A306b: Specifying Requirements for Electrical and Lighting Management Systems (ELMS) Based on NTCIP 1213 Standard v03

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1. Module Description

This is the final module of the acquisition curriculum path to procure Electrical and Lighting Management Systems, with I101, A101, A102, A201, C101, and A306a being the prerequisites. The logical next step for the participant after taking this module is to consider modules in the testing life cycle, which are T101, T201, and T202, which lead up to the potential T306 – Applying Your Test Plan to the NTCIP 1213 v03 ELMS Standard.

This **updated** module is to incorporate necessary changes resulting from new user needs and capabilities, such as connected vehicles, SMART Grid, and others included in the updated NTCIP 1213 Standard v03 (from v02), and assist technical staff in specifying clear requirements from the list of requirements that exists in the NTCIP 1213 v03 Standard and meet identified user needs. This module will continue to provide participants with information on how to identify the appropriate use of the NTCIP 1213 Standard and acquire an ELMS system based on what the user is seeking to accomplish as identified by tracing the user needs to the requirements with support from tools and resources, such as a Requirements Traceability Matrix (RTM) and Protocol Requirements List (PRL), in following a systems engineering process.

2. Introduction/Purpose

This module provides participants with information on how to identify their user needs for an ELMS. An ELMS is used to control, monitor, and manage field-deployed electrical and lighting infrastructure.

ELMS user need and requirement identification is based on what the user is seeking to accomplish; this task has been simplified with the introduction of a standardized Concept of Operations as documented in NTCIP 1213 v03, which follows the Systems Engineering Process (SEP). This document provides the user with a Protocol Requirements List (PRL), which provides an easy checklist of all user needs and requirements and can be included in procurement specifications.

3. ELMS PRL

Protocol Requirements List (PRL) Table						
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.

Protocol Requirements List (PRL) Table						
User Need ID	**User Need**	**FR ID**	**Functional Requirement**	**Conformance**	**Support**	**Additional Specifications**
		3.5.2.2.2	Configure Number of Event Classes	M	Yes / No	The ELMS device shall support at least _____ (1..255) classes.
		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 Predefined Event Configurations	M	Yes	
		3.5.2.10.1	Supported Event Classes	M	Yes	

Protocol Requirements List (PRL) Table						
User Need ID	**User Need**	**FR ID**	**Functional Requirement**	**Conformance**	**Support**	**Additional Specifications**
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	
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	

Protocol Requirements List (PRL) Table						
User Need ID	**User Need**	**FR ID**	**Functional Requirement**	**Conformance**	**Support**	**Additional Specifications**
		3.5.2.10.9	Energy Meter Switch State Log	O	Yes / No	
2.5.1.2.9	Provide Periodic Energy Meter Measurement Logging			O	Yes / No	
		3.5.2.10.10	Periodic Energy Meter Measurement Log	O	Yes / No	
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 Exception 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	

Protocol Requirements List (PRL) Table						
User Need ID	**User Need**	**FR ID**	**Functional Requirement**	**Conformance**	**Support**	**Additional Specifications**
		3.5.3.3	Provide Automatic Reporting of Events (SNMP Traps)	M	Yes	
		3.5.3.4	Manage Exception Reporting	M	Yes	
		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	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	

Protocol Requirements List (PRL) Table						
User Need ID	**User Need**	**FR ID**	**Functional Requirement**	**Conformance**	**Support**	**Additional Specifications**
		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	
		3.5.4.1.1.8	Retrieve Luminaire Voltage	O	Yes / No	
		3.5.4.1.1.9	Retrieve Luminaire Ballast / Driver Description	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	

Protocol Requirements List (PRL) Table						
User Need ID	**User Need**	**FR ID**	**Functional Requirement**	**Conformance**	**Support**	**Additional Specifications**
		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	
2.5.2.1.1.4	Manage Luminaire Color Temperature			O		
		3.5.4.1.4	Manage 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	

Protocol Requirements List (PRL) Table						
User Need ID	**User Need**	**FR ID**	**Functional Requirement**	**Conformance**	**Support**	**Additional Specifications**
		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	
		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	

Protocol Requirements List (PRL) Table						
User Need ID	**User Need**	**FR ID**	**Functional Requirement**	**Conformance**	**Support**	**Additional Specifications**
		3.5.4.5.7	Support a Number of Actions	M	Yes	The ELMS Device shall support at least _____ (1..255) Actions.
		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 a 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	

Protocol Requirements List (PRL) Table						
User Need ID	**User Need**	**FR ID**	**Functional Requirement**	**Conformance**	**Support**	**Additional Specifications**
		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.
		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	

Protocol Requirements List (PRL) Table						
User Need ID	**User Need**	**FR ID**	**Functional Requirement**	**Conformance**	**Support**	**Additional Specifications**
		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.
		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	

Protocol Requirements List (PRL) Table						
User Need ID	**User Need**	**FR ID**	**Functional Requirement**	**Conformance**	**Support**	**Additional Specifications**
		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	
		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	
		3.5.4.11.1.4	Retrieve Branch Circuit Electrical Parameters	O	Yes / No	
2.5.2.1.10.2	Configure Branch Circuit			O	Yes / No	

