Capacitor Bank
Controls
CA916001EN

Effective March 2023
Supersedes November 2020

**COOPER POWER**
SERIES

# CBC-8000 capacitor bank control



## Description

Eaton's Cooper Power™ series CBC-8000 Capacitor Bank Control (CBC) is specifically designed to operate utility distribution feeder capacitors. This highly flexible control can be deployed using site metrology, which include Voltage, VARs, Current, Temperature and Time control configurations. Furthermore, each control is a low cost, remote controlled unit which can be readily deployed in advance automation schemes such as Eaton's Yukon™ Integrated Volt/VAR Control Application, SCADA or Distribution Management System. Each control also includes a robust offering of communication loss or "failsafe" back up modes in the event that communications become unavailable, the control can utilize the site metrology to maintain grid stability.

The CBC-8000 Capacitor Bank Control is part of a new line of fully integrated controls developed by Eaton. These controls feature a standard look and feel that can be programmed for almost any application. This means one standard software programming application and front panel on which to train field technicians. That translates to fewer training expenses, reduced inventory, and a distribution system that is much easier to maintain.

In addition to the flexible and user-friendly platform, Eaton's Cooper Power series controls have the communications technology to take your system into the future. With modular communication compatibility, these controls support cellular and radio communications utilizing the DNP3 protocol. Side panel RS-232 and Ethernet SelectComm™ communication modules are available for connection to SCADA and Distribution Management Systems.

The CBC-8000 control has an optional neutral current sensor which can be used to lockout the control and provide an alarm to SCADA in the event that a capacitor fuse is blown. With the appropriate sensor installed the CBC-8000 control can also supply current, voltage, VARs on each of the three phases, making it an ideal automation monitoring and control device.

The standardized front panel of the control is used to program and interrogate the control, as well as to display metering and alarm information. Control parameters can also be programmed via personal computer using the ProView™ NXG application software. Temporary connection to the control is made through the front panel USB port. The ProView NXG application software includes the functionality to provide diagnostic information.

The control analysis tools include event recording, data profiling, and various metering capabilities.

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## Ordering information

To order a basic CBC-8000 control:

- From Table 1, construct a catalog number that describes the required control.
- From Table 2, specify the catalog number that describes the control accessories that can ordered as spare parts or extended warranties.
- From Tables 3 through 13, specify the catalog numbers that describe the required field equipment.

**Table 1. Base CBC-8000 control**

| Description | Catalog number |
|---|---|
| Base letters for a CBC-8000 control<br>Standard door radio mounting area<br>H x W x D = 6.75 in x 9.87 in x 2.26 in<br>(17.15 cm x 25.07 cm x 5.74 cm) | **C8** |
| Deeper/Extended door radio mounting depth<br>H x W x D = 6.75 in x 9.87 in x 3.26 in<br>(17.15 cm x 25.07 cm x 8.28 cm) | **D8** |
| Language:<br>  English<br>  Portuguese<br>  Spanish | **0**<br>**P**<br>**S** |
| Auxiliary (Communication) Slot #1:<br>  02 for Stand Alone, No Communication Module<br>  20 for Ethernet, IP Stack<br>  21 for Ethernet, IP Stack with<br>    Power Over Ethernet (PoE)<br>  24 for RS232 Serial Port | **02**<br>**20**<br>**21**<br><br>**24** |
| Mounting Types ①<br>  1 for 4 Jaws<br>  2 for 4 Jaws<br>  3 for 6 Jaws<br>  4 for 6 Jaws<br>  5 for 6 Jaws<br>  6 for 6 Jaws<br>  7 for 6 Jaws<br>  8 for Pole mount w/7-Pin DIN (Input Power, Current,<br>    Neutral Current, and TR/CL) ②<br>  9 for Pole Mount w/14-Pin DIN (Input Power,<br>    Three-Phase Current/Voltage, NC, and TR/CL) ②③<br>  0 for Pole Mount w/5-Pin DIN ②<br>    (Input Power and Trip/Close)<br>  A for Custom Socket Mount<br>  B for Custom Pole Mount ② | **1**<br>**2**<br>**3**<br>**4**<br>**5**<br>**6**<br>**7**<br>**8**<br><br>**9**<br><br>**0**<br><br>**A**<br>**B** |
| Sensor Input Configuration<br>(Additional DIN for Sensor Inputs):<br>  0 for None<br>  1 for Circular DIN - Std. 8-Pin (Three-Phase Current/<br>    Voltage and Neutral Current) ③<br>  9 for Custom DIN | **0**<br>**1**<br><br>**9** |
| Auxiliary Slot #2<br>  0 for None<br>  1 for Serial Card with 12 volt Power Supply<br>  2 for DNP3 Master Ethernet Card<br>  3 for Serial Card with 5 Volt Power Supply<br>  4 for Wi-Fi | **0**<br>**1**<br>**2**<br>**3**<br>**4** |
| RFN AMI solutions<br>  Add to end of catalog number | **RFN1-013** |
| Custom Features (Optional)<br>_ _ _ _ = Custom Features Factory Provided Number | |

① Refer to mounting options section, Options 1-7 for jaw diagrams and Tables 6-9 pinout designation.

