



IQ Mixer/Multiplexer

AMB-5, MPX-6, SMX-6

HARDWARE INSTALLATION MANUAL

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| | |
|-------------------------|----------------------------|
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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 Crown Technical Support Group.

Crown Technical Support Group, POB 1000, Elkhart, Indiana 46515-1000 U.S.A.
Phone: 800-342-6939 or 219/294-8200 Fax: 219-294-8301



WARNING

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

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Fig. 1.1 Three Mixer / Multiplexer Models

1 Welcome

Thank you for purchasing a Crown IQ mixer/multiplexer. IQ mixer/multiplexers are intelligent mixers with special signal routing capabilities. Their intelligence stems from a powerful onboard microprocessor which enables them to be controlled and monitored by a Crown *IQ System*[®]. Each input and each output can be individually controlled and, with their *distributed intelligence*[™] capability, continue to operate even when an *IQ System* is not connected.

In addition to two main outputs (one for each channel), each model has a second set of \mp -bus outputs which are switched on/off by a relay. This enables many mixer/multiplexers to be connected to a common audio bus without loading it down. They are designed to work as stand-alone units in a small audio system or as modules in a large audio system.

Three different models are available to serve a wide variety of needs. The *MPX-6*[™] and *SMX-6*[™] models operate as 6x2 mixers. The *AMB-5*[™] can operate as a 5x2 mixer. Multiple units can be connected together to form larger mixers. For example, a *MPX-6* and *SMX-6* can be connected together to form a single 12x2 mixer. They can also be connected as a 6x4 mixer.

The *MPX-6* is the simplest of the three models. It provides basic mixing capabilities. All control and monitor functions are handled by the *IQ System*. The *MPX-6* does not have the automatic mixing capability of the other models because it does not have input sensing.

The *SMX-6* is more sophisticated because it has *sensing* ability. A sensing circuit is located at the beginning of each input to sense the input signal level ahead of any signal processing. Similar sensors are located at each output. These sensors, along with its onboard intelligence, enable the *SMX-6* to perform many versatile functions like automatic mixing, compression, and automatic level control.

The *AMB-5* has the same functions as an *SMX-6* plus it has the ability to sense the ambient sound level and automatically adjust its output level accordingly. In this way it serves as the ultimate automatic level controller. Input 6 is dedicated as the sensing input, leaving five to function normally as a 5x2 mixer. Unlike the *SMX-6*, signal processing is only available for Channel 1. Channel 2 functions like an *MPX-6*.

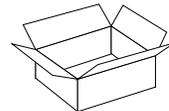
1.1 Options

In a standard *IQ System*, the IQ components like the mixer/multiplexers are connected to the system via the Crown Bus. The Crown Bus is a serial communication loop which carries IQ commands and data. IQ mixer/multiplexers are also able to bypass the Crown Bus and connect (one at a time) directly to a computer (PC compatible or Macintosh[®]). Once configured, the mixer/multiplexers can be disconnected and allowed to operate by themselves.

Option 1 allows an *AMB-5*, *MPX-6* or *SMX-6* to connect to a host computer and serve as a Crown Bus interface between the computer and other IQ components. This eliminates the need to purchase a separate IQ interface (IQ-INT) for a small *IQ System*.

Option 4 allows an *SMX-6* (only) to connect to a Crown Local Net loop. The Crown Local Net is a communication subsystem within an *IQ System*. Using it, two or more *SMX-6s* can communicate between themselves to keep track of the total number of open microphones. This information can then be used to prevent feedback when more mics are open.

Note: Options 2-3 are not presently available.



1.2 Unpacking

Please unpack and inspect the unit for any damage that may have occurred during transit. If any damage is found, notify the transportation company immediately. Only you, the consignee, may initiate a claim with the carrier for damage resulting from shipment. Crown will 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 so you will have them if you ever need to transport the unit. **NEVER SHIP THE UNIT WITHOUT THE FACTORY PACK.**

(Front View)



(Rear View)

Figure 2.1 Front and Rear Panels

2 Facilities

AUX Connector

A 3-pin male mini-XLR connector is used for remote control of equipment lacking the Crown Bus. A 10 VDC power source is provided to control solid state relays and other logic circuits. The auxiliary connector also includes a high-impedance 10 VDC input. (Section 3.4)

Stack Audio Inputs

These two stack inputs allow you to multiply the number of audio inputs by stacking 2, 3, or more units to build a 12x2, 18x2, or larger mixer. (Section 3.3.3)

DSPI

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

Enable Indicator

This amber enable indicator shows that the unit is receiving AC power.

Audio Input Gain Control

Each of the six input channels has a screwdriver-set, calibrated gain potentiometer for adjusting the input gain to the input signal level. They can be used to compensate for different microphone sensitivities. (Section 3.3.1)

RS232/RS422 Connector

This DB25 connector functions as a standard RS232 or RS422 serial communications port. It can be used for connection directly to a host computer (Section 3.1) or, if Option 4 was purchased, for connection to a Crown Local Net loop (Section 4.2).

Crown Bus Ground Connector

This chassis ground stud is provided to connect an

Important: TURN THE UNIT OFF before connecting to the RS232/RS422 (F) or Crown Bus (H) connectors. TURN THE UNIT OFF before changing the settings of the IQ Address (M), Baud Rate & Parity (N) or Communication Standard (O) switches.

optional shield for the Crown Bus cable. Only the shield of the input cable should be connected. Shielded wire will reduce the total distance a Crown Bus loop can be run, but shielding may be necessary to reduce interference with certain kinds of audio cables. (Section 3.2)

Crown Bus Input/Output Connector

A 4-pin removable barrier block plug is used for input and output connection to the Crown Bus. **The pins are numbered backward from right to left (as you face the back panel of the unit).** Pin 1 is input negative (-), pin 2 is input positive (+), pin 3 is output negative (-), and pin 4 is output positive (+). (Section 3.2)

Main Audio Outputs

A 3-pin removable barrier block plug is used to connect to the main output of each channel. These outputs can also be connected to the stack inputs (B) of other mixer/multiplexers to make a 12x2 (or larger) mixer. (Section 3.3.2)

Auxiliary Bus Audio Outputs

A 3-pin removable barrier block plug is used to connect to the bus audio output of each channel. The bus outputs are isolated switchable outputs that can be turned on when needed by the *IQ System*. This allows many multiplexers to be tied together on the same bus without loading down the outputs. (Section 3.3.2)

Audio Inputs

A 3-pin removable barrier block plug is used to connect to the input of each of the six audio inputs. The input gain control (E) and the input selector (K) of each one should be set to match the input signal level. These inputs can also be connected in parallel

with the inputs of other mixer/multiplexers to make a 6x4 (or larger) mixer. (Section 3.3.1)

Input Selector

A three-position input selector accommodates different input signal levels. The three settings are L for line-level input, M for mic-level input, and P for mic-level input with phantom power. The P setting supplies 44 volts DC for phantom-powered mics.

IQ Address

An 8-section DIP switch is used to set the IQ address of the unit. The unit must be given a unique IQ address so it can be independently controlled and monitored by the system. It must also be set properly if the unit is to be used in a Crown Local Net. Two or more IQ components of the same type should NEVER have the same address on the same Crown Bus loop. (Section 3.2) **Important: The IQ address should only be set with the power cord disconnected from the AC supply.**

Baud Rate & Parity

A 6-section DIP switch is used to set the baud rate and parity for RS232/RS422 serial communication. This is only necessary when the DB25 connector (F) is used. **Important: The baud rate should only be set with the power cord disconnected from the AC supply.**

Communication Standard

A communication standard switch which allows the unit to be configured for the RS232 or RS422 communications. (Sections 3.1³3.1.1) **Important: The communication standard should only be set with the power cord disconnected from the AC supply.**

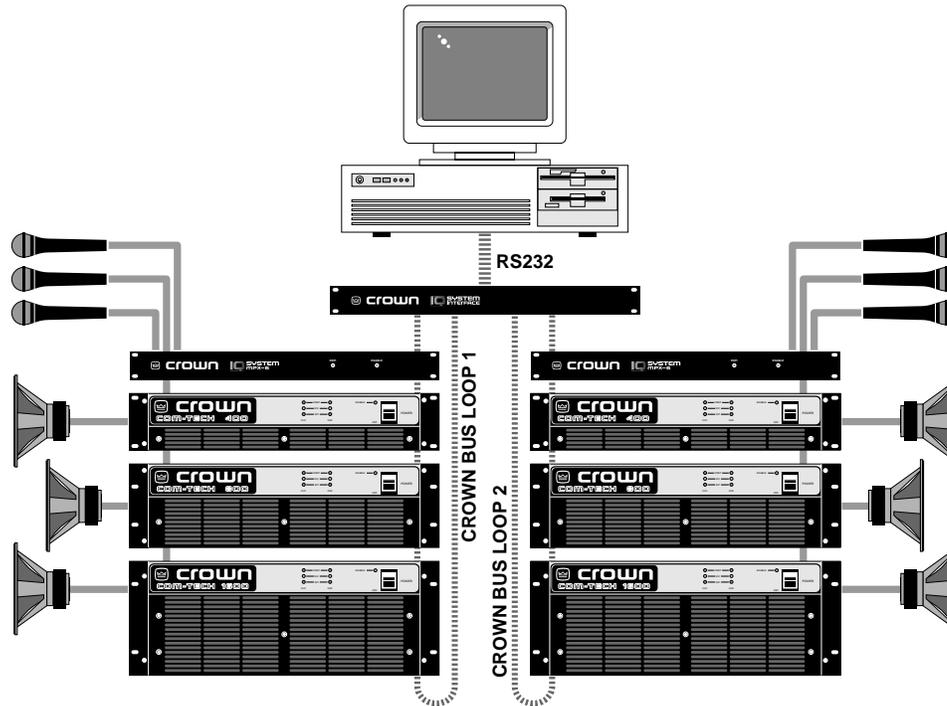


Fig. 3.1 An IQ System with a PC Host Computer and Two Mixer/Multiplexers

3 Hardware Installation

The installation of an IQ mixer/multiplexer consists of two major parts: installing the hardware and configuring the software. This manual deals only with hardware installation. Refer to the appropriate software manual for instructions in setting up and operating your unit.

