

RAVEN ELECTRONICS CORPORATION

M4x

SNR Voter/Comparator

User Manual



Table of Contents

Chapter 1: Raven M4x SNR Voter/Comparator Features	4
Chapter 2: Raven M4x SNR Voter/Comparator Hardware Interface	5
Chapter 3: Creating a Raven SNR Vote Group Using the M4x Software	8
3.1 Using the Wizard to Create a Raven SNR Vote Group.....	8
3.2 Manually Modifying a Raven SNR Vote Group.....	17
Chapter 4: Modifying the Configuration of a Member of a Raven SNR Vote Group	18
4.1 Modifying a Receiver's SNR Settings.....	19
4.2 Modifying a Transmitter's Keying Options.....	20
Chapter 5: Raven SNR Vote Group Status.....	22
Chapter 6: Saving M4x Blade Configurations.....	23

Contact Raven

Thank you for purchasing the M4x Blade from Raven Electronics Corporation. Please contact us if you have any questions, concerns, product ideas, or suggestions on how to improve this manual. We can be contacted at:

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ESD Handling

Please follow static-safe ESD guidelines when handling this product.



Raven Electronics' Warranty

This warranty expressly precludes any liability by Raven for consequential damages however arising after delivery to the purchaser of the affected equipment, and is limited to the expressed warranty, excluding all implied warranties including merchantability. All equipment manufactured by Raven is warranted against defective materials and workmanship for a period of two (2) years from the date of delivery to the original purchaser or end-user. Liability under this warranty is limited to servicing, adjusting, repairing or replacing, as necessary, any equipment returned to the factory, transportation prepaid for that purpose. Factory examination must disclose a manufacturing defect. Repaired or replaced items will be returned to the purchaser surface freight prepaid within the continental U.S.A. This warranty does not extend to any equipment which has been subjected to transportation damage, misuse, neglect, accident, improper installation, or any other circumstances reasonably beyond the control of Raven.

Beyond the warranty period, repairs will be billed to the purchaser at cost. In such cases, an estimate will be submitted for approval before repair is initiated. Repaired equipment will be returned to the purchaser with transportation charges collect, unless agreed to between the purchaser and Raven.

Chapter 1: Raven M4x SNR Voter/Comparator Features

Receiver voting provides a method of expanding coverage for a radio network. Receivers in the network are routed to a central voting system which votes the receiver with the best quality audio, and routes the voted audio to a console or to other repeaters.

The Raven M4x SNR Voter/Comparator product is a special version of the Raven M4x Blade (shown on the front cover of this manual). The Raven M4x Blade can be licensed to enable the creation of SNR (signal-to-noise) vote groups. The licensing basically “turns on” the SNR feature which allows the audio from receivers to be analyzed to determine its quality; the quality level is translated into a value (in decibels) that is used to compare the quality of audio between different receivers. The receiver with the highest SNR value is chosen as the “voted” receiver.

“Raven M4x SNR Voter/Comparator” and “Raven M4x Blade” are used interchangeably in this manual.

A Raven SNR vote group is created using the Raven M4x Communication System Software provided with the Raven M4x Blade. There are a number of features that can be software-configured to create a vote group tailored to a specific network. These features include:

- Automatic transmitter steering
- Manual transmitter steering
- Default transmission
- Flexible audio routing to any transmitter based on which receiver is voted
- Console priority
- Voting that commences based on status tone, COR, or VOX threshold
- Lack-of-audio timeout for voted receivers
- Keying of transmitters/repeaters with keying tones or with PTT
- Visual representation of voting activity for each member of the vote group
- Sub-comparators can be created and fed into a main vote comparator to create large vote groups

The Raven M4x Communication System Software also contains a wizard to help walk the user through the individual steps involved in building a vote group. Once vote groups are created and saved, the vote group can later be modified (using the M4x Software) either manually, or via the wizard. Additionally, multiple, unrelated, vote groups can be created on a single Raven M4x Blade. Further, vote group configurations can be “burned” to the flash memory on the M4x Blade so that a host PC isn’t needed to control the vote group.

Chapter 2: Raven M4x SNR Voter/Comparator Hardware Interface

A Raven M4x Blade can house up to 4 Raven-manufactured, DSP-based (digital signal processing) communication modules (see Figure 1). The types of modules can be mixed and matched to tailor the M4x system to a particular need. Raven Electronics manufactures a number of different types of modules to interface to radios (or other 4-wire devices), 2- and 4-wire telephones, the public telephone network, and other types of communications equipment. Each M4x Blade is a USB device that can accept commands from a host computer. The host computer can also respond to different events that occur on a particular port.

A Raven M4x SNR Voter/Comparator generally uses either the Raven 476-150 or 476-151 4-wire E&M modules. The 476-150 module has a 600 ohm, 300-3400Hz interface; the 476-151 has a 600 ohm or high impedance input (software-selectable), a 600 ohm output, with a 5-3400Hz frequency range. The Raven 476-150/151 4-wire E&M module is used to interface to 4-wire communication equipment. Each 476-150/151 4-wire E&M module supports two ports of audio.

The main function of the 476-150/151 4-wire E&M module is to convert analog audio to the digital domain on one end and back to analog on the other. Once the audio is converted to the digital domain, it can be bridged with any other port in the system using the switching fabric provided by the backplane upon which the M4x modules ride. The 476-150/151 4-wire module can also provide the following features via software commands from the host computer:

- Notch filtering
- Level control
- PTT generation (for radios)
- COR detection (for radios)
- Audio delay
- Tone Detection (including DTMF and single tones)
- Tone Generation (single tones, call progress tones, DTMF)
- Signal-to-Noise Ratio Analysis for voting applications

