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Information technology - Computer graphics - Graphical Kernel System for Three Dimensions (GKS-3D) language bindings - Part 4: C (ISO/IEC 8806-4:1991)

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LJUBLJANA
SIST EN 28806-4
PREVZET PO METODI RAZGLASITVE
-12- 1997

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

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

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Ref. No. EN 28806-4:1993 E

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Foreword

On the proposal of the CEN Central Secretariat, the Technical Board has decided to submit the international Standard:

"Information technology - Computer graphics - Graphical Kernel System for Three Dimensions (GKS-3D) language bindings - Part 4: C (ISO/IEC 8806-4:1991)"

to the formal vote.

The result of the formal vote was positive.

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

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of an identical text or by endorsement, at the latest by November 1993, and conflicting national standards shall be withdrawn at the latest by November 1993.

In accordance with the CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard:

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Endorsement notice

The text of this European Standard is identical to the text of the International Standard ISO/IEC 8806-4:1991 without any modifications.

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INTERNATIONAL STANDARD

ISO/IEC 8806-4

First edition
1991-12-15

Information technology — Computer graphics — Graphical Kernel System for Three Dimensions (GKS-3D) language bindings —

Part 4:
C

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Technologies de l'information — Infographie — Interfaces de langages pour GKS (Graphical Kernel System) pour trois dimensions —

Partie 4: C

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SIST EN 28806-4:1997

Contents

1 Scope 1
2 Normative references 2
3 The C Language Binding of GKS-3D 3
3.1 Conformance 3
3.2 Functions versus Macros 3
3.3 Character Strings 3
3.4 Function Identifiers 3
3.5 Registration 3
3.6 Identifiers for Graphical Items 4
3.7 Return Values 4
3.8 Header Files 4
3.9 Memory Management 4
3.9.1 Functions which Return Simple Lists 5
3.9.2 Functions which Return Complex Data Structures 5
3.10 Error Handling 6
3.10.1 Application Supplied Error Handlers 6
3.10.2 Error Codes 7
3.10.3 C-specific GKS-3D errors 7
3.11 Colour Representations 7
3.12 Storage of Multi-dimensional Arrays 8
3.12.1 Storage of 2*3 Matrices 8
3.12.2 Storage of 3*4 Matrices 8
3.12.3 Storage of 4*4 Matrices 8
3.12.4 Storage of Colour Arrays 8
4 Tables 9
4.1 Abbreviation Policy in Construction of Identifiers 9
4.2 Table of Abbreviations Used 9
4.3 Function Names 13
4.3.1 List Ordered Alphabetically by Bound Name 13
4.3.2 List Ordered Alphabetically by GKS-3D Name 19
4.3.3 List Ordered Alphabetically by Bound Name within Level 25
5 Type Definitions 32
5.1 Mapping of GKS-3D data types 32
5.2 Environmental Type Definitions 32
5.3 Implementation Dependent Type Definitions 33
5.4 Implementation Independent Type Definitions 44
6 Macro Definitions 65
6.1 Function identifiers 65
6.2 Error Codes 68
6.3 Miscellaneous Macros 75
6.3.1 Linetypes 75
6.3.2 Marker Types 75
6.3.3 Colour Models 75
6.3.4 Prompt and Echo Types 75
6.3.5 Default Parameters of OPEN GKS 76
7 C GKS-3D Function Interface 77
7.1 Notational Conventions 77
7.2 Control Functions 77
7.3 Output Functions 79

iTeh STANDARD PREVIEW
(standards.iteh.ai)
SIST EN 28806-4:1997
https://standards.iteh.ai/catalog/standards/sist/8386b90b-e951-445b-8399-ee8128991c18/sist-en-28806-4-1997

