Digital BUS-WATCH®

R1001 / R4001
710131 / 710134

Hardware User Manual
Hardware Installation Manual

Radio Engineering Industries, Inc.
640370 -- Rev B -- 12/14/2007

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Introduction

All of us at Radio Engineering Industries, Inc. would like to thank you for purchasing a Digital BUS-WATCH® surveillance system. This manual is intended to provide the user with the information required for proper installation, initial setup and explanation of the individual programming options. If you have any questions, or need assistance, please call:

SERVICE HOT LINE
USA & CANADA
1-877-726-4617 Toll Free
1-402-339-2200

The R1001 and R4001 are a series of cost effective, fanless, embedded mobile DVR PC platform solutions supporting up to 4 camera inputs. These systems feature a unique compact rugged design engineered to meet the demands of harsh mobile environments. These mobile DVRs feature the latest technologies including removable USB hard disk drive modules, Ethernet, and GPS. The R1001/R4001 have the ability to perform DVR functions for safety and security purposes, along with managing media advertising for education and entertainment, or to create extra value-added services for all public and commercial transportation in the current and future markets.

Features

- Ultra compact extruded aluminum housing, low weight, high temperature and vibration resistant
- Low-voltage, low-current architecture designed for harsh mobile environments
- USB removable hard drive modules with tamper-resistant lock and secure controls
- All DVRs fully support NTSC and PAL, Fahrenheit and Celsius, KM/H and MPH
- Communications are supported through a TCP / IP network interface and a USB connection to PCs
- Each DVR comes with a hand-held IR remote control with on-screen display (OSD) for configuration and control of the DVR
- The DVR features a 2.5" removable mobile HDD module with internal anti-vibration and shock resistance
- 4 channels for video input, full-motion (30 FPS / camera) continuous video recording and display. 4 channels for high-fidelity, digitally recorded, 4 independent synchronized audio channels matched to 4 independent video channels

- Secure, constant recording while system is powered with event bookmarks for easy event searching
- Utilizes MPEG-4 video compression for high video quality, low storage requirements, and long record times
- User-selectable settings for quality and audio record enable / disable for each video channel
- Multi-level password protection for settings, playback, remote access, and more
- Integrated and filtered power supply for cameras, sensors, relays and other accessories
- Selectable idle frame rate with event-triggered burst recording speeds up to 30fps / camera
- Multiple alarm inputs with selectable pre-alarm and post-alarm recording
- Full event logging of every operation controlled by the DVR
- TV output channel for recorded, live, and advertising video

Video Viewing

- Streaming video output for advertising, entertainment, and information
- DVD-quality steaming audio / video channel with independent NTSC or PAL television output
- Convenient HDD, USB, or TCP / IP media updating and status file downloading
- Simultaneous and independent operation of DVR and streaming advertising

Video Retrieval and Archiving

- Ethernet port on the front panel for easy video retrieval on the vehicle with a notebook computer
- Two sets of RCA video and stereo audio outputs for monitor viewing on the vehicle
- USB 2.0 connections on both DVR and removable hard drives for fast file transfer utilizing PC-based file formats
- Easy to use PC-based software application for playback, file transfer, archiving management, and video file format conversion
- Vehicle management PC software interprets audio, video, and vehicle data for driver and vehicle use assessment
- Video event search software allows intelligent searching of video based on event information

Supplemental Data and Driver Management Modules

- External GPS antenna module for embedded digital information of GPS location, speed, heading, and time
- External 3-axis inertia sensor for embedded digital information or trigger of video-matched motion events for accident reconstruction
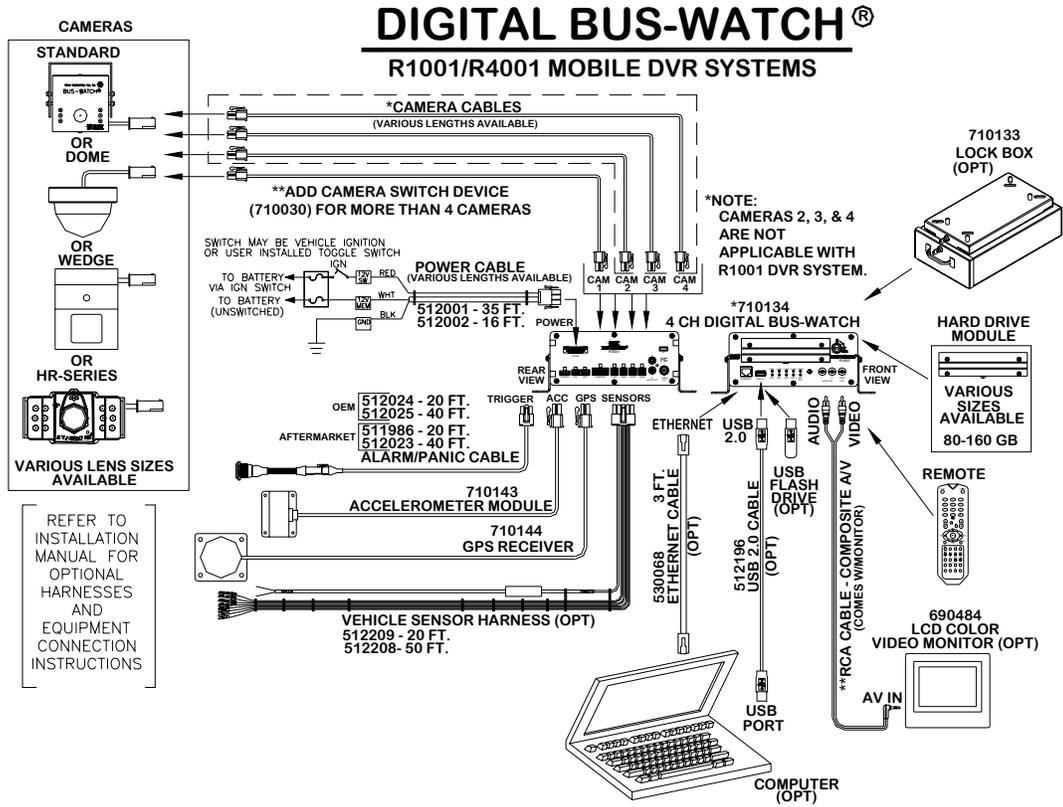
System Overview

Figure 1: R1001/R4001 Expanded System Overview

Front and Back Panels

FRONT PANEL LAYOUT

1	HARD DRIVE BAY
2	ETHERNET CABLE CONNECTION
3	USB 2.0 CABLE CONNECTION
4	LED STATUS INDICATORS
5	AUDIO OUTPUT CONNECTIONS, L (Left) AND R (Right)
6	VIDEO OUTPUT CONNECTION
7	HARD DRIVE LOCK
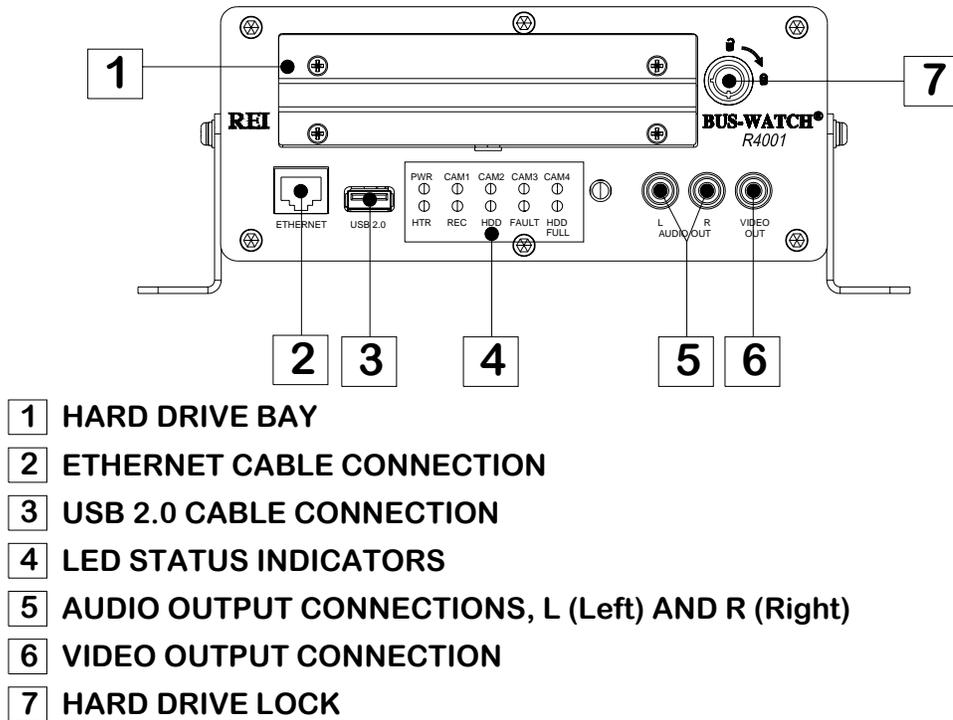
Figure 2: Front Panel Layout

REAR PANEL LAYOUT
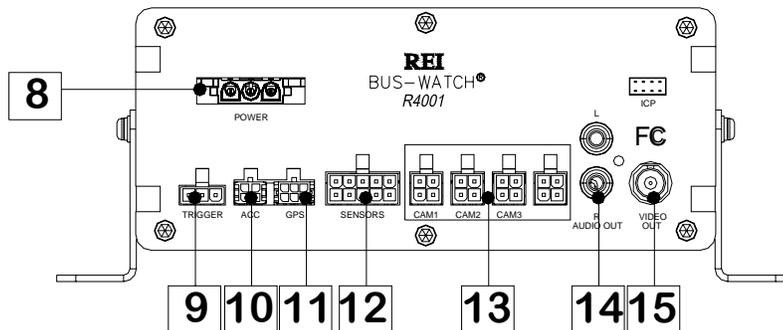
8 POWER CABLE CONNECTION

9 TRIGGER (ALARM/PANIC CABLE CONNECTION)

10 ACC (ACCELEROMETER MODULE CONNECTION)

11 GPS (GPS RECEIVER CONNECTION)

12 SENSORS (VEHICLE SENSOR CABLE CONNECTION)

13 CAMERA INPUTS (CAM1 ON R1001 MODEL; CAM 1-4 ON R4001 MODEL)

14 AUDIO OUTPUT CONNECTIONS, R AND L

15 VIDEO OUTPUT CONNECTION

Figure 3: Rear Panel Layout

Remote Control

REMOTE
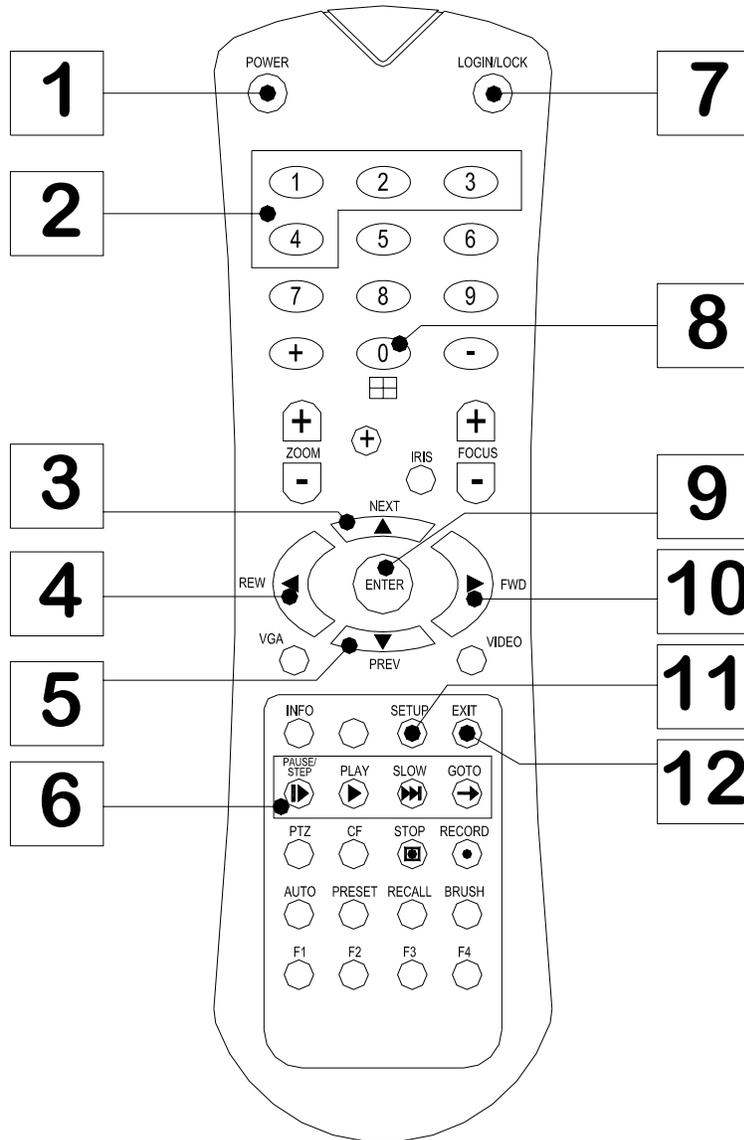
Figure 4: DVR Remote Control

I.D.	LABEL	FUNCTION
1	POWER	Turn DVR On/Off
2	Numeric "1" through "4"	Select Camera
3	NEXT	Volume UP
4	REW	Playback Function, X2, X4
5	PREV	Volume DOWN
6	PAUSE/STEP PLAY SLOW GOTO	Playback Functions
7	LOGIN/LOCK	Access Menu
8	"0"	Quad Screen
9	ENTER	Installers Mode
10	FWD	Playback Function, X2, X4
11	SETUP	Menu
12	EXIT	Exit

Figure 5: Remote Control Button Description

NAVAGATION ARROWS
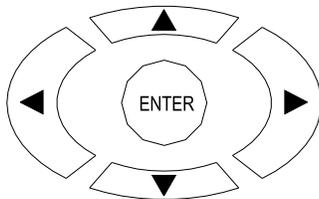
Use the ARROW keys to move between selections, input fields and icons. Press ENTER to select and EXIT to return. NEXT and PREV is also used to increase or decrease volume.

Figure 6: Remote Control Navigation Arrows

NUMERIC INPUT KEYS

Use the numbers to input values in the system setup screen or switch through the channels in live and playback modes.
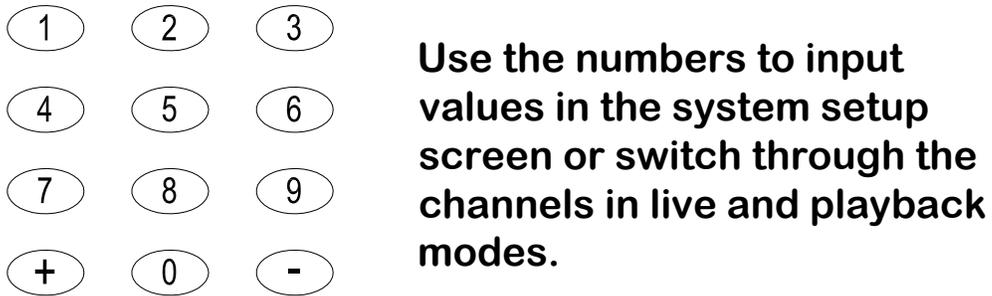
Figure 7: Remote Control Numeric Input Keys

Initial Set Up

The Digital BUS-WATCH® system will operate prior to any user setup with the default settings. However, it may not show the correct time and date (factory set to Central Standard Time). To set the correct date and time, and program the system operation to your requirements, please refer to the *Menu Configuration* section of this manual.

When accessing the menu, it is necessary to connect a video monitor to the video jack on the front or back of the unit. REI recommends our battery-powered 7-inch Color LCD monitor, P/N 690554.

Removable Hard Drive Modules

DVR Loading and Unloading

Inserting the Hard Drive: Turn the hard drive key to the unlocked and off position. Insert the hard drive into the bay. Turn the hard drive key to the locked and on position, as shown in Figure 8 on Page 15.

Removing the Hard Drive: Turn the hard drive key to the unlocked and off position. Gently remove the hard drive from the bay.

Note: The Digital BUS-WATCH® R1001 & R4001 will not function properly if the hard drive key is in the unlocked or off positions. If there is no hard drive present in the bay but the key is in the locked and on position, the Digital BUS-WATCH® will still power up normally, the menus can be accessed, etc.; however, the unit will not be able to record any video.
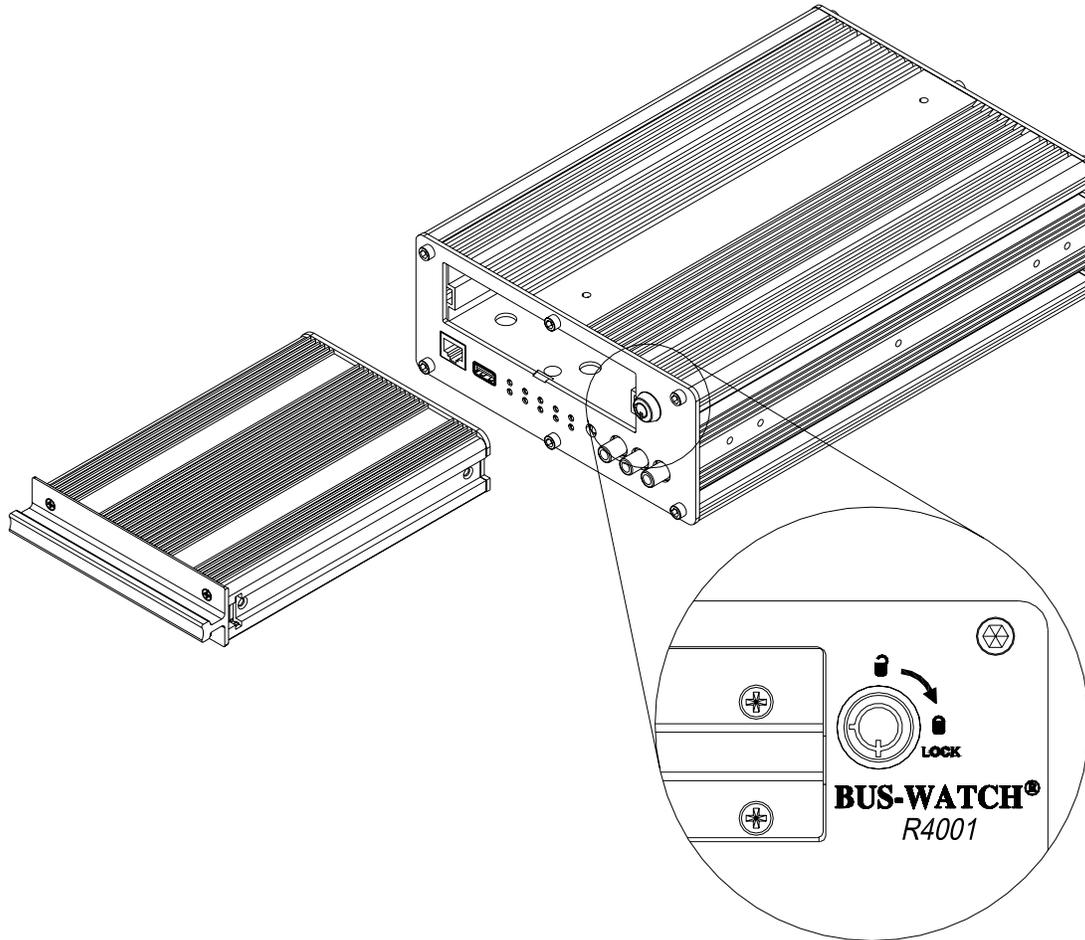
Figure 8: Removable Hard Drive Module Loading and Unloading

Hard Drive Module Directory Structure
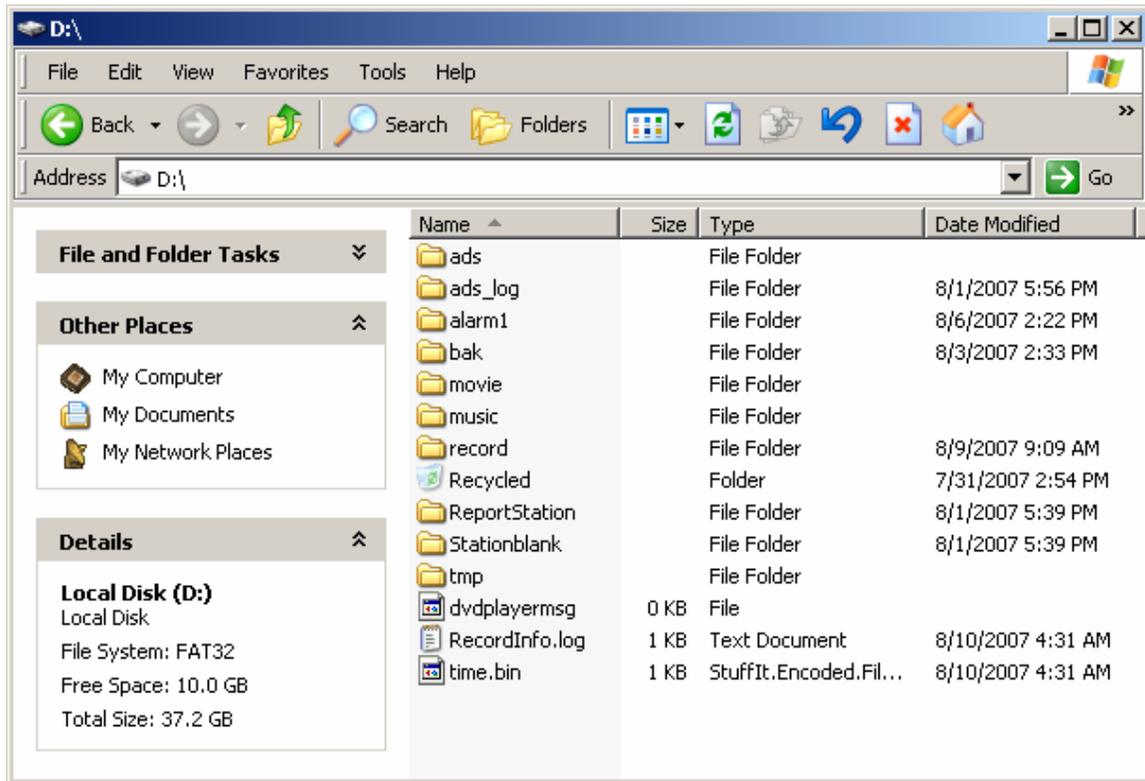
Figure 9: Hard Drive Module Directory Structure

The Directory structure of the Removable Hard Drive Module is shown above in Figure 9. Listed below are the general purposes of the files and folders.

ads:	The folder for advertising files.
ads_log:	The folder for the advertising logs.
alarm1:	The folder with the recorded video associated with alarms.
bak:	For internal DVR use only.
movie:	The folder for movie files.
music:	The folder for music files.
record:	The folder with the recorded video.
Recycled:	Windows file.
ReportStation:	Future use.
Stationblank:	Future use.
tmp:	For internal DVR use only.
dvdplayermsg:	For internal DVR use only.
RecordInfo.log:	For internal DVR use only.
time.bin:	For internal DVR use only.

