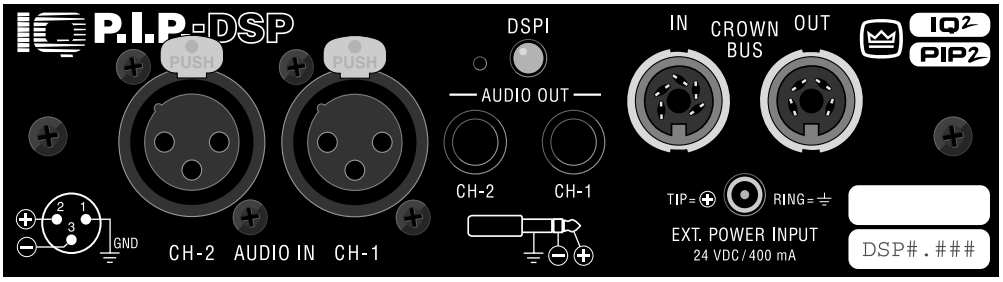
P.I.P.-DSP

REFERENCE MANUAL



An IQ System® Programmable Input Processor with DSP for Crown® P.I.P.®-compatible Power Amplifiers

Printed on recycled paper.

103291-2
9/99

THREE YEAR FULL WARRANTY

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 Crown[1] 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 AND 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.

9/90

Telephone: 219-294-8200. Facsimile: 219-294-8301

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 AND 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.

Telephone: 219-294-8200. Facsimile: 219-294-8301 9/90

Important Safety Instructions

1) Read these instructions.
2) Keep these instructions.
3) Heed all warnings.
4) Follow all instructions.
5) Do not use this apparatus near water.
6) Clean only with a damp cloth.
7) Do not block any of the ventilation openings. Install in accordance with the manufacturer's instructions.
8) Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus that produce heat.
9) Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding-type plug has two blades and a third grounding prong. The wide blade or the third prong is provided for your safety. When the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.
10) Protect the power cord from being walked on or pinched, particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.
11) Only use attachments/accessories specified by the manufacturer.
12) Use only with a cart, stand, bracket, or table specified by the manufacturer, or sold with the apparatus. When a cart is used, use caution when moving the cart/apparatus combination to avoid injury from tip-over.
13) Unplug this apparatus during lightning storms or when unused for long periods of time.
14) Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.

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 Division 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 Fax Back (North America only): 800-294-4094 or 219-293-9200

Fax Back (International): 219-294-8100 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 A digital Device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. 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. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

"The user is cautioned that any changes or modifications not expressly approved by Crown International could void the user's authority to operate the equipment."

Quick Install Procedure

This procedure is provided for those who are already familiar with Crown's *IQ System* and who would like to install the *IQ–P.I.P.–DSP* in the shortest time possible. Less experienced installers or those wishing a full explanation of the installation procedure are encouraged to go to Section 4 where the full installation procedure is described.

Prepare the IQ–P.I.P.–DSP:

1. Set the IQ address switch SW1 (Figures 4.1 and 4.2) on the *IQ–P.I.P.–DSP* to an unused IQ address. (Tip: Record the IQ address on the small blank label that is provided on lower right corner of the *P.I.P.* panel.)
2. Set jumpers JP4 and JP5. Set both jumper JP4 and JP5 to the "OUT" position if either a *PIP2*-compatible or *Macro-Tech 5000VZ* amplifier will be used (Figures 2.1 and 4.7). Both JP4 and JP5 should be set to the "IN" position for all other amplifiers.

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 *P.I.P.* or cover panel from the amplifier back panel (two screws).
6. Set the amplifier input sensitivity switch to 0.775 V. (See the *Reference* or *Owner's Manual* of the amplifier.)

Install the IQ–P.I.P.–DSP into the amplifier:

7. Carefully ground yourself to the chassis of the amplifier before installing the *IQ–P.I.P.–DSP*. It is a good idea to maintain ground contact between yourself and the amplifier while inserting the module into the *P.I.P.* card rails in the next step.
8. Install the *IQ–P.I.P.–DSP* into the amplifier:

   Standard P.I.P. Amplifiers: Align the edges of the *IQ–P.I.P.–DSP* in the *P.I.P.* card rails and firmly push the unit in until it is seated against the mounting bracket (Figure 4.4).

   PIP2 Compatible Amplifiers: Connect the *PIP2* input adapter to the amplifier input cables. Plug the *IQ–P.I.P.–DSP* into the *PIP2* input adapter and insert the assembly into the *P.I.P.* opening in the back of the amplifier (Figures 4.5 and 4.6).
9. Tighten the two *P.I.P.* mounting screws until it is secured to the amplifier back panel.

Install the wiring:

10. Connect the *IQ–P.I.P.–DSP* to the *IQ System* via the Crown Bus (see Section 4.6 if more information is needed).
11. Connect the audio signal wiring to the *IQ–P.I.P.–DSP*. This includes the XLR input wiring and the phone jack daisy chain wiring—if desired (see Section 4.7 if more information is needed). *Note: FCC and EC EMI regulations require that the EMI suppression core provided with this P.I.P. be installed on the daisy chain cables, if used.*
12. Connect the amplifier back to the AC receptacle. *Note: The IQ–P.I.P.–DSP may require an external power supply in some amplifiers. See Section 4.8 for more information.*

Adjust the levels and scale factors:

13. Turn the level controls of the amplifier to their full setting. Use the software-controlled input attenuators on the *IQ–P.I.P.–DSP* to adjust the input levels down.
14. *Standard P.I.P. Amplifiers:* Manually configure the scaling factors of the *IQ–P.I.P.–DSP* with appropriate *IQ System* software.

    PIP2 Compatible Amplifiers: The scaling factors will be automatically set.

CONTENTS

ILLUSTRATIONS

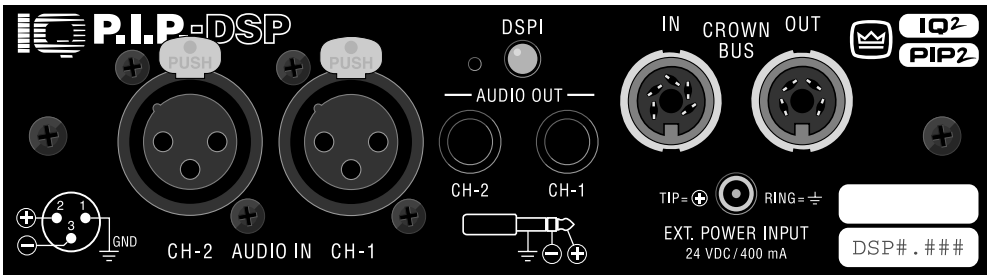


Fig. 1.1 IQ–P.I.P.–DSP

1 Welcome

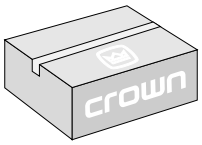
The *IQ–P.I.P.–DSP* is a powerful IQ component that connects an IQ-compatible amplifier to the Crown Bus of an *IQ System* so the amplifier can be controlled and monitored. Its DSP (digital signal processing) capabilities enable it to offer a variety of programmable functions, such as filters and crossovers, signal delay, input compressor and output limiter and a variety of other useful features similar to those included with our other *SmartAmp™ IQ P.I.P.s*. The module is powered by the amplifier (an external AC power adapter may be required with certain amplifiers).

The *IQ–P.I.P.–DSP* is a *PIP2* input module for Crown *P.I.P.*® (programmable input processor) and *PIP2*-compatible amplifiers. Because it is also an *IQ2*-series component, it supports Crown's 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–P.I.P.–DSP*.

To ensure fast and accurate processing, the *IQ–P.I.P.-DSP* features two separate onboard processors. A Motorola 6811 microprocessor inside the *P.I.P.* oversees communication with the *IQ System* and most *SmartAmp* features (similar to an *IQ–P.I.P.–SMT)*. A Motorola 56002 microprocessor handles all digital signal processing.

Each *IQ–P.I.P.–DSP* is easy to install and includes an IQ address switch, allowing the unit to have a unique address on the Crown Bus. Its error-tolerant design enables it to automatically reset itself if noise "spikes" or other disturbances are encountered.

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.



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. For added safety, touch the outer metal collar of either Crown Bus connector. Avoid unnecessarily touching the components, edge connector or solder pads on the circuit boards.

