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

**Part 4:
C**

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

Partie 4: C



Reference number
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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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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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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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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*.

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.

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-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 registration¹ 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.

Registration**The C Language Binding of GKS-3D**

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 */
```

3.7 Return Values

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

3.8 Header Files

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.

The C Language Binding of GKS-3D

Memory Management

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_INVALID` 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 E, a possible underlying mechanism is described.

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

Memory Management

The C Language Binding of GKS-3D

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 8806 defines two new errors that can occur when using or creating a *Store*; these errors are described in 3.10.3. 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		GKOP, WSOP, WSAC, SGOP	L0a
<i>Parameters:</i>			
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 *store* parameter is set to NULL and the error indicator is set to one of the following error values:

- 8 GKS-3D not in proper state; GKS-3D shall be in one of the states GKOP, WSOP, WSAC or SGOP
- 2203 Error while allocating Store

Errors: None.

DELETE STORE		GKOP, WSOP, WSAC, SGOP	L0a
<i>Parameters:</i>			
Out	error indicator	I	
In/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 indicator is set to one of the following values:

- 8 GKS-3D not in proper state; GKS-3D shall be in one of the states GKOP, WSOP, WSAC or SGOP

Errors: None.

In 7.10.2, the C specification of these functions is given. In annex E, a possible underlying mechanism is 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 7.10.2)

SET ERROR HANDLER GKCL, GKOP, WSOP, WSAC, SGOP L0a*Parameters:*

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

Effect: Sets the GKS-3D 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 8805 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 8806 defines a set of constants for the GKS-3D error numbers. Each error constant begins with the characters GE_. See also 6.2 for the error macros.

3.10.3 C-specific GKS-3D errors

This part of ISO/IEC 8806 knows some specific error messages. This section gives the messages and the error macros.

Value	Message
2200	Start index out of range Is issued when the start index is less than zero or larger than the last element in the implementation's list
2201	Length of application list is negative Is issued when the length of the application's list is less than zero
2202	Enumeration type out of range Is issued when a parameter value whose type is an enumeration is out range of the enumeration
2203	Error while allocating Store Is issued when an error is detected during CREATE STORE
2204	Error while allocating memory for Store Is issued when a function using a <i>Store</i> is unable to allocate memory for the <i>Store</i>

3.11 Colour Representations

GKS-3D 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 is defined in GKS-3D/C as

Colour Representations

The C Language Binding of GKS-3D

```

typedef union {
    Grgb      rgb;          /* Red Green Blue colour specification */
    Gcieluv   cieluv;      /* CIE L*u*v* 1976 colr. spec.      */
    Ghls      hls;         /* Hue Luminance Saturation colr. spec. */
    Ghsv      hsv;         /* Hue Saturation Value colr. spec.    */
    Gdata     impl_dep;    /* impl. dep. colr. spec.            */
} Gcolr_rep;

```

which guarantees extensibility of GKS-3D/C for other colour models.

3.12 Storage of Multi-dimensional Arrays

3.12.1 Storage of 2*3 Matrices

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

$$\begin{aligned} \text{Tp.x} &= \text{mat}[0,0]*\text{p.x} + \text{mat}[0,1]*\text{p.y} + \text{mat}[0,2]; \\ \text{Tp.y} &= \text{mat}[1,0]*\text{p.x} + \text{mat}[1,1]*\text{p.y} + \text{mat}[1,2]; \end{aligned}$$

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

3.12.2 Storage of 3*4 Matrices

The entries of `Gtran_matrix3` data types shall be stored such that the segment transformation is defined by

$$\begin{aligned} \text{Tp.x} &= \text{mat}[0,0]*\text{p.x} + \text{mat}[0,1]*\text{p.y} + \text{mat}[0,2]*\text{p.z} + \text{mat}[0,3]; \\ \text{Tp.y} &= \text{mat}[1,0]*\text{p.x} + \text{mat}[1,1]*\text{p.y} + \text{mat}[1,2]*\text{p.z} + \text{mat}[1,3]; \\ \text{Tp.z} &= \text{mat}[2,0]*\text{p.x} + \text{mat}[2,1]*\text{p.y} + \text{mat}[2,2]*\text{p.z} + \text{mat}[2,3]; \end{aligned}$$

where `p` is a 3D point, `Tp` its transformation and `mat` is of type `Gtran_matrix3`.

3.12.3 Storage of 4*4 Matrices

The entries of `Gmatrix3` data types shall be stored such that the projection transformation is defined by

$$\begin{aligned} \text{Tp.x} &= \text{x}' / \text{w}'; \\ \text{Tp.y} &= \text{y}' / \text{w}'; \\ \text{Tp.z} &= \text{z}' / \text{w}'; \\ \text{x}' &= \text{mat}[0,0]*\text{p.x} + \text{mat}[0,1]*\text{p.y} + \text{mat}[0,2]*\text{p.z} + \text{mat}[0,3]; \\ \text{y}' &= \text{mat}[1,0]*\text{p.x} + \text{mat}[1,1]*\text{p.y} + \text{mat}[1,2]*\text{p.z} + \text{mat}[1,3]; \\ \text{z}' &= \text{mat}[2,0]*\text{p.x} + \text{mat}[2,1]*\text{p.y} + \text{mat}[2,2]*\text{p.z} + \text{mat}[2,3]; \\ \text{w}' &= \text{mat}[3,0]*\text{p.x} + \text{mat}[3,1]*\text{p.y} + \text{mat}[3,2]*\text{p.z} + \text{mat}[3,3]; \end{aligned}$$

where `p` is a 3D point, `Tp` its projection transformation and `mat` is of type `Gmatrix3`.

3.12.4 Storage of Colour Arrays

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

$$\begin{aligned} \text{Colr_ind}_{i,j} &= \text{colr_rect.colr_array}[i + \text{DX}*j]; \\ i &= 0, \dots, \text{DX} - 1; & j &= 0, \dots, \text{DY} - 1; \\ \text{DX} &= \text{colr_rect.dims.size_x}; & \text{DY} &= \text{colr_rect.dims.size_y}; \end{aligned}$$

where `colr_rect` is of type `Gpat_rep`.

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, except for the 3, if the 3D extension is denoted;
- 4) The words POLYLINE, POLYMARKER and FILL AREA (SET) are not abbreviated in the output primitive function names; in all other cases they are abbreviated using the list in 4.2;
- 5) Construction of GKS-3D/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 colour index in the field of `Gxxx_bundle` is abbreviated to `colr_ind`, because the context makes clear which colour index is used;
 - d) Function macros:
"Gfn_" followed by abbreviation of function name;
 - e) GKSM item types:
"Gksm_" followed by abbreviation of item name;
 - f) Error macros:
"GE_" followed by some abbreviated expression;
 - g) 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;
GKSM item types.

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

Word or Phrase	Abbreviation
accepted	NULL

Table of Abbreviations Used

Tables

accumulate	accum
action	NULL
actual	act
addition	add
alignment	align
allocate	alloc
and	NULL
application	appl
arithmetic	arith
as soon as possible	asap
aspect source flag	asf
associate(d)	assoc
at some time	asti
at	NULL
attribute	attr
availability	avail
available	avail
before the next interaction globally	bnig
before the next interaction locally	bnil
between	NULL
buffer	buf
cannot	cant
category	cat
centre	ctr
character	char
CIE L*u*v* (colour model)	cieluv
classification	class
clipping	clip
collinear	col
colour	colr
concatenation	concat
conditional(ly)	cond
connection	conn
control	ctrl
coordinate	coord
corner	cnr
current	cur
dashed	dash
default	def
deferral	defer
delete	del
deletion	del
detectability	det
detectable	det
device coordinate(s)	dc
device(s)	NULL
digital	digit
dimension	dim
direction	dir
display	disp
distance	NULL
dotted	dot

Tables

Table of Abbreviations Used

duplicate	dup
dynamic	dyn
equal	eq
error	err
evaluate	eval
expansion	expan
facility	fac
factor	NULL
fill area	fill
from	NULL
function	func
generalized drawing primitive	gdp
gks closed	gkcl
gks open	gkop
gksm	NULL
graphical	graph
handling	hand
height	ht
hidden line/hidden surface removal	hlhsr
highlighted	high
highlighting	highl
horizontal	hor
hue lightness saturation (colour model)	hls
hue saturation value (colour model)	hsv
identifier	id
immediate(ly)	imm
implicit regeneration	irg
implicit	impl
in use	NULL
in	NULL
index	ind
indicator	ind
individual	indiv
initial	init
initialize	init
input/output	io
input	in
inquire	inq
integer	int
interior	int
invalid	inval
invisible	invis
length	NULL
less than or equal	le
less than	lt
level x	lx (with x = 0a, 0b, ...)
library	lib
locator	loc
logical	NULL
luminance	lum
mapping	map
maximum	max

Table of Abbreviations Used

Tables

memory	mem
metafile input	mi
metafile output	mo
minimum	min
modification	mod
monochrome	monochr
necessary	nec
nominal	nom
normal	norm
normalization	norm
normalized device coordinate(s)	ndc
number	num
of	NULL
on	NULL
operating	op
orientation	ori
output and input	outin
output	out
overflow	overf
parallel(ogram)	paral
pattern	pat
pending	pend
perspective	perspect
pointer	ptr
polyline	line
polymarker	marker
position	pos
precision	prec
predefined	pred
presence	pres
primitive	prim
priority	pri
projection	proj
prompt and echo type	pet
prompt	pr
queue	NULL
record	NULL
rectangle	rect
red green blue (colour model)	rgb
reference	ref
regeneration	regen
registered	r
relative	rel
representation	rep
request(ed)	req
rubber	rub
saturation	satur
scale factor	NULL
segment open	sgop
segment	seg
select	sel
simultaneous(ly)	simult

Tables

Table of Abbreviations Used

spacing	space
specification	specif
specified	specif
state	st
storage	store
supported	NULL
suppressed	suppr
to	NULL
tracking	track
transform(ation)	tran
unavailable	unavail
undefined	undef
undetectable	undet
unregistered	u
update	upd
used	NULL
valuator	val
value	NULL
vector	vec
vertical	vert
viewport	vp
visibility	vis
visible	vis
volume	vol
which	NULL
window	win
with	NULL
workstation active	wsac
workstation independent segment store	wiss
workstation open	wsop
workstation	ws
world coordinate	wc

4.3 Function Names

4.3.1 List Ordered Alphabetically by Bound Name

gaccum_tran_matrix	ACCUMULATE TRANSFORMATION MATRIX
gaccum_tran_matrix3	ACCUMULATE TRANSFORMATION MATRIX 3
gactivate_ws	ACTIVATE WORKSTATION
gassoc_seg_ws	ASSOCIATE SEGMENT WITH WORKSTATION
gawait_event	AWAIT EVENT
gcell_array	CELL ARRAY
gcell_array3	CELL ARRAY 3
gclear_ws	CLEAR WORKSTATION
gclose_gks	CLOSE GKS
gclose_seg	CLOSE SEGMENT
gclose_ws	CLOSE WORKSTATION
gcopy_seg_ws	COPY SEGMENT FROM WORKSTATION
gcreate_seg	CREATE SEGMENT
gcreate_store	CREATE STORE (GKS-3D/C only)
gdeactivate_ws	DEACTIVATE WORKSTATION

Function Names

Tables

gdel_seg	DELETE SEGMENT
gdel_seg_ws	DELETE SEGMENT FROM WORKSTATION
gdel_store	DELETE STORE (GKS-3D/C only)
gemergency_close_gks	EMERGENCY CLOSE GKS
gerr_hand	ERROR HANDLING
gerr_log	ERROR LOGGING
gescape	ESCAPE
geval_tran_matrix	EVALUATE TRANSFORMATION MATRIX
geval_tran_matrix3	EVALUATE TRANSFORMATION MATRIX 3
geval_view_map_matrix3	EVALUATE VIEW MAPPING MATRIX 3
geval_view_ori_matrix3	EVALUATE VIEW ORIENTATION MATRIX 3
gfill_area	FILL AREA
gfill_area3	FILL AREA 3
gfill_area_set	FILL AREA SET
gfill_area_set3	FILL AREA SET 3
gflush_events	FLUSH DEVICE EVENTS
ggdp	GENERALIZED DRAWING PRIMITIVE
ggdp3	GENERALIZED DRAWING PRIMITIVE 3
gget_choice	GET CHOICE
gget_item_type	GET ITEM TYPE FROM GKSM
gget_loc	GET LOCATOR
gget_loc3	GET LOCATOR 3
gget_pick	GET PICK
gget_string	GET STRING
gget_stroke	GET STROKE
gget_stroke3	GET STROKE 3
gget_val	GET VALUATOR
ginit_choice	INITIALIZE CHOICE
ginit_choice3	INITIALIZE CHOICE 3
ginit_loc	INITIALIZE LOCATOR
ginit_loc3	INITIALIZE LOCATOR 3
ginit_pick	INITIALIZE PICK
ginit_pick3	INITIALIZE PICK 3
ginit_string	INITIALIZE STRING
ginit_string3	INITIALIZE STRING 3
ginit_stroke	INITIALIZE STROKE
ginit_stroke3	INITIALIZE STROKE 3
ginit_val	INITIALIZE VALUATOR
ginit_val3	INITIALIZE VALUATOR 3
ginq_asfs	INQUIRE ASPECT SOURCE FLAGS
ginq_asfs3	INQUIRE ASPECT SOURCE FLAGS 3
ginq_char_base_vec	INQUIRE CHARACTER BASE VECTOR
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_char_width	INQUIRE CHARACTER WIDTH
ginq_choice_st	INQUIRE CHOICE DEVICE STATE
ginq_choice_st3	INQUIRE CHOICE DEVICE STATE 3
ginq_clip	INQUIRE CLIPPING
ginq_clip3	INQUIRE CLIPPING 3
ginq_colr_fac	INQUIRE COLOUR FACILITIES

Tables

Function Names

ginq_colr_model	INQUIRE COLOUR MODEL
ginq_colr_model_fac3	INQUIRE COLOUR MODEL FACILITIES
ginq_colr_rep	INQUIRE COLOUR REPRESENTATION
ginq_cur_hlhrs_id	INQUIRE CURRENT HLHSR IDENTIFIER VALUE
ginq_cur_indiv_attr3	INQUIRE CURRENT INDIVIDUAL ATTRIBUTE VALUES
ginq_cur_norm_tran_num	INQUIRE CURRENT NORMALIZATION TRANSFORMATION NUMBER
ginq_cur_pick_id	INQUIRE CURRENT PICK IDENTIFIER VALUE
ginq_cur_prim_attr3	INQUIRE CURRENT PRIMITIVE ATTRIBUTE VALUES
ginq_def_choice_data	INQUIRE DEFAULT CHOICE DEVICE DATA
ginq_def_choice_data3	INQUIRE DEFAULT CHOICE DEVICE DATA 3
ginq_def_defer_sts	INQUIRE DEFAULT DEFERRAL STATE VALUES
ginq_def_loc_data	INQUIRE DEFAULT LOCATOR DEVICE DATA
ginq_def_loc_data3	INQUIRE DEFAULT LOCATOR DEVICE DATA 3
ginq_def_pick_data	INQUIRE DEFAULT PICK DEVICE DATA
ginq_def_pick_data3	INQUIRE DEFAULT PICK DEVICE DATA 3
ginq_def_string_data	INQUIRE DEFAULT STRING DEVICE DATA
ginq_def_string_data3	INQUIRE DEFAULT STRING DEVICE DATA 3
ginq_def_stroke_data	INQUIRE DEFAULT STROKE DEVICE DATA
ginq_def_stroke_data3	INQUIRE DEFAULT STROKE DEVICE DATA 3
ginq_def_val_data	INQUIRE DEFAULT VALUATOR DEVICE DATA
ginq_def_val_data3	INQUIRE DEFAULT VALUATOR DEVICE DATA 3
ginq_disp_space_size	INQUIRE DISPLAY SPACE SIZE
ginq_disp_space_size3	INQUIRE DISPLAY SPACE SIZE 3
ginq_dyn_mod_seg_attr3	INQUIRE DYNAMIC MODIFICATION OF SEGMENT ATTRIBUTES
ginq_dyn_mod_ws_attr3	INQUIRE DYNAMIC MODIFICATION OF WORKSTATION ATTRIBUTES
ginq_dyn_mod_ws_attr33	INQUIRE DYNAMIC MODIFICATION OF WORKSTATION ATTRIBUTES 3
ginq_edge_colr_ind	INQUIRE EDGE COLOUR INDEX
ginq_edge_fac3	INQUIRE EDGE FACILITIES
ginq_edge_flag	INQUIRE EDGE FLAG
ginq_edge_ind	INQUIRE EDGE INDEX
ginq_edge_rep	INQUIRE EDGE REPRESENTATION
ginq_edgetype	INQUIRE EDGETYPE
ginq_edgewidth	INQUIRE EDGEWIDTH SCALE FACTOR
ginq_fill_colr_ind	INQUIRE FILL AREA COLOUR INDEX
ginq_fill_fac3	INQUIRE FILL AREA FACILITIES
ginq_fill_ind	INQUIRE FILL AREA INDEX
ginq_fill_int_style	INQUIRE FILL AREA INTERIOR STYLE
ginq_fill_rep	INQUIRE FILL AREA REPRESENTATION
ginq_fill_style_ind	INQUIRE FILL AREA STYLE INDEX
ginq_gdp	INQUIRE GENERALIZED DRAWING PRIMITIVE
ginq_gdp3	INQUIRE GENERALIZED DRAWING PRIMITIVE 3
ginq_hlhrs_id_fac3	INQUIRE HLHSR IDENTIFIER FACILITIES
ginq_hlhrs_mode	INQUIRE HLHSR MODE
ginq_hlhrs_mode_fac3	INQUIRE HLHSR MODE FACILITIES
ginq_in_overf	INQUIRE INPUT QUEUE OVERFLOW
ginq_level_gks	INQUIRE LEVEL OF GKS
ginq_line_colr_ind	INQUIRE POLYLINE COLOUR INDEX
ginq_line_fac3	INQUIRE POLYLINE FACILITIES
ginq_line_ind	INQUIRE POLYLINE INDEX
ginq_line_rep	INQUIRE POLYLINE REPRESENTATION

Function Names

Tables

ginq_linetype	INQUIRE LINETYPE
ginq_linewidth	INQUIRE LINewidth SCALE FACTOR
ginq_list_avail_gdps	INQUIRE LIST OF AVAILABLE GENERALIZED DRAWING PRIMITIVES
ginq_list_avail_gdps3	INQUIRE LIST OF AVAILABLE GENERALIZED DRAWING PRIMITIVES 3
ginq_list_avail_ws_types	INQUIRE LIST OF AVAILABLE WORKSTATION TYPES
ginq_list_colr_inds	INQUIRE LIST OF COLOUR INDICES
ginq_list_edge_inds	INQUIRE LIST OF EDGE INDICES
ginq_list_fill_inds	INQUIRE LIST OF FILL AREA INDICES
ginq_list_line_inds	INQUIRE LIST OF POLYLINE INDICES
ginq_list_marker_inds	INQUIRE LIST OF POLYMARKER INDICES
ginq_list_norm_tran_nums	INQUIRE LIST OF NORMALIZATION TRANSFORMATION NUMBERS
ginq_list_pat_inds	INQUIRE LIST OF PATTERN INDICES
ginq_list_text_inds	INQUIRE LIST OF TEXT INDICES
ginq_list_view_inds	INQUIRE LIST OF VIEW INDICES
ginq_loc_st	INQUIRE LOCATOR DEVICE STATE
ginq_loc_st3	INQUIRE LOCATOR DEVICE STATE 3
ginq_marker_colr_ind	INQUIRE POLYMARKER COLOUR INDEX
ginq_marker_fac	INQUIRE POLYMARKER FACILITIES
ginq_marker_ind	INQUIRE POLYMARKER INDEX
ginq_marker_rep	INQUIRE POLYMARKER REPRESENTATION
ginq_marker_size	INQUIRE MARKER SIZE SCALE FACTOR
ginq_marker_type	INQUIRE MARKER TYPE
ginq_max_norm_tran_num	INQUIRE MAXIMUM NORMALIZATION TRANSFORMATION NUMBER
ginq_max_ws_st_tables	INQUIRE MAXIMUM LENGTH OF WORKSTATION STATE TABLES
ginq_max_ws_st_tables3	INQUIRE MAXIMUM LENGTH OF WORKSTATION STATE TABLES 3
ginq_more_simult_events	INQUIRE MORE SIMULTANEOUS EVENTS
ginq_name_open_seg	INQUIRE NAME OF OPEN SEGMENT
ginq_norm_tran	INQUIRE NORMALIZATION TRANSFORMATION
ginq_norm_tran3	INQUIRE NORMALIZATION TRANSFORMATION 3
ginq_num_avail_in	INQUIRE NUMBER OF AVAILABLE LOGICAL INPUT DEVICES
ginq_num_seg_pris	INQUIRE NUMBER OF SEGMENT PRIORITIES SUPPORTED
ginq_op_st	INQUIRE OPERATING STATE VALUE
ginq_pat_fac	INQUIRE PATTERN FACILITIES
ginq_pat_ht_vec	INQUIRE PATTERN HEIGHT VECTOR
ginq_pat_ref_point	INQUIRE PATTERN REFERENCE POINT
ginq_pat_ref_point_vecs	INQUIRE PATTERN REFERENCE POINT AND VECTORS
ginq_pat_rep	INQUIRE PATTERN REPRESENTATION
ginq_pat_width_vec	INQUIRE PATTERN WIDTH VECTOR
ginq_pick_st	INQUIRE PICK DEVICE STATE
ginq_pick_st3	INQUIRE PICK DEVICE STATE 3
ginq_pixel	INQUIRE PIXEL
ginq_pixel_array	INQUIRE PIXEL ARRAY
ginq_pixel_array_dims	INQUIRE PIXEL ARRAY DIMENSIONS
ginq_pred_colr_rep	INQUIRE PREDEFINED COLOUR REPRESENTATION
ginq_pred_edge_rep	INQUIRE PREDEFINED EDGE REPRESENTATION
ginq_pred_fill_rep	INQUIRE PREDEFINED FILL AREA REPRESENTATION
ginq_pred_line_rep	INQUIRE PREDEFINED POLYLINE REPRESENTATION
ginq_pred_marker_rep	INQUIRE PREDEFINED POLYMARKER REPRESENTATION
ginq_pred_pat_rep	INQUIRE PREDEFINED PATTERN REPRESENTATION
ginq_pred_text_rep	INQUIRE PREDEFINED TEXT REPRESENTATION
ginq_pred_view_rep	INQUIRE PREDEFINED VIEW REPRESENTATION
ginq_seg_attrs	INQUIRE SEGMENT ATTRIBUTES

Tables

Function Names

ginq_seg_attrs3	INQUIRE SEGMENT ATTRIBUTES 3
ginq_set_active_wss	INQUIRE SET OF ACTIVE WORKSTATIONS
ginq_set_assoc_wss	INQUIRE SET OF ASSOCIATED WORKSTATIONS
ginq_set_open_wss	INQUIRE SET OF OPEN WORKSTATIONS
ginq_set_seg_names	INQUIRE SET OF SEGMENT NAMES IN USE
ginq_set_seg_names_ws	INQUIRE SET OF SEGMENT NAMES ON WORKSTATION
ginq_string_st	INQUIRE STRING DEVICE STATE
ginq_string_st3	INQUIRE STRING DEVICE STATE 3
ginq_stroke_st	INQUIRE STROKE DEVICE STATE
ginq_stroke_st3	INQUIRE STROKE DEVICE STATE 3
ginq_text_align	INQUIRE TEXT ALIGNMENT
ginq_text_colr_ind	INQUIRE TEXT COLOUR INDEX
ginq_text_extent	INQUIRE TEXT EXTENT
ginq_text_extent3	INQUIRE TEXT EXTENT 3
ginq_text_facfs	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_val_st	INQUIRE VALUATOR DEVICE STATE
ginq_val_st3	INQUIRE VALUATOR DEVICE STATE 3
ginq_view_facfs	INQUIRE VIEW FACILITIES
ginq_view_ind	INQUIRE VIEW INDEX
ginq_view_rep3	INQUIRE VIEW REPRESENTATION 3
ginq_ws_cat	INQUIRE WORKSTATION CATEGORY
ginq_ws_class	INQUIRE WORKSTATION CLASSIFICATION
ginq_ws_conn_type	INQUIRE WORKSTATION CONNECTION AND TYPE
ginq_ws_defer_upd_sts	INQUIRE WORKSTATION DEFERRAL AND UPDATE STATES
ginq_ws_max_nums	INQUIRE WORKSTATION MAXIMUM NUMBERS
ginq_ws_st	INQUIRE WORKSTATION STATE
ginq_ws_tran	INQUIRE WORKSTATION TRANSFORMATION
ginq_ws_tran3	INQUIRE WORKSTATION TRANSFORMATION 3
ginsert_seg	INSERT SEGMENT
ginsert_seg3	INSERT SEGMENT 3
ginterpret_item	INTERPRET ITEM
gmessage	MESSAGE
gopen_gks	OPEN GKS
gopen_ws	OPEN WORKSTATION
gpolyline	POLYLINE
gpolyline3	POLYLINE 3
gpolymarker	POLYMARKER
gpolymarker3	POLYMARKER 3
gread_item	READ ITEM FROM GKSM
gredraw_all_segs_ws	REDRAW ALL SEGMENTS ON WORKSTATION
grename_seg	RENAME SEGMENT
greq_choice	REQUEST CHOICE
greq_loc	REQUEST LOCATOR
greq_loc3	REQUEST LOCATOR 3
greq_pick	REQUEST PICK
greq_string	REQUEST STRING
greq_stroke	REQUEST STROKE
greq_stroke3	REQUEST STROKE 3

Function Names

Tables

greq_val	REQUEST VALUATOR
gsample_choice	SAMPLE CHOICE
gsample_loc	SAMPLE LOCATOR
gsample_loc3	SAMPLE LOCATOR 3
gsample_pick	SAMPLE PICK
gsample_string	SAMPLE STRING
gsample_stroke	SAMPLE STROKE
gsample_stroke3	SAMPLE STROKE 3
gsample_val	SAMPLE VALUATOR
gsel_norm_tran	SELECT NORMALIZATION TRANSFORMATION
gset_asfs	SET ASPECT SOURCE FLAGS
gset_asfs3	SET ASPECT SOURCE FLAGS
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_clip_ind	SET CLIPPING INDICATOR
gset_colr_model	SET COLOUR MODEL
gset_colr_rep	SET COLOUR REPRESENTATION
gset_defer_st	SET DEFERRAL STATE
gset_det	SET DETECTABILITY
gset_edge_colr_ind	SET EDGE COLOUR INDEX
gset_edge_flag	SET EDGE FLAG
gset_edge_ind	SET EDGE INDEX
gset_edge_rep	SET EDGE REPRESENTATION
gset_edgetype	SET EDGETYPE
gset_edgewidth	SET EDGEWIDTH SCALE FACTOR
gset_err_hand	SET ERROR HANDLER (GKS-3D/C only)
gset_fill_colr_ind	SET FILL AREA COLOUR INDEX
gset_fill_ind	SET FILL AREA INDEX
gset_fill_int_style	SET FILL AREA INTERIOR STYLE
gset_fill_rep	SET FILL AREA REPRESENTATION
gset_fill_style_ind	SET FILL AREA STYLE INDEX
gset_highl	SET HIGHLIGHTING
gset_hlhr_id	SET HLHSR IDENTIFIER
gset_hlhr_mode	SET HLHSR MODE
gset_line_colr_ind	SET POLYLINE COLOUR INDEX
gset_line_ind	SET POLYLINE INDEX
gset_line_rep	SET POLYLINE REPRESENTATION
gset_linetype	SET LINETYPE
gset_linewidth	SET LINewidth SCALE FACTOR
gset_loc_mode	SET LOCATOR MODE
gset_marker_colr_ind	SET POLYMARKER COLOUR INDEX
gset_marker_ind	SET POLYMARKER INDEX
gset_marker_rep	SET POLYMARKER REPRESENTATION
gset_marker_size	SET MARKER SIZE SCALE FACTOR
gset_marker_type	SET MARKER TYPE
gset_pat_ref_point	SET PATTERN REFERENCE POINT
gset_pat_ref_point_vecs	SET PATTERN REFERENCE POINT AND VECTORS
gset_pat_rep	SET PATTERN REPRESENTATION
gset_pat_size	SET PATTERN SIZE

Tables

Function Names

gset_pick_id	SET PICK IDENTIFIER
gset_pick_mode	SET PICK MODE
gset_seg_pri	SET SEGMENT PRIORITY
gset_seg_tran	SET SEGMENT TRANSFORMATION
gset_seg_tran3	SET SEGMENT TRANSFORMATION 3
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_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_val_mode	SET VALUATOR MODE
gset_view_ind	SET VIEW INDEX
gset_view_rep3	SET VIEW REPRESENTATION 3
gset_view_tran_in_pri	SET VIEW TRANSFORMATION INPUT PRIORITY
gset_vis	SET VISIBILITY
gset_vp	SET VIEWPORT
gset_vp3	SET VIEWPORT 3
gset_vp_in_pri	SET VIEWPORT INPUT PRIORITY
gset_win	SET WINDOW
gset_win3	SET WINDOW 3
gset_ws_vp	SET WORKSTATION VIEWPORT
gset_ws_vp3	SET WORKSTATION VIEWPORT 3
gset_ws_win	SET WORKSTATION WINDOW
gset_ws_win3	SET WORKSTATION WINDOW 3
gtext	TEXT
gtext3	TEXT 3
gupd_ws	UPDATE WORKSTATION
gwrite_item	WRITE ITEM TO GKSM

4.3.2 List Ordered Alphabetically by GKS-3D Name

ACCUMULATE TRANSFORMATION MATRIX	gaccum_tran_matrix
ACCUMULATE TRANSFORMATION MATRIX 3	gaccum_tran_matrix3
ACTIVATE WORKSTATION	gactivate_ws
ASSOCIATE SEGMENT WITH WORKSTATION	gassoc_seg_ws
AWAIT EVENT	gawait_event
CELL ARRAY	gcell_array
CELL ARRAY 3	gcell_array3
CLEAR WORKSTATION	gclear_ws
CLOSE GKS	gclose_gks
CLOSE SEGMENT	gclose_seg
CLOSE WORKSTATION	gclose_ws
COPY SEGMENT FROM WORKSTATION	gcopy_seg_ws
CREATE SEGMENT	gcreate_seg
CREATE STORE (GKS-3D/C only)	gcreate_store
DEACTIVATE WORKSTATION	gdeactivate_ws
DELETE SEGMENT	gdel_seg
DELETE SEGMENT FROM WORKSTATION	gdel_seg_ws
DELETE STORE (GKS-3D/C only)	gdel_store

Function Names

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EMERGENCY CLOSE GKS	gemergency_close_gks
ERROR HANDLING	gerr_hand
ERROR LOGGING	gerr_log
ESCAPE	gescape
EVALUATE TRANSFORMATION MATRIX	geval_tran_matrix
EVALUATE TRANSFORMATION MATRIX 3	geval_tran_matrix3
EVALUATE VIEW MAPPING MATRIX 3	geval_view_map_matrix3
EVALUATE VIEW ORIENTATION MATRIX 3	geval_view_ori_matrix3
FILL AREA	gfill_area
FILL AREA 3	gfill_area3
FILL AREA SET	gfill_area_set
FILL AREA SET 3	gfill_area_set3
FLUSH DEVICE EVENTS	gflush_events
GENERALIZED DRAWING PRIMITIVE	ggdp
GENERALIZED DRAWING PRIMITIVE 3	ggdp3
GET CHOICE	gget_choice
GET ITEM TYPE FROM GKSM	gget_item_type
GET LOCATOR	gget_loc
GET LOCATOR 3	gget_loc3
GET PICK	gget_pick
GET STRING	gget_string
GET STROKE	gget_stroke
GET STROKE 3	gget_stroke3
GET VALUATOR	gget_val
INITIALIZE CHOICE	ginit_choice
INITIALIZE CHOICE 3	ginit_choice3
INITIALIZE LOCATOR	ginit_loc
INITIALIZE LOCATOR 3	ginit_loc3
INITIALIZE PICK	ginit_pick
INITIALIZE PICK 3	ginit_pick3
INITIALIZE STRING	ginit_string
INITIALIZE STRING 3	ginit_string3
INITIALIZE STROKE	ginit_stroke
INITIALIZE STROKE 3	ginit_stroke3
INITIALIZE VALUATOR	ginit_val
INITIALIZE VALUATOR 3	ginit_val3
INQUIRE ASPECT SOURCE FLAGS	ginq_asfs
INQUIRE ASPECT SOURCE FLAGS 3	ginq_asfs3
INQUIRE CHARACTER BASE VECTOR	ginq_char_base_vec
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 CHARACTER WIDTH	ginq_char_width
INQUIRE CHOICE DEVICE STATE	ginq_choice_st
INQUIRE CHOICE DEVICE STATE 3	ginq_choice_st3
INQUIRE CLIPPING	ginq_clip
INQUIRE CLIPPING 3	ginq_clip3
INQUIRE COLOUR FACILITIES	ginq_colr_fac
INQUIRE COLOUR MODEL	ginq_colr_model
INQUIRE COLOUR MODEL FACILITIES	ginq_colr_model_fac
INQUIRE COLOUR REPRESENTATION	ginq_colr_rep

Tables

Function Names

INQUIRE CURRENT HLHSR IDENTIFIER VALUE	ginq_cur_hlhsr_id
INQUIRE CURRENT INDIVIDUAL ATTRIBUTE VALUES	ginq_cur_indiv_attrs
INQUIRE CURRENT INDIVIDUAL ATTRIBUTE VALUES 3	ginq_cur_indiv_attrs3
INQUIRE CURRENT NORMALIZATION TRANSFORMATION NUMBER	ginq_cur_norm_tran_num
INQUIRE CURRENT PICK IDENTIFIER VALUE	ginq_cur_pick_id
INQUIRE CURRENT PRIMITIVE ATTRIBUTE VALUES	ginq_cur_prim_attrs
INQUIRE CURRENT PRIMITIVE ATTRIBUTE VALUES 3	ginq_cur_prim_attrs3
INQUIRE DEFAULT CHOICE DEVICE DATA	ginq_def_choice_data
INQUIRE DEFAULT CHOICE DEVICE DATA 3	ginq_def_choice_data3
INQUIRE DEFAULT DEFERRAL STATE VALUES	ginq_def_defer_sts
INQUIRE DEFAULT LOCATOR DEVICE DATA	ginq_def_loc_data
INQUIRE DEFAULT LOCATOR DEVICE DATA 3	ginq_def_loc_data3
INQUIRE DEFAULT PICK DEVICE DATA	ginq_def_pick_data
INQUIRE DEFAULT PICK DEVICE DATA 3	ginq_def_pick_data3
INQUIRE DEFAULT STRING DEVICE DATA	ginq_def_string_data
INQUIRE DEFAULT STRING DEVICE DATA 3	ginq_def_string_data3
INQUIRE DEFAULT STROKE DEVICE DATA	ginq_def_stroke_data
INQUIRE DEFAULT STROKE DEVICE DATA 3	ginq_def_stroke_data3
INQUIRE DEFAULT VALUATOR DEVICE DATA	ginq_def_val_data
INQUIRE DEFAULT VALUATOR DEVICE DATA 3	ginq_def_val_data3
INQUIRE DISPLAY SPACE SIZE	ginq_disp_space_size
INQUIRE DISPLAY SPACE SIZE 3	ginq_disp_space_size3
INQUIRE DYNAMIC MODIFICATION OF SEGMENT ATTRIBUTES	ginq_dyn_mod_seg_attrs
INQUIRE DYNAMIC MODIFICATION OF WORKSTATION ATTRIBUTES	ginq_dyn_mod_ws_attrs
INQUIRE DYNAMIC MODIFICATION OF WORKSTATION ATTRIBUTES 3	ginq_dyn_mod_ws_attrs3
INQUIRE EDGE COLOUR INDEX	ginq_edge_colr_ind
INQUIRE EDGE FACILITIES	ginq_edge_fac
INQUIRE EDGE FLAG	ginq_edge_flag
INQUIRE EDGE INDEX	ginq_edge_ind
INQUIRE EDGE REPRESENTATION	ginq_edge_rep
INQUIRE EDGETYPE	ginq_edgetype
INQUIRE EDGEWIDTH SCALE FACTOR	ginq_edgewidth
INQUIRE FILL AREA COLOUR INDEX	ginq_fill_colr_ind
INQUIRE FILL AREA FACILITIES	ginq_fill_fac
INQUIRE FILL AREA INDEX	ginq_fill_ind
INQUIRE FILL AREA INTERIOR STYLE	ginq_fill_int_style
INQUIRE FILL AREA REPRESENTATION	ginq_fill_rep
INQUIRE FILL AREA STYLE INDEX	ginq_fill_style_ind
INQUIRE GENERALIZED DRAWING PRIMITIVE	ginq_gdp
INQUIRE GENERALIZED DRAWING PRIMITIVE 3	ginq_gdp3
INQUIRE HLHSR IDENTIFIER FACILITIES	ginq_hlhsr_id_fac
INQUIRE HLHSR MODE	ginq_hlhsr_mode
INQUIRE HLHSR MODE FACILITIES	ginq_hlhsr_mode_fac
INQUIRE INPUT QUEUE OVERFLOW	ginq_in_overf
INQUIRE LEVEL OF GKS	ginq_level_gks
INQUIRE LINETYPE	ginq_linetype
INQUIRE LINewidth SCALE FACTOR	ginq_linewidth
INQUIRE LIST OF AVAILABLE GENERALIZED DRAWING PRIMITIVES	ginq_list_avail_gdps
INQUIRE LIST OF AVAILABLE GENERALIZED DRAWING PRIMITIVES 3	ginq_list_avail_gdps3
INQUIRE LIST OF AVAILABLE WORKSTATION TYPES	ginq_list_avail_ws_types
INQUIRE LIST OF COLOUR INDICES	ginq_list_colr_inds
INQUIRE LIST OF EDGE INDICES	ginq_list_edge_inds

Function Names

Tables

INQUIRE LIST OF FILL AREA INDICES	gingq_list_fill_inde
INQUIRE LIST OF NORMALIZATION TRANSFORMATION NUMBERS	gingq_list_norm_tran_nums
INQUIRE LIST OF PATTERN INDICES	gingq_list_pat_inde
INQUIRE LIST OF POLYLINE INDICES	gingq_list_line_inde
INQUIRE LIST OF POLYMARKER INDICES	gingq_list_marker_inde
INQUIRE LIST OF TEXT INDICES	gingq_list_text_inde
INQUIRE LIST OF VIEW INDICES	gingq_list_view_inde
INQUIRE LOCATOR DEVICE STATE	gingq_loc_st
INQUIRE LOCATOR DEVICE STATE 3	gingq_loc_st3
INQUIRE MARKER SIZE SCALE FACTOR	gingq_marker_size
INQUIRE MARKER TYPE	gingq_marker_type
INQUIRE MAXIMUM LENGTH OF WORKSTATION STATE TABLES	gingq_max_ws_st_tables
INQUIRE MAXIMUM LENGTH OF WORKSTATION STATE TABLES 3	gingq_max_ws_st_tables3
INQUIRE MAXIMUM NORMALIZATION TRANSFORMATION NUMBER	gingq_max_norm_tran_num
INQUIRE MORE SIMULTANEOUS EVENTS	gingq_more_simult_events
INQUIRE NAME OF OPEN SEGMENT	gingq_name_open_seg
INQUIRE NORMALIZATION TRANSFORMATION	gingq_norm_tran
INQUIRE NORMALIZATION TRANSFORMATION 3	gingq_norm_tran3
INQUIRE NUMBER OF AVAILABLE LOGICAL INPUT DEVICES	gingq_num_avail_in
INQUIRE NUMBER OF SEGMENT PRIORITIES SUPPORTED	gingq_num_seg_pris
INQUIRE OPERATING STATE VALUE	gingq_op_st
INQUIRE PATTERN FACILITIES	gingq_pat_fac
INQUIRE PATTERN HEIGHT VECTOR	gingq_pat_ht_vec
INQUIRE PATTERN REFERENCE POINT	gingq_pat_ref_point
INQUIRE PATTERN REFERENCE POINT AND VECTORS	gingq_pat_ref_point_vecs
INQUIRE PATTERN REPRESENTATION	gingq_pat_rep
INQUIRE PATTERN WIDTH VECTOR	gingq_pat_width_vec
INQUIRE PICK DEVICE STATE	gingq_pick_st
INQUIRE PICK DEVICE STATE 3	gingq_pick_st3
INQUIRE PIXEL	gingq_pixel
INQUIRE PIXEL ARRAY	gingq_pixel_array
INQUIRE PIXEL ARRAY DIMENSIONS	gingq_pixel_array_dims
INQUIRE POLYLINE COLOUR INDEX	gingq_line_colr_ind
INQUIRE POLYLINE FACILITIES	gingq_line_fac
INQUIRE POLYLINE INDEX	gingq_line_ind
INQUIRE POLYLINE REPRESENTATION	gingq_line_rep
INQUIRE POLYMARKER COLOUR INDEX	gingq_marker_colr_ind
INQUIRE POLYMARKER FACILITIES	gingq_marker_fac
INQUIRE POLYMARKER INDEX	gingq_marker_ind
INQUIRE POLYMARKER REPRESENTATION	gingq_marker_rep
INQUIRE PREDEFINED COLOUR REPRESENTATION	gingq_pred_colr_rep
INQUIRE PREDEFINED EDGE REPRESENTATION	gingq_pred_edge_rep
INQUIRE PREDEFINED FILL AREA REPRESENTATION	gingq_pred_fill_rep
INQUIRE PREDEFINED PATTERN REPRESENTATION	gingq_pred_pat_rep
INQUIRE PREDEFINED POLYLINE REPRESENTATION	gingq_pred_line_rep
INQUIRE PREDEFINED POLYMARKER REPRESENTATION	gingq_pred_marker_rep
INQUIRE PREDEFINED TEXT REPRESENTATION	gingq_pred_text_rep
INQUIRE PREDEFINED VIEW REPRESENTATION	gingq_pred_view_rep
INQUIRE SEGMENT ATTRIBUTES	gingq_seg_attr
INQUIRE SEGMENT ATTRIBUTES 3	gingq_seg_attr3
INQUIRE SET OF ACTIVE WORKSTATIONS	gingq_set_active_wss
INQUIRE SET OF ASSOCIATED WORKSTATIONS	gingq_set_assoc_wss

Tables

Function Names

INQUIRE SET OF OPEN WORKSTATIONS	gingq_set_open_wss
INQUIRE SET OF SEGMENT NAMES IN USE	gingq_set_seg_names
INQUIRE SET OF SEGMENT NAMES ON WORKSTATION	gingq_set_seg_names_ws
INQUIRE STRING DEVICE STATE	gingq_string_st
INQUIRE STRING DEVICE STATE 3	gingq_string_st3
INQUIRE STROKE DEVICE STATE	gingq_stroke_st
INQUIRE STROKE DEVICE STATE 3	gingq_stroke_st3
INQUIRE TEXT ALIGNMENT	gingq_text_align
INQUIRE TEXT COLOUR INDEX	gingq_text_colr_ind
INQUIRE TEXT EXTENT	gingq_text_extent
INQUIRE TEXT EXTENT 3	gingq_text_extent3
INQUIRE TEXT FACILITIES	gingq_text_fac
INQUIRE TEXT FONT AND PRECISION	gingq_text_font_prec
INQUIRE TEXT INDEX	gingq_text_ind
INQUIRE TEXT PATH	gingq_text_path
INQUIRE TEXT REPRESENTATION	gingq_text_rep
INQUIRE VALUATOR DEVICE STATE	gingq_val_st
INQUIRE VALUATOR DEVICE STATE 3	gingq_val_st3
INQUIRE VIEW FACILITIES	gingq_view_fac
INQUIRE VIEW INDEX	gingq_view_ind
INQUIRE VIEW REPRESENTATION 3	gingq_view_rep3
INQUIRE WORKSTATION CATEGORY	gingq_ws_cat
INQUIRE WORKSTATION CLASSIFICATION	gingq_ws_class
INQUIRE WORKSTATION CONNECTION AND TYPE	gingq_ws_conn_type
INQUIRE WORKSTATION DEFERRAL AND UPDATE STATES	gingq_ws_defer_upd_sts
INQUIRE WORKSTATION MAXIMUM NUMBERS	gingq_ws_max_nums
INQUIRE WORKSTATION STATE	gingq_ws_st
INQUIRE WORKSTATION TRANSFORMATION	gingq_ws_tran
INQUIRE WORKSTATION TRANSFORMATION 3	gingq_ws_tran3
INSERT SEGMENT	ginsert_seg
INSERT SEGMENT 3	ginsert_seg3
INTERPRET ITEM	ginterpret_item
MESSAGE	gmessage
OPEN GKS	gopen_gks
OPEN WORKSTATION	gopen_ws
POLYLINE	gpolyline
POLYLINE 3	gpolyline3
POLYMARKER	gpolymarker
POLYMARKER 3	gpolymarker3
READ ITEM FROM GKSM	gread_item
REDRAW ALL SEGMENTS ON WORKSTATION	gredraw_all_segs_ws
RENAME SEGMENT	grename_seg
REQUEST CHOICE	greq_choice
REQUEST LOCATOR	greq_loc
REQUEST LOCATOR 3	greq_loc3
REQUEST PICK	greq_pick
REQUEST STRING	greq_string
REQUEST STROKE	greq_stroke
REQUEST STROKE 3	greq_stroke3
REQUEST VALUATOR	greq_val
SAMPLE CHOICE	gsample_choice
SAMPLE LOCATOR	gsample_loc

Function Names

Tables

SAMPLE LOCATOR 3	gsample_loc3
SAMPLE PICK	gsample_pick
SAMPLE STRING	gsample_string
SAMPLE STROKE	gsample_stroke
SAMPLE STROKE 3	gsample_stroke3
SAMPLE VALUATOR	gsample_val
SELECT NORMALIZATION TRANSFORMATION	gsel_norm_tran
SET ASPECT SOURCE FLAGS	gset_asfs
SET ASPECT SOURCE FLAGS	gset_asfs3
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
SET CLIPPING INDICATOR	gset_clip_ind
SET COLOUR MODEL	gset_colr_model
SET COLOUR REPRESENTATION	gset_colr_rep
SET DEFERRAL STATE	gset_defer_st
SET DETECTABILITY	gset_det
SET EDGE COLOUR INDEX	gset_edge_colr_ind
SET EDGE FLAG	gset_edge_flag
SET EDGE INDEX	gset_edge_ind
SET EDGE REPRESENTATION	gset_edge_rep
SET EDGETYPE	gset_edgetype
SET EDGEWIDTH SCALE FACTOR	gset_edgewidth
SET ERROR HANDLER (GKS-3D/C only)	gset_err_hand
SET FILL AREA COLOUR INDEX	gset_fill_colr_ind
SET FILL AREA INDEX	gset_fill_ind
SET FILL AREA INTERIOR STYLE	gset_fill_int_style
SET FILL AREA REPRESENTATION	gset_fill_rep
SET FILL AREA STYLE INDEX	gset_fill_style_ind
SET HIGHLIGHTING	gset_highl
SET HLHSR IDENTIFIER	gset_hlshr_id
SET HLHSR MODE	gset_hlshr_mode
SET LINETYPE	gset_linetype
SET LINEWIDTH SCALE FACTOR	gset_linewidth
SET LOCATOR MODE	gset_loc_mode
SET MARKER SIZE SCALE FACTOR	gset_marker_size
SET MARKER TYPE	gset_marker_type
SET PATTERN REFERENCE POINT	gset_pat_ref_point
SET PATTERN REFERENCE POINT AND VECTORS	gset_pat_ref_point_vecs
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 POLYLINE COLOUR INDEX	gset_line_colr_ind
SET POLYLINE INDEX	gset_line_ind
SET POLYLINE REPRESENTATION	gset_line_rep
SET POLYMARKER COLOUR INDEX	gset_marker_colr_ind
SET POLYMARKER INDEX	gset_marker_ind
SET POLYMARKER REPRESENTATION	gset_marker_rep
SET SEGMENT PRIORITY	gset_seg_pri

Tables

Function Names

SET SEGMENT TRANSFORMATION	gset_seg_tran
SET SEGMENT TRANSFORMATION 3	gset_seg_tran3
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 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 VALUATOR MODE	gset_val_mode
SET VIEW INDEX	gset_view_ind
SET VIEW REPRESENTATION 3	gset_view_rep3
SET VIEW TRANSFORMATION INPUT PRIORITY	gset_view_tran_in_pri
SET VIEWPORT	gset_vp
SET VIEWPORT 3	gset_vp3
SET VIEWPORT INPUT PRIORITY	gset_vp_in_pri
SET VISIBILITY	gset_vis
SET WINDOW	gset_win
SET WINDOW 3	gset_win3
SET WORKSTATION VIEWPORT	gset_ws_vp
SET WORKSTATION VIEWPORT 3	gset_ws_vp3
SET WORKSTATION WINDOW	gset_ws_win
SET WORKSTATION WINDOW 3	gset_ws_win3
TEXT	gtext
TEXT 3	gtext3
UPDATE WORKSTATION	gupd_ws
WRITE ITEM TO GKSM	gwrite_item

4.3.3 List Ordered Alphabetically by Bound Name within Level

4.3.3.1 Level 0A

gactivate_ws	ACTIVATE WORKSTATION
gcell_array	CELL ARRAY
gcell_array3	CELL ARRAY 3
gclear_ws	CLEAR WORKSTATION
gclose_gks	CLOSE GKS
gclose_ws	CLOSE WORKSTATION
gcreate_store	CREATE STORE (GKS-3D/C only)
gdeactivate_ws	DEACTIVATE WORKSTATION
gdel_store	DELETE STORE (GKS-3D/C only)
gemergency_close_gks	EMERGENCY CLOSE GKS
gerr_hand	ERROR HANDLING
gerr_log	ERROR LOGGING
gescape	ESCAPE
geval_view_map_matrix3	EVALUATE VIEW MAPPING MATRIX 3
geval_view_ori_matrix3	EVALUATE VIEW ORIENTATION MATRIX 3
gfill_area	FILL AREA
gfill_area3	FILL AREA 3
gfill_area_set	FILL AREA SET
gfill_area_set3	FILL AREA SET 3

Function Names

Tables

ggdp	GENERALIZED DRAWING PRIMITIVE
ggdp3	GENERALIZED DRAWING PRIMITIVE 3
gget_item_type	GET ITEM TYPE FROM GKSM
ginq_asfs	INQUIRE ASPECT SOURCE FLAGS
ginq_asfs3	INQUIRE ASPECT SOURCE FLAGS 3
ginq_char_base_vec	INQUIRE CHARACTER BASE VECTOR
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_char_width	INQUIRE CHARACTER WIDTH
ginq_clip	INQUIRE CLIPPING
ginq_clip3	INQUIRE CLIPPING 3
ginq_colr_fac	INQUIRE COLOUR FACILITIES
ginq_colr_model	INQUIRE COLOUR MODEL
ginq_colr_model_fac	INQUIRE COLOUR MODEL FACILITIES
ginq_colr_rep	INQUIRE COLOUR REPRESENTATION
ginq_cur_indiv_attr	INQUIRE CURRENT INDIVIDUAL ATTRIBUTE VALUES
ginq_cur_indiv_attr3	INQUIRE CURRENT INDIVIDUAL ATTRIBUTE VALUES 3
ginq_cur_norm_tran_num	INQUIRE CURRENT NORMALIZATION TRANSFORMATION NUMBER
ginq_cur_prim_attr	INQUIRE CURRENT PRIMITIVE ATTRIBUTE VALUES
ginq_cur_prim_attr3	INQUIRE CURRENT PRIMITIVE ATTRIBUTE VALUES 3
ginq_disp_space_size	INQUIRE DISPLAY SPACE SIZE
ginq_disp_space_size3	INQUIRE DISPLAY SPACE SIZE 3
ginq_dyn_mod_ws_attr	INQUIRE DYNAMIC MODIFICATION OF WORKSTATION ATTRIBUTES
ginq_dyn_mod_ws_attr3	INQUIRE DYNAMIC MODIFICATION OF WORKSTATION ATTRIBUTES 3
ginq_edge_colr_ind	INQUIRE EDGE COLOUR INDEX
ginq_edge_fac	INQUIRE EDGE FACILITIES
ginq_edge_flag	INQUIRE EDGE FLAG
ginq_edge_ind	INQUIRE EDGE INDEX
ginq_edgetype	INQUIRE EDGETYPE
ginq_edgewidth	INQUIRE EDGEWIDTH SCALE FACTOR
ginq_fill_colr_ind	INQUIRE FILL AREA COLOUR INDEX
ginq_fill_fac	INQUIRE FILL AREA FACILITIES
ginq_fill_ind	INQUIRE FILL AREA INDEX
ginq_fill_int_style	INQUIRE FILL AREA INTERIOR STYLE
ginq_fill_style_ind	INQUIRE FILL AREA STYLE INDEX
ginq_gdp	INQUIRE GENERALIZED DRAWING PRIMITIVE
ginq_gdp3	INQUIRE GENERALIZED DRAWING PRIMITIVE 3
ginq_level_gks	INQUIRE LEVEL OF GKS
ginq_linetype	INQUIRE LINETYPE
ginq_linewidth	INQUIRE LINewidth SCALE FACTOR
ginq_list_avail_gdps	INQUIRE LIST OF AVAILABLE GENERALIZED DRAWING PRIMITIVES
ginq_list_avail_gdps3	INQUIRE LIST OF AVAILABLE GENERALIZED DRAWING PRIMITIVES 3
ginq_list_avail_ws_types	INQUIRE LIST OF AVAILABLE WORKSTATION TYPES
ginq_list_colr_inds	INQUIRE LIST OF COLOUR INDICES
ginq_list_norm_tran_nums	INQUIRE LIST OF NORMALIZATION TRANSFORMATION NUMBERS
ginq_list_view_inds	INQUIRE LIST OF VIEW INDICES
ginq_marker_size	INQUIRE MARKER SIZE SCALE FACTOR
ginq_marker_type	INQUIRE MARKER TYPE
ginq_max_ws_st_tables	INQUIRE MAXIMUM LENGTH OF WORKSTATION STATE TABLES
ginq_max_ws_st_tables3	INQUIRE MAXIMUM LENGTH OF WORKSTATION STATE TABLES 3

Tables

Function Names

ginq_max_norm_tran_num	INQUIRE MAXIMUM NORMALIZATION TRANSFORMATION NUMBER
ginq_norm_tran	INQUIRE NORMALIZATION TRANSFORMATION
ginq_norm_tran3	INQUIRE NORMALIZATION TRANSFORMATION 3
ginq_op_st	INQUIRE OPERATING STATE VALUE
ginq_pat_fac	INQUIRE PATTERN FACILITIES
ginq_pat_ht_vec	INQUIRE PATTERN HEIGHT VECTOR
ginq_pat_ref_point	INQUIRE PATTERN REFERENCE POINT
ginq_pat_ref_point_vecs	INQUIRE PATTERN REFERENCE POINT AND VECTORS
ginq_pat_width_vec	INQUIRE PATTERN WIDTH VECTOR
ginq_pixel	INQUIRE PIXEL
ginq_pixel_array	INQUIRE PIXEL ARRAY
ginq_pixel_array_dims	INQUIRE PIXEL ARRAY DIMENSIONS
ginq_line_colr_ind	INQUIRE POLYLINE COLOUR INDEX
ginq_line_fac	INQUIRE POLYLINE FACILITIES
ginq_line_ind	INQUIRE POLYLINE INDEX
ginq_marker_colr_ind	INQUIRE POLYMARKER COLOUR INDEX
ginq_marker_fac	INQUIRE POLYMARKER FACILITIES
ginq_marker_ind	INQUIRE POLYMARKER INDEX
ginq_pred_colr_rep	INQUIRE PREDEFINED COLOUR REPRESENTATION
ginq_pred_edge_rep	INQUIRE PREDEFINED EDGE REPRESENTATION
ginq_pred_fill_rep	INQUIRE PREDEFINED FILL AREA REPRESENTATION
ginq_pred_pat_rep	INQUIRE PREDEFINED PATTERN REPRESENTATION
ginq_pred_line_rep	INQUIRE PREDEFINED POLYLINE REPRESENTATION
ginq_pred_marker_rep	INQUIRE PREDEFINED POLYMARKER REPRESENTATION
ginq_pred_text_rep	INQUIRE PREDEFINED TEXT REPRESENTATION
ginq_pred_view_rep	INQUIRE PREDEFINED VIEW REPRESENTATION
ginq_set_active_wss	INQUIRE SET OF ACTIVE WORKSTATIONS
ginq_set_open_wss	INQUIRE SET OF OPEN WORKSTATIONS
ginq_text_align	INQUIRE TEXT ALIGNMENT
ginq_text_colr_ind	INQUIRE TEXT COLOUR INDEX
ginq_text_extent	INQUIRE TEXT EXTENT
ginq_text_extent3	INQUIRE TEXT EXTENT 3
ginq_text_fac	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_view_fac	INQUIRE VIEW FACILITIES
ginq_view_ind	INQUIRE VIEW INDEX
ginq_view_rep3	INQUIRE VIEW REPRESENTATION 3
ginq_ws_cat	INQUIRE WORKSTATION CATEGORY
ginq_ws_class	INQUIRE WORKSTATION CLASSIFICATION
ginq_ws_conn_type	INQUIRE WORKSTATION CONNECTION AND TYPE
ginq_ws_defer_upd_sts	INQUIRE WORKSTATION DEFERRAL AND UPDATE STATES
ginq_ws_max_nums	INQUIRE WORKSTATION MAXIMUM NUMBERS
ginq_ws_st	INQUIRE WORKSTATION STATE
ginq_ws_tran	INQUIRE WORKSTATION TRANSFORMATION
ginq_ws_tran3	INQUIRE WORKSTATION TRANSFORMATION 3
ginterpret_item	INTERPRET ITEM
gopen_gks	OPEN GKS
gopen_ws	OPEN WORKSTATION
gpolyline	POLYLINE
gpolyline3	POLYLINE 3

Function Names

Tables

gpolymarker	POLYMARKER
gpolymarker3	POLYMARKER 3
gread_item	READ ITEM FROM GKSM
gsel_norm_tran	SELECT NORMALIZATION TRANSFORMATION
gset_asfs	SET ASPECT SOURCE FLAGS
gset_asfs3	SET ASPECT SOURCE FLAGS
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_clip_ind	SET CLIPPING INDICATOR
gset_colr_model	SET COLOUR MODEL
gset_colr_rep	SET COLOUR REPRESENTATION
gset_edge_colr_ind	SET EDGE COLOUR INDEX
gset_edge_flag	SET EDGE FLAG
gset_edge_ind	SET EDGE INDEX
gset_edgetype	SET EDGETYPE
gset_edgewidth	SET EDGEWIDTH SCALE FACTOR
gset_err_hand	SET ERROR HANDLER (GKS-3D/C only)
gset_fill_colr_ind	SET FILL AREA COLOUR INDEX
gset_fill_ind	SET FILL AREA INDEX
gset_fill_int_style	SET FILL AREA INTERIOR STYLE
gset_fill_style_ind	SET FILL AREA STYLE INDEX
gset_linetype	SET LINETYPE
gset_linewidth	SET LINEWIDTH SCALE FACTOR
gset_marker_size	SET MARKER SIZE SCALE FACTOR
gset_marker_type	SET MARKER TYPE
gset_pat_ref_point	SET PATTERN REFERENCE POINT
gset_pat_ref_point_vecs	SET PATTERN REFERENCE POINT AND VECTORS
gset_pat_size	SET PATTERN SIZE
gset_line_colr_ind	SET POLYLINE COLOUR INDEX
gset_line_ind	SET POLYLINE INDEX
gset_marker_colr_ind	SET POLYMARKER COLOUR INDEX
gset_marker_ind	SET POLYMARKER INDEX
gset_text_align	SET TEXT ALIGNMENT
gset_text_colr_ind	SET TEXT COLOUR INDEX
gset_text_font_prec	SET TEXT FONT AND PRECISION
gset_text_ind	SET TEXT INDEX
gset_text_path	SET TEXT PATH
gset_view_ind	SET VIEW INDEX
gset_view_rep3	SET VIEW REPRESENTATION 3
gset_vp	SET VIEWPORT
gset_vp3	SET VIEWPORT 3
gset_win	SET WINDOW
gset_win3	SET WINDOW 3
gset_ws_vp	SET WORKSTATION VIEWPORT
gset_ws_vp3	SET WORKSTATION VIEWPORT 3
gset_ws_win	SET WORKSTATION WINDOW
gset_ws_win3	SET WORKSTATION WINDOW 3
gtext	TEXT
gtext3	TEXT 3
gupd_ws	UPDATE WORKSTATION

Tables

Function Names

gwrite_item

WRITE ITEM TO GKSM

4.3.3.2 Level 0B

ginit_choice	INITIALIZE CHOICE
ginit_choice3	INITIALIZE CHOICE 3
ginit_loc	INITIALIZE LOCATOR
ginit_loc3	INITIALIZE LOCATOR 3
ginit_string	INITIALIZE STRING
ginit_string3	INITIALIZE STRING 3
ginit_stroke	INITIALIZE STROKE
ginit_stroke3	INITIALIZE STROKE 3
ginit_val	INITIALIZE VALUATOR
ginit_val3	INITIALIZE VALUATOR 3
ginq_choice_st	INQUIRE CHOICE DEVICE STATE
ginq_choice_st3	INQUIRE CHOICE DEVICE STATE 3
ginq_def_choice_data	INQUIRE DEFAULT CHOICE DEVICE DATA
ginq_def_choice_data3	INQUIRE DEFAULT CHOICE DEVICE DATA 3
ginq_def_loc_data	INQUIRE DEFAULT LOCATOR DEVICE DATA
ginq_def_loc_data3	INQUIRE DEFAULT LOCATOR DEVICE DATA 3
ginq_def_string_data	INQUIRE DEFAULT STRING DEVICE DATA
ginq_def_string_data3	INQUIRE DEFAULT STRING DEVICE DATA 3
ginq_def_stroke_data	INQUIRE DEFAULT STROKE DEVICE DATA
ginq_def_stroke_data3	INQUIRE DEFAULT STROKE DEVICE DATA 3
ginq_def_val_data	INQUIRE DEFAULT VALUATOR DEVICE DATA
ginq_def_val_data3	INQUIRE DEFAULT VALUATOR DEVICE DATA 3
ginq_loc_st	INQUIRE LOCATOR DEVICE STATE
ginq_loc_st3	INQUIRE LOCATOR DEVICE STATE 3
ginq_num_avail_in	INQUIRE NUMBER OF AVAILABLE LOGICAL INPUT DEVICES
ginq_string_st	INQUIRE STRING DEVICE STATE
ginq_string_st3	INQUIRE STRING DEVICE STATE 3
ginq_stroke_st	INQUIRE STROKE DEVICE STATE
ginq_stroke_st3	INQUIRE STROKE DEVICE STATE 3
ginq_val_st	INQUIRE VALUATOR DEVICE STATE
ginq_val_st3	INQUIRE VALUATOR DEVICE STATE 3
greq_choice	REQUEST CHOICE
greq_loc	REQUEST LOCATOR
greq_loc3	REQUEST LOCATOR 3
greq_string	REQUEST STRING
greq_stroke	REQUEST STROKE
greq_stroke3	REQUEST STROKE 3
greq_val	REQUEST VALUATOR
gset_choice_mode	SET CHOICE MODE
gset_loc_mode	SET LOCATOR MODE
gset_string_mode	SET STRING MODE
gset_stroke_mode	SET STROKE MODE
gset_val_mode	SET VALUATOR MODE
gset_view_tran_in_pri	SET VIEW TRANSFORMATION INPUT PRIORITY
gset_vp_in_pri	SET VIEWPORT INPUT PRIORITY

Function Names

Tables

4.3.3.3 Level 0C

gawait_event	AWAIT EVENT
gflush_events	FLUSH DEVICE EVENTS
gget_choice	GET CHOICE
gget_loc	GET LOCATOR
gget_loc3	GET LOCATOR 3
gget_string	GET STRING
gget_stroke	GET STROKE
gget_stroke3	GET STROKE 3
gget_val	GET VALUATOR
ginq_in_overf	INQUIRE INPUT QUEUE OVERFLOW
ginq_more_simult_events	INQUIRE MORE SIMULTANEOUS EVENTS
gsample_choice	SAMPLE CHOICE
gsample_loc	SAMPLE LOCATOR
gsample_loc3	SAMPLE LOCATOR 3
gsample_string	SAMPLE STRING
gsample_stroke	SAMPLE STROKE
gsample_stroke3	SAMPLE STROKE 3
gsample_val	SAMPLE VALUATOR

4.3.3.4 Level 1A

gaccum_tran_matrix	ACCUMULATE TRANSFORMATION MATRIX
gaccum_tran_matrix3	ACCUMULATE TRANSFORMATION MATRIX 3
gclose_seg	CLOSE SEGMENT
gcreate_seg	CREATE SEGMENT
gdel_seg	DELETE SEGMENT
gdel_seg_ws	DELETE SEGMENT FROM WORKSTATION
geval_tran_matrix	EVALUATE TRANSFORMATION MATRIX
geval_tran_matrix3	EVALUATE TRANSFORMATION MATRIX 3
ginq_cur_hlhrs_id	INQUIRE CURRENT HLHSR IDENTIFIER VALUE
ginq_def_defer_sts	INQUIRE DEFAULT DEFERRAL STATE VALUES
ginq_dyn_mod_seg_attrs	INQUIRE DYNAMIC MODIFICATION OF SEGMENT ATTRIBUTES
ginq_edge_rep	INQUIRE EDGE REPRESENTATION
ginq_fill_rep	INQUIRE FILL AREA REPRESENTATION
ginq_hlhrs_id_fac	INQUIRE HLHSR IDENTIFIER FACILITIES
ginq_hlhrs_mode	INQUIRE HLHSR MODE
ginq_hlhrs_mode_fac	INQUIRE HLHSR MODE FACILITIES
ginq_list_edge_inds	INQUIRE LIST OF EDGE INDICES
ginq_list_fill_inds	INQUIRE LIST OF FILL AREA INDICES
ginq_list_pat_inds	INQUIRE LIST OF PATTERN INDICES
ginq_list_line_inds	INQUIRE LIST OF POLYLINE INDICES
ginq_list_marker_inds	INQUIRE LIST OF POLYMARKER INDICES
ginq_list_text_inds	INQUIRE LIST OF TEXT INDICES
ginq_name_open_seg	INQUIRE NAME OF OPEN SEGMENT
ginq_num_seg_pri	INQUIRE NUMBER OF SEGMENT PRIORITIES SUPPORTED
ginq_pat_rep	INQUIRE PATTERN REPRESENTATION
ginq_line_rep	INQUIRE POLYLINE REPRESENTATION
ginq_marker_rep	INQUIRE POLYMARKER REPRESENTATION
ginq_seg_attrs	INQUIRE SEGMENT ATTRIBUTES
ginq_seg_attrs3	INQUIRE SEGMENT ATTRIBUTES 3
ginq_set_assoc_wss	INQUIRE SET OF ASSOCIATED WORKSTATIONS

Tables

Function Names

ginq_set_seg_names	INQUIRE SET OF SEGMENT NAMES IN USE
ginq_set_seg_names_ws	INQUIRE SET OF SEGMENT NAMES ON WORKSTATION
ginq_text_rep	INQUIRE TEXT REPRESENTATION
gmessage	MESSAGE
gredraw_all_segs_ws	REDRAW ALL SEGMENTS ON WORKSTATION
grename_seg	RENAME SEGMENT
gset_defer_st	SET DEFERRAL STATE
gset_edge_rep	SET EDGE REPRESENTATION
gset_fill_rep	SET FILL AREA REPRESENTATION
gset_highl	SET HIGHLIGHTING
gset_hlhr_id	SET HLHR IDENTIFIER
gset_hlhr_mode	SET HLHR MODE
gset_pat_rep	SET PATTERN REPRESENTATION
gset_line_rep	SET POLYLINE REPRESENTATION
gset_marker_rep	SET POLYMARKER REPRESENTATION
gset_seg_pri	SET SEGMENT PRIORITY
gset_seg_tran	SET SEGMENT TRANSFORMATION
gset_seg_tran3	SET SEGMENT TRANSFORMATION 3
gset_text_rep	SET TEXT REPRESENTATION
gset_vis	SET VISIBILITY

4.3.3.5 Level 1B

ginit_pick	INITIALIZE PICK
ginit_pick3	INITIALIZE PICK 3
ginq_cur_pick_id	INQUIRE CURRENT PICK IDENTIFIER VALUE
ginq_def_pick_data	INQUIRE DEFAULT PICK DEVICE DATA
ginq_def_pick_data3	INQUIRE DEFAULT PICK DEVICE DATA 3
ginq_pick_st	INQUIRE PICK DEVICE STATE
ginq_pick_st3	INQUIRE PICK DEVICE STATE 3
greq_pick	REQUEST PICK
gset_det	SET DETECTABILITY
gset_pick_id	SET PICK IDENTIFIER
gset_pick_mode	SET PICK MODE

4.3.3.6 Level 1C

gget_pick	GET PICK
gsample_pick	SAMPLE PICK

4.3.3.7 Level 2A

gassoc_seg_ws	ASSOCIATE SEGMENT WITH WORKSTATION
gcopy_seg_ws	COPY SEGMENT FROM WORKSTATION
ginsert_seg	INSERT SEGMENT
ginsert_seg3	INSERT SEGMENT 3

5 Type Definitions

5.1 Mapping of GKS-3D data types

The GKS-3D 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 8806.

GKS-3D data type		C binding data type
I	integer	Gint
R	real	Gfloat
S	string	char *
P	2D point	Gpoint
P3	3D point	Gpoint3
L	list of 2D points	Gpoint_list
L3	list of 3D points	Gpoint_list3
2*R	2D vector	Gvec, Gfloat_size
3*R	3D vector	Gvec3, Gfloat_size3
N	name	Gint, char *, void *
E	enumeration type	typedef enum
CLR	colour specification	Gcolr_rep

5.2 Environmental Type Definitions

The data types defined in this section allow for the ease of porting GKS-3D/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-3D/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 GKS-3D/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-3D/C. Suggest:

```
typedef int Gint;
```

size_t

An additional environmental data type is the type `size_t`. Depending on the environment, `size_t` can be defined as `int`, `unsigned`, `unsigned long`, etc. `size_t` is defined in the `#include` file `<stddef.h>`.

Type Definitions

Implementation Dependent Type Definitions

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, most implementation and registration dependent parts are of type `Gdata`. They can be replaced by any other structure.
- The data records of registered prompt and echo types are represented by structures with the names `pet_rn` (n the prompt and echo type), whereas the data records of unregistered prompt and echo types are represented by structures with the names `pet_un` (-n the prompt and echo type).
- The data records of registered and unregistered GDPs, escape input and escape output are denoted in a similar way.
- For the input data records, the mandatory part, as specified in GKS-3D (ISO 8805), 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-3D defines prompt and echo type 2 this way for the CHOICE device;
- For illustrative reasons, `Gitem_data` is sketchily (and incompletely) defined such that the items described in ISO 8805, Annex E could be represented by GKS-3D/C data types. This definition is, however, not mandatory. Anyway, `Gitem_data` shall be defined in such a way that items which correspond with unsupported GDP's can be read from GKSM and written to GKSM.

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Gchoice_data choice data record

```

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_ul {
            Gdata    impl_dep;        /* impl. dep. */
        } pet_ul; /* pet -1 data */
        /* . . . impl. defined PET's */
    } pets;
} Gchoice_data;

```

Type Definitions

Implementation Dependent Type Definitions

Gchoice_data3 choice data record 3

```

typedef struct {
    union Gchoice3_pets {
        struct Gchoice3_pet_r1 {
            Gdata    impl_dep;        /* impl. dep. */
        } pet_r1; /* pet 1 data */
        struct Gchoice3_pet_r2 {
            Gint      num_prs;        /* number of prompts */
            Gpr_flag  *prs;           /* prompt array */
            Gdata    impl_dep;        /* impl. dep. */
        } pet_r2; /* pet 2 data */
        struct Gchoice3_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 Gchoice3_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 Gchoice3_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 Gchoice3_pet_ul {
            Gdata    impl_dep;        /* impl. dep. */
        } pet_ul; /* pet -1 data */
        /*. . . impl. defined PET's */
    } pets;
} Gchoice_data3;

```

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 */
    Gdata     unsupp;    /* impl. dep. colour specification */
                /* etc. */
} Gcolr_rep;

```

Implementation Dependent Type Definitions

Type Definitions

Gescape_in_data escape input data record

```

typedef union {
    struct Gescape_in_r1 {
        Gdata reg_dep; /* reg. 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 reg_dep; /* reg. 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 reg_dep; /* reg. dep. */
    } gdp_r1; /* gdp 1 data */
    struct Ggdp_u1 {
        Gdata impl_dep; /* impl. dep. */
    } gdp_u1; /* gdp -1 data */
    /* etc. */
} Ggdp_data;

```

Ggdp_data3 gdp data record 3

```

typedef union {
    struct Ggdp3_r1 {
        Gdata reg_dep; /* reg. dep. */
    } gdp3_r1; /* gdp 1 data */
    struct Ggdp3_u1 {
        Gdata impl_dep; /* impl. dep. */
    } gdp3_u1; /* gdp -1 data */
    /* etc. */
} Ggdp_data3;

```

Type Definitions

Implementation Dependent Type Definitions

Gitem_data item data record

```

typedef struct {
    Gint          type;          /* item type          */
    Gint          length;       /* item data record length */
    union {
        Gctrl_flag clear_ws;   /* control flag      */
        Gupd_regen_flag upd_ws; /* regen. flag      */
        struct Gdefer_st {
            Gdefer_mode defer_mode; /* deferral mode    */
            Girg_mode irg_mode; /* irg mode          */
        } defer_st; /* deferrral state  */
        /* etc. */
        Gdata gdp_unsupp; /* GDPs not supported by impl. */
        Gdata impl_dep; /* impl. dependent */
    } data;
} Gitem_data;

```

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Implementation Dependent Type Definitions

Type Definitions

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;
            /* polyline                          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;
            /* polyline/fill area                control flag */
            union Gloc_attrs {
                Gline_attrs                      line_attrs;
                /* polyline                      attrs. */
                Gfill_attrs                      fill_attrs;
                /* fill area                    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;

```

Type Definitions

Implementation Dependent Type Definitions

Gloc_data3 locator data record 3

```

typedef struct {
    union Gloc3_pets {
        struct Gloc3_pet_r1 {
            Gdata                                impl_dep;        /* impl. dep. */
        } pet_r1; /* pet 1 data */
        struct Gloc3_pet_r2 {
            Gdata                                impl_dep;        /* impl. dep. */
        } pet_r2; /* pet 2 data */
        struct Gloc3_pet_r3 {
            Gdata                                impl_dep;        /* impl. dep. */
        } pet_r3; /* pet 3 data */
        struct Gloc3_pet_r4 {
            Gattr_ctrl_flag                    attr_ctrl_flag;
            /* attribute                        control flag */
            Gline_attrs                       line_attrs;
            /* polyline                        attributes */
            Gdata                                impl_dep;        /* impl. dep. */
        } pet_r4; /* pet 4 data */
        struct Gloc3_pet_r5 {
            Gattr_ctrl_flag                    attr_ctrl_flag;
            /* attribute                        control flag */
            Gline_fill_ctrl_flag              line_fill_ctrl_flag;
            /* polyline/fill area              control flag */
            union Gloc3_attrs {
                Gline_attrs                    line_attrs;
                /* polyline                    attrs. */
                Gfill_attrs                    fill_attrs;
                /* fill area                    attrs. */
            } attrs;
            Gdata                                impl_dep;        /* impl. dep. */
        } pet_r5; /* pet 5 data */
        struct Gloc3_pet_r6 {
            Gdata                                impl_dep;        /* impl. dep. */
        } pet_r6; /* pet 6 data */
        struct Gloc3_pet_u1 {
            Gdata                                impl_dep;        /* impl. dep. */
        } pet_u1; /* pet -1 data */
        /*. . . impl. defined PET's */
    } pets;
} Gloc_data3;

```

Gpick_data pick data record

```

typedef struct {
    union Gpick_pets {
        struct Gpick_pet_r1 {
            Gdata impl_dep; /* impl. dep. */
        } pet_r1; /* pet 1 data */
        struct Gpick_pet_r2 {
            Gdata impl_dep; /* impl. dep. */
        } pet_r2; /* pet 2 data */
        struct Gpick_pet_r3 {
            Gdata impl_dep; /* impl. dep. */
        } pet_r3; /* pet 3 data */
        struct Gpick_pet_u1 {
            Gdata impl_dep; /* impl. dep. */
        } pet_u1; /* pet -1 data */
        /* etc. */
    } pets;
} Gpick_data;

```

Gpick_data3 pick data record 3

```

typedef struct {
    union Gpick3_pets {
        struct Gpick3_pet_r1 {
            Gdata impl_dep; /* impl. dep. */
        } pet_r1; /* pet 1 data */
        struct Gpick3_pet_r2 {
            Gdata impl_dep; /* impl. dep. */
        } pet_r2; /* pet 2 data */
        struct Gpick3_pet_r3 {
            Gdata impl_dep; /* impl. dep. */
        } pet_r3; /* pet 3 data */
        struct Gpick3_pet_u1 {
            Gdata impl_dep; /* impl. dep. */
        } pet_u1; /* pet -1 data */
        /* etc. */
    } pets;
} Gpick_data3;

```

Type Definitions

Implementation Dependent Type Definitions

Gstring_data string data record

```

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

```

Gstring_data3 string data record 3

```

typedef struct {
    Gint  in_buf_size; /* input buffer size (nr. of bytes) */
    Gint  init_pos;   /* initial [editing] position */
    union string3_pets {
        struct Gstring3_pet_r1 {
            Gdata  impl_dep; /* impl. dep. */
        } pet_r1; /* pet 1 data */
        struct Gstring3_pet_ul {
            Gdata  impl_dep; /* impl. dep. */
        } pet_ul; /* pet -1 data */
        /* etc. */
    } pets;
} Gstring_data3;

```

Implementation Dependent Type Definitions

Type Definitions

Gstroke_data stroke data record

```

typedef struct {
    Gint    in_buf_size;    /* input buffer size (nr. of points) */
    Gint    init_pos;      /* initial [editing] position */
    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;
            /* polymarker 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;
            /* polyline attrs. */
            Gdata          impl_dep; /* impl. dep. */
        } pet_r4;          /* pet 4 data */
        struct Gstroke_pet_ul {
            Gdata          impl_dep; /* impl. dep. */
        } pet_ul;          /* pet -1 data */
        /* etc. */
    } pets;
} Gstroke_data;

```

Type Definitions

Implementation Dependent Type Definitions

Gstroke_data3 stroke data record 3

```

typedef struct {
    Gint    in_buf_size;    /* input buffer size (nr. of points) */
    Gint    init_pos;      /* initial [editing] position */
    Gfloat  x_interval;    /* X interval */
    Gfloat  y_interval;    /* Y interval */
    Gfloat  z_interval;    /* Z interval */
    Gfloat  time_interval; /* time interval */
    union Gstroke3_pets {
        struct Gstroke3_pet_r1 {
            Gdata          impl_dep; /* impl. dep. */
        } pet_r1;          /* pet 1 data */
        struct Gstroke3_pet_r2 {
            Gdata          impl_dep; /* impl. dep. */
        } pet_r2;          /* pet 2 data */
        struct Gstroke3_pet_r3 {
            Gattr_ctrl_flag attr_ctrl_flag;
            /* attribute control flag */
            Gmarker_attr   marker_attr;
            /* polymarker attrs. */
            Gdata          impl_dep; /* impl. dep. */
        } pet_r3;          /* pet 3 data */
        struct Gstroke3_pet_r4 {
            Gattr_ctrl_flag attr_ctrl_flag;
            /* attribute control flag */
            Gline_attr     line_attr;
            /* polyline attrs. */
            Gdata          impl_dep;
        } pet_r4;          /* pet 4 data */
        struct Gstroke3_pet_ul {
            Gdata          impl_dep; /* impl. dep. */
        } pet_ul;          /* pet -1 data */
        /* etc. */
    } pets;
} Gstroke_data3;

```

Implementation Dependent Type Definitions

Type Definitions

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;

```

Gval_data3 valuator data record 3

```

typedef struct {
    Gfloat  low_value;    /* low value */
    Gfloat  high_value;  /* high value */
    union Gval3_pets {
        struct Gval3_pet_r1 {
            Gdata  impl_dep; /* impl. dep. */
        } pet_r1;    /* pet 1 data */
        struct Gval3_pet_r2 {
            Gdata  impl_dep; /* impl. dep. */
        } pet_r2;    /* pet 2 data */
        struct Gval3_pet_r3 {
            Gdata  impl_dep; /* impl. dep. */
        } pet_r3;    /* pet 3 data */
        struct Gval3_pet_u1 {
            Gdata  impl_dep; /* impl. dep. */
        } pet_u1;    /* pet -1 data */
        /* etc. */
    } pets;
} Gval_data3;

```

5.4 Implementation Independent Type Definitions**REMARKS:**

- 1) For some two-field enumeration types, the order of the fields has been reversed with respect to ISO 8805; this reversal has been done in order to keep numerical compatibility with ISO/IEC 8806-1 (GKS-3D/ FORTRAN); the enumeration types are:

Type Definitions

Implementation Independent Type Definitions

Gclip_ind, Gcolr_avail, Gdisp_surf_empty, Gecho_switch,
Gupd_regen_flag, Gvis;

- 2) For the enumeration type STATUS, the fields NO CHOICE and NO PICK have been compacted to the field NO INPUT, in order to keep numerical compatibility with GKS-3D/FORTRAN.

Gasf aspect source flag

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

Gasfs aspect source flags

```
typedef struct {
    Gasf linetype; /* linetype ASF */
    Gasf linewidth; /* linewidth scale factor ASF */
    Gasf line_colr_ind; /* polyline colour index ASF */
    Gasf marker_type; /* marker type ASF */
    Gasf marker_size; /* marker size scale factor ASF */
    Gasf marker_colr_ind; /* polymarker colour index 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 index ASF */
    Gasf fill_int_style; /* fill area interior style ASF */
    Gasf fill_style_ind; /* fill area style index ASF */
    Gasf fill_colr_ind; /* fill area colour index ASF */
} Gasfs;
```

Gasfs3 aspect source flags 3

```
typedef struct {
    Gasf linetype; /* linetype ASF */
    Gasf linewidth; /* linewidth scale factor ASF */
    Gasf line_colr_ind; /* polyline colour index ASF */
    Gasf marker_type; /* marker type ASF */
    Gasf marker_size; /* marker size scale factor ASF */
    Gasf marker_colr_ind; /* polymarker colour index 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 index ASF */
    Gasf fill_int_style; /* fill area interior style ASF */
    Gasf fill_style_ind; /* fill area style index ASF */
    Gasf fill_colr_ind; /* fill area colour index ASF */
    Gasf edge_flag; /* edge flag ASF */
    Gasf edgetype; /* edgetype ASF */
    Gasf edgewidth; /* edgewidth scale factor ASF */
    Gasf edge_colr_ind; /* edge colour index ASF */
} Gasfs3;
```

Implementation Independent Type Definitions

Type Definitions

Gattr_ctrl_flag attribute control flag

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

Gattrrs attributes [used]

```
typedef enum {
    GATTR_LINE,
    GATTR_MARKER,
    GATTR_TEXT,
    GATTR_FILL,
    GATTR_EDGE
} Gattrrs;
```

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

```
typedef struct {
    Gfloat   cieluv_x; /* x coefficient */
    Gfloat   cieluv_y; /* y coefficient */
    Gfloat   cieluv_y_lum; /* y luminance */
} Gcieluv;
```

Gclip clipping

```
typedef struct {
    Gclip_ind clip_ind; /* clipping indicator */
    Glimit clip_rect; /* clipping rectangle */
} Gclip;
```

Gclip3 clipping 3

```
typedef struct {
    Gclip_ind clip_ind; /* clipping indicator */
    Glimit3 clip_vol; /* clipping volume */
} Gclip3;
```

Gclip_ind clipping indicator

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

Gcolr_avail colour available

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

Type Definitions

Implementation Independent Type Definitions

Gcolr_facs colour facilities

```

typedef struct {
    Gint    num_colrs;    /* num. of colours          */
    Gcolr_avail  colr_avail; /* colour availability      */
    Gint    num_pred_inde; /* num. of predef. colour indices */
} Gcolr_facs;

```

Gcoord_switch coordinate switch

```

typedef enum {
    GCOORD_WC,
    GCOORD_NDC
} Gcoord_switch;

```

Gctrl_flag control flag

```

typedef enum {
    GFLAG_COND,
    GFLAG_ALWAYS
} Gctrl_flag;

```

Gdata data

```

typedef struct {
    size_t  size;    /* size of data          */
    void    *data;  /* pointer to data       */
} Gdata;

```

Gdc_units device coordinate units

```

typedef enum {
    GDC_METRES,
    GDC_OTHER
} Gdc_units;

```

Gdefer_mode deferral mode

```

typedef enum {
    GDEFER_ASAP,
    GDEFER_BNIG,
    GDEFER_BNIL,
    GDEFER_ASTI
} Gdefer_mode;

```

Gdet detectability

```

typedef enum {
    GSEG_UNDET,
    GSEG_DET
} Gdet;

```

Implementation Independent Type Definitions

Type Definitions

Gdisp_space_size display space size

```
typedef struct {
    Gdc_units    dc_units;    /* device coordinate units          */
    Gfloat_size  size_dc;     /* display space size [in] dc [units] */
    Gint_size    size_raster; /* display space size [in] raster [units] */
} Gdisp_space_size;
```

Gdisp_space_size3 display space size 3

```
typedef struct {
    Gdc_units    dc_units;    /* device coordinate units          */
    Gfloat_size3 size_dc;     /* display space size [in] dc [units] */
    Gint_size3   size_raster; /* display space size [in] raster [units] */
} Gdisp_space_size3;
```

Gdisp_surf_empty display surface empty

```
typedef enum {
    GSURF_NOT_EMPTY,
    GSURF_EMPTY
} Gdisp_surf_empty;
```

Gdyn_mod dynamic modification [accepted]

```
typedef enum {
    GDYN_IRG,
    GDYN_IMM
} Gdyn_mod;
```

Gdyn_mod_seg_attrs dynamic modification [of] segment attributes

```
typedef struct {
    Gdyn_mod    tran;        /* changeability of:                */
    Gdyn_mod    invis_vis;  /* segment transformation            */
    Gdyn_mod    vis_invis;  /* appearing (invisible → visible)   */
    Gdyn_mod    highl;     /* disappearing (visible → invisible) */
    Gdyn_mod    pri;       /* highlighting                       */
    Gdyn_mod    add_prims;  /* priority                          */
    Gdyn_mod    del;       /* addition of primitives to segment  */
} Gdyn_mod_seg_attrs; /* deletion of segment                */
```

Type Definitions

Implementation Independent Type Definitions

Gdyn_mod_ws_attrs dynamic modification [of] workstation attributes

```

typedef struct {
    Gdyn_mod   line_bundle;    /* changeability of:          */
    Gdyn_mod   marker_bundle; /* polyline representation    */
    Gdyn_mod   text_bundle;   /* polymarker representation  */
    Gdyn_mod   fill_bundle;   /* text representation        */
    Gdyn_mod   pat_rep;       /* fill area representation   */
    Gdyn_mod   colr_rep;      /* pattern representation     */
    Gdyn_mod   ws_tran;       /* colour representation      */
    Gdyn_mod   ws_tran;       /* workstation transformation */
} Gdyn_mod_ws_attrs;

```

Gdyn_mod_ws_attrs3 dynamic modification [of] workstation attributes 3

```

typedef struct {
    Gdyn_mod   line_bundle;    /* changeability of:          */
    Gdyn_mod   marker_bundle; /* polyline representation    */
    Gdyn_mod   text_bundle;   /* polymarker representation  */
    Gdyn_mod   fill_bundle;   /* text representation        */
    Gdyn_mod   edge_bundle;   /* fill area representation   */
    Gdyn_mod   pat_rep;       /* edge representation        */
    Gdyn_mod   colr_rep;      /* pattern representation     */
    Gdyn_mod   view_rep;      /* colour representation      */
    Gdyn_mod   ws_tran;       /* view representation        */
    Gdyn_mod   hlhsr_mode;    /* workstation transform      */
    Gdyn_mod   hlhsr_mode;    /* HLHSR mode                 */
} Gdyn_mod_ws_attrs3;

```

Gecho_switch echo switch

```

typedef enum {
    GSWITCH_NO_ECHO,
    GSWITCH_ECHO
} Gecho_switch;

```

Gedge_bundle edge bundle

```

typedef struct {
    Gedge_flag  flag;         /* edge flag                  */
    Gint        type;         /* edgetype                   */
    Gfloat      width;       /* edgewidth scale factor    */
    Gint        colr_ind;    /* edge colour index          */
} Gedge_bundle;

```

Implementation Independent Type Definitions

Type Definitions

Gedge_fac edge facilities

```

typedef struct {
    Gint_list  types;           /* list of edgetypes           */
    Gint       num_widths;     /* num. of available edgewidths */
    Gfloat     nom_width;     /* nominal edgewidth           */
    Gfloat     min_width;     /* min. edgewidth              */
    Gfloat     max_width;     /* max. edgewidth              */
    Gint       num_pred_inde; /* num. of predef. edge indices */
} Gedge_fac;

```

Gedge_flag edge flag

```

typedef enum {
    GEDGE_OFF,
    GEDGE_ON
} Gedge_flag;

```

Gfill_attr fill area attributes

```

typedef struct {
    Gasf       int_style_asf; /* fill area interior style asf */
    Gasf       style_ind_asf; /* fill area style index asf    */
    Gasf       colr_ind_asf; /* fill area colour index asf   */
    Gint       ind;          /* fill area index               */
    Gfill_bundle bundle;    /* fill area bundle              */
} Gfill_attr;

```

Gfill_bundle fill area bundle

```

typedef struct {
    Gfill_int_style int_style; /* fill area interior style */
    Gint            style_ind; /* fill area style index    */
    Gint            colr_ind; /* fill area colour index   */
} Gfill_bundle;

```

Gfill_fac fill area facilities

```

typedef struct {
    Gint            num_int_styles; /* num. of interior styles      */
    Gfill_int_style int_styles[4]; /* list of available interior styles */
    Gint_list      hatch_styles; /* list of available hatch styles */
    Gint           num_pred_inde; /* num. of predef. fill area indices */
} Gfill_fac;

```

Type Definitions

Implementation Independent Type Definitions

Gfill_int_style fill area interior style

```
typedef enum {
    GSTYLE_HOLLOW,
    GSTYLE_SOLID,
    GSTYLE_PAT,
    GSTYLE_HATCH
} Gfill_int_style;
```

Gfloat_size float size

```
typedef struct {
    Gfloat size_x; /* x size */
    Gfloat size_y; /* y size */
} Gfloat_size;
```

Gfloat_size3 float size 3

```
typedef struct {
    Gfloat size_x; /* x size */
    Gfloat size_y; /* y size */
    Gfloat size_z; /* z size */
} Gfloat_size3;
```

Ghighl highlighting

```
typedef enum {
    GSEG_NORM,
    GSEG_HIGHL
} Ghighl;
```

Ghls Hue Luminance Saturation [colour specification]

```
typedef struct {
    Gfloat hue; /* hue */
    Gfloat lightness; /* lightness */
    Gfloat satur; /* saturation */
} Ghls;
```

Ghor_text_align horizontal text alignment

```
typedef enum {
    GHOR_NORM,
    GHOR_LEFT,
    GHOR_CTR,
    GHOR_RIGHT
} Ghor_text_align;
```

Implementation Independent Type Definitions

Type Definitions

Ghsv Hue Saturation Value [colour specification]

```
typedef struct {
    Gfloat   hue;      /* hue          */
    Gfloat   satur;   /* saturation   */
    Gfloat   value;   /* value       */
} Ghsv;
```

Gin_class input class

```
typedef enum {
    GIN_NONE,
    GIN_LOC,
    GIN_STROKE,
    GIN_VAL,
    GIN_CHOICE,
    GIN_PICK,
    GIN_STRING
} Gin_class;
```

Gin_status [input] status

```
typedef enum {
    GIN_STATUS_NONE,
    GIN_STATUS_OK,
    GIN_STATUS_NO_IN
} Gin_status;
```

Gindiv_attrs individual attributes

```
typedef struct {
    Gint      linetype;      /* linetype          */
    Gfloat    linewidth;    /* linewidth scale factor */
    Gint      line_colr_ind; /* polyline colour index */
    Gint      marker_type;  /* marker type       */
    Gfloat    marker_size;  /* marker size scale factor */
    Gint      marker_colr_ind; /* polymarker colour index */
    Gtext_font_prec text_font_prec; /* text font and precision */
    Gfloat    char_expan;   /* character expansion factor */
    Gfloat    char_space;   /* character spacing   */
    Gint      text_colr_ind; /* text colour index   */
    Gfill_int_style fill_int_style; /* fill area interior style */
    Gint      fill_style_ind; /* fill area style index */
    Gint      fill_colr_ind; /* fill area colour index */
    Gasfs     asfs;        /* aspect source flags  */
} Gindiv_attrs;
```

Type Definitions

Implementation Independent Type Definitions

Gindiv_attrs3 individual attributes 3

```

typedef struct {
    Gint      linetype;          /* linetype          */
    Gfloat    linewidth;        /* linewidth scale factor */
    Gint      line_colr_ind;     /* polyline colour index  */
    Gint      marker_type;      /* marker type         */
    Gfloat    marker_size;      /* marker size scale factor */
    Gint      marker_colr_ind;   /* polymarker colour index */
    Gtext_font_prec text_font_prec; /* text font and precision */
    Gfloat    char_expan;       /* character expansion factor */
    Gfloat    char_space;      /* character spacing     */
    Gint      text_colr_ind;     /* text colour index     */
    Gfill_int_style fill_int_style; /* fill area interior style */
    Gint      fill_style_ind;    /* fill area style index  */
    Gint      fill_colr_ind;     /* fill area colour index  */
    Gedge_flag edge_flag;       /* edge flag            */
    Gint      edgetype;         /* edgetype            */
    Gfloat    edgewidth;        /* edgewidth scale factor */
    Gint      edge_colr_ind;     /* edge colour index     */
    Gasfs3    asfs;            /* aspect source flags 3  */
} Gindiv_attrs3;

```

Ginq_type inquire type

```

typedef enum {
    GINQ_SET,
    GINQ_REALIZED
} Ginq_type;

```

Gint_list integer list

```

typedef struct {
    Gint  num_ints; /* num. of integers in list */
    Gint  *ints;   /* list of integers          */
} Gint_list;

```

Gint_size integer size

```

typedef struct {
    Gint  size_x; /* x size */
    Gint  size_y; /* y size */
} Gint_size;

```

Gint_size3 integer size 3

```

typedef struct {
    Gint  size_x; /* x size */
    Gint  size_y; /* y size */
    Gint  size_z; /* z size */
} Gint_size3;

```

Girg_mode implicit regeneration mode

```
typedef enum {
    GIRG_SUPPR,
    GIRG_ALLOWED
} Girg_mode;
```

Glevel GKS-3D level

```
typedef enum {
    GLEVEL_0A,
    GLEVEL_0B,
    GLEVEL_0C,
    GLEVEL_1A,
    GLEVEL_1B,
    GLEVEL_1C,
    GLEVEL_2A,
    GLEVEL_2B,
    GLEVEL_2C
} Glevel;
```

Glimit limit

```
typedef struct {
    Gfloat x_min; /* x min */
    Gfloat x_max; /* x max */
    Gfloat y_min; /* y min */
    Gfloat y_max; /* y max */
} Glimit;
```

Glimit3 limit3

```
typedef struct {
    Gfloat x_min; /* x min */
    Gfloat x_max; /* x max */
    Gfloat y_min; /* y min */
    Gfloat y_max; /* y max */
    Gfloat z_min; /* z min */
    Gfloat z_max; /* z max */
} Glimit3;
```

Gline_attrs polyline attributes

```
typedef struct {
    Gasf type_asf; /* linetype asf */
    Gasf width_asf; /* linewidth asf */
    Gasf colr_ind_asf; /* polyline colour index asf */
    Gint ind; /* polyline index */
    Gline_bundle bundle; /* polyline bundle */
} Gline_attrs;
```

Type Definitions

Implementation Independent Type Definitions

Gline_bundle polyline bundle

```
typedef struct {
    Gint    type;          /* linetype          */
    Gfloat  width;        /* linewidth scale factor */
    Gint    colr_ind;     /* polyline colour index */
} Gline_bundle;
```

Gline_facs polyline facilities

```
typedef struct {
    Gint_list types;      /* list of linetypes          */
    Gint    num_widths;   /* num. of available linewidths */
    Gfloat  nom_width;    /* nominal linewidth          */
    Gfloat  min_width;    /* min. linewidth            */
    Gfloat  max_width;    /* max. linewidth            */
    Gint    num_pred_inds; /* num. of predef. polyline indices */
} Gline_facs;
```

Gline_fill_ctrl_flag polyline/fill area control flag

```
typedef enum {
    GFLAG_LINE,
    GFLAG_FILL
} Gline_fill_ctrl_flag;
```

Gmarker_attrs polymarker attributes

```
typedef struct {
    Gasf    type_asf;     /* marker type asf          */
    Gasf    size_asf;     /* marker size scale factor asf */
    Gasf    colr_ind_asf; /* marker colour index asf     */
    Gint    ind;         /* polymarker index         */
    Gmarker_bundle bundle; /* polymarker bundle        */
} Gmarker_attrs;
```

Gmarker_bundle polymarker bundle

```
typedef struct {
    Gint    type;        /* marker type          */
    Gfloat  size;        /* marker size scale factor */
    Gint    colr_ind;    /* polymarker colour index */
} Gmarker_bundle;
```

Implementation Independent Type Definitions

Type Definitions

Gmarker_fac polymarker facilities

```

typedef struct {
    Gint_list  types;           /* list of marker types          */
    Gint       num_sizes;      /* num. of available marker sizes */
    Gfloat     nom_size;       /* nominal marker size           */
    Gfloat     min_size;       /* min. marker size              */
    Gfloat     max_size;       /* max. marker size              */
    Gint       num_pred_inde;  /* num. of predef. polymarker indices */
} Gmarker_fac;

```

Gmatrix3 4*4[view] matrix

```

typedef Gfloat Gmatrix3[4][4];

```

Gmax_ws_st_tables max. [length of] workstation state tables

```

typedef struct {
    Gint  line_bundles; /* max. num. of :          */
    Gint  marker_bundles; /* polyline bundle table entries */
    Gint  text_bundles; /* polymarker bundle table entries */
    Gint  fill_bundles; /* text bundle table entries */
    Gint  pat_reps; /* fill area bundle table entries */
    Gint  colr_reps; /* pattern table entries */
    Gint  colr_reps; /* colour table entries */
} Gmax_ws_st_tables;

```

Gmax_ws_st_tables3 max. [length of] workstation state tables 3

```

typedef struct {
    Gint  line_bundles; /* max. num. of :          */
    Gint  marker_bundles; /* polyline bundle table entries */
    Gint  text_bundles; /* polymarker bundle table entries */
    Gint  fill_bundles; /* text bundle table entries */
    Gint  pat_reps; /* fill area bundle table entries */
    Gint  edge_bundles; /* pattern table entries */
    Gint  colr_reps; /* edge bundle table entries */
    Gint  colr_reps; /* colour table entries */
    Gint  view_reps; /* view table entries */
} Gmax_ws_st_tables3;

```

Gmore_simult_events more simultaneous events

```

typedef enum {
    GSIMULT_NO_MORE,
    GSIMULT_MORE
} Gmore_simult_events;

```

Type Definitions

Implementation Independent Type Definitions

Gnew_frame_nec_upd new frame [action] necessary [at] update

```
typedef enum {
    GNEW_NO,
    GNEW_YES
} Gnew_frame_nec_upd;
```

