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# HD IP Camera with H.264 Compression Hardware Manual

Model 3011 | Ver. 1.0.1 | February 2015

SENSORAY | embedded electronics |



Designed and manufactured in the U.S.A

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## ***Introduction***

Model 3011 is a miniature HD IP camera that fits in a 2.25 x 2.00 x 1.20 inch enclosure (including the lens). The camera is capable of providing an H.264 compressed stream at the standard HD resolution (1080p30), or multiple streams at lower resolutions. Model 3011 consumes less than 3 Watts using either POE option, or an external 5 V DC power supply. Configuration and control are performed using a web interface with optional password protection. Network settings (IP address, ports) can be changed to accommodate various network configurations. All settings are stored in non-volatile memory and restored after power up.

Model 3011 is capable of providing 2 simultaneous video streams, for example, a high quality stream for archiving on the remote server and a lower bitrate stream for live viewing on hand-held devices.

# Connectors

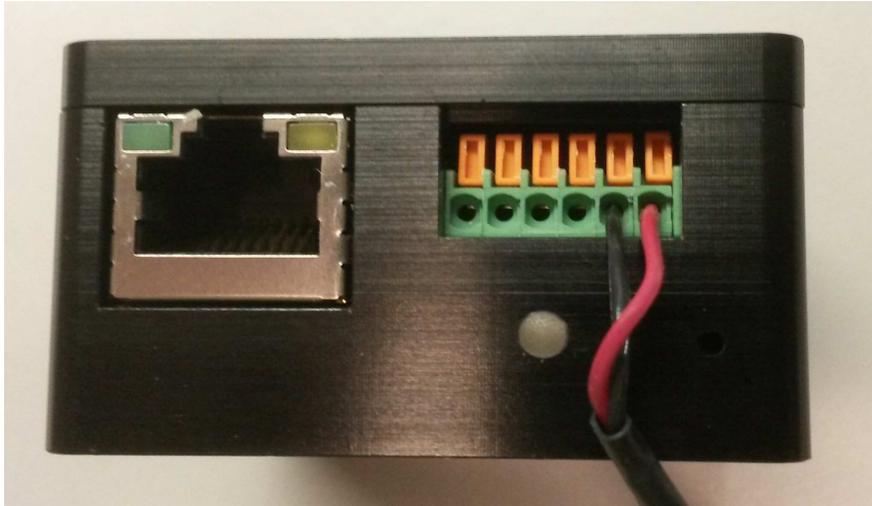


Fig.1. Model 3011 connectors.

Left to right:

- Ethernet connector;
- GPIO and power terminal block.

Below:

- status LED;
- configuration button.

Model 3011 provides 1 optoisolated input and 1 optoisolated output. The GPIO schematic is shown on Fig.2.

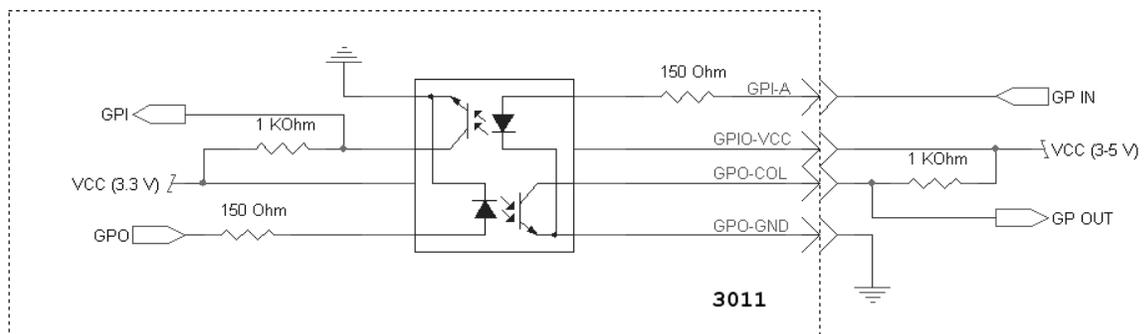


Fig.2. Optoisolated GPIO.

GPIO requires power (pins GPIO-VCC and GND) in the range of 3 to 5 VDC. The input pin (GPI-A) is connected to an anode of an input LED via a 150 Ohm resistor. Input diode's current must be kept between 7 and 15 mA (with a forward voltage of 1.5 V). For additional information on the optocoupler please refer to the documentation on Avago ACSL-6210.

Table 1. GPIO and power terminal block pinout (left to right):

