

Protocol Implementation conformance Statement White Paper

What is a PICS?

The NTCIP is a standard to establish inter-operability, however one must go beyond the specification of a common protocol to ensure inter-operability of implementations. One of the next steps to ensure inter-operability other than the standard itself is to develop a statement of conformance to the specification and to embody this as a part of a Protocol Implementation Conformance Statement (PICS) proforma.

There are two main reasons for a PICS. The first is to clearly define what elements within the NTCIP standard are required and which are optional. The second is to clearly document which options are provided within a specific product which conforms to the NTCIP protocol.

A PICS proforma is a detailed statement of support capabilities. The proforma is in the form of a questionnaire to be completed by the supplier of an implementation of a specific protocol (NTCIP in this instance). Once completed, the PICS proforma becomes the PICS for the particular implementation.

This PICS is intended to capture the implementation flexibility, where allowed, which would not be obvious in the NTCIP protocol standard.

For a prototype of a PICS for the NTCIP standard refer to addendum A. For more information on PICS please refer to addendum B titled PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENT (PICS) for the NATIONAL TRAFFIC CONTROL/IVHS COMMUNICATIONS PROTOCOL (NTCIP)

Why is one needed?

A PICS statement is required to ensure interpretability between two products which claim to be NTCIP compliant. In order for the NTCIP specification to be acceptable to the market place, it was required to allow the standard to support optional features (as is with other standard protocols). The manufacture of the device must document which optional portions of the standard the device supports.

There are many products within the transportation industry which could make use of the NTCIP standard. These products can include everything from simple routers, to complicated traffic signal controllers, to Changeable Message Signs. The NTCIP standard may define application data frames for all these applications, but the manufactured devices may only support application data frames for it's primary functionality (i.e. Traffic Signal Controller). It would be unreasonable to assume that a device will exist which will support 100% of NTCIP, including application frames.

The PICS statement allows for each manufacture to clearly identify the functionality of their device in addition to the elements of the NTCIP protocol the device supports

Why Is input needed from Traffic Engineers?

Input is needed from Traffic Engineers to determine what the PICS should address. Clearly the PICS should address most of the low level communications standards of the protocol. More importantly the PICS should also address functionality options, and allow for future expansion of the PICS document as new transportation devices are invented.

What are some of the outstanding issues?

Additional thought must be put into "who will be the controlling agency for the PICS"? Who should certify a device's protocol conformance? Who should develop the initial PICS document. How would the PICS categorize functionality. If all messages are not supported how should error handling occur.

Should closed loop systems have to support second-by-second control? Should systems have to support all allowable addressing scheme (i.e. the one, two, and three bytes address debate)?

ADDENDUM A

Protocol Implementation Conformance Statement (PICS) Proforma for NTCIP¹

Introduction

The supplier of a protocol implementation that claims to conform to NTCIP shall complete the Protocol Implementation Conformance Statement (PICS) proforma contained in this appendix starting at Section A.0.

A completed PICS proforma is the PICS for the specific implementation. The PICS is a statement of which capabilities and options of NTCIP have been implemented. The PICS can have several uses, including use by:

- the protocol implementor, as a check-list to reduce the risk of failure to conform to the standard;
- the supplier and procurer (or potential procurer) of the implementation, as a basis for what is desired and what is supplied;
- the user (or potential user) of the implementation, as a basis for initially checking the possibility of interworking with another implementation (note that, while interworking can never be guaranteed, especially based on a paper review of capabilities, failure to interwork can often be predicted from incompatible PICS's); and
- a protocol tester, as the basis for selecting appropriate tests against which to assess the claim for conformance of the implementation.

Abbreviations and special symbols

Status Symbols

FS	further study
M	mandatory
O	optional
O.<n>	optional, but support of at least one of the group of options labeled by the same numeral <n> is required
X	prohibited
<pred>	conditional item symbol, including predicate identification; see Section A.3.0 below
¬	logical negation, applied to a conditional item's predicate

General Abbreviations

N/A	not applicable
PICS	Protocol Implementation Conformance Statement

Instructions for completing the PICS proforma

General structure of the PICS proforma

The first part of the PICS proforma — System Identification — is to be completed as indicated with the information necessary to identify fully both the supplier and the implementation.

¹ Copyright release for NTCIP PICS proforma:

[Text developed by NEMA giving users of the NTCIP standard permission to reproduce this PICS proforma.]

