TRICONEX®

TRICONEX PRODUCTS – INVENSYS PROCESS SYSTEMS

Project:	TRICON v10 NUCLEAR QUALIFICATION PROJECT

Non -Proprietary copy per 10CFR2.390
- Areas of proprietary information have been redacted.
- Designation letter corresponds to Triconex proprietary policy categories (Ref. transmittal number NRC-V10-09-001, Affidavit, Section 4.)

ELECTRICAL FAST TRANSIENT (EFT) TEST PROCEDURE

Document No: 9600164-514

Rev. 0

March 8, 2007

MPR ASSOCIATES QUALITY ASSURANCE DOCUMENT

This document has been prepared, reviewed and approved in accordance with the Quality Assurance requirements of 10CFR50, Appendix B, as specified in the MPR Quality Assurance Manual and in accordance with the requirements of Invensys Triconex Purchase Order No. 113803, dated March 23, 2006.

	Name	Signature	Title
Preparer:	Mitchell Albers		MPR Project Manager
Reviewer:	David Schwade		MPR Level II Test Engineer
Approval:	Eric Claude		MPR ICT Group Manager

Document Change History			
Revision	**Date**	**Change**	**Preparer**
Rev. 0	03/08/07	Initial issue for Triconex review	M. Albers

TABLE OF CONTENTS

1.0 PURPOSE

The purpose of this procedure is to provide instruction for Electrical Fast Transient (EFT) Testing of the Tricon v10 Nuclear Qualification Project Tricon-Under-Test (TUT). EFT Testing is performed as part of EMI/RFI qualification testing as discussed in NRC Regulatory Guide 1.180, Rev. 1, Section 5.3 (Reference 5.1) and Triconex Document No. 9600164-500, "Master Test Plan," (Reference 5.2).

2.0 OBJECTIVE

The objective of EFT Testing is to demonstrate the suitability of the Tricon v10 PLC for qualification as a safety-related device with respect to susceptibility to repetitive electrical fast transients on the power and signal input/output leads. EFT Testing will be performed on the TUT.

3.0 SCOPE

RG 1.180, Rev. 1, Section 5.3, requires that the PLC under qualification be tested for EFT susceptibility in accordance with the requirements of IEC 61000-4-4 (Reference 5.3). The Triconex Master Test Plan (Reference 5.2) specifies that EFT Testing be performed in accordance with NRC RG 1.180, Rev 1.

3.1 EFT Test Method

Section 5.3 of NRC RG 1.180, Rev. 1 includes the requirements for EFT Testing of the AC and DC power supplies of safety related instrumentation and control (I&C) systems. Section 5.3 specifies testing to either IEEE C62.41-1991 (Reference 5.4) or IEC 61000-4-4 (Reference 5.3). EFT susceptibility testing of the TUT power supplies will be done to the IEC 61000-4-4 test method.

Section 4.2 of NRC RG 1.180, Rev. 1 includes the requirements for EFT Testing of the signal leads of safety related instrumentation and control (I&C) systems. Section 4.2 specifies testing to either Military Standard MIL-STD-461E (Reference 5.5) or IEC 61000-4-4 (Reference 5.3). EFT susceptibility testing of the TUT signal leads will be done to the IEC 61000-4-4 test method.

EFT Testing of the TUT will be performed at National Technical Systems (NTS) Laboratories in Boxborough, Massachusetts. The testing will be performed in accordance with NTS Test Procedure No. TP-62987-07N-EMI (Reference 5.6). This procedure implements EFT Testing in accordance with NRC RG 1.180, Rev. 1 test method requirements.

3.2 EFT Test Levels

Table 22 of Regulatory Guide 1.180, Rev. 1 defines the IEC 61000-4-4 EFT withstand levels for the AC and DC power supplies of safety related instrumentation installed in various plant locations. Based on the discussion in Section 5.3 of Regulatory Guide 1.180, Rev. 1, the AC and DC power supplies of a Tricon v10 system are expected to be installed in *Category B* locations with EFT *Low Exposure* levels. The corresponding EFT withstand level is 2 kV.

Table 15 of Regulatory Guide 1.180, Rev. 1 defines the IEC 61000-4-4 EFT withstand levels for the signal leads of safety related instrumentation installed in various plant locations. Based on the discussion in Section 4.2 of Regulatory Guide 1.180, Rev. 1, the signal circuits of a Tricon v10 system are expected to be installed in *Category B* locations with EFT *Low Exposure* levels. The corresponding EFT Withstand level is 1 kV.

The applied EFT test levels will be stepped up from 0.5 kV to the maximum specified test voltage in 0.5 kV increments.

3.3 EFT Test Equipment Mounting

For EFT Testing, the TUT will be installed in the NTS anechoic test chamber in accordance with the requirements of References 5.2 and 5.6. The TUT will be mounted in two metal frame instrument cabinets (with all sides removed) as follows:

- Cabinet 1: TUT Chassis No. 1 and 2, with external termination panels
- Cabinet 2: TUT Chassis No. 3 and 4, with external termination panels

Cabinets 1 and 2 will be mounted on non-conductive material approximately 4 inches above the floor of the test chamber. The test system power distribution panel (Cabinet 4) will also be located inside the test chamber. However, this cabinet is not part of the equipment under test. All other test system equipment will be located outside the anechoic test chamber.

Grounding of the TUT is in accordance with the manufacturer's recommendations. Grounding details are shown on Triconex Drawing Nos. 9600164-201 through 9600164-207 (References 5.7 through 5.13). Per NTS Test Procedure No. TP-62987-07N-EMI, the TUT grounds will be bonded to the test chamber floor, which acts as a ground plane for the entire test chamber.

The mounting configuration described above meets the intent of Section 7.2 of IEC 61000-4-4, which specifies the test set-up for type tests performed in laboratories.

3.4 EFT Test Power Supply Configuration

Section 8.2 of IEC 61000-4-4 specifies that the equipment-under-test shall be in the normal operating conditions. The AC and DC power sources to the TUT chassis power supplies will be set at nominal source voltage and frequency conditions during the EFT Testing.

In order to minimize transmission of applied EFT disturbances outside the anechoic test chamber, all test system power supply cables entering the test chamber must pass through filter capacitors (provided by NTS) located in the chamber walls. The power supply feeds to the TUT chassis power supplies will also pass through L.I.S.N.'s (provided by NTS) located inside the test chamber.

3.5 TUT Operation

Section 8.2 of IEC 61000-4-4 specifies that the equipment-under-test shall be in the normal operating conditions. During EFT Testing, the TUT will be powered with the TSAP operating in a mode which will cycle a number of the discrete and analog output circuits on timed ON/OFF cycles, and will also hold a number of the discrete and relay output points in the ON (closed) position.

In order to minimize transmission of applied EFT disturbances outside the anechoic test chamber, most of the test system signal and communication wiring entering or exiting the test chamber will pass through PI filters (provided by MPR) located in the chamber walls. In order to limit the number of required signal wire pass-through filters, the normal test system configuration shown on Triconex Drawing No. 9600164-103 (Reference 5.14), must be altered for EFT Testing. The number of signal wires passing from the TUT (located inside the test chamber) to the test system Data Logger, the Simulator Tricons and the manual simulation instruments (located outside the test chamber) will in most cases be limited to one circuit per TUT input/output module. Notable exceptions include three circuits to the thermocouple input module, and eight circuits to the RTD input module. All other normally interconnected signal wires must be disconnected and input/output point jumpers installed as necessary. The EMI/RFI Test procedure (Reference 5.17) provides instruction for reconfiguration of the test system, and includes documentation of the make and model number of the PI filters installed in the test system signal and communication interface wires. As a result of the system reconfiguration, except for the thermocouple and RTD input modules as noted above, only one point on each TUT input/output module will be monitored for acceptable operation during EFT Testing. Internal TUT diagnostics will still perform limited surveillance of the operation of the unmonitored input/output points.

3.6 Test Instrumentation

NTS Laboratories will provide the test instrumentation required for generating and monitoring the applied levels of EFT disturbances during testing. NTS Test Procedure No. TP-62987-07N-EMI includes identification and description of the NTS test equipment and instrumentation used to perform EFT Testing.

3.7 TUT Performance Monitoring

Appendix 8 of the Triconex Master Test Plan (Reference 5.2) lists the EFT test acceptance criteria. Appendix 8 states that monitoring of normal TUT operation during EFT Testing will demonstrate satisfaction of the acceptance criteria. To clarify the definition of normal operation, the following additional acceptance criteria from Section 4.3.7 of EPRI TR-107330 (Reference 15) will be applied during EFT Testing:

a.) The main processors and coprocessors shall continue to function.
b.) The transfer of I/O data shall not be interrupted.
c.) The applied EFT disturbances shall not cause the discrete I/O to change state.
d.) Analog I/O levels shall not vary more than 3% (of full scale).

During EFT Testing, NTS Laboratories will be responsible for generating and exposing the test system to the required levels of EFT disturbances given in Sections 4.2 and 5.3 of NRC RG 1.180, Rev. 1. During EFT Testing, MPR and Triconex will be responsible for monitoring operation of the test system and determining the susceptibility of the TUT to the applied levels of EFT disturbances.

During EFT Testing, operation of the TUT will be monitored and recorded by the test system Data Logger and the TUT Tristation/Trilogger Console interface. The recorded data will be evaluated for time periods before, during and after each EFT Test. The data evaluations will consider operation (per the TSAP) of at least one input or output point on each I/O module installed in the TUT, and operation of the peripheral communication interfaces including the Simulator Tricon Peer-to-Peer and serial communication interfaces. These data evaluations are documented on Attachment 3, which was developed from the Test Specimen Application Program (TSAP) Function Diagrams (Reference 5.16).

The status of the TUT Chassis 1 diagnostic indicating LED's will also be reviewed and recorded to demonstrate continued correct operation or to detect system faults. The data recorded during EFT Testing is sufficient to demonstrate the Triconex performance criteria listed above.

