BRITISH STANDARD

BS ISO/IEC 8651-4:1995

Information technology — Computer graphics — Graphical Kernel System (GKS) language bindings —

Part 4: C

ICS 35.140

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee IST/31, Computer graphics and Image Processing, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled "International Standards Correspondence Index", or by using the "Find" facility of the BSI Standards Electronic Catalogue.

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Part 4:
C

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Partie 4: C

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. 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 voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

International Standard ISO/IEC 8651-4 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology,* Subcommittee SC 24, *Computer graphics and image processing*.

This second edition cancels and replaces the first edition (ISO/IEC 8651-4:1991), which has been technically revised.

ISO/IEC 8651-4 consists of the following parts, under the general title *Information technology — Computer graphics — Graphical Kernel System (GKS) language bindings*:

— *Part 1: FORTRAN*

— *Part 2: Pascal*

— *Part 3: Ada*

— *Part 4: C*

Annexes A to F of this part of ISO/IEC 8651 are for information only.

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Introduction

The Graphical Kernel System (GKS) functional description is registered as ISO/IEC 7942-1:1994. As explained in the Scope and Field of Application of ISO/IEC 7942-1, 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 8651 is to define a standard binding for the C computer programming language.

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Information technology — Computer graphics — Graphical Kernel System (GKS) language bindings —

Part 4:
C

1 Scope

The Graphical Kernel System (GKS), ISO/IEC 7942–1:1994 , specifies a language independent nucleus of a graphics system. For integration into a programming language, GKS is embedded in a language dependent layer obeying the particular conventions of that language. This part of ISO/IEC 8651 specifies such a language dependent layer for the C language.

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2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC 8651. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO/IEC 8651 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/IEC 7942-1:1994, *Information technology – Computer graphics and image processing – Graphical Kernel System (GKS) – Part 1 : Functional description.*
ISO/IEC 9899:1990, *Programming languages – C.*
ISO/IEC TR 9973:1994, *Information technology – Computer graphics and image processing – Procedures for registration of graphical Items.*

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3 The C language binding

The C language binding of GKS shall be as described in clauses 3 to 7.

3.1 Classification and designation

This part of ISO/IEC 8651 incorporates the rules of conformance defined in the GKS Standard (ISO/IEC 7942-1) for GKS implementations, with those additional requirements specifically defined for C bindings in GKS.

The following criteria shall determine conformance of an implementation to this part of ISO/IEC 8651:

In order to conform, an implementation of the C binding of GKS shall implement GKS as specified in ISO/IEC 7942–1. It shall make visible all of the declarations in the C binding specified in this part of ISO/IEC 8651 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.

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.

3.4 Function identifiers

The function names of GKS are all mapped to C functions which begin with the letter **`g`**. Words and phrases used in the GKS 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 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 language (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 object-like macros in the header which equate the long names to a set of short names. A possible set of short names for a compiler that accepts only 8 characters for external definitions may be found in annex C.

3.5 Registration

ISO/IEC 7942 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 binding will be consistent with the binding presented in this part of ISO/IEC 8651.

[1] For the purpose of this part of ISO/IEC 8651 and according to the rules for the designation and operation of registration authorities in the ISO/IEC Directives, the ISO/IEC council has 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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3.6 Identifiers for graphical items

Generalized Drawing Primitives and Escape functions are referenced via identifiers. This part of ISO/IEC 8651 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** 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)         /* where 'n' is the registered GDP
                                    identifier */
```

The format for unregistered GDP identifiers is:

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

The format for registered Escape function identifiers is:

```
#define     GESCAPE_Rn  (n)         /* where 'n' is the registered
                                    Escape identifier */
```

The format for unregistered Escape function identifiers is:

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

3.7 Return values

All GKS/C functions have return value **void**.

3.8 Headers

3.8.1 gks.h

C provides a mechanism to access information stored in a header via the **#include** preprocessing directive. Clause 5 of this part of ISO/IEC 8651 describes the data types that shall be defined in the header **gks.h** which shall be included in any application program that intends to use GKS via the C binding.

This part of ISO/IEC 8651 uses the data type **size_t** (inter alia as a field in the data type **Gdata**). The type **size_t** is environment-defined (i.e. **unsigned long** or **unsigned int**) and is defined in the headers **<stdio.h>, <stddef.h>, <stdlib.h>, <string.h>, <time.h>**.

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

The header **gks.h** shall also contain external declarations for all GKS/C functions because they have a **void** return type. For example, the declaration for the function **gopen_gks** would look like this:

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

3.8.2 gks_compat.h

For application programs which used to run on top of the 1991 edition of this part of ISO/IEC, the header **gks_compat.h** is provided. **gks_compat.h** includes GKS/C data types that are no longer supported, as well as external declarations for all GKS/C functions that are no longer supported. Implementations of this part of ISO/IEC 8651 shall support these functions in a compatibility layer, according to the guidelines in Annex G of ISO/IEC 7942-1:1994.

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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 LIST OF MARKER INDICES returns a list of the available marker indices. The other class returns complex, heterogeneous data structures. For example, the function INQUIRE GKS STATE LIST ENTRY returns a piece of the GKS state which may include several data structures of different length. 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.

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.

In annex D, a possible underlying mechanism is described.

3.9.2 Functions which return complex data structures

The data returned by inter alia the ESCAPE function, the AWAIT INPUT function and the functions which return state lists or description 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 8651 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

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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 data structures. At that time, the old information is replaced with the new. Thus multiple calls to functions overwrite the contents of a *Store*. A *Store* only contains the results of the last function.

This part of ISO/IEC 8651 defines two errors that can occur when using or creating a *Store*; these errors are described in 6.2. For most functions using a *Store*, these and other errors are returned via the "error indicator" parameter. However, the function ESCAPE does not have an error indicator parameter. For this function, the error reporting mechanism is used when an error is encountered. For this function, the implementation shall, in addition to reporting the error, set the pointer to the returned data to NULL when an error occurs. See the binding of these functions for more information.

The definitions for the functions CREATE STORE and DELETE STORE follow:

CREATE STORE

Parameters:

Out	error indicator	I
Out	store	STORE

Effect: Creates a *Store* and returns a handle to it in the output parameter *store*. If the *Store* cannot be created, the error indicator is set to one of the following error values:

GE_GKS_NOT_OPEN	GKS not in proper state; GKS shall be in the state (GKOP, *)
GE_ERR_ALLOC_STORE	Error while allocating Store

Errors: None.

DELETE STORE

Parameters:

Out	error indicator	I
Out	store	STORE

Effect: Deletes the *Store* and all internal resources associated with it. If there is not an error, the parameter *store* will be set to NULL to signify that it is no longer valid. If an error is detected, the error indiocator is set to one of the following values:

GE_GKS_NOT_OPEN	GKS not in proper state; GKS shall be in the state (GKOP, *)

Errors: None.

In 7.2.13.2, the C specification of these functions is given. In annex D, a possible underlying mechanism is

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illustrated.

3.10 Error handling

3.10.1 Application supplied error handlers

User-defined error handlers shall accept the same arguments as the standard error handler. The user-defined error handler is specified by the utility function (see also 7.2.13.2)

SET ERROR HANDLER

Parameters:

In	New error handling function	Function
Out	Old error handling function	Function

Effect: Sets the GKS error handling function to *New error handling function* and returns the current error handling function to *Old error handling function.*

Errors: None.

Application defined error handling functions accept the same arguments as the standard error handler. They may invoke the standard error logging function ERROR LOGGING.

ISO/IEC 7942 defines the initial error handling function to be ERROR HANDLING, that is, the value of the parameter *Old error handling function* points to ERROR HANDLING, when SET ERROR HANDLER is called for the first time.

When the application changes the error handling function, the implementation will invoke the new function when an error is detected. If the application calls the default error handling function ERROR HANDLING, ERROR HANDLING will always call the function ERROR LOGGING.

If *New error handler* is not a valid pointer, the error handling will automatically be done by the standard error handler ERROR HANDLING.

User-defined error handlers may invoke the standard error logging function ERROR LOGGING.

3.10.2 Error codes

Hard coding numbers into a program decreases its maintainability. Therefore, this part of ISO/IEC 8651 defines a set of constants for the GKS error numbers. Each error constant begins with the characters **GE_**. See also 6.2 for the error macros.

3.10.3 C-specific GKS errors

This part of ISO/IEC 8651 defines some additional error messages. In 6.2 the numbers and their macros are given.

3.11 Colour representations and specifications

GKS defines 4 colour models (RGB, CIE L*u*v* 1976, HLS and HSV) of which RGB and CIE L*u*v* are mandatory. For each of these models, a colour specification is defined (**Grgb, Gcieluv, Ghsv, Ghls**). The colour representation and specification are defined in 5.4 by the types **Gcolr_rep** and **Gcolr_specif.**

3.12 Colour characteristics

GKS defines the colour characteristics as a basic type. The colour characteristics is defined in this part of ISO/IEC 8651 by the data type **Gcolr_chars**, which is documented in 5.3.

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3.13 Storage of multi-dimensional arrays

3.13.1 Storage of 2*3 matrices

The entries of **Gtran_matrix** data types shall be stored such that the segment transformation is defined by

