DESCRIPTION

The CBX-8R8(-H) is a fully programmable BTL-listed BACnet® Advanced Application Controller (B-AAC) that communicates on an RS-485 local area network using the BACnet® MS/TP protocol.

This controller features 8 UniPuts™ with Relay and 8 Universal Inputs as well as support for up to three FLX (Field Level eXpansion) series extension modules providing up to 64 points of control. FLX expansion modules are available in a variety of options to allow maximum flexibility in achieving the required point configuration.

The CBX-8R8(-H) is designed for a wide range of applications for intelligent control of HVAC equipment, lighting control, and electrical systems including metering applications.

APPLICATION

The CBX-8R8(-H) is suitable for controlling various equipment such as; air handling units, boilers, chillers, cooling towers, pump systems, central plant equipment, variable frequency drives, lighting control and metering. The controller supports multi-protocol communications simultaneously including BACnet® MS/TP and Modbus® RTU.

The fully programmable CBX-8R8(-H) can be tailored to meet a variety of applications by creating and modifying strategies using Cylon’s CXproHD™ programming interface.

CBX System

CBX-8R8

- 8 UniPuts™ + Relays
  - hardware connections that can be used as inputs, outputs or relays (software selectable)
- 8 Universal Inputs

CBX-8R8-H

- Including Hand/Off/Auto Local Override Function

Field Level eXpansion Modules

- FLX-4R4
  - 4 UniPuts™ with Relay
  - 4 Universal Inputs
- FLX-8R8
  - 8 UniPuts™ with Relay
  - 8 Universal Inputs
- FLX-16DI
  - 16 Digital Inputs
- FLX-4R4-H, FLX-8R8-H
  - Including Hand/Off/Auto Local Override Function

Support for Cylon smart thermostat bus

LED status on all I/O channels provides indication of fault or override status

Compact form factor to maximize enclosure space

Scalable from 16 points to 64 points using FLX modules

Easy module expansion using simple bus connectors

Up to 64 Trendlogs, 1024 entries per Trendlog

Accurate Universal Inputs support a variety of thermistors and RTDs that range from 0 to 450 kΩ

INSTALLATION GUIDE: see page 5
**SPECIFICATIONS**

**MECHANICAL**

- **Size** (excluding terminal plugs): CBX-8R8 166 x 89.5 x 57 mm [6.5 x 3.5 x 2"
- CBX-8R8-H 166 x 89.5 x 57 mm [6.5 x 3.5 x 2.25"
- FLX-4R4 104 x 89.5 x 57 mm [4.1 x 3.5 x 2.25"
- FLX-4R4-H 104 x 89.5 x 57 mm [4.1 x 3.5 x 2.25"
- FLX-8R8 104 x 89.5 x 57 mm [4.1 x 3.5 x 2.25"
- FLX-8R8-H 104 x 89.5 x 57 mm [4.1 x 3.5 x 2.25"
- FLX-16R8 104 x 89.5 x 57 mm [4.1 x 3.5 x 2.25"

**Enclosure**

- Flame-Retardant ABS
- DIN 43880 type-2 compatible

**Mounting**

- DIN rail

**COMMUNICATIONS**

- **Note:** Use Copper or Copper Clad Aluminum 70 °C conductors only.

**TERMINALS**

- **Conductor Area:**
  - Max: AWG 12 (3.1 mm²)
  - Min: AWG 22 (0.355 mm²)

**ENVIRONMENT**

- **Note:** This equipment is intended for field installation within an enclosure.

**ELECTRICAL**

**Supply Requirements**

- 24 V AC ±20% 50/60 Hz

**Supply**

- CBX 50 VA (no FLX modules)
- CBX + 1 x FLX 66 VA
- CBX + 2 x FLX 82 VA
- CBX + 3 x FLX 98 VA

**FLX Power Connection**

- Proprietary FLX bus connector carries power and carries from CBX-8R8(H)-unit. CBX-8R8(-H) can supply power up to 3 FLX modules.

