volt-Var Optimization (VVO) and Conservation Voltage Reduction (CVR) implementations
- Embedded Cybersecurity features to implement NERC/CIP v5 requirements, including IPsec and RADIUS server security
- Meets IEEE 1686 Password Requirement

Monitoring

- Advanced metering with integrated Power Quality monitoring including voltage and current harmonics up to the 31st, THD, detection of sags, swells and sub-synchronous transients
- Advanced Data Logging and Load Profile Recorder – Data stored in non-volatile memory requiring no battery backup
- 132 Event Sequence of Events (SOE) Recorder
- Oscillographic records with adjustable sampling rate up to 64 s/c
- Three phase overcurrent detection for through fault monitoring

CapTalk

- Uncomplicated Windows based application software for easy local or remote programming, monitoring, operation or downloading of recorded information

Flexibility

- Optional M-2980A Control Cabinet offers a wide range of Pole top mounting options and accessories for communication hardware

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Standard Features

- Three-phase sensing voltage (std) and current (optional)
- Operation based on per phase or average of the three phases
- Three phase (Ganged) capacitor switch operation with optional Independent Phase switching
- Three control modes of operation:
  - Classic Automatic (Voltage, optional VAr Control or optional Current Control)
  - Remote
  - Manual
- Two override modes of operation:
  - Temperature
  - Time
- Time Delay – Definite and Inverse
- Adjustable Maximum/Minimum Voltage Limits
- Neutral Unbalance current detection
  - Bank/Switch Failed
  - Bank Closed
  - Bank Open
  - Supports 200 mA input to control
- Setpoint Profiles (8) Triggerable by SCADA, Seasonal (4), Above/Below Temperature, and Reverse Power
- Compare Setpoints Tool
- User selectable Overvoltage limit/ Undervoltage limit and time delay for remote control supervision
- Adjustable warning timers for Close/Open/ Re-close
- Adjustable Close/Open output pulse duration
- Real-Time Metering of measured and calculated parameters
- VT Ratio Correction, VT and CT (Phase and Neutral) Multiplier
- Operations Counter for each phase (Configurable)
- Resettable Operations Counter with Alarm
- Harmonic Analysis of Voltage and Current Signals, up to the 31st plus THD
- THD Voltage and Current Tripping and Lockout
- Data Logging
- Remote/Auto – Local/Manual switch
- Outputs: Close, Open and Alarm
- Minimum Time Between Operations Delay
- 20 Character by 2 Row LCD display (LED backlit)
- Up to 30 unique 15 character User Access Codes (Level 1 or Level 2)
- CBEMA monitoring to detect sags and swells within a range of 90 Vac to 180 Vac, and trigger data collection
- Smart Flash SD Card Slot supports standard SD Memory Cards: SD, SDHC, SDXC, UHS-I.
- Smart Flash SD Card can be linked to one or multiple controls providing a physical security "Key" which provides User Access Level 2 Access to the control when the SD Card is inserted for settings manipulation
- Sequence of Events (SOE) recorder
- Device Discovery
- Source Address Validation
- Oscillography
- Front Panel LEDs for Remote/Auto, Local/ Manual, Alarm, Close, Open, OK, RSSI, Neutral Unbalance, (TX) Transmit and (RX) Receive
- Programmable Alarms
- Front Panel Hot Buttons provide direct access to menu headers
- Front Panel testing:
  - Int/Ext Voltage Source switch
  - External Power input terminals
  - Meter Out terminals
- Communication Protocols DNP3.0 and MODBUS
- Time sync via DNP3.0 Set Time Command
- DNP mapping templates to match SCADA historical databases
- FULL DNP implementation – Including DNP File Transfer, multi-addressing, unsolicited response, source address validation
- DNP+Ethernet – Send/receive DNP configuration files using DNP File Transfer Protocol
- Adaptive Delta Voltage sensing during switch operations
- Daily Operations Counter Limit with Alarm
- CapTalk® S-6283 Communications Software
- Capacitor Bank switch status inputs for phase A, B and C
- Graphical display of real-time harmonic spectrum of voltage and current using CapTalk Communications Software

Standard Features (Cont.)

- Communication Ports:
  - USB
  - RS-232
- SCADA "HeartBeat" (with DNP3.0 only)
- Supports Station and Feeder Level DNP addressing in addition to individual addressing for Smart Grid applications
- One pushbutton access to user configurable Wakeup screen for manual data recording with Smart Flash SD Card saving feature
- One set (3) of spare fuses are included
- Capacitor Bank Switch selection "Solenoid Driven" or "Motor Driven" for Close/Open Pulse Duration
- 200 mA Neutral Current input for Neutral Unbalance detection
- SCADA Test Mode
- IEEE 1686 Standard Compliant Cyber Security
- IPsec (Internet Protocol Security)
- RADIUS Client Capability to manage local and remote access to the control
- Complies with California Password Law (SB-327)

Optional Control Features

- Independent Phase Switching
- Automatic VAr Control Mode option includes: 0 to 10 V Line Post Sensor input (Impedance ≈ 1 MΩ)
- COM2, RS-232 Communications Port or Bluetooth*

  *Bluetooth option is not available in 50 Hz units shipped to locations subject to Radio Equipment Directive RE-D 2014/53/EU. Contact the factory for more information.
- Ethernet Port (10/100 Base-T) is available through a RJ-45 jack or Fiber Optic ST Connector. This port supports DNP over TCP/IP and UDP; MODBUS over TCP/IP; and SNTP.
- 5 A Neutral Current input for Neutral Unbalance detection
- Line Post Current Sensor input for Neutral Unbalance detection (Impedance ≈ 200 KΩ)
- Communications Ports:
  - ST Fiber Optic
  - V-pin Fiber Optic
  - RS-485
- External Temperature Sensor
- The M-6283A can be housed in a Molded Lexan, Cold Rolled Steel or Stainless Steel Control cabinet. (See "M-2980A Capacitor Control Cabinet" section of this specification for detailed information).

CAPACITOR BANK CONTROL OPERATION

Control Modes of Operation

Depending on the control mode of operation, the control parameter can be either Voltage, VArs* or Current*. For example the control Voltage is the measurement used in the control algorithm to make the load voltage regulation decision. The control parameter is user selectable.

The three user selectable options are:

- Single Phase Selection (A, B, or C)
- Three Phase Average/Total
- Single Independent Phase Switch (Optional)

Single Phase Selection

This option will allow the user to choose which phase: A, B or C is used as the controlling parameter. Once this is selected, the control will use that phase value in Classic voltage control mode to make a decision on how to regulate the load voltage. The option is valid for all three methods of control: Voltage, VArs and Current. In addition, each individual Open or Close contact will operate simultaneously during a Trip or Close operation.

Three Phase Average/Total

This option will average the value of all three phase quantities and this average will be used to make the control decision. The option is valid for all three methods of control: Voltage, VArs and Current. It is important to note that when the control is using VAr Control, the averaging is replaced by the total sum of the VArs of all three phases.

In addition when the option is selected the CT Multiplier is assumed to be equal. In Control Mode Limits the maximum and minimum of the 3 phases is used to evaluate whether the voltage is violating the user assigned limits. In addition, each individual Open or Close contact will operate simultaneously during a Trip or Close operation.

Independent Phase Switching (Optional)

This option will allow the user to independently operate each phase of a Capacitor Bank switch based on the chosen Control Mode of Operation. The chosen operational mode's settings are not duplicated for each phase but instead use one group of settings which are used by all three phases to make Independent Phase Switching decisions. Each phase will have a dedicated set of Close and Open contacts.

Control Modes of Operation

■ **NOTE:** Open or close operations in Automatic mode will be blocked if the sensing voltage is less than 85 V. This block was designed to prevent capacitor switches from operating when voltage is low on the system. As of firmware version 05.09.01, this block does not apply to Local/Manual or Remote operations.

Automatic Voltage Control Mode

The control will make its Open and Close switching decisions based on measured Line Voltage conditions and Time and/or Temperature overrides when applied. Voltage excursions beyond the set value for greater duration than the time delay will result in appropriate control operation.

- **Control Open Voltage:** Adjustable from 95.0 to 140.0 V in 0.1 V increments
- **Control Close Voltage:** Adjustable from 95.0 to 140.0 V in 0.1 V increments
- **Close and Open Time Delays:** Definite or Inverse; adjustable from 0 seconds to 600 seconds, in 1 second increments. Timer reset can be selected as instantaneous or integrating.
- **Time Override**: In the Auto Control Mode a Time Override can be applied to capacitor bank Open and Close operations. The Time Override feature considers Start Date, Start Time, End Date, End Time, Duration, Recurrence Pattern and a Range Of Occurrences to implement the override.
- **Temperature Override**: In the Auto Control Mode a Temperature Override can be applied to capacitor bank Open and Close operations. The Temperature Override feature considers sensed ambient temperature and implements override action (Open, Close or None) for either above or below temperature setpoint conditions.

■ **NOTE:** Time and Temperature Overrides can be overridden by Control Mode Limits.

*Only available with VAr and Current Control Mode option.

Automatic VAr Control Mode Option*

The control will make its Open and Close switching decisions based on measured line VAr conditions and Time and/or Temperature overrides when applied. VAr excursions beyond the set value for greater duration than the time delay will result in appropriate control operation. The control can be ordered with Line Post Current Sensor inputs to provide phase current measurement to the control.

- **Control Open VArs:** –100 % to 100 % of single-phase capacitor Bank size in 1 % increments
- **Control Close VArs:** 0 % to 100 % of single-phase capacitor Bank size in 1 % increments
- **Close and Open Time Delays:** Definite only; adjustable from 0 seconds to 600 seconds, in 1 second increments. Timer reset can be selected as instantaneous or integrating.
- **Time Override:** In the Auto Control Mode a Time Override can be applied to capacitor bank Open and Close operations. The Time Override feature considers Start Date, Start Time, End Date, End Time, Duration, Recurrence Pattern and a Range Of Occurrences to implement the override.
- **Temperature Override:** In the Auto Control Mode a Temperature Override can be applied to capacitor bank Open and Close operations. The Temperature Override feature considers sensed ambient temperature and implements override action (Open, Close or None) for either above or below temperature setpoint conditions.

■ **NOTE:** Time and Temperature Overrides can be overridden by Control Mode Limits.

Automatic Current Control Mode Option*

The control will make its switching decisions based on measured Line Current conditions and Time and/or Temperature overrides when applied. Current excursions beyond the set value for greater duration that the time delay will result in appropriate control operation. The control can be ordered with Line Post Sensor inputs to provide phase current measurement to the control.

- **Control Open Current:** Adjustable from 10 to 600 Amps
- **Control Close Current:** Adjustable from 10 to 600 Amps
- **Close and Open Time Delays:** Definite only; adjustable from 0 seconds to 600 seconds, in 1 second increments. Timer reset can be selected as instantaneous or integrating.
- **Time Override:** In the Auto Control Mode a Time Override can be applied to capacitor bank Open and Close operations. The Time Override feature considers Start Date, Start Time, End Date, End Time, Duration, Recurrence Pattern and a Range Of Occurrences to implement the override.
- **Temperature Override:** In the Auto Control Mode a Temperature Override can be applied to capacitor bank Open and Close operations. The Temperature Override feature considers sensed ambient temperature and implements override action (Open, Close or None) for either above or below temperature setpoint conditions.

■ **NOTE:** Time and Temperature Overrides can be overridden by Control Mode Limits.

Remote Control Mode

In this mode, the control receives commands through communications for Closing or Opening of the Capacitor Bank.

Remote Control Mode Limits: These limits can be disabled or enabled. If control operation will result in voltage outside of these limits operation will be **blocked** and notification will be sent to the sender. If measured voltage is outside of these limits, the control will **initiate** an operation in the direction to return voltage within limits.

- **Overvoltage Limit:** Adjustable from 95.0 to 140.0 V in 0.1 V increments
- **Undervoltage Limit:** Adjustable from 95.0 to 140.0 V in 0.1 V increments
- **Voltage Limits Timer:** Definite or Inverse; adjustable from 0 seconds to 600 seconds, in 1 second increments. Timer reset can be selected as instantaneous or integrating.

*Only available with VAr and Current Control Mode option.

Control Mode Limits

When enabled, if control operation will result in voltage outside of the Control Mode Limits, operation will be blocked. If measured voltage is outside of these limits, the control will **initiate** an operation in the direction to return voltage within limits after the set time delay. Only the **block** and not the **initiate** operation is implemented in Remote Manual Mode due to personnel safety considerations. Control Mode Limits can be selected as: Disable All, Enable in Auto, Enable in Remote, Enable in Manual. Any combination of Enable in Auto, Enable in Remote and Enable in Manual can be selected. These limits will apply regardless of the control mode of operation selected providing voltage override functionality in all operational modes.

- **Maximum Voltage Limit:** Adjustable from 95.0 to 140.0 V in 0.1 V increments
- **Minimum Voltage Limit:** Adjustable from 95.0 to 140.0 V in 0.1 V increments
- **Definite Time:** Adjustable from 0 to 60 seconds in 1 second increments

Local Manual Mode

In this mode, the control will disable Automatic and Remote Control modes. In this mode, the control will respond to the front panel CLOSE/OPEN switch position.

Bank Operational Delays:

- **Minimum Time Between Operations:** Adjustable from 0 to 3600 seconds in 1 second increments
- **Close Warning Delay:** Adjustable from 0 to 90 seconds in 1 second increments (Enable/Disable)
- **Open Warning Delay:** Adjustable from 0 to 90 seconds in 1 second increments (Enable/Disable)
- **Re-Close Delay:** Adjustable from 300 to 600 seconds in 1 second increments
- **Close/Open Pulse Duration (Non Individual Phase Operation):**
  - Solenoid Driven Switch Type – Adjustable from 50 to 100 ms in 1 ms increments
  - Motor Driven Switch Type – Adjustable from 5 to 15 seconds in 1 second increments
- **Close/Open Pulse Duration (Individual Phase Operation):**
  - Solenoid Driven Switch Type – Adjustable from 50 to 300 ms in 1 ms increments
  - Motor Driven Switch Type – Adjustable from 5 to 30 seconds in 1 second increments

■ **NOTE:** The Close and Open Warning Delays "Auto" and "Remote" can be enabled or disabled. However, "Manual" is always enabled.

Voltage and Current Total Harmonic Distortion (THD) Trip and Lockout

The Voltage and Current THD Trip and Lockout feature will Trip and Lockout individual phases of the capacitor bank when either Voltage or Current THD exceeds its associated THD Trip Pickup Setting.

When Voltage or Current THD increases above its associated THD Trip Pickup Setting for the period defined by its THD Trip Time Delay setting, the control will Trip individual phases of the capacitor bank and Lockout further operation. If THD is still present above the THD Trip Pickup Setting after the trip has occurred, the Lockout will remain in effect until individual phase THD decreases to less than the Voltage or Current THD Lockout Reset setting for the duration of it's THD Lockout Reset Delay setting.

Neutral Unbalance Current Detection for Three Phase Switching

Current measured by the Neutral Unbalance Current Detection feature is used to detect bank or switch failures as well as bank Open or Close status. The M-6283A Digital Capacitor Bank Control makes use of a neutral current input from the neutral circuit. This input is developed in a number of ways, as an input to the cap bank control.

Utilizing a direct measurement of current flowing in the neutral, and comparing the value with either Bank Status Open/Closed current limit, or hardwired bank switch status auxiliary contacts, the control can make differentiations as to the cause of the unbalance current flow.

Neutral Unbalance Current is measured using one of the following:

- **200 mA CT Input:** This option is offered by default in the unit.
- **5 A CT Input:** This option must be specified when ordered.
- **10 V Line Post Current Sensor:** This option must be specified when ordered and should be chosen if either a Voltage or Current Line Post Sensor will be used.

Neutral Unbalance Current Levels:

Bank/Switch Failed Level 1 (can be enabled or disabled)

- **Bank/Switch Failed:** Adjustable from 1.0 to 200.0 A in 0.1 A increments

Bank/Switch Failed Level 2 (can be enabled or disabled)

- **Bank/Switch Failed Level 2:** Adjustable from 1.0 to 200.0 A in 0.1 A increments
- **Time Delay:** Adjustable from 1 to 300 seconds in 1 second increments
- **Prior Operation:**
  - **Action Taken:** Retry Operation, Reverse Operation and Block, Reset Block
  - **Number of Attempts:** 1 to 9
  - **Block Reset Time Delay:** Adjustable from 0 to 72 hours in 1 hour increments
- **No Prior Operation:** (can be enabled or disabled)
  - **Open and Lockout Time Delay:** Adjustable from 1 to 4320 minutes in 1 minute increments
  - **Reset Lockout:** Can be enabled or disabled
  - **Lockout Reset Time Delay:** Adjustable from 0 to 72 hours in 1 hour increments

Bank Status (can be enabled or disabled)

- **Bank Status Closed:** Adjustable from 0.10 to 10.00 A in 0.01 A increments. If Neutral Current is greater than this setting, the bank is confirmed to be closed.
- **Bank Status Open:** Adjustable from 0.10 to 10.00 A in 0.01 A increments. If Neutral Current is less than this setting, the bank is confirmed to be open.
- **Bank Status Time Delay:** Adjustable from 10 to 300 seconds in 1 second increments for both (Close and Open).
- **Action Taken:** If bank status indicates an unsuccessful operation, the control can be programmed to take no action or retry the operation.

Neutral Unbalance Current Detection for Optional Independent Phase Switching

In Independent Phase Switching mode, the control will determine whether an operation is successful depending on the magnitude of the Neutral Current of the phase angle measurement with references to a user selected phase. The level above which a neutral unbalance is detected is identified by the nominal voltage and max cap bank size settings.

Bank Switch Status Feedback

Switch auxiliary position contacts can be connected to the control to confirm individual phase switch positions. Individual phase switch position indicators can be observed on the CapTalk Metering and Status Screen (Figure 2). Bank Switch Status detection can be disabled or enabled.

Settings Profiles and Profile Triggering

The Settings Profiles are groupings of settings within the control created to allow changing from one group to another quickly based on internal or external triggers. Additionally, several methods of Triggering a change from one Setting Profile to another automatically are provided.

Settings Profiles – Settings Profiles are defined as a group of settings in the control that can be selected as the Active Profile either automatically based on selected triggers, or via SCADA. The Active Profile is defined as the Settings Profile currently in use providing the parameters the control is operating with. There are eight Settings Profiles that can be created in the control.

Profile Triggers – Once a trigger has been selected as a trigger for one profile, it is no longer available as a trigger for the other profiles. Only one trigger can be assigned to a profile with the exception of the SCADA trigger. Triggers may also be prioritized from 2 to 8 with the exception being SCADA, which is always priority 1.

- **SCADA Profile Trigger –** SCADA can be selected to trigger any profile up to all eight. An Analog Output DNP point named "SCADAHB Profile Switch" allows the user to change what Settings Profile is the Active Profile in the control as long as the Heartbeat is active.
- **Season Profile Trigger –** Each Season Trigger allows the user to set the following parameters:
  - Start Date/End Date
  - Start Time
  - End Time – Selecting the End Time Calculates the Duration and displays it rounded to the nearest tenth of a minute.
  - Duration – Selecting Duration calculates the End Time and displays it rounded to the nearest tenth of a minute.
  - Recurrence Pattern – Provides a choice between Daily and Weekly.
- **Above and Below Temperature Profile Trigger –** The Above and Below Temperature Triggers provide the user with the ability to set a temperature between -40° and 185° F, or -40° and 85° C that will trigger a Settings Profile change when exceeded.
- **Reverse Power Profile Trigger –** When Reverse Power is sensed, the selected Settings Profile will be switched to.

Additional Settings

VT/CT Setup:

- **Voltage Multiplier:** Adjustable from 0.1 to 3260.0 in 0.1 increments
- **VT Correction:** Adjustable from -15.0 V to +15.0 V in 0.1 V increments
- **Phase Current Multiplier*:** Adjustable from 1.00 to 200.00 in .01 increments
- **Neutral Current Multiplier:**
  - 5 A Neutral CT and Line Post Sensor – Adjustable from 1.0 to 150.0 in 0.1 increments
  - 200 mA Neutral CT – Adjustable from 1.0 to 3260.0 in 0.1 increments

Counters:

- **Resettable Counter:** A software counter that increments by one count per Close or Open operation. Resettable to 0.
- **Operation Counter Preset:** A software counter which increments by one count per Close Only or Open or Close operation. Presettable from 0 to 999,999.
- **Resettable Counter Alarm Limit:** A limit that alerts the user either by communications and/or a programmable alarm. It is settable from 0 to 999,999.
- **Daily Operation Counter Limit:** When the Operation Counter reaches this limit, any further operation is blocked until 12:00 AM. The user is alerted either by communications and/or a programmable alarm. The limit is settable from 2 to 99. The counter can be enabled or disabled in "Remote" and/or "Manual" Mode. This counter is always enabled in "Auto" Mode.

*Only available with VAr and Current Control Mode option.

Monitoring

Harmonic Analysis: Provides the total harmonic distortion and the harmonic content of the voltage and current up to the 31st harmonic.

Alarms: The alarm relay is user-programmable with a non-latching output contact.

- Maximum Voltage Limit
- Minimum Voltage Limit
- Remote Overvoltage Limit
- Remote Undervoltage Limit
- Neutral Magnitude Unbalance
- Neutral Phase Unbalance
- Resettable Counter Limit
- Daily Operation Counter Limit
- Voltage Harmonics
- Current Harmonics*
- Remote Manual
- Self Test
- Leading VAr*
- Current THD Lockout*
- Voltage THD Lockout
- Lagging VAr*
- Leading Power Factor*
- Lagging Power Factor*

Sequence of Events: A built-in Sequence of Events (SOE) Recorder has the capability to record up to 132 events. It allows trigger events to be AND'ed and OR'ed for Pickup and Dropout. Trigger Events include:

- Close Command
- Open Command
- Maximum Voltage Limit
- Minimum Voltage Limit
- Remote Overvoltage Limit
- Remote Undervoltage Limit
- Neutral Magnitude Unbalance
- Neutral Phase Unbalance
- SCADA HeartBeat (DNP only)
- Voltage Harmonics
- Current Harmonics*
- CBEMA 1 through 4
- Delta Voltage Alarm
- Phase Overcurrent*
- HMI Active
- Leading VAr*
- Lagging VAr*
- Leading Power Factor*
- Lagging Power Factor*
- Bank Failed Level 2

Parameters that are captured with each Sequence of Events Record include:

- Voltage (Phase A, B, C)
- RMS Voltage (Phase A, B, C)
- Delta Voltage (Phase A, B, C)
- Primary Volt. (Phase A, B, C)
- Frequency
- Neutral Current
- Neutral Current Phase Angle
- Real Power (Phase A, B, C)
- Reactive Power (Ph. A, B, C)
- Current (Phase A, B, C)
- Active Profile

Oscillography: A built-in Oscillograph Recorder continuously records voltage and current waveform data in a buffer memory. This memory can be configured from 1 to 16 partitions. When triggered, a snapshot of waveform data from 321 to 2730 cycles is captured. The data captured can be specified from 5% to 95% post-trigger event. The remainder of the percentage is pre-trigger data (samples per cycle is selectable as 16, 32 or 64 samples/cycle). Trigger Events include:

- Close Command
- Open Command
- Maximum Voltage Limit
- Minimum Voltage Limit
- Remote Overvoltage Limit
- Remote Undervoltage Limit
- Neutral Magnitude Unbalance
- Neutral Phase Unbalance
- SCADA HeartBeat (DNP only)
- Voltage Harmonics
- Current Harmonics*
- CBEMA 1 Through 4
- Delta Voltage Alarm
- Phase Overcurrent
- Leading VAr*
- Lagging VAr*
- Leading Power Factor*
- Lagging Power Factor*

Data Logging: A built-in Data Logging Recorder that continually records data in non-volatile memory. Data logging will continue indefinitely as long as the data interval is set to a non-zero value. Data to be retrieved:

- Voltage
- Delta Voltage
- Primary Neutral Current
- Frequency
- Operation Counter
- Resettable Counter
- Capacitor Bank Status
- Temperature
- Real Power
- Reactive Power

*Only available with VAr and Current Control Mode option.

Metering

Figure 1 provides an example of the Metering parameters that are available from the control.

■ **NOTE:** Power Factor and Primary; Phase Current, Watts, VArs and VA are only available when the VAr Control Mode option is present.

Figure 1 Independent Phase Metering Dialog Screen

Figure 2 provides an example of the Independent Phase Status Dialog Screen.

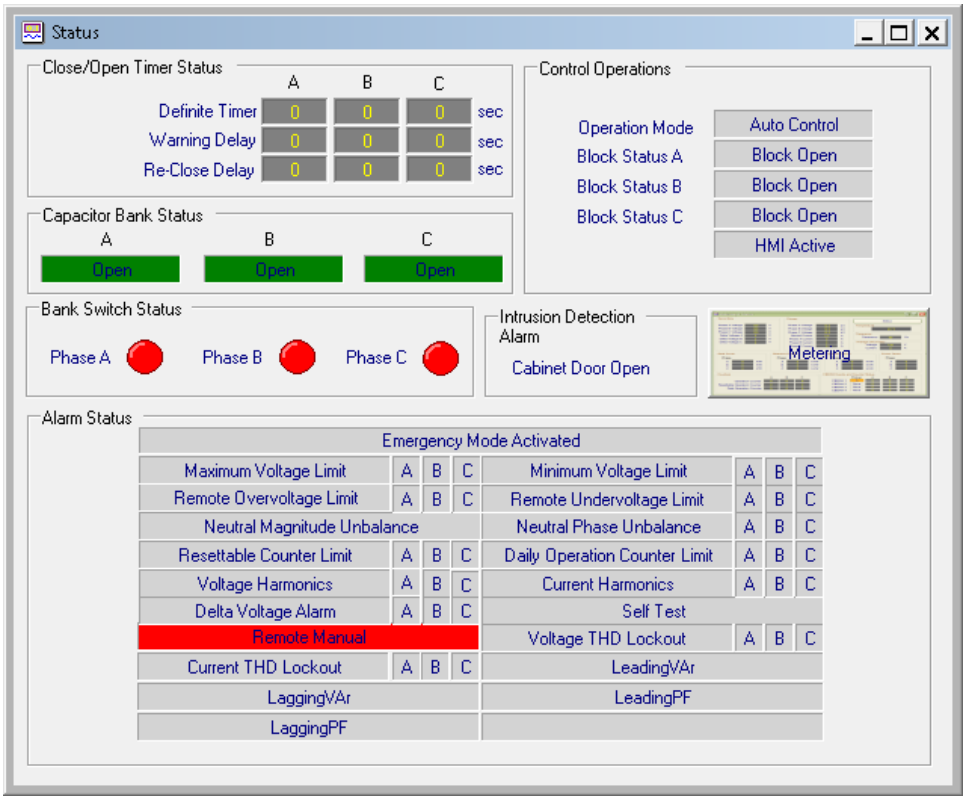


Figure 2 Independent Phase Status Dialog Screen

Inputs

Switch Power Input: Nominal 120 Vac, 60 Hz (50 Hz optional); operates properly from 95 to 140 Vac. If set at 60 Hz, the operating system frequency is from 55 to 65 Hz; if set at 50 Hz, the operating system frequency is from 45 to 55 Hz. The burden imposed on the input is 8 VA or less. The unit will withstand twice the nominal voltage for one second and four times the nominal voltage input for one cycle.

V_1, V_2, and V_3 Monitor Voltage Inputs: 0 – 10 Vac Line Post Voltage Sensor input, optional 0 to 150 Vac VT input. These inputs are suitable for use with high impedance voltage dividers. Input impedance is approximately 1 MΩ. The inputs will withstand twice the maximum voltage rating for one second and four times the maximum voltage rating for one cycle.

Phase Current Input: 0 – 10 Vac Line Post Current Sensor input. External current to voltage conversion is required if 5 A CT is to be used. Appropriate multiplier is utilized to calculate the primary phase current. Line Post Current Sensor option also includes a phase shift compensation setting.

Neutral Unbalance Current Input: 0 – 10 Vac Line Post Current Sensor, 200 mA, or 5 A input will also be supported. Appropriate multiplier is utilized to calculate the primary neutral unbalance current.

Outputs

One Close Output (Three Close Outputs with Independent Phase Switching option): Capable of switching 10 A for 30 sec or 45 A for 25 ms.

One Open Output (Three Open Outputs with Independent Phase Switching option): Capable of switching 10 A for 30 sec or 45 A for 25 ms.

User-Programmable Alarm Output: One Form "C" contact capable of switching 6 A at 125 Vac or 0.2 A at 125 Vdc.

Digital Inputs

Three 12 Vdc Inputs for switch status and one internally wetted intrusion detection input.

Front Panel Controls

Menu-driven access to all functions by way of six pushbuttons and a two-line alphanumeric display. There are up to 30 programmable User Access Codes (Level 1 or Level 2) available to provide various levels of access to the control functions.

The Capacitor Bank control offers a 2-line by 20 character LCD display (LED backlit) for enhanced viewing in direct sunlight.

CLOSE/OPEN switch allows local manual Close and Open commands to be initiated.

REMOTE/AUTO – LOCAL/MANUAL switch allows Automatic operation of the control or Manual operation from the front panel by using the CLOSE/OPEN toggle switch.

VOLTAGE SOURCE switch disconnects all power from the unit when selected to the **OFF** position. The **EXT** position allows the control to be powered from the front panel test jacks.

EXTERNAL POWER binding posts allow application of a 120 V RMS nominal voltage to the unit for testing.

METER OUT binding posts allow reading of the input voltage.

Unit Identifier

A 2-row by 20-character alphanumeric sequence, set by the user, can be used for unit identification.

Smart Flash SD Card Slot

Allows the user to perform the following functions:

- Load Setpoints
- Save Oscillograph Records
- Save DNP Config
- SD Card User Access (Physical Security Key)
- Multiuser Access Code Log
- Save Setpoints
- Clone Save
- Firmware Update
- Save Data Log
- Clone Load
- Save Metering Data
- Quick Capture
- Save Sequence of Events
- Load DNP Config
- Save Wake Screen Data
- Multiuser Access Code

■ **NOTE:** The Smart Flash SD Card slot supports standard SD Memory Cards: **SD, SDHC, SDXC, and UHS-I** format. The following formats are **NOT** supported: SDUC, UHS-II, UHS-III, and UHS-I Express.

LED Indicators

Front panel LED indicators show the following control conditions: **REMOTE/AUTO, LOCAL/MANUAL, ALARM, NEUTRAL UNBALANCE, CLOSE, OPEN, CPU OK, RSSI** and **TX** (Transmit) and **RX** (Receive).

Communications

The communication ports provide access to all features, including metering, software updates, and programming of all functions. This is accomplished using a connection from any Windows compatible computer running the CapTalk S-6283 Communications Software or SCADA communications software.

Protocols: The standard protocols included in the M-6283A are DNP3.0 and MODBUS. The USB port uses MODBUS for local communications. The optional Ethernet Port supports DNP3.0 and MODBUS protocols simultaneously. DNP Master Source Address Authentication is supported allowing multiple SCADA Masters to coexist on the same communications network.

Communications Via Direct Connection: CapTalk supports direct communication (MODBUS protocol) with the M-6283A using the applicable connector (USB cable) for the computer. Additionally, the standard RS-232 communications port as well as the 2-wire RS-485 and Serial Fiber (ST or Vpin) optional communications ports can be used to communicate via CapTalk.

Optional Ethernet Port: The optional Ethernet Port provides an RJ-45 (10/100 Base-T) or a (100 Base-Fx) Fiber Optic interface for ethernet communication to the M-6283A. The protocols supported are: MODBUS over TCP, DNP3.0 over TCP and DNP3.0 over UDP. The port supports up to eight concurrent connections. The maximum number of allowed DNP connections is five for each protocol (5 for UDP, 5 for TCP). The maximum number of MODBUS connections is eight. Ethernet Port settings can be configured manually or via DHCP protocol. MODBUS protocol "Port Number" and DNP Protocol "Port Number" can be changed manually from default values. DNP Master Source Address Authentication is supported allowing multiple SCADA Masters to coexist on the same communications network. This option can be field installed. Also, SNTP (Simple Network Time Protocol) Protocol is available to synchronize the control's RTC clock with the network server.

Optional Bluetooth: The optional Bluetooth (V2.0 +EDR Class 1 Type) provides wireless access to the M-6283A. With Bluetooth the user is able to configure the control, read status and metering values as well as change setpoints. This option can be field installed. There are two modes of operation for the Bluetooth:

- **Mode 0 –** The device is discoverable and connectable to any client station.
- **Mode 1 –** The device is non-discoverable but it is connectable to any client station who knows the control Bluetooth device address indicated under **Control BT Device** in the HMI. Mode 1 has been added to meet CIP requirement (CIP-0007-4 System Security Management) (R2.3).

Communications Using Networking: The addressing capability of the M-6283A allows networking of multiple M-6283A's. Each capacitor bank control can be assigned an Address, Feeder Address or Substation Address ranging from 1 to 65519. Selected commands may be broadcast to all controls on the network. Figures 3, 4 and 5 illustrate typical network configurations. Addresses 1-255 can be assigned to MODBUS and 1-65519 for DNP 3.0.

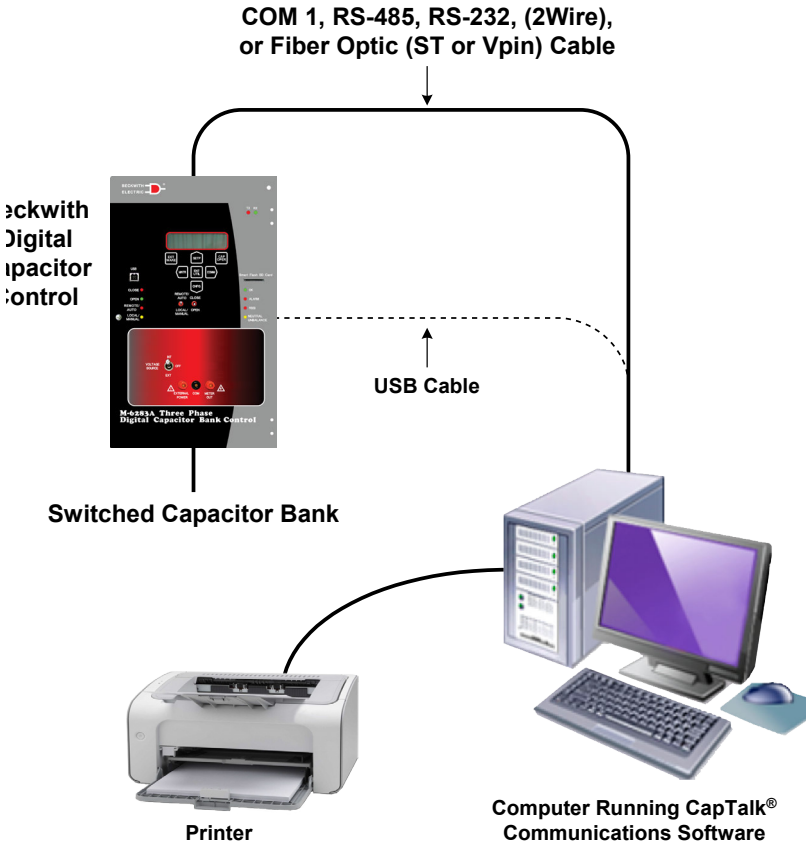


Figure 3 Direct Connection

Cyber Security

NERC CIP Compliance: The M-6283A provides all the necessary tools to help customers be NERC and Cyber Security compliant. The M-6283A meets or exceeds the following standards:

- IEEE 1686-2007 Compliant
- FIPS180-2, 186-2
- IEC 62351-1, -2, -3, -5
- ISO/IEC 9798-4
- IPsec using Internet Key Exchange (IKE) Version 1 and 2, compliant with: RFC 2367, 2393, 2394, 2401, 2402, 2406, 2407, 2408, 2409, 2411, 2412, 3456, 3706, 3947 and 3948
- RADIUS Server Support (optional), compliant with: RFC 2865 and 2866

BECO Standard Security: The default Level Access Code Security provides authentication and multi level access codes. A Smart Flash SD card may also serve as a cyber security hard-key with a user access audit log.

Application

Using CapTalk Communications Software, the operator has real-time, remote access to all functions of the M-6283A. The protocols implement half-duplex, two-way communications. This allows all functions, which would otherwise require the presence of an operator at the control, to be performed remotely. Communication capabilities include:

- Interrogation and modification of setpoints
- Broadcast of commands
- Recognition of alarm conditions, such as voltage extremes
- Unsolicited exception reporting
- Multicast capability using UDP

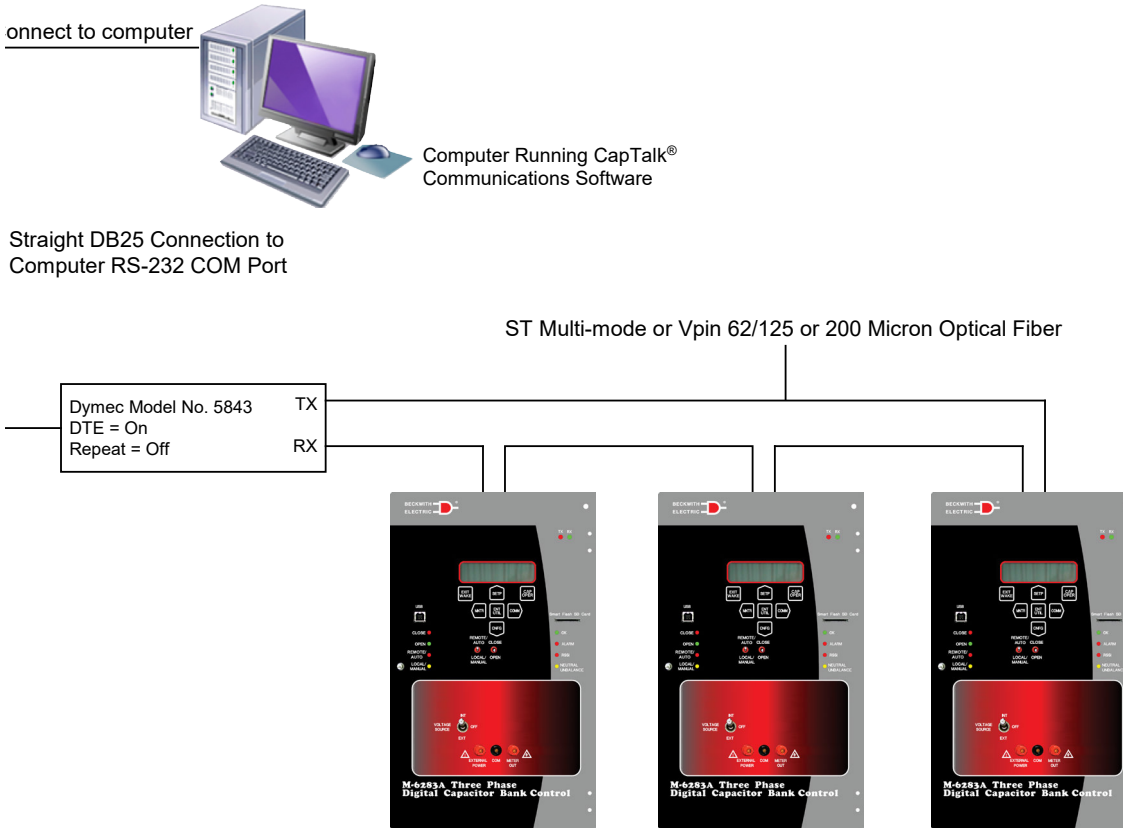


Figure 4 Fiber Optic Connection Loop

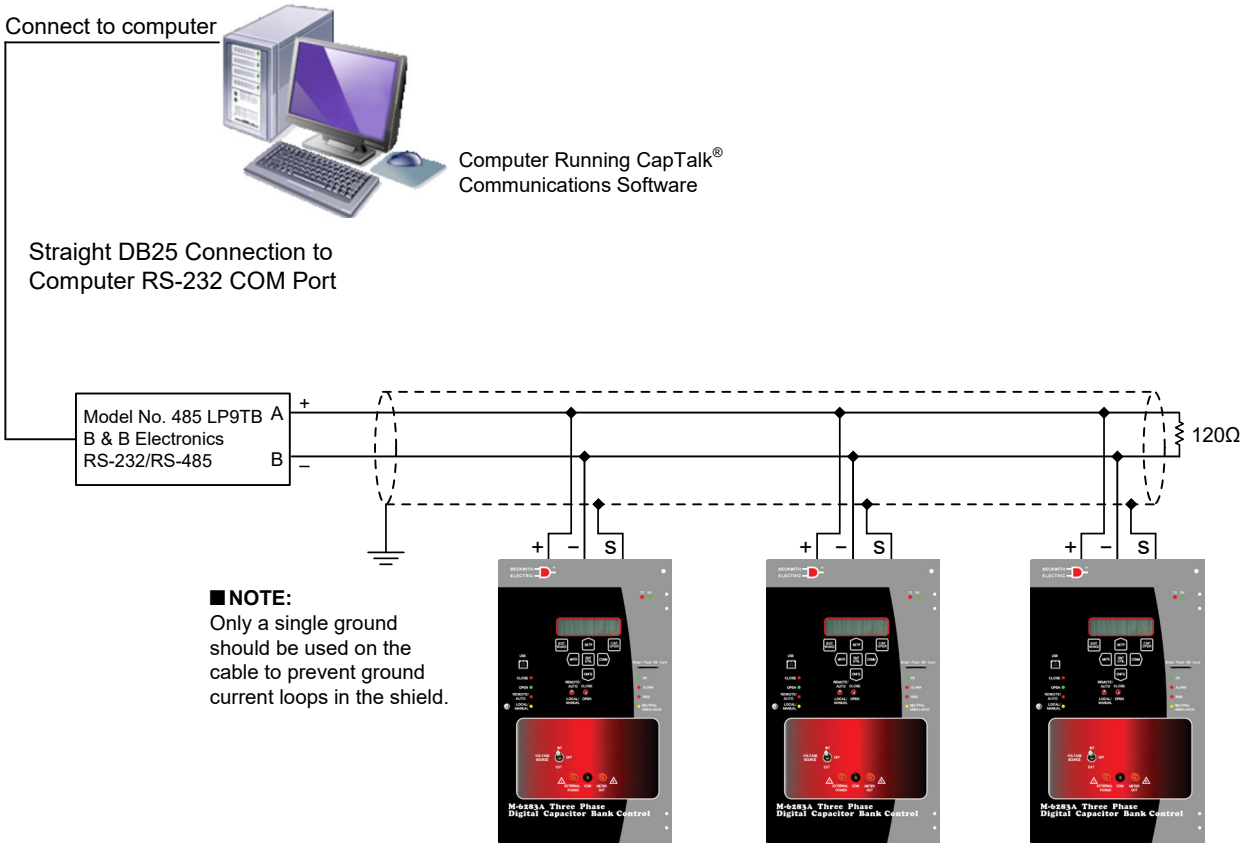


Figure 5 RS-485 Network Connection

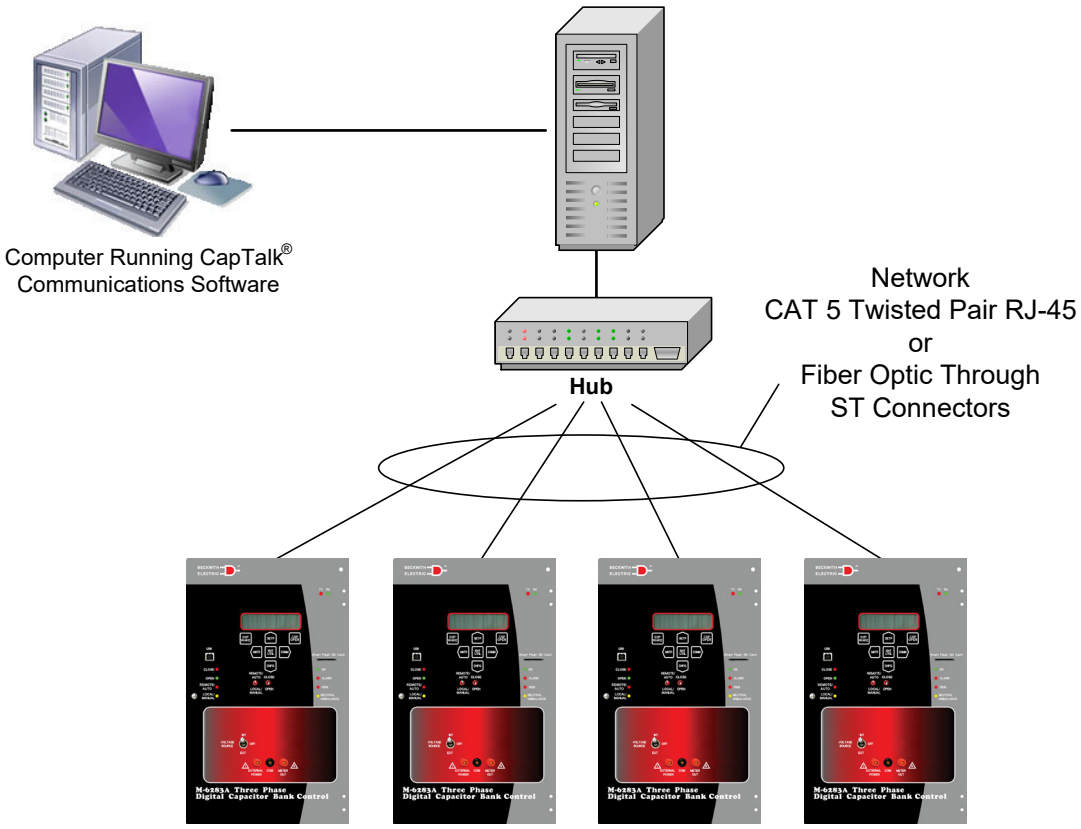


Figure 6 Optional Ethernet Network Connection

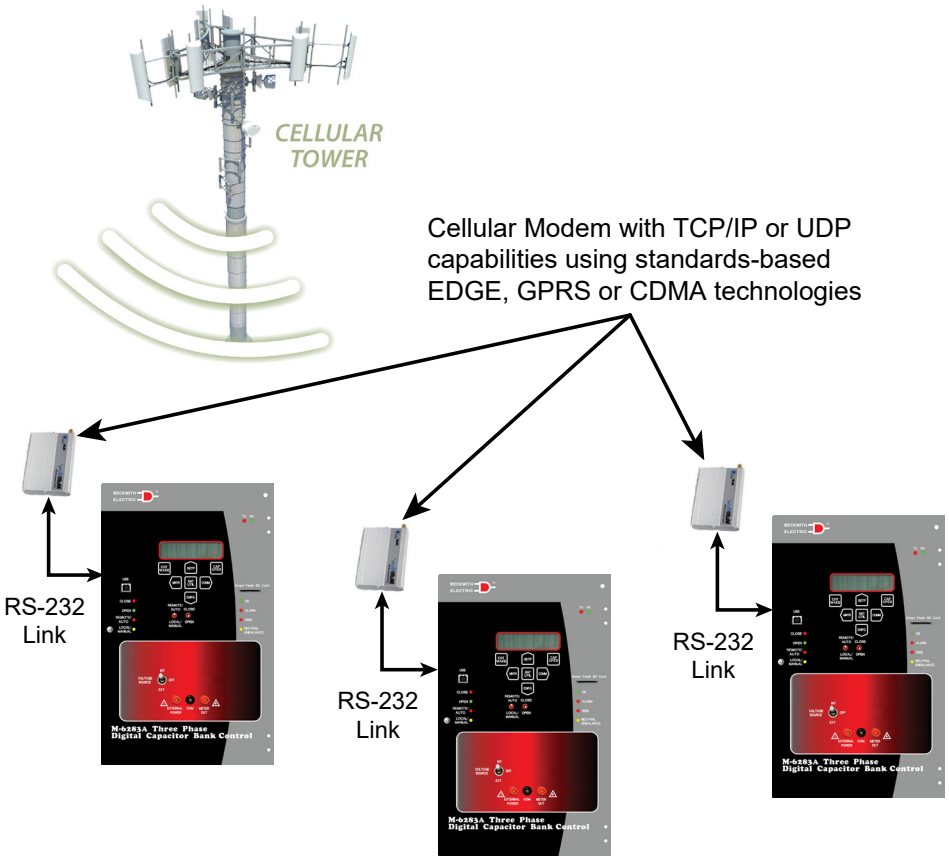


Figure 7 Cellular Modem Network

Environmental

Temperature: Control operates from -50° C to +85° C.

■ **NOTE:** The LCD display's visible temperature range is -20° C to +70° C.

IEC 60068-2-1	Cold, -50° C (-58° F)
IEC 60068-2-2	Dry Heat, +85° C (+185° F)
IEC 60068-2-78	Damp Heat, +40° C @ 95% RH
IEC 60068-2-30	Damp Heat condensation cycles +25° C, +55° C @ 95% RH
IEC 60068-2-38	Damp Heat condensation / frost cycles +25° C, +65° C, -10° C @ 95% RH
IEC 60664-3	Conformal coat grade UV40-250 board protection -50° C (-58° F) to +125° C (+257° F) CAT IV

Tests and Standards

Surge Withstand Capability

IEEE C37.90.1	±2,500 Vpk Oscillatory 1MHz ±4,000 Vpk Fast Transient Burst 5kHz
IEEE C37.90.1-1989	±2,500 Vpk Oscillatory 1MHz ±5,000 Vpk Fast Transient 1MHz
IEC 61000-4-18	±2,500 Vpk Oscillatory 1MHz

Electrostatic Discharge

IEC 61000-4-2	±8kV Contact ±15kV Air
IEEE C37.90.3	±8kV Contact ±15kV Air

Radiated Field Immunity

IEC 61000-4-3 10 V/m 80MHz – 1000MHz

Fast Transient/Burst Immunity

IEC 61000-4-4 ±4,000 Vpk Fast Transient Burst 5kHz

Surge Immunity

IEC 61000-4-5 ±4,000 Vpk 12Ω power / sensing voltage port, 40Ω I/O ports

Conducted Disturbance Immunity

IEC 61000-4-6 10 V_{rms} 150kHz – 80MHz

Power Frequency Magnetic Field Immunity

IEC 61000-4-8 50A/m continuous, 300A/m short duration

Voltage Interruptions Immunity

IEC 61000-4-11 10 cycles maximum hold-up duration

Power Frequency Conducted Immunity DC Bank Switch Status Input Ports

IEC 61000-4-16	100v 50/60Hz differential mode coupling
	150v 50/60Hz differential mode coupling
	300v 50/60Hz common mode coupling

Voltage Withstand

IEC 60255-27	Impulse ±5 kV
	Dielectric 2 kVac
	Insulation >3 GΩ
IEC 60664-1	Category IV

Electromagnetic Emissions

EN 55022 Radiated	30 MHz-2000 MHz Class A Limits
EN 55022 Conducted	150 kHz-30 MHz Class A Limits
	(when used with B-1722 RJ45 Cable Adapter)

Mechanical Environment

IEC 60255-21-1	Vibration Response Class 1	0.5 g
	Vibration Endurance Class 1	1 g
IEC 60255-21-2	Shock Response Class 1	5 g
	Shock Withstand Class 1	15 g
	Bump Endurance Class 1	10 g

Physical

Size: 9.18" wide x 15" high x 3.22" deep (23.32 cm x 38.1 cm x 8.18 cm)

Approximate Weight: 6 lbs, 5 oz (2.92 kg)

Approximate Shipping Weight: 10 lbs, 5 oz (4.56 kg) est.

Disposal and Recycling

Disposal of E-Waste for Beckwith Electric Products

The customer shall be responsible for and bear the cost of ensuring all governmental regulations within their jurisdiction are followed when disposing or recycling electronic equipment removed from a fixed installation.

Equipment may also be shipped back to Beckwith Electric for recycling or disposal. The customer is responsible for the shipping cost, and Beckwith Electric shall cover the recycling cost. Contact Beckwith Electric for an RMA # to return equipment for recycling.

Patent & Warranty

The M-6283A Three Phase Digital Capacitor Bank Control is covered by U.S. Patent No. 10,122,162.

The M-6283A Three Phase Digital Capacitor Bank Control is covered by a ten year warranty from date of shipment.

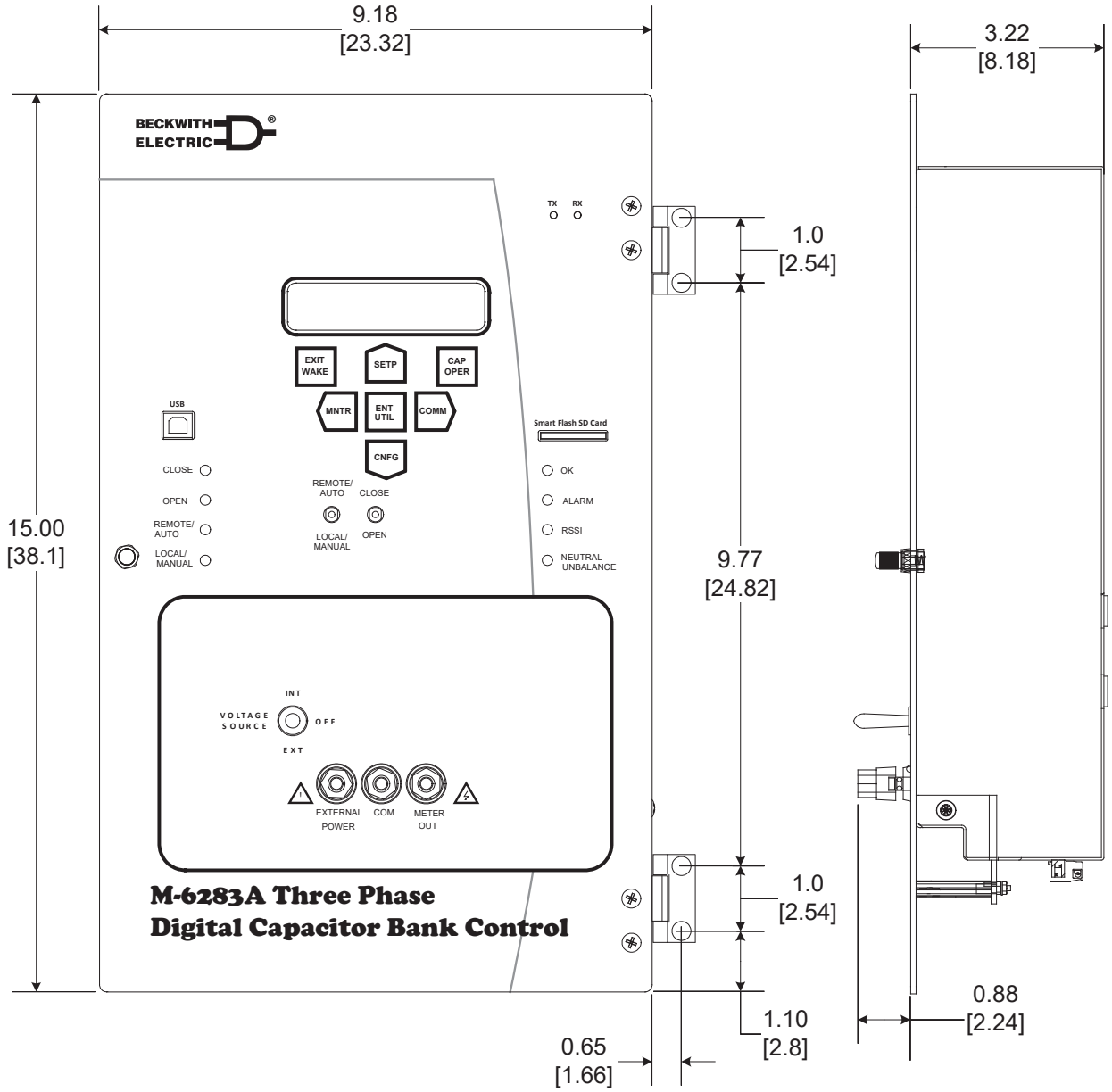


Figure 8 M-6283A Control Outline Dimensions

Hardware Change Notification

M-6283A Controls with Serial Numbers 25000 and higher include a new hardware version. The inclusion of the hardware change can be verified by confirmation that TB4 is on the rear of the control. The Line Post Sensor inputs of the M-6283A were redesigned to minimize variation of the input impedance and reduce noise, thereby improving the accuracy of voltage and current measurements.

Hardware Compatibility

A new 14-pin Cannon Harness (Beckwith Electric Assembly B-1843) has been created for compatibility with the improved hardware. Retrofitting an M-6283A with the improved Line Post Sensor Inputs into existing cabinets will require a field modification of 14-pin Cannon Harness (Beckwith Electric Assembly B-1400). This simple modification requires removal of the terminal lugs that connect to TB1 and TB2, stripping the wires where the terminal lugs were removed, and redressing the harness to connect to TB4.

■ **NOTE:** Previous connections to TB1 and TB2 for phase voltages and phase currents are **not used** with this hardware update.

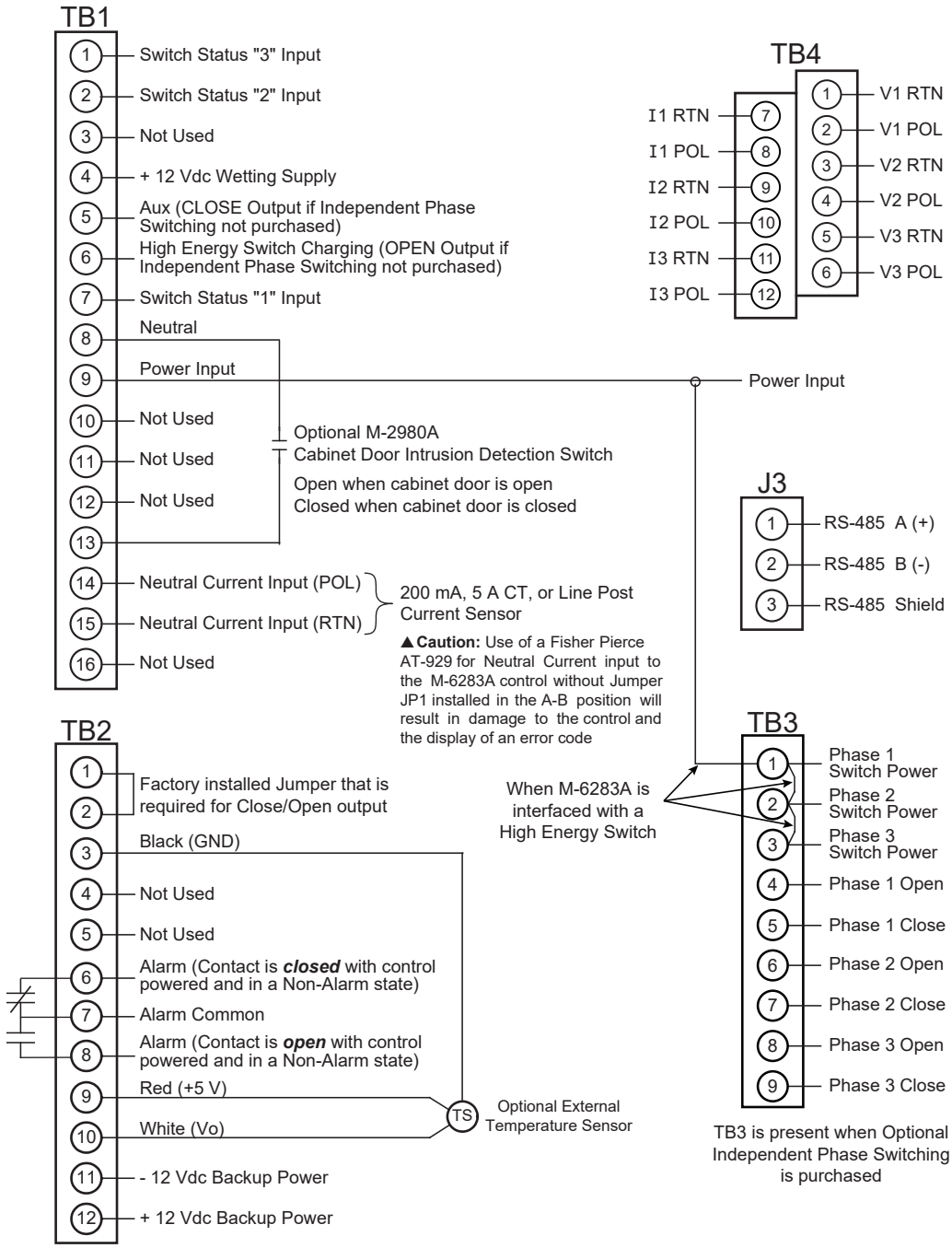
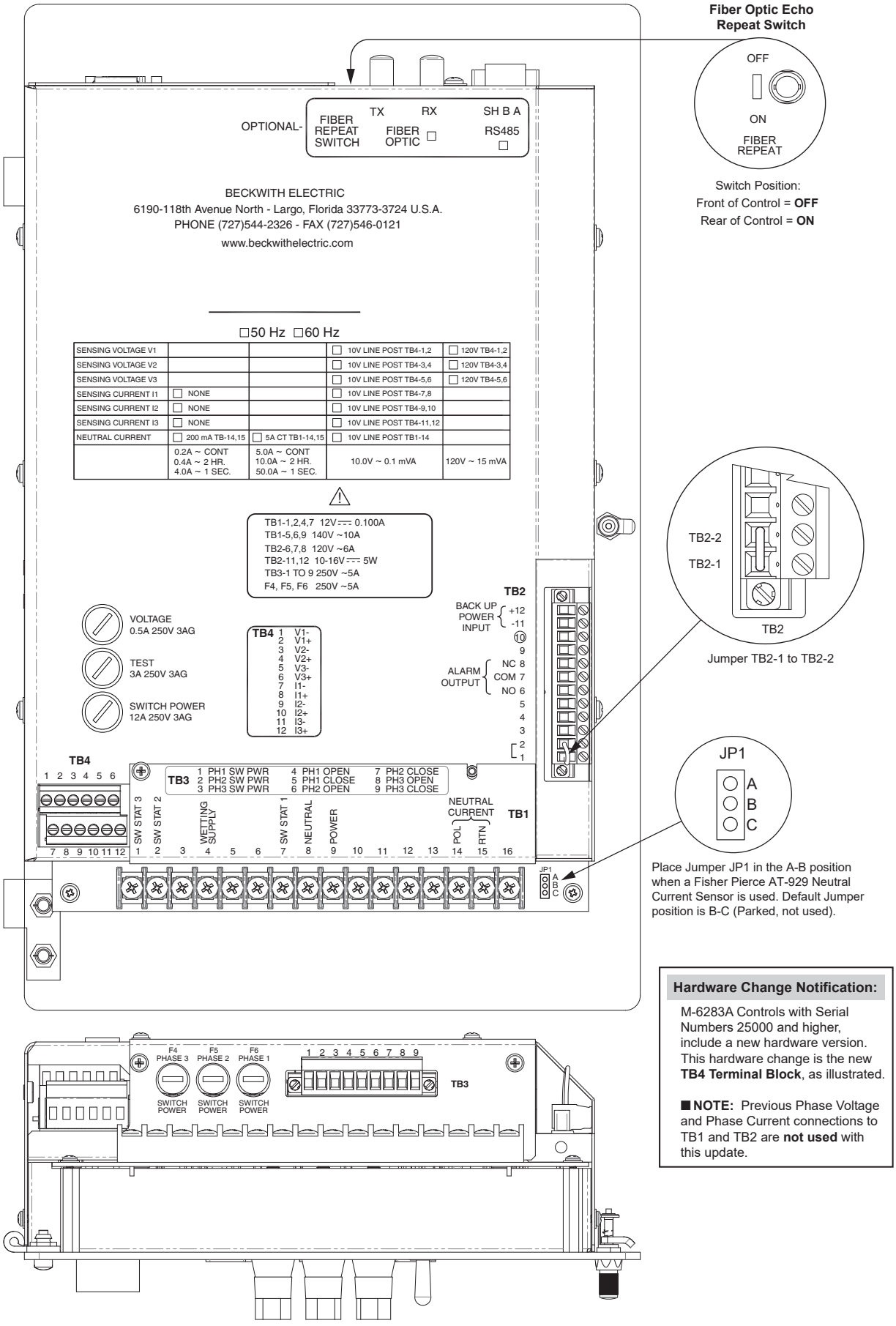


Figure 9 M-6283A Typical External Connections



Hardware Change Notification:

M-6283A Controls with Serial Numbers 25000 and higher, include a new hardware version. This hardware change is the new **TB4 Terminal Block**, as illustrated.

■ **NOTE:** Previous Phase Voltage and Phase Current connections to TB1 and TB2 are **not used** with this update.

Figure 10 M-6283A Rear View with Independent Phase Switching Option

M-2980A Capacitor Control Cabinet

Construction

Molded Lexan®

- Body and door fabricated from molded Lexan
- EXL 9330 Copolymer (.150" nominal thickness)
- UV Inhibitor
- Passed drop test on all eight corners
- Flame Retardant UL 94V-0
- NEMA 3RX water ingress and corrosion protection
- Stronger than standard polycarbonate
- Excellent low temperature impact strength (11 $^{ft. lb.}/_{in.}$ @ -60° F) ASTM D256
- Silicone closed cell gasket
- External adjustable mounting bracket
- Integral door hinges with stainless steel hinge pin
- Enclosure door accommodates optional power supplies, battery and communications devices
- External Grounding stud provided

Cold Rolled Steel/Stainless Steel (304)

- Body and door fabricated from 14/16 gauge steel
- Continuously welded seams ground smooth
- Closed cell neoprene gasket
- External adjustable mounting bracket
- Stainless steel door hinge
- Enclosure accommodates optional power supplies, battery and communications devices
- External Grounding stud provided
- Powder coated, ANSI 70 Grey

Cabinet to Capacitor Bank Interface Type

Direct Pole-Mount with 4 Wire Cable ONLY (no connector)

Integrated Meter Socket Mount (not available for Cold Rolled Steel/Stainless Steel Cabinets) (see Figure 11)

- Integrated 4, 5 or 6 Blade Meter Socket Plug
- Meter Socket Plug wiring is available in Standard 4, 5 and 6 Blade configurations (4S, 5S and 6S) (Table 1)
- Optional custom Meter Socket Plug wiring configurations are available (refer to Table 1)

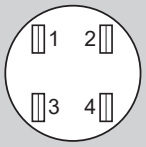
Direct Pole-Mount with cabled Meter Socket Plug (see Figure 12)

- 4, 5, or 6 Blade Meter Socket Plug with standard five foot control cable
- Meter Socket Plug wiring is available in Standard 4, 5 and 6 Blade configurations (4S, 5S and 6S) (Table 1)
- Optional cable lengths available in five foot increments up to 50 feet
- Optional custom Meter Socket Plug wiring configurations are available (Table 1)

M-2980A Capacitor Control Cabinet (Cont.)

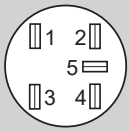
M-6283A Three-Phase Control – Meter Socket Wiring

4 Blade Selection				
Config	1	2	3	4
4S	Line	Neutral	OPEN	CLOSE
41	Line	Neutral	CLOSE	OPEN
42	Neutral	Line	OPEN	CLOSE
43	Neutral	Line	CLOSE	OPEN



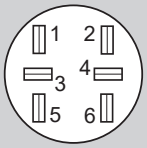
4 Jaw Base

5 Blade Selection					
Config	1	2	3	4	5
5S	Line	Neutral	OPEN	CLOSE	NC POL



5 Jaw Base

6 Blade Selection						
Config	1	2	3	4	5	6
63	Line	Neutral	NC RTN	NC POL	OPEN	CLOSE
67	- - - - - -	Neutral	Line	OPEN	- - - - - -	CLOSE
69	Line	Neutral	- - - - - -	- - - - - -	OPEN	CLOSE



6 Jaw Base

View as shown, is looking into female Meter Socket

▲**CAUTION:** Neutral Current or Phase Current input wires located in the same physical cable as Line-in, Open, and Close wiring may experience induced Neutral Current and/or Phase Current transients during Opening and Closing operations.

Table 1 Meter Socket Wiring Configurations

Direct Pole-Mount with Cannon Connector (Integrated or Cabled)

- 5-Pin Cannon Connector (Table 2)
- 8-Pin Cannon Connector (Table 3)
- 19-Pin Cannon Connector (Table 4)
- Optional cable lengths available in five foot increments up to 50 feet
- Optional custom Cannon 5-Pin, 8-Pin, 19-Pin wiring configurations available (Table 2 through Table 4)

▲**CAUTION:** Neutral Current or Phase Current input wires located in the same physical cable as Line-in, Open, and Close wiring may experience induced Neutral Current and/or Phase Current transients during Opening and Closing operations.

M-2980A Capacitor Control Cabinet (Cont.)

Lexan® Cabinet with Integrated Meter Socket Mount

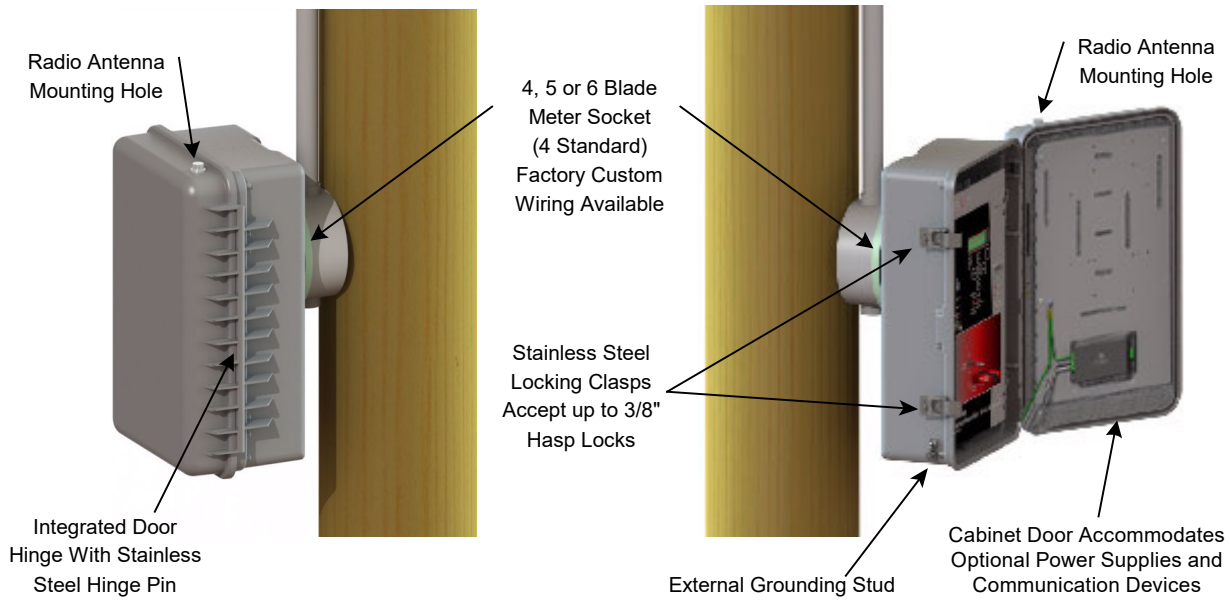


Figure 11 Lexan Cabinet with Integrated Meter Socket Mount

Lexan® Cabinet Direct Pole-Mount with cabled Meter Socket Plug

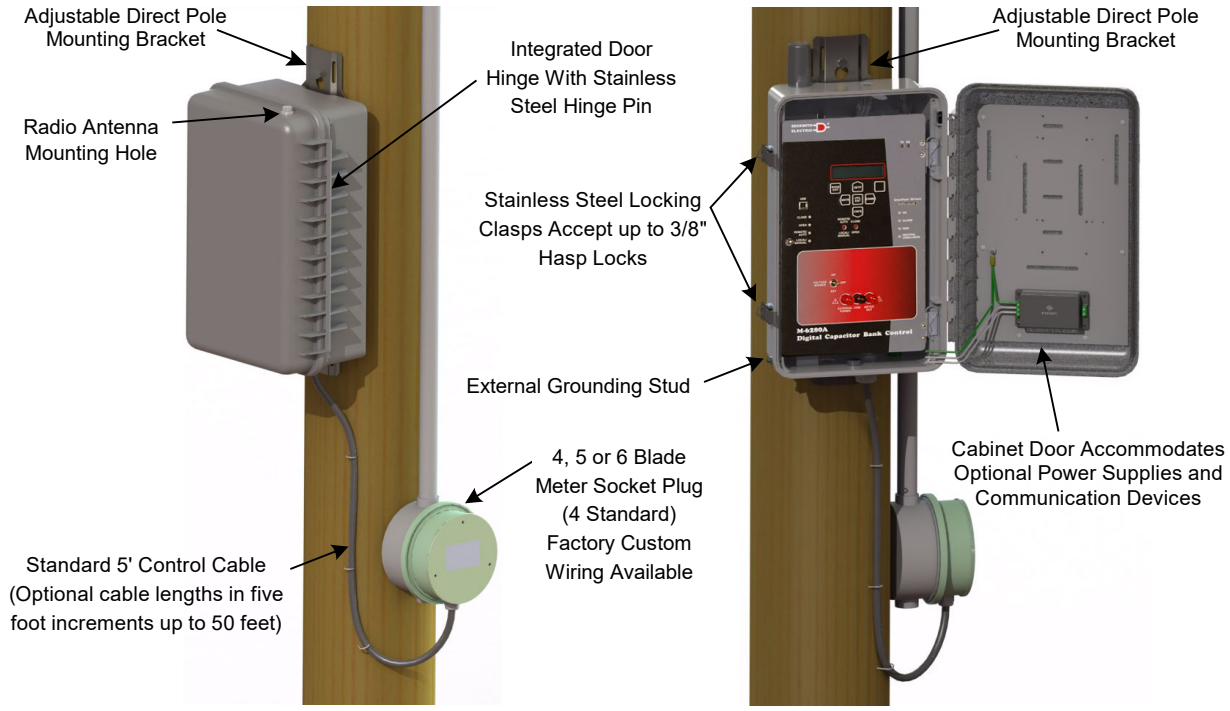


Figure 12 Lexan Pole Mount Cabinet and Meter Socket Plug

M-2980A Capacitor Control Cabinet (Cont.)

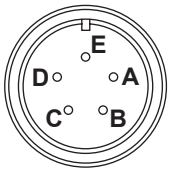
M-6283A – 5-Pin Cannon Configurations						
 5-Pin Plug	PIN					
	Config	A	B	C	D	E
	5E	Line	Neutral	CLOSE	OPEN	- - - - - -
	5N	Line	Neutral	CLOSE	OPEN	Neutral Current Polarity

Table 2 5-Pin Cannon Plug Configurations

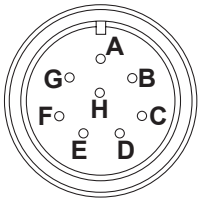
M-6283A 8-Pin Cannon Configurations									
 8-Pin PLUG	PIN								
	Config	A	B	C	D	E	F	G	H
	8A	LINE	NEUTRAL	CLOSE	OPEN	Switch Status 1	Switch Status 2	Switch Status 3	Status RTN
	8C	V1	V2	V3	CLOSE	OPEN	NEUTRAL	- - - - - -	- - - - - -

Table 3 8-Pin Cannon Plug Configurations

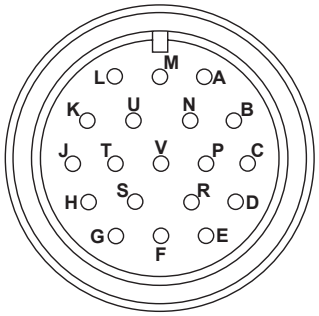
M-6283A 19-Pin Cannon Configurations – Independent Phase Switching						
 19-Pin Plug	PIN					
	Config	A	B	C	D	E
	19 and 9S*	POWER	NEUTRAL	PHASE 1 OPEN	PHASE 1 CLOSE	NEUTRAL
		F	G	H	J	K
		PHASE 2 OPEN	PHASE 2 CLOSE	NEUTRAL	PHASE 3 OPEN	PHASE 3 CLOSE
		L	M	N	P	R
		NEUTRAL	- - - - - -	SW STATUS 1	- - - - - -	SW STATUS 2
		S	T	U	V	
		- - - - - -	SW STATUS 3	WETTING SUP.	- - - - - -	
	***9S**	19-Pin Cannon Connector for 120V Switch Status Contact (Single Pole Switching). **NOTE:** Wetting supply (U) is not connected through the wiring harness.				

Table 4 19-Pin Cannon Plug Configurations

M-2980A Capacitor Control Cabinet (Cont.)

Neutral Current Wiring Option

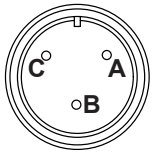
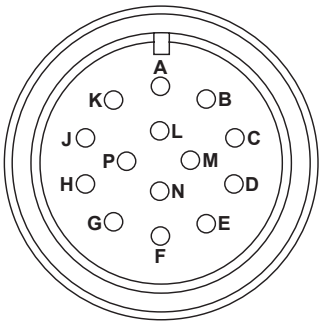
M-6283A 3-Pin Cannon Configuration				
 3-Pin Plug (Cabinet Side)	PIN			
	Config	A	B	C
	Neutral Current 50:0.2 CT	Neutral Current Polarity	Neutral Current Return	Ground

Table 5 3-Pin Cannon Plug Configuration (Neutral Current)

Three-Phase Sensor Input Wiring Option

M-6283A 14-Pin Cannon Configuration – Three-Phase Sensor Interface						
 14-Pin Plug		PIN				
	Config	A	B	C	D	E
	1, 3, L Matches Sensing Voltage Input Selection*	V1 RTN (connected but not used Configs 1, 3)	V2 RTN (connected but not used Config 3)	------ or NC POL (with Neutral Current option)	------ or NC RTN (with Neutral Current option)	------ (Configs 1,3) or V1 POL (Config L)
		F	G	H	J	K
		------ (Config 3) or V2 POL (Configs 1, L)	------ (Config 3) or V3 POL (Configs 1, L)	V1, 2, 3 RTN (connected but not used Config 3)	I1 POL	I1 RTN
		L	M	N	P	
		I2 POL	I2 RTN	I3 POL	I3 RTN	
		***Sensing Voltage Input Selections** **Config 1:** Phase 1 = 120 Vac, Phases 2 & 3 = 0-10 V Line Post Sensor **Config 3:** Phases 1, 2, & 3 = 120 Vac **Config L:** Phases 1, 2 & 3 = 0-10 V Line Post Sensor **NOTE:** Any phase that uses 120 Vac for Voltage Sensing does not run through the 14-Pin Cannon.				

▲**CAUTION:** Neutral Current or Phase Current input wires located in the same physical cable as Line-in, Open, and Close wiring may experience induced Neutral Current and/or Phase Current transients during Opening and Closing operations.

Table 6 14-Pin Cannon Plug Configuration (for Three-Phase Sensor Input)

M-2980A Cabinet – Optional Equipment/Accessories

- Three-Phase Sensor Input Options (see Table 6):
  - 15 kV Lindsey Multicore Voltage and Current Sensor
  - Cannon Converter Cable – connects B-1400-1 to Lindsey sensor
  - 15 kV Lindsey Voltage Sensor
  - Lindsey Connector with cable assembly
  - Current Sensor – 15 kV Lindsey Line Post Sensor
  - Cable for Lindsey Line Post Sensor (20, 30, or 45 foot)

- Neutral Current Sensor Options (see Table 5):
  - 50:0.2 CT Neutral Current Sensor terminated with 3-Pin Cannon connector using customer specified (10, 20, 35, or 45 foot) length of shielded twisted pair cable. Includes Cabinet Side Connections installed.
  - 50:0.2 CT Neutral Current Sensor with customer specified (10, 20, 35, or 45 foot) length of shielded twisted pair cable
  - Cannon Connector, cabinet side 3-Pin

▲ **CAUTION:** Use of a Fisher Pierce AT-929 for Neutral Current input to the M-6283A Control without Jumper JP1 placed in the A-B position will result in damage to the control and the display of an error code.

Radio/Communication Accessories

■ **NOTE:** Consult the Factory for the latest Antenna, Lightning Protection, and Radio options.

- Antennas
- Antenna Cable & Bulkhead Connector (for installation with antennas mounting direct to cabinet)
- Lightning Protection (for installations with external antennas)
- Radio Options including: 2 Way VHF (154 MHz) radio, 2 Way (130 MHz to 7 GHz) radio modems, and Digital Cellular Modems
- Radio ready options including: Universal Radio Bracket, Bracket with 12 or 24 Vdc power supply, and Bracket with customer supplied power supply installed
- Radio Factory Installation for both Beckwith supplied radio, or customer supplied radio
- RS-232 and Ethernet Radio Communication Cables
- Universal Radio/Modem Bracket (for field mounting in the door of the M-2980A Cabinet)
- Power Supply for radio: available in 12 Vdc or 24 Vdc
- Universal Power Cable provides fused 120 Vac to a radio power supply (included on all radio brackets)

Miscellaneous Accessories

- Pole-Mount bracket (Figure 12)
- DB9 to DB25: RS-232 Cable Converter
- External Temperature Sensor
- Intrusion Detection Microswitch: the cabinet door intrusion detection microswitch (Figure 9) status is monitored by the M-6283A and is available in the CapTalk Status screen. If an Open condition is detected, a DNP binary input point for intrusion detection will be set and will generate a DNP event. The intrusion detection will also be monitored using MODBUS register 1725 @ bit 3.
- 1/2" HEYCO Liquid Tight Cordgrip to secure cable coming into cabinet
- 25 foot N male to N male LMR-400 antenna extension cable

Battery Backup Power

This option provides backup power to the control, and radio (if equipped). The Battery Backup system consists of:

- MEAN WELL Power Supply: Model Number PSC-100A-C
- Battery Cell Pack: CYCLON® Battery BC Single Cell Model Number 0850-0108

M-2980A Capacitor Control Cabinet (Cont.)

Physical

Molded Lexan Cabinet

Size: 18.38" high x 12.43" wide x 7.81" deep (46.7 cm x 31.6 cm x 19.84 cm)

Approximate Weight: 10 lbs, 8 oz (4.76 kg)

Approximate Shipping Weight: 12 lbs (5.44 kg)

Approximate Weight with M-6283A Digital Capacitor Bank Control: 18 lbs (8.17 kg)

Approximate Shipping Weight with M-6283A Control: 21 lbs, 8 oz (9.75 kg)

Cold Rolled Steel/Stainless Steel (304) B7B346

Size: 22.6" high x 11.38" wide x 10.09" deep (57.5 cm x 28.91 cm x 27.69 cm)

Approximate Weight: 16 lbs, 8 oz (7.48 kg)

Approximate Shipping Weight: 24 lbs (10.89 kg)

Approximate Weight with M-6283A Digital Capacitor Bank Control: 23 lbs, 8 oz (12.36 kg)

Approximate Shipping Weight with M-6283A Control: 36 lbs (16.33 kg)

■ **NOTE:** Add approximately 7.5 lbs (3.4 kg) when equipped with Battery Backup option.

Warranty

The M-2980A Weatherproof Capacitor Control Cabinet is covered by a ten year warranty from date of shipment. Third party mounted options will carry their respective manufacturer's warranty, passed along through Beckwith Electric.

Trademarks

Specification subject to change without notice. Beckwith Electric has approved only the English version of this document.

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ISO 9001:2015

A proud member of the Hubbell family.

M-6283A-SP Rev-12 12/24

WARNING

DANGEROUS VOLTAGES, capable of causing death or serious injury, are present on the external terminals and inside the equipment. Use extreme caution and follow all safety rules when handling, testing or adjusting the equipment. However, these internal voltage levels are no greater than the voltages applied to the external terminals.

DANGER! HIGH VOLTAGE

– This sign warns that the area is connected to a dangerous high voltage, and you must never touch it.

PERSONNEL SAFETY PRECAUTIONS

The following general rules and other specific warnings throughout the manual must be followed during application, test or repair of this equipment. Failure to do so will violate standards for safety in the design, manufacture, and intended use of the product. Qualified personnel should be the only ones who operate and maintain this equipment. Beckwith Electric assumes no liability for the customer's failure to comply with these requirements.

– This sign means that you should refer to the corresponding section of the operation manual for important information before proceeding.

Always Ground the Equipment

To avoid possible shock hazard, the chassis must be connected to an electrical ground. When servicing equipment in a test area, the Protective Earth Terminal must be attached to a separate ground securely by use of a tool, since it is not grounded by external connectors.

Do NOT operate in an explosive environment

Do not operate this equipment in the presence of flammable or explosive gases or fumes. To do so would risk a possible fire or explosion.

Keep away from live circuits

Operating personnel must not remove the cover or expose the printed circuit board while power is applied. In no case may components be replaced with power applied. In some instances, dangerous voltages may exist even when power is disconnected. To avoid electrical shock, always disconnect power and discharge circuits before working on the unit.

Exercise care during installation, operation, & maintenance procedures

The equipment described in this manual contains voltages high enough to cause serious injury or death. Only qualified personnel should install, operate, test, and maintain this equipment. Be sure that all personnel safety procedures are carefully followed. Exercise due care when operating or servicing alone.

Do not modify equipment

Do not perform any unauthorized modifications on this instrument. Return of the unit to a Beckwith Electric repair facility is preferred. If authorized modifications are to be attempted, be sure to follow replacement procedures carefully to assure that safety features are maintained.