1	GPO-COL
2	GPI-A
3	GPIO-VCC
4	GPO-GND
5	POWER GND (-)
6	POWER +5 V DC

# Web page interface

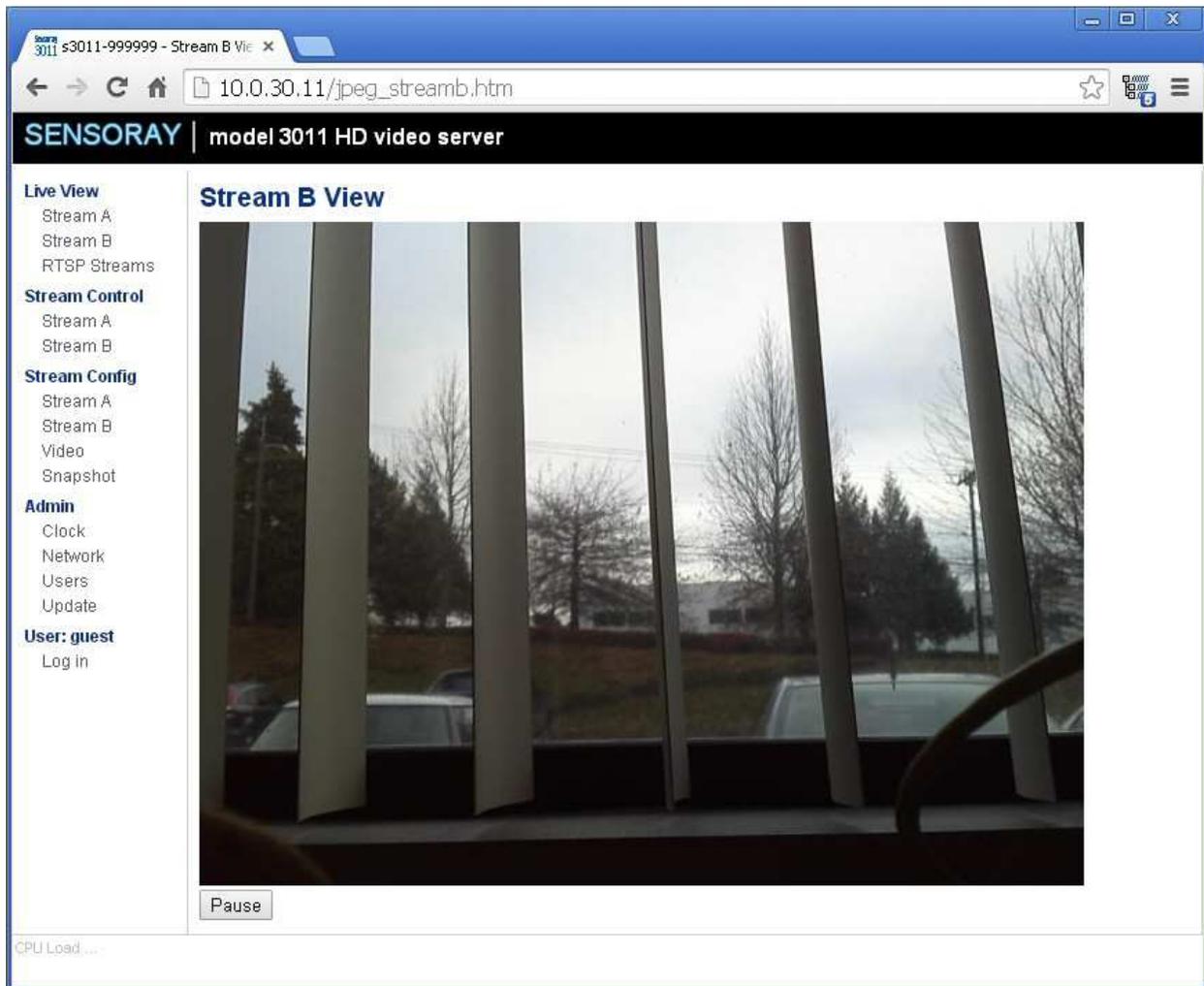
## Main menu



Main Menu is the default screen displayed when the browser connects to the 3011. The default IP address as shipped is 192.168.30.11. Connect to the board by typing this address in the browser's address bar.

Note: if the default IP address can not be accessed on your network, please refer to the Network Configuration section below.

## Live stream view



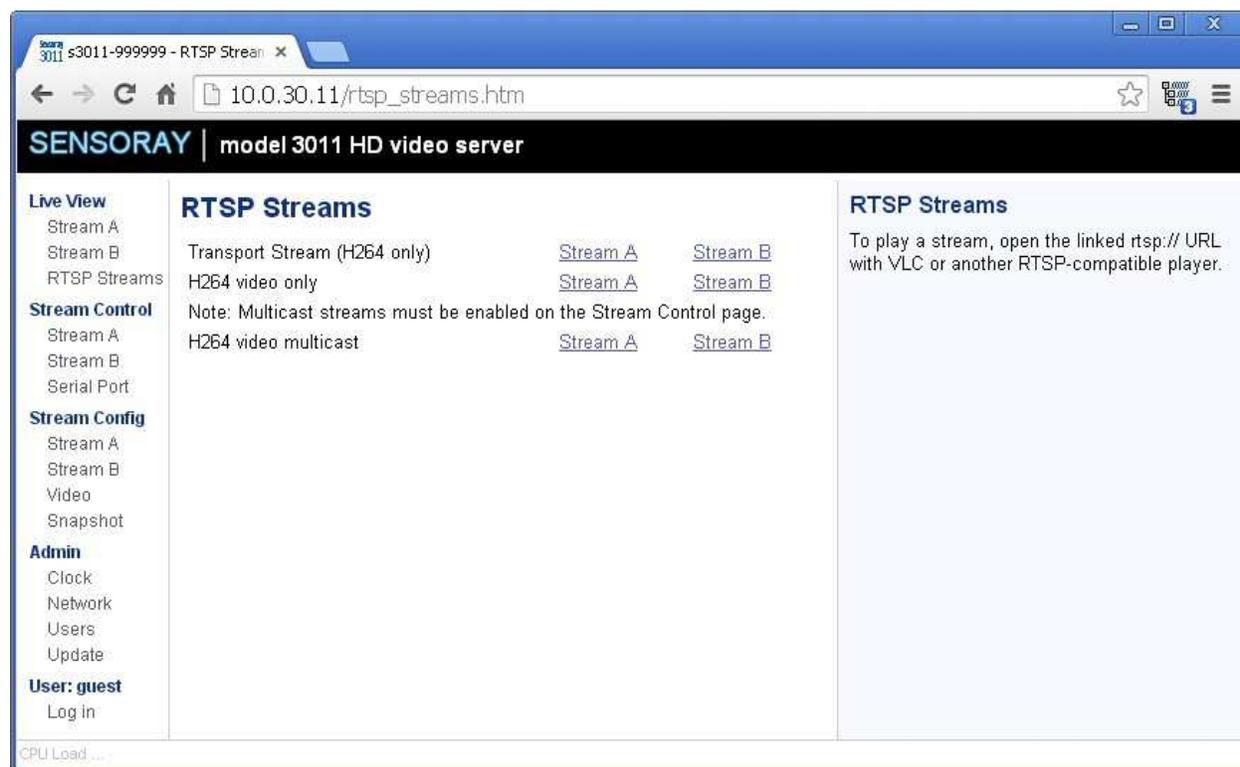
Live stream view windows display the live view of one of the two streams available from the 3011. To access the window click on one of the links (Live View/Stream A or Live View/Stream B) in the navigation bar. Streams are configured as described below in sections “Stream Controls” and “Stream Configuration”.

