OPERATOR'S MANUAL

RVC 2000 Series

Receiver
Voting
Comparator

THE JRD GROUP
OF COMPANIES

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RVC2000 Series Operator's Manual.
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TABLE OF CONTENTS

1 INTRODUCTION

1.1 SUMMARY

This manual details the operation of the RVC2000 Series Receiver Voting Comparator.

RVC2000 Series voters are designed for use in wide-area analog radio networks. They provide dynamic receiver selection based on best received signal level in a multiple-site radio network.

The RVC2000 series voter may be configured to suite a wide range of common voting scenarios and situations. The installer may select the method the Digital Signal Processor uses to assess the relative merits of audio from remote sites, the way in which the presence of audio is detected.

The options for determining the best audio include "RSSI" which accepts a variable frequency glide tone indicating the received signal strength, "SQ" (Signal Quality) which assess the noise component in received audio and "SNR" which assess the signal to noise ratio of the incoming audio. (*See 5.4.8 Options*).

Incoming audio may be signalled by the cessation of a configurable idle tone, an E&M control (COR) or may be automatically detected (VOX).
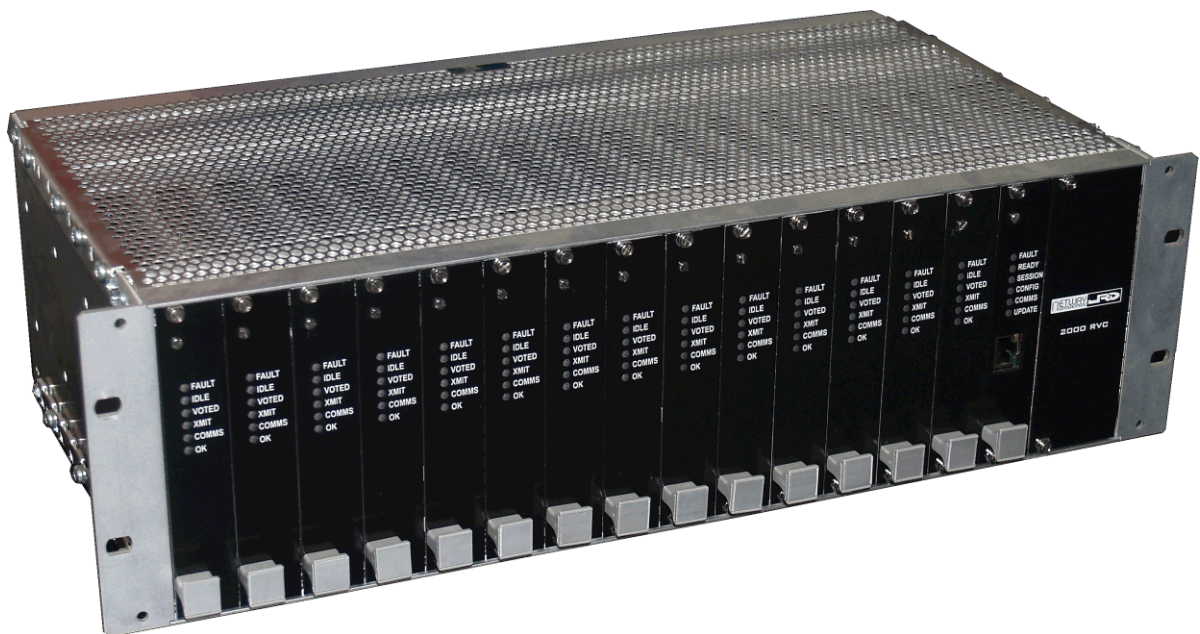
Transmit control is available with E&M outputs from each channel or a configurable key-tone.

Figure 1. RVC2000 Series voter

A typical 14 channel single-rack RVC2000 Series voter is depicted above.

An ethernet port is provided for intranet/internet connectivity. Configuration and monitoring are facilitated by an in-built web server. The menu structure of the web interface is described in *5 Using the Web Interface*.

Other documents relevant to the RVC2000 Series voter are:

- Synchronous Base Station installation document *00189 TB8100*

- RVC2500 installation document *00190*

- Synchrotone III user manual *00207*

1.2 UPGRADEABLE CHANNEL CONFIGURATION

The RVC2000 Series voter is available in configurations of various sizes to suit small to very large networks. In order to cater for network growth the channel capacity may be increased by adding line cards, or an additional rack, if required.

Single rack configuration

- RVC2600/SR/WS14

The single-rack RVC2000 has 15 slots available. One slot is required for the web configuration card, leaving 14 for line cards. If a console is used, 13 line cards are available for repeater site audio.

RVC2000 voters may be ordered with between two and 14 line cards.

The WS14 web server is installed by default on single rack voters, and is optimised for use with 14 channels, or 13 channels plus console.

Dual rack configuration

- RVC2600/DR/WS30

In order to accommodate larger networks, two RVC2000 racks may be interconnected. This does not affect voting time.

A dual-rack voter has 30 slots available. One slot is required for the web configuration card, leaving 29 for line cards. If a console is used, 28 line cards are available for repeater site audio.

The dual-rack RVC2000 may be ordered with between two and 29 line cards. The single rack voter may be upgraded to the dual rack configuration if required by adding the second rack, additional line cards and re-configuring the web server.

The WS30 web server is installed by default on dual rack voters and is optimised for use with 29 channels, or 28 channels plus console.

1.3 OPTIONS

RVC2000 Series voters may be fitted with several optional facilities.

1.3.1 Dynamic Timing System

The Dynamic Timing System (DTS) automatically compensates for different audio delays between the voter and remote base stations that result from differences in interconnection methods and routing. DTS allows the voter to operate in a synchronous network with overlapping base-station coverage. DTS operation requires Synchrotone III units to be installed at base station sites.

1.3.2 SNMP

The voter may be ordered with a SNMP (Simple Network Management Protocol) agent. This permits monitoring of RVC2000 voter status by network management software, and integration of fault reporting with other network equipment. SNMP traps are transmitted when faults are detected or key configuration items are modified.

1.3.3 Transmitter Steering

The transmitter steering option allows the voter's transmit behaviour to be configured such that the channels that are activated for transmit when there is an incoming transmission from a remote site or from the console operator, depend on the voted incoming channel.

1.3.4 Five-tone blanking

The five-tone option provides for blanking of CCIR 5-tone signalling.

1.4 RVC SYSTEM ARCHITECTURE

Figure 2. RVC2000 Series system architecture below illustrates the architecture of the RVC2000 Series. The RVC2000 Series features parallel processing for each channel, redundant power supplies, and IP connectivity. Each channel and the console is connected to its own line card, which provides precision voting in the shortest time possible, and maximum reliability. Evaluation and voting of the incoming signal take place simultaneously over all channels. Configuration and status information are routed though the web server and individual line card
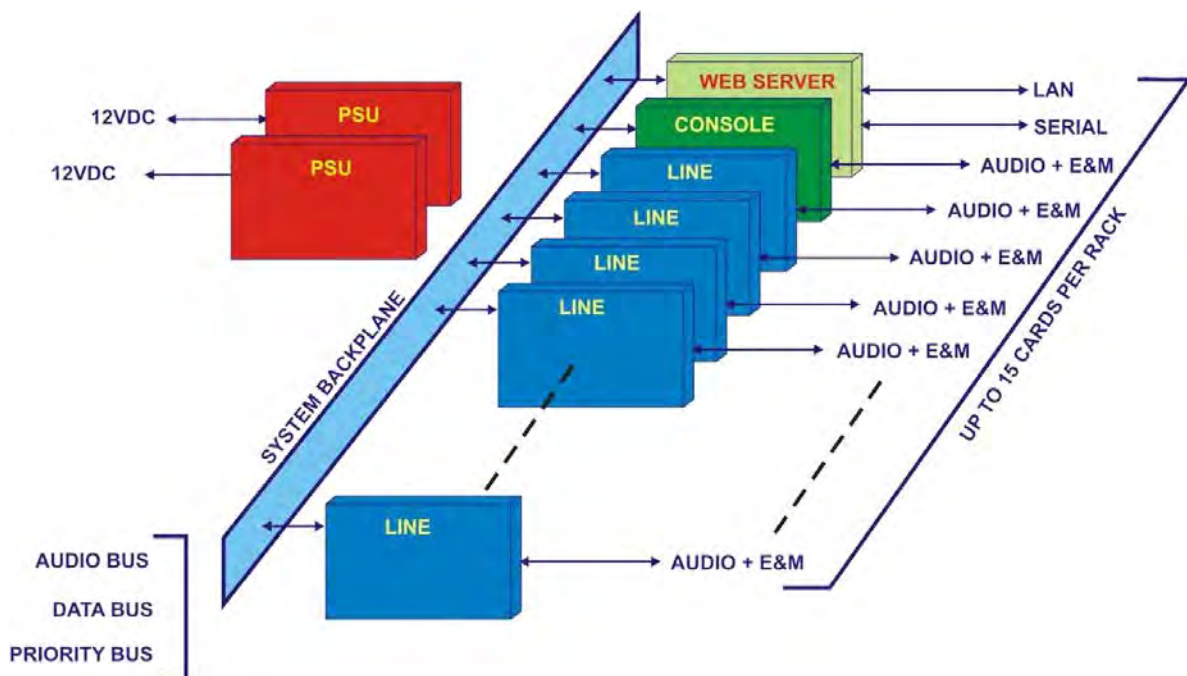
controllers.

Figure 2. RVC 2000 Series system architecture
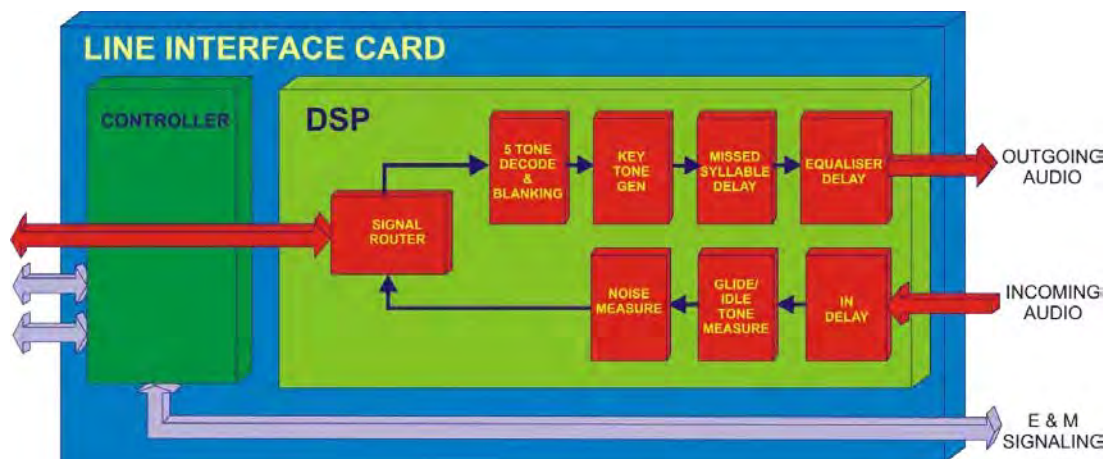
Figure 3. RVC2000 Series line card

As illustrated in *Figure 3* above, *the* RVC2000 Series line cards utilise a Digital Signal Processor (DSP) for evaluation of the incoming audio quality and strength; implementation of delays; key tone generation; and 5-tone decode and blanking. A separate micro-controller evaluates the received audio quality in conjunction with the controllers on other line cards, and decides which channel should be voted.

1.5 VOTER FRONT PANEL INDICATORS

RVC2000 Series voters support three different card types: line cards for connection to remote bases or the console; a web card for configuration purposes; and power supply cards. The indicators on the line cards and the web card are explained below. There are no indicators associated with the power supply cards.

Figure 4. Line Card LEDs indicate status of line card and associated channel

Figure 5. Web card LEDs indicate status of web server and configuration

2 INSTALLATION

2.1 EQUIPMENT AND PARTS

The following equipment and parts are required to operate the voter.

- RVC2000 Series Voter Shelf

- 10BASE-T or 100BASE-TX Ethernet connection for remote configuration and monitoring. (Web server is tested with recent versions of Firefox and Internet Explorer, i.e. Firefox 3.0 and IE 7 as a minimum)

- Cables and adaptors as required.

- Remote base stations with Synchrotone III or compatible signalling. (DST operates only with Synchrotone III and DST licences.)

2.2 VOTER CARD INSTALLATION

2.2.1 Introduction

RVC2000 Series voters consist of up to two inter-connected racks, each with 15 card slots, and two special slots for redundant power supplies. RVC DSP-based line cards provide for connection of remote base stations or the operator console. A web server card is required for configuration purposes. A single rack voter configuration may therefore be configured for up to 13 remote base stations, a console and web server card. The dual rack configuration provides for connection of 28 base stations, a console and web server card. If a console is not required, an additional base station connection is available. Larger configurations may be supplied upon request.

Figure 6 (next page) shows a voter rack with 14 line cards, one of which would usually be dedicated to the operator's console. The console card is usually in slot 14, but may be configured to occupy any convenient unused slot.
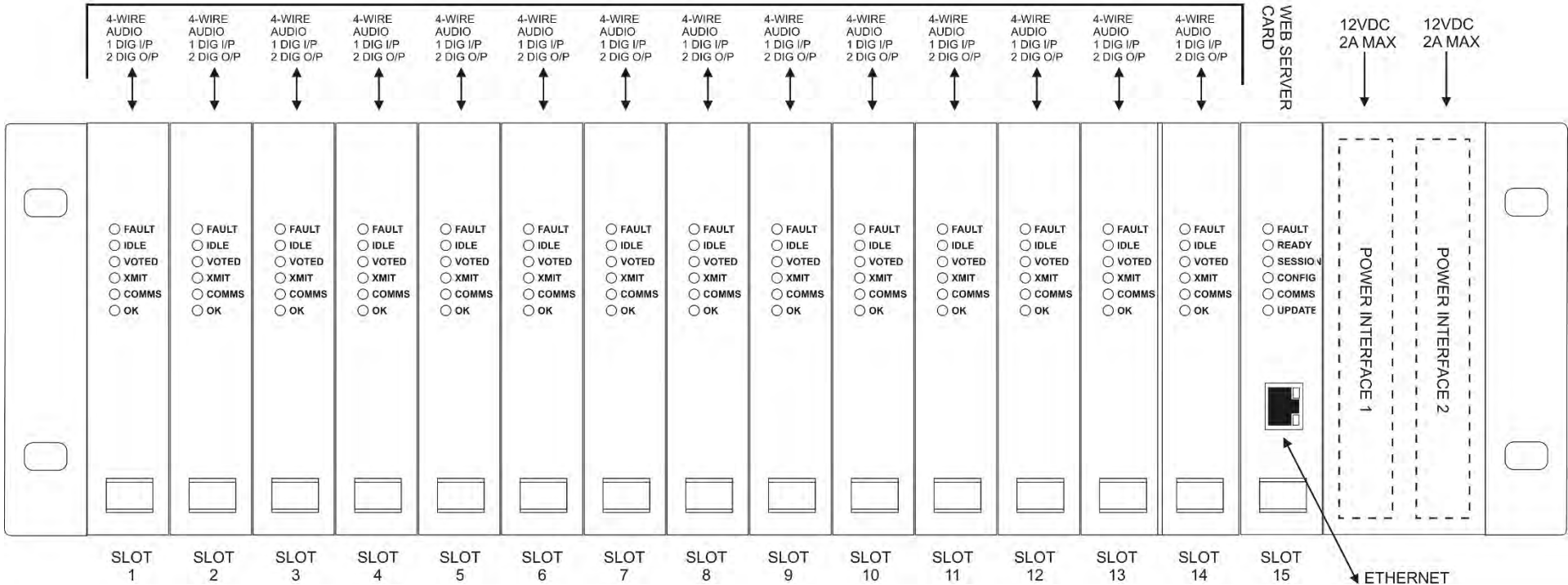
Figure 6. Diagram showing line card and PSU slots

2.2.2 Line(Site) cards

Each remote site is connected to a separate line card. Line cards may occupy any position in the rack except slot 15 which is reserved for the web card.