PRODUCT CAUTIONS

Before attempting any test, calibration, or maintenance procedure, personnel must be completely familiar with the particular circuitry of this unit, and have an adequate understanding of field effect devices. If a component is found to be defective, always follow replacement procedures carefully to that assure safety features are maintained. Always replace components with those of equal or better quality as shown in the Parts List of the Instruction Book.

Avoid static charge

This unit contains MOS circuitry, which can be damaged by improper test or rework procedures. Care should be taken to avoid static charge on work surfaces and service personnel.

Use caution when measuring resistances

Any attempt to measure resistances between points on the printed circuit board, unless otherwise noted in the Instruction Book, is likely to cause damage to the unit.

WARNING

This equipment contains a certified transmitter found to comply with FCC Part 15.247 rules regarding frequency hopping spread spectrum intentional radiators. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy, and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Only the antenna provided is authorized for use with the M-6283A. If the antenna is lost or damaged, please contact Beckwith Electric to secure a replacement antenna.

This product generates, uses, and can radiate radio frequency (RF). If it is not installed and used in accordance with the operating instructions, it can cause harmful interference to communications. If this equipment causes harmful interference to radio or television reception, the user should try and correct the interference by:

- Reorienting or relocating the receiving/transmitting antenna
- Increasing the separation between the equipment and the M-6283A
- Connecting the equipment into an outlet on a different circuit from the M-6283A

If these do not correct the interference, consult an experienced radio/television technician for assistance. Correcting such interference is the responsibility of the user, not the manufacturer.

Changes or modifications not expressly approved by Beckwith Electric may void the user's authority to operate the equipment.

FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for uncontrolled equipment. This equipment should be installed and operated with a minimum distance of at least 20 cm between the radiator and person's body (excluding extremities) and must not be located or operated with any other antenna or transmitter.

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TABLE OF CONTENTS

M-6283A Digital Capacitor Bank Control Instruction Book

Chapter 2 Operation (Cont.)

Chapter 3 System Application and Setpoints

Chapter 3 System Application and Setpoints (Cont.)

Chapter 4 CapTalk Remote Setup and Operation

Chapter 5 Installation

Chapter 6 Testing

Appendix A HMI Menus

List of Figures

Chapter 1 Introduction

Chapter 2 Front Panel Operation

Chapter 3 System Application and Setpoints

Chapter 3 System Application and Setpoints (Cont.)

Chapter 4 CapTalk Remote Setup and Operation

Chapter 4 CapTalk Remote Setup and Operation (Cont.)

Chapter 5 Installation

Chapter 6 Testing

Appendix A HMI Menus

Appendix B DNP Configuration Editor

Appendix D Cyber Security

Chapter D Cyber Security (Cont.)

Appendix E Legacy Hardware Connections

List of Tables

Chapter 2 Front Panel Operation

Chapter 3 System Application and Setpoints

Chapter 4 CapTalk Remote Setup and Operation

Chapter 5 Installation

Appendix D Cyber Security

1 Introduction

1.1 Instruction Book Contents

Chapter 1: Introduction

Chapter One introduces the instruction book contents, provides an overview of M-6283A Three Phase Capacitor Bank Control and describes the available accessories and options.

Chapter 2: Front Panel Operation

Chapter Two provides an overview of the control Front Panel, including the typical LCD display startup and message screens. The Front Panel user interface operation pushbuttons, LED status indicators and HMI menu structure navigation are described for manual operation of the M-6283A.

Chapter 3: System Application and Setpoints

Chapter Three defines the system quantities and equipment characteristics required in the M-6283A control application environment. It describes the procedures for entering all required data into the M-6283A for setup and configuration of the system, including Cap Bank Settings and Setpoints.

Chapter 4: CapTalk Remote Setup and Operation

Chapter Four provides the necessary information to setup Remote Communications. This Chapter also provides an overview of the powerful features included in CapTalk S-6283 Communications Software. The CapTalk menu structure and commands are illustrated for each feature and function.

Chapter 5: Installation

Chapter Five includes all mechanical information required for physical installation, equipment ratings, and all external connections for the M-6283A.

Chapter 6: Testing

Chapter Six provides step-by-step test procedures for LEDs, Inputs, Front Panel pushbuttons, SCADA mode, and Re-Close Delay Override.

Appendix A: Human Machine Interface (HMI)

This Appendix provides a graphical representation of the Human Machine Interface (HMI) menu structure.

Appendix B: DNP Configuration Editor

This Appendix includes the DNP Configuration Editor features and functions.

Appendix C: Self-Test Error Codes

This Appendix lists all error codes and their definitions.

Appendix D: Cyber Security

This Appendix includes comprehensive setup procedures to implement a NERC/CIP compliant security system.

Appendix E: Legacy Hardware Connections

Refer to the Tables and Diagrams in this Appendix for hardware connections that are applicable to M-6283A Controls with Serial Numbers prior to 25000.

Appendix E: Index

This Appendix includes the Index for the Instruction Book.

Configuration Record Form

An PDF **Configuration Record Form** is available for download from our website BeckwithElectric.com. This document may be used to record and save all configuration, setpoint and communication settings. Also included are the default values for each setting, where applicable.

1.2 General Overview of M-6283A Capacitor Bank Control

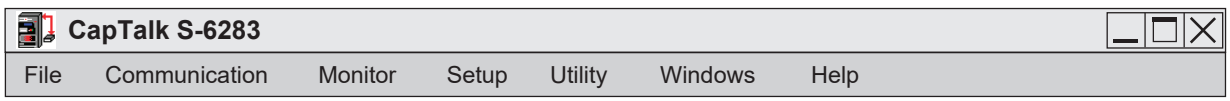
The M-6283A Three Phase Capacitor Bank Control is a microprocessor-based capacitor bank control for local and/or remote capacitor automation. Figure 1-1 provides an overview of the functional elements of the control. The M-6283A Capacitor Control and wireless communications module is housed in a NEMA 3RX UV-resistant Lexan enclosure (Figure 1-2).

The M-6283A offers the following main categories for System Setup and Monitoring directly through the unit front panel HMI, or remotely through CapTalk Communications Software.

- **Communication –** Communication Port and Protocol setup, Ethernet setup and security, LCD Contrast (HMI), and Memory Card features (HMI)
- **Monitor –** Comprehensive Primary and Secondary Metering, Status information, Alarms, Counters, Harmonics, and CBEMA Events
- **Configuration –** Nameplate, Cap Bank Settings, VT/ CT Setup, Delays, Data Logging, Harmonics, Phase Overcurrent, and System Clock
- **Setpoints –** Control Operation Mode, Setpoint Profiles, and Limits
- **Utilities –** Unit Information and Calibration, Cybersecurity Management (CapTalk)

HMI Menus:

CapTalk Menus:



Interrogation of the control and setting changes are made using either the front panel Human Machine Interface (HMI), or through the communications ports utilizing CapTalk S-6283 Communications Software. The HMI consists of a 20-character by 2-line backlit LCD display and seven pushbuttons. All setpoints are stored in nonvolatile memory which is unaffected by control voltage disturbances.

Ten LEDs are used to indicate Capacitor Bank Control **CLOSE** and **OPEN** command status, **REMOTE/ AUTO, LOCAL/MANUAL,** CPU **OK, ALARM, RSSI** Signal Strength, **NEUTRAL UNBALANCE** status and communications Transmit **(TX)** and Receive **(RX)**.

The alphanumeric display and seven pushbutton interface provides complete front panel access to the scrolling menu program shown in Appendix A.

Control Operation Modes

The control has three modes of operation: **Automatic**, **Remote**, and **Local**. Operations are prioritized in the following manner: in Local/Manual mode, Remote commands are blocked and Automatic mode is disabled; in Remote/Manual mode, Automatic mode is disabled. Time and Temperature Overrides are functions in Automatic Control Mode, which override Voltage, Current and VAr modes.

The control is configured at the factory to initially power up in Automatic Operation mode. The only change between operating modes the control can self-initiate, is based on the presence of a "SCADA HeartBeat" signal, that may be used to shift between Automatic Operation and Remote Operation.

The control can be placed in Automatic, Remote, or Local Mode by operator control. Once placed in any of these modes, the control will remain in the selected mode until reset to another mode, except as stated above. The control will not change the operation mode as a result of a power outage, with the exception of Remote Mode. In this case, a power outage will result in the control initiating in Automatic Mode and remaining in Auto Mode until communications are resumed.

■**NOTE:** Open or close operations in Automatic mode will be blocked if the sensing voltage is less than 85 V. This block was designed to prevent capacitor switches from operating when voltage is low on the system. As of firmware version 05.09.01, this block does not apply to Manual or Remote open or close operations.

Optional Independent Phase Switching

This feature allows the user to independently operate each phase of a Capacitor Bank switch based on the chosen Control Mode of Operation. The chosen operational mode's settings are not duplicated for each phase but instead use one group of settings that are used by all three phases to make Independent Phase Switching decisions. Each phase includes a dedicated set of Close and Open contacts.

1.3 Accessories

CapTalk S-6283 Communications Software

CapTalk is a Windows based communications software program available for remote control and monitoring of the M-6283A Capacitor Bank Control. It is designed to interface with the microprocessor of the control through the standard USB Port (MODBUS) and all installed communication ports. The CapTalk software displays all pertinent operating information. All operations that can be performed from the front panel user interface of the control can be duplicated remotely, through CapTalk.

Data Logging – The control can internally store various parameters at selected intervals. CapTalk can retrieve the data and display the file in the included CapPlot Analysis Software. The datalog file may also be converted to a (*.csv) spreadsheet file in the CapTalk/Utility submenu. This utility will also convert any Datalog file downloaded onto a Smart Flash SD Card into a (*.csv) spreadsheet readable format. Alternatively, the PC can be programmed to poll the control and obtain a pre-selected list of parameters at selected intervals.

Remote Control – The Remote Control feature allows the user to remotely Open or Close the capacitor bank switch.

Optional Communication Ports

The M-6283A Three Phase Capacitor Bank Control can be ordered with either RS-485 or RS-232 standard on COM1. Additional COM1 options include any combination of RS-232, RS-485, and either ST or V-pin Serial Fiber Optic connections. COM1 is located on the top rear of the unit. COM1 utilizes either the DNP3.0 or MODBUS protocols. The unit supports up to three physical ports on COM1 but only one may be selected to be operational.

The M-6283A can also be equipped with an optional COM2 with either RS-232 or Bluetooth capability. COM2 is located on the top rear of the unit. COM2 utilizes the DNP3.0 and MODBUS protocols.

The M-6283A can also be equipped with an optional Ethernet Port through a RJ-45 Jack (10/100 Base-T) or Fiber Optic through ST connectors (100 Base-FX). These ports support DNP over TCP/IP and MODBUS over TCP/IP.

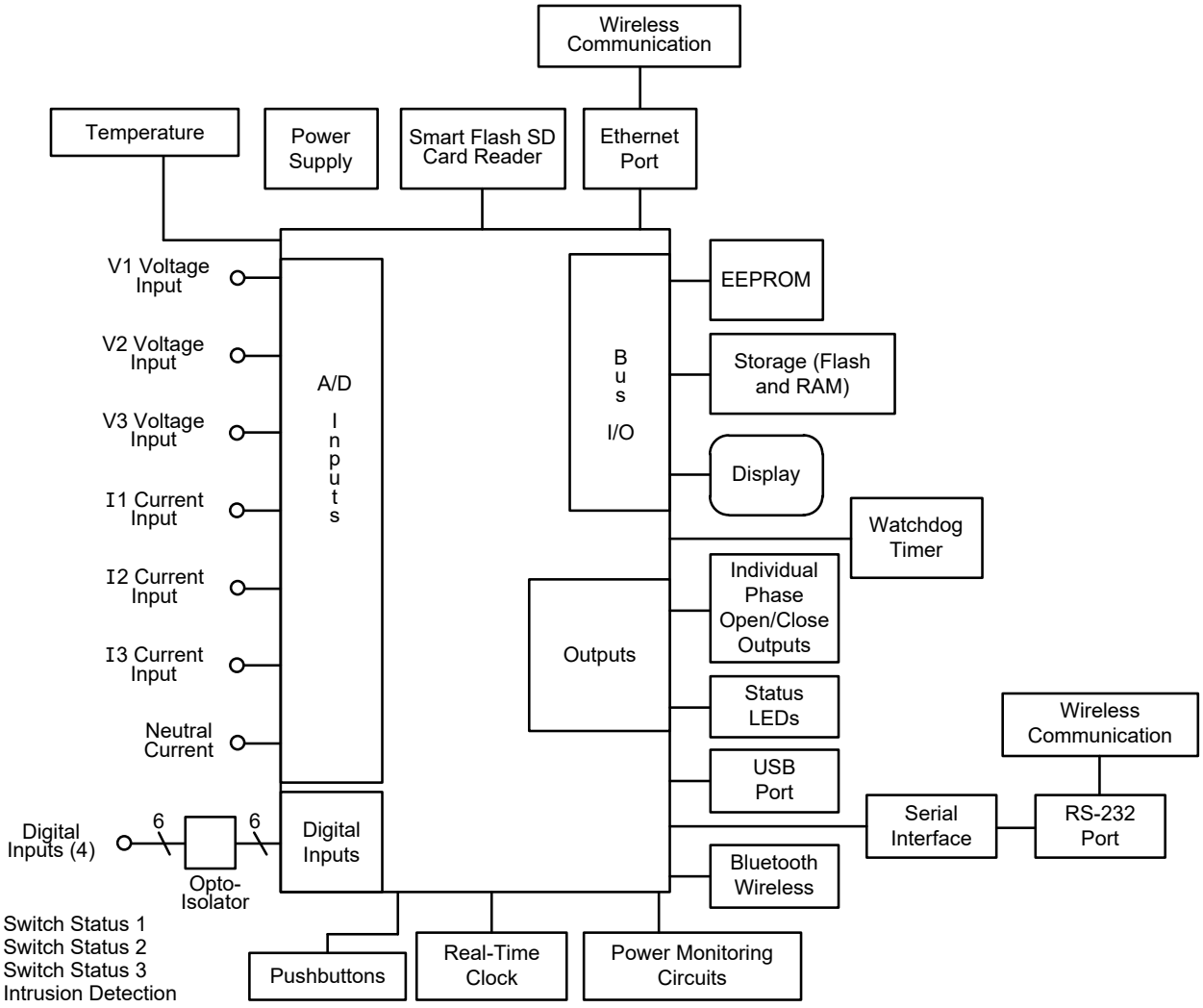


Figure 1-1 Functional Diagram

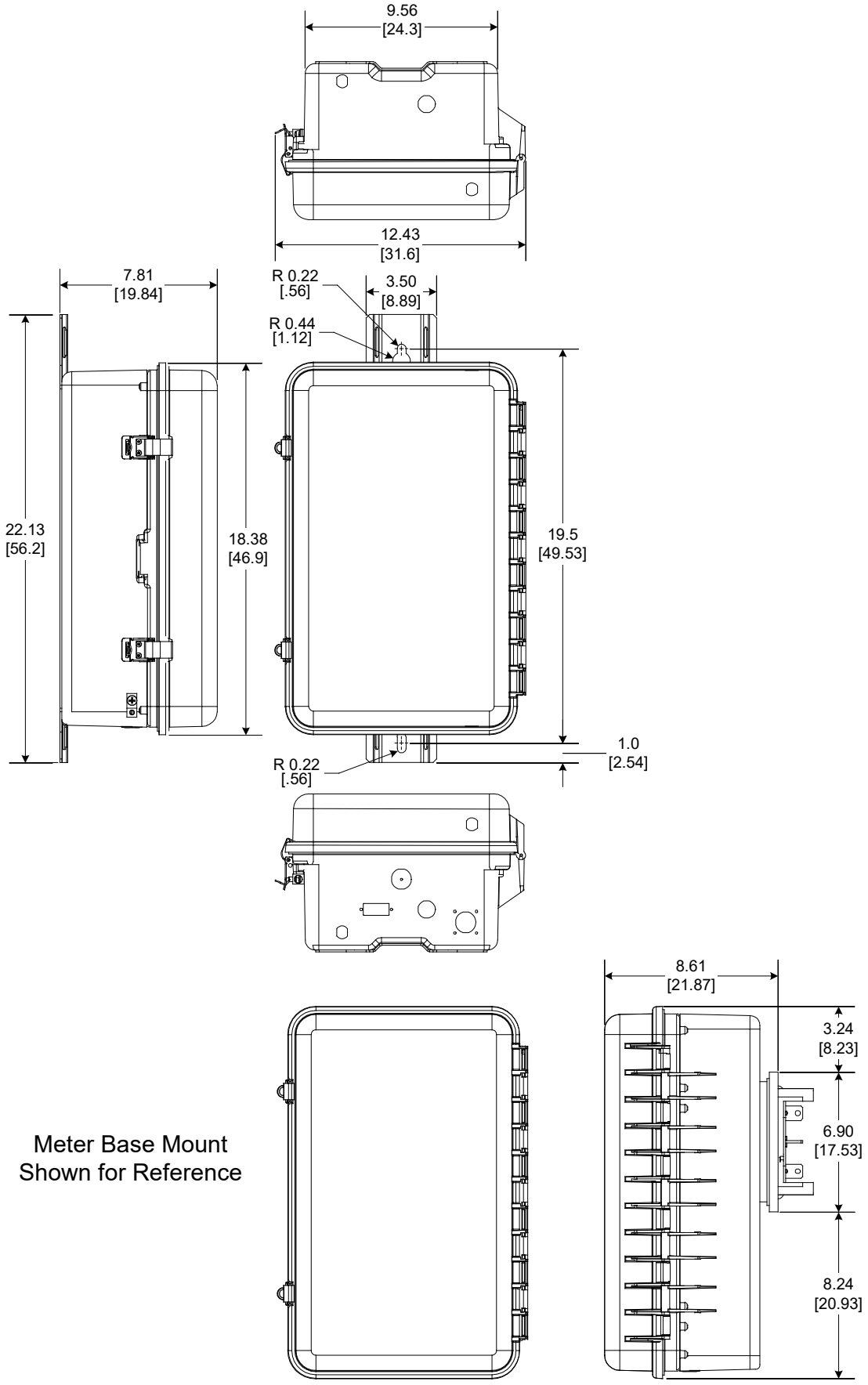


Figure 1-2 M-2980A Lexan Cabinet Outline Dimensions

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2 Front Panel Operation

2.1 Overview

Chapter 2 describes the Front Panel and HMI display screen of the M-6283A, and includes the following:

- The typical startup and message screens displayed by the control.
- Toggle switch operations used for manual control of the regulator.
- Binding posts for external power supply and voltage metering (see Shock Hazard Warning).
- The Front Panel user interface and status indicator LEDs.
- The extensive Status and Metering values available in the Front Panel **MONITOR** Menu.
- The powerful advantages of the Smart Flash SD Card Slot.

2.2 HMI Startup Screens

DISPLAY

A two row by 20 character Liquid Crystal Display (LCD) with configurable contrast is provided on the M-6283A Digital Voltage Regulator Control front panel. The HMI screen normally displays user lines until any navigation pushbutton is depressed or a control cycling message is displayed.

Power Up Screens

Each time the control is powered up, it will briefly display a series of screens that include:

- User Lines
- Control Firmware Number
- Serial Number
- Date and Time

LCD Screen Contrast

■**NOTE:** Level 2 User Access is required to make this adjustment.

The visibility of the LCD screen depends on the LCD Contrast setting, and the ambient temperature of the unit. If the LCD screen is not readable, press the ⬅ and ➡ arrow pushbuttons at the same time, to display the LCD Contrast screen. The screen will slowly cycle through the contrast settings from dim to bright. When the display contrast is at the desired level, press the **ENT** pushbutton **twice** to save that setting. Press **EXIT** to continue.

If pressing the ⬅ and ➡ arrow pushbuttons at the same time *does not* display the LCD Contrast screen, cycle power to the unit and wait at least 90 seconds to ensure the unit completes the boot up sequence. This will ensure the User Lines are being displayed, and pressing the ⬅ and ➡ arrow pushbuttons at the same time, will display the LCD Contrast screen.

HMI MESSAGE SCREENS

Default Message Screen

The HMI screen displays the user message lines after 15 minutes of unattended operation or after exiting Header level menus.

Wake Up Message Screens

When the **EXIT/Wake** pushbutton is selected, the display will initiate a cycling display of any parameters selected using the CapTalk Wake Up Screens feature, as described in Chapter 4. The Wake screen cycles at a 3 second interval between parameters. The display can also be directed to a specific parameter by utilizing the ⬆ or ⬇ pushbuttons. Pressing the **EXIT** pushbutton returns to the User Lines screen.

When the **EXIT/WAKE** pushbutton is selected, the control will respond as follows:

- Pressing **EXIT/WAKE** when the User Lines are displayed will initiate a cycling display of the selected Wake Up parameters for a period of 15 minutes, then return to the User Lines display.
- If no Wake Up screens have been selected, the User Lines will flash for a moment.
- Press **ENT** to stop the wake screen cycling, and use the ⬆ or ⬇ pushbuttons to view the individual Wake Up parameters.
- When a Smart Flash SD Card is present during the Wake Up screen cycling, an additional screen will be displayed. This selection allows the user to save the Wake Up screen data to the SD Card in (.csv) format.

```
Save Wake Data to SD
Press ENT to begin
```

Oscillograph Record Triggered Message Screen

When the "ENABLE OSC Message" feature is enabled (default setting is Enabled) and the Oscillograph has been triggered, the HMI will cycle the "Oscillograph Record Triggered" message to indicate that there is an oscillograph record available for download. The screen will be displayed until the oscillograph record is cleared or the "ENABLE OSC Message" is disabled. If the Oscillograph record is not cleared, re-enabling this feature will restart the cycling message.

Re-Close Delay Complete Screen

If the Re-Close Delay is active, the display will cycle the "Re-Close Delay Complete" Screen that will indicate in seconds the delay that is complete. When the Re-Close Delay has timed out, the display will return to the User Lines.

Alarm and Condition Alert Message Screens

The following Alarms and Conditions will initiate a cycling display as long as the alarm/condition is active.

- Resettable Counter Alarm Limit
- Setpoint Mismatch Auto Control Mode
- Setpoint Mismatch Remote Control Mode
- Setpoint Mismatch Bank Failed L1/L2
- Setpoint Mismatch Control Mode Limits
- Maximum/Minimum Voltage Limit Alarm
- Remote Overvoltage/ Undervoltage Limit
- Bank/Switch Failed Level 1/2
- Resettable Counter Limit
- Daily Operation Counter Limit
- Remote-Manual Operation Alarm
- Voltage/Current Harmonics Alarm
- Voltage/Current THD Lockout in Effect
- Invalid Switch Type or Pulse Time
- Setpoint Mismatch Cntrl Var Limits
- Setpoint Mismatch Cntrl Current Limits
- Delta Voltage Alarm
- SCADA Test Mode Outputs are Disabled
- NC Lockout/Block in Effect
- Neutral Magnitude Unbalance
- Neutral Phase Unbalance

2.3 Front Panel Controls and Indicators Overview

The front panel user interface consists of the HMI LCD, toggle switches, binding posts, pushbuttons, and LED status indicators.

BINDING POSTS

Located below the manual toggle switches are binding posts that are used for supplying external power to the control and for metering internal power.

WARNING: Operating personnel must not connect uninsulated test connections to the binding post as they can create a shock hazard.

EXTERNAL POWER binding posts allow application of a 120 V RMS nominal voltage to the unit for test procedures. The expected power consumption of the control (burden) is a maximum of 8 VA at 140 Vac input.

WARNING: A shock hazard exists due to the presence of voltage on the Meter Out Binding Posts.

METER OUT binding posts allow reading of the input voltage with insulated test equipment.

CONTROL TOGGLE SWITCHES

REMOTE/AUTO, LOCAL MANUAL Switch

The REMOTE/AUTO, LOCAL MANUAL switch selects the desired mode of operation from the control front panel. When selected to "LOCAL MANUAL" no automatic operation is permitted and the O/C (Open/ Close) switch is functional. In the "REMOTE/AUTO" mode the control considers all settings and operates the capacitor bank as required.

OPEN/CLOSE Switch

The OPEN/CLOSE switch allows Manual Local control of the capacitor bank subject to the Timed Function settings.

VOLTAGE SOURCE

▲CAUTION: Do not reverse the ground and hot wires when connecting an external source. A U_L® recognized replaceable fuse, 3 A, 250 Vac, 3 AG fuse is installed to protect the control from damage if these connections are accidentally reversed.

The Voltage Source switch position determines what input (or none) is used to provide to the control and energize the Capacitor Bank Switches.

- The **INT** position allows voltage applied to the terminal block on the rear of the unit to power the control and Capacitor Bank Switches. This is the nominal position of the switch
- The **EXT** position allows voltage applied to the front panel binding posts labeled "External Power" and "GND" to power the control and energize the Capacitor Bank Switches when needed. This position is used for testing purposes only and is typically used for control bench testing.
- The **OFF** position removes all sources of AC power to the control. This position is used by some utilities as an extra method of ensuring that the control cannot operate the Capacitor Bank Switches during maintenance, switching etc.

As long as the control is powered via the Backup DC input, none of the three positions of this switch have any affect on communications to a control or to any other device in the same communications loop. If backup power is not supplied to the control, then placing the switch in **EXT** without a source applied to the front panel meter jacks, or in **OFF** will result in the control being de-energized. While de-energized, the control will not respond to any communications via fiber. If a serial fiber loop is used to connect multiple devices to one communication port, any other device in the serial loop will not be able to communicate.

With the Voltage Source switch in **EXT** with no AC input voltage applied or in **OFF**, Primary and Secondary parameters that use secondary voltage as a component will not read correctly as there is no AC sensing voltage applied. This includes Load Voltage, Source Voltage, Meter Out Voltage, Normalizing Voltage, Primary Voltage, Primary Watts, Primary VAr's, etc.

DEFAULT LEVEL ACCESS CODE SECURITY

Level Access Code Cyber Security is the default security method and is implemented as described below. Access Codes are invalid when User Name/Password Cyber Security is enabled.

To prevent unauthorized access to the control functions, there are provisions in the software for assigning up to 30 unique Access Codes. These Access codes can be assigned to have Level 1 or Level 2 access to the control as defined below. The Access Codes are programmed into the control by creating a Multi-Level Access Code file in CapTalk and uploading it to a control. The control will record a date and time stamp each time any of the 30 passwords or Level 1 or 2 passwords are used to access the control and when that access expires or is changed. This log can be retrieved from the control using CapTalk. The Access Codes can be set in the Communication/HMI Menu or from CapTalk.

Level Access protection will be automatically reinstated when either of the following conditions are met:

- No HMI menu activity for a period of 15 minutes
- The user exits to the top of the HMI menu for a period of greater than 10 seconds

Access Levels

General access to read setpoints and monitor status does not require an Access Code.

The **Level 1** Access Code, if set, is required to make setpoint changes. If the Level 1 Access Code is set to all zeros, this request for an Access Code will not be seen and changes can be made without an Access Code. The default Level 1 Access Code, when enabled, is 111111.

The **Level 2** Access Code, if set, is required to make changes to the configuration, communication, and utilities. If the Level 2 Access Code is set to all zeros, this request for an Access Code will not be seen and changes can be made without an Access Code. The default Level 2 Access Code is 222222.

The **Level 3** user Access Code is fixed and can not be changed. The Level 3 Access Code is required to change Calibration parameters. Contact Beckwith Electric Customer Service for Level 3 Access Code. When IEEE 1686 User Name/Password Security is enabled, "Change Configuration" permission is required to change Calibration parameters. Units are fully calibrated at the factory and no additional adjustment is needed in the field. Access to change Calibration parameters is provided in case the calibration needs to be restored to factory settings.

There is a Factory Mode which may be accessed by qualified Beckwith Manufacturing personnel ONLY. This access is authenticated. The following functions are available in Factory Mode: Initialization of the control to Factory defaults, Auto-Calibration, enabling of Factory options, Flash Memory clean-up.

■**NOTE:** Please record all user access codes in a secure location. If the user access code is lost or forgotten, please contact the factory.

Smart Flash SD Card User Access Key Code

A user Access Code Level 1 or 2 can be written to a Smart Flash SD Card. The user Access Code will be read by the control when the SD Card is inserted into the slot on the front of the control. As long as the SD Card is inserted, the control will not prompt for the Level Access Code.

HMI Level Access Prompt

When Level Access is enabled, settings which require a Level Access Code, will display a Level Access prompt. Enter a valid Level Access Code as described below:

1. When prompted, press the **ENT** pushbutton to enter the "Change" mode.
2. If Level Access is active, the applicable Level Access prompt will be displayed.

```
ENTER LEVEL 1 (2,3) ACCESS
_
```

3. Enter a valid Level Access Code, then press the **ENT** pushbutton. If a valid Level Access Code was entered, the display will briefly flash a confirmation screen and then display the applicable change mode screen. If the control briefly displays an "Access Denied" screen, re-enter a valid code.

IEEE 1686 NERC/CIP COMPLIANT CYBER SECURITY

To provide NERC/CIP compliance, the M-6283A offers enhanced Cyber Security utilizing User Name/ Password authorization. When this cyber security is enabled, access to the control is restricted to authorized users. Access to specific HMI menus is determined by the User Permissions assigned by the Security Administrator. Refer to Table 2-1.

Compliance with 2020 California Password Law

As of July 1st, 2020 all Beckwith Electric IED's with network communication capabilities, shipping to the state of California, will comply with California Password Law (SB-327). M-6283A controls will ship with the enhanced IEEE 1686 Standard Cyber Security feature **Enabled** and with a single pre-loaded default administrator account and password. Under this law, default passwords are not permitted to be used. The first time the control is accessed using the default pre-loaded administrator account, the control will prompt the administrator to change the default password. The control will not allow any setting changes until the default password is changed.

■**NOTE:** Refer to **Appendix D, Cyber Security** for detailed information.

Permission	Access Permitted
View Data	The user is able to view metering data (Monitor). See "View Data Permission".*
View Setpoints	The user can only view setpoints. See "View Setpoints Permission".*
Change Setpoints	The user must have this permission in order to change any setpoints. See "Change Setpoints Permission".*
Read Files	The user is able to download Oscillograph, Sequence of Events, and Data Log files from the device using either CapTalk or an SD card. Using an SD card, the user can also Save Setpoints and Save Metering Data. See "Read Files Permission".*
View Configuration	The user can only view the Configuration of the Control and Read configuration files such as DNP configuration and IPsec configuration. See "View Configuration Permission".*
Change Configuration	The user has the ability to alter the configuration values of the Control (Force Values). This permission also allows a user to write files (DNP and IPsec configuration) to the control. See "Change Configuration Permission".*
Firmware Upgrade	The user has the ability to upgrade the firmware version of the control. This applies solely to the firmware file.
Manage Users	This user is allowed to administer the list of allowed users. This user is allowed to create any user with any combination of permissions. In addition, this user is allowed to delete an existing User ID/Password combination by using the CapTalk Manage Users tool. This user is not allowed to view any User ID/Password once it is created. If the user changes his or her password, the administrator does not have the permission to view the password. The only way to retrieve a user's password is to create a new User ID/Password pair.
View Audit Log	This user is able to view the Audit Log.
Remote Control	This user is permitted to send remote commands to the control. For example, Open or Close the Capacitor Bank, and Block Auto Control via Communication.
Change Date and Time	The User must have this permission set in order to be able to change the Date and Time of the control.

Table 2-1 Permissions Implemented for IEEE 1686 Standard

■**NOTE:** *Refer to the permission details in **Appendix D** Cyber Security.

NAVIGATION PUSHBUTTONS

The Navigation pushbuttons provide access to the HMI menu selections and submenus. The pushbuttons also allow the user to enter and change settings. The pushbuttons are used to enter new values by incrementing or decrementing the displayed value. The new value is not stored until the **ENT** pushbutton is pressed a second time.

The navigation pushbuttons also provide direct access "Hot Buttons" to HMI menu headers. Pressing the pushbutton will display the heading corresponding to the "Hot Button" label contained in the pushbutton.

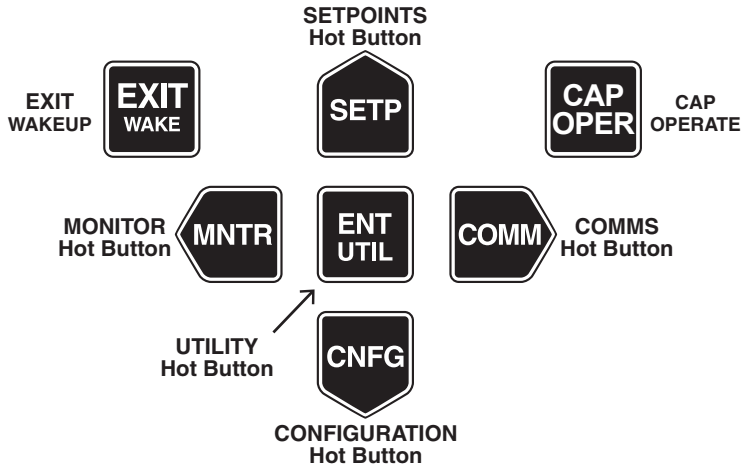


Figure 2-1 Pushbuttons With Hot Button Functions

The "Hot Buttons" directly access the main menu headers and can only be selected from either the user lines or the cycling display. While the **EXIT** pushbutton is not a Hot Button, it provides the means to navigate back to upper level menus and also "Wakes" the control.

CAP OPERATE Pushbutton

The CAP OPERATE pushbutton provides hot button access to the Independent Phase Switching menu when the Optional Individual Phase Switching Mode is active.

LED STATUS INDICATORS

REMOTE/AUTO LED

The REMOTE/AUTO LED (red) will remain illuminated whenever the control is selected to automatic operation.

LOCAL/MANUAL LED

The LOCAL/MANUAL LED (yellow) will illuminate when Manual mode has been selected using the front panel REMOTE/AUTO, LOCAL/MANUAL Switch.

ALARM LED

The ALARM LED (red) will illuminate when any of the Alarm Functions are in an alarm condition.

CLOSE LED

The CLOSE LED (red) will remain illuminated when the capacitor bank switch is closed. The LED will flash any time the control is timing to perform a Close operation. When in Manual or Remote, if a Close operation is initiated while the control is in the Re-Close delay, the Close LED will flash until the operation is completed.

OPEN LED

The OPEN LED (green) will illuminate to indicate when the capacitor bank switch is open. The LED will flash any time the control is timing to perform an Open operation.

OK LED

The OK LED (green) will remain illuminated whenever power is applied to the unit and the watchdog circuit indicates the microcontroller is functioning properly.

RSSI LED

When the RSSI LED (red) is illuminated, it indicates that communications have been established with the client. Depending on the wireless modem that is installed, RSSI may also indicate the Receive Signal Strength.

NEUTRAL UNBALANCE

The NEUTRAL UNBALANCE LED (yellow) illuminates when the control detects a neutral unbalance current. This is indicative of failed capacitors or failed switch closures on the capacitor bank.

TX/RX COM1 LEDS

The TX (red) and RX (green) LEDs indicate that the control is transmitting and/or receiving through COM1. Also, during the boot-up sequence the TX and RX LEDs will blink indicating that the memory test is in progress. If the memory test is successful, then the TX and RX LEDs will be extinguished. If the memory test fails then both TX and RX LEDs will illuminate.

LOCAL BANK STATUS

In addition to Remote Status and Monitoring the M-6283A reports bank status locally at the control front panel utilizing either the "Open" and "Close" LEDs or the LCD display window utilizing the "CAP OPER" pushbutton or through the Monitoring "Bank Switch Status" HMI Menu.

Open and Close LED Status Indication with Independent Phase Switching Option

The Independent Phase Switching control is equipped with one front panel "Open" and one "Close" LED. However, Independent Phase Switching is accomplished utilizing three individual outputs. The Open and Close LEDs convey capacitor bank status for each output as described in the following five examples.

■**NOTE:** "In Band" is defined as the selected control mode "Voltage", "VAr" or "Current" being within band limits.

1. **Independent Phase Status** – All three capacitor banks are Closed and the capacitor bank is in band.
   LED Indication: The Close LED is illuminated and the Open LED is extinguished.

2. **Independent Phase Status** – All three capacitor banks are Open and the capacitor bank is in band.
   LED Indication: The Open LED is illuminated and the Close LED is extinguished.

3. **Independent Phase Status** – All three capacitor banks are Closed, the capacitor bank is in band, and one bank starts timing to Open.
   LED Indication: The following sequence will occur:
   a. The Open LED will start to flash to indicate one or more capacitor banks are timing to Open. The Open LED will flash as long as any bank is timing to Open. This means if a second bank started to time in this example, the Open LED would continue flashing even after the first bank has Opened because the second one is timing.
   b. The Close LED will remain illuminated until one or more capacitor banks Open and then extinguish.

4. **Independent Phase Status** – All three capacitor banks are Open, the capacitor bank is in band, and one bank starts timing to Close.

   LED Indication: The following sequence will occur:

   a. The Close LED will start to flash to indicate one or more capacitor banks are timing to Close. The Close LED will flash as long as any bank is timing to Close. This means if a second bank started to time in this example, the Close LED would continue flashing even after the first bank has Closed because the second one is timing.

   b. The Open LED will remain illuminated until one or more capacitor banks Close and then extinguish.

5. **Independent Phase Status** – A Re-Close Delay is in effect and a Close is called for.

   LED Indication: The associated Close LED will flash until the Close operation completes. This means that if the Close Timer expires before the Re-Close Delay Timer, the LED will continue to flash until the Re-Close Delay is complete and the Close Operation occurs.

Optional Independent Phase Switching HMI Capacitor Operation Status Display

In addition to the Open and Close LEDs the control includes the "CAP OPER" pushbutton on the control front panel. When this pushbutton is pressed once, the HMI will display a screen similar to the following Bank Status Screen (No timing in progress):

```
  PH A    PH B    PH C
CLOSED  CLOSED  CLOSED
```

If there are any capacitor bank operations timing (Open or Close) the control will display a screen similar to the following when the CAP OPER pushbutton is pressed once:

```
  PH A    PH B    PH C
CL 999  OP 999  CL 999
```

The control will display any combination depending on which capacitor banks are timing or not:

```
  PH A    PH B    PH C
CLOSED  OP 999  CLOSED
```

The Key to the "CAP OPER" pushbutton HMI display for capacitor bank status is as follows

- CL = Close, indicates the capacitor bank is Closed.
- OP = Open, indicates the capacitor bank is Open.
- 999 = Any timer that is in effect on that output. (Re-Close Delay Timer and Warning Timers).
- Blank Display = If the capacitor bank state can not be determined for any reason the display will be blank.

Local Capacitor Bank Operation

In addition to providing local capacitor bank status the "CAP OPER" pushbutton also provides the means to operate Independent Phase Switches individually or all together. Local operation of the capacitor bank is accomplished as follows:

1. From the control front verify the status of all capacitor bank switches by pressing the CAP OPER pushbutton. The control will display a screen similar to the following:

```
  PH A    PH B    PH C
CLOSED  OP 999  CLOSED
```

2. Place the "REMOTE/AUTO – LOCAL/MANUAL toggle switch in the "LOCAL/MANUAL" position. The LOCAL/MANUAL LED will illuminate.

3. Press the CAP OPER pushbutton as necessary to display the "Manual Bank Operate" screen:

```
MANUAL BANK OPERATE
ALL
```

4. Press **ENT**. The control will display the following:

```
MANUAL BANK OPERATE
ALL                  C
```

5. Utilizing the Up and/or Down pushbuttons select the desired operation. The selections for the Manual Bank Operate screen are; ALL, Phase A, Phase B or Phase C.
6. When the desired operation is displayed press the **ENT** pushbutton. Depending on the selection that was made, one of the following screens will be displayed:

```
     ALL PHASES
  READY TO OPERATE
```

```
   PHASE A (B or C)
   READY TO OPERATE
```

■**NOTE:** If "High Energy Switch" is enabled, there is an 8 second delay between capacitor bank switching operations to allow the High Energy Switch to recharge. This delay is in effect if "ALL" is selected in Independent Phase Switching Mode. The "ALL" selection in "Single Phase" and "Three Phase Average" Modes operates all three phases (A, B, C) at the same time without the 8 second delay.

7. Initiate the desired Open/Close operation by toggling the CLOSE/OPEN control switch. The CLOSE/OPEN LED status lights will respond as described the "Local Bank Status".

   Capacitor bank status can be observed by pressing the CAP OPER pushbutton to display the status.

FUSES

▲**CAUTION:** Failure to utilize proper replacement fuses will result in damage to the control.

The Digital Capacitor Bank Control back panel provides access to three U_L recognized replaceable fuses:

- Test – 3 A, 250 Vac, 3 AG
  BECO Part No. 420-00826
- Switch Power – 12 A, 250 Vac, 3 AG
  BECO Part No. 420-00871
- Voltage – 0.5 A, 250 Vac, 3 AG
  BECO Part No. 420-00832

When optional Independent Phase Switching is purchased (TB3 present on control bottom panel), there will be access to three additional U_L recognized replaceable fuses:

- Phase 1, 2, 3 – 12 A, 250 Vac, 3 AG
  BECO Part No. 420-00871

Replace using proper type voltage and current rating.

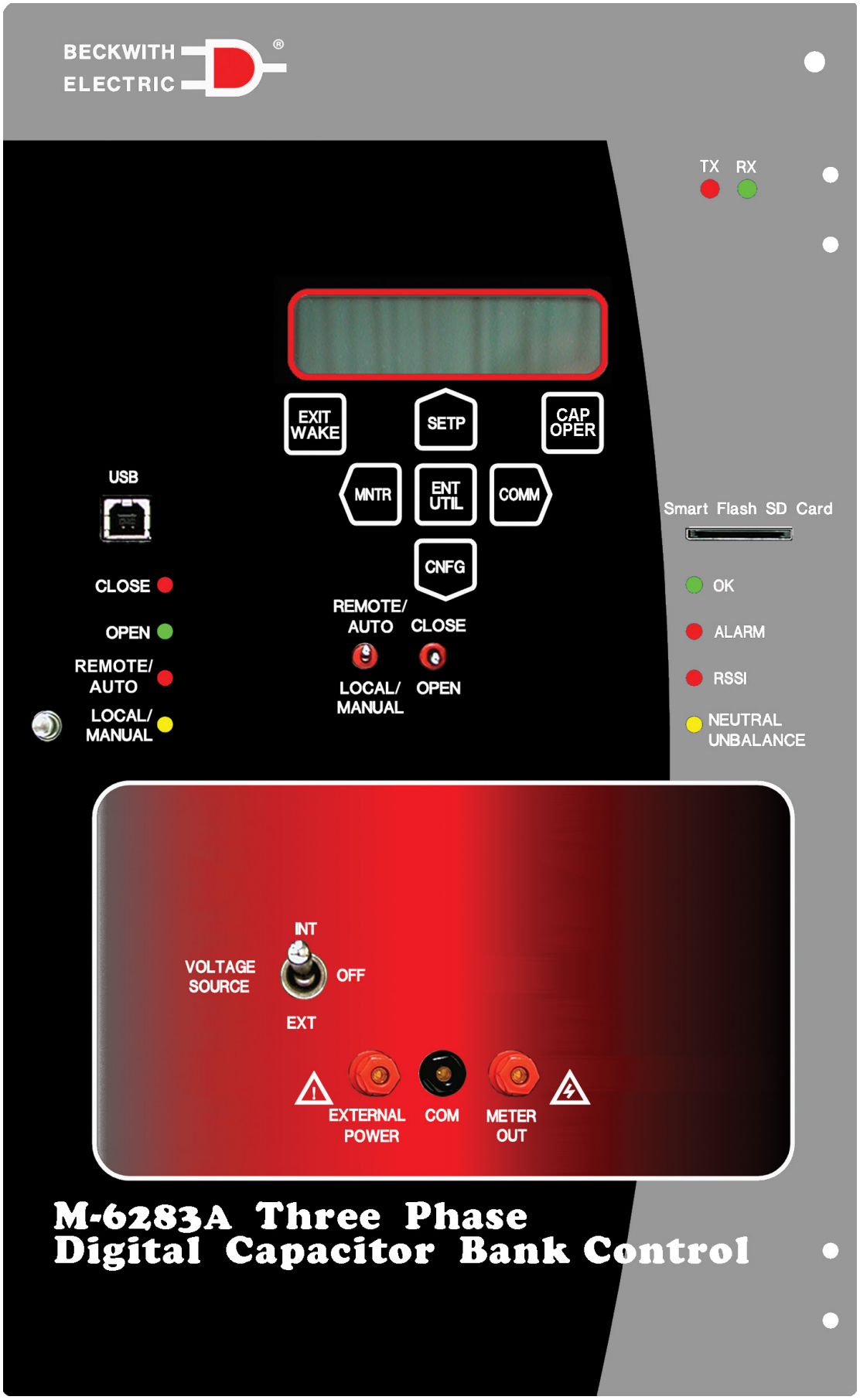


Figure 2-2 M-6283A Front Panel

2.4 HMI Menu Structure

The HMI menu structure (Appendix A) consists of three levels; Header, Sub-Header and Data/Data Entry. From the Header level the user can navigate to the adjacent headers with the ⬅ or ➡ pushbuttons (Figure 2-3), go to the sub-header level by pressing **ENT** or ⬇ pushbutton, or clear the screen by pressing the **EXIT** pushbutton.

From the Sub-Header level, the user can navigate to the adjacent sub-headers with the ⬅ or ➡ pushbuttons, return to the header level by pressing the **EXIT** or ⬆ pushbuttons, or enter the Data/Data Entry level by pressing **ENT** or ⬇. Once in the Data/Data Entry screens, the user can navigate through the list with the ⬆ and ⬇ pushbuttons. In this level the list wraps around. To exit the level, the user can press **EXIT** to return to the corresponding sub-header, or use the ⬅ or ➡ pushbuttons to go to the adjacent sub-header level. To enter data, reset parameters or access data screens, press **ENT**.

ENT Pushbutton

ENT UTIL The **ENT** pushbutton is a hot button for the "Utility Menu". It is also used to perform the following functions:

- Enter the "edit" mode of a screen
- Store a setpoint or condition in memory
- Enter the sub-header or data level
- Reset certain monitoring screens

EXIT Pushbutton

EXIT WAKE The **EXIT** pushbutton is a hot button for a unit "Wake Up", which begins cycling through a series of user selectable screens, as described previously, "Wake Up Message Screens" on page 2–2.

The **EXIT** pushbutton is also used to perform the following functions:

- Exit a level to the next higher level
- Cancel data entry
- Clear the screen when at the header level

Data Entry Screens

There are three types of Data Entry screens:

- Alphanumeric – the ⬅ and ➡ pushbuttons advance the cursor to the digit to be edited and the ⬆ and ⬇ pushbuttons change the value
- List – the ⬆ and ⬇ pushbuttons change the data
- Bit Mask – the ⬅ and ➡ pushbuttons move the cursor to the bit and the up and down pushbuttons change the value

For all screens the **ENT** pushbutton saves the value and **EXIT** pushbutton cancels the operation. An "underscore" beneath the far left or far right character or digit indicates the user is in the **EDIT** mode.

"C" Change Prompt and EDIT Mode Prompt

The **ENT** pushbutton is used to enter the edit mode of any user settable property screen. The HMI screen will display a "C" in the bottom right corner of the screen, indicating that the value may be changed. Settings parameters may be selected either from a scrolling list, or entered manually. Scrolling setting selections are accessed using the ⬆ or ⬇ pushbuttons. Press **ENT** a second time to execute the setting change.

Values that are entered manually are indicated by an underscore beneath the far left or far right character or digit. This prompt indicates that the desired values can be entered by using the ⬅ and ➡ pushbuttons to move the underscore from left to right, and then using the ⬆ or ⬇ pushbuttons to increment or decrement the values. Values have factory preset increments, such as 0.1 volt or 1 second. Press **ENT** a second time to execute the setting change.

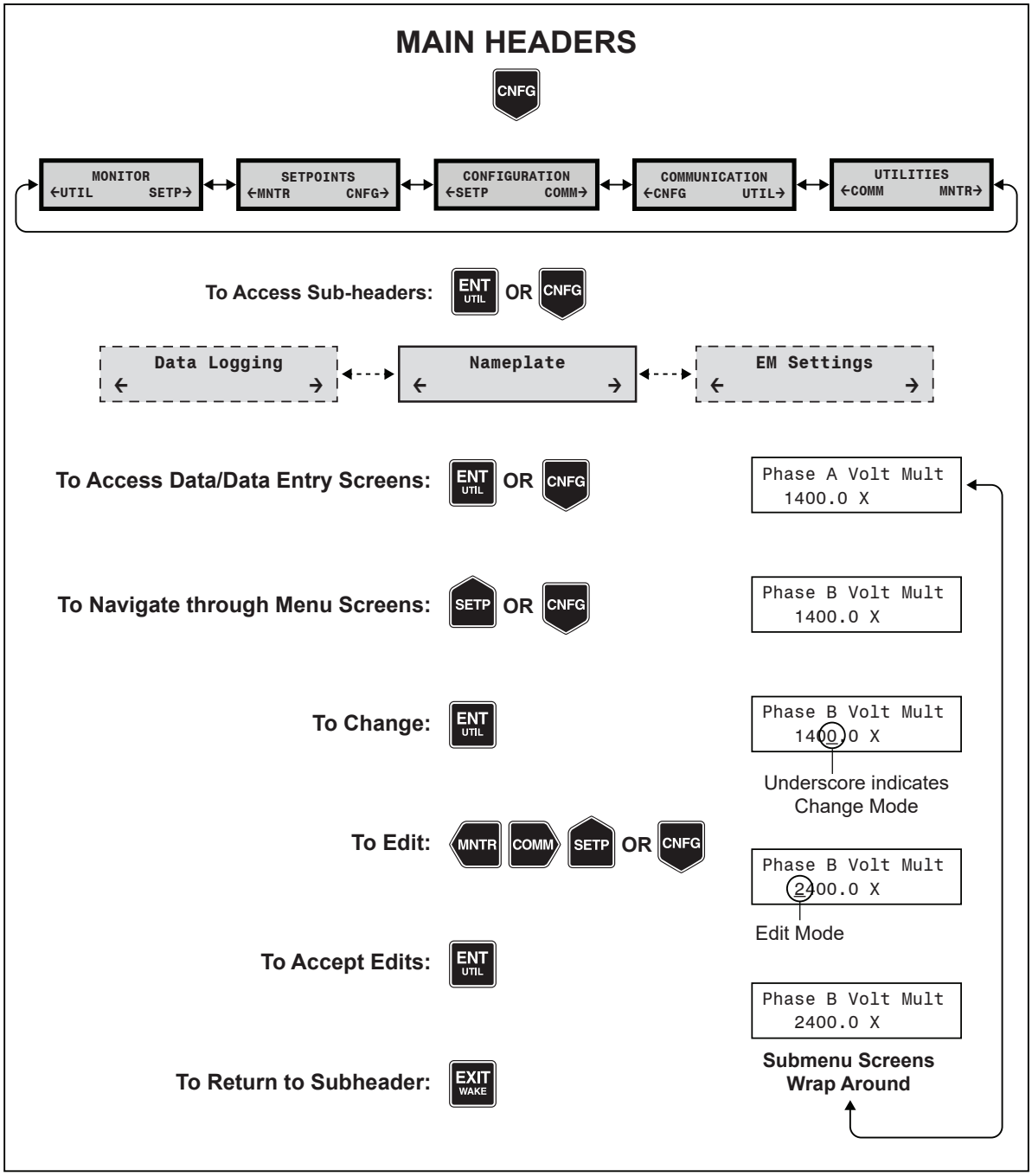


Figure 2-3 HMI Menu Structure and Navigation Example

USER LINES

The user station identification lines (User Lines) allow the user to uniquely identify the unit. Each line of this display can have up to 20 ASCII characters. User Lines are factory preset with "Beckwith Electric" for Line 1 and "M-6283A" for Line 2.

Setting User Lines from the HMI

When **ENT** is pressed at the COMMUNICATION/HMI/User Line 1 or User Line 2 menu, an underline cursor is displayed under the left-most character. Each character is changed by using the ⬆ and ⬇ pushbuttons to select the ASCII character (the ASCII character list begins with "!"). The ⬅ or ➡ pushbutton is used to move the underline to the next character. When the **ENT** pushbutton is pressed, the new user line is stored into nonvolatile memory.

1. Press **COMM**➡ to advance to either "COMMUNICATION" or "Memory Card" (when a Smart Flash SD CARD is present).

   ```
         COMMUNICATION
   ←CNFG              UTIL→
   ```

   ```
          Memory Card
   ←                      →
   ```

2. From the COMMUNICATION menu, press **ENT** or **CNFG**⬇ once. The unit will display the "Comm Settings" menu.

   From the "Comm Settings" or "Memory Card" menu, press ⬅**MNTR** or **COMM**➡ as necessary until **HMI** is displayed.

   ```
              HMI
   ←                      →
   ```

3. Press **CNFG**⬇ to navigate to the User Lines entry screen.

   ```
   User Line 1              E
   Beckwith Electric
   ```

4. Press the **ENT** pushbutton. If prompted, enter a valid Level 2 Access Code. The following will be displayed, including the Change Mode underline.

   ```
   New User Line 1
   _Beckwith Electric
   ```

5. Utilizing the arrow pushbuttons enter the new User Line, press **ENT** to save the User Line. Press **CNFG**⬇ to advance to the User Line 2 screen.

SYSTEM CLOCK

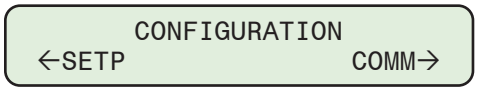
The control is equipped with a real-time, 24 hour clock which is used with the Data Logging feature to record date/time stamp information on quantities saved in memory. The system clock includes the capability to enable/disable Daylight Savings Time.

The power source for the clock is maintained for at least 24 hours during a system power outage by a charged capacitor (no battery). If the power outage lasts longer than 24 hours, check the clock and reset if necessary.

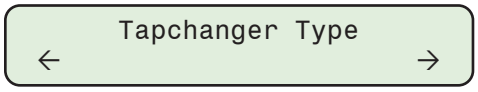
Setting the System Clock from the HMI

▲**CAUTION:** Whenever clock is reset and data logging is enabled, the data log should be cleared.

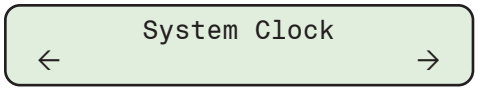
1. Press **CNFG**🡻 to advance to the CONFIGURATION menu.



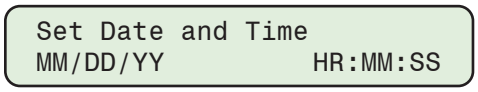
2. Press **ENT** or **CNFG**🡻 once. The unit will advance to the Tapchanger Type menu:



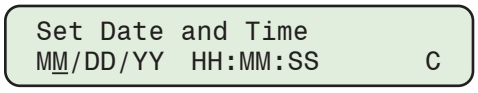
3. Press 🡸**MNTR** or **COMM**🡺 as necessary, to the "System Clock" screen.



4. Press **CNFG**🡻 as necessary, until the "Set Date and Time" screen is displayed.



5. Press the **ENT** pushbutton. If prompted, enter a valid Level 2 Access Code. The cursor will be positioned under the left hand "Month" element of the date. Utilizing the Up/Down arrow pushbuttons will change the Month. Utilizing the Right/Left arrow pushbuttons will move the cursor between each element of the date and time. Enter the settings, then press **ENT** to Save.



6. Press **CNFG**🡻 to access the "Daylight Savings" settings screen.

2.5 Monitor – Metering and Status

Accessing the HMI Monitor Screens

1. Press ⬅**MNTR**. The menu will advance to **MONITOR**.
2. Press **ENT** or **CNFG**⬇ once. The unit will display **Metering**.
3. Press ⬅**MNTR** or **COMM**➡ as necessary to navigate to the desired **MONITOR** Sub-Header.
4. Press **CNFG**⬇ as necessary to view specific parameters within the selected Sub-Header:

METERING

Phase Voltage (A, B, C)
Forward Power Delta Voltage (A, B, C)
Frequency
Primary Voltage (A, B, C)
Neutral Current
Sampling Period Secondary Average Voltage
Average Voltage (A, B, C)
Neutral Phase Angle
Reverse Power Delta Voltage

METERING (with VAr Control Mode Option)

Power Factor
Phase Current (A, B, C)
Primary Watts
Primary VArs
Primary VA
Delta Current

STATUS

Bank Status, Bank Switch Status, and Alarm Status

HARMONICS

Voltage % THD (A, B, C)
View Voltage Harmonics (A, B, C)
Current % THD (A, B, C) with VAr Control Mode Option
View Current Harmonics (A, B, C) with VAr Control Mode Option

CAP INFORMATION

Operations Counter (A, B, C)
Reset Op Counter (A, B, C) (E) – indicates parameter that can be pre-set or reset to zero
Daily Operation Counter (A, B, C)
Emergency Control Mode Active

2.6 Smart Flash SD Card

Pressing the **COMM➡** Hot Button when a formatted Smart Flash SD Card (FAT32) is present in the SD Card slot, advances directly to the "Memory Card" menu. Depending on User Permissions, the Memory Card can now be utilized to:

- Load and Save Setpoints Files
- Load and Save Clone Files
- Load and Save Configuration Files (DNP, Users, IPsec)
- Save Data Files (Datalog, Sequence of Events, Oscillograph, Metering Data)
- Update Firmware
- Perform a Quick Capture
- Save Wakeup Screen Parameter Data

■**NOTE:** The Smart Flash SD Card slot supports standard SD Memory Cards: **SD, SDHC, SDXC, and UHS-I** format. The following formats are **NOT** supported: SDUC, UHS-II, UHS-III, and UHS-I Express.

LOADING SETTINGS FILES FROM A SMART FLASH SD CARD

A user with the appropriate Access Level or Permission may load Setpoints and Clone files contained on the SD Card onto the control.

Loading Setpoints from a Smart Flash SD Card

▲**CAUTION:** Setpoint changes are immediately acted upon by the control and may cause undesired control operation.

The **Memory Card/Load Setpoints** submenu allows the user to load a Setpoints file onto the control. The Setpoints file (*.CPT) consists of the specific setpoint settings for ALL Profiles. Loading a setpoint file from an SD Card overwrites the existing setpoint file. Care must be taken to ensure the correct file has been selected for loading onto the control.

```
Load Setpoints
Press ENT to begin
```

Press **ENT** to continue. The control will prompt the user to confirm the selection:

- **Confirm press ENT**
  Cancel press EXIT

Press **ENT** to continue. The control will prompt the user to select the (*.CPT) file to be loaded.

```
File Name.CPT
MM/DD/YYY   hh:mm  →
```

■**NOTE:** If an arrow is displayed on either end of the bottom display line, additional setpoint files are available for selection.

Select the file to be loaded onto the control. The control will display the following sequence of screens:

- **Loading file.**
  Please wait...
- **Setpoints loaded.**
  Any key to continue

The new setpoints are now available to the control.

Load Clone from a Smart Flash SD Card

The **Memory Card/ Load Clone** submenu allows the user to load a control Clone File containing ALL of a cloned control's settings to another control with the exception of the serial number. A Clone File may contain a DNP Configuration file and a Multi-User Password file, if the Clone File was Saved with these options.

▲**CAUTION:** Loading a Clone file that was created from a different firmware version may cause unintended operation. Contact Beckwith Electric to determine Clone file compatibility.

Clone Load with "DNP Configuration" and "Multi-user Password" files

When the Load Clone feature is initiated, the user must select the Clone File name that includes the Serial Number (SNxxxxxx) of the cloned control. If the Clone File was saved with associated DNP Configuration and Multi-user Password files, the control will check for the DNP and Multi-user Password files associated with the serial number of the Clone File, and will write those files to the target control.

If the DNP and/or Password files do not exist in the Clone File, a message stating "DNP CFG file does not exist" or "Multi-user Password file doesn't exist" will be displayed during the Load sequence.

```
Load Clone
Press ENT to begin
```

Press **ENT** to continue. The control will prompt the user to confirm the selection:

- **Confirm press ENT**
  Cancel press EXIT

Press **ENT** to continue. The control will display the name of the first Clone file available:

```
SN000001.cln
MM/DD/YYYY   HH:MM  →
```

Navigate to the target Clone File, then press **ENT**. The control will display the following sequence of screens:

- **Loading file**
  Please wait...
- **Loading...**
  DNP CFG File
- **Loading...**
  Multi-user Password
- **Clone loaded**
  Any key to continue

SAVING SETTINGS FILES TO A SMART FLASH SD CARD

Saving Setpoints to a Smart Flash SD Card

The **Memory Card/Save Setpoints** selection saves the control's (*.cpt) file to the SD Card. This file consists of the setpoint settings for ALL Profiles. Saving the control setpoints file to an SD Card allows the user to open the saved file in CapTalk and then edit specific profiles while retaining any existing setpoint information for the profiles that are NOT changing. This edited file can then be saved to an SD Card and then reloaded onto the control. The reloaded Setpoint changes are immediately acted on by the control and may cause undesired control operation.

Clone Save to a Smart Flash SD Card

Two options are available to save a Clone File to the SD Card:

- Save a Clone File that includes the control Setpoints File (*.cpt), the DNP Configuration File, and the Multi-user Password file
- Save a Clone File containing ONLY the control Setpoints File

Clone Save Including "DNP Configuration" and "Multi-user Password" files

When the Clone Save feature is initiated, a default file name that includes the control Serial Number is displayed (SNXXXXXX). If the user **keeps the default file name**, the control will save the control Setpoints File, including the DNP Configuration File and Multi-user Password File (if those files exist on the control) to the Smart Flash SD Card.

If the DNP and/or Password files do not exist on the cloned control, a "File doesn't exist!" message will be displayed during the Save sequence.

Clone Save Without "DNP Configuration" and "Multi-user Password" files

When the Clone Save feature is initiated, a default file name that includes the control Serial Number is displayed. If the user **enters a different file name**, the control will write ONLY the control Setpoints File to the Smart Flash SD Card.

FIRMWARE UPDATE FROM A SMART FLASH SD CARD

The **Memory Card/Firmware Update** selection allows the user to update the control firmware. During the firmware update, the unit will display the following sequence of screens:

- **`Updating From SDCARD`**
  `...`
- **`Update Complete`**
  `Rebooting...`
- **`Update Successful`**
  `Any key to continue`

Press any key. The control will cycle through the Startup screens. If the restoration of setpoints and configuration fails, the control will display:

- **`Failed to restore!`**
  `Any key to continue`

In this condition, the control will operate with the **default** initialized setpoints and configuration data. If this condition occurs, the user should reload the correct file settings, and contact Beckwith Electric Customer Service.

LOADING & SAVING CONFIGURATION FILES USING A SMART FLASH SD CARD

Control Configuration files may be saved to the SD card, or loaded from the SD Card. The following Configuration files are available to Save or Load from the "Memory Card" menu:

- DNP Configuration File
- User Configuration File
- IPsec Configuration File

SAVING DATA FILES TO A SMART FLASH SD CARD

Control data record files may be saved to a Smart Flash SD card. The following data files are available from the "Memory Card" menu:

- Data Log (selectable data range)
- Sequence of Events
- Oscillograph Record (selectable partition)
- Metering Data
- Wakeup Screen Data

SD CARD QUICK CAPTURE

The SD Card Quick Capture feature allows the user to save the following data files to an SD Card in one step:

- Control Clone
- Data Logging
- Oscillography
- Sequence of Events
- DNP Map
- Multi-user Access Code
- Multi-user Access Code Log

A Level 2 Access Code is required to initiate the SD Card Quick Capture feature. If a file (other than control Clone) does not exist on the control at the time the Quick Capture is initiated, the control will display a "XXX file doesn't exist" message for approximately three seconds before continuing with the Quick Capture process.

Quick Capture File Naming Convention

Since Data Logging and Oscillograph files both utilize the same Comtrade format, the Quick Capture feature will name Data Logging files as DSXXXXXX.dat and DSXXXXXX.cfg. Oscillograph files will be named as YYXXXXXX.dat and YYXXXXXX.cfg, with YY representing the "Partition" and XXXXXX representing the "Serial Number" of the control. For example, 16009999.dat is an Oscillograph file of the 16th Partition in control Serial Number 9999.

2.7 Utility/Calibration

CALIBRATION/TEST

The UTILITIES Calibration/Test screens provide access to calibration parameters that can be reset by the user when necessary, to restore calibration settings to those that were calculated at the factory.

▲ **CAUTION:** Access to the control calibration parameters requires **Level 3 Access**, which must be obtained from the factory, and is intended for authorized personnel only. Changes to calibration parameters can result in physical damage to the control and the system/component that it is applied to.

Read only parameters are also available in the Calibration/Test submenu:

- Voltage (A, B, C)
- Neutral Current
- Uncompensated Power Factor (1, 2, 3)
- Compensated Power Factor (1, 2, 3)
- Temperature (C/F)
- Watchdog Resets
- Total Resets

The Calibration/Test submenu also allows access to the following:

- Neutral Current Phase Shift Comp.
- Reset Delta Voltage
- Reset Delta Current
- Phase Shift Compensation (1, 2, 3)
- Enable External Temperature Sensor
- External Temperature Calibration
- Internal Temperature Calibration
- LED Scroll Test
- Input Test
- Button Input Test
- Clear Reset Counters
- SCADA Test Mode
- Reset Reverse Power Delta Voltage
- Set Communication Options
- Initialize Setpoints
- Erase Flash Files

Communication Options

For additional security, the user may restrict access to the control by enabling/disabling specific communication ports and/or protocols.

■**NOTE:** This feature is ONLY available through the front panel HMI.

1. Press the **ENT UTIL** to advance to the UTILITIES menu.

```
        UTILITIES
←COMM             MNTR→
```

2. Press **ENT** or **CNFG**⬇ once. The unit will advance to the Calibration/Test menu:

```
     Calibration/Test
←                      →
```

3. Press **CNFG**⬇ as necessary, until the "Comm Options En/Dis" screen is displayed.

```
Comm Options En/Dis
11111111111111
```

4. Press the **ENT** pushbutton. If prompted, enter a valid Level 2 Access Code. The cursor will be positioned under the far right hand digit which corresponds to ICMP. The remaining Comm Option selections are displayed by moving the cursor to the left.

```
ICMP
111111111111111        C
```

5. Utilizing the Up/Down Arrow pushbuttons enter a "1" for those Communication Ports and/or Protocols to be enabled and a "0" for those that are to be disabled. Enter the settings, then press **ENT** to Save.

   From right to left, the Comm Options that can be enabled/disabled are:

   - ICMP
   - DNP TCP
   - DNP UDP
   - MODBUS TCP
   - FXFER
   - TERMINAL
   - DEVICE DISCOVERY
   - ETHERNET
   - RADIUS
   - USB
   - COM1
   - COM2
   - SD CARD
   - FTP

CHECKSUM ERROR

■**NOTE:** When a Checksum ERROR occurs, the voltage control element of the control is NOT available.

In the event a Checksum Error occurs, the control will initiate a cycling "Checksum Error" display. A Checksum Error message indicates a possible Setpoints setting error when writing setpoints to memory. In this case, the "Clear Reset Counters" screen in the Configuration/Test submenu will change to "Init Setpoints". Select "Init Setpoints" to begin the Setpoints Initialization process, which returns the unit to its factory default Setpoints. The Checksum Error message will be cleared when the initialization is complete.

This error could have occurred due to cycling power immediately after writing settings to the unit or, in rare cases when power cycling immediately following a control operation. If the error clears after following the steps above, no further action is needed. If the error continues to occur, please record the conditions surrounding the error and contact Beckwith Electric to assist in troubleshooting.

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3 System Application and Setpoints

■ **CYBER SECURITY NOTE:**

When Cyber Security is enabled, access to any feature described in this Chapter is subject to the Access Permissions Policy as designated by the Security Policy Administrator.

3.1 Overview

Chapter 3 is designed for the person or group responsible for the System Setup, System Configuration, and Setpoints of the M-6283A Capacitor Bank Control, and includes the following:

- The System Setup and Configuration section provides the definitions of system quantities and equipment characteristics required in the control application environment. This includes the "Nameplate" settings, such as Capacitor Bank Size, Primary Nominal Voltage, CT and VT configuration, and Phase Shift Compensation.
- The Setpoints section describes Setpoint Profiles, Delta Voltage, Auto Control Mode, Remote Control Mode, and Control Mode Limits.

3.2 System Setup and Configuration

CAP BANK SETTINGS

Select **Setup/Configuration/Cap Bank Settings** to display the M-6283A Cap Bank Settings Screen (Figure 3-1). The Configuration screen allows the user to set the "Nameplate" settings, including 3 Phase Cap Bank Size, Primary Nominal Voltage, Emergency Mode, Ratio Multipliers, Correction Factors, System Quantities, and Equipment Characteristics required in the control application environment.

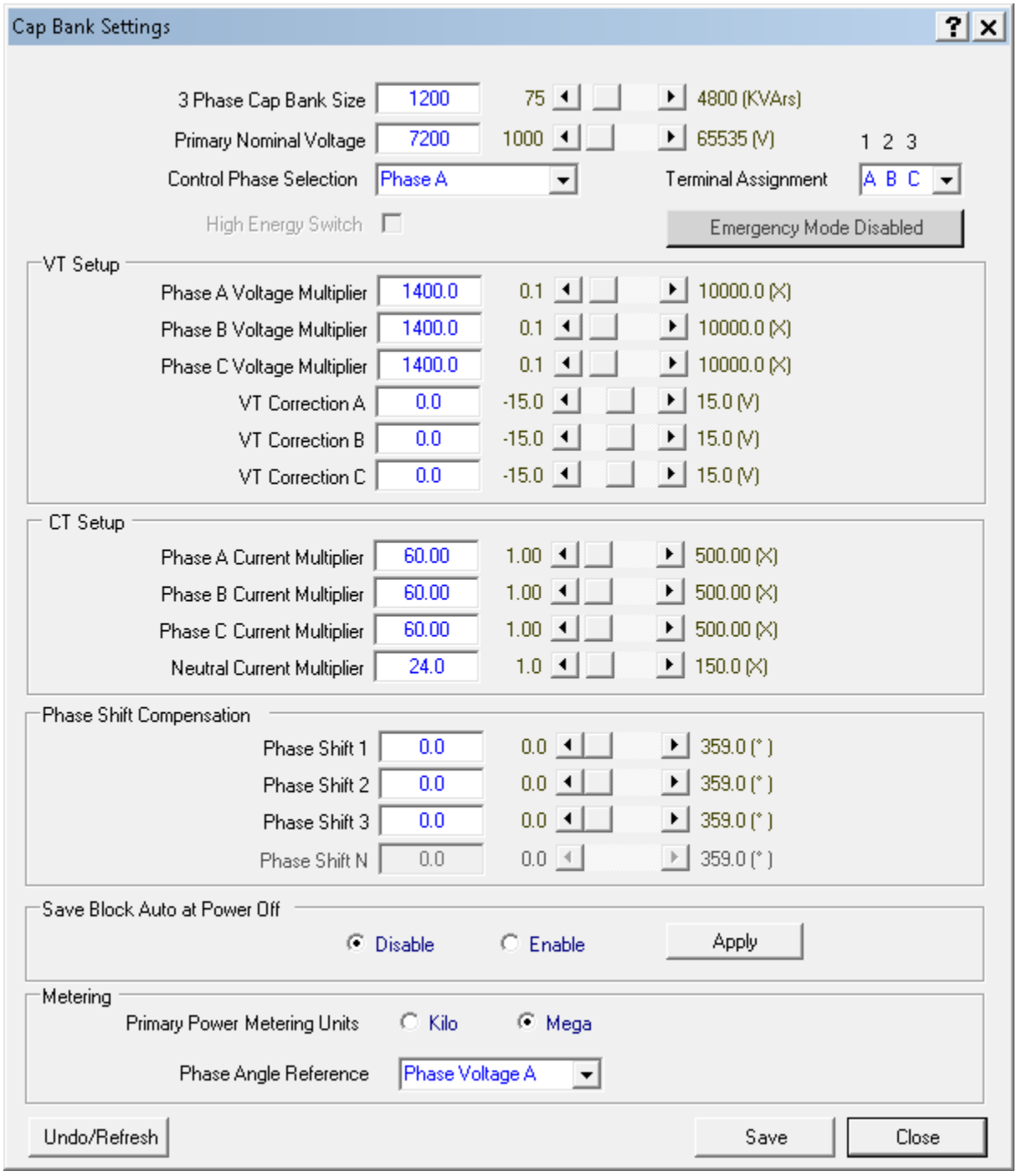


Figure 3-1 Cap Bank Settings Screen

Primary Nominal Voltage

The Primary Nominal voltage is the nominal primary phase to ground voltage. It is used in the calculation of secondary metering voltages when those voltages are based on Line Post Sensor inputs, not 120 Vac to equate the LPS inputs to secondary voltage levels. The secondary voltage 120 V nominal is used to represent traditional VT inputs. For controls with line-post sensor inputs the nominal sensor output voltage may be very low (Example 5 V). However, in order to keep the compatibility of the voltage settings with traditional VTs, the line-post sensor nominal control voltage input is scaled to 120 V. This conversion is applicable for settings and secondary metering quantities only.

The formula for secondary metering of the voltage is as follows:

$$V_{SEC} = (120 \times V_{SEN} \times V_{MULT})/(V_{PRI\_N})$$

Where:

V_{SEC} *is the secondary voltage*

V_{SEN} *is the output voltage of the sensor*

V_{PRI_N} *is the primary nominal voltage*

V_{MULT} *is the voltage multiplier of the sensor*

Example:

A primary nominal voltage (V_{PRI_N}) of 7200 V with a voltage sensor having a nominal voltage of 5.1429 V.

This gives a voltage multiplier (V_{MULT}) of 1400.

If the primary voltage is 7000 V then V_{SEN} = 7000/1400 = 5 V.

$$V_{SEC} = (120 \times 5 \times 1400)/7200 = 116.67\ V$$

Control Phase Selection

Single Phase Selection

This selection allows the user to choose which phase: A, B or C is used as the controlling parameter. Once this is selected, the control will use that phase value in Classic voltage control mode to make a decision on how to regulate the load voltage. The selection is valid for all three methods of control namely Voltage, VArs and Current. In addition, each individual Open or Close contact will operate simultaneously during a Trip or Close operation.

Three Phase Average/Total

This selection will average the value of all three phase quantities and this average will be used to make the control decision. The selection is valid for all three methods of control: Voltage, VArs and Current. It is important to note that when the control is using VAr Control, the averaging is replaced by the total sum of the VArs of all three phases.

In addition when Average is selected the CT Multiplier is assumed to be equal. In Control Mode Limits the maximum and minimum of the 3 phases is used to evaluate whether the voltage is violating the user assigned limits. In addition, each individual Open or Close contact will operate simultaneously during a Trip or Close operation.

Optional Independent Phase Switching

This option will allow the control/user to independently operate each phase of a Capacitor Bank switch based on the chosen Control Mode of Operation. The chosen operational mode's settings are not duplicated for each phase but instead use one group of settings which are used by all three phases to make Independent Phase Switching decisions. Each phase will have a dedicated set of Close and Open contacts.

Terminal Assignment

The Terminal Assignment setting allows a user to assign which Phase (A, B, or C) is connected to the (1, 2, and 3) Voltage Input, Current Input , Open and Close Capacitor Bank Switch Outputs (if Independent Phase Switching is purchased), and Capacitor Bank Switch Status Inputs. It is critical that when connecting, ALL inputs and outputs connected to phase 1 are on the same physical phase, all inputs and outputs connected to phase 2 are on the same physical phase, and all inputs and outputs connected to phase 3 are on the same physical phase. When using Beckwith supplied cabling, the connections to the Voltage Sensors, Current Sensors, Capacitor Bank Switches are labeled 1, 2, and 3 in order to simplify the installers task of connecting correctly. It is important to be aware that a mismatch of the connections with this setting will result in improper metering and/or operation of the control.

High Energy Switch

Enabling/Disabling the High Energy Switch from the HMI

■**NOTE:** This setting is only available with the Independent Phase Switching hardware option and can only be enabled through the HMI. Manual Capacitor Bank operations with "High Energy Switch" enabled will include an 8 second delay between switching phases when "ALL" is selected.

1. Press the Down Arrow (CNFG Hot Button) pushbutton to wake the unit. The menu will advance to "CONFIGURATION".

```
      CONFIGURATION
←SETP              COMM→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
      Cap Settings
←                      →
```

3. Press the Right or Left Arrow pushbutton as necessary until "Nameplate" is displayed.

```
        Nameplate
←                      →
```

4. Press the Down Arrow as necessary until the "High Energy Switch" setting screen is displayed.

```
High Energy Switch
disable
```

5. Press the **ENT** pushbutton. If prompted, enter a valid Level Access Code. The following will be displayed:

```
High Energy Switch
disable                C
```

6. Utilizing the arrow pushbuttons select either **ENABLE** or **disable**, then press the **ENT** pushbutton.

Emergency Mode

The Emergency Mode feature when enabled, allows the user to choose either Phase A, B or C (default is A) for Control/Switch Power in both Automatic and Manual control modes.

Automatic Control Mode

The Emergency Mode (EM) feature will operate the control based on the following rules with regard to Automatic Control Operation when in any Automatic Control Mode. These rules apply whether operating in Independent Phase Switching or Ganged mode:

- If the voltage on any phase other than the selected Control/Switch Power Phase decreases to less than the Voltage Loss EM Activate Level setting for a period greater than the Voltage Loss EM Time Delay setting, the control will shift to (or stay in) the Ganged mode of operation using the Control/Switch Power Phase as the controlling phase.

  In Independent Phase Switching Mode, after the Voltage Loss EM Time Delay expires, the control will perform an Open ALL (Emergency Initiate) and then operate using the Control/Switch Power Phase as the controlling phase.

- The control will assert an "Emergency V Loss Triggered" alarm and an Emergency Mode Status screen will be available in the MONITOR/Cap Information menu.
- If the selected Control/Switch Power Phase voltage decreases to less than the Voltage Loss EM Activate Level for the duration of the Voltage Loss EM Time Delay setting, then the control will block further operation and assert the "Emergency V Loss Triggered" alarm. In the MONITOR/Cap Information menu, the Emergency Mode Status screen will display "Active Emerg. Ctrl Switch Pwr Phase A (B or C)".
- If the voltage returns above the Voltage Restore EM De-Activate Level for greater than the duration of the Voltage Restore EM Time Delay, the Emergency Mode alarms will be cleared and the control will resume operation using the normal control settings.

Remote Control Mode

The Emergency Mode (EM) feature will operate the control based on the following rules with regard to Remote Control Operation when in any Remote Control Mode. These rules apply whether operating in Independent Phase Switching or Ganged mode:

- In Independent Phase Switching Mode, if the voltage on any phase other than the selected Control/Switch Power Phase decreases to less than the Voltage Loss EM Activate Level setting for a period greater than the Voltage Loss EM Time Delay setting, the control will automatically open all three phases if any of them were not already open. They will remain open until the voltage on all three phases is above the Voltage Restore EM De-Activate Level setting for the duration of the Voltage Restore EM Time Delay.
- The control will assert an "Emergency V Loss Triggered" alarm and an Emergency Mode Status screen will be available in the MONITOR/Cap Information menu.
- If the selected Control/Switch Power Phase voltage decreases to less than the Voltage Loss EM Activate Level for the duration of the Voltage Loss EM Time Delay setting, then the control will block further operation and assert the "Emergency V Loss Triggered" alarm. In the MONITOR/Cap Information menu, the Emergency Mode Status screen will display "Active Emerg. Ctrl Switch Pwr Phase A (B or C)".
- If the voltage returns above the Voltage Restore EM De-Activate Level for greater than the duration of the Voltage Restore EM Time Delay, the Emergency Mode alarms will be cleared and the control will resume operation using the normal control settings.

Manual Control Mode

The Emergency Mode feature will operate the control based on the following rules with regard to control operation when in Manual Control Mode (Front Panel Switch is placed in the LOCAL MANUAL position). These rules apply whether operating in Independent Phase Switching or Ganged mode:

- If the voltage on any phase other than the selected Control/Switch Power Phase decreases to less than the Voltage Loss EM Activate Level setting for a period greater than the Voltage Loss EM Time Delay setting, the control will not initiate any operation as long as the switch is in MANUAL. Should the switch be placed in REMOTE/AUTO while the Emergency Mode condition exists, the control will respond based on the existing mode (Remote or Auto) as defined previously for these modes of operation.
- If the voltage of the selected Control/Switch Power Phase decreases to less than the Voltage Loss EM Activate Level for the duration of the Voltage Loss EM Time Delay setting, then the control will block manual operation and assert the "Emergency V Loss Triggered" alarm. In the MONITOR/Cap Information menu, the Emergency Mode Status screen will display "Active Emerg. Ctrl Switch Pwr Phase A (B or C)".
- If the voltage returns above the Voltage Restore EM De-Activate Level for greater than the duration of the Voltage Restore EM Time Delay, the Emergency Mode alarms will be cleared and the control will resume operation using the normal control settings.

Enabling and Setting Emergency Mode from CapTalk

1. Select "Emergency Mode Disabled" from the Cap Bank Settings screen.
2. CapTalk will display the Emergency Mode Activation screen (Figure 3-2).

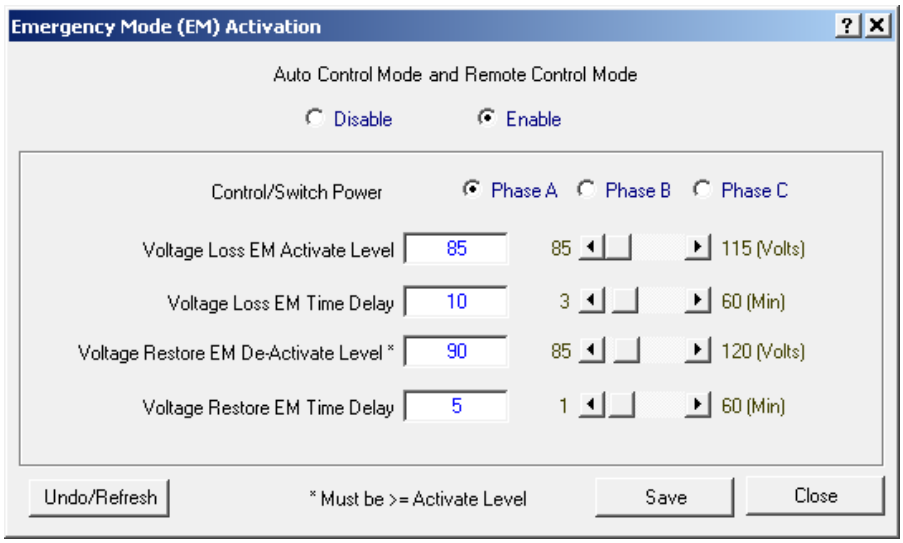


Figure 3-2 Emergency Mode Activation Settings Screen

3. Select **ENABLE** to enable Emergency Mode, and enter the application settings:

■**NOTE:** Voltage Restore Emergency Mode De-Activate Level (must be greater than or equal to the Activate Level)

4. Select **Save**. CapTalk will display a confirmation screen. Select **OK**. CapTalk will display the "Setpoints Successfully Written to Control" confirmation screen.
5. Select **Close**. CapTalk will return to the Cap Bank Settings screen with Emergency Mode Enabled indicated in yellow (Figure 3-3).

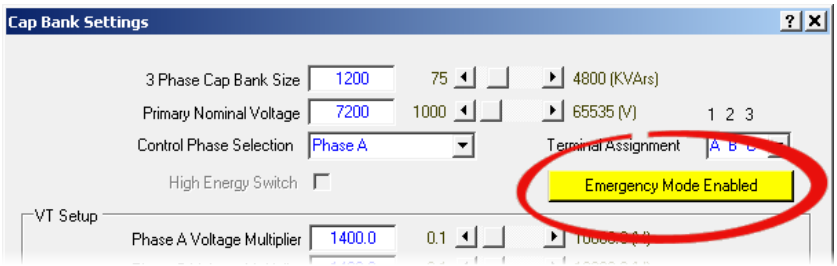


Figure 3-3 Cap Bank Settings Screen – Emergency Mode Enabled

Emergency Mode Alarms and Status Indicators from CapTalk

When Emergency Mode is Enabled, the Alarm Status section of the CapTalk Metering and Status screen will display the Emergency Mode status. If Emergency Mode is NOT enabled, this status item will not appear. There are two possible states for the Emergency Mode Activated status:

- Emergency Mode Activated (gray) – Enabled but not Activated
- Emergency Mode Activated (red) – Enabled and Activated (Figure 3-4).

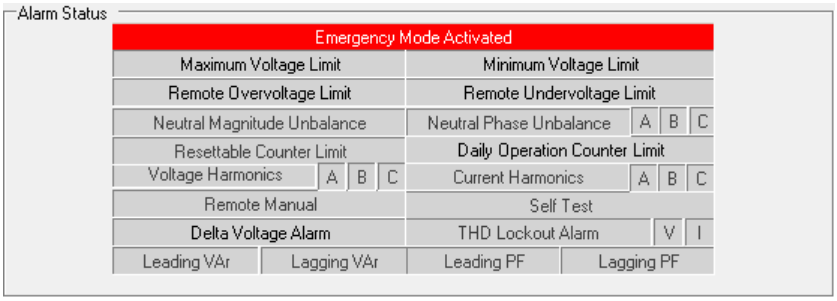


Figure 3-4 CapTalk Metering and Status Screen – Emergency Mode ACTIVATED

HMI Emergency Mode Alarm and Status Indicator

When the control detects an Emergency Mode Activated condition, the HMI will display the following cycling alarm message:

```
Emergency V Loss
Triggered ...
```

In addition, the Emergency Mode Activated screen will be displayed in the **MONITOR/Cap Information** menu:

```
Active Emerg. Ctrl
Switch Pwr Phase A(B/C)
```

Reset Emergency Voltage Loss Alarm

The Emergency Voltage Loss Alarm may be manually reset, using any of the following methods:

- Front Panel HMI: Configuration/ Programmable Alarms/ Reset Emergency V Loss
- CapTalk Alarms screen: Setup/ Alarms/ Emergency Voltage Loss "Reset"
- DNP Communications
- Reboot the unit

Ratio Multipliers

Voltage and Current Multipliers

■**NOTE:** The voltage and current multipliers do not affect the regulation of the control. They are only used in the calculation of primary values.

