International Standard 6429

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Information processing — ISO 7-bit and 8-bit coded character sets — Additional control functions for character-imaging devices

Traitement de l'information — Jeux ISO de caractères codés à 7 et à 8 éléments — Fonctions de commande supplémentaires pour les dispositifs de visualisation de caractères

First edition — 1983-05-01

UDC 681.3.06 : 681.327.1 **Ref. No. ISO 6429-1983 (E)**

Descriptors : data processing, information interchange, character sets, ISO seven-bit codes, central procedures.

Price based on 37 pages

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of *national standards bodies* (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been authorized 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.

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.

International Standard ISO 6429 was developed by Technical Committee ISO/TC 97, *Information processing systems*, and was circulated to the member bodies in February 1982.

It has been approved by the member bodies of the following countries :

Australia	France	South Africa, Rep. of
Belgium	Germany, F. R.	Spain
Canada	Hungary	Sweden
China	Japan	Switzerland
Czechoslovakia	Netherlands	United Kingdom
Egypt, Arab Rep. of	Poland	USA
Finland	Romania	USSR

No member body expressed disapproval of the document.

Printed in Switzerland

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Information processing — ISO 7-bit and 8-bit coded character sets — Additional control functions for character-imaging devices

1 Scope and field of application

1.1 This International Standard defines additional control functions for use in an extended 7-bit or 8-bit code structured in accordance with ISO 2022. This International Standard comprises a C1 set, control functions derived therefrom and a number of single control functions.

1.2 The control functions defined in this International Standard are intended to be used, in combination with the C0 set defined in ISO 646, 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 coded control functions and graphics, 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 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 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 intention of this International Standard is to facilitate data interchange, not to standardize equipment. The specifications of the architectural device concepts are included only to delimit the field of application of the International Standard. The definitions of the control functions may not be applicable to devices which do not conform to the specified concepts.

The structure of this International 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 International Standard is of a different nature and as a result, it is only practicable to envisage limited conformance to it, as defined hereunder.

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

a) A device shall implement a subset of the control functions, the parameters of control functions, and modes specified in this International Standard, with the specified coded representation, and with the specified meaning where such meaning is defined in this International Standard, so long as no private mode as permitted in e) is in effect;

b) If the implemented subset of the control functions contains a control sequence which has a default value of a parameter defined in this International Standard, the device shall be capable of receiving and correctly interpreting that control sequence when the default value is explicitly or implicitly represented;

c) Any coded representation for a control function specified in this International Standard shall not be used to represent a different control function;

d) Any coded representation reserved for future standardization by this International Standard shall not be used;

e) A device may implement modes other than those specified in this International Standard. However, one of the states of each such private mode shall be such that the control functions and modes from this International Standard are implemented with the coded representation and the meaning defined in this International Standard;

f) Any documents claiming that a device conforms to this International 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

The following ISO standards are related to this International Standard :

ISO 646, *Information processing — 7-bit coded character set for information interchange.*

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

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

ISO 4873, *Information processing — 8-bit coded character set for information interchange.*

ISO 6937/3, *Information processing — Coded character sets for text communication — Part 3 : Control functions for page image format.* [1)]

4 Notation and terminology

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 (whether they are defined in this International Standard or in ISO 646). This usage was found necessary in order to avoid confusion between the general concepts and the specific encoded control functions, for example, the concept "space" and the character SPACE (pos. 2/0).

Sub-clause 8.2 lists the acronyms, names and characteristics of the control functions defined in this International Standard. They are ordered according to the alphabetic order of their acronyms. It is intended that the acronyms and this convention be retained in all translations of the text.

4.2 Definitions

For the purpose of this International 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 — In this International Standard the term display does not mean a cathode ray tube device exclusively.

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

4.2.11 Intermediate character :

a) 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.

b) 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 in a control sequence.

4.2.12 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.

1) At present at the stage of draft.

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

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

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

4.2.16 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 International 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 :

a) control functions which are elements of the C1 set;

b) control functions represented by control sequences;

c) control functions represented by ESC Fs sequences.

