

SMX-6 Sensing Mixer/Multiplexer OPERATION GUIDE

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This guide describes how to operate an SMX-6 using control blocks and sub-blocks. It is also possible to operate an SMX-6 from a graphics plate. Please refer to the *Graphics Plate Operation Guide* for additional instructions.



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THE
FEDERAL
BUREAU OF
INVESTIGATION
UNITED STATES DEPARTMENT OF JUSTICE

MEMORANDUM FOR THE DIRECTOR
FROM THE SAC, NEW YORK
SUBJECT: [Illegible]

RE: [Illegible]

1 The SMX-6

The SMX-6 is a sensing 6x2 mixer/multiplexer with six mic/line inputs, two main line-level outputs and two switchable bus outputs. It contains a sensing circuit at the beginning of each input to sense the input signal level ahead of any signal processing. Similar sensors are located at each output channel. These sensors, along with its on-board intelligence, enable the SMX-6 to perform many versatile functions like automatic mixing, compression, limiting and automatic level control. In addition, an SMX-6 also has all the manual switching and routing capabilities of an MPX-6.

A single SMX-6 can be used to automate a small cost-effective audio system for a church so that skilled audio personnel are not required. It can also safeguard against feedback and other common audio problems. In larger systems, SMX-6 mixer/multiplexers can help automate audio systems for complex conference setups, hotel room combining systems or any system where automatic mixing, automatic level control and adaptability are required.

Because the SMX-6 is configured and controlled by computer software, its function is limited only by the sophistication and imagination of the programmer. But you don't have to be a computer hack to unlock the power of a sensing multiplexer. The straight-forward settings in the individual *algos* which comprise the SMX-6 algo pack and the logical organization of the IQ software *dataframe* make it very easy for a non-programmer to set up and operate an SMX-6.



1.1 The SMX-6 Algo Pack

The on-board intelligence of the SMX-6 is controlled by the algo pack in its microprocessor. The algo pack contains the individual *algos* which control its various automation features. Each *algo* is listed below along with a brief description.

- ☐ **Gate algo:** Automatically turns an input on and off (called "gating") whenever an incoming audio signal level passes a preset threshold level.
- ☐ **Duck Priority algo:** Controls the priority of each input and how much the low priority inputs will be attenuated or "ducked" when a higher priority input is activated (its gate is opened). There are six different priority levels.

- ☐ **Input Compressor/Limiter algo:** Controls the threshold, compression ratio and release time of a feed-forward input compressor/limiter. There is a separate Channel 1 and 2 compressor/limiter for each input.
- ☐ **Auto Level algo:** Automatically adjusts the level of selected inputs to achieve a target level. Each input has a separate Channel 1 and 2 target level.
- ☐ **Output Compressor/Limiter algo:** Controls the threshold, compression ratio and release time of each channel's output compressor/limiter.
- ☐ **Gate Count algo:** Counts how many inputs are activated at any instant and applies a preset attenuation as the number increases to prevent feedback.
- ☐ **External algos:** Enables multiple SMX-6s with Option 4 to respond to external Duck and Gate Count algos via Crown Local Net (CLN) wiring.

All *algos* can be individually turned on and off for each input or output channel, making them extremely versatile. This is controlled from the IQ software sub-block screens for each unit. As a group, all *algos* in the SMX-6 algo pack can be turned on or off with the ASA control on the SMX-6 control block screen.

The SMX-6 contains a built-in battery which preserves all algo pack settings for at least 60 days (when fully charged). This enables you to configure an SMX-6 before it is physically installed into an audio system. *Note: It is a good idea to plug an SMX-6 into an active AC receptical for 24 hours before programming it to make sure its battery is fully charged.*

1.2 SMX-6 Features

Manual controls (software):

The manual software features are controlled on the control block screen.

- ☐ Increase and decrease each input level in ½ dB steps over a 125 dB range.
- ☐ Independently switch each audio bus output on and off.
- ☐ Independently mute each input (mute = full attenuation).
- ☐ Turn any auxiliary device connected to the AUX port on or off.
- ☐ Force the DSPI (Data Signal Presence Indicator) to remain on. (A troubleshooting feature for Crown Bus loop communication.)

Manual controls (hardware):

The manual hardware controls are located on the back panel of the unit.

- ☐ Individual three-position input level control for each input. The positions are for line, mic and phantom powered mic level signals.
- ☐ Individual preamp gain control for each input. (Can be used to compensate for differing input levels.)

Automation controls (software):

The automation software features are controlled in the sub-block screens.

Notes: The signal processing of each input and each output channel can be controlled separately, providing excellent flexibility. The switchable audio bus outputs receive the same post-processed signal that the main audio outputs receive.

- ☐ Gate logic and gate counting controls supervise automatic input switching and can prevent unwanted feedback.

What is a feed-forward compressor?

Most compressors are "feedback" compressors. This means they watch the output level and if it rises above a preset threshold the compressor adds input attenuation. In this way it feeds back from the output to the input. The Output Compressor/Limiter *algo* works like this.

On the other hand, a "feed-forward" compressor watches the input and if it rises above a preset threshold the compressor adds attenuation downstream. In this way it feeds forward along the audio path. The Input Compressor/Limiter *algo* operates like this.

- ❑ Input ducking controls supervise priority input mixing. (“Ducking” is the attenuation of an input to a preset “duck” level. This happens when an input with a higher priority is switched on by a gate *algo*.)
- ❑ Auto level controls work to achieve a target level for each input. Each input has a separate target level for each output channel.
- ❑ Feed-forward input compressor/limiter and output compressor/limiter controls. Each input and each output channel has a separate compressor/limiter.

Protection features:

- ❑ Automatic microprocessor reset if noise spikes, power dropouts or other disturbances are encountered.
- ❑ DSPI (Data Signal Presence Indicator) provides swift isolation of wiring problems, improper IQ addresses and disconnected or off-line IQ components.
- ❑ NiCad battery and built-in charger maintain all settings. When fully charged, the unit can be disconnected from power for 60+ days.

Digitally controlled analog circuitry:

- ❑ Because the analog circuitry is digitally controlled, each input can be processed by more than one *algo* at the same time without the unexpected side affects which would occur under analog control.
- ❑ Digital control also permits precise calibration. The gain settings of the SMX-6 are accurate to better than ± 1.0 dB.

Communication features:

- ❑ The SMX-6 can function as an IQ interface for one Crown Bus loop.
- ❑ Local area communication is supported with Crown Local Net (CLN).

1.3 About this Operation Guide...

This *Operation Guide* describes how to use IQ software to configure and control an SMX-6 mixer/multiplexer. It begins with manual operation in Section 2, describes the Display screen in Section 3 and delves into the configuration of its automatic features in Section 4.

