Technical Documentation

Pro-Bel protocol support on Vista consoles

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Introduction

Starting with version 3.5 of the Vista Software Vista products are able to support Pro-Bel enabled devices natively, and so a second PC is not necessary for this functionality.

Two versions of the protocol are supported: SW-P-02 and SW-P-08. The following conditions apply when using these protocols and may influence the decisions which protocol is used in certain situations:

SW-P-02

- Allows more than 1 controlling device to control Vista
- Limited to 1'000 controllable inputs and outputs
- By referencing to Vista "Fixed Labels" it is possible to control any patch point within the General Patch window, including channel inputs, insert sends/returns, direct outputs etc.
- Support of one or multiple Studer "Hardware Patch Selector Panels" by using a modified version of this protocol

SW-P-08

- Allows only 1 external controller per desk (one port)
- "unlimited" number of controllable patch points by using multiple "matrices"
- By referencing physical interfaces only patches between input and output ports can be controlled.

Therefore it is recommended to use the SW-P-08 protocol in case parts of the console DSP core should act as a largely separated router within the facility and if a maximum of 1'000 controllable sets is not enough.

Set up – Overview

Both protocols may be used simultaneously and in parallel. To enable either of the protocol a COM port needs to be defined in the D950System.ini. It is to be decided at this level whether a COM port is used for one or the other protocol. Use {b} to enable SW-P-02 on a specified port and {r} or {q} to enable SW-P-08.

SW-P-02

Enable the serial port in the D950System.ini:

```
[d950SerialPorts]
1= {p} COM1 baud=115200 parity=N data=8 stop=1
2= {b} COM2 baud=115200 parity=N data=8 stop=1
3= {r} COM3 baud=115200 parity=N data=8 stop=1
4= {n} COM4 baud=115200 parity=N data=8 stop=1
```

See "Operation SW-P-02" for further steps and how to have the appropriate files generated for you.

SW-P-08

Enable the serial port in the D950System.ini

```
[d950SerialPorts]
1= {p} COM1 baud=115200 parity=N data=8 stop=1
2= {b} COM2 baud=115200 parity=N data=8 stop=1
3= {r} COM3 baud=115200 parity=N data=8 stop=1
4= {n} COM4 baud=115200 parity=N data=8 stop=1
```

To use SW-P-08 for label transfer and "router control" uncomment following line in the [options] section of the ini file:

```
RouterProtocol=Pro-Bel
;RouterProtocol=GVGSeries7000
```

See "Implementation Notes Pro-Bel SW-P-08" for setting up patches for label transfer and router control.

SW-P-08 without label support (patching only)

Enable the serial port in the D950System.ini

```
[d950SerialPorts]
1= {p} COM1 baud=115200 parity=N data=8 stop=1
2= {b} COM2 baud=115200 parity=N data=8 stop=1
3= {q} COM3 baud=115200 parity=N data=8 stop=1
4= {n} COM4 baud=115200 parity=N data=8 stop=1
```

To use SW-P-08 for "router control" uncomment following line in the [options] section of the ini file:

```
RouterProtocol=Pro-Bel
;RouterProtocol=GVGSeries7000
```

