**Bose** Professional Systems Division

Design | Performance | Support

# System examples using CobraNet® networking with Bose® ControlSpace® and PowerMatch™ products.

*CobraNet network audio expansion cards are available for both the ESP-88/00 engineered sound processors and the PowerMatch™ PM8500/N configurable professional power amplifiers. The cards use industry-proven CobraNet technology to transport multiple channels of high quality, uncompressed digital audio in real time across a standard Ethernet network. This is particularly useful when passing audio between ControlSpace and PowerMatch products in different parts of a large building or complex. It also works well to interlink multiple devices within an equipment rack to reduce analog cabling and connections.*

This document is intended to be read alongside the '**Using CobraNet networking with Bose ControlSpace and PowerMatch products**' Tech Note and includes a number of system examples that illustrate how to configure the products for different applications:

**System Examples:**

1. **Bi-directional link from one ESP to another**
2. **Primary ESP sending to multiple secondary ESPs**
3. **ESP sends one Bundle to multiple PowerMatch amplifiers**
4. **ESP sends multiple Bundles to PowerMatch amplifiers**
5. **Using the PowerMatch amplifier audio monitor bus**
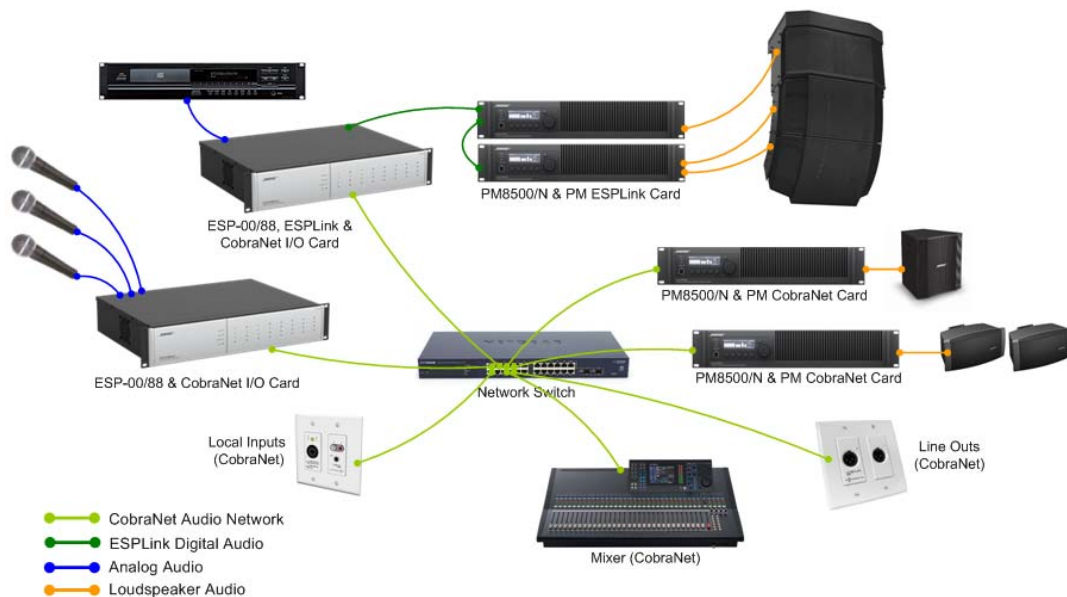


