



T306: Applying Your Test Plan to the Electrical and Lighting Management Systems based on NTCIP 1213 ELMS Standard v03

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1. Module Description

An electric and lighting management system (ELMS) is defined as any system that is able to automatically control and manage roadside electrical and lighting devices using the National Transportation Communications for Intelligent Transportation System Protocol (NTCIP). In general, an ELMS is composed of a set of field devices (luminaires, electric circuits, electric vehicle chargers, connected vehicle, smart grid connectivity, etc.) that are controlled by one or more management stations (computing platforms).

2. Introduction/Purpose

This module assists user agencies in creating and applying a test plan specific to their electrical and lighting management system needs based on the NTCIP1213 v03 Standard. Prior to developing such a test plan, the user is expected to be knowledgeable of the NTCIP 1213 v03 Standard and testing methodologies. This module will cover material related to elements of the NTCIP 1213 v03 standard required to apply test plans to verify that an agency's product or system meets design specifications and other conformance requirements of the NTCIP 1213 Standard v03, while following standard testing methodologies, including test procedures. (NTCIP 1203 v03 does not contain test procedures).

The module will include a brief description of the ELMS standard with examples on how to perform the verification mentioned above. This module will cover the role of other modes of testing including compliance, manufacturing and acceptance tests, and verification and validation as part of the testing life cycle.

This module shall use a sample test plan for NTCIP 1213 to demonstrate the proper way to create a test plan specific to the user needs and requirements based on the ELMS standard, including test procedures. The module will walk them through the process of correctly creating a test plan.

This module will be placed in the context of the systems engineering process as well in the acquisition curriculum path. The complete series of ITS Standards Training Modules for acquisition of an ESS is as follows: I101, A101, A102, A201, A306a, A306b, T101, T201, T202, T203, T204, and T306. This module is the final module in the ELMS acquisition series.

Recommended Prerequisite(s)

- T101: Introduction to ITS Standards Testing
- T201: How to Write a Test Plan
- T202: Overview of Test Design Specifications, Test Cases, and Test Procedures
- T203: Part 1 of 2: How to Develop Test Cases for an ITS Standards-Based Test Plan,
- T203: Part 2 of 2: How to Develop Test Cases for an ITS Standards-Based Test Plan,
- T204: Part 1 of 2: How to Develop a Test Procedure for ITS Standards-based Test
- T204: Part 2 of 2: How to Develop Test Procedures for ITS Standards-Based Test Plan,
- A306a: Understanding User Needs for ELMS Systems Based on NTCIP 1213 Standard
- A306b: Specifying Requirements for ESS Systems Based on NTCIP 1213 Standard



2.1. Discussion

This course commences with learning objective (LO) one. This LO describes, within the context of the testing lifecycle, the role of test plans and the testing to be undertaken for ELMS applications. Sub-objectives include detailed examinations of exactly "why we test." This analysis includes the rationale and purpose of a Test Plan, as well as the three major components of a Test Plan - the Test Design Specification, the Test Case Specification and the Test Procedure Specification

Learning objective two describes the application of a well-prepared test plan to an ELMS system being procured. In this section, an example Test Plan for a project-specific ELMS application is examined.

Learning objective three continues the testing theme by exploring exactly what is being tested. This includes a comprehensive discussion of Test Design, Test Cases and Test procedures. Also introduced is the process of adapting the test plan based on the selected user needs and requirements.

3. Case Study

In the T306 module, before we introduce the case study, we examine the relationship between dialogs, requirements, and user needs. Remember that the Protocol Requirements List (PRL) possesses User Needs and Requirements, and the relationship between them. Similarly, the Requirements Traceability Matrix (RTM) possesses Requirements and Dialogs, and the relationship between them. Both of these tables are included in their entirety in this student study guide.

As described in learning objective two, the test plan development process begins with a selection of project-specific requirements - as described in detail in course A306b Specifying Requirements for Electrical and Lighting Management Systems based on NTCIP 1213 ELMS Standard v03.

Since the NTCIP 1213 v03 does not possess testing content, this must be developed. In order to do so, Requirements to Test Case Traceability Matrix (RTCTM) must be developed (as seen below).



Requirements to Test Case Traceability Matrix (RTCTM)

Requirement ID	Requirement	Test Case ID	Test Case
3.5.4.1.1.1	Retrieve Luminaire Pole Identifier	3.5.4.1.1	Retrieve Luminaire Pole Identifier
3.5.4.1.1.2	Retrieve Luminaire Location	3.5.4.1.1.2	Retrieve Luminaire Location
3.5.4.1.3	Configure Luminaire Mode	3.5.4.1.3.1	Configure Luminaire Mode
		3.5.4.1.3.2	Incorrectly Configure Luminaire Mode
3.5.4.1.4.1	Configure Luminaire Color Temperature	3.5.4.1.4.1.1	Configure Luminaire Color Temperature
		3.5.4.1.4.1.2	Incorrectly Configure Luminaire Color Temperature

Add: requirements come from PRL and Test Cases must be developed to test each requirement for conformance to the standard.

Requirements to Test Case Traceability Matrix (RTCTM)

Requirement ID	Requirement	Test Case ID	Test Case
3.5.4.1.1.1	Retrieve Luminaire Pole Identifier	3.5.4.1.1	Retrieve Luminaire Pole Identifier
3.5.4.1.1.2	Retrieve Luminaire Location	3.5.4.1.1.2	Retrieve Luminaire Location
3.5.4.1.3	Configure Luminaire Mode	3.5.4.1.3.1	Configure Luminaire Mode
		3.5.4.1.3.2	Incorrectly Configure Luminaire Mode
3.5.4.1.4.1	Configure Luminaire Color Temperature	3.5.4.1.4.1.1	Configure Luminaire Color Temperature
		3.5.4.1.4.1.2	Incorrectly Configure Luminaire Color Temperature

Notice the one-to-one relationship of Test Cases to Requirements.

To begin development of a Test Plan, first your project-specific User Needs must be selected in the PRL, as shown in the graphic below:



User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
2.5.2.2.2	Control Electrical Service			O	Yes / No	
		3.5.5.2.1	Control Electrical Service by Permanent/Continuous Override	M	Yes	
		3.5.5.2.2	Control Electrical Service by Transitory Override	O	Yes / No	
		3.5.5.2.3	Control Electrical Service by Timed Override	O	Yes / No	
		3.5.5.2.4	Control Electrical Service in Stagger Mode	O	Yes / No	
		3.5.5.2.5	Control Electrical Service by Photocell	O	Yes / No	
		3.5.5.2.6	Control Electrical Service by Adaptive Means	O	Yes / No	

Next, using the project-specific requirements we've selected in the PRL, we next move to the RTM. In the RTM, we "trace" these functional requirements to the objects in the RTM.

Requirements Traceability Matrix (RTM)					
FR ID	Functional Requirement	Dialog ID	Object ID	Object Name	Additional Specifications
3.5.5.2.2	Control Electrical Service by Transitory Override	G.3			
			5.5.1.6	electricalserviceSwitchMode	
3.5.5.2.3	Control Electrical Service by Timed Override	4.2.13			
			5.5.1.6	electricalserviceSwitchMode	
			5.5.1.7	electricalserviceSwitchModeTime	
3.5.5.2.4	Control Electrical Service in Stagger Mode	G.3			
			5.5.1.28	electricalserviceSwitchState	
3.5.5.2.5	Control Electrical Service by Photocell	G.3			
			5.5.1.29	electricalservicePhotocellIndex	
3.5.5.2.6	Control Electrical Service by Adaptive Means	G.3			
			5.5.1.6	electricalserviceSwitchMode	

Continuing, we begin completing a Test Case by assigning an ID, as well as defining an objective.

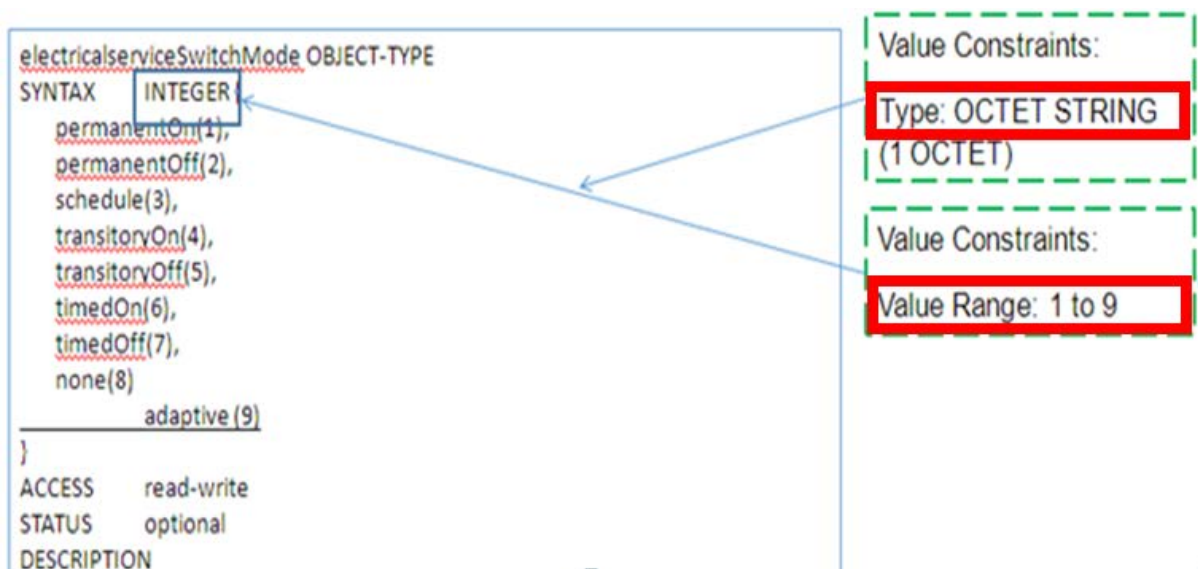
Test Case	
ID: TC001	Title: RequestStatus Condition within the Device Dialog Verification (Positive Test Case)
Objective:	To verify system interface implements (positive test case) requirements for a sequence of OBJECT requests for: <ul style="list-style-type: none"> 3.5.5.2.2 3.5.5.2.3 3.5.5.2.4 3.5.5.2.5 The test case ranges. The object identifier specification is definitions.
Inputs:	To verify system interface implements (positive test case) requirements for a series of object requests for: 3.5.5.2.2 electricalserviceSwitchMode 3.5.5.2.3 electricalserviceSwitchModeTime 3.5.5.2.4 electricalserviceSwitchState 3.5.5.2.5 electricalservicePhotocellIndex The test case verifies that the data value of the OBJECTS requested are within specified ranges The object identifier (OID) of each object requested is the only input required. An output specification is provided to show valid value constraints per the NTCIP 1205 v01 object definitions
Outcome(s):	
Environmental Needs:	
Tester/Reviewer	
Special Procedure Requirements:	
Intercase Dependencies:	



Our next step is to define the Input and Output Constraints in the Test Case definition.

Test Case Output Specification			
ID: TCOS001		Title: Status Condition within the Device	
Data Concept ID	Data Concept Name (Variable)	Data Concept Type	Value Constraints
3.5.5.2.2	<u>electrcialServiceSwitchMode</u>	Data Element	
3.5.5.2.3	<u>electrcialServiceSwitchModeTime</u>	Data Element	
3.5.5.2.4	<u>electrcialServiceSwitchModeState</u>	Data Element	
3.5.5.2.5	<u>electrcialServicePhotocellIndex</u>	Data Element	

In order to find the Data Concept Type and Value Constraints, we look to the Object definition in the standard, as pictured below:



Notice in this example the Data Concept Type and the Value Range.

