

Request #: HUTRR29

Title: Repurposing the Alphanumeric Display Page (0x14) as a generic Auxiliary Display Page and adding bitmap and custom segment capabilities

Spec Release: HUT 1.11

Received: 5/20/2004

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CurrentStatus: Review

Priority: Normal

Submitted: 5/20/2004

Voting Starts: June 7, 2004

Voting Ends: June 14, 2004

Required Voter: Nathan Sherman (Microsoft) (Chair)

Required Voter: Steve McGowan (Intel)

Required Voter: Mark Lavelle (Logitech)

Summary:

To augment the Alphanumeric Display Page to include Auxiliary Display, add bitmap enumerating and blitting and respective properties (ie. Resolution, palette format data, display bit depth, etc..), functionality parameters (ie. blit buffer), and custom segment enumeration and usage.

Background:

In order to use space on a display the controller/processor driving the display must understand the capabilities of a device. This can be easily implemented on a case by case basis, as shown with a VGA display. However, when users can interchange these display devices, the controller needs a way to render information in a way specific to the capabilities of a specific display device. This proposal will allow LCD manufacturers to create displays that can be driven with a standard interface (no new electronics and no hardware (display) specific device drivers). The bandwidth of the USB, functionality provided by these displays are intended to provide still images that include static icons, lines, polygons and text (list not exhaustive and provided to better understand the static nature of the device).

Proposal:

The objective of this HUT Review Request is to evolve the Alphanumeric Display Page into a more generic display type that will continue to

support the Alphanumeric functionality and in addition support small displays. Making the alphanumeric and bitmap specific types of segments on an Auxiliary Display and creating a Custom Segments Report (CL) will allow display manufacturers to produce displays with different segments. An example of a custom segment is the battery indicator on a mobile phone.

Note: Because the Auxiliary Display Page will continue to have the Usage IDs and Usage Types found in the Alphanumeric Display Page, legacy hardware devices and legacy software will not be affected by the renaming and adding of functionality.

Please refer to <http://www.usb.org/developers/hidpage> for references into the HID Usage Pages.

The following are the changes and additions to Usage Page 0x14:

Usage Page 0x14 Renamed from Alphanumeric Display Page to Auxiliary Display Page 0x14.

Additions

Usage ID	Usage Name	Usage Type
02	Auxiliary Display	CA
80	Bitmap Size X	SV
81	Bitmap Size Y	SV
82	Max Blit Size	SV
83	Bit Depth Format	SV
84	Display Orientation	DV
85	Palette Report	CL
86	Palette Data Size	SV
87	Palette Data Offset	SV
88	Palette Data	Buffered Bytes
8A	Blit Report	CL
8B	Blit Rectangle X1	SV
8C	Blit Rectangle Y1	SV
8D	Blit Rectangle X2	SV
8E	Blit Rectangle Y2	SV
8F	Blit Data	Buffered Bytes
90	Soft Button	CL
91	Soft Button ID	SV
92	Soft Button Side	SV
93	Soft Button Offset 1	SV
94	Soft Button Offset 2	SV
95	Soft Button Report	SV

1 Alphanumeric Display

1.1 Bitmapped Display

There are 3 types of Bit Depth Formats supported:

- Monochrome, where a pixel value is interpreted as a monochrome intensity.
- Indexed, where a pixel value is either used as an index into a palette table to determine the color to be displayed.
- RGB, where each pixel value contains the respective color component values to be displayed.

Some Bit Depth formats support an Alpha channel. The following formula is applied to each color when calculating the resulting displayed pixel value.

Displayed Pixel Component = (Blit Data component * Alpha) + (frame buffer data component * (MaximumPossibleAlphaValue - Alpha))

Where a “component” is the R, G, or B value of the an RGB pixel or the brightness value of a monochromatic display. The *MaximumPossibleAlphaValue* is 1 for a 1 bit Alpha value or 255 for an 8-bit Alpha value.

Auxiliary Display CA - A collection of auxiliary display related usages.

1.1.1 Display Attributes Report

The usages defined in this section must be contained in a Display Attributes Report feature report, which declares the basic capabilities of the device.

1.1.1.1 Display Specification

Bitmap Size X SV - Specifies the X Resolution -1 of the bitmap segment on the display.

Bitmap Size Y SV - Specifies the Y Resolution -1 of the bitmap segment on the display.