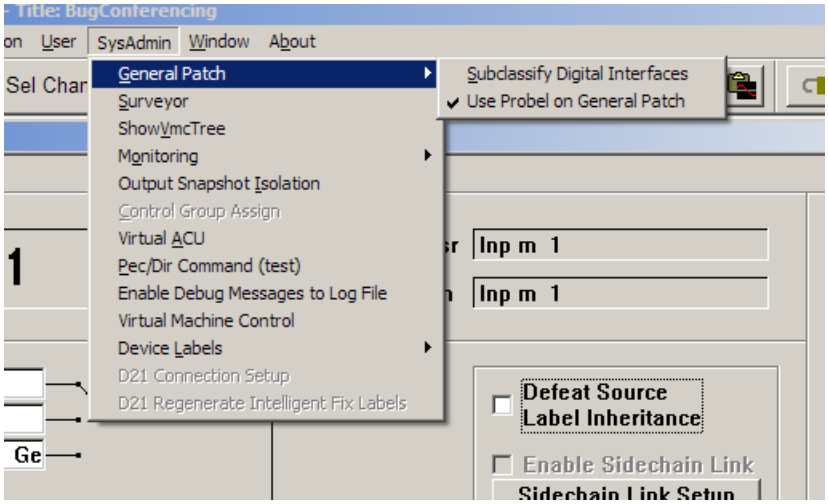
Operation SW-P-02

Supported Functionality

Our implementation enables the ability to map certain Pro-Bel connect requests to a set of definable Patch connections. This set up procedure is done from the General Patch screen, where certain patches can be selected (by just selecting the affected targets) and which are being mapped to a Pro-Bel source/destination combination with a single click on a dialogue.

Enabling Pro-Bel Setup

To be able to activate and see the Setup Probel button on the General Patch the system has to be in Sysadmin Mode.The SysAdmin menu contains a sub menu GeneralPatch and a switch to use Pro-Bel.



Menu for activating native Pro-Bel support

This setting will be written to the D950System.ini as well, resulting in the same behavior as if it was edited by hand in the first place.
The button will then be visible whenever the System enters the Sysadmin Mode.

Enabling COM ports for the use with the Pro-Bel SW-P-02 protocol

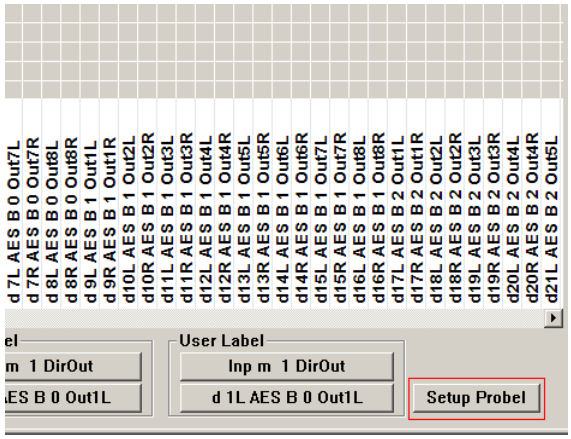
Ports that are to be used for Pro-Bel need to be specified in the D950System.ini in the [d950SerialPorts] section. This gives the possibility to use non standard data rates and parity settings.

```
[d950SerialPorts]
1= {p} COM1 baud=115200 parity=N data=8 stop=1
2= {b} COM6 baud=38400 parity=E data=8 stop=1
```

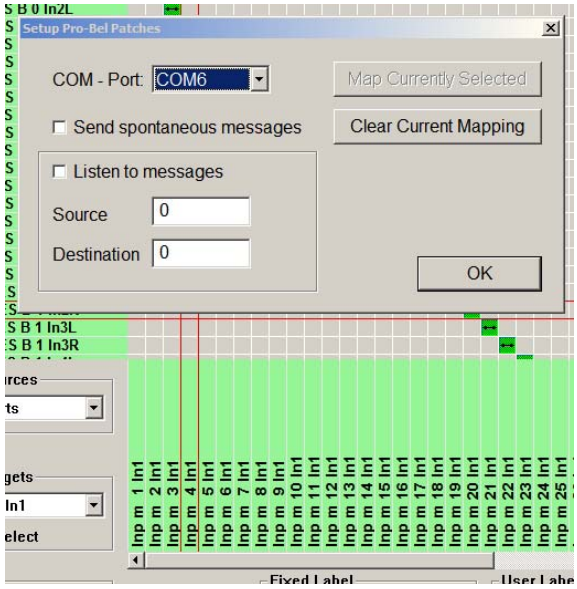
The b is used to indicate the Pro-Bel SW-P-02 utilization. Only the COM ports defined like this will be available in the Pro-Bel setup dialogue (the b stands for the b in Pro-**B**el).

Set up Window for Pro-Bel

With Pro-Bel setup button enabled the General Patch presents a new button on the bottom right. Hitting this button the system brings up the set up dialogue and enters Pro-Bel set up mode.