The main part of the PICS proforma is a fixed-format questionnaire. Answers to the questionnaire items are to be provided in the rightmost column by simply marking an answer to indicate a restricted choice (usually Yes or No) or by entering a value or a set or range of values. Note that there may be items where two or more choices from a set of possible answers can apply; all relevant choices are to be marked.

Each item is identified by an item reference in the first column; the second column contains the question to be answered; the third column, the reference or references to the material that specifies the item in this Standard. The remaining columns record the status of the item — whether support is mandatory, optional, prohibited or conditional — and provide the space for the answers; see also Section A.3.0 below. (Status is sometimes indicated by other means than a separate Status column: for example, where the same status applies to a whole group of items.)

A supplier may also provide — or be required to provide — further information, categorized as either Additional Information or Exception Information. When present, each kind of further information is to be provided in a further sub-section of items labeled A<i> or X<i>, respectively, for cross-referencing purposes, where <i> is any unambiguous identification for the item (e.g., simply a numeral); there are no other restrictions on its format and presentation.

A completed PICS proforma, including any Additional Information and Exception Information, is the Protocol Implementation Conformance Statement for the implementation in question.

NOTE — Where an implementation is capable of being configured in more than one way, a single PICS may be able to describe all such configurations. However, the supplier has the choice of providing more than one PICS, each covering some subset of the implementation's configuration capabilities, in case this makes for easier and clearer presentation of the information.

Additional information

Items of Additional Information allow a supplier to provide further information intended to assist the interpretation of the PICS. It is not intended or expected that a large quantity will be supplied, and a PICS can be considered complete without any such information. Examples might be an outline of the ways in which a (single) implementation can be set up to operate in a variety of environments and configurations or a brief rationale — based perhaps upon specific applications needs — for the exclusion of features which, although optional, are nonetheless commonly present in implementations of this Standard.

References to items of Additional Information may be entered next to any answer in the questionnaire and may be included in items of Exception Information.

Exception information

It may occasionally happen that a supplier will wish to answer an item with mandatory or prohibited status (after any conditions have been applied) in a way that conflicts with the indicated requirement. No pre-printed answer will be found in the Support column for this. Instead, the supplier is required to write the missing answer into the Support column, together with an X<i> reference to an item of Exception Information and to provide the appropriate rationale in the Exception item itself.

An implementation for which an Exception item is required in this way does not conform to this Standard.

NOTE — A possible reason for the situation described above is that a defect in the standard has been reported, a correction for which is expected to change the requirement not met by the implementation.

Conditional status

Conditional items

The PICS proforma contains a number of conditional items. These are items for which the status — mandatory, optional or prohibited — that applies is dependent upon whether or not certain other items are supported or upon the values supported for other items.

In many cases, whether or not the item applies at all is conditional in this way, as well as the status when the item does apply.

Where a group of items is subject to the same condition for applicability, a separate preliminary question about the condition appears at the head of the group, with an instruction to skip to a later point in the questionnaire if the "Not Applicable" answer is selected. Otherwise, individual conditional items are indicated by one or more conditional symbols (on separate lines) in the Status column.

A conditional symbol is of the form "<pred>: <s>" where "<pred>" is a predicate as described in Section A.3.4.0 below, and "<s>" is one of the status symbols M, O, O.<n>, or X.

If the value of the predicate in any line of a conditional item is true (see Section A.3.4.0), the conditional item is applicable, and its status is that indicated by the status symbol following the predicate; the answer column is to be marked in the usual way. If the value of a predicate is false, the Not Applicable (N/A) answer is to be marked in the relevant line. (Each line in a multi-line conditional item is to be marked; at most, one line will require an answer other than N/A.)

Predicates

A predicate is one of the following:

- a) an item-reference for an item in the PICS proforma: the value of the predicate is true if the item is marked as supported, and is false otherwise; or
- b) a predicate-name, for a predicate defined elsewhere in the PICS proforma (see below); or
- c) the logical negation symbol "¬" prefixed to an item-reference or predicate-name: the value of the condition is true if the value of the item-reference or predicate-name formed by omitting the "¬" symbol is false, and vice versa.

