

# Product Manual

## 232-FMA

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**Stereo FM Tuner**

**Rev 1.3 August 11, 2005**



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## Overview

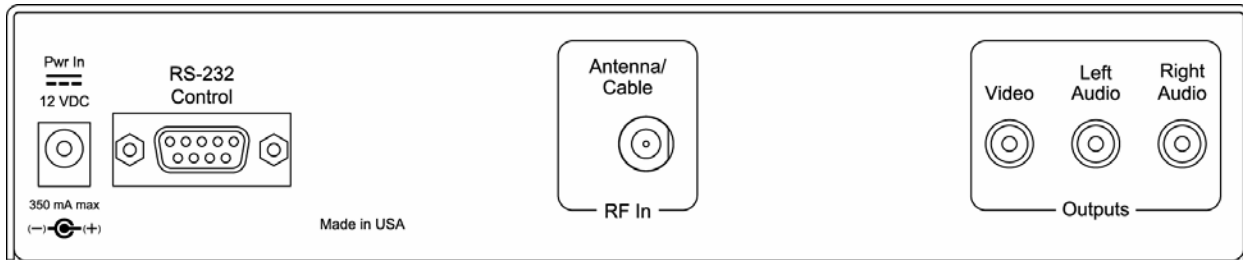


The Contemporary Research 232-FMA is a versatile RS-232 controlled FM tuner featuring stereo audio, 10-preset memory, front-panel operation and feedback, and intelligent control. Fully programmable, the unit can restore all settings on power-up from non-volatile memory.

The front-panel buttons and LED display can be used for general operation and to program basic features for tuning, RS-232 baud rate and local control. Full setup, control, and feedback is provided by RS-232. Up to three FM, TV tuners, and AV6x4 Routers can be controlled from a single RS-232 port. In addition, remote preset up and down operation can be accessed through contact closure inputs.

- Tunes FM stereo broadcasts with local/DX modes, auto stereo/mono operation
- Interacts with PCs and control systems via RS-232, using simple ASCII-format commands and feedback, up to 3 tuners can be linked to a single RS-232 control port
- Stores up to 10 presets in onboard memory, unlimited presets via external control system
- Accesses presets via front-panel control, RS-232, and contact closures
- Provides front-panel control for A/V Mute, Seek up/down, and Preset up/down; with LED feedback for Mute, current frequency and programming mode
- Restores all operation status after loss of power from data stored in non-volatile memory
- Mutes audio with front-panel LED indicator
- Enables and disables front-panel operation via front-panel and RS-232 commands
- Mounts in 19" rack with optional RK1 or RK2 kit for dual side-by-side installation

## Specifications



### Physical

Size: 8.5" [216mm] wide x 1.75" [38mm] height (1RU) x 6.0" [153mm] deep  
 Weight: 1.25 lbs [0.57kg]  
 Enclosure: All aluminum with durable black powder coat paint  
 Mounting: Rack mounting for one or two units side-by-side optional (RK1, RK2)

### Front Panel

Push Buttons: Preset up and down, Seek up and down, and Mute All A/V  
 Indicators: Red LED: Mute All A/V status  
 3 digit, 7 segment red LED display for frequency and stereo/mono mode

### Rear Panel

Power In: 2.1mm coaxial jack (inside center conductor positive)  
 11.5 to 16.5 VDC, 12 VDC typical, 100 mA max (may be unregulated)  
 RS-232 Control: DB-9 male  
 User selectable 300 to 9600 (default) baud, 8 data bits, No parity, 1 stop bit  
 All standard ASCII keyboard character strings available from any terminal program  
 2 momentary closure inputs close to ground (pin 5) to select stored presets  
 Preset Up (Pin 4), Preset Down (Pin 9)  
 Antenna: F female antenna connector  
 87.7 to 108MHz automatic fine tuning to 1 KHz  
 +35dBmV maximum, -20dBmV minimum input level (DX Mode)  
 -20dBmV typical local mode attenuation (Local mode)  
 Video Output: RCA female, not implemented presently  
 Audio Outputs: Stereo RCA female, left and right channels  
 Unbalanced line level, 600 ohm impedance  
 40Hz to 14KHz response  
 3% maximum, <1% typical total harmonic distortion (THD)  
 24dB minimum, 28dB typical stereo channel separation  
 68dB typical signal to noise ratio  
 160mV RMS typical output level (or mute)

### Includes

12 VDC Power Supply (North America shipments only)

## Front Panel Programming

**To Enter** a Front Panel Programming Mode:

1. Press **and hold** the Mute A/V button such that the red LED light above is lit (indicating Mute On).
2. Press Seek Up.
3. Release all buttons, the 232-FMA will now be in the front panel programming mode.
4. The front panel display is dedicated to programming information display while in this mode.
5. Changes are saved in non-volatile memory as they are entered.
6. The Seek up/down buttons scroll through programming modes 0 through 9.
7. The Preset up/down buttons scroll through possible parameters for each mode.