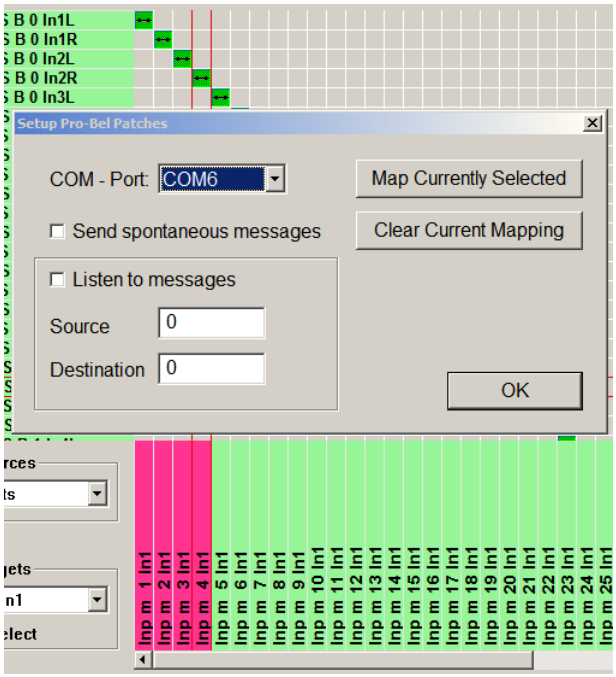


Pro-Bel Setup button



Active Pro-Bel set up dialogue

Targets with their respective connections can be selected by clicking on them in the list on the general patch. Selected targets change their color to pink to show their selection state.



Hitting the “Map Currently Selected” button maps the patches for the selected targets (the pink colored ones) to the Pro-Bel connect command specified on the left.
With the listen button enabled, incoming connect messages are mapped to the edit fields on the dialog. To select targets affected by this connect command simply click on them in the target list of the general patch (colour is set to pink).
Make sure to always associate the same Pro-Bel destination to the same set of targets.
Selecting a Source/Destination combination that was not used previously keeps the already selected targets active.

It is possible to map any connection on the patch to certain Pro-Bel connect commands. You are not limited to outputs or inputs!

It's possible to activate spontaneous messages. The appropriate CONNECTED message is sent whenever one of the defined patch combinations matches the combination when they were defined.

Implementation Notes Pro-Bel SW-P-02

File format to store Pro-Bel P-02 set up

The system creates human readable files (ini-file format) in the D950System directory to store the set up. The files are named according to the COM – port used.
Filename: PortX.probel
with X being the COM – port used.

```
[TARGET_1 SOURCE_6]
Im23 Inp m 23 In1 left=D12L AES B 1 In4L left
Im24 Inp m 24 In1 left=D12L AES B 1 In4L left
[TARGET_1 SOURCE_7]
Im23 Inp m 23 In1 left=D11R AES B 1 In3R left
Im24 Inp m 24 In1 left=D11R AES B 1 In3R left
[TARGET_1 SOURCE_4]
Im23 Inp m 23 In1 left=
Im24 Inp m 24 In1 left=
[TARGET_0 SOURCE_0]
Im23 Inp m 23 In1 left=D11R AES B 1 In3R left
Im24 Inp m 24 In1 left=D11R AES B 1 In3R left
Im25 Inp m 25 In1 left=
Im26 Inp m 26 In1 left=
[TARGET 10 SOURCE 10]
Ix 1 Inp x  1 In1 left=
Ix 1 Inp x  1 In1 right=
Ix 1 Inp x  1 In1 center=
Ix 1 Inp x  1 In1 lfe=
Ix 1 Inp x  1 In1 ls=
Ix 1 Inp x  1 In1 rs=
```

Example for a .probel file

This file basically has a section for each used Source/Target combination. The fixed labels are being used with one of left, right, center, lfe, ls or rs strings appended to specify which one of the patch of a multiformat patch is to be used.

- **left** for mono or left sources or targets
- **right**
- **center**
- **lfe**
- **ls**
- **rs**

Simpler Format for the .probel file

While being pretty powerful in terms of allowing complicated patching to be possible upon one simple Probel-Source/Destination combination, the .probel file format is too complicated and too memory demanding if a simple patch source to Probel-Source and patch target to Probel-Destination association is requested.

For such usage Version 3.5.07 of the D950System.exe software introduced a simpler format.