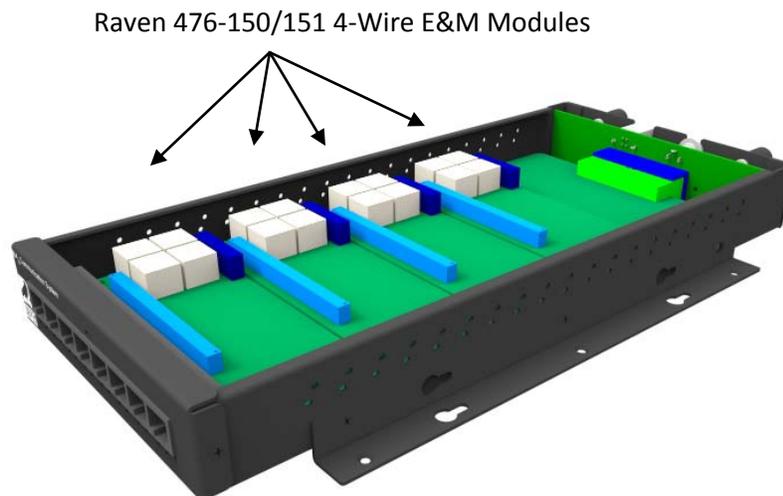
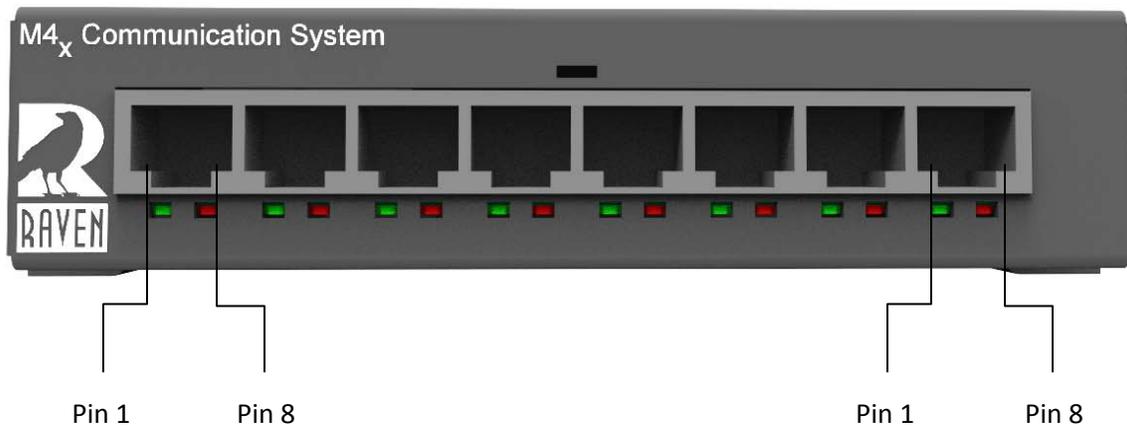


Figure 1. Raven M4x Blade with Cover Removed

The Raven M4x SNR Voter/Comparator takes advantage of the 476-150/151 module's Signal-to-Noise Ratio Analysis feature to synthesize a simple, software-configurable voting product. A Raven M4x SNR Voter/Comparator is expandable simply by adding additional modules, and configuring those modules with the Raven M4x Software.

Physical connection to an individual port is made via an RJ45 connector available on the front of the M4x Blade. Each 476-150/151 4-wire RJ45 port has the following connections:

- 2 wires for analog receive
- 2 wires for analog transmit
- 2 wires for the PTT relay switch closure
- 2 wires for the COR input



RJ-45 port pin number	M4x Blade Signal	Direction (with respect to the M4x Blade)
1	RX-A	Input
2	RX-B	Input
3	PTT	Output (switch closure)
4	TX-A	Output
5	TX-B	Output
6	PTT return	Output (switch closure return, optionally ground-able via jumper)
7	COR	Input (active low)
8	COR GND ref	Ground reference

Figure 2. Pinout for a Raven M4x 476-150/151 Module

There's a USB port on the rear of the Raven M4x Blade. This USB port is used by the Raven M4x Communication System Software to control and configure the M4x Blade. The M4x Blade is powered by a source of 9 to 18VDC; the power connector is also on the rear of the M4x Blade. See Figure 3.



Figure 3. Raven M4x Blade Rear Panel Power and USB Connections

Chapter 3: Creating a Raven SNR Vote Group Using the M4x Software

To create a Raven SNR Vote Group, start the Raven M4x Software and attach to the Raven M4x Blade (as explained in the Raven M4x Communication System user manual).

3.1 Using the Wizard to Create a Raven SNR Vote Group



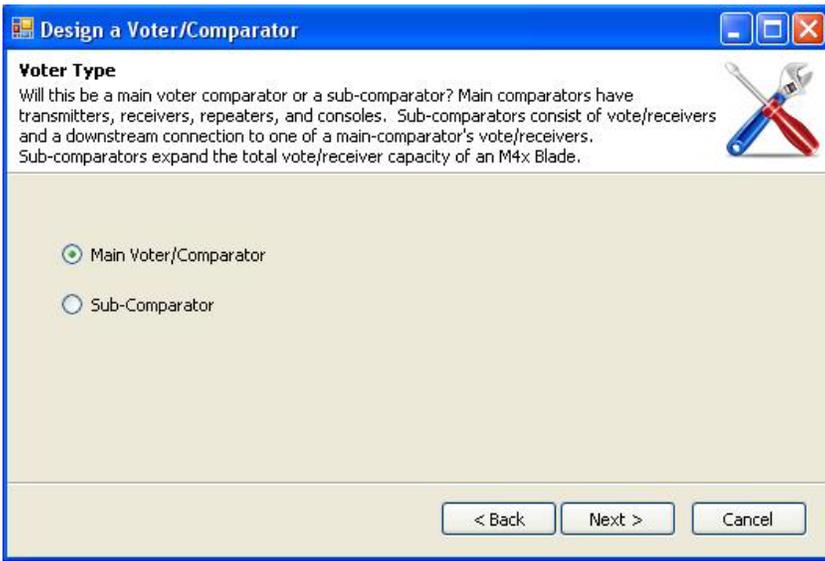
STEP 1

To create an SNR Vote Group, click on “Add Vote Group” in the System Components tree.



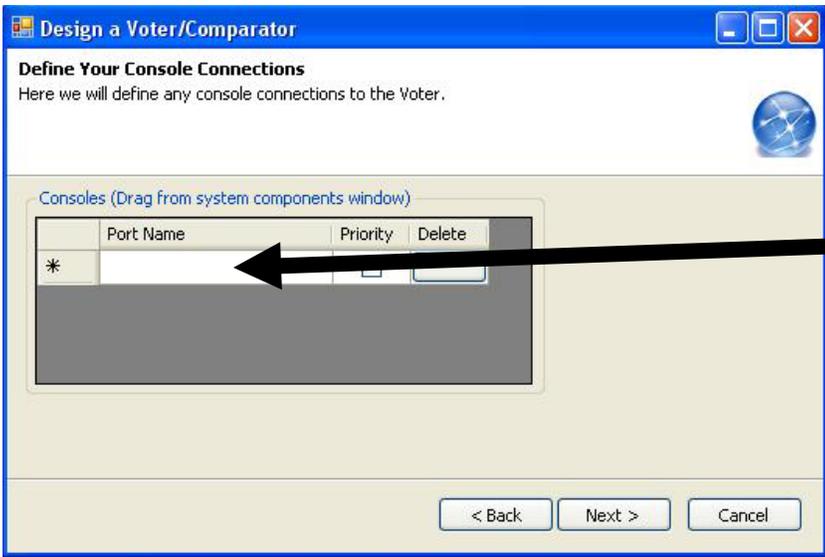
STEP 2

A wizard window appears to help you build and configure the SNR Vote Group. Click “Next” to continue.