4.0 ACCEPTANCE CRITERIA

The following EFT Test acceptance criteria are as given in Appendix 8 of the Master Test Plan (Reference 5.2), and EPRI TR-107330, Section 4.3.7 (Reference 5.15). Section 10.10 of this test procedure provides the specific EFT Test acceptance criteria based on the design and operation of the TUT and the test system, and based on the TUT performance data collected as part of implementation of this procedure.

4.1 Applying the EFT Test voltages to the specified TUT interfaces will not damage any other module or device in the test specimen, or cause disruption of the operation of the backplane signals or any other data acquisition signals.

4.2 The TUT shall operate as intended during and after application of the IEC 61000-4-4 EFT test levels specified in Sections 4.2 and 5.3 of NRC RG 1.180, Rev. 1 for low exposure applications. Specifically:

IEC 61000-4-4: Power Leads, Level 3	Test Voltage Level: 2 kV max.
IEC 61000-4-4: Signal Leads, Level 3	Test Voltage Level: 1 kV max.

Evaluation of normal operating performance data (inputs, outputs and diagnostic indicators) shall demonstrate operation as intended, including the following specific operational performance from Section 4.3.7 of EPRI TR-107330:

a.) The main processors and coprocessors shall continue to function.
b.) The transfer of I/O data shall not be interrupted.
c.) The applied EFT disturbances shall not cause the discrete I/O to change state.
d.) Analog I/O levels shall not vary more than 3% (of full scale).

5.0 REFERENCES

NOTE: Current revisions of all Triconex documents are as per the current revision of Triconex Document No. 9600164-540, Master Configuration List. This test procedure was developed using Triconex document revisions in effect on the date of the procedure, as documented in the Master Configuration List revision in effect on that date.

5.1 U.S. Nuclear Regulatory Commision Regulatory Guide 1.180, Revision 1, "Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems," October 2003

5.2 Triconex Document No. 9600164-500, "Master Test Plan"

5.3 IEC 61000-4-4, "Electromagnetic Compatibility (EMC), Part 4-4: Testing and Measurement Techniques, Electrical Fast Transient/Burst Immunity Test," 2004

5.4 IEEE Standard C62.41-1991, "IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits," 1991, Reaffirmed 1995

5.5 Department of Defense Interface Standard MIL-STD-461E, "Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment," August 20, 1999

5.6 National Technical Systems Test Procedure No. TP-62987-07N-EMI, "Test Procedure for Electromagnetic Compatibility Qualification of the Tricon v10 Nuclear Qualification Project Tricon-Under-Test"

5.7 Triconex Drawing No. 9600164-201, Sheets 1 and 2, Tricon v10 Nuclear Qualification Project - Power Distribution Wiring Diagram

5.8 Triconex Drawing No. 9600164-202, Sheet 1, Tricon v10 Nuclear Qualification Project - Test Chassis #1 Power Distribution Wiring Diagram

5.9 Triconex Drawing No. 9600164-203, Sheets 1 and 2, Tricon v10 Nuclear Qualification Project - Test Chassis #2 Power Distribution Wiring Diagram

5.10 Triconex Drawing No. 9600164-204, Sheets 1 and 2, Tricon v10 Nuclear Qualification Project - Test Chassis #3 Power Distribution Wiring Diagram

5.11 Triconex Drawing No. 9600164-205, Sheets 1 and 2, Tricon v10 Nuclear Qualification Project - Test Chassis #4 Power Distribution Wiring Diagram

5.12 Triconex Drawing No. 9600164-206, Sheet 1, Tricon v10 Nuclear Qualification Project - Simulator Chassis #5 Power Distribution Wiring Diagram

5.13 Triconex Drawing No. 9600164-207, Sheet 1, Tricon v10 Nuclear Qualification Project - Simulator Chassis #6 Power Distribution Wiring Diagram

5.14 Triconex Drawing No. 9600164-103, Sheets 1 and 2, Tricon v10 Nuclear Qualification Project - System Block Diagram

5.15 EPRI Report TR-107330, "Generic Requirements Specification for Qualifying a Commercially Available PLC for Safety-Related Applications in Nuclear Power Plants," Final Report dated December 1996

5.16 Triconex Diagram Nos. 9600164-600-614, "Function Diagrams"

5.17 Triconex Procedure No. 9600164-510, "EMI/RFI Test Procedure"

5.18 Triconex Document No. 9600164-540, "Master Configuration List"

5.19 MPR Associates, Inc. Quality Assurance Manual, Edition 2, Revision 5, Effective Date March 31, 2006

5.20 Triconex Procedure No. 9600164-502, "System Setup and Checkout Procedure"

5.21 MPR Document No. 0449-0602-QAP-01, Rev. 0 dated May 12, 2006, "Quality Assurance Plan for Triconex Corporation Tricon v10 PLC Nuclear Qualification Project"

5.22 Triconex Document No. 9600164-002, "Nuclear Qualification Quality Plan"

6.0 PREREQUISITES

6.1 Record the revision number of the current Master Configuration List (Reference 5.18):

Current Master Configuration List Revision No.: _____ _____
Initials

6.2 Verify the EFT Test procedure in hand is the current approved revision as indicated on the Master Configuration List. _____
Initials

6.3 Verify a record of indoctrination in the MPR Associates Quality Assurance Manual (Reference 5.19) is on file for all MPR personnel involved in performance of this procedure. These personnel shall be certified to Level I, II or III, Instrumentation and Control (or appropriately supervised) to perform testing activities in accordance with Procedure No. QA-11.1 of the MPR Quality Assurance Manual. _____
Initials

6.4 Personnel associated with performance of this test have received training in this test procedure and the equipment as indicated by their signature below.

Test Personnel Identification:

Printed Name	Signature	Initials

6.5 Verify that Triconex personnel initiate a Test Log as required by Paragraph 9.8.5 of the Triconex Nuclear Qualification Quality Plan (Reference 5.22). Triconex personnel are responsible for maintaining this Test Log throughout performance of this test procedure. MPR personnel are responsible for maintaining the Test Log included as Attachment 2 to this test procedure.

_____
Initials

6.6 Test Prerequisites:

Performed By: _____ **Date:** _____

Invensys Triconex QA: _____ **Date:** _____

7.0 PRECAUTIONS

7.1 **Voltages of 230 VAC, 115 VAC, 120 VDC, 48 VDC, and 24 VDC are present within the test system. Extreme care must be taken when measuring or working within the test system.**

7.2 **The EFT susceptibility tests performed by NTS may result in generation of electromagnetic fields which are potentially dangerous to personnel. The permissible exposure levels in ANSI C95.1 shall not be exceeded in areas where personnel are present. Safety procedures and devices shall be used to prevent accidental exposure of personnel to radio frequency hazards.**

7.3 **Personnel performing this test shall ensure that a suitable environment for testing is maintained. The test environment should include provisions to avoid possible equipment damage during handling, to control personnel safety hazards, and to maintain equipment being tested within the specified operating parameters for proper performance.**

7.4 **Test personnel shall apply the appropriate procedural steps included in Section 10.8 of Triconex Procedure No. 9600164-502, "System Setup and Checkout Procedure" (Reference 5.20) when energizing the test system source power supplies in order to preclude damage to the TUT chassis power supplies or the test system source power supplies.**

8.0 MEASURING AND TEST EQUIPMENT

8.1 The configured Tricon v10 Test System equipment will be used to support EFT Testing. This includes simulating inputs with the Simulator Tricons and portable simulation devices (mV, RTD, T/C, and pulse generator), manipulating the simulated inputs through the test specimen application program (TSAP), monitoring the TUT operation using the TUT Tristation/Trilogger Console interface, and collecting system operating data with the Data Logger. This equipment will be calibrated as necessary to support collection of quality data. The identification, configuration and calibration status of this equipment will be recorded using the System Setup and Checkout Procedure (Reference 5.20).

8.2 The following additional measuring and test equipment will be used during performance of this test:

- Fluke Model 87-V digital multimeter, or equivalent

8.3 Record the following for the Fluke Model 87-V digital voltage/frequency meter (or equivalent) used to conduct the EFT Test.

_____
Initials

M&TE MAKE/MODEL NO.	SERIAL NUMBER	RANGE/ACCURACY	CAL. DUE DATE

9.0 TEST SET-UP

9.1 Test System Setup

9.1.1 Record the run identification of the Setup and Checkout Procedure (Reference 5.20) that was last performed prior to performing this test.

Prior Setup and Checkout Run ID: _____ _____
Initials

9.1.2 Verify that the test equipment calibration due dates identified by the completed System Setup and Checkout Procedure identified above will not be exceeded during performance of this procedure.

_____
Initials

9.1.3 Verify that the test system remains configured in the NTS anechoic test chamber in accordance with Steps 9.1.3 through 9.1.14 of the EMI/RFI Test procedure (Reference 5.17).

_____
Initials

9.1.4 For each TUT and Simulator chassis, measure the "System Ground Isolation Resistance" using the Fluke digital multimeter. Measure resistance between the "AC Safety or Chassis Ground" termination and the "Signal or Instrument Ground" termination. These terminations are located on the chassis backplane terminal strip. Record the measured value for each chassis in the following table:

_____
Initials

Tricon Chassis	Measured System Ground Isolation Resistance	Measured Resistance ≥ 2200 ohms
TUT Chassis 1	_____ ohms	**SAT UNSAT**
TUT Chassis 2	_____ ohms	**SAT UNSAT**
TUT Chassis 3	_____ ohms	**SAT UNSAT**
TUT Chassis 4	_____ ohms	**SAT UNSAT**
Simulator No. 5S	_____ ohms	**SAT UNSAT**
Simulator No. 6S	_____ ohms	**SAT UNSAT**

9.1.5 EFT Testing is performed with all TUT chassis power supplies energized and operating at nominal source power supply settings. Energize and adjust each TUT power supply as indicated below. Use the digital multimeter to verify settings. Record the as-tested power supply settings. Measurements shall be taken at the appropriate power distribution bus.

