Standard ECMA-156
2nd Edition - June 1993
Reprinted June 1999

ECMA

Standardizing Information and Communication Systems

Private Telecommunication Networks - Signalling at the S Reference Point - Generic Keypad Protocol for the Support of Supplementary Services

Phone: +41 22 849.60.00 - **Fax:** +41 22 849.60.01 - **URL:** http://www.ecma.ch - **Internet:** helpdesk@ecma.ch

Standard ECMA-156
2nd Edition - June 1993
Reprinted June 1999

ECMA

Standardizing Information and Communication Systems

Private Telecommunication Networks - Signalling at the S Reference Point - Generic Keypad Protocol for the Support of Supplementary Services

(PTN SSIG-KP)

Phone: +41 22 849.60.00 - **Fax:** +41 22 849.60.01 - **URL:** http://www.ecma.ch - **Internet:** helpdesk@ecma.ch

IW ECMA-156.DOC 23-06-99 09,57

Brief History

This Standard is one of a series of ECMA standards defining services and signalling protocols applicable to Private Telecommunication Networks (PTNs). The series uses the ISDN concepts as developed by the ITU-TS and is also within the framework of standards for open systems interconnection as defined by ISO.

This particular Standard defines the keypad stimulus signalling protocol for use at the S reference point in support of basic circuit mode services.

Differences compared to the corresponding standard for public ISDNs (coincident S and T reference points) and the impact of these on terminal interchangeability can be found in annex B.

This Standard is based upon the practical experience of ECMA member companies and the results of their active and continuous participation in the work of ISO/IEC JTC1, ITU-TS, ETSI and other international and national standardization bodies. It represents a pragmatic and widely based consensus.

Compared to the 1st Edition of Standard ECMA-156 (published by ECMA in June 1991), various changes have been made in order to achieve alignment with ETS 300 190 (which is based on the 1st Edition of ECMA-156 but modified during Public Enquiry and published by ETSI in December 1992).

Accepted as 2nd Edition of Standard ECMA-156 by the General Assembly of June 1993.

Table of contents

.

1 Scope

This Standard defines the Keypad signalling protocol for the purpose of supplementary service control at an interface at the S reference point between a Terminal Equipment (TE) and a Private Telecommunication Network (PTN).

The Keypad protocol operates in conjunction with the signalling protocol specified in ETS 300 192. It is based on use of the Keypad facility and Display information elements. While the procedures associated with keypad invocation are specified in this Standard, the allocation of the access codes used to request or indicate a supplementary service is outside the scope of this Standard.

This Standard is applicable to TEs which are intended for connection to PTNs, and is also applicable to the user accesses of PTNs.

2 Conformance

In order to conform to this Standard, a PTNX shall satisfy the requirements identified in the Protocol Implementation Conformance Statement (PICS) proforma in C.3 of annex C.

In order to conform to this Standard, a TE shall satisfy the requirements identified in the Protocol Implementation Conformance Statement (PICS) proforma in C.4 of annex C.

3 References

ETS 300 102-1	Integrated Services Digital Network (ISDN); User-network interface layer 3; Specification for basic call control; Application of CCITT Rec. Q.930/I.450 and Rec. Q.931/I.451 (1990)
ETS 300 192	Private Telecommunication Network (PTN); Signalling protocol at the S-reference point; Circuit mode basic services (1992)
ENV 41007-1	Definition of terms in private telecommunication networks, Part 1: Definition of general terms (1991)
CCITT Rec. I.112	Vocabulary of terms for ISDNs (1988)
CCITT Rec. T.50	International alphabet No. 5 (1984)

4 Definitions

The specific terminology defined in ENV 41007-1 and CCITT Rec. I.112 applies. If there is conflict, the definition in ENV 41007-1 shall take precedence.

When applying a clause of ETS 300 102-1 to the TE-PTN interface, the term "user" shall be interpreted as "TE", and the term "network" shall be interpreted as "PTN".

For the purpose of this Standard, the following additional definition applies:

4.1 Access code

A sequence of characters from the set specified in CCITT Rec. T.50 used to invoke or provide information for a supplementary service.