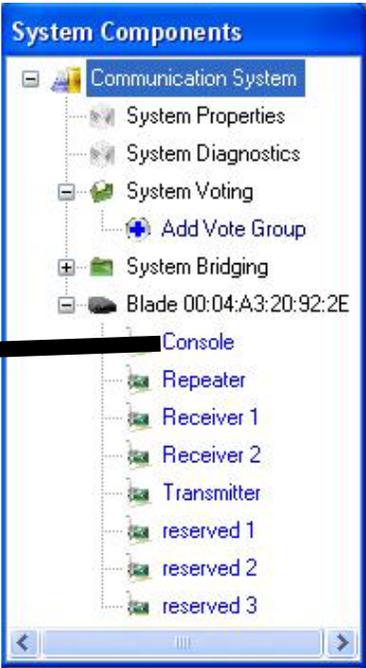
STEP 3

To start, you need to designate whether this SNR Vote Group is to be a Main Voter/Comparator or a Sub-comparator. A Sub-comparator feeds into the Main Voter/Comparator and allows voting to extend past the 8 port limit of an M4x Blade. Any transmission path (i.e., a console, a repeater, or a transmitter **MUST** reside on the Main Voter/Comparator. A Sub-comparator can only be used to vote receivers, and cannot have console, repeater, or transmitter connections. Choose the Voter Type and click “Next” to continue.

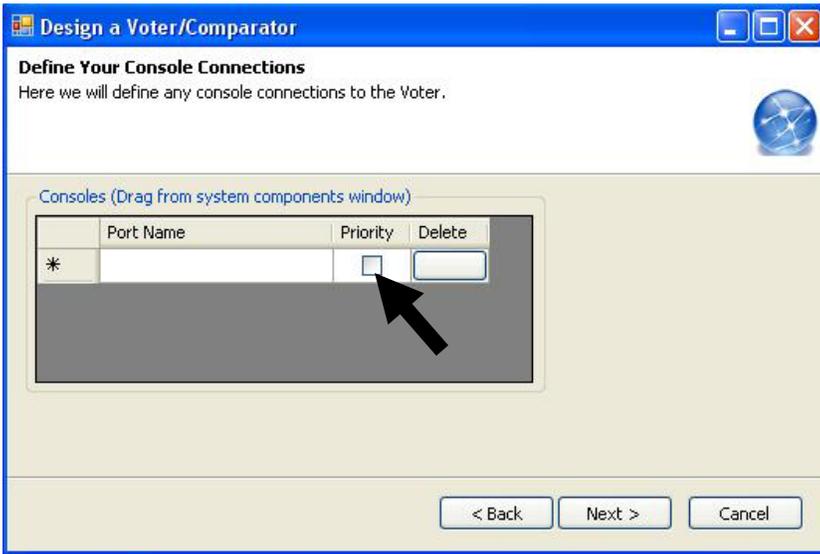


STEP 4

Some vote groups have a console connection. If you need voted audio to be sent to a console, drag and drop your console port into the Console Connections form.

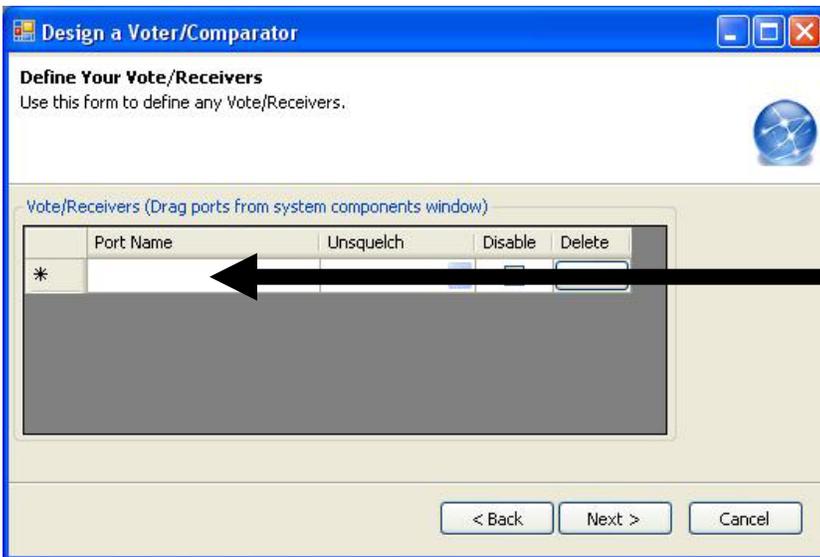


Note: You can designate more than 1 console connection if necessary.



