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INTERNATIONAL TELECOMMUNICATION UNION

**ITU-T**

**Addendum 1**

**X.28**

(07/94)

TELECOMMUNICATION  
STANDARDIZATION SECTOR  
OF ITU

**DATA NETWORKS AND OPEN SYSTEM  
COMMUNICATIONS**

**PUBLIC DATA NETWORKS – INTERFACES**

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**ADDENDUM 1 TO RECOMMENDATION X.28  
TO ENABLE MAP SUPPORT IN  
ACCORDANCE WITH RECOMMENDATION X.8**

**Addendum 1 to  
ITU-T Recommendation X.28**  
Superseded by a more recent version

(Previously “CCITT Recommendation”)

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## FOREWORD

The ITU-T (Telecommunication Standardization Sector) is a permanent organ of the International Telecommunication Union (ITU). The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1 (Helsinki, March 1-12, 1993).

Addendum 1 to ITU-T Recommendation X.28 was prepared by ITU-T Study Group 7 (1993-1996) and was approved under the WTSC Resolution No. 1 procedure on the 1st July 1994.

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## NOTE

In this Recommendation, the expression “Administration” is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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## ITU-T X-SERIES RECOMMENDATIONS DATA NETWORKS AND OPEN SYSTEM COMMUNICATIONS

(February 1994)

### ORGANIZATION OF X-SERIES RECOMMENDATIONS

| Subject area                                | Recommendation series |
|---------------------------------------------|-----------------------|
| PUBLIC DATA NETWORKS                        |                       |
| Services and Facilities                     | X.1-X.19              |
| Interfaces                                  | X.20-X.49             |
| Transmission, Signalling and Switching      | X.50-X.89             |
| Network Aspects                             | X.90-X.149            |
| Maintenance                                 | X.150-X.179           |
| Administrative Arrangements                 | X.180-X.199           |
| OPEN SYSTEMS INTERCONNECTION                |                       |
| Model and Notation                          | X.200-X.209           |
| Service Definitions                         | X.210-X.219           |
| Connection-mode Protocol Specifications     | X.220-X.229           |
| Connectionless-mode Protocol Specifications | X.230-X.239           |
| PICS Proformas                              | X.240-X.259           |
| Protocol Identification                     | X.260-X.269           |
| Security Protocols                          | X.270-X.279           |
| Layer Managed Objects                       | X.280-X.289           |
| Conformance Testing                         | X.290-X.299           |
| INTERWORKING BETWEEN NETWORKS               |                       |
| General                                     | X.300-X.349           |
| Mobile Data Transmission Systems            | X.350-X.369           |
| Management                                  | X.370-X.399           |
| MESSAGE HANDLING SYSTEMS                    | X.400-X.499           |
| DIRECTORY                                   | X.500-X.599           |
| OSI NETWORKING AND SYSTEM ASPECTS           |                       |
| Networking                                  | X.600-X.649           |
| Naming, Addressing and Registration         | X.650-X.679           |
| Abstract Syntax Notation One (ASN.1)        | X.680-X.699           |
| OSI MANAGEMENT                              | X.700-X.799           |
| SECURITY                                    | X.800-X.849           |
| OSI APPLICATIONS                            |                       |
| Commitment, Concurrency and Recovery        | X.850-X.859           |
| Transaction Processing                      | X.860-X.879           |
| Remote Operations                           | X.880-X.899           |
| OPEN DISTRIBUTED PROCESSING                 | X.900-X.999           |



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## CONTENTS

|                                                                                                                                     | <i>Page</i> |
|-------------------------------------------------------------------------------------------------------------------------------------|-------------|
| 6 Multi-Aspect PAD (MAP) operation in accordance with Recommendation X.8 .....                                                      | 3           |
| 6.1 Procedures required to support MAP .....                                                                                        | 3           |
| 6.2 Formats of <i>MAP command</i> signals.....                                                                                      | 4           |
| 6.3 Format of <i>MAP service</i> signals .....                                                                                      | 5           |
| 6.4 Error Conditions.....                                                                                                           | 6           |
| 6.5 Format of Additional <i>MAP command</i> signals and <i>MAP service</i> signals available in the extended<br>dialogue mode ..... | 6           |