Gnum_in number [of] input [devices]

```
typedef struct {
    Gint loc; /* num. of locator devices */
    Gint stroke; /* num. of stroke devices */
    Gint val; /* num. of valuator devices */
    Gint choice; /* num. of choice devices */
    Gint pick; /* num. of pick devices */
    Gint string; /* num. of string devices */
} Gnum_in;
```

Gop_mode operating mode

```
typedef enum {
    GOP_REQ,
    GOP_SAMPLE,
    GOP_EVENT
} Gop_mode;
```

Gop_st operating state

```
typedef enum {
    GST_GKCL,
    GST_GKOP,
    GST_WSOP,
    GST_WSAC,
    GST_SGOP
} Gop_st;
```

Gparal parallelogram

```
typedef struct {
    Gpoint3 p; /* point p */
    Gpoint3 q; /* point q */
    Gpoint3 r; /* point r */
} Gparal;
```

Gpat_rep pattern representation

```
typedef struct {
    Gint_size dims; /* colour array's dimensions */
    Gint *colr_array; /* colour array */
} Gpat_rep;
```

Implementation Independent Type Definitions

Type Definitions

Gpick pick [value]

```
typedef struct {
    Gint  seg_name; /* segment name */
    Gint  pick_id; /* pick identifier */
} Gpick;
```

Gpoint point

```
typedef struct {
    Gfloat x; /* x coordinate */
    Gfloat y; /* y coordinate */
} Gpoint;
```

Gpoint3 point 3

```
typedef struct {
    Gfloat x; /* x coordinate */
    Gfloat y; /* y coordinate */
    Gfloat z; /* z coordinate */
} Gpoint3;
```

Gpoint_list point list

```
typedef struct {
    Gint  num_points; /* num. of points in the list */
    Gpoint *points; /* list of points */
} Gpoint_list;
```

Gpoint_list3 point list 3

```
typedef struct {
    Gint  num_points; /* num. of points in the list */
    Gpoint3 *points; /* list of points */
} Gpoint_list3;
```

Gpoint_list_list list of point lists

```
typedef struct {
    Gint  num_point_lists; /* num. of point lists in the list */
    Gpoint_list *point_lists; /* list of point lists */
} Gpoint_list_list;
```

Gpoint_list_list3 list of point lists 3

```
typedef struct {
    Gint  num_point_lists; /* num. of point lists in the list */
    Gpoint_list3 *point_lists; /* list of point lists */
} Gpoint_list_list3;
```

Type Definitions

Implementation Independent Type Definitions

Gpr_flag prompt flag

```
typedef enum {
    GPR_OFF,
    GPR_ON
} Gpr_flag;
```

Gpres_inval presence [of] invalid [values]

```
typedef enum {
    GINVAL_ABSENT,
    GINVAL_PRESENT
} Gpres_inval;
```

Gprim_attrs primitive attributes

```
typedef struct {
    Gint      line_ind;      /* polyline index      */
    Gint      marker_ind;   /* polymarker index   */
    Gint      text_ind;     /* text index          */
    Gfloat    char_ht;      /* character height    */
    Gvec      char_up_vec;  /* character up vector */
    Gfloat    char_width;   /* character width     */
    Gvec      char_base_vec; /* character base vector */
    Gtext_path text_path;   /* text path           */
    Gtext_align text_align; /* text alignment      */
    Gint      fill_ind;     /* fill area index     */
    Gvec      pat_width_vec; /* pattern width vector */
    Gvec      pat_ht_vec;   /* pattern height vector */
    Gpoint    pat_ref_point; /* pattern reference point */
} Gprim_attrs;
```

Gprim_attrs3 primitive attributes 3

```
typedef struct {
    Gint      line_ind;      /* polyline index      */
    Gint      marker_ind;   /* polymarker index   */
    Gint      text_ind;     /* text index          */
    Gfloat    char_ht;      /* character height    */
    Gvec      char_up_vec;  /* character up vector */
    Gfloat    char_width;   /* character width     */
    Gvec      char_base_vec; /* character base vector */
    Gtext_path text_path;   /* text path           */
    Gtext_align text_align; /* text alignment      */
    Gint      fill_ind;     /* fill area index     */
    Gvec      pat_width_vec; /* pattern width vector */
    Gvec      pat_ht_vec;   /* pattern height vector */
    Gpoint3   pat_ref_point; /* pattern reference point */
    Gvec3     pat_ref_vec[2]; /* pattern reference vectors */
    Gint      edge_ind;     /* edge index          */
    Gint      view_ind;     /* view index          */
} Gprim_attrs3;
```

Implementation Independent Type Definitions

Type Definitions

Gproj_type projection type

```
typedef enum {
    GPROJ_PARAL,
    GPROJ_PERSPECT
} Gproj_type;
```

Grect rectangle

```
typedef struct {
    Gpoint p; /* point p */
    Gpoint q; /* point q */
} Grect;
```

Grel_pri relative priority

```
typedef enum {
    GPRI_HIGHER,
    GPRI_LOWER
} Grel_pri;
```

Grgb Red Green Blue [colour specification]

```
typedef struct {
    Gfloat red; /* red intensity */
    Gfloat green; /* green intensity */
    Gfloat blue; /* blue intensity */
} Grgb;
```

Gseg_attrs segment attributes

```
typedef struct {
    Gtran_matrix tran_matrix; /* transformation matrix */
    Gvis vis; /* visibility */
    Ghighl highl; /* hightlighting */
    Gfloat pri; /* segment priority */
    Gdet det; /* detectability */
} Gseg_attrs;
```

Gseg_attrs3 segment attributes 3

```
typedef struct {
    Gtran_matrix3 tran_matrix; /* transformation matrix */
    Gvis vis; /* visibility */
    Ghighl highl; /* hightlighting */
    Gfloat pri; /* segment priority */
    Gdet det; /* detectability */
} Gseg_attrs3;
```

Type Definitions

Implementation Independent Type Definitions

Gstore store

```
typedef void *Gstore;
```

Gtext_align text alignment

```
typedef struct {
    Ghor_text_align hor; /* horizontal component */
    Gvert_text_align vert; /* vertical component */
} Gtext_align;
```

Gtext_bundle text bundle

```
typedef struct {
    Gtext_font_prec text_font_prec; /* text font and precision */
    Gfloat char_expan; /* character expansion factor */
    Gfloat char_space; /* character spacing */
    Gint colr_ind; /* text colour index */
} Gtext_bundle;
```

Gtext_extent text extent

```
typedef struct {
    Gpoint concat_point; /* concatenation point */
    Gpoint paral[4]; /* text extent parallelogram */
} Gtext_extent;
```

Gtext_extent3 text extent 3

```
typedef struct {
    Gpoint3 concat_point; /* concatenation point */
    Gpoint3 paral[4]; /* text extent parallelogram */
} Gtext_extent3;
```

Gtext_fac text facilities

```
typedef struct {
    Gint num_font_precs; /* num. of fonts and precisions */
    Gtext_font_prec *font_precs; /* list of fonts and precisions */
    Gint num_char_hts; /* num. of character heights */
    Gfloat min_char_ht; /* min. character height */
    Gfloat max_char_ht; /* max. character height */
    Gint num_char_expans; /* num. of char. expansion factors */
    Gfloat min_char_expan; /* min. expansion factor */
    Gfloat max_char_expan; /* max. expansion factor */
    Gint num_pred_inds; /* num. of predef. text indices */
} Gtext_fac;
```

Gtext_font_prec text font [and] precision

```
typedef struct {
    Gint      font; /* text font      */
    Gtext_prec prec; /* text precision */
} Gtext_font_prec;
```

Gtext_path text path

```
typedef enum {
    GPATH_RIGHT,
    GPATH_LEFT,
    GPATH_UP,
    GPATH_DOWN
} Gtext_path;
```

Gtext_prec text precision

```
typedef enum {
    GPREC_STRING,
    GPREC_CHAR,
    GPREC_STROKE
} Gtext_prec;
```

Gtran transformation

```
typedef struct {
    Glimit win; /* window */
    Glimit vp; /* viewport */
} Gtran;
```

Gtran3 transformation 3

```
typedef struct {
    Glimit3 win; /* window */
    Glimit3 vp; /* viewport */
} Gtran3;
```

Gtran_matrix transformation matrix

```
typedef Gfloat Gtran_matrix[2][3];
```

Gtran_matrix3 transformation matrix 3

```
typedef Gfloat Gtran_matrix3[3][4];
```

Gupd_regen_flag update regeneration flag

```
typedef enum {
    GFLAG_POSTPONE,
    GFLAG_PERFORM
} Gupd_regen_flag;
```

Type Definitions

Implementation Independent Type Definitions

Gupd_st update state

```
typedef enum {
    GUPD_NOT_PEND,
    GUPD_PEND
} Gupd_st;
```

Gvec vector

```
typedef struct {
    Gfloat delta_x; /* x coordinate */
    Gfloat delta_y; /* y coordinate */
} Gvec;
```

Gvec3 vector 3

```
typedef struct {
    Gfloat delta_x; /* x coordinate */
    Gfloat delta_y; /* y coordinate */
    Gfloat delta_z; /* z coordinate */
} Gvec3;
```

Gvert_text_align vertical text alignment

```
typedef enum {
    GVERT_NORM,
    GVERT_TOP,
    GVERT_CAP,
    GVERT_HALF,
    GVERT_BASE,
    GVERT_BOTTOM
} Gvert_text_align;
```

Gview_map3 view mapping 3

```
typedef struct {
    Glimit win; /* window limits */
    Glimit3 proj_vp; /* projection viewport limits */
    Gproj_type proj_type; /* projection type */
    Gpoint3 proj_ref_point; /* projection reference point */
    Gfloat view_plane; /* view plane distance */
    Gfloat front_plane; /* front plane distance */
    Gfloat back_plane; /* back plane distance */
} Gview_map3;
```

Implementation Independent Type Definitions

Type Definitions

Gview_rep3 view representation 3

```

typedef struct {
    Gmatrix3    ori_matrix; /* orientation matrix      */
    Gmatrix3    map_matrix; /* mapping matrix         */
    Glimit3     clip_limit; /* clipping limits        */
    Gclip_ind   xy_clip;   /* X-Y clipping [indicator] */
    Gclip_ind   back_clip; /* back clipping [indicator] */
    Gclip_ind   front_clip; /* front clipping [indicator] */
} Gview_rep3;

```

Gvis visibility

```

typedef enum {
    GSEG_INVIS,
    GSEG_VIS
} Gvis;

```

Gws_cat workstation category

```

typedef enum {
    GCAT_OUT,
    GCAT_IN,
    GCAT_OUTIN,
    GCAT_WISS,
    GCAT_MO,
    GCAT_MI
} Gws_cat;

```

Gws_class workstation classification

```

typedef enum {
    GCLASS_VEC,
    GCLASS_RASTER,
    GCLASS_OTHER
} Gws_class;

```

Gws_max_nums workstation max. numbers

```

typedef struct {
    Gint    simult_open; /* max. num. of simult. open wss */
    Gint    simult_active; /* max. num. of simult. active wss */
    Gint    assoc_seg; /* max. num. of wss associated with segment */
} Gws_max_nums;

```

Gws_st workstation state

```

typedef enum {
    GWS_INACTIVE,
    GWS_ACTIVE
} Gws_st;

```

6 Macro Definitions

6.1 Function identifiers

The error functions require a unique mapping of the GKS-3D functions to a set of numbers. The names for these function identifiers are the same as the GKS-3D function names except that the sentinel character has been replaced by "Gfn_".

Below, the function macros are listed, with their numerical values. These values are identical with the values of the function identifiers in ISO/IEC 8806-1 (GKS-3D FORTRAN).

```

#define Gfn_open_gks (0)
#define Gfn_close_gks (1)
#define Gfn_open_ws (2)
#define Gfn_close_ws (3)
#define Gfn_activate_ws (4)
#define Gfn_deactivate_ws (5)
#define Gfn_clear_ws (6)
#define Gfn_redraw_all_segs_ws (7)
#define Gfn_upd_ws (8)
#define Gfn_set_defer_st (9)
#define Gfn_message (10)
#define Gfn_escape (11)
#define Gfn_polyline3 (109)
#define Gfn_polyline (12)
#define Gfn_polymarker3 (110)
#define Gfn_polymarker (13)
#define Gfn_text3 (111)
#define Gfn_text (14)
#define Gfn_fill_area3 (112)
#define Gfn_fill_area (15)
#define Gfn_fill_area_set3 (114)
#define Gfn_fill_area_set (113)
#define Gfn_cell_array3 (115)
#define Gfn_cell_array (16)
#define Gfn_gdp3 (116)
#define Gfn_gdp (17)
#define Gfn_set_line_ind (18)
#define Gfn_set_linetype (19)
#define Gfn_set_linewidth (20)
#define Gfn_set_line_colr_ind (21)
#define Gfn_set_marker_ind (22)
#define Gfn_set_marker_type (23)
#define Gfn_set_marker_size (24)
#define Gfn_set_marker_colr_ind (25)
#define Gfn_set_text_ind (26)
#define Gfn_set_text_font_prec (27)
#define Gfn_set_char_expan (28)
#define Gfn_set_char_space (29)
#define Gfn_set_text_colr_ind (30)
#define Gfn_set_char_ht (31)
#define Gfn_set_char_up_vec (32)

```

Function identifiers

Macro Definitions

#define	Gfn_set_text_path	(33)
#define	Gfn_set_text_align	(34)
#define	Gfn_set_fill_ind	(35)
#define	Gfn_set_fill_int_style	(36)
#define	Gfn_set_fill_style_ind	(37)
#define	Gfn_set_fill_colr_ind	(38)
#define	Gfn_set_pat_size	(39)
#define	Gfn_set_pat_ref_point_vecs	(117)
#define	Gfn_set_pat_ref_point	(40)
#define	Gfn_set_edge_ind	(118)
#define	Gfn_set_edge_flag	(119)
#define	Gfn_set_edgetype	(120)
#define	Gfn_set_edgewidth	(121)
#define	Gfn_set_edge_colr_ind	(122)
#define	Gfn_set_asfs3	(123)
#define	Gfn_set_asfs	(41)
#define	Gfn_set_pick_id	(42)
#define	Gfn_set_line_rep	(43)
#define	Gfn_set_marker_rep	(44)
#define	Gfn_set_text_rep	(45)
#define	Gfn_set_fill_rep	(46)
#define	Gfn_set_pat_rep	(47)
#define	Gfn_set_edge_rep	(124)
#define	Gfn_set_colr_model	(125)
#define	Gfn_set_colr_rep	(48)
#define	Gfn_set_colr_rep_ext	(153)
#define	Gfn_set_win3	(126)
#define	Gfn_set_win	(49)
#define	Gfn_set_vp3	(127)
#define	Gfn_set_vp	(50)
#define	Gfn_set_vp_in_pri	(51)
#define	Gfn_sel_norm_tran	(52)
#define	Gfn_set_clip_ind	(53)
#define	Gfn_set_view_ind	(128)
#define	Gfn_set_view_rep3	(129)
#define	Gfn_set_view_tran_in_pri	(130)
#define	Gfn_set_hlhr_id	(131)
#define	Gfn_set_hlhr_mode	(132)
#define	Gfn_set_ws_win3	(133)
#define	Gfn_set_ws_win	(54)
#define	Gfn_set_ws_vp3	(134)
#define	Gfn_set_ws_vp	(55)
#define	Gfn_create_seg	(56)
#define	Gfn_close_seg	(57)
#define	Gfn_rename_seg	(58)
#define	Gfn_del_seg	(59)
#define	Gfn_del_seg_ws	(60)
#define	Gfn_assoc_seg_ws	(61)
#define	Gfn_copy_seg_ws	(62)
#define	Gfn_insert_seg3	(135)
#define	Gfn_insert_seg	(63)
#define	Gfn_set_seg_tran3	(136)

Macro Definitions

Function identifiers

#define	Gfn_set_seg_tran	(64)
#define	Gfn_set_vis	(65)
#define	Gfn_set_high1	(66)
#define	Gfn_set_seg_pri	(67)
#define	Gfn_set_det	(68)
#define	Gfn_init_loc3	(137)
#define	Gfn_init_loc	(69)
#define	Gfn_init_stroke3	(138)
#define	Gfn_init_stroke	(70)
#define	Gfn_init_val3	(139)
#define	Gfn_init_val	(71)
#define	Gfn_init_choice3	(140)
#define	Gfn_init_choice	(72)
#define	Gfn_init_pick3	(141)
#define	Gfn_init_pick	(73)
#define	Gfn_init_string3	(142)
#define	Gfn_init_string	(74)
#define	Gfn_set_loc_mode	(75)
#define	Gfn_set_stroke_mode	(76)
#define	Gfn_set_val_mode	(77)
#define	Gfn_set_choice_mode	(78)
#define	Gfn_set_pick_mode	(79)
#define	Gfn_set_string_mode	(80)
#define	Gfn_req_loc3	(143)
#define	Gfn_req_loc	(81)
#define	Gfn_req_stroke3	(144)
#define	Gfn_req_stroke	(82)
#define	Gfn_req_val	(83)
#define	Gfn_req_choice	(84)
#define	Gfn_req_pick	(85)
#define	Gfn_req_string	(86)
#define	Gfn_sample_loc3	(145)
#define	Gfn_sample_loc	(87)
#define	Gfn_sample_stroke3	(146)
#define	Gfn_sample_stroke	(88)
#define	Gfn_sample_val	(89)
#define	Gfn_sample_choice	(90)
#define	Gfn_sample_pick	(91)
#define	Gfn_sample_string	(92)
#define	Gfn_await_event	(93)
#define	Gfn_flush_events	(94)
#define	Gfn_get_loc3	(147)
#define	Gfn_get_loc	(95)
#define	Gfn_get_stroke3	(148)
#define	Gfn_get_stroke	(96)
#define	Gfn_get_val	(97)
#define	Gfn_get_choice	(98)
#define	Gfn_get_pick	(99)
#define	Gfn_get_string	(100)
#define	Gfn_write_item	(101)
#define	Gfn_get_item_type	(102)
#define	Gfn_read_item	(103)

Function identifiers

Macro Definitions

```

#define Gfn_interpret_item          (104)
#define Gfn_eval_view_ori_matrix3  (149)
#define Gfn_eval_view_map_matrix3  (150)
#define Gfn_eval_tran_matrix3      (151)
#define Gfn_eval_tran_matrix       (105)
#define Gfn_accum_tran_matrix3     (152)
#define Gfn_accum_tran_matrix      (106)
#define Gfn_emergency_close_gks    (153)
#define Gfn_err_hand                (154)
#define Gfn_err_log                 (155)
#define Gfn_set_err_hand            (156)

```

6.2 Error Codes

The error codes are represented by macros. The range of the numeric values of the macros is between 0 and 1000.

Below, the error macros are listed.

```

#define GE_NO_ERR                    (0) /* No Errors */

/* operating state errors */

#define GE_NOT_GKCL                  (1) /* GKS-3D not in proper state: GKS-3D
                                         shall be in the state GKCL */
#define GE_NOT_GKOP                  (2) /* GKS-3D not in proper state: GKS-3D
                                         shall be in the state GKOP */
#define GE_NOT_WSAC                  (3) /* GKS-3D not in proper state: GKS-3D
                                         shall be in the state WSAC */
#define GE_NOT_SGOP                  (4) /* GKS-3D not in proper state: GKS-3D
                                         shall be in the state SGOP */
#define GE_NOT_WSAC_SGOP             (5) /* GKS-3D not in proper state: GKS-3D
                                         shall be either in the state WSAC or in
                                         the state SGOP */
#define GE_NOT_WSOP_WSAC            (6) /* GKS-3D not in proper state: GKS-3D
                                         shall be either in the state WSOP or in
                                         the state WSAC */
#define GE_GKCL_GKOP                 (7) /* GKS-3D not in proper state: GKS-3D
                                         shall be in one of the states WSOP, WSAC
                                         or SGOP */
#define GE_GKCL                      (8) /* GKS-3D not in proper state: GKS-3D
                                         shall be in one of the states GKOP, WSOP,
                                         WSAC or SGOP */

/* workstation errors */

#define GE_WS_ID_INVALID             (20) /* Specified workstation identifier is
                                         invalid */
#define GE_CONN_ID_INVALID          (21) /* Specified connection identifier is
                                         invalid */
#define GE_WS_TYPE_INVALID          (22) /* Specified workstation type is invalid
                                         */
#define GE_NO_WS_TYPE               (23) /* Specified workstation type does not

```

Macro Definitions

Error codes

```

                                exist */
#define GE_WS_OPEN                (24) /* Specified workstation is open */
#define GE_WS_NOT_OPEN            (25) /* Specified workstation is not open */
#define GE_WS_CANT_OPEN           (26) /* Specified workstation cannot be opened
                                */
#define GE_WISS_NOT_OPEN          (27) /* Workstation Independent Segment
                                Storage is not open */
#define GE_WISS_OPEN              (28) /* Workstation Independent Segment
                                Storage is already open */
#define GE_WS_ACTIVE              (29) /* Specified workstation is active */
#define GE_WS_INACTIVE           (30) /* Specified workstation is not active */
#define GE_WS_MO                  (31) /* Specified workstation is of category
                                MO */
#define GE_WS_NOT_MO             (32) /* Specified workstation is not of
                                category MO */
#define GE_WS_MI                  (33) /* Specified workstation is of category
                                MI */
#define GE_WS_NOT_MI             (34) /* Specified workstation is not of
                                category MI */
#define GE_WS_IN                  (35) /* Specified workstation is of category
                                INPUT */
#define GE_WS_WISS                (36) /* Specified workstation is Workstation
                                Independent Segment Storage */
#define GE_WS_NOT_OUTIN           (37) /* Specified workstation is not of
                                category OUTIN */
#define GE_WS_NOT_IN_OUTIN        (38) /* Specified workstation is neither of
                                category INPUT nor of category OUTIN */
#define GE_WS_NOT_OUT_OUTIN       (39) /* Specified workstation is neither of
                                category OUTPUT nor of category OUTIN */
#define GE_WS_NO_PIXEL            (40) /* Specified workstation has no pixel
                                store readback capability */
#define GE_WS_TYPE_NO_GDP         (41) /* Specified workstation type is not able
                                to generate the specified generalized
                                drawing primitive */
#define GE_WS_MAX_OPEN            (42) /* Maximum number of simultaneously open
                                workstations would be exceeded */
#define GE_WS_MAX_ACTIVE          (43) /* Maximum number of simultaneously
                                active workstations would be exceeded */

/* transformation errors */

#define GE_TRAN_NUM_INVALID        (50) /* Transformation number is invalid */
#define GE_RECT_INVALID           (51) /* Rectangle definition is invalid */
#define GE_VP_INVALID             (52) /* Viewport is not within the Normalized
                                Device Coordinate unit square */
#define GE_WIN_INVALID            (53) /* Workstation window is not within the
                                Normalized Device Coordinate unit square
                                */
#define GE_WS_VP_INVALID           (54) /* Workstation viewport is not within the
                                display space */

/* output attribute errors */

```

Error codes

Macro Definitions

```

#define GE_LINE_IND_INVALID      (60) /* Polyline index is invalid */
#define GE_LINE_REP_UNDEF       (61) /* A representation for the specified
                                     polyline index has not been defined on
                                     this workstation */
#define GE_LINE_REP_NOT_PRED    (62) /* A representation for the specified
                                     polyline index has not been predefined on
                                     this workstation */
#define GE_LINETYPE_ZERO        (63) /* Linetype is equal to zero */
#define GE_LINETYPE_NOT_WS      (64) /* Specified linetype is not supported on
                                     this workstation */
#define GE_LINEWIDTH_LT_ZERO    (65) /* Linewidth scale factor is less than
                                     zero */
#define GE_MARKER_IND_INVALID   (66) /* Polymarker index is invalid */
#define GE_MARKER_REP_UNDEF     (67) /* A representation for the specified
                                     polymarker index has not been defined on
                                     this workstation */
#define GE_MARKER_REP_NOT_PRED  (68) /* A representation for the specified
                                     polymarker index has not been predefined
                                     on this workstation */
#define GE_MARKER_TYPE_ZERO     (69) /* Marker type is equal to zero */
#define GE_MARKER_TYPE_NOT_WS   (70) /* Specified marker type is not supported
                                     on this workstation */
#define GE_MARKER_SIZE_LT_ZERO  (71) /* Marker size scale factor is less than
                                     zero */
#define GE_TEXT_IND_INVALID     (72) /* Text index is invalid */
#define GE_TEXT_REP_UNDEF       (73) /* A representation for the specified
                                     text index has not been defined on this
                                     workstation */
#define GE_TEXT_REP_NOT_PRED    (74) /* A representation for the specified
                                     text index has not been predefined on
                                     this workstation */
#define GE_FONT_ZERO            (75) /* Text font is equal to zero */
#define GE_FONT_NOT_WS          (76) /* Requested text font is not supported
                                     for the specified precision on this
                                     workstation */
#define GE_EXPAN_LE_ZERO        (77) /* Character expansion factor is less
                                     than or equal to zero */
#define GE_HT_LE_ZERO           (78) /* Character height is less than or equal
                                     to zero */
#define GE_UP_VEC_ZERO          (79) /* Length of character up vector is zero
                                     */
#define GE_FILL_IND_INVALID     (80) /* Fill area index is invalid */
#define GE_FILL_REP_UNDEF       (81) /* A representation for the specified
                                     fill area index has not been defined on
                                     this workstation */
#define GE_FILL_REP_NOT_PRED    (82) /* A representation for the specified
                                     fill area index has not been predefined
                                     on this workstation */
#define GE_INT_STYLE_NOT_WS     (83) /* Specified fill area interior style is
                                     not supported on this workstation */
#define GE_STYLE_IND_ZERO       (84) /* Style (pattern or hatch) index is
                                     equal to zero */

```

Macro Definitions

Error codes

```

#define GE_PAT_IND_INVALID (85) /* Specified pattern index is invalid */
#define GE_HATCH_STYLE_NOT_WS (86) /* Specified hatch style is not supported
on this workstation */
#define GE_PAT_SIZE_LE_ZERO (87) /* Pattern size value is not positive */
#define GE_PAT_REP_UNDEF (88) /* A representation for the specified
pattern index has not been defined on
this workstation */
#define GE_PAT_REP_NOT_PRED (89) /* A representation for the specified
pattern index has not been predefined on
this workstation */
#define GE_PAT_NOT_WS (90) /* Interior style PATTERN is not sup-
ported on this workstation */
#define GE_DIM_INVALID (91) /* Dimensions of colour array are invalid
*/
#define GE_COLR_IND_LT_ZERO (92) /* Colour index is less than zero */
#define GE_COLR_IND_INVALID (93) /* Colour index is invalid */
#define GE_COLR_REP_UNDEF (94) /* A representation for the specified
colour index has not been defined on this
workstation */
#define GE_COLR_REP_NOT_PRED (95) /* A representation for the specified
colour index has not been predefined on
this workstation */
#define GE_COLR_INVALID (96) /* Colour component is outside valid
range for colour model */
#define GE_PICK_ID_INVALID (97) /* Pick identifier is invalid */
#define GE_COLR_MODEL_UNAVAIL (98) /* Specified colour model is not avail-
able on the workstation */

/* output errors */

#define GE_NUM_POINT_INVALID (100) /* Number of points is invalid */
#define GE_INVALID_CODE (101) /* Invalid code in string */
#define GE_GDP_ID_INVALID (102) /* Generalized drawing primitive identif-
ier is invalid */
#define GE_GDP_DATA_INVALID (103) /* Content of generalized drawing primi-
tive data record is invalid */
#define GE_CANT_GEN_GDP (104) /* At least one active workstation is not
able to generate the specified general-
ized drawing primitive */
#define GE_CANT_GEN_GDP_CLIP (105) /* At least one active workstation is not
able to generate the specified general-
ized drawing primitive under the current
transformations and clipping conditions
*/

/* segment errors */

#define GE_SEG_NAME_INVALID (120) /* Specified segment name is invalid */
#define GE_SEG_NAME_USED (121) /* Specified segment name is already in
use */
#define GE_SEG_ABSENT (122) /* Specified segment does not exist */
#define GE_SEG_NOT_WS (123) /* Specified segment does not exist on

```

Error codes

Macro Definitions

```

specified workstation */
#define GE_SEG_NOT_WISS (124) /* Specified segment does not exist on
Workstation Independent Segment Storage
*/
#define GE_SEG_OPEN (125) /* Specified segment is open */
#define GE_SEG_PRI_INVAL (126) /* Segment priority is outside the range
[0,1] */

/* input errors */

#define GE_IN_DEV_NOT_WS (140) /* Specified input device is not present
on workstation */
#define GE_IN_DEV_NOT_REQ (141) /* Input device is not in REQUEST mode */
#define GE_IN_DEV_NOT_SAMPLE (142) /* Input device is not in SAMPLE mode */
#define GE_EV_SAMPLE_UNAVAIL (143) /* EVENT and SAMPLE input mode are not
available at this level of GKS-3D */
#define GE_PET_NOT_WS (144) /* Specified prompt and echo type is not
supported on this workstation */
#define GE_ECHO_INVAL (145) /* Echo area is outside display space */
#define GE_IN_DATA_INVAL (146) /* Contents of input data record are
invalid */
#define GE_QUE_OVERF (147) /* Input queue has overflowed */
#define GE_NO_QUE_OVERF (148) /* Input queue has not overflowed since
GKS-3D was opened or the last invocation
of INQUIRE INPUT QUEUE OVERFLOW */
#define GE_ASSOC_WS_CLOSED (149) /* Input queue has overflowed, but asso-
ciated workstation has been closed */
#define GE_NO_CUR_EV (150) /* No input value of the correct class is
in the current event report */
#define GE_TIMEOUT_INVAL (151) /* Timeout is invalid */
#define GE_INIT_INVAL (152) /* Initial value is invalid */
#define GE_INIT_STROKE_INVAL (153) /* Number of points in the initial stroke
is greater than the buffer size */
#define GE_INIT_STRING_INVAL (154) /* Length of the initial string is
greater than the buffer size */

/* GKSM errors */

#define GE_ITEM_RESERVED (160) /* Item type is not allowed for user
items */
#define GE_ITEM_LENGTH_INVAL (161) /* Item length is invalid */
#define GE_NO_ITEM_MI (162) /* No item is left in GKS-3D Metafile
input */
#define GE_ITEM_INVAL (163) /* Metafile item is invalid */
#define GE_ITEM_GKS_INVAL (164) /* Item type is not a valid GKS-3D item
*/
#define GE_ITEM_DATA_INVAL (165) /* Content of item data record is invalid
for the specified item type */
#define GE_MAX_ITEM_DATA_INVAL (166) /* Maximum item data record length is
invalid */
#define GE_USER_ITEM (167) /* User item cannot be interpreted */
#define GE_FUNC_UNAVAIL (168) /* Specified function is not supported in

```

Macro Definitions

Error codes

this level of GKS-3D */

```

/* escape errors */

#define GE_ESCAPE_FUNC_UNAVAIL      (180) /* Specified escape function is not supported */
#define GE_ESCAPE_ID_INVAL          (181) /* Specified escape function identification is invalid */
#define GE_ESCAPE_DATA_INVAL       (182) /* Contents of escape data record are invalid */

/* error file errors */

#define GE_ERR_FILE_INVAL           (200) /* Specified error file is invalid */

/* I/O errors */

#define GE_MEM_OVERF                (300) /* Storage overflow has occurred in GKS-3D */
#define GE_SEG_MEM_OVERF           (301) /* Storage overflow has occurred in segment storage */
#define GE_IO_ERR_READ              (302) /* Input/Output error has occurred while reading */
#define GE_IO_ERR_WRITE             (303) /* Input/Output error has occurred while writing */
#define GE_IO_ERR_WRITE_WS         (304) /* Input/Output error has occurred while sending data to a workstation */
#define GE_IO_ERR_READ_WS          (305) /* Input/Output error has occurred while receiving data from a workstation */
#define GE_IO_ERR_LIB               (306) /* Input/Output error has occurred during program library management */
#define GE_IO_ERR_WS_TABLE         (307) /* Input/Output error has occurred while reading workstation description table */
#define GE_ARITH_ERR                (308) /* Arithmetic error has occurred */

/* 3-D Transformation errors */

#define GE_UP_VEC_PLANE_NORM_COLL   (400) /* View up vector and view plane normal are collinear */
#define GE_PLANE_NORM_NULL          (401) /* View plane normal is a null vector */
#define GE_UP_VEC_NULL              (402) /* View up vector is a null vector */
#define GE_CLIP_LIM_INVAL          (403) /* View clipping limits are not within NPC range */
#define GE_PROJ_REF_POINT_INVAL     (404) /* Projection reference point is between the front and back clipping planes */
#define GE_PROJ_REF_POINT_PLANE     (405) /* Projection reference point is on the view plane */
#define GE_BOX_DEF_INVAL            (406) /* Box definition is invalid */
#define GE_VP3_INVAL                (407) /* Viewport is not within NDC unit cube */
#define GE_VIEW_IND_INVAL           (408) /* Specified view index is invalid */

```

Error codes

Macro Definitions

```

#define GE_VIEW_REP_UNDEF          (409) /* A representation for the specified
                                         view index has not been defined on this
                                         workstation. */
#define GE_VIEW_REP_NOT_PRED       (410) /* A representation for the specified
                                         view index has not been predefined on
                                         this workstation */
#define GE_WS_WIN_LIM_INVALID      (411) /* Workstation window limits are not
                                         within the NPC unit cube */
#define GE_BACK_CLIP_INVALID       (412) /* Back clipping plane is in front of the
                                         front clipping plane */
#define GE_CLIP_PLANE_EQ           (413) /* Front and back clipping planes are the
                                         same */

/* 3-D output attribute errors */

#define GE_EDGE_IND_INVALID        (420) /* Edge index is invalid */
#define GE_EDGE_REP_UNDEF         (421) /* A representation for the specified
                                         edge index has not been defined on this
                                         workstation */
#define GE_EDGE_REP_NOT_PRED       (422) /* A representation for the specified
                                         edge index has not been predefined on
                                         this workstation */
#define GE_EDGETYPE_ZERO          (423) /* Edgetype is equal to zero */
#define GE_EDGETYPE_NOT_WS        (424) /* Specified edgetype is not supported on
                                         this workstation */
#define GE_EDGEWIDTH_LT_ZERO      (425) /* Edgewidth scale factor is less than
                                         zero */
#define GE_PAT_REF_VEC_COLL        (426) /* Pattern reference vectors are col-
                                         linear */
#define GE_HLHSR_NOT_WS           (427) /* Specified HLHSR mode not supported on
                                         workstation */
#define GE_HLHSR_ID_INVALID       (428) /* Specified HLHSR identifier is invalid
                                         */
#define GE_HLHSR_MODE_INVALID     (429) /* Specified HLHSR mode is invalid */

/* 3-D output errors */

#define GE_TEXT_VEC_COLL          (430) /* The text direction vectors are col-
                                         linear */
#define GE_LIST_POINT_LIST_INVALID (431) /* List of point lists is invalid */

/* binding specific errors */

#define GE_START_IND_INVALID       (2200) /* Start index out of range*/
#define GE_APPL_LIST_LENGTH_LT_ZERO (2201) /* Length of application list is nega-
                                         tive */
#define GE_ENUM_TYPE_INVALID       (2202) /* Enumeration type out of range*/
#define GE_ALLOC_STORE             (2203) /* Error while allocating Store */
#define GE_ALLOC_MEM_STORE        (2204) /* Error while allocating memory for
                                         Store */

```

Macro Definitions

Miscellaneous Macros

6.3 Miscellaneous Macros

6.3.1 Linetypes

```
#define GLINE_SOLID      (1) /* Solid linetype */
#define GLINE_DASH      (2) /* Dashed linetype */
#define GLINE_DOT       (3) /* Dotted linetype */
#define GLINE_DASH_DOT  (4) /* Dashed-dotted linetype */
#define GLINE_DASH_DOT_DOT (5) /* Dashed-dotted-dotted linetype */
```

6.3.2 Marker Types

```
#define GMARKER_DOT      (1) /* Dotted marker type */
#define GMARKER_PLUS    (2) /* Plus (+) marker type */
#define GMARKER_ASTERISK (3) /* Asterisk (*) marker type */
#define GMARKER_CIRCLE  (4) /* Circle (o) marker type */
#define GMARKER_CROSS   (5) /* Cross (X) marker type */
```

6.3.3 Colour Models

```
#define GMODEL_RGB      (1) /* Red-Green-Blue */
#define GMODEL_CIELUV   (2) /* CIE Luv 1976 */
#define GMODEL_HSV      (3) /* Hue-Saturation-Value */
#define GMODEL_HLS      (4) /* Hue-Lightness-Saturation */
```

6.3.4 Prompt and Echo Types

```
#define GLOC_DEF        (1) /* Locator default */
#define GLOC_CROSS_HAIR (2) /* Locator cross-hair */
#define GLOC_TRACK_CROSS (3) /* Locator tracking cross*/
#define GLOC_RUB_BAND   (4) /* Locator rubber band */
#define GLOC_RECT       (5) /* Locator rectangle */
#define GLOC_DIGIT      (6) /* Locator digital */

#define GSTROKE_DEF     (1) /* Stroke default */
#define GSTROKE_DIGIT   (2) /* Stroke digit */
#define GSTROKE_MARKER  (3) /* Stroke polymarker */
#define GSTROKE_LINE    (4) /* Stroke polyline */

#define GVAL_DEF        (1) /* Valuator default */
#define GVAL_GRAPH      (2) /* Valuator graphical */
#define GVAL_DIGIT      (3) /* Valuator digital */

#define GCHOICE_DEF     (1) /* Choice default */
#define GCHOICE_PR_ECHO (2) /* Choice prompt and echo */
#define GCHOICE_STRING_PR (3) /* Choice string and prompt */
#define GCHOICE_STRING_IN (4) /* Choice string input*/
#define GCHOICE_SEG     (5) /* Choice segment */

#define GPICK_DEF       (1) /* Pick default */
#define GPICK_GROUP_HIGHL (2) /* Pick group highlighting */
#define GPICK_SEG_HIGHL (3) /* Pick segment highlighting */

#define GSTRING_DEF     (1) /* String default */
```

Miscellaneous Macros

Macro Definitions

6.3.5 Default Parameters of OPEN GKS

```
#define GDEF_MEM_SIZE ((size_t) (-1))/* Default memory size */  
#define GDEF_ERR_FILE ((char *) (""))/* Default error file name*/
```

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7 C GKS-3D Function Interface

7.1 Notational Conventions

The binding of each GKS-3D function follows the following template:

GKS-3D Function Name	LEVEL
<pre>void gfunction(Gtype0 arg0, /* argument 0 explanation */ Gtype1 arg1, /* argument 1 explanation */ Gtype2 arg2, /* argument 2 explanation */);</pre>	

"GKS-3D Function Name" is the name of the function as listed in the GKS-3D standard.

"LEVEL" is the GKS-3D level of the function as listed in the GKS-3D standard.

The C function name bound to the GKS-3D function is `gfunction`. `arg0`, `arg1`, and `arg2` are the arguments to the function and correspond to the parameters of the GKS-3D function definition. `Gtype0`, `Gtype1`, and `Gtype2` are the C data types of the arguments. The definitions of these types are listed in clause 5 of this part of ISO/IEC 8806.

To the right of each argument declaration is a C comment field which contains a brief explanation of the argument. If the comment begins with "OUT" it means the argument is used as an output parameter; the implementation returns data to the application through this argument. Arguments without "OUT" are input parameters.

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

7.2 Control Functions

OPEN GKS	0A
<pre>void gopen_gks(const char *err_file, /* name of error file */ size_t mem_units /* number of units of memory available for buffer space */);</pre>	

REMARK. If `err_file` has the value `GDEF_ERR_FILE`, the `stderr` file is used. If `mem_units` has the value `GDEF_MEM_SIZE`, the number of available bytes is implementation dependent.

CLOSE GKS	0A
<pre>void gclose_gks(void);</pre>	

Control Functions

C GKS-3D Function Interface

OPEN WORKSTATION **0A**

```
void gopen_ws(
    Gint      ws_id,      /* workstation identifier */
    const void *conn_id, /* connection identifier */
    Gint      ws_type     /* workstation type       */
);
```

CLOSE WORKSTATION **0A**

```
void gclose_ws(
    Gint ws_id /* workstation identifier */
);
```

ACTIVATE WORKSTATION **0A**

```
void gactivate_ws(
    Gint ws_id /* workstation identifier */
);
```

DEACTIVATE WORKSTATION **0A**

```
void gdeactivate_ws(
    Gint ws_id /* workstation identifier */
);
```

CLEAR WORKSTATION **0A**

```
void gclear_ws(
    Gint      ws_id,      /* workstation identifier */
    Gctrl_flag ctrl_flag /* control flag           */
);
```

REDRAW ALL SEGMENTS ON WORKSTATION **1A**

```
void gredraw_all_segs_ws(
    Gint ws_id /* workstation identifier */
);
```

UPDATE WORKSTATION **0A**

```
void gupd_ws(
    Gint      ws_id,      /* workstation identifier */
    Gupd_regen_flag upd_regen_flag /* update regeneration flag */
);
```

C GKS-3D Function Interface

Control Functions

SET DEFERRAL STATE **1A**

```
void gset_defer_st(
    Gint      ws_id,      /* workstation identifier */
    Gdefer_mode defer_mode, /* deferral mode */
    Girg_mode  irg_mode   /* implicit regeneration mode */
);
```

MESSAGE **1A**

```
void gmessage(
    Gint      ws_id,      /* workstation identifier */
    const char *message /* message string */
);
```

ESCAPE **0A**

```
void gescape(
    Gint      func_id,      /* escape function identifier */
    const Gescape_in_data *in_data, /* escape input data record */
    Gstore     store,      /* handle to Store object */
    Gescape_out_data **out_data /* OUT escape output data record */
);
```

REMARK. The memory referenced by *out_data is managed by store.

7.3 Output Functions

POLYLINE 3 **0A**

```
void gpolyline3(
    const Gpoint_list3 *point_list /* list of points */
);
```

POLYLINE **0A**

```
void gpolyline(
    const Gpoint_list *point_list /* list of points */
);
```

POLYMARKER 3 **0A**

```
void gpolymarker3(
    const Gpoint_list3 *point_list /* list of points */
);
```

Output Functions

C GKS-3D Function Interface

POLYMARKER 0A

```
void gpolymarker(
    const Gpoint_list *point_list /* list of points */
);
```

TEXT 3 0A

```
void gtext3(
    const Gpoint3 *text_pos, /* text position */
    const Gvec3 text_dir[2], /* text direction vectors */
    const char *char_string /* character string */
);
```

TEXT 0A

```
void gtext(
    const Gpoint *text_pos, /* text position */
    const char *char_string /* character string */
);
```

FILL AREA 3 0A

```
void gfill_area3(
    const Gpoint_list3 *point_list /* list of points */
);
```

FILL AREA 0A

```
void gfill_area(
    const Gpoint_list *point_list /* list of points */
);
```

FILL AREA SET 3 0A

```
void gfill_area_set3(
    const Gpoint_list_list3 *point_list_list /* list of point lists */
);
```

FILL AREA SET 0A

```
void gfill_area_set(
    const Gpoint_list_list *point_list_list /* list of point lists */
);
```

C GKS-3D Function Interface

Output Functions

CELL ARRAY 3 **0A**

```
void gcell_array3(
    const Gparal    *paral,    /* cell parallelogram */
    const Gpat_rep  *colr_array /* colour array       */
);
```

CELL ARRAY **0A**

```
void gcell_array(
    const Grect     *rect,     /* cell rectangle    */
    const Gpat_rep  *colr_array /* colour array       */
);
```

GENERALIZED DRAWING PRIMITIVE 3 **0A**

```
void ggdp3(
    const Gpoint_list3 *point_list, /* list of points */
    Gint                gdp3_id,    /* gdp 3 identifier */
    const Ggdp_data3   *gdp_data   /* gdp data record */
);
```

GENERALIZED DRAWING PRIMITIVE **0A**

```
void ggdp(
    const Gpoint_list *point_list, /* list of points */
    Gint              gdp_id,      /* gdp identifier  */
    const Ggdp_data   *gdp_data   /* gdp data record */
);
```

7.4 Output Attribute Functions**7.4.1 Workstation Independent Primitive Attributes**

SET POLYLINE INDEX **0A**

```
void gset_line_ind(
    Gint line_ind /* polyline index */
);
```

SET LINETYPE **0A**

```
void gset_linetype(
    Gint linetype /* linetype */
);
```

Output Attribute Functions

C GKS-3D Function Interface

SET LINEWIDTH SCALE FACTOR**0A**

```
void gset_linewidth(
    Gfloat linewidth /* linewidth scale factor */
);
```

SET POLYLINE COLOUR INDEX**0A**

```
void gset_line_colr_ind(
    Gint line_colr_ind /* polyline colour index */
);
```

SET POLYMARKER INDEX**0A**

```
void gset_marker_ind(
    Gint marker_ind /* polymarker index */
);
```

SET MARKER TYPE**0A**

```
void gset_marker_type(
    Gint marker_type /* marker type */
);
```

SET MARKER SIZE SCALE FACTOR**0A**

```
void gset_marker_size(
    Gfloat marker_size /* marker size scale factor */
);
```

SET POLYMARKER COLOUR INDEX**0A**

```
void gset_marker_colr_ind(
    Gint marker_colr_ind /* polymarker colour index */
);
```

SET TEXT INDEX**0A**

```
void gset_text_ind(
    Gint text_ind /* text index */
);
```

SET TEXT FONT AND PRECISION**0A**

```
void gset_text_font_prec(
    const Gtext_font_prec *text_font_prec /* text font and precision */
);
```

SET CHARACTER EXPANSION FACTOR **0A**

```
void gset_char_expan(
    Gfloat char_expan /* character expansion factor */
);
```

SET CHARACTER SPACING **0A**

```
void gset_char_space(
    Gfloat char_space /* character spacing */
);
```

SET TEXT COLOUR INDEX **0A**

```
void gset_text_colr_ind(
    Gint text_colr_ind /* text colour index */
);
```

SET CHARACTER HEIGHT **0A**

```
void gset_char_ht(
    Gfloat char_ht /* character height */
);
```

SET CHARACTER UP VECTOR **0A**

```
void gset_char_up_vec(
    const Gvec *char_up_vec /* character up vector */
);
```

SET TEXT PATH **0A**

```
void gset_text_path(
    Gtext_path text_path /* text path */
);
```

SET TEXT ALIGNMENT **0A**

```
void gset_text_align(
    const Gtext_align *text_align /* text alignment */
);
```

SET FILL AREA INDEX **0A**

```
void gset_fill_ind(
    Gint fill_ind /* fill area index */
);
```

Output Attribute Functions

C GKS-3D Function Interface

SET FILL AREA INTERIOR STYLE 0A

```
void gset_fill_int_style(
    Gfill_int_style fill_int_style /* fill area interior style */
);
```

SET FILL AREA STYLE INDEX 0A

```
void gset_fill_style_ind(
    Gint fill_style_ind /* fill area style index */
);
```

SET FILL AREA COLOUR INDEX 0A

```
void gset_fill_colr_ind(
    Gint fill_colr_ind /* fill area colour index */
);
```

SET PATTERN SIZE 0A

```
void gset_pat_size(
    const Gfloat_size *pat_size /* pattern size */
);
```

SET PATTERN REFERENCE POINT AND VECTORS 0A

```
void gset_pat_ref_point_vecs(
    const Gpoint3 *pat_ref_point, /* pattern reference point */
    const Gvec3 pat_ref_vec[2] /* 1st ref. vector: X axis of pattern */
    /* 2nd ref. vector: Y axis of pattern */
);
```

SET PATTERN REFERENCE POINT 0A

```
void gset_pat_ref_point(
    const Gpoint *pat_ref_point /* pattern reference point */
);
```

SET EDGE INDEX 0A

```
void gset_edge_ind(
    Gint edge_ind /* edge index */
);
```

SET EDGE FLAG 0A

```
void gset_edge_flag(
    Gedge_flag edge_flag /* edge flag */
);
```

SET EDGETYPE **0A**

```
void gset_edgetype(
    Gint  edgetype /* edgetype */
);
```

SET EDGEWIDTH SCALE FACTOR **0A**

```
void gset_edgewidth(
    Gfloat edgewidth /* edgewidth scale factor */
);
```

SET EDGE COLOUR INDEX **0A**

```
void gset_edge_colr_ind(
    Gint  edge_colr_ind /* edge colour index */
);
```

SET ASPECT SOURCE FLAGS3 **0A**

```
void gset_asfs3(
    const Gasfs3 *list_asf /* list of aspect source flags */
);
```

SET ASPECT SOURCE FLAGS **0A**

```
void gset_asfs(
    const Gasfs *list_asf /* list of aspect source flags */
);
```

SET PICK IDENTIFIER **1B**

```
void gset_pick_id(
    Gint  pick_id /* pick identifier */
);
```

7.4.2 Workstation Attributes

SET POLYLINE REPRESENTATION **1A**

```
void gset_line_rep(
    Gint          ws_id,          /* workstation identifier */
    Gint          line_ind,      /* polyline index */
    const Gline_bundle *line_bundle /* polyline representation */
);
```

SET POLYMARKER REPRESENTATION **1A**

```

void gset_marker_rep(
    Gint          ws_id,          /* workstation identifier */
    Gint          marker_ind,     /* polymarker index      */
    const Gmarker_bundle *marker_bundle /* polymarker representation */
);

```

SET TEXT REPRESENTATION **1A**

```

void gset_text_rep(
    Gint          ws_id,          /* workstation identifier */
    Gint          text_ind,       /* text index             */
    const Gtext_bundle *text_bundle /* text representation   */
);

```

SET FILL AREA REPRESENTATION **1A**

```

void gset_fill_rep(
    Gint          ws_id,          /* workstation identifier */
    Gint          fill_ind,       /* fill area index        */
    const Gfill_bundle *fill_bundle /* fill area representation */
);

```

SET PATTERN REPRESENTATION **1A**

```

void gset_pat_rep(
    Gint          ws_id,          /* workstation identifier */
    Gint          pat_ind,        /* pattern index          */
    const Gpat_rep *pat_rep      /* pattern representation */
);