Audio to remote sites – Each line card has "Line Output" terminals for outgoing audio. See section *7.1 Voter Krone Interface* (Group 1 connections) for wiring and interfacing details.

Several methods are provided for the voter to cause the remote site to go into a transmit state.

Keytone - A configurable tone may be added to outgoing audio in order to "key-up" the remote transmitter. See section *5.2.1 Common (Output Keytone)* for options.

E&M Signalling - Each line card has two configurable E&M outputs. Either may be configured for "Transmit". If so configured, the output will be asserted when the channel goes into the transmit state. See section *7.1   Voter Krone Interface* (Group 2 connections) for wiring and interfacing details.

Audio from remote sites – Each line card has "Line Input" terminals for audio incoming from remote sites. See section *7.1   Voter Krone Interface* (Group 1 connections) for wiring and interfacing details.

The presence of audio from a remote site is signalled in a number of different ways depending on the Voting Type selected. (see *4.2.5 Setting voting type*)

If the voter is configured for RSSI voting, then the presence of remote audio is encoded along with the "glide-tone" from the remote.

If the voter is configured for SQ or SNR voting, the method by which incoming audio is indicated depends on the setting "Audio indication". See section *5.2.4 Advanced (SQ/SNR Voting*). If the selection is "Direct E&M Input", then the E&M input (see *7.1 Voter Krone Interface* - Group 2 connections) associated with the channel should be activated to cause the voter to become unsquelched for the corresponding channel. The channel with the best signal amongst those with audio presence indicated, will be voted.

2.2.2 Console card

A specially configured line card is used to interface to an operator's console. The console interface provides priority for operator audio and allows the operator to hear voted audio even while transmitting.

Any line card may be designated as the "Console" card. (See *5.2.1 Common*) There is no hardware difference between ordinary line cards and the "Console" card, however, the wiring to the console card will be different, and it is usually better placed in a voter card slot that will not be confused with a regular line card, usually slot 14.

Audio from remote sites – Voted audio from remote sites is always output from the console card "Line Output". See section *7.1   Voter Krone Interface* (Group 1 connections) for wiring and

interfacing details. If the system is <u>not</u> configured "Simplex", audio from remote sites may be received whilst the operator is also transmitting audio to remote sites

Audio from operator's console – Audio for transmission to remote sites should be connected to the "Line Input" on the console card. See section *7.1 Voter Krone Interface* (Group 1 connections) for wiring and interfacing details.

The presence of operator audio is signalled by asserting the E&M Input to the relevant console card. See section *7.1 Voter Krone Interface* (Group 2 connections).

If the voter is configured for RSSI voting (see *4.2.5 Setting voting type)* a keytone, nominally 2970 Hz, may also be used to indicated the presence of audio from the operator's console to the voter. . If this tone is not available from a console, an additional keytone generator (JRD BSI-001) may be provided for this purpose.

2.2.3 Placement of web server card

Each RVC2000 Series voter has one web server card for the purposes of configuration and status reporting. The web server card may be placed in any slot in any interconnected rack; however the last slot in each rack – i.e. 15 or 30 – has additional connections for diagnostic serial output, and is therefore the preferred position.

2.2.4 Power supply connection

Each voter rack may contain either one or two power supply cards. Usage of two supplies provides redundancy in the event of a power supply failure. In addition, if the two power supply cards are connected to separate 12VDC power sources, additional redundancy may be achieved.

3 VOTER WEB INTERFACE

To access the voter using a web browser, enter the IP address or DNS-assigned name in the browser address window. The voter will initially display the **System Status** page, which does not require login. To access functions, log in as admin (see *3.1 Accessing the Web Server,* below).

3.1 ACCESSING THE WEB SERVER

Assuming the voter has been assigned an IP address or configured for DHCP operation, the voter web server may be accessed from any web browser using its IP address or DNS-assigned name. Details on configuring the IP address are provided in *5.4.5 IP Address*.

The voter will initially display the **System Status** page. The **System Status** and **Site Status** screens may be accessed without login; however configuration functions require the appropriate login level and password to be entered.

3.2 LOGIN LEVELS

The login area appears at the top of the screen. If there is no current login, the *Login* button will be displayed with entry fields for the user level and password. If an operator is logged in from a different IP address, the login level and the IP address from which the remote user is logged in are shown in red. A higher level or the same level login may replace an existing login.

The following login levels are provided:

- None – Allows display of system and site only.

- "operator" – Allows modification of channel vote enables, vote and transmit enables settings only. The default password is "operator."

- "admin" – Allows access to all other functions. The default password is "admin".
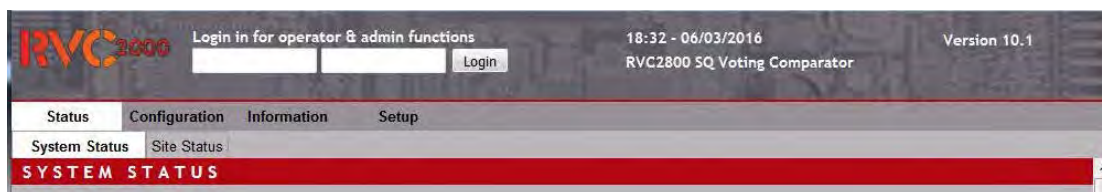
Figure 7. Login Screen.

On successful login the field will change to display the message "User logged in from xxx.xxx.xxx.xxx (being the IP address). The *Logout* button will also display.

Note that the login area also displays the network name, and current RVC version number.

You will now have access to pages which allow operation and configuration of the voter. These pages are detailed in *5 Using the Web Interface*.

3.3 LOGIN TIMEOUTS

The voter will not permit a user with a lesser permission level to log in while another user is already logged in. For example, if the voter is already logged in with "admin" access, a second user cannot log in as "operator" from a different location. The "operator" and "admin" level logins are therefore subject to an automatic timeout.

Default settings are one hour for "operator" and three hours for "admin". They may be altered by changing the "OperatorTimeout" and "AdminTimeout" options respectively in the "vconfig.ini" configuration file (see *7.3.2 Configuration directory*). (The maximum setting is 10 hours, but this setting should be used with caution, as a second user will not be able to log in during this time.)

4 COMMISSIONING

Before commissioning the voter, ensure that all connections have been made and that the voter is accessible via Ethernet at a known IP address. If the IP address is not known, refer to *5.4.5 IP Address.*

4.1 INTRODUCTION

RVC2000 Series voters are commissioned using the in-built http server. Additionally, the voter may be accessed via ftp for the purpose of downloading the event log or transferring configuration files from a PC to the voter or vice versa. See *7.3.1 Logging in user for FTP access* & *7.4 Event Log.*

4.2 PROCEDURE

The following subsections describe how to configure RVC2000 Series voters initially.

4.2.1 Turning voter on/logging in

When the voter is turned on, voting activity will start in a few seconds, however, the web server will take about 30 seconds to start up. The "READY" LED light on the web server card front panel is illuminated when this activity is complete.

The voter may be accessed via its web server, entering the IP address or DNS-assigned name in a browser. The voter defaults to the **System Status** page, which does not require the user to log in. The page shows the state of the power supplies and indicates whether the SNMP agent is running if this option is installed. The **Site Status** page is also accessed from the **Status** menu, showing the overall status of each line card and remote sites, including any faults. However, if the voter has not been commissioned, this information will not be correct. (See *5.1.1 System Status* for detailed information.)

4.2.2 Setting the time

The current voter date and time are displayed in the top frame. If they are not correct, the time and date may be set. The time is set according to the current PC time. Ensure that the PC is set to the correct time first. Select **Setup > Set time**, and then click the *Set voter time from PC* button.

NB If the voter is left without power for a protracted period of time, the time setting may be lost.

4.2.3 Enabling channels

Select **Setup > Channel Enable**. The **Channel Enable** page displays. This screen controls which sites/line cards are enabled.

The screen shows which channels have line cards installed, and allows the operator to select which channels should be enabled. All channels are enabled by default. Disable channels for which line cards are not fitted. NB Avoid disabling channels with installed line cards (see *5.4.1 Channel Enable* for detailed information).

Enabled channels with installed line cards appear have hyperlinked site names in the *Modify Configuration* column.

Select the channels corresponding to installed line cards in the *Enable Channel* column, select the *Talk-through* mode required and press the *Update* button.

The form does not automatically refresh. To confirm that the selected cards have been enabled, press the *Channels* selector again or refresh the page after few seconds. Enabled sites corresponding to installed line cards should now be hyperlinked.

4.2.4 Setting voter name/assigning site names

Select **Setup > Site Names**. Enter site names corresponding to enabled channels as required, and replace the default voter/network identification text where indicated. Click the *Update* button. (See *5.4.3 Profiles* for detailed information.)

4.2.5 Setting voting type

Select *Setup > Options* in order to select the voting type to be used. See *5.4.8 Options.*

The voting type should be selected prior to setting other configuration parameters.

4.2.6 Setting common line card configuration

Select **Configuration > Common** in order to access configuration options common to all channels. The *Default* option will set all parameter to reasonable values and program the line cards accordingly. Adjust parameters as required. (See *5.2.1 Common* for detailed information.)

4.2.7 Setting advanced features

Select the **Configuration > Advanced** option. Depending on the type of voter, i.e. RSSI or SQ, various parameters may need to be set in the **Advanced** configuration window for optimal voting. (See *5.2.4 Advanced* for further details).

4.2.8 Setting line card configuration for individual channels

Select the **Configuration > Channels** option. Channels that have been previously enabled can now be configured. Click on the channel name in the *Modify Configuration* column to access the configuration page for each channel. (See *5.2.3 Individual channel configuration* for a detailed description of individual channel configuration.) All channels may be selected for voting and transmit also, if required, and the talk-through configuration may be set. (See *5.2.2 Channels* for further details.)

4.2.9 Setting optional features

If optional features are present such as Transmitter Steering, Dynamic Timing, 5-Tone blanking or SNMP, they may also be configured if required. The defaults will usually be appropriate. Select Configuration > Transmitter Steering (see *6.1 Transmitter steering*), Dynamic Timing (*6.2)*, or 5-Tone Blanking (*6.3* Five-Tone Blanking) and SNMP setup (*6.4* SNMP) as required to customise these options if required.

4.2.10 Saving total configuration

The voter is now fully configured. However, it would be wise to save the total configuration.

Select **Setup > Profiles** from the menu. Save the current voter configuration profile into one of twelve profiles by pressing one of the twelve *Save* buttons. Type some meaningful text in the associated box to describe the configuration and press *Update.* The saved profile will be indicated as the current profile.

4.2.11 Changing passwords

If you wish to modify the "admin" or "operator" passwords, select **Setup > Change Password**. The passwords may now be changed.

4.2.12 Access control

Select **Setup > Options** in order to control external access to the voter. See *5.4.8 Options*.

If remote access is not required, leave the options unselected, particularly if the voter is available from the Internet. FTP access is required for upgrading the web server component of the voter, see *7.5 Upgrade procedures*, but can be disabled whilst not in use. Enabling FTP also enables Telnet access, but this should not be required in normal operation.

If the "RvcRemote" mobile application is being used to monitor the voter, the remote status monitoring option should be enabled. An Android version of this app will be available in the third quarter of 2016.
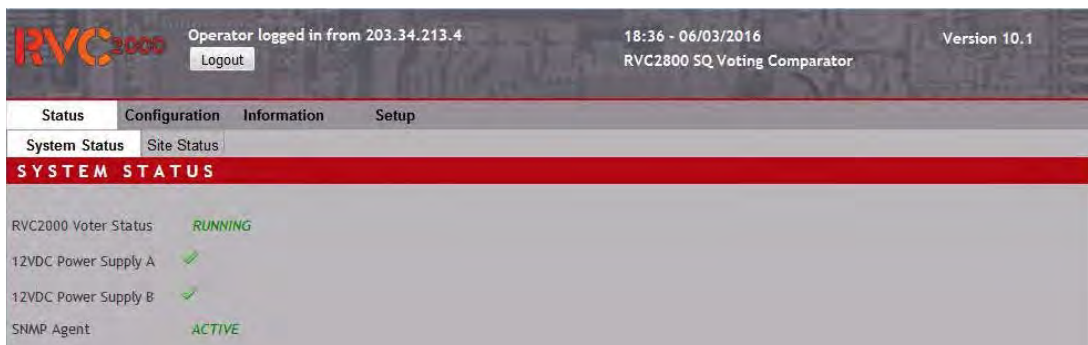
5 USING THE WEB INTERFACE

5.1 STATUS

Clicking on the **Status** menu tab at the far left displays a submenu with three links: **System Status, Site Status** and **Timing**.

5.1.1 System Status

Clicking on the **System Status** submenu tab will bring up the **System Status** page. (Note that this

is also the default starting page.)

Figure 8. System Status page

This page displays the current status of the voter as follows:

RVC Voter Status – RUNNING indicates normal operation.

12VDC Power Supply A – A tick indicates power is connected; a cross indicates no power.

12VDC Power Supply B – A tick indicates power is connected; a cross indicates no power.

SNMP Agent – Either *Active* or *Not Running* will be indicated. This is a voter option.

5.1.2 Site Status

The **Site Status** page displays (from left to right):

Figure 9. Site Status page – 14-channel version

Channel number – Corresponds to card position in the rack.

Site name – The site name as entered in the site name configuration.

