

ECMA

EUROPEAN COMPUTER MANUFACTURERS ASSOCIATION

STANDARD ECMA-48

ADDITIONAL CONTROL FUNCTIONS FOR CHARACTER-IMAGING I/O DEVICES

3rd Edition – March 1984

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1. SCOPE AND FIELD OF APPLICATION

- 1.1. This Standard ECMA-48 defines additional control functions for use in an extended 7-bit or 8-bit code structured in accordance with ECMA-35. This Standard comprises a C1 set, control functions derived therefrom and a number of single control functions.
- 1.2. The control functions defined in this Standard are intended to be used, in combination with the C0 set defined in ECMA-6, when these control functions are embedded in character-coded data for interchange with character-imaging devices.

A character-imaging device is a device which is capable of receiving a data stream that consists of control functions and graphic characters in coded form, and of producing character image output, i.e. output that can be read by a human being. The character image output is, in general, produced in the form of one or more rectangular arrays of characters which are called pages.

If the device is an input/output device rather than merely an output device, it is also capable of transmitting a data stream that consists of the coded representations of control functions and graphic characters; the transmitted data stream is, in general, composed of a combination of data which have been sent to the device and data which have been locally entered into the device, for example by an associated keyboard.

The control functions are defined by their effects on a character-imaging input/output device. It is, therefore, necessary to make certain assumptions about the device architecture. These assumptions are as unrestrictive as possible; they are specified in clause 6.

The structure of this Standard is open-ended, so that more control functions can be included in future versions.

2. CONFORMANCE

Full conformance to a standard means that all of its requirements are met. For such conformance to be unique the standard must contain no options. This is typically the case for hardware standards. This Standard is of a different nature and as a result, it is only practicable to envisage limited conformance to it, as defined below.

This Standard addresses a whole class of devices which can vary greatly from each other depending on the application for which a device has been specifically designed. Obviously, a product which implements all facilities described in this Standard - thus being in "full conformance" with it - whilst theoretically possible, is technically and economically impracticable.

Limited conformance does not require the implementation of all

control functions, all parameters of control functions and all modes of this Standard, nor does it preclude the use of other control functions and modes. Limited conformance means that all the following conditions are met :

- i) A device shall implement a subset of the control functions of the parameters of control functions, and of modes specified in this Standard, with the specified coded representation, and with the specified meaning where such meaning is defined in this Standard, so long as no private mode as permitted in v) is in effect.
- ii) If the implemented subset of the control functions contains a control sequence which has a default value of a parameter defined in this Standard, the device shall be capable of receiving and correctly interpreting that control sequence when the default value is explicitly or implicitly represented.
- iii) Any coded representation for a control function specified in this Standard shall not be used to represent a different control function.
- iv) Any coded representation reserved for future standardization by this Standard shall not be used.
- v) A device may implement modes other than those specified in this Standard. However, one of the states of each such private mode shall be such that the control functions and modes from this Standard are implemented with the coded representation and the meaning defined in this Standard.
- vi) Any documents claiming that a device conforms to this Standard shall explicitly describe by reference the sections or functions implemented. Statements such as "according to", "based on", etc., shall not be used unless accompanied by such enumeration.

3. REFERENCES

ECMA-6	7-Bit Input/Output Coded Character Set
ECMA-35	Code Extension Techniques
ECMA-43	8-Bit Coded Character Set
ISO 2375	Data Processing - Procedure for Registration of Escape Sequences
ISO 6937/3	Coded Character Sets For Text Communication Control Functions For Page-Image Format
ISO 7350	Text Communication - Registration of Graphic Character Subrépertoires.

4. NOTATION AND TERMINOLOGY

4.1. Notation

In this Standard ECMA-48, a convention has been adopted to assist the reader. Capital letters are used to refer to a specific control function, mode, mode setting, or graphic character (whether they are defined in this Standard or in ECMA-6). This usage was found necessary in order to avoid confusion between a general concept and a specific encoded character, for example, the concept "space" and the character SPACE (pos. 2/0).

Clause 8.2 lists the acronyms, names and characteristics of the control functions defined in this Standard. They are ordered according to the alphabetic order of their acronyms.

4.2. Definitions

For the purpose of this Standard, the following definitions apply :

4.2.1. Area

A string of adjacent character positions that are not necessarily on the same line.

4.2.2. Auxiliary Device

A device connected to a character-imaging device for the purpose of storing, retrieving, or imaging data.

4.2.3. Character-Imaging Device

A device that gives a visual representation of data in the form of graphic symbols using any technology, for example, cathode ray tube or printer.

4.2.4. Character Position

That portion of a display which is imaging or is capable of imaging a graphic symbol.

4.2.5. Control Function

An action that affects the recording, processing, transmission, or interpretation of data.

4.2.6. Default

A value or a state that is to be assumed when no value or state is explicitly specified.

4.2.7. Display

The region for visual presentation of data on any type of character-imaging device, including printer and cathode ray tube devices. A display consists of a series of lines composed of character positions.

Note 1

In this Standard the term display does not mean exclusively a cathode ray tube device.

4.2.8. Field

An area the boundaries of which are specified by horizontal tabulation stops.

4.2.9. Final Character

The character the bit combination of which terminates an escape sequence or a control sequence.

4.2.10. Graphic Symbol

A visual representation of a graphic character or of a control function.

4.2.11. Graphic Rendition

The visual style of displaying a set of graphic symbols.

4.2.12. Intermediate Character

- i) A character the bit combination of which occurs between that of the character ESCAPE (ESC) and that of the Final character in an escape sequence consisting of more than two bit combinations.
- ii) A character, other than a character in a parameter string, the bit combination of which occurs between that of CONTROL SEQUENCE INTRODUCER (CSI) and that of the Final character of a control sequence.

4.2.13. Operating System

The software that controls the execution of computer programs and that may provide scheduling, debugging, input/output control, accounting, compilation, storage assignment, data management, and related services.

4.2.14. Private (or Experimental) Use

The means of representing a non-standardized control function in a manner compatible with this Standard.

4.2.15. Scroll

The action whereby all or a part of the graphic symbols of a display are moved in a specific direction.

4.2.16. Tabulation

The technique identifying character positions in a display for the purpose of arranging information systematically.

4.2.17. Tabulation Stop

The indication that a character position is to be used for tabulation; a horizontal tabulation stop may also serve as a boundary between fields.

5. CODED REPRESENTATION

5.1. General

The set of additional control functions in this Standard consists of more control functions than those which can be coded in a C1 set.

Each additional control function belongs to one of the following categories, depending on the method of representation :

- i) control functions which are elements of the C1 set;
- ii) control functions represented by control sequences;
- iii) control functions represented by ESC Fs sequences.

This Standard also defines a method of representations of control functions by means of control strings (see 5.6.).

5.1.1 Control Functions which are Elements of the C1 Set

As in ECMA-35 such a control function is represented :

- a) in a 7-bit code by a 2-character escape sequence of the form ESC Fe, where Fe is represented by a bit combination of column 4 or 5;
- b) in an 8-bit code by a bit combination of column 08 or 09.

This method of representation permits coding of up to 32 control functions. The corresponding bit combinations are specified in Table 1.

5.1.2. Control Functions Represented by Control Sequences

A control sequence consists of CONTROL SEQUENCE INTRODUCER (CSI) followed by one or more characters which identify the control function and, if applicable, represent the parameters of the control function. The control function CSI itself is an element of the C1 set.

The format of a control sequence shall be

CSI P1... Pn I1... ImF

where :

- CSI is represented by ESC 5/11 in a 7-bit code and by bit combination 09/11 in an 8-bit code (see 5.2.).
- P1... Pn correspond to parameter values and are represented by bit combinations of column 3; these bit combinations are omitted if the control function has no parameter, and may be omitted if the default parameter value is to apply.
- I1... Im are Intermediate characters represented by bit combinations of column 2 which, together with the bit combination representing the Final character F, identify the control function; these bit combinations are omitted if the control function is identified only by the bit combination representing the Final character F;

Note 2

The number of Intermediate characters is not limited by this Standard; in practice, at most one Intermediate character will be sufficient since over one thousand control functions may be identified using not more than one Intermediate character.

- F is the Final character; it is represented by a bit combination of column 4, 5, 6 or 7 (except 7/15);

it terminates the control sequence and, together with the Intermediate characters, if present, identifies the control function (see also 10).

The occurrence of any bit combinations which do not conform to the above format is an error condition for which recovery is not specified by this Standard.

The Final characters (either used alone or together with Intermediate characters) are classified in two categories :

- i) the control functions identified by a Final character represented by a bit combination of columns 4, 5 and 6 are either standardized or reserved for future standardization;
- ii) the control functions identified by a Final character represented by a bit combination of column 7 (except 7/15) are not standardized and are available for private (or experimental) use.

The bit combinations of columns 4, 5 and 6 representing the Final characters and the bit combinations representing the Intermediate characters are specified in table 2 and table 3.

5.1.3. Control Functions Represented by ESC Fs Sequences

As in ECMA-35 the coded representations of these control functions in 7-bit and 8-bit codes are 2-character escape sequences of the form ESC Fs, where Fs is represented by a bit combination from 6/0 to 7/14 (see 5.5). These control functions are not part of the C1 set.

5.2. Elements of the C1 Set

The following control functions are the elements of the C1 set :

Acronym	Name
APC	APPLICATION PROGRAM COMMAND
CCH	CANCEL CHARACTER
CSI	CONTROL SEQUENCE INTRODUCER
DCS	DEVICE CONTROL STRING
EPA	END OF GUARDED PROTECTED AREA
ESA	END OF SELECTED AREA
HTJ	HORIZONTAL TABULATION WITH JUSTIFICATION
HTS	HORIZONTAL TABULATION SET
IND	INDEX
MW	MESSAGE WAITING
NEL	NEXT LINE
OSC	OPERATING SYSTEM COMMAND
PLD	PARTIAL LINE DOWN
PLU	PARTIAL LINE UP
PM	PRIVACY MESSAGE
PU1	PRIVATE USE ONE
PU2	PRIVATE USE TWO
RI	REVERSE INDEX
SPA	START OF GUARDED PROTECTED AREA
SS2	SINGLE SHIFT TWO
SS3	SINGLE SHIFT THREE

Acronym	Name
SSA	START OF SELECTED AREA
ST	STRING TERMINATOR
STS	SET TRANSMIT STATE
VTs	VERTICAL TABULATION SET

The definitions of the control functions are specified in 8.2. The bit combinations used for their representation are specified in table 1.

If a control function is represented by a 2-character escape sequence (in a 7-bit code), the table specifies the bit combination of the Final character by taking A = 4 and B = 5.

If a control function is represented by a single 8-bit combination the table specifies this bit combination by taking A = 08 and B = 09.

The open positions in the table are reserved for future standardization. They are not available for private (or experimental) use.

The 3-character escape sequence designated and invoking this C1 set is ESC 2/2...

TABLE 1

Row No	Column No.	
	A	B
0	-	DCS
1	-	PU1
2	-	PU2
3	-	STS
4	IND	CCH
5	NEL	MW
6	SSA	SPA
7	ESA	EPA
8	HTS	-
9	HTJ	-
10	VTs	-
11	PLD	CSI
12	PLU	ST
13	RI	OSC
14	SS2	PM
15	SS3	APC

5.3. Control Sequences

The control functions listed below are represented by control sequences.

The definitions of the control functions are specified in 8.2. The bit combinations representing the Final characters of the control sequences are specified in tables 2 and 3.