_____
Initials

As-tested power supply settings:

PS1 (120 VAC, 60 Hz): _____ VAC _____ Hz

PS2 (24 VDC): _____ **VDC**

PS3 (120 VAC, 60 Hz): _____ **VAC** _____ **Hz**

PS4 (24 VDC): _____ **VDC**

PS5 (48 VDC): _____ **VDC**

PS6 (120 VDC): _____ **VDC**

Chassis 1, Power Supply PS1: ON

Chassis 1, Power Supply PS2: ON

Chassis 2, Power Supply PS1: ON

Chassis 2, Power Supply PS2: ON

Chassis 3, Power Supply PS1: ON

Chassis 3, Power Supply PS2: ON

Chassis 4, Power Supply PS1: ON

Chassis 4, Power Supply PS2: ON

9.1.5 Test System Setup Complete

Performed By: _____ **Date:** _____

Invensys Triconex QA: _____ **Date:** _____

9.2 Tricon-Under-Test and Simulator Tricon Operation Verification

9.2.1 Verify correct operation of the TUT by observing the following.

_____
Initials

Main Processor Modules

- The PASS indicators are lit, indicating the TUT has passed the self-diagnostic tests.
- The FAULT indicators are off, indicating no faults on the modules.

- The I/O TX and I/O RX indicators are periodically lit, indicating data transfer on the TUT I/O bus.
- The ACTIVE indicators are flashing, indicating the TSAP program is running.

Remote Extender Modules

- The PASS indicators are lit, indicating the TUT has passed the self-diagnostic tests.
- The FAULT indicators are off, indicating no faults on the modules.
- The ACTIVE indicators are lit, indicating active operation of the modules.
- The TX and RX1 indicators are periodically lit, indicating data transfer between the TUT chassis.

Power Supply Modules

- The PASS indicators are lit, indicating the TUT has passed the self-diagnostic tests.
- The FAIL, LOWBAT, and TEMP indicators are off, indicating no faults on the power supplies.

I/O Modules

- The PASS indicators are lit, indicating the TUT has passed the self-diagnostic tests.
- The FAULT indicators are off, indicating no faults on the modules.
- The ACTIVE indicators are lit, indicating active operation of the modules.

9.2.2 Verify correct operation of the Simulator Tricons by observing the following.

_____
Initials

Main Processor Modules

- The PASS indicators are lit, indicating the Simulator Tricons have passed the self-diagnostic tests.
- The FAULT indicators are off, indicating no faults on the modules.
- The I/O TX and I/O RX indicators are periodically lit, indicating data transfer on the Simulator Tricon I/O busses.
- The ACTIVE indicators are flashing, indicating the Simulator Tricon application programs are running.

Power Supply Modules

- The PASS indicators are lit, indicating the Simulator Tricons have passed the self-diagnostic tests.

- The FAIL, LOWBAT, and TEMP indicators are off, indicating no faults on the power supplies.

I/O Modules

- The PASS indicators are lit, indicating the Simulator Tricons have passed the self-diagnostic tests.
- The FAULT indicators are off, indicating no faults on the modules.
- The ACTIVE indicators are lit, indicating active operation of the modules.

9.2.3 Tricon-Under-Test and Simulator Tricon Operation Verification Complete

Performed By: _____ **Date:** _____

9.3 Input Simulator Equipment Configuration

9.3.1 If necessary, install new batteries in any battery-powered devices, as indicated by device displays or other battery level indicators.

_____
Initials

9.3.2 The connecting circuits to five of the DAS discrete input points are configured with interposing relays that can be switched into and out of the circuits. Verify that the selector switch for each of these five circuits is set such that the interposing relay is switched into the circuit (switch position 3).

_____
Initials

9.3.3 Set or adjust the following input simulation equipment as indicated.

_____
Initials

PG1 (pulse generator):	**10,000 Hz**
RTDS1 (RTD simulator):	**300°C**
RTDS2 (RTD simulator):	**100°C**
RTDS3 (RTD simulator):	**100°C**
RTDS4 (RTD simulator):	**150°C**
RTDS5 (RTD simulator):	**50°C**
RTDS6 (RTD simulator):	**25°C**
RTDS7 (simulator):	**50 mV**

RTDS8 (RTD simulator): **75°C**

TCS1 (T/C simulator): **100°C**

TCS2 (T/C simulator): **500°C**

TCS3 (T/C simulator): **1000°C**

9.3.4 Verify the TUT chassis 1 keyswitch is in the "PROGRAM" position to enable the TUT Tristation/Trilogger Console interface during testing. If installed, remove the TUT key from the keyswitch.

_____
Initials

9.3.5 At the TUT Tristation/Trilogger Console, view the version number of the TSAP loaded in the TUT. Record the version number below:

TSAP Version Number: _____

_____
Initials

9.3.6 At the TUT Tristation/Trilogger Console:

- Change TSAP variable "DO_Power_Loading" to "TRUE"
- Change TSAP variable "RO_Mode" to "TRUE"
- Disable and change TSAP variable "IO_Point_Disabled" to "FALSE"
- Disable and change TSAP variable "Keyswitch_Out_of_Position" to "FALSE"
- Reset TSAP variable "Common_Diagnostics_Alm" to "FALSE"
- Change TSAP variable "TSAP_Mode" to "1"

_____
Initials

9.3.7 Test System Power Supply and Simulator Settings Complete

Performed By: _____ **Date:** _____

9.4 Test System Operation Verification

9.4.1 From the Data Logger **Test Selection** Screen:

A) Select "**EFT Test**" from the **Select Test** menu.

B) Verify the correct **Test Description** is displayed.

C) Record the **Save As** file name in the space below.

File Name: _____

D) Left click on the **OK** box.

_____
Initials

9.4.2 From the Data Logger **Data Acquisition** Screen:

A) Verify data is being acquired.

B) Left click on the **Log Data?** box to begin saving data.

_____
Initials

9.4.3 Set the TUT Tristation/Trilogger Console interface to begin recording and displaying the following TSAP variables:

_____
Initials

Peer-to-Peer Communications

- P2P_1_Comm_Alarm
- P2P_2_Comm_Alarm

Modbus Communications

- MB_1_Comm_Alarm
- MB_2_Comm_Alarm

RTD Inputs

- AI040701ind
- AI040702ind
- AI040703ind
- AI040704ind
- AI040705ind
- AI040706ind
- AI040707ind
- AI040708ind

T/C Inputs

- TC010701eu
- TC010708eu
- TC010716eu

Pulse Input

- PI010401raw

Analog Inputs

- AI040101raw
- AI040117raw
- AI040201raw
- AI040301raw
- AI040717raw
- AI040801raw
- AI040817raw

Discrete Inputs/Outputs

- DI020405in
- DI020406in
- DI020417in
- DO020608out
- DI030201in
- DI030220in
- DI030222in
- DI030707in
- DI030717in
- DI030718in

Internal Diagnostics Alarm

- Common_Diagnostics_Alm

9.4.4 Review the data displays of the TUT Tristation/Trilogger Console interface and the Data Logger. Using the table provided in Attachment 3, verify the expected trending of a data point associated with the operation of each module installed in the TUT.

_____
Initials

9.4.5 Perform the following:

_____
Initials

A) From the Data Logger **Data Acquisition** Screen, left click on the **STOP** box to stop saving data.

B) Save a backup copy of the Data Logger data file generated during System Operation Verification Testing to the Data Logger external hard disk drive.

C) Stop data recording at the TUT Tristation/Trilogger Console interface. Save the recorded data to CD/DVD. Record the data file name in the space below.

File Name: _____

9.4.6 Test System Operation Verification Complete

Performed By: _____ **Date:** _____

10.0 PROCEDURE

NOTE: This procedure may be revised during the test performance, in accordance with MPR Document No. 0449-0602-QAP-01, (Reference 5.21). Any procedure revisions required during test performance will be documented using the Test Exception and Resolution Report (TERR) form from Reference 5.21 and included as Attachment 4 to this procedure.

NOTE: MPR Document No. 0449-0602-QAP-01, (Reference 5.21), provides instruction for disposition of nonconforming items detected during performance of this test procedure.

NOTE: Failures of the test specimen to meet the EFT Test acceptance criteria will be addressed by Triconex personnel. Triconex Document No. 9600164-002, (Reference 5.22) provides instruction for disposition of test specimen failures to meet test acceptance criteria during qualification testing.

NOTE: The completed test procedure shall be maintained as an MPR Quality Assurance record in accordance with Procedure QA-17.1 of the MPR Quality Assurance Manual (Reference 5.19).

10.1.1 Ensure that NTS personnel have verified all test generators and coupling networks to be used for performing IEC 61000-4-4 testing in accordance with Sections 6.1.2 and 6.2.2 of IEC 61000-4-4.

_____
Initials

10.1.2 Verify through NTS personnel that the arrangement of the TUT and inter-connecting cabling is in accordance with the requirements of IEC 61000-4-4.

_____
Initials

10.2 IEC 61000-4-4 EFT Susceptibility, TUT 120 VAC Chassis Power Supply Modules

NOTE: Each TUT chassis receives 120 VAC supply power from the test system power distribution panel (Cabinet 4 located inside the anechoic test chamber at the opposite end from the TUT cabinets). The 120 VAC power supply connection to test system power distribution panel DP1 represents the final point in the TUT chassis power distribution system prior to separation of the power supply lines to each of the four TUT chassis. The EFT disturbance signals will be injected into the 120 VAC chassis power supply circuit at this point.

10.2.1 De-energize distribution panel DP1 by de-energizing test system power supply PS1. Verify de-energization of power at distribution panel DP1 using the digital multimeter.

