

Product Manual

232-ATSC

HDTV Tuner

March 10, 2010

S12 Control Version 1.9
HD Processor Version 1.12



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Overview



The 232-ATSC HDTV Tuner is an integrator-friendly universal HDTV tuner, controllable via two-way RS-232 and discrete IR commands. Able to fit two-across in a 2RU rack space, the compact tuner outputs HDMI, RGB/Component, and composite video simultaneously. NTSC broadcasts are upscaled for HD display. Digital audio is available from HDMI, coax, and optical connections, as well as variable-level stereo audio. Setup is a snap, employing on-screen menus, included IR remote, front-panel programming, and RS-232 control commands.

For home theater applications, the 232-ATSC offers no-compromise full-bandwidth image quality of local HDTV broadcasts and can access multi-channel programs - features not supported by over-compressed cable and satellite "HD" programming.

For commercial installations, the 232-ATSC tunes in today's and tomorrow's programming, and can receive conventional cable channels as well as local HDTV broadcasts from an off-air antenna.

- **New! SmartScan®** - Skips encrypted cable channels when you scan - no need to manually delete programs you can't see
- **Universal Tuning** - Handles a mix of ATSC, clear QAM and NTSC channels
- **Pro Integration** - Features 2-way RS-232 control and feedback with simple ASCII commands, as well as discrete IR and wired IR - AMX and Crestron modules available
- **Dual Channel RF** - Tune channels from switchable Cable and Off-Air RF inputs
- **Fast Tuning** - Changes analog and digital channels instantly with improved RF reception
- **Total Video** - Simultaneous HDMI, RGB/Component, and composite video output (RGB and Component switchable)
- **Total Audio** - Simultaneous digital Dolby 5.1/PCM/Variable PCM HDMI, coax, and optical outputs, as well as variable-level analog stereo
- **HD Scaling** - Upscales NTSC broadcasts for HD output
- **Easy Set-up** - Front-panel programming supported by LCD display, on-screen menus using HD2-RC IR remote (included), and RS-232 control commands
- **Closed Captioning** - Displays analog and digital captioning text
- **On-Screen Menus** - Setup, Electronic Program Guide, Channel, Favorites, and Program Information menus
- **Compact Rack Mounting** - Mounts in 2RU single RK1-HD or dual RK2-HD 19" rack kits
- **Includes** - HD2-RC IR wireless remote, 12 VDC switching power supply
- **Green Machine** - Meets RoHS safety and California energy standards
- **Field Updatable** - Download new HD and control versions from CR website

Versions

- S12 V 1.3, HD V 0.62 - Added front-panel options, improved compatibility with monitors with DVI connections, menu option for variable-level PCM output, Zoom option for 4:3 display of 16:9 video
- S12 V1.4, HD V 0.62 - Adds Air/Cable and channel scanning to front-panel setup
- S12 V1.5 - Disables closure inputs during firmware download (enables use of fully wired COM cable)
- S12 V1.7, HD V 0.68 - Selective digital/analog scanning, overscanning, channel add and delete
- S12 V1.8 - AMX Device Discovery
- S12 V1.9 - Handles status from "one-part" digital channels and Mute from an IR remote (p 20)
- HD 0.71 - Fixes sync polarity
- HD 1.09 - Cumulative version, updates a variety of processor features
- HD 1.10 - Enables SmartScan

Specifications

Physical

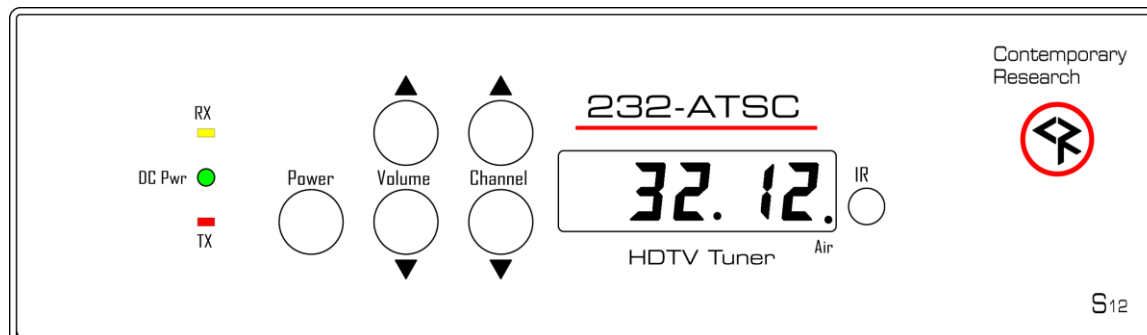
Size (HWD): 8.5" [216mm] wide x 2.43" [62mm] height (2RU) x 8.0" [203mm] deep

Weight: 2.25 lbs [1 kg]

Enclosure: Steel with black powder coat paint

Mounting: Rack mounting for one or two units side-by-side optional (RK1-HD, RK2-HD)

Front Panel



LEDs: DC Power (Green), RS-232 RX (Yellow), RS-232 TX (Red)