Provide adequate cooling if the unit will be used in a hot environment. **Allow one empty rack space (1.75 inches or 4.4 cm.) between each unit if more than four units will be stacked in a cabinet.** Each empty rack space should be sealed with a blank rack panel.

The hardware installation is divided into 4 steps: 1) connecting to a host computer, 2) connecting to the Crown Bus, 3) connecting the audio inputs and outputs and 4) connecting auxiliary devices.

3.1 Connecting to a Host Computer (Step 1)

An IQ host computer is an IBM® PC compatible or Apple® Macintosh computer which is used to configure or control/monitor part or all of an *IQ System*. Depending upon the design of your *IQ System*, it may or may not require a host computer during normal operation.

How the mixer/multiplexer will be used will determine whether or not it will need to be connected directly to a host computer. If the unit will be connected to the Crown Bus it will not need to be connected directly to a host computer. The following circumstances require connection to a host computer:

- If a Crown Bus will not be used, the mixer/multiplexer will need to be connected to a host computer so the software inside the unit can be configured. Afterward, if manual control is not required, the host computer can be disconnected.
- If the mixer/multiplexer must be configured before it is installed into an IQ System, it must be connected directly to a host computer for configuration. The onboard battery of the unit will maintain its software configuration for up to 60 days without it being plugged into an AC source.
- If the mixer/multiplexer will be used as an IQ interface (Option 1) it will need to be connected directly to a host computer.

One of the advantages of connecting directly to a host computer is that a separate IQ interface (IQ-INT) is not required. If you plan to configure the unit

while it is connected to the Crown Bus, skip ahead to Section 3.2.

There are two main communication standards supported by the unit for serial communication with a host computer. They are RS232 and RS422.

RS232 is commonly used with IBM PCs and compatibles. Because it uses unbalanced signal wiring, it cannot be used for distances over 50 feet (15.2 m).

RS422 is commonly used with Macintosh computers. It uses balanced signal wiring and can be used for distances up to 2,000 feet (610 m).

Although uncommon, **RS423** communication can also be used. It uses the unbalanced transmitter (TXD) wiring of RS232 and the balanced receiver (RXD) wiring of RS422 to provide signal ground isolation between the transmit and receive lines. With a proper cable it can be used over a greater distance than RS232...but a shorter distance than RS422. For details contact either Crown Tech. Support or Amcron Tech. Services (see page 22).

The following illustrations show how to wire the two most common serial cables:

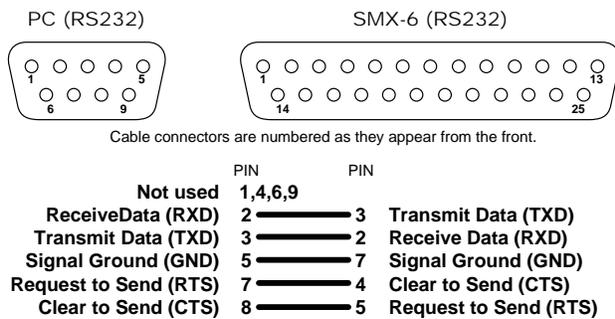


Fig. 3.2 RS232 Cable Wiring for a PC

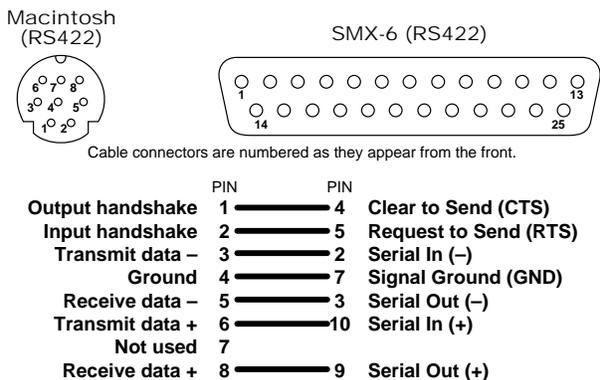


Fig. 3.3 RS422 Cable Wiring for a Macintosh

It is also possible to use RS232 to communicate with a Macintosh computer. Here's how to wire the cable:

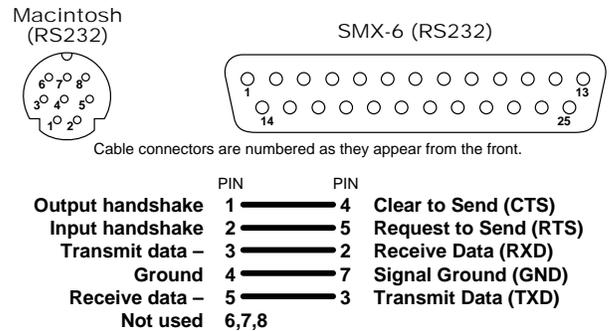


Fig. 3.4 RS232 Cable Wiring for a Macintosh

Important: Do not use twisted-pair wire for RS232 because it increases crosstalk. Instead use an untwisted cable or ribbon cable. Twisted-pair wire can be used for RS422.

3.1.1 Communication Standards and Parameters

Before communication can take place between the unit and a host computer the communication standard must be selected and the communication parameters must be set with switches accessed through an opening in the side of the chassis. (Figures 2.2 and 3.5)

Caution: Be sure to disconnect the AC power from the unit before selecting a different communication standard or changing the parameters.

IBM PC-compatible computers typically have an RS232 serial port, so the communication standard switch should be moved to the right (Figure 3.5). With a Macintosh host computer, the standard is usually RS422, and the communication standard switch should be moved to the left. In the rare event that RS423 communication is used, set the switch to the RS422 position.

Setting the communication parameters for RS232 and RS422 serial communication is accomplished using the six segment baud rate and parity DIP switch in Figure 3.5. The first four switches select the baud rate and the last two set the parity. Use the fastest baud rate possible. The highest baud rate supported by the unit is 19.2 K baud. Parity checking is not presently supported and should be OFF. The odd/even parity bit doesn't matter when parity is switched OFF. The unit has been factory set to 1 stop bit and 8 data bits.

Important: The communication standard and param-

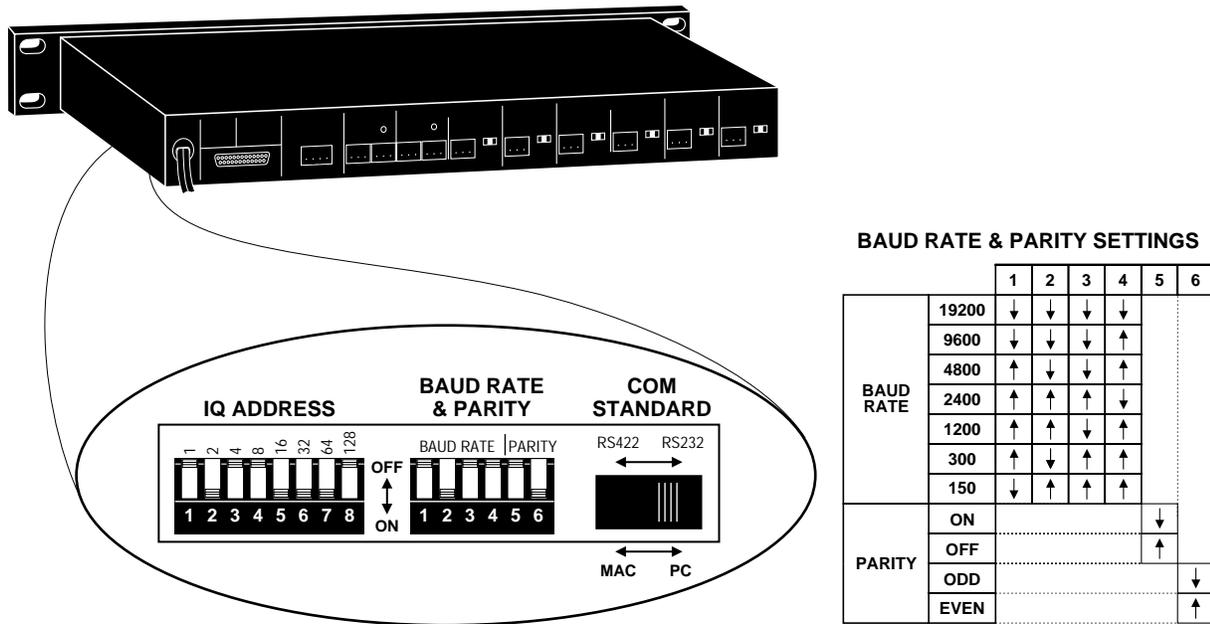


Fig. 3.5 Selecting the Communication Standard and Parameters

eters of the mixer/multiplexer and the host computer must be the same. Any mismatch will prevent communication from taking place.

The communication parameters of the host computer are set by the IQ software. This is true for both PCs and Macintosh computers. Please refer to the appropriate software manual for details.

Here are some important guidelines when configuring serial communication:

- Use the same communication *standard* at each end. If the unit is set for RS232, the computer must also be set for RS232. (Refer also to the appropriate IQ software manual.)
- Use the same communication *parameters* at each end. The unit and the computer must be set for the same baud rate and parity checking.
- Use the highest baud rate possible but be aware that *the communication circuitry (UART) in some PCs cannot function over 9600 baud.* (IQ mixer/multiplexers can be set as high as 19.2 K baud.)
- If the host computer fails to communicate with the unit and the communication standard and parameters are set correctly, try reducing the baud rate of both the unit and the computer.

- If communication problems persist, check the serial cable for improper wiring or possible shorted or broken wires.
- For further assistance call either the Crown Technical Support Group or Amcron Technical Services Dept. (see page 22 for telephone numbers).

3.2 Connecting to the Crown Bus (Step 2)

The Crown Bus is a serial communication loop designed to transmit IQ commands and data. As a communication standard it is independent of the wiring system used. This flexibility is a great strength, enabling a Crown Bus loop to be wired with either fiber optic cabling or with inexpensive twisted-pair wire, whichever the installation requires. A single *IQ System* can have more than one Crown Bus loop. To function properly, a Crown Bus loop must be unbroken.

