EUROPEAN TELECOMMUNICATION STANDARD

ETS 300 708

March 1997

Source: EBU/CENELEC/ETSI JTC

Reference: DE/JTC-TTEXT-DT

ICS: 33.020

Key words: Broadcasting, data, TV, Teletext

European Broadcasting Union

Union Européenne de Radio-Télévision

Television systems; Data transmission within Teletext

ETSI

European Telecommunications Standards Institute

ETSI Secretariat

Postal address: F-06921 Sophia Antipolis CEDEX - FRANCE
Office address: 650 Route des Lucioles - Sophia Antipolis - Valbonne - FRANCE
X.400: c=fr, a=atlas, p=etsi, s=secretariat - **Internet:** secretariat@etsi.fr

Tel.: +33 4 92 94 42 00 - Fax: +33 4 93 65 47 16

Copyright Notification: No part may be reproduced except as authorized by written permission. The copyright and the foregoing restriction extend to reproduction in all media.

© European Telecommunications Standards Institute 1997. All rights reserved.

Whilst every care has been taken in the preparation and publication of this document, errors in content, typographical or otherwise, may occur. If you have comments concerning its accuracy, please write to "ETSI Editing and Committee Support Dept." at the address shown on the title page.

Contents

Foreword 5

1 Scope 7

2 Normative references 7

3 Definitions and abbreviations 7
3.1 Definitions 7
3.2 Abbreviations 8

4 Page Format - Clear 8
4.1 General points 8
4.2 Advantages 8
4.3 Disadvantages 8
4.4 Coding of the packets 8
4.4.1 Page header 9
4.4.2 Packets 1 to 23 (in future up to 25) 10
4.4.2.1 Transmission order 11
4.4.2.2 The Structure Header (SH) 11
4.4.2.3 Packing the data into the pages 11
4.4.3 Packet 28 12
4.5 Providing a service according to Page Format - Clear 12
4.5.1 General points on Page Format - Clear 13
4.5.2 Encoding scheme for electronic data transmission 13

5 Page Format - CA 13
5.1 General points 13
5.2 Advantages 13
5.3 Disadvantages 14
5.4 Method of coding 14
5.4.1 Teletext page data 15
5.4.1.1 Scrambled Data Pages 15
5.4.1.2 Pages containing Reformatted Data 15
5.4.2 The Page Key Packet 16
5.4.2.1 Service Mode bits 16
5.4.2.2 Service Identification 17
5.4.2.3 Continuity and Repeat Indicators 17
5.4.2.4 Packet Flags 17
5.4.2.5 Data Length 17
5.4.2.6 Scrambling Method 18
5.4.2.7 The Cyclic Redundancy Check (CRC) word 18
5.4.3 Terminal Equipment Addressing Pages 19
5.4.3.1 System Key Packet 19
5.4.3.2 Shared User Packets 19
5.4.3.3 Unique User Packets 20
5.4.3.4 Service/Page Link packets 21
5.4.3.5 Link to Independent Data Line Services 21
5.5 Security of Page Format - CA 21
5.5.1 Cipher feedback algorithm 21
5.5.2 One-way function 22
5.5.3 Text scrambling 23

6 Independent Data Lines (IDL) 23
6.1 General points 23
6.2 Advantages 23
6.3 Disadvantages 23
6.4 Methods of coding 23

6.4.1 Designation code ... 23
6.4.1.1 Transmission multiplexing ... 23
6.4.2 Data Channel addressing ... 23
6.5 IDL Format A ... 24
6.5.1 Format Type (FT) ... 24
6.5.2 Interpretation and Address Length (IAL) ... 24
6.5.3 Service Packet Address (SPA) ... 25
6.5.4 Repeat Indicator (RI) ... 25
6.5.5 Continuity Indicator (CI) ... 25
6.5.6 Data Length (DL) byte ... 25
6.5.7 User Data Group ... 25
6.5.7.1 Dummy bytes ... 26
6.5.8 Cyclic Redundancy Check (CRC) word ... 26
6.5.8.1 Check word generation ... 26
6.5.9 Transmission sequence ... 27
6.6 Datavideo format ... 27
6.6.1 Packet address ... 27
6.6.2 Control Bytes (CB) ... 27
6.6.2.1 Packet Continuity Indicator (CI) ... 27
6.6.3 Masking indicator ... 27
6.6.4 Packet type indicator ... 28
6.6.5 User data group ... 28
6.6.6 Cyclic Redundancy Check (CRC) word ... 28
6.6.6.1 Check word generation ... 28
6.6.6.2 Check result ... 28
6.7 Low bit-rate audio ... 28
6.7.1 Method of coding ... 29
6.7.1.1 Decoder action ... 29
6.7.2 Programme-related audio service ... 29
6.7.2.1 Service Byte (SB) ... 29
6.7.2.2 Control Byte (CB) ... 29
6.7.2.3 Audio data ... 30
6.7.3 Programme independent audio service ... 30
6.7.3.1 Service Byte (SB) ... 30
6.7.3.2 Control Byte (CB) ... 30
6.7.3.3 Audio data ... 30

7 IDL - CA (type A) ... 30
7.1 General points ... 30
7.2 Advantages ... 31
7.3 Disadvantages ... 31
7.4 Methods of coding ... 31
7.4.1 Block Separator ... 31
7.4.2 Block Formats ... 31
7.4.3 Block Format A ... 31
7.4.3.1 Block Types ... 31
7.4.3.2 Primary Block Key Messages ... 32
7.4.3.3 Secondary Block Messages and Scrambled User Data ... 32
7.4.3.4 System-Key Message Block ... 32
7.4.3.5 Shared-User Message Block ... 32
7.4.3.6 Unique User Message Block ... 33
7.4.3.7 Service Address Message Block - Independent Data Service ... 33
7.4.3.8 Service Address Message Block - Link to Page Format - CA ... 33

History ... 34

Foreword

This European Telecommunication Standard (ETS) has been produced by the Joint Technical Committee (JTC) of the European Broadcasting Union (EBU), Comité Européen de Normalisation ELECtrotechnique (CENELEC) and the European Telecommunications Standards Institute (ETSI).

NOTE: The EBU/ETSI JTC was established in 1990 to co-ordinate the drafting of ETSs in the specific field of broadcasting and related fields. Since 1995 the JTC became a tripartite body by including in the Memorandum of Understanding also CENELEC, which is responsible for the standardization of radio and television receivers. The EBU is a professional association of broadcasting organizations whose work includes the co-ordination of its Members' activities in the technical, legal, programme-making and programme-exchange domains. The EBU has Active Members in about 60 countries in the European Broadcasting Area; its headquarters is in Geneva *.

* European Broadcasting Union
Case Postale 67
CH-1218 GRAND SACONNEX (Geneva)
Switzerland

Tel: +41 22 717 21 11
Fax: +41 22 717 24 81

Transposition dates	
Date of adoption:	7 March 1997
Date of latest announcement of this ETS (doa):	30 June 1997
Date of latest publication of new National Standard or endorsement of this ETS (dop/e):	31 December 1997
Date of withdrawal of any conflicting National Standard (dow):	31 December 1997

Blank page

1 Scope

This European Telecommunication Standard (ETS) describes the various ways in which Teletext may be used to carry non-Teletext services. It should be used in conjunction with ETS 300 706 [1]. An example is fully described in ETS 300 707 [2]. This ETS includes additional practical information on implementing a data service of this type.

Hooks into existing Teletext services may be provided from within the application which is carried as a non-Teletext service. A data broadcast application may be pointed to from the Magazine Inventory Page (MIP) or it may be allocated a specific page number. A Code of Practice (CoP) shall ensure that services destined for the consumer may be found quickly by "low-end" Teletext decoders but this is outside the scope of this ETS.

There are two methods available for carrying data services. The first method carries the data within Teletext pages. The data in these pages is not sui for direct display by a Teletext decoder and shall normally be allocated a special page number and/or have the display inhibited. The second method carries the data within Independent Data Lines (IDL) and these are independent of the page service.

With both Page and IDL formats there exist versions which offer Conditional Access (CA).

There are other specific IDL data services which have been defined but it is beyond the scope of this ETS to cover all of these.

2 Normative references

This ETS incorporates, by dated or undated references, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references subsequent amendments to, or revisions of, any of these publications apply to this ETS only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1] ETS 300 706: "Enhanced Teletext specification".

[2] ETS 300 707: "Electronic Programme Guide (EPG); Protocol for a TV Guide using electronic data transmission".

[3] ETS 300 231: "Television systems; Specification of the domestic video Programme Delivery Control system (PDC)".

3 Definitions and abbreviations

3.1 Definitions

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

data stream: The sequence of bytes carried in a uniquely addressable data service.

encryption: The process whereby a sequence of data is made secret. See subclause 5.5 for further information.

network operator: The organization responsible for the compilation of the Teletext service for insertion into the available Vertical Blanking Interval (VBI) lines.

scrambling: The process whereby a sequence of data is made unintelligible. See subclause 5.5 for further information.

service provider: The organization responsible for the creation and supply of the data service application.

3.2 Abbreviations

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

AUDETEL	AUdio DEscription of TELevision
BL	Block Length
BP	Block Pointer
BS	Block Separator
BT	Block Type
CA	Conditional Access
CI	Continuity Index
CoP	Code of Practice
EPG	Electronic Programme Guide
FB	Filler Bytes
IDL	Independent Data Lines
LSB	Least Significant Bit
MIP	Magazine Inventory Page
MSB	Most Significant Bit
RI	Repeat Indicator
SH	Structure Header
VBI	Vertical Blanking Interval (fully defined in this ETS)

4 Page Format - Clear

4.1 General points

A page number which includes at least one hexadecimal digit should be chosen for this type of service. For an Electronic Programme Guide (EPG) service this will generally be page 1DF as fully described in ETS 300 707 [2]. The value nFF is not permitted for any data service, where n can take the value from 1 to 8 inclusive. The page number is defined in the Magazine Inventory Page (MIP), ETS 300 706 [1].

The user data is divided into blocks, each of whose length is defined. An additional check of where the block boundaries are located is provided by means of a block pointer placed in the first byte in each packet. The data stream is further identified by means of additional data provided in the page header. It is possible to carry several independent data services within the same page number.

4.2 Advantages

This mode is appropriate for reception by all existing Teletext decoders. A default coding method is defined in order that services may be offered using existing Teletext systems. Synchronization of the user data blocks is assured by means of a simple robust method of dual pointing to each block start location. Future possibilities exist by providing an additional packet 28 which will further define the coding system in use. It is left up to the service provider to apply any additional protection to those parts of his service which require it. It is possible to sub-divide the service into those parts which will be required by all decoders and those parts which will only be required by the more sophisticated decoders.