**An example system using CobraNet network audio distribution**

3rd May 2012

## 1. Bi-directional link from one ESP to another

**This first example includes two ESP-88s with eight channels of audio passing in each direction between them.**

Before following these steps to configure this example system it is assumed that a CobraNet I/O card has been correctly installed into each ESP and that the independent networks have been created for CobraNet and the ControlSpace control network.
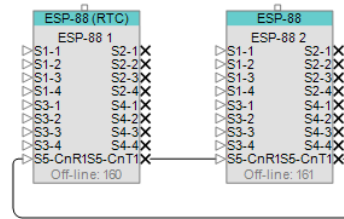
**Example 1**
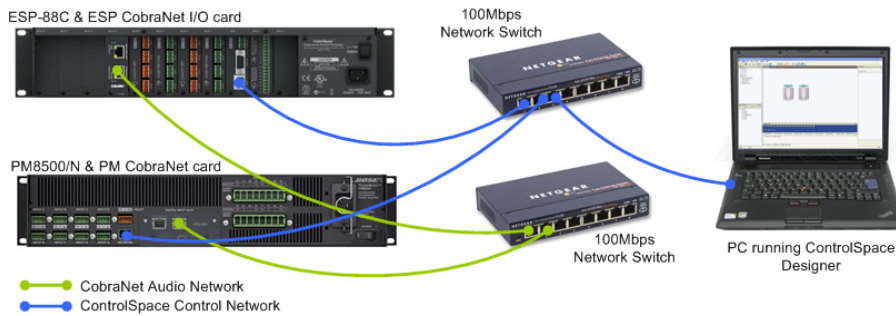
1. Using ControlSpace Designer v2.321 or later create a new design file and perform a hardware 'Scan' either by choosing the option from the 'Tools' menu or by using the toolbar button.

2. Assuming that all the network connections and settings are correct the two ESP-88s should be detected, populated with their standard 4x4 cards plus the additional CobraNet I/O expansion card. By default the card will be shown as the '16 in, 16 out' variant unless there is an existing design file in the ESP with the card configured differently.

3. Since this system design only requires the CobraNet I/O cards to have 8 inputs and 8 outputs the card can be configured as the '8 in, 8 out' variant, leaving four routing slots (three physical slots) available for other expansion cards. This can be changed in the ESP Properties window which is accessed by right-clicking on each ESP in Project View and selecting 'Properties'.

System examples using CobraNet networking with
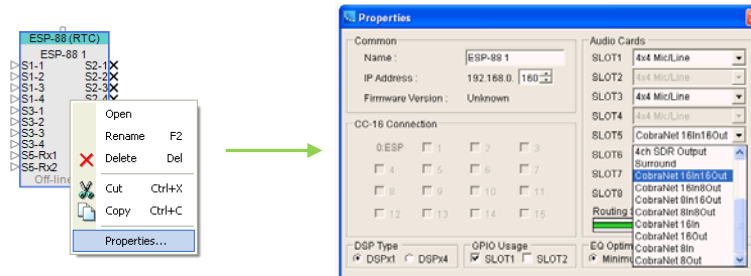
4. Once the card variant has been changed it is recommended that the required connections between CobraNet transmitters and receivers are drawn in Project View. Whilst this has no influence over the actual operation it is a good visual reference of the CobraNet links that will be required.
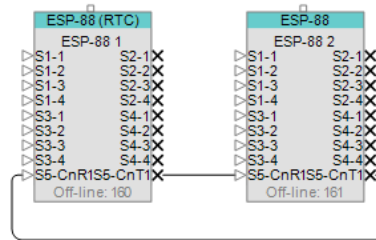


5. The next step is to check that both the cards are set to 'Standard [5.33mS]' latency and that the option for 'ControlSpace Designer to configure CobraNet settings' is checked. These options can be found in the card Properties which are accessed by right-clicking on any CobraNet input or output module in ESP view and selecting 'Properties'. These are the default settings and should not require any changes.
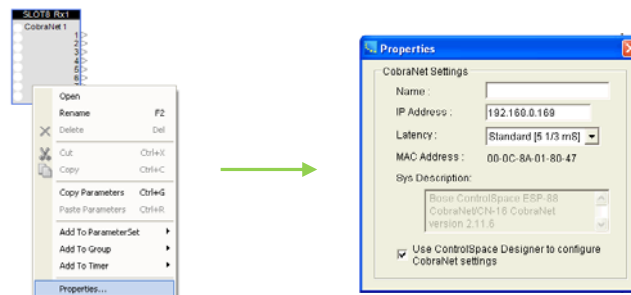


