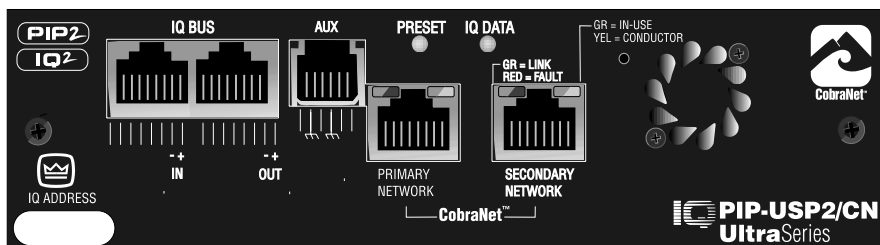


IQ-PIP-USP2/CN

UltraSeries

REFERENCE MANUAL



An IQ System® Programmable Input Processor with CobraNet™ and DSP for Crown® PIP2-Compatible Amplifiers

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To obtain information in another language about the use of this product, please contact your local Crown Distributor. If you need assistance locating your local distributor, please contact Crown at 219-294-8200.

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4/01

The information furnished in this manual does not include all of the details of design, production, or variations of the equipment. Nor does it cover every possible situation which may arise during installation, operation or maintenance. If you need special assistance beyond the scope of this manual, please contact our Technical Support Group.

Crown Audio Technical Support Group

Plant 2 SW, 1718 W. Mishawaka Rd., Elkhart, Indiana 46517 U.S.A.
Phone: **800-342-6939** (North America, Puerto Rico and Virgin Islands)
or 219-294-8200
Fax: 219-294-8301 Internet: <http://www.crownaudio.com>



WARNING

**TO REDUCE THE RISK OF ELECTRIC
SHOCK, DO NOT EXPOSE THIS
EQUIPMENT TO RAIN OR MOISTURE!**

FCC COMPLIANCE NOTICE

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

The user is cautioned that any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note: Fast-Ethernet equipment typically complies only with Class-A specifications and, therefore, the supplied EMI suppression cores may be required on the Primary and Secondary network connections for system compliance.

	DECLARATION of CONFORMITY	
Crown Audio, Inc. 1718 W. Mishawaka Road Elkhart, Indiana 46517 U.S.A.		
European Representative's Name and Address: Peter Christensen, Nilesco Europe Willem Pyerstraat 21 1077 XK Amsterdam, Netherlands		
Equipment Type:	Control System Components	
Family Name:	IQ	
Model Name:	IQ-PIP-USP2/CN	
EMC Standards:	EN 55103-1:1995 Electromagnetic Compatibility – Product Family Standard for Audio, Video, Audio-Visual and Entertainment Lighting Control Apparatus for Professional Use, Part 1: Emissions EN 55103-1:1995 Magnetic Field Emissions-Annex A @ 10 cm and 1 M EN 61000-3-3:1995 Limitation of Voltage Fluctuations and Flicker in Low-Voltage Supply Systems Rated Current ≤16A EN 55022:1992 + A1:1995 & A2:1997 Limits and Methods of Measurement of Radio Disturbance Characteristics of ITE: Radiated, Class B Limits; Conducted, Class A EN 55103-2:1996 Electromagnetic Compatibility – Product Family Standard for Audio, Video, Audio-Visual and Entertainment Lighting Control Apparatus for Professional Use, Part 2: Immunity EN 61000-4-2:1995 Electrostatic Discharge Immunity (Environment E2- Criteria B, 4k V Contact, 8k V Air Discharge) EN 61000-4-3:1996 Radiated, Radio-Frequency, Electromagnetic Immunity (Environment E2, criteria A) EN 61000-4-4:1995 Electrical Fast Transient/Burst Immunity (Criteria B) EN 61000-4-5:1995 Surge Immunity (Criteria B) EN 61000-4-6:1996 Immunity to Conducted Disturbances Induced by Radio-Frequency Fields (Criteria A) EN 61000-4-11:1994 Voltage Dips, Short Interruptions and Voltage Variation	
Safety Standard:	EN 60065: 1998 Safety Requirements – Audio Video and Similar Electronic Apparatus	
I certify that the product identified above conforms to the requirements of the EMC Council Directive 89/336/EEC as amended by 92/31/EEC, and the Low Voltage Directive 73/23/EES as amended by 93/68/EEC.		
Signed	 Larry Coburn	Date of Issue: March 15, 2001
Title	Senior Vice President of Manufacturing	

Quick Install Procedure

This procedure is provided for those who are already familiar with IQ System and CobraNet™ technologies, and who would like to install the IQ-PIP-USP2/CN in the shortest time possible. Less experienced installers or those wishing a full explanation of the installation procedure are encouraged to refer to Section 3 where the full installation procedure is described.

Prepare the IQ-PIP-USP2/CN:

1. Set the IQ address switch S1 (see Figures 2.1 and 3.1) on the IQ-PIP-USP2/CN to an unused IQ address. (Tip: Record the IQ address on the small field labeled "IQ ADDRESS" that is provided on the PIP panel.)

Prepare the amplifier:

3. Turn down the level controls of the amplifier and turn off the amplifier.
4. **Unplug the power cord of the amplifier from the AC mains.**
5. Remove the existing PIP or cover panel from the amplifier back panel (two screws).

Install the IQ-PIP-USP2/CN into the amplifier:

6. Carefully ground yourself to the chassis of the amplifier before installing the IQ-PIP-USP2/CN. It is a good idea to maintain ground contact between yourself and the amplifier while inserting the module into the amplifier in the next step.
7. Turn the PIP upside down so you can clearly see the two ribbon cable connectors located on the underside of the board near the back corner (see Figure 2.1). Attach the ribbon cables from your amp to the ribbon-cable connectors. The 20-pin cable should be connected first, then the 18-pin cable should be connected. Both ribbon cables should run untwisted from the amplifier to the PIP module.

Important: Be careful when attaching the ribbon cable to the connector that the cable is properly seated before applying pressure to the connector. Forcing the cable onto the connector could cause the keying tabs, which ensure proper pin alignment, to break. Connecting the ribbon cables with improper pin alignments may result in damage to the PIP.

When both cables are firmly attached, turn the IQ-PIP-USP2/CN back to an upright position and insert into the PIP opening in the back of the amplifier. Take care while inserting the PIP to make sure you do not crimp, pinch or stretch the ribbon cables.

8. Tighten the two PIP mounting screws until it is secured to the amplifier back panel, making sure the supplied star-washers penetrate the powder-coat finish of the PIP panel for good ground connection.

Install the wiring:

9. Connect the IQ-PIP-USP2/CN to the IQ System via the IQ Bus (see Section 3.4 if more information is needed).
10. Connect the IQ-PIP-USP2/CN to the CobraNet network hub or switch. Install the supplied ferrite cores on the network cable, making two turns. (see Section 3.4 if more information is needed).
11. Reconnect the amplifier to the AC mains.

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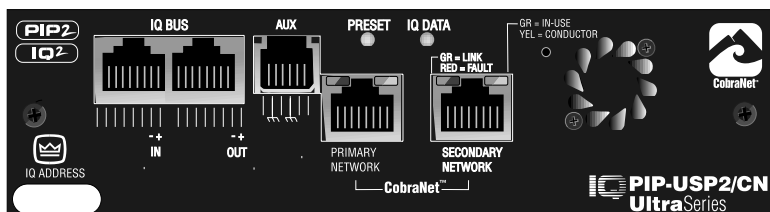


Figure 1.1 IQ-PIP-USB2/CN Front Panel

1 Welcome

The IQ-PIP-USB2/CN is a PIP™ (Programmable Input Processor) input module for Crown® PIP2™-compatible amplifiers.* It connects the amplifier to the IQ Bus of an IQ System®, allowing the amplifier to be controlled and monitored via IQ, and features CobraNet™ connectivity for digital audio networking.

The IQ-PIP-USB2/CN is an IQ2™-series component. This means it supports IQ UCODE protocol and requires an IQ System with an IQ2-compatible IQ interface. UCODE (universal code) enables users and third parties to develop custom software objects to control and monitor IQ2-compatible components like the IQ-PIP-USB2/CN.

The IQ-PIP-USB2/CN utilizes the latest advancements in DSP technology to provide state-of-the-art features and performance. Similar to the the IQ-PIP-USB2, it offers a variety of programmable functions in-

cluding crossovers, equalizers, signal delay, input compressors, multi-mode (peak, average, clip) output limiters and load supervision. The familiar IQ-AUX port has been enhanced and the "Listen-Bus" feature is now available via CobraNet.

A full 24-bit signal path is maintained by using state-of-the-art 24-bit Digital-to-Analog Converters, along with the audio-industry standard Motorola 56000 series 24/48-bit DSP.

The IQ-PIP-USB2/CN is powered by the amplifier, and all unit parameters are stored in non-volatile Flash memory for reliable system backup. Ten presets are available for quick and easy unit configuration changes. Each IQ-PIP-USB2/CN includes an IQ address switch allowing the unit to have a unique address on the IQ Bus.

This manual will help you successfully install your unit. We strongly recommend you read all the instructions, warnings and cautions contained within. Also, for your protection, please send in the warranty registration card today and save the bill of sale since it is your official proof of purchase.

* You must have a PIP2-compatible amplifier to use the IQ-PIP-USB2/CN. To determine if your amplifier is PIP2-compatible, look for the **PIP2** logo on the back of the amplifier. The IQ-PIP-USB2/CN is NOT compatible with older Crown PIP amplifiers.

1.1 Unpacking

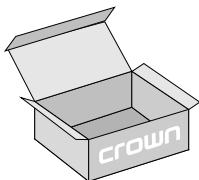
The unit is shipped in a protective antistatic bag.

CAUTION: STATIC ELECTRICITY MAY DAMAGE THE UNIT. Use caution when handling the unit. Carefully ground yourself BEFORE touching the unit. Avoid unnecessarily touching the components or solder pads on the circuit boards.

Please unpack and inspect the unit for any damage that may have oc-

curred during transit. If damage is found, notify the transportation company immediately. Only you, the consignee, may initiate a claim with the carrier for shipping damage. Crown will be happy to cooperate fully as needed. Save the shipping carton as evidence of damage for the shipper's inspection.

Even if the unit arrived in perfect condition, as most do, save all packing materials. **NEVER SHIP THE UNIT WITHOUT THE FACTORY PACK.**



2 Controls, Connectors & Indicators

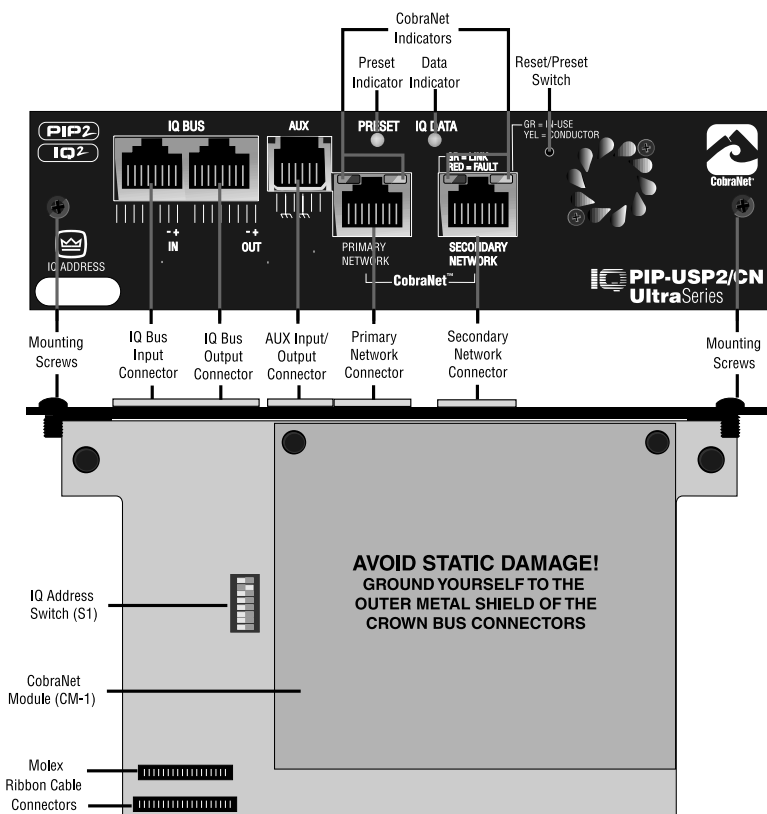


Figure 2.1 IQ-PIP-USP2/CN Controls, Connectors and Indicators

3 Installation

Before beginning, please carefully note:

CAUTION: STATIC ELECTRICITY MAY DAMAGE THE IQ-PIP-USP2/CN MODULE. Use caution when handling the unit. Carefully ground yourself **BEFORE** touching the IQ-PIP-USP2/CN module. Avoid unnecessarily touching the components or solder pads on the circuit boards.

3.1 Prepare the PIP

1. **Set the IQ address switch S1.** By giving each IQ component a unique address, it can be individually controlled and monitored. Whenever the IQ System wants to send a command to just one IQ component, it first sends its address and then the command down the IQ Bus.

S1 has eight segments because it actually contains eight tiny switches inside. The word "ON" is printed on the switch along its upper left side to indicate the ON position and the switches are numbered along the bottom (Figure 3.1).

Each of the eight switches in S1 has a value which doubles as the

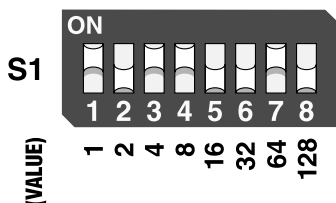


Figure 3.1 Address Switch (S1)

switch number increases. For example switch 1 has a value of 1; switch 2 has a value of 2; switch 3 has a value of 4; switch 4 has a value of 8 and so on.

The address is determined by adding the values of all "ON" switches. In Figure 3.1, switches 1, 3, 4 and 7 are on. Simply add the values to find the address: $1+4+8+64=77$.

A convenient series of IQ address tables are included in Section 10.9. The tables show the switch settings for all 250 addresses.

No two IQ components of the same type which are connected to the same IQ Bus can have the same address.* Suppose, for example, an IQ System has two IQ Bus loops, 1 and 2, and this IQ-PIP-USP2/CN is to be installed into loop 1 and given an address of 77. No other IQ PIPs can be given the same address in loop 1. However, an IQ PIP in loop 2 can have the same address.

Different IQ components in the same IQ Bus loop can have the same address. For example, both an IQ-USM 810 mixer/processor and an IQ-PIP-USP2/CN can use address 77 in the same loop.

A valid IQ address is any number from 1 to 250. Do not use a number higher than 250 since they are

* Note: All IQ PIP modules (IQ-P.I.P.-DSP, IQ-P.I.P.-SMT, IQ-PIP-USP2, etc.) are considered the same type, and so may not share the same address on the same IQ Bus.

reserved for special use. An address of "0" (zero) places the unit in "stand alone" mode. This special mode disables the IQ bus port, preventing communication with the IQ System.

3.2 Prepare the Amplifier

3. **Turn down the level controls** (full counterclockwise) and **turn off the amplifier.**
4. **Disconnect the amplifier's power cord.**
5. **Remove the existing PIP from the amplifier back panel** (two screws). This may involve disconnecting the PIP from a PIP2 input adapter. If a PIP2 input adapter is already present, remove the ribbon cables from the adapter.

3.3 Install the PIP into the Amplifier

6. **Carefully ground yourself to the chassis of the amplifier** before installing the IQ-PIP-USP2/CN. It is a good idea to maintain ground contact between yourself and the amplifier while inserting the module into the amplifier.
7. **Install the IQ-PIP-USP2/CN into the amplifier:** Turn the IQ-PIP-USP2/CN over so that you can clearly see the two ribbon-cable connectors located on the underside of the circuit board (see Figure 3.2). Connect the two input ribbon cables of the amplifier. The 20-pin cable (A) should be connected first, then the 18-pin cable (B) should be connected.

