Product Brochure

CQ930
Automatic Capacitor Bank Controller
Introduction

Meeting the growing demand from utility customers for higher data resolution and greater control, the CQ930 range of capacitor bank controllers provides a low cost and reliable method of monitoring and switching three phase pole-mounted capacitors.

Overview
The CQ930 is a fully-featured controller specifically designed for real time 3-phase measurement and monitoring. With the ability to operate capacitor bank switches individually or in traditional gang operation, the CQ930 is equally capable operating in automatic or via remote master SCADA controls. It is designed for easy setup, configuration and monitoring with the use of keypad and the large back-lit LCD screen, or by using the supplied PC software.

The CQ930 controller includes a range of control modes including remote, automatic and manual control, and is designed to offer customers true value through smarter management of their electrical systems and reliable integration with Smart Grid systems.
New features

3-Phase Measurement and Monitoring
Real time RMS measurements of the network conditions can be captured, displayed and recorded. This also includes voltage and current harmonic measurements with global system values and THD, up to the 19th harmonic. System average values are also calculated. Value of kvar, KW, kVA and power factor also calculated on a phase by phase basis.

Individual Phase Switching and Local Control Modes
The CQ930 is capable of specific capacitor phase switching in manual and remote mode which can reduce line unbalance situations.

The control unit can also be set with Auto-Switching Control Functions which includes the following parameters:
- Voltage
- Current
- VAR
- Schedule
- Temperature

Any combination of three of the above parameters can be used together to set a priority threshold switching system. This allows for complete control over a 3-phase capacitor bank.

Multi-Bank Switching
The CQ930 is also capable multi-bank or multi-step control which can be applied to both polemounts and metal enclosed capacitor banks (MECB).

Depending on the switch signal requirement, the CQ930 is capable of controlling up to 7 steps using contactor relay signals or 3 steps using standard relay signals.

Enhanced Fault Detection
New fault detection includes:
- Neutral current / voltage detection
- Switch status monitoring
- Fault current detection
- Bank online/offline confirmation
- Brown-out detection
- Data logging

With feedback alerts and system alarms, the user can be notified of any faults with installed equipment.

Safety and Security
The CQ930 is enclosed in a stainless steel (IPXX) enclosure with a padlock-able clasp. An enhanced password protection system limits access to programmable parameters and a programmable keypad lockout can be used to prevent tampering on site.

Other security features include
- “Door Opened” intrusion detection that can remotely alert users of unit access
- Programmable capacitor re-closing (0-10mins)
- Auto mode ‘jump back’ feature to prevent the unit from being accidentally left in Manual mode

Compensation Voltage Reduction
With the ability to control capacitor banks with more precision, users will also be able to reap the benefits of voltage optimisation. Using the inbuilt schedules, local control modes and real-time system measurement, CVR strategies can be put in place to lower peak demands and energy consumption whilst maintain the delivered power quality.
### Benefits