② Includes a pole mount bracket.

③ Accommodates three-phase sensing.

**Table 2. CBC-8000 control accessories**

| Description | Catalog number |
|---|---|
| Serial Communications Card, 12 volt | **70240x24G16** |
| Serial Communication card, 5 volt output<br>for local Wi-Fi service | **70240X24G17** |
| Ethernet Communication Card | **CBC8K-ETHERNET-R2** ① |
| Cable Security Sleeve Kit | **CBC8K-CBLSLEEVE** |
| Open Door Hold Kit | **CBC8K-DOORHOLD** |
| Wi-Fi field upgrade kit. Includes Wi-Fi Radio, 5v serial card, Serial Cable, Power Cable, and mounting screws (Field kit is not required when WiFi is ordered as part of the CBC catalog number) | **CBC8K-WIFIKIT** |
| Additional Pole Mount Bracket<br>(Included in Pole Mount Order Options) | **POLE-MT-BRACKET** |
| Optional Panel Mount Bracket<br>(Typically used in pad-mounted capacitors) | **PANEL-MT-BRACKET** |
| Replacement Standard Door. Compatible replacement for standard doors C8 or D8 deep or extended doors | **CBC8K-STDDOOR** |
| Replacement Deeper/Extended Door. This is compatible with all CBC-8000 controls. C8 and D8 versions. This door increased 1 inch of depth for radio mounting as compared to the standard door | **CBC8k-DEEPDOOR** |
| Replacement Door Seal/Gasket | **CBC8K-DOOR-SEAL** |
| 120 AC Lab Power Cables for CBC-testing:<br>5-PIN DIN control connector (CBC-8000 mounting option 0) | **CBC8K-PWR-5P** |
| 7-PIN DIN control connector. (CBC-8000 Mounting Option 8) | **CBC8K-PWR-7P** |
| 14-PIN DIN control connector. (CBC-8000 Mounting 9) | **CBC8K-PWR-14P** |
| Optional 5-year warranty<br>(extends warranty to a total of 5 years) | **EXT-CBC8K-5YR** |
| Optional 10-year warranty<br>(extends warranty to a total of 10 years) | **EXT-CBC8K-10YR** |

① The CBC8K-ETHERNET-R2 is a direct replacement of the CBC8K-ETHERNET card. For more information, see CBC-8000 Product Notification posted on Eaton.com/Secure.

**Note:** Eaton's standard warranty is 12 months. Additional warranty lengths are available for purchase.

**Table 3.  CBC-8000 setting files**

| Description | Catalog number |
|---|---|
| Customer Provided Settings File | **CUSTOMCONFIG-CBC** |
| Default Factory Setting File ① | **DEFAULTSETTING-CBC** |

① Firmware version must be supplied.

**Note:** If no setting file requirements are requested, Eaton will install our default settings file.

**Table 4.  Firmware**

| Description | Catalog number |
|---|---|
| Specified Firmware Version ① | **CUSTOMCFW-CBC** |
| Default Currently Publicly Released Firmware ② | **DEFAULTFW-CBC** |

① Firmware version must be supplied.

② If no firmware versions are specified, Eaton will install our default firmware.

**Table 5.  Neutral current sensors**

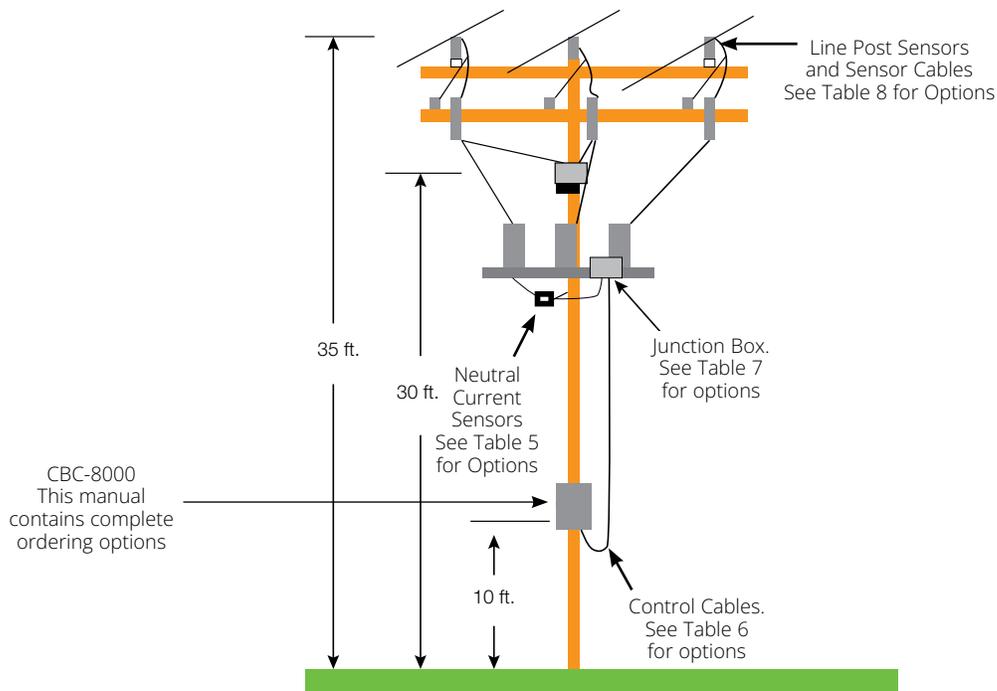| Description | Catalog number |
|---|---|
| Neutral Current Sensors. Includes Split core Neutral Current Sensor and 35 foot cable | **CBC-NCSENSOR-35** |
| Neutral Current Sensors. Includes Split Core Neutral Current Sensor, 35 foot cable and din connector ① | **CBC-NCSENSOR8P-35** |

