**VECTOR**



# Universal Programmable Controller TCX2

The TCX2 is a programmable universal controller with communication capabilities. Each control loop may use 2 PI sequences and 6 binary stages. The TCX2 uses the universal X2 operating system. Serial communication options are realized with Modbus RTU/ASCII and BACnet MS/TP. There is also a Wi-Fi and an Ethernet communication option which supports Modbus TCP and BACnet IP. An embedded webserver provides a web interface to operate the controller or change the connection settings. Complete parameter sets may be copied by use of an accessory called AEC-PM1 or exchanged with a PC using an RS485-USB converter, Wi-Fi or Ethernet communication and the EasySet program.

## Functions

- 4 universally configurable control loops:
  - Functions for dehumidifying, set point shift and cascade control
  - Multiple auxiliary functions: heat-cool auto changeover, automatic enable, set point compensation
  - Free heating and cooling with economizer function based on enthalpy or temperature
  - Differential, averaging, min and max functions, enthalpy and dew point calculations
  - Transmitter function for inputs and set points
- 8 selectable universal inputs (VDC, mA, NTC)
- 3 universal analog outputs (VDC, mA) and 6 relays with each a normally open contact (SPST)
- 8 freely assigned alarm conditions, selectable state of outputs on alarm condition
- Power cap protected real-time clock with 48hr power backup
- 7-day programmable schedules, with options including change of set points and direct position of manual outputs
- Password protected programmable user and control parameters
- Peer to peer communication to optional X2 operation terminal OPxx-VC
- Communication over Modbus, BACnet, Ethernet or Wi-Fi (optional interface required)
- Webserver that supports TCX2 operation trough mobile devices or EasySet IP access (Ethernet or Wi-Fi interface required)

## Types and Ordering

| Product Name | Product No. | Loop | UI | DO | AO | Functions |
|---|---|---|---|---|---|---|
| TCX2-40863 | 40-110032 | | | | | |
| TCX2-40863-OP | 40-110036 | | | | | |
| TCX2-40863-MOD | 40-110077 | | | | | |
| TCX2-40863-OP-MOD | 40-110078 | | | | | = Standalone |
| TCX2-40863-BAC | 40-110079 | | | | | OP = With display |
| TCX2-40863-OP-BAC | 40-110080 | | | | | MOD = Communication with Modbus RTU or ASCII |
| TCX2-40863-WEM | 40-110117 | 4 | 8 | 6 Relays | 3 | BAC = Communication with BACnet MS/TP |
| TCX2-40863-OP-WEM | 40-110133 | | | | | WEM = Com. with Modbus TCP over Wi-Fi with ext. antenna |
| TCX2-40863-ETM | 40-110118 | | | | | WEB = Com. with BACnet IP over Wi-Fi with ext. antenna |
| TCX2-40863-OP-ETM | 40-110134 | | | | | ETM = Communication with Modbus TCP over Ethernet plug |
| TCX2-40863-WEB | 40-110126 | | | | | ETB = Communication with BACnet IP over Ethernet plug |
| TCX2-40863-OP-WEB | 40-110135 | | | | | |
| TCX2-40863-ETB | 40-110127 | | | | | |
| TCX2-40863-OP-ETB | 40-110136 | | | | | |

UI = Universal inputs, DO = Digital outputs, AO = Analog outputs

## Accessories

| Product Name | Product No. | Description |
|---|---|---|
| *Communication* | | |
| AEX-MOD | 40-500013 | Modbus RTU or ASCII communication |
| AEX-BAC | 40-500044 | BACnet MS/TP communication |
| AEC-SMA-01 | 40-500146 | Antenna cable kit for external mounting of the Wi-Fi antenna (cable length 1 m) |
| AEC-USB-01 | 40-500046 | USB to RS-485 converter cable kit used for EasySet tool. Not needed for -WIM or -WIB type |
| *Input Extension* | | |
| AEI-4UI | 40-500138 | Accessory for additional 4 universal inputs on a X2 device |
| *Mounting* | | |
| AMM-1 | 40-510022 | Mounting kit for panel mounting of the TCX2 |
| *Memory* | | |
| AEC-PM1 | 40-500016 | Plug-In memory module for saving and fast copying of parameter sets |
| *External Operation Terminal* | | |
| OPT1-xx | 40-50xxxx | A large range of external operation terminals may be found on our website www.vectorcontrols.com. |
| OPA2-xx | 40-50xxxx | All -VC type operation terminals work with this controller. |

## Safety

> **DANGER! Safety advice**
> This device is for use as an operating controller. It is not a safety device. Where a device failure could endanger human life and property, it is the responsibility of the client, installer and system designer to add additional safety devices to prevent such a device failure. Ignoring specifications and local regulations may cause equipment damage and endangers life and property. Tampering with the device and misapplication will void warranty.

