BEAM

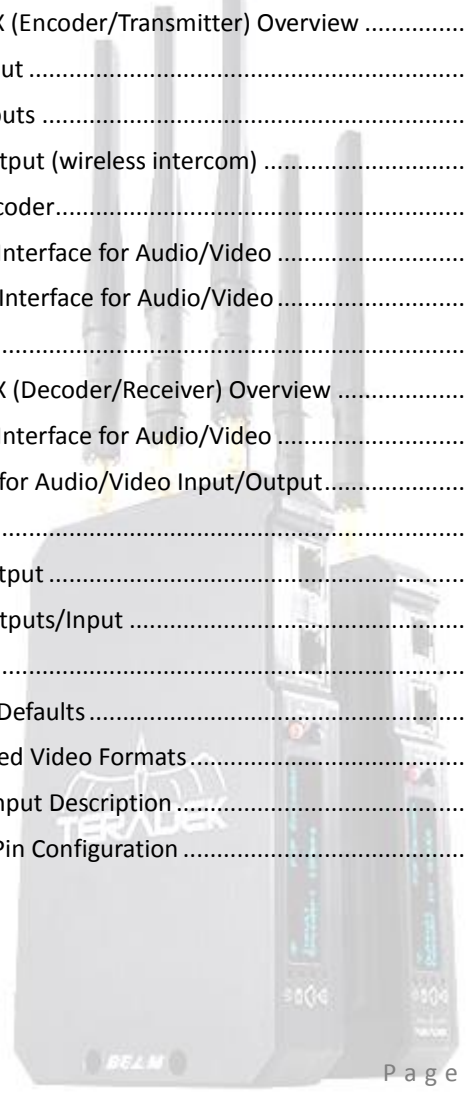
User Guide v1.3

July, 2015

Document Revision History

Revision	Date	Description
v1.0	October 1, 2014	Initial release of Beam User's Manual v1.0 based on firmware version 1.0.1
v1.1	October 14, 2014	Updated instructions for streaming to multiple RX over WiFi
V1.2	December 29, 2014	Update to match changes in Beam 1.1.0 firmware
V1.3	July 2, 2015	Update to match changes in Beam 1.2.0 firmware, including Ethernet over WiFi (p. 13)

Contents



1. Introduction

1.1 About this Manual

This user manual provides step-by-step instructions for the setup and configuration of Beam.

1.2 Overview

Beam is a WiFi-equipped H.264 encoder for applications demanding high quality, low-latency video transmission. Beam can transmit to up to 4 decoders over WiFi or an unlimited number on a wired network using multicast. Beam supports SD/HD/3G-SDI video inputs with embedded stereo audio and bidirectional stereo IFB communication. Beam can stream video in RTP and MPEG-TS formats, re-stream from the decoder, and more.

1.3 Features

Video

- High performance SD/HD/3G-SDI transmission over Wi-Fi or Ethernet LAN (IP)
- H.264 encoding/decoding engine: Baseline profile level 4.2 with de-interlacing
- Full HD encoding up to 1920x1080p60
- Streaming server function on both Beam TX and Beam RX
- Very low encode/decode end-to-end latency in 1080i59.94 HD: 70ms ~ 80ms
- Single video stream + stereo audio
- SDI/HD-SDI/3G-SDI supported for PAL, NTSC and full HD video
- Supports DTV Standards
    - SMPTE 244, BT601 (NTSC): 525i59.94
    - IEC61179-5, BT601 (PAL): 625i50
    - SMPTE 296M: 720p23.98, 720p24, 720p25, 720p30, 720p50, 720p59.94, 720p60
    - SMPTE 274M: 1080i50, 1080i59.94, 1080i60, 1080PsF23.98,1080PsF24, 1080PsF25, 1080PsF29.97, 1080PsF30, 1080p23.98, 1080p24, 1080p25, 1080p29.97, 1080p30, 1080p50, 1080p59.94, 1080p60
- Supported bitrates : 100kbps - 30Mbps over Wireless, 50Mbps over Ethernet
- Error resiliency : Variable GOP size, random intra-refresh, contiguous intra-refresh, I-frame control

Audio

- SD/HD/3G-SDI embedded audio
- Mini-stereo phone jack in and out for analog stereo audio
- Analog stereo audio: 48kHz sampling with 16 bit ADC
- Wireless IFB audio from TX to RX and from RX to TX with 8kHz sampling and 16bit ADC

Network

- Wireless Output for Audio/Video : Supporting IEEE 802.11n/5GHz
- Wide radio coverage up to 800m (2,500ft) with 12Mbps at line of sight
- Ethernet port for audio/video transmission: Ethernet LAN (10/100 BASE-TX, Cat.5e UTP cable)
- 1 TX to 1 RX connection or 1 TX to 4 RX connections on wireless mode

- One to one connection & one to many connection on the Ethernet LAN mode
- Multi-casting and simulcast modes to both the Beam RX and software decoder on PC
- RTSP streaming server or MPEG-TS streaming device over Wi-Fi or LAN port on the Beam TX
- RTSP streaming relay server over LAN port on the Beam RX

User Interface

- Internet Explorer/Chrome web browser for changing system configurations or firmware upgrade
- USB for firmware upgrade
- OLED front panel for configuration and status information
- RS-422 serial port for relaying bidirectional external control signals

1.4 Package Contents

Front View Back View

Beam TX

Front View Back View

Beam RX

AC/DC Power adapter (2-pin Lemo) x 1

Antenna x 6

1.4.1 Front and Rear panel of Beam TX

Front View

Item	Component	Description
1	Power (LED)	This LED shows the power status
2	Video (LED)	This LED shows the SDI video input signal status. This LED illuminates when video is present and the TX is encoding
3	Link (LED)	This LED shows the link status. This LED illuminates when a valid client is connected
4	Fault (LED)	This LED illuminates during boot up, or if an error occurs
5	OLED Display	The OLED display contains multiple status and configuration screens. These can be navigated using the Status (6) and Menu (7) joysticks. The main status screen (shown) displays the WiFi or Ethernet status at top left, the device mode, video resolution (if connected), and the encoder bitrate
6	Status Joystick	Use the status Joystick to cycle between Beam's status screens. Separate screens contain information about the WiFi, Ethernet, video resolution, and firmware version
7	Menu Joystick	Use the menu joystick to view and modify Beam's configuration
8	RS-422	RS-422 interface (See section 3.7 for pin description)
9	LAN	RJ-45 Ethernet LAN port

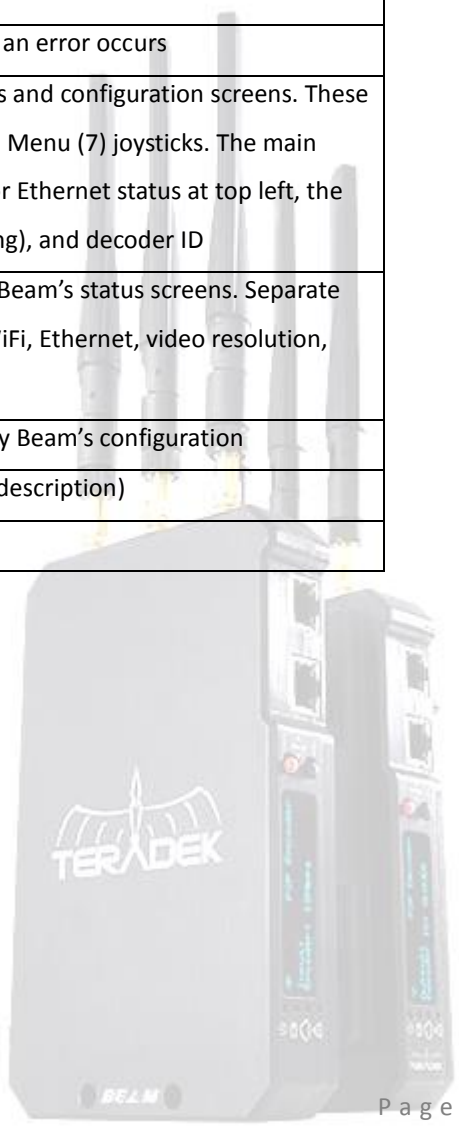
Rear View

Item	Component	Description
1	Power Input	2-pin Lemo DC Input (7-17V)
2	Power switch	On/off switch
3	USB Port	Used for Firmware upgrade
4	Aux. Audio out	IFB audio (Intercom) stereo output (Analog)
5	Aux. Audio in	IFB audio (Intercom) stereo input (Analog)
6	SDI output	SD/HD/3G-SDI looped output
7	SDI input	SD/HD/3G-SDI input