1.1.1.2 Bit Depth Format

Bit Depth Format SV – ID of the bit depth format supported by the device. The format specifies whether the display is Indexed or RGB, Monochrome or Color, and the bit depth and format of the pixel

data. See the Indexed and RGB Formats described below for more details.

Bit Depth Format DV – If multiple Bit Depth formats are supported by a display then multiple Bit Depth Format usages will be declared in a Display Attributes Report. And a Bit Depth usage must be declared in a feature report to allow the client to set the current bit depth format.

1.1.1.2.1 Monochrome and Indexed Formats

An Indexed format is specified by ORing it with an RGB BitDepth format value. The resulting value not only specifies the size of the palette table, but the RGB format of its entries. For instance, a BitDepth Format value of 0x13 indicates the palette has 16 entries, where each entry supports a 555 RGB color value.

It is not legal to declare an RGB Format that supports Alpha channels for an Indexed format.

A Palette Report must be declared if an Indexed format is defined. For Indexed formats the system is responsible for initializing all palette entries. For Monochrome formats, a 0 pixel value displays the background color and the maximum pixel value displays the foreground or Active color at maximum intensity.

0x1 - BitDepth Indexed 1 Bit

Specifies the display supports a pixel bit depth of 1 bit. If an Indexed format is specified, the palette table will contain 2 entries for specifying two possible colors, where pixel value is the index into the palette table. If a Monochrome format is declared, a 0x0 value displays the Background color for the pixel and a value of 1 displays is the Active color at maximum intensity.

0x2 - BitDepth Indexed 2 Bits

Specifies the display supports a bit depth of 2 bits. If an Indexed format is specified, the palette table will contain 4 entries. Not finding a Palette Report indicates a Monochrome format, where a 0x0 value displays the Background color for the pixel and a value of 3 displays is the Active color at maximum intensity.

0x3 - BitDepth Indexed 4 Bits

Specifies the display supports a bit depth of 4 bits. If an Indexed format is specified, the palette table will contain 16 entries. If a Monochrome format is declared, a 0x0 value displays the Background color for the pixel and a value of 0xF displays is the Active color at maximum intensity.

0x4 - BitDepth Indexed 8 Bits

Specifies the display supports a bit depth of 8 bits. If an Indexed format is specified, the palette table will contain 256 entries. If a Monochrome format is declared, a 0x0 value displays the Background color for the pixel and a value of 0xFF displays the Active color at maximum intensity.

1.1.1.2.2 RGB Formats

Note that bit 8 of the usage value is asserted if an alpha channel is supported.

0x10 - BitDepth RGB 555

Specifies the display supports a bit depth of 15 bits in a 16-bit value. Finding this usage specifies that a Palette Report is invalid. Bits 0-4 indicate the red aspect of a specific pixel. Bits 5-9 indicate the green aspect of the specific pixel. Bits 10-14 indicate the blue aspect of the indexed pixel. Bit 15 is unused in this pixel bit depth.

0x90 - BitDepth ARGB 1555

Specifies the display supports a bit depth of 16 bits. Finding this usage specifies that a Palette Report is invalid. Bits 0-4 indicate the red aspect of a specific pixel. Bits 5-9 indicate the green aspect of the specific pixel. Bits 10-14 indicate the blue aspect of the indexed pixel. Bit 15 is the alpha value of the pixel.

0x20 - BitDepth RGB 565

Specifies the display supports a bit depth of 16 bits. Finding this usage specifies that a Palette Report is invalid. Bits 0-4 indicate the red aspect of a specific pixel. Bits 5-10 indicate the green aspect of the specific pixel. Bits 11-15 indicate the blue aspect of the indexed pixel.

0x30 - BitDepth RGB 888

Specifies the display supports a bit depth of 24 bits. Finding this usage specifies that a Palette Report is invalid. Bits 0-7 indicate the red aspect of a specific pixel. Bits 8-15 indicate the green aspect of the specific pixel. Bits 16-23 indicate the blue aspect of the indexed pixel.

0xC0 - BitDepth ARGB 8888

Specifies the display supports a bit depth of 32 bits. Finding this usage specifies that a Palette Report is invalid. Bits 0-7 indicate the red aspect of a specific pixel. Bits 8-15 indicate the green aspect of the specific pixel. Bits 16-24 indicate the blue aspect of the indexed pixel. Bits 25-31 indicate the alpha value of the pixel.