Continuing, we define the Value Constraints in the Test Case Input Specification from the values that we found in the object definition, as described in the figure below:



Test Case Input Specification			
ID TCI201		Title: Input Specification for <u>electricalserviceswitchmode</u> (Positive test case)	
Data Concept ID	Data Concept Name (Variable)	Data Concept Type	Value Constraints
3.5.5.52.2	electricalserviceSwitchMode	Data Element	1 = " <u>permanentOn</u> " 2 = " <u>permanentOff</u> " 3 = "schedule" 4 = " <u>transitoryOn</u> " 5 = " <u>transitoryOff</u> " 6 = " <u>timedOn</u> " 7 = " <u>timedOff</u> " 8 = "none" 9 = "adaptive"

Next we need to define the Output Value Constraints. We do this in the Test Case figure below:

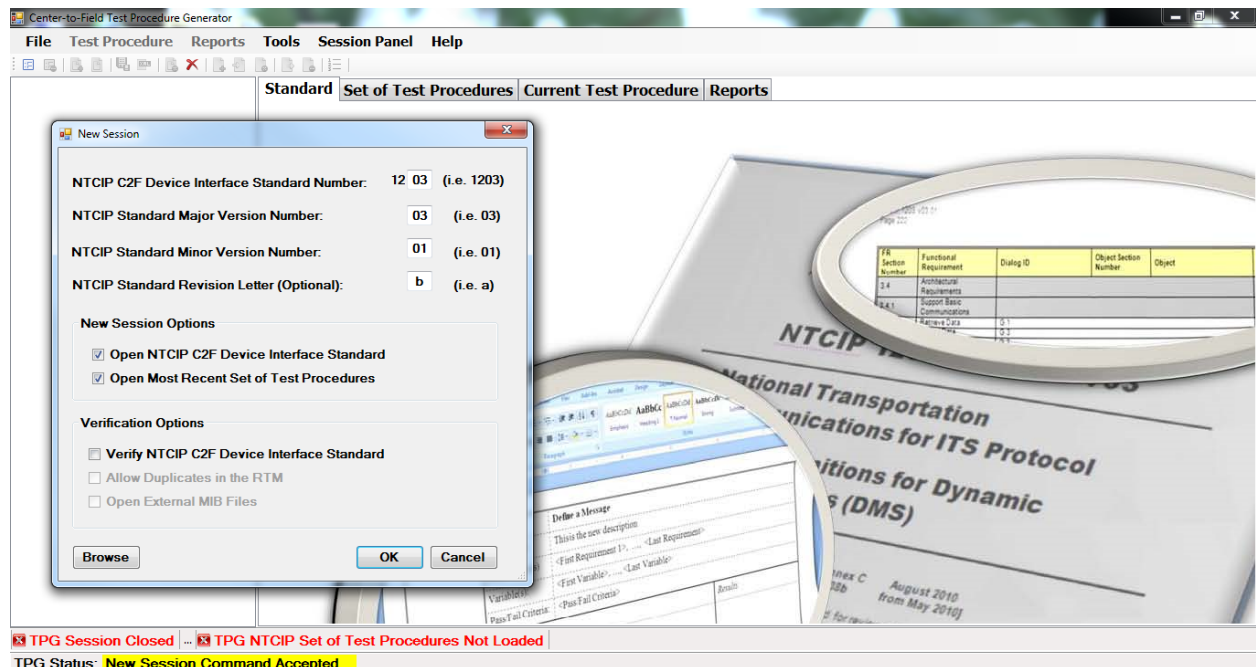
Test Case Output Specification			
ID TCI201		Title: Output Specification for <u>electricalserviceswitchmode</u> (Positive test case)	
Data Concept ID	Data Concept Name (Variable)	Data Concept Type	Value Constraints
3.5.5.52.2	electricalserviceSwitchMode	Data Element	1 = " <u>permanentOn</u> " 2 = " <u>permanentOff</u> " 3 = "schedule" 4 = " <u>transitoryOn</u> " 5 = " <u>transitoryOff</u> " 6 = " <u>timedOn</u> " 7 = " <u>timedOff</u> " 8 = "none" 9 = "adaptive"

Our last step in defining a Test case is to define environmental needs, the name of the tester /reviewer, any special procedure requirements and any intercase dependencies. Once we complete these, our test case is complete and a test procedure can be performed.



This manual process described above for creating a test plan can be automated using the Test Program Generator (TPG) v02 Tool available as a free download from <https://www.standards.its.dot.gov/DeploymentResources/Tools>

The free download package will include the TPG v2.1 Installation file and a TPG User Manual.



4. Reference to Standards

IEEE 829-2008 - IEEE Standard for Software and System Test Documentation, IEEE, July 18, 2008.

NTCIP 1103:2010, National Transportation Communications for ITS Protocol: Transportation Management Protocols, AASHTO/ITE/NEMA, v02.17, July 2010.

NTCIP 1201:2010, National Transportation Communications for ITS Protocol: Global Object Definitions, AASHTO/ITE/NEMA, v03.15r, December 2010.

NTCIP 1213:2016, National Transportation Communications for ITS Protocol: Object Definitions Electrical and Lighting Management Systems based upon the NTCIP 1213 v03 Protocol.

NTCIP 9001 Version v04, National Transportation Communications for ITS Protocol, The NTCIP Guide, AASHTO/ITE/NEMA, July 2009.

NTCIP 8007 Version 1.21, National Transportation Communications for ITS Protocol, Testing and CA Documentation within NTCIP Standards (www.ntcip.org).



5. NTCIP 1213 v03 Tables

Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
2.5.1	Operational User Needs			M	Yes	
2.5.1.1	Provide Live Data			M	Yes	
		3.5.1.1	Retrieve Data	M	Yes	
		3.5.1.2	Deliver Data	M	Yes	
		3.5.1.3	Data Retrieval and Data Delivery Action Performance	M	Yes	
		3.5.1.4	Live Data Response Time	M	Yes	
2.5.1.2	Provide Off-line Log Data			O	Yes / No	
		3.5.2.1	Retrieve Configuration of Logging Service	M	Yes	
		3.5.2.2	Configure Logging Service	M	Yes	
		3.5.2.2.1	Configure Number of Events in Event Log	M	Yes / No	The ELMS device shall support at least _____ (1..255) events.
		3.5.2.2.2	Configure Number of Event Classes	M	Yes / No	The ELMS device shall support at least _____ (1..255) classes.



Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
		3.5.2.2.3	Configure Number of Event Types	M	Yes / No	The ELMS device shall support at least _____ (1..255) event types.
		3.5.2.3	Retrieve Logged Data			
		3.5.2.4	Clear Log	M	Yes	
		3.5.2.5	Retrieve Capabilities of Event Logging Services	M	Yes	
		3.5.2.6	Retrieve Number of Events Currently Logged	M	Yes	
		3.5.2.7	Set Time	M	Yes	
		3.5.2.8	Retrieve Current Time	M	Yes	
		3.5.2.9	Set Daylight Saving Time Mode	M	Yes	
		3.5.2.10	ELMS Pre-Defined Event Configurations	M	Yes	
		3.5.2.10.1	Supported Event Classes	M	Yes	
2.5.1.2.1		Provide Luminaire Switch State Logging		O	Yes / No	
		3.5.2.10.2	Luminaire Switch State Log	O	Yes / No	
2.5.1.2.2		Provide Luminaire Condition Logging		O	Yes / No	
		3.5.2.10.3	Luminaire Condition Log	O	Yes / No	



Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
2.5.1.2.3			Provide Luminaire Operating Hours Condition Logging	O	Yes / No	
		3.5.2.10.4	Luminaire Operating Hours Condition Log	O	Yes / No	
2.5.1.2.4			Provide Periodic Luminaire Operating Hours Time Logging	O	Yes / No	
		3.5.2.10.5	Periodic Luminaire Operating Hours Time Log	O	Yes / No	
2.5.1.2.5			Provide Luminaire Temperature Logging	O	Yes / No	
		3.5.2.10.6	Luminaire Temperature Log	O	Yes / No	
2.5.1.2.6			Provide Luminaire Pole Condition Logging	O	Yes / No	
		3.5.2.10.7	Luminaire Pole Condition Log	O	Yes / No	
2.5.1.2.7			Provide Relay Switch State Logging	O	Yes / No	
		3.5.2.10.8	Relay Switch State Log	O	Yes / No	
2.5.1.2.8			Provide Energy Meter Switch State Logging	O	Yes / No	
		3.5.2.10.9	Power Meter Switch State Log	O	Yes / No	
2.5.1.2.9			Provide Periodic Power Meter Measurement Logging	O	Yes / No	
		3.5.2.10.10	Periodic Energy Meter Measurement Log	O	Yes / No	



Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
2.5.1.2.10	Provide Energy Meter Condition Logging			O	Yes / No	
		3.5.2.10.11	Energy Meter Condition Log	O	Yes / No	
2.5.1.2.11	Provide Ground Fault Switch State Logging			O	Yes / No	
		3.5.2.10.12	Ground Fault Switch State Log	O	Yes / No	
2.5.1.2.12	Provide Periodic Ground Fault Measurement Logging			O	Yes / No	
		3.5.2.10.13	Periodic Ground Fault Measurement Log	O	Yes / No	
2.5.1.2.13	Retrieve Logged Data			M	Yes	
		3.5.2.3	Retrieve Logged Data	M	Yes	
2.5.1.3	Monitor Exceptional Conditions			O	Yes / No	
		3.5.3.1	Retrieve Current Configuration of Exception Reporting Service	M	Yes	
		3.5.3.2	Configure Events	M	Yes	
		3.5.3.3	Provide Automatic Reporting of Events (SNMP Traps)	M	Yes	
		3.5.3.4	Manage Exception Reporting	M	Yes	



Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
		3.5.3.5	Retrieve Capabilities of Exception Reporting Service	M	Yes	
		3.5.3.6	Retrieve Current Number of Exception Events	M	Yes	
		3.5.3.7	Record and Timestamp Events	M	Yes	
2.5.2	Functional User Needs			M	Yes	
2.5.2.1	Configure ELMS Device			M	Yes	
2.5.2.1.1	Configure Luminaire			O	Yes / No	
2.5.2.1.1.1	Retrieve Luminaire Information			O	Yes / No	
		3.5.4.1.1.1	Retrieve Luminaire Pole Identifier	O	Yes / No	
		3.5.4.1.1.2	Retrieve Luminaire Location	M	Yes	
		3.5.4.1.1.3	Retrieve Luminaire Mode	M	Yes	
		3.5.4.1.1.4	Retrieve Luminaire Zone	O	Yes / No	
		3.5.4.1.1.5	Retrieve Luminaire Vendor Information	M	Yes	
		3.5.4.1.1.6	Retrieve Luminaire Light Source Type	O	Yes / No	
		3.5.4.1.1.7	Retrieve Luminaire Wattage	O	Yes / No	



Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
		3.5.4.1.1.8	Retrieve Luminaire Voltage	O	Yes / No	
		3.5.4.1.1.9	Retrieve Luminaire Ballast / Driver Type	O	Yes / No	
		3.5.4.1.1.10	Retrieve Luminaire Communications Protocol	O	Yes / No	
2.5.2.1.1.2	Configure Luminaire Identification Information			O	Yes / No	
		3.5.4.1.1.2.1	Specify Location in Longitude/Latitude Coordinates	O	Yes / No	
		3.5.4.1.1.2.2	Specify Location Information Using Textual Description of a Road/Street/Block Name/Number	O	Yes / No	The ELMS device shall support a location name of at least _____ (8..255) Characters.
		3.5.4.1.1.2.3	Specify Location in local reference coordinate grid	O	Yes / No	
		3.5.4.1.2.1	Configure Luminaire Pole Identifier	O	Yes / No	
		3.5.4.1.2.2	Configure Luminaire Location	M	Yes	
2.5.2.1.1.3	Configure Luminaire Mode			O	Yes	
		3.5.4.1.3	Configure Luminaire Mode	M	Yes	



Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
2.5.2.1.1.4	Manage Luminaire Color Temperature			O		
		3.5.4.1.4.1	Configure Luminaire Color Temperature	O	Yes / No	
2.5.2.1.2	Configure Electrical Service			O	Yes	
2.5.2.1.2.1	Retrieve Electrical Service Information			O	Yes / No	
		3.5.4.2.1.1	Retrieve Electrical Service Location	M	Yes	
		3.5.4.2.1.2	Retrieve Electrical Service Zone	O	Yes / No	
		3.5.4.2.1.3	Retrieve Electrical Service Pole Identifier	O	Yes / No	
		3.5.4.3.1	Configure Electrical Service Location	M	Yes	
		3.5.4.3.2	Configure Electrical Service Pole Identifier	O	Yes / No	
2.5.2.1.3	Configure for Light-Activated Operation			O	Yes / No	
		3.5.4.4.1	Configure Luminaire for Light Activated Operations	M	Yes	
		3.5.4.4.2	Configure Electrical Service for Light Activated Operations	O	Yes / No	



Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
		3.5.4.4.3	Configure Branch Circuit for Light Activated Operations	O	Yes / No	
		3.5.4.4.4	Configure Devices in Zone for Light Activated Operations	O	Yes / No	
2.5.2.1.4	Configure for Scheduled Operation			O	Yes / No	
		3.5.4.5.1	Configure Luminaire for Scheduled Operations	O.1 (1..*)	Yes / No	
		3.5.4.5.2	Configure Electrical Service for Scheduled Operations	O.2 (1..*)	Yes / No	
		3.5.4.5.3	Configure Branch Circuit for Scheduled Operations	O.3 (1..*)	Yes / No	
		3.5.4.5.4	Configure Devices in Zone for Scheduled Operations	O.4 (1..*)	Yes / No	
		3.5.4.5.5	Schedule ELMS Device Event	M	Yes	
		3.5.4.5.6	Retrieve a Schedule	M	Yes	
		3.5.4.5.7	Support a Number of Actions	M	Yes	The ELMS Device shall support at least _____ (1..255) Actions.



Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
		3.5.4.5.8	Support a Number of Day Plans	M	Yes	The ELMS Device shall support at least _____ (1..255) Day Plans.
		3.5.4.5.9	Perform Action at Scheduled Time	M	Yes	
2.5.2.1.5	Configure Zones			O	Yes / No	
		3.5.4.6.1	Configure Luminaire Zone	M	Yes	
		3.5.4.6.2	Configure Electrical Service Zone	O	Yes / No	
		3.5.4.6.3	Configure Branch Circuit Zone	O	Yes / No	
		3.5.4.6.4	Configure Electric Vehicle Charger Zone	O	Yes / No	
		3.5.4.6.5	Define Zones	M	Yes	
		3.5.4.6.6	Define Number of Zones Supported by an ELMS Device	M	Yes / No	The ELMS Device shall support at least _____ (0..65535) Zones.



Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
		3.5.4.6.7	Define Number of ELMS Devices for a Zone	M	Yes / No	At least _____ (0..65535) ELMS devices shall be able to be assigned to a single zone.
2.5.2.1.6	Configure for Manual Operation			M	Yes	
		3.5.4.9.1	Configure Luminaire for Manual Operation	O	Yes	
		3.5.4.9.2	Configure Electrical Service for Manual Operations	O	Yes / No	
		3.5.4.9.3	Configure Branch Circuit for Manual Operations	O	Yes / No	
		3.5.4.9.4	Configure Devices in Zone for Manual Operations	O	Yes / No	
2.5.2.1.7	Configure Stagger Interval			O	Yes / No	
		3.5.4.7.1	Configure Luminaire Stagger Interval	O	Yes	The ELMS device shall support a stagger interval with a maximum value of _____ (0..255) seconds.



Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
		3.5.4.7.2	Configure Branch Circuit Stagger Interval	O	Yes / No	The ELMS device shall support a stagger interval with a maximum value of _____ (0..255) seconds.
		3.5.4.7.3	Configure Electrical Service Stagger Interval	O	Yes / No	The ELMS device shall support a stagger interval with a maximum value of _____ (0..255) seconds.
2.5.2.1.8	Configure Light Levels			O	Yes / No	
		3.5.4.8.1	Configure Luminaire Light Level	O	Yes	
		3.5.4.8.2	Configure Electrical Service Light Level	O	Yes / No	
		3.5.4.8.3	Configure Branch Circuit Light Level	O	Yes / No	
		3.5.4.8.4	Configure Light Level for Devices in Zone	O	Yes / No	
2.5.2.1.9	Configure Electrical Service Monitoring and Metering Equipment			O	Yes / No	



Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
		3.5.4.10.1	Configure Branch Circuit Ground Fault Detector	O	Yes / No	
		3.5.4.10.2	Configure Branch Circuit Power Meter	O	Yes / No	
		3.5.4.10.3	Configure Branch Circuit Arc Fault Detector	O	Yes / No	
2.5.2.1.10	Configure Branch Circuit			O	Yes / No	
2.5.2.1.10.1	Retrieve Branch Circuit Information			O	Yes / No	
		3.5.4.11.1.1	Retrieve Branch Circuit Zone	O	Yes / No	
		3.5.4.11.1.2	Retrieve Branch Circuit Location	O	Yes / No	
		3.5.4.11.1.3	Retrieve Branch Circuit Pole Identifier	O	Yes / No	
2.5.2.1.10.2	Configure Branch Circuit			O	Yes / No	
		3.5.4.11.2.1	Configure Branch Circuit Location	O	Yes / No	
		3.5.4.11.2.2	Configure Branch Circuit Pole Identifier	O		
2.5.2.1.11	Manage Configuration of Astronomical Clock			O	Yes / No	
2.5.2.1.11.1	Configure Astronomical Clock			O	Yes / No	
		3.5.4.12.1	Configure Latitude of Installation	O	Yes / No	



Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
		3.5.4.12.2	Configure Longitude of Installation	O	Yes / No	
		3.5.4.12.3	Configure Date	O	Yes / No	D
2.5.2.1.11.2	Retrieve Astronomical Clock Information			O	Yes / No	
		3.5.4.13.1	Retrieve Latitude of Installation	O	Yes / No	
		3.5.4.13.2	Retrieve Longitude of Installation	O	Yes / No	
		3.5.4.13.3	Retrieve Date	O	Yes / No	
		3.5.4.13.4	Retrieve Sunrise Time	O		
		3.5.4.13.5	Retrieve Sunset Time	O		
2.5.2.1.12	Manage Configuration of Photocell			O	Yes / No	
2.5.2.1.12.1	Configure Photocell			O	Yes / No	
		3.5.4.14.1	Configure Photocell for Analog, Digital or Reverse Operations	O	Yes / No	
2.5.2.1.12.2	Retrieve Photocell Configuration			O	Yes / No	
		3.5.4.14.2	Retrieve Configuration of Photocell	O	Yes / No	
2.5.2.1.13	Configure Energy Meter			O	Yes / No	
2.5.2.1.13.1	Configure Energy Meter Accuracy			O	Yes / No	
		3.5.4.15.1	Configure Accuracy of Energy Meter	M	Yes / No	



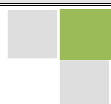
Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
2.5.2.1.13.2			Retrieve Energy Meter Accuracy	O	Yes / No	
		3.5.4.15.2	Retrieve Accuracy of Energy Meter	M	Yes / No	
2.5.2.1.14			Retrieve Connected Vehicle Sensor Information	O	Yes / No	
		3.5.4.16.1	Retrieve Connected Vehicle Speed	O	Yes / No	
		3.5.4.16.2	Retrieve Connected Vehicle Direction	O	Yes / No	
		3.5.4.16.3	Retrieve Connected Vehicle Location	O	Yes / No	
		3.5.4.16.4	Retrieve Connected Vehicle Ambient Light Level	O	Yes / No	
		3.5.4.16.5	Retrieve Connected Vehicle Headlight Status	O	Yes / No	
		3.5.4.16.6	Retrieve Connected Vehicle Road Friction	O	Yes / No	
2.5.2.1.15			Retrieve Electric Vehicle Charger Information	O	Yes / No	
		3.5.4.17.1	Retrieve Electric Vehicle Charger Manufacturer Name	O	Yes / No	
		3.5.4.17.2	Retrieve Electric Vehicle Charger Model Number	O	Yes / No	
		3.5.4.17.3	Retrieve Electric Vehicle Charger Serial Number	O	Yes / No	



Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
		3.5.4.17.4	Retrieve Electric Vehicle Charger Ground Fault Current	O	Yes / No	
		3.5.4.17.5	Retrieve Electric Vehicle Charger Charge Current	O	Yes / No	
		3.5.4.17.6	Retrieve Electric Vehicle Charger Proximity Resistance	O	Yes / No	
		3.5.4.17.7	Retrieve Electric Vehicle Charger Temperature	O	Yes / No	
		3.5.4.17.8	Retrieve Electric Vehicle Charger Activation	O	Yes / No	
		3.5.4.17.9	Retrieve Electric Vehicle Charger Operational Status	O	Yes / No	
		3.5.4.17.10	Retrieve Electric Vehicle Charger Total Energy Delivered	O	Yes / No	
		3.5.4.17.11	Retrieve Electric Vehicle Charger Energy Delivered for the Current Charging Session	O	Yes / No	
		3.5.4.17.12	Retrieve Electric Vehicle Charger Energy Delivered for the Previous Charging Session	O	Yes / No	
		3.5.4.17.13	Retrieve Electric Vehicle Charger Energy Loss	O	Yes / No	



Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
2.5.2.1.16			Retrieve Energy Automatic Demand Response Information	O	Yes / No	
		3.5.4.18.1	Retrieve Electricity Price	O	Yes / No	
		3.5.4.18.2	Retrieve Energy Price	O	Yes / No	
		3.5.4.18.3	Retrieve Demand Charge	O	Yes / No	
		3.5.4.18.4	Retrieve Bid Price	O	Yes / No	
		3.5.4.18.5	Retrieve Bid Load	O	Yes / No	
		3.5.4.18.6	Retrieve Bid Energy	O	Yes / No	
		3.5.4.18.7	Retrieve Load Dispatch	O	Yes / No	
		3.5.4.18.8	Retrieve Load Control Capacity	O	Yes / No	
		3.5.4.18.9	Retrieve Load Control Offset	O	Yes / No	
		3.5.4.18.10	Retrieve Load Control Setpoints	O	Yes / No	
		3.5.4.18.11	Retrieve Load Control Percent Offset	O	Yes / No	
2.5.2.1.17			Configure Ground Fault Interrupter Setpoint	O	Yes / No	
		3.5.4.19	Configure Ground Fault Interrupter Setpoint	O	Yes / No	
2.5.2.1.18			Retrieve Ground Fault Interrupter Setpoint	O	Yes / No	



Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
		3.5.4.20	Retrieve Ground Fault Interrupter Setpoint	O	Yes / No	
2.5.2.1.19	Retrieve Ground Fault Status			O	Yes / No	
		3.5.4.21	Retrieve Ground Fault Status	O	Yes / No	
2.5.2.1.20	Configure Power Outage Message			O	Yes / No	
		3.5.4.22	Configure Power Outage Message	O	Yes / No	
2.5.2.1.21	Configure ELMS Device for Adaptive Operation			O	Yes / No	
		3.5.4.23	Configure ELMS Device for Adaptive Operation	O	Yes / No	
		3.5.4.23.1	Configure Connected Vehicle Speed Setpoint	O		
		3.5.4.23.2	Configure Connected Vehicle Direction Setpoint	O		
		3.5.4.23.3	Configure Connected Vehicle Setpoint	O		
		3.5.4.23.4	Configure Connected Vehicle Ambient Light Level Setpoint	O		
		3.5.4.23.5	Configure Connected Vehicle Headlight Status Setpoint	O		



Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
		3.5.4.23.6	Configure Connected Vehicle Road Friction Setpoint	O		
2.5.2.1.22	Retrieve ELMS Device Adaptive Operation Configuration			O	Yes / No	
		3.5.4.24	Retrieve ELMS Device Adaptive Operation Configuration	O	Yes / No	
		3.5.4.24.1	Retrieve Connected Vehicle Speed Setpoint	O		
		3.5.4.24.2	Retrieve Connected Vehicle Direction Setpoint	O		
		3.5.4.24.3	Retrieve Connected Vehicle Location Setpoint	O		
		3.5.4.24.4	Retrieve Connected Vehicle Ambient Light Level Setpoint	O		
		3.5.4.24.5	Retrieve Connected Vehicle Headlight Status Setpoint	O		
		3.5.4.24.6	Retrieve Connected Vehicle Road Friction Setpoint	O		
2.5.2.2	Control Device			M	Yes	
2.5.2.2.1	Control Luminaire			O	Yes / No	



Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
		3.5.5.1.1	Control Luminaire by Permanent/Continuous Override	M	Yes	
		3.5.5.1.2	Control Luminaire by Transitory Override	O	Yes / No	
		3.5.5.1.3	Control Luminaire by Timed Override	O	Yes / No	
		3.5.5.1.4	Control Luminaire in Stagger Mode	O	Yes / No	
		3.5.5.1.5	Control Luminaire by Adaptive Means	O	Yes / No	
2.5.2.2.2	Control Electrical Service			O	Yes / No	
		3.5.5.2.1	Control Electrical Service by Permanent/Continuous Override	M	Yes	
		3.5.5.2.2	Control Electrical Service by Transitory Override	O	Yes / No	
		3.5.5.2.3	Control Electrical Service by Timed Override	O	Yes / No	
		3.5.5.2.4	Control Electrical Service in Stagger Mode	O	Yes / No	
		3.5.5.2.5	Control Electrical Service by Adaptive Means	O	Yes / No	
2.5.2.2.3	Control Branch Circuit			O	Yes / No	



Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
		3.5.5.3.1	Control Branch Circuit by Permanent/Continuous Override	M	Yes	
		3.5.5.3.2	Control Branch Circuit by Transitory Override	O	Yes / No	
		3.5.5.3.3	Control Branch Circuit by Timed Override	O	Yes / No	
		3.5.5.3.4	Control Branch Circuit in Stagger Mode	O	Yes / No	
		3.5.5.3.5	Control Branch Circuit by Adaptive Means	O	Yes / No	
2.5.2.2.4	Control Electric Vehicle Charger			O	Yes / No	
		3.5.5.4.1	Control Soft Start	O	Yes / No	
		3.5.5.4.2	Control Automatic Reclosure on Fault Time	O	Yes / No	
		3.5.5.4.3	Control Power-up Delay Minimum Time	O	Yes / No	
		3.5.5.4.4	Control Power-up Delay Maximum Time	O	Yes / No	
		3.5.5.4.5	Control Electric Vehicle Charger Activation	O	Yes / No	
2.5.2.2.5	Control Energy Demand Response			O	Yes / No	
		3.5.5.5.1	Control Electricity Price	O	Yes / No	



Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
		3.5.5.5.2	Control Energy Price	O	Yes / No	
		3.5.5.5.3	Control Demand Charge	O	Yes / No	
		3.5.5.5.4	Control Bid Price	O	Yes / No	
		3.5.5.5.5	Control Bid Load	O	Yes / No	
		3.5.5.5.6	Control Bid Energy	O	Yes / No	
		3.5.5.5.7	Control Load Dispatch	O	Yes / No	
		3.5.5.5.8	Control Load Control Capacity	O	Yes / No	
		3.5.5.5.9	Control Load Control Offset	O	Yes / No	
		3.5.5.5.10	Control Load Control Setpoints	O	Yes / No	
		3.5.5.5.11	Control Load Control Percent Offset	O	Yes / No	
2.52.3	Control Devices by Zone			O	Yes / No	
		3.5.5.6.1	Control Devices in Zone by Permanent/Continuous Override	O	Yes	
		3.5.5.6.2	Control Devices in Zone by Transitory Override	O	Yes / No	
		3.5.5.6.3	Control Devices in Zone by Timed Override	O	Yes / No	



Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
		3.5.5.6.4	Control Devices in Zone by Adaptive Means	O	Yes / No	
2.5.2.4	Monitor Device Status			M	Yes	
2.5.2.4.1	Monitor Luminaire			O	Yes / No	
		3.5.6.1.1	Retrieve Luminaire Switch Status	M	Yes / No	
		3.5.6.1.2	Retrieve Luminaire Temperature	O	Yes / No	Units are in tenths of degrees Celsius
		3.5.6.1.3	Retrieve Luminaire Operating Time Statistics	O	Yes / No	
		3.5.6.1.4	Retrieve Luminaire Pole Status	O	Yes / No	
		3.5.6.1.5	Retrieve Luminaire Light Level Output	O	Yes / No	
		3.5.6.1.6	Retrieve Luminaire Status	O	Yes / No	
		3.5.6.1.7	Retrieve Luminaire Power Usage Statistics	O	Yes / No	
		3.5.6.1.9	Retrieve Luminaire Ballast/Driver Status	O	Yes / No	
		3.5.6.1.9	Retrieve Luminaire Starter Status	O	Yes / No	
2.5.2.4.2	Monitor Electrical Service			O	Yes / No	



Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
		3.5.6.2.1	Retrieve Electrical Service Ground Fault Status	O	Yes / No	
		3.5.6.2.2	Retrieve Electrical Service Hours	O	Yes / No	
		3.5.6.2.3	Retrieve Electrical Service Operational Status	M	Yes	
		3.5.6.2.4	Retrieve Electrical Service Energy Readings	O	Yes / No	
		3.5.6.2.5	Retrieve Electrical Service Main Breaker Status	O	Yes / No	
		3.5.6.2.6	Retrieve Electrical Service Arc Fault Status	O	Yes / No	
2.5.2.4.3	Monitor Branch Circuit			O	Yes / No	
		3.5.6.3.1	Retrieve Branch Circuit Power Readings	O	Yes / No	
		3.5.6.3.2	Retrieve Branch Circuit Arc Fault Status	O	Yes / No	
		3.5.6.3.3	Retrieve Branch Circuit Breaker Status	O	Yes / No	
		3.5.6.3.4	Retrieve Branch Circuit Operational Status	M	Yes	
		3.5.6.3.5	Retrieve Branch Circuit Hours	O	Yes / No	



Protocol Requirements List (PRL)						
User Need ID	User Need	FR ID	Functional Requirement	Conformance	Support	Additional Specifications
		3.5.6.3.6	Retrieve Branch Circuit Ground Fault Status	O	Yes / No	



5.1. NTCIP 1213 v03 Requirements Traceability Matrix (RTM)

Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
3.3	Operational Environment Requirements				
3.3.1	Provide Live Data				
3.3.1.1	Retrieve Data				
		4.2.1	Generic SNMP Get Interface		
3.3.1.2	Deliver Data				
		4.2.3	Generic SNMP Set Interface		
3.3.1.3	Data Retrieval and Data Delivery Action Performance				
		4.2.1	Generic SNMP Get Interface		
		4.2.2	Generic SNMP Get-Next Interface		
		4.2.3	Generic SNMP Set Interface		
3.3.2	Provide Off-line Log Data				
3.3.2.1	Retrieve Configuration of Logging service				
		4.2.1	Generic SNMP Get Interface		
			NTCIP1201.2.5.1	maxEventClasses	
			NTCIP1201.2.5.2.1	eventClassNumber	
			NTCIP1201.2.5.2.2	eventClassLimit	
			NTCIP1201.2.5.2.3	eventClassClearTime	
			NTCIP1201.2.5.2.4	eventClassDescription	



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
				NTCIP1201.2.5.2.5	eventClassNumRowsInLog
				NTCIP1201.2.5.2.6	eventClassNumEvents
				NTCIP1201.2.5.3	maxEventLogConfigs
				NTCIP1201.2.5.4.1	eventConfigID
				NTCIP1201.2.5.4.2	eventConfigClass
				NTCIP1201.2.5.4.3	eventConfigMode
				NTCIP1201.2.5.4.4	eventConfigCompareValue
				NTCIP1201.2.5.4.5	eventConfigCompareValue2
				NTCIP1201.2.5.4.6	eventConfigCompareOID
				NTCIP1201.2.5.4.7	eventConfigLogOID
				NTCIP1201.2.5.4.8	eventConfigAction
				NTCIP1201.2.5.4.9	eventConfigStatus
3.3.2.2	Configure Logging Service				
		4.3.16	Configure Reporting/Logging Service		
				NTCIP1201.2.5.2.1	eventClassNumber
				NTCIP1201.2.5.2.2	eventClassLimit
				NTCIP1201.2.5.2.3	eventClassClearTime
				NTCIP1201.2.5.2.4	eventClassDescription
				NTCIP1201.2.5.4.1	eventConfigID
				NTCIP1201.2.5.4.2	eventConfigClass
				NTCIP1201.2.5.4.3	eventConfigMode



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
				NTCIP1201.2.5.4.4	eventConfigCompareValue
				NTCIP1201.2.5.4.5	eventConfigCompareValue2
				NTCIP1201.2.5.4.6	eventConfigCompareOID
				NTCIP1201.2.5.4.7	eventConfigLogOID
				NTCIP1201.2.5.4.8	eventConfigAction
				NTCIP1201.2.5.4.9	eventConfigStatus
3.3.2.3	Retrieve Logged Data				
		4.3.17	Retrieve Logged Data		
				NTCIP1201.2.5.2.5	eventClassNumRowsInLog
				NTCIP1201.2.5.2.6	eventClassNumEvents
				NTCIP1201.2.5.6.1	eventLogClass
				NTCIP1201.2.5.6.2	eventLogNumber
				NTCIP1201.2.5.6.3	eventLogID
				NTCIP1201.2.5.6.4	eventLogTime
				NTCIP1201.2.5.6.5	eventLogValue
3.3.2.4	Clear Log				
		4.2.3	Generic SNMP Set Interface		
				NTCIP1201.2.5.2.3	eventClassClearTime
3.3.2.5	Retrieve Capabilities of Event Logging Services				
		4.2.1	Generic SNMP Get Interface		
				NTCIP1201.2.5.1	maxEventClasses



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
				NTCIP1201.2.5.3	maxEventLogConfigs
				NTCIP1201.2.5.5	maxEventLogSize
3.3.2.6	Retrieve Number of Events Currently Logged				
		4.2.1	Generic SNMP Get Interface		
				NTCIP1201.2.5.2.5	eventClassNumRowsInLog
				NTCIP1201.2.5.2.6	eventClassNumEvents
3.3.2.7	Set Time				
		4.2.3	Generic SNMP Set Interface		
				NTCIP1201.2.4.1	globalTime
				NTCIP1201.2.4.2	globalDaylightSaving
				NTCIP1201.2.4.6	controllerStandardTimeZone
3.3.2.8	Retrieve Current Time				
		4.2.1	Generic SNMP Get Interface		
				NTCIP1201.2.4.1	globalTime
				NTCIP1201.2.4.2	globalDaylightSaving
				NTCIP1201.2.4.6	controllerStandardTimeZone
				NTCIP1201.2.4.7	controllerLocalTime
3.3.2.9	Set Daylight Saving Time Mode				
		4.2.3	Generic SNMP Set Interface		
				NTCIP1201.2.4.2	globalDaylightSaving
3.3.2.10	ELMS Pre-defined Event Configurations				



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
3.3.2.10.1	Supported Event Classes				
		4.2.3	Generic SNMP Set Interface		
				NTCIP1201.2.5.4.2	eventConfigClass
3.3.2.10.2	Luminaire Switch State Log				
		4.3.19	Configure Luminaire Switch State Log		
				NTCIP1201.2.5.2.1	eventClassNumber
				NTCIP1201.2.5.2.2	eventClassLimit
				NTCIP1201.2.5.2.3	eventClassClearTime
				NTCIP1201.2.5.2.4	eventClassDescription
				NTCIP1201.2.5.4.1	eventConfigID
				NTCIP1201.2.5.4.2	eventConfigClass
				NTCIP1201.2.5.4.3	eventConfigMode
				NTCIP1201.2.5.4.4	eventConfigCompareValue
				NTCIP1201.2.5.4.5	eventConfigCompareValue2
				NTCIP1201.2.5.4.6	eventConfigCompareOID
				NTCIP1201.2.5.4.7	eventConfigLogOID
				NTCIP1201.2.5.4.8	eventConfigAction
				NTCIP1201.2.5.4.9	eventConfigStatus
3.3.2.10.3	Luminaire Condition Log				
		4.3.20	Configure Luminaire Condition Log		
				NTCIP1201.2.5.2.1	eventClassNumber



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
				NTCIP1201.2.5.2.2	eventClassLimit
				NTCIP1201.2.5.2.3	eventClassClearTime
				NTCIP1201.2.5.2.4	eventClassDescription
				NTCIP1201.2.5.4.1	eventConfigID
				NTCIP1201.2.5.4.2	eventConfigClass
				NTCIP1201.2.5.4.3	eventConfigMode
				NTCIP1201.2.5.4.4	eventConfigCompareValue
				NTCIP1201.2.5.4.5	eventConfigCompareValue2
				NTCIP1201.2.5.4.6	eventConfigCompareOID
				NTCIP1201.2.5.4.7	eventConfigLogOID
				NTCIP1201.2.5.4.8	eventConfigAction
				NTCIP1201.2.5.4.9	eventConfigStatus
3.3.2.10.4	Luminaire Burn Condition Log				
		4.3.21	Configure Luminaire Burn Condition Log		
				NTCIP1201.2.5.2.1	eventClassNumber
				NTCIP1201.2.5.2.2	eventClassLimit
				NTCIP1201.2.5.2.3	eventClassClearTime
				NTCIP1201.2.5.2.4	eventClassDescription
				NTCIP1201.2.5.4.1	eventConfigID
				NTCIP1201.2.5.4.2	eventConfigClass
				NTCIP1201.2.5.4.3	eventConfigMode