▲**CAUTION:** The use of a voltage correction factor is incorporated in the calculation of primary quantities in the control. Although the control operation is not affected, erroneous values will be displayed and recorded if the VT correction factor is not included in the PT multiplier.

Primary quantities are displayed when voltage and current multipliers are set in the control. The voltage multiplier is:

$$V_{mult} = V_{pri}/(V_{sec} + V_{corr})$$

For a VT ratio of 7620/117 V and a voltage correction of 3 V, the multiplier is:

$$V_{mult} = 7620/(117 + 3) = 63.5$$

The voltage multiplier setting range is from 0.1 to 3260.0 in 0.1 steps.

The current multiplier is the value of the line CT primary rating divided by 0.2 A. For a CT primary rating of 1000 A, the multiplier is:

$$CT_{mult} = 1000/0.2 = 5000$$

The current multiplier setting range is from 1 to 32600 in 1 step increments.

Correction Factors

VT Ratio Correction

The operation of some capacitor banks is such that the internal VT does not provide the desired voltage ratio. In these cases, it is desirable to correct the VT secondary voltage to a 120 Vac reference base. This change is easily made in software, eliminating the need for a multi-tap sensing transformer.

The correction is derived from information provided by the capacitor bank original equipment manufacturer (OEM). The numerical value of the correction is the value, in volts, required to adjust the VT nominal secondary voltage to 120.0 volts. The correction range is ±15 volts in 0.1 volt increments.

■**NOTE:** The maximum allowable continuous VT secondary voltage is 140 volts. The correction is made only in software. As a result, the value of V_{Load} read on the control display will differ from that measured at the voltmeter test terminals by the percent of the correction voltage.

Phase Shift Compensation (with VAr Control Option)

With VAr Control Mode option, this feature allows the user to manually compensate for any phase shift deviation that could be introduced by the line sensor or line CTs. The range is from 0.0 to 359.0 degrees.

Save Block Auto at Power Off

Save Block Auto at Power Off allows the state of the "Block Auto Operation" communication command to be Saved or Not Saved when power has been lost. The default is Disabled "DON'T SAVE".

Capacitor Bank Metering Options

The **Setup/Configuration/Cap Bank Settings** screen (Figure 3-1) contains a Metering section which allows the selection of Primary Power Metering Units and Phase Angle Reference.

Primary Power Metering Units may be selected as Kilo or Mega (default). The CapTalk Metering & Status screen Primary Metering values (Watts, VAr, VA) are scaled based on this selection. This setting applies to the CapTalk Metering & Status screen only; the HMI always displays power values in Mega.

The **Phase Angle Reference** setting is used to set the phase reference for the phase angle calculation in the phase angle DNP points. The Phase Angle values are available as DNP points. The Phase Angles of currents and voltages are calculated from real and imaginary component quantities, and are also calculated in reference to the phase selected in the Phase Angle Reference dropdown. The selection is also available as a DNP point.

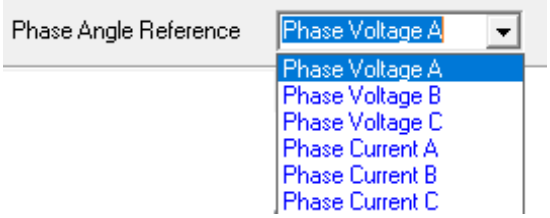


Figure 3-5 Phase Angle Reference Selection Dropdown Menu

CAPACITOR BANK/SWITCH STATUS

■**NOTE:** At bootup, if bank status is enabled, the control will determine the current status of the bank based on bank closed and bank open settings.

■**NOTE:** When the capacitor bank switch auxiliary contacts are wired to the M-6283A status inputs, and **Bank Switch Detect** is enabled, this becomes the absolute method of determining the Switch State. The settings for either 52a or 52b supersede any other means of changing bank status, even when neutral current is available and selected for bank status.

Capacitor bank Open or Close status can be determined by measuring the neutral current. Typically there will be some level of current in the neutral (1 to 10 Amps) due to capacitor tolerance differences from phase to phase due to unbalance loading and untransposed lines, when the bank is Closed. Likewise when the bank is Open there will be a smaller amount of current in the neutral (1 to 250 mA) due to the stray capacitance to ground and other induced noise. Using these two neutral current levels, Open status as well as Closed status can be verified. Capacitor bank status can also be confirmed, more reliably, if capacitor bank switch auxiliary contacts are wired to the M-6283A status inputs.

In some systems, it is common practice to retry capacitor bank operations to ensure operation of stuck capacitor bank switches when bank status is available. The M-6283A offers the user a choice of whether to retry an operation or not.

If the command for Open has been given, the control measures the discrete Fourier transform (DFT) based neutral current and compares this measurement to the Bank Status Open current limit (0.10 to 100.00 A). If the measured neutral current exceeds the programmed limit after the switch operation, either a switch failed to operate or a capacitor is defective. The control can initiate an alarm output to the user at this point through an unsolicited report (DNP users only) if enabled. The control may also retry the Open operation in an attempt to clear the unbalanced current condition, if enabled. There will not be any retry operations if the command is the same repeated command. Retry operation is applicable only in Auto and Remote modes.

If the Close command has been given, the control compares the measured neutral current to the programmed Bank Status Closed and Bank Status Open current limits (0.10 to 100.00 A). If the measured current is above the Closed limit or below the Open limit and the time delay has expired, the control will generate an alarm through unsolicited report. If Retry Operation is enabled, the control will then also retry the close operation to clear the unbalanced condition. There will not be any retry operations if the command is the same repeated command. Retry operation is applicable only in Auto and Remote modes.

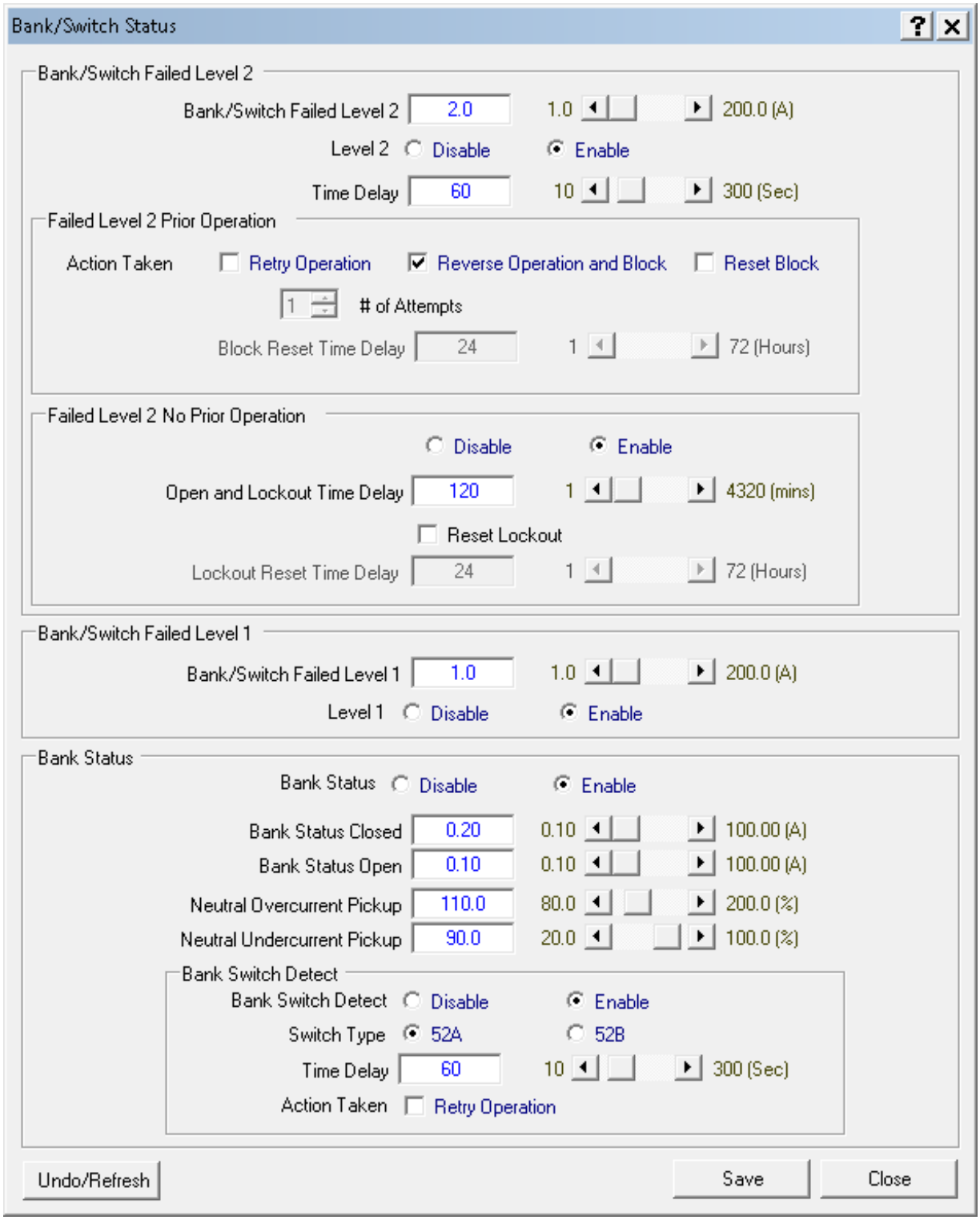


Figure 3-6 Bank/Switch Status Settings Screen

Bank Status Close and Open

The Bank Status Close and Open settings, when enabled, are used to verify whether the Capacitor Bank is Open or Closed using neutral current measurements. When all three Capacitor switches are closed, the magnitude of the measured neutral current should be between the Bank status Closed and Open settings. When all three Capacitor switches are open, the neutral current should be below the Bank Status Open setting.

Before Setting the Bank Status Close Limit, first calculate what the expected Neutral Current will be if the capacitor banks are not all in the same Close or Open state. Once that value is calculated, then set the Bank Status Closed Limit to a value less than the Neutral Undercurrent Pickup setting. This ensures that an unbalanced condition will be detected properly.

■**NOTE:** The Neutral Unbalance Front Panel LED does not illuminate for Bank Status conditions.

Neutral Phase Unbalance Alarm

Once Neutral Current has been detected outside the Bank Status Close and Open settings, the Neutral Current Algorithm will indicate a Phase Unbalance if one exists by comparing the phase angle of the Neutral Current to expected values based on the bank status (Open or Closed) for each phase. The control will indicate a Phase A, B, or C Unbalance Alarm indicating which phase or phases are causing the unbalance. If the phase angle does not fall within expected guidelines, then a general Phase Unbalance Alarm is generated instead. (The phase(s) causing the unbalance cannot be determined.) Table 3-1 shows the expected Phase angle values for all conditions.

Open/Close state of each Phase			Phase angle of I_N with respect to VA
A	B	C	
Open	Open	Open	N/A
Close	Open	Open	90° ± 10°
Open	Close	Open	-30° ± 10°
Open	Open	Close	210° ± 10°
Close	Close	Open	30° ± 10°
Open	Close	Close	270° ± 10°
Close	Open	Close	150° ± 10°
Close	Close	Close	N/A

Table 3-1 Expected Phase Angle Values

Neutral Unbalance Current Detection

Neutral Unbalance current in a capacitor bank neutral circuit can be caused by a number of system operational conditions. These may include Can or Pack failure in a phase capacitor, blown fuse(s), stuck switch(es) and/or unbalanced loading. Any of these conditions will be seen as a current flowing in the neutral of the capacitor bank.

To determine which condition is the most likely cause of the unbalance, the M-6283A Digital Capacitor Bank Control makes use of a neutral current input from the neutral circuit. This input may be developed in a number of ways, as an input to the cap bank control. The neutral unbalance input to the control can come from any one of the following:

- A fixed ratio donut type current transformer (CT) with a 200 mA secondary
- A split core CT with a 200 mA secondary
- A CT with a burden resistor across the secondary which develops a 0 to 10 volt representative signal such as a Fisher Pierce AT-929 Current Sensor
- A Fisher Pierce 1301 Current Sensor

Utilizing any one these input configurations, which are a direct measurement of current flowing in the neutral, and comparing the value with either Bank Status Open/Closed current limit, or hardwired bank switch status auxiliary contacts, the control can make differentiations as to the cause of the unbalance current flow.

Neutral Magnitude Unbalance Alarm

The Neutral Current algorithm also detects the health of the capacitor bank by implementing over and undercurrent functions. It calculates the expected magnitude of the neutral current based on the Capacitor bank size and measured voltage on each phase of the bank that is closed as follows:

$$Expected\ neutral\ current\ (I_{NE}) = magnitude\ of\ (I_A{*}a + I_B{*}b + I_C{*}c)$$

Where

$a = 1$ *if phase A is closed else* $a = 0$

$b = 1$ *if phase B is closed else* $b = 0$

$c = 1$ *if phase C is closed else* $c = 0$

$I_A = Q_{CAP} / (3{*}V_A)$

$I_B = Q_{CAP} / (3{*}V_B)$

$I_C = Q_{CAP} / (3{*}V_C)$

Q_{CAP} = *3 Phase Capacitor Bank Size (From Cap Bank settings menu in Configuration)*

V_A, V_B, V_C = *phase to ground voltage phasors*

I_A, I_B *and* I_C = *Capacitor Bank current phasors*

Neutral Overcurrent Pickup and Neutral Undercurrent Pickup settings determine how much deviation from expected Neutral Current magnitude will be allowed before a Neutral Magnitude Unbalance Alarm is generated. The Neutral Magnitude Unbalance Alarm is generated if the measured Neutral Current is either greater than the Neutral Overcurrent Pickup or less than the Neutral Undercurrent Pickup. A Neutral Magnitude Unbalance Alarm due to either an overcurrent or undercurrent condition is an indication of the deterioration of the capacitor bank or problems with the switches.

Bank/Switch Failed Measured Current (Level 1 OR Level 2 Enabled)

■**NOTE:** Bank/Switch Failed Level 1 and Level 2 settings are not available when Control Phase Selection is Independent Phase.

If either Level 1 or Level 2 alone is enabled and set to a value of current that is in the range of 1 to 200 Amps, the control has the capability of determining two types of failures:

- Failed Cap Bank Switch (if the bank is Open)
- Open Phase/Failed Cap Bank Switch (if the bank is Closed).

The current value chosen is dependent on the size of the capacitor bank and the line voltage of the circuit (see Table 3-2). This is used to detect a single switch stuck in the closed position when the bank has been commanded to Open. When this occurs, the level of unbalanced current seen in the neutral is typically in the range referenced in Table 3-2.

KVAr/0	L - N Voltage		
	4160 V	7.2 kV	19.9 kV
100	24.04 A	13.89 A	5.03 A
200	48.08 A	27.78 A	10.05 A
300	72.12 A	41.67 A	15.08 A
400	96.15 A	55.56 A	20.10 A

Table 3-2 Calculated Values of Unbalanced Current in the Cap Bank Neutral

Likewise, if the capacitor bank is Open and a command to Close is issued, and Level 1 or Level 2 current has been exceeded, it could be the result of a switch that did not close completely or an open phase capacitor or a blown fuse. In this scenario, two of the capacitor bank switches would be closed. The neutral unbalance current is the same whether one or two phases are closed. The value is only dependent on the kVAr size of the capacitor and the line voltage. Table 3-2 is again referenced.

If either failure mode occurs, the control can be programmed to retry the previous operation, or to reverse the previous operation, or both. In the case where both retry and reverse operations are enabled, the retry operation will always be performed before the reverse operation, and each operation will only be performed once. There will not be retry/reverse operations (due to neutral current) if the same repeated Close/Open command is detected. Retry and Reverse operations are applicable only in Auto and Remote modes.

Bank/Switch Failed Measured Current (Level 1 AND Level 2 Enabled)

■**NOTE:** Bank/Switch Failed Level 1 and Level 2 settings are not available when Control Phase Selection is Independent Phase.

If the phase capacitors are large enough to be constructed from multiple segments or packs within each capacitor can, it may be possible to detect a pack failure within a can, by setting both current detection levels.

This is accomplished by setting the Bank/Switch Failed Level 2 to the value shown in Table 3-2, which indicates a complete failure or one or two phases of the bank.

A value can then be chosen for the Bank/Switch Failed – Level 1 which is a fraction of the current of Bank/Switch Failed – Level 2. To properly set this value, it is necessary to know the internal connection geometry of the capacitors being used in the bank, such that a failure of one of the internal packs or segments of the capacitor will generate a Bank/Switch Failed – Level 1 signal. This will work if a segment fails open in paralleled segment internal connection geometry, or if a segment fails short in a series segment internal connection geometry for higher voltage capacitors. A short in a paralleled geometry will open the capacitor phase fuse, and an open in a series geometry will generate a Bank/Switch/Failed – Level 2 signal.

It is recommended that the user consult the capacitor manufacturer to obtain data on the internal construction geometry of the capacitors used.

Bank/Switch Failed Level 2 Prior Operation Element

The "Prior Operation" element of the Bank/Switch Failed Level 2 feature considers detected neutral current within a prescribed time period (Prior Operation is considered to be within 60 seconds of switch operation) and in the event that the detected neutral current exceeds the Bank/Switch Failed Level 2 setpoint, activates user selected "Prior Operation" actions in a specific sequence.

The "Prior Operation" element includes the following user selectable actions:

- Retry Operation (1 to 9 Attempts)
- Reverse Operation (1 Attempt)
- Block Operation (Block Reset Time Delay 1 to 72 hours)

■**NOTE:** If at any time during the "Prior Operation" sequence of actions the control is placed in Manual Mode or detected neutral current decreases to less than the Bank/Switch Failed Level 2 setting the sequence of actions will stop and normal control operation will resume.

Sequence with all "Prior Operation" actions enabled

When a capacitor bank performs an Open or Close operation, and within 1 minute of the Open/Close operation the detected neutral current exceeds the Bank/Switch Failed Level 2 setting for the duration of the Bank/Switch Failed Level 2 Time delay setting, the control will sequence through the following actions as long as detected neutral current exceeds the Bank/Switch Failed Level 2 setting:

1. Retry the operation (up to nine retry operations)
2. Attempt a reverse operation (1)
3. Block Operation
4. HMI displays "NC Block in effect", CapTalk Metering and Status screen Block Status indicates a Neutral Current Block is in effect
5. Start "Block Reset Time Delay" timer
6. Remove Block control operation when "Block Reset Time Delay" timer times out
7. HMI and CapTalk Metering and Status screen no longer indicate a Neutral Current Block is in effect
8. Resume operation

If at any time the detected neutral current decreases to less than the Bank/Switch Failed Level 2 setting the sequence of actions will stop and normal control operation will resume.

During a Retry Operation the control will ignore the controlling parameter (voltage or current) in relation to being in band or not unless the parameter exceeds the band opposite the operation it is Retrying. If that occurs, the control will halt the Retry Operation function and perform the required operation instead. For example, if Retrying a Close and a voltage based controls measured voltage rises above the Control Open Voltage setting and times out, the Control will stop the Retry Close operation and perform the Open.

During a Reverse Operation, the control will ignore the controlling parameter (voltage or current) in relation to being in band or not unless the parameter exceeds the band limit of the operation it is reversing to. If that occurs, the control will halt the Reverse Operation and Block function and perform the required operation instead. For example, if opening due to a Reverse condition after a Close operation and a voltage based controls measured voltage rises above the Control Open Voltage setting and times out, the Control will stop reversing and perform the normal Open operation.

The "Block Reset Time Delay" timer is stored on a loss of power to the control. When power is restored, the control will compare the Block start date/time with the unit's date/time and apply the remaining time if any. If the time is exceeded, the block will be cleared/reset.

Clear Neutral Current Block (Prior Operation)

The Neutral Current Block initiated in the "Prior Operation" scheme can be cleared/reset by any of the following methods:

- Remotely from the CapTalk/ Alarms screen "Neutral Current Block Reset" selection.
- Remotely through a DNP Binary/Control Output point named "Reset NC Block".
- From the Front Panel HMI CONFIGURATION/Programmable Alarm "Rst Neutral Block" menu.
- The capacitor bank switch is manually operated in the direction that caused the block and the detected neutral current is less than the Bank/Switch Failed Level 2 setting.
- The "Lockout Reset Time Delay" is enabled and the timer expires.

Bank/Switch Failed Level 2 No Prior Operation Element

The "No Prior Operation" element of the Bank/Switch Failed Level 2 feature considers detected neutral current after a prescribed time period (No Prior Operation is considered to be greater than one minute following switch operation) and in the event that the detected neutral current exceeds the Bank/Switch Failed Level 2 setpoint, activates user selected "No Prior Operation" actions in a specific sequence.

The "No Prior Operation" element includes the following user selectable actions:

- Open and Lockout Time Delay (1 to 4320 minutes)
- Lockout Reset Time Delay (1 to 72 hours)

Sequence with all "No Prior Operation" actions enabled

When a capacitor bank performs a Close operation and greater than 1 minute after the Close operation the detected neutral current exceeds the Bank/Switch Failed Level 2 setting for the duration of the Prior Operation Time delay setting, the control will sequence through the following actions as long as detected neutral current exceeds Bank/Switch Failed Level 2 setting:

1. Start "Open and Lockout Reset Time Delay" timer
2. When "Open and Lockout Reset Delay Timer" times out, capacitor bank Open is initiated and control operation is locked out
3. HMI displays "NC Lockout in effect", CapTalk Metering and Status screen Block Status indicates a Neutral Current Lockout is in effect
4. Start "Lockout Reset Time Delay" timer
5. Remove control operation lockout when "Lockout Reset Time Delay" times out
6. HMI and CapTalk Metering and Status screen no longer indicate a Neutral Current Lockout is in effect
7. Resume operation

If at any time the detected neutral current decreases to less than the Bank/Switch Failed Level 2 setting the sequence of actions will stop and normal control operation will resume.

Clear Neutral Current Lockout (No Prior Operation)

The Neutral Current Lockout initiated in the "No Prior Operation" scheme can be cleared/reset by any of the following methods:

- Remotely from the CapTalk/ Alarms screen "Neutral Current Lockout Reset" selection.
- Remotely through a DNP Binary/Control Output point named "Reset NC Lockout".
- From the Front Panel HMI CONFIGURATION/Programmable Alarm "Rst Neutral Lockout" menu.
- The capacitor bank switch is Closed manually and the detected neutral current is less than the Bank/Switch Failed Level 2 setting.
- The "Lockout Reset Time Delay" is enabled and the timer expires.

The "Lockout Reset Time Delay" timer is stored on power loss and upon power restoration it will compare the Lockout start date/time with the unit's date/time and apply the remaining time if any. If the time is exceeded, the lockout would be cleared/reset.

If the control is placed in Manual from the front panel Auto/Manual switch and a neutral overcurrent alarm is received, the control will not take action to operate the bank to retry, reverse, or lockout. It will alarm only.

Bank/Switch Failed Level 1

The Bank/Switch Failed Level 1 feature provides a neutral current element that has a range of 1.0 to 200.0 Amps. When the Level 1 neutral current is exceeded the control initiates a "Bank/Switch Failed Level 1" alarm.

Bank Switch Detect

■**NOTE:** When the capacitor bank switch auxiliary contacts are wired to the M-6283A status inputs, and **Bank Switch Detect** is enabled, this becomes the absolute method of determining the Switch State. The settings for either 52a or 52b supersede any other means of changing bank status, even when neutral current is available and selected for bank status.

When the control has been physically connected to the Bank Switch Contacts, enable Bank Switch Detect. When Bank Switch Detect is enabled, 52A is the default configuration of the switch status inputs contact type. When selected to 52A, a high on an input equates to a Closed capacitor switch. When selected to 52B, a high on an input equates to an Open capacitor switch.

COUNTERS

The control includes the Operation Counter, Daily Operation Counter, and Resettable Operation Counter.

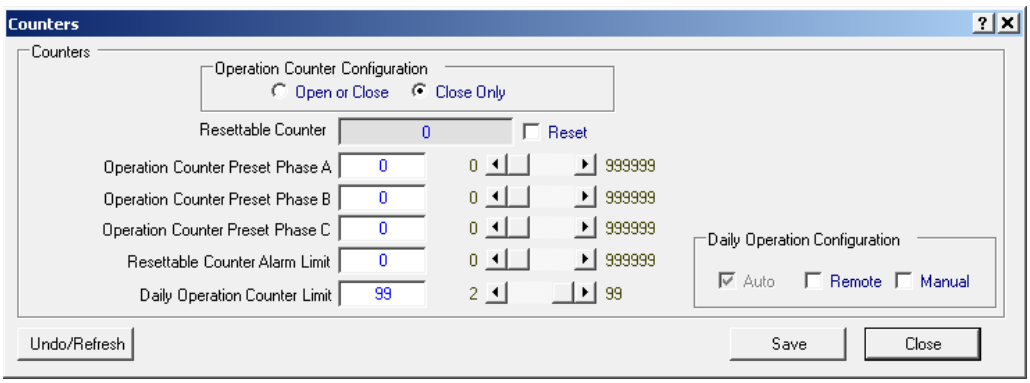


Figure 3-7 Counters Screen

Operation Counter Configuration

The method by which these counters count capacitor bank operations is determined by the "Operation Counter Configuration" setting. The control will count an operation for either a "Close Only" or an "Open or Close" operation.

■**NOTE:** Counters will not increment for retry operations (close to close or open to open).

Operation Counter

The Operation Counter will increment based on the Operation Counter Configuration. It allows the user to preset a value up to 999,999. The Operation Counter will increment from the preset value. Setting the counter to zero resets the counter.

When Bank Switch Detect is enabled, the individual phase operation counters will use the switch status inputs (52a or 52b) as the method of incrementing. For example, if the inputs are set to 52b and the operations counter configuration is set to "Close Only", the operations counter will only increment when the physical switch status inputs are low (Closed).

The counter accommodates 999,999 operation counts and the number of counts stored in memory is not affected by a loss of supply power. Total operation count is displayed in the HMI Monitor/Cap Information menu. This counter can be preset to any value up to 999,999 in the Configuration/Cap Settings menu.

Resettable Operation Counter

The Resettable Operation Counter will increment based on the Operation Counter Configuration "Close Only" or "Open or Close". The Resettable Operation Counter accommodates 999,999 operation counts. The number of counts is stored in non-volatile memory and is not affected by a loss of supply power to the control. The total number of operation counts is displayed in the Status Menu. The Resettable Operation Counter can be reset to zero.

Resettable Operation Counter Alarm Limit

The Resettable Operation Counter Alarm Limit feature allows the user to set a predefined alarm point for the number of capacitor bank operations initiated by the control. Entering a zero value disables the alarm. When the Resettable Operation Counter Alarm Limit setting is exceeded, the Resettable Counter Limit alarm will be displayed on the CapTalk Metering and Status screen and on the control HMI screen.

Daily Operation Counter

The Daily Operation Counter will increment based on the Operation Counter Configuration ("Close Only" or "Open or Close") and the Daily Operation Counter Configuration (Operational Mode dependent). The Daily Operation Counter counts all operations in Auto. Auto Mode is enabled by default and cannot be disabled. The Daily Operation Counter can also be configured such that Remote and/or Manual mode operations are counted.

The Daily Operation Counter also includes a Daily Operation Counter Limit that can be set from 2 to 99 operations. When the set value is exceeded, ALL Open and Close operations are blocked until 12:00 AM. However, this feature allows a single Open by Remote or Manual if the capacitor bank is Closed when the Daily Operation Counter Limit is exceeded.

DELAY SETTINGS

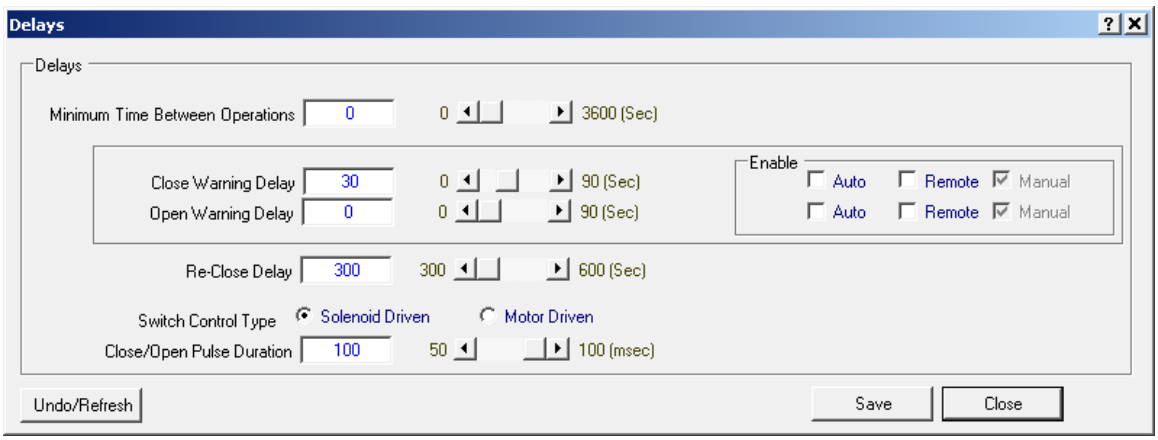


Figure 3-8 Delays Screen (Individual Phase Switching Not Enabled)

Minimum Time Between Operations Delay

The "Minimum Time Between Operations Delay" will begin timing each time an Open or Close capacitor bank operation is completed. When it is set to a non-zero value, this setting inhibits the Open and Close Timers from timing down when the Control Open and Close Limits have been exceeded from the time an operation completes until the timer expires. The Minimum Time Between Operations Delay only applies to Auto Control Mode and does not prevent capacitor bank operations that are required when Control Mode Limits are exceeded.

For example, if the control is in Automatic Voltage Control Mode and closes, the Minimum Time Between Operations Delay timer will start timing. If the voltage exceeds the Control Open Voltage setting, the Open Definite (or Inverse) timer will not begin timing until the Minimum Time Between Operations Delay timer has timed out. Then the Open Definite (or Inverse) timer can begin timing.

The Minimum Time Between Operations Delay will run concurrently with the Re-Close Delay without affecting the Re-Close delay's blocking of a Close until it expires. Also, the Minimum Time Between Operations Delay timer does not affect timing or capacitor bank operation due to exceeding the Control Mode Limits.

When the Minimum Time Between Operations Delay is active the HMI displays the timer counting down alternating with the user lines.

Close/Open Warning Delay

The Close Warning Delay is the time delay before the Close contact is energized. The delay is indicated on the front panel by the flashing Close LED. The Open Warning Delay is the time delay before the Open contact is energized. The delay is indicated on the front panel by the flashing Open LED. The Close and Open Warning delays can be enabled or disabled in Auto Control Mode and/or Remote Control Mode.

■**NOTE:** Close and Open warning delays are enabled in Manual mode at all times.

Re-Close Delay

The Re-Close Delay defines the minimum time that the control will wait before allowing a Close operation after an Open operation. This delay is indicated on the HMI display by a cycling message indicating how much time (in seconds) is left before a Close operation will be executed. In the event the unit is powered down, the timer will keep track of time elapsed such that on power restoration, if the Re-Close Delay timer would have elapsed, the control recognizes this and allows a close operation without resuming the timer value at the moment of power down.

Capacitor Bank Switch Type Selection

Pole top capacitor bank switches appear to fall into one of two main categories for their actuating mechanisms; solenoid driven switches and motor driven switches. There also appear to be combinations of these that Open with one method and Close with another. Please consult the factory if it is not obvious how to program the M-6283A for a given cap bank switch type.

Solenoid Driven Switches

Solenoid Driven Switches use Open and/or Close motor coils to pull in a moveable actuator that is mechanically connected to the interrupting medium switch contacts. These contacts connect and disconnect each phase's capacitor(s) from the feeder. The actual interrupting medium can include vacuum, gas, oil, air, or solid dielectrics.

These solenoid motor coils typically draw in excess of 10 Amperes at 120 Vac for each phase, for a short time duration while the actuator is in transit. Typical values are several cycles, (20 to 40 ms). Some motor coils disconnect after the actuator operates, and some do not. Those that do not disconnect, continue to draw a substantial current, until the control output shuts off.

To prevent unnecessary current draw and subsequent heating, the control includes a Close/Open Pulse Duration Timer for use with solenoid switches that is user settable.

■**NOTE:** If "Solenoid Driven" Switch Control Type is chosen, the user MUST set the Close and Open time delay for Auto Control Mode to at least equal to 10 seconds. This allows the line voltage to settle and will prevent "hunting" when reverse operation is selected in the Bank/Switch neutral current level detection.

Motor Driven Switches

Motor Driven Switches use a Geneva Drive-type mechanism with a small bi-directional motor that typically stores energy in a mechanical spring. That spring actuates the high voltage, high current switch contacts. These motors usually run from 2 to 5 seconds to load the spring for a switching operation that lasts a few milliseconds. The motor runs in one direction for an Open operation and in the opposite direction for a Close operation. The switch has auxiliary contacts that open the motor winding circuit just actuated, eliminating a stalled rotor condition since the motor cannot continue in that direction after switching once without switching in the opposite direction.

To match these characteristics, the control includes a Close/Open Pulse Duration Timer for use with motor driven switches that is user settable.

Close/Open Pulse Duration

Close/Open Pulse Duration is the period of time that the Close or Open contact stays energized. The M-6283A includes two Close/Open Pulse Duration setting ranges. When connected to a control using CapTalk, or accessing the unit from the HMI, the firmware/software autimatically detects whether a six output board is present allowing Independent Phase Switching. The Open/Close Pulse Duration settings are available based on the output board detected and the Switch Type selection:

- Six Output Board: Close/Open Pulse Duration based on the Switch Type selection:
  - Solenoid Driven, 50 to 300 msec in 1 msec increments.
  - Motor Driven, 5 to 30 seconds in 1 second increments.
- Two Output Board: Close/Open Pulse Duration based on the Switch Type selection:
  - Solenoid Driven, 50 to 100 msec in 1 msec increments.
  - Motor Driven, 5 to 15 seconds in 1 second increments.

■**NOTE:** When using CapTalk in File Mode, the user must enable or disable Independent Phase Switching. This selection will display the applicable Close/Open Pulse Duration setting.

TEMPERATURE UNIT

The Temperature Unit feature allows the user to select either Fahrenheit or Celsius. This setting is used in the following features:

- Auto Control Mode Temperature Override
- Temperature Metering
- Setpoint Profile Switching Trigger (Above and Below Temperature)

Figure 3-9 Temperature Unit Screen

VAR AND POWER FACTOR ALARMS

With the advent of Integrated Volt VAr Control (IVVC), utilities are starting to monitor and control the voltage and power factor to reduce load and line losses. Power factor can only be controlled to the resolution of the smallest switched capacitor bank on the circuit. For instance, if a utility has 600 kVAr switched banks on a feeder and enough of them are in service, then the power factor should always be between 600 kVar Lead and 600 kVAr Lag. If the power factor is outside this range for any length of time, then one of the following conditions is occurring:

- When the power factor is lagging more than 600 kVAr the circuit may need more capacitor banks.
- When the circuit is more than 600 kVAr lagging and one or more banks are not closed, then there is an issue with the control scheme (whether it is a central control or local control).
- An existing bank may be out of service. By having the controls measure the power factor ranges at different locations on the grid, users will see an alarm if the control algorithm is not functioning properly or if the controls or capacitors of neighboring cap banks are out of service.

This can also be caused by improper settings. A capacitor bank may need to close to provide VArs under a lagging power factor but may be blocked due to an out of range delta voltage or due to harmonics. This will further alarm the remote users as to the local conditions (Figure 3-10).

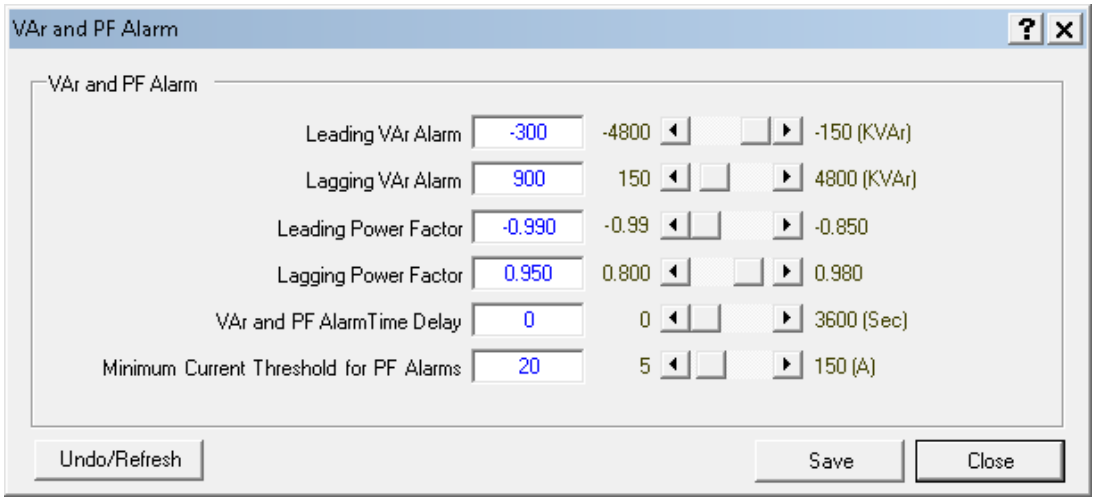


Figure 3-10 VAr and Power Factor Alarms Screen

PHASE OVERCURRENT

The control measures three phase load currents providing phase overcurrent detection. Phase Overcurrent detection can be used to detect the faulty segment of the distribution feeder. When the control detects an overcurrent condition, it triggers an input to the Sequence of Events recorder and Oscillograph recorder for an Overcurrent Phase A, B, or C event and records which individual phase caused the event, along with the magnitude of current.

Any phase current that exceeds the pickup level (10 to 20000 Amps) will cause the control to start a Time Delay timer (1 to 8160 Cycles). When the Time Delay expires, the control issues an Overcurrent Phase (A, B, C) event. If at any time during Time Delay timing, the phase current value decreases to less than the pickup level, the Time Delay will reset. The control keeps track of which individual phase caused the event.

When the Phase Overcurrent function is enabled, if the Sequence of Events recorder is **not** enabled, a screen will be displayed prompting the user to enable Phase Overcurrent Sequence of Events. Select **Yes**, to display the Sequence of Events setup screen and select the desired Phase Overcurrent trigger.

■**NOTE:** To trigger the Oscillograph recorder, Phase Overcurrent must be selected as a trigger in the Oscillograph Setup screen. CapTalk does not display an Oscillograph prompt screen.

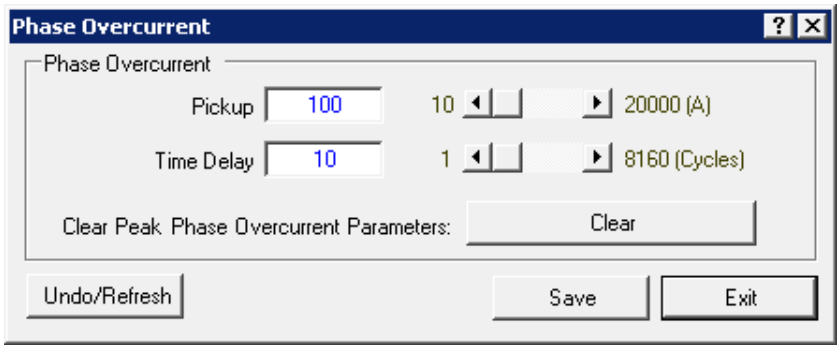


Figure 3-11 Phase Overcurrent Settings Screen

POWER UP OPEN COMMAND

When the Power Up Open Command is enabled and the Control loses power the following will apply when power is restored to the control except when in Manual Mode.

1. If the voltage is less than 85 V then the Control will continue the boot up sequence and wait until the voltage is greater than 85 V before continuing.
2. When the voltage is greater than 85 V, then the Control will issue an Open command, energizing the Open output, upon completion of the Warning Delay, if enabled.
3. The Bank Status will be set to Open
4. The Re-Close Delay Timer will be initiated

If the Control is in **Manual Mode**, when power is restored, then the Re-Close Delay Timer will be initiated and the Bank Status will not be changed from the value before power loss.

If the Control boots up in **Remote Mode** the following will apply:

- Remote Mode Limits Enabled:
  - The Control will issue an Open command, energizing the Open output, upon completion of the Warning Delay, if enabled.
  - Bank Status will be set to Open
  - The Re-Close Delay Timer will be initiated
- Remote Mode Limits Disabled:
  - The Re-Close Delay Timer will be initiated
  - The Bank Status will not be changed from the value before power loss.

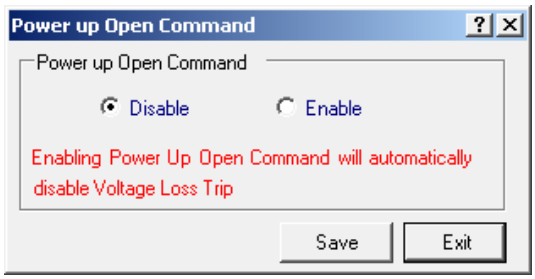


Figure 3-12 Power Up Open Command Screen

VOLTAGE LOSS TRIP

This feature is designed to work with the B-1649 Low Voltage Trip Circuit. When the Voltage Loss Trip feature is enabled, the Alarm contact is dedicated to interface with the B-1649 and is not available for normal use. When power to the control is lost, then the following conditions will apply upon boot up:

- The Bank Status will be set to Open.
- The Re-Close Delay Timer will be initiated.

If the following conditions are met: Bank Status is Close, and Voltage drops below 85 V, then the Control will initiate a reboot sequence.

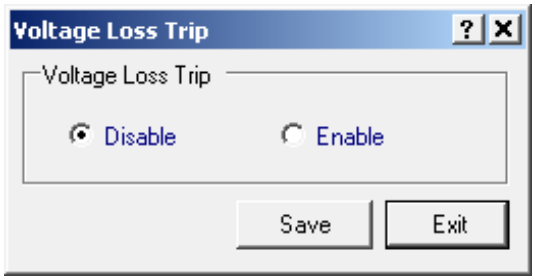


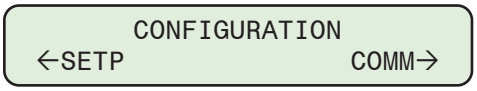
Figure 3-13 Voltage Loss Trip Screen

3.3 System Configuration from the HMI

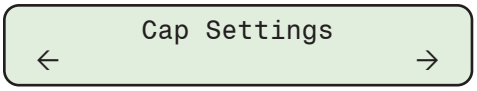
SYSTEM CONFIGURATION

The System Configuration settings detailed in this Chapter are also available in the Front Panel HMI. See **Chapter 2 Front Panel Operation** for an overview of the HMI Menu structure and navigation.

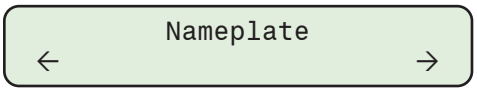
1. Press **CNFG**🡻 to advance to the CONFIGURATION menu.



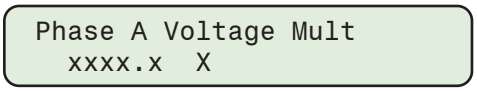
2. Press **ENT** or **CNFG**🡻 once. The unit will advance to the Cap Settings menu:



3. Press 🡸**MNTR** or **COMM**🡺 as necessary, to the "Nameplate" screen.



4. Press **ENT** or **CNFG**🡻 once. The control will display the following.

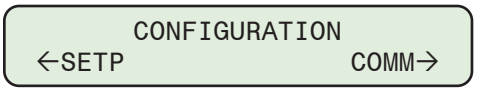


Continue through the Nameplate submenu to access the following Configuration screens:

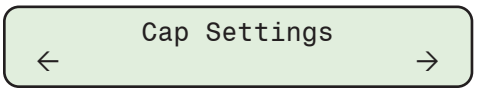
- Phase A/B/C Voltage Multiplier
- Phase A/B/C VT Correction
- Phase A/B/C Current Multiplier
- Neutral Current Multiplier
- 3 Phase Cap Bank Size
- Primary Nominal Voltage
- Control Phase Selection
- Input Terminal Setup
- High Energy Switch (optional)
- Switch Contact Type

ADDITIONAL CONFIGURATION SETTINGS

1. Press **CNFG**🡻 to advance to the CONFIGURATION menu.



2. Press **ENT** or **CNFG**🡻 once. The unit will advance to the Cap Settings menu:



3. Press 🡸**MNTR** or **COMM**🡺 as necessary, to navigate to the additional Configuration Sub-headers:

- Cap Settings
- Programmable Alarm
- System Clock
- CBEMA Setup
- Bank/Switch Status
- Common Settings
- Harmonics Setup
- THD Trip Settings
- Phase Overcurrent
- Data Logging
- Emergency Mode Settings

3.4 System Setpoints

SETTINGS PROFILES AND PROFILE TRIGGERING

The Settings Profiles are groupings of settings within the control created to allow changing from one group to another quickly based on internal or external triggers. Additionally, several methods of Triggering a change from one Setting Profile to another automatically are provided.

Settings Profiles

Settings Profiles are defined as a group of settings in the control that can be selected as the Active Profile either automatically based on selected triggers, or via SCADA. The Active Profile is defined as the Settings Profile currently in use providing the parameters the control is operating with. There are eight Settings Profiles that can be created in the control.

The user can name the Settings Profiles (Figure 3-14) and that name is displayed on the Profile Tab in CapTalk under the tab heading "Profile X". Once named, the name will be displayed along with the Profile Number at any location that it is displayed in CapTalk. The ability to name Profiles and display that name in the HMI is located in the Setpoints/Profile Settings menu. Profile names are limited to 16 alphanumeric characters.

Level 1 and 2 Access Code restrictions apply, Level 1 allows "Read Only" access to the settings that are contained in Profiles including being able to change the Active Profile. All other settings are protected by Level 2 Access Code.

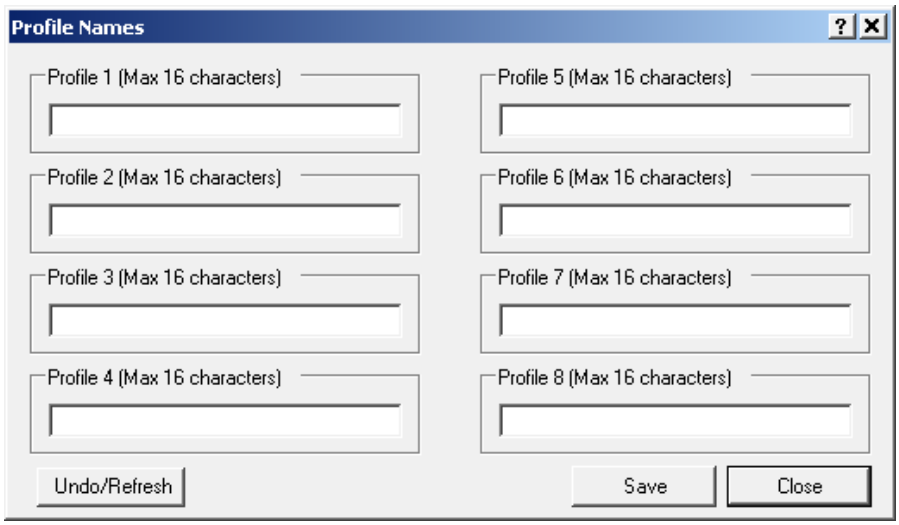


Figure 3-14 Profile Names Screen

Profile Triggers

A Profile Trigger is defined as a method of automatically switching from the Active Profile to one specified by the trigger. CapTalk includes the "Settings Profile Trigger" menu item in the Setup drop down menu.

Selecting the Settings Profile Trigger menu item opens the Settings Profile Trigger screen (Figure 3-15) which displays the triggers and allow each trigger to be assigned a profile. Once a trigger has been selected as a trigger for one profile, it is no longer available as a trigger for the other profiles. Only one trigger can be assigned to a profile with the exception of the SCADA trigger.

SCADA is the default trigger for all Settings Profiles. No other Profile Triggers are selected by default. Triggers may also be prioritized from 2 to 8 with the exception being SCADA, which is always Priority 1.

■**NOTE:** The SCADA Profile Trigger is always Priority 1 and cannot be changed.

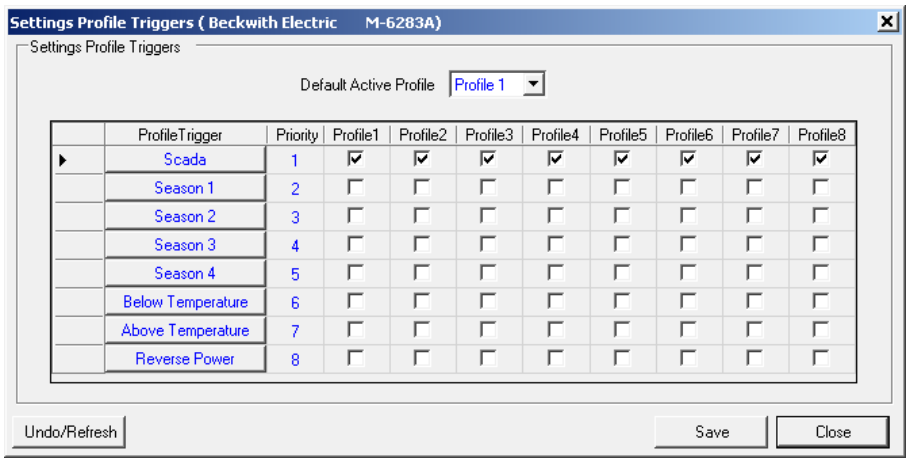


Figure 3-15 Settings Profile Trigger Screen

SCADA Profile Trigger

SCADA can be selected to trigger any profile up to all eight. An Analog Output DNP point named "SCADAHB Profile Switch" allows the user to change what Settings Profile is the Active Profile in the control as long as the Heartbeat is active.

When the DNP SCADAHB Profile Switch point is used to change the Active Profile, the control will only change to the specified profile if that profile has been selected in the control for SCADA. For example, if Profile 1 is not set to SCADA, but SCADA uses the "SCADAHB Profile Switch" point to change to Profile 1, the control will ignore the command and generate a DNP message, "Value Out of Range" in response to the Master.

Season Profile Trigger

Each Season Trigger allows the user to set the following parameters (Figure 3-16):

- **Start Date –** The starting date of the selected Season Trigger.
- **End Date –** The end date of the selected Season Trigger.
- **Start Time –** The starting time of the selected Season Trigger.
- **End Time –** Selecting the End Time Calculates the Duration and displays it rounded to the nearest tenth of a minute.
- **Duration –** Selecting Duration calculates the End Time and displays it rounded to the nearest tenth of a minute.
- **Recurrence Pattern –** Provides a choice between Daily and Weekly.

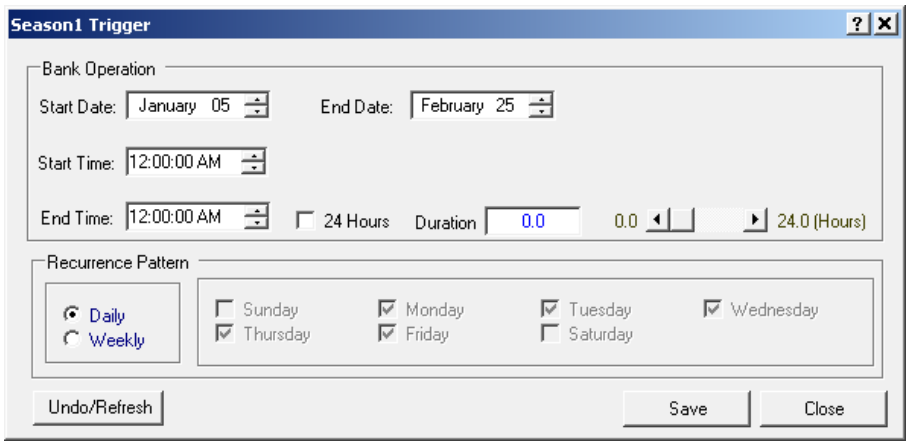


Figure 3-16 Season Trigger Screen

Above and Below Temperature Profile Triggers

The Above and Below Temperature Triggers (Figure 3-17 and Figure 3-18) provide the user with the ability to set a temperature between -40° and 185° F, or -40° and 85° C that will trigger a Settings Profile change when exceeded.

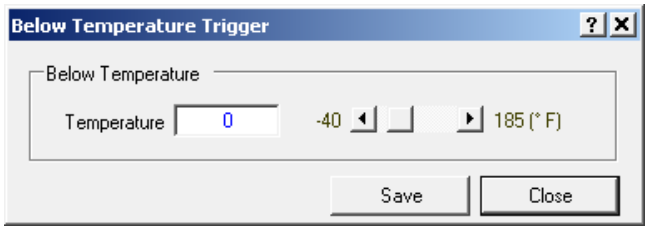


Figure 3-17 Below Temperature Screen

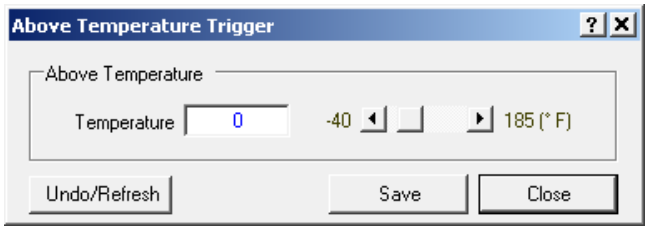


Figure 3-18 Above Temperature Screen

Manual Profile Switching Interactions

The following are examples of interaction between Automatic Profile Switching and Manual Profile Switching:

- If the user attempts to change the Active Profile from the HMI while a Profile Trigger (including Heartbeat) is in effect, the HMI will display the following message:

  ```
  Profile Sw. Active
  Disable Trig to Edit
  ```

  The user must disable the trigger or triggers that are active in order to change the active profile.

- If a user attempts to change the Active Profile from CapTalk while a Profile Trigger (including Heartbeat) is in effect, CapTalk will display a warning message (Figure 3-19). In order to change the Active Profile, the user must disable the trigger(s) that are active in order to change the Active Profile.

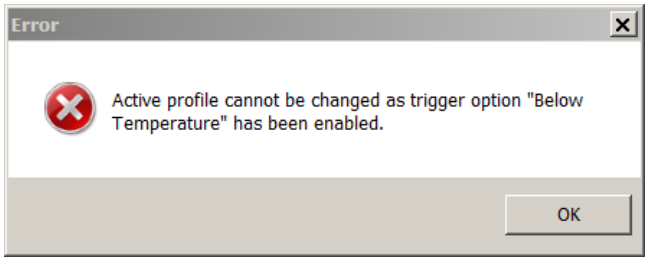


Figure 3-19 Profile Switching Warning Message Example

- If a user attempts to change the Active Profile via the DNP Analog Output (named Change Profile) while a profile trigger (including heartbeat) is in effect, the control will not act on the request but will respond with a DNP error. In order to change the Active Profile, the user must disable the trigger(s) that are active in order to change the active profile.

Configuring Settings Profile Triggers from CapTalk

The Settings Profile Triggers can only be configured from the CapTalk "Settings Profile Triggers" (Figure 3-15) screen.

1. Select **Setup/Settings Profile Triggers** from the CapTalk toolbar.
2. If desired, select the "Default Active Profile" (1 through 8).
3. If desired, Prioritize the Profile Triggers by dragging and dropping them in the desired priority order.

■**NOTE:** The SCADA Profile Trigger is always Priority 1 and can not be changed.

4. Select the desired Profile Trigger for each Settings Profile.

Season Profile Trigger

▲**CAUTION:** The control will immediately respond to the new Settings Profile Trigger settings when the new Profile Trigger settings are saved to the control.

1. For those Profiles assigned "Season 1, 2, 3 or 4" select the respective Season. CapTalk will display the corresponding Season Settings screen (Figure 3-16). Enter the desired settings.
2. Select **Save**. CapTalk will display a "Confirm Writing to Device" confirmation screen.
3. Select **OK**. CapTalk will display a "Setpoints Successfully Written to Control" confirmation screen.

Below/Above Temperature Profile Triggers

▲**CAUTION:** The control will immediately respond to the new Settings Profile Trigger settings when the new Profile Trigger settings are saved to the control.

1. If a Profile has been assigned to the Below or Above Temperature trigger(s), then select **Below or Above Temperature**. CapTalk will display the applicable Temperature screen Figure 3-17 or Figure 3-18. Enter the desired Below or Above Temperature setting.
2. Select **Save**. CapTalk will display a "Confirm Writing to Device" confirmation screen.
3. Select **OK**. CapTalk will display a "Setpoints Successfully Written to Control" confirmation screen.

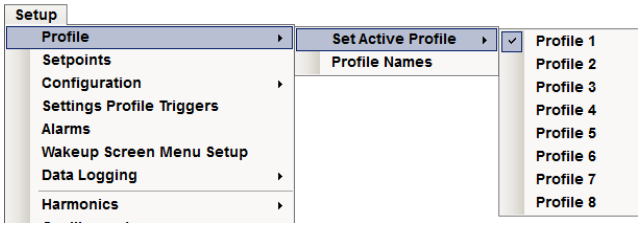
Reverse Power Profile Trigger

▲**CAUTION:** The control will immediately respond to the new Settings Profile Trigger settings when the new Profile Trigger settings are saved to the control.

1. If a Profile has been assigned to the Reverse Power trigger, then select "Reverse Power". No additional settings are necessary.
2. Select **Save**. CapTalk will display a "Confirm Writing to Device" confirmation screen.
3. Select **OK**. CapTalk will display a "Setpoints Successfully Written to Control" confirmation screen.

Setting the Active Setpoint Profile from CapTalk

1. Start CapTalk, then establish communications with the target control.
2. Select **Setup/Set Active Profile** from the CapTalk toolbar.



▲**CAUTION:** The control will immediately respond to the new Active Setpoint Profile settings.

3. Select the desired profile to activate. The Active Profile will be indicated in the menu dropdown and the CapTalk Lower Information Bar (Figure 3-20).

   The Active Profile can also be selected from the Lower Information Bar as well.

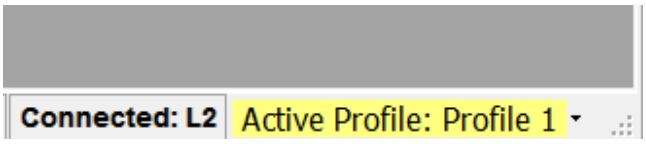


Figure 3-20 Select Active Profile From CapTalk Main Screen Lower Information Bar

EDITING SETPOINT PROFILES

Selecting a Setpoint Profile for Editing from CapTalk

Editing Setpoint Profiles from CapTalk is accomplished from the "Setpoints" screen (Figure 3-21). Selecting the desired Profile Tab presents the setpoints for editing. When connected to a control the **Save** selection saves all settings for each individual Profile to the control. In File Mode, File/Save must be selected to capture settings changes in the File.

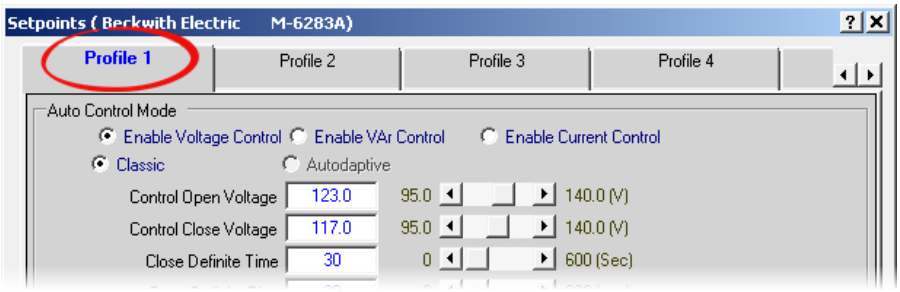


Figure 3-21 Setpoints Screen – Select Profile for Editing

Copy Profiles

From the Setpoints Screen, the selected profile may be copied to other profiles. The Copy Profiles selection is accessed by right-clicking on the active profile tab as shown below.

CapTalk will display the Copy Profiles screen (Figure 3-22). Select the destination profile(s) or Select All button. Select **OK** to copy the profiles and close the Setpoints window.

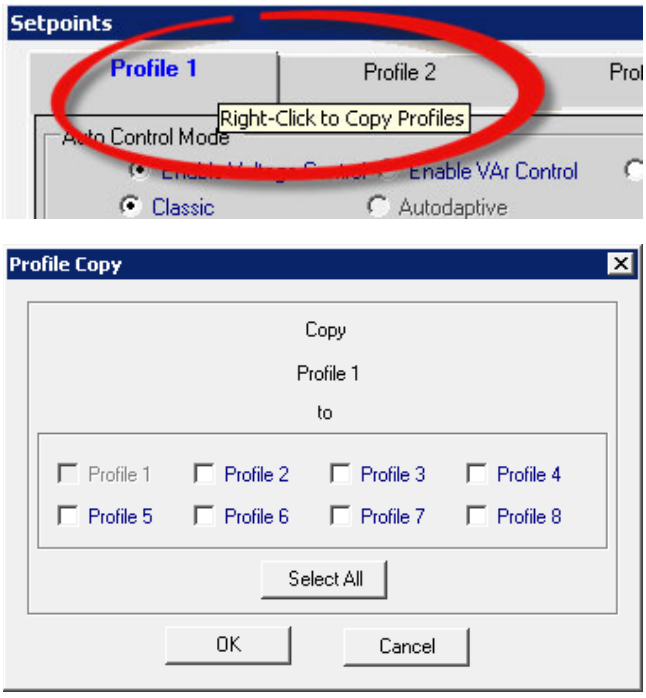


Figure 3-22 Profile Copy Screen

COMPARING SETPOINT FILES

Comparing Setpoint Files does not require CapTalk to be connected to a relay as long as the files to be compared are present on the PC. To compare two setpoint files proceed as follows:

1. Start CapTalk.
2. From the CapTalk menu bar select **File/Compare** and select ".cpt Files".
   CapTalk will display an "Open – File to Edit or Both Files" screen with a default file extension of ".cpt".
3. Navigate to the desired "File to Edit or Both Files" location.
4. If the files to be compared are located in the same directory, both files may be selected and opened in one step. Select the desired file(s) and then select Open. If only one file was selected, CapTalk will display an "Open – Reference File or Older File" screen with a default file extension of ".cpt".
5. Navigate to the desired Reference File location.
6. Select the desired Reference File and then select Open. CapTalk will perform a comparison of the selected files and display the results (Figure 3-23).

■**NOTE:** If a Selected Setup Points file is compared with an All Points file, CapTalk will display an error message and close the File Compare window.

The CapTalk File Compare results screen includes the following features:

- Print/Print Preview
- Edit the newer file settings from the File Compare screen by selecting the settings header hyperlink to display the settings screen. Changes may be saved into the newer Setpoint File.
- Save – allows any changes to be saved into the newer Setpoint File.
- Options/Show Settings Link if Equal – allows the user to also display those setting hyperlinks that are the same in both files.
- Options/Clone Next Function Clicked – clones the selected function (by clicking on the Settings Link) from the "Reference" file to the "Edit" file. System settings and Communication settings cannot be cloned.

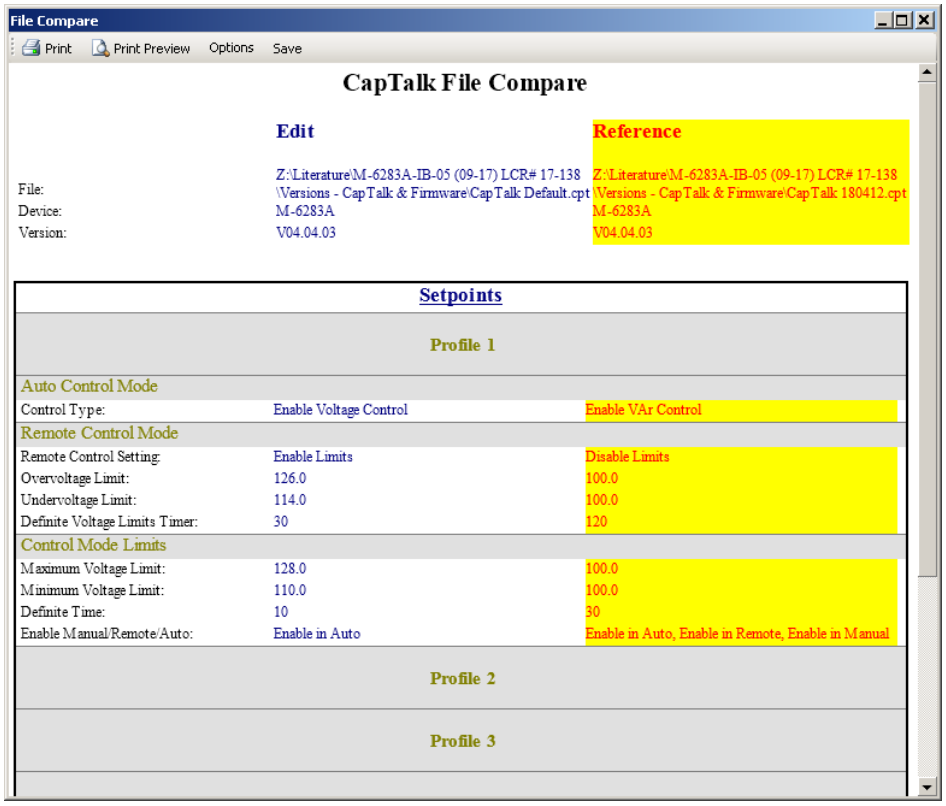


Figure 3-23 CapTalk Setpoint File Compare Results Screen

DELTA VOLTAGE OVERVIEW

Delta Voltage is a calculated average of the measured value of the change in voltage just before a Capacitor Bank operation and 1 second after the Close/Open Pulse Duration setting in the control (1.1 second for solenoid if the setting is at default, and 8 seconds for motor). Any one of the following conditions will result in the measured delta voltage not being used in the delta voltage average calculation:

- The measured delta voltage is outside the 0.8 to 30 Volt range
- Capacitor Bank operation occurred as a result of exceeding the Control Mode Maximum or Minimum Voltage limits
- Capacitor Bank operation occurred as a result of exceeding Remote Control Mode Overvoltage or Undervoltage limits
- Any retry operation (Bank/Switch Failed Level 2 Prior Operation Neutral Overcurrent or Bank Status)
- Reverse operation as a result of Bank/Switch Failed Level 2 Prior Operation Neutral Overcurrent

Delta Voltage Alarm

The Delta Voltage Alarm is activated when the Delta Voltage value exceeds the bandwidth established by the Open "Voltage/Overvoltage" setting, and the Close "Voltage/Undervoltage" setting. The alarm activates the Programmable Alarm Relay (cannot be deselected). The alarm is displayed in the CapTalk Status screen, the HMI as a cycling alarm message, and from the HMI Monitor/Alarm Status menu. The Delta Voltage alarm also can be selected as a triggering event for the Oscillograph and Sequence of Events Recorders. The Oscillograph Recorder, Sequence of Events Recorder and Data Logging include the Delta Voltage parameter. A DNP Binary Status Point named "Delta Voltage Alarm" is also included.

The Delta Voltage Alarm can be reset from the CapTalk/Setup/Alarms screen, and from the HMI Configuration/Programmable Alarm menu. When the alarm is reset from the CapTalk Alarms screen, CapTalk will momentarily display "Delta Voltage will be reset to ½ the Bandwidth to clear this alarm". When the alarm is reset from the HMI, the control will display "Resetting Delta V to 1/2 Bandwidth".

Delta Voltage in Automatic Classic Voltage Control Mode

The Delta Voltage value is continuously compared to the difference between the Control Open Voltage setting and the Control Close Voltage setting (termed bandwidth for this description). If the Delta Voltage value is greater than or equal to the bandwidth, then control operation is blocked (Open or Close) and will initiate the following actions:

1. Activate the Delta Voltage Alarm
2. Start an internal 48 hour timer (stored in non-volatile memory)
3. When the internal timer reaches 48 hours, the Delta Voltage will be set to ½ the bandwidth
4. The Delta Voltage Alarm is reset
5. Control operation resumes

Delta Voltage in Remote Control Mode with Remote Control Mode Limits Enabled

When the control is in the Remote Control Mode with Remote Control Mode Limits enabled, the control continuously compares the Delta Voltage value to the difference between the Overvoltage and Undervoltage limits (termed bandwidth for this description). If the Delta Voltage value is greater than or equal to the bandwidth, then control operation is blocked (Open or Close) and will initiate the following actions:

1. Activate the Delta Voltage Alarm
2. Start an internal 48 hour timer (stored in non-volatile memory).
3. When the internal timer reaches 48 hours, the Delta Voltage will be set to ½ the bandwidth
4. The Delta Voltage Alarm is reset.
5. Control operation resumes

Internal 48 Hour Delta Voltage Timer

In the event of a loss of power to the control, when power is restored the control will compare the Internal 48 Hour Timer start time to the control's internal time. The control will resume timing, taking the elapsed time the control was without power into account.

For example:

1. The Timer starts and the start date/time is stored
2. 3 hours later the control loses power
3. The control is without power for 26 hours
4. When power to the control is restored, the timer will resume timing with 19 hours remaining.
5. If the time the unit was without power was ≥ 48 hours, the Delta Voltage will be set to ½ the bandwidth value and the Delta Voltage alarm will be reset.

Overview of Auto/Remote Limits and Auto Control Setting Time Delay Implementation

The Auto/Remote Limits and Auto Control Setting Time Delays are required to inhibit the capacitor bank control from unnecessary operations on temporary voltage excursions and is commonly set at 30 to 60 seconds. The timer includes two selectable elements:

- **Time Delay Selection –** Definite Time/Inverse Time
- **Basic Timer Type –** Integrating/Instant Reset

■**NOTE:** Inverse Time only applies to Voltage Control Mode. VAr and Current Control Modes use Definite Time, regardless of the Timer Type setting.

The control will only respond to an over-the-limit voltage excursion after the Auto/Remote Limits and Auto Control Time Delay have timed out. The Time Delay timer can reset instantaneously or as an integrating timer upon voltage returning in band. As an integrating timer, it decrements during time over the limit and increments during time within the limits, but not above the Open or Close time settings. The Integrating Timer type does not apply to Inverse Time selection.

The Time Delay can be set to either a Definite or Inverse delay. The inverse time delay will follow the curve in Figure 3-24, Inverse Time Delay Curve.

■**NOTE:** When in Remote Control Mode the Open Voltage becomes Overvoltage Limit and Close Voltage becomes Undervoltage Limit.

Inverse Time Example

Open Voltage: 121.5 V

Close Voltage: 118.5 V

Inverse Time Delay Setting: 120 s

$$\Delta V = \frac{(Open\ Voltage - Close\ Voltage)}{2} = 1.5\ V$$

$$\Delta V = \frac{(121.5 - 118.5)}{2} = 1.5\ V$$

$$V_{in} = 123\ V$$

Voltage deviation in multiples of ΔV:

= (V_{in} – Effective Bandcenter)/ΔV

= (123 – 120)/1.5

= 2

Time delay from Figure 3-24:

= 50% of Inverse Time Delay setting

= 60 sec

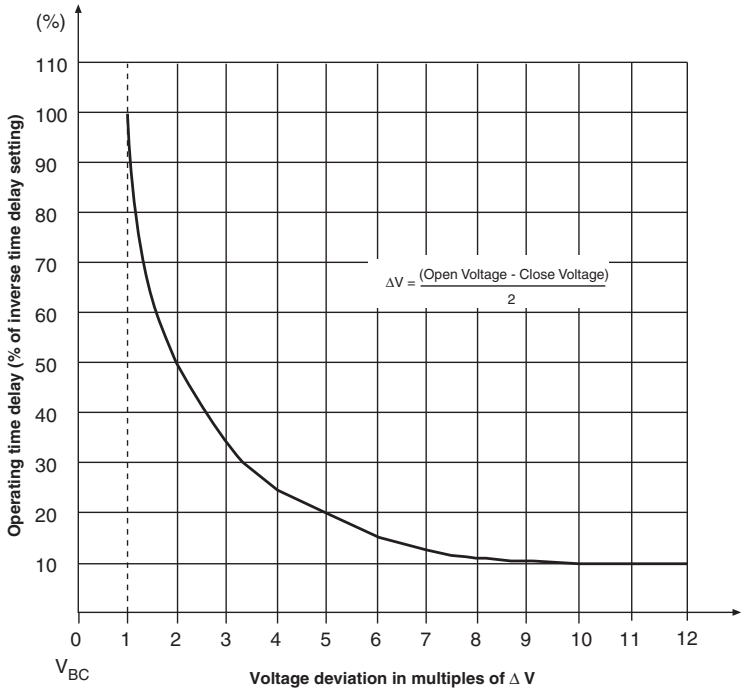


Figure 3-24 Inverse Time Delay Curve

Reset Delta Voltage

This feature allows the user to reset the Forward/Reverse Power Delta Voltage to the default value of 1.0 V or to any value from 0.5 to 20.0 V.

- To reset the Delta Voltage to 1.0 V, verify that the "Reset Delta Voltage to 1.0 V" box is checked, then select **Send**.
- To reset to a custom value, uncheck the "Reset Delta Voltage to 1.0 V" box and enter a value from 0.5 to 20.0 V, then select **Send**.

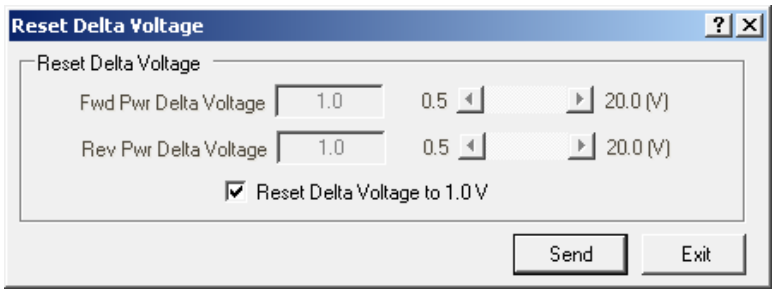


Figure 3-25 Reset Delta Voltage Screen

Delta Voltage Offset Buffer

The Delta Voltage Offset Buffer feature operates in conjunction with the blocking function of the Delta Voltage limits. When a Control Mode Limit has been exceeded and a Capacitor Bank operation has been initiated, further control operation will be blocked until the voltage returns to within the Control Mode Limit that was exceeded plus the Delta Voltage plus the Delta Voltage Offset Buffer. Control Mode Limits override all other modes and initiate an operation if exceeded unless that operation would exceed the opposite Control Mode Limits. The Delta Voltage Offset Buffer always applies to Control Mode Limits.

For example, if the Delta Voltage is 2 Volts and the Delta Voltage Offset Buffer setting is 20%, and the Maximum Voltage Limit was exceeded at 128 Volts, then the Voltage must return to less than 125.6 Volts before a Close operation will be allowed if required by the normal mode of operation:

128 Volts – (2 Volts +[2 Volts x 20%]) = 125.6 Volts

DV + (DV x Buffer)

Setting the Delta Voltage Offset Buffer from CapTalk

Select **Setup/Delta Voltage/Offset Buffer** from the CapTalk toolbar. CapTalk will display the Delta Voltage Offset Buffer screen (Figure 3-26).

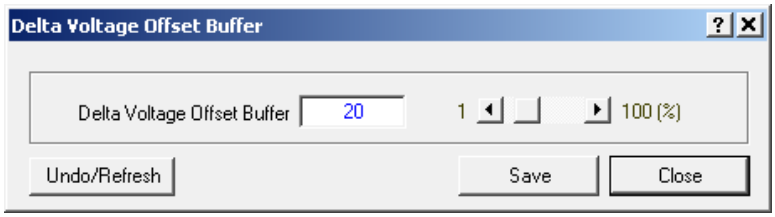


Figure 3-26 Delta Voltage Offset Buffer Screen

AUTO CONTROL MODE

The control is in Auto Control Mode when there is no active DNP communication with the client device and the DNP communication has not placed the unit in Remote.

■NOTE: To prevent capacitor switches from operating when voltage is low on the system, open or close operations in this mode are blocked if the sensing voltage is less than 85 V.

Automatic Voltage Control Classic Mode – The control opens and closes the capacitor bank based on measured voltage at the bank location. The Open and Close voltage points are individually selectable allowing the user to determine the desired "hysteresis" range of operation (see Figure 3-28). The normal operation of this mode can be overridden by pre-selected values of either Temperature or Time.

Automatic VAr Control Mode – The control opens and closes the capacitor bank based on Measured VAr values at the bank, expressed as a percentage of the bank size. The Open and Close VAr percentage points are individually selectable allowing the user to determine the desired "hysteresis" range of operation. The normal operation of this mode can be overridden by pre-selected values of either Temperature or Time.

■NOTE: When the Open or Close VAr settings would result in hunting or no operation due to the Max Cap Bank size, CapTalk will display a warning message and block the setting from being written (Figure 3-27).

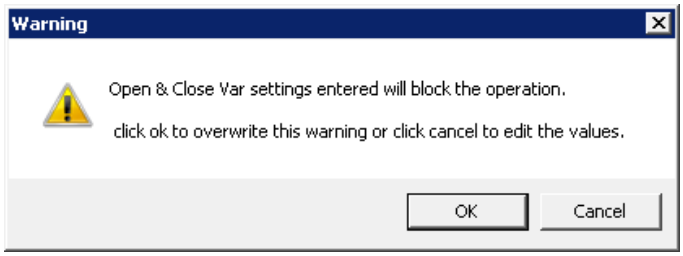


Figure 3-27 VAr Settings Warning Screen

Automatic Current Control Mode – The control opens and closes the capacitor bank based on measured current at the bank location. The Open and Close current points are individually selectable allowing the user to determine the desired "hysteresis" range of operation. The normal operation of this mode can be overridden by pre-selected values of either Temperature or Time.

Control Open Setting

The Control Open Voltage, VArs or Current setting is the upper threshold limit above which the control will initiate an Open operation by loading an Open timer with the Open Time Delay specified by the user.

When the Open timer expires, the control will determine whether the Open operation will be completed based on the following:

- If the "Temperature" or "Time Override" feature is enabled and is not overriding the Open operation.
- If "Control Mode Limits" are enabled and the Open operation will cause the load voltage to drop below the Control Close limit.
- If the Open operation will cause the Voltage, VArs, or Current Close Limit to be exceeded.

If either condition exists, the control will inhibit the Open operation, otherwise the Open operation will take place. The following inequality is used to determine if the Open operation is inhibited by enabled Control Mode Limits.

$$V_m - \Delta V < \textit{Control Close Voltage then Inhibit Open Operation}$$

$$\textit{where: } V_m \textit{ is the instantaneous measured load voltage}$$

Control Close Setting

The Control Close Voltage, VArs or Current setting is the lower threshold limit below which the control will initiate an Close operation by loading an Close timer with the Close Time Delay specified by the user.

When the Close timer expires, the control will determine whether the Close operation will be completed based on the following:

- If the "Temperature" or "Time Override" feature is enabled and is not overriding the Close operation.
- If "Control Mode Limits" are enabled and the Close operation will cause the load voltage to increase greater than the Control Open limit.
- If the Close operation will cause the Voltage, VArs, or Current Open Limit to be exceeded.

If either condition exists, the control will inhibit the Close operation, otherwise the Close operation will take place. The following inequality is used to determine if the Close operation is inhibited by enabled Control Mode Limits.

$$V_m + \Delta V > \textit{Control Open Voltage then Inhibit Close Operation}$$

$$\textit{where: } V_m \textit{ is the instantaneous measured load voltage}$$

AUTO CONTROL MODE VOLTAGE CONTROL – CLASSIC

Auto Control Mode Voltage Control – Classic Setup from CapTalk

1. Select Setup/Setpoints from the CapTalk toolbar. CapTalk will display the Setpoints screen (Figure 3-28).
2. Verify that the correct Setpoint Profile is selected for editing.
3. From the Auto Control Mode section of the Setpoints screen select "Enable Voltage Control" and "Classic".
4. From the Auto Control Mode section of the screen enter the desired:
   - Control Open setting
   - Control Close setting
   - Close Time Delay
   - Open Time Delay
   - Time Delay Selection
   - Basic Timer Type
5. Select **Save**. CapTalk will display a "Confirm Writing to Device" confirmation screen.
6. Select **OK**. CapTalk will display a "Setpoints Successfully Written to Control" confirmation screen.

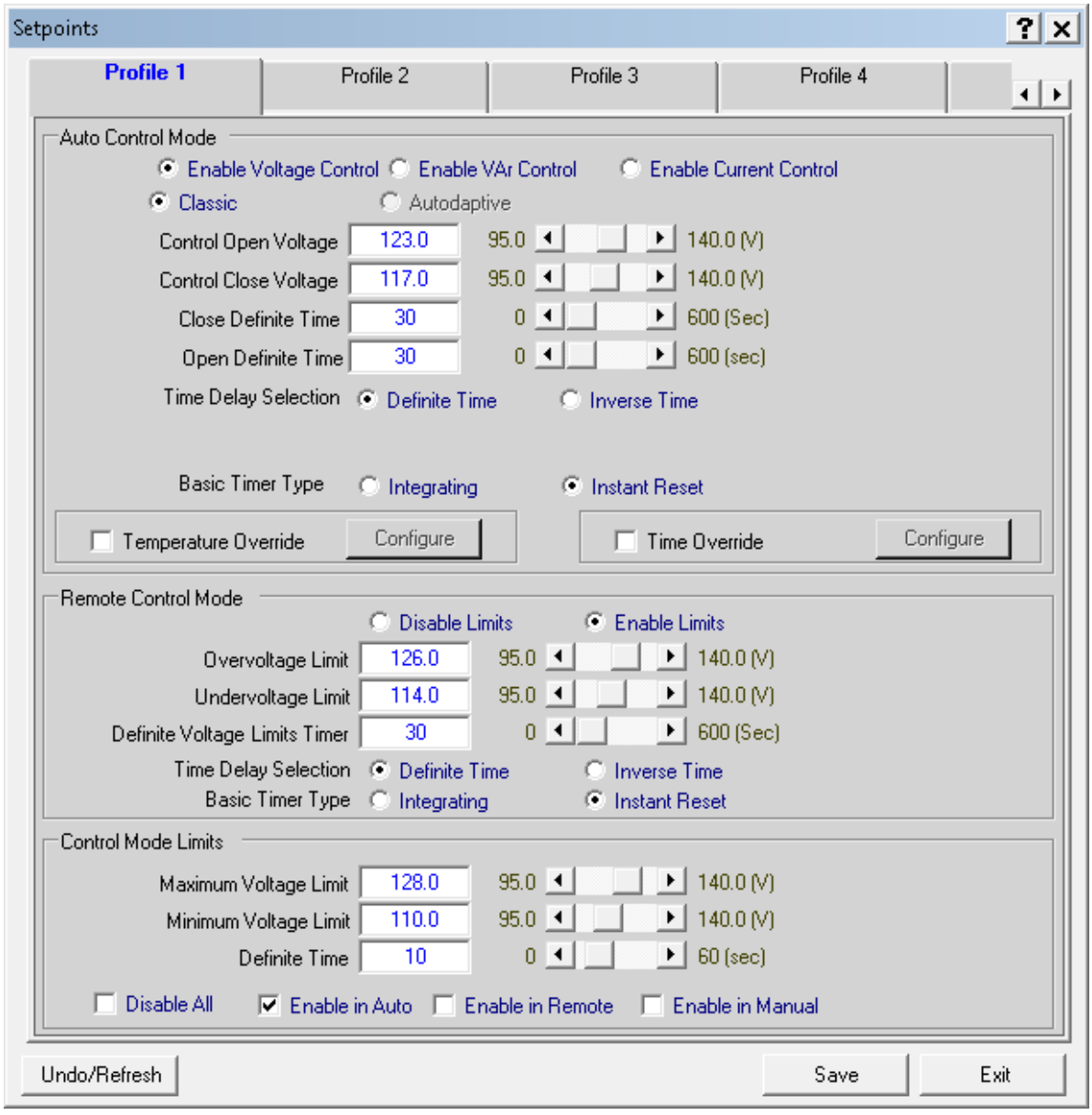


Figure 3-28 Setpoints Screen Voltage Control/Classic

AUTO CONTROL MODE VAR CONTROL OR CURRENT CONTROL

Auto Control Mode VAr or Current Control Setup from CapTalk

1. Select Setup/Setpoints from the CapTalk toolbar. CapTalk will display the Setpoints screen (Figure 3-28).
2. Verify that the correct Setpoint Profile is selected for editing.
3. From the Auto Control Mode section, select either "Enable VAr Control" (Figure 3-29) or "Enable Current Control" (Figure 3-30).
4. From the VAr or Current Control Mode screen, enter the desired settings.

■**NOTE:** When VAr or Current Control Mode is selected, then the Time Delay Selection defaults to "Definite Time" and cannot be changed.