5.3.1. Control Functions with Numeric Parameters

Acronym	Name	Table
CBT	CURSOR BACKWARD TABULATION	2
CHA	CURSOR HORIZONTAL ABSOLUTE	2
CHT	CURSOR HORIZONTAL TABULATION	2
CNL	CURSOR NEXT LINE	2
CPL	CURSOR PRECEDING LINE	2
CPR	CURSOR POSITION REPORT	2
CUB	CURSOR BACKWARD	2
CUD	CURSOR DOWN	2
CUF	CURSOR FORWARD	2
CUP	CURSOR POSITION	2
CUU	CURSOR UP	2
CVT	CURSOR VERTICAL TABULATION	2
DCH	DELETE CHARACTER	2
DL	DELETE LINE	2
ECH	ERASE CHARACTER	2
GSM	GRAPHIC SIZE MODIFICATION	3
GSS	GRAPHIC SIZE SELECTION	3
HPA	HORIZONTAL POSITION ABSOLUTE	2
HPB	HORIZONTAL POSITION BACKWARD	2
HPR	HORIZONTAL POSITION RELATIVE	2
HTSA	HORIZONTAL TABULATION SET ABSOLUTE	3
HVP	HORIZONTAL AND VERTICAL POSITION	2
ICH	INSERT CHARACTER	2
IL	INSERT LINE	2
NP	NEXT PAGE	2
PP	PRECEDING PAGE	2
PPA	PAGE POSITION ABSOLUTE	3
PPB	PAGE POSITION BACKWARD	3
PPR	PAGE POSITION RELATIVE	3
REP	REPEAT	2
SD	SCROLL DOWN	2
SL	SCROLL LEFT	3
SPI	SPACING INCREMENT	3
SR	SCROLL RIGHT	3
SU	SCROLL UP	2
TSS	THIN SPACE SPECIFICATION	3
VPA	VERTICAL POSITION ABSOLUTE	2
VPB	VERTICAL POSITION BACKWARD	2
VPR	VERTICAL POSITION RELATIVE	2

5.3.2. Control Functions with Selective Parameters

Acronym	Name	Table
CTC	CURSOR TABULATION CONTROL	2
DA	DEVICE ATTRIBUTES	2
DAQ	DEFINE AREA QUALIFICATION	2
DSR	DEVICE STATUS REPORT	2
EA	ERASE IN AREA	2
ED	ERASE IN DISPLAY	2
EF	ERASE IN FIELD	2
EL	ERASE IN LINE	2
FNT	FONT SELECTION	3
IDCS	IDENTIFY DEVICE CONTROL STRING	3
JFY	JUSTIFY	3
IGS	IDENTIFY GRAPHIC SUBREPERTOIRE	3
MC	MEDIA COPY	2
PFS	PAGE FORMAT SELECTION	3
QUAD	QUAD	3
RM	RESET MODE	2
SEE	SELECT EDITING EXTENT	2
SGR	SELECT GRAPHIC RENDITION	2
SHS	SELECT HORIZONTAL SPACING	3
SM	SET MODE	2
SSU	SELECT SIZE UNIT	3
SVS	SELECT VERTICAL SPACING	3
TBC	TABULATION CLEAR	2

5.3.3. Coded Representation of Final Characters

Table 2 specifies the bit combinations representing the Final characters of the control sequences without Intermediate characters.

TABLE 2

Row No	Column No.		
	4	5	6
0	ICH	DCH	HPA
1	CUU	SEE	HPR
2	CUD	CPR	REP
3	CUF	SU	DA
4	CUB	SD	VPA
5	CNL	NP	VPR
6	CPL	PP	HVP
7	CHA	CTC	TBC
8	CUP	ECH	SM
9	CHT	CVT	MC
10	ED	CBT	HPB
11	EL	-	VPB
12	IL	-	RM
13	DL	-	SGR
14	EF	-	DSR
15	EA	-	DAQ

Table 3 specifies the bit combinations representing the Final character of the control sequences which contain a single Intermediate character represented by bit combination 2/0.

TABLE 3

Row No	Column No.		
	4	5	6
0	SL	PPA	
1	SR	PPR	
2	GSM	PPB	
3	GSS		
4	FNT		
5	TSS		
6	JFY		
7	SPI		
8	QUAD		
9	SSU		
10	PFS		
11	SHS		
12	SVS		
13	IGS		
14	HTSA		
15	IDCS		

The open positions in the tables, as well as all bit combinations of columns 4, 5 and 6 which are used with bit combinations other than one 2/0 for representing Intermediate characters, are reserved for future standardization. All bit combinations of column 7 except 7/15 are available for representing the Final character of a control sequence (with or without Intermediate characters) for private (or experimental) use.

5.4. Parameter Representations

A control sequence may contain a string P1... Pn representing one or more parameters to complete the specification of the control function.

The string of bit combinations representing P1... Pn contained in a control sequence is called the parameter string. It consists of bit combinations of column 3 and is interpreted as follows :

- i) If the first bit combination of the parameter string is in the range 3/0 to 3/11, the parameter string is interpreted according to the format described below.
- ii) If the first combination of the parameter string is in the range 3/12 to 3/15, the parameter string is available for private (or experimental) use. Its format and meaning are not defined by this Standard.

5.4.1. Parameter String Format

A parameter string shall have the following format :

- i) a parameter string consists of one or more parameter sub-strings;
- ii) each parameter sub-string consists of one or more bit combinations from 3/0 to 3/9, representing the digits ZERO to NINE;
- iii) parameter sub-strings are separated by one bit combination 3/11;
- iv) bit combination 3/10 is reserved for future standardization as an additional parameter separator;
- v) bit combinations 3/12 to 3/15 shall not be used;
- vi) in each parameter sub-string, leading bit combinations 3/0 are not significant and may be omitted;
- vii) if the parameter string starts with the bit combination 3/11, an empty parameter sub-string is assumed preceding the separator; if the parameter string terminates with the bit combination 3/11, an empty parameter sub-string is assumed following the separator; if the parameter string contains successive bit combinations 3/11, empty parameter sub-strings are assumed between the separators;

- viii) if the control function has more than one parameter, and some parameter sub-strings are empty, the separators (bit combination 3/11) must still be present. However, if the last parameter sub-string(s) is empty, the separator preceding it may be omitted (see Appendix B);
- ix) an empty parameter sub-string or a parameter sub-string which consists of bit combinations 3/0 only represents a default value which depends on the control function.

5.4.2. Types of Parameters

In a control sequence representing a control function with parameters, each parameter sub-string corresponds to one parameter, and represents the value of that parameter. The number of parameters is either fixed or variable, depending on the control function. If the number of parameters is variable, neither the maximum number of values nor the order in which the corresponding actions are performed are defined by this Standard.

5.4.2.1. Numeric Parameters

In a control sequence representing a control function with numeric parameters, each parameter sub-string which has a numerical value other than zero represents a quantity in decimal notation.

5.4.2.2. Selective Parameters

In a control sequence representing a control function with selective parameters, each parameter sub-string whilst consisting of digits, is not quantitative i.e. does not represent a quantity in decimal notation. Each value corresponds to one of the actions the control function can perform.

A particular parameter value may have the same meaning as a combination of two or more separate values.

5.5. ESC Fs Sequences

The following control functions are represented by ESC Fs sequences in 7-bits and 8-bits.

TABLE - 4 - ESC Fs Sequences

Acronym	Name	Coding
DMI	DISABLE MANUAL INPUT	ESC 6/0
EMI	ENABLE MANUAL INPUT	ESC 6/2
INT	INTERRUPT	ESC 6/1
RIS	RESET TO INITIAL STATE	ESC 6/3

The definitions of these control functions are specified in 8.2.

Note 3

ESC Fs sequences are registered in the ISO International Register of Character Sets to be used with Escape Sequences, which is maintained by the Registration Authority for ISO 2375. When any candidates for ESC Fs sequences have been approved by ISO/TC 97/SC 2 for registration, the coding for the Final character, Fs, will be assigned by the Registration Authority.

5.6. Control Strings

A control string is a delimited string of characters which may occur in the data stream as a logical entity for control purposes. A control string consists of an opening delimiter, a command string and a terminating delimiter, the STRING TERMINATOR (ST). The command string consists of a sequence of characters represented by bit combinations in the range 0/8 to 0/13 and 2/0 to 7/14 (See also 10). The occurrence of other bit combinations within a command string is an error condition for which recovery is not defined by this Standard.

The opening delimiter indicates the class of the component of the system which is the sender or recipient of the control string. The interpretation of the command string is not defined by this Standard, but instead requires prior agreement between the sender and the recipient of the data.

The opening delimiters defined in this Standard are :

APPLICATION PROGRAM COMMAND	(APC)
DEVICE CONTROL STRING	(DCS)
OPERATING SYSTEM COMMAND	(OSC)
PRIVACY MESSAGE	(PM)

Examples of applications of device control strings are : program loading, configuration control, mode control, diagnostics.

An example of the use of an application program command string is the interjection of application program commands in a data stream or file being processed by the application program as data.

6. DEVICE CONCEPTS

The definitions of the control functions in this Standard are based on general assumptions about the architecture of character-imaging devices. Examples of devices conforming to these concepts are : an alpha-numeric display device, a printer or a micro-film output device.

6.1. The Received Data Stream

The received data stream is considered to be a continuous stream. It may be structured in messages, records and/or blocks, but this does not affect the operation in this device at the abstract level of description of the Standard; the logical or physical units of data are regarded as being concatenated to form a continuous stream.

The device may contain a buffer in which the received data are temporarily stored before they are used to produce the character image output, or in which the received data are permanently stored and continuously used to produce the character image output.

6.2. The Character Image Output

The character image output may consist of one or more pages of a pre-determined size.

A page is composed of a pre-determined number of lines, each being composed of a number of character positions.

The devices may have the capability of varying the number of lines per page, the number of character positions per line, and the character spacing during the operation of the device.

If the character image output is not structured in pages, it is regarded as consisting of a single page of an unlimited number of lines.

The lines constituting a page as well as the character positions constituting a line are identified by the natural numbers 1, 2, 3...

Each character position either is in the erased state or images SPACE or a graphic symbol. A graphic symbol represents a graphic character or one of the control functions for which a graphic representation is required.

The initial state of all character positions is "erased".

Depending on implementation, there may or may not be a distinction between a character position in erased state and a character position imaging SPACE.

Depending on the characteristics of the device, a character position may be capable of imaging a combination of two or more graphic symbols. This would permit the use of BACKSPACE or CARRIAGE RETURN to generate accented letters or other composite graphic symbols.

The width of a character position may be fixed or may depend on the character being imaged.

In this Standard, the character image output is regarded as being produced in the form of a continuous stream, but it may in actual fact be made available character-by-character, line-by-line, or page-by-page.

The character positions are numbered relative to the character image (page) output, not to the buffer (if any).

The character style and font design of the graphic symbols are not defined by this Standard, but their shapes and relative positioning to accomodate overlay of two or more symbols may be influenced by control functions in the received data stream.

6.3. The Active Position

At any time, there is a unique character position which is called the "active position".

The active position is the character position which is to image the graphic symbol representing the next graphic character of the received data stream or the next control function for which a graphic representation is required. The active position is also the reference position against

which certain format effectors or editor functions or editing operations are performed (see 6.4. and 6.5.).

The line containing the active position is called the "active line".

Implicit Movement

If the active position is not the last character position of a line, it is moved to the following character position of the active line.

An implicit movement is performed after SPACE or a graphic character is received or a control function, for which a graphic representation is required, is executed.

Explicit Movement

The active position is moved to a specific character position.

An explicit movement is performed when a control function is executed which causes the active position to be moved to a specific position.

Note 4

In the case of an interactive display device it is common practice to mark the active position by means of a special indicator which is called the "cursor".

Note 5

In the following situations, the effect of an attempt to move the active position is not defined by this Standard;

- a) an attempt to perform an implicit movement when the active position is the last character position of a line;*
- b) an attempt to perform an explicit movement to a non-existing character position, for example beyond the last character position of a line, or beyond the last line of a page.*

Depending on implementation, an attempt to perform such an active position movement may :

- i) cause a wrap-around movement;*
- ii) cause the active position to be blocked (a condition in which no graphic symbol can be imaged until a valid explicit active position movement is performed);*
- iii) cause the active position to remain where it is but permit graphic symbols to be imaged thereby replacing or over-striking the previously imaged graphic symbol;*
- iv) cause the cursor to disappear from the operator's view;*
- v) cause the cursor to move to the opposite end of the display but one row or column offset;*
- vi) cause scrolling to occur;*
- vii) cause other implementation-dependent action.*

6.4. Format Effectors and Editor Functions

Two classes of control functions have an action on the layout or positioning of information in character-imaging devices. They are format effectors and editor functions. Format effectors are intended to be used on all classes of character-imaging devices while editor functions are

supplementary control functions required for a certain class of devices only in circumstances where an action is to be performed on previously entered data. The principal difference between editor functions and format effectors is that the latter are sensitive to the FORMAT EFFECTOR ACTION MODE, whereas the former are not (see Appendix A).

6.4.1. Format Effectors

Format effectors belong to the data stream and are treated as data which happen to have a format representation rather than a graphic representation. Format effectors describe how the originator of the data stream wishes the information to be formatted.

Therefore, if format effectors are not stored by the receiving device they shall be regenerated by the device for subsequent transmission to additional recipients in order to preserve data integrity.

Format effectors are processed as follows depending on the setting of the FORMAT EFFECTOR ACTION MODE (7.2.4.) of the device.