Please unpack and inspect the unit for any damage that may have occurred 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.**

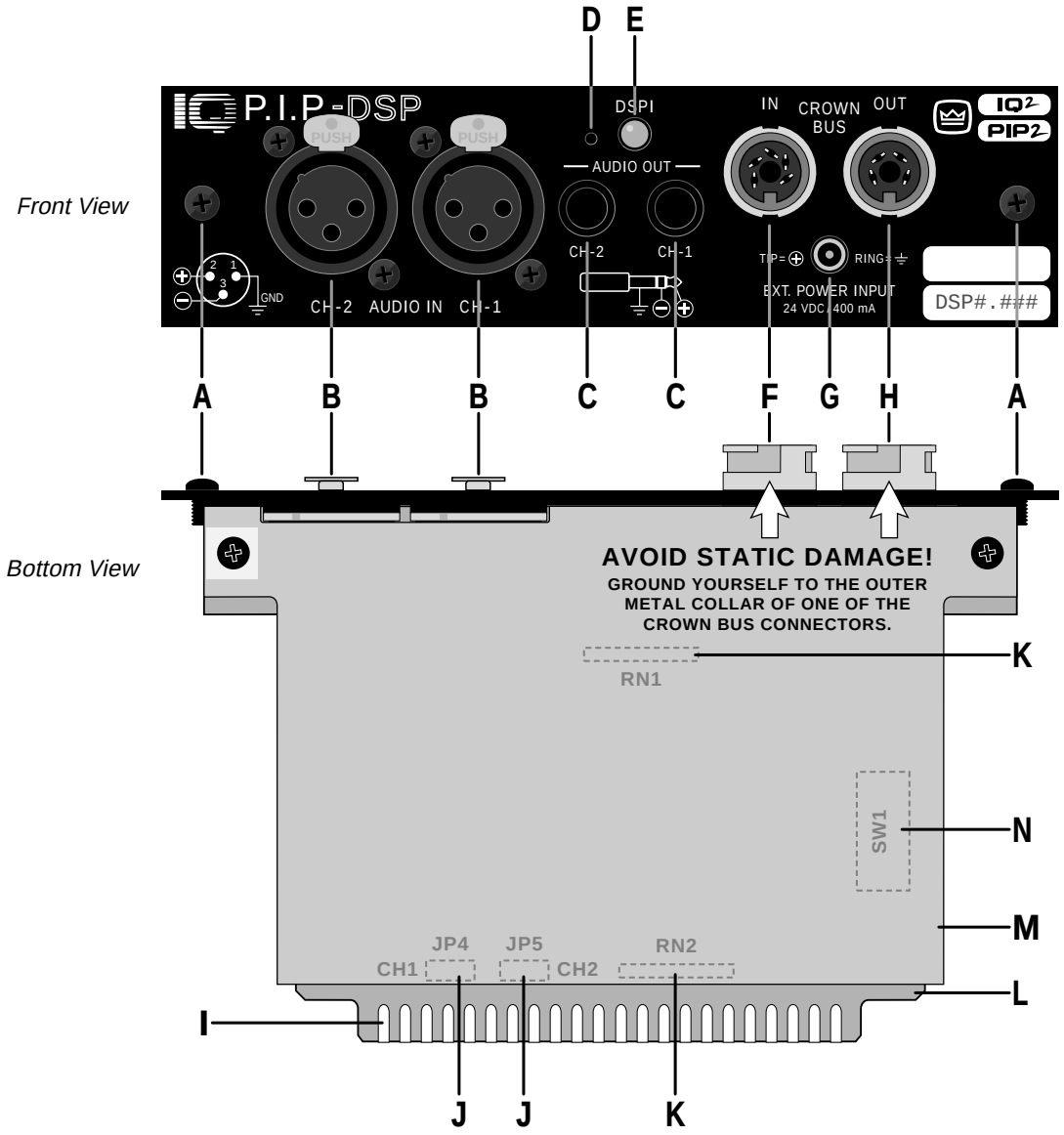


Fig. 2.1 The IQ–P.I.P.–DSP Facilities

2 Facilities

A. Mounting Screws

The *IQ–P.I.P.–DSP* is secured to the back panel of the amplifier with two phillips-head screws and star-tooth lock washers. The lock washers are required for proper ground connection.

B. Balanced Audio Inputs

A 3-pin female XLR connector is provided for balanced audio input to each channel of the amplifier. Pin 1 is ground (gnd); pin 2 is not inverted (+); and pin 3 is inverted (–). *Do not use the Ch.2 input if the amplifier is configured in either Bridge or Parallel-Mono mode.*

C. Balanced Audio Outputs

A balanced phone jack is provided at the output of each channel for “daisy chain” connection to other components. Either balanced (tip, ring, sleeve) or unbalanced (tip, sleeve) wiring may be used. The audio signal feeding these outputs is post-processed.

D. Reset Switch

A multifunction reset switch is provided to restore the *IQ–P.I.P.–DSP* to a prior state. It can be depressed with a straightened paper clip through the small hole in the *P.I.P.* panel. Press the reset switch for less than 2 seconds and all settings, except the amplifier model scale factors, will be reset with "user default" parameters and the Data LED will flash once. (If no "user default" settings have been stored, the unit will be reset to the "factory default" settings described next.) Press the reset switch for more than 2 seconds and the same settings will be reset with "factory default" parameters and the Data LED will flash twice. After the unit has been reset to the factory default settings, it will behave like a standard *P.I.P.-FX* until it is reprogrammed by an *IQ System* or it is toggled to the "user default" settings.

WARNING: Pressing the reset switch can cause the *IQ–P.I.P.–DSP* to emit a brief pulse. We recommend that the level controls of the amplifier be turned down before pressing the reset switch.

E. Data Signal Presence Indicator (DSPI)

The Data Signal Presence Indicator (DSPI) is a Data LED which flashes whenever a valid IQ command has been received. The indicator can also be forced to stay on to aid rapid troubleshooting of the Crown Bus wiring.

F. Crown Bus Input Connector

A lockable 5-pin female DIN connector is provided for input connection to the Crown Bus. A mating Switchcraft 502-series connector can be ordered from Crown (part C 7776-5). Pin 1 is negative (–), pin 2 is positive (+), and pin 3 is ground (gnd). Pins 4 and 5 are not used.

G. External Power Input

A mini jack is provided to receive power from an external 24 VDC, 400 mA source. External power is not needed when the *IQ–P.I.P.–DSP* is installed in a *Macro-Tech 5000VZ* or *10,000*, a Com-Tech, a Reference or a *PIP2*-compatible amplifier. However, other *Macro-Tech* models may require additional power for the *IQ–P.I.P.–DSP*. An external 120 VAC power adapter (C 7926-6) is available from Crown. See Section 3.8.

CAUTION: Use only an individual, isolated power supply for each *IQ–P.I.P.–DSP*. Do not attempt to share a common power supply with more than one unit or the *IQ–P.I.P.–DSP* modules may be damaged.

H. Crown Bus Output Connector

A lockable 4-pin female DIN connector is used for output connection to the Crown Bus. A mating Switchcraft 502 series connector can be ordered from Crown (part C 7777-3). Pin 1 is negative (–) and pin 2 is positive (+). Pins 3 and 4 are not used.

I. *P.I.P.* Edge Connector

The gold-plated edge connector of the top IQ circuit board inserts into the *P.I.P.* connector inside the back of the amplifier. Use care when installing a *P.I.P.* module to be certain that the edge connector is properly inserted into the amplifier's *P.I.P.* connector.

J. Amplifier Output Pad Jumpers (JP4, JP5)

These jumpers enable the circuitry that pads the output signal feeding the *IQ–P.I.P.–DSP* so it can be properly scaled. They should normally be set to the "IN" position as marked on the digital circuit board. Use the "OUT" position whenever the unit is installed into a *PIP2*-compatible or *Macro-Tech 5000VZ* amplifier.

K. *PIP2* SIP Sockets (RN1, RN2)

These eight-pin SIP (single in-line package) sockets are provided for full *PIP2* compatibility. *IQ-P.I.P.-DSP-PIP2* modules (required for PIP2-compatible amplifiers) should come with the SIP networks already installed. The SIP networks are not required and should be absent on standard *IQ-P.I.P.-DSP* modules.

L. IQ Circuit Board (Top)

The top circuit board contains the IQ communication and data acquisition circuitry, including the IQ address switch (SW1), amplifier output pad jumpers (JP4, JP5), *PIP2* SIP sockets (RN1, RN2) and the *P.I.P.* edge connector.

M. Audio Circuit Board (Bottom)

The bottom circuit board contains the audio analog and digital signal processing circuitry.

N. IQ Address Switch (SW1)

An 8-section DIP (dual in-line package) switch is used to set the IQ address of the unit (see Section 3.1). This switch is located on the top circuit board. Each IQ component on a Crown 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 Crown Bus loop.

3 Installation

Before beginning, please carefully note:

CAUTION: STATIC ELECTRICITY MAY DAMAGE THE *IQ–P.I.P.–DSP* MODULE. Use caution when handling the unit. Carefully ground yourself BEFORE touching the *IQ–P.I.P.–DSP* module. For added safety, touch the outer metal collar of either Crown Bus connector (see Figure 2.1). This should safely discharge any static electricity through the ground plane of the module. Avoid unnecessarily touching the components, edge connector or solder pads on the circuit boards.

