

*A Joint Standard of AASHTO, ITE, and NEMA*

# **NTCIP 2101:2001** v01.19

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## **National Transportation Communications for ITS Protocol Point to Multi-Point Protocol Using RS-232 Subnetwork Profile**

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## FOREWORD

This document uses only metric units.

This document defines a subnetwork profile that is a combination of standards intended to meet specific requirements for data transfers to and from roadside devices in either a networked or direct-connect environment.

This document is an NTCIP Subnetwork Profile Standard. Subnetwork Profile (SP) Standards provide definitions and requirements for the data link and physical layers of a communications stack that follows the OSI Basic Reference Model.

The text includes mandatory requirements in Annex A that are defined as normative.

For more information about NTCIP standards, visit the NTCIP Web Site at <http://www.ntcip.org>. For a hardcopy summary of NTCIP information, contact the NTCIP Coordinator at the address below.

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### History

From 1996 to 1999, this document was referenced as NEMA TS 3.SP-PMPP232. However, to provide an organized numbering scheme for the NTCIP documents, this document is now referenced as NTCIP 2101. The technical specifications of NTCIP 2101 are identical to the former reference, except as noted in the development history below:

TS 3.SP-PMPP232 v98.01.07. August 1998 – Accepted as a User Comment Draft by the Joint Committee on the NTCIP.

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## INTRODUCTION

The context of the NTCIP is one part of the Intelligent Transportation Systems standardization activities covering base standards, profiles, and registration mechanisms.

- Base Standards define procedures and rules for providing the fundamental operations associated with communications and information that is exchanged over fixed-point communications links.
- Profiles define subsets or combinations of base standards used to provide specific functions or services. Profiles prescribe particular subsets or options available in base standards necessary for accomplishing a particular function or service. This provides a basis for the development of uniform, nationally recognized conformance.
- Registration Mechanisms provide a means to specify and uniquely identify detailed parameters within the framework of base standards and/or profiles.

Within the Joint Committee on the NTCIP, the Profiles Working Group is concerned with the methodology of defining profiles, and the definition and documentation of profiles in Standards Publications. This document is intended to provide a complete subnetwork profile (SP) that specifies the communications over an asynchronous, half-duplex or full-duplex dedicated digital circuit. This SP specifies the requirements for an unbalanced connectionless operation. This subnetwork profile can be used with different transport profiles (TP) addressing the network and transport layers with protocols such as UDP or TCP, or it can be used directly with an application profile (AP) such as the Simple Transportation Management Framework. The objective is to facilitate the specification of ITS systems characterized by a high degree of interoperability and interchangeability of its components.

This publication defines a subnetwork profile that is a combination of standards intended to meet specific requirements for data transfers to and from roadside devices in either a networked or direct-connect environment. The purpose of this standard is to provide the information necessary to establish a connection using the Point to Multi-Point Protocol (PMPP) via an RS-232 interface. This combination of protocols and standards has been combined in a profile termed SP-PMPP232 within the NTCIP. The SP-PMPP232 is a subnetwork specification and uses protocols and standards to address the Data Link Layer (Layer 2 of the OSI Reference Model) and Physical Layer (Layer 1 of the OSI Reference Model) to manage connected devices that coexist on a common channel. The SP-PMPP232 supports a variety of upper layer protocols over a common physical implementation. It contains mandatory requirement statements that are applicable to all devices claiming conformance to this standard. It also contains options and conditional requirements, which may be applicable to a specific environment in which a device is used.

In 1992, the NEMA 3-TS Transportation Management Systems and Associated Control Devices Section began the effort to develop the NTCIP. The Transportation Section's purpose was to respond 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. The Joint Committee on the NTCIP created the Profiles Working Group to develop a method for organizing Class Profiles. The first meeting of the working group was in September 1997.

After research into how national and international standards organizations combine protocols and standards to address all seven layers of the OSI Basic Reference Model, the committee adopted the approach defined in the *NTCIP Profile Framework*. Following that approach, a protocol stack was

specified by application, transport, and subnetwork profiles. An application profile addresses the application, presentation, and session layers. A transport profile addresses the transport and network layers. A subnetwork profile addresses the data link and physical layers. The *NTCIP - Point to Multi-Point Protocol Using RS-232 Subnetwork Profile* (SP - PMPP232) is a subnetwork profile for use in center-to-roadside communications.

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NTCIP Profile Requirements List  
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## **Section 1 GENERAL**

### **1.1 SCOPE**

This standard is applicable to transportation related devices that must operate in a typical primary/secondary configuration where one device is the designated primary while one or more other devices are connected to one channel acting as secondaries. As a subnetwork profile, it specifies a set of protocols and standards applicable to the data link and physical layers of the OSI Reference Model. The SP-PMPP232 is intended to provide an interoperability standard for the Physical and Data Link Layer aspects of communications in transportation related devices. The primary purpose of this standard is to provide a simple data exchange tool that uses a connectionless delivery mechanism.

This subnetwork profile lists the requirements for an implementation using an unbalanced mode of operation for the data link layer that have been derived from the High-Level Data Link Control (HDLC) standard. This subnetwork profile defines not only the definition of the physical and the data link layer protocols but also the interface definition between the data link layer and higher layer protocols.

### **1.2 PROFILE-PROTOCOL-LAYER RELATIONSHIPS**

A profile defines a combination of base standards and/or other profiles that collectively perform the intended function. The definition of Subnetwork Profiles and their functions and responsibilities are defined within NTCIP 8003 - Profile Framework. This profile references computer communications and transportation protocol standards for the Data Link and Physical Layers of the OSI Reference Model.

The OSI Reference Model defines seven layers, each performing a particular role in the transmission of data over a medium. This subnetwork profile defines the first two layers.

The first layer, the Physical Layer, deals with how the bits of information are transmitted over a communications channel. It deals with the mechanical and electrical interfaces, and the physical transmission medium.

The second layer, the Data Link Layer, has the task of transforming the information that came in over the wire into data that appears to be free of transmission errors. It should incorporate mechanisms to insure the integrity of the data and provide a method of insuring that, if need be, no data is lost. An unbalanced configuration provides for only one primary station and one or more secondary stations to operate as point-to-point or point-to-multipoint, half duplex or full duplex, and stop/start (asynchronous) transmission. An unbalanced configuration is a scenario where a designated primary station is responsible for controlling the interchange of data with each secondary station and for establishing and maintaining the link.

This subnetwork profile requires a Primary/Secondary relationship between devices and controllers (i.e., this profile does not support contention-based communications). The profile will function on low speed communications links that may either be full or half duplex. This SP does not address higher layer functionality such as routing, segmentation and re-transmission of data packets, nor is it concerned with the application(s) residing in the device.