Protocol Requirements List (PRL) Table						
User Need ID	**User Need**	**FR ID**	**Functional Requirement**	**Conformance**	**Support**	**Additional Specifications**
		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	
		3.5.4.12.2	Configure Longitude of Installation	O	Yes / No	
		3.5.4.12.3	Configure Date	O	Yes / No	
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 Photocells			O	Yes / No	
2.5.2.1.12.1	Configure Photocells			O	Yes / No	
		3.5.4.14.1	Configure Photocell for Analog, Digital, or Reverse Operations	O	Yes / No	

Protocol Requirements List (PRL) Table						
User Need ID	**User Need**	**FR ID**	**Functional Requirement**	**Conformance**	**Support**	**Additional Specifications**
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	
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	

Protocol Requirements List (PRL) Table						
User Need ID	**User Need**	**FR ID**	**Functional Requirement**	**Conformance**	**Support**	**Additional Specifications**
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	
		3.5.4.17.4	Retrieve Electric Vehicle Charger Ground Fault Current Status	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	

Protocol Requirements List (PRL) Table						
User Need ID	**User Need**	**FR ID**	**Functional Requirement**	**Conformance**	**Support**	**Additional Specifications**
		3.5.4.17.10	Retrieve Electric Vehicle Charger Total Energy Consumed	O	Yes / No	
		3.5.4.17.11	Retrieve Electric Vehicle Charger Energy Delivered for Current Charging Session	O	Yes / No	
		3.5.4.17.12	Retrieve Electric Vehicle Charger Energy Delivered for Previous Charging Session	O	Yes / No	
		3.5.4.17.13	Retrieve Electric Vehicle Charger Energy Loss	O	Yes / No	
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	

Protocol Requirements List (PRL) Table						
User Need ID	**User Need**	**FR ID**	**Functional Requirement**	**Conformance**	**Support**	**Additional Specifications**
		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 Setpoint	O	Yes / No	
2.5.2.1.18	Retrieve Ground Fault Setpoint			O	Yes / No	
		3.5.4.20	Retrieve Ground Fault 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	

Protocol Requirements List (PRL) Table						
User Need ID	**User Need**	**FR ID**	**Functional Requirement**	**Conformance**	**Support**	**Additional Specifications**
		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 Location 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		
		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		

Protocol Requirements List (PRL) Table						
User Need ID	**User Need**	**FR ID**	**Functional Requirement**	**Conformance**	**Support**	**Additional Specifications**
		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	
		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 Photocell	O	Yes / No	
		3.5.5.1.6	Control Luminaire by Adaptive Means	O	Yes / No	

Protocol Requirements List (PRL) Table						
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	
2.5.2.2.3	Control Branch Circuit			O	Yes / No	
		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	

Protocol Requirements List (PRL) Table						
User Need ID	**User Need**	**FR ID**	**Functional Requirement**	**Conformance**	**Support**	**Additional Specifications**
		3.5.5.3.4	Control Branch Circuit in Stagger Mode	O	Yes / No	
		3.5.5.3.5	Control Branch Circuit by Photocell	O	Yes / No	
		3.5.5.3.6	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	
2.5.2.3	Control Devices by Zone			O	Yes / No	
		3.5.5.5.1	Control Devices in Zone by Permanent/Continuous Override	O	Yes	
		3.5.5.5.2	Control Devices in Zone by Transitory Override	O	Yes / No	

Protocol Requirements List (PRL) Table						
User Need ID	**User Need**	**FR ID**	**Functional Requirement**	**Conformance**	**Support**	**Additional Specifications**
		3.5.5.5.3	Control Devices in Zone by Timed Override	O	Yes / No	
		3.5.5.5.4	Control Devices in Zone by Photocell	O	Yes / No	
		3.5.5.5.5	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	
		3.5.6.1.8	Retrieve Luminaire Ballast/Driver Status	O	Yes / No	

Protocol Requirements List (PRL) Table						
User Need ID	**User Need**	**FR ID**	**Functional Requirement**	**Conformance**	**Support**	**Additional Specifications**
		3.5.6.1.9	Retrieve Luminaire Starter Status	O	Yes / No	
2.5.2.4.2	Monitor Electrical Service			O	Yes / No	
		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 Energy 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	

Protocol Requirements List (PRL) Table						
User Need ID	**User Need**	**FR ID**	**Functional Requirement**	**Conformance**	**Support**	**Additional Specifications**
		3.5.6.3.4	Retrieve Branch Circuit Operational Status	M	Yes	
		3.5.6.3.5	Retrieve Branch Circuit Hours	O	Yes / No	
		3.5.6.3.6	Retrieve Branch Circuit Ground Fault Status	O	Yes / No	

Sample Specification Text

The following text should be considered when inserting NTCIP wording into a procurement specification.

S.1. PRL

The ELM shall conform to NTCIP 1213 and to the items selected in the following Protocol Requirements List (PRL).

<< Insert completed PRL here >>

S.2. Object Ranges

The ELMS shall support all values for all supported NTCIP objects, except as indicated within the PRL and this supplemental.