```

SET EDGE REPRESENTATION **1A**

```

void gset_edge_rep(
    Gint          ws_id,          /* workstation identifier */
    Gint          edge_ind,       /* edge index             */
    const Gedge_bundle *edge_bundle /* edge representation   */
);

```

SET COLOUR MODEL

```

void gset_colr_model(
    Gint          ws_id,          /* workstation identifier */
    Gint          colr_model      /* colour model           */
);

```

SET COLOUR REPRESENTATION **0A**

```

void gset_colr_rep(
    Gint      ws_id,      /* workstation identifier */
    Gint      colr_ind,   /* colour index           */
    const Gcolr_rep *colr_rep /* colour representation */
);

```

7.5 Transformation Functions**7.5.1 Normalization Transformation**

SET WINDOW 3 **0A**

```

void gset_win3(
    Gint      tran_num,   /* transformation number */
    const Glimit3 *win_limits /* window limits       */
);

```

SET WINDOW **0A**

```

void gset_win(
    Gint      tran_num,   /* transformation number */
    const Glimit *win_limits /* window limits       */
);

```

SET VIEWPORT 3 **0A**

```

void gset_vp3(
    Gint      tran_num,   /* transformation number */
    const Glimit3 *vp_limits /* viewport limits      */
);

```

SET VIEWPORT **0A**

```

void gset_vp(
    Gint      tran_num,   /* transformation number */
    const Glimit *vp_limits /* viewport limits      */
);

```

SET VIEWPORT INPUT PRIORITY **0B**

```

void gset_vp_in_pri(
    Gint      tran_num,   /* transformation number */
    Gint      ref_tran_num, /* reference transformation number */
    Grel_pri  rel_pri     /* relative priority      */
);

```

Transformation Functions

C GKS-3D Function Interface

SELECT NORMALIZATION TRANSFORMATION 0A

```
void gsel_norm_tran(
    Gint tran_num /* transformation number */
);
```

SET CLIPPING INDICATOR 0A

```
void gset_clip_ind(
    Gclip_ind clip_ind /* clipping indicator */
);
```

7.5.2 View transformation functions

SET VIEW INDEX 0A

```
void gset_view_ind(
    Gint view_ind /* view index */
);
```

SET VIEW REPRESENTATION 3 0A

```
void gset_view_rep3(
    Gint ws_id, /* workstation identifier */
    Gint view_ind, /* view index */
    const Gview_rep3 *view_rep /* view representation */
);
```

SET VIEW TRANSFORMATION INPUT PRIORITY 0B

```
void gset_view_tran_in_pri(
    Gint ws_id, /* workstation identifier */
    Gint view_ind, /* view index */
    Gint ref_ind, /* reference view index */
    Grel_pri pri /* relative priority */
);
```

7.5.3 HLHSR functions

SET HLHSR IDENTIFIER 1A

```
void gset_hlhr_id(
    Gint hlhr_id /* HLHSR identifier */
);
```

SET HLHSR MODE **1A**

```
void gset_hlhsr_mode(
    Gint    ws_id,        /* workstation identifier */
    Gint    hlhsr_mode   /* HLHSR mode             */
);
```

7.5.4 Workstation transformation

SET WORKSTATION WINDOW 3 **0A**

```
void gset_ws_win3(
    Gint    ws_id,        /* workstation identifier */
    const Glimit3 *ws_win_limits /* workstation window limits */
);
```

SET WORKSTATION WINDOW **0A**

```
void gset_ws_win(
    Gint    ws_id,        /* workstation identifier */
    const Glimit *ws_win_limits /* workstation window limits */
);
```

SET WORKSTATION VIEWPORT 3 **0A**

```
void gset_ws_vp3(
    Gint    ws_id,        /* workstation identifier */
    const Glimit3 *ws_vp_limits /* workstation viewport limits */
);
```

SET WORKSTATION VIEWPORT **0A**

```
void gset_ws_vp(
    Gint    ws_id,        /* workstation identifier */
    const Glimit *ws_vp_limits /* workstation viewport limits */
);
```

7.6 Segment Functions**7.6.1 Segment Manipulation Functions**

CREATE SEGMENT **1A**

```
void gcreate_seg(
    Gint    seg_name /* segment name */
);
```

Segment Functions

C GKS-3D Function Interface

CLOSE SEGMENT 1A

```
void gclose_seg(
    void
);
```

RENAME SEGMENT 1A

```
void grename_seg(
    Gint  old_seg_name, /* old segment name */
    Gint  new_seg_name /* new segment name */
);
```

DELETE SEGMENT 1A

```
void gdel_seg(
    Gint  seg_name /* segment name */
);
```

DELETE SEGMENT FROM WORKSTATION 1A

```
void gdel_seg_ws(
    Gint  ws_id, /* workstation identifier */
    Gint  seg_name /* segment name */
);
```

ASSOCIATE SEGMENT WITH WORKSTATION 2A

```
void gassoc_seg_ws(
    Gint  ws_id, /* workstation identifier */
    Gint  seg_name /* segment name */
);
```

COPY SEGMENT TO WORKSTATION 2A

```
void gcopy_seg_ws(
    Gint  ws_id, /* workstation identifier */
    Gint  seg_name /* segment name */
);
```

INSERT SEGMENT 3 2A

```
void ginsert_seg3(
    Gint  seg_name, /* segment name */
    Gtran_matrix3 tran_matrix /* transformation matrix */
);
```

INSERT SEGMENT 2A

```
void ginsert_seg(
    Gint      seg_name,    /* segment name */
    Gtran_matrix tran_matrix /* transformation matrix */
);
```

7.6.2 Segment Attribute Functions

SET SEGMENT TRANSFORMATION 3 1A

```
void gset_seg_tran3(
    Gint      seg_name,    /* segment name */
    Gtran_matrix3 tran_matrix /* transformation matrix */
);
```

SET SEGMENT TRANSFORMATION 1A

```
void gset_seg_tran(
    Gint      seg_name,    /* segment name */
    Gtran_matrix tran_matrix /* transformation matrix */
);
```

SET VISIBILITY 1A

```
void gset_vis(
    Gint seg_name, /* segment name */
    Gvis vis       /* visibility */
);
```

SET HIGHLIGHTING 1A

```
void gset_highl(
    Gint seg_name, /* segment name */
    Ghighl highl  /* highlighting */
);
```

SET SEGMENT PRIORITY 1A

```
void gset_seg_pri(
    Gint seg_name, /* segment name */
    Gfloat seg_pri /* segment priority */
);
```

SET DETECTABILITY 1B

```
void gset_det(
    Gint seg_name, /* segment name */
    Gdet det       /* detectability */
);
```

Input Functions

C GKS-3D Function Interface

7.7 Input Functions

7.7.1 Initialization of Input Devices Functions

INITIALIZE LOCATOR 3

0B

```

void ginit_loc3(
    Gint          ws_id,          /* workstation identifier */
    Gint          loc_num,        /* locator device number */
    Gint          init_norm_tran_num, /* initial normalization
                                   transformation number */
    Gint          init_view_ind,  /* initial view index */
    const Gpoint3 *init_loc_pos,  /* initial locator position */
    Gint          pet,            /* prompt and echo type */
    const Glimit3 *echo_vol,      /* echo volume */
    const Gloc_data3 *loc_data    /* locator data record */
);

```

INITIALIZE LOCATOR

0B

```

void ginit_loc(
    Gint          ws_id,          /* workstation identifier */
    Gint          loc_num,        /* locator device number */
    Gint          init_norm_tran_num, /* initial normalization
                                   transformation number */
    const Gpoint *init_loc_pos,  /* initial locator position */
    Gint          pet,            /* prompt and echo type */
    const Glimit *echo_area,     /* echo area */
    const Gloc_data *loc_data    /* locator data record */
);

```

INITIALIZE STROKE 3

0B

```

void ginit_stroke3(
    Gint          ws_id,          /* workstation identifier */
    Gint          stroke_num,     /* stroke device number */
    Gint          init_norm_tran_num, /* initial normalization
                                   transformation number */
    Gint          init_view_ind,  /* initial view index */
    const Gpoint_list3 *init_stroke, /* initial stroke */
    Gint          pet,            /* prompt and echo type */
    const Glimit3 *echo_vol,      /* echo volume */
    const Gstroke_data3 *stroke_data /* stroke data record */
);

```

C GKS-3D Function Interface

Input Functions

INITIALIZE STROKE**0B**

```

void ginit_stroke(
    Gint          ws_id,          /* workstation identifier */
    Gint          stroke_num,     /* stroke device number  */
    Gint          init_norm_tran_num, /* initial normalization
                                transformation number */
    const Gpoint_list *init_stroke, /* initial stroke         */
    Gint          pet,           /* prompt and echo type  */
    const Glimit  *echo_area,   /* echo area              */
    const Gstroke_data *stroke_data /* stroke data record    */
);

```

INITIALIZE VALUATOR 3**0B**

```

void ginit_val3(
    Gint          ws_id,          /* workstation identifier */
    Gint          val_num,       /* valuator device number */
    Gfloat        init_value,    /* initial value          */
    Gint          pet,           /* prompt and echo type  */
    const Glimit3 *echo_vol,    /* echo volume           */
    const Gval_data3 *val_data /* valuator data record  */
);

```

INITIALIZE VALUATOR**0B**

```

void ginit_val(
    Gint          ws_id,          /* workstation identifier */
    Gint          val_num,       /* valuator device number */
    Gfloat        init_value,    /* initial value          */
    Gint          pet,           /* prompt and echo type  */
    const Glimit  *echo_area,   /* echo area              */
    const Gval_data *val_data /* valuator data record  */
);

```

INITIALIZE CHOICE 3**0B**

```

void ginit_choice3(
    Gint          ws_id,          /* workstation identifier */
    Gint          choice_num,    /* choice device number  */
    Gint_status  init_status,   /* initial status        */
    Gint          init_choice,  /* initial choice        */
    Gint          pet,           /* prompt and echo type  */
    const Glimit3 *echo_vol,    /* echo volume           */
    const Gchoice_data3 *choice_data /* choice data record   */
);

```

Input Functions

C GKS-3D Function Interface

INITIALIZE CHOICE**0B**

```

void ginit_choice(
    Gint          ws_id,          /* workstation identifier */
    Gint          choice_num,     /* choice device number   */
    Gint_status  init_status,    /* initial status         */
    Gint          init_choice,   /* initial choice         */
    Gint          pet,           /* prompt and echo type  */
    const Glimit *echo_area,    /* echo area              */
    const Gchoice_data *choice_data /* choice data record    */
);

```

INITIALIZE PICK 3**1B**

```

void ginit_pick3(
    Gint          ws_id,          /* workstation identifier */
    Gint          pick_num,      /* pick device number     */
    Gint_status  init_status,    /* initial status         */
    const Gpick  *init_pick,     /* initial pick value     */
    Gint          pet,           /* prompt and echo type  */
    const Glimit3 *echo_vol,     /* echo volume            */
    const Gpick_data3 *pick_data /* pick data record      */
);

```

INITIALIZE PICK**1B**

```

void ginit_pick(
    Gint          ws_id,          /* workstation identifier */
    Gint          pick_num,      /* pick device number     */
    Gint_status  init_status,    /* initial status         */
    const Gpick  *init_pick,     /* initial pick value     */
    Gint          pet,           /* prompt and echo type  */
    const Glimit *echo_area,    /* echo area              */
    const Gpick_data *pick_data /* pick data record      */
);

```

INITIALIZE STRING 3**0B**

```

void ginit_string3(
    Gint          ws_id,          /* workstation identifier */
    Gint          string_num,    /* string device number   */
    const char    *init_string,  /* initial string         */
    Gint          pet,           /* prompt and echo type  */
    const Glimit3 *echo_vol,     /* echo volume            */
    const Gstring_data3 *string_data /* string data record    */
);

```

C GKS-3D Function Interface

Input Functions

INITIALIZE STRING **0B**

```

void ginit_string(
    Gint          ws_id,          /* workstation identifier */
    Gint          string_num,     /* string device number  */
    const char    *init_string,  /* initial string        */
    Gint          pet,           /* prompt and echo type  */
    const Glimit  *echo_area,    /* echo area             */
    const Gstring_data *string_data /* string data record   */
);

```

7.7.2 Setting the Mode of Input Devices Functions**SET LOCATOR MODE** **0B**

```

void gset_loc_mode(
    Gint          ws_id,          /* workstation identifier */
    Gint          loc_num,       /* locator device number  */
    Gop_mode      op_mode,      /* operating mode        */
    Gecho_switch  echo_switch   /* echo switch           */
);

```

SET STROKE MODE **0B**

```

void gset_stroke_mode(
    Gint          ws_id,          /* workstation identifier */
    Gint          stroke_num,    /* stroke device number  */
    Gop_mode      op_mode,      /* operating mode        */
    Gecho_switch  echo_switch   /* echo switch           */
);

```

SET VALUATOR MODE **0B**

```

void gset_val_mode(
    Gint          ws_id,          /* workstation identifier */
    Gint          val_num,       /* valuator device number */
    Gop_mode      op_mode,      /* operating mode        */
    Gecho_switch  echo_switch   /* echo switch           */
);

```

SET CHOICE MODE **0B**

```

void gset_choice_mode(
    Gint          ws_id,          /* workstation identifier */
    Gint          choice_num,    /* choice device number  */
    Gop_mode      op_mode,      /* operating mode        */
    Gecho_switch  echo_switch   /* echo switch           */
);

```

Input Functions

C GKS-3D Function Interface

SET PICK MODE**1B**

```

void gset_pick_mode(
    Gint      ws_id,          /* workstation identifier */
    Gint      pick_num,      /* pick device number    */
    Gop_mode  op_mode,      /* operating mode        */
    Gecho_switch echo_switch /* echo switch           */
);

```

SET STRING MODE**0B**

```

void gset_string_mode(
    Gint      ws_id,          /* workstation identifier */
    Gint      string_num,    /* string device number   */
    Gop_mode  op_mode,      /* operating mode        */
    Gecho_switch echo_switch /* echo switch           */
);

```

7.7.3 Request Input Functions**REQUEST LOCATOR 3****0B**

```

void greq_loc3(
    Gint      ws_id,          /* workstation identifier */
    Gint      loc_num,       /* locator device number  */
    Gin_status *in_status,   /* OUT input status      */
    Gint      *norm_tran_num, /* OUT normalization     */
                                transformation number */
    Gint      *view_ind,    /* OUT view index        */
    Gpoint3   *loc_pos,     /* OUT locator position  */
);

```

REQUEST LOCATOR**0B**

```

void greq_loc(
    Gint      ws_id,          /* workstation identifier */
    Gint      loc_num,       /* locator device number  */
    Gin_status *in_status,   /* OUT input status      */
    Gint      *norm_tran_num, /* OUT normalization     */
                                transformation number */
    Gpoint    *loc_pos,     /* OUT locator position  */
);

```

C GKS-3D Function Interface

Input Functions

REQUEST STROKE 3 **0B**

```

void greq_stroke3(
    Gint      ws_id,          /* workstation identifier */
    Gint      stroke_num,    /* stroke device number  */
    Gin_status *in_status,   /* OUT input status      */
    Gint      *norm_tran_num, /* OUT normalization
                               transformation number */
    Gint      *view_ind,    /* OUT view index        */
    Gpoint_list3 *stroke     /* OUT stroke            */
);

```

REMARK. The application shall allocate the memory for the point list returned by this function. The maximum size of the returned `stroke` is specified by `ginit_stroke` or `ginit_stroke3`. The maximum size of `stroke` supported by the implementation is returned by `ginq_def_stroke_data` or `ginq_def_stroke_data3`.

REQUEST STROKE **0B**

```

void greq_stroke(
    Gint      ws_id,          /* workstation identifier */
    Gint      stroke_num,    /* stroke device number  */
    Gin_status *in_status,   /* OUT input status      */
    Gint      *norm_tran_num, /* OUT normalization
                               transformation number */
    Gpoint_list *stroke     /* OUT stroke            */
);

```

REMARK. The application shall allocate the memory for the point list returned by this function. The maximum size of the returned `stroke` is specified by `ginit_stroke`. The maximum size of `stroke` supported by the implementation is returned by `ginq_def_stroke_data`.

REQUEST VALUATOR **0B**

```

void greq_val(
    Gint      ws_id,          /* workstation identifier */
    Gint      val_num,       /* valuator device number */
    Gin_status *in_status,   /* OUT input status      */
    Gfloat    *value        /* OUT value             */
);

```

REQUEST CHOICE **0B**

```

void greq_choice(
    Gint      ws_id,          /* workstation identifier */
    Gint      choice_num,    /* choice device number  */
    Gin_status *in_status,   /* OUT input status      */
    Gint      *choice        /* OUT requested choice  */
);

```

Input Functions

C GKS-3D Function Interface

REQUEST PICK**1B**

```

void greq_pick(
    Gint    ws_id,          /* workstation identifier */
    Gint    pick_num,      /* pick device number    */
    Gin_status *in_status, /* OUT input status      */
    Gpick   *pick          /* OUT requested pick value */
);

```

REQUEST STRING**0B**

```

void greq_string(
    Gint    ws_id,          /* workstation identifier */
    Gint    string_num,    /* string device number   */
    Gin_status *in_status, /* OUT input status      */
    char    *string        /* OUT requested string   */
);

```

REMARK. The application shall allocate the memory for the string returned by this function. The maximum size of the returned string is specified by `ginit_string` or `ginit_string3`. The maximum size of string supported by the implementation is returned by `ginq_def_string_data` or `ginq_def_string_data3`.

7.7.4 Sample Input Functions**SAMPLE LOCATOR 3****0C**

```

void gsample_loc3(
    Gint    ws_id,          /* workstation identifier */
    Gint    loc_num,       /* locator device number  */
    Gint    *norm_tran_num, /* OUT normalization      */
                          /* transformation number  */
    Gint    *view_ind,     /* OUT view index        */
    Gpoint3 *loc_pos       /* OUT locator position   */
);

```

SAMPLE LOCATOR**0C**

```

void gsample_loc(
    Gint    ws_id,          /* workstation identifier */
    Gint    loc_num,       /* locator device number  */
    Gint    *norm_tran_num, /* OUT normalization      */
                          /* transformation number  */
    Gpoint  *loc_pos       /* OUT locator position   */
);

```

C GKS-3D Function Interface

Input Functions

SAMPLE STROKE 3**0C**

```

void gsample_stroke3(
    Gint      ws_id,          /* workstation identifier */
    Gint      stroke_num,     /* stroke device number   */
    Gint      *norm_tran_num, /* OUT normalization
                             transformation number */
    Gint      *view_ind,     /* OUT view index         */
    Gpoint_list3 *stroke     /* OUT stroke             */
);

```

REMARK. The application shall allocate the memory for the point list returned by this function. The maximum size of the returned stroke is specified by `ginit_stroke3`. The maximum size of stroke supported by the implementation is returned by `ginq_def_stroke_data3`.

SAMPLE STROKE**0C**

```

void gsample_stroke(
    Gint      ws_id,          /* workstation identifier */
    Gint      stroke_num,     /* stroke device number   */
    Gint      *norm_tran_num, /* OUT normalization
                             transformation number */
    Gpoint_list *stroke     /* OUT stroke             */
);

```

REMARK. The application shall allocate the memory for the point list returned by this function. The maximum size of the returned stroke is specified by `ginit_stroke`. The maximum size of stroke supported by the implementation is returned by `ginq_def_stroke_data`.

SAMPLE VALUATOR**0C**

```

void gsample_val(
    Gint      ws_id,          /* workstation identifier */
    Gint      val_num,       /* valuator device number */
    Gfloat    *value         /* OUT value              */
);

```

SAMPLE CHOICE**0C**

```

void gsample_choice(
    Gint      ws_id,          /* workstation identifier */
    Gint      choice_num,    /* choice device number   */
    Gint_status *in_status,  /* OUT input status       */
    Gint      *choice        /* OUT choice              */
);

```

Input Functions

C GKS-3D Function Interface

SAMPLE PICK**1C**

```

void gsample_pick(
    Gint      ws_id,      /* workstation identifier */
    Gint      pick_num,   /* pick device number    */
    Gin_status *in_status, /* OUT input status      */
    Gpick     *pick       /* OUT pick value        */
);

```

SAMPLE STRING**0C**

```

void gsample_string(
    Gint  ws_id,      /* workstation identifier */
    Gint  string_num, /* string device number   */
    char *string      /* OUT string            */
);

```

REMARK. The application shall allocate the memory for the string returned by this function. The maximum size of the returned string is specified by `ginit_string` or `ginit_string3`. The maximum size of string supported by the implementation is returned by `ginq_def_string_data` or `ginq_def_string_data3`.

7.7.5 Event Input Functions**AWAIT EVENT****0C**

```

void gawait_event(
    Gfloat  timeout, /* timeout (seconds) */
    Gint    *ws_id,  /* OUT workstation identifier */
    Gin_class *class, /* OUT device class */
    Gint    *in_num, /* OUT logical input device number */
);

```

FLUSH DEVICE EVENTS**0C**

```

void gflush_events(
    Gint  ws_id, /* workstation identifier */
    Gin_class class, /* device class */
    Gint  in_num /* logical input device number */
);

```

GET LOCATOR 3**0C**

```

void gget_loc3(
    Gint  *norm_tran_num, /* OUT normalization
                           transformation number */
    Gint  *view_ind,     /* OUT view index */
    Gpoint3 *loc_pos     /* OUT locator position */
);

```

C GKS-3D Function Interface

Input Functions

GET LOCATOR **0C**

```

void gget_loc(
    Gint      *norm_tran_num, /* OUT normalization
                             transformation number */
    Gpoint    *loc_pos       /* OUT locator position */
);

```

GET STROKE 3 **0C**

```

void gget_stroke3(
    Gint      *norm_tran_num, /* OUT normalization
                             transformation number */
    Gint      *view_ind,     /* OUT view index */
    Gpoint_list3 *stroke     /* OUT stroke */
);

```

GET STROKE **0C**

```

void gget_stroke(
    Gint      *norm_tran_num, /* OUT normalization
                             transformation number */
    Gpoint_list *stroke      /* OUT stroke */
);

```

GET VALUATOR **0C**

```

void gget_val(
    Gfloat *value /* OUT value */
);

```

GET CHOICE **0C**

```

void gget_choice(
    Gint_status *in_status, /* OUT input status */
    Gint        *choice     /* OUT choice */
);

```

GET PICK **1C**

```

void gget_pick(
    Gint_status *in_status, /* OUT input status */
    Gpick       *pick       /* OUT pick value */
);

```

GET STRING **0C**

```

void gget_string(
    char *string /* OUT string */
);

```

Metafile Functions

C GKS-3D Function Interface

7.8 Metafile Functions

WRITE ITEM TO GKSM **0A**

```

void gwrite_item(
    Gint      ws_id,          /* workstation identifier */
    Gint      item_type,     /* item type */
    Gint      item_data_length, /* item data record length */
    const Gitem_data *item_data /* item data record */
);

```

GET ITEM TYPE FROM GKSM **0A**

```

void gget_item_type(
    Gint      ws_id,          /* workstation identifier */
    Gint      *item_type,    /* OUT item type */
    Gint      *item_data_length /* OUT item data record length */
);

```

READ ITEM FROM GKSM **0A**

```

void gread_item(
    Gint      ws_id,          /* workstation identifier */
    Gint      max_item_data_length, /* max. item data record length */
    Gitem_data *item_data    /* OUT item data record */
);

```

INTERPRET ITEM **0A**

```

void ginterpret_item(
    Gint      type,          /* item type */
    Gint      item_data_length, /* item data record length */
    const Gitem_data *item_data /* item data record */
);

```

7.9 Inquiry Functions

7.9.1 Inquiry Functions for Operating State Value

INQUIRE OPERATING STATE VALUE **0A**

```

void ginq_op_st(
    Gop_st *op_st /* OUT operating state value */
);

```

C GKS-3D Function Interface

Inquiry Functions

7.9.2 Inquiry Functions for GKS-3D Description Table

INQUIRE LEVEL OF GKS **0A**

```

void ginq_level_gks(
    Gint    *err_ind,    /* OUT error indicator    */
    Glevel  *level      /* OUT level of GKS-3D   */
);

```

INQUIRE LIST OF AVAILABLE WORKSTATION TYPES **0A**

```

void ginq_list_avail_ws_types(
    Gint      num_elems_appl_list, /* length of application list    */
    Gint      start_ind,          /* starting index                 */
    Gint      *err_ind,          /* OUT error indicator           */
    Gint_list *ws_type,          /* OUT list of available ws types */
    Gint      *num_elems_impl_list /* OUT length of impl. list      */
);

```

INQUIRE WORKSTATION MAXIMUM NUMBERS **0A**

```

void ginq_ws_max_nums(
    Gint      *err_ind,    /* OUT error indicator    */
    Gws_max_nums *ws_max_num /* OUT workstation maximum numbers */
);

```

INQUIRE MAXIMUM NORMALIZATION TRANSFORMATION NUMBER **0A**

```

void ginq_max_norm_tran_num(
    Gint *err_ind,    /* OUT error indicator    */
    Gint *max_norm_tran_num /* OUT maximum normalization transformation number */
);

```

7.9.3 Inquiry Functions for GKS-3D State List

INQUIRE SET OF OPEN WORKSTATIONS **0A**

```

void ginq_set_open_wss(
    Gint      num_elems_appl_list, /* length of application list    */
    Gint      start_ind,          /* starting index                 */
    Gint      *err_ind,          /* OUT error indicator           */
    Gint_list *open_ws,          /* OUT list of open ws ids       */
    Gint      *num_elems_impl_list /* OUT length of impl. list      */
);

```

Inquiry Functions

C GKS-3D Function Interface

INQUIRE SET OF ACTIVE WORKSTATIONS 1A

```

void ginq_set_active_wss(
    Gint    num_elems_appl_list, /* length of application list */
    Gint    start_ind,          /* starting index */
    Gint    *err_ind,           /* OUT error indicator */
    Gint_list *active_ws,       /* OUT list of active ws ids */
    Gint    *num_elems_impl_list /* OUT length of impl. list */
);

```

INQUIRE CURRENT PRIMITIVE ATTRIBUTE VALUES 3 0A

```

void ginq_cur_prim_attr3(
    Gint    *err_ind, /* OUT error indicator */
    Gprim_attr3 *prim_attr3 /* OUT current primitive
                             attribute 3 structure */
);

```

INQUIRE CURRENT PRIMITIVE ATTRIBUTE VALUES 0A

```

void ginq_cur_prim_attr(
    Gint    *err_ind, /* OUT error indicator */
    Gprim_attr *prim_attr /* OUT current primitive
                           attribute structure */
);

```

**(INQUIRE CURRENT PRIMITIVE ATTRIBUTE VALUES [3])
INQUIRE POLYLINE INDEX** 0A

```

void ginq_line_ind(
    Gint    *err_ind, /* OUT error indicator */
    Gint    *line_ind /* OUT current polyline index */
);

```

**(INQUIRE CURRENT PRIMITIVE ATTRIBUTE VALUES [3])
INQUIRE POLYMARKER INDEX** 0A

```

void ginq_marker_ind(
    Gint    *err_ind, /* OUT error indicator */
    Gint    *marker_ind /* OUT current polymarker index */
);

```

**(INQUIRE CURRENT PRIMITIVE ATTRIBUTE VALUES [3])
INQUIRE TEXT INDEX** 0A

```

void ginq_text_ind(
    Gint    *err_ind, /* OUT error indicator */
    Gint    *text_ind /* OUT current text index */
);

```

(INQUIRE CURRENT PRIMITIVE ATTRIBUTE VALUES [3])
INQUIRE CHARACTER HEIGHT **0A**

```
void ginq_char_ht(
    Gint    *err_ind,    /* OUT error indicator    */
    Gfloat  *char_ht    /* OUT current character height */
);
```

(INQUIRE CURRENT PRIMITIVE ATTRIBUTE VALUES [3])
INQUIRE CHARACTER UP VECTOR **0A**

```
void ginq_char_up_vec(
    Gint    *err_ind,    /* OUT error indicator    */
    Gvec    *char_up_vec /* OUT current character up vector */
);
```

(INQUIRE CURRENT PRIMITIVE ATTRIBUTE VALUES [3])
INQUIRE CHARACTER WIDTH **0A**

```
void ginq_char_width(
    Gint    *err_ind,    /* OUT error indicator    */
    Gfloat  *char_width /* OUT current character width */
);
```

(INQUIRE CURRENT PRIMITIVE ATTRIBUTE VALUES [3])
INQUIRE CHARACTER BASE VECTOR **0A**

```
void ginq_char_base_vec(
    Gint    *err_ind,    /* OUT error indicator    */
    Gvec    *char_base_vec /* OUT current character base vector */
);
```

(INQUIRE CURRENT PRIMITIVE ATTRIBUTE VALUES [3])
INQUIRE TEXT PATH **0A**

```
void ginq_text_path(
    Gint    *err_ind,    /* OUT error indicator    */
    Gtext_path *text_path /* OUT current text path */
);
```

(INQUIRE CURRENT PRIMITIVE ATTRIBUTE VALUES [3])
INQUIRE TEXT ALIGNMENT **0A**

```
void ginq_text_align(
    Gint    *err_ind,    /* OUT error indicator    */
    Gtext_align *text_align /* OUT current text alignment */
);
```

Inquiry Functions

C GKS-3D Function Interface

(INQUIRE CURRENT PRIMITIVE ATTRIBUTE VALUES [3])
INQUIRE FILL AREA INDEX **0A**

```
void ginq_fill_ind(
    Gint *err_ind, /* OUT error indicator */
    Gint *fill_ind /* OUT current fill area index */
);
```

(INQUIRE CURRENT PRIMITIVE ATTRIBUTE VALUES [3])
INQUIRE PATTERN WIDTH VECTOR **0A**

```
void ginq_pat_width_vec(
    Gint *err_ind, /* OUT error indicator */
    Gvec *pat_width_vec /* OUT current pattern width vector */
);
```

(INQUIRE CURRENT PRIMITIVE ATTRIBUTE VALUES [3])
INQUIRE PATTERN HEIGHT VECTOR **0A**

```
void ginq_pat_ht_vec(
    Gint *err_ind, /* OUT error indicator */
    Gvec *pat_ht_vec /* OUT current pattern height vector */
);
```

(INQUIRE CURRENT PRIMITIVE ATTRIBUTE VALUES 3)
INQUIRE PATTERN REFERENCE POINT AND VECTORS **0A**

```
void ginq_pat_ref_point_vecs(
    Gint *err_ind, /* OUT error indicator */
    Gpoint3 *pat_ref_point, /* OUT current pattern reference point */
    Gvec3 pat_ref_vec[2] /* OUT current reference vectors;
                          1st ref. vector: X axis of pattern
                          2nd ref. vector: Y axis of pattern */
);
```

(INQUIRE CURRENT PRIMITIVE ATTRIBUTE VALUES)
INQUIRE PATTERN REFERENCE POINT **0A**

```
void ginq_pat_ref_point(
    Gint *err_ind, /* OUT error indicator */
    Gpoint *pat_ref_point /* OUT current pattern reference point */
);
```

(INQUIRE CURRENT PRIMITIVE ATTRIBUTE VALUES 3)
INQUIRE EDGE INDEX **0A**

```
void ginq_edge_ind(
    Gint *err_ind, /* OUT error indicator */
    Gint *edge_ind /* OUT current edge index */
);
```

C GKS-3D Function Interface

Inquiry Functions

INQUIRE VIEW INDEX **0A**

```

void ginq_view_ind(
    Gint  *err_ind,  /* OUT error indicator */
    Gint  *view_ind /* OUT current view index */
);

```

INQUIRE CURRENT PICK IDENTIFIER VALUE **1B**

```

void ginq_cur_pick_id(
    Gint  *err_ind,  /* OUT error indicator */
    Gint  *pick_id  /* OUT current pick identifier */
);

```

INQUIRE CURRENT HLHSR IDENTIFIER VALUE **1A**

```

void ginq_cur_hlhsr_id(
    Gint  *err_ind,  /* OUT error indicator */
    Gint  *hlhsr_id /* OUT current HLHSR identifier */
);

```

INQUIRE CURRENT INDIVIDUAL ATTRIBUTE VALUES 3 **0A**

```

void ginq_cur_indiv_attr3(
    Gint          *err_ind,  /* OUT error indicator */
    Gindiv_attr3 *indiv_attr3 /* OUT current individual
                                attribute 3 structure */
);

```

INQUIRE CURRENT INDIVIDUAL ATTRIBUTE VALUES **0A**

```

void ginq_cur_indiv_attr(
    Gint          *err_ind,  /* OUT error indicator */
    Gindiv_attr  *indiv_attr /* OUT current individual
                                attribute structure */
);

```

**(INQUIRE CURRENT INDIVIDUAL ATTRIBUTE VALUES [3])
INQUIRE LINETYPE** **0A**

```

void ginq_linetype(
    Gint  *err_ind,  /* OUT error indicator */
    Gint  *linetype /* OUT current linetype */
);

```

Inquiry Functions

C GKS-3D Function Interface

(INQUIRE CURRENT INDIVIDUAL ATTRIBUTE VALUES [3])**INQUIRE LINEWIDTH SCALE FACTOR** **0A**

```
void ginq_linewidth(
    Gint    *err_ind,    /* OUT error indicator    */
    Gfloat  *linewidth  /* OUT current linewidth scale factor */
);
```

(INQUIRE CURRENT INDIVIDUAL ATTRIBUTE VALUES [3])**INQUIRE POLYLINE COLOUR INDEX** **0A**

```
void ginq_line_colr_ind(
    Gint    *err_ind,    /* OUT error indicator    */
    Gint    *line_colr_ind /* OUT current polyline colour index */
);
```

(INQUIRE CURRENT INDIVIDUAL ATTRIBUTE VALUES [3])**INQUIRE MARKER TYPE** **0A**

```
void ginq_marker_type(
    Gint    *err_ind,    /* OUT error indicator    */
    Gint    *marker_type /* OUT current marker type */
);
```

(INQUIRE CURRENT INDIVIDUAL ATTRIBUTE VALUES [3])**INQUIRE MARKER SIZE SCALE FACTOR** **0A**

```
void ginq_marker_size(
    Gint    *err_ind,    /* OUT error indicator    */
    Gfloat  *marker_size /* OUT current marker size scale factor */
);
```

(INQUIRE CURRENT INDIVIDUAL ATTRIBUTE VALUES [3])**INQUIRE POLYMARKER COLOUR INDEX** **0A**

```
void ginq_marker_colr_ind(
    Gint    *err_ind,    /* OUT error indicator    */
    Gint    *marker_colr_ind /* OUT current polymarker colour index */
);
```

(INQUIRE CURRENT INDIVIDUAL ATTRIBUTE VALUES [3])**INQUIRE TEXT FONT AND PRECISION** **0A**

```
void ginq_text_font_prec(
    Gint    *err_ind,    /* OUT error indicator    */
    Gtext_font_prec *font_prec /* OUT current text font and precision */
);
```

C GKS-3D Function Interface

Inquiry Functions

(INQUIRE CURRENT INDIVIDUAL ATTRIBUTE VALUES [3])
INQUIRE CHARACTER EXPANSION FACTOR **0A**

```
void ginq_char_expan(
    Gint    *err_ind,      /* OUT error indicator      */
    Gfloat  *char_expan   /* OUT current character expansion factor */
);
```

(INQUIRE CURRENT INDIVIDUAL ATTRIBUTE VALUES [3])
INQUIRE CHARACTER SPACING **0A**

```
void ginq_char_space(
    Gint    *err_ind,      /* OUT error indicator      */
    Gfloat  *char_space   /* OUT current character spacing */
);
```

(INQUIRE CURRENT INDIVIDUAL ATTRIBUTE VALUES [3])
INQUIRE TEXT COLOUR INDEX **0A**

```
void ginq_text_colr_ind(
    Gint    *err_ind,      /* OUT error indicator      */
    Gint    *text_colr_ind /* OUT current text colour index */
);
```

(INQUIRE CURRENT INDIVIDUAL ATTRIBUTE VALUES [3])
INQUIRE FILL AREA INTERIOR STYLE **0A**

```
void ginq_fill_int_style(
    Gint    *err_ind,      /* OUT error indicator      */
    Gfill_int_style *fill_int_style /* OUT current fill area interior style */
);
```

(INQUIRE CURRENT INDIVIDUAL ATTRIBUTE VALUES [3])
INQUIRE FILL AREA STYLE INDEX **0A**

```
void ginq_fill_style_ind(
    Gint    *err_ind,      /* OUT error indicator      */
    Gint    *fill_style_ind /* OUT current fill area style index */
);
```

(INQUIRE CURRENT INDIVIDUAL ATTRIBUTE VALUES [3])
INQUIRE FILL AREA COLOUR INDEX **0A**

```
void ginq_fill_colr_ind(
    Gint    *err_ind,      /* OUT error indicator      */
    Gint    *fill_colr_ind /* OUT current fill area colour index */
);
```

Inquiry Functions

C GKS-3D Function Interface

(INQUIRE CURRENT INDIVIDUAL ATTRIBUTE VALUES 3)
INQUIRE EDGE FLAG **0A**

```
void ginq_edge_flag(
    Gint    *err_ind,    /* OUT error indicator    */
    Gedge_flag *edge_flag /* OUT current edge flag  */
);
```

(INQUIRE CURRENT INDIVIDUAL ATTRIBUTE VALUES 3)
INQUIRE EDGETYPE **0A**

```
void ginq_edgetype(
    Gint    *err_ind,    /* OUT error indicator    */
    Gint    *edgetype   /* OUT current edgetype   */
);
```

(INQUIRE CURRENT INDIVIDUAL ATTRIBUTE VALUES 3)
INQUIRE EDGEWIDTH SCALE FACTOR **0A**

```
void ginq_edgewidth(
    Gint    *err_ind,    /* OUT error indicator    */
    Gfloat  *edgewidth  /* OUT current edgewidth scale factor */
);
```

(INQUIRE CURRENT INDIVIDUAL ATTRIBUTE VALUES 3)
INQUIRE EDGE COLOUR INDEX **0A**

```
void ginq_edge_colr_ind(
    Gint    *err_ind,    /* OUT error indicator    */
    Gint    *edge_colr_ind /* OUT current edge colour index */
);
```

(INQUIRE CURRENT INDIVIDUAL ATTRIBUTE VALUES 3)
INQUIRE LIST OF ASPECT SOURCE FLAGS 3 **0A**

```
void ginq_asfs3(
    Gint    *err_ind,    /* OUT error indicator    */
    Gasfs3  *list_asf   /* OUT current aspect source flags */
);
```

(INQUIRE CURRENT INDIVIDUAL ATTRIBUTE VALUES)
INQUIRE LIST OF ASPECT SOURCE FLAGS **0A**

```
void ginq_asfs(
    Gint    *err_ind,    /* OUT error indicator    */
    Gasfs   *list_asf   /* OUT current aspect source flags */
);
```

C GKS-3D Function Interface

Inquiry Functions

INQUIRE CURRENT NORMALIZATION TRANSFORMATION NUMBER 0A

```

void ginq_cur_norm_tran_num(
    Gint *err_ind, /* OUT error indicator */
    Gint *norm_tran_num /* OUT current normalization
                        transformation number */
);

```

INQUIRE LIST OF NORMALIZATION TRANSFORMATION NUMBERS 0A

```

void ginq_list_norm_tran_nums(
    Gint num_elems_appl_list, /* length of application list */
    Gint start_ind, /* starting index */
    Gint *err_ind, /* OUT error indicator */
    Gint_list *norm_tran_num, /* OUT list of normalization
                             transformation numbers */
    Gint *num_elems_impl_list /* OUT length of impl. list */
);

```

INQUIRE NORMALIZATION TRANSFORMATION 3 0A

```

void ginq_norm_tran3(
    Gint num, /* normalization transformation number */
    Gint *err_ind, /* OUT error indicator */
    Gtran3 *norm_tran3 /* OUT normalization transformation */
);

```

INQUIRE NORMALIZATION TRANSFORMATION 0A

```

void ginq_norm_tran(
    Gint num, /* normalization transformation number */
    Gint *err_ind, /* OUT error indicator */
    Gtran *norm_tran /* OUT normalization transformation */
);

```

INQUIRE CLIPPING 3 0A

```

void ginq_clip3(
    Gint *err_ind, /* OUT error indicator */
    Gclip3 *clip_ind_vol /* OUT current clipping indicator
                        and volume */
);

```

INQUIRE CLIPPING 0A

```

void ginq_clip(
    Gint *err_ind, /* OUT error indicator */
    Gclip *clip_ind_rect /* OUT current clipping indicator
                        and rectangle */
);

```

Inquiry Functions

C GKS-3D Function Interface

INQUIRE NAME OF OPEN SEGMENT**1A**

```

void ginq_name_open_seg(
    Gint *err_ind, /* OUT error indicator */
    Gint *name_open_seg /* OUT name of open segment */
);

```

INQUIRE SET OF SEGMENT NAMES IN USE**1A**

```

void ginq_set_seg_names(
    Gint num_elems_appl_list, /* length of application list */
    Gint start_ind, /* starting index */
    Gint *err_ind, /* OUT error indicator */
    Gint_list *seg_names, /* OUT list of segment names */
    Gint *num_elems_impl_list /* OUT length of impl. list */
);

```

INQUIRE MORE SIMULTANEOUS EVENTS**0C**

```

void ginq_more_simult_events(
    Gint *err_ind, /* OUT error indicator */
    Gmore_simult_events *simult_events /* OUT [more] simultaneous events */
);

```

7.9.4 Inquiry Functions for Workstation State List**INQUIRE WORKSTATION CONNECTION AND TYPE****0A**

```

void ginq_ws_conn_type(
    Gint ws_id, /* workstation identifier */
    Gstore store, /* handle to Store object */
    Gint *err_ind, /* OUT error indicator */
    void **conn_id, /* OUT connection identifier */
    Gint *ws_type /* OUT workstation type */
);

```

REMARK. The memory referenced by *conn_id is managed by store.

INQUIRE WORKSTATION STATE**0A**

```

void ginq_ws_st(
    Gint ws_id, /* workstation identifier */
    Gint *err_ind, /* OUT error indicator */
    Gws_st *ws_st /* OUT workstation state */
);

```

INQUIRE WORKSTATION DEFERRAL AND UPDATE STATES**0A**

```

void ginq_ws_defer_upd_sts(
    Gint      ws_id,          /* workstation identifier      */
    Gint      *err_ind,      /* OUT error indicator        */
    Gdefer_mode *defer_mode, /* OUT deferral mode          */
    Girg_mode *irg_mode,    /* OUT implicit regeneration mode */
    Gdisp_surf_empty *disp_surf_empty, /* OUT display surface empty */
    Gnew_frame_nec_upd *new_frame /* OUT new frame action
                                   necessary at update          */
);

```

INQUIRE LIST OF POLYLINE INDICES**1A**

```

void ginq_list_line_inds(
    Gint      ws_id,          /* workstation identifier      */
    Gint      num_elems_appl_list, /* length of application list */
    Gint      start_ind,      /* starting index             */
    Gint      *err_ind,      /* OUT error indicator        */
    Gint_list *def_line_inds, /* OUT list of defined polyline indices */
    Gint      *num_elems_impl_list /* OUT length of impl. list */
);

```

INQUIRE POLYLINE REPRESENTATION**1A**

```

void ginq_line_rep(
    Gint      ws_id,          /* workstation identifier      */
    Gint      line_ind,      /* polyline index             */
    Ginq_type type,          /* type of returned values    */
    Gint      *err_ind,      /* OUT error indicator        */
    Gline_bundle *line_rep /* OUT polyline representation */
);

```

INQUIRE LIST OF POLYMARKER INDICES**1A**

```

void ginq_list_marker_inds(
    Gint      ws_id,          /* workstation identifier      */
    Gint      num_elems_appl_list, /* length of application list */
    Gint      start_ind,      /* starting index             */
    Gint      *err_ind,      /* OUT error indicator        */
    Gint_list *def_marker_inds, /* OUT list of defined polymarker indices */
    Gint      *num_elems_impl_list /* OUT length of impl. list */
);

```

Inquiry Functions

C GKS-3D Function Interface

INQUIRE POLYMARKER REPRESENTATION 1A

```

void ginq_marker_rep(
    Gint      ws_id,          /* workstation identifier */
    Gint      marker_ind,    /* polymarker index      */
    Ginq_type type,          /* type of returned values */
    Gint      *err_ind,      /* OUT error indicator    */
    Gmarker_bundle *marker_rep /* OUT polymarker representation */
);

```

INQUIRE LIST OF TEXT INDICES 1A

```

void ginq_list_text_inds(
    Gint      ws_id,          /* workstation identifier */
    Gint      num_elems_appl_list, /* length of application list */
    Gint      start_ind,      /* starting index         */
    Gint      *err_ind,      /* OUT error indicator    */
    Gint_list *def_text_inds, /* OUT list of defined text indices */
    Gint      *num_elems_impl_list /* OUT length of impl. list */
);

```

INQUIRE TEXT REPRESENTATION 1A

```

void ginq_text_rep(
    Gint      ws_id,          /* workstation identifier */
    Gint      text_ind,      /* text index             */
    Ginq_type type,          /* type of returned values */
    Gint      *err_ind,      /* OUT error indicator    */
    Gtext_bundle *text_rep /* OUT text representation */
);

```

INQUIRE TEXT EXTENT 3 0A

```

void ginq_text_extent3(
    Gint      ws_id,          /* workstation identifier */
    const Gpoint3 *pos,      /* text position          */
    const Gvec3  text_dir[2], /* text direction vectors */
    const char  *str,        /* text string            */
    Gint      *err_ind,      /* OUT error indicator    */
    Gtext_extent3 *extent /* OUT concatenation point and text extent parallelogram */
);

```

C GKS-3D Function Interface

Inquiry Functions

INQUIRE TEXT EXTENT**0A**

```

void ginq_text_extent (
    Gint      ws_id,      /* workstation identifier      */
    const Gpoint *pos,    /* text position              */
    const char *str,      /* text string                 */
    Gint      *err_ind,   /* OUT error indicator        */
    Gtext_extent *extent  /* OUT concatenation point and
                           text extent parallelogram */
);

```

INQUIRE LIST OF FILL AREA INDICES**1A**

```

void ginq_list_fill_inds (
    Gint      ws_id,      /* workstation identifier      */
    Gint      num_elems_appl_list, /* length of application list */
    Gint      start_ind,   /* starting index              */
    Gint      *err_ind,   /* OUT error indicator        */
    Gint_list *def_fill_inds, /* OUT list of defined fill area indices */
    Gint      *num_elems_impl_list /* OUT length of impl. list */
);

```

INQUIRE FILL AREA REPRESENTATION**1A**

```

void ginq_fill_rep (
    Gint      ws_id,      /* workstation identifier      */
    Gint      fill_ind,   /* fill area index            */
    Ginq_type type,       /* type of returned values    */
    Gint      *err_ind,   /* OUT error indicator        */
    Gfill_bundle *fill_rep /* OUT fill area representation */
);

```

INQUIRE LIST OF PATTERN INDICES**1A**

```

void ginq_list_pat_inds (
    Gint      ws_id,      /* workstation identifier      */
    Gint      num_elems_appl_list, /* length of application list */
    Gint      start_ind,   /* starting index              */
    Gint      *err_ind,   /* OUT error indicator        */
    Gint_list *def_pat_inds, /* OUT list of defined pattern indices */
    Gint      *num_elems_impl_list /* OUT length of impl. list */
);

```

Inquiry Functions

C GKS-3D Function Interface

INQUIRE PATTERN REPRESENTATION**1A**

```

void ginq_pat_rep(
    Gint      ws_id,      /* workstation identifier */
    Gint      pat_ind,    /* pattern index          */
    Ginq_type type,      /* type of returned values */
    Gstore    store,     /* handle to Store object */
    Gint      *err_ind,   /* OUT error indicator    */
    Gpat_rep  **pat_rep  /* OUT pattern representation */
);

```

REMARK. The memory referenced by *pat_rep is managed by store.

