232-ATSC 4K HDTV Tuner

Product Manual

Contents

Overview

The 232-ATSC 4K HDTV Tuner, our 5th-generation ATSC HDTV tuner, adds new capabilities to the industry-standard 232-ATSC series. New features include decoding H.264 programs up to 1080p, output scaling up to 4K, and IPTV output stream. The tuner is fully compatible with RS-232 control commands for previous models.

The integrator-friendly HDTV tuner is controllable via 2-way RS-232, IP Telnet and UDP, as well as wireless and wired IR commands. Onboard web pages enable remote configuration, control, and monitoring from a web browser.

A full-featured, commercial grade HDTV tuner, the 232-ATSC 4K can receive both analog and digital MPEG-2/H.264 channels, in ATSC, NTSC, and clear QAM formats. Using an optional RF-AB switch, the tuner can switch between separate antenna and cable feeds.

Features

Tuning
- ATSC air and Clear QAM cable channels
- NTSC analog air and cable channels
- Air channels 2-69
- Cable channels 2-135, Standard, HRC, and IRC

Decoding
- MPEG-2 or H.264 digital channels
- Supports AC-3, MPEG-1 Layer 2, or AAC audio formats
- Supports multiple audio programs

Video
- HDMI Type A, Version 1.4b
- Analog component RCA and HD15 RGBHV (VGA) outputs, selectable YPbPr or RGB
- Analog composite video output
- Output scaling to 480i, 720p, 1080i, 1080p, 2160p or Auto

Audio
- HDMI embedded AC-3 pass-through, PCM Fixed, or PCM Variable
- S/PDIF coaxial and optical AC3 pass-through, PCM Fixed, or PCM Variable
- Variable Analog stereo

Closed Captions
- Decodes analog and digital closed captioning
- Caption data available as Line 21 closed caption data on composite video output

Setup and Control
- Control via front panel, optional IR remote, on-board web pages, or RS-232 commands
- Two-way control via RS-232, Telnet, or UDP for use with third-party control systems.
- RS-232 can be daisy-chained to control up to 9 tuners from a single RS-232 port
- CEC control available on HDMI output for most CEC enabled displays.
- Setup via Front panel menu, On-screen menu, web pages, or RS-232 commands.
- Firmware updateable over Ethernet with CR Toolbox software

IPTV Output
- Passes through IPTV stream from received digital channel
- Stream all programs, individual program, or tuned program

Installing the 232-ATSC 4K

The 232-ATSC 4K may be placed freestanding on a suitable surface or installed in a standard EIA 19" equipment rack with the included RKU rack mount hardware. The RKU rack mount hardware kit facilitates mounting of a single tuner in one rack space or two tuners side by side in a single rack space.

Connect the HDMI output or other available output to a video display, video matrix/router input, or video encoder input. Analog and S/PDIF digital audio outputs are available for connection to an amplifier, audio system processor, or other compatible audio input. Connect a coaxial cable from the CATV or antenna source to the Air/Cable input. The 232-ATSC 4K will need to be connected to an appropriate mains power source using the included external power supply or equivalent.

After the 232-ATSC 4K is connected, a channel scan will need to be performed prior to viewing programs. The channel scan may be initiated from the on-screen menu, front panel setup menu, RS-232 command, or web page.

Setup

Multiple methods are available to access control functions and configuration settings for the 232-ATSC 4K:

Front Panel
For normal operation, the **Up/Down** buttons step through the channels in the channel memory. **Left/Right** buttons are used to control the variable audio output level.

Front Panel Menu
Configuration settings for AV setup, System setup and Network setup are available on the front panel LCD display.

- Press the red **SETUP** button to access the front-panel menus
- Press the **Left/Right** arrows to step through each configuration menu category
- Press **SELECT** to enter the menu
- Press the **Up/Down** arrows to view the settings
- Press the **Left/Right** arrows to step through the setting options
- Press **SELECT** to save the changes for each menu
- Press **SETUP** to back out of a menu or exit configuration settings

On-Screen Menu
Many of the common AV settings can be configured in the on-screen menu. Buttons on the front panel or HD2-RC handheld remote may be used.

- Press **MENU** to bring up the on-screen menu
- Press **Up/Down** to step through each menu category
- Press **SELECT** to enter the menu
- Press the **Up/Down** arrows to view the settings
- Press **SELECT** to select a setting
- Press **MENU** to back out of a menu or exit the on-screen menu

Web Pages
On board web pages are available control and configuration. Connect the ethernet port of the 232-ATSC 4K to a PC. A crossover cable is not required. Open a web browser in the PC and enter the IP address of the 232-ATSC 4K into the address bar to access the web pages.

RS-232 Control
The 232-ATSC 4K may be controlled and configured using RS-232 ASCII strings from a terminal program or control system processer. Connection to the unit for RS-232 communication can be through the DB-9 connector on the rear panel, the front panel USB virtual serial port, Telnet, or UDP.

Up to nine individual tuners may be controlled using one RS-232 serial port in a control system processor. Each tuner will need to be configured with a unique unit number. A daisy chain serial cable will be required.

Front Panel Setup Menus

A/V Setup	*Factory Defaults settings are shown in* **Bold**.
HD Output	Select RGBHV or **YPbPr** for analog HD output. This also sets color space for HDMI. *HDMI and analog HD video outputs are always active.*
HD Res	Sets the output resolution from 480i to 2160p or Auto (Native resolution).
Tune Mode	Select **CATV** | Air | IRC | HRC | CATV Auto
RefreshRate	**59.94** | 60 Hz for 1080i and 720p *1080p and 2160p are fixed at 60 Hz.*
Digital Audio	PCM | **PCM Variable** | AC-3
Captions	On | **Off**
ACap Mode	**CC1** | CC2 | CC3 | CC4 | Text1 | Text2 | Text3 | Text4
Dcap Mode	**Service 1** | Service 2 | Service 3 | Service 4 | Service 5 | Service 6
Scan Mode	**Analog+Digital** *standard full scan* Digital–Delete Analog *scan for digital, delete any analog channels* Digital–Keep Analog *scan for digital, but keep all analog channels* Analog–Delete Digital *scan for analog, delete any digital channels* Analog–Keep Digital *scan for analog, but keep all digital channels*
Channel Scan	Press **SELECT** to start scanning. *No LCD text or feedback will be displayed to confirm that the scanning is in progress. The on-screen menu will display a list of channels as they are found. The tuner scans analog channels first, then digital.* Press **SELECT** to skip the analog scan.
Overscan	**0**–9 *Selects percentage of overscan for video output.*
HDMI-DVI	**Auto** | HDMI | DVI *DVI does not hot-patch, may need to reboot tuner in DVI mode.*
HDMI Audio	**On** | Off
AC3 Cmpr	**Line** | RF *Compression mode for AC-3 downmix to stereo (RF enhances dialog).*
System Setup	
Baud Rate	1200 | 2400 | 4800 | **9600** | 19200 | 38400 | 115K | 230K
Unit Number	**1**–9 *For RS-232 daisy chain operation.*
Panel Lockout	**None** | Ch+Menu | Vol+Menu | Ch+Vol+Menu | Power | Setup | Menu | All | Setup+Menu | Pwr+Setup+Menu
Backlight	1–10
LCD Contrast	1–10
IR Receive	**IR On** | IR Off
CEC Mode	**Disable |** Turn Display On | Turn Display On/Off
Firmware	**Right** or **Left** arrow scrolls through firmware versions and displays power supply voltage. *Example:* 232-ATSC 4K_V1.04a — Control Firmware BL Ver V0.11C — Bootloader Firmware HD Version 7.08 — HD Firmware Volt in = 11.8
Network Setup	
IP Address	**192.168.1.231**
IP Mode	**Static** | DHCP *IP address, gateway, and subnet cannot be changed in DHCP mode.*
IP Gateway	**192.168.1.1**
Subnet Mask	**255.255.255.0**
IP Port	**23** *Telnet port*
MAC/SN	**00:14:C8:14:**xx:xx
UDP Reply	On | **Off**
IPTV Setup	
Enable	On | **Off**
DestAddr	xxx.xxx.xxx.xxx *Address may be unicast or multicast*
DestPort	1-65534
Program	All, Tuned, or select from available programs

Front-Panel Button Sequences

Air/Cable Tuning
Pressing the **Up** and **Down** keys toggles air/cable tuning.