This Subnetwork Profile does not address the organization and definition of the information related to transportation device's end application. Additionally, it does not require a particular Transport Profile or Application Profile. However, it does indicate a particular mechanism to identify higher layer protocols by means of the Initial Protocol Identifier (IPI). The IPI is directly analogous to the Protocol Identifier employed

in the Point-to-Point protocol. It provides a mechanism to permit “multiplexing” messages generated by multiple protocols using a single physical channel. The IPI is a number assigned internationally for the Internet community by an organization called IANA.

At the data link layer, the Point to Multi-Point Protocol (PMPP) is used to provide error detection, link activation and deactivation control, and notification. It provides for connectionless delivery and is designed for operation in a primary-secondary environment. A secondary will not transmit unless explicitly allowed to by a primary. This protocol is based on three ISO standards (ISO 3309, ISO 4335, and ISO 7809) and is very similar to the Point to Point Protocol (PPP).

This standard calls for the use of an RS-232 interface at the physical layer. The RS-232 (now referred to as EIA/TIA 232) interface can serve as the interconnect method directly or act as an interface to other technologies. The direct interface is applicable, where the transportation device is relatively close to the management station. Alternatively, the EIA/TIA 232 interface can serve as the interface to external modems.

The layers, base standards, and profile taxonomy that make up this profile are shown in Figure 1.

ISO Layers	Base Standards	Profile
DATA LINK LAYER	ISO/IEC 3309 ISO/IEC 4335 ISO/IEC 7809	SP-PMPP-232 Subnetwork Profile
PHYSICAL LAYER	EIA/TIA 232-E	

**Figure 1**  
**SP-PMPP232 - Subnetwork Profile Relationship**

### 1.3 REFERENCES

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For draft revisions of this document, which are under discussion by the relevant NTCIP Working Group, and recommended revisions of the NTCIP Joint Committee, visit the World Wide Web at <http://www.ntcip.org>.

The following standards (normative references) contain provisions, which, through references in this text, constitute provisions to this Standard. Other documents and standards (other references) are referenced in these documents, which might provide a complete understanding of the structure and use of profiles. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below.

### 1.3.1 Normative References

#### **American National Standards Institute (ANSI)**

11 West 42nd Street, 13th Floor  
New York, NY 10036

EIA/TIA 232-E: 1997 *EIA 232-E, Interface Between Data Terminal Equipment and Data Circuit-Termination Equipment Employing Serial Binary Data Interchange.*

ISO/IEC 3309: 1993 *Information technology — Telecommunications and information exchange between systems — High-level data link control (HDLC) procedures — Frame structure.*

ISO/IEC 4335: 1993 *Information technology — Telecommunications and information exchange between systems — High-level data link control (HDLC) procedures — Elements of procedures*

ISO/IEC 7809: 1993 *Information technology — Telecommunications and information exchange between systems — High-level data link control (HDLC) procedures — Classes of procedures*

EIA/TIA-232-E-1991 *Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange*

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RFC 1381 *SNMP MIB Extension for the X.25 Packet Layer; D. Throop, F. Baker*

RFC 1317 *Definitions of Managed Objects for RS-232-like Devices, B. Stewart*

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NTCIP 1201:1996 v01.08 *NATIONAL TRANSPORTATION COMMUNICATIONS FOR ITS PROTOCOL (NTCIP) - Global Object Definitions*

### 1.3.2 Informative References

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IAB STD 2 *(RFC 1700: Assigned Numbers, Internet Assigned Number Authority (IANA))*

IAB STD 3 *(RFC 1122: Requirements For Internet Hosts - Communication Layers, RFC 1123: Requirements For Internet Hosts - Application and Support)*

IAB STD 15 *(RFC 1157: Simple Network Management Protocol)*

IAB STD 16 *(RFC 1155: Structure and Identification of Management Information for TCP/IP-based Internets, RFC 1212: 1991, Concise MIB Definitions)*

- IAB STD 17      *RFC 1213: Management Information Base for Network Management of TCP/IP-based internets: MIB-II, K. McCloghrie*
- IAB STD 51      *RFC 1661: The Point-to-Point Protocol (PPP); W. Simpson*

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- NTCIP 8003:1998    *NATIONAL TRANSPORTATION COMMUNICATIONS FOR ITS PROTOCOL - Profile Framework*
- NTCIP 1101:1996   *NATIONAL TRANSPORTATION COMMUNICATIONS FOR ITS PROTOCOL - Simple Transportation Management Framework*
- NTCIP 2001:1996   *NATIONAL TRANSPORTATION COMMUNICATIONS FOR ITS PROTOCOL - Class B Profile*

US-DOD Internet Related Standardized Profiles, DISA Internet Librarian, [http://www-library.itsi.disa.mil/org/mil\\_std.html](http://www-library.itsi.disa.mil/org/mil_std.html), October 31, 1997

#### **1.4 DEFINITIONS**

For the purpose of this Standard, the following definitions apply. Many of these definitions define the nomenclature frequently used in regard to the EIA-232 interfaces and modems.

**baud rate:** The number of discrete signal events per second occurring on a communications channel. It is often referred to as bits per second (bps), which is technically incorrect but widely accepted.

**bit:** Binary Digit. A single basic computer signal consisting of a value of 0 or 1, off or on.

**byte:** A group of bits acted upon as a group, which may have a readable ASCII value as a letter or number or some other coded meaning to the computer. It is commonly used to refer to 8-bit groups.

**data:** Information before it is interpreted.

**Data Link Layer:** That portion of an OSI Reference Model (Layer 2) responsible for flow control, framing, synchronization and error control over a communications link.

**datagram:** A self-contained unit of data transmitted independently of other datagrams.

**Data packet:** Another term for "information field" (as used within this standard). This term is mainly used with Network Layer Protocol describing all information that is passed from the Network Layer to the Data Link Layer.

**Intelligent Transportation Systems:** A major national initiative to improve information, communication and control technologies in order to improve the efficiency of surface transportation.

**International Organization for Standardization (ISO):** An international standards organization. ANSI is the primary interface to ISO within the United States. Often thought to be International Standards Organization because of the usage ISO for short.

**Internet:** A large collection of connected networks, primarily in the United States, running the Internet suite of protocols. Sometimes referred to as the *DARPA Internet*, *NSF/DARPA Internet*, or the *Federal Research Internet*.

**Internet Protocol (IP):** The network protocol offering a connectionless mode network service in the Internet suite of protocols.

**Internet Protocol Suite:** A collection of computer-communication protocols originally developed under DARPA sponsorship.

**internetwork:** The ability of devices to communicate across multiple networks.

**network:** A collection of subnetworks connected by intermediate systems and populated by end systems.

**Network Layer:** That portion of an OSI Reference Model (Layer 3) responsible for data transfer across the network, independent of both the media comprising the underlying subnetworks and the topology of those subnetworks.