Signal strength – A value of 0 to 9. (1 = Worst signal that may be voted, 9 = Full strength or best quality signal.)

Vt (Voted) – Any receiver which has voted during refresh period displays *Y*.

Tx (Transmit) – Active transmitter(s) display *Y*.

Tone – Correct glide tone or idle tone (normal state) is indicated by *Y*; fault (abnormal state) indicated by *Flt*.

Mute – No mute is indicated by *Y*; automatic channel muting due to continuous signal lockout event is indicated by *Flt*.

OK – Correct operation of line card is indicated by *OK*.

Lev (Level) – Incoming signal level in dBm. May be used to calibrate or verify the level of glide tone or idle tone. See section xxxxx for further details.. (See *2 Installation.*)

Note that the display status depends on the configured refresh rate (3 seconds) of the web server. The state displayed is that at the last refresh. Unconfigured sites are greyed out and the channel designated as the *Console* is shown in blue.

5.2 CONFIGURATION MENU

Clicking on the **Configuration** tab will display two drop-down submenus: **Common** and **Channels**.

5.2.1 Common

The **Common Line Card Configuration** page enables the user to enter many configuration

parameters that apply globally across all voter line cards.

Figure 10.Common Line Card Configuration page (depicted with optional features)

Voting configuration

The following parameters may be configured:

Start voting delay

Start voting delay is the time taken from receipt of the first valid glide tone until a voting selection is made. This time is configured to allow signals to arrive from multiple sites, and is also critical when 5-tone blanking is employed. The default is 10ms. If no delay is required, this may be set to zero.

Initial voting hold delay

The initial revote period is the time from first vote selection until next vote. This parameter is intended to provide an uninterrupted period for tone-sequential signalling. The default is 500ms. This may be set to zero if the facility is not required.

Re-vote Period

The revote period is the interval between each voting selection. The default period is 50ms. The minimum setting is 12ms.

Voting Hysteresis

The voting hysteresis parameter may be used to prevent the voted channel from changing on tiny changes in signal strength or quality. In the case of *RSSI* voting with glide tone, the setting controls how much the glide tone must change in frequency in order for another channel to be voted. If *SQ voting* is selected, then the hysteresis is specified in dB.

Simplex operation

When Simplex operation is selected, voting is disabled whilst the console channel is active (ie audio being sent to the console card from the operators console / microphone for transmission to sites). This ensures that in a Simplex radio system, the output of the voter will not be regarded as votable audio by channels that are not transmitting or enabled for transmit.

Delay Settings

The delay settings field enables configuration of the missed syllable delay and the *Last Voted Timeout*.

Missed-syllable delay

Missed-syllable delay provides a lead-in transmitter key-up, commensurate with audio delay, to enhance operation of mobile voting. The default setting is 300ms.

Note that if this value is set too high, users may be able to hear the end of their transmission on key down.

Last voted timeout

The last voted timeout is used in conjunction with the transmitter steering option. It controls how long the console will continue to be steered to the configured sites for the last voted site. If Transmitter Steering is not in use, it should be disabled. (See *6.1 Transmitter steering*)

Output keytone

The Output keytone settings allow configuration of the keytone level and keytone frequency sent from the voter to the base station. NB each line card also has an "open collector"-type output, which may be used as an alternative to key up base stations.

Tx Keytone Mode

Controls tone associated with transmit function.

No keytone –   Audio is transmitted with no keytone. (Used if remote transmitters are activated by an alternative method)

Keytone –   When line card is transmitting, a keytone, controlled by parameters "Keytone level" and "Keytone frequency" are added to the audio signal.

MTRL –   Special (Motorola) tone sequence to activate remote transmit.

Keytone Level

The keytone level may be set in 0.1 dBm increments. The default setting is -23.5dBm.

Keytone Frequency

The keytone frequency may be set in 1Hz increments. The default setting is 2970Hz.

Digital Output

Output A – E&M Mode

The function of E&M Output A on line cards (see *7.1 Voter Krone Interface)* may be selected from the following options.

None –   Output is not used

Transmit – Active when line card is transmitting. Intended to activate remote transmitter.

Voted –   Active when line card has voted audio.

Non-Idle – Active when line card is non-idle, i.e., unmuted / idle tone ceased or E&M input (COR) activated.

Fault –   Active when line card is in fault, e.g. when idle tone absent for too long and no audio present.

No-Fault – Logical inverse of "Fault"

Output B – E&M Mode - **Same as Output A – *E&M Mode for E&M Output B***

System

The System settings field provides for control of the front panel indicator mode and selection of the Console Card.

Indicator mode

The Indicator mode drop down box allows selection of the LED display mode on the voter. There are four selections available:

Normal –   All indicators are active.

No comms –   Blue Comms LED activity is suppressed.

Vote only –   Only the Voted and Fault LEDs are enabled.

Fault only – Only the Fault LEDs are enabled.

The default setting is Normal.

Console card

This setting selects the line card that will be used as the Console card, i.e. the line card which is interconnected to the operator's console.

Default is card slot 14, but any slot may be specified. Set to zero if not used.

5.2.2 Channels

The Channels submenu tab opens the page entitled Channel Configuration.

The **Channel Configuration** page provides a visual indication of the channel status in regard to voting and transmit operation within the system. Unused channels are greyed out and the console channel, if one is configured, is shown in blue.

The available options depend on login level, as shown in *Figure 11.* Channel Configuration page (operator level login) depicted with optional SNMPand *Figure 12 on the next page.* At an "operator" level login, the user is able to configure global vote enable and transmit enable operations only. If the user is logged in at "admin" level, the voter talk-through configuration may also be modified. Additionally, if the optional SNMP component is present, the sending of SNMP traps on a per-channel basis may be selected.
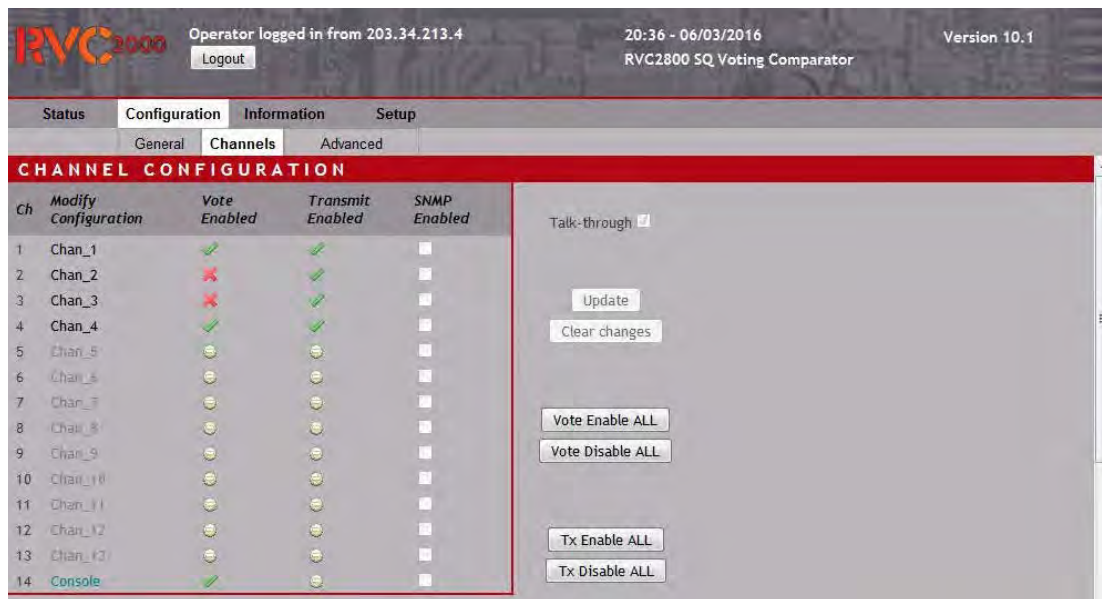
Figure 11. Channel Configuration page (operator level login) depicted with optional SNMP

The fields displayed are:

Ch – The channel number

Modify configuration – The site name for the channel. Remote base sites are shown in black, and the console is shown in blue. Clicking on the site name for a configured channel will open the individual channel configuration page (see *5.2.3 Individual channel configuration,* below). Disabled channels are greyed out.

Voted Enabled – A tick or a cross indicates whether the channel is enabled for voting.

Transmit Enabled – A tick or a cross indicates whether the channel is enabled for transmit.

SNMP Enabled – A tick indicates whether the sending of SNMP traps is enabled. If logged in as "admin", the box may be selected to enable the transmission of SNMP traps relevant to the

channel.

Figure 12. Channel Configuration page (admin level login)

Buttons:

Update – Updates talk through or SNMP enable configuration.

Clear changes – Clears any entries prior to Update

Vote Enable ALL – Enables voting for all channels. Updates config to corresponding line cards.

Disable Vote ALL – Disables voting for all channels. Updates config to corresponding line cards.

Tx Enable ALL – Enables transmit for all channels. Updates config to corresponding line cards.

Disable Tx ALL – Disables transmit for all channels. Updates config to corresponding line cards.

5.2.3 Individual channel configuration

Clicking on the site name of a configured channel in the *Modify Configuration* column of the **Channel Configuration** page will open the individual channel configuration page.

The available options depend on the user login level. At "operator" level (see *Figure 13,* next page) individual channel configuration provides "Voter and Transmit Control" only. At "admin" level, all the parameters for the selected channel may be configured.

Figure 13. Individual Channel Configuration page (operator level login)
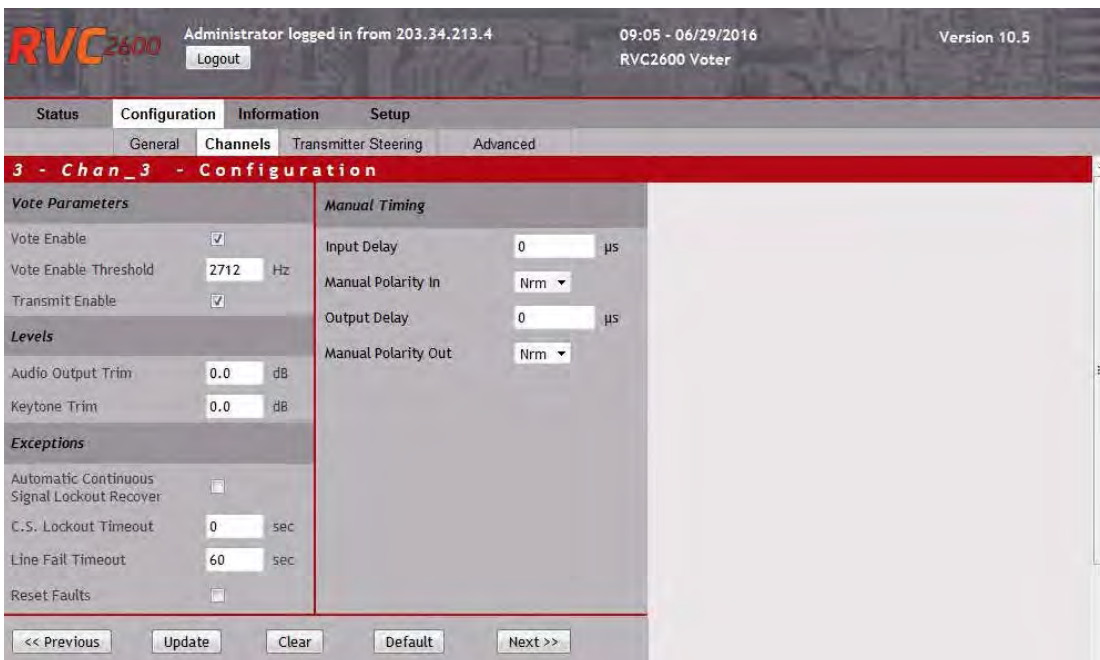

Figure 14. Individual Channel Configuration page for RSSI mode operation (admin level login)
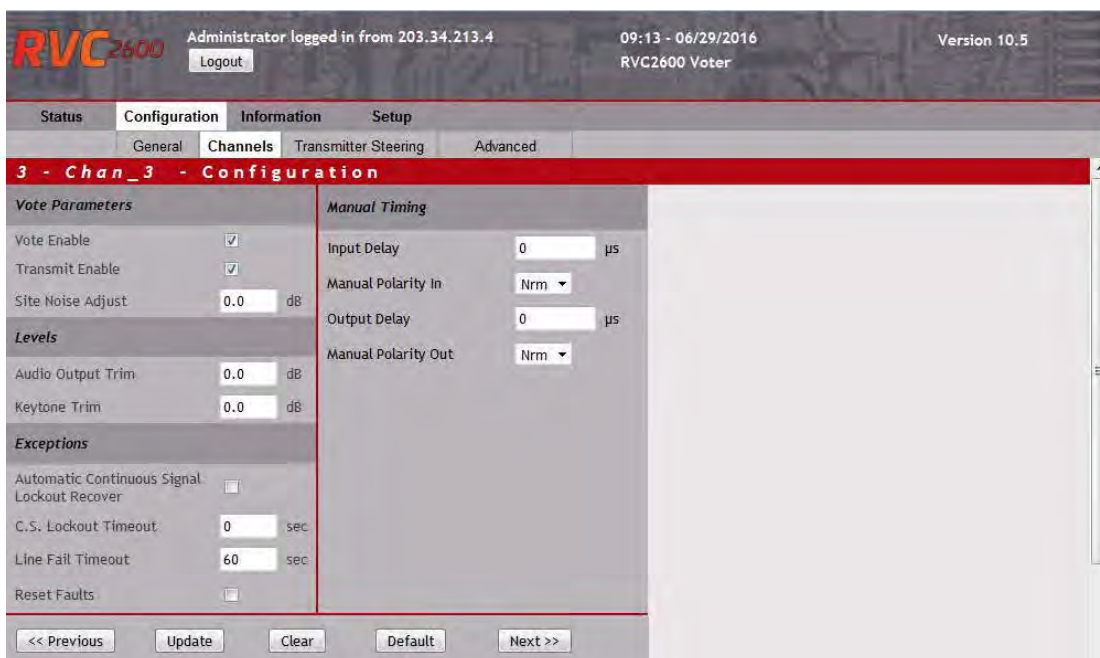
Figure 15. Individual Channel Configuration page for SQ or SNR modes of operation (admin level login)

The fields shown on this page are:

Vote Parameters

Vote Enable – When ticked, allows this channel to be included in vote selection.

Vote Enable Threshold – Defines the lowest glide tone frequency for vote selection. Default is 2712 Hz. (NB This configuration option is only available when the Voting Source is configured for RSSI operation.)

Transmit Enable – When ticked, enables transmit for this channel.