Live View will display a Multipart-Replace JPEG image if the stream is configured a MJPEG VES. This mode is not supported in Microsoft Internet Explorer browser.

Live View will display a Flash video player with H264 video and AAC audio if the stream is configured as H264.

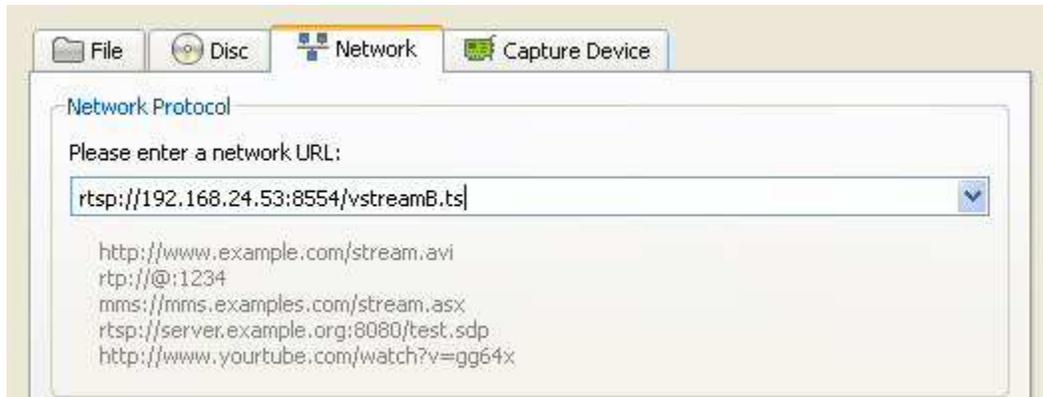
Live View is not supported when the stream is configured as MPEG4.  
The web player is using Flash RTMP protocol on TCP port 1935.

## RTSP streams



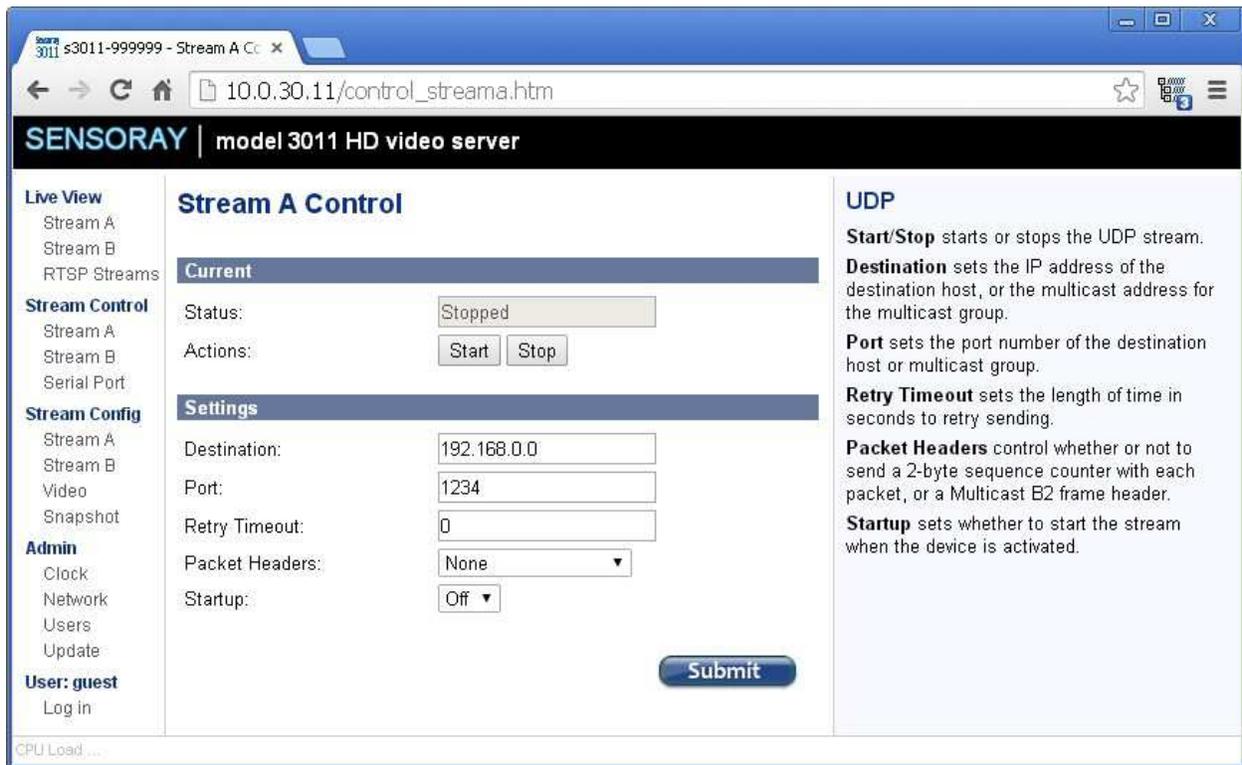
Live View / RTSP Streams page provides a list of `rtsp://` URLs which can be viewed using VLC or another RTSP-compatible player. The player is responsible for requesting the video and starting and stopping the stream.

Right click on the link that corresponds to current configuration of selected stream (A or B), copy link address, and paste it into the player's stream address field, as shown below for VLC.