**To Exit** the Front Panel Mode

Push and release the Mute All A/V button.

### Front Panel Modes

#### Mode 0: RF Tune Select

Selects U.S. standard FM odd frequency presets or both even and odd FM frequencies for international use. Factory default is odd frequencies only.

#### Mode 1: Baud Rate Select

Selects the baud rate for the RS-232 control port. Factory default is 9600 baud. Higher baud rates are recommended for quicker response time.

#### Mode 2: Unit Address Select

Selects unit address used in RS-232 remote control protocol. Factory default is unit address 1 and should only be 2 or 3 if multiple units are RS-232 daisy chained.

#### Mode 3: Not used

#### Mode 4: Front Panel Disable level

Selects front panel buttons to be disabled. Different levels of lockout are possible. Levels are as follows:

| Level | Buttons Disabled                   |
|-------|------------------------------------|
| 0     | None (normal operation)            |
| 1     | Preset Up/Dn                       |
| 2     | Seek Up/Dn                         |
| 3     | Preset & Seek Up/Dn                |
| 4     | Mute A/V                           |
| 5     | Preset Up/Dn & Mute A/V            |
| 6     | Seek Up/Dn & Mute A/V              |
| 7     | All (complete front panel disable) |

#### Mode 5: Power-up Volume level

Seeks the audio volume level at power-up. '0' restores volume to previous muted or full level, '1' restores volume to full level. May be set from 0 – 63, but any value above zero sets volume to full on.

#### Mode 6: Special Test Mode (for factory testing)

Displays unit software version. Holding Preset Up button while exiting this mode will return the unit to all **factory default settings**: 9600 baud, unit #1, panel lockout level 0, power-up volume restore, stereo local

#### Mode 7: Audio Decoding

Seeks mono/local, stereo/local, mono/DX or stereo/DX.

#### Mode 8: Bass setting fixed at 0dB

## Mode 9: Treble setting fixed at 0dB

### Front Panel Programming Quick Reference

|                  | Mode:        | Parameter:                                  |
|------------------|--------------|---|
| FM Tune          | <b>0 .0</b>  | FM odd frequencies (US standard)            |
|                  | <b>1</b>     | FM even and odd frequencies (international) |
| Baud Rate        | <b>1 .1</b>  | 300   |
|                  | <b>2</b>     | 600   |
|                  | <b>3</b>     | 1200  |
|                  | <b>4</b>     | 2400  |
|                  | <b>5</b>     | 4800  |
|                  | <b>6</b>     | 9600  |
| Unit Number      | <b>2 .1</b>  | one   |
|                  | <b>2</b>     | two   |
|                  | <b>3</b>     | three                                       |
| Not Used         | <b>3 .0</b>  |   |
| Panel Lockout    | <b>4 .0</b>  | none  |
|                  | <b>1</b>     | preset up/dn                                |
|                  | <b>2</b>     | seek up/dn                                  |
|                  | <b>3</b>     | preset & seek up/dn                         |
|                  | <b>4</b>     | mute A/V                                    |
|                  | <b>5</b>     | preset up/dn & Mute A/V                     |
|                  | <b>6</b>     | seek up/dn & Mute A/V                       |
|                  | <b>7</b>     | all   |
| Power-up Volume  | <b>5 .0</b>  | restore previous level                      |
|                  | <b>1</b>     | full volume                                 |
| Firmware Version | <b>6 .13</b> | displays firmware version*                  |
| Audio Decode     | <b>7 .0</b>  | mono local                                  |
|                  | <b>1</b>     | stereo local                                |
|                  | <b>2</b>     | mono DX                                     |
|                  | <b>3</b>     | stereo DX                                   |
| Bass Gain        | <b>8 .8</b>  | 0 dB fixed                                  |
| Treble Gain      | <b>9 .4</b>  | 0 dB fixed                                  |

\*Press and hold Channel Up, then Mute AV to restore tuner to default settings

# RS-232 Control Protocol

## Overview

The 232-FMA full duplex RS-232 scheme enables a system programmer to control all FM Tuner functions as well as monitor 3 groups of FM Tuner status. All commands are sent as ASCII strings. No delays between characters or commands are required, as data is interrupt driven and buffered.