**network management:** The technology used to manage a network, usually referring to the management of devices that contain information about setup, control, and status of the layers in a communications stack. The term refers to all devices, both intermediate and end systems, that are present on the network or internetwork.

**Open Systems Interconnection (OSI):** An international effort to facilitate communications among computers of different manufacture and technology.

**OSI Reference Model:** A widely accepted structuring technique that provides an abstract representation of the communication process that is divided into seven basic, functional layers.

**Physical Layer:** That portion of an OSI Reference Model (Layer 1) responsible for the electrical and mechanical interface between communicating systems.

**proforma:** A guide provided in advance to prescribe form or describe items.

**protocol:** A system of rules and procedures governing communications between two devices. File transfer protocols in your communications program refer to a set of rules governing how error checking will be performed on blocks of data.

**Reserved:** reserved for future designation by the standards effort.

**Spare:** allows for implementation specific use, e.g., proprietary use, within the constraints of the EIA/TIA-232-E standard.

**Subnetwork:** A physical network within a network. All devices on a subnetwork share a common physical medium.

**Subnetwork Profile (SP):** A suite of protocols combined in a profile that specifies the lower layers of the OSI Reference Model. The only layers addressed within the SP are the Physical and the Data Link layer.

**taxonomy:** A classification scheme for referencing profiles or sets of profiles unambiguously.

**Transport Layer:** That portion of an OSI Reference Model (Layer 4) which attempts to guarantee reliable data transfers between two end-systems, using flow control and error recovery, and may provide multiplexing.

## 1.5 ABBREVIATIONS AND ACRONYMS

The abbreviations and acronyms used in this Standard Publication are defined as follows:

AASHTO	American Association of State Highway and Transportation Officials
ANSI	American National Standards Institute
ASN.1	Abstract Syntax Notation One
bps	Bits per Second
BCC	Balanced operation Connectionless-mode Class
CCITT	Formerly Consultative Committee on International Telegraph and Telephone [Now ITU-Telecommunications Sector (ITU-T)]
DARPA	Defense Advanced Research Projects Agency
DLSDU	Data Link Service Data Unit
EIA	Electronic Industries Alliance
FCS	Frame Check Sequence
FHWA	Federal Highway Administration
HDLC	High-level Data Link Control
IAB STD	Internet Activities Board Standard
IANA	Internet Assigned Number Authority
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IP	Internet Protocol
IPI	Initial Protocol Identifier
ISO	International Organization for Standardization
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation Systems
ITU	International Telecommunications Union
NEMA	National Electrical Manufacturers Association
NTCIP	National Transportation Communications for ITS Protocol
OSI	Open Systems Interconnection
PDU	Protocol Data Unit
PICS	Protocol Implementation Conformance Statement
PMPP	Point to Multi-Point Protocol
PPP	Point-to-Point Protocol
PRL	Profile Requirements List
RFC	Request for Comments
RS	Recommended Standard, e.g., EIA RS232, (a.k.a., EIA/TIA 232)
SNMP	Simple Network Management Protocol
SP	Subnetwork Profile
STMF	Simple Transportation Management Framework
STMP	Simple Transportation Management Protocol
TCP	Transmission Control Protocol
TIA	Telecommunications Industries Alliance
TP	Transport Profile
UCC	Unbalanced Connectionless Class
UDP	User Datagram Protocol
UI	HDLC Unnumbered Information
UP	HDLC Unnumbered Poll

## Section 2 CONFORMANCE

### 2.1 GENERAL REQUIREMENTS

Implementations claiming conformance to the SP-PMPP232 shall support the following elements as stated.

- a. All requirements in the remainder of Section 2 of this profile.
- b. All of the constraints specified in Annex A (normative) of this profile.
- c. All requirements of the standards referenced by this profile.

### 2.2 DATA LINK LAYER REQUIREMENTS

The data link channel shall be asynchronous (start/stop) as specified in the HDLC standards (ISO 3309: 1993; ISO 4335: 1993; ISO 7809: 1993). The HDLC requirements must be implemented except if specified otherwise in the following paragraphs.

#### 2.2.1 Protocol Parameters

There shall be two timers normally associated with the Data Link Layer, T1 and T2. They shall be settable in the range of 1 to 2147483647 milliseconds, by 1. Their context only applies to the Data Link Layer; not other layers.

- a. T1—This specifies the maximum time a primary station shall wait for a UI frame. T1 is only activated for a command frame with the poll bit set.
- b. T2—This specifies the maximum time a secondary station can delay before sending an UI frame. This timer ensures that secondary starts a response so that it is received by a primary before T1 times out ( $T2 < T1$ ). T2 is only activated when the receiving station accepts a frame with the poll bit set.

To ensure that data is transmitted as rapidly as possible, the maximum total byte-to-byte delay time in a frame shall be one bit time (e.g., 0.83 ms for 1200 bps). In full duplex operation at a primary station, the transmission of the closing flag may exceed the byte-to-byte delay.

##### 2.2.1.1 Primary Station Timers

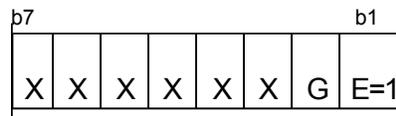
If the device is acting as a primary station, the T1 timer shall be supported.

##### 2.2.1.2 Secondary Station Timers

If device is acting as a secondary station, the T2 timer shall be supported.

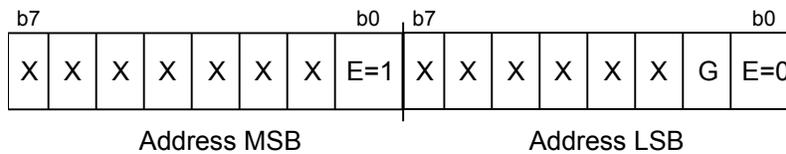
### 2.2.2 Addressing

The address field of data link layer frames shall use single or extended byte addressing, as provided for in clause 5.1 of ISO/IEC 3309, and shall incorporate support for group addressing. The low order bit of the first byte of an address shall be set to zero (0) to indicate that the next byte is part of the address field. When extended addressing is used, then the address values are a concatenation of the six higher-ordered bits of the first octet, and the seven higher-ordered bits from the second octet. Examples of 1-byte and 2-byte addressing are shown in the following figures.



G=1 if Group Address  
E=1 for Non-extended Address

**Figure 2.2.2-1  
Single Byte Address Field**



**Figure 2.2.2-2  
Two Byte Address Field**

NOTE—The LSB of the address field is transmitted first and is referred to as "the first byte" within this text.