4.3 Disadvantages

This mode is not efficient for sending a small amount of data as there is always the overhead of including a page header and the optional, but useful, packet 28. Another disadvantage of this mode is that the data transmission efficiency is further reduced when the Teletext broadcaster wishes to send the data in a fragmented way in order to interleave the data service with his primary Teletext service.

4.4 Coding of the packets

In order to provide greater flexibility for the network operator it is not necessary to fill each data page. Several separated headers, each with some data packets, may be required to provide the data service and this technique is covered fully in ETS 300 706 [1]. In the case of a data service it is possible to send full but fragmented pages as well as to simply send shorter pages.

Fragmented pages are usually interleaved with one or more other pages. Each fragmented page contains, in row order, parts of a full page. Fragmented pages transmitted in stream 1 shall obey the 20 ms rule for each fragment.

4.4.1 Page header

This is necessary but shall not generally contain any of the application data. It may be identical to all others in the same magazine. The use of the Teletext page sub-code is defined as shown in figure 1.

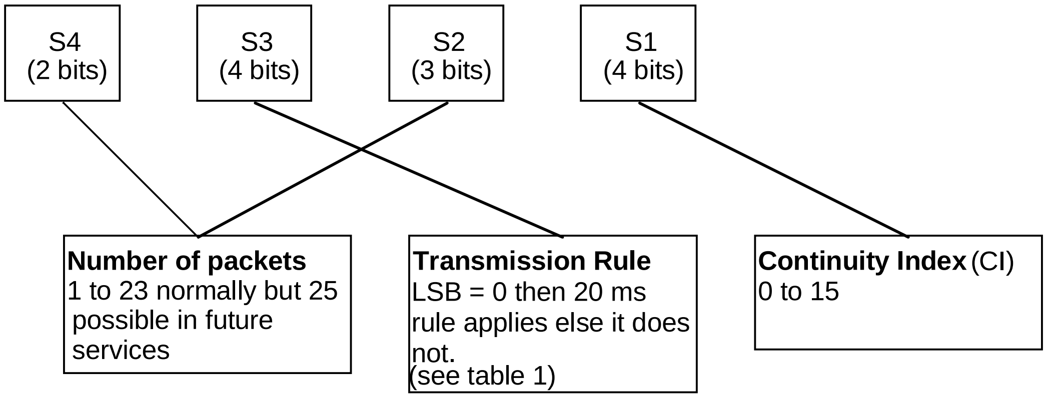


Figure 1: The use of the Teletext page sub-code

The default valid range for the number of packets is 1 to 23 where this value provides the last row which is being transmitted for the page with this particular value for the Continuity Index (CI). The packets of the page are transmitted in ascending address order. There are no missing rows and where a new header is required to complete the page then this shall be provided with the same CI. The maximum number of packets per page is 25 and as a result S2 and S4 will never have values of 7 and 3 simultaneously. Thus the reserved sub-code value of 3F7F defined in ETS 300 706 [1] can never occur. As expected the Least Significant Bit (LSB) of each parameter in the page sub-code is transmitted first. S2 contains least significant 3 bits of the "Number of packets".

The 20 ms rule requires that the header packet 0 is sent during a previous field. This rule shall be followed when the LSB of S3 is set to 0. When this bit is set to 1 then the header may be followed immediately by the packets associated with this header. The following values have been defined in table 1.

Table 1: Values of S3

Hex value of S3	Interpretation
0	20 ms rule applies - data stream 1
1	no 20 ms rule - data stream 2
2	20 ms rule applies - data stream 3
3	no 20 ms rule - data stream 4
4, 6, 8, A, C & E	20 ms rule applies - data stream 5, 7, 9, 11, 13 & 15 respectively
5,7,9,B & D	no 20 ms rule - data stream 6, 8, 10, 12 & 14 respectively
F	reserved for future use, no 20 ms rule applies

In each stream the **CI value** increments modulo 16 for each page which contains different application data.

Page control bytes C4 to C14; their action is as follows:

The values for C5, C6, C7, C8, C11, C12, C13 and C14 depend upon the type of service which the network provider is offering and have the same meaning as for normal Teletext pages. The following control bytes in table 2 have a recommended value.

Table 2: Page Control Bits

C4	C9	C10
Erase Page	Interrupted Sequence	Inhibit Display
0	1	1

The next 24 bytes should normally match those of the other pages in the same magazine. This is to avoid possible display problems with viewers of the normal Teletext service which shares this Magazine.

The last 8 bytes of the header shall be used in a way which takes account of the rest of the Teletext service. Where the time can be the same as that on the normal Teletext service it shall be presented in the same format. Where this is not possible these 8 bytes should be filled with spaces. In the case where there is no other Teletext service then the local time shall be placed in these 8 bytes according to the Enhanced Teletext Specification ETS 300 706 [1].

4.4.2 Packets 1 to 23 (in future up to 25)

These packets may carry the data service. The page sub-code indicates to the decoder how many packets to expect. The default maximum number of packets is 23 although future services may be able to use up to 25. Each Teletext packet is constructed in the manner shown in figure 2.

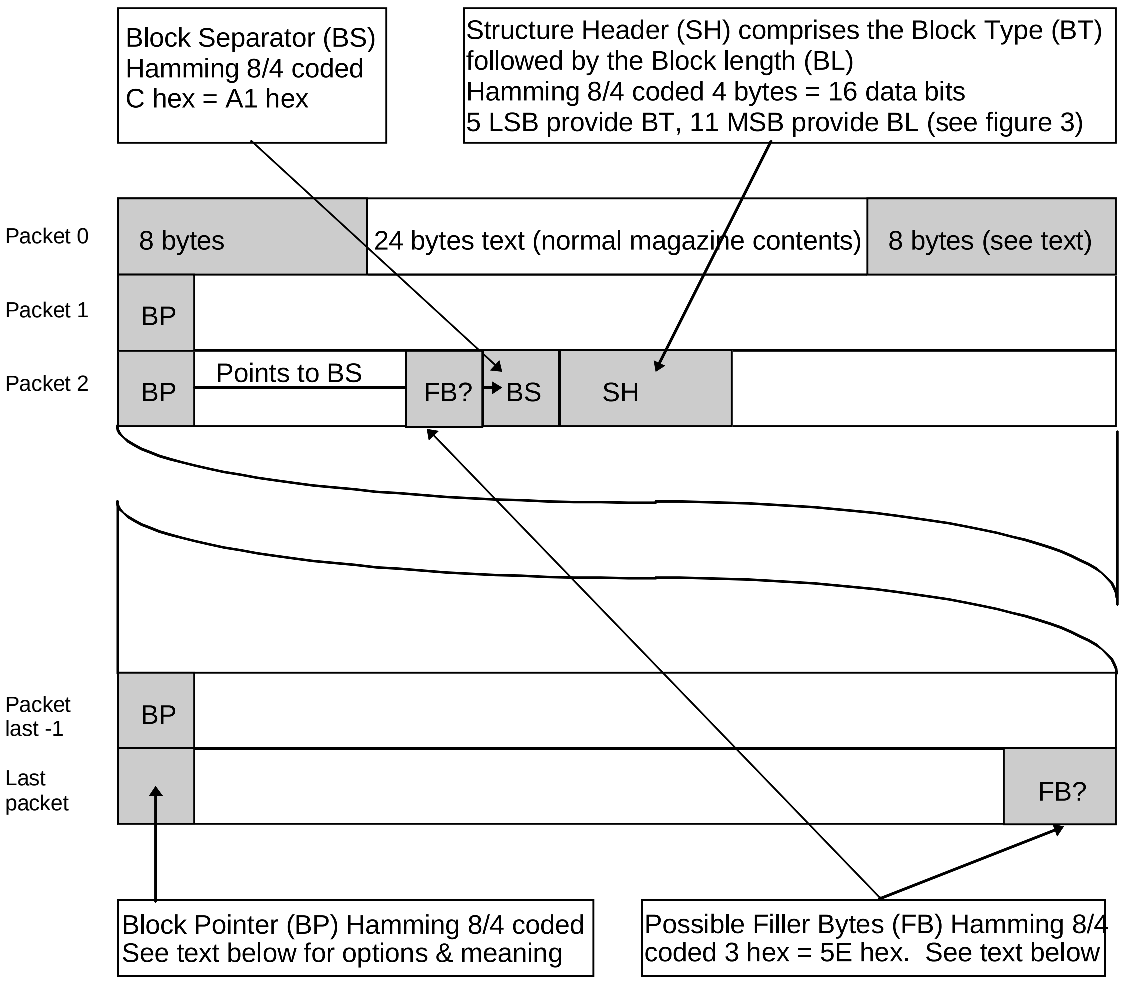


Figure 2: Example of a page according to Page Format - Clear

4.4.2.1 Transmission order

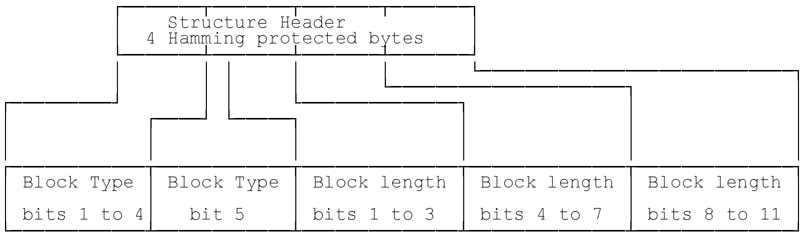
This follows the normal Teletext format where the LSB is transmitted first. For example in the Structure Header (SH) the least significant 4 bits of the Block Type shall be placed in the byte which is transmitted first. The most significant bit of BT shall be placed in the least significant position of the next byte. The Hamming 8/4 coding is carried out in the same way as fully described in ETS 300 706 [1]. The bytes defined above are all transmitted in the same way. It is up to the data service provider how he codes the bytes which constitute the "user data". The values for BP are given in table 3.

Table 3: Values for Block Pointer (BP)

Hex value for BP	Interpretation
0 to C	point to BS in byte position (BP x 3) + 1
D	means that there is no BS in this packet
E and F	reserved for future use

4.4.2.2 The Structure Header (SH)

The SH comprises four Hamming 8/4 coded bytes. This is put in by the data service provider and the 16 available data bits are used in the following way.



Shown in transmission order from left to right. LSB transmitted first. Only the data bytes are shown.

Figure 3: The Structure Header

The first 5 bits (BT) provide the Application ID. This gives the data application provider the possibility of providing up to 31 different categories of data within one page service. This is addition to the separation into a number of streams which is possible by means of the page sub-code value for S3. The actual value for the Application ID is up to the application provider. When the Application ID has the value 0 this is used to provide the system with information about which services are carried in this data channel. This is fully covered in ETS 300 707 [2].