_____
Initials

10.2.2 Verify that NTS personnel have connected the EFT coupling network and test generator to the input power leads to 120 VAC distribution panel DP1 in accordance with the test setup specified in IEC 61000-4-4.

_____
Initials

10.2.3 Energize test system power supply PS1.

_____
Initials

10.2.4 Verify correct operation of the TUT and Simulator Tricons by repeating Steps 9.2.1 and 9.2.2 of this procedure.

_____
Initials

The TUT 120 VAC chassis power supply modules will be tested at the EFT Category B Low Exposure susceptibility level defined in NRC RG 1.180, Rev. 1, Section 5.3 and Table 22, at test voltage levels of 0.5 kV, 1.0 kV, 1.5 kV and 2.0 kV. For each test voltage level, repeat Steps 10.2.5 through 10.2.13.

Before Each EFT Susceptibility Test

10.2.5 Record the date, time of start, and test voltage level of the IEC 61000-4-4, EFT Test of the TUT 120 VAC chassis power supply modules on the EFT Test Log Sheet (Attachment 2).

_____
Initials

10.2.6 From the Data Logger **Test Selection** Screen:

_____
Initials

A) Select "**EFT Test**" from the **Select Test** menu.

B) Verify the correct **Test Description** is displayed.

C) Record the **Save As** file name in the space provided below for the specific test being performed.

0.5 kV Test - File Name: _____

1.0 kV Test - File Name: _____

1.5 kV Test - File Name: _____

2.0 kV Test - File Name: _____

D) Left click on the **OK** box.

10.2.7 From the Data Logger **Data Acquisition** Screen:

_____
Initials

A) Verify data is being acquired.

B) Left click on the **Log Data?** box to begin saving data.

10.2.8 Set the TUT Tristation/Trilogger Console interface to begin recording and displaying the following TSAP variables:

_____
Initials

Peer-to-Peer Communications

- P2P_1_Comm_Alarm
- P2P_2_Comm_Alarm

Modbus Communications

- MB_1_Comm_Alarm
- MB_2_Comm_Alarm

RTD Inputs

- AI040701ind
- AI040702ind
- AI040703ind
- AI040704ind
- AI040705ind
- AI040706ind
- AI040707ind
- AI040708ind

T/C Inputs

- TC010701eu
- TC010708eu
- TC010716eu

Pulse Input

- PI010401raw

Analog Inputs

- AI040101raw
- AI040117raw
- AI040201raw
- AI040301raw
- AI040717raw
- AI040801raw
- AI040817raw

Discrete Inputs/Outputs

- DI020405in
- DI020406in
- DI020417in
- DO020608out
- DI030201in
- DI030220in
- DI030222in
- DI030707in
- DI030717in
- DI030718in

Internal Diagnostics Alarm

- Common_Diagnostics_Alm

During Each EFT Susceptibility Test

10.2.9 Instruct NTS personnel to inject the EFT disturbance signal onto the input power leads to 120 VAC distribution panel DP1 in accordance with the test procedure specified in IEC 61000-4-4.

_____
Initials

10.2.10 Monitor the following and record on the Test Procedure Comment Sheet (Attachment 1) any indications of abnormal operation or system faults:

_____
Initials

- The front face of TUT Chassis 1
- The Data Logger display
- The TUT Tristation/Trilogger Console displayed data points

After Each EFT Susceptibility Test

10.2.11 On completion of the test, perform the following:

_____
Initials

A) From the Data Logger **Data Acquisition** Screen, left click on the **STOP** box to stop saving data.

B) Save a backup copy of the Data Logger data file generated during IEC 61000-4-4 EFT Testing of the TUT 120 VAC chassis power supply modules to the Data Logger external hard disk drive.

C) Stop data recording at the TUT Tristation/Trilogger Console interface. Save the recorded data to CD/DVD. Record the data file name in the space below for the specific test being performed.

0.5 kV Test - File Name: _____

1.0 kV Test - File Name: _____

1.5 kV Test - File Name: _____

2.0 kV Test - File Name: _____

10.2.12 Review the recorded test data from the Data Logger and the TUT Tristation/Trilogger Console interface. Using the table provided in Attachment 3, verify the expected trending of a data point associated with the operation of each module installed in the TUT.

_____
Initials

10.2.13 Record the date and time of the end of IEC 61000-4-4 EFT Testing of the TUT 120 VAC chassis power supply modules on the EFT Test Log Sheet (Attachment 2).

_____
Initials

10.2.14 Record satisfactory completion of IEC 61000-4-4 EFT Testing of the TUT 120 VAC chassis power supply modules. Satisfactory completion includes:

_____
Initials

i) The results of completion of Attachment 3 for data collected during each test indicate all modules functioning properly.

ii) No system alarms or faults indicated by the TUT Chassis 1 LED's, the monitored TUT Chassis 1 Power Supply Alarm Relay, or the TSAP fault/alarm indicators.

If results of any test are unsatisfactory, record the highest test voltage level at which satisfactory test results were obtained.

TUT 120 VAC Chassis Power Supply Module EFT Susceptibility

Test Results: Sat. ____ Unsat. ____ (Highest Acceptable Test Level: _____ kV)

10.2.15 TUT 120 VAC Chassis Power Supply Module Electrical Fast Transient Testing Complete

Performed By: _____ **Date:** _____

Invensys Triconex QA: _____ **Date:** _____

10.3 IEC 61000-4-4 EFT Susceptibility, TUT 230 VAC Chassis Power Supply Modules

NOTE: TUT chassis 1 and 2 receive 230 VAC supply power from the test system power distribution panel (Cabinet 4 located inside the anechoic test chamber at the opposite end from the TUT cabinets). The 120VAC to 230 VAC transformer T-1 power supply connection to the test system power distribution panel DP4 represents the final point in the TUT chassis power distribution system prior to separation of the power supply lines to TUT chassis 1 and 2. The EFT disturbance signal will be injected into the 230 VAC chassis power supply circuit at this point.

10.3.1 De-energize distribution panels DP1 and DP4 by de-energizing test system power supply PS1. Verify de-energization of power at distribution panels DP1 and DP4 using the digital multimeter.

_____
Initials

10.3.2 Verify that NTS personnel have disconnected the EFT coupling network and test generator from the input power leads to 120 VAC distribution panel DP1, and reconnected the EFT coupling network and test generator to the input power leads to 230 VAC distribution panel DP4 in accordance with the test setup specified in IEC 61000-4-4.

_____
Initials

10.3.3 Energize test system power supply PS1.

_____
Initials

10.3.4 Verify correct operation of the TUT and Simulator Tricons by repeating Steps 9.2.1 and 9.2.2 of this procedure.

_____
Initials

The TUT 230 VAC chassis power supply modules will be tested at the EFT Category B Low Exposure susceptibility level defined in NRC RG 1.180, Rev. 1, Section 5.3 and Table 22, at test voltage levels of 0.5 kV, 1.0 kV, 1.5 kV and 2.0 kV. For each test voltage level, repeat Steps 10.3.5 through 10.3.13.

Before Each EFT Susceptibility Test

10.3.5 Record the date, time of start, and test voltage level of the IEC 61000-4-4, EFT Test of the TUT 230 VAC chassis power supply modules on the EFT Test Log Sheet (Attachment 2).

_____
Initials

10.3.6 From the Data Logger **Test Selection** Screen:

_____
Initials

A) Select "**EFT Test**" from the **Select Test** menu.

B) Verify the correct **Test Description** is displayed.

C) Record the **Save As** file name in the space provided below for the specific test being performed.

0.5 kV Test - File Name: _____

1.0 kV Test - File Name: _____

1.5 kV Test - File Name: _____

2.0 kV Test - File Name: _____

D) Left click on the **OK** box.

10.3.7 From the Data Logger **Data Acquisition** Screen:

_____
Initials

A) Verify data is being acquired.

B) Left click on the **Log Data?** box to begin saving data.

10.3.8 Set the TUT Tristation/Trilogger Console interface to begin recording and displaying the TSAP variables listed in Step 10.2.8 above.

_____
Initials

During Each EFT Susceptibility Test

10.3.9 Instruct NTS personnel to inject the EFT disturbance signal onto the input power leads to 230 VAC distribution panel DP4 in accordance with the test procedure specified in IEC 61000-4-4.

_____
Initials

10.3.10 Monitor the following and record on the Test Procedure Comment Sheet (Attachment 1) any indications of abnormal operation or system faults:

_____
Initials

- The front face of TUT Chassis 1
- The Data Logger display
- The TUT Tristation/Trilogger Console displayed data points

After Each EFT Susceptibility Test

10.3.11 On completion of the test, perform the following:

_____
Initials

A) From the Data Logger **Data Acquisition** Screen, left click on the **STOP** box to stop saving data.

B) Save a backup copy of the Data Logger data file generated during IEC 61000-4-4 EFT Testing of the TUT 230 VAC chassis power supply modules to the Data Logger external hard disk drive.

C) Stop data recording at the TUT Tristation/Trilogger Console interface. Save the recorded data to CD/DVD. Record the data file name in the space below for the specific test being performed.

0.5 kV Test - File Name: _____

1.0 kV Test - File Name: _____

1.5 kV Test - File Name: _____

2.0 kV Test - File Name: _____

10.3.12 Review the recorded test data from the Data Logger and the TUT Tristation/Trilogger Console interface. Using the table provided in Attachment 3, verify the expected trending of a data point associated with the operation of each module installed in the TUT.

_____
Initials

10.3.13 Record the date and time of the end of IEC 61000-4-4 EFT Testing of the TUT 230 VAC chassis power supply modules on the EFT Test Log Sheet (Attachment 2).

_____
Initials

10.3.14 Record satisfactory completion of IEC 61000-4-4 EFT Testing of the TUT 230 VAC chassis power supply modules. Satisfactory completion includes:

_____
Initials

i) The results of completion of Attachment 3 for data collected during each test indicate all modules functioning properly.

ii) No system alarms or faults indicated by the TUT Chassis 1 LED's, the monitored TUT Chassis 1 Power Supply Alarm Relay, or the TSAP fault/alarm indicators.