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability</td>
<td>– Fast on-board micro-processor for accurate sampling, measurement and decision making.</td>
</tr>
<tr>
<td></td>
<td>Flash upgradeable software allows new features to be deployed in the field</td>
</tr>
<tr>
<td></td>
<td>– Advanced automatic switching</td>
</tr>
<tr>
<td></td>
<td>– External temperature sensor</td>
</tr>
<tr>
<td></td>
<td>– Real time battery backed clock (approximately 10 year life in unpowered state)</td>
</tr>
<tr>
<td></td>
<td>– ISO-9001 manufacturing environment</td>
</tr>
<tr>
<td>Flexibility</td>
<td>– Universal power supply (90 VAC to 264 VAC)</td>
</tr>
<tr>
<td></td>
<td>– Frequency auto detection (47 Hz to 63 Hz real-time frequency measurement)</td>
</tr>
<tr>
<td></td>
<td>– Flexible mounting options</td>
</tr>
<tr>
<td></td>
<td>– Wide range of switch types supported (e.g. motor/solenoid driven, electrically held switch types)</td>
</tr>
<tr>
<td></td>
<td>– Optional available features:</td>
</tr>
<tr>
<td></td>
<td>– ABB CapLink short range Wi-Fi communications</td>
</tr>
<tr>
<td></td>
<td>– Neutral current measurement via sensor input</td>
</tr>
<tr>
<td></td>
<td>– Capacitor bank switch status feedback monitoring</td>
</tr>
<tr>
<td>Durability</td>
<td>– Wide environmental operating conditions (-40°C to +70°C)</td>
</tr>
<tr>
<td></td>
<td>– IP65 (NEMA 4R) rated enclosure</td>
</tr>
<tr>
<td></td>
<td>– Electrical protection via 450 V varistors and transient voltage suppressors to provide</td>
</tr>
<tr>
<td></td>
<td>fast spike and ESD protection (1500 V 8/20μs impulse protection)</td>
</tr>
<tr>
<td>Easy to Use</td>
<td>– Includes a logical, structured menu system and user-friendly navigation interface including</td>
</tr>
<tr>
<td></td>
<td>16-line LCD screen</td>
</tr>
<tr>
<td></td>
<td>– Fully user programmable via unit faceplate or PC software for maximum flexibility in operation</td>
</tr>
<tr>
<td></td>
<td>– MS Windows™ compatible software package supplied for external configuration and data</td>
</tr>
<tr>
<td></td>
<td>retrieval process</td>
</tr>
<tr>
<td></td>
<td>– USB2.0 PC interface</td>
</tr>
<tr>
<td>Data Integrity</td>
<td>– Real-time monitoring of network parameters</td>
</tr>
<tr>
<td></td>
<td>– Flash stored programmed settings</td>
</tr>
<tr>
<td></td>
<td>– Data logging capture 10,000 events at set time periods into non-volatile memory</td>
</tr>
</tbody>
</table>
Features

Modes of operation
The CQ930 has the ability to be used either as a manually controlled device or an automatically controlled device, which switches the capacitors on/off based on a wide range of standard control modes.

The following automatic control modes are available on all CQ930 controllers:
– Schedule (time)
– Voltage
– Temperature
– VAR*
– Current*
* requires a current sensor to be installed

Allowing great flexibility, any combination of three of the above control modes can be used in conjunction, with the hierarchy of control being selected by the user. The threshold values and time-outs for each control parameter are fully programmable by the user, either through the unit faceplate or the supplied PC Utility Software.

Where schedule switching is required, the CQ930 supports both a single schedule as well as different schedules for summer and winter. Separate schedules for weekdays (work days) and weekends (non-work days) are supported along with the ability to select which days are work and non-work days. Holidays and daylight saving time are also supported.

Data logging
The CQ930 has internal storage for 10,000+ data log entries. The data log is useful for troubleshooting and load profiling. A data log entry is made upon all controller events such as switch open or close, threshold values being exceeded or alarms triggered. Data log entries can also be programmed to be recorded at predetermined time intervals from 30 seconds to every hour.

The data log is stored in non-volatile flash memory, with the oldest log entries being overwritten cyclically when storage is full. Log data is downloaded as a .CSV file (com sep val) allowing easy transportation and manipulation of information in programs such as MS Excel.

PC utility software
The CQ930 utilises a standard USB connection for communicating directly with a PC or laptop, while also supporting communication via ABB CapLink. The software provides an intuitive, user friendly interface which allows rapid programming and deployment of CQ930 controller units. Configuration files can be created and saved for future unit download further reducing the time taken to deploy multiple units.

The software is designed so that no file extraction is required for it to run, allowing the software to be stored and operated on a portable device. This allows greater flexibility for operating in the field.

Real time status and measured values are updated every second and are displayed on the monitor tab. Please see figure 1.
Communications

With the increasing requirement for smart grids and the need for flexible switching options, the CQ930 controller comes fully equipped for modern communication.