The 3 status groups are: Frequency/Source Seek, Audio Levels/Mode and Front Panel. The Mute A/V button-function status from the 232-FMA front panel has been grouped with the Frequency/Source for simplicity in the most common modes of operation. Each of the groups has one ASCII status response string containing all of the status data for that group. The current status string of a group is sent from the 232-FMA whenever a valid command for that group is received by the 232-FMA RS-232 port or front panel. A group's status may be requested (without making a change) via the RS-232 port. Status of all 3 groups is sent at power up. The format of each group's status response string remains the same always.

Up to 3 232-FMAs may be cabled together and addressed for individual control from a single RS232 port. Each 232-FMA is assigned a unique unit code (Front Panel Mode 2).

Communications parameters (Front Panel Mode 1) are 300 to 9600 baud, 8 data bits, No parity, and 1 stop bit. Factory default is 9600 baud, Unit#1.

All settings are saved to NVRAM in the 232-FMA.

## General protocol specifications

Characters in command strings to the 232-FMA are common ASCII keyboard characters.

Command strings sent to the 232-FMA begin with the ASCII > (greater than symbol) as an 'Attention' character and end with the ASCII CR (carriage return) as an 'End-of-command' character.

Responses from the 232-FMA begin with the ASCII < (less than symbol) as an 'Attention' character and end with the ASCII CR (carriage return) followed by an ASCII LF (line feed) as 'End-of-command' characters.

ASCII CR (carriage return) is required at the end of each command and is assumed in all examples.

## Command String Structure

[Attention] (Unit#) [Command] (Parameters) [CR]

|                  |   |
|------------------|---|
| <b>Attention</b> | Single character (>) starts the string  |
| <b>Unit #</b>    | The Unit# is expressed as an ASCII 1 2 or 3 when used in multi 232-FMA applications. It may be omitted for a default of Unit#1 for a single 232-FMA set as Unit#1.  |
| <b>Command</b>   | A two-character command   |
| <b>Parameter</b> | Added attributes to command   |
| <b>Return</b>    | A carriage return ends the command string, you may use ASCII CR, Hex \$0D, or keyboard 'Enter' in programming. For simplicity, the programming examples in the manual will not show the 'CR' – so remember, you'll need to add it in your control code. |

## General RS-232 Commands

|            |   |  |
|------------|---|--|
| <b>TT=</b> | Select tuned frequency<br><i>Example:</i> >TT=94.5  | 87.7-108.0<br>Selects preset 94.5, if currently stored as a Preset   |
| <b>TC=</b> | Force tuned frequency<br><i>Example:</i> >TC=101.9' | 87.7-108.0<br>Selects preset 101.9 regardless of current Presets   |
| <b>TP</b>  | Set to previous preset                              | Accesses previously selected frequency   |
| <b>TU</b>  | Tune channel up<br><i>Example:</i> >3TU'            | Selects next higher channel in stored Tune Ring<br>Bumps Unit#3 to next higher preset                                |
| <b>TD</b>  | Tune preset down                                    | Selects next lower preset.   |
| <b>T+</b>  | Tune frequency up                                   | Selects next higher frequency (depends on <b>S0</b> setting).  |
| <b>T-</b>  | Tune frequency down<br><i>Example:</i> >T-          | Selects next higher frequency (depends on <b>S0</b> setting)<br>Bumps frequency down one step (200 or 100 KHz).      |
| <b>TS=</b> | Set Preset<br><i>Example:</i> >TS=1                 | Set current frequency as Preset 0 – 9<br>Sets current tuned frequency as Preset 1                                    |
| <b>TG=</b> | Recall Preset                                       | Recall preset by number 0 – 9  |
| <b>T!</b>  | Delete Presets                                      | Deletes all presets  |
| <b>XT</b>  | Toggle Mute A/V                                     | Alternates Mute A/V on and off   |
| <b>XX</b>  | Mute A/V off  | Turn A/V outputs on at previous level  |
| <b>XM</b>  | Mute A/V on<br><i>Example:</i> '>XM'                | Mutes A/V outputs<br>Mutes audio and video outputs   |
| <b>VX</b>  | Volume Mute off                                     | Restores audio volume to previous level  |
| <b>VV</b>  | Stop volume ramp                                    | Stops volume ramping   |
| <b>VT</b>  | Toggle Volume Mute                                  | Alternates audio mute on and off   |
| <b>VM</b>  | Volume Mute on<br><i>Example:</i> >VM'              | Turns off audio outputs<br>Mutes audio outputs   |
| <b>S0=</b> | Set tune mode                                       | 0=Odd frequencies only (200KHz steps - U.S. - default)<br>1=Even and odd frequencies (100 KHz steps - international) |
| <b>S4=</b> | Set front panel lockout mode                        | 0=None<br>1=Preset<br>2=Seek<br>3=Preset & Seek<br>4=Mute A/V<br>5=Preset & Mute A/V<br>6=Seek & Mute A/V<br>7=All   |
| <b>S5=</b> | Power-up volume                                     | 0=restore to previous level<br>1-63= Restore to preset volume level (1 min, 63 max)                                  |
| <b>S7=</b> | Set audio mode<br><br><i>Example:</i> >S7=2         | 0=Mono/Local<br>1=Stereo/Local (default)<br>2=Mono/DX<br>3=Stereo/DX<br>Sets audio mode to mono/DX                   |
| <b>ST</b>  | Request Channel status<br><i>Example:</i> '>ST'     | Unit sends "T" Frequency/Source status string<br>Returns Frequency/Source status response string                     |
| <b>SV</b>  | Request A/V status                                  | Unit sends "V" Audio status string   |
| <b>SS</b>  | Request Front Panel status                          | Unit sends "S" Front Panel status string   |