S.3. Specify Location Information Using Textual Description of a Road/Street/Block Name/Number

The ELMS device shall support a location name of at least _____ (8..255) characters.

S.4. Configure Stagger Interval

a. Configure Luminaire Stagger Interval

The ELMS device shall support a stagger interval with a maximum value of _____ (0..255) seconds.

b. Configure Branch Circuit Stagger Interval

The ELMS device shall support a stagger interval with a maximum value of _____ (0..255) seconds.

S.5. Supplemental Requirements for Scheduled

a. Support a Number of Actions

The ELMS Device shall support at least _____ (1..255) actions.

b. Support a Number of Day Plans

The ELMS Device shall support at least _____ (1..255) day plans.

S.6. Supplemental Requirements for Zones

a. Define Number of Zones Supported by an ELMS

The ELMS Device shall support at least _____ (0..65535) zones.

b. Define Number of ELMS Devices for a Zone

At least _____ (0..65535) ELMS devices shall be able to be assigned to a single zone.

S.7. Supplemental Requirements for Event Logs

a. Configure Number of Events in Event Log

The ELMS device shall support at least _____ (1..255) events.

b. Configure Number of Event Classes

The ELMS device shall support at least _____ (1..255) classes.

c. Configure Number of Event Types

The ELMS device shall support at least _____ (1..255) event types.

S.8. Supplemental Requirements for Live Data

Live Data Response Time – The device shall initiate the transmission of the appropriate response (assuming that the device has permission to transmit) within _____ millisecond(s) of receiving the last byte of the request, plus 1 millisecond for each byte in the response variable-bindings field Communications Profile.

NTCIP communications shall operate over the following communications stack:

See Modules for details

C101: Introduction to the Communications Protocols and Their Uses in ITS Applications

4. Reference to Other Standards

Electrical and Lighting Management Systems

- **NTCIP 1213 v02 National Transportation Communications for ITS Protocol Object Definitions for Electrical and Lighting Management Systems (ELMS)**
- **NTCIP 9001 v04, National Transportation Communications for ITS Protocol, The NTCIP Guide**, AASHTO/ITE/NEMA, July 2009.

Systems Engineering

- **IEEE Standard 1362-1998, IEEE Guide for Information Technology – System Definition – Concept of Operations (ConOps) Document**, IEEE, 1998.

5. Glossary

Term	Definition
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.
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.
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.
Dialogs	A sequence of information or message exchanges.
ELMS	Electrical and Lighting Management Systems
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 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.

Interoperability	The ability of two or more systems or components to exchange information and use the information that has been exchanged.
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. Objects in the MIB are defined using a subset of Abstract Syntax Notation One (ASN.1) called "Structure of Management Information Version 2 (SMIv2)"RFC 2578.The software that performs the parsing is an MIB compiler. The database is hierarchical (tree-structured) and entries are addressed through object identifiers. Internet documentation for RFCs discusses MIBs, notably RFC 1155, "Structure and Identification of Management Information for TCP/IP-based internets," and its two companions, RFC 1213, "Management Information Base for Network Management of TCP/IP-based Internets."
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).
Protocol Requirements List (PRL)	A table mapping user needs with its associated 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.
Requirements Traceability Matrix (RTM)	A table that links the requirements to the corresponding dialogs and objects.
SNMP/Simple Network Management Protocol	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. SNMP 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. SNMP exposes management data in the form of variables on the managed systems, which describe the system configuration.

	These variables can then be queried (and sometimes set) by managing applications.
SSM	
Specification	A document that specifies in a complete, precise, and verifiablemanner the requirements, design, behavior, or other characteristics of a system or component, and, often, the procedures for determining whether these provisions have been satisfied.
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, that satisfies customer expectations and meets public acceptability.
TMS	Transportation /Traffic Management System
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.

6. References

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  http://www.ntcip.org

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- *Using ITS Standards: An Overview,* ITE PCB Module I101, 2011.
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7. Study Questions

1. What tool is used to show the relationship of objects and dialogs within the standard?

    a) Information Profile

    b) Protocol Requirements List (PRL)

    c) Requirements Traceability Matrix (RTM)

    d) Dialogs

2. Which of the following is not a major group of requirements in NTCIP 1213?

    a) Configure ELMS Device

    b) Control Device

    c) Monitor Device Status

    d) Backwards Compatibility Requirements

3. Where should the PRL be included in the specification?

    a) Hardware Specification

    b) In a Standalone Section

    c) Software Specification

    d) Interface Specification

4. What does the following table mean?

Requirement ID	Requirement	Dialog ID	Dialog	Object ID	Object
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

a) All of the objects must be supported

b) At least one of the objects must be supported

c) All of the objects must be supported if the requirement is supported

d) At least one of the objects must be supported if the requirement is supported

5. Which of the following is the best reason to extend a standard?

a) There is an unmet need that justifies the added cost

b) The existing system uses a nonstandard method

c) You want to use your specification to favor a specific vendor

d) When the standardized solution is overly complex for your simple needs

8. Icon Guide

The following icons are used throughout the module to visually indicate the corresponding learning concept listed 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:** Used to indicate a process that is being laid out sequentially.