The remaining 11 bits define the block length which permits block lengths of up to 2 048 bytes long.

4.4.2.3 Packing the data into the pages

The network operator packs the available data into the Teletext packets. He has to read the block lengths in order to put in the Block Pointer (BP) values. The BP may point to 1 of 13 locations in a Teletext packet according to table 3. Where a data block does not fill up to 1 of the 13 possible start locations the free bytes are filled with Filler Bytes (FB). Filler bytes are also used to pad out the end of a packet if the broadcaster has no data available to fill it. The benefit of this process is that each block start is not only pointed to from the previous block length but also from the BP. It provides a robust method of synchronizing the application data stream. Block Pointer (BP), Block Separator (BS) and Block Length (BL) are all Hamming 8/4 coded. Even with bit errors it should be possible for the reception device to have a high confidence that it is in correct synchronization. The BL may not point precisely to the next BS as these may only be placed in every third byte, when pointed to from the BP. The existence of the FB informs the decoder to look forward to find the next BS.

Where the Service Operator provides very short data blocks it is possible that 2 blocks may commence in the same Teletext Packet. Where this occurs the BP shall point to the first BS. The second BS shall be placed immediately after the end of the first block, as indicated by the BL in the previous SH. There is no requirement for Filler Bytes between the two data blocks as the second BS will not be pointed to from a BP.

The Filler Byte (FB) (5E hex = 01011110 binary) has the inverted value of the Block Separator (BS) (A1 hex = 10100001 binary).

Where the broadcaster starts from no data then the first Block Separator (BS) shall occur at the start of the page. Data Blocks may start within one page and finish in a different one. The network operator requires no knowledge of the data which he is transporting apart from knowing where each block commences and how long it is. Each of the user data bytes contains 8 usable bits and it is up to the Data service provider to determine how he uses them. The packets shall be sent in ascending sequence through from 1 to n (given by the n value in the page sub-code provided by S4 and S2). In this way any lost packets can be detected.

The employment of a packet 28 permits these data bytes to be encoded in various different ways but currently only the one mode is defined. When the service provider requests the use of more than one data stream then the network operator shall treat each stream as an independent data service. In the case of an EPG there are some restrictions and these shall be checked in each circumstance as they will vary according to the capabilities of the reception equipment.

4.4.3 Packet 28

Packet 28 is optionally required to unambiguously define the format and purpose of the data contained in the following packets which comprise the page. It should be sent, as soon as possible, following the header. Some Teletext decoders do not acquire the packet 28 and so it should be employed only for applications which are aimed at newer decoders. The designation code should be set to 0000 and the page function set to 0001. The contents of the packet is given in table 4.

Table 4: The Packet 28 for Page Format - Clear

Triplet	Bits	Function
1	1 ⇩ 4	**Page Function** 0001 Page used to carry general purpose data
1	5 ⇩ 7	**Page Coding** These bits define the coding of packets X1 to X25, if present, of the associated page. Where these bits are set to 000 then the packets are defined as for Page Format - Clear. All other values are reserved for future use.
1	8 ⇩ 18	**Reserved for future use**
2 ⇩ 13	1 ⇩ 18	**Reserved for future use**

4.5 Providing a service according to Page Format - Clear

The following lists lay down the conditions which are necessary for a satisfactory transmission and reception of a data broadcast application which employs this method for transporting data.

4.5.1 General points on Page Format - Clear

1) The 20 ms rule applies between transmission of the header and any following packets when the received data is required to be processed by all "low end" decoders. The value for the LSB of the S3 value in the page header shall be set to 0. Enhanced data which is destined for use by new "high end" decoders does not need to follow the 20 ms rule (LSB of S3 = 1).

2) The maximum number of packets following the header shall be limited to 23.

3) The data within the packets shall be treated by the Teletext decoder as 8-bit data.

4) The data shall all be transmitted using the method described in Page Format - Clear.

5) The user data shall not necessarily be synchronized to the page format.

6) The block structure shall be as indicated under Page Format - Clear.

7) Where the service is constructed from more than one data stream then each stream shall be dealt with as an independent data service. It is up to the application to make intelligent use of the data extracted from more than one stream.

8) The implication of 7) is that the decoder may have to simultaneously build up two separate data pages. This may happen if fragmented pages from two streams are interleaved with each other. This can be managed by a Code of Practice (CoP) document for the data service.

4.5.2 Encoding scheme for electronic data transmission

This subclause shows how to take the application to the transport system. The main issues are:

1) The application data is encoded in a way appropriate to its purpose. Critical data is better protected. This function is left to the data service provider, or his agent, and is of no concern to the transportation layer. He may group together items or divide them but the end result shall be blocks of data which he wishes to deliver to the network operator.

2) The user data blocks are linked together into one data stream by means of the Block Separators (BS). The Data service provider puts in the Application ID the Block Type (BT) and the Block Lengths (BL) as defined in Page Format - Clear.

3) The resulting data stream is fitted into pages by the network operator who shall shift through the data in order to put in the Block Pointers (BP) and the Filler Bytes (FB). Apart from this the network operator has no interest in the data.

4) Where 2 Blocks start in the same Teletext Packet the network operator inserts the BP for the first one only as described in subclause 4.4.2.3.

5) Where the data is destined to be transmitted in more than one data stream then the data for each stream shall be supplied separately and considered as an independent and separate service.

6) The network operator shall take account of the capabilities of the receiving equipment when he inserts the data streams into the Teletext service (see subclause 4.5.1, point 8).

5 Page Format - CA

5.1 General points

This mode provides the means for subscription data services where the subscriber management centre is under the control of the network operator.

5.2 Advantages

This mode enables many service providers the means to transmit large amounts of data efficiently to subscriber groups. As the network operator is providing a value added service it potentially provides him with additional revenue. The service provider does not need to concern himself with the complex issues of Conditional Access (CA).

An efficient scheme has been defined which provides an effective way of managing large numbers of subscribers with varying requirements. It achieves this by employing a hierarchical approach to handling the required encryption keys.

5.3 Disadvantages

This method requires the use of special Teletext decoders which incorporate the appropriate CA sub-system. It is not a very efficient way to transmit short blocks of data in view of the essential overhead of the page header and the packet 28. Error checking, at the transport level, is only possible on a per page basis.

5.4 Method of coding

There may be an introductory page of non-scrambled text. When no introductory text for display is required, this page shall at least include the header packet with Y = 0 and a packet or packets with Y = 27 to provide links to the conditional access service. The links are provided in a packet with Y = 27, designation codes 0100 to 0111 (see ETS 300 706 [1]). Figure 4 shows how the system works.

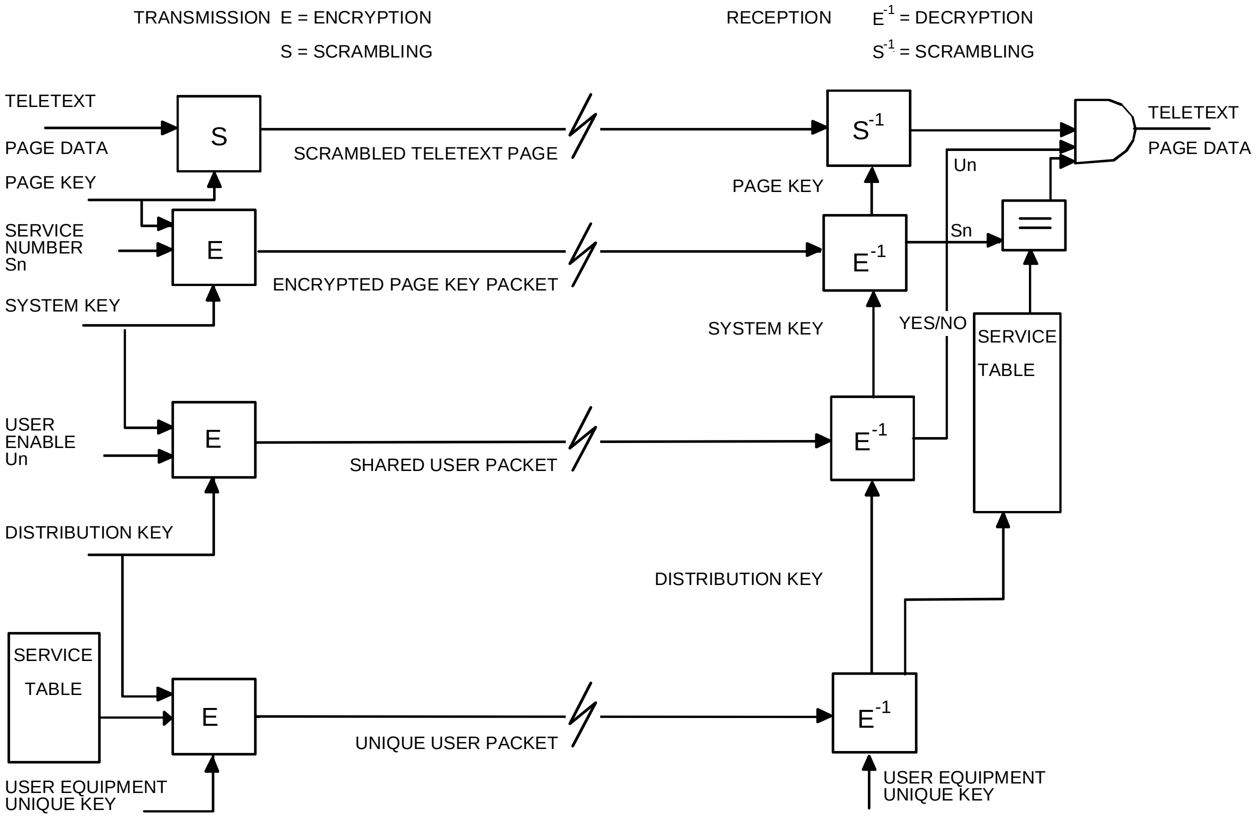


Figure 4: Component parts required for the service

Figure 4 helps to understand the operation of a service operating to the Page Format - CA standard.

5.4.1 Teletext page data

For the purpose of scrambling, two types of pages are defined.

1) **Scrambled Data Pages** are essentially normal Teletext pages but with each byte scrambled to make it unintelligible. The scrambling process is initialized at the start of each packet. Unused packets need not be transmitted. See subclause 5.4.1.1.

2) **Pages containing Reformatted Data** shall be signalled by means of the packet X/28 as shown in table 5. In this case the scrambling process is initialized at the start of each page. See subclause 5.4.1.2.