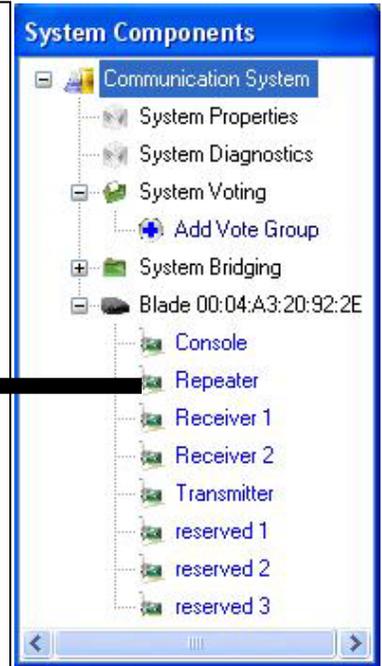
STEP 5

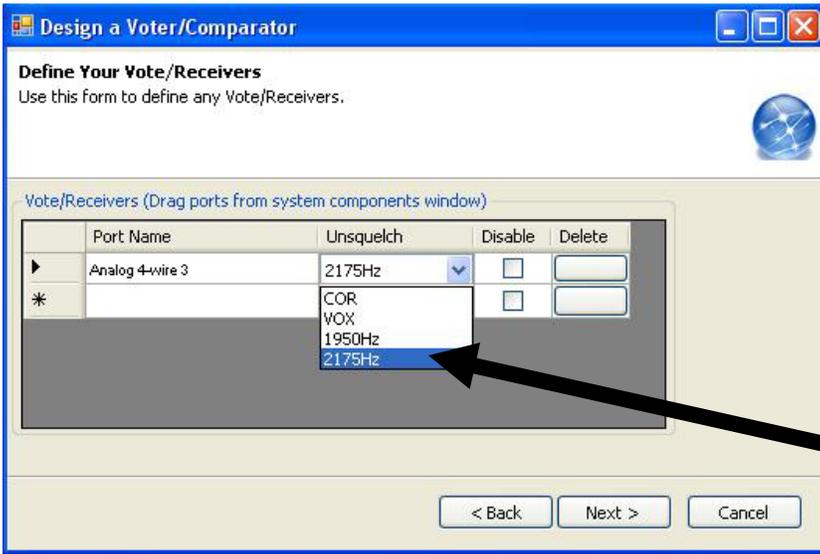
A console can be assigned “console priority”, if necessary. When enabled, the console priority feature gives priority to any audio coming from the console (over any audio coming from a voted receiver). To assign priority to a console, check the “Priority” check box. Click the “Delete” button to remove a port from the list of consoles.



STEP 6

Drag and drop any port connections that you want voted into the Vote/Receiver form.





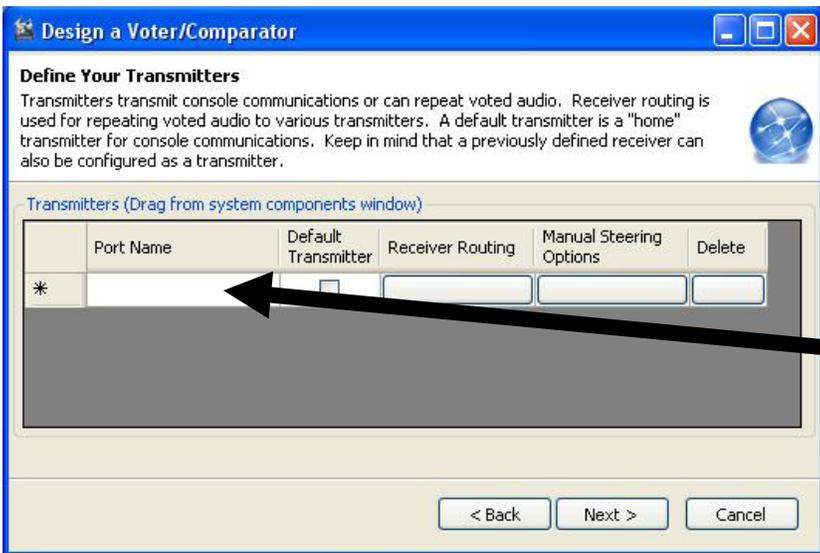
STEP 7

The Raven SNR Voter/Comparator can start voting on any one of these unsquelch indicators:

- COR
- Lack of 2175Hz status tone
- Lack of 1950Hz status tone
- VOX

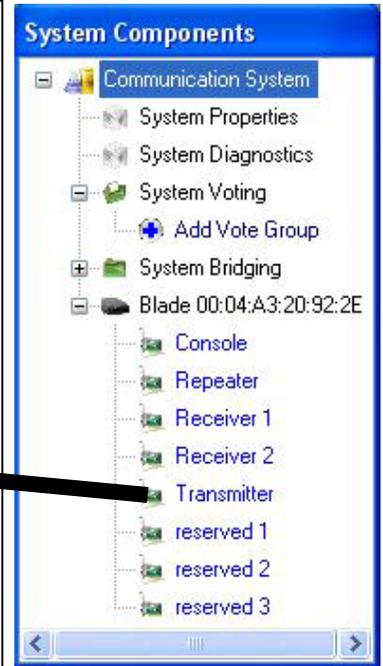
Choose your unsquelch indicator for each vote/receiver.

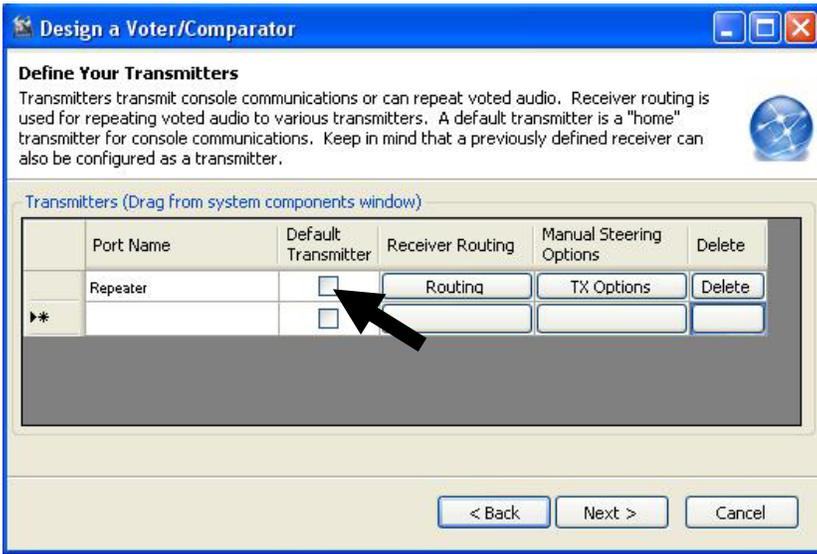
Note: A receiver can be removed from the voting pool while the vote group is active by clicking the “Disable” check box.