Audio Mute
Pressing the **Left** and **Right** keys toggles mute on/off.

Unlock Front Panel
If the **Setup** key is locked out, pressing **Setup** and the Right key will unlock setup until the tuner resets. The tuner will power on if it is off (even if the Power button is locked).

Factory Reset
Press **Power** and **Up** together when at the **System: Firmware** menu to reset to the default settings.

Display IP Address
Hold **Setup** to display the IP address on the front panel LCD display.

Display Info Banner
Hold **Select** to display the on-screen info banner.

Setup Notes

Channel Scan

A channel scan will be required prior to initial use and subsequently following any changes to the received channel line-up. The channel scan may be initiated in the on-screen setup menu, front panel setup menu, web page, or by RS-232 command. The Air or Cable scan mode should be selected for the intended application prior to initiating the scan.

Tuning Cable Channels

The 232-ATSC 4K will skip encrypted channels automatically when a channel scan is initiated. Scanning analog channels may be skipped by pressing **Select** the front panel or IR remote after the scan has started. Typically, the unencrypted digital cable channels will not use the same Guide numbers as a cable box.

Air/Cable

The 232-ATSC-4K has separate channel memories for air and cable channels. It is possible to toggle between the two channel memories. A separate channel scan for each mode will be required. The toggle may be initiated by simultaneously pressing the **Up** and **Down** buttons on the front panel, pressing the **A/C** button on the IR remote or web page, or RS-232 command.

If the air and cable channels are delivered on two separate coax cables, the accessory RF-AB selector switch may be utilized. The control cable to the RF-AB selector switch will connect to the A/C jack on the rear panel of the tuner. The input selection of the RF-AB selector switch will follow the Air/Cable toggle command received by the tuner.

RGB/Component Video

Analog HD output is available on both the HD15 RGBHV (VGA) and Component jacks. The YPbPr/RGB configuration setting applies to both sets of analog HD outputs. Use the front-panel menu, web page, or RS-232 command to select the desired output mode.

DVI

DVI compatibility is normally supported. Forced DVI may be manually selected from the HDMI-DVI menu setting.

Audio

The volume settings do not affect digital audio in AC-3 or PCM modes. PCM Variable supports volume control. The analog audio outputs always follow the volume settings. If there is no audio, make sure the volume is all the way up (and not muted). A "motorboat" sound means the display does not support AC-3, and the mode should be changed to PCM.

IR Control

- Interference from room fluorescent lights can cause problems with IR remote operation. If this occurs, the frequency of the IR can be changed. Hold **Select** on the remote and press "**9**" to set the IR frequency at 57 KHz. Hold Select and press "**4**" to set the IR to the normal 38 KHz frequency.
- Check the front-panel menu to see if IR Receive is turned on or off.
- If there is significant IR interference, an IR-RXC Remote Sensor may be required. Cover the front-panel IR sensor to reduce interference.
- The 232-ATSC 4K will respond to a universal remote with the TV type set to Sharp.

Captioning

Embedded Line 21 captioning data is available on the Composite video output. If the tuner is feeding a compatible digital encoder or encoder/modulator, the Composite video output may be used as the source of the captioning data.

On-screen captioning may be enabled from the on-screen menu, IR remote, web page, or RS-232 commands. For CEA-708 digital captions, options are available in the on-screen menu for font, color, style, and other appearance settings.

Consumer Electronics Control

Consumer Electronics Control (CEC) is available for use with the HDMI output for power control of compatible displays.

HDMI CEC may be selected for sending power commands to the display. No other control functions are available for CEC control. HDMI CEC sends standardized control commands over the HDMI cable. CEC functionality is available in many TVs and displays designed for the consumer market. If control of the TV or display via HDMI CEC is desired, it is important to check the TV or display's documentation to determine if CEC is supported.

It is common for manufacturers to use their own unique term to refer to HDMI CEC. For example, Samsung refers to CEC as Anylink. LG refers to it as SimpLink.

CEC will likely need to be enabled in the display. Some displays will automatically detect that a CEC supported device has been connected and prompt for confirmation.

Although the industry strives for standardization relating to CEC, it is possible that some or all CEC control communication between the ICC1-TC and connected display may not function depending on display make and model. In this situation, RS-232 is recommended for reliable display control.

When enabled, the options are:

- The display will turn on when the tuner receives a power on command, but will not turn off with a tuner power off command
- The power state of the display will follow the power state of the tuner

IPTV Streaming

The 232-ATSC 4K can passthrough the MPEG transport stream of the received digital RF channel as a UDP MPEG-TS IPTV stream via the Ethernet output. The destination IP address may be a unicast or multicast address. The allowable range for the destination port is 1 to 65534.

For received channels with multiple programs or sub-channels, the output stream may be configured to contain all programs, an individual program, or the program of tuned digital channel.

For a source RF channel that has multiple programs and the output stream is configured for all programs, the MPTS (multiple program transport stream) output will include each of the received programs of the original RF broadcast. The entire PSIP (Program and System Information Protocol) information present in the broadcast will be included unaltered in the IPTV stream.

If an individual program is selected, the SPTS (single program transport stream) will contain an individual program. All the tables in the PSIP except the PAT (Program Association Table) and PMT (Program Map Table) of the selected program will be stripped from the IPTV stream.

Restore Factory Default Settings

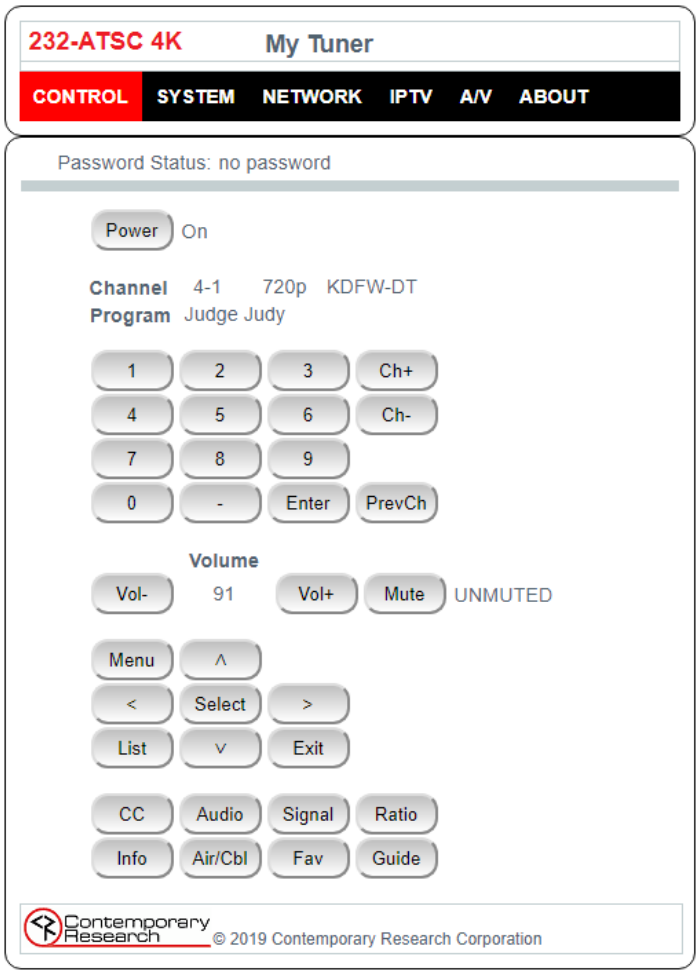
The unit may have the configuration restored to the factory default settings. The channel list is not changed as this data is stored in separate memory.