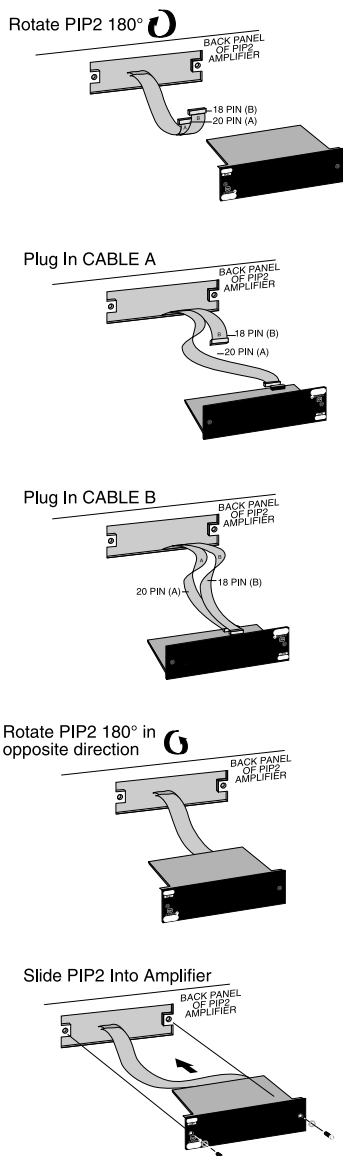


Figure 3.2 Installing the IQ-PIP-USP2/CN

Both ribbon cables should run smoothly from the amplifier to the PIP card (see Figure 3.2).

Important: Be careful when attaching the ribbon cable to the connector that the cable is properly seated before applying pressure to the connector.

Forcing the cable onto the connector could cause the keying tabs, which ensure proper pin alignment, to break. Connecting the ribbon cables with improper pin alignments may result in damage to the PIP.

When both cables are firmly attached, turn the IQ-PIP-USP2/CN back to an upright position and insert into the PIP opening in the back of the amplifier. Take care while inserting the PIP to make sure you do not crimp, pinch or stretch the ribbon cables.

8. **Tighten the two PIP mounting screws** until the PIP is secured to the amplifier back panel. **Be sure to use the supplied star-washers for good ground connection.**

3.4 Install the Wiring

9. **Connect the IQ-PIP-USP2/CN to the IQ system via the IQ Bus.** The IQ components in a IQ Bus loop are wired sequentially. The loop begins and ends with the IQ interface. The output of one IQ component “loops” to the input of the next and so on as shown in Figure 3.3.

There are three different types of connectors used for IQ Bus wiring on IQ components. These include DIN connectors, screw terminal plugs, and RJ-45 connectors. The IQ-PIP-USP2/CN uses RJ-45 connectors that accept standard RJ-45 plugs like the one shown in Figure 3.4, allowing the use of industry-standard straight-thru type network cables. The left RJ-45 connector is used for input and the right RJ-45 connector is used for output.

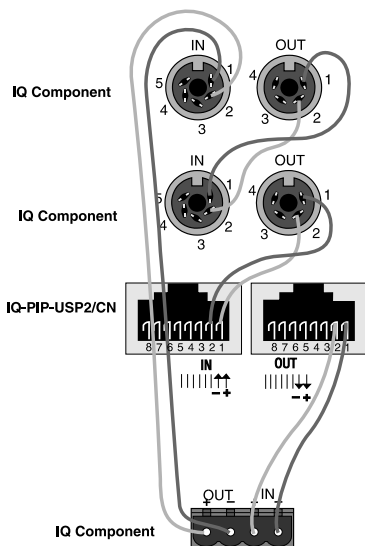


Figure 3.3 Standard IQ Bus Wiring “Loops” from the Output to the Input of each IQ Component.



Figure 3.4 RJ-45 Mating Plug

The following examples show how to connect the IQ-PIP-USP2/CN to other IQ components:

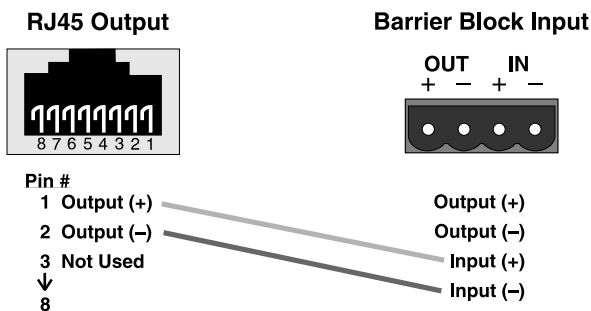


Figure 3.5 RJ-45 Output to Barrier Block Input.

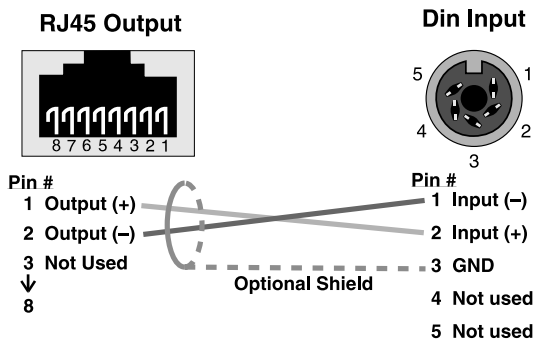
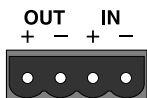
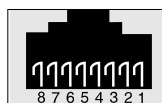


Figure 3.6 RJ-45 Output to Din Input.

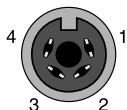
Barrier Block IQ Component Output

Output (+)
Output (-)
Input (+)
Input (-)

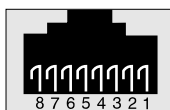
RJ45 Input

Pin #
1 Input (+)
2 Input (-)
3 Not Used
↓
8

Figure 3.7 RJ-45 Input to Barrier Block Output.

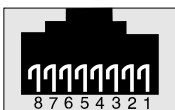
Din IQ Component Output

Pin #
1 Output (-)
2 Output (+)
3 Not Used
4 Not Used

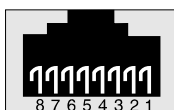
RJ45 Input

Pin #
1 Input (+)
2 Input (-)
3 Not Used
↓
8

Figure 3.8 RJ-45 Input to Din Output.

RJ45 Output

Pin #
1 Output (+)
2 Output (-)
3 Not Used
↓
8

RJ45 Input

Pin #
1 Input (+)
2 Input (-)
3 Not Used
↓
8

Figure 3.9 RJ-45 Output to RJ-45 Input.

10. Connect the CobraNet network

to the IQ-PIP-USP2/CN. Connect the primary network hub or switch to the primary network port on the PIP using high-grade UTP Cat-5 and “best” wiring practices for best results. For compliance with emission regulations, one of the supplied ferrite cores must be placed on the cable, with the cable making two passes through the core (see Figure 3.10).^{*} Good network design and wiring practices are essential for reliable system operation.

11. Connect the secondary network

port to the secondary “backup” network hub or switch if desired. For compliance with emission

regulations, one of the supplied ferrite cores must be placed on the cable, with the cable making two passes through the core (see Figure 3.10).^{*} The IQ-PIP-USP2/CN will automatically “switch-over” to this backup connection if the primary network connection fails.

12. Reconnect amplifier to the AC receptacle.**3.5 Adjust System Levels**

13. Adjust attenuator levels both on the amplifier and on the IQ-PIP-USP2/CN control panels within your IQ software for optimum system gain.

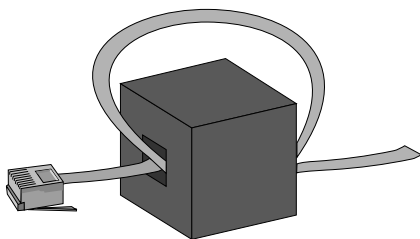


Figure 3.10 Network Cable with Installed Core

^{*} To minimize the possibility of a cable conductor being broken as a result of installing the ferrite core, use stranded Cat-5 cable, which is flexible and unlikely to break under this condition.

4 Hardware Features

This section describes the IQ-PIP-USP2/CN hardware features. These features are accessed via controls located on the unit itself.

4.1 IQ Address Switch (S1)

An 8-section DIP switch is used to set the IQ address of the unit. A valid IQ address is any number from 1 to 250. Numbers higher than 250 are reserved for special use. An address of "0" places the unit in stand-alone mode. In this mode, the IQ bus port is disabled and the PIP will not function with IQ software.

This switch is located on the underside of the circuit board. Each IQ component on a IQ Bus is given a unique IQ address so it can be independently controlled and monitored. Two or more IQ components of the same type should NEVER have the same address on the same IQ Bus loop.

For information on setting the IQ Address Switch, see Section 3.1.

4.2 Reset/Preset Switch

A recessed reset/preset switch, accessible from outside the PIP panel, performs two functions. First, it enables the IQ-PIP-USP2/CN to be restored to factory default settings, and second, allows the user to recall any of ten presets.* A straightened paper clip or similar small object is required to press the reset switch.

* Max Preset and Min Preset objects dictate the range of Presets that can be selected by the Reset/Preset Switch.

To select one of the ten presets, complete the following steps:

Remove all input signals. With the power on, briefly press the switch for less than two seconds to toggle through the 10 user-defined presets stored in firmware. Each press will increment the selected preset by one. After the switch is released, the DATA light will flash rapidly for a moment, then the PRESET indicator will blink to indicate the preset number selected. Restore input signals.

To restore the unit to the factory default settings, complete the following steps:

Remove all input signals. With the power on, press the switch and hold for more than 2 seconds, or until the DATA indicator blinks twice, and all settings will be reset to factory default. When the switch is released, the DATA indicator will flash rapidly for a moment. Restore input signals.

To clear all memory and set to factory default presets:

Remove all input signals. Press in and hold the switch while applying power to the unit. The settings will be reset to factory default. **Important: This action will re-write the flash memory and erase stored presets.** With the button held in and power applied, the DATA and PRESET indicators will both be lit. When the button is released, then the DATA indicator will flash rapidly for a moment. After the unit has been reset to the factory default settings, it will behave like a standard PIP until it is reprogrammed by an IQ System. Restore input signals.

4.3 Data Indicator

An amber Data Indicator (IQ DATA) is provided on the front panel (see Figure 4.1). It flashes whenever commands addressed to the IQ-PIP-USP2/CN are received. To assist with troubleshooting, an option that forces the DATA indicator to remain lit is available through IQ software.

4.4 Preset Indicator

A green PRESET indicator is provided on the front panel (see Figure 4.1). This indicator signals the number of the currently selected preset by emitting a series of flashes which match the preset number, followed by a pause. The indicator will continuously repeat the number selected until a change is made to any setting.

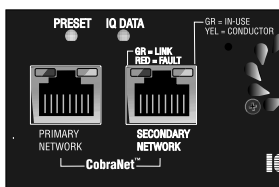


Figure 4.1 Indicators

4.5 CobraNet Indicators

Each CobraNet RJ-45 connector has two indicators to show network status (See Figure 4.1).

The indicator on the left side of each RJ-45 connector is dual-color. It flashes Green if the network link is connected and operating normally, and turns ON Red to indicate detection of an unexpected condition within the CobraNet interface (Fault)

The indicator on the right side of each RJ-45 connector is also dual-color. It turns ON Green if the port is “in-use” (i.e. the link is being used to transmit or receive active CobraNet channels), and turns ON Orange if the port is operating as the network “Conductor” (Conductor Mode is described in section 6.1.1.)

4.6 IQ Bus Input Connector

An RJ-45 connector provides input connection to the IQ Bus. A drop-out relay maintains loop integrity in the event power is removed from the IQ-PIP-USP2/CN.

4.7 IQ Bus Output Connector

An RJ-45 connector is provided for wiring output to the next device on the loop in the IQ Bus.

4.8 Primary Network Connector

This connector is the main connection to a CobraNet network. The port is implemented as a standard 100Base-T Fast-Ethernet interface and should be wired with standard UTP Cat-5 or better cabling.

4.9 Secondary Network Connector

This connector is the “backup” or redundant connection to the CobraNet network. If the Primary connection fails due to cut-wire, failed network switch, etc., this port is automatically enabled and ready to receive the network data within a

few seconds. The port is implemented as a standard 100Base-T Fast-Ethernet interface and should be wired with standard UTP Cat-5 or better cabling.

4.10 AUX Input/Output Connector

An RJ-11 connector provides both Auxiliary input and output connection to outside circuits. Operation of

the AUX Output is described in Section 9.3, and AUX Input operation is described in Section 9.4.

4.11 IQ Bus Drop Out Relay

A “Drop out” relay is provided on the IQ Bus ports to maintain the continuity of the IQ communication loop even if the IQ-PIP-USP2/CN loses power.

5 Amplifier Control and Monitoring

This section describes the IQ-PIP-USP2/CN amplifier control and monitoring features. These features are accessed via IQ for Windows software. Please refer to the *IQ for Windows* documentation if you are unfamiliar with IQ software.

5.1 IOC Event Monitor

The Input/Output Comparator (IOC®) of each channel of the amplifier can be monitored by the IQ System. The IOC circuitry acts as a sensitive distortion meter to provide you proof of distortion-free performance. If distortion of any kind equals or exceeds 0.05%, the IOC circuit will cause an IOC Event Monitor on the front of the amplifier to flash. The IQ-PIP-USP2/CN can cause a warning to flash on your computer screen via IQ for Windows software indicating an IOC event. Also, it can report IOC events to its AUX port.

5.2 Input Signal Level Monitor

The input signal level of each channel can be monitored. This monitor feature has a range from +20 dBu to -40 dBu in 1/2-dB steps.

5.3 Output Signal Level Monitor

The output signal level of each channel of the amplifier can be monitored. This monitor feature has a range from 0 dB to -40 dB where

0 dB is referenced to the rated output voltage of the amplifier model.*

The IQ-PIP-USP2/CN features scaled output level meters. By factory default, the meters are calibrated such that 0 dB equals the amplifier's rated output into 4 or 8 ohms. If the IQ-PIP-USP2/CN is installed into a *Com-Tech®* amplifier, the meters default to 0 dB equals 70 Vrms. Changing the 4/8 - 70V mode software switch selects the respective scaling.

5.4 Thermal Headroom Level Monitor

The Thermal Headroom level** of each channel of the amplifier can be monitored by the IQ software. This level represents the percent of available power/thermal capacity that is currently being used within the output section of the amplifier. When the thermal headroom level reaches 100%, the amplifier cannot produce any more power and it will begin to limit the drive level to the output devices to protect them from too much stress*** The Thermal Limiter feature of the IQ-PIP-USP2/CN can be set to engage upon a pre-selected thermal level. (See Section 5.9.)

* This is assumed to be 70V or the rated 8-ohm output for Com-Tech amplifiers or the rated 8-ohm output voltage for all other amplifiers.

** Thermal Headroom on your Crown amplifier may be labeled Output Device Emulation Protection (ODEP®).

***See the amplifier's *Reference or Owner's Manual* for more information about ODEP and how it works.

5.5 Power/Standby Control

Each channel's high-voltage supply can be independently turned on and off.

5.6 Amp Information

Several useful items of information about the host amplifier are determined by the IQ-PIP-USP2/CN at start-up. These include manufacturer, model, date code, serial number, and revision level. These can be printed from the system inventory (no on-screen display is available).

5.7 Amp Mode

The Stereo (Dual), Bridge-Mono or Parallel-Mono mode of the amplifier can be stored in the IQ-PIP-USP2/CN's memory so the IQ System is aware of the position of the amplifier's output mode switch. Storing this setting serves as an "electronic reminder" to the system; however, the actual mode of the amplifier cannot be controlled with this setting. The software amp mode setting can be displayed or modified via IQ for Windows software.

5.8 Amp Output Mode

On Com-Tech series amplifiers, the output mode (4/8 ohm or 70V) of the amplifier can be stored in the IQ-PIP-USP2/CN's memory so the IQ System is aware of the amplifier's output mode setting. This software switch also scales the output level meters for calibrated output indication.

