
British Standard

Computer graphics: programmer's hierarchical interactive graphics system (PHIGS)

Part 1 . Specification for a set of functions

Infographie: Interface entre un programme d'application et son support graphique
Partie 1. Ensemble de fonctions

Hierarchisches Interaktives Graphisches System für Programmierer
Teil 1. Funktionsbeschreibung

National foreword

This Part of BS 7217 has been prepared under the direction of the Information Systems Technology Standards Policy Committee. It is identical with ISO/IEC 9592-1 'Information processing systems — Computer graphics — Programmer's Hierarchical Interactive Graphics System (PHIGS) — Part 1 : 1989 Functional description' published by the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC).

The UK actively participated through BSI Technical Committee IST/31 in the development of ISO/IEC 9592-1.

Cross-references

International standard	Corresponding British Standard
ISO 646 : 1983	BS 4730 : 1985 Specification for UK 7-bit coded character set (Identical, exercising national options)
ISO 2022 : 1986	BS 6856 : 1987 Specification for code extension techniques for United Kingdom 7-bit and 8-bit coded character sets (Identical)
ISO 6093 : 1985	BS 6727 : 1987 Specification for representation of numerical values in character strings for information interchange (Identical)
ISO 7942 : 1985	BS 6390 : 1985 Specification for a set of functions for computer graphics programming, the Graphical Kernel System (GKS) (Identical)
ISO 8632-1 : 1987	BS 6945 Specification for computer graphics: metafile for the storage and transfer of picture description information (CGM) Part 1 : 1988 Functional specification (Identical)
ISO 8632-2 : 1987	Part 2 : 1988 Character encoding (Identical)
ISO 8632-3 : 1987	Part 3 : 1988 Binary encoding (Identical)
ISO 8632-4 : 1987	Part 4 : 1988 Clear text encoding (Identical)
ISO 8805 : 1988	BS 7196 : 1989 Specification for a set of functions for computer graphics programming: Graphical Kernel System for Three Dimensions (GKS-3D) (Identical)

NOTE. The cross-references are undated in the text.

The Technical Committee has reviewed the provisions of ISO 2382-13:1984, CIE Recommendations on colour space — supplement to CIE publication 15 and CIE 1976 Supplementary standard colour metric of server and coordinate systems, to which reference is made in the text, and has decided that they are suitable for use in conjunction with this standard.

It is envisaged that a British Standard identical with ISO/IEC 9593 will be published in due course.

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

Amendment No. 1
published and effective from 30 September 1991
to BS 7217 : Part 1 : 1989
Computer graphics : programmer's hierarchical
interactive graphics system (PHIGS)
Part 1. Specification for a set of functions

NOTE. The European Committee for Standardization (CEN) has accepted ISO/IEC 9592-1 : 1989 as a European Standard designated as EN 29592-1 : 1991. This amendment implements EN 29592-1 : 1991 as a British Standard.

Revised text

AMD 6386
September 1991

Front and back covers

In the top right-hand corner of the front cover and twice on the back cover, immediately above 'ISO/IEC 9592-1 : 1989' insert 'EN 29592-1 : 1991'.

At the foot of the front cover, insert the following.

'This European Standard EN 29592-1 : 1991 has the status of a British Standard'

AMD 6386
September 1991

National foreword

At the end of paragraph 1, insert the following new paragraph.

'In 1991 the European Committee for Standardization (CEN) accepted ISO/IEC 9592-1 : 1989 as European Standard EN 29592-1 : 1991.'

AMD 6386
September 1991

New EN title page, foreword and endorsement notice

Immediately after the national foreword, insert the attached new EN title page, foreword and endorsement notice.

UDC: 681.3.01 : 681.3.072.2 : 084

Descriptors: Data processing, teleprocessing, information interchange, graphic data processing, computer interfaces, computer programs

English version

Information processing systems — Computer graphics — Programmer's Hierarchical Interactive Graphics System (PHIGS) — Part 1 : Functional description

(ISO/IEC 9592-1 : 1989 – edition 1)

Systèmes de traitement de l'information
– Infographie – Interface de programmation
du système graphique hiérarchisé (PHIGS) –
Partie 1 : Description fonctionnelle
(ISO/IEC 9592-1 : 1989 – édition 1)

Graphische Systeme der Informationsverarbeitung
– Hierarchisches Interaktives Graphisches Systems
für Programmierer –
Teil 1 : Funktionsbeschreibung
(ISO/IEC 9592-1 : 1989 – Ausgabe 1)

This European Standard was approved by CEN on 6 March 1991, and is identical to the ISO standard as referred to.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in two official versions (English and French). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxemburg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Foreword

The Technical Board has decided to submit the International Standard

Information processing systems — Computer graphics —
Programmer's Hierarchical Interactive Graphics System
(PHIGS) — Part 1 : Functional description

to Formal Vote, and the result was positive.

For the time being, this document exists only in the English and French versions.

According to the CEN/CENELEC Common Rules, the following countries are bound to implement this standard:

Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxemburg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom.

Endorsement notice

The text of the International Standard ISO/IEC 9592-1, edition 1, 1989, was approved by CEN as a European Standard without any modification.

Amendment No. 2
published and effective from 15 May 1994
to BS 7217 : Part 1 : 1989 (EN 29592-1)

**Computer graphics : Programmer's hierarchical interactive
graphics system (PHIGS)**
Part 1. Specification for a set of functions

NOTE. This amendment implements amendment A1 to
EN 29592-1 : 1991. This amendment together with European
Standard EN 29592-1 : 1991 has the status of a British Standard.

Revised text

National foreword (as amended by Amendment No. 1)
In line 3, after 'description', insert ' , including Amendment 1. '.

AMD 8136/May 1994

EN amendment title page and foreword
Insert the attached EN amendment title page (foreword on reverse).

AMD 8136/May 1994

Text of EN 29592-1
Amend the text of European Standard EN 29592-1 in accordance with the details
given on the attached pages.

AMD 8136/May 1994

UDC 681.3.01 : 681.3.072.2 : 084

Descriptors: Data processing, teleprocessing, information interchange, graphic data processing, computer interfaces, computer programs, files

English version

Information processing systems — Computer graphics — Programmer's Hierarchical Interactive Graphics System (PHIGS) — Part 1: Functional description

(ISO/IEC 9592-1 : 1989, Amendment 1 : 1992)

Systèmes de traitement de l'information —
Infographie — Interface de programmation du
système graphique hiérarchisé (PHIGS) —
Partie 1: Description fonctionnelle
(ISO/IEC 9592-1 : 1989, Amendement 1 : 1992)

Graphische Systeme der Informationsverarbeitung
— Hierarchisches Interaktives Graphisches
Systems für Programmierer — Teil 1:
Funktionsbeschreibung
(ISO/IEC 9592-1 : 1989, Änderung 1 : 1992)

This European Standard was approved by CEN on 1993-09-06. CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Foreword

On the proposal of the CEN Central Secretariat, the Technical Board has decided to submit this draft amendment:

Information processing systems — Computer graphics — Programmer's Hierarchical Interactive Graphics System (PHIGS) — Part 1: Functional description (ISO/IEC 9592-1 : 1989, Amendment 1 : 1992) to the Unique Acceptance Procedure (UAP).