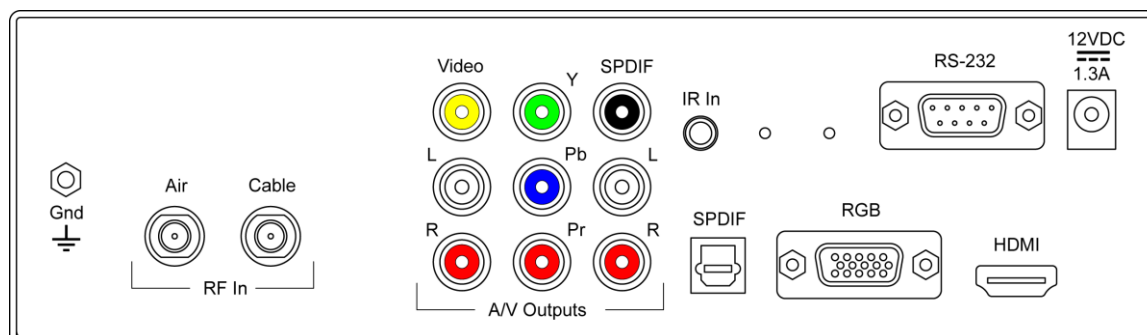
Control: Power, Volume Up/Down, Channel Up/Down

Display: Red LED Channel Display, dot separated major and minor channel numbers,

Air: Dot at end of display indicates Off-Air tuning

IR: IR sensor

Rear Panel



RF In: 2 'F', female, 75 ohm impedance, Off-air and cable

User can switch between inputs

Video Output: Simultaneous HDMI, Component/RGB, NTSC video out

Video Out: RCA composite video output, 1V p-p at 75 ohm impedance, 480i

Component Out: 3 RCA Y, Pr, Pb outputs (1080i/720p/480p/480i)

RGB Out: RGBHV DB-15 female (1080i/720p/480p, 59.95 Hz)

HDMI: HDMI receptacle, Type A, HD video and digital audio, version 1.2 (1080i/720p/480p), HDCP
Use PCM mode if HDMI audio connection is used

Audio Output: Simultaneous HDMI, Coax, Optical, and Stereo

Digital Audio SPDIF: Coax and Toslink optical output, Dolby 5.1 AC3/PCM/Variable PCM

Analog Audio Out: Stereo RCA audio, Mono, Stereo, or SAP, variable level

RS-232 Control: DB-9 male, RS-232 data link to control system or PC, up to 9 tuners, 300-19,200 baud

IR In: 3.5mm stereo jack for optional IR-RXC IR Receiver

Sleeve= DC power+ from power jack input, limited to less than 100mA

Ring=DC power- (GND)

Tip= IR data signal

Power In: 2.1mm coaxial jack (inside center conductor positive)

1.3 A maximum, 11.5 to 15 VDC, 12 VDC typical

Tuning

Frequency Range: ATSC and Clear QAM (cable) television 55.25 to 801.25 MHz

TV System: ATSC, NTSC, Cable, and Clear QAM (1080i/720p/480p/480i)

Tuning: Off-air 2-69 (NTSC and 8-VSB) and CATV 1-135 (Analog, 64QAM, 256QAM, 8-VSB)

Aspect Ratio: 4:3, 16:9 (Digital), 4:3, 16:9, Zoom (Analog channels)

Captioning: DTV and analog, set by program or customized for size, font and display attributes

Lock: Parental option for channels and/or rating

Captioning

All outputs, including composite video, display digital and analog captioning

The composite video also carries Line 21 coding when tuned to digital sources

Includes

HD2-RC IR Tuner Remote, 4 AAA batteries

Power Supply, 1.5A maximum, 12 VDC

Options

IR-RXC External IR Receiver

RK1-HD Single Rack Kit

RK2-HD Dual Rack Kit

CC-232 RS-232 Cable

Trademarks

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Troubleshooting

DIGITAL TUNING OF CABLE Channels

Symptom: Channel ID is in XX-XX form, not cable box Guide form

- Cable boxes translate the actual channel #s into a virtual Channel Guide, using channels 2 – 900, or more.
- The actual (physical) channels have IDs in XXX-XX form, just like off-air channels. Non-cable HDTV tuners like the ATSC or LCD TVs don't provide Guide features, so the channels will be displayed in their native, physical major-minor channel form.
- Some cable franchisees have a listing by physical channel, many do not. You can press the INFO button on the HD2-RC remote to view the channel name.

Symptom: The tuner found the Channel, but the screen is blank when tuned in

- If the channel is scrambled, the screen will be blank, and a "SCRAMBLED" message will appear on the screen. That means the channel is not Clear QAM.
- Cable companies scramble all premium channels, while local HD and some basic channels may or may not be scrambled, depending on the local cable provider.
 - **The best approach is to call the cable provider and ask for Engineering. They can give you a list of clear QAM channels, complete with major-minor channel numbers. That way, you know what can be tuned before you install (and when you design the system).**
 - With that list, you could skip scanning and enter the channel numbers manually in the tuner.
 - Type in the Physical # of the channel, plus a – and 1. That way, the tuner knows to look for a digital channel. Usually, the major number of a cable channel is its physical channel
 - When the tuner finds the channel, it will add all associated sub-channels
 - Go to the onscreen Menu/Channels/Add-Delete. Move through the list of sub-channels, using Enter to Delete any scrambled channels
 - If you already scanned the channels, and have long list of scrambled channels, you can erase scanned digital channels by using the D0=3, and T^ RS-232 commands. This will scan analog channels and delete any digital channels in the scan list so you have a clean slate for tuning.

Tip – to skip scanning analog channels, press Select or Enter once scanning begins.

POWER/VIDEO OUTPUT

Symptom: Tuner appears to be on, channel display is lit, but unresponsive, no video/audio out

- This often occurs when a 232-ATSC is used to replace an old 232-series analog tuner.
- The solution is to not use the old 500 Ma power supply, and use the 1.5 Amp power supply that comes with the ATSC. The old supply has enough juice to light up the front panel LEDs, but nothing else.