① Used with Sensor Input Configuration Option 1.



**Figure 1. Generic capacitor bank installation**

**Table 6.  Cables and connectors**

| Description | Length (feet) | Catalog number |
|---|---|---|
| Cables:<br>5-Pin Control Cable (for Mounting Option 0)<br>7-Pin Control Cable (for Mounting Option 8)<br>14-Combined Control and Sensor Cable (for Mounting Option 9) ①<br>8-Pin Sensor Cable (for Sensor Input Option 1) ① | 40<br>40<br>40<br>40 | **CBC-CTRLCBL5P-40**<br>**CBC-CTRLCBL7P-40**<br>**CBC-CTRLSEN14P-40**<br>**CBC-SENCBL8P-40** |

① Accommodates Three-Phase Sensing.

**Note: Drawings of the cables can be found in Service Information, MN916001EN CBC-8000 Capacitor Bank Control Installation and Operation Instructions.**

**Table 7.  Junction box**

| Description | Catalog number |
|---|---|
| 7-Position Wiring Junction Box<br>Polymer construction with water tight cord grips designed for:<br>1 Power Line<br>3 Switch Cables<br>1 Control Cable<br>1 Neutral Current Sensor<br>1 Line Post Sensor | **CCR100K4** |
| 9-Position Junction Box<br>Metal construction with water tight cord grips designed for:<br>1 Power Line<br>3 Switch Cables<br>1 Control Cable<br>1 Neutral Current Sensor<br>3 CVMI Sensors (Combined Current and Voltage Monitoring Sensor) ① | **CCR100K5** |

① Accommodates Three-Phase Sensing.

**Note:** Drawings of the cables can be found in Service Information, MN916001EN CBC-8000 Capacitor Bank Control Installation and Operation Instructions.

**Ordering information for Eaton's optical sensors can be found in CA910002EN catalog guide.**

**Table 8.  Line post sensors and sensor cables**

| Description | Gen 1 Catalog Number | Gen 2 Catalog number |
|---|---|---|
| **Single Current Sensor**<br>Current Ratio–600 A:10 V | | |
|   Voltage Rating–15 kV | **9650/E1006** | 9E650/E1006 |
|   Voltage Rating–25 kV | **9660/E1004** | 9E660/E1006 |
| **Required Sensor Cable** | | |
|   25 foot Sensor Cable | **9610-25** | 9620/25 |
| **Combined Current and Voltage Sensors (CVMI)** ①<br>Current Ratio –600 A:10 V<br>Voltage Ratio (effective) | | |
|   1400:1 for 15 kV rated units | **9650/E1104A** ① | 9E650/E1106 |
|   2200:1 for 25 kV rated units | **9650/E1204A** ① | 9E660/E1206 |
| **Required Sensor Cable** | | |
|   25 foot Sensor Cable | **9-587/25** | 9620/25 |
| **Voltage Monitoring Insulators (SMVI)** | | |
|   15 kV rated | **931X/1400/1M** | |
|   25 kV rated | **932X/2200/1M** | |
| **ElbowSense** | | |
|   15 kV | **9552/0111** | |
|   25 kV | **9553/0211** | |

① These sensors are required for three-phase monitoring. One sensor is needed per phase to monitor all three phases.

**Note:** Sensors are manufactured by Lindsey Manufacturing.

Eaton can provide radio and radio installation. Contact your local Eaton representative to provide a quotation.