This *Operation Guide* does not discuss the hardware installation or hardware controls. Please refer to the *IQ Mixer/Multiplexer Hardware Installation Manual* for those details. Nor does this *Operation Guide* discuss the general features of the IQ software. Please refer to the IQ software *User's Manual* for that information.

Please also consult the *SMX-6 Application Notes* for additional detail on how to use an SMX-6 in a variety of different applications.

2 Manual Control

Like an MPX-6, the SMX-6 can be manually controlled with the control block screen of the IQ software. To switch to the SMX-6 control block screen, press **F1** to access the Device menu then press **S**. **↑** **↓** can also be used to select the SMX-6 control block screen from the Device menu followed by **Enter** to execute the selection. A mouse () can also be used. The SMX-6 control block screen is shown below:

F1-Device	F2-Display	F5-Print	SMX				F9-FILE	F10-Control			
Multiplexer 001	Zone 1		DSPI	Input	1	2	3	4	5	6	All
Model	:SMX-6		Aux	Ch 1	-20	-25	-15	-20	-15	-25	03
Location	:AUDITORIUM		Sel	Ch 2	-20	-25	-15	-20	-15	-25	03
Purpose	:MAIN MIXER		Lock	Bus 1:	On	Bus 2: On				ASA	
Multiplexer 002	Zone 1		DSPI	Input	1	2	3	4	5	6	All
Model	:SMX-6		Aux	Ch 1	-10	-10	-10	-10	-10	-10	03
Location	:CONFERENCE ROOM		Sel	Ch 2	-10	-10	-10	-10	-10	-10	03
Purpose	:MAIN MIXER		Lock	Bus 1:	Off	Bus 2: Off				ASA	
Multiplexer 003	Zone 1		DSPI	Input	1	2	3	4	5	6	All
Model	:SMX-6		Aux	Ch 1	Off	Off	Off	Off	Off	Off	03
Location	:TRAINING CENTER		Sel	Ch 2	Off	Off	Off	Off	Off	Off	03
Purpose	:MAIN MIXER		Lock	Bus 1:	Off	Bus 2: Off				ASA	
Multiplexer 004	Zone 1		DSPI	Input	1	2	3	4	5	6	All
Model	:SMX-6		Aux	Ch 1	-25	-15	-20	-15	Off	Off	03
Location	:GYMNASIUM		Sel	Ch 2	-25	-15	-20	-15	Off	Off	03
Purpose	:MAIN MIXER		Lock	Bus 1:	Off	Bus 2: Off				ASA	
Offset = 1											
SAMPLE											
Esc - Exit											

Please refer to the IQ software *User's Manual* for general instruction on how to navigate in the control block screen and how to select and change a control.

Tip: Because there are two levels of control for a sensing mixer/multiplexer, manual and automatic, it is possible to have two separate preset mixes. This can be a great advantage when it is necessary to have the capability to quickly switch to a second mix. One mix is created with the manual controls on the control block screen. The second mix is created with the *algo* controls on the sub-block screens. Toggling the ASA control on and off causes the SMX-6 to switch between the two mixes. To toggle ASA on from the control block, select the ASA control and press **Spacebar**. To toggle ASA on and off from the sub-blocks, press **Ctrl** + **A**.

A description of each control in an SMX-6 control block follows:

Information Area:

Each control block contains an information area. The **IQ address** and **zone** number are automatically entered in the information area of each IQ component's control block when a roll call is run. The IQ address and zone can also be manually entered or changed by selecting either number and entering a new one. A valid IQ address is a number from 1 to 250. Valid zones range from 1 to 8.

Under the IQ address and zone number is a line for the **Model**, **Location**, and **Purpose**. These lines are provided for you to enter information which will help you identify the SMX-6 controlled by the control block.

The phrase "On Line" will be displayed with green letters in the upper right corner of the information area for all SMX-6s which are found by the IQ software. This makes it easy to tell which control blocks are controlling active units and which are not.

DSPI:

The DSPI or Data Signal Presence Indicator is an LED on the front panel of the unit which flashes whenever it receives a data signal, addressed to it. It can be forced to stay on as an aid to troubleshooting by turning the DSPI control on. If the DSPI is forced on by the IQ software and the indicator does not light on the unit, it signifies that there is a break in communication before it or the unit is defective.

Tip: Use the DSPI light to verify that all units in the system are responding to IQ commands. For example, turn all DSPI lights on before a show to verify that all equipment is operating properly.

Tip: When there is more than one SMX-6 in a system, use the DSPI light to quickly identify a particular one. For example, turn the DSPI light on to help a technician quickly locate a particular unit in a large equipment rack.

Aux:

The AUX port of the SMX-6 is turned on and off with the Aux control. When turned on, the AUX port supplies +10 VDC across pins 3 (+) and 1 (gnd) of the 3-pin AUX connector located on the back panel of the unit. This can be used to signal non-IQ devices or it can be used to turn non-IQ components on and off (with the use of a solid state relay). For example, an auxiliary rack cooling system can be manually turned on with the Aux feature.

The AUX port also has the ability to sense the presence of an external signal. When a logic "high" is detected across pins 2 (+) and 1 (gnd) of the AUX connector, an **asterisk** will appear beside the Aux control to signal its presence. Normally, the AUX port is left to float. This means an asterisk may appear most of the time and can be disregarded. To use this function, the AUX port must be held "low" until a legitimate logic "high" is received.

Sel:

An SMX-6 is selected with the Sel control. This feature is presently used by the Turbo version of the IQ-MSD software only. When switching to the graphics mode, a graphics display module will be automatically created and displayed for all selected units. The Display control of the Graphics control block must also be switched to the "Selected" position. The Sel control serves no purpose for other versions of the IQ-MSD software.

Input:

The gain of each input is controlled separately for each output channel. When a gain control is turned down as far as it will go (-100 dB) the input control will say "Off". The range of the input level controls is +25 to -100 dB.

Keyboard: The input gain can be incremented and decremented in ½ dB steps by pressing **[+]** **[-]**. A whole number can be entered directly by first selecting the desired Input gain control and then entering a level with the number keys. Do not use **[-]** to enter a negative number. Instead, use **[S]**. ("S" means "sign" to the IQ program.) For example, enter **[S]** **[1]** **[0]** to enter a level of -10 dB. A level change is not sent to the SMX-6 until either **[Enter]** is pressed or the cursor is moved to another control.

Mouse: Press and hold **[⇧ Shift]** and move the mouse () upward to increment and downward to decrement. Do not click or drag while moving the mouse.

