

Technical Support

Technical Bulletin

Distribution:	Application Engineers, Technical Support Engineers, Vision Solutions Engineers, Technical Documentation Group, Worldwide Sales	☐ INTERNAL ONLY
Bulletin No.:	TB-07-002	☒ Internal & Customers (as needed)
Date:	01/29/2008	☐ Internal & Customers (MANDATORY)
Product:	VPRO	
Rev:	5.0	
Title: FireWire Camera Ordering Changes		

PURPOSE

Beginning in VisionPro 5.0, the detection order of FireWire cameras when an application starts has been changed. This Technical Bulletin applies only to applications that contain more than one FireWire camera. The detection order of FireWire cameras was changed to simplify the process of configuring multi-camera FireWire systems and resolve an issue of replacing FireWire cameras in the field.

Existing multi-camera FireWire applications (prior to VisionPro 5.0) are likely to be affected when the application is upgraded to VisionPro 5.0. Guidelines in this document outline the impact to existing applications and how to take advantage of the improved multi-camera FireWire ordering.

TECHNICAL DETAILS

A VisionPro .vpp file contains one or more jobs. Each job refers to a FireWire camera by a zero-based index. These indexes represent the order in which VisionPro has detected FireWire cameras on the PC. To make system configuration easier, and to improve camera replacement, the VisionPro FireWire camera detection order has changed in VisionPro 5.0.

VisionPro 4.4 and earlier releases:

In previous VisionPro releases, FireWire cameras were detected in an order based upon the individual model & serial number of the cameras themselves. This method causes difficulties in the field, both when attempting to replace cameras, and when trying to configure new deployment systems. When a camera is removed and a new camera put in its place, the previous ordering method would cause the new camera to appear anywhere in the camera list. This would in turn cause the wrong camera to be associated with each VisionPro QuickBuild job. The only remedy for this problem was to remount the cameras themselves such that each camera was in its new proper location on the deployment machine.

When configuring a new machine with multiple FireWire cameras, the camera order had to be determined empirically. All cameras had to be attached, and their detection order determined (by running QuickBuild and examining what image was shown by each camera number). Then, the cameras would be mounted in the appropriate locations on the machine, such that each job of the .vpp file received the image it required.

VisionPro 5.0 and later releases

Beginning in VisionPro 5.0, VisionPro detects FireWire cameras in an order based solely on the FireWire port to which they are connected. Every FireWire bus has a tree topology of cameras, hubs and repeaters. The FireWire specification assigns a Physical ID (or "node number") to each device in this tree (the FireWire Physical ID specification is described in more detail below in Appendix A). This physical ID is always the same, regardless of the kind of device (model, serial number, etc) attached to a location in

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the tree. VisionPro builds its zero-based list of FireWire cameras by adding cameras in increasing order of their physical ID.

In this way, when a camera needs to be replaced, the new camera can be plugged into the same FireWire port as the old camera, and the VisionPro FireWire camera order will remain the same. No other system changes are required. When configuring a new machine with multiple FireWire cameras, each camera can simply be attached to the proper FireWire port, and each job in the VisionPro .vpp file will receive the correct image.

Using the new ordering method, each FireWire port (both those on adapters and those on hubs) could be labeled with a sticker indicating what camera should be attached to that port. Initial system configuration and maintenance in the field is greatly simplified.

This new Physical ID camera order is the default order for VisionPro 5.0. The old camera order used by VisionPro 4.4 and earlier releases is still supported. There is a setting in the VisionPro.ini file that can be used to select whether "Legacy" or "Physical ID" FireWire camera ordering should be used on a given PC. VisionPro.ini is typically located in c:\windows\system32:

```
*****
; This section specifies the configuration of the 1394 camera order. The
; possible settings are:
;
;      1394CameraOrder = Legacy      : Use the legacy camera ordering, based
;                                     on a unique identifier in each camera.
;      1394CameraOrder = PhysicalID : * Use a physical ID camera ordering, based
;                                     on which port each camera is connected to.
;
; * the default if not explicitly specified
;
; uncomment the following lines to use legacy camera ordering
;[Cog1394DCAM]
;1394CameraOrder = Legacy
```

It is recommended that all existing applications be upgraded to use the new default "Physical ID" method, described in this document.

MOVING FORWARD

VisionPro job or QuickBuild .vpp files save acquisition configurations. They refer to FireWire cameras by index. When loading a .vpp file saved from an older version of VisionPro (where camera indexes are encoded in "legacy" mode) into a new version of VisionPro (which defaults to "physical id" mode), problems can result.