**Figure 2. Neutral current sensor**



**Figure 3. Pole mount bracket**

## Mounting options

### Option 1    ET

TOP OF SOCKET & CBC

Line — — Neutr

Open — — Close

### Option 2

TOP OF SOCKET & CBC

Line — — Neutral

Close — — Open

### Option 3

TOP OF SOCKET & CBC

Line Current Signal Low — — Neutral

Line — — Trip

Line Current Signal High — — Close

### Option 4

TOP OF SOCKET & CBC

Line — — Neutral

Line Current Signal Low — — Line Current Signal High

Trip — — Close

### Option 5

TOP OF SOCKET & CBC

Line — — Neutral

Neutral Current Signal Low — — Neutral Current Signal High

Trip — — Close

### Option 6

TOP OF SOCKET & CBC

Line — — Neutral

Neutral Current Signal High — — Neutral Current Signal Low

Trip — — Close

### Option 7

TOP OF SOCKET & CBC

Line — — Neutral Neut. Cur. Sig. Low Current Signal Low

Neutral Current Signal High — — Line Current Signal High

Trip — — Close

**Figure 4. CBC-8000 capacitor bank control**

**Table 9.  Wire color and location codes**

| Wire color | Black | White | Green | Red | Yellow | Blue | Brown |
|---|---|---|---|---|---|---|---|
| Code | L | N/COM | TR | CL | NSH | NSL/CSL | CSH |
| N | = | Neutral | | | | | |
| L | = | Line | | | | | |
| CL | = | Close | | | | | |
| TR | = | Trip | | | | | |
| CSH | = | Line Current Signal High | | | | | |
| CSL | = | Line Current Signal Low | | | | | |
| NSH | = | Neutral Current Signal High | | | | | |
| NSL | = | Neutral Current Signal Low | | | | | |

Location Codes

# Mounting options

## Table 10. Mounting Option 8
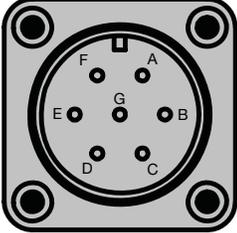
**Pole-mount 7-pin DIN configuration**

| Circular connector MS3102R16S-1P | | Mating connector MS3106F16S-1S |
|---|---|---|



| Pin | Location | Wire color |
|---|---|---|
| A | L | Black |
| B | TR | Green |
| C | CL | Red |
| D | NSL / CSL | Blue |
| E | NSH | Yellow |
| F | CSH | Brown |
| G | N | White |

## Table 11. Mounting Option 9

**14-pin DIN configuration**

| Circular connector MS3102R20-27P | | Mating connector MS3106F20-27S |
|---|---|---|



| Pin | Location | Wire color |
|---|---|---|
| A | L | Black |
| B | N/COM | White |
| C | TR | Green |
| D | CL | Red |
| E | Va | Red w/White Stripe |
| F | Vb | YLW w/White Stripe |
| G | Vc | ORG w/White Stripe |
| H | Ia | Brown |
| I | Ib | BLK w/White Stripe |
| J | Ic | BRW w/White Stripe |
| K | NC | Yellow |
| M | COM | Blue |
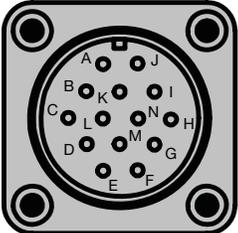
## Table 12. Mounting Option 0

**Pole-mount 5-pin DIN configuration**

| Circular Connector MS3102R16S-8P | | Mating connector MS3106F16S-8S |
|---|---|---|



| Pin | Location | Wire color |
|---|---|---|
| A | L | Black |
| B | N | White |
| C | CL | Red |
| D | TR | Green |
| E | N/A | N/A |
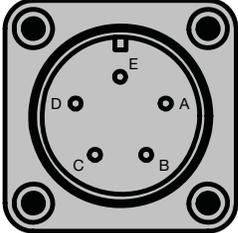
## Table 13. Sensor input configuration

**Sensor input wiring 8-pin DIN configuration**

| Circular connector MS3102R20-7P | | Mating connector MS3106F20-7S |
|---|---|---|



| Pin | Location | Wire color |
|---|---|---|
| A | Va | Red w/White Stripe |
| B | Vb | Yellow w/White Stripe |
| C | Vc | Orange w/White Stripe |
| D | Ia | Brown |
| E | Ib | Black w/White Stripe |
| F | Ic | Brown w/White Stripe |
| G | NC | Yellow |
| H | COM | Blue |
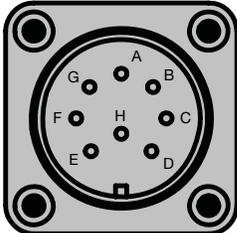
**Front view**

**Side view**



6.75"
(17.15 cm)

9.87"
(25.07 cm)

