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British Standard Specification for

Control functions for ISO 7-bit and 8-bit coded character sets

British Standards Institution

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National foreword

This British Standard has been prepared under the direction of the Information Systems Technology Standards Policy Committee and is identical with ISO 6429:1988 'Information processing — Control functions for 7-bit and 8-bit coded character sets', published by the International Organization for Standardization (ISO). It is a revision of DD 94 : 1983, which is now withdrawn.

This British Standard improves the clarity of the text of DD 94 and includes all the control functions defined in British Standards and ISO texts (see annex E).

Cross-references

International standard	Corresponding British Standard
ISO 646:1983	BS 4730 : 1985 Specification for UK 7-bit coded character sets (Identical exercising national options)
ISO 1745:1975	BS 4505 Digital data transmission Part 1 : 1981 Specification for basic mode control procedures (Identical)
ISO 2022 : 1986	BS 6856 : 1987 Specification for code extension techniques for United Kingdom 7-bit and 8-bit coded character sets (Identical)
ISO 4873:1986	BS 6006 : 1987 Specification for structure and rules for implementation of UK 8-bit coded character set (Identical)
ISO 8859-1:1987	BS 7203 8-bit single-byte coded graphic character set Part 1 : 1989 Specification for Latin alphabet No. 1 (Identical)
ISO 8859-2:1987	Part 2 : 1989 Specification for Latin alphabet No. 2 (Identical)

The Technical Committee has reviewed the provisions of ISO 2375:1985 and ISO 7350:1988, to which reference is made in the text, and has decided that they are acceptable for use in conjunction with this publication.

The Technical Committee (IST/18) concerned with Text and Office Systems is currently considering whether to implement ISO 8613-6 as an identical (dual numbered) British Standard.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Information processing — Control functions for 7-bit and 8-bit coded character sets

1 Scope

1.1 This International Standard defines control functions and their coded representations for use in a 7-bit code, an extended 7-bit code, an 8-bit code or an extended 8-bit code, if such a code is structured in accordance with ISO 2022. This International Standard specifies a C0 set, a C1 set, control functions derived therefrom and a number of independent control functions.

1.2 The control functions are intended to be used 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 coded control functions and graphic characters, and is capable 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 character positions and lines 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 coded 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 entered locally into the device, for example by an associated keyboard.

In general, 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.

In addition to being performed the control functions may need to be represented by a graphic symbol.

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

Other International Standards specifying control functions may define more restricted definitions of them than those in this International Standard.

1.3 The devices to which this International Standard applies can vary greatly from each other depending on the application for which a device has been specifically designed. It is

technically and economically impractical for one device to implement all the facilities specified in this International Standard. The intention is that within any type of device only a limited selection of the facilities appropriate to the application will be implemented.

2 Conformance

2.1 Types of conformance

Full conformance to a standard means that all of its requirements are met. Conformance will only have a unique meaning if the standard contains no options. If there are options within the standard they must be clearly identified, and any claim of conformance must include a statement that identifies those options that have been adopted.

This International Standard is of a different nature since it specifies a large number of facilities from which different selections may be made to suit individual applications. These selections are not identified in this International Standard, but must be identified at the time that a claim of conformance is made. Conformance to such an identified selection is known as limited conformance.

2.2 Conformance of information interchange

A CC-data-element within coded information for interchange is in conformance with this International Standard if the coded representations of control functions within that CC-data-element satisfy the following conditions:

- a) a coded representation of a control function that is specified in this International Standard shall always represent that control function;
- b) a control function that is specified in this International Standard shall always be represented by the coded representation that is specified in this International Standard for that control function;
- c) any coded representation that is reserved for future standardization by this International Standard shall not appear.

Coded representations of control functions and modes not specified in this International Standard may appear in interchanged information subject to the above conditions (see 5.5, 5.5.1 and 7.4).

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2.3 Conformance of devices

A device is in conformance with this International Standard if it conforms to the requirements of 2.3.1, and either or both 2.3.2 and 2.3.3 below. Any claim of conformance shall identify the document which contains the description specified in 2.3.1.

2.3.1 Device description

A device that conforms to this International Standard shall be the subject of a description that

- a) identifies, by reference to the clauses of, or to the control functions specified in, this International Standard, the selection of coded representations that the device can originate or can receive and interpret;
- b) for each such control function with selective parameters, specifies the parameter values implemented;
- c) if the identified selection contains a control function for which a default value for a parameter is specified in this International Standard, includes the explicit and implicit representations of this default value;
- d) identifies the means by which the user may supply the corresponding control functions or may recognize them, as specified in 2.3.2 and 2.3.3, respectively.

2.3.2 Originating devices

An originating device shall be capable of transmitting within a CC-data-element the coded representations of an identified selection of control functions conforming to this International Standard.

Such a device shall allow the user to supply any control function that he chooses from among the identified selection for the purpose of transmitting its coded representation within a CC-data-element.

2.3.3 Receiving devices

A receiving device shall be capable of receiving within a CC-data-element and interpreting the coded representations of an identified selection of control functions conforming to this International Standard. It shall be able to interpret default values in both explicit and implicit representations.

Such a device shall make available to the user any control function that is within the identified selection, and the coded representation of which is received within a CC-data-element, in such a form that the user can recognize it from among the control functions of the identified selection.