```
Tp.x  =  mat[0,0]*p.x  +  mat[0,1]*p.y  +  mat[0,2];
Tp.y  =  mat[1,0]*p.x  +  mat[1,1]*p.y  +  mat[1,2];
```

where **p** is a 2D point, **Tp** its transformation and **mat** is of type **Gtran_matrix**.

3.13.2 Storage of conics in 3*3 matrices

The entries of **Gconic_matrix** data types shall be stored such that the conic is defined by

$$a[0,0]x^2 + (a[0,1] + a[1,0])\ xy + a[1,1]y^2$$
$$+ (a[0,2] + a[2,0])x + (a[1,2] + a[2,1])y + a[2,2] = 0$$

where **a** is of type **Gconic_matrix**.

3.13.3 Storage of colour arrays

The entries of **Gpat_rep** data types shall be stored such that the colour specifier at the (i,j)-th entry is given by

$xxx_{i,j}$ = **colr_rect.dir_colr.xxx[i + DX*j]**; i = 0, . . . , DX - 1; j
$colr_ind_{i,j}$ = **colr_rect.colr_array[i + DX*j]**;
DX = **colr_rect.dims.size_x**;
DY = **colr_rect.dims.size_y**;

where xxx = (rgb|cieluv|hls|hsv) is of type **Gxxx** and **colr_rect** is of type **Gpat_rep**.

3.14 Compatibility with the 1991 edition

In the second (1994) edition of ISO/IEC 7942 some functions and data types of the 1985 edition have been overtaken or deprecated. They are documented in the informative annex G. Examples are the GKSM functions, which have been overtaken by AUDIT functions.

In this edition of ISO/IEC 8651–4 *all* functions and *all* data types of of the 1991 edition (the C binding of the 1985 edition of ISO/IEC 7942) have been preserved. The support of overtaken or deprecated functions or data types falls into two categories:

1) *Functions which have been renamed (e.g. INQUIRE TEXT EXTENT → GET TEXT EXTENT) or which have been incorporated into more compact functions (e.g. the OUTPUT functions).*
   These functions and their related data types are documented in clauses 5 and 7. For example, the function CREATE OUTPUT PRIMITIVE has been bound to the C function **gcreate_out_prim**. Besides that, however, the output functions **gpolyline, gpolyline_set, gnurb_set, gconic_sec_set, gpolymarker, gfill_area, gfill_area_set, gell_sec_set, gell_seg_set, gell_disc_set, gclosed_nurb_set, gtext, gcell_array, gdesign, ggdp** have been defined.

2) *Functions which have been deprecated (INQUIRE GKS LEVEL) or which have been overtaken by other functions (GKSM functions, for example) .*
   These functions are documented in annex E. They will be deleted at the next edition of this part of ISO/IEC 8651.

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4 Tables

4.1 Abbreviation policy in construction of identifiers

In the construction of the several data types, function names, etc., the following policy is applied:

1) All identifiers in the C binding are abbreviated using the same abbreviations for every component and using underscores to denote blanks.
2) The plural of an expression is constructed by adding an "s" after its abbreviation; so, for example, "vector" is abbreviated to "vec" and "vectors" is abbreviated to "vecs"; if an expression is mapped to NULL, so will be its plural.
3) Digits are also preceded by underscores.
4) The word REALIZED is not abbreviated in the second field of the enumeration data type **`Ginq_type`**; in all other cases it is abbreviated using the list in 4.2.
5) Construction of GKS/C identifiers:
   a) Function names:
      "**`g`**" (lower case) followed by abbreviated function name in lower case;
   b) Data types:
      "**`G`**" (upper case) followed by abbreviated data type in lower case;
   c) Fields of data types; the following refinements are used: "redundant" (words in the field name that are identical to those in the structure name) parts are omitted, if the context allows this; thus the linewidth in the field of **`Gline_bundle`** is abbreviated to **`width`**, because the context makes clear which width is used;
   d) Function macros:
      "**`Gfn_`**" followed by abbreviation of function name;
   e) Error macros:
      "**`GE_`**" followed by some abbreviated expression;
   f) Fields of enumeration types:
      "**`G`**" (upper case) followed by a prefix followed by an abbreviation of the field name; this prefix is constant for each enumeration field; all the fields are in upper case.

4.2 Table of abbreviations used

In this table, only words which are abbreviated are listed. They are used for

function names;
data types;
fields of data types;
error macros.

The word "NULL" denotes those words which are deleted completely when forming function names or data types.

Word or Phrase	Abbreviation
CIE L*u*v* (colour model)	cieluv
accumulate	accum
actual	act
addition	add
alignment	align
allocate	alloc
and	NULL

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application	appl
arithmetic	arith
associate(d)	assoc
at	NULL
attribute	attr
attribute source flag	asf
availability	avail
available	avail
begin	beg
between	NULL
boundaries	bndries
boundary	bndry
buffer	buf
cannot	cant
centre	ctr
character	char
characteristics	chars
circular	circ
classification	class
clipping	clip
colour	colr
component	comp
composite	comp
composition	comp
concatenation	concat
connection	conn
contour	cont
control	ctrl
conversion	conv
coordinate	coord
correspondence	corr
criterion	crit
current	cur
dashed	dash
default	def
defined	def
delete	del
deletion	dcl
dependent	dep
description table	dt
designation	design
detectability	det
detectable	det
device	dev
device coordinate(s)	dc
digital	digit
dimension	dim
direction	dir
display	disp
dotted	dot
duplicate	dup
elliptic	ell

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equal	eq
error	err
evaluate	eval
expansion	expan
facility	fac
factor	NULL
fill area	fill
from	NULL
function	func
generalized drawing primitive	gdp
generic	gen
gks closed	gkcl
gks open	gkop
graphical	graph
handling	hand
height	ht
highlighted	highl
highlighting	highl
homogeneous	homo
horizontal	hor
hue lightness saturation (colour model)	hls
hue saturation value (colour model)	hsv
hyperbola	hyp
identifier	id
implemantation	impl
implicit	impl
in	NULL
in use	NULL
index	ind
indicator	ind
individual	indiv
initial	init
initialize	init
input	in
input/output	io
inquire	inq
instance	inst
integer	int
interior	int
invalid	inval
invisible	invis
length	NULL
less than	lt
less than or equal	le
library	lib
locator	loc
logical	NULL
luminance	lum
mapped	map
mapping	map
maximum	max
measure	meas

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memory	mem
metafile	mf
minimum	min
monochrome	monochr
nominal	nom
normal	norm
normalization	norm
normalized device coordinate(s)	ndc
number	num
of	NULL
on	NULL
operating	op
operation	op
orientation	ori
output	out
overflow	overf
parallelogram	paral
parameter	param
pattern	pat
picture	pic
picture part closed	ppcl
picture part open	ppop
pointer	ptr
polynomial	pol
position	pos
precision	prec
predefined	pred
primary	prim
primitive	prim
priority	pri
process	proc
prompt	pr
prompt and echo type	pet
queue	NULL
rational	rat
realized	real
record	rec
rectangle	rect
red green blue (colour model)	rgb
reference	ref
registered	reg
reject	rej
relative	rel
replication	repl
representation	rep
request(ed)	req
retrieve	ret
rubber	rub
saturation	satur
scale factor	NULL
section	sec
sector	sec

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segment	seg
segment closed	sgcl
segment open	sgop
select	sel
selection	sel
selector	sel
sequence	seq
source	src
spacing	space
specification	specif
specified	specif
specifier	specif
state	st
state list	sl
stencil closed	stcl
stencil open	stop
storage	store
supported	NULL
suppress	suppr
tiling closed	tlcl
tiling open	tlop
to	NULL
tracking	track
transform(ation)	tran
unavailable	unavail
undefined	undef
undetectable	undet
unregistered	u
used	NULL
valuator	val
vector	vec
vertical	vert
viewport	vp
visibility	vis
visible	vis
visual	vis
which	NULL
window	win
with	NULL
workstation	ws
world coordinate	wc

4.3 Function names

4.3.1 List ordered alphabetically by bound name

gaccum_tran_matrix	ACCUMULATE TRANSFORMATION MATRIX
gactivate_ws	ACTIVATE WORKSTATION
gadd_set_names_nameset	ADD SET OF NAMES TO NAMESET
gadd_set_names_ndc_pic	ADD SET OF NAMES TO NDC PICTURE
gadd_set_scissors_ndc_pic	ADD SET OF SCISSORS TO NDC PICTURE
gadd_set_scissors_scissor_set	ADD SET OF SCISSORS TO SCISSOR SET

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gappend_pic_part	APPEND PICTURE PART
gar_pic_part	ARCHIVE PICTURE PART
gassoc_seg_ws	ASSOCIATE SEGMENT WITH WORKSTATION
gaudit	AUDIT
gawait_event	AWAIT EVENT
gawait_in	AWAIT INPUT
gcell_array	CELL ARRAY
gclear_ws	CLEAR WORKSTATION
gclose_gks	CLOSE GKS
gclose_pic_part	CLOSE PICTURE PART
gclose_seg	CLOSE SEGMENT
gclose_stencil	CLOSE STENCIL
gclose_tiling	CLOSE TILING
gclose_ws	CLOSE WORKSTATION
gclosed_nurb_set	CLOSED NURB SET
gconic_sec_set	CONIC SECTION SET
gconv_colr	CONVERT COLOUR
gcopy_blank_real_pic_real_mf	COPY BLANK REALIZED PICTURE TO REALIZED METAFILE
gcopy_ndc_mf_pic_ndc_pic	COPY NDC METAFILE PICTURE TO NDC PICTURE
gcopy_ndc_pic_ndc_mf	COPY NDC PICTURE TO NDC METAFILE
gcopy_ndc_pic_pic_part_store	COPY NDC PICTURE TO PICTURE PART STORE
gcopy_pic_part_pic_part_store	COPY PICTURE PART FROM PICTURE PART STORE
gcopy_real_mf_pic_backdrop	COPY REALIZED METAFILE PICTURE TO BACKDROP
gcopy_real_pic_real_mf	COPY REALIZED PICTURE TO REALIZED METAFILE
gcopy_seg_ws	COPY SEGMENT FROM WORKSTATION
gcreate_out_prim	CREATE OUTPUT PRIMITIVE
gcreate_seg	CREATE SEGMENT
gcreate_stencil_bndry	CREATE STENCIL FROM BOUNDARY
gcreate_stencil_conts	CREATE STENCIL FROM CONTOURS
gcreate_store	CREATE STORAGE
gcreate_tiling_comp	CREATE TILING COMPONENT
gdeactivate_ws	DEACTIVATE WORKSTATION
gdef_in_dev	DEFINE LOGICAL INPUT DEVICE
gdel_pic_part	DELETE PICTURE PART
gdel_prims_ndc_pic	DELETE PRIMITIVES FROM NDC PICTURE
gdel_seg	DELETE SEGMENT
gdel_seg_ws	DELETE SEGMENT FROM WORKSTATION
gdel_stencil	DELETE STENCIL
gdel_store	DELETE STORAGE
gdel_tiling	DELETE TILING
gdesign	DESIGN
gell_disc_set	ELLIPTIC DISC SET
gell_sec_set	ELLIPTIC SECTOR SET
gell_seg_set	ELLIPTIC SEGMENT SET
gemergency_close_gks	EMERGENCY CLOSE GKS
gerr_hand	ERROR HANDLING
gerr_log	ERROR LOGGING
gescape	ESCAPE
geval_circ_arc_3_point	EVALUATE CIRCULAR ARC 3 POINT
geval_circ_arc_ctr	EVALUATE CIRCULAR ARC CENTRE
geval_circle	EVALUATE CIRCLE
geval_ell	EVALUATE ELLIPSE

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geval_ell_arc	EVALUATE ELLIPTIC ARC
geval_hyp_arc	EVALUATE HYPERBOLIC ARC
geval_par_arc	EVALUATE PARABOLIC ARC
geval_tran_matrix	EVALUATE TRANSFORMATION MATRIX
geval_view_map_matrix	EVALUATE VIEW MAPPING MATRIX
geval_view_ori_matrix	EVALUATE VIEW ORIENTATION MATRIX
geval_wc_ord	EVALUATE WC ORDINATE
gfill_area	FILL AREA
gfill_area_set	FILL AREA SET
gflush_dev_events	FLUSH DEVICE EVENTS
ggdp	GENERALIZED DRAWING PRIMITIVE
gget_choice	GET CHOICE
gget_glyph_name	GET GLYPH NAME
gget_loc	GET LOCATOR
gget_map_seg_name	GET MAPPED SEGMENT NAME
gget_map_ws_id	GET MAPPED WORKSTATION IDENTIFIER
gget_pick	GET PICK
gget_stencil_attr	GET STENCIL ATTRIBUTE
gget_string	GET STRING
gget_stroke	GET STROKE
gget_text_extent	GET TEXT EXTENT
gget_val	GET VALUATOR
gget_ws_status	GET WORKSTATION STATUS
ginit_choice	INITIALIZE CHOICE
ginit_in_dev	INITIALIZE LOGICAL INPUT DEVICE
ginit_loc	INITIALIZE LOCATOR
ginit_pick	INITIALIZE PICK
ginit_string	INITIALIZE STRING
ginit_stroke	INITIALIZE STROKE
ginit_val	INITIALIZE VALUATOR
ginq_area_facs	INQUIRE AREA FACILITIES
ginq_area_ind	INQUIRE AREA INDEX
ginq_area_rep	INQUIRE AREA REPRESENTATION
ginq_asfs	INQUIRE ATTRIBUTE SOURCE FLAGS
ginq_char_expan	INQUIRE CHARACTER EXPANSION FACTOR
ginq_char_ht	INQUIRE CHARACTER HEIGHT
ginq_char_space	INQUIRE CHARACTER SPACING
ginq_char_up_vec	INQUIRE CHARACTER UP VECTOR
ginq_choice_st	INQUIRE CHOICE DEVICE STATE
ginq_colr_facs	INQUIRE COLOUR FACILITIES
ginq_colr_rep	INQUIRE COLOUR REPRESENTATION
ginq_cur_cont_attrs	INQUIRE CURRENT CONTOUR ATTRIBUTES
ginq_cur_norm_tran_num	INQUIRE CURRENT NORMALIZATION TRANSFORMATION NUMBER
ginq_cur_pick_id	INQUIRE CURRENT PICK IDENTIFIER VALUE
ginq_def_choice_data	INQUIRE DEFAULT CHOICE DEVICE DATA
ginq_def_font_ind_map	INQUIRE DEFAULT FONT INDEX MAPPING
ginq_def_loc_data	INQUIRE DEFAULT LOCATOR DEVICE DATA
ginq_def_pick_data	INQUIRE DEFAULT PICK DEVICE DATA
ginq_def_string_data	INQUIRE DEFAULT STRING DEVICE DATA
ginq_def_stroke_data	INQUIRE DEFAULT STROKE DEVICE DATA
ginq_def_val_data	INQUIRE DEFAULT VALUATOR DEVICE DATA
ginq_disp_space_size	INQUIRE DISPLAY SPACE SIZE

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ginq_edge_colr_ind	INQUIRE EDGE COLOUR INDEX
ginq_edge_colr_specif	INQUIRE EDGE COLOUR SPECIFIER
ginq_edge_flag	INQUIRE EDGE FLAG
ginq_edgetype	INQUIRE EDGETYPE
ginq_edgewidth	INQUIRE EDGEWIDTH SCALE FACTOR
ginq_font_ind_map	INQUIRE FONT INDEX MAPPING
ginq_gen_ws_dt_entry	INQUIRE GENERIC WORKSTATION DESCRIPTION TABLE ENTRY
ginq_gks_dt_entry	INQUIRE GKS DESCRIPTION TABLE ENTRY'
ginq_gks_sl_entry	INQUIRE GKS STATE LIST ENTRY
ginq_global_tran_matrix	INQUIRE GLOBAL TRANSFORMATION MATRIX
ginq_in_dev_comps	INQUIRE INPUT DEVICE COMPOSITIONS
ginq_in_dev_init_values	INQUIRE INPUT DEVICE INITIAL VALUES
ginq_in_overf	INQUIRE INPUT QUEUE OVERFLOW
ginq_in_queue	INQUIRE INPUT QUEUE
ginq_in_table	INQUIRE INPUT DEVICE OPERATING MODES AND INITIAL VALUES
ginq_int_colr_ind	INQUIRE INTERIOR COLOUR INDEX
ginq_int_colr_specif	INQUIRE INTERIOR COLOUR SPECIFIER
ginq_int_style	INQUIRE INTERIOR STYLE
ginq_int_style_ind	INQUIRE INTERIOR STYLE INDEX
ginq_line_colr_ind	INQUIRE LINE COLOUR INDEX
ginq_line_colr_specif	INQUIRE LINE COLOUR SPECIFIER