5. Select **Save**. CapTalk will display a "Confirm Writing to Device" confirmation screen.
6. Select **OK**. CapTalk will display a "Setpoints Successfully Written to Control" confirmation screen.

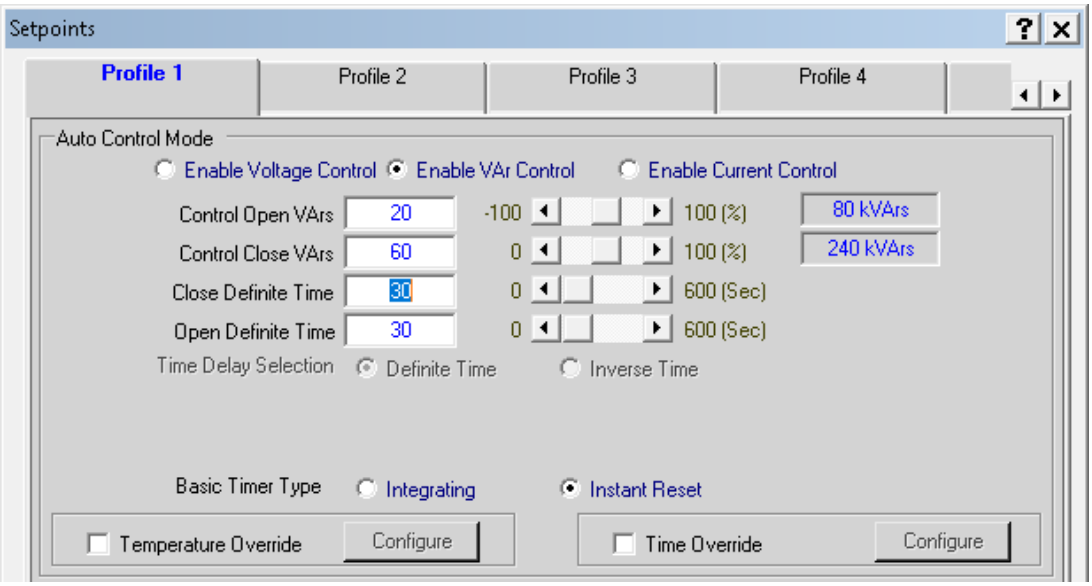


Figure 3-29 Setpoints – VAr Control Mode

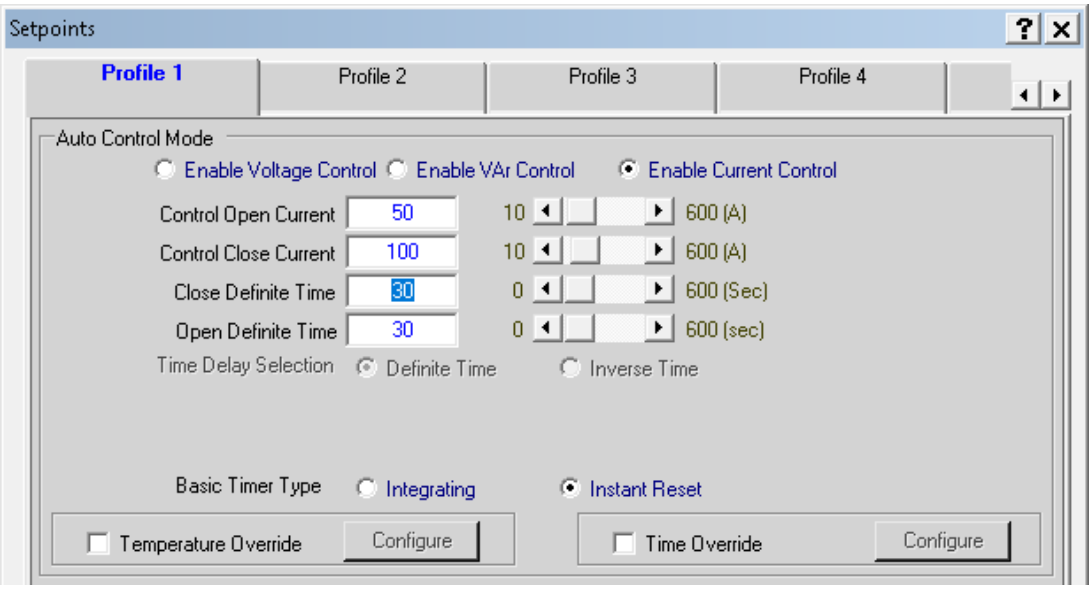


Figure 3-30 Setpoints – Current Control Mode

AUTO CONTROL MODE TIME OVERRIDES

Time Override

In the Auto Control Mode a Time Override can be applied to capacitor bank Open and Close operations. The Time Override feature considers Start Date, Start Time, End Date, End Time, Duration, Recurrence Pattern and a Range Of Occurrences to implement the override.

■**NOTE:** This function requires at least 85 V of sensing voltage.

Time Override Option

The Time Override may be selected as "Classic" or "Enhanced". The Time Override selection applies to all 8 profiles. The Classic Time Override operates using the original M-6283A Time Override settings.

The Enhanced Time Override option allows the user to setup two individual time overrides in a 24 hour period. Each override has its own Start Time, End Time and Duration. Each time override may be either Open or Close. The settings will not allow times to overlap.

Selecting Time Override Option from CapTalk

1. Select **Setup/Time Override Option** from the CapTalk toolbar. CapTalk will display the Time Override Option screen (Figure 3-31).
2. Select the desired Time Override Option (Classic or Enhanced)

■**NOTE:** The Time Override Option selection applies to all 8 profiles.

3. Select **Save**. CapTalk will display a "Confirm Writing to Device" confirmation screen.
4. Select **OK**. CapTalk will display a "Setpoints Successfully Written to Control" confirmation screen.

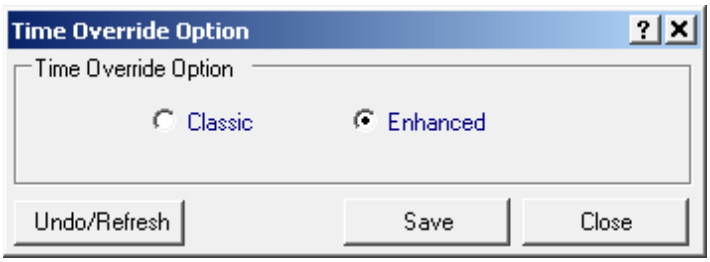


Figure 3-31 Time Override Option Screen

■**NOTE:** The Enhanced Time Override feature is designed to allow a second time override within a 24 hour period. The user must ensure that the time settings for the second override "Ov-2" do not overlap within 24 hours.

Enabling and Setting Auto Control Mode Time Override from CapTalk

1. Select **Setup/Setpoints** from the CapTalk toolbar. CapTalk will display the Setpoints screen (Figure 3-29.
2. Verify that the correct Setpoint Profile is selected for editing.
3. From the "Auto Control Mode" section of the Setpoints screen select "Time Override" then select "Configure".

CapTalk Will display the applicable Time Override Configuration screen, either Classic (Figure 3-32) or Enhanced (Figure 3-33).

4. Based on the selected Time Override Option, enter the desired settings.
5. Select **Save**. CapTalk will display a "Confirm Writing to Device" confirmation screen.
6. Select **OK**. CapTalk will display a "Setpoints Successfully Written to Control" confirmation screen.

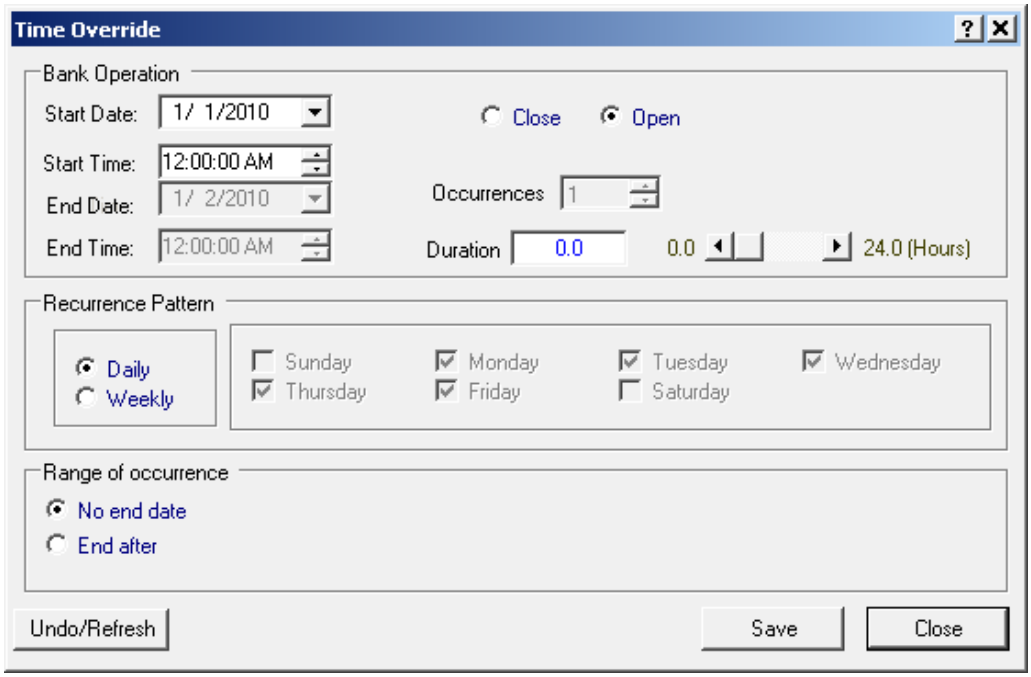


Figure 3-32 Classic Time Override Configuration Screen

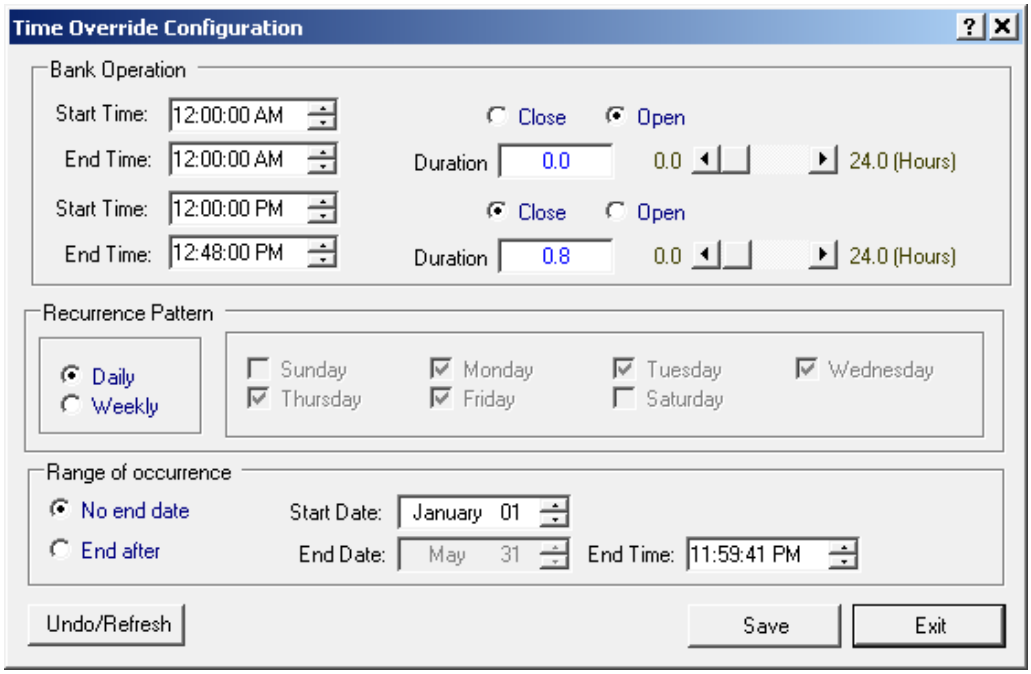


Figure 3-33 Enhanced Time Override Configuration Screen

AUTO CONTROL MODE TEMPERATURE OVERRIDES

Temperature Override

In the Auto Control Mode a Temperature Override can be applied to capacitor bank Open and Close operations. The Temperature Override feature considers sensed ambient temperature and implements override action (Open, Close or None) for either Above or Below Temperature setpoint conditions.

■**NOTE:** This function requires at least 85 V of sensing voltage.

Enabling and Setting Auto Control Mode Temperature Override from CapTalk

1. Select **Setup/Setpoints** from the CapTalk toolbar. CapTalk will display the Setpoints screen (Figure 3-28).
2. Verify that the correct Setpoint Profile is selected for editing.
3. From the "Auto Control Mode" section of the screen select "Temperature Override" then select "Configure".

CapTalk Will display the Temperature Override Configuration screen (Figure 3-34)

4. Enter the desired settings.
5. Select **Save**. CapTalk will display a "Confirm Writing to Device" confirmation screen.
6. Select **OK**. CapTalk will display a "Setpoints Successfully Written to Control" confirmation screen.

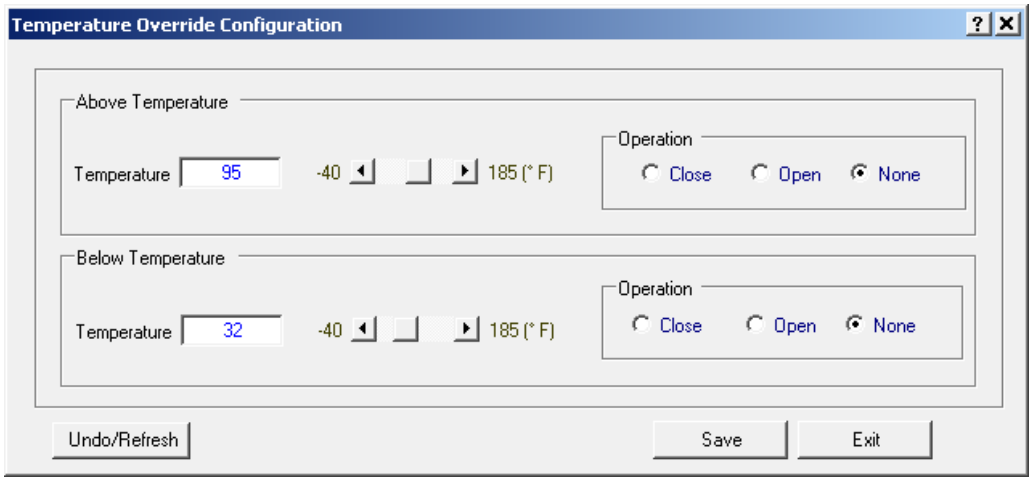


Figure 3-34 Temperature Override Configuration Screen

REMOTE CONTROL MODE SETTINGS

The control is in Remote Control Mode when an active DNP communication channel exists between the control and a client device. If the SCADA HeartBeat feature is enabled, communication must occur in such a way as to refresh the SCADA HeartBeat timer before the timer expires, otherwise the control will revert to Auto Control Mode. In order to execute a Close or Open command from the client device when the SCADA HeartBeat feature is disabled, the client device must first send a "Remote" command to the control in order to block automatic operation. When the Remote command is received the control will then operate in the Remote Control Mode.

In the normal Remote Control Mode when the SCADA HeartBeat feature is enabled, the control will receive an Open or a Close command from a client application.

Open Command from the Client

When the control receives an Open command from the client, the control will evaluate the following inequalities based on whether Remote Control Limits or the Control Mode Limits are enabled before making a decision to either allow or inhibit the Open command.

Remote Control Limits Enabled:

$$V_m - \Delta V < \text{Undervoltage Limit, then Inhibit Open Command}$$

$$\text{where: } V_m \text{ is the instantaneous measured load voltage}$$

Remote Control Limits Disabled and Control Mode Limits Enabled:

$$V_m - \Delta V < \text{Minimum voltage Limit, then Inhibit Open Command}$$

$$\text{where: } V_m \text{ is the instantaneous measured load voltage}$$

Close Command from the Client

When the control receives an Close command from the client, the control will evaluate the following inequalities based on whether Remote Control Limits or the Control Mode Limits are enabled before making a decision to either allow or inhibit the Close command.

Remote Control Limits Enabled:

$$V_m + \Delta V > \text{Overvoltage Limit, then Inhibit Close Command}$$

$$\text{where: } V_m \text{ is the instantaneous measured load voltage}$$

Remote Control Limits Disabled and Control Mode Limits Enabled:

$$V_m + \Delta V > \text{Maximum voltage Limit, then Inhibit Close Command}$$

$$\text{where: } V_m \text{ is the instantaneous measured load voltage}$$

Load Voltage Outside the Remote Limits

In the Remote Control Mode there exists a situation where the control will automatically make an operation without receiving a command from the client device. This situation arises when the load voltage goes outside the remote limits.

Overvoltage Limit Setting

The Overvoltage Limit setting becomes the upper threshold limit above which the control will initiate an Open operation by loading an Open timer with the Voltage Limit Timer Delay specified by the user. When the Open timer expires, the control will determine whether the Open operation will cause the load voltage to drop below the Undervoltage Limit, if so, the control will inhibit the Open operation, otherwise the Open operation will take place. The following inequalities are used to determine if the Open operation is inhibited.

Remote Control Limits enabled:

$$V_m - \Delta V < \text{Undervoltage Limit, then Inhibit Open Command}$$

$$\text{where: } V_m \text{ is the instantaneous measured load voltage}$$

Remote Control Limits Disabled and Control Mode Limits Enabled:

$$V_m - \Delta V < \text{Minimum voltage Limit, then Inhibit Open Command}$$

$$\text{where: } V_m \text{ is the instantaneous measured load voltage}$$

Undervoltage Limit Setting

The Undervoltage Limit setting becomes the lower threshold limit below which the control will initiate a Close operation by loading a Close timer with the Voltage Limit Timer Delay specified by the user. When the Close timer expires, the control will determine whether the Close operation will cause the load voltage to go above the Overvoltage Limit, if so the control will inhibit the Close operation, otherwise the Close operation will take place. The following inequalities are used to determine if the Close operation is inhibited.

Remote Control Limits enabled:

$$V_m + \Delta V > \text{Overvoltage Limit, then Inhibit Close Command}$$

$$\text{where: } V_m \text{ is the instantaneous measured load voltage}$$

Remote Control Limits Disabled and Control Mode Limits Enabled:

$$V_m + \Delta V > \text{Maximum voltage Limit, then Inhibit Close Command}$$

$$\text{where: } V_m \text{ is the instantaneous measured load voltage}$$

This automatic feature of the Remote Control Mode can be disabled by the user.

■**NOTE:** It is important to note that during an automatic operation when the control is in Remote Control Mode, any command from the client device will supersede any ongoing operation only during the initial timing phase.

Enabling and Setting Remote Control Mode Limits and Timer from CapTalk

1. Select **Setup/Setpoints** from the CapTalk toolbar. CapTalk will display the Setpoints screen (Figure 3-28).
2. Verify that the correct Setpoint Profile is selected for editing.
3. From the Remote Control Mode section of the screen (Figure 3-35) select either Enable or Disable Limits.
4. If Remote Control Mode "Enable Limits" is selected, enter the desired settings.
5. Select **Save**. CapTalk will display a "Confirm Writing to Device" confirmation screen.
6. Select **OK**. CapTalk will display a "Setpoints Successfully Written to Control" confirmation screen.

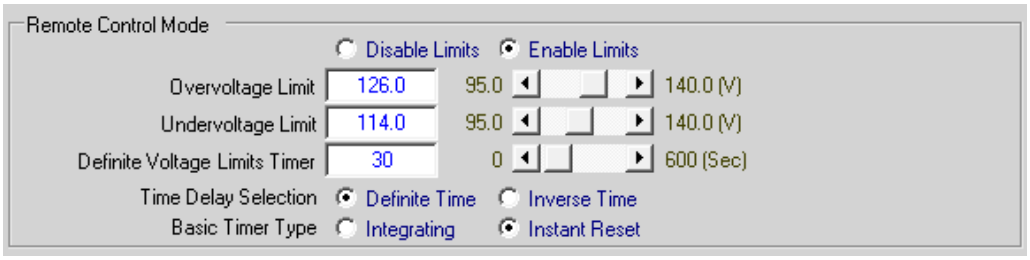


Figure 3-35 Setpoints – Remote Control Mode

CONTROL MODE LIMITS

Remote Control Mode – The control opens and closes the bank based on commands received through communications. The Remote Control Mode has its own set of "Overvoltage" and "Undervoltage" limits which can be enabled to block remote commands, should they result in bank voltages beyond the limits. When the Control Phase Selection is Average or Independent Phase and the voltage on any of the individual phases exceeds these limits, the control will also initiate the appropriate Open or Close command. When the Control Phase Selection is A, B or C, only the voltage on that phase will be used to initiate if these limits are exceeded. This is determined by a running average of voltage differential recorded during recent switching operations of the bank. A "HeartBeat" or "Keep Alive" signal must be received from the SCADA Control system on a user defined periodic basis, or the control will determine the communications link to be inoperable and revert to one of the automatic modes of operation. This continues until the control receives two valid "HeartBeat" signals within the predetermined interval and will then revert to Remote Control Mode. If the Control Mode Limits are enabled in Remote and the Remote Mode limits are disabled, the control will perform the blocking as described above, but will not initiate any operation on its own.

The Control Mode Limits are used as outside limits to the auto and remote control mode. The control will inhibit the operation if the resulting calculated load voltage ($V_m - \Delta V$) is below or above the voltage settings of the Auto or Remote control mode.

LOCAL/MANUAL Mode – The control can be disabled from the above modes of operation by a front panel toggle switch and will respond only to front panel CLOSE and OPEN switch commands when placed in LOCAL/MANUAL mode. The control can only be returned to Automatic or Remote Operation by returning the front panel switch to the REMOTE/AUTO position.

When Control Mode Limits are enabled in Manual mode, the control will inhibit a manual Close command if the load voltage is already below the Minimum Voltage Limit. Similarly the control will inhibit a manual Open command if the load voltage is already above the Maximum Voltage Limit. Note that the Definite Time Delay does not apply to Manual Control Mode Limits.

> ■**NOTE:** When sensing voltage is below the Battery Backup Limit (85.0 V), open and close operations are permitted in Remote and Local/Manual modes with firmware versions 05.09.01 and above.

Enabling/Disabling and Setting Control Mode Limits from CapTalk

1. Select **Setup/Setpoints** from the CapTalk toolbar. CapTalk will display the Setpoints screen (Figure 3-28).
2. Verify that the correct Setpoint Profile is selected for editing.
3. From the Control Mode Limits section of the screen (Figure 3-36) select the desired Control Mode: Disable All, Enable in Auto, Enable in Remote, Enable in Manual.
4. If any Control Mode Limits were Enabled, enter the desired setings.
5. Select **Save**. CapTalk will display a "Confirm Writing to Device" confirmation screen.
6. Select **OK**. CapTalk will display a "Setpoints Successfully Written to Control" confirmation screen.

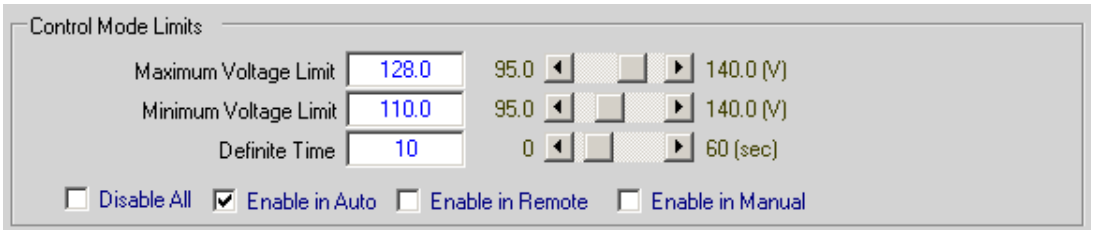


Figure 3-36 Setpoints – Control Mode Limits

3.5 Editing Setpoints from the HMI

The Setpoints settings detailed in this Chapter are also available in the Front Panel HMI. See **Chapter 2 Front Panel Operation** for an overview of the HMI Menu structure and navigation.

Selecting a Setpoint Profile for Editing

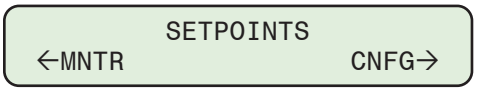
Editing setpoints is accomplished only when the specific setpoint profile has been selected for editing. The following setpoint categories are included in the four setpoint profiles:

- Override Function
- Auto/Remote Limits
- Auto Control Setting

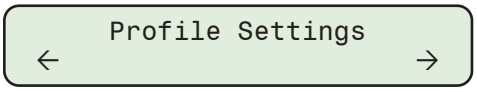
The Setpoints sub-headers indicate in the upper right hand corner the setpoint profile that is being edited. If a specific setpoint profile has not been previously selected for editing, then the number in the submenu header will indicate the Active Setpoint Profile.

To select a Setpoint Profile for Editing or to change the Active Setpoint Profile:

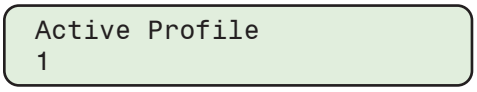
1. Press **SETP**⬆ to advance to the SETPOINTS menu.



2. Press **ENT** or **CNFG**⬇ once. The unit will advance to the Profile Settings menu.



3. Press **ENT** or **CNFG**⬇ once. The unit will advance to the Active Profile menu.



Continue through the Profile Settings submenu to access the following settings screens:

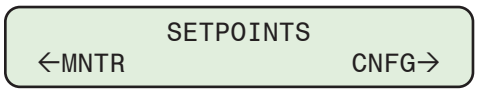
- Active Profile (1 to 8)
- Profile to Edit (1 to 8)
- Edit Profile 1 Name
- Edit Profile Name (2 to 8)

■**NOTE:** After changing the Active Setpoint Profile, the user must exit the Profile Settings sub header for approximately 1 minute to see the Active Setpoint Profile change indicated in the Setpoints sub-header.

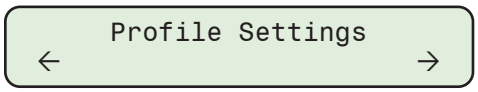
▲**CAUTION:** The control will immediately respond to the new Active Setpoint Profile settings.

Editing Setpoints

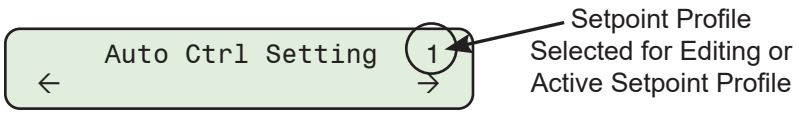
1. Press **SETP**⬆ to advance to the SETPOINTS menu.



2. Press **ENT** or **CNFG**⬇ once. The unit will advance to the Profile Settings menu.



3. Press ⬅**MNTR** or **COMM**➡ as necessary, to Auto Ctrl Setting:



4. Ensure that the correct Setpoint Profile is selected for editing.
5. To edit Auto Control Setting setpoints, press **ENT** or **CNFG**⬇ once. The control will display the following.

Continue through the Control Mode submenu to access the applicable settings screens:

- Voltage Control Type
- Control Open Voltage
- Control Close Voltage
- Close Def. (or Inv.) Delay
- Open Def. (or Inv.) Delay
- Time Delay Selection (Def. or Inv.)
- Basic Timer Type

To access additional Setpoints sub-headers, press ⬅**MNTR** or **COMM**➡ from the Auto Ctrl Setting sub-header, to Auto/Remote Limits or Override Function.

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4 CapTalk Remote Setup and Operation

■ CYBER SECURITY NOTE:

When Cyber Security is enabled, access to any feature described in this Chapter is subject to the Access Permissions Policy as designated by the Security Policy Administrator.

4.1 Overview

This chapter is designed for the person or group responsible for the remote setup and operation of the M-6283A. The CapTalk S-6283 Communications Software can be used to successfully communicate system settings and operational commands to the M-6283A as well as access the extensive monitoring and status reporting features. This chapter provides a general overview of each CapTalk menu selection and command in the same order as they are displayed in the software program. Those CapTalk features and functions that are covered in other sections of this Instruction Book will be noted and referenced.

Availability

CapTalk S-6283 Communications Software is available for download from *www.beckwithelectric.com*. The companion Instruction Book in PDF format is also available for download.

4.2 Hardware Requirements

CapTalk will run on any computer that provides at least the following:

- Windows 2000 or later
- One USB (serial) port

■**NOTE:** Although Beckwith Electric software is compatible with Windows 2000 and later, it is only tested for Cyber Security compliance on a network using Windows 10. Windows 7 and prior operating systems (Windows 2000, XP, Vista) no longer receive security updates from Microsoft. To maintain full Cyber Security compliance, it is recommended to upgrade to the latest Windows version.

Hardware Required for Direct USB (Serial) Communication

To use CapTalk to communicate with a Beckwith Electric M-6283A Digital Capacitor Bank Control using a direct USB (serial) connection, a USB cable is required.

The M-6283A Digital Capacitor Bank Control may also include a fiber optic port and RS-485 port standard, and may also include other optional communication ports. See **Chapter 5, Communications Ports**, for detailed information regarding the use of these connections.

4.3 Installing CapTalk

The CapTalk S-6283 installation program has been written to overwrite previous versions of CapTalk unless stated otherwise in the CapTalk installation and installed "Read Me" file. However, considering variations in installed software, hardware and operating systems, if you are upgrading from a previous version of CapTalk, it is recommended that any older versions of the CapTalk program be removed before installing the new CapTalk.

CapTalk runs with the Windows operating system. Familiarity with Windows is important in using CapTalk, as the conventions defined in the Windows documentation are strictly followed.

CapTalk will be installed on the host PC's hard disk. While it does not require special installation procedures, an installation utility has been provided to make the process easier.

■**NOTE:** The user must have Administrator rights on the host computer to install CapTalk.

1. Download the CapTalk software from www.beckwithelectric.com.
2. Double-click the (.exe) file located in the download folder, to start the Installation Wizard.
3. The Installation Wizard will prompt the user through the installation process. After installation, the CapTalk program icon is placed on the desktop (Figure 4-1).

Starting CapTalk

Select the CapTalk program-icon from the Becoware group in the Program Manager, or select **CapTalk** from the program list using the **Start** menu. The CapTalk startup screen will be displayed.

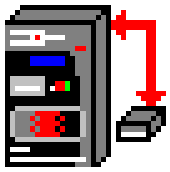


Figure 4-1 CapTalk S-6283 Program Icon

4.4 Initial Communication Setup

The communication ports provide access to all features, including metering, software updates, and programming of all functions. This is accomplished using a connection from any personal computer running the CapTalk S-6283 Communications Software or SCADA communications software.

Using a PC, the operator has real-time, remote access to all functions of the Digital Capacitor Bank Control. The control can act as the monitoring point for all voltage, current, and related power quantities. This simplifies operation while avoiding transducers and multiple Remote Terminal Unit (RTU) analog inputs. The protocols implement half-duplex, two-way communications. This allows all functions, which would otherwise require the presence of an operator at the control, to be performed remotely.

Communication capabilities include:

- Interrogation and modification of setpoints
- Broadcast of commands, such as "Block Automatic" to networked controls
- Recognition of alarm conditions, such as voltage extremes and bank failure
- Selective control of Open and Close Capacitor Bank operations
- Re-configuration of the control, such as a change to the demand integration time period or a selection of different alarm parameters

CapTalk allows the user to enable or disable installed RS-232, Ethernet ports, and Bluetooth modules. This option is located in the CapTalk **Utility/Communication Options** menu. Prompts to enable communication hardware are also contained in the individual port setup menus.

Protocols

The standard protocols included in the M-6283A are DNP3.0 and MODBUS. The USB port uses MODBUS for local communications. The optional Ethernet Port supports DNP over TCP/IP and UDP; and MODBUS over TCP/IP protocols simultaneously. The user must select the protocol that is to be used with the M-6283A Capacitor Bank Control's RS-232/RS485/Fiber Optic Port.

Detailed descriptions of the data points used for the standard protocols are available from Beckwith Electric upon request, and are available for download from *www.beckwithelectric.com*. For information regarding Communication Port connections, please see **Chapter 5, Communication Ports**.

INITIAL LOCAL COMMUNICATIONS USING DIRECT USB CONNECTION

Communication setup can be accomplished utilizing either CapTalk or the HMI. Initial Communication with the M-6283A must first be established using a direct USB connection in order to access the Comm Port, Modem, Ethernet, and Bluetooth setup features.

CapTalk supports direct communication (MODBUS protocol) with a Beckwith Electric Digital Capacitor Bank Control using the applicable connector (USB cable) for the PC, Fiber Optic communication using ST standard, two-wire RS-485 or RS-232.

To use CapTalk to interrogate, set, or monitor the M-6283A Digital Capacitor Bank Control using a direct USB connection, the appropriate driver must be loaded. This driver is automatically loaded by the CapTalk installation software. If the host PC cannot identify the proper driver for the M-6283A, the driver file (beco.inf) can be found in the software installation folder: Program Files (x86)/BECOWare/CapTalk M-6283 Series Model S-6283/USB Drivers.

When the control is connected to the PC utilizing a USB cable, Windows will enumerate the control as a serial com device and will assign an unused COM Port to the control.

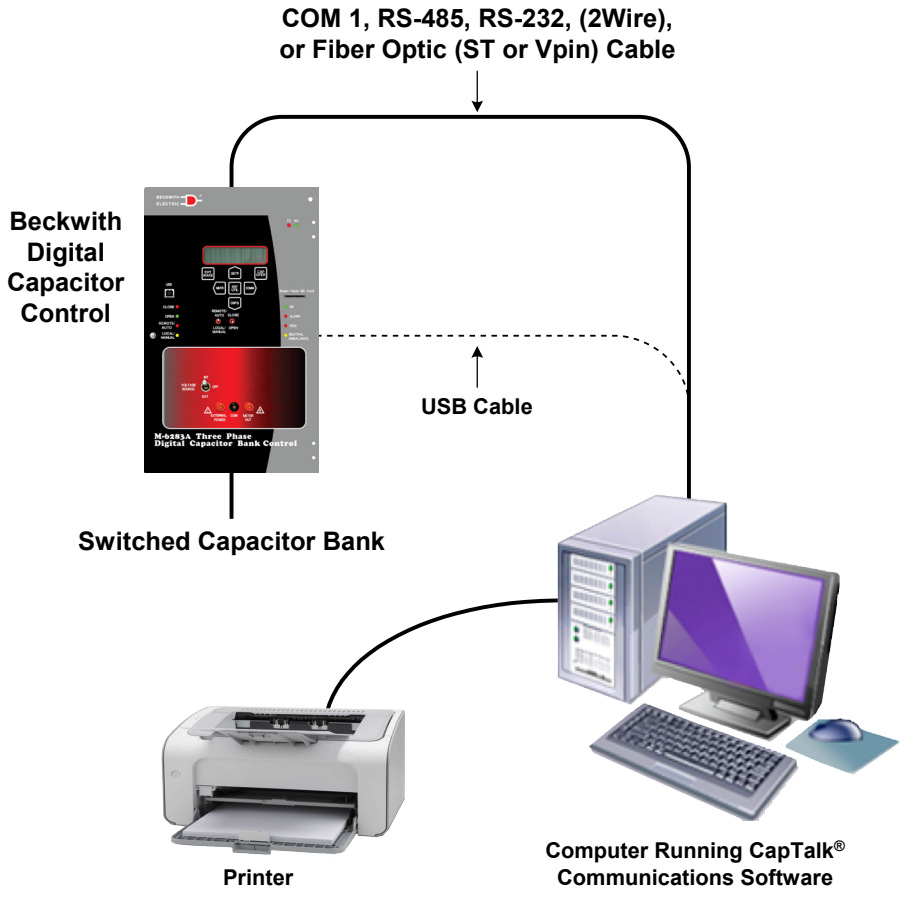


Figure 4-2 Direct Connection

Direct Communication Using USB (Serial) Connection

1. Plug the USB cable into the host computer USB port.
2. Plug the USB cable into the USB port on the control. The host computer will interrogate the control to determine the type of hardware device it is.
3. Start the CapTalk program, CapTalk will display the CapTalk Startup screen.
4. Select **Communication/USB** from the "Communication" drop-down menu. CapTalk will display the USB Device screen.

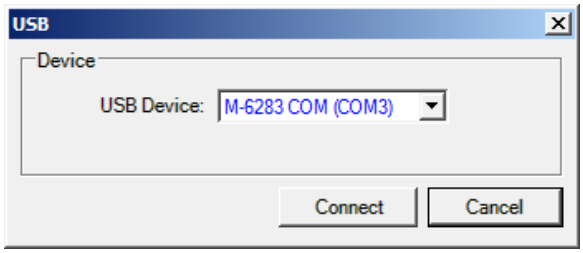


Figure 4-3 USB Device Connection Screen

5. Ensure that the correct USB device is displayed. Select **Connect**. If Communications Security is disabled, CapTalk will attempt to connect to the target control. If CapTalk returns a "Cannot Connect" error screen, verify the USB connections and retry the procedure.
6. When Communications Security is enabled, depending on the Security mode enabled in the control, CapTalk will display either the "Access Level Code" entry screen (Figure 4-4) or the "Log On – User Name and Password" entry screen (Figure 4-5).

   When **Access Level** communications security is enabled, enter Access Level Code. Default Values: Level 1=111111, Level 2=222222. Select **OK**. CapTalk will attempt to connect to the target control.

   When **IEEE 1686 Cyber Securit**y is enabled, enter a valid User Name and Password and select **Log On**. CapTalk will attempt to connect to the target control. If CapTalk returns a "User Access Permissions Denied" error screen, CapTalk will deny access until a valid User Name and Password are entered.

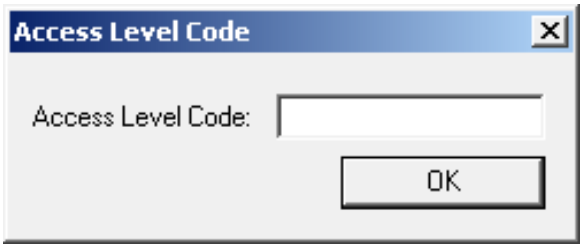


Figure 4-4 Access Level Code Entry Screen

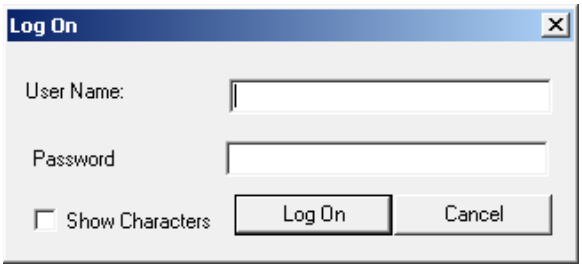


Figure 4-5 Log On – User Name and Password Entry Screen

7. When communication is established, CapTalk will briefly display an "Access Granted" screen followed by the "Connected through USB" confirmation screen. CapTalk will display the connected version of the CapTalk Main Screen. The USB connection name is displayed in the Connection Status area at the bottom right of the main screen.

SERIAL COM1 PORT SETUP

■**NOTE:** Communication must be established with the target control for this procedure, using the Direct USB Connection described previously.

Select **Communication/Setup/Comm Port**. CapTalk will display the Setup Comm Port screen (Figure 4-6). Select the Comm Port Type (RS232, RS485, or Fiber), then enter the communication parameters. Select **Save**. CapTalk will save the settings to the device. The Serial comm port for the control is now enabled.

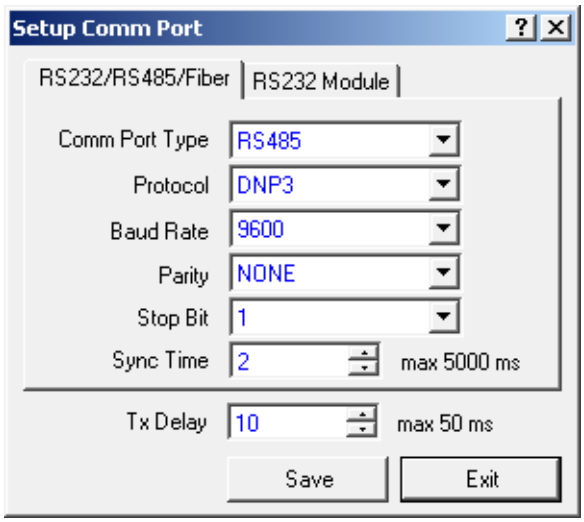


Figure 4-6 Setup Comm Port Screen

Fiber Optic Communications

The fiber optic interface is connected to the COM1 Port of the device. When fiber optic is selected, the RS-485 is disabled. The echoing of the received data is supported by the hardware. The Fiber Repeat switch is located to the right of the TX fiber transmitter connection as viewed from the rear of the control. The Switch can be set to Echo OFF to disable the echoing feature. Echo ON is primarily used if the control is in a daisy chain network. Disabling the echo transmission is usually done when there is peer to peer communication. If the client software supports echo canceling, as is the case with CapTalk, then there is no need to disable echo transmission. In this case, echo cancel should be enabled on the client software. Physical specification:

- Fiber type: Multimode
- Tested with fiber size 62.5/125

Serial Comm Port Setup from the HMI

The Serial Comm Port may also be setup from the HMI COMMUNICATION main menu.

OPTIONAL COM2 SERIAL RS-232 PORT

■**NOTE:** Communication must be established with the target control for this procedure, using the Direct USB Connection described previously.

Select **Communication/Setup/Comm Port**. CapTalk will display the Setup Comm Port screen. Select the RS232 Module tab (Figure 4-7), then enter the communication parameters. Select **Save**. CapTalk will save the settings to the device. The optional RS232 COM2 port is now enabled.

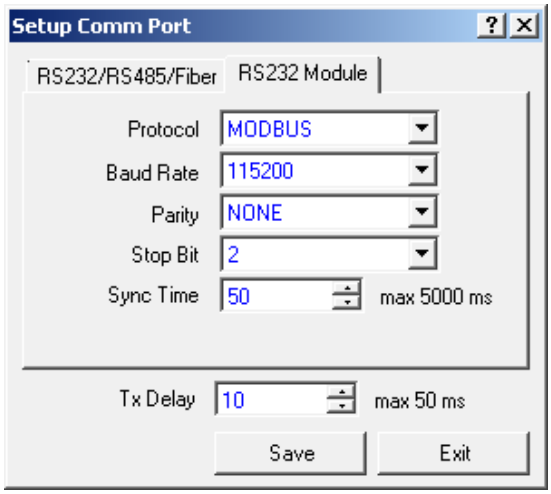


Figure 4-7 Setup RS-232 Comm Port Screen

OPTIONAL ETHERNET PORT

The optional Ethernet Port can be purchased as either a RJ-45 (10/100 Base-T) interface or Fiber Optic through ST connector (100 Base-Fx) for Ethernet communication to the M-6283A. The port supports up to eight concurrent connections. The maximum number of MODBUS connections is eight. The maximum number of allowed DNP TCP/UDP connections is five. The maximum number of DNP connections is user settable. The port supports DHCP protocol and also allows manual configuration of the Ethernet port.

■**NOTE:** CapTalk can be used through the Ethernet port and may be considered a MODBUS connection for the purpose of determining how many concurrent connections are allowed.

If the control is to be connected to a network that does not support DHCP protocol, then the following information must be obtained from the Network Administrator, to be entered locally at the control or remotely utilizing CapTalk:

- IP Address
- Net Mask
- Gateway (may be necessary)

DHCP Protocol

- ENABLE: If the network server supports the DHCP protocol the network server will assign the IP Address, Net Mask and Gateway Address.
- DISABLE: If the network server does not support the DHCP protocol or the user chooses to manually input ethernet settings, then obtain the IP Address, Net Mask and Gateway address from the Network Administrator and enter the settings.

Auto Negotiation

Auto negotiation is an Ethernet procedure by which two connected devices choose common transmission parameters, such as speed and duplex mode. In this process, the connected devices first share their capabilities as for these parameters and then choose the fastest transmission mode they both support.

■**NOTE:** Auto Negotiation must be disabled if using Fiber Ethernet.

Ethernet Keepalive Time

If no communication activity is detected on a previously open ethernet socket, for the amount of time specified by the "Keepalive Time" setting, the control will then close the socket and make it available for future connection.

■**NOTE:** Keepalive Time applies only to Ethernet communication.

Ethernet Port Settings

When manual configuration of the ethernet network is required, if the network MODBUS Port address is not "502", or the DNP Port address is not "20000", these parameters must be set to match the target network settings. The number of **DNP Sessions Allowed** is user-settable from 1 to 5, with a default value of 5.

■**NOTE:** To enable a change to the value of DNP Sessions Allowed, the control must be rebooted. After rebooting, the number of DNP TCP and UDP connections will each be limited to the new setting.

Network Time Synchronization

To enable the Network Time Synchronization feature, the user must have access to either the SNTP (Simple Network Time Protocol) Server Name or Server IP Address of the target control. It is also necessary to enter the Time Zone of the target control. If the Server Name is known, enter the Server Name and then select the magnifier glass icon. CapTalk will search for the corresponding IP Address, or enter the IP Address manually.

Ethernet Port Setup from CapTalk

■**NOTE:** Communication must be established with the target control for this procedure, using the Direct USB Connection or Serial Port Connection described previously. The host computer and the control must be physically connected to the target Ethernet network.

Select **Communication/Setup/Ethernet Settings**, CapTalk will display the Ethernet Setup screen (Figure 4-8). Enter the communication parameters. Select **Save** to enable the Ethernet option for the control.

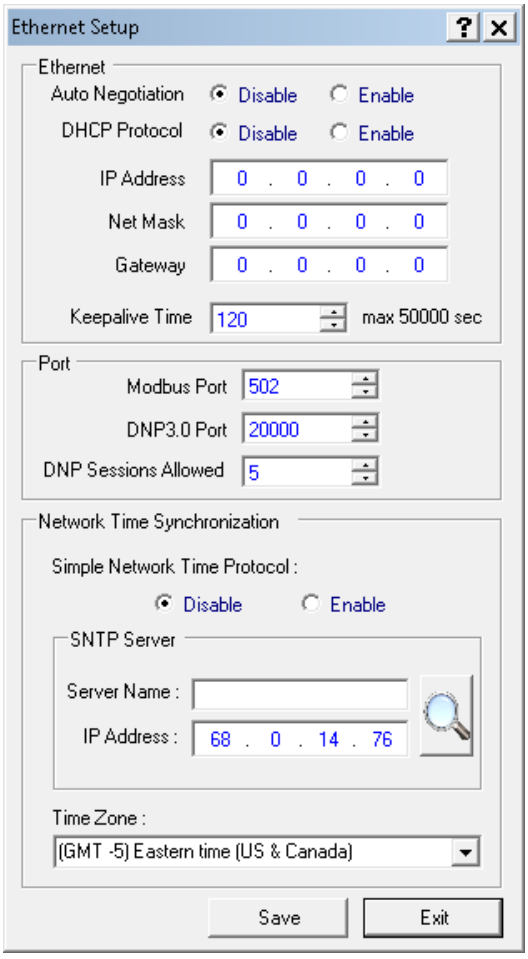


Figure 4-8 Ethernet Setup Screen

Ethernet Port Setup from the HMI

The Ethernet Port may also be setup from the HMI COMMUNICATION main menu.

OPTIONAL BLUETOOTH

The Bluetooth option enables wireless access to the M-6283A. Utilizing the Bluetooth wireless feature the user is able to configure the control, read status and metering values, as well as change setpoints. The following lists the initialization scheme and setpoint options available for Bluetooth.

The M-6283A provides generic serial Bluetooth service. The user must select the generic serial service among any other listed services, if the user's Bluetooth device doesn't automatically recognize the available service.

Bluetooth Module Initialization

■**NOTE:** For first time Bluetooth module use, the Bluetooth module needs to be reset to ensure that the Bluetooth module functions according to the Beckwith factory values.

Following a control power cycle, the M-6283A hardware is checked for Bluetooth by sending an AT command and waiting for an "OK" response. If no response is received, a "Bluetooth not present" message will be displayed on the HMI. If an "ERROR" message is received, Bluetooth is reset to factory default values and the hardware is checked again.

The Bluetooth device information will be retrieved. The Beckwith Electric factory default values for device information are:

- **Friendly Name –** 6280A-Serial Number
- **Mode of Device –** Mode0
- **Internal operation status –** Standby
- **Authentication –** None
- **Encryption –** None

The retrieved Bluetooth device information is compared to the factory defaults, if they are not the same; they are forced to the default values. The device is now in connectable mode, and the Bluetooth device can be used to connect to the M-6283A using the generic serial service.

Bluetooth Setup from CapTalk

In order to setup the Bluetooth feature on the M-6283A, the Bluetooth Factory Option must be enabled on the control, and the Bluetooth Status on the control must be "Present" and "Connectable".

To verify these conditions, observe the display while applying power to the control. The following sequence of messages will be displayed during the control boot up:

- **`Factory Options`**
  `BLUETOOTH`
- **`Bluetooth Status`**
  `BLUETOOTH PRESENT`
  `CONNECTABLE`

Select **Communication/Setup/Bluetooth Settings**. CapTalk will display the Bluetooth Information screen (Figure 4-9). Enter the communication parameters:

- **Protocol –** MODBUS or DNP.
- **Mode – Mode 0:** the device is discoverable and connectable to any client station, or **Mode 1**: the device is non-discoverable but it is connectable to any client station that knows the control Bluetooth device address indicated under "Control BT Device" in the HMI menu.
- **Friendly Name –** A maximum of 20 alphanumeric characters, as well as the '_' and '-' characters.
- **Enable/Disable –** Enable or disable Bluetooth functionality.
- **Enable Authentication –** If enabled, a password is required to connect to the device.
- **Set Password –** When Authentication is enabled, the user can assign a password of up to 16 alphanumeric characters.
- **Reset –** The Bluetooth Module can be reset to Beckwith Electric factory default values.

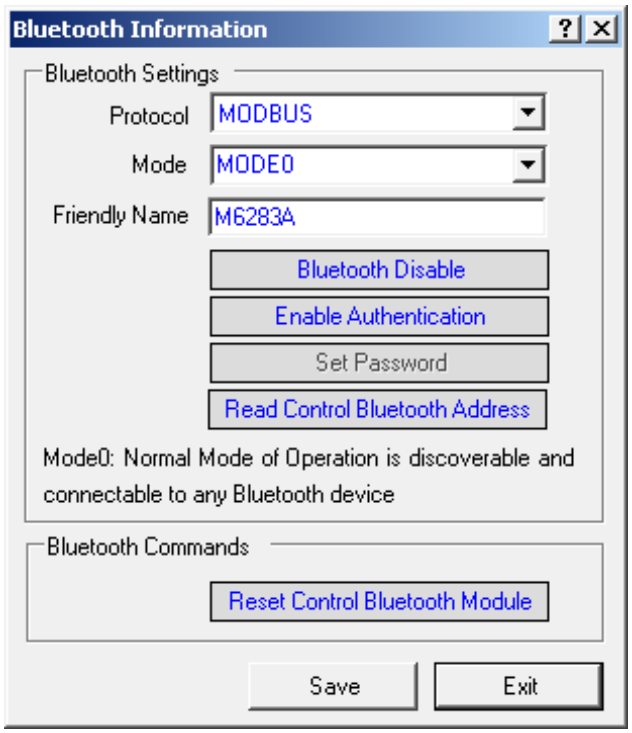


Figure 4-9 Bluetooth Information Screen

When the Bluetooth parameters have been entered, select **Save**. CapTalk will display a confirmation screen. Power to the control must be cycled for changes to take effect.

Verify that removing power to the control will not cause undesired operating conditions. Remove power to the control, and then reapply power to the control. The Bluetooth feature is now available for use. Consult the documentation of the Bluetooth wireless device that is going to be used for communications with the M-6283A for setup information.

INSTALLING MODEMS

Configuring CapTalk to communicate with the control using a modem, requires both a **Remote** modem connected at the control's location and a **Local** modem connected to the computer running CapTalk. The CapTalk host computer must also have access to a compatible internal or external modem, that meets the following requirements:

- An external modem (1200 baud or higher), capable of understanding standard AT commands.
- Serial modem cable with 9-pin connector for the control and the applicable modem connector.

■**NOTE:** Any compatible modem may be used; however, the unit only communicates at 1200 to 9600 baud.

Connecting the Local Modem to the Computer

1. If the computer has an external modem, then use a standard straight-through RS-232 modem cable (BECO# M-3933) to connect the computer to the modem.
2. If the computer has an internal modem, then refer to the modem's instruction book to determine which communications port should be selected.
3. Verify that the modem is attached to (if external) or assigned to (if internal) the same serial port as assigned in CapTalk. While CapTalk can use any of the 255 serial ports (COM1 through COM255), most computers support only COM1 and COM2.
4. Connect the modem to a telephone line, then energize the modem.

Connecting the Remote Modem to the Control

Setup of the modem attached to the control may be slightly complicated. It involves programming parameters (using the AT command set), and storing this profile in the modem's nonvolatile memory. After programming, the modem will power up in the proper state for communicating with the control. Programming may be accomplished by using the "Bring Up Terminal Window after dialing" selection. Refer to your modem manual for further information.

1. Connect the control to an external modem by attaching a standard RS-232 modem cable to the appropriate serial communications port on both the unit and the modem.
2. Connect the modem to a telephone line, then energize the modem.

■**NOTE:** The control does not issue or understand any modem commands. It will not adjust the baud rate and should be considered a "dumb" peripheral. It communicates with 1 start, 8 data, and 0, 1 or 2 stop bits.

The modem attached to the control must have the following AT command configuration:

E0 – No Echo
Q1 – Don't return result code
&D3 – On to OFF DTR, hangup and reset
&S0 – DSR always on
&C1 – DCD ON when detected
S0=2 – Answer on second ring

The following commands may also be required at the modem:

&Q6 – Constant DTE to DCE
N0 – Answer only at specified speed
W – Disable serial data rate adjust
\Q3 – Bidirectional RTS/CTS relay
&B1 – Fixed serial port rate
S37 – Desired line connection speed

When connected to another terminal device, the Terminal Window allows the user to send messages or commands. Outgoing communications are displayed in the top pane and incoming messages are displayed in the bottom two panes, in ASCII text and HEX format.

There are some variations in the AT commands supported by modem manufacturers. Refer to the hardware user documentation for a list of supported AT commands and issuing these commands.

Initializing the Local Computer Modem from CapTalk

Select **Connect/Modem**. CapTalk will display the Modem Connection screen (Figure 4-10). Enter the communication parameters, then select **Connect**.

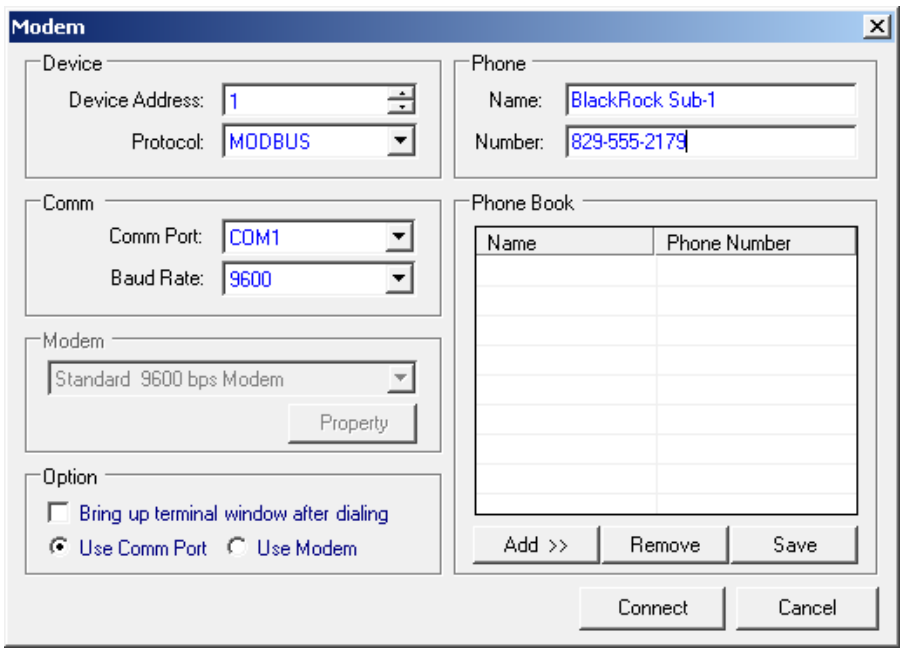


Figure 4-10 Modem Connection Screen

SCADA HEARTBEAT

The SCADA HeartBeat feature can be disabled, enabled in standard mode or enabled direct method. If enabled in the Standard Mode, the control will stay in or enter the Remote Control Mode if a valid DNP poll is received from a client device before the SCADA HeartBeat timer expires. If at the end of the SCADA HeartBeat period the control did not receive a valid DNP poll, the control will then revert to the Auto Control Mode. If the SCADA HeartBeat feature is disabled, the control resides in Auto Control Mode and will enter Remote Control Mode ONLY after the Client Device sends a Block Auto command to the control.

If the control is configured to Direct Method, the SCADA HeartBeat timer will be refreshed to the new value written through communication (to specific communication point). The specific communication point can be accessed using "Direct SCADA Heart Beat Timer (Sec)" in DNP and Register 946 in MODBUS.

■**NOTE:** The SCADA HeartBeat feature is only available with the DNP protocol.

Select **Communication/Setup/SCADA Heart Beat Setting**. CapTalk will display the SCADA Settings screen (Figure 4-11). Select either Standard or Direct Heart Beat Method, then enter the Timer setting. Select **Save**. CapTalk will display the "Confirm Writing to Device" screen. Select **OK**. CapTalk will display a "Setpoints Successfully Written" confirmation screen.

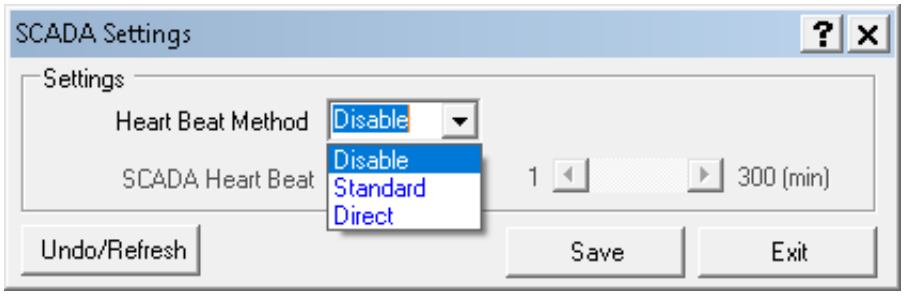


Figure 4-11 SCADA HeartBeat Settings Screen

4.5 Communications with Multiple Controls

▲**CAUTION:** Each control connected to either a direct or modem connection configuration must have a unique communications address. If two or more controls share the same address, corrupted communication will result. A control address of zero is a "wild card" that will illicit a response from all controls on a shared connection and result in corrupted communication.

The remote addressing capability of CapTalk and the M-6283A Three Phase Capacitor Bank Control allows multiple controls to share a direct or network connection. A Fiber Optic Loop network (Figure 4-12), RS-485 network (Figure 4-13), or optional Ethernet network (Figure 4-14) may also be used.

With these arrangements, any control can be selected from within CapTalk by specifying its unique communications address, ranging from 1 to 65519. The communication address must have previously been set from the control's front panel.

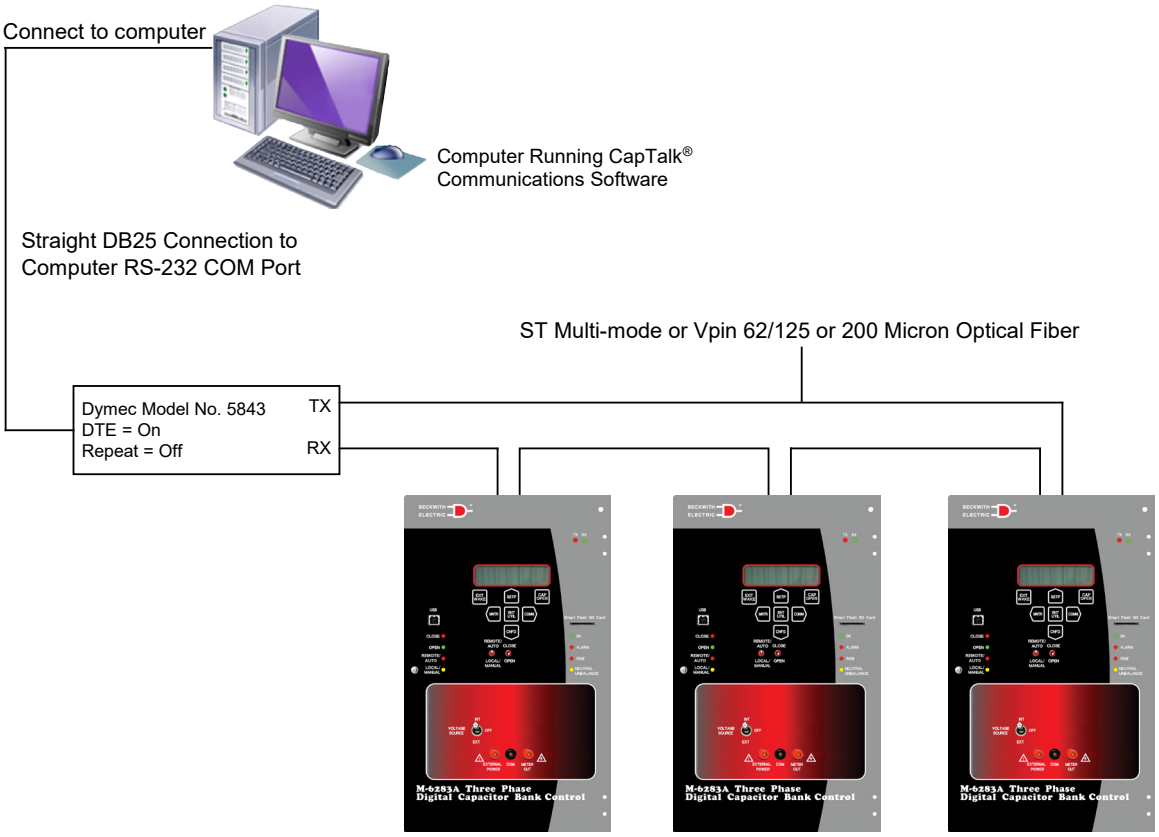


Figure 4-12 Fiber Optic Connection Loop

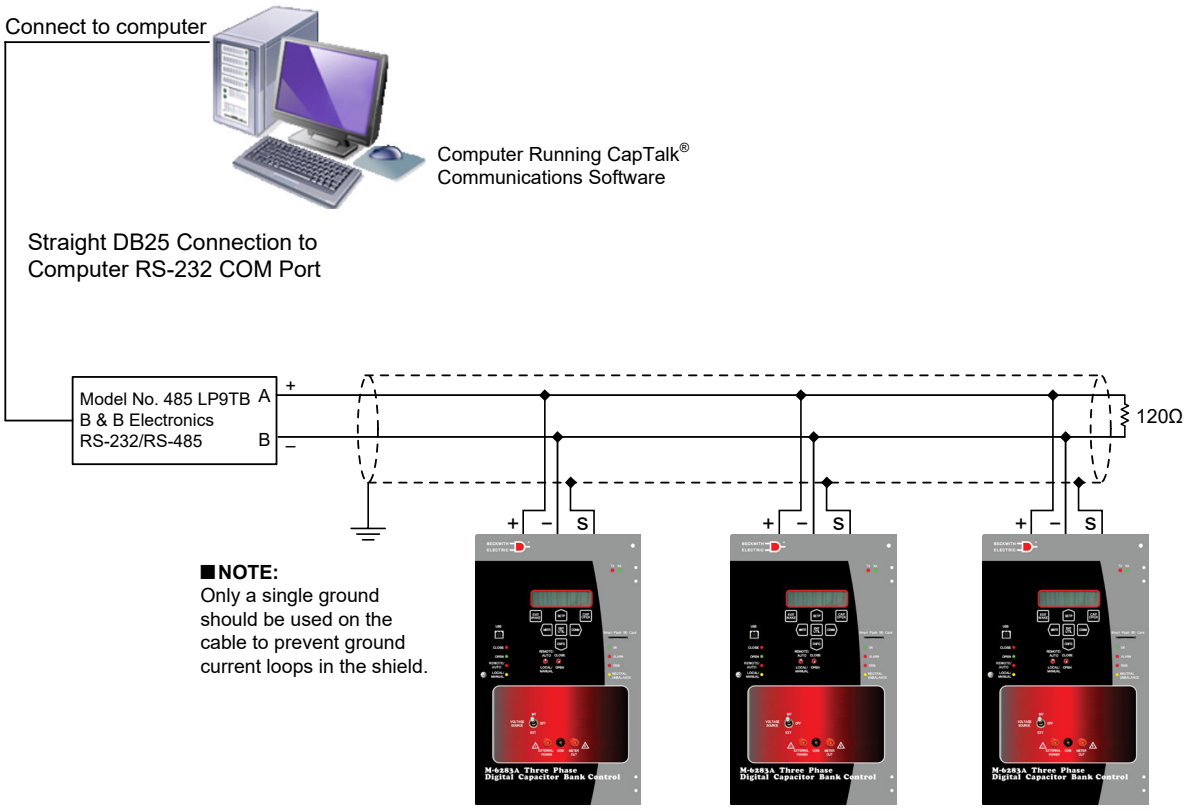


Figure 4-13 RS-485 Connection Diagram

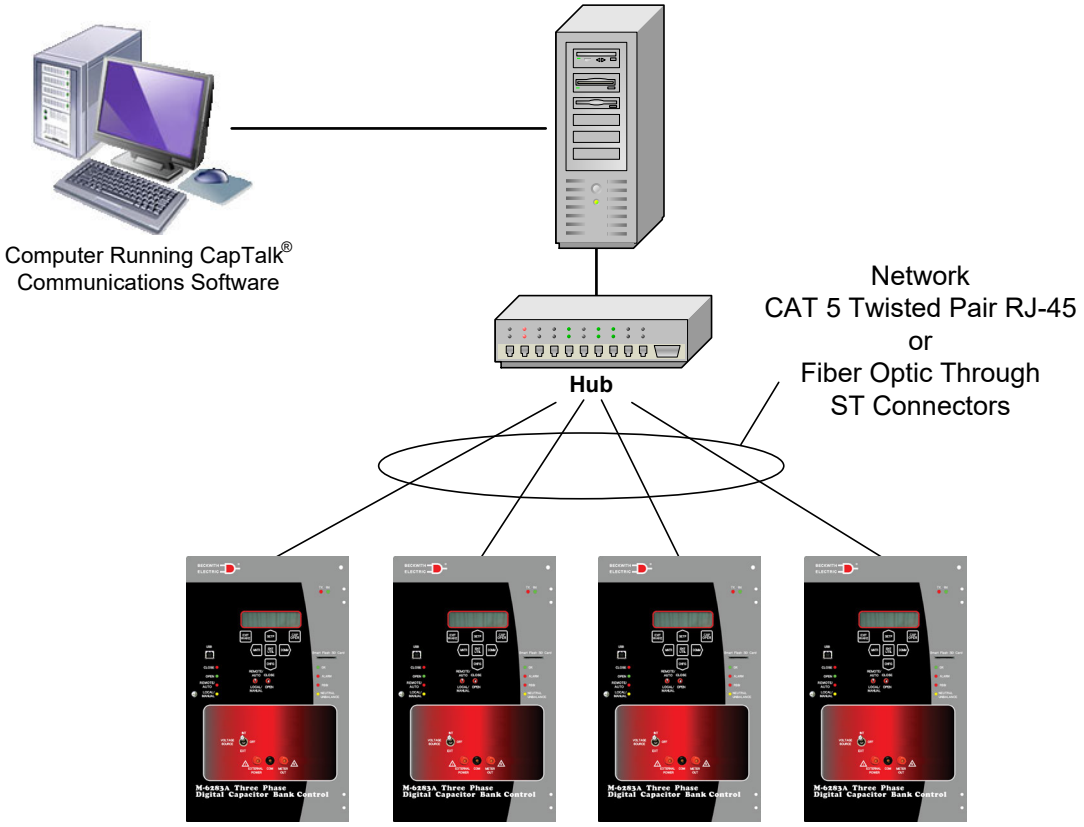


Figure 4-14 Optional Ethernet Network Connection

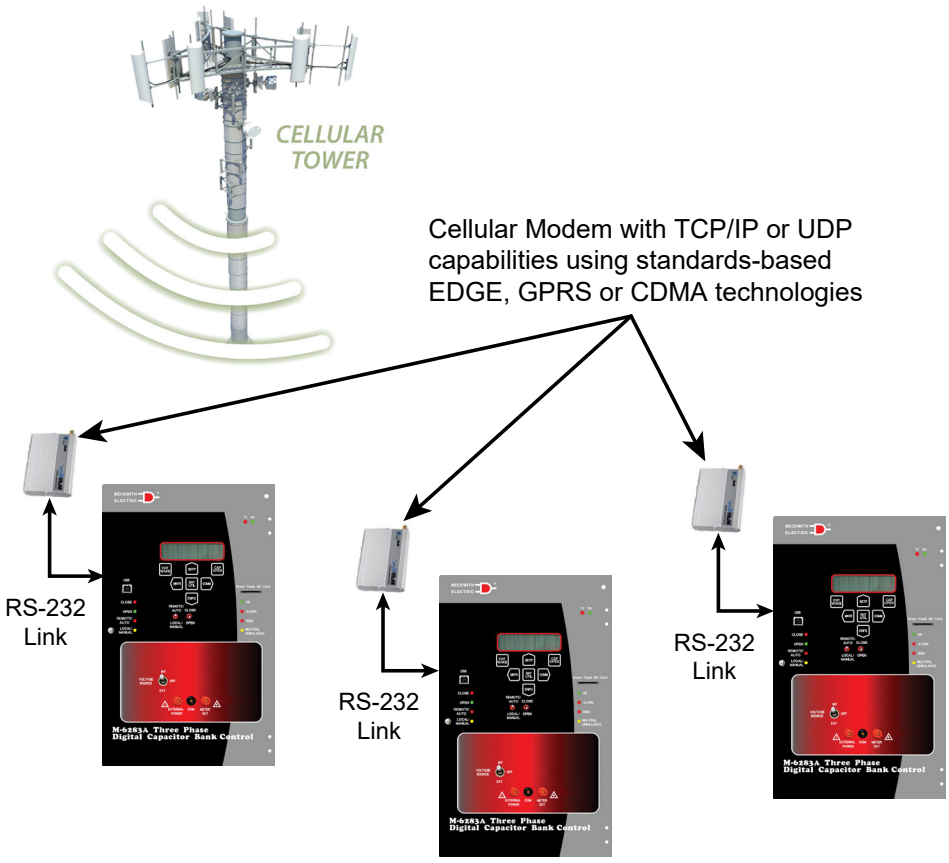


Figure 4-15 Cellular Modem Network

FEEDER AND/OR SUBSTATION ADDRESSING

Each control has three addresses.

1. Communications address
2. Feeder address
3. Substation address

Any valid DNP command can be used to communicate with individual controls using the **Communications** address. To address a group of controls using the **Feeder** and/or the **Substation** addresses, a DNP command with no acknowledgment shall be used. For example Direct Operate with NO acknowledgment (FC 06). If a command with acknowledgment is sent by the Client, the control will accept the command but will not reply with an acknowledgment.

All addresses range from 0 to 0xFFEF. For feeder and substation addresses, setting the value to zero effectively **disables** the corresponding address. It is important that there are no duplicate addresses on any device on the network.

In the system depicted in Figure 4-16, there are three substations: S1, S2, and S3. There are a total of 9 feeders, F1-F9, grouped as shown. Each feeder has 3 controls, one for each phase. Each control will have 3 addresses assigned to it.

For example: Control D1 on Feeder F4 in Substation S2 will have the following:

1. Individual not duplicated communications address (0x212)
2. Feeder address = 0x4003
3. Substation address = 0x5001

In order to poll Control D1 on an individual basis, address 0x212 is used. For example, to invoke voltage reduction individually on Control D1, use direct operate with or without acknowledge to address 0x212 on the appropriate point.

To invoke voltage reduction on Feeder F4 grouping, use direct operate without acknowledge to address 0x4003, instead of three different commands sent to Control D1, D2 and D3 individually.

To invoke voltage reduction on the entire Substation S2, use a direct operate command without acknowledge to address 0x5001.

■**NOTE:** The same concept applies to network configuration (Figure 4-17).

Change Communication Addresses from CapTalk

To change to a different Communication Address, Substation or Feeder Address, select **Communication/ Setup/Change Address**. CapTalk will display the "Change Address Warning" screen. Verify the criteria presented in the Warning screen and select **Yes** to proceed. CapTalk will display the "Change Communication Address" screen. Enter the desired Communication, Substation or Feeder address, then select **Save**. CapTalk will display a Save confirmation screen. Select **OK**. CapTalk will display a confirmation screen.

Using Ethernet with Substation and Feeder Addresses

In order to use the Substation and Feeder addresses over ethernet, the user must send the commands as mentioned above using DNP over UDP instead of TCP and must use 255.255.255.255 as the IP address to send to (the DNP Broadcast IP address).

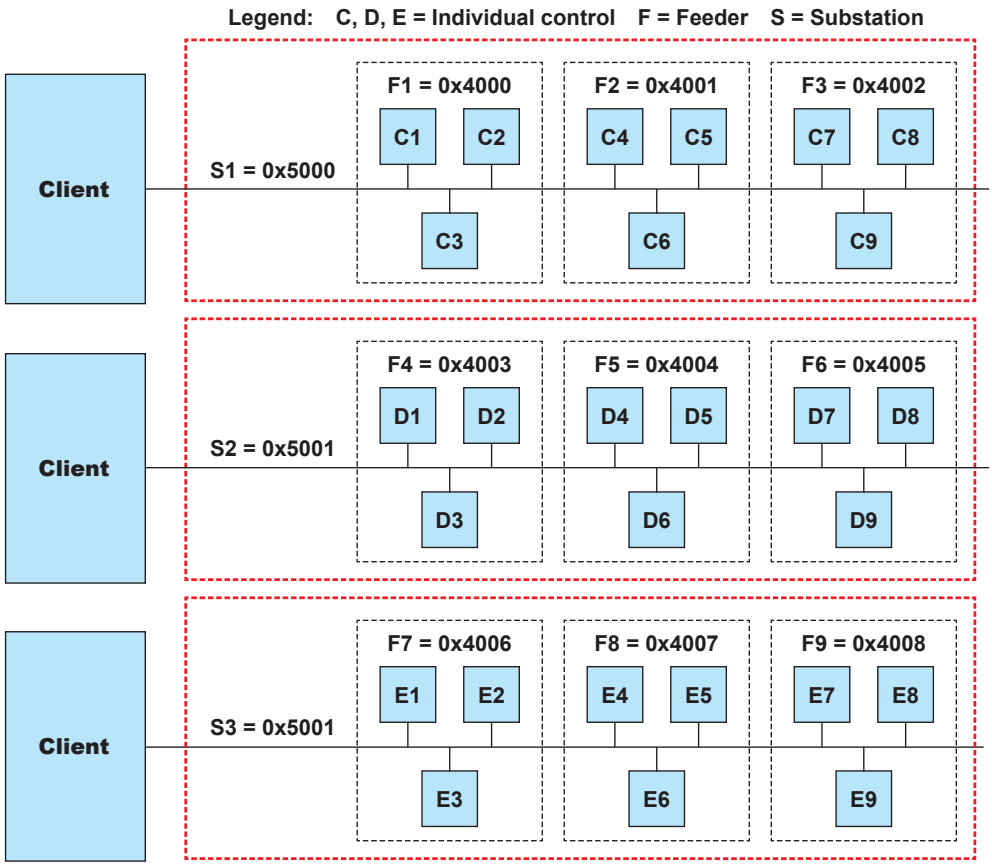


Figure 4-16 Multiple Client, Feeder and/or Substation Addressing

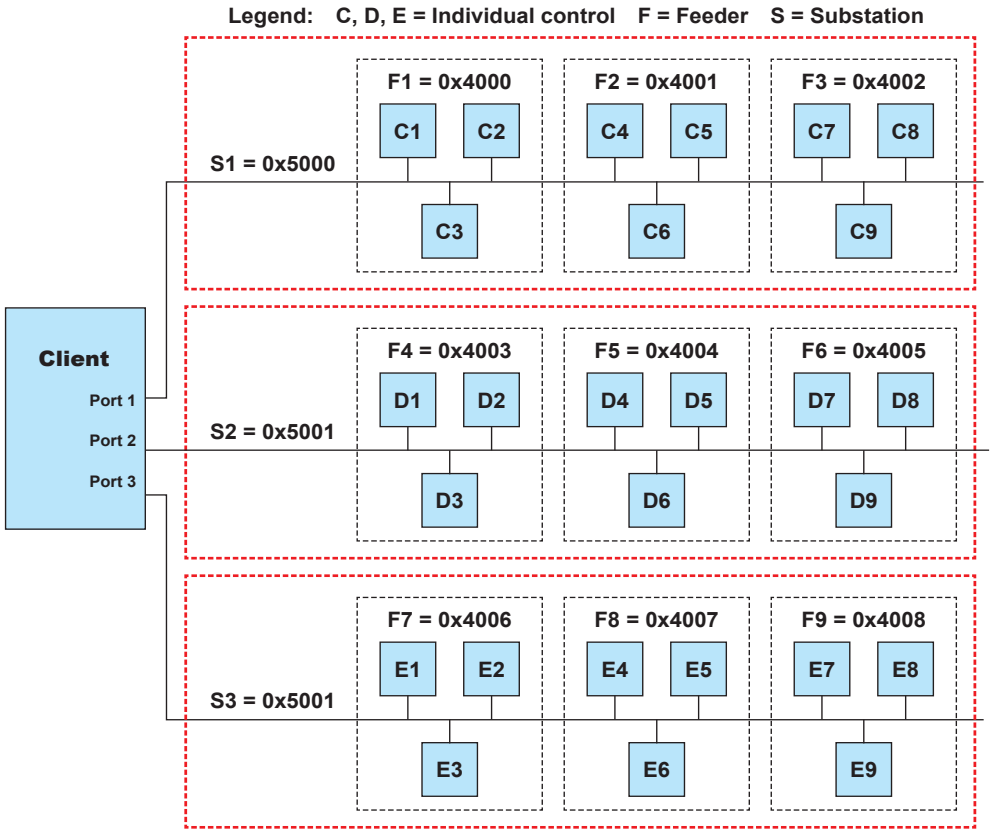


Figure 4-17 Single Client, Feeder and/or Substation Addressing Network Connection

4.6 Cautions

Control and CapTalk Compatibility

Every attempt has been made to maintain compatibility with previous control software versions. In some cases (most notably, with older controls), compatibility cannot be maintained. However, CapTalk should work correctly with more than one version of the M-6283A Series Digital Capacitor Bank Controls on a single bus, provided that the controls are all set to use the same protocol.

CapTalk versions D-0323V10.16.XX and higher will restrict access to any control with a firmware version that is higher than the firmware version supported by the user's version of CapTalk. Newer firmware will not be supported by earlier versions of CapTalk. When attempting to connect to a control with a firmware version that is not supported, CapTalk will not connect to the control, and will display an error message with the version incompatibility details (Figure 4-18). If there is any question about compatibility, contact the factory.

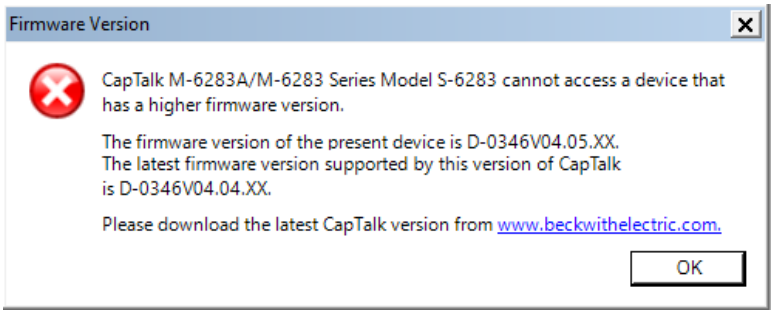


Figure 4-18 CapTalk Firmware Version Incompatibility Error Screen

Control Priority

Control conflicts will not occur as local commands initiated from the front panel receive priority recognition.

Time and Date Stamping

Time and date stamping of events is only as useful as the validity of the control's internal clock. Under the Configuration/System Clock menu, the Set Control Date/Time command allows you to manually set the control's clock. For reference, the computer's clock is also displayed.

4.7 Overview of CapTalk Features

The CapTalk CapTalk Startup screen menu structure is shown in Figure 4-19. The CapTalk Main Screen menu structures are presented in Figure 4-20. The CapTalk main screen Connected (Figure 4-20) also displays the type of connection that is active (top of menu bar), and on the bottom menu bar the Control Time, Firmware Version, Connection Status, and Setpoint Profile Active.

■**NOTE:** If communication is not established with the unit and no file is open, items relating to settings and monitoring are disabled. If not connected but a file is open, monitoring screens are displayed with sample data, and some screens may be grayed out.

When in **File Mode** with a named file open, the file name and path to the file are displayed in the top Menu Bar. When **Connected**, the CapTalk Main Screen will display the type of Connection that is in effect in the top Menu Bar.

