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Contents

Foreword

This ETSI Technical Report (ETR) has been produced by the Terminal Equipment (TE) Technical Committee of the European Telecommunications Standards Institute (ETSI).

ETRs are informative documents resulting from ETSI studies which are not appropriate for European Telecommunication Standard (ETS) or Interim European Telecommunication Standard (I-ETS) status. An ETR may be used to publish information which is either of an informative nature, relating to the use or application of ETSs or I-ETSs, or which is immature and not yet suitable for formal adoption as an ETS or I-ETS.

Introduction

This ETR covers the minimum set of network requirements for CCITT Recommendation X.28 [1] indirect access through a Public Switched Telephone Network (PSTN) to a Packet Switched Public Data Network (PSPDN).

For the purposes of this ETR the 1988 version of CCITT Recommendation X.28 [1] is used.

Comments on the existing standards

CCITT Recommendation X.28 [1] contains various options and points that are left for further study, leading to different network implementations. For these reasons there is a difference for the various national PSPDN networks, between conforming to this CCITT Recommendation and being able to interwork. Many of these points are of great importance for the implementation of CCITT Recommendation X.28 [1] and subsequently for the definition of a proposed minimum set of requirements.

Also in CCITT Recommendation X.28 [1], some functions described in the text are not shown in the relevant figures or are not clearly defined. These functions are incorporated in figures 3 and 4 according to the text of CCITT Recommendation X.28 [1].

NOTE 1: See Annex A of this ETR for a detailed explanation.

ENV 41901 [20] is a functional profile definition for end systems dealing with CCITT Recommendations X.3 [2], X.28 [1] and X.29 [4] operation. However ENV 41901 [20] also describes interworking aspects between CCITT Recommendation X.28 [1] start-stop mode Data Terminal Equipment (DTE), CCITT Recommendation X.29 [4] packet mode DTEs and Packet Assembly/Disassembly facilities (PADs). Parts of this ENV could be used to specify the CCITT Recommendation X.28 [1] indirect access requirements for the PSPDN.

ENV 41901 [20] defines two profiles Y.11 for the CCITT Recommendation X.29 [4] operation and Y.12 for the start-stop mode operation. Parts of the Y.12 description are used in this ETR to describe the access to a PAD operated by a service operator. Parts of the Y.11 description are used to describe the interworking requirements for the PAD communicating with a packet mode DTE using CCITT Recommendation X.29 [4] procedures.

Profile Y.11 classifies the support of PAD parameters and values as shown in table 1.

Table 1: Y.11 classification of PAD parameters

CATEGORY	PARAMETERS	PARAMETER VALUES
Basic	CCITT (1980) essential	Mandatory
Basic with Option 1	CCITT (1984) essential + additional	Mandatory
Full	CCITT (1980) essential + additional	Mandatory
Full with Option 1	CCITT (1984) essential + additional	Mandatory + Optional

In this ETR reference is made to the 1988 versions of the relevant CCITT Recommendations. Direct reference to the categories described in table 1 are thus not possible. A network offering PAD access under the conditions set out in this ETR supports parameters 1 to 18 with their mandatory values (see Clause 6).

NOTE 2: The five profiles (Y.11 sub-options of ENV 41901 [20]) are mentioned in this ETR as optional standard profiles which could be supported by the PAD although these profiles were only defined in Y.11 for the packet mode DTE operation. This reference is a result of the GAP proposal in ETS 300 114 [21].

Implementation of CCITT Recommendation X.28 [1] in Europe

Due to historical reasons, and the reasons referred to above the implementation of CCITT Recommendation X.28 [1] differs widely in the various countries in Europe.

Some of the main differences are given below:

a) different access arrangements implemented (e.g. data signaling rates, provision for error correcting modems etc.);

b) not all the PAD parameters are implemented;

c) confusion about whether conformance to standard profiles of CCITT Recommendation X.28 [1] (Simple and Transparent) means the same for all implementations. In some countries there are deviations in some parameters from those specified in the Recommendation profiles;

d) not all PAD commands and service signals are implemented;

e) the same procedures are not implemented, e.g. in some networks there is a service request signal implemented while in others there is not;

f) the same range of facilities are not offered.

1 Scope

This ETR aims to propose a minimum set of access requirements for the PSPDN X.28/indirect access through PSTN in order to ensure equivalent offerings and full interconnectivity between the different networks within the European Community. The current situation about the implementation of CCITT Recommendation X.28 [1] in Europe has been taken into account in this ETR.

The cases where the CCITT Recommendation X.28 [1] permits various options and the points that are left for further study, leading to different network implementations, have also been taken into account.

For the issues which are not explicitly mentioned in this ETR, concerning CCITT Recommendation X.28 [1] indirect access to PSPDN (through PSTN), CCITT Recommendation X.28 [1] applies .

In this ETR references are made to other documents. When in these reference documents there are options, these options are considered as "NETWORK OPTIONS" except if otherwise stated.

NOTE: This ETR makes no provision for the PSPDN to establish a PSTN call path to Data Terminal Equipment (DTE).

2 References

For the purposes of this ETR, the following references apply.

[1] CCITT Recommendation X.28 (1988): "DTE/DCE interface for a start-stop mode data terminal equipment accessing the packet assembly/disassembly facility (PAD) in a public data network situated in the same country".

[2] CCITT Recommendation X.3 (1988): "Packet assembly/disassembly facility (PAD) in a public data network".

[3] CCITT Recommendation X.25 (1988): "Interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) for terminals operating in the packet mode and connected to the public data networks by dedicated circuit".

[4] CCITT Recommendation X.29 (1988): "Procedures for the exchange of control information and user data between a packet assembly/disassembly (PAD) facility and a packet mode DTE or another PAD".

[5] CCITT Recommendation X.32 (1988): "Interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) for terminals operating in the packet mode and accessing a packet switched public data network through a public switched telephone network or an integrated services digital network or a circuit switched public data network".

[6] CCITT Recommendation X.4 (1988): "General structure of signals of International Alphabet No. 5 code for character oriented data transmission over public data networks".

[7] CCITT Recommendation X.75 (1988): "Packet-switched signalling system between public data networks providing data transmission services".

[8] CCITT Recommendation X.96 (1988): "Call progress signals in public data networks".

[9] CCITT Recommendation X.121 (1988): "International numbering plan for public data networks".

[10] CCITT Recommendation V.21 (1988): "300 bits per second duplex modem standardized for use in the general switched telephone network".

[11] CCITT Recommendation V.22 (1988): "1200 bits per second duplex modem standardized for use in the general switched telephone network and on point-to-point 2-wire leased telephone-type circuits".

[12] CCITT Recommendation V.22 bis (1988): "2400 bits per second duplex modem using the frequency division technique standardized for use on the general switched telephone network and on point-to-point 2-wire leased telephone-type circuits".

[13] CCITT Recommendation V.24 (1988): "List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE)".

[14] CCITT Recommendation V.28 (1988): "Electrical characteristics for unbalanced double-current interchange circuits".

[15] CCITT Recommendation V.25 (1988): "Automatic answering equipment and/or parallel automatic calling equipment on the general switched telephone network including procedures for disabling of echo control devices for both manually and automatically established calls".

[16] CCITT Recommendation V.25 bis (1988): "Automatic calling and/or answering equipment on the general switched telephone network (GSTN) using the 100-series interchange circuits".

[17] CCITT Recommendation V.42 (1988): "Error-correcting procedures for DCE using asynchronous-to-synchronous conversion"

[18] CCITT Recommendation V.54 (1988): "Loop test devices for modems".

[19] CCITT Recommendation T.50 (1988): "International Alphabet No. 5"

[20] CEN/CENELEC ENV 41901 (June 1987): "X.28 character-mode access via a telephonic circuit or data circuit to a PAD".

[21] ETS 300 114 (1991): "Attachments to the Public Switched Telephone Network (PSTN); Basic attachment requirements for modems standardized for use on the PSTN (Candidate NET 20)".

[22] ETS 300 115 (1991): "Attachments to the Public Switched Telephone Network (PSTN); Category II attachment requirements for 300 bits per second duplex modems standardized for use on the PSTN (Candidate NET 21)".

[23] ETS 300 116 (1991): "Attachments to the Public Switched Telephone Network (PSTN); Category II attachment requirements for 1 200 bits per second duplex modems standardized for use on the PSTN (Candidate NET 22)".

[24] ETS 300 117 (1991): "Attachments to the Public Switched Telephone Network (PSTN); Category II attachment requirements for 2 400 bits per second duplex modems standardized for use on the PSTN (Candidate NET 23)".

[25] ETS 300 118 (1990): "Attachments to the Public Switched Telephone Network (PSTN); Category II requirements for 1 200 bits per second half-duplex and 1 200/75 asymmetrical duplex modems standardized for use on the PSTN (Candidate NET 24)".

[26] ISO 2110 (1989): Information technology - Data communication - 25-pole DTE/DCE interface connector and contact number assignments.

3 Definitions and abbreviations

3.1 Definitions

For the purposes of this ETR, the following definitions apply:

Packet Assembly/Disassembly facility (PAD): the logical entity that is capable of using logical connections via a CCITT Recommendation X.25 [3] packet level protocol or ISO 8208 packet level entity to a packet mode DTE supporting application services and to a start-stop mode DTE according to CCITT Recommendations X.3 [2], X.28 [1] and X.29 [4].

Packet mode DTE: the logical entity that is capable of using logical connections via a CCITT Recommendation X.25 [3] packet level protocol or ISO 8208 packet level entity to an application according to CCITT Recommendations X.3 [2] and X.29 [4].