# VECTOR

## Technical specifications

| | | |
|---|---|---|
| **Power supply** | Operating voltage | 24 VAC ±10%, 50/60 Hz, 15…34 VDC |
| | Power consumption | Max. 10 VA |
| | Safety extra-low voltage (SELV) | HD 384, class II |
| | Clock backup | Min. 48 hours |
| **Signal inputs** | Universal input<br>Input signal<br>Resolution<br>Impedance | Input jumper set for voltage or current<br>0…10 VDC or 0…20 mA<br>9.76 mV or 0.019 mA (10 bit)<br>Voltage: 98kΩ      Current: 250Ω |
| | Passive input<br>Type:<br>Range | Input jumper set to temperature (RT) or digital input (DI)<br>NTC (Sxx-Tn10) 10kΩ@25°C<br>-40…100 °C (-40…212 °F) |
| **Signal outputs** | Analog outputs:    Output signal<br>Resolution<br>Maximum load | 0…10 VDC or 0…20 mA<br>9.76 mV or 0.019 mA (10 bit)<br>Voltage: ≥1kΩ, Current: ≤250Ω |
| | Relay outputs:    AC Voltage<br>(SPST NO)         DC Voltage | 0…250 VAC, full-load current 3A, locked-rotor 18A<br>0…30 VDC, full-load current 3A, locked-rotor 18A |
| | Insulation strength between relays<br>contacts and system electronics:<br>between neighboring contacts: | 4000 VAC to EN 60 730-1<br>1250 VAC to EN 60 730-1 |
| **Electrical connections** | Connector type | Removable connectors, wire 0.34…2.5 mm² (AWG 24…12) |
| | Remote terminal | RS485 in accordance with EIA/TIA 485, Shielded twisted pair cable |
| **Environment** | Operation<br>Climatic conditions<br>Temperature<br>Humidity | To IEC 721-3-3<br>class 3K5<br>0…50 °C (32…122 °F)<br><85 % RH non-condensing |
| | Transport & storage<br>Climatic conditions<br>Temperature<br>Humidity<br>Mechanical conditions | To IEC 721-3-2 and IEC 721-3-1<br>class 3K3 and class 1K3<br>-25…70 °C (-13…158 °F)<br><95 % RH non-condensing<br>class 2M2 |
| **Standards** | Electromagnetic compatibility for<br>industrial and domestic sector | Emissions: EN 60 730-1<br>Immunity: EN 60 730-1 |
| | Degree of protection | IP30 to EN 60 529 |
| | Pollution class | II (EN 60 730-1) |
| | Safety class: Local regulations must<br>be observed! | III (IEC 60536) if SELV is connected to DO<br>II (IEC 60536) if line voltage is connected to DO. |
| | Overvoltage category | III (EN 60 730-1) |
| | Product standards:<br>Temperature- indicating<br>and -regulating equipment<br>Mark: c(ETL)us | UL 873<br>CSA C22.2 No. 24<br>Certified by Intertek: 4005917 |
| **General** | Material | Fire proof ABS plastic (UL94 class V-0) |
| | Dimensions (H x W x D) | 56 x 147 x 115 mm (2.3 x 5.8 x 4.5 in) |
| | Weight (including package) | TCX2-40863:      430g (15.2 oz)<br>TCX2-40863-OP: 490g (17.3 oz) |