Preset frequencies act similar to a video tuner Tune Ring, after the last preset is selected (Preset 9), the next Preset Up command will start at the lowest Preset (0). While the 232-FMA has only audio outputs at present, we have kept the Mute A/V commands to be consistent with programming and operation for the 232-STA and 232-MTA TV Tuners.



## Terminal Communication Commands

|           |            |  |
|-----------|------------|--|
| <b>EF</b> | Echo Off   | Characters received will not be re-transmitted (power up default)  |
| <b>EN</b> | Echo On    | Characters received will be re-transmitted.<br><b>Example:</b> '>EN' Characters received will be re-transmitted. |
| <b>ID</b> | Product ID | Returns the product model number and software version.   |
| <b>Z!</b> | Zap        | Reconfigures unit for all factory default settings.  |

## RS-232 Command Hints and Tips

Leading zeros may be included or omitted from command parameters.

**Example:** '>TC=089.5' Selects preset 89.5 as A/V output, same as '>TC=89.5'.

Multiple commands may be concatenated as single strings up to 120 ASCII characters long.

**Example:** '>XXTC=89.5' Selects Mute A/V off, station 89.5.

**Example:** '>S0=0S4=0' Selects odd frequency mode, no front panel lockout

Mute A/V Off command is not required in any command; however it may be useful to send Mute A/V Off in case Mute A/V had been set On from the front panel.

Sending all 3 status request commands to the 232-STA back-to-back for a full status update is allowed.

**Example:** '>STSVSS' Returns all 3 response strings back-to-back.

The carriage return line feed at the end of each response allows for easy monitoring of responses with an ASCII terminal program. You may use ASCII CR, Hex \$0D, or keyboard 'Enter' in programming.

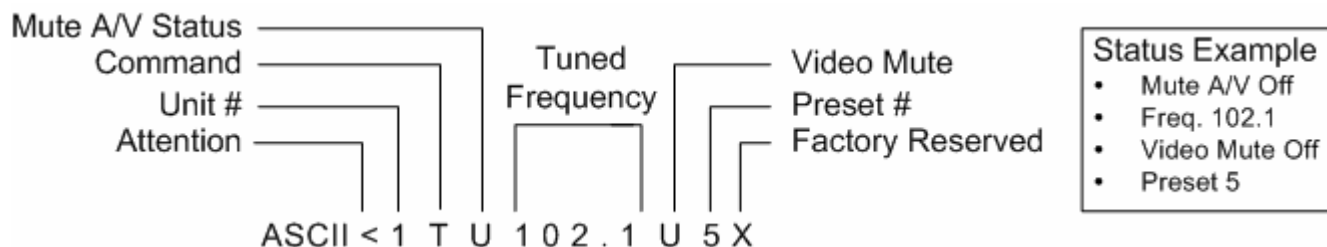
You don't have to use the '=' character between the command and parameter – the string works either way.