5.9 Error Reporting

Four different error conditions can be detected by the IQ-PIP-USP2/CN. They include IOC, Thermal, Fault, and Load. Reporting for each condition can be individually configured for output to the AUX port, the IQ for Windows software, or both. If you choose system software notification, you will receive notice of the fault condition via the IQ System. If you choose AUX out notification, the AUX out signal will switch from ON to OFF when a selected error has occurred. If you prefer, reporting can be switched off completely. Following is a description of each error condition:

IOC: You can choose to be informed when an excessive number of IOC events occur over a unit of time in either channel of the amplifier. When IOC error reporting is on, an alert will be generated when the number of IOC events per unit of time specified exceeds a count that you set. The **Count** control lets you set a number of IOC events per unit of time allowed before an error is generated. The range is 1 to 100. The **Time** control lets you set the unit of time in seconds during which the number of IOC error events are counted for possible error reporting. The range is 1 to 10 seconds.

Thermal: You can choose to be warned if the thermal level rises above a predetermined level. The **Threshold** control lets you set the thermal level above which an error message will be reported. The range is from 1 to 100%.

Fault: You can choose to be warned

when an amplifier “fault” condition occurs when a channel fails. PIP2-compatible devices monitor a “fault” signal from the amplifier.

Load: You can choose to be warned

if the impedance of the load being driven by the amplifier falls out of a pre-selected range. See Section 8 for instructions on setting up the load supervision feature.

6 CobraNet

CobraNet is a licensed technology developed by Peak Audio, Inc. consisting of proprietary communications protocol, firmware and hardware. It allows reliable, deterministic transmission of digital audio over a 100Base-T Fast-Ethernet network. The IQ-PIP-USP2/CN operates as a networked device on a CobraNet network, and interfaces digital audio from the network to the amplifier. Refer to Section 10.4 for a more thorough discussion about CobraNet technology.*

This section describes the IQ-PIP-USP2/CN's CobraNet control and monitoring features. These features are accessed via IQ for Windows software. Please refer to the IQ for Windows documentation if you are unfamiliar with IQ software.

6.1 CobraNet Module Parameters

The internal CobraNet Network Interface Module contains several parameters for control and monitor of status of the CobraNet network, and do not directly affect the IQ network. These variables can also be con-

trolled and monitored through the CobraNet network using *CobraCAD*^{™**} or other industry-standard SNMP-enabled network management software.

6.1.1. Conductor

Any CobraNet device can be configured to operate either as Network Conductor or a Performer:

- **Active Indicator:** This indicator, viewable in IQ for Windows software, reports the present Conductor status of the device. If the indicator is ON, the unit is operating as the network Conductor. When OFF, the unit is operating as a Performer.
- **Priority:** This parameter adjusts the priority level for becoming the Conductor. When set to zero, the IQ-PIP-USP2/CN will never function as the Conductor, and when set to 255 it will always function as the Conductor. The higher the priority number, the more likely unit will act as the Conductor. The Priority object is stored in presets.

6.1.2 System Name

This parameter is user-settable to any alpha-numeric string of 30 characters or less. The intended use is to communicate a unique name for the particular device to a network. The System Name object is stored in presets.

6.1.3 System Description

This parameter is configured at the factory and is read-only. The intended use is to communicate a unique device description to a network.

* For the most comprehensive information available on CobraNet technology, visit Peak Audio's CobraNet website at www.peakaudio.com/CobraNet/.

** CobraCAD is a software tool that provides a simple graphic user interface for the design, configuration and monitoring of CobraNet networks. It is available for download from Peak Audio's website at www.peakaudio.com/CobraNet/.

6.1.4 System Location

This parameter is user-settable to any alpha-numeric string of 30 characters or less. The intended use is to communicate a unique description of the device location to a network. This object is stored in presets.

6.1.5 System Contact

This parameter is user-settable to any alpha-numeric string of 30 characters or less. The intended use is to communicate the designated contact person (in case of service or other network issue) to the network. This object is stored in presets.

6.1.6 Firmware Version

This parameter is configured at the factory and is read-only. The intended use is to communicate the presently loaded CobraNet module firmware version to a network.

6.1.7 MAC Address

This parameter is configured at the factory and is read-only. The setting defines a unique IEEE802-recognized address for use with any Ethernet based network.

6.1.8 IP Address

This parameter is user-configured for IP based networks. The intended use is to uniquely identify the device with respect to the available IP address space. The IP address must be configured in order to control/monitor the device with IP based software.

6.2 CobraNet Input Routing

CobraNet input routing includes the following controls:

6.2.1 CobraNet Receive Bundles

The IQ-PIP-USP2/CN can receive four unique CobraNet Bundles (RxA, RxB, RxC, RxD). Each Bundle includes an "Active" indicator to indicate whether the particular Bundle is being actively transmitted onto the network.

6.2.2 CobraNet Receive Channels

Each CobraNet Bundle contains up to eight digital audio channels. Each channel is selected at its respective transmitter to contain none, 16-, 20- or 24-bit audio sample data. A total of two audio channels can be processed by the IQ-PIP-USP2/CN at any one time. Any of the eight channels on a bundle can be can be routed to either of the two processing channel inputs on the IQ-PIP-USP2/CN.

- **Channel Label:** Each received digital audio channel can be assigned a user-specified label to indicate intended use, source or other information. The label is stored in presets along with the bundle number and receive channel information.

6.3 CobraNet Output Routing

CobraNet output routing includes the following controls:

6.3.1 CobraNet Transmit Bundles

The IQ-PIP-USP2/CN can transmit up to four unique CobraNet Bundles (TxA, TxB, TxC, TxD). Each Trans-

mit Bundle includes the following controls and monitor functions:

- **Receiver Count:** This meter reports the number of CobraNet nodes actively receiving the Bundle being sourced to the network by this bundle.
- **Transmit Position:** This meter reports the transmitter's relative position as assigned by the CobraNet Conductor. Lower numbers are transmitted before higher numbers.
- **Transmit Priority:** This control adjusts the relative priority for the particular transmitter. Higher numbers indicate a higher priority. One may choose to increase the transmitter priority for an emergency page microphone in a heavily loaded network. The Transmit Priority object is stored in presets.

6.3.2. CobraNet Transmit Channels

Each CobraNet Bundle can contain up to eight unique digital audio channels. Each channel is selected at its

respective transmitter to contain none, 16-, 20- or 24-bit audio sample data. A total of 32 channels can be transmitted by a single IQ-PIP-USP2/CN at any one time; however, only two channels available to source from. The CobraNet Transmit Channel object is stored in presets.

- **Channel Label:** Each transmitted digital audio channel can be assigned a user-specified label to indicate intended use, source or other information. The Channel Label object is stored in presets.

It is important to note that the signal being placed on the CobraNet network comes from the **actual output of the amplifier**. The signal is scaled down and converted to a digital signal, and as such, it is a true representation of the output of the amplifier. Having this signal available on the Cobranet network extends the "Listen Bus" feature found on other IQ-PIP modules to any network user, allowing them to listen to the output of any networked amplifier from any location on the network.

7 Signal Processing

This section describes the IQ-PIP-USP2/CN DSP signal processing features. These features are accessed via IQ for Windows software. Please refer to the IQ for Windows documentation if you are unfamiliar with IQ software.

7.1 Signal Processing Forms

Many of the advanced features of the IQ-PIP-USP2/CN are accessed from the IQ for Windows software **Signal Path** panel.* This special feature allows the audio signal to be processed and routed according to three available “form” specifications: **2x2 Dual Processor**, **1x2 Crossover/Processor + EQ**, and **AMCb+**.

When a new form type is selected, the required signal processing blocks are automatically arranged to fit the scheme of the selected form. The result is a preset “template” for signal processing that makes it faster and easier for you to tailor your system to your specific needs.

7.1.1 2x2 Dual Processor

2x2 Dual Processor is the default form configuration, and provides true stereo signal processing, with all signal processing options available on both channels.

* For more information about the structure of the forms environment within IQ for Windows, consult the documentation and help files which accompany the software.

7.1.2 1x2 Crossover/Processor + EQ

The 1x2 Crossover/Processor + EQ form provides **Auto Standby**, **Input Compression Limiter**, **Crossover**, and **DSP Filter Processing** options on the signal for Channel 1 only. The signal is then routed to the Channel 1 and Channel 2 signal processing blocks for further processing and routing to the amplifier.

7.1.3 AMCb+

The **AMCb+** form mimics the function of Crown's *PIP-AMCb*.* The signal is routed only to Channel 1 for DSP crossover, then the signal is routed to the Channel 1 and Channel 2 signal processing blocks for further processing and routing to the amplifier. In the **AMCb** form, **Box EQ** is specified for Channel 1, and **CD Horn EQ** is specified for Channel 2.

7.2 Signal Routing

Using IQ for Windows software, you can choose either or both Channel 1 and Channel 2 inputs to drive the processing path for each channel of the IQ-PIP-USP2/CN. You can also route the output of either processing channel to Channel 1 or Channel 2 amplifier inputs.

7.3 Input Signal Attenuator

An attenuator at the input of each channel is used to control the input

* For more information about the PIP-AMCb, consult the *PIP-AMCb Reference Manual*, or contact Crown Technical Support.

signal level. Each attenuator has a range from 0 dB to -80 dB in ½ dB steps. (Zero equals no attenuation.)

7.4 Auto Standby

The Auto Standby feature automatically turns off the high-voltage supplies of the amplifier output when no audio signal is detected at the input for a predetermined period of time. The channels are controlled independently. Four parameters control this feature:

On/Off: Turns this function on/off.

Input Gate Level: Sets the level, in dB, below which the high voltage supply of an amplifier channel will be turned off. The range is from +16 dBu to -40 dBu.

Turn-Off Delay: Sets the time, in minutes, that the input signal must remain below the Standby Level before the channel's high-voltage supply is turned off. The range is from 0 to 255 minutes. A setting of 0 (zero) yields a turn-off delay of approximately 2 seconds to facilitate setup of the function.

Power-On Delay: Enables or disables the IQ address turn-on delay. This delay prevents all the amplifiers from turning on at the same instant and tripping power breakers. The turn-on delay is calculated by: 10 msec x IQ address value. It may be desirable to disable this feature so that the first syllable of speech is not missed in a voice page application.

7.5 Input Signal Compressor/Limiter

An input signal compressor/limiter is available for each channel. Five parameters control this feature:

On/Off: Turns this function on or off.

Threshold: Sets the threshold, in dB, above which the compressor acts. The level is measured at the input to the PIP and corresponds to the level shown on an input meter. The compressor is "feed-forward," meaning that the level detection point is located before the gain control stage. The range is from +16 dBu to -40 dBu.

Attack Time: Sets the attack time of the compressor. The attack time is defined as the time it takes the compressor to attenuate the input signal by 10 dB. The range is from 1 millisecond to 2 seconds.

Release Time: Sets the release time of the compressor. The release time is defined as the time it takes the compressor to increase the input gain by 10 dB. The range is 100 milliseconds to 30 seconds.

Compressor Ratio: Sets the compression ratio for the compressor. The range is 1, 2, 4, 8, 16, 32, ∞ to 1.*

7.6 Programmable Filters

Each channel can have as many as eight different cascaded filters (the

* 1:1 is the same as "off."

actual number depends on the mix of filters chosen). There are seven different filter types from which to choose.

Low-Pass Crossover Filter (1st–4th order)

High-Pass Crossover Filter (1st–4th order)

Parametric Equalization Filter (2nd order only)

Low-Pass Equalization Filter (2nd order only)

High-Pass Equalization Filter (2nd order only)

Low-Pass Shelving Equalization (1st order only)

High-Pass Shelving Equalization (1st order only)

DSP filters can be processed pre or post crossover, depending upon which **form** the IQ-PIP-USP2/CN is configured in (see the IQ for Windows documentation for more information about **forms**).

All filters have IIR based topologies to insure a proper magnitude/phase relationship for use in professional audio applications such as equalizer or crossover (dividing) networks. Each channel has a total of eight “biquad” filter cells.*

All filters with adjustable Q-factors can be set in fractions of an octave. See Section 10.7 for information about calculating Q-factors.

* “Biquad” refers to the double quadratic equations which mathematically describe each filter implemented in the digital signal processor.

An indicator in the software shows how much DSP resources are being used by the selected filters. One 3rd- or 4th-order filter uses the equivalent of two 1st- or 2nd-order filters.

1st-, 2nd-, 3rd- and 4th-order responses result in 6-, 12-, 18- and 24-dB/octave roll-offs, respectively.

A description and list of the parameters of each filter type are presented next:

7.6.1 Low-Pass Crossover Filter



Description: This filter rolls off high frequencies at a rate determined by the shape parameter. The filter is commonly used to feed the low frequency portion of an audio signal to woofers or subwoofers. It can be combined with a high-pass crossover filter to create a band-pass crossover filter for driving mid-range drivers.

- **Passband gain:** Fixed at unity.
- **Frequency:** Sets the –3 dB corner frequency of the filter. The range is 20 Hz to 20 kHz.
- **Shape:** Sets the response shape of the filter. Available response shapes are:
1st-order Butterworth,
2nd-order Butterworth,
3rd-order Butterworth,
4th-order Butterworth,
2nd-order Bessel,
3rd-order Bessel,
4th-order Bessel and
4th-order Linkwitz-Riley.

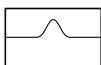
7.6.2 High-Pass Crossover Filter



Description: This filter rolls off low frequencies at a rate determined by the shape parameter. The filter is commonly used to feed the high frequency portion of an audio signal to horns or tweeters. It can be combined with a low-pass crossover filter to create a band-pass crossover filter for driving mid-range drivers.

- **Passband gain:** Fixed at unity.
- **Frequency:** Sets the -3 dB corner frequency of the filter. The range is 20 Hz to 20 kHz.
- **Shape:** Sets the response shape of the filter. See Section 7.6.1 for available response shapes.

7.6.3 Parametric Equalization Filter



Description: This filter boosts or cuts a relatively narrow frequency band like a band-pass filter. It is commonly used to correct specific anomalies in the response of drivers.

- **Passband Gain:** Sets the amount of boost or cut for the filter. The range is $+12$ dB to -24 dB.
- **Frequency:** Sets the center frequency of the filter. The range is 20 Hz to 20 kHz.
- **Q:** Sets the width and slope of the filter. The range is 0.1 to 34. The lower the Q, the wider the filter

and the better the transient response and visa versa.

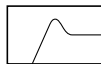
7.6.4 Low-Pass Equalization Filter



Description: This filter combines the functions of the parametric equalization filter to boost or cut a relatively narrow frequency band with a low-pass filter to roll of the frequencies above the center frequency.*

- **Frequency:** Sets the center frequency of the filter. The range is 20 Hz to 20 kHz.
- **Q:** Sets the width, slope and gain of the filter. The range is 0.1 to 34. The lower the Q, the wider the filter, the lower the gain and the better the transient response and visa versa. Gain examples: A Q of 2 will result in 6 dB of gain at the center frequency and a Q of 4 will result in 12 dB of gain.

7.6.5 High-Pass Equalization Filter



Description: This filter combines the functions of the parametric equalization filter to boost or cut a relatively narrow frequency band with a high-pass filter to roll of the frequencies below the center frequency.* It is commonly used to create a B6 (6th-order Butterworth) response in a vented loudspeaker enclosure.

* The low and high-pass equalization filters can be cascaded to form unique inter-order crossover-type filters.

- **Frequency:** Sets the center frequency of the filter. The range is 20 Hz to 20 kHz.
- **Q:** Sets the width, slope and gain of the filter. The range is 0.1 to 34. The lower the Q, the wider the filter, the lower the gain and the better the transient response and visa versa. Gain examples: A Q of 2 will result in 6 dB of gain at the center frequency and a Q of 4 will result in 12 dB of gain.

7.6.6 Low-Pass Shelving Equalization Filter



Description: This filter boosts or cuts low frequencies by the specified amount of gain. When used to cut rather than boost, the filter acts like a high-pass filter rather than a low-pass filter. It has a fixed 1st-order slope (6 dB/octave).

- **Passband Gain:** Sets the amount of boost or cut for the filter. The range is +12 dB to -24 dB.
- **Frequency:** Sets the -3 dB corner frequency of the filter. The range is 20 Hz to 20 kHz.

7.6.7 High-Pass Shelving Equalization Filter



Description: This filter boosts or cuts high frequencies by the specified amount of gain. When used to cut rather than boost, the filter acts like a low-pass rather than a high-pass filter. It has a fixed 1st-order slope (6 dB/octave). It is commonly used to compensate for the natural high-

frequency roll-off of constant directivity horns.