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## **SUMMARY**

Recommendation X.28 is the basic protocol or “aspect” used in accessing the PDN. It is based on a simple asynchronous start/stop mode terminal mode of operation. X.28 procedures provide a concise set of procedures to enable call control when accessing the PDN. The ITU-T defined X.28 PAD, often referred to as “C-PAD” or “S/S PAD” was the first PAD aspect standardized in the CCITT having its origin in the 1970s. Millions of C-PAD implementations exist today, providing for uniform worldwide access procedures. This addendum to Recommendation X.28 adds the multi-aspect PAD (MAP) capability (as outlined in Recommendation X.8) to the C-PAD. This enables different protocol aspects to be supported on the PAD; with C-PAD being one or more of the protocols.

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## Recommendation X.28

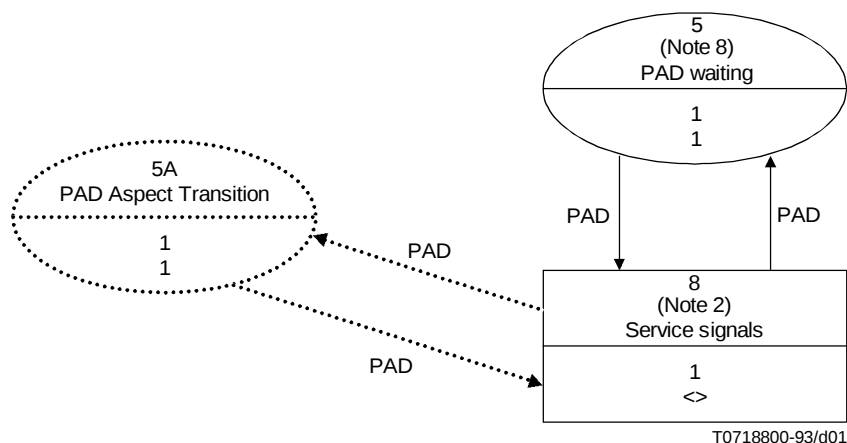
### ADENDUM 1 TO RECOMMENDATION X.28 TO ENABLE MAP SUPPORT IN ACCORDANCE WITH RECOMMENDATION X.8

(Geneva, 1994)

*Modify the Preface to include the following reference to Recommendation X.8:*

(h) that Recommendation X.8 defines the Multi-Aspect PAD (MAP) Framework and Service Definition.

*Modify the state diagram in Figure 2a) to include the dashed portion of the following:*



*Modify Note 2 in Figure 2a) to allow for the identification PAD service signal in state 8 so that it reads:*

2 State 8 is used to represent a state during which all PAD service signals are transmitted (except for the *editing PAD service signals*).

*Modify the state diagram in Figure 2b) to include the dashed portion of the following:*

*Replace 3.5.11 in its entirety with the following:*

#### 3.5.11 Standard format of the status engaged and status free PAD service signals

The *status engaged PAD service signal* consists of the following elements :

<status engaged> ::= <ENGAGED> <text> <MAP status block>

where

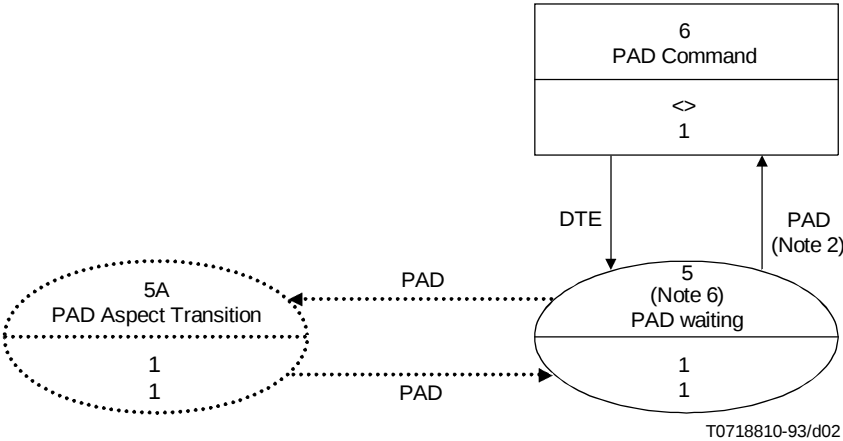
<ENGAGED> ::= 4/5 (E) 4/14 (N) 4/7 (G) 4/1 (A) 4/7 (G) 4/5 (E) 4/4 (D)