**Auxiliary Power**

- 18 V DC / 60 mA output

**BACnet® Loading**

- ¼ unit load device

**PROCESSOR**

- **Type:** STM32 ARM Cortex-M3 processor
- **Clock Speed:** 8 MHz crystal, 72 MHz internal processor clock rate
- **System Memory**
  - 1MByte external SRAM + 16 Mbyte external flash (soldered to PCB not removable)
- **Real-Time Clock**
  - Battery backed for 2 years minimum

**SOFTWARE FEATURES**

- **Maximum number of Strategy Blocks:** 1024
- **Maximum number of Trendlog Modules:** 64
- **Maximum internal Trendlog capacity (standard):** 1024
- **Data Security:** Strategy and set points backed up in Flash

**INTERFACE**

- **Engineering Software**
  - CxproHD

**ACCOUNTS**

- Automatix
- HD

**INPUTS / OUTPUTS**

- **Note:** Shielded cable is recommended for all input connections.

**UniPuts™ with Relay**

When configured as Input:

- **Analog Input**
  - Range: 0 ... 10 V @ 40 kΩ
  - Accuracy: ±0.5% full scale [50mV]
- **Resistance Measurement**
  - Range: 0 ... 450 kΩ
  - Accuracy: ±0.5% of measured resistance
- **Temperature Measurement**
  - Range: -40 °C ... +110 °C
  - Accuracy: ±0.5°C

When configured as Output:

- **Analog Output 0 ... 10 V, 20 mA, 12-bit resolution**
- **Digital Volt-Free contact, 2 mA contact-wetting current**
  - Pulse counting up to 20 Hz, 25 ms - 25 ms

**Notes:**

1) All inputs and outputs are protected against short circuit, as well as over-voltage up to 24 V AC.
2) Inputs use on-board 16-bit analog to digital converter.
3) 18 V DC supply, max 60mA per CBX/FLX unit, is available for powering sensors.
DIMENSIONS

WIRING

CBX-8R8 and CBX-8R8-H

FLX-4R4 and FLX-4R4H

FLX-16DI

FLX-8R8 and FLX-8R8H

CAUTION - DANGER OF EXPLOSION IF BATTERY IS INCORRECTLY REPLACED. REPLACE ONLY WITH THE SAME OR EQUIVALENT TYPE RECOMMENDED BY THE MANUFACTURER. DISPOSE OF USED BATTERIES ACCORDING TO THE MANUFACTURER’S INSTRUCTIONS.
SYSTEM ARCHITECTURE

Remote Web Browser, Mobile Applications and Tools

CBX System
## INSTALLATION GUIDE

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<th>Description</th>
</tr>
</thead>
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<td></td>
<td>1 … 12</td>
<td>Universal Inputs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>When input is configured as <strong>Digital</strong>:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>● LED Off: open circuit or logic 'off'</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>● LED On: logic 'on'</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>When input is configured as <strong>Resistor/thermistor</strong>:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>● LED Off: valid resistance connected (Note: 0 Ω is counted as valid)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>● LED Slow blink: resistor/thermistor not connected</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>When input is configured as <strong>Analog</strong>:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>● LED intensity is modulated by the analog signal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>When the LED is blinking:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>● Fast blink indicates error condition</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>● Two short flashes followed by a value* indicates the input is in an override state (overridden by CXpro™).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>*Note: The LED intensity illustrates the value measured at the input terminals. The flash indicates that this value has been overridden.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25 … 38</td>
<td>UniPuts™ + Relay</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>When a UniPut™ channel is configured as an input, the LED signals are identical to Universal Inputs above. When configured as an output the following apply:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>When output is configured as <strong>Digital</strong>:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>● LED Off: open circuit or logic 'off'</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>● LED On: logic 'on'</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>When output is configured as <strong>Analog</strong>:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>● LED intensity is modulated by the analog signal</td>
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<td></td>
<td></td>
<td></td>
<td>When the LED is blinking:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>● Fast blink indicates error condition</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>● Two short flashes followed by a value indicates the output is in an override state (overridden by CXpro™ or HOA).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 … 12, 26 … 37</td>
<td>Digital Inputs (FLX16DI only)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>● LED Off: open circuit or logic 'off'</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>● LED On: logic 'on'</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>When the LED is blinking:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>● Fast blink indicates error condition</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>● Two short flashes followed by a value indicates the output is in an override state (overridden by CXpro™).</td>
</tr>
<tr>
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<td>24 V AC Power</td>
</tr>
<tr>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>95, 96</td>
<td>BACnet® MS/TP Port (RS-485) screw terminal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MS/TP subnet terminator switch is located beside the port. If the switch is towards the icon, then termination is in and if the switch is towards the icon then termination is out.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>39 … 42</td>
<td>UCU Room Display / CBT-STAT Port</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The CBT-STAT bus Terminator Switch is located beside the port. If the switch is towards the icon, then termination is in and if the switch is towards the icon then termination is out.</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>Modbus RTU</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The Modbus Terminator Switch is located beside the port. If the switch is towards the icon, then termination is in and if the switch is towards the icon then termination is out.</td>
</tr>
</tbody>
</table>
### Location Illustration Description

