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Information technology — Computer graphics — Interfacing techniques for dialogues with graphical devices (CGI) — Functional specification —

Part 5:
Input and echoing

Technologies de l'information — Infographie — Interfaces pour l'infographie — Spécifications fonctionnelles —

Partie 5: Entrée et résonance

Reference number
ISO/IEC 9636-5:1991(E)

Contents

Foreword

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

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

International Standard ISO/IEC 9636-5 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology.*

ISO/IEC 9636 consists of the following parts, under the general title *Information technology — Computer graphics — Interfacing techniques for dialogues with graphical devices (CGI) — Functional specification*:

— *Part 1: Overview, profiles, and conformance*
— *Part 2: Control*
— *Part 3: Output*
— *Part 4: Segments*
— *Part 5: Input and echoing*
— *Part 6: Raster*

Annexes A and B form an integral part of this part of ISO/IEC 9636. Annex C is for information only.

Introduction

This part of ISO/IEC 9636 describes the interface between a device-independent part of a graphics system and INPUT or OUTIN Virtual Devices from which graphical and non-graphical inputs can be obtained.

CGI input functions control and perform different methods of input from a Virtual Device, allowing the return of an input value according to user requirement.

CGI input functions return a variety of data types which correspond to output data commonly used in graphics systems.

Information technology – Computer graphics – Interfacing techniques for dialogues with graphical devices (CGI) – Functional specification –

Part 5:
Input and echoing

1 Scope

This part of ISO/IEC 9636 defines those functions of the Computer Graphics Interface concerned with obtaining graphical and non-graphical input from a Virtual Device of device class INPUT or OUTIN. This part of ISO/IEC 9636 also defines functions to support echoing of input operations on separate Virtual Devices.

This part of ISO/IEC 9636 is part 5 of ISO/IEC 9636, and should be read in conjunction with ISO/IEC 9636-1, ISO/IEC 9636-2, and ISO/IEC 9636-4. The relationship of this part of ISO/IEC 9636 to the other parts of of ISO/IEC 9636 is described in ISO/IEC 9636-1 and in clause 4.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC 9636. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO/IEC 9636 are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO/IEC 9636-1 : 1991 *Information technology — Computer graphics — Interfacing techniques for dialogues with graphical devices (CGI) — Functional specification — Part 1: Overview, profiles, and conformance.*

ISO/IEC 9636-2 : 1991 *Information technology — Computer graphics — Interfacing techniques for dialogues with graphical devices (CGI) — Functional specification — Part 2: Control.*

ISO/IEC 9636-3 : 1991 *Information technology — Computer graphics — Interfacing techniques for dialogues with graphical devices (CGI) — Functional specification — Part 3: Output.*

ISO/IEC 9636-4 : 1991 *Information technology — Computer graphics — Interfacing techniques for dialogues with graphical devices (CGI) — Functional specification — Part 4: Segments.*

ISO/IEC 9636-6 : 1991 *Information technology — Computer graphics — Interfacing techniques for dialogues with graphical devices (CGI) — Functional specification — Part 6: Raster.*

ISO/IEC 9637-1 : -[1] *Information technology — Computer graphics — Interfacing techniques for dialogues with graphical devices (CGI) — Data stream binding — Part 1: Character encoding.*

ISO/IEC 9637-2 : -[1] *Information technology — Computer graphics — Interfacing techniques for dialogues with graphical devices (CGI) — Data stream binding — Part 2: Binary encoding.*

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

[1] To be published.

3 Concepts

3.1 Introduction

This part of ISO/IEC 9636 defines those functions of the Computer Graphics Interface concerned with input and echoing. This functionality is divided into the following areas

- *Input control functions,* which provide control over initialization and deallocation of Logical Input Devices (LIDs), together with the means to tailor their characteristics.
- *Request and sample functions,* which permit LIDs to be used with Request and Sample input methods.
- *Echo request input functions,* which permit LIDs to be used with the Echo Request input method, a special type of Request method in which changes to the LID's measure value can be tracked by the client.
- *Event input functions,* which permit LIDs to be used with the Event input method; this allows the client to control a number of active LIDs simultaneously while concurrently performing graphical output.
- *Echo output functions,* which allow values to be echoed on a given CGI Virtual Device when the source of such values was not the given device.
- *Input and echoing inquiry functions,* which provide access to the description tables and state lists concerned with input and echoing.

3.2 Basic input model

The functions specified by this part of ISO/IEC 9636 are defined in terms of a model of the operation of graphical input. This sub-clause defines the relationship between the top level concepts involved, and the following sub-clauses detail each of the elements of the input model.

An INPUT or OUTIN CGI Virtual Device provides input capabilities through *Logical Input Devices (LIDs).*

Input may be acquired by means of different *input methods*, and the client of the CGI may also exert control of the operation of *prompt*, *echo*, and *acknowledgement* capabilities of the Virtual Device.

3.3 Logical input devices

A logical input device consists of a *measure*, *state information* and a set of associated *triggers.* (A LID's set of associated triggers may be empty.)

A LID is identified by the *input class* of its measure (see table 1) and by its *LID index.* There is a separate set of LID indices for each class of measure.

Each LID has a description table and a state list; each is divided into a class-independent and a class-specific portion. The Class-Independent Logical Input Device State List holds entries for the input device state, the sample input state, and the controls for prompt, echo and acknowledgement. The Class-Specific Logical Input Device State List defines the control that is applied to the LID's measure. Both the class-specific and the class-independent state lists form the Logical Input Device State List, which exists for every LID. It is not required that the list of available logical input device indices for a specific input class be dense.

Table 1 – Input Classes

Input classes		
Input Class	**Data returned**	**Example**
LOCATOR	a single VDC point	digitizer, mouse
STROKE	a sequence of VDC points	digitizer
VALUATOR	a number from a continuous range of alternatives	potentiometer
CHOICE	an integer from a bounded range of alternatives	button box
PICK	a pick status, and the list of pick values, containing a pick identifier and segment identifier	light pen
STRING	a character string	alphanumeric keyboard
RASTER	an input colour value array	scanner
GENERAL	a data record	voice input

3.4 Measures

A measure is the modelled counterpart of the real-world entity that generates values that feed into the CGI input mechanisms. For the purposes of the input model, a measure has three components, an *input tool*, a *current value* and a *measure validity*. Both the current value and the measure validity are interrogated by the LID as part of any input action; the measure validity status determines completeness and reliability of the measure. If the measure validity is VALID, the measure value is complete and reliable and may be returned. If the measure validity is INVALID, the current value of the measure may not be returned and no meaning should be attached to the returned parameter value.

In normal operation, the input tool modifies the current value and the measure validity under the influence of an outside agent (for example, an operator).

The CGI client may also set the current value and the measure validity, using the function PUT CURRENT <input class> MEASURE. Some physical implementations of measures may render implementation of this function impractical; this situation is indicated by the Put Current Measure Effective entry in the Class-Independent Logical Input Device Description Table.

3.4.1 Measures of input class LOCATOR

The value of a LOCATOR measure is a point in VDC space. A separate VDC coordinate system, independent of that used for graphical output, may be specified for each LOCATOR LID. (See 3.5.)

The criterion for the validity of a LOCATOR measure is that the point measured should be within the Input Extent.

Measures of input class LOCATOR may be implemented, for example, by a mouse, trackball, tablet puck, joystick, thumb-wheels, and by digitizing tables.

3.4.2 Measures of input class STROKE

The value of a STROKE measure is a list of points in VDC space. A separate VDC coordinate system, independent of that used for graphical output, may be specified for each STROKE LID. (See 3.5.)

There is no criterion for a STROKE measure to be invalid; points outside the Input Extent are rejected.

An implementation of a STROKE measure will typically involve several external actions before a measure value becomes available. Successive use of SAMPLE input from a STROKE measure will characteristically produce values that (at least in part) repeat one another. The "complete" measure value is that returned to a REQUEST or ECHO REQUEST input function, or that entered in the event queue when a trigger fires. After the complete measure value has been made available, use of SAMPLE will return an "empty" measure value until further external action has occurred.

Measures of input class STROKE may be implemented by the same sorts of devices as for class LOCATOR, with a (possibly) separate method of signalling "input complete".

3.4.3 Measures of input class VALUATOR

The value of a VALUATOR measure is a real number in a range defined by maximum and minimum values specified by entries in the Class-Specific Logical Input Device State List.

The criterion for the validity of a VALUATOR measure is that its value should fall in the specified range.

Measures of input class VALUATOR may be implemented, for example, by a single thumb-wheel or by a potentiometer knob.

3.4.4 Measures of input class CHOICE

The value of a CHOICE measure is an integer in a range whose lower bound is 1 and whose upper bound is defined in the Class-Specific Logical Input Device Description Table.

The criterion for the validity of a CHOICE measure is that its value should fall in the specified range.

Measures of input class CHOICE may be implemented, for example, by a button box, by a tablet, or screen menu.

3.4.5 Measures of input class PICK

The value of a PICK measure is a list of pick values, (see the definition of data type PV in ISO/IEC 9636-1, 5.2.10). The implementation of input class PICK requires an OUTIN Virtual Device to support the capabilities defined in ISO/IEC 9636-4. A separate VDC coordinate system, independent of that used for graphical output, may be specified for each PICK LID. (See 3.5.) This VDC coordinate system is used to define the pick aperture relative to the pick location.

The criteria that define which segments are picked are defined in ISO/IEC 9636-4, 3.8. PICK measures may exist only on Virtual Devices of device class OUTIN, since they derive values from an interaction between an input tool and segment storage of the Virtual Device. The PICK measure is INVALID if the number of pick values exceeds the maximum specified in the Class-Specific Logical Input Device State List.

Measures of input class PICK may be implemented by the same sort of devices as for class LOCATOR with some means to link it to segment storage.

3.4.6 Measures of input class STRING

The value of a STRING measure is a string of characters which is subject to the Input Character Set Index, Alternate Input Character Set Index, and the Input Character Coding Announcer entries in the Class-Specific Logical Input Device State List.

The STRING measure is INVALID if the number of characters exceeds the maximum specified in the Class-Specific Logical Input Device State List.

An implementation of a STRING measure will typically involve several external actions before a measure value becomes available. Successive use of SAMPLE input from a STRING measure will characteristically produce values that (at least in part) repeat one another. The "complete" measure value is that returned to a REQUEST or ECHO REQUEST input function, or that entered in the event queue when a trigger fires. After the complete measure value has been made available, use of SAMPLE will return an "empty" measure value until further external action has occurred.

A measure of input class STRING may be implemented, for example, by means of a computer keyboard.

3.4.7 Measures of input class RASTER

The value of a RASTER measure is an array of input colour values (typically colour or grey-scale intensities of an external image). The representation of each colour value is determined by the entries Colour and Bits Per Colour in the Class-Specific Logical Input Device State List. The Source Window, specified in pixels, in the Client-Specific Logical Input Device State List, determines the region from which the returned input colour values are obtained. Invoking the function RASTER DEVICE DATA can be used to change the setting of this Source Window. The pixel offsets used to specify the source window may result in the return of an invalid RASTER measure.

The measure of input class RASTER may be implemented, for example, by a video camera, a scanner, facsimile machine, or remote-sensing equipment. A conforming measure of input class RASTER shall not be implemented using the contents of a CGI bitmap. (GET PIXEL ARRAY, defined in ISO/IEC 9636-6, can be used for this purpose.)

3.4.8 Measures of input class GENERAL

The value of a GENERAL measure is a data record, whose format is determined by a measure format identifier. The GENERAL input class provides a mechanism for addressing, within the CGI model of input, logical input devices which do not match one of the other standardized input classes. The GENERAL measure is INVALID if the data record size exceeds the maximum specified in the Class-Specific Logical Input Device State List.

Non-negative measure format identifiers for input class GENERAL are reserved for those registered with the ISO Registration Authority. Negative measure format identifiers may be used for implementation-dependent formats.

3.5 Coordinate systems for VDC measures

LOCATOR and STROKE devices deliver VDC measure values. A GENERAL input device may also deliver a VDC measure value. Although PICK devices do not deliver VDC measure values, pick input uses a pick aperture specified in VDC that is used in determining the list of pick values returned.

The characteristics of the physical device that supports such logical input devices appear in the Class-Specific Logical Input Device Description Table. These physical characteristics include:

- Input device address space. This is the native coordinate range of the input device, and is expressed as a pair of ISPs, being the extreme lower left and upper right corners of the address range.
- Input device physical size. This is expressed as a pair of real numbers which gives the dimensions of the device in millimetres. For certain types of device (e.g. mouse, trackball) this may refer to a nominal rectangle rather than an actual size.
- Input device resolution. This is expressed as the number of resolvable steps over the complete address range of each axis. This information is of an advisory nature, since the resolution may vary across a device's range and through its operational lifetime.

For device of class LOCATOR, STROKE, and PICK, the Class-Specific Logical Input Device Description Table specifies a Physical Input Surface Size entry, in millimetres, and an Input Surface Size Interpretation entry with possible values of NOMINAL, ACTUAL, and UNLIMITED. The value ACTUAL is used for input devices for which an exact physical size is meaningful (e.g. tablets). The value NOMINAL is used for input devices for which an effective bounding region of a conceptual approximate size is more appropriate (e.g. a mouse or trackball). The value UNLIMITED indicates that no bound is meaningful and the Physical Input Surface Size entry only relates to the interpretation of the Number of Distinguishable Steps in XY Directions entry in the Class Specific Logical Input Device Description Table.

Logical Input Devices of class LOCATOR, STROKE, and PICK all start from a point in ISC space which determines a point in VDC space. The ISC-to-VDC Mapping for such a LID maps points on its input surface to VDC space. In order to echo such a point for an operator, the resulting VDC point is transformed by the echo mapping associated with the LID.

The ISC-to-VDC Mapping is specified in terms of an Input Viewport in ISC space and an Input Extent for the LID. The Input Viewport is a parallelogram on the input surface. It is nominally a rectangle aligned with the ISC axes; however, provision is made for the possibility that this rectangle is rotated or skewed. The Input Viewport rectangle is parameterized by three ISPs, conceptually corresponding to bottom left, bottom right and top right. The resulting ISC-to-VDC Mapping is a transformation which maps the first point of the Input Viewport onto the first point of the Input Extent, the second point of the Input Viewport onto a VDC point with the same x-coordinate as the second point of the Input Extent, and the same y-coordinate as the first point of the Input Extent. The third point of the Input Viewport is mapped onto the second point of the Input Extent.

For devices of class OUTIN, the echo mapping is determined by the Input Extent for the LID and an Echo Viewport for the LID on the display surface. The Echo Viewport is specified as two VPs. The echo mapping is linear in each of x and y and maps the first point of the Input Extent onto the first point of the Echo Viewport, and similarly for the second points, see figure 1.

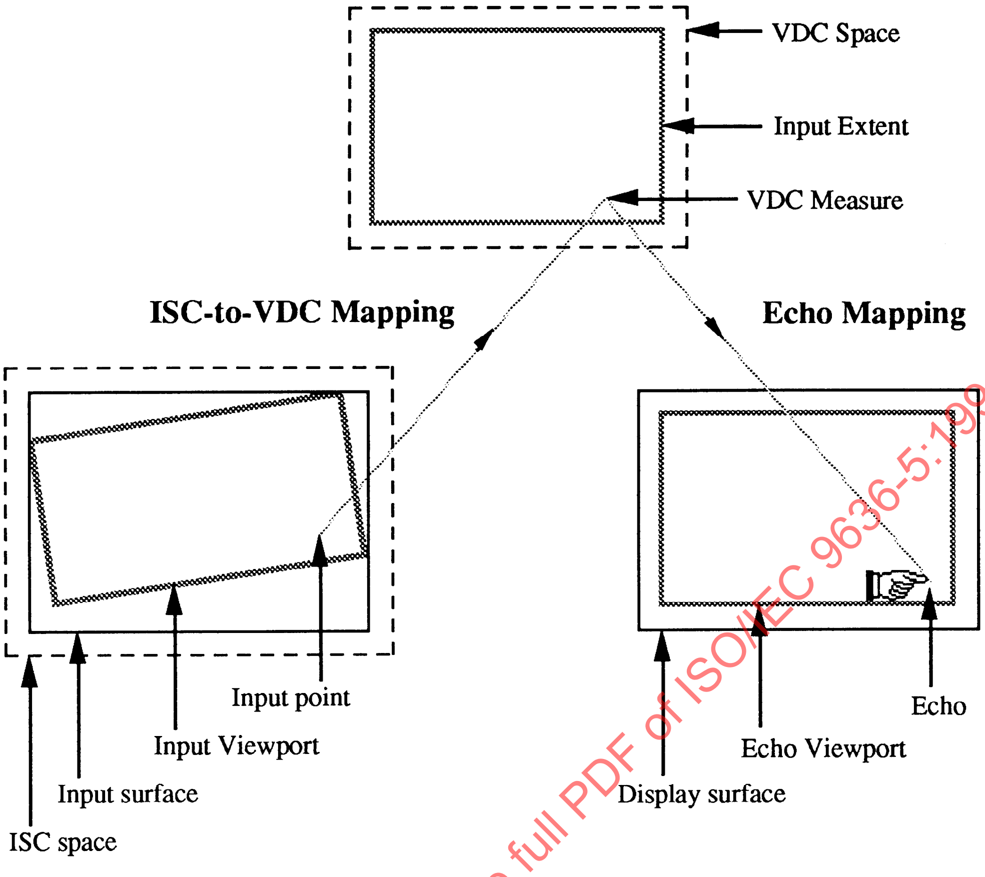


Figure 1 – Input Surface Coordinate mapping

When a LID with a VDC measure is initialized on a device of class OUTIN, the state list entries controlling its ISC-to-VDC Mapping and its echo mapping are initialized in such a way that the Input Viewport is mapped isotropically onto the entire display surface. This Input Viewport is initialized to the largest rectangle within the input surface, aligned at the lower left with respect to the input surface, having the same aspect ratio as the display surface, where both aspect ratios are measured in length units as perceived by an operator. The echo mapping (determined by the Input Extent and Echo Viewport state list entries for the LID) is initialized in such a way that the transformations for the echo mapping and the VDC-to-Device Mapping (for the display surface) are effectively the same, although they need not be parameterized in the same way. Specifically, the Echo Viewport is initialized to the entire display surface and the Input Extent is initialized to the image of this Echo Viewport under the inverse of the VDC-to-Device Mapping for the display surface.

The entries for Input Extent, Input Viewport and Echo Viewport are maintained in the Class-Specific Logical Input Device State List. Using the function <input class> DEVICE DATA, the client may redefine the ISC-to-VDC Mapping in a relatively unconstrained manner, as the Input Viewport is not required to be entirely inside the input surface. For example, the client might wish to map the entire input surface onto an Echo Viewport that is smaller than the display surface and accessed by (input) VDC points which bear no direct relation to VDCs being used for graphic output. Conversely, the client might map only a subset of the input surface onto the entire display surface.

For devices of class INPUT, when the LID is initialized the Input Extent is set to an implementation-dependent rectangle and the Input Viewport is set to the full range of the input device.

The Input Extent entry is interpreted in accordance with the VDC type and precision in effect at the time of its definition. Hence, changing the VDC type sets the Input Extent to the default for the chosen type.

The settings of the Device Viewport Specification Mode and Device Viewport Mapping have no relevance to the Input Viewport, which is always specified in native input coordinates (ISPs). Its mapping to the Input Extent is not necessarily isotropic.

For devices of class OUTIN, the position of a geometric echo on the display surface is determined by the current value of the measure. The appearance of an echo should be altered as its image in VDC passes outside of the Input Extent. This part of ISO/IEC 9636 allows latitude from this preferred behaviour and whether the preferred behaviour is supported is indicated by the Echo Change Support entry in the Class-Independent Logical Input Device Description Table. If the LID is sampled in such circumstances, the measure validity status is INVALID.

For devices of class OUTIN, the Echo Area rectangle, which is used to position certain types of non-geometric echo on the display surface, has no relevance to geometric echoing which automatically tracks the current value of a measure over the display surface.

3.6 Triggers

A trigger is typically (though not exclusively) a physical control manipulated by an operator. When a defined set of conditions is satisfied, the trigger is said to *fire*. The trigger firing defines the moment in time at which an input action takes place; if a LID with which the trigger is associated is enabled for request, echo request or event input, the current value of the LID's measure is stored, and thereby made available to the client. If the LID's Acknowledgement Control is ENABLED, then acknowledgement output is also performed when the trigger fires for request or echo request input or when the event report is enqueued for event input.

3.6.1 Trigger association

Triggers may exist independently of any particular LID. For trigger firing to have effect, it is necessary that the trigger be associated with at least one LID.