**DNP3.0**

For remote control and monitoring, the CQ930 utilises the DNP3.0 protocol. For full flexibility this includes polled and unsolicited responses, support up to class 3 polling, and DNP3.0 time synchronisation. Using analogue output points the auto switch mode programmable parameters can also be remotely configured.

For transmitting remote data, the CQ930 supports both RS232 and Ethernet (TCP or UDP) communication ports. This allows a wide range of modem / radio devices to be used, while also allowing the CQ930 to retrofit with existing communications infrastructure.

In case there is a problem with the communication system (i.e. master station is down, communication tower failure), the CQ930 has a configurable time-out period which returns the unit to local automatic mode until the communication link has been restored.

The controller also allows remote monitoring and recording while the unit is in local automatic control mode.

**ABB CapLink™**

Given that the majority of capacitor controllers are mounted in an elevated position in the field, a physical connection between the controller and a laptop can be an undesirable proposition.

The ABB CapLink™ allows the user the full connection functionality of the standard USB connection over a secure short range wireless link (up to 50m / 150ft). This allows field technicians to communicate with the CQ930 from the ground or service vehicle, resulting in much safer operation of the controller regardless of the weather conditions.
### Controller Selection Table

<table>
<thead>
<tr>
<th>Mounting Configuration:</th>
<th>CQ930</th>
<th>X</th>
<th>XX</th>
<th>XX</th>
<th>X</th>
<th>X</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>P - Standard pole mount bracket</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A - Meter base socket mount configuration &quot;A&quot; *</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M - Metal Enclosed Bank Application 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Also available in 6jaw configurations B, C, D, E, F and 4jaw configuration G

<table>
<thead>
<tr>
<th>Control Connector Configuration²:</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>00 - None</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 - 7-pin male (16S-1P)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 - 14-pin male (20-27P)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19 - 19-pin male (22-14P)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>99 - Custom controls</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Options Connector Configuration²:</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>00 - None</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07 - 7-pin male (16S-1P)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 - 14-pin male (22-19P)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>99 - Custom options</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ABB CapLink:</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>C - CapLink is fitted (includes removable antenna)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X - CapLink is not fitted</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* CapLink PC communication dongles ordered separately. Use part code CQ900-CLD

<table>
<thead>
<tr>
<th>Measuring Input Configuration:</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>L - Voltage: 0-10VAC 1Mohm / Current: 0-10VAC current sensor (voltage output)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M - Voltage: 0-10VAC 1Mohm / Current: 0-10A current transformer (current output) 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S - Voltage: 0-240VAC 1Mohm / Current: 0-10VAC current sensor (voltage output)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T - Voltage: 0-240VAC 1Mohm / Current: 0-10A current transformer (current output) 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X - Voltage: 0-10VAC 1Mohm / No current measurement required</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y - Voltage: 0-240VAC 1Mohm / No current measurement required</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* For LEA input requirements use L, M or Y configuration.
* For other load impedance requirements, please contact ABB.

<table>
<thead>
<tr>
<th>Switching Method Options:</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>G - Gang switching enabled</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P - Individual phase switching enabled 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M - Multi-bank control enabled 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Enclosure type:</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>S - Stainless steel enclosure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[Optional] Custom Build Number 4

### Notes:
1. Custom MECB enclosure used for panel mounting in a control cubicle. No plugs are required as connections are terminated directly at the base of the controller.
2. Contact ABB for more information on wiring configurations for control and option connectors.
3. If CT inputs, individual phase switching, or multi-bank control is required, then the advanced option PCB adder is a requirement.
4. Indicates non-standard build requirements for specific customers. Contact ABB for more information.
**Technical Data**

**Control system**
- Micro-processor-based system for balanced three-phase networks
- Field upgradeable firmware capability through USB interface allows future upgrades and features to be deployed in field