Start-stop mode DTE: the logical entity that is capable of using a connection to a PAD according to CCITT Recommendation X.28 [1].

PAD profile: any combination of parameter values of the PAD parameters (each parameter shall have one of its permitted values), constitute a PAD profile.

NOTE: There is a distinction between this use of the word "profile" and its use in describing option selection by a functional standard.

PAD standard profile: any PAD profile that can be invoked by a reference name.

PAD initial profile: the PAD profile with which a PAD operates when a connection is first established between the start-stop mode DTE and the PAD. This may be set as a result of a CCITT Recommendation X.28 [1] service request signal, or by default.

PAD default profile: the PAD profile assumed by a PAD if no specific PAD initial profile is set as a result of a PAD service request signal.

Modem: a functional unit that modulates and demodulates signals in order to enable digital data to be transmitted over analogue transmission facilities.

Internal modem: a modem which is physically incorporated in a terminal equipment and which takes its electrical power supply from the terminal.

Different types of internal modems are defined: built-in, plug-in and integrated modems.

Built-in modem: a functionally separate internal modem which is mechanically combined with a terminal.

Plug-in modem: a physically and functionally separate internal modem which is interchangeable from a terminal.

Integrated modem: an internal modem which is functionally and physically merged with the terminal.

Service Operator: the entity that runs a PSPDN.

User: the human operator of a start-stop mode DTE or equipment which may simulate the operator.

3.2 Abbreviations

For the purposes of this ETR, the following abbreviations apply:

CCITT	Comité Consultatif International Télégraphique et Téléphonique
CEC	Commission of the European Communities
CEN	Comité Européen de Normalisation
CENELEC	Comité Européen de Normalisation Electrotechnique
CEPT	Conférence Européenne des Administrations des Postes et des Télécommunications
DCE	Data Circuit-terminating Equipment
DTE	Data Terminal Equipment
ETR	ETSI Technical Report
ETS	European Telecommunication Standard
ETSI	European Telecommunications Standards Institute
EN	European Standard (Norme Européene)
ENV	European prestandard
NPI	Numbering Plan Indicator
NTP	Network Termination Point
NUI	Network User Identification
PAD	Packet Assembly/Disassembly facility
PDN	Public Data Network
PNIC	Private data Network Indicator Code
PSPDN	Packet Switched Public Data Network
PSTN	Public Switched Telephone Network
TOA	Type Of Address

4 Access arrangements

4.1 Network Termination Points (NTPs)

There are two Network Terminations Points (NTPs) defined as: NTP1 and NTP2.

NTP1 is located at the interface between the DTE and the modem if the modem is provided by the service operator (see figure 1).

NTP2 is located at the interface between the modem and the PSTN if the modem is not provided by the service operator or if the modem is internal (see figure 2).

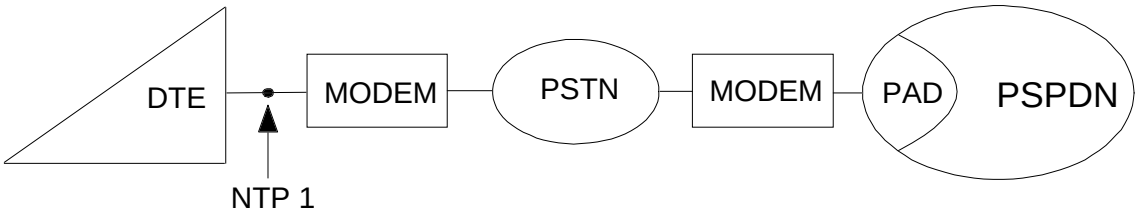


Figure 1: Network Termination Point 1

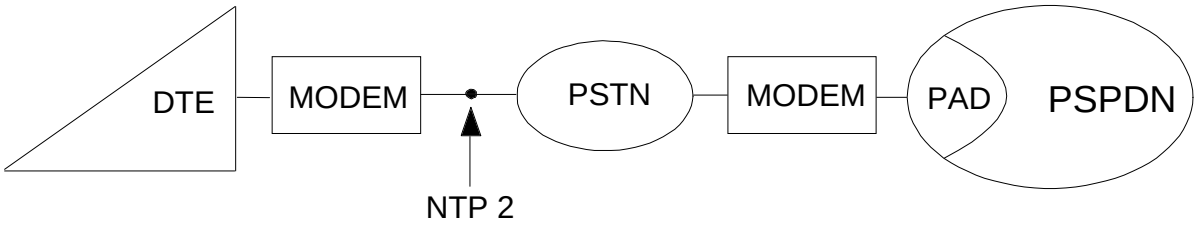


Figure 2: Network Termination Point 2

NOTE: In figures 1 and 2, the modems represent functional units which, in some cases, may be integrated with the start-stop mode DTE or the network accordingly.

4.2 DTE/modem interface requirements

DTE/modem interface requirements are specified in the case of NTP1. Only the requirements on the modem side are relevant for this ETR.

The interchange circuits are defined in CCITT Recommendation V.24 [13]. The essential interchange circuits to be provided by the modem are specified in CCITT Recommendations V.21 [10], V.22 [11] and V.22 bis [12] depending on the bit rate at the interface. Clamping of circuit 104 should be implemented in accordance with section 4.3 of CCITT Recommendation V.24 [13].

The electrical characteristics of the interchange circuits should conform to CCITT Recommendation V.28 [14].

The connector and pin assignment plan should conform to ISO 2110 [29].

The bit rate is either 300, 1 200 or 2 400 bit/s. The operation is full duplex.

NETWORK OPTIONS

Higher bit rates may also be offered by some networks.

4.3 Modem requirements

Requirements for the modem close to the PAD are specified in the case of NTP2.

The modem close to the PSPDN should conform to all of the following requirements:

- ETS 300 115 [22] as far as all of the following modes of operation/use are concerned:
  - 300 bit/s, answer mode.
- ETS 300 116 [23] as far as the following modes of operation/use are concerned:
  - 1 200 bit/s, asyncronous (10 bits/char), answer
- ETS 300 117 [24] as far as both of the following modes of operation/use are concerned:
  - 2 400 bit/s, asynchronous (10 bits/char), answer;
  - 1 200 bit/s, asynchronous (10 bits/char), answer

NETWORK OPTIONS

Where it is intended to provide other bit rates, other types of modems may also be used.

4.4 Setting up the access information path

4.4.1 PSTN numbers

The service operator should arrange it so that the access information path to the PAD can be established using the numbering and call set-up procedures required by the PSTN service operator (see Annex D).

4.4.2 DTE/modem operation

The modems should allow for establishing the access information path in accordance with CCITT Recommendation V.25 [15] for a manual data station calling an automatic answering station.

The mechanism for echo suppressor disablement may not be implemented in some national networks where the access information path does not include echo suppressors.

Subsequent to the completion of the above, both DTE and modem should transmit binary 1 on circuits 103 and 104, or on the equivalent internal circuits.

NETWORK OPTIONS

In case of NTP1, it is preferred that the modem should allow for an automatic calling mode operation according to CCITT Recommendation V.25 bis [16] procedures.

4.5 Disconnecting the access information path

4.5.1 Disconnecting by the DTE

In the case of NTP1, the access information path should be disconnected by:

a) reversion of the data circuit to the voice mode;

b) the DTE turning circuit 108/1 or 108/2 OFF for a period greater than Z. The value of Z is 50 ms.

In the case of NTP2, the access information path should be disconnected by clearing the PSTN communication.

4.5.2 Disconnecting by the network

In the case of NTP1, disconnection of the access information path will be indicated by the modem turning circuits 106 and 109 OFF, while circuit 108 is ON.

NOTE: Access information path clear indication to the DTE is not signalled by circuit 107 OFF. Not all DTEs allow circuit 107 to be turned OFF if circuit 108 has not previously been turned OFF.

In the case of NTP2, disconnection of the access information path should be indicated by clearing the PSTN communication.

4.6 Error correcting capabilities

NETWORK OPTIONS

Service operators may use modems with error correcting capabilities.

The flow control mechanism utilized by the modems is not covered by this ETR. Implementors are referred to CCITT Recommendation V.42 [17].

NOTE: CCITT Recommendation V.42 [17] specifies two error-correction procedures. Compliance with the Recommendation requires that both methods be implemented in the modem.

4.7 Loops

The definitions of test loops and the principles of maintenance testing using test loops are provided in CCITT Recommendation V.54 [18].

Additional information on loops 2 and 3 can be found in CCITT Recommendations V.22 [11] and V.22 bis [12].

In the case of NTP1, the modem should provide for the manual activation of loop 3.

NETWORK OPTIONS

In the case of NTP1, the modem may also allow for the automatic activation of loop 3.

In the case of NTP2, manual or automatic activation of loop 2 in the modem close to the PAD may be possible.

5 PAD command and service signals

5.1 PAD command signals

The PAD should recognize PAD command signals (direction start-stop mode DTE to PAD) for:

- the establishment and clearing of a virtual call;
- the selection of a standard profile;
- the selection of individual PAD parameter values;
- requesting the current values of PAD parameters;
- sending an interrupt;
- requesting the status of the circuit;
- resetting the virtual call.

The PAD command signals, transmitted by the start-stop mode DTE, activate actions at the PAD, which are described in CCITT Recommendation X.28 [1].

Four sets of PAD command signals are defined, one mandatory and three optional, as follows:

- PAD command signals which activate actions at the local PAD Basic set.