RTSP streams use TCP port 8554 and UDP ports 6970-6999.

## Stream Control



Stream control window allows individual network configuration and control of each of the two streams.

The “Current” section displays the stream status and allows starting and stopping the stream.

The “Settings” section configures the following stream parameters:

Destination: an IP address of the destination host.

Port: network port of the destination host.

Retry timeout: determines the length of time (in seconds) during which the 3011 tries to obtain destination's ARP entry.

Packet Headers: allows the choice of no headers, a 2 byte sequence counter, or a multicast B2 frame.

Startup: if set to On, the stream will start automatically when the 3011 is powered up.

## Stream Configuration

**Stream A Configuration**

**Stream**

Format: H.264 MPEG-TS

**Video**

Resolution: 640x480

Frame Rate: 30

Bit Rate: 2400000

GOP Size: 30

Aspect Ratio: None

Transform: None

**OSD**

Enable: Off

Message: ^j^n^d^n^t

X Position: 20

Y Position: 2

Date Display: MM-DD-YYYY

Seconds Display: Whole

Background: Black

**Stream Settings**

**Format** sets the AV encoding and mux format.

- H.264+AAC MPEG-TS:** H.264 video, AAC-LC audio
- H.264 MPEG-TS:** H.264 video, no audio, MPEG transport stream
- H.264 VES:** H.264 video elementary stream.
- MPEG4+AAC MPEG-TS:** MPEG4 video, AAC-LC audio
- MPEG4 MPEG-TS:** MPEG4 video, no audio, MPEG transport stream
- MPEG4 VES:** MPEG4 video elementary stream.
- MJPEG VES:** Motion JPEG video elementary stream

**Video Settings**

**Resolution** sets the frame size, in pixels.

**Frame Rate** sets the frame rate, in frames-per-second.

**Bit Rate** sets the H.264 stream rate, in bits-per-second.

**GOP Size** sets the H.264 I-frame interval.

**Aspect Ratio** sets the H.264 aspect ratio.

- None:** No aspect ratio information, implies 1:1 pixel aspect ratio.
- 4:3:** Full-frame aspect ratio for NTSC and PAL.
- 16:9:** Wide-screen aspect ratio.

**JPEG Quality** sets the JPEG quality setting, range 1-100.

**Transform** sets the image transformations.

- None:** No transformation.
- Mirror Vertical:** Mirror the video image vertically.
- Mirror Horizontal:** Mirror the video image horizontally.
- Rotate 180:** Rotate the video image 180 degrees.

**OSD Settings**

**Enable** sets the on-screen-displayed text on/off.

**Message** sets the text to be displayed. Control characters: ^d: Insert the current date.

Stream configuration window allows configuring individual stream parameters which may differ between streams A and B.

**Format:** allows selection of compression (H.264, or MJPEG) and stream types (video elementary stream, VES; MPEG transport stream, MPEG-TS).

**Video setup** allows selecting from several resolution and frame rate settings, choosing target bitrate of the compressed stream. GOP size controls the interval between reference frames. Smaller GOP results in faster recovery from transmission errors, but higher bitrate.

Aspect ratio setting may help achieve better viewing experience with some combinations of video sources and stream players. Transform field allows selection of optional video rotation or mirroring.

OSD (on screen display): allows putting an optional text overlay (caption) on top of video (up to 160 characters). Standard formatting functions allow automatic insertion of date, time and some other information into the caption.

Message field allows setting the caption text.

The following formatting codes are supported:

^d – inserts current date;

^t – inserts current time;

^i – inserts unit's IP address;

^c – inserts current value of the frame counter;

^n – inserts the new line.

## Stream Configuration - Video

The screenshot shows a web browser window with the URL `10.0.30.11/setup_video.htm`. The page title is "SENSORAY | model 3011 HD video server". The interface is divided into three main sections:

- Live View:** Includes links for Stream A, Stream B, and RTSP Streams.
- Stream Control:** Includes links for Stream A, Stream B, and Serial Port.
- Stream Config:** Includes links for Stream A, Stream B, Video, and Snapshot.
- Admin:** Includes links for Clock, Network, Users, and Update.
- User:** Currently shows "User: guest" with a "Log in" link.

The **Stream Config - Video** section contains the following parameters:

- Frame Rate: 30 fps (dropdown)
- Image Stabilization: On (dropdown)
- Face Detect: On (dropdown)
- Focus: Select... (dropdown)
- Zoom: 1X (dropdown)
- Exposure Mode: Auto (dropdown)
- Auto Exp. Shutter: 1/5000 (dropdown)
- Auto Exp. ISO: 1 (slider)
- Wide Dynamic Range: Disable (dropdown)
- WDR Gain: 0 (slider)
- WDR Wide D: Disable (dropdown)
- WDR Contrast: 0 (slider)
- WDR Chroma: 0 (slider)
- Sharpness: 0 (slider)
- Brightness: 128 (slider)
- Saturation: 128 (slider)
- Hue: 0 (slider)
- Contrast: 128 (slider)

A "Restore defaults" button is located below the sliders. A "Submit" button is at the bottom right of the configuration area.