The CGI offers the client a mechanism for creating and deleting associations between triggers and LIDs. Each LID's Class-Independent Logical Input Device Description Table holds a list of trigger indices indicating those triggers that may be associated with the LID; a (possible empty) subset of this list is designated as triggers that are necessarily associated with the LID, and may not be dissociated. A single trigger may be associated with more than one LID; in this case, when the trigger fires each LID with which it is associated may *simultaneously* deliver input events to the client.

3.6.2 Timeouts

Some input functions offer a timeout capability. This occurs in situations where the function may not be able to return until the operator takes some action. In case the operator has left or is not paying attention, this provides a mechanism whereby control will eventually be returned to the client in any case.

The duration of a timeout interval is specified in seconds by a real number. A negative value of timeout indicates *wait forever*. That is, there is no possibility of the function returning due to an elapsed timeout interval.

Even if a Virtual Device cannot present a true timeout capability, this wait forever capability is always available. In these cases, a positive value indicates wait forever for the functions REQUEST and INITIALIZE ECHO REQUEST, and indicates a zero timeout for the function AWAIT EVENT. The Timeout Capability entry in the Input Device Description Table specifies the implemented timeout behaviour. The preferred behaviour is FULL timeout capability.

3.6.3 The break action

The operator may abort input by executing a *break action*. The break action cause the LID to abort any input, and to return a pseudo-event to the client, which has no valid measure associated with it. The precise effect of the break action on a LID depends on its input class.

There are two possibilities for the method of triggering a break action. A break action may be initiated by a single method that is common to the entire Virtual Device and applies over a multiplicity of LIDs (in which case, no LID class is associated with it). On the other hand, one may be initiated by a method that is specifically associated with a particular LID (e.g. one of the buttons on a mouse).

If the operator initiates a break action when a LID is in the state REQUEST PENDING or ECHO REQUEST PENDING, then the effect of that break is limited to the (single) LID in that state and the REQUEST or ECHO REQUEST soliciting function returns immediately. At other times, there may be multiple LIDs which are all active for sampling or event input, in which case the effect of the break (discarding all partially constructed input) is applicable to all active LIDs of class STRING or STROKE.

3.7 Input methods and state model

3.7.1 Logical input device model

There are four methods of performing input with any logical input device of the input classes described above. These four methods are available through groups of functions for request, sample, event, and echo request input.

The interface to CGI input functions is a synchronous interface, although asynchronous actions may occur inside the Virtual Device.

The operating state of each logical input device is specified in the appropriate Class-Independent Logical Input Device State List by two input device state variables, the Input Device State and the Sampling State. In addition, the Event Queue State variable in the Event Queue State List defines further input states which are applicable when any input device is using the event input method.

The states in which it is not permissible to invoke the various input functions are defined in tables 13 and 14 and in terms of the logical input device state diagram, figure 2. This state diagram depicts transitions in the value of the Input Device State variable. The transitions take place either as a result of the client invoking a function, as a result of operator action, or as a result of certain other standardized conditions within the LID.

The Input Device State and the Sampling State (see 3.7.3) are defined separately for every instance of a logical input device. Thus, state restrictions apply on an individual basis for each logical input device.

The initial Input Device State of a LID is RELEASED and its measure is unavailable. A LID Input Device State will be set to state READY by the function INITIALIZE LOGICAL INPUT DEVICE. The function RELEASE LOGICAL INPUT DEVICE may be invoked in any state of the LID, the state after invoking RELEASE LOGICAL INPUT DEVICE is always RELEASED. The function INITIALIZE LOGICAL INPUT DEVICE may be invoked in any state of the LID, the state after invoking INITIALIZE LOGICAL INPUT DEVICE is always READY. Note, those transitions are not shown in the state diagrams to avoid unnecessary complexity in the figures.

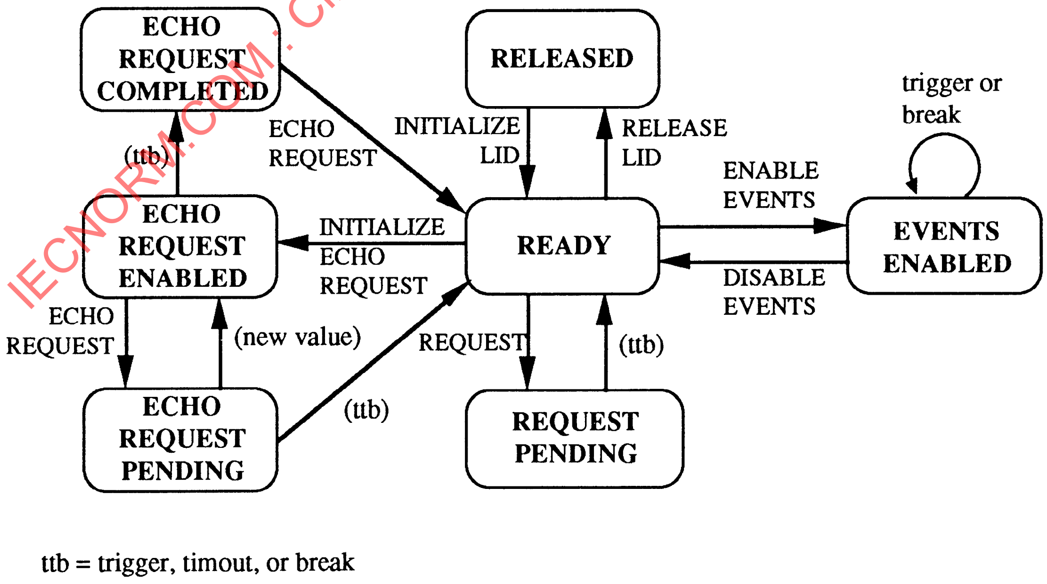


Figure 2 – Logical Input Device state diagram

There are state transitions from READY to other states, in which the LID is said to be *active* and which differ for the different input methods. In general, the LID is active if its Sampling State is ENABLED or if its Input Device State is anything other than READY or RELEASED. The transition to *active* is relevant for prompting and echo, (see 3.8). The state list of a LID may not be modified by the client except for its state variables when a LID is active. The states in which the LID is active are described in 3.7.2, 3.7.3, 3.7.4, and 3.7.5.

3.7.2 Request input

The invocation of REQUEST <input class> changes the LID's Input Device State from READY to REQUEST PENDING and, if the LID was not already active (due to sampling being enabled), the LID becomes active until the return to state READY. There are three reasons for a state transition back to state READY:

a) A *trigger fires*:If the Acknowledgement Control is ENABLED, an acknowledgement is performed, the trigger index and the measure are returned and the request status is TRIGGER FIRED.

b) If no trigger fires and no break occurs, the function returns after a time interval, which is defined in the timeout parameter, and the request status is TIMEOUT.

c) The *break action* is performed:The returned measure is undefined and the request status is BREAK.

3.7.3 Sample input

The Sampling State variable of a logical input device, controls the use of the LID for the sample input method. The possible values for Sampling State are ENABLED and DISABLED (see figure 3). When the LID is initialized the Sampling State is set to DISABLED. The function SAMPLING STATE may be used to change the Sampling State to ENABLED. The LID is *active* at all times when its Sampling State is ENABLED. The Sampling State ENABLED may exist in parallel to other LID states which also activate the LID (i.e. when the LID is enabled for echo request or events, the Sampling State may also be ENABLED).

The invocation of SAMPLE <input class> returns the measure immediately. For input classes STRING and STROKE, the measure is returned as far as it is constructed at the time of invocation. If the device is also enabled for another input method, the buffers are cleared when an associated trigger fires or a break is performed. SAMPLE <input class> may also be called when no trigger is associated with the LID.

The function SAMPLING STATE may also be used to reset the Sampling State of a logical input device to DISABLED.

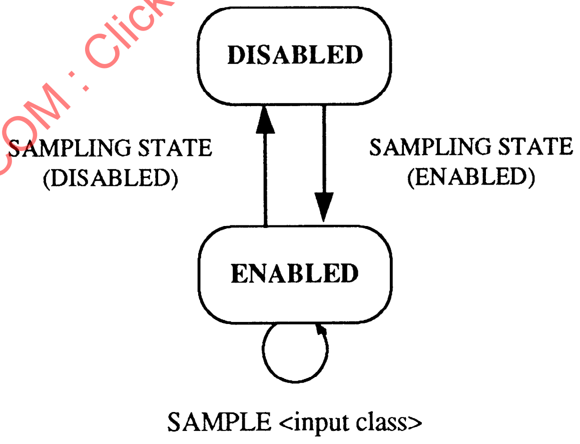


Figure 3 – Sampling State diagram

3.7.4 Remote echoing

The CGI provides functions to permit the echoing of the current measure value of a logical input device on one CGI Virtual Device during an echo request input, using the display surface of a different CGI Virtual Device (see figure 4). This other output device may also be used for prompting and acknowledgement output. This is referred to as *echo output*. For example, remote echoing might be used to echo the input from a digitizer on a physically separate graphics terminal display surface, since it may be useful or necessary for the digitizer and terminal to be treated as distinct Virtual Devices. (Note that echo output capability may be used whether or not the source of the data being echoed is a CGI implementation.) Prompt and acknowledgement can be performed by the INPUT device, the OUTPUT device, or both, dependent on the settings of the echo controls.

Remote Echoing enables a client of the CGI to manage echoing on the remote device in a manner which emulates the automatic echoing performed below the CGI for an OUTIN CGI Virtual Device in which echo output is directed to the same display surface as is being used for output.

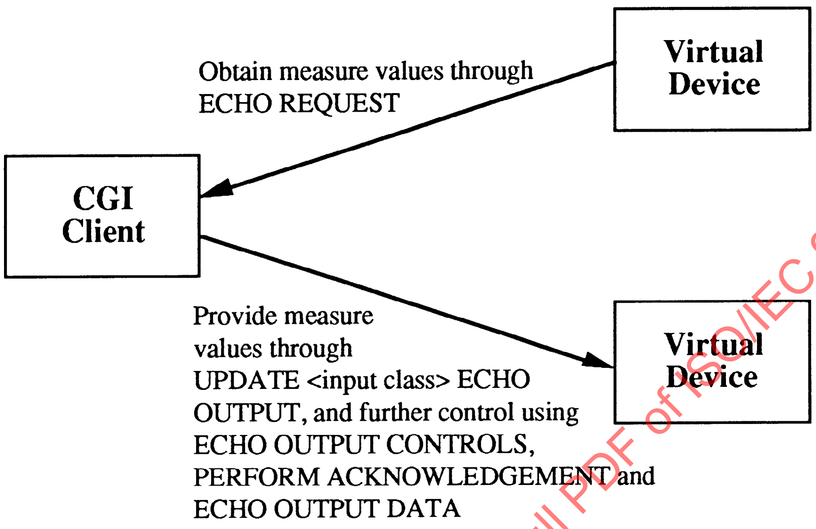

Virtual Device
Obtain measure values through ECHO REQUEST
CGI Client
Provide measure values through UPDATE <input class> ECHO OUTPUT, and further control using ECHO OUTPUT CONTROLS, PERFORM ACKNOWLEDGEMENT and ECHO OUTPUT DATA
Virtual Device

Figure 4 – Flow of data during remote echoing

A client performing echo output of an echo request input can initiate a timeout interval for a logical input device, then alternate between obtaining the current value of the measure and echoing this value on the output Virtual Device, until the timeout interval elapses. This differs from the basic request input method, since control is returned to the CGI client before the timeout interval has elapsed.

The following CGI input functions are provided in the Echo Request Input function group:

- INITIALIZE ECHO REQUEST
- ECHO REQUEST <input class>

The effect of INITIALIZE ECHO REQUEST is to initiate the timeout interval and arm triggers for the logical input device.

Unlike REQUEST, the function ECHO REQUEST has the property that it will return a new value to the client at such time as the measure value *changes*. No trigger, break, or timeout is required, although such events will also cause the ECHO REQUEST function to return. In the presence of Remote Echoing, the state diagram for a logical input device has three states associated with the ECHO REQUEST function:

ECHO REQUEST ENABLED:	The logical input devices goes into this state after an INITIALIZE ECHO REQUEST.
ECHO REQUEST COMPLETED:	The logical input device enters this state from ECHO REQUEST ENABLED on occurrence of a timeout, break, or the firing of a trigger.
ECHO REQUEST PENDING:	The logical input device enters this state from ECHO REQUEST ENABLED in response to an ECHO REQUEST function. It is somewhat analogous to REQUEST PENDING. In particular, like REQUEST, the ECHO REQUEST function does not return until the state is exited, and the firing of a trigger will return the logical input device to the state READY. However, for the ECHO REQUEST PENDING state, a *change* in measure value returns the logical input device to the state ECHO REQUEST ENABLED.

The following CGI output functions are provided in the Echo Output function group to control the echoing of output on a separate output Virtual Device:

- INITIALIZE ECHO OUTPUT
- RELEASE ECHO OUTPUT
- ECHO OUTPUT CONTROLS
- PERFORM ACKNOWLEDGEMENT
- UPDATE <input class> ECHO OUTPUT
- ECHO OUTPUT DATA

The process of performing echo output for a given stream of input data is controlled by means of a conceptual object which is referred to as an *echo output entity*. Conceptually, an echo output entity is created by INITIALIZE ECHO OUTPUT and deleted by RELEASE ECHO OUTPUT.

A given echo output entity is created for the purpose of providing the echoing function corresponding to measure values for a logical input device of some input class. Normally, the echo output entity would exist on a different CGI Virtual Device from the logical input device whose measure is being echoed. Functionally, echo output entities are concerned solely with output. The connection with the measure of any input device (or other source of value to be echoed) is the responsibility of the client of the CGI Virtual Device.

Echo output entities are only logical constructs; they need not correspond to any physical reality. Once an echo output has been set up (using INITIALIZE ECHO OUTPUT and ECHO OUTPUT CONTROLS), it is expected that new values for echoing will be repeatedly sent by the client using UPDATE <input class> ECHO OUTPUT.

The operating state of each echo output entity is specified in the corresponding Individual Echo Entity State List by the Echo Entity State entry.

The states in which it is not permissible to invoke the various echo output functions are defined in table 14, and in terms of the echo output entity state diagram, figure 5. This state diagram depicts transitions of the value of the Echo Entity State variable. The state transitions always take place as a result of the client invoking a function.

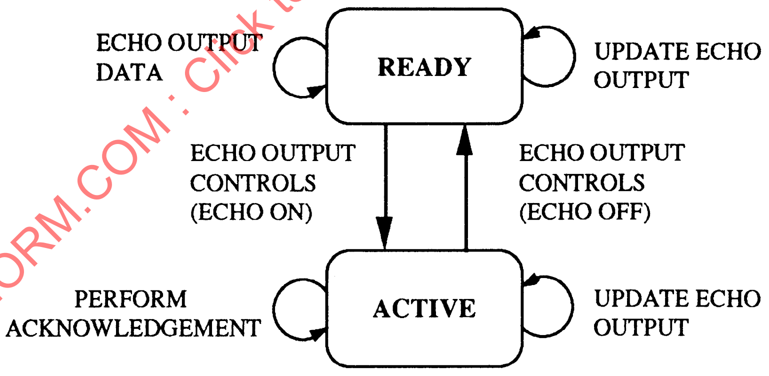


Figure 5 – Echo Output Entity State diagram

As an example of the use of remote echoing, consider a program which is simultaneously a client of two different CGI Virtual Devices: one an INPUT device, the other an OUTPUT device. Assume that there is a logical input device of type LOCATOR on the INPUT device. The client program should echo measure values from the INPUT device on the OUTPUT device. The following sequence of operations can occur:

1) The client uses PUT CURRENT LOCATOR MEASURE on the INPUT device to initialize the measure of the locator. (This step is optional.)
2) The client uses INITIALIZE ECHO OUTPUT to set the Echo Entity State to state READY.
3) The client uses ECHO OUTPUT DATA, if necessary, to customize the echo output entity.

4) The client uses SAMPLING STATE on the INPUT device to enable sampling.

5) The client uses SAMPLE LOCATOR on the INPUT device to obtain the locator measure.

6) The client uses SAMPLING STATE on the INPUT device to disable sampling.

7) The client sends the current value to the OUTPUT device using UPDATE LOCATOR ECHO OUTPUT.

8) On the INPUT device, the client uses INITIALIZE ECHO REQUEST to arm the locator's trigger(s) and start the timeout interval.

9) ECHO OUTPUT CONTROLS (LOCATOR, entity index, ECHO ON, PROMPT ON) is used on the OUTPUT device to perform the prompt action and to generate the echo of the current value; the Echo Entity State is set to state ACTIVE.

10) The client sends an ECHO REQUEST LOCATOR to the INPUT device. When the function returns control to the client, there are four cases depending on the value of the returned request status parameter:

MEASURE CHANGED –	The client passes the returned new value to the OUTPUT device using UPDATE LOCATOR ECHO OUTPUT and goes back to step 10.
TRIGGER FIRED –	The client notes the returned measure value and its validity.
BREAK or *TIMEOUT* –	The client notes that it has not received a valid input value.

11) If the returned request status parameter was TRIGGER FIRED then the client uses PERFORM ACKNOWLEDGEMENT to effect acknowledgement on the OUTPUT device.

12) The client uses ECHO OUTPUT CONTROLS (LOCATOR, entity index, ECHO OFF, PROMPT OFF) on the OUTPUT device to terminate the echoing process and set the Echo Entity State to state READY.

13) If it will not need the echo output entity again, the client releases those resources associated with it by using the RELEASE ECHO OUTPUT function on the OUTPUT device.

3.7.5 Event input

When the event input method is used, an operator may create input asynchronously by firing the triggers of one or more logical input devices which are enabled for event input. In response to such a trigger, an *event report* is normally stored in the *event queue* and an acknowledgement performed if Acknowledgement Control is ENABLED. The event queue is a first-in first-out queue that is common to all logical input devices and is part of the Virtual Device. The event report contains the logical input device class, the logical input device index, the trigger index of the trigger which caused the event, a timestamp, the measure value, and the measure validity status. The timestamp can be used to serialize events from different Virtual Devices which are used simultaneously. If one trigger is associated with two or more LIDs, its firing creates more than one event, which are marked by identical timestamps. The order in which such simultaneous events are placed in the event queue is implementation-dependent. If the input device does not have a true clock facility, the timestamp may be implemented as a count of trigger firing, otherwise timestamps are real numbers in units of seconds.

There are several mechanisms which control event input. These are discussed in terms of states (see figure 6) and control entries in the Class-Independent Logical Input Device State Lists and the Event Input State List.

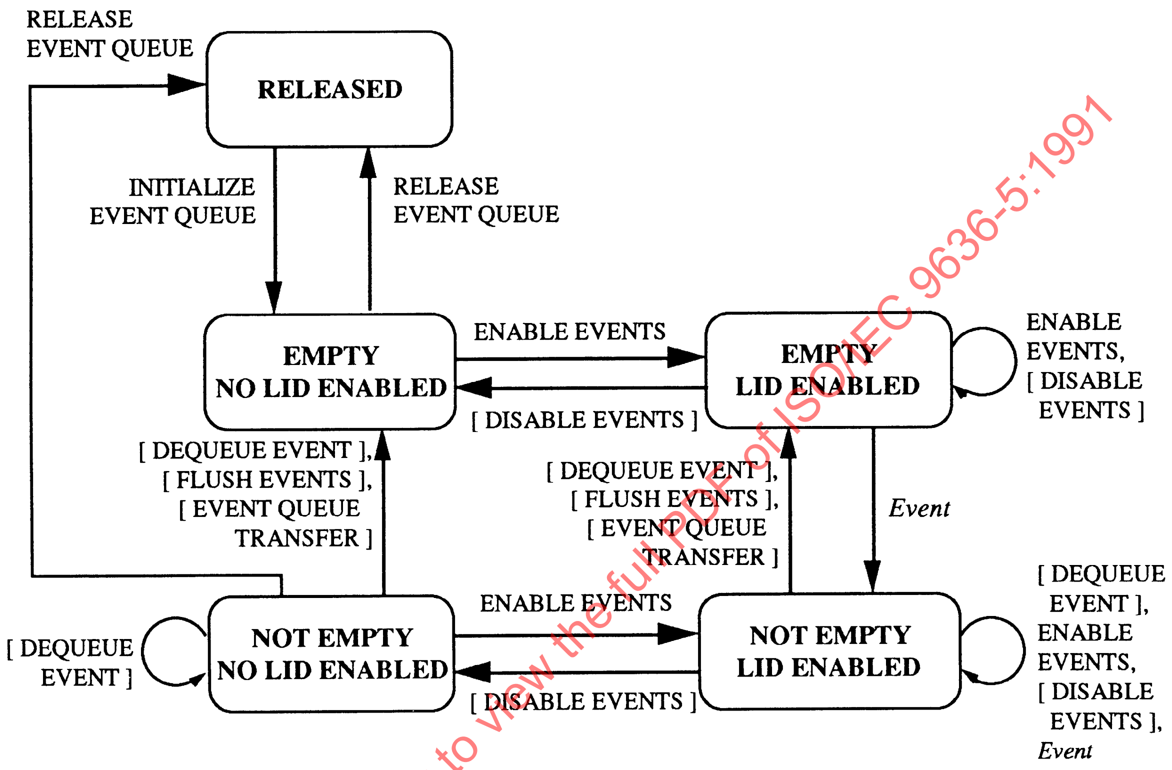
In order to use event input, it is first necessary to initialize the event queue (by use of INITIALIZE EVENT QUEUE) and then to enable events on at least one LID (by use of ENABLE EVENTS).