3.2.1 Setting the IQ Address

Before installing a mixer/multiplexer on a Crown Bus loop, it must be given a unique IQ address. This address will be used by the *IQ System* whenever it communicates with the unit.

The 8-segment DIP switch shown in Figure 3.5 is used to set the IQ address. No two IQ components of the same model which are connected to the same

Crown Bus can have the same address. Suppose, for example, an *IQ System* has two Crown Bus loops as shown in Figure 3.1 and an *SMX-6* is installed in loop 1 and given IQ address 77. No other *SMX-6* can be given the same address in Crown Bus loop 1. However, an *SMX-6* can have the same address if it is installed in loop 2. Different IQ components can have the same address and be in the same Crown Bus loop. In the previous example, an *AMB-5* could be installed in loop 1 and use IQ address 77 because it is not an *SMX-6*.

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 ±0š (zero) should not be used. The IQ address is determined by adding the values of each segment of the DIP switch which is turned on (pushed down). Figure 3.5 shows the value of each DIP switch segment. For example, if the desired unit address is 1, only switch 1 should be down. If the desired unit address is 217, switches 8, 7, 5, 4, and 1 should be down (128+64+16+8+1=217). See Appendix A for list of all valid DIP switch settings.

If the IQ interface used is an IQ-INT, the system can have up to eight separate Crown Bus loops. This will enable the audio system to be divided into different zones, each with its own Crown Bus loop. Dividing the *IQ System* into multiple Crown Bus loops has advantages and disadvantages which are listed below:

Multiloop Advantages

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

Single Loop Advantages

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

3.2.2 Crown Bus Wiring

The Crown Bus is implemented in IQ mixer/multiplexers as a 20 milliamp current loop operating at 38.4 K baud so that it can function with inexpensive twisted-pair wiring. If fiber optic wiring is required contact Crown Tech. Support or Amcron Tech. Ser-

vices (see page 22) for information on adding the appropriate transceivers.

Here are some guidelines for twisted-pair wiring:

- **Use shielded twisted-pair wire** at least 26 AWG in size. The wire should be of good quality and should NOT have high capacitance (30 picofarads/foot or less is good). Shielded wire is recommended for situations where interference is a problem. (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.
- If shielded wire is used, **connect the shield only to the input connector.**
- **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



Cable connectors are numbered as they appear from the front.

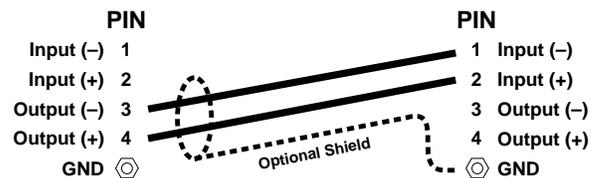


Fig. 3.6 Crown Bus Wiring for Removable Barrier Blocks

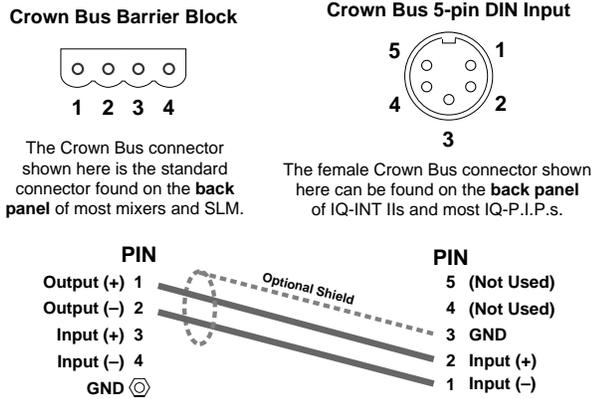


Fig. 3.7 Crown Bus Wiring for 5-pin DIN Input

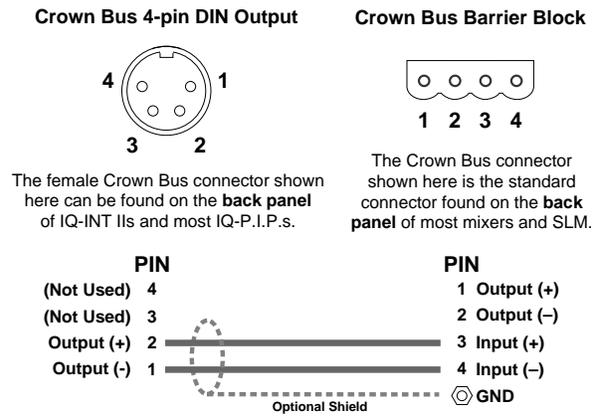
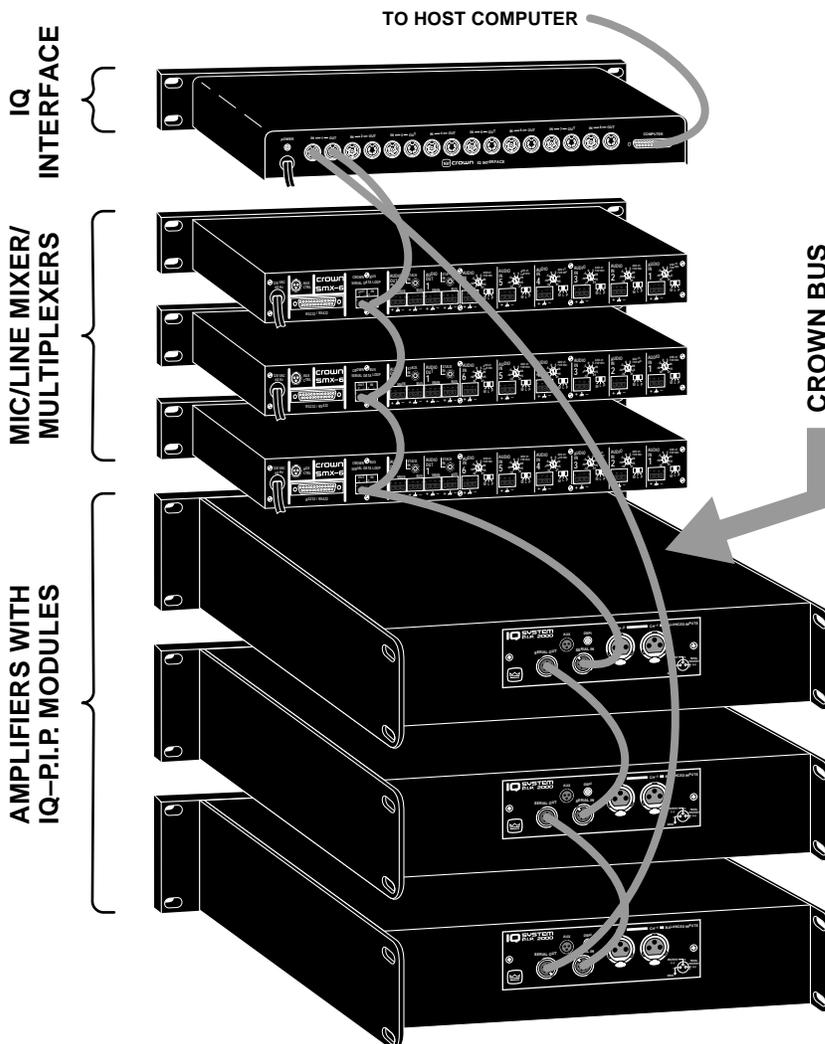


Fig. 3.8 Crown Bus Wiring for 4-pin DIN Output



Important: Provide adequate cooling if the unit will be used in a hot environment. Allow one empty rack space (1.75 inches or 4.4 centimeters) between each unit if more than four units will be stacked in a cabinet. Each empty rack space should be sealed with a blank rack panel to facilitate proper air flow inside the cabinet.

Figure 3.9 Crown Bus Wiring -Loops from Output to Input of Each IQ Component

added to the audio lines. Use only the signal lines which normally connect to pins 2 and 3 of the XLRs. *Note: Because typical mic cables have high capacitance, the maximum possible Crown Bus loop distance will be less.*

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 (greater than 10 miles) may also require fiber optic cabling.

Some examples of twisted pair wiring follow. Figure 3.6 shows point-to-point wiring for the Crown Bus using two female removable barrier block connectors:

Some IQ components use separate 5-pin and 4-pin DIN connectors for Crown Bus input and output wiring. Connecting to them is shown below:

The IQ components in each Crown Bus loop are wired in series. The output of one IQ component loops to the input of the next and so on. This is shown in Figure 3.9.

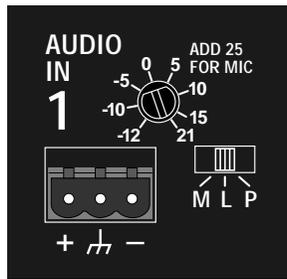


Fig. 3.10 An Audio Input Section

3.3 Connecting the Audio Ins & Outs (Step 3)

IQ mixer/multiplexers have 6 mic/line inputs and 2 stack inputs. (Input 6 of the AMB-5 is dedicated for ambient sensing and is discussed in Section 3.3.2.) For output, there are two audio channels that feed two main and two auxiliary bus outputs.