0xA - BitDepth PARGB 8888

Specifies the display supports a bit depth of 32 bits. Finding this usage specifies that a Palette Report is invalid. The first 8 bit is the alpha value of the pixel. Note that the alpha value should be calculated into the following 24 bits of the pixel data. The second 8 bits indicate the red aspect of a specific pixel. The third 8 bits indicate the green aspect of the specific pixel. The fourth 8 bits indicate the blue aspect of the indexed pixel.

0x40 - BitDepth 8880

Specifies the display supports a bit depth of 32 bits. Finding this usage specifies that a Palette Report is invalid. Bits 0-7 indicate the red aspect of a specific pixel. Bits 8-15 indicate the green aspect of the specific pixel. Bits 16-23 indicate the blue aspect of the indexed pixel. Bits 24-31 of the pixel data should be set to 0 and are ignored by the display.

1.1.1.3 Soft Buttons

Soft (unlabeled) Buttons can be positioned around the edges of the display. Knowing the position of the button, an application can render text or an icon close to the button that has the associated function, defining its purpose.

The existence of a Soft Button collection in a Report descriptor indicates that the device supports Soft Buttons. A Soft Button collection defines the position of soft button. This information is normally retrieved at initialization time. During run time, input reports are generated to indicate changes in the state of a button.

Note: The button collection will include usages from the functional Button Usage Page (0x09) in order to represent hardware buttons with an associated function.

Soft Button CL - This usage encapsulates 4 usages that define a Soft Button. The usages are; a Button Usage Page declaration that defines button number, and Soft Button Offset 1, Soft Button Offset 2, and Soft Button Side that defined the position of the button on the periphery of the display. A Soft Button collection is declared for each soft button present on the display.

Soft Button ID SV – This usage specifies the usage value from the Button Usage table (0x09) that will be used to identify this button.

Soft Button Side SV – This usage specifies the side of the display where the button resides. Where, 0 = top, 1 = bottom, 2 = left side. 3 = right side.

Soft Button Offset 1 SV – A static value that specifies the offset in pixels of the top or left edge of the button. If the Soft Button Side usage equals *top* or *bottom* then the offset is in the column position of the side of the button nearest the origin. If the Soft Button Side usage equals *right* or *left* then the offset is in the row position of the side of the button nearest the origin.

Soft Button Offset 2 SV – A static value that specifies the offset in pixels of the bottom or right edge of the button. If the Soft Button Side usage equals *top* or *bottom* then the offset is in the column position of the side of the button farthest from the origin. If the Soft Button Side usage equals *right* or *left* then the offset is in the row position of the side of the button farthest from the origin.

1.1.2 Orientation

Pixels are addressed in row and columns. The origin or 0,0 position is always in the upper left hand corner of the display. Below is an example of a 128x64 bitmapped display.

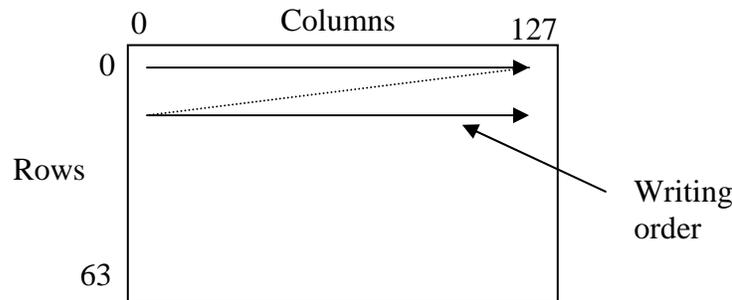


Figure 1: Display Orientation and Writing Order

Display Orientation DV – This usage is declared if the orientation of the display can be changed during usage. It identifies the location of the origin as viewed by the user.

Note: the application must perform the translations necessary to correctly display the screen to the user given the Orientation information.