2.26" (5.74 cm)
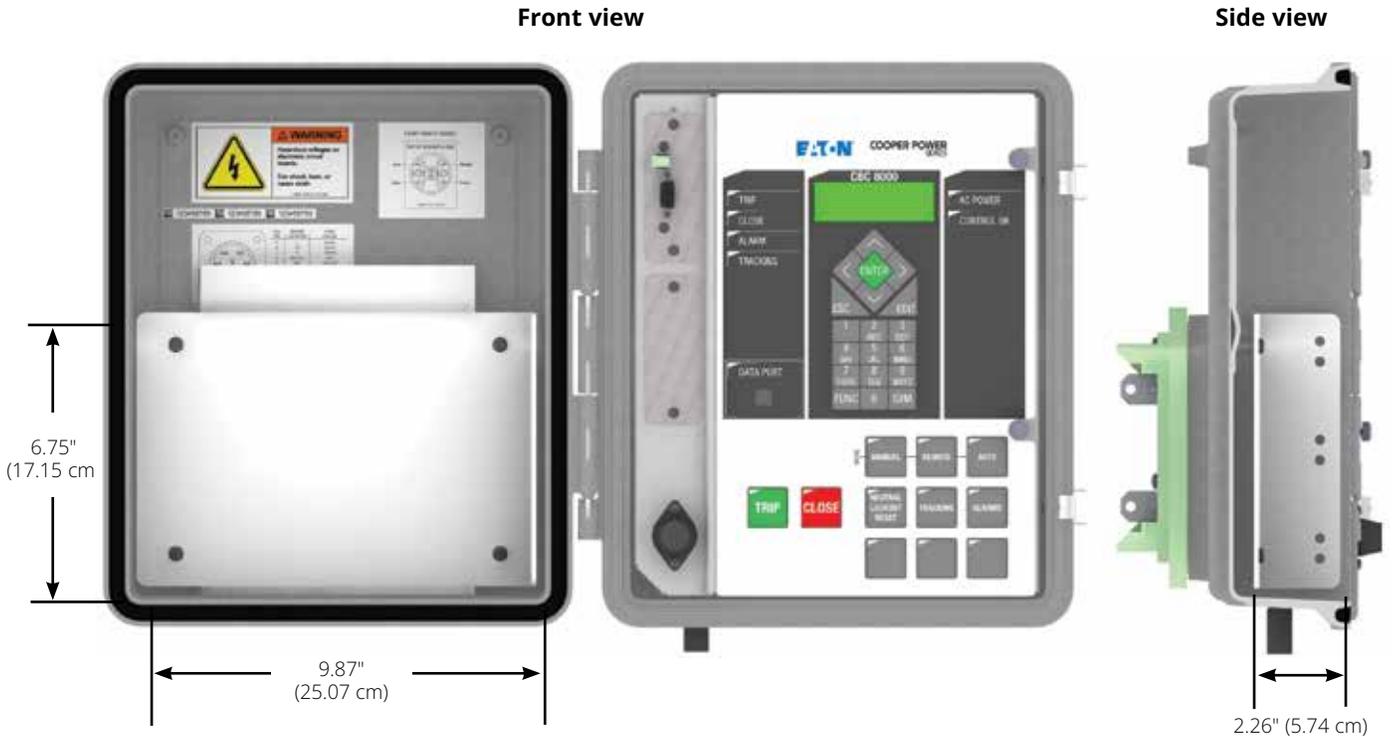
**Figure 6. CBC-8000 capacitor bank control weight and dimensions (standard depth door)**



6.75"
(17.15 cm)

9.87"
(25.07 cm)

3.26" (8.28 cm)

**Figure 5. CBC-8000 capacitor bank control weight and dimensions (extended depth door)**

## Control features

### Automatic mode

The Automatic operating mode allows control of the capacitor bank based on local conditions, while preventing manual or remote control of the capacitor bank.

**Note:** The AUTO LED illuminates when the control is in automatic operating mode.

If the control is in Manual or Remote mode and the AUTO button is pressed, any trip or close operation that was initiated when the control was in Manual or Remote mode is performed before the control changes to Automatic operating mode.

The following automatic operation features are supported:

• **Alarming—**Alarming allows the control to set alerts under specific conditions

• **Overvoltage/UnderVoltage Control—**Control of the capacitor bank or the setting of an alarm is based on the line voltage measurement and whether or not it is outside of a configurable OverVoltage/UnderVoltage (OVUV) threshold for a configurable period of time

- **Emergency Voltage Control—**Control of the capacitor bank is based on the line voltage measurement and whether or not it is outside of a configurable Emergency OVUV threshold for a configurable period of time
- **VAR Control—**Control of the capacitor bank or the setting of an alarm is based on the kVAR measurement and whether or not it is outside of a configurable threshold for a configurable period of time
- **Time Control—**Control of the capacitor bank is based on the time of day
- **Seasonal Control—**Seasonal control allows the control to use a different set of control parameters for two separate control seasons
- **Temperature Control—**Control of the capacitor bank or the setting of an alarm is based on the temperature measurement and whether or not it is outside of a configurable threshold for a configurable period of time
- **Sensor Input Control—**Control of the capacitor bank or the setting of an alarm is based on the sensor input value and whether or not it is outside of a configurable threshold for a configurable period of time
- **Neutral Current Fault Control—**Control of the capacitor bank or the setting of an alarm is based on the fundamental neutral current measurement and whether or not it exceeds a configurable threshold for a configurable period of time
- **Neutral Current Verification—**Capacitor bank operation is verified by comparing the fundamental neutral current measurement to a configurable set point. If neutral current fault control is enabled and the neutral current of the control is in fault condition, the control will not perform neutral current verification
- **Communications Loss Control—**Control of the capacitor bank or the setting of an alarm is based on the length of time that the control does not hear from the master station and whether or not that communications lost time exceeds a configurable period of time
- **Adaptive Voltage Control—**Control of the capacitor bank is based on a predictive algorithm that determines whether or not a capacitor bank operation will cause an OVUV condition or emergency voltage condition

## Alarming

The alarming feature is used to indicate when an event or condition has occurred. The control supports data alarms, status alarms, and event alarms. In addition, information about an alarm can be stored in the Sequence or Event (SOE) log.