The **Connected Mode** bottom Menu Bar will display:

- Control Time
- Firmware Version
- Connection Status
- Active Setpoint Profile

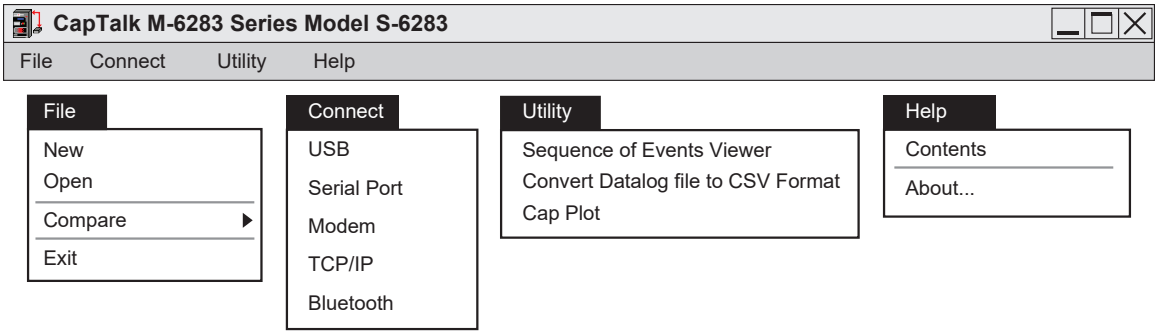


Figure 4-19 CapTalk Startup Screen Menu Selections

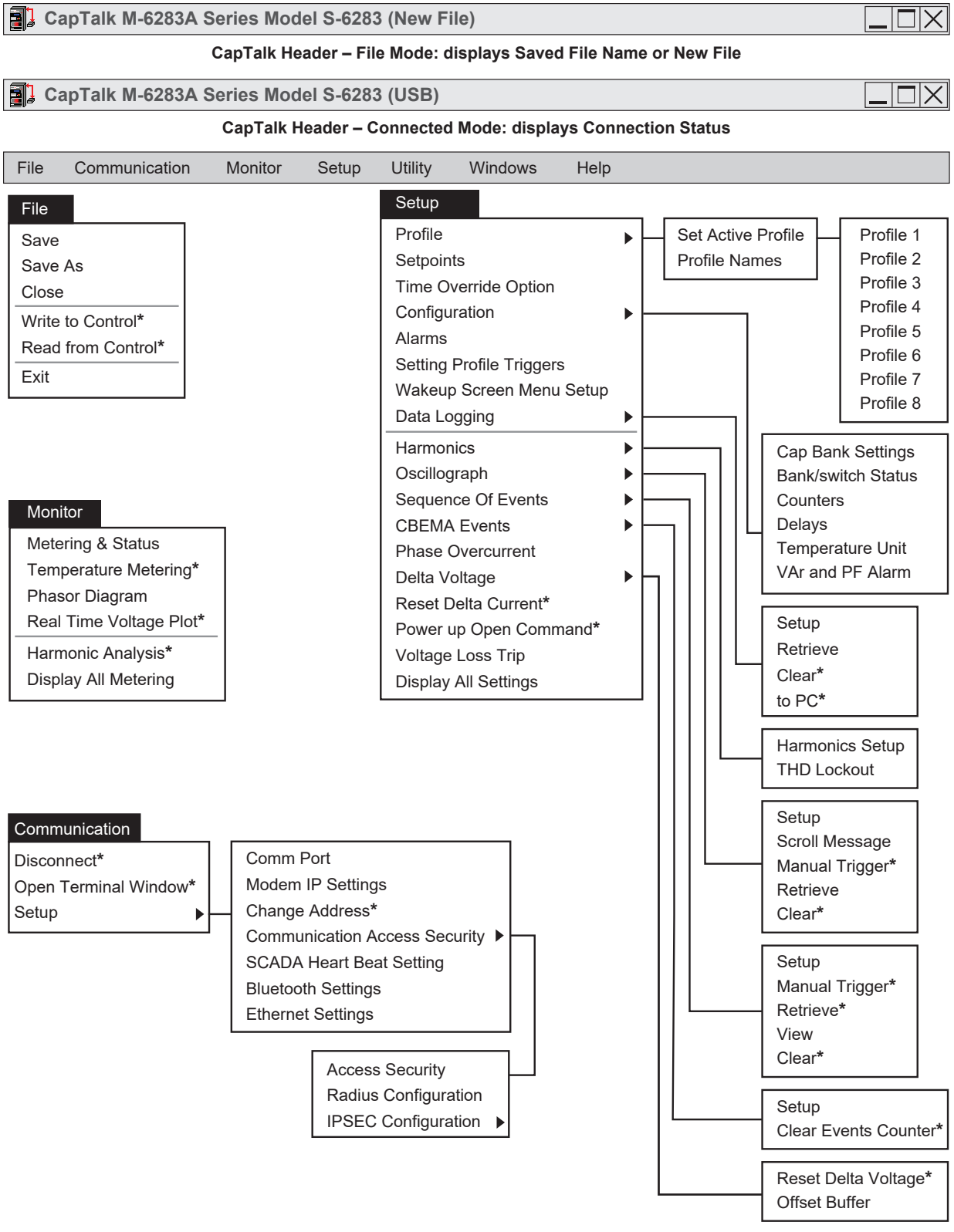
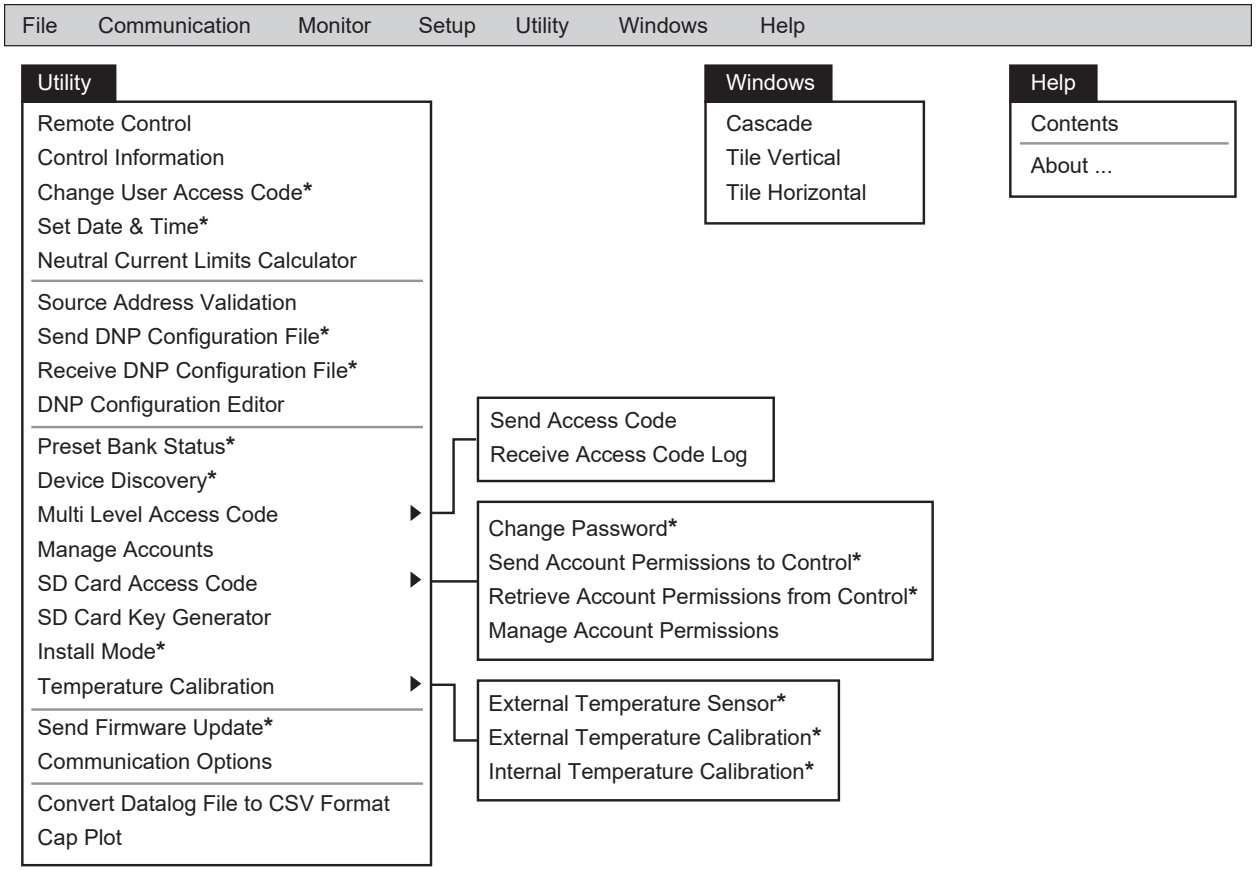


Figure 4-20 CapTalk Main Screen Menu Selections (Continued on next page)



■**NOTE:** Items with * are Grayed out in File Mode

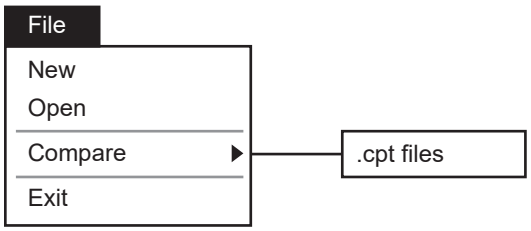
CapTalk Main Screen Menu Selections (Continued)

CapTalk Quick Access Toolbar

The default CapTalk Quick Access Toolbar contains commonly used feature icons for the Save, Metering & Status, Motor Current Profile, Setpoints, Trigger Oscillograph, and Trigger Sequence of events. This toolbar may be customized by right-clicking on the toolbar, to display the "Start Edit/End Edit Toolbar" selections. Drag and drop any CapTalk menu to add it to the Quick Access Toolbar.

4.8 File Menu

File Not Open or Not Connected Mode



The File dropdown menu when CapTalk is not connected to a control or a file is not open provides the following features:

New – Opens the New File screen which allows the user to enter the parameters of the New File including: the Unit Type, Firmware Version, Nominal Frequency, Neutral Current option, VAr Option, Independent Phase Switching, and Switch Control Type.

Open – Opens the file browser window to allow the user to select an existing file. It will not allow the user to create a new file.

Compare – The Setpoint File Compare feature allows the user to compare two Setpoints Files (.cpt) and generate a report that presents the differences in setpoint values and settings in a side by side format. The report can be printed and can be displayed with just the differences or all the settings that exist in both files. The more current setpoint file may be edited and saved. See **Chapter 3, System Setpoints** for detailed information.

Exit – Exits the CapTalk program.

New File Selective Mode

■**NOTE:** This feature is available in firmware versions 04.05.XX or greater.

The ability to create a Settings File with only Selected Setup Points is available in CapTalk New File Selective Mode. The Selected Setup Points feature allows the user to easily modify only particular settings, without reviewing or re-entering the entire range of parameters loaded in a control. Changes are saved in a local (*.cpt) file that can be sent to the control(s) when appropriate.

■**NOTE:** In the **New File Selective Mode**, the Communication, Monitor and Utility menus are grayed out. Close or relaunch CapTalk and use default "Create Settings File with: **All Points"** to enable these menus.

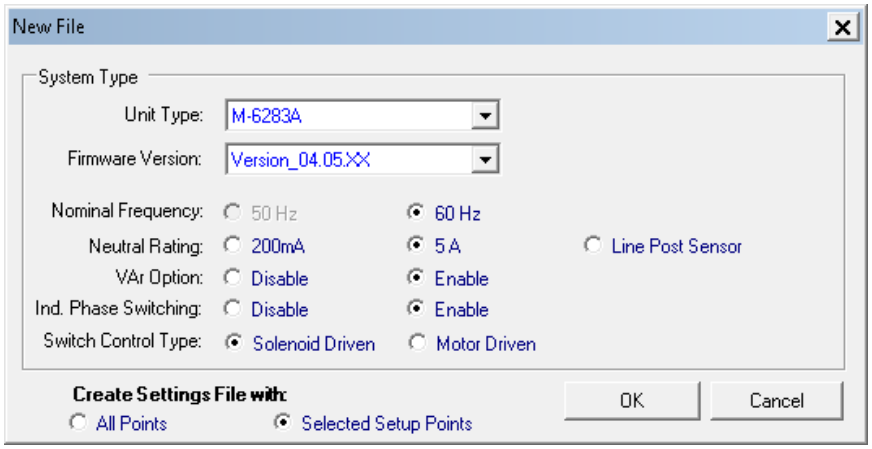


Figure 4-21 New File Screen with Selected Setup Points Feature

After launching CapTalk, in the **File** menu select **New** then select the Firmware Version in use. At the bottom of the New File screen, select "Create Settings File with: **Selected Setup Points**". Then the **Setup** dropdown menu will display the setting screens that may be used to create a Selected Setup Points file.

When a **Setup** dropdown option is selected, the screen name will be followed by "(New File Selective Mode)" to indicate this editing function is active (Figure 4-22). Each Setup screen also displays a line of yellow at the top and yellow highlighted note at the bottom. Screens in this mode show empty data fields until a change is made to a specific point.

The **Setup** dropdown menu provides these screen selections:

- Profile
- Setpoints
- Time Override Option
- Configuration
- Alarms
- Settings Profile Triggers
- Wakeup Screen Menu Setup
- Data Logging
- Harmonics
- Oscillograph
- Sequence of Events
- CBEMA Events
- Phase Overcurrent
- Delta Voltage Offset Buffer
- Voltage Loss Trip.
- Display All Settings*

*In this mode, the **Display All Settings** summary shows only changed settings.

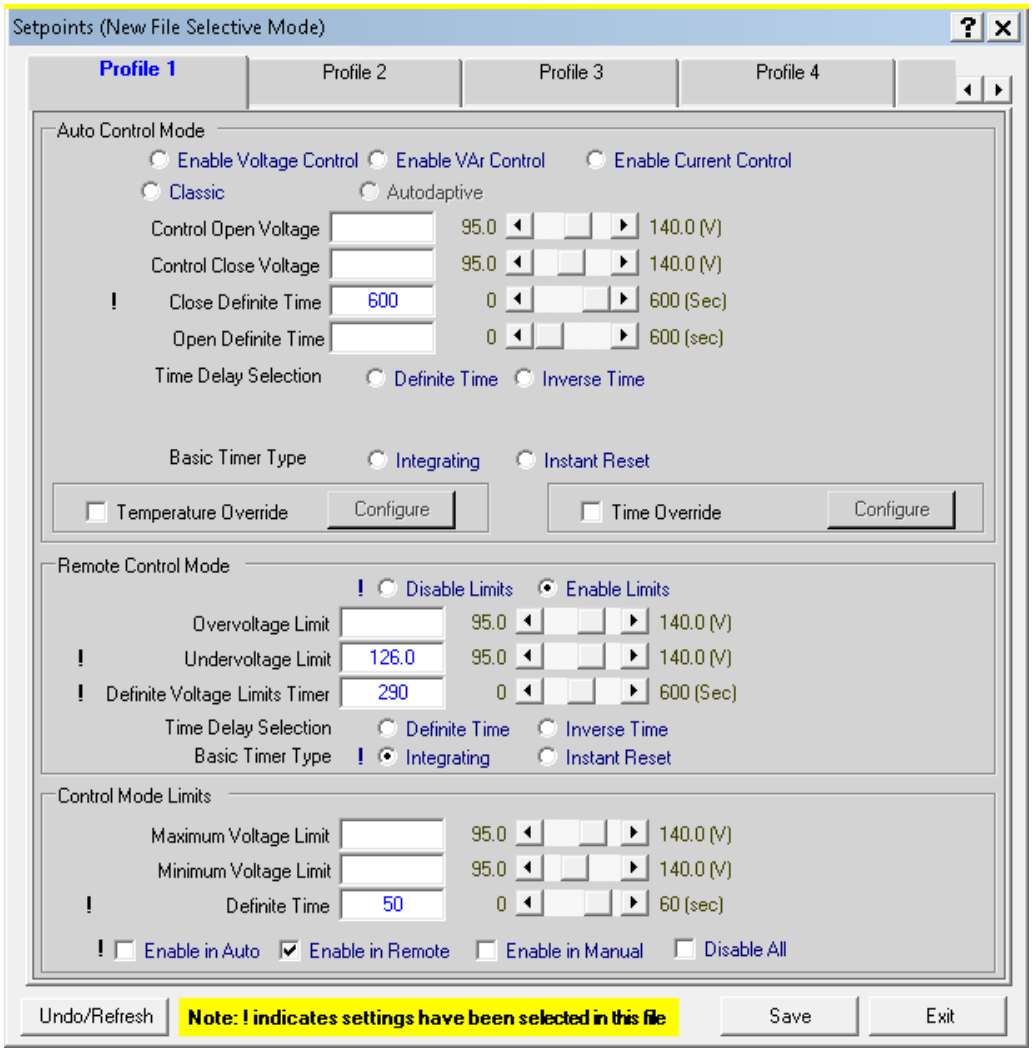


Figure 4-22 Setpoints (New File Selective Mode) Screen

Whenever a value is entered in any field of a screen, an exclamation point "**!**" appears to indicate that a setting has been selected to be saved. "Save" in each screen saves the changes but does not yet write a file.

■**NOTE:** Click the adjacent "**!**" to clear any entry. Deleting an entry then saving a blank field could create an error. Clicking "**!**" clears each edit so CapTalk does not save an unwanted change.

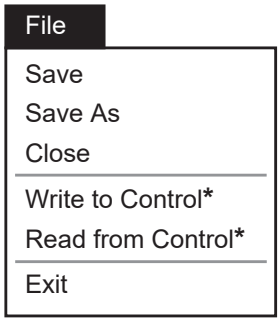
Exit or File/Save the Selected Setup Points File

After making all desired selections, Save the new (*.cpt) file. If the user selects Exit or Close without saving, CapTalk will display a warning prompt where selecting Yes will open a **Save As** screen. Once a (*cpt) file has been created and is open, the top of each Setup screen will display the directory path and name of the open file. After exiting CapTalk, the saved file can be opened for editing or sent to a connected control.

Remotely Update a Control using REFU

A saved (*.cpt) file, that is either Selected Setup Points or All Points, can be sent to a control or a series of controls using the Remote Ethernet File Update Utility (REFU) which is available from Beckwith Electric.

File Menu (File Mode or Connected Mode)



* Grayed out in File Mode

The **File** toolbar item when CapTalk is connected to a control or a file is open provides the following features:

Save – Saves the open file.

Save As – Allows the user to save the open file with a different file name.

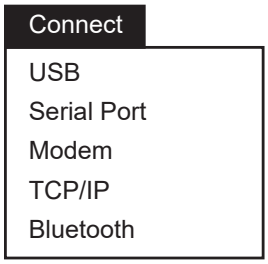
Close – Closes the open file in the control window.

Write to Control – When connected to a control, this function allows the user to open a (*.cpt) file and send the settings to the control.

Read from Control – When connected to a control, this function allows the user to retrieve the control settings file and save the file (*.cpt) to the PC.

Exit – Exits the CapTalk program.

4.9 Connect Menu



The **Connect** dropdown menu is displayed when the unit is not connected to a control. This menu allows the user to access the screens that are necessary to set CapTalk communication parameters and connect to the target control. Menu selections include **USB**, **Serial Port**, **Modem, TCP/IP**, and **Bluetooth**.

Connect/USB

The USB menu selection initiates the USB screen to connect to the M-6283A USB Port (Figure 4-3). The user is prompted to input the required Device and Access code. The USB/CommPort selection identifies the computer Comm Port to be utilized for communication.

Connect/Serial Port

The **Serial Port** menu selection initiates the **Serial Port** screen (Figure 4-23). The user is prompted to input the necessary communications information to open Serial communications through the selected Comm Port.

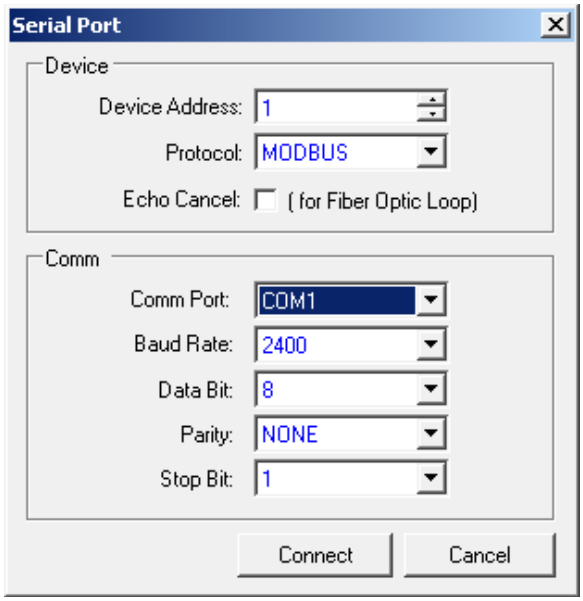


Figure 4-23 Serial Port Connection Screen

Default device parameters, or those that have been configured locally at the control include:

- Device Address (1)
- Protocol (MODBUS)
- Echo Cancel for Fiber Optic Loop (None)

■**NOTE:** The Echo Cancel check box should only be used when several relays are connected using a fiber optic loop network. Otherwise, echo cancel must not be selected because communication will be prevented.

Connect/Modem

The **Modem** menu selection initiates the **Modem** connection screen (Figure 4-10). This screen contains the Device, Phone, PC Comm Port and Modem parameters that are necessary to setup and communicate with a modem attached to the host computer and the target M-6283A. The user can add a Name and Phone Number into the Phone Book and **Save** for future use.

Connect/TCP/IP

The **TCP/IP** menu selection initiates the **TCP/IP** connection screen (Figure 4-24). Input the necessary communication parameters to open communications through the Ethernet port. Multiple Domain/Name and IP Addresses may be added to the Address book and **Saved** for future use. The Address Book may also be **Exported** as an Excel spreadsheet file (*.xlsx) to a local directory. The file may be edited as necessary and then **Imported** into the Address Book.

During the file **Import** process, CapTalk will perform IP address validation. If there are any IP address errors, those addresses will not be imported. Cap Talk will display a Warning message: *"The IP addresses have not been loaded. Invalid IP address format."* The Import selection allows the user to import either an Excel (*xlsx) file, or a (*.xml) file.

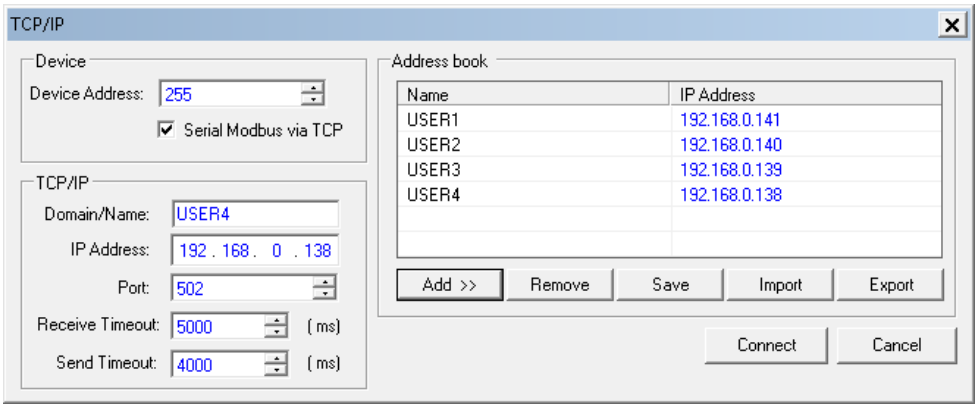


Figure 4-24 TCP/IP Connection Screen

Connect/Bluetooth

When the control's Bluetooth module is set to MODE1, the only way to connect to the control is to use the Secure Non-Discoverable connection method.

Select **Connect/Bluetooth** from the CapTalk toolbar. CapTalk will display the Secure Bluetooth connection screen (Figure 4-25). Enter the communication parameters and select **Connect**. The connection time to the control will depend on the distance between the control and the client device and also on the amount of RF interference present.

The user has the option to create a Bluetooth session and save it to an address book. The session must contain a name unique to the address book, the MAC address, Pass Key and Device address.

■**NOTE:** When using the SENA Parani SD1000U USB to Bluetooth adapter, no user configuration of the device is required, and the utility provided with the device is not needed. CapTalk will communicate directly with the SD1000U using the "Secure Bluetooth" screen.

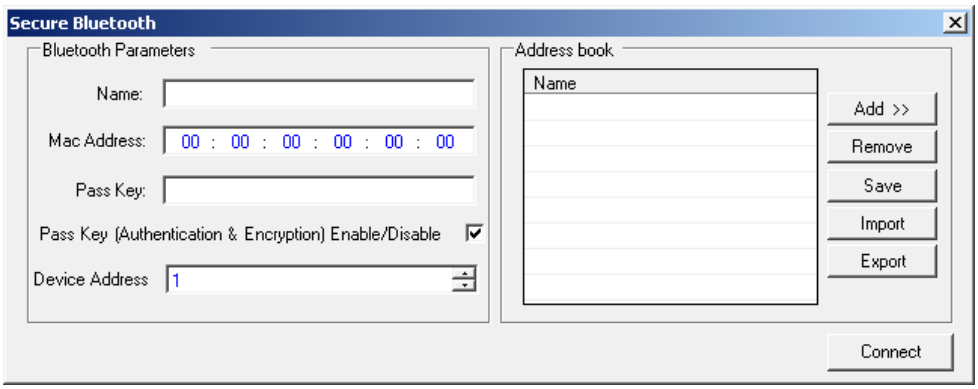
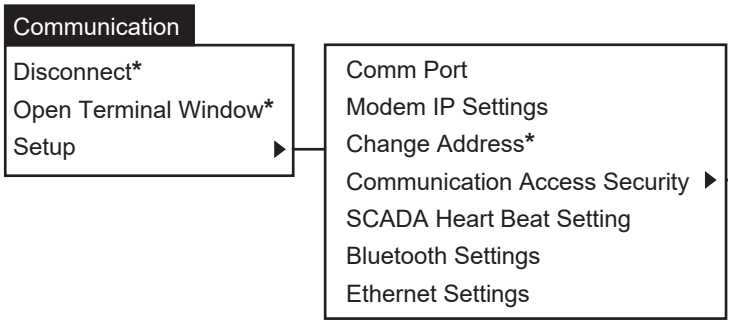


Figure 4-25 Secure Bluetooth Connection Mode 1 Screen

COMMUNICATION MENU



The **Communication** dropdown menu is displayed when CapTalk is connected to a control. This menu provides the user with access to the screens that are necessary to **Disconnect** from the target control, or access the **Communication Setup** menu items.

Communication/Disconnect

The Disconnect menu item when selected prompts the user to confirm the disconnect command.

Communication/Open Terminal Window

Not Available at this time.

Communication/Setup/Comm Port

The **Setup/Comm Port** submenu allows the user to setup and configure Serial Port COM1 (Figure 4-6) and the optional Serial Port COM2 (Figure 4-7).

Communication/Setup/Modem IP Settings

The **Setup/Modem IP Settings** submenu allows the user to assign a static IP Address when the SCADA HeartBeat feature is enabled.

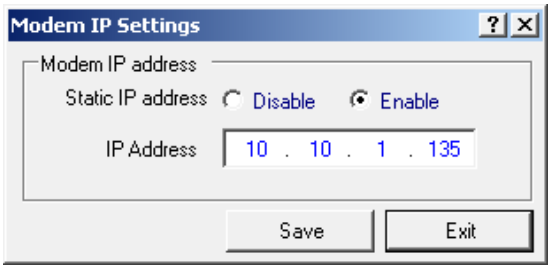


Figure 4-26 Modem IP Settings Screen

Communication/Setup/Change Address

The Communication Address is used for both DNP and MODBUS protocols. Substation and Feeder Addresses apply only to DNP protocol. Refer to Substation and Feeder Addresses earlier in this chapter. As long as communication to the remote location is maintained, the user can switch between controls.

Communication/Setup/Communication Access Security

When Communication Access Security is enabled it applies only when the MODBUS protocol has been selected, regardless of the physical interface. When enabled, the user Level Access Code must match either the Level 1 or Level 2 Access Code. If an invalid Level 1 or Level 2 Access Code is entered at the connection prompt, then read only access will be granted. When this feature is enabled, CapTalk must be closed for the Communication Access Timeout setting (15 to 50000 seconds) before any Access Code changes will take effect (Figure 4-27).

The Comm Access Security feature should be enabled when CapTalk is the only MODBUS application that will be used to communicate with the control. It will prevent any non-CapTalk utility from communicating via MODBUS to the control. If this security is desired for 3rd party MODBUS applications, contact Beckwith Electric to discuss partnering to create a secure interface on the customer end to accomplish this.

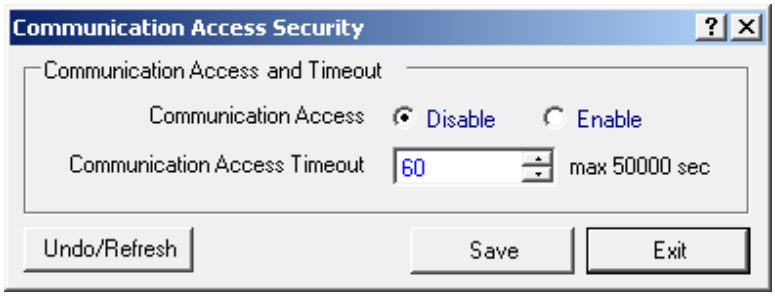


Figure 4-27 Communication Access Security Screen

Radius Configuration

The Radius Configuration submenu allows up to two Remote Authentication RADIUS servers to be enabled and configured. See **Appendix D Cyber Security** for detailed information.

IPSEC Configuration

The IPSEC Configuration submenu allows Internet Protocol Security (IPsec) to be enabled and configured. The ability to Send and Retrieve IPsec Configuration files is also provided. See **Appendix D Cyber Security** for detailed information.

Communication/Setup/SCADA HeartBeat Setting

The Setup/SCADA Heart Beat Setting submenu DNP Option submenu allows the user to Enable/Disable SCADA HeartBeat in either the Standard or Direct mode and set the HeartBeat timer. See "SCADA HeartBeat" on page 4–12 for detailed information.

Communication/Setup/Bluetooth Settings

The **Setup/Bluetooth Settings** submenu allows the user to setup and configure optional Bluetooth communication parameters (Figure 4-9).

Communication/Setup/Ethernet

The **Setup/Ethernet** submenu allows the user to setup and configure the optional Ethernet Port (Figure 4-8).

4.10 Monitor Menu

Monitor
- Metering & Status
- Temperature Metering*
- Phasor Diagram
- Real Time Voltage Plot*
- Harmonic Analysis*
- Display All Metering

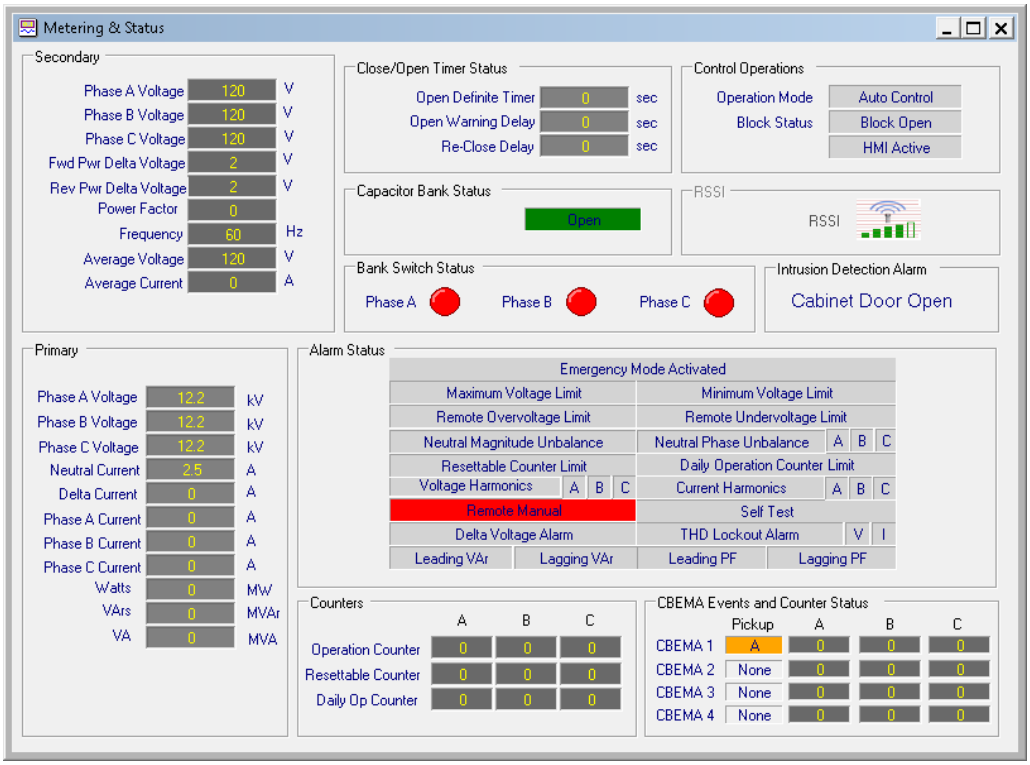
* Grayed out in File Mode

The **Monitor** menu item provides the user with access to the **Metering & Status**, **Temperature Metering, Phasor Diagram, Real Time Voltage Plot, Harmonic Analysis,** and **Display All Metering** submenu items.

MONITOR/METERING & STATUS

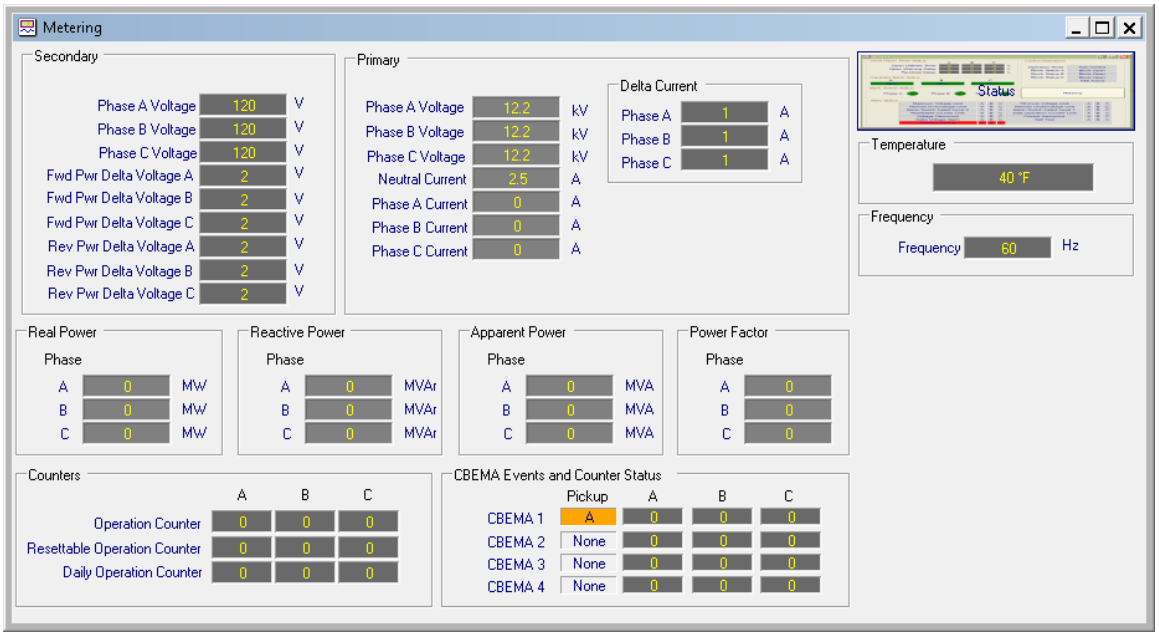
The **Metering & Status** submenu items displays the Metering & Status screen (Figure 4-28). Values displayed are updated depending on communication system capabilities.

When the Control Phase Selection is set to **Independent Phase**, the Monitor menu contains two submenus: Metering and Status. When selected, CapTalk will display separate screens (Figure 4-29) or (Figure 4-30).



■**NOTE:** Power Factor, Average Current, Phase Current, Real Power (MW), Reactive Power (MVAr), and Apparent Power (MVA) and are only available with the VAr Control Mode option.

Figure 4-28 Metering & Status Screen



■**NOTE:** Phase Current, Real Power, Reactive Power, Apparent Power and Power Factor are only available with the VAr Control Mode option.

Figure 4-29 Metering Screen (with Independent Phase Switching)

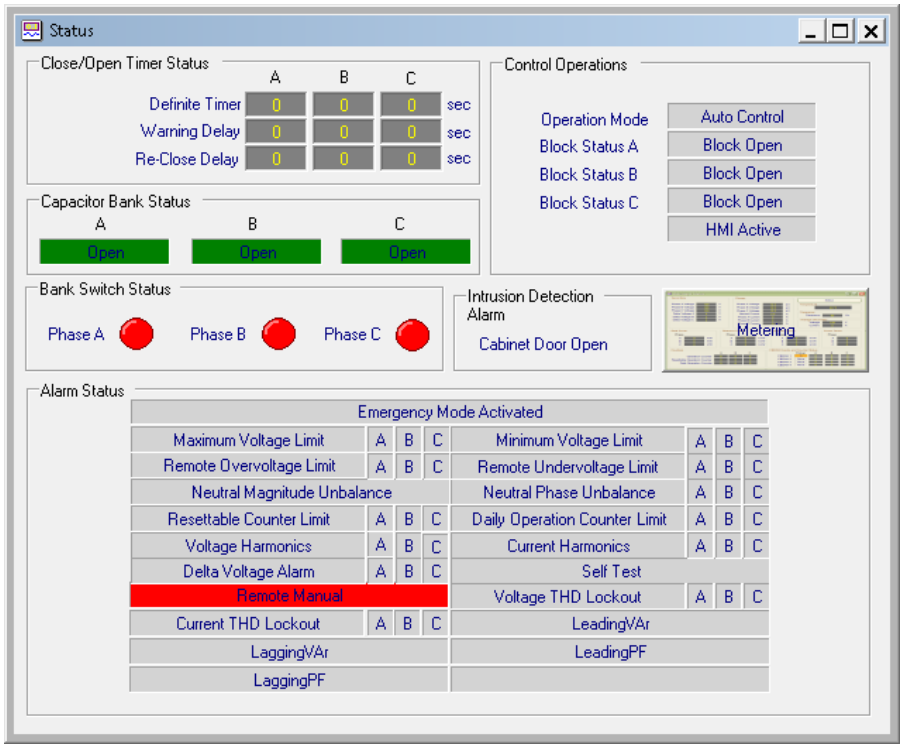


Figure 4-30 Status Screen (with Independent Phase Switching)

Secondary Metering

Phase Voltage (A, B, C) – Displays the real-time measured value of voltage and includes any corrections made using the user-selected VT correction voltage. Also displays the average voltage value.

Forward Power Delta Voltage (A, B, C) – Displays the real-time calculated forward power delta voltage.

Reverse Power Delta Voltage (A, B, C) – Displays the real-time calculated reverse power delta voltage.

Frequency – Displays the real-time measured frequency value.

Primary Metering

Primary Power Metering Units

The displayed Primary Metering values (Watts, VAr, VA) are scaled based on the "Primary Power Metering Units" selection in the Cap Bank Settings screen. The selections are Kilo or Mega (default). This setting applies to the CapTalk Metering & Status screen only; the HMI always displays power values in Mega.

Phase Voltage (A, B, C) – Displays the calculated primary voltage based on the user-selected voltage multiplier, VT corrections, and measured secondary voltage.

Neutral Current – Displays the calculated value of neutral current based on the user-selected current multiplier, VT corrections, and measured secondary voltage.

Delta Current (A, B, C) – Displays the calculated delta current for each close/open operation.

Phase Current (A, B, C) – With the VAr Control Mode option, displays the calculated primary phase current based on the user-selected phase current multiplier, and measured secondary phase current.

Real Power (A, B, C) – With the VAr Control Mode option, displays the calculated primary quantity based on the user-selected voltage and current multipliers; VT configuration (line-to-ground), single-phase, and measured secondary voltage and current.

Reactive Power (A, B, C) – With the VAr Control Mode option, displays the calculated primary quantity based on the user-selected voltage and current multipliers, VT configuration (line-to-ground), single-phase, and measured secondary voltage and current.

Apparent Power (A, B, C) – Displays the calculated primary quantity based on the user-selected voltage and current multipliers, VT configuration (line-to-ground), single-phase, and measured secondary voltage and current with VAr Control Mode option.

Power Factor (A, B, C) – Displays the real-time calculated value of power factor with VAr Control Mode option.

Close/Open Timer Status

The Close/Open Timer Status display is control mode dependent, and will identify the specific control mode limit that is currently timing (or has timed) toward an Open or Close operation.

Depending on the Auto/Remote Control settings that have been established in the control, the operational mode dependent limit that has been exceeded will be displayed along with the type of timer (Definite or Inverse). The **Definite Timer** counts down in seconds to zero, and the **Inverse Timer** counts down in percent to zeros. When the Inverse Timer is applicable, the percent value indicates the amount that the timer has timed in percent. A value of 75% would indicate that a 100 sec time delay has 75 seconds until it is timed out.

The Open/Close **Warning Delay** will display (in seconds) the current timing delay (Open/Close) when timing towards an Open or Close operation.

The **Re-Close Delay** will display (in seconds) that portion of the delay that has timed until the delay has timed out.

Capacitor Bank Status

Indicates the status of the Capacitor Bank switch (Open or Closed). The last bank status is saved at the end of the pulse duration on a loss of power to the control. It is reinstated when power is reapplied to the control. If Neutral Current Bank Status is enabled, the Neutral Current Bank Status will override the saved bank status. The bank status can be preset from the HMI or CapTalk.

Control Operations

The Control Operations section displays the **Operation Mode** of the control "Auto" or "Manual" (yellow).This section also displays the **Blocks**, **Limits** and **Lockouts** that are active. These can include:

- None (light gray)
- Block Open (green)
- Block Close (red)
- Daily Op Limit (red)
- Min Voltage Limit
- Max Voltage Limit
- NC Block (red)
- NC Lockout (red)

■**NOTE:** DNP Binary input points Block Close with Hysteresis and Block Open with Hysteresis are available with a fixed five second Hysteresis.

The **HMI Active** (yellow) indicates that the local HMI menu of the control is active. Turns off after 15 minutes of inactivity. HMI Active can also be selected as a Sequence of Events trigger, to record a time/date record of the front panel HMI access.

Bank Switch Status

Indicates the status of the individual phase switch contacts, when present (Gray = OFF, Green = ON).

Intrusion Detection Alarm

The Intrusion Detection Alarm displays the real-time status of the optional M-2980 Intrusion Detection Switch. The Status screen will display either "Cabinet Door Open" or "Cabinet Door Closed". If the Intrusion Detection Switch is not present, the status screen will display "Cabinet Door Open".

Alarm Status

There are four available states designated by color for each of the Alarm Status elements:

- Gray with Dark Gray Text – Alarm disabled and condition not met
- Gray with Black Text – Alarm enabled and condition not met
- RED – Alarm enabled and condition exists
- Gray with Bold Text – Alarm previously tripped

■**NOTE:** Time based Hysteresis is included during triggering/releasing of the Maximum/Minimum Voltage Limit and Remote Overvoltage/Undervoltage Limit Alarms. Definite timer values associated with each setpoint are used for each respective Hysteresis duration.

Counters

The Counters section displays the Phase A, B, C Counter value for the Operation Counter, Resettable Operation Counter, and Daily Operation Counter based on the Operation Counter Configuration setting (either a "Close Only" or an "Open or Close" operation).

■**NOTE:** Counters will not increment for retry operations (close to close or open to open).

CBEMA Events and Counter Status

This section displays the current CBEMA events and a counter for each event.

MONITOR/TEMPERATURE METERING

The Temperature Metering screen displays the Temperature reading from either the Internal Temperature Sensor or the optional External Temperature Sensor. When the Control Phase Selection is **Independent Phase**, the "Metering" screen will display the current unit temperature (Figure 4-29).

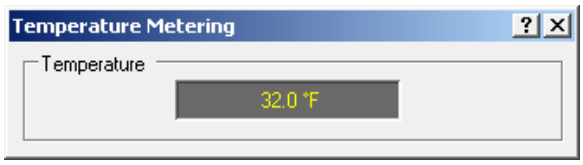


Figure 4-31 Temperature Metering Screen

MONITOR/PHASOR DIAGRAM

The Phasor Diagram (Figure 4-32) allows the user to evaluate a reference Phase Angle to Phase Angle data from other windings. The Phasor Diagram also includes a menu that allows the user to select/deselect sources to be displayed and Freeze capability to freeze the data displayed on the Phasor Diagram.

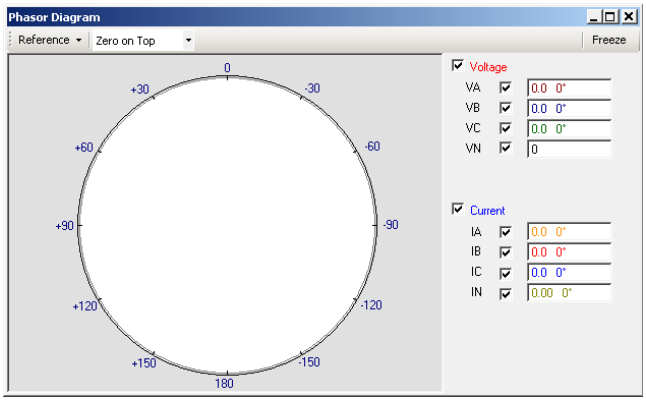


Figure 4-32 Phasor Diagram

MONITOR/REAL TIME VOLTAGE PLOT

The Real Time Voltage Plot (Figure 4-33) feature allows the user to monitor in real time the last 60 seconds of the source voltage value. The Voltage Plot freezes the last 30 seconds of the voltage profile and displays the current values.

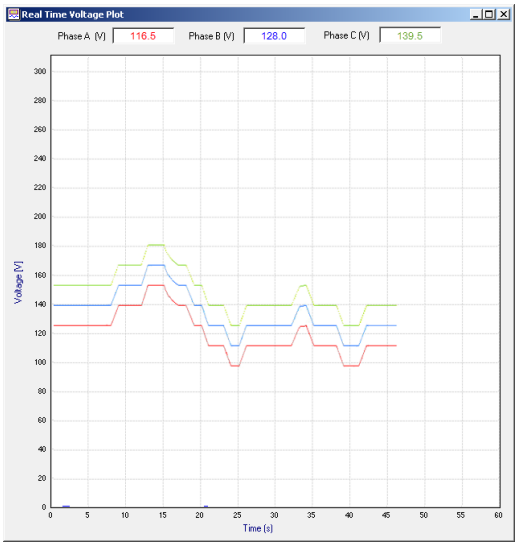


Figure 4-33 Real Time Voltage Plot

MONITOR/HARMONICS ANALYSIS

The input signal is sampled at 64 samples per cycle, giving an overall sampling rate of 3840 samples per second for a 60 Hz system. This provides the ability to reproduce signals of up to 1920 Hz. Therefore, up to the 31st harmonic can be calculated using Discrete Fourier Transform with a fundamental frequency of 60 Hz. The fundamental for both the Voltage and Current channels is calculated every sample, meaning, every 260.41 µs. These voltage and current magnitudes are used in a real-time decision making algorithm and real-time metering. Total Harmonic Distortion (THD) for both voltage and current are calculated and displayed using the following equation:

$$THD = \frac{\sqrt{[\sum_{k=2}^{31} A_k^2]}}{A_1}$$

Where k is the Harmonic number

In addition to Harmonics and THD calculations the secondary task also triggers the Sequence of Events (SOE) recorder whenever any Harmonic selected by the user exceeds a preset threshold level. The user is able to select which Harmonic(s) will trigger the SOE function and also set the threshold level, above which the SOE recorder will be initiated and below which the current will be ignored. The threshold level is set as a percentage of the magnitude of the fundamental. The user can also set the threshold level of either the Voltage or the Current Harmonic.

The Harmonic Analysis screen will display THD as well as the individual 2-31st harmonics for both Voltage and Current (if available). Both magnitude and percent are displayed in the table view and % is graphed for each harmonic with the magnitude displayed as a tooltip when hovering over each harmonic.

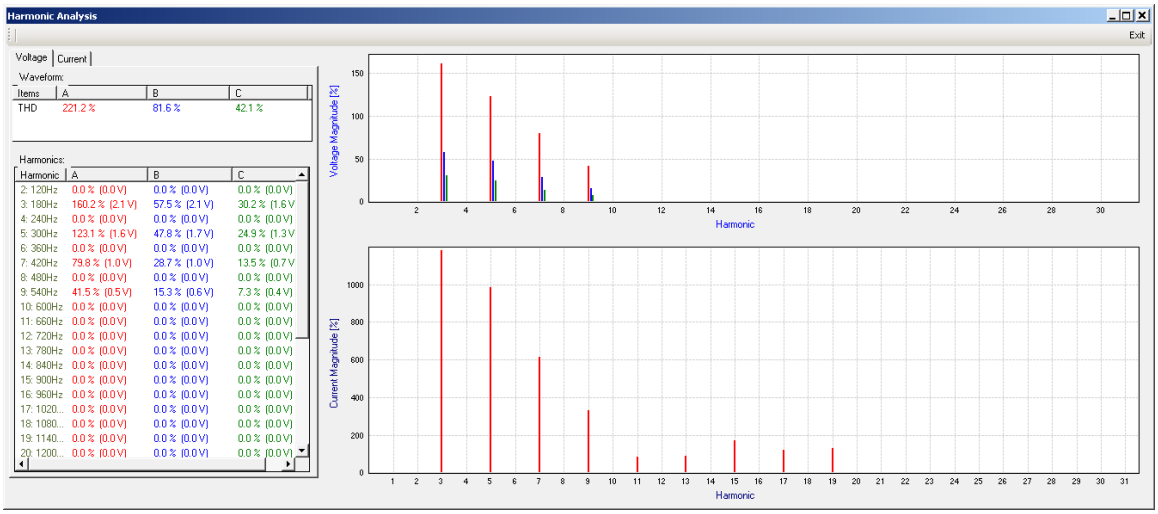
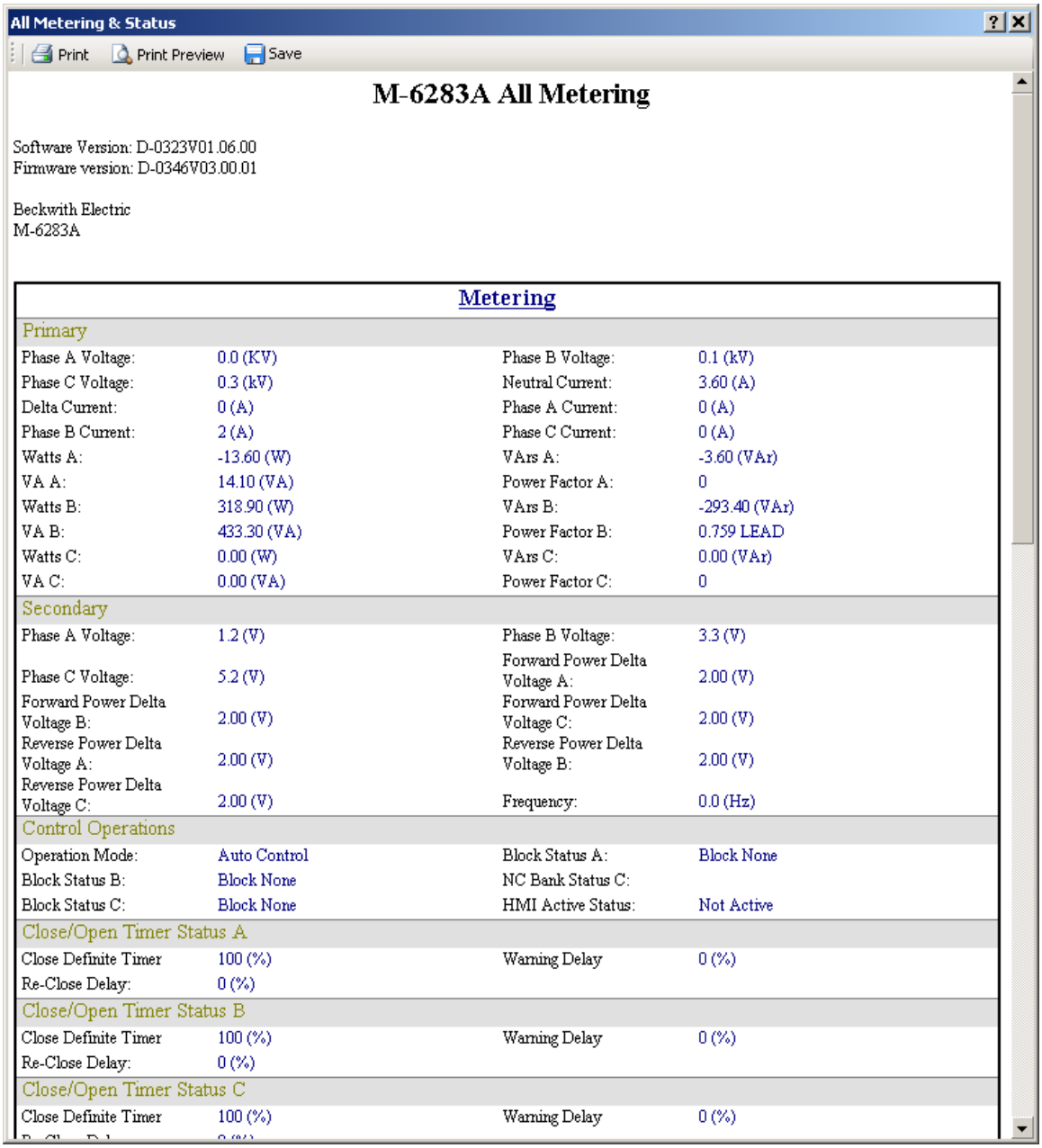


Figure 4-34 Harmonic Analysis Screen

MONITOR/DISPLAY ALL METERING

The Display All Metering feature provides the user with a snapshot of all metering parameters. This feature also allows the Display All Metering screen to be printed or saved as a HTM file.



All Metering & Status

Print | Print Preview | Save

M-6283A All Metering

Software Version: D-0323V01.06.00
Firmware version: D-0346V03.00.01

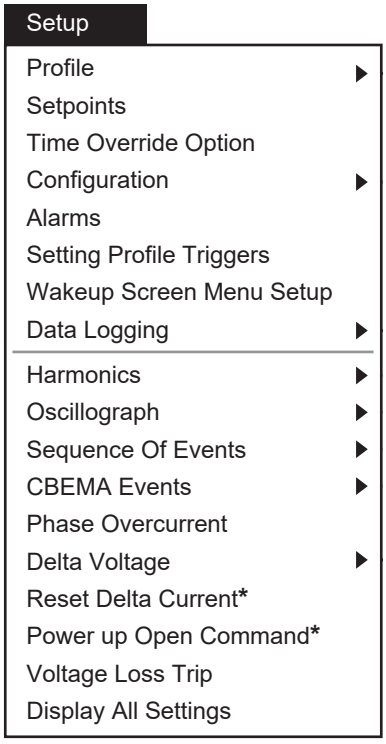
Beckwith Electric
M-6283A

Metering

Primary			
Phase A Voltage:	0.0 (KV)	Phase B Voltage:	0.1 (kV)
Phase C Voltage:	0.3 (kV)	Neutral Current:	3.60 (A)
Delta Current:	0 (A)	Phase A Current:	0 (A)
Phase B Current:	2 (A)	Phase C Current:	0 (A)
Watts A:	-13.60 (W)	VArs A:	-3.60 (VAr)
VA A:	14.10 (VA)	Power Factor A:	0
Watts B:	318.90 (W)	VArs B:	-293.40 (VAr)
VA B:	433.30 (VA)	Power Factor B:	0.759 LEAD
Watts C:	0.00 (W)	VArs C:	0.00 (VAr)
VA C:	0.00 (VA)	Power Factor C:	0
Secondary			
Phase A Voltage:	1.2 (V)	Phase B Voltage:	3.3 (V)
Phase C Voltage:	5.2 (V)	Forward Power Delta Voltage A:	2.00 (V)
Forward Power Delta Voltage B:	2.00 (V)	Forward Power Delta Voltage C:	2.00 (V)
Reverse Power Delta Voltage A:	2.00 (V)	Reverse Power Delta Voltage B:	2.00 (V)
Reverse Power Delta Voltage C:	2.00 (V)	Frequency:	0.0 (Hz)
Control Operations			
Operation Mode:	Auto Control	Block Status A:	Block None
Block Status B:	Block None	NC Bank Status C:	
Block Status C:	Block None	HMI Active Status:	Not Active
Close/Open Timer Status A			
Close Definite Timer	100 (%)	Warning Delay	0 (%)
Re-Close Delay:	0 (%)		
Close/Open Timer Status B			
Close Definite Timer	100 (%)	Warning Delay	0 (%)
Re-Close Delay:	0 (%)		
Close/Open Timer Status C			
Close Definite Timer	100 (%)	Warning Delay	0 (%)

Figure 4-35 Display All Metering Screen

4.11 Setup Menu



* Grayed out in File Mode.

The **Setup** menu item provides the user with access to the **Profile**, **Setpoints**, **Time Override Option, Configuration**, **Alarms**, **Setting Profile Triggers**, **Wakeup Screen Menu Setup**, **Data Logging**, **Harmonics, Oscillograph**, **Sequence of Events**, **CBEMA Events**, **Phase Overcurrent** and **Delta Voltage** submenu items. The setpoint information displayed on these screens can be from either the control or from an open CapTalk file.

Also included in the Setup submenu is the **Reset Delta Voltage**, **Reset Delta Current**, **Power up Open Command**, and **Voltage Loss Trip** commands. The **Display All Settings** command displays the M-6283A All Setpoints Screen.

Setup – System Settings in Chapter 3

The **Profile, Setpoints, Time Override Option, Configuration, Setting Profile Triggers, Delta Voltage, Phase Overcurrent, Power Up Open Command,** and **Voltage Loss Trip** menu selections are described in detail in **Chapter 3**.

SETUP/ALARMS

Programmable Alarm Relay

The Programmable Alarm function (Figure 4-36) allows the user to enable alarm monitoring for one or more of the following conditions:

- Maximum/Minimum Voltage Limit
- Remote Overvoltage/Undervoltage Limit
- Neutral Magnitude/Phase Unbalance
- Resettable/Daily Operation Counter Limit
- Voltage/ Current Harmonics
- Remote Manual
- Self Test
- Current/Voltage THD Lockout
- Leading/Lagging VAr
- Leading/Lagging Power Factor

■**NOTE:** The Delta Voltage Alarm is enabled by default, and cannot be disabled.

Alarm conditions are continuously displayed in the **Monitor/Metering and Status** screens. The alarm contact relay will not be energized during initial power up of the control. In addition, the relay alarm contact will be energized every 24 hours at midnight for a period of 5 seconds.

Alarm Reset

The Delta Voltage Alarm, Neutral Current Block, Neutral Current Lockout, THD Alarm and Lockout, and Emergency Voltage Loss can be **Reset** from the Alarms screen.

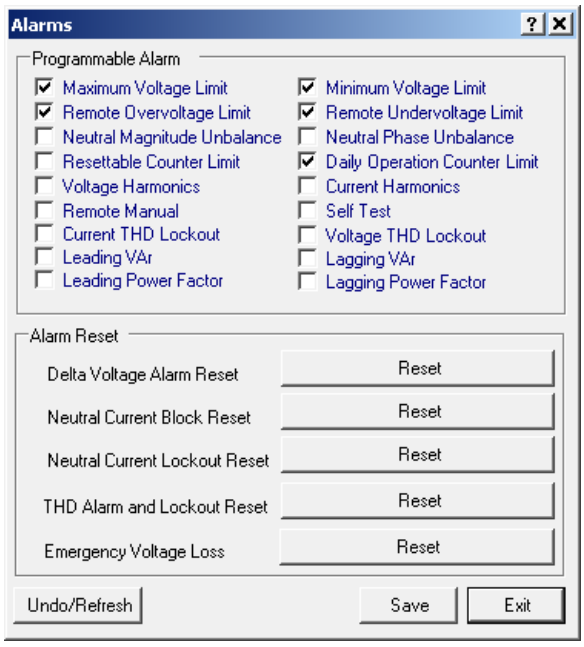


Figure 4-36 Setup Alarms Screen

SETUP/WAKEUP SCREENS

The Wakeup Screens (Figure 4-37) feature allows the user to select specific control parameters that will be displayed when the control is wakened by pressing the **EXIT/WAKE** pushbutton, as described in Chapter 2. Select the Wakeup Screens to be displayed by moving (dragging and dropping) each parameter from the "Disable Metering Items" to the "Active Metering Items" list. Similarly, Wakeup Screen parameters that are not to be displayed may be moved to the "Disable Metering Items" list. Default Wakeup screens are displayed in blue text.

■**NOTE:** The order in which parameters will be displayed can be changed by dragging and dropping the items in the Active Metering Items list.

■**NOTE:** Changes to the Wakeup Screen setup will not take effect if the HMI Wakeup Screen display is active. To refresh the Wakeup Screen changes, EXIT out of the Wakeup Screen menu, and then reopen the menu.

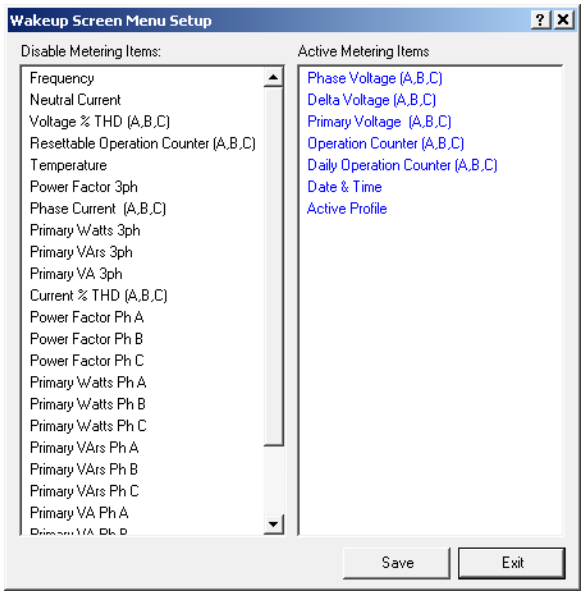


Figure 4-37 Wakeup Screen Menu Setup Screen

SETUP/DATA LOGGING

▲**CAUTION:** Whenever the M-6283A clock is reset and data logging is enabled the data log should be cleared.

The Data Logging feature allows the user to initiate data logging of all control parameters for downloading at a later time. Data is recorded internally into non volatile memory. The data log is transferred in Comtrade (*.cfg) format. The Comtrade format consist of two files, the configuration file (*.cfg) and the data file (*.dat). When downloading to a Smart Flash SD Card, three files are downloaded, the configuration file, the data file, and a *.csv file (comma separated value).

Data logging will continue indefinitely as long as the data interval is set to a non-zero value. A zero value for the data interval will effectively disable data logging. The data log can be downloaded using CapTalk, MODBUS (see M-6283A protocol document), or DNP (using file transfer) protocol. The data can be viewed using the included CapPlot Analysis Software or any Comtrade compatible viewer.

The Data Log Interval ranges from 0 to 120 minutes, in increments of 1, 2, 5, 10, 15, 30, 60 or 120 minutes. Once data logging is enabled, the control will store the data in records at the Data Log Interval rate. The checksum is used to ensure the integrity of the record stored. Due to the internal structure of the Comtrade format, time stamping is always performed. A total of 6 Mbytes (200,000 records) of data can be saved in non volatile memory.

■**NOTE:** The Data Logging Setup Screen contains a self calculating Duration parameter that represents the number of Days and the specific time when the data logging buffer will be full. The number of parameters selected to log and the Data Log Interval are considered in this calculation.

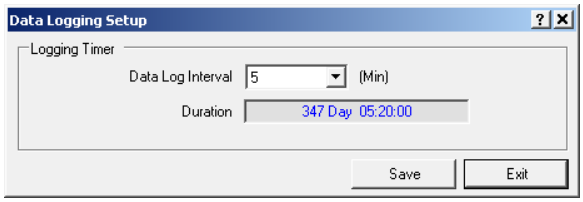


Figure 4-38 Data Logging Setup Screen

Setup/Data Logging/Retrieve

This submenu item when selected, displays the Data Log Download Screen (Figure 4-39) which allows selection of the parameters and date/time range to be retrieved. Selecting "Download" initiates the retrieval of the current data logging file from the control.

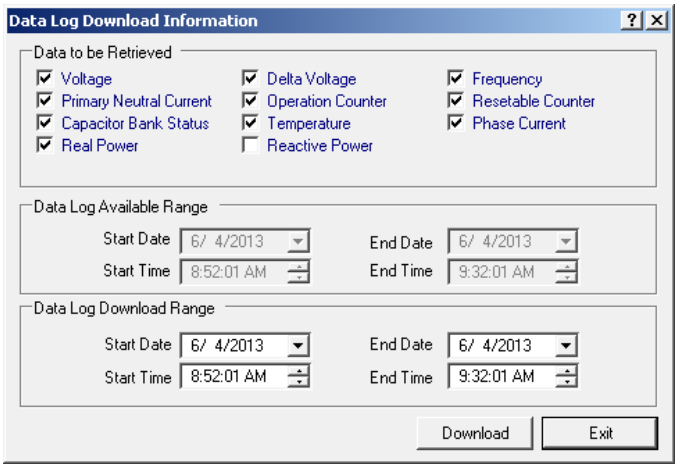


Figure 4-39 Data Log Download Screen

Data Logging/Clear

This submenu item when selected, clears the data logging information stored in the control.

SETUP/HARMONICS

The Harmonics Setup screen allows the user to select Voltage and Current Harmonics for monitoring, relative to a Voltage and Current threshold setting. The threshold level is set as a percentage of the fundamental. The Harmonic Voltage and/or Current Threshold pickup and dropout can be selected as inputs to trigger the Oscillograph Recorder and the Sequence of Events Recorder.

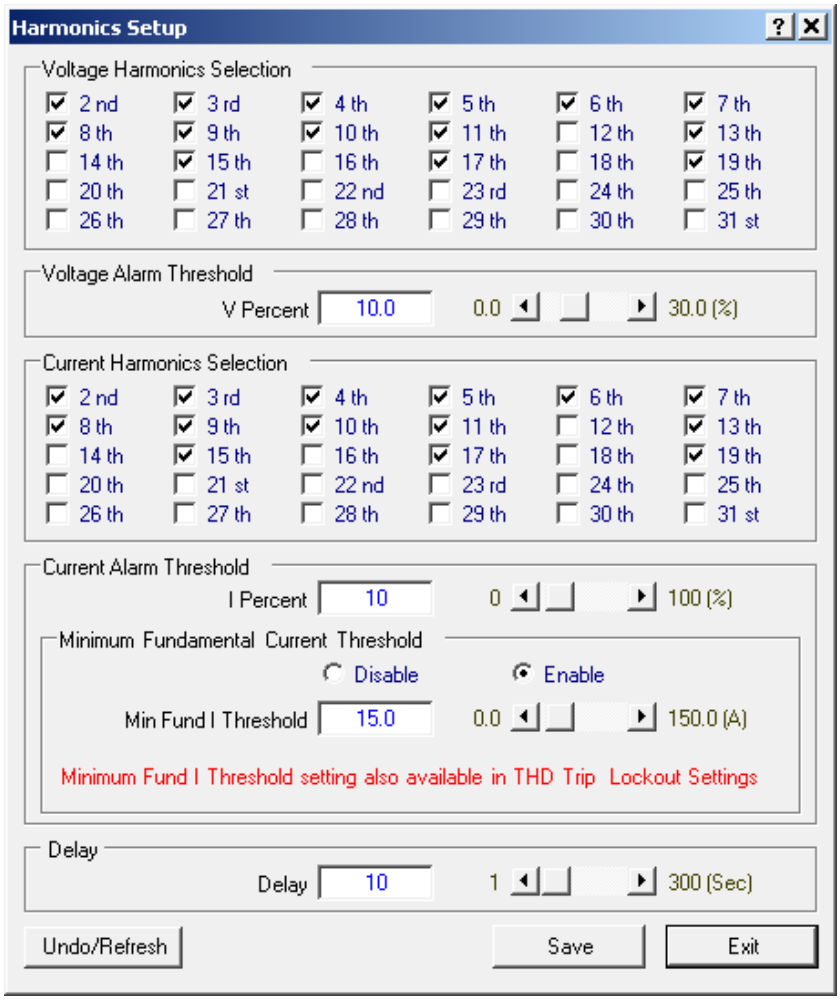


Figure 4-40 Harmonics Setup Screen

Harmonics/THD Lockout

The Voltage and Current Total Harmonic Distortion (THD) Trip and Lockout feature will Trip and Lockout individual phases of the capacitor bank when either Voltage or Current THD exceeds its associated individual phase THD Trip Pickup Setting.

When Voltage or Current THD of an individual phase increases above its associated THD Trip Pickup Setting for the period defined by its THD Trip Time Delay setting, the control will Trip the associated capacitor bank phase and Lockout further operation. If THD is still present above the THD Trip Pickup Setting after the trip has occurred, the Lockout will remain in effect until THD of the individual phase decreases to less than the Voltage or Current THD Lockout Reset setting for the duration of its THD Lockout Reset Delay setting.

If the Voltage or Current THD levels that caused the Trip, immediately decrease (within 1 second) to less than the THD Lockout Reset Setting when the bank trips, then the Lockout will remain in effect for the duration of its THD Lockout Reset Delay setting.

A Maximum THD Lockout/Reset Operation is counted each time the following sequence occurs:

1. Voltage or Current THD Measurement is greater than its associated phase THD Trip Pickup setting for the duration of the THD Trip Time Delay.
2. The control Trips the individual phase of the capacitor bank and a Lockout is imposed.
3. Voltage or Current THD measurement decreases to less than the THD Lockout Reset Setting as soon as the Trip occurs (within one second).
4. The THD Lockout Reset Delay times out and the Lockout resets.

The Maximum THD Lockout/Reset Operations setting is used to determine how many Trip and Lockout/Reset Operations, within the time period of the Maximum Time for THD Lockout/Reset Operations setting, are allowed before the control will Lockout and require a user reset either locally or remotely to continue operation.Both Voltage and Current share the same settings used to determine how many Trip and Lockout/Reset Operations are allowed before the control will lockout and require a user reset either locally or remotely to continue operation.

The THD Lockout does not allow operation of the capacitor bank by any means except from the front panel LOCAL/MANUAL switch. This includes: Automatic Operation, Control Mode Limits exceeded, Time/Temperature Override, or Remote Manual commands sent.

When selected in the Setup/Alarms screen (Figure 4-36), a Voltage/Current THD Lockout Alarm will actuate when the control Locks out any phase. The alarm will clear when the Lockout clears or if reset by a user either locally or remotely. The Lockout Reset from CapTalk is located in the Setup/Alarms screen, and locally from the HMI Configuration/THD Trip Settings menu.

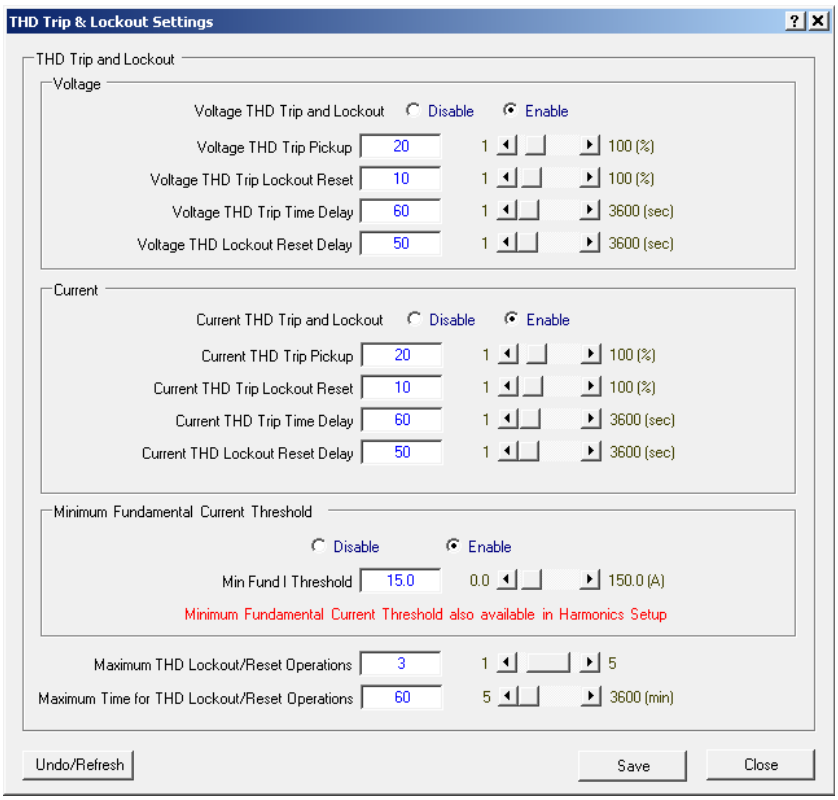


Figure 4-41 THD Trip & Lockout Settings Screen

THD Lockout Interaction with Other Control Features/Functions

Neutral Overcurrent No Prior Operation

Both Neutral Overcurrent No Prior Operation and THD Lockout features will trip and lockout the control. If either of these features trips and locks out the control, then the other will still alarm and will still lockout. In this scenario, if the conditions to trip and lockout for both features still exist and one of the conditions clears, the lockout will remain in effect until the second condition is also cleared.

Neutral Overcurrent Prior Operation

Neutral Overcurrent Prior operation can result in a capacitor bank being Blocked in either Close or Open condition. The THD Trip and Lockout feature *always* results in an Open condition. For this reason, specific rules apply to the interaction of these two features, depending on whether the bank is Open or Closed:

- If the capacitor bank just Closed and the Neutral Current results in the bank retrying, but a THD Trip is concurrently required to Trip and Lockout, then the THD Trip and Lockout has priority and will Trip and Lockout the capacitor bank. No further retries are allowed in this case.
- If the capacitor bank just Closed and the Neutral Current results in the capacitor bank reversing and blocking, and a THD Trip is concurrently required to Trip and Lockout, both features would result in an Open and Locked out capacitor bank, so there is no conflict. The feature that times out first will Trip the capacitor bank and apply a Lockout. The other feature will then only apply a Lockout.
- If the capacitor bank just Opened and the Neutral Current results in the capacitor bank reversing and blocking, and a THD Trip is concurrently required to Trip and Lockout, then the THD Trip and Lockout will be ignored and the capacitor bank will remain Closed and blocked. In this scenario, it is recommended to leave the capacitor bank Closed and remove the unbalance, rather than Trip due to high THD. Should the the Neutral Current Block clear, and theTHD conditions remain, then the capacitor bank will Trip and Lockout due to THD.

Manual Control

If the control is in Manual and either Voltage or Current THD increases to a level that results in its associated THD alarm, the alarm will be in effect, but no Trip is allowed and Manual operation will not be prevented. Consider the feature in standby, waiting to Trip and Lockout the capacitor bank if it should be placed back into Automatic or Remote Manual mode.

SETUP/OSCILLOGRAPH

The Oscillograph Recorder provides comprehensive data recording (voltage, current and status input/output signals) for all monitored waveforms (at 16, 32 or 64 samples per cycle). Oscillograph data can be downloaded using the communications ports to any Windows based computer running the CapTalk S-6283 Communications Software. Once downloaded, the waveform data can be examined and printed using CapPlot Analysis Software. The waveform data is also available in COMTRADE file format. Oscillograph records are retained if power to the control is interrupted.

The general information required to be input to complete the Oscillograph Setup includes:

- **Number of Partitions –** When untriggered, the recorder continuously records waveform data, keeping the data in a buffer memory. The recorder's memory may be partitioned into 1 to 16 partitions. The Oscillograph Recorder memory buffer is fixed and contains room for a finite number of cycles of recorded data. Consider Table 4-1 through Table 4-3 when determining the number of Oscillograph records. The number of cycles of recorded data is directly related to the number of records selected.

  When triggered, the time stamp is recorded and the recorder continues recording for a user-defined period. The snapshot of the waveform is stored in memory for later retrieval using CapPlot Analysis Software.

- **Samples/Cycle –** The number of samples/cycle can be selected to either 16, 32 or 64 samples/cycle.
- **Post-Trigger Delay –** A post-trigger delay of 5% to 95% must be specified. After triggering, the recorder will continue to store data for the programmed portion of the total record before re-arming for the next record. For example, a setting of 80% will result in a record with 20% pretrigger data, and 80% post-trigger data.
- **Inputs and Outputs –** The recorder can be triggered remotely through serial communications using CapTalk, or automatically, using programmed status signals.

■**NOTE:** If the Number of Partitions, the Samples/Cycle or the Post Trigger Delay is changed, the Oscillograph data stored in the control will be lost. CapTalk will display a **Warning** screen. Download any desired Oscillograph files before saving the changes.

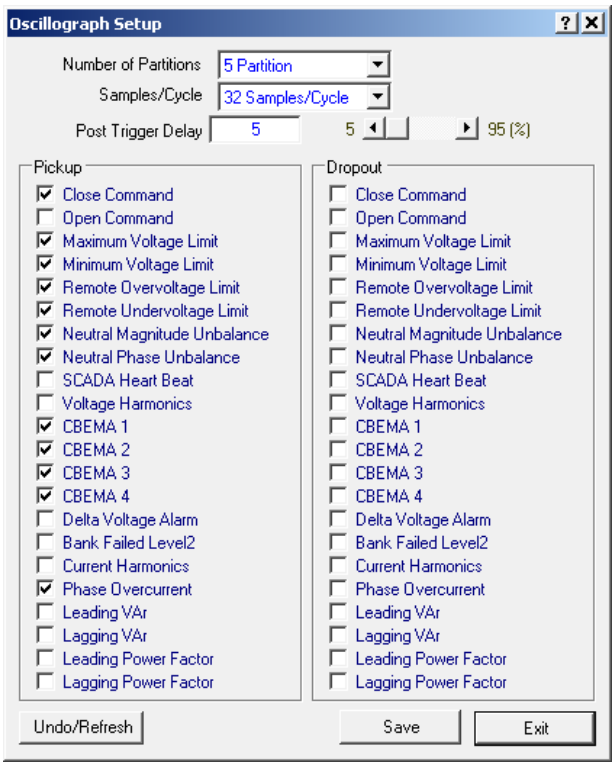


Figure 4-42 Oscillograph Setup Screen

16 Samples Per Cycle				
Settings	VArs Disabled		VArs Enabled	
Number of Partitions	Cycles Per Partition	Partition Length (msec)	Cycles Per Partition	Partition Length (msec)
1	1460	25000.000	1061	18166.667
2	973	16666.667	707	12116.667
3	730	12500.000	530	9083.333
4	584	10000.000	424	7266.667
5	486	8333.333	535	6050.000
6	412	7133.333	303	5183.333
7	365	6250.000	265	4533.333
8	324	5550.000	235	4033.333
9	292	5000.000	212	3633.333
10	265	4533.333	193	3300.000
11	243	4166.667	176	3016.667
12	224	3833.333	163	2783.333
13	208	3566.667	151	2583.333
14	194	3333.333	141	2416.667
15	182	3116.667	132	2266.667
16	171	2933.333	124	2133.333

Table 4-1 Recorder Partitions and Cycles for 16 Samples/Cycle

32 Samples Per Cycle				
Settings	VArs Disabled		VArs Enabled	
Number of Partitions	Cycles Per Partition	Partition Length (msec)	Cycles Per Partition	Partition Length (msec)
1	750	12500.000	545	9083.333
2	500	8333.333	363	6050.000
3	375	6250.000	272	4533.333
4	300	5000.000	218	3633.333
5	250	4166.667	181	3016.667
6	214	3566.667	155	2583.333
7	187	3116.667	136	2266.667
8	166	2766.667	121	2016.667
9	150	2500.000	109	1816.667
10	136	2266.667	99	1650.000
11	125	2083.333	90	1500.000
12	115	1916.667	83	1383.333
13	107	1783.333	77	1283.333
14	100	1666.667	72	1200.000
15	93	1550.000	68	1133.333
16	88	1466.667	64	1066.667

Table 4-2 Recorder Partitions and Cycles for 32 Samples/Cycle

64 Samples Per Cycle				
Settings	VArs Disabled		VArs Enabled	
Number of Partitions	Cycles Per Partition	Partition Length (msec)	Cycles Per Partition	Partition Length (msec)
1	375	6250.000	272	4533.333
2	250	4166.667	181	3016.667
3	187	3116.667	136	2266.667
4	150	2500.000	109	1816.667
5	125	2083.333	90	1500.000
6	107	1783.333	77	1283.333
7	93	1550.000	68	1133.333
8	83	1383.333	60	1000.000
9	75	1250.000	54	900.000
10	68	1133.333	49	816.667
11	62	1033.333	45	750.000
12	57	950.000	41	683.333
13	53	883.333	38	633.333
14	50	833.333	36	600.000
15	46	766.667	34	566.667
16	44	733.333	32	533.333

Table 4-3 Recorder Partitions and Cycles for 64 Samples/Cycle

Oscillograph/Scroll Message

The "Oscillograph Record Triggered" cycling HMI display can be enabled by navigating to **Oscillograph/ Scroll Message**. It can also be enabled from the HMI in the **Communication/HMI** menu. The cycling message on the control will continue until the oscillograph records are cleared.

Oscillograph/Manual Trigger

The Oscillograph Recorder can be manually triggered by the user. When "Manual Trigger" is selected, CapTalk will display a confirmation screen. Select **Yes** to trigger the Oscillograph Recorder.

Oscillograph/Retrieve

The **Retrieve** command displays the Retrieve Oscillograph Record Screen which allows the user to download the selected Oscillograph data from the currently connected control. Selecting "Retrieve" will display a "Save As" Screen. Oscillograph data must be retrieved from the control in a Comtrade file (*.cfg) in order to be viewed. CapPlot can be utilized to view the file contents.

Oscillograph/Clear

The **Clear** command clears any Oscillograph records on the connected control.

SETUP/SEQUENCE OF EVENTS

The **Sequence of Events Setup** consists of selecting the initiating Pickup and Dropout elements of the control and also setting any logical conditions relative to the Pickup and Dropout sequence to trigger the Sequence of Events recorder. The total number of events that can be recorded is 132.

Selecting the OR and AND Trigger elements is accomplished by selecting either OR or AND Gate boxes on Figure 4-44. CapTalk will display the OR Gate (Figure 4-45) or AND Gate Setup Screen (Figure 4-46). After selections are made in the OR Gate and AND Gate screens the user must select either **OR** or **AND** logic to initiate the Sequence of Events recorder. Selecting **SAVE** then writes the settings to the control.

Event Logic

Combinations of the trigger signals can be AND'ed and OR'ed to produce the desired trigger logic. the trigger logic that can be applied is illustrated in Figure 4-43. The first level of the Event Logic consists of an "AND" gate and an "OR" gate which uses the trigger parameters as inputs. The output of the "AND" and "OR" gates are passed to a logic gate that is user selectable as either an "AND" or "OR" gate. When the logic is true, it triggers the Sequence of Events Recorder.

The event will be recorded in volatile SDRAM and transferred to non-volatile flash memory every four cycles. There is a possibility that events can be lost in cases where the control loses power in the middle of a storage cycle.

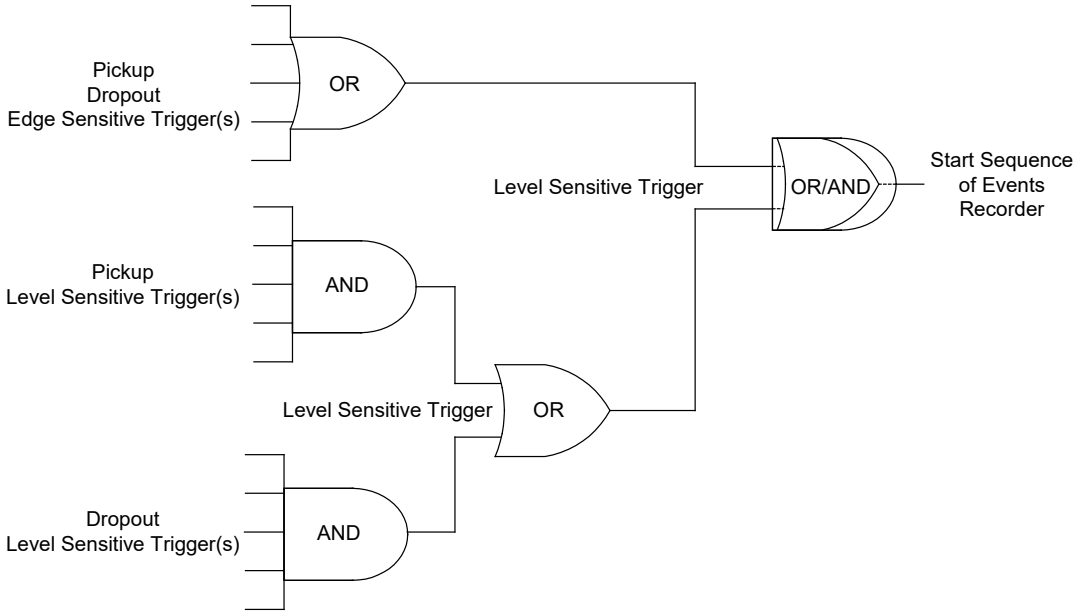


Figure 4-43 Sequence Of Events Recorder Trigger Logic

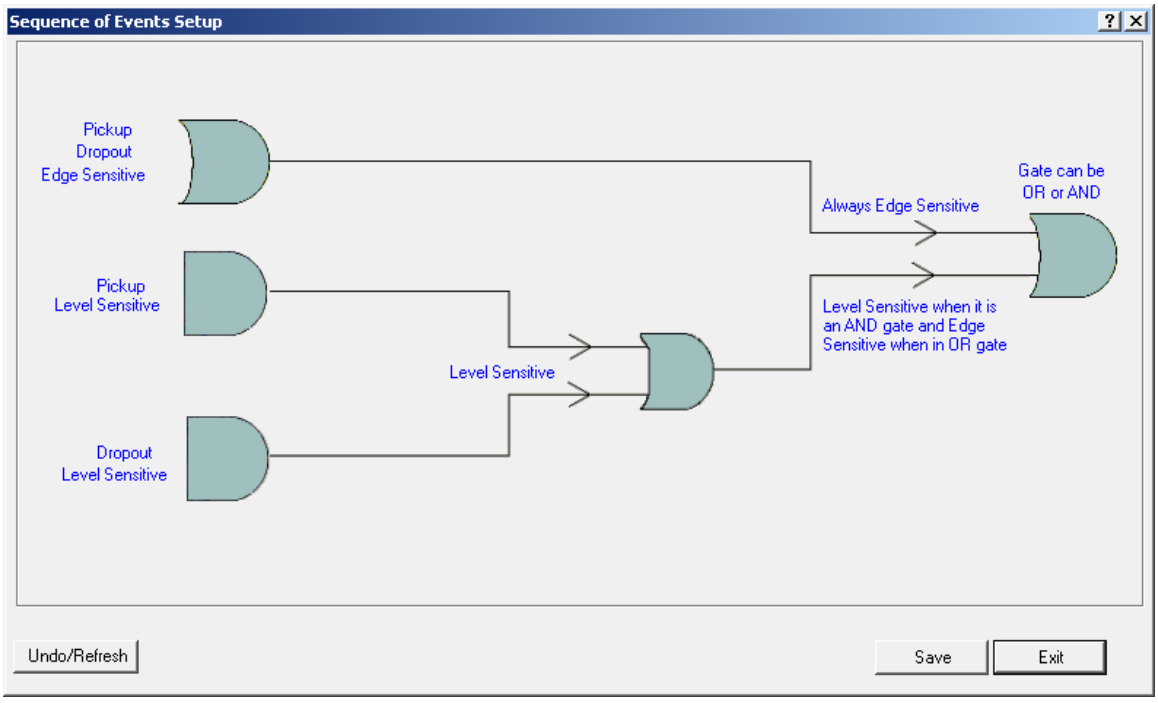


Figure 4-44 Sequence of Events Trigger Logic and Element Selection Screen

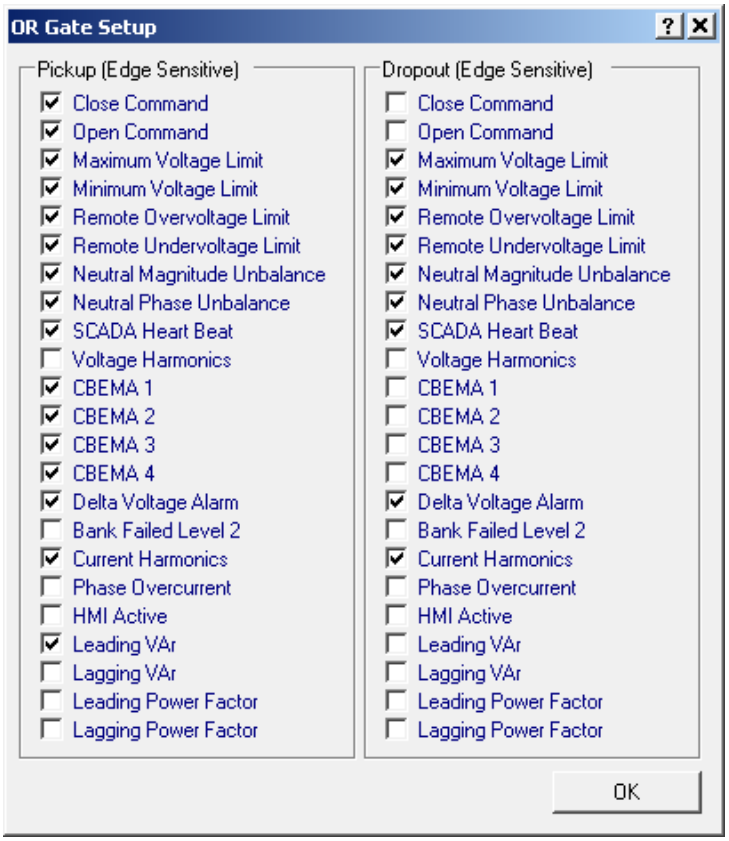


Figure 4-45 Sequence of Events OR Gate Setup Screen

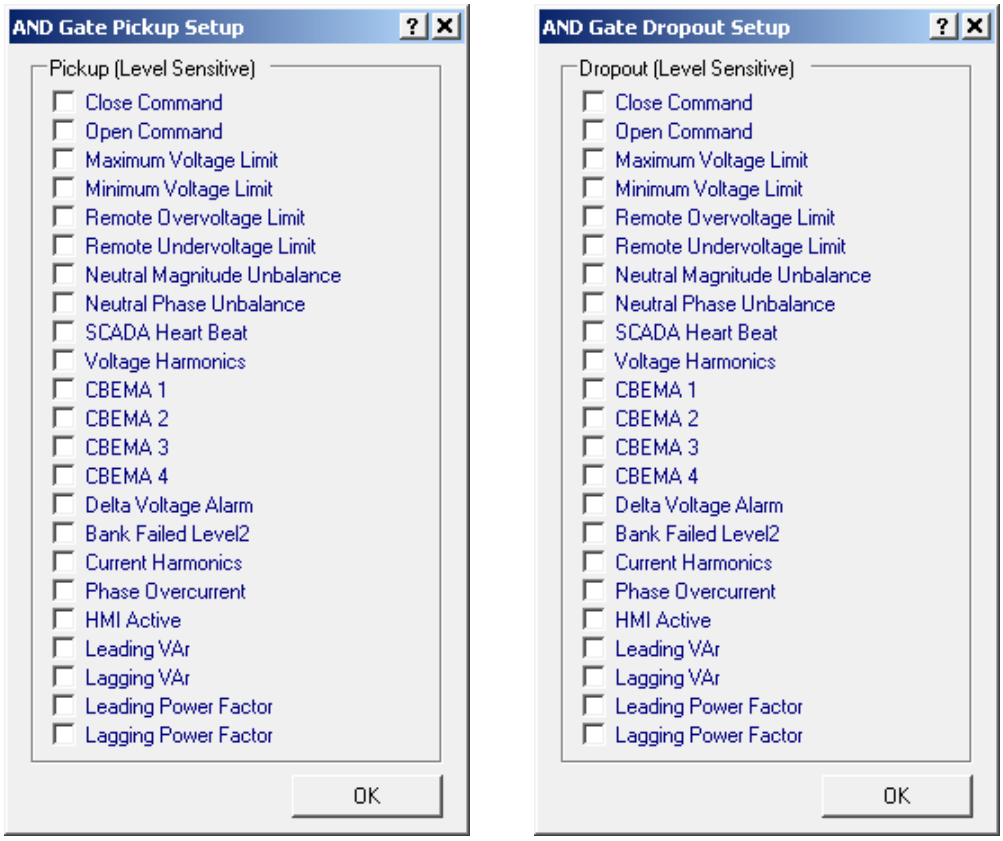


Figure 4-46 Sequence of Events AND Gate Setup Screens

Sequence of Events/Manual Trigger

The Sequence of Events Recorder can be manually triggered by the user.

