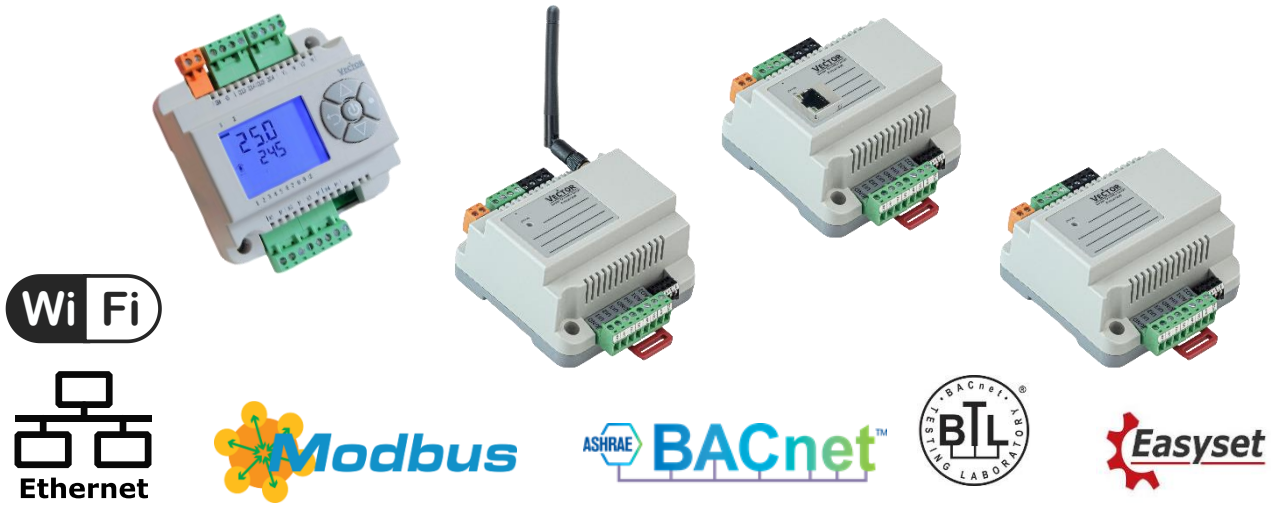


Universal Programmable Controller TCI2

The TCI2 is a programmable universal controller with communication capabilities. Each control loop may use 2 PI sequences and 2 binary stages. The TCI2 comes with a built-in RS485 communication interface that allows peer-to-peer communication with an operation terminal such as OPA2-(2TH)-VC. The TCI2 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 Ethernet communication option available which supports Modbus TCP and BACnet IP. An embedded webserver provides a web interface to access the controller in order to change the connection settings and to operate the controller.
Complete parameter sets may be copied by use of an accessory called AEC-PM2 or exchanged with a PC using an RS485-USB converter, Wi-Fi or Ethernet communication and the EasySet program.

Functions

- Two 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
- 4 selectable universal inputs (VDC, mA, NTC, Pt1000) and 2 analog outputs (VDC, mA)
- 2 relays with each a normally open contact (SPST NO)
- 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 TCI2 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	COM	Functions
TCI2-222.200	40-110125	2	2 NTC+2 VDC	2	0	Stand alone	24 V low cost
TCI2-204.202UC-OP	40-110115	2	4	2	2	Stand alone	24 V with display
TCI2-204.202UC-OP-L	40-110114	2	4	2	2	Stand alone	100 – 250 VAC with display
TCI2-204.202UC-MOD	40-110107	2	4	2	2	Modbus RTU/ASCII	24 V, RS485
TCI2-204.202UC-OP-MOD	40-110109	2	4	2	2	Modbus RTU/ASCII	24 V. RS485 with Display
TCI2-204.202UC-OP-MOD-L	40-110110	2	4	2	2	Modbus RTU/ASCII	100 – 250 VAC, RS485 with display
TCI2-204.202UC-BAC	40-110111	2	4	2	2	BACnet MS/TP	24 V. RS485
TCI2-204.202UC-OP-BAC	40-110113	2	4	2	2	BACnet MS/TP	24 V, RS485 with display
TCI2-204.202UC-WEM	40-110123	2	4	2	2	Modbus TCP	24 V, TCP/IP - WI-FI
TCI2-204.202UC-WEM-L	40-110122	2	4	2	2	Modbus TCP	100 - 250 VAC, TCP/IP - WI-FI
TCI2-204.202UC-ETM	40-110124	2	4	2	2	Modbus TCP	24 V, TCP/IP - Ethernet
TCI2-204.202UC-WEB	40-110131	2	4	2	2	BACnet IP	24 V, TCP/IP - WI-FI
TCI2-204.202UC-WEB-L	40-110130	2	4	2	2	BACnet IP	100 - 250 VAC, TCP/IP - WI-FI
TCI2-204.202UC-ETB	40-110132	2	4	2	2	BACnet IP	24 V, TCP/IP - Ethernet