The definition for a predicate-name is a boolean expression constructed by combining simple item-references or other predicate-names, as at (a) or (b) above, using the boolean operators AND, OR and NOT, and parentheses, in the usual way. The expression defining a predicate-name appears under the table in which it is first used (although, in general, it may appear elsewhere in the PICS proforma such as one location for all predicate-names). The value of such a predicate is true if the boolean expression evaluates to true when the item-references or predicate-names are interpreted as at (a) above.

Each item-reference which is used as a predicate or in a predicate definition is highlighted by an asterisk in the Item column to help in identifying it as the subject of a predicate reference. Predicate definitions that are used elsewhere are highlighted in the defining-location as the subject of a predicate reference.

Use of Base Standard PICS's

In the case of support for the X.25 PLP (either in an end system or in an intermediate system), a complete PICS proforma is not given in this appendix. Rather, reference is made to the PICS proforma for ISO/IEC 8208. This reference would contain the original ISO/IEC 8208 PICS proforma modified:

- a) to inquire about the support status of only those items of ISO/IEC 8208 applicable to the NTCIP environment; and
- b) to reflect the specific modifications to the ISO/IEC 8208 PICS proforma when supporting ISO/IEC 8878 (for supporting the Connection-mode Network Service in Class A communications) or ISO/IEC 10177 (for supporting relaying).

The user of this PICS proforma shall also complete the ISO/IEC 8208 PICS proformas in Appendix F if applicable. The completed PICS shall then be attached to the PICS below to form a complete NTCIP PICS.

System Identification

Product Information

Product name/code number, version number, release date, etc. ¹⁾	
Supplier company name, address, including contact point	
Other information — operating system, name/version of machine, etc. ¹⁾	

- 1) The terms “name” and “version” should be interpreted appropriately to correspond with a supplier’s terminology (e.g., “Type”, “Series”, or “Model”)

Information about this PICS

Date of Statement	
Contact point (name, telephone, etc.) for questions about PICS	
Identification of changes to this PICS proforma that have been completed as part of this PICS (identify protocol, date and nature of change to NTCIP)	
Have any Exception items been required? No • Yes • (The answer Yes means that the implementation does not conform to NTCIP.)	

Port Configuration

Item	Feature	Reference	Status	Support
	Number of Ports Supported:			
* Pt/1	— one port		O	Yes • No •
Pt/M	— more than one port		-Pt/1:M	Yes • ¹⁾
				•
Pt/C	How are port(s) configured? ²⁾			

- 1) Additional information required: number of ports supported is ____.
- 2) Additional Information required: are all ports configured the same or can they be each individually configured per the protocol-stack definitions in A.4.0 and the protocol-function definitions in A.4.0? If necessary, indicate each valid combination in which a port may be configured.

Protocol Stack(s) Implemented

Item	Feature	Reference	Status	Support
* PS/ESA	Is the ES-A stack supported?	3.2.1	O.1	Yes • No •
* PS/ESB	Is the ES-B stack supported?	3.2.1	O.1	Yes • No •
* PS/IS	Is the IS stack supported?	3.2.1	O.1	Yes • No •

Protocols/Functions Implemented

Item	Feature	Reference	Status	Support
	Which of the following are implemented?			
* PF/L1Ra	RS-232-C, asynchronous mode?	3.3.2	O.2	Yes • No •
* PF/L1Fa	FSK, asynchronous mode?	3.3.3	O.2	Yes • No •
PF/L2UC	HDLC Unbalanced Connectionless Class (UCC-7,15.1)?	3.4.3	M	Yes •
* PF/L3PId	Protocol Identification?	3.2.1,3.5.2	PID:M	N/A • Yes •
* PF/L3RT	Class B Real-Time protocol?	3.5.3	PS/ESB:M	N/A • Yes •
* PF/L3PL	Class A X.25 PLP as end system?	3.5.4	PS/ESA:M	N/A • Yes •
* PF/L3IS	Class A X.25 PLP as intermediate system?	3.5.4	PS/IS:M	N/A • Yes •
* PF/L3Rtg	Routing?	3.5.6	M	Yes •
* PF/L3Rly	Relaying?	3.5.7	PS/IS:M	N/A • Yes •
* PF/Dial	Dial-up operation: ¹⁾	3.5.5	O	Yes • No •
* PF/Dorig	— originate calls?	3.5.5	PF/Dial:O.3	N/A • Yes • No •
* PF/Dans	— answer calls?	3.5.5	PF/Dial:O.3	N/A • Yes • No •

1) If dial-up operation is supported, specify what information is associated with the station: telephone dialing information and hang-up procedures are required; modem initialization, command set interpretations, or other items are optional.