The Pro-Bel implementation now takes a simpler format to describe patch sources and destinations to be used by Pro-Bel P-02 controllers. The maximum of controllable patch point is limited to 1'000. It's now possible to specify a one to one relationship between patch sources and destination as seen on the patch and their respective Pro-Bel id's. It is however still possible to use the more sophisticated format to define a pattern of patch points to be set or reset upon reception of one Pro-Bel `CONNECT` message for the same port. This means that a .probel file may contain both type of specifications.

The new format is defined as follows: Start the section which describes Pro-Bel destination to Vista target association with the `[TARGETS]` tag. The `[SOURCES]` tag does the same for sources:

```
[TARGETS]
1=i  1 B 1 Ch 1 left
3=Ix 1 Inp x  1 In1 center
[SOURCES]
1=I  1 B 1 Ch 1 left
3=Ix 2 Inp x  2 InsSnd lfe
```

Example taken from a .probel file using the simple format

This example defines Pro-Bel destination 1 to be "`i  1`" output interface and Pro-Bel source 1 to be "`I 1`" output interface using the patch points fix label syntax.

The format is:
`destination|source=`*fix label of patch element* `+ [left, right, center, lfe, rs, ls]`

Hint: Please note that if a source or destination is listed twice by accident, once in the simple format and once in a xy combination the simple format takes priority and the xy listing isn't recognized. This situation is regarded as an error and should not occur in regular cases.

Supported Commands P-02

A subset of the Pro-Bel SW-P-02 protocol is implemented in the Studer Vista system. In order to accommodate the Studer "Hardware Patch Selector panel" some additional cases were introduced which are not included in the standard P-02 protocol. The goal was to offer a complete set of cross points on a Pro-Bel source/destination combination. This might even include clearing crosspoint connections with a source/destination combination. See "Probel Quick Start" for a description on how to set up cross points to be set on certain Pro-Bel commands.

The Vista uses the format as defined by Pro-Bel SW-P-02 protocol:

SOM	COMMAND	Message	Checksum

SOM is defined as FF.

The system supports only very few basic commands as used by the "Studer Hardware Patch Selector" and other simple hardware controllers.

- INTERROGATE (Command: 0x01, 2 Message bytes)
- CONNECT (Command: 0x02, 3 Message bytes)
- TALLY (Command: 0x03, 3 Message bytes)
- CONNECTED (Command: 0x04, 3 Message bytes)

The exact message format is described in the Pro-Bel SW-P-02 documentation.

Additions made for the Studer Hardware Patch Selector Panel

Studer's proprietary hardware patch selectors have a special mode that instead of using a row for each destination handles each button separately. This mode is called BITMODE and controlled by commands also sent over the serial line and using a similar protocol as Pro-Bel. As these panels require to be polled the Vista keeps sending out individual bytes from time to time. To prevent problems with certain controllers we had to add a flag in D950System.ini (available with V3.5.06 or newer) that prevents the system from doing so. To prevent the D950 from polling add following line to the [Options] section in the D950System.ini file:

```
PollStuderPanels=No
```

Additional "Spontaneous Response" mode

This was added to accommodate solutions that don't use INTERROGATE commands or want to be informed immediately about cross point changes.

Internal Table

The implementation keeps its own table for the cross points defined in the .probel file. This internal table is updated asynchronously by a different thread than the one used to handle incoming messages. This table represents best the internal state of the actual audio.

Command handling

Interrogate

The interrogate command is handled by checking all cross points defined for the destination in question from the internal table. If a crosspoint set matches the definition from the .probel file, the corresponding source is returned with the destination number in a TALLY message. If no cross point set is found the TALLY message returns 1023 (out of range used as not connected) as source number.
This is done immediately without any further wait states or context changes.

Connect

The connect message is handled differently depending on whether spontaneous messages are enabled or not.

If spontaneous messages are switched off, the system looks up the internal table and if it finds the source/destination set it triggers the setting of the audio for these cross points. In any case it creates a response with the right source number or 1023 depending on whether there is an entry for this source/destination pair.