3 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International

Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 1745 : 1975, *Information processing — Basic mode control procedures for data communication systems*.

ISO 2022 : 1986, *Information processing — ISO 7-bit and 8-bit coded character sets — Code extension techniques*.

ISO 2375 : 1985, *Data processing — Procedure for registration of escape sequences*.

ISO 6937 : 1983, *Information processing — Coded character sets for text communication*.

ISO 7350 : 1984, *Text communication — Registration of graphic character subrepertoires*.

ISO 8613-6 : —¹⁾, *Information processing — Text and office systems — Office Document Architecture (ODA) and interchange format — Part 6: Character content architectures*.

ISO International Register of Coded Character Sets to be Used with Escape Sequences.

CCITT Recommendation T.61, 1984, *Character repertoire and coded character sets for the international teletex service*.

4 Notation and definitions

4.1 Notation

In this International Standard 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 in order to avoid confusion, for example, between the concept "space" and the character SPACE.

It is intended that this convention and the acronyms of the modes and the control functions be retained in all translations of the text. (See annex E.)

This International Standard uses the notation of the form xx/yy, where xx represents the column number 00 to 07 in a 7-bit code table or 00 to 15 in an 8-bit code table, and yy represents the row number 00 to 15.

4.2 Definitions

For the purposes of this International Standard, the following definitions apply.

4.2.1 active area: The area which contains the active position.

1) To be published.

4.2.2 active field: The field which contains the active position.

4.2.3 active line: The line which contains the active position.

4.2.4 active page: The page which contains the active position.

4.2.5 active position: The character position which is to image the graphic symbol representing the next graphic character or the next control function for which a graphic representation is required.

In general, the active position is indicated by a cursor.

4.2.6 area: A series of successive character positions that are not necessarily on the same line.

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

4.2.8 bit combination: An ordered set of bits that represents a coded character or is used as part of the representation of a coded character.

4.2.9 byte: A bit string that is operated upon as a unit.

4.2.10 to cancel: To mark data in such a way that it can be ignored in subsequent processing.

4.2.11 character: A member of a set of elements used for the organization, control or representation of data.

4.2.12 character-coded-data-element (CC-data-element): An element of interchanged information that is specified to consist of a sequence of coded representations of characters, in accordance with one or more identified standards for coded character sets.

4.2.13 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.

4.2.14 character path: The direction of presentation of successive graphic characters along a line.

4.2.15 character position: The portion of a display that is imaging or is capable of imaging a graphic symbol.

4.2.16 to clear: To remove the display of data or the information used for the display of data, for example tabulation stops marking the boundaries between fields.

4.2.17 coded character set; code: A set of unambiguous rules that establishes a character set and the one-to-one relationship between the characters of the set and their bit combinations.

4.2.18 code extension: The techniques for the encoding of characters that are not included in the character set of a given code.

4.2.19 code table: A table showing the character allocated to each bit combination in a code.

4.2.20 control character: A control function the coded representation of which consists of a single bit combination.

4.2.21 control function: An element of a character set that effects the recording, processing, transmission, or interpretation of data, and that has a coded representation consisting of one or more bit combinations.

4.2.22 control sequence: A sequence of bit combinations starting with that representing the control character CONTROL SEQUENCE INTRODUCER (CSI), used for the coded representation of control functions with parameters.

4.2.23 control string: A delimited string of characters which may occur in the data stream as a logical entity for control purposes.

4.2.24 cursor: A special indicator used to mark the active position in a display.

4.2.25 decimal mark: A graphic symbol, usually a FULL STOP or a COMMA, used to separate the fractional part of a decimal number from the integer part of that number.

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

4.2.27 to delete: To remove the contents from character positions and closing the resulting gap by moving adjacent graphic characters into the empty positions.

4.2.28 to designate: To identify a set of characters that are to be represented, in some cases immediately and in others on the occurrence of a further control function, in a prescribed manner.

4.2.29 device: A component of information processing equipment which can transmit, and/or receive, coded information within CC-data-elements. (It may be an input/output device in the conventional sense, or a process such as an application program or gateway function.)

4.2.30 display: The region for visual presentation of data on any type of character-imaging device, including printer, cathode ray tube and similar devices.

4.2.31 editor function: Control functions used for editing, altering or transposing the visual arrangement of data.

4.2.32 eligible: The term used to denote an area considered for transmission or transfer.

4.2.33 environment: The characteristic that identifies the number of bits used to represent a character in a data processing or data communication system or in a part of such a system.

4.2.34 to erase: To remove the contents from character positions and leaving the resulting gap open.

4.2.35 escape sequence: A bit string that is used for control purposes in code extension procedures and that consists of two or more bit combinations. The first of these bit combinations represents the character ESCAPE.

4.2.36 field: An area consisting of the character position at a character tabulation stop (beginning of the field) and the character positions up to, but not including, the character position at the following character tabulation stop (end of the field).

4.2.37 Final Byte: The bit combination that terminates an escape sequence or a control sequence.

4.2.38 formator function: Control functions describing how the originator of the data stream wishes the information to be formatted or presented.

4.2.39 graphic character: A character, other than a control function, that has a visual representation normally handwritten, printed or displayed, and that has a coded representation consisting of one or more bit combinations.