The four control methods for which alarming can be enabled are:

- Phase A, B, or C Current or Voltage Control
- Neutral Current Fault Control
- OverVoltage/UnderVoltage Control
- Temperature Control

## Seasonal control

The seasonal control feature is used to configure two separate seasonal time periods for the following control methods:

- Voltage Control
- VAR Control
- Time Control
- Temperature Control

When seasonal control is enabled, each control method within season 1 or season 2 can have a unique set of control parameters.

## Over voltage under voltage control

The Over Voltage Under Voltage (OVUV) control feature allows control of the capacitor bank or setting an alarm if the line voltage measured by the control is outside of the configurable OVUV thresholds for a configurable period of time.

- The control supports the following OVUV thresholds:
- Comms Loss OVUV thresholds—Used when the control loses communications with the master station
- CVR thresholds—Used when the control performs CVR (Conservation Voltage Reduction) control
- Seasonal OVUV thresholds—Used when the control performs seasonal control
- Non-seasonal OVUV thresholds—Used when the control performs non-seasonal control
- The configurable periods of time that the line voltage must be outside of a threshold are the OV track time and UV track time, which are in seconds

If adaptive voltage control is also enabled, OVUV control releases its priority when the control determines that a control operation will not cause an OVUV condition.

## Emergency voltage control

The emergency voltage control feature allows control of the capacitor bank or setting an alarm if the line voltage measured by the control is outside of the emergency voltage thresholds for a configurable period of time.

If adaptive voltage control is also enabled, emergency voltage control releases its priority when the control determines that a control operation will not cause an emergency OVUV condition.

## VAR control

The VAR control feature allows control of the capacitor bank or setting an alarm if the kVAR measurement is outside of a configurable threshold for a configurable period of time.

- The configurable thresholds are the trip and close points, which are in kVARs
- The configurable period of time that the kVAR value must be outside of a threshold is the VAR track time, which is in seconds

The control stops tracking kVAR measurements if the capacitor bank is already tripped and the kVAR value is below the trip point or the capacitor bank is already closed and the kVAR value is above the close point.

## Time control

The time control feature allows daily control of the capacitor bank when the local time reaches the On time or Off time.

- **On time—**When the local time reaches the On time, the control closes the capacitor bank and it remains closed until the local time reaches the Off time
- **Off time—**When the local time reaches the Off time, the control opens the capacitor bank it remains open until the local time reaches the On time

Time control can be used during the week (Monday through Friday) and on the weekend. In addition, the control supports the following time control options:

- **Holidays—**User-defined holidays and perpetual holidays, which are holidays that do not occur on a specific date, such as Thanksgiving, Memorial Day, and Labor Day
- **ON/OFF control—**On/Off control with a selectable Off state.
- **Weekend override control—**The control places the capacitor bank into a specified state from the start of the Off time on Friday to the start of the On time on Monday

## Temperature control

The temperature control feature allows control of the capacitor bank, or setting of an alarm, if the temperature is outside of the temperature thresholds for a configurable period of time.

The control action that occurs is configurable.

• **None—**Do not perform an operation

• **Trip above—**Perform a trip operation when the temperature is above the threshold

• **Close above—**Perform a close operation when the temperature is above the threshold

• **Trip above close below—**Perform a trip operation when the temperature is above the threshold and perform a close operation when the temperature is below the threshold

• **Trip below—**Perform a trip operation when the temperature is below the threshold

• **Close below—**Perform a close operation when the temperature is below the threshold

• **Close above trip below—**Perform a close operation when the temperature is above the threshold and perform a trip operation when the temperature is below the threshold

• **Alarm above—**Set an alarm when the temperature is above the threshold

• **Alarm below—**Set an alarm when the temperature is below the threshold

**Note:** Make sure the actions that are specified for the minimum and maximum thresholds do not cause conflicting control operations. For example, the minimum action cannot be trip above if the maximum action is close below.

## Sensor input control

The sensor input control feature allows control of the capacitor bank, or setting of an alarm, if the sensor input value stays outside of a configurable threshold for a configurable period of time.

The control action that occurs is configurable.

