VECTOR

Wall-mounted Controller and Sensor TRI2-FA

The TRI2 is a programmable controller and sensor with communication capabilities. Each control loop may use 2 PI sequences and 2 binary stages. The TRI2 uses the universal X2 operating system. Serial communication options are realized with Modbus RTU/ASCII and BACnet MS/TP over RS485. There is also a Wi-Fi communication option available 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-PM2 or exchanged with a PC using an RS485-USB converter or Wi-Fi communication, the EasySet program and the configuration adapter called AEC-TRI-2.

Applications

- Ventilation control
- Temperature control
- Zone control
- Air humidifier and dehumidifier

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
- Built in humidity and temperature sensors (-TH type) or temperature sensor (-T type)
- 2 passive inputs (NTC, open contact), 1 analog input (VDC) and 2 analog outputs (VDC)
- 2 relays with a normally open contact (SPST NO) to switch line voltage
- 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
- Measures temperature and humidity
- Communication over Modbus, BACnet or Wi-Fi (optional interface required)
- Webserver that supports TRI2 operation trough browser or mobile devices (Wi-Fi interface required)

Types and Ordering

Product Name	Product No.	Loop	UI	DO	AO	Functions
TRI2-FA-TH-221.202C	40-100223	2	3	2	2	
TRI2-FA-TH-221.202C-MOD	40-100224	2	3	2	2	
TRI2-FA-TH-221.202C-BAC	40-100225	2	3	2	2	T = Temperature sensor
TRI2-FA-TH-221.202C-WIM	40-100235	2	3	2	2	TH = Temperature- and humidity sensor
TRI2-FA-TH-221.202C-WIB	40-100253	2	3	2	2	MOD = Communication with Modbus RTU or ASCII
TRI2-FA-T-221.202C	40-100232	2	3	2	2	BAC = Communication with BACnet MS/TP
TRI2-FA-T-221.202C-MOD	40-100233	2	3	2	2	WIM = Communication with Modbus TCP over Wi-Fi
TRI2-FA-T-221.202C-BAC	40-100234	2	3	2	2	WIB = Communication with BACnet IP over Wi-Fi
TRI2-FA-T-221.202C-WIM	40-100241	2	3	2	2	
TRI2-FA-T-221.202C-WIB	40-100254	2	3	2	2	

Accessories

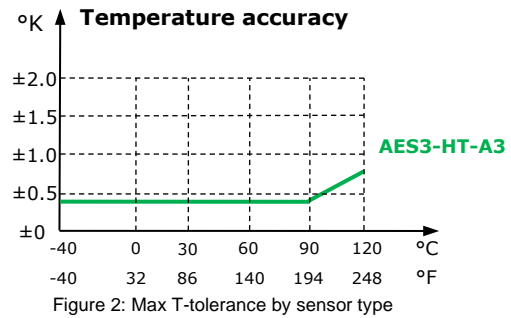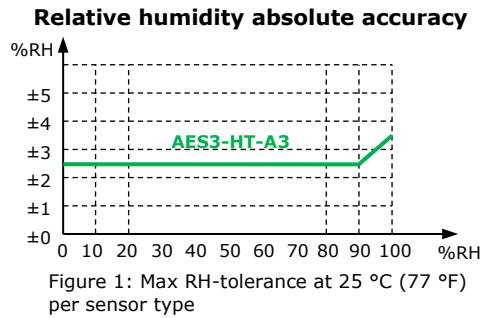| Product Name	Product No.	Description
AEC-PM2	40-500130	Plug-In memory module for fast copying of parameter sets
AEC-TRI-2	40-500154	Configuration adapter with cable
AEC-USB-01	40-500046	USB to RS-485 converter cable kit for EasySet tool (only for device without Wi-Fi)

Safety

⚠️ **DANGER! Safety advice**
This device is for use as an operating controller or sensor. 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	24 VAC ±10%, 50/60 Hz, 15…34 VDC
	Power consumption	Max. 10 VA
	Safety extra-low voltage (SELV)	HD 384, class II
Built in sensors (Type) -T -TH	Temperature sensor Range Measuring accuracy Repeatability	NTC (Tn10 B25/50: 3935, 10kΩ@25 °C) 0…50 °C (32…122 °F) 0.5 °C (1 °F) $\pm$ 0.1 °C, $\pm$ 0.2 °F
-TH	Humidity sensor Range Measuring accuracy Hysteresis Repeatability Stability	Capacity sensor element 0…100% RH See Figure 1 $\pm$ 1% $\pm$ 0.1% < 0.5% / year
	Temperature sensor Range Measuring accuracy Repeatability	Bandgap sensor 0…50 °C (32…122 °F) See Figure 2 $\pm$ 0.1°C ($\pm$ 0.2°F)
Signal inputs	Passive input Type Range	UI4 to UI5, Passive Temperature NTC or open contact NTC (Sxx-Tn10) 10kΩ@25 °C -40…100 °C (-40…212 °F)
	Analog input Type & range Resolution	UI6, in Voltage mode 0 – 10 VDC 9.76 mV (10 Bit)
Signal outputs	Analog output Output signal Resolution Maximum load	AO1 to AO2 0…10 VDC 9.76 mV ≥1kΩ
	Relay outputs: AC Voltage (SPST NO) DC Voltage	0…250 VAC, full-load current 1.2 A 0…30 VDC, full-load current 2 A
	Insulation strength between relays contacts and system electronics: between neighboring contacts:	 1500 VAC to EN 60 730-1 1000 VAC to EN 60 730-1
Electrical connections	Connector type	Screw terminal connectors for wire 0.34…1.3 mm2 (AWG 22…16)
	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 0…50 °C (32…122 °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	II (IEC 60536)
	Overvoltage category	II (EN 60 730-1)
General	Material	Flame retardant PC+ABS plastic (UL94 class V-0)
	Dimensions (L x W x H)	Front part: 88 x 88 x 14 mm (3.5 x 3.5 x 0.6 in) Power Case: 50 x 50 x 31 mm (2.0 x 2.0 x 1.2 in)
	Weight (including package)	184g (6.5 oz)