Sequence of Events/Retrieve

The **Retrieve** command displays the SOE File "Save As" screen to save the downloaded events from the currently connected control. Events must be retrieved from the control and stored in a file in order to be viewed.

Sequence of Events/View

The **View** command permits the user to display a detailed list of past Sequence of Events and their corresponding captured parameters (Figure 4-47).

The "Trigger Status" section of the View Sequence of Events Screen displays the current trigger status at the instant the Sequence of Events Recorder was triggered. Sequence of Events is monitored at a fixed period of 1 cycle. The "Pickup and Dropout" sections of the screen indicate which signal caused the Sequence of Events recorder to trigger. These sections also include all the signals that changed at the instant that the Sequence of Events Recorder triggered.

View Detailed Sequence of Events Record

The displayed record may also be viewed in a Detailed Record screen, which shows the Control Status, Pickup, Dropout and Harmonics details. To view the details of a particular SOE Record, either double-click on the desired record, or right-click on the desired record, and select View. Captalk will display the "Sequence of Events Detailed Record" screen (Figure 4-48).

■**NOTE:** Up to four Sequence of Events Detailed Record Screens can be opened at one time.

Sequence of Events/Clear

The **Clear** command clears the Sequence of Events records from a connected control.

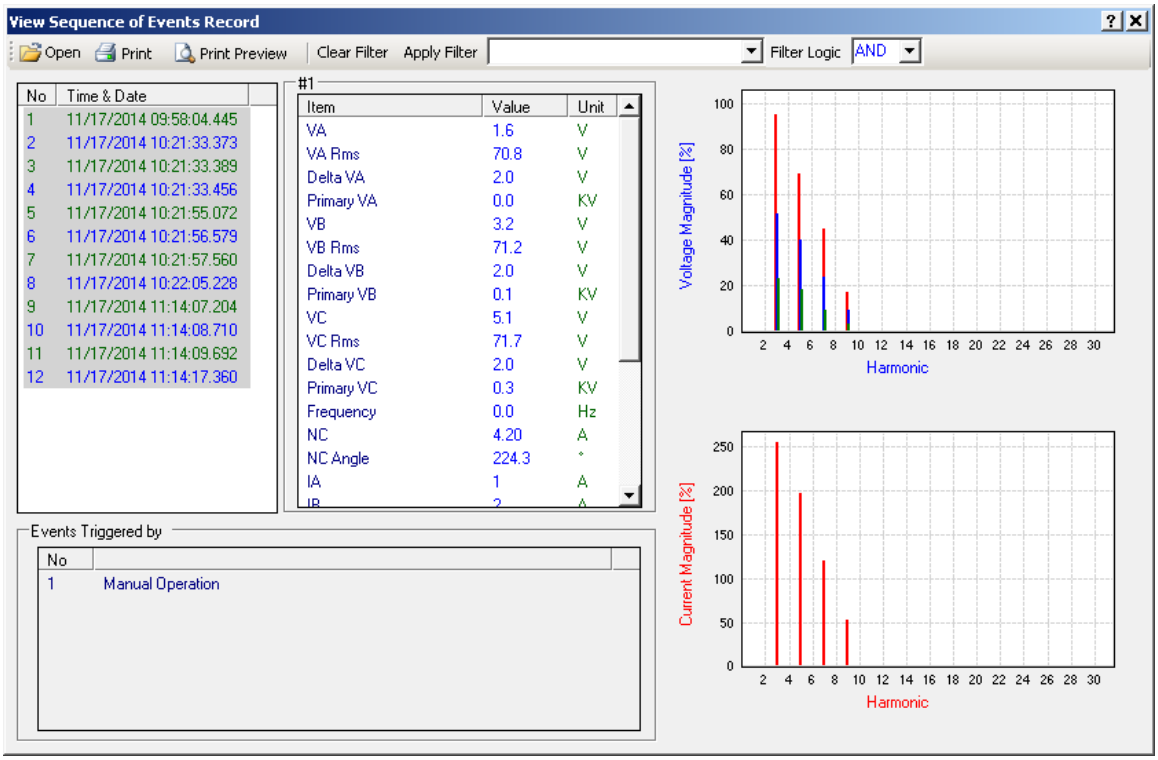


Figure 4-47 View Sequence of Events Record Screen

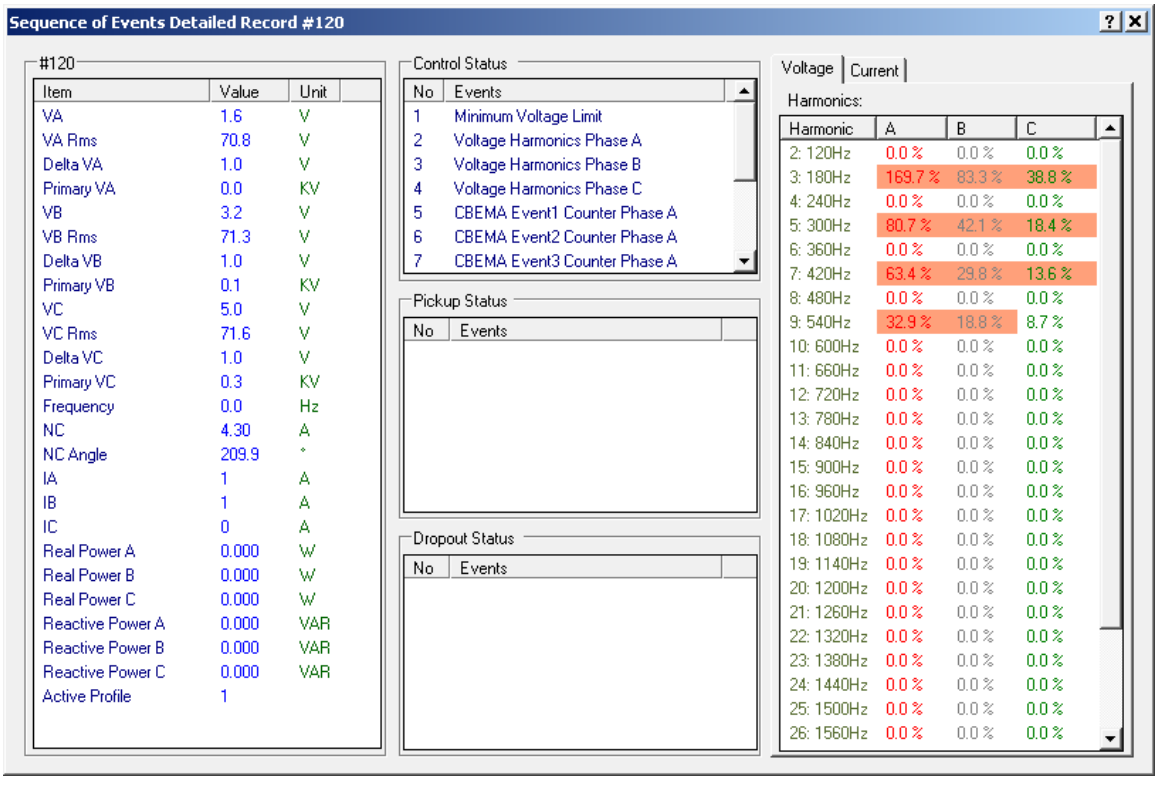


Figure 4-48 Sequence of Events Detailed Record Screen

SETUP/CBEMA EVENTS

There are a total of 4 Event Monitors in CBEMA (Computer Business Equipment Manufacturers Association). Each CBEMA event monitor has a different minimum duration limit: Event 1, 1 – 60 cycles; Event 2, 1 – 120 cycles; Event 3, 60 – 60000 cycles and Event 4, 1 – 60 cycles. When Pickup is set to less than 100% it operates as a sag (under voltage) function, and when it is greater than 100% it operates as a swell (over voltage) function. Sags and swells can be accurately detected from 90 to 180 Vac.

The following rules need to be followed when setting up CBEMA Setpoints (Figure 4-49):

- The Dropout should always be greater than Pickup in the Sag case
- The Dropout should be fixed to 100% in the Swell case
- The Pickup cannot be 100%

If any of the above rules are violated, an ERROR message will scroll across the HMI and the error can also be read using DNP.

When the load voltage is sagging or swelling greater than the pickup setting, then a pickup status will be set after the set minimum duration, in addition to incrementing the counter. When the load voltage is back to the dropout level, the status is cleared. Any or all of the Event Pickup statuses can be used to trigger Sequence of Events and/or Oscillography. The CBEMA counters are cleared after it reaches 10,000 counts, or it can also be cleared through the CapTalk S-6283 Communication Software or the HMI.

Each of the CBEMA Events has a Binary Input DNP point associated with it that will indicate the status of the event, as well as an Analog Input that will indicate the duration in cycles of the most recent event.

When saving the CBEMA settings, CapTalk will display the "Enable CBEMA Sequence of Events?" prompt screen. Select **Yes** or **No**. If CBEMA Events are to be used to trigger the Sequence of Events recorder, select **Yes**. CapTalk will then display the Sequence of Events Setup Screen. CBEMA Events can also be used to trigger the Oscillograph Recorder.

CBEMA Events/Clear Events Counter

This selection clears the CBEMA Events Counter from a connected control.

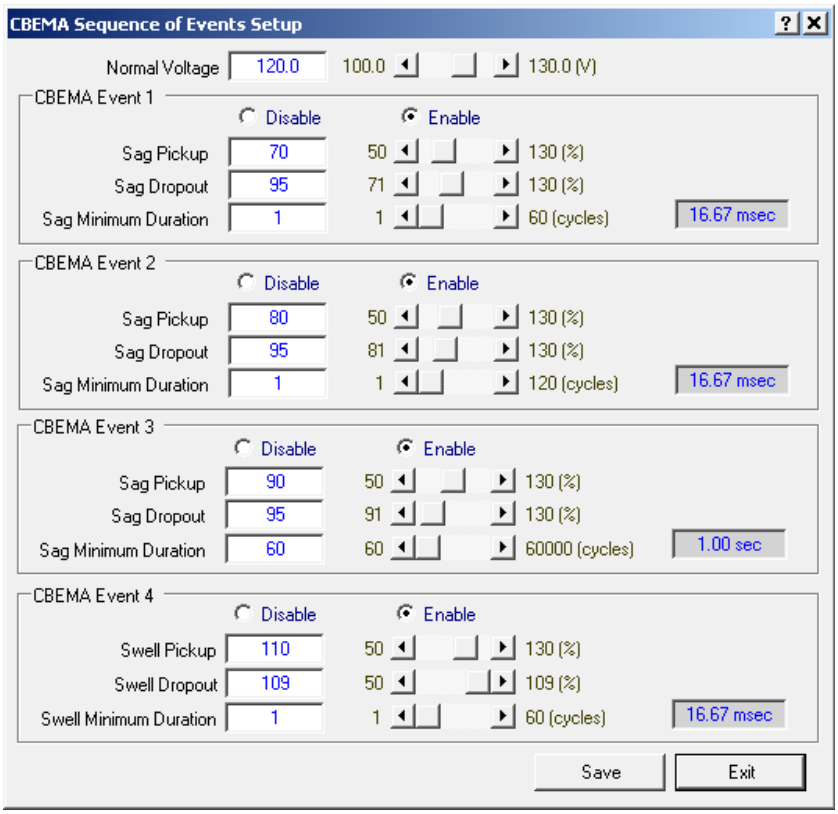


Figure 4-49 CBEMA Settings Screen

SETUP/MISCELLANEOUS

The following **Setup** menu items are detailed in **Chapter 3, System Setup and Configuration:**

- Phase Overcurrent
- Delta Voltage/Reset Delta Voltage
- Power Up Open Command
- Voltage Loss Trip

Setup/Reset Delta Current

When the Auto Control Mode is selected to "Current Control", the Reset Delta Current command allows the user to reset the Delta Current parameter to the default value of zero, in a connected control.

SETUP/DISPLAY ALL SETTINGS COMMAND

Selecting **Display All Settings** displays the **All Setpoints** screen (Figure 4-50). This screen contains the settings for each control function within a single window to allow scrolling through all control setpoint and configuration values. The All Setpoints Table includes Hyperlinks which allow the user to access an individual control function screen and then return to the All Setpoints window. All available parameters can be reviewed or changed when accessing an individual control function screen. The All Setpoints screen can be printed or saved to a *.HTM file for viewing.


All Setpoints

Print Print Preview Save

M-6283A All Setpoints

Serial Number: 0
Software Version: D-0323V01.06.01
BECKWITH ELECTRIC
M-6283A

Setpoints

PROFILE 1

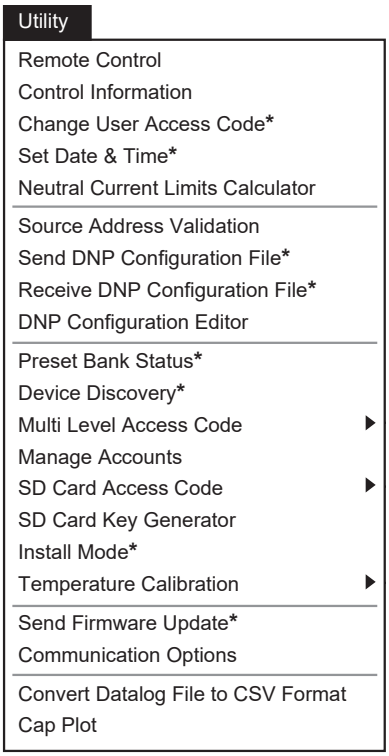
Auto Control Mode			
Voltage/Current/VAr Selection:	Enable Voltage Control	Classic/Autodaptive Classic/Autodaptive Enhanced Selection:	Classic
Control Open Voltage:	123.0 (V)	Control Close Voltage:	117.0 (V)
Close Definite Time:	30 (Sec)	Open Definite Time:	30 (Sec)
Time Delay Selection:	Definite Time	Basic Timer Type:	Instant Reset
Remote Control Mode			
Limits:	Enable Limits	Overvoltage Limit:	126.0 (V)
Undervoltage Limit:	114.0 (V)	Definite Voltage Limits Timer:	30 (Sec)
Time Delay Selection:	Definite Time	Basic Timer Type:	Instant Reset
Control Mode Limits			
Control Mode Limits:	Enable in Auto,	Maximum Voltage Limit:	128.0 (V)
Minimum Voltage Limit:	110.0 (V)	Definite Time:	10 (Sec)
Temperature Override Configuration			
Temperature Override:	Disable	Above Temperature:	95.0 (° F)
Above Temperature Operation:	Close ()	Below Temperature:	32.0 (° F)
Below Temperature Operation:	Close ()		
Time Override Configuration			
Time Override:	Disable	Start Date and Time:	01/01/2010 00:00:00
Bank Operation:	Open	Duration:	0.0 (Hours)
Recurrence Pattern:	Daily	Range of occurrences:	No end date

PROFILE 2

Auto Control Mode			
Voltage/Current/VAr Selection:	Enable Voltage Control	Classic/Autodaptive Classic/Autodaptive Enhanced Selection:	Classic
Control Open Voltage:	123.0 (V)	Control Close Voltage:	117.0 (V)
Close Definite Time:	30 (Sec)	Open Definite Time:	30 (Sec)

Figure 4-50 All Setpoints Screen

4.12 Utility Menu



The **Utility** menu includes the Remote Control, Control Information, Change User Access Code, Set Date & Time, Neutral Current Limits Calculator, Source Address Validation, Send/Receive DNP Configuration File, DNP Configuration Editor, Preset Bank Status, Device Discovery, Multi Level Access Code, Manage Accounts, SD Card Access Code, SD Card Key Generator, Temperature Calibration, Send Firmware Update, Communication Options, Convert Datalog File to CSV Format, and CapPlot submenu items.

* Grayed out in File Mode. Install Mode is not available at this time.

UTILITY/REMOTE CONTROL

▲**CAUTION:** This feature should be used with extreme caution, as the feature allows Remote Operation of the Capacitor Bank.

The **Remote Control** menu item displays the Remote Control screen (Figure 4-51). Remote Control allows the user to remotely Open or Close the Capacitor Bank. The control operation mode may be set to either Remote or Auto.

Operate Cap Bank – When **Control Mode** is selected to Remote, the Operate Cap Bank selections send Open or Close commands to the control. The Open/Close commands are subject to any active Blocks or Delays.

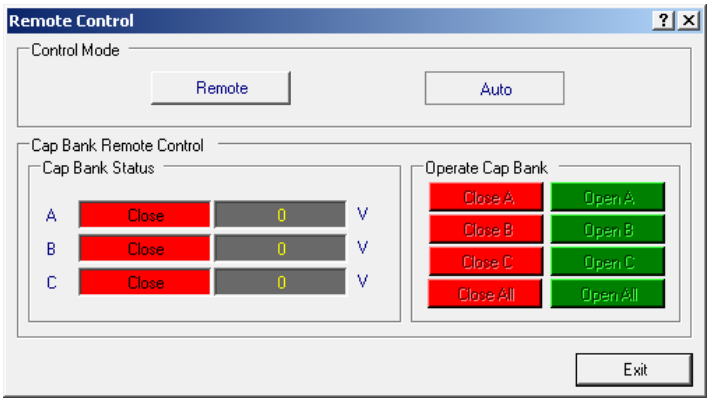


Figure 4-51 Remote Control Screen (with Optional Independent Phase Switching)

UTILITY/CONTROL INFORMATION

The **Control Information** submenu item displays the Control Information Screen. The Control Information screen provides specific information about the target control. The Control Information screen also allows the user to review and change the User Lines for the target control. The **Control Information** screen includes the following:

- The target control's serial number
- Control's firmware version
- The text currently displayed in the User Lines 1 and 2

UTILITY/CHANGE USER ACCESS CODE

The Change User Access Code screen allows the user to change or assign User Access Level Codes. The Level 1 and Level 2 User Access Codes restrict access to the control from the front panel interface and CapTalk. User Access Code protection, when implemented, is as follows:

- **Default –** View All
- **Level 1 –** Change Setpoints, Date/Time
- **Level 2 –** Change Setpoints, Configuration, Communication, Set New Access Codes, Start Data Logging, Setup Data Logging, Remote Control, Set User Text Lines, Set Control Date/Time

■**NOTE:** When new User Access Codes are entered and saved, they will immediately be required to change any setpoint or configuration parameter. To assign additional Access Codes, refer to the **Utility/Multi Level Access Code** section.

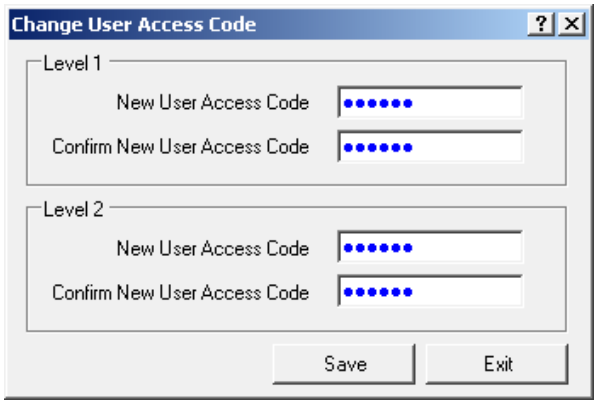


Figure 4-52 Change User Access Code Screen

UTILITY/SET DATE & TIME

The **Set Date & Time** submenu allows the user to review the internal clocks for the connected control or the PC. Daylight Saving time can be Enabled/Disabled. Sync Time at Startup settings are also available.

▲**CAUTION:** Whenever the clock is reset, the data log should be cleared. Changing the unit's time can cause time stamped values in the control such as Data Logging records, Resettable Counter, Drag Hands and Demand Metering to be corrupted or contain incorrect data. To retain the current records in the control, download the data prior to making a time change.

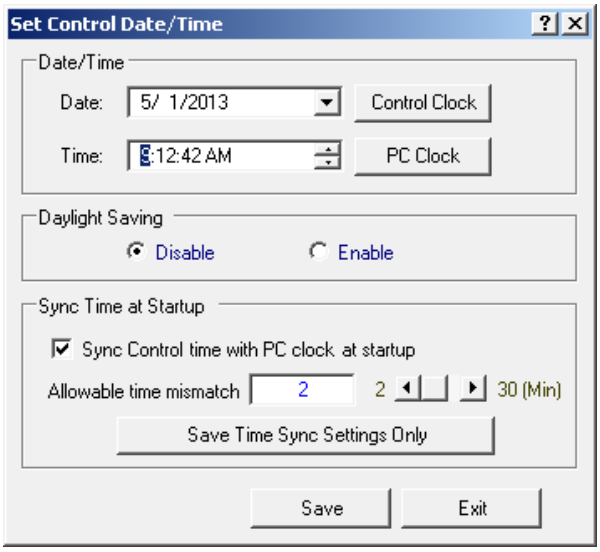


Figure 4-53 Set Control Date/Time Screen

UTILITY/NEUTRAL CURRENT LIMITS CALCULATOR

The Neutral Current Limits Calculator utility is a simulation tool that is designed to assist the user when commissioning a capacitor bank, to determine the expected normal neutral current when an imbalance is present. This will allow setting the neutral current alarms based on real world values.

The utility performs internal calculations, based on user settings, to determine the Neutral Current Limits. Enter the applicable Voltage Selection, General Settings and Phase A/B/C Phase Angle. With 10 V or 1 V Voltage Selection, the user must also enter the Calculated Secondary Voltage (Cal V Sec). In the "Bank Status" section of the screen, toggle the Phase A/B/C **Open** and **Close** buttons. CapTalk will calculate and display the resultant Upper, Center, and Lower Limits, in the "Neutral Current Limits" section.

■**NOTE:** This is a simulation tool only. The values entered in this screen are not written to the control, and the capacitor bank is not performing Open or Close operations.

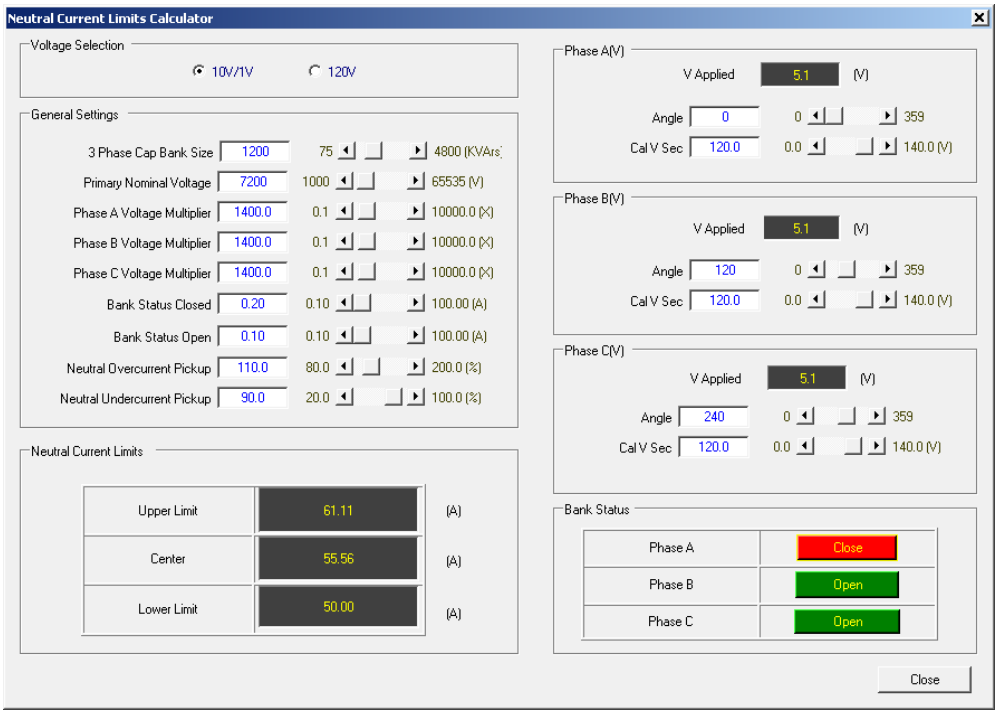


Figure 4-54 Neutral Current Limits Calculator Screen

UTILITY/SUBMENUS

Utility/Source Address Validation

When Source Address Validation is enabled it applies only when DNP3.0 Protocol has been selected regardless of the physical interface. If enabled, the client address must match the address set by the user in the DNP Configuration file before accepting the message as a valid one.

Utility/Send or Receive DNP Configuration File

The Send/Receive DNP Configuration File menu selections allow the user to either upload or download a DNP configuration file (*.xml) to the control.

■**NOTE:** When using Ethernet communications, Port 62000 must be available through the user's firewall for this feature to operate.

Utility/DNP Configuration Editor

The **DNP Configuration Editor** menu selection opens the M-6283A DNP Configuration Editor tool which allows the user to create a custom DNP Configuration file. See **Appendix B** for detailed information.

Utility/Preset Bank Status

The Preset Bank Status feature allows the user to set the Current Bank Status to Open or Close.

Utility/Device Discovery

The **Device Discovery** menu selection can be used when the control exists on an Ethernet network. Device Discovery is a Beckwith Electric Communications protocol that utilizes fixed UDP Port 50000 or 55010 (not user configurable). It utilizes CapTalk to discover M-6200A/M-6280A/M-6283A Beckwith Electric products on the network without the need to know the individual IP Addresses of other controls. When a control is found and selected, the user can send and receive DNP Configuration files and receive Access Code Log files.

Utility/Multi Level Access Code

The **Multi Level Access Code** menu selection allows the user to create up to 30 unique Access Codes. Each Access Code can be up to 15 characters in length including spaces. After creating a list of Access Codes, the list can be saved to the control or on the host computer. The Access Code file is encrypted for security measures. Once a list has been saved to a control, the user can download a log of the date and time that each Access Code was used to access the control, as well as the date and time when that access was terminated.

Utility/Manage Accounts

The Manage Accounts menu selection allows the user to change the password for an authorized User, Send or Retrieve the Account Permissions file, and if logged in as the Security Policy Administrator, to Manage Account Permissions. See **Appendix D Cyber Security** for detailed information.

Utility/SD Card Access Code

A user Access Code Level 1 or 2 can be written to a Smart Flash SD Card. The user Access Code will be read by the control each time the SD Card is inserted into the card slot on the front of the control. As long as the SD Card is inserted, the control will not prompt for the Level Access Code.

Utility/SD Card Key Generator

The SD Card Key Generator menu selection allows an authorized user to save a valid User Name and Password to an SD Card Key file (sdkey.sdc) which can be loaded onto an SD Card to allow user access to the control without having to enter the User Name/Password manually. See **Appendix D Cyber Security** for detailed information.

Utility/Temperature Calibration

The Temperature Calibration menu selection allows the user to enable an optional External Temperature Sensor. The Internal or optional External temperature sensor may be calibrated to match any external temperature. Depending on the units chosen in the Setup/Configuration/Temperature Unit selection screen, the Temperature Calibration screen will display either Celsius or Fahrenheit.

Utility/Send Firmware Update

The Send Firmware Update menu selection allows the user to upload firmware updates to the control from CapTalk. Firmware updates may be uploaded at any time, as the control settings are not affected. To send a firmware update to the control proceed as follows:

1. Remove the control from service.
2. From the CapTalk Main Screen select **Utility/Send Firmware Update**. CapTalk will display the Open File screen with a default (*.bot) file extension.
3. Navigate to the target file, then select **Open**. CapTalk will display the **Firmware Upload** Screen. Follow the screen prompt to press the **ENT** pushbutton on the control and then verify that the control displays "On the PC click OK" :

```
On the PC
Click OK
```

4. In the CapTalk **Firmware Upload** screen select **OK**. CapTalk will display an upload status screen. When the file transfer has been completed, CapTalk will display a Firmware Upload Confirmation screen and close communications.
5. The control will display **"Update Complete Rebooting"** and reboot automatically. CapTalk communications will need to be reestablished.

■**NOTE:** After a Firmware Update, remove power to the control and then reapply power to initialize the unit.

■**NOTE:** The Remote Ethernet Firmware Update Utility (**REFU**) is a stand-alone application available from the factory. The REFU Utility allows the user to remotely update one or more control's firmware to a new version using an ethernet connection.

Utility/Communication Options

This feature allows the user to enable the optional RS-232, Ethernet ports, and Bluetooth module if equipped.

Utility/Convert Datalog File to CSV Format

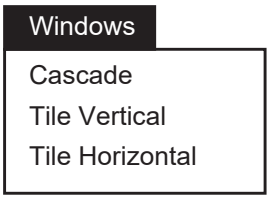
This feature allows Datalog Files created on the M-6283A (*.cfg) to be converted to (*.csv) format files that can be opened in any spreadsheet program. Navigate to the target (*.cfg) file and then select **Open** to automatically convert the file. The resulting (*.csv) file will be saved in the same target file directory.

Utility/CapPlot

Provides access to the CapPlot feature (see **Section 4.14**).

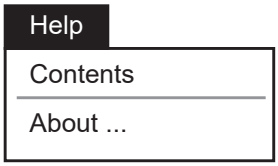
4.13 Windows and Help Menus

Windows



The Window toolbar item provides the Cascade and Tile display options. The Window toolbar item also allows the user to select between open CapTalk windows.

Help



The Help toolbar item provides the user with information about the control and the software version that is installed in the unit.

Help/Contents

The Contents submenu will open a PDF file of the Instruction Book in the user's default PDF Reader. The Bookmarks pane allows direct access to selected topics. The Table of Contents also contains hyperlinks to all topics.

Help/About S-6283

The About submenu item provides the CapTalk software version number, control firmware version (when connected), and copyright information.

4.14 CapPlot Analysis Software

The CapPlot Analysis Software operates in conjunction with all CapTalk Communications Software on any computer running Windows. CapPlot allows the user to plot and print capacitor bank Data Logging and Oscillograph Comtrade data files (*.cfg) retrieved from M-6283A series controls.

Starting CapPlot

1. Select **Utility/CapPlo**t. The CapPlot Window and Toolbar is displayed (Figure 4-55).
2. Select **File/Open** from the menu, and browse for the (*.cfg) file.
3. Open the file. CapPlot should display the saved data, as shown in Figure 4-56 and Figure 4-57.

Overview

CapPlot is a windows based program for viewing the data that has been retrieved using the Data Logging and Oscillograph features of CapTalk.

When CapPlot is started, a menu and tool bar are displayed. This section describes each CapPlot menu selection and explains each CapPlot command in the same order that they are displayed in the software program. The Figure 4-55 presents the CapPlot Menu and Submenu Callouts.

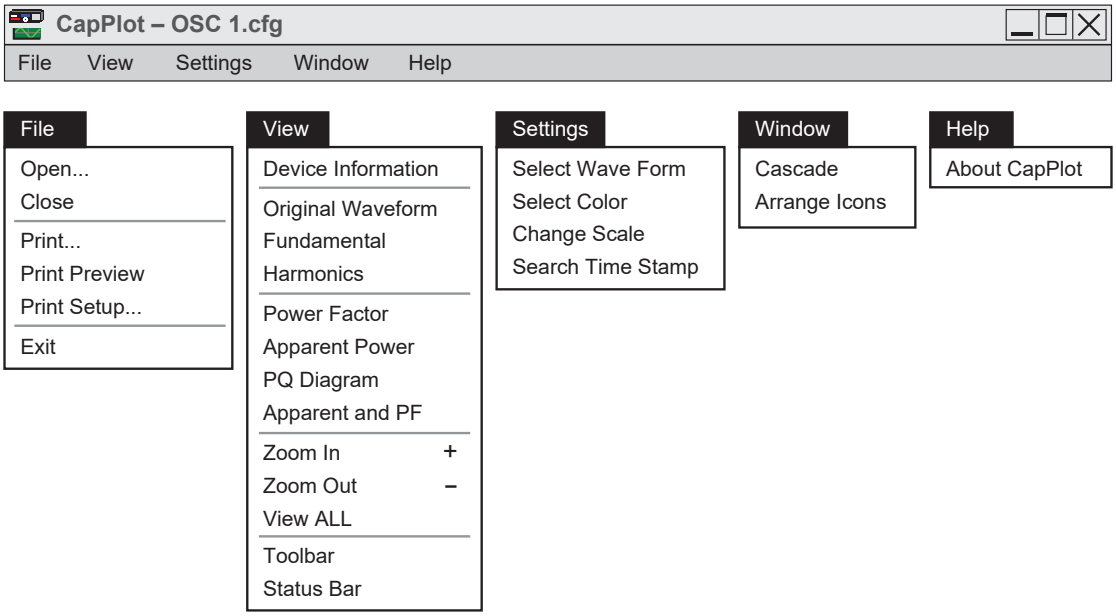


Figure 4-55 CapPlot Submenu Callouts

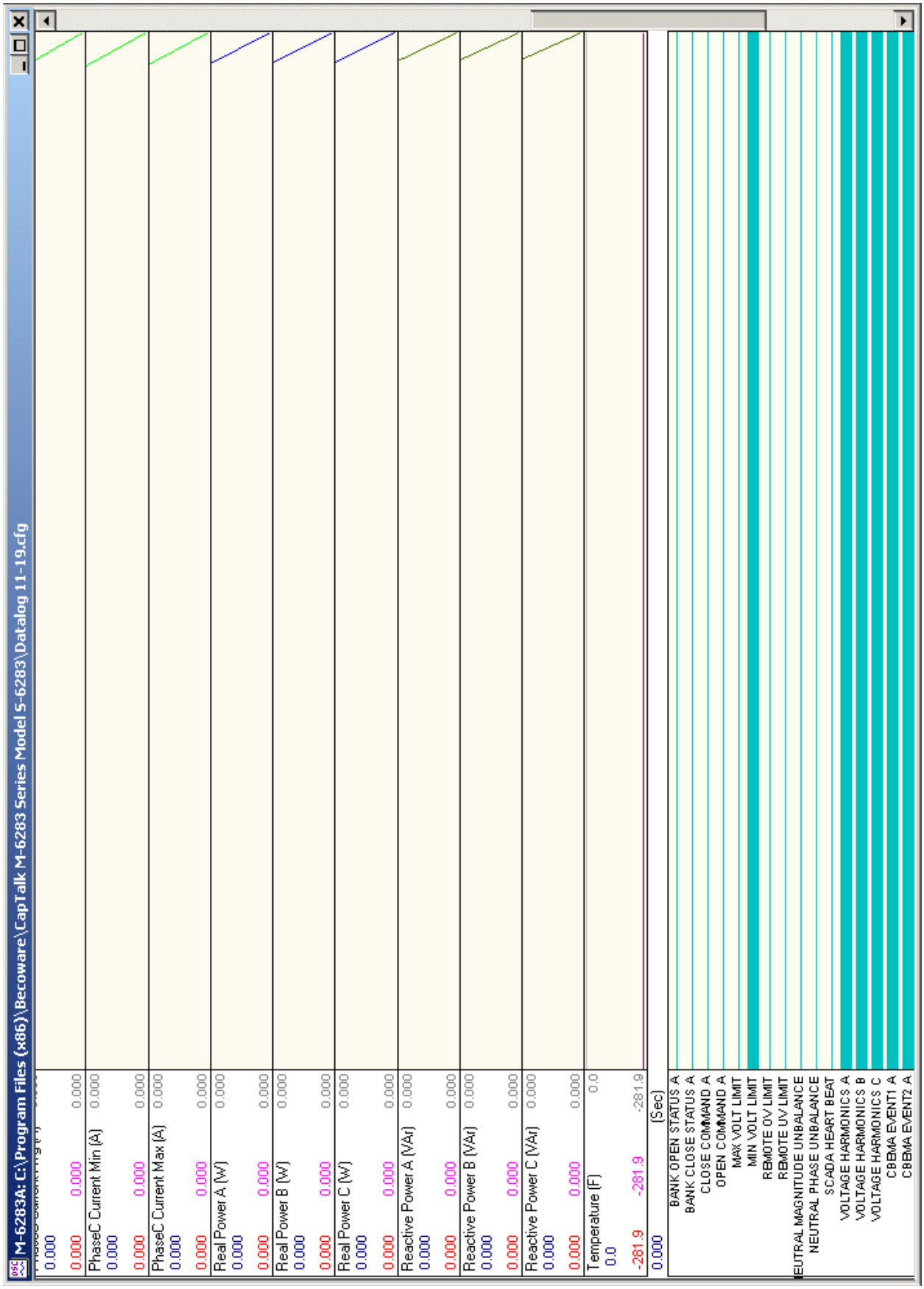


Figure 4-56 CapPlot Window with Data Logging Data Example

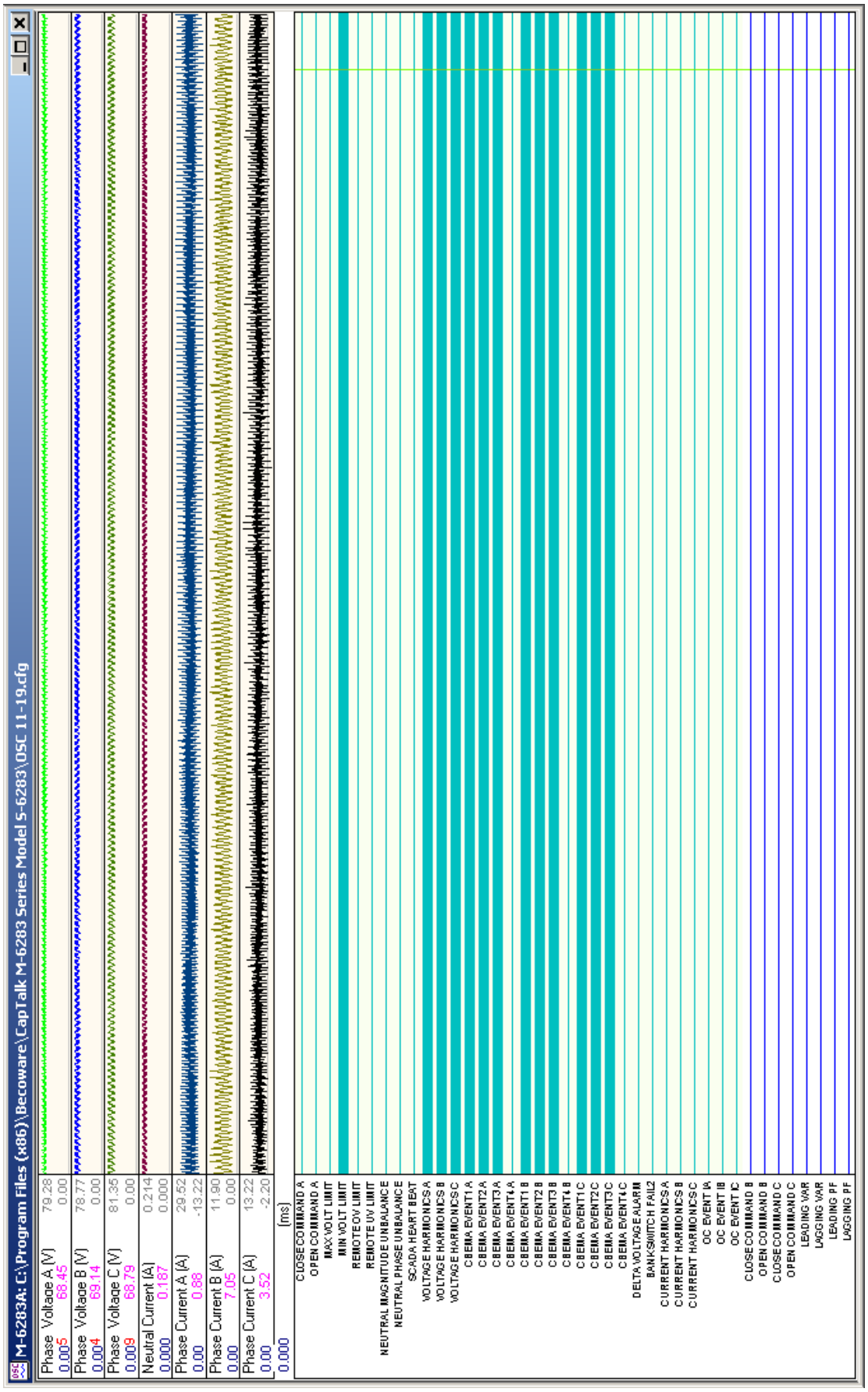


Figure 4-57 CapPlot Window with Oscillograph Data Example

Markers

CapPlot includes two user selectable markers. The first is positioned by double clicking on the plotted wave form data. The second is positioned by pressing and holding the **SHIFT** key and then double clicking on the plotted wave form data.

The markers can be dragged by moving the cursor over the marker until the cursor changes to a double-headed arrow ↔, then holding down the Left mouse button and dragging the marker. The first marker can also be moved an interval at a time by pressing the **LEFT** or **RIGHT** arrow key. The second marker can be moved by pressing the Shift key and the Left or Right arrow key.

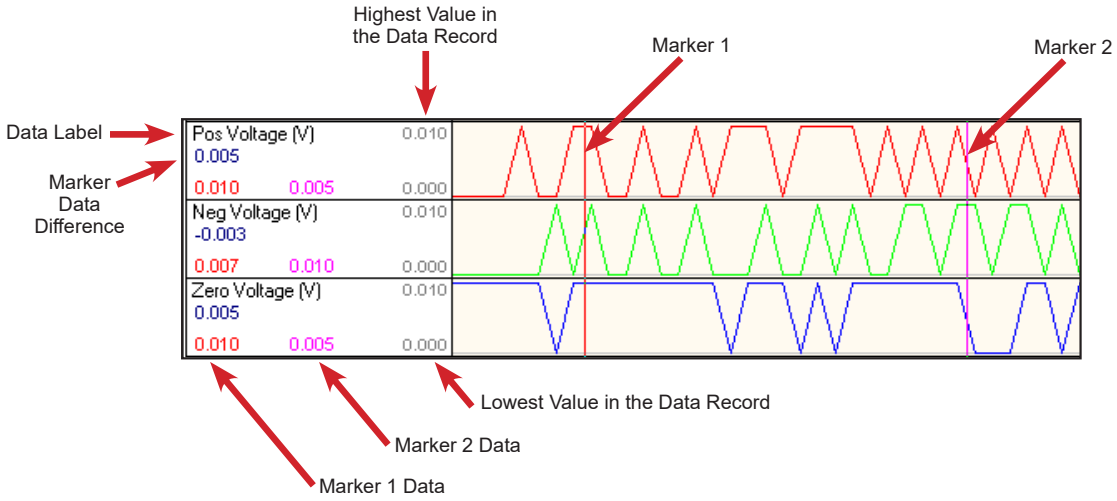


Figure 4-58 CapPlot Screen With Callouts

Figure 4-59 CapPlot Main Screen Bottom Right Data Display

Right-Click Filter Menus

Right-Click menus are available that allow filtering of the displayed data. By default, all available Datalog and Oscillograph file parameters are displayed. Right-Click on the display areas of the Datalog or Oscillograph screen to filter the parameters to display.

File Menu

The **File** menu allows the user to:

- Open a CapPlot (.cfg) file previously downloaded by CapTalk.
- Print the displayed CapPlot data.
- A Print Preview of the displayed CapPlot data.
- Select the printer and printer settings to be used.
- Select from previously viewed .cfg files (the last eight files displayed).
- Exit the CapPlot program.

View Menu

The **View** menu allows the user to:

- Display the Device Information for the corresponding CapPlot data file.
- View Original Waveform
- View Fundamental
- View Harmonics
- Power Factor
- View Apparent Power
- View Power Quality Diagram
- Zoom In, increase the resolution of the tap data displayed on the screen.
- Zoom Out, decrease the resolution of the tap data displayed on the screen.
- View ALL, returns the display to include all data within the record.
- Select which Tool Bar (Toolbar/Status Bar) is available on the display window.

Settings Menu

The Settings menu allows the selection of the waveforms to be displayed and the format of display colors.

Select Waveform allows the selection of the available Data Log or Oscillograph parameters to be plotted or printed. The Waveform selections are made from the Select Waveform screen.

Select Color allows the user to change Foreground and Background display color of individual Waveform traces for customized plotting.

Change Scale allows the user to change the scaling of the displayed parameter.

Search Time Stamp allows the user to place the marker exactly at the desired time stamp in the CapPlot window.

Help Menu

The **Help** menu provides access to the **About CapPlot** command which displays version information for CapPlot.

5 Installation

■ **CYBER SECURITY NOTE:**

When Cyber Security is enabled, access to any feature described in this Chapter is subject to the Access Permissions Policy as designated by the Security Policy Administrator.

5.1 Overview of Installation Chapter

This Chapter is intended for those personnel that are responsible for the installation of the M-6283A Three Phase Capacitor Bank Control. This Chapter provides the mechanical orientation of inputs and outputs as well as physical dimensions of the control. External connections to the control are detailed to assist installation personnel with various applications of the control.

Instructions for the installation of CapTalk S-6283 Communications Software and establishing initial local communications with the target control are provided in Chapter 4.

5.2 Mechanical/Physical Information

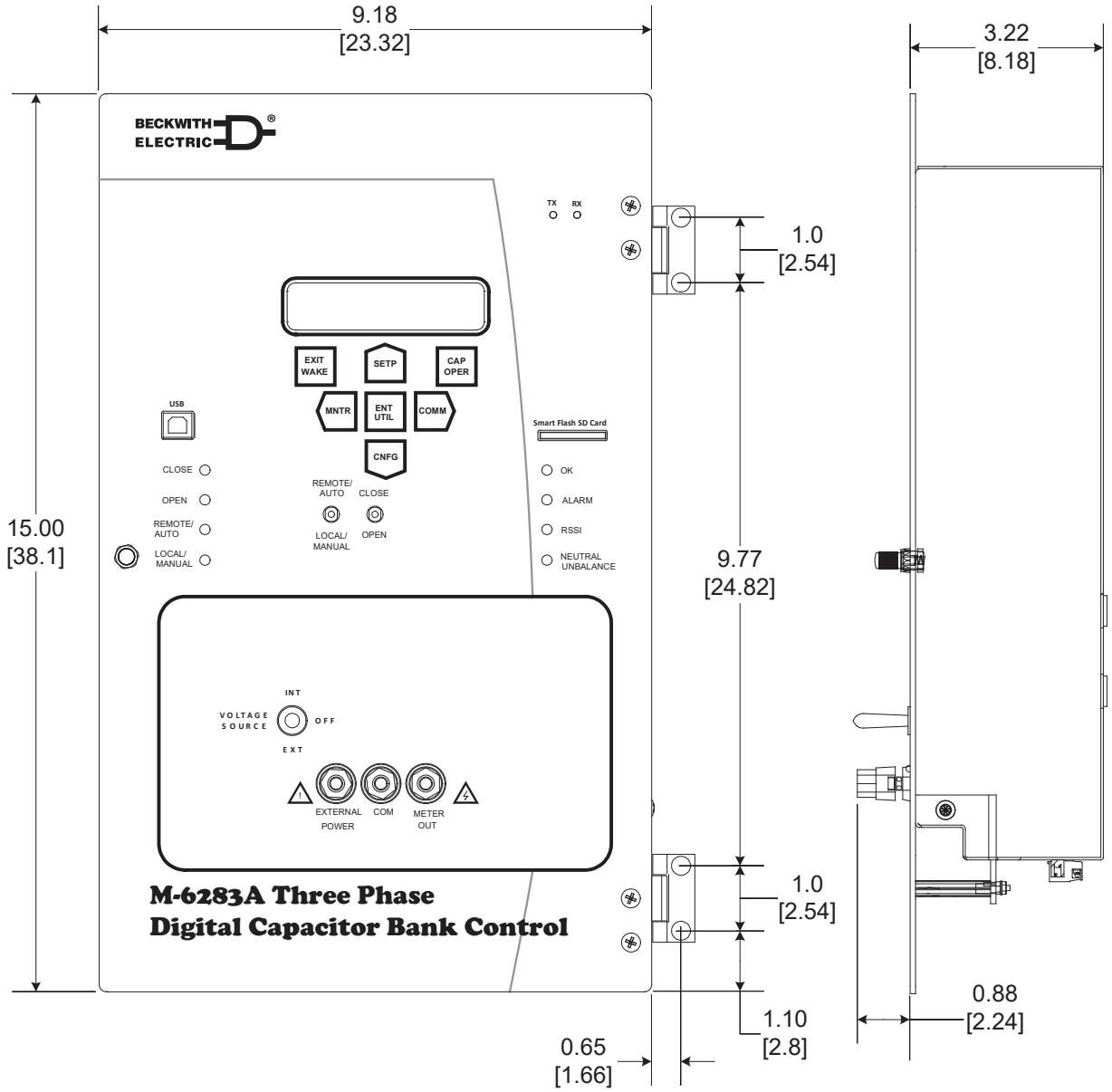
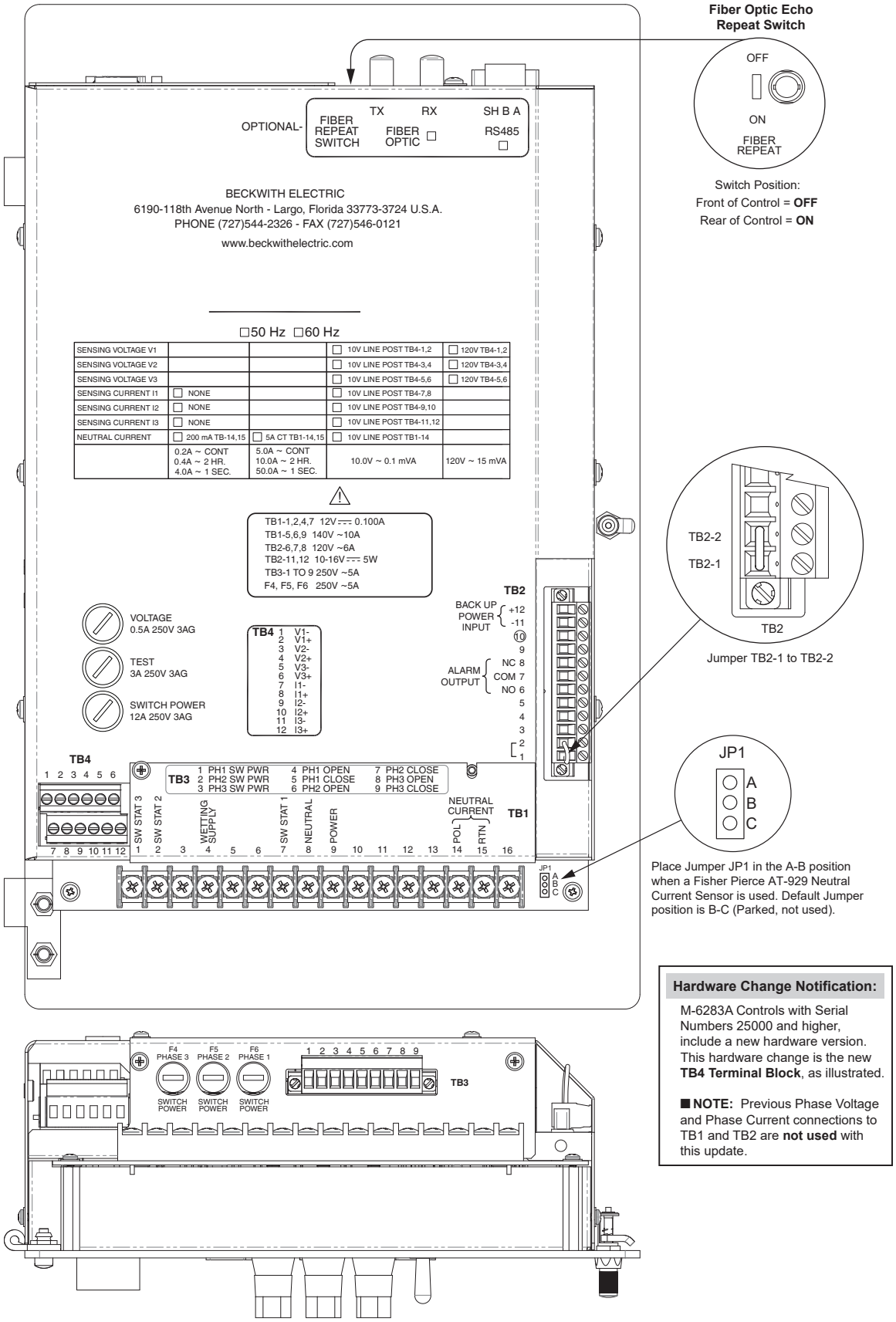


Figure 5-1 M-6283A Control Outline Dimensions



Hardware Change Notification:

M-6283A Controls with Serial Numbers 25000 and higher, include a new hardware version. This hardware change is the new **TB4 Terminal Block**, as illustrated.

■ **NOTE:** Previous Phase Voltage and Phase Current connections to TB1 and TB2 are **not used** with this update.

Figure 5-2 M-6283A Rear View with Independent Phase Switching Option

5.3 External Connections

HARDWARE CHANGE NOTIFICATION

M-6283A Controls with Serial Numbers 25000 and higher include a new hardware version. The inclusion of the hardware change can be verified by confirmation that TB4 is on the rear of the control. The Line Post Sensor inputs of the M-6283A were redesigned to minimize variation of the input impedance and reduce noise, thereby improving the accuracy of voltage and current measurements.

Hardware Compatibility

A new 14-pin Cannon Harness (Beckwith Electric Assembly B-1843) has been created for compatibility with the improved hardware. Retrofitting an M-6283A with the improved Line Post Sensor Inputs into existing cabinets will require a field modification of 14-pin Cannon Harness (Beckwith Electric Assembly B-1400). This simple modification requires removal of the terminal lugs that connect to TB1 and TB2, stripping the wires where the terminal lugs were removed, and redressing the harness to connect to TB4.

■**NOTE:** Previous connections to TB1 and TB2 for phase voltages and phase currents are **not used** with this hardware update. Refer to **Appendix E** for Legacy Hardware connections.

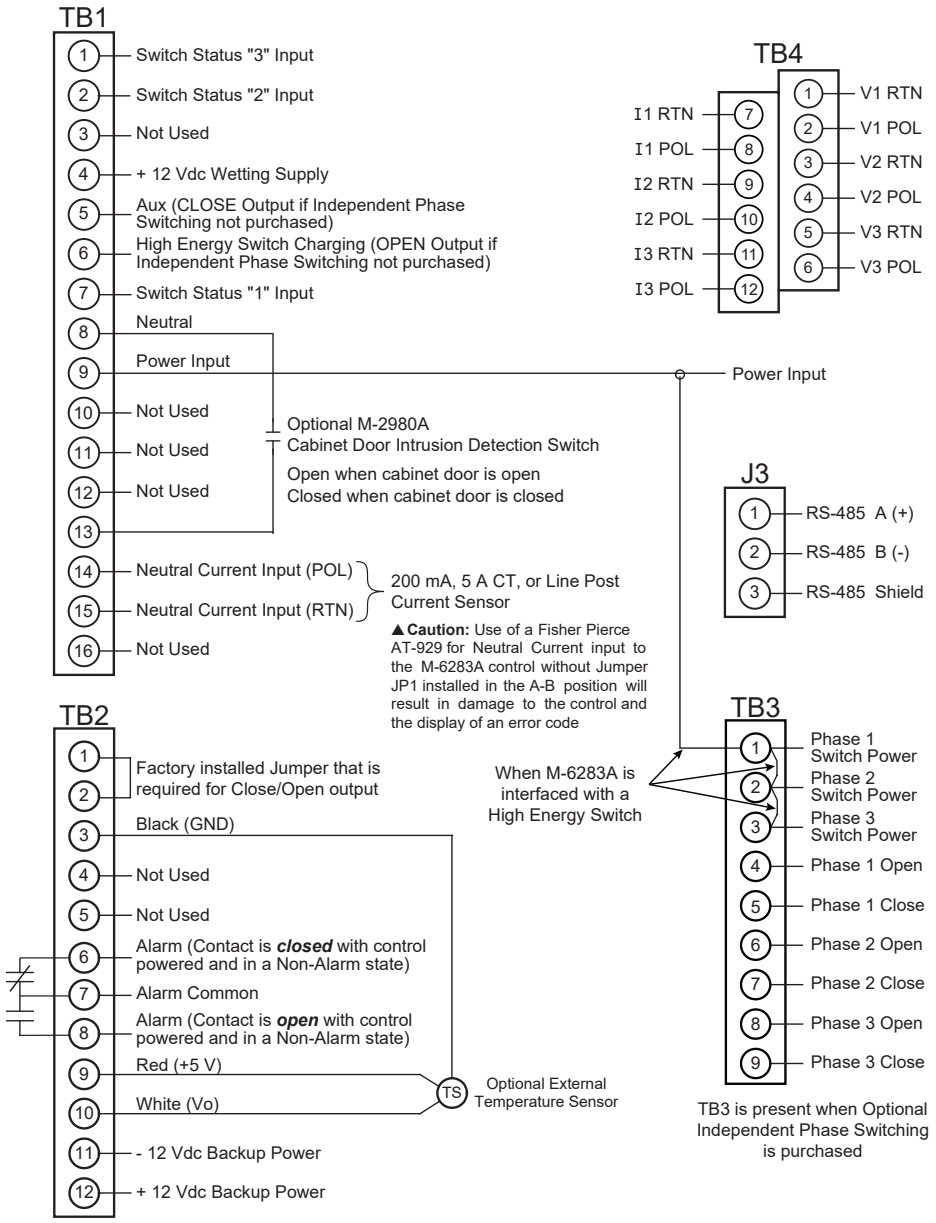


Figure 5-3 M-6283A Typical External Connections

Control

The external connections for the control/enclosure are made by utilizing one of the following:

- Meter Base Adapter that is integrated into the enclosure
- Meter Base Adapter and cable assembly
- 3-Pin, 5-Pin, 8-Pin, 14-Pin and 19-Pin Cannon Connector

The available Meter Base Adapter blade configurations are presented in Table 5-1 through Table 5-3. Cannon Plug configurations (3-Pin, 5-Pin, 8-Pin, 14-Pin and 19-Pin) are illustrated in Table 5-4 through Table 5-8 and Figure 5-4 through Figure 5-9.

Neutral Current Unbalance

The Neutral Current Unbalance Input is provided at Terminal Block TB1, at TB1-14 and TB1-15. The Neutral Current sensor must be installed such that correct polarity is observed in order for the Neutral Phase Unbalance alarm to function correctly. In order to verify correct polarity, the following can be performed:

1. Close Phase A switch and Open Phase B and C.
2. On the Front Panel, press the **MNTR** button, press the **CNFG** button once, then press the **SETP** button once. The LCD should display Neutral Phase Angle.
3. If the Neutral Phase Angle displays approximately 90°, the polarity is correct. If it displays approximately 270°, polarity is incorrect.
4. If polarity is incorrect, either re-install the sensor or switch TB1-14 and TB1-15 connections to correct the issue.

Neutral Current Sensor Considerations

▲ **CAUTION:** Use of a Fisher Pierce AT-929 for Neutral Current input to the M-6283A control without Jumper JP1 placed in the A-B position will result in damage to the control and the display of an error code.

Jumper JP1 is installed between position A and B when a Fisher Pierce AT-929 Neutral Current sensor is being used with this product. It provides the proper burden to the control input for this sensor to operate correctly. Default Jumper position is B-C (Parked, not used).

Phase Current

The Phase Current Input is provided at Terminal Block TB4, as illustrated in Figure 5-3.

Neutral Current and Phase Current Grounding Considerations

If the Neutral Current or Phase Current input wires are located in the same physical cable as the Line In, Open, and Close wiring, transients during Opening and Closing can be induced into the Neutral Current or Phase Current inputs. These transients will not harm the control, but can generate spurious alarms.

To prevent these transients from causing false alarming, ground TB1-15 (Neutral Current) or TB2-4 (Phase Current) to TB1-8. A wire has been provided in the cloth fuse bag attached to the control for this purpose. The wire is labeled for TB1-15 to TB1-8. If it is used for Phase Current, install it from TB2-4 to the ground stud to the right of TB-1 instead of TB1-8.

Control Connections

- **LINE:** 120 Vac line voltage from the capacitor bank Voltage Transformer for control power and driving switching outputs.
- **NEUTRAL:** Common return for the line input voltage, the switched outputs and the CT.
- **PHASE CURRENTS:** Phase Current Inputs are provided utilizing a Line Post Sensor.
- **PHASE VOLTAGES:** Phase Voltage Inputs are provided utilizing a Line Post Sensor, 120 Vac Nominal Transformer, or a combination of the two.
- **CLOSE:** Switches 120 Vac to the "Close" terminal of the motor or solenoid-driven capacitor switches.
- **OPEN:** Switches 120 Vac to the "Open" terminal of the motor or solenoid-driven capacitor switches.
- **NEUTRAL CURRENT:** Neutral Current Input can be provided by the following:
  - Line Post Sensor
  - 5 A CT equipped with automatic shorting disconnects.
  - 200 mA CT equipped with automatic shorting disconnects.

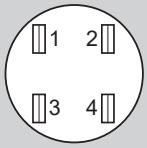
The pin-out for the Cannon 3-Pin, 5-Pin, 8-Pin, 14-Pin and 19-Pin connectors are illustrated in Figure 5-4 through Figure 5-8.

The Open and Close outputs use single pole relay contacts that make and carry up to 10 Amperes total for a 30 second duration, and 45 Amperes total for a 25 millisecond duration. These ratings are make and carry ratings, not break ratings. It is assumed that the capacitor switches break the "Open" and "Close" currents. If this is not the case, an interposing relay contactor must be provided to withstand the break currents. It is recommended that the data sheets of the intended switches be consulted to make sure that these ratings are not exceeded. (These ratings are for operation of three switches simultaneously). If the control's current switching ratings are exceeded, it is recommended that provisions for interposing contactors be made, to reduce the switching burdens to allowable levels.

Torque Requirements

Terminals TB1-1-16 & TB2-1-12: 7.5 in-lbs, minimum and 8.0 in-lbs, maximum.

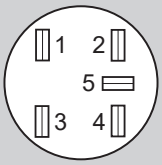
4 Blade Meter Socket/ Control Wiring				
	BLADE			
Config	1	2	3	4
4S	Line	Neutral	OPEN	CLOSE
Control	TB1-9	TB1-8	TB1-6	TB1-5
41	Line	Neutral	CLOSE	OPEN
Control	TB1-9	TB1-8	TB1-5	TB1-6
42	Neutral	Line	OPEN	CLOSE
Control	TB1-8	TB1-9	TB1-6	TB1-5
43	Neutral	Line	CLOSE	OPEN
Control	TB1-8	TB1-9	TB1-5	TB1-6



4 Jaw Base

Table 5-1 4-Blade Meter Base Adapter Configurations

5 Blade Meter Socket/Control Wiring					
	BLADE				
Config	1	2	3	4	5
5S	Line	Neutral	OPEN	CLOSE	NC POL
Control	TB1-9	TB1-8	TB1-6	TB1-5	TB1-14



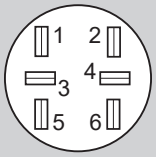
5 Jaw Base

▲**CAUTION:** Neutral Current or Phase Current input wires located in the same physical cable as Line-in, Open, and Close wiring may experience induced Neutral Current and/or Phase Current transients during Opening and Closing operations.

■**NOTE:** See "Neutral Current and Phase Current Grounding Considerations" earlier in this Chapter.

Table 5-2 5-Blade Meter Base Adapter Configurations

6 Blade Meter Socket/Control Wiring						
	BLADE					
Config	1	2	3	4	5	6
63	Line	Neutral	NC RTN	NC POL	OPEN	CLOSE
Control	TB1-9	TB1-8	TB1-15	TB1-14	TB1-6	TB1-5
67	NC	Neutral	Line	OPEN	NC	CLOSE
Control	NC	TB1-8	TB1-9	TB1-6	NC	TB1-5
69	Line	Neutral	NC	NC	OPEN	CLOSE
Control	TB1-9	TB1-8	NC	NC	TB1-6	TB1-5



6 Jaw Base

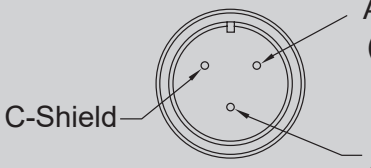
NC = Not Connected

▲**CAUTION:** Neutral Current or Phase Current input wires located in the same physical cable as Line-in, Open, and Close wiring may experience induced Neutral Current and/or Phase Current transients during Opening and Closing operations.

■**NOTE:** See "Neutral Current and Phase Current Grounding Considerations" earlier in this Chapter.

Table 5-3 6-Blade Meter Base Adapter Configurations

3-Pin Cannon Connector/Control Wiring			
	PIN		
Config	A	B	C
Neutral Current 50:0.2 CT	NC POL	NC RTN	Ground
Control	TB1-14	TB1-15	Enclosure Ground Stud



3-Pin Plug
(Cabinet Side)

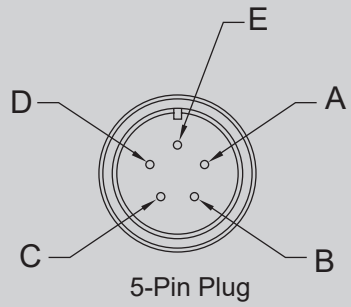
NC POL - Neutral Current Polarity
NC RTN - Neutral Current Return

* Wire color coding does not apply to control terminal block wiring.

Table 5-4 3-Pin Cannon Plug Configurations

5-Pin Cannon Plug/Control Wiring

	PIN				
Config	A	B	C	D	E
5E	Line	Neutral	CLOSE	OPEN	- - - - - -
Control	TB1-9	TB1-8	TB1-5	TB1-6	- - - - - -
5N	Line	Neutral	CLOSE	OPEN	NC POL
Control	TB1-9	TB1-8	TB1-5	TB1-6	TB1-14



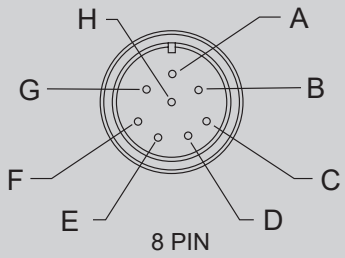
5-Pin Plug

NC POL - Neutral Current Polarity
LC POL - Line Current Polarity
NC RTN - Neutral Current Return
LC RTN - Load Current Return

Table 5-5 5-Pin Cannon Plug Configurations

8-Pin Cannon Plug/Control Wiring

	PIN							
Config	A	B	C	D	E	F	G	H
8A	LINE	NEUTRAL	CLOSE	OPEN	Sw Stat 1	Sw Stat 2	Sw Stat 3	Status RTN
Control	TB1-9	TB1-8	TB1-5	TB1-6	TB1-7	TB1-2	TB1-1	TB1-4
Config	A	B	C	D	E	F	G	H
8B	V1	V2	V3	CLOSE	OPEN	NEUTRAL	NC	NC
Control	TB4-2	TB4-4	TB4-6	TB1-5	TB1-6	TB1-8		



8 PIN
PLUG

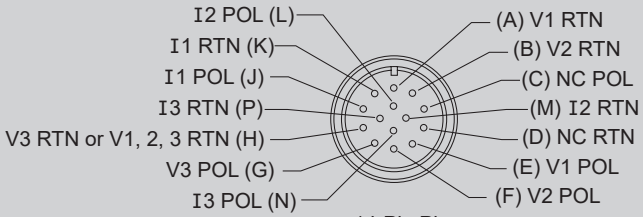
NC = Not Connected

■**NOTE:** M-6283A Controls with Serial Numbers 25000 and higher include a new hardware version. This hardware change is the new **TB4 Terminal Block**, as referenced in this Table. Previous Phase Voltage and Phase Current connections to TB1 and TB2 are **not used** with this update. Refer to **Appendix E** for Legacy Hardware connections.

Table 5-6 8-Pin Cannon Plug Configurations

14-Pin Cannon Plug/Control Wiring

	PIN						
1	A	B	C	D	E	F	G
	V1 RTN TB4-1	V2 RTN TB4-3	NC POL TB1-14	NC RTN TB1-15	V1 POL TB4-2	V2 POL TB4-4	V3 POL TB4-6
	H	J	K	L	M	N	P
	V3 RTN or V1, 2, 3 RTN TB4-5	I1 POL TB4-8	I1 RTN TB4-7	I2 POL TB4-10	I2 RTN TB4-9	I3 POL TB4-12	I3 RTN TB4-11



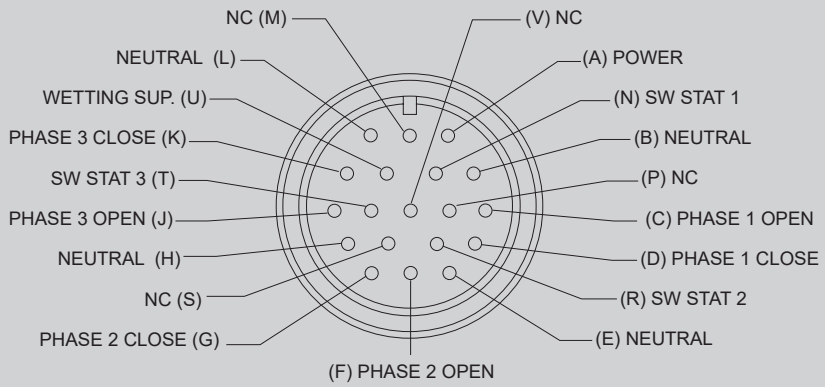
14-Pin Plug

■**NOTE:** M-6283A Controls with Serial Numbers 25000 and higher include a new hardware version. This hardware change is the new **TB4 Terminal Block**, as referenced in this Table. Previous Phase Voltage and Phase Current connections to TB1 and TB2 are **not used** with this update. Refer to **Appendix E** for Legacy Hardware connections.

Table 5-7 14-Pin Cannon Plug Configurations

19-Pin Cannon Plug/Control Wiring

	SOCKET						
19	A	B	C	D	E	F	G
	POWER TB1-9	NEUTRAL TB1-8	PHASE 1 OPEN TB3-4	PHASE 1 CLOSE TB3-5	NEUTRAL TB1-8	PHASE 2 OPEN TB3-6	PHASE 2 CLOSE TB3-7
	H	J	K	L	M	N	P
	NEUTRAL TB1-8	PHASE 3 OPEN TB3-8	PHASE 3 CLOSE TB3-9	NEUTRAL TB1-8	NC	SW STAT 1 TB1-7	NC
	R	S	T	U	V		
	SW STAT 2 TB1-2	NC	SW STAT 3 TB1-1	WETTING SUP. TB1-4	NC		
9S	19-Pin Cannon Connector for 120V Switch Status Contact (Single Pole Switching). **NOTE**: Wetting supply (U) is not connected through the wiring harness.						



NC = Not Connected

19-Pin Plug

Table 5-8 19-Pin Cannon Plug Configuration

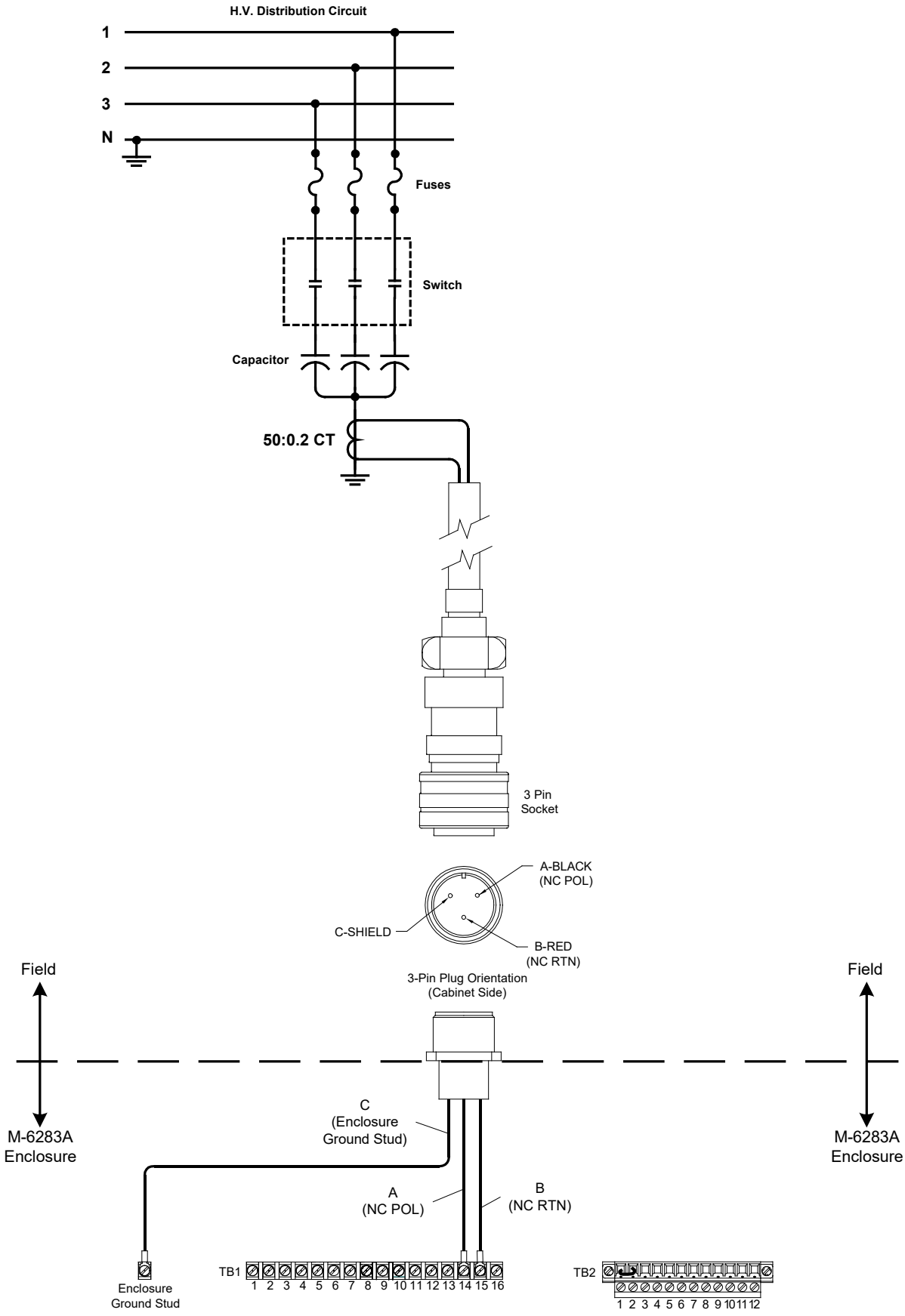


Figure 5-4 3-Pin Cannon Cabinet Connection Neutral Current/CT Sensor

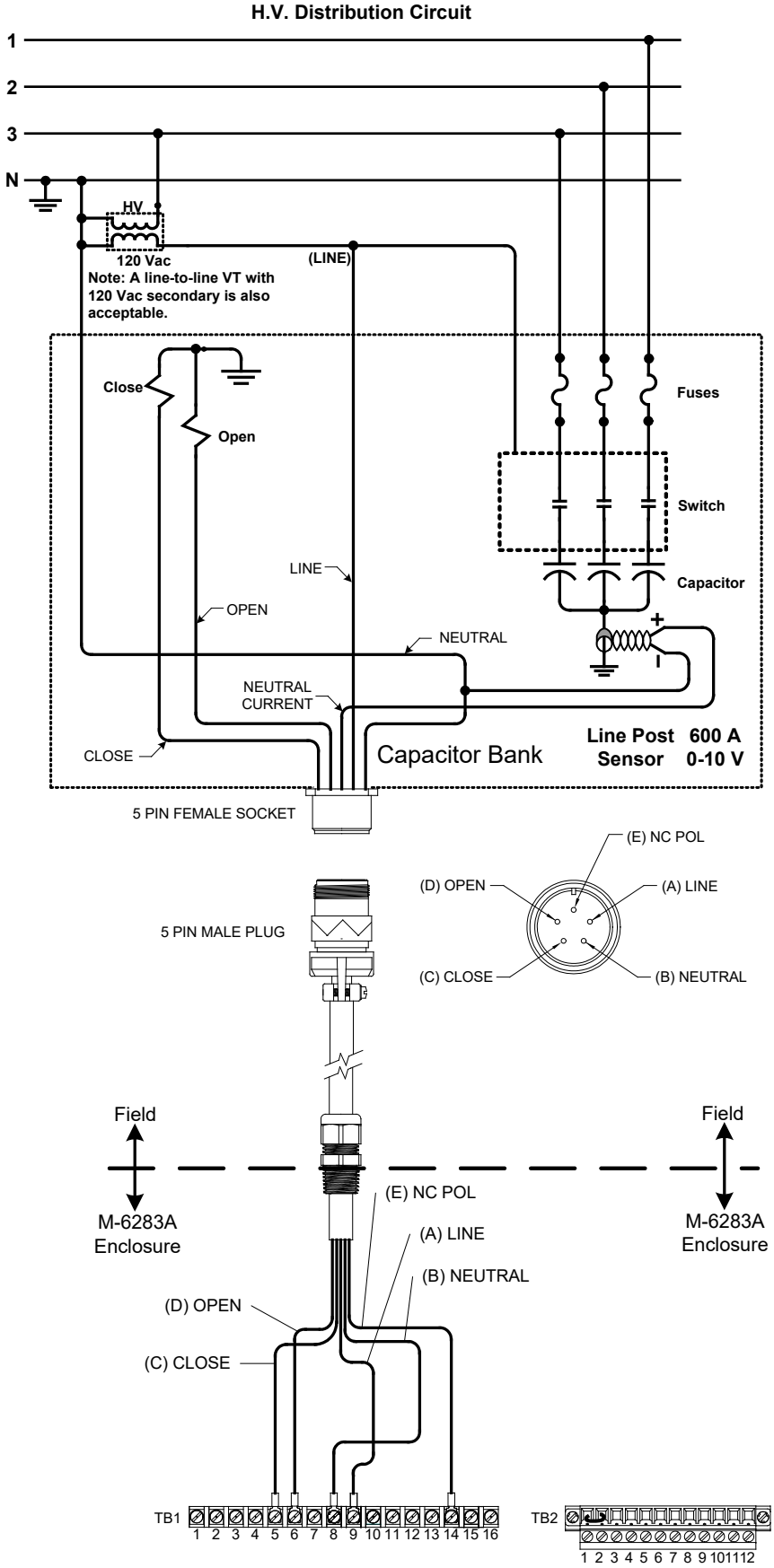


Figure 5-5 5-Pin Cannon Plug (Configuration 5N) Line Post Sensor/Neutral Current Configuration

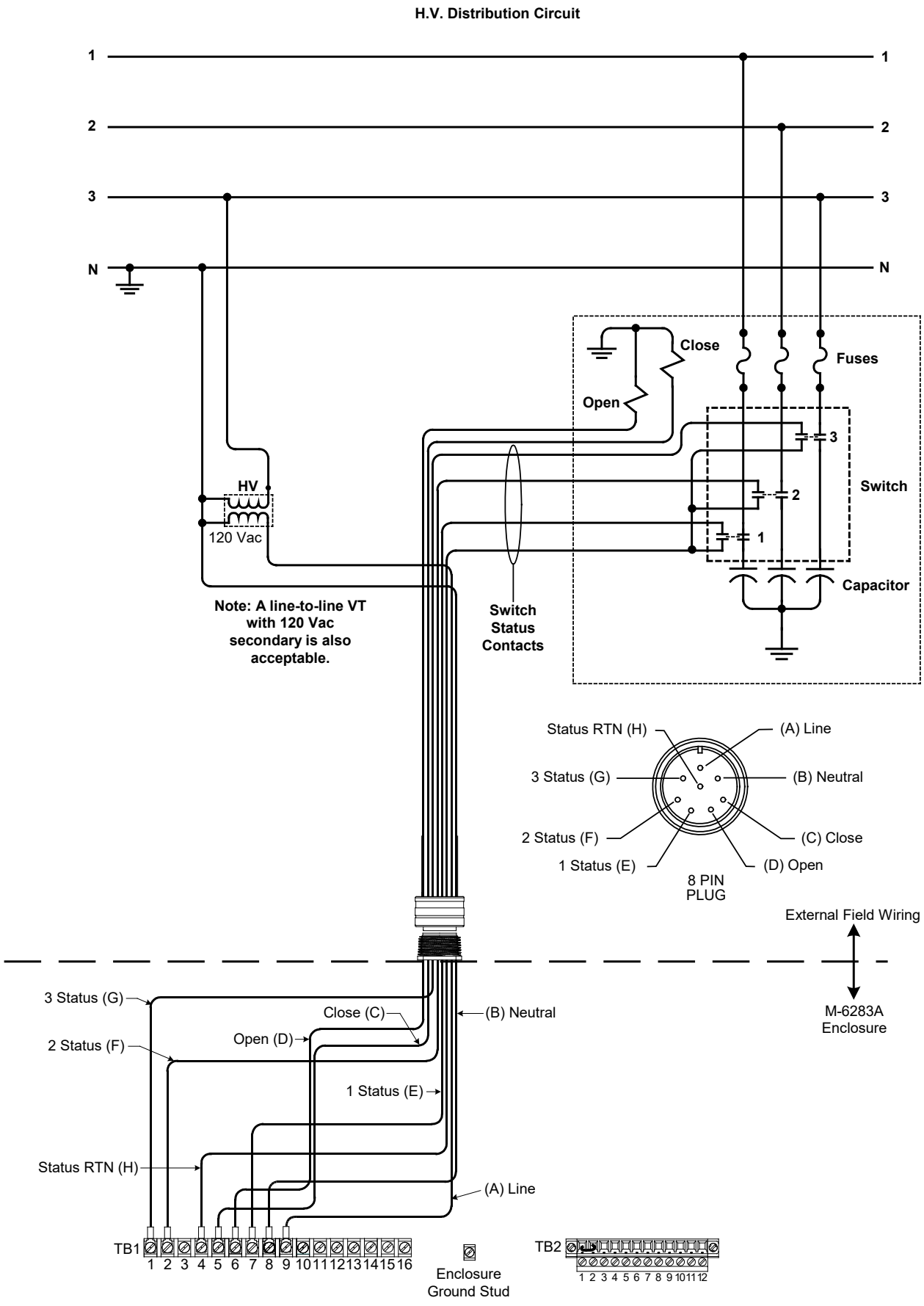
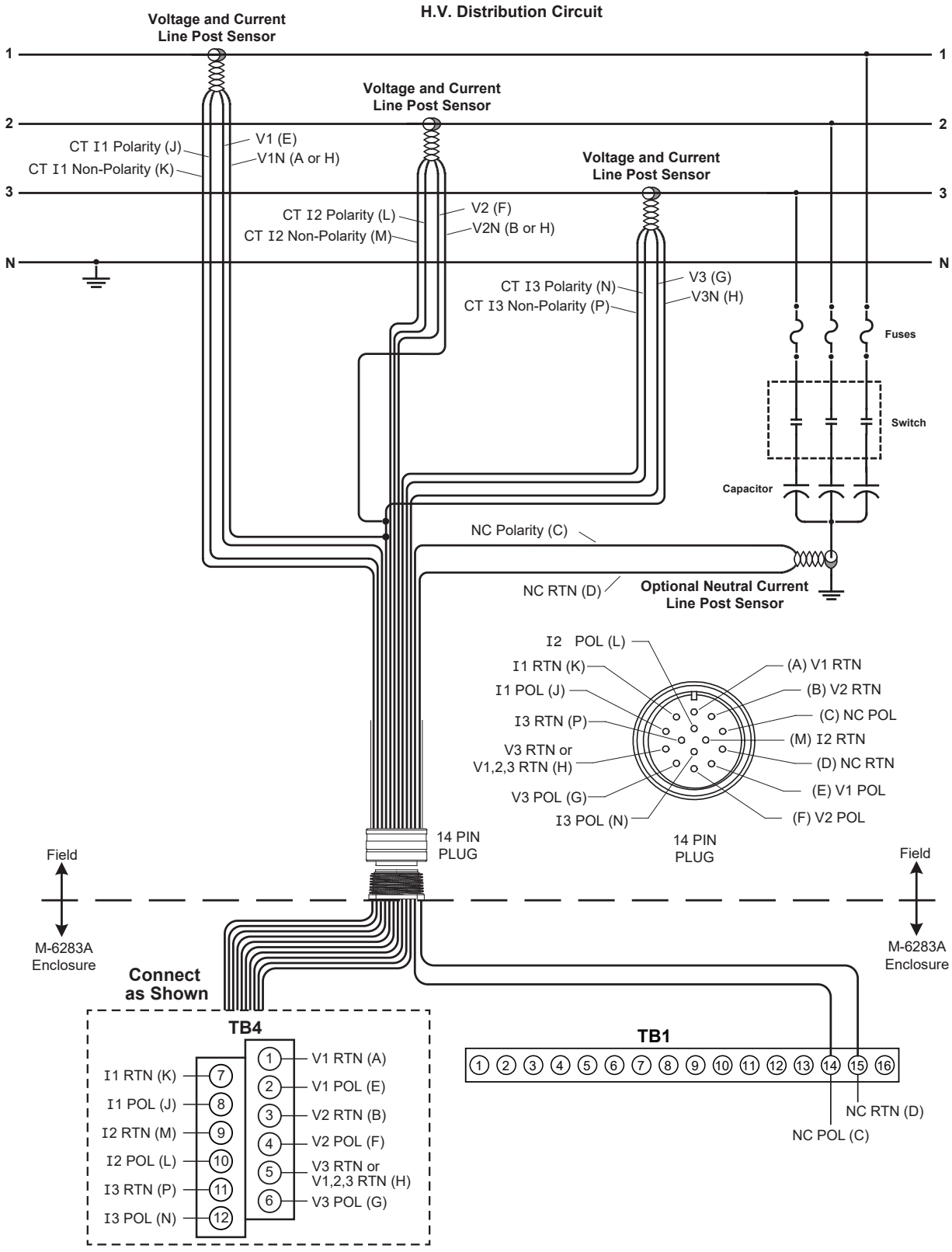


Figure 5-6 8-Pin Cannon Plug (Configuration 8A) Control and Switch Status Configuration



■**NOTE:** M-6283A Controls with Serial Numbers 25000 and higher include a new hardware version. This hardware change is the new **TB4 Terminal Block**, as referenced in this Diagram. Previous Phase Voltage and Phase Current connections to TB1 and TB2 are **not used** with this update. Refer to **Appendix E** for Legacy Hardware connections.

