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

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

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

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Systemes de traitement de l'information - Infographie - Interface de programmation du systeme graphique hiérarchisé (PHIGS) - Partie 1: Description fonctionnelle (ISO/IEC 9592-1:1989, éd. 1)

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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
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According to the CEN/CENELEC Common Rules, the following countries
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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.

INTERNATIONAL
STANDARD

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9592-1

First edition
1989-04-01

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

Part 1 :

Functional description

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*Systèmes de traitement de l'information — Infographie — Interface de
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Partie 1 : Description fonctionnelle
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Reference number
ISO/IEC 9592-1 : 1989 (E)

Contents	Page
0 Introduction	1
1 Scope and field of application	3
2 References	4
3 Definitions	5
4 The Programmer's Hierarchical Interactive Graphics System	15
4.1 About this part of ISO/IEC 9592	15
4.1.1 Specification and conformance	15
4.1.2 Registration	15
4.2 Overview	16
4.3 Concepts	18
4.3.1 PHIGS concepts	18
4.3.2 Relationship to ISO 7942 (GKS) and ISO 8805 (GKS-3D)	20
4.3.3 Notational conventions	20
4.4 The centralized structure store	22
4.4.1 Structure elements and structures	22
4.4.2 Structure networks	24
4.4.3 Structure traversal and display	25
4.4.4 Structure editing	28
4.4.5 Manipulation of structures in CSS	29
4.4.6 CSS search and inquiry	30
4.4.7 Structure archival and retrieval	32
4.4.8 Generalized Structure Elements (GSE)	33
4.4.9 Application data	33
4.5 Graphical output	34
4.5.1 Structure elements and output primitives	34
4.5.2 Output primitive attributes	38
4.5.3 Polyline attributes	43
4.5.4 Polymarker attributes	43
4.5.5 Text attributes	44
4.5.6 Annotation text attributes	55
4.5.7 Text extent and concatenation	55
4.5.8 Fill area attributes	58
4.5.9 Fill area set attributes	62
4.5.10 Cell array attributes	63
4.5.11 Generalized drawing primitive attributes	63
4.5.12 Colour	63
4.5.13 View index	64
4.5.14 Hidden line / hidden surface removal (HLHSR) identifier	64

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4.5.15	Name set attribute	64
4.5.16	Minimal simulations	65
4.5.17	Degenerate primitives	65
4.6	Workstations	67
4.6.1	Workstation characteristics	67
4.6.2	Workstation selection	68
4.6.3	Controlling picture changes	68
4.6.4	Clearing the display surface	75
4.6.5	Sending messages to a workstation	75
4.6.6	Hidden line / hidden surface removal	76
4.7	Coordinate systems and transformations	77
4.7.1	Coordinate system handedness	77
4.7.2	Modelling transformations and clipping	77
4.7.3	Modelling utility functions	79
4.7.4	Viewing	80
4.7.5	Viewing utility functions	84
4.7.6	Workstation transformation	90
4.7.7	Transformation of locator input	92
4.7.8	Transformation of stroke input	93
4.8	Graphical input	95
4.8.1	Introduction to logical input devices	95
4.8.2	Logical input device model	96
4.8.3	Operating modes of logical input devices	97
4.8.4	Measures of each input class	100
4.8.5	Input queue and current event report	101
4.8.6	Initialization of input devices	102
4.8.7	Locator and stroke input using 2D input	104
4.9	PHIGS metafile interface	105
4.10	PHIGS states	107
4.11	Inquiry functions	108
4.12	Error handling	109
4.13	Special interfaces between PHIGS and application program	112
4.14	Minimum support criteria	113
5	PHIGS Functional Specification	116
5.1	Notational conventions	116
5.2	Control functions	117
5.3	Output primitive functions	122
5.4	Attribute specification functions	132
5.4.1	Bundled attribute selection	132
5.4.2	Individual attribute selection	133
5.4.3	Aspect source flag setting	150
5.4.4	Workstation attribute table definition	150
5.4.5	Workstation filter definition	158
5.4.6	Colour model control	159
5.4.7	HLHSR attributes	160
5.5	Transformation and clipping functions	161
5.5.1	Modelling transformations and clipping	161
5.5.2	View operations	165
5.5.3	Workstation transformation	167
5.5.4	Utility functions to support modelling	169
5.5.5	Utility functions to support viewing	176
5.6	Structure content functions	179
5.7	Structure manipulation functions	185
5.8	Structure display functions	188
5.9	Structure archiving functions	190
5.10	Input functions	197
5.10.1	Pick identifier and filter	197
5.10.2	Initialization of input devices	197

