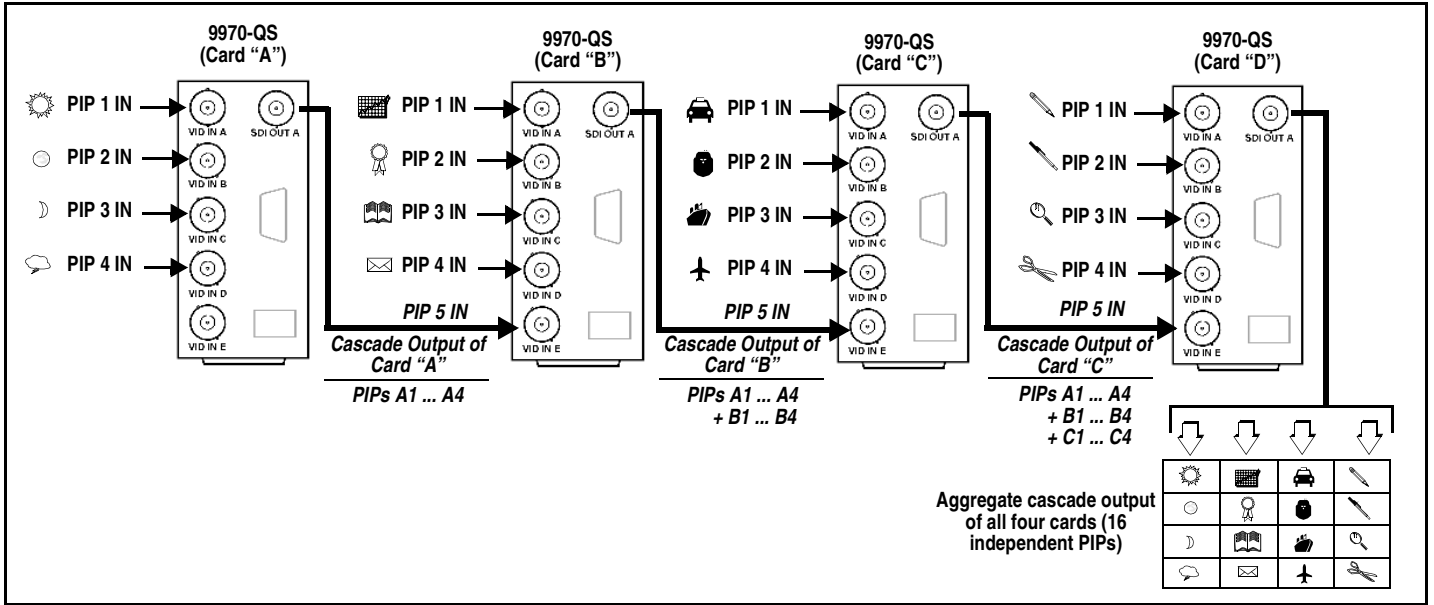


### Multiviewer Layouts Using the 9970-QS Cascade Mode

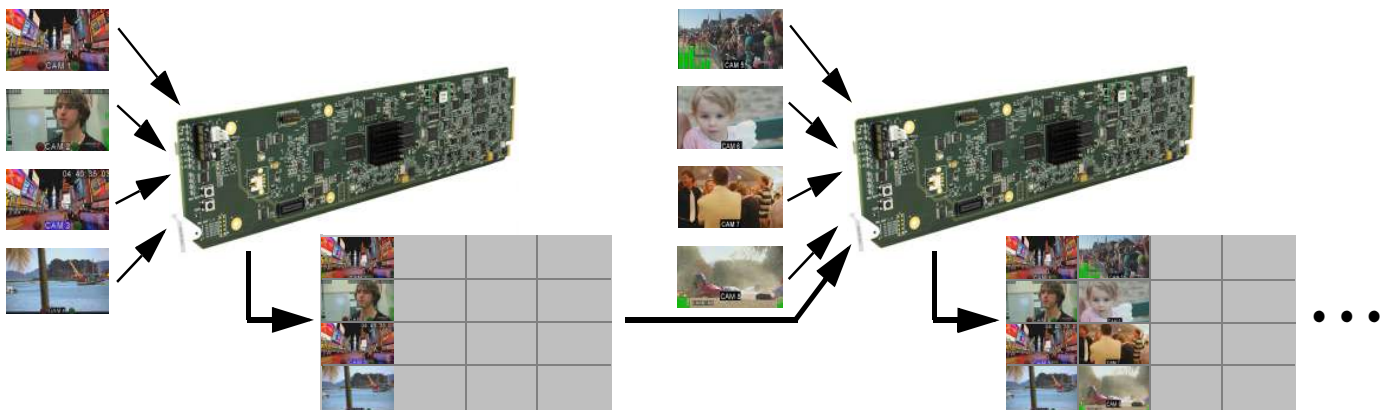
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The 9970-QS **PIP 5** (using VID IN E here) input is ideally suited to allow multiple 9970-QS cards to operate in a **cascading** arrangement where on all cards PIP 1 thru PIP 4 card inputs serve as program video inputs, and the PIP 5 input receives the cascading combined layout of a preceding 9970-QS card in a daisy-chain arrangement.



