ECMA

EUROPEAN COMPUTER MANUFACTURERS ASSOCIATION

STANDARD ECMA-24

FOR

CODE INDEPENDENT INFORMATION TRANSFER

An Extension of the Basic Mode Control Procedures
for Data Communication Systems
According to Standard ECMA-16

December 1969

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BRIEF HISTORY

Committee TC9 of ECMA issued in May 1968 their Standard ECMA-16 for Basic Mode Control Procedures for Data Communication System using the ECMA 7 bit Code. Further work was undertaken on procedures allowing for text transfer without coding restrictions. A proposal by ECMA was filed in November 1969 with ISO/TC97/SC6 and passed after slight modification by this Committee for accelerated processing as an ISO Draft Recommendation.

The present Standard ECMA-24 corresponds exactly to this future ISO Recommendation. It has been accepted by the General Assembly of ECMA on Dec. 12, 1969.

INTRODUCTION

General

The present Standard ECMA-24 is an extension of the Basic Mode, it defines the means by which a system operating in Basic Mode can transfer texts without coding restrictions. This is achieved by use of the DLE character as defined by the Standard.

As already mentioned in the introduction to the Standard ECMA-6, 7 Bit Coded Input/Output Character Set, the 7 Bit Code was designed to assist the integration of computers and Data Communication Systems, without necessarily being optimized for either.

The 128 characters of the standard 7 Bit Code comprise graphic characters, general purpose control characters, and 10 transmission control characters, the unique purpose of which is to control or facilitate transmission of information over telecommunication networks.

The main objective of the Standard ECMA-16, Basic Mode Control Procedures for Data Communication Systems using the ECMA 7 Bit Code, was to supplement the Standard ECMA-6 by giving more precise definitions of the transmission control characters. Rules are also given for assembling information for remote transmission and for carrying out a dialogue between remote stations; these rules are commonly called "Communication Control Procedures". It should be noted that a number of technical parameters must be defined before compatibility can be achieved between equipments made by different manufacturers.

The rules are based on the assumption that one of the stations in each connection would either be a computer or a device capable of handling automatically an exchange of information. The rules are designed to allow the complexity of operation to be increased from a basic level by adding options. These options are designed so that any number of stations can still communicate even though they normally operate at different levels of complexity. The rules may be difficult to implement in very simple systems involving low cost devices and human control, and the existence of this Standard does not preclude the use of simpler control procedures in such cases. On the other hand, in computer to computer links, the rules may seriously restrict the throughput of information. These two cases are regarded as the upper and lower fringes of the present Standard and may be the subject of future recommendations.

System Concepts

A Data Communication System may be considered as the set of the terminal installations and the interconnecting network that permits information to be exchanged.

A Data Link comprises terminal installations connected to the same network, operating at the same speed, in the same code. Any "store and forward" delay or intermediate Data Processing really separates Data Links and any system is constituted of one or several Data Links.

The Information Transfer in a Data Link is monitored by Data Link Control Procedures where some characters, selected within a coded character set, are given particular meanings according to the transmission phase and are used for various purposes such as to delineate information, to reverse the direction of transmission, to ask questions, to answer, etc.

The Data Link Control Procedures are categorized in classes which are referred to as modes of operation. The Basic Mode is defined in the Standard ECMA-16 as follows:

In the Basic Mode all the necessary transmission control information (e.g. message framing and supervisory instructions) passing from one station to another is carried over the Link by discrete control characters selected from the ten transmission control characters which are defined in Appendix B*. The control of the Data Link is not affected by any characters other than the ten transmission control characters. Other codes than the ISO/ECMA/CCITT code may therefore be transmitted provided that they do not contain any of the ten transmission control characters in either a heading or a text. The use of DLE is not permitted, with the one exception DLE EOT which is defined as Disconnect.

* See also Standard ECMA-6 for a 7 Bit Coded Input/Output Character Set.

1 SCOPE

1.1 This Standard defines the means by which a Data Communication System operating according to the Basic Mode Procedures defined in the Standard ECMA-16 can transfer texts without code restrictions.

1.2 This Standard extends Phase 3 (Information Transfer) as defined in the Standard ECMA-16 (para. 2.3.1). It also describes other uses of the DLE character than that described in the Standard ECMA-16 (page 7). Phase 2 (Establishment of Data Link) and Phase 4 (Termination) are not affected by this Standard.

