TRICONEX

INVENSYS PROCESS AUTOMATION

15345 Barranca Parkway
Irvine, California 92618
United States of America

Telephone +1 949 885 0700
Facsimile +1 949 753 9101
http://www.triconex.com

March 20, 2001

Document Control Desk
United States Nuclear Regulatory Commission
Washington, DC 20555

Subject: Nuclear 1E Qualification of the TRICON TMR Programmable Logic Controller
(PLC) –Inclusion of Recent Upgrades in NRC Qualification Review

References: 1. Letter, T. Martel (Triconex) to NRC, February 23, 2001, subject; Nuclear 1E
Qualification of the TRICON TMR Programmable Logic Controller (PLC) –
Qualification of Recent TRICON Equipment Upgrades

2. Project Number 709

Gentlemen:

In Reference 1, we indicated our desire to include the most recent Triconex product upgrades in
the generic 1E qualification of our TRICON PLC system. The results of our qualification testing
and analyses were previously provided to you in our final summary (topical) report, Triconex
document No. 7286-545. This and other documentation currently under review by the NRC staff
addresses Version 9.3.1 of the TRICON PLC system and its associated software. Our current
marketing focus is on TRICON Version 9.5.3, which is the result of our normal ongoing product
evolution. Version 9.5.3 provides identical or improved functionality over the previous versions.

Enclosed for your review is Triconex document No. 7286-546, which serves as an Amendment
to our previously submitted Qualification Summary Report. This Amendment report
characterizes all significant differences between our updated product versions versus the
previously defined test specimen, and includes a discussion of any impact on performance or
safety. Accordingly, we would like to request that the current versions of the TRICON PLC
product line as defined in this Amendment be considered in your review and addressed in the
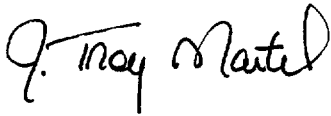Safety Evaluation Report (SER) for the TRICON.

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If you have any questions pertaining to this request or wish further information, please contact me at (281) 360-6401 or Mr. Michael Phillips at (949) 885-0711.

Sincerely,

J. Troy Martel, P. E.
Triconex Nuclear Qualification Project Director

Enclosure
cc: L. Raynard Wharton, NRC
      P. Loeser, NRC
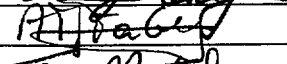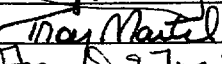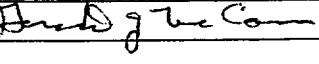
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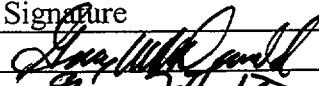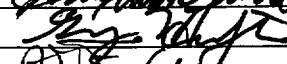| Project:	NUCLEAR QUALIFICATION OF TRICON PLC SYSTEM
Purchase Order No.:	ST - 401734
Project Sales Order:	7286

AMENDMENT 1 TO
QUALIFICATION SUMMARY REPORT -
Qualification Upgrade Evaluation

Document No.: 7286-546

Revision 0

March 19, 2001

	Name	Signature	Title
Author:	Gary McDonald		Sr. Nuclear QA Engineer
Reviewer:	Gary Hufton		Director, Hardware Development
Reviewer:	Aad Faber		Director, Product Assurance
Approvals:	Troy Martel		Triconex Project Director
	Jerry McCann		VP, Development

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Document Change History			
Revision	Date	Change	Author
0	3/19/2001	Initial Issue	G. McDonald

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1.0 INTRODUCTION

Triconex has completed a Nuclear Qualification Program for its TRICON Triple Modular Redundant (TMR) PLC for safety related (1E) applications in nuclear power plants. The qualification program was performed and documented in accordance with NRC-approved EPRI TR-107330, "Generic Requirements Specification for Qualifying a Commercially Available PLC for Safety-Related Applications in Nuclear Power Plants." Triconex report 7286-545, "Qualification Summary Report," presented the final results of all testing and analyses performed in accordance with this EPRI specification and was provided to the NRC for review and issuance of a Safety Evaluation Report (SER).