Symptom: No video on Component Out

- The RGB and Component outputs are switchable, and the tuner ships set to RGB. Use Front Panel Mode, next section to switch the HD analog video to Component.

HDMI

Symptom: No Video or Signal

- Most monitors accept HDMI in the RGB and Component color space, but there are exceptions. Try switching from RGB to Component (Front panel mode 48).
- Switch between 720p and 1080i, or down to 480P or 480i for old DVI sets. (Front panel mode 49)
- If you're connecting via a Cat5 interface, HDMI receiver, or switcher, some delay the HDCP signal slightly out of range. Call CR Support on how to extend the delay on HDMI.

Symptom: No audio or fluttering sound in display speakers connected via HDMI

Change ATSC digital audio to PCM or PCM variable (most displays do not use Dolby 5.1)

RGB/Component

Symptom: No RGB or Component Video output

Check the RGB or Component output setting in Front Panel mode 48 (48.0 is RGB, 48.2 is Component).

Symptom: No output display on VGA input

Some monitors or projectors do not support 1080i or 720P operation on the RGB port. Set resolution in Front Panel mode 49 (49.2 for 480P).

Composite Video

Symptom: Composite video out has small image in 16:9 setting, analog channels

- For a 4:3 set, tune to an analog channel and press **RATIO** on the remote to set to 16:9. Image will fill left to right, you'll always have a black band top and bottom.
- Set to 4:3 if you're only feeding video to 4:3 TVs.
- Set output ratio on a digital channel as well - this is a different setting than for analog channels.
- If the tuner is used for 16:9 displays and analog TVs, choose the best setting for the widescreen, and the NTSC will have to be a compromise. Most of the time, setting the **RATIO** while tuned to an analog channel and again for a digital channel will provide the best result.

IR Control

Symptom: IR remote won't control tuner

Hold down IR remote **Select**, press **9**, and release both. Front-panel setting should be **15.9**. In addition, check if the remote works when the lights are off. Some energy-saving fluorescent lights produce interference at our IR frequency (57 Hz). Try to cover the IR sensor so the lights don't affect operation, or add the IR-RXC External IR Sensor. It's easier to hide and tilt the sensor to help with reception, and you can try **Select** and **4** to use the lower IR frequency (the RXC has both types of sensors).

Line 21 (analog) Captioning on Video Output

Symptom: Video out does not include captioning

The 232-ATSC does not carry forward closed captioning codes when tuned to an analog channel. However, all captioning from digital TV channels is converted to analog captioning on the video output.

Front Panel Setup

To Enter a Front Panel Programming Mode:

1. Press **and hold** the Power button, then press the Volume Up button.
2. Release all buttons, the 232-ATSC will now be in the front-panel programming mode. The Air LED will flash, indicating programming mode.
3. The first two digits show the mode, the second show the option.
4. Changes are saved in non-volatile memory as they are entered.
5. The Volume up/down buttons scroll through programming modes, forward and reverse.
6. The Channel up/down buttons scroll through possible options for each mode.

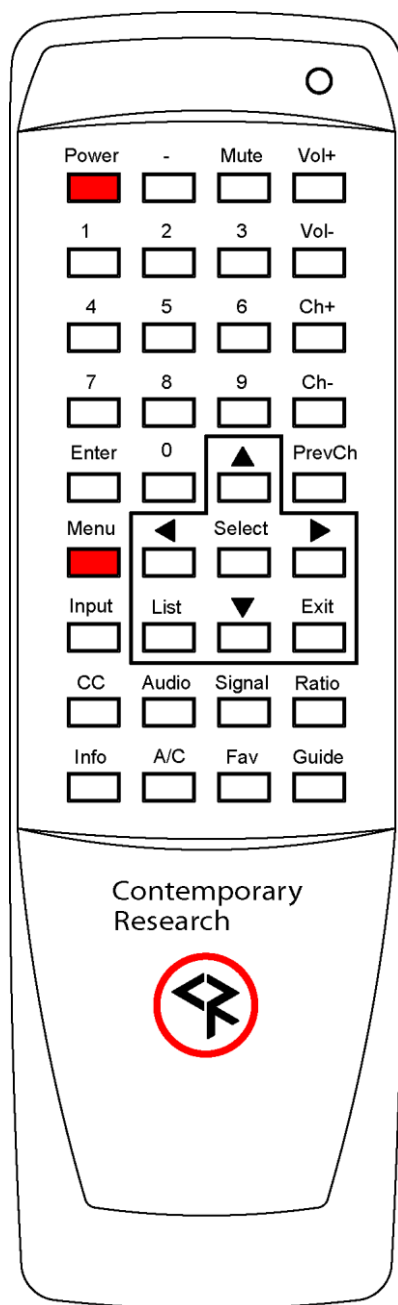
To Exit the Front Panel Mode

Push and release the Power button.