- 0 – Origin at top left (default)
- 1 – Origin at top right (rotated 90 degrees clockwise)
- 2 – Origin at bottom right (rotated 180 degrees clockwise)
- 3 – Origin at bottom left (rotated 270 degrees clockwise)

1.1.3 Palette Report

Palette Report	CL – Finding this usage in a display application descriptor indicates the Auxiliary Display supports loadable Palettes. This usages applies to a logical collection that defines the palette download report.
Palette Data Size	SV - Specifies the number of palette table entries contained in the Palette Data buffered bytes field.
Palette Data Offset	SV - Specifies the offset into the palette table of the first entry contained in the Palette Data buffered bytes field. This field can be optional if the Palette Data Size is large enough to initialize the complete Palette table at once. If not declared, then the all Palette table entries must be included in a Palette Rptr report
Palette Data	Buffered Bytes – A collection of buffered bytes data that contains the palette data. The size of the individual palette entries are determined by the Bit Depth Format, see the descriptions above. If a Palette Data Offset is declared then the palette entries are loaded into the palette table starting at the offset declared by the Palette Data Offset. If a Palette Data Offset is not declared then the palette entries are loaded into the palette table starting at offset 0.

1.1.4 Blit Report

Blit Report	CL – This usage is required for moving data to or from a Bitmapped Display Device.
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The maximum size of a blit (in bytes) that is supported by the display, is defined by the size of the buffered bytes field in the Blit Report.

The following Blit Rectangle coordinates specify the bounding rectangle X1, Y1, X2, Y2 where the Blit Data buffer will be moved. The coordinate values assume the default Orientation of the display. See section 1.1.2 for more information on the default orientation.

If no Blit Rectangle usages are declared, then the client should assume that the data provided in the Blit Data is for the entire display buffer. i.e. the blit rectangle is (0,0, Bitmap Size X – 1, Bitmap Size Y – 1).

If a coordinate of the bounding rectangle is outside the boundaries of the display, the display will ignore data for this part of the Blit Data Buffer.

Blit Rectangle X1	DV – Specifies the X component of the top left corner of the rectangle for the blit.
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Blit Rectangle Y1	DV - Specifies the Y component of the top left corner of the rectangle for the blit.
Blit Rectangle X2	DV - Specifies the X component of the bottom right corner of the rectangle for the blit.
Blit Rectangle Y2	DV - Specifies the X component of the bottom right corner of the rectangle for the blit.
Blit Data	<p>Buffered Bytes – The buffer that contains the pixel data for each pixel in a blit to a display. The number of pixels contained in the Blit Data buffer equals</p> <p>$(\text{Blit Rectangle X1} - \text{Blit Rectangle X2})$ $* (\text{Blit Rectangle Y1} - \text{Blit Rectangle Y2}).$</p> <p>The format of the pixel data is a function of the Bit Depth Format, see section 18.2.1.</p>

1.1.5 Soft Button Report

Soft Button Report	CL - The Soft Button Report collection will include usages from the Button Usage page (0x09), which provides usages for generic non-function based button usages. The IDs of these buttons are defined in a Soft Button collection.
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1.2 Sample Aux Display Device

The following example of a 128 x 64 bitmap display device with a 256 color 555 palette and 4 soft buttons on the bottom edge of the display. The Soft Buttons are 24 pixels wide, on 32 pixel centers, where the left-most button is offset 4 pixels from the edge of the display.

Five reports are defined:

- A Display Attributes feature report is declared for identifying fixed features of the display. This report defines the size of the display, the bit depth and format, and the positions of the soft buttons. All of the Feature report's fields are constant.
- A Display Status input report that identifies state changes in the display.
- A Palette output report for loading the palette. Note that up to 256 bytes of palette data can be sent to the display in a single Palette report. Given 16-bits per palette entry, 2 reports are required to load the complete palette. One report with a Palette Data Offset = 0 and a second report with a Palette Data Offset = 128.
- A Blit output report for loading pixel data to the display. Note that up to 256 bytes of pixel data can be sent to the display in a single Blit report. Given 8-bits per pixel, 32 reports are required to completely refresh the screen.

- And a Soft Button input report for notifying the client of any buttons pressed by the user.