Site Noise Adjust – The ratio of idle tone level to audio level can vary between base stations of different manufacture or due to their set up. This can cause a bias in the SQ measurement. This parameter allows adjustment for this variation without the need to visit or modify the base station at the remote site. The default value for this parameter is 0 dB. It can be adjusted +/- in 0.1dB increments. For example if all but one base stations have an idle tone level of -13.5 dBm and one base station has an idle tone setting of -15 dBm, adjust the parameter to 2.5dBm for that base station.

Levels

Audio Output Trim – The audio level output from the line card may be adjusted in +/- 0.1 dB increments (default is 0 dB).

Keytone Trim – Allows adjustment +/- relative to normal level in dB (default is 0 dB).

Exceptions

Automatic Continuous Signal Lockout Recover – When ticked, provides "rogue carrier lockout recovery" function. An idle glide tone signal, if present for more than five seconds, will re-enable the channel after rogue carrier lockout. When unticked, channel will remain locked out until this option is checked or the *Lockout Timeout* is set to zero and the "rogue carrier" situation has been removed.

C.S. Lockout Timeout – Defines a period for which a non-idle glide tone will be present, after which it will be considered as a rogue carrier and locked out. This action will be indicated as a *Mute* fail on the **Site Status** screen. A setting of 0 disables this function.

Line Fail Timeout

Set the number of seconds the audio circuit to the voter may fail before a fault is raised. A setting of 0 will disable this feature. If the line fail fault is triggered, the channel will be locked out of voting until such time as a valid idle condition exits. (Not used if "Audio Indication" is set to "Audio Presence Detect".)

Reset Faults – When ticked, allows reset of faults under manufacturer instruction. Default condition is unticked.

Manual timing

If the DTS system is not in use, the input and output delays and polarities may be configured manually. Each channel has independent setting for inbound (input) and outbound (output) delay.

Input Delay may be adjusted to account for spread in the arrival of signals from remote base stations. Variation in delays may be due to the use of different link technologies such as VOIP, muxes or microwave links. Significant (more than 10ms) variation is undesirable as it can affect the performance of the voting algorithm. It is preferable that incoming signals be matched in arrival time.

Manual Polarity In can be set to be *normal* or *inverted*. This is to allow for 180-degree phase inversion caused by equipment in the intervening path from the base station to the voter. Phase inversions can be caused by the characteristics of transmission equipment or by incorrect wiring of balanced audio lines. This function is not usually critical and should be left to the *Normal* (*Nrm*) position in most cases.

Output Delay may be adjusted to ensure that signals transmitted from multiple sites are synchronised. For synchronous transmission systems, where two or more base stations transmit at the same frequency in an overlapping area, this adjustment ensures the synchronised transmission of audio over the air and will need to be set to the nearest 50 microseconds or so. For non-synchronous systems the timing is less critical, but should match within a few milliseconds to avoid false voting at the mobile receiver.

Manual Polarity Out can be set to be normal or inverted. For non-synchronous systems, this function is not critical and may be left in the *Nrm* mode. For synchronous systems, audio in the overlap area will be badly distorted if the phases of the arriving audio streams is not matched. If there is an audio phase inversion due to incorrect wiring or due to equipment characteristics, this setting can be used to correct it.

Dynamic Simulcast Timing (optional- not shown here)

When the optional DTS system is in use, the *Manual Timing* options are greyed out and the current DTS status is displayed.

The Dynamic Timing System (DTS) uses a proprietary algorithm to fully characterise the delays and signal polarities of each channel. Input (inbound) and Output (outbound) polarities are detected and corrected so that all the input polarities are matched across all the channels and all the output polarities are matched across all the channels.

Correct output polarity is crucial for minimising audio distortion in overlap areas served by synchronous systems, as is output delay.

The measured delay and polarities are displayed, but cannot be changed.

Buttons:

Update – Updates entered configuration to selected channel.

Clear – Clears any entries prior to *Update*.

Default – Sets factory default configuration and updates to selected channel line card.

Previous – Selects next lowest configured channel configuration. Current channel config is not updated.

Next – Selects next highest configured channel configuration. Current channel config is not updated.

Additional channels may be programmed, either by re-selecting the **Channels** submenu tab and selecting another channel, or by using the *Next* or *Previous* buttons on the bottom of the **Channel Configuration** page. (NB, the *Next* and *Previous* buttons simply move to the next or previous channel, but don't actually program a line card.)

Figure 16 shows the individual configuration when the line card associated with the Console is selected. Most of the configuration for normal line cards is not relevant to the console. Please leave the "Vote Enable" and "Transmit Enable" selected as shown.

The audio output from the console card to the operators console may be trimmed with the "Console Output Trim" if desired.

Figure 16. Console configuration

5.2.4 Advanced

The options available for the **Advanced** configuration depend on the type of voting.

RSSI Setup

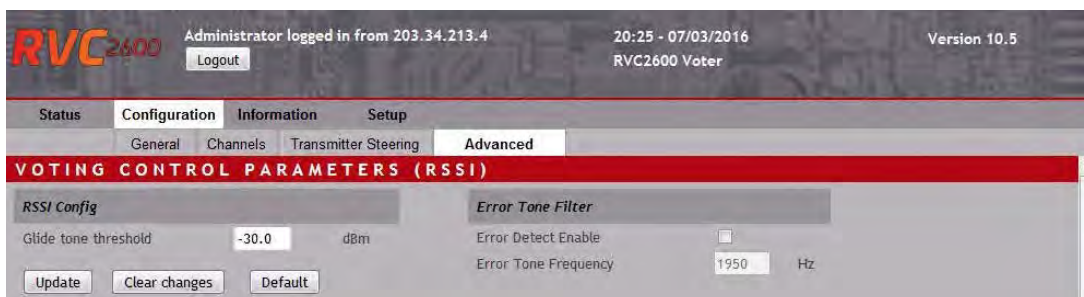There is only one important parameter that needs to be set here.

Figure 17. Parameters specific to RSSI mode

Glide tone threshold – Glide tone threshold - To ensure that voting is not triggered by low-level spurious audio signals, a threshold is applied to the glide tone level. This should be set to 3dBm lower than the expected incoming glide tone level.

Error Tone Filter – Usually not required with RSSI voting. Please leave disabled. See SQ/SNR voting below.

SQ / SNR Voting
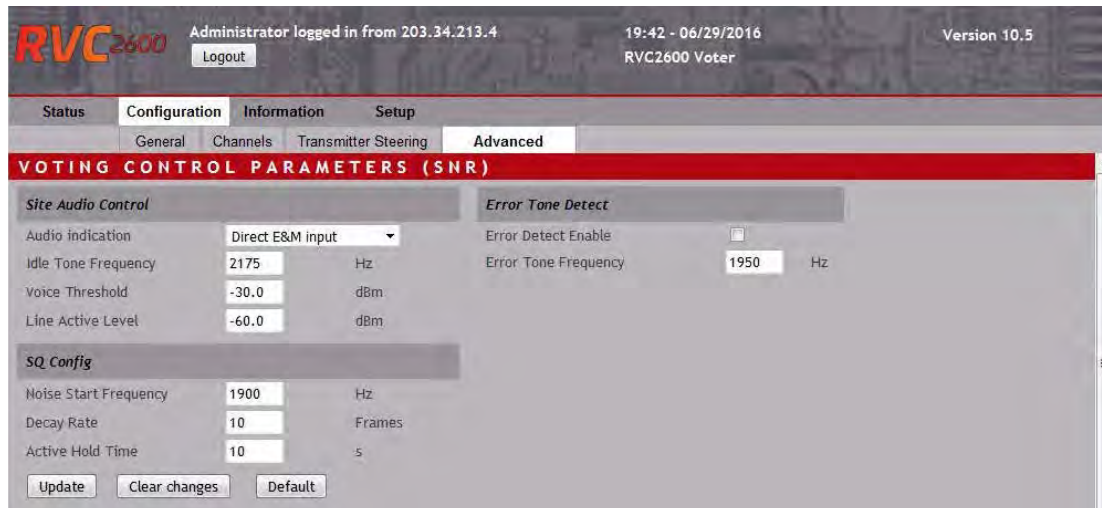
Default Signal Quality parameters should be suitable in most cases.

Figure 18. Parameters specific to SQ mode

Site Audio Control

Audio Indication – Sets the method by which the presence of incoming audio is indicated to the voter

- *Idle tone cessation* – When the configured idle tone ceases, the channel actively votes on received audio.

- *Direct E&M input* – The presence of votable audio is indicated by the E&M input being pulled to ground (i.e., Carrier Operated Relay)

- *Audio Presence Detect* – The presence of audio is automatically detected – (i.e., VOX) Not recommended unless either of the alternatives are not available.

Idle Tone Frequency– If *Audio Indication* is set to *Idle Tone Cessation*, this is the frequency of the tone signal sent by the remote base station to the voter when it is squelched. When the remote base station received a signal and unsquelches, the idle tone is replaced by incoming audio. The expected idle tone frequency may be set between the range 500 Hz to 2900 Hz.

Voice Threshold – The system uses this threshold to detect voice activity of the incoming audio. This should be set to about 10dB below expected average incoming voice levels in dBm. If the average level is -10 dBm, set this to -20dBm. The value is not critical.

Line Active Level – If the incoming audio level drops below this value, it is assumed that the line in has become disconnected and an error is flagged. Typical noise levels from an open remote

base station receiver may be -40 or -50 dBm depending on signal quality. Setting a level of -60dBm will typically detect line breakage.

SQ Config

Noise Start Frequency – The point of division of the audio spectrum to assist calculation of the SNR. Leave as the factory default of 1900 Hz unless advised otherwise.

Decay Rate – Sets the number of DSP frames over which the quality of the incoming signal is averaged. Leave this set to factory default of 10 unless advised otherwise.

Active Hold Time – The line is constantly monitored for audio signals. If incoming audio or idle tone are absent for this length of time then a line fault is declared.

Error Tone Detect

Error Detect Enable – Enables detection or error tone in received audio. If enabled, reception of error tone sets line fault for the channel and prevents channel from voting until channel returns to the idle state. The error tone is blocked from transmitted audio.

Error Tone Frequency – The frequency of the error tone to be detected if enabled.

5.3 INFORMATION

The **Information** menu options provide access to channel statistics and downloadable information and configuration. **Stats** and **Downloads** sub-menus may be selected.

5.3.1 Stats

The **Site Statistics** window provides statistical information on voting percentage per site and transmitter up time.

This information is updated dynamically, and reset daily at midnight, at which time the information for that day is transferred to the web server event log.

Figure 19. Site Statistics Window

The fields displayed are:

Ch – The channel number

Site – The site name for the channel. Remote base sites are shown in black; the console is shown in blue.

Voted % – The current percentage of time the current channel is the voted channel.

Tx Time – The total transmit time per channel since midnight.

5.3.2 Timing

Clicking on the **Timing** submenu tab will transfer to **Site Audio Timing**.

Figure 20. Site Audio Timing page

The **Site Audio Timing** window displays the current audio timing, either that automatically determined if the Dynamic Timing System is in use, or the manually set timing and polarities if not.

Ch – The channel number.

Site – The site name for the channel. Remote base sites are shown in black, the console is shown in blue. Timing is not relevant for the Console card.

Timing Mode – Whether *Automatic* (with DTS and Synchrotone III) or *Manual.*

µs – The measured delay to the remote site in microseconds (Automatic) or the inserted delay to site (Manual)

Polarity In – Current incoming polarity.

Polarity Out – Current outgoing polarity.

5.3.3 Downloads

Clicking on the **Downloads** submenu tab will display the **File Download** window.

The **File Download** window provides access for downloading to the user's PC, event logs, voter profiles and configuration files.
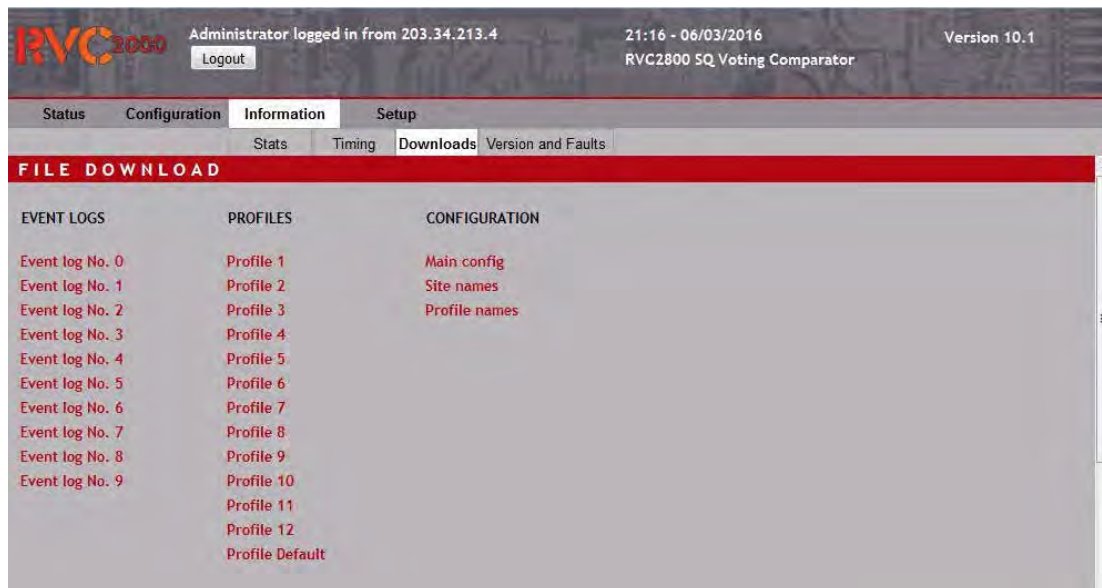
Figure 21. File Download window

Event Logs

All important voter events are written to a series of 10 event logs used on a rotating basis. The event log files use ".csv" format, which facilitates display by Microsoft Excel or similar if the browser is so configured. See *Figure 22. Example of an event log* on the next page.

Further information on event logs may be found in the Appendix (*7.4 Event Log*). Event logs may also be accessed through FTP. See Appendix (*7.3.1 Logging in user for FTP access*).

Profiles.

Each of the 12 voter profiles and the default profile may be downloaded. This is primarily provided so the entire voter configuration may be backed up. See *5.4.3 Profiles* for a description of voter profiles.

Voter profiles may also be accessed through FTP. See Appendix, *7.3.1* Logging in user for FTP access.

Figure 22. Example of an event log

Configuration

The main voter configuration file, site names config and profile names config may also be downloaded for backup purposes. It is not intended that these files be modified by the user.

See Appendix (*7.3.2 Configuration directory*) for further details.

5.3.4 Version and Faults

Version and Faults may be used to diagnose problems, and check the version of installed line cards. The information may be useful if reporting a problem or requiring an upgrade. It is not necessary to access this information during commissioning or normal operation.