The **Video Settings** section provides detailed descriptions for each parameter:

- Frame Rate:** sets the video frame rate used for all s
- Focus:** sets the focus of the camera lens.
  - Auto:** automatically set the focus.
  - Inf:** manually set the focus to optical Inf position.
  - Macro:** manually set the focus to optical Macro positio
  - Step +/- N:** manually move the focus by N steps; positio
- Zoom:** sets the magnification of the camera image.
- Exposure Mode:** sets the exposure mode for the ca
  - Auto:** Controls the exposure automatically.
  - Hold:** Holds the current exposure state.
  - Manual:** Sets the shutter speed and PGA output manu
  - Shutter Priority:** While prioritizing the shutter (manua
  - Gain Priority:** While prioritizing ISO sensitivity (manua
- Auto Exp. Shutter:** Shutter setting value for exposu are approximate.
- Auto Exp. ISO:** ISO sensitivity setting value for exp
- Wide Dynamic Range:** (WDR) Controls adaptive g
- WDR Gain:** Sets maximum value for WDR gain (po
- WDR Wide D:** Enhances effects such as WIDE-D.
- WDR Contrast:** Sets the WDR contrast gain.
- WDR Chroma:** Sets the WDR chromaticness
- Sharpness:** sets the sharpness of captured video.
- Brightness:** sets the brightness of captured video.
- Saturation:** sets the saturation of captured video.
- Hue:** sets the hue of captured video.
- Contrast:** sets the contrast of captured video.
- Restore defaults:** restores the settings for Brightnes default values.

Stream Config – Video window allows configuration of video parameters common to both streams A and B.

Brightness, saturation, hue, contrast: video adjustments. Hue only affects NTSC video.

## Stream Configuration - Snapshot

The screenshot shows a web browser window with the address bar displaying `10.0.30.11/snapshot.htm`. The page title is "SENSORAY | model 3011 HD video server". The interface is divided into several sections:

- Live View:** Includes links for Stream A, Stream B, and RTSP Streams.
- Stream Control:** Includes links for Stream A, Stream B, and Serial Port.
- Stream Config:** Includes links for Stream A, Stream B, Video, and Snapshot.
- Admin:** Includes links for Clock, Network, Users, and Update.
- User:** Shows the current user as "guest" and a "Log in" link.

The main content area is titled "Snapshot" and contains the following controls:

- "Take a New Snapshot:" with a link to "Snapshot".
- "Most Recent Snapshot:" with a link to "Snapshot.jpg".
- "Snapshot Resolution:" with a dropdown menu set to "4096x3096".
- "Snapshot Quality:" with a slider control set to "90".
- A "Submit" button.

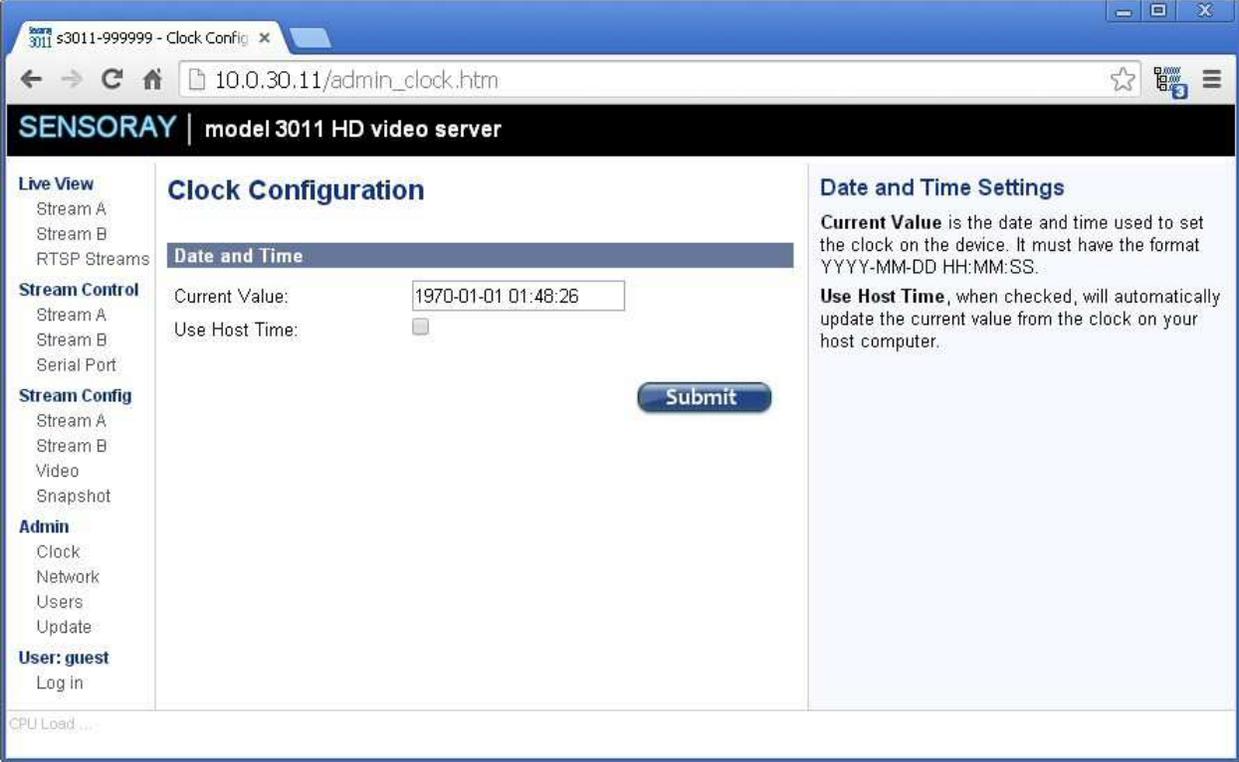
On the right side, there is a "Snapshot" section with explanatory text:

- Take a New Snapshot** will store a new image in device memory, and download the captured JPEG image.
- Most Recent Snapshot** will download the last captured JPEG image from the device memory. If there is no image yet, it will be captured.
- Snapshot Resolution** will select the frame size, in pixels.
- Snapshot Quality** controls the JPEG quality setting, ranged 10 to 90.

At the bottom left, there is a "CPU Load ..." indicator.

This page allows taking JPEG snapshots at up to full 13 Mp resolution.

# Clock Configuration



The Clock Configuration page allows setting the 3011 internal clock either manually (using a 24-hour format), or to the host's time.