Hard Drive Record Times

1 Camera with a 160GB Hard Drive (in Hours)

D1

Quality \ FPS	30	15	8	4	2	1
1	92	184	372	748	1496	2992
2	104	208	416	836	1672	3344
3	116	236	472	944	1892	3788
4	136	272	544	1092	2184	4372
5	160	320	644	1292	2584	5168
6	196	392	788	1576	3156	6316
7	252	504	1012	2028	4060	8120
8	352	708	1420	2840	5684	11368

HD1

Quality \ FPS	30	15	8	4	2	1
1	184	372	748	1496	2992	5984
2	208	416	836	1672	3344	6688
3	236	472	944	1892	3788	7580
4	272	544	1092	2184	4372	8744
5	320	644	1292	2584	5168	10336
6	392	788	1576	3156	6316	12632
7	504	1012	2028	4060	8120	16244
8	708	1420	2840	5684	11368	22740

CIF

Quality \ FPS	30	15	8	4	2	1
1	252	504	1012	2028	4060	8120
2	296	592	1184	2368	4736	9472
3	352	708	1420	2840	5684	11368
4	444	888	1776	3552	7104	14212
5	592	1184	2368	4736	9472	18952
6	708	1420	2840	5684	11368	22740
7	888	1776	3552	7104	14212	28424
8	1012	2028	4060	8120	16244	32492

32492 hours = 3 years, 8 months, & 18 days of constant 24 hour recording

USB Security Lockout
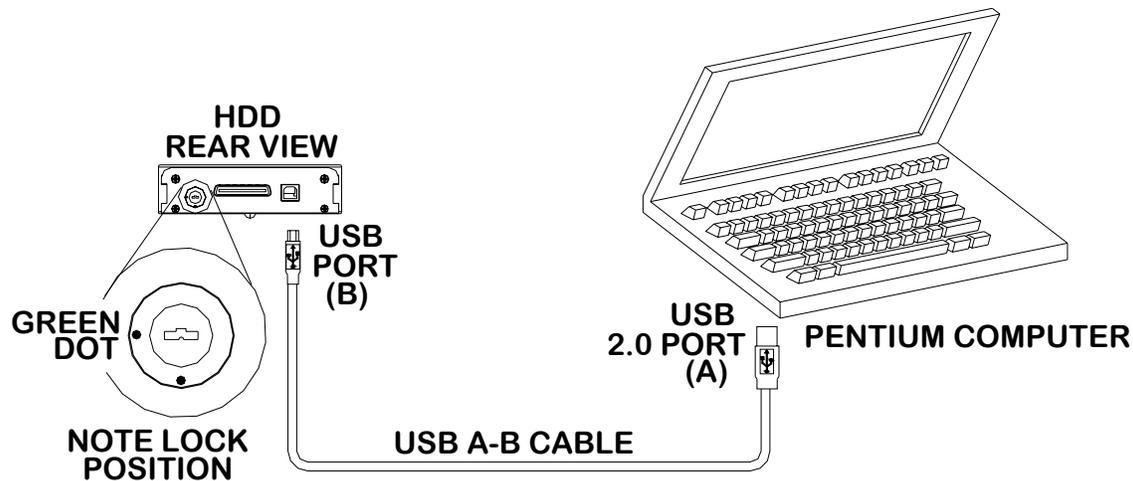
Figure 10: Hard Disk Drive Module USB Security Lockout

The REI Removable Hard Drive Module comes with an enhanced security feature that allows the property to lock out the USB port on the back of the module. This is shown above in Figure 10. This feature provides another level of protection to ensure that information stored on the drive will not be tampered with or erased. When the key lock on the back of the DVR is switched into the green dot position, the USB port functions normally and the hard drive will be recognized by a PC as an external USB hard drive. When the key lock is switched into the red dot position, the USB port is disabled and a computer will not be able to access the files stored on the drive. Regardless of the position of the key lock switch, the DVR is always able to access the drive, so the switch can be left in the red dot (USB off) position during normal DVR operation with no adverse effects. In this situation, the hard drive USB keys can be safely kept with the proper personnel for added assurance of video evidence integrity.

Automatic Hard Drive Heater

In order to prevent the possibility of hard-drive damage during cold periods, the Digital BUS-WATCH® is equipped with a temperature sensor. The heater is activated when the temperature is below 40° F and the Digital BUS-WATCH® is turned on via system switch or timer. The red LED labeled HTR on the front panel indicates this. The colder the temperature, the longer the heater remains on, with a maximum of fifteen minutes at the coldest temperatures. When the unit has completed its heating cycle, it will restart and operate normally. As the temperature inside the unit drops during operation, the heater will periodically come on to maintain a working operating temperature. The unit can operate to temperatures below -40° F. The menus and the installer's mode are still operational during the initial drive warming period.

Long Term Storage

Although the Digital BUS-WATCH® systems draw very little current in the stand-by mode, if the systems are installed but not used for an extended period of time (longer than 2 weeks) it is recommended that the power be disconnected from the DVR to avoid draining the vehicle battery. The DVR internal clock will hold time and date for up to 10 years sitting on a shelf, and the daylight saving time functions will kick in upon re-initialization when power is applied.

Installation

WARNING

DISCONNECT VEHICLE BATTERY VOLTAGE <u>BEFORE</u> INSTALLING SYSTEM WIRING

WARNING

DISCONNECT POWER TO THE DIGITAL BUS-WATCH® <u>BEFORE</u> JUMP STARTING VEHICLE

WARNING

INSTALL DVR HORIZONTALLY. USE EXTERNAL SHOCK AND VIBRATION DAMPENING IF NEEDED.

System Wiring – Power and Camera Cables

Note: All cables should be hidden from view.

For the basic system (shown in Figure 11 on Page 21), there are five cables, one power (P/N 512002 – 16 Feet, or 512001 – 35 Feet) and 4 camera (P/N 510993 or any different length cable). For external record indication and alarm/event marking, the record indicator / event mark button harness (P/N 511986) is available (shown in Figure 12 on Page 22). The GPS harness (P/N 710144) is used for satellite location and movement information (shown in Figure 13 on Page 23). For additional vehicle monitoring, the BUS-WATCH® vehicle sensor options harness (P/N 512008) is available (shown in Figure 15 on Page 24).

Connect the camera(s) using cable P/N 510781, or equivalent. There is no specific orientation for camera cables to be installed. If multiple types of cameras are installed in a single system, be careful to note which cameras are located where. Use lenses with more magnification (8mm) to bring objects closer. Use lenses with less magnification (4mm) for wide angle viewing.

Connect power using cable P/N 512002, or equivalent. The black wire connects to the negative terminal of the battery. The white wire (labeled 12V Battery) connects directly to the positive terminal of the battery. **The white wire should be fused at 10**

Amps if using a 7 or more camera system with a Quad Video Processor (P/Ns 700483 or 700848). See Figure 11.

Connect Camera Switching Devices (P/N 700462 or 710030) as needed for multiple camera systems.

IF THE SYSTEM OPERATES IN THE MANUAL RECORD MODE, connect the red wire (labeled 12V SW), to the switched side of the ignition switch. The red wire should be fused at 1 A. The red wire does not need to be connected if the system is in TIMER record mode.
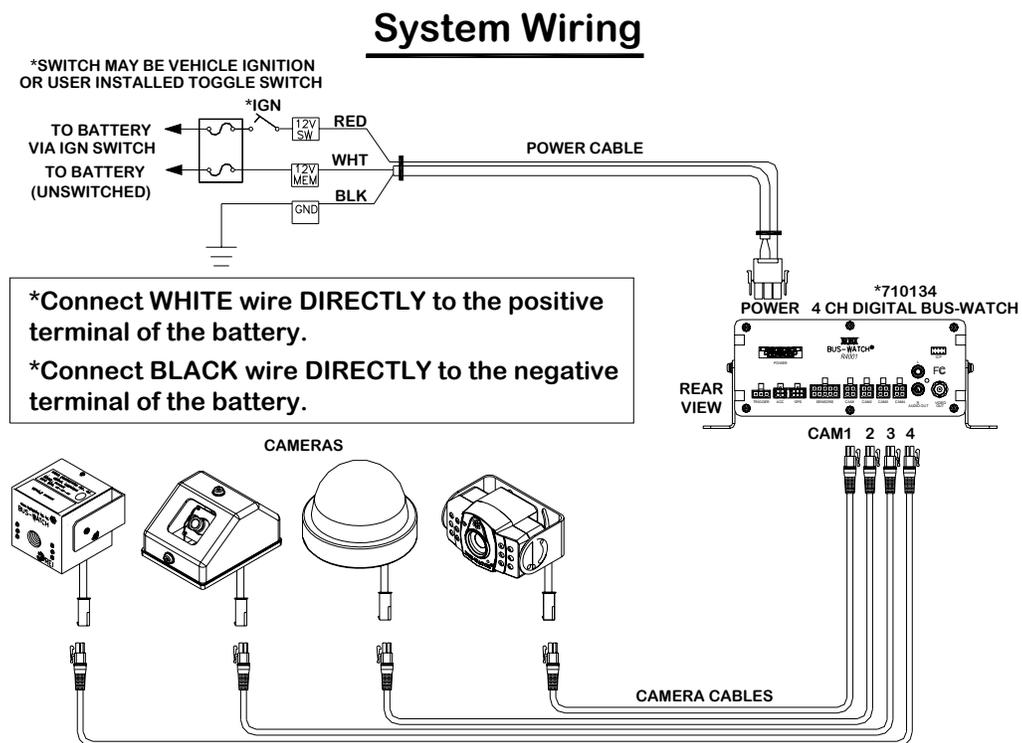
System Wiring

Note: White wire fused @ 7A (1-6 Cameras), 10A for more cameras; Red wire fused @ 1A.

Figure 11: System Wiring – Power and Camera Cables

External Record Indicator / Event Mark Button Harness

710131 or 710134
DIGITAL BUS-WATCH®

TRIGGER   **REAR VIEW**

20 FT.   511986
ALARM/PANIC CABLE

ALSO AVAILABLE: 512023 40 FT. (AFTERMARKET)
512024 20 FT. (OEM)
512025 40 FT. (OEM)
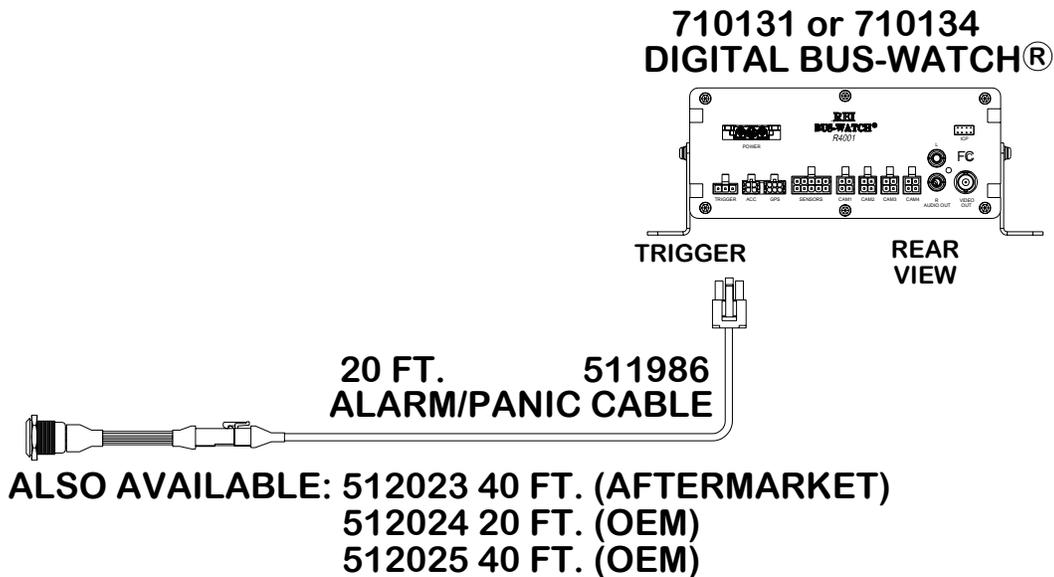
Figure 12: External Record Indicator / Event Mark Button Harness Connection

The optional Digital BUS-WATCH® external record indicator / event mark button harnesses come in 2 different types of switches, both in 2 different lengths. Reference the Digital BUS-WATCH® systems related part numbers – system harnesses section of this manual on Page 89 for specific part numbers. The 2 types of switches are OEM and aftermarket. The OEM switch is rectangular and fits into a standard size dashboard knockout. The aftermarket switch is round, for easier installation in vehicles without spare switch knockouts. All of the cables plug into the same port on the back of the DVR. See Figure 12 for connection illustration.

GPS Antenna Module Harness

710131 or 710134
DIGITAL BUS-WATCH®

GPS   **REAR VIEW**

710144   GPS RECEIVER
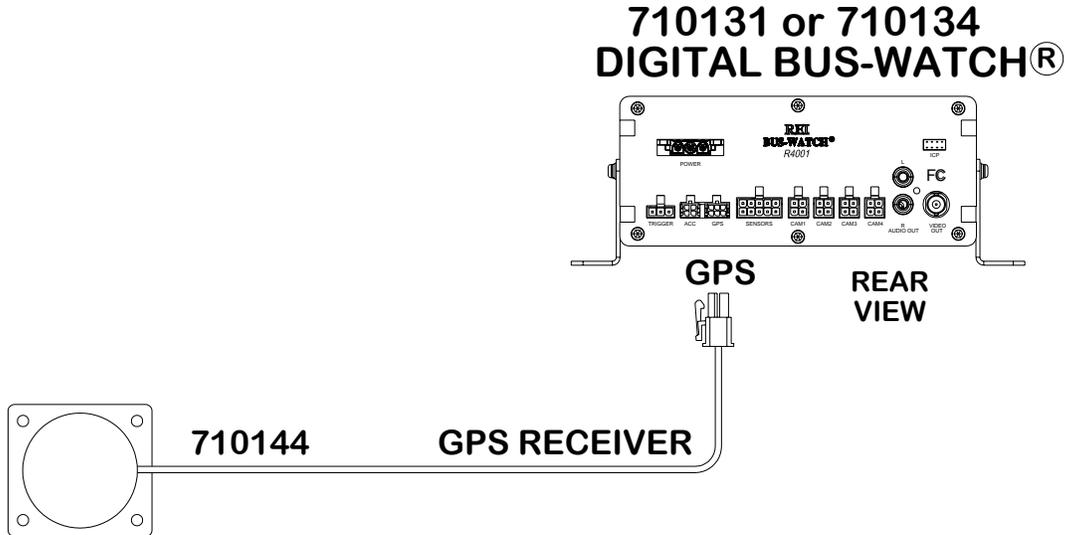
Figure 13: GPS Antenna Module Harness Connection

The optional Digital BUS-WATCH® GPS antenna module harness plugs into the back of the DVR as shown in Figure 13 above. This module will track up to twelve satellites at a time while providing one-second navigation updates at low power consumption. The GPS antenna module is housed in a black, water-resistant case and designed to withstand rugged operating conditions. Information provided to the DVR system includes longitude, latitude, speed, heading, date, and time. Internal memory backup allows the GPS antenna module to retain critical data such as satellite orbital parameters, last position, date, and time, to reduce valid data acquisition time.

When the GPS System is recognized by the DVR, a notification icon will appear on the DVR video outputs to allow the installer or end user to verify proper operation. See Figure 14 below.

Figure 14: GPS Notification Icon

Vehicle Sensor Options Harness
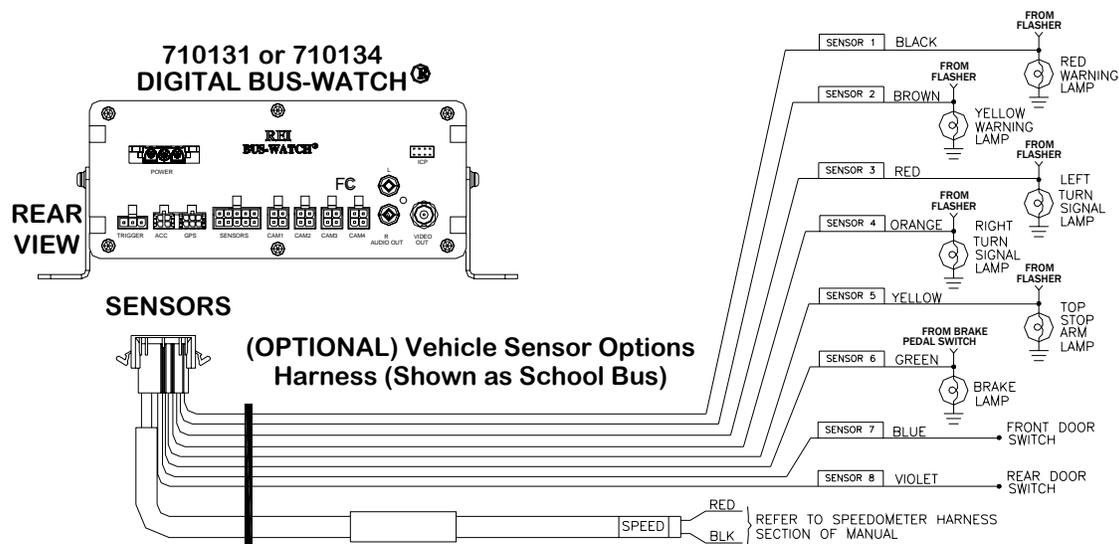
Figure 15: Vehicle Sensor Options Harness Connection

The BUS-WATCH® Vehicle Sensor Options Harness (shown in Figure 15 above) connects to various locations in the vehicle to provide on-screen information regarding vehicle performance. Vehicles have different sets of signals that can be monitored. Three levels of on-screen displays are available to the installer: SCHOOL BUS, TRANSIT, and CUSTOM.

The default SCHOOL BUS monitored points in the vehicle are:

- Vehicle speed
- Brake activation
- Amber warning lamp operation
- Red warning lamp operation
- Stop arm lamp operation
- Front and Back Doors
- Turn Signals

The default TRANSIT monitored points in the vehicle are:

- Vehicle speed
- Brake activation
- Warning lamp operation (de-acceleration lights)

- Turn signals
- Front door switch operation
- Back door switch operation
- Optional point with Auxiliary (Aux 1 is user-defined and may be used to monitor points such as wheelchair lifts, inertia sensors, etc.)

The CUSTOM vehicle sensor option allows for most other situations. The letters that appear on the screen are settable through the menu system. The default settings are blank.

When using these options, the DEFAULT condition is that the Digital BUS-WATCH® considers a low voltage (or ground) the OFF state. A high voltage (5-15 VDC) is interpreted as the ON state. To switch the polarity of these signals, reference the Vehicle Sensor Levels Options menu page as shown in Figure 71 on Page 70.

Speedometer Harness Wiring Instructions

> **Refer to the vehicle service manual for speedometer type, exact wire location, and transmission manufacturer warnings.**

The BUS-WATCH® speedometer input wires are designed to be spliced directly onto the transmission speedometer transducer wires. In some installations, this may not be possible (i.e. mechanical speedometer, transmission manufacturer warnings, etc.). The BUS-WATCH® Vehicle Speed Sensor Kit (P/N 750086) may be required.

Vehicle Sensor Options Harness Vehicle Connections
(Shown as School Bus)

WIRE COLOR	WIRE DESCRIPTION
BLACK	RED WARNING LAMP
BROWN	YELLOW WARNING LAMP
RED	LEFT TURN SIGNAL
ORANGE	RIGHT TURN SIGNAL
YELLOW	STOP ARM
GREEN	BRAKES
BLUE	FRONT DOOR
VIOLET	REAR DOOR

Yellow Warning Lamps
Connect the BROWN wire to the Warning Lamp Flashers' Yellow lamp output.

Red Warning Lamps
Connect the BLACK wire to the Warning Lamp Flashers' Red lamp output.

Stop Arm Lamps
Connect the YELLOW wire to the switched side of the top stop arm lamp.

Brake Lamp
Connect the GREEN wire to the switched side of one brake lamp.

Turn Signals
Connect the RED and ORANGE wires to the left and right turn signal lamps.

Front and Back Doors
Connect the BLUE and VIOLET wires to the switched side of the door switches.

On-Screen Information with Vehicle Sensor Options Harness

The Digital BUS-WATCH® Surveillance system, when equipped with the BUS-WATCH® Option Harness, will display information on-screen in the Installers Mode when the vehicle's monitored switches are activated and signals are applied to the monitored sensors.

ACTIVE SWITCH OR SIGNAL	ON-SCREEN DISPLAY
BRAKE APPLIED	BR
STOP ARM DEPLOYED	SA
YELLOW WARNING LAMPS ON	YW
RED WARNING LAMPS ON	RW
LEFT TURN SIGNAL ON	LT
RIGHT TURN SIGNAL ON	RT
FRONT DOOR OPEN	FD
REAR DOOR OPEN	RD
SPEEDOMETER (SEE NOTE 1)	XX MPH

NOTE:
1. The XXs represent the vehicle speed (i.e. 35).

Accelerometer Module Harness

710131 or 710134
DIGITAL BUS-WATCH®

ACC

REAR VIEW

710143
ACCELEROMETER MODULE
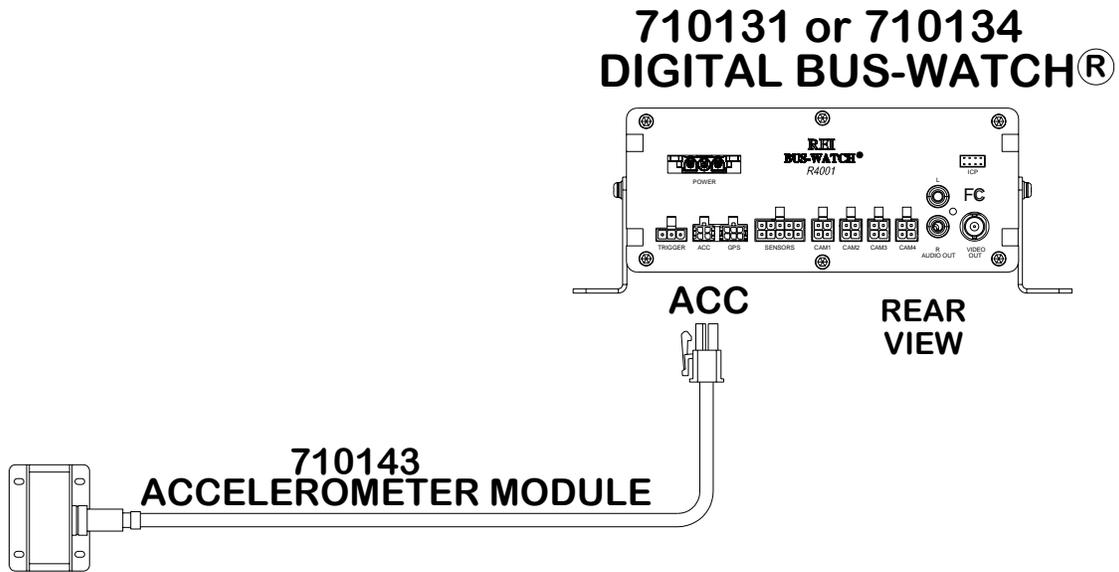
Figure 16: Accelerometer Module Harness Connection

The optional external Accelerometer, or Inertia Sensor, must be hard mounted to the vehicle floor, frame, or some other non-dampened part of the vehicle. The reason for this is so that if external dampening is used for the DVR, it will not throw off the Accelerometer readings.