<text> ::= 2/0 (SP) 2/13 (-) 2/0 (SP) followed by the extended dialogue mode text “Call Established”

<MAP status block> ::= see 6.3.1

NOTE – The inclusion of additional information (e.g. destination address) is for further study.

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The status free PAD service signal consists of the following elements:

<status free> ::= <FREE> <text> <MAP status block>

where

<FREE> ::= 4/6 (F) 5/2 (R) 4/5 (E) 4/5 (E)

<text> ::= 2/0 (SP) 2/13 (–) 2/0 (SP) followed by the extended dialogue mode text

“No Call Established”

<MAP status block> ::= see 6.3.1

NOTE – The inclusion of additional information, (e.g. see 3.5.18) is for further study.

**Modify Table 2 to indicate that the Modify, Change, and Confirm Change MAP command signals are valid before virtual call set-up as shown in the following:**

| PAD command signal | Valid before virtual call set-up | Valid after escaping from data transfer state | Valid after escaping from connection-in-progress state |
|--------------------|----------------------------------|-----------------------------------------------|--------------------------------------------------------|
| Modify MAP         | X                                | X                                             | X                                                      |
| Change MAP         | X                                |                                               |                                                        |
| Confirm change MAP | X                                |                                               |                                                        |

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*Add the Modify and Change MAP command signals to Table 9 as shown in the following:*

| Standard keyword | Extended dialogue mode keyword(s) | PAD command signal name |
|------------------|-----------------------------------|-------------------------|
| MOD              | MODIFY                            | Modify PAD aspect       |
| CHA              | CHANGE                            | Change PAD aspect       |
| Y                | YES                               | Confirm Change          |

*Modify the Status PAD command signal to include optional MAP status information in Table A.1 and add the Modify and Change MAP command signals to Table A.1 as shown in the following:*

| PAD command signal format                                       | Function                                                                                                                | PAD service signal sent in response (see Note)  |
|-----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| STAT                                                            | To request status regarding a virtual call connected to the DTE and MAP status                                          | FREE [MAP status]<br>or<br>ENGAGED [MAP status] |
| MOD PAD aspect, duration applicable, and additional information | To modify the PAD aspect, indicate the duration that the modify applies, and include additional call set-up information | MOD CONF                                        |
| CHA PAD aspect and additional information                       | To change the default PAD aspect and specify additional information                                                     | CHANGE PORT TO (new PAD aspect)?                |
| Y                                                               | To verify the PAD aspect default value is correct                                                                       | CHA CONF                                        |

*Delete 5.6.*

*Add the following in its totality as clause 6:*

## 6 Multi-Aspect PAD (MAP) operation in accordance with Recommendation X.8

### 6.1 Procedures required to support MAP

#### 6.1.1 Procedures for MAP status inquiry

The DTE may inquire about the status of the current aspect, available aspects and the default aspect by sending the *status PAD command* signal to the PAD. The PAD will respond by sending the *status engaged* or *status free* PAD service signal, including the MAP status block, to the DTE. The format of the *PAD command* signal and the standard format of the PAD service signals is given in 3.5.10 and 3.5.11 respectively.

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## 6.1.2 Procedures to temporarily modify the PAD aspect

The *Modify MAP command* signal procedures operates in accordance with 6.2/X.8. The format for the *Modify MAP command* signal is specified in 6.2.1. The format for the *Confirm Modify MAP service* signal is specified in 6.3.2.

