3501E

32-Point 115 VAC/VDC TMR Digital Input Module

Product scope

- Accepts thirty-two non-commoned, isolated 115 VAC/VDC digital input points.
- Triplicates signal processing and votes the input data before the application uses each state.
- Supports a hot-spare module through the documented external termination arrangement.

Manufacturer source

Triconex Product Specifications, 32-Point Digital Input Module Specifications

Triconex Product Specifications, 32-Point Digital Input Module Specifications, document 01-9302048-MM-001.

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3501E product reference

32-Point 115 VAC/VDC TMR Digital Input Module

Verified configuration

Triconex 3501E is a 32-point, non-commoned 115 VAC/VDC TMR digital input module with isolated channels, voted input data and hot-spare support.

Manufacturer	Triconex
Model	3501E
Product family	Tricon TMR Digital Input Modules
Product type	TMR Digital Input Module
Model	3501E
Architecture	TMR digital input
Nominal voltage	115 VAC/VDC
Input points	32 non-commoned, isolated
Input range	90 to 155 VAC/VDC
Frequency range	DC or 47 to 63 Hz
Maximum input voltage	155 VAC/VDC
Off-to-On guaranteed level	At or above 86 VAC/VDC

Manufacturer source

Triconex Product Specifications, 32-Point Digital Input Module Specifications

The following pages retain the manufacturer technical content for configuration and engineering review.

The Tricon controller supports a comprehensive range of modules to meet customers' needs.

Product Specifications

The Triconex product family includes a comprehensive range of modules. This section includes: a summary of the system components and their uses, a table that lists standard products and their model numbers, and a summary of specifications for each standard product in the Tricon controller family.

See the *Planning and Installation Guide for Tricon v9-v10 Systems* for complete information.

Summary of Tricon System Components

Chassis

- *Main Chassis*—houses Main Processors, memory back-up batteries, communication modules and I/O modules.
- *Expansion Chassis*—for additional I/O modules with up to 100 feet (30 meters) total cable length between the Main Chassis and the last Expansion Chassis.
- *RXM Chassis*—for I/O modules up to 7.5 miles (12 kilometers) away from the Main Chassis.
- *Mechanical Keying*—Each slot in the Tricon controller is mechanically keyed to correspond with a specific type of module. This prevents the installation of modules into improper slots.

For chassis mounting and enclosure specifications, see page 31.

Power Supply Modules

- Provide logic power to modules in the Main, Expansion or RXM Chassis. Available in 24 VDC, 115 VAC and 230 VAC versions. The power rating of each power supply is 175 watts at 140° F (60° C).

Main Processors

The Main Processors execute the system diagnostics and the user-written control program.

Communication Modules

- *Tricon Communication Modules (TCM)* support a number of Triconex protocols and applications and user-written applications on Ethernet (802.3) networks, including TriStation, Modbus TCP, and OPC. It also supports RS-232 and RS-485 serial communication with Modbus devices, TriStation 1131, and GPS for time synchronization.
- *Enhanced Intelligent Communication Modules (EICM)* support RS-232, RS-422 and RS-485 serial communication with Modbus devices and TriStation 1131 applications.
- *Network Communication Modules (NCM)* support a number of Triconex protocols and applications and user-written applications on Ethernet (802.3) networks, including the TriStation 1131 software.
- *Safety Manager Modules (SMM)* act as an interface between a Tricon controller and a Honeywell Universal Control Network (UCN), one of three principal networks of the TDC-3000 DCS.
- *Hiway Interface Modules (HIM)* act as an interface between a Tricon controller and a Honeywell TDC-3000 Hiway Gateway and Local Control Network (LCN).
- *Advanced Communication Modules (ACM)* allow a Tricon controller to interface with a Foxboro Industrial Automation (I/A) Series DCS and a TriStation 1131 application.

Fiber-Optic Remote Extender Modules (RXM)

For operation of Expansion Chassis up to 7.5 miles (12 kilometers) away from the Main Chassis, with exceptional immunity against electro-static and electro-magnetic interference.

Interface Modules

- *HART Analog Input Interface Modules* act as an interface between 4-20 mA analog input points from HART smart devices in the field and HART Host software running on a PC.
- *HART Analog Output Interface Modules* act as an interface between 4-20 mA analog output points from HART smart devices in the field and HART Host software running on a PC.

I/O Modules

- *Digital Input Modules* receive discrete signals of these nominal voltages: 115 VAC/VDC, 48 VAC/VDC, and 24 VAC/VDC. All voltages are available in TMR modules. Non-TMR modules are available in 24 VDC and 48 VDC only. Speed input and totalization modules are also available.
- *Supervised Digital Output Modules* produce discrete output signals of these nominal voltages, with diagnostic coverage of the field circuit and load device: 115 VAC, 120 VDC, 48 VDC, and 24 VDC.
- *Digital Output Modules* produce discrete output signals of these nominal voltages: 115 VAC, 120

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Product Specifications

VDC, 24 VDC, and 48 VDC. Dual output modules are also available.

