ASHRAE BACnet™

Universal Programmable Controller TCI2-BAC

The TCI2 is a programmable universal controller with BACnet® fieldbus connection. 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. Complete parameter sets may be copied by use of an accessory called AEC-PM2 or exchanged with a PC using an RS485-USB converter and the Easyset program. The TCI2 uses the universal X2 operating system.

Applications

- Refrigeration / air conditioning units
- Ventilators
- Humidifying / dehumidifying
- Pressure / pump systems
- and many more…

Functions

- BACnet® MS/TP-Communication via RS485
- BACnet® B-ASC device profile
- 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
- 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

Ordering

Model	Item	Loop	UI	DO	AO	Functions
TCI2-204.202UC-BAC	40-110111	2	4	2	2	Controller with BACnet® MS/TP communication
TCI2-204.202UC-OP-BAC	40-110113	2	4	2	2	Controller with display and BACnet® MS/TP communication
AEC-PM2	40-500130					Plug-In memory module
AEX2-MOD	40-500105					Modbus RTU or ASCII communication
AEX2-BAC	40-500106					BACnet® MS/TP communication
AMM-1	40-510022					Accessory for cabinet door mounting

A large range of remote operation terminals may be found on our website. All -VC operation terminals work with this controller.

Technical specifications

Important notice and safety advice

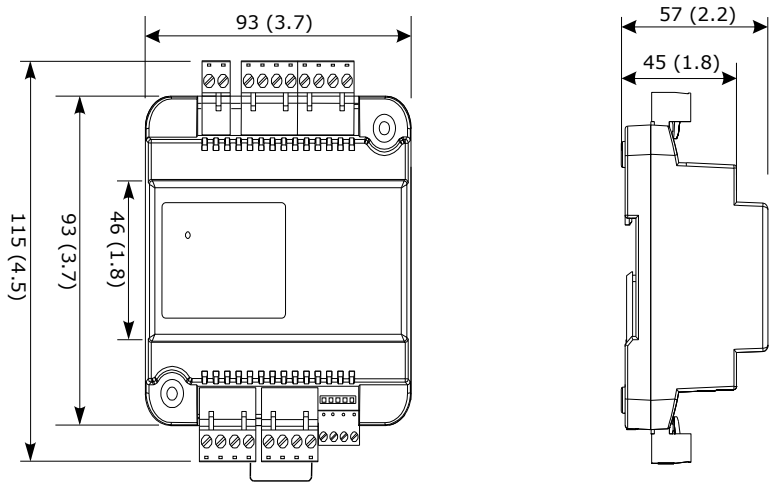
This device serves as a universal control device. It's not a safety device! If equipment failure endangers people's lives and/or property, it is the responsibility of the customer, installer and system integrator to add additional safety devices to prevent a system failure caused by such equipment failure. Failure to comply with specifications and local regulations may result in damage to equipment and endanger life and property. Tampering with the device and improper use will void the warranty.

Power supply	Power requirements	TCI2-204.202U	24 VAC ±10%, 50/60 Hz, 15..34 VDC, SELV to HD 384, Class II, 48 VA max
		TCI2-204.202U-L	85..264 VAC, 50/60 Hz, 120..370 VDC
	Power consumption		Max. 5 VA
	Electrical connection		Removable terminal connectors, wire 0.34…2.5 mm² (AWG 24…12)
	Clock backup		Min. 48 hours
Signal inputs	Universal input Input signal Resolution Impedance		Input jumper set for voltage or current 0...10 V or 0...20 mA 9.76 mV or 0.019 mA (10 bit) Voltage: 74.8kΩ Current: 158Ω
	Passive input Type & range:		Input jumper set to temperature (RT) or digital input (DI) NTC (Sxx-Tn10) 10kΩ, Type 2: -40…100 °C (-0…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	DC 0...10 V or 0...20 mA
		Resolution	9.76 mV or 0.019 mA (10 bit)
		Maximum load	Voltage: ≥1kΩ Current: ≤250Ω
	Relay outputs:	AC Voltage	0…250 VAC, full-load current 3A, locked-rotor 18A.
		DC Voltage	0…30 VDC, full-load current 3A, locked-rotor 18A.
	Insulation strength between relays contacts and system electronics:		4000V AC to EN 60 730-1
	between neighbouring contacts:		1250V AC to EN 60 730-1
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 16pF/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.)
BACnet™	Communication standard		BACnet™ MS/TP over RS485
	Communication speed		9600, 19200, 38400, 57600, 76800, 115200
Connection to remote terminal	Hardware interface		RS485 in accordance with EIA/TIA 485
	Cabling		Twisted pair cable category 5 or 6
Environment	Operation		To IEC 721-3-3
	Climatic conditions		class 3K5
	Temperature		0…50 °C (32…122 °F)
	Humidity		<85 % 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

Technical Specifications continued

Standards	CE conformity EMC directive Low voltage directive	2014/30/EU 2014/35/EU
	Product standards Automatic electrical controls for household and similar use Special requirement on temperature dependent controls	 EN 60 730 –1 EN 60 730 – 2 – 9
	Electromagnetic compatibility for industrial and domestic sector	Emissions: EN 60 730-1 Immunity: EN 60 730-1
	Degree of protection	IP00 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)

Dimensions, mm (inch)