INQUIRE LIST OF EDGE INDICES**1A**

```

void ginq_list_edge_inds(
    Gint      ws_id,      /* workstation identifier */
    Gint      num_elems_appl_list, /* length of application list */
    Gint      start_ind,   /* starting index         */
    Gint      *err_ind,   /* OUT error indicator    */
    Gint_list *def_edge_inds, /* OUT list of defined edge indices */
    Gint      *num_elems_impl_list /* OUT length of impl. list */
);

```

INQUIRE EDGE REPRESENTATION**1A**

```

void ginq_edge_rep(
    Gint      ws_id,      /* workstation identifier */
    Gint      edge_ind,   /* edge index             */
    Ginq_type type,      /* type of returned values */
    Gint      *err_ind,   /* OUT error indicator    */
    Gedge_bundle *edge_rep /* OUT edge representation */
);

```

INQUIRE COLOUR MODEL**0A**

```

void ginq_colr_model(
    Gint      ws_id,      /* workstation identifier */
    Gint      *err_ind,   /* OUT error indicator    */
    Gint      *model     /* OUT current colour model */
);

```

INQUIRE LIST OF COLOUR INDICES**0A**

```

void ginq_list_colr_inds(
    Gint      ws_id,          /* workstation identifier          */
    Gint      num_elems_appl_list, /* length of application list     */
    Gint      start_ind,      /* starting index                  */
    Gint      *err_ind,       /* OUT error indicator            */
    Gint_list *def_colr_inds, /* OUT list of defined colour indices */
    Gint      *num_elems_impl_list /* OUT length of impl. list       */
);

```

INQUIRE COLOUR REPRESENTATION**0A**

```

void ginq_colr_rep(
    Gint      ws_id,          /* workstation identifier          */
    Gint      colr_ind,      /* colour index                    */
    Ginq_type type,          /* type of returned values        */
    Gint      *err_ind,       /* OUT error indicator            */
    Gcolr_rep *colr_rep      /* OUT colour representation      */
);

```

INQUIRE LIST OF VIEW INDICES**0A**

```

void ginq_list_view_inds(
    Gint      ws_id,          /* workstation identifier          */
    Gint      num_elems_appl_list, /* length of application list     */
    Gint      start_ind,      /* starting index                  */
    Gint      *err_ind,       /* OUT error indicator            */
    Gint_list *def_view_inds, /* OUT list of defined view indices */
    Gint      *num_elems_impl_list /* OUT length of impl. list       */
);

```

INQUIRE VIEW REPRESENTATION 3**0A**

```

void ginq_view_rep3(
    Gint      ws_id,          /* workstation identifier          */
    Gint      view_ind,      /* view index                      */
    Gint      *err_ind,       /* OUT error indicator            */
    Gupd_st   *view_upd_st,  /* OUT viewing transformation update state */
    Gview_rep3 *req_view,    /* OUT requested view representation */
    Gview_rep3 *cur_view     /* OUT current view representation  */
);

```

Inquiry Functions

C GKS-3D Function Interface

INQUIRE HLHSR MODE**1A**

```

void ginq_hlhsr_mode(
    Gint    ws_id,          /* workstation identifier */
    Gint    *err_ind,      /* OUT error indicator */
    Gupd_st *hlhsr_upd_st, /* OUT HLHSR update state */
    Gint    *req_mode,     /* OUT requested HLHSR mode */
    Gint    *cur_mode     /* OUT current HLHSR mode */
);

```

INQUIRE WORKSTATION TRANSFORMATION 3**0A**

```

void ginq_ws_tran3(
    Gint    ws_id,          /* workstation identifier */
    Gint    *err_ind,      /* OUT error indicator */
    Gupd_st *ws_tran_upd_st, /* OUT workstation transformation
                               update state */
    Glimit3 *req_ws_win,   /* OUT requested workstation window */
    Glimit3 *cur_ws_win,   /* OUT current workstation window */
    Glimit3 *req_ws_vp,   /* OUT requested workstation viewport */
    Glimit3 *cur_ws_vp    /* OUT current workstation viewport */
);

```

INQUIRE WORKSTATION TRANSFORMATION**0A**

```

void ginq_ws_tran(
    Gint    ws_id,          /* workstation identifier */
    Gint    *err_ind,      /* OUT error indicator */
    Gupd_st *ws_tran_upd_st, /* OUT workstation transformation
                               update state */
    Glimit  *req_ws_win,   /* OUT requested workstation window */
    Glimit  *cur_ws_win,   /* OUT current workstation window */
    Glimit  *req_ws_vp,   /* OUT requested workstation viewport */
    Glimit  *cur_ws_vp    /* OUT current workstation viewport */
);

```

INQUIRE SET OF SEGMENT NAMES ON WORKSTATION**1A**

```

void ginq_set_seg_names_ws(
    Gint    ws_id,          /* workstation identifier */
    Gint    num_elems_appl_list, /* length of application list */
    Gint    start_ind,     /* starting index */
    Gint    *err_ind,      /* OUT error indicator */
    Gint_list *seg_names,  /* OUT list of segment names */
    Gint    *num_elems_impl_list /* OUT length of impl. list */
);

```

C GKS-3D Function Interface

Inquiry Functions

INQUIRE LOCATOR DEVICE STATE 3**0B**

```

void ginq_loc_st3(
    Gint      ws_id,          /* workstation identifier      */
    Gint      loc_num,       /* locator device number      */
    Ginq_type type,         /* type of returned values    */
    Gstore    store,        /* handle to Store object     */
    Gint      *err_ind,     /* OUT error indicator        */
    Gop_mode  *mode,        /* OUT operating mode         */
    Gecho_switch *esw,     /* OUT echo switch           */
    Gint      *init_norm_tran_num, /* OUT initial normalization
                                transformation number      */
    Gint      *init_view_ind, /* OUT initial view index     */
    Gpoint3   *init_loc_pos, /* OUT initial locator position */
    Gint      *pet,         /* OUT prompt/echo type      */
    Glimit3   *echo_vol,   /* OUT echo volume           */
    Gloc_data3 **loc_data  /* OUT locator data record    */
);

```

REMARK. The memory referenced by *loc_data is managed by store.

INQUIRE LOCATOR DEVICE STATE**0B**

```

void ginq_loc_st(
    Gint      ws_id,          /* workstation identifier      */
    Gint      loc_num,       /* locator device number      */
    Ginq_type type,         /* type of returned values    */
    Gstore    store,        /* handle to Store object     */
    Gint      *err_ind,     /* OUT error indicator        */
    Gop_mode  *mode,        /* OUT operating mode         */
    Gecho_switch *esw,     /* OUT echo switch           */
    Gint      *init_norm_tran_num, /* OUT initial normalization
                                transformation number      */
    Gpoint3   *init_loc_pos, /* OUT initial locator position */
    Gint      *pet,         /* OUT prompt/echo type      */
    Glimit3   *echo_area,  /* OUT echo area             */
    Gloc_data3 **loc_data  /* OUT locator data record    */
);

```

REMARK. The memory referenced by *loc_data is managed by store.

Inquiry Functions

C GKS-3D Function Interface

INQUIRE STROKE DEVICE STATE 3**0B**

```

void ginq_stroke_st3(
    Gint      ws_id,          /* workstation identifier      */
    Gint      stroke_num,    /* stroke device number       */
    Ginq_type type,          /* type of returned values    */
    Gstore    store,        /* handle to Store object     */
    Gint      *err_ind,     /* OUT error indicator        */
    Gop_mode  *mode,        /* OUT operating mode         */
    Gecho_switch *esw,     /* OUT echo switch            */
    Gint      *init_norm_tran_num, /* OUT initial normalization
                                transformation number      */
    Gint      *init_view_ind, /* OUT initial view index     */
    Gpoint_list3 **init_stroke, /* OUT initial stroke         */
    Gint      *pet,         /* OUT prompt/echo type       */
    Glimit3   *echo_vol,    /* OUT echo volume            */
    Gstroke_data3 **stroke_data /* OUT stroke data record     */
);

```

REMARK. The memory referenced by `*init_stroke` and `*stroke_data` is managed by `store`.

INQUIRE STROKE DEVICE STATE**0B**

```

void ginq_stroke_st(
    Gint      ws_id,          /* workstation identifier      */
    Gint      stroke_num,    /* stroke device number       */
    Ginq_type type,          /* type of returned values    */
    Gstore    store,        /* handle to Store object     */
    Gint      *err_ind,     /* OUT error indicator        */
    Gop_mode  *mode,        /* OUT operating mode         */
    Gecho_switch *esw,     /* OUT echo switch            */
    Gint      *init_norm_tran_num, /* OUT initial normalization
                                transformation number      */
    Gpoint_list **init_stroke, /* OUT initial stroke         */
    Gint      *pet,         /* OUT prompt/echo type       */
    Glimit    *echo_area,   /* OUT echo area              */
    Gstroke_data **stroke_data /* OUT stroke data record     */
);

```

REMARK. The memory referenced by `init_stroke` and `*stroke_data` is managed by `store`.

INQUIRE VALUATOR DEVICE STATE 3**0B**

```

void ginq_val_st3(
    Gint      ws_id,          /* workstation identifier */
    Gint      val_num,       /* valuator device number */
    Gstore    store,        /* handle to Store object */
    Gint      *err_ind,     /* OUT error indicator */
    Gop_mode  *mode,        /* OUT operating mode */
    Gecho_switch *esw,     /* OUT echo switch */
    Gfloat    *init_value,  /* OUT initial value */
    Gint      *pet,         /* OUT prompt/echo type */
    Glimit3   *echo_vol,    /* OUT echo volume */
    Gval_data3 **val_data   /* OUT valuator data record */
);

```

REMARK. The memory referenced by *val_data is managed by store.

INQUIRE VALUATOR DEVICE STATE**0B**

```

void ginq_val_st(
    Gint      ws_id,          /* workstation identifier */
    Gint      val_num,       /* valuator device number */
    Gstore    store,        /* handle to Store object */
    Gint      *err_ind,     /* OUT error indicator */
    Gop_mode  *mode,        /* OUT operating mode */
    Gecho_switch *esw,     /* OUT echo switch */
    Gfloat    *init_value,  /* OUT initial value */
    Gint      *pet,         /* OUT prompt/echo type */
    Glimit    *echo_area,   /* OUT echo area */
    Gval_data **val_data    /* OUT valuator data record */
);

```

REMARK. The memory referenced by *val_data is managed by store.

INQUIRE CHOICE DEVICE STATE 3**0B**

```

void ginq_choice_st3(
    Gint      ws_id,          /* workstation identifier */
    Gint      choice_num,    /* choice device number */
    Gstore    store,        /* handle to Store object */
    Gint      *err_ind,     /* OUT error indicator */
    Gop_mode  *mode,        /* OUT operating mode */
    Gecho_switch *esw,     /* OUT echo switch */
    Gin_status *init_status, /* OUT initial choice status */
    Gint      *init_choice, /* OUT initial choice */
    Gint      *pet,         /* OUT prompt/echo type */
    Glimit3   *echo_vol,    /* OUT echo volume */
    Gchoice_data3 **choice_data /* OUT choice data record */
);

```

REMARK. The memory referenced by *choice_data is managed by store.

Inquiry Functions

C GKS-3D Function Interface

INQUIRE CHOICE DEVICE STATE**0B**

```

void ginq_choice_st(
    Gint      ws_id,          /* workstation identifier */
    Gint      choice_num,    /* choice device number   */
    Gstore    store,        /* handle to Store object */
    Gint      *err_ind,     /* OUT error indicator    */
    Gop_mode  *mode,        /* OUT operating mode     */
    Gecho_switch *esw,     /* OUT echo switch       */
    Gin_status *init_status, /* OUT initial choice status */
    Gint      *init_choice, /* OUT initial choice     */
    Gint      *pet,         /* OUT prompt/echo type  */
    Glimit    *echo_area,   /* OUT echo area         */
    Gchoice_data **choice_data /* OUT choice data record */
);

```

REMARK. The memory referenced by *choice_data is managed by store.

INQUIRE PICK DEVICE STATE 3**1B**

```

void ginq_pick_st3(
    Gint      ws_id,          /* workstation identifier */
    Gint      pick_num,     /* pick device number     */
    Ginq_type  type,        /* type of returned values */
    Gstore    store,        /* handle to Store object */
    Gint      *err_ind,     /* OUT error indicator    */
    Gop_mode  *mode,        /* OUT operating mode     */
    Gecho_switch *esw,     /* OUT echo switch       */
    Gin_status *init_status, /* OUT initial pick status */
    Gpick     *init_pick,   /* OUT initial pick value */
    Gint      *pet,         /* OUT prompt/echo type  */
    Glimit3   *echo_vol,    /* OUT echo volume       */
    Gpick_data3 **pick_data /* OUT pick data record  */
);

```

REMARK. The memory referenced by *pick_data is managed by store.

INQUIRE PICK DEVICE STATE**1B**

```

void ginq_pick_st(
    Gint      ws_id,          /* workstation identifier */
    Gint      pick_num,      /* pick device number    */
    Ginq_type type,          /* type of returned values */
    Gstore    store,        /* handle to Store object */
    Gint      *err_ind,     /* OUT error indicator    */
    Gop_mode  *mode,        /* OUT operating mode     */
    Gecho_switch *esw,      /* OUT echo switch        */
    Gin_status *init_status, /* OUT initial pick status */
    Gpick     *init_pick,   /* OUT initial pick value */
    Gint      *pet,         /* OUT prompt/echo type  */
    Glimit    *echo_area,   /* OUT echo area          */
    Gpick_data **pick_data  /* OUT pick data record   */
);

```

REMARK. The memory referenced by *pick_data is managed by store.

INQUIRE STRING DEVICE STATE 3**0B**

```

void ginq_string_st3(
    Gint      ws_id,          /* workstation identifier */
    Gint      string_num,     /* string device number   */
    Gstore    store,        /* handle to Store object */
    Gint      *err_ind,     /* OUT error indicator    */
    Gop_mode  *mode,        /* OUT operating mode     */
    Gecho_switch *esw,      /* OUT echo switch        */
    char      **init_string, /* OUT initial string     */
    Gint      *pet,         /* OUT prompt/echo type  */
    Glimit3   *echo_vol,    /* OUT echo volume        */
    Gstring_data3 **string_data /* OUT string data record */
);

```

REMARK. The memory referenced by *init_string and *string_data is managed by store.

Inquiry Functions

C GKS-3D Function Interface

INQUIRE STRING DEVICE STATE**0B**

```

void ginq_string_st(
    Gint      ws_id,          /* workstation identifier */
    Gint      string_num,    /* string device number   */
    Gstore    store,         /* handle to Store object */
    Gint      *err_ind,      /* OUT error indicator     */
    Gop_mode  *mode,        /* OUT operating mode     */
    Gecho_switch *esw,      /* OUT echo switch        */
    char      **init_string, /* OUT intial string      */
    Gint      *pet,         /* OUT prompt/echo type   */
    Glimit    *echo_area,   /* OUT echo area          */
    Gstring_data **string_data /* OUT string data record */
);

```

REMARK. The memory referenced by *init_string and *string_data is managed by store.

7.9.5 Inquiry Functions for Workstation Description Table**INQUIRE WORKSTATION CATEGORY****0A**

```

void ginq_ws_cat(
    Gint      ws_type,      /* workstation type        */
    Gint      *err_ind,    /* OUT error indicator     */
    Gws_cat   *cat         /* OUT workstation category */
);

```

INQUIRE WORKSTATION CLASSIFICATION**0A**

```

void ginq_ws_class(
    Gint      ws_type,      /* workstation type        */
    Gint      *err_ind,    /* OUT error indicator     */
    Gws_class *class       /* OUT workstation class   */
);

```

INQUIRE DISPLAY SPACE SIZE 3**0A**

```

void ginq_disp_space_size3(
    Gint      ws_type,      /* workstation type        */
    Gint      *err_ind,    /* OUT error indicator     */
    Gdisp_space_size3 *disp_size /* OUT display [space] size */
);

```

INQUIRE DISPLAY SPACE SIZE**0A**

```

void ginq_disp_space_size(
    Gint      ws_type,      /* workstation type        */
    Gint      *err_ind,    /* OUT error indicator     */
    Gdisp_space_size *disp_size /* OUT display [space] size */
);

```

C GKS-3D Function Interface

Inquiry Functions

INQUIRE DYNAMIC MODIFICATION OF WORKSTATION ATTRIBUTES 3 1A

```

void ginq_dyn_mod_ws_attrs3(
    Gint          ws_type,      /* workstation type          */
    Gint          *err_ind,     /* OUT error indicator       */
    Gdyn_mod_ws_attrs3 *dyn_mod /* OUT dynamic modification of
                                workstation attributes      */
);

```

INQUIRE DYNAMIC MODIFICATION OF WORKSTATION ATTRIBUTES 1A

```

void ginq_dyn_mod_ws_attrs(
    Gint          ws_type,      /* workstation type          */
    Gint          *err_ind,     /* OUT error indicator       */
    Gdyn_mod_ws_attrs *dyn_mod /* OUT dynamic modification of
                                workstation attributes      */
);

```

INQUIRE DEFAULT DEFERRAL STATE VALUES 1A

```

void ginq_def_defer_sts(
    Gint          ws_type,      /* workstation type          */
    Gint          *err_ind,     /* OUT error indicator       */
    Gdefer_mode   *defer_mode, /* OUT default deferral mode */
    Girg_mode     *irg_mode     /* OUT default impl. reg. mode */
);

```

INQUIRE POLYLINE FACILITIES 0A

```

void ginq_line_facs(
    Gint          ws_type,      /* workstation type          */
    Gint          num_elems_appl_list, /* length of application list */
    Gint          start_ind,     /* starting index           */
    Gint          *err_ind,     /* OUT error indicator       */
    Gline_facs    *line_facs,   /* OUT polyline facilities   */
    Gint          *num_elems_impl_list /* OUT length of linetype
                                list in impl.                */
);

```

INQUIRE PREDEFINED POLYLINE REPRESENTATION 0A

```

void ginq_pred_line_rep(
    Gint          ws_type,      /* workstation type          */
    Gint          ind,         /* predefined index          */
    Gint          *err_ind,     /* OUT error indicator       */
    Gline_bundle  *line_rep     /* OUT predefined polyline rep. */
);

```

Inquiry Functions

C GKS-3D Function Interface

INQUIRE POLYMARKER FACILITIES**0A**

```

void ginq_marker_facs(
    Gint      ws_type,          /* workstation type          */
    Gint      num_elems_appl_list, /* length of application list */
    Gint      start_ind,        /* starting index            */
    Gint      *err_ind,         /* OUT error indicator       */
    Gmarker_facs *marker_facs, /* OUT polymarker facilities */
    Gint      *num_elems_impl_list /* OUT length of marker type
                                   list in impl.                */
);

```

INQUIRE PREDEFINED POLYMARKER REPRESENTATION**0A**

```

void ginq_pred_marker_rep(
    Gint      ws_type,          /* workstation type          */
    Gint      ind,              /* predefined index           */
    Gint      *err_ind,         /* OUT error indicator       */
    Gmarker_bundle *marker_rep /* OUT predefined polymarker rep. */
);

```

INQUIRE TEXT FACILITIES**0A**

```

void ginq_text_facs(
    Gint      ws_type,          /* workstation type          */
    Gint      num_elems_appl_list, /* length of application list */
    Gint      start_ind,        /* starting index            */
    Gint      *err_ind,         /* OUT error indicator       */
    Gtext_facs *text_facs,      /* OUT text facilities       */
    Gint      *num_elems_impl_list /* OUT length of text font
                                   and precision list in impl.  */
);

```

INQUIRE PREDEFINED TEXT REPRESENTATION**0A**

```

void ginq_pred_text_rep(
    Gint      ws_type,          /* workstation type          */
    Gint      ind,              /* predefined index           */
    Gint      *err_ind,         /* OUT error indicator       */
    Gtext_bundle *text_rep     /* OUT predefined text rep.  */
);

```

C GKS-3D Function Interface

Inquiry Functions

INQUIRE FILL AREA FACILITIES**0A**

```

void ginq_fill_fac(
    Gint      ws_type,           /* workstation type          */
    Gint      num_elems_appl_list, /* length of application list */
    Gint      start_ind,        /* starting index           */
    Gint      *err_ind,         /* OUT error indicator      */
    Gfill_fac *fill_fac,       /* OUT fill area facilities */
    Gint      *num_elems_impl_list /* OUT length of hatch list */
);

```

INQUIRE PREDEFINED FILL AREA REPRESENTATION**0A**

```

void ginq_pred_fill_rep(
    Gint      ws_type,           /* workstation type          */
    Gint      ind,              /* predefined index          */
    Gint      *err_ind,         /* OUT error indicator      */
    Gfill_bundle *fill_rep      /* OUT predefined fill area rep. */
);

```

INQUIRE PATTERN FACILITIES**0A**

```

void ginq_pat_fac(
    Gint      ws_type,           /* workstation type          */
    Gint      *err_ind,         /* OUT error indicator      */
    Gint      *num_pred_inde     /* OUT num. of predef. pattern indices */
);

```

INQUIRE PREDEFINED PATTERN REPRESENTATION**0A**

```

void ginq_pred_pat_rep(
    Gint      ws_type,           /* workstation type          */
    Gint      ind,              /* predefined index          */
    Gstore    store,           /* handle to Store object    */
    Gint      *err_ind,         /* OUT error indicator      */
    Gpat_rep  **pat_rep        /* OUT predefined pattern rep. */
);

```

REMARK. The memory referenced by *pat_rep is managed by store.

Inquiry Functions

C GKS-3D Function Interface

INQUIRE EDGE FACILITIES**0A**

```

void ginq_edge_facs(
    Gint      ws_type,          /* workstation type          */
    Gint      num_elems_appl_list, /* length of application list */
    Gint      start_ind,       /* starting index            */
    Gint      *err_ind,        /* OUT error indicator       */
    Gedge_facs *edge_facs,     /* OUT edge facilities       */
    Gint      *num_elems_impl_list /* OUT length of edgetype
                                list in impl.                */
);

```

INQUIRE PREDEFINED EDGE REPRESENTATION**0A**

```

void ginq_pred_edge_rep(
    Gint      ws_type,          /* workstation type          */
    Gint      ind,             /* predefined index          */
    Gint      *err_ind,        /* OUT error indicator       */
    Gedge_bundle *edge_rep     /* OUT predefined edge rep.  */
);

```

INQUIRE COLOUR MODEL FACILITIES**0A**

```

void ginq_colr_model_facs(
    Gint      ws_type,          /* workstation type          */
    Gint      num_elems_appl_list, /* length of application list */
    Gint      start_ind,       /* starting index            */
    Gint      *err_ind,        /* OUT error indicator       */
    Gint_list *models,         /* OUT list of colour models */
    Gint      *num_elems_impl_list /* OUT length of impl. list  */
);

```

INQUIRE COLOUR FACILITIES**0A**

```

void ginq_colr_facs(
    Gint      ws_type,          /* workstation type          */
    Gint      *err_ind,        /* OUT error indicator       */
    Gcolr_facs *colr_facs     /* OUT colour facilities     */
);

```

INQUIRE PREDEFINED COLOUR REPRESENTATION**0A**

```

void ginq_pred_colr_rep(
    Gint      ws_type,          /* workstation type          */
    Gint      ind,             /* predefined index          */
    Gint      *err_ind,        /* OUT error indicator       */
    Gcolr_rep *colr_rep       /* OUT predefined colour rep. */
);

```

INQUIRE VIEW FACILITIES **0A**

```

void ginq_view_facs(
    Gint  ws_type,          /* workstation type          */
    Gint  *err_ind,        /* OUT error indicator       */
    Gint  *num_pred_inds   /* OUT num. of predef. view indices */
);

```

INQUIRE PREDEFINED VIEW REPRESENTATION **0A**

```

void ginq_pred_view_rep(
    Gint  ws_type,          /* workstation type          */
    Gint  view_ind,        /* predefined view index     */
    Gint  *err_ind,        /* OUT error indicator       */
    Gview_rep3 *view_rep   /* OUT predefined view rep. */
);

```

(INQUIRE HLHSR FACILITIES)**INQUIRE HLHSR IDENTIFIER FACILITIES** **1A**

```

void ginq_hlhsr_id_facs(
    Gint  ws_type,          /* workstation type          */
    Gint  num_elems_appl_list, /* length of application list */
    Gint  start_ind,        /* starting index           */
    Gint  *err_ind,        /* OUT error indicator       */
    Gint_list *hlhsr_id,    /* OUT list of HLHSR ids     */
    Gint  *num_elems_impl_list /* OUT length of impl. list  */
);

```

(INQUIRE HLHSR FACILITIES)**INQUIRE HLHSR MODE FACILITIES** **1A**

```

void ginq_hlhsr_mode_facs(
    Gint  ws_type,          /* workstation type          */
    Gint  num_elems_appl_list, /* length of application list */
    Gint  start_ind,        /* starting index           */
    Gint  *err_ind,        /* OUT error indicator       */
    Gint_list *hlhsr_mode,  /* OUT list of HLHSR modes   */
    Gint  *num_elems_impl_list /* OUT length of impl. list  */
);

```

Inquiry Functions

C GKS-3D Function Interface

INQUIRE LIST OF AVAILABLE GENERALIZED DRAWING PRIMITIVES 3 0A

```

void ginq_list_avail_gdps3(
    Gint      ws_type,          /* workstation type          */
    Gint      num_elems_appl_list, /* length of application list */
    Gint      start_ind,        /* starting index            */
    Gint      *err_ind,         /* OUT error indicator       */
    Gint_list *gdp3,           /* OUT list of GDP3s        */
    Gint      *num_elems_impl_list /* OUT length of impl. list  */
);

```

INQUIRE LIST OF AVAILABLE GENERALIZED DRAWING PRIMITIVES 0A

```

void ginq_list_avail_gdps(
    Gint      ws_type,          /* workstation type          */
    Gint      num_elems_appl_list, /* length of application list */
    Gint      start_ind,        /* starting index            */
    Gint      *err_ind,         /* OUT error indicator       */
    Gint_list *gdp,            /* OUT list of GDPs         */
    Gint      *num_elems_impl_list /* OUT length of impl. list  */
);

```

INQUIRE GENERALIZED DRAWING PRIMITIVE 3 0A

```

void ginq_gdp3(
    Gint      ws_type,          /* workstation type          */
    Gint      gdp,             /* GDP function number       */
    Gint      *err_ind,         /* OUT error indicator       */
    Gint      *num_attr,        /* OUT num. of attributes used */
    Gattrrs   attr[5]          /* OUT list of attributes used */
);

```

INQUIRE GENERALIZED DRAWING PRIMITIVE 0A

```

void ginq_gdp(
    Gint      ws_type,          /* workstation type          */
    Gint      gdp,             /* GDP function number       */
    Gint      *err_ind,         /* OUT error indicator       */
    Gint      *num_attr,        /* OUT num. of attributes used */
    Gattrrs   attr[4]          /* OUT list of attributes used */
);

```

INQUIRE MAXIMUM LENGTH OF WORKSTATION STATE TABLES 3 0A

```

void ginq_max_ws_st_tables3(
    Gint      ws_type,          /* workstation type          */
    Gint      *err_ind,         /* OUT error indicator       */
    Gmax_ws_st_tables3 *lengths /* OUT lengths of workstation tables */
);

```

INQUIRE MAXIMUM LENGTH OF WORKSTATION STATE TABLES 0A

```

void ginq_max_ws_st_tables(
    Gint      ws_type,      /* workstation type          */
    Gint      *err_ind,     /* OUT error indicator       */
    Gmax_ws_st_tables *lengths /* OUT lengths of workstation tables */
);

```

INQUIRE NUMBER OF SEGMENT PRIORITIES SUPPORTED 1A

```

void ginq_num_seg_pris(
    Gint      ws_type,      /* workstation type          */
    Gint      *err_ind,     /* OUT error indicator       */
    Gint      *num_seg_pris /* OUT num. of segment priorities */
);

```

INQUIRE DYNAMIC MODIFICATION OF SEGMENT ATTRIBUTES 1A

```

void ginq_dyn_mod_seg_attrs(
    Gint      ws_type,      /* workstation type          */
    Gint      *err_ind,     /* OUT error indicator       */
    Gdyn_mod_seg_attrs *dyn_mod /* OUT dynamic modification of segment attributes */
);

```

INQUIRE NUMBER OF AVAILABLE LOGICAL INPUT DEVICES 0B

```

void ginq_num_avail_in(
    Gint      ws_type,      /* workstation type          */
    Gint      *err_ind,     /* OUT error indicator       */
    Gnum_in   *num_in      /* OUT num. of input devices */
);

```

INQUIRE DEFAULT LOCATOR DEVICE DATA 3 0B

```

void ginq_def_loc_data3(
    Gint      ws_type,      /* workstation type          */
    Gint      loc_num,      /* logical input device number */
    Gstore    store,        /* handle to Store object     */
    Gint      *err_ind,     /* OUT error indicator       */
    Gpoint3   *loc_pos,     /* OUT default initial position */
    Gint_list **pet_list,   /* OUT list of prompt and echo types */
    Glimit3   *echo_vol,    /* OUT default echo volume    */
    Gloc_data3 **loc_data  /* OUT default data record    */
);

```

REMARK. The memory referenced by *pet_list and *loc_data is managed by store.

Inquiry Functions

C GKS-3D Function Interface

INQUIRE DEFAULT LOCATOR DEVICE DATA **0B**

```

void ginq_def_loc_data(
    Gint      ws_type,      /* workstation type          */
    Gint      loc_num,      /* logical input device number */
    Gstore    store,       /* handle to Store object    */
    Gint      *err_ind,     /* OUT error indicator       */
    Gpoint    *loc_pos,    /* OUT default locator position */
    Gint_list **pet_list,   /* OUT list of prompt and echo types */
    Glimit    *echo_area,  /* OUT default echo area    */
    Gloc_data **loc_data   /* OUT default data record   */
);

```

REMARK.The memory referenced by *pet_list and *loc_data is managed by store.

INQUIRE DEFAULT STROKE DEVICE DATA 3 **0B**

```

void ginq_def_stroke_data3(
    Gint      ws_type,      /* workstation type          */
    Gint      stroke_num,   /* logical input device number */
    Gstore    store,       /* handle to Store object    */
    Gint      *err_ind,     /* OUT error indicator       */
    Gint      *max_buf_size, /* OUT max. input buffer size
                               (nr. of points)           */
    Gint_list **pet_list,   /* OUT list of prompt and echo types */
    Glimit3   *echo_vol,    /* OUT default echo volume    */
    Gstroke_data3 **stroke_data /* OUT default data record   */
);

```

REMARK.The memory referenced by *pet_list and *stroke_data is managed by store.

INQUIRE DEFAULT STROKE DEVICE DATA **0B**

```

void ginq_def_stroke_data(
    Gint      ws_type,      /* workstation type          */
    Gint      stroke_num,   /* logical input device number */
    Gstore    store,       /* handle to Store object    */
    Gint      *err_ind,     /* OUT error indicator       */
    Gint      *max_buf_size, /* OUT max. input buffer size
                               (nr. of points)           */
    Gint_list **pet_list,   /* OUT list of prompt and echo types */
    Glimit    *echo_area,  /* OUT default echo area    */
    Gstroke_data **stroke_data /* OUT default data record   */
);

```

REMARK.The memory referenced by *pet_list and *stroke_data is managed by store.

C GKS-3D Function Interface

Inquiry Functions

INQUIRE DEFAULT VALUATOR DEVICE DATA 3 **0B**

```

void ginq_def_val_data3(
    Gint      ws_type,      /* workstation type          */
    Gint      val_num,      /* logical input device number */
    Gstore    store,        /* handle to Store object    */
    Gint      *err_ind,     /* OUT error indicator       */
    Gfloat    *def_val,     /* OUT default initial value */
    Gint_list **pet_list,   /* OUT list of prompt and echo types */
    Glimit3   *echo_vol,    /* OUT default echo volume   */
    Gval_data3 **val_data   /* OUT default data record   */
);

```

REMARK. The memory referenced by *pet_list and *val_data is managed by store.

INQUIRE DEFAULT VALUATOR DEVICE DATA **0B**

```

void ginq_def_val_data(
    Gint      ws_type,      /* workstation type          */
    Gint      val_num,      /* logical input device number */
    Gstore    store,        /* handle to Store object    */
    Gint      *err_ind,     /* OUT error indicator       */
    Gfloat    *def_val,     /* OUT default initial value */
    Gint_list **pet_list,   /* OUT list of prompt and echo types */
    Glimit    *echo_area,   /* OUT default echo area     */
    Gval_data **val_data   /* OUT default data record   */
);

```

REMARK. The memory referenced by *pet_list and *val_data is managed by store.

INQUIRE DEFAULT CHOICE DEVICE DATA 3 **0B**

```

void ginq_def_choice_data3(
    Gint      ws_type,      /* workstation type          */
    Gint      choice_num,   /* logical input device number */
    Gstore    store,        /* handle to Store object    */
    Gint      *err_ind,     /* OUT error indicator       */
    Gint      *max_num_choices, /* OUT max. num. of choices */
    Gint_list **pet_list,   /* OUT list of prompt and echo types */
    Glimit3   *echo_vol,    /* OUT default echo volume   */
    Gchoice_data3 **choice_data /* OUT default data record   */
);

```

REMARK. The memory referenced by *pet_list and *choice_data is managed by store.

Inquiry Functions

C GKS-3D Function Interface

INQUIRE DEFAULT CHOICE DEVICE DATA**0B**

```

void ginq_def_choice_data(
    Gint      ws_type,          /* workstation type          */
    Gint      choice_num,      /* logical input device number */
    Gstore    store,          /* handle to Store object    */
    Gint      *err_ind,        /* OUT error indicator       */
    Gint      *max_num_choices, /* OUT max. num. of choices  */
    Gint_list **pet_list,      /* OUT list of prompt and echo types */
    Glimit    *echo_area,     /* OUT default echo area    */
    Gchoice_data **choice_data /* OUT default data record   */
);

```

REMARK.The memory referenced by *pet_list and *choice_data is managed by store.

INQUIRE DEFAULT PICK DEVICE DATA 3**1B**

```

void ginq_def_pick_data3(
    Gint      ws_type,          /* workstation type          */
    Gint      pick_num,        /* logical input device number */
    Gstore    store,          /* handle to Store object    */
    Gint      *err_ind,        /* OUT error indicator       */
    Gint_list **pet_list,      /* OUT list of prompt and echo types */
    Glimit3   *echo_vol,      /* OUT default echo volume   */
    Gpick_data3 **pick_data   /* OUT default data record   */
);

```

REMARK.The memory referenced by *pet_list and *pick_data is managed by store.

INQUIRE DEFAULT PICK DEVICE DATA**1B**

```

void ginq_def_pick_data(
    Gint      ws_type,          /* workstation type          */
    Gint      pick_num,        /* logical input device number */
    Gstore    store,          /* handle to Store object    */
    Gint      *err_ind,        /* OUT error indicator       */
    Gint_list **pet_list,      /* OUT list of prompt and echo types */
    Glimit    *echo_area,     /* OUT default echo area    */
    Gpick_data **pick_data   /* OUT default data record   */
);

```

REMARK.The memory referenced by *pet_list and *pick_data is managed by store.

INQUIRE DEFAULT STRING DEVICE DATA 3 **0B**

```

void ginq_def_string_data3(
    Gint      ws_type,          /* workstation type          */
    Gint      string_num,       /* logical input device number */
    Gstore    store,           /* handle to Store object    */
    Gint      *err_ind,         /* OUT error indicator       */
    Gint      *max_buf_size,    /* OUT max. input buffer size
                                (nr. of bytes)            */
    Gint_list **pet_list,       /* OUT list of prompt and echo types */
    Glimit3   *echo_vol,       /* OUT default echo volume   */
    Gstring_data3 **string_data /* OUT default data record   */
);

```

REMARK. The memory referenced by *pet_list and *string_data is managed by store.

INQUIRE DEFAULT STRING DEVICE DATA **0B**

```

void ginq_def_string_data(
    Gint      ws_type,          /* workstation type          */
    Gint      string_num,       /* logical input device number */
    Gstore    store,           /* handle to Store object    */
    Gint      *err_ind,         /* OUT error indicator       */
    Gint      *max_buf_size,    /* OUT max. input buffer size
                                (nr. of bytes)            */
    Gint_list **pet_list,       /* OUT list of prompt and echo types */
    Glimit    *echo_area,      /* OUT default echo area     */
    Gstring_data **string_data /* OUT default data record   */
);

```

REMARK. The memory referenced by *pet_list and *string_data is managed by store.

7.9.6 Inquire functions for the Segment State List**INQUIRE SET OF ASSOCIATED WORKSTATIONS** **1A**

```

void ginq_set_assoc_wss(
    Gint      seg_name,         /* segment name              */
    Gint      num_elems_appl_list, /* length of application list */
    Gint      start_ind,        /* starting index            */
    Gint      *err_ind,         /* OUT error indicator       */
    Gint_list *ws,             /* OUT list of workstations  */
    Gint      *num_elems_impl_list /* OUT length of impl. list  */
);

```

Inquire functions

C GKS-3D Function Interface

INQUIRE SEGMENT ATTRIBUTES 3**1A**

```

void ginq_seg_attr3(
    Gint      seg_name, /* segment name          */
    Gint      *err_ind, /* OUT error indicator   */
    Gseg_attr3 *seg_attr /* OUT segment attribute structure */
);

```

INQUIRE SEGMENT ATTRIBUTES**1A**

```

void ginq_seg_attr(
    Gint      seg_name, /* segment name          */
    Gint      *err_ind, /* OUT error indicator   */
    Gseg_attr *seg_attr /* OUT segment attribute structure */
);

```

7.9.7 Pixel Inquiries**INQUIRE PIXEL ARRAY DIMENSIONS****0A**

```

void ginq_pixel_array_dims(
    Gint      ws_id, /* workstation identifier */
    const Grect *rect, /* rectangle              */
    Gint      *err_ind, /* OUT error indicator     */
    Gint_size *dims /* OUT pixel array dimensions */
);

```

INQUIRE PIXEL ARRAY**0A**

```

void ginq_pixel_array(
    Gint      ws_id, /* workstation identifier */
    const Gpoint *pixel_loc, /* pixel location         */
    const Gint_size *dims, /* pixel array dimensions */
    Gint      *err_ind, /* OUT error indicator     */
    Gpres_inval *pres_inval, /* OUT presence of invalid values */
    Gint      *pixel_array /* OUT colour index array */
);

```

REMARK. Before this function is called, the application shall allocate the parameter `pixel_array` as an integer array of size `dims->size_x*dims->size_y`. The entries of `pixel_array` shall be such that `pixel_array[i + j*dims->size_x]` corresponds with the (i,j)-th entry of the colour grid.

INQUIRE PIXEL**0A**

```

void ginq_pixel(
    Gint      ws_id,          /* workstation identifier */
    const Gpoint *pixel_loc, /* pixel location         */
    Gint      *err_ind,      /* OUT error indicator    */
    Gint      *colr_ind     /* OUT colour index      */
);

```

7.9.8 Inquiry Functions for Error State List**INQUIRE INPUT QUEUE OVERFLOW****0C**

```

void ginq_in_overf(
    Gint      *err_ind,      /* OUT error indicator    */
    Gint      *ws_id,       /* OUT workstation identifier */
    Gint      *in_class,    /* OUT input class        */
    Gint      *in_num       /* OUT logical input device number */
);

```

7.10 Utility Functions**7.10.1 Utility Functions in GKS-3D****EVALUATE VIEW ORIENTATION MATRIX 3****0A**

```

void geval_view_ori_matrix3(
    const Gpoint3 *view_ref_point, /* view reference point */
    const Gvec3   *view_norm,     /* view plane normal    */
    const Gvec3   *view_up_vec,   /* view up vector       */
    Gcoord_switch coord_switch,   /* coordinate switch    */
    Gint          *err_ind,       /* OUT error indicator  */
    Gmatrix3      view_ori_matrix /* OUT view orientation matrix */
);

```

EVALUATE VIEW MAPPING MATRIX 3**0A**

```

void geval_view_map_matrix3(
    const Gview_map3 *map,          /* view mapping */
    Gint            *err_ind,      /* OUT error indicator */
    Gmatrix3        view_map_matrix /* OUT view mapping matrix */
);

```

Utility Functions

C GKS-3D Function Interface

EVALUATE TRANSFORMATION MATRIX 3**1A**

```

void geval_tran_matrix3(
    const Gpoint3  *point,          /* fixed point          */
    const Gvec3    *shift,          /* shift vector         */
    Gfloat         x_angle,         /* rotation angle X    */
    Gfloat         y_angle,         /* rotation angle Y    */
    Gfloat         z_angle,         /* rotation angle Z    */
    const Gvec3    *scale,          /* scale factors        */
    Gcoord_switch coord_switch,     /* coordinate switch    */
    Gtran_matrix3  tran_matrix      /* OUT transformation matrix */
);

```

EVALUATE TRANSFORMATION MATRIX**1A**

```

void geval_tran_matrix(
    const Gpoint  *point,          /* fixed point          */
    const Gvec    *shift,          /* shift vector         */
    Gfloat        angle,           /* rotation angle       */
    const Gvec    *scale,          /* scale factors        */
    Gcoord_switch coord_switch,     /* coordinate switch    */
    Gtran_matrix  tran_matrix      /* OUT transformation matrix */
);

```

ACCUMULATE TRANSFORMATION MATRIX 3**1A**

```

void gaccum_tran_matrix3(
    Gtran_matrix3  matrix,          /* transformation matrix */
    const Gpoint3  *point,          /* fixed point          */
    const Gvec3    *shift,          /* shift vector         */
    Gfloat         x_angle,         /* rotation angle X    */
    Gfloat         y_angle,         /* rotation angle Y    */
    Gfloat         z_angle,         /* rotation angle Z    */
    const Gvec3    *scale,          /* scale factors        */
    Gcoord_switch coord_switch,     /* coordinate switch    */
    Gtran_matrix3  tran_matrix      /* OUT transformation matrix */
);

```

ACCUMULATE TRANSFORMATION MATRIX**1A**

```

void gaccum_tran_matrix(
    Gtran_matrix  matrix,          /* transformation matrix */
    const Gpoint  *point,          /* fixed point          */
    const Gvec    *shift,          /* shift vector         */
    Gfloat        angle,           /* rotation angle       */
    const Gvec    *scale,          /* scale factors        */
    Gcoord_switch coord_switch,     /* coordinate switch    */
    Gtran_matrix  tran_matrix      /* OUT transformation matrix */
);

```

7.10.2 Binding Specific Utilities

SET ERROR HANDLING **0A**

```

void gset_err_hand(
    const void (*new_hand)(Gint , Gint , const char *),
    /* the application's error handling address */
    void (**old_hand)(Gint , Gint , const char *)
    /* OUT address of the error handling replaced */
);

```

Effect: See 3.10.

CREATE STORAGE **0A**

```

void gcreate_store(
    Gint *err_ind, /* OUT error indicator */
    Gstore *store /* OUT pointer to allocated storage */
);

```

Effect: See 3.9.2

DELETE STORAGE **0A**

```

void gdel_store(
    Gint *err_ind, /* OUT error indicator */
    Gstore *store /* IN/OUT storage to be deleted */
);

```

Effect: See 3.9.2

7.11 Error Handling

EMERGENCY CLOSE GKS **0A**

```

void gemergency_close_gks(
    void
);

```

ERROR HANDLING **0A**

```

void gerr_hand(
    Gint err_num, /* error number */
    Gint func_num, /* number of function that detected the error */
    const char *err_file /* name of error file */
);

```

ERROR LOGGING**0A**

```
void gerr_log(  
    Gint      err_num,      /* error number          */  
    Gint      func_num,    /* number of function that detected the error */  
    const char *err_file   /* name of error file   */  
);
```

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Annex A (informative)

Compiled GKS-3D/C Specification

This annex contains a print of the file `gks.h`. This file should be included in any GKS-3D/C application program and contains the following information:

- 1) The basic `#include` statements

```
#include <stdio.h>
#include <stddef.h>
```

- 2) The data types from clause 5 in compilation order;
- 3) The macros from clause 6 and annex C; the numerical values of the macros from annex C are optional;
- 4) The specification of the GKS-3D functions as `extern void`;
- 5) Additional implementation-dependent items; they should preferably have the sentinels "g" or "G".

This annex only contains the parts 1)-4).

```
/*
 * -----          gks.h          -----
 */

/*
 *      A.1  Standard #include Files
 */
#include <stdio.h>
#include <stddef.h>
/*
 *      A.2  Data Types in Compilation Order
 */
/*
 *      A.2.1 Basic Types
 */
/* --- Gfloat -- floating point number --- */
typedef float  Gfloat;
/* --- Gint -- integer --- */
typedef int    Gint;
/* --- Gstore store --- */
typedef void *Gstore;
/* --- Gtran_matrix3 transformation matrix 3 --- */
typedef Gfloat Gtran_matrix3[3][4];
/* --- Gtran_matrix transformation matrix --- */
typedef Gfloat Gtran_matrix[2][3];
/* --- Gmatrix3 4*4 [view] matrix --- */
typedef Gfloat Gmatrix3[4][4];
/* --- Gdata data --- */
typedef struct {
    size_t  size; /* size of data */
    void *  data; /* pointer to data */
}
```

Compiled GKS-3D/C Specification

Annex A

```

    } Gdata;
/*
 *      A.2.2 Enumeration Types
 */
/* --- Gasf aspect source flag --- */
typedef enum {
    GASF_BUNDLED, GASF_INDIV
} Gasf;
/* --- Gattr attributes [used] --- */
typedef enum {
    GATTR_LINE,    GATTR_MARKER,    GATTR_TEXT,    GATTR_FILL,
    GATTR_EDGE
} Gattr;
/* --- Gattr_ctrl_flag attribute control flag --- */
typedef enum {
    GFLAG_CUR, GFLAG_SPECIF
} Gattr_ctrl_flag;
/* --- Gclip_ind clipping indicator --- */
typedef enum {
    GIND_NO_CLIP, GIND_CLIP
} Gclip_ind;
/* --- Gcolr_avail colour available --- */
typedef enum {
    GAVAIL_MONOCHR, GAVAIL_COLR
} Gcolr_avail;
/* --- Gcoord_switch coordinate switch --- */
typedef enum {
    GCOORD_WC, GCOORD_NDC
} Gcoord_switch;
/* --- Gctrl_flag control flag --- */
typedef enum {
    GFLAG_COND, GFLAG_ALWAYS
} Gctrl_flag;
/* --- Gdc_units device coordinate units --- */
typedef enum {
    GDC_METRES, GDC_OTHER
} Gdc_units;
/* --- Gdefer_mode deferral mode --- */
typedef enum {
    GDEFER_ASAP, GDEFER_BNIG, GDEFER_BNIL, GDEFER_ASTI
} Gdefer_mode;
/* --- Gdet detectability --- */
typedef enum {
    GSEG_UNDET, GSEG_DET
} Gdet;
/* --- Gdisp_surf_empty display surface empty --- */
typedef enum {
    GSURF_NOT_EMPTY, GSURF_EMPTY
} Gdisp_surf_empty;
/* --- Gdyn_mod dynamic modification [accepted] --- */
typedef enum {
    GDYN_IRG, GDYN_IMM

```

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```

    } Gdyn_mod;
/* --- Gecho_switch  echo switch --- */
typedef enum {
    GSWITCH_NO_ECHO, GSWITCH_ECHO
} Gecho_switch;
/* --- Gedge_flag  edge flag --- */
typedef enum {
    GEDGE_OFF, GEDGE_ON
} Gedge_flag;
/* --- Gfill_int_style  fill area interior style --- */
typedef enum {
    GSTYLE_HOLLOW, GSTYLE_SOLID, GSTYLE_PAT, GSTYLE_HATCH
} Gfill_int_style;
/* --- Ghighl  highlighting --- */
typedef enum {
    GSEG_NORM, GSEG_HIGHL
} Ghighl;
/* --- Ghor_text_align  horizontal text alignment --- */
typedef enum {
    GHOR_NORM, GHOR_LEFT, GHOR_CTR, GHOR_RIGHT
} Ghor_text_align;
/* --- Gin_class  input class --- */
typedef enum {
    GIN_NONE, GIN_LOC, GIN_STROKE, GIN_VAL, GIN_CHOICE,
    GIN_PICK, GIN_STRING
} Gin_class;
/* --- Ginq_type  inquire type --- */
typedef enum {
    GINQ_SET, GINQ_REALIZED
} Ginq_type;
/* --- Girg_mode  implicit regeneration mode --- */
typedef enum {
    GIRG_SUPPR, GIRG_ALLOWED
} Girg_mode;
/* --- Glevel  GKS-3D level --- */
typedef enum {
    GLEVEL_0A, GLEVEL_0B, GLEVEL_0C, GLEVEL_1A, GLEVEL_1B,
    GLEVEL_1C, GLEVEL_2A, GLEVEL_2B, GLEVEL_2C
} Glevel;
/* --- Gline_fill_ctrl_flag  polyline/fill area control flag
    --- */
typedef enum {
    GFLAG_LINE, GFLAG_FILL
} Gline_fill_ctrl_flag;
/* --- Gnew_frame_nec_upd  new frame [action] necessary [at]
    update --- */
typedef enum {
    GNEW_NO, GNEW_YES
} Gnew_frame_nec_upd;
/* --- Gop_mode  operating mode --- */
typedef enum {
    GOP_REQ, GOP_SAMPLE, GOP_EVENT

```

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```

    } Gop_mode;
/* --- Gop_st operating state --- */
typedef enum {
    GST_GKCL, GST_GKOP, GST_WSOP, GST_WSAC, GST_SGOP
} Gop_st;
/* --- Gpr_flag prompt flag --- */
typedef enum {
    GPR_OFF, GPR_ON
} Gpr_flag;
/* --- Gpres_inval presence [of] invalid [values] --- */
typedef enum {
    GINVAL_ABSENT, GINVAL_PRESENT
} Gpres_inval;
/* --- Gproj_type projection type --- */
typedef enum {
    GPROJ_PARAL, GPROJ_PERSPECT
} Gproj_type;
/* --- Grel_pri relative priority --- */
typedef enum {
    GPRI_HIGHER, GPRI_LOWER
} Grel_pri;
/* --- Gmore_simult_events more simultaneous events --- */
typedef enum {
    GSIMULT_NO_MORE, GSIMULT_MORE
} Gmore_simult_events;
/* --- Gin_status [input] status --- */
typedef enum {
    GIN_STATUS_NONE, GIN_STATUS_OK, GIN_STATUS_NO_IN
} Gin_status;
/* --- Gtext_path text path --- */
typedef enum {
    GPATH_RIGHT, GPATH_LEFT, GPATH_UP, GPATH_DOWN
} Gtext_path;
/* --- Gtext_prec text precision --- */
typedef enum {
    GPREC_STRING, GPREC_CHAR, GPREC_STROKE
} Gtext_prec;
/* --- Gupd_regen_flag update regeneration flag --- */
typedef enum {
    GFLAG_POSTPONE, GFLAG_PERFORM
} Gupd_regen_flag;
/* --- Gupd_st update state --- */
typedef enum {
    GUPD_NOT_PEND, GUPD_PEND
} Gupd_st;
/* --- Gvert_text_align vertical text alignment --- */
typedef enum {
    GVERT_NORM, GVERT_TOP, GVERT_CAP, GVERT_HALF,
    GVERT_BASE, GVERT_BOTTOM
} Gvert_text_align;
/* --- Gvis visibility --- */
typedef enum {