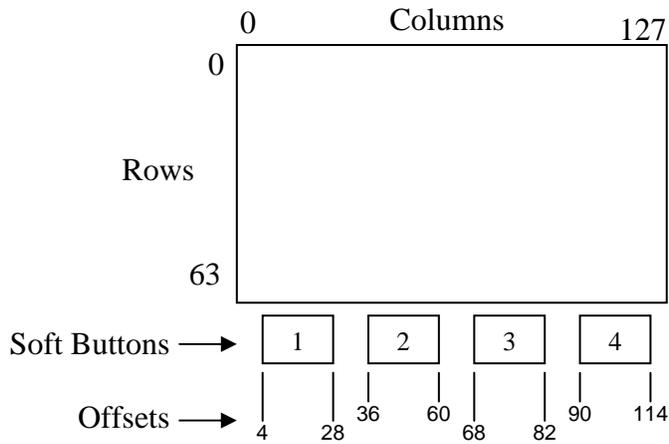


Figure 2: Example Display Layout

1.2.1 Example Aux Display Report Descriptor

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USAGE_PAGE (Alphanumeric Display)                05 14
USAGE (Auxiliary Display)                        09 02
COLLECTION (Application)                        A1 01
  USAGE (Display Attributes Report)              09 20
  COLLECTION (Logical)                          A1 02
    REPORT_ID (1)                               85 01
    USAGE (Bitmap Size X)                       Constant = 128-1    09 80
    USAGE (Bitmap Size Y)                       Constant = 64-1    09 81
    USAGE (Bit Depth Format)                     Constant = 0x14    09 83
                                          (Blit Format = 8 bit-Indexed with 555 palette)
    LOGICAL_MINIMUM (0)                         15 00
    LOGICAL_MAXIMUM (255)                       26 FF 00
    REPORT_SIZE (8)                             75 08
    REPORT_COUNT (3)                            95 03
    FEATURE (Cnst,Var,Abs)                      B1 03
    USAGE (Soft Button)                         09 90
    COLLECTION (Logical)                        A1 02
      USAGE (Soft Button ID)                    Constant = 1 (Button 1) 09 91
      USAGE (Soft Button Side)                  Constant = 1 (Bottom)  09 92
      REPORT_SIZE (4)                           75 04
      REPORT_COUNT (2)                          95 02
      LOGICAL_MAXIMUM (15)                      25 0F
      FEATURE (Cnst,Var,Abs)                    B1 03
      USAGE (Soft Button Offset 1)              Constant = 4 (left side of button) 09 93
      USAGE (Soft Button Offset 2)              Constant = 28 (right side of button) 09 94
      REPORT_SIZE (8)                           75 08
      LOGICAL_MAXIMUM (255)                     26 FF 00
      FEATURE (Cnst,Var,Abs)                    B1 03
    END_COLLECTION                             C0
  USAGE (Soft Button)                           09 90
  COLLECTION (Logical)                          A1 02
    USAGE (Soft Button ID)                      Constant = 2 (Button 2) 09 91
    USAGE (Soft Button Side)                    Constant = 1 (Bottom)  09 92
    REPORT_SIZE (4)                              75 04
    LOGICAL_MAXIMUM (15)                        25 0F
    FEATURE (Cnst,Var,Abs)                      B1 03
    USAGE (Soft Button Offset 1)                Constant = 36 (left side of button) 09 93
    USAGE (Soft Button Offset 2)                Constant = 60 (right side of button) 09 94
    REPORT_SIZE (8)                             75 08