Using the cascade mode on successive downstream cards, the PIP 5 input is configured to serve as a full-size underlay. The downstream-card PIP 1 thru PIP 4 inputs are then inserted as overlays placed on top of the cascade underlay. In this manner, added PIPs are positioned over the imported underlay resulting in a combined image of the imported underlay PIPs and the locally added PIPs.

Multiple 9970-QS cards can operate in a **cascading** mode, where four PiP inputs serve as program video inputs, and the PiP 5 input receives the cascading combined layout of a preceding 9970-QS card in a daisy-chain arrangement.



The cascade output (consisting of the four PiP images and a full-size underlay) can be sent to another 9970-QS as a **cascade** input, serving as an underlay which can accept more PiP insertions.

A Quickset grid definer precisely sets up a multiviewer grid where columns and rows of each of the cards PIPs are arranged to work together in a cascaded aggregate arrangement. Simply set for the number of rows and columns desired.

More downstream 9970-QS cards can be added and have its PiPs added next to those furnished from the upstream card cascade. Here, PiP insertions are arranged in columns, although almost any desired grid and arrangement scheme is possible.

Even more cards and PiPs can be added using open adjacent cells in the grid. Grids of up to 8x8 are supported, providing for a 64:1 multiviewer using 16 cards.

## Applying The Desired Layout Grid

The 9970-QS cascading mode provides precise PIP image sizing and positioning using a **PIP Layout QuickSet** dialog that lets you set a symmetrical grid of a desired number of rows and columns using the QuickSet **Number of Rows** and **Number of Columns** drop-downs (located in the **PIP Position** sub-tab for each PIP input tab). Each resulting cell of a grid is a default identically-sized 16:9 cell. Once this is set for any PIP on a card, the row-column layout carries across to the other PIP input tabs on the card. Applying the same row-column setting on downstream cards in the chain set these cards to also have the same layout, with identically sized and positioned PIP cells.

PIP 1 ... PIP 4

PIP Position

PIP Layout QuickSet

Number of Rows: 4

Number of Columns: 4

1	5	9	13
2	6	10	14
3	7	11	15
4	8	12	16

The example **Number of Rows** and **Number of Columns** setting here provides a 4x4 (16:1) multiviewer grid when used with four 9970-QS cards. Other grids of any matrix arrangement from 1 to 8 rows or columns can be set up as desired using these drop-down selectors.

In this example, this same setting of four rows and four columns would be applied to all four 9970-QS cards in the chain, resulting in a 4x4 grid available for each card's four PIP inputs.

PIP 1 ... PIP 4

PIP Position

Row Position: 1

Column Position: 1

Row Position: 2

Column Position: 1

Row Position: 3

Column Position: 1

Row Position: 4

Column Position: 1

For each PIP input, a **Row Position** and **Column Position** drop-down directs each PIP input to its desired cell location within the grid.

In the example here, the first 9970-QS card in a cascaded setup has its PIP1 thru PIP4 correlated to column 1, with PIP1 thru PIP4 position drop-downs set to position PIP1 thru PIP4 in rows 1 thru 4, respectively.