Selection of actuators and sensors

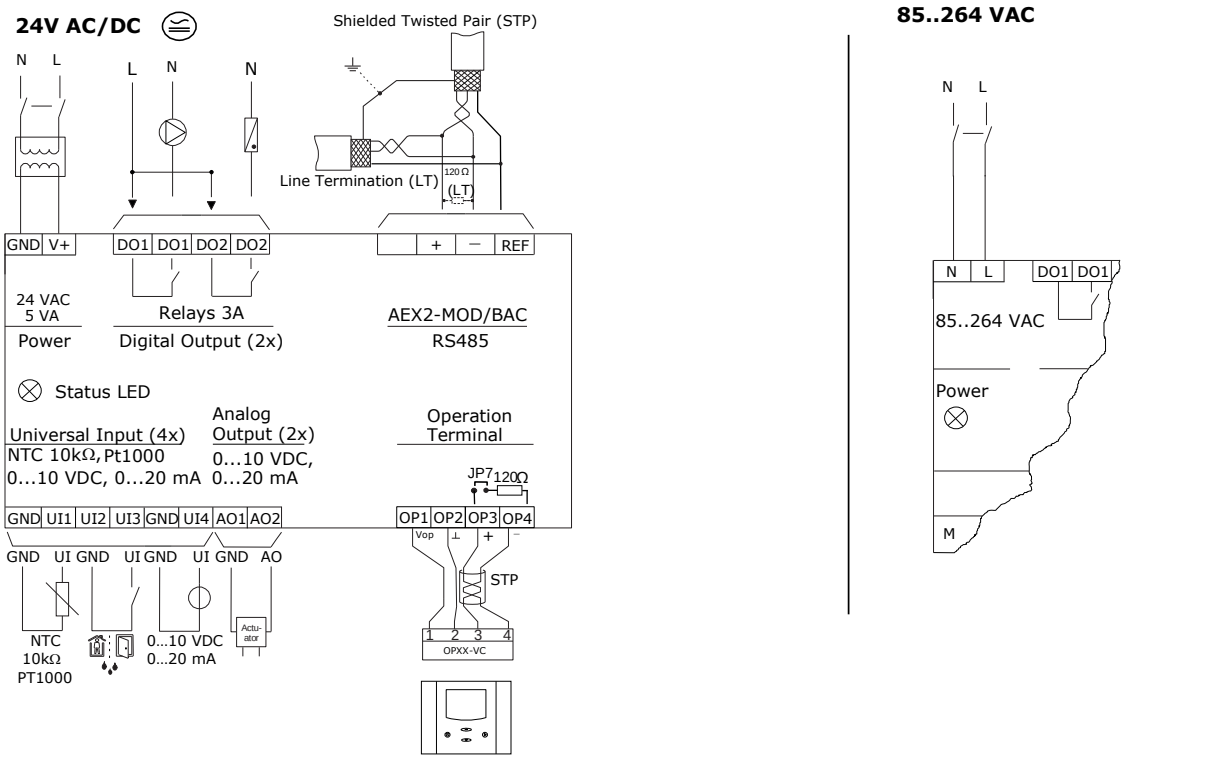
Temperature sensors
Use Vector Controls NTC sensors to achieve maximum accuracy: SDB-Tn10-20 (duct), SRA-Tn10 (room), SDB-Tn10-20 + AMI-S10 as immersion sensor.

Actuators
Choose modulating actuators with an input signal type of 0-10 V DC 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 startup current on inductive loads.

Connection diagram



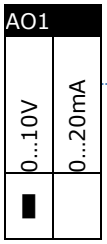
Configuration Jumpers

The inputs and outputs are configured with wire jumpers. These are located on the bottom of 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

LED-indicators

A status LED is located on the upper left side of the controller housing. During normal operation the LED blinks briefly once every 5 seconds. If there is an alarm or fault condition it will blink every second. On devices with OP the LED display is omitted.
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.

Installation

See installation sheet no:

- TCI2 70-000688 (www.vectorcontrols.com)

Wire type

An EIA-485 network shall use shielded, twisted-pair cable for data signalling with characteristic impedance between 100 and 130 ohms. Distributed capacitance between conductors shall be less than 100 pF per meter (30 pF per foot). Distributed capacitance between conductors and shield shall be less than 200 pF per meter (60 pF per foot). Foil or braided shields are acceptable.

Maximum length

The maximum recommended length per segment is 1200 meters (4000 feet) with AWG 18 (0.82 mm2 conductor area) cable.

TCI2-BAC Protocol Implementation Conformance Statement (PICS)

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. Needs a password which is “Vector” (case sensitive and without the quotes).
- I-Am
- I-Have
- TimeSynchronisation
- UTCTimeSynchronisation
- ReinitializeDevice (“cold” or “warm”). Needs a password which is “Vector” (case sensitive and without the quotes).

Supported standard Object types

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

Functional Scope

The controller has the following 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

Operation manual and configuration

This controller uses the latest generation X2 operating system. Detailed operating instructions for all devices equipped with this operating system can be downloaded here
http://www.vectorcontrols.com/products/x2
Also available are programming instructions for technicians and an application database.

The device can be fully configured using EasySet.
EasySet may be downloaded free of charge from www.vectorcontrols.com.

**Efficient use of energy -
for a better future**

Quality - Innovation - Partnership
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