ISO/IEC 9592-1 : 1989 (E)

5.10.3	Setting the mode of input devices	215
5.10.4	Request input functions	218
5.10.5	Sample input functions	221
5.10.6	Event input functions	225
5.11	Metafile functions	230
5.12	Inquiry functions	232
5.12.1	Introduction	232
5.12.2	Inquiry functions for operating state values	232
5.12.3	Inquiry functions for PHIGS description table	233
5.12.4	Inquiry functions for PHIGS state list	235
5.12.5	Inquiry functions for workstation state list	238
5.12.6	Inquiry functions for workstation description table	259
5.12.7	Inquiry function for structure state list	288
5.12.8	Inquiry functions for structure content	289
5.12.9	Inquiry functions for error state list	300
5.13	Error control functions	302
5.14	Special interface function	304
6	PHIGS data structures	305
6.1	Notation and data types	305
6.2	Operating states	308
6.3	PHIGS description table	309
6.4	PHIGS traversal state list	312
6.5	PHIGS state list	314
6.6	Workstation state list	316
6.7	Workstation description table	320
6.8	Structure state list	326
6.9	PHIGS error state list	327

Annexes

	SIST EN 29592-1:1998	
A	Function Lists	328
A.1	Alphabetic	328
A.2	Order of appearance	334
B	Error list	341
B.1	Implementation dependent	341
B.2	States	341
B.3	Workstations	341
B.4	Output attributes	341
B.5	Transformations and viewing	342
B.6	Structures	342
B.7	Input	343
B.8	Metafiles	343
B.9	Escape	343
B.10	Archive / retrieve	343
B.11	Miscellaneous	344
B.12	System	344
B.13	Reserved errors	344
C	Interfaces	345
C.1	Introduction	345
C.2	Language Binding	345
C.3	Implementation	346
D	Allowable differences in PHIGS implementations	348
D.1	Introduction	348
D.2	Global differences	348
D.3	Workstation dependent differences	349
E	The PHIGS viewing model	352
F	PHIGS/GKS differences	353

G	HLHSR considerations	355
H	Relationship of CGM and PHIGS	356
H.1	Introduction	356
H.2	Scope	356
H.3	Overview of the differences between PHIGS and CGM	356
H.4	Mapping concepts	357
H.4.1	Principles	357
H.4.2	Workstations	357
H.4.3	Picture generation	358
H.4.4	Picture input	358
H.4.5	Coordinates and clipping	359
H.4.6	Workstation transformation	359
H.4.7	Colour table	360
H.4.8	Set representation	360
H.5	Metafile generation	360
H.5.1	Control functions	360
H.5.2	Structure traversal	362
H.5.3	Metafile description	363
H.5.4	User items	364
H.6	Interpretation of CGM by PHIGS	364
H.7	Mapping between item types and elements	366
I	Colour models	367
I.1	Introduction	367
I.2	RGB colour model	368
I.3	CIELUV colour model	368
I.3.1	CIE XYZ colour space	368
I.3.2	CIE 1931 (Y,x,y) space	369
I.3.3	The CIE 1976 (L*u*v*) CIELUV uniform colour space	372
I.3.4	Colour differences	373
I.4	HSV colour model	374
I.5	HLS colour model	375
I.6	Conversion between colour models	375
I.6.1	CIE XYZ reference model	375
I.6.2	Conversion between CIELUV and CIE XYZ models	376
I.6.3	Conversion between RGB and CIE XYZ models	376
I.6.3.1	Derivation of conversion factors	376
I.6.3.2	Conversion from RGB to CIE XYZ	377
I.6.3.3	Conversion from CIE XYZ to RGB	377
I.6.3.4	Representation of black	377
I.6.3.5	Example conversion	377

ISO/IEC 9592-1 : 1989 (E)

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) together form a system for worldwide standardization as a whole. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for approval before their acceptance as International Standards. They are approved in accordance with procedures requiring at least 75 % approval by the national bodies voting.

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

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Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

ISO/IEC 9592 consists of the following parts, under the general title *Information processing systems — Computer graphics — Programmer's Hierarchical Interactive Graphics System (PHIGS)*:

- *Part 1: Functional description*
- *Part 2: Archive file format*
- *Part 3: Clear-text encoding of archive file*

Annex D forms an integral part of this part of ISO/IEC 9592. Annexes A, B, C, E, F, G, H, I are for information only.

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:

ISO/IEC 9592-1 : 1989 (E)

Introduction

- 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.

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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.

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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*

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

SIST EN 29592-1:1998

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.