The focus of the qualification effort was TRICON product version V9.3.1, which was the prevailing version being marketed at the time the qualification project was being organized. As with any high-tech product, during the extended period of qualification testing and evaluation, the TRICON products continued to evolve such that upgraded versions beyond V9.3.1 are now being manufactured and provided to industry. For business reasons, it is now desired to obtain NRC approval of the current TRICON product offering, specifically TRICON V9.5.3 and its associated support software.

2.0 PURPOSE

All data pertaining to testing and analysis of TRICON V9.3.1 have been provided to the NRC and are under review. The purpose of this report is to provide a listing of any pertinent differences between the product under review (V9.3.1) and the current product upgrades (represented by V9.5.3). A discussion of impact to qualification testing already completed is also provided. This additional information is provided for the NRC's consideration, with the express intent that the SER approval should be applied to the most recent TRICON product version specified herein.

3.0 DISCUSSION

Table 1 provides the current listing of Triconex products considered to be 1E qualified as a result of the EPRI specification (& IEEE-323) qualification program. This is basically identical to the hardware/software listing described in the Qualification Summary Report, with minor upgrades reflected. The routine product upgrades have not altered the critical characteristics of the product, i.e., current modules have the same functional and environmental characteristics as the V9.3.1 Test Specimen (or better).

A discussion of the software changes between V9.3.1 and V9.5.3 is provided in Attachment 1, "Evaluation of the differences between TRICON V9.3.1 and TRICON V9.5.3."

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Routine component and board changes to maintain production needs are ongoing and are reviewed by the Configuration Control Board (CCB) in accordance with Triconex Appendix B QA procedures. This review confirms that no significant changes have been made to modules which would adversely affect performance specifications or qualification characteristics (seismic, environmental, electrical) as specified in the EPRI TR 107330. The most significant component change, replacement of the obsolete 80C451 microprocessor on most I/O boards, necessitated additional firmware upgrades and retesting as described in Attachment 1. Also, as indicated in paragraph 3.0 (2) below, component upgrades were made for four "T" (high voltage) modules; 3501TN, 3601TN, 3623TN, and 3636TN. These module upgrades significantly improved the surge and isolation capabilities of these modules.

In addition to evolutionary upgrades to the modules, Table 1 reflects other minor changes from the previous list of equipment described in the Qualification Summary Report. These equipment list changes fall into 3 categories:

(1) Nuclear Model Numbers - Unique model numbers have been assigned to the successfully qualified TRICON modules for marketing purposes. A trailing "N" has been added to each qualified module identified in 7286-545. Thus, the 3006 Main Processor will be identified in our product literature as 3006N if it is to be provided to a nuclear power plant for a 1E application (on a Safety Related customer purchase order). These modules will receive a special faceplate overlay with the N number in lieu of the base model number. Only the N module will receive a Triconex Certificate of Conformance attesting to its 1E qualification status. The commercial version of the same module will not receive this certification. The SER should therefore reflect the N model numbers exactly as indicated in the Attachment 1 list.

(2) High Voltage (T) Models - "T" modules have been substituted in place of four of the I/O modules in original test specimen. As described in paragraph 4.6 (4) of the Qualification Summary Report, the 3603E module was swapped out during surge testing and replaced with the 3603T module, which was functionally identical to the original module but provided a higher surge voltage withstand capability. Equivalent high voltage upgrades ("T" versions) to modules 3501E, 3601E, 3623, and 3636R are now available, and it is intended to offer these as the preferred nuclear versions. Even though the original versions of these modules passed the qualification tests, the T versions provide improved performance and are better suited to the nuclear industry.

The "T" modules were introduced to comply with the latest international (IEC) product safety and EMC standards. The high voltage modules were designed to be in compliance with the applicable US and Canadian national standards in effect at the time of their introduction. As the global world economy has matured, our customers are demanding

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that all Triconex products fully comply with the latest IEC standards. The required changes were in 2 general categories:

a) Improve the module isolation from 1500VDC to 2500VDC for compliance with IEC 61010-1: 1990, Safety Requirements for electrical equipment for measurement, control, and laboratory use, Part 1: General requirements. This required improved voltage ratings on field de-coupling capacitors, and modification of the per unit acceptance test procedures.

b) Test and modify as required for compliance with IEC 61000-4-5, Surge Withstand. This required the installation of transient protection devices on selected modules and/or termination panels.