5 List of acronyms

ISDN	Integrated Services Digital Network
PICS	Protocol Implementation Conformance Statement
PTN	Private Telecommunication Network
PTNX	Private Telecommunication Network Exchange
TE	Terminal Equipment

6 Keypad protocol

The text in this clause is based on clause 4 of CCITT Rec. Q.932. Differences are indicated by emboldening.

6.1 General

This generic procedure is based on the use of:

- the Keypad facility information element by the **TE** to invoke a supplementary service from the **PTN** by providing access codes either en-bloc or overlap sending; and
- the Display information element by the **PTN** to give an indication to the local or remote user regarding a supplementary service being invoked. This procedure may be complemented in the case of calls where the Bearer capability information element in the SETUP message is coded indicating "speech" or "3,1 kHz audio", by the provision of in-band tones and/or announcements to the user.

The Keypad protocol is based on the use of the Keypad facility information element within the INFORMATION or SETUP messages during the establishment, active and clearing phases of a call.

6.2 Messages and information elements used in the Keypad protocol

The following messages and information elements shall be used in the Keypad protocols:

- **The Keypad facility information element may be included in the SETUP and INFORMATION messages in the TE to PTN direction. This extends these messages beyond their specification in ETS 300 192.**
- **The Display information element may be included in any basic call control message sent from the PTN to the TE. This extends these messages beyond their specification in ETS 300 192.**
- **The Signal information element may be included in any of the following basic call control messages of ETS 300 192 in PTN to TE direction: ALERTING, CONNECT, CONNECT ACKNOWLEDGE, DISCONNECT, INFORMATION, RELEASE, RELEASE COMPLETE, SETUP and SETUP ACKNOWLEDGE.**

6.3 Coding of the information elements

6.3.1 Keypad facility information element

Clause 4.5.17 of prETS 300 102-1 shall apply.

6.3.2 Display information element

Clause 4.5.15 of prETS 300 102-1 shall apply.

6.3.3 Signal information element

Clause 4.5.27 of prETS 300 102-1 shall apply.

6.4 Elements of procedure

The Keypad protocol includes the following aspects:

1) the Keypad protocol may be used during the call establishment, active and clearing phases of a call to invoke supplementary services. Supplementary service information **from the TE to the PTN shall be** conveyed in Keypad facility information elements sent in either SETUP or INFORMATION messages;

2) supplementary service information **shall** be sent from the **TE** to the **PTN** either en-bloc or using overlap sending;

3) When overlap sending is used, the PTN may prompt the user at certain stages to send further required information. Prompting can be by means of the Display information element and/or, for applicable bearer capabilities, e.g. "speech", by in-band tones or announcements.

Whether prompting occurs or not is supplementary service and implementation dependent.

NOTE 1

Additional procedures for handling the Display information by the TE (especially in case of limited display capabilities) are implementation dependent.

6.5 Procedures at the invocation interface

6.5.1 En-bloc sending of access codes from the TE to the PTN

En-bloc sending of supplementary service information **shall be** accomplished by sending the "complete" supplementary service information in:

a) the SETUP message; or

b) the INFORMATION message, if the supplementary service is being invoked **during the overlap sending, active, disconnect indication, outgoing call proceeding or call delivered state of a call**.

NOTE 2

Call states are specified in subclause 6.4 of ETS 300 192.

The term "complete" supplementary service information **shall** mean that sufficient supplementary service information is sent to the **PTN** to specify a service without any additional **PTN** prompting being required. The **PTN** determines that the supplementary service information is "complete" by either:

– analysis of the information contents of the Keypad facility information element; or

– the presence of a sending complete information element indication (see **subclause 8.1 of ETS 300 192**).

If the **PTN** determines that the information contents of the Keypad facility information element are invalid, the **PTN** shall use the error procedures specified in **subclause 6.5.5**.

If the **PTN** determines that the information contents of the Keypad facility information element are valid and the user is allowed to invoke the requested service, the **PTN** shall respond using the procedures as specified in **subclause 6.5.3**.