## Technical specification for serial communication -MOD and -BAC types

| Network | Hardware interface | RS485 in accordance with EIA/TIA 485 |
|---|---|---|
| | Max nodes per network | 128 |
| | Max nodes per segment | 64 (Vector devices only) |
| | Conductors | Shielded Twisted Pair (STP) cable |
| | Impedance | 100 - 130 ohm |
| | Nominal capacitance | 100 pF/m 16 pF/ft. or lower |
| | Galvanic isolation | The communication circuitry is isolated |
| | Line termination | A line termination resistance (120 ohm) shall be connected between the terminals (+) and (-) of the furthermost node of the network |
| | Network topology | Daisy chain according EIA/TIA 485 specifications |
| | Recommended maximum length per chain | 1200 m (4000 ft.) |
| **Modbus (-MOD)** | Communication standard | Modbus (www.modbus.org) |
| | Default setting | 19200 baud rate, RTU 8 data bits, 1 even parity bit, 1 stop bit |
| | Communication speed | 4800, 9600, 19200, 38400 |
| | Protocol: Data bits Parity – stop bit | RTU - 8 data bits, ASCII – 7 data bits, no parity – 2 stops, even or odd parity – 1 stop |
| **BACnet (-BAC)** | Communication standard | BACnet MS/TP over RS485 BTL tested and listed B-ASC |
| | Communication speed | 9600, 19200, 38400, 57600, 76800, 115200 |

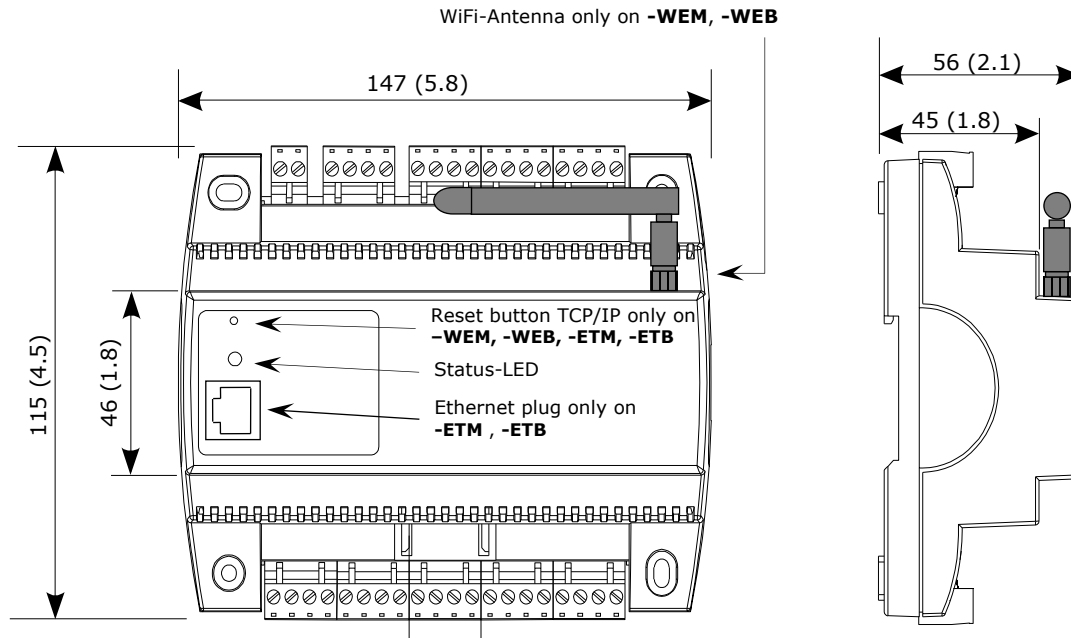## Technical specification for TCP/IP communication -WEM, -WEP, -ETM and -ETB types

| Wi-Fi | | Wi-Fi Alliance FCC/CE-RED/IC/TELEC/KCC/SRRC/NCC |
|---|---|---|
| | Standards | 802.11 b/g/n (802.11n up to 150 Mbps) A-MPDU and A-MSDU aggregation and 0.4 µs guard interval support |
| | Frequency range | 2.4 GHz ~ 2.5 GHz |
| | Antenna | External |
| **Ethernet** | Compliant with | IEEE802.3/802.3u (Fast Ethernet) ISO 802-3/IEEE 802.3 (10BASE-T) |
| | Speed | 10/100 BASE-T (10Mbit/s, 100Mbit/s) |
| **Modbus TCP (-WEM) (-ETM)** | Standard | IEC 61158 |
| | Communication protocol | Modbus TCP (www.modbus.org) |
| | Transport Layer | TCP/IP |
| | TCP/IP Port | 502 |
| **BACnet/IP (-WEB) (-ETB)** | Communication standard | BACnet/IP BTL tested and listed B-ASC |
| | Transport Layer | UDP |
| | UDP Port | 47808 |

## Product testing and certification

CE | Declaration of conformity | Information on the conformity of our products can be found on our website www.vectorcontrols.com on the corresponding product page under "Downloads".