The input gain control has its own "emergency mute" feature. Pressing **[Spacebar]** when

an Input gain control is selected immediately mutes the gain (sets it to -100 dB). This feature is a toggle. If the control is still selected, press **[Spacebar]** again to toggle back to the previous setting. The previous level setting is lost if the cursor is moved to another control.

All:

The level of each output channel can be increased or decreased in 3 dB increments with the All controls. To do so, select one of the controls labelled "03" under the "All" heading and press **[+]** or **[-]** to increment or decrement it. The output level change will be reflected by an appropriate increase or decrease of each input gain setting.

Bus:

The SMX-6 has two switchable "bus" outputs (one for each output channel). They receive the exact same post-processed audio signal that the main outputs receive. They are each turned on and off with the Bus controls.

The purpose for the audio bus outputs is twofold: First, to provide a switchable output for each channel; Second, to make it possible to connect many mixer/multiplexers together to the same audio bus without loading down the outputs of each one. The first capability is very handy for small installations which want an on/off output for recording. The latter capability enables large number of mixer/multiplexers to be connected, for example, to an airport paging bus. The bus outputs would be off until an airport terminal gate needs to make an announcement. When this happens, the appropriate bus output of only the affected mixer/multiplexer is turned on, allowing the announcement to be sent to the paging bus.

ASA:

"ASA" means "Auto-System Algos" and the ASA control serves three purposes. First, it is used to turn all *algos* on and off. Turning ASA off, restores manual-only control and causes the manual control settings of the SMX-6 control block to be downloaded to the unit. Turning ASA on restores automatic operation. To turn ASA on and off, select it and press **[Spacebar]** just as you would for most other on/off controls. Turning the ASA control on and off can also be used to switch between two different mixes. See the tip at the beginning of Section 2 for more on this.

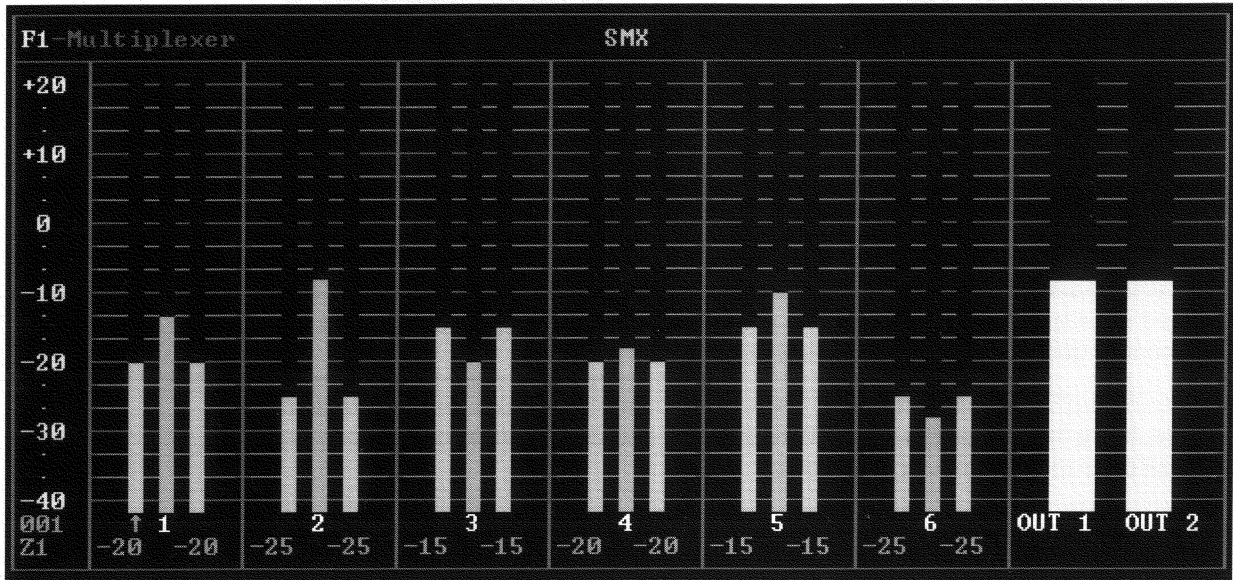
The second function of the ASA control is to serve as a door or entrance to the sub-block screens where the *algos* are configured. To bring up to the sub-block screens, highlight the ASA control and press either **[Enter↵]** or **[↓]**.

The third function of the ASA control is to tie several sensing mixer/multiplexers together in a large *IQ System*. For example, several SMX-6s could be wired with parallel inputs. Each SMX-6 would be switched on as needed via the ASA control. A supervisor could use this capability to "listen in" or monitor events. It could be used to control recording or to provide additional feeds for overflow seating.

IMPORTANT: Turn ASA off before switching to the sub-block screens and making changes to the algo settings. The IQ software is designed for changes to be made to the *algos* with ASA off. Although it is possible to make changes while ASA is on, the algo pack is not correctly configured until the ASA control is switched from off to on. *Note: ASA can be toggled on and off from the sub-block by pressing **[Ctrl]+[A]**.*

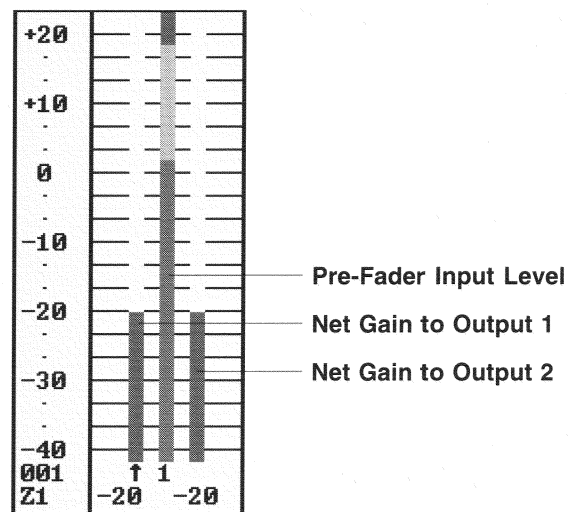
3 Display Screen

Pressing **[F2]** from an SMX-6 control block or sub-block summons the Display screen of the selected SMX-6. Only one unit can be shown in the Display screen at a time.



The Display screen provides a dynamic representation of peak audio level of each input and output channel as well as the net gain setting of each input.

When you are ready to leave the Display screen, press **[Esc]**, **[F1]** or  (right mouse button) to return to the control block screen.