6.5.2 Overlap sending of access codes from the TE to PTN

Overlap sending of supplementary service information is the sending of the "complete" supplementary service information (see **subclause 6.5.1** for the definition of complete) segmented such that a number of **ETS 300 192** messages are used to convey the "complete" supplementary service information. **The messages shall be either:**

a) a SETUP message **followed by** one or more INFORMATION messages; or

b) two or more INFORMATION messages.

For case a), normal overlap sending procedures, as specified in **subclause 8.1 of ETS 300 192**, shall be used.

For case b), **INFORMATION messages shall be sent only in states outgoing call proceeding, call delivered, active and disconnect indication. Overlap sending may commence in one of these states and continue in another of these states**. The transmission or receipt of INFORMATION messages shall not cause any change to the **ETS 300 192** call state.

NOTE 3

This also includes the possibility of omitting supplementary service information from the SETUP message, but including it in two or more INFORMATION messages during the overlap sending state.

The **PTN** shall respond to valid supplementary service information with one of the **PTN** responses as described in **subclause 6.5.3**. If the supplementary service information is invalid, then the error procedures as described in **subclause 6.5.5** shall apply.

6.5.3 PTN response to user requests

After receiving information from the **TE, the action taken by the PTN is supplementary service and implementation dependent. Possibilities include the following**:

1 Clear the call reference via the normal call clearing procedures (see **subclause 8.3 of ETS 300 192)** including the appropriate Cause and optional Display information element(s).

2 Send a CALL PROCEEDING message to the TE. This **PTN** response is only applicable **in case a) of subclause 6.5.1 and case a) of subclause 6.5.2.**

3 Send an INFORMATION or clearing message to the **TE** including a Display **and/or Signal** information element containing an appropriate response to the request for a supplementary service. The receipt of an INFORMATION message by the **TE** shall not cause any change to the **ETS 300 192** call state.

NOTE 4

The TE, on receiving the Display or Signal information element in any of the specified messages in subclause 6.2, may either use it in providing notifications to the user or discard it.

4 Prompt the user for more information using the procedures as specified in **subclause 6.5.4**.

NOTE 5

*This further information **may** be additional, or new information input by the user or another attempt by the user to re-input the original information correctly.*

5 Wait for more overlap information.

NOTE 6

*The allowed waiting period is governed by **ETS 300 192** timer T302 in the case of information sent in the overlap sending state. **The use of timers in other states is supplementary service and implementation dependent.***

6.5.4 PTN prompting and in-band tone/announcement control

The **PTN** may prompt the user for more information or may provide in-band or announcements regardless of whether or not the Keypad facility information element was included in the initial SETUP message. The **PTN determines** whether prompting and/or in-band tone or announcement control should occur. Possible factors governing the provision of prompting and in-band information are:

- the nature of the supplementary service;
- the type of interface; and
- the current status or progress of the supplementary service request.

Simultaneously with the application of in-band tones or announcements, the **PTN** may send a PROGRESS message containing a Progress indicator information element with the progress description value No. 8 (In-band information or appropriate pattern now available).

The **PTN** may, in addition to an audible prompt (i.e. tone or announcement), request information from the user by sending an INFORMATION message which contains the Display and/or Signal information elements (but not the Called party number information element).

The **PTN** may prompt the user more than once (i.e. multiple stages may occur), but the **PTN** should not prompt the user again prior to the user's response, or when in the overlap sending state, prior to the expiry of timer T302. This is to avoid situations where a user's response could be related to two unacknowledged **PTN** prompts.

6.5.5 Error conditions and treatment

An error condition exists in the following circumstances:

a timer T302 expires and complete information has not been received;

b information containing a "sending complete" indication indicating en-bloc sending, but the user information sent is not complete;

c information received by the **PTN** (complete or incomplete) is invalid. Invalid information is information sent with incorrect format or containing invalid facility identifier or parameters codes;

d the user attempts to invoke a supplementary service to which the user has not subscribed or to which the user is not allowed access.