STEP 8

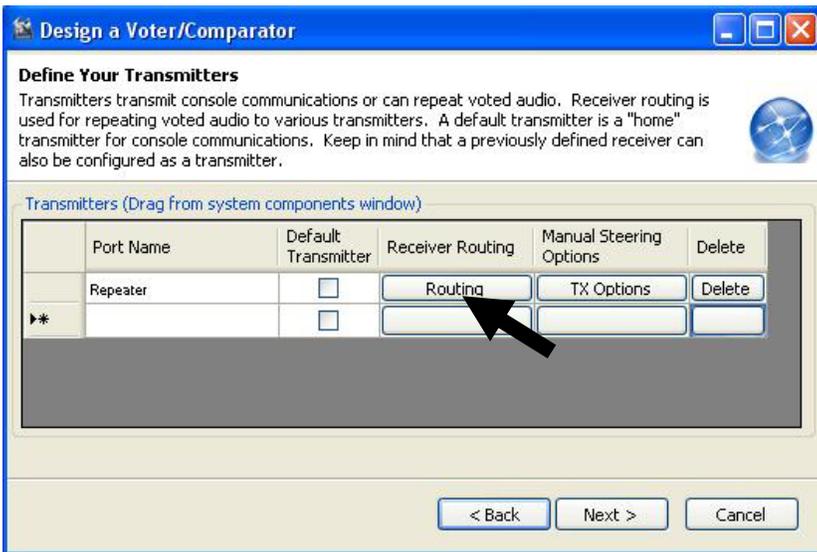
Drag and drop any port connections that you want to designate as transmitters. A transmitter transmits either console audio or repeated voted audio.





STEP 9

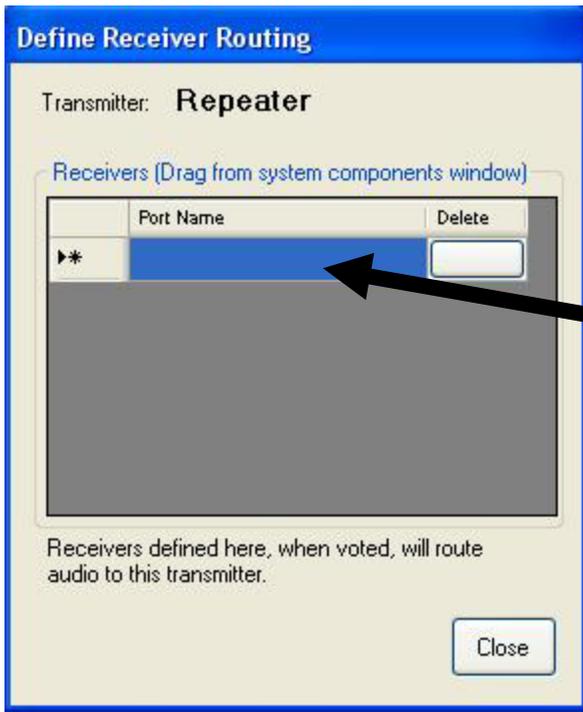
You can designate any transmitter as a “default” transmitter. Default transmitters transmit console audio when steering isn’t active. Check the “Default Transmitter” check box to designate a transmitter as a default transmitter.



STEP 10

Any transmitter can be configured to transmit audio from any voted receiver. Click the “Receiver Routing” button to designate which receiver’s voted audio will be transmitted by this transmitter.

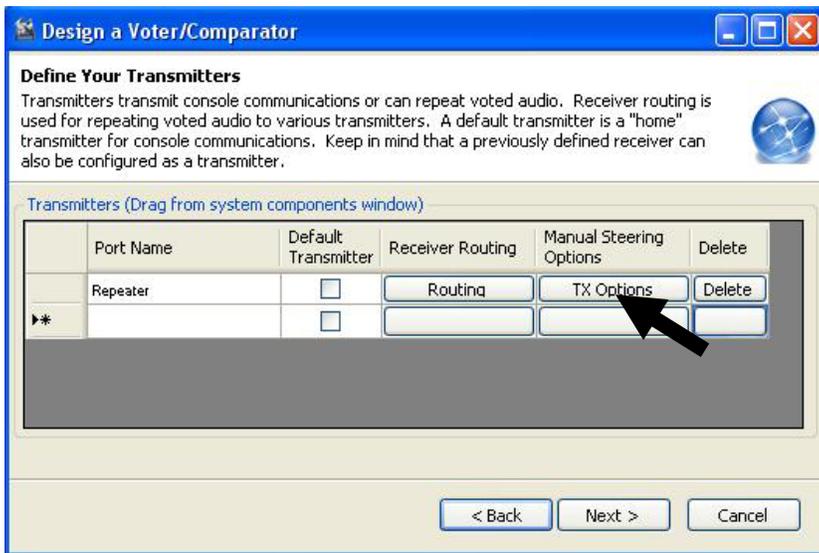
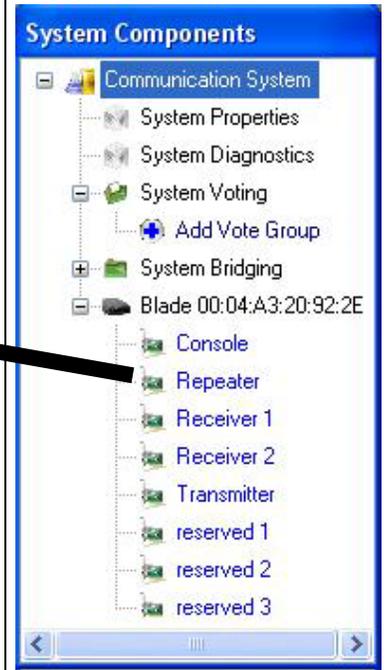
The “Define Receiver Routing” window opens when the “Receiver Routing” button is clicked.



STEP 11

Drag and drop into the “Define Receiver Routing” window any receiver port that you want transmitted by the selected transmitter when the given

receiver gets voted. Any receiver can be added to the selected transmitter’s receiver routing list.



STEP 12

The transmitters in a Raven SNR Vote Group can be manually steered using function tones from a console. Click the “TX Options” button under the “Manual Steering Options” column to define the manual steering configuration for this transmitter.

The “Transmitter Options” window opens when the “TX Options” button is clicked.

STEP 13

The “Transmitter Options” window is used to set up manual steering capabilities for this transmitter. To designate which function tones enable or disable this transmitter, click the check box next to the desired function tone. When a console generates the chosen function tone, the Raven SNR Vote Group will change to Manual Steering mode, and any transmitter that has been configured to be enabled (or disabled) by the chosen function tone will be enabled (or disabled). Once the vote group transitions to Manual Steering mode, a manual steering countdown timer starts that keeps the vote group in Manual Steering mode for the set time period. (This timer is set up in the next step).

The “Transmitter Options” window is also used to designate whether or not this transmitter is activated by keying tones. The vote group needs to know if keying tones are used so that keying tones are generated when necessary (it’s assumed that if console audio is active, the keying tones were already generated by the console, and therefore don’t need to be generated by the vote group).