1.4.2 Front and Rear panel of Beam RX

Front View

Item	Component	Description
1	Power (LED)	This LED shows the power status
2	Video (LED)	This LED shows the SDI video output signal status. It will blink when there is no SDI video signal output, and will light when SDI video signal is outputting
3	Link (LED)	This LED shows the Wi-Fi link status. This LED illuminates when video is received from the TX
4	Fault (LED)	This LED illuminates during boot up, or if an error occurs
5	OLED Display	The OLED display contains multiple status and configuration screens. These can be navigated using the Status (6) and Menu (7) joysticks. The main status screen (shown) displays the WiFi or Ethernet status at top left, the device mode, video resolution (if decoding), and decoder ID
6	Status Joystick	Use the status Joystick to cycle between Beam's status screens. Separate screens contain information about the WiFi, Ethernet, video resolution, and firmware version
7	Menu Joystick	Use the menu joystick to view and modify Beam's configuration
8	RS-422	RS-422 interface (See section 3.7 for pin description)
9	LAN	RJ-45 Ethernet LAN port



Rear View

Item	Component	Description
1	Power Input	2-pin Lemo DC Input (7-17V)
2	Power switch	On/off switch
3	USB Port	Used for Firmware upgrade
4	Aux. Audio out	IFB audio (Intercom) stereo output (Analog)
5	Aux. Audio in	IFB audio (Intercom) stereo input (Analog)
6	Audio output	Program audio output
7	SDI output	SD/HD/3G-SDI output

1.5 Quick Start Guide

Connect and Power Your Device

1. Connect the SDI output from your video source to the SD/HD/3G-SDI input on the Beam TX. Connect the SD/HD/3G-SDI output from the Beam RX to the SDI input on your monitor.
2. Connect power to your Beam TX using the included A/C adapter or a compatible AB/V-mount battery. Power the Beam RX with the included A/C adapter.
3. Attach the included antennas to the Beam TX and RX.
4. Move the power switches on both the transmitter and receiver to the ON position. Boot up time is approximately 45 seconds.

Wireless operation

1. The Beam TX and RX are pre-configured for point-to-point operation over WiFi. When powered on, they will connect to the same Wireless network, TeradekBeam_00 (SSID number may vary if multiple units are purchased together).
2. Beam TX can send video to up to four RX units over WiFi. To enable multicast, enter the Beam TX *Streamer* menu and set the *Mode* to Multicast. Do the same for all Beam RX units. Next, set a different Decoder ID for each receiver, available values are 1 to 4. This can be configured via the Beam RX front panel, under the Decoder ID menu.

Ethernet operation

1. Connect the Beam TX and RX LAN ports to a network switch. The TX and RX default IP addresses are 192.168.0.161 and 192.168.0.162, respectively.
2. Enter the WiFi menu on the TX and select ‘Ethernet LAN’. Repeat this process on the RX.

3. After the network mode is switched, the TX will transmit to the RX.

Network settings can be changed using Beam's web interface. See the next section for information on configuring the network interfaces.

Accessing the Configuration Interface

To access Beam's configuration interface via Ethernet, connect a computer to the same network as Beam TX or RX. Change the computer's IP address to 192.168.0.100 (or any other valid value not equal to 192.168.0.161 or 192.168.0.162). Next, open a web browser and navigate to http://192.168.0.161 to access the TX, or http://192.168.0.162 to access the RX.

To access Beam's configuration interface via WiFi, connect a computer to the Beam TX's WiFi network. The TX is available at http://192.168.2.1 and the RX can be accessed at http://192.168.2.2.

Video/audio streaming server for RTSP client

1. First, enable the RTSP Server on the Beam TX. To do this, enter the *Streamer* menu on Beam's front panel, select *RTSP Server* and set it to enabled. Verify that the *Streamer -> Encapsulation* value is set to *RTP*.
2. The RTSP URL is *rtsp://192.168.0.161:8554/stream* when streaming over Ethernet from a Beam TX, or rtsp://192.168.2.1:8554/stream if streaming over WiFi. Note that the URL will change if the Ethernet address is changed.

Streaming video to VLC player/set-top box via MPEG-TS

Beam TX can stream to a software decoder or set-top box over IP by using the MPEG Transport Stream (MPEG-TS) stream type.

1. From the Beam TX front panel, Enter the WiFi menu and select Ethernet LAN.
2. Open the Beam TX web UI and Navigate to the *Streaming Control* page. Set the *Encapsulation* to TS2UDP, and enter the decoder client's IP address (P2P mode) or multicast group IP address (Multicast mode). Click Submit.
3. Next, navigate to *Encoder Control* and set the *Coding Mode* to Frame Encoding. Click *Submit*, and then *Save*.
4. If the Beam TX is set to P2P mode, the stream URL (for players like VLC), will be *udp://@:1234/* and *udp://@227.2.2.7:1234/* in multicast mode (replace the default group IP or 227.2.2.7 with the group IP configured in step 2, if necessary).

2. Operating the Beam TX and RX

2.1 Front Panel Operation

Status Screens

Cycle through status screens or return from the menu by pressing the red *Status* joystick.

- Main Status screen – The main status screen displays the WiFi/Ethernet status, and encoder/decoder mode. On the Beam TX, video input and encoder bitrate are also displayed. On Beam RX the decoder output and ID are displayed instead.
- WiFi – Displays the WiFi SSID and wireless IP address.
- Ethernet – Displays the current Ethernet IP address.
- System – Displays the device serial number and firmware version.

Menu Operation

Launch the menu and navigate through it with the black 'Menu' joystick.

Beam TX

Encoder – Contains controls for the encoding bitrate and frame rate

- Bitrate – Select bitrates between 5 and 30 mbps from this menu. Settings take effect immediately after they are applied.
- Frame rate – Select from *Same as input, 25*, *30*, *50*, or *60* frames per second.

WiFi – This menu allows you to configure the WiFi SSID and channel, or to enable Ethernet LAN mode.

- WiFi Channels/SSIDs – The Following options are available:

SSID	**Wi-Fi Ch. (Frequency)**	**SSID**	**Wi-Fi Ch. (Frequency)**
TeradekBeam_00	36 (5180 MHz)	TeradekBeam_07	157 (5785MHz)
TeradekBeam_01	44 (5220MHz)	TeradekBeam_08	36 (5180 MHz)
TeradekBeam_02	149 (5745MHz)	TeradekBeam_09	44 (5220MHz)
TeradekBeam_03	157 (5785MHz)	TeradekBeam_10	149 (5745MHz)
TeradekBeam_04	36 (5180 MHz)	TeradekBeam_11	157 (5785MHz)
TeradekBeam_05	44 (5220MHz)	Ethernet LAN	N/A
TeradekBeam_06	149 (5745MHz)		

- Ethernet LAN mode – Select Ethernet LAN when using MPEG-TS or multicast over a wired network.