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SIST EN 28806-4:1997

7.4 Output Attribute Functions 81
7.4.1 Workstation Independent Primitive Attributes 81
7.4.2 Workstation Attributes 85
7.5 Transformation Functions 87
7.5.1 Normalization Transformation 87
7.5.2 View transformation functions 88
7.5.3 HLHSR functions 88
7.5.4 Workstation transformation 89
7.6 Segment Functions 89
7.6.1 Segment Manipulation Functions 89
7.6.2 Segment Attribute Functions 91
7.7 Input Functions 92
7.7.1 Initialization of Input Devices Functions 92
7.7.2 Setting the Mode of Input Devices Functions 95
7.7.3 Request Input Functions 96
7.7.4 Sample Input Functions 98
7.7.5 Event Input Functions 100
7.8 Metafile Functions 102
7.9 Inquiry Functions 102
7.9.1 Inquiry Functions for Operating State Value 102
7.9.2 Inquiry Functions for GKS-3D Description Table 103
7.9.3 Inquiry Functions for GKS-3D State List 103
7.9.4 Inquiry Functions for Workstation State List 112
7.9.5 Inquiry Functions for Workstation Description Table 124
7.9.6 Inquire functions for the Segment State List 135
7.9.7 Pixel Inquiries 136
7.9.8 Inquiry Functions for Error State List 137
7.10 Utility Functions 137
7.10.1 Utility Functions in GKS-3D 137
7.10.2 Binding Specific Utilities 138
7.11 Error Handling 139
A Compiled GKS-3D/C Specification 141
B Sample Programs 204
B.1 STAR Program 204
B.2 IRON Program 206
B.3 MAP Program 213
B.4 MANIPULATE Program 215
B.5 SHOW LINE Program 221
B.6 DODECA Program 226
C Metafile Items 231
D Short Function Identifiers 233
E Memory Management 240
E.1 Introduction 240
E.2 Functions That Return Simple Lists 240
E.2.1 Operation of `ginq_list_line_inds` 240
E.3 Functions That Return Structured Data 243
E.3.1 Operation of `gcreate_store` 244
E.3.2 Operation of `ginq_stroke_st` and `ginq_pat_rep` 246
E.3.3 Operation of `gdel_store` 250
F Function Lists 253
F.1 Alphabetic by GKS-3D Name 253
F.2 Alphabetic by Binding Name 259

iTeh STANDARD PREVIEW
(standards.iteh.ai)
SIST EN 28806-4:1997
https://standards.iteh.ai/catalog/standards/sist/8386b90b-e951-445b-8399-ee8f28991c18/sist-en-28806-4-1997

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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 the 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 JTC1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

International Standard ISO/IEC 8806-4 was prepared by Joint Technical Committee ISO/IEC JTC1, *Information technology.*

ISO/IEC 8806 consists of the following parts, under the general title

Information technology - Computer graphics - Graphical Kernel System for Three Dimensions (GKS-3D) language bindings -

- *Part 1: FORTRAN*
- *Part 2: PASCAL*
- *Part 3: ADA*
- *Part 4: C*

Annexes A to F of this part of ISO/IEC 8806 are for information only.

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SIST EN 28806-4:1997

Introduction

The Graphical Kernel System for Three Dimensions (GKS-3D) functional description is registered as ISO 8805 : 1988. As explained in the Scope and Field of Application of ISO 8805, that International Standard is specified in a language independent manner and needs to be embedded in language dependent layers (language bindings) for use with particular programming languages.

The purpose of this part of ISO/IEC 8806 is to define a standard binding for the C computer programming language.

Some functions in ISO 8805 also appear in the Graphical Kernel System (GKS) functional description (ISO 7942). The binding of those functions in this part of ISO/IEC 8806 is the same as in ISO/IEC 8651-4, the C language binding of GKS.

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SIST EN 28806-4:1997

Information technology – Computer graphics – Graphical Kernel System for Three Dimensions (GKS-3D) language bindings -

Part 4:

C

1 Scope

The Graphical Kernel System for Three Dimensions (GKS-3D), ISO 8805 : 1988, specifies a language independent nucleus of a graphics system. For integration into a programming language, GKS-3D is embedded in a language dependent layer obeying the particular conventions of that language. This part of ISO/IEC 8806 specifies such a language dependent layer for the C language.

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SIST EN 28806-4:1997

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provision of this part of ISO/IEC 8806. At the time of publication, the editions indicated were valid. All standards are subject to revisions, and parties to agreements based on this part of ISO/IEC 8806 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 7942:1985, *Information processing systems – Computer graphics – Graphical Kernel System (GKS) functional description.*

ISO/IEC 8651-4:1991, *Information technology – Computer graphics – Graphical Kernel System (GKS) language bindings - Part 4 : C.*

ISO 8805:1988, *Information processing systems – Computer graphics – Graphical Kernel System for Three Dimensions (GKS-3D) functional description.*

ISO/IEC 8806-1:1991, *Information processing systems – Computer graphics – Graphical Kernel System for three dimensions (GKS-3D) - language bindings - Part 1 : FORTRAN .*

ISO/IEC 9899:1990, Programming languages - C.

ISO/IEC TR 9973:1988, *Information processing – Procedures for registration of graphical items.*

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https://standards.iteh.ai/catalog/standards/sist/8386b90b-e951-445b-8399-ee8f28991c18/sist-en-28806-4-1997

SIST EN 28806-4:1997

3 The C Language Binding of GKS-3D

The C language binding of GKS-3D shall be as described in clauses 3, 4, 5 and 6.