If results of any test are unsatisfactory, record the highest test voltage level at which satisfactory test results were obtained.

TUT 230 VAC Chassis Power SupplyModule EFT Susceptibility

Test Results: Sat. ____ Unsat. ____ (Highest Acceptable Test Level: _____ kV)

10.3.15 TUT 230 VAC Chassis Power Supply Module Electrical Fast Transient Testing Complete

Performed By: _____ **Date:** _____

Invensys Triconex QA: _____ **Date:** _____

10.4 IEC 61000-4-4 EFT Susceptibility, TUT 24 VDC Chassis Power Supply Modules

NOTE: TUT chassis 3 and 4 receive 24 VDC supply power from the test system power distribution panel (Cabinet 4 located inside the anechoic test chamber at the opposite end from the TUT cabinets). The 24 VDC power supply connection from test system switch SW-2 to the test system power distribution panel DP5 represents the final point in the TUT chassis power distribution system prior to separation of the power supply lines to TUT chassis 3 and 4. The electromagnetic disturbance signal will be injected into the 24 VDC chassis power supply circuit at this point.

10.4.1 De-energize distribution panels DP1, DP4 and DP5 by de-energizing test system power supplies PS1 and PS2. Verify de-energization of power at distribution panels DP4 and DP5 using the digital multimeter.

_____
Initials

10.4.2 Verify that NTS personnel have disconnected the EFT coupling network and test generator from the input power leads to 230 VAC distribution panel DP4, and reconnected the EFT coupling network and test generator to the input power leads

from test system switch SW-2 to 24 VDC distribution panel DP5 in accordance with the test setup specified in IEC 61000-4-4.

_____
Initials

10.4.3 Energize test system power supplies PS1 and PS2.

_____
Initials

10.4.4 Verify correct operation of the TUT and Simulator Tricons by repeating Steps 9.2.1 and 9.2.2 of this procedure.

_____
Initials

The TUT 24 VDC chassis power supply modules will be tested at the EFT Category B Low Exposure susceptibility level defined in NRC RG 1.180, Rev. 1, Section 5.3 and Table 22, at test voltage levels of 0.5 kV, 1.0 kV, 1.5 kV and 2.0 kV. For each test voltage level, repeat Steps 10.4.5 through 10.4.13.

Before Each EFT Susceptibility Test

10.4.5 Record the date, time of start, and test voltage level of the IEC 61000-4-4, EFT Test of the TUT 24 VDC chassis power supply modules on the EFT Test Log Sheet (Attachment 2).

_____
Initials

10.4.6 From the Data Logger **Test Selection** Screen:

_____
Initials

A) Select "**EFT Test**" from the **Select Test** menu.

B) Verify the correct **Test Description** is displayed.

C) Record the **Save As** file name in the space provided below for the specific test being performed.

0.5 kV Test - File Name: _____

1.0 kV Test - File Name: _____

1.5 kV Test - File Name: _____

2.0 kV Test - File Name: _____

D) Left click on the **OK** box.

10.4.7 From the Data Logger **Data Acquisition** Screen: _____ Initials

A) Verify data is being acquired.

B) Left click on the **Log Data?** box to begin saving data.

10.4.8 Set the TUT Tristation/Trilogger Console interface to begin recording and displaying the TSAP variables listed in Step 10.2.8 above. _____ Initials

During Each EFT Susceptibility Test

10.4.9 Instruct NTS personnel to inject the EFT disturbance signal onto the input power leads to 24 VDC distribution panel DP5 in accordance with the test procedure specified in IEC 61000-4-4. _____ Initials

10.4.10 Monitor the following and record on the Test Procedure Comment Sheet (Attachment 1) any indications of abnormal operation or system faults: _____ Initials

- The front face of TUT Chassis 1
- The Data Logger display
- The TUT Tristation/Trilogger Console displayed data points

After Each EFT Susceptibility Test

10.4.11 On completion of the test, perform the following: _____ Initials

A) From the Data Logger **Data Acquisition** Screen, left click on the **STOP** box to stop saving data.

B) Save a backup copy of the Data Logger data file generated during IEC 61000-4-4 EFT Testing of the TUT 24 VDC chassis power supply modules to the Data Logger external hard disk drive.

C) Stop data recording at the TUT Tristation/Trilogger Console interface. Save the recorded data to CD/DVD. Record the data file name in the space below for the specific test being performed.

0.5 kV Test - File Name: _____

1.0 kV Test - File Name: _____

1.5 kV Test - File Name: _____

2.0 kV Test - File Name: _____

10.4.12 Review the recorded test data from the Data Logger and the TUT Tristation/Trilogger Console interface. Using the table provided in Attachment 3, verify the expected trending of a data point associated with the operation of each module installed in the TUT.

_____ Initials

10.4.13 Record the date and time of the end of IEC 61000-4-4 EFT Testing of the TUT 24 VDC chassis power supply modules on the EFT Test Log Sheet (Attachment 2).

_____ Initials

10.4.14 De-energize distribution panel DP5 by de-energizing test system power supply PS2. Verify de-energization of power at distribution panel DP5 using the digital multimeter.

_____ Initials

10.4.15 Verify that NTS personnel have disconnected the EFT coupling network and test generator from the input power leads to 24 VDC distribution panel DP5.

_____ Initials

10.4.16 Energize test system power supply PS2.

_____ Initials

10.4.17 Record satisfactory completion of IEC 61000-4-4 EFT Testing of the TUT 24 VDC chassis power supply modules. Satisfactory completion includes:

_____ Initials

i) The results of completion of Attachment 3 for data collected during each test indicate all modules functioning properly.

ii) No system alarms or faults indicated by the TUT Chassis 1 LED's, the monitored TUT Chassis 1 Power Supply Alarm Relay, or the TSAP fault/alarm indicators.

If results of any test are unsatisfactory, record the highest test voltage level at which satisfactory test results were obtained.

TUT 24 VDC Chassis Power Supply Module EFT Susceptibility

Test Results: Sat. ____ Unsat. ____ (Highest Acceptable Test Level: _____ kV)

10.4.18 TUT 24 VDC Chassis Power Supply Module Electrical Fast Transient Testing Complete

Performed By: _____ **Date:** _____

Invensys Triconex QA: _____ **Date:** _____

10.5 IEC 61000-4-4 EFT Susceptibility, Peripheral Communications Cable Group

10.5.1 Verify that NTS personnel have connected the EFT clamp-on coupling device and test generator to the Peripheral Communications Cable Group in accordance with the test setup specified in IEC 61000-4-4.

_____
Initials

10.5.2 Verify correct operation of the TUT and Simulator Tricons by repeating Steps 9.2.1 and 9.2.2 of this procedure.

_____
Initials

The Peripheral Communications Cable Group will be tested at the EFT Low Exposure susceptibility level defined in NRC RG 1.180, Rev. 1, Section 4.2 and Table 15, at test voltage levels of 0.5 kV and 1.0 kV. For each test voltage level, repeat Steps 10.5.3 through 10.5.11.

Before Each EFT Susceptibility Test

10.5.3 Record the date, time of start, and test voltage level of the IEC 61000-4-4, EFT Test of the Peripheral Communications Cable Group on the EFT Test Log Sheet (Attachment 2).

_____
Initials

10.5.4 From the Data Logger **Test Selection** Screen:

_____
Initials

A) Select "**EFT Test**" from the **Select Test** menu.

B) Verify the correct **Test Description** is displayed.

C) Record the **Save As** file name in the space provided below for the specific test being performed.

0.5 kV Test - File Name: _____

1.0 kV Test - File Name: _____

D) Left click on the **OK** box.

10.5.5 From the Data Logger **Data Acquisition** Screen:

_____
Initials

A) Verify data is being acquired.

B) Left click on the **Log Data?** box to begin saving data.

10.5.6 Set the TUT Tristation/Trilogger Console interface to begin recording and displaying the TSAP variables listed in Step 10.2.8 above.

_____
Initials

During Each EFT Susceptibility Test

10.5.7 Instruct NTS personnel to inject the EFT disturbance signal onto the Peripheral Communications Cable Group in accordance with the test procedure specified in IEC 61000-4-4.

_____
Initials

10.5.8 Monitor the following and record on the Test Procedure Comment Sheet (Attachment 1) any indications of abnormal operation or system faults:

_____
Initials

- The front face of TUT Chassis 1
- The Data Logger display
- The TUT Tristation/Trilogger Console displayed data points

After Each EFT Susceptibility Test

10.5.9 On completion of the test, perform the following:

_____
Initials

A) From the Data Logger **Data Acquisition** Screen, left click on the **STOP** box to stop saving data.

B) Save a backup copy of the Data Logger data file generated during IEC 61000-4-4 EFT Testing of the Peripheral Communications Cable Group to the Data Logger external hard disk drive.

C) Stop data recording at the TUT Tristation/Trilogger Console interface. Save the recorded data to CD/DVD. Record the data file name in the space below for the specific test being performed.

0.5 kV Test - File Name: _____

1.0 kV Test - File Name: _____

10.5.10 Review the recorded test data from the Data Logger and the TUT Tristation/Trilogger Console interface. Using the table provided in Attachment 3, verify the expected trending of a data point associated with the operation of each module installed in the TUT.

_____
Initials

10.5.11 Record the date and time of the end of IEC 61000-4-4 EFT Testing of the Peripheral Communications Cable Group on the EFT Test Log Sheet (Attachment 2).

_____
Initials

10.5.12 Verify that NTS personnel have disconnected the EFT clamp-on coupling device and test generator from the Peripheral Communications Cable Group.