1.3 The procedures described allow for information messages with format and error protection in accordance with ECMA-6 and ECMA-16 to alternate with code independent information messages.

2 FORMATTING RULES

2.1 Initiation of Code Independent Text

The sequence "DLE STX" shall be used to initiate a code independent text.

2.2 Termination of Code Independent Text

The sequence "DLE ETB" or "DLE ETX" shall be used to terminate a code independent block or text respectively.

2.3 Filling

When filling is necessary the sequence "DLE SYN" shall be used in lieu of the single character "SYN". Filling sequences shall not be inserted within existing 2-character DLE sequences.

2.4 Character Parity

The character forming the DLE sequence shall carry the character parity used by the data transmission system through which the code independent text is being transferred. When the system is asynchronous the character parity shall be even; when the system is synchronous, it shall be odd (see ECMA-16, character structure, p.29).

3 PRESENTATION OF DATA

3.1 Texts will be presented in octets or 8 bit characters, e.g. 7 bit plus parity, 8 bit code, packed numerics, etc. If a binary data stream split into groups of 8 bits is used, bit padding by an agreed method may be required (to complete the last octet).

3.2 All 8 bit combinations are acceptable in the original text.

3.3 For each occurrence of the 8 bit combination corresponding to "DLE" an additional adjacent "DLE" shall be inserted.

3.4 "DLE" characters which are used to form DLE sequences for transmission control (e.g. DLE STX, DLE SYN, DLE ETB) shall not be doubled.

4 RECEPTION OF DATA

Received data shall be inspected for DLE sequences and the following independent rules observed:

4.1 "DLE STX" shall be interpreted as the initiator of the code independent text.

4.2 When a double DLE sequence occurs one "DLE" shall be suppressed and the other shall be regarded as data. The data following shall be inspected for new DLE sequences.

4.3 "DLE ETB" or "DLE ETX" when not immediately preceded by an odd number of DLE characters shall be interpreted as the terminators of the code independent block or text.

4.4 Unless immediately preceded by an odd number of DLE characters the "DLE SYN" sequence will normally be discarded.

5 ERROR PROTECTION

5.1 Since the use of character parity cannot be guaranteed for error checking within the Data Link a Block Check Sequence (BCS) shall be used.

5.2 The initiating sequence shall initiate the calculation of the BCS.

5.3 The initiating sequence shall not be included in the BCS calculation.

5.4 The filling sequence "DLE SYN" shall not be included in the BCS calculation.

5.5 The first DLE in each two-character DLE sequence (DLE DLE, DLE ETB, etc.) shall not be included in the BCS calculation.

5.6 The BCS shall follow immediately after the terminating sequence.

5.7 The form which the BCS takes is given in section 6.

6 BLOCK CHECK SEQUENCE (BCS)

The BCS shall conform to the following rules:

6.1 It shall be a 16 bit sequence (two octets).

6.2 The BCS is the remainder after the division (modulo 2)

- of the information bits to be protected arranged in serial form as they will be transferred to the Data Communication Equipment.
- by the generating polynomial $X^{16} + X^{12} + X^5 + 1$.

6.3 The BCS is transmitted to the line commencing with the highest order bits.

6.4 At the receiver the serial incoming protected data and the BCS when divided by the generating polynomial will result in a zero remainder in the absence of transmission errors.

NOTE: Some applications may require the use of other 16 bit polynomials. Such applications conform to the Standard provided the polynomial specified in 6.2 above is available as an option.

If future applications show that more bits are needed to provide adequate protection, the number of bits of the BCS shall be a multiple of 8.

7 HEADING

If a heading is required it may be transmitted either:

a) as a separate information message in the ECMA 7 bit code in conformity with the ECMA-16 Standard

or b) as part of the code independent information message transmission

or c) as a code dependent or independent heading which can be prefixed to the code independent text by the use of "DLE SOH" as the initiating sequence. The rules for code independent text generally apply.

NOTE: Special consideration must be given to the handling of the text. A method to delineate the heading from the text is by the sequence DLE STX.