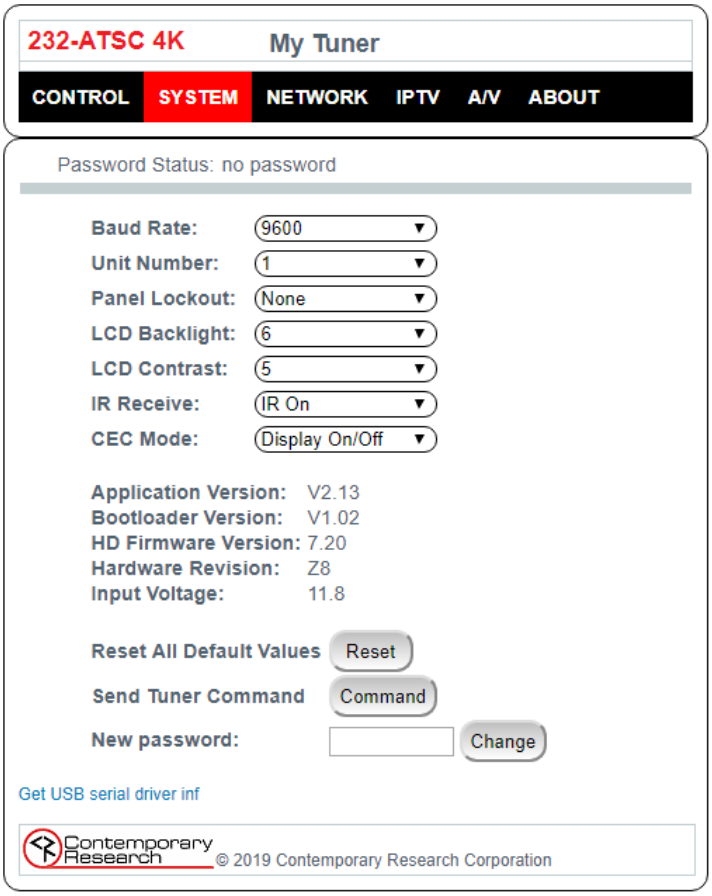
The factory default settings may be restored using the on-screen text menu. Hold the **Menu** button to open the on-screen text menu. Select the System menu and scroll to Firmware. Verify that the System firmware is displayed. Simultaneously press **Power** and **Up**.

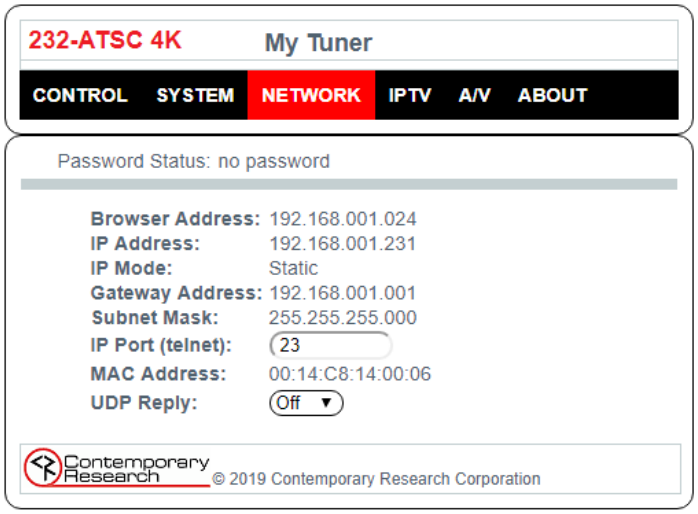
The factory default settings may also be restored via the RS-232 command '>Z!'. Note that the RS-232 port settings will be changed if different than the default and the RS-232 communication will be lost.

Web Pages

The 232-ATSC 4K includes web pages accessible by any browser over IP. Open a web browser and type in the tuner's IP address in the address bar. The tuner's IP address may be displayed on the front panel by holding down the **Setup** button. The default IP address is 192.168.1.231.