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
				NTCIP1201.2.5.4.4	eventConfigCompareValue
				NTCIP1201.2.5.4.5	eventConfigCompareValue2
				NTCIP1201.2.5.4.6	eventConfigCompareOID
				NTCIP1201.2.5.4.7	eventConfigLogOID
				NTCIP1201.2.5.4.8	eventConfigAction
				NTCIP1201.2.5.4.9	eventConfigStatus
3.3.2.10.5	Periodic Luminaire Burn Time Log				
		4.3.22	Configure Periodic Luminaire Burn Time Log		
				NTCIP1201.2.5.2.1	eventClassNumber
				NTCIP1201.2.5.2.2	eventClassLimit
				NTCIP1201.2.5.2.3	eventClassClearTime
				NTCIP1201.2.5.2.4	eventClassDescription
				NTCIP1201.2.5.4.1	eventConfigID
				NTCIP1201.2.5.4.2	eventConfigClass
				NTCIP1201.2.5.4.3	eventConfigMode
				NTCIP1201.2.5.4.4	eventConfigCompareValue
				NTCIP1201.2.5.4.5	eventConfigCompareValue2
				NTCIP1201.2.5.4.6	eventConfigCompareOID
				NTCIP1201.2.5.4.7	eventConfigLogOID
				NTCIP1201.2.5.4.8	eventConfigAction
				NTCIP1201.2.5.4.9	eventConfigStatus



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
				5.4.1.28	luminairePeriodicBurnTimesLogInterval
3.3.2.10.6	Luminaire Temperature Log				
		4.3.23	Configure Luminaire Temperature Log		
			NTCIP1201.2.5.2.1	eventClassNumber	
			NTCIP1201.2.5.2.2	eventClassLimit	
			NTCIP1201.2.5.2.3	eventClassClearTime	
			NTCIP1201.2.5.2.4	eventClassDescription	
			NTCIP1201.2.5.4.1	eventConfigID	
			NTCIP1201.2.5.4.2	eventConfigClass	
			NTCIP1201.2.5.4.3	eventConfigMode	
			NTCIP1201.2.5.4.4	eventConfigCompareValue	
			NTCIP1201.2.5.4.5	eventConfigCompareValue2	
			NTCIP1201.2.5.4.6	eventConfigCompareOID	
			NTCIP1201.2.5.4.7	eventConfigLogOID	
			NTCIP1201.2.5.4.8	eventConfigAction	
			NTCIP1201.2.5.4.9	eventConfigStatus	
			5.4.1.29	luminaireTempLogHysteresisUpperBound	
			5.4.1.30	luminaireTempLogHysteresisLowerBound	
3.3.2.10.7	Luminaire Pole Condition Log				
		4.3.24	Configure Luminaire Pole Condition Log		
			NTCIP1201.2.5.2.1	eventClassNumber	



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
				NTCIP1201.2.5.2.2	eventClassLimit
				NTCIP1201.2.5.2.3	eventClassClearTime
				NTCIP1201.2.5.2.4	eventClassDescription
				NTCIP1201.2.5.4.1	eventConfigID
				NTCIP1201.2.5.4.2	eventConfigClass
				NTCIP1201.2.5.4.3	eventConfigMode
				NTCIP1201.2.5.4.4	eventConfigCompareValue
				NTCIP1201.2.5.4.5	eventConfigCompareValue2
				NTCIP1201.2.5.4.6	eventConfigCompareOID
				NTCIP1201.2.5.4.7	eventConfigLogOID
				NTCIP1201.2.5.4.8	eventConfigAction
				NTCIP1201.2.5.4.9	eventConfigStatus
3.3.2.10.8	Relay Switch State Log				
		4.3.25	Configure Relay Switch State Log		
				NTCIP1201.2.5.2.1	eventClassNumber
				NTCIP1201.2.5.2.2	eventClassLimit
				NTCIP1201.2.5.2.3	eventClassClearTime
				NTCIP1201.2.5.2.4	eventClassDescription
				NTCIP1201.2.5.4.1	eventConfigID
				NTCIP1201.2.5.4.2	eventConfigClass
				NTCIP1201.2.5.4.3	eventConfigMode



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
				NTCIP1201.2.5.4.4	eventConfigCompareValue
				NTCIP1201.2.5.4.5	eventConfigCompareValue2
				NTCIP1201.2.5.4.6	eventConfigCompareOID
				NTCIP1201.2.5.4.7	eventConfigLogOID
				NTCIP1201.2.5.4.8	eventConfigAction
				NTCIP1201.2.5.4.9	eventConfigStatus
3.3.2.10.9	Power Meter Switch State Log				
		4.3.2.26	Configure Power Meter Switch State Log		
				NTCIP1201.2.5.2.1	eventClassNumber
				NTCIP1201.2.5.2.2	eventClassLimit
				NTCIP1201.2.5.2.3	eventClassClearTime
				NTCIP1201.2.5.2.4	eventClassDescription
				NTCIP1201.2.5.4.1	eventConfigID
				NTCIP1201.2.5.4.2	eventConfigClass
				NTCIP1201.2.5.4.3	eventConfigMode
				NTCIP1201.2.5.4.4	eventConfigCompareValue
				NTCIP1201.2.5.4.5	eventConfigCompareValue2
				NTCIP1201.2.5.4.6	eventConfigCompareOID
				NTCIP1201.2.5.4.7	eventConfigLogOID
				NTCIP1201.2.5.4.8	eventConfigAction



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
				NTCIP1201.2.5.4.9	eventConfigStatus
3.3.2.10.10	Periodic Power Meter Measurement Log				
		4.3.27	Configure Periodic Power Meter Measurement Log		
			NTCIP1201.2.5.2.1	eventClassNumber	
			NTCIP1201.2.5.2.2	eventClassLimit	
			NTCIP1201.2.5.2.3	eventClassClearTime	
			NTCIP1201.2.5.2.4	eventClassDescription	
			NTCIP1201.2.5.4.1	eventConfigID	
			NTCIP1201.2.5.4.2	eventConfigClass	
			NTCIP1201.2.5.4.3	eventConfigMode	
			NTCIP1201.2.5.4.4	eventConfigCompareValue	
			NTCIP1201.2.5.4.5	eventConfigCompareValue2	
			NTCIP1201.2.5.4.6	eventConfigCompareOID	
			NTCIP1201.2.5.4.7	eventConfigLogOID	
			NTCIP1201.2.5.4.8	eventConfigAction	
			NTCIP1201.2.5.4.9	eventConfigStatus	
			5.6.1.43	branchcircuitPowerMeterMeasLogInterval	
3.3.2.10.11	Power Meter Condition Log				
		4.3.28	Configure Power Meter Condition Log		
			NTCIP1201.2.5.2.1	eventClassNumber	
			NTCIP1201.2.5.2.2	eventClassLimit	



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
				NTCIP1201.2.5.2.3	eventClassClearTime
				NTCIP1201.2.5.2.4	eventClassDescription
				NTCIP1201.2.5.4.1	eventConfigID
				NTCIP1201.2.5.4.2	eventConfigClass
				NTCIP1201.2.5.4.3	eventConfigMode
				NTCIP1201.2.5.4.4	eventConfigCompareValue
				NTCIP1201.2.5.4.5	eventConfigCompareValue2
				NTCIP1201.2.5.4.6	eventConfigCompareOID
				NTCIP1201.2.5.4.7	eventConfigLogOID
				NTCIP1201.2.5.4.8	eventConfigAction
				NTCIP1201.2.5.4.9	eventConfigStatus
3.3.2.10.12	Ground Fault Switch State Log				
		4.3.29	Configure Ground Fault Switch State Log		
				NTCIP1201.2.5.2.1	eventClassNumber
				NTCIP1201.2.5.2.2	eventClassLimit
				NTCIP1201.2.5.2.3	eventClassClearTime
				NTCIP1201.2.5.2.4	eventClassDescription
				NTCIP1201.2.5.4.1	eventConfigID
				NTCIP1201.2.5.4.2	eventConfigClass
				NTCIP1201.2.5.4.3	eventConfigMode
				NTCIP1201.2.5.4.4	eventConfigCompareValue



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
				NTCIP1201.2.5.4.5	eventConfigCompareValue2
				NTCIP1201.2.5.4.6	eventConfigCompareOID
				NTCIP1201.2.5.4.7	eventConfigLogOID
				NTCIP1201.2.5.4.8	eventConfigAction
				NTCIP1201.2.5.4.9	eventConfigStatus
3.3.2.10.13	Periodic Ground Fault Measurement Log				
		4.3.30	Configure Periodic Ground Fault Measurement Log		
				NTCIP1201.2.5.2.1	eventClassNumber
				NTCIP1201.2.5.2.2	eventClassLimit
				NTCIP1201.2.5.2.3	eventClassClearTime
				NTCIP1201.2.5.2.4	eventClassDescription
				NTCIP1201.2.5.4.1	eventConfigID
				NTCIP1201.2.5.4.2	eventConfigClass
				NTCIP1201.2.5.4.3	eventConfigMode
				NTCIP1201.2.5.4.4	eventConfigCompareValue
				NTCIP1201.2.5.4.5	eventConfigCompareValue2
				NTCIP1201.2.5.4.6	eventConfigCompareOID
				NTCIP1201.2.5.4.7	eventConfigLogOID
				NTCIP1201.2.5.4.8	eventConfigAction
				NTCIP1201.2.5.4.9	eventConfigStatus
				5.6.1.44	branchcircuitGroundFaultMeasLogInterval



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
3.3.3	Monitor Exceptional Conditions				
3.3.3.1	Retrieve Current Configuration of Exception Reporting Service				
		4.2.1	Generic SNMP Get Interface		
			NTCIP1201.2.5.2.1	eventClassNumber	
			NTCIP1201.2.5.2.2	eventClassLimit	
			NTCIP1201.2.5.2.3	eventClassClearTime	
			NTCIP1201.2.5.2.4	eventClassDescription	
			NTCIP1201.2.5.4.1	eventConfigID	
			NTCIP1201.2.5.4.2	eventConfigClass	
			NTCIP1201.2.5.4.3	eventConfigMode	
			NTCIP1201.2.5.4.4	eventConfigCompareValue	
			NTCIP1201.2.5.4.5	eventConfigCompareValue2	
			NTCIP1201.2.5.4.6	eventConfigCompareOID	
			NTCIP1201.2.5.4.7	eventConfigLogOID	
			NTCIP1201.2.5.4.8	eventConfigAction	
			NTCIP1201.2.5.4.9	eventConfigStatus	
3.3.3.2	Configure Events				
		4.3.16	Configure Reporting/Logging Service		
			NTCIP1201.2.5.2.1	eventClassNumber	
			NTCIP1201.2.5.2.2	eventClassLimit	
			NTCIP1201.2.5.2.3	eventClassClearTime	



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
				NTCIP1201.2.5.2.4	eventClassDescription
				NTCIP1201.2.5.4.1	eventConfigID
				NTCIP1201.2.5.4.2	eventConfigClass
				NTCIP1201.2.5.4.3	eventConfigMode
				NTCIP1201.2.5.4.4	eventConfigCompareValue
				NTCIP1201.2.5.4.5	eventConfigCompareValue2
				NTCIP1201.2.5.4.6	eventConfigCompareOID
				NTCIP1201.2.5.4.7	eventConfigLogOID
				NTCIP1201.2.5.4.8	eventConfigAction
				NTCIP1201.2.5.4.9	eventConfigStatus
3.3.3.3	Provide Automatic Reporting of Events (SNMP Traps)				
		4.3.18	Automatic Reporting of Events (SNMP Traps)		
3.3.3.4	Manage Exception Reporting				
		4.3.18	Automatic Reporting of Events (SNMP Traps)		
3.3.3.5	Retrieve Capabilities of Exception Reporting Service				
		4.2.1	Generic SNMP Get Interface		
			NTCIP1201.2.5.1	maxEventClasses	
			NTCIP1201.2.5.3	maxEventLogConfigs	
			NTCIP1201.2.5.5	maxEventLogSize	
3.3.3.6	Retrieve Current Number of Exception Events				
		4.2.1	Generic SNMP Get Interface		



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
				NTCIP1201.2.5.2.5	eventClassNumRowsInLog
				NTCIP1201.2.5.2.6	eventClassNumEvents
3.3.3.7	Record and Timestamp Events				
		4.3.17	Retrieve Logged Data		
				NTCIP1201.2.5.2.5	eventClassNumRowsInLog
				NTCIP1201.2.5.2.6	eventClassNumEvents
				NTCIP1201.2.5.6.1	eventLogClass
				NTCIP1201.2.5.6.2	eventLogNumber
				NTCIP1201.2.5.6.3	eventLogID
				NTCIP1201.2.5.6.4	eventLogTime
				NTCIP1201.2.5.6.5	eventLogValue
3.4	Functional Requirements				
3.4.1	Configure ELMS Device				
3.4.1.1	Configure Luminaire				
3.4.1.1.1	Retrieve Luminaire Information				
3.4.1.1.1.1	Retrieve Luminaire Pole Identifier				
		4.2.1	Generic SNMP Get Interface		
				5.4.1.26	luminairePoleIdentifier
3.4.1.1.1.2	Retrieve Luminaire Location				
		4.2.1	Generic SNMP Get Interface		
				5.4.1.2	luminaireLocation