To properly install the Accelerometer Module, the user must align the device with the picture on top of the module as shown in Figure 17 below. The X axis is drawn from the back to the front of the bus, the Y axis is drawn from the side of the bus to the other side of the bus, and the Z axis is drawn from the bottom to the top of the bus. The Accelerometer Module then needs to be calibrated as shown in Figure 80 on Page 79.
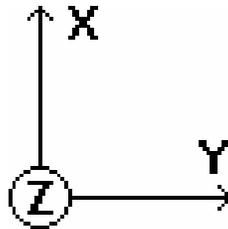
Figure 17: 3 Axis Inertia Sensor Directions

Physical Mounting Requirements

L Bracket Mounting
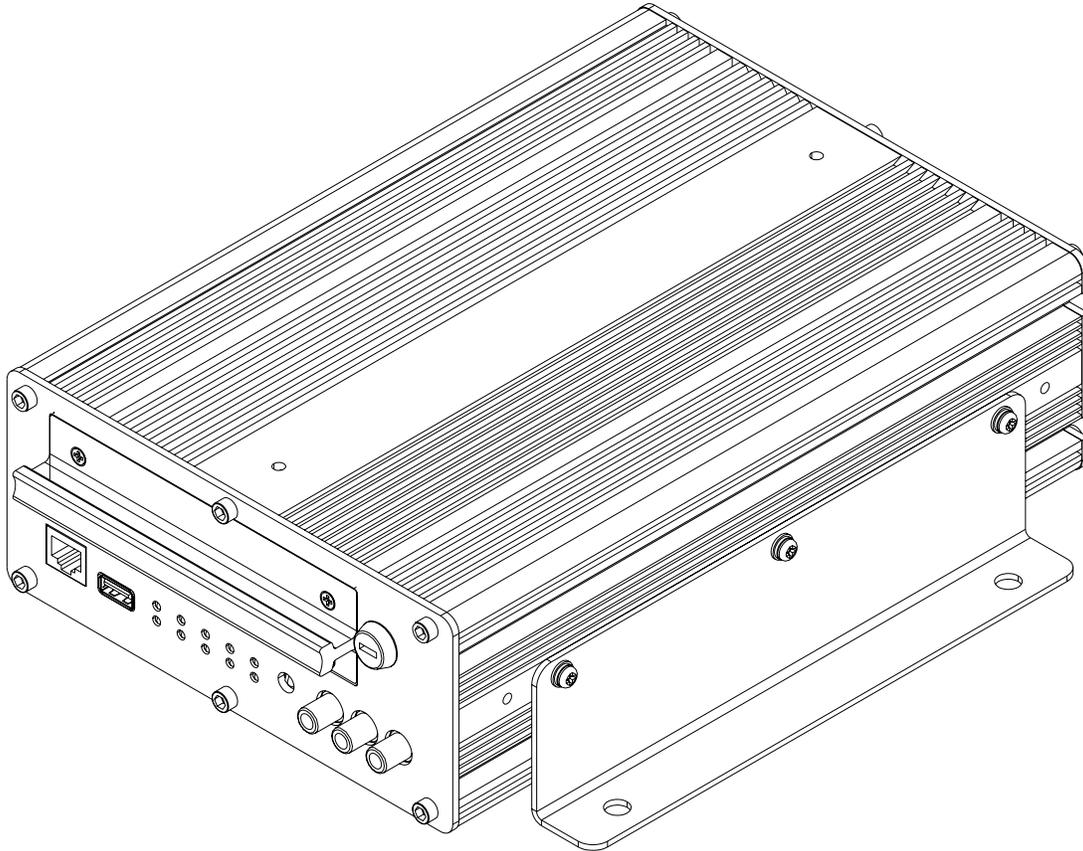
Figure 18: L Bracket Floor Mounting

The DVR has 3 holes on each side for easy mounting with the included L Brackets, as shown in Figure 18 above. The mounting holes are positioned so that the L Brackets can be flipped for a hanging mount installation if necessary, required, etc. This type of installation is recommended for vehicles that have a secured compartment, such as a radio box, where the DVR cannot be tampered with.

Security Cabinet Mounting

There may be installations that require the DVR be enclosed in its own protective enclosure. The R1001 and R4001 DVRs can be installed in REI's industrial grade security cabinet (P/N 710133) as shown in Figure 19 below.
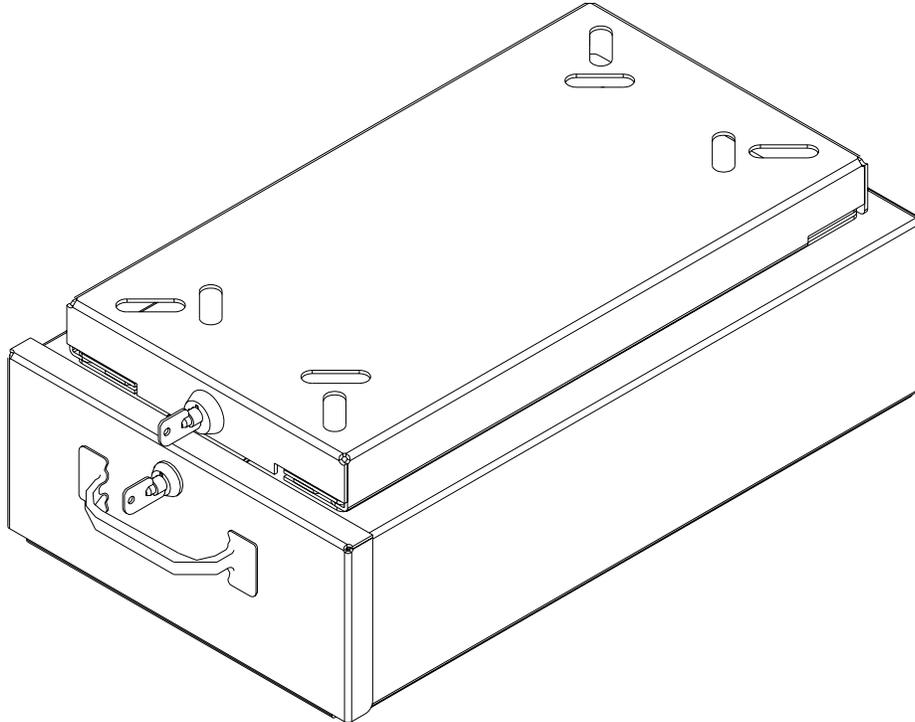
Figure 19: REI's Industrial Grade DVR Security Cabinet

Security Cabinet Clearance Requirements

When using the DVR Protective Enclosure (P/N 710133) the Installers need to ensure the correct amount of open space in front of the installation so that the DVR may be removed from the slide bracket, as shown in Figure 20 below.

TOP VIEW

9.00 IN.

15.50 IN.

SLIDE BRACKET WITH RECORDER

15.50 IN.

THIS AREA FREE OF OBSTACLES
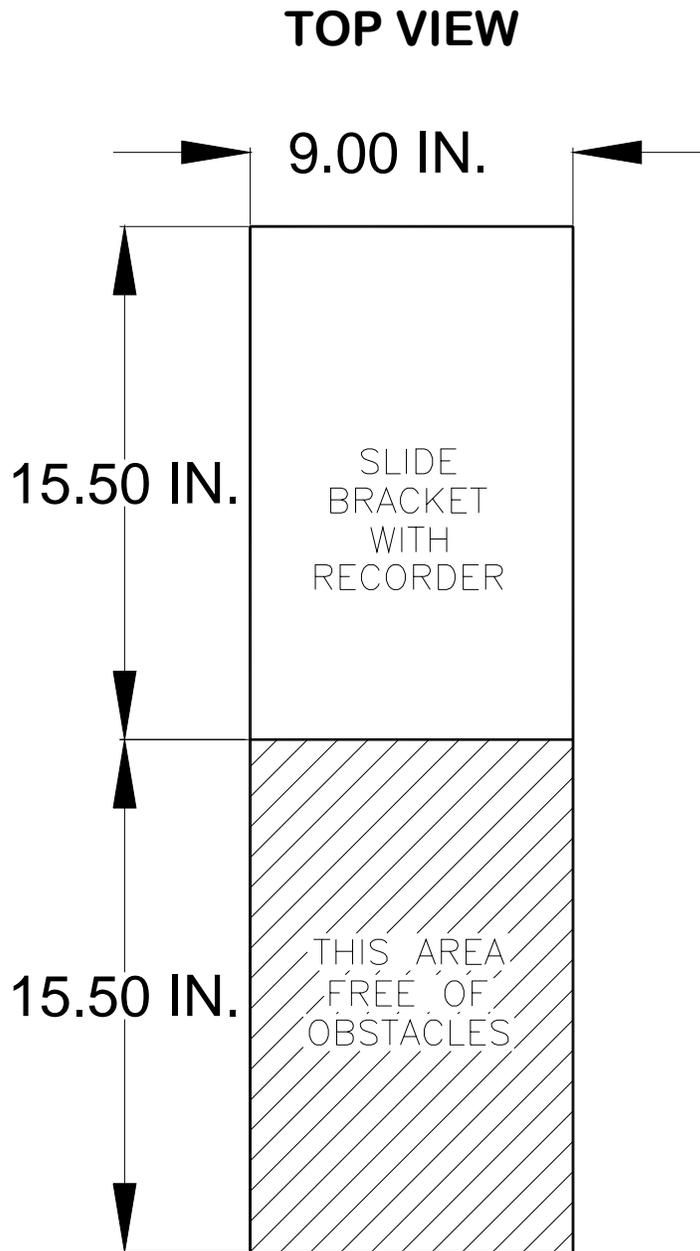
Figure 20: Physical Mounting Clearance Requirements

Security Cabinet Hanging Mount
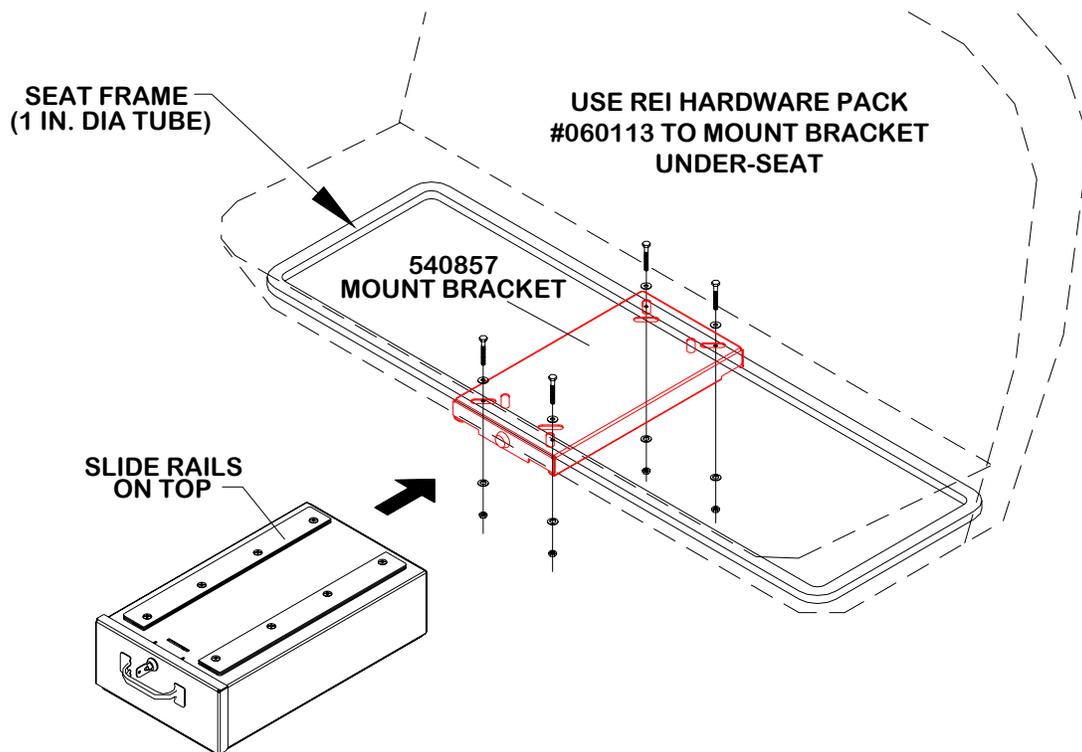
Figure 21: Security Cabinet Under-Seat Mount

There are two common ways to mount the Digital BUS-WATCH® Security Cabinet. First is the under-seat, or hanging, method. This method mounts the slide bracket to the underside of a seat as shown in Figure 21 above. Second is the floor-mount method. This method mounts the Digital BUS-WATCH® to the floor of the bus as shown in Figure 23 on Page 33.

1) Find a suitable location under the first seat behind the driver or under the driver's seat. An area 15-1/2 inches should be unobstructed in front of the slide bracket to allow sliding the security cabinet onto the slide bracket.
2) If necessary, modify the slide rails according to the instructions on Page 32.
3) Position the slide bracket on the frame of the seat in the desired location. Firmly secure to the seat either by using clamps or drilling 5/16th inch holes through the frame using the bracket as a guide.
4) Attach slide bracket to clamps or seat frame using nuts and bolts.

IMPORTANT:
Check local, state, and federal guidelines as to modification of the existing structures within the vehicle.

Security Cabinet Mount Conversion

SLOTS FACE OUTWARD

TOP
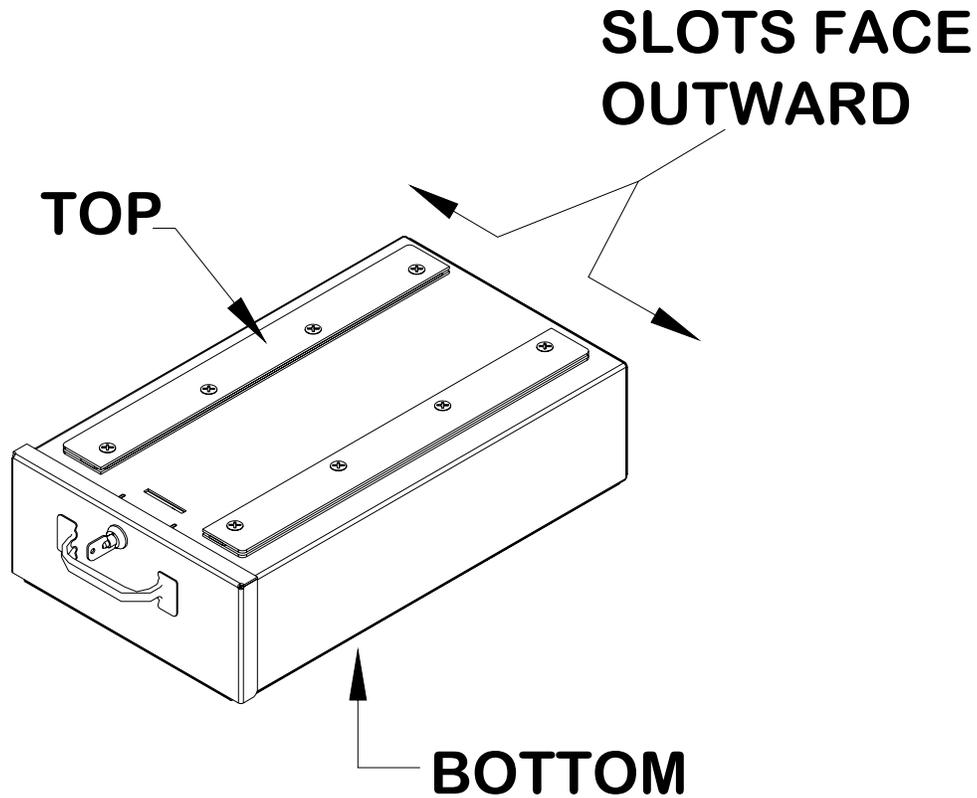
BOTTOM

Figure 22: Security Cabinet Mount Conversion

        To change the protective enclosure from Hanging Mount to Floor Mount, remove the 8 thread protection caps from the bottom side of the Security Cabinet. Next, reverse the placement of the slide rails and screws from top to bottom of the Digital BUS-WATCH® Security Cabinet. Put the 8 thread protection caps into the 8 holes on top of the enclosure.

Security Cabinet Floor Mount

SLIDE RAILS ON
BOTTOM OF LOCK BOX

USE REI HARDWARE PACK
#060094 TO MOUNT
BRACKET ON THE FLOOR

540857
MOUNT BRACKET

RUBBER
MOUNTS
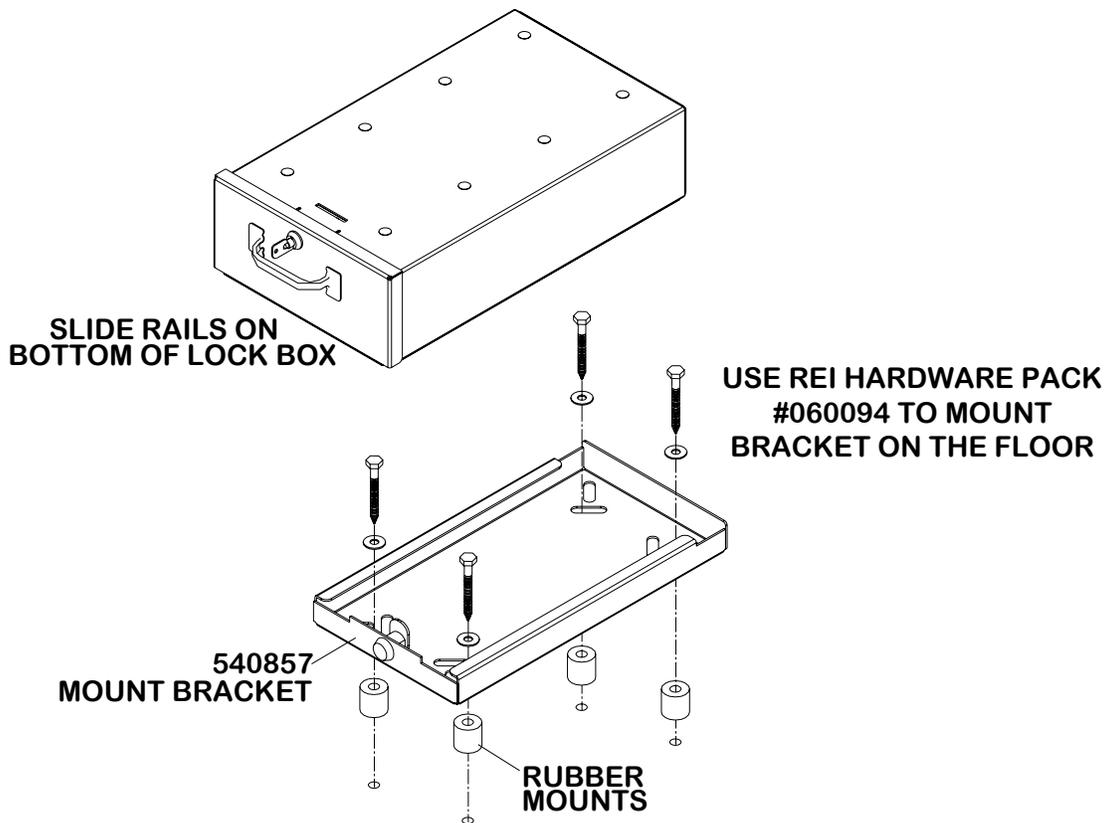
Figure 23: Security Cabinet Floor Mounting

Find a suitable location to mount the slide bracket on the floor. The Digital BUS-WATCH® should not present a trip hazard or head impact hazard and should not interfere with the seating, safety, or comfort of the passengers.

1) An area 15 and 1/2 inches should be unobstructed in front of the slide bracket to allow sliding the Digital BUS-WATCH® onto the bracket.
2) Position the slide bracket on the floor and drill four 3/16th inch holes into the floor using the mounting holes as a guide.
3) Set aside the slide bracket. Position four rubber shock mounts over the pilot holes.
4) Place the slide bracket over the rubber shock mounts. Align the mounting holes to the center of the shock mounts.
5) Secure slide bracket to the floor using four lag bolts.
6) Carefully slide the cabinet onto the slide bracket being sure to check alignment of the connector. Lock to secure.

Camera Placement

The Digital BUS-WATCH® cameras can be mounted anywhere in the vehicle, unless this does not give a stable mount or it vibrates excessively. Use outdoor cameras for exterior placement.
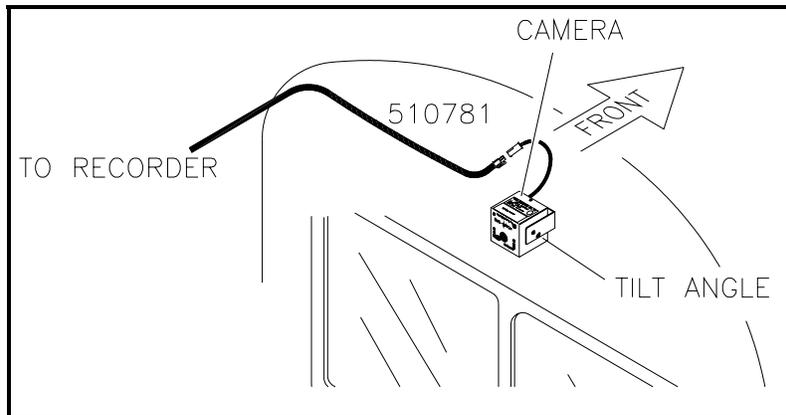
Figure 24: Camera Connection and Placement

For a single camera installation, it is common to place the camera in the front of the vehicle looking towards the rear of the vehicle. The Digital BUS-WATCH® camera shown in Figure 24 above is mounted to the center of the front header panel.
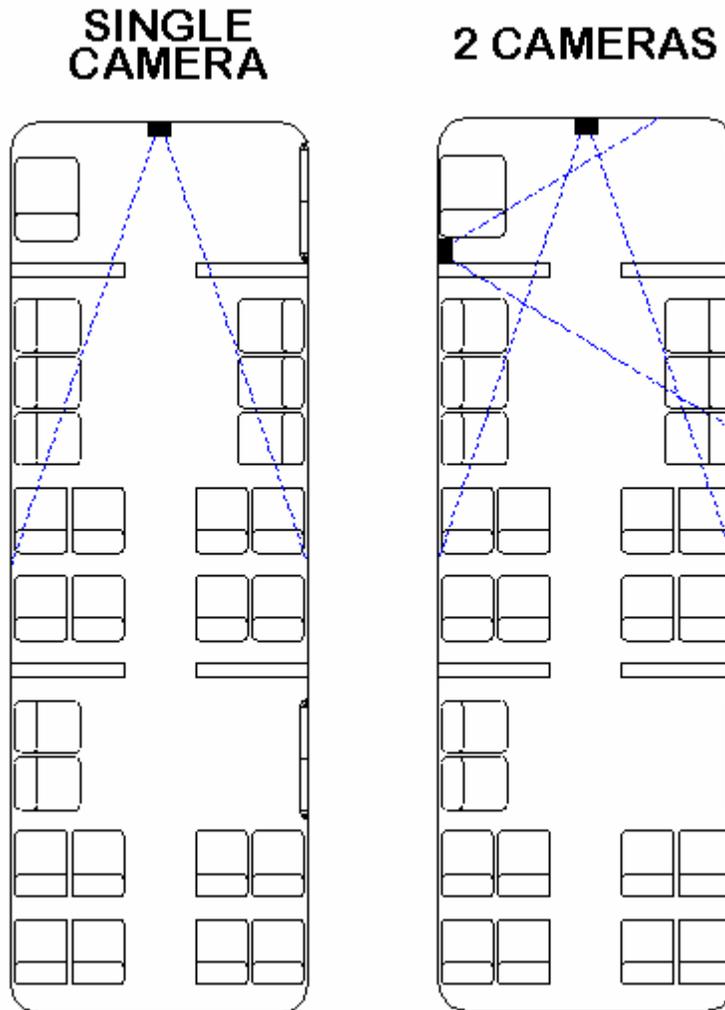
Figure 25: Potential Single and Two Camera Placement Options