Figure 23. Version and Faults configuration

Fields are as follows

Ch – Channel number

Site – The site name for the channel. Remote base sites are shown in black; the console is shown in blue.

Mstr mode – Indicates which line card is currently controlling the internal voter bus. It can be any card, but usually defaults to channel 1.

Flt min – Binary coded minor faults. Specific bits have meanings as shown on the right. These faults are mainly internal to the voter, and unlikely to occur.

```
Minor faults

0x01 – Minor fault test (Manufacturer only)
0x02 – Unused
0x04 – DSP configuration fault
0x08 – DSP read fault
0x10 – DSP write fault
0x20 – DSP poll fault
0x40 – Watchdog occurred
0x80 - Unused
```

Flt Urg – Binary coded urgent faults.

In practice, only the faults that depend on conditions external to the voter are likely to arise. Primarily the power supply faults, tone failure (i.e. glide tone or idle tone) from a base

```
Urgent faults

0x01 – System integrity disabled (Factory use)
0x02 – Configuration defaulted due to failure
0x04 – DSP failure
0x08 – Configuration in progress
0x10 – Power supply A failed
0x20 – Power supply B failed
0x40 – Tone failure from base
0x80 – Continuous signal lockout current
```

station and the continuous signal lockout () if enabled).

SI Code – System Integrity Code

Internal fault indications. If any bits set, refer to distributor or JRD Communications

```
0x0001 – DSP Stalled
0x0002 – Configuration problem
0x0004 – DSP configuration changed
```

Raw SQUal – Primarily for diagnostic purposes. For RSSI voting, (ie voting with variable glide tone) this is the currently measured frequency being received by the voter channel. When SQ or SNR voting is configured, this is a measure of signal quality internal to the voter.

Proto Ver – Protocol version

CPU Maj, Min & Bld – Major, minor and build number of control CPU on line card.

DSP Maj & Min – Major and minor number of DSP firmware on line card.

DSP ChkSum – Checksum of DSK configuration – used internally

5.4 SETUP MENU

The **Setup** menu provides access to configuration screens required to configure the voter initially. Setup options do not normally need modification after this time, except perhaps, for example, where site names are changed or the voter IP address must be changed.

5.4.1 Channel Enable

Clicking on the **Channel Enable** submenu (**Setup > Channel Enable**) brings up the **Channel Enable** page.
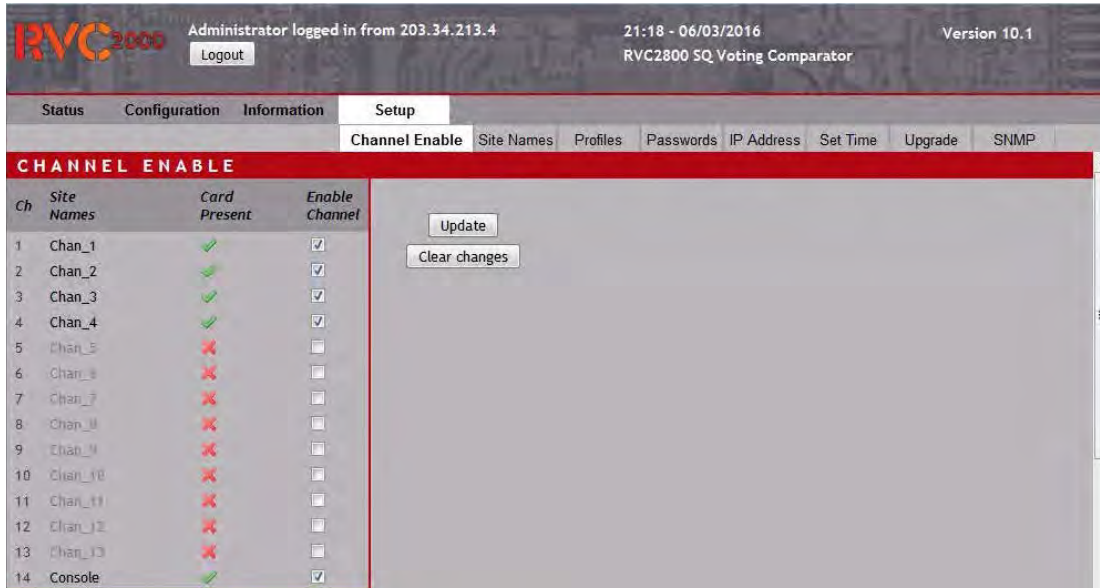
Figure 24. Channel Enable window

This screen shows which channel has a line card installed, and allows the operator to select which channels should be enabled. Usually, any channel with an installed line card should be enabled. Channels which are not enabled cannot be configured, and will be ignored by the voter. The site name of operational channels are shown in black. Channels for which the line card is present, but which are not enabled, are shown in green. If a channel is enabled, but no line card is installed, the site/channel name is shown in red and the channel should be disabled.

All channels are enabled by default. Disable channels if line cards are not fitted.

Click *Update* to program the RVC2000 accordingly.

5.4.2 Site Names

Clicking on the **Site Names** submenu tab brings up the **Site Names** page. This page allows entry of site names for each line card, and also a Network Identification.

Figure 25. Site Names page

The *Base Site Name* may consist of any fifteen (15) characters, including spaces. It should be entered in the entry field box adjacent to the channel number.

The *Network Identification* may consist of fifty (50) characters, including spaces. It should be entered in the entry field box *Network Identification.*

On completion, select the *Update* button at the bottom of the page to update the settings to the RVC2000.

5.4.3 Profiles

Clicking on the **Profiles** submenu tab (**Setup > Profiles**) will transfer to the **Voter Profiles** page, which allows the administrator to save and restore 12 different complete voter configuration profiles.
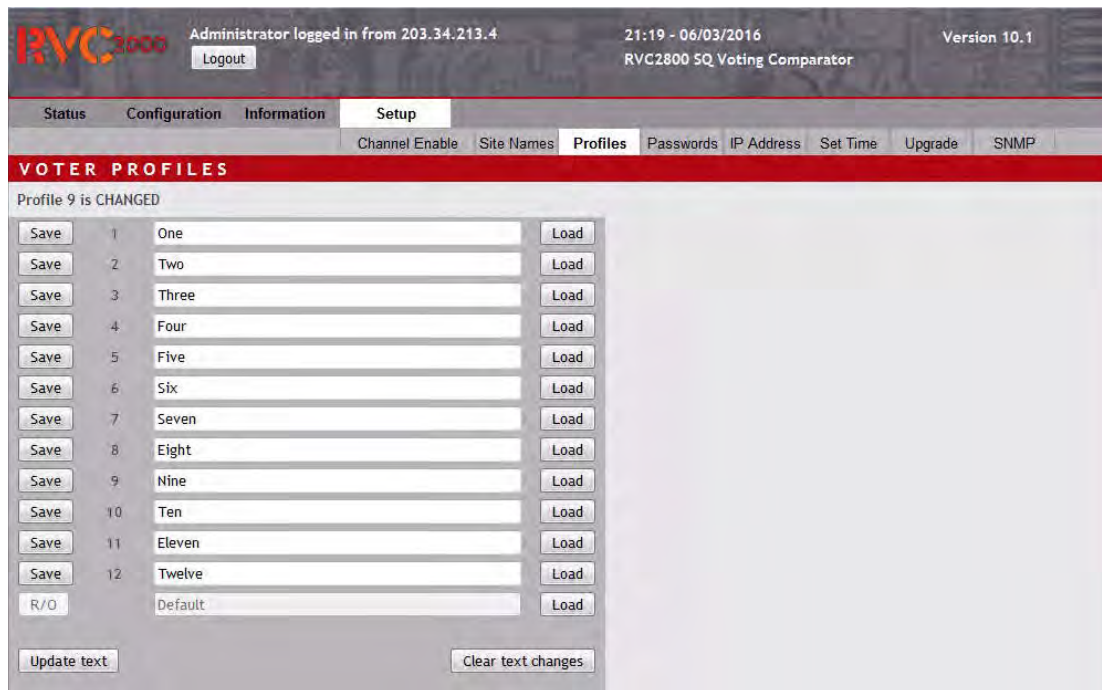
Figure 26. Voter Profiles page

To save the complete current voter configuration to one of the twelve profiles, select the corresponding *Save* button. The voter can be configured to one of the twelve saved profiles by selecting the appropriate *Load* button. An error message will be displayed if an attempt is made to load a profile that has not been saved.

Each profile may be given a meaningful name by entering text in the text box provided for each profile and pressing the *Update text* button. Entries may be cleared before update with the *Clear text changes* button. It is not mandatory to name each profile, but it is highly recommended.

A special default profile is provided by the manufacturer which will return the voter to a valid, but not necessarily appropriate, state. This profile cannot be modified in this window.

The profile status line (in the example above, "Current profile is 1") indicates the current configuration profile operating in the voters. It is updated whenever an operator saves or loads one of the 13 configurations available. If changes are made to global or line card configuration, the voter configuration may no longer correspond with one of the saved profiles, and thus the current profile is indicated as *Changed*. The web card front panel "CONFIG" LED will also light up whenever the configuration is not one of the saved profiles.

If adjustments to the voter configuration are made by selecting different profiles rather than by changing parameters or controls individually, the exact state of the configuration will always be known.

Note that if a system administrator makes manual changes to voter configuration – thus by-passing the standard configuration mechanism – or cards are physically changed in the voter, the indicated current profile may no longer be correct.

Saved profiles may be downloaded for backup purposes as described in *5.3.3 Downloads.*

5.4.4 Change Password

The **Change Password** screen (**Setup > Change Password**) allows the changing of passwords for the "operator" and "admin" accounts". "Admin" level access is required for this feature.
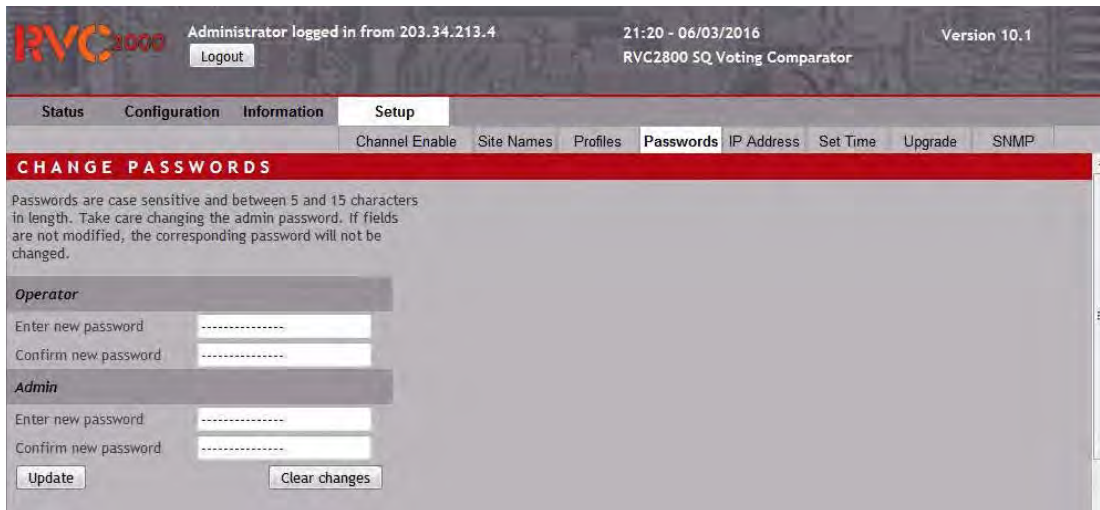
Figure 27. Change Password page

Passwords must be between 5 and 15 characters long and must be entered in both the Enter new password and Confirm new password fields in order to effect a change.

The default passwords as supplied by JRD are listed in *3.2 Login Levels* and are unchanged from the previous release.

5.4.5 IP Address

The IP Address selection provides for the modification of IP address parameters.
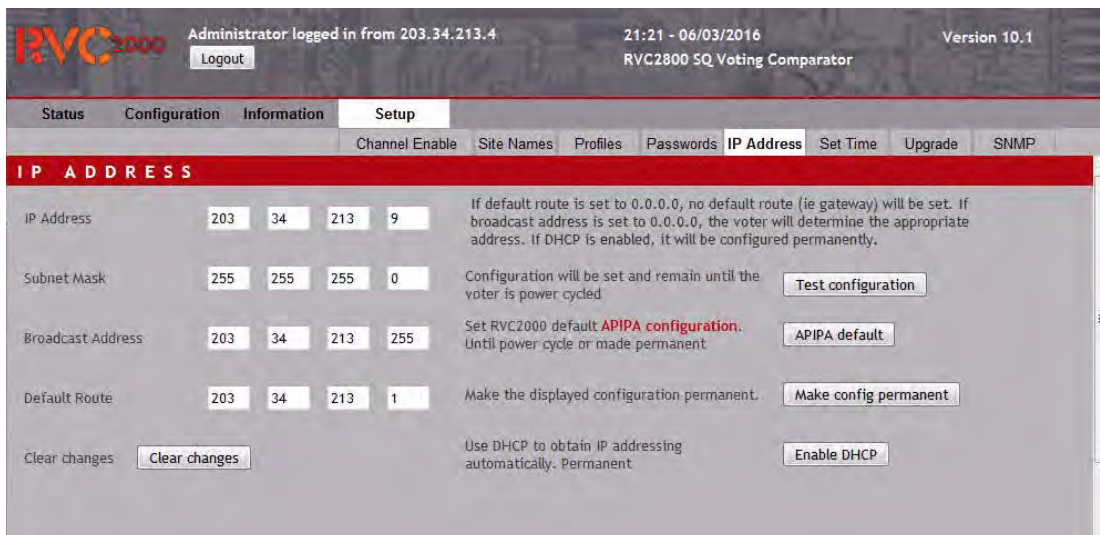
Figure 28. IP Address page

Changing the IP address assumes that the RVC2000 voter is accessible via a known IP address in the first place. If this is not the case, a procedure for obtaining connectivity for purposes of configuring the IP address is described in the following section. See *Voter Default IP Address* on the next page.

IP Address Type

The voter may be configured with Dynamic Host Configuration Protocol (DHCP) for automatic allocation of IP address information from a DHCP server, or more usually its IP address may be statically set. The best choice will depend on the circumstances of the installation. DHCP is often simpler. However, it may be difficult to determine the address allocated to the voter. This issue is addressed below in the section on *Determining the dynamically assigned IP address* on the next page.. Selecting a static IP address is recommended.

Setting a static IP address

The IP Address screen allows access to the following parameters.

IP Address – Static IP address in standard IPv4 notation. This should be a suitable unused address on the user's network.

Subnet Mask – Determines which part of the IP address defines the network, and which part defines the address of the RVC2000. Standard format is used, e.g. 255.255.255.0 for a class C network, where the first 24 bits of the address define the network.