This International 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 ISO 2022 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 ... Im F

where :

a) 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).

b) 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.

c) 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 — The number of Intermediate characters is not limited by this International 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.

d) 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 (however, see clause 10).

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

There are two types of parameters; numeric and selective (see 5.4).

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 ISO 2022 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
PU 1	PRIVATE USE 1
PU 2	PRIVATE USE 2
RI	REVERSE INDEX
SPA	START OF GUARDED PROTECTED AREA
SS2	SINGLE SHIFT 2
SS3	SINGLE SHIFT 3
SSA	START OF SELECTED AREA
ST	STRING TERMINATOR
STS	SET TRANSMIT STATE
VTS	VERTICAL TABULATION SET

The bit combinations used for their representation are specified in table 1.

The definitions of the control functions are specified in 8.2.

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 designating and invoking this C1 set is ESC 2/2 F.[1)]

Table 1 — Bit combinations used for the representation of the control functions of the C1 set

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.

1) The Final character F of the designating 3-character escape sequence is not assigned at this moment; the assignment, which is subject to registration procedures in accordance with ISO 2375, is expected to be complete by the end of 1983.

5.3.1 Control functions with numeric parameters

Abbreviation	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

Abbreviation	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
MC	MEDIA COPY	2
QUAD	QUAD	3
RM	RESET MODE	2
SEE	SELECT EDITING EXTENT	2
SGR	SELECT GRAPHIC RENDITION	2
SM	SET MODE	2
SSU	SELECT SIZE UNIT	3
TBC	TABULATION CLEAR	2

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

Table 2 — Bit combinations representing the Final character of control sequences without Intermediate characters

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 — Bit combinations representing the Final character of control sequences with a single Intermediate character represented by 2/0

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	—		
11	—		
12	—		
13	—		
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 :

a) 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.

b) 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 International Standard.

5.4.1 Parameter string format

A parameter string shall have the following format :

a) a parameter string consists of one or more parameter sub-strings;

b) each parameter sub-string consists of one or more bit combinations from 3/0 to 3/9, representing the digits ZERO to NINE;

c) parameter sub-strings are separated by one bit combination 3/11;

d) bit combination 3/10 is reserved for future standardization as an additional parameter separator;

e) bit combinations 3/12 to 3/15 shall not be used;

f) In each parameter sub-string, leading bit combinations 3/0 are not significant and may be omitted;

g) 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;

h) 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 annex B);

i) 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 International 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 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 expressed by 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 according to ISO 2022.

Table 4 — ESC Fs sequences

Abbreviation	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 — 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 (however, see clause 10). The occurrence of other bit combinations within a command string is an error condition for which recovery is not defined by this International 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 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)

Examples of applications of device control strings are :

a) program loading

b) configuration control

c) mode control

d) diagnostics

An example of the use of 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 International 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 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 pre-determined size.

A page is composed of a pre-determined number of lines, each being composed of a 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, 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 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 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 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 International 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 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 position.

NOTES

1 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".

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 :

a) cause a wrap-around movement;

b) cause the active position to be blocked (a condition in which no graphic symbol can be entered until a valid explicit active position movement is performed);

c) cause the active position to remain where it is but permit graphic symbols to be entered thereby replacing or overstriking the previously entered character;

d) cause the cursor to disappear from the operator's view;

e) cause the cursor to move to the opposite end of the display but one row or column offset;

f) cause scrolling to occur;

g) 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 imaging devices while editor functions are supplementary control functions required only in circumstances for a certain class of devices 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 annex 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 an active position movement) 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 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 not already available may be obtained using the format effector BACKSPACE (BS); editor functions shall not be used for this purpose (see clause A.3).

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 use of editor functions are :

a) Coding of local functions for example encoding keyboard functions when the keyboard is logically uncoupled from the output imaging mechanism of a device.

b) 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 sub-clause is applicable primarily to buffered input/output devices. Editing operations (erasure, deletion, and insertion) are performed either in execution of control 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 or 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 sub-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 :

a) the contents of the character positions are protected against manual alteration;

b) the set of characters which are permitted to be entered is restricted (for example, to numeric or alphabetic characters only);

c) the character positions are protected against erasure;

d) a tabulation stop is associated with the first character position;

e) 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).