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

*Traitement de l'information — Fonctions de commande pour jeux de caractères codés à 7 et
à 8 éléments*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 6429 was prepared by the European Computer Manufacturers Association (as Standard ECMA-48) and was adopted, under a special "fast-track procedure", by Technical Committee ISO/TC 97, *Information processing systems*, in parallel with its approval by the ISO member bodies.

This second edition cancels and replaces the first edition (ISO 6429 : 1983), of which it constitutes a full revision.

Annexes A, B, C, D and E of this International Standard are for information only.

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).

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, ...