4 CAMERAS INTERIOR

4 CAMERAS EXTERIOR
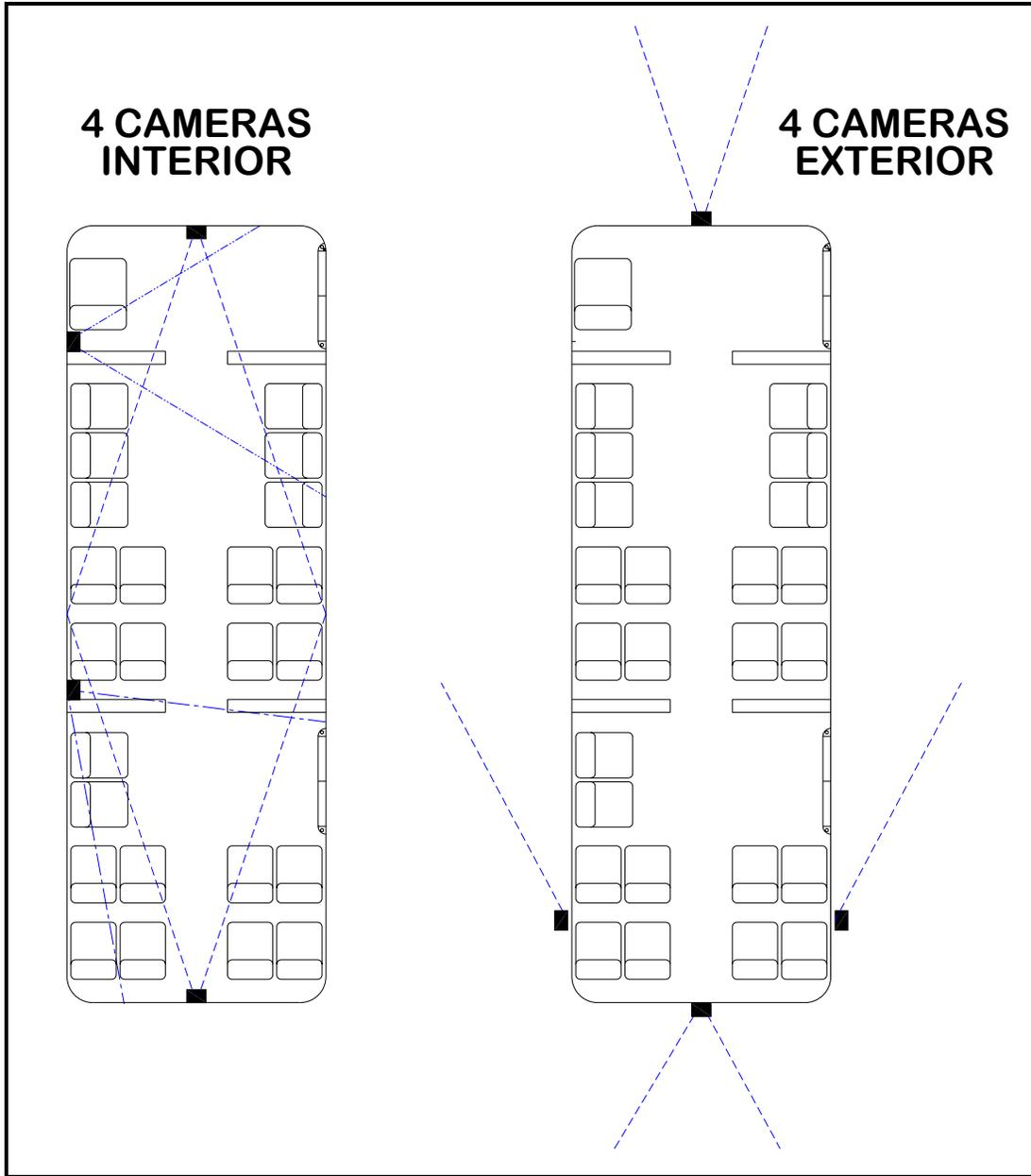
Figure 26: Potential Multiple Camera Placement Options

Typical Camera Lens Viewing Angles
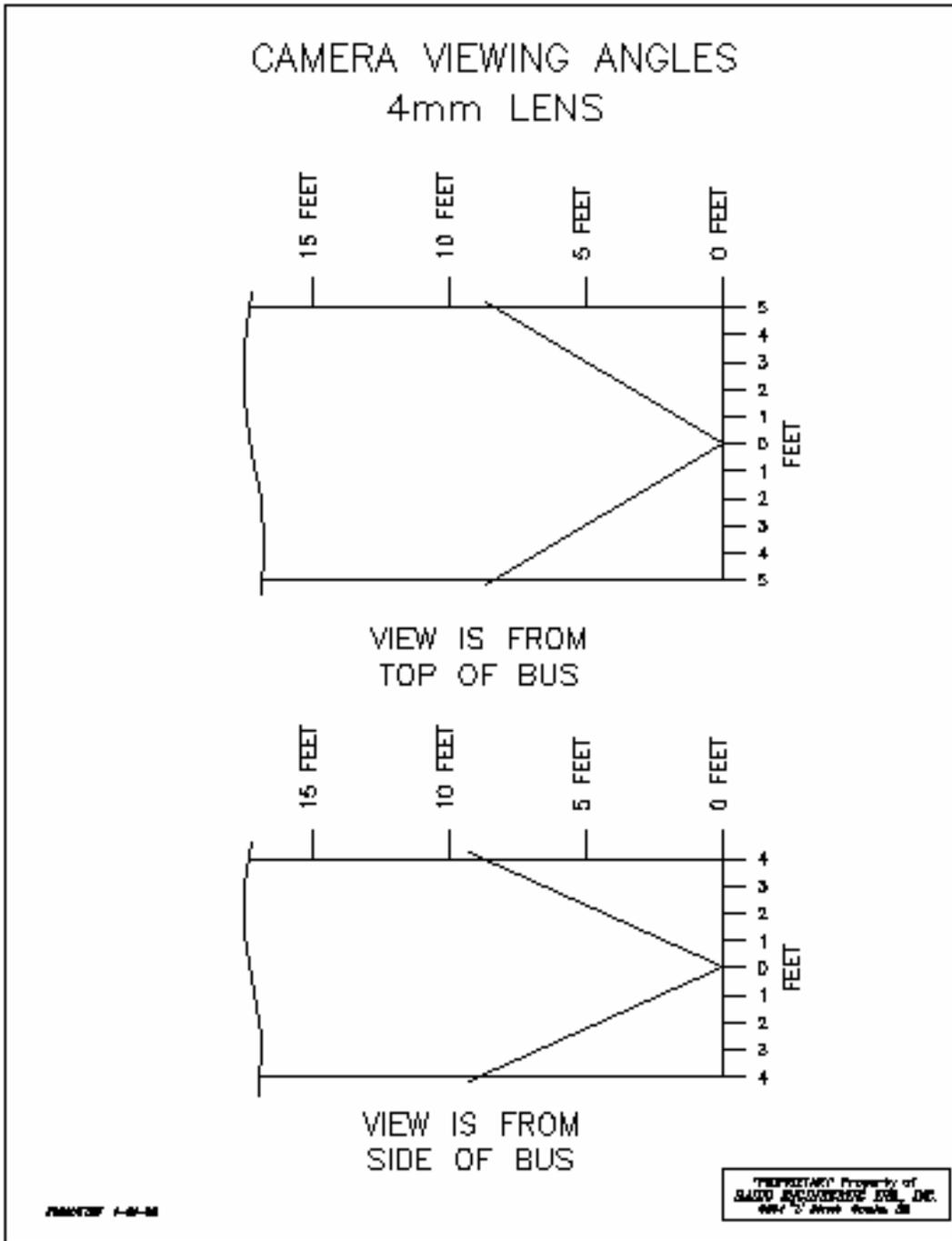
Figure 27: 4mm Lens Angles
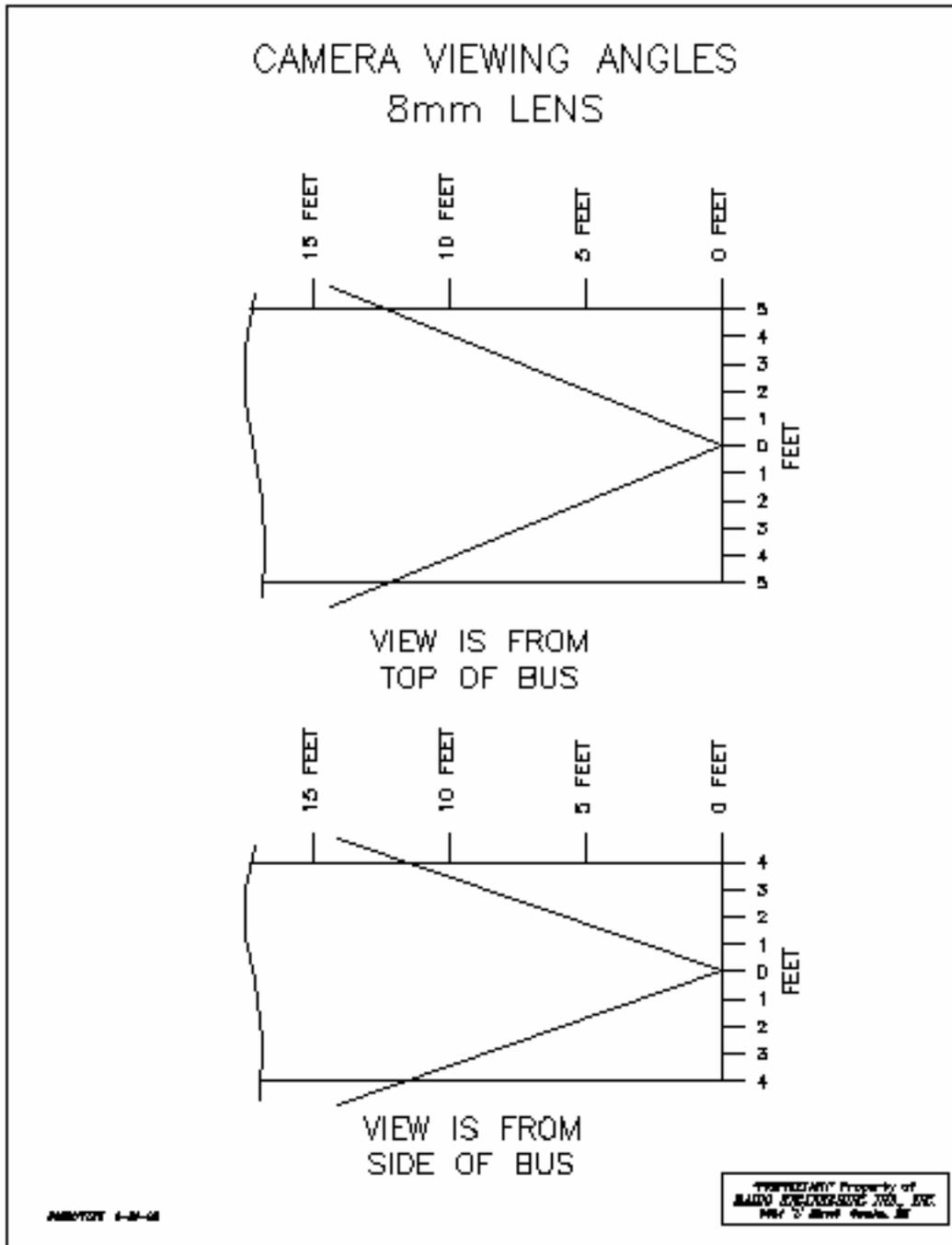
Figure 28: 8mm Lens Angles

Recording & Playback

System Start-Up

To start the recording process, place the *system switch* in the ON position (this will be done automatically if the *system switch* is connected to the ignition switch and the ignition switch is in the ON position). Upon turning the system switch ON, the Digital BUS-WATCH® will commence recording.

System Shut-Down

To stop the recording process, place the *system switch* in the OFF position. If the OFF DELAY option is enabled, the Digital BUS-WATCH® will continue to record for the prescribed number of minutes. When the off-delay expires, the camera and Digital BUS-WATCH® shut off.

Playback Options

There are 4 main ways to view the recorded video. The connection options are: through the TV Video Outputs (Front or Back), through the Removable Hard Drive USB Connection, through the Front Panel USB Connection, and through the Front Panel PC Network Connection.

TV Video Outputs (Front and Back)

Using a TV Monitor and a Remote Control, the user can access recorded video files by Date and Time or by Event. After selecting the appropriate file, the user can review the video using Play, Stop, Pause, Fast Forward, Fast Rewind, Slow Forward, Slow Rewind, Frame Forward, and Frame Reverse. The user can select individual video channels to be displayed full screen by pressing the numeric button on the remote corresponding to that channel, or view all channels at the same time by pressing the zero button on the remote.

Removable Hard Drive USB Connection

Using the REI RMS PC Software, the user can access the files by connecting the computer to the Removable Hard Drive Module Back Panel USB port as shown in Figure 10 on Page 18.

Front Panel USB Connection

Using the REI RMS PC Software, the user can access the files by connecting the computer to the DVR Front Panel USB port.

PC Network Connection

Using the REI RMS PC Software, the user can access the files by connecting the computer to the DVR Front Panel Ethernet port, as shown in Figure 29 below.
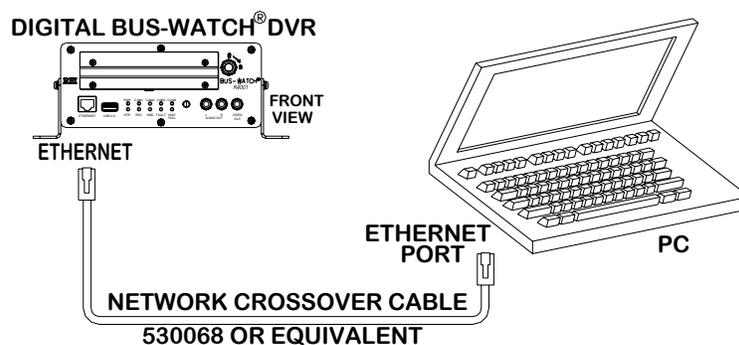
Figure 29: Connecting to the DVR with a Computer through the Ethernet Connection

Menu Configuration

Installers Mode Page

Figure 30: Installers Mode Screen Shot

The Installers Mode Page is a display that is brought up and taken away by pressing the ENTER button on the remote control and is displayed on the video output RCA ports. The purpose of this on-screen text overlay mode is to give the installers an easy way to see some of the important information relating to the proper installation of the DVR. Any of the vehicle sensor options that are being currently activated, such as brakes or turn signals, would display on the screen in this mode. No text placed over the screen, either in this mode or any other, is ever recorded to the video. All of the data associated with the video is digitally embedded into the video frames, creating a proprietary format that requires REI PC Software to decode and display.

Main Menu Page

Figure 31: Main Menu Screen Shot

The DVR Configuration Menu can be accessed by pressing the SETUP button on the remote control. Using the UP, DOWN, and ENTER buttons on the remote control, the user can access all of the different options of the DVRs. SYSTEM SETUP is where all of the various record configuration settings can be viewed or set. TIME/DATE SEARCH is where the user can play back video by choosing the specific Time and Date they would like to view. EVENT SEARCH allows the user to select video playback by pre-defined event triggers. ADVERTISING shows all of the files that have been put on the Hard Disk Drive Module for playback during recording. MOVIES and MUSIC also show the files that have been put onto the HDD Module and are the access points for the user to select playback during recording.

System Setup

This Section, SYSTEM SETUP, describes where all of the various record configuration settings can be viewed or set using a video monitor and a remote control.

The SYSTEM SETUP Section of the Menu is subdivided into 5 main categories, SYSTEM, CAMERA, SCHEDULE, EVENT SETUP, and SYSTEM INFO.

System
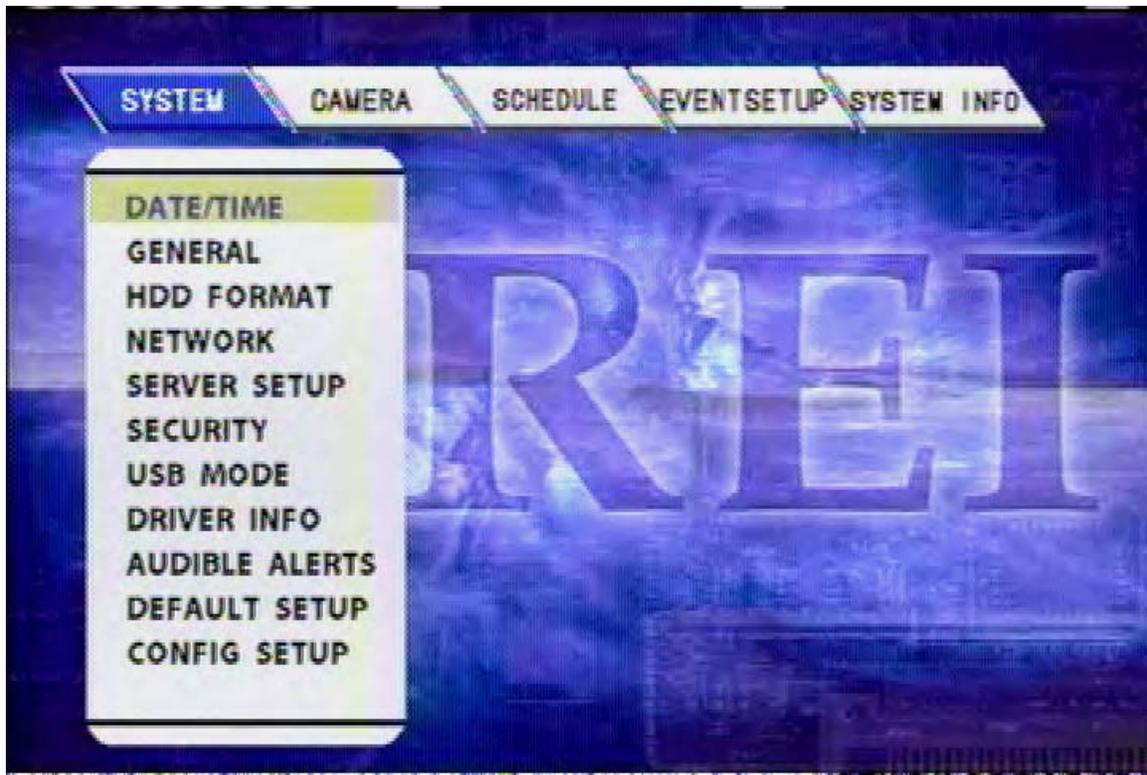
Figure 32: System Setup Screen Shot

The SYSTEM Section of the SYSTEM SETUP Sub-Menu is subdivided into 11 subcategories, DATE/TIME, GENERAL, HDD FORMAT, NETWORK, SERVER SETUP, SECURITY, USB MODE, DRIVER INFO, AUDIBLE ALERTS, DEFAULT SETUP, and CONFIG SETUP.

Date/Time
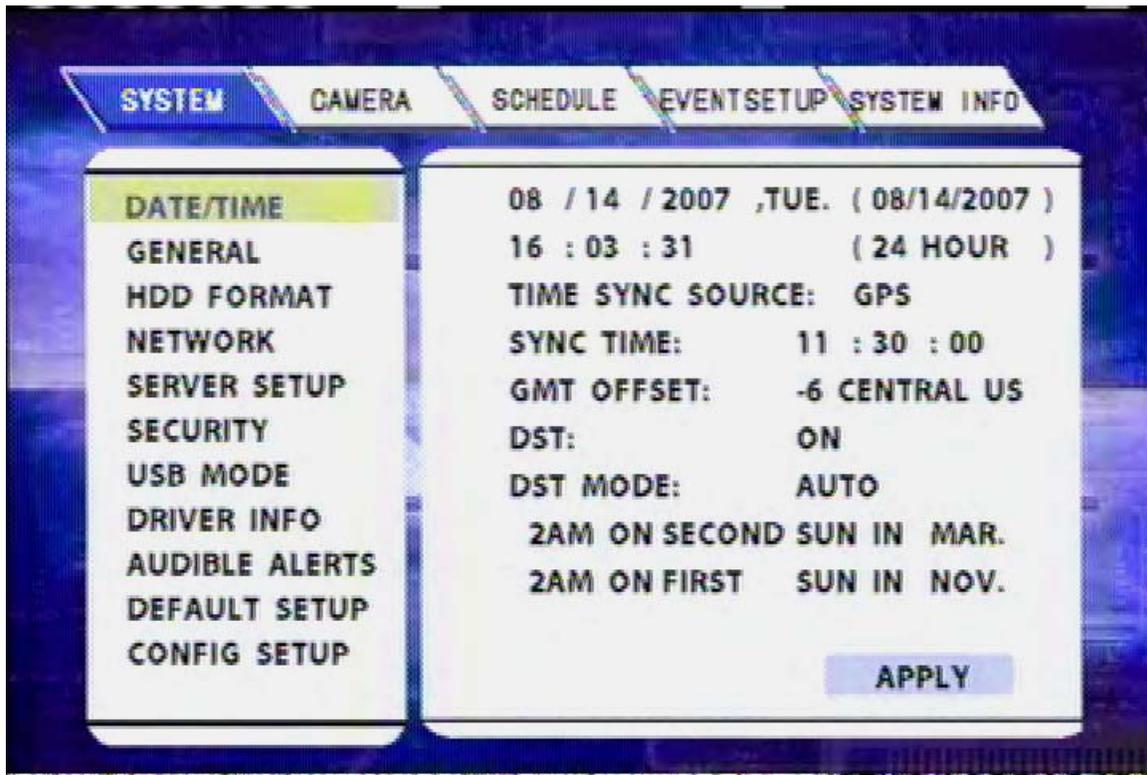
Figure 33: System – Date/Time Screen Shot

The DATE/TIME subsection of the SYSTEM Sub-Menu presents the user configurable options for setting the Date and the Time. All REI DVRs use high accuracy, extended temperature range Real Time Clocks with 10 year internal battery backup for consistent and reliable time keeping over the life of the DVR system. Using the arrow, enter, and numeric buttons (as shown in Figure 6 on Page 12 and Figure 7 on Page 13) on the remote control, the user can change these settings.

The first line in this subsection gives the user a place to manually enter the date and also to change the format of the date as it appears on the OSD overlay of the video feed-through.

The second line allows the user to manually change the time and the time display format from AM/PM to 24 Hour.

TIME SYNC SOURCE allows the user to use a time synchronization system, either GPS, or NTP (Network Time Server), or NONE.

SYNC TIME gives the option to set a specific time.

Date/Time (continued)

GMT OFFSET is for use with the GPS and TIME SYNC, as GPS satellite time comes in as GMT and needs to be offset for your time zone for proper automatic time synchronization.

DST, when set to **Yes**, will make the system clock change automatically with Daylight Saving Time. If your region does not use Daylight Saving Time, setting this item to **No** disables the Daylight Saving Time function.

DST MODE can be changed from AUTO to CUSTOM. The Energy Policy Act of 2005 changed the time change dates for Daylight Saving Time in the U.S. DST begins on the second Sunday of March and ends the first Sunday of November. Because Congress retains the right to revert Daylight Saving Time back to the 1986 time schedule, certain real-time clock embedded systems need to have the ability to be changed. Figure 33 shows the default Daylight Saving Time settings sanctioned by the EPA of '05. The DST Mode can be set from 'AUTO' to 'CUSTOM'. When the DST Mode is set to 'AUTO', the Daylight Saving Time triggers will conform to the EPA of '05 rules. When the DST Mode is set to 'CUSTOM', the Daylight Saving Time triggers can be changed to any of the first, second, third, fourth, or last week of any month, not overlapping, as shown in Figure 34 below.

```
DST MODE:        CUSTOM
  2AM ON FIRST   SUN IN  APR.
  2AM ON LAST    SUN IN  OCT.
```

Figure 34: Custom DST Triggers

General
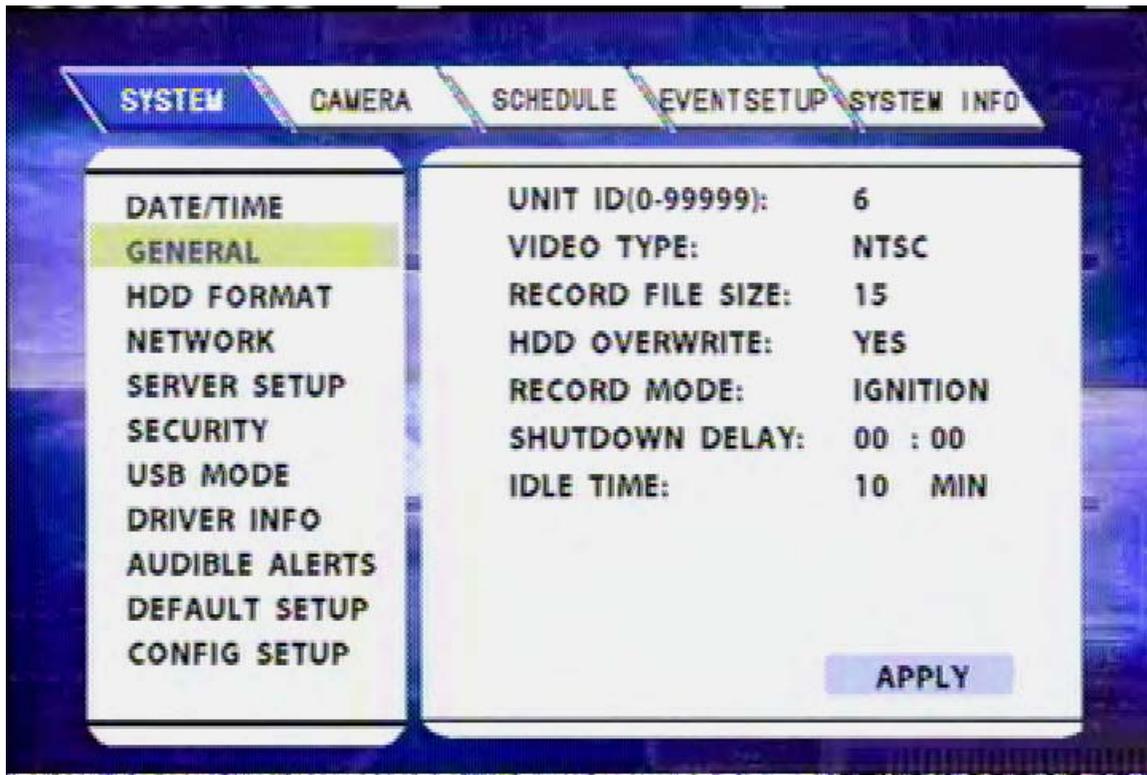
Figure 35: System – General Screen Shot

UNIT ID: the identification number of the DVR is changeable. This is used in conjunction with the Security Function as shown in Figure 42 on Page 51.