<table>
<thead>
<tr>
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<th>Illustration</th>
<th>Description</th>
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<tbody>
<tr>
<td>Service Port (Micro USB)</td>
<td><img src="image1" alt="Image" /></td>
<td>8-Way M5/TP address DIP switch (CBX only) The controller’s BACnet® MAC address can be set either electronically (USB or BACnet®) or manually using the 8-way DIP switch. 1) Manual setting for ease of replacement: Setting the 8-way DIP switch to an address between 1 and 254, and then cycling the power, will force the controller to update its MAC address to match the DIP settings. To replace a manually-addressed controller in the field simply copy the DIP switch setting of the controller you are replacing. 2) Electronic setting for remote configuration: Setting the 8-way DIP switch to all zeros will allow the MAC address to be set electronically either locally by USB or remotely over BACnet®. It is also possible to use manual setting for initial commissioning, and then cycling the power to force the controller to update its MAC address to match the DIP settings. To enable subsequent electronic configuration, set the DIP switch to all zeros. The controller will retain the manually-set address until it is electronically overwritten.</td>
</tr>
<tr>
<td><img src="image2" alt="Image" /></td>
<td><img src="image3" alt="Image" /></td>
<td>5-Way FLX bus address DIP switch (FLX only). This sets the address of the FLX unit on its local FLX bus.</td>
</tr>
<tr>
<td><img src="image4" alt="Image" /></td>
<td><img src="image5" alt="Image" /></td>
<td>Output Override (-H variants only: CBX-8R8-H, FLX-8R8-H, FLX-4R4-H) Bottom position: Off - outputs forced off. Centre position: Auto - outputs are controlled by strategy. Top position: Manual – for digital outputs, the output is forced on. For analog outputs the knob setting controls the output value. Note: Manual position is supervised, i.e. the strategy is aware of the manual value.</td>
</tr>
<tr>
<td><img src="image6" alt="Image" /></td>
<td><img src="image7" alt="Image" /></td>
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</tr>
<tr>
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<td>Inter-module connector</td>
</tr>
<tr>
<td><img src="image10" alt="Image" /></td>
<td><img src="image11" alt="Image" /></td>
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</tr>
<tr>
<td><img src="image12" alt="Image" /></td>
<td><img src="image13" alt="Image" /></td>
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1.1. Set the CBX MS/TP Address

To communicate to other MS/TP devices on a BACnet® MS/TP network, the MS/TP address must be set to a unique address within the MS/TP subnet. Where possible, there should be no gaps between addresses. The BACnet® Instance Number must also be unique for the BACnet® site.

The 8-way DIP switch can be used to set the MS/TP address when the device is first powered on.

- The address is set in binary, from 1 (00000001) to 127 (1111111).  
- A switch moved to the center (towards the ‘ON’ mark) represents 1, moved to the edge represents 0.  
- The right-most switch (labeled “1”) is the least-significant bit; the switch on the left (labeled “8”) is the most-significant bit.

![Address Mask](image)

*Note: If it is required that the CBX-8R8(-H)’s address can be configured remotely via BACnet® or electronically via USB, then once the CBX-8R8(-H) has been powered up (Installation step 1.2) the 8-way DIP switch should be set to all zeros.

Setting the 8-way DIP switch to all zeros will allow the MAC address to be set electronically either locally by USB or remotely over BACnet®.

It is also possible to use manual setting for initial commissioning, and then cycling the power to force the controller to update its MAC address to match the DIP settings. To enable subsequent electronic configuration, set the DIP switch to all zeros. The controller will retain the manually-set address until it is electronically overwritten.

Note: If no address had previously been set (e.g. when the device is received from the factory), then a device that is powered-on with the DIP switch set to all zeros will use the last 2 digits of its serial number as its initial address.

The MS/TP baud rate must match on all devices on the MS/TP subnet.

1.2. Connect 24 V AC Power to the CBX-8R8(-H)

For the initial configuration of the device, the controller must first be powered on.

*Note: Service Port (USB connection) must not be connected until after the device is powered on.