- If the FORMAT EFFECTOR ACTION MODE is set to EXECUTE, the action specified by the format effector (usually a movement of the active position) is immediately performed. Depending on implementation, a format effector may be stored in addition to being performed.
- If the FORMAT EFFECTOR ACTION MODE is set to STORE, the format effector is treated as a graphic character and stored in the buffer. In this case, the specified action is intended to be performed by an auxiliary input/output device when the associated data are transferred.

6.4.2. Composite Characters

Composite characters may be obtained using the format effectors BACKSPACE (BS), or CARRIAGE RETURN (CR), editor functions shall not be used for this purpose (see Appendix A).

6.4.3. Editor Functions

The main purpose of editor functions is to edit, alter, or transpose the visual arrangement of data.

In most cases, editor functions are performed immediately by the first receiver and then removed from the data stream.

Typical uses of editor functions are :

- i) Coding of local functions for example encoding keyboard functions when the keyboard is logically uncoupled from the output imaging mechanism of a device.
- ii) Transposing intended representation to an alternate representation in those cases where the receiving device is unable to display the intended image.

6.5. Editing Operations

This clause is applicable primarily to buffered input/output devices. Editing operations (erasure, deletion,

and insertion) are performed either in execution of functions in the received data stream, or under control of a keyboard or another manual entry device.

The active position (or the active line, where applicable) is the reference position against which all editing operations are performed.

6.5.1. Erasure

The state of one or more character positions is changed to "erased". Other character positions remain unaffected.

6.5.2. Deletion

Characters are deleted by removing the contents of the active position and, depending on the parameter of the control function, the contents of adjacent positions. The resulting gap is closed by shifting the contents of an adjacent string of character positions towards the active position. As a result, a number of character positions equal to the number of deleted characters are put into the erased state at the other end of the shifted part.

Lines are deleted by removing the contents of the active line and, depending on the parameter of the control function, the contents of adjacent lines. The resulting gap is closed by shifting the contents of adjacent lines towards the active line. As a result, a number of lines equal to the number of deleted lines are put into the erased state at the other end of the shifted part.

6.5.3. Insertion

When characters are inserted, the contents of the active position and of adjacent character positions are shifted away from the active position. As a result, the contents of a number of character positions equal to the number of inserted characters are removed at the other end of the shifted part.

When lines are inserted, the contents of the active line and of the adjacent lines are shifted away from the active line. As a result, a number of lines equal to the number of inserted lines are removed at the other end of the shifted part.

6.5.4. Editing Modes and Insertion/Deletion

Whether a character insertion or a character deletion affects the character positions preceding or following the active position depends on the setting of the HORIZONTAL EDITING MODE (see 7.2.8.).

Whether a line insertion or a line deletion affects the lines preceding or following the active line depends on the setting of the VERTICAL EDITING MODE (see 7.2.18.).

6.6. Selected and qualified Areas

This clause is applicable primarily to buffered input/output devices. It may be also applicable to unbuffered input/output devices when the SEND/RECEIVE MODE (see 7.2.14) is set to SIMULTANEOUS.

6.6.1. Selected Areas

A selected area is a string of character positions, the contents of which may be eligible (see 7.3.1.) to be transmitted in the form of a data stream or to be transferred to an auxiliary input/output device (see 6.7.).

The beginning of a selected area is established by START OF SELECTED AREA (SSA). The character position which is the active position after receipt of SSA is the first character position of the selected area.

The end of a selected area is established by END OF SELECTED AREA (ESA). The character position which is the active position before receipt of ESA is the last character position of the selected area.

6.6.2. Qualified Areas

A qualified area is a string of character positions with which certain characteristics are associated, such as one or a combination of the following :

- i) the contents of the character positions are protected against manual alteration;
- ii) the set of characters which are permitted to be entered is restricted (for example, to numeric or alphabetic characters only);
- iii) the character positions are protected against erasure;
- iv) a tabulation stop is associated with the first character position;
- v) the character positions are to be excluded, i.e. guarded (see 6.6.2.2.) from transmission as a data stream, or from transfer to an auxiliary input/output device (see 6.7.).

The beginning of a qualified area is established by DEFINE AREA QUALIFICATION (DAQ). The character position which is the active position after receipt of DAQ is the first character position of the qualified area. The type of area qualification is specified by the parameter of DAQ. The end of a qualified area is established by the beginning of the following qualified area.

6.6.2.1. Protected Areas

A protected area is a special case of a qualified area. It is a string of character positions, the contents of which are protected against manual alteration and may also be protected against erasure depending on the setting of the ERASURE MODE (see 7.2.3.). A protected area may, in general, be either guarded or unguarded.

6.6.2.2. Guarded Areas

A guarded area is a special case of a qualified area. It is a protected area which is to be excluded from transmission as a data stream and from transfer to an auxiliary input/output device.

An alternative way to establish the beginning and end of a guarded protected area is by means of START OF GUARDED PROTECTED AREA (SPA) and END OF GUARDED PROTECTED AREA (EPA).

Note 6

Interaction between guarded areas established by SPA and EPA, and those established by DAQ is not defined by this Standard.

6.7. Auxiliary Input/Output Devices

This clause is applicable primarily to buffered input/output devices. It may be also applicable to unbuffered input/output devices when the SEND/RECEIVE MODE is set to SIMULTANEOUS.

Data transfer from, or to, an auxiliary input/output device is initiated either by the operation of an appropriate button on a keyboard or by the control function MEDIA COPY (MC) appearing in the received data stream.

If there are more than one auxiliary input/output devices, the relevant device is specified by the parameter of MC.

An input data stream which is received from an auxiliary device is processed in the same way as any other received data stream. The method of terminating the input from the auxiliary device depends on implementation.

7. MODES

7.1. The Concept of Modes

This Standard is intended to be applicable to a very large range of devices. Within that board range it is recognized that variations exist. Some of these variations have been formalized in this Standard in the form of modes. They deal with the way in which a device transmits, receives, processes, or images data. Each mode is defined as having two states. The initial of each mode is defined by the implementation.

The modes may be established explicitly within the data stream or by agreement between sender and recipient. In an implementation, some or all of the modes may have a fixed state incapable of being altered.

7.2. Definition of Modes

The modes listed below are defined in this Standard. They are set and reset by the control functions SET MODE (SM) and RESET MODE (RM). The parameter of SM or RM specifies the mode which is affected. In each of the mode definitions below, the first state is caused by RM, the second one by SM.

Note 7

The parameter values assigned to the modes are specified in 8.2.68 and 8.2.74.

7.2.1. CONTROL REPRESENTATION MODE

CONTROL

All control functions are performed as defined, subject to the setting of the FORMAT EFFECTOR ACTION MODE in so far as format effectors are concerned (see 7.3.2.).

In addition to being performed some control functions may have a graphic representation.

GRAPHIC

All control functions, except RESET MODE (RM), are treated as graphic characters.

7.2.2. EDITING BOUNDARY MODE

DISPLAY

The effects of the control functions DCH, DL, EA, ECH, ED, EF, EL, ICH and IL are limited to the displayed portion of a multiple-page buffer.

ALL

The control functions DCH, DL, EA, ECH, ED, EF, EL, ICH and IL may affect character positions outside the displayed portion of a multiple-page buffer.

7.2.3. ERASURE MODE

PROTECT

Only unprotected data are affected by an erasure control function.

ALL

Protected as well as unprotected data are affected by an erasure control function.

7.2.4. FORMAT EFFECTOR ACTION MODE

EXECUTE

A format effector causes the specified action to be performed immediately. Implementations may store format effectors in a buffer in addition to performing them.

STORE

A format effector is treated as a graphic character. This mode is significant only if the CONTROL REPRESENTATION MODE is set to CONTROL.

7.2.5. FORMAT EFFECTOR TRANSFER MODE

INSERT

Format effectors are inserted in a transmitted data stream or in data transferred to an auxiliary input/output device :

- i) The format effectors CARRIAGE RETURN (CR) and LINE FEED (LF), or NEXT LINE (NEL), are inserted in the data stream to separate successive lines;
- ii) other format effectors may be inserted as appropriate, for example, HORIZONTAL TABULATION (HT) to represent a string of character positions in the erased state preceding a tabulation stop.

EXCLUDE

No format effectors other than those received while the FORMAT EFFECTOR ACTION MODE is set to STORE are included in a transmitted data stream or in data transferred to an auxiliary input/output device.

7.2.6. GRAPHIC RENDITION COMBINATION MODE

REPLACING

Each occurrence of the control function SELECT GRAPHIC RENDITION (SGR) cancels the effect of any preceding occurrence. Any graphic rendition aspects that are to remain unchanged after an occurrence of SGR shall be re-specified by that SGR.

CUMULATIVE

Each occurrence of the control function SELECT GRAPHIC RENDITION (SGR) causes only those graphic rendition aspects to be changed that are specified by that SGR. All other graphic rendition aspects remain unchanged.

7.2.7. GUARDED AREA TRANSFER MODE

GUARD

Only unguarded data in an eligible area are transmitted or transferred.

ALL

Guarded as well as unguarded data in an eligible area are transmitted or transferred.

7.2.8. HORIZONTAL EDITING MODE

FOLLOWING

A character insertion causes the contents of the active position and of the following character positions to be shifted forward; a character deletion causes the contents of character positions following the active position to be shifted backward.

PRECEDING

A character insertion causes the contents of the active position and of preceding character positions to be shifted backward; a character deletion causes the contents of character positions preceding the active position to be shifted forward.

7.2.9. INSERTION REPLACEMENT MODE

REPLACE

The receipt of a graphic character or a control function for which a graphic representation is required causes the appropriate graphic symbol to replace (or, depending on implementation, to be combined with) the graphic symbol currently imaged at the active position.

INSERT

The receipt of a graphic character or a control function for which a graphic representation is required causes the appropriate graphic symbol to be inserted at the active position.

The operation of inserting a character is performed as described in 6.5.

7.2.10. KEYBOARD ACTION MODE

ENABLED

All or part of the manual input facilities are enabled to be used.

DISABLED

All or part of the manual input facilities are disabled.

7.2.11. MULTIPLE AREA TRANSFER MODE

SINGLE

Only the contents of character positions in the selected area which contains the active position is eligible to be transmitted or transferred.

MULTIPLE

The contents of character positions in all selected areas are eligible to be transmitted or transferred.

This mode is significant only if the SELECTED AREA TRANSFER MODE is set to SELECT.

7.2.12. POSITIONING UNIT MODE

CHARACTER

The unit for numeric parameters of the positioning format effectors is one character position.

SIZE

The unit for numeric parameters of the positioning format effectors is that established by SELECT SIZE UNIT (SSU).

7.2.13. SELECTED AREA TRANSFER MODE

SELECT

Only the contents of character positions in selected areas are eligible to be transmitted or transferred.

ALL

The contents of all character positions, irrespective of any explicitly defined selected areas, are eligible to be transmitted or transferred.

7.2.14. SEND/RECEIVE MODE

MONITOR

Data which are locally entered are immediately imaged.

SIMULTANEOUS

Local input facilities are logically disconnected from the output mechanism; only data which are sent to the device are imaged.

7.2.15. STATUS REPORT TRANSFER MODE

NORMAL

No device status reports are generated automatically.

DIAGNOSTIC

A device status report in the form of a device control string is automatically included in every data stream transmitted or transferred.

7.2.16. TABULATION STOP MODE

MULTIPLE

A horizontal tabulation stop applies to the corresponding character positions of all lines.

SINGLE

A horizontal tabulation stop applies only to the line in which it is set.

Note 8

This mode is effective only when setting and clearing horizontal tabulation stops.

7.2.17. TRANSFER TERMINATION MODE

CURSOR

Only the contents of character positions preceding the active position are eligible to be transmitted or transferred.

ALL

The contents of character positions preceding, following and at the active position are eligible to be transmitted or transferred.

7.2.18. VERTICAL EDITING MODE

FOLLOWING

A line insertion causes the contents of the active line of following lines to be shifted down; a line deletion and causes the contents of the lines following the active line to be shifted up.

PRECEDING

A line insertion causes the contents of the active line and of preceding lines to be shifted up; a line deletion causes the contents of the lines preceding the active line to be shifted down.

7.3. Interaction Between Modes

Three groups of modes are specified below. Each group contains two or more modes which interact with one another.