3.1 Conformance

This part of ISO/IEC 8806 incorporates the rules of conformance defined in the GKS-3D Standard (ISO 8805) for GKS-3D implementations, with those additional requirements specifically defined for C bindings in GKS-3D.

The following criteria shall determine conformance of an implementation to this part of ISO/IEC 8806:

In order to conform, an implementation of the C binding of GKS-3D shall implement a specific level of GKS-3D as specified in ISO 8805. It shall make visible all of the declarations in the C binding specified in this part of ISO/IEC 8806 for that same level of GKS-3D and all lower levels and for a specific level of C.

Thus, for example, the syntax of the function names shall be precisely as specified in the binding and parameters shall be of the data types stated in the binding.

3.2 Functions versus Macros

An implementation may substitute macros for functions. However, the macros shall be designed so that side-effects work properly. In general, a macro cannot be used to replace the error handling function `gerr_hand`. See also 3.10.

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3.3 Character Strings

The C language represents character strings as an array of characters terminated by the null character (i.e. `'\0'`). This means that the null character is not usable as a printable character.

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3.4 Function Identifiers

The function names of GKS-3D are all mapped to C functions which begin with the letter `g`. Words and phrases used in the GKS-3D function names are often abbreviated in the representation and are always separated with the underscore character `"_"`. The set of such abbreviations is given in 4.2, and the resulting C function names are listed in 4.3. For example, the abbreviation for the GKS-3D function DELETE SEGMENT FROM WORKSTATION is `gdel_seg_ws`. `del`, `seg`, and `ws` are abbreviations for DELETE, SEGMENT, and WORKSTATION. The conjunctive FROM is mapped to the null string.

The C standard (ISO/IEC 9899) requires that compilers recognize internal identifiers which are distinct in at least 31 characters. That standard also requires that external identifiers (i.e. those seen by the linker) be recognized to a minimum of six characters, independent of case.

Implementations which run in environments where two distinct C internal identifiers would be equivalent, if they were both external identifiers, shall include a set of `#defines` in the header file which equate the long names to a set of short names. A possible set of short names for a compiler that accepts only eight characters for external definitions may be found in annex D.

3.5 Registration

ISO 8805 reserves certain value ranges for registration[1] as graphical items. The registered graphical items will be bound to the C programming language (and other programming languages). The registered item

[1]) For the purpose of this part of ISO/IEC 8806 and according to the rules for the designation and operation of registration authorities in the ISO/IEC Directives, the ISO and IEC councils have designated the National Institute of Standards and Technology (Institute of Computer Sciences and Technology), A-266 Technology Building, Gaithersburg, MD 20899, USA to act as registration authority.

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binding will be consistent with the binding presented in this part of ISO/IEC 8806.

3.6 Identifiers for Graphical Items

Generalized Drawing Primitives and Escape functions are referenced via identifiers. This part of ISO/IEC 8806 specifies the format of the identifiers but it does not specify the registration of the identifiers. The identifiers are used as arguments to the functions `ggdp`, `ggdp3`, and `gescape`.

An implementation may also represent GDPs and Escapes as separate functions, but this is not required.

There are two formats for these identifiers. One format is for registered GDPs and Escapes and the other format is for unregistered GDPs and Escapes.

The format for registered GDP identifiers is:

```
#define     GGDP_Rn      (n)    /* 'n' is the registered GDP id. */
#define     GGDP3_Rn     (n)    /* 'n' is the registered GDP3 id. */
```

The format for unregistered GDP identifiers is:

```
#define     GGDP_Un      (-n)   /* 'n' is implementation dependent */
#define     GGDP3_Un     (-n)   /* 'n' is the registered GDP3 id. */
```

The format for registered Escape function identifiers is:

```
#define   GESCAPE_Rn     (n)    /* 'n' is the registered Escape id. */
```

The format for unregistered Escape function identifiers is:

```
#define   GESCAPE_Un     (-n)   /* 'n' is implementation dependent */
```

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3.7 Return Values

All GKS-3D/C functions return `void`.

3.8 Header Files

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C provides a mechanism to allow external files to be included in a compilation. Clause 5 of this part of ISO/IEC 8806 describes the data types that shall be defined in the file `gks.h` which should be included in any application program that intends to use GKS-3D via the C binding.