NOTE — Amplifier Compatibility

The version of the *IQ-P.I.P.-DSP* card you received will vary depending on whether you indicated the card will be installed on a PIP2-compatible amplifier (such as the Crown MA-5000VZ or CT-10 Series amplifiers). The correct card to install in a PIP2-compatible amplifier is the *IQ-P.I.P.-DSP-PIP2*. The standard *IQ-P.I.P.-DSP* should be ordered for non-PIP2-compatible amplifiers.

Should you later wish to change the amplifier you are using for your *IQ-P.I.P.-DSP* installation, it is possible to alter the card's configuration by simply removing or installing two SIPS from the card's circuit boards[1]. For instructions on installing or removing these SIPS, contact Crown Technical Support.

3.1 Prepare the *IQ–P.I.P.–DSP*

1. **Set the IQ address switch SW1.** 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 Crown Bus.

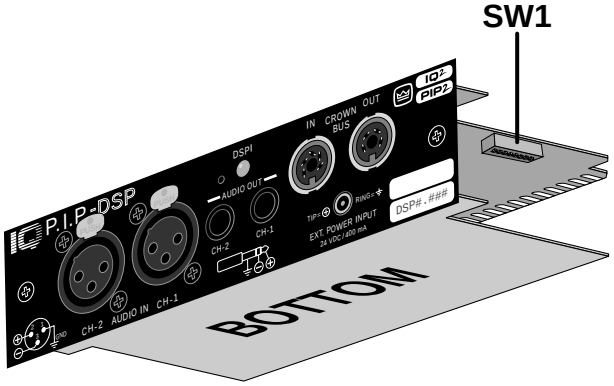


Fig. 3.1 IQ Address Switch (SW1) Location

The 8-segment DIP switch (SW1) shown above is used to set the IQ address of the *IQ–P.I.P.–DSP.* No two IQ components of the same type which are connected to the same Crown Bus can have the same address. Suppose, for example, an *IQ System* has two Crown Bus loops, 1 and 2, and this *IQ–P.I.P.–DSP* is to be installed into loop 1 and given an address of 77. No other *IQ–P.I.P.–DSP* can be given the same address in loop 1. However, an *IQ–P.I.P.–DSP* in loop 2 can have the same address.

Different IQ components in the same Crown Bus loop can have the same address. For example, both an *SMX-6* mixer and an *IQ–P.I.P.–DSP* 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 reserved for special use. An address of "0" (zero) should never be used except to put the *IQ–P.I.P.–DSP* into a stand-alone mode where it is invisible to the *IQ System* and acts as a "dumb" balanced audio input.

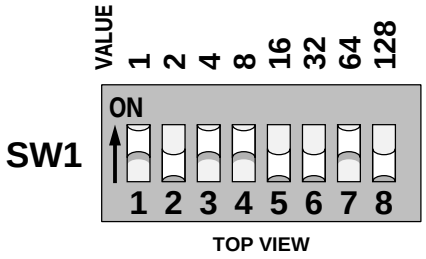


Fig. 3.2 IQ Address Switch (SW1) Values

Switch SW1 is located on the right side on the underside of the top circuit board (Figure 3.1). It has eight segments because it actually contains eight tiny switches inside. There is an arrow printed on the switch along its left side that points to the "ON" position and the switches are numbered along the bottom (Figure 3.2).

Each of the eight switches in SW1 has a value which doubles as the 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 3.2 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 7. The tables show the switch

[1] *IQ-P.I.P.-DSP-PIP2* has SIPS installed; *IQ-P.I.P.-DSP* has SIPS removed.

settings for all 250 addresses.

2. **Set the jumpers JP4 and JP5.** If the *IQ–P.I.P.–DSP* is being installed into a *PIP2*-compatible or *Macro-Tech 5000VZ* amplifier, move both jumper JP4 and JP5 on the IQ circuit board to the "OUT" position (Figures 2.1 and 3.6). Set both JP4 and JP5 to the "IN" position for all other amplifiers.

3.2 Prepare the Amplifier

3. **Turn down the level controls** (full counter-clockwise) and **turn off the amplifier**.
4. **Disconnect the amplifier's power cord.**
5. **Remove the existing *P.I.P.*** or cover panel from the amplifier back panel (two screws). For *PIP2* amplifiers this may involve disconnecting the *P.I.P.* from a *PIP2* input adapter (Figure 3.4). If a *PIP2* input adapter is already present, do not remove the ribbon cables from the adapter. Otherwise you will have to reconnect them in Step 9.
6. **Set the amplifier input sensitivity to 0.775 V.** (See the amplifier's *Reference Manual*.)

3.3 Install the *IQ–P.I.P.–DSP* into the Amplifier

7. **Carefully ground yourself** to the chassis of the amplifier before installing the *IQ–P.I.P.–DSP*. It is a good idea to maintain ground contact between yourself and the amplifier while inserting the module into the *P.I.P.* card rails (standard *P.I.P.*-compatible amplifiers) or the *PIP2* connector (*PIP2*-compatible amplifiers).
8. **Install the *IQ–P.I.P.–DSP* into the amplifier:**

   Standard P.I.P. Amplifiers: Align the edges of the *IQ–P.I.P.–DSP* in the *P.I.P.* card rails and firmly push the unit in until it is seated against the mounting bracket (see Figure 3.3).

   PIP2 Amplifiers: Connect the *PIP2* input adapter to the two input cables of the amplifier (Figure 3.4). Notice that the *PIP2* input adapter should be positioned with the *P.I.P.* edge connector on top facing away from the amplifier. The 20 pin cable (A) is connected first then the 18 pin cable (B) is connected. Both ribbon cables should extend below the *PIP2* input adapter.

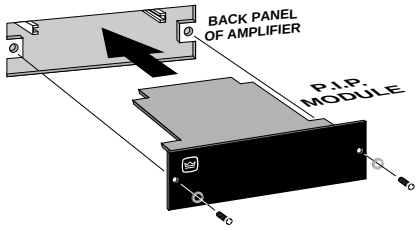


Fig. 3.3 Installation into a Standard P.I.P. Amplifier

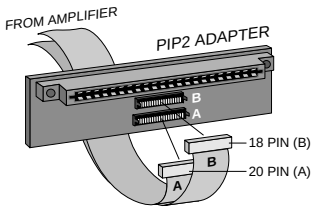


Fig. 3.4 PIP2 Input Adapter Connection

Next, insert the edge connector of the *IQ–P.I.P.–DSP* into the *PIP2* input adapter (see Figure 3.5)

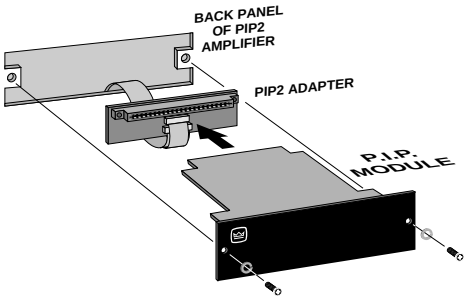


Fig. 3.5 Installation into a PIP2 Amplifier

and insert the assembly into the *P.I.P.* opening in the back of the amplifier.

9. **Tighten the two *P.I.P.* mounting screws** until the *P.I.P.* is secured to the amplifier back panel.

3.4 Install the Wiring

10. **Connect the *IQ–P.I.P.–DSP* to the *IQ System* via the Crown Bus.** See Section 3.6 for full instructions.
11. **Connect the audio signal wiring** to the *IQ–P.I.P.–DSP*. This includes the XLR input wiring and, if desired, the phone jack daisy chain wiring. See Section 3.7 for full instructions. *Note: The supplied EMI suppression core must be used on the daisy chain outputs for the IQ–P.I.P.–DSP to comply with FCC and EC EMC regulations (see Section 3.7).*
12. **Connect the amplifier back to the AC receptacle.** *Note: The IQ–P.I.P.–DSP may require an external power supply in some amplifiers. See*

Section 3.8 for more information.