The CBX-8R8(-H) requires 24 V AC supplied from an externally mounted power transformer. One conductor of the transformer must be grounded to an earth ground to avoid damage to the controller. This conductor will be wired to the COM (common) terminal of the controller. The wiring diagram is shown here:

![Wiring Diagram](image)

*Note: Ensure the 24 V AC and Common wires are correctly connected to the controller. If the wires are swapped, it may cause damage to anything connected to the controller.

2. Connect the CBX to the MS/TP Network

2.1. Attach RS-485 communication wires to the MS/TP Subnet port

Wiring the RS-485 network involves connecting the A+ (95) and B- (96) terminals in a daisy-chained configuration. One end of the network will be connected to the Fieldbus of the Network-level controller or BACnet® router. At the other end of the network, the last device must be “terminated” by either installing a 100 Ω…120 Ω resistor or, if the last device is a CBX, users can switch the MS/TP Subnet terminator switch (located beside the MS/TP port) towards the [ ] icon. This will effectively terminate the network. The shield (screen) must be carried through the entire network.

If the RS-485 network is wired to an eSC, then the shield will be grounded at the eSC.

If the RS-485 network is wired to a CBX, the shield must be grounded at one point on the network as shown below:

Network cable segment daisy-chained to next device

Network cable segment daisy-chained to next device

![Network Terminations](image)
2.2. Terminate the MS/TP network
If the CBX-8R8(-H) is the last device on the RS-485 network, then its MS/TP subnet terminator switch must be set to “In”. If the Controller serial number is 10000024C, the ‘numeric portion’ is 24. In that case the MS/TP address would be 2400. If the MS/TP address is set to 2400, then users would set the MS/TP Max Masters to 63. This will speed up communications as it will not go into the “poll for masters” state and immediately pass the token back to the e5C or CBM at MS/TP address 0.

3. CONFIGURE THE CBX-8R8(-H) FOR BACnet® Communications

3.1. CBX-8R8(-H) Default Settings
The CBX-8R8(-H) is shipped with the following default settings:

- **MS/TP Address**: last 2 digits of the numeric portion of the serial number*
- **BACnet® Instance Number**: entire numeric portion of the Controller’s serial number*
- **MS/TP Baud Rate**: 38,400 bps

*Note CBX serial numbers are structured as "CXX" followed by a sequential number followed by a letter (CXX (numeric portion) (letter)).

3.2. Connect CXpro®HD to the CBX-8R8(-H)
Connect the laptop to the CBX-8R8(-H) through a BACnet® Router such as CBR or ASPECT® Control Engine (ACE - Matrix or Nexus Series) via Ethernet, or directly using a standard Micro-B USB cable.

**Note**: When the CXpro®HD PC is connected to the CBX USB port for the first time, you will be prompted to install a driver. Install “STMicroelectronics Virtual COM port”, and then select the corresponding serial port in CXpro®HD to connect to the CBX. If you are using Windows 8.1 this driver may not be available by default, please contact Cylon TSG for a copy of the driver.

Once connected to the controller, it is possible to change the settings on the controller using CXpro®HD - for details see the CXpro® User Guide (MAN0133J) available from the Cylon support site (http://support.cylon.com).

**Note**: It is not required to change the Site Number or Comms Controller preset values. It is however recommended to match the Field Controller address with the MS/TP Station address (see below).

3.3. (If required) Set Device Instance & MS/TP Address

**Note**: This is only possible if the MS/TP address switch is set to Zero.

3.4. Confirm or set MS/TP parameters
**MS/TP Baud Rate** is the Baud rate at which all the other devices on the subnet (Fieldbus) are communicating. All devices must be configured for the same baud rate for communications on the subnet.

**Device ID** is the BACnet device instance number. Every BACnet controller within the site must receive a unique BACnet instance number to ensure proper communications. This BACnet instance number should be unique even across subnets. By default, it is set to the entire numeric portion of the Controller’s serial number. See the Cylon BACnet® Manual (MAN0106US) for further information.

**Device Name** is the user-assigned name for the controller. This is not necessary for BACnet communications; however, it is useful to name each controller for organizational purposes.

**APDU Timeout Seconds** leave this at the default setting of 3 seconds.

**MS/TP Station** is the device MS/TP address. This is the unique address users must give each controller on the subnet (Fieldbus).