Upon entry into the start-stop PAD from another PAD aspect shall issue an *Aspect Entry MAP service* signal to indicate successful transition to the start-stop PAD instance (see 6.3.3).

The *Modify MAP PAD Command* signal is entered to cause the PAD to change Aspects normally for one complete call sequence (i.e. call request through clear indication). The command is entered from the PAD Waiting state. All PAD Parameter settings and values set previous to the *Modify MAP PAD Command* signal remain as set. No changes to any values take place due to the new Aspect. The command is valid both when a virtual call is in progress, and when it is not. If a virtual call was in progress at the time of the *Modify MAP PAD Command* signal, the PAD will remain in the modified Aspect until that virtual call has cleared or as indicated by the duration parameter value. If the virtual call was not in progress, then the PAD will remain in the modified Aspect as specified by the duration parameter value.

## 6.1.3 Procedures to permanently change the PAD aspect

The DTE may permanently change the PAD aspect as defined in 7.1/X.8. The DTE will issue the *Change MAP command* signal and the PAD will respond with the *Change MAP service* signal. Formats for these signals may be found in 6.2.2 and 6.3.4 respectively.

## 6.1.4 Procedures for entering a CPAD from another aspect

Upon entering the PAD the PAD identification PAD service signal defined in 3.5.18 is sent.

## 6.1.5 Procedures for the provision of multi-session

The procedures for the provision of multi-session are for further study.

## 6.1.6 Procedures for the provision of remote MAP control

The procedures for the provision of remote MAP control are for further study.

## 6.1.7 PAD Aspect Transition – Exit and Entry State SA

*PAD Aspect Transition* state is introduced for the MAP support. This state is entered directly from PAD Waiting state (if no *PAD Service* signals are utilized) or from State 8 (if *PAD Service* signals are enabled). The purpose of the *PAD Aspect Transition state* is to provide a finite state for the PAD to transition from one PAD Aspect to another Aspect. State 5A also provides the re-entry point for entering into the PAD Aspect from a different Aspect. The impact to the state diagrams can be found in the specific Recommendations associated with the originating PAD Aspect. State diagrams can be found below in Figures 2a) and 2b).

## 6.2 Formats of MAP command signals

### 6.2.1 Format of the Modify MAP command signal

The *Modify MAP command* signal consists of the following elements:

<modify> ::= <MOD-> <new aspect> <duration> <additional information>

<MOD-> ::= 4/13 (M) 4/15 (0) 4/4 (D) 2/3 (-)

<new aspect> ::= the 1A5 PAD code for the aspect requested. See Table 1/X.8 PAD Aspect Codes.

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<duration> ::= 2/12 (,) followed by one of the following elements <VC> <idle time> <AIP>

<VC> ::= 56 (V) 4/3 (C)

<idle time> ::= a decimal number 1-255 representing the length of time in seconds before the aspect will revert to the default.

<AIP> ::= 4/1 (A) 4/9 (1) 5/0 (P) is used to revert to the default aspect after the access information path is disconnected.

<additional information> ::= the format and contents of this element are for further study.

NOTE – The <duration> and <additional information> are optional. The omission of <duration>, the setting of the <idle timer> to zero, or the inclusion of <VC> indicate that the duration is for one complete call sequence.

### 6.2.2 Format of the *change MAP command signal*

The *change MAP command signal* consists of the following elements.

<change> ::= <CHA> <new aspect> <additional information>

<CHA> ::= 4/3 (C) 4/8 (H) 4/1 (A)

<new aspect> ::= the 1A5 PAD code for the aspect requested. See Table 1/X.8 PAD Aspect Codes.

<additional information> ::= information that may be defined for entering a new aspect

### 6.2.3 Standard format of the *confirm change MAP command signal*

The 1A5 character 5/9 (Y) is sent.

### 6.2.4 Format for the *multi-session MAP command signals*

The format of the MAP command signals for the provision of multi-session, including New Instance Establishment, Switch Instance, and Close Instance, are for further study.