Figure 5-7 14-Pin Cannon Plug Configuration

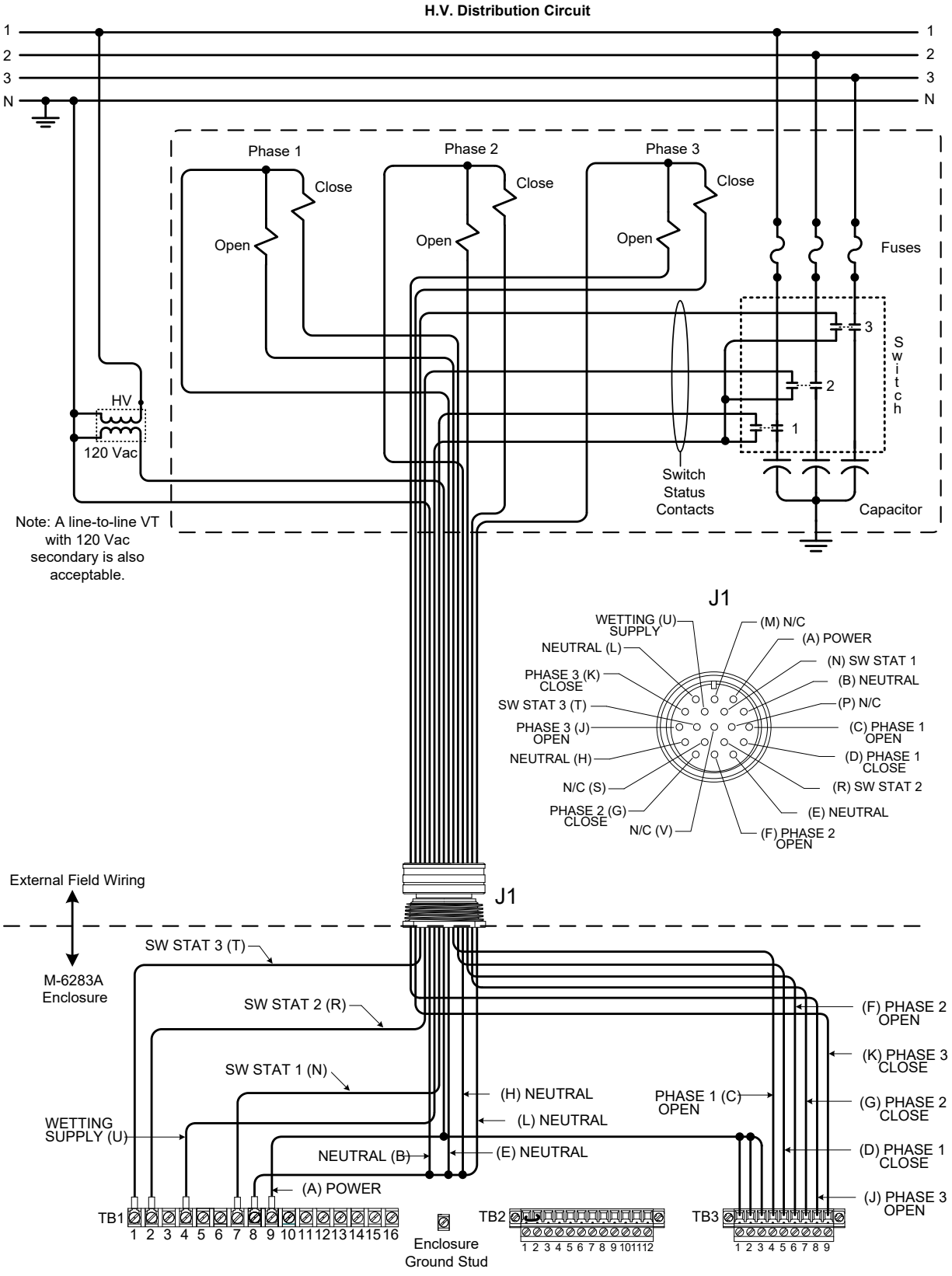
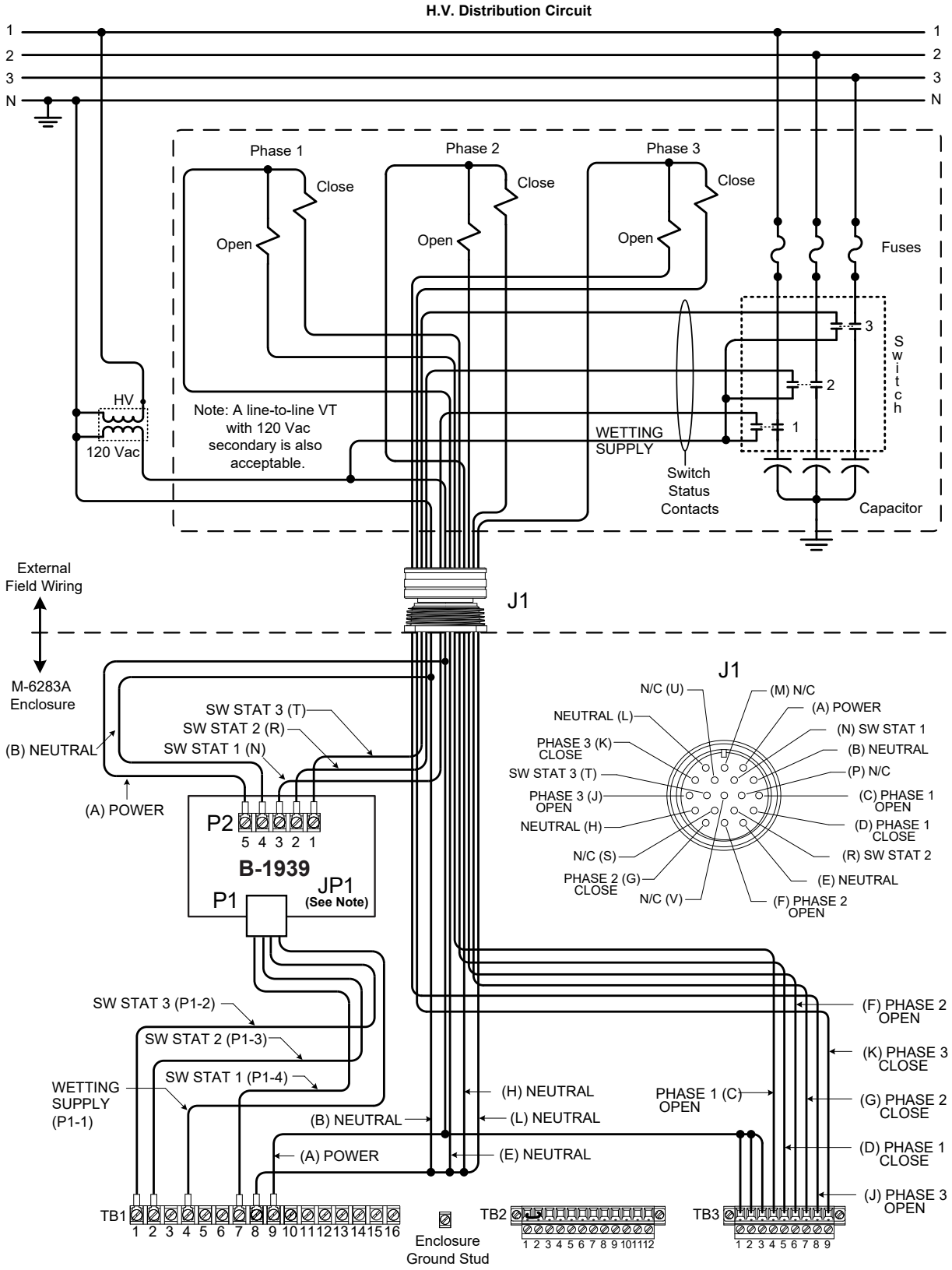


Figure 5-8 19-Pin Cannon Plug Configuration



■**NOTE:** Jumper JP1 on the B-1939 allows selection of neutral or line common as reference. **Position A-B** = Line Contact/Neutral Return, **Position A-C** = Neutral Contact/Line Return.

Figure 5-9 19-Pin Cannon Configuration 9S: 120V Switch Status Contact (Single Pole Switching)

5.4 Communication Ports

The control includes a standard USB Port (front), RS-485/Fiber Optic port (top) and optional Ethernet port (top) if equipped (RJ45, ST connector). USB is an internal port, and supports only MODBUS protocol and software updates. Top COM Ports support MODBUS and DNP3.0 protocols. The M-6283A and wireless communication unit are powered by the VT provided with the switched capacitor bank.

Fiber Optic Interface

The Fiber Optic interface is connected to COM1 of the M-6283A. It can be enabled through the front panel under the Comm Settings menu. When Fiber Optic is selected, the RS-485 is disabled. The Fiber Optic baud rate is selectable from 300 to 115200.

The echoing of the received data is supported by the hardware. The fiber repeat switch is located to the right of the TX fiber transmitter connector. Placing the switch toward the back cover turns on Fiber Repeat (sometimes called Echo Repeat or Echo ON) and placing it towards the front panel disables it (See Figure 5-2). Echo ON is primarily used if the control is in a daisy chain network. If the client software supports echo cancelling, as it is the case for CapTalk, then there is no need to disable echo transmission. In this case, echo cancel should be enabled on the client software.

The fiber optic feature was tested with a clad fiber of 62.5 micron diameter with 125 micron diameter cladding (62.5/125). A manufacturer of this product is Amphenol Corporation. A typical part number tested by Beckwith Electric is 943-32255-10030 from Amphenol Corporation, Lisle, Illinois. This is a dual-fiber with a total of four ST connectors. See Figure 5-10 for Amphenol part number selection.

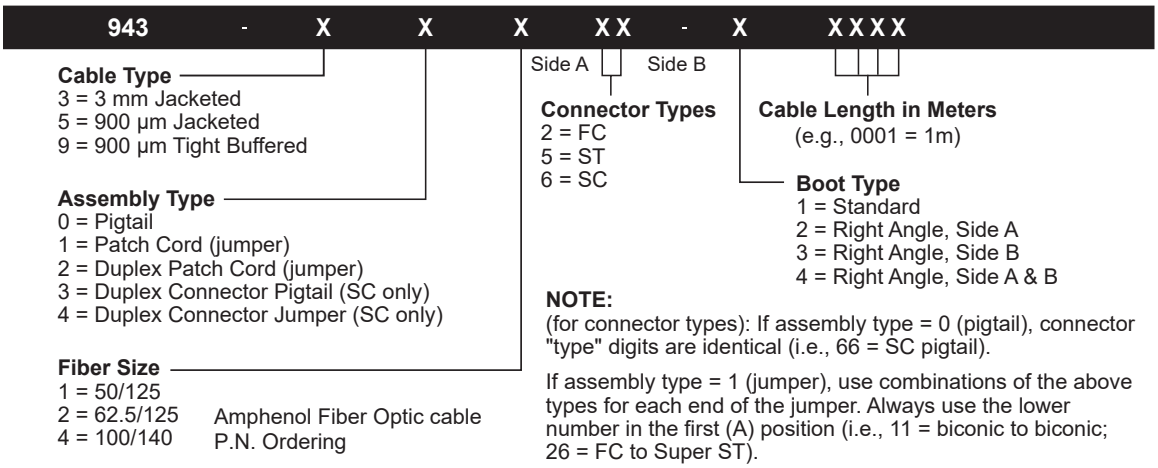


Figure 5-10 Amphenol Fiber Optic Cable Part Number Selection

RS-485 Interface

The communication protocols, MODBUS and DNP3.0 are a 2-wire, half duplex RS-485 link of the M-6283A top COM Port.

A port-powered converter made by B & B Electronics of Ottawa, IL (Model 485LP9TB) was used to test the two-wire RS-485 link. This converter is available in commercial and extended temperature ranges. When connecting the RS-485 a 120 Ohm resistor (See Figure 5 in specification) should be connected at the last control connector across A/B. However, in some cases communications can be improved without the resistor. The two-wire RS-485 port assigns Pin (+) and Pin (–). The SH connection on the RS-485 plug should be connected to the cable shield. The shield should only be connected on one end of the RS-485 cable. If more than one M-6283A control is connected via RS-485 only one shield/SH connection should be made. The top COM Port should be set to RS-485. When selecting RS-485 transmission lines, there are cables specifically made for this purpose. These cables have a shunt capacitance of 16 pF or less per foot, and are usually solid wire. Plenum-rated cabling is recommended. The RS-485 connector is designed to accommodate 12 to 24 AWG wire.

Optional Ethernet Port

The optional Ethernet Port can be purchased as either a RJ-45 (10/100 Base-T) interface or Fiber Optic through ST or SC connectors (100 Base-Fx) for ethernet communication to the M-6283A. The port supports up to eight concurrent connections. The maximum number of allowed DNP connections is five. The maximum number of MODBUS connections is eight. The port supports DHCP protocol and also allows manual configuration of the Ethernet port. MODBUS protocol "Port Number" and DNP Protocol "Port Number" are required for manual configuration.

■**NOTE:** Using Fiber Ethernet requires the Auto Negotiate setting in the control to be set to Disable to operate correctly.

5.5 Grounding

Ground the control by connecting a suitably sized wire from the ground stud next to TB-1 of the control panel, to a solid connection to ground.

5.6 Intrusion Detection

Intrusion Detection Microswitch – The M-2980A cabinet door intrusion detection microswitch (Figure 5-3) status (Close/Open Condition) is monitored by the M-6283A and is available in the CapTalk Status screen.

If an Open Condition is detected, a DNP binary input point for intrusion detection will be set and will generate a DNP event. The intrusion detection will also be monitored using MODBUS register 1725 @ bit 3.

5.7 Auxiliary Equipment Connections

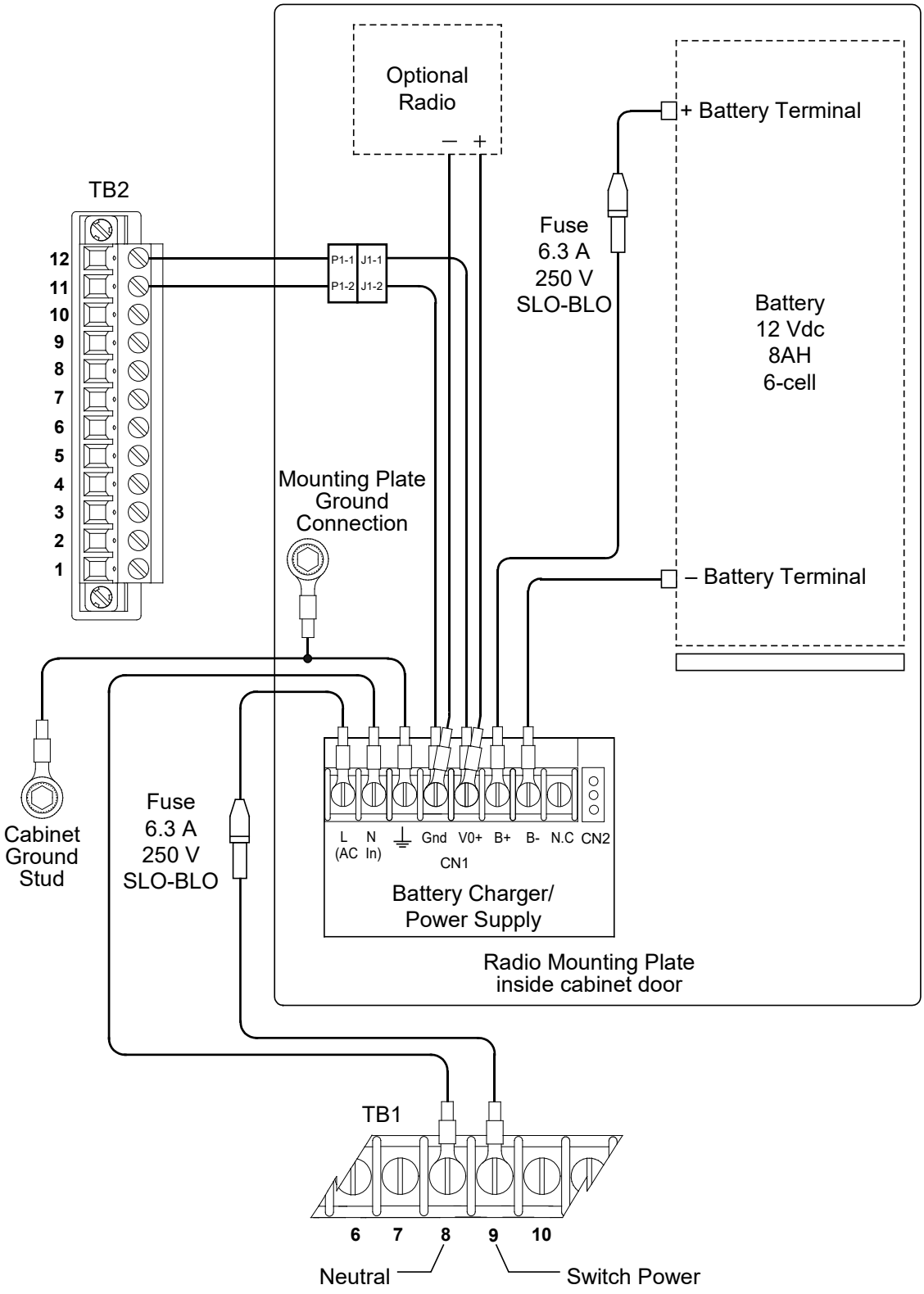


Figure 5-11 Battery Charger/Power Supply/Optional Radio Connections

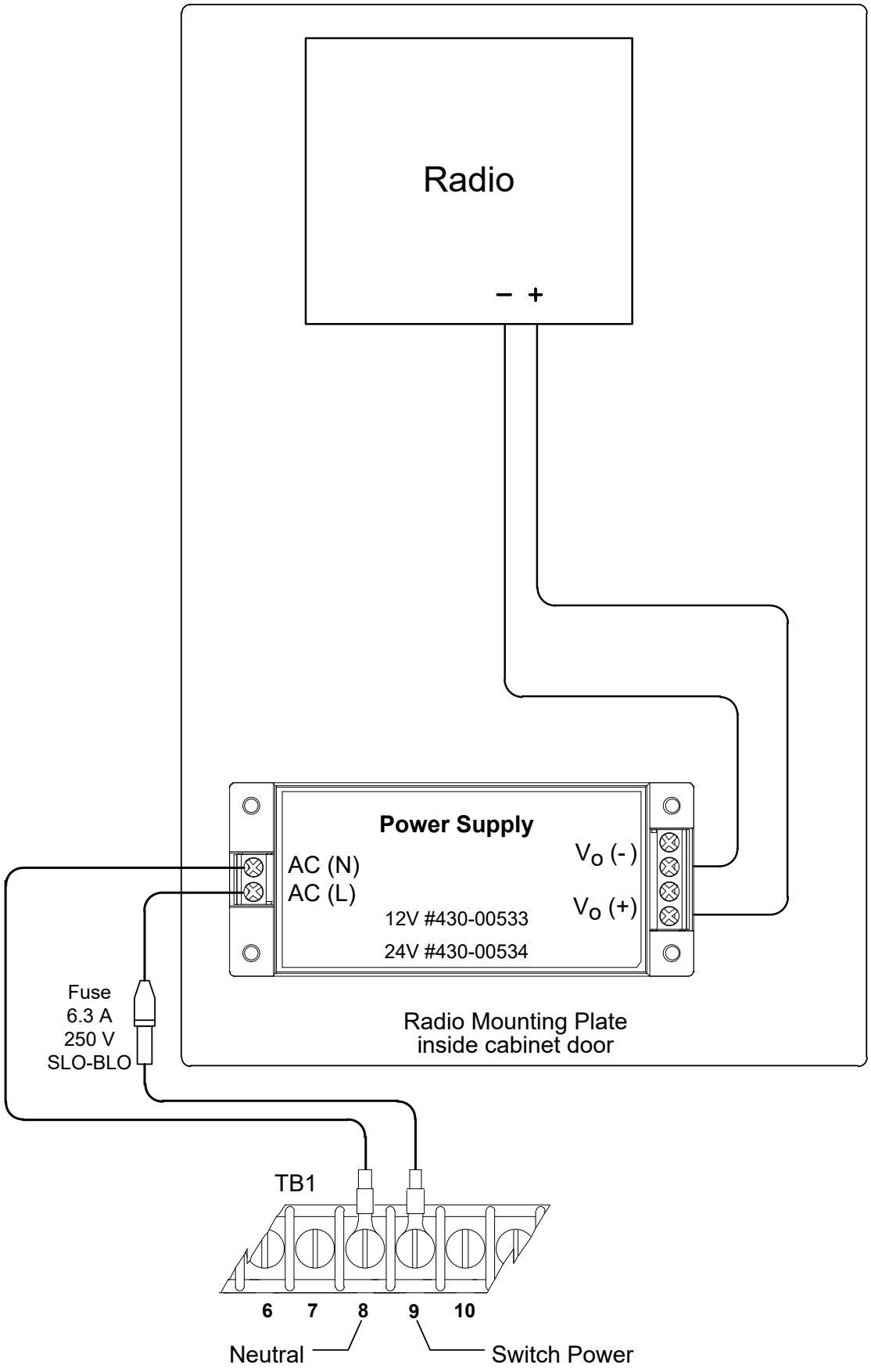


Figure 5-12 Radio Power Supply Connections

6 Testing

■ **CYBER SECURITY NOTE:**

When Cyber Security is enabled, access to any feature described in this Chapter is subject to the Access Permissions Policy as designated by the Security Policy Administrator.

6.1 Testing Related Control Switches and Binding Posts

Voltage Source

The Voltage Source switch disconnects the voltage transformer input to the voltage control section of the control and connects the **EXTERNAL POWER** binding posts to the voltage input and motor circuit.

▲**CAUTION:** Do not reverse the ground and hot wires when connecting an external source. A U_L recognized replaceable fuse, 3A, 250 Vac, 3 AG fuse is installed to protect the control from damage if these connections are accidentally reversed.

With the **VOLTAGE SOURCE** switch in the **EXT** position, the sensing and motor power circuits are connected to the External Power binding post on the front panel. The unit can be tested using an external 120 V RMS source of proper polarity applied to these terminals. Testing can be accomplished by adjusting the amplitude of the external source.

The **VOLTAGE SOURCE** switch will disconnect all power to the voltage control section of the control unit when selected to the **EXT** position with no source connected to the front panel voltage inputs.

Binding Posts

EXTERNAL POWER binding posts allow application of a 120 V RMS nominal voltage to the unit for test procedures.

■**NOTE:** The Binding Posts are rated for a maximum power input of 140 Vac, 8 VA.

⬢**WARNING: Operating personnel MUST NOT connect uninsulated test connections to the binding post as they can create a shock hazard.**

METER OUT binding posts allow reading of the input voltage.

⬢**WARNING: A shock hazard exists due to the presence of voltage on the Meter Out Binding Posts.**

6.2 LED Scroll Test

To test the control front panel LEDs proceed as follows:

1. Press the **ENT** (UTIL Hot Button) pushbutton to wake the unit. The menu will advance to "UTILITIES".

```
        UTILITIES
←COMM             MNTR→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
     Calibration/Test
←                      →
```

3. Press the Down arrow pushbutton as necessary to navigate to the "LED Scroll Test" menu item.

```
LED Scroll Test
Press ENT to begin
```

4. Press the **ENT** pushbutton. If prompted, enter a valid Level 2 Access Code. The following will be displayed:

```
LED Scroll Test
Test in Progress...
```

■**NOTE:** The Transmit (TX) and Receive (RX) LED's are NOT tested here.

5. The control will illuminate each of the eight LEDs. To stop the LED test press the **EXIT** pushbutton.

6.3 Input Test

To test the control inputs proceed as follows:

1. Press the **ENT** (UTIL Hot Button) pushbutton to wake the unit. The menu will advance to "UTILITIES".

```
        UTILITIES
←COMM             MNTR→
```

2. Press the Down Arrow pushbutton once. The unit will display the following:

```
     Calibration/Test
←                      →
```

3. Press the Down arrow pushbutton as necessary to navigate to the "Input Test" menu item.

```
Input Test
Press ENT to begin
```

4. Press the **ENT** pushbutton. If prompted, enter a valid Level 2 Access Code. The following will be displayed:

```
Input Test
      10000000
```

5. Determine the inputs to be tested and the corresponding position (from right to left) in the input test screen.
   - Position #1: Close
   - Position #2: Open
   - Position #3: Auto/Manual
   - Position #4: N/A
   - Position #5: N/A
   - Position #6: N/A
   - Position #7: N/A
   - Position #8: N/A

   As each input is activated the corresponding indicator will change from a "0" to a "1" to indicate that the control has read the input.
6. Verify that the control is in a configuration that supports input testing. If the control is connected to field connections, then determine the necessary test method(s) for testing the desired input.
7. When all input testing has been completed, then restore the control back to pre-test conditions.

6.4 Front Panel Pushbutton Test

To test the control front panel pushbuttons proceed as follows:

1. Press the **ENT** (UTIL Hot Button) pushbutton to wake the unit. The menu will advance to "UTILITIES".

   ```
          UTILITIES
   ←COMM              MNTR→
   ```

2. Press the Down Arrow pushbutton once. The unit will display the following:

   ```
       Calibration/Test
   ←                      →
   ```

3. Press the Down arrow pushbutton as necessary to navigate to the Button Input Test menu item.

   ```
   Button Input Test
   Press ENT to Begin
   ```

4. Press the **ENT** pushbutton. If prompted, enter a valid Level 2 Access Code. The following will be displayed:

   ```
   Button Input Test
      10000000
   ```

■**NOTE:** The following key identifies each pushbutton position from left to right:

Position	Pushbutton
1	CAP OPERATE
2	N/A
3	ENT/UTIL
4	➡/COMM
5	⬇/CNFG
6	⬆/SETP
7	⬅/MNTR
8	EXIT/WAKE

5. Test the desired pushbutton by pressing and holding the pushbutton. The display will change from "0" to "1" if the pushbutton is working correctly.

6.5 SCADA Test Mode

The SCADA Test Mode allows the user to initiate a local Close command to a unit without waiting for the 5 minute Re-Close Delay after an Open has been requested. The SCADA Test Mode results in the following control operational elements:

- The Re-Close Delay will be bypassed when an Open command would normally initiate it.
- The Close and Open physical output relays do not operate.
- The Delta Voltage calculation will not recognize any operations performed in this mode.
- The Delta Current calculation will not recognize any operations performed in this mode.
- The Operation Counter will not function in this mode.

The Close and Open Status LED's, MODBUS/DNP points, and CapTalk indicators all function as if the outputs were not disabled.

When SCADA Test Mode has been enabled, it will remain in effect until the control power is cycled or it is disabled by the user from the HMI.

When enabled the user lines of the control will be replaced with the following when this mode is active:

User Line 1: SCADA Test Mode

User Line 2: Outputs are Disabled

▲**CAUTION:** If a cont rol is currently in a Re-Close Delay and SCADA Test Mode is activated, the control will not initiate a Close operation until the Re-Close Delay timer has timed out.

Enabling SCADA Test Mode

1. Verify that the capacitor bank associated with the control is in a configuration that supports testing. If the control is connected to field connections (Programmable Alarm Relay), then determine the necessary test method(s).
2. Press the **ENT** (Util Hot Button) pushbutton. The control will go directly to the "Utilities" menu.

   ```
           UTILITIES
   ←COMM              MNTR→
   ```

3. Press the Down Arrow pushbutton as necessary to navigate to the "SCADA TEST Mode" menu item.

   ```
   SCADA TEST MODE
   disabled
   ```

4. Press the **ENT** pushbutton. If prompted, enter a valid Level 2 Access Code. The following will be displayed:

   ```
   Confirm press ENT
   Cancel press EXIT.
   ```

5. Utilizing the Up/Down Arrow pushbuttons select **ENABLE** SCADA Test Mode, then press the ENT pushbutton. The following will be displayed reflecting the selection that was made.

   ```
   SCADA Test Mode
   (ENABLE or disable)
   ```

   The SCADA Test Mode is now enabled, it will remain in effect until the control power is cycled or it is disabled by the user.

6.6 Re-Close Delay Override

WARNING: This feature must only be used for testing purposes when either no capacitor bank is connected or the capacitor bank disconnects are OPEN.

Utility/Re-Close Delay Override

The Re-Close Delay Override is a factory option and is ***only*** available in CapTalk. The Re-Close Delay Override, when enabled, allows the control to bypass the 5-minute Re-Close Delay which is started at the end of every OPEN operation. This feature is intended for use in a Lab or Testing environment, when the control is not physically connected to a Capacitor Bank, or the Capacitor Bank disconnects are open.

The **Re-Close Delay Override** submenu item is only visible and accessible when all of the following requirements are met:

- CapTalk is connected to the control through the USB port.
- CapTalk has granted either Level 2 access or an authorized user with "Change Configuration" permission is logged on.
- The Re-Close Delay Override feature has been made accessible, either at the factory or by utilizing an enabling tool available on request.
- The CapTalk "Re-Close Delay Override Code" has been changed to a non-zero value. The factory default code is 15 zeros and must be changed to a new 15 digit alphanumeric code before this feature is accessible.

Once all of the above requirements are met, the CapTalk Utility menu will contain a new submenu "Re-Close Delay Override" (Figure 6-1).

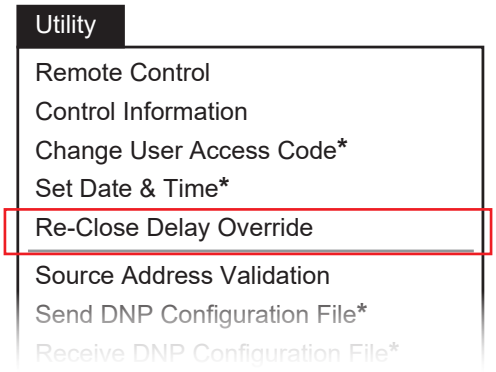


Figure 6-1 CapTalk Utility Menu with Re-Close Delay Override Submenu

When the Reclose Delay Override feature is activated, the Re-Close Delay Override is in effect until any of the following conditions exist:

- 6 minutes elapses without an Open or Close operation taking place.
- The control is de-energized.
- The feature is Disabled from the CapTalk Utility menu.
- Communication between CapTalk and the control is terminated.

While the Reclose Delay Override feature is active, the following message will cycle on the User Lines of the control front panel display: "RE-CLOSE DELAY OVERRIDE ENABLED".

When a non-zero Re-Close Delay Override code has been programmed into the control, the user is required to re-enter the existing code in order to change it.

When a user enters the 15 digit Override Code to enable the feature, it is logged into the User Access Log. A separate PC based log is also kept detailing information regarding time, date, user, etc.

Setting the Re-Close Delay Override Code to a Non-Zero Value

■**NOTE:** The factory default code is 15 zeros and must be changed to a new 15 digit alphanumeric code before this feature is accessible.

To set the Re-Close Delay Override Code and enable the Re-Close Override feature, perform the following:

1. Start CapTalk.
2. Login to CapTalk with Level 2 Security Access or an Authorized User with "Change Configuration" permission.
3. Select **Utility/Change User Access Code** from the CapTalk toolbar. CapTalk will display the Change User Access Code screen (Figure 6-2).

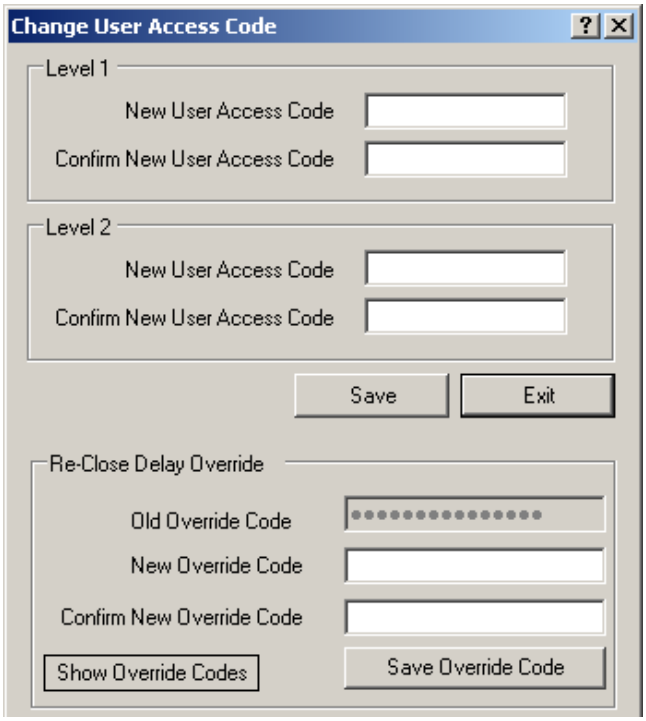


Figure 6-2 Change User Access Code Re-Close Delay Override Screen

4. From the Re-Close Delay Override section, enter a new 15 digit alphanumeric code and re-enter code for confirmation.
5. Select **Save Override Code**. CapTalk will display the "Override Code was sent successfully" confirmation screen.
6. Select **OK**. CapTalk will return to the main screen.

Activating the Re-Close Delay Override Feature

WARNING: This feature must only be used for testing purposes when either no capacitor bank is connected or the capacitor bank disconnects are OPEN.

To enable the Re-Close Delay Override feature, perform the following:

1. Select **Utility/Re-Close Delay Override** from the CapTalk toolbar. CapTalk will display the first of two "Re-Close Delay Override" screens (Figure 6-3).
2. Read the Warnings contained in this screen and then select either "No capacitor bank is connected" or "Capacitor bank disconnects are open".

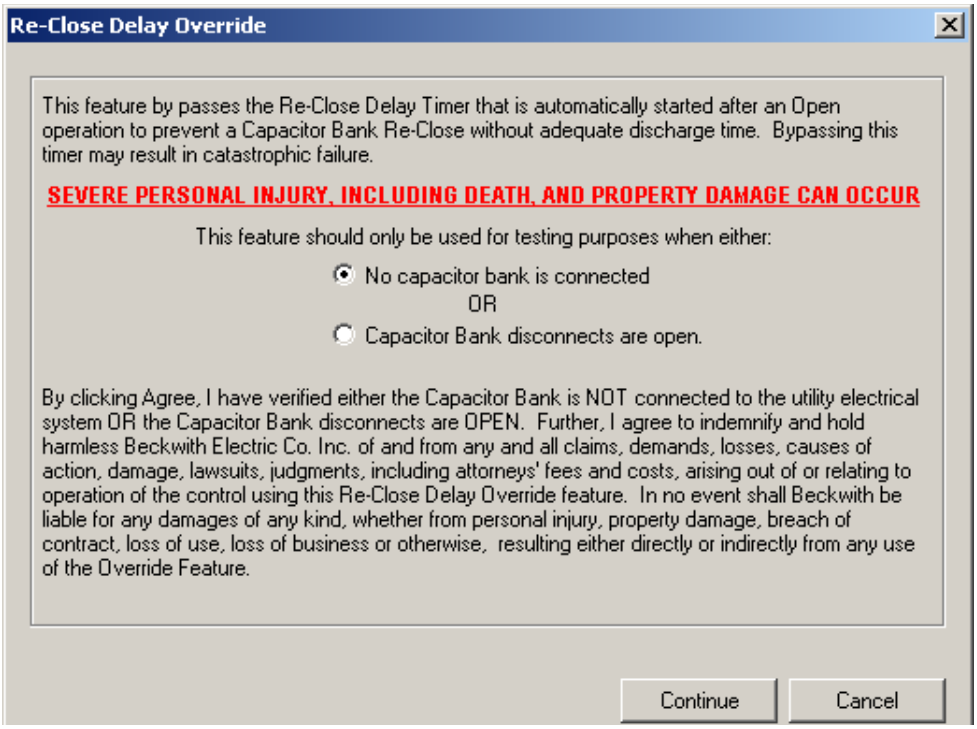


Figure 6-3 Re-Close Delay Override Screen #1

3. Select **Continue**. CapTalk will display the second "Re-Close Delay Override" screen (Figure 6-4).
4. Select either "Are Capacitor Bank Disconnects Open?" or "Is the control DISCONNECTED from the switch?".

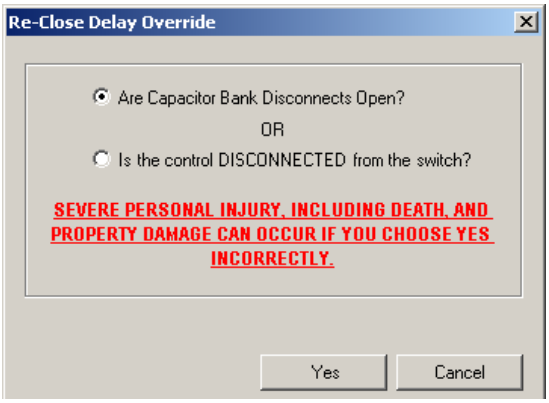


Figure 6-4 Re-Close Delay Override Screen #2

5. Select **Yes**. CapTalk will display the "Re-Close Delay Override Code" screen (Figure 6-5).

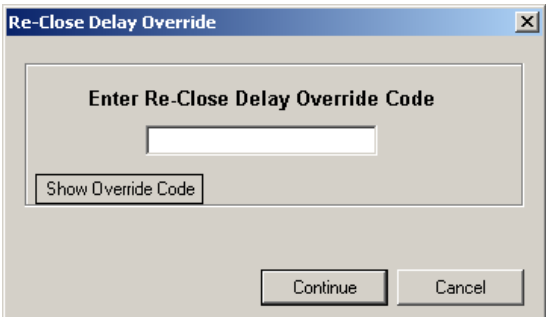


Figure 6-5 Re-Close Delay Override Code Screen

6. Enter the non-zero Re-Close Delay Override Code and then select **Continue**. CapTalk will display the "Re-Close Delay Override Are You Sure?" confirmation screen (Figure 6-6).

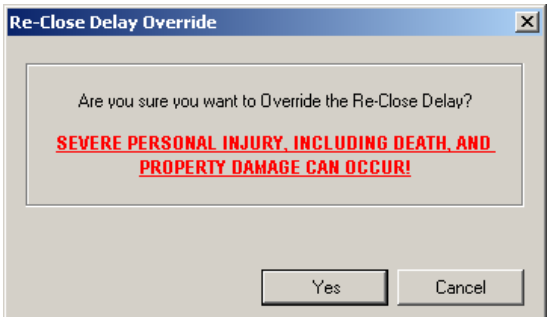


Figure 6-6 Re-Close Delay Override Are You Sure? Screen

7. Select **Yes**. CapTalk will display the "Re-Close Delay Override 10 seconds to confirm" screen (Figure 6-7).

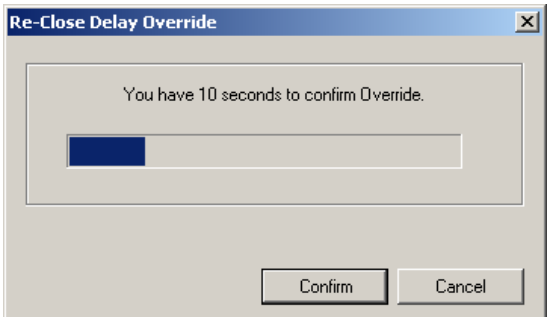


Figure 6-7 Re-Close Delay Override 10 Seconds to Confirm Screen

8. Select **Confirm** within 10 seconds. CapTalk will display the "Override Enabled" confirmation screen (Figure 6-8).

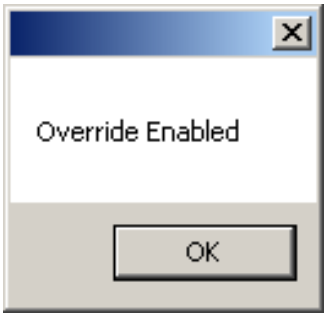


Figure 6-8 Re-Close Delay Override Enabled Confirmation Screen

9. Select **OK**. CapTalk will return to the main screen.

The Reclose Delay Override feature is activated, the Re-Close Delay Override will be in effect until any of the following conditions exist:

- 6 minutes elapses without an Open or Close operation taking place.
- The control is de-energized.
- The feature is Disabled from the CapTalk Utility menu.
- Communication between CapTalk and the control is terminated.

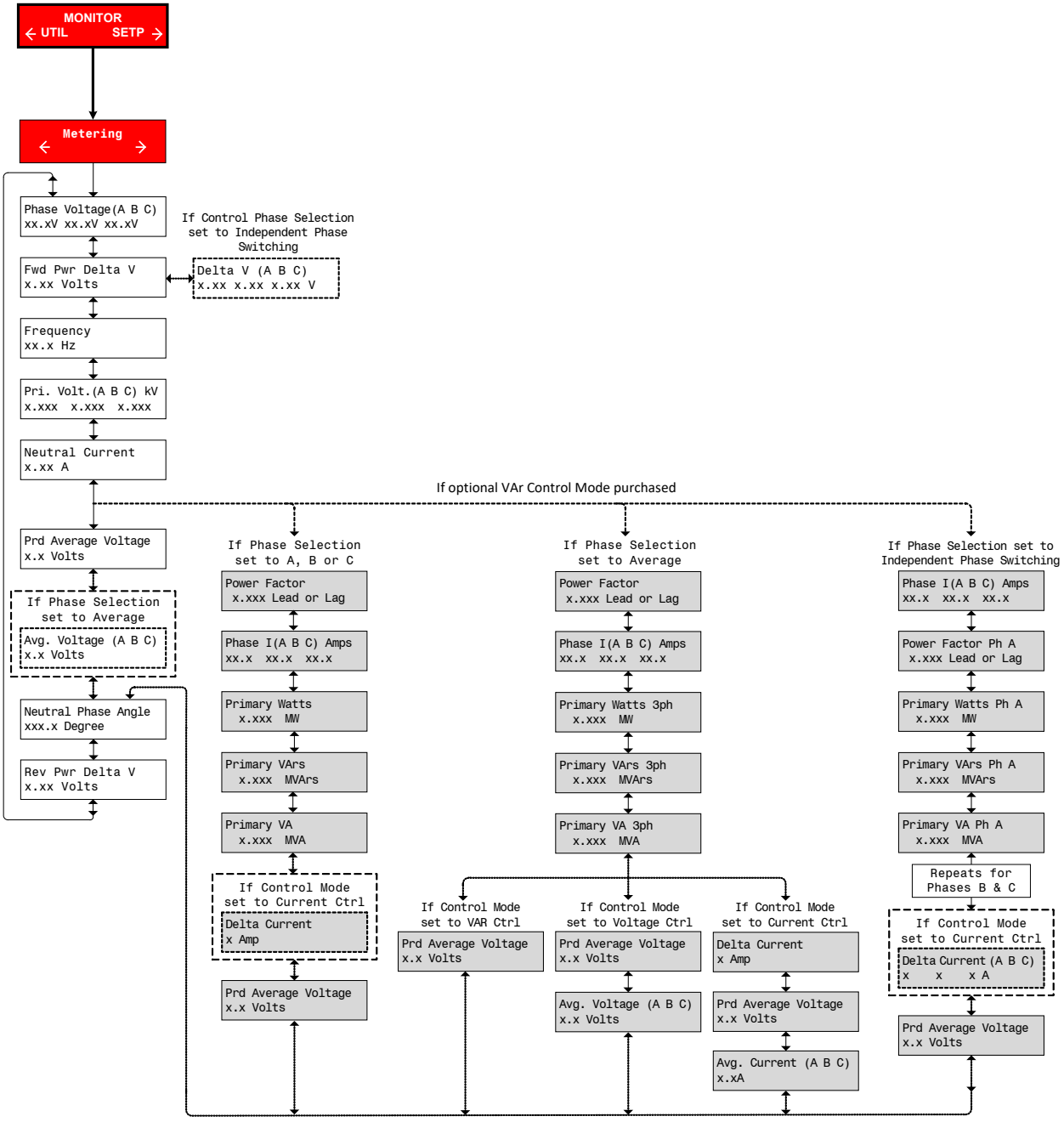
A HMI Menus

■ **CYBER SECURITY NOTE:**

When Cyber Security is enabled, access to any feature described in this Chapter is subject to the Access Permissions Policy as designated by the Security Policy Administrator.

A.1 HMI Menu Flow

MONITOR continues on next page ➡



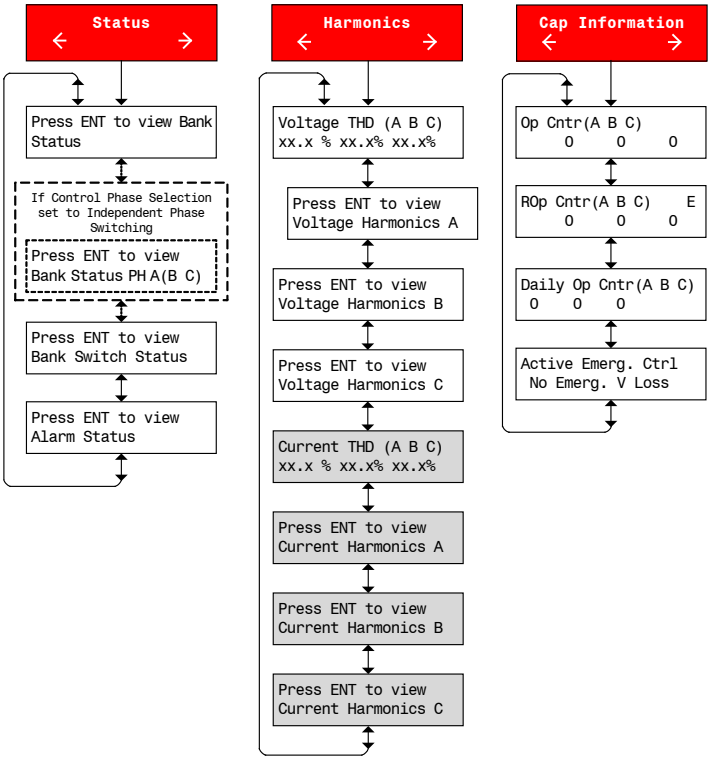
At any menu screen:

Press **EXIT** to go to the Menu Header.

Press either ← → to move sideways to the adjacent Menu Header.

Figure A-1 Monitor Menu Flow (1 of 2)

⬅ **MONITOR** continued from previous page



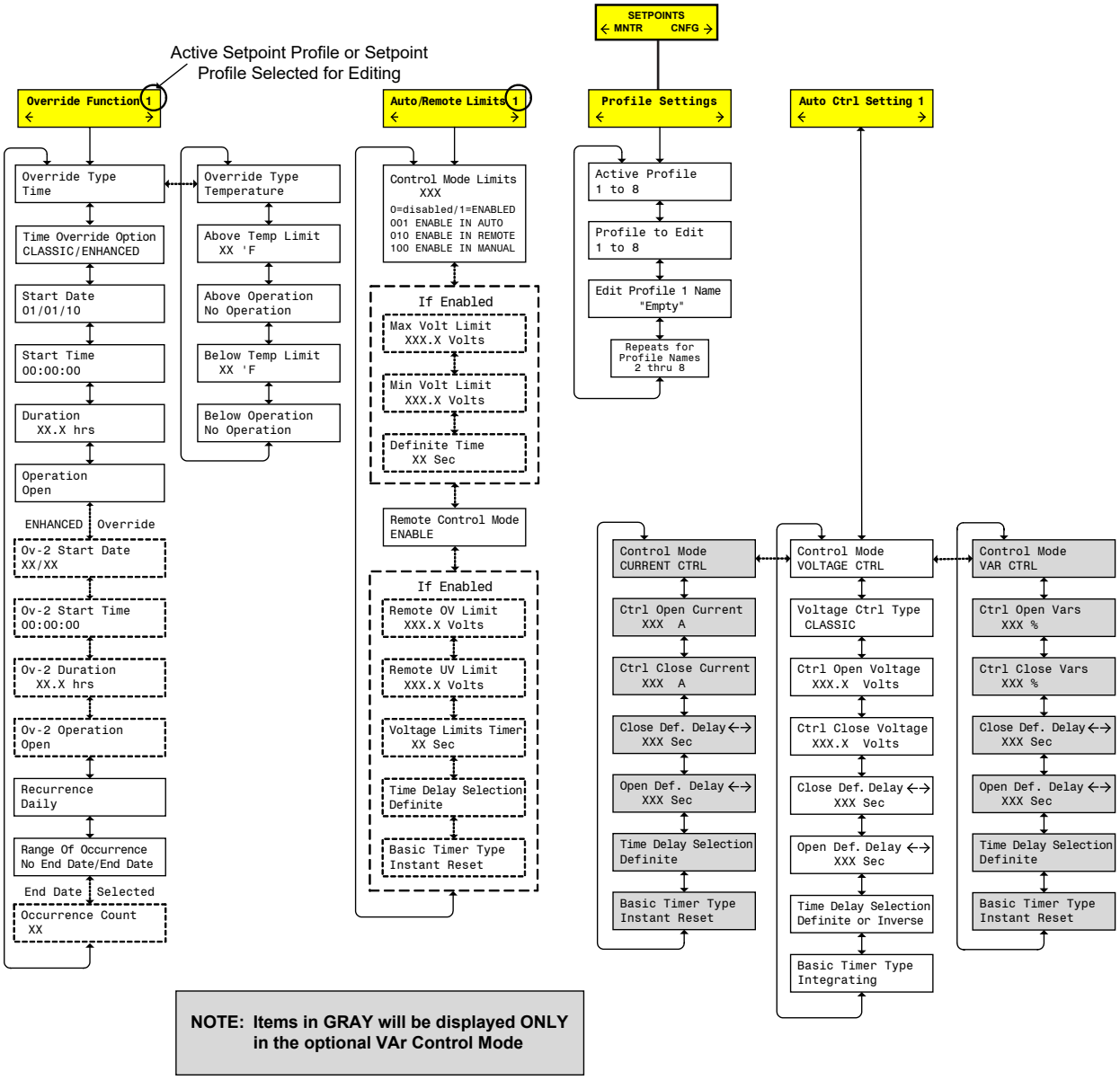
NOTE: Items in GRAY will be displayed ONLY in the optional VAr Control Mode

At any menu screen:

Press **EXIT** to go to the Menu Header.

Press either ← → to move sideways to the adjacent Menu Header.

Figure A-1 Monitor Menu Flow (2 of 2)



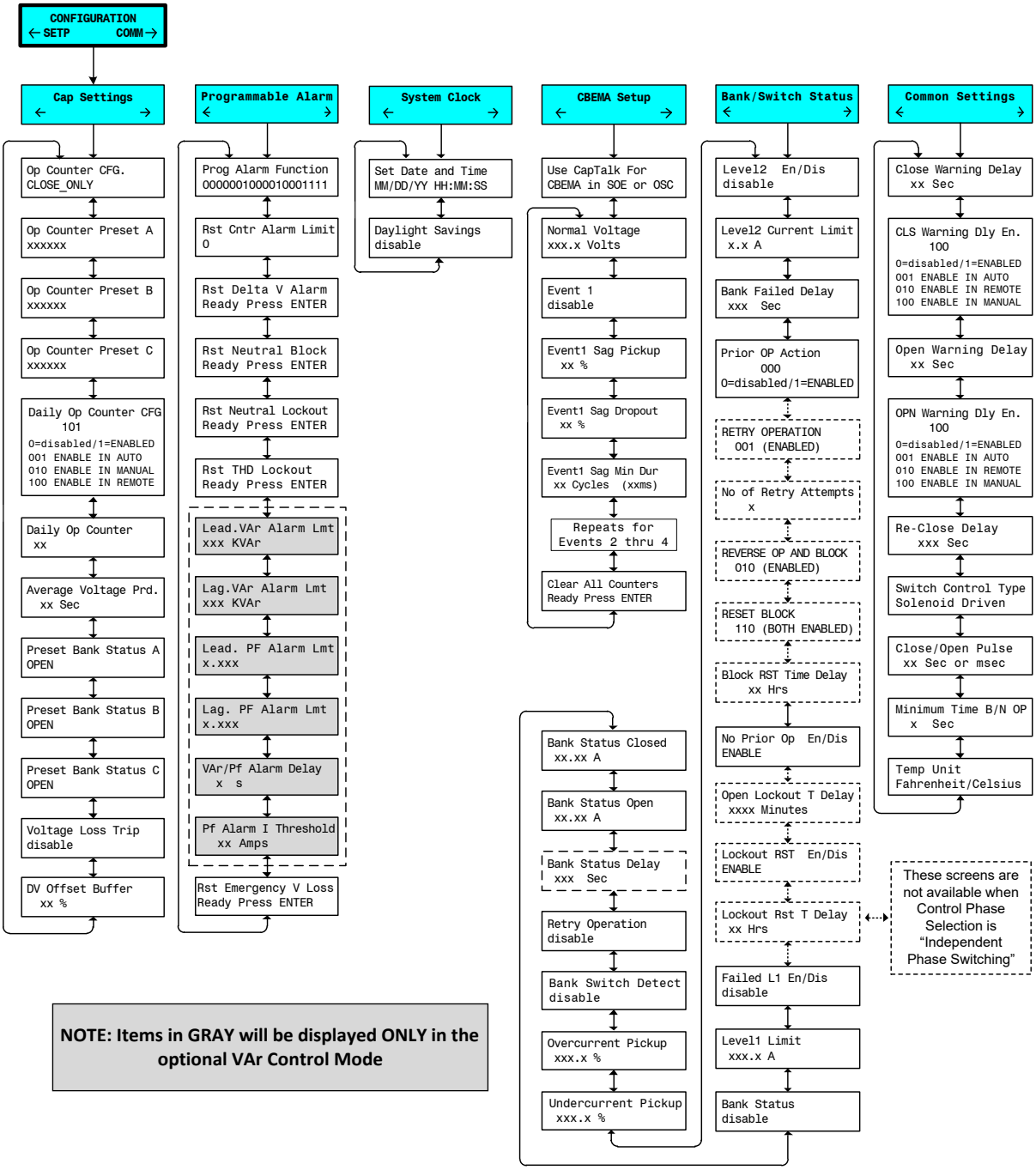
At any menu screen:

Press **EXIT** to go to the Menu Header.

Press either ← → to move sideways to the adjacent Menu Header.

Figure A-2 Setpoints Menu Flow

CONFIGURATION continues on next page ➡



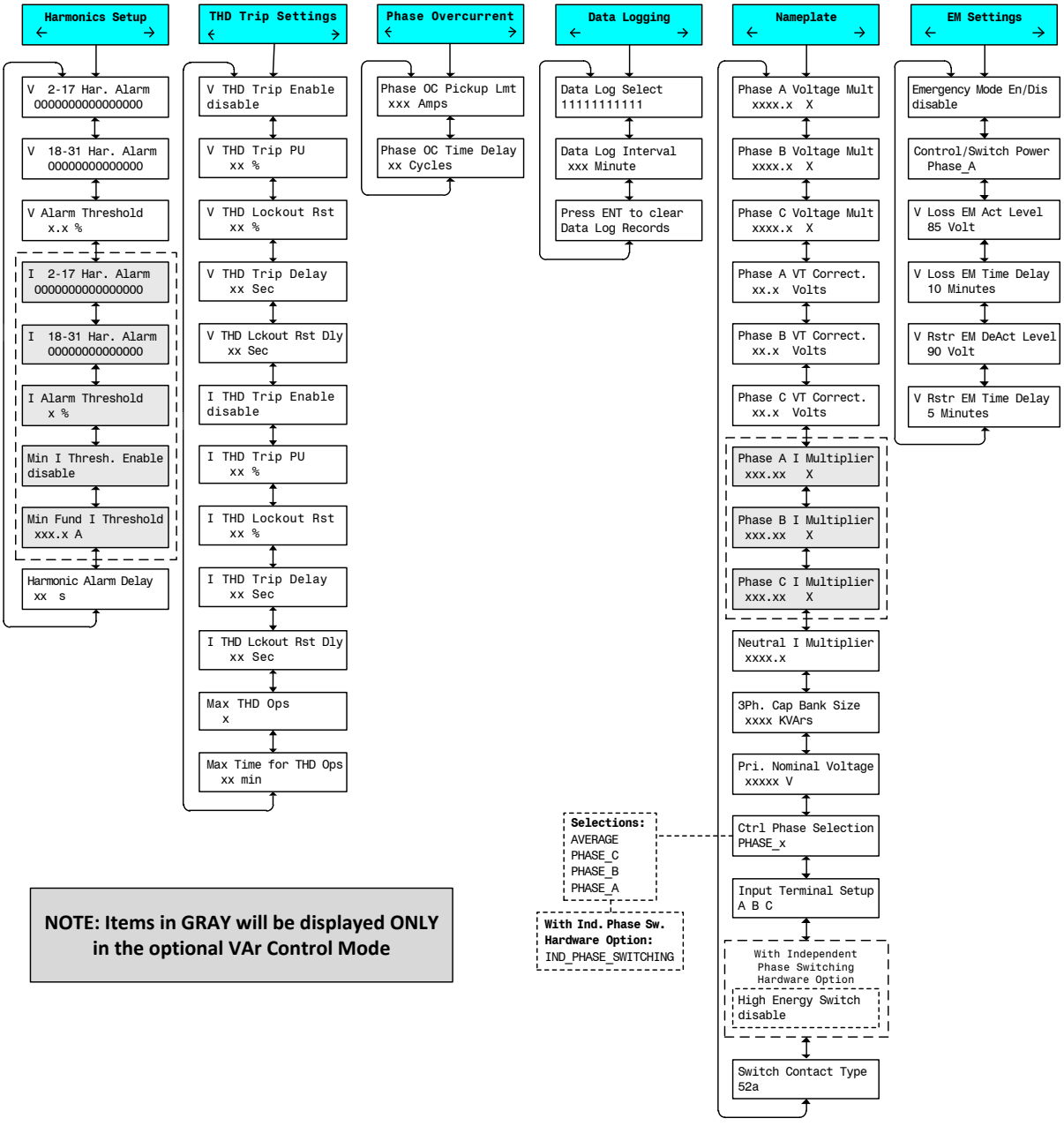
At any menu screen:

Press **EXIT** to go to the Menu Header.

Press either ← → to move sideways to the adjacent Menu Header.

Figure A-3 Configuration Menu Flow (1 of 2)

← CONFIGURATION continued from previous page

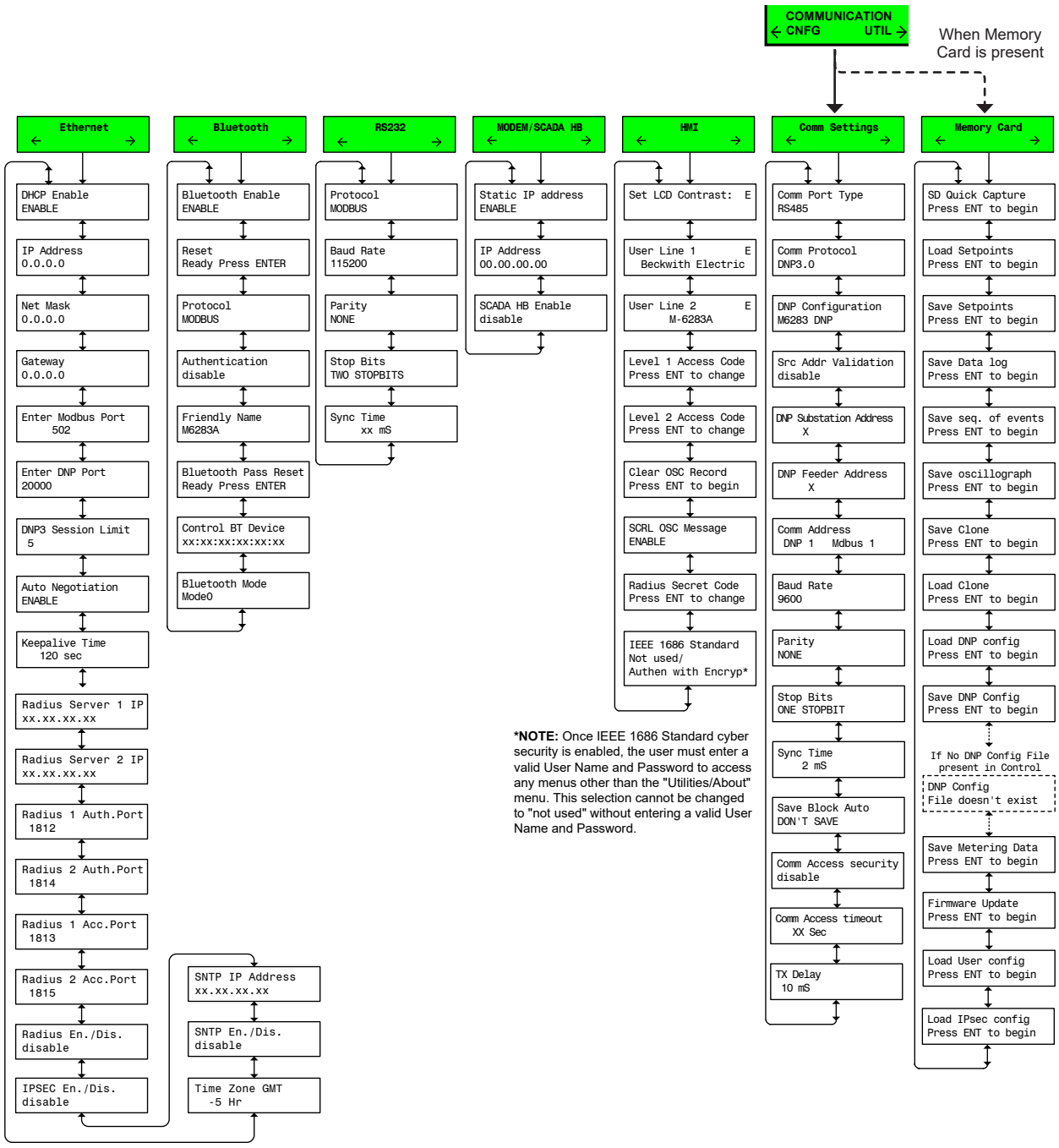


At any menu screen:

Press **EXIT** to go to the Menu Header.

Press either ← → to move sideways to the adjacent Menu Header.

Figure A-3 Configuration Menu Flow (2 of 2)

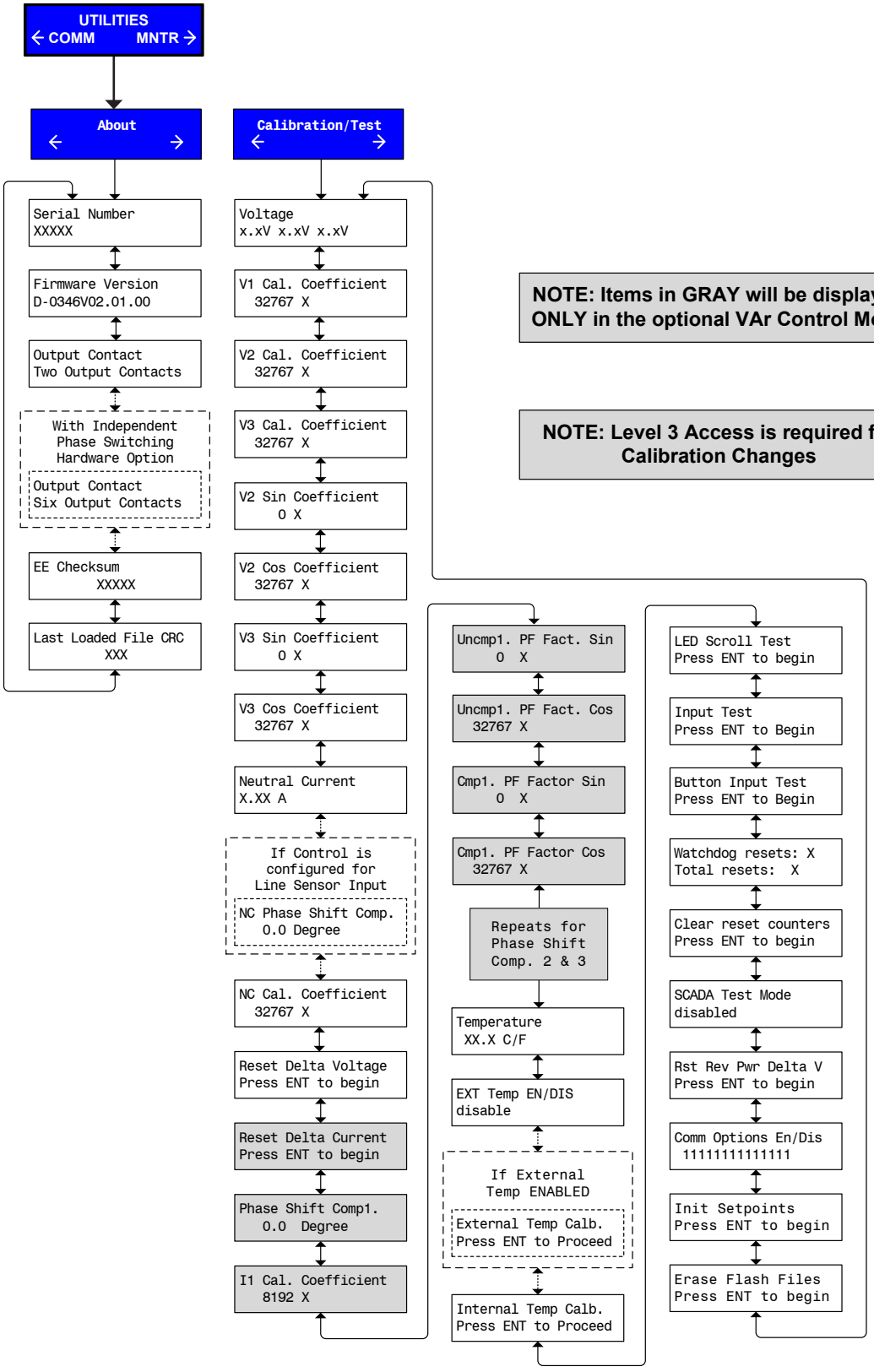


At any menu screen:

Press **EXIT** to go to the Menu Header.

Press either ← → to move sideways to the adjacent Menu Header.

Figure A-4 Communication Menu Flow



At any menu screen:

Press **EXIT** to go to the Menu Header.

Press either ← → to move sideways to the adjacent Menu Header.

Figure A-5 Utilities Menu Flow

B DNP Configuration Editor

The DNP Configuration Editor includes the following features and functions:

Variations – The variation of an object gives a different representation of the same data point, such as the size of the object or whether or not the object has flag information. Accordingly, the **Variations** section will configure listed objects with the desired and supported variations.

Master Address used for Unsolicited responses – This address will be used as the address to send unsolicited responses.

Modem Unsolicit Setting – Applies to RS-232 interface connected to an Ethernet Modem. TCP/IP and UDP/IP unsolicit settings are used when DNP is being deployed over an Ethernet network. The setting elements are described below:

- Allow Unsolicit: Determines whether unsolicited null responses will be sent when session comes online. If enabled, subsequent unsolicited responses will be enabled through function code 0x14 (Enable unsolicited responses) and disabled through function code 0x15 (Disable unsolicited responses). If "Allow Unsolicit" is disabled, then function codes 0x14 and 0x15 will be responded to with an error.
- Class 1 Max Delay (Sec): If unsolicited responses are enabled, this parameter specifies the maximum amount of time after an event in the corresponding class is received before an unsolicited response will be generated.
- Class 1 Max Events: If unsolicited responses are enabled, the parameter specifies the maximum number of events in the corresponding class to be allowed before an unsolicited response will be generated.
- Class 2 Max Delay (Sec): If unsolicited responses are enabled, this parameter specifies the maximum amount of time after an event in the corresponding class is received before an unsolicited response will be generated.
- Class 2 Max Events: If unsolicited responses are enabled, the parameter specifies the maximum number of events in the corresponding class to be allowed before an unsolicited response will be generated.
- Confirm Timeout (Sec): Application confirm timeout specifies how long the slave DNP device will wait for an application layer confirmation from the master. This in combination with Retry Delay or Offline Retry Delay determines how frequently an unsolicited response will be resent.
- Max Retries: Specifies the maximum number of unsolicited retries before changing to the Offline Retry Period.
- Retry Delay (Sec): Specifies the time to delay after an unsolicited confirm timeout before retrying the unsolicited response.
- Offline Retry Delay (Sec): Specifies the time to delay after an unsolicited timeout before retrying the unsolicited response after Max Retries have been attempted.

Choosing Points – The Available Points window is populated when a DNP source file is opened. The selection of points from the Binary Inputs, Analog Inputs, Binary/Control Outputs and Analog Outputs tabs can be accomplished by either individually selecting, dragging and dropping points in the Selected Points window or utilizing the "Copy All" feature. The Copy All feature only copies the points in the open tab to the Selected Points window. The "Remove All" feature removes all the points displayed in the Selected Points window for the tab that is open.

Ordering Selected Points – Selected points can be reordered to match the users SCADA, RTU or Master setup by selecting, dragging and dropping the desired point within the Selected Points window.

Adding Dummy Points – The purpose of the Dummy Point is to allow the user to match other device DNP maps that contain points that are not supported in the control. This feature allows the user to communicate with the M-6283A control when it is connected to an RTU that contains other brands of controls and eliminates the need to re-configure the RTU or the other controls.

To insert a Dummy point, select **Insert Dummy**. The Dummy Point will be inserted at the end of the Selected Points list. To move the Dummy Point, select, drag and drop the point at the desired location in the Selected Points list. The Dummy point will assume the Index Position and the remaining Selected Points will be modified to accommodate the Dummy Point.

Insert Offset – This allows an offset to be created in the DNP map without the point number being transmitted, thus providing the ability to construct a DNP profile that has non-consecutive point numbers within a group.

Editing Binary Input Points – The Binary Input "Value" and "Mask" values can be edited by double left clicking on the desired point Value or Mask elements. The default value for Value is TRUE, which means that the point will return a High or True when the item being monitored is active in the control. It can be changed to "FALSE" to match a SCADA Master if necessary. The "Mask" value defaults to "CLASS_ONE" and defines what polling class type the point is mapped to. The Mask value can also be set to CLASS_TWO or THREE by double left clicking on the desired point Mask element.

Editing Analog Input Points – The Analog Input "Deadband" and "Mask" values can be edited by double left clicking on the desired point Deadband or Mask elements. The Deadband can be set to define when the point will report by exception under the class type in the Mask setting. When the point value exceeds the deadband value, it will initiate a report by exception to the master. The "Mask" value defaults to "CLASS_TWO" and defines what polling class type the point is mapped to. The Mask value can also be set to CLASS_ONE or THREE by double left clicking on the desired point Mask element.

Editing Binary/Control Output Points – The Binary/Control Output Point "Crob", "Mask" and "Inverse" values can be edited by double left clicking on the desired point Crob, Mask or Inverse elements. The Crob (Control Relay Output Block) setting is used to define what control method will be used to operate the point. The possible settings for "Crob" are listed below:

- Latch On
- Latch Off
- Latch OnOff
- Latch OnOff_TC
- Pulse On
- Pulse Off
- Pulse OnOff
- Pulse OnOff_TC
- Paired Close
- Paired Trip
- Paired TripClose

The "Mask" value defaults to "CLASS_THREE" and defines what polling class type the point is mapped to. The Mask value can also be set to CLASS_ONE or TWO by double left clicking on the desired point Mask element.

Inverse defines whether the command to be sent would be inverted, meaning that when TRUE is selected, sending a Trip, Close, etc., will have the opposite effect. This was implemented due to variations seen in RTU manufacturer's implementation of direct control with DNP to allow full compatibility with the widest possible number of RTU's.

Editing Analog Output Points – The Analog Output "Mask" value can be edited by double left clicking on the desired point Mask element. The "Mask" value defaults to "CLASS_THREE" and defines what polling class type the point is mapped to. The Mask value can also be set to CLASS_ONE or TWO by double left clicking on the desired point Mask element.

Editing Counters – The Counters "Mask" value can be edited by double left clicking on the desired point Mask element. The "Mask" value defaults to "CLASS_THREE" and defines what polling class type the point is mapped to. The Mask value can also be set to CLASS_ZERO, CLASS_ZERO_FRZN, CLASS_ONE, CLASS_TWO, CLASS_NONE, CLASS_ONE_NOTCLASS0, CLASS_TWO_NOTCLASS0 or CLASS_THREE_NOTCLASS0 by double left clicking on the desired point Mask element.

■**NOTE:** For security, the DNP Security tab will only be available when CapTalk is connected to a control with an Access Code of Level 2, otherwise it will be grayed out.

DNP Security – DNP authentication is now available and can be independently enabled in the DNP security tab for either serial or Ethernet (both TCP or UDP) interfaces.

The concepts of the Hashed Message Authentication Code (HMAC) and challenge-response as defined in the DNP3 specification for Secure Authenticate Version 2.0 document is employed.

When authentication is enabled, the following settings should be selected:

- HMAC Algorithm and Update key
- Challenge Response timeout
- Duration of session key
- Aggressive Mode
- Critical Request Function Codes

■**NOTE:** Before CapTalk allows a user to change the Update key, the user has to enter the old update key.

HMAC Algorithm and Update Key – The HMAC algorithm is either SHA1 (4 OCT) or SHA1(10OCT). An Update key is necessary to provide secure SESSION key negotiation. Once a SESSION key is obtained any subsequent challenge/response session will employ that session key. The Update key can be up to 32 hex characters (0123456789ABCDF) (128 bits).

Challenge Response Timeout – The range is from 0-100 seconds. This is the response time within which the control is expecting a response to a challenge.

Duration of Session Key – This duration must be configured in minutes (0-100) and in count 0-65535. This duration represents the maximum time or the maximum number of challenges a particular session key is used before key negotiation is again performed.

Aggressive Mode – Full challenge/response exchanges increase the number of messages in the protocol, which affects throughput performance. Therefore, DNP Secure Authentication provides an aggressive mode in which the data from a single challenge can be used to authenticate many subsequent messages. The sender of the critical message includes the HMAC at the end of the critical message without having to be challenged. At least one challenge must occur, however, before aggressive mode can be used.

Critical Request Function Codes – This represents the function codes that will require authentication if selected. If none is selected, authentication will not be performed on any function code although authentication has been enabled.