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LOGICAL_MAXIMUM (255)		26 FF 00
FEATURE (Cnst,Var,Abs)		B1 03
END_COLLECTION		C0
USAGE (Soft Button)		09 90
COLLECTION (Logical)		A1 02
USAGE (Soft Button ID)	Constant = 3 (Button 3)	09 91
USAGE (Soft Button Side)	Constant = 1 (Bottom)	09 92
REPORT_SIZE (4)		75 04
LOGICAL_MAXIMUM (15)		25 0F
FEATURE (Cnst,Var,Abs)		B1 03
USAGE (Soft Button Offset 1)	Constant = 68 (left side of button)	09 93
USAGE (Soft Button Offset 2)	Constant = 82 (right side of button)	09 94
REPORT_SIZE (8)		75 08
LOGICAL_MAXIMUM (255)		26 FF 00
FEATURE (Cnst,Var,Abs)		B1 03
END_COLLECTION		C0
USAGE (Soft Button)		09 90
COLLECTION (Logical)		A1 02
USAGE (Soft Button ID)	Constant = 4 (Button 4)	09 91
USAGE (Soft Button Side)	Constant = 1 (Bottom)	09 92
REPORT_SIZE (4)		75 04
LOGICAL_MAXIMUM (15)		25 0F
FEATURE (Cnst,Var,Abs)		B1 03
USAGE (Soft Button Offset 1)	Constant = 90 (left side of button)	09 93
USAGE (Soft Button Offset 2)	Constant = 114 (right side of button)	09 94
REPORT_SIZE (8)		75 08
LOGICAL_MAXIMUM (255)		26 FF 00
FEATURE (Cnst,Var,Abs)		B1 03
END_COLLECTION		C0
END_COLLECTION		C0
USAGE (Display Status)		09 2D
COLLECTION (Logical)		A1 02
USAGE (Stat Not Ready)		09 2E
USAGE (Stat Ready)		09 2F
REPORT_SIZE (8)		75 08
REPORT_COUNT (1)		95 01
LOGICAL_MAXIMUM (1)		25 01
INPUT (Data,Ary,Abs,Null)		81 40
END_COLLECTION		C0
USAGE (Palette Report)		09 85
COLLECTION (Logical)		A1 02
USAGE (Palette Data Size)		09 86
	Number of Palette table entries in the buffered bytes Palette Data field	
USAGE (Palette Data Offset)		09 87
	Start offset in palette table for palette entries in Palette Data	
REPORT_SIZE (8)		75 08
REPORT_COUNT (2)		95 02
OUTPUT (Data,Var,Abs,Null)		91 42
USAGE (Palette Data)	Palette Data buffer	09 88
REPORT_SIZE (8)		75 08
REPORT_COUNT (256)		96 00 01
OUTPUT (Data,Var,Abs,Buf)		92 02 01
END_COLLECTION		C0
USAGE (Blit Report)		09 8A
COLLECTION (Logical)		A1 02
REPORT_ID (2)		85 02
USAGE (Blit Rectangle X1)	Blit rectangle definition	09 8B
USAGE (Blit Rectangle Y1)		09 8C
USAGE (Blit Rectangle X2)		09 8D
USAGE (Blit Rectangle Y2)		09 8E
REPORT_SIZE (8)		75 08
REPORT_COUNT (4)		95 04
LOGICAL_MAXIMUM (127)		25 7F
OUTPUT (Data,Var,Abs)		91 02
USAGE (Blit Data)	Blit Data buffer	09 8F
REPORT_SIZE (8)		75 08
REPORT_COUNT (256)		96 00 01
OUTPUT (Data,Var,Abs,Buf)		92 02 01
END_COLLECTION		C0

USAGE (Soft Button Report)	09 95
COLLECTION (Logical)	A1 02
USAGE_PAGE (Button)	05 09
USAGE_MINIMUM (Button 1)	19 01
USAGE_MAXIMUM (Button 4)	29 04
REPORT_SIZE (1)	75 01
REPORT_COUNT (4)	95 04
LOGICAL_MAXIMUM (1)	25 01
INPUT (Data,Var,Abs)	81 02
REPORT_SIZE (4)	75 04
REPORT_COUNT (1)	95 01
INPUT (Cnst,Var,Abs)	81 03
END_COLLECTION	C0
END_COLLECTION	C0

Response:

<sam> I dropped the Custom Segment usage because that's what Vendor Defined Usages are for.

nathans@microsoft.com Minor edit to sample descriptor comment field clarifying that Bitmap Size X and Bitmap Size Y are 0-based.

Notes on Approval Procedure:

HID WG On Line Voting Procedures

1. Votes are on a per company basis.
2. Each Review Request shall have attached a Required Voter List that is the result of recruiting by the HID Chair and submitter of members of the USB IF. Required Voter List must include the HID Chair plus 2 companies (other than the submitter) plus any others designated by the HID Chair at the Chair's discretion. The Required Voter List ensures that a quorum is available to approve the Request.
3. Impose a 7-calendar-day posting time limit for new Review Requests. HID Chair or designate must post the RR within 7 calendar days. HID Chair or designate must work with the submitter to make sure the request is valid prior to posting. Valid review request must include all fields marked as required in the template. A new template will be adopted that requires at least the following fields: Change Text, Required Voter List, Review Period End Date and Voting End Date, Submittal Date, Submitter, Review Request Title and RR Number.
4. If a RR approval process stalls, the HID Chair may call a face-to-face meeting or conference call to decide the issue. Submitter may request that this take place.
5. Impose a minimum 15-calendar-day review period on a posted RR prior to the voting period. At HID Chair discretion, changes to the RR may require this review period to restart.

6. The Chair will accept votes via documentable means such as mail or e-mail during the 7 calendar days after the close of the review period. If a Required Voter does not vote during the period, then there is no quorum and the Chair may pursue the absent required voter and extend the voting period. The Chair may designate a substitute for the absent voter and extend the voting period if necessary.