6. To create the first CobraNet connection that will pass audio from ESP-88 #1 to ESP-88 #2 open the control panel for the CobraNet output module on ESP-88 #1 with a double left-click.
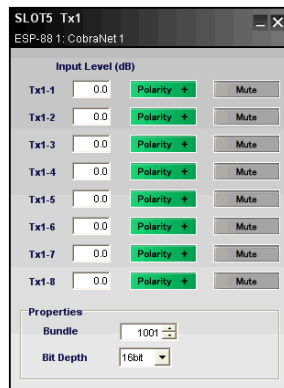


You can then assign a suitable Bundle number that will reference this group of eight channels. Since the connection is from a single transmitter (ESP-88 #1) to a single receiver (ESP-88 #2) a Unicast Bundle should be used from the range 256-65,279 to minimise network traffic. You can use any number in this range but typically it is easier to remember if it ends in '01' for the first link and '02' for the second link (e.g. 301, 302 or 1001, 1002).

If desired the Bit depth can also be changed but the default of 20bit should be fine for most applications.
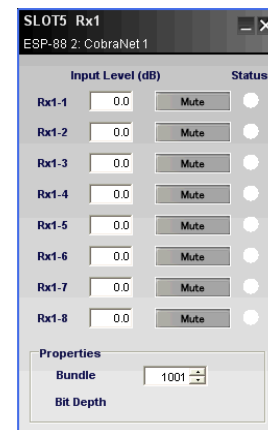
7. Having set the Bundle number for the CobraNet output module on ESP-88 #1, you then need to use the same Bundle number for the CobraNet input module on ESP-88 #2 so the link is formed.



System examples using CobraNet networking with

8. The previous two steps then need to be repeated to form the return link between the CobraNet output module on ESP-88 #2 and the input module on ESP-88 #1. This should also use a Unicast Bundle from the range 256-65,279 but should be a different number from the one used for the first link.



9. At this point the CobraNet configuration is complete and once this design has been sent to the ESPs it should be possible to pass audio in both directions between them. To test this one could create a simple design using a source and a powered loudspeaker (or similar), passing the source to the second ESP and back again to prove that both connections are working.
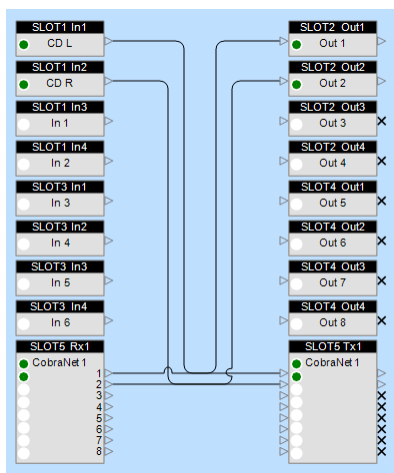


**ESP-88 #1**                    **ESP-88 #2**
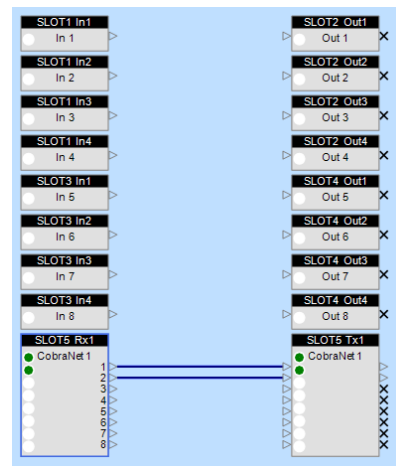
10. In addition to monitoring the audio signal level or listening to the audio output, the correct operation of the CobraNet links can also be verified using the Status indicators on the input module. These are not audio signal indicators; instead they indicate the presence of valid CobraNet data for each channel. When ControlSpace Designer is on-line the indicators will be green if there is a valid CobraNet connection.



| Black | Channel not being received |
|-------|----------------------------|
| Green | Channel being received correctly |
| Red | Channel being received with errors (typically incorrect latency or network issues) |