VIDEO TYPE: can be changed to either NTSC or PAL.

RECORD FILE SIZE: selectable to 15 or 30 minutes.

HDD OVERWRITE: when set to YES, the DVR overwrites the hard drive, first in, first out, as the DVR needs more room for storage. When this is set to NO, the DVR will write once and then stop, lighting the HDD FULL LED on the face of the DVR. When this setting is set to NO, the user must manually delete files off the hard drive, or format the drive for more record time.

RECORD MODE can be set to IGNITION, TIMERS, IGN or TIMER, and IGN and TIMER. The record timers are set in the SCHEDULE section as shown in Figure 69 on Page 68.

SHUTDOWN DELAY: the number of hours and minutes the DVR will continue recording after the RECORD MODE expires.

IDLE TIME: how long the DVR will stay in the menus before timing out. This feature ensures that the advertising media (if applicable) will always play during routes, even if the last user of the DVR did not exit out of the menus.

HDD Format
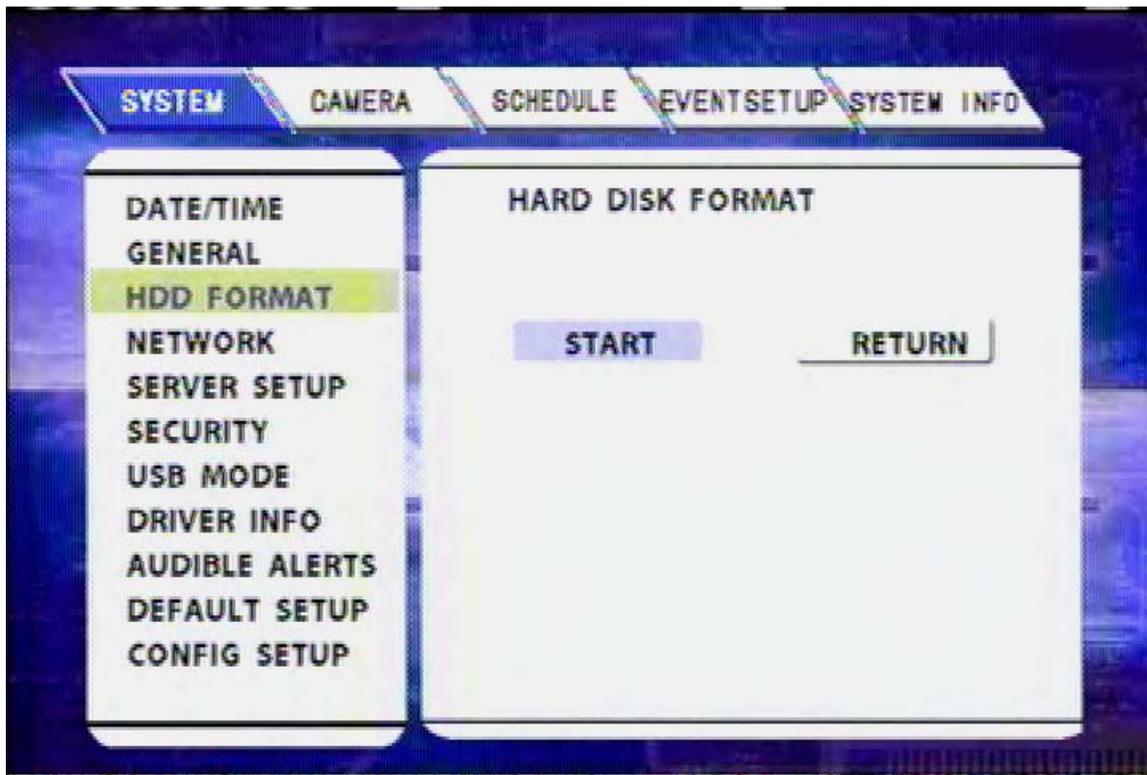
Figure 36: System – Hard Disk Format – Start Screen Shot

HDD FORMAT: the user can completely erase the video and audio files off of the DVR. The HDD FORMAT function will rebuild the basic directory structure of the drive to allow for continued and immediate recording of audio and video. All advertising, movies, and music will also be erased from the drive if this is executed.

HDD Format (continued)
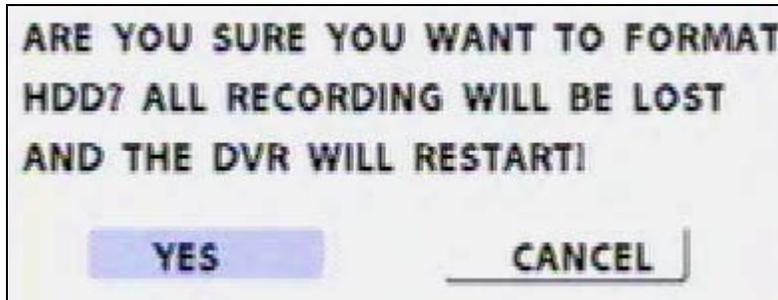
Figure 37: System – Hard Disk Format – Are You Sure? Screen Shot

Figure 38: System – Hard Disk Format – Formatting HDD Screen Shot
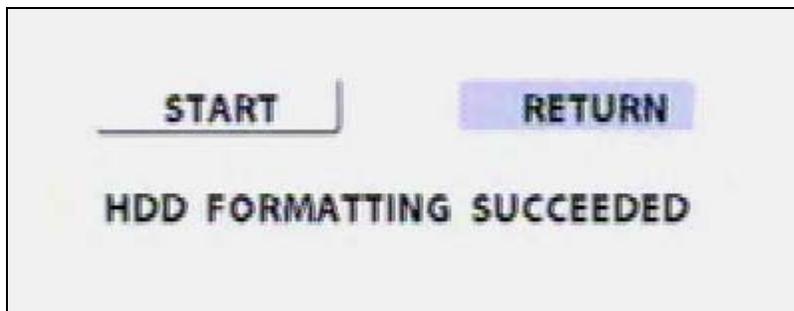
Figure 39: System – Hard Disk Format – Formatting Successful Screen Shot

Network
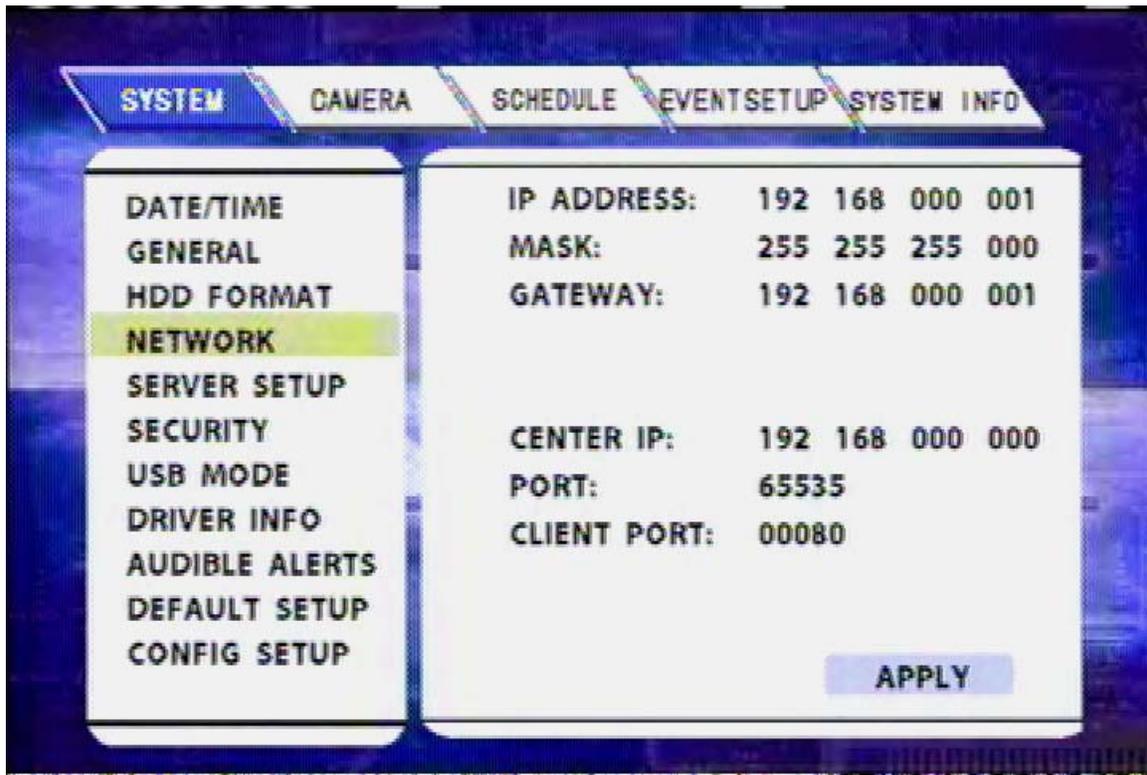
Figure 40: System – Network Screen Shot

In the NETWORK subsection of the SYSTEM section, the user can change the network address settings of the DVR. Contact your system administrator or IT department for a suitable network addressing format.

IP ADDRESS: the IP address of the DVR

MASK: the net mask of the DVR

GATEWAY: the gateway address on the local network

CENTER IP: the IP address of the central server

PORT: the corresponding port of the central server

CLIENT PORT: the corresponding port of the DVR

Server Setup
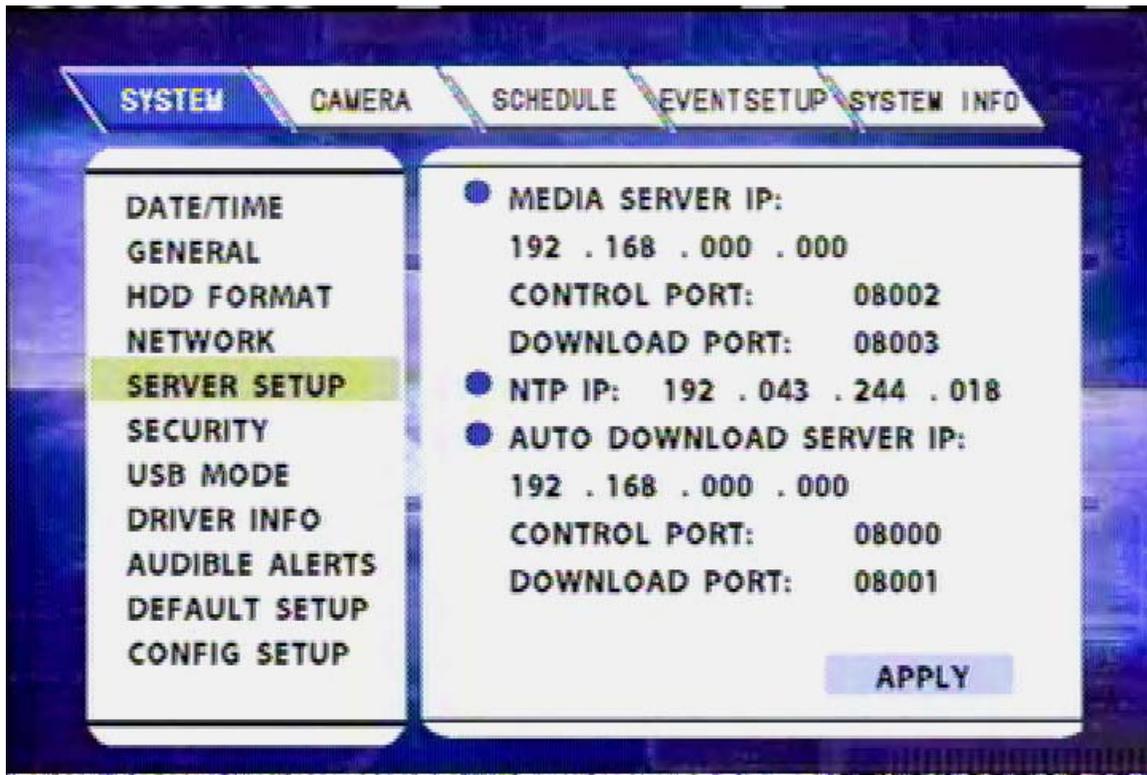
Figure 41: System – Server Setup Screen Shot

In the SERVER SETUP subsection of the SYSTEM section, the user can change the network address settings for the Network Server. Work with your System Administrator or IT Department for a suitable network addressing scheme.

MEDIA SERVER IP: the IP address of the Media Server

   CONTROL PORT: the control port of the Media Server

   DOWNLOAD PORT: the download port of the Media Server

NTP IP: the IP address of the Network Time Synchronization Server

AUTO DOWNLOAD SERVER IP: the address of the Download Server

   CONTROL PORT: the control port of the Download Server

   DOWNLOAD PORT: the download port of the Download Server

Security
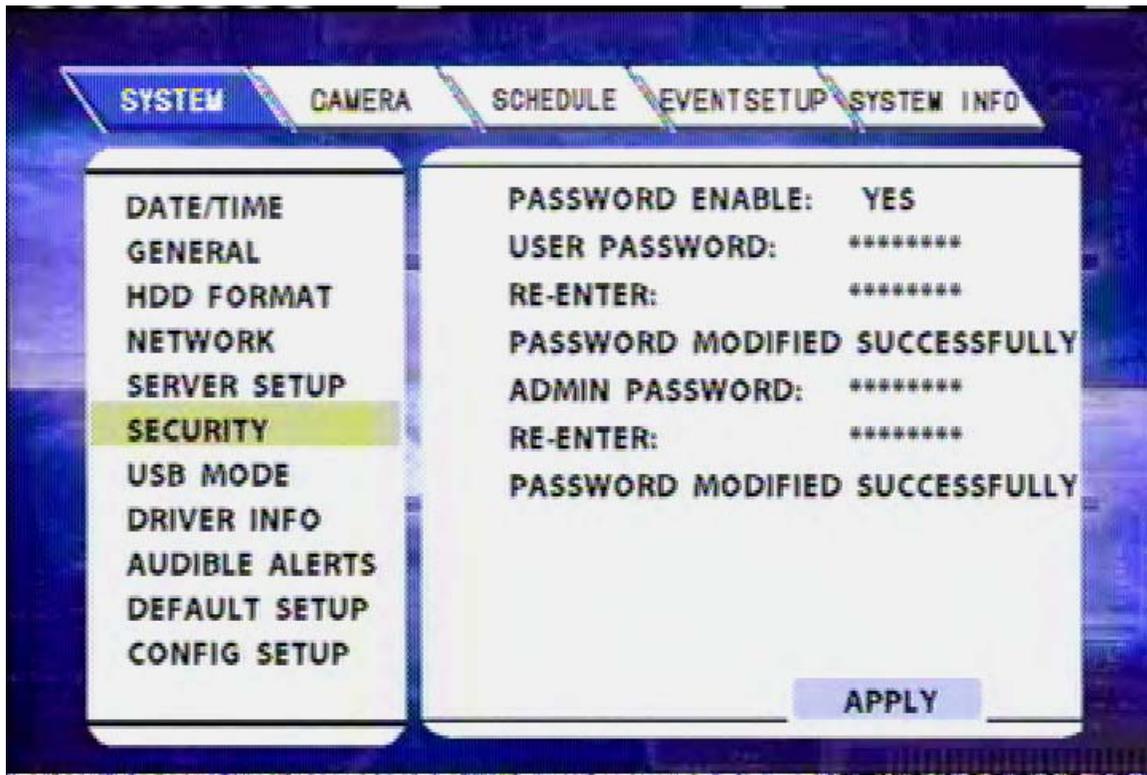
Figure 42: System – Security Screen Shot

In the SECURITY subsection of the SYSTEM section, the user can configure the DVR menus to only be accessed by password. There are 3 levels of security: USER, ADMIN, & REI.

The USER password allows a user to access the main menu as shown in Figure 31 on Page 42, but will not allow the user to access any of the SYSTEM SETUP pages as shown in Figure 32 on Page 43. This would be useful for a user who needs to use the remote control to play movies or music, but not to change any of the recorder settings.

The ADMIN password allows the user to gain full access to all the menus, as if there were no password protection.

The REI password is used by REI service personnel to gain access to the menus during any field service work or repairs. The REI password cannot be changed through the menu configuration pages and will not be given out to end users. However, the DVRs can be sent in to REI for password resetting.

To enable password security protection, the person configuring the DVR must enter the password twice. If the passwords are not entered correctly, the person configuring the DVR will see an error message, as shown in Figure 43 on Page 52.

Security (continued)

RE-ENTER: ********

PASSWORDS DO NOT MATCH!
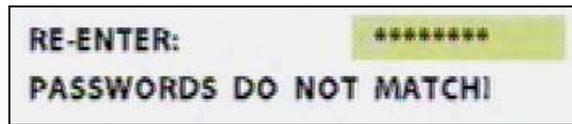
Figure 43: Security Password Setting Error Message

      When the DVR is password enabled, the user will see a password prompt when trying to access the menu system, as shown in Figure 44 below. If the user enters the wrong unit ID or password, the user will see an error message towards the bottom of the screen, as shown in Figure 45 and Figure 46 below. If the operator password is entered correctly, the user will see an affirmation message towards the bottom of the screen, as shown in Figure 47 below. If the administrator password is entered correctly, the user will see an affirmation message towards the bottom of the screen, as shown in Figure 48 below.

PLEASE ENTER UNIT ID & PASSWORD:

UNIT ID: (00006)

PASSWORD:

ENTER   CANCEL
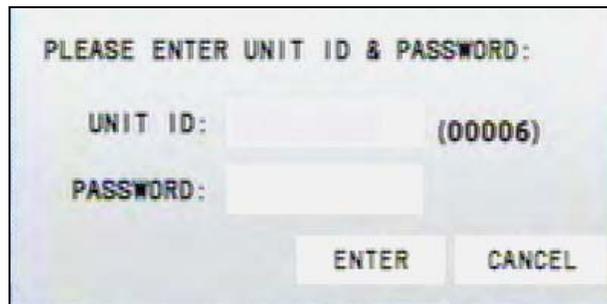
Figure 44: Security Password Screen Shot

UNIT ID ERROR

Figure 45: Security DVR Unit ID Error Message

PASSWORD ERROR

Figure 46: Security DVR Password Error Message

OPERATOR PASSWORD CORRECT

Figure 47: Security DVR Operator Password Correct Message

ADMIN PASSWORD CORRECT

Figure 48: Security DVR Administrator Password Correct Message

USB Mode
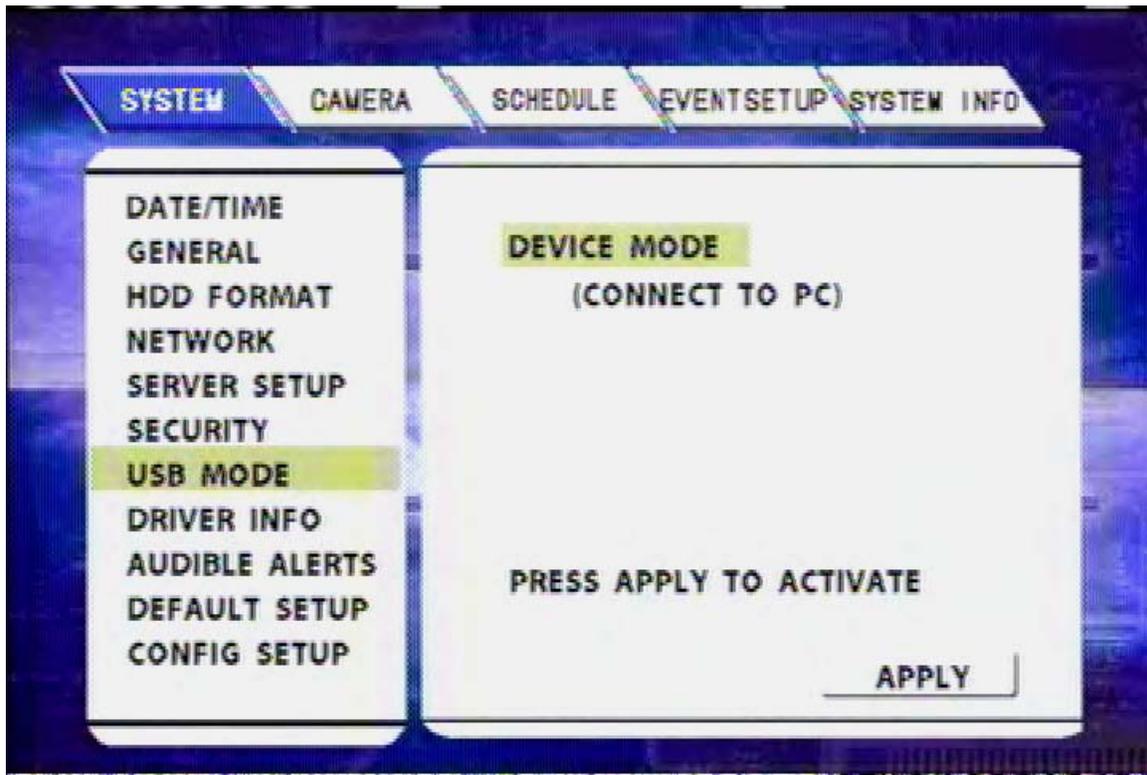
Figure 49: System – USB Mode – Device Mode Screen Shot

USB MODE: There are two options available with the USB operation: Device mode and Host mode.

DEVICE MODE: The DEVICE MODE allows a PC (or laptop PC) to connect to the DVR via USB cable. Once connected, the drive appears as a regular hard drive to the computer. Normal Windows operations could be performed (example: download the recorded data from the unit to the computer hard drive, upload advertisement clips from the computer to the DVR, etc). The DVR will present 2 drives to the computer: the removable hard drive, and an internal compact flash slot. Make sure your computer has enough drive letters available for this or you may not be able to see the drives. Contact your system administrator or IT department for help with drive letters. For a complete file description of the DVR hard drive layout, please reference Figure 9 on Page 16.

NOTE for USB Operation: To maintain a live connection between the Windows PC and the DVR via USB cable, the device mode menu screen needs to stay active.   Exiting the option will interrupt the connection.