Page Mode Definition is achieved by means of a Packet X/28. The first 8 bits in the first triplet define the type of page data which follows. Table 5 below provides the relevant values but for more detail see ETS 300 706 [1]. Note that this table only refers to packets X/28 with designation codes of 0000 & 0010. Table 6 provides details on how to interpret bits 15 to 18 in this packet X/28.

Table 5: Coding of Packets X/28 - interpretation of the following page

8 7 6 5 4 3 2 1	Bit Numbers
1 0 0 0 0 1 0 0	Reformatted Data
1 0 0 0 0 1 0 1	Terminal Equipment Addressing page
0 * * 0 0 0 0 0	Page has standard character position and row format

* = don't care value

Table 6: Coding of Packets X/28 - data bit organization and protection

18 17 16 15	Bit Numbers
0 0 0 0	Data coded as 8-bit bytes, 7 bits data plus 1 parity bit
0 0 0 1	Data coded as 8-bit bytes, with 8 data bits each
0 0 1 0	Data coded as 3 groups of 8-bit bytes, 18 data bits Hamming protected 24/18
0 0 1 1	Data coded as 8-bit bytes, 4 data bits Hamming protected 8/4

This interpretation is only defined when the remaining bits in this 18 bit group, bits 9 through to 14 all have the value 0.

5.4.1.1 Scrambled Data Pages

The data for transmission in bytes 6 to 45 of packets with Y = 1 to Y = 25, plus the 18 data bits in each three byte data group for transmission in packets with Y = 26, is scrambled, using a suitable scrambling algorithm. Subclause 5.5 provides an example of a suitable algorithm. The numbers of the packets included in a scrambled text page are specified as in subclause 5.4.2.4.

Parity protected 7-bit data

To provide a sequence of complete bytes for scrambling when 7-bit data is used, a most significant bit is added. The resulting bytes are scrambled and the respective bit masked before the odd parity bit added.

Data in Packets with Y = 26

To provide a sequence of complete bytes for scrambling, the 18 data bits have the 6 most significant bits added. The resulting 3 bytes are scrambled and the respective 6 bits masked before Hamming protection bits are calculated and added.

5.4.1.2 Pages containing Reformatted Data

The data for transmission in bytes 14 to 37 of packets with Y = 0 and bytes 6 to 45 of packets with Y = 1 to Y = 25 are scrambled using an encryption algorithm. The number of bytes included in the page of scrambled data is indicated by the Data Length parameter according to subclause 5.4.2.5.

Parity protected 7-bit data

To provide a sequence of complete bytes for scrambling when 7-bit data is used, a most significant bit is added. The resulting bytes are scrambled and the respective bit masked before the odd parity bit is added.

5.4.2 The Page Key Packet

Descrambling of a Scrambled Teletext Page Data is by means of a Page Key contained in a packet with Y = 28 of a scrambled page. The Page Key Packet also provides details concerning the scrambled data which is carried by the Teletext page. Byte 6, 4 bits data plus 4 bits Hamming protection, carries the Designation Code with the data bits set to 0010. Bytes 7 to 45 are used as 13 groups of 18 data bits plus 6 bits Hamming protection as shown in figure 5.

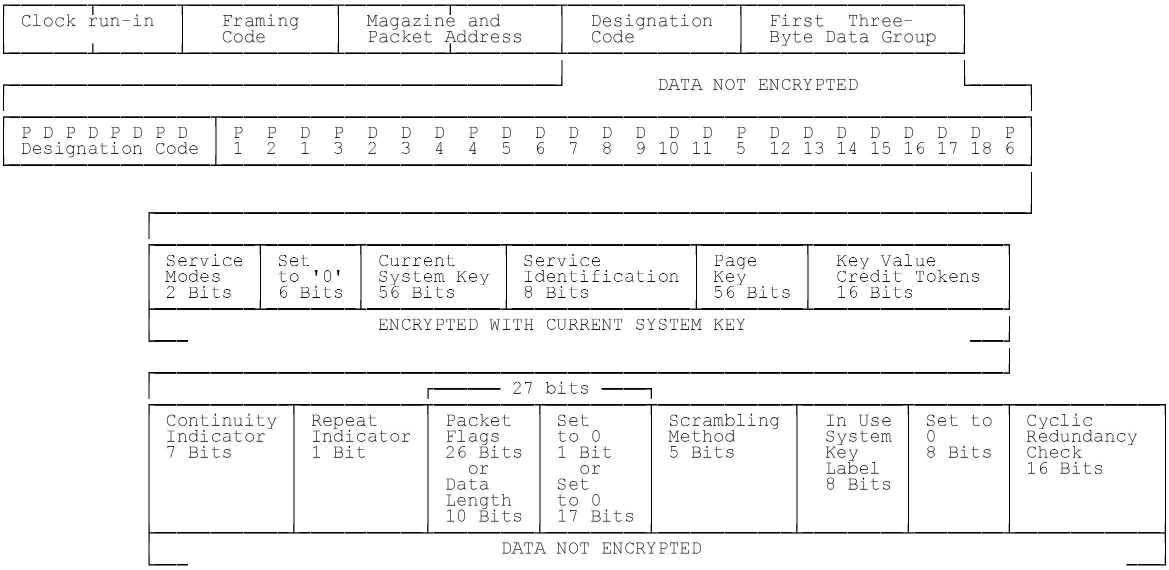


Figure 5: Format of Page Key Packet (X/28)

The first group of 18 data bits is not encrypted and shall be set to designate the page type as provided in table 5 and table 6. The next 144 bits of data are encrypted with the Current System Key. The following subclauses provide additional detail which is not included in figure 5.

5.4.2.1 Service Mode bits

The two Service Modes bits are interpreted as shown in table 7.

Table 7: Service Mode Bits

Bit 2	Bit 1	Service Mode	Mode Description
0	0	1	256 Services Non-Tiered
0	1	2	64 Services Tiered
1	0	3	256 Services with Credit Tokens
1	1	4	Not Assigned

5.4.2.2 Service Identification

The 9-bit Service Identification Number is used in the following way dependent on the Service Mode:

Service Mode 1 or 3: 8 bits define service number, 0 to 255;
or
Service Mode 2: 6 most significant bits of 8-bit group define service number 0 to 63.
2 least significant bits define the service tier as shown in table 8.

Table 8: Service Tiers

Bit 2	Bit 1	Service Tier
0	0	Basic Tier
0	1	Basic + Premium Tier
1	0	Basic + Premium + Extra Tier
1	1	Not Assigned

The 16-bit Key Value Credit Tokens are defined as shown below:

8 bits: fraction part;
8 bits: whole part.

The remaining 72 bits of data are not encrypted. The following subclauses provide additional detail on these.

5.4.2.3 Continuity and Repeat Indicators

The Continuity Indicator is incremented by 1, modulo 127, for each subsequent page with the same service number.

The Repeat Indicator is set to 1 when it is expected that the page will be repeated. It is set to 0 when no repeat is planned.

5.4.2.4 Packet Flags

Packet Flags are used for Scrambled Data Pages. The Packet Flags are set to 1 if the packet is present. Each flag bit refers to one packet in the page starting with packet 1 and finishing with packet 26. This last flag may indicate a sequence of Packets with Y = 26. The least significant packet number is transmitted first.

5.4.2.5 Data Length

The Data Length parameter is used for Pages containing Reformatted Data. The 10 bits permit data lengths up to 1 024 bytes which is the maximum possible with 24 bytes in packet 0 and 25×40 in packets 1 through 25.

5.4.2.6 Scrambling Method

The Scrambling Method is selected from those listed in table 9 below.

Table 9: Register of Scrambling Methods

Method number	Bits 1 to 5 in transmission order	Scrambling Method
1	00000	Variable Length Algorithm using a One Way Function Method A (see figures 9 and 10)
2	10000	Block Enciphering Algorithm using Differential Code Book or Output Feedback (note 1)
3	01000	Variable Length Algorithm using a One Way Function Method B (note 2)
4	11000	MAC Scrambler (note 3)
32	11111	Method not specified
NOTE 1: Differential Code Book. It is not covered further here.		
NOTE 2: Proposed for use in connection with non-Teletext data packets. It is not covered further here.		
NOTE 3: Proposed for use in connection with non-Teletext data packets. It is not covered further here.		

5.4.2.7 The Cyclic Redundancy Check (CRC) word

This is shown in figure 6. This is not the same as a classical CRC word generator and is only defined for use here.

16-bit Shift Register

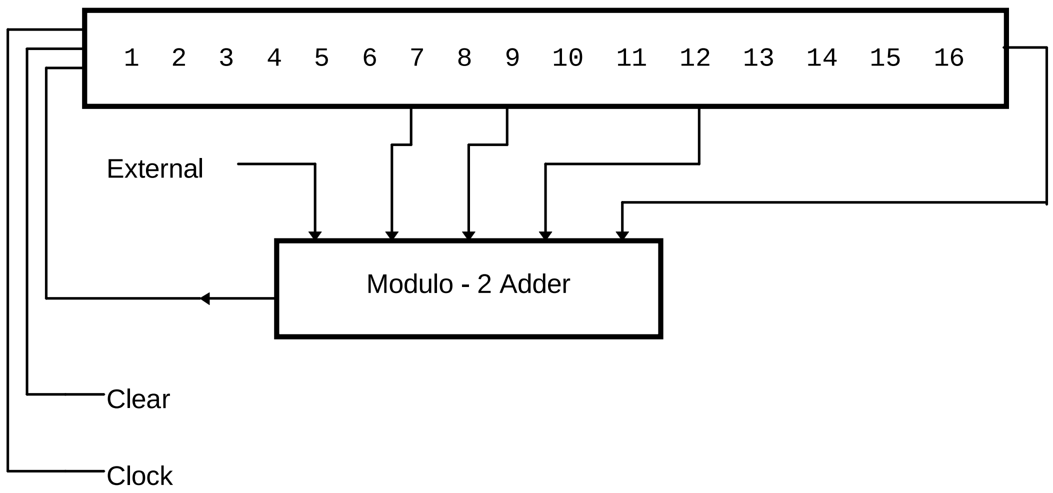


Figure 6: Example of suitable Check Word Generator

In the example shown a 16-bit shift register has as input the modulo-2 sum of an external input and the contents of the 7th, 9th, 12th and 16th stages of the register. Initially the register is cleared to "all zeros". During a sequence of 8 192 clock pulses, the first 24 character bytes (192 bits) of the page header packet and the following character bytes of packets with Y up to 25, in conventional transmission order, form the input. Any absent packets are considered to contain the character SPACE (2/0) throughout. In each byte, the bit order is b8 to b1 inclusive. This order, that is the reverse of that used in the transmission sequence, is to facilitate decoder operation where the data used is stored in the page memory.

At the transmitting end of the generating process the contents of the register are the basic page check word and it is transmitted along the register beginning with the bit held in the first stage.