The result of the Unique Acceptance Procedure was positive.

For the time being, this document exists only in English.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 1994, and conflicting national standards shall be withdrawn at the latest by March 1994.

In accordance with the CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

1 Scope and field of application

Replace the first sentence of the first paragraph with the following sentence.

“ISO/IEC 9592 is a multi-part standard that specifies a set of functions for computer graphics programming, the Programmers’s Hierarchical Interactive Graphics System (PHIGS).”

Add the following paragraph before the last paragraph:

“This part of ISO/IEC 9592 is the base part and forms the kernel of PHIGS functionality. ISO/IEC 9592-2 and ISO/IEC 9592-3 are related to archives. Other parts may be defined that presume the functionality of part 1. They may extend part 1 specifications, including, but not limited to, specifying additional output primitives, aspects of output primitives and attributes; extending lists of enumerated types; extending the error lists; etc. Additional parts shall describe their relationship to part 1.”

OPEN ARCHIVE FILE

Add error message to end of list of error messages:

409 Ignoring function, this version of the PHIGS archive file cannot be opened by this implementation

B.10 Archive/retrieve

Add the error message.

409 Ignoring function, this version of the PHIGS archive file cannot be opened by this implementation

Implementation of Technical Corrigendum 1
published and effective from 15 May 1995
to BS EN 29592-1 : 1991

Information processing system — Computer graphics —
Programmer's Hierarchical Interactive Graphics Systems
(PHIGS) —
Part 1: Functional description

National foreword

In line 1, after BS EN 29592-1 : 1991 insert, 'including Technical Corrigendum 1'.

AMD 8519/May 1995

ISO/IEC text

Amend the text of the international standard in accordance with the details given on the attached pages.

AMD 8519/May 1995

EUROPEAN STANDARD

EN 29592-1:1991
AC:1994

NORME EUROPEENNE

EUROPÄISCHE NORM

August 1994

Août 1994

Août 1994

English version
Version française
Deutsche Fassung

Amends EN 29592-1, March 1991
Amende EN 29592-1, mars 1991
Änderung zur EN 29592-1, März 1991

Information processing systems -
Computer graphics -
Programmer's Hierarchical Interactive Graphics System
(PHIGS) - Part 1: Functional description
(ISO/IEC 9592-1:1989)

Systèmes de traitement de l'information -
Infographie - Interface de programmation
du système graphique hiérarchisé (PHIGS) -
Partie 1: Description fonctionnelle
(ISO/IEC 9592-1:1989)

Graphische Systeme der
Informationsverarbeitung - Hierarchisches
Interaktives Graphisches Systems für
Programmierer - Teil 1: Funktionsbeschreibung
(ISO/IEC 9592-1:1989)

This corrigendum becomes effective on 1994-08-31 for incorporation in the official language versions of the EN.

Ce corrigendum prendra effet le 1994-08-31 pour introduction dans les versions officielles de la EN.

Die Berichtigung tritt am 1994-08-31 in Kraft und ist in den offiziellen Fassungen der EN einzufügen.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Rue de Stassart 36, B - 1050 Brussels

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Ref. no. EN 29592-1:1991/AC:1994 E/F/D



Information processing systems – Computer graphics – Programmer's Hierarchical Interactive Graphics System (PHIGS) –

Part 1: Functional description

TECHNICAL CORRIGENDUM 1

*Systèmes de traitement de l'information – Infographie – Interface de programmation du système graphique hiérarchisé
(PHIGS) –*

Partie 1: Description fonctionnelle

RECTIFICATIF TECHNIQUE 1

Technical corrigendum 1 to International Standard ISO/IEC 9592-1:1989 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*.

Page 29

Subclause 4.4.5

Replace the third paragraph with the following:

A function is provided to delete a structure network. The DELETE STRUCTURE NETWORK function will delete the indicated structure and structures in the structure network originating with the specified structure. The handling of structures referenced by other structures outside the specified structure network is controlled by a reference handling flag. When this flag is specified as KEEP, those structures of the specified structure network which have at least one maximal ancestor path which does not contain the specified structure are not deleted. Those structures of the specified structure network for which all maximal ancestor paths contain the specified structure are deleted as if DELETE STRUCTURE were called to delete each structure individually. A maximal ancestor path of a structure S is a path ((A1,E1),(A2,E2), ..., (S,0)) where A1 is not referenced in any EXECUTE STRUCTURE element in the CSS. When this flag is specified as DELETE each structure of the specified structure network is deleted as if DELETE STRUCTURE were called to delete each structure individually. The specified structure is deleted; the effect is the same as if DELETE STRUCTURE were called with the specified structure.

Page 30

Subclause 4.4.6

Third paragraph, change "path order" to "truncation method" in two places.

Page 32

Subclause 4.4.7

Fourth paragraph, change "path order" to "truncation method" in two places.

Page 43

Subclause 4.5.3

Replace the third paragraph with the following:

The linewidth is calculated as a nominal linewidth multiplied by the linewidth scale factor. If necessary, the linewidth scale factor is adjusted by the workstation to give the nearest available linewidth. For example, if the value is less than or equal to zero (0), the thinnest available linewidth is used.

Page 44

Subclause 4.5.4

Replace the third paragraph with the following:

The marker size is calculated as a nominal marker size multiplied by the marker size scale factor. If necessary, the marker size scale factor is adjusted by the workstation to give the nearest available marker size. For example, if the value is less than or equal to zero (0), the smallest available marker size is used. Marker type 1 is always displayed as the smallest displayable dot.

Page 60

Subclause 4.5.8

In the sentence beginning "The pattern box is...", insert the words "of equal size" after the word "cells".

Page 65

Subclause 4.5.15

Final paragraph, replace the second and third sentences with the following:

The range of accessible names shall be [0..(number of available names-1)] and during traversal, any NAME SET shall be able to contain all of the names in that range. In addition, workstation filters shall be able to contain all of the names in that range.

Page 67

Subclause 4.6.1

First paragraph, replace the fifth sentence with the following:

Data in the centralized structure store may be displayed under application control on any open workstation which has output capability.

Page 76

Subclause 4.6.6

Second paragraph, add the words "or through registration" at the end of the second sentence.

Page 87

Subclause 4.7.5

In the first full paragraph, add the word "boundaries" after "view window" in the fifth line.

Page 92

Subclause 4.7.7

Sixth paragraph, first sentence, insert the text "(without regard to the current clipping indicators)" after the words "clipping limits" in the first line.

Page 98

Subclause 4.8.3

Add the following text to the end of the second last paragraph:

For the Prompt and Echo Types (PETs) defined in 5.10.2, the measure value is not changed when a trigger is received. For other registered or implementation-defined PETs, the description of the PET should document the impact on the measure value when a trigger is received while in EVENT mode.

Page 100

Subclause 4.8.4

Item b), first sentence and item e), first sentence, insert the text "(without regard to the current clipping indicators)" after the words "clipping limits".

