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National Transportation Communications for ITS Protocol Environmental Sensor Station (ESS) Interface Protocol

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ACKNOWLEDGEMENTS

NTCIP 1204 v04 was prepared by the NTCIP Environmental Sensor Station Working Group (ESS WG), which is a subdivision of the Joint Committee on the NTCIP. The Joint Committee is organized under a Memorandum of Understanding among the American Association of State Highway and Transportation Officials (AASHTO), the Institute of Transportation Engineers (ITE), and the National Electrical Manufacturers Association (NEMA). The Joint Committee on the NTCIP consists of six representatives from each of the standards organizations, and provides guidance for NTCIP development.

When NTCIP 1204 v04 was prepared, the following individuals were voting members of the NTCIP ESS WG:

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FOREWORD

NTCIP 1204 v04, an NTCIP standards publication, identifies and defines how a management station may wish to interface with a field device to control and monitor pavement sensors, weather stations, air quality sensors, and other equipment related to the monitoring of and response to environmental conditions in an NTCIP-conformant fashion. NTCIP 1204 v04 uses only metric units.

NTCIP 1204 v04 is titled *Environmental Sensor Station (ESS) Interface Protocol* to express the multiple sections and annexes that are included in this standards publication. This NTCIP 1200-series standards publication has grown beyond the “object definitions” that were reflected in the title for the NTCIP 1204 versions v01, v02 and v03.

NTCIP 1204 v04 provides definitions of data elements for environmental sensor data, including weather data, pavement condition data, water level data, and air quality data. The data is defined using the Simple Network Management Protocol (SNMP) object-type format as defined in RFC 1212 and NTCIP format defined in NTCIP 8004 v02. This data is typically exchanged between a management station and a field device using one of the NTCIP 1103 v03-recognized Application Layers (e.g., SNMP). The data may also be exchanged among management stations using other protocols.

NTCIP 1204 v04 defines requirements that are applicable to all NTCIP environments and it also contains optional and conditional sections that are applicable to specific environments for which they are intended.

The following keywords apply to NTCIP 1204 v04: AASHTO, ITE, NEMA, NTCIP, ESS, data, data dictionary, object, environmental sensor.

NTCIP 1204 v04 contains four normative and four informative annexes:

- a) Annex A is normative and contains a Requirements Traceability Matrix (RTM) that traces requirements to dialogs and data concepts (messages, data frames, and data elements) used to fulfill one or more requirements.
- b) Annex B is informative and provides a graphical representation of the major nodes of the ISO tree as defined by NTCIP 1204 v04.
- c) Annex C is normative and defines the test procedures for NTCIP 1204 v04.
- d) Annex D is informative and identifies the significant revisions in NTCIP 1204 v04 that have been made since previous versions of NTCIP 1204 v04.
- e) Annex E is informative and responds to user requests by providing an explanation as to how certain complex features can be supported by NTCIP 1204 v04 and why certain other features are not supported by NTCIP 1204 v04.
- f) Annex F is informative and provides sample encodings of block objects.
- g) Annex G is normative and contains the definitions for the Generic SNMP interface including the definitions to perform GET, SET, GET NEXT commands. These definitions may be moved to a different NTCIP standard at a future date, because this content is applicable to all device-specific NTCIP standards.
- h) Annex H is normative and serves as a placeholder for systems engineering descriptions that may be moved to a different NTCIP standard at a future date, because this content is applicable to all device-specific NTCIP standards.

NTCIP 1204 v04 is also an NTCIP Data Dictionary standard. Data Dictionary standards provide definitions of data concepts (messages, data frames, and data elements) for use within NTCIP systems; they are approved by AASHTO, ITE, and NEMA through a ballot process, after a recommendation by the NTCIP Joint Committee. For more information about NTCIP standards, visit www.ntcip.org.

