Tricon v10.x Equipment Certified for Use in Nuclear 1E Applications

Invensys has qualified specific Tricon version 10 products for use in 1E (safety-related) applications in nuclear power plants in accordance with EPRI Report TR-107330, "Generic Requirements Specification for Qualifying Commercially Available PLC for Safety-Related Applications in Nuclear Power Plants." EMC testing was performed in accordance with USNRC Regulatory Guide 1.180, Revision 1, "Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems."

All of the information (specifications, simplified schematics, installation guidelines, and so on) for standard equipment also applies to nuclear equipment. The following table lists the model numbers of Tricon v10.x equipment certified for use in Nuclear 1E applications and identifies the standard model to see for information about the equipment.

Model Number	Description	See This Standard Model
Modules[a]		
8110N2	Main Chassis	8110
8111N	Expansion Chassis	8111
8112N	Remote Expansion Chassis	8112
8310N2	High-Density Power Module, 120 V	8310
8311N2	High-Density Power Module, 24 VDC	8331
8312N2	High-Density Power Module, 230 VAC	8312
3008N	Enhanced Main Processor III, 16 Mb	3008
4200N	Remote Extender Module	4200
4200-3N	Remote Extender Module (Set)	4200-3
4201N	Remote Extender Module	4201
4201-3N	Remote Extender Module (Set)	4201-3
4352AN	Tricon Communication Module (TCM)	4352A
4352BN	Tricon Communication Module (TCM)	4352B
3701N2	0–10 VDC, Differential DC Coupled, TMR	3701
3703EN	0–5 VDC or 0–10 VDC, Differential, Isolated, TMR	3703E
3721N	0–5 VDC or –5 to +5 VDC, Differential, DC Coupled, TMR	3721
3805HN	4–20 mA, Current Loop, DC Coupled, TMR	3805H
3501TN2	115 VAC, Opto-isolated, Non-commoned, TMR	3501T
3502EN2	48 VAC/VDC, Commoned in Groups of 8, Self-Test, TMR	3502E
3503EN2	24 VAC/VDC, Commoned in Groups of 8, Self-Test, TMR	3503E
3601TN	115 VAC, Opto-isolated, Non-commoned, TMR	3601T
3603TN	120 VDC, Opto-isolated, Commoned, TMR	3603T
3607EN	48 VDC, Opto-isolated, Non-commoned, TMR	3607
3623TN	120 VDC, Opto-isolated, Commoned, Supervised, TMR	3623T
3625N	24 VDC, Supervised/Non-supervised, Commoned, TMR	3625
3511N	Pulse Input, Differential, AC Coupled, TMR	3511
3708EN	Thermocouple, Differential, Isolated, TMR	3708
3636TN	Relay Output, Normally Open, Non-triplicated	3636T
8105N	Blank Module Panel	8105

General Environmental and EMC Specifications

Other than the optional conformal coating of all PCB assemblies, the Tricon controller is not explicitly protected against dust or falling debris. Atmospheric and airborne-particle protection must be provided by housing the Tricon controller in an appropriate NEMA-rated enclosure.

Operating Temperature	32° to 140° F (0° to 60° C), ambient, as measured at the bottom of the chassis, per IEC 60068-2-1 Test Nb
Storage Temperature	-40° to 167° F (-40° to 75° C), per IEC 60068-2-14, Test Na
Relative Humidity	5% to 95%, non-condensing, per IEC 60068-2-2, Test Bb, and IEC 60068-2-3 test Db
Corrosive Environment	Class G3 Level as defined in ISA Standard S71.04, based on exposure testing according to EIA Standard 364-65A, Class IIIA
Sinusoidal Vibrations per Axis	2 G @ 10 to 150 Hz, per IEC 60068-2-6, Test Fc
Shock	15 G for 6-11 ms in each axis, per IEC 60068-2-27
Electrostatic Discharge	IEC 61000-4-2, 8 kV air, 4 kV contact
Conducted Susceptibility	IEC 61000-4-4, Fast Transient/Burst, 2 kV power, 1 kV signal lines and IEC 61000-4-5, Surge Withstand, 2 kV CM AC power lines, etc. IEC 61000-4-6, RFI, 0.15-80 MHz, 10V
Radiated Susceptibility	IEC 61000-4-3, 26-1000 MHz, 10 V/m and IEC 61000-4-8, 50-60 Hz, 30 A/m
Conducted Emissions	CISPR 16, Class A, 0.15-30 MHz, 73-79 db when installed per the guidelines of the *P&I Guide*
Radiated Emissions	CISPR 11, Class A, 30-1000 MHz @ 10 m, 4-47 db when installed per the guidelines of the *P&I Guide*
Cable Flame Test Rating[a]	**Interface cables** (connect external termination panels to I/O modules): FT4 Vertical Flame Test-Cables in Cable Trays per C.S.A. C22.2 No. 0.3-92 Para 4.11.4[b] **I/O bus cables** (connect chassis): FT6 Horizontal Flame & Smoke Test-per C.S.A. C22.2 No. 0.3-92 Appendix B[c]

a.Applies to cables shipped after April 1, 2009.

b.Cables will be marked with FT4 or CMG rating, but they all actually meet the more stringent FT4 rating.

c.Cables will be marked with FT6 or CMR rating, but they all actually meet the more stringent FT6 rating.