```

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```

    GSEG_INVIS, GSEG_VIS
  } Gvis;
/* --- Gws_cat workstation category --- */
typedef enum {
    GCAT_OUT, GCAT_IN, GCAT_OUTIN, GCAT_WISS, GCAT_MO,
    GCAT_MI
} Gws_cat;
/* --- Gws_class workstation classification --- */
typedef enum {
    GCLASS_VEC, GCLASS_RASTER, GCLASS_OTHER
} Gws_class;
/* --- Gws_st workstation state --- */
typedef enum {
    GWS_INACTIVE, GWS_ACTIVE
} Gws_st;
/*
 *      A.2.3 Simple Structures
 */
/* --- Gasfs aspect source flags --- */
typedef struct {
    Gasf   linetype;           /* linetype ASF */
    Gasf   linewidth;         /* linewidth scale factor ASF */
    Gasf   line_colr_ind;     /* polyline colour index ASF */
    Gasf   marker_type;       /* marker type ASF */
    Gasf   marker_size;       /* marker size scale factor ASF */
    Gasf   marker_colr_ind;   /* polymarker colour index 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 index ASF */
    Gasf   fill_int_style;    /* fill area interior style ASF */
    Gasf   fill_style_ind;    /* fill area style index ASF */
    Gasf   fill_colr_ind;     /* fill area colour index ASF */
} Gasfs;
/* --- Gasfs3 aspect source flags 3 --- */
typedef struct {
    Gasf   linetype;           /* linetype ASF */
    Gasf   linewidth;         /* linewidth scale factor ASF */
    Gasf   line_colr_ind;     /* polyline colour index ASF */
    Gasf   marker_type;       /* marker type ASF */
    Gasf   marker_size;       /* marker size scale factor ASF */
    Gasf   marker_colr_ind;   /* polymarker colour index 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 index ASF */
    Gasf   fill_int_style;    /* fill area interior style ASF */
    Gasf   fill_style_ind;    /* fill area style index ASF */
    Gasf   fill_colr_ind;     /* fill area colour index ASF */
    Gasf   edge_flag;         /* edge flag ASF */
    Gasf   edgetype;          /* edgetype ASF */
    Gasf   edgewidth;         /* edgewidth scale factor ASF */
}

```

Compiled GKS-3D/C Specification

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```

        Gasf   edge_colr_ind;      /* edge colour index ASF          */
    } Gasfs3;
/* --- Gcieluv CIE L*u*v* [colour specification] --- */
typedef struct {
    Gfloat   cieluv_x;             /* x coefficient          */
    Gfloat   cieluv_y;             /* y coefficient          */
    Gfloat   cieluv_y_lum;         /* y luminance           */
} Gcieluv;
/* --- Gcolr_fac colour facilities --- */
typedef struct {
    Gint     num_colrs;            /* num. of colours       */
    Gcolr_avail   colr_avail;      /* colour availability    */
    Gint     num_pred_inds;        /* num. of predef. colour indices */
} Gcolr_fac;
/* --- Gdyn_mod_seg_attrs dynamic modification [of] segment
    attributes --- */
typedef struct {
    Gdyn_mod   tran;              /* changeability of:     */
    Gdyn_mod   invis_vis;         /* segment transformation */
    Gdyn_mod   vis_invis;         /* appearing (invisible -> visible) */
    Gdyn_mod   highl;             /* disappearing (visible -> invisible) */
    Gdyn_mod   pri;               /* highlighting           */
    Gdyn_mod   add_prims;         /* priority               */
    Gdyn_mod   add_prims;         /* addition of primitives to segment */
    Gdyn_mod   del;               /* deletion of segment   */
} Gdyn_mod_seg_attrs;
/* --- Gdyn_mod_ws_attrs dynamic modification [of] worksta-
    tion attributes --- */
typedef struct {
    Gdyn_mod   line_bundle;        /* changeability of:     */
    Gdyn_mod   marker_bundle;      /* polyline representation */
    Gdyn_mod   text_bundle;        /* polymarker representation */
    Gdyn_mod   fill_bundle;        /* text representation    */
    Gdyn_mod   pat_rep;            /* fill area representation */
    Gdyn_mod   colr_rep;           /* pattern representation  */
    Gdyn_mod   ws_tran;            /* colour representation  */
    Gdyn_mod   ws_tran;            /* workstation transformation */
} Gdyn_mod_ws_attrs;
/* --- Gdyn_mod_ws_attrs3 dynamic modification [of] works-
    tation attributes 3 --- */
typedef struct {
    Gdyn_mod   line_bundle;        /* changeability of:     */
    Gdyn_mod   marker_bundle;      /* polyline representation */
    Gdyn_mod   text_bundle;        /* polymarker representation */
    Gdyn_mod   fill_bundle;        /* text representation    */
    Gdyn_mod   edge_bundle;        /* fill area representation */
    Gdyn_mod   pat_rep;            /* edge representation    */
    Gdyn_mod   colr_rep;           /* pattern representation  */
    Gdyn_mod   view_rep;           /* colour representation  */
    Gdyn_mod   ws_tran;            /* view representation    */
    Gdyn_mod   hlhsr_mode;         /* workstation transform  */
    Gdyn_mod   hlhsr_mode;         /* HLHSR mode             */
}

```

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```

    } Gdyn_mod_ws_attrs3;
/* --- Gedge_bundle edge bundle --- */
typedef struct {
    Gedge_flag    flag;          /* edge flag          */
    Gint          type;         /* edgetype           */
    Gfloat        width;       /* edgewidth scale factor */
    Gint          colr_ind;    /* edge colour index  */
} Gedge_bundle;
/* --- Gfill_bundle fill area bundle --- */
typedef struct {
    Gfill_int_style int_style; /* fill area interior style */
    Gint            style_ind; /* fill area style index    */
    Gint            colr_ind; /* fill area colour index   */
} Gfill_bundle;
/* --- Gfloat_size float size --- */
typedef struct {
    Gfloat    size_x; /* x size */
    Gfloat    size_y; /* y size */
} Gfloat_size;
/* --- Gfloat_size3 float size 3 --- */
typedef struct {
    Gfloat    size_x; /* x size */
    Gfloat    size_y; /* y size */
    Gfloat    size_z; /* z size */
} Gfloat_size3;
/* --- Ghls Hue Luminance Saturation [colour specification]
   --- */
typedef struct {
    Gfloat    hue;          /* hue          */
    Gfloat    lightness;   /* lightness   */
    Gfloat    satur;       /* saturation   */
} Ghls;
/* --- Ghsv Hue Saturation Value [colour specification] ---
   */
typedef struct {
    Gfloat    hue;          /* hue          */
    Gfloat    satur;       /* saturation   */
    Gfloat    value;       /* value       */
} Ghsv;
/* --- Gint_list integer list --- */
typedef struct {
    Gint    num_ints; /* num. of integers in list */
    Gint    *ints;   /* list of integers         */
} Gint_list;
/* --- Gint_size integer size --- */
typedef struct {
    Gint    size_x; /* x size */
    Gint    size_y; /* y size */
} Gint_size;
/* --- Gint_size3 integer size 3 --- */
typedef struct {
    Gint    size_x; /* x size */

```

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```

        Gint    size_y;    /* y size    */
        Gint    size_z;    /* z size    */
    } Gint_size3;
/* --- Glimit limit --- */
typedef struct {
    Gfloat    x_min;    /* x min    */
    Gfloat    x_max;    /* x max    */
    Gfloat    y_min;    /* y min    */
    Gfloat    y_max;    /* y max    */
} Glimit;
/* --- Glimit3 limit 3 --- */
typedef struct {
    Gfloat    x_min;    /* x min    */
    Gfloat    x_max;    /* x max    */
    Gfloat    y_min;    /* y min    */
    Gfloat    y_max;    /* y max    */
    Gfloat    z_min;    /* z min    */
    Gfloat    z_max;    /* z max    */
} Glimit3;
/* --- Gline_bundle polyline bundle --- */
typedef struct {
    Gint      type;      /* linetype    */
    Gfloat    width;    /* linewidth scale factor    */
    Gint      colr_ind; /* polyline colour index    */
} Gline_bundle;
/* --- Gmarker_bundle polymarker bundle --- */
typedef struct {
    Gint      type;      /* marker type    */
    Gfloat    size;      /* marker size scale factor    */
    Gint      colr_ind; /* polymarker colour index    */
} Gmarker_bundle;
/* --- Gmax_ws_st_tables max. [length of] workstation state
        tables --- */
typedef struct {
    Gint      line_bundles;    /* max. num. of :    */
    Gint      marker_bundles;  /* polyline bundle table entries    */
    Gint      text_bundles;    /* polymarker bundle table entries    */
    Gint      fill_bundles;    /* text bundle table entries    */
    Gint      pat_reps;        /* fill area bundle table entries    */
    Gint      colr_reps;       /* pattern table entries    */
    Gint      edge_bundles;    /* colour table entries    */
} Gmax_ws_st_tables;
/* --- Gmax_ws_st_tables3 max. [length of] workstation
        state tables 3 --- */
typedef struct {
    Gint      line_bundles;    /* max. num. of :    */
    Gint      marker_bundles;  /* polyline bundle table entries    */
    Gint      text_bundles;    /* polymarker bundle table entries    */
    Gint      fill_bundles;    /* text bundle table entries    */
    Gint      pat_reps;        /* fill area bundle table entries    */
    Gint      edge_bundles;    /* pattern table entries    */
    Gint      edge_bundles;    /* edge bundle table entries    */
}

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```

        Gint    colr_reps;          /* colour table entries          */
        Gint    view_reps;         /* view table entries           */
    } Gmax_ws_st_tables3;
/* --- Gnum_in number [of] input [devices] --- */
typedef struct {
    Gint    loc;          /* num. of locator devices      */
    Gint    stroke;      /* num. of stroke devices       */
    Gint    val;         /* num. of valuator devices     */
    Gint    choice;      /* num. of choice devices       */
    Gint    pick;        /* num. of pick devices         */
    Gint    string;      /* num. of string devices       */
} Gnum_in;
/* --- Gpick pick [value] --- */
typedef struct {
    Gint    seg_name;     /* segment name                  */
    Gint    pick_id;     /* pick identifier               */
} Gpick;
/* --- Gpoint point --- */
typedef struct {
    Gfloat   x;          /* x coordinate                  */
    Gfloat   y;          /* y coordinate                  */
} Gpoint;
/* --- Gpoint3 point 3 --- */
typedef struct {
    Gfloat   x;          /* x coordinate                  */
    Gfloat   y;          /* y coordinate                  */
    Gfloat   z;          /* z coordinate                  */
} Gpoint3;
/* --- Grgb Red Green Blue [colour specification] --- */
typedef struct {
    Gfloat   red;        /* red intensity                 */
    Gfloat   green;      /* green intensity               */
    Gfloat   blue;       /* blue intensity                */
} Grgb;
/* --- Gseg_attrs segment attributes --- */
typedef struct {
    Gtran_matrix   tran_matrix; /* transformation matrix      */
    Gvis           vis;         /* visibility                  */
    Ghighl        highl;       /* hightlighting              */
    Gfloat        pri;         /* segment priority           */
    Gdet          det;         /* detectability              */
} Gseg_attrs;
/* --- Gseg_attrs3 segment attributes 3 --- */
typedef struct {
    Gtran_matrix3   tran_matrix; /* transformation matrix      */
    Gvis           vis;         /* visibility                  */
    Ghighl        highl;       /* hightlighting              */
    Gfloat        pri;         /* segment priority           */
    Gdet          det;         /* detectability              */
} Gseg_attrs3;
/* --- Gtext_align text alignment --- */
typedef struct {

```

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```

        Ghor_text_align    hor;    /* horizontal component */
        Gvert_text_align   vert;   /* vertical component  */
    } Gtext_align;
/* --- Gtext_font_prec text font [and] precision --- */
typedef struct {
    Gint      font;    /* text font          */
    Gtext_prec prec;  /* text precision     */
} Gtext_font_prec;
/* --- Gvec vector --- */
typedef struct {
    Gfloat    delta_x; /* x coordinate      */
    Gfloat    delta_y; /* y coordinate      */
} Gvec;
/* --- Gvec3 vector 3 --- */
typedef struct {
    Gfloat    delta_x; /* x coordinate      */
    Gfloat    delta_y; /* y coordinate      */
    Gfloat    delta_z; /* z coordinate      */
} Gvec3;
/* --- Gws_max_nums workstation max. numbers --- */
typedef struct {
    Gint      simult_open; /* max. num. of simult. open wss */
    Gint      simult_active; /* max. num. of simult. active wss */
    Gint      assoc_seg; /* max. num. of wss associated with segment */
} Gws_max_nums;
/*
 *      A.2.4 Nested Structures
 */
/* --- Gclip clipping --- */
typedef struct {
    Gclip_ind clip_ind; /* clipping indicator */
    Glimit     clip_rect; /* clipping rectangle */
} Gclip;
/* --- Gclip3 clipping.3 --- */
typedef struct {
    Gclip_ind clip_ind; /* clipping indicator */
    Glimit3    clip_vol; /* clipping volume     */
} Gclip3;
/* --- Gdisp_space_size display space size --- */
typedef struct {
    Gdc_units    dc_units; /* device coordinate units */
    Gfloat_size  size_dc; /* display space size [in] dc [units] */
    Gint_size     size_raster; /* display space size [in] raster [units] */
} Gdisp_space_size;
/* --- Gdisp_space_size3 display space size 3 --- */
typedef struct {
    Gdc_units    dc_units; /* device coordinate units */
    Gfloat_size3 size_dc; /* display space size [in] dc [units] */
    Gint_size3   size_raster; /* display space size [in] raster [units] */
} Gdisp_space_size3;
/* --- Gedge_fac edge facilities --- */
typedef struct {

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    Gint_list  types;          /* list of edgetypes          */
    Gint       num_widths;     /* num. of available edgewidths */
    Gfloat     nom_width;      /* nominal edgewidth          */
    Gfloat     min_width;      /* min. edgewidth            */
    Gfloat     max_width;      /* max. edgewidth            */
    Gint       num_pred_inds;  /* num. of predef. edge indices */
} Gedge_facs;
/* --- Gfill_attrs fill area attributes --- */
typedef struct {
    Gasf       int_style_asf;  /* fill area interior style asf */
    Gasf       style_ind_asf;  /* fill area style index asf    */
    Gasf       colr_ind_asf;   /* fill area colour index asf   */
    Gint       ind;            /* fill area index              */
    Gfill_bundle bundle;      /* fill area bundle             */
} Gfill_attrs;
/* --- Gfill_facs fill area facilities --- */
typedef struct {
    Gint       num_int_styles; /* num. of interior styles      */
    Gfill_int_style int_styles[4]; /* list of available interior styles */
    Gint_list  hatch_styles;  /* list of available hatch styles */
    Gint       num_pred_inds;  /* num. of predef. fill area indices */
} Gfill_facs;
/* --- Gindiv_attrs individual attributes --- */
typedef struct {
    Gint       linetype;       /* linetype                    */
    Gfloat     linewidth;      /* linewidth scale factor      */
    Gint       line_colr_ind;   /* polyline colour index       */
    Gint       marker_type;     /* marker type                 */
    Gfloat     marker_size;     /* marker size scale factor    */
    Gint       marker_colr_ind; /* polymarker colour index     */
    Gtext_font_prec text_font_prec; /* text font and precision    */
    Gfloat     char_expan;      /* character expansion factor   */
    Gfloat     char_space;      /* character spacing           */
    Gint       text_colr_ind;   /* text colour index           */
    Gfill_int_style fill_int_style; /* fill area interior style    */
    Gint       fill_style_ind;  /* fill area style index       */
    Gint       fill_colr_ind;   /* fill area colour index      */
    Gasfs     asfs;            /* aspect source flags         */
} Gindiv_attrs;
/* --- Gindiv_attrs3 individual attributes 3 --- */
typedef struct {
    Gint       linetype;       /* linetype                    */
    Gfloat     linewidth;      /* linewidth scale factor      */
    Gint       line_colr_ind;   /* polyline colour index       */
    Gint       marker_type;     /* marker type                 */
    Gfloat     marker_size;     /* marker size scale factor    */
    Gint       marker_colr_ind; /* polymarker colour index     */
    Gtext_font_prec text_font_prec; /* text font and precision    */
    Gfloat     char_expan;      /* character expansion factor   */
    Gfloat     char_space;      /* character spacing           */
    Gint       text_colr_ind;   /* text colour index           */
    Gfill_int_style fill_int_style; /* fill area interior style    */

```

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```

    Gint          fill_style_ind; /* fill area style index */
    Gint          fill_colr_ind; /* fill area colour index */
    Gedge_flag    edge_flag; /* edge flag */
    Gint          edgetype; /* edgetype */
    Gfloat        edgewidth; /* edgewidth scale factor */
    Gint          edge_colr_ind; /* edge colour index */
    Gasfs3        asfs; /* aspect source flags 3 */
} Gindiv_attrs3;
/* --- Gline_attrs polyline attributes --- */
typedef struct {
    Gasf          type_asf; /* linetype asf */
    Gasf          width_asf; /* linewidth asf */
    Gasf          colr_ind_asf; /* polyline colour index asf */
    Gint          ind; /* polyline index */
    Gline_bundle  bundle; /* polyline bundle */
} Gline_attrs;
/* --- Gline_facs polyline facilities --- */
typedef struct {
    Gint_list     types; /* list of linetypes */
    Gint          num_widths; /* num. of available linewidths */
    Gfloat        nom_width; /* nominal linewidth */
    Gfloat        min_width; /* min. linewidth */
    Gfloat        max_width; /* max. linewidth */
    Gint          num_pred_inde; /* num. of predef. polyline indices */
} Gline_facs;
/* --- Gmarker_attrs polymarker attributes --- */
typedef struct {
    Gasf          type_asf; /* marker type asf */
    Gasf          size_asf; /* marker size scale factor asf */
    Gasf          colr_ind_asf; /* marker colour index asf */
    Gint          ind; /* polymarker index */
    Gmarker_bundle bundle; /* polymarker bundle */
} Gmarker_attrs;
/* --- Gmarker_facs polymarker facilities --- */
typedef struct {
    Gint_list     types; /* list of marker types */
    Gint          num_sizes; /* num. of available marker sizes */
    Gfloat        nom_size; /* nominal marker size */
    Gfloat        min_size; /* min. marker size */
    Gfloat        max_size; /* max. marker size */
    Gint          num_pred_inde; /* num. of predef. polymarker indices */
} Gmarker_facs;
/* --- Gparal parallelogram --- */
typedef struct {
    Gpoint3      p; /* point p */
    Gpoint3      q; /* point q */
    Gpoint3      r; /* point r */
} Gparal;
/* --- Gpat_rep pattern representation --- */
typedef struct {
    Gint_size     dims; /* colour array's dimensions */
    Gint          *colr_array; /* colour array */

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} Gpat_rep;
/* --- Gprim_attrs primitive attributes --- */
typedef struct {
    Gint      line_ind;      /* polyline index          */
    Gint      marker_ind;   /* polymarker index       */
    Gint      text_ind;     /* text index             */
    Gfloat    char_ht;      /* character height       */
    Gvec      char_up_vec;  /* character up vector    */
    Gfloat    char_width;   /* character width        */
    Gvec      char_base_vec; /* character base vector  */
    Gtext_path text_path;   /* text path              */
    Gtext_align text_align; /* text alignment         */
    Gint      fill_ind;     /* fill area index       */
    Gvec      pat_width_vec; /* pattern width vector   */
    Gvec      pat_ht_vec;   /* pattern height vector  */
    Gpoint    pat_ref_point; /* pattern reference point */
} Gprim_attrs;
/* --- Gprim_attrs3 primitive attributes 3 --- */
typedef struct {
    Gint      line_ind;      /* polyline index          */
    Gint      marker_ind;   /* polymarker index       */
    Gint      text_ind;     /* text index             */
    Gfloat    char_ht;      /* character height       */
    Gvec      char_up_vec;  /* character up vector    */
    Gfloat    char_width;   /* character width        */
    Gvec      char_base_vec; /* character base vector  */
    Gtext_path text_path;   /* text path              */
    Gtext_align text_align; /* text alignment         */
    Gint      fill_ind;     /* fill area index       */
    Gvec      pat_width_vec; /* pattern width vector   */
    Gvec      pat_ht_vec;   /* pattern height vector  */
    Gpoint3   pat_ref_point; /* pattern reference point */
    Gvec3     pat_ref_vec[2]; /* pattern reference vectors */
    Gint      edge_ind;     /* edge index            */
    Gint      view_ind;     /* view index            */
} Gprim_attrs3;
/* --- Gpoint_list point list --- */
typedef struct {
    Gint      num_points;   /* num. of points in the list */
    Gpoint    *points;      /* list of points            */
} Gpoint_list;
/* --- Gpoint_list3 point list 3 --- */
typedef struct {
    Gint      num_points;   /* num. of points in the list */
    Gpoint3   *points;      /* list of points            */
} Gpoint_list3;
/* --- Gpoint_list_list list of point lists --- */
typedef struct {
    Gint      num_point_lists; /* num. of point lists in the list */
    Gpoint_list *point_lists; /* list of point lists          */
} Gpoint_list_list;
/* --- Gpoint_list_list3 list of point lists 3 --- */

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```

typedef struct {
    Gint      num_point_lists; /* num. of point lists in the list */
    Gpoint_list3 *point_lists; /* list of point lists */
} Gpoint_list_list3;
/* --- Grect  rectangle --- */
typedef struct {
    Gpoint  p; /* point p */
    Gpoint  q; /* point q */
} Grect;
/* --- Gtext_extent  text extent --- */
typedef struct {
    Gpoint  concat_point; /* concatenation point */
    Gpoint  paral[4]; /* text extent parallelogram */
} Gtext_extent;
/* --- Gtext_extent3  text extent 3 --- */
typedef struct {
    Gpoint3  concat_point; /* concatenation point */
    Gpoint3  paral[4]; /* text extent parallelogram */
} Gtext_extent3;
/* --- Gtext_bundle  text bundle --- */
typedef struct {
    Gtext_font_prec  text_font_prec; /* text font and precision */
    Gfloat           char_expan; /* character expansion factor */
    Gfloat           char_space; /* character spacing */
    Gint             colr_ind; /* text colour index */
} Gtext_bundle;
/* --- Gtext_fac  text facilities --- */
typedef struct {
    Gint      num_font_precs; /* num. of fonts and precisions */
    Gtext_font_prec *font_precs; /* list of fonts and precisions */
    Gint      num_char_hts; /* num. of character heights */
    Gfloat    min_char_ht; /* min. character height */
    Gfloat    max_char_ht; /* max. character height */
    Gint      num_char_expans; /* num. of char. expansion factors */
    Gfloat    min_char_expan; /* min. expansion factor */
    Gfloat    max_char_expan; /* max. expansion factor */
    Gint      num_pred_inds; /* num. of predef. text indices */
} Gtext_fac;
/* --- Gtran  transformation --- */
typedef struct {
    Glimit  win; /* window */
    Glimit  vp; /* viewport */
} Gtran;
/* --- Gtran3  transformation 3 --- */
typedef struct {
    Glimit3  win; /* window */
    Glimit3  vp; /* viewport */
} Gtran3;
/* --- Gview_map3  view mapping 3 --- */
typedef struct {
    Glimit      win; /* window limits */
    Glimit3     proj_vp; /* projection viewport limits */

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```

    Gproj_type   proj_type;           /* projection type           */
    Gpoint3      proj_ref_point;      /* projection reference point */
    Gfloat       view_plane;          /* view plane distance      */
    Gfloat       front_plane;         /* front plane distance     */
    Gfloat       back_plane;          /* back plane distance      */
} Gview_map3;
/* --- Gview_rep3 view representation 3 --- */
typedef struct {
    Gmatrix3     ori_matrix;          /* orientation matrix       */
    Gmatrix3     map_matrix;          /* mapping matrix           */
    Glimit3      clip_limit;          /* clipping limits          */
    Gclip_ind    xy_clip;             /* X-Y clipping [indicator] */
    Gclip_ind    back_clip;          /* back clipping [indicator] */
    Gclip_ind    front_clip;         /* front clipping [indicator] */
} Gview_rep3;
/*
 *      A.2.5 Implementation Dependent Types
 */
/* --- Gchoice_data choice data record --- */
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_ul {
            Gdata      impl_dep;      /* impl. dep. */
        } pet_ul; /* pet -1 data */
        /* . . . impl. defined PET's */
    } pets;
} Gchoice_data;
/* --- Gchoice_data3 choice data record 3 --- */

```

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```

typedef struct {
    union Gchoice3_pets {
        struct Gchoice3_pet_r1 {
            Gdata    impl_dep;        /* impl. dep. */
        } pet_r1; /* pet 1 data */
        struct Gchoice3_pet_r2 {
            Gint      num_prs;        /* number of prompts */
            Gpr_flag  *prs;          /* prompt array */
            Gdata      impl_dep;      /* impl. dep. */
        } pet_r2; /* pet 2 data */
        struct Gchoice3_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 Gchoice3_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 Gchoice3_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 Gchoice3_pet_ul {
            Gdata      impl_dep;      /* impl. dep. */
        } pet_ul; /* pet -1 data */
        /* . . . impl. defined PET's */
    } pets;
} Gchoice_data3;
/* --- 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 */
    Gdata      unsupp; /* impl. dep. colour specification */
    /* etc. */
} Gcolr_rep;
/* --- Gescape_in_data escape input data record --- */
typedef union {
    struct Gescape_in_r1 {
        Gdata      reg_dep; /* reg. dep. */
    } escape_r1; /* escape 1 data */
    struct Gescape_in_ul {
        Gdata      impl_dep; /* impl. dep. */
    } escape_ul; /* escape -1 data */
    /* etc. */
} Gescape_in_data;
/* --- Gescape_out_data escape output data record --- */

```

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```

typedef union {
    struct Gescape_out_rl {
        Gdata reg_dep; /* reg. dep. */
    } escape_rl; /* escape 1 data */
    struct Gescape_out_ul {
        Gdata impl_dep; /* impl. dep. */
    } escape_ul; /* escape -1 data */
    /* etc. */
} Gescape_out_data;
/* --- Ggdp_data gdp data record --- */
typedef union {
    struct Ggdp_rl {
        Gdata reg_dep; /* reg. dep. */
    } gdp_rl; /* gdp 1 data */
    struct Ggdp_ul {
        Gdata impl_dep; /* impl. dep. */
    } gdp_ul; /* gdp -1 data */
    /* etc. */
} Ggdp_data;
/* --- Ggdp_data3 gdp data record 3 --- */
typedef union {
    struct Ggdp3_rl {
        Gdata reg_dep; /* reg. dep. */
    } gdp3_rl; /* gdp 1 data */
    struct Ggdp3_ul {
        Gdata impl_dep; /* impl. dep. */
    } gdp3_ul; /* gdp -1 data */
    /* etc. */
} Ggdp_data3;
/* --- Gitem_data item data record --- */
typedef struct {
    Gint type; /* item type */
    Gint length; /* item data record length */
    union {
        Gctrl_flag clear_ws; /* control flag */
        Gupd_regen_flag upd_ws; /* regen. flag */
        struct Gdefer_st {
            Gdefer_mode defer_mode; /* deferral mode */
            Girg_mode irg_mode; /* irg mode */
        } defer_st; /* deferrral state */
        /* etc. */
        Gdata gdp_unsupp; /* GDPs not supported by impl. */
        Gdata impl_dep; /* impl. dependent */
    } data;
} Gitem_data;
/* --- Gloc_data locator data record --- */
typedef struct {
    union Gloc_pets {
        struct Gloc_pet_rl {
            Gdata impl_dep; /* impl. dep. */

```

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```

} pet_r1; /* pet 1 data */
struct Gloc_pet_r2 {
    Gdata
} pet_r2; /* pet 2 data */
struct Gloc_pet_r3 {
    Gdata
} pet_r3; /* pet 3 data */
struct Gloc_pet_r4 {
    Gattr_ctrl_flag          attr_ctrl_flag;
    /* attribute             control flag */
    Gline_attrs              line_attrs;
    /* polyline             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;
    /* polyline/fill area   control flag */
    union Gloc_attrs {
        Gline_attrs          line_attrs;
        /* polyline          attrs. */
        Gfill_attrs           fill_attrs;
        /* fill area        attrs. */
    } attrs;
    Gdata                    impl_dep; /* impl. dep. */
} pet_r5; /* pet 5 data */
struct Gloc_pet_r6 {
    Gdata
} pet_r6; /* pet 6 data */
struct Gloc_pet_ul {
    Gdata
} pet_ul; /* pet -1 data */
/* . . . impl. defined PET's */
} pets;
} Gloc_data;
/* --- Gloc_data3 locator data record 3 --- */
typedef struct {
    union Gloc3_pets {
        struct Gloc3_pet_r1 {
            Gdata
        } pet_r1; /* pet 1 data */
        struct Gloc3_pet_r2 {
            Gdata
        } pet_r2; /* pet 2 data */
        struct Gloc3_pet_r3 {
            Gdata
        } pet_r3; /* pet 3 data */
        struct Gloc3_pet_r4 {
            Gattr_ctrl_flag          attr_ctrl_flag;
            /* attribute             control flag */
            Gline_attrs              line_attrs;
        }
    }
}

```

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```

        /* polyline
        Gdata
    } pet_r4; /* pet 4 data */
    struct Gloc3_pet_r5 {
        Gattr_ctrl_flag
        /* attribute
        Gline_fill_ctrl_flag
        /* polyline/fill area
        union Gloc3_attrs {

            } attrs;
            Gdata
        } pet_r5; /* pet 5 data */
        struct Gloc3_pet_r6 {
            Gdata
        } pet_r6; /* pet 6 data */
        struct Gloc3_pet_u1 {
            Gdata
        } pet_u1; /* pet -1 data */
        /*. . . impl. defined PET's */
    } pets;
} Gloc_data3;
/* --- Gpick_data pick data record --- */
typedef struct {
    union Gpick_pets {
        struct Gpick_pet_r1 {
            Gdata impl_dep; /* impl. dep. */
        } pet_r1; /* pet 1 data */
        struct Gpick_pet_r2 {
            Gdata impl_dep; /* impl. dep. */
        } pet_r2; /* pet 2 data */
        struct Gpick_pet_r3 {
            Gdata impl_dep; /* impl. dep. */
        } pet_r3; /* pet 3 data */
        struct Gpick_pet_u1 {
            Gdata impl_dep; /* impl. dep. */
        } pet_u1; /* pet -1 data */
        /* etc. */
    } pets;
} Gpick_data;
/* --- Gpick_data3 pick data record 3 --- */
typedef struct {
    union Gpick3_pets {
        struct Gpick3_pet_r1 {
            Gdata impl_dep; /* impl. dep. */
        } pet_r1; /* pet 1 data */
        struct Gpick3_pet_r2 {
            Gdata impl_dep; /* impl. dep. */
        } pet_r2; /* pet 2 data */
    }
}

```

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```

    struct Gpick3_pet_r3 {
        Gdata impl_dep; /* impl. dep. */
    } pet_r3; /* pet 3 data */
    struct Gpick3_pet_ul {
        Gdata impl_dep; /* impl. dep. */
    } pet_ul; /* pet -1 data */
    /* etc. */
} pets;
} Gpick_data3;
/* --- Gstring_data string data record --- */
typedef struct {
    Gint in_buf_size; /* input buffer size (nr. of bytes) */
    Gint init_pos; /* initial [editing] position */
    union string_pets {
        struct Gstring_pet_r1 {
            Gdata impl_dep; /* impl. dep. */
        } pet_r1; /* pet 1 data */
        struct Gstring_pet_ul {
            Gdata impl_dep; /* impl. dep. */
        } pet_ul; /* pet -1 data */
        /* etc. */
    } pets;
} Gstring_data;
/* --- Gstring_data3 string data record 3 --- */
typedef struct {
    Gint in_buf_size; /* input buffer size (nr. of bytes) */
    Gint init_pos; /* initial [editing] position */
    union string3_pets {
        struct Gstring3_pet_r1 {
            Gdata impl_dep; /* impl. dep. */
        } pet_r1; /* pet 1 data */
        struct Gstring3_pet_ul {
            Gdata impl_dep; /* impl. dep. */
        } pet_ul; /* pet -1 data */
        /* etc. */
    } pets;
} Gstring_data3;
/* --- Gstroke_data stroke data record --- */
typedef struct {
    Gint in_buf_size; /* input buffer size (nr. of points) */
    Gint init_pos; /* initial [editing] position */
    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 {

```

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```

        Gattr_ctrl_flag attr_ctrl_flag;
        /* attribute control flag */
        Gmarker_attrs marker_attrs;
        /* polymarker 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;
        /* polyline attrs. */
        Gdata impl_dep; /* impl. dep. */
    } pet_r4; /* pet 4 data */
    struct Gstroke_pet_ul {
        Gdata impl_dep; /* impl. dep. */
    } pet_ul; /* pet -1 data */
    /* etc. */
} pets;
} Gstroke_data;
/* --- Gstroke_data3 stroke data record 3 --- */
typedef struct {
    Gint in_buf_size; /* input buffer size (nr. of points) */
    Gint init_pos; /* initial [editing] position */
    Gfloat x_interval; /* X interval */
    Gfloat y_interval; /* Y interval */
    Gfloat z_interval; /* Z interval */
    Gfloat time_interval; /* time interval */
    union Gstroke3_pets {
        struct Gstroke3_pet_r1 {
            Gdata impl_dep; /* impl. dep. */
        } pet_r1; /* pet 1 data */
        struct Gstroke3_pet_r2 {
            Gdata impl_dep; /* impl. dep. */
        } pet_r2; /* pet 2 data */
        struct Gstroke3_pet_r3 {
            Gattr_ctrl_flag attr_ctrl_flag;
            /* attribute control flag */
            Gmarker_attrs marker_attrs;
            /* polymarker attrs. */
            Gdata impl_dep; /* impl. dep. */
        } pet_r3; /* pet 3 data */
        struct Gstroke3_pet_r4 {
            Gattr_ctrl_flag attr_ctrl_flag;
            /* attribute control flag */
            Gline_attrs line_attrs;
            /* polyline attrs. */
            Gdata impl_dep;
        } pet_r4; /* pet 4 data */
        struct Gstroke3_pet_ul {
            Gdata impl_dep; /* impl. dep. */
        } pet_ul; /* pet -1 data */
    } /* etc. */
}

```

```

    } pets;
  } Gstroke_data3;
/* --- 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;
/* --- Gval_data3 valuator data record 3 --- */
typedef struct {
  Gfloat  low_value;    /* low value */
  Gfloat  high_value;  /* high value */
  union Gval3_pets {
    struct Gval3_pet_r1 {
      Gdata  impl_dep; /* impl. dep. */
    } pet_r1; /* pet 1 data */
    struct Gval3_pet_r2 {
      Gdata  impl_dep; /* impl. dep. */
    } pet_r2; /* pet 2 data */
    struct Gval3_pet_r3 {
      Gdata  impl_dep; /* impl. dep. */
    } pet_r3; /* pet 3 data */
    struct Gval3_pet_u1 {
      Gdata  impl_dep; /* impl. dep. */
    } pet_u1; /* pet -1 data */
    /* etc. */
  } pets;
} Gval_data3;
/*
 *   A.3  Macros
 */
/*
 *   A.3.1  Error Macros
 */
#define GE_NO_ERR          (0)/* No Errors */
/* operating state errors */
#define GE_NOT_GKCL       (1)/* GKS-3D not in proper state: GKS-3D shall be
                               in the state GKCL */

```

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```

#define GE_NOT_GKOP          (2)/* GKS-3D not in proper state: GKS-3D shall be
                               in the state GKOP */
#define GE_NOT_WSAC         (3)/* GKS-3D not in proper state: GKS-3D shall be
                               in the state WSAC */
#define GE_NOT_SGOP         (4)/* GKS-3D not in proper state: GKS-3D shall be
                               in the state SGOP */
#define GE_NOT_WSAC_SGOP    (5)/* GKS-3D not in proper state: GKS-3D shall be
                               either in the state WSAC or in the state SGOP
                               */
#define GE_NOT_WSOP_WSAC    (6)/* GKS-3D not in proper state: GKS-3D shall be
                               either in the state WSOP or in the state WSAC
                               */
#define GE_GKCL_GKOP        (7)/* GKS-3D not in proper state: GKS-3D shall be
                               in one of the states WSOP, WSAC or SGOP */
#define GE_GKCL              (8)/* GKS-3D not in proper state: GKS-3D shall be
                               in one of the states GKOP, WSOP, WSAC or SGOP
                               */

/* workstation errors */
#define GE_WS_ID_INVALID    (20)/* Specified workstation identifier is
                               invalid */
#define GE_CONN_ID_INVALID (21)/* Specified connection identifier is invalid
                               */
#define GE_WS_TYPE_INVALID  (22)/* Specified workstation type is invalid */
#define GE_NO_WS_TYPE       (23)/* Specified workstation type does not exist
                               */
#define GE_WS_OPEN          (24)/* Specified workstation is open */
#define GE_WS_NOT_OPEN     (25)/* Specified workstation is not open */
#define GE_WS_CANT_OPEN    (26)/* Specified workstation cannot be opened */
#define GE_WISS_NOT_OPEN   (27)/* Workstation Independent Segment Storage is
                               not open */
#define GE_WISS_OPEN       (28)/* Workstation Independent Segment Storage is
                               already open */
#define GE_WS_ACTIVE       (29)/* Specified workstation is active */
#define GE_WS_INACTIVE     (30)/* Specified workstation is not active */
#define GE_WS_MO           (31)/* Specified workstation is of category MO */
#define GE_WS_NOT_MO       (32)/* Specified workstation is not of category
                               MO */
#define GE_WS_MI           (33)/* Specified workstation is of category MI */
#define GE_WS_NOT_MI       (34)/* Specified workstation is not of category
                               MI */
#define GE_WS_IN           (35)/* Specified workstation is of category INPUT
                               */
#define GE_WS_WISS         (36)/* Specified workstation is Workstation
                               Independent Segment Storage */
#define GE_WS_NOT_OUTIN    (37)/* Specified workstation is not of category
                               OUTIN */
#define GE_WS_NOT_IN_OUTIN (38)/* Specified workstation is neither of
                               category INPUT nor of category OUTIN */
#define GE_WS_NOT_OUT_OUTIN (39)/* Specified workstation is neither of
                               category OUTPUT nor of category OUTIN */
#define GE_WS_NO_PIXEL     (40)/* Specified workstation has no pixel store
                               readback capability */

```

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```

#define GE_WS_TYPE_NO_GDP (41)/* Specified workstation type is not able to
generate the specified generalized drawing
primitive */
#define GE_WS_MAX_OPEN (42)/* Maximum number of simultaneously open
workstations would be exceeded */
#define GE_WS_MAX_ACTIVE (43)/* Maximum number of simultaneously active
workstations would be exceeded */

/* transformation errors */
#define GE_TRAN_NUM_INVALID (50)/* Transformation number is invalid */
#define GE_RECT_INVALID (51)/* Rectangle definition is invalid */
#define GE_VP_INVALID (52)/* Viewport is not within the Normalized Dev-
ice Coordinate unit square */
#define GE_WIN_INVALID (53)/* Workstation window is not within the Nor-
malized Device Coordinate unit square */
#define GE_WS_VP_INVALID (54)/* Workstation viewport is not within the
display space */

/* output attribute errors */
#define GE_LINE_IND_INVALID (60)/* Polyline index is invalid */
#define GE_LINE_REP_UNDEF (61)/* A representation for the specified poly-
line index has not been defined on this
workstation */
#define GE_LINE_REP_NOT_PRED (62)/* A representation for the specified poly-
line index has not been predefined on this
workstation */
#define GE_LINETYPE_ZERO (63)/* Linetype is equal to zero */
#define GE_LINETYPE_NOT_WS (64)/* Specified linetype is not supported on
this workstation */
#define GE_LINEWIDTH_LT_ZERO (65)/* Linewidth scale factor is less than zero
*/
#define GE_MARKER_IND_INVALID (66)/* Polymarker index is invalid */
#define GE_MARKER_REP_UNDEF (67)/* A representation for the specified poly-
marker index has not been defined on this
workstation */
#define GE_MARKER_REP_NOT_PRED (68)/* A representation for the specified poly-
marker index has not been predefined on this
workstation */
#define GE_MARKER_TYPE_ZERO (69)/* Marker type is equal to zero */
#define GE_MARKER_TYPE_NOT_WS (70)/* Specified marker type is not supported on
this workstation */
#define GE_MARKER_SIZE_LT_ZERO (71)/* Marker size scale factor is less than zero
*/
#define GE_TEXT_IND_INVALID (72)/* Text index is invalid */
#define GE_TEXT_REP_UNDEF (73)/* A representation for the specified text
index has not been defined on this worksta-
tion */
#define GE_TEXT_REP_NOT_PRED (74)/* A representation for the specified text
index has not been predefined on this works-
tation */
#define GE_FONT_ZERO (75)/* Text font is equal to zero */
#define GE_FONT_NOT_WS (76)/* Requested text font is not supported for
the specified precision on this workstation
*/

```

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```

#define GE_EXPAN_LE_ZERO (77)/* Character expansion factor is less than or
equal to zero */
#define GE_HT_LE_ZERO (78)/* Character height is less than or equal to
zero */
#define GE_UP_VEC_ZERO (79)/* Length of character up vector is zero */
#define GE_FILL_IND_INVALID (80)/* Fill area index is invalid */
#define GE_FILL_REP_UNDEF (81)/* A representation for the specified fill
area index has not been defined on this
workstation */
#define GE_FILL_REP_NOT_PRED (82)/* A representation for the specified fill
area index has not been predefined on this
workstation */
#define GE_INT_STYLE_NOT_WS (83)/* Specified fill area interior style is not
supported on this workstation */
#define GE_STYLE_IND_ZERO (84)/* Style (pattern or hatch) index is equal to
zero */
#define GE_PAT_IND_INVALID (85)/* Specified pattern index is invalid */
#define GE_HATCH_STYLE_NOT_WS (86)/* Specified hatch style is not supported on
this workstation */
#define GE_PAT_SIZE_LE_ZERO (87)/* Pattern size value is not positive */
#define GE_PAT_REP_UNDEF (88)/* A representation for the specified pattern
index has not been defined on this worksta-
tion */
#define GE_PAT_REP_NOT_PRED (89)/* A representation for the specified pattern
index has not been predefined on this works-
tation */
#define GE_PAT_NOT_WS (90)/* Interior style PATTERN is not supported on
this workstation */
#define GE_DIM_INVALID (91)/* Dimensions of colour array are invalid */
#define GE_COLR_IND_LT_ZERO (92)/* Colour index is less than zero */
#define GE_COLR_IND_INVALID (93)/* Colour index is invalid */
#define GE_COLR_REP_UNDEF (94)/* A representation for the specified colour
index has not been defined on this worksta-
tion */
#define GE_COLR_REP_NOT_PRED (95)/* A representation for the specified colour
index has not been predefined on this works-
tation */
#define GE_COLR_INVALID (96)/* Colour component is outside valid range
for colour model */
#define GE_PICK_ID_INVALID (97)/* Pick identifier is invalid */
#define GE_COLR_MODEL_UNAVAIL (98)/* Specified colour model is not available on
the workstation */

/* output errors */
#define GE_NUM_POINT_INVALID (100)/* Number of points is invalid */
#define GE_INVALID_CODE (101)/* Invalid code in string */
#define GE_GDP_ID_INVALID (102)/* Generalized drawing primitive identifier
is invalid */
#define GE_GDP_DATA_INVALID (103)/* Content of generalized drawing primitive
data record is invalid */
#define GE_CANT_GEN_GDP (104)/* At least one active workstation is not
able to generate the specified generalized
drawing primitive */

```

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```

#define GE_CANT_GEN_GDP_CLIP (105)/* At least one active workstation is not
    able to generate the specified generalized
    drawing primitive under the current transfor-
    mations and clipping conditions */

/* segment errors */
#define GE_SEG_NAME_INVALID (120)/* Specified segment name is invalid */
#define GE_SEG_NAME_USED (121)/* Specified segment name is already in use
    */
#define GE_SEG_ABSENT (122)/* Specified segment does not exist */
#define GE_SEG_NOT_WS (123)/* Specified segment does not exist on
    specified workstation */
#define GE_SEG_NOT_WISS (124)/* Specified segment does not exist on
    Workstation Independent Segment Storage */
#define GE_SEG_OPEN (125)/* Specified segment is open */
#define GE_SEG_PRI_INVALID (126)/* Segment priority is outside the range
    [0,1] */

/* input errors */
#define GE_IN_DEV_NOT_WS (140)/* Specified input device is not present on
    workstation */
#define GE_IN_DEV_NOT_REQ (141)/* Input device is not in REQUEST mode */
#define GE_IN_DEV_NOT_SAMPLE (142)/* Input device is not in SAMPLE mode */
#define GE_EV_SAMPLE_UNAVAIL (143)/* EVENT and SAMPLE input mode are not
    available at this level of GKS-3D */
#define GE_PET_NOT_WS (144)/* Specified prompt and echo type is not
    supported on this workstation */
#define GE_ECHO_INVALID (145)/* Echo area is outside display space */
#define GE_IN_DATA_INVALID (146)/* Contents of input data record are invalid
    */
#define GE_QUE_OVERFLOW (147)/* Input queue has overflowed */
#define GE_NO_QUE_OVERFLOW (148)/* Input queue has not overflowed since
    GKS-3D was opened or the last invocation of
    INQUIRE INPUT QUEUE OVERFLOW */
#define GE_ASSOC_WS_CLOSED (149)/* Input queue has overflowed, but associ-
    ated workstation has been closed */
#define GE_NO_CUR_EV (150)/* No input value of the correct class is in
    the current event report */
#define GE_TIMEOUT_INVALID (151)/* Timeout is invalid */
#define GE_INIT_INVALID (152)/* Initial value is invalid */
#define GE_INIT_STROKE_INVALID (153)/* Number of points in the initial stroke is
    greater than the buffer size */
#define GE_INIT_STRING_INVALID (154)/* Length of the initial string is greater
    than the buffer size */

/* GKSM errors */
#define GE_ITEM_RESERVED (160)/* Item type is not allowed for user items
    */
#define GE_ITEM_LENGTH_INVALID (161)/* Item length is invalid */
#define GE_NO_ITEM_MI (162)/* No item is left in GKS-3D Metafile input
    */
#define GE_ITEM_INVALID (163)/* Metafile item is invalid */
#define GE_ITEM_GKS_INVALID (164)/* Item type is not a valid GKS-3D item */
#define GE_ITEM_DATA_INVALID (165)/* Content of item data record is invalid
    for the specified item type */

```

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```

#define GE_MAX_ITEM_DATA_INVAL (166)/* Maximum item data record length is
invalid */
#define GE_USER_ITEM (167)/* User item cannot be interpreted */
#define GE_FUNC_UNAVAIL (168)/* Specified function is not supported in
this level of GKS-3D */

/* escape errors */
#define GE_ESCAPE_FUNC_UNAVAIL (180)/* Specified escape function is not sup-
ported */
#define GE_ESCAPE_ID_INVAL (181)/* Specified escape function identification
is invalid */
#define GE_ESCAPE_DATA_INVAL (182)/* Contents of escape data record are
invalid */

/* error file errors */
#define GE_ERR_FILE_INVAL (200)/* Specified error file is invalid */
/* I/O errors */
#define GE_MEM_OVERF (300)/* Storage overflow has occurred in GKS-3D
*/
#define GE_SEG_MEM_OVERF (301)/* Storage overflow has occurred in segment
storage */
#define GE_IO_ERR_READ (302)/* Input/Output error has occurred while
reading */
#define GE_IO_ERR_WRITE (303)/* Input/Output error has occurred while
writing */
#define GE_IO_ERR_WRITE_WS (304)/* Input/Output error has occurred while
sending data to a workstation */
#define GE_IO_ERR_READ_WS (305)/* Input/Output error has occurred while
receiving data from a workstation */
#define GE_IO_ERR_LIB (306)/* Input/Output error has occurred during
program library management */
#define GE_IO_ERR_WS_TABLE (307)/* Input/Output error has occurred while
reading workstation description table */
#define GE_ARITH_ERR (308)/* Arithmetic error has occurred */
/* 3-D Transformation errors */
#define GE_UP_VEC_PLANE_NORM_COLL (400)/* View up vector and view plane normal
are collinear */
#define GE_PLANE_NORM_NULL (401)/* View plane normal is a null vector */
#define GE_UP_VEC_NULL (402)/* View up vector is a null vector */
#define GE_CLIP_LIM_INVAL (403)/* View clipping limits are not within NPC
range */
#define GE_PROJ_REF_POINT_INVAL (404)/* Projection reference point is between
the front and back clipping planes */
#define GE_PROJ_REF_POINT_PLANE (405)/* Projection reference point is on the
view plane */
#define GE_BOX_DEF_INVAL (406)/* Box definition is invalid */
#define GE_VP3_INVAL (407)/* Viewport is not within NDC unit cube */
#define GE_VIEW_IND_INVAL (408)/* Specified view index is invalid */
#define GE_VIEW_REP_UNDEF (409)/* A representation for the specified view
index has not been defined on this worksta-
tion. */
#define GE_VIEW_REP_NOT_PRED (410)/* A representation for the specified view
index has not been predefined on this works-
tation */

```

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```

#define GE_WS_WIN_LIM_INVALID (411)/* Workstation window limits are not within
the NPC unit cube */
#define GE_BACK_CLIP_INVALID (412)/* Back clipping plane is in front of the
front clipping plane */
#define GE_CLIP_PLANE_EQ (413)/* Front and back clipping planes are the
same */
/* 3-D output attribute errors */
#define GE_EDGE_IND_INVALID (420)/* Edge index is invalid */
#define GE_EDGE_REP_UNDEF (421)/* A representation for the specified edge
index has not been defined on this worksta-
tion */
#define GE_EDGE_REP_NOT_PRED (422)/* A representation for the specified edge
index has not been predefined on this worksta-
tion */
#define GE_EDGETYPE_ZERO (423)/* Edgetype is equal to zero */
#define GE_EDGETYPE_NOT_WS (424)/* Specified edgetype is not supported on
this workstation */
#define GE_EDGEWIDTH_LT_ZERO (425)/* Edgewidth scale factor is less than zero
*/
#define GE_PAT_REF_VEC_COLL (426)/* Pattern reference vectors are collinear
*/
#define GE_HLHSR_NOT_WS (427)/* Specified HLHSR mode not supported on
workstation */
#define GE_HLHSR_ID_INVALID (428)/* Specified HLHSR identifier is invalid */
#define GE_HLHSR_MODE_INVALID (429)/* Specified HLHSR mode is invalid */
/* 3-D output errors */
#define GE_TEXT_VEC_COLL (430)/* The text direction vectors are collinear
*/
#define GE_LIST_POINT_LIST_INVALID (431)/* List of point lists is invalid */
/* binding specific errors */
#define GE_START_IND_INVALID (2200)/* Start index out of range*/
#define GE_APPL_LIST_LENGTH_LT_ZERO (2201)/* Length of application list is nega-
tive */
#define GE_ENUM_TYPE_INVALID (2202)/* Enumeration type out of range*/
#define GE_ALLOC_STORE (2203)/* Error while allocating Store */
#define GE_ALLOC_MEM_STORE (2204)/* Error while allocating memory for Store
*/
/*
* A.3.2 Function Macros
*/
#define Gfn_open_gks (0)
#define Gfn_close_gks (1)
#define Gfn_open_ws (2)
#define Gfn_close_ws (3)
#define Gfn_activate_ws (4)
#define Gfn_deactivate_ws (5)
#define Gfn_clear_ws (6)
#define Gfn_redraw_all_segs_ws (7)
#define Gfn_upd_ws (8)
#define Gfn_set_defer_st (9)
#define Gfn_message (10)
#define Gfn_escape (11)