NETWORK OPTIONS

- PAD command signals which activate actions at the remote PAD;
- extended dialogue mode PAD command signals; and
- network specific PAD command signals.

5.1.1 PAD command signals which activate actions at the local PAD

The set of PAD command signals which activate actions at the local PAD is defined as the Basic set of PAD command signals. This Basic set is specified in table 2.

Table 2: The Basic set of PAD command signals

PAD command signals	Valid before virtual call set-up	Valid after escaping from data transfer state	Valid after escaping from connection-in-progress state
Selection	X		
Profile selection	X	X	
Set	X	X	
Set and read	X	X	
Read	X	X	
Clear request		X	X
Status	X	X	
Reset		X	
Interrupt		X	

The format of the PAD command signals included in the Basic set is given in section 3.5 of CCITT Recommendation X.28 [1].

5.1.2 Character code independent break signal

The character code independent break signal is provided by either the start-stop mode DTE or the PAD to convey signalling without loss of character transparency, when the start-stop mode DTE/PAD interface is in the data transfer or the connection in progress state.

The format of this signal is given in sections 1.2.2.6 and 3.1.2 of CCITT Recommendation X.28 [1].

The actions taken by the PAD on reception of this signal are determined by the values of parameter 7, as described in section 3.7 of CCITT Recommendation X.3 [2], and also in sections 3.2.1.5 and 4.11 of CCITT Recommendation X.28 [1].

NETWORK OPTIONS

When in the extended dialogue mode, if the PAD receives the break PAD command signal, it should act as if it had received the above mentioned break signal (except of escaping from the data transfer state).

5.1.3 PAD command signals which activate actions at the remote PAD

NETWORK OPTIONS

The start-stop mode DTE may change the values of one or more parameters of a remote PAD, or cause it to clear, by transmitting to the local PAD the PAD command signals included in table 3.

The PAD command signals for the remote PAD are only valid, when transmitted after escaping from the data transfer state.

Table 3: Remote PAD command signals

PAD command signals	Valid before virtual call set-up	Valid after escaping from data transfer state	Valid after escaping from connection-in-progress state
Remote set and read		X	
Remote read		X	
Invitation to clear		X	

The format of these PAD command signals is given in section 3.5 of CCITT Recommendation X.28 [1].

5.1.4 Extended dialogue mode PAD command signals

NETWORK OPTIONS

When in the extended dialogue mode, the PAD may accept additional PAD command signals. These signals are included in table 4.

These additional PAD command signals are transmitted by the start-stop mode DTE for:

- requesting the action associated with the break signal;
- indicating a Network User Identification (NUI) prior to establishing calls, or terminating the use of it;
- selecting a language for PAD service signals;
- requesting explanatory information on PAD command signals, PAD parameters, standard profiles, etc.

The operation of the PAD in this mode is determined by the appropriate value of parameter 6.

Table 4: PAD command signals in the extended dialogue mode

PAD command signals	Valid before virtual call set-up	Valid after escaping from data transfer state	Valid after escaping from connection-in-progress state
Break		X	
Help	X	X	
Language	X	X	
NUI on	X		
NUI off	X		

The formats of all PAD command signals in the extended dialogue mode are given in section 5 of CCITT Recommendation X.28 [1], while the keywords are given in table 9 of CCITT Recommendation X.28 [1].

5.1.5 Network specific PAD commands

NETWORK OPTIONS

Some PADs may optionally accept network specific commands. With these signals, the PAD may recognize the type of the terminal, identify the user, activate a standard profile, etc. The format of these signals is network dependent.

5.1.6 Editing PAD command signals

The start-stop mode DTE may edit the PAD command signals before they are actioned by the PAD, by using the procedures in section 3.6 of CCITT Recommendation X.28 [1].

5.2 PAD service signals

PAD service signals (direction PAD to DTE) are provided to:

- transmit call progress signals to the calling DTE;
- acknowledge the PAD command signals;
- transmit to the start-stop mode DTE, information regarding the PAD operation.

Three sets of PAD service signals are defined, the Basic set, the Supplementary set and the Network specific set.

Tables 5 and 6 of this ETR contain the service signals of the Basic and the Supplementary set correspondingly. The information content of these signals is summarized in Annex A, table A-2 of CCITT Recommendation X.28 [1].

The formats of PAD service signals, except the network specific, are given in section 3.5 of CCITT Recommendation X.28 [1].

5.2.1 Basic set of PAD service signals

The Basic set of PAD service signals is presented in table 5.

Table 5: Basic set of PAD service signals

PAD identification
Indication of call connected
Indication that a PAD command signal is in error
Response to read, set and read PAD command signals, and to set PAD command signal if at least one parameter is invalid
Response to status PAD command signal, when a call has been established
Response to status PAD command signal, when a call is not established
Reset indication
Clear indication
Clear confirmation
Acknowledgement
Indication of line delete function completed, for printing terminals
Indication of character delete function completed, for printing terminals

The format of the PAD service signals included in the Basic set is given in section 3.5 of CCITT Recommendation X.28 [1].

5.2.2 Supplementary set of PAD service signals

NETWORK OPTIONS

In addition to the Basic class of PAD service signals, a Supplementary set of PAD service signals is defined. The Supplementary set is shown in table 6.

Table 6: Supplementary set of PAD service signals

Indication that a page wait condition has occurred
Indication of character delete function completed, for video terminals (NOTE)
Indication of reselection function being in progress
Prompt signal
Indication of remote PAD parameter settings
NOTE: Repetition of this signal consists also the standard format of the indication of line delete function completed PAD service signal for video terminals.

The standard format of the PAD service signals included in the Supplementary set is given in section 3.5 of CCITT Recommendation X.28 [1].

5.2.3 Network specific PAD service signals

NETWORK OPTIONS

Some PADs may optionally transmit network specific PAD service signals to provide additional information to the start-stop mode DTE, e.g. for parity errors. The format of these signals is network dependent.

5.2.4 Cause and diagnostic field in PAD service signals

The format of the reset indication and clear indication PAD service signals provides for a cause field.

The format of the cause field is as represented in tables 7 and 8.

Table 7: Cause field in reset indication PAD service signal

<Cause>	Explanation
D T E	Reset by remote DTE
E R R	Local procedure error
N C	Network congestion
R P E	Remote procedure error

Table 8: Cause field in clear indication PAD service signal

<Cause>	Explanation
O C C	Number busy
N C	Network congestion
I N V	Invalid facility requested
N A	Access barred
E R R	Local procedure error
R P E	Remote procedure error
N P	Number not assigned
D E R	Number out of order
P A D	Call cleared by remote request (NOTE)
D T E	Call cleared by remote device
R N A	Reverse charging refused
NOTE: A remote request is considered to be: a) an invitation issued from the local DTE to the remote PAD to clear; b) an invitation issued from the remote DTE to the local PAD to clear.	

NETWORK OPTIONS

The format of the reset indication and clear indication PAD service signals provides also for diagnostic field. The format of the diagnostic field is as defined in sections 3.5.7 and 3.5.17.1 of CCITT recommendation X.28 [1] correspondingly, while the coding of this field is defined in table E-1 of CCITT Recommendation X.25 [3].

The text that should follow when the PAD is operating in the extended dialogue mode is defined in tables 5 and 6 of CCITT Recommendation X.28 [1].

Some networks may additionally implement table 9 for the cause field of the clear indication PAD service signal

Some networks may additionally implement specific causes and diagnostic codes for the reset indication and clear indication PAD service signals.

Table 9: Additional formats of the cause field in clear indication PAD service signal

<Cause>	Explanation
I D	Incompatible destination
S A	Ship cannot be contacted
F N A	Fast select refused
R O O	Cannot be routed

6 PAD internal variables relating to CCITT Recommendation X.28 indirect access

The indirect access of a start-stop mode DTE to the PAD depends on the values of:

- a set of PAD internal variables, usually called PAD parameters;

- a set of PAD constants (timers and number of retries).

6.1 PAD parameters and parameter values

The operation of the PAD depends on the values of a set of internal variables called PAD parameters. The current value of each PAD parameter defines the characteristics of its related function.

This set of parameters exists independently for each port of the PAD and provides for functions which concern:

- management of the procedures between the start-stop mode DTE and the PAD;

- management of the assembly and disassembly of packets;

- a number of additional functions related to the operational characteristics of the start-stop mode DTE.

The method for the control of these functions is specified in CCITT Recommendation X.28 [1] for the start-stop mode DTE and CCITT Recommendation X.29 [4] for the packet mode DTE or another PAD.

The set of PAD parameters and the meaning of each PAD parameter when assigned one of its possible values is defined in table 1 of CCITT Recommendation X.3 [2], (see also Annex E of this ETR). The necessary PAD command signals to set or read the values of PAD parameter are described in Clause 5 of this ETR.

In this ETR, two subsets of CCITT Recommendation X.3 [2] full set of PAD parameters are defined, the Basic set and the Supplementary set.

The Basic set includes the PAD parameters numbered from 1 to 18 with the CCITT Recommendation X.3 [2] mandatory values.

Networks conforming to this ETR should implement the Basic set of PAD parameters.

NOTE: Networks conforming to this ETR should at least implement the values 2, 3 and 12 of PAD parameter 11.

NETWORK OPTIONS

The Supplementary set includes the PAD parameters numbered from 19 to 22 with CCITT Recommendation X.3 [2] mandatory values.

6.1.1 PAD profiles

Any combination of PAD parameters, each parameter with one of its permitted values, constitute a PAD profile. A profile can be a standard one or established by the user setting one by one the proper values of each parameter.