International Approvals

The Tricon controller has been certified as complying with multiple internationally recognized standards by the following internationally recognized certification agencies, these certifications have qualified the Tricon for use around the world in safety critical applications. Test reports from the various certification agencies are available upon request.

TÜV Rheinland — TÜV has certified that the Tricon v9 and v10 controllers are in full compliance with the internationally recognized standards listed below, and thus are qualified for use in the following applications and jurisdictions.

- Emergency safety shut-down or other critical control applications requiring SIL 1-3 certification per the functional safety requirements of IEC 61508 9 (only Tricon v9.6 or later systems)
- Emergency safety shut-down or other critical control applications requiring AK 1-AK6 certification per the functional safety requirements of DIN V 19250 and DIN V VDE 0801 (only Tricon v9.x systems)
- Fire and gas detection applications requiring certification per the requirements of EN 54
- Fire and gas detection applications requiring certification per the requirements of NFPA 72 (only Tricon v9.6 or later systems)
- Burner management applications requiring certification per the requirements of DIN VDE 0116
- Burner management applications requiring certification per the requirements of NFPA 8501 or NFPA 8502 (only Tricon v9.6 or later systems)
- All applications in the European Union or other jurisdictions requiring compliance with the EMC Directive No. 89/336/EEC and Low Voltage Equipment Directive No. 72/23/EEC
- All applications in the European Union or other jurisdictions requiring compliance with the ATEX Directive No. 94/9/EC for Zone 2, Group IIB hazardous locations
- Environmental, health, and safety applications in semiconductor manufacturing facilities per the requirements of SEMI S2

For hazardous location applications, see the *Planning and Installation Guide for Tricon v9-v10 Systems* for application-specific installation instructions.

Canadian Standards Association (CSA) — CSA has certified that the Tricon v10 controller is in full compliance with the internationally recognized electrical safety standards and is qualified for general use in North American and other jurisdictions requiring compliance with these standards.

Factory Mutual Research (FM) — Factory Mutual has certified that the Tricon v10 controller is in full compliance with the internationally recognized standards and is qualified for use in Class I, Division 2 Temperature T4, Groups A, B, C, and D hazardous indoor (or outdoor in a NEMA 4 cabinet) locations. For hazardous location applications, see the *Planning and Installation Guide for Tricon v9-v10 Systems* for application-specific installation instructions.

Bureau Veritas (BV) — BV has certified specific Tricon products as being in full compliance with the internationally recognized standard and qualified for use in marine environments. For more information, see “Tricon Equipment Certified for Use in Marine Environments” on page 21. Also, for application-specific installation instructions, see the *Planning and Installation Guide for Tricon v9-v10 Systems*.

European Union CE Mark — Based upon the independent TÜV evaluation and test results, Triconex has certified the Tricon controller is suitable to use in the European Union and all other jurisdictions requiring compliance with the European Union EMC Directive No. 89/336/EEC and Low Voltage Equipment Directive No. 72/23/EEC, see Certificate of Compliance for details. For hazardous location applications, see the *Planning and Installation Guide for Tricon v9-v10 Systems* for application-specific installation instructions.