### 6.2.5 Format for the *remote MAP control command signals*

The format *MAP command signals* for the provision of remote MAP control, including Remote Inquiry, Remote Modify, and Remote Synchronize, are for further study.

## 6.3 Format of *MAP service signals*

### 6.3.1 Standard format of the MAP status block

The MAP status block has the following format:

<MAP status block> ::= <format effector>

<MAP text> <format effector>

<current aspect> <format effector>

<available aspects> <format effector>

<default aspect>

<format effector> ::= see 3.5.2

<MAP text> ::= 4/13 (M) 4/1 (A) 5/0 (P) 2/0 (SP) 4/1 (A) 5/3 (S) 5/0 (P) 4/5 (E) 4/3 (C) 5/4 (T) 5/3 (S)

<current aspect> ::= <CUR> <current value>

<CUR> ::= 4/3 (C) 5/5 (U) 5/2 (R) 2/0 (SP)

<current value> ::= 4/3 (.C) 5/0 (P) 4/1 (A) 4/4 (D)

<available aspects> ::= <AVA> <available values>

<AVA> ::= 4/1 (A) 5/6 (V) 4/1 (A) 2/0 (SP)

<available values> ::= list of codes for aspects available on this MAP. If more than one aspect value is contained in this list then the characters 2/12 (,) 2/0 (SP) are sent before the next aspect code.

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<default aspect> ::= <DEF> <default value>

<DEF> ::= 4/4 (D) 4/5 (E) 4/6 (F) 2/0 (SP)

<default value> ::= code for default aspect value

Example: Free – No Call Established

MAP ASPECTS

CUR CPAD

AVA CPAD, FPAD

DEF CPAD

## 6.3.2 Standard format of the *confirm modify MAP* service signal

The characters 4/13 (M) 4/15 (O) 4/4 (D) 2/0 (SP) 4/3 (C) 4/15 (O) 4/14 (N) 4/6 (F) are sent.

## 6.3.3 Standard format of the aspect entry *MAP* service signal

The PAD identification PAD service signal defined in 3.5.18 is sent.

## 6.3.4 Change confirm signals

The *change confirm MAP* service signal is a dialogue to verify the change is intentional.

### 6.3.4.1 Standard format of the *verify change MAP* service signal

The *verify change MAP* service signal has the following format:

<verify change> ::= <CHANGE PORT TO> <new aspect> 3/15 (?)

<ChANGE PORT TO> ::= 4/3 (C) 4/8 (H) 4/1 (A) 4/14 (N) 4/7 (G) 4/5 (E) 2/0 (SP) 5/0

(P) 4/15 (O) 5/2 (R) 5/4 (T) 2/0 (SP) 5/4 (T) 4/15 (O) 2/0 (SP)

<new aspect> ::= the IA5 PAD code for the aspect requested. See Table I /X. 8 PAD

Aspect Codes.

### 6.3.4.2 Standard format of the *confirm change MAP* service signal

The characters 4/3 (C) 4/8 (H) 4/1 (A) 2/0 (SP) 4/3 (C) 4/15 (O) 4/14 (N) 4/6 (F) are sent.

## 6.3.5 Format for the *multi session MAP* service signals

The format of the *MAP* service signals for the provision of multi-session, including New Instance Establishment, Switch Instance, and Close Instance, are for further study.

## 6.3.6 Format for the *remote MAP* control service signals

The format *MAP* service signals for the provision of remote MAP control, including Remote Inquiry, Remote Modify, and Remote Synchronize, are for further study.

## 6.4 Error Conditions

The error PAD service signal defined in 3.5.19 is used when an invalid *MAP command* signal is sent.

## 6.5 Format of Additional *MAP command* signals and *MAP* service signals available in the extended dialogue mode

In addition to the *MAP command* signals and *MAP* service signals defined above (see 6.2 and 6.3), some networks may support additional capabilities in the extended dialogue mode. Additional *MAP command* signal keywords, which are provisionally defined in Table 9, can be used instead of the corresponding standard keywords. Some networks may provide these keywords when the MAP is not in the extended dialogue mode.