_____
Initials

10.5.13 Record satisfactory completion of IEC 61000-4-4 EFT Testing of the Peripheral Communications Cable Group. Satisfactory completion includes:

_____
Initials

i) The results of completion of Attachment 3 for data collected during each test indicate all modules functioning properly.

ii) No system alarms or faults indicated by the TUT Chassis 1 LED's, the monitored TUT Chassis 1 Power Supply Alarm Relay, or the TSAP fault/alarm indicators.

If results of any test are unsatisfactory, record the highest test voltage level at which satisfactory test results were obtained.

Peripheral Communications Cable Group EFT Susceptibility

Test Results: Sat. ____ Unsat. ____ (Highest Acceptable Test Level: _____ kV)

10.5.14 Peripheral Communications Cable Group Electrical Fast Transient Testing Complete

Performed By: _____ Date: _____

Invensys Triconex QA: _____ Date: _____

10.6 IEC 61000-4-4 EFT Susceptibility, ETP Power Wire Group

10.6.1 Verify that NTS personnel have connected the EFT clamp-on coupling device and test generator to the ETP Power Wire Group in accordance with the test setup specified in IEC 61000-4-4.

_____
Initials

10.6.2 Verify correct operation of the TUT and Simulator Tricons by repeating Steps 9.2.1 and 9.2.2 of this procedure.

_____
Initials

The ETP Power Wire Group will be tested at the EFT Low Exposure susceptibility level defined in NRC RG 1.180, Rev. 1, Section 4.2 and Table 15, at test voltage levels of 0.5 kV and 1.0 kV. For each test voltage level, repeat Steps 10.6.3 through 10.6.11.

Before Each EFT Susceptibility Test

10.6.3 Record the date, time of start, and test voltage level of the IEC 61000-4-4, EFT Test of the ETP Power Wire Group on the EFT Test Log Sheet (Attachment 2).

_____
Initials

10.6.4 From the Data Logger **Test Selection** Screen:

_____
Initials

A) Select "**EFT Test**" from the **Select Test** menu.

B) Verify the correct **Test Description** is displayed.

C) Record the **Save As** file name in the space provided below for the specific test being performed.

0.5 kV Test - File Name: _____

1.0 kV Test - File Name: _____

D) Left click on the **OK** box.

10.6.5 From the Data Logger **Data Acquisition** Screen:

_____
Initials

A) Verify data is being acquired.

B) Left click on the **Log Data?** box to begin saving data.

10.6.6 Set the TUT Tristation/Trilogger Console interface to begin recording and displaying the TSAP variables listed in Step 10.2.8 above.

_____
Initials

During Each EFT Susceptibility Test

10.6.7 Instruct NTS personnel to inject the EFT disturbance signal onto the ETP Power Wire Group in accordance with the test procedure specified in IEC 61000-4-4.

_____
Initials

10.6.8 Monitor the following and record on the Test Procedure Comment Sheet (Attachment 1) any indications of abnormal operation or system faults:

_____
Initials

- The front face of TUT Chassis 1
- The Data Logger display
- The TUT Tristation/Trilogger Console displayed data points

After Each EFT Susceptibility Test

10.6.9 On completion of the test, perform the following:

_____
Initials

A) From the Data Logger **Data Acquisition** Screen, left click on the **STOP** box to stop saving data.

B) Save a backup copy of the Data Logger data file generated during IEC 61000-4-4 EFT Testing of the ETP Power Wire Group to the Data Logger external hard disk drive.

C) Stop data recording at the TUT Tristation/Trilogger Console interface. Save the recorded data to CD/DVD. Record the data file name in the space below for the specific test being performed.

0.5 kV Test - File Name: _____

1.0 kV Test - File Name: _____

10.6.10 Review the recorded test data from the Data Logger and the TUT Tristation/Trilogger Console interface. Using the table provided in Attachment 3, verify the expected trending of a data point associated with the operation of each module installed in the TUT.

_____
Initials

10.6.11 Record the date and time of the end of IEC 61000-4-4 EFT Testing of the ETP Power Wire Group on the EFT Test Log Sheet (Attachment 2).

_____
Initials

10.6.12 Verify that NTS personnel have disconnected the EFT clamp-on coupling device and test generator from the ETP Power Wire Group.

_____
Initials

10.6.13 Record satisfactory completion of IEC 61000-4-4 EFT Testing of the ETP Power Wire Group. Satisfactory completion includes:

_____
Initials

i) The results of completion of Attachment 3 for data collected during each test indicate all modules functioning properly.

ii) No system alarms or faults indicated by the TUT Chassis 1 LED's, the monitored TUT Chassis 1 Power Supply Alarm Relay, or the TSAP fault/alarm indicators.

If results of any test are unsatisfactory, record the highest test voltage level at which satisfactory test results were obtained.

ETP Power Wire Group EFT Susceptibility

Test Results: Sat. ____ Unsat. ____ (Highest Acceptable Test Level: _____ kV)

10.6.14 ETP Power Wire Group Electrical Fast Transient Testing Complete

Performed By: _____ Date: _____

Invensys Triconex QA: _____ Date: _____

10.7 IEC 61000-4-4 EFT Susceptibility, Analog Input/Output Wire Group

10.7.1 Verify that NTS personnel have connected the EFT clamp-on coupling device and test generator to the Analog Input/Output Wire Group in accordance with the test setup specified in IEC 61000-4-4.

_____
Initials

10.7.2 Verify correct operation of the TUT and Simulator Tricons by repeating Steps 9.2.1 and 9.2.2 of this procedure.

_____
Initials

The Analog Input/Output Wire Group will be tested at the EFT Low Exposure susceptibility level defined in NRC RG 1.180, Rev. 1, Section 4.2 and Table 15, at test voltage levels of 0.5 kV and 1.0 kV. For each test voltage level, repeat Steps 10.7.3 through 10.7.11.

Before Each EFT Susceptibility Test

10.7.3 Record the date, time of start, and test voltage level of the IEC 61000-4-4, EFT Test of the Analog Input/Output Wire Group on the EFT Test Log Sheet (Attachment 2).

_____
Initials

10.7.4 From the Data Logger **Test Selection** Screen:

_____
Initials

A) Select "**EFT Test**" from the **Select Test** menu.

B) Verify the correct **Test Description** is displayed.

C) Record the **Save As** file name in the space provided below for the specific test being performed.

0.5 kV Test - File Name: _____

1.0 kV Test - File Name: _____

D) Left click on the **OK** box.

10.7.5 From the Data Logger **Data Acquisition** Screen:

_____
Initials

A) Verify data is being acquired.

B) Left click on the **Log Data?** box to begin saving data.

10.7.6 Set the TUT Tristation/Trilogger Console interface to begin recording and displaying the TSAP variables listed in Step 10.2.8 above.

_____
Initials

During Each EFT Susceptibility Test

10.7.7 Instruct NTS personnel to inject the EFT disturbance signal onto the Analog Input/Output Wire Group in accordance with the test procedure specified in IEC 61000-4-4.

_____
Initials

10.7.8 Monitor the following and record on the Test Procedure Comment Sheet (Attachment 1) any indications of abnormal operation or system faults:

_____
Initials

- The front face of TUT Chassis 1
- The Data Logger display
- The TUT Tristation/Trilogger Console displayed data points

After Each EFT Susceptibility Test

10.7.9 On completion of the test, perform the following:

_____
Initials

A) From the Data Logger **Data Acquisition** Screen, left click on the **STOP** box to stop saving data.

B) Save a backup copy of the Data Logger data file generated during IEC 61000-4-4 EFT Testing of the Analog Input/Output Wire Group to the Data Logger external hard disk drive.

C) Stop data recording at the TUT Tristation/Trilogger Console interface. Save the recorded data to CD/DVD. Record the data file name in the space below for the specific test being performed.

0.5 kV Test - File Name: _____

1.0 kV Test - File Name: _____

10.7.10 Review the recorded test data from the Data Logger and the TUT Tristation/Trilogger Console interface. Using the table provided in Attachment 3, verify the expected trending of a data point associated with the operation of each module installed in the TUT.

_____
Initials

10.7.11 Record the date and time of the end of IEC 61000-4-4 EFT Testing of the Analog Input/Output Wire Group on the EFT Test Log Sheet (Attachment 2).

_____
Initials

10.7.12 Verify that NTS personnel have disconnected the EFT clamp-on coupling device and test generator from the Analog Input/Output Wire Group.

_____
Initials

10.7.13 Record satisfactory completion of IEC 61000-4-4 EFT Testing of the Analog Input/Output Wire Group. Satisfactory completion includes:

_____
Initials

i) The results of completion of Attachment 3 for data collected during each test indicate all modules functioning properly.

ii) No system alarms or faults indicated by the TUT Chassis 1 LED's, the monitored TUT Chassis 1 Power Supply Alarm Relay, or the TSAP fault/alarm indicators.

If results of any test are unsatisfactory, record the highest test voltage level at which satisfactory test results were obtained.

Analog Input/Output Wire Group EFT Susceptibility

Test Results: Sat. ____ Unsat. ____ (Highest Acceptable Test Level: _____ kV)

10.7.14 Analog Input/Output Wire Group Electrical Fast Transient Testing Complete

Performed By: _____ **Date:** _____

Invensys Triconex QA: _____ **Date:** _____

10.8 IEC 61000-4-4 EFT Susceptibility, RTD/Thermocouple/Pulse Input Wire Group

10.8.1 Verify that NTS personnel have connected the EFT clamp-on coupling device and test generator to the RTD/Thermocouple/Pulse Input Wire Group in accordance with the test setup specified in IEC 61000-4-4.

_____
Initials

10.8.2 Verify correct operation of the TUT and Simulator Tricons by repeating Steps 9.2.1 and 9.2.2 of this procedure.

_____
Initials

The RTD/Thermocouple/Pulse Input Wire Group will be tested at the EFT Low Exposure susceptibility level defined in NRC RG 1.180, Rev. 1, Section 4.2 and Table 15, at test voltage levels of 0.5 kV and 1.0 kV. For each test voltage level, repeat Steps 10.8.3 through 10.8.11.