Broadcast Address – The address is used to send a message to all devices on the network. This is usually the highest address in the particular subnet. For a class C address, the first three numbers would be the same as the network and the last number would be 255.

If the address is entered as 0.0.0.0, the voter will determine the address automatically. However there may be circumstances where a system administrator will want to set a different address.

Default Route – This is the IP address through which IP packets initiated by the voter will be routed through, also referred to as the "gateway" address. For normal voter operations this should not be required. If configured as 0.0.0.0, the voter will not configure a default route. It will be required if transmission of SNMP traps is desired.

Buttons

The following additional controls are provided.

Test configuration – Sets the IP configuration to that selected, but is not permanently recorded. If the voter fails to respond with the selected settings, a power cycle will restore the previous IP address config.

APIPA default – This configures the voter to the APIPA address and saves the change.

Make config permanent – The displayed IP address configuration is permanently recorded. Use if you are sure about the change or after testing a change with the *Test configuration* option.

***Enable DHCP* – Enables the RVC2000 for use when a DHCP server is available. Will require determination of the actual IP address, either by searching the address space or as described below. See** *Determining the dynamically assigned IP address*

Voter Default IP Address

IP Address   169.254.0.42

Subnet Mask   255.255.0.0

Broadcast Address   Automatic.

Default Route   Nil

This class B address falls within a range of specially assigned addresses used for "link-local" addressing also known as "Automatic Private IP Addressing" (APIPA) by Microsoft. It may be used to recover from a situation where the IP address of the voter is not known.

This default address may be set either by selecting the *APIPA default* option on the IP address screen or by operating a special switch on the voter web card.
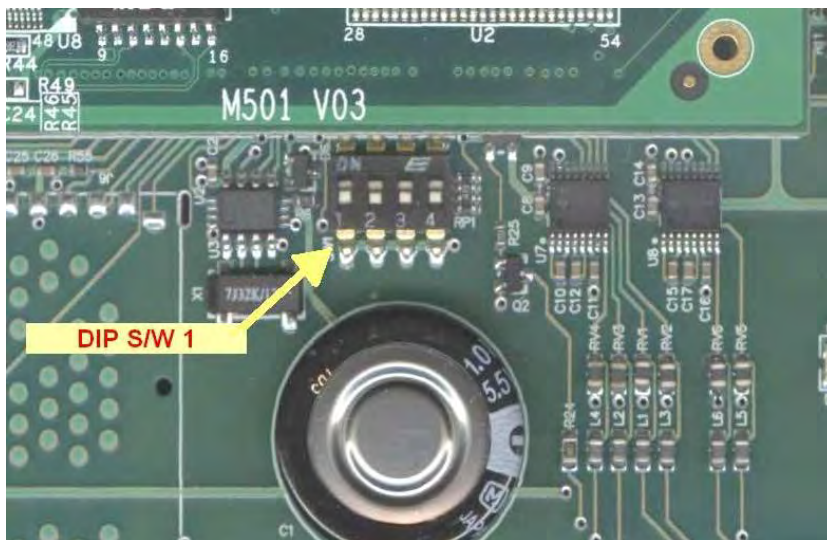
Figure 29. Switch 1 of the 4-way DIP switch

Regardless of the current IP address setting, if the voter is powered up with Switch 1 of the 4-way DIP switch located near the large capacitor set to the on position (see *Figure 29. Switch 1 of the 4-way DIP switch, above)*, the IP address of the voter will be set to the above default address on power-up. Once connectivity is established, the IP address of the voter may be set differently.

NB Once the desired IP address has been set, the switch must be returned to the off position or the default address will be set each time the voter is power-cycled.

Connecting to the voter with default (APIPA) address

In order to establish a connection to the voter using the default address, a PC running Windows may be directly to the voter via Ethernet. If the PC is set to acquire its IP address automatically on its Ethernet LAN, it will, after failing to obtain an IP address from a DHCP server, automatically set an address in the APIPA network range. By this mechanism, communications to the voter may be established by specifying the default address (169.254.0.42) in the browser window. A more suitable IP address may then be set.

Determining the dynamically assigned IP address

Assuming an IP address has been dynamically assigned by the switch or router the voter is connected to, and that IP address cannot be determined by reference to the switch's or router's status, the following describes how to determine the dynamically assigned IP address.

- Connect a dumb terminal (e.g. PC with terminal program such as MS HyperTerminal or Tera Term) to the first serial voter port. This should be configured for 38400 bps, 8,1,N. (Access to voter serial ports assumes the web card is placed in the rightmost slot, i.e. slot 15 or slot 30. See Appendix (*7.1 Voter Krone Interface*) for wiring details.

- Start or power-cycle the voter.

- About 30 seconds after start-up, the web server version number will be output to the serial port, for example:

    Voter WEB Server Vers 10.0.0 – June 28 2015 - 13:55:46
    Copyright © 2015 – Netway-JRD
    Ethernet IP Addr is AAA.BBB.CCC.DDD

5.4.6 Set Time

The current time and date held by the voter real-time clock are displayed in the top frame when a user is logged in.

Figure 30. Set Voter Time page

This time is used for event logging in the voter. Select the option *Set Voter Clock*. The time will be set when the user presses the *Set voter time from PC* button. Note: You must be logged in as "admin" to access this feature.

The time is set from the PC clock used to access the web page, so it is necessary to ensure that the time on the PC is correct before using this feature.

5.4.7 Upgrade

The voter upgrade facility provides for the upgrading of the voter web server which provides for configuring and monitoring the voter. At the current time, the lines cards are not updated by this procedure.

Voters which have a SD Card slot or USB socket installed on the Web Server Card, may be updated by writing the update package supplied by the distributor or manufacturer to an SD card or USB flash memory device and inserting into the supplied socket. If no such sockets are installed, the upgrade package may be sent to the voter using FTP

If no upgrade package has been loaded into the voter, the Upgrade screen will appear as follows.
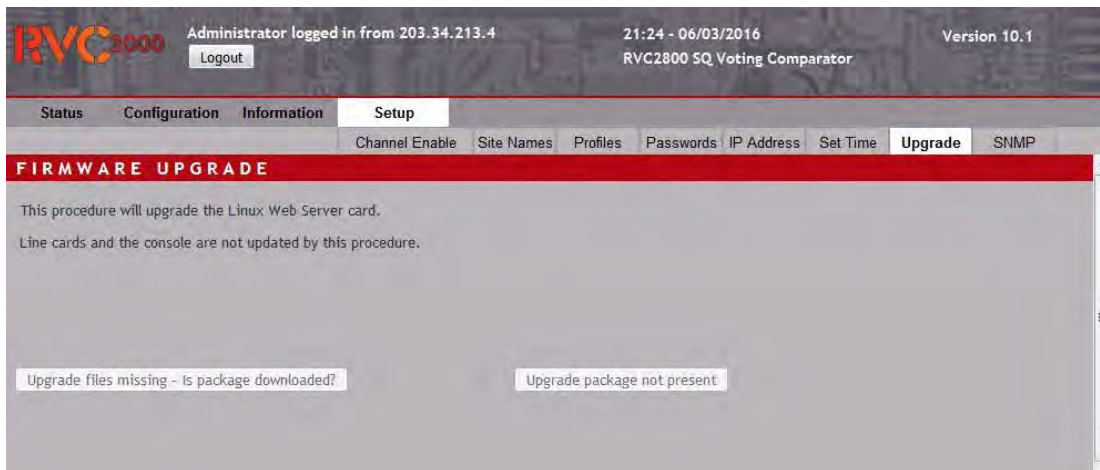
Figure 31. Firmware upgrade

See Appendix *(7.5 Upgrade procedures)* for detailed instructions for upgrading voter.

5.4.8 Options

Optional voter feature selection
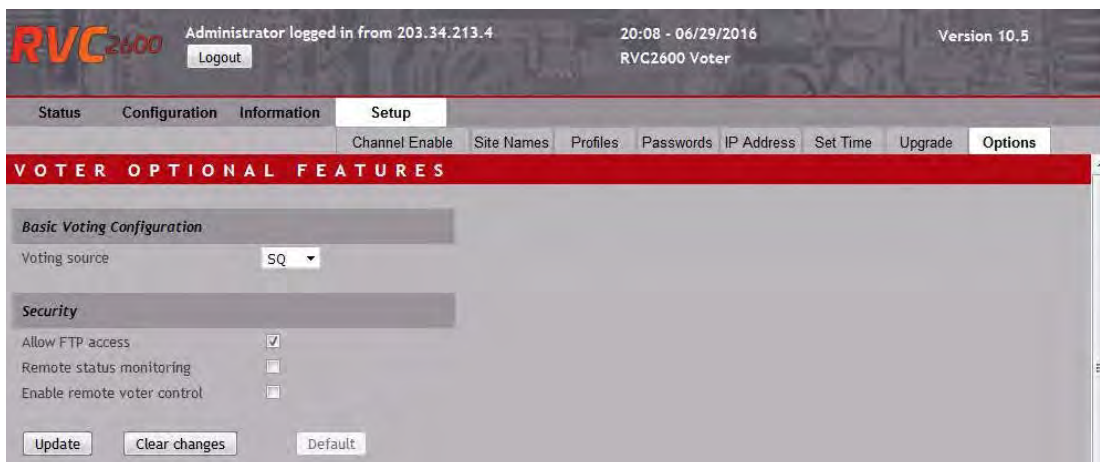
Figure 32. Selection of optional features

Basic Voting Configuration

Voting source

The voting source selection allows selecting of the method by which the voter determines which channel should be voted when presented with remote audio from more than one site.

The alternatives are

- RSSI

In Received Signal Strength Indication mode, the voter relies entirely on the RF signal strength as indicated by the remote base station receiver to select the best voted site. The signal strength is represented by an audio glide tone from the base station. The glide tone varies from 2712 Hz (lowest acceptable signal) to 2990 Hz for the best signal and is filtered out by the voter so is not heard in the audio going to air or to the console.

If the base station receiver does not have the facility to generate its own glide tone, then a BSIU (Base Station Interface Unit) must be installed at the remote site to take a voltage RSSI and generate a corresponding glide tone frequency.

In order for RSSI voting to operate consistently, the glide tone must be calibrated against actual received signal level for each base station so that the indications match. Each BSIU has an inbuilt calibration facility which can be performed in conjunction with it associated base station receiver either at the remote site or on the bench prior to installation. If a new BSIU or receiver is deployed, the calibration process should be repeated to ensure that the glide tone is correct.

- SNR

In Signal to Noise Ratio mode the voter constantly evaluates the ratio of the energy in the lower audio band to the energy in the higher audio band. As voice content adds more energy to the lower region than it does to the higher one, it is possible to estimate the SNR in real time. The frequency at which the higher audio band starts is a user settable parameter (Noise Start Frequency) and defaults to 1900 Hz.

This method better tolerates mismatched incoming audio levels when compared to the SQ system but is less tolerant of interference sources.

- SQ

In Signal Quality mode, the voter measures and tracks the background noise of the incoming audio between voiced syllables. The measurement is based on energy content in the higher frequency region of the audio band above 2 kHz.

For this mode to operate correctly, all input sources should have the same audio characteristics and levels. Unmatched levels will cause a bias in the noise evaluation. Incoming audio levels should be adjusted to match across all base station receivers. If this is not practical, each line card may be adjusted using the Site Signal Offset parameter.

SQ is the recommended mode for voice communications if the above requirements are met and the RSSI system is unavailable.

Security

Allow FTP access – If set, allows FTP and Telnet access to the voter. If voter is connected to the Internet, this option should be disable when not required. When upgrading the voter as described in section 7.5, it will be necessary to temporarily enable FTP access.

Remote status monitoring – When enabled, the operation of the voter may be monitored remotely using the "Rvc Remote" mobile application. (Expected release 3rd quarter 2016)

Enable remote voter control – If this option is enabled, each site may be configured for voting and transmitting via the "Remote status monitoring" option. If this option is not enabled, then only status information is available via the remote protocol.

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6 OPTIONAL FEATURES

6.1 TRANSMITTER STEERING
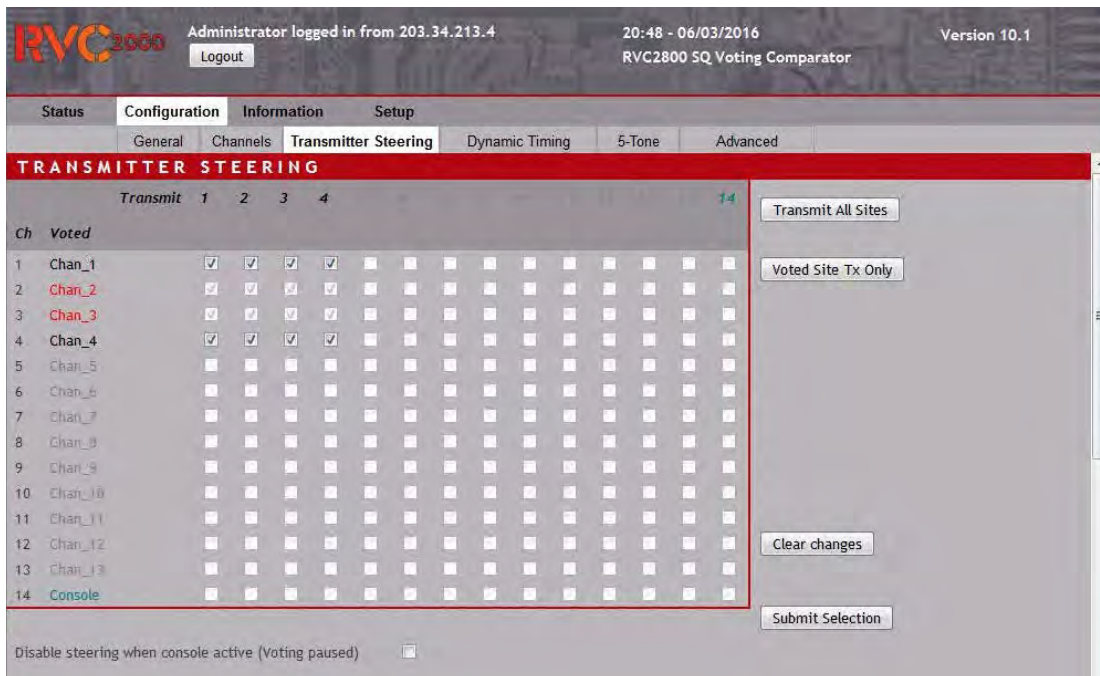
Figure 33. Transmitter Steering configuration

The transmitter steering matrix controls the transmission behaviour of sites when console audio is being transmitted. (Ie operator audio being transmitted to enabled remote sites.)