(3) Generic Cable Lengths - On the Table 1 equipment list, the part numbers for qualified connector cables have been generalized to indicate that, while specific lengths of certain cables were used in the test specimen, all of the varying lengths of the same base cable are considered qualified. Thus, while a 4000056-099 (dash number indicating 99 ft length) was tested, a 25 foot length (4000056-025) would also be considered qualified, as the base parts specification is the same. The list therefore identifies the qualified cable family part number as 4000056-xxx, consistent with our internal nomenclature standards.

4.0   CONCLUSION

The TRICON V9.5.3 products indicated in Table 1 continue to meet TR 107330 and IEEE requirements for 1E service and accurately represent the TRICON Qualification Test results as presented in Qualification Summary Report 7286-545. Changes made to the TRICON product since V9.3.1 are considered minor and evolutionary and have no adverse effect on qualification program results previously submitted for review.

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TABLE 1: NUCLEAR 1E QUALIFIED EQUIPMENT LIST – (Hardware)

QUALIFIED TRICON SYSTEM VERSION: **V9.5.3**

Model No.	Item Description	Triconex Part Number	Previous Model/PN (Referenced in 7286-545)		Comment
	(1. Module Assemblies)				
8110N	Main Chassis	3000602-150	8110	7400101-100	(1)
8111N	Expansion Chassis	3000603-150	8111	7400102-100	(1)
8112N	Remote Expansion Chassis	3000604-150	8112	7400101-200	(1)
8310N	High Density Power Module, 115 V	3000600-150	8310	7400160-100	(1)
8311N	High Density Power Module, 24 VDC	3000600-350	8311	7400160-300	(1)
3006N	Enhanced Main Processor II, V9, 2 Mb	3000348-650	3006	7400120-500	(1)
4210N	Remote Extender Module	3000611-350	4210	7400176-300	(1)
4211N	Remote Extender Module	3000611-150	4211	7400176-100	(1)
4119AN	EICM., V9, Isolated	3000445-550	4119A	7400145-200	(1)
4329N	Network Communication Module, V9	3000336-850	4329	7400124-200	(1)
4609N	Advanced Communication Module	3000612-150	4609	7400170-100	(1)
3700AN	AI Module, 0-5 VDC, 6% Overrange	3000041-065	3700A	7400069-015	(1)
3701N	AI Module, 0-10 VDC	3000041-060	3701	7400069-010	(1)
3703EN	EAI Module, Isolated	3000329-070	3703E	7400112-010	(1)
3704EN	HDAI Module, 0-5/0-10 VDC	3000355-160	3704E	7400125-110	(1)
3805EN	Analog Output Module, 4-20 mA	3000316-160	3805E	7400097-110	(1)

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Model No.	Item Description	Triconex Part Number	Previous Model/PN (Referenced in 7286-545)		Comment
3501TN	EDI Module, 115V AC/DC	3000303-155	3501E	7400090-050	(1) (2)
3502EN	EDI Module, 48V AC/DC	3000303-185	3502E	7400090-085	(1)
3503EN	EDI Module, 24V AC/DC	3000303-175	3503E	7400090-025	(1)
3504EN	HDDI Module, 24/48 VDC (24V)	3000354-170	3504E	7400125-120	(1)
3505EN	EDI Module, 24 VDC, Low Threshold	3000303-225	3505E	7400090-125	(1)
3601TN	EDO Module, 115 VAC	3000307-155	3601E	7400091-050	(1) (2) (4)
3603TN	EDO Module, 120 VDC	3000608-185	3603T	7400157-085	(1)
3604EN	EDO Module, 24 VDC	3000341-120	3604E	7400116-020	(1)
3607EN	EDO Module, 48 VDC	3000341-180	3607E	7400116-080	(1)
3623TN	SDO Module, 120 VDC	3000609-285	3623	7400157-180	(1) (2)
3624N	SDO Module, 24 VDC	3000609-230	3624	7400174-130	(1)
3510N	Pulse Input Module	3000152-110	3510	7400068-010	(1)
3706AN	NITC Input Module	3000041-250	3706A	7400069-200	(1)
3708EN	ITC Thermocouple Input Module	3000329-250	3708E	7400112-100	(1)
3636TN	ERO Module, N.O., Simplex	3000314-390	3636R	7400123-310	(1) (2) (4)
8105N	Blank Module Panel	3000051-101	8105	3000051-001	(1)
8107N	Seismic Balance Module	3000632-101	8107	3000632-001	(1)
---	Standard Chassis Mounting Bracket (for Chassis rear)	2000240-001	(same)		
	(2. External Termination Assemblies - ETA)	----------------	----------------		
2551-1N	Term Panel (for use with DI 3501TN)	3000568-110	2551-1	7400056-110	(1)
2552-6N	Term Panel (for use with DI 3502EN)	3000569-610	2552-6	7400056-260	(1)
2553-6N	Term Panel (for use with DI 3503EN, DI 3505EN)	3000567-610	2553-6	7400056-360	(1)
2554-6N	Term Panel (for use with DI 3504EN)	3000566-610	2554-6	7400126-380	(1)
2651-1N	Term Panel (for use with DO 3601TN)	3000576-110	2651-1	7400058-110	(1)
2652-1N	Term Panel (for use with DO 3604EN)	3000578-110	2652-1	7400058-310	(1)
2657-1N	Term Panel (for use with DO 3607EN)	3000579-110	2657-1	7400058-210	(1)