- i) GUARDED AREA TRANSFER MODE
MULTIPLE AREA TRANSFER MODE
SELECTED AREA TRANSFER MODE
TRANSFER TERMINATION MODE
- ii) CONTROL REPRESENTATION MODE
FORMAT EFFECTOR ACTION MODE
- iii) HORIZONTAL EDITING MODE
INSERTION REPLACEMENT MODE

7.3.1. GUARDED AREA TRANSFER MODE, MULTIPLE AREA TRANSFER MODE, SELECTED AREA TRANSFER MODE and TRANSFER TERMINATION MODE

These modes have a combined effect on the format of a transmitted data stream or of a data stream transferred to an auxiliary input/output device, as described hereafter.

The term "active selected area" is used to denote the selected area containing the active position. The term "eligible" is used to denote any area which may be considered for transmitting or transferring.

- i) If the TRANSFER TERMINATION MODE is set to CURSOR, the SELECTED AREA TRANSFER MODE to SELECT, and the MULTIPLE AREA TRANSFER MODE to SINGLE, then the contents of the active selected area, up to but excluding the active position, are eligible.
- ii) If the TRANSFER TERMINATION MODE is set to CURSOR, the SELECTED AREA TRANSFER MODE to SELECT, and the MULTIPLE AREA TRANSFER MODE to MULTIPLE, then the contents of any selected area, up to but excluding the active position, are eligible.
- iii) If the TRANSFER TERMINATION MODE is set to CURSOR and the SELECTED AREA TRANSFER MODE to ALL, then the contents of the buffer up to but excluding the active position, are eligible.
- iv) If the TRANSFER TERMINATION MODE is set to ALL, the SELECTED AREA TRANSFER MODE to SELECT, and the MULTIPLE AREA TRANSFER MODE to SINGLE, then the complete contents of the active selected area are eligible.
- v) If the TRANSFER TERMINATION MODE is set to ALL, the SELECTED AREA TRANSFER MODE to SELECT and the MULTIPLE AREA TRANSFER MODE to MULTIPLE, then the contents of all selected areas are eligible.
- vi) If the TRANSFER TERMINATION MODE and the SELECTED AREA TRANSFER MODE are both set to ALL, then the complete contents of the buffer are eligible.
- vii) If the GUARDED AREA TRANSFER MODE is set to GUARD, the contents of the eligible area or areas are transmitted or transferred, except for the contents of guarded areas which are completely contained within an eligible area. In the case where a guarded area is only partly contained within an eligible area, the contents of the part contained in the eligible area may be transmitted or not, depending on the implementation.
- viii) If the GUARDED AREA TRANSFER MODE is set to ALL, guarded as well as unguarded data in an eligible area are transmitted.

If the active position is not within a selected area, the format of the data stream in the first and fourth case above is not defined by this Standard.

7.3.2. CONTROL REPRESENTATION MODE and FORMAT EFFECTOR ACTION MODE

- i) If the CONTROL REPRESENTATION MODE is set to GRAPHIC, it overrides the setting of the FORMAT EFFECTOR ACTION MODE.

If the INSERTION REPLACEMENT MODE is set to REPLACE, the HORIZONTAL EDITING MODE influences the control

functions DELETE CHARACTER (DCH) and INSERT CHARACTER (ICH) only.

- ii) If the CONTROL REPRESENTATION MODE is set to CONTROL, the way format effectors are processed depends on the setting of the FORMAT EFFECTOR ACTION MODE.

7.3.3. HORIZONTAL EDITING MODE and INSERTION REPLACEMENT MODE

If the INSERTION REPLACEMENT MODE is set to INSERT then, in addition, the effect of the receipt of a graphic character or a control function for which a graphic representation is required depends on the setting of the HORIZONTAL EDITING MODE. If the latter is set to FOLLOWING, the implicit movement of the active position is performed normally. If it is set to PRECEDING, the active position does not move.

8. CONTROL FUNCTIONS

8.1. Categories of Control Functions

The following list groups the control functions defined in this Standard. This grouping is intended solely to aid in understanding the Standard and does not restrict the use of the control functions to the indicated categories.

This list also indicates the form of the control functions by the following notations following the acronym :

- i) no sign : the control function is an element of the C1 set;
- ii) (n) : control sequence with one numeric parameter;
- iii) (n, m) : control sequence with two numeric parameters;
- iv) (n...) : control sequence with a variable number of numeric parameters;
- v) (s...) : control sequence with a variable number of selective parameters;
- vi) (s, t) : control sequence with two selective parameters;
- vii) (Fs) : ESC Fs sequence.

8.1.1. Control String Delimiters

APC	APPLICATION PROGRAM COMMAND
DCS	DEVICE CONTROL STRING
OSC	OPERATING SYSTEM COMMAND
PM	PRIVACY MESSAGE
ST	STRING TERMINATOR

8.1.2. Introducers

CSI	CONTROL SEQUENCE INTRODUCER
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8.1.3. Shift Functions

SS2	SINGLE-SHIFT TWO
SS3	SINGLE-SHIFT THREE

EF	(s...)	ERASE IN FIELD
EL	(s...)	ERASE IN LINE
ICH	(n)	INSERT CHARACTER
IL	(n)	INSERT LINE

8.1.7. Editor Functions for Moving the Active Position

CBT	(n)	CURSOR BACKWARD TABULATION
CHA	(n)	CURSOR HORIZONTAL ABSOLUTE
CHT	(n)	CURSOR HORIZONTAL TABULATION
CNL	(n)	CURSOR NEXT LINE
CPL	(n)	CURSOR PRECEDING LINE
CTC	(s...)	CURSOR TABULATION CONTROL
CUB	(n)	CURSOR BACKWARD
CUD	(n)	CURSOR DOWN
CUF	(n)	CURSOR FORWARD
CUP	(n, m)	CURSOR POSITION
CUU	(n)	CURSOR UP
CVT	(n)	CURSOR VERTICAL TABULATION
NP	(n)	NEXT PAGE
PP	(n)	PRECEDING PAGE
SD	(n)	SCROLL DOWN
SL	(n)	SCROLL LEFT
SR	(n)	SCROLL RIGHT
SU	(n)	SCROLL UP

8.1.8. Area Definition

DAQ	(s...)	DEFINE AREA QUALIFICATION
EPA		END OF GUARDED PROTECTED AREA
ESA		END OF SELECTED AREA
SPA		START OF GUARDED PROTECTED AREA
SSA		START OF SELECTED AREA

8.1.9. Mode Setting

RM	(s...)	RESET MODE
SM	(s...)	SET MODE

8.1.10. Miscellaneous Control Functions

CCH		CANCEL CHARACTER
CPR	(n, m)	CURSOR POSITION REPORT
DA	(s...)	DEVICE ATTRIBUTES
DMI	(Fs)	DISABLE MANUAL INPUT

DSR	(s...)	DEVICE STATUS REPORT
EMI	(Fs)	ENABLE MANUAL INPUT
IDCS	(s...)	IDENTIFY DEVICE CONTROL STRING
IGS	(s...)	IDENTIFY GRAPHIC SUBREPERTOIRE
INT	(Fs)	INTERRUPT
MC	(s...)	MEDIA COPY
MW		MESSAGE WAITING
PU1		PRIVATE USE ONE
PU2		PRIVATE USE TWO
REP	(n)	REPEAT
RIS	(Fs)	RESET TO INITIAL STATE
SEE	(s...)	SELECT EDITING EXTENT
STS		SET TRANSMIT STATE

8.2. Definition of Control Functions

The symbol *n* used hereafter denotes the value of a numeric parameter. If there are two numeric parameters, the symbol *n* denotes the value of the first parameter and the symbol *m* that of the second parameter. The symbol *s* denotes the value of a selective parameter. If there are two selective parameters, the symbol *s* denotes the value of the first parameter and the symbol *t* denotes the value of the second parameter. Unassigned selective parameter values are reserved for future standardization.

8.2.1. APC - APPLICATION PROGRAM COMMAND

Representation : Table 1.

APC is the opening delimiter of a control string for an application program use. The command string following consists of a sequence of bit combinations in the range 0/8 to 0/13 and 2/0 to 7/14. The control string is closed by the terminating delimiter STRING TERMINATOR (ST). The interpretation of the command string depends on the relevant application program.

This control function may need to be represented by a graphic symbol.

8.2.2. CBT - CURSOR BACKWARD TABULATION

Representation : Table 2 - one numeric parameter; default value : 1.

The active position is moved to the character position corresponding to the *n*-th preceding horizontal tabulation stop.

8.2.3. CCH - CANCEL CHARACTER

Representation : Table 1.

CCH indicates that both the preceding character in the data stream, if it is a graphic character (represented by one or more bit combinations) including SPACE, and the control function CCH itself are to be ignored for further interpretation of the data stream. If the

character preceding CCH is a control function or part of a coded control function, the effect of CCH is not defined by this Standard.

8.2.4. CHA - CURSOR HORIZONTAL ABSOLUTE

Representation: Table 2 - one numeric parameter; default value: 1.

The active position is moved to the n-th character position of the active line.

8.2.5. CHT - CURSOR HORIZONTAL TABULATION

Representation: Table 2 - one numeric parameter; default value: 1.

The active position is moved to the character position corresponding to the n-th following horizontal tabulation stop.

8.2.6. CNL - CURSOR NEXT LINE

Representation: Table 2 - one numeric parameter; default value: 1.

The active position is moved to the first character position of the n-th following line.

8.2.7. CPL - CURSOR PRECEDING LINE

Representation: Table 2 - one numeric parameter; default value: 1.

The active position is moved to the first character position of the n-th preceding line.

8.2.8. CPR - CURSOR POSITION REPORT

Representation: Table 2 - two numeric parameters; default values: 1; 1.

CPR reports the active position of the sending device as residing on the n-th line at the m-th character position.

CPR may be solicited by a DSR or unsolicited.

8.2.9. CSI - CONTROL SEQUENCE INTRODUCER

Representation: Table 1.

CSI is the first character of a control sequence (see 5.3).

8.2.10. CTC - CURSOR TABULATION CONTROL

Representation: Table 2 - selective parameters; default value: 0.

CTC causes one or more tabulation stops to be set or cleared, depending on the parameter values:

- 0 set a horizontal tabulation stop at the active position,
- 1 set a vertical tabulation stop at the active line,
- 2 clear the horizontal tabulation stop at the active position,
- 3 clear the vertical tabulation stop at the active line,
- 4 clear all horizontal tabulation stops in the active line,
- 5 clear all horizontal tabulation stops,

6 clear all vertical tabulation stops.

In case of parameter values 0, 2 and 4, when horizontal tabulation stops are set or cleared, the number of lines affected depends on the setting of the TABULATION STOP MODE.

8.2.11. CUB - CURSOR BACKWARD

Representation: Table 2 - one numeric parameter; default value: 1.

The active position is moved to the n-th preceding character position.

8.2.12. CUD - CURSOR DOWN

Representation: Table 2 - one numeric parameter; default value: 1.

The active position is moved to the corresponding character position of the n-th following line.

8.2.13. CUF - CURSOR FORWARD

Representation: Table 2 - one numeric parameter; default value: 1.

The active position is moved to the n-th following character position.

8.2.14. CUP - CURSOR POSITION

Representation: Table 2 - two numeric parameters; default values: 1; 1.

The active position is moved to the n-th line at the m-th character position. (The default values define the so-called home position).

8.2.15. CUU - CURSOR UP

Representation: Table 2 - one numeric parameter; default value: 1.

The active position is moved to the corresponding character position of the n-th preceding line.

8.2.16. CVT - CURSOR VERTICAL TABULATION

Representation: Table 2 - one numeric parameter; default value: 1.

The active position is moved to the corresponding character position of the line corresponding to the n-th following vertical tabulation stop.

8.2.17. DA - DEVICE ATTRIBUTES

Representation: Table 2 - selective parameters; default value: 0.

With a parameter value not equal to 0, DA identifies the sending device. The parameter value is a device type identification code according to some register which is to be established. If the parameter value is 0, DA is used to solicit an identifying DA from the receiving device.

8.2.18. DAQ - DEFINE AREA QUALIFICATION

Representation: Table 2 - selective parameters; default value: 0.

DAQ indicates that the active position is the first character position of a qualified area. The end of the qualified area is indicated by the beginning of the following qualified area.

The parameter value designates the type of qualified area :

- 0 unprotected and unguarded
- 1 protected and guarded
- 2 graphic character input
- 3 numeric input
- 4 alphabetic input
- 5 input to be aligned to the right
- 6 fill with ZEROs
- 7 set horizontal tabulation stop at the active position (the start of the qualified area)
- 8 protected and unguarded
- 9 fill with SPACES
- 10 input to be aligned to the left

This control function operates independently of the setting of the TABULATION STOP MODE. The horizontal tabulation stop set by parameter 7 applies to the active line only.