System examples using CobraNet networking with
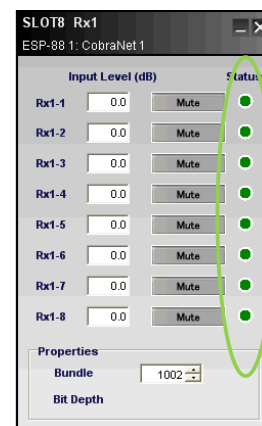
## 2. Primary ESP sending to multiple secondary ESPs

**In this second example the same eight channels are to be passed from ESP-88 #1 to each of the other ESPs.**

Since the same Bundle is to be sent to multiple receivers a Multicast Bundle in the range 1-255 should be used. The same Multicast Bundle could be received by any number of devices on the CobraNet network.

To configure this system the same basic steps are required as for the first example but with different Bundle assignments.

1. Install the CobraNet I/O cards and hook up independent networks for the CobraNet audio data and the ControlSpace control data.
2. Open ControlSpace Designer, create a new design and perform a 'Scan' of the hardware or add the ESPs to Project View manually.
3. Select the card variant that most closely matches the project requirements in the ESP Properties. In this example ESP-88 #1 is configured as '8 out' and all the others are configured as an '8 in'.
4. Ensure that the ESP CobraNet I/O card is set to 'Standard [5.33mS]' latency and that ControlSpace Designer has control over the CobraNet settings in the Card Properties (default settings).
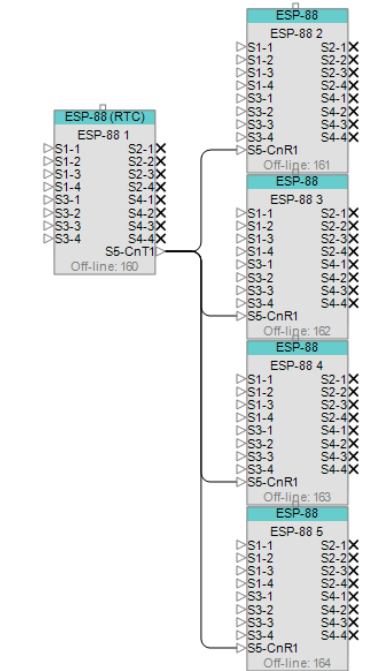


**Example 2**



5. Open the CobraNet output module on ESP-88 #1 and assign a Bundle number in the Multicast range of 1-255. Then open the CobraNet input module on each of the other ESPs and set them to receive the same Bundle number.
6. Upload the project and confirm that the audio sent from ESP-88 #1 is being received correctly by each of the other ESPs.

An alternative to using a Multicast bundle in this example would be to have ESPs 2-4 configured as the '8 in, 8 out' variant and daisy-chain the transmit of one ESP to the receiver of the next and so on. Although this would avoid using a Multicast bundle it would make the system more vulnerable should any one of the links fail and latency would increase for every link.

System examples using CobraNet networking with

## 3. ESP sends one Bundle to multiple PowerMatch amplifiers

**Similar to the previous example but with PowerMatch™ amplifiers in lieu of the receiving ESPs, this simple out-of-the-box solution allows a single Bundle of 8 channels to be sent from an ESP to one or more amplifiers.**

Since the same 8-channel Bundle is to be sent to multiple receivers a Multicast Bundle in the range 1-255 is required. The PowerMatch CobraNet cards come factory set to '100' for this purpose.

To configure this system the same basic steps are followed but the Bundle assignments will be set correctly by default.