The second low order bit of the first byte can be set to one (1) to indicate that the frame is intended only for a selected group of addresses. The G-Bit is set for all group addresses. With bit 0 and bit 1 set to 1 and 0 respectively, the upper 6 bits can be used to address stations 1 to 63. If the second low order bit is set to 1, the upper 6 bits shall indicate that the frame is intended for a group of secondary addresses. Group address 63 (0xFF) is reserved for the "all stations address" and this shall always be transmitted as a single byte. The support of the Group address (0xFF) is mandatory.

Address 0x00 (0 in decimal) shall be never assigned and address 0x3F (63 in decimal) is reserved.

The UI response frame shall always contain its own address in the address field.

Transmissions to the all-station address or to a group address shall not generate a response from the secondaries. UP frames shall not be sent to the all-station address or to a group address.

Support for 1-byte addressing is mandatory, recognition of 2- byte addresses is mandatory and support for creating 2-byte addressing is optional.

### 2.2.3 Control Field

The control field shall be one octet in length; it shall not be extended.

#### 2.2.3.1 P/F Bit in Control Field

The supported settings of the P/F bit are as specified in ISO 4335, Clause 6.3, 7.3.1.9, and 7.3.1.10 with the following exceptions. A UI frame sent to a group or all-station address shall always have its P-bit set to P=0, while UP frames sent to a single address shall always have the P- or F- (in case of a response) bit set to 1. Within UI frames, setting the P-bit shall be optional.

#### **2.2.4 Initial Protocol Identifiers (IPI)**

The purpose of an IPI is to identify the protocol used at the next higher layer. The IPI is the first field of the information field within an HDLC frame.

RFC 1661 defines the Point to Point Protocol (PPP) which specifies the use of a Protocol Field, referred to in this standard as IPI. IAB STD 2 is the official document detailing “assigned numbers” including all known Protocol Field, or IPI, numbers.

Support for one of the following Protocol Field values, or IPI, values is mandatory:

- 0x21 (indicating that the next higher layer protocol is IP)
- 0xC1 (indicating that the next higher layer protocol is STMF)

The IPI field value must be at least one byte in length. A receiving device must be able to recognize a 2-byte IPI field. The support for creating a 2-byte IPI value is optional.

Support for at least one of the following transport profiles is mandatory:

- NTCIP 2202 - Internet Transport Profile (IPI = 0x21)
- NTCIP 2201 - Null Transport Profile (IPI = 0xC1)

#### **2.2.5 Information Field Length**

The maximum DLSDU length shall be at least the size of the maximum upper layer PDUs (Network Layer PDU) plus 2 octets for the IPI.

#### **2.2.6 FCS Field**

The 16-bit FCS procedure defined in clause 4.6.2 of ISO/IEC 3309 shall be used.

#### **2.2.7 Modes of Operation**

The HDLC protocol shall provide for an unbalanced data link operating in two-way alternate transmission mode. In an unbalanced data link, a primary station assumes responsibility for managing the communications line to the connected secondary devices.

In terms of HDLC, the NTCIP Data Link Layer protocol shall be the Unbalanced Connectionless Class (UCC) of procedures defined in ISO/IEC 7809 with HDLC optional functions number 7 applied for multi-octet addressing and number 15.1 for start/stop transmission with basic transparency. This is designated as UCC-7,15.1.

Those clauses of ISO/IEC 3309, 4335, and 7809 dealing with the following shall not apply to NTCIP:

- a. synchronous transmission
- b. classes and associated modes other than UCC
- c. HDLC optional functions other than 7 and 15.1

## 2.2.8 Frame Types

Primary and secondary NTCIP stations shall make use of the following HDLC frame types as defined in ISO/IEC 4335 and in ISO/IEC 7809 for use with the UCC procedures. Additionally, primary or secondary NTCIP stations may support TEST frames to perform a basic test of the data link layer (ISO/IEC 7809 with HDLC optional function number 12).

Command:	Response:
Unnumbered Information (UI)	Unnumbered Information (UI)
Unnumbered Poll (UP)	Unnumbered Information (UI)
TEST command	TEST response

The encoding for the control field of the above frames is given in ISO/IEC 4335. The Poll/Final bit of the control field shall be used as described in the referenced standards except that the Poll bit shall always be set in an unnumbered poll. An unnumbered poll shall never be used with a broadcast or group address. An unnumbered poll shall never contain a data field.

### 2.2.8.1 Invalid Frames

ISO 3309, Clause 4.9.2 and ISO 4335, Clause 8.3 define what constitutes an invalid frame.

Additionally, the following conditions shall also lead to an invalid frame:

- a.) unsupported address within the HDLC address field,
- b.) unsupported control value within the HDLC control field.

All invalid frames shall be discarded without further actions being required.

## 2.2.9 Procedures

Transmission of frames on the link shall be in Unbalanced mode as described in the Introduction of ISO/IEC 4335 and clause 6 of ISO/IEC 7809. That is, transmission shall be controlled by the Data Link layer of the station designated as the Primary station (referred to as the "control" station in ISO/IEC 7809) on that link and shall be responded to by the addressed Secondary station (referred to as the "tributary" station in ISO/IEC 7809).

A Secondary station shall transmit only one UI response frame per respond opportunity. The response of the secondary shall contain its address in the address field, not the primary's (recipient's) address. Clause 6.4.2.2 of ISO/IEC 7809, which states that the last UI response frame (F-bit=1) must have an information field length of zero, shall be ignored.

The data link layer shall allow buffering for at least one outstanding frame.

## 2.3 PHYSICAL LAYER REQUIREMENTS

A device conforming to this part of this SP shall satisfy the mandatory requirements of EIA/TIA 232-E and as specified in this profile.

The requirements for the physical layer shall be in accordance with the following.

### 2.3.1 Interface

The physical interface shall consist of an EIA/TIA-232-E serial interface. An EIA/TIA-232-E interface conforming to this standard shall conform to the requirements as shown in Annex A.5 of this standard.

Certain pin designations that are specified in EIA/TIA-232-E have been changed (see Annex A.5). These exceptions were made because the current implementations do not support these designations and because spare pins are needed for manufacturer specific installations.

The EIA/TIA-232-E Data Terminal Equipment (DTE) interface shall provide for interconnection to external communications devices. The connector shall be a female 25 pin metal shell "D" subminiature type connector.

### **2.3.2 RS-232 Data Rate and Programmable Bit Rates**

An EIA/TIA-232-E serial interface shall support a data rate of 1200 bits per second. Additionally, any of the following data rates may also be supported:

- 2400 bps,
- 4800 bps,
- 9600 bps,
- 19200 bps,
- 38400 bps, or
- 56800 bps.

The EIA/TIA-232-E interface shall use asynchronous transmission and the byte structure shall be 1 start bit, 8 data bits, no parity, and 1 stop bit.