Streamer

- Mode – Select *P2P* mode when streaming to a client via WiFi or to a single receiver on a LAN. Select *Multicast* when streaming to 2-4 Beam receivers wirelessly or to many devices over a multicast-enabled wired network.
- Encapsulation – Select *RTP* when streaming to a Beam RX or when the RTSP server is enabled. Select *UDP TS* when using MPEG-TS to a compatible decoder.
- RTSP Server – Enabling this allows multiple clients to pull the stream from an encoder using the RTSP stream mode.

Audio

- Mode – Select *Stereo*, *Mono*, or *Disabled* for the primary embedded audio stream.
- IFB – Select *Enabled* to allow for two-way stereo talkback communication.

Factory Default – To reset all settings to their factory default values, select this menu, and then select Reset All Settings. The device reboots after the configuration is reset.

Beam RX

Decoder – Use this menu to set the decoder ID value. When streaming from one Beam TX to multiple Beam RX units, each RX must be configured with a different ID. There are four different IDs available.

WiFi – This menu allows you to configure the WiFi SSID and channel, or to enable Ethernet LAN mode. See the encoder WiFi menu description for the available options.

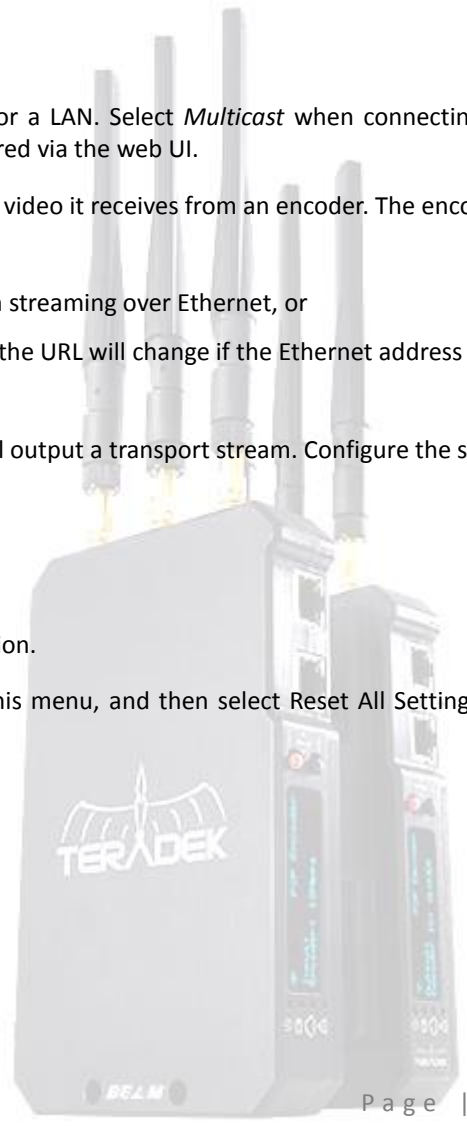
Streamer

- Mode – Select *P2P* mode when streaming point-to-point over WiFi or a LAN. Select *Multicast* when connecting to a multicast encoder. If multicast is selected, the *Group IP* can be configured via the web UI.
- Relay Server – Enable this to allow the Beam decoder to re-stream the video it receives from an encoder. The encoder determines whether the relay server uses RTSP or MPEG-TS.
    - RTSP: stream available at *rtsp://192.168.0.162:8554/stream* when streaming over Ethernet, or rtsp://192.168.2.2:8554/stream if streaming over WiFi. Note that the URL will change if the Ethernet address is changed.
    - MPEG-TS: If the encoder encapsulation is UDP TS, the decoder will output a transport stream. Configure the stream destination and port via the web UI.

Audio

- IFB – Select *Enabled* to allow for two-way stereo talkback communication.

Factory Default – To reset all settings to their factory default values, select this menu, and then select Reset All Settings. The device reboots after the configuration is reset.

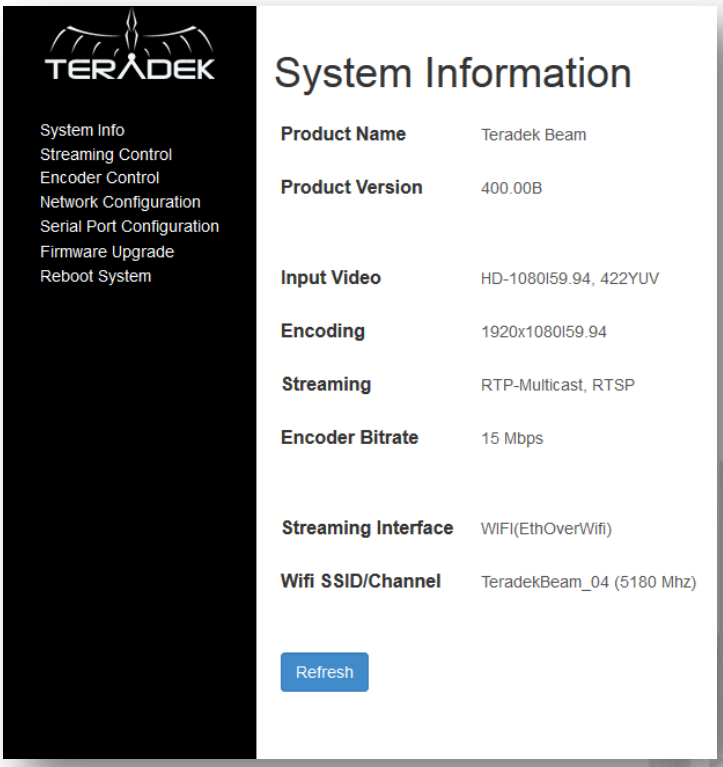


2.2 Web-based Operation

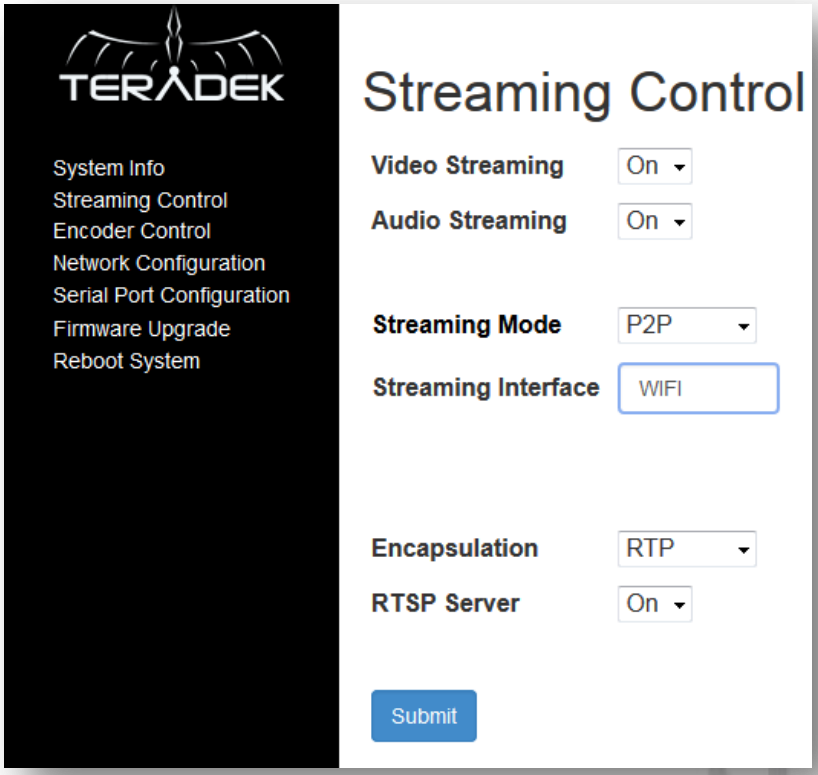
All Beam TX and RX parameters (except the WiFi/LAN mode) can be configured via Beam's web interface. The interface can be accessed by connecting to the same network as Beam and opening the device's IP address in a web browser. The current IP address can be seen on Beam's front panel display.

