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Warranty and Handling Instructions

Sensoray Company, Incorporated (Sensoray) warrants the Model 3016 system to be free from defects in material and workmanship and perform to applicable published Sensoray specifications for two years from the date of shipment to purchaser. Sensoray will, at its option, repair or replace equipment that proves to be defective during the warranty period. This warranty includes parts and labor.

The warranty provided herein does not cover equipment subjected to abuse, misuse, accident, alteration, neglect, or unauthorized repair or installation. Sensoray shall have the right of final determination as to the existence and cause of defect.

As for items repaired or replaced under warranty, the warranty shall continue in effect for the remainder of the original warranty period, or for ninety days following date of shipment by Sensoray of the repaired or replaced part, whichever period is longer.

A Return Material Authorization (RMA) number must be obtained from the factory and clearly marked on the outside of the package before any equipment will be accepted for warranty work. Sensoray will pay the shipping costs of returning to the owner parts which are covered by warranty. A restocking charge of 25% of the product purchase price, or \$105, whichever is less, will be charged for returning a product to stock.

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1 Introduction

1.1 General Functional Description

The model 3016 system is a complete stand-alone IP Camera.

It encodes an NTSC video input signal to MPEG1/2 formats and transmits the compressed video over Ethernet networks. The 3016 system uses RTP and UDP protocols for transmission of video over a network. The system allows the user to record video clips sent over the Ethernet for remote viewing.

a) Possible Uses of the 3016 System

There are a wide variety of applications where the 3016 systems may be used. Here are just some of them:

- Various types of security systems
- Traffic monitoring
- Remote monitoring over internet/network
- Remote camera control and recording
- Wireless monitoring/control
- Police patrol in-cruiser video monitoring and recording
- Digital video distribution
- Digital video recorder
- Streaming video over network

c) Latency

If RTP protocol is used in the transmission of video then the latency is approximately 2 to 5 seconds, depending on the set bitrate. Higher bitrate produces lower delay. If Sensoray stream format is used (modified transport stream) then the latency is less than 1 second if Sensoray's 2400WDCS control and display software is used.

If system is configured for RTP protocol then Apple Computer's free QuickTime player may be used to view the stream.

If system is configured for UDP protocol then Sensoray's Control and Display software may be used to view the video.

d) Supported Protocols

The 3016 system supports UDP and RTP protocols. The UDP format (user datagram protocol) offers the fastest data rates and minimum CPU usage at the expense of minimal error checking. A disadvantage of the UDP format is that it cannot be played using popular stream players such as QuickTime. However, the latency i.e., the time delay between recording and displaying, while using these players, can be several seconds.

The RTP format (real time protocol) trades off CPU and memory usage for error correction and compatibility with QuickTime and Real Player. Sensoray sells a multi-stream, low-latency software RTP player for Windows 2000 and XP. The latency of Sensoray's software player can be as low as one half second.

2.1 Web Server

The 3016 is an Ethernet appliance that executes commands from a Telnet command line, Sensoray's Display & Control software or from its internal Apache web server. Most browsers can control and display information from the 3016 system however to use the system's controls through the web page the user must have Internet Explorer V6 or higher.

The system is supplied with specially configured Linux for high reliability and fast response. After power is applied, the software is automatically loaded to RAM from flash memory. The system will then start performing the default configuration instructions set up by the user.

2.2 Digital Video Recorder

Video clips may be stored on 3016 servers that have internal storage media as described in this section. The video may be replayed from local or from remote 3016's or they may be rapidly downloaded to remote clients. For example, the daily movies accumulated in a vehicle's DVR may be rapidly transferred over an 802.3 wired Ethernet.

Movies can be stored on a removable compact flash card. In the local record mode, MPEG data from the codec is recorded to a storage media. Proper care is taken to prevent significant data loss in the event of a power loss. While data is being recorded it is also available as composite video from the codec, see (Fig. 3.1) below.

Once MPEG video data is stored on the 3016 it may be decoded and viewed by using the 3016's hardware decoding and a video output channel.

Recorded movies can also be sent over the Ethernet for remote viewing with QuickTime or Real Player. In this case, the 3016 sends MPEG data which the software player must decode.

2.4 Camera Control

The 3016's CPU sends camera control commands received from the Ethernet to the embedded camera.

Using Sensoray's model 2400WDCS real-time display and control software users may decode, control and display up to fifteen 3016 videostreams with a low latency of 1/2 to one second. Thumbnail images from remote video servers may be positioned over a background such as a map or building plan. Multiple server images may be selected for expansion to full size and full frame rate. Users can have several preinstalled configurations (background with arranged cameras) with easy switching between.