Page 102

Subclause 4.8.6

Item a), delete the third and fourth sentences.

Page 120

Subclause 5.2

Item f), in the note, replace "INQUIRE WORKSTATION STATE" with "INQUIRE DISPLAY UPDATE STATE".

Page 134

Subclause 5.4.2

SET LINETYPE Effect section, replace the final paragraph with the following:

When an element of this type is interpreted, if the element's linetype is not available on the workstation, the 'current linetype' entry in the PHIGS traversal state list is set to 1.

Page 135

Subclause 5.4.2

SET LINEWIDTH SCALE FACTOR Effect section, replace the final paragraph with the following:

When an element of this type is interpreted, the element's linewidth scale factor value is multiplied by the nominal linewidth on a workstation; if the resulting linewidth is not available on the workstation, the linewidth scale factor is adjusted to give the nearest available linewidth.

SET POLYLINE COLOUR INDEX Effect section, replace the final paragraph with the following:

When an element of this type is interpreted, if the element's polyline colour index is not available on the workstation, the 'current polyline colour index' entry in the PHIGS traversal state list is set to 1.

Page 136

Subclause 5.4.2

SET MARKER SIZE SCALE FACTOR Effect section, replace the final paragraph with the following:

When an element of this type is interpreted, the element's marker size scale factor value is multiplied by the nominal marker size on a workstation; if the resulting marker size is not available on the workstation, the marker size scale factor is adjusted to give the nearest available marker size.

Page 149

Subclause 5.4.2

ADD NAMES TO SET Effect section, add a third paragraph as follows:

When an element of this type is interpreted, only those members of the name set associated with the element which are contained in the range $[0..(\text{number of available names} - 1)]$ are processed. Any members of the name set associated with the element which are outside of the range $[0..(\text{number of available names} - 1)]$ are ignored.

REMOVE NAMES FROM SET Effect section, add a third paragraph as follows:

When an element of this type is interpreted, only those members of the name set associated with the element which are contained in the range [0..(number of available names - 1)] are processed. Any members of the name set associated with the element which are outside of the range [0..(number of available names - 1)] are ignored.

Page 158

Subclause 5.4.5

SET HIGHLIGHTING FILTER Effect section, add the following to the end of the first paragraph:

Only those members of the highlighting filter parameter which are contained in the range [0..(number of available names - 1)] are used to set the 'highlighting filter' entry in the workstation state list of the specified workstation. Any members of the highlighting filter parameter which are outside of the range [0..(number of available names - 1)] are ignored.

Page 159

Subclause 5.4.5

SET INVISIBILITY FILTER Effect section, add the following to the end of the first paragraph:

Only those members of the invisibility filter parameter which are contained in the range [0..(number of available names - 1)] are used to set the 'invisibility filter' entry in the workstation state list of the specified workstation. Any members of the invisibility filter parameter which are outside of the range [0..(number of available names - 1)] are ignored.

Page 160

Subclause 5.4.7

SET HLHSR IDENTIFIER Effect section, insert the following text between the two paragraphs:

The HLHSR IDENTIFIERS are as follows:

≤ 0	implementation dependent
> 0	reserved for registration

SET HLHSR MODE Effect section, insert the following text between the two paragraphs:

The HLHSR {IDENTIFIERS/MODES} are as follows:

≤ 0	implementation dependent
> 0	reserved for registration

Page 163

Subclause 5.5.1

SET MODELLING CLIPPING VOLUME 3 Effect section, add a paragraph after the note as follows:

When an element of this type is interpreted, if the resulting modelling clipping volume exceeds the "maximum number of distinct planes in modelling clipping volumes" specified in the PDT, the structure element is ignored.

Page 164

Subclause 5.5.1

SET MODELLING CLIPPING VOLUME Effect section, add a paragraph after the note as follows:

When an element of this type is interpreted, if the resulting modelling clipping volume exceeds the "maximum number of distinct planes in modelling clipping volumes" specified in the PDT, the structure element is ignored.

Page 165

Subclause 5.5.2

SET VIEW INDEX Effect section, add a third paragraph as follows:

When an element of this type is interpreted, if the element's view index is not supported by the workstation, the 'current view index' entry in the PHIGS traversal state list is set to 0.

SET VIEW REPRESENTATION 3 Effect section, second paragraph, first line, delete the second occurrence of "OUTIN".

Page 166

Subclause 5.5.2

SET VIEW REPRESENTATION Effect section, second paragraph, first line, delete the second occurrence of "OUTIN".

Page 175

Subclause 5.5.4

COMPOSE TRANSFORMATION MATRIX 3 Effect section, first paragraph, insert the following text between the first and second sentences:

The composition is the same as COMPOSE MATRIX 3 (specified matrix, defined matrix).

Page 176

Subclause 5.5.4

COMPOSE TRANSFORMATION MATRIX Effect section, first paragraph, insert the following text between the first and second sentences:

The composition is the same as COMPOSE MATRIX (specified matrix, defined matrix).

Page 182

Subclause 5.6

SET ELEMENT POINTER AT LABEL Effect section, replace the second sentence with the following:

Whether or not the 'element pointer' is already positioned at an occurrence of the specified label, the search for the specified label begins with the next structure element (if any).

Page 183

Subclause 5.6

DELETE ELEMENTS BETWEEN LABELS Effect section, replace the second sentence with the following:

A search for label identifier 1 is first performed starting at the next element after the 'element pointer'. A search for label identifier 2 is then performed starting with the element following label identifier 1. If either of these searches fail, an error is generated, the deletion operation is not performed, and the 'element pointer' is left unchanged.

Page 185

Subclause 5.7

DELETE STRUCTURE Effect section, add a third paragraph as follows:

If the deleted structure is referenced by an element in the currently open structure, and if the 'element pointer' is positioned after the "execute structure" element to be deleted, the 'element pointer' is updated such that it still refers to the same element. If the 'element pointer' is positioned at the "execute structure" element to be deleted, the 'element pointer' will be positioned at the preceding element after the structure deletion operation.

DELETE STRUCTURE NETWORK Effect section, replace the second paragraph with the following:

If the reference handling flag is KEEP, those structures of the specified structure network which have at least one maximal ancestor path which does not contain the specified structure are kept. Those structures of the specified structure network for which all maximal ancestor paths contain the specified structure are deleted as if DELETE STRUCTURE were called to delete each structure individually. A maximal ancestor path of a structure S is a path ((A1,E1),(A2,E2), ..., (S,0)) where A1 is not referenced in any EXECUTE STRUCTURE element in the CSS.

DELETE STRUCTURE NETWORK Effect section, replace the last paragraph with the following:

The specified structure is deleted; the effect is the same as if DELETE STRUCTURE were called with the specified structure. If the specified structure does not exist, no action is taken.

Page 188

Subclause 5.8

POST STRUCTURE, replace the Effect section with the following:

If the specified structure is not already in the 'list of posted structures' in the workstation state list of the specified workstation, it is added to that list. The workstation identifier is added to the 'list of workstations to which posted' in the structure state list. If the specified structure is already in the 'list of posted structures', the display priority associated with the structure in that list is replaced with the display priority in this invocation of POST STRUCTURE. In both cases, the structure is treated as the most recently posted structure for the purpose of deriving the implicit display priority. If the specified structure does not exist, a new empty structure is created.