The Event Queue State variable in the Event Input State List may have one of five values:

RELEASED
EMPTY NO LID ENABLED
NOT EMPTY NO LID ENABLED
EMPTY LID ENABLED
NOT EMPTY LID ENABLED

This state variable restricts the usage of RELEASE EVENT QUEUE; it may only be released if there are no LIDs enabled for event input.

If there is an attempt to trigger an event whose event report cannot be enqueued because of lack of space, the Unreported Overflow State and Event Queue Block State entries in the Event Input State List are set to OVERFLOW and BLOCKED respectively. The Unreported Overflow State entry is reset to NO OVERFLOW when it is reported to the client. If the Event Queue Block State is BLOCKED, no triggers for events are accepted and the echoes of the input devices which are enabled for events disappear. The Event Queue Block State may be set explicitly by the client, using the function EVENT QUEUE BLOCK CONTROL, if there are application dependent reasons for prohibiting entries in the event queue. The Event Queue Block State is reset explicitly by EVENT QUEUE BLOCK CONTROL.



[ ] indicates that a state transition is dependent on either the resulting number of LIDs enabled or the resulting number of events enqueued.

Figure 6 – Event Queue state diagram

The Unreported Break State entry in the Event Input State List is set to BREAK if the operator performs a break action. The break action does not create an event report entry in the event queue, the prompt is not affected, and the break action is not acknowledged. The part of the echo which reflected a partially constructed measure is removed. As with OVERFLOW, the Unreported Break State is reset to NO BREAK when it is reported to the client. Partially constructed string and stroke measures are discarded by the break action. Information about the most recent break action (if any) is held in the Event Input State List and is returned by AWAIT EVENT when its *event status* parameter has the value BREAK. If the break action is associated with a particular LID, identifying information for that LID is available; if the cause of the break action is defined generally for the CGI Virtual Device, the input class associated with the break is NONE and the LID index is undefined. The timestamp associated with any applicable break action is always defined.

For retrieving event input, the functions AWAIT EVENT, EVENT QUEUE TRANSFER, and DEQUEUE <input class> EVENT are provided.

The AWAIT EVENT function returns the event status, and (depending on the event status) the input class, the input device index, the trigger index, and the timestamp. The event status is set to EVENT if at least one event report is available in the event queue. The other parameters returned by AWAIT EVENT describe the oldest event in the queue.

TIMEOUT is returned as the event status if no event is available within the specified timeout interval and a break action was not performed. The response validity is returned as INVALID if an error condition exists, e.g. the event queue is not initialized, or AWAIT EVENT was invoked when the event queue is empty and blocked.

After an overflow occurs, the next invocation of AWAIT EVENT reports OVERFLOW, and subsequent calls indicate EVENT as long as event reports are available.

If the state of the event queue is both BREAK and OVERFLOW at the time AWAIT EVENT is invoked, BREAK is reported before OVERFLOW.

If the event status EVENT is returned by AWAIT EVENT, the client may call EVENT QUEUE TRANSFER or the appropriate DEQUEUE <input class> EVENT function to retrieve the required event report data. The function DEQUEUE <input class> EVENT removes one event report and passes the measure and measure validity status of this event to the client. The function EVENT QUEUE TRANSFER returns a data record containing an event reports list.

To clear the whole event queue or to delete events which belong to a certain device the functions FLUSH EVENTS or FLUSH DEVICE EVENTS may be used.

Table 2 defines which parameters of AWAIT EVENT, besides the event status, are valid for the different values of the event status.

Table 2 – Event Status of AWAIT EVENT

Event Status	Valid Return Parameters
TIMEOUT	none
EVENT	all
OVERFLOW	all
BREAK	timestamp, class, and LID index when class ≠ NONE

3.8 Prompting, echoing, and acknowledgement

There are three mechanisms defined in CGI which control the interaction between the operator and the Virtual Device: *prompting* is a signal which tells the operator to start some input action; *echoing* is the visualization of the current value of a LID's measure; *acknowledgement* is the signal that the input action was accepted by the input device.

The form of prompt, echo, and acknowledgement is controlled for each logical input device by the respective Prompt Type, Echo Type, and Acknowledgement Type as specified in the Class-Independent Logical Input Device State List. For all logical input devices, prompt, echo, and acknowledgement type 1 is required to be supported and is implementation-dependent. Further prompt, echo, and acknowledgement types appropriate to each input class are defined but not required. These types are listed in the following tables. Other positive prompt, echo, and acknowledgement types are reserved for registration (see ISO/IEC 9636-1, 4.4.7); negative values for prompt, echo, and acknowledgement types are available for private use.

Additional information to control prompt, echo, and acknowledgement is passed in a data record, which the client may set through the <input class> DEVICE DATA function. In addition, prompt, echo, and acknowledgement behaviour of a LID may be customized in an implementation-dependent manner by use of the input device data record.

A Virtual Device of class OUTIN or OUTPUT with echo output capabilities shall support at least echo type 1 for each input class supported.

The Class-Independent Logical Input Device State List contains additional information for the control of prompting, echoing, and acknowledgement on an OUTIN Virtual Device. The Echo Area is a rectangular region specified by two VPs which may be used to position or restrict certain types of static non-geometric prompting, echoing, and acknowledgement. The Echo Data Record has contents which depend on the current Prompt Type, Echo Type, and Acknowledgement Type.

The functions ECHO CONTROLS and ECHO DATA are used to control the prompt, echo, and acknowledgement behaviour of the logical input device. See also 3.7.4.

3.8.1 Prompting

Prompting is a form of output (possibly non-graphical) which indicates that the LID is ready for input and which occurs when the Prompt Control is ENABLED and the LID becomes active. The concept of an *active* LID is described in 3.7. Examples of prompting are displaying a prompt message on the display surface of an OUTIN Virtual Device or sounding a tone on an INPUT Virtual Device. Conceptually, drawing surfaces and particularly bitmaps (see ISO/IEC 9636-6) are unaffected by prompting.

Table 3 – Prompt Types

Number	Description
1	Implementation-dependent. No data record is required in the echo data record.
2	Prompt by sounding *a tone*. For devices capable of sounding multiple pitches, a prompt tone is given in the echo data record. The echo data record contains the following prompt information: Prompt tone I
3	Prompt by displaying one from a set of *device prompt outputs*, such as LED indicators or icons. The echo data record contains the following prompt information: Prompt display identifier IX
4	Display a *prompt message*. The echo data record contains the following prompt information: Prompt message S

3.8.2 Echoing

The current value of a logical input device's measure may be made visible to the operator via the process of echoing. While the logical input device is active and the Echo Control is ENABLED, the current measure value is displayed in a form determined by the logical input device's Echo Type. For example, one echo type for a LOCATOR input device may represent the current measure value by the position of crosshairs on a display surface, while another type might display the numeric coordinates of the current measure value near a cursor. Conceptually, drawing surfaces and particularly bitmaps (see ISO/IEC 9636-6) are unaffected by echoing.

For an OUTIN Virtual Device, CGI functions are defined that control the use of its display surface to echo the measure values of its logical input devices; these functions also apply to an INPUT Virtual Device, to the extent that the echoing method need not employ graphical output (for example, a digital numeric display).

Table 4 – Echo Types: LOCATOR

Number	Description
1	Implementation-dependent. No data record is required in the echo data record.
2	Echo the current value with a *crosshair* (i.e. horizontal and vertical lines spanning the display surface and intersecting at the current value position).
3	Echo the current value with a *tracking symbol*. The echo data record contains the following echo information: Symbol identifier IX
4	Echo the current value with a *rubber band line*. The starting point of the line is given in the echo data record; the end point is the current value position. The echo data record contains the following echo information: Initial position P
5	Echo the current value with a *rubber band rectangle*. The starting point of the rectangle's diagonal line is given in the echo data record; the end point is the current value position. The echo data record contains the following echo information: Initial position P
6	Display a *digital representation* of the current value within the echo area.

Table 5 – Echo Types: STROKE

Number	Description
1	Implementation-dependent. No data record is required in the echo data record.
2	Display a *digital representation* of the current stroke within the echo area
3	Display a *symbol* at each stroke point and a *tracking symbol* at the current stroke point. The echo data record contains the following echo information: Symbol identifier IX Tracking symbol identifier IX
4	Display a *line* joining each stroke point and a *rubber band line* between the current position and the previous point.
5	Echo the current value with a *rubber band rectangle*. The starting point of the rectangle's diagonal line is given in the echo data record; the end point is the current value position. The echo data record contains the following echo information: Initial position P
6	Display a *symbol* at each stroke point and at the current value position display a crosshair (i.e. horizontal and vertical lines spanning the display surface and intersecting at the current value position). Symbol identifier IX

Table 6 – Echo Types: CHOICE

Number	Description
1	Implementation-dependent. No data record is required in the echo data record.
2	*Display CHOICE strings* and alter the appearance of the currently selected string. The choice strings are contained in the echo data record and are displayed within the echo area. The operator may choose among the strings using an appropriate technique. The echo data record contains the following echo information: List of strings nS
3	*Display segment* and alter the appearance of the primitives for the currently selected pick identifier. The echo data record contains a segment identifier for a segment to be displayed within the echo area. The segment transformation is applied, the default VDC extent for the currently selected VDC type is mapped to the echo area. The active VDC extent is ignored. The pick identifiers in the echo data record are mapped to CHOICE numbers. Picking these primitives selects the corresponding CHOICE value. The echo data record contains the following echo information: Segment identifier SN List of pick identifiers nPN

Table 7 – Echo Types: VALUATOR

Number	Description
1	Implementation-dependent. No data record is required in the echo data record.
2	Display a *graphical representation* of the current value within the echo area.
3	Display a *digital representation* of the current value within the echo area.

Table 8 – Echo Types: PICK

Number	Description
1	Implementation-dependent. No data record is required in the echo data record.
2	*Alter the appearance* of all objects with a pick value that would be returned by the input operation.
3	*Alter the appearance* of all objects within the segment that would be picked.
4	Display the current VDC position with a *tracking symbol*. The echo data record contains the following echo information: Symbol identifier IX
5	*Alter the appearance* of all objects with a pick value that would be returned by the input operation and display the position of the cursor using a *tracking symbol*; the echo data record contains the following: Symbol identifier IX
6	*Alter the appearance* of all objects within the segment that would be picked and display the position of the cursor using a *tracking symbol*; the echo data record contains the following: Symbol identifier IX

Table 9 – Echo Types: STRING

Number	Description
1	Implementation-dependent. No data record is required in the echo data record.
2	Display the input character string in the echo area using code extension techniques defined by Input Character Coding Announcer, Input Character Set Index and Alternate Input Character Set Index in the Class-Specific Logical Input Device State List.

Table 10 – Echo Types: RASTER

Number	Description
1	Implementation-dependent. No data record is required in the echo data record.
2	Display a *graphical representation* of the current value within the echo area.

Table 11 – Echo Types: GENERAL

Number	Description
1	Implementation-dependent. No data record is required in the echo data record.

3.8.3 Acknowledgement

Acknowledgement is performed if the Acknowledgement Control is ENABLED, a trigger has fired, and the measure has been accepted. The form of acknowledgement is specified by the Acknowledgement Type. Conceptually, drawing surfaces and particularly bitmaps (see ISO/IEC 9636-6) are unaffected by acknowledgements.

A break action performs no acknowledgement.

Table 12 – Acknowledgement Types

Number	Description
1	Implementation-dependent. No data record is required in the echo data record.
2	Acknowledge by *sounding a tone*. For devices capable of sounding multiple pitches, an acknowledgement tone is given in the echo data record. The echo data record contains the following acknowledgement information: Acknowledgement tone I
3	Display an *acknowledgement message*. The echo data record contains the following acknowledgement information: Acknowledgement message S
4	The colour of the displayed prompt changes.

3.9 Portioning of returned input data

For STROKE, PICK, STRING, and RASTER, input devices, the returned value is a list of data. If this data cannot be returned in one portion with the related functions REQUEST <input class>, ECHO REQUEST <input class>, SAMPLE <input class>, or DEQUEUE <input class> EVENT, then the GET ADDITIONAL <input class> DATA functions may be used. These functions have to be invoked before the next input function for the same LID, otherwise, the data is lost.

The GET ADDITIONAL <input class> DATA function is only used to portion data at the interface to the client and returns one portion of the data representing the complete measure of the corresponding previous REQUEST, ECHO REQUEST, SAMPLE, or DEQUEUE function. It is independent of the effective buffer size for the various types of input data given in the Class-Specific Logical Input Device State List.

3.10 State restrictions

The state variables, Input Device State and Sampling State, defined in the Class-Independent Logical Input Device State List, and the Event Queue State defined in the Event Input State List provide certain state restrictions over the functions defined in this part of ISO/IEC 9636.

Tables 13, 14 and 15 list the state restrictions that apply. Functions not listed in these tables are not restricted.

Table 13 – State Restrictions For Input Functions

Function	Input Device State	Sample State	Event Queue State
INITIALIZE LOGICAL INPUT DEVICE	-	-	-
RELEASE LOGICAL INPUT DEVICE	-	-	-
ECHO CONTROLS	RL, EV, ERE, ERC	-	-
PUT CURRENT <input class> MEASURE	RL	-	-
ECHO DATA	RL, EV, ERE, ERC	-	-
<input class> DEVICE DATA	RL, EV, ERE, ERC	-	-
ASSOCIATE TRIGGERS	RL	-	-
REQUEST <input class>	RL, ERE, ERC, EV	-	-
SAMPLE <input class>	RL	SD	-
SAMPLING STATE	RL	-	-
INITIALIZE ECHO REQUEST	RL, ERE, ERC, EV	-	-
ECHO REQUEST <input class>	RL, RY, EV	-	-

Table 13 – State Restrictions For Input Functions – (concluded)

Function	Input Device State	Sample State	Event Queue State
RELEASE EVENT QUEUE	-	-	ELE, NELE
ENABLE EVENTS	RL, ERE, ERC, EV	-	RL
DISABLE EVENTS	RL	-	-
EVENT QUEUE BLOCK CONTROL	-	-	RL
FLUSH EVENTS	-	-	RL
FLUSH DEVICE EVENTS	-	-	RL
AWAIT EVENT	-	-	RL, ENLE
DEQUEUE <input class> EVENT	-	-	RL, ENLE, ELE
EVENT QUEUE TRANSFER	-	-	RL, ENLE, ELE

Table 14 – State Restrictions For Echo Output Functions

Echo Output Entity State	
Function	**Echo Entity State**
INITIALIZE ECHO OUTPUT	-
RELEASE ECHO OUTPUT	-
ECHO OUTPUT CONTROLS	-
PERFORM ACKNOWLEDGEMENT	RY
UPDATE <input class> ECHO OUTPUT	-
ECHO OUTPUT DATA	AC

Table 15 – Key to abbreviations in tables 13 and 14.

Input Device States	Abbrev.	Sampling States	Abbrev.
RELEASED	RL	DISABLED	SD
READY	RY		
ECHO REQUEST ENABLED	ERE		
ECHO REQUEST COMPLETED	ERC		
EVENTS ENABLED	EV		
Event Queue States	**Abbrev.**	**Echo Entity States**	**Abbrev.**
RELEASED	RL	READY	RY
EMPTY LID ENABLED	ELE	ACTIVE	AC
EMPTY NO LID ENABLED	ENLE		
NOT EMPTY NO LID ENABLED	NENL		
NOT EMPTY LID ENABLED	NELE		

3.11 Inquiry

Input inquiry functions, as defined in clause 6, provide the client with the means to access the information in the Input and Echoing state lists and description tables. These lists and tables provide information about the current state and capabilities of the CGI Virtual Device.

Details about the relationship between a description table or state list and the corresponding inquiry functions are described in ISO/IEC 9636-1.

4 Interactions with other parts of ISO/IEC 9636

4.1 Interactions with more than one part of ISO/IEC 9636

The input states defined in this part of ISO/IEC 9636 are orthogonal to states defined in other parts of ISO/IEC 9636.

4.2 Interactions with ISO/IEC 9636-1 (Overview)

The Principles of Inquiry given in ISO/IEC 9636-1 require that functions which return information provide an indication whether that information is valid or invalid. For the functions defined in this part of ISO/IEC 9636, there is a response validity flag with values INVALID or VALID. When an error reaction states, "Function ignored", this means that the return parameter(s) are set to the appropriate values to indicate an error resulting in invalid data, but that the function returns immediately with no other effect.

4.3 Interactions with ISO/IEC 9636-2 (Control)

The INITIALIZE function will release all logical input devices, all echo output entities, and any event queue. There are no state restrictions on the use of INITIALIZE and TERMINATE, i.e. INITIALIZE and TERMINATE may be used at any time (see ISO/IEC 9636-2, 5.2.1).

The default for the Input Extent is obtained from the output VDC Extent current at the time of INITIALIZE LOGICAL INPUT DEVICE. Changing the VDC type sets the Input Extent to the default for the chosen type. The default for the Input Viewport is based upon the Device Viewport current at the time of INITIALIZE LOGICAL INPUT DEVICE. The method of calculation is described in clause 3.

Input operations for class PICK are affected by the current VDC-to-Device Mapping.

4.4 Interactions with ISO/IEC 9636-3 (Output)

There are no interactions between this part of ISO/IEC 9636 and the functions and features specified in ISO/IEC 9636-3. However, an implementation may wish to make use of some of the attributes specified for output when defining implementation-dependent echoes.

4.5 Interactions with ISO/IEC 9636-4 (Segments)

Input operations for class PICK return pick values which consist of segment name and pick name created with functions defined in ISO/IEC 9636-4. The segment attributes of Detectability, Visibility, and Pick Priority determine which segments are candidates for picking.

The function GET ADDITIONAL PICK DATA, defined in this part of ISO/IEC 9636, may be enabled following execution of the SIMULATE PICK function, defined in ISO/IEC 9636-4.

The states specified in this part of ISO/IEC 9636 are orthogonal to those specified in ISO/IEC 9636-4, i.e. the two sets of states do not interact and any combination of them is allowed.

4.6 Interactions with ISO/IEC 9636-6 (Raster)

There are no interactions between this part of ISO/IEC 9636 and ISO/IEC 9636-6. In particular, output of prompt, echo, and acknowledgement is conceptually performed downstream of any drawing or display bitmap and shall not produce client detectable effects in these bitmaps.

5 Abstract specification of functions

5.1 Introduction

This clause describes the abstract functional capabilities of the Input and Echoing part of the CGI.

To avoid replicating the description of certain groups of related functions, a generic description technique is employed using "<input class>" in the function name. It should be emphasized that these related functions will not be represented by a single function in a binding or encoding of the CGI. For functions in which none of the parameter data types depend on the input class, there is only one function for all classes and the input class is passed as one explicit *In* parameter of the function.

The descriptions of functions are ordered in the following manner:

- Input control functions.
- Input functions, which provide for the return of graphical and non-graphical operator-set data values in request or sample modes;
- Echo request input functions.
- Input functions associated with event mode input;
- Echo output functions.

5.1.1 Data types employed

The abstract specifications of functions detail the functions in terms of input and output parameters. The data type of each parameter is selected from a standard set and is identified in the functional specification by a standard abbreviation.

The data types and the abbreviations used in this part of ISO/IEC 9636 are taken from the complete list of data types given in ISO/IEC 9636-1, 5.2.10.

5.1.2 Validity of returned information

For all of the functions specified in this clause which solicit a response from the Virtual Device, a response validity flag is returned as INVALID if an error was detected in executing the function. In such cases, other output parameters are undefined and no meaning should be applied to any of these parameter values. Additionally, functions which return measure values also return an associated measure validity flag which applies only to the measure value itself. It is possible to get a response in which the response validity is VALID and the measure validity is INVALID.