3.3.1 Mic/Line Inputs

Three-terminal removable barrier block connectors are provided for the audio inputs. Each input has an input selector switch. Slide it to the left (M) for microphone signal levels up to +7 dBu (0 dBu =

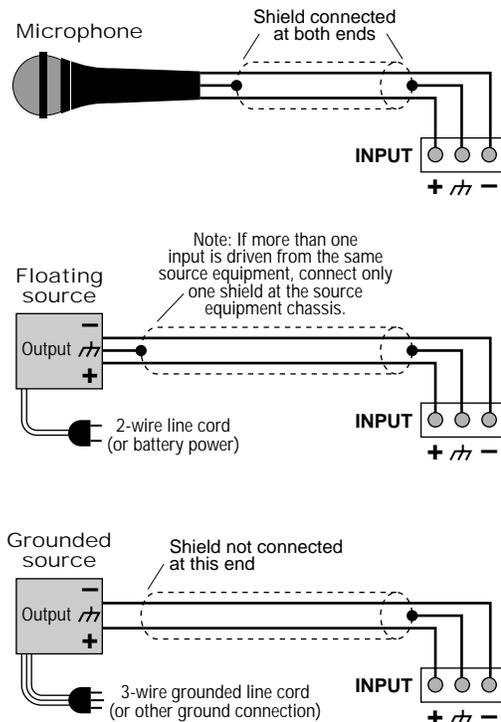


Fig. 3.12 Balanced Audio Input Wiring

| | Pro audio equipment | Semi-pro or consumer equipment | Dynamic mic, speech | Condenser mic, speech | Hot condenser mic, speech | Dynamic mic, music | Hot condenser mic, music | Close-miked dynamic mic, bass/drums | Close-miked dynamic mic, kick drum, guitar amp |
|--------------------------|---------------------|--------------------------------|---------------------|-----------------------|---------------------------|--------------------|--------------------------|-------------------------------------|--|
| dBm/dBV | +4 dBm | -10 dBV | -75 dBV | -65 dBV | -45 dBV | -55 dBV | -25 dBV | -15 dBV | -5 dBV |
| dBu | +4 dBu | -8 dBu | -73 dBu | -63 dBu | -43 dBu | -53 dBu | -23 dBu | -13 dBu | -3 dBu |
| Suggested Setting | -4 (L) | +8 (L) | +21 (M) | +11 (P) | +18 (P) | +21 (M) | -2 (P) | -12 (M) | -12 (M) or +3 (L) |

0 dBm = 0.775 VRMS with a 600 ohm load, 0 dBV = 1 VRMS, 0 dBu = 0.775 VRMS

Fig. 3.11 Suggested Audio Input Gain Control Settings

0.775 volts). Select the center position (L) for line level signals up to +32 dBu. Slide it to the right (P) to provide 44 VDC to mics requiring phantom power.

Each input has a screwdriver-set, calibrated gain control to compensate for different input source levels. The slot on the control shaft points to the gain setting. The settings are labelled for line-level input. Add 25 dB to the scale if the inputs are switched for microphone level signals.

Use a screwdriver to adjust the gain pot so that the input signal level plus gain equals roughly 0 dBu. You will need to know, or estimate, the level of the input source. Setting the source signal level to approximately 0 dBu will provide 20 dBu of headroom in the input preamp. Some recommended settings follow in Figure 3.11:

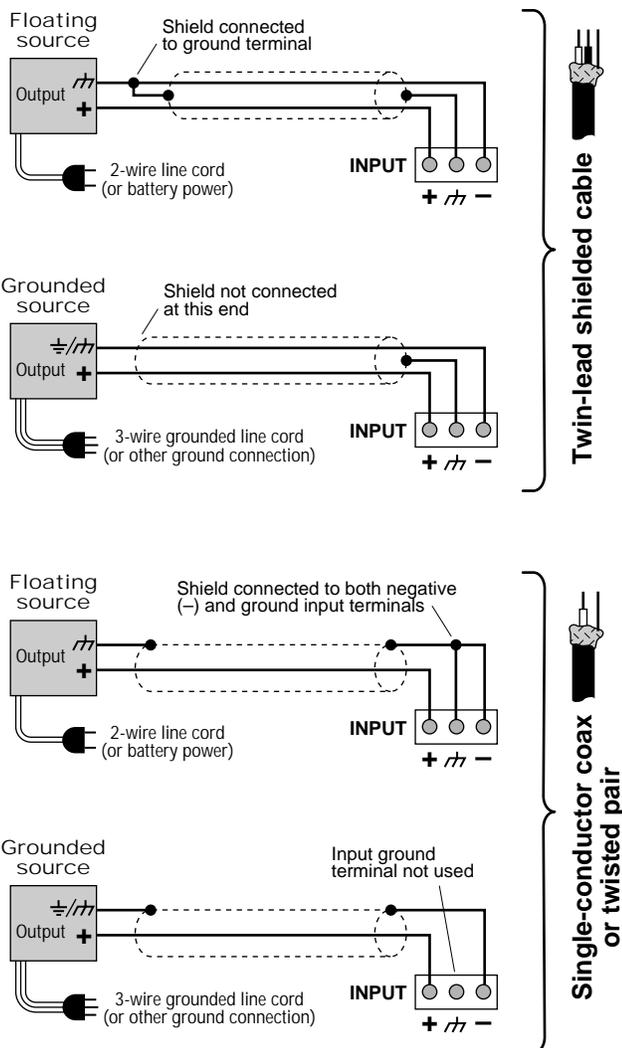


Fig. 3.13 Unbalanced Audio Input Wiring

Figures 3.12-13 show the normal wiring for balanced and unbalanced inputs. It is also possible to parallel the inputs of multiple units to increase the number of mixer outputs. For example, the inputs of two 6x2 MPX-6s can be paralleled to create a 6x4 mixer. This technique is described in Section 3.3.6.

Balanced sources should be wired as shown below in Figure 3.12. Notice that the shield is not connected to the chassis ground of the source if the source is also connected to the AC ground (that is, it has a grounded AC plug). This prevents unwanted ground loops.

Unbalanced sources should be wired as shown below in Figure 3.13. The examples in Figure 3.13 are grouped according to whether twin-lead shielded wire or single-conductor coax (and twisted pair) wire is used.

3.3.2 AMB-5 Ambient Sensing Input

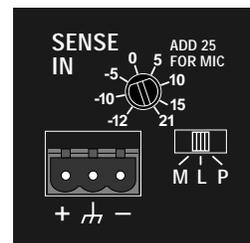


Fig. 3.14 Sensing Input Section

In addition to its automatic mixing capabilities, the AMB-5 also has the ability to adjust the output level of Channel 1 to the ambient sound level. (Remember, Channel 2 functions only as an MPX-6.) It does this with its sensing input (input 6). This is an extremely useful feature. With an AMB-5 the paging level at a train station can be automatically adjusted so pages can be heard over the roar of an incoming train and yet quieted to an appropriate level during periods of softer ambient sound levels.

The sensing input section of the back panel is shown in Figure 3.14 below. It has the same features as the other mic/line inputs: input gain control and input level switch.

The obvious way to use the sensing input is to connect a microphone (such as a Crown PZM-6D) to it and locate the microphone so that it can accurately receive the ambient sound level. **Great care must be taken in the placement of the ambient sensing microphone so that it is not too close to the loudspeakers being driven by the system. If it is too close, the system could go into feedback oscillation.**

It is also possible to connect more than one ambient sensing microphone to the sense input. This can be accomplished by taking advantage of the manual mixing function of Channel 2. Simply connect each ambient sensing microphone to one of the five regular inputs of the *AMB-5* and use the IQ software to assign each of them to Channel 2 only. Switch the sense input to the line-level position (L) and connect the main audio output of Channel 2 to it. Use the IQ software to control the level of the ambient sensing microphones. The microphones which are located in more critical areas can be set to a higher level so they will trigger the level controller first.

Be sure the microphone has adequate sensitivity for the spectral content of the ambient sound. For example, a microphone with a bandwidth designed solely for speech reinforcement may not have adequate low-frequency sensitivity to pick up the low-frequency noise of machinery in a factory.

3.3.3 Audio Outputs

Three-terminal removable barrier block connectors are provided for audio output (Figure 3.15). Both a main and bus output are provided for each of the two mixer channels. They are balanced and can drive 1200 ohms or more to +26 dBu or 600 ohms to +20 dBu. Each bus output can drive any number of inputs within this impedance range.

The main audio outputs are provided for connection with other audio equipment such as power amplifiers. They can also be stacked with the outputs of other mixer/multiplexers to increase the number of mixer inputs. For example, two 6x2 *MPX-6s* can be stacked to create a 12x2 mixer. This is described in Section 3.3.4.

The bus outputs are turned on or off by relays and function like the aux send outputs on a conventional mixing console. They are switched on or off by the *IQ System*. This special design allows many bus outputs to be connected to a common audio bus in a multiple-zone network (like a large airport paging

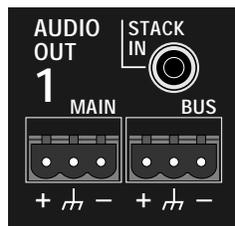


Fig. 3.15 Audio Output Section

system). Because the bus outputs are controlled by the *IQ System*, they can be kept off until they are actually used, preventing too many of them being on at the same time and loading down a common audio bus network.

The versatile bus outputs can be used for any audio system, small or large, where switchable outputs are desired, such as switchable recording outputs.

Both main and bus outputs are wired the same way. Balanced output wiring is shown below.

Notice that the shield is not connected to the output ground terminal if the load is connected to AC ground. This prevents unwanted ground loops. Unbalanced output wiring is shown next.

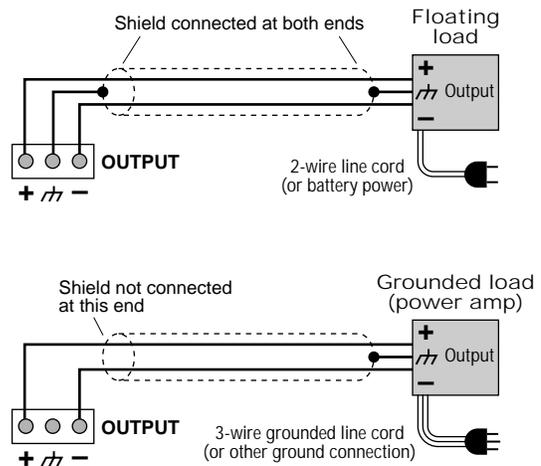


Fig. 3.16 Balanced Audio Output Connections

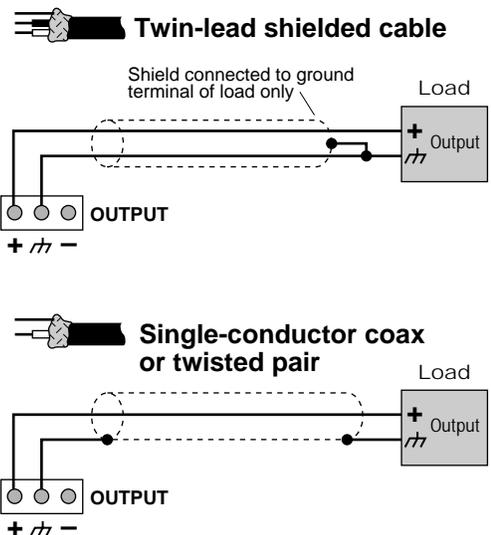


Fig. 3.17 Unbalanced Audio Output Connections

3.3.4 Stack Inputs

The stack in jacks (Figure 3.15) enable the audio inputs to be increased by stacking 2, 3, or more mixer/multiplexers to create a 12x2, 18x2 or wider mixer. Use 2-conductor shielded cable to route the signal from the main output of one unit to the stack input (RCA phono jack) of the second unit. This is shown in Figure 3.19. The stack input routes the signal directly to the output of the second unit. Use the outputs of the last unit in the stack for connection to amplifiers or other external audio equipment.