232-ATSC 4K
My Tuner
CONTROL SYSTEM NETWORK IPTV A/V ABOUT
Password Status: no password
Browser Address: 192.168.001.024
IP Address: 192.168.001.231
IP Mode: Static
Gateway Address: 192.168.001.001
Subnet Mask: 255.255.255.000
IP Port (telnet): 23
MAC Address: 00:14:C8:14:00:06
UDP Reply: Off
Contemporary Research
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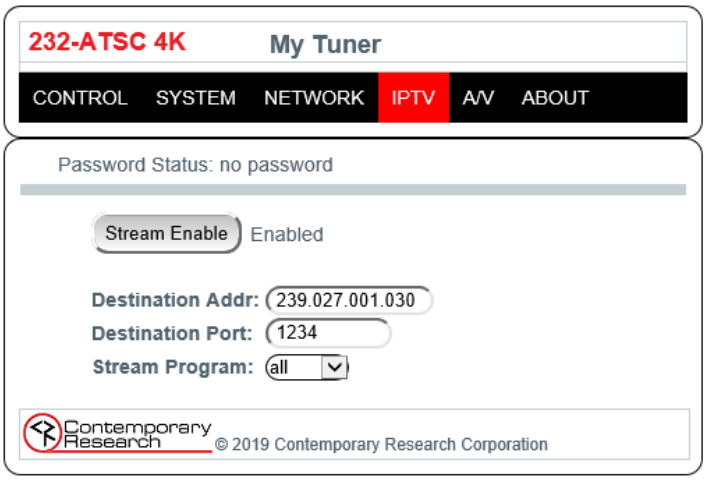
232-ATSC 4K
My Tuner
CONTROL SYSTEM NETWORK IPTV A/V ABOUT
Password Status: no password
Stream Enable
Enabled
Destination Addr: 239.027.001.030
Destination Port: 1234
Stream Program: all
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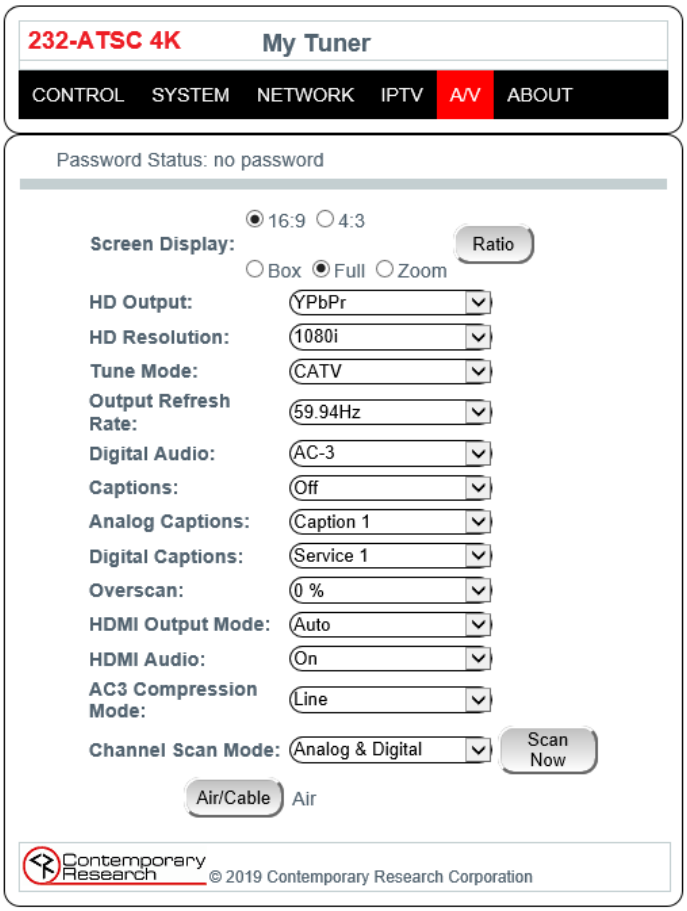
232-ATSC 4K
My Tuner
CONTROL SYSTEM NETWORK IPTV A/V ABOUT
Password Status: no password
Screen Display: 16:9 4:3
Box Full Zoom
Ratio
HD Output: YPbPr
HD Resolution: 1080i
Tune Mode: CATV
Output Refresh Rate: 59.94Hz
Digital Audio: AC-3
Captions: Off
Analog Captions: Caption 1
Digital Captions: Service 1
Overscan: 0 %
HDMI Output Mode: Auto
HDMI Audio: On
AC3 Compression Mode: Line
Channel Scan Mode: Analog & Digital
Scan Now
Air/Cable
Air
Contemporary Research
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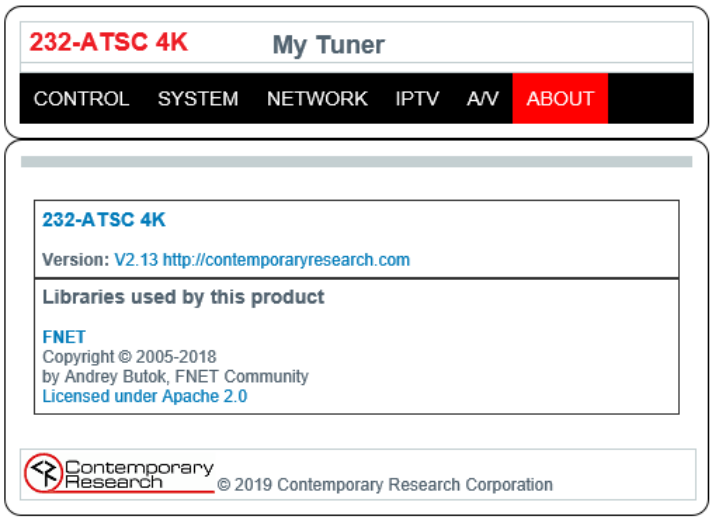
232-ATSC 4K
My Tuner
CONTROL SYSTEM NETWORK IPTV A/V ABOUT
232-ATSC 4K
Version: V2.13 http://contemporaryresearch.com
Libraries used by this product
FNET
Copyright © 2005-2018
by Andrey Butok, FNET Community
Licensed under Apache 2.0
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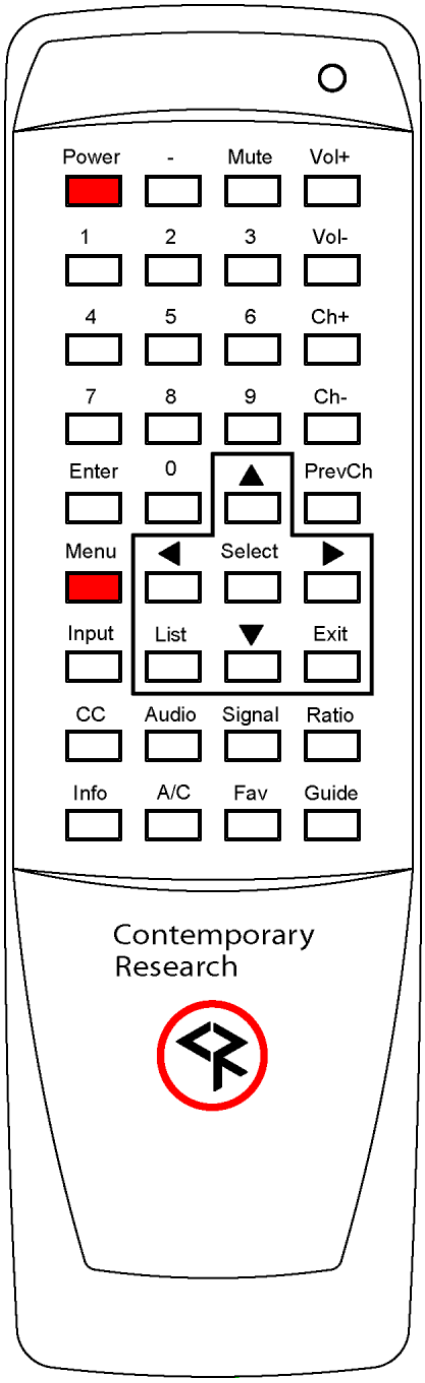
HD2-RC IR Remote

The optional HD2-RC IR Remote 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 4K front panel buttons are available for Power, Channel, Volume, Menu, and Select. The tuner will display a "^" symbol in the upper right corner of the front panel display when an IR command is received.



Power

Press to toggle on and off.

Volume Control

Use the **Vol+**, **Vol-** and **Mute** buttons to control volume.

Channel Selection

Two-part major/minor channel numbers are separated by a – (dash). Example 21-3
One-part channels are accessed by entering the channel number
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 on-screen menus.
- **Exit** closes the on-screen menu
- **Menu** reverts to the previous menu or closes the on-screen menu from the Main Menu
- **Enter** selects the menu choice

Special Functions

- **CC** steps through available closed-captioning options
- **Audio** steps through main and SAP audio options
- **Signal** launches up on-screen signal strength meter (digital channels only)
- **Ratio** steps through aspect ratio options.
- **Info** launches on-screen information banner.
- **A/C** toggles air or cable tuning
- **Fav** displays list of favorite channels
- **Guide** launches on-screen guide, select a program and press **Info** to display program information

Some of the Special Function commands may not be available on all channels.

Hold the Select button and press "9" to set the IR frequency to 57 KHz. Hold the Select button and press "4" to set the IR to the normal 38 KHz frequency.

On-Screen Menus

Main Menu	
	Main on-screen menu accessible front panel **Menu** button or menu command. Select Sub Menus - **Down** or **Up** highlights option - **Select** chooses Option - **Menu** steps back or exits menu - **Exit** closes on-screen menu

Channel Menus	
	Sub menu for Channels offers options for: - Channel Auto Scan - Favorite Channels - Channel Add/Delete - Fine Tune Channel (Analog Channels Only) - Signal Strength (Digital Channels Only)
Auto Scan 	- Press **Up/Down** to highlight scan mode - Press **Select** to initiate channel scan Analog channels will be scanned first, then digital channels. The channel list will be populated as channels are found. Press **Select** during scan to skip analog channels.
Favorite Channels 	Menu page for creating a list of favorite channels. Channels will be advanced by FAV button or favorite channel commend - Press **Up/Down** to highlight channel - Press **Select** to Add//Delete from list
Channel Add/Delete 	Channels may be added or deleted from the list of memorized channels. **Channel Up/Down** will step through the physical RF channels displaying the virtual channel numbers of received channels. **Select** will add or delete the selected channel. Note that in the case of multiple sub channels on a physical channel, only the displayed sub channel will be added or deleted.

Signal Strength

This page also displays from the **Signal** remote command. The graphic shows the current signal strength and changes in real time. The strength of a channel may be monitored as the antenna is adjusted for best reception.