ginq_line_facs	INQUIRE LINE FACILITIES
ginq_line_ind	INQUIRE LINE INDEX
ginq_line_rep	INQUIRE LINE REPRESENTATION
ginq_linetype	INQUIRE LINETYPE
ginq_linewidth	INQUIRE LINEWIDTH SCALE FACTOR
ginq_list_area_inds	INQUIRE LIST OF AREA INDICES
ginq_list_avail_fonts	INQUIRE LIST OF AVAILABLE FONTS
ginq_list_avail_gdps	INQUIRE LIST OF AVAILABLE GENERALIZED DRAWING PRIMITIVES
ginq_list_avail_ws_types	INQUIRE LIST OF AVAILABLE WORKSTATION TYPES
ginq_list_colr_inds	INQUIRE LIST OF COLOUR INDICES
ginq_list_line_inds	INQUIRE LIST OF LINE INDICES
ginq_list_marker_inds	INQUIRE LIST OF MARKER INDICES
ginq_list_norm_trans	INQUIRE LIST OF NORMALIZATION TRANSFORMATIONS
ginq_list_pat_inds	INQUIRE LIST OF PATTERN INDICES
ginq_list_text_inds	INQUIRE LIST OF TEXT INDICES
ginq_list_vp_in_pris	INQUIRE LIST OF VIEWPORT INPUT PRIORITIES
ginq_loc_st	INQUIRE LOCATOR DEVICE STATE
ginq_local_tran_matrix	INQUIRE LOCAL TRANSFORMATION MATRIX
ginq_marker_colr_ind	INQUIRE MARKER COLOUR INDEX
ginq_marker_colr_specif	INQUIRE MARKER COLOUR SPECIFIER
ginq_marker_facs	INQUIRE MARKER FACILITIES
ginq_marker_ind	INQUIRE MARKER INDEX
ginq_marker_rep	INQUIRE MARKER REPRESENTATION
ginq_marker_size	INQUIRE MARKER SIZE SCALE FACTOR
ginq_marker_type	INQUIRE MARKER TYPE
ginq_name_open_pic_part	INQUIRE NAME OF OPEN PICTURE PART
ginq_name_open_seg	INQUIRE NAME OF OPEN SEGMENT
ginq_name_open_stencil	INQUIRE NAME OF OPEN STENCIL
ginq_name_open_tiling	INQUIRE NAME OF OPEN TILING
ginq_nameset	INQUIRE NAMESET
ginq_norm_tran	INQUIRE NORMALIZATION TRANSFORMATION

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ginq_num_avail_in	INQUIRE NUMBER OF AVAILABLE INPUT DEVICES
ginq_op_st_entry	INQUIRE OPERATING STATE ENTRY
ginq_pat_facs	INQUIRE PATTERN FACILITIES
ginq_pat_ref_point	INQUIRE PATTERN REFERENCE POINT
ginq_pat_rep	INQUIRE PATTERN REPRESENTATION
ginq_pat_size	INQUIRE PATTERN SIZE
ginq_pick_st	INQUIRE PICK DEVICE STATE
ginq_pred_area_rep	INQUIRE PREDEFINED AREA REPRESENTATION
ginq_pred_colr_rep	INQUIRE PREDEFINED COLOUR REPRESENTATION
ginq_pred_line_rep	INQUIRE PREDEFINED LINE REPRESENTATION
ginq_pred_marker_rep	INQUIRE PREDEFINED MARKER REPRESENTATION
ginq_pred_pat_rep	INQUIRE PREDEFINED PATTERN REPRESENTATION
ginq_pred_text_rep	INQUIRE PREDEFINED TEXT REPRESENTATION
ginq_route_dir	INQUIRE ROUTE DIRECTION
ginq_scissor_mode	INQUIRE SCISSOR MODE
ginq_scissor_set	INQUIRE SCISSOR SET
ginq_seg_attrs	INQUIRE SEGMENT ATTRIBUTES
ginq_sel_table	INQUIRE TABLE OF SELECTION CRITERIA
ginq_set_active_wss	INQUIRE SET OF ACTIVE WORKSTATIONS
ginq_set_assoc_wss	INQUIRE SET OF ASSOCIATED WORKSTATIONS
ginq_set_avail_in_devs	INQUIRE SET OF AVAILABLE INPUT DEVICES
ginq_set_avail_meass	INQUIRE SET OF AVAILABLE MEASURES
ginq_set_avail_triggers	INQUIRE SET OF AVAILABLE TRIGGERS
ginq_set_open_audits	INQUIRE SET OF OPEN AUDITS
ginq_set_open_playbacks	INQUIRE SET OF OPEN PLAYBACKS
ginq_set_open_wss	INQUIRE SET OF OPEN WORKSTATIONS
ginq_set_pic_part_names	INQUIRE SET OF PICTURE PART NAMES IN USE
ginq_set_seg_names	INQUIRE SET OF SEGMENT NAMES IN USE
ginq_set_seg_names_ws	INQUIRE SET OF SEGMENT NAMES ON WORKSTATION
ginq_set_stencil_names	INQUIRE SET OF STENCIL NAMES IN USE
ginq_set_tiling_names	INQUIRE SET OF TILING NAMES IN USE
ginq_specif_ws_dt_entry	INQUIRE SPECIFIC WORKSTATION DESCRIPTION TABLE ENTRY
ginq_specif_ws_dt_entry_st	INQUIRE SPECIFIC WORKSTATION DESCRIPTION TABLE ENTRY STATE
ginq_stencil_attrs	INQUIRE STENCIL ATTRIBUTES
ginq_string_st	INQUIRE STRING DEVICE STATE
ginq_stroke_st	INQUIRE STROKE DEVICE STATE
ginq_text_align	INQUIRE TEXT ALIGNMENT
ginq_text_colr_ind	INQUIRE TEXT COLOUR INDEX
ginq_text_colr_specif	INQUIRE TEXT COLOUR SPECIFIER
ginq_text_extent	INQUIRE TEXT EXTENT
ginq_text_facs	INQUIRE TEXT FACILITIES
ginq_text_font_prec	INQUIRE TEXT FONT AND PRECISION
ginq_text_ind	INQUIRE TEXT INDEX
ginq_text_path	INQUIRE TEXT PATH
ginq_text_rep	INQUIRE TEXT REPRESENTATION
ginq_text_skew_angle	INQUIRE TEXT SKEW ANGLE
ginq_val_st	INQUIRE VALUATOR DEVICE STATE
ginq_view_pris	INQUIRE VIEW PRIORITIES
ginq_view_rep	INQUIRE VIEW REPRESENTATION
ginq_vis_effects_st	INQUIRE VISUAL EFFECTS STATE
ginq_ws_class	INQUIRE WORKSTATION CLASSIFICATION
ginq_ws_conn_type	INQUIRE WORKSTATION CONNECTION AND TYPE

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ginq_ws_sl_entry	INQUIRE WORKSTATION STATE LIST ENTRY
ginq_ws_st	INQUIRE WORKSTATION STATE
ginq_ws_win_vp	INQUIRE WORKSTATION WINDOW AND VIEWPORT
ginsert_seg	INSERT SEGMENT
ginst_stencil	INSTANCE STENCIL
ginst_stencil_path	INSTANCE STENCIL ALONG PATH
ginst_stencil_seq_path	INSTANCE STENCIL SEQUENCE ALONG PATH
gmessage	MESSAGE
gnurb_set	NURB SET
gopen_gks	OPEN GKS
gopen_pic_part	OPEN PICTURE PART
gopen_stencil	OPEN STENCIL
gopen_tiling	OPEN TILING
gopen_ws	OPEN WORKSTATION
gplayback	PLAYBACK
gpolyline	POLYLINE
gpolyline_set	POLYLINE SET
gpolymarker	POLYMARKER
gproc_audit_item	PROCESS AUDIT ITEM
gread_item_audit	READ ITEM FROM AUDIT
gread_item_func_name_audit	READ ITEM FUNCTION NAME FROM AUDIT
gremove_backdrop	REMOVE BACKDROP
gremove_set_names_nameset	REMOVE SET OF NAMES FROM NAMESET
gremove_set_names_ndc_pic	REMOVE SET OF NAMES FROM NDC PICTURE
gremove_set_scissors_ndc_pic	REMOVE SET OF SCISSORS FROM NDC PICTURE
gremove_set_scissors_scissor_set	REMOVE SET OF SCISSORS FROM SCISSOR SET
grename_pic_part	RENAME PICTURE PART
grename_seg	RENAME SEGMENT
grename_stencil	RENAME STENCIL
grename_tiling	RENAME TILING
greopen_pic_part	REOPEN PICTURE PART
greorder_ndc_pic	REORDER NDC PICTURE
greq_choice	REQUEST CHOICE
greq_in	REQUEST INPUT
greq_loc	REQUEST LOCATOR
greq_pick	REQUEST PICK
greq_string	REQUEST STRING
greq_stroke	REQUEST STROKE
greq_val	REQUEST VALUATOR
greset_specif_ws_dt_entry_st	RESET SPECIFIC WORKSTATION DESCRIPTION TABLE ENTRY STATE
grestore_gks_sl	RESTORE GKS STATE LIST
grestore_ws_sl	RESTORE WORKSTATION STATE LIST
gret_pic_part_ar	RETRIEVE PICTURE PART FROM ARCHIVE
groute	ROUTE
gsample_choice	SAMPLE CHOICE
gsample_in	SAMPLE INPUT
gsample_loc	SAMPLE LOCATOR
gsample_pick	SAMPLE PICK
gsample_string	SAMPLE STRING
gsample_stroke	SAMPLE STROKE
gsample_val	SAMPLE VALUATOR
gsave_gks_sl	SAVE GKS STATE LIST

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gsave_ws_sl	SAVE WORKSTATION STATE LIST
gsel_norm_tran	SELECT NORMALIZATION TRANSFORMATION
gset_area_ind	SET AREA INDEX
gset_area_rep	SET AREA REPRESENTATION
gset_asfs	SET ATTRIBUTE SOURCE FLAGS
gset_char_code	SET CHARACTER CODE
gset_char_expan	SET CHARACTER EXPANSION FACTOR
gset_char_ht	SET CHARACTER HEIGHT
gset_char_space	SET CHARACTER SPACING
gset_char_up_vec	SET CHARACTER UP VECTOR
gset_choice_mode	SET CHOICE MODE
gset_colr_rep	SET COLOUR REPRESENTATION
gset_cont_attr	SET CONTOUR ATTRIBUTE
gset_det	SET DETECTABILITY
gset_edge_colr_ind	SET EDGE COLOUR INDEX
gset_edge_colr_specif	SET EDGE COLOUR SPECIFIER
gset_edge_flag	SET EDGE FLAG
gset_edgetype	SET EDGETYPE
gset_edgewidth	SET EDGEWIDTH SCALE FACTOR
gset_err_hand	SET ERROR HANDLING
gset_font_ind_map	SET FONT INDEX MAPPING
gset_global_tran_matrix	SET GLOBAL TRANSFORMATION MATRIX
gset_highl	SET HIGHLIGHTING
gset_in_dev_mode	SET LOGICAL INPUT DEVICE MODE
gset_int_colr_ind	SET INTERIOR COLOUR INDEX
gset_int_colr_specif	SET INTERIOR COLOUR SPECIFIER
gset_int_style	SET INTERIOR STYLE
gset_int_style_ind	SET INTERIOR STYLE INDEX
gset_line_colr_ind	SET LINE COLOUR INDEX
gset_line_colr_specif	SET LINE COLOUR SPECIFIER
gset_line_ind	SET LINE INDEX
gset_line_rep	SET LINE REPRESENTATION
gset_linetype	SET LINETYPE
gset_linewidth	SET LINEWIDTH SCALE FACTOR
gset_loc_mode	SET LOCATOR MODE
gset_local_tran_matrix	SET LOCAL TRANSFORMATION MATRIX
gset_marker_colr_ind	SET LINE COLOUR INDEX
gset_marker_colr_specif	SET MARKER COLOUR SPECIFIER
gset_marker_ind	SET MARKER INDEX
gset_marker_rep	SET MARKER REPRESENTATION
gset_marker_size	SET MARKER SIZE SCALE FACTOR
gset_marker_type	SET MARKER TYPE
gset_nameset	SET NAMESET
gset_ndc_pic_prim_attr	SET NDC PICTURE PRIMITIVE ATTRIBUTE
gset_norm_tran_num	SET NORMALIZATION TRANSFORMATION NUMBER
gset_pat_ref_point	SET PATTERN REFERENCE POINT
gset_pat_rep	SET PATTERN REPRESENTATION
gset_pat_size	SET PATTERN SIZE
gset_pick_id	SET PICK IDENTIFIER
gset_pick_mode	SET PICK MODE
gset_prim_attr	SET PRIMITIVE ATTRIBUTE
gset_rep	SET REPRESENTATION

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gset_scissor_mode	SET SCISSOR MODE
gset_scissor_set	SET SCISSOR SET
gset_seg_attr	SET SEGMENT ATTRIBUTE
gset_seg_pri	SET SEGMENT PRIORITY
gset_seg_tran	SET SEGMENT TRANSFORMATION
gset_stencil_attr	SET STENCIL ATTRIBUTE
gset_string_mode	SET STRING MODE
gset_stroke_mode	SET STROKE MODE
gset_text_align	SET TEXT ALIGNMENT
gset_text_colr_ind	SET TEXT COLOUR INDEX
gset_text_colr_specif	SET TEXT COLOUR SPECIFIER
gset_text_font_prec	SET TEXT FONT AND PRECISION
gset_text_ind	SET TEXT INDEX
gset_text_path	SET TEXT PATH
gset_text_rep	SET TEXT REPRESENTATION
gset_text_skew_angle	SET TEXT SKEW ANGLE
gset_val_mode	SET VALUATOR MODE
gset_view	SET VIEW
gset_view_pri	SET VIEW PRIORITY
gset_view_sel_crit	SET VIEW SELECTION CRITERION
gset_vis	SET VISIBILITY
gset_vp	SET VIEWPORT
gset_vp_in_pri	SET VIEWPORT INPUT PRIORITY
gset_win	SET WINDOW
gset_win_vp	SET WINDOW AND VIEWPORT
gset_ws_sel_crit	SET WORKSTATION SELECTION CRITERION
gset_ws_vis_effects	SET WORKSTATION VISUAL EFFECTS
gset_ws_vp	SET WORKSTATION VIEWPORT
gset_ws_win	SET WORKSTATION WINDOW
gset_ws_win_vp	SET WORKSTATION WINDOW AND VIEWPORT
gtext	TEXT
gwrite_user_rec_audit	WRITE USER RECORD TO AUDIT

4.3.2 List ordered alphabetically by GKS name

ACCUMULATE TRANSFORMATION MATRIX	**gaccum_tran_matrix**
ACTIVATE WORKSTATION	**gactivate_ws**
ADD SET OF NAMES TO NAMESET	**gadd_set_names_nameset**
ADD SET OF NAMES TO NDC PICTURE	**gadd_set_names_ndc_pic**
ADD SET OF SCISSORS TO NDC PICTURE	**gadd_set_scissors_ndc_pic**
ADD SET OF SCISSORS TO SCISSOR SET	**gadd_set_scissors_scissor_set**
APPEND PICTURE PART	**gappend_pic_part**
ARCHIVE PICTURE PART	**gar_pic_part**
ASSOCIATE SEGMENT WITH WORKSTATION	**gassoc_seg_ws**
AUDIT	**gaudit**
AWAIT EVENT	**gawait_event**
AWAIT INPUT	**gawait_in**
CELL ARRAY	**gcell_array**
CLEAR WORKSTATION	**gclear_ws**
CLOSE GKS	**gclose_gks**
CLOSE PICTURE PART	**gclose_pic_part**
CLOSE SEGMENT	**gclose_seg**

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CLOSE STENCIL	gclose_stencil
CLOSE TILING	gclose_tiling
CLOSE WORKSTATION	gclose_ws
CLOSED NURB SET	gclosed_nurb_set
CONIC SECTION SET	gconic_sec_set
CONVERT COLOUR	gconv_colr
COPY BLANK REALIZED PICTURE TO REALIZED METAFILE	gcopy_blank_real_pic_real_mf
COPY NDC METAFILE PICTURE TO NDC PICTURE	gcopy_ndc_mf_pic_ndc_pic
COPY NDC PICTURE TO NDC METAFILE	gcopy_ndc_pic_ndc_mf
COPY NDC PICTURE TO PICTURE PART STORE	gcopy_ndc_pic_pic_part_store
COPY PICTURE PART FROM PICTURE PART STORE	gcopy_pic_part_pic_part_store
COPY REALIZED METAFILE PICTURE TO BACKDROP	gcopy_real_mf_pic_backdrop
COPY REALIZED PICTURE TO REALIZED METAFILE	gcopy_real_pic_real_mf
COPY SEGMENT FROM WORKSTATION	gcopy_seg_ws
CREATE OUTPUT PRIMITIVE	gcreate_out_prim
CREATE SEGMENT	gcreate_seg
CREATE STENCIL FROM BOUNDARY	gcreate_stencil_bndry
CREATE STENCIL FROM CONTOURS	gcreate_stencil_conts
CREATE STORAGE	gcreate_store
CREATE TILING COMPONENT	gcreate_tiling_comp
DEACTIVATE WORKSTATION	gdeactivate_ws
DEFINE LOGICAL INPUT DEVICE	gdef_in_dev
DELETE PICTURE PART	gdel_pic_part
DELETE PRIMITIVES FROM NDC PICTURE	gdel_prims_ndc_pic
DELETE SEGMENT	gdel_seg
DELETE SEGMENT FROM WORKSTATION	gdel_seg_ws
DELETE STENCIL	gdel_stencil
DELETE STORAGE	gdel_store
DELETE TILING	gdel_tiling
DESIGN	gdesign
ELLIPTIC DISC SET	gell_disc_set
ELLIPTIC SECTOR SET	gell_sec_set
ELLIPTIC SEGMENT SET	gell_seg_set
EMERGENCY CLOSE GKS	gemergency_close_gks
ERROR HANDLING	gerr_hand
ERROR LOGGING	gerr_log
ESCAPE	gescape
EVALUATE CIRCLE	geval_circle
EVALUATE CIRCULAR ARC 3 POINT	geval_circ_arc_3_point
EVALUATE CIRCULAR ARC CENTRE	geval_circ_arc_ctr
EVALUATE ELLIPSE	geval_ell
EVALUATE ELLIPTIC ARC	geval_ell_arc
EVALUATE HYPERBOLIC ARC	geval_hyp_arc
EVALUATE PARABOLIC ARC	geval_par_arc
EVALUATE TRANSFORMATION MATRIX	geval_tran_matrix
EVALUATE VIEW MAPPING MATRIX	geval_view_map_matrix
EVALUATE VIEW ORIENTATION MATRIX	geval_view_ori_matrix
EVALUATE WC ORDINATE	geval_wc_ord
FILL AREA	gfill_area
FILL AREA SET	gfill_area_set
FLUSH DEVICE EVENTS	gflush_dev_events
GENERALIZED DRAWING PRIMITIVE	ggdp

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GET CHOICE	gget_choice
GET GLYPH NAME	gget_glyph_name
GET LOCATOR	gget_loc
GET MAPPED SEGMENT NAME	gget_map_seg_name
GET MAPPED WORKSTATION IDENTIFIER	gget_map_ws_id
GET PICK	gget_pick
GET STENCIL ATTRIBUTE	gget_stencil_attr
GET STRING	gget_string
GET STROKE	gget_stroke
GET TEXT EXTENT	gget_text_extent
GET VALUATOR	gget_val
GET WORKSTATION STATUS	gget_ws_status
INITIALIZE CHOICE	ginit_choice
INITIALIZE LOCATOR	ginit_loc
INITIALIZE LOGICAL INPUT DEVICE	ginit_in_dev
INITIALIZE PICK	ginit_pick
INITIALIZE STRING	ginit_string
INITIALIZE STROKE	ginit_stroke
INITIALIZE VALUATOR	ginit_val
INQUIRE AREA FACILITIES	ginq_area_facs
INQUIRE AREA INDEX	ginq_area_ind
INQUIRE AREA REPRESENTATION	ginq_area_rep
INQUIRE ATTRIBUTE SOURCE FLAGS	ginq_asfs
INQUIRE CHARACTER EXPANSION FACTOR	ginq_char_expan
INQUIRE CHARACTER HEIGHT	ginq_char_ht
INQUIRE CHARACTER SPACING	ginq_char_space
INQUIRE CHARACTER UP VECTOR	ginq_char_up_vec
INQUIRE CHOICE DEVICE STATE	ginq_choice_st
INQUIRE COLOUR FACILITIES	ginq_colr_facs
INQUIRE COLOUR REPRESENTATION	ginq_colr_rep