1. Install the CobraNet cards and hook up independent networks for the CobraNet audio data and the ControlSpace control data.
2. Open ControlSpace Designer, start a new file and perform a 'Scan' of the hardware or add the ESP and PM amplifiers with CobraNet cards installed to Project View manually.
3. Select the ESP CobraNet I/O card variant that most closely matches the project requirements in the ESP Properties. In this example it is configured as '8 out' and will be allocated Bundle number '100' automatically (because it is the first CobraNet transmitter in the project) and requires no further configuration.
4. Since the PowerMatch CobraNet cards also come factory set to receive Bundle '100' no changes to the card configurations are required.
5. Ensure that the ESP CobraNet card is set to 'Standard [5.33mS]' latency and that ControlSpace Designer has control over the CobraNet settings in the Card Properties (default settings).
6. Route audio to the CobraNet output module in the ESP processing view.
7. Open the Input Control Panel for each PM amplifier and select 'Digital' source for each of the inputs.
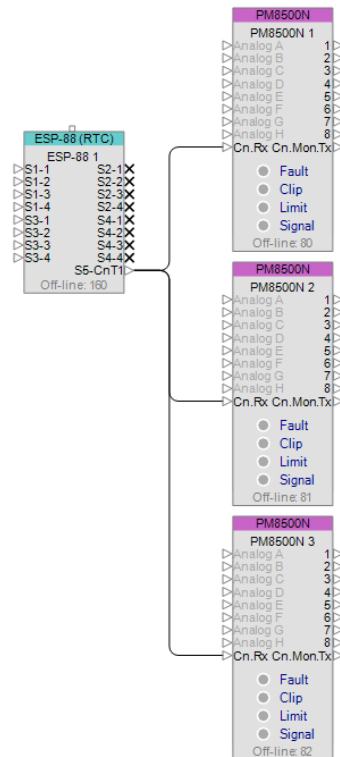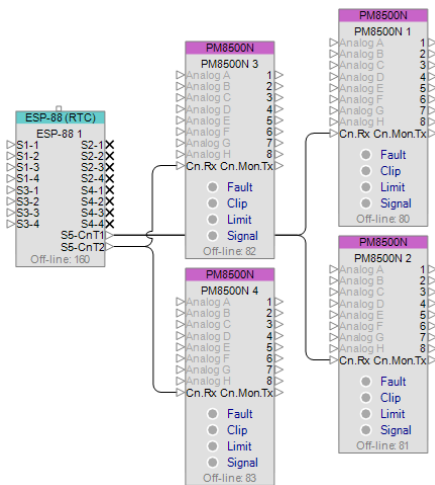
**Example 3**
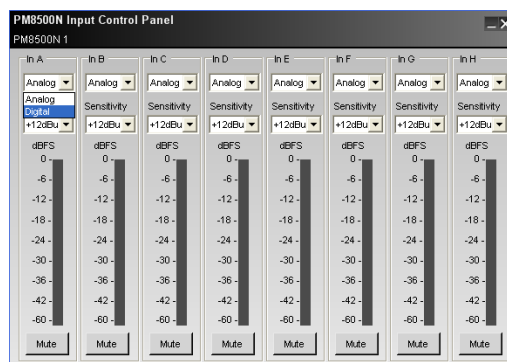
8. Send the configuration to the hardware and confirm that the audio sent from ESP-88 #1 is being received correctly by each of the PM amplifiers.

## 4. ESP sends multiple Bundles to PowerMatch amplfiers



**Example 4**

This slightly more complex configuration with PowerMatch™ amplifiers has one Bundle of 8 channels routed to amplifiers 1 & 2, and a second Bundle of different channels routed to amplifiers 3 & 4.

*Since this example involves sending multiple Bundles to PowerMatch amplifiers some configuration of the PM CobraNet cards using the CobraNet Discovery utility will be required.*

To configure this system follow these steps:

1. Install the CobraNet cards and hook up independent networks for the CobraNet audio data and the ControlSpace control data.
2. Open ControlSpace Designer, start a new file and perform a 'Scan' of the hardware or add the ESP and PM amplifiers with CobraNet cards installed to Project View manually.
3. Select the ESP CobraNet I/O card variant that most closely matches the project requirements in the ESP Properties. In this example it is configured as '16 out' so that two eight channel Bundles can be sent.
4. The first transmitter will be assigned Bundle number '100' automatically (because it is the first CobraNet transmitter in the project), but the second transmitter will need to be set manually to '101' in the CobraNet Tx2 output module control panel.
5. Ensure that the ESP CobraNet card is set to 'Standard [5.33mS]' latency and that ControlSpace Designer has control over the CobraNet settings in the Card Properties (default settings).
6. Open the Input Control Panel for each PM amplifier and select 'Digital' source for each of the inputs.
7. Whilst connected to the ControlSpace control network, send the design to the hardware and then disconnect.
8. Since the PowerMatch CobraNet cards come pre-configured all the amplifiers should be receiving audio, but it will the audio intended for amplifiers 1 & 2. To change the Bundle assignment for amplifiers 3 and 4 will require the use of the CobraNet Discovery utility.