Note: The level of each signal on the stacked output bus is controlled by the unit having the signal as an input.

Stacking mixer/multiplexers can create an almost unlimited number of inputs. However, there will still only be two main and two auxiliary bus outputs for connection to other equipment. See Section 3.3.5 to find out how to increase the number of outputs.

The correct way to wire stacked units is shown below:

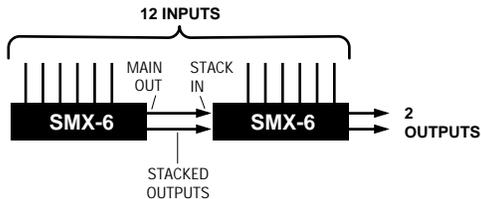


Fig. 3.18 A 12x2 Mixer Using 2 Mixer/Multiplexers

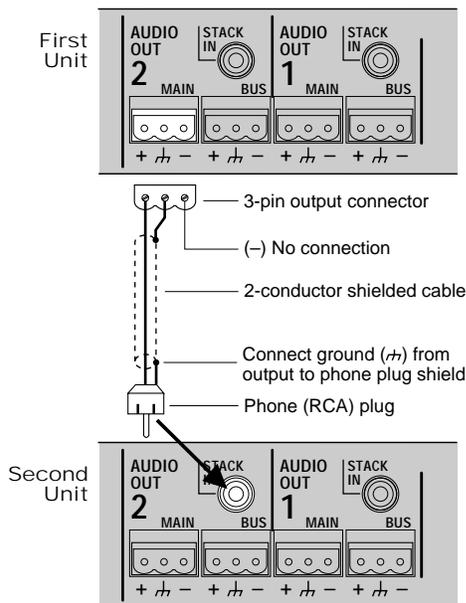


Fig. 3.19 Stacking the Outputs of Multiple Units

3.3.5 Paralleling Inputs

When using more than one unit, the inputs may be wired in parallel to increase the number of outputs that a source can drive. This is shown in Figures 3.20-21. For example, the audio signal in Figure 21 which feeds Input 1 is available to the outputs of both units, creating a 6x4 mixer.

Important: If the source is a microphone which requires phantom power (P) select it only at the first input. Switch all other parallel inputs to mic (M).

Note: When mixer inputs are paralleled, the total input impedance will drop by $1/N$ where N is the number of inputs to be connected. Depending on the signal source, this may place a limit on the number of possible outputs.

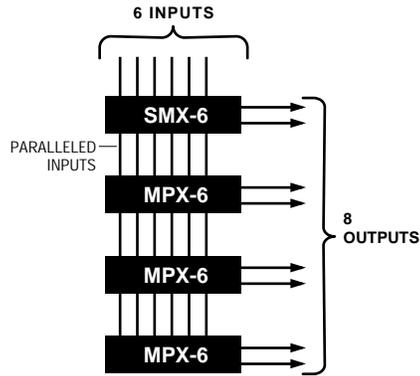


Fig. 3.20 A 6x8 Mixer Using 4 Mixer/Multiplexers

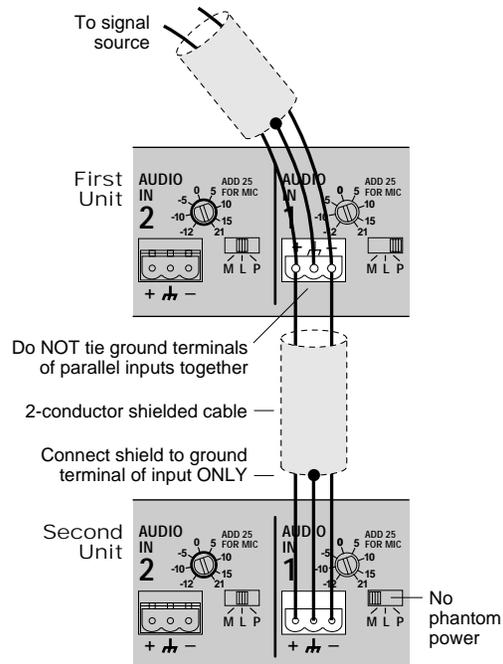


Fig. 3.21 Paralleling the Inputs of Multiple Units

By using several units and a combination of parallel inputs and stacked outputs, larger mixing configurations (12x8, 24x4, etc.) can be created as shown below:

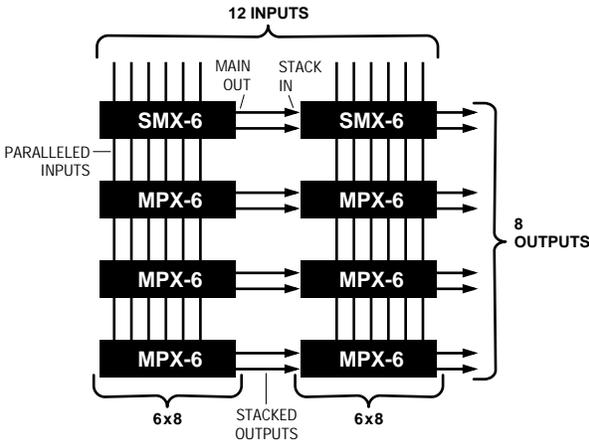


Fig. 3.22 A 12x8 Mixer Using 8 Mixer/Multiplexers

3.4 Connecting Auxiliary Devices (Step 4)

Auxiliary devices, external to the *IQ System*, can be turned on and off using the Aux port on the mixer/multiplexer. For example, auxiliary cooling for an amplifier equipment rack can be controlled using the Aux port to control a solid state relay which in turn controls a cooling fan. This is shown below in Figure 3.23:

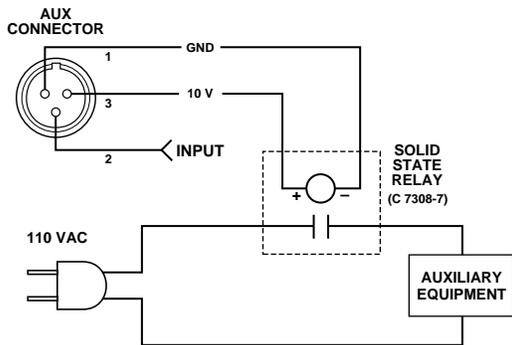


Fig. 3.23 Sample Auxiliary System Wiring

The solid state relay shown (Crown part number C 7308-7) can be ordered from Crown.

The Aux port uses a male 3-pin mini XLR connector which is located above the DB25 connector (Figure 2.1). Use a Switchcraft® TA3F cable connector or equivalent to make the connection.

When the Aux port is turned on by the *IQ System* it provides 10 VDC across pins 3 (+) and 1 (ground). An internal 1500 ohm resistor limits the current to a

maximum of 16 mA. This is shown below in Figure 3.24.

Notice in Figure 3.24 that the Aux port also has the capability to receive a signal across pins 2 (+) and 1 (ground). It is a high impedance input and includes a pull-down resistor.

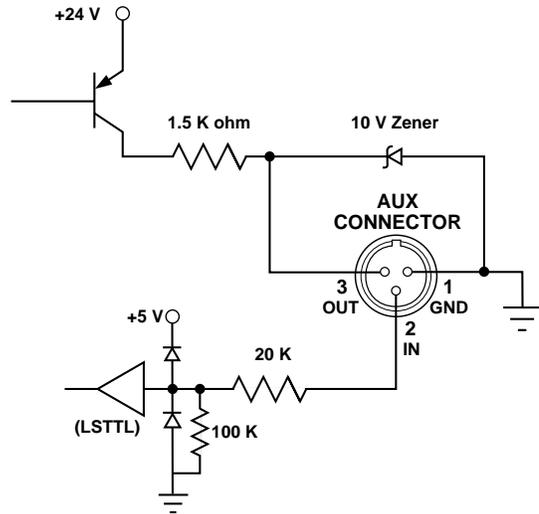


Fig. 3.24 Internal Auxiliary Circuit

4 Options

There are two optional uses for mixer serial ports. The first is direct RS232/RS422 communication with the unit where the unit is its own interface and interface for any connected components. The second, called Crown Local Net, applies only to SMX-6 mixers.

4.1 A 1-Loop IQ Interface

The serial port allows any of the mixer models to serve as an IQ interface between a host computer and a single Crown Bus loop.

Note: While 250 IQ components of each type can be controlled on a single Crown Bus loop, it is recommended that no more than 20 units be connected to an AMB-5 or SMX-6. This is because of the tremendous timing demands on their microprocessors. More than 20 IQ components may cause timing problems. The MPX-6 has no such limitations.

Note: While the mixers may be used as a system interface, they do not support IO2 protocol as an interface. The only components that an IQ mixer may use as interface for are other mixers, MRX relay modules, and IQ-PIP-AP modules.

With the built in serial port an IQ mixer can eliminate the need for an external IQ Interface (IQ-INT II) in a small system. The mixer connects directly to the host computer via the DB25 serial connector. Switches accessed through the side of the chassis are used to select the serial interface configuration, parity and baud rate. See Section 3.1 for specific wiring and switch instructions.