Mode	0-9	Parameters
RF Tune	0.0	0=CATV (Default) - Switches tuner to Cable, sets Scan mode (See mode 6) 1=Off-Air - Switches tuner to Air, sets for Off-Air channel scan 2=IRC - Switches tuner to Cable, sets Scan mode 3=HRC - Switches tuner to Cable, sets Scan mode 4=Cable Auto - Switches tuner to Cable, sets Scan mode
Baud Rate	1.1 1.2 1.3 1.4 1.5 1.6 1.7	300 600 1200 2400 4800 9600 19200
Unit Number	2.1	1-9, default is 1
Not Used	3.0	
Panel Lockout	4.0 4.1 4.2 4.3 4.4 4.5 4.6 4.7	None Channel up/dwn Volume up/dwn Channel & Volume up/dwn Power Channel up/dwn & Power Volume up/dwn & Power All
Power-up Volume	5.0	Restore previous level (default)
Firmware Version	6.17	Ex: Version 1.7 - Other options: Hold Channel Up, then Power to restore tuner to default settings Hold down Channel Up and Down, then press Power to scan channels, see Mode 0 to set Air and Cable To check HD firmware, use the remote to select Menu, Captions, then Version
Captions	10.0	0= Captioning off (default), 1= Captioning on
Caption Mode	11.1 11.2 11.3 11.4 11.X	1=Caption 1 (default) 2=Caption 2 3=Caption 3 4=Caption 4 5-8= Text 1-4 (rarely used)
Video Detect	12.3	No AV mute (fixed)
AV Status	13.0	No AV status (default)
Label Mode	14.2	Numeric (fixed)
IR Receive	15.9	0= Off, 9=Receive IR
Not Used	16.0	
Digital Captions	17.1	1-6, Default is 1
Digital Audio	47.0 47.1 47.2	0 = AC-3- Dolby 5.1 (Default) 1 = PCM (use this or Variable for audio through HDMI) 2 = PCM Variable
HD Output	48.0 48.2	RGB (Default) Component
HD Format	49.0 49.1 49.2 49.3	0=1080i (Default) 1=720p 2=480p 3=480i

HD2-RC IR Remote

The HD2-RC IR Remote included with the 232-ATSC can be used to setup the tuner and for daily operation. All of the functions on the remote have equivalent commands in RS-232, Ethernet, and Wired IR formats. In addition, the 232-ATSC front panel buttons can perform Power, Channel, and Volume control.



Power

Turns tuner on and off. Discrete on and off IR commands are available as well.

Volume Control

Use the **Vol+**, **Vol-** and **Mute** buttons.

Channel Selection

The key change in digital tuning is the need to add a dash (-) and number after the traditional channel number. Analog channels are accessed using XX-0, digital channels using XX-1 (or -2, -3, etc).

Ch+, **Ch-** and **PrevCh** can be used to access and recall channels.

Menu Operation

Press Menu to access the on-screen menus.

- Use the directional **Arrows**, **Select** and **Exit** to navigate the menus.
- **List** displays the list of all channels, arrow keys add/remove channels, set Favorite Channel list
- **Exit** steps backwards out of menus
- **Enter** selects menu choice




Special Functions




- **CC** steps through available closed-captioning options
- **Audio** selects audio and SAP modes
- **Signal** displays channel signal level
- **Ratio** steps through aspect ratios, options depend on channel and output types
- **Info** launches on-screen information window
- **A/C** selects Air or Cable tuning
- **Fav** Displays list of favorite channels
- **Guide** displays on-screen Guide




Features of many of the Special Function commands depend on whether the current channel is analog or digital.

Tip: The output rules behave differently for digital and analog channels. When you set up the tuner, use the **RATIO** button to set image output for a digital channel, then tune to an analog channel and set that to 16:9 or 4:3. The same rule applies to the Menu/Setup/Screen Format menus. Set for analog and digital.

On-Screen Menus

<p>Main Menu</p> 	<p>Selects sub-menus.</p> <ul style="list-style-type: none"> • Arrow keys highlight option • Select (or Enter) chooses option • Menu steps back or exits menu • Exit exits all menus • Some options are only available if you are currently tuned to an analog or digital channel
<p>Channel Menus</p> 	<p>Sub-Menu for Channels offers options for:</p> <ul style="list-style-type: none"> • Channel Auto-Scan • Favorite Channel Selection • Add/Delete Channels • Fine Tune (If tuned to an analog channel) • Signal Strength Meter
<p>Auto-Scan</p> 	<p>Starts scan of analog and digital channels. SmartScan for cable channels skips encrypted programs.</p> <ul style="list-style-type: none"> • Air – looks for NTSC and ATSC channels • Cable Auto – looks for analog and digital QAM cable channels, as well as all frequency plans • Cable STD - standard cable spacing • Cable HRC – HRC cable spacing • Cable IRC – IRC cable spacing • Press Select once scanning begins to skip analog scanning <p>Tip: Normally, use Auto. Most cable channels will be in standard frequencies. If all the channels tune in STD but channels 5 and 6, scan for IRC. If few channels can be found, scan for HRC.</p>

<p>Favorite Channels</p> 	<p>Menu is also displayed from the List command, selects channels advanced by the FAV favorite channel command.</p> <p>Use the Up, Down arrows to move through the list, press Select to add a channel to Favorites.</p>
<p>Channel Add/Delete</p> 	<p>This menu can add or delete a channel accessed from Channel Up and Down.</p> <p>You can tune to a channel you want to delete, then press Menu/Channel/Add-Delete. Press Select to delete the channel. You can also keep the page on screen as you step through channels, adding and deleting as desired. If the channel has a good signal, it will be displayed in the background.</p> <p>Note that HDTV channels are broadcast on UHF frequencies. The Add/Delete will show the name of the digital channel, as well as the actual UHF channel used for broadcasting.</p> <p>You can delete one of a digital channel's sub-channels without affecting the others.</p>
<p>Signal Strength</p> 	<p>This page also displays from the Signal remote command. The graphic shows the current signal strength, and changes in real time. This allows you to monitor the strength of a channel as you adjust the antenna for best reception.</p>