## Network Management

**Network Management**

**Network Configuration**

Network mode:

Hostname:

MAC Address:

**Static Configuration #1**

Address:

Netmask:

Gateway:

Primary DNS:

Secondary DNS:

**Static Configuration #2**

Address:

Netmask:

Gateway:

Primary DNS:

Secondary DNS:

**Network Settings**

**Network Mode.** This field determines how the device will configure its network interface. When set DHCP, it will configure the network interface automatically using a DHCP server on the local network. When set to static, it will configure using the specified network configuration entered below.

**Hostname** This hostname is used for the DHCP configuration and may allow external access through this name instead of ip address (if the DHCP server configures a DNS entry for this device)

**MAC address** This MAC address allows the device to use a different Media Access Control address for the local network. No two devices should ever use the same MAC address on the same local network.

**Static Configuration Settings**

**Address** This specifies the IP address of this device.

**Netmask** This specifies the network mask to use for the local network.

**Gateway** This specifies the IP address of the router that provides access to the Wide Area Network or Internet.

**Primary and Secondary DNS** This specifies the IP addresses of the Domain Name Servers to use when looking up hostnames. In some cases, this may be the same address as the Gateway, or it may be provided by your network administrator.

Each 3011 is shipped with a default IP address 192.168.30.11 and a netmask 255.255.0.0. Those settings can be modified using a Web page interface. The unit has to be powered up and connected to the LAN using an Ethernet patch cable, Cat5 or better. The 3011 automatically detects the type of the host interface, so it can be connected both to the computer and to a switch (hub) using the same type of cable.

When DHCP mode is selected, it may be unknown what IP address is given to the device. The IP address may be discovered by querying the router/DHCP server for the hostname.

Depending on the network restrictions one or two steps may be necessary to set a new IP address. If the network used to configure the unit can not access 192.168.x.x IP address range, start with Step 1, otherwise go directly to Step 2.

### **Step 1 - Setting up a temporary IP address**

This step is only necessary if the network used to configure the unit can not access the default IP address (192.168.30.11). In this case the unit must be switched into the Configuration Mode which allows setting up a *temporary* IP address accessible from the current network. The temporary IP address should be selected such that it is:

- 1) accessible on the network;
- 2) is not already used by any other device on the same network.

In Windows, run ARP on the computer that is connected to the same network with the following command line:

```
arp -s <temporary_address> 08-00-56-ff-ff-ff
```

To run ARP either navigate to Start/Run and type the command line in the “Open” box, or start a Command Prompt window and type the command line followed by Enter.

In Linux, type the command line in the terminal window at the shell prompt followed by Enter. Please use colons (:) instead of dashes (-) in MAC address.

For example:

```
arp -s 10.135.1.61 08-00-56-ff-ff-ff (Windows)
```

```
arp -s 10.135.1.61 08:00:56:ff:ff:ff (Linux)
```

It is recommended to use a temporary IP address that is different from the target permanent address to be assigned to the unit.

Now switch the 3011 into the Configuration Mode by pressing the configuration button. The status LED starts blinking.

Note: you need to wait for 15 seconds after the 3011 is powered up before the board is able to switch to Configuration Mode.

Once the 3011 receives a network packet addressed to it, the temporary IP address will be in effect. To send a packet either ping the board or connect to it with a browser. Using an IP address from the example, either run

```
ping 10.135.1.61
```

or type

```
http://10.135.1.61
```

into the address bar of your browser on the computer connected to the same network as the 3011. Once the temporary address is enabled the red LED will blink fast several times and go off.

Once the unit is accessible using a temporary IP address, the standard Web page procedure (Step 2) can be used to set up the desired permanent IP address and other settings.

## **Step 2 – Setting up a permanent IP address**

Connect to the unit with a Web browser by typing the unit's temporary IP address in the address field.