Beam TX

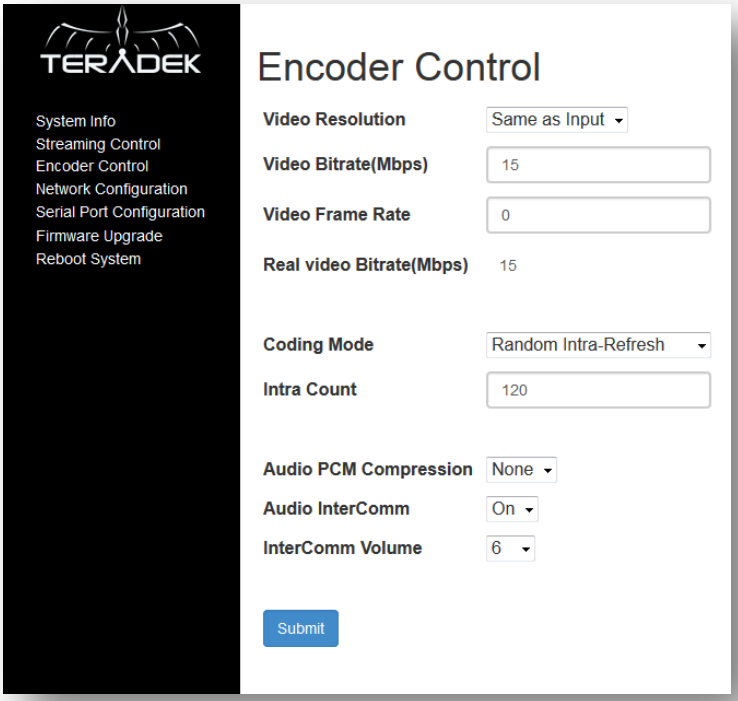
System Information



Item	Description
Product Name	Displays the product name.
Product Version	Firmware version number.
Input Video	Displays the video input resolution if a video signal is present.
Encoding	Indicates whether or not the Encoder is running.
Streaming	Displays the current encapsulation (RTP/TS2UDP), encoder mode (P2P or Multicast), and whether or not the RTSP server is enabled.
Encoder Bitrate	Current Encoder Bitrate.
Streaming Interface	Current streaming interface: WiFi or Ethernet LAN.
Wi-Fi SSID/Channel	Disaplys the current WiFi SSID and channel (frequency): 36(5180MHz), 44(5220MHz), 149(5745MHz), or 157(5785MHz).



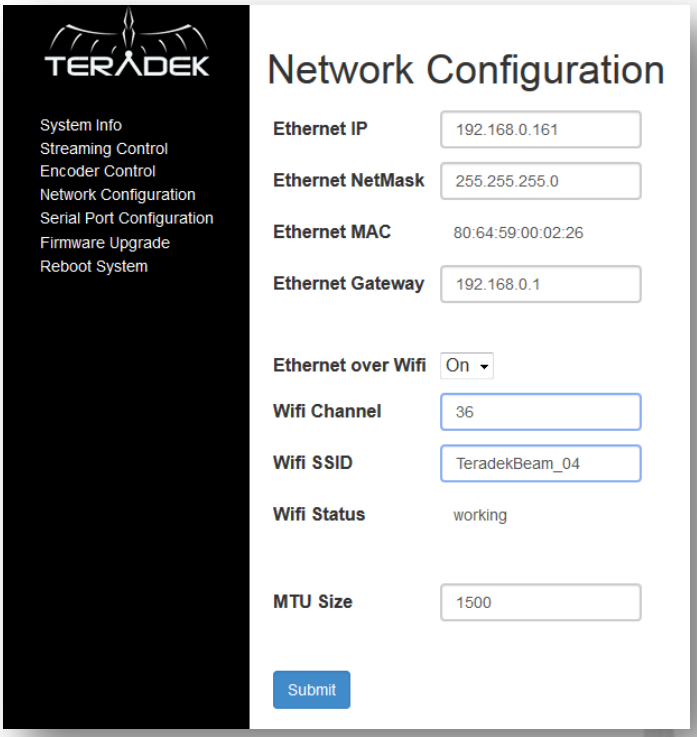
Item	Description
Video Streaming	Select *On/Off* to enable or disable Video Streaming.
Audio Streaming	Select *On/Off* to enable or disable Audio Streaming.
Streaming Mode	Select *P2P* mode when streaming to a client via WiFi or to a single Beam RX on a LAN. Select *Multicast* when streaming to multiple devices over a multicast-enabled network.
Streaming Interface	Current streaming interface: WiFi or Ethernet LAN, this can be configured from Beam's front panel.
Encapsulation	Select *RTP* when streaming to a Beam RX or when the RTSP server is enabled. Select *UDP TS* when using MPEG-TS to a compatible decoder.
RTSP Server	Enabling this allows multiple clients to pull the stream from an encoder using the RTSP stream mode. Beam RX can still decode video while other RTSP clients are connected.



Item	Description
Video Resolution	Select *Same as Input*, 720, or 480 to set the streamed video resolution.
Video Bitrate	Use this to set the video bitrate, in Mbps. Maximum bitrates are 30 Mbps over WiFi, and up to 50 Mbps over Ethernet, depending on the video resolution.
Video Frame Rate	Frame rate can be set to any value up to the source frame rate. Set this to zero to match the input frame rate.
Coding Mode	Select Frame coding, Random Intra-refresh, or continuous intra-refresh. Frame coding is necessary for MPEG-TS, while random intra-refresh gives the best encoding performance at a given bitrate.
Intra Count/GOP size	When using intra-refresh modes, this specifies the amount of I-frame segments. In Frame coding mode, GOP size specifies the number of frames between I-frames.
Audio PCM Compression	Select *None*, aLaw, or uLaw. None: no PCM linear compression is applied. 768kbps for one channel audio, and 1,536kbps for stereo audio. aLaw: European standard of G.711 compression. 384kbps for one channel audio, and 768kbps for stereo audio. uLaw: North American standard of G.711 compression. 384kbps for one

	channel audio, and 768kbps for stereo audio.
Audio Intercomm	Select *On* to allow for two-way stereo talkback communication.
Intercomm volume	Adjusts the IFB output volume