## Dimensions, mm (inch)

WiFi-Antenna only on **-WEM**, **-WEB**



147 (5.8)

115 (4.5)

46 (1.8)

Reset button TCP/IP only on
**–WEM, -WEB, -ETM, -ETB**

Status-LED

Ethernet plug only on
**-ETM , -ETB**

56 (2.1)

45 (1.8)

# Mounting and Installation

## Mounting location

- In a cabinet on a flat surface
- In a cabinet on a top-hat rail
- In a panel (cabinet door) with the optional panel mounting kit
- The following mounting locations should be avoided:
  - For the types with wireless transmission (-WEM or -WEB), avoid locations that interfere with the radio signals, e.g. metal boxes or devices that generate electrical interferences.

## Mounting instructions

See the TXC2-40863 installation sheet, document no. 70-00-0599 or 70-00-0884 ([www.vectorcontrols.com](http://www.vectorcontrols.com)).

## Selection of sensors and actuators

▲ **Temperature sensors**

Use Vector Controls NTC sensors to achieve maximum accuracy: SDB-Tn10-20 (duct), SRA-Tn10 (room), SDB-Tn10-20 + AMI-S10 as immersion sensor.
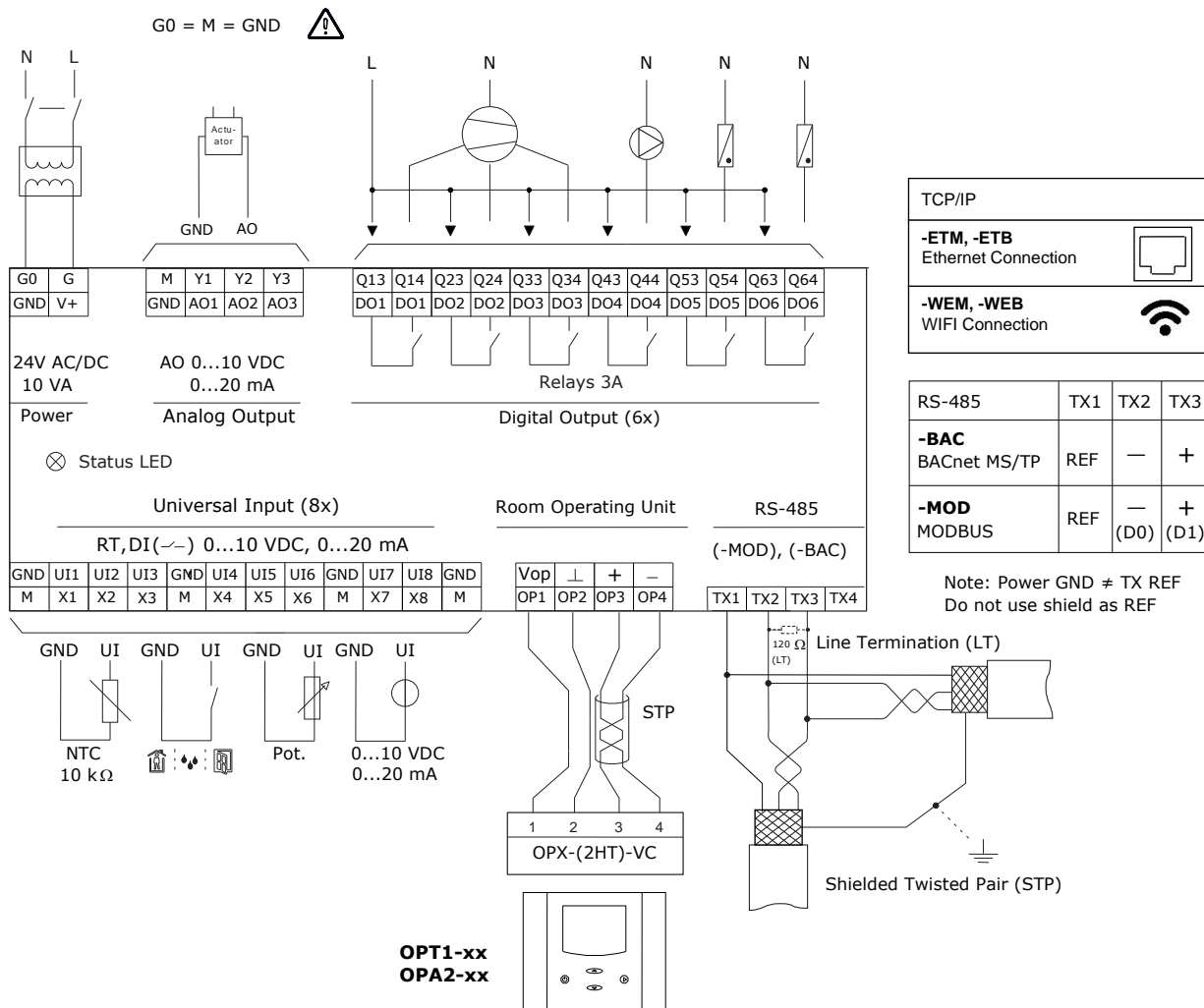
▲ **Actuators**