• **Trip above—**Perform a trip operation when the sensor input value is above the threshold

• **Close above—**Perform a close operation when the sensor input value is above the threshold

• **Trip above close below—**Perform a trip operation when the sensor input value is above the threshold and perform a close operation when the temperature is below the threshold

• **Trip below—**Perform a trip operation when the sensor input value is below the threshold

• **Close below—**Perform a close operation when the sensor input value is below the threshold

• **Close above trip below—**Perform a close operation when the sensor input value is above the threshold and perform a trip operation when the sensor input value is below the threshold

• **Alarm above—**Set an alarm when the sensor input value is above the threshold

• **Alarm below—**Set an alarm when the sensor input value is below the threshold

**Note:** Make sure the actions that are specified for the minimum and maximum thresholds do not cause conflicting control operations. For example, the minimum action cannot be trip above if the maximum action is close below.

## Neutral current fault control

The neutral current fault control feature provides a method to determine if the capacitor bank is in a fault condition, such as a phase imbalance. If neutral fault current control is enabled and the measured fundamental neutral current exceeds the configurable set point for a configurable period of time, the following occurs:

• The control places the capacitor bank into the opposite state from the one that caused the fault current

• All controls, except for manual controls, are prohibited

• The LCD display changes to indicate that the control is in a lockout state and the home screen of the LCD display changes to the lockout state screen

**Note:** The keypad can still be used to view control settings and data during a fault condition.

• The measured fundamental neutral current, at the time of the fault, is stored in non-volatile memory. The neutral current value that caused the fault can then be retrieved at a later time.

The neutral current lockout can be cleared by pressing the Neutral Lockout Reset button on the operating panel or by sending a neutral lockout reset command to the control over local/remote comms. When the neutral current lockout is cleared, the display reverts back to the normal home screen and the fault current value in non-volatile memory is cleared.

## Neutral current verification

The neutral current verification feature provides a method to verify capacitor bank operation by comparing the fundamental neutral current measurement to a configurable set point.

**Note:** Neutral current sensing must be enabled to use neutral current readings to verify capacitor bank operation.

The neutral current measurement is expected to be above the configurable set point for a closed capacitor bank and below this set point for a tripped capacitor bank.

• If the neutral current measurement is not above the set point for a closed capacitor bank, the control attempts to close the capacitor bank a configurable number of times before the operation is considered a failure

• If the neutral current measurement is not below the set point for an open capacitor bank, the control attempts to open the capacitor bank a configurable number of times before the operation is considered a failure

**Note:** If neutral current fault control is enabled and the control is in a fault current condition, neutral current verification will not be performed.

## Communications loss control

If the control cannot communicate with the master station for a configurable period of time, the control enters comms loss mode.

The following automatic control types may be enabled when the control enters comms loss mode:

• OVUV Control

• VAR Control

• Time Control

• Temperature Control

• Phase A, B, or C Voltage or Current Control

**Note:** OVUV control uses a secondary set of thresholds when the control is in comms loss mode.

## Adaptive voltage control

Adaptive voltage control is a predictive algorithm that is used to determine if a control operation will cause an OVUV or emergency voltage condition. The average delta voltage, which measures the change in voltage due to a capacitor bank operation, is used along with a 10 second average of the instantaneous line voltage to see if a control operation will cause the voltage to be outside of the OVUV thresholds or emergency voltage thresholds.

If the pending control operation will cause an OVUV or emergency voltage condition and it has a priority lower than OVUV or emergency voltage control, the control operation is ignored. Any control operation that has a higher priority than OVUV or emergency voltage control is allowed.

Adaptive voltage control is used only if OVUV control or emergency voltage control is enabled.

## Priority control

Priority control is used to determine if one control can override another control when more than one control method is enabled. Table 14 lists the default priority level for each control method and if that control method's priority is configurable.

**Note:** The lower the number, the higher the priority.

If more than one control method has been configured with the same priority, the default priority level is used to determine which control method has the highest priority.

## Communications

Remote operation of the control requires the use of a communication port and a SelectComm communication module.

**Table 14. Priority control levels**

| Default priority | Control method | Priority level configurable? |
|---|---|---|
| 0 | Manual Control | No |
| 1 | SCADA Override | No |
| 2 | Fault Current Control | No |
| 3 | Emergency Voltage | No |
| 4 | Time Control (when set to On/Off | No |
| 5 | OVUV Control | Yes |
| 6 | VAR Control | Yes |
| 7 | Phase A Voltage Control (Analog Input 1) | Yes |
| 8 | Phase B Voltage Control (Analog Input 2) | Yes |
| 9 | Phase C Voltage Control (Analog Input 3) | Yes |
| 10 | Phase A Current Control (Analog Input 4) | Yes |
| 11 | Phase B Current Control (Analog Input 5) | Yes |
| 12 | Phase C Current Control (Analog Input 6) | Yes |
| 13 | Temperature Control | Yes |
| 14 | Remote Control | No |
| 15 | Time Control (when in Normal state) | No |
| 16 | None | No |

## Communication ports

The CBC-8000 control has two communication ports. The first communication port, which is located above the second port, supports serial and Ethernet SelectComm communication modules.