Before Each EFT Susceptibility Test

10.8.3 Record the date, time of start, and test voltage level of the IEC 61000-4-4, EFT Test of the RTD/Thermocouple/Pulse Input Wire Group on the EFT Test Log Sheet (Attachment 2).

_____
Initials

10.8.4 From the Data Logger **Test Selection** Screen:

_____
Initials

A) Select "**EFT Test**" from the **Select Test** menu.

B) Verify the correct **Test Description** is displayed.

C) Record the **Save As** file name in the space provided below for the specific test being performed.

0.5 kV Test - File Name: _____

1.0 kV Test - File Name: _____

D) Left click on the **OK** box.

10.8.5 From the Data Logger **Data Acquisition** Screen:

_____
Initials

A) Verify data is being acquired.

B) Left click on the **Log Data?** box to begin saving data.

10.8.6 Set the TUT Tristation/Trilogger Console interface to begin recording and displaying the TSAP variables listed in Step 10.2.8 above.

_____
Initials

During Each EFT Susceptibility Test

10.8.7 Instruct NTS personnel to inject the EFT disturbance signal onto the RTD/Thermocouple/Pulse Input Wire Group in accordance with the test procedure specified in IEC 61000-4-4.

_____
Initials

10.8.8 Monitor the following and record on the Test Procedure Comment Sheet (Attachment 1) any indications of abnormal operation or system faults:

_____
Initials

- The front face of TUT Chassis 1
- The Data Logger display
- The TUT Tristation/Trilogger Console displayed data points

After Each EFT Susceptibility Test

10.8.9 On completion of the test, perform the following:

_____
Initials

A) From the Data Logger **Data Acquisition** Screen, left click on the **STOP** box to stop saving data.

B) Save a backup copy of the Data Logger data file generated during IEC 61000-4-4 EFT Testing of the RTD/Thermocouple/Pulse Input Wire Group to the Data Logger external hard disk drive.

C) Stop data recording at the TUT Tristation/Trilogger Console interface. Save the recorded data to CD/DVD. Record the data file name in the space below for the specific test being performed.

0.5 kV Test - File Name: _____

1.0 kV Test - File Name: _____

10.8.10 Review the recorded test data from the Data Logger and the TUT Tristation/Trilogger Console interface. Using the table provided in Attachment 3, verify the expected trending of a data point associated with the operation of each module installed in the TUT.

_____
Initials

10.8.11 Record the date and time of the end of IEC 61000-4-4 EFT Testing of the RTD/Thermocouple/Pulse Input Wire Group on the EFT Test Log Sheet (Attachment 2).

_____
Initials

10.8.12 Verify that NTS personnel have disconnected the EFT clamp-on coupling device and test generator from the RTD/Thermocouple/Pulse Input Wire Group.

_____
Initials

10.8.13 Record satisfactory completion of IEC 61000-4-4 EFT Testing of the RTD/Thermocouple/Pulse Input Wire Group. Satisfactory completion includes:

_____
Initials

i) The results of completion of Attachment 3 for data collected during each test indicate all modules functioning properly.

ii) No system alarms or faults indicated by the TUT Chassis 1 LED's, the monitored TUT Chassis 1 Power Supply Alarm Relay, or the TSAP fault/alarm indicators.

If results of any test are unsatisfactory, record the highest test voltage level at which satisfactory test results were obtained.

RTD/Thermocouple/Pulse Input Wire Group EFT Susceptibility

Test Results: Sat. ____ Unsat. ____ (Highest Acceptable Test Level: _____ kV)

10.8.14 RTD/Thermocouple/Pulse Input Wire Group Electrical Fast Transient Testing Complete

Performed By: _____ Date: _____

Invensys Triconex QA: _____ Date: _____

10.9 IEC 61000-4-4 EFT Susceptibility, Discrete Input/Output Wire Group

10.9.1 Verify that NTS personnel have connected the EFT clamp-on coupling device and test generator to the Discrete Input/Output Wire Group in accordance with the test setup specified in IEC 61000-4-4.

_____
Initials

10.9.2 Verify correct operation of the TUT and Simulator Tricons by repeating Steps 9.2.1 and 9.2.2 of this procedure.

_____
Initials

The Discrete Input/Output Wire Group will be tested at the EFT Low Exposure susceptibility level defined in NRC RG 1.180, Rev. 1, Section 4.2 and Table 15, at test voltage levels of 0.5 kV and 1.0 kV. For each test voltage level, repeat Steps 10.9.3 through 10.9.11.

Before Each EFT Susceptibility Test

10.9.3 Record the date, time of start, and test voltage level of the IEC 61000-4-4, EFT Test of the Discrete Input/Output Wire Group on the EFT Test Log Sheet (Attachment 2).

_____
Initials

10.9.4 From the Data Logger **Test Selection** Screen:

_____
Initials

A) Select "**EFT Test**" from the **Select Test** menu.

B) Verify the correct **Test Description** is displayed.

C) Record the **Save As** file name in the space provided below for the specific test being performed.

0.5 kV Test - File Name: _____

1.0 kV Test - File Name: _____

D) Left click on the **OK** box.

10.9.5 From the Data Logger **Data Acquisition** Screen:

_____
Initials

A) Verify data is being acquired.

B) Left click on the **Log Data?** box to begin saving data.

10.9.6 Set the TUT Tristation/Trilogger Console interface to begin recording and displaying the TSAP variables listed in Step 10.2.8 above.

_____
Initials

During Each EFT Susceptibility Test

10.9.7 Instruct NTS personnel to inject the EFT disturbance signal onto the Discrete Input/Output Wire Group in accordance with the test procedure specified in IEC 61000-4-4.

_____
Initials

10.9.8 Monitor the following and record on the Test Procedure Comment Sheet (Attachment 1) any indications of abnormal operation or system faults:

_____
Initials

- The the front face of TUT Chassis 1
- The Data Logger display
- The TUT Tristation/Trilogger Console displayed data points

After Each EFT Susceptibility Test

10.9.9 On completion of the test, perform the following:

_____
Initials

A) From the Data Logger **Data Acquisition** Screen, left click on the **STOP** box to stop saving data.

B) Save a backup copy of the Data Logger data file generated during IEC 61000-4-4 EFT Testing of the Discrete Input/Output Wire Group to the Data Logger external hard disk drive.

C) Stop data recording at the TUT Tristation/Trilogger Console interface. Save the recorded data to CD/DVD. Record the data file name in the space below for the specific test being performed.

0.5 kV Test - File Name: _____

1.0 kV Test - File Name: _____

10.9.10 Review the recorded test data from the Data Logger and the TUT Tristation/Trilogger Console interface. Using the table provided in Attachment 3, verify the expected trending of a data point associated with the operation of each module installed in the TUT.

_____
Initials

10.9.11 Record the date and time of the end of IEC 61000-4-4 EFT Testing of the Discrete Input/Output Wire Group on the EFT Test Log Sheet (Attachment 2).

_____
Initials

10.9.12 Verify that NTS personnel have disconnected the EFT clamp-on coupling device and test generator from the Discrete Input/Output Wire Group.

_____
Initials

10.9.13 Record satisfactory completion of IEC 61000-4-4 EFT Testing of the Discrete Input/Output Wire Group. Satisfactory completion includes:

_____
Initials

i) The results of completion of Attachment 3 for data collected during each test indicate all modules functioning properly.

ii) No system alarms or faults indicated by the TUT Chassis 1 LED's, the monitored TUT Chassis 1 Power Supply Alarm Relay, or the TSAP fault/alarm indicators.

If results of any test are unsatisfactory, record the highest test voltage level at which satisfactory test results were obtained.

Discrete Input/Output Wire Group EFT Susceptibility

Test Results: Sat. ____ Unsat. ____ (Highest Acceptable Test Level: _____ kV)

10.9.14 Discrete Input/Output Wire Group Electrical Fast Transient Testing Complete

Performed By: _____ **Date:** _____

Invensys Triconex QA: _____ **Date:** _____

10.10 EFT Test Acceptance Criteria Verification

10.10.1 The satisfactory completion of test procedure Sections 10.1 through 10.9 as recorded above demonstrates satisfaction of the acceptance criteria for Electrical Fast Transient Suceptibility Testing given in the individual test sections and in Section 4.0. Record satisfactory completion of Sections 10.1 through 10.9 below:

EFT Test Acceptance Criteria Met: Sat. _____ Unsat: _____ _____
Initials

10.10.2 EFT Test Acceptance Criteria Verification Complete

Performed By: _____ **Date:** _____

Invensys Triconex QA: _____ **Date:** _____

11.0 TEST APPROVAL

MPR Review and Approval

_____ Date _____
MPR Level II / III Test Engineer

_____ Date _____
MPR Project Manager

Invensys Triconex Test Review Board (TRB) Approval

The EFT Tests were performed on the Tricon-Under-Test (TUT) and the test results were reviewed for completeness, accuracy and acceptability.

The Master Configuration List (MCL) has been updated, as necessary, to accurately document the as-tested configuration of the TUT.

There are no open Invensys Triconex or vendor deficiency documents, e.g., QPAR, associated with the nuclear qualification test system.

The test results, including all supporting documentation, are acceptable to the TRB.