8.2.19. DCH - DELETE CHARACTER

Representation : Table 2 - one numeric parameter; default value : 1.

The contents of the active position and, depending on setting of the HORIZONTAL EDITING MODE, the contents of the n-1 preceding or following character positions are removed. The contents of an adjacent string of character positions are shifted towards the active position. At the other end of the shifted part n character positions are put into the erased state.

The extent of the shifted part depends on the setting of the EDITING BOUNDARY MODE and on the extent established by SELECT EDITING EXTENT (SEE).

The effect of DCH on the start or end of a selected area, the start or end of a qualified area, or a tabulation stop in the shifted part is not defined by this Standard.

8.2.20. DCS - DEVICE CONTROL STRING

Representation : Table 1.

DCS is the opening delimiter of a control string for device control use. The command string following consists of a sequence of bit combinations in the range 0/8 to 0/13 and 2/0 to 7/14. The control string is closed by the terminating delimiter STRING TERMINATOR (ST).

The command string represents either one or more commands for the receiving device, or one or more status reports from the sending device. The purpose and the format

of the command string are specified by the most recent occurrence of IDENTIFY DEVICE CONTROL STRING (IDCS), if any, or depend on the sending and/or the receiving device.

This control function may need to be represented by a graphic symbol.

8.2.21. DL - DELETE LINE

Representation : Table 2 - one numeric parameter; default value : 1.

The contents of the active line and, depending on the setting of the VERTICAL EDITING MODE, the contents of the n-1 preceding or following lines are removed. The contents of a number of adjacent lines are shifted towards the active line. At the other end of the shifted part n lines are put into the erased state.

The extent of the shifted part depends on the setting of the EDITING BOUNDARY MODE.

Any occurrences of the start or end of a selected area, the start or end of a qualified area, or a tabulation stop in the shifted part are also shifted.

If the TABULATION STOP MODE is set to SINGLE, horizontal tabulation stops in the erased lines are cleared.

The effect of DL on the active position is not defined by this Standard.

8.2.22. DMI - DISABLE MANUAL INPUT

Representation : Table 4.

A control function which causes all or part of the manual input facilities of the receiving device to be disabled.

Note 9

This control function does not affect those parts of the manual input facilities which are enabled or disabled by the setting of the KEYBOARD ACTION MODE.

8.2.23. DSR - DEVICE STATUS REPORT

Representation : Table 2 - selective parameters; default value : 0.

DSR either reports the status of the sending device or requests a status report from the receiving device, depending on the parameter values :

- 0 ready, no malfunction detected
- 1 busy, another DSR must be requested later
- 2 busy, another DSR will be sent later
- 3 some malfunction detected, another DSR must be requested later
- 4 some malfunction detected, another DSR will be sent later
- 5 a DSR is requested
- 6 a report of the active position in the form of a CPR is requested.

DSR with parameter value 0, 1, 2, 3 or 4 may be sent

either unsolicited or as a response to a request such as a DSR with a parameter value 5 or MESSAGE WAITING (MW).

8.2.24. EA - ERASE IN AREA

Representation : Table 2 - selective parameters;
default value : 0.

Some or all character positions in the active qualified area, i.e. the qualified area in which the active position resided, are put into the erased state depending on the parameter values :

- 0 the active position and the character positions up to the end of the qualified area are put into the erased state;
- 1 the character positions from the beginning of the qualified area up to and including the active position are put into the erased state;
- 2 all character positions of the qualified area are put into the erased state.

The extent of the data affected by the erasure depends on the setting of the EDITING BOUNDARY MODE. Whether protected areas are erased, or unprotected areas only, depends on the setting of the ERASURE MODE.

8.2.25. ECH - ERASE CHARACTER

Representation : Table 2 - one numeric parameter;
default value : 1.

The active position and the n-1 following character positions are put into the erased state.

The extent of the data affected by the erasure depends on the setting of the EDITING BOUNDARY MODE. Whether protected areas are erased, or unprotected areas only, depends on the setting of the ERASURE MODE.

8.2.26. ED - ERASE IN DISPLAY

Representation : Table 2 - selective parameters;
default value : 0.

Some or all character positions of the active page i.e. the page in which the active position resides, are put into the erased state, depending on the parameter values :

- 0 the active position and the character positions up to the end of the page are put into the erased state;
- 1 the character positions from the beginning of the page up to and including the active position are put into the erased state;
- 2 all character positions of the page are put into the erased state.

The extent of the data affected by the erasure depends on the setting of the EDITING BOUNDARY MODE. Whether protected areas are erased, or unprotected areas only, depends on the setting of the ERASURE MODE.

8.2.27. EF - ERASE IN FIELD

Representation : Table 2 - selective parameters;
default value : 0.

Some or all character positions of the active field, i.e. the field in which the active position resides, are put into the erased state, depending on the parameters values :

- 0 the active position and the character positions up to the end of the field are put into the erased state;
- 1 the character positions from the beginning of the field up to and including the active positions are put into the erased state;
- 2 all character positions of the field are put into the erased state.

The extent of the data affected by the erasure depends on the setting of the EDITING BOUNDARY MODE. Whether protected areas are erased, or unprotected areas only depends on the setting of the ERASURE MODE.

8.2.28. EL - ERASE IN LINE

Representation : Table 2 - selective parameters;
default value : 0.

Some or all character positions of the active line are put into the erased state, depending on the parameter values :

- 0 the active position and the character positions up to the end of the line are put into the erased state;
- 1 the character positions from the beginning of the line up to and including the active position are put into the erased state;
- 2 all character positions of the line are put into the erased state.

The extent of the data affected by the erasure depends on the setting of the EDITING BOUNDARY MODE. Whether protected areas are erased, or unprotected areas only, depends on the setting of the ERASURE MODE.

8.2.29. EMI - ENABLE MANUAL INPUT

Representation : Table 4.

EMI enables all or part of the manual input facilities of the receiving device to be used.

Note 10

This control function does not affect those parts of the manual input facilities which are enabled or disabled by the setting of the KEYBOARD ACTION MODE.

8.2.30. EPA - END OF GUARDED PROTECTED AREA

Representation : Table 1.

EPA indicates that the active position is the last of a string of character positions, the contents of which are protected against manual alteration, are guarded against transmission or transfer, and may be protected

against erasure, depending on the setting of the ERASURE MODE. The beginning of this string is indicated by START OF GUARDED PROTECTED AREA (SPA).

8.2.31. ESA - END OF SELECTED AREA

Representation : Table 1

ESA indicates that the active position is the last of a string of character positions, the contents of which are eligible to be transmitted in the form of a data stream or transferred to an auxiliary input/output device. The beginning of this string is indicated by START OF SELECTED AREA (SSA).

8.2.32. FNT - FONT SELECTION

Representation : Table 3 - two selective parameters;
default value : 0; 0.

FNT is a format effector which identifies the character font to be selected as primary or alternative font by SELECT GRAPHIC RENDITION (SGR). s specifies the primary or alternative font concerned :

- 0 primary font
- 1 first alternative font
- 2 second alternative font
- 3 third alternative font
- 4 fourth alternative font
- 5 fifth alternative font
- 6 sixth alternative font
- 7 seventh alternative font
- 8 eighth alternative font
- 9 ninth alternative font

t identifies the character font according to some register which is to be established.

Note 11

A font is a specific stylization for the imaging of graphic characters.

8.2.33. GSM - GRAPHIC SIZE MODIFICATION

Representation : Table 3 - two numeric parameters;
default values : 100; 100.

GSM is a format effector which causes the height and/or the width of all primary and alternative fonts identified by FONT SELECTION (FNT), as established by GRAPHIC SIZE SELECTION (GSS), to be modified, until the following occurrence of either GSM or GSS in the data stream.

- n specifies the height as a percentage of the height established by GSS;
- m specifies the width as a percentage of the width established by GSS.

GSM affects only those characters which follow it in the data stream, not those previously received.

8.2.34. GSS - GRAPHIC SIZE SELECTION

Representation : Table 3 - one numeric parameter;
no default value.

GSS is a format effector which causes the height and the width of all primary and alternative fonts identified by FONT SELECTION (FNT) to be established, until the following occurrence of GSS in the data stream. Where *n* specifies the height, the width is implicitly defined by the height. The unit in which *n* is expressed is that established by SELECT SIZE UNIT (SSU).

GSS affects only those characters which follow it in the data stream, not those previously received.

8.2.35. HPA - HORIZONTAL POSITION ABSOLUTE

Representation : Table 2 - one numeric parameter;
default value : 1.

HPA is a format effector which causes the active position to be moved to the *n*-th horizontal position of the active line.

The unit in which *n* is expressed depends on the setting of the POSITIONING UNIT MODE.

8.2.36. HPB - HORIZONTAL POSITION BACKWARD

Representation : Table 2 - one numeric parameter;
default value : 1.

HPB is a format effector which causes the active position to be moved to the *n*-th preceding position. The unit in which *n* is expressed depends on the setting of the POSITIONING UNIT MODE.

8.2.37. HPR - HORIZONTAL POSITION RELATIVE

Representation : Table 2 - one numeric parameter;
default value : 1.

HPR is a format effector which causes the active position to be moved to the *n*-th following horizontal position.

The unit in which *n* is expressed depends on the setting of the POSITIONING UNIT MODE.

8.2.38. HTJ - HORIZONTAL TABULATION WITH JUSTIFICATION

Representation : Table 1.

HTJ is a format effector which causes the contents of the string of character positions between the preceding horizontal tabulation stop and the active position to be shifted forward to the following horizontal tabulation stop. The active position is also moved to the following horizontal tabulation stop. The character positions between the preceding horizontal tabulation stop and the beginning of the shifted string are put in the erased state.

8.2.39. HTS - HORIZONTAL TABULATION SET

Representation : Table 1.

HTS is a format effector which causes a horizontal tabulation stop to be set at the active position.

The number of lines affected depends on the setting of the TABULATION STOP MODE.

8.2.40. HTSA - HORIZONTAL TABULATION SET ABSOLUTE

Representation : Table 3 - variable number of numeric parameters;
no default value.

HTSA is a format effector which causes a horizontal tabulation stop to be set at each position corresponding to a parameter value. All other horizontal tabulation stops in the affected line or lines are cleared. The active position is not affected.

The unit in which the parameters are expressed depends on the setting of the POSITIONING UNIT MODE.

The number of lines affected depends on the setting of the TABULATION STOP MODE.

8.2.41. HVP - HORIZONTAL AND VERTICAL POSITION

Representation : Table 2 - two numeric parameters;
default values 1; 1.

HVP is a format effector which causes the active position to be moved to the n-th vertical position at the m-th horizontal position.

The unit in which n and m are expressed depends on the setting of the POSITIONING UNIT MODE.

8.2.42. ICH - INSERT CHARACTER

Representation : Table 2 - one numeric parameter;
default value : 1.

This control function prepares the insertion of n characters, by putting into the erased state the active position and, depending on the setting of the HORIZONTAL EDITING MODE, the n-1 preceding or following character positions. The previous contents of the active position and an adjacent string of character positions are shifted away from the active position. The contents of n character positions at the other end of the shifted part are removed.

The extent of the shifted part depends on the setting of the EDITING BOUNDARY MODE and on the extent established by SELECT EDITING EXTENT (SEE).

The effect of ICH on the start or end of a selected area, the start or end of a qualified area, or a tabulation stop in the shifted part is not defined by this Standard. The effect of ICH on the active position is also not defined by this Standard.

8.2.43. IDCS - IDENTIFY DEVICE CONTROL STRING

Representation : Table 3 - selective parameters;
no default value.

IDCS specifies the purpose and format of the command string of following DEVICE CONTROL STRINGS (DCS), until the next occurrence of IDCS, according to the parameter values :

- 1 reserved for use with the DIAGNOSTIC state of the STATUS REPORT TRANSFER MODE;
- 2 reserved for Dynamically Redefinable Character Sets (DRCS) according to ECMA-35.

The format and interpretation of the command string corresponding to these parameter values are to be defined in appropriate standards. If this control function is used to identify a private command string format and interpretation, then a private parameter value shall be used.

8.2.44. IGS - IDENTIFY GRAPHIC SUBREPERTOIRE

Representation : Table 3 - one selective parameter 2; no default value.

IGS is a control function which indicates that a subrepertoire of the graphic character repertoire of ISO 6937 is used in the subsequent text. All graphic character sets that are used to represent the indicated graphic character subrepertoire shall be explicitly or implicitly designated, but need not be invoked, prior to the occurrence of IGS. The identification of the graphic character subrepertoire may be changed at any point within a document and becomes effective immediately. No graphic characters other than those of the specified subrepertoire shall be used in the text following the occurrence of IGS. The effect of a graphic character subrepertoire identification ceases upon the next occurrence of

- another IGS, or
- a page terminator, or
- a document terminator, or
- the designation of any graphic character set.