The vertical axis list shows channels (sites) that are enabled for voting in black. The horizontal axis shows sites that are enabled for transmit. For a channel to influence transmitter steering it must be enabled for voting and for a site to actually transmit, it must be enabled for transmit. Usually all sites will be enabled for voting and transmit.

Transmitter steering depends on which site/channel was last voted. Ie if for example channel 6 was last voted, then when the console is activated, the channels that are enabled in the channel 6 row in the matrix, will be the sites to which audio is directed.

The matrix may be set-up arbitrarily, however, two common options may be configured with special buttons.

Transmit All Sites – Basically, if this is selected, all combinations of vote and transmit enabled channels will be configured. When console audio is sent to the voter, it will be sent out all channels that are configured for transmit. Effectively, transmitter steering is not used.

Voted Site Tx Only – If this options is selected, then console operator audio is directed back at the channel that was most recently (ie "last") voted.

NB The "last voted" channel is the channel that was voted the most times since the voter was unsquelched. For example, if incoming audio is present for 5 seconds and the "Re-vote period" is 50ms, then there would have been 100 votes in that period.

After some time following the cessation of incoming audio, directing console audio to the last channel on which a transmission was received probably doesn't make sense. The time between an incoming transmission and transmitter steering being applied can be configured as part of the "Common Line Card Configuration. (*See 5.2.1 Common*). The default setting of 1 minute means that after that period of time following the cessation of incoming audio, any console output will be directed at all channel configured for transmission. Ie no transmitter steering will take place.

6.2 DYNAMIC SIMULCAST TIMING

Dynamic Timing System

Figure 34. Dynamic Simulcast Timing

The *Dynamic Timing System* (DTS) is a method of maintaining simulcast transmission timing on a synchronous or quasi-synchronous network. This feature will only work in conjunction with base stations that have been equipped with a DTS-enabled Synchrotone III module and external GPS reference.

The *Dynamic Timing System* check box should be ticked to enable this feature if used in a Synchronous network with the necessary hardware.

DTS equalised delay

The equalised delay is the bulk delay period by which each base station is compensated by the automatic timing compensation. As an example, if the equalised delay is set to 100ms, and the path delay to base station A is 42.54ms, and the path delay to base station B is 76.58ms, the delays added to each path to provide a 100ms equalised delay are 57.46ms and 33.42ms respectively.

In practice, the equalised delay should be set to a value which is significantly larger than the longest path delay measured. The default setting is 20ms.

DTS Auto Re-time Period

The *DTS auto re-time period* parameter is used to set the interval for dynamic timing interrogation. This setting is in minutes. The default setting is 60 minutes. The *auto re-time period* may not be set to less than 1 minute if *Dynamic Timing System* is enabled.

Echo Threshold

Default setting. Please do not change.

Pulse Level

Default setting. Please do not change.

Buttons:

Update – Updates entered configuration to selected channel.

Clear – Clears any entries prior to *Update.*

Default – Sets factory default configuration and updates to selected channel line card.

6.3 FIVE-TONE BLANKING

5-tone Blanking

The 5-tone blanking system provides complete outbound (voter to transmitter) blanking of leading-edge 5-tone sequential signalling which conforms to the set parameters, providing that:

1. *Missed-syllable delay* is larger than the 5-tone signalling period.

2. *Start voting delay* is less than the period between receiver gating and first tone received (i.e.
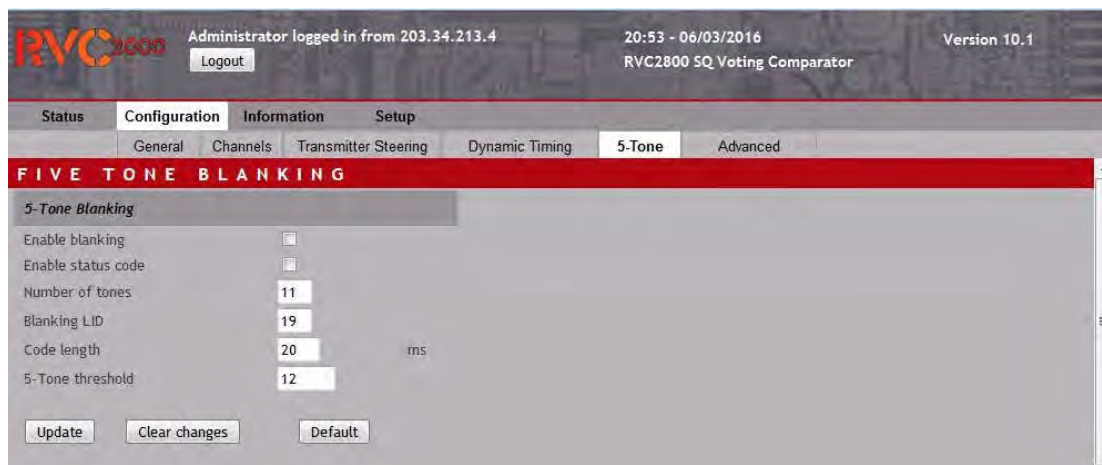
10ms).

Figure 35. Five-tone blanking configuration

Enable blanking

This should be ticked if tone blanking is required.

Enable status code

This should be ticked if a 6th status tone is transmitted by the mobile in addition to the 5 normal identification tones.

Number of tones

This is the number of sequential valid tones the voter will look for before deciding to blank. This number can range from 2 to 5. For very noisy signals, a smaller number ensures blanking even if part of the tone sequence is overloaded with burst noise or interference. If blanking is desired under adverse transmission signals, set the number to 2 or 3. If it is imperative that voice is not falsely blanked at the start of a transmission, set this parameter to 5.

Blanking LID (Lead In Duration)

This is the time period at the *start* of a transmission where 5-tone blanking is operative. The units are multiples of 10ms, so the number 20 means that the voter will find and blank any 5-tone sequence detected within the first 200ms. Any tones that are transmitted after the Lead In Duration will not be blanked.

Code length

Code length refers to the tone period of a single tone in the 5/6-tone transmission, and depends on the radio transceiver's hardware. Default value is 20ms.

6.4 SNMP

SNMP (Simple Network Management Protocol) is an optional voter feature for remote monitoring of voter status and faults.

The SNMP configuration page provides for configuring SNMP traps which may be sent when abnormal operating conditions arise. In addition to faults, abnormal conditions include voter

configuration settings that prevent channels from participating in voting or transmitting, etc.

Figure 36. SNMP configuration screen

Send SNMP Traps – Global enable for sending of traps. NB the SNMP config may be polled at any time regardless of this setting.

Trap Destinations – Primary & Secondary – Two IPv4 trap destinations may be configured. Unused trap destinations should be set to 0.0.0.0.0.

UDP Ports – Polling and Traps – If necessary, the IP ports used for SNMP may be reconfigured. By default, the voter will expect SNMP polls on port 161 and will send traps on port 162.

Trap Severity – A severity code is associated with each trap when the abnormal condition occurs. Severities range from *Critical, Severe, Major, Minor, Warning, Normal and Information* to *Trap Disabled*. When the abnormal condition is removed or no longer exists, a trap with *Normal* severity is sent, allowing the SNMP management system to clear the alarm.

General Traps

PSU A – Sent when a failure is detected in power supply A.

PSU B – Sent when a failure is detected in power supply B.

Talk Through – Sent if "talk-through" is disabled.

Channel Traps

Traps are sent on a per channel basis under certain conditions. SNMP traps must be enabled for each channel on the **Channel Control** menu. See *5.2.2 Channels.*

Channel enable – Trap sent when the channel is disabled. When disabled, no further traps will be sent for the channel concerned. Re-enabling the channel will clear the trap.

Channel status – Sent when there is a channel failure or failure of the line card associated with the channel. Trap cleared when condition no longer exists.

Vote enable – Sent when the channel voting is disabled and cleared on enable.

Transmit enable – Sent when transmit is disabled and cleared on enable.

Glide tone – Sent when glide tone has been absent for specified number of seconds. Cleared when glide tone returns. (Indicates a failure of the link to the remote base or failure of the base itself.)

Mute status – Sent when the configured period for "Lockout Timeout" for the individual channel (see *5.2.3 Individual channel configuration*) is exceeded, and cleared when the condition no longer exists. (Indicates a channel stuck in a non-muted condition, possibly due to a stuck transmit on a mobile or similar failure.)

DTS status – Sent when the DTS timing system has detected a failure. Applicable only if the optional Dynamic Timing System intended for synchronous networks is installed.

7 APPENDIX

7.1 VOTER KRONE INTERFACE

The connections to and from the voter are facilitated using a Krone interface module, which is connected to the voter rack using two 50-way ribbon cables, between the Krone module and the voter backplane.

The interface module potentially affords 50 pairs for connection, dependent on voter interface configuration.

Line In/Line Out - (Krone module 1)

The nomenclature "Line In" refers to a signal received from a remote site – i.e. base station receiver. The nomenclature "Line Out" refers to an outbound signal to a remote site – i.e. base station transmitter.

Krone Module 1 – Group 1, Bottom-most module

Krone Position	Function	Rack Position
1A	Line Input 1 (-)	Card slot 1
1B	Line Input 1 (+)	Card slot 1
2A	Line Output 1 (-)	Card slot 1
2B	Line Output 1 (+)	Card slot 1
3A	Line Input 2 (-)	Card slot 2
3B	Line Input 2 (+)	Card slot 2
4A	Line Output 2 (-)	Card slot 2
4B	Line Output 2 (+)	Card slot 2
5A	Line Input 3 (-)	Card slot 3
5B	Line Input 3 (+)	Card slot 3
6A	Line Output 3 (-)	Card slot 3
6B	Line Output 3 (+)	Card slot 3
7A	Line Input 4 (-)	Card slot 4
7B	Line Input 4 (+)	Card slot 4

8A	Line Output 4 (-)	Card slot 4
8B	Line Output 4 (+)	Card slot 4
9A	Line Input 5 (-)	Card slot 5
9B	Line Input 5 (+)	Card slot 5
0A	Line Output 5 (-)	Card slot 5
0B	Line Output 5 (+)	Card slot 5

Krone Module 2 – Group 1, Second module from the bottom

Krone Position	Function	Rack Position
1A	Line Input 6 (-)	Card slot 6
1B	Line Input 6 (+)	Card slot 6
2A	Line Output 6 (-)	Card slot 6
2B	Line Output 6 (+)	Card slot 6
3A	Line Input 7 (-)	Card slot 7
3B	Line Input 7 (+)	Card slot 7
4A	Line Output 7 (-)	Card slot 7
4B	Line Output 7 (+)	Card slot 7
5A	Line Input 8 (-)	Card slot 8
5B	Line Input 8 (+)	Card slot 8
6A	Line Output 8 (-)	Card slot 8
6B	Line Output 8 (+)	Card slot 8
7A	Line Input 9 (-)	Card slot 9
7B	Line Input 9 (+)	Card slot 9
8A	Line Output 9 (-)	Card slot 9
8B	Line Output 9 (+)	Card slot 9
9A	Line Input 10 (-)	Card slot 10
9B	Line Input 10 (+)	Card slot 10
0A	Line Output 10 (-)	Card slot 10

	Line Output 10 (+)	Card slot 10
0B		

Krone Module 3 – Group 1, Third module from the bottom

Krone Position	Function	Rack Position
1A	Line Input 11 (-)	Card slot 11
1B	Line Input 11 (+)	Card slot 11
2A	Line Output 11 (-)	Card slot 11
2B	Line Output 11 (+)	Card slot 11
3A	Line Input 12 (-)	Card slot 12
3B	Line Input 12 (+)	Card slot 12
4A	Line Output 12 (-)	Card slot 12
4B	Line Output 12 (+)	Card slot 12
5A	Line Input 13 (-)	Card slot 13
5B	Line Input 13 (+)	Card slot 13
6A	Line Output 13 (-)	Card slot 13
6B	Line Output 13 (+)	Card slot 13
7A	Line Input 14 (-)	Card slot 14
7B	Line Input 14 (+)	Card slot 14
8A	Line Output 14 (-)	Card slot 14
8B	Line Output 14 (+)	Card slot 14
9A	Line Input 15 (-)	Card slot 15
9B	Line Input 15 (+)	Card slot 15
0A	Line Output 15 (-)	Card slot 15
0B	Line Output 15 (+)	Card slot 15

NB The Line Input and Line Output for card slot 15 only applies if this slot is used for a line card – either for a remote site or console. This card slot is usually occupied by the web interface card, in which case the connections in the following table apply.

Krone Module 4 – Group 1, Fourth module from the bottom

Krone Position	Function	Rack Position
1A	Rx DATA 2 (Web Card)	Card Slot 15
1B	Rx DATA 1 (Web Card)	Card Slot 15
2A	Tx DATA 2 (Web Card)	Card Slot 15
2B	Tx DATA 1 (Web Card)	Card Slot 15
3A	Not connected	
3B	Not connected	
4A	Not connected	
4B	Not connected	
5B	Not connected	
6A	Not connected	
6B	Not connected	
7A	Not connected	
7B	Not connected	
8A	Not connected	
8B	Not connected	
9A	Not connected	
9B	Not connected	
0A	Not connected	
0B	Not connected	

E&M Signalling - (Krone module 2)

Each line card has an E&M input for signalling the presence of votable audio from the remote base receiver, and two configurable E&M outputs. The use of these inputs and outputs is slightly different between regular line cards and the console card. The options are explained in sections *2.2.2 Line(Site) cards* and *2.2.2 Console card.*

E&M signalling can be employed to signal the presence of audio on the line in and line out pairs.

For audio incoming to the voter, the E&M input should be pulled low by the remote site when valid audio is present.