**MS/TP Max Masters** is the maximum address that this controller will poll when in the “poll for masters” state. Because this is a BACnet master device, it will go into this state to search for the next BACnet master device to pass the token to. To optimize the speed of the network, it is recommended that the last master device on the subnet be set at the maximum MS/TP address on the network. For example, if the last device on the subnet (Fieldbus) is the CBX at address 63, then users would set the MS/TP Max Masters to 63. This will speed up communications as it will not go into the “poll for masters” state and immediately pass the token back to the e5C or CBM at MS/TP address 0.

See the Cylon BACnet® Manual (MAN0106US) for more details regarding this functionality and for other tips on optimizing the BACnet network.

4. Connect the CBX-8R8(-H) to FLX units
The I/O capabilities of a CBX-8R8(-H) can be extended by the addition of FLX-8R8 and FLX-8R8H devices.

These are connected to the CBX-8R8(-H) by means of a standard module interconnector (FLX bus connector), one of which is shipped with each FLX device.

4.1. Set the FLX address
Each of the FLX units connected to a single CBX must have an address that is unique on that CBX’s FLX bus. The address is set by the 5-way DIP switch.

The terminals on a FLX unit will be accessible within the CBX Strategy with point numbers prefixed by this address as illustrated below:

<table>
<thead>
<tr>
<th>Inter-module bus Address</th>
<th>DIP switch setting</th>
<th>Point numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>00001 1</td>
<td></td>
<td>101 ... 116</td>
</tr>
<tr>
<td>00010 2</td>
<td></td>
<td>201 ... 216</td>
</tr>
<tr>
<td>00011 3</td>
<td></td>
<td>301 ... 316</td>
</tr>
</tbody>
</table>
4.2. Join or terminate the FLX bus

Place the devices side-by-side and place the FLX bus connector into the two adjacent sockets at once.

The end device on a CBX set (either a FLX device or the CBX itself if no FLX devices are connected) must have a terminator inserted into its interconnector socket. One terminator is shipped with each CBX-8R8(-H) device.

4.3. (If required) Set up FLX bus extension

If a FLX device cannot be located beside a CBX device or another FLX device then the FLX bus can be connected by cable using two FLX-RMC Remote Module Connectors, sold separately.

Connect cables to the two supplied FLX-RMC screw-terminal connectors as shown above with the appropriate length of cable.

Note: Use Copper or Copper Clad Aluminum conductors only. Multiple wired connections can be used between FLX modules, but the total FLX bus FLX bus length must not exceed the following lengths:

<table>
<thead>
<tr>
<th>Cable gauge</th>
<th>Max length</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWG 18</td>
<td>30 m / 100 ft.</td>
</tr>
<tr>
<td>AWG 22</td>
<td>15 m / 50 ft.</td>
</tr>
</tbody>
</table>

Remove the Interconnect (if installed) from the right-hand side of the FLX or CBX where the RMC is to be installed.

Slide one RMC connector into the T-slot of the CBX or FLX at the point at which the BUS is to be extended.
5. ADD THE CONTROLLER TO THE SITE

5.1. Set Controller Date and Time
Use CXproHD to set the controller’s Date and Time.
Alternatively, if a device on the site has been set up as a Time Sync Master, then the CBX-8R8(-H) controller time will be automatically updated.

5.2. Set I/O to a known Safe Mode
Before connecting equipment to the CBX-8R8(-H) or FLX devices, carry out a Wipe Controller command from CXproHD to put I/O into a Known Safe Mode:
- In CXproHD select Wipe Controller from the Controller tab on the Ribbon. In the Wipe Controller dialog, click in the ’Wipe All’ checkbox.
- Click on the ’Wipe’ button.
When the Wipe operation is complete, a ’Controller Wiped’ message is displayed.

5.3. Set up the CBX and connected FLX in a Site
In the Cylon Configuration Utility (CCConfig) select the CBR Comms Controller to which the CBX device is connected, and add a new controller by clicking the Add button:
In the New Field Controller Details dialog change the Controller Type to CBX8R8.
If the CBX device has one or more FLX modules connected to it, add the same number of entries in the I/O Modules table:
When FLX modules have been added, the specific FLX type can be set in the I/O Modules Table Type Column:
If you attempt to add more modules than the CBX can support, an error message will be displayed:

When the correct number of FLX modules has been added, enter a Device Instance number and click OK.