5.2 Input control functions

5.2.1 INITIALIZE LOGICAL INPUT DEVICE

Parameters:

In	input class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E
In	input device index	(1..n)	IX

Effect:

The Input Device State of the specified logical input device becomes READY. Any input actions are terminated. The Logical Input Device State List is set to its default initial values.

NOTE – If the logical input device is not in the state RELEASED, then INITIALIZE LOGICAL INPUT DEVICE is functionally equivalent to RELEASE LOGICAL INPUT DEVICE followed by INITIALIZE LOGICAL INPUT DEVICE. Hence, this function may be used in any LID state to return the logical input device to its default state.

State Restrictions:
This function may be invoked in all LID states.

5.2.2 RELEASE LOGICAL INPUT DEVICE

Parameters:

In	input class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E
In	input device index	(1..n)	IX

Effect:
The Input Device State of the specified logical input device becomes RELEASED. Any input actions are terminated.

State Restrictions:
This function may be invoked in all LID states.

5.2.3 ECHO CONTROLS

Parameters:

In	input class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E
In	input device index	(1..n)	IX
In	prompt control	(DISABLED, ENABLED)	E
In	echo control	(DISABLED, ENABLED)	E
In	acknowledgement control	(DISABLED, ENABLED)	E

Effect:
The Prompt Control, Echo Control, and Acknowledgement Control entries in the Class-Independent Logical Device State List of the specified logical input device are set to the specified value.

State Restrictions:
This function may only be invoked in LID State READY.

Errors:

Error identifier:	5:501
Cause:	Function illegal in LID State RELEASED
Reaction:	Function ignored.
Error identifier:	5:502
Cause:	Function illegal in LID State ECHO REQUEST ENABLED
Reaction:	Function ignored.
Error identifier:	5:503
Cause:	Function illegal in LID State ECHO REQUEST COMPLETED
Reaction:	Function ignored.
Error identifier:	5:504
Cause:	Function illegal in LID State EVENTS ENABLED
Reaction:	Function ignored.
Error identifier:	5:514
Cause:	Function illegal in LID Sampling State ENABLED
Reaction:	Function ignored.

5.2.4 PUT CURRENT <input class> MEASURE

Parameters:

In	input device index		(1..n)	IX
In	measure validity		(INVALID, VALID)	E
In	measure value			
	if input class = LOCATOR:	position		P
	if input class = STROKE:	list of points		nP
	if input class = VALUATOR:	value		R
	if input class = CHOICE:	choice number	(1..n)	I
	if input class = PICK:	list of pick values		nPV
	if input class = STRING:	string		S
	if input class = RASTER:	xcount, ycount	(1..n)	2I
		list of input colour values		nICO
	if input class = GENERAL:	data record		D

Effect:

The measure value and the measure validity are set for the specified logical input device. The resulting measure validity is VALID if the *measure value* parameter is valid for the measure of the specified logical input device and the *measure validity* parameter is VALID. In all other cases, the resulting measure validity shall be INVALID. When a specified *measure validity* of VALID is overridden by an invalid measure value, the situation is not regarded as an error.

Some input devices will not be able to set the measure; in this case, the function is ignored. The Put Current Measure Effective entry in the Class-Independent Logical Input Device State List indicates whether this function has any effect on the LID.

NOTE – This function may be used to set the initial value before an input action is performed. It can be used for repositioning the built-in echo on an OUTIN device.

State Restrictions:

This function may be invoked in all LID states except state RELEASED.

Errors:

Error identifier:	3:504
Cause:	PUT CURRENT MEASURE not effective for this LID
Reaction:	Function ignored.
Error identifier:	3:508
Cause:	Too many stroke points for this LID
Reaction:	Maximum stroke buffer size used.
Error identifier:	3:509
Cause:	Choice number exceeds maximum available for this LID
Reaction:	Function ignored.
Error identifier:	3:510
Cause:	Too many pick values for this LID
Reaction:	Maximum pick buffer used.
Error identifier:	3:511
Cause:	Too many string characters for this LID
Reaction:	Maximum string buffer used.
Error identifier:	3:513
Cause:	General input data record too large
Reaction:	Maximum data record size used.
Error identifier:	3:521
Cause:	Valuator value out of range
Reaction:	Function ignored.

Error identifier:	3:529
Cause:	Too many raster pixels
Reaction:	Function ignored.

Error identifier:	5:501
Cause:	Function illegal in LID State RELEASED
Reaction:	Function ignored.

5.2.5 ECHO DATA

Parameters:

In	input class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E
In	input device index	(1..n)	IX
In	prompt type	(-n..-1,1..n)	IX
In	echo type	(-n..-1,1..n)	IX
In	acknowledgement type	(-n..-1,1..n)	IX
In	echo area		2VP
In	echo data record		D

Effect:

The Prompt Type, Echo Type, Acknowledgement Type, Echo Area and Echo Data Record entries in the Class-Independent Logical Input Device State List for the specified logical input device are set to the values specified.

The Prompt Type defines the form of prompting output which occurs when the logical input device Prompt Control is ENABLED. The Echo Type defines the form of echoing output which appears when the logical input device Echo Control is ENABLED. The Acknowledgement Type defines the form of acknowledgement output which occurs when the logical input device Acknowledgement Control is ENABLED. The prompt, echo, and acknowledgement types are specified in 3.8.

For OUTIN Virtual Devices, the Echo Area defines a rectangle in Viewport Specification space as given by the current value of Device Viewport Specification Mode in the Control State List (see ISO/IEC 9636-2); certain types of static non-geometric echo, prompt, and acknowledgement output may be positioned within this rectangle on the display surface.

The contents of the specified *echo data record* depends upon the *prompt type*, *echo type*, and *acknowledgement type*. The order of the contents within the echo data record is prompt data, echo data, followed by acknowledgement data.

State Restrictions:

This function may only be invoked in LID state READY and Sampling State DISABLED.

Errors:

Error identifier:	3:505
Cause:	LID does not support this echo type
Reaction:	Function ignored.

Error identifier:	3:506
Cause:	LID does not support this prompt type
Reaction:	Function ignored.

Error identifier:	3:507
Cause:	LID does not support this acknowledgement type
Reaction:	Function ignored.

Error identifier:	3:522
Cause:	Echo Area not wholly contained within display surface
Reaction:	Echo Area set to intersection of supplied echo area and display surface limits.

Error identifier:	3:523
Cause:	Contents of Echo Data Record invalid
Reaction:	Default data record used.

Error identifier:	5:501
Cause:	Function illegal in LID State RELEASED
Reaction:	Function ignored.
Error identifier:	5:502
Cause:	Function illegal in LID State ECHO REQUEST ENABLED
Reaction:	Function ignored.
Error identifier:	5:503
Cause:	Function illegal in LID State ECHO REQUEST COMPLETED
Reaction:	Function ignored.
Error identifier:	5:504
Cause:	Function illegal in LID State EVENTS ENABLED
Reaction:	Function ignored.
Error identifier:	5:514
Cause:	Function illegal in LID Sampling State ENABLED
Reaction:	Function ignored.

5.2.6 <input class> DEVICE DATA

Parameters:

In	input device index		(1..n)	IX
In	input device value:			
	if input class = LOCATOR:	input extent (P, P')	($P_x \neq P'_x$, $P_y \neq P'_y$)	2P
		input viewport	(not collinear)	3ISP
		echo viewport		2VP
	if input class = STROKE:	maximum number of points	(1..n)	I
		sampling interval for x-, y- displacement	(≥ 0)	2VDC
		minimum time interval per sample (milliseconds)	(≥ 0)	I
		maximum time interval per sample (milliseconds)	(≥ 0)	I
		input extent (P, P')	($P_x \neq P'_x$, $P_y \neq P'_y$)	2P
		input viewport	(not collinear)	3ISP
		echo viewport		2VP
	if input class = VALUATOR:	minimum value of range		R
		maximum value of range		R
	if input class = CHOICE:	maximum number of choice alternatives	(-1, 1..n)	I
	if input class = PICK:	pick aperture		2VDC
		maximum number of segment picks	(1..n)	I
		input extent (P, P')	($P_x \neq P'_x$, $P_y \neq P'_y$)	2P
		input viewport	(not collinear)	3ISP
		echo viewport		2VP
	if input class = STRING:	maximum string size	(> 0)	I
		input character set index		IX
		alternate input character set index		IX
		input character coding announcer	(BASIC 7-BIT, BASIC 8-BIT, EXTENDED 7-BIT, EXTENDED 8-BIT, PRIVATE)	E
	if input class = RASTER:	spot centre separations	(> 0)	2R
		colour capability	(NO, YES)	E
		threshold level		I
		bits per colour	(> 0)	I
		source window first corner (in pixels)	(0..n)	I
		source window second corner (in pixels)	(0..n)	I
	if input class = GENERAL:	maximum data record size		I
		measure format identifier	(-n..-1,1..n)	I

In	input device data record	D

Effect:

The Class-Specific Logical Input Device State List for the specified logical input device is updated with the specified class dependent values.

The effects of changing the ISC-to-VDC Mapping or Echo Mapping while a LID is active are implementation-dependent.

The *input device data record* contains additional information used to control the behaviour of the logical input device in an implementation-dependent manner.

Locator devices: (See 3.5.)

Stroke devices: The measure values returned by STROKE input functions are limited to no more than the *maximum number of stroke points* given in the *input device value* parameter.

The values *sampling interval for x-displacement, sampling interval for y-displacement, minimum time interval per sample* and *maximum time interval per sample* are used to control when a point is stored in the stroke buffer. The point is accepted when:

- The distance to the last point is greater than *sampling interval for x-displacement* or *sampling interval for y-displacement* and the time interval since the last point was accepted is longer than *minimum time interval per sample*, or;
- The time interval since the last point was accepted is longer than *maximum time interval per sample*.

Symbolically, this condition may be expressed as:

```
    Δx = current_x - last_x
    Δy = current_y - last_y
    dx = sampling interval for x-displacement
    dy = sampling interval for y-displacement
    t1 = minimum time interval per sample
    t2 = maximum time interval per sample
    t = (current_time) - (time_of_last_point)
    if (((|Δx| > dx or |Δy| > dy) and t > t1) or t > t2)
    then Point accepted
```

This is the only standardized way that a stroke can be constructed, however, other implementation-dependent ways, e.g. use of a subtrigger, are also possible. (See 3.5.)

Valuator devices: The measure values returned by VALUATOR input functions are scaled to the range specified by the *minimum value of range* and *maximum value of range* parameters.

Choice devices: the measure values returned by CHOICE input functions are limited to the value specified for the *maximum number of choice alternatives* parameter.

Pick devices: The *pick aperture* is a VDC region as defined in ISO/IEC 9636-4, 3.8. The pick aperture defines a VDC area around the pick point. (See 3.5.)

String devices: Input Character Set Index and Alternate Input Character Set Index are indices which refer to the character sets in the List of Available Input Character Sets in the Class-Specific Logical Input Device Description Table. Input Character Coding Announcer will be the coding technique used for coding strings returned by STRING input functions. The strings returned by STRING input functions are limited to the *maximum string size* given in the *input device value* parameter for input class STRING.

See ISO/IEC 9636-3, annex F for further details of character coding techniques.

Raster devices: The parameter *spot centre separations* determines the separation, in millimetres, along the x and y axes respectively, of the centres of pixels to be scanned by the device. Together with the physical size of the device in the RASTER Class-Specific Logical Input Device Description Table, this parameter determines the number of pixels that will be returned by the measure. Note that, when the entry Interpretation of Spot Centre Separation in the RASTER Class-Specific Logical Input Device Description Table is NOMINAL, this is the *only* meaning of this parameter. Only certain values of this parameter are permitted for each LID; the List of Permitted Spot Centre Separations in the RASTER Class-Specific Logical Input Device Description Table details the permissible values.

The parameter *source window* determines the subset of the full extent of the LID that will be returned by the measure.

Black and white RASTER operation is achieved by setting *colour* to NO and *bits per colour* to 1. Grey scales can be obtained by setting *bits per colour* to more than one.

Colour RASTER operation is achieved by setting *colour* to YES; *bits per colour* then determines the number of bits used for each of red, green, and blue. Hence, the total number of bits per pixel is three times the number of bits per colour.

On an implementation-dependent basis, the *threshold level* parameter may be used to control the mapping from a grey scale digitization to a black and white (binary) image. In such cases, levels greater than or equal to the Threshold Level are mapped to pixels of value 1, while those less than the Threshold Level map to pixels of value 0.

General devices: The *measure format identifier* selects one of the data record formats which the device provides, as indicated in its Class-Specific Logical Input Device Description Table. Subsequent input operations return data records in this format. The identifier may be one registered with the Registration Authority, or a negative number indicating an implementation-dependent value.

State Restrictions:
This function may only be invoked in LID state READY and Sampling State DISABLED.

Errors:

Error identifier:	3:508
Cause:	Too many stroke points for this LID
Reaction:	Maximum stroke buffer size used.
Error identifier:	3:509
Cause:	Choice number exceeds maximum available for this LID
Reaction:	Maximum number of choice alternatives used.
Error identifier:	3:510
Cause:	Too many pick values for this LID
Reaction:	Maximum pick buffer used.
Error identifier:	3:511
Cause:	Too many string characters for this LID
Reaction:	Maximum string buffer used.
Error identifier:	3:512
Cause:	Raster input colour capability not supported
Reaction:	Function ignored.
Error identifier:	3:513
Cause:	General input data record too large
Reaction:	Maximum data record size used.
Error identifier:	3:514
Cause:	LID does not support this General input measure format identifier
Reaction:	Function ignored.
Error identifier:	3:529
Cause:	Too many raster pixels
Reaction:	Function ignored.
Error identifier:	3:530
Cause:	Unsupported input character set index or alternate input character set index
Reaction:	Function ignored.
Error identifier:	3:531
Cause:	Unsupported input character coding announcer
Reaction:	Function ignored.
Error identifier:	5:501
Cause:	Function illegal in LID State RELEASED
Reaction:	Function ignored.

Error identifier:	5:502
Cause:	Function illegal in LID State ECHO REQUEST ENABLED
Reaction:	Function ignored.
Error identifier:	5:503
Cause:	Function illegal in LID State ECHO REQUEST COMPLETED
Reaction:	Function ignored.
Error identifier:	5:504
Cause:	Function illegal in LID State EVENTS ENABLED
Reaction:	Function ignored.
Error identifier:	5:514
Cause:	Function illegal in LID Sampling State ENABLED
Reaction:	Function ignored.

5.2.7 ASSOCIATE TRIGGERS

Parameters:

In	input class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E
In	input device index	(1..n)	IX
In	list of triggers		nIX

Effect:

The given *list of triggers*, along with any non-dissociable triggers, are associated with the logical input device.

The *list of triggers* can be empty, in which case the input device is only available for SAMPLE input unless there are non-dissociable triggers.

State Restrictions:

This function may only be invoked in LID State READY.

Errors:

Error identifier:	5:501
Cause:	Function illegal in LID State RELEASED
Reaction:	Function ignored.
Error identifier:	5:502
Cause:	Function illegal in LID State ECHO REQUEST ENABLED
Reaction:	Function ignored.
Error identifier:	5:503
Cause:	Function illegal in LID State ECHO REQUEST COMPLETED
Reaction:	Function ignored.
Error identifier:	5:504
Cause:	Function illegal in LID State EVENTS ENABLED
Reaction:	Function ignored.

5.2.8 GET ADDITIONAL STROKE DATA

Parameters:

In	number of requested points		I
Out	response validity	(INVALID, VALID)	E
Out	list of points		nP

Effect:

Input data which was not returned by the previous REQUEST STROKE, SAMPLE STROKE, ECHO REQUEST STROKE, DEQUEUE STROKE EVENT, or GET ADDITIONAL STROKE DATA function is returned. The total number of available points was returned by the initiating REQUEST (SAMPLE, ECHO REQUEST, DEQUEUE EVENT) STROKE function.

Errors:

Error identifier:	5:515
Cause:	Function was not invoked directly following a REQUEST (SAMPLE, ECHO REQUEST, DEQUEUE EVENT, or GET ADDITIONAL DATA) function or all data has been previously returned
Reaction:	Function ignored.

5.2.9 GET ADDITIONAL PICK DATA

Parameters:

In	number of requested pick values		I
Out	response validity	(INVALID, VALID)	E
Out	list of pick values		nPV

Effect:

Input data which was not returned by the previous SIMULATE PICK, REQUEST PICK, SAMPLE PICK, ECHO REQUEST PICK, DEQUEUE PICK EVENT, or GET ADDITIONAL PICK DATA function is returned. The total number of available pick values was returned by the initiating REQUEST (SAMPLE, ECHO REQUEST, DEQUEUE EVENT) PICK function.

Errors:

Error identifier:	5:516
Cause:	Function was not invoked directly following a SIMULATE PICK or a REQUEST (SAMPLE, ECHO REQUEST, DEQUEUE EVENT, or GET ADDITIONAL DATA) function or all data has been previously returned
Reaction:	Function ignored.

5.2.10 GET ADDITIONAL STRING DATA

Parameters:

In	number of requested characters		I
Out	response validity	(INVALID, VALID)	E
Out	string		S

Effect:

Input data which was not returned by the previous REQUEST STRING, SAMPLE STRING, ECHO REQUEST STRING, DEQUEUE STRING EVENT, or GET ADDITIONAL STRING DATA function is returned. The total number of available characters was returned by the initiating REQUEST (SAMPLE, ECHO REQUEST, DEQUEUE EVENT) STRING function.

Errors:

Error identifier:	5:515
Cause:	Function was not invoked directly following a REQUEST (SAMPLE, ECHO REQUEST, DEQUEUE EVENT, or GET ADDITIONAL DATA) function or all data has been previously returned
Reaction:	Function ignored.

5.2.11 GET ADDITIONAL RASTER DATA

Parameters:

In	number of requested colour values		I
Out	response validity	(INVALID, VALID)	E
Out	list of input colour values		nICO

Effect:

Input data which was not returned by the previous REQUEST RASTER, SAMPLE RASTER, ECHO REQUEST RASTER, DEQUEUE RASTER EVENT, or GET ADDITIONAL RASTER DATA function is returned. The total number of available input colour values was returned by the initiating REQUEST (SAMPLE, ECHO REQUEST, DEQUEUE EVENT) RASTER function.

Errors:

Error identifier:	5:515
Cause:	Function was not invoked directly following a REQUEST (SAMPLE, ECHO REQUEST, DEQUEUE EVENT, or GET ADDITIONAL DATA) function or all data has been previously returned
Reaction:	Function ignored.

5.3 Request and sample functions

5.3.1 REQUEST <input class>

Parameters:

In	input device index		(1..n)	IX
In	timeout			R
In	if input class = STROKE:	number of requested points		I
	if input class = PICK:	number of requested pick values		I
	if input class = STRING:	number of requested characters		I
	if input class = RASTER:	number of requested input colour specifiers		I
Out	response validity		(INVALID, VALID)	E
Out	request status		(TRIGGER FIRED, BREAK, TIMEOUT)	E
Out	trigger		(1..n)	IX
Out	measure validity		(INVALID, VALID)	E
Out	value			
	if input class = LOCATOR:	position		P
	if input class = STROKE:	total number of points		I
		list of points		nP
	if input class = VALUATOR:	value		R
	if input class = CHOICE:	choice number	(1..n)	I
	if input class = PICK:	total number of pick values		I
		list of pick values		nPV
	if input class = STRING:	total number of characters		I
		string		S
	if input class = RASTER:	total number of input colour values		I
		xcount, ycount		2I
		list of input colour values		nICO
	if input class = GENERAL:	data record		D

Effect:

The *value*, *measure validity*, *trigger*, and *request status* for the specified logical input device are returned.

The timeout value is specified in units of seconds. If the timeout value is greater than zero, then the function does not return until one of three events occurs:

- a trigger associated with the specified logical input device fires, or
- a timeout occurs, or
- a break action occurs.

Specifying a timeout value less than zero means wait forever. In this case, either a trigger firing or a break action shall occur before a value is returned. If a timeout value of zero is specified, the function shall return immediately with *response validity* returned as INVALID. If the request status is BREAK or TIMEOUT, the *value* and the *trigger* are undefined.

A true timeout capability need not be implemented; if it is not, then a positive timeout value is treated as wait forever.

If there are too many points for a stroke device, the excess points are lost and the measure validity is returned as INVALID.

If there are too many pick values for a pick device, the excess pick values are discarded and the measure validity is returned as INVALID.

If a string measure is too long for a string device, the string is truncated and the measure validity is returned as INVALID.