*The CobraNet Discovery utility can be downloaded from* www.cobranet.info.

9. Swap the PC network connection to the CobraNet network, launch the CobraNet Discovery utility and ensure that all five CobraNet devices are discovered.

10. Identify the PowerMatch CobraNet cards by temporarily disconnecting each in turn, making a note of the MAC address associated with each amplifier.
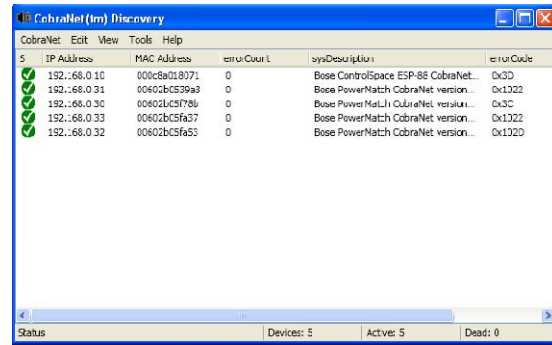
11. Assign a valid IP address to each of the PM CobraNet cards by right-clicking on each device and selecting 'New IP Address..' or enable auto IP assignment in the Tools, Options menu. Remember that IP addresses are only temporary.

12. With the cards identified double-click on the card for amplifier #3 to open the 'CobraNet Configuration' dialog.
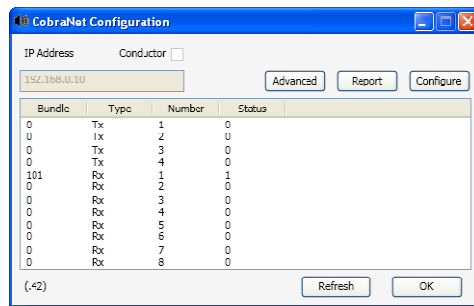
Then either select the row for Receiver 1 (Rx1) and click 'Configure' or simply double-click the row to open the 'Receiver 1 Configuration' dialog.

13. Since the card is already receiving valid audio data (audio for amplifiers 1 & 2) the status indicators should be green.

14. Change the Bundle assignment from '100' to '101' and then click 'Apply'.

15. To verify that the card is now receiving valid audio data from the second transmitter on the ESP click 'Refresh' and ensure that the status indicators are still green.

16. Repeat steps 12-15 for amplifier #4 and the system then be configured and working as expected.
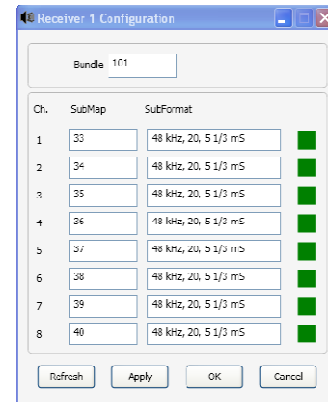
*Note: In order to configure ESP CobraNet cards to via the Discovery utility as well the 'Use ControlSpace Designer to configure CobraNet setings' property in ControlSpace Designer should be un-checked for each ESP in the project to prevent settings from being overwritten.*

System examples using CobraNet networking with

## 5. Using the PowerMatch amplifier audio monitor bus

**This last example is similar to Example 3, but also utilizes the audio monitor bus feature of PowerMatch amplifiers to allow for remote monitoring.**

*Since this example utilizes the audio monitor bus, some configuration of the PM CobraNet cards using the CobraNet Discovery utility will be required.*

To configure this system firstly follow the steps described for Example 3 to configure the routing of audio from the ESP-88 to the PowerMatch amplifiers. Once this is complete the audio monitor bus can be configured by following the steps described below:

1. Swap the PC network connection to the CobraNet network, launch the CobraNet Discovery utility and ensure that all four CobraNet devices are discovered.