Choose modulating actuators with an input signal type of 0/2-10 VDC or 4-20 mA (min. and max. signal limitations may be set with parameters).
3-point actuators with constant running time are recommended.

**Binary auxiliary devices** (e.g. pumps, fans, on/off valves, humidifiers, etc.)
Do not directly connect devices that exceed specified limits in technical specifications – observe start up current on inductive loads.

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## Connection diagram



### TCP/IP

| | |
|---|---|
| **-ETM, -ETB** Ethernet Connection | |
| **-WEM, -WEB** WIFI Connection | |

| RS-485 | TX1 | TX2 | TX3 |
|---|---|---|---|
| **-BAC** BACnet MS/TP | REF | — | + |
| **-MOD** MODBUS | REF | — (D0) | + (D1) |

Note: Power GND ≠ TX REF
Do not use shield as REF

## Configuration of in- and outputs

The inputs and outputs are configured with jumpers. Jumpers are located underneath the controller.
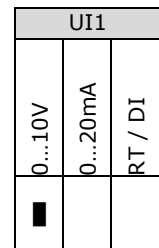
**AO: Selection of analog output type**

Left position:
voltage output (0... 10 V)
*factory default*

Right position:
current output (0... 20 mA)

| AO1 | |
|---|---|
| 0...10V | 0...20mA |

**UI: Selection of universal input type**

Left position:
voltage output (0... 10 V)
*factory default*

Middle position: current input (0... 20 mA)

Right position: RT or dry contact

| UI1 | | |
|---|---|---|
| 0...10V | 0...20mA | RT / DI |

See the TXC2-40863 installation sheet, document no. 70-00-0599 or 70-00-0884 ([www.vectorcontrols.com](http://www.vectorcontrols.com)).

## Status-LED

The TCX2 has a status-LED which is located on the upper left side of the controller housing.
The location of the LED is described in the installation sheet. The function of the LED is explained in the X2 Operations Manual.

## Rest button TCP/IP (-WEM, -WEB, -ETM, -ETB only)

The TCP/IP configuration setting of the TCX2 can be reset by pressing the reset button with a 1 mm pin through the small hole located next to the Status-LED. The function of the TCP/IP reset is explained in the X2 Wi-Fi / Ethernet Configuration Manual.

# Operation and Configuration

### ▲ Documentation

This controller uses the latest generation X2 operating system. Detailed operation instructions for all devices equipped with this operating system can be found on our website.

Also available are programming instructions for technicians and an application database.

### ▲ Configuration

(i) **The device can be fully configured and commissioned using the EasySet program.**
EasySet may be downloaded free of charge from our website www.vectorcontrols.com.