4.2.40 graphic rendition: The visual style of displaying a set of graphic symbols.

4.2.41 graphic symbol: A visual representation of a graphic character or of a control function.

4.2.42 guarded area: A special case of a qualified area.

4.2.43 initial state: The state a device has after it is made operational.

It is the recommended "reset" state of the modes.

4.2.44 Intermediate Byte

a) In an Escape Sequence, a bit combination that may occur between the control function ESCAPE (ESC) and the Final Byte.

b) In a Control Sequence, a bit combination that may occur between the control function CONTROL SEQUENCE INTRODUCER (CSI) and the Final Byte, or between a Parameter Byte and the Final Byte.

4.2.45 to invoke: To cause a designated set of characters to be represented by the prescribed bit combinations whenever those bit combinations occur, until an appropriate code extension function occurs.

4.2.46 line: A set of a predetermined number of character positions.

4.2.47 line progression: The direction of presentation of successive lines.

4.2.48 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.

4.2.49 page: A set of a predetermined number of lines.

4.2.50 Parameter Byte: In a control sequence, a bit combination that may occur between the control function CONTROL SEQUENCE INTRODUCER (CSI) and the Final Byte, or between CSI and an Intermediate Byte.

4.2.51 position: The part of a code table identified by its column and row coordinates.

4.2.52 private (or experimental) use: The means of representing a non-standardized control function in a manner compatible with this International Standard.

4.2.53 protected area: A special case of a qualified area.

4.2.54 qualified area: A string of character positions to which certain characteristics are associated.

4.2.55 repertoire: The set of characters which can be represented by means of a coded representation using a coded character set.

4.2.56 scroll: The action whereby all, or part of, the graphic symbols of a display are moved in a specified direction.

4.2.57 selected area: A string of character positions, the contents of which may be eligible to be transmitted in the form of a data stream or to be transferred to an auxiliary input/output device.

4.2.58 tabulation: The technique of identifying character positions or lines in a display for the purpose of arranging information systematically.

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

4.2.60 user: A person or other entity that invokes the services provided by a device. (This entity may be a process such as an application program if the "device" is a code convertor or a gateway function, for example.)

5 Coded representation

5.1 General

Each control function in this International Standard (except DELETE) belongs to one of the following types:

- a) elements of the C0 set;
- b) elements of the C1 set;

- c) control sequences;
- d) independent control functions;
- e) control strings.

5.2 DELETE

This control function does not belong to any set. For reference purposes it is considered to be an element of the Cx set.

5.3 Elements of the C0 set

These control functions are represented in 7-bit and 8-bit codes by bit combinations from 00/00 to 01/15.

This method of representation permits coding of up to 32 control functions.

The definitions and the coded representations of the control functions are specified in 8.3 (see also table 1).

The 3-character escape sequence designating and invoking this C0 set is ESC 02/01 04/00.

NOTE — It is assumed that even with no invoked C0 set the control character ESCAPE is available and is represented by bit-combination 01/11.

Table 1 — Bit combinations representing the control functions of the C0 set

Row number	Column number	
	00	01
00	NUL	DLE
01	SOH	DC1
02	STX	DC2
03	ETX	DC3
04	EOT	DC4
05	ENQ	NAK
06	ACK	SYN
07	BEL	ETB
08	BS	CAN
09	HT	EM
10	LF	SUB
11	VT	ESC
12	FF	IS4
13	CR	IS3
14	SO or LS1	IS2
15	SI or LS0	IS1

5.4 Elements of the C1 set

These control functions are represented

- a) in a 7-bit code by 2-character escape sequences of the form ESC Fe, where ESC is represented by bit combination 01/11 and Fe is represented by a bit combination from 04/00 to 05/15;
- b) in an 8-bit code by bit combinations from 08/00 to 09/15; however, when the announcer sequence ESC 02/00 04/06 according to ISO 2022 is used, the control functions of the C1 set are represented by ESC Fe sequences.

The definitions and the coded representations of the control functions are specified in 8.3 (see also table 2).

The 3-character escape sequences designating and invoking this C1 set are ESC 02/06 04/00 and ESC 02/02 04/03.

Table 2 — Bit combinations representing the control functions of the C1 set

Row number	Column number		
	7-bit code	04	05
	8-bit code	08	09
00		—	DCS
01		—	PU1
02		BPH	PU2
03		NBH	STS
04		IND*	CCH
05		NEL	MW
06		SSA	SPA
07		ESA	EPA
08		HTS	SOS
09		HTJ	—
10		VTs	SCI
11		PLD	CSI
12		PLU	ST
13		RI	OSC
14		SS2	PM
15		SS3	APC

* See annex E.

The unallocated bit combinations are reserved for future standardization and shall not be used. They are not available for private (or experimental) use.

5.5 Control sequences

A control sequence consists of a sequence of bit combinations starting with that representing the control character CONTROL SEQUENCE INTRODUCER (CSI) followed by one or more bit combinations representing parameters, if any, and by one or more bit combinations identifying the control character. The control function CSI itself is an element of the C1 set.