**Example 5**
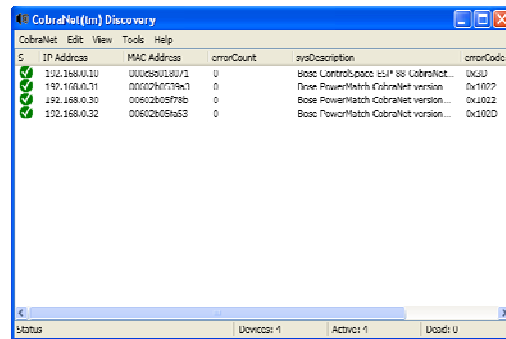
2. Identify the PowerMatch CobraNet cards by temporarily disconnecting each in turn, making a note of the MAC address associated with each amplifier.

3. Assign a valid IP address to each of the cards by right-clicking on each device and selecting 'New IP Address..' or enable auto IP assignment in the Tools, Options menu. Remember that IP addresses are only temporary.

4. With the cards identified double-click on the card for amplifier #1 to open the 'CobraNet Configuration' dialog. Note that receiver Rx will be factory set to Bundle '100' and for this example this will not need to be changed.

   Then either select the row for Transmitter 1 (Tx1) and click 'Configure' or simply double-click the row to open the 'Transmitter 1 Configuration' dialog.

System examples using CobraNet networking with
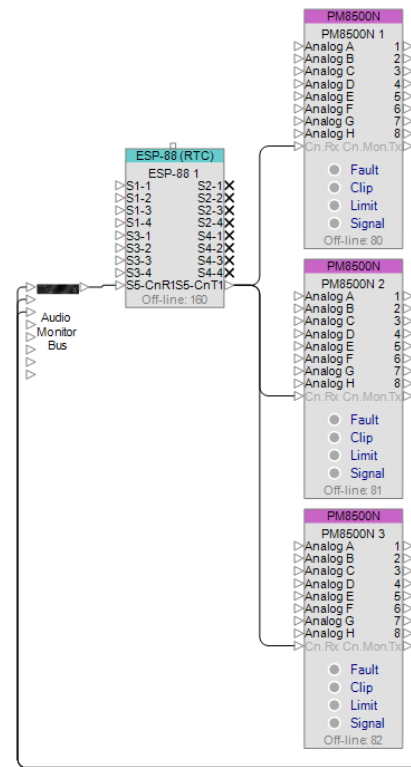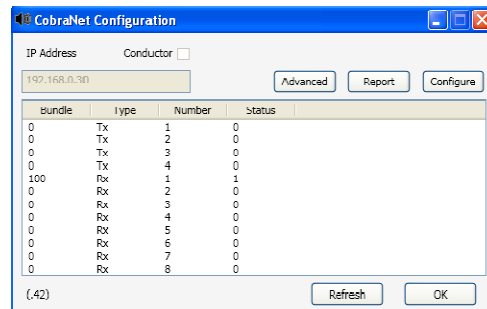
5. Change the Bundle assignment from '0' to '1001' and then click 'Apply'. The default values for all the other parameters are correct and should not be changed.

   *Typically the audio monitor bus should use Bundles in the Unicast range because there is normally only one receiver and Unicast Bundles are only transmitted when requested so monitoring traffic will not increase with additional amplifiers.*

6. Close this dialog and repeat steps 4-6 for the other two PowerMatch amplifiers using Bundle numbers '1002' and '1003' respectively. Do not change any of the CobraNet properties for the ESP-88, they will be set via ControlSpace Designer.