UNPOST STRUCTURE Effect section, replace the third sentence with the following:

If the specified structure does not exist in the 'list of posted structures' in the workstation state list of the specified workstation, no action takes place.

Page 193

Subclause 5.9

RETRIEVE PATHS TO ANCESTORS Parameters section, replace

"In path order (TOPFIRST,BOTTOMFIRST) E"

with

"In truncation method (HEAD,TAIL) E".

Page 194

Subclause 5.9

RETRIEVE PATHS TO ANCESTORS Effect section, in the first paragraph replace the two occurrences of "path order" with "truncation method". In the second paragraph, delete the second sentence, replace "path order = TOPFIRST" with "truncation method = HEAD" and replace "path order = BOTTOMFIRST" with "truncation method = TAIL".

RETRIEVE PATHS TO DESCENDANTS Parameters section, replace

"In path order (TOPFIRST,BOTTOMFIRST) E"

with

"In truncation method (HEAD,TAIL) E".

RETRIEVE PATHS TO DESCENDANTS Effect section, in the first paragraph replace the two occurrences of "path order" with "truncation method". In the second paragraph, delete the second sentence, replace "path order = TOPFIRST" with "truncation method = HEAD" and replace "path order = BOTTOMFIRST" with "truncation method = TAIL".

Page 197

Subclause 5.10.1

SET PICK FILTER Effect section, add the following to the end of the first paragraph:

Only those members of the pick filter parameter which are contained in the range [0..(number of available names - 1)] are used to set the 'pick filter' entry in the workstation state list of the specified workstation. Any members of the pick filter parameter which are outside of the range [0..(number of available names - 1)] are ignored.

Page 220

Subclause 5.10.4

REQUEST STROKE Errors section, replace

"060 Ignoring function, specified workstation is not of category OUTIN"

with

"061 Ignoring function, specified workstation is neither of category INPUT nor of category OUTIN".

Page 240

Subclause 5.12.5

INQUIRE HLHSR MODE Effect section, replace

"057 Ignoring function, specified workstation is of category MI"

with

"059 Ignoring function, the specified workstation does not have output capability (i.e., the workstation category is neither OUTPUT, OUTIN, nor MO)".

Page 261

Subclause 5.12.6

INQUIRE HLHSR FACILITIES Effect section, replace

"057 Ignoring function, specified workstation is of category MI"

with

"059 Ignoring function, the specified workstation does not have output capability (i.e., the workstation category is neither OUTPUT, OUTIN, nor MO)".

Page 265

Subclause 5.12.6

INQUIRE POLYLINE FACILITIES Effect section, second paragraph, in the fourth line replace "value and the linetype" with "value of the linetype".

Page 266

Subclause 5.12.6

INQUIRE POLYMARKER FACILITIES Effect section, second paragraph, in the fourth line replace "value and the marker type" with "value of the marker type".

Page 267

Subclause 5.12.6

INQUIRE TEXT FACILITIES Parameters section, delete "DC" from the line containing "range of character expansion factors".

Page 270

Subclause 5.12.6

INQUIRE INTERIOR FACILITIES Effect section, second paragraph, in the fourth line replace "value and the hatch style" with "value of the hatch style".

Page 272

Subclause 5.12.6

INQUIRE EDGE FACILITIES Effect section, second paragraph, in the fourth line replace "value and the edge type" with "value of the edge type".

Page 292

Subclause 5.12.8

INQUIRE ELEMENT TYPE AND SIZE Effect section, replace the third sentence of the second paragraph with the following:

If the 'element position' is 0, the NIL value is returned in the element type parameter.

Page 296

Subclause 5.12.8

ELEMENT SEARCH Effect section, replace the two occurrences of "open" in the third paragraph with "specified".

Pages 316 and 317

Subclause 6.6

Move the entries "HLHSR update state", "requested HLHSR mode", and "current HLHSR mode" from the group "do not exist for category MI" into the group "do not exist for category INPUT and MI".

Page 320

Subclause 6.7

Move the entries "number of available HLHSR identifiers", "list of available HLHSR identifiers", "number of available HLHSR modes", and "list of available HLHSR modes" from the group "do not exist for category MI" into the group "do not exist for category INPUT and MI".

Page 324

Subclause 6.7

Fifth line, remove the entry "maximum number of hatch styles".

Page 349

Clause D.3

Renumber item a) 6) as a) 7) and insert a new item a) 6) as follows:

- 6) Description of the implementation of a non-continuous range of display priorities.

Page 377

Subclause I.6.3.5

Change the value of x_G to 0.268.

**Implementation of Technical Corrigendum 2
published and effective from 15 May 1995
to BS EN 29592-1 : 1991**

**Information processing systems — Computer graphics —
Programmer's Hierarchical Interactive Graphics Systems
(PHIGS) —
Part 1 : Functional description**

National foreword (as amended by Technical Corrigendum 1)

In line 1, after 'Technical Corrigendum 1' insert 'and Technical Corrigendum 2'.

AMD 8520/May 1995

ISO text

Amend the text of the international standard in accordance with the details given on the attached pages.

AMD 8520/May 1995

EUROPEAN STANDARD

EN 29592-1:1991

AC:1994

NORME EUROPEENNE

EUROPÄISCHE NORM

August 1994

Août 1994

Août 1994

English version
Version française
Deutsche Fassung

Amends EN 29592-1, March 1991
Amende EN 29592-1, mars 1991
Änderung zur EN 29592-1, März 1991

Information processing systems -
Computer graphics -
Programmer's Hierarchical Interactive Graphics System
(PHIGS) - Part 1: Functional description
(ISO/IEC 9592-1:1989)

Systèmes de traitement de l'information -
Infographie - Interface de programmation
du système graphique hiérarchisé (PHIGS) -
Partie 1: Description fonctionnelle
(ISO/IEC 9592-1:1989)

Graphische Systeme der
Informationsverarbeitung - Hierarchisches
Interaktives Graphisches Systems für
Programmierer - Teil 1: Funktionsbeschreibung
(ISO/IEC 9592-1:1989)

This corrigendum becomes effective on 1994-08-31 for incorporation in the official language versions of the EN.

Ce corrigendum prendra effet le 1994-08-31 pour introduction dans les versions officielles de la EN.

Die Berichtigung tritt am 1994-08-31 in Kraft und ist in den offiziellen Fassungen der EN einzufügen.

CEN

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Comité Européen de Normalisation
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Ref. no. EN 29592-1:1991/AC:1994 E/F/D

- E Incorporate Technical Corrigendum 1:1993 and Technical Corrigendum 2:1994 to ISO/IEC 9592-1:1989 in the European Standard
- F Incorporez le Rectificatif Technique 1:1993 et Rectificatif Technique 2:1994 à l'ISO/IEC 9592-1:1989 dans la norme européenne.
- D Füge das Technische Corrigendum 1:1993 und das Technische Corrigendum 2:1994 auf ISO/IEC 9592-1:1989 in die Europäische Norm ein.