6.1.1.1 PAD standard profiles

Any PAD profile that can be invoked by a reference name is called a standard profile.

A standard profile may be:

- provided by default by the network; or
- detected by the PAD with a service request signal transmitted by the start-stop mode DTE;
- activated with the profile selection PAD command signal transmitted by the start-stop mode DTE.

The standard profile determined upon initialization is called an initial standard profile.

If there is not any notification from the start-stop mode DTE for the preferable profile, the PAD will use, as an initial profile, a default standard profile.

For each set of PAD parameters (the Basic and the Supplementary) two standard profiles are defined the Simple and the Transparent. These profiles are specified in table 1 of CCITT Recommendation X.28 [1], (see also Annex E of this ETR).

Networks conforming to this ETR should allow the Simple or the Transparent standard profile to be obtained with the profile selection PAD command signal, when the start-stop mode DTE/PAD interface is in the proper state.

Networks conforming to this ETR, which implement one or more service request signals with profile recognition, should allow the Simple standard profile to be obtained by at least one of these signals.

NETWORK OPTIONS

Networks conforming to this ETR which do not implement the service request signal or implement the service request signal but without profile recognition, may offer by default as initial profile the Simple standard profile with the exception of parameter 6 which may differ.

Some networks allow the selection of additional standard profiles. These profiles are either network specific or standardized by other Standardization Organizations; e.g. Sub-options 1, 2, 3, 4, 5 of CEN/CENELEC ENV 41 901 [20] have been defined for the operation of packet mode DTEs but could also be implemented in the PAD as standard profiles. These profiles could be invoked with CCITT Recommendation X.28 [1] procedures with the use of a network defined identifier, or with a service request signal or even with a network specific PAD command signal.

6.1.1.2 Profile identifiers

The standard PAD profiles are invoked with a profile identifier, which consists of one or more alphanumeric characters, in the profile selection PAD command signal. The format of this signal is given in section 3.5.5 of CCITT Recommendation X.28 [1].

The profile identifiers for the Simple and the Transparent standard profiles are listed in table 10.

Table 10: Identifiers for Simple and Transparent standard profiles

Profile identifier	Standard profile
90	Simple standard profile
91	Transparent standard profile

NETWORK OPTIONS

Additional profile identifiers may be implemented by some networks.

6.1.1.3 PAD profiles after clearing or disconnecting the access information path procedures

a) In the case of clear condition without disconnecting the access information path, in the call establishment phase but prior to a virtual circuit being set-up, the current values of PAD parameters are left as they are.

b) In the case of clear condition without disconnecting the access information path, after the virtual circuit is set-up, the PAD will reset the parameters to the initial profile.

c) After disconnection of the access information path, the PAD will reset the parameters to those of the default profile.

6.2 PAD constants

6.2.1 Timers

Table B-1 of Annex B to CCITT Recommendation X.28 [1] defines for each PAD timer, if implemented, the interface state, the beginning and end of it, and the action to be taken when time-out expires.

NETWORK OPTIONS

In table 11 recommended values for each time-out are given.

Table 11: PAD timers and relative values

PAD Timer	Minimum value	Maximum value
Y (T10)	30 s	60 s
T (T11)	60 s	120 s
S (T12)	60 s	120 s
R (T13)	60 s	120 s
P (T14)	60 s	-
Q (T15)	60 s	120 s
Z (T31)	50 ms	

The maximum assembly timer delay period, as defined in section 4.4 (Data forwarding conditions) of CCITT Recommendation X.28 [1], when implemented, should be greater than 15 minutes.

6.2.2 Number of retries

NETWORK OPTIONS

In some networks the entry to the PAD waiting state is not permitted for an unlimited number of times before the PAD disconnects the access information path. This constant is designated by the letter N and its value should be greater than 3.

6.3 8-bit start-stop mode DTE access to the PAD

NETWORK OPTIONS (see Annex C)

If the network implements the service request signal and also the PAD parameter 21, there should be:

- parity recognition with the service request signal;
- transmission of PAD service signals, with the parity detected with the service request signal.

7 Facilities

The PAD should accept facilities requested by the start-stop mode DTE, when indicated to the PAD in the facility request block of the selection PAD command signal by the relevant facility request code.

Characters representing the facility request code should be sent, as defined in table 4 of CCITT Recommendation X.28 [1]. When more than one facility request code is to be sent, the character 2/12 (,) should be sent to separate the facility request codes. The character 2/13 (-) should be sent at the end of the facility request block.

If the PAD receives an invalid facility request code the PAD should perform PAD clearing in accordance with subclause 8.5.2 of this ETR.

The formats of the facility request signals should be as defined in section 3.5.15 of the CCITT Recommendation X.28 [1].

The facilities included in table 12, as follows, should be offered:

Table 12: Basic set of facilities

Network User Identification (NUI)
Reverse Charging

When accessing to the network and a NUI facility is not used, the reverse charging facility should be used.

NETWORK OPTIONS

For each user a unique NUI should be valid over the whole network (Network-wide NUI).

Some networks may also optionally offer the facilities included as shown in table 13:

Table 13: Supplementary set of facilities

Abbreviated addressing
Charging Information
Called address extension
Fast select with no restriction on response
Fast select with restriction on response
RPOA transit network selection
* Bilateral closed user group
Closed User Group
Closed User Group with outgoing access
* Throughput class negotiation
* Called line address modified notification
* Packet size negotiation
* Window size negotiation
Called DTE reselection prevention
NOTE: For the facilities marked with an asterisk (*), the format is not defined in CCITT Recommendation X.28 [1].

The formats of the facility request signals should be as defined in section 3.5.15 of CCITT Recommendation X.28 [1].

In some networks, users can subscribe to some facilities for a contractual period.

8 Procedures between the start-stop mode DTE and the PAD

In the following procedures, the references to states correspond to the state diagram in figure 3 except if otherwise stated.

NOTE: The symbol definitions of the state diagrams are those given in figure 3 of CCITT Recommendation X.28 [1]

The sequence of the events at the start-stop mode DTE/DCE interface during call establishment, data transfer and call clearing are those of figures 1a and 1b of CCITT Recommendation X.28 [1].

The details on the action expected of the start-stop mode DTE following receipt of a PAD service signal are defined in CCITT Recommendation X.96 [8].

8.1 Procedures for establishing the access information path

For the procedures for establishing the access information path see subclause 4.4.2 of this ETR.

8.1.1 Active link (state 1)

After the access information path has been established, the start-stop mode DTE and the PAD exchange binary 1 across the start-stop mode DTE/DCE interface and the interface is in the active link state.

8.1.2 Character interchange

The PAD should generate and be capable of receiving characters, at least in accordance with International Alphabet No. 5, as described in CCITT Recommendation T.50 [19].

The general structure of characters, should be in accordance with CCITT Recommendation X.4 [6].

The PAD will transmit and expect to receive 8-bit characters. The action of the PAD with respect to the parity bit (bit 8) of the characters interchanged between start-stop mode DTE and the PAD should be in accordance with section 2.1.2 of CCITT Recommendation X.28 [1].

The default type of parity used, when not determined by alternate means, is defined to be even.

NETWORK OPTIONS

By proper selection of the PAD parameter values and the type of parity used or when in the extended dialogue mode, the PAD may optionally generate and be capable of receiving characters in accordance with any other standard alphabet.

8.2 Procedures for service initialization

8.2.1 Service request (state 2)

If the interface is in the active link state, the DTE should transmit a sequence of characters to indicate service request and to initialize the PAD.

While in this state the PAD will transmit binary 1.

The service request signal enables the PAD to detect the data rate.

The format of the service request signal is network dependent.

If a valid service request signal is expected, but not received by the PAD, within "Y" seconds, after the interface entered the active link state, the PAD will disconnect the access information path.

The value of "Y" should be between 30 seconds and 60 seconds.

NETWORK OPTIONS

In some networks, the service request signal enables the PAD to detect the parity used by the DTE and also to select the initial profile of the PAD.

Some networks may allow states 2 and 3A to be by-passed. In this case, no service request signal is required (dotted line (1) applies in figure 3) and the interface, immediately after active link state (state 1), will enter service ready state (state 4).

8.2.2 DTE waiting (state 3A)

Following the transmission of the service request signal, the start-stop mode DTE and the PAD should exchange binary 1 and the interface will be in the DTE waiting state.