When loading pre-VisionPro 5.0 .vpp files, there are 3 cases:

1. No FW camera, or just one FW camera. No problems in these cases.
2. Multiple FW cameras attached, all of the same make & model
3. Multiple FW cameras attached, not all of the same make & model

Below is a manual step-by-step process that can be used for cases (2) and (3) above to handle the switch from Legacy to PhysicalID mode.

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Note that users always have the option to just select Legacy mode in their VisionPro.ini and continue to run that way with no other changes required.

How to manually update a .vpp file from Legacy to PhysicalID camera detection, using VisionPro 5.0

1. Start QuickBuild & load the .vpp file. By default, PhysicalID mode will be used.
2. If the .vpp file fails to load (as it will in case (3)), then exit QuickBuild and change to Legacy mode in the VisionPro.ini file. Restart QuickBuild and load the .vpp file again (it will always succeed this time). Note that .vpp file load failure will occur only in case (3) above.
3. Once the .vpp file is successfully loaded, look at the Image Source for each job and notice what camera number it is selecting. Make a list of cameras from 0 to N and the job associated with each camera.

Example list:

Camera 0: "left view job"
Camera 1: "right view job"
etc

4. Exit QuickBuild.
5. If you changed VisionPro.ini to Legacy mode, change it back to PhysicalID mode.
6. Unplug all cameras and plug them back such that the cameras are correct (plug the "left view" camera in the lowest port, "right view" into a higher port, etc).
7. Start QuickBuild, load your .vpp file and confirm that each job is now selecting the proper camera.

At this point a single .vpp file can be used on all deployed machines, and both configuring new systems and replacing cameras in the field are simple operations, requiring no further changes to the .vpp file.

APPENDIX A: HOW FIREWIRE PHYSICAL IDS ARE DETERMINED

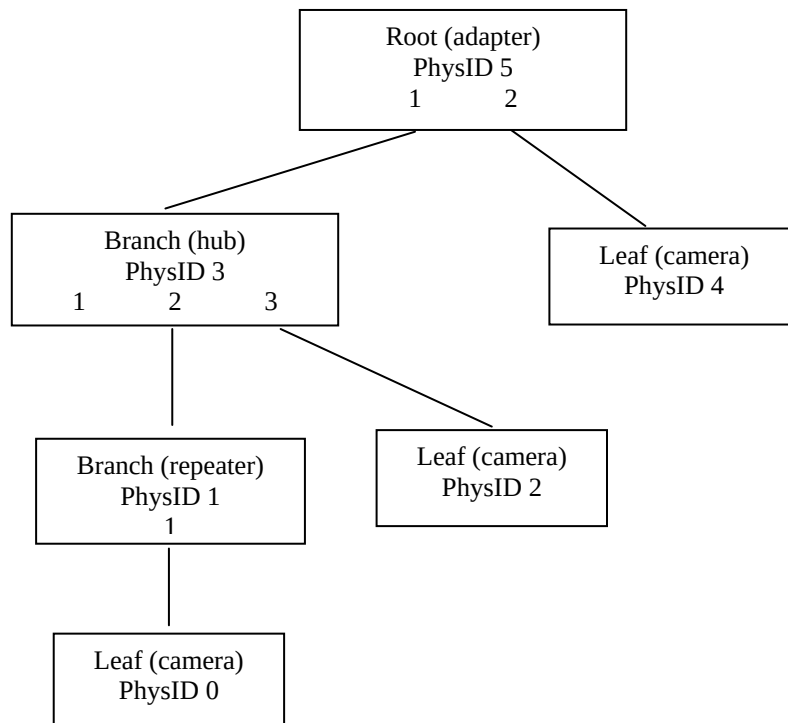
FireWire physical IDs are assigned following every bus reset. Physical IDs are assigned based on the location of devices in the topology of the FireWire bus. Each FireWire adapter is the "top" of the FireWire bus (and, as will be seen, always ends up with the highest Physical ID on the bus). There are 2 kinds of device nodes on a bus – branch nodes (those that have ports, like adapters, hubs and repeaters) and leaf nodes (those that don't have ports). The ports of each branch node are ordered, such that they can be numbered from 1 to N.

To determine the device with Physical ID 0, start at the lowest numbered port of the FireWire adapter, and follow the lowest numbered port of every branch node until a leaf node is reached. This leaf node device is ID 0. Continue this process (following the lowest numbered port that contains a device that *has not yet been assigned an ID*) to assign all IDs in incrementing order. When the devices attached to all ports of a given branch node have been assigned an ID, then the branch node itself is assigned its ID.

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An example of a bus topology and the physical IDs assigned to each device is below.



Note that each 1394 bus builds its own independent set of physical IDs, so if there are multiple 1394 adapters, each will have a device with physical ID 0, 1, etc. VisionPro orders the 1394 adapters in the system in slot order to allow all cameras to be deterministically ordered.