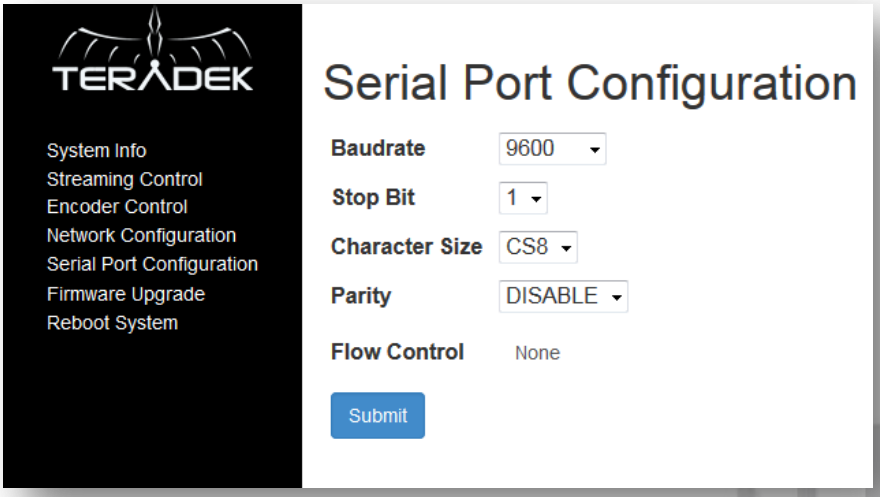
Network Configuration



Item	Description
Ethernet IP	Displays the current IP address and allows users to set a new value. Note that if the IP address is changed, you will need to reload the web UI using the new address.
Ethernet NetMask	Displays the current subnet mask and allows users to set a new value.
Ethernet MAC	Displays the device's MAC address.
Ethernet Gateway	Displays the Ethernet gateway IP address and allows users to set a new value.
Ethernet over WiFi	When set to On, Beam's Ethernet ports are bridged over the wireless connection. In a typical network environment, no additional configuration is required for other network devices to communicate across the bridged connection. The Ethernet bridge takes approximately 30 seconds to establish after network cables are connected.
WiFi Channel	Displays the current WiFi channel. This value can be changed from

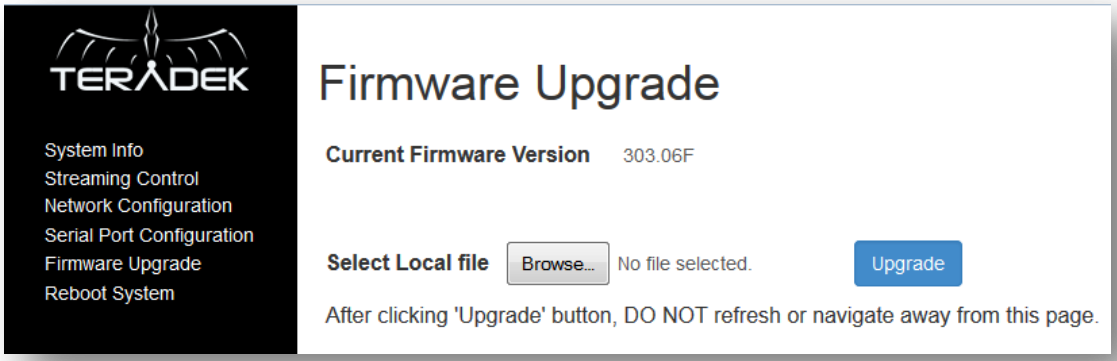
	Beam's front panel.
WiFi SSID	Displays the current WiFi SSID. This value can be changed from Beam's front panel.
WiFi Status	Indicates whether or not the WiFi is enabled.

Serial Port configuration



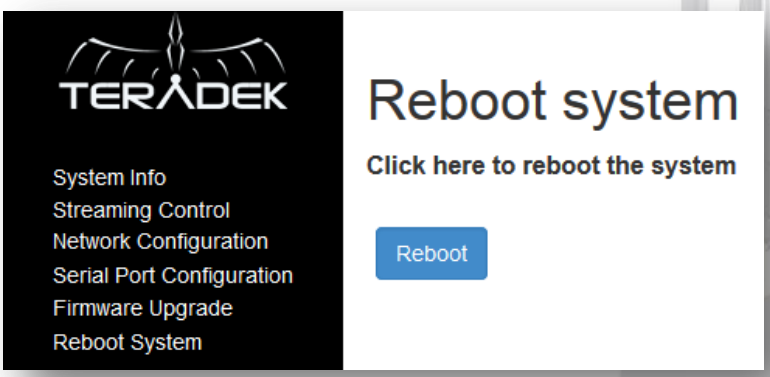
Item	Description
Baud Rate	Sets the serial port baud rate. This should match the receiver's baud rate and the equipment you wish to connect.
Stop Bit	Sets the stop bit – 1 or 2.
Character Size	Character size can be set from 5 bits (*CS5*) to 8 bits (*CS8*).
Parity	Set to *Odd, Even, or Disable.*
Flow Control	Flow Control is disabled.

Save Changes



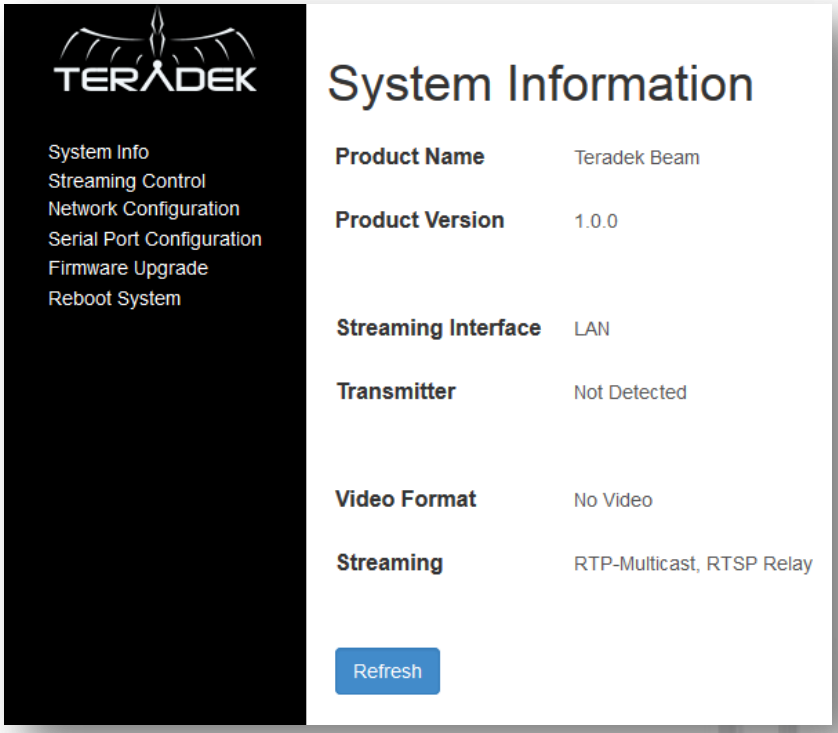
Item	Description
Current Firmware Version	Indicates the Device's current firmware version.
Select Local File	Allows users to browse for a locally stored firmware image. Firmware can be found at Teradek.com. After selecting the file, click 'Upgrade' and follow the instructions. The device will reboot after an update.