3.5 Adjust the Levels & Scale Factors

13. **Turn the level controls of the amplifier to their full or maximum setting.** This is required by the *IQ–P.I.P.–DSP*. If needed, use the software-controlled input attenuators on the *IQ–P.I.P.–DSP* to reduce the audio levels.
14. **Configure the amplifier scale factors.** (Standard *P.I.P.*-compatible amplifiers only—the scale factors for *PIP2*-compatible amplifiers are set automatically.) It is necessary to configure software scale factors in the microprocessor of the *IQ–P.I.P.–DSP* in order for it to properly interpret the output signal level of the amplifier model in which it is installed. This is easily done by connecting a host computer to the *IQ–P.I.P.–DSP* via an IQ interface and the Crown Bus and running the appropriate software (see the IQ software *User's Manual* for details). In the appropriate input area of the software, specify the amplifier model. The software will then send the appropriate scale factors to the P.I.P. Note that for some amplifiers, the scale factors will also need to be specified by the user. When prompted by the software, input the appropriate scale factor. The scale factor values are listed in Figure 3.6

Amplifier Model	Scale Values (Decimal)		Output Signal Pads
	Channel 1	Channel 2	(JP4, JP5)
Com-Tech 200 (8 ohm)	57	57	IN
Com-Tech 400 (8 ohm)	45	45	IN
Com-Tech 800 (8 ohm)	40	40	IN
Com-Tech 1600 (8 ohm)	30	30	IN
All Com-Tech (70-volt)	27	27	IN
Macro-Tech 600	44	44	IN
Macro-Tech 1200	39	39	IN
Macro-Tech 2400	30	24	IN
Macro-Tech 24x6	30	44	IN
Macro-Tech 3600VZ	14	14	IN
Macro-Tech 36x12	14	39	IN
Macro-Tech 5000VZ	30	30	OUT
Macro-Tech 10000	24	24	IN
Reference I	17	17	IN
Reference II	30	30	IN
PIP2-Compatible (Auto)	51	51	OUT

Fig. 3.6 Amplifier Scale Factor Values and Output Signal Pad Settings

along with the settings of jumpers JP4 and JP5.

Note: Since it is possible to configure one channel of a Com-Tech amplifier in the 8-Ohm output mode and the other channel in the 70-Volt output mode, it may be necessary to configure the scale factors differently for each channel.

3.6 A Closer Look at Crown Bus Wiring

The *IQ–P.I.P.–DSP* must be connected to a Crown Bus loop having an *IQ2*-compatible IQ interface in order for the *IQ System* to control or monitor it. The Crown Bus is a serial communication loop designed to transmit IQ commands and data. As implemented in the *IQ–P.I.P.–DSP*, 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 Crown Bus loops or zones. Dividing the sound system into different zones, each with its own Crown 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–P.I.P.–DSP* can be connected to the Crown Bus with inexpensive twisted-pair wiring (shielded or unshielded). If fiber optic wiring is required contact the Crown Technical Support Group (see page 4).

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 Crown 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 adding 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. The lower the capacitance, the longer the loop can be. Unshielded wire typically has less capacitance.

- **Never use the ground wire in a mic snake line.** It may sometimes be convenient to run Crown Bus data signals to and from stage monitor amplifiers along unused wire pairs in a mic snake. If this is done, 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. The maximum possible Crown Bus loop distance will be less because typical mic cables have high capacitance.

Outside RF interference is seldom a problem for a Crown 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 Crown Bus loop next to an AM radio transmission line may require fiber optic cabling. An extremely long Crown Bus loop distance may also require fiber optic cabling.

There are two different types of connectors used for Crown Bus wiring: DIN connectors and screw terminal plugs. The *IQ–P.I.P.–DSP* uses a 5-pin DIN connector for input and a 4-pin DIN connector for output. Figure 3.7 shows how they should be wired.

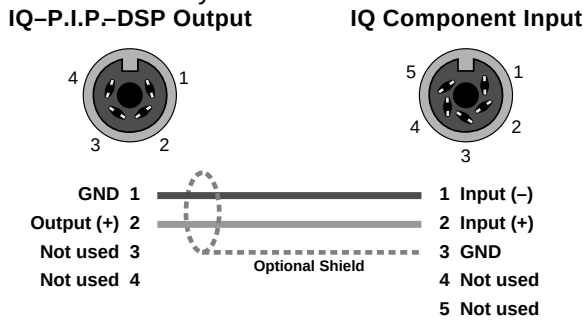


Figure 3.7 IQ–P.I.P.–DSP Output Connection to Another IQ Component with DIN Connectors

The next two figures show how to connect the *IQ–P.I.P.–DSP* to other IQ components with different connectors. Figure 3.8 shows how the Crown Bus output of the *IQ–P.I.P.–DSP* should be connected to an IQ component with a screw terminal plug. Figure 3.9 shows how the Crown Bus input of the *IQ–P.I.P.–DSP* should be connected to an IQ component with a screw terminal plug.

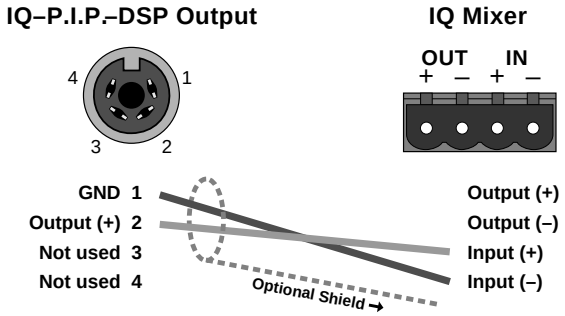


Figure 3.8 IQ–P.I.P.–DSP Output Connection to an IQ Component with a Screw Terminal Plug Connector

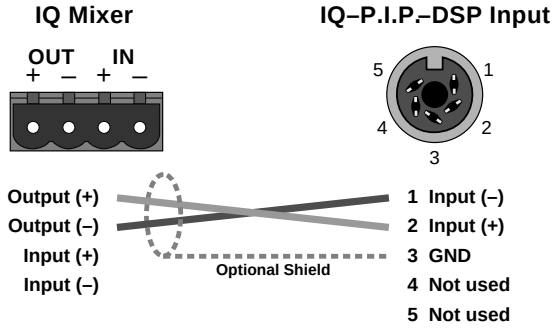


Figure 3.9 An IQ Component with Screw Terminal Plug Connected to the IQ–P.I.P.–DSP Input

The IQ components in a Crown 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 3.10.

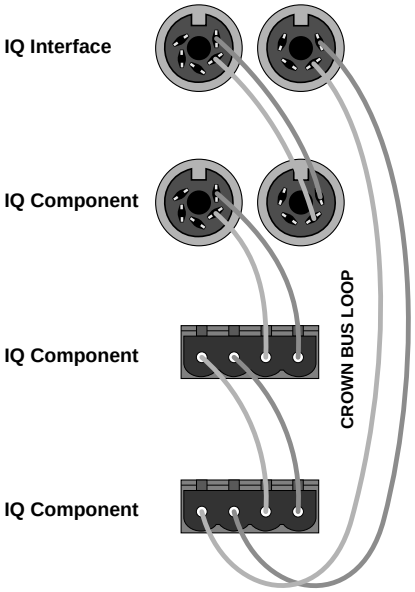


Fig. 3.10 Crown Bus Wiring "Loops" from the Output to the Input of Each IQ Component

3.7 A Closer Look at Audio Signal Wiring

Balanced 3-pin female XLR connectors are provided for audio input connection. The audio cables should be wired in one of the following manners:

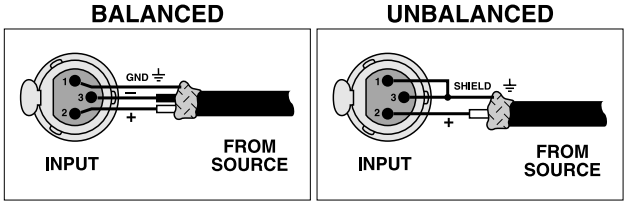


Fig. 3.11 Audio Input Wiring

We strongly recommend that balanced wiring be used if possible. Some important guidelines follow:

- Always use shielded wire. The higher the density of the shield (the outer conductor), the better. Spiral wrapped shield is not recommended.
- When using unbalanced lines, keep the cables as short as possible. Avoid lengths greater than 10 feet (3 meters).
- Do not run audio input cables together with high-level wiring such as loudspeaker wires or AC cords. (This lessens the chance of hum or noise being induced into the input cables.)
- Do not connect audio and data grounds together. For example, do not connect the audio ground to the Crown Bus ground.
- Turn the entire sound system off before changing any connections. Turn the level controls down before powering the system back up. Crown is not liable for damage incurred when any transducer or component is overdriven.

Balanced phone jacks are provided for "daisy chain" audio output connection. The audio cables should be wired in one of the following manners:

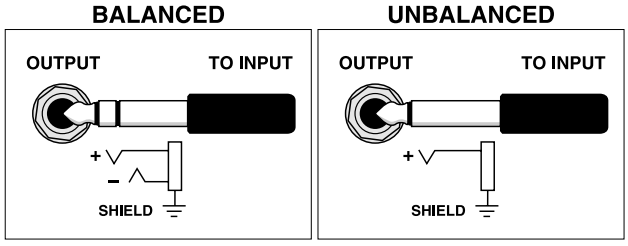


Fig. 3.12 Audio Output Wiring

In order to comply with FCC and EC EMC regulations, it is necessary to add an EMI (electro-magnetic interference) core to the daisy chain cable(s). A core, large enough to snap over both cables, is provided.