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Model No.	Item Description	Triconex Part Number	Previous Model/PN (Referenced in 7286-545)	Comment
2658-1N	Term Panel (for use with RO 3636TN)	3000598-110	2658-1 7400110-010	(1)
2750-8N	Term Panel (for use with AI 3700AN, AI 3701N)	3000586-810	2750-8 7400061-810	(1)
2752-2N	Term Panel (for use with AI 3703EN)	3000587-210	2752-2 7400061-220	(1)
2755-6N	Term Panel (for use with TC 3708EN)	3000589-610	2755-6 7400061-600	(1)
2756-2N	Term Panel (for use with TC 3706AN)	3000588-710	2756-2 7400061-600	(1)
2760-2N	Term Panel (for use with AI 3704EN)	3000588-110	2760-2 7400126-120	(1)
2790-310TN	Term Panel (for use with AI 3700AN/RTD)	3000620-110	2790-310T 3000619-100	(1)
2852-1N	Term Panel (for use with AO 3805EN)	3000596-110	2852-1 7400111-100	(1)
9661-910N	Term Panel (for use with DO 3603TN, DO 3623TN)	3000525-810	9661-910 7400166-180	(1)
9662-610N	Term Panel (for use with DO 3624N)	3000524-910	9662-610 7400166-390	(1)
9753-110N	Term Panel (for use with PI 3510N)	3000406-110	9753-110 7400143-510	(1)
---	Mounting Plate for V9 ETAs	9420017-070	(same)	
	(3. Signal Conditioners)	--------------	--------------	
---	Signal Conditioner (-100/+100) Pt	1600024-010	(same)	
---	Signal Conditioner (0/+100) Pt	1600024-020	(same)	
---	Signal Conditioner (0/+200) Pt	1600024-030	(same)	
---	Signal Conditioner (0/+600) Pt	1600024-040	(same)	
	(4. Connector Cables)	--------------	--------------	
---	I/O Bus Cable Set (No. 9000, various lengths)	4000056-xxx	4000056-099 (100ft) 4000056-006 (6 ft)	(3)
---	Ethernet Cable Assy (NCM, various lengths)	1600010-xxx	1600010-015 (50 ft)	(3)

COMMENTS:
(1) Nuclear Model Number. "N" added to base model number. Model part number encompasses the qualified (tested) board assembly. ETA Nuclear Model part number includes qualified connector cable assemblies.
(2) Indicates base module upgraded to "T" (high voltage) module.
(3) Part Number for generic cable lengths.
(4) Pending Release.

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TABLE 2:   NUCLEAR 1E QUALIFIED EQUIPMENT LIST- (Software)