### **2.3.3 Duplexing**

A conformant device shall support half duplex. Optionally, it may support full duplex. The implementation of both transmission formats are allowed; however, since they are exclusive, it needs to be predefined which one is used on a particular link. The specification or setup must be done before communications are established.

### **2.3.4 Buffering (Frame Size)**

Each device conforming to this standard shall provide sufficient buffering space to store the maximum transmission unit. The maximum transmission unit (MTU) is defined as the size of the upper layer PDUs (=DLPDU) of at least 515 octets plus header and footer information. Additionally, the implementation must allow for byte stuffing. A device supporting lengths greater than this value shall also state what lengths are supported in the PICS.

## **2.4 DATA LINK LAYER / INTERNET PROTOCOL INTERFACE**

If the Internet Protocol (IP) is being used as the Network Layer Protocol, then the following additional requirement shall apply.

Support for the Type of Service (TOS) parameter as specified in the IP protocol, shall not be implemented within this profile.

## **2.5 MIB REQUIREMENTS**

Devices claiming conformance to this standard AND to the AP-STMF shall support the following objects as specified in RFC 1381, RFC 1317 and NTCIP 1201. All other object definitions listed within these base standards are optional.

### **2.5.1 The HDLC Group**

If the semantics of the HDLC Group is applicable to an implementation, then that implementation shall support the following object definitions as specified in RFC 1381, Section 4.

- lapbAdmnTable,
  - lapbAdmnEntry,
    - lapbAdmnIndex,
    - lapbAdmnTransmitN1FrameSize,
    - lapbAdmnReceiveN1FrameSize,
    - lapbAdmnT1AckTimer,
    - lapbAdmnT2AckDelayTimer
- lapbOperTable,
  - lapbOperEntry,
    - lapbOperIndex,
    - lapbOperPortId

### **2.5.2 The RS232 Group**

If the semantics of the RS232 Group is applicable to an implementation, then that implementation shall support the following object definitions as specified in RFC 1317, Section 5.

- rs232Number,
- rs232PortTable,
  - rs232PortEntry,
    - rs232PortIndex,
    - rs232PortType,
    - rs232PortInSpeed,
    - rs232PortOutSpeed

### **2.5.3 The RS232 Asynchronous Group**

If the semantics of the RS232 Asynchronous Group is applicable to an implementation, then that implementation shall support the following object definitions as specified in RFC 1317, Section 5.

- rs232AsyncPortTable,
  - rs232AsyncPortEntry,
    - rs232AsyncPortIndex,
    - rs232AsyncPortFramingErrs,
    - rs232AsyncPortOverrunErrs

### **2.5.4 The HDLC Group Address Group**

If the semantics of the HDLC Group Address Group is applicable to an implementation, then that implementation shall support the following object definitions as specified in NTCIP 1201:1996 v01.08, Global Object Definitions, Clause 2.7.

- maxGroupAddresses,
- hdlcGroupAddressTable,
  - hdlcGroupAddressEntry,
    - hdlcGroupAddressIndex,
    - hdlcGroupAddress

## Annex A PMPP SUBNETWORK PROFILE REQUIREMENT LISTS

### A.1 Introduction

This annex provides the Profile Requirements List (PRL) for implementations of the PMPP and EIA/TIA-232 -- Subnetwork Profile in the form of proforma.<sup>1</sup> A Profile Implementation Conformance Specification (PICS) for an implementation is generated by an implementer or supplier by indicating the appropriate level of support provided by an implementation.

To claim conformance with this profile, an implementation shall satisfy the mandatory conformance requirements of this profile.

An implementation's completed PRL is called the PICS. The PICS states which capabilities and options of the protocol have been implemented. The following can use the PICS:

- a. The protocol implementer, as a checklist to reduce the risk of failure to conform to the standard through oversight.
- b. The supplier and user, as a detailed indication of the capabilities of the implementation.
- c. The user, as a basis for initially checking the possibility of interworking with another implementation (note that, while interworking can never be guaranteed, failure to do so can often be predicted from incompatible PICSs).
- d. A user, as the basis for selecting appropriate tests against which to assess the claim for conformance of the implementation.

#### A.1.1 Notation

The following notations and symbols are used to indicate status and conditional status in the PRL and PICS within all NTCIP standards. Not all of these notations and symbols may be used within this standard.

##### A.1.1.1 Status Symbols

The following symbols are used to indicate base standard and profile status:

m	mandatory
m.<n>	support of every item of the group labeled by the same numeral <n> required, but only one is active at time.
o	optional
o.<n>	optional, but support of at least one of the group of options labeled by the same numeral <n> is required
c	conditional
n/a	non-applicable (i.e., logically impossible in the scope of the profile)
x	excluded or prohibited

The o.<n> notation is used to show a set of selectable options (i.e., one or more of the set must be implemented) with the same identifier <n>. Two character combinations are used for dynamic conformance requirements. In this case, the first character refers to the static (implementation) status,

<sup>1</sup> See the PRL Reproduction Notice in the front of the document.

and the second refers to the dynamic (use); thus "mo" means "mandatory to be implemented, optional to be used." Base standard requirements are shown using the equivalent notations in upper case (e.g., M, O, X).

The classification of the requirements and options in Internet RFCs does not correspond to the convention described in above, and shall be mapped into the profile as follows:

RFC	Profile
MUST	Mandatory <sup>2</sup>
SHOULD	Mandatory <sup>2</sup>
MAY	Optional
SHOULD NOT	Prohibited
MUST NOT	Prohibited

#### A.1.1.2 Conditional Status Notation

The following predicate notations are used:

<predicate>:	This notation introduces a single item that is conditional on the <predicate>.
<predicate>::	This notation introduces a table or a group of tables, all of which are conditional on the <predicate>.

The <predicate>: notation means that the status following it applies only when the PRL or PICS states that the feature or features identified by the predicate are supported. In the simplest case, <predicate> is the identifying tag of a single PICS item. The <predicate>:: notation may precede a table or group of tables in a clause or subclause. When the group predicate is true then the associated clause shall be completed. The symbol <predicate> also may be a Boolean expression composed of several indices. "AND", "OR", and "NOT" shall be used to indicate the Boolean logical operations.

#### A.1.1.3 Support Column Symbols

This profile is in the form of a PICS and, therefore, includes a support column. An implementer claims support of an item by circling the appropriate answer (Yes, No, or N/A) in the support column:

Yes	Supported by the implementation.
No	Not supported by the implementation.
N/A	Not applicable

#### A.1.1.4 Footnotes

Footnotes to the proforma are indicated by superscript numerals. The footnote appears on the page of the first occurrence of the numeral. Subsequent occurrences of a numeral refer to the footnote of the first occurrence.