UI = Universal input, DO = Digital output, AO = Analog output, COM = Communication

Accessories

Product Name	Product No.	Description
Communication		
AEX2-MOD	40-500105	Modbus RTU or ASCII communication
AEX2-BAC	40-500106	BACnet MS/TP communication
AEC-SMA-01	40-500146	Antenna cable kit for external mounting of the Wi-Fi antenna (cable length 1 m)
Mounting		
AMM-2	40-510023	Mounting kit for panel mounting of the TCI2
Memory		
AEC-PM2	40-500103	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. All -VC type operation terminals work with this controller.
OPA2-xx	40-50xxxx	

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.

Technical specifications

Power supply	Operating voltage	TCI2-204.202U	24 VAC ±10%, 50/60 Hz, 12…34 VDC
	Safety extra-low voltage (SELV)		HD 384, Class II
	Operating voltage	TCI2-204.202U-L	85…264 VAC, 50/60 Hz, 120…370 VDC
	Power consumption		Max. 3 VA
	Clock backup		Min. 48 hours
Signal inputs	Universal input Input signal Resolution Impedance		Input jumper set for voltage or current 0…10 VDC or 0…20 mA 9.76 mV or 0.019 mA (10 bit) Voltage: 74.8kΩ, Current: 158Ω Input jumper set to temperature (RT) or digital input (DI)
	Passive input Type & range:		NTC (Sxx-Tn10) 10kΩ@25°C: -40…100 °C (-40…212 °F) PT1000 (Sxx-Tp2): -50…205 °C (-58…401 °F) NI1000 (Sxx-Tk5): -50…180 °C (-58…356 °F)
Signal outputs	Analog outputs:	Output signal Resolution Maximum load	0...10 VDC or 0…20 mA 9.76 mV or 0.019 mA (10 bit) Voltage: ≥1kΩ Current: ≤250Ω
	Relay outputs: (SPST NO) Insulation strength between relays contacts and system electronics: between neighboring contacts:	AC Voltage DC Voltage	0…250 VAC, full-load current 3A, locked-rotor 18A. 0…30 VDC, full-load current 3A, locked-rotor 18A. 4000 VAC to EN 60 730-1 1250 VAC to EN 60 730-1
Electrical connections	Connector type		Screw terminal connectors for wire 0.34…2.5 mm2 (AWG 22…12)
	Remote terminal		RS485 in accordance with EIA/TIA 485, Shielded twisted pair cable
Environment	Operation Climatic conditions Temperature Humidity		To IEC 721-3-3 class 3K5 0…50 °C (32…122 °F) <85 % RH non-condensing
	Transport & storage Climatic conditions Temperature Humidity Mechanical conditions		To IEC 721-3-2 and IEC 721-3-1 class 3K3 and class 1K3 -25…70 °C (-13…158 °F) <95 % RH non-condensing class 2M2
Standards	Degree of protection		IP30 to EN 60 529
	Pollution class		II (EN 60 730-1)
	Safety class:	TCI2-202.202U TCI2-204.202U-L	III (IEC 60536) if SELV is connected to DO, else II II (IEC 60536)
	Overvoltage category		III (EN 60 730-1)

General	Material	Fire proof ABS plastic (UL94 class V-0)
	Dimensions (H x W x D)	57 x 93 x 115 mm (2.4 x 3.7 x 4.5) inch
	Weight (including package) TCI2 (24V) without display / with display TCI2 (230V without display / with display	 245g (8.6oz) / 290g (10.2oz) 275g (9.7oz) / 320g (11.3oz)