Krone Module 5 – Group 2, Bottom-most module

Krone Position	*Function*	*Rack Position*
1A	E&M Input 1	Card Slot 1
1B	E&M Output 1A	Card Slot 1
2A	E&M Output 1B	Card Slot 1
2B	GND	Card Slot 1
3A	E&M Input 2	Card Slot 2
3B	E&M Output 2A	Card Slot 2
4A	E&M Output 2B	Card Slot 2
4B	GND	Card Slot 2
5A	E&M Input 3	Card Slot 3
5B	E&M Output 3A	Card Slot 3
6A	E&M Output 3B	Card Slot 3
6B	GND	Card Slot 3
7A	E&M Input 4	Card Slot 4
7B	E&M Output 4A	Card Slot 4
8A	E&M Output 4B	Card Slot 4
8B	GND	Card Slot 4
9A	E&M Input 5	Card Slot 5
9B	E&M Output 5A	Card Slot 5

| 0A | E&M Output 5B | Card Slot 5 |
| 0B | GND | Card Slot 5 |

Krone Module 6 – Group 2, Second module from the bottom

Krone Position	Function	Rack Position
1A	E&M Input 6	Card Slot 6
1B	E&M Output 6A	Card Slot 6
2A	E&M Output 6B	Card Slot 6
2B	GND	Card Slot 6
3A	E&M Input 7	Card Slot 7
3B	E&M Output 7A	Card Slot 7
4A	E&M Output 7B	Card Slot 7
4B	GND	Card Slot 7
5A	E&M Input 8	Card Slot 8
5B	E&M Output 8A	Card Slot 8
6A	E&M Output 8B	Card Slot 8
6B	GND	Card Slot 8
7A	E&M Input 9	Card Slot 9
7B	E&M Output 9A	Card Slot 9
8A	E&M Output 9A	Card Slot 9
8B	GND	Card Slot 9
9A	E&M Input 10	Card Slot 10
9B	E&M Output 10A	Card Slot 10
0A	E&M Output 10B	Card Slot 10
0B	GND	Card Slot 10

Krone Module 7 – Group 2, Third module from the bottom

Krone Position	Function	Rack Position
1A	E&M Input 11	Card Slot 11
1B	E&M Output 11A	Card Slot 11
2A	E&M Output 11B	Card Slot 11
2B	GND	Card Slot 11
3A	E&M Input 12	Card Slot 12
3B	E&M Output 12A	Card Slot 12
4A	E&M Output 12B	Card Slot 12
4B	GND	Card Slot 12
5A	E&M Input 13	Card Slot 13
5B	E&M Output 13A	Card Slot 13
6A	E&M Output 13B	Card Slot 13
6B	GND	Card Slot 13
7A	E&M Input 14	Card Slot 14
7B	E&M Output 14A	Card Slot 14
8A	E&M Output 14B	Card Slot 14
8B	GND	Card Slot 14
9A	E&M Input 15	Card Slot 15
9B	E&M Output 15A	Card Slot 15
0A	E&M Output 15B	Card Slot 15
0B	GND	Card Slot 15

E&M Signalling I/O Characteristics

E&M Signalling Input to Voter		
Parameter	Value	Units
Type	Internal pull up to 12V	-
Polarity	Pull to ground to activate	-

Absolute maximum Input Voltage Range	+/- 20	VDC
Recommended operating range	0 to 16	VDC
Active low voltage	< 3	VDC
Nominal current at 0V (pulled to ground)	6	mA

E&M Signalling Outputs from Voter		
Parameter	Value	Units
Type	Open Collector	-
Polarity	Pulls to ground when active	-
Maximum current (PTC fuse limited)	+/- 250	mA DC
Recommended operating current range (output low, sinking current)	1 to 50	mA DC
Open circuit voltage limit	50	VDC

7.2 VOTER COMMS PORTS

The serial communications ports are intended for diagnostic trace and set to 4800 8-N-1. They may be used for custom applications where required.

The ethernet port on the front of the Web Interface Network card supports 10/100 operation

7.3 ACCESS TO LINUX CONFIGURATION

Caution: Modification of the configuration may lead to failure of the voter to perform its intended function. Anyone changing the configuration of the voter, other than through the web interface, must be fully conversant with the Linux operating system and procedures.

7.3.1 Logging in user for FTP access

Username – "tech"

Password – "Rvc2000"

Home directory – "/home/voter"

The tech user is intended to provide ftp or telnet access to the /home/voter directory where configuration files and the event log are stored.

All files are ASCII plain text, delimited only with a line-feed, as is the custom with Linux. Editing them on a PC with an inappropriate editor may render them unreadable by the voter.

JRD recommends the use of the "FileZilla" FTP client program for accessing the voter configuration directory. For editing files "Notepad++" is recommended.

7.3.2 Configuration directory

The picture shows the /home/voter directory as displayed by FileZilla when an FTP connection is made using the "tech" user name.

Figure 37. Home/Voter directory displayed by FileZilla

The configuration files in this directory contain all the information necessary to configure the voter. It is suggested that they be uploaded and saved in a secure place in case it should become necessary to re-constitute the voter configuration or transfer the entire configuration to another voter.

Files are as follows:

vprofiles.ini	Names associated with each of the twelve configuration profiles and current profile in use.
vconfig.ini	Various configuration options and encrypted passwords not normally requiring modification.
sitenames.ini	The names assigned to each of the channels and the voter.
evlog_0.csv to evlog_9.csv	Event log files used on a rotating basis. Upload and sort with Excel or other suitable tool.
config_1.ini to config_12.ini	Config files containing complete global and line card configuration for each of the 12 profiles.
config_d.ini	Config file containing the default "read-only" configuration.

The configuration of a voter may be transferred to another as follows.

1. Save the voter configuration to a profile as described in section 5.4.3. E.g., if profile 4 is saved, the current voter configuration will be saved to file "config_4.ini".

2. Upload the saved configuration file to a PC as described in this section.

3. Download the save configuration file from the PC to a second voter

4. On the second voter, load the profile, (i.e., 4)

This will configure the second voter the same as the first. The IP address and the "Name" of the second voter will not be changed by this procedure.

NB If the two voters are running different revisions of firmware, advice should be sought from the distributor before proceeding.

7.4 EVENT LOG

RVC2000 voters support an event log system for reporting significant events and statistics. The event log is contained in files "evlog_[0..9].csv" in the voters "/home/voter" directory. This is the home directory for the "tech" user.

The voter uses the 10 event log files on a rotating basis in order to constrain the total amount of flash disk space used. When all 10 files are present, the voter erases the oldest file and re-uses it when the end of the current file is reached. As configured, each event log file may contain up to 5,000 event log records and thus a total of 50,000 event log records may be available at any time. Due to the erasing of the oldest record, the guaranteed maximum number of records is 45,000.

7.4.1 Accessing the event log

Connect to the voter using FTP protocol with user "tech". Extract the required event log files (usually just all files starting with "evlog_") to a PC or other equipment. (NB a new voter will only have a single event log file "evlog_0.csv"; the others will be created as required.

If required, the event logs may be concatenated on a PC for analysis purposes. However it would be necessary to determine the time order of the files. This may be done by checking the sequence number of the first record of each file, or perhaps a program such as Excel could simply sort the concatenated file by sequence number.

7.4.2 Event log format

The RVC2000 event log format is comma-delimited ASCII for easy analysis and examination. The following shows a sample. If opened by Excel, the .csv extension will cause the comma-separated items to occupy separate columns on the spread-sheet.

```
00000001, Thu Dec 20 09:37:59 2007, System,  Event log system initialised

00000002, Thu Dec 20 09:37:59 2007, System,  Voter daemon started

00000003, Thu Dec 20 09:37:59 2007, Fault,   Site 8 line card now OK

00000004, Thu Dec 20 09:37:59 2007, Fault,   Site 15 line card now OK

00000005, Thu Dec 20 09:37:59 2007, Fault,   Site 28 line card now OK

00000006, Thu Dec 20 09:38:36 2007, Access,  ADMIN login

00000007, Thu Dec 20 09:38:47 2007, Config,  Global config updated

00000008, Thu Dec 20 09:38:58 2007, Config,  Config saved to profile 2
```

Figure 38. Event log

Parameter 3 shows the type of event for sorting or filtering purposes. Event types include:

System   System events such as power on, etc.

Access   Logs when users log on and off.

Config   Logs events that change voter configuration.

Stats   Daily logging (at midnight) of transmit usage and voted percentage for each site.

Fault   Voter card or line faults – i.e. tone loss or "continuous signal lockout" conditions.

Admin   Change to passwords or IP address etc.

7.5 UPGRADE PROCEDURES

The following procedure will upgrade the voter web server. Please follow the instructions carefully. The voter will not allow an inappropriate upgrade to be installed.

The procedure assumes a basic knowledge of using FTP and of the Linux file system.

Step 1 – Preparation of upgrade file

An upgrade file will be supplied as a single file with the following form.

"upgrade-version-comment.pkg"

For example "upgrade-Ver10.5-Special_Customer_Feature.pkg"

Before the upgrade can applied to the voter, it must be renamed simply "upgrade.pkg"

Step 2 - Establish FTP connection

Using a suitable FTP program (e.g. Filezilla), establish a connection to the voter as described in *7.3.1 Logging in user for FTP access*.

Note: In order to establish an FTP connection, the "Allow FTP access" option must be configured. See *5.4.8 Options*

For purposes of upgrade, the remote directory should be "/sdcard". Note this is equivalent to

"/mnt/disk/dummy_mmc"

Step 3 – Uploading upgrade package

Upload the "upgrade.pkg" file to the /sdcard directory in the voter. The transfer must be done in BINARY mode. It will take up to a minute to transfer this file to the voter

Step 4 – Check if upgrade is ready

Select the Setup > Upgrade option from the voter web interface. If the upgrade package has been
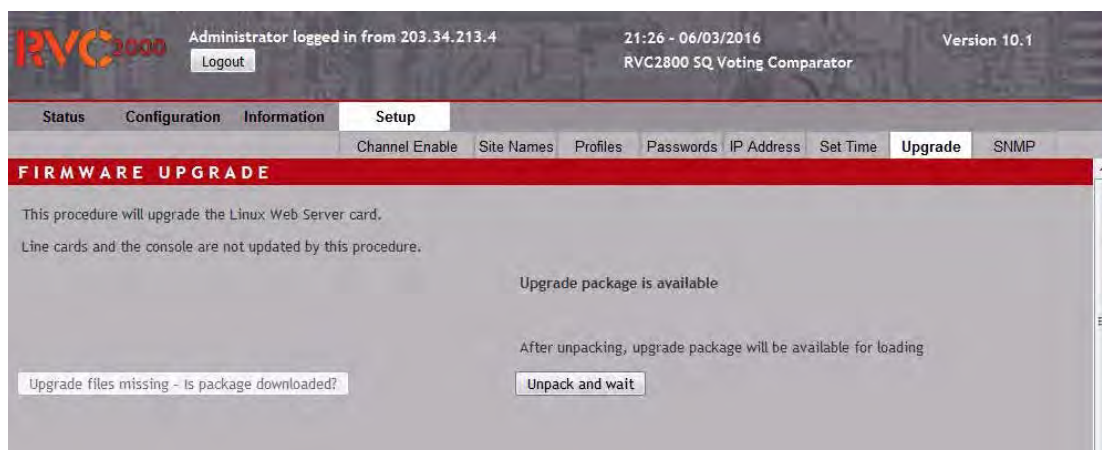
upgraded, it should look like the following screen.

Figure 39. Firmware upgrade available

Step 5 – Unpacking the upgrade package.

Press the "Unpack and wait" button ONCE only, and then wait for the indication that the upgrade has been unpacked. Do not select any other options during this time. When the upgrade is unpacked, the following screen should be displayed. The unpacking process may also take about a minute.

The upgrade package is deleted from the voter after unpacking. It may be loaded again if required.
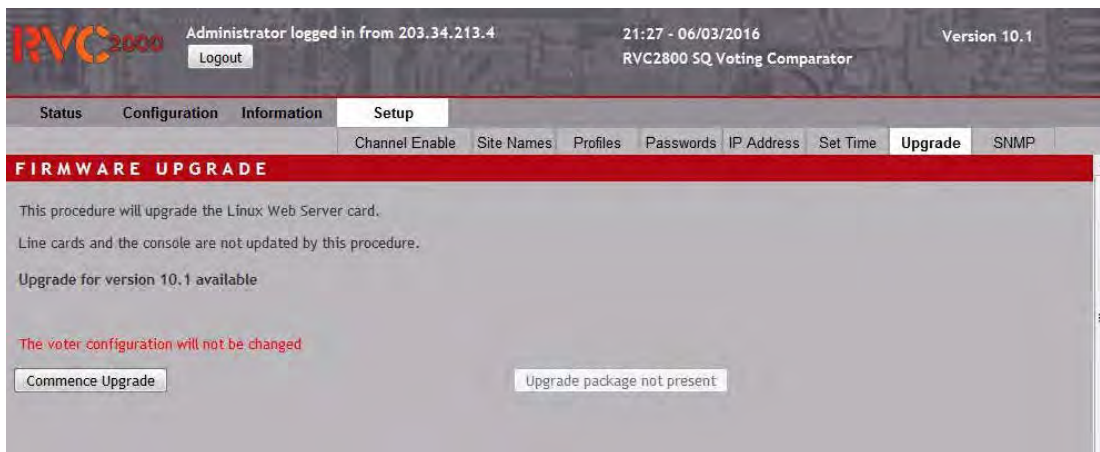
Figure 40. Firmware upgrade ready for installation

The screen will indicate the version of the upgrade, and may contain comments regarding its purpose which may be reviewed prior to commencing the actual upgrade.

In the event the upgrade is not compatible with the voter, a message will be displayed and the "Commence Upgrade" button will not be enabled.

Step 6 – Perform upgrade

Until the "Commence Upgrade" button is pressed, no change has been made to the current voter firmware.

Assuming the upgrade is desired, press the "Commence Upgrade" button ONCE. The following

screen will appear.

Figure 41. Firmware upgrade in progress

The upgrade process will take a minute or so. Do not select any other options during this time. The end of the upgrade process is indicated by the "Login" screen re-appearing as follows.
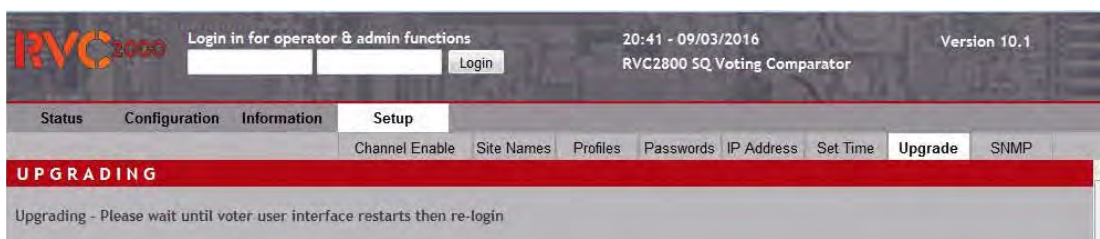

Figure 42. Firmware upgrade complete

Step 7 – Re-start web interface

After the "login" prompt has re-appeared, re-enter the IP address of the voter in the browser address bar to re-load the web forms. This step may be required in case the menu structure has changed in some way.

Step 8 – Optional retrieval of log file and deletion of upgrade files.

The upgrade process creates a log file which may be received if desired. If the upgrade process did not proceed correctly, the log file may indicate the reason.

To retrieve the log file, re-connect to the voter using FTP as described in Step 2. You should find a number of files in the voter "/sdcard" directory including the file "upgrade.log". The file may be uploaded for examination. The file will have Unix line endings, so is best uploaded in "ASCII" mode or view with a text editor that understands Linux files.

After a successful upgrade, the upgrade can be deleted from the voter in order to avoid accidental re-upgrading. Using the FTP program, delete all files in the "/sdcard" directory. Do NOT alter ANY other files on the voter or it may become inoperable.