USB Mode (continued)
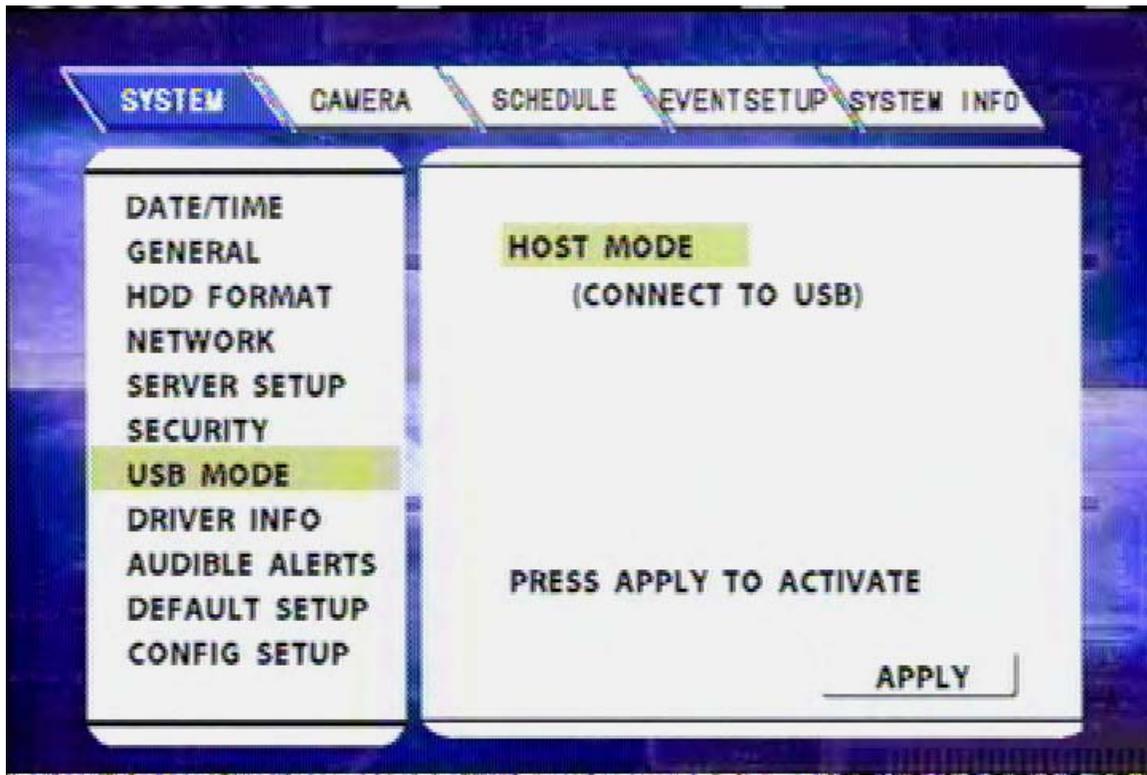
Figure 50: System – USB Mode – Host Mode Screen Shot

HOST MODE: HOST MODE allows an external USB flash drive to be connected. Once the connection is established, the contents of the jump drive can be uploaded to the DVR hard drive. For a description of the files and folders on the hard drive module, please reference Figure 9 on Page 16.

To upload files from the USB flash drive, select APPLY. Depending on how big, or how many files on the flash drive, it may take a few minutes for the DVR to access the flash drive. After the DVR accesses the flash drive, the DVR needs to upload the files, as shown in Figure 51 on Page 55. After the DVR uploads the files, a list of the files and folders on the flash drive will appear on the screen, as shown in Figure 52 on Page 55. After using the up and down arrow buttons to choose the file, use the right arrow to bring up the file destination options, as shown in Figure 53 on Page 56. The DVR will then upload the file, giving the user status messages, as shown in Figure 54 and Figure 55 on Page 56. When done uploading the desired files, press the EXIT key on the remote control. The DVR will then restart. Upon restarting, a series of affirmation messages will appear, as shown in Figure 56 on Page 56.

USB Mode (continued)
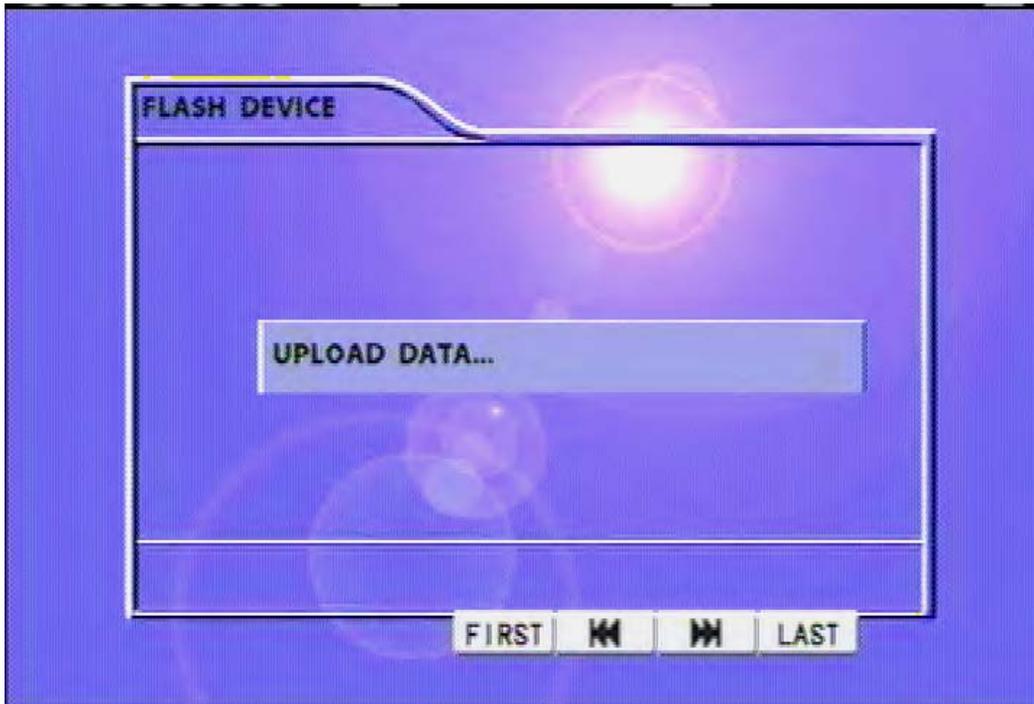
Figure 51: USB Host Mode – Upload Data Screen Shot
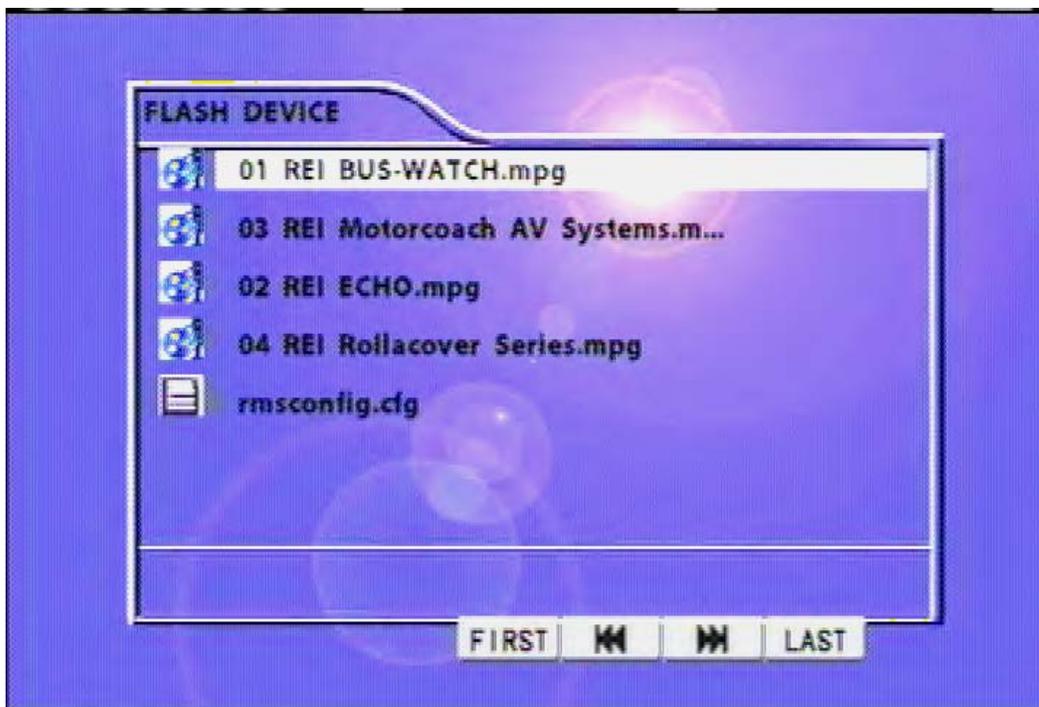
Figure 52: USB Host Mode – Flash Drive File List Screen Shot

USB Mode (continued)
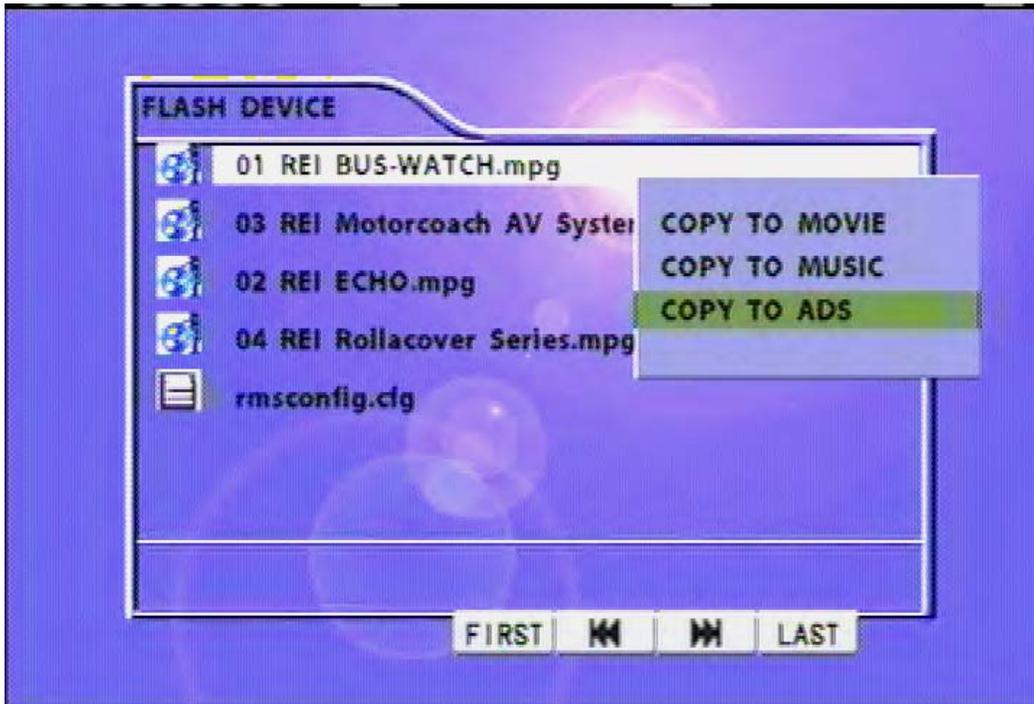
Figure 53: USB Host Mode – File Destination Screen Shot
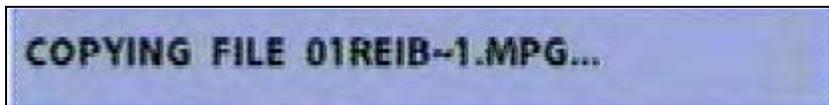
Figure 54: USB Host Mode – Copying File Message
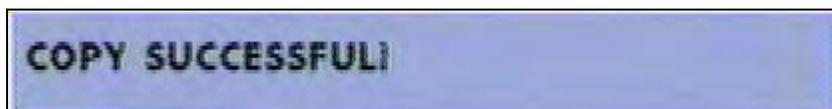
Figure 55: USB Host Mode – Copy Successful Message
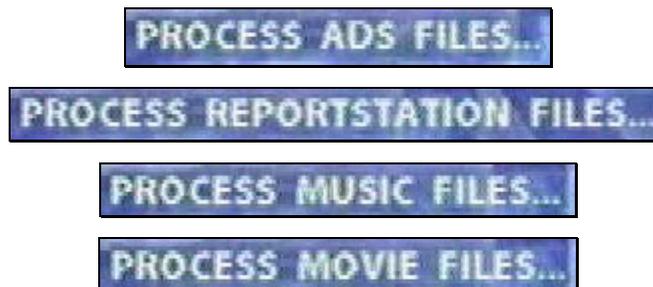
Figure 56: USB Host Mode – Restart Messages

Driver Information
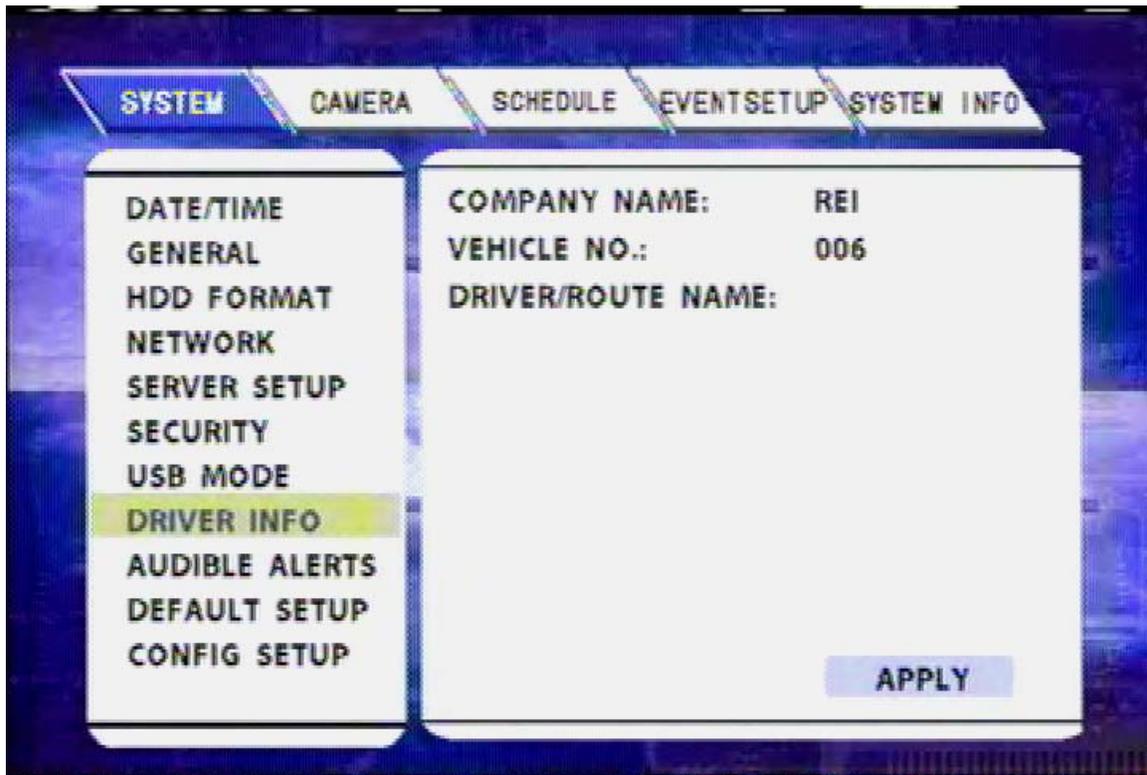
Figure 57: System – Driver Information Screen Shot

COMPANY NAME, VEHICLE NO. and DRIVER/ROUTE NAME (as shown in Figure 57 above): Use arrow keys to select the option for modification. Press ENTER at the highlighted line.

The screen will pop up a text entry keyboard as shown in Figure 58 on Page 58. Use arrows to choose characters and press ENTER to type. Press APPLY and EXIT to return to the previous menu.

Press EXIT to return to the SETUP list.

Driver Information (continued)

Figure 58: Data Entry Keyboard Screen Shot

Audible Alerts
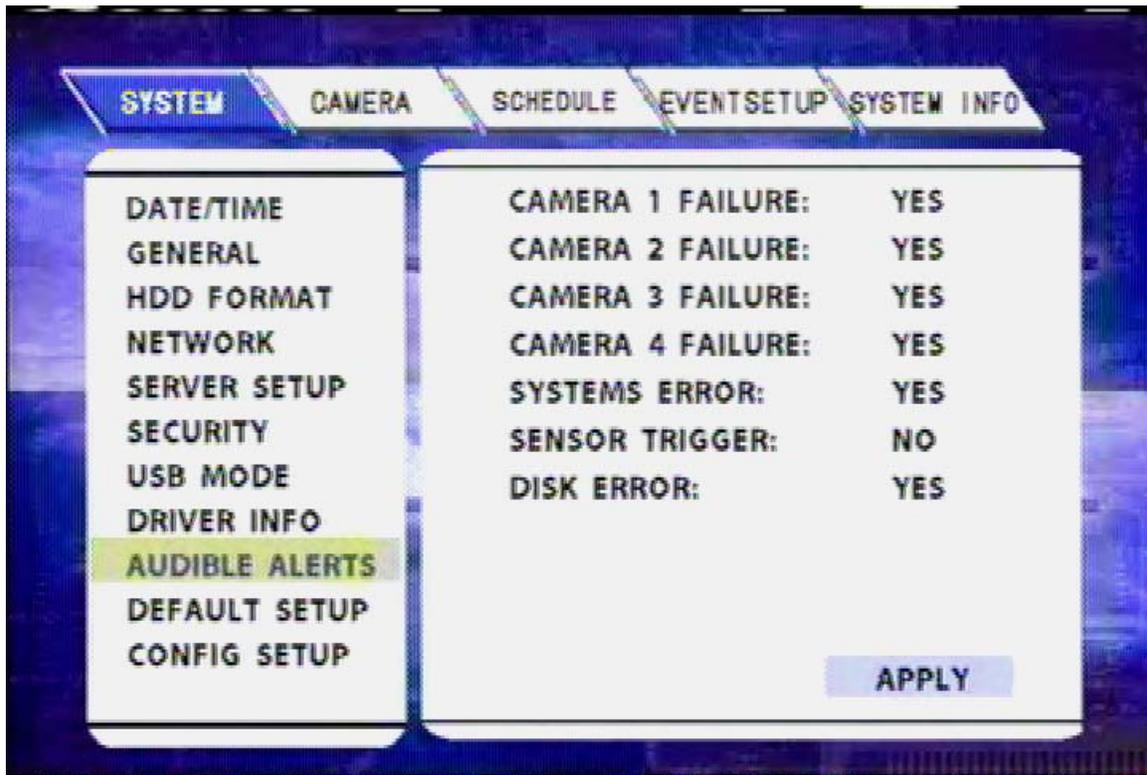
Figure 59: System – Audible Alerts Screen Shot

The DVRs come with audible alarm options, as shown in Figure 59 above. These audible alarms can be configured to on or off. The audible alarm options are as follows:

CAMERA 1 FAILURE:	YES / NO
CAMERA 2 FAILURE:	YES / NO*
CAMERA 3 FAILURE:	YES / NO*
CAMERA 4 FAILURE:	YES / NO*
SYSTEMS ERROR:	YES / NO
SENSOR TRIGGER:	YES / NO
DISK ERROR:	YES / NO

*NOTE: Cameras 2, 3, & 4 do not appear as options on the R1001 Single Channel DVR.

Default Setup
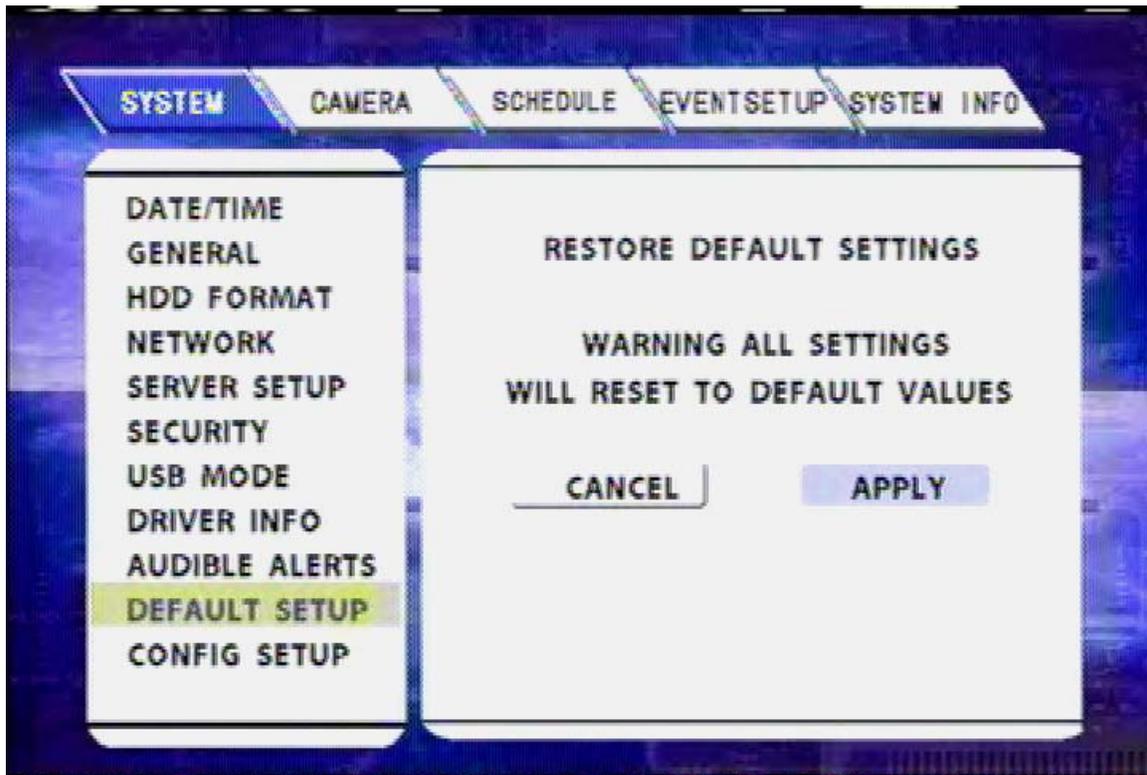
Figure 60: System – Default Setup – Warning Screen Shot

The DVRs have the option to have all of the configuration settings reset to the factory defaults. Executing this function is irreversible, and once the settings have been changed, the user must either manually change the settings using the USB flash drive to upload the new configuration file, placing the configuration file on the hard drive with Windows Explorer, or using the PC remote management software to change the configuration.

To reset the unit to the default settings, select DEFAULT SETUP, then select APPLY. The unit will display RESTORING, PLEASE WAIT…as shown in Figure 61 on Page 61. Once this message disappears, the unit has been reset to the default settings.