Reboot System

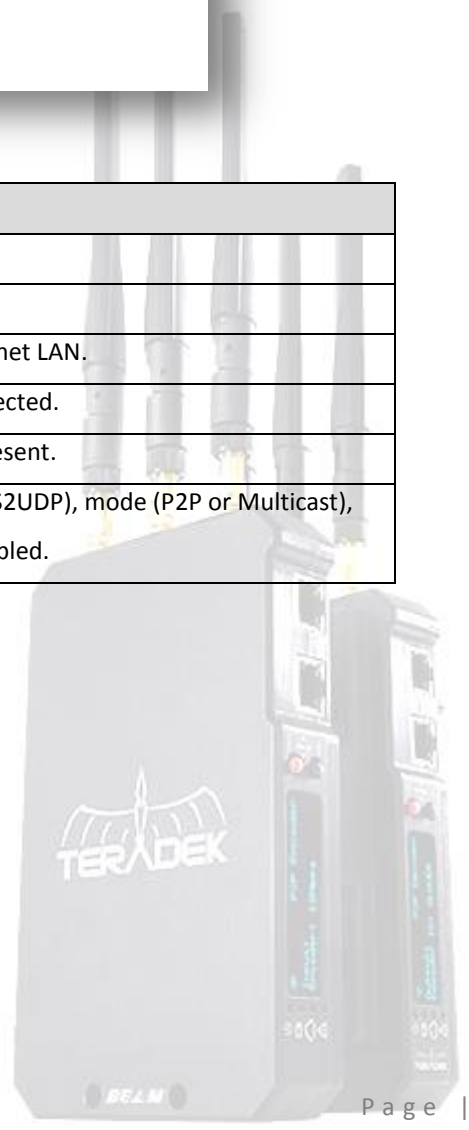


Item	Description
Reboot	Click on "Reboot" will restart the system with all settings which were modified and saved. It will show the "Reboot" button one more time to confirm rebooting the system.

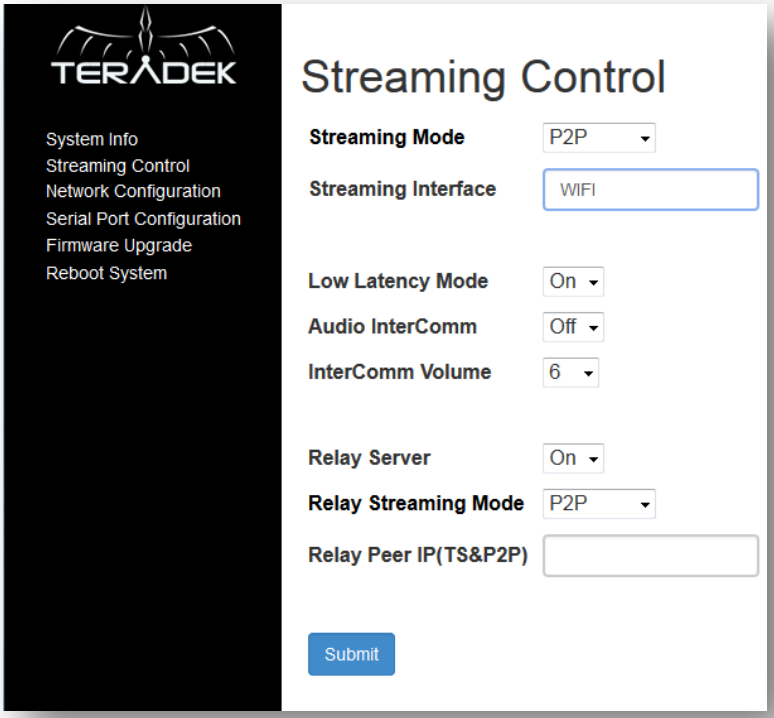
System Configuration



Item	Description
Product Name	Displays the product name.
Product Version	Firmware version number.
Streaming Interface	Current streaming interface: WiFi or Ethernet LAN.
Transmitter	Indicates whether or not a Beam TX is detected.
Video Format	Displays the detected stream format, if present.
Streaming	Displays the current encapsulation (RTP/TS2UDP), mode (P2P or Multicast), and whether or not the RTSP server is enabled.



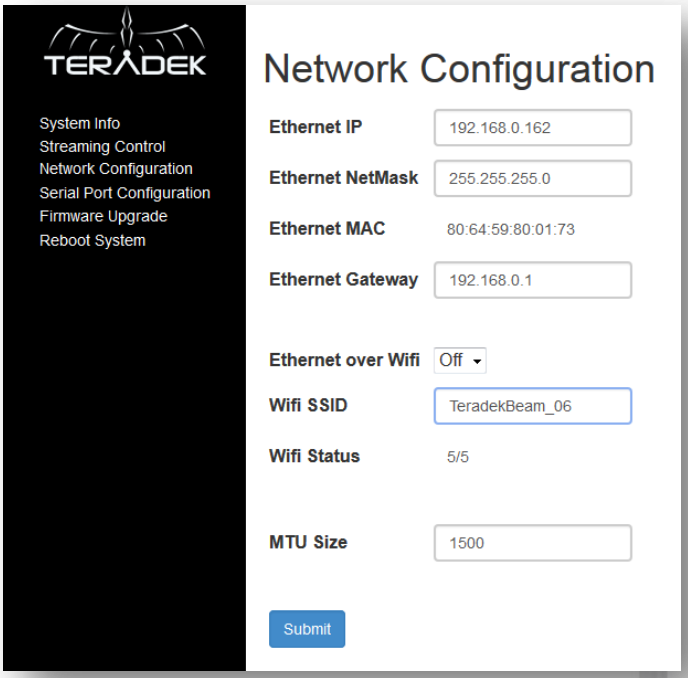
Streaming Control



Item	Description
Streaming Mode	Select P2P mode when streaming over WiFi, or when connecting point-to-point over a LAN. Select Multicast when connecting to a multicast encoder.
Streaming Interface	Current streaming interface: WiFi or Ethernet LAN. This can be configured via Beam's Front panel.
Peer IP (LAN)	In P2P mode, set the Peer IP to the encoder's IP address. This option is hidden when streaming via WiFi.
Group IP (Multicast)	In Multicast mode, set the Group IP to match the address configured at the Beam TX. This option is hidden when streaming via WiFi.
Low Latency Mode	Select On to minimize streaming latency when streaming video only. Select Off to improve audio performance. Latency difference is approximately one frame.
Audio Intercomm	Select *On* to allow for two-way stereo talkback communication.
Intercomm volume	Adjusts the IFB output volume.
Relay Server	Enable this to allow the Beam decoder to re-stream the video it receives from an encoder. The encoder determines whether the relay server uses RTSP or MPEG-TS. The decoder can output video and relay the stream simultaneously.
RTSP Streaming Mode	Select whether to use Unicast (P2P) or Multicast for the decoder's Relay server. When multicast is enabled, the RTSP stream is still available at

	rtsp://192.168.0.162:8554/stream (replace the IP address with the decoder's Ethernet LAN or WiFi address, not the multicast group IP).
Relay Peer/Group IP	Enter your TS stream destination (when relaying Transport Stream), or group IP address (Transport Stream and RTSP).
Relay Multicast TTL	Enter a value between 1 and 255 for the multicast TTL.

Network Configuration



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Ethernet IP	Displays the current IP address and allows users to set a new value. Note that if the IP address is changed, you will need to reload the web UI using the new address.
Ethernet NetMask	Displays the current subnet mask and allows users to set a new value.
Ethernet MAC	Displays the device's MAC address.
Ethernet Gateway	Displays the Ethernet gateway IP address and allows users to set a new value.
Ethernet over WiFi	When set to On, Beam's Ethernet ports are bridged over the wireless connection. In a typical network environment, no additional configuration is required for other network devices to communicate across the bridged connection. The Ethernet bridge takes approximately 30 seconds to establish after network cables are connected.
WiDi SSID	Displays the current WiFi network name.
WiFi Status	Indicates whether or not the WiFi is enabled.