- **Passband Gain:** Sets the amount of boost or cut for the filter. The range is +12 dB to -24 dB.
- **Frequency:** Sets the +3 dB corner frequency of the filter. The range is 20 Hz to 20 kHz.

7.7 Signal Delay

Signal delay can be set for each channel. The delay for each channel can be set using "Coarse" or "Fine" adjustment controls:

- **"Coarse" Delay:** Sets the amount of signal delay. The range is 0 milliseconds to 500 milliseconds in 1 millisecond steps.
- **"Fine" Delay:** Sets the amount of signal delay. The range is 0.6250 milliseconds to 100 milliseconds in 20.83 millisecond steps. (The minimum delay of 0.6250 milliseconds is inherent in the DSP system design.)

The net delay through the IQ-PIP-USP2/CN is the sum of the coarse and fine delay settings. Use of both controls provides a means for greater delay control. For example, the Coarse Delay control can be adjusted to provide cabinet-to-cabinet alignment, while the Fine Delay control can provide alignment within a cluster or cabinet.

7.8 Peak Voltage Limiter

This limits the peak voltage output of the amplifier. There are four parameters which control this limiter.

7.8.1 On/Off

Turns the limiter on or off.

7.8.2 Attack

Attack time is adjustable from 10 milliseconds to 1 second per 10 dB of overdrive.

7.8.3 Release

Release rate is adjustable from 100 milliseconds to 10 seconds per 10 dB or release.

7.8.4 Threshold

Absolute voltage threshold is adjustable from 12 Vpk to 255 Vpk in 1 volt steps.

7.9 Average Power Limiter

Limits the long-term power output from the amp. The actual output limiter threshold is determined by an absolute power threshold and the nominal load impedance setting. There are five parameters which control this limiter.

7.9.1 On/Off

Turns the limiter on or off.

7.9.2 Average Power Threshold

The threshold is adjustable from 10 to 1000 watts.*

7.9.3 Nominal Load Impedance

The nominal load impedance is adjustable from 1 to 1000 ohms, and should be set to correspond to the nominal impedance rating of the load

* The average power threshold should be set per the loudspeaker's "long-term" power rating (consult your speaker documentation).

connected to the respective channel.

7.9.4 Attack Time

Adjustable from 1 second to 30 seconds in 1 second increments.

7.9.5 Release Time

Adjustable from 1 second to 30 seconds in 1 second increments.

7.10 Clip Eliminator

This limiter eliminates amplifier clipping by monitoring IOC signals. The only control for this limiter is **On/Off**.

7.11 Thermal Limiter

A thermal limiter is provided to limit amplifier output as a function of available thermal headroom, allowing smooth system level reduction while preventing amplifier overload. There are four parameters which control this feature:

7.11.1 On/Off

Turns the thermal limiter on or off.

7.11.2 Threshold

Sets the thermal level, in percent, above which limiting will begin. The range is from 1 to 100%.

7.11.3 Attenuation

Sets the amount, in dB, that the input signal level will be attenuated for each percentage point that the thermal level exceeds the trigger level. The range is ½ to 6 dB in ½-dB steps.

7.12 Signal Mute

The output signal of each channel can be independently muted. This function typically provides 80 dB or more of attenuation.

7.13 Output Trim Controls

An output trim control is provided for each channel to adjust the output gain after processing, allowing for “make-up” gain to compensate for losses due to crossovers, etc. Range is +12 dB to –80 dB in ½-dB steps.

7.14 Polarity Inverter

The polarity of the input signal of each channel can be independently inverted.

7.15 Tie Switch

The Tie switch connects all active compressors and limiters together so that any limiting/compression affects the signal on both channels, such as would typically be desired when processing stereo signals.

7.16 “Ghost Faders”

These indicators let you monitor the signal path gain where it may differ from manual gain set on input attenuation and output trim as the result of limiting or compression. They appear as flying faders “behind” the input attenuators in IQ for Windows.

8 Load Supervision

This section describes the IQ-PIP-USP2/CN Load Supervision features. These features are accessed via IQ for Windows software. Please refer to the IQ for Windows documentation if you are unfamiliar with IQ software.

The Load Supervision feature allows real time monitoring of the load connected to each amplifier channel. When enabled, the IQ-PIP-USP2/CN continuously monitors the amplifier output voltage and current and calculates the long-term average load impedance. The measured load impedance is compared against user defined high and low limits. If either limit is exceeded, the status indicator and/or IQ System error reporting functions alert the user of the problem. There are six controls and two indicators for each channel:

8.1 On/Off

This feature turns the Load Supervision feature on or off.

8.2 High Limit

This feature sets the upper bound above which the system will report a "high" error status.

8.3 Low Limit

This feature sets the lower bound below which the system will report a "low" error status.

8.4 Nominal Load Impedance

This feature sets the expected average impedance for the connected

load. This value determines the output signal level required for test. This parameter is also used by the average power limiter to determine the expected power limit threshold. (see Section 7.9).

8.5 Calculate

The Calculate button invokes an impedance calculator. Entering output voltage and power will give the expected impedance.

8.6 Include in Standard Error Reporting

This feature enables error reporting so that any high/low status condition is reported via the IQ System (see Section 5.9).

8.7 Report to AUX

Enables any high/low status condition to be reported via the IQ-PIP-USP2/CN AUX port output (see Section 4.10).

8.8 Test Indicator

This indicator lights when the load supervision algorithm is actually performing a load impedance calculation and test verification.

8.9 Low/Normal/High Indicator

This indicator shows the present status of the load with respect to the user defined high/low limits.

8.10 Z Avg Monitor

Reports actual calculated average load impedance.

9 Utilities

This section describes the IQ-PIP-USP2/CN Utility features. Some of these features are accessed via IQ for Windows software. Please refer to the IQ for Windows documentation if you are unfamiliar with IQ software.

9.1 User Presets

The parameters for all functions can be saved as presets. A total of ten user presets can be stored in the IQ-PIP-USP2/CN's flash memory. Preset names are stored on the PIP.

9.2 Memory Backup

A memory backup feature is provided which can be disabled, if desired. The factory default setting is "enabled." When enabled, the memory backup stores all run-time parameters that can be controlled by the IQ software into nonvolatile flash memory. Memory backup occurs within 2 seconds after any parameter change. When disabled, all run-time parameters are returned to the last backed-up values whenever the unit loses power.

CAUTION: Care should be taken to backup "safe" levels for the input attenuators and output trim controls. Changes made after disabling backup are not saved; therefore, it is possible for the memory backup feature to be turned off with "unsafe" levels stored. This may result in significantly greater system gain the next time power is re-applied to the IQ-PIP-USP2/CN.

9.3 AUX Output

The AUX Output delivers 15 VDC at 10 mA maximum output when switched to logic High, and may be controlled via software or may be programmed to switch when a fail condition is present on any channel. The logic of the AUX Output can be set to either non-inverted (enabled output transitions from low to high) or inverted (enabled output transitions from high to low).

9.4 AUX Input

The high-impedance (10Kohm) AUX Input can sense 5-35 VDC logic signals and can be programmed to any of seven different operating modes as shown in Figure 9.1:

Default	the AUX Input provides no function in this mode.
Mute Ch. 1	mutes amplifier Channel one.
Mute Ch. 2	mutes amplifier Channel two.
Mute Ch. 1 and Ch. 2	mutes both amplifier Channels one and two.
Ch. 1 Standby	places amplifier Channel one in Standby mode.
Ch. 2 Standby	places amplifier Channel two in Standby mode.
Ch. 1 and Ch. 2 Standby	places both amplifier Channels one and two in Standby mode.
Increment Preset	increments to the next preset.

Figure 9.1 Aux Input Modes

The range of Presets available to be incremented via the AUX Input in **Increment Preset** mode can be lim-

ited to prevent Presets outside a set range from being selected.* The Min Preset and Max Preset settings allow minimum and maximum Preset values to be specified. In the event the AUX Input is engaged while the

* Regardless of the state of the Min Preset and Max Preset settings, all Presets are available for selection within IQ for Windows software.

IQ-PIP-USP2/CN is set in this mode, and the currently-selected Preset is outside the specified range, the Preset will be changed to the minimum Preset value. Once the AUX Input has been used to select a Preset in this mode, it must be toggled to the OFF position and a five-second waiting period must occur before a Preset can again be selected via the AUX Input.

10 Working With IQ

This section provides additional information about the IQ System with special guides to aid in the installation and use of the IQ-PIP-USP2/CN.

For more information about any of these topics, contact the Crown Technical Support Group.

10.1 A Closer Look at IQ

An IQ System is a computerized system which uses the IQ command protocol to control and monitor system functions. An IQ System can monitor and control audio components like amplifiers, mixers, and equalizers, but is not limited to audio. For example, an IQ System can also control an auxiliary cooling system, emergency backup power system, security system and much more.

An IQ System typically consists of a set of IQ components connected to each other and a host computer. The host computer is typically used to control and monitor the operation of the connected IQ components, although sometimes it may be required only to set up the system. IQ for Windows is the name of a software program which runs on the host computer, and allows you to setup, control and monitor the components in an IQ System.

10.1.1 Communications Overview

Communication in the IQ System is strictly “client-server” or “speak when spoken to.” In other words, all communication is initiated by the host through the interface. A 20mA current loop, called the “IQ Bus,” connects the interface and all IQ

components in the system. A component on the IQ Bus may not initiate communication. Only one command can be on the IQ Bus at any one time.

In most cases, a component receives a message much like a radio receives a broadcast. A message sent from the interface is simultaneously received by all components on the IQ Bus and also at the IN connector of the interface at the end of the IQ Bus.

A component can also send a response down the IQ Bus. This response passes through all “downstream” components, then through the IN connector of the interface. All IQ components have the ability to block or “open” the IQ Bus.

To communicate with an IQ component, the host sends a command via its RS-232 port to the interface. The interface collects and buffers the command, waiting until it has the entire command. This command is then transmitted out to the IQ Bus. A command that is transmitted is also simultaneously received in the interface receive side along with any responses from any IQ components. This response is then returned to the host via the RS-232 port.

10.1.2 IQ2 Protocol (UCode)

IQ2 is an advanced type of IQ command protocol developed primarily to allow third party IQ manufacturers to more quickly and easily produce compatible products that do not require intense software programming. Components that are designed with or are otherwise compatible with UCode protocol carry the IQ2 logo.

10.1.3 IQ for Windows

IQ for Windows is a Microsoft[®] Windows[®] 32-bit-compatible application for operating an IQ System. It offers the friendly look and feel of Windows with the power of IQ. In addition to control and monitoring of IQ components in a Windows environment, it also offers TCP/IP network support and numerous other capabilities.

For more information about IQ for Windows, see the online documentation that accompanies the program, or visit the IQ website at www.iqaudiosystems.com/.

10.1.4 IQNET

Crown IQNET describes the ability of IQ for Windows to communicate with one or more remote systems using a network connection. It makes

use of the TCP/IP protocol services built into Windows and can run over any network that can be configured under Windows.*

IQNET requires the use of an additional software package called IQNETServer which runs on a computer connected to the IQ System via the serial port. Any number of additional computers can access these systems as network clients using IQ for Windows software.

In IQNET, the computer connected to the IQ System via serial port is called the server. A client is any computer on the same network running IQ for Windows in network client mode. The server acts as a gateway between the parts of an IQ System and client computers that are able to control and monitor that system.

For more information about IQ for Windows, see the online documentation that accompanies the program, or visit the IQ website at www.iqaudiosystems.com.

* IQ for Windows is compatible with any 32-bit Windows operating system. It is not compatible with older Windows 3.x operating systems.

10.2 IQ-PIP-USP2/CN User Interface

Please note: It is assumed the reader has a basic familiarity with IQ for Windows. For more information about IQ for Windows, see the online documentation that accompanies the program, or visit the IQ website at www.iqaudiosystems.com.

The IQ-PIP-USP2/CN GUI (Graphic User Interface), called the Control Panel, provides access to all available features. The Control Panel initially opens within IQ for Windows as a basic form designed to allow meter monitoring while taking up minimal space on the desktop (see Figure 10.1). Clicking on the yellow bar along the bottom changes the Control Panel to a larger window that includes a few more monitor features as well as the most basic amplifier controls such as Power, Mute, Polarity, Input Attenuators and AUX Port

control. Clicking on the yellow bar along the bottom of this window opens the “tabbed” control area, allowing access to all remaining features, as shown in Figure 10.2. In the tabbed control area, features and controls are arranged into logical groupings, or forms, and are accessed by clicking a tab along the top of the expanded Control Panel. Cross-links are located within the Control Panel forms to allow quick navigation to similar or related features. Clicking again on the yellow bar reduces the Control Panel to the basic form.

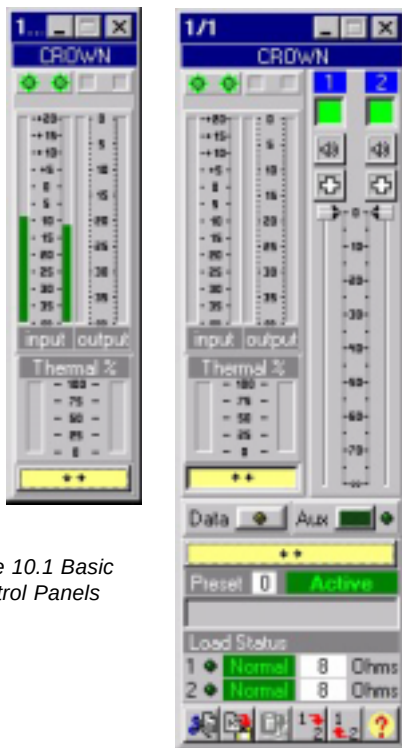


Figure 10.1 Basic Control Panels

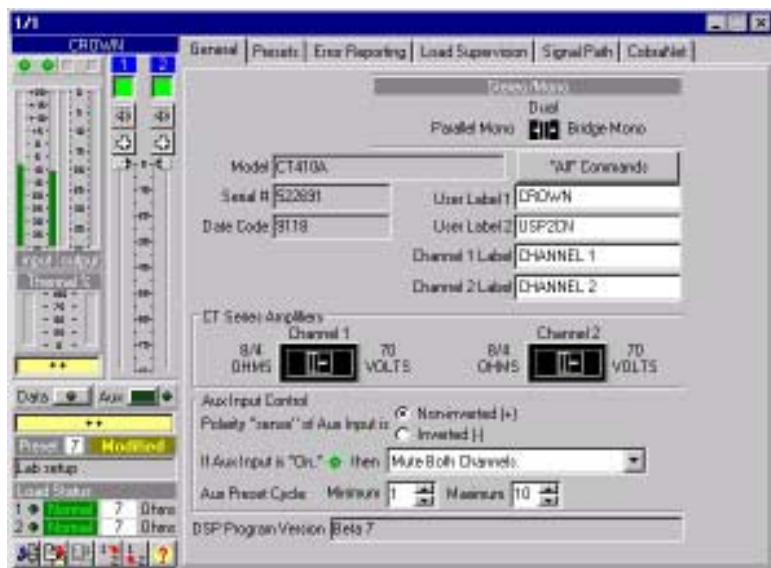


Figure 10.2 General Control Tab

10.2.1 General Control Tab

The General Control Tab contains controls common to most Crown PIPs. These include Stereo/Mono Switching, Model Selection, Amplifier Serial Number, Date Code, User Labels, Access to "All" commands, 8/4 Ohm - 70 volt switching for Crown

Com-Tech "02" amplifiers, AUX Input Controls for polarity, mode, min preset and max preset and Firmware Program Version number. Figure 10.2 shows the General Control Tab.