The parameter value is the identifier assigned to a subrepertoire of the repertoire of ISO 6937 in accordance with the registration procedure specified in ISO 7350.

In the absence of IGS, the entire repertoire of the currently designated graphic character sets applies. An occurrence of IGS without a parameter value cancels any subrepertoire identified by a preceding IGS.

8.2.45. IL - INSERT LINE

Representation : Table 2 - one numeric parameter; default value : 1.

This control function prepares the insertion of n lines, by putting into the erased state the active line and, depending on the setting of the VERTICAL EDITING MODE, the n-1 preceding or following lines. The previous contents of the active line and of adjacent lines are shifted away from the active line. The contents of n lines at the other end of the shifted part are removed.

The extent of the shifted part depends on the setting of the EDITING BOUNDARY MODE.

Any occurrences of the start or end of a selected area, the start or end of a qualified area, or a tabulation stop in the shifted part are also shifted.

If the TABULATION STOP MODE is set to SINGLE, horizontal tabulation stops in erased lines are cleared.

The effect of IL on the active position is not defined by this Standard.

8.2.46. IND - INDEX

Representation : Table 1.

IND is a format effector which causes the active position to be moved to the corresponding character position of the following line (see Appendix E).

8.2.47. INT - INTERRUPT

Representation : Table 4.

INT indicates to the receiving device that the current process is to be interrupted and an agreed procedure is to be initiated. This control function is applicable to either direction of transmission.

8.2.48. JFY - JUSTIFY

Representation : Table 3 - selective parameters;
default value : 0.

JFY is a format effector which indicates the beginning of a string of character positions, the contents of which are to be justified according to the layout specified by the parameter values (see Appendix C) :

- 0 end of justification
- 1 word fill
- 2 inter-word space
- 3 letter space
- 4 hyphenation
- 5 flush to left margin
- 6 centre between margins
- 7 flush to right margin
- 8 Italian hyphenation.

JFY affects only those characters which follow it in the data stream, not those previously received. The end of the string to be justified is indicated by the next occurrence of JFY in the data stream.

8.2.49. MC - MEDIA COPY

Representation : Table 2 - selective parameters;
default value : 0.

MC controls the transfer of data from or to an auxiliary input /output device. It either initiates a transfer of data from or to an auxiliary input/output device or enables or disables the received data stream

to be relayed to an auxiliary input/output device depending on the parameter values :

- 0 initiate transfer to primary auxiliary device
- 1 initiate transfer from primary auxiliary device
- 2 initiate transfer to secondary auxiliary device
- 3 initiate transfer from secondary auxiliary device
- 4 stop relay to primary auxiliary device
- 5 start relay to primary auxiliary device
- 6 stop relay to secondary auxiliary device
- 7 start relay to secondary auxiliary device

This control function is not intended to switch on and off an auxiliary device.

8.2.50. MW - MESSAGE WAITING

Representation : Table 1.

MW causes a message waiting indicator to be set in the receiving device. An appropriate acknowledge to the receipt of MW may be given by DEVICE STATUS REPORT (DSR).

8.2.51. NEL - NEXT LINE

Representation : Table 1

NEL is a format effector which causes the active position to be moved to the first character position of the following line (see Appendix E).

8.2.52. NP - NEXT PAGE

Representation : Table 2 - one numeric parameter; default value : 1.

The n-th following page of a multiple-page buffer is displayed.

The effect of this control function on the active position is not defined by this Standard.

8.2.53. OSC - OPERATING SYSTEM COMMAND

Representation : Table 1.

OSC is the opening delimiter of a control string for operating system use. The command string following consists of a sequence of bit combinations in the range 0/8 to 0/13 and 2/0 to 7/14. The control string is closed by the terminating delimiter STRING TERMINATOR (ST). The interpretation of the command string depends on the relevant operating system.

This control function may need to be represented by a graphic symbol.

8.2.54. PFS - PAGE FORMAT SELECTION

Representation : Table 3 - selective parameters; default value : 0.

PFS is a format effector with a selective parameter which specifies the text area format of the pages to be introduced by subsequent occurrences of FORM FEED. The effect of PFS is cancelled by any subsequent

occurrence of PSF or by a page terminator or a document terminator. Each format is specified by a parameter value :

- 0 vertical basic text communication format
- 1 horizontal basic text communication format
- 2 vertical basic A4 format
- 3 horizontal basic A4 format
- 4 vertical North-American letter format
- 5 horizontal North-American letter format
- 6 vertical extended A4 format
- 7 horizontal extended A4 format
- 8 vertical North-American legal format
- 9 horizontal North-American legal format.

8.2.55. PLD - PARTIAL LINE DOWN

Representation : Table 1.

PLD is a format effector which causes the active position to be moved to the corresponding character position of an imaginary line with a partial vertical offset. This offset should be sufficient either to image following characters as subscripts until the first following occurrence of PARTIAL LINE UP (PLU) in the data stream or, if the immediately preceding character is imaged as a superscript, to restore subsequent imaging of characters to the active line.

Any interactions between PLD and vertical format effectors other than PLU are not defined by this Standard.

8.2.56. PLU - PARTIAL LINE UP

Representation : Table 1.

PLU is a format effector which causes the active position to be moved to the corresponding character position of an imaginary line with a partial vertical offset. This offset should be sufficient either to image following characters as superscripts until the first following occurrence of PARTIAL LINE DOWN (PLD) in the data stream or, if the immediately preceding character is imaged as a subscript, to restore subsequent imaging of characters to the active line.

Any interactions between PLU and vertical format effectors other than PLD are not defined by this Standard.

8.2.57. PM - PRIVACY MESSAGE

Representation : Table 1.

PM is the opening delimiter of a control string for privacy message use. The command string following consists of a sequence of bit combinations in the range 0/8 to 0/13 and 2/0 to 7/14. The control string is closed by the terminating delimiter STRING TERMINATOR (ST). The interpretation of the command

string depends on the relevant privacy discipline.
This control function may need to be represented by a graphic symbol.

8.2.58. PP - PRECEDING PAGE

Representation : Table 2 - one numeric parameter;
default value : 1.

The n-th preceding page of a multiple-page is displayed.

The effect of this control function on the active position is not defined by this Standard.

8.2.59. PPA - PAGE POSITION ABSOLUTE

Representation : Table 3 - one numeric parameter;
default value : 1.

PPA is a format effector which causes the active position to be moved to the corresponding horizontal and vertical character position on the n-th page.

8.2.60. PPB - PAGE POSITION BACKWARD

Representation : Table 3 - one numeric parameter;
default value : 1.

PPB is a format effector which causes the active position to be moved to the corresponding horizontal and vertical character position on the n-th preceding page.

8.2.61. PPR - PAGE POSITION RELATIVE

Representation : Table 3 - one numeric parameter;
default value : 1.

PPR is a format effector which causes the active position to be moved to the corresponding horizontal and vertical character position on the n-th following page.

8.2.62. PU1 - PRIVATE USE ONE

Representation : Table 1.

PU1 is reserved for a function without standardized meaning for private use as required, subject to the prior agreement of the sender and the recipient of the data.

8.2.63. PU2 - PRIVATE USE TWO

Representation : Table 1.

PU2 is reserved for a function without standardized meaning for private use as required, subject to the prior agreement of the sender and the recipient of the data.

8.2.64. QUAD -QUAD

Representation : Table 3 - selective parameters;
default value : 0.

QUAD is a format effector which indicates the end of a string of character positions in the data stream, the contents of which are to be positioned on a

single line according to the layout specified by the parameter values (see Appendix C) :

- 0 flush to left margin
- 1 flush to left margin and fill with leader
- 2 centre between margins
- 3 centre between margins and fill with leader
- 4 flush to right margin
- 5 flush to right margin and fill with leader

The beginning of the string to be positioned is indicated by the preceding occurrence of either QUAD or one of the following vertical format effectors : FF, HVP, IND, LF, NEL, PPA, PPB, PPR, RI, VPA, VPB, VPR or VT in the data stream.

8.2.65. REP - REPEAT

Representation : Table 2 - one numeric parameter; default value : 1.

REP indicates that the preceding character in the data stream, if it is a graphic character (represented by one or more bit combinations) including SPACE, is to be repeated n times. If the character preceding REP is a control function or part of a control function, the effect of REP is not defined by this Standard.

8.2.66. RI - REVERSE INDEX

Representation : Table 1.

RI is a format effector which causes the active position to be moved to the corresponding character position of the preceding line.

8.2.67. RIS - RESET TO INITIAL STATE

Representation : Table 4.

RIS resets a device to its initial state, i.e. the state it has after it is made operational. This may imply, if applicable : remove tabulation stops, remove qualified areas, reset graphic rendition, all character positions in the erased state, move active position to first character position of first line.

8.2.68. RM - RESET MODE

Representation : Table 2 - selective parameters; no default value.

RM resets the modes of the receiving device as specified by the parameter values :

- 1 GUARDED AREA TRANSFER MODE
- 2 KEYBOARD ACTION MODE
- 3 CONTROL REPRESENTATION MODE
- 4 INSERTION REPLACEMENT MODE
- 5 STATUS REPORT TRANSFER MODE
- 6 ERASURE MODE
- 7 VERTICAL EDITING MODE

- 8 *(Reserved for future standardization)*
- 9 *(Reserved for future standardization)*
- 10 HORIZONTAL EDITING MODE
- 11 POSITIONING UNIT MODE
- 12 SEND/RECEIVE MODE
- 13 FORMAT EFFECTOR ACTION MODE
- 14 FORMAT EFFECTOR TRANSFER MODE
- 15 MULTIPLE AREA TRANSFER MODE
- 16 TRANSFER TERMINATION MODE
- 17 SELECTED AREA TRANSFER MODE
- 18 TABULATION STOP MODE
- 19 EDITING BOUNDARY MODE
- 20 *(Reserved for use as defined in Appendix E)*
- 21 GRAPHIC RENDITION COMBINATION MODE

Note 12

Private modes may be implemented using private parameters (see 5.4.).

8.2.69. SD - SCROLL DOWN

Representation : Table 2 - one numeric parameter;
default value : 1.

The displayed portion of a multiple-page buffer is moved by n lines such that the displayed data appear to move down.

The effect of this control function on the active position is not defined by this Standard.

8.2.70. SEE - SELECT EDITING EXTENT

Representation : Table 2 - selective parameters;
default value : 0.

SEE establishes the editing extent for character insertion or deletion, depending on the parameter values :

- 0 the shifted part consists of the entire buffer or of the displayed portion, depending on the setting of the EDITING BOUNDARY MODE
- 1 the shifted part consists of the active line
- 2 the shifted part consists of the data between the preceding and the following horizontal tabulation stop
- 3 the shifted part consists of the qualified area containing the active position.

8.2.71. SGR - SELECT GRAPHIC RENDITION

Representation : Table 2 - selective parameters;
default value : 0.

SGR is a format effector which specifies one or more graphic rendition aspects for the characters following in the data stream. The specified graphic rendition

aspects remain in effect either until the next occurrence of SGR, or until they are explicitly changed by a following occurrence of SGR, depending on the setting of the GRAPHIC RENDITION COMBINATION MODE. Each graphic rendition aspect is specified by a parameter value :

- 0 default rendition (implementation-defined), cancels the effect of any preceding occurrence of SGR regardless of the setting of the GRAPHIC RENDITION COMBINATION MODE.
- 1 bold or increased intensity
- 2 faint, decreased intensity or second color
- 3 italicized
- 4 underlined
- 5 slowly blinking (less than 150 per minute)
- 6 rapidly blinking (150 per minute or more)
- 7 negative image
- 8 concealed characters
- 9 crossed-out (characters still legible but marked as to be deleted)
- 10 primary (default) font
- 11 first alternative font
- 12 second alternative font
- 13 third alternative font
- 14 fourth alternative font
- 15 fifth alternative font
- 16 sixth alternative font
- 17 seventh alternative font
- 18 eighth alternative font
- 19 ninth alternative font
- 20 fraktur (Gothic)
- 21 doubly underlined
- 22 normal color or normal intensity (neither bold nor faint)
- 23 not italicized, not fraktur
- 24 not underlined (neither singly nor doubly)
- 25 steady (not blinking)
- 26 *(reserved for future standardization)*
- 27 positive image
- 28 revealed characters
- 29 not crossed out
- 30 black display
- 31 red display
- 32 green display

- 33 yellow display
- 34 blue display
- 35 magenta display
- 36 cyan display
- 37 white display
- 38 *(Reserved for future standardization)*
- 39 default display colour (implementation-defined)
- 40 black background
- 41 red background
- 42 green background
- 43 yellow background
- 44 blue background
- 45 magenta background
- 46 cyan background
- 47 white background
- 48 *(Reserved for future standardization)*
- 49 default background colour (implementation-defined)

Note 13

The usable combinations of parameter values are implementation-defined.