QUALIFIED TRICON SYSTEM VERSION: <u>V9.5.3</u>

TYPE		IDENTIFICATION	VERSION	USED IN
Application Program Development Software		TriStation 1131, Developer's Workbench Suite	**V3.1**	TriStation Workstation
Operating System Firmware	Main Processors	TSX	**5211**	3006N (MP)
		IOC	**5212**	3006N (MP)
		COM	**5206**	3006N (MP)
	Communication Modules	ICM	4930	4119AN (EICM), 4329N (NCM)
		ACMX	**5203**	4609N (ACM)
		NCMX	5028	4329N (NCM)
		IICX	**5276**	4119AN (EICM)
		RXM	3310	4210N (RXM), 4211N (RXM)
	I/O Modules	AI/NITC	4873	3700AN (AI), 3701N (AI), 3706AN (TC)
		EIAI/ITC	**5491**	3703EN(AI), 3708EN (TC)
		PI	4559	3510N (PI)
		EDI	**5490**	3501TN (DI), 3502EN (DI), 3503EN (DI), 3505EN (DI)
		HDI	**5499**	3704EN (AI), 3504EN (DI)
		EAO	**5530**	3805EN (AO)
		EDO	**5488**	3601TN (DO), 3604EN (DO), 3607E (DO)
		ERO	**5497**	3636TN (RO)
		TSDO	**5502**	3603TN (DO), 3623TN (DO), 3624N (DO)

(Bolded versions = upgraded from V9.3.1)

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ATTACHMENT 1

An Evaluation of the Differences between TRICON V9.3.1 and TRICON V9.5.3

(Nuclear Qualified Modules only)

Aad Faber

March 2001

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1.0 Introduction

The TRICON Nuclear Qualification project resulted in a Qualification Summary Report (7286-545) that forms the basis for the generic qualification of the TRICON system for safety-related applications in nuclear power plants. The basis for qualification is compliance with EPRI TR-107330. The Qualification Summary Report as well as all testing and analysis described in that report is based on a TRICON V9.3.1 configuration. This document describes the differences between TRICON V9.3.1 and TRICON V9.5.3 and provides justification for the argument that the basic findings and results described in the Qualification Summary Report are also valid for TRICON Version 9.5.3.

In order to be able to properly market and track a Nuclear Qualified TRICON System, Triconex has decided to modify the model numbers of the qualified modules listed in Table 3-1 of the Qualification Summary Report. All Nuclear Qualified Model numbers will have an additional "N" suffix. Table 1 of this document includes a listing of the newly assigned model numbers.

Following V9.3.1 TRICON Firmware and application software that were listed in the Qualification Summary Report were changed in the V9.5.3 release.

Firmware Module / PC Application	V9.3.1	V9.5.3
TSX	5124	5211
IOC	5106	5212
COM	4931	5206
ACM	5141	5203
IICX	5148	5276
ERO	3568	5497
EDO	4621	5488
EDI	4299	5490
EIAI/ITC	5087	5491
HDI	4843	5499
TSDO	5066	5502
EAO	4532	5530
TS1131	V1.1SP1	V3.1

Note: TS1131 V2.0 was referenced in the qualification report.

Detailed descriptions of the changes and an evaluation of the changes are provided in section 3 through 9 of this document.

2.0 Summary and Conclusions

- No changes to basic functionality were made. Updates were primarily to accommodate a new processor, recognize new module/model numbers, and bug fixes identified in Product Discrepancy Reports (PDRs).
- All changes described in this document were validated and released in accordance with current Triconex Quality Assurance procedures.
- Triconex has no reason to believe that any of the changes made from V9.3.1 to V9.5.3 invalidate the findings and results of the generic qualification of the TRICON in accordance with EPRI TR-107330.

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3.0   TSX Changes

3.1   TSX 5124

This version of TSX was used in the V9.3.1 qualification system.

3.2   TSX 5211

TSX 5211 was released in version 9.5.0 (12/21/99).

Supporting Documentation for this change:

    (1) Software Requirements Definition (SRD), 6200003-111, 12/21/1999 (E3319)
    (2) V9.5 SQA Validation Plan rev 1.1, 12/9/1999
    (3) SQA Tricon V9.5 Test Report, 3/20/2000

3.2.1   Description of the change

The TSX firmware was changed to support a new Pulse Totalizer module (Model number 3515). The nuclear qualification does not include this new module. The differences in the firmware are described in detail in the SRD appendix A. This description includes a source code diff., an assembly code and a binary image diff.

3.2.2   V&V activity to support the change

Verification of the change in TSX firmware was carried out by review of the code differences documented in the SRD. The code differences were prepared by the responsible design Engineer and reviewed by issuer of the SRD (Director of real time software Triconex QA, and TUV).

TSX 5211 was validated in accordance with the V9.5 SQA Validation Plan. This plan included the requirement to execute a number of applicable sections in the QA Validation Procedures 9600047-001 and 9600038-001. The Director of Product Assurance issued a TRICON V9.5 Test Report. This report documents the recommendation to release V9.5.0 as specified in the SRD. TSX 5211 was released as part of V9.5.0.