```

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```

#define Gfn_polyline3 (109)
#define Gfn_polyline (12)
#define Gfn_polymarker3 (110)
#define Gfn_polymarker (13)
#define Gfn_text3 (111)
#define Gfn_text (14)
#define Gfn_fill_area3 (112)
#define Gfn_fill_area (15)
#define Gfn_fill_area_set3 (114)
#define Gfn_fill_area_set (113)
#define Gfn_cell_array3 (115)
#define Gfn_cell_array (16)
#define Gfn_gdp3 (116)
#define Gfn_gdp (17)
#define Gfn_set_line_ind (18)
#define Gfn_set_linetype (19)
#define Gfn_set_linewidth (20)
#define Gfn_set_line_colr_ind (21)
#define Gfn_set_marker_ind (22)
#define Gfn_set_marker_type (23)
#define Gfn_set_marker_size (24)
#define Gfn_set_marker_colr_ind (25)
#define Gfn_set_text_ind (26)
#define Gfn_set_text_font_prec (27)
#define Gfn_set_char_expan (28)
#define Gfn_set_char_space (29)
#define Gfn_set_text_colr_ind (30)
#define Gfn_set_char_ht (31)
#define Gfn_set_char_up_vec (32)
#define Gfn_set_text_path (33)
#define Gfn_set_text_align (34)
#define Gfn_set_fill_ind (35)
#define Gfn_set_fill_int_style (36)
#define Gfn_set_fill_style_ind (37)
#define Gfn_set_fill_colr_ind (38)
#define Gfn_set_pat_size (39)
#define Gfn_set_pat_ref_point_vecs (117)
#define Gfn_set_pat_ref_point (40)
#define Gfn_set_edge_ind (118)
#define Gfn_set_edge_flag (119)
#define Gfn_set_edgetype (120)
#define Gfn_set_edgewidth (121)
#define Gfn_set_edge_colr_ind (122)
#define Gfn_set_asfs3 (123)
#define Gfn_set_asfs (41)
#define Gfn_set_pick_id (42)
#define Gfn_set_line_rep (43)
#define Gfn_set_marker_rep (44)
#define Gfn_set_text_rep (45)
#define Gfn_set_fill_rep (46)
#define Gfn_set_pat_rep (47)
#define Gfn_set_edge_rep (124)

```

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#define Gfn_set_colr_model	(125)
#define Gfn_set_colr_rep	(48)
#define Gfn_set_colr_rep_ext	(153)
#define Gfn_set_win3	(126)
#define Gfn_set_win	(49)
#define Gfn_set_vp3	(127)
#define Gfn_set_vp	(50)
#define Gfn_set_vp_in_pri	(51)
#define Gfn_sel_norm_tran	(52)
#define Gfn_set_clip_ind	(53)
#define Gfn_set_view_ind	(128)
#define Gfn_set_view_rep3	(129)
#define Gfn_set_view_tran_in_pri	(130)
#define Gfn_set_hlhrs_id	(131)
#define Gfn_set_hlhrs_mode	(132)
#define Gfn_set_ws_win3	(133)
#define Gfn_set_ws_win	(54)
#define Gfn_set_ws_vp3	(134)
#define Gfn_set_ws_vp	(55)
#define Gfn_create_seg	(56)
#define Gfn_close_seg	(57)
#define Gfn_rename_seg	(58)
#define Gfn_del_seg	(59)
#define Gfn_del_seg_ws	(60)
#define Gfn_assoc_seg_ws	(61)
#define Gfn_copy_seg_ws	(62)
#define Gfn_insert_seg3	(135)
#define Gfn_insert_seg	(63)
#define Gfn_set_seg_tran3	(136)
#define Gfn_set_seg_tran	(64)
#define Gfn_set_vis	(65)
#define Gfn_set_highl	(66)
#define Gfn_set_seg_pri	(67)
#define Gfn_set_det	(68)
#define Gfn_init_loc3	(137)
#define Gfn_init_loc	(69)
#define Gfn_init_stroke3	(138)
#define Gfn_init_stroke	(70)
#define Gfn_init_val3	(139)
#define Gfn_init_val	(71)
#define Gfn_init_choice3	(140)
#define Gfn_init_choice	(72)
#define Gfn_init_pick3	(141)
#define Gfn_init_pick	(73)
#define Gfn_init_string3	(142)
#define Gfn_init_string	(74)
#define Gfn_set_loc_mode	(75)
#define Gfn_set_stroke_mode	(76)
#define Gfn_set_val_mode	(77)
#define Gfn_set_choice_mode	(78)
#define Gfn_set_pick_mode	(79)
#define Gfn_set_string_mode	(80)

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#define Gfn_req_loc3          (143)
#define Gfn_req_loc          (81)
#define Gfn_req_stroke3      (144)
#define Gfn_req_stroke      (82)
#define Gfn_req_val          (83)
#define Gfn_req_choice       (84)
#define Gfn_req_pick         (85)
#define Gfn_req_string       (86)
#define Gfn_sample_loc3     (145)
#define Gfn_sample_loc       (87)
#define Gfn_sample_stroke3  (146)
#define Gfn_sample_stroke   (88)
#define Gfn_sample_val       (89)
#define Gfn_sample_choice   (90)
#define Gfn_sample_pick     (91)
#define Gfn_sample_string   (92)
#define Gfn_await_event     (93)
#define Gfn_flush_events    (94)
#define Gfn_get_loc3        (147)
#define Gfn_get_loc         (95)
#define Gfn_get_stroke3     (148)
#define Gfn_get_stroke      (96)
#define Gfn_get_val         (97)
#define Gfn_get_choice      (98)
#define Gfn_get_pick        (99)
#define Gfn_get_string      (100)
#define Gfn_write_item      (101)
#define Gfn_get_item_type   (102)
#define Gfn_read_item       (103)
#define Gfn_interpret_item  (104)
#define Gfn_eval_view_ori_matrix3 (149)
#define Gfn_eval_view_map_matrix3 (150)
#define Gfn_eval_tran_matrix3 (151)
#define Gfn_eval_tran_matrix (105)
#define Gfn_accum_tran_matrix3 (152)
#define Gfn_accum_tran_matrix (106)
#define Gfn_emergency_close_gks (153)
#define Gfn_err_hand        (154)
#define Gfn_err_log         (155)
#define Gfn_set_err_hand    (156)
/*
 *      A.3.3 Miscellaneous Macros
 */
#define GLINE_SOLID      (1) /* Solid linetype */
#define GLINE_DASH       (2) /* Dashed linetype */
#define GLINE_DOT        (3) /* Dotted linetype */
#define GLINE_DASH_DOT   (4) /* Dashed-dotted linetype */
#define GLINE_DASH_DOT_DOT (5) /* Dashed-dotted-dotted line-
type */
#define GMARKER_DOT      (1) /* Dotted marker type */
#define GMARKER_PLUS    (2) /* Plus (+) marker type */
#define GMARKER_asterisk (3) /* Asterisk (*) marker type

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*/
#define GMARKER_CIRCLE (4) /* Circle (o) marker type */
#define GMARKER_CROSS (5) /* Cross (X) marker type */
#define GMODEL_RGB (1) /* Red-Green-Blue */
#define GMODEL_CIELUV (2) /* CIE Luv 1976 */
#define GMODEL_HSV (3) /* Hue-Saturation-Value */
#define GMODEL_HLS (4) /* Hue-Lightness-Saturation */
#define GLOC_DEF (1) /* Locator default */
#define GLOC_CROSS_HAIR (2) /* Locator cross-hair */
#define GLOC_TRACK_CROSS (3) /* Locator tracking cross*/
#define GLOC_RUB_BAND (4) /* Locator rubber band */
#define GLOC_RECT (5) /* Locator rectangle */
#define GLOC_DIGIT (6) /* Locator digital */
#define GSTROKE_DEF (1) /* Stroke default */
#define GSTROKE_DIGIT (2) /* Stroke digit */
#define GSTROKE_MARKER (3) /* Stroke polymarker */
#define GSTROKE_LINE (4) /* Stroke polyline */
#define GVAL_DEF (1) /* Valuator default */
#define GVAL_GRAPH (2) /* Valuator graphical */
#define GVAL_DIGIT (3) /* Valuator digital */
#define GCHOICE_DEF (1) /* Choice default */
#define GCHOICE_PR_ECHO (2) /* Choice prompt and echo */
#define GCHOICE_STRING_PR (3) /* Choice string and prompt */
*/
#define GCHOICE_STRING_IN (4) /* Choice string input*/
#define GCHOICE_SEG (5) /* Choice segment */
#define GPICK_DEF (1) /* Pick default */
#define GPICK_GROUP_HIGHL (2) /* Pick group highlighting */
#define GPICK_SEG_HIGHL (3) /* Pick segment highlighting */
*/
#define GSTRING_DEF (1) /* String default */
#define GDEF_MEM_SIZE ((size_t) (-1)) /* Default memory size */
*/
#define GDEF_ERR_FILE ((char *) ("")) /* Default error file
name*/
/*
* A.3.4 GKSM Item Macros
*/
/*
* control items
*/
#define Gksm_end_item (0) /* end item */
#define Gksm_clear_ws (1) /* clear workstation */
#define Gksm_redraw_all_segs_ws (2) /* redraw all segments */
#define Gksm_upd_ws (3) /* update workstation */
#define Gksm_defer_st (4) /* deferral state */
#define Gksm_message (5) /* message */
#define Gksm_escape (6) /* escape */
/*
* output items
*/
#define Gksm_polyline (11) /* polyline */

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#define Gksm_polymarker      (12) /* polymarker */
#define Gksm_text            (13) /* text */
#define Gksm_fill_area      (14) /* fill area */
#define Gksm_fill_area_set  (15) /* fill area set */
#define Gksm_cell_array     (16) /* cell array */
#define Gksm_gdp            (17) /* gdp */
/*
 * output attribute items
 */
#define Gksm_line_ind       (21) /* polyline index */
#define Gksm_linetype       (22) /* linetype */
#define Gksm_linewidth     (23) /* linewidth scale
#define Gksm_line_colr_ind  (24) /* polyline colour index */
#define Gksm_marker_ind    (25) /* polymarker index */
#define Gksm_marker_type   (26) /* marker type */
#define Gksm_marker_size   (27) /* marker size scale
#define Gksm_marker_colr_ind (28) /* polymarker colour
#define Gksm_text_ind      (29) /* text index */
#define Gksm_text_font_prec (30) /* text font
#define Gksm_char_expan    (31) /* character expansion
#define Gksm_char_space    (32) /* character spacing */
#define Gksm_text_colr_ind  (33) /* text colour index */
#define Gksm_char_vec      (34) /* character vectors */
#define Gksm_text_path     (35) /* text path */
#define Gksm_text_align    (36) /* text alignment */
#define Gksm_fill_ind      (37) /* fill area index */
#define Gksm_fill_int_style (38) /* fill area interior style */
#define Gksm_fill_style_ind (39) /* fill area style index */
#define Gksm_fill_colr_ind  (40) /* fill area colour index */
#define Gksm_pat_ref_point_vecs (41) /* pattern reference point and vectors */
#define Gksm_edge_ind      (42) /* edge index */
#define Gksm_edge_flag     (43) /* edge flag */
#define Gksm_edgetype      (44) /* edgetype */
#define Gksm_edgewidth     (45) /* edgewidth scale factor */
#define Gksm_edge_colr_ind  (46) /* edge colour index */
#define Gksm_asf           (47) /* aspect source flags */
#define Gksm_pick_id      (48) /* pick identifier */
/*
 * workstation attribute items
 */
#define Gksm_line_rep       (51) /* polyline repr. */
#define Gksm_marker_rep    (52) /* polymarker repr. */
#define Gksm_text_rep      (53) /* text repr. */
#define Gksm_fill_rep      (54) /* fill area repr. */
#define Gksm_pat_rep       (55) /* pattern repr. */
#define Gksm_edge_rep      (56) /* edge repr. */
#define Gksm_colr_model    (57) /* colour model */
#define Gksm_colr_rep      (58) /* colour repr. */
/*
 * transformation items
 */
#define Gksm_clip_vol      (61) /* clipping volume */

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#define Gksm_clip_ind          (62) /* clipping indicator */
#define Gksm_view_ind         (63) /* view index */
#define Gksm_view_rep         (64) /* view repr. */
#define Gksm_hlhsr_id         (65) /* HLHSR identifier */
#define Gksm_hlhsr_mode       (66) /* HLHSR mode */
#define Gksm_ws_win           (71) /* workstation window */
#define Gksm_ws_vp            (72) /* workstation viewport */
/*
 * segment items
 */
#define Gksm_create_seg       (81) /* create segment */
#define Gksm_close_seg        (82) /* close segment */
#define Gksm_rename_seg       (83) /* rename segment */
#define Gksm_del_seg          (84) /* delete segment */
#define Gksm_set_seg_tran     (91) /* segment transformation */
#define Gksm_set_vis          (92) /* visibility */
#define Gksm_set_highl        (93) /* highlighting */
#define Gksm_set_seg_pri      (94) /* segment priority */
#define Gksm_set_det          (95) /* detectability */
/*
 *
 *      A.4 GKS-3D/C Function Specification
 */
/*
 *
 *      A.4.1 Control Functions
 */
extern void gopen_gks(
    const char *err_file, /* name of error file */
    size_t mem_units /* number of units of memory available
                      for buffer space */);

extern void gclose_gks(
    void);

extern void gopen_ws(
    Gint ws_id, /* workstation identifier */
    const void *conn_id, /* connection identifier */
    Gint ws_type /* workstation type */);

extern void gclose_ws(
    Gint ws_id /* workstation identifier */);

extern void gactivate_ws(
    Gint ws_id /* workstation identifier */);

extern void gdeactivate_ws(
    Gint ws_id /* workstation identifier */);

extern void gclear_ws(
    Gint ws_id, /* workstation identifier */
    Gctrl_flag ctrl_flag /* control flag */);

extern void gredraw_all_segs_ws(
    Gint ws_id /* workstation identifier */);

extern void gupd_ws(
    Gint ws_id, /* workstation identifier */
    Gupd_regen_flag upd_regen_flag /* update regeneration flag */);

extern void gset_defer_st(
    Gint ws_id, /* workstation identifier */
    Gdefer_mode defer_mode, /* deferral mode */);

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    Girg_mode    irg_mode    /* implicit regeneration mode */);
extern void gmessage(
    Gint         ws_id,      /* workstation identifier */
    const char   *message    /* message string */);
extern void gescape(
    Gint         func_id,    /* escape function identifier */
    const Gescape_in_data *in_data, /* escape input data record */
    Gstore       store,     /* handle to Store object */
    Gescape_out_data **out_data /* OUT escape output data record */);
/*
 *      A.4.2 Output Functions
 */
extern void gpolyline3(
    const Gpoint_list3 *point_list /* list of points */);
extern void gpolyline(
    const Gpoint_list *point_list /* list of points */);
extern void gpolymarker3(
    const Gpoint_list3 *point_list /* list of points */);
extern void gpolymarker(
    const Gpoint_list *point_list /* list of points */);
extern void gtext3(
    const Gpoint3 *text_pos, /* text position */
    const Gvec3   text_dir[2], /* text direction vectors */
    const char   *char_string /* character string */);
extern void gtext(
    const Gpoint *text_pos, /* text position */
    const char   *char_string /* character string */);
extern void gfill_area3(
    const Gpoint_list3 *point_list /* list of points */);
extern void gfill_area(
    const Gpoint_list *point_list /* list of points */);
extern void gfill_area_set3(
    const Gpoint_list_list3 *point_list_list /* list of point lists */);
extern void gfill_area_set(
    const Gpoint_list_list *point_list_list /* list of point lists */);
extern void gcell_array3(
    const Gparal *paral, /* cell parallelogram */
    const Gpat_rep *colr_array /* colour array */);
extern void gcell_array(
    const Grect *rect, /* cell rectangle */
    const Gpat_rep *colr_array /* colour array */);
extern void ggdp3(
    const Gpoint_list3 *point_list, /* list of points */
    Gint               gdp3_id, /* gdp 3 identifier */
    const Ggdp_data3 *gdp_data /* gdp data record */);
extern void ggdp(
    const Gpoint_list *point_list, /* list of points */
    Gint               gdp_id, /* gdp identifier */
    const Ggdp_data *gdp_data /* gdp data record */);
/*
 *      A.4.3 Output Attribute Functions
 */

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extern void gset_line_ind(
    Gint line_ind /* polyline index */);
extern void gset_linetype(
    Gint linetype /* linetype */);
extern void gset_linewidth(
    Gfloat linewidth /* linewidth scale factor */);
extern void gset_line_colr_ind(
    Gint line_colr_ind /* polyline colour index */);
extern void gset_marker_ind(
    Gint marker_ind /* polymarker index */);
extern void gset_marker_type(
    Gint marker_type /* marker type */);
extern void gset_marker_size(
    Gfloat marker_size /* marker size scale factor */);
extern void gset_marker_colr_ind(
    Gint marker_colr_ind /* polymarker colour index */);
extern void gset_text_ind(
    Gint text_ind /* text index */);
extern void gset_text_font_prec(
    const Gtext_font_prec *text_font_prec /* text font and precision */);
extern void gset_char_expan(
    Gfloat char_expan /* character expansion factor */);
extern void gset_char_space(
    Gfloat char_space /* character spacing */);
extern void gset_text_colr_ind(
    Gint text_colr_ind /* text colour index */);
extern void gset_char_ht(
    Gfloat char_ht /* character height */);
extern void gset_char_up_vec(
    const Gvec *char_up_vec /* character up vector */);
extern void gset_text_path(
    Gtext_path text_path /* text path */);
extern void gset_text_align(
    const Gtext_align *text_align /* text alignment */);
extern void gset_fill_ind(
    Gint fill_ind /* fill area index */);
extern void gset_fill_int_style(
    Gfill_int_style fill_int_style /* fill area interior style */);
extern void gset_fill_style_ind(
    Gint fill_style_ind /* fill area style index */);
extern void gset_fill_colr_ind(
    Gint fill_colr_ind /* fill area colour index */);
extern void gset_pat_size(
    const Gfloat_size *pat_size /* pattern size */);
extern void gset_pat_ref_point_vecs(
    const Gpoint3 *pat_ref_point, /* pattern reference point */
    const Gvec3 pat_ref_vec[2], /* 1st ref. vector: X axis of pattern */
                                /* 2nd ref. vector: Y axis of pattern */);
extern void gset_pat_ref_point(
    const Gpoint *pat_ref_point /* pattern reference point */);
extern void gset_edge_ind(
    Gint edge_ind /* edge index */);

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extern void gset_edge_flag(
    Gedge_flag edge_flag /* edge flag */);
extern void gset_edgetype(
    Gint edgetype /* edgetype */);
extern void gset_edgewidth(
    Gfloat edgewidth /* edgewidth scale factor */);
extern void gset_edge_colr_ind(
    Gint edge_colr_ind /* edge colour index */);
extern void gset_asfs3(
    const Gasfs3 *list_asf /* list of aspect source flags */);
extern void gset_asfs(
    const Gasfs *list_asf /* list of aspect source flags */);
extern void gset_pick_id(
    Gint pick_id /* pick identifier */);
extern void gset_line_rep(
    Gint ws_id, /* workstation identifier */
    Gint line_ind, /* polyline index */
    const Gline_bundle *line_bundle /* polyline representation */);
extern void gset_marker_rep(
    Gint ws_id, /* workstation identifier */
    Gint marker_ind, /* polymarker index */
    const Gmarker_bundle *marker_bundle /* polymarker representation */);
extern void gset_text_rep(
    Gint ws_id, /* workstation identifier */
    Gint text_ind, /* text index */
    const Gtext_bundle *text_bundle /* text representation */);
extern void gset_fill_rep(
    Gint ws_id, /* workstation identifier */
    Gint fill_ind, /* fill area index */
    const Gfill_bundle *fill_bundle /* fill area representation */);
extern void gset_pat_rep(
    Gint ws_id, /* workstation identifier */
    Gint pat_ind, /* pattern index */
    const Gpat_rep *pat_rep /* pattern representation */);
extern void gset_edge_rep(
    Gint ws_id, /* workstation identifier */
    Gint edge_ind, /* edge index */
    const Gedge_bundle *edge_bundle /* edge representation */);
extern void gset_colr_model(
    Gint ws_id, /* workstation identifier */
    Gint colr_model /* colour model */);
extern void gset_colr_rep(
    Gint ws_id, /* workstation identifier */
    Gint colr_ind, /* colour index */
    const Gcolr_rep *colr_rep /* colour representation */);
/*
 * A.4.4 Transformation Functions
 */
extern void gset_win3(
    Gint tran_num, /* transformation number */
    const Glimit3 *win_limits /* window limits */);
extern void gset_win(

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    Gint          tran_num,      /* transformation number */
    const Glimit  *win_limits    /* window limits          */);
extern void gset_vp3(
    Gint          tran_num,      /* transformation number */
    const Glimit3 *vp_limits     /* viewport limits       */);
extern void gset_vp(
    Gint          tran_num,      /* transformation number */
    const Glimit  *vp_limits     /* viewport limits       */);
extern void gset_vp_in_pri(
    Gint          tran_num,      /* transformation number */
    Gint          ref_tran_num,  /* reference transformation number */
    Grel_pri      rel_pri       /* relative priority     */);
extern void gsel_norm_tran(
    Gint          tran_num      /* transformation number */);
extern void gset_clip_ind(
    Gclip_ind     clip_ind     /* clipping indicator     */);
extern void gset_view_ind(
    Gint          view_ind     /* view index            */);
extern void gset_view_rep3(
    Gint          ws_id,        /* workstation identifier */
    Gint          view_ind,     /* view index            */
    const Gview_rep3 *view_rep /* view representation   */);
extern void gset_view_tran_in_pri(
    Gint          ws_id,        /* workstation identifier */
    Gint          view_ind,     /* view index            */
    Gint          ref_ind,      /* reference view index   */
    Grel_pri      pri          /* relative priority     */);
extern void gset_hlhrs_id(
    Gint          hlhrs_id     /* HLHSR identifier     */);
extern void gset_hlhrs_mode(
    Gint          ws_id,        /* workstation identifier */
    Gint          hlhrs_mode   /* HLHSR mode           */);
extern void gset_ws_win3(
    Gint          ws_id,        /* workstation identifier */
    const Glimit3 *ws_win_limits /* workstation window limits */);
extern void gset_ws_win(
    Gint          ws_id,        /* workstation identifier */
    const Glimit  *ws_win_limits /* workstation window limits */);
extern void gset_ws_vp3(
    Gint          ws_id,        /* workstation identifier */
    const Glimit3 *ws_vp_limits /* workstation viewport limits */);
extern void gset_ws_vp(
    Gint          ws_id,        /* workstation identifier */
    const Glimit  *ws_vp_limits /* workstation viewport limits */);
/*
 *      A.4.5 Segment Functions
 */
extern void gcreate_seg(
    Gint          seg_name     /* segment name         */);
extern void gclose_seg(
    void);
extern void grename_seg(

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    Gint    old_seg_name,    /* old segment name    */
    Gint    new_seg_name    /* new segment name    */);
extern void gdel_seg(
    Gint    seg_name    /* segment name    */);
extern void gdel_seg_ws(
    Gint    ws_id,    /* workstation identifier    */
    Gint    seg_name    /* segment name    */);
extern void gassoc_seg_ws(
    Gint    ws_id,    /* workstation identifier    */
    Gint    seg_name    /* segment name    */);
extern void gcopy_seg_ws(
    Gint    ws_id,    /* workstation identifier    */
    Gint    seg_name    /* segment name    */);
extern void ginsert_seg3(
    Gint    seg_name,    /* segment name    */
    Gtran_matrix3    tran_matrix    /* transformation matrix    */);
extern void ginsert_seg(
    Gint    seg_name,    /* segment name    */
    Gtran_matrix    tran_matrix    /* transformation matrix    */);
extern void gset_seg_tran3(
    Gint    seg_name,    /* segment name    */
    Gtran_matrix3    tran_matrix    /* transformation matrix    */);
extern void gset_seg_tran(
    Gint    seg_name,    /* segment name    */
    Gtran_matrix    tran_matrix    /* transformation matrix    */);
extern void gset_vis(
    Gint    seg_name,    /* segment name    */
    Gvis    vis    /* visibility    */);
extern void gset_highl(
    Gint    seg_name,    /* segment name    */
    Ghighl    highl    /* highlighting    */);
extern void gset_seg_pri(
    Gint    seg_name,    /* segment name    */
    Gfloat    seg_pri    /* segment priority    */);
extern void gset_det(
    Gint    seg_name,    /* segment name    */
    Gdet    det    /* detectability    */);
/*
 *   A.4.6 Input Functions
 */
extern void ginit_loc3(
    Gint    ws_id,    /* workstation identifier    */
    Gint    loc_num,    /* locator device number    */
    Gint    init_norm_tran_num,    /* initial normalization
                                transformation number    */
    Gint    init_view_ind,    /* initial view index    */
    const Gpoint3    *init_loc_pos,    /* initial locator position    */
    Gint    pet,    /* prompt and echo type    */
    const Glimit3    *echo_vol,    /* echo volume    */
    const Gloc_data3    *loc_data    /* locator data record    */);
extern void ginit_loc(
    Gint    ws_id,    /* workstation identifier    */

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Gint          loc_num,          /* locator device number */
Gint          init_norm_tran_num, /* initial normalization
                                transformation number */
const Gpoint  *init_loc_pos,    /* initial locator position */
Gint          pet,              /* prompt and echo type */
const Glimit  *echo_area,      /* echo area */
const Gloc_data *loc_data      /* locator data record */);
extern void ginit_stroke3(
Gint          ws_id,            /* workstation identifier */
Gint          stroke_num,      /* stroke device number */
Gint          init_norm_tran_num, /* initial normalization
                                transformation number */
Gint          init_view_ind,   /* initial view index */
const Gpoint_list3 *init_stroke, /* initial stroke */
Gint          pet,              /* prompt and echo type */
const Glimit3  *echo_vol,     /* echo volume */
const Gstroke_data3 *stroke_data /* stroke data record */);
extern void ginit_stroke(
Gint          ws_id,            /* workstation identifier */
Gint          stroke_num,      /* stroke device number */
Gint          init_norm_tran_num, /* initial normalization
                                transformation number */
const Gpoint_list *init_stroke, /* initial stroke */
Gint          pet,              /* prompt and echo type */
const Glimit  *echo_area,     /* echo area */
const Gstroke_data *stroke_data /* stroke data record */);
extern void ginit_val3(
Gint          ws_id,            /* workstation identifier */
Gint          val_num,         /* valuator device number */
Gfloat        init_value,     /* initial value */
Gint          pet,              /* prompt and echo type */
const Glimit3  *echo_vol,     /* echo volume */
const Gval_data3 *val_data    /* valuator data record */);
extern void ginit_val(
Gint          ws_id,            /* workstation identifier */
Gint          val_num,         /* valuator device number */
Gfloat        init_value,     /* initial value */
Gint          pet,              /* prompt and echo type */
const Glimit  *echo_area,     /* echo area */
const Gval_data *val_data    /* valuator data record */);
extern void ginit_choice3(
Gint          ws_id,            /* workstation identifier */
Gint          choice_num,     /* choice device number */
Gin_status    init_status,    /* initial status */
Gint          init_choice,    /* initial choice */
Gint          pet,              /* prompt and echo type */
const Glimit3  *echo_vol,     /* echo volume */
const Gchoice_data3 *choice_data /* choice data record */);
extern void ginit_choice(
Gint          ws_id,            /* workstation identifier */
Gint          choice_num,     /* choice device number */
Gin_status    init_status,    /* initial status */

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    Gint          init_choice, /* initial choice          */
    Gint          pet,         /* prompt and echo type   */
    const Glimit  *echo_area, /* echo area              */
    const Gchoice_data *choice_data /* choice data record    */
extern void ginit_pick3(
    Gint          ws_id,      /* workstation identifier  */
    Gint          pick_num,   /* pick device number     */
    Gin_status    init_status, /* initial status         */
    const Gpick   *init_pick, /* initial pick value     */
    Gint          pet,         /* prompt and echo type   */
    const Glimit3 *echo_vol,  /* echo volume            */
    const Gpick_data3 *pick_data /* pick data record      */
extern void ginit_pick(
    Gint          ws_id,      /* workstation identifier  */
    Gint          pick_num,   /* pick device number     */
    Gin_status    init_status, /* initial status         */
    const Gpick   *init_pick, /* initial pick value     */
    Gint          pet,         /* prompt and echo type   */
    const Glimit  *echo_area, /* echo area              */
    const Gpick_data *pick_data /* pick data record      */
extern void ginit_string3(
    Gint          ws_id,      /* workstation identifier  */
    Gint          string_num, /* string device number   */
    const char    *init_string, /* initial string         */
    Gint          pet,         /* prompt and echo type   */
    const Glimit3 *echo_vol,  /* echo volume            */
    const Gstring_data3 *string_data /* string data record    */
extern void ginit_string(
    Gint          ws_id,      /* workstation identifier  */
    Gint          string_num, /* string device number   */
    const char    *init_string, /* initial string         */
    Gint          pet,         /* prompt and echo type   */
    const Glimit  *echo_area, /* echo area              */
    const Gstring_data *string_data /* string data record    */
extern void gset_loc_mode(
    Gint          ws_id,      /* workstation identifier  */
    Gint          loc_num,    /* locator device number  */
    Gop_mode      op_mode,    /* operating mode         */
    Gecho_switch  echo_switch /* echo switch            */
extern void gset_stroke_mode(
    Gint          ws_id,      /* workstation identifier  */
    Gint          stroke_num, /* stroke device number   */
    Gop_mode      op_mode,    /* operating mode         */
    Gecho_switch  echo_switch /* echo switch            */
extern void gset_val_mode(
    Gint          ws_id,      /* workstation identifier  */
    Gint          val_num,    /* valuator device number */
    Gop_mode      op_mode,    /* operating mode         */
    Gecho_switch  echo_switch /* echo switch            */
extern void gset_choice_mode(
    Gint          ws_id,      /* workstation identifier  */
    Gint          choice_num, /* choice device number   */

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    Gop_mode      op_mode,      /* operating mode      */
    Gecho_switch  echo_switch   /* echo switch         */
extern void gset_pick_mode(
    Gint          ws_id,        /* workstation identifier */
    Gint          pick_num,     /* pick device number    */
    Gop_mode      op_mode,     /* operating mode        */
    Gecho_switch  echo_switch   /* echo switch           */
extern void gset_string_mode(
    Gint          ws_id,        /* workstation identifier */
    Gint          string_num,   /* string device number  */
    Gop_mode      op_mode,     /* operating mode        */
    Gecho_switch  echo_switch   /* echo switch           */
extern void greq_loc3(
    Gint          ws_id,        /* workstation identifier */
    Gint          loc_num,     /* locator device number  */
    Gin_status    *in_status,  /* OUT input status      */
    Gint          *norm_tran_num, /* OUT normalization
                                transformation number */
    Gint          *view_ind,   /* OUT view index        */
    Gpoint3       *loc_pos     /* OUT locator position  */
extern void greq_loc(
    Gint          ws_id,        /* workstation identifier */
    Gint          loc_num,     /* locator device number  */
    Gin_status    *in_status,  /* OUT input status      */
    Gint          *norm_tran_num, /* OUT normalization
                                transformation number */
    Gpoint        *loc_pos     /* OUT locator position  */
extern void greq_stroke3(
    Gint          ws_id,        /* workstation identifier */
    Gint          stroke_num,   /* stroke device number   */
    Gin_status    *in_status,  /* OUT input status      */
    Gint          *norm_tran_num, /* OUT normalization
                                transformation number */
    Gint          *view_ind,   /* OUT view index        */
    Gpoint_list3  *stroke      /* OUT stroke            */
extern void greq_stroke(
    Gint          ws_id,        /* workstation identifier */
    Gint          stroke_num,   /* stroke device number   */
    Gin_status    *in_status,  /* OUT input status      */
    Gint          *norm_tran_num, /* OUT normalization
                                transformation number */
    Gpoint_list   *stroke      /* OUT stroke            */
extern void greq_val(
    Gint          ws_id,        /* workstation identifier */
    Gint          val_num,     /* valuator device number */
    Gin_status    *in_status,  /* OUT input status      */
    Gfloat        *value       /* OUT value             */
extern void greq_choice(
    Gint          ws_id,        /* workstation identifier */
    Gint          choice_num,   /* choice device number   */
    Gin_status    *in_status,  /* OUT input status      */
    Gint          *choice      /* OUT requested choice  */

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extern void greq_pick(
    Gint      ws_id,      /* workstation identifier */
    Gint      pick_num,   /* pick device number     */
    Gint_status *in_status, /* OUT input status       */
    Gpick     *pick      /* OUT requested pick value */);

extern void greq_string(
    Gint      ws_id,      /* workstation identifier */
    Gint      string_num, /* string device number   */
    Gint_status *in_status, /* OUT input status       */
    char      *string    /* OUT requested string   */);

extern void gsample_loc3(
    Gint      ws_id,      /* workstation identifier */
    Gint      loc_num,    /* locator device number  */
    Gint      *norm_tran_num, /* OUT normalization
                               transformation number */
    Gint      *view_ind,  /* OUT view index         */
    Gpoint3   *loc_pos    /* OUT locator position   */);

extern void gsample_loc(
    Gint      ws_id,      /* workstation identifier */
    Gint      loc_num,    /* locator device number  */
    Gint      *norm_tran_num, /* OUT normalization
                               transformation number */
    Gpoint    *loc_pos    /* OUT locator position   */);

extern void gsample_stroke3(
    Gint      ws_id,      /* workstation identifier */
    Gint      stroke_num, /* stroke device number   */
    Gint      *norm_tran_num, /* OUT normalization
                               transformation number */
    Gint      *view_ind,  /* OUT view index         */
    Gpoint_list3 *stroke  /* OUT stroke             */);

extern void gsample_stroke(
    Gint      ws_id,      /* workstation identifier */
    Gint      stroke_num, /* stroke device number   */
    Gint      *norm_tran_num, /* OUT normalization
                               transformation number */
    Gpoint_list *stroke   /* OUT stroke             */);

extern void gsample_val(
    Gint      ws_id,      /* workstation identifier */
    Gint      val_num,    /* valuator device number */
    Gfloat    *value     /* OUT value              */);

extern void gsample_choice(
    Gint      ws_id,      /* workstation identifier */
    Gint      choice_num, /* choice device number   */
    Gint_status *in_status, /* OUT input status       */
    Gint      *choice     /* OUT choice             */);

extern void gsample_pick(
    Gint      ws_id,      /* workstation identifier */
    Gint      pick_num,   /* pick device number     */
    Gint_status *in_status, /* OUT input status       */
    Gpick     *pick      /* OUT pick value         */);

extern void gsample_string(
    Gint      ws_id,      /* workstation identifier */

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    Gint    string_num,    /* string device number    */
    char    *string       /* OUT string              */);
extern void gawait_event(
    Gfloat    timeout,    /* timeout (seconds)      */
    Gint      *ws_id,     /* OUT workstation identifier */
    Gin_class *class,     /* OUT device class       */
    Gint      *in_num    /* OUT logical input device number */);
extern void gflush_events(
    Gint      ws_id,     /* workstation identifier   */
    Gin_class class,    /* device class            */
    Gint      in_num    /* logical input device number */);
extern void gget_loc3(
    Gint      *norm_tran_num, /* OUT normalization
                                transformation number */
    Gint      *view_ind,    /* OUT view index         */
    Gpoint3   *loc_pos     /* OUT locator position   */);
extern void gget_loc(
    Gint      *norm_tran_num, /* OUT normalization
                                transformation number */
    Gpoint    *loc_pos     /* OUT locator position   */);
extern void gget_stroke3(
    Gint      *norm_tran_num, /* OUT normalization
                                transformation number */
    Gint      *view_ind,    /* OUT view index         */
    Gpoint_list3 *stroke    /* OUT stroke             */);
extern void gget_stroke(
    Gint      *norm_tran_num, /* OUT normalization
                                transformation number */
    Gpoint_list *stroke     /* OUT stroke             */);
extern void gget_val(
    Gfloat    *value /* OUT value */);
extern void gget_choice(
    Gin_status *in_status, /* OUT input status */
    Gint      *choice     /* OUT choice       */);
extern void gget_pick(
    Gin_status *in_status, /* OUT input status */
    Gpick      *pick      /* OUT pick value   */);
extern void gget_string(
    char *string /* OUT string */);
/*
 * A.4.7 GKSM Functions
 */
extern void gwrite_item(
    Gint      ws_id,     /* workstation identifier */
    Gint      item_type, /* item type              */
    Gint      item_data_length, /* item data record length */
    const Gitem_data *item_data /* item data record      */);
extern void gget_item_type(
    Gint      ws_id,     /* workstation identifier */
    Gint      *item_type, /* OUT item type          */
    Gint      *item_data_length /* OUT item data record length */);
extern void gread_item(

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    Gint      ws_id,                /* workstation identifier      */
    Gint      max_item_data_length, /* max. item data record length */
    Gitem_data *item_data          /* OUT item data record       */
extern void ginterpret_item(
    Gint      type,                /* item type                   */
    Gint      item_data_length,    /* item data record length     */
    const Gitem_data *item_data    /* item data record            */
/*
 *      A.4.8 Inquire Functions
 */
extern void ginq_op_st(
    Gop_st *op_st /* OUT operating state value */);
extern void ginq_level_gks(
    Gint *err_ind, /* OUT error indicator */
    Glevel *level /* OUT level of GKS-3D */);
extern void ginq_list_avail_ws_types(
    Gint      num_elems_appl_list, /* length of application list */
    Gint      start_ind,          /* starting index              */
    Gint      *err_ind,          /* OUT error indicator         */
    Gint_list *ws_type,          /* OUT list of available ws types */
    Gint      *num_elems_impl_list /* OUT length of impl. list    */
extern void ginq_ws_max_nums(
    Gint *err_ind, /* OUT error indicator */
    Gws_max_nums *ws_max_num /* OUT workstation maximum numbers */);
extern void ginq_max_norm_tran_num(
    Gint *err_ind, /* OUT error indicator */
    Gint *max_norm_tran_num /* OUT maximum normalization
    transformation number */);
extern void ginq_set_open_wss(
    Gint      num_elems_appl_list, /* length of application list */
    Gint      start_ind,          /* starting index              */
    Gint      *err_ind,          /* OUT error indicator         */
    Gint_list *open_ws,          /* OUT list of open ws ids     */
    Gint      *num_elems_impl_list /* OUT length of impl. list    */
extern void ginq_set_active_wss(
    Gint      num_elems_appl_list, /* length of application list */
    Gint      start_ind,          /* starting index              */
    Gint      *err_ind,          /* OUT error indicator         */
    Gint_list *active_ws,        /* OUT list of active ws ids   */
    Gint      *num_elems_impl_list /* OUT length of impl. list    */
extern void ginq_cur_prim_attr3(
    Gint *err_ind, /* OUT error indicator */
    Gprim_attr3 *prim_attr3 /* OUT current primitive
    attribute 3 structure */);
extern void ginq_cur_prim_attr(
    Gint *err_ind, /* OUT error indicator */
    Gprim_attr *prim_attr /* OUT current primitive
    attribute structure */);
extern void ginq_line_ind(
    Gint *err_ind, /* OUT error indicator */
    Gint *line_ind /* OUT current polyline index */);
extern void ginq_marker_ind(

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    Gint  *err_ind,      /* OUT error indicator          */
    Gint  *marker_ind  /* OUT current polymarker index */);
extern void ginq_text_ind(
    Gint  *err_ind,      /* OUT error indicator          */
    Gint  *text_ind    /* OUT current text index      */);
extern void ginq_char_ht(
    Gint  *err_ind,      /* OUT error indicator          */
    Gfloat *char_ht    /* OUT current character height */);
extern void ginq_char_up_vec(
    Gint  *err_ind,      /* OUT error indicator          */
    Gvec  *char_up_vec  /* OUT current character up vector */);
extern void ginq_char_width(
    Gint  *err_ind,      /* OUT error indicator          */
    Gfloat *char_width  /* OUT current character width  */);
extern void ginq_char_base_vec(
    Gint  *err_ind,      /* OUT error indicator          */
    Gvec  *char_base_vec /* OUT current character base vector */);
extern void ginq_text_path(
    Gint  *err_ind,      /* OUT error indicator          */
    Gtext_path *text_path /* OUT current text path      */);
extern void ginq_text_align(
    Gint  *err_ind,      /* OUT error indicator          */
    Gtext_align *text_align /* OUT current text alignment  */);
extern void ginq_fill_ind(
    Gint  *err_ind,      /* OUT error indicator          */
    Gint  *fill_ind    /* OUT current fill area index  */);
extern void ginq_pat_width_vec(
    Gint  *err_ind,      /* OUT error indicator          */
    Gvec  *pat_width_vec /* OUT current pattern width vector */);
extern void ginq_pat_ht_vec(
    Gint  *err_ind,      /* OUT error indicator          */
    Gvec  *pat_ht_vec  /* OUT current pattern height vector */);
extern void ginq_pat_ref_point_vecs(
    Gint  *err_ind,      /* OUT error indicator          */
    Gpoint3 *pat_ref_point, /* OUT current pattern reference point */
    Gvec3  pat_ref_vec[2] /* OUT current reference vectors;
                          1st ref. vector: X axis of pattern
                          2nd ref. vector: Y axis of pattern */);
extern void ginq_pat_ref_point(
    Gint  *err_ind,      /* OUT error indicator          */
    Gpoint *pat_ref_point /* OUT current pattern reference point */);
extern void ginq_edge_ind(
    Gint  *err_ind,      /* OUT error indicator          */
    Gint  *edge_ind    /* OUT current edge index      */);
extern void ginq_view_ind(
    Gint  *err_ind,      /* OUT error indicator          */
    Gint  *view_ind    /* OUT current view index      */);
extern void ginq_cur_pick_id(
    Gint  *err_ind,      /* OUT error indicator          */
    Gint  *pick_id    /* OUT current pick identifier  */);
extern void ginq_cur_hlshr_id(
    Gint  *err_ind,      /* OUT error indicator          */

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    Gint    *hlhsr_id    /* OUT current HLHSR identifier    */);
extern void ginq_cur_indiv_attrs3(
    Gint    *err_ind,    /* OUT error indicator    */
    Gindiv_attrs3    *indiv_attr3    /* OUT current individual
                                     attribute 3 structure    */);
extern void ginq_cur_indiv_attrs(
    Gint    *err_ind,    /* OUT error indicator    */
    Gindiv_attrs    *indiv_attr    /* OUT current individual
                                     attribute structure    */);
extern void ginq_linetype(
    Gint    *err_ind,    /* OUT error indicator    */
    Gint    *linetype    /* OUT current linetype    */);
extern void ginq_linewidth(
    Gint    *err_ind,    /* OUT error indicator    */
    Gfloat    *linewidth    /* OUT current linewidth scale factor    */);
extern void ginq_line_colr_ind(
    Gint    *err_ind,    /* OUT error indicator    */
    Gint    *line_colr_ind    /* OUT current polyline colour index    */);
extern void ginq_marker_type(
    Gint    *err_ind,    /* OUT error indicator    */
    Gint    *marker_type    /* OUT current marker type    */);
extern void ginq_marker_size(
    Gint    *err_ind,    /* OUT error indicator    */
    Gfloat    *marker_size    /* OUT current marker size scale factor    */);
extern void ginq_marker_colr_ind(
    Gint    *err_ind,    /* OUT error indicator    */
    Gint    *marker_colr_ind    /* OUT current polymarker colour index    */);
extern void ginq_text_font_prec(
    Gint    *err_ind,    /* OUT error indicator    */
    Gtext_font_prec    *font_prec    /* OUT current text font and precision    */);
extern void ginq_char_expan(
    Gint    *err_ind,    /* OUT error indicator    */
    Gfloat    *char_expan    /* OUT current character expansion factor    */);
extern void ginq_char_space(
    Gint    *err_ind,    /* OUT error indicator    */
    Gfloat    *char_space    /* OUT current character spacing    */);
extern void ginq_text_colr_ind(
    Gint    *err_ind,    /* OUT error indicator    */
    Gint    *text_colr_ind    /* OUT current text colour index    */);
extern void ginq_fill_int_style(
    Gint    *err_ind,    /* OUT error indicator    */
    Gfill_int_style    *fill_int_style    /* OUT current fill area
                                     interior style    */);
extern void ginq_fill_style_ind(
    Gint    *err_ind,    /* OUT error indicator    */
    Gint    *fill_style_ind    /* OUT current fill area style index    */);
extern void ginq_fill_colr_ind(
    Gint    *err_ind,    /* OUT error indicator    */
    Gint    *fill_colr_ind    /* OUT current fill area colour index    */);
extern void ginq_edge_flag(
    Gint    *err_ind,    /* OUT error indicator    */
    Gedge_flag    *edge_flag    /* OUT current edge flag    */);

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extern void ginq_edgetype(
    Gint *err_ind, /* OUT error indicator */
    Gint *edgetype /* OUT current edgetype */);
extern void ginq_edgewidth(
    Gint *err_ind, /* OUT error indicator */
    Gfloat *edgewidth /* OUT current edgewidth scale factor */);
extern void ginq_edge_colr_ind(
    Gint *err_ind, /* OUT error indicator */
    Gint *edge_colr_ind /* OUT current edge colour index */);
extern void ginq_asfs3(
    Gint *err_ind, /* OUT error indicator */
    Gasfs3 *list_asf /* OUT current aspect source flags */);
extern void ginq_asfs(
    Gint *err_ind, /* OUT error indicator */
    Gasfs *list_asf /* OUT current aspect source flags */);
extern void ginq_cur_norm_tran_num(
    Gint *err_ind, /* OUT error indicator */
    Gint *norm_tran_num /* OUT current normalization
        transformation number */);
extern void ginq_list_norm_tran_nums(
    Gint num_elems_appl_list, /* length of application list */
    Gint start_ind, /* starting index */
    Gint *err_ind, /* OUT error indicator */
    Gint_list *norm_tran_num, /* OUT list of normalization
        transformation numbers */
    Gint *num_elems_impl_list /* OUT length of impl. list */);
extern void ginq_norm_tran3(
    Gint num, /* normalization transformation number */
    Gint *err_ind, /* OUT error indicator */
    Gtran3 *norm_tran3 /* OUT normalization transformation */);
extern void ginq_norm_tran(
    Gint num, /* normalization transformation number */
    Gint *err_ind, /* OUT error indicator */
    Gtran *norm_tran /* OUT normalization transformation */);
extern void ginq_clip3(
    Gint *err_ind, /* OUT error indicator */
    Gclip3 *clip_ind_vol /* OUT current clipping indicator
        and volume */);
extern void ginq_clip(
    Gint *err_ind, /* OUT error indicator */
    Gclip *clip_ind_rect /* OUT current clipping indicator
        and rectangle */);
extern void ginq_name_open_seg(
    Gint *err_ind, /* OUT error indicator */
    Gint *name_open_seg /* OUT name of open segment */);
extern void ginq_set_seg_names(
    Gint num_elems_appl_list, /* length of application list */
    Gint start_ind, /* starting index */
    Gint *err_ind, /* OUT error indicator */
    Gint_list *seg_names, /* OUT list of segment names */
    Gint *num_elems_impl_list /* OUT length of impl. list */);
extern void ginq_more_simult_events(

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    Gint          *err_ind,          /* OUT error indicator          */
    Gmore_simult_events *simult_events /* OUT [more] simultaneous events */);
extern void ginq_ws_conn_type(
    Gint    ws_id,          /* workstation identifier      */
    Gstore  store,         /* handle to Store object      */
    Gint    *err_ind,      /* OUT error indicator         */
    void    **conn_id,     /* OUT connection identifier   */
    Gint    *ws_type       /* OUT workstation type        */);
extern void ginq_ws_st(
    Gint    ws_id,          /* workstation identifier      */
    Gint    *err_ind,      /* OUT error indicator         */
    Gws_st  *ws_st         /* OUT workstation state       */);
extern void ginq_ws_defer_upd_sts(
    Gint    ws_id,          /* workstation identifier      */
    Gint    *err_ind,      /* OUT error indicator         */
    Gdefer_mode *defer_mode, /* OUT deferral mode          */
    Girg_mode *irg_mode,   /* OUT implicit regeneration mode */
    Gdisp_surf_empty *disp_surf_empty, /* OUT display surface empty */
    Gnew_frame_nec_upd *new_frame /* OUT new frame action       */
                                necessary at update
                                */);
extern void ginq_list_line_inde(
    Gint    ws_id,          /* workstation identifier      */
    Gint    num_elems_appl_list, /* length of application list */
    Gint    start_ind,       /* starting index              */
    Gint    *err_ind,        /* OUT error indicator         */
    Gint_list *def_line_inde, /* OUT list of defined polyline indices */
    Gint    *num_elems_impl_list /* OUT length of impl. list   */);
extern void ginq_line_rep(
    Gint    ws_id,          /* workstation identifier      */
    Gint    line_ind,       /* polyline index              */
    Ginq_type type,         /* type of returned values    */
    Gint    *err_ind,      /* OUT error indicator         */
    Gline_bundle *line_rep /* OUT polyline representation */);
extern void ginq_list_marker_inde(
    Gint    ws_id,          /* workstation identifier      */
    Gint    num_elems_appl_list, /* length of application list */
    Gint    start_ind,       /* starting index              */
    Gint    *err_ind,        /* OUT error indicator         */
    Gint_list *def_marker_inde, /* OUT list of defined polymarker indices */
    Gint    *num_elems_impl_list /* OUT length of impl. list   */);
extern void ginq_marker_rep(
    Gint    ws_id,          /* workstation identifier      */
    Gint    marker_ind,     /* polymarker index            */
    Ginq_type type,         /* type of returned values    */
    Gint    *err_ind,      /* OUT error indicator         */
    Gmarker_bundle *marker_rep /* OUT polymarker representation */);
extern void ginq_list_text_inde(
    Gint    ws_id,          /* workstation identifier      */
    Gint    num_elems_appl_list, /* length of application list */
    Gint    start_ind,       /* starting index              */
    Gint    *err_ind,        /* OUT error indicator         */
    Gint_list *def_text_inde, /* OUT list of defined text indices */

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    Gint      *num_elems_impl_list  /* OUT length of impl. list      */);
extern void ginq_text_rep(
    Gint      ws_id,                /* workstation identifier      */
    Gint      text_ind,             /* text index                  */
    Ginq_type type,                 /* type of returned values    */
    Gint      *err_ind,             /* OUT error indicator        */
    Gtext_bundle *text_rep         /* OUT text representation    */);
extern void ginq_text_extent3(
    Gint      ws_id,                /* workstation identifier      */
    const Gpoint3 *pos,             /* text position              */
    const Gvec3 text_dir[2],        /* text direction vectors     */
    const char *str,               /* text string                */
    Gint      *err_ind,             /* OUT error indicator        */
    Gtext_extent3 *extent          /* OUT concatenation point and
                                   text extent parallelogram */);
extern void ginq_text_extent(
    Gint      ws_id,                /* workstation identifier      */
    const Gpoint *pos,             /* text position              */
    const char *str,               /* text string                */
    Gint      *err_ind,             /* OUT error indicator        */
    Gtext_extent *extent          /* OUT concatenation point and
                                   text extent parallelogram */);
extern void ginq_list_fill_inde(
    Gint      ws_id,                /* workstation identifier      */
    Gint      num_elems_appl_list,  /* length of application list  */
    Gint      start_ind,            /* starting index              */
    Gint      *err_ind,             /* OUT error indicator        */
    Gint_list *def_fill_inde,      /* OUT list of defined fill area
                                   indices                      */
    Gint      *num_elems_impl_list  /* OUT length of impl. list   */);
extern void ginq_fill_rep(
    Gint      ws_id,                /* workstation identifier      */
    Gint      fill_ind,             /* fill area index            */
    Ginq_type type,                 /* type of returned values    */
    Gint      *err_ind,             /* OUT error indicator        */
    Gfill_bundle *fill_rep         /* OUT fill area representation */);
extern void ginq_list_pat_inde(
    Gint      ws_id,                /* workstation identifier      */
    Gint      num_elems_appl_list,  /* length of application list  */
    Gint      start_ind,            /* starting index              */
    Gint      *err_ind,             /* OUT error indicator        */
    Gint_list *def_pat_inde,       /* OUT list of defined pattern
                                   indices                      */
    Gint      *num_elems_impl_list  /* OUT length of impl. list   */);
extern void ginq_pat_rep(
    Gint      ws_id,                /* workstation identifier      */
    Gint      pat_ind,              /* pattern index               */
    Ginq_type type,                 /* type of returned values    */
    Gstore    store,               /* handle to Store object     */
    Gint      *err_ind,             /* OUT error indicator        */
    Gpat_rep  **pat_rep            /* OUT pattern representation */);
extern void ginq_list_edge_inde(
    Gint      ws_id,                /* workstation identifier      */
    Gint      num_elems_appl_list,  /* length of application list  */

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Gint      start_ind,          /* starting index          */
Gint      *err_ind,          /* OUT error indicator     */
Gint_list *def_edge_inds,    /* OUT list of defined edge indices */
Gint      *num_elems_impl_list /* OUT length of impl. list */
extern void ginq_edge_rep(
Gint      ws_id,            /* workstation identifier   */
Gint      edge_ind,        /* edge index              */
Ginq_type type,            /* type of returned values */
Gint      *err_ind,        /* OUT error indicator     */
Gedge_bundle *edge_rep    /* OUT edge representation */);
extern void ginq_colr_model(
Gint      ws_id,            /* workstation identifier   */
Gint      *err_ind,        /* OUT error indicator     */
Gint      *model           /* OUT current colour model */);
extern void ginq_list_colr_inds(
Gint      ws_id,            /* workstation identifier   */
Gint      num_elems_appl_list, /* length of application list */
Gint      start_ind,        /* starting index          */
Gint      *err_ind,        /* OUT error indicator     */
Gint_list *def_colr_inds,    /* OUT list of defined colour indices */
Gint      *num_elems_impl_list /* OUT length of impl. list */
extern void ginq_colr_rep(
Gint      ws_id,            /* workstation identifier   */
Gint      colr_ind,        /* colour index            */
Ginq_type type,            /* type of returned values */
Gint      *err_ind,        /* OUT error indicator     */
Gcolr_rep *colr_rep       /* OUT colour representation */);
extern void ginq_list_view_inds(
Gint      ws_id,            /* workstation identifier   */
Gint      num_elems_appl_list, /* length of application list */
Gint      start_ind,        /* starting index          */
Gint      *err_ind,        /* OUT error indicator     */
Gint_list *def_view_inds,    /* OUT list of defined view indices */
Gint      *num_elems_impl_list /* OUT length of impl. list */
extern void ginq_view_rep3(
Gint      ws_id,            /* workstation identifier   */
Gint      view_ind,        /* view index              */
Gint      *err_ind,        /* OUT error indicator     */
Gupd_st   *view_upd_st,    /* OUT viewing transformation update state */
Gview_rep3 *req_view,      /* OUT requested view representation */
Gview_rep3 *cur_view       /* OUT current view representation */);
extern void ginq_hlhrs_mode(
Gint      ws_id,            /* workstation identifier   */
Gint      *err_ind,        /* OUT error indicator     */
Gupd_st   *hlhrs_upd_st,   /* OUT HLHSR update state   */
Gint      *req_mode,       /* OUT requested HLHSR mode */
Gint      *cur_mode        /* OUT current HLHSR mode   */);
extern void ginq_ws_tran3(
Gint      ws_id,            /* workstation identifier   */
Gint      *err_ind,        /* OUT error indicator     */
Gupd_st   *ws_tran_upd_st, /* OUT workstation transformation update state */

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    Glimit3  *req_ws_win,      /* OUT requested workstation window */
    Glimit3  *cur_ws_win,      /* OUT current workstation window */
    Glimit3  *req_ws_vp,      /* OUT requested workstation viewport */
    Glimit3  *cur_ws_vp       /* OUT current workstation viewport */);
extern void ginq_ws_tran(
    Gint     ws_id,           /* workstation identifier */
    Gint     *err_ind,        /* OUT error indicator */
    Gupd_st  *ws_tran_upd_st, /* OUT workstation transformation
                               update state */
    Glimit   *req_ws_win,     /* OUT requested workstation window */
    Glimit   *cur_ws_win,     /* OUT current workstation window */
    Glimit   *req_ws_vp,     /* OUT requested workstation viewport */
    Glimit   *cur_ws_vp      /* OUT current workstation viewport */);
extern void ginq_set_seg_names_ws(
    Gint     ws_id,           /* workstation identifier */
    Gint     num_elems_appl_list, /* length of application list */
    Gint     start_ind,       /* starting index */
    Gint     *err_ind,        /* OUT error indicator */
    Gint_list *seg_names,     /* OUT list of segment names */
    Gint     *num_elems_impl_list /* OUT length of impl. list */);
extern void ginq_loc_st3(
    Gint     ws_id,           /* workstation identifier */
    Gint     loc_num,         /* locator device number */
    Ginq_type type,           /* type of returned values */
    Gstore   store,          /* handle to Store object */
    Gint     *err_ind,        /* OUT error indicator */
    Gop_mode *mode,          /* OUT operating mode */
    Gecho_switch *esw,       /* OUT echo switch */
    Gint     *init_norm_tran_num, /* OUT initial normalization
                               transformation number */
    Gint     *init_view_ind,   /* OUT initial view index */
    Gpoint3  *init_loc_pos,    /* OUT initial locator position */
    Gint     *pet,            /* OUT prompt/echo type */
    Glimit3  *echo_vol,       /* OUT echo volume */
    Gloc_data3 **loc_data     /* OUT locator data record */);
extern void ginq_loc_st(
    Gint     ws_id,           /* workstation identifier */
    Gint     loc_num,         /* locator device number */
    Ginq_type type,           /* type of returned values */
    Gstore   store,          /* handle to Store object */
    Gint     *err_ind,        /* OUT error indicator */
    Gop_mode *mode,          /* OUT operating mode */
    Gecho_switch *esw,       /* OUT echo switch */
    Gint     *init_norm_tran_num, /* OUT initial normalization
                               transformation number */
    Gpoint   *init_loc_pos,   /* OUT initial locator position */
    Gint     *pet,            /* OUT prompt/echo type */
    Glimit   *echo_area,     /* OUT echo area */
    Gloc_data **loc_data     /* OUT locator data record */);
extern void ginq_stroke_st3(
    Gint     ws_id,           /* workstation identifier */
    Gint     stroke_num,      /* stroke device number */

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Ginq_type      type,          /* type of returned values */
Gstore         store,        /* handle to Store object */
Gint           *err_ind,     /* OUT error indicator */
Gop_mode       *mode,        /* OUT operating mode */
Gecho_switch   *esw,         /* OUT echo switch */
Gint           *init_norm_tran_num, /* OUT initial normalization
                                transformation number */
Gint           *init_view_ind, /* OUT initial view index */
Gpoint_list3   **init_stroke, /* OUT initial stroke */
Gint           *pet,         /* OUT prompt/echo type */
Glimit3        *echo_vol,    /* OUT echo volume */
Gstroke_data3  **stroke_data /* OUT stroke data record */);

extern void ginq_stroke_st(
Gint           ws_id,        /* workstation identifier */
Gint           stroke_num,   /* stroke device number */
Ginq_type      type,          /* type of returned values */
Gstore         store,        /* handle to Store object */
Gint           *err_ind,     /* OUT error indicator */
Gop_mode       *mode,        /* OUT operating mode */
Gecho_switch   *esw,         /* OUT echo switch */
Gint           *init_norm_tran_num, /* OUT initial normalization
                                transformation number */
Gpoint_list    **init_stroke, /* OUT initial stroke */
Gint           *pet,         /* OUT prompt/echo type */
Glimit         *echo_area,   /* OUT echo area */
Gstroke_data   **stroke_data /* OUT stroke data record */);

extern void ginq_val_st3(
Gint           ws_id,        /* workstation identifier */
Gint           val_num,     /* valuator device number */
Gstore         store,        /* handle to Store object */
Gint           *err_ind,     /* OUT error indicator */
Gop_mode       *mode,        /* OUT operating mode */
Gecho_switch   *esw,         /* OUT echo switch */
Gfloat         *init_value,  /* OUT initial value */
Gint           *pet,         /* OUT prompt/echo type */
Glimit3        *echo_vol,    /* OUT echo volume */
Gval_data3     **val_data    /* OUT valuator data record */);

extern void ginq_val_st(
Gint           ws_id,        /* workstation identifier */
Gint           val_num,     /* valuator device number */
Gstore         store,        /* handle to Store object */
Gint           *err_ind,     /* OUT error indicator */
Gop_mode       *mode,        /* OUT operating mode */
Gecho_switch   *esw,         /* OUT echo switch */
Gfloat         *init_value,  /* OUT initial value */
Gint           *pet,         /* OUT prompt/echo type */
Glimit         *echo_area,   /* OUT echo area */
Gval_data      **val_data    /* OUT valuator data record */);

extern void ginq_choice_st3(
Gint           ws_id,        /* workstation identifier */
Gint           choice_num,   /* choice device number */
Gstore         store,        /* handle to Store object */

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Gint          *err_ind,          /* OUT error indicator      */
Gop_mode      *mode,            /* OUT operating mode       */
Gecho_switch  *esw,            /* OUT echo switch          */
Gin_status    *init_status,     /* OUT initial choice status */
Gint          *init_choice,     /* OUT initial choice       */
Gint          *pet,             /* OUT prompt/echo type     */
Glimit3       *echo_vol,       /* OUT echo volume          */
Gchoice_data3 **choice_data    /* OUT choice data record   */
extern void ginq_choice_st(
  Gint          ws_id,          /* workstation identifier    */
  Gint          choice_num,     /* choice device number     */
  Gstore        store,         /* handle to Store object   */
  Gint          *err_ind,      /* OUT error indicator      */
  Gop_mode      *mode,        /* OUT operating mode       */
  Gecho_switch  *esw,        /* OUT echo switch          */
  Gin_status    *init_status,  /* OUT initial choice status */
  Gint          *init_choice,  /* OUT initial choice       */
  Gint          *pet,         /* OUT prompt/echo type     */
  Glimit        *echo_area,    /* OUT echo area            */
  Gchoice_data3 **choice_data /* OUT choice data record   */
);
extern void ginq_pick_st3(
  Gint          ws_id,          /* workstation identifier    */
  Gint          pick_num,      /* pick device number       */
  Ginq_type     type,          /* type of returned values  */
  Gstore        store,         /* handle to Store object   */
  Gint          *err_ind,      /* OUT error indicator      */
  Gop_mode      *mode,        /* OUT operating mode       */
  Gecho_switch  *esw,        /* OUT echo switch          */
  Gin_status    *init_status,  /* OUT initial pick status  */
  Gpick         *init_pick,    /* OUT initial pick value   */
  Gint          *pet,         /* OUT prompt/echo type     */
  Glimit3       *echo_vol,     /* OUT echo volume          */
  Gpick_data3   **pick_data    /* OUT pick data record     */
);
extern void ginq_pick_st(
  Gint          ws_id,          /* workstation identifier    */
  Gint          pick_num,      /* pick device number       */
  Ginq_type     type,          /* type of returned values  */
  Gstore        store,         /* handle to Store object   */
  Gint          *err_ind,      /* OUT error indicator      */
  Gop_mode      *mode,        /* OUT operating mode       */
  Gecho_switch  *esw,        /* OUT echo switch          */
  Gin_status    *init_status,  /* OUT initial pick status  */
  Gpick         *init_pick,    /* OUT initial pick value   */
  Gint          *pet,         /* OUT prompt/echo type     */
  Glimit        *echo_area,    /* OUT echo area            */
  Gpick_data3   **pick_data    /* OUT pick data record     */
);
extern void ginq_string_st3(
  Gint          ws_id,          /* workstation identifier    */
  Gint          string_num,    /* string device number     */
  Gstore        store,         /* handle to Store object   */
  Gint          *err_ind,      /* OUT error indicator      */
  Gop_mode      *mode,        /* OUT operating mode       */

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    Gecho_switch    *esw,           /* OUT echo switch          */
    char            **init_string,  /* OUT initial string       */
    Gint            *pet,           /* OUT prompt/echo type     */
    Glimit3         *echo_vol,     /* OUT echo volume          */
    Gstring_data3   **string_data   /* OUT string data record   */
extern void ginq_string_st(
    Gint            ws_id,         /* workstation identifier    */
    Gint            string_num,    /* string device number     */
    Gstore          store,        /* handle to Store object   */
    Gint            *err_ind,     /* OUT error indicator       */
    Gop_mode        *mode,        /* OUT operating mode       */
    Gecho_switch    *esw,         /* OUT echo switch          */
    char            **init_string, /* OUT intial string        */
    Gint            *pet,         /* OUT prompt/echo type     */
    Glimit          *echo_area,   /* OUT echo area            */
    Gstring_data    **string_data /* OUT string data record   */
extern void ginq_ws_cat(
    Gint            ws_type,      /* workstation type         */
    Gint            *err_ind,     /* OUT error indicator      */
    Gws_cat         *cat         /* OUT workstation category */
extern void ginq_ws_class(
    Gint            ws_type,      /* workstation type         */
    Gint            *err_ind,     /* OUT error indicator      */
    Gws_class       *class       /* OUT workstation class    */
extern void ginq_disp_space_size3(
    Gint            ws_type,      /* workstation type         */
    Gint            *err_ind,     /* OUT error indicator      */
    Gdisp_space_size3 *disp_size /* OUT display [space] size */
extern void ginq_disp_space_size(
    Gint            ws_type,      /* workstation type         */
    Gint            *err_ind,     /* OUT error indicator      */
    Gdisp_space_size *disp_size /* OUT display [space] size */
extern void ginq_dyn_mod_ws_attr3(
    Gint            ws_type,      /* workstation type         */
    Gint            *err_ind,     /* OUT error indicator      */
    Gdyn_mod_ws_attr3 *dyn_mod /* OUT dynamic modification of
                               workstation attributes */
extern void ginq_dyn_mod_ws_attr(
    Gint            ws_type,      /* workstation type         */
    Gint            *err_ind,     /* OUT error indicator      */
    Gdyn_mod_ws_attr *dyn_mod /* OUT dynamic modification of
                               workstation attributes */
extern void ginq_def_defer_sts(
    Gint            ws_type,      /* workstation type         */
    Gint            *err_ind,     /* OUT error indicator      */
    Gdefer_mode     *defer_mode, /* OUT default deferral mode */
    Girg_mode       *irg_mode    /* OUT default impl. reg. mode */
extern void ginq_line_fac3(
    Gint            ws_type,      /* workstation type         */
    Gint            num_elems_appl_list, /* length of application list */
    Gint            start_ind,    /* starting index           */
    Gint            *err_ind,     /* OUT error indicator      */

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    Gline_fac  *line_fac,          /* OUT polyline facilities */
    Gint       *num_elems_impl_list /* OUT length of linetype
                                   list in impl. */);

extern void ginq_pred_line_rep(
    Gint       ws_type,          /* workstation type */
    Gint       ind,              /* predefined index */
    Gint       *err_ind,        /* OUT error indicator */
    Gline_bundle *line_rep      /* OUT predefined polyline rep. */);

extern void ginq_marker_fac(
    Gint       ws_type,          /* workstation type */
    Gint       num_elems_appl_list, /* length of application list */
    Gint       start_ind,        /* starting index */
    Gint       *err_ind,        /* OUT error indicator */
    Gmarker_fac *marker_fac,     /* OUT polymarker facilities */
    Gint       *num_elems_impl_list /* OUT length of marker type
                                   list in impl. */);

extern void ginq_pred_marker_rep(
    Gint       ws_type,          /* workstation type */
    Gint       ind,              /* predefined index */
    Gint       *err_ind,        /* OUT error indicator */
    Gmarker_bundle *marker_rep  /* OUT predefined polymarker rep. */);

extern void ginq_text_fac(
    Gint       ws_type,          /* workstation type */
    Gint       num_elems_appl_list, /* length of application list */
    Gint       start_ind,        /* starting index */
    Gint       *err_ind,        /* OUT error indicator */
    Gtext_fac  *text_fac,       /* OUT text facilities */
    Gint       *num_elems_impl_list /* OUT length of text font
                                   and precision list in impl. */);

extern void ginq_pred_text_rep(
    Gint       ws_type,          /* workstation type */
    Gint       ind,              /* predefined index */
    Gint       *err_ind,        /* OUT error indicator */
    Gtext_bundle *text_rep      /* OUT predefined text rep. */);

extern void ginq_fill_fac(
    Gint       ws_type,          /* workstation type */
    Gint       num_elems_appl_list, /* length of application list */
    Gint       start_ind,        /* starting index */
    Gint       *err_ind,        /* OUT error indicator */
    Gfill_fac  *fill_fac,       /* OUT fill area facilities */
    Gint       *num_elems_impl_list /* OUT length of hatch list */);

extern void ginq_pred_fill_rep(
    Gint       ws_type,          /* workstation type */
    Gint       ind,              /* predefined index */
    Gint       *err_ind,        /* OUT error indicator */
    Gfill_bundle *fill_rep      /* OUT predefined fill area rep. */);

extern void ginq_pat_fac(
    Gint       ws_type,          /* workstation type */
    Gint       *err_ind,        /* OUT error indicator */
    Gint       *num_pred_inds    /* OUT num. of predef. pattern indices */);

extern void ginq_pred_pat_rep(
    Gint       ws_type,          /* workstation type */

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Gint      ind,          /* predefined index          */
Gstore    store,       /* handle to Store object   */
Gint      *err_ind,    /* OUT error indicator      */
Gpat_rep  **pat_rep    /* OUT predefined pattern rep. */);
extern void ginq_edge_facs(
  Gint      ws_type,    /* workstation type        */
  Gint      num_elems_appl_list, /* length of application list */
  Gint      start_ind, /* starting index          */
  Gint      *err_ind,  /* OUT error indicator      */
  Gedge_facs *edge_facs, /* OUT edge facilities     */
  Gint      *num_elems_impl_list /* OUT length of edgetype
                                list in impl.          */);
extern void ginq_pred_edge_rep(
  Gint      ws_type,    /* workstation type        */
  Gint      ind,        /* predefined index         */
  Gint      *err_ind,  /* OUT error indicator      */
  Gedge_bundle *edge_rep /* OUT predefined edge rep. */);
extern void ginq_colr_model_facs(
  Gint      ws_type,    /* workstation type        */
  Gint      num_elems_appl_list, /* length of application list */
  Gint      start_ind, /* starting index          */
  Gint      *err_ind,  /* OUT error indicator      */
  Gint_list *models,   /* OUT list of colour models */
  Gint      *num_elems_impl_list /* OUT length of impl. list */);
extern void ginq_colr_facs(
  Gint      ws_type,    /* workstation type        */
  Gint      *err_ind,  /* OUT error indicator      */
  Gcolr_facs *colr_facs /* OUT colour facilities   */);
extern void ginq_pred_colr_rep(
  Gint      ws_type,    /* workstation type        */
  Gint      ind,        /* predefined index         */
  Gint      *err_ind,  /* OUT error indicator      */
  Gcolr_rep *colr_rep /* OUT predefined colour rep. */);
extern void ginq_view_facs(
  Gint      ws_type,    /* workstation type        */
  Gint      *err_ind,  /* OUT error indicator      */
  Gint      *num_pred_inds /* OUT num. of predef. view indices */);
extern void ginq_pred_view_rep(
  Gint      ws_type,    /* workstation type        */
  Gint      view_ind,  /* predefined view index    */
  Gint      *err_ind,  /* OUT error indicator      */
  Gview_rep3 *view_rep /* OUT predefined view rep. */);
extern void ginq_hlhr_id_facs(
  Gint      ws_type,    /* workstation type        */
  Gint      num_elems_appl_list, /* length of application list */
  Gint      start_ind, /* starting index          */
  Gint      *err_ind,  /* OUT error indicator      */
  Gint_list *hlhr_id, /* OUT list of HLHR ids    */
  Gint      *num_elems_impl_list /* OUT length of impl. list */);
extern void ginq_hlhr_mode_facs(
  Gint      ws_type,    /* workstation type        */
  Gint      num_elems_appl_list, /* length of application list */

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    Gint      start_ind,          /* starting index          */
    Gint      *err_ind,          /* OUT error indicator     */
    Gint_list *hlhsr_mode,      /* OUT list of HLHSR modes */
    Gint      *num_elems_impl_list /* OUT length of impl. list */
extern void ginq_list_avail_gdps3(
    Gint      ws_type,          /* workstation type        */
    Gint      num_elems_appl_list, /* length of application list */
    Gint      start_ind,          /* starting index          */
    Gint      *err_ind,          /* OUT error indicator     */
    Gint_list *gdp3,           /* OUT list of GDP3s      */
    Gint      *num_elems_impl_list /* OUT length of impl. list */
extern void ginq_list_avail_gdps(
    Gint      ws_type,          /* workstation type        */
    Gint      num_elems_appl_list, /* length of application list */
    Gint      start_ind,          /* starting index          */
    Gint      *err_ind,          /* OUT error indicator     */
    Gint_list *gdp,           /* OUT list of GDPs       */
    Gint      *num_elems_impl_list /* OUT length of impl. list */
extern void ginq_gdp3(
    Gint      ws_type,          /* workstation type        */
    Gint      gdp,             /* GDP function number     */
    Gint      *err_ind,          /* OUT error indicator     */
    Gint      *num_attr,        /* OUT num. of attributes used */
    Gattrs    attr[5]          /* OUT list of attributes used */
extern void ginq_gdp(
    Gint      ws_type,          /* workstation type        */
    Gint      gdp,             /* GDP function number     */
    Gint      *err_ind,          /* OUT error indicator     */
    Gint      *num_attr,        /* OUT num. of attributes used */
    Gattrs    attr[4]          /* OUT list of attributes used */
extern void ginq_max_ws_st_tables3(
    Gint      ws_type,          /* workstation type        */
    Gint      *err_ind,          /* OUT error indicator     */
    Gmax_ws_st_tables3 *lengths /* OUT lengths of workstation tables */
extern void ginq_max_ws_st_tables(
    Gint      ws_type,          /* workstation type        */
    Gint      *err_ind,          /* OUT error indicator     */
    Gmax_ws_st_tables *lengths /* OUT lengths of workstation tables */
extern void ginq_num_seg_pris(
    Gint      ws_type,          /* workstation type        */
    Gint      *err_ind,          /* OUT error indicator     */
    Gint      *num_seg_pris /* OUT num. of segment priorities */
extern void ginq_dyn_mod_seg_attrs(
    Gint      ws_type,          /* workstation type        */
    Gint      *err_ind,          /* OUT error indicator     */
    Gdyn_mod_seg_attrs *dyn_mod /* OUT dynamic modification of
                                segment attributess */
extern void ginq_num_avail_in(
    Gint      ws_type,          /* workstation type        */
    Gint      *err_ind,          /* OUT error indicator     */
    Gnum_in   *num_in          /* OUT num. of input devices */
extern void ginq_def_loc_data3(

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Gint      ws_type,      /* workstation type          */
Gint      loc_num,     /* logical input device number */
Gstore    store,       /* handle to Store object    */
Gint      *err_ind,    /* OUT error indicator       */
Gpoint3   *loc_pos,    /* OUT default initial position */
Gint_list **pet_list,  /* OUT list of prompt and echo types */
Glimit3   *echo_vol,   /* OUT default echo volume   */
Gloc_data3 **loc_data /* OUT default data record   */);

extern void ginq_def_loc_data(
Gint      ws_type,     /* workstation type          */
Gint      loc_num,     /* logical input device number */
Gstore    store,       /* handle to Store object    */
Gint      *err_ind,    /* OUT error indicator       */
Gpoint    *loc_pos,    /* OUT default locator position */
Gint_list **pet_list,  /* OUT list of prompt and echo types */
Glimit    *echo_area, /* OUT default echo area     */
Gloc_data **loc_data  /* OUT default data record   */);

extern void ginq_def_stroke_data3(
Gint      ws_type,     /* workstation type          */
Gint      stroke_num,  /* logical input device number */
Gstore    store,       /* handle to Store object    */
Gint      *err_ind,    /* OUT error indicator       */
Gint      *max_buf_size, /* OUT max. input buffer size
                        (nr. of points)          */
Gint_list **pet_list,  /* OUT list of prompt and echo types */
Glimit3   *echo_vol,   /* OUT default echo volume   */
Gstroke_data3 **stroke_data /* OUT default data record   */);

extern void ginq_def_stroke_data(
Gint      ws_type,     /* workstation type          */
Gint      stroke_num,  /* logical input device number */
Gstore    store,       /* handle to Store object    */
Gint      *err_ind,    /* OUT error indicator       */
Gint      *max_buf_size, /* OUT max. input buffer size
                        (nr. of points)          */
Gint_list **pet_list,  /* OUT list of prompt and echo types */
Glimit    *echo_area, /* OUT default echo area     */
Gstroke_data **stroke_data /* OUT default data record   */);

extern void ginq_def_val_data3(
Gint      ws_type,     /* workstation type          */
Gint      val_num,     /* logical input device number */
Gstore    store,       /* handle to Store object    */
Gint      *err_ind,    /* OUT error indicator       */
Gfloat    *def_val,    /* OUT default initial value   */
Gint_list **pet_list,  /* OUT list of prompt and echo types */
Glimit3   *echo_vol,   /* OUT default echo volume   */
Gval_data3 **val_data /* OUT default data record   */);

extern void ginq_def_val_data(
Gint      ws_type,     /* workstation type          */
Gint      val_num,     /* logical input device number */
Gstore    store,       /* handle to Store object    */
Gint      *err_ind,    /* OUT error indicator       */
Gfloat    *def_val,    /* OUT default initial value   */