The PTN shall take one of the following actions for supplementary service **invocation according to case a.) of subclause 6.5.1 and case a.) of subclause 6.5.2**:

i) In-band tones or announcements are applied. If a SETUP ACKNOWLEDGE message has not already been sent, the **PTN sends** a CALL PROCEEDING message to the user, indicating the B-channel to be used and

including the Progress indicator information element with progress description value No. 8 (In-band information or appropriate pattern now available).

If a SETUP ACKNOWLEDGE message has already been sent, the **PTN sends** a PROGRESS message to the user, including the Progress indicator information element with progress description value No. 8 (In-band information or appropriate pattern now available).

The **PTN** may prompt the user using the procedures as specified in **subclause 6.5.4** to re-input the required information. Otherwise, after the in-band tone or announcement has been applied, the call reference **is** cleared by either the **TE** initiating call clearing or the **PTN** initiating call clearing at the expiry of a tone or announcement timer **according** to the clearing procedures in **subclause 8.3 of ETS 300 192**.

ii) No in-band tones or announcements are applied. The call reference **is** cleared by the **PTN** initiating call clearing procedures as specified in **subclause 8.3 of ETS 300 192**.

iii) Other implementation or supplementary service dependent actions.

The PTN shall take one of the following actions for supplementary service **invocation according to case b.) of subclause 6.5.1 and case b.) of subclause 6.5.2**:

i) In-band tones or announcements are applied. The **PTN prompts** the user using the procedures as specified in **subclause 6.5.4** to re-input the required information. Otherwise, depending on the specific supplementary service being invoked, the call **may** either be cleared or remain in the same state. In the case where the call is cleared, clearing **may** occur after the in-band tone or announcement has been applied. Clearing **may** occur either by the **TE** initiating call clearing or the **PTN** initiating call clearing at the expiry of a tone or announcement timer **according to** the clearing procedures specified in **subclause 8.3 of ETS 300 192**.

ii) No in-band tones or announcements are applied. Depending on the specific supplementary service being invoked, the call **is** either cleared or remains in the same state. In the case where the call is cleared, the call reference **may** be cleared by the **PTN** initiating call clearing using the procedures as specified in **subclause 8.3 of ETS 300 192**. If the call remains in the same call state, the user may be informed that the supplementary service request was unsuccessful by the **PTN** sending an INFORMATION message in accordance with **subclause 6.5.3** item 3).

iii) Other implementation or supplementary service specific actions.

6.6 Sending of unsolicited information to the user

The Display and/or Signal information elements may be used for the purpose of providing notifications **to the user from the PTN. The INFORMATION message shall be used, if no other message is appropriate.**

NOTE 7

The TE, on receiving the Display or Signal information element in any of the specified messages in subclause 6.2, may either use it in providing notifications to the user or discard it.

Annex A

(informative)

Illustration of the keypad protocol

The text in this annex is based on appendix I.2 of CCITT Rec. Q.932. Differences are indicated by emboldening.

The examples show the application of the Keypad protocol using the Keypad facility and Display information elements. It should be noted that the Keypad protocol does not necessarily allow a supplementary service to be supported to the same degree of functionality as the approach based on the Functional protocol. In addition, this protocol does not impose a need for the terminal to be aware of any states other than those required for basic call control. An objective of the Keypad protocol is to provide for the support of supplementary services in circumstances where a reduced level of functionality can be tolerated.

The **generic** example in figure A.1 illustrates a user supplementary service request using the Keypad protocol. The **PTN** associates the contents of the Keypad information element with the appropriate supplementary service. The user is shown to subsequently enter supplementary service parameters using the Keypad protocol. Supplementary service status information may be provided by the **PTN** in the Display information element. The **PTN** completes supplementary service processing and the **TE** is shown to clear the call reference. Alternatively, depending on the specific supplementary service request, a CALL PROCEEDING message might be returned by the **PTN** and the normal call processing procedures would continue.

The specific example in figure A.2 illustrates the support of a hold/retrieve function based on the use of INFORMATION messages for the conveyance of Keypad facility or Display information elements. An enquiry call is established through the conveyance of the called party address digits via a Keypad facility information element within INFORMATION messages. These address digits are sent after putting the existing call on hold through the transfer of a facility request via a Keypad facility information element within an INFORMATION message.