1	5	9	13	1
2	6	10	14	2
3	7	11	15	3
4	8	12	16	4
	1	2	3	4

Rows

Columns

## Example 4x4 (16:1) Multiviewer Setup

In the example here, a 4x4 (16:1) multiviewer setup is obtained using the following:

- Four 9970-QS cascaded cards, each receiving four PIP inputs on card inputs **In A** thru **In D**.
- Card A handles CAM1 thru CAM4, card B handles CAM5 thru CAM8, and so on (CAM1 thru CAM16 total).
- The **In E** input is used as the cascade input for cards B thru D.

- First, on the **Layout/Routing** tab on all cards, input routing is set to route card inputs **In A** thru **In E** as PIP sources **PIP 1** thru **PIP 5**, respectively.

Layout / Routing

PIP 1 Input Source: In A

PIP 2 Input Source: In B

PIP 3 Input Source: In C

PIP 4 Input Source: In D

PIP 5 Input Source: In E

- For all cards in the chain, **Cascade Mode** is set to **Enabled**. This sets the PIP 5 input to receive a cascade output from another 9970-QS card. Because this cascaded underlay will have any burn-in insertions already in place from the source card, all PIP 5 burn-in insertions are automatically disabled in this mode. Also, since in this mode this PIP will serve as an underlay for any added PIPs, the PIP 5 cascade is inserted as full-screen 16:9, with all sizing and positioning controls locked out for the cascaded PIP insertion.

Layout / Routing

Cascade Mode: Enabled

3. Since a 4x4 grid is being set up in this example, on the **PIP 1 > PIP Position** sub-tab the **PIP Layout QuickSet** is set for a 4-row x 4-column layout on Card A. (This setting will propagate for PIP 2 thru PIP 4 on Card A.)

This setting should now also be applied to Cards B thru D in the chain, since these cards also need to be set for the same 4x4 grid.

**PIP 1**  
**PIP Position**

PIP Layout QuickSet

Number of Rows: 4  
Number of Columns: 4

4. Now that the grid is defined, the PIPs can be directed to the desired grid locations using the **Row Position** and **Column Position** drop-downs on the **PIP Position** sub-tab. Shown below, the **PIP 1 > PIP Position** sub-tab controls are set to direct PIP 1 thru PIP 4 to position each PIP in a desired cell location within the grid.

When the PIP position is selected, click **Apply QuickSet**. The grid will now be defined, and the PIPs will snap to the intended positions in the grid.

PIP Layout QuickSet

Number of Rows: 4  
Number of Columns: 4

Row Position: 1  
Column Position: 1

QuickSet Action: Size for 4 across x 4 down, place in row 1 column 1

Apply QuickSet

Using the **PIP 1 > PIP 4 PIP Position** sub-tab position controls, Card A PIPs 1 thru 4 are positioned in Rows 1 thru 4, respectively (all aligned in Column 1)

**PIP 1**  
**PIP Position**  
Row Position: 1  
Column Position: 1

**PIP 2**  
**PIP Position**  
Row Position: 2  
Column Position: 1

**PIP 3**  
**PIP Position**  
Row Position: 3  
Column Position: 1

**PIP 4**  
**PIP Position**  
Row Position: 4  
Column Position: 1

5. On Card B (which is now receiving the cascaded Card A PIP 1 thru PIP 4 positioned in column 1 as an underlay), the Card B PIPs can now be inserted and positioned. In this example, CAM5 thru CAM8 images (using **Card B** inputs **PIP 1** thru **PIP 4**) are being directed to the cells just across from CAM1 thru CAM4 in column 2 using the Card B **Row Position** and **Column Position** drop-downs as shown below. Again, clicking **Apply QuickSet** sets up the grid on Card B and snaps the CAM5 thru CAM8 PIPs into the desired positions.

Shown here are the settings that direct Card B PIP 1 thru PIP 4 to column 2, rows 1 thru 4 respectively. The cascading now consists of CAM1 thru CAM8 progressively populating eight of the 16 cells in the 4x4 grid.