The format of a control sequence is

CSI P ... P I ... I F

where

- a) CSI is represented by bit combinations 01/11 (representing ESC) and 05/11 in a 7-bit code or by bit combination 09/11 in an 8-bit code, see 5.4;
- b) P ... P are Parameter Bytes, which, if present, consist of bit combinations from 03/00 to 03/15;
- c) I ... I are Intermediate Bytes, which, if present, consist of bit combinations from 02/00 to 02/15. Together with the Final Byte F, they identify the control function;

NOTE — The number of Intermediate Bytes is not limited by this International Standard; in practice, one Intermediate Byte will be sufficient since over one thousand control functions may be identified in this way.

d) F is the Final Byte; it consists of a bit combination from 04/00 to 07/14; it terminates the control sequence and together with the Intermediate Bytes, if present, identifies the control function. Bit combinations 07/00 to 07/14 are available as Final Bytes of control sequences for private (or experimental) use.

The definitions and the coded representations of the control functions are specified in 8.3 (see also tables 3 and 4).

Table 3 — Final Bytes of control sequences without Intermediate Bytes

Row number	Column number		
	04	05	06
00	ICH	DCH	HPA
01	CUU	SEE	HPR
02	CUD	CPR	REP
03	CUF	SU	DA
04	CUB	SD	VPA
05	CNL	NP	VPR
06	CPL	PP	HVP
07	CHA	CTC	TBC
08	CUP	ECH	SM
09	CHT	CVT	MC
10	ED	CBT	HPB
11	EL	SRS	VPB
12	IL	PTX	RM
13	DL	—	SGR
14	EF	—	DSR
15	EA	—	DAQ

The unallocated bit combinations are reserved for future standardization and shall not be used.

Table 4 — Final Bytes of control sequences with a single Intermediate Byte 02/00

Row number	Column number		
	04	05	06
00	SL	PPA	TATE
01	SR	PPR	TALE
02	GSM	PPB	TAC
03	GSS	SPD	TCC
04	FNT	DTA	TSR
05	TSS	SLH	SCO
06	JFY	SLL	SRCS
07	SPI	FNK	SCS
08	QUAD	SPQR	SLS
09	SSU	SEF	—
10	PFS	PEC	—
11	SHS	SSW	—
12	SVS	SACS	—
13	IGS	SAPV	—
14	HTSA*	STAB	—
15	IDCS	GCC	—

* See annex E.

The unallocated bit combinations are reserved for future standardization and shall not be used.

5.5.1 Parameter representation

A control sequence may contain a string of Parameter Bytes P ... P representing one or more parameters to complete the specification of the control function.

The Parameter Bytes are bit combinations from 03/00 to 03/15. The parameter string is interpreted as follows:

- If the first bit combination of the parameter string is in the range 03/00 to 03/11, the parameter string is interpreted according to the format described in 5.5.2.
- If the first bit combination of the parameter string is in the range 03/12 to 03/15, the parameter string is available for private (or experimental) use. Its format and meaning are not defined by this International Standard.

5.5.2 Parameter string format

A parameter string which does not start with a bit combination in the range 03/12 to 03/15 shall have the following format:

- A parameter string consists of one or more parameter sub-strings, each of which represents a number in decimal notation.
- Each parameter sub-string consists of one or more bit combinations from 03/00 to 03/10; the bit combinations from 03/00 to 03/09 represent the digits ZERO to NINE; bit combination 03/10 may be used as a separator in a parameter sub-string, for example, to separate the integer and decimal fraction part of a number.
- Parameter sub-strings are separated by one bit combination 03/11.
- Bit combinations 03/12 to 03/15 are reserved for future standardization except when used as the first bit combination of the parameter string.
- An empty parameter sub-string represents a default value which depends on the control function, see 7.2.20.
- In each parameter sub-string, leading bit combinations 03/00 are not significant and may be omitted. If the parameter sub-string consists of bit combinations 03/00 only, at least one of them must be retained to indicate the zero value of the sub-string, see 7.2.20.
- If the parameter string starts with the bit combination 03/11, an empty parameter sub-string is assumed preceding the separator; if the parameter string terminates with the bit combination 03/11, an empty parameter sub-string is assumed following the separator; if the parameter string contains successive bit combinations 03/11, empty parameter sub-strings are assumed between the separators.
- If the control function has more than one parameter, and some parameter sub-strings are empty, the separators (bit combination 03/11) must still be present. However, if the last parameter sub-string(s) is empty, the separator preceding it may be omitted, see clause B.2 of annex B.

5.5.3 Types of parameters

In a control sequence 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 International Standard.

A parameter may be purely numeric or it may be selective, i.e. denoting one of a numbered list of actions the control function can perform.

In the case of selected parameters a particular parameter value may have the same meaning as a combination of two or more separate values.

Unassigned selective parameter values are reserved for future standardization.

5.6 Independent control functions

These control functions are represented in 7-bit and 8-bit codes by 2-character escape sequences of the form ESC Fs, where ESC is represented by bit combination 01/11 and Fs is represented by a bit combination from 06/00 to 07/14.

The definitions and the coded representations of the control functions are specified in 8.3 (see also table 5).

Table 5 — Independent control functions

Row number	Column number	
	06	07
00	DMI	—
01	INT	—
02	EMI	—
03	RIS	—
04	CMD	—
05	—	—
06	—	—
07	—	—
08	—	—
09	—	—
10	—	—
11	—	—
12	—	LS3R
13	—	LS2R
14	LS2	LS1R
15	LS3	—

The unallocated bit combinations are reserved for future standardization and shall not be used. They are not available for private (or experimental) use.