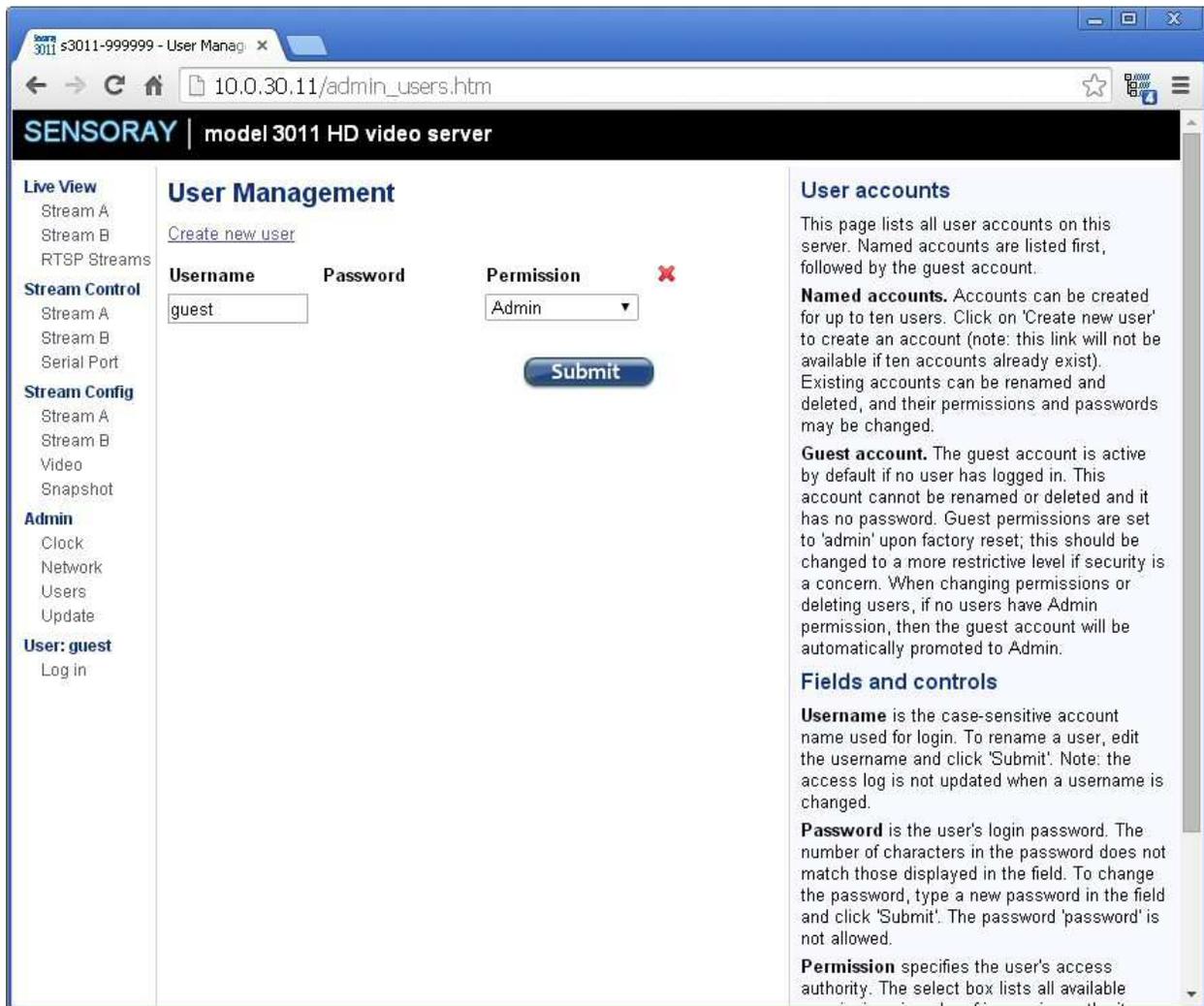
Example:

```
http://10.135.1.61
```

Once the Main Menu page is displayed, select Admin/Network.

Type in the desired permanent IP address and subnet mask values into corresponding fields. Please note that there are 2 static configurations available. Make sure that the one that you need is selected in the “Network mode” list-box before clicking on Submit. Now the unit's new IP address is set. The browser redirects to the new address automatically.

## User management



User Management window allows access to the device to be limited to certain users with an associated permission level. The permissions levels are:

- None (guest user only);
- Stream View (may only access live view or RTSP streams);
- Stream Control (Stream View permissions, plus Stream Control and Recording);
- Stream Config (Stream Control permissions, plus Stream Config and Common Config);

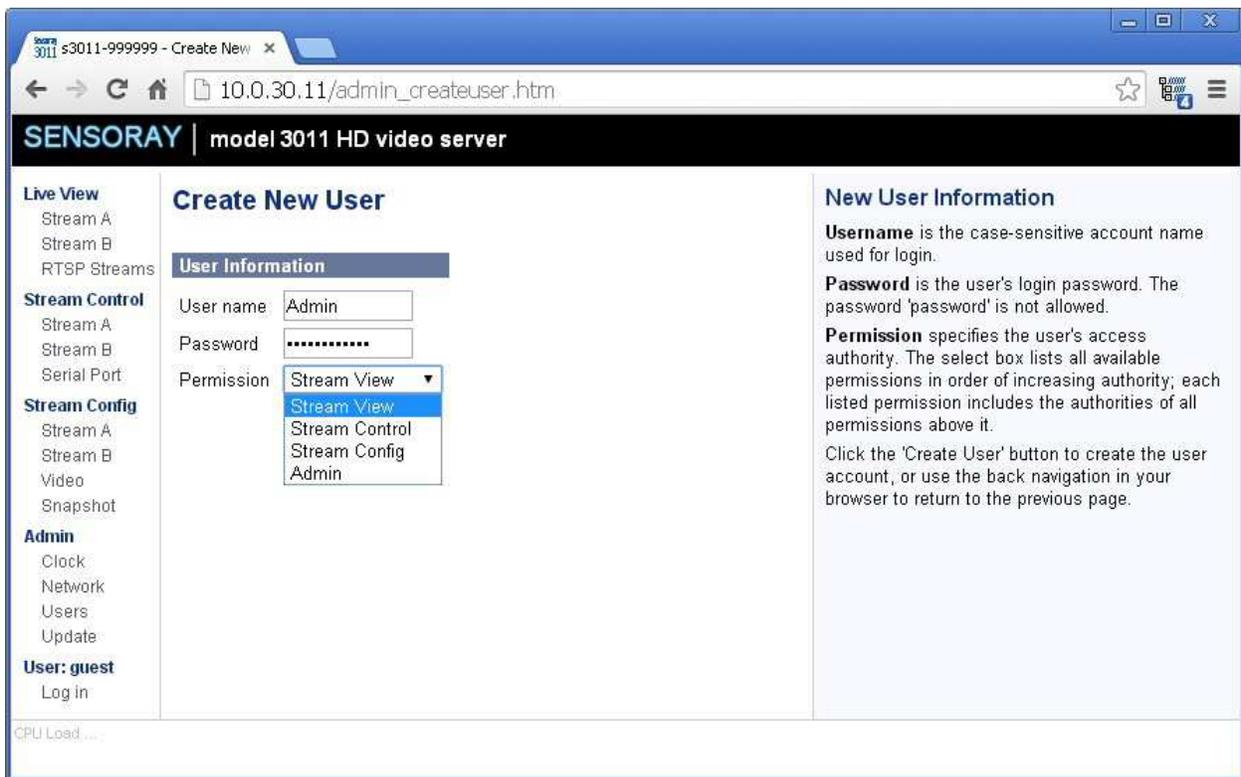
- Admin (full access).

To create a new user account, click the Create new user link.

To delete a user account, check the checkbox below the red X in the user row and click submit.

To change a user password, type the new password in the password box and click submit. The password “password” is not allowed.