Humidity and Temperature Sensor

Relative humidity absolute accuracy

Figure 1: Max RH-tolerance at 25 °C (77 °F) per sensor type

Temperature accuracy

Figure 2: Max T-tolerance by sensor type

Note on accuracy: allow one hour after power up for compensation swing in

Temperature Compensation

The TRI2 has a built-in temperature compensation algorithm to compensate for the internal heat of the product electronics. The compensation value may vary depending on the installation and wall structure and it can be corrected in order to match the temperature and humidity.

Procedure:
1. Startup the device and wait > 90 minutes for the device to warm up and for the compensation algorithm to complete. Make sure the environment is stable (windows closed).
2. Use the parameter "xu06 of the temperature input (default SI1 → 1u06) for compensation. Example:
    1u06 = 10: The temperature reading will increase 1.0°C

ⓘ The humidity sensor does not need to be compensated because it is automatically adjusted based on the temperature calibration. Just make sure the temperature reading is accurate.

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 -WIM and -WIB 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	Internal
Modbus TCP (-WIM)	Standard	IEC 61158
	Communication protocol	Modbus TCP (www.modbus.org)
	Transport Layer	TCP/IP
	TCP/IP Port	502
BACnet/IP (-WIB)	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".

Dimension, mm (inch)
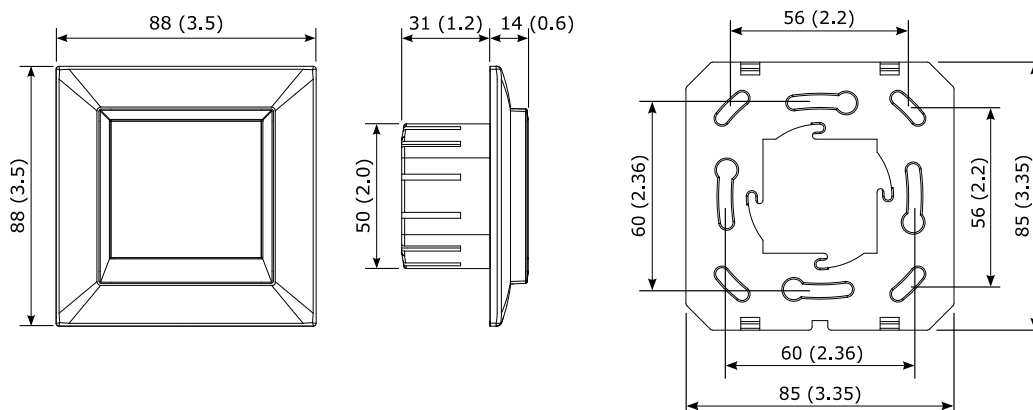
Mounting and Installation

Mounting location

- On a flat, easily accessible wall
- The following mounting locations should be avoided:
  - Protect from direct exposure to sunlight
  - Do not install near heat sources or other heat-generating devices
  - Areas with poor air circulation and niches
  - In the direct influence area of ventilation and fans
  - For the types with wireless transmission (-WIM or -WIB), avoid locations that interfere with the radio signals, e.g. metal boxes or devices that generate electrical interferences.

Mounting instructions

See the TRI2-FA installation sheet, document no. 70-00-0730 (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.
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