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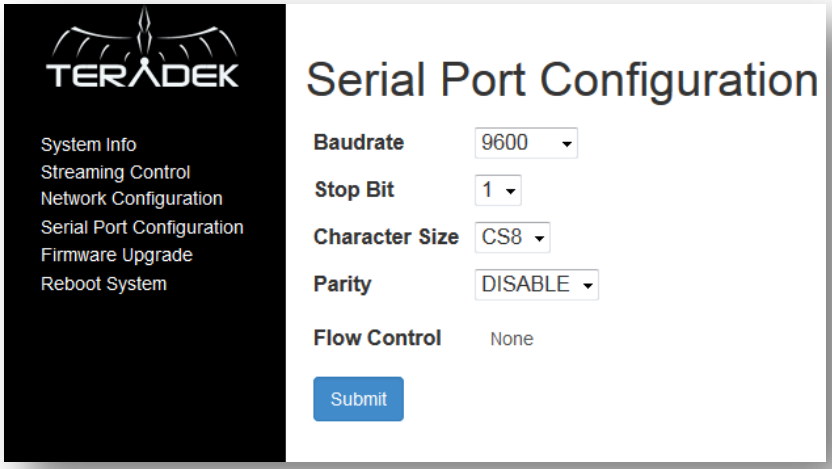
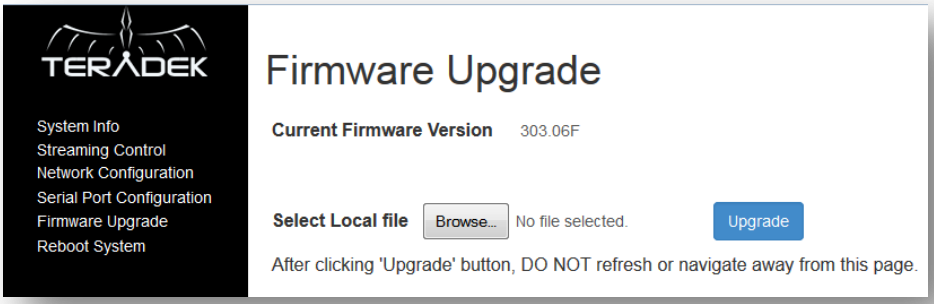


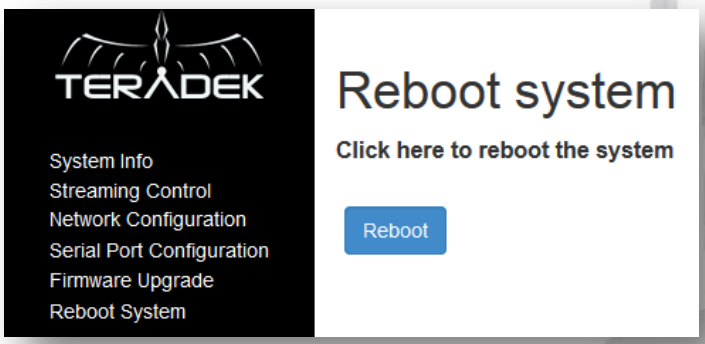
Item	Description
Baud Rate	Sets the serial port baud rate. This should match the transmitter's baud rate and the equipment you wish to connect.
Stop Bit	Sets the stop bit – 1 or 2.
Character Size	Character size can be set from 5 bits (*CS5*) to 8 bits (*CS8*).
Parity	Set to *Odd, Even, or Disable.*
Flow Control	Flow Control is disabled.

Firmware Upgrade



Item	Description
Current Firmware Version	Indicates the Device's current firmware version.
Select Local File	Allows users to browse for a locally stored firmware image. Firmware can be found at Teradek.com. After selecting the file, click 'Upgrade' and follow the instructions. The device will reboot after an update.

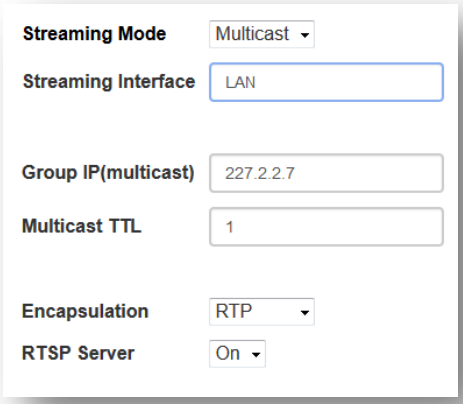
Reboot System



Item	Description
Reboot	Click on "Reboot" will restart the system with all settings which were modified and saved. It will show the "Reboot" button one more time to confirm rebooting the system.

2.3 Operation of Multicast for 1:N A/V Transmission

Beam TX can be configured to stream a single multicast stream over a LAN for decoding at multiple BEAM RX units. This section describes the necessary configuration.



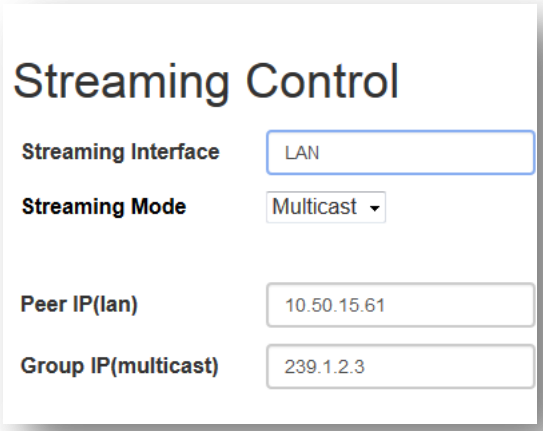
Beam TX configuration via Web UI

1. Ensure that the Beam TX is set to Ethernet LAN mode via the front panel.

2. Open your browser to the Beam TX web configuration interface and navigate to the Streaming Control page.

3. Select Multicast for the streaming mode and click Submit.

4. You can specify any valid multicast group IP address within the range 224.0.0.0 to 239.255.255.255. The default value is 227.2.2.7.



Beam RX configuration via Web UI

1. Ensure that each Beam RX to be used is set to Ethernet LAN mode via the front panel.

2. Open your browser to the Beam RX web configuration interface and navigate to the Streaming Control page.

3. Select Multicast for the streaming mode and click Submit.

4. Configure the Group IP (multicast) value to match the value set at your Beam TX.

NOTE: Multicast streaming requires properly configured multicast-capable networking equipment. Failure to configure your network infrastructure correctly may cause the encoder's stream traffic to broadcast over the entire network.

2.4 Connecting to Beam TX's WiFi Network

Computers and tablets can connect directly to the Beam TX WiFi network, if active. Connected devices can preview the video and access Beam's configuration interface.

Depending on Which WiFi channel is selected, Beam's WiFi SSID will be advertised as *TeradekBeam_xx*, where *xx* is a two digit number. The default SSID is *TeradekBeam_00* and SSIDs range from 00 to 11. The current SSID can be seen on Beam's front panel display.

After finding Beam's network with your WiFi utility, you will need to enter a WPA password. The password is *xyj<SSID>*, where *<SSID>* is the current SSID. This value cannot be modified.

Once connected, Beam TX will assign your device an IP address in the 192.168.2.x range. Beam TX's web interface can be accessed at *192.168.2.1*, and the RTSP stream (if RTSP server is enabled) can be opened with *rtsp://192.168.2.1:8554/stream*. Beam RX can be found at 192.168.2.2.

Please see your computer or tablet's user guide for information on connecting to Wireless networks.

Note: Beam operates on the 802.11a/n 5GHz band. Ensure that your device has a 5GHz compatible wireless adapter.