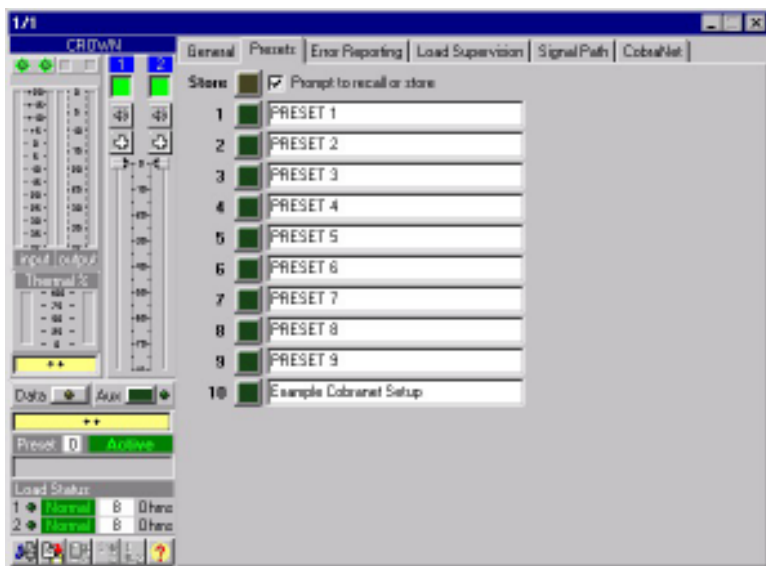


Figure 10.3 Presets Control Tab

10.2.2 Presets Control Tab

The Presets Control Tab allows you to store and recall PIP settings as Presets within the IQ-PIP-USP2/CN and assign each Preset a name (see Section 9.1 for information about Presets).

Checking the “Prompt to recall or store” checkbox causes a prompt to be issued whenever a Preset button is pressed. The prompt gives you the choice of Recalling the Preset, Storing the Preset or Cancel. When the check box is “unchecked,” no prompt will be given, and all settings contained in the selected preset will be recalled and the current setup lost when a Preset button is pressed.

Important: To store current settings as a Preset, the store button must

first be pressed, then the desired Preset button.

Preset 10 provides an example of a typical setup for a very simple Cobranet Network. When Preset 10 is recalled, the PIP will receive bundle #1 and route Channel one to amplifier input Channel one, and Channel two to amplifier input Channel two. Preset 10 is intended as a tool to help you get started and to help you observe how audio is routed into the amplifier. When this example preset is no longer needed, you can save your own Preset settings in Preset 10 and rename it; however, if the PIP is returned to factory default settings, the example Cobranet setup will again be stored in Preset 10. Figure 10.3 shows the Presets Control Tab.

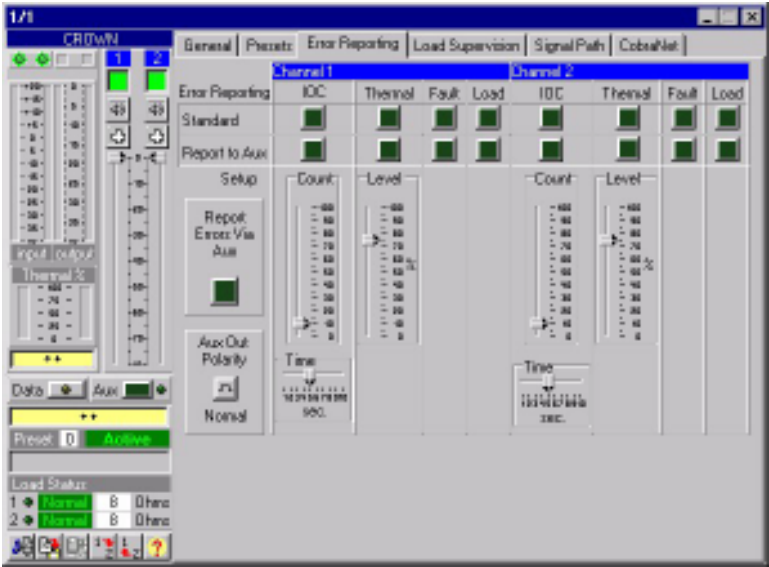


Figure 10.4 Error Reporting Control Tab

10.2.3 Error Reporting Tab

The Error Reporting Control Tab contains controls which can be used to set the conditions under which error notices are triggered (see Section 5.9 for information about Error Reporting). When an error is triggered under one of these conditions, an error alert is generated. IQ for Windows can generate alerts such as: dialog box on screen, fax, e-mail, play wave file, etc. Error conditions that can be set up include

IOC Errors, Thermal Errors, Fault Conditions and Load Supervision Errors.

The “Report Errors Via AUX” function enables any errors to also be reported to the AUX Port output. The AUX Port polarity can be set for “high-to-low” or “low-to-high” upon error detection. The default setting is “Normal” which is low-to-high. Figure 10.4 shows the Error Reporting Control Tab.

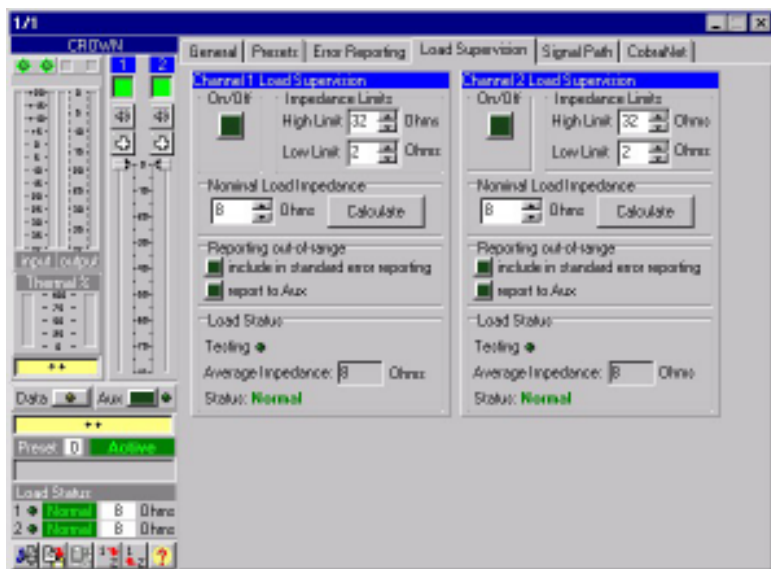


Figure 10.5 Load Supervision Control Tab

10.2.4 Load Supervision Control Tab

The Load Supervision Control Tab contains load supervision controls and test result indicators for each channel of an amplifier (see Section 8 for information about Load Supervision). Load supervision allows you

monitor the average impedance of your amplifier's load, and alerts you if it falls outside of set limits. Figure 10.5 shows the Load Supervision Control Tab.

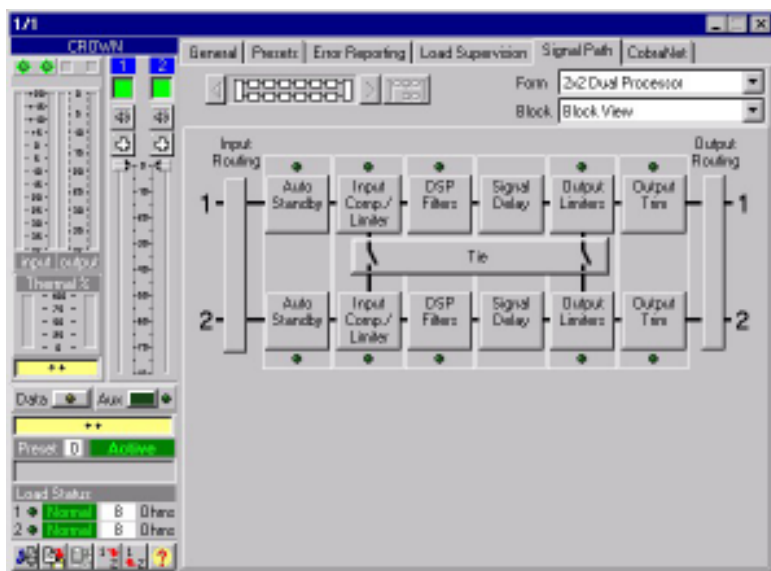


Figure 10.6 Signal Path Control Tab

10.2.5 Signal Path Control Tab

The Signal Path Control Tab allows setup and control of all the audio signal path functions available in the chosen signal processing form (see Section 7.1 for information about signal processing forms). The full set of available functions are: Input Routing, Auto-Standby, Input Compressor, Filters, Signal Delay, Peak

Voltage Limiter, Average Power Limiter, Clip Eliminator, Thermal Limiter, Output Trim Gain and Output Routing. More details on the operation of these controls are available in the Online Help section of each within IQ for Windows. Figure 10.6 shows the Signal Path Control Tab.



Figure 10.7 CobraNet Setup Control Tab

10.2.6 CobraNet Setup Control Tab

The CobraNet Setup Control Tab provides access to the CobraNet module control and monitoring features. System identification and addressing, Conductor priority, and status and error indicators are all

available within this tab (see Section 6.1 for information about the CobraNet module). Figure 10.7 shows the CobraNet Setup Control Tab.

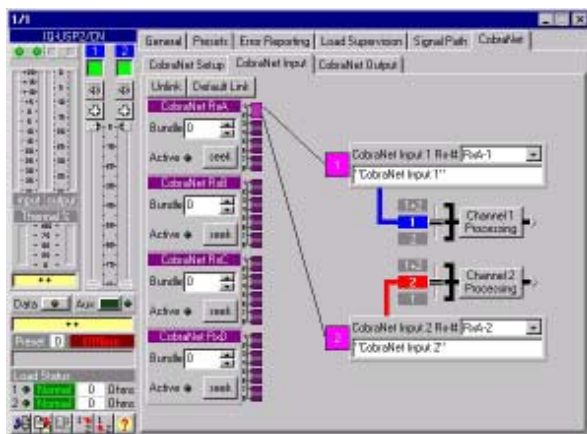
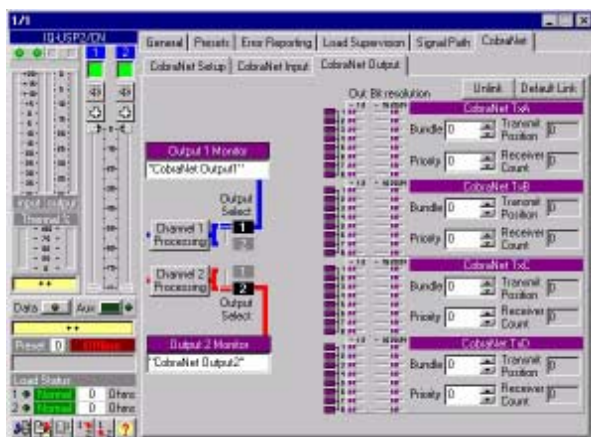


Figure 10.8
CobraNet Input
Control Tab

Figure 10.9
CobraNet Output
Control Tab



10.2.7 CobraNet Input and Output Control Tabs

The CobraNet Input and Output Control Tabs provide access to the CobraNet Network, and make it easy to route CobraNet audio into and out of the IQ-PIP-USP2/CN (see Section 6 for more information about CobraNet). Routing between the CobraNet network and the IQ-PIP-

USP2/CN is achieved by “dragging” a line between the desired CobraNet Channel and the PIP or amplifier output. Bundle numbers and priorities are assigned within these tabs as well. Figure 10.8 shows the CobraNet Input Tab, and Figure 10.9 shows the CobraNet Output Tab.

10.3 IQ Bus Wiring

The IQ-PIP-USP2/CN must be connected to a IQ Bus loop having an IQ2-compatible IQ interface in order for the IQ System to control or monitor it. The IQ Bus is a serial communication loop designed to transmit IQ commands and data. As implemented in the IQ-PIP-USP2/CN, it is a 20 milliamp current loop operating at a BAUD rate of 38.4 K. The loop must be unbroken to function properly.

If the system includes an *IQ-INT II* interface, it can accept eight different IQ Bus loops or zones. Dividing the sound system into different zones, each with its own IQ Bus loop, can have several advantages. The following list contrasts those advantages with those of a single loop.

Multiloop Advantages

- A break in communication in one loop does not affect other loops.
- Over 250 IQ components of the same type can be used in a system.
- The same IQ address can be used more than once (once per loop per model).

Single Loop Advantages

(with IQ-INT II interfaces)

- The IQ System can send and retrieve data faster in a single loop.
- “Real time” level display of a greater number of units is possible.

The IQ-PIP-USP2/CN can be connected to the IQ Bus with inexpen-

sive twisted-pair wiring (shielded or unshielded). If fiber optic wiring is required contact the Crown Technical Support Group (see page 2).

Here are some guidelines for twisted-pair wiring:

- **Use shielded twisted-pair wire** at least 26 AWG in size when interference is a problem. The wire should be of good quality and should have low capacitance—30 picofarads/foot or less is good. (West Penn 452 or an equivalent wire works well.) The shield serves two purposes: First, it helps prevent the IQ data signal from transmitting to nearby audio wiring. Second, it helps prevent outside RF from interfering with the data signal. However, in most cases interference is not a problem and, since unshielded wire has lower capacitance, it is a better choice.
- **Minimize the total capacitance of each IQ Bus loop.** The total capacitance should be less than 30 nanofarads. Allow for approximately 60 picofarads for each IQ component in a loop. This accounts for a slight delay which occurs as data signals pass through a component.
- **Add an IQ Repeater** for very long loops—greater than 1,000 feet (305 m)—or when required by high-capacitance wire. Although we recommend a repeater for loops longer than 1,000 feet, it is often possible to go 2,000 feet (610 m) or more. The most significant characteristic of the wire is its capacitance.

Lower capacitance allows longer loops. Unshielded wire usually has less capacitance.

- **Never use the ground wire in a mic snake line.** It may sometimes be convenient to run IQ Bus data signals to and from stage monitor amplifiers along unused wire pairs in a mic snake. Do not use the ground wire which is normally connected to pin 1 on an XLR connector or data noise will be added to the audio lines. Use only the signal lines which normally connect to pins 2 and 3 of the XLRs.*

Outside RF interference is seldom a problem for a IQ Bus loop—especially if shielded twisted-pair wire is used. However, there are extreme situations when fiber optic wiring is recommended. For example, locating a IQ Bus loop next to an AM radio transmission line may require fiber optic cabling. An extremely long IQ Bus loop distance may also require fiber optic cabling.

* Because typical mic cables have high capacitance, the maximum possible IQ Bus loop distance will be less.

10.4 A Closer Look at CobraNet

CobraNet is a licensed technology developed by Peak Audio, Inc. consisting of proprietary communications protocol, firmware and hardware. It allows reliable, deterministic transmission of digital audio over a 100Base-T Fast-Ethernet network.

This section provides an overview of CobraNet. Peak Audio has provided a number of technical papers that describe CobraNet in detail. These papers are available at: <http://www.PeakAudio.com/CobraNet/>.

10.4.1 Fast Ethernet (100Base-T)

Fast Ethernet (100Base-T) uses a hub to interconnect all network nodes to form a star topology (see Figure 10.10). In the star topology all PCs are connected to a central-

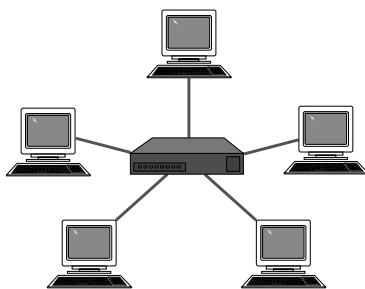


Figure 10.10 Star Network Topology

ized hub. Messages are sent from the originating PC to the hub, which then transmits the message either to the whole network or, if a switched hub is used, to the destination PC only. Hubs may be active or switched.

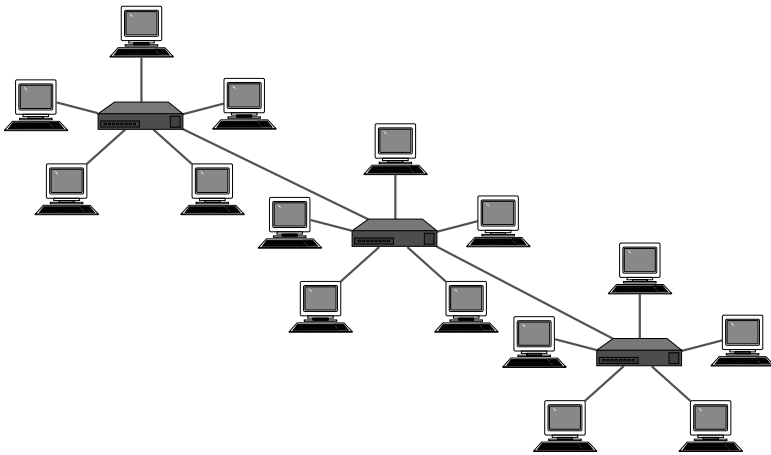


Figure 10.11 Multi-Star Topology

In larger Fast Ethernet networks, additional hubs, concentrators, and other network hardware are used to form a larger network, as shown in Figure 10.11.