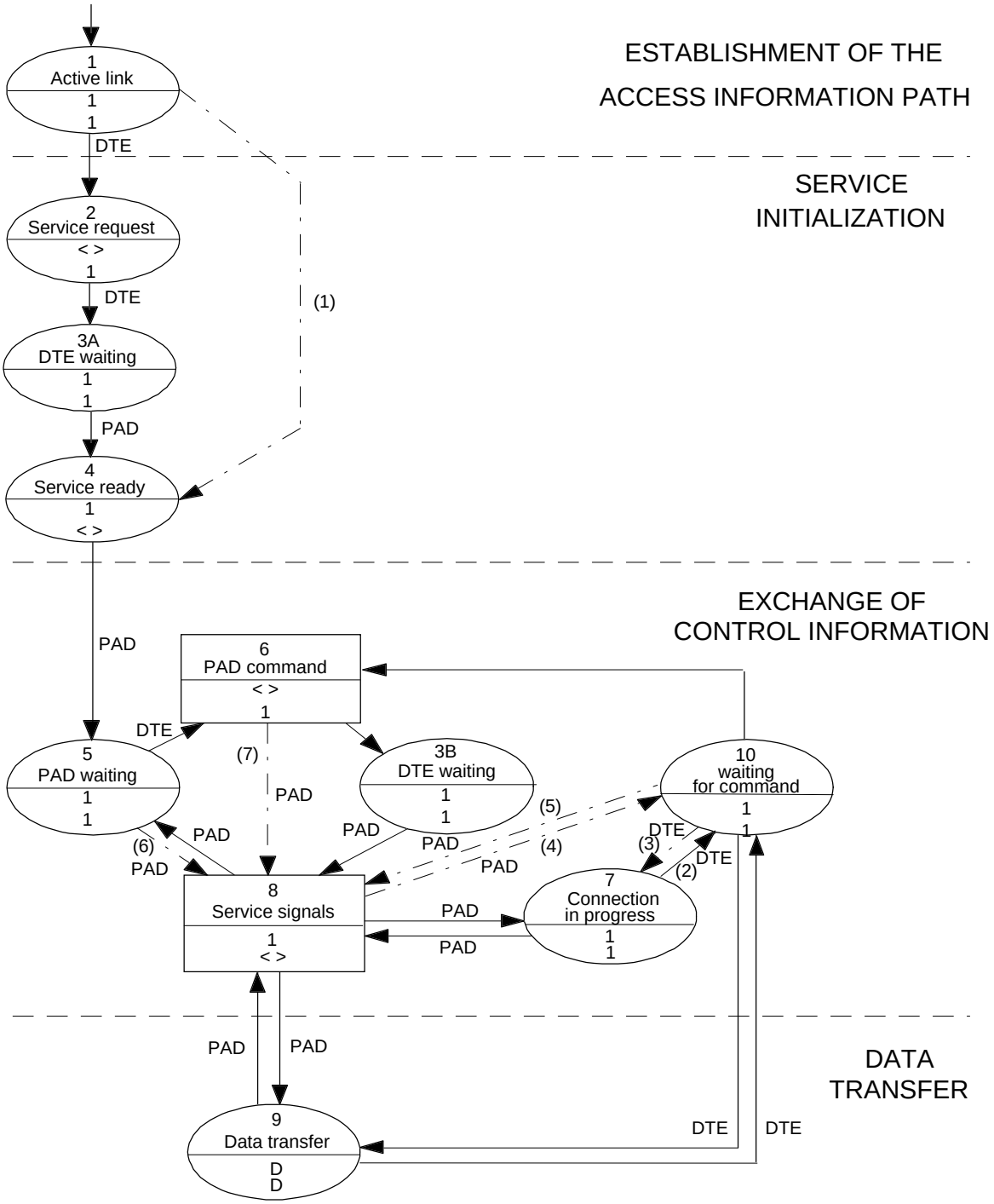
8.2.3 Service ready (state 4)

The interface will enter the service ready state when the PAD transmits a PAD identification PAD service signal after receiving a service request signal.

While in this state, the start-stop mode DTE will transmit binary 1.

The format of the PAD identification PAD service signal is network dependent but should at least indicate the PAD identity and port identity.

NOTE : When the value of parameter 6 is set to 0 (no service signals are transmitted), the interface will directly enter the PAD waiting state (state 5) following receipt of a valid service request signal, by-passing states 3A and 4. In that case state sequence of figure 4 applies.

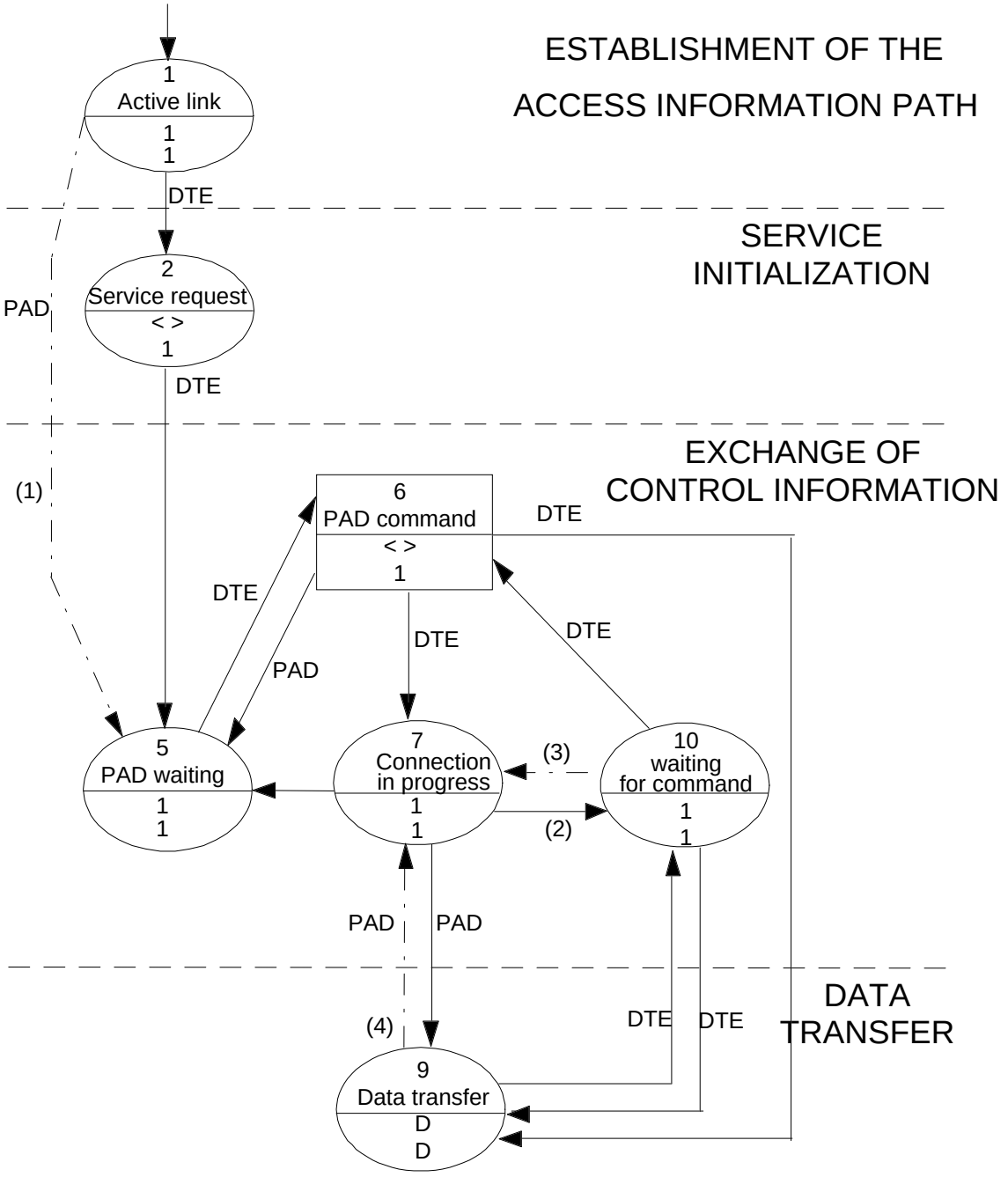


NOTE 1: In the case that a service request PAD command signal is not implemented states 2 and 3A will be by-passed (dotted line (1) applies) and the interface immediately after active link state (state 1), will enter Service ready state (state 4).

NOTE 2: For solid line No. (2) also see Annex A to this ETR.

NOTE 3: Dotted lines Nos. (3), (4), (5), (6) and (7) represent functions that are described within the text of CCITT Recommendation X.28 [1] but are not in correspondence shown in figure 2a (also see Annex A to this ETR).

Figure 3: State diagram in case of a service request signal implemented, when parameter 6 is set to a non zero value



NOTE 1: In the case that a service request PAD command signal is not implemented, state 2 will be by-passed (dotted line (1) applies) and the interface immediately after active link state (state 1), enters PAD waiting state (state 5).

NOTE 2: For solid line No (2) see also Annex A to this ETR.

NOTE 3: Dotted line (3) represents the transition from state 10 to state 7 which is described within the text of CCITT Recommendation X.28 [1] but is not in correspondence shown in figure 2b of CCITT Recommendation X.28 [1] (see also Annex A to this ETR).

NOTE 4: Dotted line (4) represents the transition from state 9 to state 7 that some networks may allow for the purpose of performing called a DTE reselection.

Figure 4: State sequence when parameter 6 is set to 0

8.3 Procedures for the exchange of control information

8.3.1 PAD waiting (state 5)

Following the transmission of a PAD service signal the interface will be in the PAD waiting state unless a virtual call is established or is being established.

During the PAD waiting state the PAD will exchange binary 1 with the start-stop mode DTE.

NETWORK OPTIONS

In some networks, on entering the PAD waiting state the PAD indicates its readiness to receive a PAD command signal by transmitting the prompt PAD service signal (if parameter 6 is set to 5).

If the prompt PAD service signal is implemented the procedures should be as in section 3.1.3 of CCITT Recommendation X.28 [1].

The format of the prompt PAD service signal is given in section 3.5.23 of CCITT Recommendation X.28 [1].

8.3.2 PAD command (state 6)

The DTE may transmit a PAD command signal when the interface is in the PAD waiting state and the interface enters the PAD command state at the start of a PAD command signal.

While in this state the PAD will transmit to the start- stop mode DTE binary 1.

The DTE may also transmit PAD command signals after escaping from the connection in progress state (state 7) and after escaping from the data transfer state (state 9).

The format of the PAD command signals are given in section 3.5 of CCITT Recommendation X.28 [1].