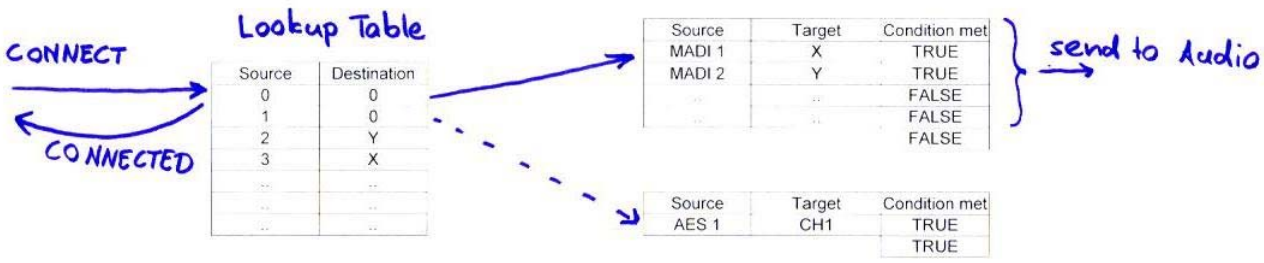


Illustration 1: Normal mode. The CONNECTED is always sent

If spontaneous messages are switched on, the system looks up the internal table and sends cross point changes to the audio if it finds the source/destination pair. It does not create a response automatically however. Instead the audio subsystem notifies our Pro-Bel subsystem about cross point changes. If cross points meet one of the sets defined in the table, the matching CONNECTED is sent out. A CONNECTED response is also generated if the respective patch points are already set. If a source/destination pair is mapped to several cross points the CONNECTED message is sent only if all conditions are met.

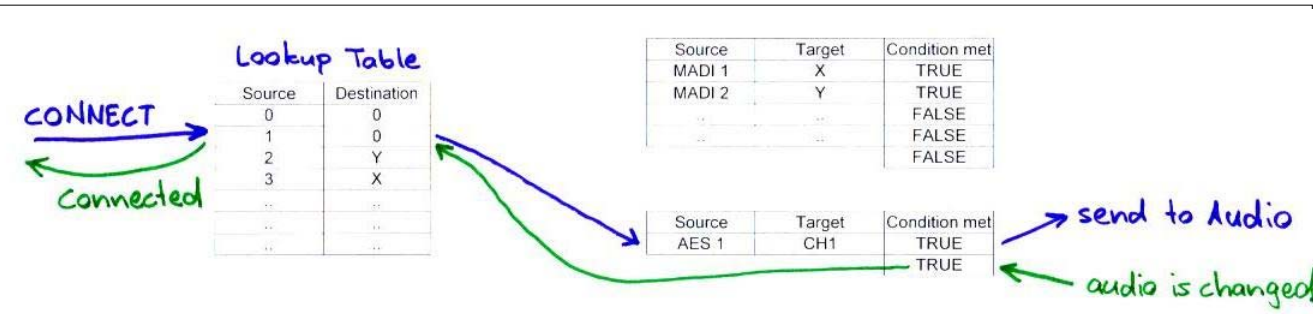


Illustration 2: Spontaneous mode, reacting on audio changes

CONNECTED messages might be sent without prior CONNECT command, if the cross points are changed through other triggers like the “General Patch Screen” of the D950System.

Known Issues

Some issues arise from the usage of the table used to map Pro-Bel source/destination combinations to Vista Patch points with spontaneous messages enabled.

Since several conditions may be met when a certain crosspoint is changed (from the audio) it is possible to get a CONNECTED message which is not expected as a reaction.

Let's look at an example for such a situation:

```
[TARGET 119 SOURCE 1]
i161 B 3 Ch33 left=I  3 B 0 Ch 3 left
i162 B 3 Ch34 left=I  3 B 0 Ch 3 left


[TARGET 112 SOURCE 1]
i161 B 3 Ch33 left=I  3 B 0 Ch 3 left

[TARGET 113 SOURCE 1]
i162 B 3 Ch34 left=I  3 B 0 Ch 3 left
```

Example taken from a .probel file

Targets i161 and i162 are both used twice, once together to form a set of cross points that are enabled from the Pro-Bel source/destination combination 1/119 and once individually with different source/destination definitions.