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

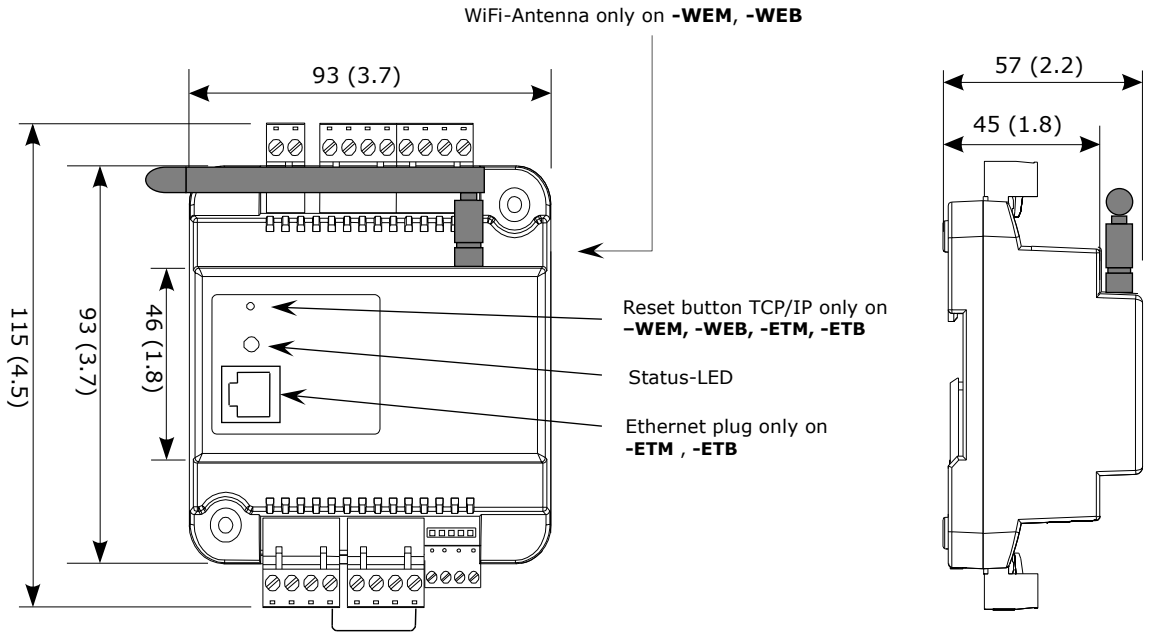
Technical specification for TCP/IP communication -WEM, WEB, -ETM and -ETB types

Wi-Fi	Standards	Wi-Fi Alliance FCC/CE-RED/IC/TELEC/KCC/SRRC/NCC 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)



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 TCI2 installation sheet, document no. 70-000688 or 70-000893 (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.