IMPORTANT: Do not feed a signal into the phone jacks on the *IQ–P.I.P.–DSP* or the back panel of the amplifier (if provided). The phone jacks are wired in parallel with the output of the *P.I.P.* connector inside the amplifier. Any audio signal fed into the phone jacks could feed back into the output of the *IQ–P.I.P.–DSP* and generate a distorted input signal. The phone jacks can be used to "daisy chain" the post-processed signal from the *IQ–P.I.P.–DSP* to the inputs of other amplifiers.

DO NOT USE THE CHANNEL 2 INPUT if the amplifier is used in either Bridge-Mono or Parallel-Mono mode.

For additional information on audio input connection please refer to the amplifier's *Reference* or *Owner's Manual*. It contains helpful information on preventing unwanted subsonic frequencies, radio frequency interference, ground loops, and feedback oscillation.

3.8 When External Power is Needed

The *IQ–P.I.P.–DSP* draws 320 mA at +24 VDC and 160 mA at –24 VDC. Many Crown amplifiers can provide this power via the *P.I.P.* edge connector inside. For these *IQ–P.I.P.-DSP*/amplifier combinations, no external power supply is needed. Amplifiers which can supply adequate power include all *Com-Tech*s, all *Macro-Tech 5000VZ*, all *Studio Reference* amplifiers and all *PIP2*-compatible amplifiers. For *IQ–P.I.P.-DSP* installations into 50-Hz versions of *Macro-Tech* amplifiers (excluding the *Macro-Tech 5000VZ),* Crown recommends use of the S4 version of these amplifiers. Please contact Crown Technical Support for more information about power supply options for the 50-Hz *Macro-Tech* versions.

Other Crown *P.I.P.*-compatible amplifiers may not be able to supply the full 320 mA of +24 VDC power for the *IQ–P.I.P.–DSP*, depending on how well regulated the AC mains are that feed them and how hard the amplifiers are driven. This includes the *Macro-Tech 600, 1200, 2400, 24x6, 3600VZ* and *36x12*. We suggest that a 400 mA +24 VDC supply be added for these amplifiers as a safety measure to be certain that adequate power is available. *Note: Actually, external power of only 200 mA is needed for these amplifiers, but a 400 mA supply is recommended to be certain that the external supply, itself, has a safety margin.* A mini jack is provided on the *P.I.P.* panel of the *IQ–P.I.P.–DSP* for external power connection.

IMPORTANT: The *IQ–P.I.P.–DSP* cannot be operated from an external power supply if the enable switch of the amplifier is turned off. The amplifier is required to provide –24 VDC.

CAUTION: If external power is needed, use an individual, isolated power supply for each *IQ–P.I.P.–DSP*. Do not attempt to share a common power supply with multiple *IQ–P.I.P.–DSP* modules or the *IQ–P.I.P.–DSP* modules may be damaged.

4 Operation

With an *IQ–P.I.P.–DSP* module, your Crown amplifier can be monitored and controlled from a remote location through the use of an *IQ System*. This P.I.P. module features *SmartAmp*™ capabilities which will enable the amplifier to function automatically. For example, the *IQ–P.I.P.–DSP* can automatically turn off the high voltage supplies of the amplifier when no input signal is present. This can lower electrical usage and provide long-term cost savings. And it can automatically limit the audio signal and detect and report various problems.

In addition, the *IQ–P.I.P.–DSP* features distinctive digital signal processing capabilities, including signal delays and a wide variety of filters. Combined, this adds up to a powerful array of audio control functions which are easily accessed via the *IQ System.*

Most of the following features can be controlled or configured using IQ software running on an *IQ System* host computer. Commands are transmitted via an IQ interface to the specified IQ component (an *IQ2*-compatible interface is required). Please contact your Crown representative or Crown's Technical Support Group if you are unfamiliar with IQ software. Where specified, some features are accessed via controls located on the unit itself.

4.1 Power/Standby Indicators

(IQ for Windows software only.) The power/standby indicators allow you to monitor the power and standby (mute) status of each channel via *IQ for Windows* software.

4.2 *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 indicator on the front of the amplifier to flash. By monitoring these events, the *IQ System* can flash an indicator on the screen of the host computer to alert a user that distortion is occurring.

4.3 Input Signal Level Monitor

The input signal level of each channel can be monitored by IQ software. This monitor feature has a range from +20 dBu to –40 dBu in ½-dB steps.

4.4 Output Signal Level Monitor

The output signal level of each channel of the amplifier can be monitored by the *IQ System*. 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. (This is assumed to be 70-V or the rated 8 ohm output for *Com-Tech* amplifiers or the rated 8 ohm output voltage for all other amplifiers.)

The output signal of some amplifiers must be padded before the *IQ–P.I.P.–DSP* can scale them. This is accomplished by setting jumpers JP4 and JP5 on the IQ circuit board to the "IN" position. Only the *Macro-Tech 5000VZ* and *PIP2*-compatible amplifiers do not require these pads. Set jumpers JP4 and JP5 to the "OUT" position for them (see Figure 3.6).

The output signals of all amplifiers must be scaled in order to "calibrate" the 0 dB level. (See Section 4.4.) This is accomplished with either an **amplifier ID code** or a user **scale factor**. The factory default setting for this is an amplifier ID code of "CT-70V" which assumes that the output level is that of a *Com-Tech* amplifier (any model) with both channels in the 70-V output mode.

4.5 *ODEP* Level Monitor

The Output Device Emulation Protection *(ODEP®)* level of each channel of the amplifier can be monitored by the IQ software. This level represents the percent of available thermodynamic capacity that is currently being used. When the *ODEP* level reaches 100%, the amplifier cannot produce any more power and *"ODEP* limiting" will begin to limit the drive level to the output devices, thereby protecting them from too much stress. (See the amplifier's *Reference* or *Owner's Manual* for more information about *ODEP* and how it works.)

4.6 Power Control

Each channel's high-voltage supply can be independently turned on and off with the Power control. The *IQ System* is used to set this control.

4.7 Signal Mute

The output signal of each channel can be independently muted by the *IQ System*. The function typically provides 80 dB or more of attenuation.

IMPORTANT: The daisy chain outputs are also muted by this function.

4.8 Polarity Inverter

The polarity of the input signal of each channel can be independently inverted by the *IQ System*.

4.9 Input Signal Attenuator

An attenuator is available at the input of each channel to control the input signal level. These attenuators are controlled and monitored by the *IQ System*. They may appear to move like "flying faders" on some IQ software screens because they reflect all reductions in gain that are dynamically applied by the input compressor/limiter, input protection limiter and *ODEP* conservation functions. Each input attenuator has a range from 0 dB to –80 dB in ½ dB steps. (Zero equals no attenuation.)

Note: The IQ–P.I.P.–DSP was designed for a nominal input level of 0 dBu. If "hot" input signals are required, use the input signal attenuators to "pad" the input levels.

4.10 Input Protection Limiter

The input protection limiter is not designed to be changed by the user. It is set at the factory for minimal interaction while providing adequate input protection. It protects the A/D converter from an excessive input signal. Normally there is no risk of this problem if the unit is installed as instructed in Section 3 of this manual.

The input protection limiter operates after the input compressor (Section 4.12) and input attenuator (Section 4.9) of each channel. If the compressor and/or attenuator reduce the input gain enough to prevent distortion, the input protection limiter will do nothing.

Note: Since the input attenuators can be dynamically monitored by the IQ System, they may appear to move as "flying faders" on some IQ software screens to reflect dynamic gain reductions. Moving faders while all other dynamic processing functions are turned off, is an indication that the input protection limiters are activating because the gain has not been optimized.

To prevent the input protection limiters from operating, configure the amplifier with an input sensitivity of 0.775 V and operate the amplifier with the output level controls at full volume as described in the installation instructions in Section 3. In this configuration the amplifier will clip before the threshold of the input protection limiter is exceeded.

4.11 Auto

An Auto function (Auto System Actuate or "ASA") is available to provide consistency with other IQ components in the *IQ System*. It is controlled by the *IQ System* and it serves as a toggle to quickly enable or disable many of the functions in the *IQ–P.I.P.–DSP*. The functions that are enabled/disabled by the Auto control are: input signal compressor/limiter, output limiter, auto standby and *ODEP* Limiter warning.

The filter and signal delay settings are not affected by the Auto function. In the case of the filters, this can be very important. For example, a high-frequency driver should not be fed a full-band signal when someone turns off the Auto control. Please refer to the *User's Manual* for your IQ software for more information about the Auto function.

4.12 Input Signal Compressor/Limiter

An input signal compressor/limiter is available for each channel. Each one is controlled by the *IQ System* and has five parameters:

Input Compressor: Turns this function on/off.

Threshold: Sets the threshold, in dB, above which the compressor acts. The level is measured at the input to the *P.I.P.* and corresponds to the level shown on an input meter. The compressor is "feedforward," 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.