If for a general class input device the data record size is exceeded, the data are truncated and the measure validity is returned as INVALID.

When the *measure validity* is returned as INVALID, the *value* is undefined. Otherwise, for STROKE, PICK, STRING, and RASTER input devices, the *total number of available points*, *total number of available pick values*, *total number of available characters*, and *total number of available input colour values*, respectively, is returned. The client specifies how much data for these input devices is to be returned with the parameters *number of requested points*, *number of requested pick values*, *number of requested characters*, and *number of requested input colour values*, respectively. Additional elements can be returned, if available, by use of the corresponding GET ADDITIONAL <input class> DATA function.

(See 3.4 and 3.6.)

State Restrictions:
This function may only be invoked in LID State READY.

Errors:

Error identifier:	3:501
Cause:	LID does not support Request method input
Reaction:	Function has no effect, response validity is set to INVALID.
Error identifier:	3:524
Cause:	LID has no associated triggers
Reaction:	Function has no effect, response validity is set to INVALID.
Error identifier:	5:501
Cause:	Function illegal in LID State RELEASED
Reaction:	Function has no effect, response validity is set to INVALID.
Error identifier:	5:502
Cause:	Function illegal in LID State ECHO REQUEST ENABLED
Reaction:	Function has no effect, response validity is set to INVALID.
Error identifier:	5:503
Cause:	Function illegal in LID State ECHO REQUEST COMPLETED
Reaction:	Function has no effect, response validity is set to INVALID.
Error identifier:	5:504
Cause:	Function illegal in LID State EVENTS ENABLED
Reaction:	Function has no effect, response validity is set to INVALID.

5.3.2 SAMPLING STATE

Parameters:

In	input class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E
In	input device index	(1..n)	IX
In	sampling state	(DISABLED, ENABLED)	E

Effect:

The Sampling State entry in the Class-Independent Logical Input Device State List for the indicated logical input device is set to the value specified.

If the Sampling State is set to ENABLED, the LID becomes *active* unless it is already active. If it is set to DISABLED, the LID becomes inactive if the Input Device State is not one of EVENTS ENABLED, ECHO REQUEST ENABLED, or ECHO REQUEST COMPLETED.

State Restrictions:

This function may be invoked in all LID states except state RELEASED.

Errors:

Error identifier:	3:502
Cause:	LID does not support Sample method input
Reaction:	Function ignored.
Error identifier:	5:501
Cause:	Function illegal in LID State RELEASED
Reaction:	Function ignored.

5.3.3 SAMPLE <input class>

Parameters:

In	input device index		(1..n)	IX
In	if input class = STROKE:	number of requested points		I
	if input class = PICK:	number of requested pick values		I
	if input class = STRING:	number of requested characters		I
	if input class = RASTER:	number of requested input colour specifiers		I
Out	response validity		(INVALID, VALID)	E
Out	measure validity		(INVALID, VALID)	E
Out	current value			
	if input class = LOCATOR:	position		P
	if input class = STROKE:	total number of points		I
		list of points		nP
	if input class = VALUATOR:	value		R
	if input class = CHOICE:	choice number	(1..n)	I
	if input class = PICK:	total number of pick values		I
		list of pick values		nPV
	if input class = STRING:	total number of characters		I
		string		S
	if input class = RASTER:	total number of input colour values		I
		xcount, ycount		2I
		list of input colour values		nICO
	if input class = GENERAL:	data record		D

Effect:

The *current value* and *measure validity* of the specified logical input device are returned.

Sampling of strokes may be performed when events are enabled for the LID; the stroke buffer is cleared on occurrence of a trigger or break. Sampling of strings may be performed when events are enabled for the LID; the string buffer is cleared on occurrence of a trigger or break.

If there are too many points for a stroke device, the excess points are lost and the measure validity is returned as INVALID.

If there are too many pick values for a pick device, the excess pick values are discarded and the measure validity is returned as INVALID.

If a string measure is too long for a string device, the string is truncated and the measure validity is returned as INVALID.

If for a general class input device the data record size is exceeded, the data are truncated and the measure validity is returned as INVALID.

When the *measure validity* is INVALID, the *current value* is undefined. Otherwise, for STROKE, PICK, STRING, and RASTER input devices, the *total number of available points*, *total number of available pick values*, *total number of available characters*, and *total number of available input colour values*, respectively, is returned. The client specifies how much data for these input devices is to be returned with the parameters *number of requested points*, *number of requested pick values*, *number of requested characters*, and *number of requested input colour values*, respectively. Additional elements can be returned, if available, by use of the corresponding GET ADDITIONAL <input class> DATA function.

(See 3.4.)

State Restrictions:

This function may only be invoked if the Sampling State of the LID is ENABLED and the Input Device State is not RELEASED.

Errors:

Error identifier:	3:502
Cause:	LID does not support Sample method input
Reaction:	Function ignored.

Error identifier:	5:501
Cause:	Function illegal in LID State RELEASED
Reaction:	Function has no effect, response validity is set to INVALID.

Error identifier:	5:506
Cause:	Function illegal in LID Sampling State DISABLED
Reaction:	Function has no effect, response validity is set to INVALID.

5.4 Echo request input functions

5.4.1 INITIALIZE ECHO REQUEST

Parameters:

In	input class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E
In	input device index	(1..n)	IX
In	timeout		R

Effect:

All triggers associated with the specified logical input device are armed and the Input Device State for the LID is set to ECHO REQUEST ENABLED.

If the Prompt Control is ENABLED, then INITIALIZE ECHO REQUEST causes the prompting action to be performed according to the Prompt Type.

The invocation of this function places the device in a state in which ECHO REQUEST may be used. The timeout interval that may affect the behaviour of the ECHO REQUEST begins within the invocation of this function, but control is returned immediately.

The timeout value is specified in units of seconds. Specifying a timeout value of zero causes the device to immediately enter the state ECHO REQUEST COMPLETED. Otherwise, the device enters the state ECHO REQUEST ENABLED. From this state, a transition to state ECHO REQUEST COMPLETED will happen on occurrence of a trigger firing, a timeout, or a break action from the operator. If a negative value is specified for the timeout interval, this transition can happen only on occurrence of a trigger firing or a break action (i.e. it signals to wait forever). If a true timeout capability is not available, then a positive timeout value is also interpreted as wait forever.

If the Acknowledgement Control is ENABLED, then the firing of a trigger causes the acknowledgement action determined by the current Acknowledgement Type to be performed. If the Prompt Control is ENABLED, then the firing of a trigger causes any continuously prompting display to be removed or terminated.

State Restrictions:
This function may only be invoked in LID State READY.

Errors:

Error identifier:	3:524
Cause:	LID has no associated triggers
Reaction:	Function ignored.
Error identifier:	5:501
Cause:	Function illegal in LID State RELEASED
Reaction:	Function ignored.
Error identifier:	5:502
Cause:	Function illegal in LID State ECHO REQUEST ENABLED
Reaction:	Function ignored.
Error identifier:	5:503
Cause:	Function illegal in LID State ECHO REQUEST COMPLETED
Reaction:	Function ignored.
Error identifier:	5:504
Cause:	Function illegal in LID State EVENTS ENABLED
Reaction:	Function ignored.

5.4.2 ECHO REQUEST <input class>

Parameters:

In	input device index		(1..n)	IX
In	if input class = STROKE:	number of requested points		I
	if input class = PICK:	number of requested pick values		I
	if input class = STRING:	number of requested characters		I
	if input class = RASTER:	number of requested input colour specifiers		I
Out	response validity		(INVALID, VALID)	E
Out	request status		(TRIGGER FIRED, BREAK, TIMEOUT, MEASURE CHANGED)	E
Out	trigger		(1..n)	IX
Out	measure validity		(INVALID, VALID)	E
Out	value:			
	if input class = LOCATOR:	position		P
	if input class = STROKE:	total number of points		I
		list of points		nP
	if input class = VALUATOR:	value		R
	if input class = CHOICE:	choice number	(1..n)	I
	if input class = PICK:	total number of pick values		I
		list of pick values		nPV

if input class = STRING:	total number of characters	I
	string	S
if input class = RASTER:	total number of input colour values	I
	xcount, ycount	2I
	list of input colour values	nICO
if input class = GENERAL:	data record	D

Effect:

This function is used for remote echoing.

When invoked in Input Device State ECHO REQUEST ENABLED, the state is set to ECHO REQUEST PENDING. The function terminates when:

- the measure changes. In this case the *request status* is returned as MEASURE CHANGED, the *value* returned is the current value, and the *trigger* is undefined.
- a trigger associated with the specified logical input device fires. The Input Device State changes to READY, the *request status* is returned as TRIGGER FIRED, and the *trigger* and *value* when the trigger fired are returned.
- a break action is indicated by the operator. The Input Device State is changed to READY, the *request status* is returned as BREAK, the *measure validity* is returned as INVALID, and the *value* and *trigger* are undefined.
- the timeout, (started by INITIALIZE ECHO REQUEST) elapses. The device is set to Input Device State READY, the *request status* is returned as TIMEOUT, the *measure validity* is returned as INVALID, and the *value* and *trigger* are undefined.

When invoked in the state ECHO REQUEST COMPLETED, the state is set to READY and the function returns immediately, returning data as if the trigger, timeout, or break had occurred while there was a request pending.

If there are too many points for a stroke device, the excess points are lost and the measure validity is returned as INVALID.

If there are too many pick values for a pick device, the excess pick values are discarded and the measure validity is returned as INVALID.

If a string measure is too long for a string device, the string is truncated and the measure validity is returned as INVALID.

If for a general class input device the data record size is exceeded, the data are truncated and the measure validity is returned as INVALID.

For STROKE, PICK, STRING, and RASTER input devices, the *total number of available points*, *total number of available pick values*, *total number of available characters*, and *total number of available input colour values*, respectively, is returned. The client specifies how much data for these input devices is to be returned with the parameters *number of requested points*, *number of requested pick values*, *number of requested characters*, and *number of requested input colour values*, respectively. Additional elements can be returned, if available, by use of the corresponding GET ADDITIONAL <input class> DATA function.

(See 3.4.)

State Restrictions:

This function may only be invoked in the LID states ECHO REQUEST ENABLED or ECHO REQUEST COMPLETED.

Errors:

Error identifier:	5:501
Cause:	Function illegal in LID State RELEASED
Reaction:	Function has no effect, response validity is set to INVALID.
Error identifier:	5:504
Cause:	Function illegal in LID State EVENTS ENABLED
Reaction:	Function has no effect, response validity is set to INVALID.
Error identifier:	5:505
Cause:	Function illegal in LID State READY
Reaction:	Function has no effect, response validity is set to INVALID.

5.5 Event input functions

5.5.1 INITIALIZE EVENT QUEUE

Parameters:

Out	response validity	(INVALID, VALID)	E
Out	initial time stamp		R

Effect:

The Virtual Device event queue is initialized and the Event Queue State is set to EMPTY NO LID ENABLED. Any needed resources are allocated. The current value of the timestamp is returned. The Event Queue Block State of the Event Input State List is set to NOT BLOCKED.

State Restrictions:

This function may only be invoked if the Event Queue State is RELEASED or EMPTY NO LID ENABLED.

Errors:

Error identifier: 5:507
Cause: Function illegal in Event Queue State EMPTY LID ENABLED
Reaction: Function has no effect, response validity is set to INVALID.

Error identifier: 5:508
Cause: Function illegal in Event Queue State NOT EMPTY NO LID ENABLED
Reaction: Function has no effect, response validity is set to INVALID.

Error identifier: 5:513
Cause: Function illegal in Event Queue State NOT EMPTY LID ENABLED
Reaction: Function has no effect, response validity is set to INVALID.

5.5.2 RELEASE EVENT QUEUE

Parameters:

None

Effect:

The Virtual Device event queue is released and the Event Queue State is set to RELEASED. The contents of the event queue are discarded and any allocated resources are deallocated.

State Restrictions:

This function may not be invoked if any LID is enabled for events.

Errors:

Error identifier: 5:507
Cause: Function illegal in Event Queue State EMPTY LID ENABLED
Reaction: Function has no effect, response validity is set to INVALID.

Error identifier: 5:513
Cause: Function illegal in Event Queue State NOT EMPTY LID ENABLED
Reaction: Function has no effect, response validity is set to INVALID.

5.5.3 ENABLE EVENTS

Parameters:

In	input class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E
In	input device index	(1..n)	IX

Effect:

The specified logical input device is enabled to enter event reports into the Virtual Device event queue. All triggers associated with the logical input device are armed and the Input Device State is set to EVENTS ENABLED.

(See 3.7.5.)

State Restrictions:

This function may only be invoked if the Event Queue State is not RELEASED and the Input Device State is READY; if the LID was not already active it becomes so.

Errors:

Error identifier:	3:503
Cause:	LID does not support Event method input
Reaction:	Function ignored.
Error identifier:	3:524
Cause:	LID has no associated triggers
Reaction:	Function ignored.
Error identifier:	5:501
Cause:	Function illegal in LID State RELEASED
Reaction:	Function ignored.
Error identifier:	5:502
Cause:	Function illegal in LID State ECHO REQUEST ENABLED
Reaction:	Function ignored.
Error identifier:	5:503
Cause:	Function illegal in LID State ECHO REQUEST COMPLETED
Reaction:	Function ignored.
Error identifier:	5:509
Cause:	Function illegal in Event Queue State RELEASED
Reaction:	Function ignored.

5.5.4 DISABLE EVENTS

Parameters:

In	input class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E
In	input device index	(1..n)	IX

Effect:

The Input Device State for the specified logical input device is set to state READY if the current Input Device State is EVENTS ENABLED. If the Sampling State is DISABLED, the LID ceases to be active.

State Restrictions:

This function may be invoked in all LID states except state RELEASED.

Errors:

Error identifier:	3:503
Cause:	LID does not support Event method input
Reaction:	Function ignored.

Error identifier:	5:501
Cause:	Function illegal in LID State RELEASED
Reaction:	Function ignored.

5.5.5 EVENT QUEUE BLOCK CONTROL

Parameters:

In	control	(NOT BLOCKED, BLOCKED)	E

Effect:

The Event Queue Block State of the Event Queue State List is set to the value specified.

(See 3.7.5.)

State Restrictions:

This function may not be invoked when the Event Queue State is RELEASED.

Errors:

Error identifier:	5:509
Cause:	Function illegal in Event Queue State RELEASED
Reaction:	Function ignored.

5.5.6 FLUSH EVENTS

Parameters:

None

Effect:

The contents of the event queue are discarded and the Event Queue State is set to EMPTY LID ENABLED or EMPTY NO LID ENABLED depending on the states of all LIDs.

State Restrictions:

This function may not be invoked when the Event Queue State is RELEASED.

Errors:

Error identifier:	5:509
Cause:	Function illegal in Event Queue State RELEASED
Reaction:	Function ignored.

5.5.7 FLUSH DEVICE EVENTS

Parameters:

In	input class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E
In	input device index	(1..n)	IX

Effect:

All event reports sent from the specified logical input device are discarded if the Event Queue State is not RELEASED. If no event reports remain in the event queue, then the Event Queue State is set to EMPTY LID ENABLED or EMPTY NO LID ENABLED depending on the Input Device State of the entire set of LIDs.

State Restrictions:

This function may not be invoked when the Event Queue State is RELEASED.

Errors:

Error identifier:	5:509
Cause:	Function illegal in Event Queue State RELEASED
Reaction:	Function ignored.

5.5.8 AWAIT EVENT

Parameters:

In	timeout		R
Out	response validity	(INVALID, VALID)	E
Out	event status	(TIMEOUT, EVENT, OVERFLOW, BREAK)	E
Out	input class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL, NONE)	E
Out	input device index	(1..n)	IX
Out	input trigger index	(1..n)	IX
Out	timestamp		R

Effect:

AWAIT EVENT is used to control and return information from the event queue. The *input class*, *input device index*, *input trigger index*, *timestamp* and *event status* of the oldest event report in the event queue are returned. This function should be called before any event report is dequeued.

The *event status* parameter has the following meanings:

- TIMEOUT
  The queue is empty and the timeout interval (which may be zero) has elapsed.
- EVENT
  There is at least one event available in the queue. All parameters are defined and refer to the oldest event. The event may be dequeued by DEQUEUE <input class> EVENT or EVENT QUEUE TRANSFER.
- OVERFLOW
  Since the last invocation of AWAIT EVENT (or when there has been no such call since initialization of the event queue), there has been an attempt to trigger an event whose report could not be enqueued because of lack of space. The parameters describe this event. The Event Queue Block State is set to BLOCKED, the Unreported Overflow State is set to NO OVERFLOW.
- BREAK
  Since the last invocation of AWAIT EVENT (or when there has been no such call since initialization of the event queue), a break action has been performed by the operator. If the mechanism indicating a break action was common for the Virtual Device, the returned *input class* is NONE and the *input device index* is undefined, otherwise, *input class* and *input device index* are defined. In neither case is the *input trigger index* defined. The Unreported Break State is set to NO BREAK. If the overflow and break conditions are both true, BREAK is reported in the first invocation of AWAIT EVENT and OVERFLOW in the next.

The timeout value is specified in units of seconds. If a timeout occurs before an event report enters the event queue, the event status is set to TIMEOUT.

Specifying a timeout value of zero causes parameters to be returned immediately. Specifying a timeout value less than zero means wait forever. A true timeout capability may not be implemented; if it is not, then a positive timeout value is equivalent to a zero timeout value.

State Restrictions:

This function may not be invoked when the Event Queue State is RELEASED.

Errors:

Error identifier:	3:525
Cause:	The event queue is blocked
Reaction:	Function has no effect, response validity is set to INVALID.

Error identifier:	5:509
Cause:	Function illegal in Event Queue State RELEASED
Reaction:	Function has not effect, response validity is set to INVALID.

Error identifier:	5:510
Cause:	Function illegal in Event Queue State EMPTY NO LID ENABLED
Reaction:	Function has no effect, response validity is set to INVALID.

5.5.9 DEQUEUE <input class> EVENT

Parameters:

In	if input class = STROKE:	number of requested points		I
	if input class = PICK:	number of requested pick values		I
	if input class = STRING:	number of requested characters		I
	if input class = RASTER:	number of requested input colour specifiers		I
Out	response validity		(INVALID, VALID)	E
Out	measure validity		(INVALID, VALID)	E
Out	measure value:			
	if input class = LOCATOR:	position		P
	if input class = STROKE:	total number of points		I
		list of points		nP
	if input class = VALUATOR:	value		R
	if input class = CHOICE:	choice number	(1..n)	I
	if input class = PICK:	total number of pick values		I
		list of pick values		nPV
	if input class = STRING:	total number of characters		I
		string		S
	if input class = RASTER:	total number of input colour values		I
		xcount, ycount		2I
		list of input colour values		nICO
	if input class = GENERAL:	data record		D

Effect:

The *measure validity* and *measure value* are returned from the oldest event report in the event queue. This event report is then removed from the event queue. If the event queue thus becomes empty, then the Event Queue State is set to EMPTY LID ENABLED or EMPTY NO LID ENABLED depending on the states of all LIDs.

For STROKE, PICK, STRING, and RASTER input devices, the *total number of available points*, *total number of available pick values*, *total number of available characters*, and *total number of available input colour values*, respectively, is returned. The client specifies how much data for these input devices is to be returned with the parameters *number of requested points*, *number of requested pick values*, *number of requested characters*, and *number of requested input colour values*, respectively. Additional elements can be returned, if available, by use of the corresponding GET ADDITIONAL <input class> DATA function.

State Restrictions:

This function may not be invoked when the Event Queue State is RELEASED.

Errors:

Error identifier:	3:526
Cause:	Event report input class inconsistent with the requested class
Reaction:	Function has no effect, response validity is set to INVALID.

Error identifier:	5:507
Cause:	Function illegal in Event Queue State EMPTY LID ENABLED
Reaction:	Function has no effect, response validity is set to INVALID.

Error identifier:	5:509
Cause:	Function illegal in Event Queue State RELEASED
Reaction:	Function has not effect, response validity is set to INVALID.
Error identifier:	5:510
Cause:	Function illegal in Event Queue State EMPTY NO LID ENABLED
Reaction:	Function has no effect, response validity is set to INVALID.

5.5.10 EVENT QUEUE TRANSFER

Parameters:

Out	response validity	(INVALID, VALID)	E
Out	event reports list		EVL

Effect:

The contents of the event queue are transferred to the client in a data record. There is no provision for partitioning large measures as there is for other functions returning measures.

If there are too many points for a stroke device, the excess points are lost and the measure validity is returned as INVALID.