When changing permissions or deleting users, if no users have Admin permission, the guest user will automatically be promoted to Admin, preventing the device from locking out Admin privileges. The guest privileges are reduced to “None” as soon as an Admin account is created.

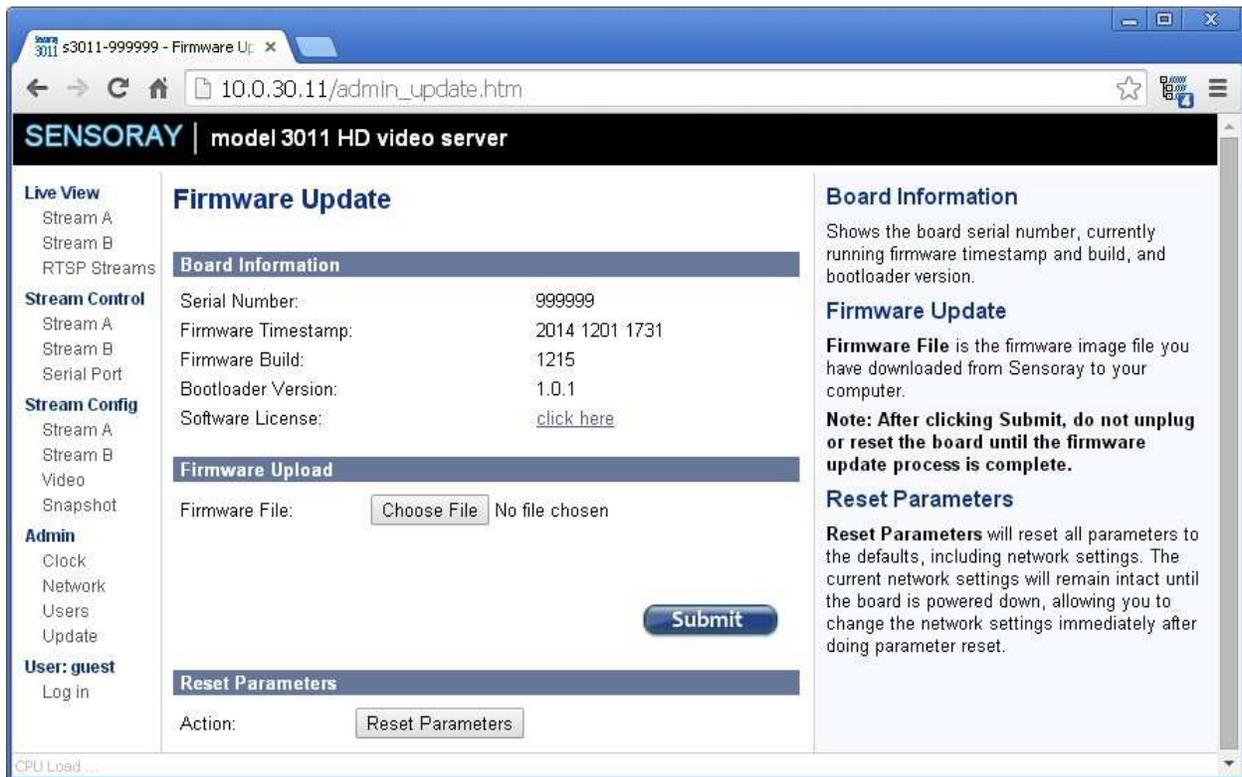


To create a new user, enter the user name and password, select the desired permission level and then click Create User.

Both user name and password are case-sensitive.

The password “password” is not allowed.

## Firmware update



The Firmware Update window displays the versions of the device's firmware components and the serial number.

To update the firmware, choose the file (`s3011_fw` provided by Sensoray) and press Submit. The firmware update should take about 30 seconds to complete. Do not unplug the device while the firmware update is in process. If a firmware update is interrupted, the device will attempt to load from a backup firmware image. During the update the red LED flashes and update status is displayed in the Firmware Status field of the web page. If the update has completed successfully a message "Firmware result: ok" is displayed in a pop-up window. All device settings are preserved across the firmware update.

To reset all parameters on the device, click the Reset Parameters button. That will reset the network settings as well, but the change to those will take effect only after the power is cycled. This allows setting an IP address different from the default even after parameters reset, if necessary.

## ***Firmware reset***

During the firmware update the new firmware image is stored into a new location of the internal flash memory storage, while the original image is preserved. To revert to the original firmware press and hold the configuration button through the pin-hole on the back panel while the power is being applied. Release the button as soon as the indicator LED lights up. The unit will boot from the original firmware image but the user settings will be preserved.

In order to reset the user settings follow the same procedure, only hold the configuration button until the LED starts flashing.

## ***Traversing routers***

The following ports need to be accessible:

- for browser preview: TCP port 1935;
- for RTSP streams: TCP port 8554, UDP ports 6970-6999.

# Specifications

Image sensor	Progressive scan, CMOS, 4192 x 3104 (Sony FCB-MA130)
Focus range	100 mm to infinity
Compression	H.264 High Profile at Level 3, JPEG
Compressed stream formats	MP4, AVI, transport stream
Text overlay	Programmable, up to 160 characters
Output Resolutions	4192 x 3104 (JPEG only, 5 fps) 1920x1080, 30 fps 1280x720, 30 fps 640x480, 30 fps
Interface	Ethernet, 100BaseTX
Power options	POE, IEEE 802.3af compliant; +5 VDC
Power consumption	2.5 W typical; 3 W maximum
Mechanical	2.25 x 2.00 x 1.20 inch metal enclosure
Environmental	-5 to +50 °C operational temperature
GPIO	Opto-isolated, 1 in, 1 out

## ***Revision history***

Version	Notes
1.0.1, February 2015	“Firmware reset” and “Traversing routers” sections added.
1.0.0, December 2014	Initial release.