**PIP 1**  
**PIP Position**  
Row Position: 1  
Column Position: 2

**PIP 2**  
**PIP Position**  
Row Position: 2  
Column Position: 2

**PIP 3**  
**PIP Position**  
Row Position: 3  
Column Position: 2

**PIP 4**  
**PIP Position**  
Row Position: 4  
Column Position: 2

6. With the cascade chain continuing now from Card B to C, and finally from Card C to D, all 16 PIPs are accommodated and directed to the desired PIP cells in the grid. In this example, each 9970-QS card in the chain is set to insert and position its PIPs in rows 1 thru 4, and then use the next adjacent column to the right.

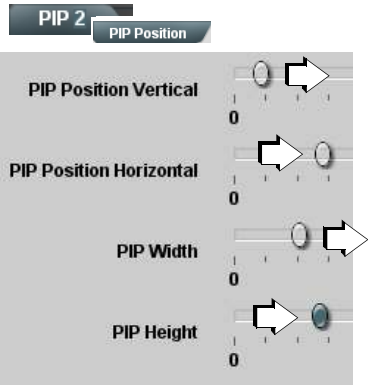
Again, clicking **Apply QuickSet** sets up the grid to snap the PIPs into the desired positions.

The **SDI OUT** and/or **HDMI OUT** of Card D comprises the 16:1 multiviewer output.



7. Once set in the grid, a PIP is not necessarily locked into its initial position. Any PIP in the cascade can be resized or repositioned into anywhere on the overall output image as desired.

In this example, the “CAM14” PIP (from Card D, PIP 2) is resized as prominent and repositioned into the right center of the overall multiviewer image.



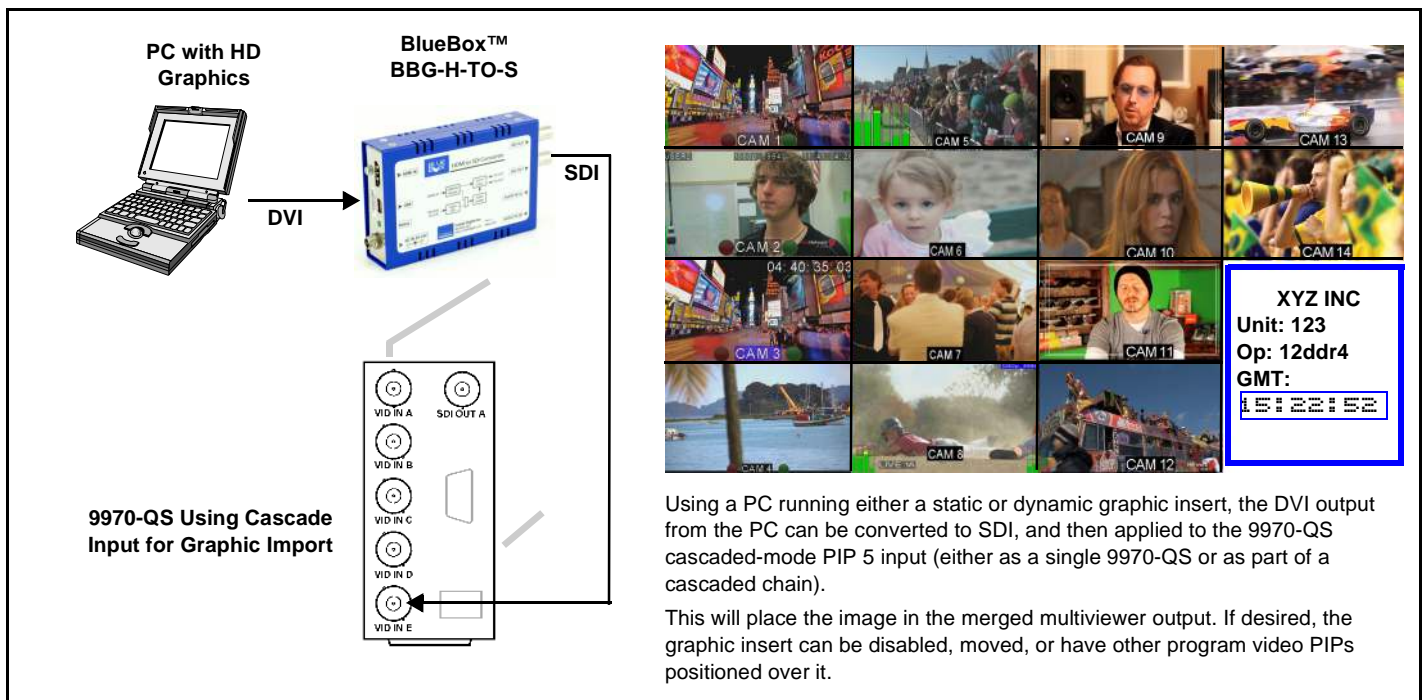
On the card handling the PIP’s insertion (Card D in this example), use the **PIP Position** and **PIP Width / PIP Height** controls shown here to move and/or resize the PIP from its initial location to anywhere desired in the multiviewer image.