Information processing systems — Computer graphics — Programmer's Hierarchical Interactive Graphics System (PHIGS) —

Part 1: Functional description

TECHNICAL CORRIGENDUM 2

Systèmes de traitement de l'information — Infographie — Interface de programmation du système graphique hiérarchisé (PHIGS) —

Partie 1: Description fonctionnelle

RECTIFICATIF TECHNIQUE 2

Technical corrigendum 2 to International Standard ISO/IEC 9592-1:1989 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 24, *Computer graphics and image processing*.

Page 6

Subclause 3.23

Change to read:

3.23 character height: An aspect of *text* which specifies the height of an upper-case character.

Subclause 3.25

Change to read:

3.25 character spacing: An aspect of *text* which specifies the fraction of the *character height* aspect to be added between adjacent character bodies in a string.

UDC 681.3.01:681.3.072.2(084)

Ref. No. ISO/IEC 9592-1:1989/Cor.2:1994(E)

Descriptors : data processing, graphic data processing, information interchange, data handling, data transfer, description.

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Printed in Switzerland

Subclause 3.27

Change to read:

3.27 character width: An aspect of *text* which specifies the width of a character. The actual width depends on the width to height ratio specified by the designer of the font to which the character belongs.

Page 35

Subclause 4.5.1

Penultimate paragraph, third and fourth sentences, change “fill area” to “fill area or fill area set” in three places.

Page 45

Subclause 4.5.5

End of the second full paragraph, replace the final sentence with:

“Character spacing is specified as a fraction of the character height aspect.”

Final full paragraph (ending in 'rotated and sheared'), delete “and sheared” from the parenthetical phrase.

Page 56

Subclause 4.5.7

Add the following text to the final paragraph:

For certain combinations of TEXT PATH and TEXT ALIGNMENT, concatenation is not meaningful. For example, if the TEXT PATH is set to LEFT or RIGHT, horizontal text alignment of CENTRE is not meaningful for concatenation since this depends on the contents of the subsequent string. For text paths UP and DOWN, horizontal text alignment of LEFT or RIGHT is not meaningful nor is vertical alignment of HALF.

Page 58

Subclause 4.5.8

Item d), change “a pointer” to “an index”.

Page 65

Subclause 4.5.15

Add a new paragraph before the final paragraph as follows:

The order of precedence of the filters is invisibility, then highlighting, then pick. When a primitive is eligible for both invisibility and highlighting, the invisibility attribute will apply.

Page 74

Subclause 4.6.3

Item J, add a new first element to the list of functions as follows:

SET VIEW REPRESENTATION 3.

Page 77

Subclause 4.7.2

Replace the second paragraph and matrix equation with the following:

A modelling transformation is specified by defining a 4×4 (for 3D) or 3×3 (for 2D) transformation matrix and a composition type as a structure element. On traversal, graphical output structure elements become output primitives as the composite modelling transformation is applied. The composite modelling transformation is formed from the hierarchy of component modelling transformations in the current structure path. This maps homogeneous coordinates in a modelling coordinate system to the world coordinate system as follows:

$$\begin{vmatrix} C_x \\ C_y \\ C_z \\ C_w \end{vmatrix} = \begin{vmatrix} C_{11} & C_{12} & C_{13} & C_{14} \\ C_{21} & C_{22} & C_{23} & C_{24} \\ C_{31} & C_{32} & C_{33} & C_{34} \\ C_{41} & C_{42} & C_{43} & C_{44} \end{vmatrix} \times \begin{vmatrix} MC_x \\ MC_y \\ MC_z \\ 1 \end{vmatrix}$$

and the homogeneous world coordinates are mapped to cartesian coordinates by

$$WC_x = \frac{C_x}{C_w}, WC_y = \frac{C_y}{C_w}, WC_z = \frac{C_z}{C_w}$$

Page 119

Subclause 5.2

REDRAW ALL STRUCTURES, change item b) to read:

b) If the control flag is set to **CONDITIONALLY**, the display surface may be cleared if the 'display surface empty' entry in the workstation state list is **NOTEMPTY**. (If the display surface is not cleared, the implementation may use knowledge of the current state of the display to optimize its actions, but it must produce a correct image.) If the control flag is set to **ALWAYS**, the display surface is cleared regardless of the setting of the 'display surface empty' entry. If the display surface is cleared, the 'display surface empty' flag is set to **EMPTY**.

REDRAW ALL STRUCTURES, change item f) to read:

f) All structures posted for this workstation (i.e., contained in the 'list of posted structures' in the workstation state list) are redisplayed. If the current state of the 'display surface empty' entry in the workstation state list is **NOTEMPTY**, the implementation may use knowledge of the current state of the display surface to optimize its actions. Typically, the redisplay of the structures causes the 'display surface empty' entry in the workstation state list to be set to **NOTEMPTY** if the set of structures posted to the workstation is also not empty.

Page 120

Subclause 5.2

UPDATE WORKSTATION, change item a) to read:

a) The display surface may be cleared if the 'display surface empty' entry in the workstation state list is **NOTEMPTY**. (If the display surface is not cleared, the implementation may use knowledge of the current state of the display to optimize its actions, but it must produce a correct image.) If the display surface is cleared, the 'display surface empty' flag is set to **EMPTY**.

Page 120

UPDATE WORKSTATION, change item e) to read:

e) All structures posted for this workstation (i.e., contained in the 'list of posted structures' in the workstation state list) are redisplayed. If the current state of the 'display surface empty' entry in the workstation state list is NOTEMPTY, the implementation may use knowledge of the current state of the display surface to optimize its actions. Typically, the redisplay of the structures causes the 'display surface empty' entry in the workstation state list to be set to NOTEMPTY if the set of structures posted to the workstation is also not empty.

Page 128

Subclause 5.3

CELL ARRAY 3, effect section, add the following to the end of the second paragraph:

If a colour index is not present in the colour table on the workstation, index 1 is used on that workstation. This also applies to index values less than 0.

CELL ARRAY 3, change the final word of the text of error 117 from "zero" to "one".

CELL ARRAY 3, remove error 113 from the list of errors for this function.

CELL ARRAY, effect section, add the following to the end of the second paragraph:

If a colour index is not present in the colour table on the workstation, index 1 is used on that workstation. This also applies to index values less than 0.

Page 129

Subclause 5.3

CELL ARRAY, change the final word of the text of error 117 from "zero" to "one".

CELL ARRAY, remove error 113 from the list of errors for this function.

Page 138

Subclause 5.4.2

SET CHARACTER EXPANSION FACTOR, third paragraph of the effect section, insert the following as the beginning of both the second and third sentences in this paragraph:

"For STRING and CHARACTER precision text, ..."

Page 140

Subclause 5.4.2

SET CHARACTER HEIGHT, fourth paragraph of the effect section, insert the following as the beginning of the paragraph:

"For STRING and CHARACTER precision text, ..."