The transmission order for the two byte group resulting from the 16 bit cyclic redundancy check on the page is bits 9 to 16 followed by bits 1 to 8 inclusive.

For Scrambled Data Pages the 24 character positions bytes 14 to 37 in packets with Y = 0 are assumed to contain the character SPACE (2/0). For Reformatted Data, the check word is calculated over the specified data length.

5.4.3 Terminal Equipment Addressing Pages

Access to the Page Key contained in a packet with Y = 28 of a scrambled page, is by means of the Current and New System Keys. These pages shall contain:

1) A System Key Packet encrypted with the New System Key;
2) Shared User Data Packets encrypted with the Shared Distribution Key;
3) Unique User Data Packets encrypted with a key that is unique to the user's equipment.

The Shared User Data Packets are transmitted relatively frequently and the Unique User Data Packets relatively infrequently. The System Key Packet is provided in the packet X/28 but in practice this will only be changed occasionally at the discretion of the network operator, perhaps once a month.

5.4.3.1 System Key Packet

There shall be a packet with Y = 28, with the designation code in byte 6 set to 0010. The first group of 18 data bits shall be set to define the page as a Terminal Equipment Addressing Page, see table 5. For the interpretation of remaining data bits in this packet see figure 7 and the supporting text. The remaining bytes 10 to 45 are used as 12 groups of 19 bits data plus 6 bits Hamming protection. See figure 7.

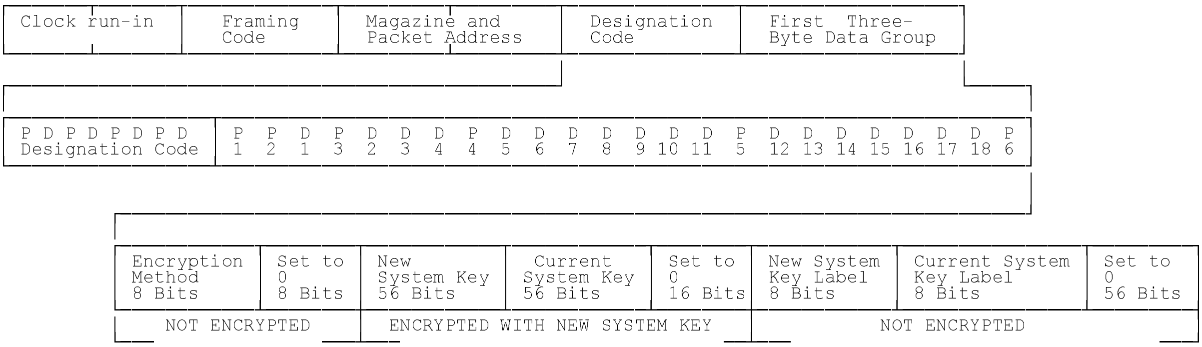


Figure 7: System Key Packet X/28 for Terminal Equipment Addressing

The Encryption Method is selected from the register of Encryption Methods provided in table 10 below.

Table 10: Register of Encryption Methods

Method number	Bits 1 to 8 in transmission order	Encryption Method
1	00000000	Variable Length Algorithm using a One Way Function (see figures 9 and 10)
2	10000000	Block Enciphering Algorithm using Differential Code Book or Output Feedback (note)
x	11111111	Method Not Specified
NOTE: Differential Code Book. This is beyond the scope of this ETS.		

5.4.3.2 Shared User Packets

These may be carried in any packet with Y = 1 to Y = 25. The designation code is provided in byte 6 (4 bits data plus 4 bits Hamming protection). The Data bits are set to 0000. Bytes 7 to 45 are used as 13 groups of 18 bits data plus 6 bits Hamming protection (see figure 8). Service is enabled when the enabling bit is set to 1 and disabled when the bit is set to 0.

5.4.3.3 Unique User Packets

See figure 8. The following provide additional detail.

The 2 Service Modes bits are interpreted as shown in the following table 11.

Table 11: Interpretation of the Service Mode bits

Bit 2	Bit 1	Service Mode	Interpretation		Number of bits
0	0	1	7 Service Numbers of 8 bits		56
0	1	2	7 Service Numbers of 8 bits		56
1	0	3	Total credit tokens purchased for 2 services		
			1st Service Number 8 bits	Credit Tokens Purchased 20 bits	28
			2nd Service Number 8 bits	Credit Tokens Purchased 20 bits	28
1	1	4	Not Assigned		

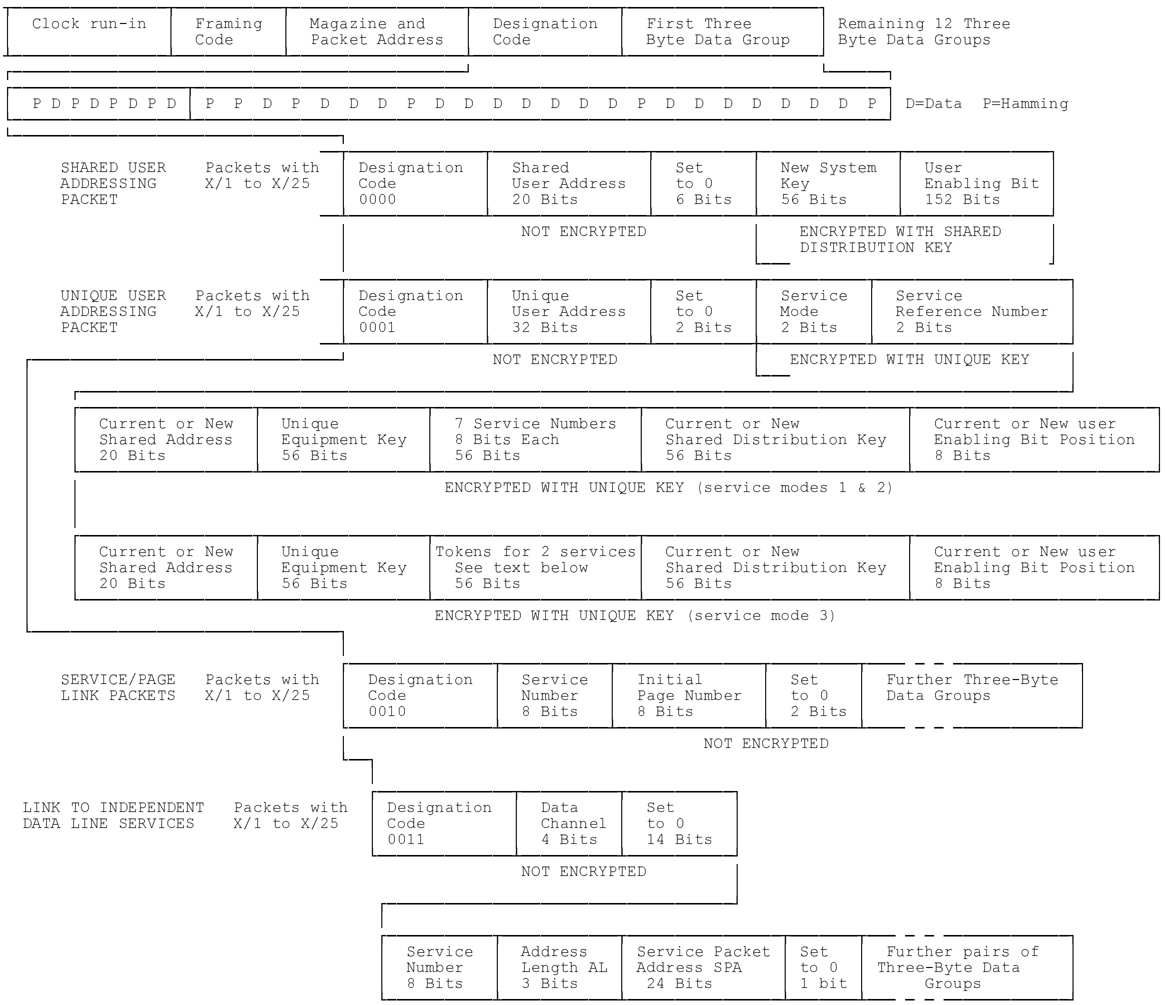


Figure 8: Terminal Equipment Addressing packets

5.4.3.4 Service/Page Link packets

Packets with Y = 1 to Y = 25. Byte 6, 4 bits data plus 4 bits Hamming protection. Designation Code Data bits are set to 0010. Each further three byte group is used in the same way to provide Service Number, Initial Page Number and the 2 bits cleared to 0. Any unused groups in a packet are set to 0.

5.4.3.5 Link to Independent Data Line Services

The Link to Independent Data Line Services is provided as shown in figure 8. Packets with Y = 1 to Y = 25. Byte 6, 4 bits data plus 4 bits Hamming protection. Designation Code Data bits are set to 0011. The first Three Byte Data Group defines the Data Channel. The following three byte groups are paired to provide 36 bits each and thus provide the Service Number and Service Packet Address details. Each further pair of three byte groups is used in the same way. Any unused groups in a packet are set to 0.

5.5 Security of Page Format - CA

The security of the user addressing process may be optimized by the use of "error extension" techniques. Should any bit of the ciphertext have been changed, this causes the message to be totally corrupted when decrypted with the correct key.

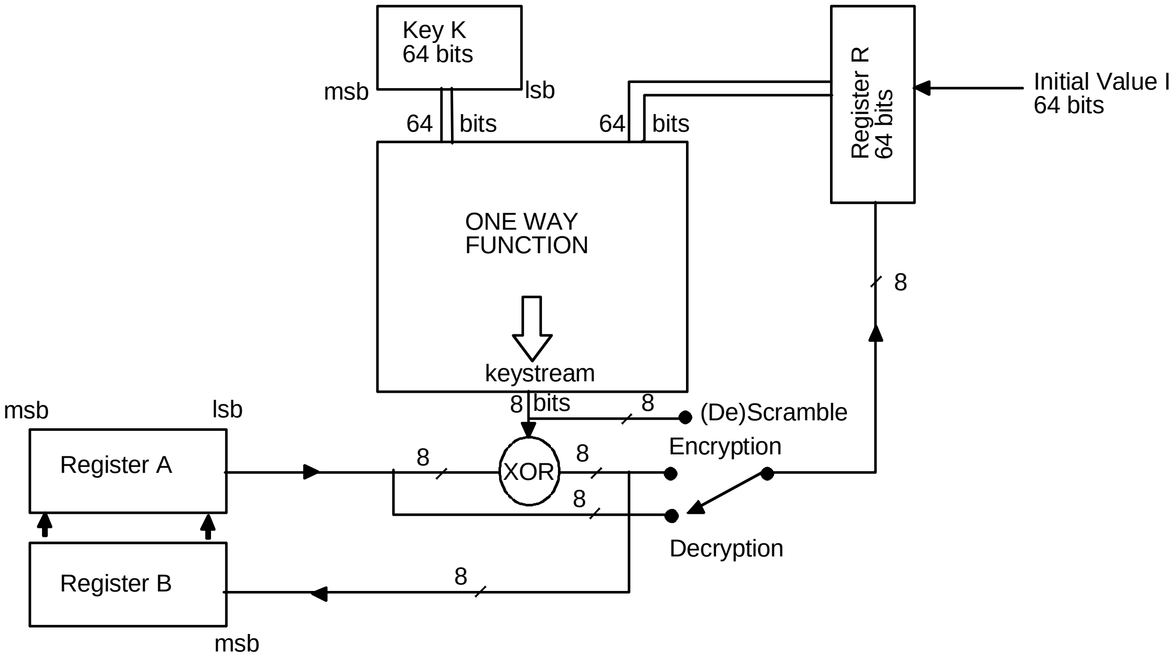


Figure 9: Variable length encryption algorithm

In order to provide the property of "error extension" a cipher feedback technique containing a "one-way function" is used with a multiple of enciphering called "rounds". Each round reverses the order of the previous ciphertext bytes, as shown in figure 9. A typical one-way function having good security is shown in figure 10.