If there are too many pick values for a pick device, the excess pick values are discarded and the measure validity is returned as INVALID.

If a string measure is too long for a string device, the string is truncated and the measure validity is returned as INVALID.

If for a general class input device the data record size is exceeded, the data are truncated and the measure validity is returned as INVALID.

State Restrictions:

This function may not be invoked when the Event Queue State is RELEASED.

Errors:

Error identifier:	5:507
Cause:	Function illegal in Event Queue State EMPTY LID ENABLED
Reaction:	Function has no effect, response validity is set to INVALID.
Error identifier:	5:509
Cause:	Function illegal in Event Queue State RELEASED
Reaction:	Function has not effect, response validity is set to INVALID.
Error identifier:	5:510
Cause:	Function illegal in Event Queue State EMPTY NO LID ENABLED
Reaction:	Function has no effect, response validity is set to INVALID.

5.6 Echo output functions

5.6.1 INITIALIZE ECHO OUTPUT

Parameters:

In	input class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E
In	echo entity index	(1..n)	IX

Effect:

If an echo output entity with the given index already exists, its Individual Echo Entity State List will be reinitialized to default values. Otherwise, an echo output entity and an associated Individual Echo Entity State List will be created. The Echo Entity State is set to READY.

State Restrictions:

None.

Errors:

Error identifier:	3:528
Cause:	Maximum number of Echo Output Entities for this input class exceeded
Reaction:	Function ignored.

5.6.2 RELEASE ECHO OUTPUT

Parameters:

In	input class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E
In	echo entity index	(1..n)	IX

Effect:

The resources associated with the specified echo entity are deallocated.

State Restrictions:

None.

Errors:

Error identifier:	3:532
Cause:	No Echo Output Entity exists for the specified class and echo entity index
Reaction:	Function ignored.

5.6.3 ECHO OUTPUT CONTROLS

Parameters:

In	input class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E
In	echo entity index	(1..n)	IX
In	prompt control	(PROMPT OFF, PROMPT ON)	E
In	echo control	(ECHO OFF, ECHO ON)	E

Effect:

The Prompt Control and Echo Control for the specified echo entity are set to the specified values.

Setting the Prompt Control to PROMPT ON causes prompting output to be performed. Setting the Prompt Control to PROMPT OFF causes any prompting output to be removed from the drawing surface. The form of prompting is determined by the Prompt Type associated with the echo entity.

If prompting is limited to a certain period of time (such as sounding a tone once), this action will occur on the transition from PROMPT OFF to PROMPT ON.

Setting the Echo Control to ECHO ON causes the specified echo to be shown on the drawing surface, according to the Echo Type associated with the echo entity. Setting the echo control to ECHO OFF causes the specified echo to be removed from the display surface.

If both the Prompt Control and Echo Control are off, the Echo Entity State is set to READY, otherwise it is set to ACTIVE.

State Restrictions:

None.

Errors:

Error identifier:	3:532
Cause:	No Echo Output Entity exists for the specified class and echo entity index
Reaction:	Function ignored.

5.6.4 PERFORM ACKNOWLEDGEMENT

Parameters:

In	input class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E
In	echo entity index	(1..n)	IX

Effect:

This function causes acknowledgement output to be performed. The form of the acknowledgement output is determined by the Acknowledgement Type in the Individual Echo Entity State List for the specified echo entity.

If acknowledgement is not supported for the echo entity, the function has no effect.

State Restrictions:

This function may only be invoked when the echo entity is in state ACTIVE.

Errors:

Error identifier:	3:532
Cause:	No Echo Output Entity exists for the specified class and echo entity index
Reaction:	Function ignored.

Error identifier:	5:512
Cause:	Function illegal in Echo Output Entity State READY
Reaction:	Function ignored.

5.6.5 UPDATE <input class> ECHO OUTPUT

Parameters:

In	echo entity index		(1..n)	IX
In	echo value:			
	if input class = LOCATOR:	position		P
	if input class = STROKE:	list of points		nP
	if input class = VALUATOR:	value		R
	if input class = CHOICE:	choice number	(1..n)	I
	if input class = PICK:	list of pick values		nPV
	if input class = STRING:	string		S
	if input class = RASTER:	xcount, ycount	(1..n)	2I
		list of input colour values		nICO
	if input class = GENERAL:	measure format identifier	(-n..-1, 1..n)	I
		data record		D

Effect:

The echo value is updated. If the Echo Entity State is ACTIVE, the display surface is updated to show the *echo value*.

This function will cause any previous echo output to be removed and replaced with the echo output for the echo value.

State Restrictions:

None.

Errors:

Error identifier:	3:517
Cause:	Too many points in Stroke measure for this Echo Output Entity
Reaction:	Excess points lost.

Error identifier:	3:518
Cause:	String too long for this Echo Output Entity
Reaction:	String truncated.
Error identifier:	3:519
Cause:	Too many pixels in Raster measure for this Echo Output Entity
Reaction:	Excess pixels lost.
Error identifier:	3:520
Cause:	General Data record too large for this Echo Output Entity
Reaction:	Depends on the specification of the echo output entity.
Error identifier:	3:532
Cause:	No Echo Output Entity exists for the specified class and echo entity index
Reaction:	Function ignored.
Error identifier:	3:533
Cause:	Content of General Data Record invalid
Reaction:	Depends on the specification of the echo output entity.

5.6.6 ECHO OUTPUT DATA

Parameters:

In	input class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E
In	echo entity index	(1..n)	IX
In	prompt type	(-n..-1,1..n)	IX
In	echo type	(-n..-1,1..n)	IX
In	acknowledgement type	(-n..-1,1..n)	IX
In	echo area		2VP
In	echo output echo data record		D

Effect:

The Prompt Type, Echo Type, Acknowledgement Type, Echo Area, and Echo Output Echo Data Record entries in the Individual Echo Entity State List for the specified echo entity are set to the specified values. The Prompt Type defines the form of prompting output which occurs when the Prompt Control is set to PROMPT ON. The Echo Type defines the form of echoing output which appears when the Echo Control is set to ECHO ON. The Acknowledgement Type defines the form of acknowledgement output which occurs upon PERFORM ACKNOWLEDGEMENT.

The Echo Area defines a rectangular area in viewport coordinates; prompting, echoing, and acknowledgement output may be restricted to remain within this area on the display surface of the Virtual Device. This rectangle is most applicable to CHOICE, STRING, and VALUATOR input, but its effect with classes, LOCATOR, STROKE, and PICK, will be to suppress the display of the echo when its position lies outside of the rectangle. If the *echo area* is not wholly contained within the device limits, the intersection of the specified *echo area* with the device limits is used. The position of a geometric echo will be transformed through the VDC-to-Device Mapping. (This does not affect the *shape* of the echo.)

The contents of the Echo Output Echo Data Record depends upon the *prompt type*, *echo type*, and *acknowledgement type*.

State Restrictions:

This function may not be invoked when the echo entity is in state ACTIVE.

Errors:

Error identifier:	3:515
Cause:	Echo Output Entity does not support this echo type
Reaction:	Function ignored.
Error identifier:	3:516
Cause:	Echo Output Entity does not support this prompt type
Reaction:	Function ignored.

Error identifier:	3:522
Cause:	Echo Area not wholly contained within display surface
Reaction:	Echo Area set to intersection of supplied echo area and display surface limits.
Error identifier:	3:523
Cause:	Contents of Echo Data Record invalid
Reaction:	Default data record used.
Error identifier:	3:527
Cause:	Echo Output Entity does not support this acknowledgement type
Reaction:	Function ignored.
Error identifier:	3:532
Cause:	No Echo Output Entity exists for the specified class and echo entity index
Reaction:	Function ignored.
Error identifier:	5:511
Cause:	Function illegal in Echo Output Entity State ACTIVE
Reaction:	Function ignored.

6 Input and echoing inquiry functions

6.1 Introduction

This clause describes the abstract functional specification of the Input and Echoing Inquiry functions of the CGI.

The abstract names of these functions start with INQUIRE and will only return the values of one or more entries in a description table or state list.

See ISO/IEC 9636-1, 5.2.7.

6.1.1 Data types employed

The abstract specifications of functions detail the functions in terms of input and output parameters. The data type of each parameter is selected from a standard set and is identified in the functional specification by a standard abbreviation. Both the data types and the abbreviations are taken from the complete list of data types given in ISO/IEC 9636-1, 5.2.10.

6.1.2 Validity of returned information

For all the inquiry functions specified in this clause, if any of the inquired information is available, the response validity flag is returned as VALID and the values specified in the output parameters are returned. In the case of a VALID response, if there is any possibility that any of the individual parameters within the response are not valid, then the response itself will contain additional (always valid) parameters which indicate which of the other returned parameters are valid.

If the inquired information is not available or the inquiry function is unsupported, the response validity flag is returned as INVALID and the specified output parameters are undefined. No other meaning should be applied to these other output parameters.

6.2 Input description table

6.2.1 INQUIRE INPUT CAPABILITY

Parameters:

Out	response validity	(INVALID, VALID)	E
Out	timeout capability	(LIMITED, FULL)	E
Out	timestamp implementation	(NA, TRIGGER COUNT, CLOCK)	E

Effect:

See 6.1.2.

6.2.2 INQUIRE LIST OF AVAILABLE INPUT DEVICES

Parameters:

In	input class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E
In	number of list elements requested	(0..n)	I
In	index (within list) of first element to return	(1..n)	I
Out	response validity	(INVALID, VALID)	E
Out	number of list elements present in description table	(0..n)	I

Out	list of available input device indices		nIX

Effect:
See 6.1.2.

6.3 Class-independent logical input device description table

6.3.1 INQUIRE COMMON INPUT DEVICE PROPERTIES

Parameters:

In	input class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E
In	input device index	(1..n)	IX
Out	response validity	(INVALID, VALID)	E
Out	physical device identifier	(0..n)	I
Out	number of non-dissociable triggers	(0..n)	I
Out	request support	(NO, YES)	E
Out	echo request support	(NO, YES)	E
Out	sample support	(NO, YES)	E
Out	event support	(NO, YES)	E
Out	put current measure effective	(NO, YES)	E
Out	echo change support	(NO, YES)	E

Effect:
See 6.1.2.

6.3.2 INQUIRE LIST OF SUPPORTED ECHO TYPES

Parameters:

In	input class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E
In	input device index	(1..n)	IX
In	number of list elements requested	(0..n)	I
In	index (within list) of first element to return	(1..n)	I
Out	response validity	(INVALID, VALID)	E
Out	total number of list elements present in description table	(0..n)	I
Out	list of echo types		nIX

Effect:
See 6.1.2.

6.3.3 INQUIRE LIST OF SUPPORTED PROMPT TYPES

Parameters:

In	input class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E
In	input device index	(1..n)	IX
In	number of list elements requested	(0..n)	I
In	index (within list) of first element to return	(1..n)	I
Out	response validity	(INVALID, VALID)	E
Out	total number of list elements present in description table	(0..n)	I

Out	list of prompt types		nIX

Effect:

See 6.1.2.

6.3.4 INQUIRE LIST OF SUPPORTED ACKNOWLEDGEMENT TYPES

Parameters:

In	input class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E
In	input device index	(1..n)	IX
In	number of list elements requested	(0..n)	I
In	index (within list) of first element to return	(1..n)	I
Out	response validity	(INVALID, VALID)	E
Out	total number of list elements present in description table	(0..n)	I
Out	list of acknowledgement types		nIX

Effect:

See 6.1.2.

6.3.5 INQUIRE LIST OF ASSOCIABLE TRIGGERS

Parameters:

In	input class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E
In	input device index	(1..n)	IX
In	number of list elements requested	(0..n)	I
In	index (within list) of first element to return	(1..n)	I
Out	response validity	(INVALID, VALID)	E
Out	total number of list elements present in description table	(0..n)	I
Out	list of triggers		nIX

Effect:

See 6.1.2.

The non-dissociable triggers come first in the returned *list of triggers*.

6.4 Class-specific logical input device description table

6.4.1 INQUIRE LOCATOR CAPABILITIES

Parameters:

In	input device index	(1..n)	IX
Out	response validity	(INVALID, VALID)	E
Out	input surface lower left corner		ISP
Out	input surface upper right corner		ISP
Out	physical input surface size (mm)	(> 0)	2R
Out	input surface size interpretation	(NOMINAL, ACTUAL, UNLIMITED)	E
Out	number of distinguishable steps in xy directions	(1..n)	2I

Effect:

See 6.1.2.

6.4.2 INQUIRE STROKE CAPABILITIES

Parameters:

In	input device index	(1..n)	IX
Out	response validity	(INVALID, VALID)	E
Out	maximum number of points	(-1,1..n)	I
Out	lower left corner		ISP
Out	upper right corner		ISP
Out	physical input surface size (mm)	(> 0)	2R
Out	input surface size interpretation	(NOMINAL, ACTUAL, UNLIMITED)	E
Out	number of distinguishable steps in xy directions	(1..n)	2I

Effect:

See 6.1.2.

6.4.3 INQUIRE CHOICE CAPABILITIES

Parameters:

In	input device index	(1..n)	IX
Out	response validity	(INVALID, VALID)	E
Out	maximum number of choice alternatives	(-1,1..n)	I

Effect:

See 6.1.2.

6.4.4 INQUIRE PICK CAPABILITIES

Parameters:

In	input device index	(1..n)	IX
Out	response validity	(INVALID, VALID)	E
Out	maximum number of segment picks	(-1,1..n)	I
Out	lower left corner		ISP
Out	upper right corner		ISP
Out	physical input surface size (mm)	(> 0)	2R
Out	input surface size interpretation	(NOMINAL, ACTUAL, UNLIMITED)	E
Out	number of distinguishable steps in xy directions	(1..n)	2I

Effect:

See 6.1.2.

6.4.5 INQUIRE STRING CAPABILITIES

Parameters:

In	input device index	(1..n)	IX
Out	response validity	(INVALID, VALID)	E
Out	maximum string buffer size	(-1, 1..n)	I
Out	number of valid character coding announcers	(1..5)	I
Out	array of available input character coding announcers	(BASIC 7-BIT, BASIC 8-BIT, EXTENDED 7-BIT, EXTENDED 8-BIT, PRIVATE)	5E

Effect:

See 6.1.2.

6.4.6 INQUIRE LIST OF AVAILABLE INPUT CHARACTER SETS

Parameters:

In	input device index	(1..n)	IX
In	number of list elements requested	(0..n)	I
In	index (within list) of first element to return	(1..n)	I
Out	response validity	(INVALID, VALID)	E
Out	total number of list elements present in description table	(0..n)	I
Out	list of available input character sets		nCS

Effect:

See 6.1.2.

6.4.7 INQUIRE RASTER INPUT CAPABILITIES

Parameters:

In	input device index	(1..n)	IX
Out	response validity	(INVALID, VALID)	E
Out	physical input surface size	(> 0)	2R
Out	colour capability	(NO, YES)	E
Out	number of levels	(1..n)	I
Out	maximum number of bits per colour	(1..n)	I
Out	maximum height (in pixels)	(-1,1..n)	I
Out	maximum width (in pixels)	(-1,1..n)	I
Out	interpretation of spot centre separation	(NOMINAL, ACTUAL)	E

Effect:

See 6.1.2.

6.4.8 INQUIRE LIST OF PERMITTED RASTER SPOT CENTRE SEPARATIONS

Parameters:

In	input device index	(1..n)	IX
In	number of list elements requested	(0..n)	I
In	index (within list) of first element to return	(1..n)	I
Out	response validity	(INVALID, VALID)	E
Out	total number of list elements present in description table	(0..n)	I
Out	list of spot centre separations	(> 0)	n2R

Effect:

See 6.1.2.

6.4.9 INQUIRE GENERAL CAPABILITIES

Parameters:

In	input device index	(1..n)	IX
Out	response validity	(INVALID, VALID)	E
Out	maximum data record size	(-1,1..n)	I

Effect:

See 6.1.2.

6.4.10 INQUIRE LIST OF SUPPORTED GENERAL MEASURE FORMATS

Parameters:

In	input device index	(1..n)	IX
In	number of list elements requested	(0..n)	I
In	index (within list) of first element to return	(1..n)	I
Out	response validity	(INVALID, VALID)	E
Out	total number of list elements present in description table	(0..n)	I
Out	list of measure format identifiers	(-n..-1,1..n)	nI

Effect:

See 6.1.2.

6.5 Class-independent logical input device state list

6.5.1 INQUIRE COMMON LOGICAL INPUT DEVICE STATE

Parameters:

In	input class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E
In	input device index	(1..n)	IX
Out	response validity	(INVALID, VALID)	E
Out	input device state	(RELEASED, READY, REQUEST PENDING, ECHO REQUEST ENABLED, ECHO REQUEST PENDING, ECHO REQUEST COMPLETED, EVENTS ENABLED)	E
Out	sampling state	(DISABLED, ENABLED)	E
Out	echo control	(DISABLED, ENABLED)	E
Out	echo type	(-n..-1,1..n)	IX
Out	specification mode of echo area	(FRACTION OF DISPLAY SURFACE, MILLIMETRES WITH SCALE FACTOR, PHYSICAL DEVICE COORDINATES)	E
Out	metric scale factor of echo area		R
Out	echo area		2VP
Out	prompt control	(DISABLED, ENABLED)	E
Out	prompt type	(-n..-1,1..n)	IX
Out	acknowledgement control	(DISABLED, ENABLED)	E
Out	acknowledgement type	(-n..-1,1..n)	IX

Effect:

See 6.1.2.

Errors:

Error identifier:	5:501
Cause:	Function illegal in LID State RELEASED
Reaction:	Function has no effect, response validity is set to INVALID.

6.5.2 INQUIRE LIST OF ASSOCIATED TRIGGERS

Parameters:

In	input class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E
In	input device index	(1..n)	IX
In	number of list elements requested	(0..n)	I
In	index (within list) of first element to return	(1..n)	I

Out	response validity	(INVALID, VALID)	E
Out	total number of list elements present in state list	(0..n)	I
Out	list of associated triggers		nIX

Effect:
See 6.1.2.

Errors:

Error identifier:	5:501
Cause:	Function illegal in LID State RELEASED
Reaction:	Function has no effect, response validity is set to INVALID.

6.5.3 INQUIRE ECHO DATA RECORD

Parameters:

In	input class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E
In	input device index	(1..n)	IX
Out	response validity	(INVALID, VALID)	E
Out	echo data record		D

Effect:
See 6.1.2.

Errors:

Error identifier:	5:501
Cause:	Function illegal in LID State RELEASED
Reaction:	Function has no effect, response validity is set to INVALID.

6.5.4 INQUIRE INPUT DEVICE DATA RECORD

Parameters:

In	input class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E
In	input device index	(1..n)	IX
Out	response validity	(INVALID, VALID)	E
Out	data record		D

Effect:
See 6.1.2.

Errors:

Error identifier:	5:501
Cause:	Function illegal in LID State RELEASED
Reaction:	Function has no effect, response validity is set to INVALID.

6.6 Class-specific logical input device state list

6.6.1 INQUIRE LOCATOR STATE

Parameters:

In	input device index	(1..n)	IX

Out	response validity	(INVALID, VALID)	E
Out	input extent		2P
Out	input viewport		3ISP
Out	specification mode of echo viewport	(FRACTION OF DISPLAY SURFACE, MILLIMETRES WITH SCALE FACTOR, PHYSICAL DEVICE COORDINATES)	E
Out	metric scale factor of echo viewport		R
Out	echo viewport		2VP

Effect:

See 6.1.2.

Errors:

Error identifier: 5:501
Cause: Function illegal in LID State RELEASED
Reaction: Function has no effect, response validity is set to INVALID.

6.6.2 INQUIRE STROKE STATE

Parameters:

In	input device index	(1..n)	IX
Out	response validity	(INVALID, VALID)	E
Out	maximum number of points	(-1, 1..n)	I
Out	sampling interval for x-displacement	(≥ 0)	VDC
Out	sampling interval for y-displacement	(≥ 0)	VDC
Out	minimum time interval per sample	(≥ 0)	I
Out	maximum time interval per sample	(≥ 0)	I
Out	input extent		2P
Out	input viewport		3ISP
Out	specification mode of echo viewport	(FRACTION OF DISPLAY SURFACE, MILLIMETRES WITH SCALE FACTOR, PHYSICAL DEVICE COORDINATES)	E
Out	metric scale factor of echo viewport		R
Out	echo viewport		2VP

Effect:

See 6.1.2.

Errors:

Error identifier: 5:501
Cause: Function illegal in LID State RELEASED
Reaction: Function has no effect, response validity is set to INVALID.