3.2.3   Evaluation of the change

Triconex has no reason to believe that any of the changes made from TSX 5124 to TSX 5211 invalidate the findings and results of the generic qualification of the TRICON in accordance with EPRI TR-107330. The changes made to TSX were minor and only affect the support of a new module. This new module is not part of the Qualified TRICON Module listing. The changes were fully validated both by Triconex SQA and TUV.

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4.0   IOC Changes

4.1   IOC 5106
This version of IOC was used in the V9.3.1 qualification system.

4.2   IOC 5212

IOC 5212 was released in version 9.5.0 (12/21/99).

Supporting Documentation for this change:

    (1) Software Requirements Definition (SRD), 6200003-111, 12/21/1999 (E3319)
    (2) V9.5 SQA Validation Plan rev 1.1, 12/9/1999
    (3) SQA Tricon V9.5 Test Report, 3/20/2000

4.2.1   Description of the change
The IOC firmware was changed to support a new Pulse Totalizer module (Model number 3515). The nuclear qualification does not include this new module. The differences in the firmware are described in detail in the SRD appendix A. This description includes a source code diff., an assembly code and a binary image diff.

4.2.2   V&V activity to support the change
Verification of the change in IOC firmware was carried out by review of the code differences documented in the SRD. The code differences were prepared by the responsible design Engineer and reviewed by issuer of the SRD (Director of real time software Triconex QA, and TUV).

IOC 5212 was validated in accordance with the V9.5 SQA Validation Plan. This plan included the requirement to execute a number of applicable sections in the QA Validation Procedures 9600047-001 and 9600038-001. The Director of Product Assurance issued a TRICON V9.5 Test Report. This report documents the recommendation to release V9.5.0 as specified in the SRD. IOC 5212 was released as part of V9.5.0.

4.2.3   Evaluation of the change
Triconex has no reason to believe that any of the changes made from IOC 5106 to IOC 5212 invalidate the findings and results of the generic qualification of the TRICON in accordance with EPRI TR-107330. The changes made to the IOC firmware were minor and only affect the support of a new module. This new module is not part of the Qualified TRICON Module listing. The changes were fully validated both by Triconex SQA and TUV.

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5.0   COM Changes

5.1   COM 4931

This version of IOC was used in the V9.3.1 qualification system.

5.2   COM 5206

COM 5206 was released in version 9.5.0 (12/21/99).

Supporting Documentation for this change:

(1) Software Requirements Definition (SRD), 6200003-111, 12/21/1999 (E3319)
(2) V9.5 SQA Validation Plan rev 1.1, 12/9/1999
(3) SQA Tricon V9.5 Test Report, 3/20/2000
(4) Product Discrepancy Report (PDR) 2446, 11/20/1998
(5) Technical Advisory Bulletin (TAB) 96, 1/27/1999

5.2.1   Description of the change
The COM firmware was modified to fix PDR 2446 / TAB 96.

5.2.2   V&V activity to support the change
The validation of changes to the COM firmware as a result of the PDR 2446 fix are documented in the SQA Validation report in section 6.2.16.

5.2.3   Evaluation of the change
Triconex has no reason to believe that any of the changes made from COM 4931 to COM 5206 invalidate the findings and results of the generic qualification of the TRICON in accordance with EPRI TR-107330. The change made to the COM firmware was a fix for a problem that was discovered during Triconex Internal Validation testing. The changes were fully validated both by Triconex SQA and TUV.

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6.0 ACM Changes

6.1 ACM 5141

This version of ACM was used in the V9.3.1 qualification system.

6.2 ACM 5203

ACM 5203 was released in version 9.4.0 (1/15/99).

Supporting Documentation for this change:

    (1) Software Requirements Definition (SRD), 6200003-104, 12/21/1999 (E3319)
    (2) V9.5 SQA Validation Plan rev 1.1, 12/9/1999
    (3) SQA Tricon V9.4 Test Report, 3/20/2000
    (4) Product Discrepancy Report (PDR) 728

6.2.1 Description of the change
The ACM Firmware was modified to improve fault insertion behavior of the module. This change was triggered by TRICON PDR 728.