- *Analog Input Modules* receive analog signals of these types: 0-5 VDC, -5 to +5 VDC, 0-10 VDC, and Thermocouple types J, K, T and E. Available in both isolated and DC-coupled versions.
- *Analog Output Modules* are available in these versions: eight output points at 4-20 mA; six output points at 4-20 mA and two at 20-320 mA; and four output points at -60 to 60 mA.

Conformal Coating

Most of the Tricon hardware models in the *Planning and Installation Guide for Tricon v9–v10 Systems* and the *Field Terminations Guide for Tricon v9–v10 Systems* can be ordered with conformal coating by adding the letter "C" to the end of the standard model number.

The following equipment *cannot* be ordered with conformal coating:

- Equipment certified for use in nuclear 1E applications
- All types of cables; including interface cables, I/O bus cables, and fanned-out cables
- Blank slot covers

Neoprene dust covers are provided with external termination panels and chassis that are conformal coated. You can install the dust covers on unused external termination panel connectors and unused backplane connectors, at your discretion.

Some of the Tricon hardware with conformal coating has been certified for use in marine environments. For more information, see "Tricon Equipment Certified for Use in Marine Environments" on page 21.

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TMR Digital Input Modules

Each TMR Digital Input (DI) module has three isolated input channels which independently process all data input to the module. A microprocessor on each channel scans each input point, compiles data, and transmits it to the Main Processors upon demand. Then input data is voted at the Main Processors just prior to processing to ensure the highest integrity. All critical signal paths are 100 percent triplicated for guaranteed safety and maximum availability. Each channel conditions signals independently and provides optical isolation between the field and the Tricon controller.

All TMR Digital Input Modules sustain complete, ongoing diagnostics for each channel. Failure of any diagnostic on any channel activates the module Fault indicator, which in turn activates the chassis alarm signal. The module Fault indicator points to a channel fault, *not* a module failure. The module is guaranteed to operate properly in the presence of a single fault and may continue to operate properly with certain kinds of multiple faults.

Models 3502E, 3503E, and 3505E can self-test to detect stuck-On conditions where the circuitry cannot tell whether a point has gone to the Off state. Since most safety systems are set up with a de-energize-to-trip capability, the ability to detect Off points is an important feature. To test for stuck-On inputs, a switch within the input circuitry is closed to allow a zero input (Off) to be read by the optical isolation circuitry. The last data reading is frozen in the I/O communication processor while the test is running.

All TMR Digital Input Modules support hot-spare capability, and require a separate external termination panel (ETP) with a cable interface to the Tricon controller backplane. Each module is mechanically keyed to prevent improper installation in a configured chassis.

32-Point Digital Input Module Specifications

Model Number	3501E/3501T	3502E	3503E	3505E
Type	TMR	TMR with Self-Test	TMR with Self-Test	TMR, Low Threshold
Voltage	115 VAC/VDC	48 VAC/VDC	24 VAC/VDC	24 VDC
Points	32, non-commoned, isolated	32, commoned in groups of 8	32, commoned in groups of 8	32, commoned in groups of 8
AC Range/DC Range	90-155 VAC/VDC	35-95 VAC/VDC	20-42.5 VAC/VDC	20-42.5 VDC
Frequency Range	DC or 47-63 Hz	DC or 47-63 Hz	DC or 47-63 Hz	n/a
Maximum Voltage	155 VAC/VDC	95 VAC/VDC	42.5 VAC/VDC	42.5 VDC
Switching Level				
Off to On[a]	< 86 VAC/VDC	< 32 VAC/VDC	< 18 VAC/VDC	< 12 VDC
On to Off[b]	> 28 VAC/VDC	> 11 VAC/VDC	> 6 VAC/VDC	> 4 VDC
Nominal Turn-On	6-9 mA	6-9 mA	6-9 mA	3 mA to 5 mA
Typical Hysteresis	32 VAC/VDC	7 VAC/VDC	4 VAC/VDC	2 VDC
Input Delay				
OFF to ON/ON to OFF	< 8 ms/< 15 ms	< 8 ms/< 15 ms	< 8 ms/< 15 ms	< 8 ms/< 15 ms
Point Isolation	1,500 VDC/ 2500 VDC[c]	1,500 VDC	1,500 VDC	1,500 VDC
Nominal Input Impedance	> 8.5 KΩ	> 2.9 KΩ	> 1.25 KΩ	> 1.25 KΩ
Nominal Field Power Load				
Per On point	1.5 watts	1.0 watts	0.5 watts	0.5 watts
@ max. field voltage	2.9 watts	3.2 watts	1.5 watts	1.5 watts
Diagnostic Indicators				
Input Status	1 per point	1 per point	1 per point	1 per point
Module Status	PASS, FAULT, ACTIVE	PASS, FAULT, ACTIVE	PASS, FAULT, ACTIVE	PASS, FAULT, ACTIVE
Stuck Test	n/a	On	On	On
Color Code	Red	Dark Red	Dark Red	Dark Red

a. Off to On transition is guaranteed at or above this level but it might occur at a lower voltage, depending on the module's hysteresis.
b. On to Off transition is guaranteed at or below this level but it might occur at a higher voltage, depending on the module's hysteresis.
c. For 3501T.

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