**Supply voltage**
90 VAC to 264 VAC universal power supply

**Consumption**
10 VA max (no modem), 30 VA max (with modem*)

**Connection type for measuring circuit and power supply**
- Phase-phase or phase-neutral. User selectable VT ratios
- External current sensor converting 0–600 A to 0–10 VAC (optional for power based measurements)

**Frequency range**
47 Hz to 63 Hz - Real time frequency measurement monitors actual system frequency and calculates kvar, PF, KVA, kW etc., based on actual system conditions

**Electrical isolation/protection**
- Phase-phase or phase-neutral. User selectable VT ratios
- Transient voltage suppressors providing fast spike and ESD protection (1500 V 8/20 us impulse protection)
- Electrically protected auxiliary digital inputs

**Fuse protection**
- Unit protection: 2 A Fast blow (M205) internal
- Switch protection: 10 A SLOW-BLO® (M205)

**Operating Environment**

**Operating temperature:**
-40°C to +70°C (ambient)
(-40°F to +158°F)

**Unit display operating temperature:**
-20°C to +70°C
(-4°F to +158°F)

**Humidity Range:**
5% to 95% (non-condensing)

**Measurement sensor performance**

**Voltage:**
± 375.8 V peak (264 Vrms) range
0.2 VAC resolution
± 1% accuracy

**Current:**
0 to 600A range
0.5A resolution
± 1% accuracy

**Phase angle:**
-179° to +180° range
1° resolution
± 0.1% accuracy

**Temperature:**
-40°C to +70°C
(-40°F to +122°F) range
1°C (1°F) resolution
± 1% non-linearity

**Output contacts**

**Switch contacts:**
Up to 7 x 20A configurable switch contacts.
Standard unit uses 2 contacts – 1x open, 1 close output

**Continuous current (max):**
20 A

**Inrush current (max):**
100 A

**Contact closure period:**
User selectable, 100ms to 10s as well as constant closed for electrically held switch operation

**Settings**

**Control modes:**
- Remote (control or monitor only)
- Automatic (local)
- Manual (local)

**Automatic control modes:**
- Schedule (Time)
- Voltage
- Schedule with temperature override
- Temperature
- VAR*
- Current*

**Switch on schedule:**
- Single or seasonal
- Work day and non-work day schedules with full customisation

**Switch on temperature range:**
-40°C to +50°C
(-40°F to +122°F)

**Switch on voltage range:**
105 V to 130 V
or 210 V to 260 V

**Switch on VAR range:**
-10 Mvar to +10 Mvar

**Open/Close time delay:**
5 s to 10 min
Separate open and close times

**Maximum operations:**
1 to 30 daily operations

**Logging periods:**
30 s to 60 min

**Enclosure**
Lockable, IP65 (NEMA 4R), powder coated, stainless steel enclosure

**Mounting**
Pole mounting brackets provided as standard.
Optional wall and meter socket mounts are also available.

**Memory/Calendar**

**Time clock:**
Battery backed RTC

**Calendar:**
- 20 years preset
- 30 user settable annual holidays
- Daylight savings operation and auto season adjust
- Fully user selectable weekdays and weekends

**Non-volatile flash data logging memory:**
10,000+ record logs

**Non-volatile storage of log and operating parameters in data FLASH**
Backup battery: 3.6V lithium cell - 10 year life (unpowered state)

**Communications**
- Unit configuration and data log transfer via USB
- Optional “ABB Smart Link” radio allows local interrogation without touching unit. (Up to 50 m range)
- RS232 and Ethernet interfaces allow monitoring over remote networks using a wide range of modem devices. DNP3.0 communication protocol enabled*

**Quality**
- Printed circuit board in accordance to IPC-D-2221
- Unit in accordance applicable electrical standards
- CE mark (C-tick), RoHS component compliant
- Manufactured in an ISO 9001 and ISO 14001 environment

*Requires a current sensor to be installed