Today, commonly available networking cards are 10/100Base-T capable, which allows them to be used on either 10BaseT or 100Base-T networks.

Fast Ethernet distance limitations apply to CobraNet installations: 100 meters over Cat-5 copper cable, 2 kilometers over multimode fiber. Proprietary Fast Ethernet via single mode fiber solutions can reach even further.

10.4.2 Audio Specs

CobraNet implements a fixed sample rate of 48 kHz. Each channel may be selected to transmit 16-, 20- or 24-bit audio data as desired. The transmitter and receiver buffering required for reliable transmission is

fixed at 256 samples yielding a network transmission latency of 5.333 ms (256 samples at 1/48 kHz per sample).

10.4.3 The Conductor

A CobraNet system is coordinated by one of the devices called the conductor. When two or more CobraNet devices are interconnected properly, one of the devices will be elected the network conductor based on a priority scheme. The Conductor indicator will light on the CobraNet device that is serving as the conductor.

Deterministic transmission on Ethernet is enabled by a protocol that implements a “Conductor” for control of time-division multiplexing and clock recovery. The “Conductor” periodically broadcasts a well-defined “beat” packet onto the network for each transmitter and receiver to recover synchronous tim-

ing information. The “beat” also includes information as to which addresses can transmit at certain time slots within the “beat” period.

The Conductor regulates the CobraNet digital audio traffic on the CobraNet network. Each transmitter is given a “permission” to transmit in a given time-slot within the Conductor controlled isochronous cycle-time. The time-slot is determined by the assigned bundle priority. Higher bundle priorities receive lower-numbered positions and are transmitted first. The “Receiver Count” monitor indicates how many devices are receiving the digital audio bundle. The “Active” indicator indicates whether the particular Bundle is being actively transmitted onto the network.

10.4.4 Bundles and Audio Channels

All audio channels are packaged into groups called Bundles (formerly called Network Channels) for transmission over the Ethernet network. Each CobraNet device has the ability to send and receive a fixed number of Bundles. The Bundle number tells the CobraNet conductor which specific CobraNet device is trying to communicate with which other CobraNet device(s) over the network. A given Bundle may have only one transmitter that places it onto the network. Unicast Bundles may have only a single receiver. Multicast Bundles may have multiple receivers.

Bundles from 1 to 255 are designated as “multi-cast” Bundles. This means that they are transmitted to multiple receivers. This type is most

used on “repeater” networks limited to 64 channels.

Bundles from 256 to 65,279 are “uni-cast”. This means that they are transmitted to one and only one receiver. This type is most used on “switched” networks requiring more than 64 channels.

A Bundle can carry up to 8 audio channels (see the block diagram in Section 10.10). The usual assignment is 8 channels at 20 bits. Using less audio channels is possible but maximum size bundles are suggested for most efficient utilization of network bandwidth. If 24 bit data is desired, then only 7 audio channels can be loaded into a single Bundle.

10.4.5 Repeater Networks

CobraNet can operate on “repeater” networks and more complex “switched” networks. Repeater networks use low-cost Ethernet hubs.* On this type of an Ethernet network, all packets are broadcast to all connected nodes. CobraNet multi-cast and uni-cast Bundles can be assigned but because of the simpler repeater-type hubs, even uni-cast transmissions are broadcast to all nodes. Therefore, a maximum of 8 full-loaded Bundles (64 audio channels) are allowed on the entire network. More Bundles may be allowed if they are loaded with less than the full eight audio channels. There is no limit to the number of active receivers on a repeater network. Generally, a repeater based CobraNet

* See Tested Ethernet Products on the Peak Audio website for a list of recommended Ethernet repeaters.

network must be dedicated to CobraNet traffic only to guarantee reliable transmission of audio packets.

10.4.6 Switched Networks

A more complex CobraNet network can be built using Ethernet Switches.* Ethernet switching technology is more sophisticated than hubs. Switches do not simply broadcast each and every packet to all nodes. Instead, they can interrogate each incoming packet transmission to determine its destination and (very quickly) transmit the data to only that destination port. This allows for more overall network traffic. In effect each port has 100MB of bandwidth and the overall network can be as large as 100MB times the number of ports on the network.

Switched networks allow both multi-cast and uni-cast CobraNet Bundles. Uni-cast transmissions can only be

received by a single node and are typically used for point-to-point routing. This technique leverages Ethernet switching technology to significantly conserve overall network bandwidth and in-turn allow many more Bundles and Audio Channels.

Another enhancement available with most switched network environments is “full-duplex” links. A full-duplex link allows simultaneous send and receive over the same Ethernet connection. This allows simultaneous send and receive of up to 64 channels per node for a total of 128 channels. That said, please keep in mind that today’s CobraNet node designs are only capable of 64 channels (32 in and 32 out).

The combination of switching and full-duplex technologies in switched CobraNet networks allows up to 128 channels per node and greater than 3000 individual uni-cast channels. There is no limit to the number of active receivers on a switched CobraNet network. Switched networks also allow control traffic such as PCs, to coexist on the same network as CobraNet devices.

* See Tested Ethernet Products on the Peak Audio website at www.peakaudio.com/CobraNet for a list of recommended Ethernet switches.

10.5 Using the AUX Connector

The IQ-PIP-USP2/CN AUX Connector adds tremendous flexibility to the IQ System. Its AUX Output capability can be used to turn peripherals on/off or send a signal to another system component. Its AUX Input capability can be used to receive a signal from another compo-

nent and either mute one or both amplifier channels, place one or both amplifier channels in standby, or increment presets.

The AUX connector is an RJ-11 type. Pins 2 and 5 are used to receive a signal and pins 3 and 4 are used to send a signal.

10.5.1 AUX Output

The AUX Output feature provides either 0 or +15 VDC across pins 3 (ground) and 4 (+) when the feature is turned on by IQ for Windows software, depending on whether the polarity is set to inverting or non-inverting (see Section 9.4). A total of 10 milliamps of current is available. A 1.8 K ohm resistor protects against shorts (See Figure 10.12).

There are many possible uses for the AUX Output. For example, it can be used to turn on auxiliary cooling fans. To do this the AUX connector might be used to close a relay.* The relay would then turn the fans on or off. This is shown in Figure 10.13.

By monitoring the operating condition of amplifiers with IQ for Windows, the need for additional cooling would be apparent. The IQ for Windows software could then be used to turn on the appropriate AUX connector. (For more information about turning the AUX feature on/off, consult the IQ for Windows software documentation).

* A suitable solid-state relay for use in such a circuit is available from Crown (CPN D8063-6). Contact your local Crown representative or the Crown Factory Parts Department (219-294-8200) to order.

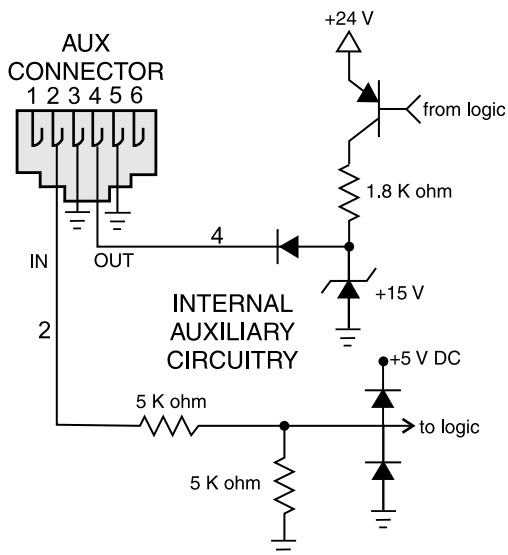


Figure 10.12 The Internal AUX Circuit

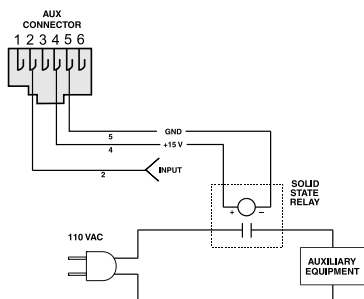


Figure 10.13
A Sample AUX Output Circuit

10.5.2 AUX Input

The AUX connector can be used to sense the presence of an input signal across pins 2 (+) and 5 (ground). Like the AUX Output, the AUX Input polarity can be set to either inverting or non-inverting. When set to non-inverting, a +5 to +35 VDC signal at the input is interpreted as a logic “high” and a signal less than +1.6 VDC is interpreted as a logic “low.”* The AUX Input will act on the received signals depending upon the AUX Input operating mode selected (see Section 9.4).

* A negative signal can also be used as a logic low because the signal is internally clamped to protect the internal circuitry.

10.6 Load Supervision Applications

The IQ-PIP-USP2/CN Load Supervision feature can be used to monitor the amplifier load in real time with almost any program material. Average load impedance is calculated as a function of amplifier output voltage and current. The system requires approximately 20-30 mA of average amplifier output current for adequate supervision. This allows typically low average output power levels of less than ½ watt with most loads. The maximum load impedance for reliable system performance is limited to about 50 ohms. Higher impedances can be measured but may require higher amplifier output levels for reliable operation.

Most amplifier/load systems can be configured and supervised by following these steps:

1. Configure your audio system using a known “good” load, then enable the Load Supervision feature.
2. Provide typical program material at a level high enough to light the “test” indicator.
3. Run the system at this level until the average impedance stabilizes. This may take seconds to minutes depending on level, duty-cycle, etc.
4. Set the nominal impedance at the measured value average. This

optimizes the supervision algorithm for voltage and current levels versus the actual load. Note: a higher nominal setting will require higher output levels.

5. Set the high limit at twice average and the low limit at one-fourth nominal.*
6. Let the system run for extended periods using any and all typical program material.
7. Adjust the high/low limits, if necessary, to account for any variance in average measured impedance.
8. Enable error reporting, if desired.

This procedure should work well for most applications. However, some applications can be a little more difficult. Some very low-level and/or low duty-cycle signals may not adequately “test” the load. Lab and situation testing have shown output levels as small 40 dB below rated amplifier output to be enough for most low-impedance loads. Higher impedance loads such as those used in “lightly-loaded” 70V distribution lines may require signal level near 20 dB below rated output.

The “Nominal Load Impedance” control is used to optimize the system for the most accurate calculation of load impedance. It should be set to the expected nominal (or rated) impedance of the “normal” load. The high limit should be set for at least 2 times the expected nominal or actual measured load, while the low limit should be set to $\frac{1}{2}$ the expected

nominal or actual measured load.

The following example calculates the SPL necessary for supervision of a typical 8-ohm system. While the resulting 80-dB SPL @ 1 meter is definitely above conversation level, it is not uncomfortable.

An “8 ohm” example:

30 mA into 8 ohms = 0.007watts

8-ohm driver sensitivity = 100 dB for 1W @ 1 meter

$0.007W/1W = -20$ dB

Required SPL for supervision test is 100 dB – 20 dB = 80 dB SPL @ 1 meter

10.6.1 Typical Load Characteristics to Know and Understand

It is well known that the typical loudspeaker impedance is not the same for all frequencies. This variance is due to the effect of electrical properties such as the expected increase in impedance at high frequencies due to driver voice-coil inductance, or the peaks and valleys due to passive crossovers. Testing of various passive boxes has shown peaks of 100 ohms or more! Low frequency impedance variation can come from the interaction of the driver compliance with that of the box. The low frequency variations are usually wide bandwidth and may vary from 6 to 30 ohms on an 8-ohm driver.

These anomalies are easily averaged out by the IQ-PIP-USP2/CN supervision algorithm in most systems. However, there may be some extreme situations for very narrow bandwidth (i.e. single-note) signals and/or very widely varying loads

* These limits are somewhat arbitrary but should be a good starting point.

that the algorithm simply cannot overcome. In these cases, widening the high and low limits will help de-

crease the “sensitivity” of supervision and decrease chance of “nuisance” error reports.

10.7 Q-Factor Calculation

Many of the DSP filters on the IQ-PIP-USP2/CN feature adjustable Q-factor, which is a measure of the filter’s selectivity or sharpness. Q-factor is adjustable in fractions of an octave on the IQ-PIP-USP2/CN.

Use the table in Figure 10.14 to determine Q-factor for a given band-

width in octaves. The table relates the Q-factor to bandwidth in octaves according to the equation:

$$Q = \frac{2^{(1/2K)}}{1^{(1/K)} - 1}$$

where K is the number of equal divisions per octave.

Q-factor	K	BW in Octaves
0.200	0.21	4.8
0.266	0.25	4
0.667	0.5	2
1.414	1	1
2.415	1.5	2/3
2.871	2	1/2
4.318	3	1/3
8.651	6	1/6
14.42	10	1/10
28.85	20	1/20
43.28	30	1/30
50.00	34.7	1/35
100.0	69.3	1/70

Figure 10.14 Q-factor vs.Bandwidth

10.8 Working with RJ-11 and RJ-45 Connectors

Pin assignments for standard RJ-11 and RJ-45 connectors are indicated in Figure 10.15.

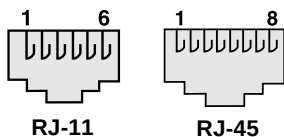


Figure 10.15 RJ-11 & RJ-45 Pin Assignments

When wiring RJ-11 connectors, it is good practice to follow the USOC protocol for RJ-11 connector cable. This protocol assigns wire colors as follows:

- | | |
|----------------|----------------|
| 1 white-green | 4 white-blue |
| 2 white-orange | 5 orange-white |
| 3 blue-white | 6 green-white |

When wiring RJ-45 connectors, it is good practice to follow the EIA/TIA 568B protocol for RJ-45 connector cable. This protocol assigns wire colors as follows:

- | | |
|----------------|---------------|
| 1 white-orange | 5 white-blue |
| 2 orange-white | 6 green-white |
| 3 white-green | 7 white-brown |
| 4 blue-white | 8 brown-white |

Extra care must be taken when attaching RJ-11 and RJ-45 connectors to cable. Make sure you use the appropriate crimping tool and verify that the connector is properly seated into the tool, or damage will result.

Contact the Crown Audio Technical Support Group for additional information about working with RJ-11 and RJ-45 connectors.

10.9 IQ Address Tables

This section provides lookup tables for every valid IQ address. The valid addresses are 1 to 250. Remember that address "0" (zero) will put the IQ-PIP-USP2/CN into a stand-alone mode where it is invisible to the *IQ System*. **Do not use an address number higher than 250!** Addresses above 250 are reserved for special system use.

Remember: No two IQ components of the same type which are connected to the same IQ Bus loop can have the same address.

To use the IQ address tables, simply find the address you want and set the IQ address switch of the IQ-PIP-USP2/CN as shown. See Section 3.1 also.