Input Level:

The peak input level of each audio input (1-6) is represented by a moving **multicolor bar graph** in the center of each input column on the screen. The portion of the bar that is equal to or less than +1.5 dB is **green**. The part between +1.5 dB and +18 dB is **yellow**. The part above +18 dB is **red**. Signal levels below -40 dB are not visible. The level shown is the pre-processed level (similar to a pre-fader or cue level on a mixing console). *Note: All dB levels are dBu.*

Net Gain:

The net gain of each input is shown by the **blue bar graphs** which flank both sides of the input level bar graph. Each bar's numeric value is displayed below the bar. The gain which feeds each channel is controlled separately for each input. The net gain bar graphs remain stationary if the unit is being controlled manually (ASA is turned off). If the unit is running automatically (ASA is turned on) the net gain bar graphs may move, showing the operation of the various *algos*. The reason they depict the "net" gain is because they show the gain settings which result from all of the *algos* working together.

With ASA off, the net gain bar graphs depict the control block gain settings and can be adjusted from the Display screen with the keyboard or a mouse as described below:

Keyboard: (ASA off.) Use   to select the input gain you want to change. The selected input gain will have a small up arrow displayed below its bar. Use   to increment or decrement the input level in 1/2 dB steps.

Mouse: (ASA off.) Move the mouse () sideways to select the input gain you want to change. Move the mouse () upward to increment and downward to decrement. Do not click or drag while moving the mouse.

Output Level:

The peak output level of each channel is shown by the wide **yellow bar graphs** on the right side of the Display screen.

Note: The Display screen is especially valuable when configuring the algo pack. It will be referred to several times during Section 4.

4 Algo Control

The real power of an SMX-6 lies in its algo pack, the collection of self-running *algos* which control its behavior when the ASA control is turned on. The *algos* are configured from the sub-block screens. To switch to the sub-block screens, select the ASA control in the control block screen and press either **Enter** or **↓**.

Max Gain To Track Control Block										Off		ASA On	
Control Block Override										Off		SMX 1 Zone 1	
GATE ALGO's													
	INPUT 1		INPUT 2		INPUT 3		INPUT 4		INPUT 5		INPUT 6		
	CH 1	CH 2	CH 1	CH 2	CH 1	CH 2	CH 1	CH 2	CH 1	CH 2	CH 1	CH 2	
MAX GAIN	0	0	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	
LOW SET	-40	-40	-40	-40	-40	-40	-40	-40	-40	-40	-40	-40	
GATE	On	On	On	On	On	On	On	On	On	On	On	On	
THRES HOLD	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	
DELAY TIME	2.0	2.0	.6	.6	.6	.6	.6	.6	.6	.6	.6	.6	
DUCK PRIORITY LEVEL	On	On	On	On	On	On	On	On	On	On	On	On	
	1	1	2	2	2	2	2	2	2	2	2	2	

The above illustration shows only the first SMX-6 sub-block screen. There are actually four. Use **PgUp** **PgDn** to move from one sub-block screen to the next. And use **Home** **End** to move from the first sub-block screen to the last.

Max Gain To Track Control Block:

Notice the control labeled "Max Gain To Track Control Block" at the top of the first sub-block screen. When this on/off control is turned on it causes the Max Gain controls in the Gate *algo* to be set equal to the input gain settings of the control block. By copying the control block settings to the Gate *algo* Max Gain controls you can easily initialize them. See Section 4.1 for a description of the Max Gain control.

Tip: Turn on the Max Gain To Track Control Block then switch back to the control block. Set the maximum level before feedback for all microphones with the control block input gain controls. When you switch to the sub-blocks again, the Max Gain settings will be automatically adjusted to avoid feedback.

Turning on the Max Gain To Track Control Block control does not cause the control block settings to be immediately copied to the Gate *algo* Max Gain control. The action takes place only when switching from the control block screen to the sub-block screen. This means you must go back to the control block screen (press **Esc** or **PgUp**) and then return to the sub-block screen for the settings to be copied.

Remember: When Max Gain To Track Control Block is turned on, the gain settings are copied every time the switch is made from the control block to the sub-blocks. Turn this feature off when you no longer want the Max Gain settings changed.

Control Block Override:

The second control at the top of the first sub-block screen is the Control Block Override control. It is reserved for future use and should be left in the off position.

A description of each *algo* follows. They are listed in the same order as they appear in the sub-block screens.

4.1 The Gate Algo

“Gating” is one of the most important SMX-6 functions. It shuts off inputs that aren’t in use. Gating is often used to prevent feedback. If several mics in a system are on at the same time, the system’s gain could become so high that it rings with transients, or breaks into feedback.

Lowering the overall gain is one way to fix this problem, but some mic levels might become too low. Gating is a better solution. A microphone is “live” only when a sound is loud enough to open its gate (for example, speaking, singing, etc.).

Max Gain To Track Control Block										Off		ASA On	
Control Block Override										Off		SMX 1 Zone 1	
GATE ALGO's													
	INPUT 1		INPUT 2		INPUT 3		INPUT 4		INPUT 5		INPUT 6		
	CH 1	CH 2	CH 1	CH 2	CH 1	CH 2	CH 1	CH 2	CH 1	CH 2	CH 1	CH 2	
MAX GAIN	0	0	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	
LOW SET	-40	-40	-40	-40	-40	-40	-40	-40	-40	-40	-40	-40	
GATE	On	On	On	On	On	On	On	On	On	On	On	On	
THRES HOLD	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	
DELAY TIME	2.0	2.0	.6	.6	.6	.6	.6	.6	.6	.6	.6	.6	
DUCK PRIORITY LEVEL	On	On	On	On	On	On	On	On	On	On	On	On	
	1	1	2	2	2	2	2	2	2	2	2	2	

Max Gain:

The Max Gain control sets the maximum gain for an input. The gain can’t rise higher, even when the Auto level *algo* is active. The Max Gain control also sets the “gate open” gain when only the Gate *algo* is in use.

When ASA is on, the Max Gain settings in the sub-block override the corresponding control block gain settings. They work like the control block gain settings when most of the *algos* are off. When ASA is off, the control block gain settings take over.

The Max Gain control has its own “emergency mute” feature. Pressing **[Spacebar]** when a Max Gain control is selected immediately mutes the gain (sets it to -100 dB). This feature is a toggle. If the control is still selected, press **[Spacebar]** again to toggle back to the previous setting. The previous level setting is lost if the cursor is moved to another control.

Tip: The final gain settings are usually made by listening. If you set the gain too high, the system could break into feedback. It is possible to attenuate all channels at once using the secondary mix capability of the control blocks. First, set the control block levels far below the feedback point. Now ASA can be used to activate the control block mix which will pull all inputs below the feedback level. (The Max Gain To Track Control Block control should be turned off.) The ASA control can be toggled on and off from the sub-block screens by pressing **[Ctrl] + [A]**.