#### A.1.1.5 Instructions for Completing the PRL

A Profile implementer shows the extent of compliance to a Profile by completing the PRL. The implementer indicates whether mandatory requirements are complied with, and whether optional

<sup>2</sup> In the course of adapting communications industry standards to the transportation industry, there may be exceptions where specific mandatory requirements are not applicable to the new environment. Where these exceptions are made, a justification shall be provided.

functions are supported. The resulting completed PRL is called a PICS. Where this profile refines the features of the base standards, the requirements expressed in this PRL shall be applied (as indicated in PRL items with no "Profile Support" column) to constrain the allowable responses in the base standard PICS proforma. When this profile makes additional requirements, the "Support" column for such PRLs shall be completed. In this column, each response shall be selected either from the indicated set of responses, or it shall comprise one or more parameter values as requested. If a conditional requirement is inapplicable, use the Not Applicable (NA) choice. If a mandatory requirement is not satisfied, exception information must be supplied by entering a reference Xi, where i is a unique identifier, to an accompanying rationale for the noncompliance. When the profile requirement is expressed as a two-character combination (as defined in A.1.1 above), the response shall address each element of the requirement; e.g., for the requirement "mo," the possible compliant responses are "yy" or "yn."

## A.2 Standards Referenced

This profile specifies the provision for data transport over point-to-multipoint links. It also specifies the provision for physical transportation, and basic datagram creation and analysis taking place in a connection-less environment. It references the following standards:

EIA/TIA 232-E-1991	<i>Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange.</i>
ISO/IEC 3309: 1993	<i>Information technology — Telecommunications and information exchange between systems — High-level data link control (HDLC) procedures — Frame structure.</i>
ISO/IEC 4335: 1993	<i>Information technology — Telecommunications and information exchange between systems — High-level data link control (HDLC) procedures — Elements of procedures</i>
ISO/IEC 7809: 1993	<i>Information technology — Telecommunications and information exchange between systems — High-level data link control (HDLC) procedures — Classes of procedures</i>
RFC 1381	<i>SNMP MIB Extension for the X.25 Packet Layer; D. Throop, F. Baker</i>
RFC 1317	<i>Definitions of Managed Objects for RS-232-like Hardware Devices, B. Stewart</i>
NTCIP 1201:1996 v01.08	<i>NTCIP - Global Object Definitions</i>

### A.3 PICS Requirements List

#### A.3.1 Implementation Identification

Ref	Question	Response
1	Supplier	
2	Contact point for queries about the profile	
3	Implementation Name(s) and Version(s)	
4	Date of statement	
5	Other Information: Machine Name, Operating Systems, System Name	
6	Amendments or revisions to the base standards or profiles that are applicable.	

#### A.3.2 Global Statement of Conformance

Are all mandatory requirements met for:

Ref	Question	Response
1	EIA/TIA-232-E	
2	ISO 3309	
3	ISO 4335	
4	ISO 7809	
5	RFC 1381(X.25 MIB), Section 4 (LAPB group)	
6	RFC 1317 (RS232 like devices MIB), Section 5 (rs232, rs232Async groups)	
7	NTCIP 1201 - Global Object Definitions (hdlcGroupAddress group)	
8	Exceptions as stated in this Standard	

#### A.4 Basic Requirements

The following table lists the basic requirements for a Point to MultiPoint over EIA 232-E – Subnetwork Profile implementation, and asks if the listed protocols or standards have been implemented. Additionally, questions regarding supported higher layer protocols are asked, since the different layer protocols interact and because this interaction has an effect on items that must be supported on the data link layer if these higher layer protocols are implemented.

Index	Protocol/Element	Clause of Profile	Profile Status	Support
pmp	ISO 3309, ISO 4335, ISO 7809 and the exceptions stated in Section 2 of this document implemented?	2.2	m	Yes
232	EIA/TIA-232-E and the exceptions stated in Section 2 of this Standard implemented?	2.3	m	Yes
ip	IAB STD 5 (RFC 791), IP, and IAB STD 3, RFC 1122, Section 3, IP, implemented?	2.2.4	o.1	Yes No
ip.1	Clause 2.4 implemented?	2.4	ip:m	Yes
null	STMF Protocol (Null Transport Profile) implemented?	2.2.4	o.1	Yes No
snmp	IAB STD 15 (RFC 1157), SNMP, implemented?		o	Yes No
snmp.1	Clause 2.5 implemented?	2.5	snmp:m	Yes

## A.5 Data Link Layer

Item	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
sLink	Single Link	ISO 4335	M		m	Yes
classPr O	<b>Class of Procedures</b>					
unc	Unbalanced operation Normal response mode Class (UNC)	ISO 7809 3.2, 4	O.1	2.2.7	x	No
uac	Unbalanced operation Asynchronous response mode Class (UAC)	ISO 7809 3.2, 4	O.1		x	No
bac	Balanced operation Asynchronous balanced mode Class (BAC)	ISO 7809 3.2, 5	O.1		x	No
ucc	Unbalanced operation Connectionless-mode Class (UCC)	ISO 7809 3.2, 6	O.1		m	Yes
bcc	Balanced operation Connectionless-mode Class (BCC)	ISO 7809 3.2, 7	O.1		x	No
trans	<b>Form of Transmission</b>					
sync	Synchronous Transmission	ISO 3309-4.5.1	O.2	2.2.7	x	No
async	Start/Stop (Asynchronous) Transmission	ISO 3309-4.5.2	O.2		m	Yes
async Basic	with basic transparency	ISO 3309-4.5.2	O.3		m	Yes
async Sbdpt	with SBDPT transparency	ISO 3309-4.5.2.1	O.3		x	No
async Octet	with Control-octet transparency	ISO 3309-4.5.2.2	O.3		x	No
startStop	Start/Stop (Asynchronous) Transmission - extended transparency	ISO 3309-4.5.3	O		x	No
comm	<b>Form of Communication</b>					
commTwa	Two Way Alternate (half duplex)	ISO 4335-6.4.5	O.2	2.2.9	o.1	Yes No
commTws	Two Way Simultaneous (full duplex)	ISO 4335-6.4.6	O.2	2.2.9	o.1	Yes No
FrameInfo	<b>Frame Information</b>					
Modulo8	Basic (Modulo 8)	ISO 4335-6.2.1	O.3	2.2.3	m	Yes
Modulo12 8	Extended (Modulo 128)	ISO 4335-6.2.1	O.3		x	No
non Alligned	Capable of sending Non-Octet Aligned Frames	ISO 3309-4.4	O		x	No
discNon Alligned	Discharge Non-Octet Aligned Frames	ISO 3309-3.4	O		m	Yes