3. System Specifications

3.1 General

Video Compression	H.264 Baseline Profile Level 4.2 with de-interlacing	
System Latency	70 ~ 80 millisecond end-to-end delay between Transmitter and Receiver	
Digital Video In/Out	SD-SDI, HD-SDI, 3G-SDI	
Video Port	TX: SDI input and looped output, RX: SDI output	
Supported Video Resolutions	SMPTE 244	480i59.94 (NTSC), 480i60 (861-D)
	IEC61179-5	576i50 (PAL)
	SMPTE 296M	720p23.98, 720p24, 720p25, 720p29.97, 720p30, 720p50, 720p59.94, 720p60
	SMPTE 274M	1080i50, 1080i59.94, 1080i60, 1080PsF23.98,1080PsF24, 1080PsF25, 1080PsF29.97, 1080PsF30, 1080p23.98, 1080p24, 1080p25, 1080p29.97,1080p30, 1080p50, 1080p59.94, 1080p60
SDI Compliance	SMPTE 259M BT.656	SDTV Digital Signal/Data Serial Digital Interface
	SMPTE 292M BT.1120	1.5Gb/s Signal/Data Serial Digital Interface
	SMPTE 425M (option)	3Gb/s Signal/Data Serial Digital Interface
	SMPTE 299M	16bit Digital Audio Format for SMPTE 292M
	SMPTE 352M	Video Payload Identification for Digital Interfaces
Main Digital Audio In/Out	TX/RX	SDI embedded audio: 48kHz 16-bit stereo linear PCM
Main Analog Audio Out	RX	48kHz 16-bit stereo linear PCM with mini stereo phone output jack
Talk-Back Analog Audio In/Out	RX/TX	8kHz 16-bit stereo linear PCM with mini stereo phone input/output jack
Radio Power	Aggregate Power: 150mW (22dBm), 50mW (17dBm)/antenna	
Radio standard	IEEE 802.11a/n: OFDM	
Frequencies	U-NII-1 (5.15~5.25 GHz), U-NII-3 (5.725~5.85 GHz)	

Antenna	3T x 3R MIMO, 3 antennas per Beam TXW/Beam RXW
Security	802.1x, 802.11i, WPA2, WPA and WEP 64/128 TKIP 128bit AES
Ethernet LAN	10/100 BASE-TX, RJ-45 jack
External Control	Full duplex RS422 serial port
USB	Firmware upgrade without PC
Power Input/ Consumption	DC 7V - 17/ 12 Watts
Dimensions (H x W x D)	323 x 30 x 118 (mm), Including mount plates: 315 x 60 x 118 (mm)
Weight (g)	520g, Including mount plate: 695g
Operating Temperature	Operating from 0°C ~ 50°C

3.2 Beam TX (Encoder/Transmitter) Overview

Video Input

- SD-SDI, HD-SDI or 3G-SDI
- Pass-through SDI output port

Audio Inputs

- SD-SDI/HD-SDI/3G-SDI: Embedded audio
- Analog stereo audio for wireless intercom: 8kHz sampling with 16-bit resolution

Audio Output (wireless intercom)

- Audio received from RX IFB Audio Input: 8kHz sampling with 16-bit resolution per channel

Video Encoder

- H.264 (MPEG-4 part 10 : AVC)
- Baseline Profile with Level 4.2 (up to 1920 x 1080p60)
- Encoding rate of max. 30Mbps for 1080p60/50 over WiFi, 50Mbps over Ethernet LAN
- Encoding rate selectable via front panel or web UI
- Video downscaling function:
    - 1080i60/59.94 → 480i60/59.94
    - 1080p60/59.94 → 720p60/59.94 or 480p60/59.94
    - 720p60/59.94 → 480p60/59.94

Wireless Interface for Audio/Video

- Supporting IEEE802.11n (5 GHz)
- MIMO interface (3x3)
- Coverage: up to 800m (2500 ft) at line of sight (LOS)

- Frequency selection via front panel interface

Ethernet Interface for Audio/Video

- 10/100 BASE-TX, Cat.5e UTP cable (100~150m)
- Multicasting over Ethernet LAN environment
- RTSP streaming server & MPEG-TS streaming
- MPEG-TS streaming: H.264 NAL video and 48kHz linear PCM audio only

Other

- USB for firmware upgrade
- RS422 serial port for bi-directional external control

3.3 Beam RX (Decoder/Receiver) Overview

Wireless Interface for Audio/Video

- Supporting IEEE802.11n (5 GHz)
- MIMO interface (3x3)
- Coverage: up to 800m (2500 ft) at line of sight (LOS)
- Multiple receiver operation against one Beam TX transmitter

Ethernet for Audio/Video Input/Output

- 10/100 BASE-TX, Cat.5e UTP cable (100~150m)
- Multicasting over Ethernet LAN environment

Decoder

- H.264 (MPEG-4 Parts10: AVC)
- Baseline Profile with Level 4.2 (up to 1920 x 1080p60) with de-interlacing

Video Output

- SD-SDI (480i60), HD-SDI (1080i60) or 3G-SDI (1080p60)

Audio Outputs/Input

- SD audio output for talk-back audio: 8kHz sampling with 16-bit
- input for talk-back audio: 8kHz sampling with 16-bit

Other

- RTSP relay streaming server
- USB for firmware upgrade
- RS422 serial port for bi-directional external control

3.4 Factory Defaults

Encoder bitrate	12 mbps
Encoder mode	P2P Encoder

Decoder ID	1
WiFi SSID and Channel	TeradekBeam_00, channel 36
WiFi password	xyjTeradekBeam_00
IP address (WiFi)	192.168.2.1 (TX), 192.168.2.2 (RX)
IP address (LAN)	192.168.0.161 (TX), 192.168.0.162 (RX)

3.5 Supported Video Formats

The following resolutions and frame rates are supported by Beam.

720 x 480 i59.94 (NTSC)	1920 x 1080 P24/23.98
720 x 576 i50 (PAL)	1920 x 1080 PsF24/PsF23.98
1280 x 720 P60/59.94	1920 x 1080 P25
1280 x 720 P50	1920 x 1080 P30/29.97
1280 x 720 P30/29.97	1920 x 1080 PsF30/PsF29.97
1280 x 720 P25	1920 x 1080 P50
1280 x 720 P24/23.98	1920 x 1080 P60/59.94
1920 x 1080 i50	1920 x 1080 PsF60/PsF59.94
1920 x 1080 i60/59.94	

3.6 Power Input Description

Lemo Connector / Pin-Out: Beam uses a OB 302 series LEMO connector (FGG.0B.302.CLADxx)

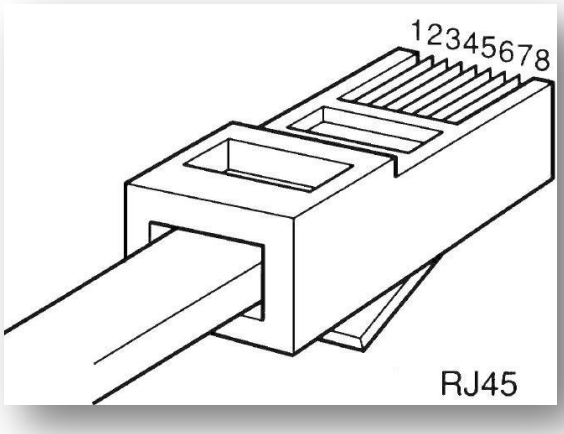
Pin	Description
1 (Closest to the red dot)	GND
2	+DC

Custom / 3rd Party Cables

- Test the power cable polarity with **ONLY** the power cable connected to Beam. Do not connect video cables.
- Check the power cable for shorts and proper grounding.

CAUTION: Using a reverse polarity or improperly-constructed power cable can damage the product and is not covered under warranty.

3.7 RS-422 Pin Configuration



Pin 1: RXD positive

Pin 2: RXD negative

Pin 3: TXD positive

Pin 6: TXD negative

NOTE: RXD (receive) refers to input into Beam, TXD (transmit) refers to output from Beam.