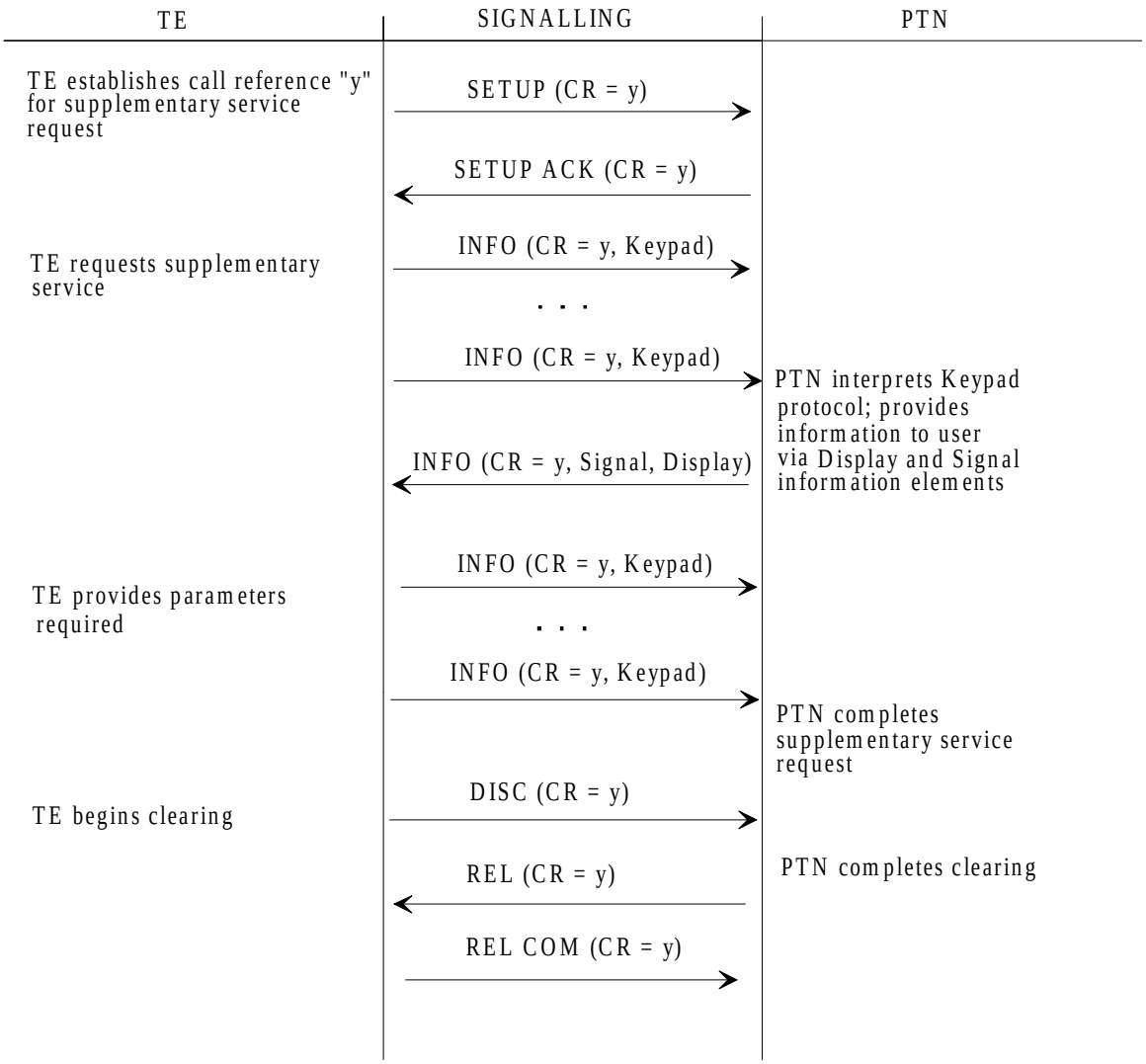