Item	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
FrmSetup	<b>Frame Setup</b>					
Oflag	Opening Flag	ISO 3309-4.1	M	2.2	m	Yes
FrmAddr	Address field	ISO 3309-4.2	M		m	Yes
frmCtrl	Control field	ISO 3309-4.3	M		m	Yes
frmInfo	Information field	ISO 3309-4.4	M		o	Yes
frmIpi	Protocol Field (IPI)	RFC 1661	M	2.2.4	frmInfo:m	Yes
frmFcs	FCS	ISO 3309-4.6	M	2.2.6	m	Yes
cFlag	Closing Flag	ISO 3309-4.1	M	2.2	m	Yes
frmAddrL	Address Field Length	ISO 3309-5.1, -6		2.2.2		
single BGen	Single Byte Generation and Recognition	ISO 3309-5.1	M		m	Yes
twoBRec	Two Byte Address Recognition	ISO 3309-5.1	M		m	Yes
twoBGen	Two Byte Address Generation	ISO 3309-5.1	O		o	Yes No
noStation	No-Station Address (Address 0)	ISO 3309-6.3	M		x	No
allStation	All-Station Address (Group Address 63) support	ISO 3309-6.2	M		m	Yes
otherAddr	Support of other group addresses	ISO 3309-6.4	M		o	Yes No
allStation Poll	All-Station Polling support	ISO 3309-6.2	O		x	No
groupPoll	Group Polling support	ISO 3309-6.4	O		x	No
SecName	Secondaries insert their address in the address field when responding	ISO 3309-4.2	M		m	Yes
CrtlLengt	Control Field Length			2.2.3		
ctrlNorm	Normal	ISO 3309-4.3	M		m	Yes
ctrlExt	Extended	ISO 3309-5.2	O		x	No
pfBit	P/F Bit settings	ISO 4335-6.3, -7.3.1.9, -7.3.1.10		2.2.3.1		
pfUp	P bit always set in UP frames		M		m	Yes
PfUiSingle	P bit always set in UI frames to single addresses		O		o	Yes No
pfUiGroup	P bit always not set to all-station or group station addresses in UI frames		M		m	Yes
pbFBit	F bit is always set to 1		M		m	Yes
pbFBit-0	Support of clause 6.4.2.2 of ISO 7809 stating that only the last frame of a UI response frame (F-bit = 1) must have an information	ISO 7809-6.4.2.2	M	2.2.9	x	No

Item	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
	field length of zero					
ipi	Initial Protocol Identifier Length	IAB STD 51, 2		2.2.4		
ipiNorm	Normal		O.4		m	Yes
ipiExt	Extended		O.4		mo	Yes Yes No
upFrm	No data in UP frames	ISO 4335-7.3.1.9	M	0	m	Yes
fcs	<b>FCS Length</b>					
fcs16	16 Bits	ISO 3309 4.6.2	O.5	2.2.6	m	Yes
fcs32	32 Bits	ISO 3309 4.6.3	O.5		x	No
singleOCflag	Ability to create a Single Flag that is used for both, as Closing Flag of one Frame and as the Opening Flag of the next	ISO 3309-4.1	O		x	No
oneFrm	One command or response frame per command / response opportunity	ISO 3309-4.1	M	2.2.9	m	Yes
frmSize	<b>Frame size</b>					
minMtu	What is the <u>maximum</u> MTU transmitted (in bytes) ?					
maxMtu	What is the <u>maximum</u> frame size received (in bytes) ?					
invalFrm	<b>Invalid Frames result from</b>					
invalFlag	Frames not bound by two flags	ISO 3309 - 4.9.2	M	2.2.8.1	m	Yes
InvalFrm	Frame not long enough	ISO 3309 - 4.9.2	M		m	Yes
InvalFcs	Invalid FCS	ISO 4335-8.3	M		m	Yes
InvalAddr	Unsupported Address				m	Yes
invalCtrl	Unsupported Control Field				m	Yes
InvalDisc	All invalid frames discarded and No action taken as a result				m	Yes
FrmTypes	<b>Frame Types</b>					
Test1	Support of TEST Frames and all associated mandatory functions?	ISO 7809-8.12	O	0	o	Yes No
Test2	Support of TEST Frames	ISO 4335-7.3.1.13, -7.3.2.8	O		o	Yes No
TestCmd	Primary capable of sending TEST command frames	ISO 4335-7.3.1.13	O		o	Yes No
TestInfo	Information field present	ISO 4335-7.3.1.13	O		o	Yes No
testOpp	Secondary capable of sending	ISO 4335-	TestCmd:		TestCmd:	Yes

Item	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
	TEST response frames at first opportunity	7.3.1.13	M		m	
TestInfo R	Information Field content returned in response	ISO 4335-7.3.1.13	testOpp: M		testOpp: m	Yes
TestInfo R2	Secondary returns TEST Frame without Information Field content when busy or cannot accept information field	ISO 4335-7.3.1.13	testOpp: M		testOpp: m	Yes
uFrame	Support of U Frames	ISO 4335-6.1.4, 7.3	O	0		
upCmd	Unnumbered Poll (Command only)	ISO 4335-6.1.4, 7.3.1.9	O		m	Yes
uilInfo	Unnumbered Information (Command and Response)	ISO 4335-6.1.4, 7.3.1.10	O		m	Yes
timer	<b>Timers</b>					
t1	Primary Station Timer (T1)			2.2.1.1	o.2	Yes No
t2	Secondary Station Timer (T2)			2.2.1.2	o.2	Yes No

## A.6 Physical Layer Conformance List

Item	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
dataRate	Data Rate			2.3.2		
1200	1200 bps		-		m	Yes
OtherData Rate	Higher Data Rates (indicate appropriate w/ checkmark) 2400 bps 4800 bps 9600 bps 19200 bps 38400 bps 56800 bps  other rate (indicate bps)		-		o	Yes No ( ) ( ) ( ) ( ) ( ) ( ) _____
sync	<b>Type of Data Communications:</b> synchronous	EIA/TIA 232-E			x	No
async	asynchronous				m	Yes
duplex	<b>Duplexing</b>					
halfDupl	Half Duplex	EIA/TIA 232-E	O.6	2.3.3	o.6	Yes
fullDupl	Full Duplex		O.6		o.6	Yes No
232 Circuits	<b>INTERCHANGE CIRCUITS FOR EIA/TIA 232-E</b>					