Note: Toggling ASA on and off switches between the sub-block mix and the control block mix. This gives you two different mixes only if Max Gain To Track Control Block is not turned on.

IMPORTANT: The Max Gain control is not intended to be adjusted in “real time” while the ASA control is turned on. Instead, use the DAOL (Desired Average Output Level) control of the Auto Level *algo*. The new level will not take effect until the Reaction Time setting of the Auto Level *algo* has transpired.

Low Set:

The Low Set gain is the “gate closed” gain. Low Set is off by default (about -100 dB). Set it higher if you want the signal to be audible even when the gate is “closed.”

Gate:

The Gate *algo* is turned on and off with the Gate control. Turning the Gate control off also turns off the Duck Priority and Gate Count *algorithms*.

Threshold:

The Threshold control determines when an input gate opens. When a signal exceeds the Threshold, the gate opens causing the gain to increase from the Low Set value to the Max Gain value. When a signal drops to the Threshold or below, the gate closes and the gain drops from Max Gain to the Low Set value. *Note: If the Threshold is set too high, the gate will never open, or only open sporadically. If it's too low, background noise may keep the gate open all the time.*

When a signal exceeds the Threshold, the gate opens almost instantly. The optimum Threshold setting depends on the signal. Speech varies more rapidly than music, and often needs a lower Threshold to keep the gate open. For a microphone, the Threshold can be set a few decibels above a room's ambient sound for ambience rejection, or set higher to reject incoming far-field or off-axis sounds.

Tip: The Display screen (press **[F2]**) is very helpful when setting the Threshold controls. It displays the input signal level, making it a simple matter to select an appropriate Threshold level. For example, it is quickly apparent from the Display screen that the gate will not open if the Threshold control is set at a higher level than the input signal.

Delay Time:

The Delay Time control determines how long the gate will stay open after the incoming signal drops below the Threshold. The optimum Delay Time setting depends on how rapidly the input changes. If a speaker walks slowly from one mic to another, you will probably want to use a long Delay Time for each mic to prevent an audibly abrupt cutoff. At a conference however, when debaters compete for microphones, a shorter Delay Time would probably be more appropriate.

The following list shows the possible settings for each Gate *algo* control. *Note: All dB settings are dBu.*

Max Gain: Off; -99½ dB to +25 dB in ½ dB steps

Low Set: Off; -99½ dB to +25 dB in ½ dB steps

Gate: On/Off

Threshold: Off; -99½ dB to +25 dB in ½ dB steps

Delay Time: 0.2, 0.4, 0.6, 0.8, 1, 1.5, 2, 3, 4, 6, 8, 10, 12, 15, 20, 30 seconds

4.2 The Duck Priority Algo

"Ducking" is the attenuation of an input when another input with a higher priority is activated by the Gate *algo*. When the higher priority gate opens, all inputs with lower priorities drop to their Low Set values. To activate the Duck Priority *algo*, turn it on and set the priority level.

IMPORTANT: The Duck Priority *algo* is dependent on the Gate *algo*. Both the Gate *algo* and the Duck Priority *algo* must be on for Ducking to function.

Max Gain To Track Control Block Off

Control Block Override Off

ASA On

SMX 1 Zone 1

GATE ALGO's

	INPUT 1		INPUT 2		INPUT 3		INPUT 4		INPUT 5		INPUT 6	
	CH 1	CH 2	CH 1	CH 2	CH 1	CH 2	CH 1	CH 2	CH 1	CH 2	CH 1	CH 2
MAX GAIN	0	0	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
LOW SET	-40	-40	-40	-40	-40	-40	-40	-40	-40	-40	-40	-40
GATE	On	On	On	On	On	On	On	On	On	On	On	On
THRES HOLD	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30	-30
DELAY TIME	2.0	2.0	.6	.6	.6	.6	.6	.6	.6	.6	.6	.6
DUCK PRIORITY LEVEL	On	On	On	On	On	On	On	On	On	On	On	On
	1	1	2	2	2	2	2	2	2	2	2	2

Duck Priority:

The Duck Priority *algo* is turned on and off with this control.

Duck Priority Level:

The Duck Priority Level control determines which input takes precedence. The priority can be set from 1 to 6 with 1 as the highest priority and 6 as the lowest. A separate priority setting is provided for each channel, making it possible to give an input a different priority for each output channel. The Duck Priority Level control is ignored if either the Duck Priority or Gate controls are turned off.

If only two inputs are used, there only needs to be two priority levels (perhaps 1 and 2). If you are unsure how many priority levels will be needed or what the final priorities will be, start with levels 3 and 4. The priorities above and below remain available for assignment to other inputs. If the SMX-6 has Option 4 and will be used in a Crown Local Net, it will be able to share Duck Priority information with other SMX-6 units. If this is the case, you will also need to consider the priorities of the other SMX-6 inputs.

Tip: When a signal ducks, the gain drops to the Low Set level for that input. The default value is off (-100 dB). This may sound too abrupt because it is such a large transition. To avoid this problem, pick a higher value for a more smooth transition. The Low Set control can be set so high that the ducked signal is still audible over background noise. This may be desirable when mixing a debate or conference.

Note: The Delay Time control of the Gate *algo* also affects the Duck Priority *algo*. When a high-priority input falls below its gate Threshold, all ducked inputs must remain at their Low Set levels until after the Delay Time.

Duck priorities can be shared by more than one SMX-6. If the Crown Local Net (Option 4) is installed and several SMX-6s are connected to it, their Duck Priority *algorithms* can work together. See Section 4.7 for more information.

The following list shows the possible settings for each Duck Priority *algorithm* control.

Duck Priority: On/Off

Duck Priority Level: 1, 2, 3, 4, 5, 6

4.3 The Input Compressor/Limiter *Algorithm*

The Max Gain settings you select in the Gate *algorithm* should be acceptable for consistent input levels—but sometimes the unexpected happens and an extremely loud input signal is present. The Input Compressor/Limiter *algorithm* “reins in” input signals that suddenly become too loud. If the excessive loudness of the input signal is not transitory but is sustained, use the Auto level *algorithm* to control it (Section 4.4). The Input Compressor/Limiter *algorithm* is located on the second SMX-6 sub-block screen.

INPUT COMPRESSOR/LIMITER ALGO'S												ASA	On
												SMX	1 Zone 1
	INPUT 1		INPUT 2		INPUT 3		INPUT 4		INPUT 5		INPUT 6		
	CH 1	CH 2	CH 1	CH 2	CH 1	CH 2	CH 1	CH 2	CH 1	CH 2	CH 1	CH 2	
COM PRESS	On	On	On	On	On	On	On	On	On	On	On	On	
THRES HOLD	-7	-7	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	
RATIO	4:1	4:1	4:1	4:1	4:1	4:1	4:1	4:1	4:1	4:1	4:1	4:1	
RELSE TIME	.2	.2	.4	.4	.4	.4	.4	.4	.4	.4	.4	.4	
Compression: Fast													

Compress:

To turn the compressor on, select the Compress control for the desired input and press Spacebar.