## Response Strings

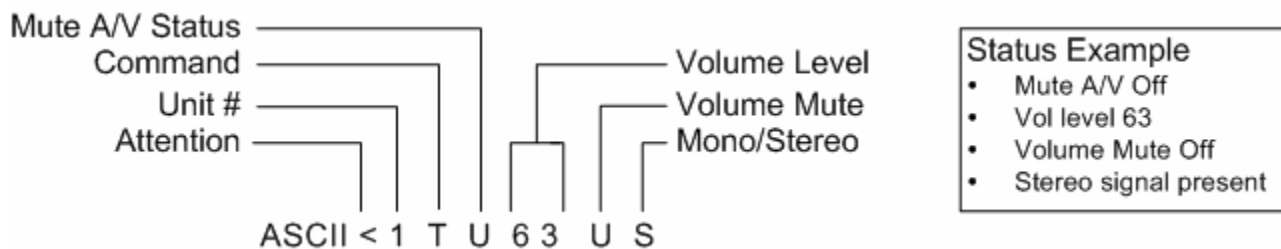
Typical: [Attention] [Unit#] [data ...data] [cr] [lf]

232-FMA status response strings contain ASCII characters similar to those used for the same functions in command strings. An ASCII 'carriage return' and 'line feed' follow each response string.

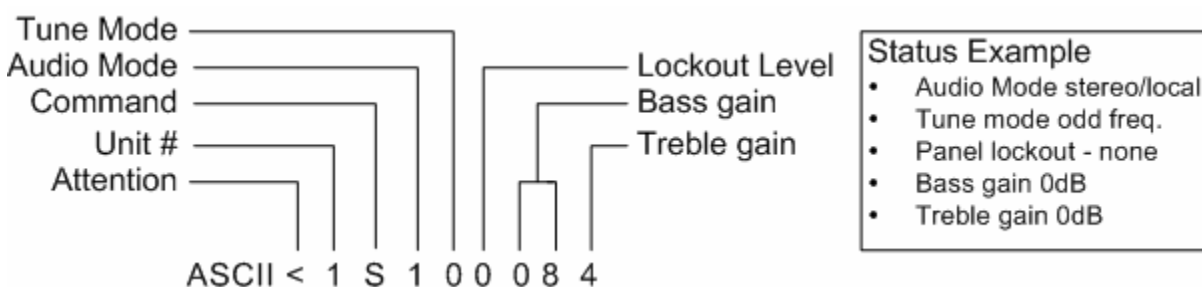
### Frequency/Source Status Response String



### Audio Status Response String



### Front Panel Mode Status Response String

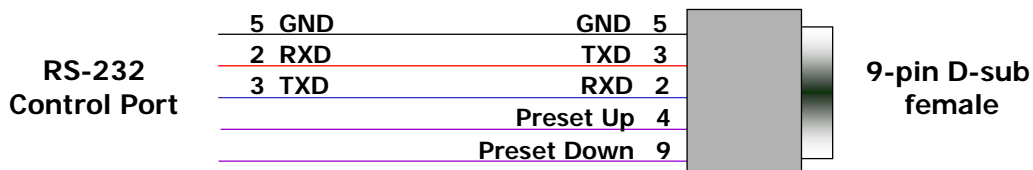


## Control Cable Connections

All drawings show pin numbers relative to a PC COM port or Axcent3 DB-9 RS-232 control port. Pin-outs to other types of control ports may vary. Pins 4 and 9 are momentary closures to GND (5).

