# BACnet® communication module for TCX2: AEX-BAC

## Features

- BACnet® MS/TP communication over RS485
- B-ASC device profile
- Slave type of communication
- Supports up to 127 nodes on one network
- Galvanic isolated bus connection
- Baudrates: Auto / 9600 / 19200 / 38400 / 57600 / 76800 / 115200
- LED indicators

## TCX2-BAC Protocol Implementation Conformance Statement (PICS)

Vendor name: Vector Controls
Product name: TCX2 Controls series
TCX2 product description:
The TCX2 communicating BACnet® controllers are designed as universal controls equipment suitable for a large number of applications. They may be used in zoning and other applications which are monitored by a BACnet® MS/TP network.

## Supported BACnet® Interoperability Blocks (BIBB)

The BACnet® interface conforms to the B-ASC device profile (BACnet® Application Specific Controller).
The following BACnet® Interoperability Building Blocks (BIBB) are supported.

| BIBB | Type | Name |
|---|---|---|
| DS-RP-B | Data sharing | Read property - B |
| DS-RPM-B | Data sharing | Read property multiple - B |
| DS-WP-B | Data sharing | Write property - B |
| DM-DCC-B | Device management | Device communication control - B |
| DM-DDB-B | Device management | Dynamic device binding - B |
| DM-DOB-B | Device management | Dynamic object binding - B |
| DM-TS-B | Device management | Time synchronisation – B |
| DM-UTC-B | Device management | UTC time synchronization – B |
| DM-RD-B | Device management | Reinitialize device - B |

## Supported standard BACnet® application services

- ReadProperty
- ReadPropertyMultiple
- WriteProperty
- DeviceCommunicationControl. Needs a password which is "Vector" (case sensitive an without the quotes)
- I-Am
- I-Have
- TimeSynchronisation
- UTCTimeSynchronization
- ReinitializeDevice ("cold" or "warm")
 Needs a password which is "Vector" (case sensitive an without the quotes)

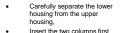## Supported standard object types

- Device
- Analog input
- Analog value
- Binary value
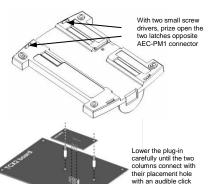- Multi-state value

## Assembly

The steps outlined below are only required if the communication plug in is to be added to a standalone controller. A clean and ESD compliant working environment is required. If you are unsure about this procedure, contact your nearest dealer.

- Disconnect all wires from the controller and remove it from its mounted position
- Turn controller around:

- Carefully separate the lower housing from the upper housing,
- Insert the two columns first into the large holes on either corner of the AEX-BAC
- Then match the two connectors of the AEX-BAC with their counterparts of the main board.

- Bend the two latches of the upper part slightly outwards and re-assemble the upper part with the lower part of the housing. Make sure the four latches connect save and the housing is secured.

With two small screw drivers, prize open the two latches opposite AEC-PM1 connector

Lower the plug-in carefully until the two columns connect with their placement hole with an audible click

## Technical specification

| Power supply | Power requirements | 5 VDC ± 5% |
|---|---|---|
| | Power consumption | Max. 2 VA |
| Network | Hardware interface | RS485 in accordance with EIA/TIA 485 |
| | Max nodes per network | 127 |
| | Max nodes per segment | 64 (Vector devices only) |
| | Cabling | Twisted Shielded Pair (TSP) cable category 5 or 6. |
| | Impedance | balanced 120 ohm |
| | Nominal capacitance | 100 pF/m 16pF/ft or lower |
| | Nominal velocity | 65% or higher |
| | Galvanic isolation | The communication circuitry is galvanic isolated |
| | Line termination | A line termination resistance (120 Ω) shall be connected between the terminals - (TX2) and + (TX3) of the furthermost node of the network |
| | Fail-safe biasing | The device supports fail-safe biasing |
| | Network topology | Daisy chain according EIA/TIA 485 specifications |
| | Maximum length per chain | 1200 m (4000 ft.) |
| BACnet® | Communication standard | BACnet® MS/TP Master on RS485 |
| | Default setting | Auto |
| | Communication speed | Auto, 9600, 19200, 38400, 57600, 76800, 115200 |
| Environment | Operation | To IEC 721-3-3 |
| | Climatic conditions | class 3K5 |
| | Temperature | 0…50 °C (32…122 °F) |
| | Humidity | < 95 % RH non-condensing |
| | Transport & storage | To IEC 721-3-2 and IEC 721-3-1 |
| | Climatic conditions | class 3K3 and class 1K3 |
| | Temperature | -25…70 °C (-13…158 °F) |
| | Humidity | < 95 % RH non-condensing |
| | Mechanical conditions | class 2M2 |
| Standards | CE conformity | |
| | EMC Directive | 2004/108/EC |
| | Low voltage directive | 2006/95/EC |
| | Product standards | |
| | Automatic electrical controls for household and similar use | EN 60730-1 |
| | Special requirement on temperature dependent controls | EN 60730-2-9 |
| | Electromagnetic compatibility for industrial and domestic sector | Emissions: EN 60730-1  Immunity: EN 60730-1 |

## Bus connection

RS485 3-wire bus Cat 5 or Cat 6 shielded cable    (24-26 AWG)

MS/TP node    MS/TP node    MS/TP node

TCX2 terminals
OP1 OP2 OP3 OP4    TX1 TX2 TX3 TX4

MS/TP: REF
MS/TP: (-)
MS/TP: (+)    balanced pair
120

On last node on either end of bus only
connect 120 Ω termination resistor between - and + (TX2 and TX3)

**Important:**
**Power GND ≠ MS/TP REF!**
**Do not use shield for REF connection**

**Fail-safe biasing:**
The device supports fail-safe biasing (line polarization). 680 Ω per wire, maximum 1 set per RS485 segment.
**Shield connection:**
The shield of the wire must not be used to connect to the REF terminal. Connect all the shields together and ground in one single point on the network. Make sure the shields do not accidentally touch the ground.
Multiple ground connections induce noise and affect communication.