Threshold:

The Threshold control sets the level at which compression begins. A signal at this level or below is not affected, and a signal that goes above this level is compressed.

Ratio:

The Ratio control sets the amount of compression applied for every step over the Threshold. This is commonly referred to as a “compression ratio”. For example, when a 4:1 compression ratio is applied to a signal that exceeds the Threshold by 20 dB, the signal is attenuated 15 dB. When an infinite compression ratio (∞ :1) is chosen, the compressor works like a limiter and prevents the level from exceeding the Threshold. *Note: A 1:1 compression ratio will not affect an incoming signal.*

Release Time:

Any input level increase over the Threshold is compressed almost instantly. The Release Time *algo* controls the time it takes for the gain to return to normal when the level drops below the Threshold. Short release times allow the compressor to respond to rapid changes in input level.

Compression (Attack Time):

This feature is available only for SMX-6s with version 1.3 firmware or later. (To see which firmware version your SMX-6 has, locate the white sticker above the DB-25 serial communication connector on the back panel of the unit. Units with version 1.3 firmware will be labeled "v 1.3".) The Compression control can be set either "Fast" or "Slow" to control the attack time of the Input Compressor/Limiter *algo*.

Set the Compression control to "**Fast**" to cause the SMX-6 to have the shortest attack time possible. This will be very fast—so fast that the compressor can stop extremely sudden loud transients like the sound caused by a dropped microphone. This is a good setting for rapid speech.

Set the Compression control to "**Slow**" for more gentle sound sources such as most music. When the "Slow" setting is used, the Release Time cannot be set any less than 0.4 seconds to avoid noticeable pumping of the Input Compressor/Limiter *algo*.

The following list shows the possible settings for each Input Compressor/Limiter *algo* control. *Note: All dB settings are dBu.*

Compress: On/Off

Threshold: Off; $-99\frac{1}{2}$ dB to +25 dB in $\frac{1}{2}$ dB steps

Ratio: 1:1, 2:1, 4:1, 8:1, 16:1, 32:1, ∞ :1

Release Time: 0.2 (Fast compression only), 0.4, 0.6, 0.8, 1, 1.5, 2, 3, 4, 6, 8, 10, 12, 15, 20, 30 seconds

Compression: Fast/Slow

4.4 The Auto Level Algo

The Auto Level *algo* is located on the third SMX-6 sub-block screen. Unlike the Input Compressor/Limiter *algo* which is designed to handle sudden or transient jumps in input level, the Auto Level *algo* is designed to control long-term changes in signal level. Using it, the average output level can be kept relatively constant over a longer time interval while transients are allowed to pass. This feature creates a more natural sound with increased dynamic range.

AUTO LEVEL ALGO's												ASA	On	Zone 1
	INPUT 1		INPUT 2		INPUT 3		INPUT 4		INPUT 5		INPUT 6			
	CH 1	CH 2	CH 1	CH 2	CH 1	CH 2	CH 1	CH 2	CH 1	CH 2	CH 1	CH 2		
AUTO LEVEL	On	On	On	On	On	On	On	On	On	On	On	On		
DAOL	-7	-7	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10		
REACT TIME	3.0	3.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		
IDLE GAIN	-7	-7	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10		
Auto Leveler Gate Function: Open to idle gain														

Auto Level:

To turn the auto level feature on, select the Auto Level control for the desired input and press Spacebar.

DAOL (Desired Average Output Level):

The DAOL control sets the desired average output level for the Auto Level *algo*. If the DAOL is set to -20 dB, and the output signal level is -20 dB, nothing changes. The signal passes at the same level. But if the signal is above -20 dB, the Auto Level *algo* will reduce the gain to bring the level down to -20 dB. And if the signal is below -20 dB, the gain is increased to increase the level up to -20 dB.

IMPORTANT: The Max Gain control is not intended to be adjusted in “real time” while the ASA control is turned on. Instead, use the DAOL (Desired Average Output Level) control of the Auto Level *algo*. The new level will not take affect until the Reaction Time setting of the Auto Level *algo* has transpired.

Reaction Time:

The Auto Level *algo* continually adjusts the signal level toward the DAOL value. But it doesn't adjust the signal in one jump. Instead, the Reaction Time control sets the size of each step. For example, if the audio input signal stays at a constant level below the DAOL value, the gain would increase it to the DAOL level over the time (in seconds) specified by the Reaction Time control. In the “real world,” audio signals continually change, and so does Auto Level's step size. This approach produces a very natural sounding auto level control.

A Reaction Time of 4 seconds is a good starting point for speech. Try 6–10 seconds

for music. Although a 4 second Reaction Time might seem slow, remember that the Auto Level *algo* compensates for average differences in level—such as between soft-spoken and boisterous speakers. If a sound source occasionally “blasts,” you might also use the Input Compressor/Limiter *algo* to control the transients.

Tip: The Auto Level *algo* never raises the gain higher than Max Gain. As you set the value of Max Gain higher, the Auto Level *algo* will have more room to adjust the incoming signal. For inputs with an unusually wide dynamic range, set Max Gain as high as possible so the Auto Level *algo* can bring up the quietest passages.

Tip: Use a long Reaction Time when the system is used to mute background music during a page. This provides a pleasing and smooth transition back to background music after the page has been completed.

Idle Gain:

If the Gate and Auto Level *algos* are used together, their interaction may produce an unexpected side effect. When Max Gain is set above the DAOL of the Auto Level *algo*, the Auto Level *algo* could start lowering the gain every time the gate opens. If there is a great difference between the signal level and the DAOL, the shift in gain will be very noticeable. The sound would start out loud and then fade.

The Idle Gain control can compensate for this situation. Idle Gain controls the initial gain when the gate first opens. You can think of it as the “starting gain” because it overrides the Max Gain when the gate opens. Start with Idle Gain equal to Max Gain. If the level audibly drops each time the gate opens, try a lower value for Idle Gain.

IMPORTANT: The Idle Gain *algo* functions only when three conditions are met. 1) The Gate *algo* is turned on. 2) The Auto Level *algo* is turned on. 3) SMX-6s with firmware version 1.3 or later have the Auto Leveler Gate Function control set to “Open to idle gain”. The third condition is not required for SMX-6s with older firmware. See the Auto Leveler Gate Function control below for more information.