8.3.2.1 Call establishment

When the interface is in the PAD waiting state (state 5) the DTE may request the establishment of a virtual call by transmitting a Selection PAD command signal.

8.3.3 DTE waiting (state 3B)

Following the transmission of a PAD command signal the DTE exchanges binary 1 with the start-stop mode DTE and the interface enters the DTE waiting state.

8.3.4 Connection-in-progress (state 7)

On receipt of a valid Selection PAD command signal the PAD transmits an Acknowledgement PAD service signal and the interface enters the Connection-in-progress state. Following, the PAD and the start-stop mode DTE exchanges binary 1.

The interface enters the PAD service signals state as necessary and the PAD transmits the Connected PAD service signal or a Clear indication PAD service signal to the DTE. During this period the PAD will not accept any PAD command signals. Characters are not echoed.

NOTE: If the value of parameter 6 is 0, the PAD will not transmit PAD service signals to the start-stop mode DTE and state diagram of figure 4 applies. Following the receipt of a valid selection PAD command signal, the interface should remain in the connection-in-progress state until the virtual call has been established.

If a call is unsuccessful for any reason, the PAD indicates the reason to the start-stop mode DTE by means of a clear indication PAD service signal (if parameter 6 is not 0). After transmission of the clear indication PAD service signal the PAD will be in the PAD waiting state.

8.3.4.1 Escaping from connection-in-progress state

During connection in progress state, the start-stop mode DTE may escape from that state by transmitting a PAD recall signal to the PAD. On detection of the PAD recall signal, the interface enters the Waiting for command state (state 10).

NOTE: At this time, if parameter 6 is set to 5, the Prompt PAD service signal will be transmitted by the PAD (if implemented).

When in this state (state 10), the PAD exchanges binary 1 with the start-stop mode DTE.

At this state, the PAD should accept the Clear request PAD command signal.

The action taken by the PAD on receipt of the next character from the start-stop mode DTE, should be in accordance with the section 3.2.1.5 of CCITT Recommendation X.28 [1].

If the first character of a PAD command signal is not received within "P" seconds of the interface entering the waiting for command state from the connection in progress state, the PAD transmits an Error PAD service signal. The interface then enters the connection in progress state, irrespective of the value of parameter 6.

The value of "P" should be greater than 60 seconds.

If the PAD command signal delimiter is not received within "Q" seconds of the interface entering the PAD command state from the connection in progress state, or an invalid PAD command signal is received, the PAD transmits an error PAD service signal indicating that an error has occurred. The interface then enters the connection in progress state, irrespective of the value of parameter 6.

The value of "Q" should be between 60-120 seconds.

8.3.5 PAD service signals (state 8)

State 8 is used to represent a state during which all PAD service signals are transmitted except the PAD identification which is transmitted in the service ready state (state 4), (also see Annex A to this ETR).

Following the transmission by the PAD of a PAD service signal or a sequence of PAD service signals (in the case of call set-up), the interface enters the state which is appropriate, e.g. in the case of a virtual call, after the transmission of the connected PAD service signal the interface enters the data transfer state (state 9), (see figure 3).

Any PAD service signal arising from events within the packet network will not be transmitted until any PAD service signal outstanding from a previously received PAD command signal has been transmitted.

NOTE: If the value of parameter 6 is set to 0, PAD service signals will not be transmitted and the PAD service signals state will be by-passed. In that case state diagram of figure 4 applies.

8.4 Procedures for the exchange of the user data between a start-stop mode DTE and a PAD

After transmitting of the Connected PAD service signal the interface should be in the data transfer state (state 9).

The procedures for the data transfer between start-stop mode DTE and the PAD should be in accordance with the section 4 of CCITT Recommendation X.28 [1].

8.4.1 Escaping from the data transfer state

During the data transfer state, the start-stop mode DTE may escape from that state by transmitting a PAD recall signal to the PAD.

The procedures for escaping from the data transfer state should be in accordance with section 4.9 of CCITT Recommendation X.28 [1].

8.5 Procedures for clearing

8.5.1 Clearing initiated by the start-stop mode DTE

8.5.1.1 Clearing by the local PAD

The procedure for DTE clearing the virtual call of the PAD to which is connected, should be as described in the section 3.2.2.1.1 of the CCITT Recommendation X.28 [1].

NOTE: In the case when a valid service request signal is expected but not received by the PAD within "Y" seconds after the transmission of binary 1 (see also subclause 8.2.1 of this ETR), the PAD performs clearing by disconnecting the access information path. The value of "Y" should be between 30 seconds and 60 seconds.

8.5.1.2 Clearing by the remote PAD

NETWORK OPTIONS

In some networks, the local PAD may support the capability to generate an invitation to clear PAD message to the remote PAD to request the remote PAD to clear the call, after receiving, by the start-stop mode DTE, a relevant PAD command signal.

In the case that such a capability is supported, the procedure for clearing of the remote PAD should be as described in section 3.2.2.1.2 of the CCITT Recommendation X.28 [1].

8.5.2 Clearing initiated by the network

Clearing by the network may occur for various reasons, e.g. local or remote procedure error, network problems, reception at the local PAD of a clear invitation PAD message or a clear indication packet, etc.

1) When parameter 6 is not set to 0, clearing by the network may be indicated by:

   a) transmitting a clear indication PAD service signal. After transmitting this service signal the interface will be in the PAD waiting state. The DTE should stop sending data on receipt of a clear indication PAD service signal and should transmit binary 1; or

   b) disconnecting the access information path.

2) When parameter 6 is set to 0, PAD clearing may performed by:

   a) not disconnecting the access information path and the interface enters the PAD waiting state (state 5); or

   b) disconnecting the access information path.

   NOTE: If the access information path is disconnected for any reason, the call attempt or the virtual call should be cleared by the PAD.

8.6 Procedures for setting, changing and reading the values of PAD parameters

The procedures for setting or changing the values of PAD parameters should be as described in section 3.3 of CCITT Recommendation X.28 [1].

The procedures for reading the values of one or several parameters should be as described in section 3.4 of CCITT Recommendation X.28 [1].

8.7 Procedures for reset

Reset of a virtual call should be performed by the PAD upon receipt of a reset PAD command signal by the start-stop mode DTE.

The procedures for reset should be as described in sections 4.7 and 4.9.2.3 of CCITT Recommendation X.28 [1].

NOTE : The PAD does not confirm to the start-stop mode DTE the reset operation. An appropriate PAD service signal is not defined in CCITT Recommendation X.28 [1].

8.8 Procedures for interrupt

The procedures for interrupt should be as described in section 4.9.2.4 of CCITT Recommendation X.28 [1].

NOTE: There is not confirmation or indication by the network to the start-stop mode DTE for the interrupt operation. Appropriate PAD service signals are not defined in CCITT Recommendation X.28 [1].

8.9 Procedures for editing

The PAD should provide functions for the start-stop mode DTE to edit characters input to the PAD in PAD command signals before being processed by the PAD. The functions provided are:

a) character delete;

b) line delete;

c) line display.

The user may also select the character used to effect each of the above functions by setting the value of parameters 16, 17 and 18.

The procedures for editing should be those described in section 3.6 of the CCITT Recommendation X.28 [1].

The formats of the PAD commands and the relevant PAD service signals should be those described in section 3.5 of the CCITT Recommendation X.28 [1]

NETWORK OPTIONS

Optionally, in some networks the user may choose if and in what format the PAD will respond to the editing characters by setting the value of parameter 19 appropriately, in accordance with sections 3.5.24 and 3.5.25 of CCITT Recommendation X.28 [1].

Also, in some networks editing functions are available for use by the start-stop mode DTE during the data transfer state, depending upon the value of parameter 15.

The procedures for editing during the data transfer state should be also those described in section 3.6 of the CCITT Recommendation X.28 [1].

8.10 Fault conditions

The procedures after a fault condition occurred should be as described in section 3.2.3.1 of CCITT Recommendation X.28 [1].

The values of the timers T and S should be those specified in subclause 6.2.1 (table 11) of this ETR. The value of the constant N (if implemented) should be as specified in subclause 6.2.2 of this ETR.

The PAD should perform PAD clearing in accordance with subclause 8.5.2 of this ETR.

8.11 Called DTE reselection

NETWORK OPTIONS

The start-stop mode DTE may prevent the called DTE reselection by including the called DTE reselection prevention facility in the selection PAD command signal. The procedure should be as described in section 3.2.5 of CCITT Recommendation X.28 [1].

9 Interoperability

Communications, through a network offering CCITT Recommendation X.28 [1] indirect access for start-stop mode DTEs, should be based on the PAD procedures as defined in CCITT Recommendation X.29 [4]. The network should implement these PAD procedures and should allow for communication between two start-stop mode DTEs, based on a PAD-to-PAD operation, and between a start-stop mode DTE and a packet mode DTE, based on a PAD to packet mode DTE operation, as defined in CCITT Recommendation X.29 [4]. Other types of communications are outside the scope of this ETR.

The network should implement the procedures to convey addresses, diagnostics and facilities as defined in subclauses 9.1 and 9.2 of this ETR.

NOTE 1: For ease of understanding, this ETR refers to specific packet types and procedures of CCITT Recommendation X.25 [3]. When PAD to PAD interworking is considered within a national network, these packet types or procedures may have a different form from those used in CCITT Recommendation X.25 [3], but have the same operational meaning.

NOTE 2: For the purpose of this ETR the indirectly connected start-stop mode DTE is referred to as the local (calling) DTE, while the directly connected start-stop mode DTE and the directly or indirectly connected packet mode DTE is referred to as the remote (called) DTE.