Page 141

Subclause 5.4.2

SET ANNOTATION TEXT CHARACTER HEIGHT, fourth paragraph of the effect section, insert the following as the beginning of the paragraph:

“For STRING and CHARACTER precision text, ...”

Page 151

Subclause 5.4.4

SET POLYLINE REPRESENTATION, effect section, change

“When an element of this type is interpreted”

to

“During structure traversal”

in two places.

Page 153

Subclause 5.4.4

SET TEXT REPRESENTATION, effect section, delete the final sentence under Text font (“During ... if the text font ... on that workstation.”) and delete the final sentence under Text precision (“During ... if the specified text precision ... on that workstation.”)

Pages 154 and 155

Subclause 5.4.4

SET INTERIOR REPRESENTATION, effect section, delete the final sentence under Interior style (“During structure traversal, if the requested interior style ... on that workstation.”)

Page 156

Subclause 5.4.4

SET EDGE REPRESENTATION, error 107 should precede error 113 in the list of errors.

Page 166

Subclause 5.5.2

SET VIEW REPRESENTATION 3, in error 150, “workstations” should be “workstation's”.

SET VIEW REPRESENTATION, effect section, first paragraph, replace the final sentence with:

The X and Y portions of the ‘requested view clipping limits’ for the specified view are set to the specified values. The Z portion of the ‘requested view clipping limits’ is set to ZMIN=0 and ZMAX=1. The ‘front clipping indicator’ and the ‘back clipping indicator’ are set to CLIP.

SET VIEW REPRESENTATION, in error 150, “workstations” should be “workstation's”.

Page 169

Subclause 5.5.4

TRANSLATE 3, effect section, change

A 3D homogeneous transformation matrix...

to

A 4×4 transformation matrix...

Page 170

Subclause 5.5.4

TRANSLATE, effect section, change

A 2D homogeneous transformation matrix...

to

A 3×3 transformation matrix...

SCALE 3, effect section, change

A 3D homogeneous transformation matrix...

to

A 4×4 transformation matrix...

Page 171

Subclause 5.5.4

SCALE, effect section, change

A 2D homogeneous transformation matrix...

to

A 3×3 transformation matrix...

ROTATE X, effect section, change

A 3D homogeneous transformation matrix...

to

A 4×4 transformation matrix...

ROTATE Y, effect section, change

A 3D homogeneous transformation matrix...

to

A 4×4 transformation matrix...

Page 172

Subclause 5.5.4

ROTATE Z, effect section, change

A 3D homogeneous transformation matrix...

to

A 4×4 transformation matrix...

ROTATE, effect section, change

A 2D homogeneous transformation matrix...

to

A 3×3 transformation matrix...

COMPOSE MATRIX 3, effect section, change

The 3D homogeneous transformation matrix...

to

The 4×4 transformation matrix...

Page 173

Subclause 5.5.4

COMPOSE MATRIX, effect section, change

The 2D homogeneous transformation matrix...

to

The 3×3 transformation matrix...

Page 174

Subclause 5.5.4

BUILD TRANSFORMATION MATRIX 3, effect section, change

A 3D homogeneous transformation matrix...

to

A 4×4 transformation matrix...

Page 175

Subclause 5.5.4

BUILD TRANSFORMATION MATRIX, effect section, change

A 2D homogeneous transformation matrix...

to

A 3×3 transformation matrix...

COMPOSE TRANSFORMATION MATRIX 3, effect section, change

A 3D homogeneous transformation matrix...

to

A 4×4 transformation matrix...

Page 176

Subclause 5.5.4

COMPOSE TRANSFORMATION MATRIX, effect section, change

A 2D homogeneous transformation matrix...

to

A 3×3 transformation matrix...

Subclause 5.5.5

EVALUATE VIEW ORIENTATION MATRIX 3, in error 161, insert a “,” between the words “parallel” and “thus” so that it reads, “... normal vectors are parallel, thus the viewing coordinate ...”.

EVALUATE VIEW ORIENTATION MATRIX, in error 161, insert a “,” between the words “parallel” and “thus” so that it reads, “... normal vectors are parallel, thus the viewing coordinate ...”.

Page 194

Subclause 5.9

RETRIEVE PATHS TO ANCESTORS, effect section, insert the following after the second sentence of the first paragraph:

If the structure S does not have any ancestors, an empty path list is returned.

RETRIEVE PATHS TO ANCESTORS, insert error 404 as the second error.

RETRIEVE PATHS TO DESCENDANTS, effect section, insert the following after the second sentence of the first paragraph:

If the structure S does not have any descendants, an empty path list is returned.

Page 195

Subclause 5.9

RETRIEVE PATHS TO DESCENDANTS, insert error 404 as the second error.

Page 196

Subclause 5.9

DELETE ALL STRUCTURES FROM ARCHIVE, effect section, change the final sentence to read:

After the completion of this operation, the archive file will be empty, in the same state as an empty archive file which has just been opened.

Page 206

Subclause 5.10.2

INITIALIZE VALUATOR 3, remove the second occurrence of error 253 (between errors 260 and 261 in the list) in the list of errors.

Page 233

Subclause 5.12.3

INQUIRE PHIGS FACILITIES, change the fifth parameter to read

Out list of available character sets (0..n) L(I)

Page 253

Subclause 5.12.5

INQUIRE STROKE DEVICE STATE 3, parameter list, “list of initial points in STROKE” should read “coordinates of initial STROKE”.

Page 254

Subclause 5.12.5

INQUIRE STROKE DEVICE STATE, parameter list, “list of initial points in STROKE” should read “coordinates of initial STROKE”.

Page 269

Subclause 5.12.6

INQUIRE TEXT EXTENT, parameter list, the “text extent rectangle” parameter description should include a designation of the TLC coordinate system.

Page 270

Subclause 5.12.6

INQUIRE TEXT EXTENT, effect section, delete the phrase “for TEXT PATHs RIGHT and LEFT,” in the final sentence of the second paragraph (“This includes, ... character spacing parameter.”).

Page 272

Subclause 5.12.6

INQUIRE EDGE FACILITIES, parameter list, the range for the “number of available edgetypes” parameter should be “(-n..-1,1..n)” rather than “(n..-4,4..n)”.

Page 275

Subclause 5.12.6

INQUIRE COLOUR FACILITIES, change the name of the parameter “number of colour indices” to “number of available colours”.

Page 295

Subclause 5.12.8

INQUIRE PATHS TO ANCESTORS, effect section, insert the following after the second sentence of the second paragraph:

If the structure S does not have any ancestors, an empty path list is returned.

Pages 295 and 296

Subclause 5.12.8

INQUIRE PATHS TO DESCENDANTS, effect section, insert the following after the second sentence of the second paragraph:

If the structure S does not have any descendants, an empty path list is returned.

Page 296

Subclause 5.12.8

ELEMENT SEARCH, second paragraph of the effect section, change the second sentence to read:

The element type ALL is a shorthand for the union of all possible element types listed for this function.