<p>Caption Menus</p> 	<p>This menu accesses captioning features:</p> <ul style="list-style-type: none"> • On/Off – turn captions on/off – <i>other options are not available if captions are off.</i> • Analog Mode - CC 1-4 and Text 1-4 • Digital Mode – Service 1-6 • Digital Font Options <ul style="list-style-type: none"> • Size – Standard (15 pixels), Large (21 pixels), or Small (11 pixels) • Style – 1-6 • Color – 8 shade of background, foreground and edge colors • Opacity – foreground and background • Edge – 6 style options <p>Version displays current version of tuner firmware</p>
<p>V-Chip Settings Menus</p> 	<p>Manages access to programming for US and Canadian standards.</p> <p>The default PIN number for access is 0000 (four zeros).</p>
<p>Change PIN</p> 	<p>Enter and confirm new PIN for access.</p>

US Rating



Use arrows and Select functions to select level of Movie and TV rating allowed.

Canada Rating



Use arrows and Select functions to select level of Movie and TV rating allowed.

Setup Menus



This series of menus select the options for tuner operation:

- **Screen Format** – 16:9 or 4:3
NOTE: Set when tuned to a digital channel, again when tuned to an analog channel – these are two different settings! You can use RATIO on the remote – does the same setting.
- **Time**
- **Sound Settings**
- **Video Noise Reduction** - On/Off (if tuned to analog)
Set to On – helps to clean up analog channels
- **Menu Language** – English, Spanish, French

Screen Format



Selects between 4:3 and 16:9 aspect ratios. The Ratio command can also adjust the settings.

- **4:3 Display** offers three options for 16:9 video: 16:9, 4:3 (stretched vertically), and Zoom (cropped sides)
- **16:9 Display** offers three options for 4:3 video: 4:3 (small centered), 16:9 (stretched horizontally), and Zoom (stretched vertically and horizontally) – or 4:3 and 16:9 if the video is 16:9

Time



Sets time settings for:

- **Daylight Saving** – Select and choose on or off
Note – The DST trigger comes from the broadcast stations, and may not be in sync with the new US standards. Use On/Off or time zone to offset time
- **Time Zone** – Select local time Zone

Time Zone





Use left-right cursors to select the time zone, Select enters the current zone.

Sound



Selects a variety of options, each is only active when you are currently tuned into an analog or digital channel:

- **Analog MTS** – Mono, Stereo, SAP (same as Audio)
- **Multi-Track** – English, French, Spanish
- **Digital Out** – AC-3 (Dolby 5.1), PCM, or variable-level PCM. Set to PCM when using audio through the HDMI connection – most displays cannot decode AC-3 (Dolby 5.1).
- **Auto Volume** – On or off

Pop-Up Menus	
<p>Info</p> 	<p>Activated from Info command.</p> <ul style="list-style-type: none"> • Channel – Analog or digital, Mode, Name • Time – current time and date • Program – Times and name (if digital) • Details – Resolution, Audio Mode, Captions, Rating
<p>Guide</p> 	<p>Shows the day's programming guide for current station. Use Up or Down arrows to move through Guide.</p>

RS-232 Control Protocol

Overview

The 232-ATSC full duplex RS-232 enables a system programmer to control all TV Tuner functions as well as monitor TV 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: Channel/Source Select, Audio Levels/Mode and Front Panel. The Power button-function status from the 232-ATSC front panel has been grouped with the Channel/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-ATSC whenever a valid command for that group is received by the 232-ATSC RS-232 port or front panel. A group's status may be requested at any time 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 9 232-ATSC units may be cabled together and addressed for individual control from a single RS-232 port. Each 232-ATSC is assigned a unique unit code.

Communications parameters (Front Panel Mode 1) are 300 to 19200 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-ATSC.

The tuner will accept non-standard RS-232 control such as voltage that swings from 0 to +5 VDC, commonly found when IR ports are used to send RS-232 commands.

General protocol specifications

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

Command strings sent to the 232-ATSC begin with the ASCII > (greater than symbol) as an 'Attention' character and end with carriage return - ASCII CR, Hex \$0D, or keyboard Enter - as an 'End-of-command' character.

Responses from the 232-ATSC begin with the ASCII < (less than symbol) as an 'Attention' character and end with a carriage return followed by line feed an ASCII LF or Hex \$0A as 'End-of-command' characters.

A carriage return is required at the end of each command and is assumed in all examples.

Command String Structure

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

Attention	Single character (>) starts the string
Unit#	The Unit# is expressed as an ASCII 0-9 when used in multiple tuner applications. To address all units, use a Unit # of 0 (Zero) No unit number will default to Unit#1
Command	A two-character command
Parameters	Added attributes to some commands
Return	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.

Command and Status Response

Commands can be sent back to back at any time without any delay. To allow for rapid, multiple commands, status responses are intentionally delayed by about 125mS, sending the most current status in response to control commands or user actions.