INQUIRE CURRENT CONTOUR ATTRIBUTES	ginq_cur_cont_attrs
INQUIRE CURRENT NORMALIZATION TRANSFORMATION NUMBER	ginq_cur_norm_tran_num
INQUIRE CURRENT PICK IDENTIFIER VALUE	ginq_cur_pick_id
INQUIRE DEFAULT CHOICE DEVICE DATA	ginq_def_choice_data
INQUIRE DEFAULT FONT INDEX MAPPING	ginq_def_font_ind_map
INQUIRE DEFAULT LOCATOR DEVICE DATA	ginq_def_loc_data
INQUIRE DEFAULT PICK DEVICE DATA	ginq_def_pick_data
INQUIRE DEFAULT STRING DEVICE DATA	ginq_def_string_data
INQUIRE DEFAULT STROKE DEVICE DATA	ginq_def_stroke_data
INQUIRE DEFAULT VALUATOR DEVICE DATA	ginq_def_val_data
INQUIRE DISPLAY SPACE SIZE	ginq_disp_space_size
INQUIRE EDGE COLOUR INDEX	ginq_edge_colr_ind
INQUIRE EDGE COLOUR SPECIFIER	ginq_edge_colr_specif
INQUIRE EDGE FLAG	ginq_edge_flag
INQUIRE EDGETYPE	ginq_edgetype
INQUIRE EDGEWIDTH SCALE FACTOR	ginq_edgewidth
INQUIRE FONT INDEX MAPPING	ginq_font_ind_map
INQUIRE GENERIC WORKSTATION DESCRIPTION TABLE ENTRY	ginq_gen_ws_dt_entry
INQUIRE GKS DESCRIPTION TABLE ENTRY'	ginq_gks_dt_entry
INQUIRE GKS STATE LIST ENTRY	ginq_gks_sl_entry
INQUIRE GLOBAL TRANSFORMATION MATRIX	ginq_global_tran_matrix
INQUIRE INPUT DEVICE COMPOSITIONS	ginq_in_dev_comps

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INQUIRE INPUT DEVICE INITIAL VALUES	**ginq_in_dev_init_values**
INQUIRE INPUT DEVICE OPERATING MODES AND INITIAL VALUES	**ginq_in_table**
INQUIRE INPUT QUEUE	**ginq_in_queue**
INQUIRE INPUT QUEUE OVERFLOW	**ginq_in_overf**
INQUIRE INTERIOR COLOUR INDEX	**ginq_int_colr_ind**
INQUIRE INTERIOR COLOUR SPECIFIER	**ginq_int_colr_specif**
INQUIRE INTERIOR STYLE	**ginq_int_style**
INQUIRE INTERIOR STYLE INDEX	**ginq_int_style_ind**
INQUIRE LINE COLOUR INDEX	**ginq_line_colr_ind**
INQUIRE LINE COLOUR SPECIFIER	**ginq_line_colr_specif**
INQUIRE LINE FACILITIES	**ginq_line_facs**
INQUIRE LINE INDEX	**ginq_line_ind**
INQUIRE LINE REPRESENTATION	**ginq_line_rep**
INQUIRE LINETYPE	**ginq_linetype**
INQUIRE LINEWIDTH SCALE FACTOR	**ginq_linewidth**
INQUIRE LIST OF AREA INDICES	**ginq_list_area_inds**
INQUIRE LIST OF AVAILABLE FONTS	**ginq_list_avail_fonts**
INQUIRE LIST OF AVAILABLE GENERALIZED DRAWING PRIMITIVES	**ginq_list_avail_gdps**
INQUIRE LIST OF AVAILABLE WORKSTATION TYPES	**ginq_list_avail_ws_types**
INQUIRE LIST OF COLOUR INDICES	**ginq_list_colr_inds**
INQUIRE LIST OF LINE INDICES	**ginq_list_line_inds**
INQUIRE LIST OF MARKER INDICES	**ginq_list_marker_inds**
INQUIRE LIST OF NORMALIZATION TRANSFORMATIONS	**ginq_list_norm_trans**
INQUIRE LIST OF PATTERN INDICES	**ginq_list_pat_inds**
INQUIRE LIST OF TEXT INDICES	**ginq_list_text_inds**
INQUIRE LIST OF VIEWPORT INPUT PRIORITIES	**ginq_list_vp_in_pris**
INQUIRE LOCAL TRANSFORMATION MATRIX	**ginq_local_tran_matrix**
INQUIRE LOCATOR DEVICE STATE	**ginq_loc_st**
INQUIRE MARKER COLOUR INDEX	**ginq_marker_colr_ind**
INQUIRE MARKER COLOUR SPECIFIER	**ginq_marker_colr_specif**
INQUIRE MARKER FACILITIES	**ginq_marker_facs**
INQUIRE MARKER INDEX	**ginq_marker_ind**
INQUIRE MARKER REPRESENTATION	**ginq_marker_rep**
INQUIRE MARKER SIZE SCALE FACTOR	**ginq_marker_size**
INQUIRE MARKER TYPE	**ginq_marker_type**
INQUIRE NAME OF OPEN PICTURE PART	**ginq_name_open_pic_part**
INQUIRE NAME OF OPEN SEGMENT	**ginq_name_open_seg**
INQUIRE NAME OF OPEN STENCIL	**ginq_name_open_stencil**
INQUIRE NAME OF OPEN TILING	**ginq_name_open_tiling**
INQUIRE NAMESET	**ginq_nameset**
INQUIRE NORMALIZATION TRANSFORMATION	**ginq_norm_tran**
INQUIRE NUMBER OF AVAILABLE INPUT DEVICES	**ginq_num_avail_in**
INQUIRE OPERATING STATE ENTRY	**ginq_op_st_entry**
INQUIRE PATTERN FACILITIES	**ginq_pat_facs**
INQUIRE PATTERN REFERENCE POINT	**ginq_pat_ref_point**
INQUIRE PATTERN REPRESENTATION	**ginq_pat_rep**
INQUIRE PATTERN SIZE	**ginq_pat_size**
INQUIRE PICK DEVICE STATE	**ginq_pick_st**
INQUIRE PREDEFINED AREA REPRESENTATION	**ginq_pred_area_rep**
INQUIRE PREDEFINED COLOUR REPRESENTATION	**ginq_pred_colr_rep**
INQUIRE PREDEFINED LINE REPRESENTATION	**ginq_pred_line_rep**
INQUIRE PREDEFINED MARKER REPRESENTATION	**ginq_pred_marker_rep**

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INQUIRE PREDEFINED PATTERN REPRESENTATION	**ginq_pred_pat_rep**
INQUIRE PREDEFINED TEXT REPRESENTATION	**ginq_pred_text_rep**
INQUIRE ROUTE DIRECTION	**ginq_route_dir**
INQUIRE SCISSOR MODE	**ginq_scissor_mode**
INQUIRE SCISSOR SET	**ginq_scissor_set**
INQUIRE SEGMENT ATTRIBUTES	**ginq_seg_attrs**
INQUIRE SET OF ACTIVE WORKSTATIONS	**ginq_set_active_wss**
INQUIRE SET OF ASSOCIATED WORKSTATIONS	**ginq_set_assoc_wss**
INQUIRE SET OF AVAILABLE INPUT DEVICES	**ginq_set_avail_in_devs**
INQUIRE SET OF AVAILABLE MEASURES	**ginq_set_avail_meass**
INQUIRE SET OF AVAILABLE TRIGGERS	**ginq_set_avail_triggers**
INQUIRE SET OF OPEN AUDITS	**ginq_set_open_audits**
INQUIRE SET OF OPEN PLAYBACKS	**ginq_set_open_playbacks**
INQUIRE SET OF OPEN WORKSTATIONS	**ginq_set_open_wss**
INQUIRE SET OF PICTURE PART NAMES IN USE	**ginq_set_pic_part_names**
INQUIRE SET OF SEGMENT NAMES IN USE	**ginq_set_seg_names**
INQUIRE SET OF SEGMENT NAMES ON WORKSTATION	**ginq_set_seg_names_ws**
INQUIRE SET OF STENCIL NAMES IN USE	**ginq_set_stencil_names**
INQUIRE SET OF TILING NAMES IN USE	**ginq_set_tiling_names**
INQUIRE SPECIFIC WORKSTATION DESCRIPTION TABLE ENTRY	**ginq_specif_ws_dt_entry**
INQUIRE SPECIFIC WORKSTATION DESCRIPTION TABLE ENTRY STATE	**ginq_specif_ws_dt_entry_st**
INQUIRE STENCIL ATTRIBUTES	**ginq_stencil_attrs**
INQUIRE STRING DEVICE STATE	**ginq_string_st**
INQUIRE STROKE DEVICE STATE	**ginq_stroke_st**
INQUIRE TABLE OF SELECTION CRITERIA	**ginq_sel_table**
INQUIRE TEXT ALIGNMENT	**ginq_text_align**
INQUIRE TEXT COLOUR INDEX	**ginq_text_colr_ind**
INQUIRE TEXT COLOUR SPECIFIER	**ginq_text_colr_specif**
INQUIRE TEXT EXTENT	**ginq_text_extent**
INQUIRE TEXT FACILITIES	**ginq_text_facs**
INQUIRE TEXT FONT AND PRECISION	**ginq_text_font_prec**
INQUIRE TEXT INDEX	**ginq_text_ind**
INQUIRE TEXT PATH	**ginq_text_path**
INQUIRE TEXT REPRESENTATION	**ginq_text_rep**
INQUIRE TEXT SKEW ANGLE	**ginq_text_skew_angle**
INQUIRE VALUATOR DEVICE STATE	**ginq_val_st**
INQUIRE VIEW PRIORITIES	**ginq_view_pris**
INQUIRE VIEW REPRESENTATION	**ginq_view_rep**
INQUIRE VISUAL EFFECTS STATE	**ginq_vis_effects_st**
INQUIRE WORKSTATION CLASSIFICATION	**ginq_ws_class**
INQUIRE WORKSTATION CONNECTION AND TYPE	**ginq_ws_conn_type**
INQUIRE WORKSTATION STATE	**ginq_ws_st**
INQUIRE WORKSTATION STATE LIST ENTRY	**ginq_ws_sl_entry**
INQUIRE WORKSTATION WINDOW AND VIEWPORT	**ginq_ws_win_vp**
INSERT SEGMENT	**ginsert_seg**
INSTANCE STENCIL	**ginst_stencil**
INSTANCE STENCIL ALONG PATH	**ginst_stencil_path**
INSTANCE STENCIL SEQUENCE ALONG PATH	**ginst_stencil_seq_path**
MESSAGE	**gmessage**
NURB SET	**gnurb_set**
OPEN GKS	**gopen_gks**
OPEN PICTURE PART	**gopen_pic_part**

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OPEN STENCIL	gopen_stencil
OPEN TILING	gopen_tiling
OPEN WORKSTATION	gopen_ws
PLAYBACK	gplayback
POLYLINE	gpolyline
POLYLINE SET	gpolyline_set
POLYMARKER	gpolymarker
PROCESS AUDIT ITEM	gproc_audit_item
READ ITEM FROM AUDIT	gread_item_audit
READ ITEM FUNCTION NAME FROM AUDIT	gread_item_func_name_audit
REMOVE BACKDROP	gremove_backdrop
REMOVE SET OF NAMES FROM NAMESET	gremove_set_names_nameset
REMOVE SET OF NAMES FROM NDC PICTURE	gremove_set_names_ndc_pic
REMOVE SET OF SCISSORS FROM NDC PICTURE	gremove_set_scissors_ndc_pic
REMOVE SET OF SCISSORS FROM SCISSOR SET	gremove_set_scissors_scissor_set
RENAME PICTURE PART	grename_pic_part
RENAME SEGMENT	grename_seg
RENAME STENCIL	grename_stencil
RENAME TILING	grename_tiling
REOPEN PICTURE PART	greopen_pic_part
REORDER NDC PICTURE	greorder_ndc_pic
REQUEST CHOICE	greq_choice
REQUEST INPUT	greq_in
REQUEST LOCATOR	greq_loc
REQUEST PICK	greq_pick
REQUEST STRING	greq_string
REQUEST STROKE	greq_stroke
REQUEST VALUATOR	greq_val
RESET SPECIFIC WORKSTATION DESCRIPTION TABLE ENTRY STATE	greset_specif_ws_dt_entry_st
RESTORE GKS STATE LIST	grestore_gks_sl
RESTORE WORKSTATION STATE LIST	grestore_ws_sl
RETRIEVE PICTURE PART FROM ARCHIVE	gret_pic_part_ar
ROUTE	groute
SAMPLE CHOICE	gsample_choice
SAMPLE INPUT	gsample_in
SAMPLE LOCATOR	gsample_loc
SAMPLE PICK	gsample_pick
SAMPLE STRING	gsample_string
SAMPLE STROKE	gsample_stroke
SAMPLE VALUATOR	gsample_val
SAVE GKS STATE LIST	gsave_gks_sl
SAVE WORKSTATION STATE LIST	gsave_ws_sl
SELECT NORMALIZATION TRANSFORMATION	gsel_norm_tran
SET AREA INDEX	gset_area_ind
SET AREA REPRESENTATION	gset_area_rep
SET ATTRIBUTE SOURCE FLAGS	gset_asfs
SET CHARACTER CODE	gset_char_code
SET CHARACTER EXPANSION FACTOR	gset_char_expan
SET CHARACTER HEIGHT	gset_char_ht
SET CHARACTER SPACING	gset_char_space
SET CHARACTER UP VECTOR	gset_char_up_vec
SET CHOICE MODE	gset_choice_mode

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SET COLOUR REPRESENTATION	gset_colr_rep
SET CONTOUR ATTRIBUTE	gset_cont_attr
SET DETECTABILITY	gset_det
SET EDGE COLOUR INDEX	gset_edge_colr_ind
SET EDGE COLOUR SPECIFIER	gset_edge_colr_specif
SET EDGE FLAG	gset_edge_flag
SET EDGETYPE	gset_edgetype
SET EDGEWIDTH SCALE FACTOR	gset_edgewidth
SET ERROR HANDLING	gset_err_hand
SET FONT INDEX MAPPING	gset_font_ind_map
SET GLOBAL TRANSFORMATION MATRIX	gset_global_tran_matrix
SET HIGHLIGHTING	gset_highl
SET INTERIOR COLOUR INDEX	gset_int_colr_ind
SET INTERIOR COLOUR SPECIFIER	gset_int_colr_specif
SET INTERIOR STYLE	gset_int_style
SET INTERIOR STYLE INDEX	gset_int_style_ind
SET LINE COLOUR INDEX	gset_line_colr_ind
SET LINE COLOUR INDEX	gset_marker_colr_ind
SET LINE COLOUR SPECIFIER	gset_line_colr_specif
SET LINE INDEX	gset_line_ind
SET LINE REPRESENTATION	gset_line_rep
SET LINETYPE	gset_linetype
SET LINEWIDTH SCALE FACTOR	gset_linewidth
SET LOCAL TRANSFORMATION MATRIX	gset_local_tran_matrix
SET LOCATOR MODE	gset_loc_mode
SET LOGICAL INPUT DEVICE MODE	gset_in_dev_mode
SET MARKER COLOUR SPECIFIER	gset_marker_colr_specif
SET MARKER INDEX	gset_marker_ind
SET MARKER REPRESENTATION	gset_marker_rep
SET MARKER SIZE SCALE FACTOR	gset_marker_size
SET MARKER TYPE	gset_marker_type
SET NAMESET	gset_nameset
SET NDC PICTURE PRIMITIVE ATTRIBUTE	gset_ndc_pic_prim_attr
SET NORMALIZATION TRANSFORMATION NUMBER	gset_norm_tran_num
SET PATTERN REFERENCE POINT	gset_pat_ref_point
SET PATTERN REPRESENTATION	gset_pat_rep
SET PATTERN SIZE	gset_pat_size
SET PICK IDENTIFIER	gset_pick_id
SET PICK MODE	gset_pick_mode
SET PRIMITIVE ATTRIBUTE	gset_prim_attr
SET REPRESENTATION	gset_rep
SET SCISSOR MODE	gset_scissor_mode
SET SCISSOR SET	gset_scissor_set
SET SEGMENT ATTRIBUTE	gset_seg_attr
SET SEGMENT PRIORITY	gset_seg_pri
SET SEGMENT TRANSFORMATION	gset_seg_tran
SET STENCIL ATTRIBUTE	gset_stencil_attr
SET STRING MODE	gset_string_mode
SET STROKE MODE	gset_stroke_mode
SET TEXT ALIGNMENT	gset_text_align
SET TEXT COLOUR INDEX	gset_text_colr_ind
SET TEXT COLOUR SPECIFIER	gset_text_colr_specif

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SET TEXT FONT AND PRECISION	**gset_text_font_prec**
SET TEXT INDEX	**gset_text_ind**
SET TEXT PATH	**gset_text_path**
SET TEXT REPRESENTATION	**gset_text_rep**
SET TEXT SKEW ANGLE	**gset_text_skew_angle**
SET VALUATOR MODE	**gset_val_mode**
SET VIEW	**gset_view**
SET VIEW PRIORITY	**gset_view_pri**
SET VIEW SELECTION CRITERION	**gset_view_sel_crit**
SET VIEWPORT	**gset_vp**
SET VIEWPORT INPUT PRIORITY	**gset_vp_in_pri**
SET VISIBILITY	**gset_vis**
SET WINDOW	**gset_win**
SET WINDOW AND VIEWPORT	**gset_win_vp**
SET WORKSTATION SELECTION CRITERION	**gset_ws_sel_crit**
SET WORKSTATION VIEWPORT	**gset_ws_vp**
SET WORKSTATION VISUAL EFFECTS	**gset_ws_vis_effects**
SET WORKSTATION WINDOW	**gset_ws_win**
SET WORKSTATION WINDOW AND VIEWPORT	**gset_ws_win_vp**
TEXT	**gtext**
WRITE USER RECORD TO AUDIT	**gwrite_user_rec_audit**

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5 Type definitions

5.1 Mapping of GKS data types

The GKS document specifies a set of abstract data types. This clause gives the mapping from those data types to the data types defined in this part of ISO/IEC 8651.

GKS data type	C binding data type
Archive name	`Gint`
Archive specifier	`void *`
Audit identifier	`Gint`
Audit specifier	`void *`
Audit user data	`Gaudit_user_data`
Character code	`char`
Colour characteristics	`Gcolr_chars`
Error file	`char *`
Escape function identifier	`Gint`
Escape input data record	`Gescape_in_data`
Escape output data record	`Gescape_out_data`
GDP data record	`Ggdp_data`
GDP function identifier	`Gint`
Glyph name	`Gint`
ISO/IEC 9541 font name	`Gint`
Input data record	`Gin_data`
Integer	`Gint`
Measure process identifier	`Gint`
NDC metafile specifier	`void *`
Name	`Gint`
Nonnegative integer	`Gint`
Pick identifier	`Gint`
Picture identifier	`Gint`
Picture part name	`Gint`
Real number	`Gfloat`
Realized metafile specifier	`void *`
Scissor identifier	`Gint`
Segment name	`Gint`
Stencil name	`Gint`
Tiling name	`Gint`
Trigger process identifier	`Gint`
Workstation generic type	`Gint`
Workstation identifier	`Gint`
Workstation specifier	`void *`

5.2 Environment-defined type definitions

The data types defined in this clause allow for the ease of porting GKS/C implementations between different environments. These types are used as the basis for all the other data types.

An implementation shall document the C types used for GKS/C types **`Gfloat`** and **`Gint`**.

`Gfloat` floating point number

This data type shall be defined by the implementation as a floating point type suitable for use within

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GKS/C. Suggest:

```
typedef     float                    Gfloat;
```

Gint integer

This data type shall be defined by the implementation as a signed integral type suitable for use within GKS/C. Suggest:

```
typedef     int                      Gint;
```

size_t

An additional environment-defined data type is the type **size_t**. Depending on the environment, **size_t** can be defined as **unsigned int** or **unsigned long**. **size_t** is defined in the headers **<stdio.h>**, **<stdlib.h>**, **<stddef.h>**, **<string.h>**, **<time.h>**.

5.3 Implementation dependent type definitions

This subclause presents the skeleton structure of the implementation dependent data types.

REMARKS:

- In order to produce syntactically correct data types, several implementation and registration dependent parts are of type **Gdata**. They can be replaced by any other structure.
- The data of registered prompt and echo types are represented by structures with the names **pet_rn** (n the prompt and echo type), whereas the data of unregistered prompt and echo types are represented by structures with the names **pet_un** (-n the prompt and echo type).
- The data of registered and unresgistered GDPs, escape input and escape output are denoted in a similar way.
- For the input data, the mandatory part, as specified in GKS (ISO/IEC 7942-1), is defined outside the union part of **Gxxx_data**. This mandatory part is implementation independent. Some of the **pet_rn** fields are given as structures of other type than **Gdata** for illustrative reasons. Thus, e.g. the **pet_r2** field of **Gchoice_data** contains a list of prompts, because GKS defines prompt and echo type 2 this way for the CHOICE device;

Gaudit_user_data audut user data record