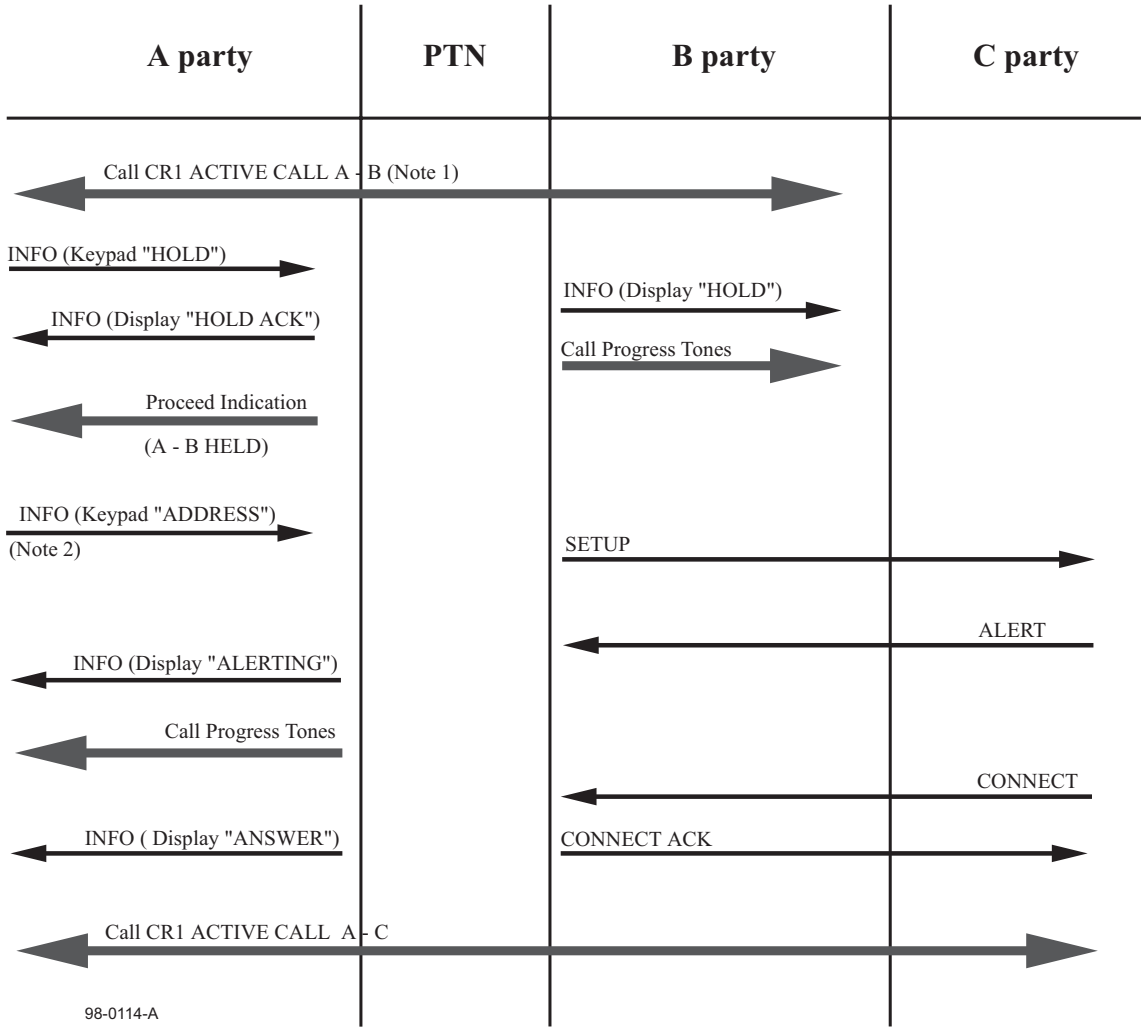