Control Commands

Code	Function	Operation
	Front Panel	
S4=	Set front panel lockout mode	0=None 1=Channel 2=Volume 3=Channel & Volume 4=Power 5=Channel & Power 6=Volume & Power 7=All
Q5=	Set IR Receive mode	0 - No IR reception 9 - CR 9 (Default)
KK=105	Menu	Opens on-screen menus
KK=106	Arrow Right	Arrow Left
KK=107	Arrow Left	Arrow Down
KK=108	Arrow Up	Arrow Up
KK=109	Arrow Down	Arrow Down
KK=110	Enter	Enter
KK=111	Exit	Exits menus
KK=95	List	Displays on-screen list to select favorite channels
P1	Power On	On
P0	Power Off	Standby, mutes audio and video
PT	Power Off/On	Power toggle
XX	Power On	On (same as 232-series Mute Off)
XM	Power Off	Standby (same as 232-series Mute On)
XT	Power Off/On	Power toggle (same as 232-series Mute Toggle)
	Tuning	
TC=	Select tuned channel	Tunes analog and digital channels <i>Examples:</i> '>TC=28:1' Selects channel 28-1 '>TC=28-2' Selects channel 28-2 '>TC=32' Selects 32-1, 32-0 if no digital '>TC=32-0' Selects analog channel
TU	Tune channel up <i>Example:</i> '>3TU'	Selects next higher channel in channel list Bumps Unit#3 tuned channel up
TD	Tune channel down	Selects next lower channel in channel list
TP	Previous channel	Selects previously viewed channel
T^	Start Channel Scan	Initiates new channel scan for analog and digital channels, scan operation set by D0 and S0.
S0=	Tuning Format	0=CATV (Default) - Switches to Cable, sets scan mode 1=Off-Air - Switches tuner to Air RF input and channels 2=IRC - Switches to Cable, sets scan mode 3=HRC - Switches to Cable, sets scan mode 4=Cable Auto - Switches to Cable, sets scan mode
D0=	Set Channel Scan Mode	Sets scan mode for digital and analog channels from the T^ or front panel scan command. 0= Scans for analog and digital channels scan (default) 1= Scans for digital only, deletes analog channels 2= Scans for digital only, keeps analog channels 3= Scans for analog only, deletes digital channels 4= Scans for analog only, keeps digital channels A scan must be triggered by T^ or front panel before the onscreen Menus will scan following D0 rules.
XD=	Channel delete	XD=<major>,<minor> removes channel from channel list. <i>Example:</i> '>XD=0,0' removes current channel
XA=	Channel add	XA=<major>,<minor>,<physical> adds channel <i>Example:</i> '>XA=38,1,0' Physical channel will be same as major
KK=153	Air	Sets tuner for antenna (Off-Air) tuning
KK=154	Cable	Sets tuner for cable tuning
KK=88	Favorite	Steps through favorite channels (selected in List menu)

Code	Function	Operation
	Display	
KK=149	RGB Out	Selects RGB output and colorspace
KK=151	YPbPr Out	Selects Component (YPbPr) output and colorspace
D4=	Overscan (0-9)%	Removes upper scan lines that may appear in RGB output, affects all outputs, 0% is default setting. <i>Example: '>D4=3' Overscan by 3% (typical solution)</i>
KK=82	Ratio	Steps through aspect ratios, options depend on channel and output types
KK=81	Signal	Displays signal Strength
KK=100	Info	Launches on-screen information window
KK=62	Guide	Displays Electronic Program Guide
KK=115	CC - Closed captions	Steps through captioning options
Q0=	Caption Mode Off (0-2) <i>Example: '>Q0=0' or '>Q00'</i>	Sets captioning mode 0=Captioning off (default) 1=Captioning on Captioning off
Q1=	Captioning Type (1-8)	Turns on captioning type 1=Caption 1 (normal setting for most captioning) 2=Caption 2 3=Caption 3 4=Caption 4 5-8= Text 1-4 (rarely used)
Q7=	Digital Caption Service	Set to 1-6 (1 is default)
	Audio	
VU	Ramp volume up	Starts volume ramping up
VD	Ramp volume down	Starts volume ramping down
VH	Sets volume level 0-100	Volume level, scaled in 100 steps
VL	Sets volume level 0-63	Volume level, scaled in 63 steps, as other 232 tuners
VX	Volume Mute off	Restores audio volume to previous level
VM	Volume Mute on <i>Example: '>VM'</i>	Turns off audio outputs Mutes audio outputs
VV	Stop volume ramp	Stops volume ramping
VT	Toggle Volume Mute	Alternates audio mute on and off
KK=85	Audio Mode	Step through audio mode options for mono, stereo, SAP
	Status Request	
SQ	Request Q Mode status	Unit sends "Q" Mode status string
SS	Request Front Panel status	Unit sends "S" Front Panel status string
ST	Request Channel status <i>Example: '>ST'</i>	Unit sends "T" Channel/Source status string Returns Channel/Source status response string
SV	Request AV status	Unit sends "V" Audio status string

A carriage return is required at the end of each command and is assumed in all examples. The '=' sign for parameters may be omitted if desired, though it is helpful for clarity in checking programming.

Terminal Communication Commands

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

HD2-RC Remote Emulation

You can also emulate IR commands sent from the CR HD2-RC Wireless Remote. If you are using the numeric keys to select a channel, the user or program will need to follow the numeric command with an Enter.

KK=<key>	* = Reserved for future products/applications	
0=*		88=Favorite
1=*		95=List
2=*		96=Add/Delete Channel
3=*		98=Air/Cable
4=*		99=Dash -
5=*		100=Info
6=*		101=Prev Chan
7=*		105=Menu
8=*		106=Cur Right
9=Power (tog)		107=Cur Left
10=0		108=Cur Up
11=1		109=Cur Down
12=2		110=Enter/Select
13=3		111=Exit
14=4		115=CC
15=5		141=Format 1080i
16=6		142=Format 720p
17=7		143=Format 480p
18=8		144=Format 480i
19=9		149=Output RGB
20=		151=Output YPbPr
21=Enter/Select		153=Air
22=Ch Up		154=Cable
23=Ch Dn		155=16:9 Ratio Pillar Box
24=Vol Up		4:3 Ratio Letterbox
25=Vol Dn		156=16:9 Ratio Full Wide
26=Vol Mute (tog)		4:3 Ratio Full
27=Power On		156=16:9 Ratio V Zoom
28=Power Off		4:3 Ratio H Zoom
29=Menu		158=AC-3(Dolby 5.1)
63=Guide		159=PCM
80=Freeze		160=PCM Variable
81=Signal		161=Display 16:9
82=Ratio		162=Display 4:3
85=Audio		

Response Strings

Response Strings

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

232-ATSC 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. Functions shown as N/A are not applicable or available in the 232-ATSC; characters will appear in status strings as lower-case x.