Ratio: Sets the compression ratio for the compressor. The range is 1, 2, 4, 8, 16, 32, ∞ to 1. *Note: 1:1 is the same as "off."*

4.13 Smooth/Output Signal Limiter

An output signal limiter is available for each channel. They can be used either as "smooth" output levelers (similar to other IQ *P.I.P.s* with *SmartAmp* features) or they can be used as fast output limiters to protect drivers and other system components from large transient signals. They follow the filter functions in the DSP, making them frequency dependent. The output voltage of the amplifier is limited (within ½ dB) based on real-time sampling of the actual amplifier output. The

output limiters are controlled by the *IQ System* and has five parameters:

Output Limiter: Turns this function on/off.

Threshold: Sets the threshold, in dB, above which the limiter acts. The level is based on the scaled output voltage monitors (see Section 4.4). The range is from 0 dB to –40 dB.

Attack Time: Sets the attack time of the limiter. The attack time is defined as the time it takes the limiter to attenuate the input signal by 10 dB. The range is from 10 milliseconds to 30 seconds.

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

Ratio: The compression ratio is fixed at ∞:1.

4.14 Auto Standby

The Auto Standby feature automatically turns off the high-voltage supplies of the amplifier when no audio signal is detected at the input for a predetermined period of time. The channels are controlled independently. Using it, many *IQ Systems* can pay for themselves in just a few years due to reduced energy costs. There are four parameters which control this feature:

Auto Standby: Turns this function on/off.

Standby 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.

Standby Time: 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.

Use Turn-On Delay: Enables or disables the IQ address turn-on delay. This is a delay that prevents all the amplifiers from turning on at the same instant and tripping power breakers when an "all amps on" command is issued by the *IQ System*. The turn-on delay is calculated by: 10 msec x IQ address value. It may be desirable to disable this turn-on delay when using the Auto Standby feature so that the first syllable of speech is not missed when a voice page suddenly causes the Auto Standby function to turn a high-voltage supply back on.

4.15 *ODEP* Limiter

The effects of "*ODEP* limiting" the drive level of the output devices (as described in Section 4.5) are very audible. To overcome this, an *ODEP* limiter is available to proportionally limit the input audio signal as the thermodynamic energy reserve of the amplifier is consumed. This helps to prevent the amplifier from "*ODEP* limiting" the drive level of the output devices as described earlier. In the majority of cases, limiting the input signal produces a very smooth sound. And since the input signal is only limited when and to the degree necessary, it is very difficult to detect. There are four parameters which control this feature:

***ODEP* Conservation:** Turns this function on/off.

***ODEP* Trigger Level:** Sets the *ODEP* level, in percent, above which the conservation limiting will begin. The range is from 1 to 100%.

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

***ODEP* Conservation Release Time:** Sets the release time of the conservation limiter. The release time is based on 10 dB of attenuation. For example, a setting of 10 seconds will result in the *IQ–P.I.P.–DSP* taking 10 seconds to release 10 dB of attenuation. The range for this parameter is 200 milliseconds to 30 seconds.

4.16 Excessive *IOC* Warning

A "trigger" can be set that will cause a warning message to appear on the host computer's screen if too many *IOC* events occur over a specified length of time. Three parameters control this feature:

***IOC* Error Detect:** Turns this function on/off.

***IOC* Error Time:** Sets the time interval over which *IOC* events will be counted. The range is from 1 to 10 seconds.

***IOC* Error Count:** Sets the number of *IOC* events that must occur during the preceding time interval before a warning message is displayed. *Note: An "IOC event" is one complete on-off-on cycle.* The range is from 1 to 100 events per unit time

4.17 Excessive *ODEP* Warning

The user can set a "trigger" that will cause a warning message to appear on the host computer's screen if the *ODEP* level ever rises above a predetermined level. It is generally assumed that a sudden rise in the *ODEP*

level would indicate a sudden decrease in the load impedance—such as a shorted speaker cable or shorted loudspeaker. There are two parameters which control this feature:

***ODEP* Short Detect:** Turns this function on/off.

***ODEP* Short Level:** Sets the *ODEP* level above which a short is presumed to have occurred in the load resulting in a warning message being displayed. The range is from 1 to 100%.

4.18 Fault Warning

Fault conditions can be monitored by the *IQ System* and a warning message displayed on the host computer's screen if they occur. If desired, the AUX port can also be turned on during a "fault" condition. An amplifier "fault" condition occurs when a channel fails. The symptoms are a normal input signal, an *IOC* condition that is "locked" on, a high voltage supply (VCC) that reports a normal condition and no signal at the output of the amplifier. *PIP2*-compatible amplifiers monitor a "fault" signal from the amplifier while standard *P.I.P.*-compatible amplifiers deduce a "fault" condition from the aforementioned symptoms. There are two parameters which control this feature:

Fault: Turns this function on/off.

Input Drive Level: Sets the threshold below which a fault condition is presumed to exist in a standard *P.I.P.* amplifier. This parameter is necessary because it may be normal for an *IOC* error to persist if the audio input signal level is high. Monitoring the input level can help determine whether a fault condition really exists or whether the amplifier output is distorted simply because of an excessive input level. The range is from +16 dBu to –40 dBu.

4.19 Signal Delay

A signal delay is available for each channel. Each one is controlled by the *IQ System* and has one parameter:

Delay: Sets the amount of signal delay. The range is 1.25 milliseconds to 0.175 seconds in 22.7 microsecond steps. (The minimum delay of 1.25 milliseconds is inherent in the DSP system design.)

Note: The signal delays are not disabled by the ASA control.

4.20 Programmable Filters

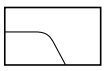
Each channel can have as many as eight different cascaded filters (the actual number depends on the mix of filters chosen and the total number of required filter cells). There are seven different filter types from which to choose—all controlled by the *IQ System:*

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)

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. *Note: "Biquad" refers to the double quadratic equations which mathematically describe each filter implemented in the digital signal processor.*

The 1st and 2nd-order filters each require one biquad filter cell. The 3rd and 4th-order filters each require two biquad filter cells. This means that a channel can have no more than four filters if they are all 3rd or 4th-order filters. Remember that only eight filter cells are available—this limits the total number of filters that a channel can have. An error message will be reported by the IQ software if this capacity is exceeded.

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



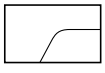
Low-Pass Crossover Filter

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.



High-Pass Crossover Filter

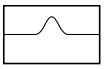
Description: This filter rolls off low frequencies at a rate determined by the shape parameter. The

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. 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.



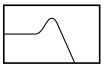
Parametric Equalization Filter

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 30. The lower the Q, the wider the filter and the better the transient response and visa versa. **CAUTION: Avoid excessive Q's.**

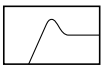


Low-Pass Equalization Filter

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. It is commonly used to create a B_6 (6th-order Butterworth) response in a vented loudspeaker enclosure. *Note: 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 30. 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. **CAUTION: Avoid excessive Q's.**



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. *Note: 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 30. 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. **CAUTION: Avoid excessive Q's.**

Low-Pass Shelving Equalization Filter

Description: This filter boosts or cuts low frequencies by the specified amount of gain. *Note: When used to cut rather than boost, the filter acts like a high-pass 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.

High-Pass Shelving Equalization Filter

Description: This filter boosts or cuts high frequencies by the specified amount of gain. *Note: 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 common to 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.

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

Note: The filters are <u>not</u> disabled by the ASA control.

4.21 Memory Backup

A memory backup feature is provided which can be disabled, if desired. The factory default setting is "enabled." When enabled, it stores all run-time parameters that can be controlled by the IQ software into nonvolatile memory (EEPROM) at approximately one second intervals. When disabled, all run-time parameters are returned to the factory defaults whenever the unit loses power.

CAUTION: Be careful to turn on the memory backup feature if the input attenuators will be used to set critical levels. If the memory backup feature is turned off and the *IQ–P.I.P.–DSP* loses power, the attenuators will be reset to 0 dB, resulting in the loudest possible signal.

4.22 Amp Mode

The stereo/mono mode of the amplifier can be stored into the unit's memory so the *IQ System* is aware of the position of the amplifier's stereo/mono switch. Storing this setting serves as an "electronic reminder" to the system—however, the stereo/mono mode cannot be controlled with this setting. The modes are Stereo (Dual), Bridge-Mono and Parallel-Mono. This software amp mode setting is controlled by the *IQ System*.

4.23 Amplifier Information

(*PIP2* amplifiers only.) Several items of information about an amplifier can be displayed by the IQ software. These include the manufacturer, model, date code, serial number and revision level. Which items are available depends on both the amplifier and the IQ software used.

4.24 IQ2 Protocol Support

The *IQ–P.I.P.–DSP* uses Crown's IQ2 protocol. This makes it possible for the user to design custom graphic display modules to control and monitor the unit with IQ2-compatible IQ software.