Default Setup (continued)
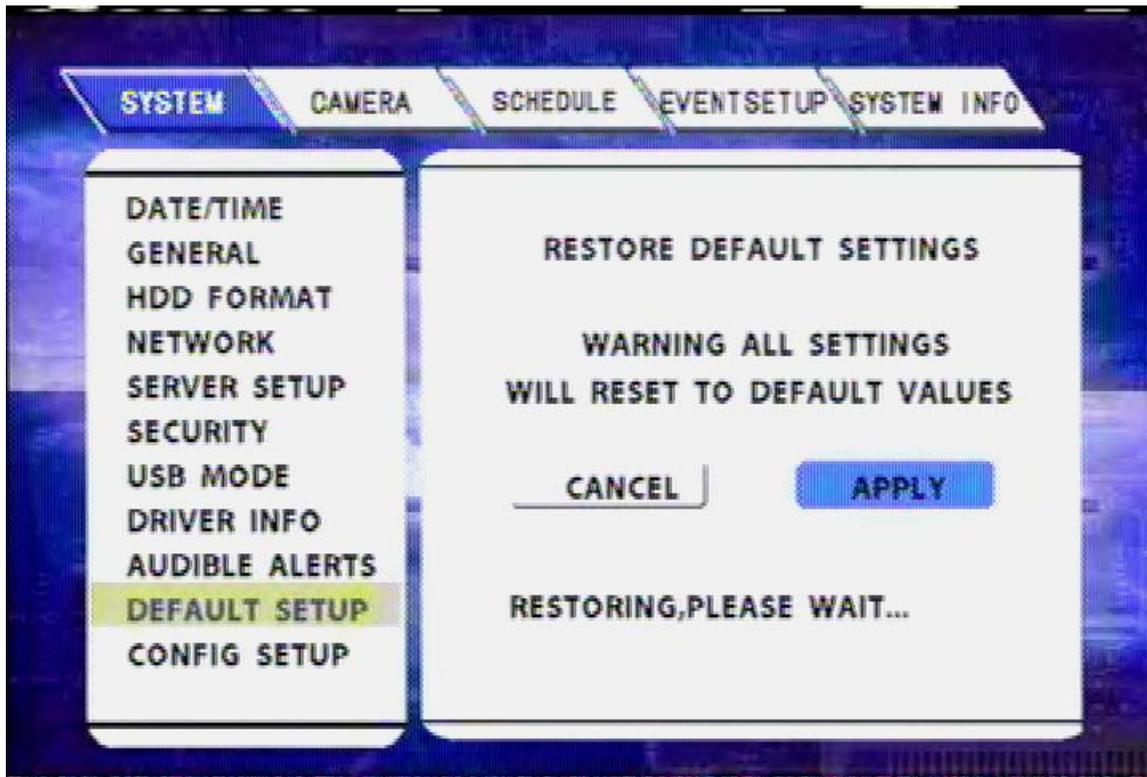
Figure 61: System – Default Setup – Restoring Screen Shot

Configuration Setup
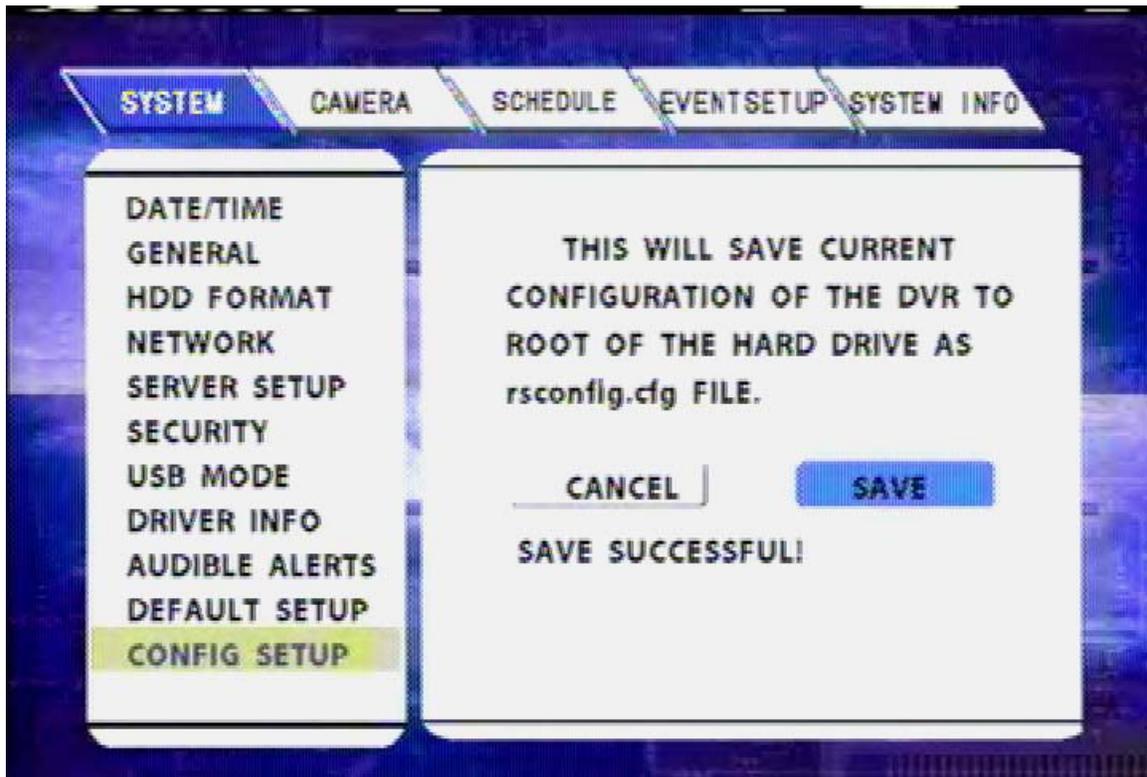
Figure 62: System – Configuration Setup – Save Successful Screen Shot

The DVRs have the option to have the current configuration settings saved to a file on the hard drive, as shown in Figure 62 above. The file is named **rsconfig.cfg** and is put in the root directory of the hard drive (Reference Figure 9 on Page 16).

Camera

Figure 63: Camera Menu Screen Shot

The CAMERA section of the menu is subdivided into 2 main categories, RECORDing PARAmeters and CAMERA NAME.

Recording Parameters
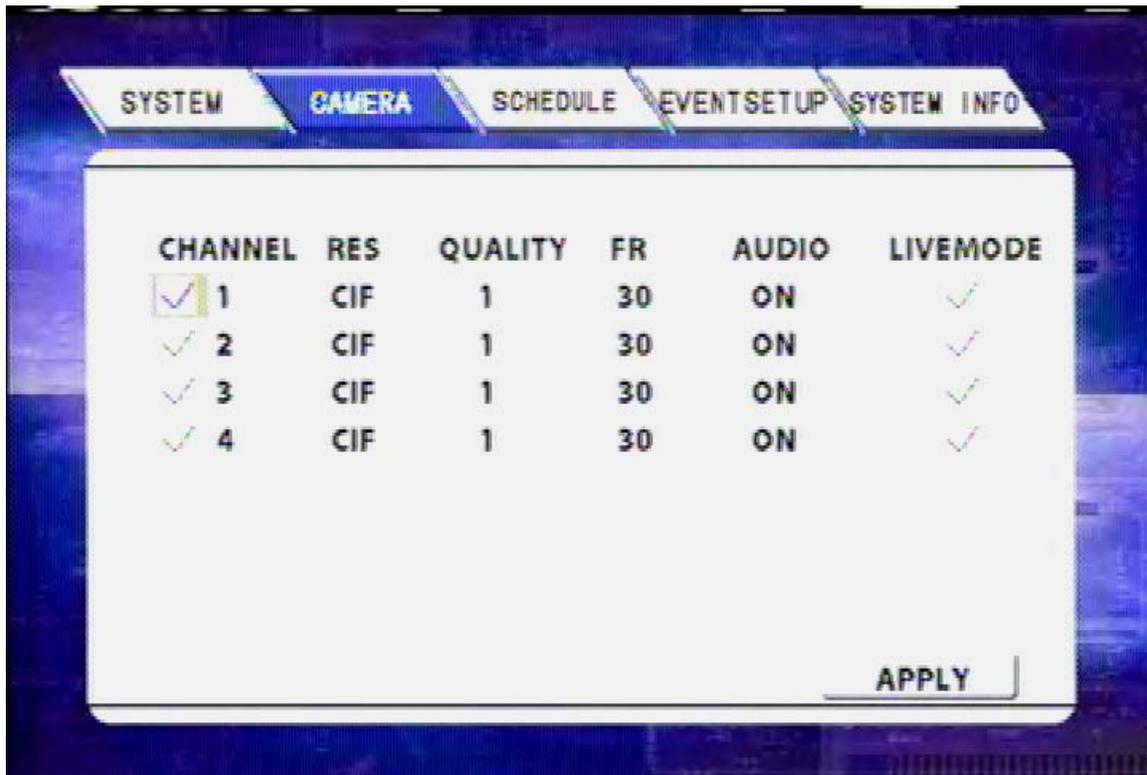
Figure 64: Camera – 4 Camera Recording Parameters Screen Shot

The RECORDing PARAmeters subsection of the CAMERA section allows the user to change the way the video is compressed before it is recorded to the removable disk drive module. The parameters of this section are: CHANNEL, RESolution, QUALITY, FrameRate, AUDIO, and LIVEMODE.

CHANNEL: a check represents that this channel will be recorded*
RESolution: CIF, HD1, D1**
QUALITY: 1-8, 1 being the best video quality
Frame Rate: 1, 2, 4, 8, 15, or 30 frames per second
AUDIO: ON or OFF for audio recording for each channel***
LIVEMODE: a check represents that this channel will be previewed on the video monitor output feeds through the front and back video ports of the DVR.

    * Channels 2-4 are not shown on the R1001 Single Channel DVR
    ** CIF: (360H x 283V), HD1: (720H x 283V), D1: (720H x 486V)
    *** Each audio channel is recorded independently
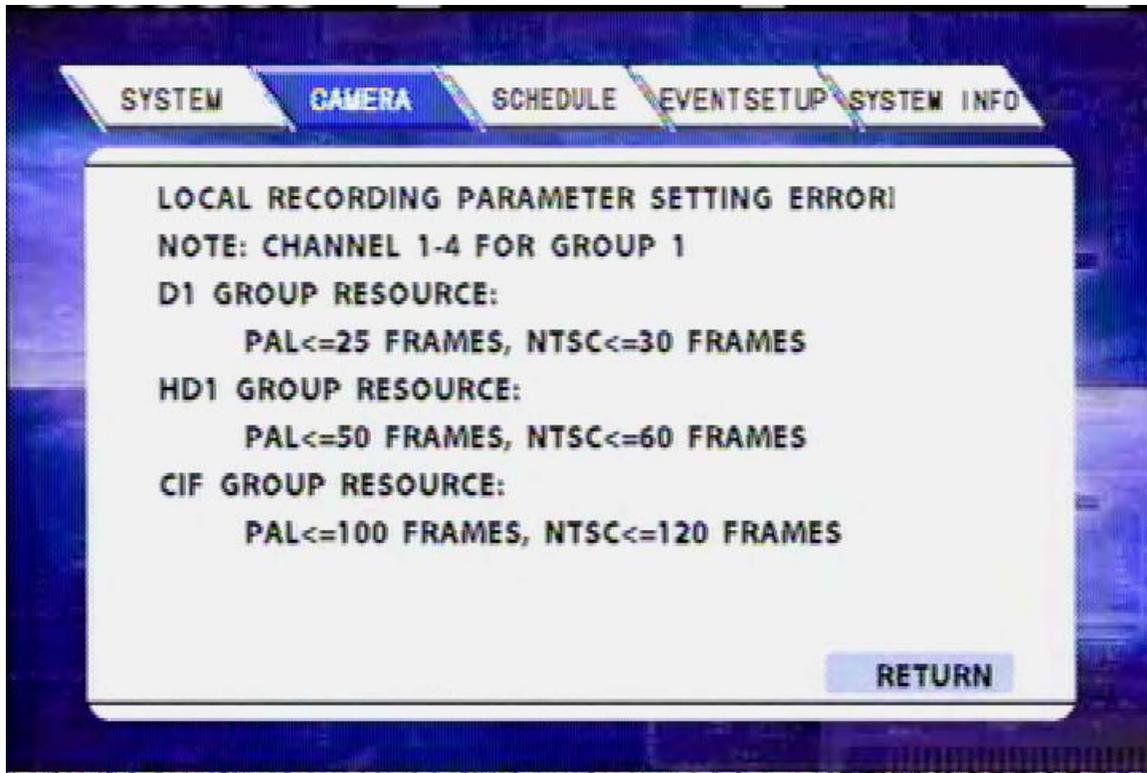
Figure 65: Record Parameter Group Resources

The Digital BUS-WATCH® R1001 single channel DVR default settings are for the best video quality (and least amount of record time) which is configured with a resolution of D1, a record quality of 1, and a frame rate of 30 FPS, as shown in Figure 66 on Page 66. For the Digital BUS-WATCH® R4001 4-channel DVR, there is a maximum bandwidth that can affect how the DVR is configured, as shown in Figure 65 above. If the DVR is set to record at a resolution of D1, the maximum frame rate for each of the 4 cameras is 8 frames per second (or 30 frames composite). If the DVR is set to record at a resolution of HD1 (or ½ D1), the maximum frame rate for each of the 4 cameras is 15 frames per second (or 60 frames composite). If the DVR is set to record at a resolution of CIF (or ¼ D1), the maximum frame rate for each of the 4 cameras is 30 frames per second (or 120 frames composite).

When using the Digital BUS-WATCH® R4001 4-channel DVR with only 3 cameras, the group resources are the same as with 4 cameras. The 3 cameras must conform to the same group resolution, quality, and frame rate resource pool. However, record times are longer with any given size hard drive when using 3 cameras as opposed to 4.

When using the Digital BUS-WATCH® R4001 4-channel DVR with only 2 cameras, the group resources can now be split differently. If the DVR is set to record at a resolution of D1, the maximum frame rate for each of the 2 cameras is 15 frames per second. If the DVR is set to record at a resolution of either HD1 or CIF, the maximum frame rate for both cameras is 30 frames per second, as shown in Figure 67 on Page 66.
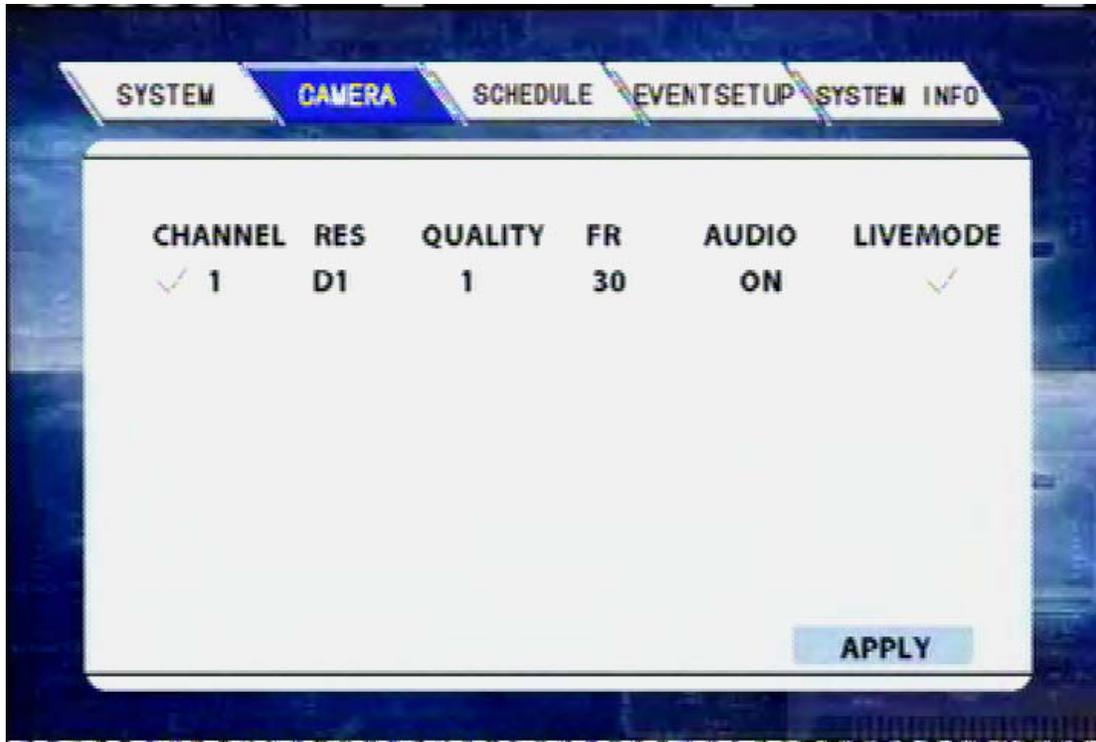
Figure 66: Camera – 1 Camera Recording Parameters Screen Shot
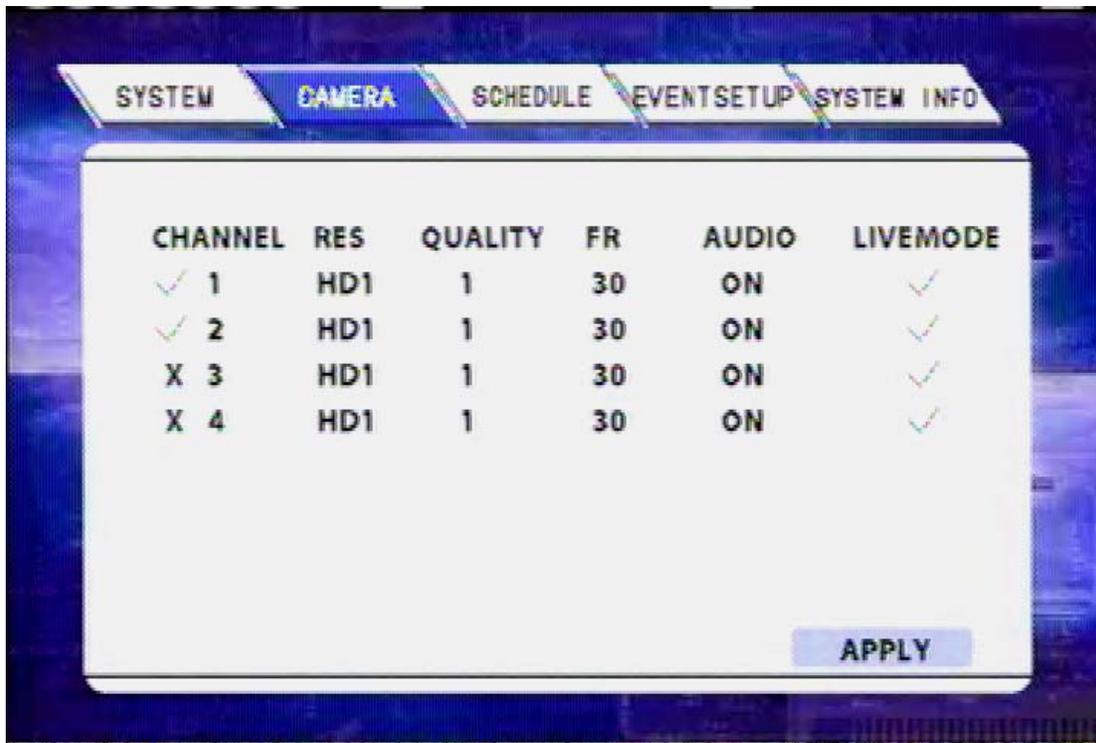
Figure 67: Camera – 2 Cameras Recording Parameters Screen Shot

Camera Name
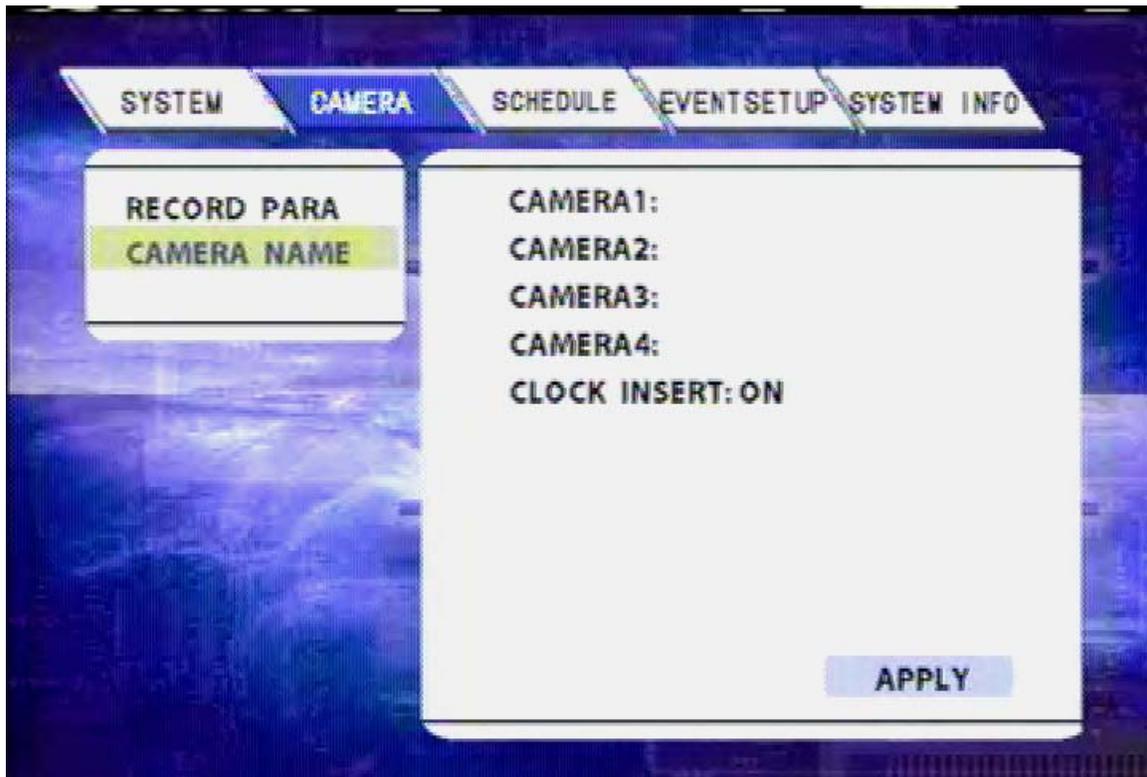
Figure 68: Camera – Camera Name Screen Shot

The CAMERA NAME subsection of the CAMERA section allows the user to change the camera on-screen display settings. The parameters of this section are: CAMERA1, CAMERA2, CAMERA3, CAMERA4, and CLOCK INSERT. Camera names are entered using the data entry keyboard, as shown in Figure 58 on Page 58. The names are limited to 8 characters. The CLOCK INSERT function overlays the time and date across the top of the video feed-through screen coming out of the video output ports on the front and back of the DVR. The inserted clock overlay is not recorded onto the video images, but the time and date information is always digitally embedded into the video frames.

CAMERA1:	Camera 1 On-Screen Display Name
CAMERA2:	Camera 2 On-Screen Display Name*
CAMERA3:	Camera 3 On-Screen Display Name*
CAMERA4:	Camera 4 On-Screen Display Name*
CLOCK INSERT:	ON or OFF

*NOTE: Cameras 2, 3, & 4 do not appear as options on the R1001 Single Channel DVR.

Schedule
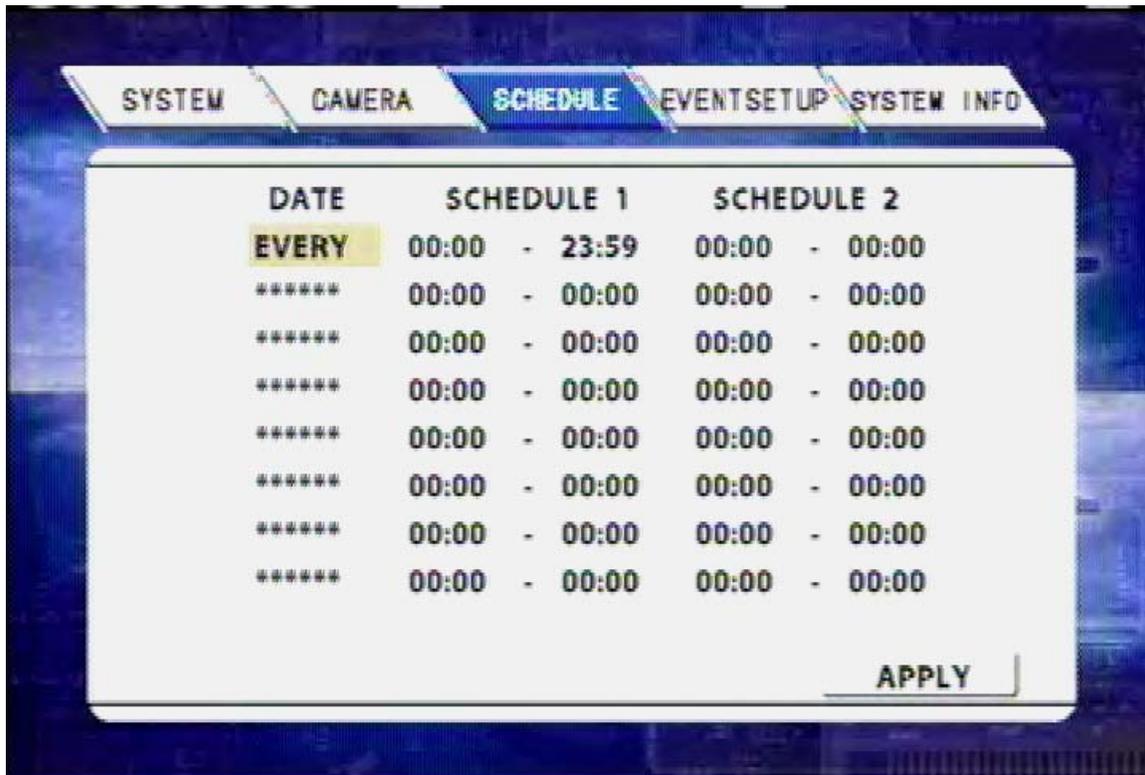
Figure 69: System Setup – Schedule Screen Shot

The SCHEDULE section of the menu is where the user can set the times that the DVR will automatically turn on and shut off. There are 3 subsections of this section: DATE, SCHEDULE 1, and SCHEDULE 2. The DVR start mode is configured in the SYSTEM – GENERAL – RECORD MODE section of the SYSTEM SETUP portion of the menu, as shown in Figure 35 on Page 46.

DATE: EVERY, SUN, MON, TUE, WED, THU, FRI, SAT, or *****.

SCHEDULE1: Start Time – Stop Time

SCHEDULE2: Start Time – Stop Time

Note: ***** represents a disabled timer slot.