The following SelectComm communication options are available when the control is ordered:

- No SelectComm modules
- One Serial SelectComm module
- One Ethernet SelectComm module

The second communication port, which is located below the first port, supports optional accessories such as a Bluetooth® communication module.

In additional, the CBC-8000 control has a front panel USB data port, which is used by the ProView NXG application software to communicate with the control. For more information about the front panel USB data port, refer to Figure 8, Operating Panel section of this manual.

## Serial SelectComm module

The serial SelectComm module enables the control to communicate over an RS-232 serial connection using the DNP3 protocol.

Figure 6 and Table 15 display the pin numbering and wiring requirements for an RS-232 communication cable that connects to the serial SelectComm module.
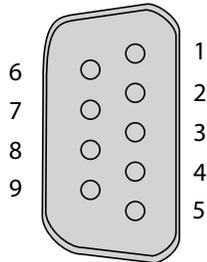


**Figure 6. Serial cable (DB9) pin numbering**



**Figure 7. CBC-8000 control with modem**

### Sensors

Eaton's Cooper Power series CBC-8000 control is commonly deployed with line post voltage and current sensors. A partial list of sensors that can be employed with the CBC-8000 control (0–10 volt range) include the Lindsey® Manufacturing Co. USA CMVI family of PolySil or Generation 2 sensors (9650/E1201, 9650/E1301, 9650/E1401 or 9E650/E1201, 96E50/E1301, 9E6/E1401), Fisher Pierce® Series 1301 PowerFlex® (1301-17A, 1301-47A, 1301-27A), or Piedmont Line Post Sensors (LSCV-110-122-23, LSCV-150-122-13, LSCV-200-122-13).

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## IMPORTANT

The CBC-8000 sensor inputs only accept voltage. The range is 0–10 volts.

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**Table 15.  TSerial cable (DB9) wiring pinout**

| Pin | Name | Pin description |
|-----|------|-----------------|
| 1 | DCD | Data Carrier Detect |
| 2 | RXD | Receive Data |
| 3 | TXD | Transmit Data |
| 4 | DTR | Data Terminal Ready |
| 5 | SGND | Signal Ground |
| 6 | DSR | Data Set Ready |
| 7 | RTS | Request to Send |
| 8 | CTS | Clear to Send |
| 9 | RI | Ring Indicator |

**Table 16.  Ethernet cable (RJ45) wiring pinout**

| Pin | Name | Pin description |
|-----|------|-----------------|
| 1 | TX+ | Transmit Data (positive) |
| 2 | TX- | Transmit Data (negative) |
| 3 | RX+ | Receive Date (positive) |
| 4 ① | PSE V+ | Power Sourcing Equipment Voltage (positive) |
| 5 ① | PSE V+ | Power Sourcing Equipment Voltage (positive) |
| 6 | RX- | Receive Data (negative) |
| 7 ① | PSE V- | Power Sourcing Equipment Voltage (negative) |
| 8 ① | PSE V- | Power sourcing Equipment Voltage (negative) |

① Optional feature included with style C8021 controls.

# Additional information

Refer to the following literature for application recommendations:

MN916001EN, CBC-8000 Capacitor Bank Control Installation and Operation Instructions

MN916002EN, CBC-8000 Capacitor Bank Control ProView NXG Application Software Programming Guide

MN916003EN, CBC-8000 Capacitor Bank Control Communications

TD916002EN, Communications Point Data Base for Serial and Ethernet Communications Protocol DNP3

PS916001EN, Guideform Specification

PA916001EN, State-of-the-Art Integrated Volt/VAR Capacitor Bank Control

## Applicable standards

| **Enclosure** | NEMA® 4X (IP65) |
|---|---|
| **Environmental** | |
| Temperature: | –40 °F to +185 °F<br>(–40 °C to +85 °C) |
| Relative humidity: | 5% to 95% non-condensing |
| UV Rating: | Meets or exceeds UL® 746C Ultraviolet Light and Water Exposure testing |
| **Standards** | |
| Power Tests: | IEC 61000-4-4 at 4 kV<br>100 kHz ring per IEEE Std 62.41™-1991 standard at 6 kV (0.5 kA)<br>1.2/50 (8/20) combination waveform per IEEE Std C62.41™-1991 standard at 6 kV (3 kA) |
| I/O Tests: | IEC 61000-4-4 at 4 kV |
| | 1.2/50 (8/20) combination waveform per IEC 61000-4-4 at 4 kV (100 A) |
| Electrostatic Discharge Tests: | ESD per IEC 61000-4-2 discharge through contact at 8 kV<br>ESD per IEC 61000-4-2 discharge through AIR at 15 kV<br>IEC 61000-4-5 Combination Surge<br>IEC 61000-4-11 Dip and Interrupts<br>IEC 61000-4-12 Ring/Oscillatory Wave<br>IEC 61000-2-27 Mechanical Shock<br>FCC 15 Part B |

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For Eaton's Cooper Power series CBC-8000 control product information, call 1-877-277-4636 or visit: www.eaton.com/cooperpowerseries.