4.25 Crown Bus "Drop Out" Relays

"Drop out" relays are provided on the Crown Bus ports to maintain the continuity of the IQ communication loop even if the *IQ–P.I.P.–DSP* loses power.

4.26 Data Signal Presence Indicator

A Data Signal Presence Indicator (DSPI) is provided on the front panel. It flashes whenever commands addressed to the *IQ–P.I.P.–DSP* are received. It can be forced to stay on by IQ software to assist with troubleshooting of an *IQ System*.

4.27 Reset

A recessed reset switch, accessible from outside the *P.I.P.* panel (see Figure 2.1), enables the *IQ–P.I.P.–DSP* to be restored to one of two sets of default settings. A straightened paper clip or similar small object is required to press the reset switch.

Press the reset switch for less than 2 seconds and all settings, except the amplifier ID code or user scale factors, will be reset with "user default" parameters and the DSPI will flash once. This feature is only available if "user default" settings have been previously established. If none have, pressing the reset switch for any length of time will cause the unit to be reset to the "factory default" settings as described below.

Press the reset switch for more than 2 seconds and the same settings will be reset with "factory default" parameters and the DSPI will flash twice. After the unit has been reset to the factory default settings, it will behave like a standard *P.I.P.-FX* until it is reprogrammed by an *IQ System* or it is toggled to the "user default" settings.

WARNING: Pressing the reset switch can cause the *IQ–P.I.P.–DSP* to emit a brief pulse. We recommend that the level controls of the amplifier be turned down before pressing the reset switch.

4.28 User Default Settings

The parameters for all functions, except the amplifier ID code or user scale factors, can be saved as "user default" parameters. Then, pressing the reset switch for less than 2 seconds will restore all settings to the "user default" values. Please consult the documentation of your IQ software for instructions on setting the "user default" values.

5 Technical Information

The purpose of the *IQ–P.I.P.–DSP* is to provide extensive signal processing capabilities and to enable an *IQ System* to control and monitor a *P.I.P.*-compatible amplifier. See Sections 2 and 3 for a list of the facilities and features. Figures 5.1 and 5.2 show hardware and signal flow block diagrams of the unit.

5.1 Audio Signals

5.1.1 Hardware Processing (see Figure 5.1)
Balanced and unbalanced audio signals enter the module at the XLR connectors. From these connectors, the signals are RFI filtered and fed into a balanced to single-ended conversion stage. Then they are sent to a monitor input (discussed below) and also to a DCA (Digitally Controlled Attenuator) for gain ranging via the *IQ System*. This is essential because the DSP (Digital Signal Processing) system has limited voltage headroom.

After the DCA, both channels are sent to an 18-bit dual-channel ADC (Analog to Digital Converter). The ADC provides brick-wall low-pass filtering and "volts to bits" conversion. The output of the ADC is a multiplexed serial bitstream which is sent to the DSP. The DSP operates on each sample of both channels (one at a time) via machine language program instructions (firmware). The output of the DSP is a serial bitstream which is sent to the DAC (Digital to Analog Converter). The DAC is an 18-bit dual-channel device which demultiplexes Channel 1 and 2 and converts the bits to volts. The DAC also provides low-pass filtering. The output of the DAC drives the amplifier inputs via the *P.I.P.* edge card connector as well as the "daisy chain" outputs.

5.1.2 Signal Flow Processing (see Figure 5.2)
The audio signals are attenuated via the input attenuators, providing system gain setting as well as gain ranging for the DSP system. The input compressor/limiters then allow dynamic scaling of signals for many applications via common parameters such as threshold, ratio, etc. The *ODEP* conservation limiters then provide system protection with dynamic (but slowly varying) gain scaling based on thermal conditions within the amplifier. Next the signals are fed to the input protection limiters to keep the signal below the voltage headroom of the DSP system.

The signal is then fed into eight cascaded fully programmable 2nd-order DSP filter cells. All filter cells are IIR based to provide a proper magnitude/phase relationship for crossover and equalization applications. Each filter cell is controllable. 1st and 2nd-order filter types use one filter cell. 3rd and 4th-order filter types use two filter cells. The output of the filter block is sent to an adjustable digital signal delay section for audio signal delay. The minimum delay is hardware-limited to 1.25 milliseconds. The output of the delay section is sent to the output limiter section. The DSP output limiter dynamically adjusts the system gain to explicitly limit the output voltage of the amplifier within ½ dB by utilizing the output voltage monitor information from the data acquisition system. Common limiter

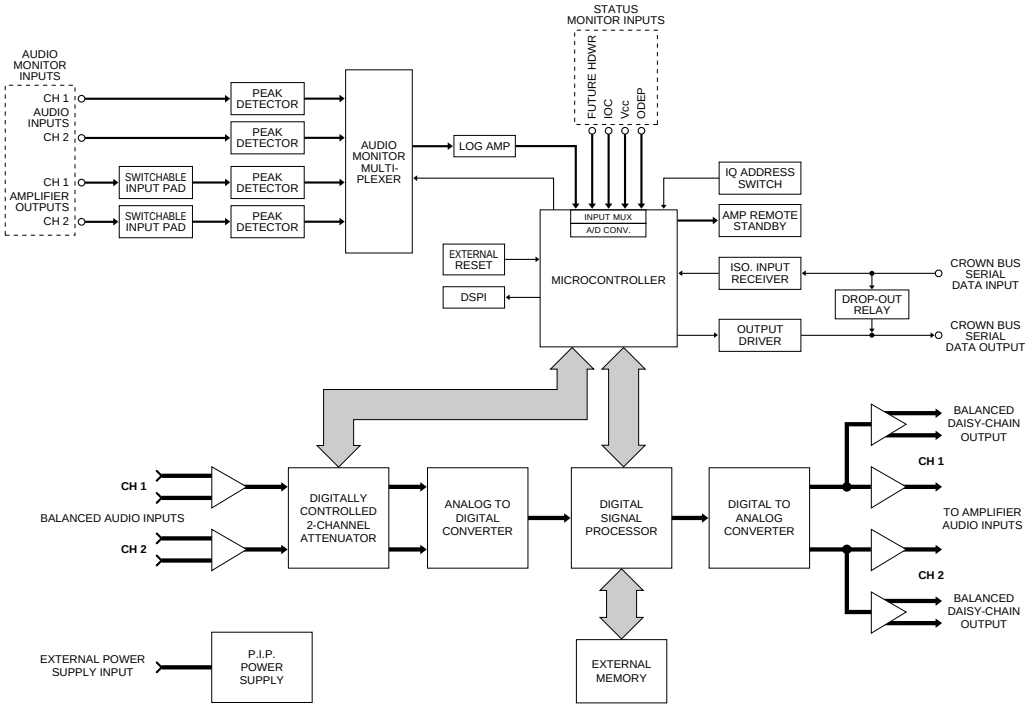


Fig. 5.1 IQ–P.I.P.–DSP Hardware Circuit Block Diagram

parameters are used here such as threshold, attack time, etc. Next, the output limiter is processed through controllable polarity inverters. The last processing section is an output muter after which the signal is sent to the main amplifier for voltage and current amplification.

All parameters are continuously controllable via the *IQ System* or can be set and will continue to operate.

5.2 Control/Monitor Functions

5.2.1 Audio Signals

In addition to controlling the audio input level and polarity, the *IQ–P.I.P.–DSP* can turn on/off the high-voltage power supplies. These functions are controlled using ports on the 6811 microprocessor and some external support circuitry. The audio level is controlled by the 6811 microprocessor through a digitally controlled analog attenuator.

The audio signals that are monitored are the input to the *P.I.P.* and the output of the amplifier. These signals enter the *P.I.P.* and are fed into a precision peak detector which insures that instantaneous signal peaks are not "missed" by the *P.I.P.* The detector outputs are then fed through a multiplexer into a logarithmic conversion circuit for dynamic range scaling. The output of this circuit is then fed into the A/D converter on the 6811 microprocessor, where the signal is converted and sent to the host computer via the Crown Bus.

5.2.2 Status Signals

The status signals that are monitored are *ODEP* level, *IOC* status and VCC status. These signals enter the *P.I.P.*, pass through a buffer stage, and are fed into the A/D converter on the 6811 microprocessor. The signals are then converted and sent to the host computer via the Crown Bus.

5.2.3 DSPI Control

The DSPI LED flashes whenever a valid IQ command has been received and can be forced to stay on to facilitate diagnosis of Crown Bus wiring problems.