IMPORTANT: **Never set Idle Gain higher than Max Gain.** Because the Idle Gain overrides the Max Gain, it is possible to force the gain above the Max Gain setting.

Auto Leveler Gate Function:

This feature is available only for SMX-6s with version 1.3 firmware or later. (To see which firmware version your SMX-6 has, locate the white sticker above the DB-25 serial communication connector on the back panel of the unit. Units with version 1.3 firmware will be labeled “V 1.3”.)

The purpose of the Auto Leveler Gate Function control is to help create smoother transitions when both the Gate and Auto Level *algos* are operating. Both of these *algos* must be operating for this feature to function.

The “**Open to idle gain**” setting is best for systems with relatively constant sound levels as with background music. When an input gate is opened, its gain is set to the Idle Gain setting. See the description of the Idle Gain control for more information.

The “**Open to last position**” setting is best for systems with widely varying sound levels where an Idle Gain setting is difficult to choose. When an input gate opens, the Idle Gain setting is ignored and the gain is restored to the previous level it had just prior to its closing. An example of when this setting is very useful is when speakers with very different voice levels share the same microphone.

The following list shows the possible settings for each Auto Level *algo* control. *Note:* All dB settings are dBu.

Auto Level: On/Off

DAOL: (Desired Average Output Level) Off; $-99\frac{1}{2}$ dB to +25 dB in $\frac{1}{2}$ dB steps

Reaction Time: 0.2, 0.4, 0.6, 0.8, 1, 1.5, 2, 3, 4, 6, 8, 10, 12, 15, 20, 30 seconds

Idle Gain: Off; $-99\frac{1}{2}$ dB to +25 dB in $\frac{1}{2}$ dB steps

Auto Leveler Gate Function: Open to idle gain/Open to last position

4.5 The Output Compressor/Limiter *Algo*

Even if every input is compressed, there is still a chance that the mix might become too loud. The Output Compressor/Limiter *algo* keeps the output from exceeding a predetermined level. It's especially valuable when used as an output limiter for the protection of amplifiers, loudspeakers and other audio equipment.

The Output Compressor/Limiter *algo* is located on the last (fourth) SMX-6 sub-block screen. It works in a very interesting way. Instead of compressing the signal on the mixing bus, it compresses the signal at each input. Compression occurs only when the mix exceeds the Limit Threshold. It doesn't matter how loud a particular input gets, the mix which feeds each output channel must exceed the Limit Threshold before compression occurs.

The controls that configure the Output Compressor/Limiter *algo* are very similar to those of the Input Compressor/Limiter *algo*.

OUTPUT COMPRESSOR/LIMITER ALGO's														ASA On
														SMX 1 Zone 1
COMPRESSOR LIMITER	CH 1 On				CH 2 On				EXTERNAL ALGOS					
LIMIT THRESHOLD	0				0									
COMPRESSION RATIO	$\infty:1$				$\infty:1$									
RELEASE TIME	1.0				1.0									
OUTPUT LIMIT	INPUT 1 CH 1 On CH 2 On		INPUT 2 CH 1 On CH 2 On		INPUT 3 CH 1 On CH 2 On		INPUT 4 CH 1 On CH 2 On		INPUT 5 CH 1 On CH 2 On		INPUT 6 CH 1 On CH 2 On			
GATE COUNT	Off		COUNT LEVEL CH 1 $\frac{1}{2}$				CH 2 $\frac{1}{2}$							
	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off

Compressor/Limiter:

To turn the output compressor/limiter feature on, select the Compress/Limiter control for the desired output channel and press Spacebar.

Limit Threshold:

The Limit Threshold control sets the peak signal level above which compression occurs. If the SMX-6 is connected to audio equipment that has a specified maximum input voltage, it is easy to limit the SMX-6's output to that level. If the specified input level were 0 dBu (0.775 V), the Limit Threshold could be set to 0 and the Compression Ratio set to $\infty:1$. In practice, this is a little harsh. A Limit Threshold of -2 dBu with a Compression Ratio of 16:1 will attenuate an incoming signal 32 dB before the

output level reaches 0 dBu. When used with the Input Compressor/Limiter, the Output Compressor/Limiter provides some of the most accurate and predictable audio system protection available today.

Tip: If you're not sure where to set the Limit Threshold, press **[F2]** to view the bar graph display. The yellow bars above OUT 1 and OUT 2 represent the instantaneous peak output levels.

Compression Ratio:

The Compression Ratio control sets the amount of compression applied for every step over the Limit Threshold. For example, when a 4:1 compression ratio is applied to a signal that exceeds the Limit Threshold by 20 dB, the signal is attenuated 15 dB. When an infinite compression ratio ($\infty:1$) is chosen, the compressor works like a limiter and prevents the output level from exceeding the Limit Threshold. *Note: A 1:1 compression ratio will have no effect on the signal.*

Release Time:

As with the Input Compressor/Limiter, the Output Compressor/Limiter *algo* responds almost instantly to signals above the Threshold. The Release Time control sets the time it takes for the gain to return to normal after the signal falls below the Limit Threshold.

Output Limit:

The Output Limit control lets you select which inputs are compressed, and which are not. This is a highly flexible feature, and can be used in some very advanced setups. To make the Output Compressor/Limiter work like a conventional output compressor, make certain that all of the Output Limit controls are turned on. Selectively turning off an Output Limit control enables its input to push all remaining inputs down whenever it exceeds the Threshold. This is a specialized function and is offered only for those unique circumstances which require it.

Tip: You don't have to compress all inputs. You could restrict compression to an offending input, leaving unchanged the signals that are unlikely to exceed the Limit Threshold. The Output Compressor/Limiter *algo* allows the SMX-6 to maintain a more natural sense of dynamics, with fewer audible side-effects.

The following list shows the possible settings for each Output Compressor/Limiter *algo* control. *Note: All dB settings are dBu.*

Compressor/Limiter: On/Off

Limit Threshold: Off; $-99\frac{1}{2}$ dB to +25 dB in $\frac{1}{2}$ dB steps

Compression Ratio: 1:1, 2:1, 4:1, 8:1, 16:1, 32:1, $\infty:1$

Release Time: 0.2, 0.4, 0.6, 0.8, 1, 1.5, 2, 3, 4, 6, 8, 10, 12, 15, 20, 30 seconds

Output Limit: On/Off

4.6 The Gate Count Algo

The Gate Count *algo* is located on the last (fourth) SMX-6 sub-block screen below the Output Compressor/Limiter *algo*. It works in conjunction with the Gate *algo*.