6.6.3 INQUIRE VALUATOR STATE

Parameters:

In	input device index	(1..n)	IX
Out	response validity	(INVALID, VALID)	E
Out	minimum value of range		R
Out	maximum value of range		R

Effect:

See 6.1.2.

Errors:

Error identifier: 5:501
Cause: Function illegal in LID State RELEASED
Reaction: Function has no effect, response validity is set to INVALID.

6.6.4 INQUIRE CHOICE STATE

Parameters:

In	input device index	(1..n)	IX
Out	response validity	(INVALID, VALID)	E
Out	maximum number of choice alternatives	(-1, 1..n)	I

Effect:

See 6.1.2.

Errors:

Error identifier: 5:501
Cause: Function illegal in LID State RELEASED
Reaction: Function has no effect, response validity is set to INVALID.

6.6.5 INQUIRE PICK STATE

Parameters:

In	input device index	(1..n)	IX
Out	response validity	(INVALID, VALID)	E
Out	pick aperture		2VDC
Out	maximum number of segment picks	(-1, 1..n)	I
Out	input extent		2P
Out	input viewport		3ISP
Out	specification mode of echo viewport	(FRACTION OF DISPLAY SURFACE, MILLIMETRES WITH SCALE FACTOR, PHYSICAL DEVICE COORDINATES)	E
Out	metric scale factor of echo viewport		R
Out	echo viewport		2VP

Effect:

See 6.1.2.

Errors:

Error identifier: 5:501
Cause: Function illegal in LID State RELEASED
Reaction: Function has no effect, response validity is set to INVALID.

6.6.6 INQUIRE STRING STATE

Parameters:

In	input device index	(1..n)	IX
Out	response validity	(INVALID, VALID)	E
Out	maximum string size	(1..n)	I
Out	input character set index		IX
Out	alternate input character set index		IX
Out	input character coding announcer	(BASIC 7-BIT, BASIC 8-BIT, EXTENDED 7-BIT, EXTENDED 8-BIT, PRIVATE)	E

Effect:

See 6.1.2.

Errors:

Error identifier: 5:501
Cause: Function illegal in LID State RELEASED
Reaction: Function has no effect, response validity is set to INVALID.

6.6.7 INQUIRE RASTER INPUT STATE

Parameters:

In	input device index	(1..n)	IX
Out	response validity	(INVALID, VALID)	E
Out	spot centre separations	(> 0)	2R
Out	colour	(NO, YES)	E
Out	threshold level	(1..n)	I
Out	bits per colour	(1..n)	I
Out	source window first corner (in pixels)		2I
Out	source window second corner (in pixels)		2I

Effect:

See 6.1.2.

Errors:

Error identifier: 5:501
Cause: Function illegal in LID State RELEASED
Reaction: Function has no effect, response validity is set to INVALID.

6.6.8 INQUIRE GENERAL STATE

Parameters:

In	input device index	(1..n)	IX
Out	response validity	(INVALID, VALID)	E
Out	maximum data record size	(-1, 1..n)	I
Out	measure format identifier	(-n..-1,1..n)	I

Effect:

See 6.1.2.

Errors:

Error identifier: 5:501
Cause: Function illegal in LID State RELEASED
Reaction: Function has no effect, response validity is set to INVALID.

6.7 Event input state list

6.7.1 INQUIRE EVENT INPUT STATE

Parameters:

Out	response validity	(INVALID, VALID)	E
Out	event queue state	(RELEASED, EMPTY NO LID ENABLED, NOT EMPTY NO LID ENABLED, EMPTY LID ENABLED, NOT EMPTY LID ENABLED)	E
Out	event queue block state	(NOT BLOCKED, BLOCKED)	E
Out	unreported overflow state	(NO OVERFLOW, OVERFLOW)	E
Out	overflow device class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E
Out	overflow device index	(1..n)	IX
Out	overflow trigger index	(1..n)	IX
Out	overflow timestamp		R
Out	unreported break state	(NO BREAK, BREAK)	E
Out	break device class	(LOCATOR, STROKE, VALUATOR, CHOICE,	

		PICK, STRING, RASTER, GENERAL, NONE)	E
Out	break device index	(1..n)	IX
Out	break timestamp		R

Effect:
See 6.1.2.

6.8 Echo output description table

6.8.1 INQUIRE ECHO OUTPUT CAPABILITIES

Parameters:

Out	response validity	(INVALID, VALID)	E
Out	maximum number of locator echo entities	(-1..n)	I
Out	maximum number of stroke echo entities	(-1..n)	I
Out	maximum number of valuator echo entities	(-1..n)	I
Out	maximum number of choice echo entities	(-1..n)	I
Out	maximum number of pick echo entities	(-1..n)	I
Out	maximum number of string echo entities	(-1..n)	I
Out	maximum number of raster echo entities	(-1..n)	I
Out	maximum number of general echo entities	(-1..n)	I
Out	maximum number of stroke points	(-1, 2..n)	I
Out	maximum string buffer size	(-1,1..n)	I
Out	maximum height (in pixels)	(-1, 1..n)	I
Out	maximum width (in pixels)	(-1, 1..n)	I
Out	maximum general input data record size	(-1, 1..n)	I

Effect:
See 6.1.2.

6.8.2 INQUIRE LIST OF ECHO OUTPUT ECHO TYPES

Parameters:

In	input class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E
In	number of list elements requested	(0..n)	I
In	index (within list) of first element to return	(1..n)	I
Out	response validity	(INVALID, VALID)	E
Out	total number of list elements present in description table	(0..n)	I
Out	list of echo types supported		nIX

Effect:
See 6.1.2.

6.8.3 INQUIRE LIST OF ECHO OUTPUT PROMPT TYPES

Parameters:

In	input class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E
In	number of list elements requested	(0..n)	I
In	index (within list) of first element to return	(1..n)	I

Out	response validity	(INVALID, VALID)	E
Out	total number of list elements present in description table	(0..n)	I
Out	list of prompt types supported		nIX

Effect:

See 6.1.2.

6.8.4 INQUIRE LIST OF ECHO OUTPUT ACKNOWLEDGEMENT TYPES

Parameters:

In	input class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E
In	number of list elements requested	(0..n)	I
In	index (within list) of first element to return	(1..n)	I
Out	response validity	(INVALID, VALID)	E
Out	total number of list elements present in description table	(0..n)	I
Out	list of acknowledgement types supported	(-n..-1, 1..n)	nIX

Effect:

See 6.1.2.

6.8.5 INQUIRE LIST OF SUPPORTED GENERAL FORMAT IDENTIFIERS

Parameters:

In	number of list elements requested	(0..n)	I
In	index (within list) of first element to return	(1..n)	I
Out	response validity	(INVALID, VALID)	E
Out	total number of list elements present in description table	(0..n)	I
Out	list of measure format identifiers	(-n..-1, 1..n)	nI

Effect:

See 6.1.2.

6.9 Echo entity state list

6.9.1 INQUIRE LIST OF CURRENTLY EXISTING ECHO ENTITIES

Parameters:

In	input class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E
In	number of list elements requested	(0..n)	I
In	index (within list) of first element to return	(1..n)	I
Out	response validity	(INVALID, VALID)	E
Out	number of list elements present in description table	(0..n)	I
Out	list of current input echo entities		nIX

Effect:

See 6.1.2.

6.10 Individual echo entity state list

6.10.1 INQUIRE ECHO ENTITY STATE

Parameters:

In	input class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E
In	echo entity index	(1..n)	IX
Out	response validity	(INVALID, VALID)	E
Out	echo entity state	(READY, ACTIVE)	E
Out	echo control	(ECHO OFF, ECHO ON)	E
Out	echo type	(-n..-1, 1..n)	IX
Out	prompt control	(PROMPT OFF, PROMPT ON)	E
Out	prompt type	(-n..-1, 1..n)	IX
Out	acknowledgement type	(-n..-1, 1..n)	IX
Out	specification mode of echo area	(FRACTION OF DISPLAY SURFACE, MILLIMETRES WITH SCALE FACTOR, PHYSICAL DEVICE COORDINATES)	E
Out	metric scale factor of echo area		R
Out	echo area		2VP

Effect:

See 6.1.2.

Errors:

Error identifier: 3:532
Cause: No Echo Output Entity exists for the specified class and echo entity index
Reaction: Function ignored.

6.10.2 INQUIRE ECHO OUTPUT DATA RECORD

Parameters:

In	input class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E
In	echo entity index	(1..n)	IX
Out	response validity	(INVALID, VALID)	E
Out	echo data record		D

Effect:

See 6.1.2.

Errors:

Error identifier: 3:532
Cause: No Echo Output Entity exists for the specified class and echo entity index
Reaction: Function ignored.

7 CGI description tables and state lists

This clause contains the description tables and state lists which define the portion of the Virtual Device relating to input and echoing.

The information in the description tables and state lists is available to a client by means of inquiry functions. The abstract specifications of these functions are found in clause 6.

7.1 Description tables

7.1.1 Input capability

The Input Description Table contains input capability information for an INPUT or OUTIN CGI Virtual Device.

Table 16 – Input Description Table

Entry	**Possible Values**	**Data Type**
Input Capability:		
Timeout Capability	(LIMITED, <u>FULL</u>) (Note 1)	E
Timestamp Implementation	(NA, TRIGGER COUNT, <u>CLOCK</u>) (Note 2)	E
Available Locator Devices:		
List of Available Locator Device Indices		nIX
Available Stroke Devices:		
List of Available Stroke Device Indices		nIX
Available Valuator Devices:		
List of Available Valuator Device Indices		nIX
Available Choice Devices:		
List of Available Choice Device Indices		nIX
Available Pick Devices:		
List of Available Pick Device Indices		nIX
Available String Devices:		
List of Available String Device Indices		nIX
Available Raster Devices:		
List of Available Raster Device Indices		nIX
Available General Devices:		
List of Available General Device Indices		nIX

NOTES

1) A FULL timeout capability implies that positive timeout values will be handled correctly. LIMITED implies that only negative timeout values, meaning wait forever, will work correctly. If the timeout capability is LIMITED, a requested positive value is treated the same as zero for AWAIT EVENT and as wait forever for REQUEST and INITIALIZE ECHO REQUEST.

2) If a true clock facility is not supported, a fallback for the event queue timestamp implementation is a count of triggers. The NA response is used when the CGI Virtual Device does not support event input.

7.1.2 Class-independent logical input capability

Each Class-Independent Logical Input Device Description Table contains the device-dependent and implementation-dependent capabilities of a particular logical input device. Note that a table exists for each logical input device as identified by its input device class (LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL) and its input device index.

Table 17 – Class-Independent Logical Input Device Description Table

Entry	Possible Values	Data Type
Common Input Device Properties:		
Physical Device Identifier	(0..n)	I
Number of Non-Dissociable Triggers	(0..n)	I
Request Support	(NO, YES)	E
Echo Request Support	(NO, YES)	E
Sample Support	(NO, YES)	E
Event Support	(NO, YES)	E
Put Current Measure Effective	(NO, YES)	E
Echo Change Support	(NO, YES)	E
Supported Echo Types:		
List of Echo Types	(Note 1)	nIX
Supported Prompt Types:		
List of Prompt Types	(Note 1)	nIX
Supported Acknowledgement Types:		
List of Acknowledgement Types	(Note 1)	nIX
Associable Triggers:		
List of Associable Triggers	(Note 2)	nIX

NOTES

1) At least type 1 is required. Positive numbers are reserved for standardization and registration, negative numbers are available for private use.

2) Non-dissociable triggers are the first entered in the List of Associable Triggers.

Table 18 – Class-Specific Logical Input Device Description Table

Entry	Possible Values	Data Type
Locator Capabilities:		
Input Surface Lower-Left Corner	*(imp.dep)*	ISP
Input Surface Upper-Right Corner	*(imp.dep)*	ISP
Physical Input Surface Size (in millimetres)	(> 0) *(imp.dep)*	2R
Input Surface Size Interpretation	(NOMINAL, ACTUAL, UNLIMITED)	E
Number of Distinguishable Steps in xy Directions	(1..n) *(imp.dep)*	2I
Stroke Capabilities:		
Maximum Number of Points	(-1,1..n) (Note 2)	I
Input Surface Lower-Left Corner	*(imp.dep)*	ISP
Input Surface Upper-Right Corner	*(imp.dep)*	ISP
Physical Input Surface Size (in millimetres)	(> 0) *(imp.dep)*	2R
Input Surface Size Interpretation	(NOMINAL, ACTUAL, UNLIMITED)	E
Number of Distinguishable Steps in xy Directions	(1..n) *(imp.dep)*	2I
Choice Capabilities:		
Maximum Number of Choice Alternatives	(-1,1..n) (Note 2)	I
Pick Capabilities:		
Maximum Number of Segment Picks	(-1,1..n) (Note 2)	I
Input Surface Lower-Left Corner	*(imp.dep)*	ISP
Input Surface Upper-Right Corner	*(imp.dep)*	ISP
Physical Input Surface Size (in millimetres)	(> 0) *(imp.dep)*	2R
Input Surface Size Interpretation	(NOMINAL, ACTUAL, UNLIMITED)	E
Number of Distinguishable Steps in xy Directions	(1..n) *(imp.dep)*	2I

Table 18 – Class-Specific Logical Input Device Description Table – (concluded)

Entry	Possible Values	Data Type
String Capabilities:		
Maximum String Buffer Size	(-1,1..n) (Note 2)	I
Available Input Character Sets:		
List of Available Input Character Sets	(Note 3)	nCS
Available Input Character Coding Announcers:		
Number of Valid Character Coding Announcers	(1..5)	I
Array of Available Input Character Coding Announcers	(BASIC 7-BIT, BASIC 8-BIT, EXTENDED 7-BIT, EXTENDED 8-BIT, PRIVATE)	5E
Raster Input Capabilities:		
Physical Input Surface Size (in millimetres)	(> 0) *(imp.dep)*	2R
Colour Capability	(NO, YES)	E
Number of Levels	(1..n)	I (Note 1)
Maximum Number of Bits Per Colour	(1..n)	I
Maximum Height (in pixels)	(-1,1..n)	I (Note 2)
Maximum Width (in pixels)	(-1,1..n)	I (Note 2)
Interpretation of Spot Centre Separation	(NOMINAL, ACTUAL)	E
Permitted Raster Spot Centre Separations:		
List of Permitted Spot Centre Separations (in millimetres)	*(imp.dep)*	n2R
General Capabilities:		
Maximum Data Record Size	(-1,1..n) (Note 2)	I
Supported General Measure Formats:		
List of Measure Format Identifiers	(-n..-1,1..n) *(imp.dep)*	nI

NOTES
1) The actual set of levels is the interval [0, n-1] where n is the specified number of levels. If Colour Capability is NO, the specified number is the number of grey levels. If Colour Capability is YES, the specified number is the number of levels per RGB colour.
2) For entries denoting maximum number supported, -1 indicates either no restriction on the number or support limited only by the available memory (for implementations using dynamic memory allocation).
3) The first character set shall satisfy ISO 646.

7.1.3 Echo output capability.

The Echo Output Description Tables contains echo output capability information for an OUTPUT or OUTIN CGI Virtual Device.

Table 19 – Echo Output Description Table

Entry	Possible Values	Data Type
Echo Output Capabilities:		
Maximum Number of Echo Entities Supported for:		
Locator	(-1..n) (Note 1)	I
Stroke	(-1..n) (Note 1)	I
Valuator	(-1..n) (Note 1)	I
Choice	(-1..n) (Note 1)	I
Pick	(-1..n) (Note 1)	I
String	(-1..n) (Note 1)	I
Raster	(-1..n) (Note 1)	I
General	(-1..n) (Note 1)	I

Table 19 – Echo Output Description Table – (concluded)

Entry	Possible Values	Data Type
Maximum Number of Stroke Points	(-1, 2..n) (Note 1)	I
Maximum String Buffer Size	(-1, 1..n) (Note 1)	I
Maximum Height (in pixels)	(-1, 1..n) (Note 1)	I
Maximum Width (in pixels)	(-1, 1..n) (Note 1)	I
Maximum General Input Data Record Size	(-1, 1..n) (Note 1)	I
Echo Output Types:		
List of Echo Types Supported for:		
Locator	(-n..-1, 1..n) (Note 2)	nIX
Stroke	(-n..-1, 1..n) (Note 2)	nIX
Valuator	(-n..-1, 1..n) (Note 2)	nIX
Choice	(-n..-1, 1..n) (Note 2)	nIX
Pick	(-n..-1, 1..n) (Note 2)	nIX
String	(-n..-1, 1..n) (Note 2)	nIX
Raster	(-n..-1, 1..n) (Note 2)	nIX
General	(-n..-1, 1..n) (Note 2)	nIX
Echo Output Prompt Types:		
List of Prompt Types Supported	(-n..-1, 1..n) (Note 2)	nIX
Echo Output Acknowledgement Types:		
List of Acknowledgement Types Supported	(-n..-1, 1..n) (Note 2)	nIX
Support for General Measure Format Identifiers:		
List of Measure Format Identifiers	(-n..-1, 1..n) (Note 2)	nI

NOTES

1) A value of -1 is used for implementations employing dynamic memory allocation and indicates that the limit is based only on the total use of memory. A value of 0 indicates no support.

2) Positive values are reserved for standardization and registration; negative values are available for private use.

7.2 State lists

7.2.1 Input state

There is no state list defined for the input portion of the CGI Virtual Device. All state information is associated with individual LID's and with the event queue.

7.2.2 Class-independent logical input device state

Each Class-Independent Logical Input Device State List contains the current state of the logical input devices for an INPUT or OUTIN CGI Virtual Device. Note that a state list exists for each logical input device as identified by its input class (LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL) and its input device index.

Table 20 – Class-Independent Logical Input Device State List

Entry	Possible Values	Data Type	Default
Common Logical Input Device State:			
Input Device State	(RELEASED, READY, REQUEST PENDING, ECHO REQUEST ENABLED, ECHO REQUEST PENDING, ECHO REQUEST COMPLETED, EVENTS ENABLED)	E	RELEASED
Sampling State	(DISABLED, ENABLED)	E	DISABLED
Echo Control	(DISABLED, ENABLED)	E	ENABLED
Echo Type	(-n..-1,1..n)	IX	1
Specification Mode of Echo Area	(FRACTION OF DISPLAY SURFACE, MILLIMETRES WITH SCALE FACTOR, PHYSICAL DEVICE COORDINATES)	E	FRACTION OF DISPLAY SURFACE
Metric Scale Factor of Echo Area		R	
Echo Area		2VP	(Note 3)
Prompt Control	(DISABLED, ENABLED)	E	ENABLED
Prompt Type	(-n..-1,1..n)	IX	1
Acknowledgement Control	(DISABLED, ENABLED)	E	ENABLED
Acknowledgement Type	(-n..-1,1..n)	IX	1
List of Associated Triggers:			
List of Associated Triggers		nIX	(Note 2)
Echo Data Record:			
Echo Data Record		D	(Note 1)
Input Device Data Record:			
List of Input Device Data Records		D	(Note 1)

NOTES
1) Contents and structure vary according to input device class, and prompt, echo, and acknowledgement controls.
2) Default is the list of non-dissociable triggers.
3) Default is set to the Device Viewport current at the time of LID initialization.

7.2.3 Class-specific logical input device state

The Class-Specific Logical Input Device State List contains the current state of the logical input devices for an INPUT or OUTIN CGI Virtual Device. Note that the state list groups exist for each input device index.