7. Exit the CobraNet Discovery utility, swap the PC network connection back to the ControlSpace network and return to ControlSpace Designer.
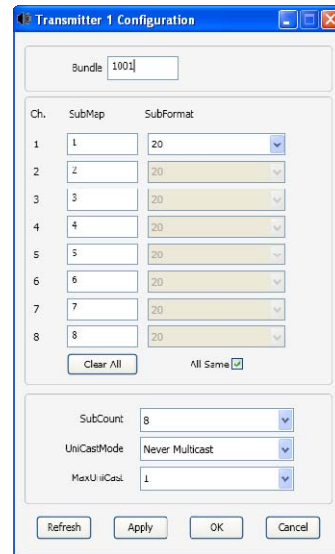
8. Add a source selector to switch between the channels of the audio monitor bus and route the signal to the monitor output.
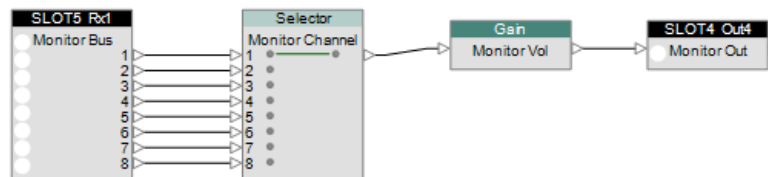
9. Open the control panel for the CobraNet receiver module, set the receive Bundle to '1001' and drag the receiver module into a Parameter Set labelled 'Amp 1'.

10. Increment the Bundle number to '1002' and drag into a second Parameter Set labelled 'Amp 2' and then increment again and add to a third Parameter Set labelled 'Amp 3'.
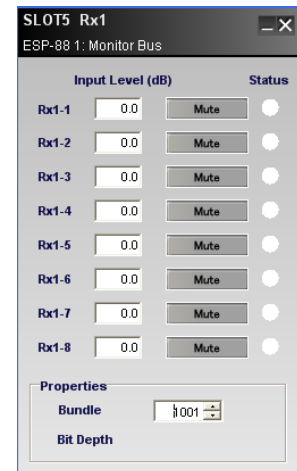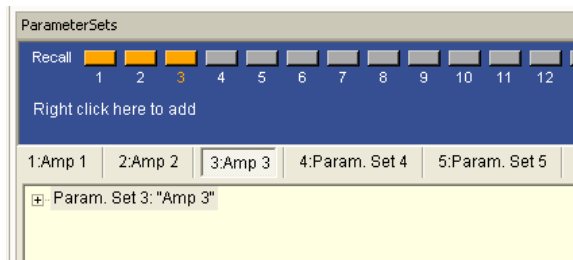
11. Add a CC-64 to the project and drag the three Parameter Sets to Bank 1 Control 1 (to facilitate the selection of the amplifier) and then drag the Source Selector to Bank 1 Control 2 (to allow selection of the channel).

12. Send the design to the hardware and then using these two controls it will be possible to monitor any channel of any of the amplifiers remotely across the CobraNet network.
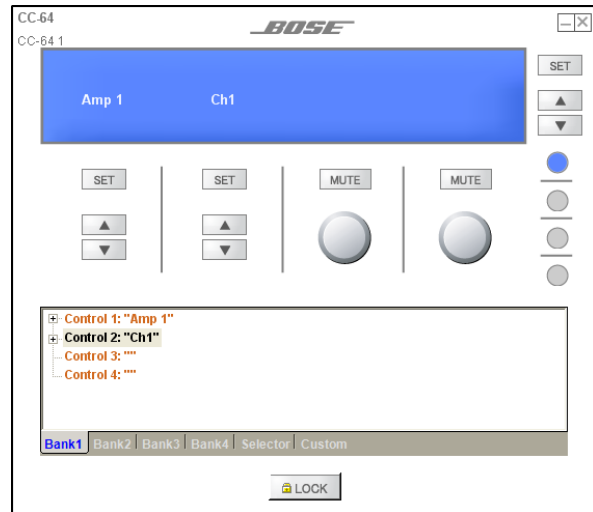


*Note: The CobraNet Discovery utility exposes a great number of settings that are factory set for correct operation and should not be changed. Changing settings other than those described in this document may cause issues with the system that are hard to diagnose and resolve without in-depth CobraNet knowledge.*

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