Transmitter: **Repeater**

Enable Transmitter Tones

HLGT + 650Hz HLGT + 750Hz HLGT + 850Hz
 HLGT + 950Hz HLGT + 1050Hz HLGT + 1150Hz
 HLGT + 1250Hz HLGT + 1350Hz HLGT + 1450Hz
 HLGT + 1550Hz HLGT + 1650Hz HLGT + 1750Hz
 HLGT + 1850Hz HLGT + 1950Hz HLGT + 2350Hz

Disable Transmitter Tones

HLGT + 650Hz HLGT + 750Hz HLGT + 850Hz
 HLGT + 950Hz HLGT + 1050Hz HLGT + 1150Hz
 HLGT + 1250Hz HLGT + 1350Hz HLGT + 1450Hz
 HLGT + 1550Hz HLGT + 1650Hz HLGT + 1750Hz
 HLGT + 1850Hz HLGT + 1950Hz HLGT + 2350Hz

This transmitter uses keying tones

STEP 14

Use the “Manual Transmitter Steering Options” window to set the Manual Steering mode countdown timer. This timer keeps the Raven SNR Vote Group in Manual Steering mode until all voted receiver audio and all console audio has ceased. Once all audio has ceased, the timer starts counting down. If any port gets voted, or any console audio occurs, the timer is reset, forcing the vote group to stay in Manual Steering mode. If all audio ceases, and the timer expires, the vote group transitions back to Default mode.

The “Manual Transmitter Steering Options” window is also used to set a function tone (produced by a console) that forces the vote group out of Manual Steering mode, and back to Default mode.

Design a Voter/Comparator

Manual Transmitter Steering Options

Consoles can manually choose which transmitters to enable during communications (see transmitter “Manual Steering Options”). This page sets the options for user-controlled (manual) transmitter steering.

Amount of time that has to elapse (after consoles and receivers have gone quiet) to transition from manual steering to default transmitters. Note that a value of 0 here will lock the Raven SNR Vote Group into manual transmitter steering mode until a manual override occurs.

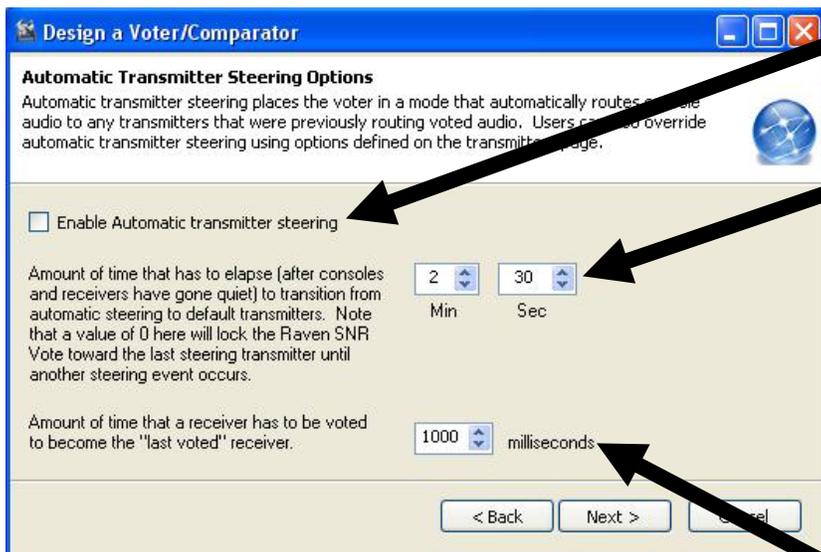
Min: 2 Sec: 30

Choose a function tone (if applicable) that will force the Raven SNR Vote Group out of manual steering back to either automatic or to default transmitters.

HLGT + 1450Hz

< Back Next > Cancel

Note: To lock a vote group into Manual Steering mode, set the Manual Steering mode countdown timer to 0. Once the vote group enters Manual Steering mode (via a function tone from the console), the vote group will remain in Manual Steering mode until the vote group is forced out of Manual Steering mode using the function tone (from the console) that’s configured in the “Manual Transmitter Steering Options” window above.



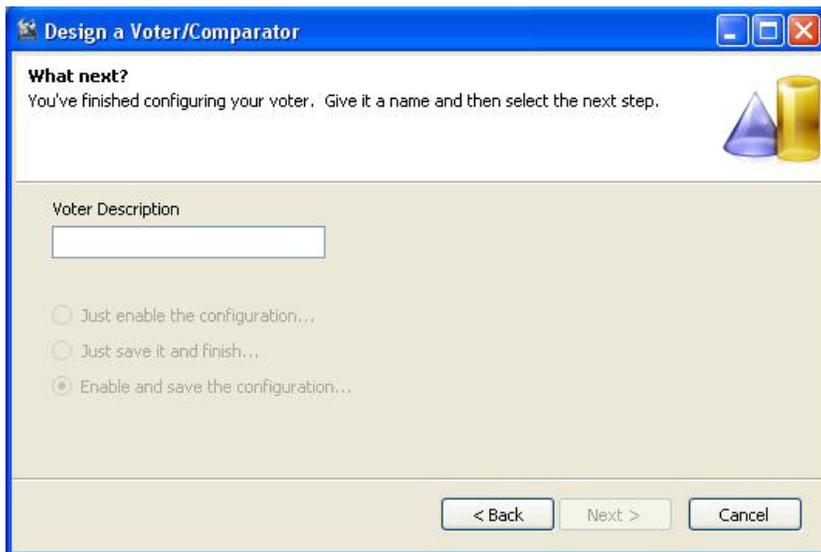
STEP 15

Check here to enable Automatic Steering.

Use the “Automatic Transmitter Steering Options” window to set the Automatic Steering mode countdown timer. This timer keeps the Raven SNR Vote Group in Automatic Steering mode until all voted receiver audio and all console audio has ceased. Once all audio has ceased, the timer starts counting down. If any port gets voted, or any console audio occurs, the timer is reset, forcing the vote group to stay in Automatic Steering mode. If all audio ceases, and the timer expires, the vote group transitions back to Default mode.

Note: Automatic Transmitter Steering affects where console audio gets transmitted. If Automatic Transmitter Steering is enabled, console audio will be transmitted from any transmitter that has the currently-voted receiver in that transmitter’s receiver routing. Also, during the countdown period of the Automatic Steering countdown timer, console audio will continue to be sent to transmitters having the “last-voted” receiver in that transmitter’s receiver routing.