5.5.1 Cipher feedback algorithm

The secret key K is loaded into the 64-bit key register K. The 64-bit key is derived from a 56-bit key that forms the 56 least significant bits. For reformatted data pages and data not in page format, the 8 least significant bits of the 56 are used to look up a corresponding 8-bit value from look-up-tables (LUT) in figure 10. This value is used as the 8 most significant bits of the 64-bit key. For textual page data, the 8 most significant bits are the magazine and row address of each packet forming the page.

The register R is first loaded with a 64-bit secret initial condition I, that is constant for the particular security device in the equipment. It is a random number having an impulse auto-correlation function. This data word I is loaded into the register R at the beginning of each round of the encryption or decryption process.

The encryption and decryption processes are represented in figure 9, the switch being placed in the appropriate position. The message to be encrypted or decrypted is placed in register A and after the appropriate number of rounds appears in register B. The data in register A is taken, byte by byte and the EXCLUSIVE-OR function with the keystream is performed. It is then placed in the B register and the output from the switch is placed in the R register. The previous contents of the B and R registers are shifted along, byte by byte until all the bytes appear in the B register. This process constitutes one round. The next round starts by placing the contents of the B register in the A register but in reverse byte order. At least three rounds are required to produce good ciphertext.

5.5.2 One-way function

A suitable one-way function is shown in figure 10. It has a 256×8-bit look-up-table (LUT) in nine positions. This table contains truly random "ones" and "zeros".

The 64-bit key and the 64-bit contents of register R are added modulo 256. The resulting 64-bit value is applied to 8 identical look-up tables. A different 1-bit output is taken from each table and these form an 8-bit value. This 8-bit value is applied to a modulo 256 accumulator. This causes each output byte to be influenced by the previous bytes generated during each round of the main algorithm.

The accumulator memory is cleared to zero at the start of each round. The output of the accumulator is applied to a ninth lookup table, identical to the others. Its output forms the key stream of figure 9.

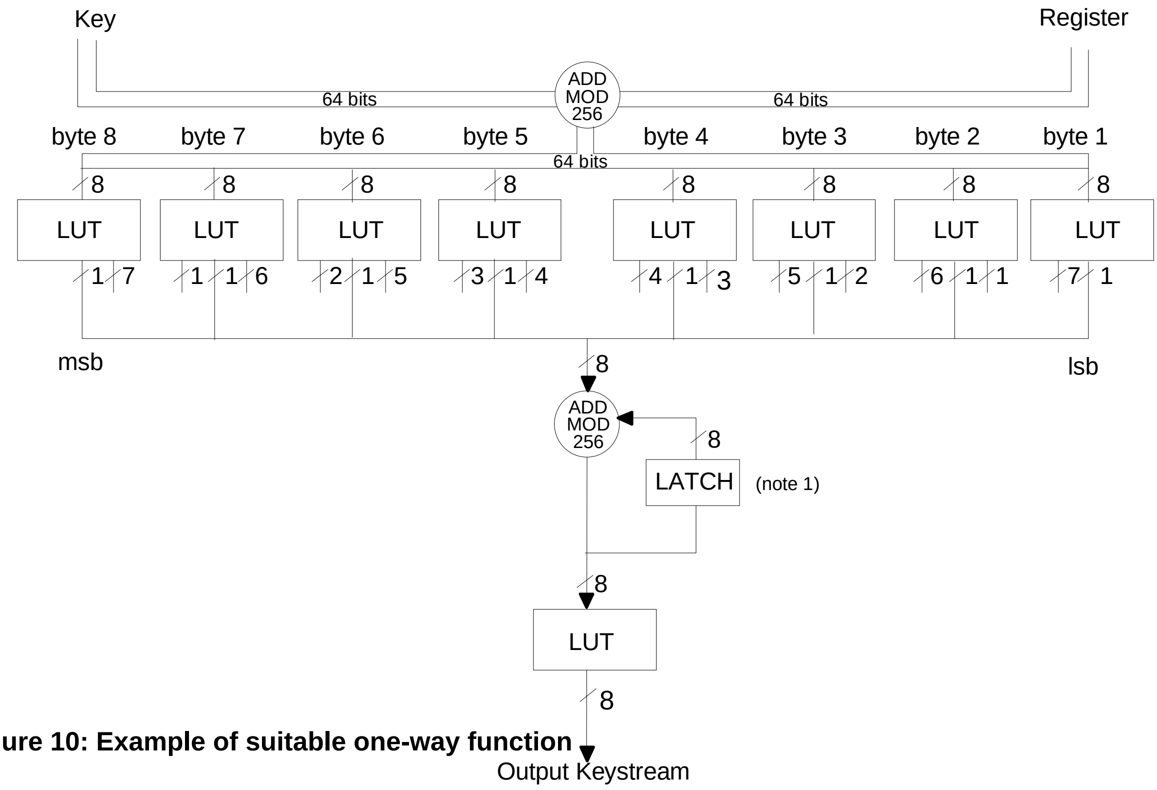


Figure 10: Example of suitable one-way function

NOTE 1: Latch cleared to 00 hexadecimal at the start of each round.

NOTE 2: Each byte in the figure has the most significant bit on the left.

Figure 10: Example of a suitable one-way function

5.5.3 Text scrambling

The algorithm can also be used to scramble or descramble the user data by placing the switch in figure 9 in the appropriate position. Only one round is required. To perform either function, the input data is placed in register A and the result appears in register B.

6 Independent Data Lines (IDL)

6.1 General points

The Independent Data Lines (IDL) provide the means for service providers to transmit, completely independently of the normal Teletext service provider, a data service.

6.2 Advantages

This mode enables many service providers the means to transmit data to their customers in a flexible way. It is an effective way to transmit data blocks of almost any length to the data receiver. Error checking can be easily done on each packet and therefore lost blocks are relatively small compared with the page format. The IDLs can readily be inserted at any point in the data stream at the convenience of the broadcaster and this is a very important point.

6.3 Disadvantages

This method currently requires the use of special Teletext decoders which incorporate the means to recognize and decode IDLs. There is little else against this format.

6.4 Methods of coding

The run-in, bytes 1 and 2, and framing code, byte 3, are the same as those for any other Teletext packet. Bytes 4 and 5 are used to unambiguously identify the service as an IDL service as described in the next subclauses.

6.4.1 Designation code

Byte 5, 4 bits data plus 4 bits Hamming protection. Data bits set to 1111 designate that this is an Independent Data Service Packet.

6.4.1.1 Transmission multiplexing

Television signal data lines carrying these packets may be included amongst the data lines of a Teletext service or may be transmitted using otherwise unused lines. These data lines may always be added at any point in the transmission chain, provided that a new data channel is used (see also subclause 6.4.2).

6.4.2 Data Channel addressing

Byte 5, 4 bits data plus 4 bits Hamming protection. The sixteen possible values define the Data Channel These are numbered 0 to 15 as shown in table 12.

Table 12: The IDL Data Channels

Data Channel number	Service name	Reference	Byte 4 Data (Transmission Order)
(0)	Packet 8/30	see ETS 300 706 [1]	0000
1	Packet 1/30		1000
2	Packet 2/30		0100
3	Packet 3/30		1100
4	Low bit rate audio	Clause 6.7	0010
5	Datavideo	Clause 6.6	1010
6	Datavideo	Clause 6.6	1010
7	Packet 7/30		1110
8	IDL Format A	Clause 6.5	0001
9	IDL Format A	Clause 6.5	1001
10	IDL Format A	Clause 6.5	0101
11	IDL Format A	Clause 6.5	1101
12	Low bit rate audio	Clause 6.7	0011
13	Datavideo	Clause 6.6	1011
14	Datavideo	Clause 6.6	0111
15	Packet 7/31		1111

6.5 IDL Format A

For IDL Format A only four data channels are allocated as shown in table 12.

Figure 11 shows the structure of a packet conforming to the IDL Format A definition.

Clock run-in	Framing Code	Data Channel	Designation Code = 1111	FT	IAL	SPA*	RI*	CI*	DL	USER DATA Variable number of bytes	CRC

* The presence and contents of these parameters will depend upon the contents of FT and IAL.

Figure 11: Structure of an IDL according to Format A

All bytes, after the framing code, up to and including the Service Packet Address (SPA) are coded as 4 bits data plus 4 bits Hamming protection. The remaining parameters are constructed from bytes containing 8 data bits.

6.5.1 Format Type (FT)

Byte 6 contains the Format Type (FT) which defines which other parameters are included before the start of the User Data as indicated in table 13.

Table 13: Interpretation of the 4 data bits in the Format Type

Bit	Value	Meaning	Include	Bytes required
Bit 1	0	Bits 2 to 4 as below		
Bit 1	1	Reserved for future use		
Bit 2	0	Repeat packet facility applies	RI	1
Bit 2	1	No repeat facility		
Bit 3	0	Explicit continuity indicator included	CI	1
Bit 3	1	Continuity indicator is implicit		
Bit 4	0	Data Length Byte in use	DL	1
Bit 4	1	Data Length Byte not in use		

6.5.2 Interpretation and Address Length (IAL)

Byte 7 contains the Interpretation and Address Length information. This byte is always present.