### Single Tuner

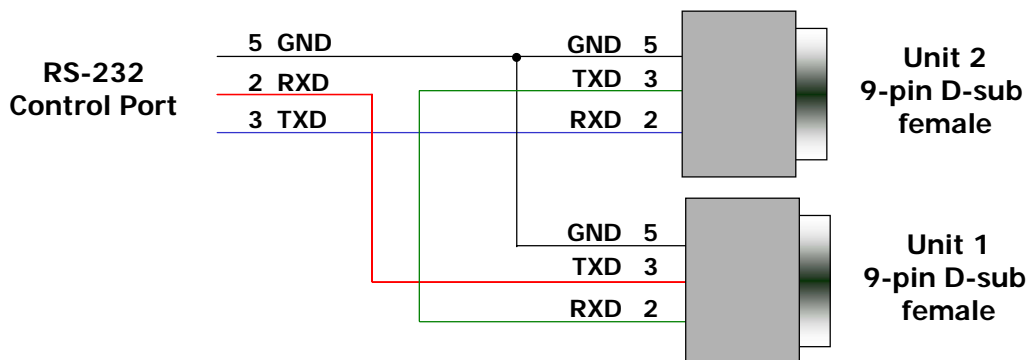
#### Control Wiring – Single Unit



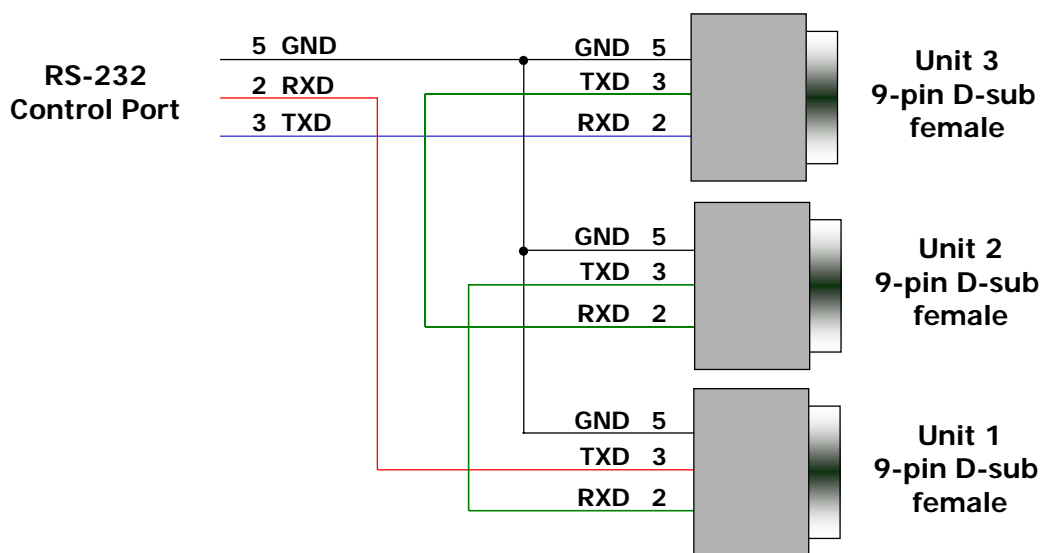
### Multiple Tuners, AV6x4 Router

Up to three tuners can be daisy-chained from one RS-232 control port. Remember that you will need to use the **Unit# address** in your programming when you control more than one tuner from the same control port. You can also daisy-chain one or two tuners with an AV6x4 A/V Router. In this application, set the Router to the lowest Unit#.

#### RS-232 Wiring – Two Units

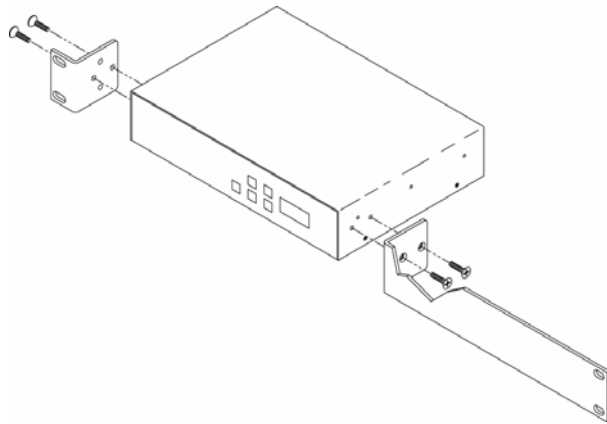


#### RS-232 Wiring – Three Units

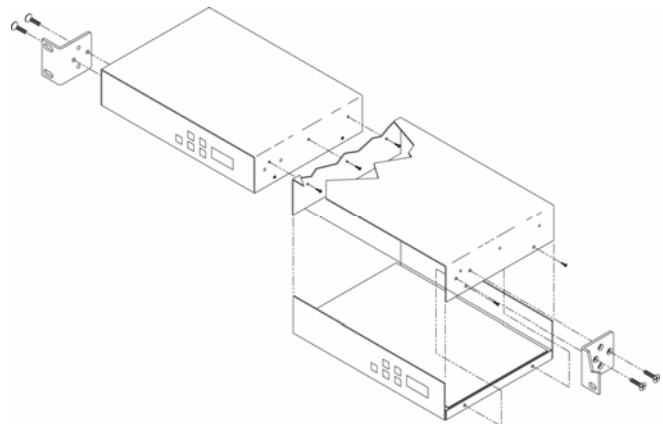


## Rack Mounting

Two options are available for rack-mounting tuners.