6.2.3 V&V activity to support the change
The ACM 5203 Firmware was validated as part the V9.4 validation effort. This validation included a full functional validation of the V9.4 TRICON system including a validation and manual fault insertion of the ACM module. The results of this validation are reported in the V9.4 SQA validation report.

6.2.3 Evaluation of the change
Triconex has no reason to believe that any of the changes made from ACM 5141 to ACM 5203 invalidate the findings and results of the generic qualification of the TRICON in accordance with EPRI TR-107330. The changes were fully validated both by Triconex SQA and TUV.

7.0 IICX Changes

7.1 IICX 5148

This version of IOC was used in the V9.3.1 qualification system.

7.2 IICX 5276

IICX 5276 was released in version 9.5.2 (8/8/2000).

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Supporting Documentation for this change:

(1) Software Requirements Definition (SRD), 6200003-118, 8/8/2000 (E3445 & E3471)
(2) V9.5.2 SQA Validation Plan rev 1.0, 3/17/2000
(3) SQA Tricon V9.5.2 Test Report
(4) Product Discrepancy Reports (PDRs) 2418, 688, 689, 690

7.2.1 Description of the change

As a result of an investigation into a problem report from one customer, a number of PDRs were generated (PDR 2418, 688, 689, 690). The IICX Firmware was modified to correct the these problems.

7.2.2 V&V activity to support the change

The changes to the IICX firmware were validated as part of the V9.5.2 release. The results of the validation are documented in the SQA V9.5.2 Validation report.

7.2.3 Evaluation of the change

Triconex has no reason to believe that any of the changes made from IICX 5148 to IICX 5276 invalidate the findings and results of the generic qualification of the TRICON in accordance with EPRI TR-107330. The changes were fully validated both by Triconex SQA and TUV.

8.0 I/O Firmware changes

TRICON Version 9.5.3 includes changes to most of the I/O firmware modules. The following table summarizes the Firmware Meta numbers for each I/O module that was affected by this change.

Firmware Module Acronym	Used on Model #	V9.3.1 Firmware Meta#	V9.5.3 Firmware Meta#	Changes made other then required to support the new processor
ERO	3636R, 3636TN	3568	5497	None
EDO	3601E, 3601T, 3601TN, 3604E, 3604EN, 3607E, 3607EN	4621	5488	Yes, PDR 716
EDI	3501E, 3501T, 3501TN 3502E, 3502EN 3503E, 3503EN 3505E, 3505EN	4299	5490	None
EIAI/ITC	3703E, 3703EN 3708E, 3708EN	5087	5491	None
HDI	3504E, 3504EN 3704E, 3704EN	4843	5499	None

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TSDO	3603E, 3603T, 3603TN 3623, 3623T,3623TN 3624, 3624N	5066	5502	None
EAO	3805E, 3805EN	4532	5530	Yes, PDR 849

8.1   Description of the change

The 80C451 chip used in the I/O boards went out of production, necessitating replacement. The firmware changes that were required to replace the 80C451 microprocessor with the 80C515 microprocessor were very localized in the code. The only change required between the new and old firmware was identified as a change in the port assignments (constants) that are used at multiple locations in the code. The port assignments are done in code header files.

8.2   Additional changes made

In addition to the changes made to support the new microprocessor, the EAO firmware and the EDO firmware were modified to fix two outstanding PDRs (PDR 849, 716). PDR 849 was fixed in EAO 5530 firmware. PDR 716 was fixed in EDO 5488 firmware.

8.3   V&V activity to support the change

All changes to the I/O firmware listed in the table above were validated as part of the TRICON V9.5.3 validation effort. In addition, the differences between the old firmware and the new firmware were analyzed by Engineering to ensure that only the port assignment numbers were changed. The validation was carried out in accordance with the TRICON I/O processor replacement validation plan (rev 1.0). The plan included a full functional validation per the I/O Modules Functional Validation Procedure (9600038-001). The plan also included fault insertion testing of the 3805E Module. Both PDR 849 and PDR 716 were fixed and validated in TRICON V9.5.3. The results of the validation are documented in the SQA V9.5.2 Validation report.

8.4   Evaluation of the change

Triconex has no reason to believe that any of the changes made to the I/O Firmware invalidate the findings and results of the generic qualification of the TRICON in accordance with EPRI TR-107330. The changes were fully validated both by Triconex SQA and TUV.