Table 14: Interpretation of the 4 data bits in IAL

Value (transmission order**)**	**Service Packet Address (SPA) length** (bits)	**Bytes required for SPA**
000X	None	0
100X	4	1
010X	8	2
110X	12	3
001X	16	4
101X	20	5
011X	24	6
111X	Future use	7

The fourth bit (X) set to 0 defines data as independent of the contents of any other channel or service packet address. The fourth bit set to 1 indicates that interpretation of the data may require the use of data in other channels or with other service packet addresses as defined by the application. This interpretation does not apply if the 3 least significant bits are all set to 1 as this value is reserved for future extensions.

6.5.3 Service Packet Address (SPA)

When present this may occupy from byte 8 up to byte 13. Its presence and size is determined by the contents of the IAL byte.

When differentiated by the appropriate service packet address length data in byte 7, the IAL, the less significant bytes of a service packet address may constitute another complete service packet address in the same data channel. Thus, for example, the 24-bit service packet address ABC123 can coexist with the 20-bit service packet address BC123 and the 8-bit service packet address 23.

6.5.4 Repeat Indicator (RI)

The RI is only present when the Format Type bits are appropriately set (see subclause 6.5.1). The first 4 bits are set to 0 when a new packet of that service data channel is first transmitted and shall be incremented modulo 16 on subsequent repeats.

The next three bits are reserved for future extensions. The last bit is set to 0 to indicate that no further repeats of the current packet should be expected. This last bit shall be set to 1 when a further repeat is to be expected.

6.5.5 Continuity Indicator (CI)

The explicit CI is only present when the Format Type bits are appropriately set (see subclause 6.5.1). It represents an 8-bit number which is incremented modulo 256 with each new packet of the same service packet address on the same data channel. It is not incremented on repeated transmissions of the same packet.

6.5.6 Data Length (DL) byte

The DL byte is only present when the Format Type bits are appropriately set (see subclause 6.5.1). The two most significant bits are not defined. The remaining six bits define the number of 8-bit bytes of user data intended to be delivered to the user. The count is taken from the start of the User Data Byte Group and includes any dummy bytes (see subclause 6.5.7.1).

The DL byte is included when it is necessary to send an incompletely filled packet. Any remaining bytes of the user data group are not defined but are subject to the CRC (see subclause 6.5.8).

The six data bits defining the data byte length may be set to 0, to keep a data service channel open when there is no data for delivery to the user.

6.5.7 User Data Group

The remaining data bytes in the data line, excepting the last two, constitute the data carried for users of the service bearing that Service Packet Address (SPA) on that data channel. The number of bytes available depends upon the SPA length, whether the repeat facility is used, and whether the continuity indicator is implicit or explicit. Thus there are between 28 and 36 data bytes available.

6.5.7.1 Dummy bytes

Certain forms of coding may give rise to long strings of 0s or 1s. It is desirable to remove these from the transmitted data field to ensure reliable operation of all equipment that may process the signal. When within any user data group a sequence of eight consecutive bytes containing all 0s or eight consecutive bytes containing all 1s occurs, taken together with its CI byte if present, a following dummy byte shall be inserted. This dummy byte is included in the calculation of the CRC, (see subclause 6.4.8) but is otherwise ignored by the decoder.

Decoders shall be designed to recognize these dummy bytes. However their inclusion may in the future no longer be necessary and it would be desirable to omit them to increase efficiency. It is therefore recommended that decoders should be capable of convenient modification or adjustment when this occurs.

6.5.8 Cyclic Redundancy Check (CRC) word

The last two bytes contain a Cyclic Redundancy Check on the User Data Group (see subclause 6.5.7) and on any Continuity Indicator (CI) or Data Length (DL) byte if present (see subclauses 6.5.5 and 6.5.6).

6.5.8.1 Check word generation

The data to be checked is considered as a polynomial in x with the highest degree term transmitted first and the term of degree zero last. This is divided, using modulo 2 arithmetic by the polynomial:

$$x^{16} + x^{9} + x^{7} + x^{4} + x^{0}$$

The remainder from this process, with the highest term transmitted first, is the CRC.

When an implicit continuity indicator is signalled by the third message bit of the FT byte, the transmitted CRC is modified such that the described generation process results in the register containing the 8-bit continuity indicator byte twice, with the least significant bit at the right-hand end.

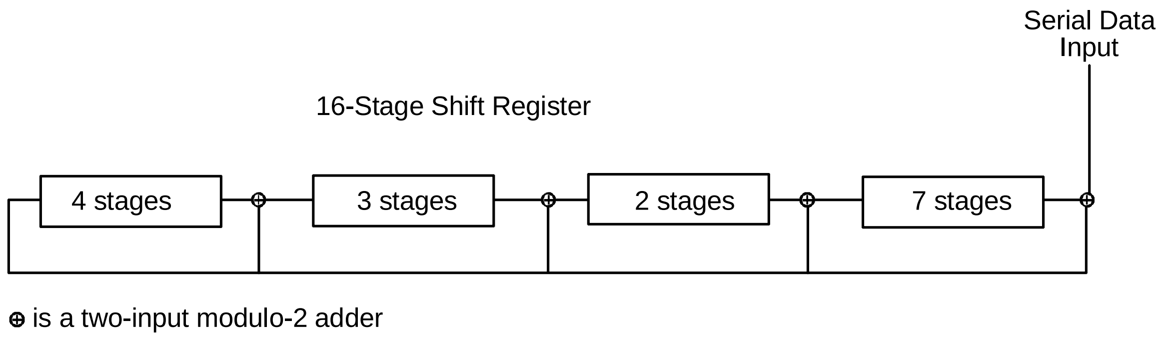


Figure 12: Cyclic Redundancy Check (CRC)

The register of figure 12 is set to 0s. The serial data followed by the CRC is then entered. The check is satisfied if the register again contains all 0s.

6.5.9 Transmission sequence

For any Service Packet Address (SPA), the corresponding serial data stream is divided into User Data Groups. These shall be transmitted in the correct sequence, which is monitored by the Continuity Indicator. Provided that the Repeat Indicator is used, each group may be repeated any number of times before the next is sent. There may or may not be an interval between consecutive data-lines with the same Service Packet Address.

Data lines carrying different Service Packet Addresses may be combined in any order to form a Data Channel, provided that the sequence for each Service Packet Address is not disturbed.

Data-lines from different Data Channels may be combined in any order provided that the sequence within each contributing source is not disturbed.

6.6 Datavideo format

This protocol is based closely upon the specification given in subclause 6.5 but with the variations indicated in the following subclauses.

Data Channel addressing is as shown in table 12.

6.6.1 Packet address

Bytes 6, 7 and 8 each contain 4 bits data plus 4 bits Hamming protection.

6.6.2 Control Bytes (CB)

Bytes 9 (CI) and 10 (CO), 4 bits data plus 4 bits Hamming protection.

6.6.2.1 Packet Continuity Indicator (CI)

The CI is represented by a 6-bit number which is incremented modulo 64 with each new packet of the same address on the same data channel. It is not incremented on repeated transmissions of the same packet. Repeated packets may be interleaved with newly transmitted ones. In order to distinguish such repeated packets from new packets, in case there is a discontinuity due to packet-losses, the interleaving space shall not be greater than 32.

The CI is transmitted in byte 9 and the first two data bits of byte 10; the least significant bit is transmitted first.

6.6.3 Masking indicator

Bit M, which is the third data bit of byte 10, indicates the presence of "masking": i.e.. when it has value 1, this means that bytes 11 to 45 (useful data + CRC) are EXOR-ed with the sequence (in hexadecimal notation):

Mask	**AF**	**AA**	**81**	**4A**	**F2**	**EE**	**07**	**3A**	**4F**	**5D**	**44**	**86**	**70**	**9D**	**83**	**43**	**BC**	**3F**	**EO**	**F7**	**C5**	**CC**	**82**	**53**	**B4**	**79**	**F3**	**62**	**A4**	**71**	**B5**	**71**	**31**	**10**	**08**
Byte No.	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**

It may be common practice to transmit the same packets once masked and once unmasked: this removes the adverse effects of critical bit combinations. Of course, masked and unmasked packets, when the information content is the same, are transmitted with the same continuity index.

6.6.4 Packet type indicator

Bit L, which is the fourth data bit of byte 10, defines the packet type. It is used by higher levels of the protocol and therefore it may be defined in a different way, according to the type of protocol used. In one version of the protocol, this bit, when it is set to 1, indicates the presence, in the User Data Group, of a "packet length indicator". This is contained in byte 11, and indicates in binary code (least significant bit transmitted first, the last three bits reserved for future use) the number of following useful bytes in the data body. In another version of the protocol, Bit L allows to distinguish between packets containing useful data (L = 0) and "control packets", i.e. packets containing service information such as access control information. The structure of such packets is defined by higher levels of the protocol, and it is not part of the present ETS.

6.6.5 User data group

The remaining data bytes in the line, except the last two, (byte 11 to 43) constitute the data carried for users of the service, bearing that Packet Address in that Data Channel. There are 33 data bytes available.

6.6.6 Cyclic Redundancy Check (CRC) word

The last two bytes contain a Cyclic Redundancy Check on the User Data Group.

6.6.6.1 Check word generation

The data to be checked is considered as a polynomial in x with the highest degree term transmitted first and the term of degree zero last.

This is divided, using modulo 2 arithmetic, by the polynomial:

$$x^{16} + x^{12} + x^{5} + x^{0}$$

The remainder from this process, with the highest term transmitted first, is the CRC. Before transmission the bits are complemented (i.e. XOR-ed with FF hex).

6.6.6.2 Check result

The register of figure 12 is set to 0s. The serial data followed by the CRC is then entered. The check is satisfied if the register again contains all 0s.

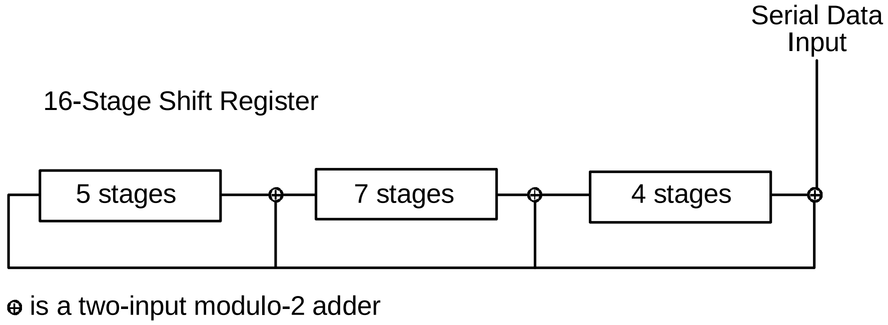


Figure 13: Cyclic Redundancy Check CRC (Datavideo)

6.7 Low bit-rate audio

A number of applications have arisen where there is a requirement to carry low bit-rate audio signals within the Teletext signal. Two channels have been allocated for this purpose as shown in table 12.