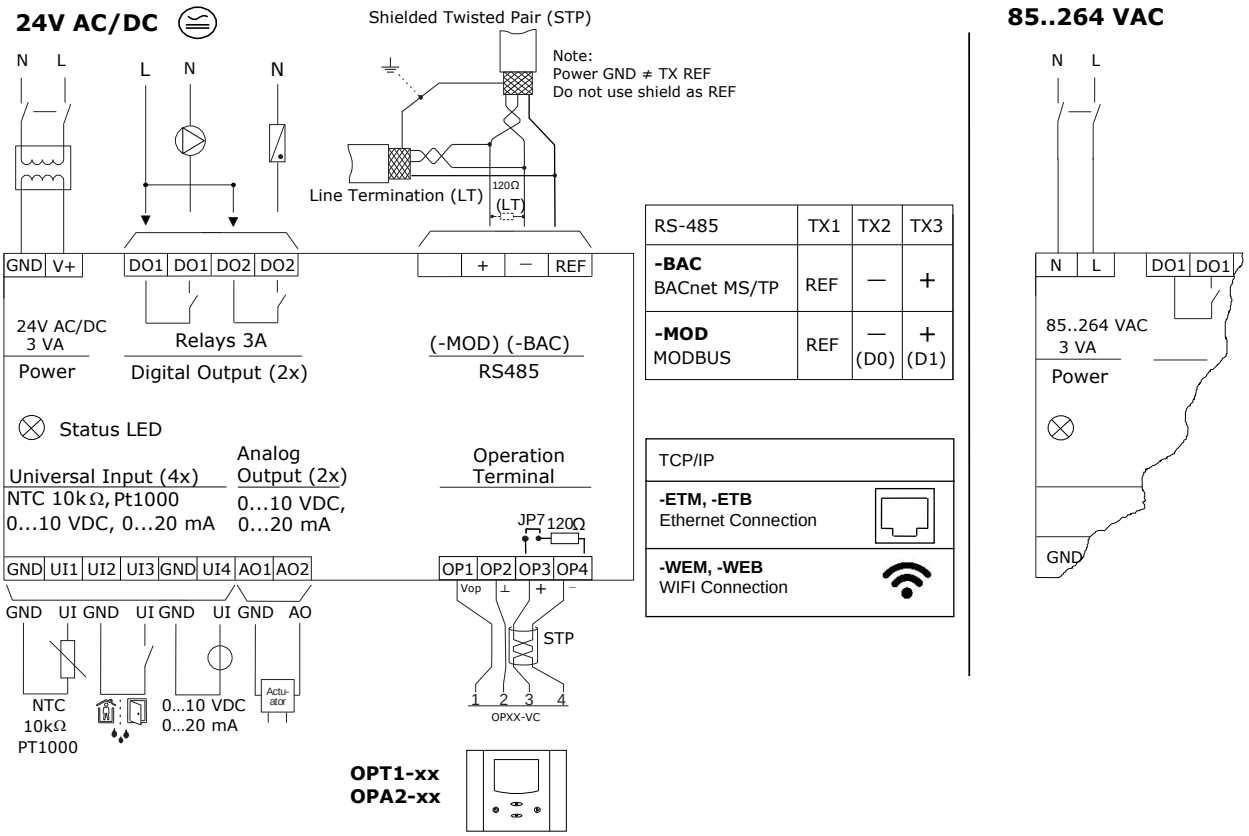
▲ **Actuators**

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

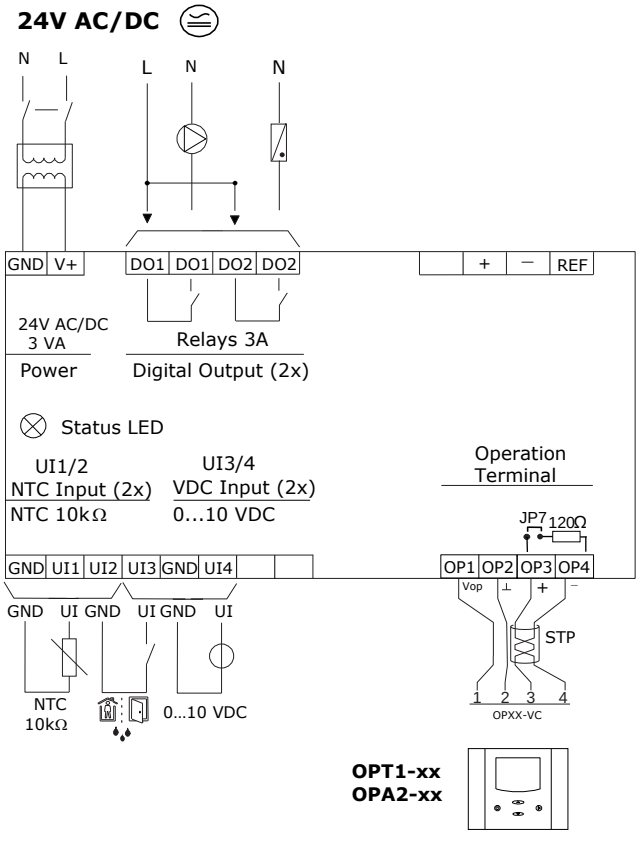
Binary auxiliary devices (e.g. pumps, fans, on/off valves, humidifiers, etc.)
Do not directly connect devices that exceed specified limits in technical specifications – observe start up current on inductive loads.

Connection diagram

Type: TCI2-204.202



Type: TCI2-222.200



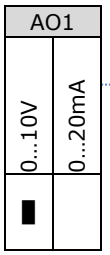
Configuration of in- and outputs

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)

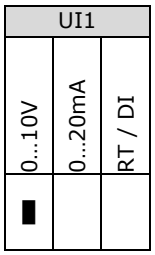


UI: Selection of universal input type

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

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

Right position: RT or dry contact



See the TCI2 installation sheet, document no. 70-000688 or 70-000893 (www.vectorcontrols.com).

Status-LED

The TCI2 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 TCI2 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

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
TCI2 Data Sheet	70-000174	Product data sheet (this document)
TCI2 Install Sheet	70-000688	Mounting and installation manual -OP, -MOD, -BAC
TCI2 Install Sheet TCP/IP	70-000893	Mounting and installation manual -WEM, -WEB, -ETM, -ETB
X2 Operations Manual button display	70-00-0950	Operations instructions of X2 system with button display
X2 Web Interface operation manual	70-00-0952	Operations instructions of X2 Web interface
X2 Engineering Manual	70-00-0737	Guidelines for configuring the X2 system
X2 Modbus Communication Module (-MOD type)	70-00-0290	Setup and configuration manual Modbus (no Modbus TCP)
X2 Modbus Communication Module (-WEM, -ETM type)	70-00-0925	Setup and configuration manual Modbus TCP
X2 BACnet Communication Module (-BAC type)	70-00-0218	Setup and configuration manual BACnet (no BACnet/IP)
X2 BACnet/IP Communication Module (-WEB, -ETB type)	70-00-0899	Setup and configuration manual BACnet/IP
X2 Wi-Fi / Ethernet Communication Manual (-WEM, -WEB, -ETM, -ETB type)	70-00-0900	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: TCI2 Controls series
TCI2 product description: The TCI2 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: TCI2 Controls series
TCI2 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

BIBB	Type	Name
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 04U	4	Universal inputs, selectable with jumper: RT/DI, mA, VDC
	05U to 08U	4	Virtual inputs for operation terminals, bus modules or special functions
AL	1AL to 8AL	8	Alarm conditions
LP	1L to 2L	2	Control loops
AO	1A to 2A	2	Analog outputs, selectable with jumper: mA, VDC
FAN	1F	1	Fan or lead lag modules, 1 to 3 fan speeds, up to 3 switching lead-lag stages each
DO	1d to 2d	2	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-PM2)
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

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Smart Sensors and Controls Made Easy!

Quality - Innovation – Partnership

Vector Controls GmbH
Switzerland

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www.vectorcontrols.com