```
typedef struct {
    Gint      id;          /* identifier          */
    union {
       Gdata  impl_dep;    /* impl. dependent   */
    } data;
} Gaudit_user_data;
```


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Gchoice_data choice data

```
typedef struct {
    union Gchoice_pets {
        struct Gchoice_pet_r1 {
                    Gdata       impl_dep;       /* impl. dep. */
        } pet_r1;   /* pet 1 data */
        struct Gchoice_pet_r2 {
                    Gint        num_prs;        /* number of prompts */
                    Gpr_flag    *prs;           /* prompt array */
                    Gdata       impl_dep;       /* impl. dep. */
        } pet_r2;   /* pet 2 data */
        struct Gchoice_pet_r3 {
                    Gint        num_strings;    /* number of choice strings */
                    char        **strings;      /* array of choice strings */
                    Gdata       impl_dep;       /* impl. dep. */
        } pet_r3;   /* pet 3 data */
        struct Gchoice_pet_r4 {
                    Gint        num_strings;    /* number of choice strings */
                    char        **strings;      /* array of choice strings */
                    Gdata       impl_dep;       /* impl. dep. */
        } pet_r4;   /* pet 4 data */
        struct Gchoice_pet_r5 {
                    Gint        seg_name;       /* segment name */
                    Gint        num_pick_ids;   /* number of pick identifiers */
                    Gint        *pick_ids;      /* array of pick identifiers */
                    Gdata       impl_dep;       /* impl. dep. */
        } pet_r5;   /* pet 5 data */
        struct Gchoice_pet_u1 {
                    Gdata       impl_dep;       /* impl. dep. */
        } pet_u1;   /* pet -1 data */
        /*. . . impl. defined PET's */
    } pets;
} Gchoice_data;
```

Gcolr_chars colour characteristics