NOTE — ESC Fs sequences are registered in the ISO International Register of Coded Character Sets to be Used with Escape Sequences, which is maintained by the Registration Authority for ISO 2375. Any candidates for ESC Fs sequences have to be approved by ISO/IEC JTC1/SC2 for registration. The coding for the Final Byte, Fs, will then be assigned by the Registration Authority.

5.7 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 or a character string, and a terminating delimiter, the STRING TERMINATOR (ST).

A command string consists of a sequence of characters represented by bit combinations in the range 00/08 to 00/13 and 02/00 to 07/14.

A character string consists of a sequence of characters represented by any bit combination, except those representing START OF STRING (SOS) or STRING TERMINATOR (ST).

The interpretation of the command string or the character string is not defined by this International Standard, but instead requires prior agreement between the sender and the recipient of the data.

The opening delimiters defined in this International Standard are

- a) APPLICATION PROGRAM COMMAND (APC)
- b) DEVICE CONTROL STRING (DCS)
- c) OPERATING SYSTEM COMMAND (OSC)
- d) PRIVACY MESSAGE (PM)
- e) START OF STRING (SOS)

6 Device concepts

The definitions of the control functions in this International Standard are based on general assumptions about the architecture of a character-imaging device. Examples of devices conforming to these concepts are: an alpha-numeric display device, a printer or a microfilm 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 of the device at the abstract level of description in this International 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 predetermined size.

A page is composed of a predetermined number of lines, each composed of a predetermined number of character positions. The device may have the capability of varying the number of lines per page, the number of character positions per line, the line spacing, and the character spacing during the operation of the device.

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

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Each character position either is in the erased state or images a graphic symbol. A graphic symbol represents SPACE, a graphic character, or a control function for which a graphical 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 the erased state and a character position imaging SPACE.

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

In this International 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 lines and the character positions are numbered relative to the character image (page) output, not to the buffer (if any), according to the directions of the established line progression and the character path.

The font design of the graphic symbols is not defined by this International Standard.

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 graphical representation is required. The active position is also the reference position against which certain format functions or editor functions are performed (see 6.4). The line containing the active position is called the active line.

The field containing the active position is called the active field.

The page containing the active position is called the active page.

The area containing the active position is called the active area.

6.3.1 Implicit movement

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

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

6.3.2 Explicit movement

The active position is moved to a specified character position.

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

NOTES

1 It is common practice to mark the active position by means of a special indicator which is called the "cursor".

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

- 1) cause a wrap-around movement;
- 2) cause the active position to be blocked (a condition in which no graphic character can be entered until a valid explicit active position movement is performed);
- 3) cause the active position to remain where it is but permit graphic characters to be entered thereby replacing or overstriking the previously entered character;
- 4) cause the cursor to disappear from the operator's view;
- 5) cause the cursor to move to the opposite end of the display but one row or column offset;
- 6) cause scrolling to occur;
- 7) cause other implementation-dependent action.

6.4 Formator functions and editor functions

Two classes of control functions have an action on the layout or positioning of information in character-imaging devices. They are formator functions and editor functions. The principal difference between editor functions and formator functions is that the latter are sensitive to the FORMAT EFFECTOR ACTION MODE (FEAM); whereas the former are not (see annex A).

6.4.1 Formator functions

They are format effectors and presentation control functions. Formator functions may be part of the data stream. They describe how the originator of the data stream wishes the information to be formatted or presented.

Therefore, if formator functions 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.

Formator functions are processed depending on the setting of the FORMAT EFFECTOR ACTION MODE (FEAM) of the device.

6.4.2 Composite graphic characters

Composite graphic characters may be obtained by using formator functions only; editor functions shall not be used for this purpose (see clause A.3 of annex A).

6.4.3 Editor functions

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

Editor functions are performed immediately and do not become part of the data stream.

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

6.5 Selected and qualified areas

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

6.5.1 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 6.6).

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

6.5.2 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:

- a) the contents are protected against manual alteration;
- b) the kind of characters which are permitted to be entered is restricted (for example, to numeric or alphabetic characters only);
- c) the contents are protected against erasure;
- d) a tabulation stop is associated with the first character position;
- e) the contents are to be excluded, i.e. guarded (see 6.5.2.2) from transmission as a data stream, or from transfer to an auxiliary input/output device (see 6.6).

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.

6.5.2.1 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 (ERM). A protected area may, in general, be either guarded or unguarded.

6.5.2.2 Guarded areas

A guarded area is a special case of a qualified area. It is a protected area the contents of which are excluded from transmission as a data stream and from transfer to an auxiliary input/output device, depending on the setting of the GUARDED AREA TRANSFER MODE (GATM).

Alternatively to using DEFINE AREA QUALIFICATION (DAQ) the start of a guarded area may also be established by START OF GUARDED AREA (SPA). The character position which is the active position after receipt of SPA is the first character position of the guarded area.

Also, alternatively to using DAQ the end of a guarded area may be established by END OF GUARDED AREA (EPA). The character position which is the active position before the receipt of EPA is the last character position of the guarded area.

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

6.6 Auxiliary input/output devices

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

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

If there is more than one auxiliary input/output device, 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 the implementation.