PID = (PS/IS AND PS/ESB) OR (PS/ESA AND PS/ESB) OR (PS/IS AND PS/ESA AND PS/ESB)

Application Layer Message Subsets Implemented

If PS/IS was the only protocol stack marked Yes in A.4.0, mark N/A and continue at A.0 N/A •

Item	Feature	Reference	Status	Support
	Which of the following Application Layer message subsets are implemented?			
AL/S1	— name of subset #1	4.x	O.x	Yes • No •
AL/S2	— name of subset #2	4.x	O.x	Yes • No •

Layer 1 Protocol Support

Supply any specific identification information for the Layer 1 protocol implementation (version, contact, etc.) if different than that given in A.4.0.

RS-232-C Support

If PF/L1Ra was answered No, mark N/A and continue at A.5.0 N/A •

Item	Feature	Reference	Status	Support
RS/1200	Operation at 1200 bps	3.3.2	O.4	Yes • No •
RS/hi	Operation at higher speeds	3.3.2	O.4	Yes • ¹⁾ No •
RS/con	Connector: female, 25-pin metal shell "D" subminiature	3.3.2	M	Yes •
RS/sig	Signals: as listed	3.3.2	M	Yes •

1) Additional information required: speeds >1200 bps supported are _____.

FSK Support

If PF/L1Fa was answered No, mark N/A and continue at A.0

N/A •

Item	Feature	Reference	Status	Support
FS/1200	Operation at 1200 bps	3.3.3	M	Yes •
	Operating mode:			
FS/2wh	— 2-wire half duplex	3.3.3	O.5	Yes • No •
FS/4wf	— 4-wire full duplex	3.3.3	O.5	Yes • No •
	Cable type::			
FS/3002	— unconditioned Type 3002, voice-grade	3.3.3	O.6	Yes • No •
FS/cus	— customer equivalent	3.3.3	O.6	Yes • No •
FS/imp	Impedance: 600 ohms \pm 10%	3.3.3	M	Yes •
FS/con	Connector: male, 9-pin metal shell "D" subminiature	3.3.3	M	Yes •
FS/sig	Signals: as listed	3.3.3	M	Yes •

Layer 2 Protocol Support

Supply any specific identification information for the Layer 2 protocol implementation (version, contact, etc.) if different than that given in A.4.0.

Functions Supported

Item	Feature	Reference	Status	Support
* Stn/Pri	Type of Station: — primary station?	3.4.3.4	PF/Dorig:M	N/A • Yes •
* Stn/Sec	— secondary station?	3.4.3.4	¬PF/Dial:O.7 PF/Dans:M	N/A • Yes • No •
			¬PF/Dial:O.7	Yes • No •
Poll/Skd	Polling schedule supported?	3.3.3.3	Stn/Pri:M	N/A • Yes • ¹⁾
Asyc/By	Byte Format: 1 start bit, 8 data bits, 1 stop bit	3.3.2, 3.3.3	M	Yes •
	Address Format supported:			
L2/Arcv	— receive all lengths?	3.4.3.1	M	Yes •
L2/Asd1	— send one-byte address?	3.4.3.1	M	Yes • No •
L2/Asd2	— send two-byte address?	3.4.3.1	O	Yes • No •
L2/Asd3	— send three-byte address?	3.4.3.1	O	Yes • No •

- 1) For each polling algorithm supported, describe its parameters and any ranges that each can take on (e.g., length of polling cycle; interval between each poll; whether a station can be polled more than once per cycle; action to be taken when no response is received — skip to next station or repeat; etc.).