Table 21 – Class-Specific Logical Input Device State List

Entry	Possible Values	Data Type	Default
Locator State:			
Input Extent		2P	(Note 1)
Input Viewport		3ISP	(Note 1)
Specification Mode of Echo Viewport	(FRACTION OF DISPLAY SURFACE, MILLIMETRES WITH SCALE FACTOR, PHYSICAL DEVICE COORDINATES)	E	FRACTION OF DISPLAY SURFACE
Metric Scale Factor of Echo Viewport		R	
Echo Viewport		2VP	(Note 1)
Stroke State:			
Maximum Number of Points	(-1, 1..n) (Note 9)	I	(Note 2)
Sampling Interval for X-Displacement	(≥ 0)	VDC	(imp.dep)
Sampling Interval for Y-Displacement	(≥ 0)	VDC	(imp.dep)
Minimum Time Interval Per Sample (ms)	(≥ 0)	I	0
Maximum Time Interval Per Sample (ms)	(≥ 0)	I	1000
Input Extent		2P	(Note 1)
Input Viewport		3ISP	(Note 1)
Specification Mode of Echo Viewport	(FRACTION OF DISPLAY SURFACE, MILLIMETRES WITH SCALE FACTOR, PHYSICAL DEVICE COORDINATES)	E	FRACTION OF DISPLAY SURFACE
Metric Scale Factor of Echo Viewport		R	
Echo Viewport		2VP	(Note 1)
Valuator State:			
Minimum Value of Range		R	0
Maximum Value of Range		R	1
Choice State:			
Maximum Number of Choice Alternatives	(-1, 1..n) (Note 9)	I	(Note 10)
Pick State:			
Pick Aperture		2VDC	(Note 3)
Maximum Number of Segment Picks	(-1, 1..n) (Note 9)	I	(Note 4)
Input Extent		2P	(Note 1)
Input Viewport		3ISP	(Note 1)
Specification Mode of Echo Viewport	(FRACTION OF DISPLAY SURFACE, MILLIMETRES WITH SCALE FACTOR, PHYSICAL DEVICE COORDINATES)	E	FRACTION OF DISPLAY SURFACE
Metric Scale Factor of Echo Viewport		R	
Echo Viewport		2VP	(Note 1)
String State:			
Maximum String Size	(-1, 1..n) (Note 9)	I	(Note 5)
Input Character Set Index		IX	1
Alternate Input Character Set Index		IX	1
Input Character Coding Announcer	(BASIC 7-BIT, BASIC 8-BIT, EXTENDED 7-BIT, EXTENDED 8-BIT, PRIVATE)	E	(imp.dep)
Raster Input State:			
Spot Centre Separations	(> 0)	2R	(Note 6)
Colour	(NO, YES)	E	(imp.dep)
Threshold Level	(1..n)	I	(imp.dep)
Bits Per Colour	(1..n)	I	(imp.dep)
Source Window First Corner (in pixels)	(0..n)	2I	(imp.dep)
Source Window Second Corner (in pixels)	(0..n)	2I	(imp.dep)

Table 21 – Class-Specific Logical Input Device State List – (concluded)

Entry	Possible Values	Data Type	Default
General State:			
Maximum Data Record Size	(-1. 1..n) (Note 9)	I	(Note 8)
Measure Format Identifier	(-n..-1,1..n)	I	(Note 7)

NOTES

1) See 3.5.
2) Defaults to maximum number of points for Stroke in the Class-Specific Logical Input Device Description Table.
3) Defaults to (VDC_1, VDC_2) such that VDC_1 is 1/100th of the VDC x Extent and VDC_2 is 1/100th of the VDC y Extent.
4) Defaults to maximum number of segment picks for Pick in the Class-Specific Logical Input Device Description Table.
5) Defaults to maximum string size for String in the Class-Specific Logical Input Device Description Table.
6) Default is the first entry taken from the List of Permitted Spot Centre Separations in the Class-Specific Logical Input Device Description Table.
7) Default is the first identifier taken from the List of Measure Format Identifiers in the Class-Specific Logical Input Device Description Table.
8) Defaults to the Maximum Data Record Size in the Class-Specific Logical Input Device Description Table.
9) A value of -1 indicates that the limit is based only on the total use of memory (for implementations using dynamic memory allocation).
10) Defaults to the Maximum Number of Choice Alternatives in the Class-Specific Logical Input Device Description Table.

7.2.4 Events

The Event Input State List contains the current state of the CGI Virtual Device event queue for an INPUT or OUTIN Virtual Device.

Table 22 – Event Input State List

Entry	Possible Values	Data Type	Default
Event State:			
Event Queue State	(RELEASED, EMPTY NO LID ENABLED, NOT EMPTY NO LID ENABLED, EMPTY LID ENABLED NOT EMPTY LID ENABLED)	E	RELEASED
Event Queue Block State	(NOT BLOCKED, BLOCKED)	E	NOT BLOCKED
Unreported Overflow State	(NO OVERFLOW, OVERFLOW)	E	NO OVERFLOW
Overflow Device Class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL)	E	*(imp.dep)*
Overflow Device Index	(1..n)	IX	*(imp.dep)*
Overflow Trigger Index	(1..n)	IX	*(imp.dep)*
Overflow Timestamp	(Note 1)	R	*(imp.dep)*
Unreported Break State	(NO BREAK, BREAK)	E	NO BREAK
Break Device Class	(LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL, NONE)	E	*(imp.dep)*
Break Device Index	(1..n)	IX	*(imp.dep)*
Break Timestamp	(Note 1)	R	*(imp.dep)*

NOTE –

1) This is measured in seconds.

7.2.5 Echo entity state

The echo entity state lists contain the echo entity state for OUTPUT or OUTIN class CGI Virtual Devices which support remote echoing. There is one general Echo Entity State List and an individual state list for each logical input device as identified by its input device class (LOCATOR, STROKE, VALUATOR, CHOICE, PICK, STRING, RASTER, GENERAL) and its echo entity index.

Table 23 – Echo Entity State List

Entry	Possible Values	Data Type	Default
Current Locator Echo Entities:			
List of Current Locator Echo Entities	(0..n)	nIX	empty
Current Stroke Echo Entities:			
List of Current Stroke Echo Entities	(0..n)	nIX	empty
Current Valuator Echo Entities:			
List of Current Valuator Echo Entities	(0..n)	nIX	empty
Current Choice Echo Entities:			
List of Current Choice Echo Entities	(0..n)	nIX	empty
Current Pick Echo Entities:			
List of Current Pick Echo Entities	(0..n)	nIX	empty
Current String Echo Entities:			
List of Current String Echo Entities	(0..n)	nIX	empty
Current Raster Echo Entities:			
List of Current Raster Echo Entities	(0..n)	nIX	empty
Current General Echo Entities:			
List of Current General Echo Entities	(0..n)	nIX	empty

Table 24 – Individual Echo Entity State List

Entry	Possible Values	Data Type	Default
Echo Entity State:			
Echo Entity State	(READY, ACTIVE)	E	READY
Echo Control	(ECHO OFF, ECHO ON)	E	ECHO OFF
Echo Type	(-n..-1,1..n)	IX	1
Prompt Control	(PROMPT OFF, PROMPT ON)	E	PROMPT OFF
Prompt Type	(-n..-1,1..n)	IX	1
Acknowledgement Type	(-n..-1,1..n)	IX	1
Specification Mode of Echo Area	(FRACTION OF DISPLAY SURFACE, MILLIMETRES WITH SCALE FACTOR, PHYSICAL DEVICE COORDINATES)	E	(Note 1)
Metric Scale Factor of Echo Area		R	
Echo Area		2VP	(Note 2)
Echo Output Echo Data Record:			
Echo Data Record		D	(Note 3)

NOTES
1) Default is the specification mode of the current Device Viewport at the time the echo entity was initialized.
2) Default is the current Device Viewport at the time the echo entity was initialized.
3) Contents and structure vary according to input device class and prompt, echo, and acknowledgement controls.

Annex A

(normative)

Formal grammar of the functional specification

A.1 Introduction

This grammar is a formal definition of the Input portion of standard CGI syntax. It shows all productions regardless of the encoding scheme. The terminal symbols correspond to the CGI basic abstract data types. Encoding and representation details of these can be found in ISO/IEC 9637.

A.2 Notation used

<symbol>	- nonterminal
<SYMBOL>	- terminal
<symbol>*	- 0 or more occurrences
<symbol>+	- 1 or more occurrences
<symbol>o	- 0 or 1 occurrences
<symbol>(n)	- exactly n occurrences; n=2,3,...
<symbol-1> ::= <symbol-2>	- symbol-1 has the syntax of symbol-2
<symbol-1> | <symbol-2>	- symbol-1 or alternatively symbol-2
<symbol: meaning>	- symbol with the stated meaning
comment	- explanation of a symbol or a production
returned: <symbol>*	- output parameter(s)

A.3 Detailed grammar

```
<part 5 function>     ::=   <input control function>
                       |    <request function>
                       |    <sample function>
                       |    <echo request input function>
                       |    <event input function>
                       |    <echo output function>
                       |    <inquiry function>
```

A.3.1 Input control functions

```
<input control function>    ::=    <INITIALIZE LOGICAL INPUT DEVICE>
                                           <logical input device identifier>
                             |     <RELEASE LOGICAL INPUT DEVICE>
                                           <logical input device identifier>
                             |     <ECHO CONTROLS>
```

```
                                              <logical input device identifier>
                                              <disabled enabled flag: prompt control>
                                              <disabled enabled flag: echo control>
                                              <disabled enabled flag: acknowledgement control>
                              |       <put current measure function>
                              |       <ECHO DATA>
                                              <logical input device identifier>
                                              <BDT_INDEX: prompt type>
                                              <BDT_INDEX: echo type>
                                              <BDT_INDEX: acknowledgement type>
                                              <viewport point: echo area>(2)
                                              <data record: for echo>
                              |       <device data function>
                              |       <ASSOCIATE TRIGGERS>
                                              <logical input device identifier>
                                              <BDT_INDEX: triggers>*
                              |       <get additional data function>

<data record>                 ::=     <typed sequence>*

<typed sequence>              ::=     <data type index>
                                      <element count>
                                      <data item: of data type index>*

<data item>                   ::=     <data record>
                              |       <BDT_COLOUR_INDEX>
                              |       <BDT_COLOUR_DIRECT>
                              |       <BDT_CSN_VALUE>
                              |       <enumerated> refer to list of terminal enumerated values
                              |       <BDT_INTEGER>
                              |       <BDT_ICO_VALUE>
                              |       <BDT_FIXED_INTEGER_8>
                              |       <BDT_FIXED_INTEGER_16>
                              |       <BDT_FIXED_INTEGER_32>
                              |       <BDT_INDEX>
                              |       <BDT_REAL>
                              |       <BDT_STRING>
                              |       <BDT_FIXED_STRING>
                              |       <vdc value>
                              |       <vc value>

<element count>               ::=     <BDT_INTEGER: number of elements in list>

<data type index>             ::=     <BDT_INDEX>

<logical input device identifier>::=     <input class>
                                         <BDT_INDEX: input device index>

<input class: enumerated>     ::=       <LOCATOR>
                              |         <STROKE>
                              |         <VALUATOR>
                              |         <CHOICE>
                              |         <PICK>
                              |         <STRING>
                              |         <RASTER>
                              |         <GENERAL>

<disabled enabled flag: enumerated>  ::=   <DISABLED> | <ENABLED>

<input surface point> ::=    <isc value>(2)
```

```
<isc value>          ::=  <BDT_FIXED_INTEGER>

<point>              ::=  <vdc value>(2)

<vdc value>          ::=  <BDT_REAL> | <BDT_INTEGER>

<viewport point>     ::=  <vc value>(2)

<vc value>           ::=  <BDT_REAL> | <BDT_INTEGER>

<viewport specification mode: enumerated> ::=
                                <FRACTION OF DISPLAY SURFACE>
                           |    <MILLIMETRES WITH SCALE FACTOR>
                           |    <PHYSICAL DEVICE COORDINATES>

<put current measure function>    ::=    <PUT CURRENT LOCATOR MEASURE>
                                             <BDT_INDEX: input device index>
                                             <measure validity>
                                             <point: position>
                                  |      <PUT CURRENT STROKE MEASURE>
                                             <BDT_INDEX: input device index>
                                             <measure validity>
                                             <point>*
                                  |      <PUT CURRENT VALUATOR MEASURE>
                                             <BDT_INDEX: input device index>
                                             <measure validity>
                                             <BDT_REAL: value>
                                  |      <PUT CURRENT CHOICE MEASURE>
                                             <BDT_INDEX: input device index>
                                             <measure validity>
                                             <BDT_INTEGER: choice number>
                                  |      <PUT CURRENT PICK MEASURE>
                                             <BDT_INDEX: input device index>
                                             <measure validity>
                                             <pick value>*
                                  |      <PUT CURRENT STRING MEASURE>
                                             <BDT_INDEX: input device index>
                                             <measure validity>
                                             <BDT_STRING>
                                  |      <PUT CURRENT RASTER MEASURE>
                                             <BDT_INDEX: input device index>
                                             <measure validity>
                                             <BDT_INTEGER: x, y counts>(2)
                                             <BDT_ICO_VALUE>*
                                  |      <PUT CURRENT GENERAL MEASURE>
                                             <BDT_INDEX: input device index>
                                             <measure validity>
                                             <data record>

<measure validity>            ::=  <validity flag>

<response validity>           ::=  <validity flag>

<validity flag: enumerated>   ::=  <INVALID> | <VALID>

<pick value>                  ::=  <BDT_CSN_VALUE: segment identifier>
                                   <BDT_CSN_VALUE: pick identifier>

<device data function>    ::=   <LOCATOR DEVICE DATA>
                                      <BDT_INDEX: input device index>
                                      <point: input extent>(2)
                                      <isp point: input viewport>(3)
                                   <viewport point: echo viewport>(2)
                                   <data record>
                         |  <STROKE DEVICE DATA>
                                   <BDT_INDEX: input device index>
                                   <BDT_INTEGER: maximum number of points>
                                   <vdc value: sample interval for x-, y- displacement>(2)
                                   <BDT_INTEGER: minimum, maximum sample time intervals>(2)
                                   <point: input extent>(2)
                                   <isp point: input viewport>(3)
                                   <viewport point: echo viewport>(2)
                                   <data record>
                         |  <VALUATOR DEVICE DATA>
                                   <BDT_INDEX: input device index>
                                   <BDT_REAL: minimum, maximum value of range>(2)
                                   <data record>
                         |  <CHOICE DEVICE DATA>
                                   <BDT_INDEX: input device index>
                                   <BDT_INTEGER: maximum number of choice alternatives>
                                   <data record>
                         |  <PICK DEVICE DATA>
                                   <BDT_INDEX: input device index>
                                   <vdc value: pick aperture>(2)
                                   <BDT_INTEGER: maximum number of segment picks>
                                   <point: input extent>(2)
                                   <isp point: input viewport>(3)
                                   <viewport point: echo viewport>(2)
                                   <data record>
                         |  <STRING DEVICE DATA>
                                   <BDT_INDEX: input device index>
                                   <BDT_INTEGER: maximum string size>
                                   <BDT_INDEX: input character set index>
                                   <BDT_INDEX: alternate character set index>
                                   <coding technique: input character coding announcer>
                                   <data record>
                         |  <RASTER DEVICE DATA>
                                   <BDT_INDEX: input device index>
                                   <BDT_REAL: spot centre separations>(2)
                                   <yes no flag: colour capability>
                                   <BDT_INTEGER: threshold level>
                                   <BDT_INTEGER: bits per colour>
                                   <isp point: source window>(2)
                                   <data record>
                         |  <GENERAL DEVICE DATA>
                                   <BDT_INDEX: input device index>
                                   <BDT_INTEGER: maximum data record size>
                                   <BDT_INTEGER: measure format identifier>
                                   <data record>

<yes no flag: enumerated>     ::=  <NO> | <YES>

<coding technique: enumerated> ::= <BASIC 7-BIT>
                                |  <BASIC 8-BIT>
                                |  <EXTENDED 7-BIT>
                                |  <EXTENDED 8-BIT>
                                |  <PRIVATE>

<get additional data function>  ::=  <GET ADDITIONAL STROKE DATA>
                                   <BDT_INTEGER: number of requested points>
```

```
                              returned:
                                      <response validity>
                                      <point>*
                          |   <GET ADDITIONAL PICK DATA>
                                      <BDT_INTEGER: number of requested pick values>
                              returned:
                                      <response validity>
                                      <pick value>*
                          |   <GET ADDITIONAL STRING DATA>
                                      <BDT_INTEGER: number of requested characters>
                              returned:
                                      <response validity>
                                      <BDT_STRING>
                          |   <GET ADDITIONAL RASTER DATA>
                                      <BDT_INTEGER: number of requested input colour values>
                              returned:
                                      <response validity>
                                      <BDT_ICO_VALUE>*
```

A.3.2 Request functions

```
<request function>          ::=   <request locator function>
                              |   <request stroke function>
                              |   <request valuator function>
                              |   <request choice function>
                              |   <request pick function>
                              |   <request string function>
                              |   <request raster function>
                              |   <request general function>

<request locator function>  ::=   <REQUEST LOCATOR>
                                        <lid index and timeout>
                                  returned:
                                        <response validity>
                                        <status and trigger>
                                        <point: position>

<request stroke function>   ::=   <REQUEST STROKE>
                                        <lid index and timeout>
                                        <BDT_INTEGER: number of requested points>
                                  returned:
                                        <response validity>
                                        <status and trigger>
                                        <BDT_INTEGER: total number of available points>
                                        <point>*

<request valuator function> ::=   <REQUEST VALUATOR>
                                        <lid index and timeout>
                                  returned:
                                        <response validity>
                                        <status and trigger>
                                        <BDT_REAL: value>

<request choice function>   ::=   <REQUEST CHOICE>
                                        <lid index and timeout>
                                  returned:
                                        <response validity>
                                        <status and trigger>
                                        <BDT_INTEGER: choice number>

<request pick function>    ::=  <REQUEST PICK>
                                        <lid index and timeout>
                                        <BDT_INTEGER: number of requested pick values>
                                returned:
                                        <response validity>
                                        <status and trigger>
                                        <BDT_INTEGER: total number of available pick values>
                                        <pick value>*

<request string function>  ::=  <REQUEST STRING>
                                        <lid index and timeout>
                                        <BDT_INTEGER: number of requested characters>
                                returned:
                                        <response validity>
                                        <status and trigger>
                                        <BDT_INTEGER: total number of available characters>
                                        <BDT_STRING>

<request raster function>  ::=  <REQUEST RASTER>
                                        <lid index and timeout>
                                        <BDT_INTEGER: number of requested input colour values>
                                returned:
                                        <response validity>
                                        <status and trigger>
                                        <BDT_INTEGER: total number of available input colour values>
                                        <BDT_INTEGER: x, y counts>(2)
                                        <BDT_ICO_VALUE>*

<request general function> ::=  <REQUEST GENERAL>
                                        <lid index and timeout>
                                returned:
                                        <response validity>
                                        <status and trigger>
                                        <data record>

<lid index and timeout>    ::=  <BDT_INDEX: input device index>
                                <BDT_REAL: timeout specifier>

<status and trigger>            ::=  <request status>
                                     <BDT_INDEX: trigger>
                                     <measure validity>

<request status: enumerated>    ::=  <TRIGGER FIRED>
                                  |  <BREAK>
                                  |  <TIMEOUT>
```

A.3.3 Sample functions

```
<sample function>   ::=  <sample state function>
                      |  <sample locator function>
                      |  <sample stroke function>
                      |  <sample valuator function>
                      |  <sample choice function>
                      |  <sample pick function>
                      |  <sample string function>
```

```
                            |  <sample raster function>
                            |  <sample general function>

<sample state function>      ::=  <SAMPLING STATE>
                                          <input device identifier>
                                          <disabled enabled flag: sampling state>

<sample locator function>    ::=  <SAMPLE LOCATOR>
                                          <BDT_INDEX: input device index>
                                  returned:
                                          <response and measure validity>
                                          <point: position>

<sample stroke function>     ::=  <SAMPLE STROKE>
                                          <BDT_INDEX: input device index>
                                          <BDT_INTEGER: number of requested points>
                                  returned:
                                          <response and measure validity>
                                          <BDT_INTEGER: total number of available points>
                                          <point>*

<sample valuator function>  ::=  <SAMPLE VALUATOR>
                                          <BDT_INDEX: input device index>
                                  returned:
                                          <response and measure validity>
                                          <BDT_REAL: value>

<sample choice function>     ::=  <SAMPLE CHOICE>
                                          <BDT_INDEX: input device index>
                                  returned:
                                          <response and measure validity>
                                          <BDT_INTEGER: choice number>

<sample pick function>::=         <SAMPLE PICK>
                                          <BDT_INDEX: input device index>
                                          <BDT_INTEGER: number of requested pick values>
                                  returned:
                                          <response and measure validity>
                                          <BDT_INTEGER: total number of available pick values>
                                          <pick value>*

<sample string function>     ::=  <SAMPLE STRING>
                                          <BDT_INDEX: input device index>
                                          <BDT_INTEGER: number of requested characters>
                                  returned:
                                          <response and measure validity>
                                          <BDT_INTEGER: total number of available characters>
                                          <BDT_STRING>

<sample raster function>     ::=  <SAMPLE RASTER>
                                          <BDT_INDEX: input device index>
                                          <BDT_INTEGER: number of requested input colour values>
                                  returned:
                                          <response and measure validity>
                                          <BDT_INTEGER: total number of available input colour values>
                                          <BDT_INTEGER: x, y counts>(2)
                                          <BDT_ICO_VALUE>*

<sample general function>   ::=  <SAMPLE GENERAL>
                                          <BDT_INDEX: input device index>
                                  returned:
```