APPENDIX A

ECMA 7 BIT CODED CHARACTER SET FOR INFORMATION INTERCHANGE

Bits b_7	b_6	b_5	b_4	b_3	b_2	b_1	Row ↓ / Column →	0	0	0	0	1	1	1	1
								0	0	1	1	0	0	1	1
								0	1	0	1	0	1	0	1
								0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
			0	0	0	0	**0**	NUL	TC_7(DLE)	SP	0	(@) ③	P	` ④	p
			0	0	0	1	**1**	TC_1 (SOH)	DC_1	!	1	A	Q	a	q
			0	0	1	0	**2**	TC_2 (STX)	DC_2	" ⑥	2	B	R	b	r
			0	0	1	1	**3**	TC_3 (ETX)	DC_3	£ ② ⑦	3	C	S	c	s
			0	1	0	0	**4**	TC_4 (EOT)	DC_4	$ ②	4	D	T	d	t
			0	1	0	1	**5**	TC_5 (ENQ)	TC_8(NAK)	%	5	E	U	e	u
			0	1	1	0	**6**	TC_6 (ACK)	TC_9(SYN)	&	6	F	V	f	v
			0	1	1	1	**7**	BEL	TC_{10}(ETB)	' ⑥	7	G	W	g	w
			1	0	0	0	**8**	FE_0 (BS)	CAN	(	8	H	X	h	x
			1	0	0	1	**9**	FE_1 (HT)	EM	)	9	I	Y	i	y
			1	0	1	0	**10**	FE_2 (LF) ①	SUB	*	: ⑧	J	Z	j	z
			1	0	1	1	**11**	FE_3 (VT)	ESC	+	; ⑧	K	([) ③	k	③
			1	1	0	0	**12**	FE_4 (FF)	IS_4 (FS)	,	<	L	③	l	③
			1	1	0	1	**13**	FE_5 (CR) ①	IS_3 (GS)	-	=	M	(]) ③	m	③
			1	1	1	0	**14**	SO	IS_2 (RS)	.	>	N	^ ④ ⑥	n	¯ ④ ⑤
			1	1	1	1	**15**	SI	IS_1 (US)	/	?	O	_	o	DEL

APPENDIX B

DEFINITIONS OF THE TRANSMISSION CONTROL CHARACTERS

The basic definitions of the ten Transmission Control Characters, as taken from the ECMA Standard for a 7 bit I/O Character Code, are listed below (see Section 2.1 for description of use.

(TC1) SOH Start of Heading

A Transmission Control Character used as the first character of a Heading of an Information Message.

(TC2) STX Start of Text

A Transmission Control Character which precedes a Text and which is used to terminate a Heading.

(TC3) ETX End of Text

A Transmission Control Character which terminates a Text.

(TC4) EOT End of Transmission

A Transmission Control Character used to indicate the conclusion of the transmission of one or more Texts.

(TC5) ENQ Enquiry

A Transmission Control Character used as a request for a response from a remote station - the response may include station identification and/or station status. When a "Who are you" function is required on the general switched transmission network, the first use of ENQ after the connection is established shall have the meaning "Who are you (station identification). Subsequent use of ENQ may, or may not, include the function "Who are you", as determined by agreement.

(TC6) ACK Acknowledge

A Transmission Control Character transmitted by a receiver as an affirmative response to the sender.

(TC7) DLE Data Link Escape

A Transmission Control Character which will change the meaning of a limited number of contiguously following characters. It is used exclusively to provide supplementary data transmission control functions. Only graphics and Transmission Control Characters can be used in DLE sequences.

(TC8) NAK Negative Acknowledge

A Transmission Control Character transmitted by a receiver as a negative response to the sender.

(TC9) SYN Synchronous Idle

A Transmission Control Character used by a synchronous transmission system in the absence of any other character (idle condition) to provide a signal from which synchronism may be achieved or retained between terminal equipments.

(TC10) ETB End of Transmission Block

A Transmission Control Character used to indicate the end of a transmission block of data where data is divided into such blocks for transmission purposes.

APPENDIX C

EXAMPLES OF THE USE OF THE DOUBLE DLE TECHNIQUE

Reception from the data link of the following sequences within the code independent text will be interpreted as shown:

RECEIVED SEQUENCE	DATA MEANING	TRANSMISSION CONTROL MEANING
DLE ETB	NONE	ETB
DLE DLE	DLE	NONE
X ETB	X ETB	NONE
X ETX	X ETX	NONE
X SYN	X SYN	NONE
DLE SYN	NONE	FILLER
DLE STX	NONE	STX

From the above for multiple sequences:

DLE DLE DLE ETB	DLE	ETB
DLE DLE DLE DLE	DLE DLE	NONE
DLE DLE ETB	DLE ETB	NONE

"X" is any character other than "DLE".