This part of ISO/IEC 8806 uses the data type `size_t` (as a field in the data type `Gdata`). The type `size_t` is environment-dependent (e.g. `int`, `long int`, `unsigned int`) and is defined in the file `<stddef.h>`. Therefore the file `gks.h` shall also include the file `<stddef.h>`.

Additional implementation-dependent items may be placed in this file if needed. These items should start with the sentinel "G" or "g", as far as applicable.

The file `gks.h` shall also contain external declarations for all GKS-3D/C functions because they return `void`. For example, the declaration for the function `gopen_gks` would look like this:

```
extern   void   gopen_gks(char *err_file, size_t mem_units);
```

3.9 Memory Management

The application shall allocate the memory needed for the data returned by the implementation. In general, the application will allocate a C structure and pass a pointer to that structure to an inquiry routine, which will then place information into the structure. However, a number of inquiry functions return variable length data, the length of which is not known *a priori* by the application.

These functions fall into two classes. One class of functions returns a simple, homogeneous, list of items. For example, the function INQUIRE SET OF SEGMENT NAMES returns a list of the segment names in use. The other class returns complex, heterogeneous data structures. For example, the function INQUIRE LOCATOR DEVICE STATE returns the device state which includes a locator data record; the data record can contain arbitrarily complex implementation-defined data structures. The binding of these two classes of functions is described in detail below. Subclause 3.10 describes the errors that can be invoked during execution of functions which use the memory management policy.

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3.9.1 Functions which Return Simple Lists

Inquiry functions which return a list of items are bound such that the application can inquire about a portion of the list. This list is a subset of the implementation's internal list and is called the application's list. This allows the application to process the implementation's list in a piecewise manner rather than all at once.

The application allocates the memory for a list and passes that list to the implementation. The implementation places the results of the inquiry into the list. In order to support this policy of memory management, three additional parameters have been added to functions which return lists:

a) `num_elems_appl_list`: An integer input parameter which is the length of the application's list. The value of `num_elems_appl_list` indicates the number of items (i.e. list elements) which will fit into the application list. A value of 0 is valid and allows the application to determine the size of the implementation's list (which is returned via `num_elems_impl_list`) without having the implementation return any of the elements of its list. If `num_elems_appl_list` is negative, `GE_APPL_LIST_LENGTH_LT_ZERO` is returned as the value of the error indicator parameter.

b) `start_ind`: An integer input parameter which is an index into the implementation's list. (Index 0 is the first element of both the implementation's and application's list.) `start_ind` indicates the first item in the implementation's list that is copied into index 0 of the application's list. Items are copied sequentially from the implementation's list into the application's list until the application's list is full or there are no more items in the implementation's list. If `start_ind` is out of range, error `GE_START_IND_INVAL` is returned as the value of the error indicator parameter.

c) `num_elems_impl_list`: An output parameter which is a pointer to an integer. The implementation stores into this parameter the number of items that are in the implementation's list.

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In annex E, a possible underlying mechanism is described.

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3.9.2 Functions which Return Complex Data Structures

The data returned by the ESCAPE function and the functions which return input device data records or pattern tables can be complex in structure. They cannot be represented by a simple list of items. It would be an onerous task for the application to have to allocate and prepare data structures for these routines. In order to facilitate this task of using these inquiry functions, the binding defines a new resource, called a *Store*, to manage the memory for these functions.

The *Store* resource is opaque to the application. The application does not know the structure of the *Store* or how it is implemented. The *Store* is defined as a `void *`. This part of ISO/IEC 8806 defines two new functions which create (in CREATE STORE, bound as `gcreate_store`) and delete (in DELETE STORE, bound as `del_store`) a *Store*.

A *Store* is used by the implementation to manage the memory needed by the functions which return complex data structures. Without specifying an implementation of a *Store*, it is safe to say that it will contain and control memory needed to hold the data returned by these functions and also contain some bookkeeping information about the contents and size of the memory.

The semantics of the *Store* resource provide two levels of memory management. The implementation is responsible for managing the memory at a low level because it uses, reuses, allocates and deallocates memory from the system in order to return information to the application. But the application is ultimately responsible for managing the memory at a high level because it creates and deletes *Stores*.

A *Store* is passed as a parameter to a function returning complex data structures. Another parameter to this function is a pointer to a pointer to a structure which defines the format of the returned data. The *Store* contains memory for the structure and any additional memory referenced by fields within the structure. The application accesses the returned data through its pointer to the structure. It does not use the *Store* to access the data.

A *Store* continues to hold the information from the function until the *Store* is deleted by the DELETE STORE function or until the *Store* is used as an argument to a subsequent function, which returns complex