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
				5.4.1.14	luminaireLocationProfile
3.4.1.1.1.2.1	Specify Location in Longitude/Latitude Coordinates				
3.4.1.1.1.2.2	Specify Location Information Using Textual Description of a Road/Street/Block Name/Number				
3.4.1.1.1.2.3	Specify Location in local reference coordinate grid				
3.4.1.1.1.3	Retrieve Luminaire Mode				
		4.2.1	Generic SNMP Get Interface		
				5.4.1.3	luminaireMode
				5.4.1.4	luminaireSwitchMode
3.4.1.1.1.4	Retrieve Luminaire Zone				
		4.2.1	Generic SNMP Get Interface		
				5.4.1.5	luminaireZoneIDList
3.4.1.1.1.5	Retrieve Luminaire Vendor Information				
		4.2.1	Generic SNMP Get Interface		
				NTCIP1201.2.2.3.1	moduleNumber
				NTCIP1201.2.2.3.2	moduleDeviceNode
				NTCIP1201.2.2.3.3	moduleMake
				NTCIP1201.2.2.3.4	moduleModel
				NTCIP1201.2.2.3.5	moduleVersion
				NTCIP1201.2.2.3.6	moduleType



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
3.4.1.1.2	Configure Luminaire Identification Information				
3.4.1.1.2.1	Configure Luminaire Pole Identifier				
		4.2.3	Generic SNMP Set Interface		
				5.4.1.26	luminairePoleIdentifier
3.4.1.1.2.2	Configure Luminaire Location				
		4.2.3	Generic SNMP Set Interface		
				5.4.1.2	luminaireLocation
				5.4.1.14	luminaireLocationProfile
3.4.1.1.3	Configure Luminaire Mode				
		4.2.3	Generic SNMP Set Interface		
				5.4.1.3	luminaireMode
				5.4.1.4	luminaireSwitchMode
3.4.1.2	Configure Electrical Service				
3.4.1.2.1	Retrieve Electrical Service Information				
3.4.1.2.1.1	Retrieve Electrical Service Location				
		4.2.1	Generic SNMP Get Interface		
				5.5.1.2	electricalserviceLocationProfile
				5.5.1.3	electricalserviceLocation
3.4.1.2.1.2	Retrieve Electrical Service Zone				
		4.2.1	Generic SNMP Get Interface		
				5.5.1.4	electricalserviceZoneIDList



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
3.4.1.2.1.3	Retrieve Electrical Service Pole Identifier				
		4.2.1	Generic SNMP Get Interface		
				5.5.1.5	electricalservicePoleIdentifier
3.4.1.2.2	Configure Electrical Service Information				
3.4.1.2.2.1	Configure Electrical Service Location				
		4.2.3	Generic SNMP Set Interface		
				5.5.1.2	electricalserviceLocationProfile
				5.5.1.3	electricalserviceLocation
3.4.1.2.2.2	Configure Electrical Service Pole Identifier				
		4.2.3	Generic SNMP Set Interface		
				5.5.1.5	electricalservicePoleIdentifier
3.4.1.3	Configure for Light Activated Operation				
3.4.1.3.1	Configure Luminaire for Light Activated Operations				
		4.2.3	Generic SNMP Set Interface		
				5.4.1.3	luminaireMode
				5.4.1.15	luminaireLightThreshold
				5.4.1.16	luminaireHoldInterval
				5.4.1.17	luminaireLightHysteresis
				5.4.1.18	luminaireDelayInterval
3.4.1.3.2	Configure Electrical Service for Light Activated Operations				
		4.2.3	Generic SNMP Set Interface		



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
				5.5.1.6	electricalserviceMode
				5.5.1.19	electricalserviceLightThreshold
				5.5.1.20	electricalserviceHoldInterval
				5.5.1.21	electricalserviceLightHysteresis
				5.5.1.22	electricalserviceDelayInterval
3.4.1.3.3	Configure Branch Circuit for Light Activated Operations				
		4.2.3	Generic SNMP Set Interface		
				5.6.1.6	branchcircuitMode
				5.6.1.19	branchcircuitLightThreshold
				5.6.1.20	branchcircuitHoldInterval
				5.6.1.21	branchcircuitLightHysteresis
				5.6.1.22	branchcircuitDelayInterval
3.4.1.3.4	Configure Devices in Zone for Light Activated Operations				
		4.2.3	Generic SNMP Set Interface		
				5.7.1.5	zoneMode
				5.7.1.8	zoneLightThreshold
				5.7.1.9	zoneHoldInterval
				5.7.1.10	zoneLightHysteresis
				5.6.1.11	zoneDelayInterval
3.4.1.4	Configure for Scheduled Operation				
3.4.1.4.1	Configure Luminaire for Scheduled Operations				



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
		4.3.1	Configure Luminaire for Scheduled Operations		
				5.4.1.4	luminaireSwitchMode
3.4.1.4.2	Configure Electrical Service for Scheduled Operations				
		4.3.2	Configure Electrical Service for Scheduled Operations		
				5.5.1.7	electricalserviceSwitchMode
3.4.1.4.3	Configure Branch Circuit for Scheduled Operations				
		4.3.3	Configure Branch Circuit for Scheduled Operations		
				5.6.1.7	branchcircuitSwitchMode
3.4.1.4.4	Configure Devices in Zone for Scheduled Operations				
		4.3.4	Configure Devices in Zone for Scheduled Operations		
				5.7.1.6	zoneSwitchMode
3.4.1.4.5	Schedule ELMS Device Event				
		4.3.5	Schedule ELMS Device Event		
				5.3.4.1	scheduleActionIndex
				5.3.4.2	scheduleAction
				5.3.4.3	scheduleActionType
				5.3.4.4	scheduleActionNumber
				5.3.4.5	scheduleActionParameter
				5.3.4.6	scheduleActionParameter2
				NTCIP1201.2.4.3.1	maxTimeBaseScheduleEntries



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
				NTCIP1201.2.4.3.2.1	timeBaseScheduleNumber
				NTCIP1201.2.4.3.2.2	timeBaseScheduleMonth
				NTCIP1201.2.4.3.2.3	timeBaseScheduleDay
				NTCIP1201.2.4.3.2.4	timeBaseScheduleDate
				NTCIP1201.2.4.3.2.5	timeBaseScheduleDayPlan
				NTCIP1201.2.4.3.3	timeBaseScheduleTablestatus
				NTCIP1201.2.4.4.1	maxDayPlans
				NTCIP1201.2.4.4.2	maxDayPlanEvents
				NTCIP1201.2.4.4.3.1	dayPlanNumber
				NTCIP1201.2.4.4.3.2	dayPlanEventNumber
				NTCIP1201.2.4.4.3.3	dayPlanHour
				NTCIP1201.2.4.4.3.4	dayPlanMinute
				NTCIP1201.2.4.4.3.5	dayPlanActionNumberOID
				NTCIP1201.2.4.4.4	dayPlanStatus
3.4.1.4.6	Retrieve a Schedule				
		4.3.6	Retrieve a Schedule		



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
				5.3.4.1	scheduleActionIndex
				5.3.4.2	scheduleAction
				5.3.4.3	scheduleActionType
				5.3.4.4	scheduleActionNumber
				5.3.4.5	scheduleActionParameter
				5.3.4.6	scheduleActionParameter2
				NTCIP1201.2.4.3.1	maxTimeBaseScheduleEntries
				NTCIP1201.2.4.3.2.1	timeBaseScheduleNumber
				NTCIP1201.2.4.3.2.2	timeBaseScheduleMonth
				NTCIP1201.2.4.3.2.3	timeBaseScheduleDay
				NTCIP1201.2.4.3.2.4	timeBaseScheduleDate
				NTCIP1201.2.4.3.2.5	timeBaseScheduleDayPlan
				NTCIP1201.2.4.3.3	timeBaseScheduleTableStatus
				NTCIP1201.2.4.4.1	maxDayPlans
				NTCIP1201.2.4.4.2	maxDayPlanEvents
				NTCIP1201.2.4.4.3.1	dayPlanNumber
				NTCIP1201.2.4.4.3.2	dayPlanEventNumber



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
				NTCIP1201.2.4.4.3.3	dayPlanHour
				NTCIP1201.2.4.4.3.4	dayPlanMinute
				NTCIP1201.2.4.4.3.5	dayPlanActionNumberOID
				NTCIP1201.2.4.4.4	dayPlanStatus
3.4.1.5	Configure Zones				
3.4.1.5.1	Configure Luminaire Zone				
		4.2.3	Generic SNMP Set Interface		
			5.4.1.5	luminaireZoneIDList	
3.4.1.5.2	Configure Electrical Service Zone				
		4.2.3	Generic SNMP Set Interface		
			5.5.1.4	electricalserviceZoneIDList	
3.4.1.5.3	Configure Branch Circuit Zone				
		4.2.3	Generic SNMP Set Interface		
			5.6.1.4	branchcircuitZoneIDList	
3.4.1.5.4	Define Zones				
		4.2.3	Generic SNMP Set Interface		
			5.7.1.2	zoneLocationProfile	
			5.7.1.3	zoneLocation	
			5.7.1.4	zoneZoneID	



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
				5.7.1.14	zoneFunctionalProfile
				5.7.1.15	zoneListofDevices
3.4.1.6	Configure Stagger Interval				
3.4.1.6.1	Configure Luminaire Stagger Interval				
		4.2.3	Generic SNMP Set Interface		
				5.4.1.27	luminaireStaggerInterval
3.4.1.6.2	Configure Branch Circuit Stagger Interval				
		4.2.3	Generic SNMP Set Interface		
				5.6.1.41	branchcircuitStaggerInterval
3.4.1.6.3	Configure Electrical Service Stagger Interval				
		4.2.3	Generic SNMP Set Interface		
				5.5.1.28	electricalserviceStaggerInterval
3.4.1.7	Configure Dim Levels				
3.4.1.7.1	Configure Luminaire Dim Level				
		4.3.7	Configure Luminaire Dim Level		
				5.4.1.18	luminaireDimLevel
				5.4.1.19	luminaireDimWarmUpInterval
3.4.1.7.2	Configure Electrical Service Dim Level				
		4.3.8	Configure Electrical Service Dim Level		
				5.5.1.23	electricalserviceDimLevel
				5.5.1.24	electricalserviceDimWarmUpInterval



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
3.4.1.7.3	Configure Branch Circuit Dim Level				
		4.3.9	Configure Branch Circuit Dim Level		
				5.6.1.23	branchcircuitDimLevel
				5.6.1.24	branchcircuitDimWarmUpInterval
3.4.1.7.4	Configure Dim Level for Devices in Zone				
		4.3.10	Configure Dim Level for Devices in Zone		
				5.7.1.12	zoneDimLevel
				5.7.1.13	zoneDimWarmUpInterval
3.4.1.8	Configure for Manual Operation				
3.4.1.8.1	Configure Luminaire for Manual Operation				
		4.2.3	Generic SNMP Set Interface		
				5.4.1.4	luminaireSwitchMode
3.4.1.8.2	Configure Electrical Service for Manual Operations				
		4.2.3	Generic SNMP Set Interface		
				5.5.1.7	electricalserviceSwitchMode
3.4.1.8.3	Configure Branch Circuit for Manual Operations				
		4.2.3	Generic SNMP Set Interface		
				5.6.1.7	branchcircuitSwitchMode
3.4.1.8.4	Configure Devices in Zone for Manual Operations				
		4.2.3	Generic SNMP Set Interface		
				5.7.1.6	zoneSwitchMode



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
3.4.1.9	Configure Electrical Service Monitoring and Metering Equipment				
3.4.1.9.1	Configure Branch Circuit Ground Fault Detector				
		4.3.11	Configure Branch Circuit Ground Fault Detector		
			5.6.1.25	branchcircuitGroundFaultCond	
			5.6.1.26	branchcircuitGroundFaultLeakageCurrent	
			5.6.1.27	branchcircuitGroundFaultLeakageCurrentThreshold	
			5.6.1.28	branchcircuitGroundFaultDetectorSwitchState	
3.4.1.9.2	Configure Branch Circuit Power Meter				
		4.2.1	Generic SNMP Get Interface		
			5.6.1.32	branchcircuitPowerMeterCond	
			5.6.1.33	branchcircuitPowerMeterCurrent	
			5.6.1.34	branchcircuitPowerMeterVoltageAB	
			5.6.1.35	branchcircuitPowerMeterVoltageBC	
			5.6.1.36	branchcircuitPowerMeterVoltageCA	
			5.6.1.37	branchcircuitPowerMeterVoltageAN	
			5.6.1.38	branchcircuitPowerMeterVoltageBN	
			5.6.1.39	branchcircuitPowerMeterVoltageCN	
			5.6.1.40	branchcircuitPowerMeterSwitchState	
3.4.1.9.3	Configure Branch Circuit Arc Fault Detector				
		4.2.3	Generic SNMP Set Interface		