IQ Address	IQ Address Switch							
	1	2	3	4	5	6	7	8
0	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
1	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
2	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
3	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF
4	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
5	ON	OFF	ON	OFF	OFF	OFF	OFF	OFF
6	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF
7	ON	ON	ON	OFF	OFF	OFF	OFF	OFF
8	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
9	ON	OFF	OFF	ON	OFF	OFF	OFF	OFF
10	OFF	ON	OFF	ON	OFF	OFF	OFF	OFF
11	ON	ON	OFF	ON	OFF	OFF	OFF	OFF
12	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF
13	ON	OFF	ON	ON	OFF	OFF	OFF	OFF
14	OFF	ON	ON	ON	OFF	OFF	OFF	OFF
15	ON	ON	ON	ON	OFF	OFF	OFF	OFF
16	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF
17	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF
18	OFF	ON	OFF	OFF	ON	OFF	OFF	OFF
19	ON	ON	OFF	OFF	ON	OFF	OFF	OFF
20	OFF	OFF	ON	OFF	ON	OFF	OFF	OFF
21	ON	OFF	ON	OFF	ON	OFF	OFF	OFF
22	OFF	ON	ON	OFF	ON	OFF	OFF	OFF
23	ON	ON	ON	OFF	ON	OFF	OFF	OFF
24	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF
25	ON	OFF	OFF	ON	ON	OFF	OFF	OFF
26	OFF	ON	OFF	ON	ON	OFF	OFF	OFF
27	ON	ON	OFF	ON	ON	OFF	OFF	OFF
28	OFF	OFF	ON	ON	ON	OFF	OFF	OFF
29	ON	OFF	ON	ON	ON	OFF	OFF	OFF
30	OFF	ON	ON	ON	ON	OFF	OFF	OFF
31	ON	ON	ON	ON	ON	OFF	OFF	OFF
32	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF
33	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF
34	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF
35	ON	ON	OFF	OFF	OFF	ON	OFF	OFF
36	OFF	OFF	ON	OFF	OFF	ON	OFF	OFF
37	ON	OFF	ON	OFF	OFF	ON	OFF	OFF
38	OFF	ON	ON	OFF	OFF	ON	OFF	OFF
39	ON	ON	ON	OFF	OFF	ON	OFF	OFF
40	OFF	OFF	OFF	ON	OFF	ON	OFF	OFF
41	ON	OFF	OFF	ON	OFF	ON	OFF	OFF
IQ Address	IQ Address Switch							
	1	2	3	4	5	6	7	8
42	OFF	ON	OFF	ON	OFF	ON	OFF	OFF
43	ON	ON	OFF	ON	OFF	ON	OFF	OFF
44	OFF	OFF	ON	ON	OFF	ON	OFF	OFF
45	ON	ON	ON	ON	OFF	ON	OFF	OFF
46	OFF	ON	ON	ON	OFF	ON	OFF	OFF
47	ON	ON	ON	ON	OFF	ON	OFF	OFF
48	OFF	OFF	OFF	OFF	ON	ON	OFF	OFF
49	ON	OFF	OFF	OFF	ON	ON	OFF	OFF
50	OFF	ON	OFF	OFF	ON	ON	OFF	OFF
51	ON	ON	OFF	OFF	ON	ON	OFF	OFF
52	OFF	OFF	ON	OFF	ON	ON	OFF	OFF
53	ON	OFF	ON	OFF	ON	ON	OFF	OFF
54	OFF	ON	ON	OFF	ON	ON	OFF	OFF
55	ON	ON	ON	OFF	ON	ON	OFF	OFF
56	OFF	OFF	OFF	ON	ON	ON	OFF	OFF
57	ON	OFF	OFF	ON	ON	ON	OFF	OFF
58	OFF	ON	OFF	ON	ON	ON	OFF	OFF
59	ON	ON	OFF	ON	ON	ON	OFF	OFF
60	OFF	OFF	ON	ON	ON	ON	OFF	OFF
61	ON	OFF	ON	ON	ON	ON	OFF	OFF
62	OFF	ON	ON	ON	ON	ON	OFF	OFF
63	ON	ON	ON	ON	ON	ON	OFF	OFF
64	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF
65	ON	OFF	OFF	OFF	OFF	OFF	ON	OFF
66	OFF	ON	OFF	OFF	OFF	OFF	ON	OFF
67	ON	ON	OFF	OFF	OFF	OFF	ON	OFF
68	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF
69	ON	OFF	ON	OFF	OFF	OFF	ON	OFF
70	OFF	ON	ON	OFF	OFF	OFF	ON	OFF
71	ON	ON	ON	OFF	OFF	OFF	ON	OFF
72	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF
73	ON	OFF	OFF	ON	OFF	OFF	ON	OFF
74	OFF	ON	OFF	ON	OFF	OFF	ON	OFF
75	ON	ON	OFF	ON	OFF	OFF	ON	OFF
76	OFF	OFF	ON	ON	OFF	OFF	ON	OFF
77	ON	OFF	ON	ON	OFF	OFF	ON	OFF
78	OFF	ON	ON	ON	OFF	OFF	ON	OFF
79	ON	ON	ON	ON	OFF	OFF	ON	OFF
80	OFF	OFF	OFF	OFF	ON	OFF	ON	OFF
81	ON	OFF	OFF	OFF	ON	OFF	ON	OFF
82	OFF	ON	OFF	OFF	ON	OFF	ON	OFF
83	ON	ON	OFF	OFF	ON	OFF	ON	OFF

Figure 10.16 IQ Address Switch (S1) Settings from 0 through 83

IQ Address	IQ Address Switch							
	1	2	3	4	5	6	7	8
84	OFF	OFF	ON	OFF	ON	OFF	ON	OFF
85	ON	OFF	ON	OFF	ON	OFF	ON	OFF
86	OFF	ON	ON	OFF	ON	OFF	ON	OFF
87	ON	ON	ON	OFF	ON	OFF	ON	OFF
88	OFF	OFF	OFF	ON	ON	OFF	ON	OFF
89	ON	OFF	OFF	ON	ON	OFF	ON	OFF
90	OFF	ON	OFF	ON	ON	OFF	ON	OFF
91	ON	ON	OFF	OFF	ON	OFF	ON	OFF
92	OFF	OFF	ON	ON	ON	OFF	ON	OFF
93	ON	OFF	ON	ON	ON	OFF	ON	OFF
94	OFF	ON	ON	ON	ON	OFF	ON	OFF
95	ON	ON	ON	ON	ON	OFF	ON	OFF
96	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF
97	ON	OFF	OFF	OFF	OFF	ON	ON	OFF
98	OFF	ON	OFF	OFF	OFF	ON	ON	OFF
99	ON	ON	OFF	OFF	OFF	ON	ON	OFF
100	OFF	OFF	ON	OFF	OFF	ON	ON	OFF
101	ON	OFF	ON	OFF	OFF	ON	ON	OFF
102	OFF	ON	ON	OFF	OFF	ON	ON	OFF
103	ON	ON	ON	OFF	OFF	ON	ON	OFF
104	OFF	OFF	OFF	ON	OFF	ON	ON	OFF
105	ON	OFF	OFF	ON	OFF	ON	ON	OFF
106	OFF	ON	OFF	ON	OFF	ON	ON	OFF
107	ON	ON	OFF	ON	OFF	ON	ON	OFF
108	OFF	OFF	ON	ON	OFF	ON	ON	OFF
109	ON	OFF	ON	ON	OFF	ON	ON	OFF
110	OFF	ON	ON	ON	OFF	ON	ON	OFF
111	ON	ON	ON	ON	OFF	ON	ON	OFF
112	OFF	OFF	OFF	OFF	ON	ON	ON	OFF
113	ON	OFF	OFF	OFF	ON	ON	ON	OFF
114	OFF	ON	OFF	OFF	ON	ON	ON	OFF
115	ON	ON	OFF	OFF	ON	ON	ON	OFF
116	OFF	OFF	ON	OFF	ON	ON	ON	OFF
117	ON	OFF	ON	OFF	ON	ON	ON	OFF
118	OFF	ON	ON	OFF	ON	ON	ON	OFF
119	ON	ON	ON	OFF	ON	ON	ON	OFF
120	OFF	OFF	OFF	ON	ON	ON	ON	OFF
121	ON	OFF	OFF	ON	ON	ON	ON	OFF
122	OFF	ON	OFF	ON	ON	ON	ON	OFF
123	ON	ON	OFF	ON	ON	ON	ON	OFF
124	OFF	OFF	ON	ON	ON	ON	ON	OFF
125	ON	OFF	ON	ON	ON	ON	ON	OFF
126	OFF	ON	ON	ON	ON	ON	ON	OFF
127	ON	ON	ON	ON	ON	ON	ON	OFF
128	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON
129	ON	OFF	OFF	OFF	OFF	OFF	OFF	ON
130	OFF	ON	OFF	OFF	OFF	OFF	OFF	ON
131	ON	ON	OFF	OFF	OFF	OFF	OFF	ON
132	OFF	OFF	ON	OFF	OFF	OFF	OFF	ON
133	ON	OFF	ON	OFF	OFF	OFF	OFF	ON
134	OFF	ON	ON	OFF	OFF	OFF	OFF	ON
135	ON	ON	ON	OFF	OFF	OFF	OFF	ON
136	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON
137	ON	OFF	OFF	ON	OFF	OFF	OFF	ON
138	OFF	ON	OFF	ON	OFF	OFF	OFF	ON
139	ON	ON	OFF	ON	OFF	OFF	OFF	ON
140	OFF	OFF	ON	ON	OFF	OFF	OFF	ON
141	ON	OFF	ON	ON	OFF	OFF	OFF	ON
142	OFF	ON	ON	ON	OFF	OFF	OFF	ON
143	ON	ON	ON	ON	OFF	OFF	OFF	ON
144	OFF	OFF	OFF	OFF	ON	OFF	OFF	ON
145	ON	OFF	OFF	OFF	ON	OFF	OFF	ON
146	OFF	ON	OFF	OFF	ON	OFF	OFF	ON
147	ON	ON	OFF	OFF	ON	OFF	OFF	ON
148	OFF	OFF	ON	OFF	ON	OFF	OFF	ON
149	ON	OFF	ON	OFF	ON	OFF	OFF	ON
150	OFF	ON	ON	OFF	ON	OFF	OFF	ON
151	ON	ON	ON	OFF	ON	OFF	OFF	ON
152	OFF	OFF	OFF	ON	ON	OFF	OFF	ON
153	ON	OFF	OFF	ON	ON	OFF	OFF	ON
154	OFF	ON	OFF	ON	ON	OFF	OFF	ON
155	ON	ON	OFF	ON	ON	OFF	OFF	ON
156	OFF	OFF	ON	ON	ON	OFF	OFF	ON
157	ON	OFF	ON	ON	ON	OFF	OFF	ON
158	OFF	ON	ON	ON	ON	OFF	OFF	ON
159	ON	ON	ON	ON	ON	OFF	OFF	ON
160	OFF	OFF	OFF	OFF	OFF	ON	OFF	ON
161	ON	OFF	OFF	OFF	OFF	ON	OFF	ON
162	OFF	ON	OFF	OFF	OFF	ON	OFF	ON
163	ON	ON	OFF	OFF	OFF	ON	OFF	ON
164	OFF	OFF	ON	OFF	OFF	ON	OFF	ON
165	ON	OFF	ON	OFF	OFF	ON	OFF	ON
166	OFF	ON	ON	OFF	OFF	ON	OFF	ON
167	ON	ON	ON	OFF	OFF	ON	OFF	ON

Figure 10.17 IQ Address Switch (S1) Settings from 84 through 167

IQ Address	IQ Address Switch							
	1	2	3	4	5	6	7	8
168	OFF	OFF	OFF	ON	OFF	ON	OFF	ON
169	ON	OFF	OFF	ON	OFF	ON	OFF	ON
170	OFF	ON	OFF	ON	OFF	ON	OFF	ON
171	ON	ON	OFF	ON	OFF	ON	OFF	ON
172	OFF	OFF	ON	ON	OFF	ON	OFF	ON
173	ON	OFF	ON	ON	OFF	ON	OFF	ON
174	OFF	ON	ON	ON	OFF	ON	OFF	ON
175	ON	ON	ON	ON	OFF	ON	OFF	ON
176	OFF	OFF	OFF	OFF	ON	ON	OFF	ON
177	ON	OFF	OFF	OFF	ON	ON	OFF	ON
178	OFF	ON	OFF	OFF	ON	ON	OFF	ON
179	ON	ON	OFF	OFF	ON	ON	OFF	ON
180	OFF	OFF	ON	OFF	ON	ON	OFF	ON
181	ON	OFF	ON	OFF	ON	ON	OFF	ON
182	OFF	ON	ON	OFF	ON	ON	OFF	ON
183	ON	ON	ON	OFF	ON	ON	OFF	ON
184	OFF	OFF	OFF	ON	ON	ON	OFF	ON
185	ON	OFF	OFF	ON	ON	ON	OFF	ON
186	OFF	ON	OFF	ON	ON	ON	OFF	ON
187	ON	ON	OFF	ON	ON	ON	OFF	ON
188	OFF	OFF	ON	ON	ON	ON	OFF	ON
189	ON	OFF	ON	ON	ON	ON	OFF	ON
190	OFF	ON	ON	ON	ON	ON	OFF	ON
191	ON	ON	ON	ON	ON	ON	OFF	ON
192	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON
193	ON	OFF	OFF	OFF	OFF	OFF	ON	ON
194	OFF	ON	OFF	OFF	OFF	OFF	ON	ON
195	ON	ON	OFF	OFF	OFF	OFF	ON	ON
196	OFF	OFF	ON	OFF	OFF	OFF	ON	ON
197	ON	OFF	ON	OFF	OFF	OFF	ON	ON
198	OFF	ON	ON	OFF	OFF	OFF	ON	ON
199	ON	ON	ON	OFF	OFF	OFF	ON	ON
200	OFF	OFF	OFF	ON	OFF	OFF	ON	ON
201	ON	OFF	OFF	ON	OFF	OFF	ON	ON
202	OFF	ON	OFF	ON	OFF	OFF	ON	ON
203	ON	ON	OFF	ON	OFF	OFF	ON	ON
204	OFF	OFF	ON	ON	OFF	OFF	ON	ON
205	ON	OFF	ON	ON	OFF	OFF	ON	ON
206	OFF	ON	ON	ON	OFF	OFF	ON	ON
207	ON	ON	ON	ON	OFF	OFF	ON	ON
208	OFF	OFF	OFF	OFF	ON	OFF	ON	ON
209	ON	OFF	OFF	OFF	ON	OFF	ON	ON

IQ Address	IQ Address Switch							
	1	2	3	4	5	6	7	8
210	OFF	ON	OFF	OFF	ON	OFF	ON	ON
211	ON	ON	OFF	OFF	ON	OFF	ON	ON
212	OFF	OFF	ON	OFF	ON	OFF	ON	ON
213	ON	OFF	ON	OFF	ON	OFF	ON	ON
214	OFF	ON	ON	OFF	ON	OFF	ON	ON
215	ON	ON	ON	OFF	ON	OFF	ON	ON
216	OFF	OFF	OFF	ON	ON	OFF	ON	ON
217	ON	OFF	OFF	ON	ON	OFF	ON	ON
218	OFF	ON	OFF	ON	ON	OFF	ON	ON
219	ON	ON	OFF	ON	ON	OFF	ON	ON
220	OFF	OFF	ON	ON	ON	OFF	ON	ON
221	ON	OFF	ON	ON	ON	OFF	ON	ON
222	OFF	ON	ON	ON	ON	OFF	ON	ON
223	ON	ON	ON	ON	ON	OFF	ON	ON
224	OFF	OFF	OFF	OFF	ON	ON	ON	ON
225	ON	OFF	OFF	OFF	OFF	ON	ON	ON
226	OFF	ON	OFF	OFF	OFF	ON	ON	ON
227	ON	ON	OFF	OFF	OFF	ON	ON	ON
228	OFF	OFF	ON	OFF	OFF	ON	ON	ON
229	ON	OFF	ON	OFF	OFF	ON	ON	ON
230	OFF	ON	ON	OFF	OFF	ON	ON	ON
231	ON	ON	ON	OFF	OFF	ON	ON	ON
232	OFF	OFF	OFF	ON	OFF	ON	ON	ON
233	ON	OFF	OFF	ON	OFF	ON	ON	ON
234	OFF	ON	OFF	ON	OFF	ON	ON	ON
235	ON	ON	OFF	ON	OFF	ON	ON	ON
236	OFF	OFF	ON	ON	OFF	ON	ON	ON
237	ON	OFF	ON	ON	OFF	ON	ON	ON
238	OFF	ON	ON	ON	OFF	ON	ON	ON
239	ON	ON	ON	ON	OFF	ON	ON	ON
240	OFF	OFF	OFF	OFF	ON	ON	ON	ON
241	ON	OFF	OFF	OFF	ON	ON	ON	ON
242	OFF	ON	OFF	OFF	ON	ON	ON	ON
243	ON	ON	OFF	OFF	ON	ON	ON	ON
244	OFF	OFF	ON	OFF	ON	ON	ON	ON
245	ON	OFF	ON	OFF	ON	ON	ON	ON
246	OFF	ON	ON	OFF	ON	ON	ON	ON
247	ON	ON	ON	OFF	ON	ON	ON	ON
248	OFF	OFF	OFF	ON	ON	ON	ON	ON
249	ON	OFF	OFF	ON	ON	ON	ON	ON
250	OFF	ON	OFF	ON	ON	ON	ON	ON