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Approvals

NTCIP 1204 v04 was separately balloted and approved by AASHTO, ITE, and NEMA after recommendation by the Joint Committee on the NTCIP. Each organization has approved NTCIP 1204 v04 as the following standard type, as of the date:

AASHTO—Standard Specification;
ITE—Software Standard;
NEMA—Standard;

History

In 1992, the NEMA 3-TS Transportation Management Systems and Associated Control Devices Section began development of the NTCIP. The Transportation Section’s purpose was in response to user needs to include standardized systems communication in the NEMA TS 2 standard, *Traffic Controller Assemblies*. Under the guidance of the Federal Highway Administration’s NTCIP Steering Group, the NEMA effort was expanded to include the development of communications standards for all transportation field devices that could be used in an Intelligent Transportation Systems (ITS) network.

In September 1996, an agreement was executed among AASHTO, ITE, and NEMA to jointly develop, approve, and maintain the NTCIP standards. Under the guidance of a Joint AASHTO/ITE/NEMA Committee on the NTCIP, a Working Group was created to develop the object definitions for Environmental Sensor Stations. The first meeting of this working group was in November 1996, and the 1204 version 01 was produced in 1998. In 2001, efforts began to update and enhance the standard, which resulted in version 02, produced in 2005. In 2006, efforts began to update and enhance the standard with test procedures, which resulted in NTCIP 1204 v03, produced in 2009.

NTCIP 1204 version 01 (v01) was published as NTCIP 1204:1998 and was also formerly known as NEMA TS 3.7. NTCIP 1204 v02 was developed to reflect lessons learned, to update to new documentation formats, and to add new features such as the control of automated de-icing equipment. NTCIP 1204 v03 was developed to add test procedures (Annex C) and to correct issues that had been identified with NTCIP 1204 v02. NTCIP 1204 v04 was developed to reflect lessons learned since publication of NTCIP 1204 v03 and to support newly identified user needs.

Compatibility of Versions

To distinguish NTCIP 1204 v04 (as published) from previous drafts, NTCIP 1204 v04 also includes NTCIP 1204 v04.XX on each page header. All NTCIP Standards Publications have a major and minor version number for configuration management. The version number syntax is "v00.00a," with the major version number before the period, and the minor version number and edition letter (if any) after the period.

NTCIP 1204 v04 is designated, and should be cited as, NTCIP 1204 v04. Anyone using NTCIP 1204 v04 should seek information about the version number that is of interest to them in any given circumstance. The MIB, the PRL, and the PICS should all reference the version number of the standards publication that was the source of the excerpted material.

Compliant systems based on later, or higher, version numbers MAY NOT be compatible with compliant systems based on earlier, or lower, version numbers. Anyone using NTCIP 1204 v04 should also consult NTCIP 8004 v02 for specific guidelines on compatibility.

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Section 1 General [Informative]

1.1 Scope

Environmental sensor stations (ESS) include a wide array of sensors, including those that monitor weather, roadway surface, water level, and air quality conditions. These sensors are typically connected to a nearby microprocessor termed a remote processor unit (RPU). An environmental sensor station (ESS) consists of the RPU plus its suite of sensors.

Typically, this equipment is fixed or permanently located at a site along a travel corridor. In some cases, the "stations" may be portable, or even mobile. For NTCIP 1204 v04 purposes, all three types of stations are called ESS. In the transportation community, these devices are frequently used to improve roadway maintenance and traffic operations.

Environmental sensors are also frequently co-located with pavement treatment systems (PTS) and, in fact, may use the same controller. Thus, for NTCIP 1204 v04 purposes, the term ESS may also include a PTS.

Note: The PTS portion of NTCIP 1204 v04 may be placed in a separate standard in the future.

Unfortunately, there have not been standards defining how these devices communicate with management systems. As a result, each manufacturer has developed its own protocol to meet its own particular needs. This approach has resulted in systems that are not interchangeable or interoperable. If an agency wishes to use either a central management system or additional ESS from a different vendor, the agency encounters significant systems integration challenges, requiring additional resources to address. These additional resource requirements inhibit information sharing within and between various potential users of the data and prevent vendor independence. Without manufacturer independence, resource requirements further increase because of a lack of a competitive market.