*RK1 Rack Mount*



*RK2 Rack Mount*

### RK1 Single Unit Rack Mount

|                     |   |
|---------------------|---|
| Size Long Bracket:  | 9.5" [206mm] wide x 1.75" [38mm] height (1RU) x 1.75" [38mm] deep |
| Size Short Bracket: | 1.0" [22mm] wide x 1.75" [38mm] height (1RU) x 1.75" [38mm] deep  |
| Weight:             | 3.25 oz [0.148kg]   |
| Enclosure:          | All aluminum with durable black powder coat paint                 |
| Hardware:           | Qty 4 CS, Phillip, Flathead, 82deg, Black, 8-32 x .25"            |

Attach the long and short rack ears to the side and towards the front of the unit with the four (4) supplied 8-32 by 1/4" (black) countersunk screws.

### RK2 Side-by-Side Rack Kit

1. Remove top cover of the first unit by removing the ten (10) black screws.
2. Attach cover of first unit to the side of the second with three (3) supplied 4-40 by 1/4" (silver colored) panhead screws and split lock washers. Note that only one side of the second unit has the (3) built in nuts to accept the screws above.
3. Reinstall the bottom/chassis of the first unit underneath its cover and attach with just eight (8) of the screws removed in step 1.
4. Attach short rack ears to the side and towards the front of each unit with the four (4) supplied 8-32 by 1/4" (black) countersunk screws.

## Safety Instructions

### Read before operating equipment

1. **Cleaning** - Unplug this product from the wall outlet before cleaning. Do not use liquid cleaners or aerosol cleaners. Use a damp cloth for cleaning.
2. **Power Sources** - Use supplied or equivalent UL/CSA approved low voltage DC plug-in transformer.
3. **Outdoor Antenna Grounding** - If you connect an outside antenna or cable system to the product, be sure the antenna or cable system is grounded so as to provide some protection against voltage surges and built-up static charges. Section 810 of the National Electrical Code, ANSI/NFPA No. 70, provides information with respect to proper grounding of the mast and supporting structure, grounding of the lead-in wire to an antenna discharge unit, size of grounding conductors, location of antenna discharge unit, connection to grounding electrodes, and requirements for the grounding electrode.
4. **Lightning** - Avoid installation or reconfiguration of wiring during lightning activity.
5. **Power Lines** - Do not locate an outside antenna system near overhead power lines or other electric light or power circuits or where it can fall into such power lines or circuits. When installing an outside antenna system, refrain from touching such power lines or circuits, as contact with them might be fatal.
6. **Overloading** - Do not overload wall outlets and extension cords as this can result in a risk of fire or electric shock.
7. **Object and Liquid Entry** - Never push objects of any kind into this product through openings as they may touch dangerous voltage points or short out parts, resulting in a fire or electric shock. Never spill liquid of any kind on the product.
8. **Servicing** - Do not attempt to service this product yourself as opening or removing covers may expose you to dangerous voltage or other hazards. Refer all servicing to qualified service personnel.
9. **Damage Requiring Service** - Unplug this product from the wall outlet and refer servicing to qualified service personnel under the following conditions:
  - When the power supply cord or plug is damaged.
  - If liquid spills or objects fall into the product.
  - If the product is exposed to rain or water.
  - If the product does not operate normally by following the operating instructions. Adjust only those controls that are covered by the operating instructions. An improper adjustment of other controls may result in damage and will often require extensive work by a qualified technician to restore the product to its normal operation.
  - If the video product is dropped or the cabinet is damaged.
  - When the video product exhibits a distinct change in performance, this indicates a need for service.

## **Limited Warranty and Disclaimer**

Contemporary Research Corporation (CR) warrants this product to be free from defects in material and workmanship under normal use for a period of two years from the date of purchase from CR. Should such a defect occur CR will repair or replace, at their option, the defective product at no cost for parts or labor.

This warranty extends to product purchased directly from CR or an Authorized CR Dealer. Consumers should inquire from selling dealer as to the nature and extent of the dealer's warranty, if any.

All warranty claims must be shipped pre-paid to the factory. Call or fax to obtain a Return Material Authorization (RMA) number.

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