5.3 *IQ System* Communications

The *IQ–P.I.P.–DSP* communicates with the host computer via the Crown Bus. Connections to the Crown Bus are made via the 4 and 5-pin locking DIN connectors on the rear panel. IQ commands entering the *P.I.P.* are fed into an input receiver circuit that converts the 20 mA current loop signal into a standard logic signal that the 6811 microprocessor can understand. This signal is also passed directly to the Crown Bus for output where it is passed on to the remainder of the loop. Data sent in response to IQ commands is also sent through the Crown Bus output where it passes through the remainder of the loop and back to the host computer. A "drop out" relay is also present which makes a physical contact between the Crown Bus input and output connectors in the event of a power failure. This means that as long as the Crown Bus cables are connected to the *P.I.P.*, the Crown Bus will remain unbroken—even if power to the *P.I.P.* is lost.

5.4 Microprocessors and Reset Switch

The "brains" of the *IQ–P.I.P.–DSP* are contained in its two microprocessors. A Motorola 6811 interprets commands received from the Crown Bus and responds accordingly. A Motorola 56002 manages all DSP functions. The memory of both processors is backed up with EEPROM. The *IQ–P.I.P.–DSP* is designed to provide an "automatic reset" in the event of a power failure, but the rear reset switch has also been added. Pressing this switch restores <u>all</u> *P.I.P.* settings to the "user defaults" if it is pressed for less than 2 seconds or to the factory defaults if it is pressed for more than 2 seconds. The only exception is the initialization data which can only be changed with *IQ System* software on the host computer.

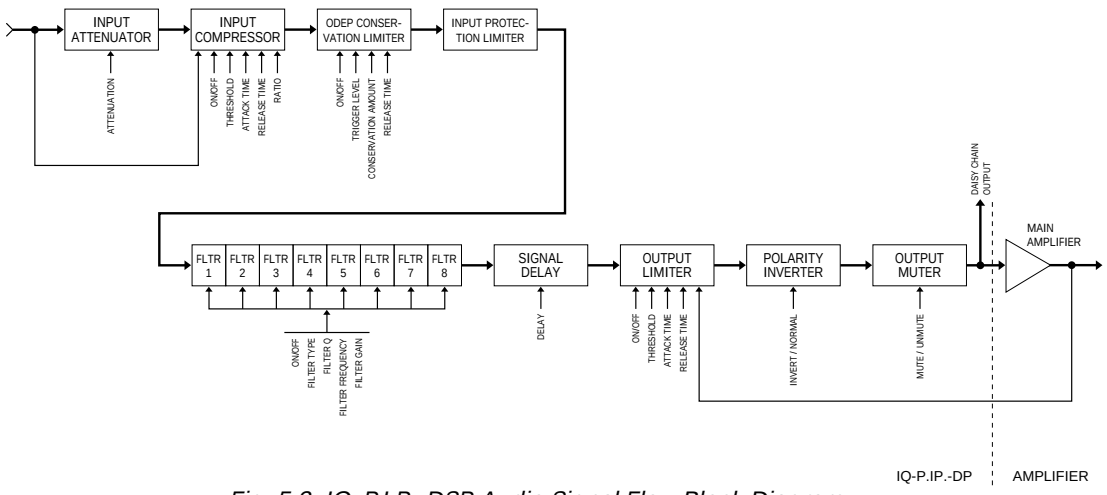


Fig. 5.2 IQ–P.I.P.–DSP Audio Signal Flow Block Diagram

6 Specifications

General

Internal Controls: An 8-segment DIP switch sets the IQ address (decimal range: 1–250). *Note: If address "0" is selected, the IQ–P.I.P.–DSP will operate in stand-alone mode.* A Reset switch, accessible with a straightened paper clip through the *P.I.P.* panel, resets all settings (except the amplifier output voltage scale factors) to the "user defaults" if it is pressed for less than 2 seconds or the factory defaults if it is pressed for more than 2 seconds. Two jumpers (JP4, JP5) enable or disable the output voltage scaling circuitry.

Connectors: Crown Bus Input: Locking 5-pin female DIN connector. Crown Bus Output: Locking 4-pin female DIN connector. Audio Input: Balanced 3-pin female XLR connector for each channel. Audio "Daisy Chain" Output: ¼-inch balanced (tip, ring, sleeve) phone jack. External Power: Mini jack.

Indicators: A yellow DSPI (Data Signal Presence Indicator) flashes when a valid IQ command is received from the *IQ System* via the Crown Bus. The DSPI can be forced on to facilitate rapid troubleshooting of Crown Bus wiring.

Nonvolatile Memory Backup: EEPROM capable of 75,000 typical writes.

Power Requirements: Power draw: 320 mA @ +24 VDC and 160 mA @ –24 VDC. When installed into a Crown *P.I.P.*-compatible amplifier, the unit receives ±24 VDC from the amplifier. No further power is required if the unit is installed in a *Com-Tech* (all models), *Macro-Tech 5000VZ* or *10000*, *Reference* or any *PIP2*-compatible amplifier. The unit may require additional power in other amplifiers. External power should be +24 VDC with a minimum of 200 mA (400 mA recommended for safety margin).

Crown Bus Data Communication

Protection: If 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.

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

Operation: Half duplex.

Intelligence: 8-bit, 8 MHz, 2 MIPS Motorola 6811 microprocessor.

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 or larger. Can be extended with an IQ Repeater.

Audio

Please note: The audio specifications are referenced to 0.775 V (0 dBu). Measurements were made at the output of the *IQ–P.I.P.–DSP* module, itself.

Digital Signal Processor (DSP): 33 MHz, 16.5 MIPS Motorola DSP56002 microprocessor with 32 K x 24 SRAM for run-time program/data storage and 32 K x 8 EEPROM for nonvolatile program/data memory backup.

Analog to Digital Conversion (ADC): 18-bit. 64x oversampled input. 44.1 kHz sample rate output.

Digital to Analog Conversion (DAC): 18-bit. 8x interpolated Linear Phase FIR reconstruction filter. 44.1 kHz sample rate input.

Input Impedance: Nominally 24 K ohms balanced and 12 K ohms unbalanced.

Maximum Input Level: +4 dBu @ 0 dB gain; +16 dBu @ –12 dB gain.

Signal-to-Noise: >90 dB (A-weighted). >85 dBu from 20 Hz to 20 kHz.

Dynamic Range: >95 dBA (A-weighted).

Frequency Response: ±0.25 dB from 20 Hz to 20 kHz.

Crosstalk: –80 dB (typical). –60 dB (worst case at signal level and signal frequency extremes).

Common Mode Rejection (CMR): >90 dB (typical). >70 dB (worst case at signal level and signal frequency extremes).

Total Harmonic Distortion (THD) + Noise: <0.05% (typical). <0.1% (worst case at signal level and signal frequency extremes).

Output Impedance: Nominally 150 ohms (balanced).

Maximum Output Level: +4 dBu.

IQ System Data Acquisition

Input/Output Monitor Accuracy: Typically ±1 dB.

7 IQ Address Tables

This section contains lookup tables for every valid IQ address. The valid addresses are 1 to 250. Remember that address "0" (zero) will put the *IQ–P.I.P.–DSP* into a standalone mode where it is invisible to the *IQ System* and acts like a "dumb" balanced audio input. **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 Crown 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–P.I.P.–DSP* as shown. See Section 4.1 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
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	OFF	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
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	ON	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

Fig. 7.1 IQ Address Switch (SW1) Settings from 0 to 125

IQ Address	IQ Address Switch 1	2	3	4	5	6	7	8
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
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
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	OFF	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

Fig. 7.2 IQ Address Switch (SW1) Settings from 126 to 250

8 Service

This unit has very sophisticated circuitry which should only be serviced by a fully trained technician.

8.1 Worldwide Service

Service may be obtained from an authorized service center. (Contact your local Crown/Amcron representative or our office for a list of authorized service centers.) To obtain service, simply present the bill of sale as proof of purchase along with the defective unit to an authorized service center. They will handle the necessary paperwork and repair.

Remember to transport your unit in the original factory pack.

8.2 North American Service

Service may be obtained from the factory. It is important that you have your copy of the bill of sale as your proof of purchase.

8.2.1 Factory Service

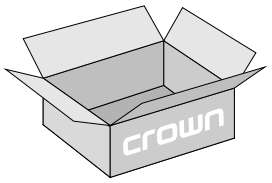
To obtain factory service, fill out the **service information page** found in the back of this manual and send it along with your proof of purchase and the defective unit to the Crown factory.

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.**
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 *Reference* or *Owner's Manual*, cables and other hardware.



Always use the original factory pack to transport the unit.

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

Crown Audio Division
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)
Fax Back: 219-293-9200 (North America only)
800-294-4094 (North America only)
219-294-8100 (International)
Internet: http://www.crownaudio.com
Email: iqsupport@crownintl.com

Crown Factory Service Information

Shipping Address: Crown International, Inc., Factory Service, Plant 2 SW, 1718 W. Mishawaka Rd., Elkhart, IN 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.)

_____

_____

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_____

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.

Detach and send with unit.