Channel/Source Status Response String (T):

Start	#	CMD	Power	Major Channel	Video Mute	Input	RF	Received Resolution	Minor Channel	NA	Function
	1-9		U=On M=Off	3 digits	Un-muted	0=RF	A=Air C=Cable	0=1080i 1=720p 2=480p 3=480i N=No Sig	3 digits		0=None
<	1	T	U	032	U	0	A	0	002	x	0

For compatibility with 232-series tuners, the 232-ATSC channel status is split into Major Channel and Minor Channel sections. The Minor Channel will always be 000 for analog channels. With version 1.9, the Minor Channel status will display "F00" if the Major channel is a special "one-part" digital channel. Also, as one-part channels can go higher than 999, the Minor status will tell you how many thousands (up to 63) you add to the Major number. So, channel 1032 would show 032 Major F01 Minor. Two-part channels are limited to 999-999.

Audio Status Response String (V):

Start	Unit	CMD	Power	Volume 1	Volume Mute	Stereo	Volume 2
	1-9		U=On M=Off	0-63 Emulated level 2 digits	U=Unmuted M=Mute	N/A	0-100 Actual level 3 digits
<	1	V	U	63	U	x	100

Volume 1 emulates 232-series volume level for compatibility with existing applications.

Volume 2 shows actual 232-ATSC level, from 0-100 steps. In V 1.9, Mute status will be sent if a user mutes volume from an IR remote

Front Panel Mode Status Response String (S):

Start	Unit	CMD	Audio	Tune Mode	Lockout	Bass	Treble	Output	Output Resolution	Output Setting	NA
	1-9		N/A	0=Cable 1=Air 2=IRC 3=HRC 3=Auto	0-7	Fixed 2 digits	Fixed	0=RGB 2=YpPr	0=1080i 1=720p 2=480p 3=480i	0=1080i 1=720p 2=480p 3=480i	4 digits
<	1	S	x	1	0	08	4	2	0	0	xxxx

Current Ratio is the actual output ratio; Ratio Mode is the selected mode (see chart on page 9)

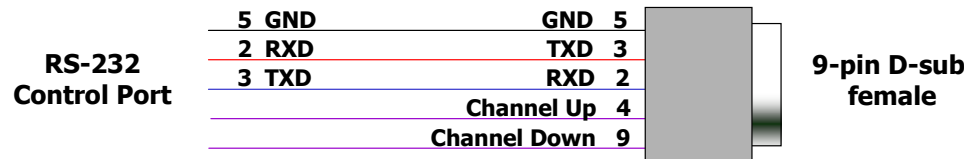
Q Mode Response String (Q):

Start	Unit	CMD	Q0	Q1	Q2	Q3	Q4	Q5	Q6	Q7	NA
	1-9		CC 0=Off 1=On	CC Type 1-8	Video Detect (fixed)	AV Detect (fixed)	Label (fixed)	IR 0=Off 9=Normal	1 digit	Digital CC 1-6	2 digits
<	1	Q	1	1	3	0	2	9	0	1	xx

RS-232 Cable Connections

Single Tuner

Control Wiring – Single Unit



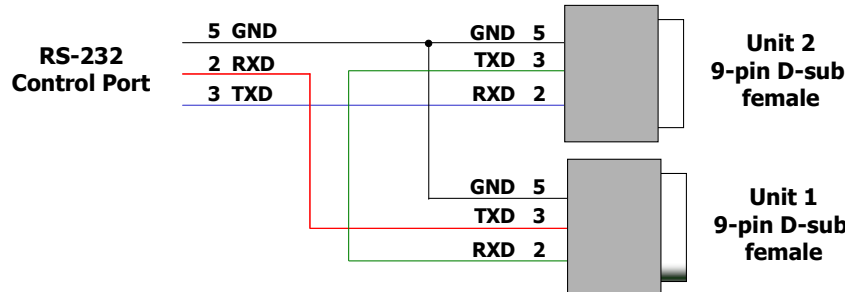
RS-232 wiring for control or programming should only use pins 2, 3, 5. Cables with all pins wired can lock out front-panel programming and data communication (Pins 4 and 9 are inputs).

Multiple Tuners

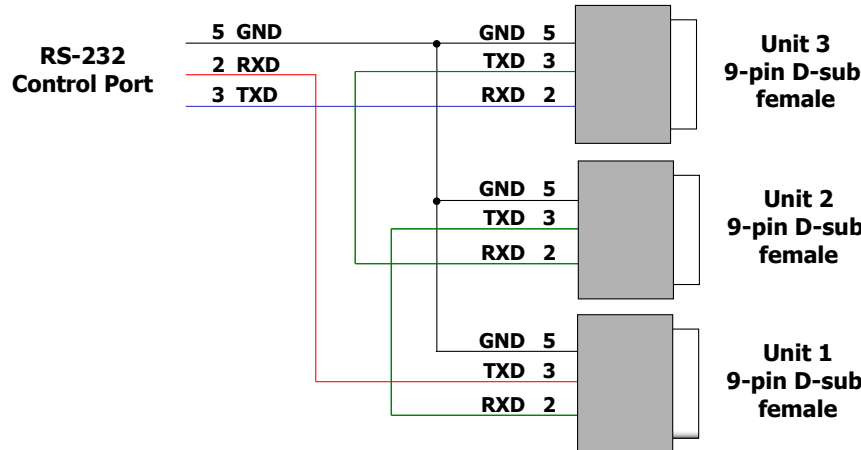
Up to nine tuners can be daisy-chained from one RS-232 control port. Remember that you will need to use the Unit# address in your programming when you control more than one tuner from the same control port.