```
typedef struct {
    enum Gcolr_chars_type {GTYPE_CIELUV, GTYPE_OTHER } type;
    union {
        Gcieluv   prim_colr[3];   /* CIELUV primary colours */
        Gdata     impl_dep;       /* impl.dep. */
    } chars;
} Gcolr_chars;
```


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Gescape_in_data escape input data record

```
typedef union {
    struct Gescape_in_r1 {
                    Gdata   impl_dep;   /* impl. dep. */
    } escape_r1;    /* escape 1 data */
    struct Gescape_in_u1 {
                    Gdata   impl_dep;   /* impl. dep. */
    } escape_u1;    /* escape -1 data */
    /* etc. */
} Gescape_in_data;
```

Gescape_out_data escape output data record

```
typedef union {
    struct Gescape_out_r1 {
                    Gdata   impl_dep;   /* impl. dep. */
    } escape_r1;    /* escape 1 data */
    struct Gescape_out_u1 {
                    Gdata   impl_dep;   /* impl. dep. */
    } escape_u1;    /* escape -1 data */
    /* etc. */
} Gescape_out_data;
```

Ggdp_data gdp data record

```
typedef union {
    struct Ggdp_r1 {
                Gdata   impl_dep;   /* impl. dep. */
    } gdp_r1;   /* gdp 1 data */
    struct Ggdp_u1 {
                Gdata   impl_dep;   /* impl. dep. */
    } gdp_u1;   /* gdp -1 data */
    /* etc. */
} Ggdp_data;
```


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Gloc_data locator data record

```
typedef struct {
    union Gloc_pets {
        struct Gloc_pet_r1 {
                    Gdata                   impl_dep;     /* impl. dep. */
        } pet_r1;   /* pet 1 data */
        struct Gloc_pet_r2 {
                    Gdata                   impl_dep;     /* impl. dep. */
        } pet_r2;   /* pet 2 data */
        struct Gloc_pet_r3 {
                    Gdata                   impl_dep;     /* impl. dep. */
        } pet_r3;   /* pet 3 data */
        struct Gloc_pet_r4 {
                    Gattr_ctrl_flag         attr_ctrl_flag;
                    /* attribute            control flag */
                    Gline_attrs             line_attrs;
                    /* line                 attributes */
                    Gdata                   impl_dep;     /* impl. dep. */
        } pet_r4;   /* pet 4 data */
        struct Gloc_pet_r5 {
                    Gattr_ctrl_flag         attr_ctrl_flag;
                    /* attribute            control flag */
                    Gline_fill_ctrl_flag    line_fill_ctrl_flag;
                    /* line/area            control flag */
                    union Gloc_attrs {
                                            Gline_attrs   line_attrs;
                                            /* line       attrs. */
                                            Garea_attrs   area_attrs;
                                            /* interior   attrs. */
                    } attrs;
                    Gdata                   impl_dep;     /* impl. dep. */
        } pet_r5;   /* pet 5 data */
        struct Gloc_pet_r6 {
                    Gdata                   impl_dep;     /* impl. dep. */
        } pet_r6;   /* pet 6 data */
        struct Gloc_pet_u1 {
                    Gdata                   impl_dep;     /* impl. dep. */
        } pet_u1;   /* pet -1 data */
        /*. . . impl. defined PET's */
    } pets;
} Gloc_data;
```


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Gpick_data pick data

```
typedef struct {
    union Gpick_pets {
        struct Gpick_pet_r1 {
                    Gdata       impl_dep;    /* impl. dep. */
        } pet_r1;   /* pet 1 data */
        struct Gpick_pet_r2 {
                    Gint        pick_id;     /* pick identifier*/
                    Gint        seg_name;    /* segment name*/
                    Gnameset    set_names;   /* set of names*/
                    Gdata       impl_dep;    /* impl. dep. */
        } pet_r2;   /* pet 2 data */
        struct Gpick_pet_r3 {
                    Gnameset    set_names;   /* set of names*/
                    Gdata       impl_dep;    /* impl. dep. */
        } pet_r3;   /* pet 3 data */
        struct Gpick_pet_u1 {
                    Gdata       data;        /* data */
        } pet_u1;   /* pet -1 data */
        /* etc. */
     } pets;
} Gpick_data;
```

Gstring_data string data record

```
typedef struct {
    Gint   in_buf_size;   /* input buffer size (nr. of bytes) */
    Gint   init_pos;      /* initial [cursor] position */
    union Gstring_pets {
          struct Gstring_pet_r1 {
                        Gdata   impl_dep;    /* impl. dep. */
          } pet_r1;     /* pet 1 data */
          struct Gstring_pet_u1 {
                        Gdata   impl_dep;    /* impl. dep. */
          } pet_u1;     /* pet -1 data */
          /* etc. */
     } pets;
} Gstring_data;
```


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Gstroke_data stroke data

```
typedef struct {
    Gint     init_pos;        /* initial buffer editing position */
    Gint     in_buf_size;     /* input buffer size (nr. of points) */
    Gfloat   x_interval;      /* X interval */
    Gfloat   y_interval;      /* Y interval */
    Gfloat   time_interval;   /* time interval */
    union Gstroke_pets {
            struct Gstroke_pet_r1 {
                             Gdata            impl_dep;   /* impl. dep. */
            } pet_r1;        /* pet 1 data */
            struct Gstroke_pet_r2 {
                             Gdata            impl_dep;   /* impl. dep. */
            } pet_r2;        /* pet 2 data */
            struct Gstroke_pet_r3 {
                             Gattr_ctrl_flag  attr_ctrl_flag;
                             /* attribute     control flag */
                             Gmarker_attrs    marker_attrs;
                             /* marker        attrs. */
                             Gdata            impl_dep;   /* impl. dep. */
            } pet_r3;        /* pet 3 data */
            struct Gstroke_pet_r4 {
                             Gattr_ctrl_flag  attr_ctrl_flag;
                             /* attribute     control flag */
                             Gline_attrs      line_attrs;
                             /* line          attrs. */
                             Gdata            impl_dep;   /* impl. dep. */
            } pet_r4;        /* pet 4 data */
            struct Gstroke_pet_u1 {
                             Gdata            impl_dep;   /* impl. dep. */
            } pet_u1;        /* pet -1 data */
            /* etc. */
    } pets;
} Gstroke_data;
```


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Gval_data valuator data record

```
typedef struct {
    Gfloat   low_value;    /* low value */
    Gfloat   high_value;   /* high value */
    union Gval_pets {
            struct Gval_pet_r1 {
                         Gdata   impl_dep;   /* impl. dep. */
            } pet_r1;    /* pet 1 data */
            struct Gval_pet_r2 {
                         Gdata   impl_dep;   /* impl. dep. */
            } pet_r2;    /* pet 2 data */
            struct Gval_pet_r3 {
                         Gdata   impl_dep;   /* impl. dep. */
            } pet_r3;    /* pet 3 data */
            struct Gval_pet_u1 {
                         Gdata   impl_dep;   /* impl. dep. */
            } pet_u1;    /* pet -1 data */
            /* etc. */
     } pets;
} Gval_data;
```

5.4 Implementation independent type definitions

Gabut_specif ABUT specifier

```
typedef enum {
    GABUT_RIGHT,
    GABUT_LEFT,
    GABUT_TOP,
    GABUT_BOTTOM,
    GABUT_CTR_VERT,
    GABUT_CTR_HOR,
    GABUT_CAP_LINE,
    GABUT_BASE_LINE
} Gabut_specif;
```

Garea_attrs area attributes