8.2.72. SHS - SELECT HORIZONTAL SPACING

Representation : Table 3 - selective parameters;
default value : 0.

SHS is a format effector with a selective parameter which specifies the character spacing for subsequent text. The effect of SHS is cancelled by any subsequent occurrence of SHS, or by a page terminator or a document terminator. Each spacing is specified by a parameter value :

- 0 10 characters per 25,4 mm
- 1 12 characters per 25,4 mm
- 2 15 characters per 25,4 mm

Note 14

The character spacing specified by SHS takes effect immediately. When it is required to specify the character spacing to become effective upon the beginning of a line, SHS should immediately precede the combination of CARRIAGE RETURN and LINE FEED of CARRIAGE RETURN and FORM FEED that indicates the beginning of that line.

Note 15

SHS affects the active position movements caused by subsequent occurrences of graphic characters, SPACE, BACKSPACE and HORIZONTAL POSITION RELATIVE.

8.2.73. SL - SCROLL LEFT

Representation : Table 3 - one numeric parameter;
default value : 1.

The displayed portion of a multiple-page buffer is moved by n character positions such that the displayed data appear to move to the left.

The effect of this control on the active position is not defined by this Standard.

8.2.74. SM - SET MODE

Representation : Table 2 - selective parameters; no default value.

SM sets the modes of the receiving device as specified by the parameter values :

1. GUARDED AREA TRANSFER MODE
2. KEYBOARD ACTION MODE
3. CONTROL REPRESENTATION MODE
4. INSERTION REPLACEMENT MODE
5. STATUS REPORT TRANSFER MODE
6. ERASURE MODE
7. VERTICAL EDITING MODE
8. *(Reserved for future standardization)*
9. *(Reserved for future standardization)*
10. HORIZONTAL EDITING MODE
11. POSITIONING UNIT MODE
12. SEND/RECEIVE MODE
13. FORMAT EFFECTOR ACTION MODE
14. FORMAT EFFECTOR TRANSFER MODE
15. MULTIPLE AREA TRANSFER MODE
16. TRANSFER TERMINATION MODE
17. SELECTED AREA TRANSFER MODE
18. TABULATION STOP MODE
19. EDITING BOUNDARY MODE
20. *(Reserved for use as defined in Appendix E)*
21. GRAPHIC RENDITION COMBINATION MODE

Note 16

Private modes may be implemented using private parameters (see 5.4.).

8.2.75. SPA - START OF GUARDED PROTECTED AREA

Representation : Table 1.

SPA indicates that the active position is the first of a string of character positions, the contents of which are protected against manual alteration, and are guarded against transmission or transfer, and may be protected against erasure, depending on the setting of the ERASURE MODE. The end of this string is indicated by END OF GUARDED PROTECTED AREA (EPA).

8.2.76. SPI - SPACING INCREMENT

Representation : Table 3 - two numeric parameters;
no default values.

SPI is a format effector which causes the interline spacing and the width of a horizontal space to be established, for characters following in the data stream, until the next occurrence of SPI in the data stream.

n specifies the interline spacing; m specifies the width of a fixed horizontal space.

The units in which n and m are expressed is that established by SELECT SIZE UNIT (SSU).

8.2.77. SR - SCROLL RIGHT

Representation : Table 3 - one numeric parameter;
default value : 1.

The displayed portion of a multiple-page buffer is moved by n character positions such that the displayed data appear to move to the right.

The effect of this control function on the active position is not defined by this Standard.

8.2.78. SS2 - SINGLE SHIFT TWO

Representation : Table 1.

SS2 alters the meaning of the single bit combination following it (see ECMA-35). That bit combination must be one of those from columns 2 to 7 except 2/0 and 7/15 (see also 10). The meaning of the bit combination concerned is derived from an appropriately designated G2 graphic character set.

8.2.79. SS3 - SINGLE SHIFT THREE

Representation : Table 1.

SS3 alters the meaning of the single bit combination following it (see ECMA-35). That bit combination must be one of those from columns 2 to 7 except 2/0 and 7/15 (see also 10). The meaning of the bit combination concerned is derived from an appropriately designated G3 graphic set.

8.2.80. SSA - START OF SELECTED AREA

Representation : Table 1.

SSA indicates that the active position is the first of a string of character positions, the contents of which are eligible to be transmitted in the form of a data stream or transferred to an auxiliary input/output device. The end of this string is indicated by END OF SELECTED AREA (ESA). The string of characters actually transmitted or transferred depends on the setting of the GUARDED AREA TRANSFER MODE and on any guarded areas established by START OF GUARDED PROTECTED AREA (SPA) and END OF GUARDED PROTECTED AREA, and or DEFINE AREA QUALIFICATION (DAQ).

8.2.81. SSU - SELECT SIZE UNIT

Representation: Table 3 - selective parameters; no default value.

SSU is a format effector which establishes the unit in which the numeric parameters of the positioning format effectors are expressed when the POSITIONING UNIT MODE is set to SIZE. SSU also establishes the unit for GSS, SPI and TSS. The unit established remains effective until the occurrence of another SSU in the data stream. The parameter values are :

- 1 INTERNATIONAL TYPOGRAPHIC STANDARD - (This unit is not yet standardized)
- 2 DECIPOINT - 0,0353 mm (1/720 inch)
- 3 DECIDIDOT - 0,0376 mm
- 4 MIL - 0,0254 mm (1/1000 inch).

Note 17

- i) *The Point is defined in the American-British typesetting industry as 1/12 of a pica and the pica is defined to be 0,1660000... inch. This yields a value of 0,013833333... inch equal to 1 point, or approx. 72,3 points equal 1 inch. In many cases, such as the word processing industry, it has been convenient to round off to 72 points to the inch.*
- ii) *The Didot is defined in the American-British typesetting industry as 1/12 of a Corps and the Corps is defined to be 0,178 inch. This yields a value of 0,01483 inch for the Didot and converted to metric the DECIDIDOT is 0,037676666... mm.*
- iii) *The horizontal and vertical dimensions corresponding to PIXEL may differ.*

8.2.82. ST - STRING TERMINATOR

Representation: Table 1.

ST is the closing delimiter of a string opened by APPLICATION PROGRAM COMMAND (APC), DEVICE CONTROL STRING (DCS), OPERATING SYSTEM COMMAND (OSC), or PRIVACY MESSAGE (PM).

This control function may need to be represented by a graphic symbol.

8.2.83. STS - SET TRANSMIT STATE

Representation: Table 1.

STS causes the transmit state to be established in the receiving device. In this state the transmission of data from the device is possible.

The actual initiation of transmission of data is performed by a data communication or input/output interface control procedure which is outside the scope of this Standard.

The transmit state is established either by the operation of an appropriate button on a keyboard or by SET TRANSMIT STATE (STS) appearing in the received data stream.

8.2.84. SU - SCROLL UP

Representation : Table 2 - one numeric parameter;
default value : 1.

The displayed portion of a multiple-page buffer is moved by n lines such that the displayed data appear to move up.

The effect of this control function on the active position is not defined by this Standard.

8.2.85. SVS - SELECT VERTICAL SPACING

Representation : Table 3 - selective parameters;
default value : 0.

SVS is a format effector with a selective parameter which specifies the line spacing for subsequent text. The effect of SVS is cancelled by any subsequent occurrence of SVS, or by a page terminator or a document terminator. Each spacing is specified by a parameter value :

0	6 lines per 25,4 mm
1	4 lines per 25,4 mm
2	3 lines per 25,4 mm
3	12 lines per 25,4 mm
4	8 lines per 25,4 mm
5	6 lines per 30,0 mm
6	4 lines per 30,0 mm
7	3 lines per 30,0 mm
8	12 lines per 30,0 mm

8.2.86. TBC - TABULATION CLEAR

Representation : Table 2 - selective parameters;
default value : 0.

TBC is a format effector which causes one or more tabulation stops to be cleared, depending on the parameter values :

- 0 clear the horizontal tabulation stop at the active position
- 1 clear the vertical tabulation stop at the active line
- 2 clear all horizontal tabulation stops in the active line
- 3 clear all horizontal tabulation stops
- 4 clear all vertical tabulation stops

In the case of parameter value 0 or 2, when horizontal tabulation stops are cleared, the number of lines affected depends on the setting of the TABULATION STOP MODE.

8.2.87. TSS - THIN SPACE SPECIFICATION

Representation : Table 3 - one numeric parameter;
no default value.

TSS is a format effector which establishes the width of thin spaces following in the data stream, until the next occurrence of TSS (see Appendix C).

n specifies the width in units as established by SELECT SIZE UNIT (SSU).

8.2.88. VPA - VERTICAL POSITION ABSOLUTE

Representation : Table 2 - one numeric parameter;
default value : 1.

VPA is a format effector which causes the active position to be moved to the corresponding horizontal position at vertical position n.

The unit in which n is expressed depends on the setting of the POSITIONING UNIT MODE.

8.2.89. VPB - VERTICAL POSITION BACKWARD

Representation : Table 2 - one numeric parameter;
default value : 1.

VPB is a format effector which causes the active position to be moved to the corresponding horizontal position at the n-th preceding vertical position.

The unit in which n is expressed depends on the setting of the POSITIONING UNIT MODE.

8.2.90. VPR - VERTICAL POSITION RELATIVE

Representation : Table 2 - one numeric parameter;
default value : 1.

VPR is a format effector which causes the active position to be moved to the corresponding horizontal position at the n-th following vertical position.

The unit in which n is expressed depends on the setting of the POSITIONING UNIT MODE.

8.2.91. VTs - VERTICAL TABULATION SET

Representation : Table 1.

VTs is a format effector which causes a vertical tabulation stop to be set at the active line.

9. RELATIONS BETWEEN MODES AND CONTROL FUNCTIONS

The relations between modes and control functions are summarized in table 5.

The modes FORMAT EFFECTOR TRANSFER MODE, GUARDED AREA TRANSFER MODE, MULTIPLE AREA TRANSFER MODE, SELECTED AREA TRANSFER MODE, STATUS REPORT TRANSFER MODE and TRANSFER TERMINATION MODE do not affect the interpretation of control functions. They have an effect on the format of the transmitted data stream and on the format of the data transferred to an auxiliary input/output device.

In the case of the modes INSERTION REPLACEMENT MODE, KEYBOARD ACTION MODE and SEND/RECEIVE MODE there is no interaction with specific control functions. These modes have a uniform affect on all characters received.

The CONTROL REPRESENTATION MODE affects all control functions except RESET MODE (RM).

Those modes which uniformly apply to format effectors defined in this Standard also apply to the format effectors of the C0 set.

Table 5 - Relations between modes and control functions

	EDITING BOUNDARY MODE	ERASURE MODE	FORMAT EFFECTOR ACTION MODE	GRAPHIC RENDITION COMBINATION MODE	HORIZONTAL EDITING MODE	POSITIONING UNIT MODE	TABULATION STOP MODE	VERTICAL EDITING MODE
CTC							X	
DCH	X				X			
DL	X						X	X
EA	X	X						
ECH	X	X						
ED	X	X						
EF	X	X						
EL	X	X						
FNT			X					
GSM			X					
GSS			X					
HPA			X			X		
HPB			X			X		
HPR			X			X		
HTJ			X					
HTS			X				X	
HTSA			X			X	X	
HVP			X			X		
ICH	X				X			
IL	X						X	X
IND			X					
JFY			X					
NEL			X					
PLD			X					
PLU			X					
PPA			X					
PPB			X					
PPR			X					
QUAD			X					
RI			X					
SEE	X							
SGR			X	X				
SPI			X					
SSU			X			X		
TBC			X				X	
TSS			X					
VPA			X			X		
VPB			X			X		
VPR			X			X		
VTs			X					

10. TRANSFORMATION BETWEEN 7-BIT AND 8-BIT CODED REPRESENTATIONS

The control functions defined in this Standard can be coded in a 7-bit code as well as in an 8-bit code; both forms of coded representation are equivalent and in accordance with ECMA-35.