ELEMENT SEARCH, effect section, add a new paragraph after the existing second paragraph:

The element type NIL is used to designate the type of the conceptual element located in position #0. Thus, ELEMENT SEARCH behaves as if there were always an element of type NIL at position 0 (but at no other position) of the searched structure. This is done so that the behaviour of ELEMENT SEARCH is consistent with that of INQUIRE ELEMENT TYPE AND SIZE and INQUIRE ELEMENT CONTENT. Since ALL designates all valid element types for searching, it includes NIL. Note that including NIL as a member of the inclusion or exclusion set is not the same as specifying a null inclusion or exclusion set. For instance, a search starting at 0 will find NIL at position 0 if NIL is a member of the inclusion set and not of the exclusion set, but will not find it if the inclusion set is empty.

Page 304

Subclause 5.14

ESCAPE, effect section, change the first b) to “neither the definition nor the content of the PHIGS State List fields defined in this part of ISO/IEC 9592 may be altered”. Change d) to “the function does not create structure elements of a new type, however, existing structure elements can be manipulated by escapes”. Add f) “the function may act as a shorthand for existing PHIGS functions, in which case the function may modify the various state lists and description tables”. Add g) “extensions to the PHIGS State List, other state lists or description table entries should be separate in purpose from existing fields. Escapes which make such extensions shall be defined in a way that programs using them can still behave meaningfully on implementations which do not support the escape.”.

Page 322

Subclause 6.7

For each of the following lines, add the text “(for STRING and CHARACTER precision text)” after the name of the field:

number of available character expansion factors
 minimum character expansion factor
 maximum character expansion factor
 number of available character heights
 minimum character height
 maximum character height
 number of available annotation text character heights
 minimum annotation text character height
 maximum annotation text character height

Page 323

Subclause 6.7

Change the name of the field “number of available colour indices” to “number of available colours”.

Page 342

Clause B.4

Error 117, change the final word of the text of error 117 from “zero” to “one”.

Clause B.5

Error 150, “workstations” should be “workstation's”.

Error 161, insert a “,” between the words “parallel” and “thus” so that it reads, “... normal vectors are parallel, thus the viewing coordinate ...”.

Page 344

Clause B.12

Error 908, “as” should be “has”.

Page 349

Clause D.2

Change c) 2) to “neither the definition nor the content of the PHIGS State List fields defined in this part of ISO/IEC 9592 may be altered”.

Add c) 5) “the function does not create structure elements of a new type, however, existing structure elements can be manipulated by escapes”.

Add c) 6) “the function may act as a shorthand for existing PHIGS functions, in which case the function may modify the various state lists and description tables”.

Page 349

Clause D.2

Add c) 7) “extensions to the PHIGS State List, other state lists or description table entries should be separate in purpose from existing fields. Escapes which make such extensions shall be defined in a way that programs using them can still behave meaningfully on implementations which do not support the escape.”.

Page 355

Annex G

Add the following as the final paragraph:

How metafile workstations support HLHSR is implementation-dependent. An implementation should provide information which describes how HLHSR is achieved for the metafile workstation. If a special metafile interpreter is required to support HLHSR, that should be described also.

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Information processing systems — Computer graphics — Programmer's Hierarchical Interactive Graphics System (PHIGS) —

Part 1 : Functional description

0 Introduction

The Programmer's Hierarchical Interactive Graphics System (PHIGS) provides a set of functions for

- definition, display and modification of 2D or 3D graphical data,
- definition, display and manipulation of geometrically related objects,
- modification of graphics data and the relationships between the graphical data.

This International Standard draws extensively on GKS (Graphical Kernel System ISO 7942) and GKS-3D (Graphical Kernel System for Three Dimensions ISO 8805) for its model and functionality. In addition this International Standard enables graphical (and application) data to be stored in a hierarchical data store. Information in the data store can be inserted, modified and deleted with the provided functions. The relationship of this part of ISO/IEC 9592 to GKS and GKS-3D is further described in 4.3.2.

The choice of which graphics standard to use will depend on a number of factors: application profile, overall system architecture, equipment available, existing application database interaction, system performance considerations, user interface requirements, management policy and other external factors. The aim of producing a compatible set of graphics standards in GKS, GKS-3D and PHIGS is to allow that choice to be made in the most flexible way.

The main reasons for introducing a standard in this area of computer graphics are

- a) to allow application programs using dynamic hierarchical graphics to be easily portable between installations,
- b) to aid the understanding and use of dynamic hierarchical graphics methods by application programmers;
- c) to reduce program development costs and time; many of the functions currently performed by the application program will now be performed by PHIGS;
- d) to serve manufacturers of graphics equipment as a guideline in providing useful combinations of graphics capabilities in a device.

To meet these objectives, a number of design principles were adopted:

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- e) Consistency: the mandatory requirements of PHIGS should not be mutually contradictory.
- f) Compatibility: this Standard will be compatible with GKS and GKS-3D except when technical reasons justify differences.
- g) Orthogonality: the functions should be independent of each other.
- h) Completeness: all the functions necessary for application programs to use a dynamic hierarchical graphics system should be included.
- i) Minimality: redundant functions are only supported where their availability enables application programs to improve performance or where some collection of capabilities is frequently used.
- j) Programmer Experience: those using PHIGS should have a working knowledge of computer graphics.
- k) Error Handling: error conditions should be minimized, and their impact well defined.
- l) Device Independence: PHIGS should allow an application program to address facilities of different graphics input and output devices with minimal changes to the application program.
- m) Device Dependence: PHIGS should allow an application program to address specific graphics input and output devices in a direct manner.
- n) Implementability: it should be possible to support PHIGS functions using most languages on most operating systems.
- o) Efficiency: PHIGS should be capable of being implemented and executed without consuming undue amounts of computer resources.
- p) Interaction: Some application programs will require realtime or near-realtime response from PHIGS. PHIGS will not exclude such application programs though specific graphics devices and dedicated computer resources may be necessary.

Annexes A to C and E to I are given for information; they do not form part of this part of ISO/IEC 9592.

1 Scope and field of application

This part of ISO/IEC 9592 specifies a set of functions for computer graphics programming, the Programmer's Hierarchical Interactive Graphics System (PHIGS). PHIGS is a graphics system for application programs that produce computer generated pictures on line graphics or raster graphics output devices. It supports operator input and interactions by supplying basic functions for graphical input and hierarchical picture definition. Picture definitions are retained in a *centralized structure store* where they may be edited by an application.

Pictures are displayed on *workstations* consisting of a single output device and a number of input devices. Several workstations can be used simultaneously. The application program is allowed to adapt its behaviour at a workstation to make best use of workstation capabilities.

Functions are specified for archiving picture definitions to file. In addition an interface to the Computer Graphics Metafile (ISO 8632) is described.

NOTE - For certain parameters of the functions, PHIGS defines value ranges as being reserved for registration (see 4.1.2). The meanings of these values will be defined using the established procedures.

This part of ISO/IEC 9592 defines a language independent nucleus of a graphics system for integration into a programming language. PHIGS is embedded in a language layer obeying the particular conventions of the language. Such language bindings are specified for ISO or ISO/IEC languages in ISO/IEC 9593.