4.2 Crown Local Net

Crown Local Net is available only for an SMX-6. It enables multiple SMX-6s to be interconnected via a Crown Local Net (CLN). This is a pseudo-RS422 communication loop designed for local communication between IQ components apart from the Crown Bus. SMX-6s can use this option to communicate the total number of open mics in the system as well as their individual ducking priorities. In this way, one SMX-6 will know how many mics are being used by other SMX-6s and can take appropriate action to prevent feedback or implement priority switching (ducking) of mics.

Note: Because RS232/422 and CLN use the same DB25 connector, they cannot be used at the same

time. This means that SMX-6s will need to be connected to a Crown Bus via an external IQ interface for setup of a CLN.

4.2.1 Wiring the Crown Local Net

A Crown Local Net is a serial loop (Figure 4.1). With two exceptions, a Crown Local Net loop is wired the same as standard RS422 wiring. **Exception 1:** The Crown Local Net does not use handshaking, therefore pins 4 and 5 (RTS/CTS) are not used. **Exception 2:** When more than 2 components will be communi-

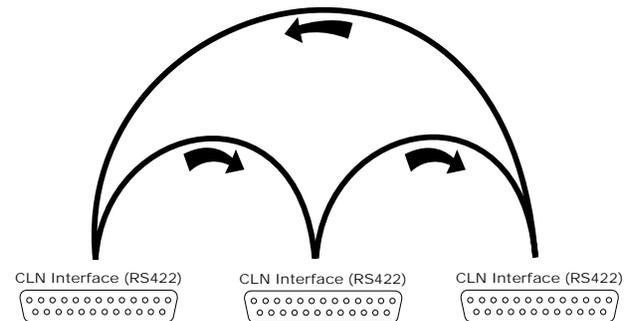


Fig. 4.1 A Crown Local Net RS422 Serial Loop

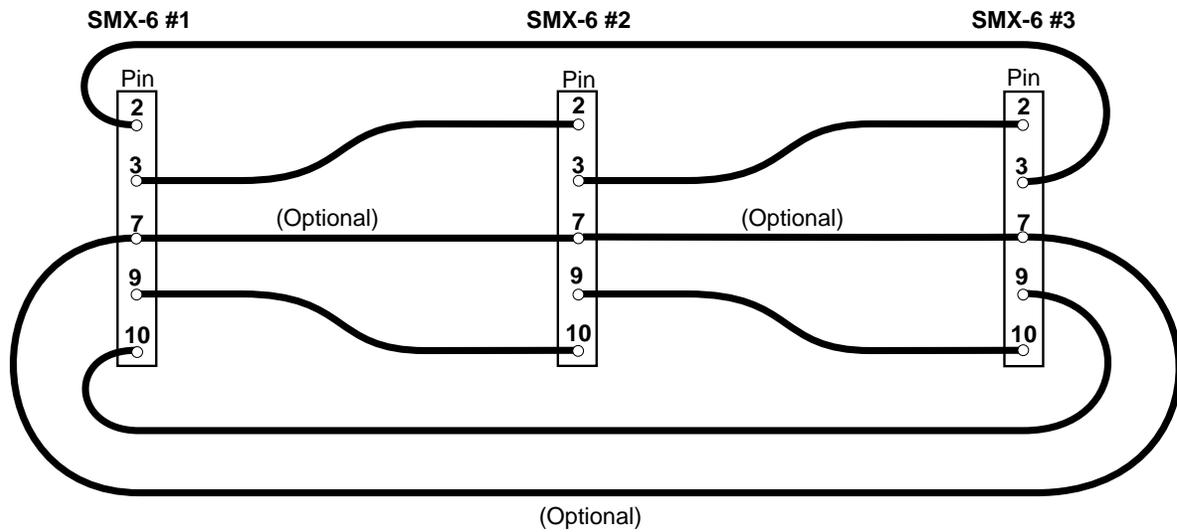
cating on a Crown Local Net, two cables must be connected to each DB25 connector...one for incoming data and one for outgoing data. With two units on a Crown Local Net, only one cable is attached to the connector.

Figure 4.2 shows the wiring for a 3-unit Crown Local Net. If more units are desired, simply add another unit and follow the same pattern for wiring. *Note: Pin 7 should not be used as a ground if the units are already properly grounded. The wire used for RS422 communication is usually unsuitable for use as a ground.*

Important: The Crown Local Net must make a complete loop. If the last unit in a group is not connected to the first unit, the system will not function.

Important: The Crown Local Net depends on proper IQ address assignments, even if the system will not be installed with a Crown Bus loop. Each unit in a Crown Local Net must have a different IQ address. See Section 3.2 for details.

As more diverse IQ communications are needed, the Crown Local Net will be available to move information directly between IQ components without affecting the performance of a host computer.



Pin 2 Serial In (-)
Pin 3 Serial Out (-)
Pin 7 GND (Optional)

Pin 9 Serial Out (+)
Pin 10 Serial In (+)
(All other pins are not used.)

Fig. 4.2 Crown Local Net Wiring

5 Service

Your unit has very sophisticated circuitry which should only be serviced by a fully trained technician. This is one reason why each unit bears the following label:

CAUTION: TO PREVENT ELECTRIC SHOCK DO NOT OPEN. NO USER SERVICEABLE PARTS INSIDE. REFER SERVICING TO A QUALIFIED TECHNICIAN.

5.1 International Service

Service may be obtained from an authorized Importer Service Center. (Contact your local Importer or our office for a list of authorized service centers.) Simply present your bill of sale as proof of purchase along with the defective unit to an authorized Service Center to obtain service. They will handle the necessary paperwork and repair.

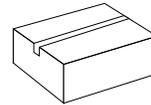
Remember to transport your unit in the original factory pack. Amcron will pay the surface shipping costs both ways **for warranty service** to the authorized service center nearest you after receiving copies of all shipping receipts. You must bear the expense of all taxes, duties, and customs fees when transporting the unit.

5.2 Crown Service

Service may be obtained in one of two ways: from an authorized Crown Service Center or from the factory. You may choose either. It is important that you have your copy of the bill of sale as your proof of purchase.

5.2.1 Service at a Crown Service Center

This method usually saves you the most time and effort. Simply present your bill of sale along with the defective unit to an authorized Crown Service Center. They will handle the necessary paperwork and repair. Remember to transport your unit in the original factory pack.



5.2.2 Crown Factory Service

To obtain factory service, fill out the *Service Information Card* in the back of this manual and send it along with proof of purchase and the defective unit to the Crown factory. Enclose a letter explaining the nature of the problem and what service you would like. Include your return shipping address and telephone number.

The unit must be shipped in the original factory pack. If you no longer have the original shipping container, contact us and we will promptly send you a replacement.

Crown will pay ground shipping costs both ways in the United States **for warranty service** after receiving copies of all shipping receipts. Shipments should be sent UPS ground. (If the unit is under warranty, you may send it C.O.D. for the cost of the shipping.) The factory will return your serviced unit via UPS ground. Please contact our Shipping Department (219-294-8246) if other arrangements are necessary.

Crown Technical Support Group
POB 1000
Elkhart, Indiana 46515-1000 U.S.A.
Phone: 1-800-342-6939
or: 1-219-294-8200
Fax: 1-219-294-8301

6 Technical Information

The *IQ System* was developed to provide a way to both monitor and control complete sound systems during operation. The system began with amplifier control using plug-in IQ-P.I.P. modules in each amplifier and an IQ-INT to connect the system to a host computer. The next major advance was the *MPX-6*, the first intelligent mixer/multiplexer able to mix and route audio inputs under computer control. Now, the *SMX-6* and *AMB-5* sensing mixers offer advanced signal processing and have the capability of mixing audio signals automatically.

6.1 Audio

6.1.1 Input Section

Each audio input signal first passes through a balanced filter designed to eliminate RF interference. The RF filters are a balanced network of chokes, ferrite beads and capacitors that attenuate both common-mode and differential-mode signals above 500 kHz. Optional input isolation transformers can also be added by the factory.

The signal then enters the input switching circuit. This circuit can insert a 25-dB pad for line level signals or apply phantom power to the input terminals (44 volts through two 6810-ohm resistors). The signal is filtered again to eliminate lower-frequency RF energy such as interference from the AM broadcast band. The signal then goes to the preamp stage.

Each of the six input preamplifier stages is a balanced circuit providing from 13 to 46 dB of voltage gain. The preamp consists of a pair of low-noise transistors followed by a high performance op-amp. The transistors, in effect, convert the input voltage to a current while maintaining reasonably high input impedance. Their transconductance (output current divided by input voltage) depends on the setting of the gain control. The op-amp then converts the current back to a voltage to drive subsequent circuits.

6.1.2 VCA Sections

Each preamplifier output drives two VCAs which then drive the two current-summing mix buses. The stack inputs also feed into the mix buses. The VCA's derive their control voltages from a multiplexer circuit driven from the microprocessor. The microprocessor uses onboard *algos* or commands from a host computer to control the VCAs (depend-

ing upon the model). Levels can be set in $\frac{1}{2}$ dB increments from 25 dB gain to 100 dB attenuation (which is considered off).

6.1.3 Output Section

The two mix buses are sent to the corresponding main output and auxiliary bus output stages. All output stages are active, balanced and can drive 1200 ohms to +26 dBu or 600 ohms to +20 dBu. The auxiliary bus output stages have internal relay contacts which can connect or disconnect the signal to the auxiliary bus output connector. These contacts are controlled by the host computer and thus allow programmed signal routing. Optional output isolation transformers can also be added by the factory.

6.1.4 Level Sense Circuits (*AMB-5* and *SMX-6* only)

The output of each input preamp and each mix amp is monitored by a corresponding level detector. Each level detector tracks the peak level of the signal and releases with a time constant of about 85 ms. The eight levels are sent to a multiplexer and the A/D converter.

6.2 Control and Interface Section

The host computer communicates with the unit microprocessor either through an outboard IQ interface (like an IQ-INT) via the Crown Bus, or directly through the RS232/RS422 port. Each unit acts only on commands with an address matching its own.