7 Modes

7.1 The concept of modes

This International Standard is intended to be applicable to a very large range of devices, in which there are variations. Some of these variations have been formalized in the form of modes. They deal with the way in which a device transmits, receives, processes, or images data. Each mode has two states. The reset state is shown first in the definitions in 7.2.

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The states of the modes may be established explicitly in the data stream by the control functions SET MODE (SM) and RESET MODE (RM) or may be established by agreement between sender and recipient. In an implementation, some or all of the modes may have one state only.

To ensure data compatibility and ease of interchange with a variety of equipment the use of modes is deprecated. If modes have to be implemented for backward compatibility it is recommended that the reset state of the modes be the initial state. Otherwise, explicit agreements will have to be negotiated between sender and recipient, to the detriment of "blind" interchange.

7.2 Definition of modes

The modes 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.

The modes are listed in the alphabetical order of their acronyms. It is intended that the acronyms be retained in all translations of the text. (See annex E.)

7.2.1 CRM — CONTROL REPRESENTATION MODE**CONTROL:**

All control functions are performed as defined; the way formator functions are processed depends on the setting of the FORMAT EFFECTOR ACTION MODE (FEAM). A device may choose to image the graphical representations of control functions in addition to performing them.

GRAPHIC:

All control functions, except RESET MODE (RM), are treated as graphic characters. A device may choose to perform some control functions in addition to storing them and imaging their graphical representations.

NOTE — All control functions, except RM, are affected.

7.2.2 EBM — EDITING BOUNDARY MODE (see annex E)

Because a relevant parameter was added to SELECT EDITING EXTENT (SEE) this mode is no longer required and should no longer be used.

7.2.3 ERM — ERASURE MODE**PROTECT:**

Only the contents of unprotected areas are affected by an erasure control function.

ALL:

The contents of protected as well as of unprotected areas are affected by an erasure control function.

NOTE — Control functions affected are: EA, ECH, ED, EF, EL.

7.2.4 FEAM — FORMAT EFFECTOR ACTION MODE**EXECUTE:**

Formator functions are performed immediately and may be stored in addition to being performed.

STORE:

Formator functions are stored but not performed. In this case, the specified action is intended to be performed by another device when the associated data are transmitted or transferred.

NOTE — Control functions affected are: BPH, BS, CR, DTA, FF, FNT, GCC, GSM, GSS, HPA, HPB, HPR, HT, HTJ, HTS, HTSA*, HVP, IND*, JFY, NEL, PEC, PFS, PLD, PLU, PPA, PPB, PPR, PTX, QUAD, RI, SACS, SAPV, SCO, SCS, SGR, SHS, SLH, SLL, SLS, SPD, SPI, SPQR, SRCS, SRS, SSU, SSW, STAB, SVS, TAC, TALE, TATE, TBC, TCC, TSS, VPA, VPB, VPR, VTS.

* See annex E.

7.2.5 FETM — FORMAT EFFECTOR TRANSFER MODE**INSERT:**

Formator functions may be inserted in a data stream to be transmitted or in data to be transferred to an auxiliary input/output device.

EXCLUDE:

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

NOTE — No control functions are affected.

7.2.6 GATM — GUARDED AREA TRANSFER MODE**GUARD:**

Only the contents of unguarded areas in an eligible area are transmitted or transferred.

ALL:

The contents of guarded as well as of unguarded areas in an eligible area are transmitted or transferred.

NOTE — No control functions are affected.

Table 6 — Mode summary

Acronym	Reset-state set-state	Name	Defined in
CRM	CONTROL GRAPHIC	CONTROL REPRESENTATION MODE	7.2.1
EBM	DISPLAY ALL	EDITING BOUNDARY MODE	clause E.2 of annex E
ERM	PROTECT ALL	ERASURE MODE	7.2.3
FEAM	EXECUTE STORE	FORMAT EFFECTOR ACTION MODE	7.2.4
FETM	INSERT EXCLUDE	FORMAT EFFECTOR TRANSFER MODE	7.2.5
GATM	GUARD ALL	GUARDED AREA TRANSFER MODE	7.2.6
GRCM	REPLACING CUMULATIVE	GRAPHIC RENDITION COMBINATION MODE	7.2.7
HEM	FOLLOWING PRECEDING	CHARACTER EDITING MODE	7.2.8
IRM	REPLACE INSERT	INSERTION REPLACEMENT MODE	7.2.9
KAM	ENABLED DISABLED	KEYBOARD ACTION MODE	7.2.10
LF/NLM	LINE FEED NEW LINE	LINE FEED/NEW LINE MODE	clause E.2 of annex E
MATM	SINGLE MULTIPLE	MULTIPLE AREA TRANSFER MODE	7.2.12
PUM	CHARACTER SIZE	POSITIONING UNIT MODE	7.2.13
SATM	SELECT ALL	SELECTED AREA TRANSFER MODE	7.2.14
SRM	MONITOR SIMULTANEOUS	SEND/RECEIVER MODE	7.2.15
SRTM	NORMAL DIAGNOSTIC	STATUS REPORT TRANSFER MODE	7.2.16
TSM	MULTIPLE SINGLE	TABULATION STOP MODE	7.2.17
TTM	CURSOR ALL	TRANSFER TERMINATION MODE	7.2.18
VEM	FOLLOWING PRECEDING	LINE EDITING MODE	7.2.19
ZDM	ZERO DEFAULT	ZERO DEFAULT MODE	7.2.20

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7.2.7 GRCM — 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 have to 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.