Caption Menus

This menu accesses captioning features:

- On/Off — turns captions on/off

Note: Other options are not available if captions are off.

- Analog Mode — CC 1-4 and Text 1-4
- Digital Mode — Service 1-6
- Digital Font Options
  - Size — Standard (15 pixels), Large (21 pixels), or Small (11 pixels)
  - Style — 1-6
  - Color — 8 shades of background, foreground, and edge colors
  - Opacity — foreground and background
  - Edge — 6 style options

Version Info

Displays the hardware type of the decoder/demodulator board and HD firmware version. Also displays the AC-3 firmware version.

V-Chip Menus

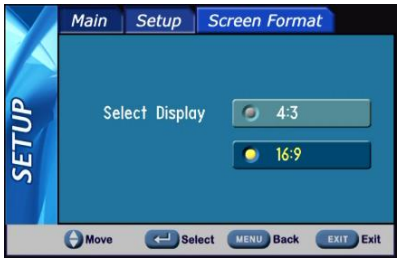
This menu manages access to programming based on US and Canadian ratings standards. A PIN number is required to access any of the sub menus. The default PIN number for access is 0000 (four zeros).

- Changing PIN accesses menu to create new PIN
- Open V-chip Setting clears all rating settings

US Rating Setting

Use navigation and Select buttons to select/deselect options. The padlock symbol indicates channels with the selected rating will be blocked and the PIN will be required for viewing.

Canada Rating Setting 	Sub menu equivalent to US Rating setting for Canadian applications.

Setup Menus	
	This series of menus select the options for tuner operation: - Screen Format —16:9 or 4:3 - Time - Sound Settings - Video Noise Reduction — Available only for analog channels - Menu Language
Screen Format 	Select the appropriate aspect ratio for the connected display.
Time 	Sub menus for time settings. Time data is extracted from the System Time Table in the digital channel's transport stream. When Daylight Saving is enabled, the tuner will adjust the time as needed if the daylight saving flag is enabled in the System Time Table.
Time Zone 	Move cursor left and right to select the time zone. **Select** stores the highlighted zone.
Sound 	Select from a variety of options: - Analog MTS — Mono, Stereo, SAP - Multi-Track Sound — English, French, Spanish - Digital Out — AC-3, PCM, or variable-level PCM. - Auto Volume — On or Off

Menu Language	
	Select the appropriate language for the on-screen menus.

Info Banner	
	On-screen Info banner may be accessed by the following: - **Info** button press on IR remote or control web page - Hold **Select** button on the front panel - Serial command

Guide	
	On-screen Guide with a list of upcoming programs may be accessed by the following: - **Guide** button press on IR remote or control web page - Serial command Use **Up/Down** to highlight a program. **Info** button press or equivalent will bring up a program description. Guide list is limited to twelve hours of programming.

RS-232/Telnet/UDP Control Protocol

The 232-ATSC 4K full duplex RS-232/Telnet protocol enables a system programmer to control all tuner functions as well as monitor tuner status. All commands are sent as ASCII strings. No delays between characters or commands are required, as data is interrupt driven and buffered.

Up to nine 232-ATSC 4K units may be cabled together and addressed for individual control from a single RS-232 port. A unique unit number will need to be assigned to each 232-ATSC 4K tuner.

Communications parameters are 1200 to 230,400 baud, 8 data bits, no parity, and 1 stop bit. Factory default is 9600 baud. All settings are saved to NVRAM in the 232-ATSC 4K tuner. 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.

The same commands can be sent over IP Telnet (up to two sessions) and via UDP to the tuner's IP address to port 31931 (fixed). UDP responses are disabled by default. UDP responses may be enabled in the front panel, web page Network Settings menu, or RS-232 command. Responses will be sent to port 31932 at the broadcast IP address of the tuner's subnet.

General Protocol Specifications

Characters in command strings to the 232-ATSC 4K are common ASCII keyboard characters. Command strings sent to the 232-ATSC 4K 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 4K begin with the ASCII < (less than symbol) as an 'Attention' character and end with a carriage return followed by a line feed - ASCII LF or Hex $0A as an 'End-of-command' character.

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.

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 applications with multiple tuners controlled from one serial port. 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. ASCII CR, Hex $0D, or keyboard 'Enter' may be used in programming. For simplicity, the programming examples in the manual will not show the 'CR'.

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.

String Example

The example below is a command for a channel change to 6-2 followed by the response string.

```
>TC=6-2
<1TU006Uxx1002x0
```

The status of a setting may be queried by omitting the = (equals symbol). The following command example queries the overscan percentage and shows the returned response.

```
>D4
<1D4=3
```

Control Commands

Code	Function	Operation
		Front Panel
P1	Power On	Brings unit out of standby
P0	Power Off	Places unit in standby, mutes audio and video
PT	Power Toggle	Toggles standby mode
S4=	Set Front Panel Lockout Mode	0=None 5=Setup 1=Ch+Menu 6=Menu 2=Vol+Menu 7=All 3=Ch+Vol+Menu 8=Setup+Menu 4=Power 9=Power+Setup+Menu Press **Select** and **Right** key to unlock temporarily
Q5=	Set IR Receive Mode	0=IR receive disabled 1=IR receive enabled
M0=	LCD Backlight	Sets LCD display backlight brightness 1-10
M8=	LCD Contrast	Sets LCD display contrast 1-10
		Tuning
TC=	Select Channel	Tunes analog and digital channels, leading zeros OK, up to 4 characters for analog or one-part digital channel, 3 characters each for digital two-part major and minor channels. *Examples:* '>TC=28:1', '>TC=28-1' Selects digital channel 28-1 '>TC=32' Selects digital channel 32, analog channel 32 if no digital '>TC=32-0' Selects analog channel 32
TU	Tune channel up	Selects next higher channel in channel list *Example:* '>3TU' Unit#3 incremented to next highest channel
TD	Tune channel down	Selects next lower channel in channel list
TP	Tune previous channel	Selects previously viewed channel
NC	Channel Name status	Returns channel name as entered in channel list, up to 7 characters
NP	Program Name status	Returns program name, up to 30 characters, 15 additional if non-ASCII characters are present, such as ñ
T^	Start Channel Scan	Initiates a new channel scan, scan operation set by D0 and S0
S0=	Tuning Format	Sets tuning format for channel scan initiated from T^ command or front panel Setup Menu 0=CATV -Switches to Cable Mode, sets standard channel spacing 1=Off-Air -Switches to Air Mode 2=IRC -Switches to Cable Mode, sets IRC channel spacing 3=HRC -Swichtes to Cable Mode, sets HRC channel spacing 4=Cable Auto -Switches to Cable Mode, auto detects channel spacing
D0=	Analog/Digital scan mode	Sets channel type for channel scan initiated from T^ command or front panel Setup Menu 0=All -Scan for analog and digital channels, delete existing analog and digital channels *(default)* 1=Digital -Scan for digital channels only, delete existing analog channels 2=Digital -Scan for digital channels only, keep existing analog channels 3=Analog -Scan for analog channels, delete existing digital channels 4=Analog -Scan for analog channels, keep existing digital channels
XA=	Channel add	XA=<major>,<minor>,<physical> Adds channel to list *Examples:* >XA=38,1,0 adds 38-1, physical channel 0 will be the same as major >XA=8,0,13 adds virtual channel 8, found on physical channel 13
XD=	Channel delete	XD=<major>,<minor> Removes channel from list