However, when data containing these control functions are transformed from a 7-bit to an 8-bit coded representation or vice versa, the transformation algorithm specified in ECMA-35 may produce results which are formally in disagreement with this Standard.

In order to make allowance for such unintended but unavoidable deviations, the format rules are extended in the manner described below.

In an 8-bit code, the bit combinations of columns 10 to 15 are permitted to represent :

- i) parameter values, Intermediate and Final characters of a control sequence;
- ii) the contents of a control string;
- iii) the operand of a single-shift character.

In these situations, the bit combinations in the range 10/00 to 15/14 have the same meanings as the corresponding bit combinations in the range 02/00 to 07/14.

In a 7-bit code, the control characters SHIFT-OUT (SO) and SHIFT-IN (SI) are permitted to occur :

- iv) between the CONTROL SEQUENCE INTRODUCER (CSI) and the Final character of a control sequence;
- v) between the opening delimiter of a control string and the STRING TERMINATOR (ST);
- vi) between a single-shift character and its operand.

SHIFT-OUT and SHIFT-IN have no effect on the interpretation of a control sequence, a control string or the operand of a single-shift character, but they may indeed affect the meanings of bit combinations following in the data stream.

APPENDIX A

EDITOR FUNCTIONS AND FORMAT EFFECTORS

A1. Correspondence between editor functions and format effectors

The table below shows on the same line editor functions and format effectors with similar functions. The notation is the same as in clause 8.1. An acronym without such a notation indicates that the control function is an element of the C0 or C1 set. Format effectors from Standard ECMA-6 are also included. Where there is only one entry on a single line, there is no control function corresponding to the one shown.

Editor function	Format effector
CBT (n)	
CHA (n)	CR, HPA (n)
CHT (n)	HT
CNL (n)	NEL, NL
CPL (n)	
CTC (s...)	HTS, TBC (s...), VTS
CUB (n)	BS, HPB (n)
CUD (n)	IND, LF, VPR, (n)
CUF (n)	HPR (n), SP
CUP (n;m)	HVP (n;m)
CUU (n)	RI, VPB (n)
CVT (n)	VT
DCH (n)	
DL (n)	
EA (s...)	
ECH (n)	
ED (s...)	
EF (s...)	
EL (s...)	
	FNT (s;t)
	GSM (n;m)
	GSS (n)
	HTSA (n...)

APPENDIX A

EDITOR FUNCTIONS AND FORMAT EFFECTORS

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Editor function	Format effector
CBT (n)	
CHA (n)	CR, HPA (n)
CHT (n)	HT
CNL (n)	NEL, NL
CPL (n)	
CTC (s...)	HTS, TBC (s...), VTS
CUB (n)	BS, HPB (n)
CUD (n)	IND, LF, VPR, (n)
CUF (n)	HPR (n), SP
CUP (n;m)	HVP (n;m)
CUU (n)	RI, VPB (n)
CVT (n)	VT
DCH (n)	
DL (n)	
EA (s...)	
ECH (n)	
ED (s...)	
EF (s...)	
EL (s...)	
	FNT (s;t)
	GSM (n;m)
	GSS (n)
	HTSA (n...)

Editor function	Format effector
	HTJ
ICH (n)	
IL (n)	
	JFY (s...)
NP (n)	FF, PPR (n)
	PFS (s...)
	PLD
	PLU
	PPA (n)
PP (m)	PPB (n)
	QUAD (s...)
	SGR (s...)
	SHS (s...)
	SPI (n;m)
SD (n)	
SL (n)	
SR (n)	
	SSU (s...)
SU (n)	
	SVS (s...)
	TSS (n)
	VPA (n)

A.2 Differences between editor functions and format effectors

The contrast between editor functions and format effectors together with their interaction with certain modes, is illustrated by the following example of the use of the control functions CURSOR NEXT LINE (CNL) and NEXT LINE (NEL).

In the example it is assumed that the string of capital letters

A B C D E F

has been entered or received, and that the active position has been moved back to the letter D, e.g. by means of CURSOR BACKWARDS (CUB). Starting from this situation, the following cases are considered.

- i) A CURSOR NEXT LINE (CNL) is received. In this case, the active position is moved to the beginning of the next line without affecting the previously received data.
- ii) The FORMAT EFFECTOR ACTION MODE being set to EXECUTE, a NEXT LINE (NEL) is received. This has the same effect as in case i.
- iii) The FORMAT EFFECTOR ACTION MODE being set to STORE and the INSERTION REPLACEMENT MODE to REPLACE, a NEXT LINE (NEL) is received. In this case, the letter D is replaced by NEL.

If the data is subsequently forwarded to another device operating with the FORMAT EFFECTOR ACTION MODE being set to EXECUTE, the effect is :

A B C
E F

- iv) The FORMAT EFFECTOR ACTION MODE being set to STORE and the INSERTION REPLACEMENT MODE to INSERT, a NEXT LINE (NEL) is received. In this case, the NEL is inserted between the letters C and D. If the data is subsequently forwarded to another device operating with the FORMAT EFFECTOR ACTION MODE being set to EXECUTE, the effect is :

A B C
D E F

Format effectors which have been received while the FORMAT EFFECTOR ACTION MODE is set to STORE can be operated upon with editing functions.

For example, the NEL which has been inserted between A B C and D E F in case iv can be deleted using DELETE CHARACTER (DCH), resulting in the initial situation being restored.

A.3 Composite graphic characters

Because the format effectors can be stored in a receiving device, as opposed to the editor functions which are immediately performed, format effectors rather than editor functions should be used for the construction of composite graphics.

For example, if the symbol \neq is to be composed using = (EQUALS SIGN) and / (SOLIDUS), the sequence :

= CUB /

does not produce the desired effect if received by a device which has no overstrike capability. Such a device may, however, process the sequence :

= BS /

in such a way that it is preserved and can be forwarded to a device which can indeed produce the intended composite symbol.

APPENDIX B

CODING EXAMPLES

B.1 Examples of complete control sequences

The general format of a control sequence is :

CSI P1 ... Pn I1 ... Im F

In an 8-bit environment the control function CURSOR FORWARD (CUF) by one position can be represented in many ways. Examples are :

9/11	3/1	4/3	
9/11	3/0	3/1	4/3
9/11	4/3		
9/11	3/0	4/3	

The second example shows that leading ZEROs (3/0) are not significant. The third and fourth examples use the fact that a default value for CUF is defined and is equal to 1.

In a 7-bit environment the corresponding examples are :

1/11	5/11	3/1	4/3	
1/11	5/11	3/0	3/1	4/3
1/11	5/11	4/3		
1/11	5/11	3/0	4/3	

In an 8-bit environment SCROLL RIGHT (SR) by 28 positions can be represented for instance by :

9/11	3/2	3/8	2/0	4/1
------	-----	-----	-----	-----

In a 7-bit environment the corresponding representation is :

1/11	5/11	3/2	3/8	2/0	4/1
------	------	-----	-----	-----	-----

In an 8-bit environment DEFINE AREA QUALIFICATION (QAD) permitting numeric and alphabetic data to be entered into an input area can be represented by :

9/11	3/3	3/11	3/4	6/15
------	-----	------	-----	------

In a 7-bit environment the corresponding representation is :

1/11	5/11	3/3	3/11	3/4	6/15
------	------	-----	------	-----	------

B.2 Examples of parameter strings

<u>Character Form</u>	<u>Bit Combination Form</u>	<u>Explanation</u>
7	3/7	A parameter having the value 7.
98	3/9 3/8	A parameter having the value 98.

<u>Character Form</u>	<u>Bit Combination Form</u>	<u>Explanation</u>
4;2	3/4 3/11 3/2	Two parameters having values 4 and 2 respectively.
<3	3/12 3/3	A private parameter string
6;	3/6 3/11	Two parameters, the first having the value 6 and the second taking the default value.
;5	3/11 3/5	Two parameters, the first taking the default value and the second having the value 5.
1;;4	3/1 3/11 3/11 3/4	Three parameters, the first having the value 1, the second taking the default value, and the third having the value 4.
0007	3/0 3/0 3/0 3/7	A parameter having the value 7.

APPENDIX C

TEXT COMPOSITION DEVICE CONCEPTS

Display devices and systems involving text composition may utilize the control functions JUSTIFY and QUAD. When working in the field of text composition several words are used with quite specialized meaning. Those words have been used in this Standard with the meaning from the terminology of the printing and publishing industry. Explanation is provided in this Annex in terms compatible with coded information interchange and the concepts of character-imaging devices.

Both QUAD and JUSTIFY deal with the positioning of text (printed graphics and free spaces) between "margins". Margins are areas protected against display at the boundaries of which lines of text may start and terminate. In the general case of a display device with a multiple page buffer (capable of the QUAD or JUSTIFY functions) the margin(s) would be set at arbitrary absolute horizontal positions. No control functions are provided in this Standard to set margins (left, right, intermediate). The QUAD function deals with single lines of text from the data stream. While the JUSTIFY function may deal with more than one line. In both cases it is possible to "flush" text. When text is flush, it starts or ends, as applicable, against a marginal boundary. Flush to left margin means start text at the left margin (or first margin to the left in columnar texts). Similarly, flush to right margin means end text at the right margin. In the process of making text flush, open spaces may be generated.

The action to "fill" open spaces involves a concept particular to the JUSTIFY and QUAD functions. The open spaces may be filled with a "leader" in the QUAD function. A leader is a pattern (most often a repeated string of graphic characters) which is inserted into the open area. In the use of the JUSTIFY function the fill operation is far more complicated and will be described below.

Having considered margins and flush text it is necessary to consider text which is not intended to be flush to the margins. Text which meets this criterion falls into two categories. They are centred text and ragged text. This Standard deals explicitly with centred text and implicitly with ragged text. Centred text is arranged between margins such that the open space to the left and right margins are as equal as possible. Ragged is the term applied when text is neither centred nor flush to a margin.

The process utilizing the JUSTIFY function involves the arrangement of text between margins either being flush (explicitly) or ragged (implicitly). In order to accomplish flush left and right, fill may be required. The fill may consist of SPACES, thin spaces, words, or parts of words. For the purposes of this description a word is considered as including the graphic

characters of the word itself and the punctuation or space terminating the word. The rules regarding a specific justification process depend on the combination of the parameter values used. A line which is to be justified left and right with word fill will first be adjusted in length by the addition or removal of text in the form of words until the remaining words fit between the established margins. Words removed from the line will be returned to the data stream in its following line(s). Subsequent to having sufficient words to fit between margins the open space (between words or graphic characters) may be adjusted to accomplish the combined flush-to-left margin and flush-to-right margin action. This spacing is adjusted by intervals, or variable-size spaces according to the implementation. When the interword space parameter value has been used, the spacing adjustment is applicable between words. When the letter space parameter value has been used the spacing adjustment is applicable between adjacent graphic characters. When both inter-word space and letter space parameter values have been used the strategy for selecting which positions are to be widened is implementation-dependent. Special cases of the above involve the use of partial words in the fill process. In these cases a hyphenation process is used. If the hyphenation parameter value is used, words may be subdivided according to an implementation strategy at language intervals often corresponding to syllables. If the Italian hyphenation parameter value is used the first word which will not fit between the margins is truncated, the last character of the line is underlined and the remainder of the word is inserted in the data stream for use in the next line.

APPENDIX D

IMPLEMENTATION-DEPENDENT FEATURES

The following introduces, but does not exhaustively list those matters left to the implementors.

1. The control functions which will be selected for implementation.
2. The number of bits, number of characters, and form of the bit combination or bit combinations generated by a single or multiple key depression.
3. Whether characters entered become immediately visible or are processed (partially or fully) prior to becoming visible.
4. If there is a buffer, whether it has a capacity larger than, identical to, or smaller than, the display area.
5. Whether a control function occupies buffer space, display space or both.
6. At what point(s) in the processing of the data stream control functions are to be executed.
7. What the representation of an erased state may be.
8. Whether certain control sequences remain in their encoded state or are transformed into data in special registers and tables.
9. Whether or not there are implementation-defined values for parametric functions when the Standard does not specify a standardized default value.
10. What action will be taken in error recovery.
11. The initial state of a device upon power-up, including the settings of the modes.
12. Whether the width of a displayed character position is fixed or variable (depending on the character occupying the position).
13. The action to be taken by a device if a control function or a graphic character is received which the device cannot implement because of design limitation or temporary functional disablement.
14. Whether a change of the setting of the CONTROL REPRESENTATION MODE affects control functions already entered into, or received by, the device or whether only those control functions are affected that are entered or received subsequently to the change.