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
				5.6.1.31	branchcircuitArcFaultDetectorSwitchState
3.4.1.10	Configure Branch Circuit				
3.4.1.10.1	Retrieve Branch Circuit Information				
3.4.1.10.1.1	Retrieve Branch Circuit Zone				
		4.2.1	Generic SNMP Get Interface		
				5.6.1.4	branchcircuitZoneIDList
3.4.1.10.1.2	Retrieve Branch Circuit Location				
		4.2.1	Generic SNMP Get Interface		
				5.6.1.2	branchcircuitLocationProfile
				5.6.1.3	branchcircuitLocation
3.4.1.10.1.3	Retrieve Branch Circuit Pole Identifier				
		4.2.1	Generic SNMP Get Interface		
				5.6.1.5	branchcircuitPoleIdentifier
3.4.1.10.2	Configure Branch Circuit Information				
3.4.1.10.2.1	Configure Branch Circuit Location				
		4.2.3	Generic SNMP Set Interface		
				5.6.1.2	branchcircuitLocationProfile
				5.6.1.3	branchcircuitLocation



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
3.4.1.10.2	Configure Branch Circuit Pole Identifier				
		4.2.3	Generic SNMP Set Interface		
			5.6.1.5	branchcircuitPoleIdentifier	
3.4.2	Control Device				
3.4.2.1	Control Luminaire				
3.4.2.1.1	Control Luminaire by Permanent/Continuous Override				
		4.2.3	Generic SNMP Set Interface		
			5.4.1.4	luminaireSwitchMode	
3.4.2.1.2	Control Luminaire by Transitory Override				
		4.2.3	Generic SNMP Set Interface		
			5.4.1.4	luminaireSwitchMode	
3.4.2.1.3	Control Luminaire by Timed Override				
		4.3.12	Control Luminaire in Timed Mode		
			5.4.1.4	luminaireSwitchMode	
			5.4.1.25	luminaireSwitchModeTime	
3.4.2.1.4	Control Luminaire in Stagger Mode				
		4.2.3	Generic SNMP Set Interface		
			5.4.1.27	luminaireStaggerInterval	
3.4.2.2	Control Electrical Service				
3.4.2.2.1	Control Electrical Service by Permanent/Continuous Override				



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
		4.2.3	Generic SNMP Set Interface		
				5.5.1.7	electricalserviceSwitchMode
3.4.2.2.2	Control Electrical Service by Transitory Override				
		4.2.3	Generic SNMP Set Interface		
				5.5.1.7	electricalserviceSwitchMode
3.4.2.2.3	Control Electrical Service by Timed Override				
		4.3.13	Control Electrical Service in Timed Mode		
				5.5.1.7	electricalserviceSwitchMode
				5.5.1.8	electricalserviceSwitchModeTime
3.4.2.2.4	Control Electrical Service in Stagger Mode				
		4.2.3	Generic SNMP Set Interface		
				5.5.1.28	electricalserviceStaggerIntervale
3.4.2.3	Control Branch Circuit				
3.4.2.3.1	Control Branch Circuit by Permanent/Continuous Override				
		4.2.3	Generic SNMP Set Interface		
				5.6.1.7	branchcircuitSwitchMode
3.4.2.3.2	Control Branch Circuit by Transitory Override				
		4.2.3	Generic SNMP Set Interface		
				5.6.1.7	branchcircuitSwitchMode
3.4.2.3.3	Control Branch Circuit by Timed Override				
		4.3.14	Control Branch Circuit in Timed Mode		



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
				5.6.1.7	branchcircuitSwitchMode
				5.6.1.8	branchcircuitSwitchModeTime
3.4.2.3.4	Control Branch Circuit in Stagger Mode				
		4.2.3	Generic SNMP Set Interface		
				5.6.1.41	branchcircuitStaggerInterval
3.4.2.4	Control Devices by Zone				
3.4.2.4.1	Control Devices in Zone by Permanent/Continuous Override				
		4.2.3	Generic SNMP Set Interface		
				5.7.1.6	zoneSwitchMode
3.4.2.4.2	Control Devices in Zone by Transitory Override				
		4.2.3	Generic SNMP Set Interface		
				5.7.1.6	zoneSwitchMode
3.4.2.4.3	Control Devices in Zone by Timed Override				
		4.3.15	Control Zone in Timed Mode		
				5.7.1.6	zoneSwitchMode
				5.7.1.7	zoneSwitchModeTime
3.4.3	Monitor Device Status				
3.4.3.1	Monitor Luminaire				
3.4.3.1.1	Retrieve Luminaire Switch Status				
		4.2.1	Generic SNMP Get Interface		
				5.4.1.6	luminaireSwitchState



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
3.4.3.1.2	Retrieve Luminaire Temperature				
		4.2.1	Generic SNMP Get Interface	5.4.1.10	luminaireTemp
3.4.3.1.3	Retrieve Luminaire Burn Time Statistics				
		4.2.1	Generic SNMP Get Interface	5.4.1.11	luminaireMonthlyBurnTime
				5.4.1.12	luminaireMonthlyExpectedBurnTime
				5.4.1.13	luminaireTotalBurnTime
3.4.3.1.4	Retrieve Luminaire Pole Status				
		4.2.1	Generic SNMP Get Interface	5.4.1.9	luminairePoleCond
3.4.3.1.5	Retrieve Luminaire Dimming Level Output				
		4.2.1	Generic SNMP Get Interface	5.4.1.19	luminaireDimLevel
3.4.3.1.6	Retrieve Luminaire Status				
		4.2.1	Generic SNMP Get Interface	5.4.1.7	luminaireCond
3.4.3.1.7	Retrieve Luminaire Power Usage Statistics				
		4.2.1	Generic SNMP Get Interface	5.4.1.21	luminaireVoltage
				5.4.1.22	luminaireCurrent



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
3.4.3.1.8	Retrieve Luminaire Ballast Status				
		4.2.1	Generic SNMP Get Interface	5.4.1.23	luminaireBallastCond
3.4.3.1.9	Retrieve Luminaire Starter Status				
		4.2.1	Generic SNMP Get Interface	5.4.1.24	luminaireStarterStatus
3.4.3.2	Monitor Electrical Service				
3.4.3.2.1	Retrieve Electrical Service Ground Fault Status				
		4.2.1	Generic SNMP Get Interface	5.5.1.25	electricalserviceGroundFaultCond
3.4.3.2.2	Retrieve Electrical Service Hours				
		4.2.1	Generic SNMP Get Interface	5.5.1.9	electricalserviceOpHours
3.4.3.2.3	Retrieve Electrical Service Operational Status				
		4.2.1	Generic SNMP Get Interface	5.5.1.10	electricalserviceOpCond
3.4.3.2.4	Retrieve Electrical Service Power Readings				
		4.2.1	Generic SNMP Get Interface	5.5.1.11	electricalserviceVoltageAB
				5.5.1.12	electricalserviceVoltageBC
				5.5.1.13	electricalserviceVoltageCA



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
				5.5.1.14	electricalserviceVoltageAN
				5.5.1.15	electricalserviceVoltageBN
				5.5.1.16	electricalserviceVoltageCN
				5.5.1.17	electricalserviceCurrent
				5.5.1.18	electricalservicePower
3.4.3.2.5	Retrieve Electrical Service Main Breaker Status				
		4.2.1	Generic SNMP Get Interface		
			5.5.1.26	electricalserviceMainBreakerCond	
3.4.3.2.6	Retrieve Electrical Service Arc Fault Status				
		4.2.1	Generic SNMP Get Interface		
			5.5.1.27	electricalserviceArcFaultCond	
3.4.3.3	Monitor Branch Circuit				
3.4.3.3.1	Retrieve Branch Circuit Power Readings				
		4.2.1	Generic SNMP Get Interface		
			5.6.1.11	branchcircuitVoltageAB	
			5.6.1.12	branchcircuitVoltageBC	
			5.6.1.13	branchcircuitVoltageCA	
			5.6.1.14	branchcircuitVoltageAN	
			5.6.1.15	branchcircuitVoltageBN	
			5.6.1.16	branchcircuitVoltageCN	
			5.6.1.17	branchcircuitCurrent	



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
				5.6.1.18	branchcircuitPower
3.4.3.3.2	Retrieve Branch Circuit Arc Fault Status				
		4.2.1	Generic SNMP Get Interface		
				5.6.1.30	branchcircuitArcFaultCond
3.4.3.3.3	Retrieve Branch Circuit Breaker Status				
		4.2.1	Generic SNMP Get Interface		
				5.6.1.29	branchcircuitBreakerCondition
3.4.3.3.4	Retrieve Branch Circuit Operational Status				
		4.2.1	Generic SNMP Get Interface		
				5.6.1.10	branchcircuitOpCond
3.4.3.3.5	Retrieve Branch Circuit Hours				
		4.2.1	Generic SNMP Get Interface		
				5.6.1.9	branchcircuitOpHours
3.4.3.3.6	Retrieve Branch Circuit Ground Fault Status				
		4.2.1	Generic SNMP Get Interface		
				5.6.1.25	branchcircuitGroundFaultCond
3.5.1	Supplemental Requirements for Scheduled Operations				
3.6.1.1	Support a Number of Actions				
		4.2.3	Generic SNMP Set Interface		
				5.3.1	ScheduleActionNumEntries
3.5.1.2	Support a Number of Day Plans				



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
		4.2.3	Generic SNMP Set Interface		
				NTCIP1201.2.4.4.1	MaxDayPlans
3.5.1.3	Perform Action at the scheduled Time				
		4.2.3	Generic SNMP Get Interface		
				NTCIP1201.2.4.4.3.1	DayPlanNumber
				NTCIP1201.2.4.4.3.2	DayPlanEventNumber
				NTCIP1201.2.4.4.3.3	DayPlanHour
				NTCIP1201.2.4.4.3.4	DayPlanMinute
				NTCIP1201.2.4.4.3.5	DayPlanActionNumberOID
3.5.2	Supplemental Requirements for Zones				
3.5.2.1	Define Number of Zones Supported by an ELMS Device				
		4.2.3	Generic SNMP Set Interface		
				5.8.1	MaxNumZonesPerDevice
3.5.2.2	Define Number ELMS Devices for a Zone				
		4.2.3	Generic SNMP Set Interface		
				5.8.2	MaxNumDevicesPerZone
3.5.3	Supplemental Requirements for Dim Levels				
3.5.3.1	Define Dim Levels as a percentage of maximum brightness				



Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
		4.2.3	Generic SNMP Set Interface		
				5.4.1.19	LuminaireDimLevel
				5.5.1.23	ElectricalServiceDimLevel
				5.6.1.23	BranchCircuitDimLevel
				5.7.1.12	ZoneDimLevel
3.5.4	Supplemental Requirements for Event Logs				
3.5.4.1	Configure Number of Events in Event Log				
		4.2.3	Generic SNMP Set Interface		
				NTCIP1201.2.5.2.2	EventClassLimit
3.5.4.2	Configure Number of Event Classes				
		4.2.3	Generic SNMP Set Interface		
				NTCIP1201.2.5.1	MaxEventClasses
3.5.4.3	Configure Number of Events in Event Types				
		4.2.3	Generic SNMP Set Interface		
				NTCIP1201.2.5.3	MaxEventLogConfigs
3.5.5	Supplemental Requirements for Live Data				
3.5.5.1	Live Data Response Time				
		4.2.1	Generic SNMP Get Interface		
		4.2.2	Generic SNMP Get Next Interface		
		4.2.3	Generic SNMP Set Interface		



6. Glossary

Term	Description
Action	An element of a day plan schedule.
ADR	See Automated Demand Response.
Agency Specification	A document that has been prepared by an agency to define requirements for a subject item or process when procured by the agency.
Ambient light level	The amount of light surrounding the luminaire location.
Automated Demand Response (ADR)	System functions that monitor and control the ELMS device in response to load and cost signals from the electric utility provider.
Boundary testing	A test that verifies the System Under Test reacts properly to error conditions.
Branch circuit	A local electrical circuit that provides power to the luminaires.
Candela	An SI unit of measure for luminous intensity, abbreviated cd.
Compatibility	The ability of two or more systems or components to exchange information.
Compliance	A condition that exists when an item meets all of the requirements of an agency specification.
Concept of Operations	A document that describes the purpose for a system project, including a description of the current and proposed system, as well as key user needs that the new system is required to address.
Configure	The process of setting parameters within the ELMS device during installation.
Conformance	A condition that exists when an item meets all of the mandatory requirements as defined by a standard. It can be measured on the standard as a whole, which means that it meets all mandatory (and applicable conditional) requirements of the standard or on a feature level (i.e., it conforms to feature X as defined in section X.X.X), which means that it meets all mandatory (and applicable conditional) requirements of the feature.
Connected vehicle sensor and status information	Includes vehicle, bicycle and pedestrian data objects.
ConOps	See Concept of Operations.
Consistent	The ability of two or more systems or components to exchange information and use the supported information that has been exchanged and gracefully reject any unsupported information according to defined rules.
Control	The process of setting or re-setting parameters within the ELMS device, during operation.
Data	Elements of information exchanged between a management station and an ELMS device used to configure, control, or monitor the operation of the ELMS device.
Data logger	A unit that collects and stores information on the state and operation of ELMS devices.