## Documentation overview

| Document Type | Document No. | Description |
|---|---|---|
| TCX2-40863 Data Sheet | 70-07-0174 | Product data sheet (this document) |
| TCX2-40863 Install Sheet | 70-00-0599 | Mounting and installation manual -OP, -MOD, -BAC |
| TCX2-40863 Install Sheet TCP/IP | 70-00-0884 | Mounting and installation manual -WEM, -WEB, -ETM, -ETB |
| X2 Operations Manual button display | 70-07-0950 | Operations instructions of X2 system with button display |
| X2 Web Interface operation manual | 70-07-0952 | Operations instructions of X2 Web interface |
| X2 Engineering Manual | 70-07-0737 | Guidelines for configuring the X2 system |
| X2 Modbus Communication Module (-MOD type) | 70-07-0290 | Setup and configuration manual Modbus (no Modbus TCP) |
| X2 Modbus Communication Module (-WEM, -ETM type) | 70-07-0925 | Setup and configuration manual Modbus TCP |
| X2 BACnet Communication Module (-BAC type) | 70-07-0218 | Setup and configuration manual BACnet (no BACnet/IP) |
| X2 BACnet/IP Communication Module (-WEB, -ETB type) | 70-07-0899 | Setup and configuration manual BACnet/IP |
| X2 Wi-Fi / Ethernet Communication Manual (-WEM, -WEB, -ETM, -ETB type) | 70-07-0900 | Setup and configuration manual TCP/IP |

Note: The above list is not complete. The documents on the website are relevant.

# BACnet Protocol Implementation Conformance Statement (PICS)

## BACnet MS/TP network

ⓘ The following is only valid for products with the **-BAC** type option.

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) is 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 synchronisation - B |
| DM-RD-B | Device management | Reinitialize device - B |

▲ **Supported standard BACnet application services**

- ReadProperty
- ReadPropertyMultiple
- WriteProperty
- DeviceCommunication (password protected)
- I-Am
- I-Have
- TimeSynchronisation
- UTCTimeSynchronisation
- ReinitializeDevice ("cold" or "warm") (password protected)

▲ **Supported standard Object types**

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

## BACnet/IP communication

ⓘ The following is only valid for products with the **-WEB**, **-ETB** type option.

Vendor Name: Vector Controls
Product Name: TCX2 Controls series
TCX2 product description: The X2 communicating BACnet/IP 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/IP 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) is 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 |
| DS-COV-B | Data sharing | Change of value - 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 synchronisation - B |
| DM-RD-B | Device management | Reinitialize device - B |

▲ **Supported standard BACnet application services**

- ReadProperty
- ReadPropertyMultiple
- WriteProperty
- ChangeOfValue
- DeviceCommunication (password protected)
- I-Am
- I-Have
- TimeSynchronisation
- UTCTimeSynchronisation
- ReinitializeDevice ("cold" or "warm") (password protected)

▲ **Supported standard Object types**

- Device
- Analog input
- Analog value
- Binary value
- Multi-state Value
- Network Port

# X2 Functional Scope

The controller has the following X2 functions and elements:

| Group | Modules | QTY | Description |
|-------|---------|-----|-------------|
| UP | - | - | User and display parameters |
| UI | 01U to 08U | 8 | Universal inputs, selectable with jumper: RT/DI, mA, VDC |
| | 09U to 12U | 4 | Virtual inputs for operation terminals, bus modules or special functions |
| AL | 1AL to 8AL | 8 | Alarm conditions |
| LP | 1L to 4L | 4 | Control loops |
| AO | 1A to 3A | 3 | Analog outputs, selectable with jumper: mA, VDC |
| FAN | 1F to 2F | 2 | Fan or lead lag modules, 1 to 3 fan speeds, up to 3 switching lead-lag stages each |
| DO | 1d to 6d | 6 | Binary outputs with a normally open (NO) relays contact |
| FU | 1FU | 1 | Remote Enable: Activation of the controller based on signal and alarm conditions |
| | 2FU | 1 | Change Operation Mode: Switching occupied and unoccupied with control signals |
| | 3FU | 1 | Heat/Cool Change: Switching heating and cooling based on a control signal |
| | 4FU | 1 | Setpoint Compensation: Summer/winter compensation of setpoint |
| | 5FU | 1 | Economizer (free heating or cooling due to the condition of outside and room air) |
| CO | - | - | Communication (if a communication module is available) |
| COPY | - | - | Copying complete parameter sets between run, default and external memory with up to 4 memory locations (AEC-PM1) |
| RTC | - | 1 | Real time clock module with 48-hour power back up (keeps clock running during power failure) |
| PRO | Pr01 to Pr12 | 12 | Time schedule programs for 7 days or annual switching events |

More detailed information on the X2 functions can be found in the "X2 Engineering Manual" on our website www.vectorcontrols.com.

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