NOTE — Control function affected is: SGR.

7.2.8 HEM — CHARACTER EDITING MODE**FOLLOWING:**

A character insertion causes the contents of the active position and of the following character positions to be shifted in the direction of the character path; a character deletion causes the contents of character positions following the active position to be shifted in the direction opposite to that of the character path.

PRECEDING:

A character insertion causes the contents of the active position and of preceding character positions to be shifted in the direction opposite to that of the character path; a character deletion causes the contents of character positions preceding the active position to be shifted in the direction of the character path.

NOTE — Control functions affected are: DCH, ICH.

7.2.9 IRM — INSERTION REPLACEMENT MODE**REPLACE:**

The graphic symbol of a graphic character or of a control function, for which a graphical representation is required, replaces (or, depending upon the implementation, is combined with) the graphic symbol imaged at the active position.

INSERT:

The graphic symbol of a graphic character or of a control function, for which a graphical representation is required, is inserted at the active position.

NOTE — Only control functions for which a graphical representation is required are affected.

7.2.10 KAM — 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.

NOTE — No control functions are affected.

7.2.11 LF/NLM — LINE FEED/NEW LINE MODE

See annex E.

7.2.12 MATM — MULTIPLE AREA TRANSFER MODE**SINGLE:**

Only the contents of the selected area which contains the active position are eligible to be transmitted or transferred.

MULTIPLE:

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

NOTE — No control functions are affected.

7.2.13 PUM — 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).

NOTE — Control functions affected are: CUB, CUD, CUF, CUU, HPA, HPB, HPR, HTSA*, HVP, SLH, SLL, SSU, VPA, VPB, VPR.

* See annex E.

7.2.14 SATM — SELECTED AREA TRANSFER MODE**SELECT:**

Only the contents of 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.

NOTE — No control functions are affected.

7.2.15 SRM — 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.

NOTE — No control functions are affected.

7.2.16 SRTM — STATUS REPORT TRANSFER MODE**NORMAL:**

Status reports in the form of DEVICE CONTROL STRINGS (DCS) are not generated automatically.

DIAGNOSTIC:

Status reports in the form of DEVICE CONTROL STRINGS (DCS) are included in every data stream transmitted or transferred.

NOTE — No control functions are affected.

7.2.17 TSM — TABULATION STOP MODE**MULTIPLE:**

Character tabulation stops are set or cleared in the active line and in the corresponding character positions of the preceding lines and of the following lines.

SINGLE:

Character tabulation stops are set or cleared in the active line only.

NOTE — Control functions affected are: CTC, DL, HTS, HTSA*, IL, TBC.

* See annex E.

7.2.18 TTM — TRANSFER TERMINATION MODE**CURSOR:**

Only the contents of the 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.

NOTE — No control functions are affected.

7.2.19 VEM — LINE EDITING MODE**FOLLOWING:**

A line insertion causes the contents of the active line and of following lines to be shifted in the direction of the line progression; a line deletion causes the contents of the lines following the active line to be shifted in the direction opposite to that of the line progression.

PRECEDING:

A line insertion causes the contents of the active line and of preceding lines to be shifted in the direction opposite to that of the line progression; a line deletion causes the contents of the lines preceding the active line to be shifted in the direction of the line progression.

NOTE — Control functions affected are: DL, IL.

7.2.20 ZDM — ZERO DEFAULT MODE**ZERO:**

A parameter value of zero of a control function means the number zero.

DEFAULT:

A parameter value of zero represents a default parameter value which may be different from zero.

NOTE — This mode is provided for implementations of the previous edition of this International Standard which specified that "an empty parameter sub-string or a parameter sub-string which consists of bit combinations 03/00 only represents a default value which depends on the control function".

For numeric parameters which are expressed in units established by SELECT SIZE UNIT (SSU), zero is now a specifiable value. For numeric parameters which are effectively repeat counts, a zero parameter value now corresponds to a 'no-op'. In either instance, non-negative computed numeric parameter values may be used without treating zero as a special (unusable) case.

Where an explicit parameter value is not used, implementors are urged to omit a parameter value (use an empty parameter sub-string) to imply a default parameter value.

Control functions affected are: CBT, CHA, CHT, CNL, CPL, CPR, CUB, CUD, CUF, CUP, CUU, CVT, DCH, DL, ECH, GSM, HPA, HPB, HPR, HVP, ICH, IL, NP, PP, PPA, PPB, PPR, REP, SD, SL, SR, SU, TCC, VPA, VPB, VPR.

7.3 Interaction between modes

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

a) GUARDED AREA TRANSFER MODE (GATM), MULTIPLE AREA TRANSFER MODE (MATM), SELECTED AREA TRANSFER MODE (SATM), and TRANSFER TERMINATION MODE (TTM)

b) CONTROL REPRESENTATION MODE (CRM), and FORMAT EFFECTOR ACTION MODE (FEAM)

c) CHARACTER EDITING MODE (HEM), and INSERTION REPLACEMENT MODE (IRM)

7.3.1 GUARDED AREA TRANSFER MODE (GATM), MULTIPLE AREA TRANSFER MODE (MATM), SELECTED AREA TRANSFER MODE (SATM), and TRANSFER TERMINATION MODE (TTM)

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.