Code	Function	Operation
		Output
D4=	Overscan	Selects Overscan percentage 0-9
Q0=	Display Closed Captions	0=Captions off 1=Captions on
Q1=	Analog Caption Service	Selects analog caption service 1-8 1=Caption 1 5=Text 1 2=Caption 2 6=Text 2 3=Caption 3 7=Text 3 4=Caption 4 8=Text 4
Q7=	Digital Caption Service	Selects digital caption service 1-6 1=Service 1 4=Service 4 2=Service 2 5=Service 5 3=Service 3 6=Service 6
R6	Refresh Rate	Sets to 59.94 Hz
RM	Refresh Rate	Sets to 60 Hz
KK=149	Output RGB	Sets colorspace to RGB
KK=151	Output YPbPr	Sets colorspace to Component
HD=	HDMI/DVI mode	0=Auto 1=HDMI 2=DVI
		Audio
VU	Ramp volume up	Starts volume ramping up
VD	Ramp volume down	Starts volume ramping down
VV	Stop volume ramp	Stops volume ramping
VH=	Sets volume level 0-100	Volume level, scaled in 100 steps
VL=	Sets volume level 0-63	Volume level, scaled in 63 steps (compatibility mode)
VM	Volume Mute Enabled	Mutes all audio outputs
VX	Volume Mute Disabled	Restores audio to previous level
VT	Toggle Volume Mute	Toggle mute mode
KK=158	AC-3	Sets the digital audio outputs to AC-3
KK=159	PCM	Sets the digital audio outputs to PCM fixed
KK=160	PCM Variable	Sets the digital audio outputs to PCM Variable
HA=	HDMI Audio Mute	0=Audio mute disabled 1=Audio mute enabled
		Status Request
ST	Request T Mode status	Returns T Channel/Source status string
SV	Request V mode status	Returns V Audio status string
SS	Request S Mode status	Returns S Front Panel status string
SQ	Request Q Mode status	Returns Q Mode status string
		Network Setup
IP=	Sets IP Address	IP=xxx.xxx.xxx.xxx Defines IP address, then sends status >IP returns the current MAC address, current IP address, subnet mask, and gateway. Response example : $MAC=0014C81A001B IP=192.168.001.241S IG=192.168.001.001 IM=255.255.255.000 IY=1. S or D at end of IP signifies DHCP or Static address. 000.000.000.000 indicates DHCP, but no DHCP server detected.
IM=	Subnet Mask	>IM=xxx.xxx.xxx.xxx. Defines subnet mask
IG=	Default Gateway	>IG=xxx.xxx.xxx.xxx. Defines default gateway
IY=	IP Mode	1=Static 2=DHCP
IX=	Telnet Port	IX=xxxxx Defines Telnet port
UO	UDP Reply	Enables reply strings to UDP port 31932
UF	UDP Reply	Disables reply strings to UDP port 31932 *(default)*

Code	Function	Operation
	IPTV Setup	
GE=	Stream Enable	0=Off 1=On
GA=	Destination Address	>GA=xxx.xxx.xxx.xxx. Defines IPTV destination address
GP=	Destination Port	1-65534
GL=	List Stream Programs	Returns a list of programs on a received digital channel
GN=	Set Stream Program	1-254 0=All 255=Tuned Program
	Serial Communication	
EN	Echo On	Echo On This command is not available for Telnet. Enable local echo in the terminal program.
EF	Echo Off	Echo Off
R5	Baud Rate	0=1200 4=19.2K 1=2400 5=38.4K 2=4800 6=115.2K 3=9600 (Default) 7=230.4K
	Miscellaneous Commands	
HE	Help	Returns a list of serial commands
NW=	Set Name	Sets the 232-ATSC 4K name. Limited to 20 characters
NM	Get Name	Returns the 232-ATSC 4K name
ID	ID	Returns the product model and application firmware version
Z!	Reload factory default settings	Reconfigures unit for all factory default settings. IP address will not revert to default until after a Z] command or power cycle.
Z]	Reboot	Emulates a reboot from a hard power cycle

Code	Function	Operation

HD2-RC IR Remote Emulation			
KK=	Emulate HD2-IR Button Presses	9=Power Toggle	105=Menu
		10=0	106=Right
		11=1	107=Left
		12=2	108=Up
		13=3	109=Down
		14=4	110=Enter/Select
		15=5	111=Exit
		16=6	115=CC
		17=7	141=Output Resolution 1080i
		18=8	142=Output Resolution 720p
		19=9	143=Output Resolution 480p
		21=Enter/Select	144=Output Resolution 480i
		22= Channel Up	145=Output Resolution 1080p
		23=Channel Down	146=Output Resolution 2160p/60
		24=Volume Up	147=Output Resolution Auto
		25=Volume Down	148=Output Resolution 2160p/30
		26=Mute Toggle	149=Output RGB
		27=Power On	151=Output YPbPr
		28=Power Off	153=Air
		29=Menu	154=Cable
		63=Guide	155=16:9 Ratio Pillar Box
		81=Signal	4:3 Ratio Letterbox
		82=Ratio	156=16:9 Ratio Full Wide
		85=Audio	4:3 Ratio Full
		88=Favorite	157=16:9 Ratio V Zoom
		95=List	4:3 Ratio H Zoom
		96=Add/Delete Channel	158=AC=3
		98=Air/Cable Toggle	159=PCM
		99=Dash	160=PCM Variable
		100=Info	161=Display 16:9
		101=Previous Channel	162=Display 4:3

Response Strings

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

232-ATSC 4K 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 4K. Characters will appear in status strings as lowercase 'x'.

Channel/Source Status Response String (T):

Start	Unit	CMD	Power	Major Channel	Video Mute	Input	RF	Received Resolution	Minor Channel	NA	Function
	1-9		U=On M=Off	3 digits	Unmuted	0=RF	A=Air C=Cable	0=1080i 1=720p 2=480p 3=480i 4=1080p N=No Sig	3 digits		0=None
<	1	T	U	032	U	0	C	0	002	x	0

The 232-ATSC 4K channel status is split into Major Channel and Minor Channel sections. The Minor Channel will always be 000 for analog channels. 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 indicate how many thousands (up to 63) should be added to the Major number. Example: Channel 1032 would return 032 for the Major Channel and F01 for the Minor Channel. 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 legacy 232-series volume level for compatibility with existing applications.
Volume 2 shows actual 232-ATSC 4K level, from 0-100. Audio status will be sent automatically following a volume toggle command from front panel control, IR remote, or RS-232- command.

Front Panel Mode Status Response String (S):

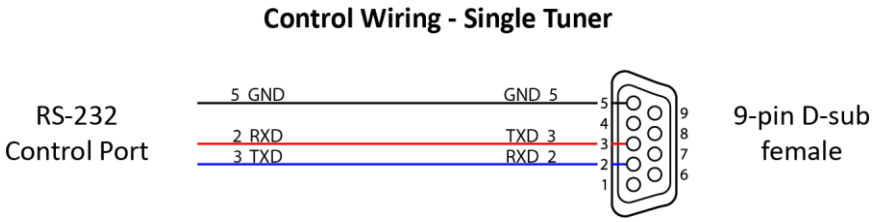
Start	Unit	CMD	Audio	Tune Mode	Lockout	Bass	Treble	Output	Output Resolution	Output Setting	NA
	1-9		N/A	0=Cable 1=Air 2=ORC 3=HRC 4=Auto	0-9	Fixed 2 digits	Fixed	0=RGB 2=YPbPr	0=1080i 1=720p 2=480p 3=480i 4=1080p 5=2160p/60 7=2160p/30	0=1080i 1=720p 2=480p 3=480i 4=1080p 5=2160p/60 6=Auto 7=2160p/30	4 digits
<	1	S	x	x	0	08	4	2	0	0	xxxx

Q Mode Response String (Q):