2.5 Bit Rates and Bandwidth

Model 3016 system features selectable bit rate functionality. Higher bit rates from the MPEG codec give better quality images than lower rates. Full-size interlaced images of 30 frames/sec will start to show noticeable distortions below 1 Mbits/sec. Selecting bit rate of 4Mbits/sec yields a DVD type quality of video. A bit rate of 4Mbits/sec and higher will be unnoticeable in majority of scenes. Some difference in video quality will only be noticeable in high action scenes. The amount of distortion in high action scenes is much more noticeable in lower quality setting (eg. 600kbits/sec).

A variable or constant bit rate may also be selected for the encoding of the MPEG stream. A variable bit rate should be chosen for the best video quality. In variable bit rate encoding, the

bit rate is adjusted according to the compression difficulty of the frame sequence. This mode tries to maintain good image quality by allocating more bits to the more difficult frame sequence (action) which yields a better image quality. Variable bit rate makes a more efficient use of the overall storage capacity.

In constant bit rate, all the motion sequences are encoded in the same rate. Therefore if there is motion in a scene then it may render lower quality video since more bits were needed to encode the more difficult part of frame sequence. Another possible way to decrease the bandwidth is by decreasing the image size. Selecting CIF size images of 320 x 240 pixels will reduce the required bit rate by four compared to 640 x 480 pixel images that occur at the same frame rate.

2.6 Multicasting and Unicasting

The 3016 system supports multicasting (see Fig. 3.6) and uni-casting. Video streams from 3016's may be viewed simultaneously by several clients on the same network by using multicasting. The 3016 automatically stops multicast streaming to RTP clients once they close their RTP player. Multicasting may be replaced with uni-casting by sending a command to the 3016's command processor.

3. System Operation and Functions

After applying power, this system will automatically boot Linux and will be fully functional after approximately 30 seconds. By default, after booting, an RTP video server will be automatically streaming MPEG video over the Ethernet to port #18888. This video stream can be viewed by any player which accepts RTP stream such as QuickTime player. The 3016 system can be set up to stream using Sensoray's format which has low latency of approximately 0.5 seconds.

4. Preference Options

There are several ways to change user preferences for the system. The recommended method is to change the settings via the browser configuration page which is accessed through the Ethernet port. You can also access the system via telnet and perform the necessary modifications, however, access via telnet will not be covered by this manual. If the system's IP address conflicts with another node on your network, you will need to connect to a dumb terminal (or terminal emulator (VT100) on a PC) to the serial port (com1) on the 3016 (9600 baud, 8 bits, no parity). A step by step procedure will be given. Only UDP multicasting is supported. All your network hardware must support multicasting.

a) Setting up the 3016 via Browser Interface (Recommended)

1. Connect video source to the system.
2. The default IP address for the system is 10.135.1.99
3. Connect network cable to the 3016, if the factory IP address (10.135.1.99) will conflict with your network you will need follow the "**Setting up the 3016 via serial terminal**" procedure described in
4. Wait approximately 30 seconds.
5. Open Internet Explorer V6.0 or higher and type in 10.135.1.99 into the address bar. If a page (Fig. 1) doesn't open then wait a few more seconds (to make sure it finished booting) and retry.
6. 3016 web interface should open up (see Fig. 1 below).
7. The default stream will be configured for RTP streaming therefore you can click on "View

real-Time stream” which will open the default RTP player on your system (such as QuickTime) and user should be able to view the video stream.

8. If video doesn't appear then make sure that in the “*Stream*” tab has the following parameters:

Server type: MPEG-over-IP transmit RTP

Auto start: NO

Multicast: NO

Port number: 18888

Encoder Picture size: MPEG-1

If the above parameters are present but the video still does not appear then please refer to Section G on basic troubleshooting tips.

b) Changing Video Stream Parameters

1. For changing various video stream parameters click on the “Stream” tab and a page will appear with many different settings (see Fig. 2). The configuration shown in Fig. 2 is also the default setting

2. For the description and effects of variable parameters please see the description table below

Fig. 2. If a certain setting, entered by the user, conflicts with another setting, the conflicting fields will be automatically disabled to prevent user errors.