The Gate Count *algo* keeps track of how many gates are open at a time, and provides feedback control when a large number of mics are open. A similar feature of other manufacturers' products is called "NOM" (Number of Open Mics). When only two or three mics are open, system gain is usually too low to cause feedback. But as more mics open, the system gain can increase enough to cause feedback.

OUTPUT COMPRESSOR/LIMITER ALGO's												ASA On	SMX 1	Zone 1										
COMPRESSOR LIMITER	CH 1 On				CH 2 On				EXTERNAL ALGOS															
LIMIT THRESHOLD	0				0																			
COMPRESSION RATIO	∞:1				∞:1																			
RELEASE TIME	1.0				1.0																			
OUTPUT LIMIT	INPUT 1 CH 1 On		CH 2 On		INPUT 2 CH 1 On		CH 2 On		INPUT 3 CH 1 On		CH 2 On		INPUT 4 CH 1 On		CH 2 On		INPUT 5 CH 1 On		CH 2 On		INPUT 6 CH 1 On		CH 2 On	
GATE COUNT	On				COUNT LEVEL		CH 1 3				CH 2 3													
	On		On		On		On		On		On		On		On		On		On		On		On	

Gate Count:

Immediately to the right of the Gate Count label is the master on/off control. Turn on this control to activate the Gate Count *algo*.

IMPORTANT: The Gate Count *algo* is dependent on the Gate *algo*. Both the Gate *algo* and the Gate Count *algo* must be on for the latter to function.

Each input also has an individual on/off control for each output channel. They are located across the bottom of the screen and are used to control which inputs participate in the Gate Count function. Inputs with this control turned off are not counted.

Count Level:

The Count Level control determines how much each input is attenuated as more gates open. It is entered in dB. When only one mic in a count group is active, there is no added attenuation. Each additional open mic increases the attenuation by the "Count Level". For example, if the Count Level were 3 dB and six mics were open, the attenuation would be 15 dB, or (NOM – 1) x Count Level.

Gate Counting can be used with more than one SMX-6. If the Crown Local Net (Option 4) is installed and several SMX-6s are connected, their Gate Count *algos* can share information. See Section 4.7 for more information.

The following list shows the possible settings for each Gate Count *algo* control.

Gate Count: On/Off

Count Level: ½ to 3 dB in ½ dB steps; 3 to 12 dB in 1 dB steps; 16 dB

4.7 External Algos

All SMX-6s must have Option 4 to operate in a Crown Local Net (CLN) and use the external *algos*. External *algos* can be controlled on the last (fourth) SMX-6 sub-block screen. Select the "External Algos" control and press the space bar to bring up the External Algos control window.

OUTPUT COMPRESSOR/LIMITER ALGO's														ASA On
														SMX 1 Zone 1
COMPRESSOR LIMITER	CH 1		CH 2											
	On		On											
LIMIT THRESHOLD	EXTERNAL ALGOS													
COMPRESSION RATIO	Zone 1 SMX 1 System: On Zone 1 SMX 2 Master: On Ext Algos: On Duck: On Gate Count: On													
RELEASE TIME	1.0		1.0											
OUTPUT LIMIT	INPUT 1	INPUT 2	INPUT 3	INPUT 4	INPUT 5	INPUT 6								
	CH 1	CH 2	CH 1	CH 2	CH 1	CH 2	CH 1	CH 2	CH 1	CH 2	CH 1	CH 2		
	On	On	On	On	On	On	On	On	On	On	On	On		
GATE COUNT	On	COUNT LEVEL	CH 1	CH 2										
	On	3	3											
	On	On	On	On	On	On	On	On	On	On	On	On		

An external *algo* is one which is controlled, in part, by other IQ components. For example, more than one SMX-6 can be linked in a CLN so their Duck Priority and Gate Count *algos* work together. A priority 1 input in one unit will override a priority 2 input in another unit. The number of open mics can be totalled among all the SMX-6s in a CLN and all open inputs attenuated to prevent feedback in a large IQ System.

The CLN must be started in a particular order for reliable operation of the external *algos*. The procedure is listed below:

1. All SMX-6s must be connected to the system via the Crown Bus.
2. All ASA controls must be turned on.
3. With the CLN wiring disconnected and the System control of the External Algos turned off, set the Master, Ext Algos, Duck and Gate Count controls.
4. Connect the CLN serial cables as described in the *IQ Mixer/Multiplexer Hardware Installation Manual*.
5. Select the master SMX-6 in the External Algos control window and turn the System control on. The CLN and external *algos* will begin to run.

After the CLN has been properly initialized, the System control can be turned on/off at any time to enable or disable CLN communication.

WARNING: You will be locked out of any further serial port communication with an SMX-6 when you initialize the CLN. This means you cannot use an SMX-6 as an IQ interface (Option1) at the same time you plan to use it in a CLN (Option 4). If you are "locked out" of an SMX-6 and are unable to connect it to a Crown Bus, you must contact the Crown Support Group or Amcron Technical Services Department

for further assistance. **All SMX-6s must be connected to the system via a Crown Bus loop when the CLN is initialized.**

The External *Algo* controls are described below in the order in which they should be set. It is very important to turn the System control on last as described in the previous CLN startup procedure.

One of the first things to do is to decide which SMX-6 will serve as the CLN master. Being the CLN master will not affect its normal operation. After the master is selected, the Duck, Gate Count and Ext *Algos* controls should be set for each SMX-6. To do this, first select the SMX-6 from the list in the External *Algos* control window then highlight each control and toggle it on or off as desired. Each time a different SMX-6 is selected in the External *Algos* control window, the controls will change to show the its current settings.

Master:

One SMX-6 in a CLN must be the master. With the System control off, choose one of the SMX-6s listed in the External *Algos* control window and turn its Master control on.

IMPORTANT: Only one SMX-6 should be the master. Make sure that the Master control of all other units is turned off. Neither the CLN and the SMX-6s will not function properly if more than one unit is selected as a master.

Duck:

Turn the Duck control on for all SMX-6s in a CLN which you want to respond to external Duck Priority *algos*.

Gate Count:

Turn the Gate Count control on for all SMX-6s in a CLN which you want to respond to external Gate Count *algos*.

Ext *Algos*:

The Ext *Algos* control enables the unit to work with external *algos*. Turn it on for all SMX-6s which you want to participate in the CLN. Turning Ext *Algos* off will prevent the Duck Priority and Gate Count *algos* from responding to external information on the CLN.

System:

The System control activates the CLN. It should only be turned on for the first time after the preceding controls have been set. The CLN startup procedure gives specific instruction how to do this. Select the master SMX-6 before turning it on.

The System control can be turned on and off at any time after the CLN has been properly initialized.