Start	Unit	CMD	Q0	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	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 0=Off 1=On	Digital CC Services 1-6	2 digits
<	1	Q	1	1	3	0	2	9	0	1	1	xx

RS-232 Cable Connections

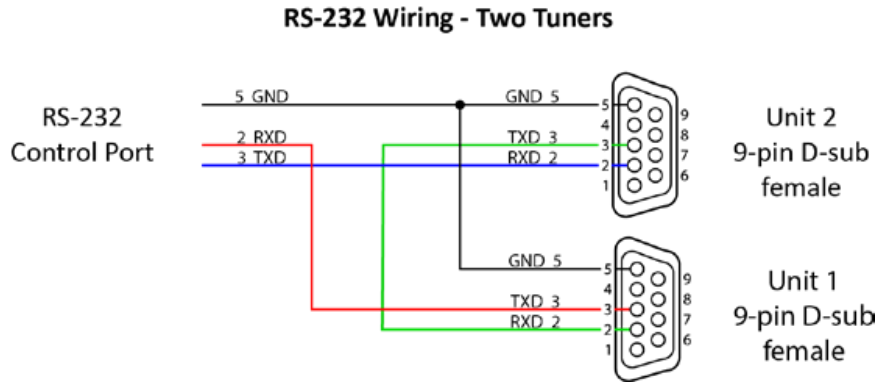
Single Tuner

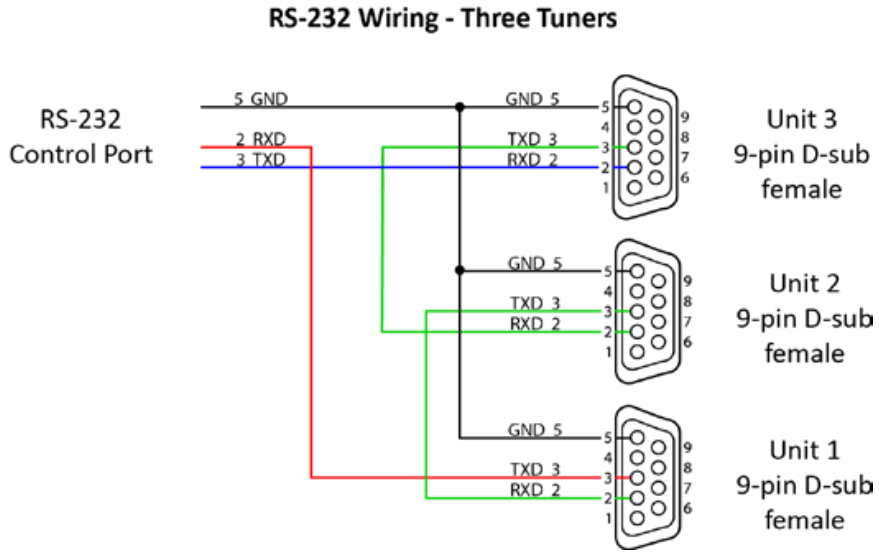


Multiple Tuners

Up to nine tuners may be daisy-chained and controlled from one RS-232 port on a control processor. Unit # addresses are required in command strings when more than one tuner is controlled 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. Contemporary Research tuners use an intelligent data bus in which the tuner with the highest Unit # receives all commands then passes through commands to tuners with lower unit numbers. The next tuner in the chain does the same, and so on.



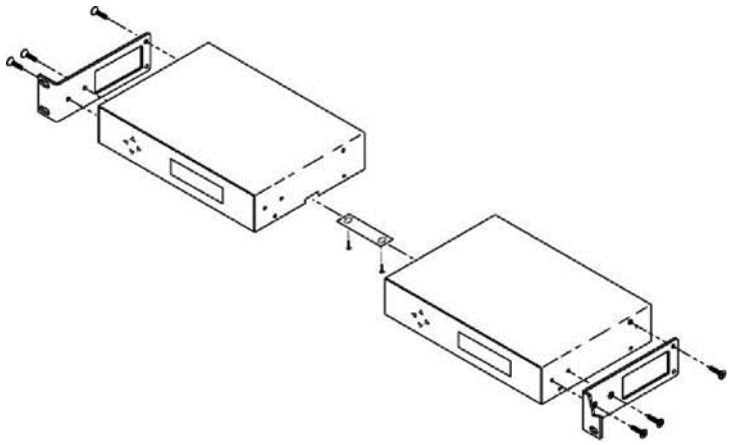


RKU Universal Rack Mount Kit

All Contemporary Research rack-mountable products will now include a Universal Rack Mounting Kit (RKU). The RKU will allow for mounting of a single unit or two units side-by-side in a 19” rack. One Universal Rack Mounting Kit will be included with the purchase of each product and will include the following parts:

- Two (2) Short Rack Ears
- One (1) Long Rack Ear
- One (1) Center Mount Tie-bar
- Six (6) 8-32 x 1/4” Screws
- Two (2) 4-40 x 3/16” Screws

2-Across Mounting

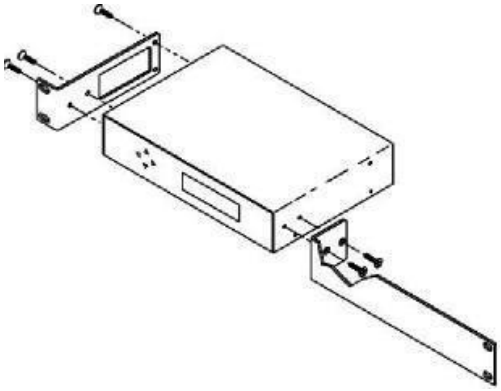


When mounting two components in one RU rack space, use the two short rack ears and the tie bar assembly.

Note that older versions of the QDA4-45 and QCA9-33 have solid side panels and should not be mounted next to components with the ventilation holes, as that will block airflow.

1. Check that the enclosures have the tie bar slot.
2. Slide the included tie bar into the side of one unit and attach with one included 4-40 x 3/16” screw, but do not tighten.
3. Slide the other unit into the tie bar, attach with the second 4-40 x 3/16” screw, and tighten both screws.
4. Add the rack mounts to the sides using the six 8-32 x 1/4” screws.

Single Unit Rack Mounting



Attach a long and short rack ear to each side at the front of the unit, using five of the 8-32 x 1/4” screws.

Specifications

Physical

Size (HWD): 8.5” [216 mm] wide x 1.75” [44 mm] high (1 RU) x 8.0” [203 mm] deep
Weight: 1.81 lbs [822 g]
Enclosure: Aluminum with black powder coat paint
Mounting: 1 RU Rack mounting for one unit or two units side-by-side (RKU, RK1, RK2EZ)
Cooling: Not required for normal applications. For installations with multiple tuners in a rack closely spaced, forced air ventilation is recommended.