Similarly, insertion and attributes control of any PIP burn-ins (UMDs, tallies, text, timecode, etc.) is exactly the same as non-cascaded use. Simply go to the card and PIP tab for the PIP where these changes are desired.



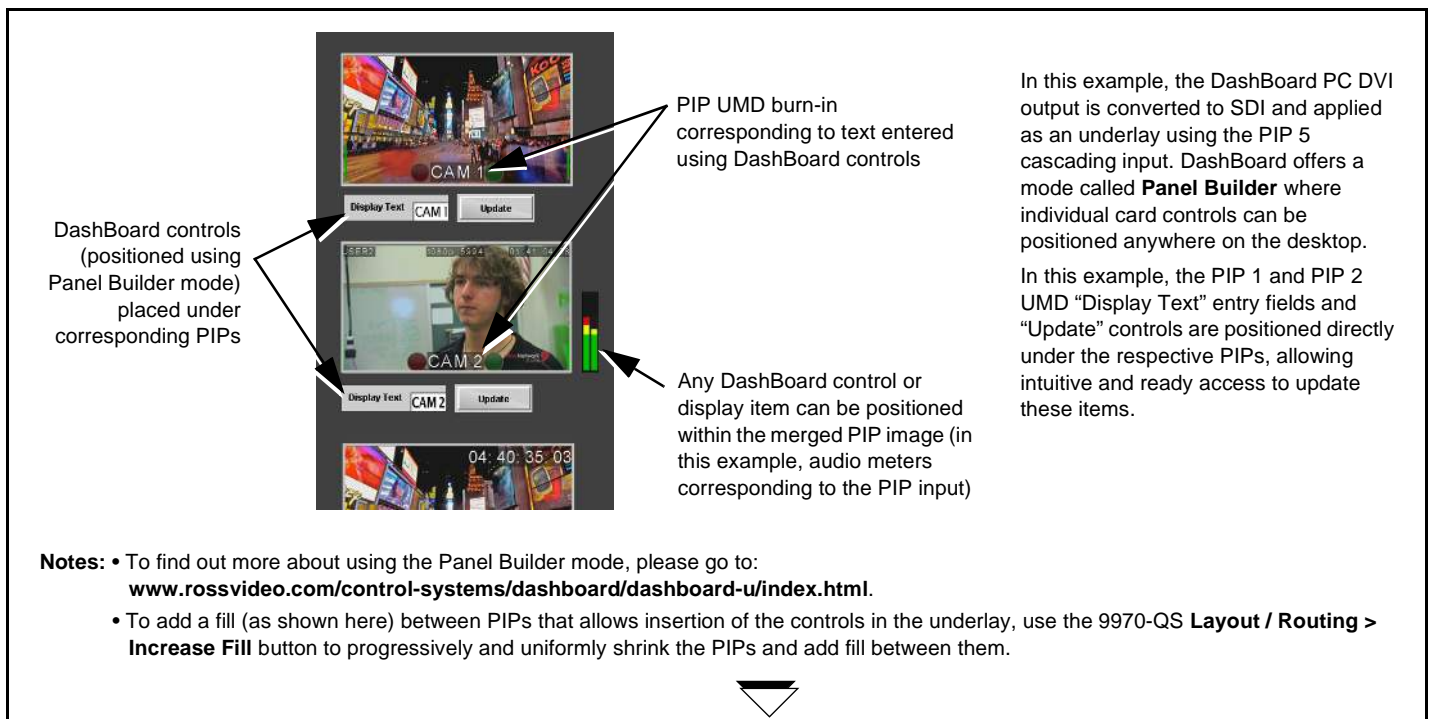
## Using the Cascade Input For Graphics Template Import

The PIP 5 cascade input (with its ability to serve as a stable, auto-sized, full-size import underlay) is perfect for serving as a means to import a graphic background **external of the program material** into the merged multiviewer output.