Figure 10.18 IQ Address Switch (S1) Settings from 168 through 250

10.10 Signal Flow Block Diagram

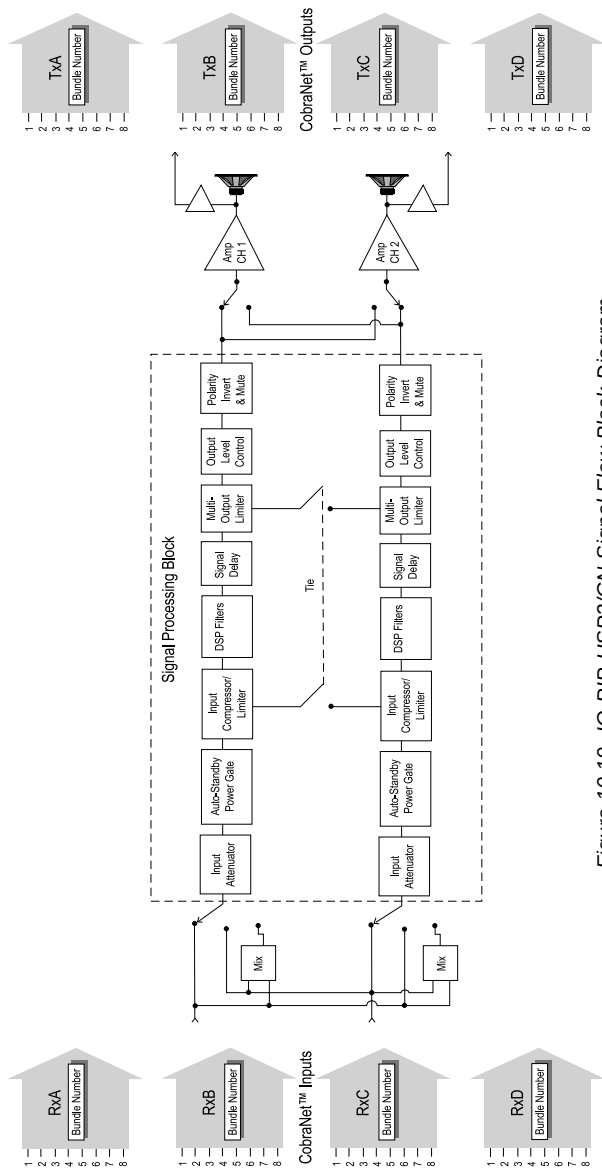


Figure 10.19 IQ-PIP-USB2/CN Signal Flow Block Diagram

11 Specifications

11.1 General

Internal Controls: An 8-segment DIP switch sets the IQ address (decimal range: 1–250).* A Reset/Preset switch, accessible with a straightened paper clip through the PIP panel, selects the next user preset if pressed for less than 2 seconds, resets the PIP to preset “0” if pressed for more than 2 seconds, or restores all settings and presets to factory default if pressed while applying power.

Connectors: IQ Bus: RJ-45 connector for input, RJ-45 connector for output. AUX In/Aux Out: RJ-11 connector. CobraNet Digital Audio Input and Output: RJ-45 connector for Primary Network, RJ-45 connector for Secondary Network.

Indicators: A yellow DATA indicator flashes when a valid IQ command is received from the IQ System via the IQ Bus. A green PRESET indicator flashes to indicate the user preset number currently selected in memory (if the PRESET indicator does not flash the preset number when selected, this indicates the preset has been modified by the user). Two dual-color indicators provide status of the CobraNet™ network. The left indicator on the Primary and Secondary RJ-45 connectors flashes green if the network link is connected and operating normally, and flashes red if the port is in

a “Fault” condition. The right indicator on the Primary and Secondary RJ-45 connectors is ON green if the port is “in-use,” and is ON orange if the port is operating as the network “Conductor.”

Memory Backup: 1 Mbyte non-volatile FLASH memory for backup of run-time parameters, presets, and program storage. Capable of greater than 10-year data retention and estimated 20+ year life-cycle.

Power Requirements: Power draw: 410 mA @ +24 VDC and 40 mA @ –24 VDC. When installed into a Crown PIP2-compatible amplifier, the unit receives ± 24 VDC from the amplifier. No external power is required.

Total Power Dissipation: 10.5 watts.

11.2 IQ Bus Data Communication

Protection: If IQ communication is lost, the unit will continue to function with the last commands received.

Data Rate: 38.4 K BAUD.

Data Format: Serial, binary, asynchronous; 1 start bit; 1 stop bit; 8 data bits; no parity.

IQ Bus Interface Type: Optically isolated 20 milliamp serial loop.

Operation: Half duplex.

Transmission Distance: Variable from 200 to 3000 feet (61 to 914 m), depending upon wire capacitance. Typically 1000 feet (305 M) using shielded twisted-pair wire, #26 AWG

* If address “0” is selected, the IQ-PIP-USP2/CN will operate in stand-alone mode. In this mode, the IQ Bus port is deactivated.

or larger. Can be extended with an IQ Repeater.

11.3 Audio

Please note: The audio specifications are referenced to 0.775 V (0 dBu). Measurements were made at the output of the IQ-PIP-USP2/CN module.

Digital Signal Processor (DSP): 60 MHz Motorola 56002 DSP processor provides 30 million operations per second.

Analog to Digital Conversion (ADC): 24-bit, 48-kHz sample rate, Delta-Sigma converter.

Digital to Analog Conversion (DAC): 24-bit, 48-kHz sample rate, Delta-Sigma converter.

Signal to Noise Ratio: Greater than 100 dB (A-weighted, 20 Hz to 20 kHz, audio sourced from muted CobraNet™ channels).

Frequency Response: ± 0.5 dB, 20 Hz to 20 kHz (referenced to 1 kHz, 0 dBu input signal).

Distortion: Less than 0.05% THD+N, 20 Hz to 20 kHz (referenced to 1 kHz, 0 dBu input signal).

Crosstalk: better than -80 dB, full-scale input level, 20 Hz to 20 kHz input frequency sweep, 20 Hz to 20 kHz bandwidth.

Listen Bus Distortion: Less than 0.1% THD+N, 20 Hz to 20 kHz bandwidth (1 kHz, 0 dB full scale input signal at the active PIP2 AO1 or AO2 input).

Listen Bus Signal to Noise: Greater than 80 dB, 20 Hz to 20 kHz bandwidth (audio sourced from muted amplifier channels. Measured at receiving CobraNet node outputs).

Maximum Output Level: +20 dBu.

11.4 IQ System Data Acquisition

Input/Output Monitor Accuracy: Typically ± 1 dB.

12 Factory Service

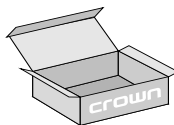
To obtain factory service, fill out the **service information page** found in the back of this manual and send it along with your proof of purchase and the defective unit to the Crown factory.

For warranty service, we will pay for ground shipping both ways in the United States. Contact Crown Factory Service or Technical Support to obtain prepaid shipping labels prior to sending the unit. Or, if you prefer, you may prepay the cost of shipping, and Crown will reimburse you. Send copies of the shipping receipts to Crown to receive reimbursement.

Your repaired unit will be returned via UPS ground. Please contact us if other arrangements are required.

Factory Service Shipping Instructions:

1. When sending a Crown product to the factory for service, be sure to fill out the service information form that follows and enclose it inside your unit's shipping pack. Do not send the service information form separately.
2. To ensure the safe transportation of your unit to the factory, ship it in an original factory packing container. If you don't have one, call or write Crown's Parts Department. With the exception of polyurethane or wooden crates, any other packing material will not be sufficient to withstand the stress of shipping. **Do not use loose, small size packing materials.**



Always use the original factory pack to transport the unit.

3. Do not ship the unit in any kind of cabinet (wood or metal). Ignoring this warning may result in extensive damage to the unit and the cabinet. Accessories are not needed—do not send the product documentation, cables and other hardware.

If you have any questions, please call or write the Crown Technical Support Group.

Crown Audio Customer Service

Technical Support / Factory Service
Plant 2 SW, 1718 W. Mishawaka Rd.,
Elkhart, Indiana 46517 U.S.A.

Telephone: 219-294-8200
800-342-6939
(North America,
Puerto Rico, and
Virgin Islands only)

Facsimile: 219-294-8301
(Technical Support)
219-294-8124
(Factory Service)

Internet: www.crownaudio.com
Email: iqsupport@crowntl.com



THREE YEAR FULL WARRANTY

NORTH AMERICA

SUMMARY OF WARRANTY

The Crown Audio Division of Crown International, Inc., 1718 West Mishawaka Road, Elkhart, Indiana 46517-4095 U.S.A. warrants to you, the ORIGINAL PURCHASER and ANY SUBSEQUENT OWNER of each NEW Crown product, for a period of three (3) years from the date of purchase by the original purchaser (the "warranty period") that the new Crown product is free of defects in materials and workmanship. We further warrant the new Crown product regardless of the reason for failure, except as excluded in this Warranty.

ITEMS EXCLUDED FROM THIS CROWN WARRANTY

This Crown Warranty is in effect only for failure of a new Crown product which occurred within the Warranty Period. It does not cover any product which has been damaged because of any intentional misuse, accident, negligence, or loss which is covered under any of your insurance contracts. This Crown Warranty also does not extend to the new Crown product if the serial number has been defaced, altered, or removed.

WHAT THE WARRANTOR WILL DO

We will remedy any defect, regardless of the reason for failure (except as excluded), by repair, replacement, or refund. We may not elect refund unless you agree, or unless we are unable to provide replacement, and repair is not practical or cannot be timely made. If a refund is elected, then you must make the defective or malfunctioning product available to us free and clear of all liens or other encumbrances. The refund will be equal to the actual purchase price, not including interest, insurance, closing costs, and other finance charges less a reasonable depreciation on the product from the date of original purchase. Warranty work can only be performed at our authorized service centers or at the factory. We will remedy the defect and ship the product from the service center or our factory within a reasonable time after receipt of the defective product at our authorized service center or our factory. All expenses in remedying the defect, including surface shipping costs in the United States, will be borne by us. (You must bear the expense of shipping the product between any foreign country and the port of entry in the United States and all taxes, duties, and other customs fees for such foreign shipments.)

HOW TO OBTAIN WARRANTY SERVICE

You must notify us of your need for warranty service not later than ninety (90) days after expiration of the warranty period. All components must be shipped in a factory pack, which, if needed, may be obtained from us free of charge. Corrective action will be taken within a reasonable time of the date of receipt of the defective product by us or our authorized service center. If the repairs made by us or our authorized service center are not satisfactory, notify us or our authorized service center immediately.

DISCLAIMER OF CONSEQUENTIAL & INCIDENTAL DAMAGES

YOU ARE NOT ENTITLED TO RECOVER FROM US ANY INCIDENTAL DAMAGES RESULTING FROM ANY DEFECT IN THE NEW CROWN PRODUCT. THIS INCLUDES ANY DAMAGE TO ANOTHER PRODUCT OR PRODUCTS RESULTING FROM SUCH A DEFECT. **SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATIONS OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.**

WARRANTY ALTERATIONS

No person has the authority to enlarge, amend, or modify this Crown Warranty. This Crown Warranty is not extended by the length of time which you are deprived of the use of the new Crown product. Repairs and replacement parts provided under the terms of this Crown Warranty shall carry only the unexpired portion of this Crown Warranty.

DESIGN CHANGES

We reserve the right to change the design of any product from time to time without notice and with no obligation to make corresponding changes in products previously manufactured.

LEGAL REMEDIES OF PURCHASER

THIS CROWN WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE. No action to enforce this Crown Warranty shall be commenced later than ninety (90) days after expiration of the warranty period.

THIS STATEMENT OF WARRANTY SUPERSEDES ANY OTHERS CONTAINED IN THIS MANUAL FOR CROWN PRODUCTS.

WORLDWIDE

SUMMARY OF WARRANTY

The Crown Audio Division of Crown International, Inc., 1718 West Mishawaka Road, Elkhart, Indiana 46517-4095 U.S.A. warrants to you, the ORIGINAL PURCHASER and ANY SUBSEQUENT OWNER of each NEW Crown¹ product, for a period of three (3) years from the date of purchase by the original purchaser (the "warranty period") that the new Crown product is free of defects in materials and workmanship, and we further warrant the new Crown product regardless of the reason for failure, except as excluded in this Crown Warranty.

¹ Note: If your unit bears the name "Amcron," please substitute it for the name "Crown" in this warranty.

ITEMS EXCLUDED FROM THIS CROWN WARRANTY

This Crown Warranty is in effect only for failure of a new Crown product which occurred within the Warranty Period. It does not cover any product which has been damaged because of any intentional misuse, accident, negligence, or loss which is covered under any of your insurance contracts. This Crown Warranty also does not extend to the new Crown product if the serial number has been defaced, altered, or removed.

WHAT THE WARRANTOR WILL DO

We will remedy any defect, regardless of the reason for failure (except as excluded), by repair, replacement, or refund. We may not elect refund unless you agree, or unless we are unable to provide replacement, and repair is not practical or cannot be timely made. If a refund is elected, then you must make the defective or malfunctioning product available to us free and clear of all liens or other encumbrances. The refund will be equal to the actual purchase price, not including interest, insurance, closing costs, and other finance charges less a reasonable depreciation on the product from the date of original purchase. Warranty work can only be performed at our authorized service centers. We will remedy the defect and ship the product from the service center within a reasonable time after receipt of the defective product at our authorized service center.

HOW TO OBTAIN WARRANTY SERVICE

You must notify us of your need for warranty service not later than ninety (90) days after expiration of the warranty period. All components must be shipped in a factory pack. Corrective action will be taken within a reasonable time of the date of receipt of the defective product by our authorized service center. If the repairs made by our authorized service center are not satisfactory, notify our authorized service center immediately.

DISCLAIMER OF CONSEQUENTIAL & INCIDENTAL DAMAGES

YOU ARE NOT ENTITLED TO RECOVER FROM US ANY INCIDENTAL DAMAGES RESULTING FROM ANY DEFECT IN THE NEW CROWN PRODUCT. THIS INCLUDES ANY DAMAGE TO ANOTHER PRODUCT OR PRODUCTS RESULTING FROM SUCH A DEFECT.

WARRANTY ALTERATIONS

No person has the authority to enlarge, amend, or modify this Crown Warranty. This Crown Warranty is not extended by the length of time which you are deprived of the use of the new Crown product. Repairs and replacement parts provided under the terms of this Crown Warranty shall carry only the unexpired portion of this Crown Warranty.

DESIGN CHANGES

We reserve the right to change the design of any product from time to time without notice and with no obligation to make corresponding changes in products previously manufactured.

LEGAL REMEDIES OF PURCHASER

No action to enforce this Crown Warranty shall be commenced later than ninety (90) days after expiration of the warranty period.

THIS STATEMENT OF WARRANTY SUPERSEDES ANY OTHERS CONTAINED IN THIS MANUAL FOR CROWN PRODUCTS.



**THREE YEAR
FULL WARRANTY**

Crown Factory Service Information

Shipping Address: Crown Factory Service,
Plant 2 SW, 1718 W. Mishawaka Rd., Elkhart, IN U.S.A. 46517
Phone: 1-800-342-6939 or 1-219-294-8200 Fax: 1-219-294-8124

Owner's Name: _____

Shipping Address: _____

Phone Number: _____ Fax Number: _____

Model: _____ Serial Number: _____

Purchase Date: _____

NATURE OF PROBLEM

(Be sure to describe the conditions that existed when the problem occurred and what attempts were made to correct it.)

Other equipment in your system: _____

If warranty has expired, payment will be:

☐ Cash/Check ☐ VISA ☐ MasterCard ☐ C.O.D.

Card Number: _____

Exp. Date: _____ Signature: _____

**ENCLOSE THIS PORTION WITH THE UNIT.
DO NOT MAIL SEPARATELY.**