GND	V+	AO1	AO2	+	–	REF
1	2	3	4	5	6	7

8	9	10	11	12	13	14
UI4	UI5	UI6		DO1	DO2	DO
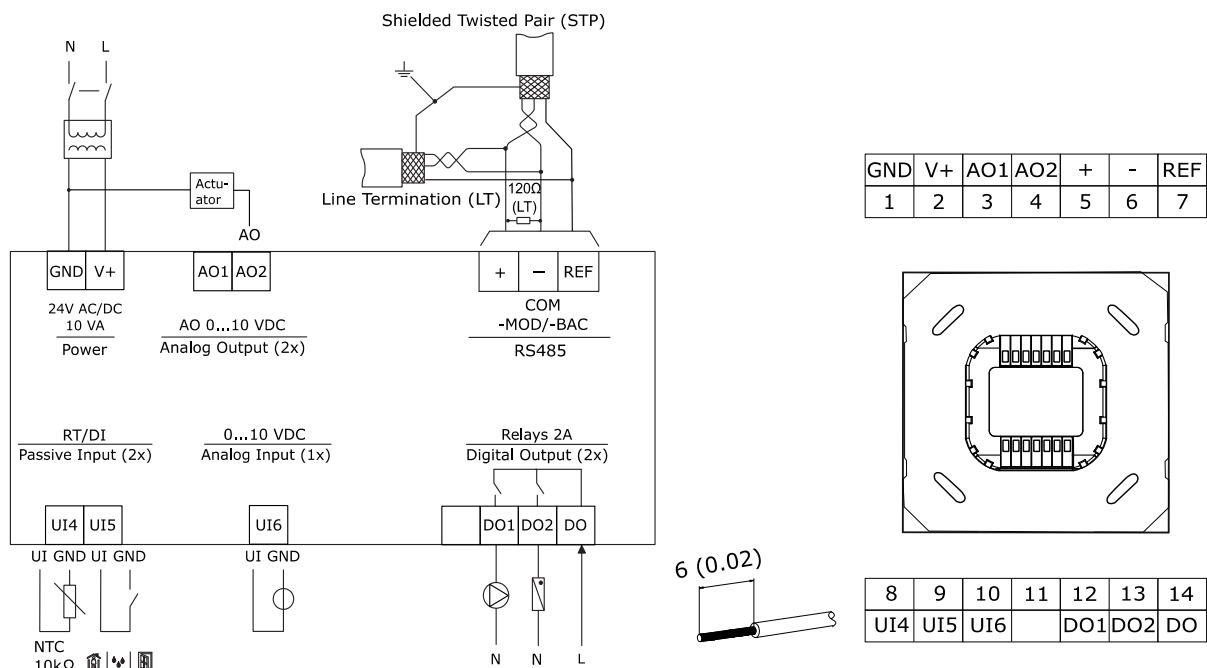
Wire type

An EIA-485 network shall use shielded, twisted-pair cable for data signaling 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.

Status-LED

The TRI2 has a status-LED which becomes visible by removing the front part. The location of the LED is described in the installation sheet. The function of the LED is explained in the X2 operation 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.
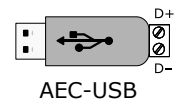
▲ Configuration

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

Configuring the TRI2 device

▲ Configuring with EasySet (free PC application)

Use the PC and the EasySet tool to easily configure the TRI2 to your needs. Connect the PC with the EasySet tool ether with the AEC-USB converter and the AEC-TRI-2 configuration adapter to the TRI2 or use the Wi-Fi communication of the PC to connect to the TRI2 (for TRI2-WIM /-WIB devices only). See TRI2 installation sheet for connection details.

AEC-USB

▲ Configuring with Operation Terminal

You can use the built-in operation terminal to configure the TRI2 to your needs. See "X2 Operations Manual touch display" and "X2 Engineering Manual" for details.
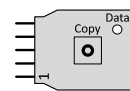
Copy Configuration to other TRI2 devices

Complete parameter sets may be copied using the accessory AEC-PM2 or exchanged with a PC using the EasySet tool and an RS485-USB converter or via Wi-Fi communication.
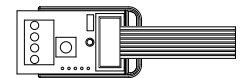
▲ Copy configuration with the AEC-PM2

Use the configuration adaptor ACE-TRI-2 to load the configuration onto the AEC-PM2 plug-in memory (see TRI2 installation sheet for connection details).

To copy the configuration to other TRI2 devices, connect the AEC-PM2 plug-in memory to the TRI2 and simply press the copy button (see TRI2 installation sheet for connection details).

AEC-PM2

AEC-TRI-2

▲ Copy configuration with EasySet (free PC application)

To copy the configuration to other TRI2 devices, connect the PC with the EasySet tool ether with the AEC-USB converter and the AEC-TRI-2 configuration adapter to the TRI2 or use the Wi-Fi communication of the PC to connect to the TRI2 (for TRI2-WIM /-WIB devices only). See TRI2 installation sheet for connection details.

Documentation overview

Document Type	Document No.	Description
TRI2-FA Data Sheet	70-00-0749	Product data sheet (this document)
TRI2-FA Install Sheet	70-00-0730	Mounting and installation manual
X2 Operations Manual touch display	70-00-0951	Operations instructions of X2 system with touch 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 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 type)	70-00-0899	Setup and configuration manual BACnet/IP
X2 Wi-Fi / Ethernet Communication Manual (-WEM, -WEB 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: TRI2 Controls series
TRI2 product description: The TRI2 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 **-WIB** type option.

Vendor Name: Vector Controls
Product Name: TRI2 Controls series
TRI2 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 supports the following X2 functions and elements:

Group	Modules	QTY	Description
UP	-	-	User and display parameters
UI	01U to 03U	3	Sensor inputs for temperature and humidity
	04U to 06U	3	Universal inputs for RT/DI, mA, VDC
	07U to 10U	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 for 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

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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Smart Sensors and Controls
Made Easy!

Quality - Innovation – Partnership

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