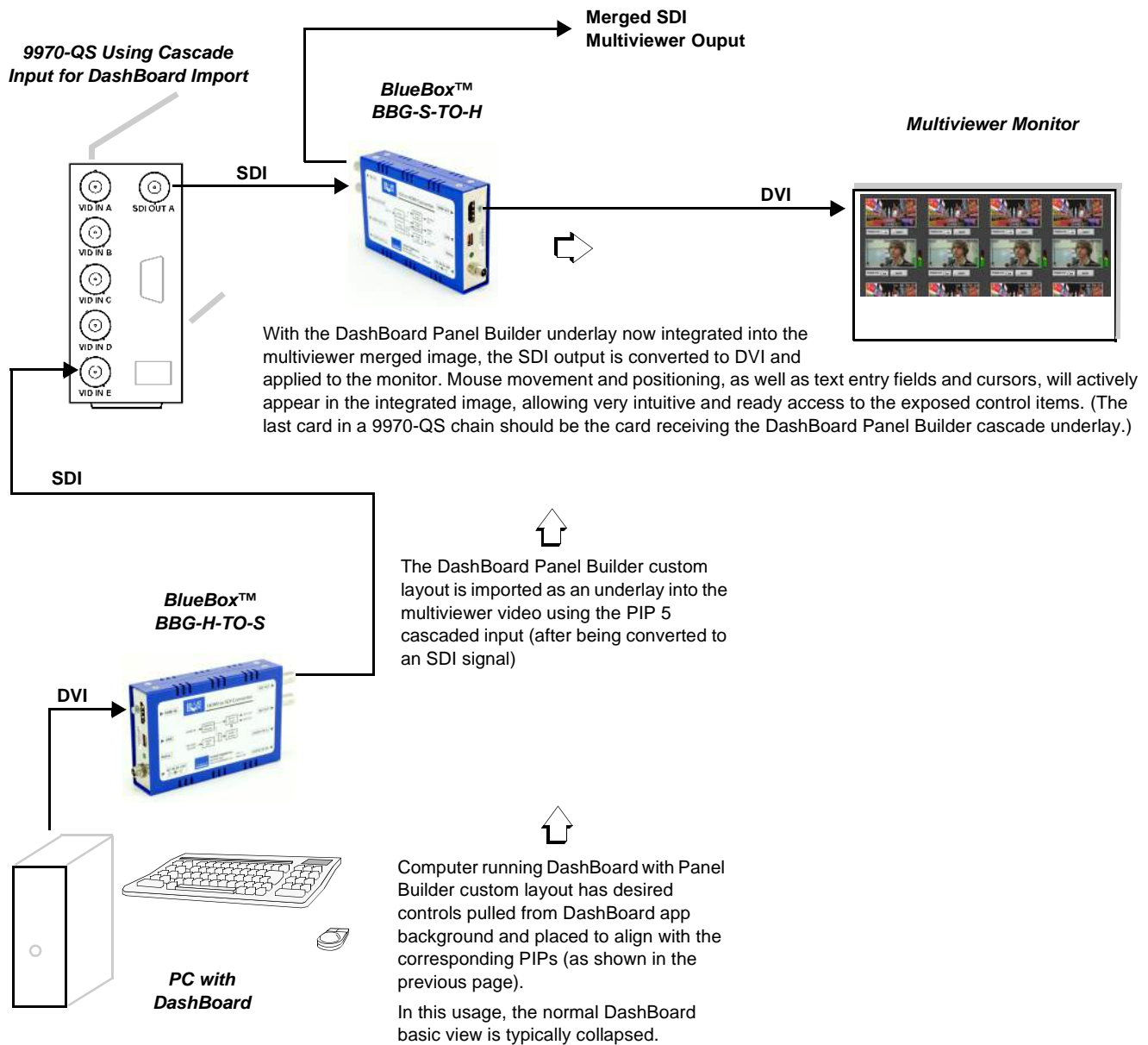


## Using the Cascade Input For Computer Desktop/DashBoard™ Underlay

Again using the PIP 5 input as a cascading underlay, this example shows how DashBoard control elements on the PC can be actively imported and inserted as part of the underlay. This allows the actual active DashBoard controls (for items such as UMD text and audio level meters) to be “pulled” from the normal DashBoard app window area and instead positioned within the QS merged image and completely unbound from being tied only to the DashBoard app area.



Shown below is the setup and accessory items that can be used to facilitate DashBoard integration into a multiviewer active layout.



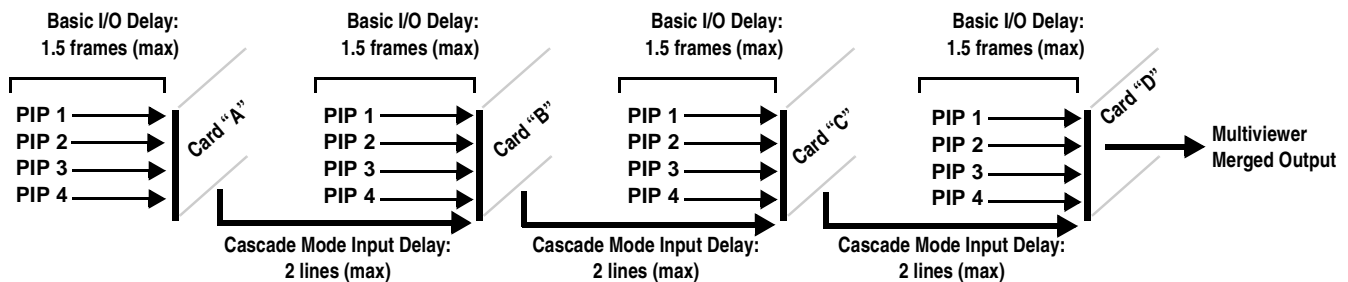
## Optimizing Setup When Using Multi-Card Cascading

The 9970-QS and its cascade mode can use certain settings that are optimized for multi-card low latency. Shown and described below are some major facets which help achieve the lowest latency possible when using the 9970-QS cards in a multi-card multiviewer cascade setup.

Because **all** inputs being used as normal PIP inputs have the same basic <1.5 frame intrinsic delay, the net delay on any input relative to any other input is nulled. (In the example here, PIP 1 of card "A" has no difference in I/O delay as that of PIP 4 of card "D", so the intra-card delays can be nulled out.)

When subsequent card inputs are set as **cascading** to receive an upstream cascaded input, this sets up a special path where many aspects/functions used for "normal" inputs are bypassed (such as scaler and framesync functions which are not needed for a cascade input). This results in an I/O latency for these paths of **< 2 lines** (many orders of magnitude less than the delays experienced for every normal input and therefore largely inconsequential).

In the example shown here, the worst-case delay offset from one PIP input to another would **only** be due to the card cascading (in this case, a maximum of 6 lines).



To take advantage of the cascade-mode bypassing/low-latency features, the following should be observed:

- All PIP inputs should be ref locked before being applied to a 9970-QS input, and all 9970-QS cards in a chain should also be set to use the same reference. Each 9970-QS card can be set to enable the **Cascade Low Latency Mode** in which the card can automatically bypass framesync when the card "sees" that inputs are in alignment with the received reference.
- Because inputs using the cascade mode bypass the card scaler, the output of a preceding (upstream) 9970-QS card should be set to match that of the subsequent downstream 9970-QS receiving the cascade output.

Refer to the 9970-QS Product Manual for more information regarding this mode and control settings.

This Application Note provides an overview and examples of using the Cascading Mode in a multi-card multiviewer setup. The 9970-QS offers extremely flexible and comprehensive controls to handle numerous aspects of signal routing and conditioning, as well as layout and attributes control. Please read and understand the **entire** 9970-QS Product Manual and familiarize with all controls and settings to get the most from the 9970-QS card.

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