These problems have not been limited to weather and environmental monitoring. Many other devices also need to exchange information. In surface transportation, examples include traffic signal controllers, dynamic message signs, bus priority sensors, etc. To address these problems, NTCIP is developing a family of open standards for communications between field devices and central management systems.

NTCIP 1204 v04 is part of that larger family and is designed to define an interoperable and interchangeable interface between a transportation management system and an ESS, while still allowing for extensions beyond NTCIP 1204 v04 to allow for new functions as needed. This approach is expected to support the deployment of ESS from one or more vendors in a consistent and resource-efficient way.

NTCIP 1204 v04 only addresses a subset of the requirements needed for procurement. It does not address requirements related to the performance of the sensors (e.g., accuracy, the supported detection range, the time it takes to detect conditions, etc.), hardware components, mounting details, etc.

NTCIP 1204 v04 standardizes the communications interface by identifying the various operational needs of the users (Section 2) and subsequently identifying the necessary requirements (Section 3) that support each need. NTCIP 1204 v04 then defines the NTCIP standardized communications interface used to fulfill these requirements by identifying the dialogs (Section 4) and related data concepts (Section 5) that support each requirement.

Traceability among the various sections is defined by the Protocol Requirements List (Section 3.3.3) and the Requirements Traceability Matrix (Annex A). Conformance requirements for NTCIP 1204 v04 are provided in Section 3.3.2.1.

An implementation of NTCIP 1204 v04 requires lower level services to structure, encode, and exchange the data concepts defined by NTCIP 1204 v04. NTCIP 1204 v04 assumes that the data concepts are exchanged by one of the protocols defined in NTCIP 2301 v02.

1.2 References

1.2.1 Normative References

Normative references contain provisions that, through reference in this text, constitute provisions of NTCIP 1204 v04. By reference herein, these standards are adopted, in whole or in part as indicated, in this publication. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on NTCIP 1204 v04 are encouraged to investigate the possibility of applying the most recent editions of the standards listed.

Identifier	Title
Glossary of Meteorology	<i>Glossary of Meteorology, Second Edition; American Meteorological Society, 2000</i>
NTCIP 1103 v03	<i>Transportation Management Protocols (TMP), AASHTO / ITE / NEMA published November 2016</i>
NTCIP 1201 v02	<i>Global Object (GO) Definitions, AASHTO / ITE / NEMA published 2005</i>
NTCIP 1201 v03	<i>Global Object (GO) Definitions, AASHTO / ITE / NEMA published March 2011</i>
NTCIP 2301 v02:2001	<i>Simple Transportation Management Framework (STMF) Application Profile (AP) (AP-STMF), AASHTO / ITE / NEMA published July 2010</i>
NTCIP 8004 v02	<i>Structure and Identification of Management Information (SMI) published June 2010, AASHTO / ITE / NEMA</i>
RFC 1213	<i>Management Information Base for Network Management of TCP/IP-based internets: MIB-II</i>
RFC 1157	<i>Simple Network Management Protocol (SNMP), J.D. Case, M. Fedor, M.L. Schoffstall, J. Davin, 2002 (Historic)</i>
WMO No. 306:1995	<i>Technical Regulations; Manual on Codes, International Codes, Volume 1.2, Annex II, FM 94-X Ext. BUFR—Binary Universal Form for the Representation of Meteorological Data</i>

1.2.2 Other References

The following documents and standards may provide the reader with a more complete understanding of the entire protocol and the relations between all parts of the protocol. However, these documents do not contain direct provisions that are required by NTCIP 1204 v04. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on NTCIP 1204 v04 are encouraged to investigate the possibility of applying the most recent editions of the standard listed.

Identifier	Title
DIN EN 15518-3:2011	<i>Winter maintenance equipment - Road weather information systems - Part 3:Requirements on measured values of stationary equipment, European Standard, 2011</i>