Figure A.1 - A generic example of the use of the Keypad protocol



NOTE 1

*The first call is established using the normal call establishment procedure specified in **ETS 300 192**.*

NOTE 2

*The same call reference as that of the active call is used to establish the enquiry call. The characteristics of the second call are assumed to be identical to the first call (e.g. same Bearer capability, High layer compatibility **and** Low layer compatibility information elements).*

Figure A.2 - Specific example of establishing a second call while holding the first one using the Keypad protocol

Annex B

(informative)

Relationship to corresponding standards for public ISDNs

The Keypad protocol for PTNs specified in this Standard complements and is compatible with the corresponding protocol for public ISDNs as specified by CCITT. There are no differences which will prevent terminal interchangeability between PTNs and public ISDNs, however terminal equipment designed for one network may be unable to access the full range of supplementary services available on other networks.

The differences between this Standard and the CCITT Rec. Q.932 Keypad protocol can be summarized as follows:

i) Clause 6.1: The sending of the Keypad information element is not specified in direction network to user in this Standard (option in § 4.1 of CCITT Rec. Q.932).

ii) Clause 6.2: The messages which may be used for the Display information element and the Signal information element are explicitly specified in this Standard.

iii) Clause 6.4: A clarification concerning the handling of the Display information element by the TE has been added in this Standard.

iv) Subclauses 6.5.1 and 6.5.2: The sending of the Keypad information element in the INFORMATION message from TE to PTN in the outgoing call proceeding and call delivered states is allowed in this Standard but not in CCITT Rec. Q.932 (§ 4.5.1.1 and § 4.5.1.2).

v) Subclause 6.5.3: The procedures for prompting the user for more information are "implementation dependent" in this Standard and "network dependent" in 4.5.2.1 of CCITT Rec. Q.932.

vi) Subclause 6.5.4: The information request procedure in annex B of CCITT Rec. Q.932 for prompting the user for additional information (using the Information request information element) is not specified in this Standard (option in § 4.5.2.2 of CCITT Rec. Q.932).

Detailed differences compared with the corresponding CCITT Rec. Q.932 for public ISDNs are highlighted throughout this Standard.

Annex C

(normative)

Protocol Implementation Conformance Statement (PICS) proforma

C.1 Introduction

The supplier of a protocol implementation which is claimed to conform to this Standard shall complete one of the following Protocol Implementation Conformance Statement (PICS) proformas. The PICS proforma in C.3 is for a PTNX. The PICS proforma in C.4 for a TE.

A completed PICS proforma is the PICS for the implementation in question. The PICS is a statement of which capabilities and options of the protocol have been implemented. The PICS can have a number of uses, including use:

- by a protocol implementor, as a check list to reduce the risk of failure to conform to the Standard through oversight;
- by the supplier and acquirer (or potential acquirer) of the implementation, as a detailed indication of the capabilities of the implementation, stated relative to the common basis for understanding provided by the Standard PICS proforma;
- by the user (or potential user) of the implementation, as a basis for initially checking the possibility of interworking with other implementation (note that, while interworking can not be guaranteed, failure to interwork can often be predicted from incompatible PICS);
- by a protocol tester, as the basis for selecting appropriate tests against which to asses the claim for conformance of the implementation.

C.2 Instructions for completing the PICS proforma

C.2.1 General structure of the PICS proforma

The PICS proforma is a fixed format questionnaire divided into subclauses each containing a group of individual items. Each item is identified by an item number, the name of the item (question to be answered) and the reference(s) to the clause(s) that specifies (specify) the item in the main body of this Standard.

The "Status" column indicates whether an item is applicable and if so whether support is mandatory or optional. The following terms are used:

m	mandatory (the capability is required for conformance to the protocol);
o	optional (the capability is not required for conformance to the protocol, but if the capability is implemented, it is required to conform to the protocol specifications);
o.<n>	optional, but support of at least one of the group of options labelled by the same numeral <n> is required;
x	prohibited;
c. <cond>	conditional requirement, depending on support for the item or items listed in condition <cond>;
<item>:m	simple conditional requirement, the capability being mandatory if item number <item> is supported, otherwise not applicable;
<item>:o	simple conditional requirement, the capability being optional if item number <item> is supported, otherwise not applicable.

Answers to the questionnaire items are to be provided either in the "Support" column, by simply marking an answer to indicate a restricted choice (Yes or No) on in the "Not Applicable" column (N/A).