```
typedef struct {
    Gasf          int_style_asf;       /* interior style ASF          */
    Gasf          style_ind_asf;       /* style index ASF             */
    Gasf          colr_ind_asf;        /* colour specifier ASF        */
    Gasf          edge_flag_asf;       /* edge flag ASF               */
    Gasf          edgetype_asf;        /* edgetype ASF                */
    Gasf          edgewidth_asf;       /* edgewidth scale factor ASF  */
    Gasf          edge_colr_ind_asf;   /* edge colour specifier ASF   */
    Gint          ind;                 /* area index                  */
    Garea_bundle  bundle;              /* area bundle                 */
} Garea_attrs;
```


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Garea_bundle area bundle

```
typedef struct {
    Gint_style   int_style;        /* interior style          */
    Gint         style_ind;        /* interior style index    */
    Gcolr_kind   colr_kind;        /* interior colour kind    */
    Gint         colr_ind;         /* interior colour index   */
    Gcolr_rep    int_dir_colr;     /* direct interior colour  */
    Gedge_flag   edge_flag;        /* edge flag               */
    Gint         edgetype;         /* edgetype                */
    Gfloat       edgewidth;        /* edgewidth scale factor  */
    Gcolr_kind   edge_colr_kind;   /* edge colour kind        */
    Gint         edge_colr_ind;    /* edge colour index       */
    Gcolr_rep    edge_dir_colr;    /* direct edge colour      */
} Garea_bundle;
```

Garea_bundle_table area bundle table

```
typedef struct {
    Gint           num_inds;   /* number of area indices   */
    Gint           *inds;      /* list of area indices     */
    Garea_bundle   *bundles;   /* list of area bundles     */
} Garea_bundle_table;
```

Garea_facs area facilities

```
typedef struct {
    Gint         num_int_styles;   /* number of interior styles          */
    Gint_style   int_styles[5];    /* list of available interior styles  */
    Gint_list    hatch_styles;     /* list of available hatch styles     */
    Gint         num_pred_inds;    /* number of predef. area indices     */
    Gint_list    edgetypes;        /* list of edgetypes                  */
    Gint         num_edgewidths;   /* number of available edgewidths     */
    Gfloat       nom_edgewidth;    /* nominal edgewidth                  */
    Gfloat       min_edgewidth;    /* min. edgewidth                     */
    Gfloat       max_edgewidth;    /* max. edgewidth                     */
} Garea_facs;
```

Gasf attribute source flag

```
typedef enum {
    GASF_BUNDLED,
    GASF_INDIV
} Gasf;
```


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Gasfs attribute source flags

```
typedef struct {
    Gasf   linetype;          /* linetype ASF                    */
    Gasf   linewidth;         /* linewidth scale factor ASF      */
    Gasf   line_colr_ind;     /* line colour ASF                 */
    Gasf   marker_type;       /* marker type ASF                 */
    Gasf   marker_size;       /* marker size scale factor ASF    */
    Gasf   marker_colr_ind;   /* marker colour ASF               */
    Gasf   text_font_prec;    /* text font and precision ASF     */
    Gasf   char_expan;        /* character expansion factor ASF  */
    Gasf   char_space;        /* character spacing ASF           */
    Gasf   text_colr_ind;     /* text colour ASF                 */
    Gasf   int_style;         /* interior style ASF              */
    Gasf   int_style_ind;     /* interior style index ASF        */
    Gasf   int_colr_ind;      /* interior colour ASF             */
    Gasf   edge_flag;         /* edge flag ASF                   */
    Gasf   edgetype;          /* edgetype ASF                    */
    Gasf   edgewidth;         /* edgewidth scale factor ASF      */
    Gasf   edge_colr_ind;     /* edge colour ASF                 */
} Gasfs;
```

Gattr_ctrl_flag attribute control flag

```
typedef enum {
    GFLAG_CUR,
    GFLAG_SPECIF
} Gattr_ctrl_flag;
```

Gaudit_flag audit flag

```
typedef enum {
    GAUDIT_OFF,
    GAUDIT_ON
} Gaudit_flag;
```

Gaudit_op audit operation

```
typedef struct {
    enum Gaudit_op_type {
            GAUDIT_OPEN, GAUDIT_CLOSE, GAUDIT_BEGIN, GAUDIT_END
    } type;
    void   *specif;   /* audit specifier            */
} Gaudit_op;
```

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Gbasic_in_data basic input data

```
typedef struct{
    Gin_class class; /* basic input [measure] class */
    union {
        Gloc_data      loc_data;      /* locator data */
        Gstroke_data   stroke_data;   /* stroke data */
        Gval_data      val_data;      /* valuator data */
        Gchoice_data   choice_data;   /* choice data */
        Gpick_data     pick_data;     /* pick data */
        Gstring_data   string_data;   /* string data */
    } in_data; /* input data */
} Gbasic_in_data;
```

Gbasic_in_value basic input value

```
typedef struct{
    Gin_class class; /* basic input [measure] class */
    union {
        Gloc        loc;         /* locator value */
        Gstroke     stroke;      /* stroke value */
        Gfloat      val;         /* valuator value */
        Gchoice     choice;      /* choice value */
        Gpick       pick;        /* pick value */
        char        *string;     /* string value */
    } in_value; /* input value */
} Gbasic_in_value;
```

Gbndry boundary

```
typedef struct {
    enum Gbndry_type {
        GBNDRY_CLOSED_PATH,
        GBNDRY_ELL_DISC
    } type;
    union {
        Gpath_list      closed_path_seq;   /* closed path sequence   */
        Gconic_matrix   ell_disc;          /* elliptic disc          */
    } value;
} Gbndry;
```

Gbndry_list boundary list

```
typedef struct {
    Gint     num_bndries;   /* number of boundaries in list   */
    Gbndry   *bndries;      /* list of boundaries             */
} Gbndry_list;
```


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Gcap cap

```
typedef enum {
    GCAP_BUT,
    GCAP_ROUND,
    GCAP_SQUARE
} Gcap;
```

Gchange_flag change flag

```
typedef enum {
    GFLAG_CHANGED,
    GFLAG_NOT_CHANGED
} Gchange_flag;
```

Gchoice choice [value]

```
typedef struct {
    Gchoice_status   status;   /* status          */
    Gint             num;      /* choice number   */
} Gchoice;
```

Gchoice_status choice status

```
typedef enum {
    GCHOICE_OK,
    GCHOICE_NO_CHOICE
} Gchoice_status;
```

Gcieluv CIE L*u*v* [colour specification]

```
typedef struct {
    Gfloat   u_prime;   /* u' coefficient   */
    Gfloat   v_prime;   /* v' coefficient   */
    Gfloat   y;         /* y luminance      */
} Gcieluv;
```

Gclip_ind clipping indicator

```
typedef enum {
    GIND_NO_CLIP,
    GIND_CLIP
} Gclip_ind;
```

Gclosed_path_op_st closed path operating state

```
typedef enum {
    GCP_ST_CPCL,
    GCP_ST_CPOP
} Gclosed_path_op_st;
```


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Gcolr_avail colour available

```
typedef enum {
    GAVAIL_MONOCHR,
    GAVAIL_COLR
} Gcolr_avail;
```

Gcolr_facs colour facilities

```
typedef struct {
    Gint          num_colr_models;   /* number of colour models            */
    Gint          colr_models[4];    /* list of available colour models    */
    Gint          num_colrs;         /* number of colours                  */
    Gcolr_chars   chars;             /* colour characteristics             */
    Gcolr_avail   colr_avail;        /* colour availability                */
    Gint          num_pred_inds;     /* number of predef. colour indices   */
} Gcolr_facs;
```

Gcolr_kind colour kind

```
typedef enum {
     GCOLR_INDIR,
     GCOLR_RGB,
     GCOLR_CIELUV,
     GCOLR_HLS,
     GCOLR_HSV
} Gcolr_kind;
```

Gcolr_rep colour representation

```
typedef union {
    Grgb      rgb;      /* Red Green Blue colour specification */
    Gcieluv   cieluv;   /* CIE L*u*v* 1976 colour specification */
    Ghls      hls;      /* Hue Luminance Saturation colour specification */
    Ghsv      hsv;      /* Hue Saturation Value colour specification */
                        /* etc. */
} Gcolr_rep;
```

Gcolr_specif colour specifier

```
typedef struct {
    Gcolr_kind   kind;     /* colour kind */
    union {
        Gint      ind;     /* colour index*/
        Grgb      rgb;     /* Red Green Blue colour specification */
        Gcieluv   cieluv;  /* CIE L*u*v* 1976 colour specification */
        Ghls      hls;     /* Hue Luminance Saturation colour specification */
        Ghsv      hsv;     /* Hue Saturation Value colour specification */
    } value;
} Gcolr_specif;
```


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Gcolr_table colour table

```
typedef struct {
    Gint          num_inds;        /* number of colour indices        */
    Gint          *inds;           /* list of colour indices          */
    Gcolr_specif  *colr_specifs;   /* list of colour specifications   */
} Gcolr_table;
```

Gcomp_data composite data

```
typedef struct {
    Gint            num_devs;         /* number of [basic] devices */
    Gbasic_in_data  *basic_in_data;   /* list of basic input data */
} Gcomp_data;
```

Gcomp_value composite value

```
typedef struct {
    Gint             num_devs;          /* number of [basic] devices */
    Gbasic_in_value  *basic_in_value;   /* list of basic input values*/
} Gcomp_value;
```

Gconic_matrix conic matrix

```
typedef Gfloat Gconic_matrix[3][3];
```

Gconic_sec conic section

```
typedef struct {
    Gconic_matrix  matrix;       /* conic matrix */
    Gpoint         point_1;      /* point # 1 */
    Gpoint         point_2;      /* point # 2 */
    Gsense_flag    sense_flag;   /* sense flag */
} Gconic_sec;
```

Gconic_sec_list conic primitive list

```
typedef struct {
    Gint         num_conic_prims;   /* number of conic primitives in list   */
    Gconic_sec   *conic_prims;      /* list of conic primitives             */
} Gconic_sec_list;
```

Gcont_attr_name contour attribute name

```
typedef enum {
    GNAME_STYLE,
    GNAME_WIDTH,
    GNAME_CAP,
    GNAME_JOIN
} Gcont_attr_name;
```


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Gcont_attr_value contour attribute value

```
typedef struct {
    Gcont_attr_name   name;    /* attribute name    */
    union {
                      Gint     style;   /* style     */
                      Gfloat   width;   /* width     */
                      Gcap     cap;     /* cap       */
                      Gjoin    join;    /* join      */
    } value;
} Gcont_attr_value;
```

Gcont_attrs contour attributes

```
typedef struct {
    Gint     style;   /* style    */
    Gfloat   width;   /* width    */
    Gcap     cap;     /* cap      */
    Gjoin    join;    /* join     */
} Gcont_attrs;
```

Gconv_flag conversion flag

```
typedef enum {
    GCONV_DONE,
    GCONV_APPROX,
    GCONV_NOT_CONV
} Gconv_flag;
```

Gcoord_switch coordinate switch

```
typedef enum {
    GCOORD_WC,
    GCOORD_NDC
} Gcoord_switch;
```

Gctrl_flag control flag

```
typedef enum {
    GFLAG_COND,
    GFLAG_ALWAYS
} Gctrl_flag;
```


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