Term	Description
Day plan	A standard device schedule element that contains a set of at least 1 or more actions to be performed for a device on a given day.
Determine	To read information from a device.
Device Under Test (DUT)	NTCIP device that is the object of testing.
Dialogs	A sequence of information or message exchanges.
Dim levels	The setting for the intensity of the light generated by the luminaire.
Download	To transfer information from the central computer into the referenced field device.
Dut	See Device Under Test.
Electrical and Lighting Management Systems (ELMS)	Any system capable of monitoring and controlling electrical and lighting systems using the National Transportation Communications for ITS Protocol (NTCIP).
Electrical service	The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.
ELMS	Electrical and Lighting Management Systems.
ELMS device	A device, module, or piece of equipment that contains an SNMP Agent, and is the interface between a component of an illumination system and the NTCIP communication system. The device may be integral to a component of the illumination system.
ELMS management station	One or more host computing platforms that controls the field devices.
Feature	A behavior of an ELMS device.
Informative	Information that identifies a document, introduces its content, and explains its background, its development and its relationship with other documents; or information that provides additional information intended to assist the understanding or use of the document (see normative).
Interchangeability	A condition which exists when two or more items possess such functional and physical characteristics as to be equivalent in performance and durability, and are capable of being exchanged one for the other without alteration of the items themselves, or adjoining items, except for adjustment, and without selection for fit and performance.
Interchangeable	A condition that exists when two or more items possess such functional and physical characteristics as to be equivalent in performance and durability, and are capable of being exchanged one for the other without alteration of the items themselves, or adjoining items, except for adjustment, and without selection for fit and performance.
Interface	A named set of operations that characterize the behavior of an element.
Interoperability	The ability of two or more systems or components to exchange information and use the information that has been exchanged. NOTE-See NTCIP 8004 v02.
Live data	A specific operational network configuration between a management station and the ELMS device where the information exchange can be performed without the need for initiating and terminating a physical network connection between a management station and ELMS device.



Term	Description
Location referencing message specification (LRMS)	Location referencing as specified in SAE J2735 SE standard.
Logged data	A specific operational network configuration between a management station and the ELMS device, where a management station is required to execute a procedure for establishing a physical connection between a management station and the ELMS device prior to being able to exchange data with the ELMS device.
Lumen	The unit of luminous flux emitted in a solid angle of one steradian by a uniform point source that has an intensity of one candela.
Luminaire	The light fixture and possibly associated sensors.
Luminance	The intensity of light per unit area at its source. Usually measured in candela per square foot or candela per square meter.
Lux	A measurement of light. A unit of luminance produced on a surface area of one square meter by a luminous flux of one lumen uniformly distributed over the surface (1 lux = 1 lumen per square meter).
Management Information Base (MIB)	A structured collection or database of related managed objects defined using Abstract Syntax Notation One (ASN.1).
Management Station	The computer system with which the device communicates. Typically, the management station commands and monitors the device.
MIB/Management Information Base	A management information base (MIB) is a virtual database used for managing the entities in a communications network. Most often associated with the Simple Network Management Protocol (SNMP), the term is also used more generically in contexts such as in OSI/ISO Network management model. While intended to refer to the complete collection of management information available on an entity, it is often used to refer to a particular subset, more correctly referred to as MIB-module.
Near Real-Time Data	Data that depict an event as it existed at the current time less the processing time. The data vary from real-time data because they depend on the type and speed of transmission.
Normative	Information that describes the scope of the document and that sets out provisions (ISO). Normative elements are considered to be a prescriptive part of the standard (see informative).
NTCIP	National Transportation Communications for Intelligent Transportation Systems (ITS) Protocol.
Object	A data structure used to monitor or control one feature, attribute, or controllable aspect of a manageable device.
Operator	An individual who needs to interact with the device by either controlling or monitoring its operations.
Photo sensor	A light-measuring device used to quantify the ambient light conditions at the luminaire. Also referred to as photo cell or photoelectric cell.
Photocell	See photo-sensor.
Point-to-multipoint	A communications architecture that supports communications between a central system and many devices. Also called multi-drop communication.



Term	Description
Point-to-point	A communications architecture that supports dedicated communications exclusively between two devices.
Pole	Pole supporting a luminaire, electrical service, or branch circuit.
PRL	See Protocol Requirements List.
Protocol	A specific set of rules, procedures, and conventions defining the format and timing of data transmissions between devices that are required to be accepted and used to understand each other.
Protocol Requirements List (PRL)	The table that graphically represents the relationship between the user needs and functional requirements., This table allows procurement personnel to specify the desired features of an ELMS or can be used by a manufacturer to document the features supported by their implementation.
Requirement	A condition or capability needed by a user to solve a problem or achieve an objective. A condition or capability to which a system must conform, either derived directly from the user needs, or stated in a contract, standard, specification, or other formally imposed document. A desired feature, property, or behavior of a system.
Requirements to Test Cases Traceability Matrix (RTCTM)	A table that defines the traceability from a requirement to the associated test case.
Requirements traceability	The ability to follow or study the logical progression among the needs, requirements, and design details in a step-by-step fashion.
Requirements Traceability Matrix (RTM)	The table that graphically represents the logical progression among the needs, requirements, and design details.
Return	Data sent to the requester (in the context of device requirements for providing data requested by an external system).
Risk	A subjective estimate of the probability of an error occurring and the amount of damage that may occur as a result of the error.
RTCTM	See Requirements to Test Cases Traceability Matrix.
RTM	See Requirements Traceability Matrix.
Schedule	A mechanism by which an operator can define times in the future at which the luminaire performs actions.
SEP	Systems Engineering Process.
Simple Network Management Protocol (SNMP)	A communications protocol developed by the Internet Engineering Task Force, used for configuration and monitoring of network devices. Simple Network Management Protocol (SNMP) is an "Internet-standard protocol for managing devices on IP networks." Devices that typically support SNMP include routers, switches, servers, workstations, printers, modem racks, and more." It is used mostly in network management systems to monitor network-attached devices for conditions that warrant administrative attention. SNMP is a component of the Internet Protocol Suite as defined by the Internet Engineering Task Force (IETF). It consists of a set of standards for network management, including an application layer protocol, a database schema, and a set of data objects.



Term	Description
Simple Transportation Management Framework (STMF)	Describes the organization of the information within devices and the methods of retrieving or modifying any information within the device. STMF also explains how to generate and use computer readable information organization descriptions.
Smart Grid device	A terminal device which provides electrical load information to the utility.
SNMP	See Simple Network Management Protocol.
SNMP agent	This is a logical entity that is hosted on an ELMS device (e.g., a data logger) that manages the communications between a management station and other ELMS devices in the system.
Specification	A document that specifies in a complete, precise, and verifiable manner, the requirements, design, behavior, or other characteristics of a system or component, and often, the procedures for determining whether these provisions have been satisfied.
Stagger interval	The amount of time, in seconds, between switching individual luminaires, electrical services, or branches assigned to a given branch circuit.
Sub-feature	A specialization of a more generic feature.
Systems Engineering	An interdisciplinary approach and means to enable the realization of successful systems. An interdisciplinary collaborative approach to derive, evolve, and verify a lifecycle balanced system solution, which satisfies customer expectations and meets public acceptability.
TCS	See Test Case Specification (TCS).
TDS	See Test Design Specification.
Test approach	A particular method that will be employed to pick the particular test case values. This may vary in specificity from very general (e.g., black box or white box) to very specific (e.g., minimum and maximum boundary values).
Test Case	A set of test inputs, execution conditions, and expected results developed for a particular objective, such as to exercise a particular program path or to verify compliance with a specific requirement.
Test Case Specification (TCS)	A document that specifies the actual inputs, predicted results, and set of execution conditions for a test. It also identifies constraints on the test procedures resulting from use of that specific test case. NOTE—See IEEE 829 for a more detailed discussion of test cases.
Test Design Specification (TDS)	Per IEEE 829, “A document specifying the details of the test approach for a ... feature or combination of ... features and identifying the associated tests.” For testing NTCIP conformance, this document includes the completed PRL and Requirements to Test Cases Traceability Matrix.
Test effort	The activity of performing one or more testing tasks.
Test Plan	A document that prescribes the scope, approach, resources, and schedule of the testing activities. It identifies the items to be tested, the features to be tested, the testing tasks to be performed, the personnel responsible for each task, and the risks associated with the plan.
Test Procedure Specification (TPS)	A document that specifies a sequence of actions for the execution of a test. The test procedures test the implementation of the requirement. Test procedures are separated from test design as they are intended to be followed step by step and should not have extraneous detail.
TPS	See Test Procedure Specification.



Term	Description
Traffic Management Center (TMC)	The location of the central computer and equipment that allows operations staff to monitor and manage roadside lighting through field devices.
User	A person who uses the system that is developed.
User Needs	The business or operational problem (opportunity) that is to be fulfilled to justify procurement or use. NOTE—While this is termed a “user need” within the NTCIP community, it reflects needs of all stakeholders.
Validate	To ensure that an item of interest is as intended. For example, to ensure that the data associated with a set operation has been stored in a device without any errors.
Zone	A logical grouping of luminaires and/or circuits; used for control and reporting purposes.

7. General References

7.1. Testing

Test Developer Software, free download available from:
<http://www.trevilon.com/download/TestDeveloper.zip>.

7.2. Systems Engineering

Systems Engineering Guidebook for Intelligent Transportation Systems Version 3.0, United States Department of Transportation, November 2009.

Building Quality Intelligent Transportation Systems through Systems Engineering prepared for Intelligent Transportation Systems, Joint Program Office U.S. Department of Transportation by Mitretek Systems, Inc., FHWA-OP-02-046, April, 2002. Available online at:
http://ntl.bts.gov/lib/jpodocs/repts_te/13620.html



8. Study Questions

1. Which is not a component of an ELMS test plan?
 - a) Test Facilitation
 - b) Test Design Specification
 - c) Test Case Specification
 - d) Test Procedure Specification

2. Which of the following statements is **not** true?
 - a) Every requirement should be tested
 - b) You should only need to perform your test plan once
 - c) Some testing may be performed by manufacturer
 - d) ELMS Traceability tables can help you to assess the impact of a test failure

3. Where can you find definitions for terms that can be used in NTCIP test steps?
 - a) IEEE 829
 - b) NTCIP 8007
 - c) ISO 9001
 - d) Student Supplement

4. Which of the following is false?
 - a) TPG v2.1 supports development and deployment NTCIP Center-to-Field (C2F) Device Interface Standards with Systems Engineering Content
 - b) TPG is a testing tool
 - c) TPG is a Windows based software tool that uses Microsoft Word to input the NTCIP Standards and output Test Procedures
 - d) TPG supports ITS Standard developers as well as end users and integrators (local and state agencies) of NTCIP C2F Standards



9. Icon Guide

The following icons are used throughout the module to visually indicate the corresponding learning concepts listed out below, and/or to highlight a specific point in the training material.

- 1) **Background information:** General knowledge that is available elsewhere and is outside the module being presented. This will be used primarily in the beginning of slide set when reviewing information readers are expected to already know.



- 2) **Tools/Applications:** An industry-specific item a person would use to accomplish a specific task, and applying that tool to fit your need.



- 3) **Remember:** Used when referencing something already discussed in the module that is necessary to recount.



- 4) **Refer to Student Supplement:** Items or information that are further explained/detailed in the Student Supplement.



- 5) **Example:** Can be real-world (case study), hypothetical, a sample of a table, etc.



- 6) **Checklist:** Use to indicate a process that is being laid out sequentially.