The “Automatic Transmitter Steering Options” window is also used to set a minimum amount of time that a receiver must be voted before it can be designated “last voted”. This avoids spuriously-voted receivers from becoming last-voted.

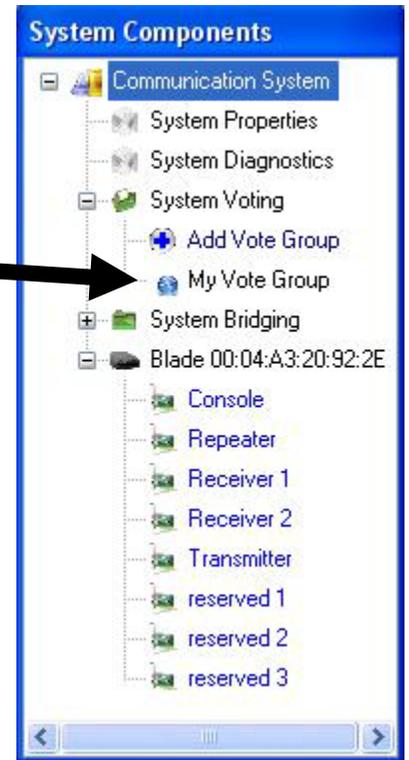


STEP 16

Finish creating the Raven SNR Vote Group by assigning a name to the vote group, and choose one of the options to enable and/or save the new vote group.

Once the vote group is enabled, it's active and performing its voting functions.

Note that the new vote group shows up in the "System Components" tree.

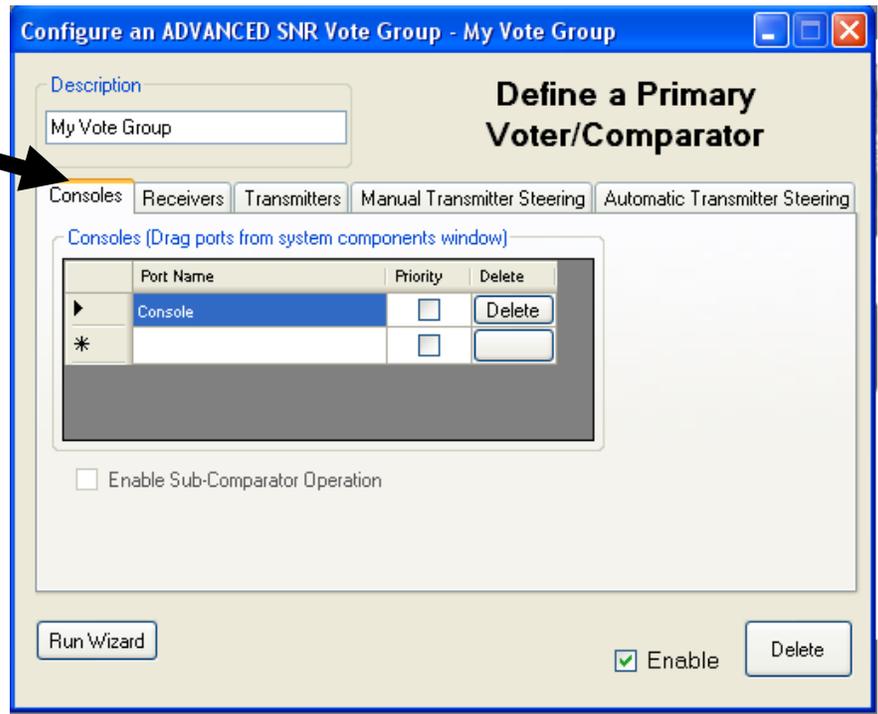


3.2 Manually Modifying a Raven SNR Vote Group

If you need to modify a vote group at a later time, click on the vote group name in the “System Components” tree. Changes can be made while the vote group is active, but some changes may not take effect until the vote group is disabled and then re-enabled.

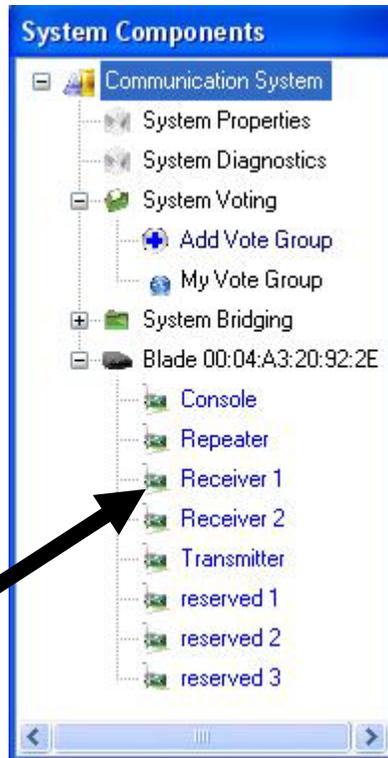
A tabbed version of the vote group setup program appears after clicking on the vote group name. The tabs allow you to view and set up the same vote group features that were set up using the wizard above.

Alternatively, to use the wizard to make changes to an existing vote group, click on the “Run Wizard” button.



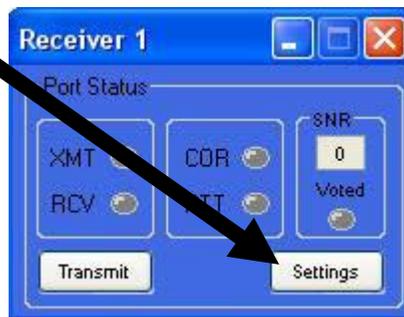
Chapter 4: Modifying the Configuration of a Member of a Raven SNR Vote Group

There are a number of parameters that can be modified on each individual vote group member to tailor voting features to your needs. To gain access to these parameters, you can individually open each vote group member's port "Settings" window.



To gain access to a vote group member's settings, click on the name of the port in the "System Components" tree.

Clicking on the name of the port opens a port status window. Click on the "Settings" button to expand the port settings.



4.1 Modifying a Receiver's SNR Settings

Click the "SNR Settings" tab to access the SNR settings available for this port.

The screenshot shows the configuration window for Receiver 1. The SNR Settings tab is active, displaying the following settings:

- Signal to Noise: Report SNR
- SNR Vote Receiver Settings:
 - Can be voted
 - Mode: Use SNR, Tone Mode
 - Unvote dBs: 3
 - No Audio Vote Timeout: 10000 ms
 - Vote Period: 500
 - Voiced Speech SE/ZC: 6
- Relay Options:
 - Disable On COR
 - PTT on Vote

Buttons: Help, Defaults, Update, Save.