2. Please refer to the table below for item descriptions on variable parameters

Symbolic name may change this to any name of user preference

Auto Server start selects to start the server automatically or manually

Type selects the type of protocol for video transmission

Multicast selects to send to single or multiple addresses **Mode**

Interface selects the interface from which to stream

Transmit Address selects the destination address where the server will be streaming

Port number selects destination port number

Address only if multicasting selected, specifies the multicast IP address to which the incoming receive stream will be directed

Port number this designates the IP port number that will be used by the 3016 to receive the video stream

Caption enable selects captioning

Caption text selects caption text

Color selects the font color for the caption text

Font

Transparency selects the background of the caption window

Scale selects the size of the font for the caption text

Position

X selects X coordinate for the caption box

Y selects Y coordinate for the caption box

Video input selects the input of the video signal, Composite or S-video inputs

Video bitrate selects the video bit rate, this also determines the visual quality of the video

Variable bit rate selects either variable or fixed video bit rate

Picture size selects various video picture sizes

Audio bit rate selects audio bit rate for sound quality

selects different types of video streams, elementary stream-video with no sound,

Encoder

Mux format A/V Muxed - video with sound synchronized, Transport stream - currently not supported

3. The settings in the table above are not available for all system configurations. Depending on the system configuration some options in the “*Stream*” tab will be disabled automatically to prevent user configuration errors.

4. For PAL users, if video is suspect make sure that you have the following:

-in the “ss0.conf” file found in “usr/etc” directory check the settings to make sure that “GOP_SIZE=“4” , GOP_IP_DISTANCE=“1” , VIDEO_SYSTEM=“PAL”

-if these settings aren’t present then make the necessary modifications and do not make any other changes

c) Changing System Parameters

1. To change system parameters such as system’s IP address, Net mask, system time and other configurations user must access the “*System*” tab. Fig. 3 below shows the default settings.

2. Please refer to the table below for item descriptions on variable parameters

Host

Name modifies host name to user's preference

Telnet allow/deny access to system through telnet protocol

Ftp allow/deny access to system through ftp protocol

Routed allow/deny access to system through routed protocol

Protocol

Secure allow/deny access to system through secure protocol

Time

Set to modifies current time of the system

Current displays current time of the system

Zone selects time zone for the system

Interface

eth0-eth3 selects IP address, Net mask, Gateway and DHCP for each of the network devices on the system used for controlling various servers on 3016, best to use numbers over 10,000 to minimize conflicts with standard devices selects the base port number for controlling peripheral devices via the camera

Camera Control control client

Stream Control selects the base port number for controlling MPEG streams, each stream is assigned one port number with Stream0 being base port number

Port ttyS0- selects and modifies such parameters as baud, data, stop, parity and

ttyS3 flow control for communication with the system through the terminal

Name specifies network name

selects peer-to-peer or access point type of networks, set to access point

Type by

Default

Network

Channel selects the channel for the specified network type

Encrypt Enable allow/deny encryption of the video stream

Key specifies the key for locking/unlocking of the encryption

Camera Controller specifies the password for camera control client to enable camera control

Stream Viewer selects the password for access to the stream viewer

selects the master password for the 3016 system, **must specify this**

System Setup

password in order to change camera and stream passwords

e) Basic Troubleshooting Tips for Wireless Ethernet

1. This section addresses very basic wireless problems that may occur. If these tips still do not solve the problem, we strongly encourage to contact Sensoray's technical support. Also, we do not insist that the solutions suggested is the only way to solve the problem but effort is put forth to simplify the solution.

2. There are many different factors that may cause the wireless system not to stream. If your system does not function with the settings you have selected then the first course of action would be to change the system settings to the default configuration and make sure that it still functions normally.

3. Problems most likely to occur are:

- a) the unit does not stream at all
- b) the stream breaks up frequently and re-connects
- c) the unit stops transmitting/receiving after a few days

Suggestions:

a) Please double check the transmit address in the "Stream" tab to make sure that the destination address, in fact, exists. Also, make sure that network class addresses match for transmitter and receiver units as well as on user's PC, if used. Check the video inputs to make sure they are correctly inserted. If the wireless Ethernet card is visible then check to make sure that LEDs are flashing rapidly and constantly which is a good indication that system is transmitting. User may log into the system via serial port or telnet (see instructions below) and use the "ifconfig" command to verify that "Tx bytes" value is actually increasing for eth1.

b) This is perhaps the most common problem that may possibly occur. The most common factors that contribute to this behavior are: the bitrate is set too high, the distance between the transmitter and receiver is too large, there are too many obstacles/walls between transmitter and receiver, there is interference from other wireless devices using the same channel.