C.2.2 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.

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.

C.2.3 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 requirements. No pre-printed answer will be found in the Support column for this. Instead, the supplier is required to write into the Support column 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 1

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.

C.3 PICS proforma for PTNX Implementation

C.3.1 Implementation identification

Supplier	
Contact point for queries about the PICS	
Implementation Name(s) and Version(s)	
Other information necessary for full identification, e.g. name(s) and version(s) for machines and/or operating systems; system name(s)	

NOTE 1

Only the first three items are required for all implementations; other information may be completed as appropriate in meeting the requirement for full identification.

NOTE 2

The terms Name and Version should be interpreted appropriately to correspond with a suppliers terminology (e.g. Type, Series, Model).

C.3.2 Protocol summary

Protocol version	1.0
Addenda Implemented (if applicable)	
Amendments Implemented	
Have any exception items been required (see C.2.3)?	No [ ] Yes [ ] (The answer Yes means that the implementation does not conform to this Standard)

Date of statement	

C.3.3 Procedures

Item	Question/feature	References	Status	N/A	Support
A1	Support of access of more than one digit	6.5	o		Yes [ ] No [ ]
A2	Receipt of access codes sent en-bloc	6.5.1	m		Yes [ ]
A3	Receipt of access codes sent using overlap procedures	6.5.2	A1:m	[ ]	Yes [ ]
A4	PTN responses to user requests	6.5.3	o		Yes [ ] No [ ]
A5	Sending of unsolicited information	6.6	o		Yes [ ] No [ ]

C.3.4 Information elements and messages

Item	Question/feature	References	Status	N/A	Support
B1	Receiving of Keypad facility information element in the SETUP and INFO messages	6.3.1, 6.2	m		Yes [ ]
B2	Sending of Display information element in one or more of the specified messages	6.3.2, 6.2	o		Yes [ ] No [ ]
B3	Sending of Signal information element in one or more of the specified messages	6.3.3, 6.2	o		Yes [ ] No [ ]

C.4 PICS proforma for TE implementation

C.4.1 Implementation identification

Supplier	
Contact point for queries about the PICS	
Implementation Name(s) and Version(s)	
Other information necessary for full identification, e.g. name(s) and version(s) for machines and/or operating systems; system name(s)	

NOTE 1

Only the first three items are required for all implementations; other information may be completed as appropriate in meeting the requirement for full identification.

NOTE 2

The terms Name and Version should be interpreted appropriately to correspond with a suppliers terminology (e.g. Type, Series, Model).

C.4.2 Protocol summary

Protocol version	1.0
Addenda Implemented (if applicable)	
Amendments Implemented	
Have any exception items been required (see C.2.3)?	No [ ] Yes [ ] (The answer Yes means that the implementation does not conform to this Standard)

Date of statement	

C.4.3 Procedures

Item	Question/feature	References	Status	N/A	Support
C1	En-bloc sending of access codes	6.5.1	o.1		Yes [ ] No [ ]
C2	Overlap sending of access codes	6.5.2	o.1		Yes [ ] No [ ]

C.4.4 Information elements and messages

Item	Question/feature	References	Status	N/A	Support
D1	Sending of Keypad information element in the SETUP and INFO messages	6.3.1, 6.2	m		Yes [ ]
D2	Receiving of Display information element in the specified messages	6.3.2, 6.2	m		Yes [ ]
D3	Receiving of Signal information element in the specified messages	6.3.3, 6.2	m		Yes [ ]

Annex D

(informative)

Other references

CCITT Rec. Q.932 (1988) - Generic Procedures for the Control of ISDN Supplementary Services

Free printed copies can be ordered from:
ECMA
114 Rue du Rhône
CH-1204 Geneva
Switzerland

Fax: +41 22 849.60.01
Email: documents@ecma.ch

Files of this Standard can be freely downloaded from the ECMA web site (www.ecma.ch). This site gives full information on ECMA, ECMA activities, ECMA Standards and Technical Reports.

ECMA
114 Rue du Rhône
CH-1204 Geneva
Switzerland

See inside cover page for obtaining further soft or hard copies.