9.1 Addressing

The local DTE may call the remote DTE by including the called address in the address field of the selection PAD command signal. The number of digits of the called address should be no more than 15, including prefixes and/or escape codes in accordance with the non-Type Of Address (TOA) or Numbering Plan Indicator (NPI) format of CCITT Recommendation X.121 [9].

NETWORK OPTIONS

The contents of the calling address field in the incoming call packet are either:

- a number provided by the PSTN as DTE identification; or

- an incomplete CCITT Recommendation X.121 [9] Public Switched Network format; this means that the contents of the calling address field are not valid with respect to the definition of a "valid number" in the various CCITT Recommendations (e.g. a four digit number representing a Data Network Identification Code (DNIC) or a number in the form 9+TCC); or

- a temporary number from the PSPDN numbering plan; this means that the contents of the calling address field, although valid with respect to the definition of a "valid number" in the various CCITT Recommendations, is not a number permanently attributed to the start-stop mode DTE. It may, for example, be attributed to the dial-in port used for a particular call.

Some networks may allow for up to 17 digits for the called address in the address field of the selection PAD command signal and the incoming call packet, in accordance with the TOA/NPI format of CCITT Recommendation X.121 [9].

Some networks may implement Private data Network Identification Code (PNIC) digits in the CCITT Recommendation X.121 [9] format, when interconnected with private networks.

Some networks may use the facility field of the selection PAD command signal, the incoming call packet and the incoming call PAD service signal, for called address extension, as specified in section 3.5.15.1.6 of CCITT Recommendation X.28 [1] and Annex G of CCITT Recommendation X.25 [3].

9.2 Procedures

9.2.1 Call set-up procedures

The network should establish and confirm a call from the local DTE to the remote DTE in accordance with the procedures of CCITT Recommendations X.28 [1] and X.25 [3]. The call user data field of the incoming call packet transmitted by the local PAD to the packet mode DTE or the remote PAD should include a protocol identifier field as defined in section 1.3 and section 4.2.1 of CCITT Recommendation X.29 [4].

NETWORK OPTIONS

Some networks may implement the reselection PAD message in accordance with section 3.6 of CCITT Recommendation X.29 [4]. This message is used by a packet mode DTE to request PAD to clear the virtual call established by the start-stop mode DTE (after transmission to the start-stop mode DTE of all the previously transmitted data), and then to establish a call to a new destination (reselected DTE).

9.2.2 Procedures for the exchange of control information

PAD messages are used to exchange control information between PADs or between the PAD and the packet mode DTE in accordance with the procedures defined in section 1 and section 3.1 of CCITT Recommendation X.29 [4].

NOTE: Implementation of the remote PAD command signals would enhance the interoperability between two start-stop mode DTEs.

9.2.3 Data transfer procedures

User sequences are used to exchange data between PADs or between the PAD and the packet mode DTE in accordance with section 1.4 of CCITT Recommendation X.29 [4].

9.2.4 D bit handling

Handling of the D bit in packets transmitted between PADs or a PAD and a packet mode DTE should be as defined in sections 1.4.3, 1.4.4 and 1.5.6 of CCITT Recommendation X.29 [4] for data packets and section 3.6 of Annex A to CCITT Recommendation X.29 [4] for call set-up packets.

9.2.5 Clearing procedures

Clearing of a call between a local DTE and a remote DTE can be initiated by either the local DTE or the remote DTE or the network and performed in accordance with the procedures defined in CCITT Recommendations X.28 [1], X.29 [4], and X.25 [3].

9.2.6 Reset procedures

Reset of a call between a local DTE and a remote DTE can be initiated by either the start-stop mode DTE or the packet mode DTE or the network and should be performed in accordance with sections 4.4.3 and 4.5 of CCITT Recommendation X.25 [3], and Annex A of CCITT Recommendation X.29 [4].

The reset of a call affects only parameter 8, which is turned to 0 (normal data delivery). The current values of all other PAD parameters are not affected.

9.2.7 Interrupt procedures

Interrupt procedures during a call from the local DTE to the remote DTE may be initiated by either of these two DTEs. These procedures should be in accordance with clause 4.3.7 of CCITT Recommendation X.25 [3] and section 3.3 of CCITT Recommendation X.29 [4].

NOTE: There is no confirmation or indication by the network to the start-stop mode DTE for the interrupt operation. An appropriate PAD service signal is not defined in CCITT Recommendation X.28 [1].

NETWORK OPTIONS

Some PADs may transmit to the start-stop mode DTE the code independent break signal upon receipt of an interrupt packet from the packet mode DTE or the remote PAD.

9.3 Cause and diagnostic fields

9.3.1 Clearing

The coding of the cause field in the clear indication PAD service signal and the clear indication packets should be as defined in table 6 of CCITT Recommendation X.28 [1] and section 5.2.4.1.1 of CCITT Recommendation X.25 [3] correspondingly.

NETWORK OPTIONS

The cause code field of the clear indication PAD service signal, when implemented, should be coded as in table 20 of CCITT Recommendation X.25 [3].

When the diagnostic field of the clear indication packet and the clear indication PAD service signal is implemented, this field should be coded as stated in section 5.2.4.1.2 of CCITT Recommendation X.25 [3].

9.3.2 Reset

The coding of the cause field in the reset indication PAD service signal and the reset indication packets should be as defined in table 5 of CCITT Recommendation X.28 [1] and section 5.4.3.1 of CCITT Recommendation X.25 [3] correspondingly.

NETWORK OPTIONS

When the diagnostic field of the reset indication packet and the reset indication PAD service signal is implemented, this field should be coded as stated in section 5.4.3.2 of CCITT Recommendation X.25 [3].

9.3.3 X.28 - X.25 Code mapping for the clear and reset cause fields

In a PAD, table 14 should apply for code mapping between cause field of a clear indication PAD service signal which is transmitted by the PAD to the start-stop mode DTE after reception of an CCITT Recommendation X.25 [3] clear indication packet, (see NOTE 1 to table 14).

In a PAD, table 15 should apply for code mapping between cause field of a reset indication PAD service signal which is transmitted by the PAD to the start-stop mode DTE after reception of an CCITT Recommendation X.25 [3] reset indication packet.

Table 14: Code mapping for clear indication cause fields

	CCITT Recommendations		
Cause	X.96 category (NOTE 2)	X.28	X.25
Number busy	C1	OCC	00000001
Network congestion	C2	NC	00000101
Invalid facility request	D1	INV	00000011
Access barred	D1	NA	00001011
Local procedure error	D1	ERR	00010011
Remote procedure error	D1	RPE	00010001
Not obtainable (Number not assigned)	D1	NP	00001101
Out of order	D1 or D2	DER	00001001
Reverse charging acceptance not subscribed	D1	RNA	00011001
DTE originated	B or D1	DTE	00000000 1XXXXXXX
Clearing by the PAD after remote request (NOTE 3)	B	PAD	00000000 1XXXXXXX
Incompatible destination	D1	ID	00100001
Ship absent	D1	SA	00111001
Fast select acceptance not subscribed	D1	FNA	00101001
RPOA out of order (Cannot be routed)	D2	ROO	00010101

NOTE 1: In the case of PAD clearing after the reception from the remote packet mode DTE or remote PAD an invitation to clear PAD message, the PAD will transmit a clear indication PAD service signal to the start-stop mode DTE as well as a clear indication packet to the remote packet mode DTE or remote PAD.

NOTE 2: The category of these signals is defined in table 2 of CCITT Recommendation X. 96 [8].

NOTE 3: In the case of PAD clearing after an invitation to clear PAD message, the clear indication packet, which is transmitted by the PAD after delivery of the last character to the start-stop mode DTE, will have a clearing cause field set to DTE clearing (00000000 or 1XXXXXXX), while the corresponding clear indication PAD service signal will have a cause field coded to PAD.

Table 15: Code mapping for reset indication cause fields

	CCITT Recommendations		
Cause	X.96 category (NOTE 1)	X.28	X.25
DTE originated	B or D1	DTE	00000000 1XXXXXXX
Local procedure error	D1	ERR	00000101
Network congestion	C2	NC	00000111
Remote procedure error	D1	RPE	00000011
Incompatible destination	D1	(NOTE 2)	00010001

NOTE 1: The category of these signals is defined in table 2 of CCITT Recommendation X. 96 [8].

NOTE 2: There is no corresponding code in CCITT Recommendation X.28 [1]

9.4 Facilities

For all the CCITT Recommendation X.28 [1] facilities of tables 12 and 13 of this ETR, used by the start-stop mode DTE, there are corresponding CCITT Recommendation X.25 [3] facilities to be used between the network and the packet mode DTE.

Annex A (informative): Comments on figures 3 and 4

Figures 3 and 4 in this ETR although they constitute, in general, subsets of figures 2a and 2b of CCITT Recommendation X.28 [1], are slightly different from them. The differences are the following:

1) CCITT Recommendation X.28 [1] optionally allows, for some networks, the transition from state 7 to state 10. This is indicated by a dotted line in figures 2 of CCITT Recommendation X.28 [1]. All networks conforming to this ETR should implement this capability and, therefore, this is indicated in figures 3 and 4 by the solid line (2);

2) dotted lines that appear in figures 3 and 4 in addition to the lines existing in CCITT Recommendation X.28 [1], represent functions that are described within the text of CCITT Recommendation X.28 [1] but are not shown in figures 2a and 2b of that Recommendation

These functions are:

a) transition from state 6 to state 8, e.g.:

When escaping from the data transfer state and the PAD command signal delimiter has not been received within "R" seconds of the interface entering the PAD command state, the PAD transmits an error PAD service signal. It then returns to the data transfer state.