6.2.1 Crown Bus Interface

The serial loop (Crown Bus) connections on the unit are made with an opto-isolated 4-pin removable barrier block connector and a ground stud for the optional connection of shielded wire. To prevent ground loops, only the input cable's shield should be connected. These connections conform to *IQ System* standards, which allow the host computer to control numerous IQ components with the same computer program.

6.2.2 RS232/RS422 Interface

Depending on selected options, the DB25 connector can be used to communicate directly with the host computer for setup or control of a Crown Bus loop, or (*SMX-6* only) for connection to an RS422 Crown Local Net. A switch selects either RS232 or RS422 operation.

6.2.3 D/A Converter

To set channel gain levels, a digital-to-analog converter continuously converts all gain settings to control voltages. An analog demultiplexer sends the appropriate control voltages to each of the twelve VCAs.

6.2.4 Log Amp and A/D Converter

The A/D converter scans through an eight-channel multiplexer to read the input and output signal levels. When a channel is selected, the signal is sent through a logarithmic amplifier for increased dynamic range. This analog voltage is then converted to a binary number that the microprocessor can read. The processor can then mathematically increase detector time constants, perform averaging or other response functions.

6.2.5 Auxiliary Port

Auxiliary devices such as supplemental cooling fans can be remotely controlled via the AUX output on the unit. When the auxiliary control feature is turned on by the host computer, 10 VDC is supplied across pin 3 and pin 1 (ground) of the male 3-pin AUX connector. This port can control solid state relays, and since it has a current-limit resistor (16 mA max.), it can directly drive an LED or optocoupler.

The AUX input function is used by applying a 5-30 VDC signal to pin 2 (with pin 1 as ground). A high or low signal here will be communicated to the host computer. A logic low can be less than 0 volts (negative); the signal is internally clamped for circuit protection.

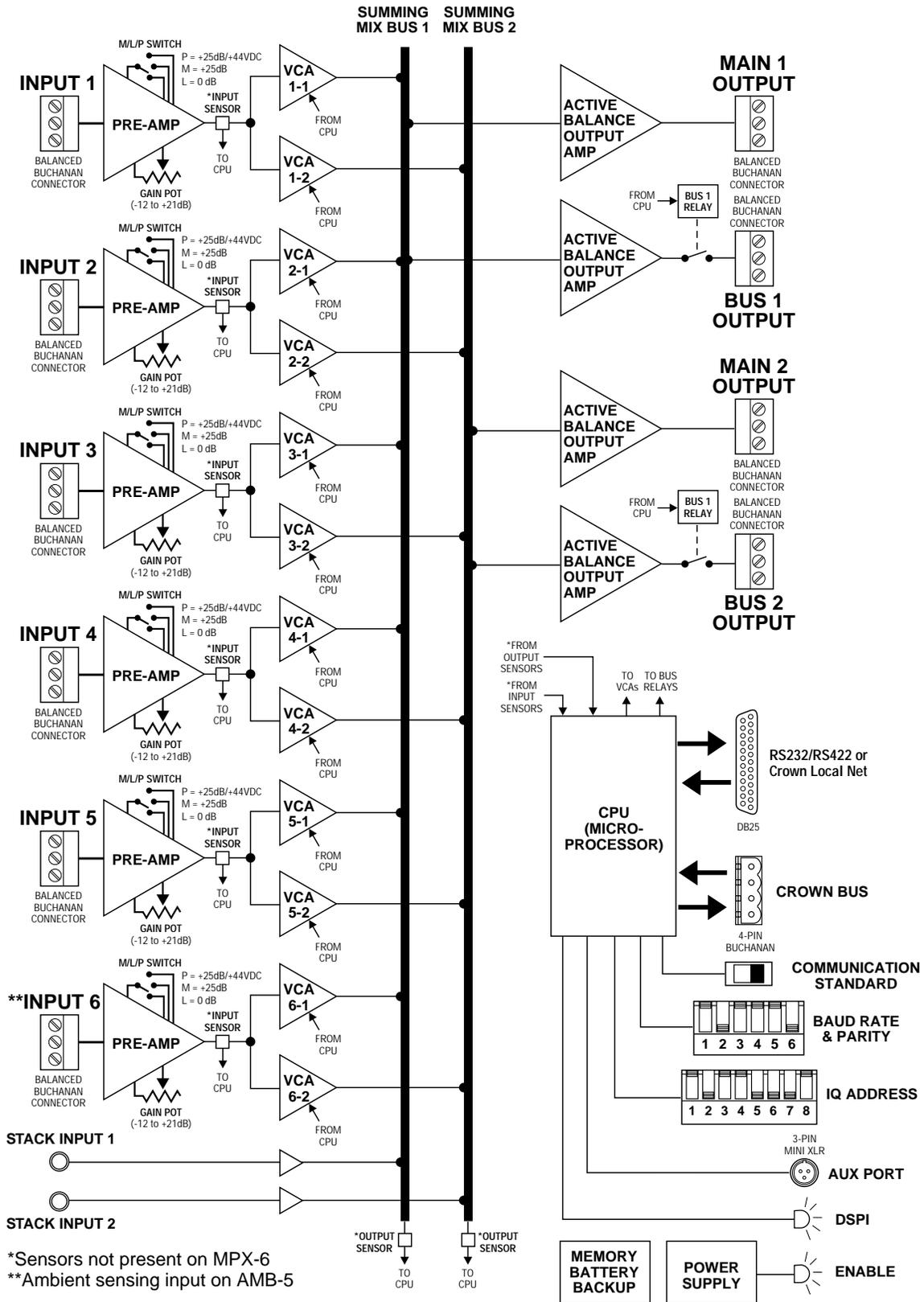


Fig. 6.1 General IQ Mixer Block Diagram

7 Specifications

7.1 General

Protection: Audio outputs can be shorted indefinitely without causing damage. If communication is lost, the unit will continue functioning as programmed. If power is interrupted, the unit will function as programmed before the AC failure after the power is restored.

Controls: DIP switches and a slide switch are accessible from the right side of the unit for setting the communication format, baud rate, parity and Crown Bus address. Each audio input has a 3-position selector (mic/line/phantom-powered mic) and a calibrated gain control.

Display: A red Enable LED lights when power is applied to the unit. A yellow DSPI (Data Signal Presence Indicator) LED lights when the appropriate command is sent from the system computer or whenever the unit is receiving data.

Connectors

Audio inputs and outputs: 3-pin male removable barrier block connectors. Buchanan® type SSB4L03S cable connector or equivalent supplied.

Crown Bus serial communication: 4-pin male removable barrier block connector and chassis ground stud. Buchanan type SSB4L04S cable connector or equivalent supplied.

Aux control: 3-pin Switchcraft TB3M. Mates with Switchcraft TA3F cable connector or equivalent.

RS232/422/Crown Local Net: Female DB25.

Stacking inputs: Phono (RCA) jacks.

Auxiliary Control: Output ON applies 10 VDC to pin 3. Input ON is caused by applying 5 to 30 VDC at pin 2. Pin 1 is ground reference.

Power Requirements: 120 VAC, 60 Hz, 20 W.

Dimensions: 19 inches (48.3 cm) wide for standard rack mounting, 1.75 inches (4.4 cm) high, 9.8 inches (24.9 cm) deep behind mounting surface, 0.15 inches (3.8 mm) deep in front of mounting surface.

Weight: 8 lbs 13 oz (4 kg).

Finish: Black splatter-coat chassis and front panel.

Construction: 16-ga. steel chassis, 18-ga. steel cover, 0.125-inch (3.2 mm) aluminum front panel.

7.2 Audio

Input Type: Active differential, transformers optional.

Input Impedance: Microphone: 4 kohms nominal. Balanced Line: 20 kohms. Unbalanced Line: 13 kohms.

Maximum Input Level: Microphone: +7 dBu. Line: +32 dBu (0 dBu = .775 Vrms).

Phantom Power: 44 VDC through two 6810-ohm resistors, switchable at each mic input.

Common Mode Rejection Ratio: (Typical) 60 Hz-1 kHz: 55 dB. 20 Hz-20 kHz: 45 dB.

Output Type: Active balanced, optional transformers. For unbalanced operation, leave the "-" terminal open.

Output Impedance: 50 ohms per side, 100 ohms balanced.

Maximum Output Level: +26 dBu balanced.

Maximum Gain: Mic input: 77 dB. Line input: 52 dB.

Frequency Response: +0/-1 dB from 20 Hz to 20 kHz.

Harmonic Distortion: Less than 0.05% at +4 dBm output. Less than 0.15% at +20 dBm output, 20 Hz to 20 kHz measured at mic input with 40 dB gain.

Noise: Output noise, all inputs off: -80 dBu (106 dB below rated output). Output noise, one line input at 0 dB gain: -80 dBu. Equivalent input noise, mic input, 46 dB gain, 150-ohm source: -125 dBu. (Specs are typical, unweighted, for 20 Hz to 20 kHz.)

Crosstalk: Adjacent inputs/outputs at 1 kHz: better than -80 dB. Adjacent inputs/outputs from 20 Hz to 20 kHz: better than -65 dB.