```

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```

    Gint_list  **pet_list,    /* OUT list of prompt and echo types */
    Glimit     *echo_area,    /* OUT default echo area             */
    Gval_data  **val_data     /* OUT default data record           */);
extern void ginq_def_choice_data3(
    Gint       ws_type,      /* workstation type                   */
    Gint       choice_num,   /* logical input device number        */
    Gstore     store,        /* handle to Store object             */
    Gint       *err_ind,     /* OUT error indicator                */
    Gint       *max_num_choices, /* OUT max. num. of choices          */
    Gint_list  **pet_list,   /* OUT list of prompt and echo types */
    Glimit3    *echo_vol,    /* OUT default echo volume            */
    Gchoice_data3 **choice_data /* OUT default data record          */);
extern void ginq_def_choice_data(
    Gint       ws_type,      /* workstation type                   */
    Gint       choice_num,   /* logical input device number        */
    Gstore     store,        /* handle to Store object             */
    Gint       *err_ind,     /* OUT error indicator                */
    Gint       *max_num_choices, /* OUT max. num. of choices          */
    Gint_list  **pet_list,   /* OUT list of prompt and echo types */
    Glimit     *echo_area,   /* OUT default echo area             */
    Gchoice_data **choice_data /* OUT default data record          */);
extern void ginq_def_pick_data3(
    Gint       ws_type,      /* workstation type                   */
    Gint       pick_num,     /* logical input device number        */
    Gstore     store,        /* handle to Store object             */
    Gint       *err_ind,     /* OUT error indicator                */
    Gint_list  **pet_list,   /* OUT list of prompt and echo types */
    Glimit3    *echo_vol,    /* OUT default echo volume            */
    Gpick_data3 **pick_data  /* OUT default data record           */);
extern void ginq_def_pick_data(
    Gint       ws_type,      /* workstation type                   */
    Gint       pick_num,     /* logical input device number        */
    Gstore     store,        /* handle to Store object             */
    Gint       *err_ind,     /* OUT error indicator                */
    Gint_list  **pet_list,   /* OUT list of prompt and echo types */
    Glimit     *echo_area,   /* OUT default echo area             */
    Gpick_data **pick_data  /* OUT default data record           */);
extern void ginq_def_string_data3(
    Gint       ws_type,      /* workstation type                   */
    Gint       string_num,   /* logical input device number        */
    Gstore     store,        /* handle to Store object             */
    Gint       *err_ind,     /* OUT error indicator                */
    Gint       *max_buf_size, /* OUT max. input buffer size        */
                                (nr. of bytes)
    Gint_list  **pet_list,   /* OUT list of prompt and echo types */
    Glimit3    *echo_vol,    /* OUT default echo volume            */
    Gstring_data3 **string_data /* OUT default data record          */);
extern void ginq_def_string_data(
    Gint       ws_type,      /* workstation type                   */
    Gint       string_num,   /* logical input device number        */
    Gstore     store,        /* handle to Store object             */
    Gint       *err_ind,     /* OUT error indicator                */

```

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```

    Gint          *max_buf_size,      /* OUT max. input buffer size
                                      (nr. of bytes)                      */
    Gint_list     **pet_list,         /* OUT list of prompt and echo types */
    Glimit        *echo_area,         /* OUT default echo area             */
    Gstring_data  **string_data      /* OUT default data record           */
extern void ginq_set_assoc_wss(
    Gint          seg_name,           /* segment name                       */
    Gint          num_elems_appl_list, /* length of application list         */
    Gint          start_ind,          /* starting index                     */
    Gint          *err_ind,           /* OUT error indicator                */
    Gint_list     *ws,                /* OUT list of workstations           */
    Gint          *num_elems_impl_list /* OUT length of impl. list          */
extern void ginq_seg_attrs3(
    Gint          seg_name,           /* segment name                       */
    Gint          *err_ind,           /* OUT error indicator                */
    Gseg_attrs3   *seg_attr          /* OUT segment attribute structure    */
extern void ginq_seg_attrs(
    Gint          seg_name,           /* segment name                       */
    Gint          *err_ind,           /* OUT error indicator                */
    Gseg_attrs    *seg_attr          /* OUT segment attribute structure    */
extern void ginq_pixel_array_dims(
    Gint          ws_id,              /* workstation identifier              */
    const Grect   *rect,              /* rectangle                           */
    Gint          *err_ind,           /* OUT error indicator                */
    Gint_size     *dims               /* OUT pixel array dimensions         */
extern void ginq_pixel_array(
    Gint          ws_id,              /* workstation identifier              */
    const Gpoint  *pixel_loc,         /* pixel location                     */
    const Gint_size *dims,            /* pixel array dimensions             */
    Gint          *err_ind,           /* OUT error indicator                */
    Gpres_inval   *pres_inval,        /* OUT presence of invalid values     */
    Gint          *pixel_array        /* OUT colour index array             */
extern void ginq_pixel(
    Gint          ws_id,              /* workstation identifier              */
    const Gpoint  *pixel_loc,         /* pixel location                     */
    Gint          *err_ind,           /* OUT error indicator                */
    Gint          *colr_ind           /* OUT colour index                   */
extern void ginq_in_overf(
    Gint          *err_ind,           /* OUT error indicator                */
    Gint          *ws_id,             /* OUT workstation identifier         */
    Gint_class    *in_class,          /* OUT input class                    */
    Gint          *in_num             /* OUT logical input device number    */
/*
 *      A.4.9 Utility Functions
 */
extern void geval_view_ori_matrix3(
    const Gpoint3  *view_ref_point,   /* view reference point               */
    const Gvec3    *view_norm,        /* view plane normal                  */
    const Gvec3    *view_up_vec,      /* view up vector                     */
    Gcoord_switch  coord_switch,      /* coordinate switch                  */
    Gint           *err_ind,           /* OUT error indicator                */
    Gmatrix3       view_ori_matrix    /* OUT view orientation matrix        */

```

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```

extern void geval_view_map_matrix3(
    const Gview_map3 *map,          /* view mapping */
    Gint *err_ind,                 /* OUT error indicator */
    Gmatrix3 view_map_matrix /* OUT view mapping matrix */);

extern void geval_tran_matrix3(
    const Gpoint3 *point,          /* fixed point */
    const Gvec3 *shift,           /* shift vector */
    Gfloat x_angle,               /* rotation angle X */
    Gfloat y_angle,               /* rotation angle Y */
    Gfloat z_angle,               /* rotation angle Z */
    const Gvec3 *scale,           /* scale factors */
    Gcoord_switch coord_switch,   /* coordinate switch */
    Gtran_matrix3 tran_matrix /* OUT transformation matrix */);

extern void geval_tran_matrix(
    const Gpoint *point,          /* fixed point */
    const Gvec *shift,           /* shift vector */
    Gfloat angle,                 /* rotation angle */
    const Gvec *scale,           /* scale factors */
    Gcoord_switch coord_switch,   /* coordinate switch */
    Gtran_matrix tran_matrix /* OUT transformation matrix */);

extern void gaccum_tran_matrix3(
    Gtran_matrix3 matrix,        /* transformation matrix */
    const Gpoint3 *point,        /* fixed point */
    const Gvec3 *shift,          /* shift vector */
    Gfloat x_angle,              /* rotation angle X */
    Gfloat y_angle,              /* rotation angle Y */
    Gfloat z_angle,              /* rotation angle Z */
    const Gvec3 *scale,          /* scale factors */
    Gcoord_switch coord_switch,   /* coordinate switch */
    Gtran_matrix3 tran_matrix /* OUT transformation matrix */);

extern void gaccum_tran_matrix(
    Gtran_matrix matrix,         /* transformation matrix */
    const Gpoint *point,        /* fixed point */
    const Gvec *shift,          /* shift vector */
    Gfloat angle,                /* rotation angle */
    const Gvec *scale,          /* scale factors */
    Gcoord_switch coord_switch,   /* coordinate switch */
    Gtran_matrix tran_matrix /* OUT transformation matrix */);

extern void gset_err_hand(
    const void (*new_hand)(Gint , Gint , const char *),
    /* the application's error handling address */
    void (**old_hand)(Gint , Gint , const char *)
    /* OUT address of the error handling replaced */);

extern void gcreate_store(
    Gint *err_ind,               /* OUT error indicator */
    Gstore *store                /* OUT pointer to allocated storage */);

extern void gdel_store(
    Gint *err_ind,               /* OUT error indicator */
    Gstore *store                /* IN/OUT storage to be deleted */);

/*
 *      A.4.10 Error Handling Functions
 */

```

```
extern void gemergency_close_gks(
    void);
extern void gerr_hand(
    Gint      err_num,      /* error number */
    Gint      func_num,    /* number of function that detected the error */
    const char *err_file   /* name of error file */
);
extern void gerr_log(
    Gint      err_num,      /* error number */
    Gint      func_num,    /* number of function that detected the error */
    const char *err_file   /* name of error file */
);
```

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Annex B (informative)

Sample Programs

B.1 STAR Program

```

/*      Program:      STAR
*      File:         star.c           Version 4.4
*      Date:        6/11/91         16:35:11
*
*      Description
*
*      This program draws a yellow star on a blue background and writes
*      The title "STAR" in white under the star.
*
*      Conformance
*
*      GKS-3D level 0a
*/

/*
*      Include files
*/
#include "gks.h" /* GKS-3D definitions */
/*
*      Local definitions (implementation and site dependent)
*/
#define GKS_ERR      "gks.err"      /* Name of the GKS-3D error file */
#define DEF_BUF      GDEF_MEM_SIZE /* Let GKS-3D choose buffer size */
#define CONN_ID      "mo_star"     /* Connection identifier */
#define WS_TYPE      (19)          /* Workstation type */
/*
*      Convenient definitions
*/
#define MY_WS        (1)           /* The workstation we'll be using */
#define TRAN_NUM     (1)           /* Normalization transformation number */
#define BLUE         (0)           /* Some colours we define below */
#define YELLOW       (1)
#define WHITE        (2)
#define PI           ((double) 3.14159265) /* The well-known number */
#define LARGE_TEXT   ((Gfloat) 0.15) /* Size of large characters */

/*
*      State Variables:
*
*      These variables are used to set the
*      corresponding GKS-3D state
*/

static Gasfs      asf = { /* Aspect Source Flags */

```

Annex B

STAR Program

```

    GASF_INDIV, GASF_INDIV, GASF_INDIV,
    GASF_INDIV, GASF_INDIV, GASF_INDIV,
    GASF_INDIV, GASF_INDIV, GASF_INDIV, GASF_INDIV,
    GASF_INDIV, GASF_INDIV, GASF_INDIV};

static Glimit      win = {      /* Window Limits */
    -1.25, 1.25, -1.25, 1.25};

Gcolr_rep          colr[3] ;    /* Colour Table */

static Gtext_align ct_half = {  /* Text Alignment */
    GHOR_CTR, GVERT_HALF};

static Gpoint      title_pos =  /* Position for title */
    {0.0, -1.1};

static char        title[] = "STAR";      /* Title text */

/* Main entry point */
int main()
{
    Gpoint_list    star;          /* Points of the star */
    double angle; /* Current angle */
    double sin(), cos();         /* the trigonometric functions */
    Gpoint *starptr;            /* Star point pointer */
    Gint colr_ind; /* Colour index */
    Gcolr_rep *colrptr;         /* Colour representation pointer */
    Gint i;

/*
 *   colours are set
 *
 *   colr[0] = blue;
 *   colr[1] = yellow;
 *   colr[2] = white;
 */

    for (i=0; i<3; i++){
        colr[i].rgb.red = 1.0;
        colr[i].rgb.green = 1.0;
        colr[i].rgb.blue = 1.0;
    }
    colr[0].rgb.red = colr[0].rgb.green = colr[1].rgb.blue = 0.0;

/*
 *   Define the coordinates of star
 */

    star.num_points = 5;
    star.points = (Gpoint *)calloc(5, sizeof(Gpoint));
    for (starptr = star.points, angle = 0.0;
        angle < (4.*PI); angle += 0.8*PI, starptr ++) {

```

STAR Program

Annex B

```

        starptr->x = (Gfloat)sin(angle);
        starptr->y = (Gfloat)cos(angle);
    }
/*
 *   Open GKS-3D and open/ and activate the workstation
 */
    gopen_gks(GKS_ERR,DEF_BUF);
    gset_asfs(&asf);
    gopen_ws(MY_WS, (void *)CONN_ID,WS_TYPE);
    gactivate_ws(MY_WS);

/*
 *   Centre the window about the origin
 */
    gset_win(TRAN_NUM,&win);
    gsel_norm_tran(TRAN_NUM);

/*
 *   Define the colours used
 */
    for (colr_ind=0, colrptr = colr; colr_ind<3; colr_ind++, colrptr++){
        gset_colr_rep(MY_WS,colr_ind,colrptr);
    }

/*
 *   Fill the star with solid yellow
 */
    gset_fill_int_style(GSTYLE_SOLID);
    gset_fill_colr_ind(YELLOW);

/*
 *   Draw the star
 */
    gfill_area(&star);

/*
 *   Select large characters centred under the star
 */
    gset_char_ht(LARGE_TEXT);
    gset_text_align(&ct_half);
    gset_text_colr_ind(WHITE);

/*
 *   Draw the title
 */
    gtext(&title_pos, title);

/*
 *   Close everything
 */
    gdeactivate_ws(MY_WS);
    gclose_ws(MY_WS);
    gclose_gks();
    exit(GE_NO_ERR);
}

```

Annex B

IRON Program

B.2 IRON Program

```

/*      Program:      IRON
*
*      File:         iron.c          Version 4.6
*      Date:         9/5/91         16:03:48
*
*      Description
*
*      This program draws a horizontal bar chart illustrating costs
*      within the iron industry. The user can select the data to be
*      displayed using a GKS-3D choice device. The plot is adapted from
*      Scientific America, May 1984, page 139.
*
*      Conformance
*
*      GKS-3D level 0b
*
*      Choice devices shall support prompt and echo type 3;
*/
/*
*      Include files
*/
#include "gks.h"                /* GKS-3D definitions */

/*
*      Local definitions (implementation and site dependent)
*/
#define GKS_ERR      "gks.err"    /* Name of the GKS-3D error file */
#define DEF_BUF      GDEF_MEM_SIZE /* Let GKS-3D choose buffer size */
#define CONN_ID      "/tmp/tty"   /* Connection identifier */
#define WS_TYPE      (20)         /* Workstation type */
/*
*      Convenient definitions
*/
#define MY_WS        (1)          /* The workstation we'll be using */
#define TRAN_NUM     (1)          /* Normalization transformation number */
#define DEF_BUF      GDEF_MEM_SIZE /* let GKS-3D choose buffer size */
#define CHOICE_DEV   (1)          /* the choice device number */
#define CHOICE_PET   (3)          /* the choice prompt/echo type */
#define GREEN        (1)
#define RED          (2)

#define NUM_COUNTRIES (3)
#define NUM_DATA      (6)
typedef struct {
    char      *name;
    Gfloat    data[2][NUM_DATA];
} Data_set;

void bar( Gfloat length, Gfloat pos);
void ticks( Gfloat tstart, Gfloat tend,

```

IRON Program

Annex B

```

        const Gtext_align      *alignment);
void border( const char      *nation);
void draw( const Data_set    *nation);

Data_set data_base[] = {
    {"United States",
     {{69.0, 50.0, 15.0, 53.0, 57.0, 150.0},
      {72.0, 50.0, 103.0, 0.0, 0.0, 56.0}}
    },
    {"West Germany",
     {{65.0, 42.0, 3.0, 89.0, 52.0, 93.0},
      {70.0, 53.0, 102.0, 0.0, 0.0, 49.0}}
    },
    {"Japan",
     {{65.0, 47.0, 2.0, 60.0, 52.0, 55.0},
      {70.0, 57.0, 105.0, 0.0, 0.0, 41.0}}
    }
};
char *labels[NUM_DATA] = {
    "Labour",
    "Iron Ore",
    "Coke or Coal",
    "Purchased Scrap",
    "Other Costs",
    "Other Energy"
};

int main()
{
/*
 *   State Variables:
 *
 *   These variables are used to set the
 *   corresponding GKS-3D state
 */
    static Glimit win = {-115.0, 160., -2.0, 14.0};
    Gcolor rep red, green ;
    static Gasfs asf = {
        GASF_INDIV, GASF_INDIV, GASF_INDIV,          /* polyline */
        GASF_INDIV, GASF_INDIV, GASF_INDIV,          /* polymarker */
        GASF_INDIV, GASF_INDIV, GASF_INDIV, GASF_INDIV, /* text */
        GASF_BUNDLED, GASF_BUNDLED, GASF_INDIV        /* fill area */
    };
    Gint err_ind;
    Gint i;
    Gop_mode op_mode; /* operating mode */
    Gecho_switch echo_switch; /* echo switch */
    Gin_status init_choice_status; /* initial choice status */
    Gint init_choice; /* initial choice value */
    Gin_status choice_status; /* choice status */
    Gint choice; /* choice value */
    Gpoint_list init_value; /* initial value */

```

Annex B

IRON Program

```

Gint          pet;          /* prompt/echo type */
Glimit        echo_area;    /* echo area */
Gstore        store;       /* storage for choice data record
Gchoice_data  *choice_data; /* choice data record */
char          *prompts[NUM_COUNTRIES + 1]; /* prompts for choice */

/*
 * open GKS-3D and open/activate a ws.
 */
gopen_gks(GKS_ERR, DEF_BUF);
gopen_ws(MY_WS, (void *)CONN_ID, WS_TYPE);
gactivate_ws(MY_WS);

/*
 * specify the window onto chart
 */
gset_win(TRAN_NUM, &win);
gset_norm_tran(TRAN_NUM);

/*
 * define the colours used
 */
green.rgb.red = green.rgb.blue = 0.0;
green.rgb.green = 1.0;
red.rgb.green = red.rgb.blue = 0.0;
red.rgb.red = 1.0;
gset_colr_rep(MY_WS, GREEN, &green);
gset_colr_rep(MY_WS, RED, &red);

/*
 * use the individual attributes, except the fill area
 * interior style and style index
 */
gset_asfs(&asf);

gcreate_store(&err_ind, &store);

ginq_choice_st(MY_WS, CHOICE_DEV, store, &err_ind,
              &op_mode, &echo_switch, &init_choice_status,
              &init_choice, &pet, &echo_area, &choice_data);
if (err_ind != GE_NO_ERR) exit(err_ind);
choice_data->pets.pet_r3.num_strings = NUM_COUNTRIES + 1;
for (i=0; i<NUM_COUNTRIES; i++) {
    prompts[i] = data_base[i].name;
}
prompts[NUM_COUNTRIES] = "EXIT";
choice_data->pets.pet_r3.strings = prompts;
ginit_choice(MY_WS, CHOICE_DEV,          /* set up this device */
             init_choice_status,       /* initial choice status */
             init_choice,              /* initial choice */
             CHOICE_PET,                /* prompt/echo type */
             &echo_area,                /* echo area */
             choice_data);              /* choice data record */

```

IRON Program

Annex B

```

/*
 *   get user's choice and display data until told to quit
 */
    for (;;) {
        greq_choice(MY_WS, CHOICE_DEV, &choice_status,
                   &choice);
        if (choice_status != GIN_STATUS_OK /* choice failed */ ||
            choice > NUM_COUNTRIES /* user selected exit */)
            break;
        draw(&data_base[choice-1]);
    }

/*
 *   delete the store
 */
    gdel_store(&err_ind, &store);

/*
 *   deactivate and close the ws and close GKS-3D
 */
    gdeactivate_ws(MY_WS);
    gclose_ws(MY_WS);
    gclose_gks();
}

void draw( const Data_set          *nation)
/*
 *   draw the border of the graph followed by the two sets of data
 *   associated with this country
 */
{
    int          i, colr_ind;
    Gfloat       offset;

    border(nation->name);

    /* draw the data bars */
    for (colr_ind=GREEN, offset = 1.6;
         colr_ind<=RED; colr_ind++, offset -=0.8)
    {
        gset_fill_colr_ind(colr_ind);
        gset_text_colr_ind(colr_ind);
        gset_fill_ind(colr_ind);
        for (i =0; i<NUM_DATA; i++){
            bar((Gfloat)nation->data[colr_ind-1][i],
               (Gfloat)(2.0*i+offset));
        }
    }
}

void border( const char          *nation)
/*
 *   draw the border surrounding the data
 */
{
    static Gpoint corner[5] = {

```

```

        {0.0, 0.0},
        {150.0, 0.0},
        {150.0, 12.0},
        {0.0, 12.0},
        {0.0, 0.0}
    };
    Gpoint_list box;
    static Gtext_align      ctr_bot = {GHOR_CTR, GVERT_BOTTOM};
    static Gtext_align      ctr_top = {GHOR_CTR, GVERT_TOP};
    static Gtext_align      left_half = {GHOR_LEFT, GVERT_HALF};

    static Gpoint pos = {-114.0, 0.0};
    static Gpoint prod_pos = {0.0, -2.0};
    static Gpoint nation_pos = {0.0, 14.0};
    int          i;

/*
 *   clear the screen
 */
    gclear_ws(MY_WS, GFLAG_COND);

/*
 *   draw the box surrounding the chart area
 */
    box.num_points = 5;
    box.points = corner;
    gpolyline(&box);

/*
 *   draw the labels centred on the bar and flush left
 */
    gset_text_align(&left_half);
    gset_char_ht(0.5);
    gset_text_colr_ind(GREEN);
    for (i=0; i<NUM_DATA; i++){
        pos.y = 1.2 + i*2.0;
        gtext(&pos, labels[i]);
    }

/*
 *   draw the top and bottom tick marks
 */
    ticks(12.0, 12.2, &ctr_bot);
    gset_text_colr_ind(RED);
    ticks(0.0, -0.2, &ctr_top);

/*
 *   draw the title text in bigger characters
 */

    gset_text_colr_ind(GREEN);
    gtext(&prod_pos, "Production Cost");
    gset_char_ht(0.7);
    gset_text_align(&ctr_top);
    gtext(&nation_pos, nation);
}

```