If the system receives the source/destination combination of 1/119 the audio is set accordingly. It occurs that the Pro-Bel subsystem is first notified about the crosspoint setting involving i161 thus fulfilling the condition for the source/destination combination 1/112 -> a CONNECTED message with 1/112 is sent out. When the second cross point is also confirmed by the audio the condition for 1/119 is met and the expected CONNECTED message is also sent out.

There are several such situations and it even depends on the order of the definitions in the .probel file whether a CONNECT is sent out. Every audio change triggers only one CONNECTED message, even if the condition of other definitions are met.

Implementation Notes Pro-Bel SW-P-08

Enabling Pro-Bel SW-P-08, settings in the D950System.ini

Enabling Pro-Bel SW-P-08 Router Protocol

To enable SW-P-08 router protocol select one of the two options in the D950System.ini file.

```
[options]

...

RouterProtocol=Pro-Bel
;RouterProtocol=GVGSeries7000
```

Enabling COM ports for the use with the Pro-Bel SW-P-08 protocol

Ports that are to be used for Pro-Bel SW-P-08 need to be specified in the D950System.ini in the [d950SerialPorts] section. This gives the possibility to use non standard data rates and parity settings.

```
[d950SerialPorts]
1= {p} COM1 baud=115200 parity=N data=8 stop=1
2= {r} COM7 baud=115200 parity=N data=8 stop=1
```

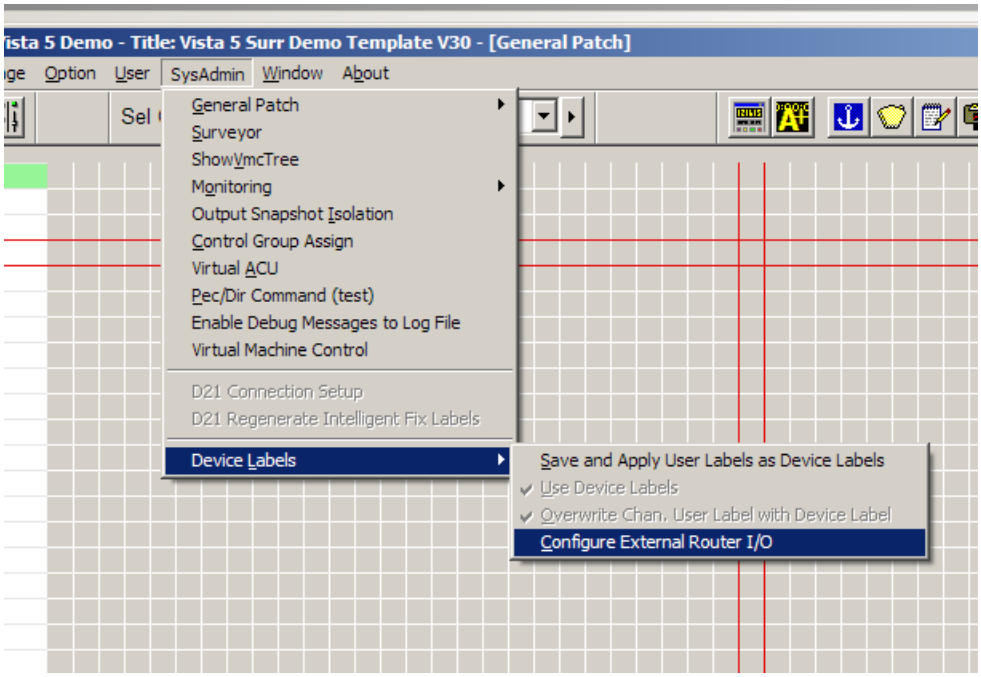
The r is used to indicate the Pro-Bel SW-P-08 utilization (r stands for Router control). Enabling COM ports for the use with the Pro-Bel SW-P-08 protocol without label support

Ports that are to be used for Pro-Bel SW-P-08 without label support need to be specified in the D950System.ini in the [d950SerialPorts] section. This gives the possibility to use non standard data rates and parity settings.

```
[d950SerialPorts]
1= {p} COM1 baud=115200 parity=N data=8 stop=1
2= {q} COM7 baud=115200 parity=N data=8 stop=1
```

Setting up inputs and outputs for Router control (SW-P-08)

To set up input and output interfaces to be used for router control with SW-P-08 D950/Vista the SysAdmin menu (available after entering Sysadmin mode) offers an entry in the “Device Label” menu popup. This brings up a dialog that helps to visually edit the “RouterConfiguration.ini” file.