**5.4. Set up the Controller Strategy**

In CXpro™, double-click on the controller in the Site Tree to open its Strategy:

If there is no existing Strategy in the controller, an invitation to create a new one will be displayed:

Click Yes to open a new blank strategy drawing:

Add strategy blocks and points to create the required strategy – see MAN0133 CXpro™ User Guide for more detail.

Note that in CBX-8R8(-H) controllers there are:

- a total of 1024 strategy blocks, numbered 1 - 1024
- a total of 1024 analog virtual points 1 - 1024
- a total of 1024 binary virtual points 1 - 1024
- a minimum of 16 and a maximum of 64 hardware points:
  - The first 16 are numbered 1-16, representing the internal I/O in the CBX
  - The 16 points in an attached FLX with MS/TP address set to “1” are numbered 101-116
  - The 16 points in an attached FLX with MS/TP address set to “2” are numbered 201-216
  - The 16 points in an attached FLX with MS/TP address set to “3” are numbered 301-316

In the Strategy drawing, IO blocks can be added up to the total on the configured FLX modules plus the CBX onboard IO.

**Note:** If a FLX module is deleted from a CBX configuration (in CConfig) after the Strategy drawing has been set up, the blocks associated with that FLX’s IO will be ‘greyed out’ to indicate that they are inactive.
**Inputs and Outputs**

The CBX-8R8(H), FLX-8R8 and FLX-8R8-H have identical I/O capabilities – each has a set of 8 Universal Inputs and a set of 8 UniPuts™ with relay. FLX-4R4 and FLX-4R4-H have 4 Universal Inputs and 4 UniPuts™ with relay. FLX-16DI has 16 Digital Inputs only.

Any of the terminals can be configured as inputs. Any of the UniPuts™ terminals can be configured as an output.

**Input modes**

Universal Input terminals and UniPuts™ terminals can be configured as inputs in almost identical fashion:

<table>
<thead>
<tr>
<th>Measurement Mode</th>
<th>Universal Input</th>
<th>UniPuts™ as Input:</th>
<th>Digital Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistance</td>
<td>Resistance measurement</td>
<td>±0.5% of measured resistance</td>
<td>-</td>
</tr>
<tr>
<td>Temperature measurement</td>
<td>Range: -40 °C ... +100 °C</td>
<td>±0.3 °C, -40 to 90 °C (40°F to 194°F); ±0.4 °C &gt; 90 °C (194°F)</td>
<td>-</td>
</tr>
<tr>
<td>Digital Volt-Free contact</td>
<td>2 mA contact-wetting current</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Pulse counting</td>
<td>up to 20 Hz, 25 ms – 25 ms</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>24 V AC Detect</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage</td>
<td>Analog Input</td>
<td>Analog Input</td>
<td>-</td>
</tr>
<tr>
<td>Range: 0 ... 10 V</td>
<td>Range: 0 ... 10 V</td>
<td>±0.5% full scale (50mV)</td>
<td>-</td>
</tr>
<tr>
<td>@ 130 kΩ</td>
<td>@ 40 kΩ</td>
<td>Accuracy: ±0.5% full scale (50mV)</td>
<td>-</td>
</tr>
<tr>
<td>Pulse counting (0 ... 10 V)</td>
<td>up to 20 Hz, 25 ms – 25 ms</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Current</td>
<td>Current input</td>
<td>Current input</td>
<td>-</td>
</tr>
<tr>
<td>Range: 0 ... 20 mA</td>
<td>Range: 0 ... 20 mA</td>
<td>±0.5% full scale (100μA)</td>
<td>-</td>
</tr>
<tr>
<td>@ 390 Ω</td>
<td>@ 390 Ω</td>
<td>Accuracy: depends on user supplied external 390 Ω resistance.</td>
<td>-</td>
</tr>
</tbody>
</table>

**Resistance Input mode (Passive Input)**

Passive inputs are all those devices that vary in resistance, including switch contacts. These all require a current supplied by the CBX-8R8(H)-H terminal so that this resistance can be measured.

The passive sensor types supported by the CBX-8R8(H)-H are:

- Pre-programmed Passive Temperature Sensors.
- Potentiometer (normally used as a 0 to 10 KΩ or a 1 KΩ to 11 KΩ variable resistor to give a 0 to 100 % output).
- Volt-Free Digital Input (the controller strategy measures the contact resistance and gives a 0 or 1 output).
- Straightforward Resistance measurement. This can be used with the Make Linear block to give a temperature output for temperature sensors that are not factory pre-programmed into the CBX-8R8(H)-H.