Note: This port is part of a Raven SNR Vote group. Some options may not be available.

When you created the Raven SNR Vote Group, the SNR settings for each vote-receiver are automatically set to the defaults shown here. The following section describes the function of each of the vote-receiver's SNR settings.

- Report SNR
 - In order to be voted, the port needs to be configured to report an SNR value. Leave this box checked.
- Can be voted
 - In order to be voted, this box needs to be checked. To temporarily remove this vote-receiver from the voting pool, un-check this box.
- Mode
 - Leave this set to "Use SNR".
- Unvote dBs

- To avoid unnecessary voting, you can set the number of SNR decibels (dBs) that are required for another receiver to out-vote this receiver. The default is 3.
- Vote Period
 - The “Vote Period” determines how quickly, once one receiver is voted, that another receiver can be voted. The Vote Period is in milliseconds. The default is 500ms.
- No Audio Vote Timeout
 - If a receiver goes unskelched, but provides no audio, the receiver can be removed from the voting pool. The “No Audio Vote Timeout” determines how long to wait before removing it from the pool. The No Audio Vote Timeout default is in milliseconds with a default of 10000 (10 seconds).
- Voice Speech SE/2C
 - Leave this value set to 6.
- Disable on COR
 - If this box is checked, the receiver will be removed from the voting pool when COR goes active.
- PTT on Vote
 - If this box is checked, the receiver will assert PTT when it gets voted.

4.2 Modifying a Transmitter’s Keying Options

Click the “Keying Options” tab to access the keying options available for this port.

The screenshot shows the 'Transmitter' configuration window for a specific port. The 'Keying Options' tab is selected, displaying the following settings:

- PTT Options:**
 - PTT is asserted when the trigger is reached.
 - PTT Key-up Delay (ms): 0
 - Relay Hold On (ms): 250
 - Key-up Triggers: [Button]
- Function Tone Macro (Keying Tone Options):**
 - Macro string: 2175@-3=120,1950@-10=40,2175@-30=0
 - Use Keying Tones
 - [Tone Macro Help] [Update]

A note at the bottom of the window states: "This port is part of a Raven SNR Vote group. Some options may not be available." A 'Save' button is located in the bottom right corner.

A transmitter can be optionally keyed using either PTT or keying tones. This section describes the different keying options.

- PTT is asserted when the trigger is reached
 - If you're using PTT to key the transmitter, check this box.
- PTT Key-up Delay
 - This sets the amount of time, in milliseconds, that the transmitter port delays- after the presence of audio- before asserting PTT. This setting is rarely used, and is almost always set to 0.
- Relay Hold On
 - This is the amount of time, in milliseconds, that the PTT relay stays engaged after audio goes away.
- Use Keying Tones
 - If keying tones are used to key the transmitter, check this box. Also, fill out the correct Function Tone Macro (click "Tone Macro Help" for more information).
- Key-up Triggers
 - Leave the Key-up Trigger for a transmitter set to "On VOX".

Chapter 5: Raven SNR Vote Group Status

This section describes some of the vote group status information provided by the vote group member's port windows.

The screenshot displays five port status windows from the Raven software interface, each with a 'Port Status' section containing several indicators and buttons.

- Console:** XMT (red dot), RCV (grey dot), CDR (grey dot), PTT (grey dot), SNR (empty box), Voted (grey dot). Buttons: Transmit, Settings.
- Repeater:** XMT (grey dot), RCV (green dot), CDR (grey dot), PTT (grey dot), SNR (28), Voted (grey dot). Buttons: Transmit, Settings.
- Receiver 1:** XMT (grey dot), RCV (grey dot), STS (green dot), CDR (grey dot), PTT (grey dot), SNR (-38), Voted (grey dot). Buttons: Transmit, Settings.
- Receiver 2:** XMT (grey dot), RCV (green dot), CDR (grey dot), PTT (grey dot), SNR (34), Voted (green dot). Buttons: Transmit, Settings.
- Transmitter:** XMT (red dot), RCV (grey dot), CDR (grey dot), PTT (grey dot), SNR (empty box), Voted (grey dot). Buttons: Transmit, Settings.

Annotations:

- Receiver 2's voted audio is being sent to the Console.
- Repeater is receiving audio. The audio has an SNR value of 28dB.
- Receiver 1 is receiving status tone.
- Receiver 2 is receiving audio. Receiver 2 has an SNR value of 34dB and is currently the voted receiver.
- This transmitter is currently repeating Receiver 2's voted audio.

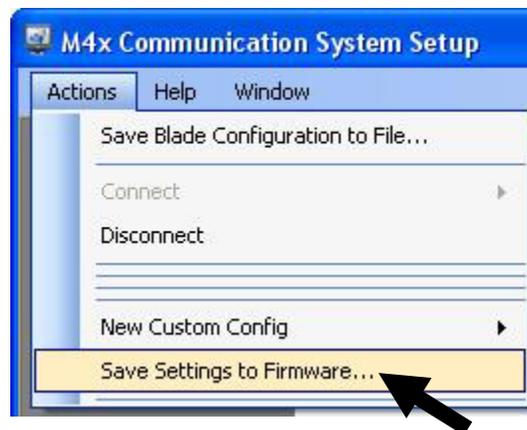


Chapter 6: Saving M4x Blade Configurations

When the USB cable is connected to the Raven M4x SNR Voter/Comparator, and the M4x Communication System Software is active and communicating with the M4x SNR Voter/Comparator, then the M4x Communication System Software is in control of the SNR voting group configuration. Any Blade settings that are saved while the M4x Communication System Software is active are saved to the Windows registry of the PC controlling the Blade's USB port. If the M4x Communication System Software is re-started, the settings from the registry are read upon software start-up, and the M4x SNR Voter/Comparator is reconfigured as it was when the settings were saved to registry.

The Raven M4x SNR Voter/Comparator does not require that a PC be connected during normal voting operations. After any SNR voting groups have been configured (using the M4x Communication System Software), vote group setting can be burned to flash memory on the Raven M4x SNR Voter/Comparator. After flashing the settings, removing the USB cable and cycling power, the Raven M4x SNR Voter/Comparator is ready to operate independently of the M4x Communication System Software.

To save your vote group settings to flash, click on "Save Settings to Firmware..." from the Raven M4x Communication Software Actions menu and follow the prompts.



End of Document