File format to store Pro-Bel P-08 set up

File name: RouterConfiguration.ini
Directory: C:\D950System

This file is for both, exporting/importing labels as well as controlling patch points. It is usually generated automatically when using the Router Configuration Dialog in the Device Labels Menu. This menu can be accessed only in Sysadmin mode.
For larger application it is possible to create the entries needed for this file with a spreadsheet application.

```
Pro-Bel SW-P-08 Issue 21
2/1/0/0/0/0,1,1,0,
2/1/0/0/0/1,2,1,0,
2/1/0/1/0/0,2,2,0,
2/1/0/1/0/1,1,1,5,
2/4/0/0/0/0,9,0,0,
2/4/0/0/0/1,0,9,0,
2/4/0/1/0/0,0,0,9,
```

The format is as follows:

```
IO/InterfaceType/BoardNumber/PortNumber/ChannelNumber/PatchNumber,Index,Matrix,Level
```

InterfaceType :
- 1 = AES in, 3 = Madi in, 9 = IO21 in
- 4 = AES out, 8 = Madi out, 10 = IO21 out

BoardNumber:
- Certain interfaces use board numbers

PortNumber:
- Certain interfaces use port numbers

ChannelNumber:
- Interfaces do not use channel numbers and it's usually 0

PatchNumber:
- The zero-based index of the patch of the selected board and port

```
IO/InterfaceType/BoardNumber/PortNumber/ChannelNumber/PatchNumber,Index,Matrix,Level
```

Index, Matrix:
- Index and Matrix as defined in the Probel specification

Level:
- Level is evaluated only for sources.
- As this might be used differently with On-Air 3000 we suggest to use 0 for the Level.

Supported Commands P-08

Our P-08 implementation first offered commands used for label transfer. This label transfer is primarily used between Vista, D950 and Router systems based on the D950.
The same set of commands implemented for the P-02 protocol for patching was later added to the P-08 protocol as well. The list of supported commands is as follows (these commands are supported with the "r" and the "q" COM port setting as well)

- INTERROGATE (Command: 0x01, 2 Message bytes), Crosspoint Interrogate Message, received
- CONNECT (Command: 0x02, 3 Message bytes), Crosspoint Connect Message, received
- TALLY (Command: 0x03, 3 Message bytes), Crosspoint Tally Message, sent
- CONNECTED (Command: 0x04, 3 Message bytes), Crosspoint Connected Message,sent

Label transfer is supported through these commands (supported only with "r" option in the COM port settings):

- SINGLE_SOURCE_NAME_REQ_MSG (Command: 0x65), Single Source Name Request Message
- SINGLE_DEST_NAME_REQ_MSG (Command: 0x67), Single Destination Association Names Request Message
- SOURCE_NAMES_RESPONSE_MSG (Command: 0x6A), Source Names Response Message
- DEST_NAMES_RESPONSE_MSG (Command: 0x6B), Destination Association Names Response Message

Label transfer commands are sent and received depending on whether inputs or outputs (or both) are set up for label transfer in the "Label Transfer Dialogue".
The dialog also offers the possibility to activate spontaneous messages when patch points are connected.

Disconnect

To disconnect a crosspoint with SW-P-08 we chose to use the same "special" source id 1023 as for SW-P-02.

Remark on SW-P-08

The D950/Vista uses SINGLE_SOURCE_NAME_REQ_MSG and SINGLE_DEST_NAME_REQ_MSG in a polling loop to keep its labels updated.
This can be separated from the usage as router (INTERROGATE, CONNECT, etc.) through appropriate usage of the "q" option instead of the "r" option in the COM ports settings of the D950System.ini.
Defining patch points in the Router Configuration dialog enables them for both, label transfer and router control and thus results in the D950/Vista using the label polling if the "r" option is used, otherwise label polling is suppressed resulting in better performance if only router control is needed.