## LED indicators

The BACnet® interface features a green LED and a red LED for indication of traffic on the RS-485 bus. The green LED is lit when an incoming packet is received, and the red LED is lit when an outgoing packet is transmitted to the bus. At power-up, both LED blink twice simultaneously as a sign of the boot process being completed. A constantly lit LED serves as an indication of a fault condition in the reception or sending process.

## Configuration of AEX-BAC

The communication parameters may be set via TCX2-OP controllers or OPA2 terminals once the device is plugged in the TCX2 base. Login to the controller as follows:

1. Press UP/DOWN buttons simultaneously for three seconds. The display will show firmware version and revision number. Press the OPTION button to start login.
2. CODE is shown in small display.
3. Select 241 using UP/DOWN buttons.
4. Press OPTION after selecting the correct code.
5. Once logged in with 241 control modules are displayed (Lp1, Lp2, 1u, 2u, etc.) – select with UP/DOWN the communication parameters **CO** and open with OPTION. As soon as the module is open its parameters are displayed.
6. Select the parameters with the UP/DOWN buttons. Change a parameter by pressing the OPTION button. Three arrows are displayed to indicate that the parameter may be modified. Use UP/DOWN buttons to adjust the value.
7. After you are done, press OPTION to save the new value and return to the selection level (arrows disappear when selection is saved). Pressing left hand POWER button without pressing OPTION will discard the value and return without saving. For control parameters press POWER again to leave parameter selection and return to control module selection.
8. Press the POWER to leave the menu. The unit will return to normal operation if no button is pressed for more than 5 minutes.

## COM parameters

| Parameter | Description | Range | Default |
|---|---|---|---|
| CO 00 | Bus plug-in hardware id (read only) | 0…255 | 3 |
| CO 01 | Bus plug-in software version (read only) | 0…255 | - |
| CO 02 | Bus plug-in software revision ( read only) | 0…255 | - |
| CO 03 | Communication address (must be unique in network) | 1…127 | 1 |
| CO 04 | Baud rate:  0 = **Auto-detect**[1]  1 = 9600  2 = 19200  3 = 38400  4 = 57600  5 = 76800  6 = 115200 | 0…5 | 0 (Auto-detect) |
| CO 05 | Highest master | 0…127 | 127 |
| CO 06 | Device object ID1 000000xx | 0…99 | 03 |
| CO 07 | Device object ID2 0000xx00 | 0…99 | 43 |
| CO 08 | Device object ID3 00xx0000 | 0…99 | 19 |
| CO 09 | Device object ID4 0x000000 | 0…4 | 4 |
| CO 10 | Send I-am at boot | 1, 0 (ON, OFF) | 1 ON |
| CO 11 | Not used | 0…255 | 255 |
| CO 12 | Not used | 0…255 | 255 |
| CO 13 | Not used | 0…255 | 255 |
| CO 14 | Not used | 0…255 | 255 |
| CO 15 | Auto increment[2] and auto-build[3] of "device object name" flags:  0 = Auto-increment and auto-build of device object name disabled  1 = Auto-increment is enabled, auto-build of device object name disabled  2 = Auto-increment disabled, auto-build of device object name enabled  3 = Auto-increment and auto-build of device object name enabled | 0…3 | 2 |

[1] **"Auto-detect baud rate"-mode**
When this option is selected, the AEC-BAC will detect the baud rate of the RS485 network. The AEX-BAC will stay in baud rate detection mode until it successfully decodes a package sent with a baud rate which is supported by the AEX-BAC. The baud rate detection mode will be entered once at hardware start-up and after a prolonged communication failure.

[2] **"Auto-increment"-function**
When this function is enabled and an automatic AEC-PM1 parameter load is executed at power up of the controller, the following variables will be incremented and written back to the AEC-PM1 unit:
- CO 03 Communication address. This is incremented only if the value is not already 127 with respect to CO 05 - the address of the highest master. If CO 05 is equal or less than the newly incremented value of CO 03, then CO 05 is written to be 127 (the maximum value of CO 05 possible).
- CO 06…CO 09 Device object ID. This is incremented only if the value is not already "4194304".

[3] **"Auto-build of device object name"-function**
The BACnet standard requires that each BACnet endpoint has a unique name on the network (device object name). The initial name of the AEX-BAC module is "AEX-BAC" equal for all devices. This means that device object names need to be edited manually.
Using the auto-build-function the device object name can be automatically assembled using the label AEX-BAC followed by the contents of CO 06…CO 09 (the device object ID). For example AEX-BAC-01050001.
If one writes the device object name manually through BACnet, the auto-build function will automatically be disabled (CO 15 set to 0 or 1).
In this case, the auto increment function will not have an effect on the device object name, only on the device object ID.

## Product documentation

Download the latest product documentation including description of objects as well as dynamic and static values online:
English international: www.vectorcontrols.com/download/AEX/70-00-0218_AEX-BAC_V1-2.pdf
English US: www.vectorcontrols.com/download/AEX/70-07-0218_AEX-BAC_V1-2.pdf
Deutsch: www.vectorcontrols.com/download/AEX/70-01-0218_AEX-BAC_V1-2.pdf
Français: www.vectorcontrols.com/download/AEX/70-02-0218_AEX-BAC_V1-2.pdf