There are two uses of low bit-rate audio within the Teletext signal, those which are related to the programme material (such as audio description) and those that are programme-independent (such as Talkback). These are allocated data channels 4 and 12 respectively.

6.7.1 Method of coding

Clock Run-in	Framing Code	Data Channel	Designation Code = 1111	SB Byte 6	CB Byte 7	AUDIO DATA Bytes 8 - 45

Byte 6 carries the Service Byte (SB);
Byte 7 carries the Control Byte (CB);
The remaining bytes 8 to 45 carry the Audio data.

Figure 14: Structure of an IDL for low bit-rate audio

6.7.1.1 Decoder action

Decoders shall decode the whole of bytes 6 and 7 to define a particular service. Low bit-rate audio Teletext packets may be multiplexed with other packets in the Teletext stream, thus the decoder shall mute the audio when there are no packets of the appropriate service being received within a time defined in that services session protocol.

6.7.2 Programme-related audio service

This is used to carry audio information related to the programme video. An example of such a service is AUDETEL.

6.7.2.1 Service Byte (SB)

Byte 6, 4 bits plus 4 bits Hamming protection.

The Data bits are set to 0000 to designate AUDETEL service.

All other bit patterns are reserved.

It is envisaged that the reserved states will be used for future services and decoders should recognize all bit states.

6.7.2.2 Control Byte (CB)

Byte 7 is available for control functions.

In AUDETEL service this byte is designated the Fade byte. The Fade byte is 4 bits data plus 4 bits Hamming protection.

Bits 2, 4 and 6 are used to control the programme sound at the receiver as shown in table 15.

Table 15: Fade byte

B8	B6	B4	B2	Interpretation
x	0	0	0	0 dB attenuation
x	0	0	1	4 dB attenuation
x	0	1	0	8 dB attenuation
x	0	1	1	12 dB attenuation
x	1	0	0	18 dB attenuation
x	1	0	1	24 dB attenuation
x	1	1	0	30 dB attenuation
x	1	1	1	0 dB attenuation

Table 16: The meaning of bit B8

Bit 8	Interpretation
0	Speech audio output unmuted
1	Speech audio output muted

6.7.2.3 Audio data

Bytes 8 to 45 contain audio data. In the AUDETEL format, bytes 8 to 26 contain the first audio frame and bytes 27 to 45 the second audio frame.

6.7.3 Programme independent audio service

This is used to carry audio information which is independent of the programme video.

6.7.3.1 Service Byte (SB)

Byte 6, 4 bits plus 4 bits Hamming protection. The SB is used to define whether the system is operating in single- or two-channel mode and how many VBI lines are being used for the service. In the two-channel mode each audio channel is totally independent of the other audio channel. In single-channel mode there are 38 bytes of audio data available. In two-channel mode there are 2 groups of 19 audio data bytes.

Table 17: Service byte for independent audio service

B8	B6	B4	B2	Interpretation
0	0	0	0	Single-channel mode using 1 VBI line per frame
0	0	0	1	Single-channel mode using 2 VBI lines per frame
0	0	1	0	Single-channel mode using 3 VBI lines per frame
0	0	1	1	Single-channel mode using 4 VBI lines per frame
0	1	0	0	Mute Channel 1
0	1	0	1	Two-channel Mode using 2 VBI lines per frame
0	1	1	0	Mute Channel 2
0	1	1	1	Two-channel Mode using 4 VBI lines per frame
1	x	x	x	User-defined service

In the single-channel mode, the channel shall mute in the absence of packets with the appropriate data channel address and Service byte. In the two-channel mode muting of individual channels is achieved by setting the appropriate bit states as shown in table 17. Both channels shall mute in the absence of packets with the appropriate channel address and service byte. In the case where bit 8 is set for a user-defined service then bits 2, 4 and 6 are user-defined.

6.7.3.2 Control Byte (CB)

Byte 7 to be used for the definition of control functions. If bit 8 in the Service Byte (SB) is set to 0 then all the bit states in the Control Byte are reserved and shall be set to 0. If bit 8 in the Service Byte is set to 1 then all the bit states in the Control Byte are user defined.

The use of Hamming protection for the Control Byte depends upon the application.

6.7.3.3 Audio data

Bytes 8 to 45 contain audio data. In the two-channel format bytes 8 to 26 shall form Channel 1 and bytes 27 to 45 shall form Channel 2.

7 IDL - CA (type A)

7.1 General points

This method employs the same CA system as in the Page Format with CA. It is possible with this method for the broadcaster to switch between IDL - CA and Page Format - CA. Data in the User Data Group (see subclause 6.5.7) of a number of Independent Data Service Packets are linked to form Data Blocks. They may contain messages concerning access that are not Encrypted, Encrypted Messages concerning access and User Data to be communicated.

7.2 Advantages

As with the Page Format - CA it is the network operator who provides the CA system as a service to the provider of the user data. All the user data and the CA information is supplied under one service packet address. This method is optimum for short data packets. It is possible for the network operator to switch between Page Format - CA and IDL - CA mode. The broadcaster is adding value.

7.3 Disadvantages

A special decoder is required with the appropriate CA system.

7.4 Methods of coding

The data is packed into Teletext packets as described in clause 6. Within the user data, in any position, the following data block structure is included. There is no alignment necessary between the Teletext packet structure and the structures described below.

7.4.1 Block Separator

Byte 1 of a data block.

Blocks of data are separated by the transmission of the character hex 10 (DLE). If the character DLE occurs within the Data Block it shall be repeated to indicate that it is not a block separator.

7.4.2 Block Formats

Block Format A is described in subclause 7.4.3. There is scope for defining other Block Formats.

7.4.3 Block Format A

DLE	Block Type 04/0X	Message Not Encrypted	Encrypted Message	User Data

Figure 15: General Form of Data Block - Block Format A

"User Data" is the data stream originated by a sender and intended for delivery to a specified recipient or group of recipients. "Messages" are groups of data concerned with the access to User Data and are for controlling the decoder or placing it in operation. A suitable encryption algorithm is shown in figure 9. The general form of a Data Block is as shown in figure 15.

7.4.3.1 Block Types

Byte 2 of a data block defines the block type.

In Format A this byte is of the form 04/0x where x may have a value of 0 to 7, as shown in table 18.

Table 18: Block Types defined for Block Format A

Block Type	Interpretation
04/00	Block contains User Data not Scrambled (see figure 13)
04/01	Block contains Key Message not Encrypted, and the Encrypted Key Message
04/02	Service Numbers and Sequence Numbers, not encrypted and Scrambled User Data
04/03	System Key Message Block
04/04	Shared User Message Block
04/05	Unique User Message Block
04/06	Service Address Message Block for Independent Data Services
04/07	Service Address Message Block for Page Format Services

7.4.3.2 Primary Block Key Messages

Block Type Code 04/01 (see figure 16).

DLE	Block Type 04/01	In Use System Key Label	Service Modes	Set to 0	Current System Key	Service Identification	Block Key
8 bits	8 bits	8 bits	2 bits	6 bits	56 bits	8 bits	56 bits
DATA NOT ENCRYPTED			ENCRYPTED WITH CURRENT SYSTEM KEY				

Key Value in Credit Units	Scrambling Method	Set to 0
16 bits	5 Bits	3 Bits
ENCRYPTED WITH CURRENT SYSTEM KEY	DATA NOT ENCRYPTED	

Figure 16: Block Type 04/01 - Primary Block Key Messages

Refer to Page Format - CA for further details on the various elements of the blocks (see clause 5).

7.4.3.3 Secondary Block Messages and Scrambled User Data

Block Type Code 04/02 (see figure 17).

DLE	Block Type 04/02	Service Identification Number	Sequence Number	Scrambled User Data
8 bits	8 bits	8 bits	8 bits	
DATA NOT ENCRYPTED				

Figure 17: Block type 04/02 - Secondary Block Messages and Scrambled Data

The Sequence Number may be used as the cipher initial variable. The rest of this data block contains the scrambled data (maximum 1 024 bytes) intended for receipt by the addressee(s).

7.4.3.4 System-Key Message Block

Block Type Code 04/03 (see figure 18).

DLE	Block Type 04/03	Encryption Method	New System Key Label	Current System Key Label	New System Key	Current System Key
8 bits	8 bits	8 bits	8 bits	8 bits	56 bits	56 bits
DATA NOT ENCRYPTED					ENCRYPTED WITH NEW SYSTEM KEY	

Figure 18: Block Type 04/03 System Key Block Messages

7.4.3.5 Shared-User Message Block

Block Type Code 04/04 (see figure 19).

DLE	Block Type 04/04	Shared User Address	Set to 0	New System Key	User Enabling Bits
8 bits	8 bits	20 bits	4 bits	56 bits	152 bits
DATA NOT ENCRYPTED				ENCRYPTED WITH SHARED DISTRIBUTION KEY	

Figure 19: Block Type 04/04 Shared User Message Block

7.4.3.6 Unique User Message Block

Block Type Code 04/05 (see figure 20).

DLE	Block Type	Unique User	Service	Service
	04/05	Address	Mode	Reference Number
8 bits	8 bits	32 bits	2 bits	2 bits
NOT ENCRYPTED			ENCRYPTED WITH UNIQUE KEY	

Current or New	Unique	7 Service Numbers	Current or New	Current or New User
Shared Address	Equipment Key	8 Bits Each	Shared Distribution Key	Enabling Bit Position
20 bits	56 bits	56 bits	56 bits	8 bits
ENCRYPTED WITH UNIQUE KEY				

Figure 20: Block Type 04/05 Unique User Message Block

7.4.3.7 Service Address Message Block - Independent Data Service

Block Type Code 04/06 (see figure 21).

DLE	Block Type	Service	Address	Set to	Service	Group Repeated for
	04/06	Number	Length	0	Address	Each Service Number
8 bits	8 bits	8 bits	3 bits	5 bits	up to 24 bits	
DATA NOT ENCRYPTED						

Figure 21: Block Type 04/06 Service Address Block Independent Data Services

7.4.3.8 Service Address Message Block - Link to Page Format - CA

Block Type Code 04/07 (see figure 22).

DLE	Block Type	Magazine	Set	Service	Initial	Groups Repeated for
	04/07	Number	to 0	Number	Page Number	Each Service Number
8 bits	8 bits	3 bits	5 bits	8 bits	8 bits	
DATA NOT ENCRYPTED						

Figure 22: Block Type 04/07 Service Address Message Block - Link to Page Format - CA

History

Document history			
November 1996	Unified Approval Procedure	UAP 57:	1996-11-04 to 1997-02-28
March 1997	First Edition		

ISBN 2-7437-1340-2
Dépôt légal : Mars 1997