Item	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
P1	Pin 1 – shield (earth ground)	EIA/TIA 232-E	M	2.3.1	o	Yes No
P2	Pin 2 – transmitted data (transmit data)	EIA/TIA 232-E	M		m	Yes
P3	Pin 3 – received data (receive data)	EIA/TIA 232-E	M		m	Yes
P4	Pin 4 – request to send	EIA/TIA 232-E	M		m	Yes
P5	Pin 5 – Clear to send	EIA/TIA 232-E	M		m	Yes
P6	Pin 6 – DCE Ready (Data set ready)	EIA/TIA 232-E	M		o	Yes No
P7	Pin 7 – signal common (logic ground)	EIA/TIA 232-E	M		m	Yes
P8	Pin 8 – received line signal detector (data carrier detect)	EIA/TIA 232-E	M		m	Yes
P9	Pin 9 – reserved for testing	EIA/TIA 232-E	M		o	Yes No
P10	Pin 10 – reserved for testing	EIA/TIA 232-E	M		o	Yes No
P11	Pin 11 – unassigned	EIA/TIA 232-E	M		o	Yes No
P12	Pin 12 – secondary received line signal detector (secondary DCD)	EIA/TIA 232-E	M		o	Yes No
P13	Pin 13 – secondary Clear to Send	EIA/TIA 232-E	M		o	Yes No
P14	Pin 14 – secondary transmit data	EIA/TIA 232-E	M		o	Yes No
P15	Pin 15 – Transmitter Signal Element timing (Synchronous Mode Transmit Clock) - DCE	EIA/TIA 232-E	M		o	Yes No
P16	Pin 16 – Secondary Received Data	EIA/TIA 232-E	M		o	Yes No
P17	Pin 17 – Receiver Signal Element Timing (Synchronous Mode Receive Clock)	EIA/TIA 232-E	M		o	Yes No
P18	Pin 18 – Local Loop Back	EIA/TIA 232-E	M		o	Yes No
P19	Pin 19 – Secondary Request to Send	EIA/TIA 232-E	M		o	Yes No
P20	Pin 20 – DTE ready (Data Terminal Ready)	EIA/TIA 232-E	M		m	Yes
P21	Pin 21 – Remote Loop Back	EIA/TIA 232-E	M		o	Yes No
P22	Pin 22 – Ring indicator	EIA/TIA 232-E	M		o	Yes No
P23	Pin 23 – Data Signal Rate Selector	EIA/TIA 232-E	M		o	Yes No
P24	Pin 24 – Transmit Signal Element Timing (Synchronous Mode Transmit Clock) - DTE	EIA/TIA 232-E	M		o	Yes No
P25	Pin 25 – Test Mode	EIA/TIA 232-E	M		o	Yes No

## A.7 Mandatory Object Definitions if SNMP is used

### A.7.1 HDLC Group

Item	Object Definition			Base Standard		Profile		Support
	Object	Syntax	Access	Reference	Status	Clause	Status	
7.1	Support of lapbAdmnTable and lapbOperTable?					2.5.1	snmp:m	Yes No
lapb AT	lapbAdmnTable	SEQUENCE OF lapbAdmn Entry	Not-accessible	RFC 1381 Section 4	M	2.5.1	7.1:m	Yes
lapb AE	lapbAdmnEntry	LapbAdmn Entry	Not-accessible		M		7.1:m	Yes
lapb AI	lapbAdmnIndex	INTEGER (IfIndex Type)	read-only		M		7.1:m	Yes
lapb TNFS	lapbAdmn TransmitN1 FrameSize	INTEGER (Positive Integer)	read-write		M		7.1:m	Yes
lapb RNFS	lapbAdmn ReceiveN1 FrameSize	INTEGER (Positive Integer)	read-write		M		7.1:m	Yes
lapb T1	lapbAdmn T1AckTimer	INTEGER (Positive Integer)	read-write		M		7.1:m	Yes
lapb T2	lapbAdmn T2AckDelayTimer	INTEGER (Positive Integer)	read-write		M		7.1:m	Yes
lapb OT	lapbOperTable	SEQUENCE OF lapbOper Entry	Not-accessible		RFC 1381 Section 4		M	2.5.1
lapb OE	lapbOperEntry	LapbOper Entry	Not-accessible	M		7.1:m	Yes	
lapb OI	lapbOperIndex	INTEGER (IfIndex Type)	read-only	M		7.1:m	Yes	
lapb Ooid	lapbOperPortId	OBJECT IDENTIFIER	read-only	M		7.1:m	Yes	

### A.7.2 RS232 Asynchronous Group

Item	Object Definition			Base Standard		Profile		Support
	Object	Syntax	Access	Reference	Status	Clause	Status	
7.2	Support of rs232PortTable?						snmp:m	Yes No
rs232 No	rs232Number	INTEGER	read-write	RFC 1317 Section 5	M	0	7.2:m	Yes
rs232 PT	rs232PortTable	SEQUENCE OF rs232 PortEntry	Not-accessible		M		7.2:m	Yes
rs232 PE	rs232PortEntry	rs232 PortEntry	Not-accessible		M		7.2:m	Yes
rs232 PI	rs232PortIndex	INTEGER	read-only		M		7.2:m	Yes
rs232 PType	rs232PortType	INTEGER	read-only		M		7.2:m	Yes
rs232 PiSpd	rs232Port InSpeed	INTEGER	read-write		M		7.2:m	Yes
rs232 PoSpd	rs232Port OutSpeed	INTEGER	read-write		M		7.2:m	Yes
rs232 APT	rs232AsyncPort Table	SEQUENCE OF rs232Async PortEntry	Not-accessible		RFC 1317 Section 5		M	2.5.3
rs232 APE	rs232 AsyncPortEntry	rs232Async PortEntry	Not-accessible	M		7.2:m	Yes	
rs232 API	rs232 AsyncPortIndex	INTEGER	read-only	M		7.2:m	Yes	
rs232 APFE	rs232AsyncPort FramingErrs	Counter	read-only	M		7.2:m	Yes	
rs232 APOE	rs232AsyncPort OverrunErrs	Counter	read-only	M		7.2:m	Yes	

**A.7.3 HDLC Group Address Group**

Item	Object Definition			Base Standard		Profile		Support
	Object	Syntax	Access	Reference	Status	Clause	Status	
7.3	Support of the hdlcGroup Address Table?						snmp:m	Yes No
max GroupAddresses	maxGroupAddresses	INTEGER	Read-only	NTCIP 1201 2.7.1	M	0	7.3:m	Yes
hdlc Group Address Table	hdlcGroupAddressTable	SEQUENCE OF HdlcGroupAddressEntry	Not-accessible	NTCIP 1201 2.7.2	M		7.3:m	Yes
hdlc Group Address Entry	hdlcGroupAddressEntry	hdlcGroupAddressEntry	Not-accessible	NTCIP 1201 2.7.2	M		7.3:m	Yes
hdlc Group Address Index	hdlcGroupAddressIndex	INTEGER	Read-only	NTCIP 1201 2.7.2.1	M		7.3:m	Yes
hdlc Group Address	hdlcGroupAddress	INTEGER	Read-write	NTCIP 1201 2.7.2.2	M		7.3:m	Yes

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