- a) If the TTM is set to CURSOR, the SATM to SELECT, and the MATM to SINGLE, then the contents of the active selected area, up to but excluding the active position, are eligible.
- b) If the TTM is set to CURSOR, the SATM to SELECT, and the MATM to MULTIPLE, then the contents of any selected area, up to but excluding the active position, are eligible.
- c) If the TTM is set to CURSOR and the SATM to ALL, then the contents of the buffer up to but excluding the active position, are eligible.
- d) If the TTM is set to ALL, the SATM to SELECT, and the MATM to SINGLE, then the complete contents of the active selected area are eligible.
- e) If the TTM is set to ALL, the SATM to SELECT, and the MATM to MULTIPLE, then the complete contents of all selected areas are eligible.
- f) If the TTM and the SATM are both set to ALL, then the complete contents of the buffer are eligible.
- g) If the GATM 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.
- h) If the GATM is set to ALL, guarded as well as unguarded data in an eligible area are transmitted or transferred.

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 International Standard.

7.3.2 CONTROL REPRESENTATION MODE (CRM) and FORMAT EFFECTOR ACTION MODE (FEAM)

- a) If the CRM is set to CONTROL, and the FEAM is set to EXECUTE, all control functions are performed as defined.
- b) If the CRM is set to CONTROL, and the FEAM is set to STORE, formator functions are treated as graphic characters.
- c) If the CRM is set to GRAPHIC, all control functions except RM are treated as graphic characters.

7.3.3 CHARACTER EDITING MODE (HEM) and INSERTION REPLACEMENT MODE (IRM)

- a) If the IRM is set to REPLACE, the HEM influences the control functions DELETE CHARACTER (DCH) and INSERT CHARACTER (ICH) only.

- b) If the IRM is set to INSERT, then, in addition, the effect of the receipt of a graphic character or a control function for which a graphical representation is required depends on the setting of the HEM. 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.

7.4 Private modes

A device may implement modes other than those specified in 7.2. Such modes are called Private Modes. See SET MODE (SM) and RESET MODE (RM), and 5.5.1.

The reset state of a private mode shall permit the selection of coded representations of control functions (including parameters for control of modes) that are identified in accordance with 2.3.1 to have the meanings specified in this International Standard.

8 Control functions

8.1 Types of control functions

There are different types of control functions. They are indicated by the following notations:

- a) (Cx) : Not an element of any set
- b) (C0) : Element of the C0 set
- c) (C1) : Element of the C1 set
- d) (Pn) : Control sequence with a single numeric parameter
- e) (Pn1;Pn2) : Control sequence with two numeric parameters
- f) (Pn...) : Control sequence with any number of numeric parameters
- g) (Ps) : Control sequence with a single selective parameter
- h) (Ps1;Ps2) : Control sequence with two selective parameters
- i) (Ps...) : Control sequence with any number of selective parameters
- k) (Fs) : Independent control function, represented by an ESC Fs sequence

8.2 Categories of control functions

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

8.2.1 Delimiters

Acronym	Notation	Name	Defined in
APC	(C1)	APPLICATION PROGRAM COMMAND	8.3.2
CMD	(Fs)	CODING METHOD DELIMITER	8.3.11
DCS	(C1)	DEVICE CONTROL STRING	8.3.27
OSC	(C1)	OPERATING SYSTEM COMMAND	8.3.90
PM	(C1)	PRIVACY MESSAGE	8.3.95
SOS	(C1)	START OF STRING	8.3.126
ST	(C1)	STRING TERMINATOR	8.3.139

8.2.2 Introducers

Acronym	Notation	Name	Defined in
CSI	(C1)	CONTROL SEQUENCE INTRODUCER	8.3.16
ESC	(C0)	ESCAPE	8.3.49
SCI	(C1)	SINGLE CHARACTER INTRODUCER	8.3.110

8.2.3 Shift functions

Acronym	Notation	Name	Defined in
LS0	(C0)	LOCKING-SHIFT ZERO	8.3.76
LS1	(C0)	LOCKING-SHIFT ONE	8.3.77
LS1R	(Fs)	LOCKING-SHIFT ONE RIGHT	8.3.78
LS2	(Fs)	LOCKING-SHIFT TWO	8.3.79
LS2R	(Fs)	LOCKING-SHIFT TWO RIGHT	8.3.80
LS3	(Fs)	LOCKING-SHIFT THREE	8.3.81
LS3R	(Fs)	LOCKING-SHIFT THREE RIGHT	8.3.82
SI	(C0)	SHIFT-IN	8.3.118
SO	(C0)	SHIFT-OUT	8.3.124
SS2	(C1)	SINGLE-SHIFT TWO	8.3.137
SS3	(C1)	SINGLE-SHIFT THREE	8.3.138

8.2.4 Format effectors

Acronym	Notation	Name	Defined in
BS	(C0)	BACKSPACE	8.3.5
CR	(C0)	CARRIAGE RETURN	8.3.15
FF	(C0)	FORM FEED	8.3.52