_____ Date _____
MPR TRB Representative

_____ Date _____
Other TRB Reviewer

_____ Date _____
Project Engineer

_____ Date _____
Project Quality Assurance Engineer

_____ Date _____
Project Manager

12.0 ATTACHMENTS

1. Completed EFT Test Procedure Comment Sheets (Attachment 1)
2. Completed EFT Test Log Sheets (Attachment 2)
3. Completed Normal Operating Performance Data Verification Checklists (Attachment 3)
4. Test Exception and Resolution Reports (TERR's), if applicable (Attachment 4)
5. Archived Data Logger and TUT Tristation/Trilogger Console Test Data
6. Completed Triconex Test Log (Prerequisites Step 6.5)

ATTACHMENT 1: TEST PROCEDURE COMMENT SHEET

PAGE _____ OF _____

No.	Comment	Initials/Date

ATTACHMENT 2: TEST LOG SHEET

PAGE _____ OF _____

Test Step	Date	Time	Comments	Initials/ Date

ATTACHMENT 3
NORMAL OPERATING PERFORMANCE DATA VERIFICATION CHECKLIST

Test Step/Description: _____

Data Source	Data Point	Expected Data Trend	Verified
Trilogger	P2P_1_Comm_Alarm P2P_2_Comm_Alarm	"0" indicates no TUT Peer-to-Peer communication port errors exist	
Trilogger	MB_1_Comm_Alarm MB_2_Comm_Alarm	"0" indicates no TUT ModBus communication port errors exist	
Trilogger	PI010401raw *	Constant at 10,000 Hz	
Trilogger	TC010701eu *	Constant at 100 Deg. C	
Trilogger	TC010708eu *	Constant at 500 Deg. C	
Trilogger	TC010716eu *	Constant at 1000 Deg. C	
Trilogger	AI040701ind *	Constant at 300 Deg. C	
Trilogger	AI040702ind *	Constant at 100 Deg. C	
Trilogger	AI040703ind *	Constant at 100 Deg. C	
Trilogger	AI040704ind *	Constant at 150 Deg. C	
Trilogger	AI040705ind *	Constant at 50 Deg. C	
Trilogger	AI040706ind *	Constant at 25 Deg. C	
Trilogger	AI040707ind *	Constant at 50 mV	
Trilogger	AI040708ind *	Constant at 75 Deg. C	
Trilogger	DI020405in	"ON" for 5 seconds, "OFF" for 5 seconds	
Trilogger	DI020417in	"ON" for 5 seconds, "OFF" for 5 seconds	
Trilogger	DI030201in	"ON" for 15 seconds, "OFF" for 15 seconds	
Trilogger	DI030220in	"ON" for 5 seconds, "OFF" for 5 seconds	
Trilogger	DI030222in	"ON" for 5 seconds, "OFF" for 5 seconds	
Trilogger	DI030707in	"ON" for 5 seconds, "OFF" for 5 seconds	
Trilogger	DI030717in	"ON" for 5 seconds, "OFF" for 5 seconds	
Trilogger	DI030718in	"ON" for 15 seconds, "OFF" for 15 seconds	
Trilogger	AI040101raw *	"2047" count for 5 seconds, "3071" count for 5 seconds	
Trilogger	AI040117raw *	"2047" count for 5 seconds, "3071" count for 5 seconds	
Trilogger	AI040201raw *	"2047" count for 5 seconds, "3071" count for 5 seconds	
Trilogger	AI040301raw *	"2047" count for 5 seconds, "3071" count for 5 seconds	
Trilogger	AI040717raw *	"2047" count for 5 seconds, "3071" count for 5 seconds	
Trilogger	AI040801raw *	"2047" count for 5 seconds, "3071" count for 5 seconds	
Trilogger	AI040817raw *	"2047" count for 5 seconds, "3071" count for 5 seconds	
Trilogger	Common_Diagnostics_Alm	"0" indicates no diagnostic alarm conditions exist	

* Analysis of these points must verify measured data does not vary from expected values by more than ± 3% (of full scale).

ATTACHMENT 3
NORMAL OPERATING PERFORMANCE DATA VERIFICATION CHECKLIST
(Continued)

Test Step/Description: _____

Data Source	Data Point	Expected Data Trend	Verified
Data Logger	2-CH2 *	5.0 V for 5 seconds, 7.5 V for 5 seconds	
Data Logger	2-CH4 *	2.5 V for 5 seconds, 3.75 V for 5 seconds	
Data Logger	2-CH6 *	5.0 V for 5 seconds, 7.5 V for 5 seconds	
Data Logger	2-CH10 *	5.0 V for 5 seconds, 7.5 V for 5 seconds	
Data Logger	2-CH11 *	2.5 V for 5 seconds, 3.75 V for 5 seconds	
Data Logger	2-CH13 *	2.5 V for 5 seconds, 3.75 V for 5 seconds	
Data Logger	2-CH15 *	2.5 V for 5 seconds, 3.75 V for 5 seconds	
Data Logger	4-J4-2	"ON" for 5 seconds, "OFF" for 5 seconds	
Data Logger	4-J6-0	"ON" for 5 seconds, "OFF" for 5 seconds	
Data Logger	4-J6-1	"ON" for 5 seconds, "OFF" for 5 seconds	
Data Logger	4-J6-2	"ON" for 5 seconds, "OFF" for 5 seconds	
Data Logger	4-J7-0	"ON" for 15 seconds, "OFF" for 15 seconds	
Data Logger	5-J2-0	"ON" for 5 seconds, "OFF" for 5 seconds	
Data Logger	5-J2-2	"ON" for 5 seconds, "OFF" for 5 seconds	
Data Logger	5-J7-2	"ON" for 5 seconds, "OFF" for 5 seconds	
Data Logger	5-J7-3	"ON" for 15 seconds, "OFF" for 15 seconds	
Data Logger	6-J6-0	Constant "ON" indicates no chassis alarm conditions exist	
Data Logger	6-J8-2	"ON" for 5 seconds, "OFF" for 5 seconds	

* Analysis of these points must verify measured data does not vary from expected values by more than ± 3% (of full scale).

Performed By: _____ **Date:** _____ **Time:** _____

Reviewed By: _____ **Date:** _____

ATTACHMENT 4

TEST EXCEPTION AND RESOLUTION REPORT (TERR)

ATTACHMENT ___ TO TEST PROCEDURE _____ Page ____ of ____

TERR No.	Test Exception Description	Reported by / Date	Test Exception Resolution	Resolved by / Date	MPR Review and Approval by / Date	Triconex Review and Approval by / Date

TABLE 1
EFT TEST DATA SET POINT IDs

Tricon-Under-Test Chassis-Slot-I/O Point	I/O Point Type	Tristation/Trilogger Console Monitored TSAP Variable	Data Logger Input Point
1-2L-Net 1, 1-2L-Net 2 1-2R-Net 1, 1-2R-Net 2	Communication	P2P_1_Comm_Alarm	N/A
1-2L-Serial 1 1-2R-Serial 1	Communication	MB_1_Comm_Alarm	N/A
2-2L-Net 1, 2-2L-Net 2 2-2R-Net 1, 2-2R-Net 2	Communication	P2P_2_Comm_Alarm	N/A
2-2L-Serial 1 2-2R-Serial 1	Communication	MB_2_Comm_Alarm	N/A
1-PS1-NO	Power Supply Alarm	N/A	6-J6-0
1-4L-01	Pulse Input	PI010401raw	3-J9-47
1-7L-01	T/C Input	TC010701eu	N/A
1-7-08	T/C Input	TC010708eu	N/A
1-7-16	T/C Input	TC010716eu	N/A
2-4-05	Discrete Input	DI020405in	N/A
2-4-06	Discrete Input	DI020406in	N/A
2-4-17	Discrete Input	DI020417in	4-J6-2
2-5-01	Discrete Output	N/A	4-J6-0
2-6-01	Discrete Output	N/A	4-J6-1
2-7-06	Discrete Output	N/A	4-J4-2
3-2-01	Discrete Input	DI030201in	N/A
3-2-20	Discrete Input	DI030220in	N/A
3-2-22	Discrete Input	DI030222in	N/A
3-3-05	Discrete Output	N/A	5-J2-0
3-3-23	Discrete Output	N/A	5-J2-2
3-5-08	Relay Output	N/A	4-J7-0

TABLE 1
EFT TEST DATA SET POINT IDs
(Continued)

Tricon-Under-Test Chassis-Slot-I/O Point	I/O Point Type	Tristation/Trilogger Console Monitored TSAP Variable	Data Logger Input Point
3-5-24	Relay Output	N/A	5-J7-3
3-6-06	Discrete Output	N/A	6-J8-2
3-7-07	Discrete Input	DI030707in	N/A
3-7-17	Discrete Input	DI030717in	5-J7-2
3-7-18	Discrete Input	DI030718in	N/A
4-1-01	Analog Input	AI040101raw	N/A
4-1-17	Analog Input	AI040117raw	N/A
4-2-01	Analog Input	AI040201raw	N/A
4-3-01	Analog Input	AI040301raw	N/A
4-4-01	Analog Output	N/A	2-CH11
4-4-02	Analog Output	N/A	2-CH13
4-4-03	Analog Output	N/A	2-CH15
4-4-04	Analog Output	N/A	2-CH10
4-4-05	Analog Output	N/A	2-CH2
4-4-06	Analog Output	N/A	2-CH4
4-4-07	Analog Output	N/A	2-CH6
4-7-01	RTD Input	AI040701ind	N/A
4-7-02	RTD Input	AI040702ind	N/A
4-7-03	RTD Input	AI040703ind	N/A
4-7-04	RTD Input	AI040704ind	N/A
4-7-05	RTD Input	AI040705ind	N/A
4-7-06	RTD Input	AI040706ind	N/A
4-7-07	RTD Input	AI040707ind	N/A

TABLE 1
EFT TEST DATA SET POINT IDs
(Continued)

Tricon-Under-Test Chassis-Slot-I/O Point	I/O Point Type	Tristation/Trilogger Console Monitored TSAP Variable	Data Logger Input Point
4-7-08	RTD Input	AI040708ind	N/A
4-7-17	Analog Input	AI040717raw	N/A
4-8-01	Analog Input	AI040801raw	N/A
4-8-17	Analog Input	AI040817raw	N/A
N/A	TSAP Alarm	Common_Diagnostics_Alm	N/A