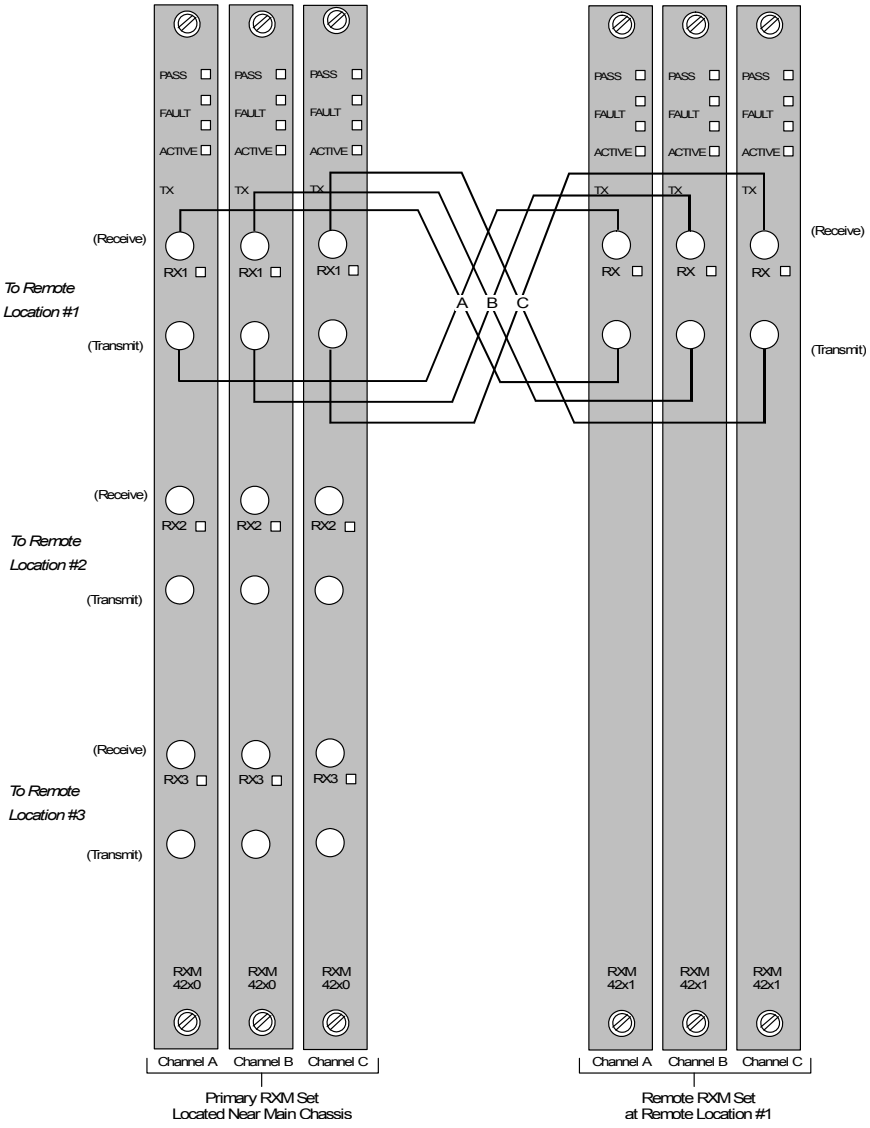
U.S. Nuclear Regulatory Commission (NRC) — The NRC has certified that the Tricon controller is suitable for use in nuclear 1E applications within the limitations and guidelines referenced in the NRC Safety Evaluation Report (SER) ML013470433, *Review of Triconex Corporation Topical Reports 7286-545, “Qualification Summary Report”* and *7286-546, “Amendment 1 To Qualification Summary Report,” Revision 1*. This report is available from the NRC via the Agency Document Access and Management System (ADAMS) website. This qualification was based upon EPRI TR-107330, *Generic Requirements Specification for Qualifying a Commercially Available PLC for Safety-Related Applications in Nuclear Power Plants*. For details on models and revisions qualified for 1E applications, please contact Invensys Nuclear by calling toll-free 866-703-6300, toll 949-885-0885, or visit the Invensys Nuclear website at http://www.invensysnuclear.com.

Remote Extender Module (RXM)

RXMs and chassis allow I/O modules to be located several kilometers from the Main Chassis. RXM sets, consisting of three identical modules, serve as repeaters and extenders of the Tricon I/O bus and provide ground loop isolation. A primary RXM set supports three remote locations by connecting to three remote RXM sets housed in a remote chassis. See "System Configuration" on page 11 regarding configurations that use RXMs.

RXM sets are available for fiber-optic cables with a communication rate of 375 kilobits per second. These sets provide maximum immunity against electro-static and electro-magnetic interference, and support configurations with optical modems and fiber-optic point-to-point cabling. Remote sites can be located as far as 7.5 miles (12 kilometers) from the primary site.

The figure at right shows uni-directional cabling for three channels of a remote location. For each channel, one cable carries data transmitted from the primary RXM to the remote RXM, and the other cable carries data received by the primary RXM from the remote RXM. A pair of modules must be wired for each of the three channels, amounting to a total of six cables for each remote location.



Sample Wiring for One Remote Location

***NOTE**: The selection and installation of fiber-optic cabling requires specialized knowledge, training and tools. Invensys recommends hiring a fiber-optic specialist to handle these tasks.*

RXM Specifications

RXM Model	4200-3	4201-3	4210-3	4211-3
RXM Chassis Location	Primary	Remote	Primary	Remote
Cable Type	Multi-mode	Multi-mode	Single-mode	Single-mode
Cable Length Limit	1.2 miles (2 kilometers)	1.2 miles (2 kilometers)	7.5 miles (12 kilometers)	7.5 miles (12 kilometers)
Connectors	6/remote site	6	6/remote site	6
Remote Sites Supported	3	n/a	3	n/a
Modem Ports	Fiber Optic with ST connectors	Fiber Optic with ST connectors	Fiber Optic with ST connectors	Fiber Optic with ST connectors
Diagnostic Indicators	PASS, FAIL, ACTIVE, TX, RX1, RX2, RX3	PASS, FAIL, ACTIVE, TX, RX1, RX2, RX3	PASS, FAIL, ACTIVE, TX, RX1, RX2, RX3	PASS, FAIL, ACTIVE, TX, RX1, RX2, RX3