NOTE: The drawing of this line, indicating the transition from state 6 to state 8, also solves the problem of the editing PAD service signals that, in CCITT Recommendation X.28 [1], are excepted from state 8 (see NOTE 2 under figure 2a, of CCITT Recommendation X.28 [1]).

b) transition from state 10 to state 8 and vice versa, e.g.:

When in a network the prompt service signal is implemented, escaping from the data transfer state the interface enters the waiting for command state (state 10) and then transmits the prompt service signal and returns to the waiting for command state.

c) transition from state 10 to state 7, e.g.:

When escaping from the connection in progress state to the waiting for command state (state 10) and the first character received by the PAD after escaping from the connection in progress state is the PAD recall character or the PAD command signal delimiter, the interface returns to the connection in progress state and no action will be taken.

d) transition from state 5 to state 8, e.g.:

In NOTE 3 under figure 2a of CCITT Recommendation X.28 [1], it is considered that a transition from PAD waiting state (state 5) to Service signals state (state 8) occurs only when the PAD receives a call destined for the start-stop mode DTE. However, when the prompt PAD service signal is implemented, every time the start-stop mode DTE/DCE interface enters the PAD waiting state (state 5) it shall immediately after, enter the Service signals state (state 8) for transmission the prompt PAD service signal and then returns to the PAD waiting state (state 5).

Annex B (informative): Summary of requirements

The following tables summarise:

- access arrangements (table B.1);
- PAD command and service signals (table B.2);
- PAD internal variables and constants (table B.3);
- PAD facilities (table B.4);

which are classified as core offerings or network options.

Table B.1: Access arrangements

Access arrangements	Phase A
Bit rate 300, 1 200, 2 400 bps full duplex (subclause 4.2)	Core
Manual activation of loop 3 (in case of NTP1)(subclause 4.7)	Core
Higher bit rates (subclause 4.2)	Network option
Automatic activation of loop 3 (in case of NTP1) (subclause 4.7)	Network option
Manual or automatic activation of loop 2 in the modem close to the PAD (in case of NTP2)(subclause 4.7)	Network option
Modems with error correction capabilities (subclause 4.6)	Network option
CCITT V.25 automatic calling mode procedures (in case of NTP1)(subclause 4.4.2)	Network option

Table B.2: PAD command and service signals

PAD command and service signals	Phase A
Basic set of PAD commands (table 2)	Core
Basic set of PAD service signals (table 5)	Core
Tables 7,8 for the cause field in clear and reset indication PAD service signals	Core
Extended dialogue mode PAD commands (table 4)	Network option
Supplementary set of PAD service signals (table 6)	Network option
Remote PAD commands (table 3)	Network option
Network specific PAD commands (subclause 5.1.5)	Network option
Network specific PAD service signals (subclause 5.2.3)	Network option
Table 9 for the cause field in clear indication PAD service signals	Network option

Table B.3: PAD internal variables and constants

PAD internal variables and constants	Phase A
Basic set of PAD parameters with the mandatory values (subclause 6.1)	Core
Simple and Transparent profile (subclause 6.1.1.1)	Core
Simple profile as initial by default (subclause 6.1.1.1)	Core
Standard profile identifiers 90, 91 (table 10)	Core
Supplementary set of PAD parameters (subclause 6.1)	Network option
Service request signal with parity recognition (subclause 6.3)	Network option
Optional values of the Basic set ofPAD parameters (subclause 6.1)	Network option
Additional standard profiles (subclause 6.1.1.1)	Network option
Additional profile identifiers (subclause 6.1.1.2)	Network option
Values of timers and number of retries (subclause 6.2)	Network option

Table B.4: PAD facilities

Facilities	Phase A
Basic set of facilities (table 12)	Core
Supplementary set of facilities (table 13)	Network option

Annex C (informative): 8-bit start-stop mode DTE access to the PAD

The control signals which are exchanged between the PAD and the start-stop mode DTE are the following:

a) PAD command signals;

b) the service request signal;

c) PAD service signals;

d) the service ready signal;

e) single control characters:

   1) PAD recall character (when parameter 1 is not set to 0);

   2) data forwarding character (when parameter 3 is not set to (0));

   3 echo characters (when parameter 2 is not set to 0);

   4) ancillary device control characters (when parameter 5 is not set to 0);

   5) flow control of the PAD characters (when parameter 12 is not set to 0);

   6) padding characters (when parameter 9 is not set to 0);

   7) line feed character (when parameters 10 and 13 are not set to 0);

   8) editing characters (when parameter 15 is not set to 0);

   9) the character BEL (when parameter 2 is set to 1 and parameter 21 is set to 1 or 3);

f) the break code independent signal.

When the start-stop mode DTE is working on an 8-bit alphabet there are limitations in the dialogue between the PAD and the DTE because the PAD recognizes and generates characters in accordance to CCITT Recommendation T.50 [19], which describes a 7-bit alphabet. When parameter 21 is set to 0 the PAD does not perform parity recognition and is not concerned about the 8th bit in characters received. In the case where the 8bit alphabet table preserves its left part as in IA5 then:

- the PAD command signals, the service request signal and control characters transmitted by the start-stop mode DTE are normally recognized by the PAD;

- the PAD service signals, the service ready signal and control characters are transmitted by the PAD with even parity, so they cannot be recognized by the start stop mode DTE. This is usually avoided activating the Transparent standard profile, which has the relevant parameters 1, 2, 3, 5, 6, 9, 10, 12, 13, 15, 19, 21 set equal to 0;

- the code independent break signal is not affected.

In order to maintain the control capability between an 8-bit start-stop mode DTE and the PAD the following requirements are recognized:

1) PAD parameter 21 should be set equal to 0;

2) the parity used by the PAD in characters transmitted should be space, so the start-stop mode DTE is able to recognize the characters received from the PAD.

The use of space parity by the PAD may adversely affect these 7-bit start-stop mode DTEs which wish to maintain the error control capability based on parity checking. For these reasons, if the network implements the service request signal and also the PAD parameter 21, there should be:

- parity recognition with the service request signal;

- transmission of PAD service signals or single control characters, with the parity detected from the service request signal.

Annex D (informative): PSTN numbers for X.28 access to a PSPDN

The necessary PSTN numbers for CCITT Recommendation X.28 [1] access to the PAD will be published by the service operator.

Annex E (informative): CCITT Recommendation X.3 PAD parameters

In table E.1 the PAD parameters and their values are presented as they appear in table 1 of CCITT Recommendation X.3 [2]. In table E.2 the Simple and Transparent standard profiles are presented as they appear in table 1 of CCITT Recommendation X.28 [1].

Table E.1: CCITT Recommendation X.3 [2] set of PAD parameters and relative parameter values

Parameter reference number	Parameter description	Mandatory values	optional values
1	PAD recall using a character	0 1	 32-126
2	Echo	0 1	
3	Selection of data forwarding character	0 2 126	1 4 6 8 16 18 32 64
4	Selection of idle timer delay	0 20 255	1 to 19 21 to 254
5	Ancillary device control	0 1	 2
6	Control of PAD service signals and PAD command signals	0 1	 5 8 to 15 16 32 48
7	Selection of operation of the PAD on receipt of break signal from the start-stop mode DTE	0 2 8 21	 1 4 5 16
8	Discard output	0 1	

Table E.1 (continued)

Table E.1: CCITT Recommendation X.3 [2] set of PAD parameters and relative parameter values (continued)

9	Padding after carriage return (CR)	0 1 to 7	 8 to 255
10	Line folding	0 1 to 255	
11	Binary speed of start-stop mode DTE (read only)		
12	Flow control of the PAD	0 1	
13	Linefeed insertion after carriage return	0 1 4 5 6 7	 2
14	Padding after linefeed	0 1 to 7	 8 to 255
15	Editing	0 1	
16	Character delete	127	0 to 126
17	Line delete	24	0 to 23 25 to 127
18	Line display	18	0 to 17 19 to 127
19	Editing PAD service signals	1	0 2 8 32 to 126
20		Echo mask	0 1 2 4 8 16 32 64 128

Table E.1 (continued)

Table E.1: CCITT Recommendation X.3 set of PAD parameters and relative parameter values (concluded)

21	Parity treatment	0	1 2 3
22	Page wait	0 23	1 to 22 24 to 255

Table E.2: Simple and Transparent standard profiles

Parameter reference number	Parameter description	Simple profile	Transparent profile
1	PAD recall using a character	1	0
2	Echo	1	0
3	Selection of data forwarding character	126	0
4	Selection of idle timer delay	0	20
5	Ancillary device control	1	0
6	Control of PAD service signals and PAD command signals	1	0
7	Selection of operation of the PAD on receipt of break signal from	2	2
8	Discard output	0	0
9	Padding after carriage return	0	0
10	Line folding	0	0
11	Binary speed of start-stop mode DTE (read only)		
12	Flow control of the PAD	1	0

Table E.2 (continued)

Table E.2: Simple and Transparent standard profiles (concluded)

13	Linefeed insertion after carriage return	0	0
14	Padding after linefeed	0	0
15	Editing	0	0
16	Character delete	127	127
17	Line delete	24	24
18	Line display	18	18
19	Editing PAD service signals	1	1
20	Echo mask	0	0
21	Parity treatment	0	0
22	Page wait	0	0

History

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