Appendix A

This Appendix contains look-up tables for every valid IQ address. The valid address are 1 to 250. **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 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 mixer/multiplexer card as shown. See Section 3.2.1 also.

| | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0 | OFF |
| 2 | OFF | ON | OFF | OFF | OFF | OFF | OFF | OFF |
| 4 | OFF | OFF | ON | OFF | OFF | OFF | OFF | OFF |
| 6 | OFF | ON | ON | OFF | OFF | OFF | OFF | OFF |
| 8 | OFF | OFF | OFF | ON | OFF | OFF | OFF | OFF |
| 10 | OFF | ON | OFF | ON | OFF | OFF | OFF | OFF |
| 12 | OFF | OFF | ON | ON | OFF | OFF | OFF | OFF |
| 14 | OFF | ON | ON | ON | OFF | OFF | OFF | OFF |
| 16 | OFF | OFF | OFF | OFF | ON | OFF | OFF | OFF |
| 18 | OFF | ON | OFF | OFF | ON | OFF | OFF | OFF |
| 20 | OFF | OFF | ON | OFF | ON | OFF | OFF | OFF |
| 22 | OFF | ON | ON | OFF | ON | OFF | OFF | OFF |
| 24 | OFF | OFF | OFF | ON | ON | OFF | OFF | OFF |
| 26 | OFF | ON | OFF | ON | ON | OFF | OFF | OFF |
| 28 | OFF | OFF | ON | ON | ON | OFF | OFF | OFF |
| 30 | OFF | ON | ON | ON | ON | OFF | OFF | OFF |
| 32 | OFF | OFF | OFF | OFF | OFF | ON | OFF | OFF |
| 34 | OFF | ON | OFF | OFF | OFF | ON | OFF | OFF |
| 36 | OFF | OFF | ON | OFF | OFF | ON | OFF | OFF |
| 38 | OFF | ON | ON | OFF | OFF | ON | OFF | OFF |
| 40 | OFF | OFF | OFF | ON | OFF | ON | OFF | OFF |
| 42 | OFF | ON | OFF | ON | OFF | ON | OFF | OFF |
| 44 | OFF | OFF | ON | ON | OFF | ON | OFF | OFF |
| 46 | OFF | ON | ON | ON | OFF | ON | OFF | OFF |
| 48 | OFF | OFF | OFF | OFF | ON | ON | OFF | OFF |
| 50 | OFF | ON | OFF | OFF | ON | ON | OFF | OFF |
| 52 | OFF | OFF | ON | OFF | ON | ON | OFF | OFF |
| 54 | OFF | ON | ON | OFF | ON | ON | OFF | OFF |
| 56 | OFF | OFF | OFF | ON | ON | ON | OFF | OFF |
| 58 | OFF | ON | OFF | ON | ON | ON | OFF | OFF |
| 60 | OFF | OFF | ON | ON | ON | ON | OFF | OFF |
| 62 | OFF | ON | ON | ON | ON | ON | OFF | OFF |
| 64 | OFF | OFF | OFF | OFF | OFF | OFF | ON | OFF |
| 66 | OFF | ON | OFF | OFF | OFF | OFF | ON | OFF |
| 68 | OFF | OFF | ON | OFF | OFF | OFF | ON | OFF |
| 70 | OFF | ON | ON | OFF | OFF | OFF | ON | OFF |
| 72 | OFF | OFF | OFF | ON | OFF | OFF | ON | OFF |
| 74 | OFF | ON | OFF | ON | OFF | OFF | ON | OFF |
| 76 | OFF | OFF | ON | ON | OFF | OFF | ON | OFF |
| 78 | OFF | ON | ON | ON | OFF | OFF | ON | OFF |
| 80 | OFF | OFF | OFF | OFF | ON | OFF | ON | OFF |
| 82 | OFF | ON | OFF | OFF | ON | OFF | ON | OFF |
| 84 | OFF | OFF | ON | OFF | ON | OFF | ON | OFF |
| 86 | OFF | ON | ON | OFF | ON | OFF | ON | OFF |
| 88 | OFF | OFF | OFF | ON | ON | OFF | ON | OFF |
| 90 | OFF | ON | OFF | ON | ON | OFF | ON | OFF |
| 92 | OFF | OFF | ON | ON | ON | OFF | ON | OFF |
| 94 | OFF | ON | ON | ON | ON | OFF | ON | OFF |
| 96 | OFF | OFF | OFF | OFF | OFF | ON | ON | OFF |
| 98 | OFF | ON | OFF | OFF | OFF | ON | ON | OFF |
| 100 | OFF | OFF | ON | OFF | OFF | ON | ON | OFF |
| 102 | OFF | ON | ON | OFF | OFF | ON | ON | OFF |
| 104 | OFF | OFF | OFF | ON | OFF | ON | ON | OFF |
| 106 | OFF | ON | OFF | ON | OFF | ON | ON | OFF |
| 108 | OFF | OFF | ON | ON | OFF | ON | ON | OFF |
| 110 | OFF | ON | ON | ON | OFF | ON | ON | OFF |
| 112 | OFF | OFF | OFF | OFF | ON | ON | ON | OFF |
| 114 | OFF | ON | OFF | OFF | ON | ON | ON | OFF |
| 116 | OFF | OFF | ON | OFF | ON | ON | ON | OFF |
| 118 | OFF | ON | ON | OFF | ON | ON | ON | OFF |
| 120 | OFF | OFF | OFF | ON | ON | ON | ON | OFF |
| 122 | OFF | ON | OFF | ON | ON | ON | ON | OFF |
| 124 | OFF | OFF | ON | ON | ON | ON | ON | OFF |

Fig. A.1 IQ Address Switch Settings from 0 to 125

| | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 126 | OFF | ON | ON | ON | ON | ON | ON | OFF |
| 128 | OFF | ON |
| 130 | OFF | ON | OFF | OFF | OFF | OFF | OFF | ON |
| 132 | OFF | OFF | ON | OFF | OFF | OFF | OFF | ON |
| 134 | OFF | ON | ON | OFF | OFF | OFF | OFF | ON |
| 136 | OFF | OFF | OFF | ON | OFF | OFF | OFF | ON |
| 138 | OFF | ON | OFF | ON | OFF | OFF | OFF | ON |
| 140 | OFF | OFF | ON | ON | OFF | OFF | OFF | ON |
| 142 | OFF | ON | ON | ON | OFF | OFF | OFF | ON |
| 144 | OFF | OFF | OFF | OFF | ON | OFF | OFF | ON |
| 146 | OFF | ON | OFF | OFF | ON | OFF | OFF | ON |
| 148 | OFF | OFF | ON | OFF | ON | OFF | OFF | ON |
| 150 | OFF | ON | ON | OFF | ON | OFF | OFF | ON |
| 152 | OFF | OFF | OFF | ON | ON | OFF | OFF | ON |
| 154 | OFF | ON | OFF | ON | ON | OFF | OFF | ON |
| 156 | OFF | OFF | ON | ON | ON | OFF | OFF | ON |
| 158 | OFF | ON | ON | ON | ON | OFF | OFF | ON |
| 160 | OFF | OFF | OFF | OFF | OFF | ON | OFF | ON |
| 162 | OFF | ON | OFF | OFF | OFF | ON | OFF | ON |
| 164 | OFF | OFF | ON | OFF | OFF | ON | OFF | ON |
| 166 | OFF | ON | ON | OFF | OFF | ON | OFF | ON |
| 168 | OFF | OFF | OFF | ON | OFF | ON | OFF | ON |
| 170 | OFF | ON | OFF | ON | OFF | ON | OFF | ON |
| 172 | OFF | OFF | ON | ON | OFF | ON | OFF | ON |
| 174 | OFF | ON | ON | ON | OFF | ON | OFF | ON |
| 176 | OFF | OFF | OFF | OFF | ON | ON | OFF | ON |
| 178 | OFF | ON | OFF | OFF | ON | ON | OFF | ON |
| 180 | OFF | OFF | ON | OFF | ON | ON | OFF | ON |
| 182 | OFF | ON | ON | OFF | ON | ON | OFF | ON |
| 184 | OFF | OFF | OFF | ON | ON | ON | OFF | ON |
| 186 | OFF | ON | OFF | ON | ON | ON | OFF | ON |
| 188 | OFF | OFF | ON | ON | ON | ON | OFF | ON |
| 190 | OFF | ON | ON | ON | ON | ON | OFF | ON |
| 192 | OFF | OFF | OFF | OFF | OFF | OFF | ON | ON |
| 194 | OFF | ON | OFF | OFF | OFF | OFF | ON | ON |
| 196 | OFF | OFF | ON | OFF | OFF | OFF | ON | ON |
| 198 | OFF | ON | ON | OFF | OFF | OFF | ON | ON |
| 200 | OFF | OFF | OFF | ON | OFF | OFF | ON | ON |
| 202 | OFF | ON | OFF | ON | OFF | OFF | ON | ON |
| 204 | OFF | OFF | ON | ON | OFF | OFF | ON | ON |
| 206 | OFF | ON | ON | ON | OFF | OFF | ON | ON |
| 208 | OFF | OFF | OFF | OFF | ON | OFF | ON | ON |
| 210 | OFF | ON | OFF | OFF | ON | OFF | ON | ON |
| 212 | OFF | OFF | ON | OFF | ON | OFF | ON | ON |
| 214 | OFF | ON | ON | OFF | ON | OFF | ON | ON |
| 216 | OFF | OFF | OFF | ON | ON | OFF | ON | ON |
| 218 | OFF | ON | OFF | ON | ON | OFF | ON | ON |
| 220 | OFF | OFF | ON | ON | ON | OFF | ON | ON |
| 222 | OFF | ON | ON | ON | ON | OFF | ON | ON |
| 224 | OFF | OFF | OFF | OFF | OFF | ON | ON | ON |
| 226 | OFF | ON | OFF | OFF | OFF | ON | ON | ON |
| 228 | OFF | OFF | ON | OFF | OFF | ON | ON | ON |
| 230 | OFF | ON | ON | OFF | OFF | ON | ON | ON |
| 232 | OFF | OFF | OFF | ON | OFF | ON | ON | ON |
| 234 | OFF | ON | OFF | ON | OFF | ON | ON | ON |
| 236 | OFF | OFF | ON | ON | OFF | ON | ON | ON |
| 238 | OFF | ON | ON | ON | OFF | ON | ON | ON |
| 240 | OFF | OFF | OFF | OFF | ON | ON | ON | ON |
| 242 | OFF | ON | OFF | OFF | ON | ON | ON | ON |
| 244 | OFF | OFF | ON | OFF | ON | ON | ON | ON |
| 246 | OFF | ON | ON | OFF | ON | ON | ON | ON |
| 248 | OFF | OFF | OFF | ON | ON | ON | ON | ON |
| 250 | OFF | ON | OFF | ON | ON | ON | ON | ON |

Fig. A.2 IQ Address Switch Settings from 126 to 250