User may change the channel number in the "System" tab and experiment with the performance on that channel. The user must also find the balance between the distance, bitrate and reliability for their particular operating environment.

c) First priority is to make sure that the power supply is still functional and outputs the correct voltages. A power surge may have corrupted the power supply operation. Also check the unit to make sure that it is not excessively hot.

Access the unit via serial port or telnet and use the "ifconfig" command for transmitter and/or receiver to see if the units are actually receiving or transmitting data by observing the change "Tx bytes" value.

f) Peripherals

1. Refer to Fig. 4 below for default settings.

Interface

ttyS0-ttyS3

Device Type Device Count Device Identifier

selects the specifies the device specifies number of a unique numerical identifier

number of translator to be used devices (as set forth for the device(s) connected the terminal on this interface. in the Device Type to this interface. The device Interface Choose a translator field) that are identifier is always 0, second that is appropriate connected to this identifier is 1, etc. Device for the type of interface. It is identifiers are contiguous; peripheral device applicable only when the range of identifier values connected to the a peripheral device is for all of 24xx devices range interface currently selected in from zero to the number of

- **Camera** - select the *Device Type* field. devices minus one a translator that is

compatible with Up to four devices your camera. For may be connected example, 'sony 30' to a single interface. should be selected For example, the if you are using a EVI - D30 camera Sony model EVI- provides an RS-232 D30/D31 or daisy chain that

equivalent camera permits multiple

- **None** - select if no cameras to be interface is used operated from one interface. All devices

connected to a common interface must have the same type, as specified in the *Device Type* field.

2. Refer to the table above for the description on setting variable parameters

g) Setting up the 3016 via Serial Terminal

1. Connect one end of a serial (crossover / null modem) cable to the 3016 system's (DB-9 to 10 pin header cable is supplied) com1 port and connect the other end of the serial cable to either a dumb terminal or a workstation with terminal emulation. The terminal settings must be 9600 baud, no parity, 8 bits, 1 stop, software flow control (xon/xoff). Ideally the terminal type should be VT100 but ANSI will work.

HINT: Most Windows based workstations have HyperTerminal installed. To setup, start HyperTerminal, go to *File -> Properties -> Configure* and set the bits per second to 9600, bits to 8, stop bits to 1, parity to none, and flow control to Xon/Xoff. Press OK and set the com port.

2. Boot up the 3016 system (for power requirements see "General Specifications" section). As system is booting up you should see various boot messages being displayed by the system.

3. At "241x Login:" type "**root**"

At "Password:" press "Enter" (no password by default). If everything is done as described a "241x:~#" should appear. If user has mistyped the login or password, just press "Enter" and user should see the login prompt appear again. Now you are ready to make changes to the 3016 system.

NOTE: ANY CHANGES DONE TO THE SYSTEM OTHER THAN FROM THE BROWSER ARE NOT RECOMMENDED

4. User may also access the system using the telnet protocol through the DOS prompt from any

Windows workstation by entering "**telnet 10.135.1.99**" and pressing "Enter" key

h) Basic Troubleshooting Tips via Serial Terminal

NOTE: See Section F on how to set up the system via serial terminal. We encourage the user to contact Sensoray's technical support first before trying to troubleshoot the system. Troubleshooting through the command line interface (CLI) should only be done by advanced users. Altering the configuration files of the system will only cause confusion and delay in resolution of the problem if Sensoray's technical support is to be contacted.

1. Once the user has successfully connected to the 3016 system through the serial terminal they may perform some simple troubleshooting steps to ensure they are connected to the system and have the right settings.
2. Please refer to the table below for basic commands on troubleshooting via the serial terminal.
3. If you have changed the IP address, you will need to use the new IP address with subsequent telnet sessions.
4. The user must make sure that the net mask on their computer is not too restrictive to allow access to the 3016 system and corresponds to the class of IP address being used.

Change System's IP

Address netconfig eth0 -i xxx.xxx.xxx.xxx where x is ip address set by the user

netconfig eth0 -n xxx.xxx.xxx.xxx where x netmask set by the user

NOTE: after changing IP Address or Net mask user must reboot the system

Change System's Netmask (reboots automatically from the browser interface)

List installed drivers lsmod

Load driver with options insmod

Network adapters

information lscfg

Reboot the system reboot

Text editor vi or joe

5. General Specifications

Input Power 12VDC @ 600mA typical for a standard 3016

Video Resolution NTSC 640x480

MPEG type MPEG2 Program/System stream - Audio/Video synchronized

Operating Temperature 0C to 70C