9.0   TS1131 Changes

9.1   Version 2.0

This version of TS1131 was used in the qualification system.

9.2   Version 2.0 SP1

This version of TS1131 was superseded by TS1131 Version 2.0 SP2. TS1131 Version 2.0 SP1 was never shipped to the customer base. All changes made in SP1 were incorporated in SP2.

9.3   Version 2.0 SP2

TS1131 Version 2.0 SP2 was released as part of the TRICON V9.4.1 release.

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9.3.1 Description of the change
TS1131 V2.0 SP2 includes the following fixes and modification the TS1131 Application Software:
- In order to change MIN and MAX settings on Memory Real R/W variables, the project state had to change to Download All (PDR 1921 / TAB97)
- The TS1131 Emulator could not maintain a DDE conversation with a client like Excel (PDR 1980)
- The PI 3511 Module uses the wrong Board ID (PDR 2441 / TAB 98)

9.3.2 V&V activity to support the change
TRICONEX SQA validated this version of TS1131 in accordance with the SQA TS1131V2.0SP2 Validation Plan revision 1.1. The results of this validation are documented in the SQA Test report.

9.4 Version 2.0 SP3

This version of TS1131 was released as part of TRICON V9.5 (12/21/99).

9.4.1 Description of the change
TS1131 V2.0 SP2 includes TS1131 support for the PT3515 Pulse Totalizer module (The PT3515 is not part of the nuclear qualification). No other changes were made to TS1131.

9.4.2 V&V activity to support the change
Triconex SQA validated this version of TS1131 in accordance with the SQA TRICON V9.5 Validation Plan revision 1.0. The results of this validation are documented in the SQA Test report.

9.5 Version 3.0

This version of TS1131 was released as part of Trident Release 1.0 only. This version does not support the TRICON hardware platform.

9.6 Version 3.0.1

This version of TS1131 was released as part of the TRICON V9.5.2 release (8/8/2000).

9.6.1 Description of the change
TS1131 Version 3.0.1 supports both TRICON and Trident hardware platforms. TS1131 V3.0.1 includes the following major functional enhancements:
- Support for Cut and Paste in CEM
- A new option in the CEM Editor for an AND or an OR matrix.
- A new auto save / back-up function for project files
In addition to these enhancements, PDRs 2336, 2367, 2398, 2693, and 2697 were fixed.

9.6.2 V&V activity to support the change
Because of the extent of the changes between Version 2.0SP3 and Version 3.0.1 it was decided to complete a full functional validation of TS1131 for the V3.0.1 release. The validation was carried out in accordance with SQA V9.5.2 Validation Plan (3/17/2000). The results of the validation are documented in the SQA Validation report. The validation included execution of the System Functional Validation Procedure (9600047-001), execution of all available TS1131 Compiler and Standard Library test vectors (35000+) and all TS1131 GUI test scripts.

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9.7   Version 3.1

9.7.1   Description of the change

Tristation Version 3.1 includes support for the new 3008 Main Processor Module and for future Trident Analog Output, Pulse Input and Communication modules. None of these modules are being considered for Nuclear Qualification currently. Furthermore TS1131 V3.1 includes some user-requested enhancements to the CEM editor and monitor functions in Tristation. Configuration libraries were also revised to recognize the new Nuclear "N" model numbers for all 1E qualified modules. In addition to the mentioned enhancements, a number of outstanding PDRs were fixed in this Tristation release. The Tristation software release definition includes a listing of all PDRs that were fixed in this release. Tristation V3.1 has been released for use with TRICON V9.6 and TRICON V9.5.

9.7.2   V&V activity to support the change

Tristation Version 3.1 was validated as part of the TRICON V9.6 / TRICON V9.5.3 validation effort. The validation of TS1131 V3.1 was carried out in accordance with the SQA TRICON V9.6/V9.5.x Validation Plan. The results of the validation are documented in the SQA Validation report. The validation included execution of the System Functional Validation Procedure (9600047-001), execution of all available TS1131 Compiler and Standard Library test vectors (35000+) and all TS1131 GUI test scripts.

9.8   Evaluation of the TS1131 changes from V2.0 to V3.1

Triconex has no reason to believe that any of the changes made to Tristation invalidate the findings and results of the generic qualification of the TRICON in accordance with EPRI TR-107330. The changes were fully validated by Triconex SQA and TUV.