In CXPro®, simply select ‘Resistance’ sensor type in the Point Module and select Pulsed in the Advanced parameters (the Pulsed option increases accuracy by eliminating any self-heating in the passive temperature sensor, while the Continuous option can trade absolute accuracy for speed).

In Passive Input Mode the UniPuts™ and Universal Inputs configure like this:

![Diagram](image)

Note: The reference voltage can be pulsed or continuous, using the solid state switch. A pulsed reference gives optimum accuracy by eliminating self-heating in the sensor, and this is the default setting.

**UniPut™ 24 V AC Detection**

If 24 V AC is connected to a UniPut™ terminal, then the 24 V AC Detect circuit will detect this and will open switch SW1. SW1 stays open for the duration of the 24 V AC state. When 24 V AC is removed from the UniPut™ terminal then the short circuit or open circuit states can again be detected.

**Voltage input mode (Active Input)**

The 0 ... 10 V input is used for Active analog and binary measurements. ‘Active’ means that there is no current supplied by the CBX-8R8(H)-H for the sensor, as the signal is generated completely by the Sensor.

The ‘(v)’ sensor setting gives a value between 0 and 10,000, which represents voltage in mV.

In 0 ... 10V Input Mode, the UniPuts™ configure like this:

![Diagram](image)
Current Input mode (Active Input)
The Current Input is used for 0 ... 20 mA or 4 ... 20 mA Active sensors. 4 ... 20 mA scaling can easily be achieved using CXpro™ by entering range values in the Point Module ‘Advanced’ parameters.

Output modes
UniPut™ terminals can generate an output as follows:
* Analog Output 0 ... 10 V, 20 mA, 12-bit resolution
* Digital Output 0 ... 10 V, 20 mA
* Relay Contacts with ability to switch up to 24 V AC
Maximum Load: 24 V AC, 2 (1) A resistive (inductive) for all relay contacts

Analog 0 ... 10 V output mode
In Analog 0 ... 10 V output Mode, the UniPut™ configure themselves like this:
where the D/A is the digital to analog converter. All circuitry is fully protected against 24 V AC.

Digital 0 ... 10 V output mode
In Digital 0 ... 10 V output Mode, the UniPut™ configure in the same way as for analog:
In this mode the output toggles between the voltages defined as “ON” and “OFF”.

Relay Mode
In Relay mode the UniPut™ are configured with a single relay common for each half of the terminals:

Auxiliary Power outputs
The CBX and FLX modules each have two 18 V DC outputs, for I/O devices that require loop power.
For 3-wire connections return can be through any COM terminal, but it is recommended that Auxiliary power wiring is through terminal 14, the COM between the two Auxiliary power terminals.
The DC output terminals provide a minimum of 18 V DC, but the combined load (on each I/O module) must remain below 60 mA.

Using a Keypad with the CBX
A CBT-STAT or UCU Room Display keypad can be connected to the CBX at the CBT-STAT port.

Note: If UCU Room Display is used, refer to the DS0064 UCU10FCX for the corresponding Strategy Point Setup.
Output Override

HOA variants (CBX-8R8-H, FLX-4R4-H and FLX-8R8-H) include hardware override switches for each of their outputs. The override controls are located behind the flap on the front of the device:

![CBX-8R8-H](image1)

![FLX-4R4-H](image2)

![FLX-8R8-H](image3)

And consist of a switch and a rotary knob for each output:

![Override controls](image4)

The channel number corresponding to the switch is shown directly below the switch.

The switch can be set to one of 3 positions:

- **Centre position**: When a switch is set to the Centre position, the corresponding output channel is set to Auto mode – the output is controlled by strategy. The rotary knob has no effect in this mode.

- **Bottom position**: When a switch is set to the Bottom position, the corresponding output is forced to Off – both the strategy setting and the rotary knob have no effect.

- **Top position**: When a switch is set to the Top position, the corresponding output is set to Manual mode:
  - for digital outputs, the output is forced on
  - for analog outputs the rotary knob setting controls the output value.

**Note**: Manual position is supervised, i.e. the strategy is aware of the manual value.

The Controller Strategy can determine if an override is in place by connecting to the Override point on the output module:

![Controller Strategy](image5)

The value of the Override point will be ‘0’ when the output is active and ‘1’ when the point has been manually overridden. This allows the strategy to react to the fact that a point has been overridden.

**Note**: The corresponding terminal LED will indicate the override condition.