Set the first unit in the RS-232 chain to the highest Unit#, then wire in sequence to the last tuner in the chain. The reason for this is that CR tuners use an intelligent data bus - the highest number tuner receives all commands, and then passes on commands addressed to tuners with lower unit numbers. The next tuner in the chain does the same, and so on until the last unit.

RS-232 Wiring – Two Units

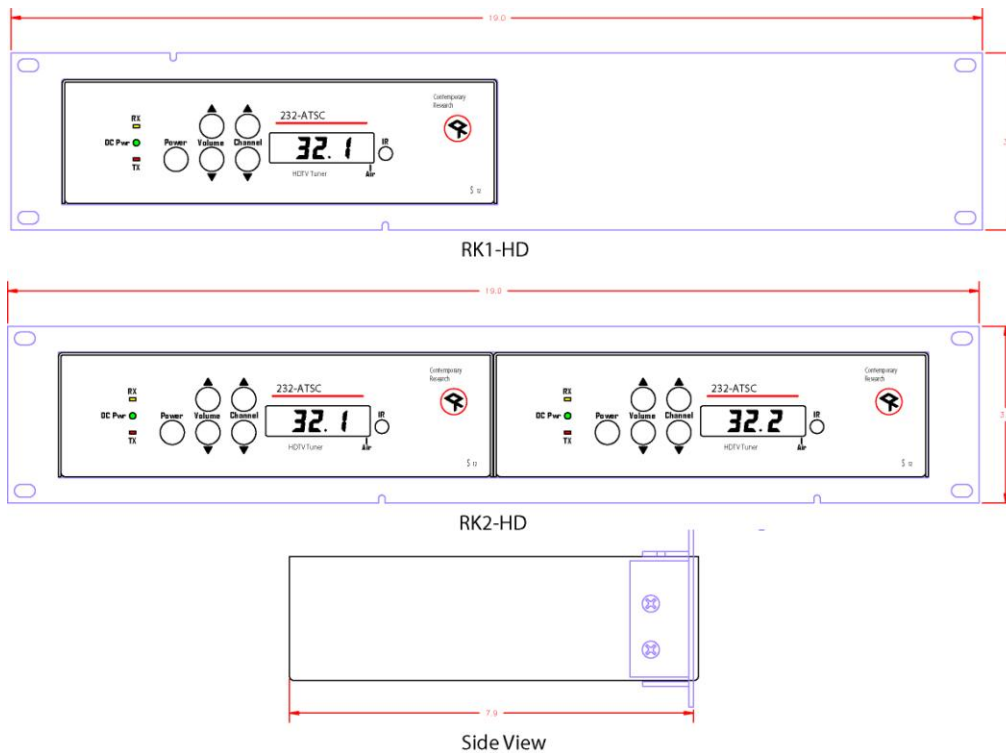


RS-232 Wiring – Three Units



Rack Mounting

Two options are available for rack-mounting tuners.



RK1-HD

- Insert 232-ATSC into RK1-HD frame.
- Use screws included with kit to attach tuner to the side flanges.

RK2-HD

- Use supplied screws to attach left tuner to left and top flanges
- Use supplied screws to attach right tuner to right and top flanges

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.

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.

5. **Overloading** - Do not overload wall outlets and extension cords as this can result in a risk of fire or electric shock.
6. **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.
7. **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.
8. **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.

* Note to CATV system installer: This reminder is provided to call CATV system installer's attention to Article 820-40 of the National Electrical Code (Section 54 of Canadian Electrical Code, Part I), that provides guidelines for proper grounding and, in particular, specifies that the cable ground shall be connected to the grounding system of the building as close to the point of cable entry as possible.

Limited Warranty

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.

CR is not liable for any damages caused by any of its products or for the failure of any products to perform, including any lost profits, lost savings, incidental damages, or consequential damages. CR is not responsible for any claim made by a third party or made for you by a third party. This limitation of liability applies whether damages are sought, or a claim is made, under this warranty or as a tort claim (including negligence and strict product liability), a contract claim, or any other claim. This limitation of liability cannot be waived or amended by any person. This limitation of liability will be effective even if CR or an authorized representative of CR has been advised of the possibility of any such damages.

Some states do not allow a limitation of how long an implied warranty lasts. Some states do not allow the limitation or exclusion of incidental or consequential damages for consumer products. In such states, the limitation or exclusion of the Limited Warranty may not apply to you. This Limited Warranty gives you specific legal rights. You may also have other rights that may vary from state to state. You are advised to consult applicable state laws for a full determination of your rights.

Except as expressly set forth in this Limited Warranty, CR makes no other warranties, expressed or implied, including any implied warranties of merchantability or fitness for a particular purpose. CR expressly disclaims all warranties not stated in this Limited Warranty. Any implied warranties that may be imposed by law are limited to the terms of this Limited Warranty.