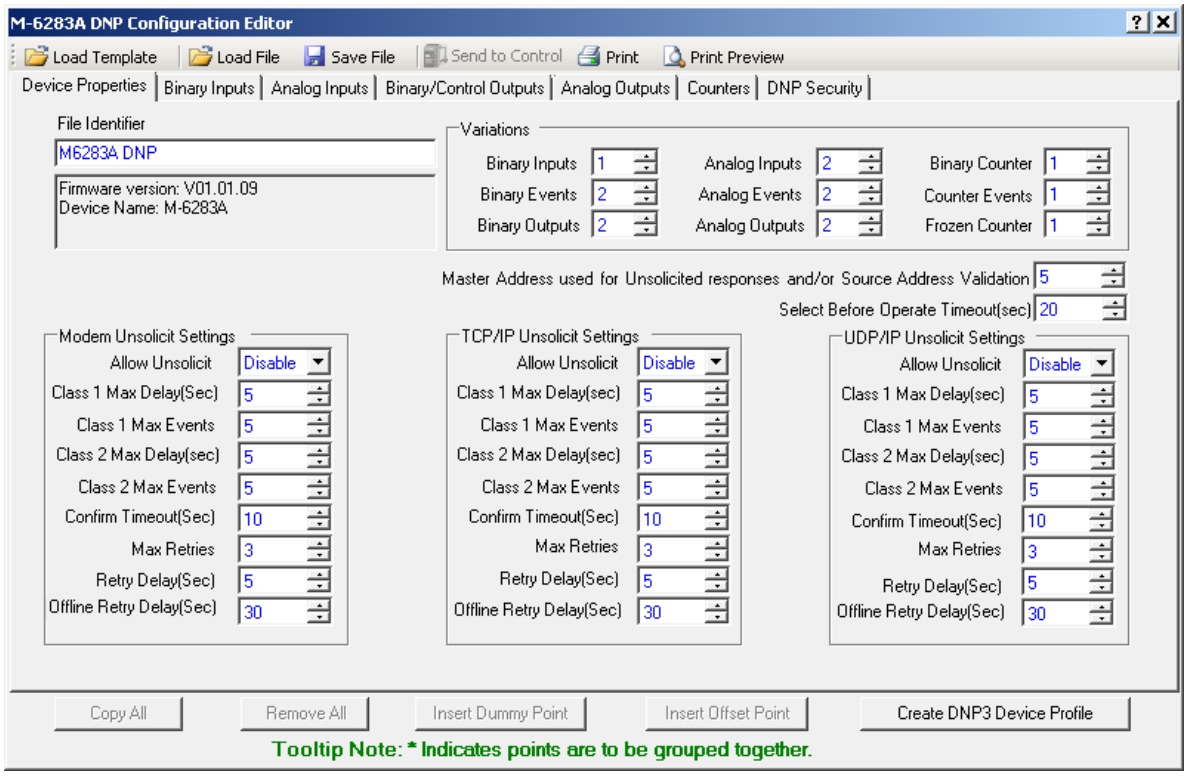


Figure B-1 DNP Configuration Editor Screen

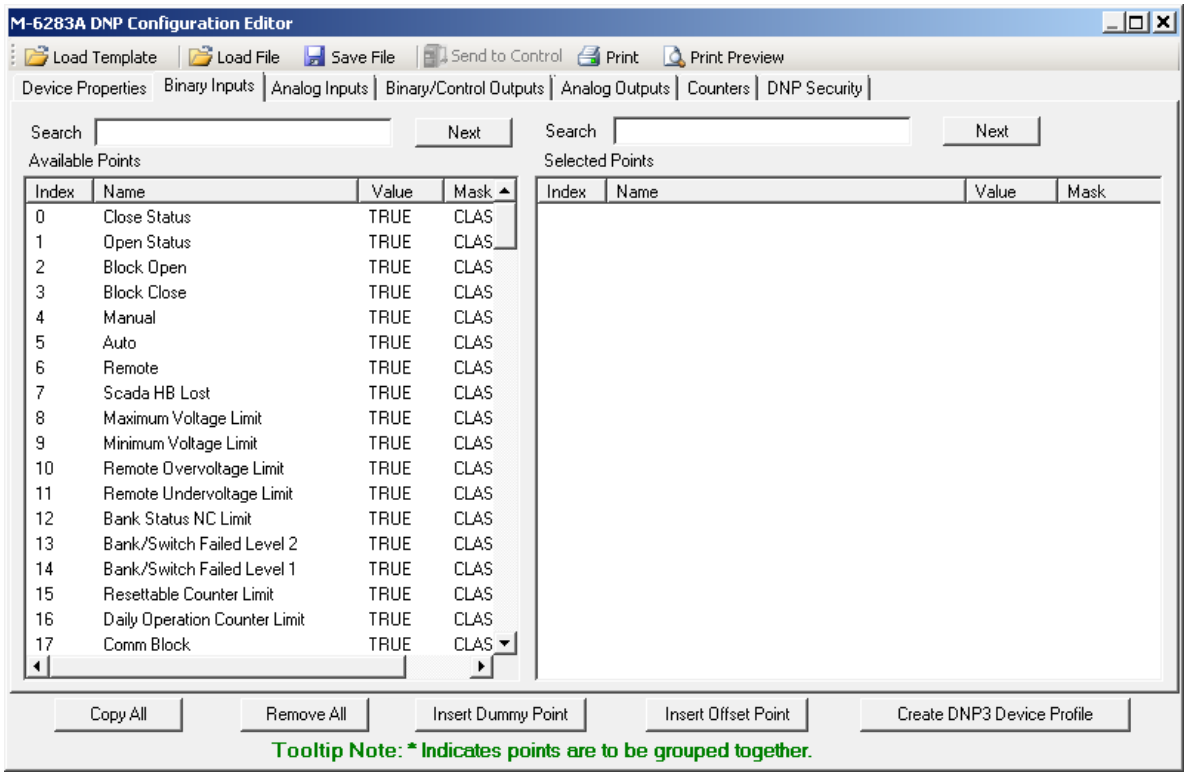


Figure B-2 DNP Configuration Editor Binary Inputs Screen

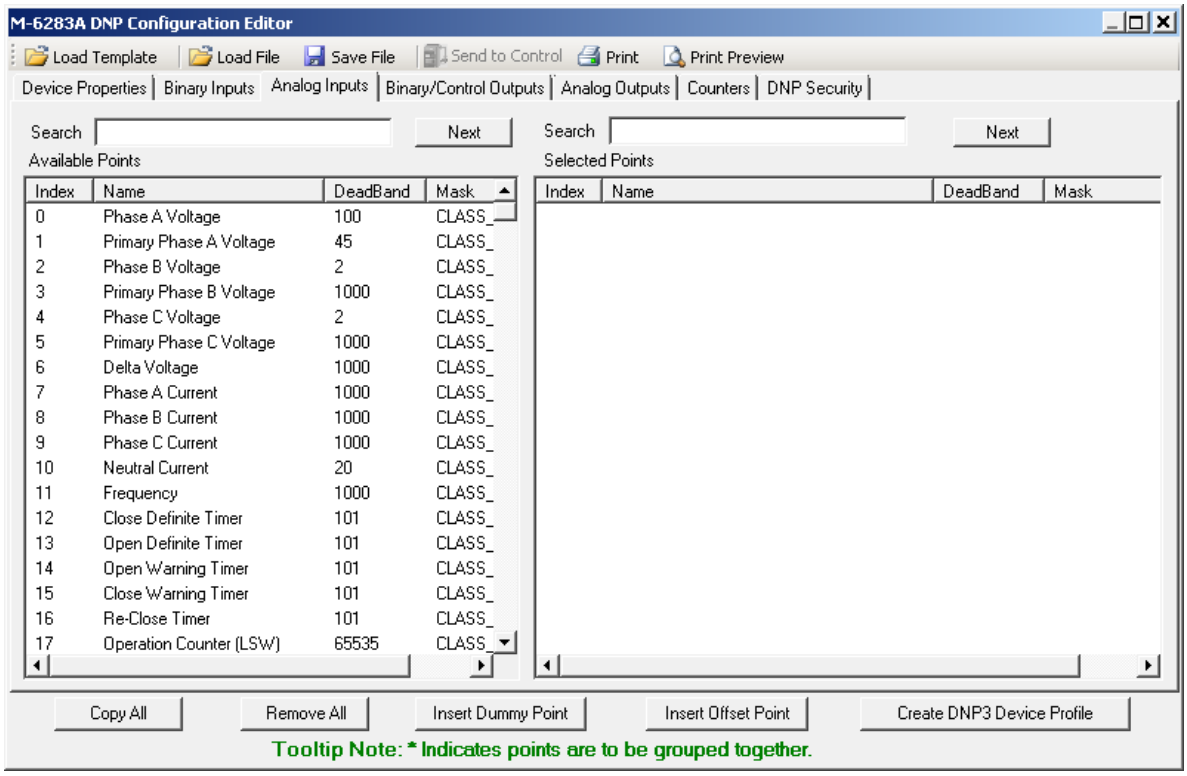


Figure B-3 DNP Configuration Editor Analog Inputs Screen

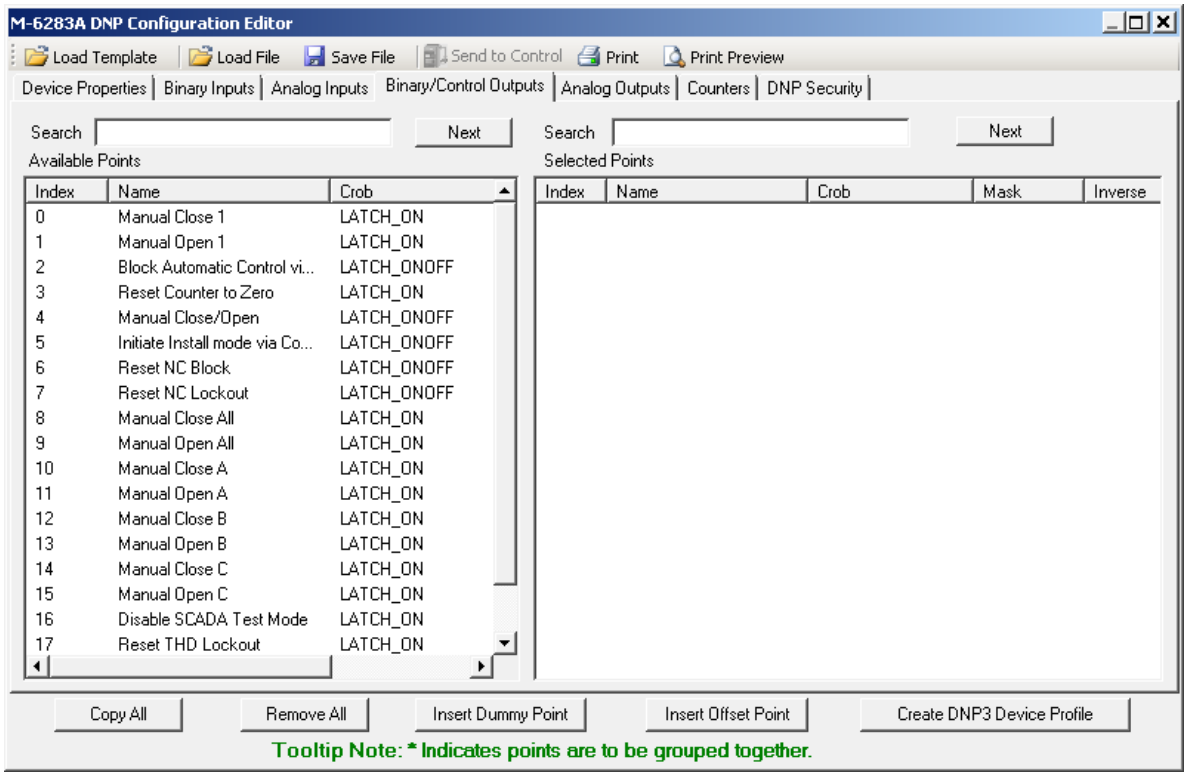


Figure B-4 DNP Configuration Editor Binary/Control Outputs Screen

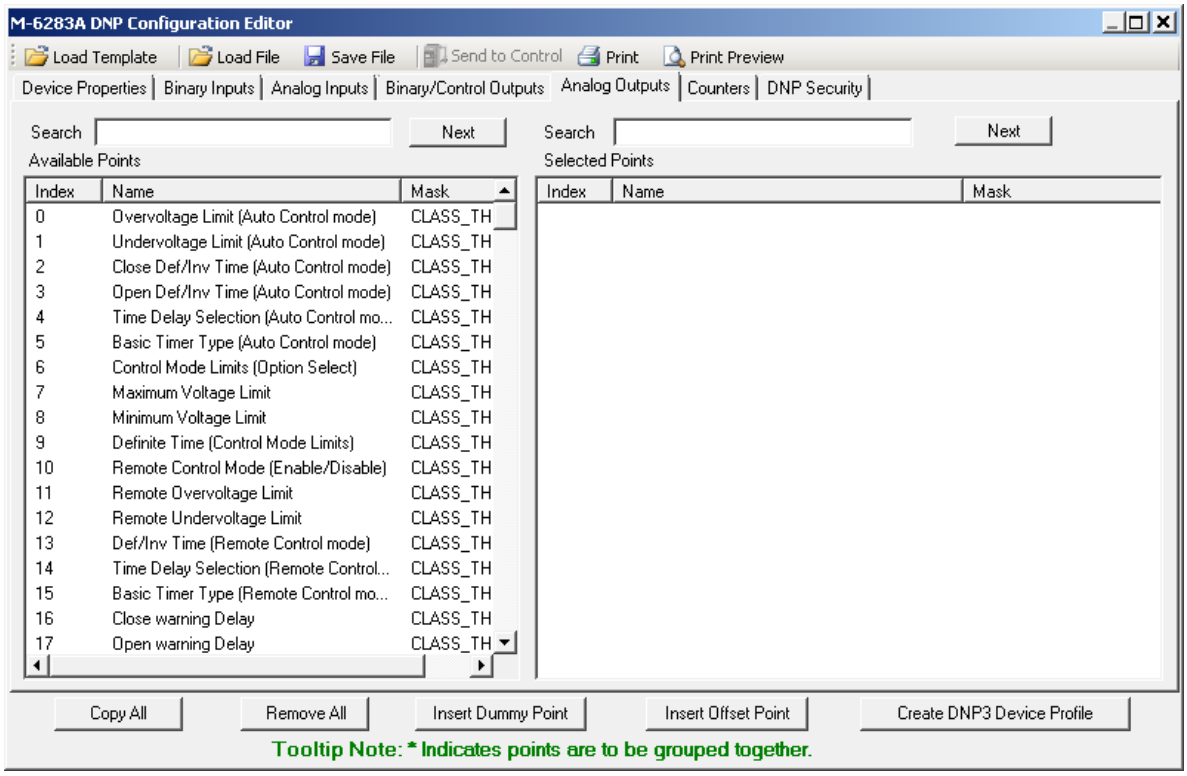


Figure B-5 DNP Configuration Editor Analog Outputs Screen

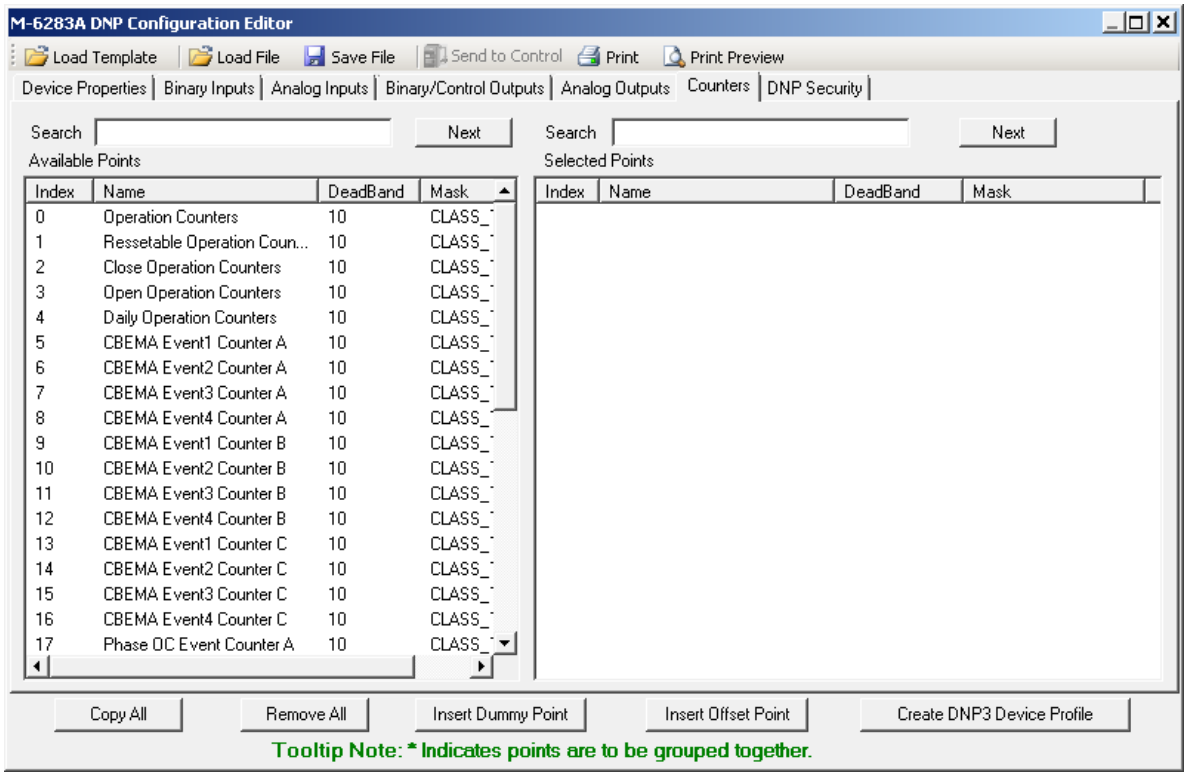


Figure B-6 DNP Configuration Editor Counters Screen

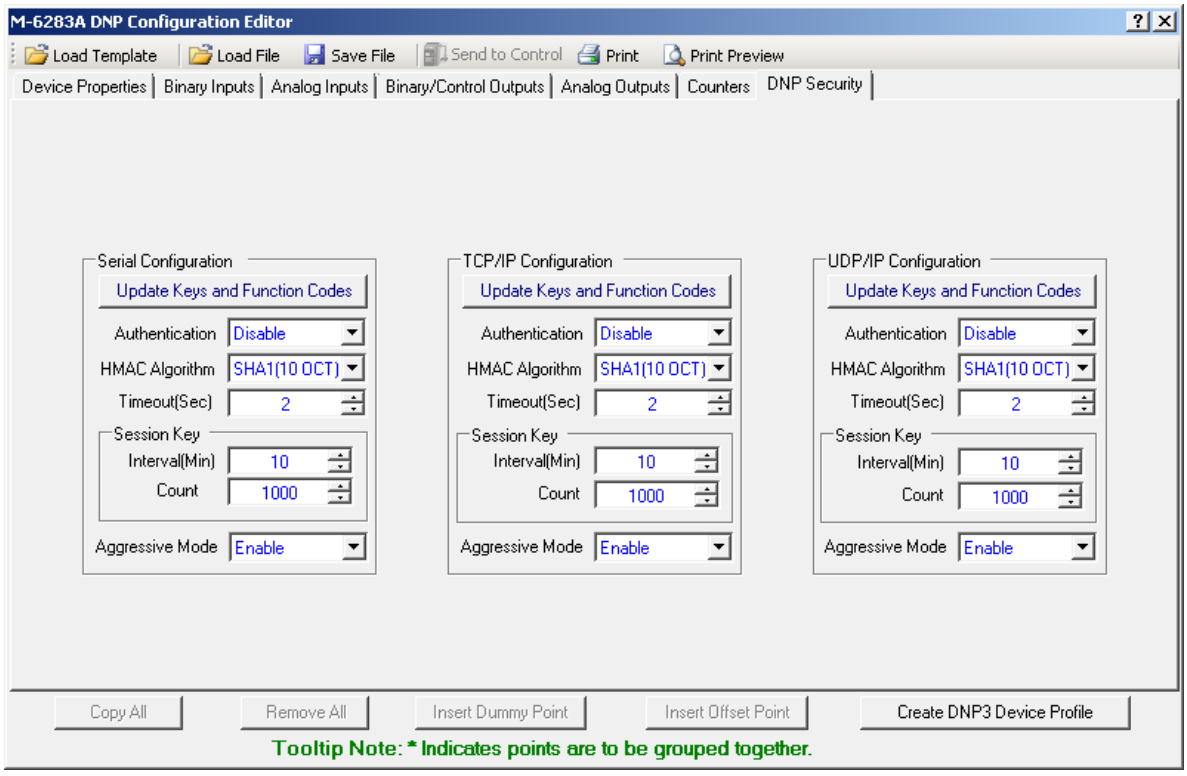


Figure B-7 DNP Configuration Editor Security Screen

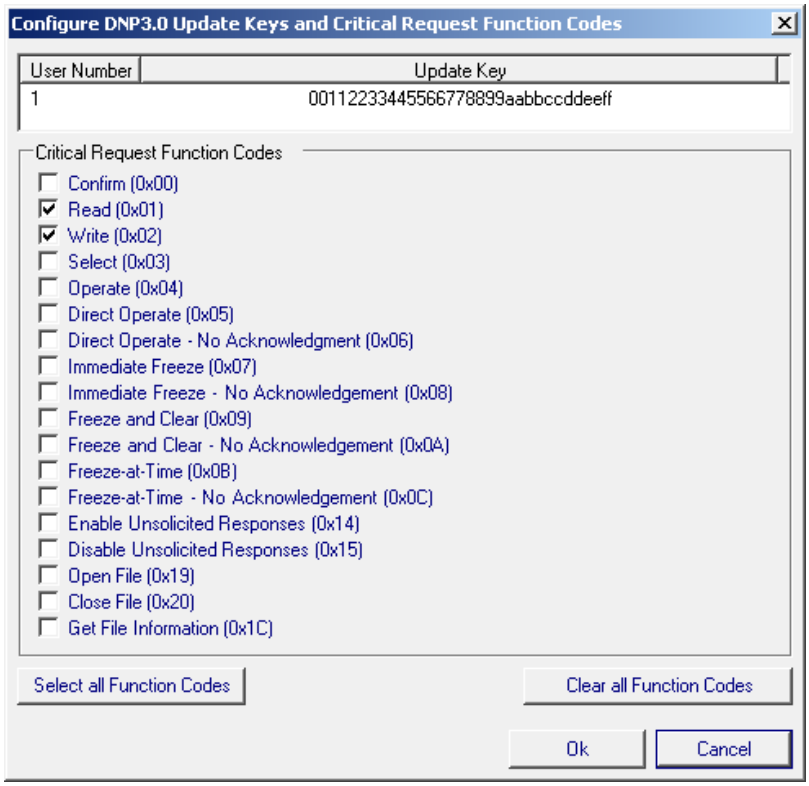


Figure B-8 DNP Configure Update Keys and Critical Request Function Codes Screen

Example of DNP Configuration Editor Use – The following sequence of steps provides an example of utilizing the DNP Configuration Editor.

1. From the CapTalk S-6283 Main Screen, select **Utility/DNP Configuration Editor**. CapTalk will display the DNP Configuration Editor screen (Figure B-1).

■**NOTE:** The M-2001C default file contains points that are unique to the M-2001 product line. It should be used if installing the control in a communications network where the same RTU is communicating with both M-2001C and M-6283A controls.

2. Select **Load Template/M-6283A Default** from the DNP Configurator menu bar. Select Binary Inputs tab, Figure B-2 is displayed. The Available Points list for each DNP Points Group tab will also be populated.
3. Select the Binary Input points you wish to include in the DNP map by selecting Copy All or dragging the desired point(s) to the Selected Points window.
4. Edit the Selected Points for each tab as necessary to match your SCADA, RTU or Master setup.
5. Select **Save File** from the DNP Configuration menu bar. CapTalk will display a "Save As" screen with a *.xml file extension.
6. Name the file and then select **Save**.
7. If CapTalk is connected to the target control then the "Send to Control" menu feature can be used as follows:
   a. Select **Send to Control**. CapTalk will display the "Authentication Key generated successfully" (Figure B-9).

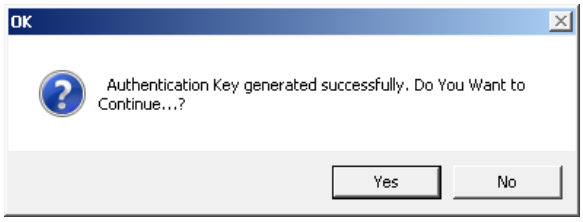


Figure B-9 Authentication Key Generated Successfully Confirmation Screen

   b. Select **Yes**. CapTalk will display the "Open File" screen with a *.xml file extension.
   c. Select the file to be sent, then select **Open**. CapTalk will initiate the file transfer and display the "Sending" progress screen, followed by a "DNP Upload Completed" confirmation screen.

C Self-Test Error Codes

8100 ERROR_EE_WR_BYTE

This code is displayed when:

- Writing to EEPROM takes more than 10 ms
- OS failed to lock eeprom_semaphore
- No ack from eeprom while it's being accessed

8101 ERROR_EE_WR_WORD

This code is displayed when:

- Writing to EEPROM takes more than 10 ms
- No ack from eeprom while it's being accessed

8102 ERROR_EE_WR_LONG

This code is displayed when:

- Writing to EEPROM takes more than 10 ms
- No ack from eeprom while it's being accessed

8103 ERROR_EE_RD_BYTE

This code is displayed when:

- No ack from eeprom while it's being accessed

8104 ERROR_EE_RD_WORD

This code is displayed when:

- No ack from eeprom while it's being accessed

8105 ERROR_EE_RD_LONG

This code is displayed when:

- No ack from eeprom while it's being accessed

8106 ERROR_EE_WR_OUT_OF_MEM

Error code indicates that the buffer used for temporary storage of the eeprom data before it is actually written is full.

8107 ERROR_EE_WR_MSG_CREATE

Error code indicates that eeprom write command message creation has failed (possibly too many writes were done prior to it and buffer got full).

8108 ERROR_EE_WR_PAGE

This code is displayed when:

- Page Writing to EEPROM takes more than 10 ms
- No ack from eeprom while it's being accessed

8109 ERROR_EE_RD_PAGE

This code is displayed when:

- No ack from eeprom while it's being accessed

8198 ERROR_VREF

Reference voltage error

8199 ERROR_VREF195

Internal temperature sensor error

-8300 Contact Beckwith

Error code indicates the internal temperature sensor (I2C based) is not responding.

-8400 Contact Beckwith

Error code indicates the control is configured to Independent Phase Switching but the six output board is not detected during boot up.

2200 ERROR_SDCARD_SPI_TIMEOUT

Error code indicates that OS has failed to lock the spi semaphore.

2300 ERROR_DAT_REC_CURRUPT

Error code indicates that data logging record is corrupted (this error code appears when data log records are being retrieved via communication or being saved to sd card).

2301 ERROR_DAT_REC_STORE

Error code indicates that verification of data log record stored in flash has failed.

2302 ERROR_DAT_REC_BUFF_OVERFLOW

Error code indicates that temporary data log buffer allocated in ram is full and no more records can be saved.

2351 ERROR_SOE_REC_STORE

Error code indicates that verification of SOE record stored in flash has failed.

2352 ERROR_SOE_RECSIZE_UNDEF

Error code indicates that number of SOE events per flash page is not defined (error appears immediately during boot up process if code is not properly configured).

2353 ERROR_SOE_TEMPREC_ERROR

SOE temp buffer is not big enough (error appears immediately during boot up process if code is not properly configured).

2354 ERROR_SOE_REC_PER_PAGE_ERROR

Incorrect number of SOE events per flash page (error appears immediately during boot up process if code is not properly configured).

2355 ERROR_SOE_RECSIZE_ERROR

Not enough space to store temp SOE events in one page (error appears immediately during boot up process if code is not properly configured).

2356 ERROR_SOE_TOTLEN_ERROR

Not enough space to store all the events in the flash section allocated for SOE storage (error appears immediately during boot up process if code is not properly configured).

2401 ERROR_FLASH_WRONG_PG_SIZE

Flash page size in the configuration table is not valid (error appears immediately during boot up process if code is not properly configured).

2402 ERROR_FLASH_ACCESS_TIMEOUT

The response for get flash id command was never received (error appears immediately during boot up process if code is not properly configured).

2403 ERROR_FLASH_CFG_MISSING

Flash chip installed on the board is not supported in configuration table (error appears immediately during boot up process if code is not properly configured).

2404 ERROR_FLASH_WRONG_CFG_FLG

Flash configuration flag is not valid (error appears immediately during boot up process if code is not properly configured).

2405 ERROR_FLASH_SECTION_MISSING

The requested flash section ID is not defined in the configuration table (error appears immediately during boot up process if code is not properly configured).

2406 ERROR_FLASH_SECTION_RANGE

The requested read/write address in particular section of flash is exceeding the section's size.

2407 ERROR_FLASH_SECTION_OUT_OF_MEM

Not enough space for particular section in the flash configuration table (error appears immediately during boot up process if code is not properly configured).

2408 ERROR_FLASH_CONFIG

Error occurs during firmware update if the program flash is not set to 1024 bytes.

2409 ERROR_FLASH_OUT_OF_MEMORY

Error occurs during firmware update if there is not enough space in RAM for firmware storage.

2500 ERROR_FFS_OUT_OF_MEM_INIT

There is not enough space in flash file system table to hold particular file (error appears immediately during boot up process if code is not properly configured).

2501 ERROR_RECEIVE_FAILED

Error occurs during firmware update if received firmware file doesn't pass certain checks (file length, crc error).

2502 ERROR_PROGRAM_FLASH

Error occurs during firmware update if verification of programmed flash fails.

2503 ERROR_ACCESSING_FLASH

Error occurs if during the firmware update flash memory was accessed by another process.

2600 ERROR_TERM_FLASH_BUFF_ERR

Error occurs in the terminal mode if the allocated temp ram buffer can't fit one page of flash memory.

2700 ERROR_XML_SP_OUT_OF_MEM

Error occurs during setpoint file or password file xml parsing if there is not enough space in ram for parser.

2710 ERROR_TAP_STAT_SIZE

Tap statistic structure has incorrect size.

2800 ERROR_XML_DNPCFG_OUT_OF_MEM

Error occurs during dnp config file xml parsing if there is not enough space in ram for parser.

9020 ERROR_UNAUTH_PROG_FL_ACCESS 9000

Error occurs if unauthorized read/write access from/to program flash memory is detected (during normal operation).

D Cyber Security

■ CYBER SECURITY NOTE:

When Cyber Security is enabled, access to any feature described in this Chapter is subject to the Access Permissions Policy as designated by the Security Policy Administrator.

CYBER SECURITY OVERVIEW

The purpose of this appendix is to describe the security elements incorporated in the M-6283A and the settings and configuration choices that are necessary to allow the M-6283A to communicate securely over Virtual Private Networks (VPN). These security elements, when enabled, ***replace*** the standard Beckwith Level Access security functions.

The M-6283A is compliant with the applicable requirements of:

- IEEE 1686-2007 Standard for Substation Intelligent Electronic Devices (IEDs) Cyber Security Capabilities
- IPsec/IKE
- RADIUS

IEEE 1686

The M-6283A firmware release versions D0346V04.00.xx or later meet or exceed the requirements established in IEEE Std 1686, IEEE Standard for Substation Intelligent Electronic Devices (IEDs) Cyber Security Capabilities.

Permissions

IEEE Standard 1686 for the most part defines the standards for User Name, Passwords and the Permissions associated with each user. The specific permission categories are listed in Table D-1 "Permissions Implemented for IEEE 1686 Standard".

Permission	Access Permitted
View Data	The user is able to view metering data (Monitor). See "View Data Permission" in this section.
View Setpoints	The user can only view setpoints. See "View Setpoints Permission" in this section.
Change Setpoints	The user must have this permission in order to change any setpoints. See "Change Setpoints Permission" in this section.
Read Files	The user is able to download Oscillograph, Sequence of Events, and Data Log files from the device using either CapTalk or an SD card. Using an SD card, the user can also Save Setpoints and Save Metering Data. See "Read Files Permission" in this section.
View Configuration	The user can only view the Configuration of the Control and Read configuration files such as DNP configuration and IPsec configuration. See "View Configuration Permission" in this section.
Change Configuration	The user has the ability to alter the configuration values of the Control (Force Values). This permission also allows a user to write files (DNP and IPsec configuration) to the control, and to calibrate the unit. See "Change Configuration Permission" in this section.
Firmware Upgrade	The user has the ability to upgrade the firmware version of the control. This applies solely to the firmware file.
Manage Users	This user is allowed to administer the list of allowed users. This user is allowed to create any user with any combination of permissions. In addition, this user is allowed to delete an existing User ID/Password combination by using the TapTalk Manage Users tool. This user is not allowed to view any User ID/Password once it is created. If the user changes his or her password, the administrator does not have the permission to view the password. The only way to retrieve a user's password is to create a new User ID/Password pair.
View Audit Log	This user is able to view the Audit Log.
Remote Control	This user is permitted to send remote commands to the control. For example OPEN, CLOSE, and set Auto or Remote Control Mode.
Change Date and Time	The User must have this permission set in order to be able to change the Date and Time of the control.

Table D-1 Permissions Implemented for IEEE 1686 Standard

View Data Permission

The View Data Permission includes the menu items listed under the **CapTalk "**Monitor" menu:

- Metering & Status
- Temperature Metering
- Phasor Diagram
- Real Time Voltage Plot
- Harmonic Analysis
- Display All Metering

The View Data Permission includes the **HMI** menu items listed under the "MONITOR" menu header:

- Metering
- Status
- Harmonics
- Cap Information
- Wakeup screen

View/Change Setpoints Permission

The "**View Setpoints**" Permission allows the user to view only those settings that are considered "Setpoints". The "**Change Setpoints**" Permission allows the user to Change Setpoints. This includes the settings in the **CapTalk** "Profile" and "Setpoints" menu items. The Change Setpoints Permission also includes the **HMI** "SETPOINTS" menu/submenu items:

- Profile Settings
- Auto Control Setting
- Auto/Remote Limits
- Override Function

Read Files Permission

The "Read Files" Permission includes the following Memory Card features:

- Save Setpoints
- Save Datalog
- Save SOE
- Save OSC
- Save Metering Data

View/Change Configuration

The "**View Configuration**" Permission allows the user to view only those settings that are considered "Configuration" settings. The "**Change Configuration**" Permission allows the user to change these settings as well as clear those elements such as OSC Trigger, SOE Event Clear and Data Logging.

Those settings that are considered to be Configuration settings include those menu items listed under the **CapTalk** "Setup" menu:

- Configuration
- Alarms
- Settings Profile Triggers
- Wakeup Screens
- Data Logging
- Harmonics
- Oscillograph
- Sequence of Events
- CBEMA Events
- Phase Overcurrent
- Delta Voltage
- Reset Delta Current
- Power Up Open Command
- Voltage Loss Trip
- Display All Settings

Also included in the Configuration View/Change Permissions are the following **CapTalk** menu selections:

- Utility/Control Information/User Lines
- Utility/Temperature Calibration
- Utility/Preset Bank Status
- Communication/Setup

View/Change Configuration Permission – HMI

The "View Configuration" and "Change Configuration" Permission also includes the **HMI** submenu items listed under the following:

CONFIGURATION

- Cap Settings
- Programmable Alarm
- System Clock
- CBEMA Setup
- Bank/Switch Status
- Common Settings
- Harmonics Setup
- THD Trip Settings
- Phase Overcurrent
- Data Logging
- Nameplate

COMMUNICATION

- Comm Settings
- Ethernet
- Bluetooth
- RS232
- MODEM/SCADA HB
- HMI

UTILITY

- Calibration/Test
- The About menu under UTILITIES can be accessed without any permission.

MEMORY CARD

- Quick Capture
- Load Setpoints
- Save Clone
- Load Clone
- Load DNP
- Save DNP
- Load IPSEC config

Manage Users Permissions

The "Manage Users" Permission allows the managing of Account Permissions and the ability to send and retrieve Account Permissions to and from the control utilizing either CapTalk or the Memory Card.

Firmware Update Permission

The "Firmware Update" Permission allows the user to update the control firmware utilizing either CapTalk or the Memory Card.

IPSEC/IKE OVERVIEW

IPsec/IKE is supported directly by the M-6283A starting with firmware version V04.00.XX. Internet Protocol security (IPsec) uses cryptographic security services to protect communications over Internet Protocol (IP) networks. IPsec is a suite of protocols specified by the Internet Engineering Task Force (IETF) that add security to the IP layer of internet traffic.

Implementing IPsec in the M-6283A secures internet traffic, including TCP and UDP packets. The important elements that are necessary to provide robust network data security include encryption and equally important authentication. Communication security cannot exist without a combination of both encryption, to prevent unauthorized monitoring of sensitive data, and authentication which validates the identity of all the parties involved in the communication scheme.

RADIUS OVERVIEW

Remote Authentication Dial In User Service (RADIUS) is a networking protocol that provides centralized Authentication, Authorization, and Accounting (AAA) management for computers to connect and use a network service. Authentication and Authorization RADIUS are described in RFC 2865 while Accounting is described by RFC 2866.

RADIUS is a client/server protocol that runs in the application layer, using UDP as transport. The following UDP ports are used:

- For Authentication and Authorization UDP port 1812 (previously 1645)
- For Accounting UDP port 1813 (previously 1646)

RADIUS serves three functions:

1. Authenticate users or devices before granting them access to a network
2. Authorize those users or devices for certain network services
3. Account for usage of those services

Password Authorization Mechanism

The M-6283A includes the capability to use Standard mode access authentication or Authentication based on IEEE 1686. When Standard mode access authentication is selected, only two access level codes are available (similar to old authentication algorithm). The RADIUS protocol although settable is not functional.

When Authentication, based on IEEE 1686 is selected, then the full functionality of the RADIUS protocol is available. The following features are available if RADIUS is enabled:

- The M-6283A provides local authentication capability if there is no other remote authentication server available to the device. Example of remote authentication server is the RADIUS server.
- The M-6283A has the capability of being configured to use two remote authentication servers. Examples are 2 RADIUS servers. In case the primary server is down and not responding, the secondary server shall be used, and finally if both servers are down, the device shall fall back to the local server which is the IEEE 1686 password authentication.

The device is shipped with a default password file configured with one Super user ID and password. It is up to the end user to change this default password to ensure the security of the network. Usually the local password should match security policy of the RADIUS server.

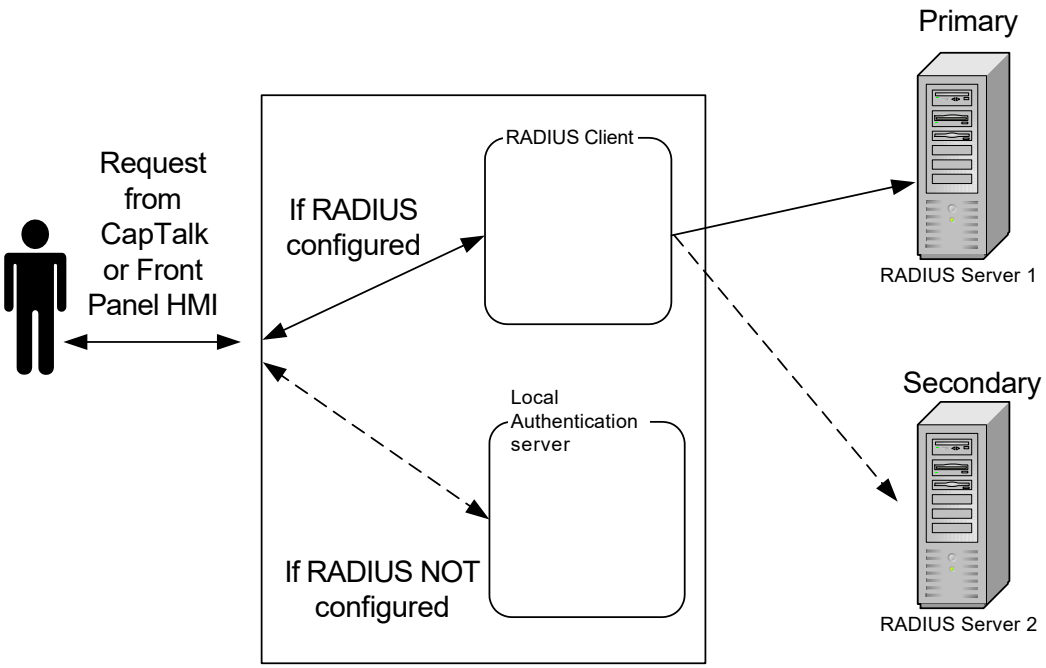


Figure D-1 RADIUS Server Configuration

Authentication and Authorization

The M-6283A firmware includes the client and the Remote Access Server (RAS) component of the RADIUS protocol implemented. The M-6283A sends a request to a RADIUS Server to gain access to a particular network resource using access credentials. The credentials are internally passed to the RAS.

In turn, the RAS sends a RADIUS Access Request message to the RADIUS server, requesting authorization to grant access via the RADIUS protocol. This request includes access credentials, typically in the form of user name and password provided by the user. The UDP port 1812 is used to communicate with the RADIUS server.

The RADIUS server checks that the information is correct using the defined authentication schemes. The User identification is verified along with the user's network address and user privileges.

The RADIUS server returns one of three responses to the client:

- Access Reject
- Access Challenge
- Access Accept

Accounting

RADIUS Accounting Flow Accounting is described in RFC 2866. The UDP port 1813 is used to communicate with the RADIUS server for accounting purpose.

When network access is granted to the user by the client, an Accounting Start (a RADIUS Accounting Request packet containing an Acct-Status-Type attribute with the value "start") is sent by the client to the RADIUS server to signal the start of the user's network access. "Start" records typically contain the user's identification, network address, point of attachment and a unique session identifier.

Periodically, Interim Update records (a RADIUS Accounting Request packet containing an Acct-Status-Type attribute with the value "interim-update") may be sent by the client to the RADIUS server, to update it on the status of an active session. "Interim" records typically convey the setpoint changes by user.

Typically, the client sends Accounting-Request packets until it receives an Accounting-Response acknowledgement, using some retry interval.

In general the primary purpose of this data is to log user activity (Login/logout, setpoint changes, file transfer).

Channel ID	Description
0	USB interface
1	Comm interface on UART 0
2	Serial interface on UART 1
3	HMI interface
4	MODBUS Ethernet (starts from Channel 4 and may run through Channel 11 since eight MODBUS Ethernet connections at a time are supported)

Figure D-2 RADIUS Accounting – Channel ID Table

CYBER SECURITY SETUP (IEEE STANDARD 1686 WITH AUTHENTICATION AND ENCRYPTION)

The Cyber Security implemented on the M-6283A includes three elements that need to be considered when configuring the M-6283A.

The three Cyber Security elements are:

- IEEE Standard 1686
- RADIUS
- IPsec

Cyber Security Setup of the M-6283A consists of determining which elements are to be enabled and then obtaining and entering the required network settings.

Cyber Security setup is enabled using the control front panel menu **Communication/HMI/IEEE 1686 Standard** by selecting **Authen with Encryp**. The **not used** selection sets the security method to the default BECO Level Access Security. IPsec is available regardless of whether IEEE Standard 1686 is enabled.

Enabling Cyber Security (IEEE Standard 1686) from the HMI

IEEE Standard 1686 MUST be enabled from the front panel HMI to allow Cyber Security with User Name/ Password to be implemented.

1. Press the Right Arrow (COMM Hot Button) to wake the unit. The menu will advance to either "**COMMUNICATION**" or "**Memory Card**" (when a Smart Flash SD CARD is present).
2. If the "**COMMUNICATION**" menu is displayed, press the Down Arrow pushbutton once. The unit will display the "Comm Settings" menu.

   From the "Comm Settings" or "Memory Card" menu, press the Right or Left Arrow pushbutton as necessary until "HMI" is displayed.

   ```
                HMI
   ←                        →
   ```

3. Press the Down arrow, as necessary, until the following is displayed.

   ```
   IEEE 1686 Standard
   not used
   ```

4. Press the **ENT** pushbutton. If prompted, enter a valid Level Access Code. The following will be displayed:

   ```
   IEEE 1686 Standard
   not used                 C
   ```

■NOTE: If the control displays the "Users Account Needed" message, then the IEEE 1686 Standard Password and User Name elements cannot be enabled. A "user.bin" file must first be loaded onto the control.

■NOTE: Once IEEE 1686 Standard Cyber Security is enabled, the user must enter a valid User Name and Password to access any menus other than the "Utilities/About" menu. This selection cannot be changed to "not used" without entering a valid User Name and Password.

5. Utilizing the Up/Down arrow pushbuttons select **Authen with Encryp**, then press the **ENT** pushbutton. The following will be displayed:

   ```
   IEEE 1686 Standard
   Authen with Encryp
   ```

   As soon as **Authen with Encryp** is selected, a valid User Name and Password will be required to change any setpoint or configuration parameter.

Smart Flash SD Card Key

When Cyber Security is enabled, a User Name/Password file can be written to a Smart Flash SD Card by the Security Policy Administrator. The User Name/Password will be read by the control when the SD Card is inserted into the Smart Flash Card slot on the front of the control and will display the following screen:

```
Access granted via
SDCARD security key
```

As long as the SD Card is inserted, the control will not prompt for the User Name/Password contained on the SD Card and the user will have access to the control HMI as allowed by the user account permissions level.

Utility/SD Card Key Generator

The CapTalk Utility/SD Card Key Generator menu selection allows an authorized user to save a valid User Name and Password to an SD Card Key file (sdkey.sdc). Enter the desired User Name and Password, then select **Generate Key**. The "Save SD Key" screen will be displayed. Select the location of the SD Card, then select **Save**. A confirmation screen will display briefly, and then return to the main screen.

■**NOTE:** The filename cannot be changed. It must be "sdkey.sdc".

Compliance with 2020 California Password Law

As of July 1st, 2020 all Beckwith Electric IED's with network communication capabilities shipping to the state of California will comply with California Password Law (SB-327). M-6283A controls will ship with the enhanced IEEE 1686 Standard Cyber Security feature **Enabled** and with a single pre-loaded default administrator account and password. Under this law, default passwords are not permitted to be used.

The first time the control is accessed using the default pre-loaded administrator account, the control will prompt the administrator to change the default password. The control will not allow any setting changes until the default password is changed.

■**NOTE:** The default pre-loaded administrator account User Name is "admin1"
The default Password is "admin1@M6283A"

Change the Default Password using CapTalk Communications Software

When the user connects to the unit the first time, CapTalk will request the Administrator login information:

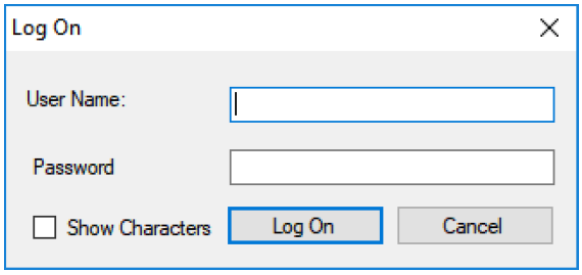


Figure D-3 Initial Log On Screen with CA Password Law Compliance

Enter the pre-loaded administrator account User Name and Password as shown in the **NOTE**. CapTalk will display a message that the default administrator password MUST be changed:

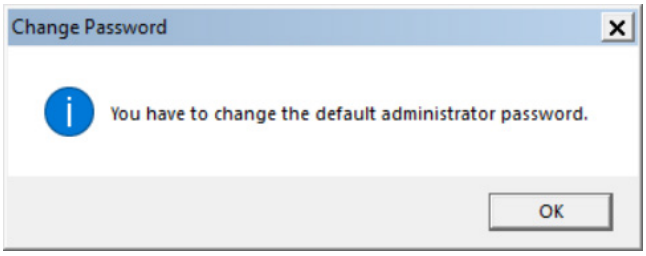


Figure D-4 Default Administrator Password Must Be Changed Message

Enter the new password as described in the "Change Password" section. The new password must meet the criteria defined in the Change Password screen (Figure D-11). If this operaton is Cancelled, the process will repeat when the user connects again. When the password has been changed successfully, CapTalk will display a confirmation screen and allow full access to the control.

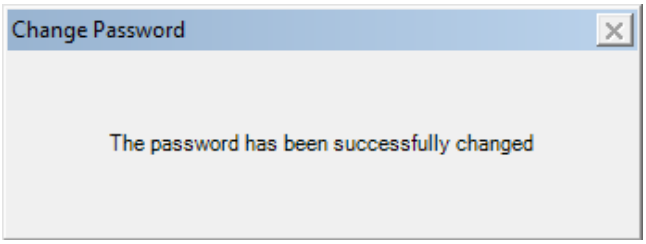


Figure D-5 Default Password Changed Successfully Confirmation Screen

Change the Default Password using the Front Panel HMI

The first time a user attempts to access an HMI menu that requires a secure login, and enters the default User Name (admin1) and default Password (admin1@M6283A). The HMI will display the following:

```
Dflt login! Exit. Or
Other key to chg pw
```

If EXIT is pressed, the HMI will display "Access Denied!". The default password must be changed before the control will allow access to any secure HMI screens.

Pressing any other key, will prompt the user through the steps necessary to change the default password:

```
Enter new pw:
_
```

When changing the default password, the password syntax must conform to the six criteria, as described in the "Change Password" section. If the user attempts to **reuse** the default password, the following is displayed:

```
Invalid Password
Enter to retry.
```

If the entered password fails to meet the six criteria, the HMI will display a message that indicates which criteria has not been met, and prompt the user to retry. See the following example:

```
Enter new pw:
6283!2aa
```

Password entered does not contain an Upper Case letter.

```
Min of 1 Upper Case.
Enter to retry.
```

Corresponding HMI message screen.

```
Enter new pw:
6283!2aA
```

Password meets all criteria and is accepted.

Once a valid password is entered, the HMI will allow full access to the menu screens.

IEEE Standard 1686 User Accounts

■**NOTE:** The default Administrator User Name is "admin1".
The default password is "admin1@M6283A"

The control contains default User Names, Passwords, and Roles. A user with the **Manage Users** permission can perform the following:

- Add/Delete a user
- Change the permissions associated with a user
- Assign a user to a specific Role
- Add/Delete a Role
- Open/Save/Save As a (.bin) file
- Retrieve (Save As) and View an Audit Log (.bkp) file

While the Manage Users permission allows the user to control all aspects of a User, the Manage Users permission does not allow changing or viewing a user's password beyond initially establishing the password when the User is created. However, the Manage Users permission can delete the user account, effectively canceling the password.

User Account information resides on the control in flash memory. When retrieving (CapTalk only), the data is saved to a file with a (.bin) file extension. The file contains all user(s) information for display and editing.

Password Requirements

When initially establishing a password or when changing a password, the password syntax must conform to the following criteria:

- Minimum length must be 8 characters
- Maximum length is 20 characters
- Must include at least one uppercase letter
- Must include at least one lowercase letter
- Must include at least one number
- Must include at least one non-alphanumeric character (e.g. @, %, *, etc.)

CapTalk presents the password criteria in red type in the "Change Password" (Figure D-11) and "Add User" (Figure D-8) screens. As the criteria is met for the entered password, the "type" that states the criteria that has been met changes to black.

During "Retrieve Accounts Permissions from Control" and "Send Account Permissions to Control" operations, all User Account information is included. However, when a Password is changed, only the password is written to the control.

■**NOTE:** The instructions presented in this section assume that IEEE Standard 1686 has been enabled and the user has been granted the appropriate permissions (Manage Users) to access and make changes to the subject features and capabilities.

User Account Modification and Setup

The control contains default User Accounts. The following instructions describe:

- Modifying Account Permissions retrieved from the control
- Modifying an existing Account Permissions (.bin) file
- Setting up a new User Account in an Account Permissions file

Modifying Account Permissions in a Retrieved or Existing (.bin) File

1. Select **Utility/Manage Accounts/Manage Account Permissions**. CapTalk will display the "Manage Users" screen. From the Manage Users menu bar select **File/Open**. CapTalk will display the File Open screen.
2. Select the target (.bin) file, then select **Open**. CapTalk will display a prompt for the User Name and Password associated with the selected file. After Login is accepted, will display the Manage Users screen (Figure D-6) with the opened Account Permissions file.

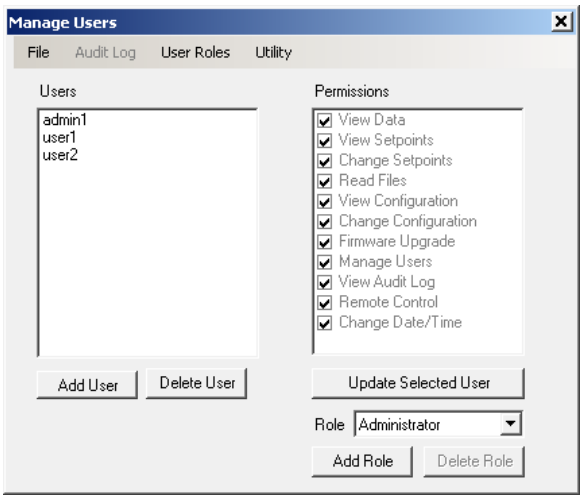


Figure D-6 Manage Users Screen with Opened Account Permissions File

3. Select the User to be modified.
4. Select the desired Permissions for the User:
   - Check or uncheck the desired Permissions
   - Select a **Role** with pre-defined Permissions from the Role dropdown menu (Figure D-7)

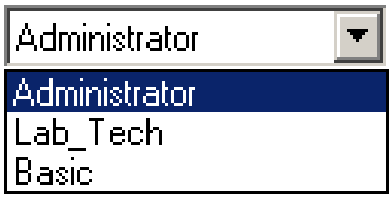


Figure D-7 Pre-defined Roles

5. When all permissions have been selected/deselected, select **Update Selected User**. The original Binary File can be saved (File/Save) or saved to a different file name and/or location (File/Save As).

▲**CAUTION:** It is very important to record the User Name and Password associated with the saved file. The only way to access the file is to have the correct User Name and Password. In the case of writing the file to a control, the control will not be able to be accessed and will require the control to be returned to the factory to restore default User Name and Password.

Setting Up a New User Account in a User Access File

1. Select **Utility/Manage Accounts/Manage Account Permissions**. CapTalk will display the "Manage Users" screen (Figure D-6).
2. From the Manage Users menu bar select **File/Open**. CapTalk will display the File Open screen.
3. Select the target file for the New User Account, then select **Open**. CapTalk will display a prompt for the User Name and Password associated with the selected file. After Login is accepted, will will open the target file in the Manage Users screen.
4. Select **Add User**. CapTalk will display the "Add User" screen (Figure D-8).

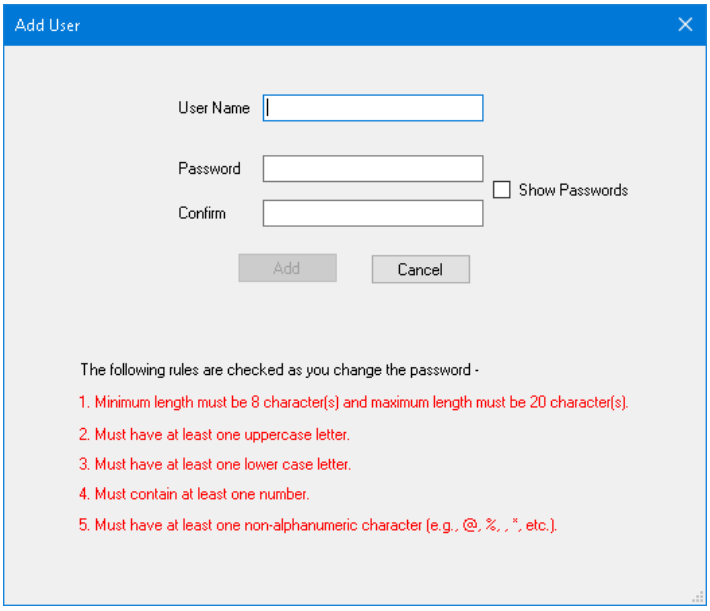


Figure D-8 Add User Screen

5. Enter a valid User Name and Password consistent with criteria presented in the User Accounts section earlier in this Appendix. CapTalk presents the password criteria in red type. As the criteria is met for the entered password, the "type" that states the criteria that has been met changes to black.
6. When all Password criteria have been met, select **Add**. CapTalk will return to the Manage Users screen (Figure D-6) and display the new User.
7. Select the new User, then select the desired Permissions:
   - Check or uncheck the desired Permissions
   - Select a **Role** with pre-defined Permissions from the Role drop down menu (Figure D-7)
8. When all permissions have been entered, select **Update Selected User**.

▲**CAUTION:** It is very important to record the User Name and Password associated with the saved file. The only way to access the file is to have the correct User Name and Password. In the case of writing the file to a control, the control will not be able to be accessed and will require the control to be returned to the factory to restore default User Name and Password.

Roles

When CapTalk is installed on the host PC, a Role file is created that contains the default Roles. Changes to existing Roles and creation of new Roles are stored in this file. However, Roles created on other CapTalk PC installations may have different permissions for the same Role name. Adding and deleting Roles is performed in the "Manage Users" screen (Figure D-6).

Retrieving Account Permissions from the Control

1. Start CapTalk, then establish communications with the target control.
2. Select **Utility/Manage Accounts/Retrieve Account Permissions from Control** from the CapTalk tool bar. CapTalk will display a Binary File Save As screen.
3. Choose the **Save As** location and enter the desired file name that will contain the Account Permissions retrieved from the control.
4. Select **Save**. CapTalk will save the (.bin) file to the selected location.

Sending Account Permissions to the Control

1. Start CapTalk, then establish communications with the target control.
2. Select **Utility/Manage Accounts/Send Account Permissions to the Control** from the CapTalk tool bar. CapTalk will display a Binary File Open screen.
3. Navigate to the file location and select the desired file name that contains the Account Permissions to be sent to the control.
4. Select **Open**. CapTalk will attempt to send the selected (.bin) file to the target control.
5. If CapTalk returns a "Failed to send Users.bin file to Control" confirmation (Figure D-9), then select **OK** and repeat Steps 2 through Step 4.

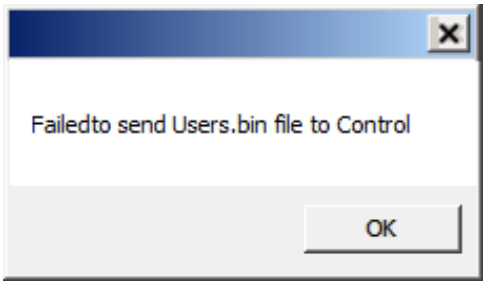


Figure D-9 Failed to Send Users.bin File to Control Screen

6. If file transfer is successful, CapTalk will display a "User Permission file sent to control" confirmation screen. Select **OK**, CapTalk will close communications.

   If any changes were made to the permissions that were sent to the control, the changes will take effect the next time the user logs on to the control.

Sending Account Permissions to the Control from the HMI/Smart Flash SD Card

1. Insert the target Smart Flash SD Card (that includes the User Account Permissions) into the control SD Card slot.
2. Press the **COMM** pushbutton. The control will go directly to the Memory Card menu.

   ```
            Memory Card
   ←                        →
   ```

3. When IEEE Standard 1686 is enabled, the control will prompt for a User Name:

   ```
   Enter user name:
   _
   ```

4. Enter a valid User Name and Password, and press the **ENT** pushbutton. The control will display the following:

   ```
   Verifying Access ...
   ```

5. If a valid User Name and Password was entered, the control will then display the Memory Card submenu. Press the Down Arrow pushbutton as necessary to navigate to the "Load User config" menu item.

```
Load User config
Press ENT to begin
```

6. Press the **ENT** pushbutton. The control will prompt the user to select the file to be loaded. When BECO Standard Security is enabled, if prompted, enter a valid Level 2 Access Code.

```
File Name.bin
MM/DD/YYYY   hh:mm        →
```

■**NOTE:** If an arrow is displayed on either end of the bottom display line, additional User Config files are available for selection.

7. Utilize the Right or Left Arrow pushbutton to select the desired (.bin) file.

▲**CAUTION:** New User Access Permissions are activated by the control when the user logs off the control or exits to the upper level menu. Re-entering User Access security passwords will be necessary.

8. Press **ENT**. The control will display the file loaded confirmation screen. The new User Access (.bin) file permissions are now available to the control.

```
File loaded!
Any key to continue
```

AUDIT LOG

The Audit Log captures security events in the order in which they occur. The Audit Log can be retrieved and viewed in CapTalk. The Audit Log is saved to the PC with a (.bkp) file extension. The Audit Log can also be saved as a (.csv) Comma Separated Values file.

Each Audit Log entry includes:

- Date (Month, Day, Year)
- Time (Hour, Minute, Second)
- User Name
- Event Description regarding:
  - USB interface
  - Comm interface on UART 0
  - Serial interface on UART 1
  - HMI interface
  - MODBUS Ethernet: MODBUS Ethernet starts from Channel 4 and may run through Channel 11 since the M-6283A supports eight MODBUS Ethernet connections at a time.

Audit Log File Retrieval, Viewing and Saving

1. Start CapTalk, then establish communications with the target control.
2. Select **Utility/Manage Accounts/Manage Account Permissions**. CapTalk will display the "Manage Users" screen (Figure D-6).
3. From the Manage Users menu bar select **Audit Log/Retrieve**. CapTalk will display a "Save As" screen with the default (.bkp) file extension.
4. Enter the Audit Log file name and file location.
5. Select **Save**. CapTalk will display a Status screen followed by a File Saved confirmation screen.
6. Select **OK**. CapTalk will return to the Manage Users screen.
7. To view the Audit Log, select **Audit Log/View**. CapTalk will display the "Audit Log file" Open screen.

8. Navigate to the desired Audit Log to be viewed. Select **Open**. CapTalk will display the Audit Log Viewer Screen (Figure D-10).

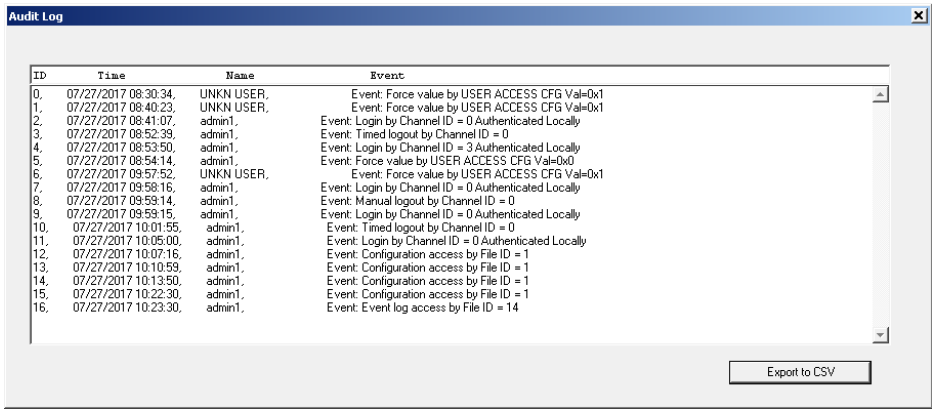


Figure D-10 Audit Log Viewer Screen

9. To save the displayed Audit Log to a (.csv) formatted file, select **Export to CSV**. CapTalk will display a File Saved confirmation screen.
10. Select **OK**. CapTalk will return to the Manage Users screen.

CHANGE PASSWORD

The Password associated with a specific User Name can only be changed by successfully connecting to the target control. When **Change Password** is selected (Figure D-11), only the new Password is written to the control.

To change the Password for a specific User, proceed as follows:

1. Start CapTalk, then establish communications with the target control.
2. Select **Utility/Manage Accounts/Change Password**. CapTalk will display the "Change Password" screen (Figure D-11).

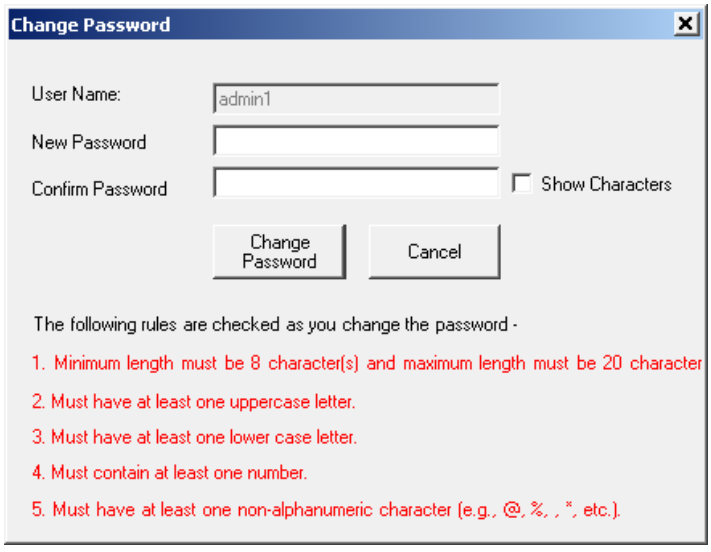


Figure D-11 Change Password Screen

3. Enter a new Password consistent with criteria presented in the User Accounts section earlier in this Appendix. CapTalk presents the password criteria in red type. As the criteria is met for the entered password, the "type" that states the criteria that has been met changes to black.
4. Re-enter the new Password to confirm.

5. When all the Password criteria have been met, select **Change Password**. CapTalk will display a status screen, followed by the "Password Has Been Changed" confirmation screen.
6. Select **OK**. CapTalk will display the "Password Changed Logout" confirmation screen (Figure D-12).

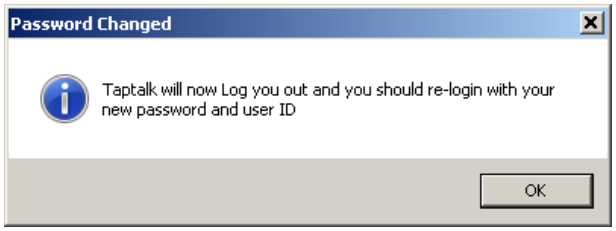


Figure D-12 Password Changed Logout Confirmation Screen

7. Select **OK**. CapTalk will log off the current user. In order to re-login to the control the new Password must be entered.

RADIUS CONFIGURATION

RADIUS Configuration from CapTalk

■**NOTE:** The instructions presented in this section assume that IEEE Standard 1686 has been enabled and the user has been granted the appropriate permissions to access and make changes to the RADIUS configuration.

To setup the M-6283A Control to apply the RADIUS elements of the Cyber Security scheme perform the following:

1. Obtain the following information from the Network Administrator:
   - Primary Server IP Address, Authentication Port, and Accounting Port
   - Secondary Server IP Address, Authentication Port, and Accounting Port
   - Secret Key
2. Start CapTalk, then establish communications with the target control.
3. Select **Communication/Setup/Communication Security/Radius Configuration**. CapTalk will display the "Radius Configuration" screen (Figure D-13).

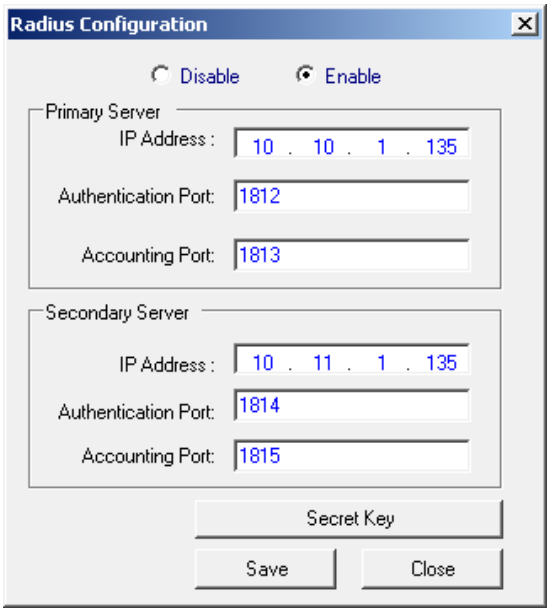


Figure D-13 Radius Configuration Screen

4. Enter the required settings in the Radius Configuration screen.

5. Select **Save**. CapTalk will display a "Confirm Writing to Device" confirmation screen.
6. Select **OK**. CapTalk will return to the Radius Configuration screen.
7. From the Radius Configuration screen select **Secret Key**. CapTalk will display the "Radius Configuration Key" screen (Figure D-14).

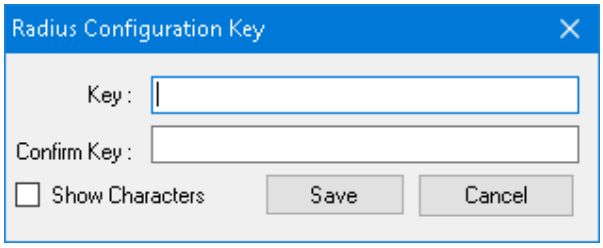


Figure D-14 Radius Configuration Key Screen

▲**CAUTION:** It is very important that the Configuration Key is entered correctly. If it is not entered correctly and Radius is "Enabled", the Radius server will deny access to the control, because the Password will be encrypted in a way that the Radius server cannot decrypt it properly.

8. Enter the Radius Configuration Key.
9. Select **Save**. CapTalk will display a "Confirm Writing to Device" confirmation screen.
10. Select **OK**. CapTalk will display a "Secret Radius Key changed successfully" confirmation screen.
11. Select **OK**. CapTalk will return to the Radius Configuration screen.

RADIUS Configuration from the HMI

RADIUS Security can also be enabled and configured from the front panel HMI. The settings are located in the COMMUNICATION/Ethernet menu.

Setting or Changing the RADIUS Secret Code from the HMI

The RADIUS Secret Code can also be set from the front panel HMI. The settings are located in the COMMUNICATION/HMI menu.

IPSEC CONFIGURATION

IPsec Configuration from CapTalk

▲CAUTION: Enabling IPsec before a valid IPsec Configuration File has been sent to the control will cause ethernet communications to be unavailable.

1. Start CapTalk, then establish communications with the target control.
2. From the **Communication/Setup/Communication Security/IPsec Configuration** dropdown menu, select IPsec Configuration/Configure Endpoint.

   CapTalk will display the "Configure Endpoint" screen (Figure D-15) which allows the user to add, open, edit, delete or save IPsec Endpoints.

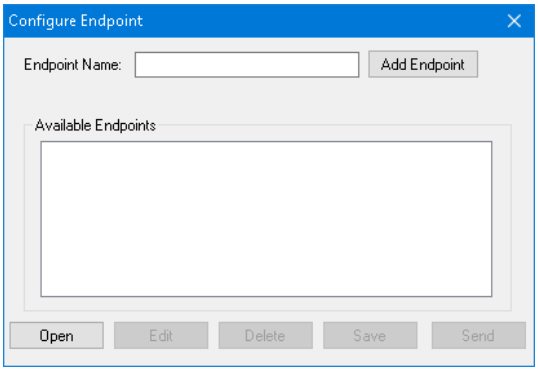


Figure D-15 IPsec Configure Endpoint Screen

3. Select an available Endpoint from the "Configure Endpoint" screen and then select **Edit**. CapTalk will display the "IPsec General Settings" screen (Figure D-16) that contains four Tabs to configure IPsec security settings, including IKE (Internet Key Exchange) Policy, IPsec Policy, Policy Lifetimes, and Identities.
4. Enter the required settings in the IPsec General Settings screen tabs (Figure D-16).

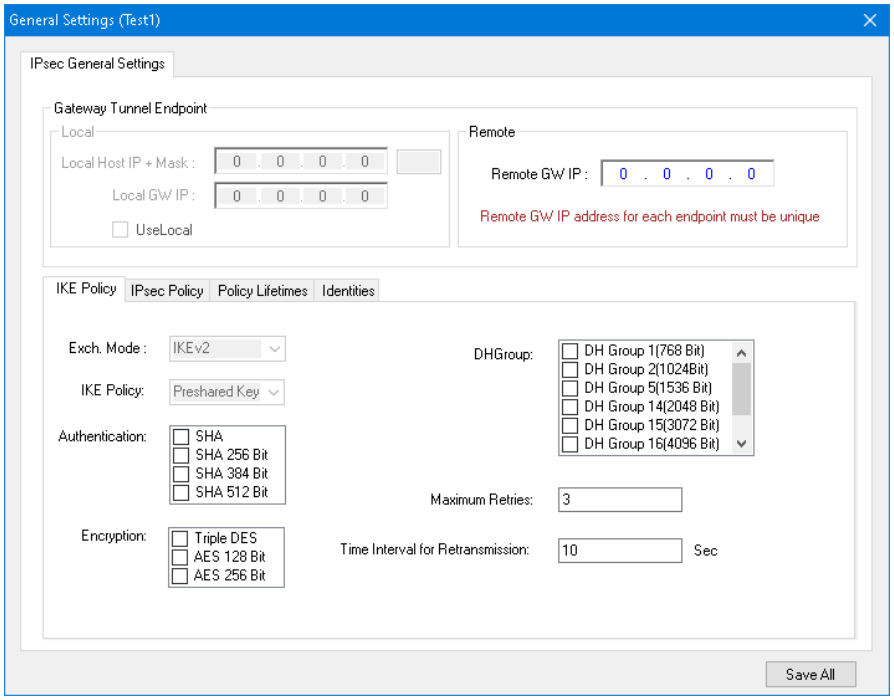


Figure D-16 IPsec General Settings Screen – IKE Policy Tab

5. CapTalk will display an Error Message alerting the user to any required settings which have not been entered (Figure D-17).

Figure D-17 IPsec Configuration Error Screen

6. If applicable, enter all required settings and select **Save All**.
7. Close the "General Settings" screen and return to the "Configure Endpoint" screen.
8. Add and/or edit any additional endpoints and select **Save**. CapTalk will display the "Save As" screen.
9. Enter the desired IPsec Configuration filename and select **Save**. CapTalk will display a confirmation screen.
10. Select **OK**. CapTalk will return to the "Configure Endpoint" screen.

■**NOTE:** IPsec configuration files may also be sent to the control from the Configure Endpoint screen.

Sending the IPsec Configuration File to the Control from CapTalk

1. Start CapTalk, then establish communications with the target control.
2. Select **Communication/Setup/Communication Security/IPsec Configuration/Send Configuration File** from the CapTalk tool bar. CapTalk will display the "IPsec Configuration File" Open screen.
3. Select the file name that contains the IPsec Configuration to be sent to the control.
4. Select **Open**. CapTalk will send the selected file to the target control.
5. CapTalk will display a confirmation screen. Select **OK**.

Retrieving the IPsec Configuration File from the Control

1. Start CapTalk, then establish communications with the target control.
2. Select **Communication/Setup/Communication Security/IPsec Configuration/Retrieve Configuration File** from the CapTalk tool bar. CapTalk will display the "IPsec File" Save As screen.
3. Choose the **Save As** location and enter the desired file name that will contain the IPsec Configuration retrieved from the control.
4. Select **Save**. CapTalk will save the (.ifg) file to the selected location and display a confirmation screen.

Enable IPsec Security from CapTalk

▲CAUTION: Enabling IPsec before a valid IPsec Configuration File has been sent to the control will cause ethernet communications to be unavailable.

1. Start CapTalk, then establish communications with the target control.
2. From the **Communication/Setup/Communication Security/IPsec Configuration** dropdown menu select **Enable**. CapTalk will display the "IPsec Enable Caution Screen" (Figure D-18).

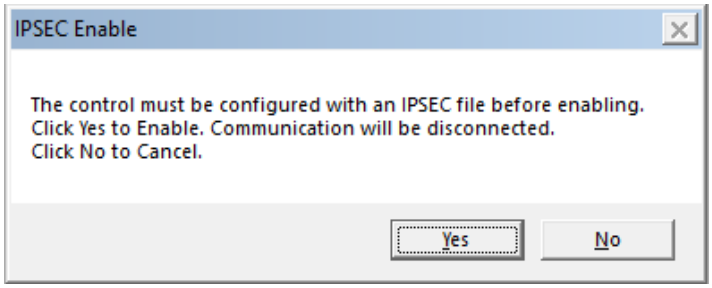


Figure D-18 IPsec Enable Caution Screen

3. Select **Yes** or **No**. When connected using Ethernet communications, CapTalk will logout the user. The user must login again to reestablish communication with the control.

Enable IPsec Security from the HMI

IPsec Security can also be enabled from the front panel HMI. The settings to enable IPsec Security are located in the **COMMUNICATION/Ethernet** menu.

Loading IPsec Configuration from a Smart Flash SD Card

The IPsec Configuration file contains the IPsec Security configuration as defined by the Security Policy Administrator. This procedure loads the file into the control to allow the implementation of IPsec Security.

1. Insert the Smart Flash SD Card (that includes the IPsec Configuration file) into the control SD Card slot.
2. Press the Right Arrow (Comm Hot Button) pushbutton. The control will go directly to the "Memory Card" menu.

```
        Memory Card
←                       →
```

3. Press the Down Arrow pushbutton as necessary to navigate to the "Load IPsec Config" menu item.

```
Load IPsec config
Press ENT to begin
```

4. Press the **ENT** pushbutton. If prompted, enter a valid Level Access Code. Press the **ENT** pushbutton again to confirm. The control will display the following.

```
IPSEC.ifg
MM/DD/YYYY  HH:MM
```

5. Select the desired file name, then press the **ENT** pushbutton. The control will display a File Loaded confirmation screen.

E Legacy Hardware Connections

HARDWARE CHANGE NOTIFICATION

M-6283A Controls with Serial Numbers 25000 and higher include a new hardware version. The inclusion of the hardware change can be verified by confirmation that **TB4** is on the rear of the control. The Line Post Sensor inputs of the M-6283A were redesigned to minimize variation of the input impedance and reduce noise, thereby improving the accuracy of voltage and current measurements.

Hardware Compatibility

A new 14-pin Cannon Harness (Beckwith Electric Assembly B-1843) has been created for compatibility with the improved hardware. Retrofitting an M-6283A with the improved Line Post Sensor Inputs into existing cabinets will require a field modification of 14-pin Cannon Harness (Beckwith Electric Assembly B-1400). This simple modification requires removal of the terminal lugs that connect to TB1 and TB2, stripping the wires where the terminal lugs were removed, and redressing the harness to connect to TB4.

■**NOTE:** Previous connections to TB1 and TB2 for phase voltages and phase currents are **not used** with this hardware update.

LEGACY HARDWARE CONNECTIONS

Refer to the Tables and Diagrams in this Appendix for hardware connections that are applicable to M-6283A Controls with Serial Numbers prior to 25000.

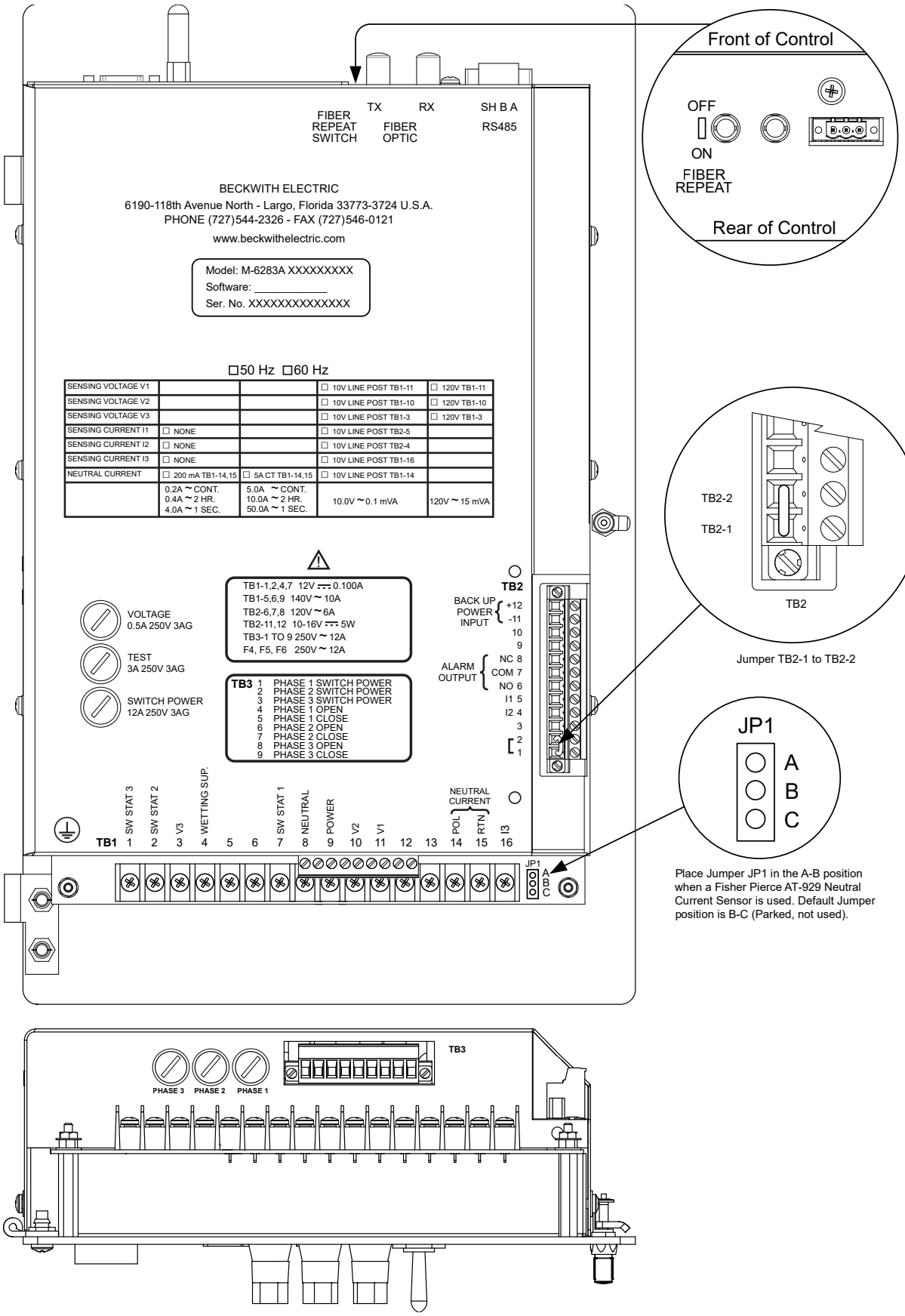


Figure E-1 M-6283A Rear View with Independent Phase Switching Option – Serial Numbers Prior to 25000

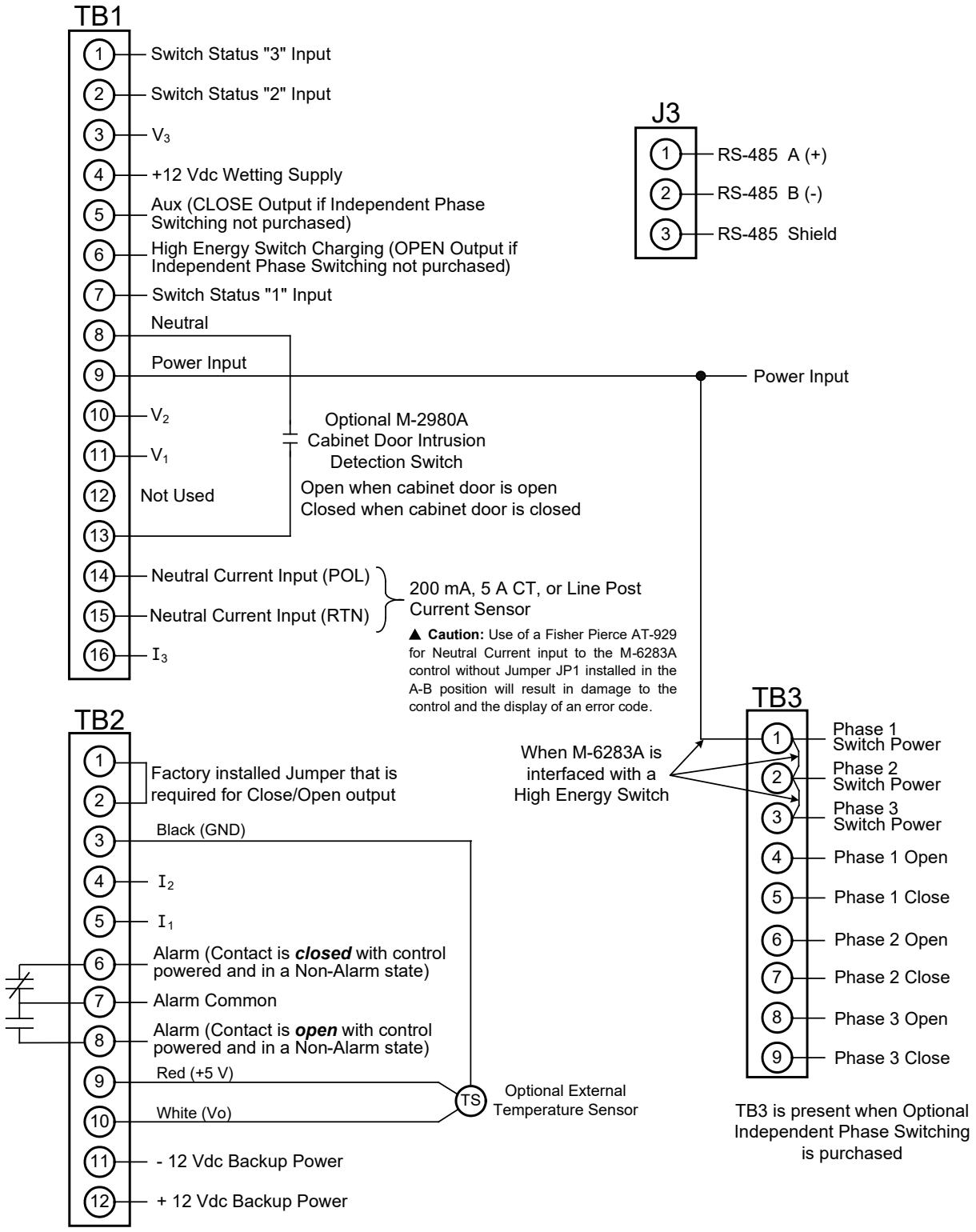
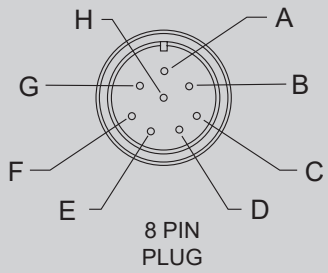


Figure E-2 M-6283A Typical External Connections - Serial Numbers Prior to 25000

8-Pin Cannon Plug/Control Wiring

	PIN							
Config	A	B	C	D	E	F	G	H
8A	LINE	NEUTRAL	CLOSE	OPEN	Sw Stat 1	Sw Stat 2	Sw Stat 3	Status RTN
Control	TB1-9	TB1-8	TB1-5	TB1-6	TB1-7	TB1-2	TB1-1	TB1-4
Config	A	B	C	D	E	F	G	H
8B	V1	V2	V3	CLOSE	OPEN	NEUTRAL	NC	NC
Control	TB1-11	TB1-10	TB1-3	TB1-5	TB1-6	TB1-8		



NC = Not Connected

Figure E-3 8-Pin Cannon Plug Configurations – Serial Numbers Prior to 25000

14-Pin Cannon Plug/Control Wiring

	PIN						
1	A	B	C	D	E	F	G
	Neutral TB1-8	Neutral TB1-8	NC POL TB1-14	NC RTN TB1-15	V1 POL TB1-11	V2 POL TB1-10	V3 POL TB1-3
	H	J	K	L	M	N	P
	V1, 2, 3 RTN TB1-8	I1 POL TB2-5	I1 RTN TB1-8	I2 POL TB2-4	I2 RTN TB1-8	I3 POL TB1-16	I3 RTN TB1-8

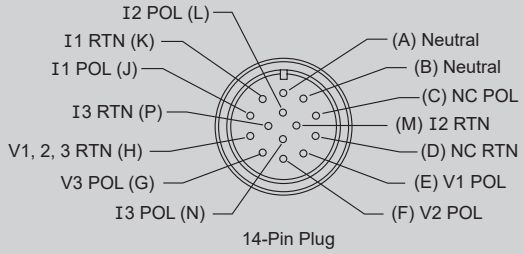


Figure E-4 14-Pin Cannon Plug Configuration – Serial Numbers Prior to 25000

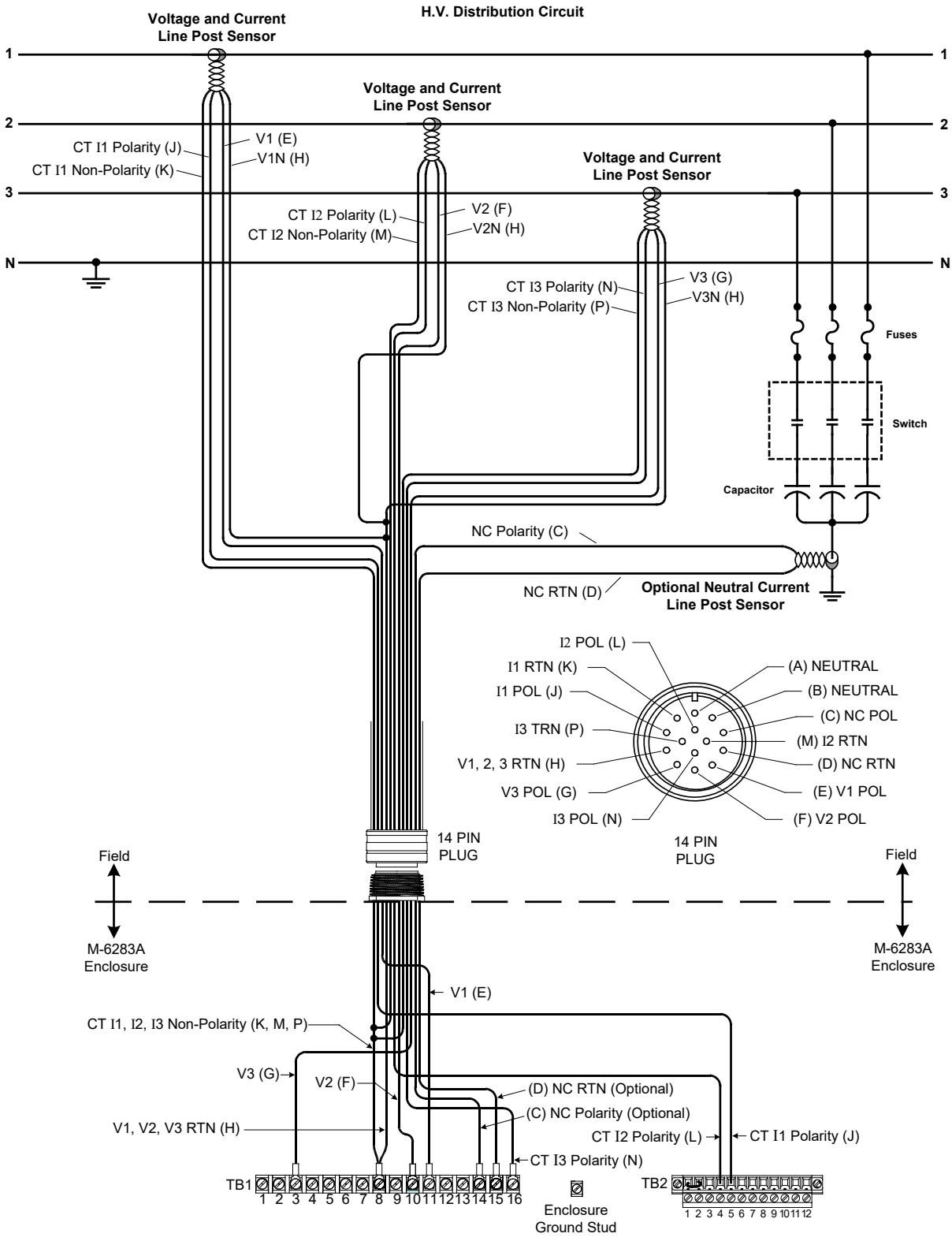


Figure E-5 14-Pin Cannon Plug Connection Diagram – Serial Numbers Prior to 25000

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F Index

A

B

C

D

E

F

H

I

L

M

N

O

P

R

S

T

U

V

W

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Legal Information

Patent

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Warranty

Seller hereby warrants that the goods which are the subject matter of this contract will be manufactured in a good workmanlike manner and all materials used herein will be new and reasonably suitable for the equipment. Seller warrants that if, during a period of ten years from date of shipment of the equipment, the equipment rendered shall be found by the Buyer to be faulty or shall fail to perform in accordance with Seller's specifications of the product, Seller shall at his expense correct the same, provided, however, that Buyers shall ship the equipment prepaid to Seller's facility. The Seller's responsibility hereunder shall be limited to replacement value of the equipment furnished under this contract.

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Any equipment returned for repair must be sent with transportation charges prepaid. The equipment must remain the property of the Buyer. The aforementioned warranties are void if the value of the unit is invoiced to the Seller at the time of return.

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Under no circumstances shall the Seller be liable for any personal injury whatsoever.

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