Front Panel

Display: Text display, white text on blue LCD
Top line indicates channel number and name.
Lower line indicates if RGB or YPbPr output is active, resolution of current channel, and Air/Cable tuning.
IR: IR sensor
Control: Power, Menu, Setup, and Select buttons
Up and Down (Channel Up and Down) buttons Left and Right (Volume Up and Down) buttons
USB: Mini USB-B virtual com port

Rear Panel

Ethernet: RJ-45 10/100 Ethernet connector for Web page access, Telnet, UDP control, and IPTV Streaming
Service: USB-A port for alternate HD firmware update
Air/Cable: ‘F’, female, 75 ohm impedance, -10 to 25 dBmV typical
Video Output: Simultaneous HDMI and NTSC video, select between RGB and Component HD analog
Video Out: RCA composite video output, 1V p-p at 75 ohm impedance, 480i
Component Out: 3 RCA YPbPr outputs (1080p/1080i/720p/480p/480i)
RGBHV: RGB Out HD-15 female (1080p/1080i/720p/480p/480i)
HDMI: HDMI receptacle, Type A, Version 1.4b (2160p/1080p/1080i/720p/480p/480i)
Resolutions and Frame Rates:

- 480i — 29.97 Hz
- 480p, 720p — 59.94/60 Hz
- 1080i — 29.97/30 Hz
- 1080p — 60 Hz
- 2160p — 30/60 Hz HDMI only

Audio Output: Simultaneous HDMI, S/PDIF, and Analog Stereo
HDMI: AC-3/PCM/PCM variable level
Digital Audio S/PDIF: Coax and optical output, AC-3/PCM/PCM variable level
Analog Audio Out: RCA stereo variable level
RS-232: DB-9 male, RS-232 data link to control system, 1200 to 230K baud (9600 default), 8 data bits, no parity, 1 stop bit
IR In: 3.5 mm stereo jack for optional IR-RXC IR Receiver
Sleeve = DC power+ from power jack input, limited to less than 100 mA
Ring = DC power– (GND)
Tip = IR data signal
A/C: 3.5 mm control output to operate the RF-AB Air/Cable Selector Switch
Power In: 2.1 mm coaxial jack (inside center conductor positive), 1.1 A maximum, 11 to 14 VDC, 12 VDC typical, 13.2 W 45 BTU, 15.2 W 52 BTU including power supply, current draw 0.198 A@114 VAC with power supply

Tuning

Frequency Range: 51.0027 to 864 MHz
TV System: ATSC 1.0, clear QAM, NTSC
Channels: Air 2-69 (8-VSB and NTSC) and CATV 2-135 (QAM-64, QAM-256, 8-VSB, and NTSC), Standard, IRC, HRC
V-Chip: Supports parental channel block based on US and Canadian ratings

Decoding

Video: MPEG-2 (480i, 480p, 720p, 1080i), H.264 (480i, 480p, 720p, 1080i, 1080p)
Audio: AC-3, MPEG-1 Layer 2, AAC

Captions

Analog: Decodes Line 21 captions
Digital: Decodes CEA-608 and CEA-708 captions, CEA-708 captions may be customized for font size and style
Embedded Caption Data: Received caption data will be output as Line 21 caption data on the composite video output

Includes

PS12-1.5 Power Supply, 1.5 A maximum, 12 VDC (5402-001)
RKU Universal Rack Kit

Options

HD2-RC IR Tuner Remote, 4AAA batteries (5024-004)
PS12-8Y 8 A power supply with Y cable (5404-001), may be ordered with every 3-4 tuners in lieu of the included PS12-1.5 power supplies
RK1 Single Rack Kit, 1RU (5008-001)
RK2EZ Dual Rack Kit, 1RU (5408-015)
RF-AB Air/Cable Selector Switch (5077-001), includes 3.5mm cable, connects to A/C control port on tuner
IR-RXC External IR Receiver (5032-001)
CC-COM-B RS-232 Null Modem Cable (5061-003)

Trademarks

VGA and XGA are trademarks of International Business Machines
SVGA is a trademark of the Video Electronics Standard Association

HDMI
HDMI, the HDMI logo, and High-Definition Multimedia Interface are trademarks or registered trademarks of HDMI Licensing, LLC

Safety Instructions and Warranty

Read before operating equipment.

- Cleaning - Unplug this product from the wall outlet before cleaning. Do not use liquid cleaners or aerosol cleaners. Use a damp cloth for cleaning.

- Power Sources - Use supplied or equivalent UL/CSA approved low voltage DC plug-in transformer.

- 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, pro- vides 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.

- 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.

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

- 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.

- 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.

- 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 product exhibits a distinct change in performance, this indicates a need for service.

- Heat – This product should be situated away from heat sources such as radiators, heat registers, stoves, or other products (including amplifiers) that produce heat.

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.*

Warranty: Three (3) year limited warranty on all parts and labor for Contemporary Research manufactured products. Contemporary Research warrants its manufactured products against defects in materials and workmanship for a period of three years from the day of purchase by authorized dealer. If Contemporary Research receives notice of such defects during the warranty period; Contemporary Research, at its option, will repair or replace products that prove to be defective.

Exclusions: The above warranty shall not apply to defects resulting from improper or inadequate maintenance by the customer, customers applied software or interfacing, unauthorized modifications or misuse, mishandling, operation outside the normal environmental specifications for the product, use of the incorrect, modified or extended power supply, acts of God, weather, or improper site operation and maintenance. Please note Contemporary Research SSV-DX Display Express PC and Luxul Managed Switch products carry a six-month limited warranty.

Product Service: Contemporary Research will test, repair, or replace the product or products without charge if the unit is under warranty. If the product is out of warranty, Contemporary Research will test, and then repair the product or products. The parts and labor charge will be estimated by a technician and confirmed by the customer prior to repair. All components must be returned for testing as a complete unit. Contemporary Research will not accept responsibility for shipment after it has left the premises.

Technical Support: Contemporary Research technicians will determine and discuss with the customer the criteria for repair and/or replacement. Contemporary Research Technical Support can be contacted through one of the following resources: e-mail support at support@crwww.com or phone at: 972-931-2728

Return Material Authorization (RMA) Number: Before returning a product for repair or replacement, request an RMA from Contemporary Research's technical support. Provide tech support with a return phone number, e-mail address, shipping address, product serial numbers and original purchase order number. Describe the reason for repairs or returns as well as the date of purchase. See the General RMA Terms and Procedures section for more information. RMA's are valid for 30 days and will be issued to authorized Contemporary Research dealers only. End users must return products through authorized Contemporary Research dealers. Include the assigned RMA number in all correspondence with Contemporary Research. Write the assigned RMA number clearly on the shipping label of the box when returning the product.

Voided Warranty: The warranty does not apply if the original serial number has been removed or if the product has been disassembled or damaged through misuse, accident, acts of God, weather, modifications, use of incorrect, modified or extended power supply, or unauthorized repair.

Shipping and Handling: Contemporary Research will not pay for inbound shipping transportation or insurance charges or accept any responsibility for laws and ordinances from inbound transit. Contemporary Research will pay for outbound shipping, transportation, and insurance charges for all items under warranty, but will not assume responsibility for loss and/or damage by the outbound freight carrier. If the return shipment appears damaged, retain the original boxes and packing material for inspection by the carrier. Contact your carrier immediately.

Products not under Warranty: Payment arrangements are required before outbound shipment for all out of warranty products.

General RMA Terms and Procedures: RMA's are valid for 30 days and will be issued only to authorized Contemporary Research dealers only.

- End users must return products through authorized Contemporary Research dealers.
- Before a defective product can be authorized to send in for repair, it must first go through the troubleshooting process with a member of the Contemporary Research Technical Support team.
- Products authorized for repair must have a valid RMA (Return Material Authorization) number.
- Contemporary Research Technical Support will approve the issue of an RMA number.
- An RMA number is to be included in all correspondence with Contemporary Research.
- The RMA number must appear clearly on the shipping label when the product is returned.
- A packing slip must be included on the inside of the box with the RMA number listed and reason for RMA return.
- Products received at Contemporary Research that do not have a valid RMA number clearly marked on the outside of the shipping container may be refused and returned to sender.
- Boxes showing external damage will be refused and sent back to the sender regardless of the clearly marked RMA number and will remain the responsibility of the sender.

Advanced Replacement Policies: For Contemporary Research manufactured products, advance replacement will be provided for "out-of-the-box" failures up to thirty (30) days after the initial shipment of products.

Shipments of equipment that are refused upon attempted delivery, for any reason, are subject to restocking charges.