2 References

ISO 646, *Information processing - ISO 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 2382-13, *Data processing - Vocabulary - Part 13: Computer graphics.*

ISO 6093, *Information processing - Representation of numeric values in character strings for information interchange.*

ISO 7942, *Information processing systems - Computer graphics - Graphical Kernel System (GKS) functional description.*

ISO 8632, *Information processing systems - Computer graphics - Metafile for the storage and transfer of picture description information*

- *Part 1 : Functional description*
- *Part 2 : Character encoding*
- *Part 3 : Binary encoding*
- *Part 4 : Clear text encoding*

ISO 8805, *Information processing systems - Computer graphics - Graphical Kernel System for Three Dimensions (GKS-3D) functional description.*

ISO/IEC 9593, *Information processing systems - Computer graphics - Programmer's Hierarchical Interactive Graphics System (PHIGS) language bindings.*

CIE Recommendations on colour space, supplement to CIE publication 15.

CIE 1976 Supplementary standard colour metric of server and coordinate systems.

3 Definitions

For the purpose of this part of ISO/IEC 9592 the following definitions apply.

NOTE - As far as possible, graphics terminology which is commonly accepted and consistent with other graphics Standards is used.

3.1 acknowledgement: Output to the *operator* of a *logical input* device indicating that a *trigger* has fired.

3.2 addressable point: Any point of a device that can be addressed.

3.3 ancestor structure: A *parent structure* or the ancestor of a *parent structure*.

3.4 annotation: A class of *output primitives* that are defined in *normalized projection coordinates* but are placed with respect to a reference point which may be anywhere in *modelling coordinate space*. The plane on which the annotation appears is always parallel to the x-y plane of the *display space* and is unaffected by modelling and viewing transformations, but the reference point is transformed in the normal manner.

3.5 annotation style: An aspect of *annotation* indicating how relationships between an annotation primitive and a reference point are displayed.

3.6 annotation text relative: An *output primitive* consisting of a character string which is always drawn parallel to the x-y plane of the *display space*. Its position is determined by a reference point defined in *modelling coordinate space* and an offset in *normalized projection coordinates*.

3.7 application data: Data used by an application program, the nature of which is not specified in this standard. Application data is inserted into a *structure* as an “application data” *structure element*.

3.8 archive file: A mechanism for the storage and transportation of graphical data, represented by *PHIGS structures* and their contents.

3.9 aspects of output primitives: The appearance of *output primitives* is controlled by the values of a set of characteristics called “aspects” examples of which are the height of a character or the *linetype* of a *polyline*. Geometric aspects are *workstation* independent and are controlled by the corresponding *attributes*. For non-geometric aspects, the mapping between a particular aspect and its controlling *attribute* is defined by an associated *aspect source flag* (ASF). If the ASF is set to BUNDLED this aspect of the *output primitive* is controlled by the *bundle index attribute*. If the ASF is set to INDIVIDUAL then the aspect is controlled by the corresponding attribute.

3.10 aspect ratio: The ratio of lengths along the principal axes of an object.

3.11 aspect source flag (ASF): A flag indicating whether a particular *workstation* dependent *aspect* of an *output primitive* is selected from an *attribute bundle*, or as an individual *attribute* selection.

3.12 attribute: Attributes control the properties of *output primitives*. There are four types of attributes: geometric, non-geometric, viewing and identification. The geometric and non-geometric attributes control the values of *aspects* of *output primitives*.

3.13 back plane: A plane parallel to the *view plane* whose location is specified as an N coordinate value in the *view reference coordinate system*. *Output primitives* behind the back plane lie outside the *view volume*.

3.14 break action: An implementation dependent and *workstation* dependent mechanism enabling the *operator* to interrupt an input operation.

3.15 bundle index: An *attribute* of an *output primitive* which is an index into a *bundle table*; which defines the *workstation* dependent *aspects* of the *output primitive*.

3.16 bundle table: A *workstation* dependent table specifying aspects of one or more *output primitives*. *PHIGS* has *polyline*, *polymarker*, *text*, *interior*, and *edge* bundle tables.

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- 3.17 bundle table entry:** A single entry in a *bundle table*. Each entry contains one value for each aspect which applies to the corresponding *output primitive*. This set is *workstation* dependent.
- 3.18 cell array:** An *output primitive* consisting of a parallelogram of equal sized cells, each of which is a parallelogram and has a single colour.
- 3.19 centralized structure store (CSS):** The conceptual *workstation* independent storage area for *structure networks*.
- 3.20 character base vector:** An aspect of *text* which defines the direction of the baseline of a character. It is a two-dimensional vector in the *text plane* specified in the “*text*” *structure element*.
- 3.21 character body:** The rectangle defining the horizontal and vertical limits of an individual character.
- 3.22 character expansion factor:** An aspect of *text* which specifies the deviation of *character width* from the defined *nominal value* of a given font on a given *workstation*.
- 3.23 character height:** An aspect of *text* which specifies the *nominal value* for the height of an upper case character.
- 3.24 character set:** A registered interpretation for entries in the character code table (see ISO 2022).
- 3.25 character spacing:** An aspect of *text* which specifies the fraction of the font *nominal value* for *character height* to be added between adjacent *character bodies* in a *string*.
- 3.26 character up vector:** An aspect of *text* which defines the principal up direction of the text string. It is a two-dimensional vector in the *text plane* specified in the “*text*” *structure element*.
- 3.27 character width:** An aspect of *text* which specifies the *nominal value* of the width of a character. The actual width depends on the width to height ratio specified by the designer of the font to which the character belongs.
- 3.28 child structure:** A *structure* specified in a *structure reference*.
- 3.29 choice device:** A *logical input device* providing a non-negative integer defining one of a set of alternatives.
- 3.30 CIE:** Abbreviation for the Commission Internationale de l’Eclairage. Used to refer to the CIE universal colour definition system used as a colour model.
- 3.31 CIELUV:** Abbreviation for the CIE 1976 ($L^*u^*v^*$) colour space.
- 3.32 clipping:** Removing parts of *output primitives* which lie outside a specified volume. The exact effect of clipping some *output primitives* may be implementation or *workstation* dependent.
- 3.33 colour index:** An index used to access an entry in a *colour table*.
- 3.34 colour model:** Characterization of a *colour space* in terms of explicit parameters.
- 3.35 colour space:** Geometric representation of colours in space, usually of three dimensions.
- 3.36 colour system:** A colour coordinate system.
- 3.37 colour table:** A *workstation* dependent table, in which the entries specify the values defining a particular colour.
- 3.38 composite modelling transformation:** A transformation applied to *output primitives* produced during *structure traversal*. It is defined as the concatenation of the *local modelling transformation* and *global modelling transformations* such that the *local modelling transformation* is the first transformation to be applied.
- 3.39 conflict resolution flag:** During the process of *structure archiving* from the CSS or *structure retrieval* from an archive, naming conflicts may occur between *structures* on the *archive file* and *structures* in the CSS. The conflict resolution flag indicates how these conflicts will be resolved.
- 3.40 connection identifier:** An implementation specific means of defining the connection to one or more physical entities which constitutes a single *workstation*.