PDU Types and PDU Fields Supported

Item	Feature	Reference	Status	Support		
L2/Adr=0	Support an address=0?	3.4.3.1	X	No •		
GA/send	Support Group Addressing: — send a group address?		Stn/Pri:O	N/A	Yes •	No •
			¬Stn/Pri:X	N/A		No •
GA/rcv	— receive a group address?		Stn/Sec:O	N/A	Yes •	No •
			¬Stn/Sec:X	N/A		No •
Cntl/1By	Control-field length: — 1-byte control field?	3.4.3.1	M		Yes •	
			X			No •
FCS/16	FCS length: — 16-bit FCS?	3.4.3.1	M		Yes •	
			X			No •
UI/Pri	Supported Frame Types: — send UI commands and receive UI responses?	3.4.3.3	Stn/Pri:M	N/A	Yes •	
			¬Stn/Pri:X	N/A		No •
UI/Sec	— send UI responses and receive UI commands?	3.4.3.3	Stn/Sec:M	N/A	Yes •	
			¬Stn/Sec:X	N/A		No •
UI/Send1	Send only 1 UI response frame per opportunity?	3.4.3.4	Stn/Sec:M	N/A	Yes •	
UI/L515	Maximum Information Field Length supported: — 515 byte?	3.4.2	M		Yes •	
			O		Yes • ¹⁾	No •

1) Additional information required: lengths >515 bytes supported are _____.

Protocol Identification Support

If PF/L3PId was answered N/A, mark N/A and continue at A.0

N/A •

Supply any specific identification information for the Protocol Identification implementation (version, contact, etc.) if different than that given in A.4.0.

Item	Feature	Reference	Status	Support	
PId/PLP	Are all values used to identify the X.25 PLP supported?	Fig. 3.5.2-1	VAL/PLP:M	N/A •	Yes •
PId/RT	Is the value used to identify the Class B Real-Time protocol supported?	Fig. 3.5.2-1	PF/L3RT:M	N/A •	Yes •

PId/Oth	Are other values supported?	X	No •
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VAL/PLP = PF/L3PL OR PF/L3IS

Class B Real-Time Protocol Support

If PF/L3RT was answered N/A, mark N/A and continue at A.0

N/A •

Supply any specific identification information for the Class B Real-Time protocol implementation (version, contact, etc.) if different than that given in A.4.0.

Item	Feature	Reference	Status	Support
RT/Data	Are transmission and receipt of Real-Time data supported?	3.5.3.2.3	M	Yes •
	Maximum Information Field supported:			
RT/IEQ	— equal to DLSDU–1 bytes?	3.5.3.2.4	O.8	Yes • No •
RT/ILT	— less than DLSDU–1 bytes?	3.5.3.2.4	O.8	Yes • ¹⁾ No •

1) Additional information required: if the maximum Information Field supported is less than DLSDU–1 bytes, the maximum is _____.

X.25 PLP Class A End System Support

If PF/L3PL was answered N/A, mark N/A and continue at A.0

N/A •

When the X.25 PLP is used in a Class A end system, the PICS proforma for ISO/IEC 8208 (including the changes per the PICS proforma for ISO/IEC 8878) shall be completed. This PICS proforma is found in Appendix F and shall be attached to this PICS when completed.

Supply any specific identification information for the X.25 PLP Class A protocol implementation (version, contact, etc.) if different than that given in A.4.0.

Routing Function Support

Supply any specific identification information for the routing implementation (version, contact, etc.) if different than that given in A.4.0.

TEMP NOTE: No PICS Proforma material is given here since no details of a routing function are provided in Section 3.5.6 at this time. Any routing function that is provided is considered to be proprietary from the NTCIP perspective. However, a distinction could be made between outgoing packets and incoming packets, as suggested in Section 3.5.6: the former always requires some type of routing function to be supported whereas the latter may not, depending on the protocol stack(s) or functions supported (e.g., the protocol identification function may suffice for incoming packets).

Relaying Function Support

If PF/L3Rly was answered N/A, mark N/A and continue at A.0

N/A •

When the X.25 PLP is used in an intermediate system supporting the relaying function, the PICS proforma for ISO/IEC 8208 (including the changes per the PICS proforma for ISO/IEC 10177) shall be completed. This PICS proforma is found in Appendix F and shall be attached to this PICS when completed.

Supply any specific identification information for the X.25 PLP intermediate-system implementation (version, contact, etc.) if different than that given in A.4.0.

Application Layer Messages Supported

If PS/IS was the only protocol stack marked Yes in A.4.0, mark N/A

N/A •

Supply any specific identification information for the Application Layer implementation (version, contact, etc.) if different than that given in A.4.0.

ADDENDUM B

OVERVIEW

**PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENT (PICS) for the NATIONAL
TRAFFIC CONTROL/IVHS COMMUNICATIONS PROTOCOL (NTCIP)**