Event Setup

EVENT SETUP contains all of the various input settings that the DVR can log or use to trigger alarms or events.

The EVENT SETUP section of the menu is subdivided into 2 main categories; SENSOR and EVENT RECORD MODE.

Figure 70: Event Setup – Sensor Screen Shot

The SENSOR subsection of the EVENT SETUP SECTION is subdivided into 3 categories; IO INPUT, ACCELEROMETER, and SPEED, as shown in Figure 70 above.

Sensor

IO Input – School Bus

	NAME	DISPLAY	SET	ALARM
SENSOR1:	RED WARN	RW	HIGH	NO
SENSOR2:	YEL WARN	YW	HIGH	NO
SENSOR3:	LEFT	LT	HIGH	NO
SENSOR4:	RIGHT	RT	HIGH	NO
SENSOR5:	STOP ARM	SA	HIGH	NO
SENSOR6:	BRAKES	BK	HIGH	NO
SENSOR7:	F-DOOR	FD	HIGH	NO
SENSOR8:	R-DOOR	RD	HIGH	NO
SENSOR9:	PANIC	PB	N.O.	NO
VEHICLE TYPE:		SCHOOL BUS		APPLY

Figure 71: Event Setup – Sensor – IO Input – School Bus Screen Shot

The IO INPUT subsection of the SENSOR section is used to change the vehicle sensor options that are associated with the vehicle sensor options harness, as shown in Figure 15 on Page 24, and the event mark / external record indicator harness, as shown in Figure 12 on Page 22.

The IO INPUT sections are sub-sectioned into 3 main options: SCHOOL BUS, as shown in Figure 71 above, TRANSIT BUS, as shown in Figure 72 on Page 71, and CUSTOM, as shown in Figure 73 on Page 72.

The purpose of the 3 main options is ease of setup for the installer. The installer can wire the vehicle sensor options harness directly for the type of bus in question, or they can use the CUSTOM settings to wire the bus any way that is appropriate. Using the CUSTOM setting requires data entry be properly set.

IO Input – Transit Bus

Figure 72: Event Setup – Sensor – IO Input – Transit Bus Screen Shot

Each of the SCHOOL BUS, TRANSIT BUS, and CUSTOM screens has 4 settings: NAME, DISPLAY, SET, and ALARM.

NAME: The name of the signal connected to the DVR. The names of the signals are entered using the data entry keyboard, as shown in Figure 58 on Page 58, and are limited to 8 characters.

DISPLAY: The characters that are displayed on the Installers Mode Page, as shown in Figure 30 on Page 41. The display characters of the signals are entered using the data entry keyboard, as shown in Figure 58 on Page 58, and are limited to 2 characters.

SET: Active HIGH, active LOW, or OFF for SENSORs 1-8,
            N.O. (normally open circuit), N.C. (normally closed), or OFF for SENSOR 9.

ALARM: YES or NO

IO Input – Custom
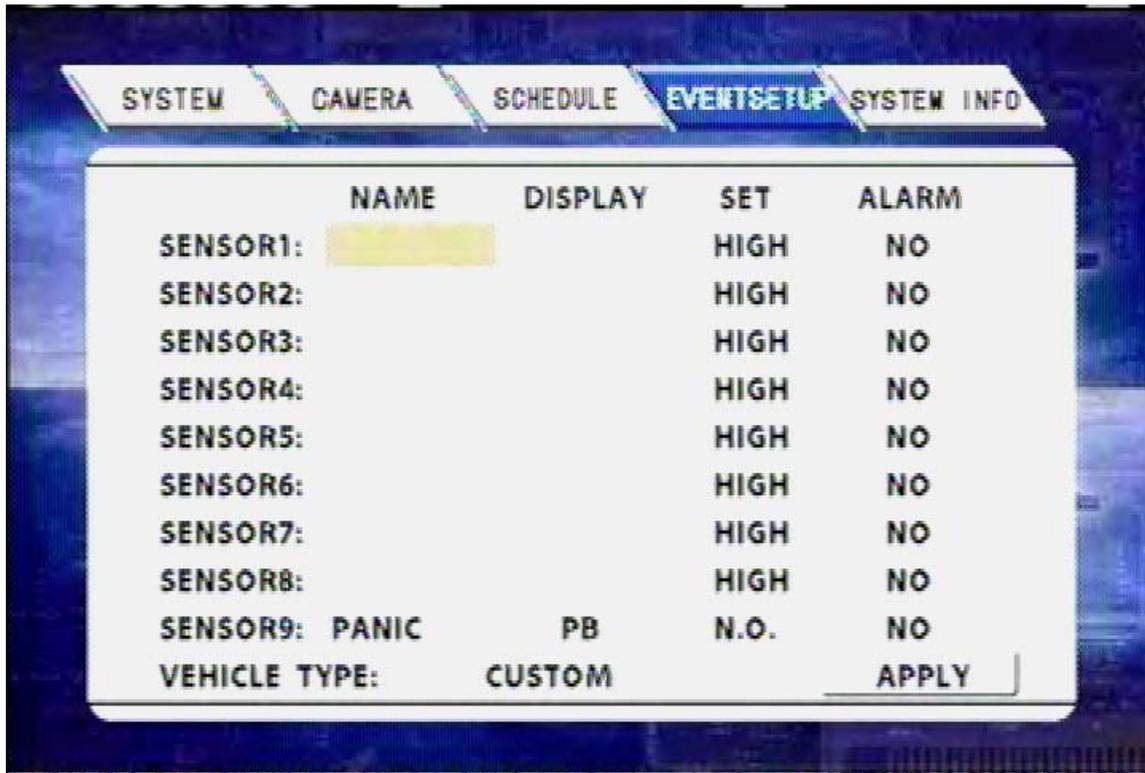
Figure 73: Event Setup – Sensor – IO Input – Custom Screen Shot

ACTIVE HIGH: When set to this state, a voltage above 4 volts (generally 12 volts DC) on the given sensor input is interpreted by the DVR that the signal is activated; a voltage below 4 volts (generally 0 volts DC or ground) is interpreted as inactivated.

ACTIVE LOW: When set to this state, a voltage below 4 volts (generally 0 volts DC or ground) on the given sensor input is interpreted by the DVR that the signal is activated; a voltage above 4 volts (generally 12 volts DC) is interpreted as inactivated.

The ACTIVE LOW setting is very useful on certain types of vehicles and can be used so that (brakes, for example) the Installers Mode Screen says BR when the brakes are being applied; as opposed to saying BR all the time, until the brakes are applied.

Accelerometer Setup

SYSTEM   CAMERA   SCHEDULE   EVENTSETUP   SYSTEM INFO

DIR.	ENABLE	LIMIT	SAMPLE	ALARM
X	ON	0.2	+00.000g	NO
Y	ON	0.2	+00.000g	NO
Z	ON	0.2	+00.000g	NO

CALIBRATE

APPLY
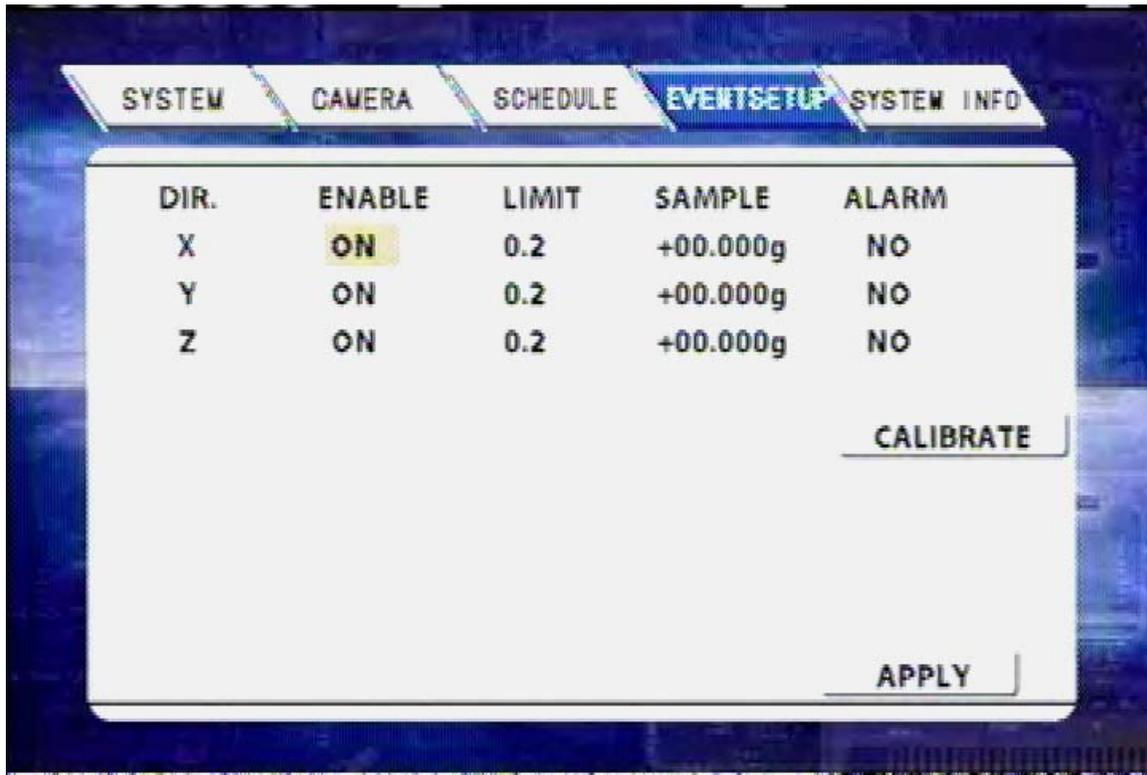
Figure 74: Event Setup – Sensor – Accelerometer Screen Shot

The ACCELEROMETER subsection of the SENSOR section, shown in Figure 74 above, is used to calibrate the accelerometer readings coming out of the accelerometer / inertia sensor harness, as shown in Figure 16 on Page 27. Because of the varying nature of the installation options, the installer should go to this page and select CALIBRATE, and then APPLY, to zero out the readings on the display. This should be done when the vehicle is not moving and the engine is not running. If properly installed, the accelerometer should read about 1 G in the Z axis before calibration.

Speedometer Setup
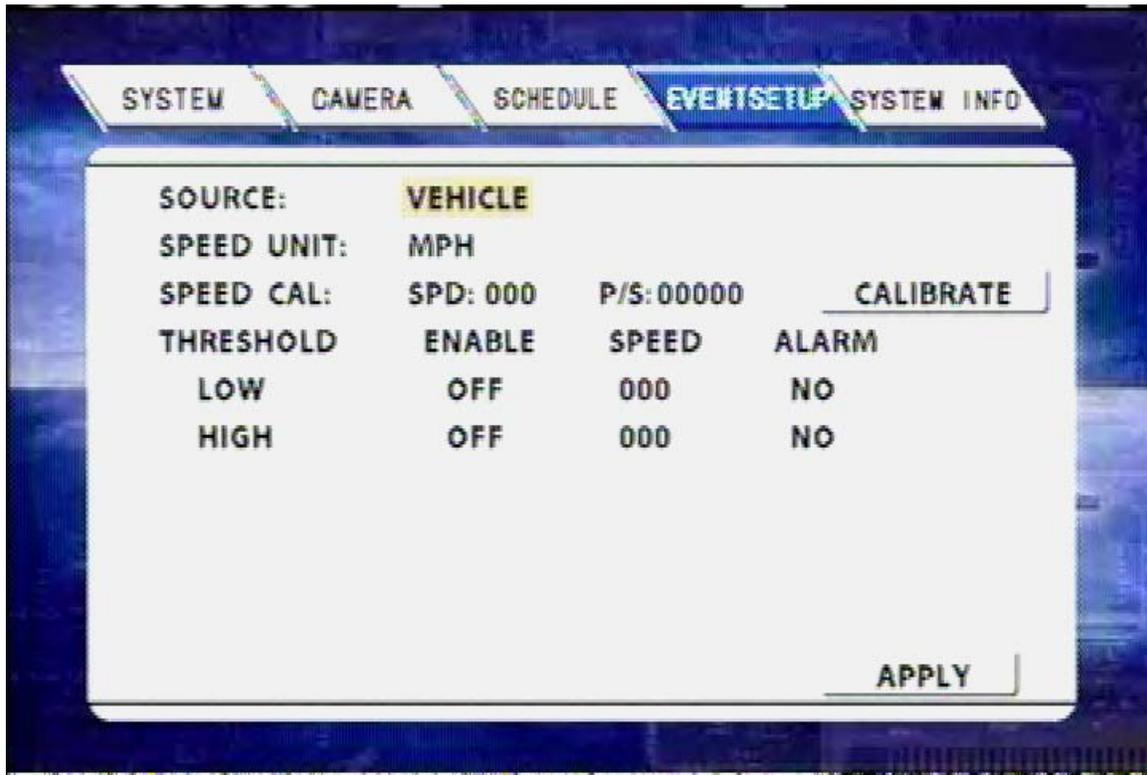
Figure 75: Event Setup – Sensor – Speedometer Screen Shot

The SPEEDOMETER subsection of the SENSOR section, shown in Figure 75 above, is used to set speed thresholds and to calibrate the speedometer readings coming out of the vehicle sensor options harness, as shown in Figure 15 on Page 24.

SOURCE:	VEHICLE or GPS
SPEED UNIT:	MPH or KM/H
SPEED CAL:	For calibration of analog speedometer pulses
SPD:	The target speed of the bus (i.e. 030 MPH)
P/S:	The number of pulses/second that the DVR is counting
CALIBRATE:	Press ENTER when vehicle is going the set speed
THRESHOLD:	LOW and HIGH speed limits
ENABLE:	ON or OFF
SPEED:	Usually set to 0 for tagging stops and to the highest legal speed limit the vehicle will travel (i.e. 50, 60, 75 MPH)
ALARM:	YES or NO. Alarm set to YES will log file in event search

Event Record Mode
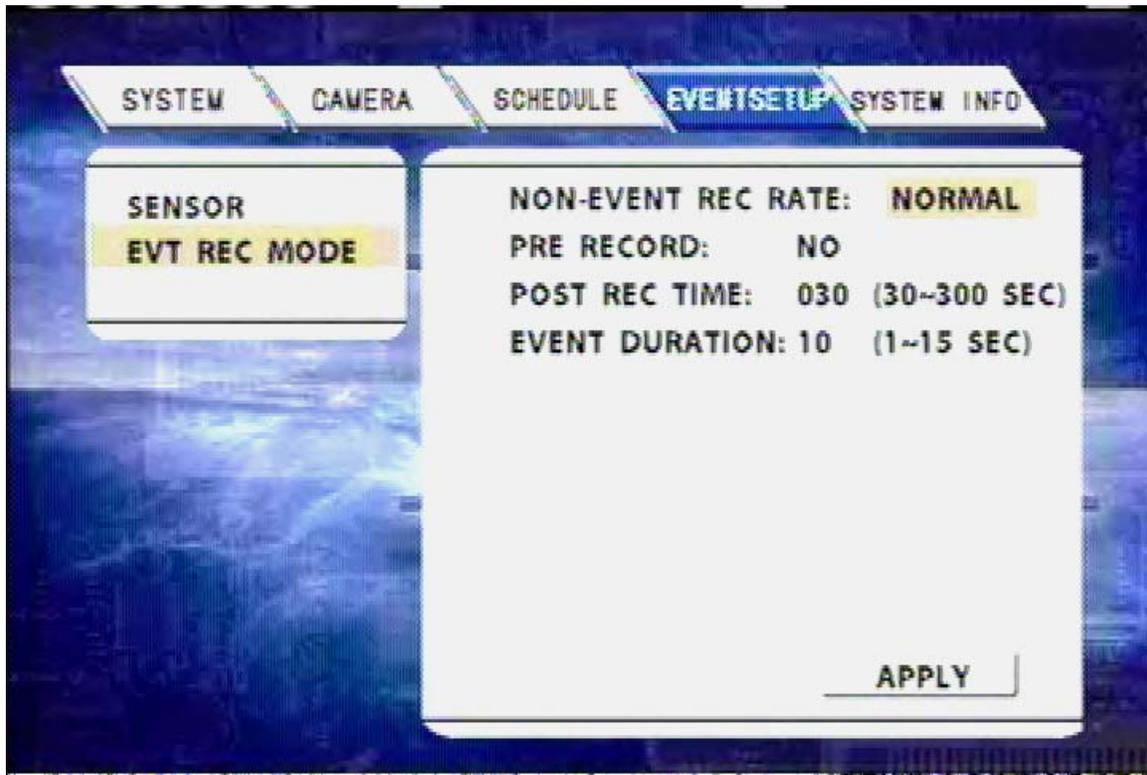
Figure 76: Event Setup – Event Record Mode Screen Shot

The EVENT RECORD MODE subsection of the EVENT SETUP SECTION has 4 options; NON-EVENT RECORD RATE, PRE RECORD, POST RECORD TIME, and EVENT DURATION, as shown in Figure 76 above. The EVENT RECORD MODE is an option that allows the user to save on hard drive space by recording all cameras using a low frame rate (about 1/64th the rate set in the CAMERA section in Figure 64 on Page 64) until a pre-defined alarm(s) is triggered. When in this mode, the DVR changes to the quality and frame rate settings, as shown in the CAMERA section in Figure 64 on Page 64, for the set amount of time. Depending on the record settings set in Figure 64 on Page 64, the amount of pre-record time will vary, as the pre-record memory buffer is a set size. The DVR will always give the maximum amount of pre-record time available, which is often around 10 seconds. The event record mode is disabled by setting the NON-EVENT RECORD RATE to NORMAL.

NON-EVENT RECORD RATE:	NORMAL or I FRAME
PRE RECORD:	YES or NO
POST RECORD TIME:	30 – 300 Seconds
EVENT DURATION:	1 – 15 Seconds

System Info
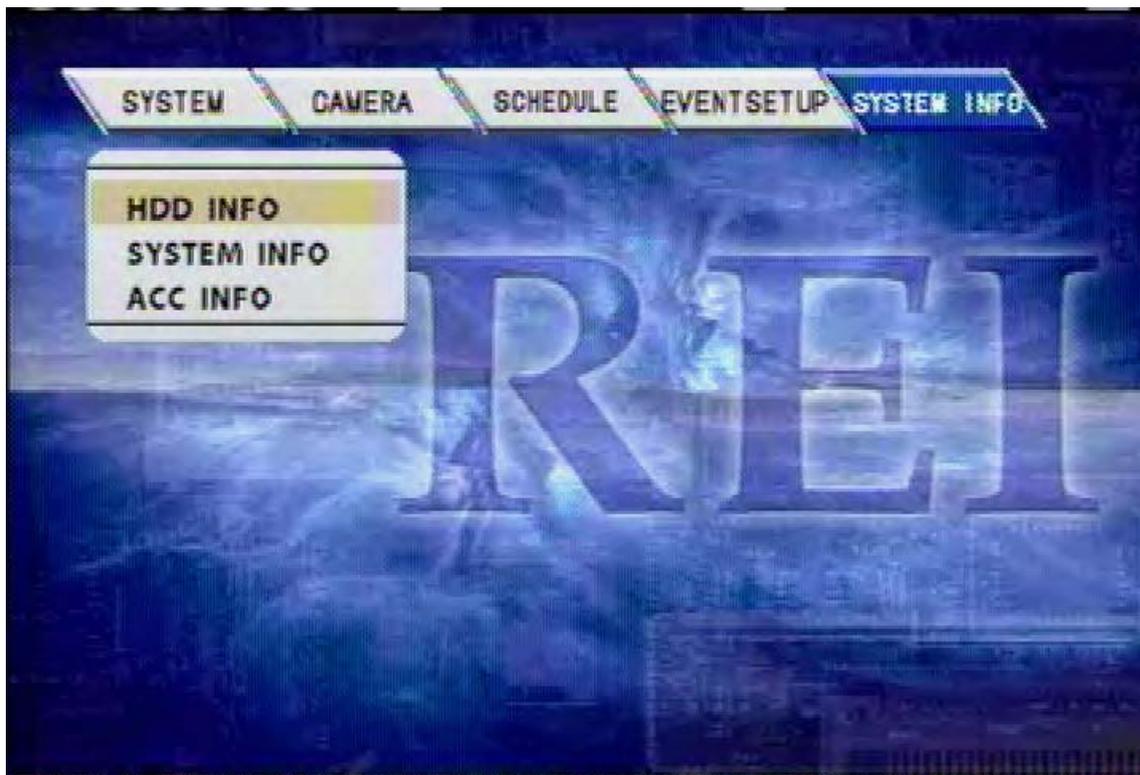
Figure 77: System Setup – System Information Screen Shot

SYSTEM INFO contains recorded information about the DVR system, as shown in Figure 77 above.

The SYSTEM INFO section of the menu is subdivided into 3 main categories; HDD INFOrmation, SYSTEM INFOrmation, and ACCelerometer INFOrmation.

HDD Information
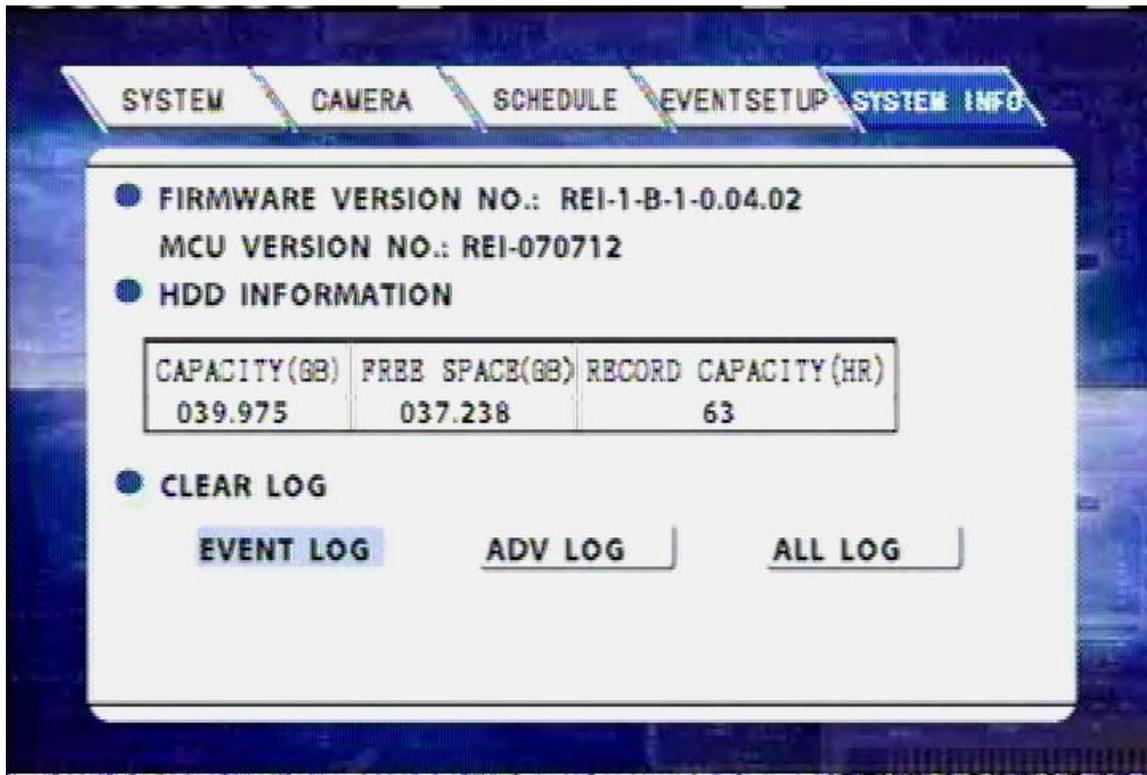
Figure 78: System Information – HDD Information Screen Shot

The HDD INFO subsection of the SYSTEM INFO section, shown in Figure 78 above, is used to display information about the DVR operating systems and hard drive module. The HDD INFO subsection is also where the user can go to clear the EVENT and ADVertising logs.

The HDD INFORMATION section shows the capacity of the drive in Gigabytes, the amount of free space left on the hard drive module and the record capacity (total) in hours.

System Information
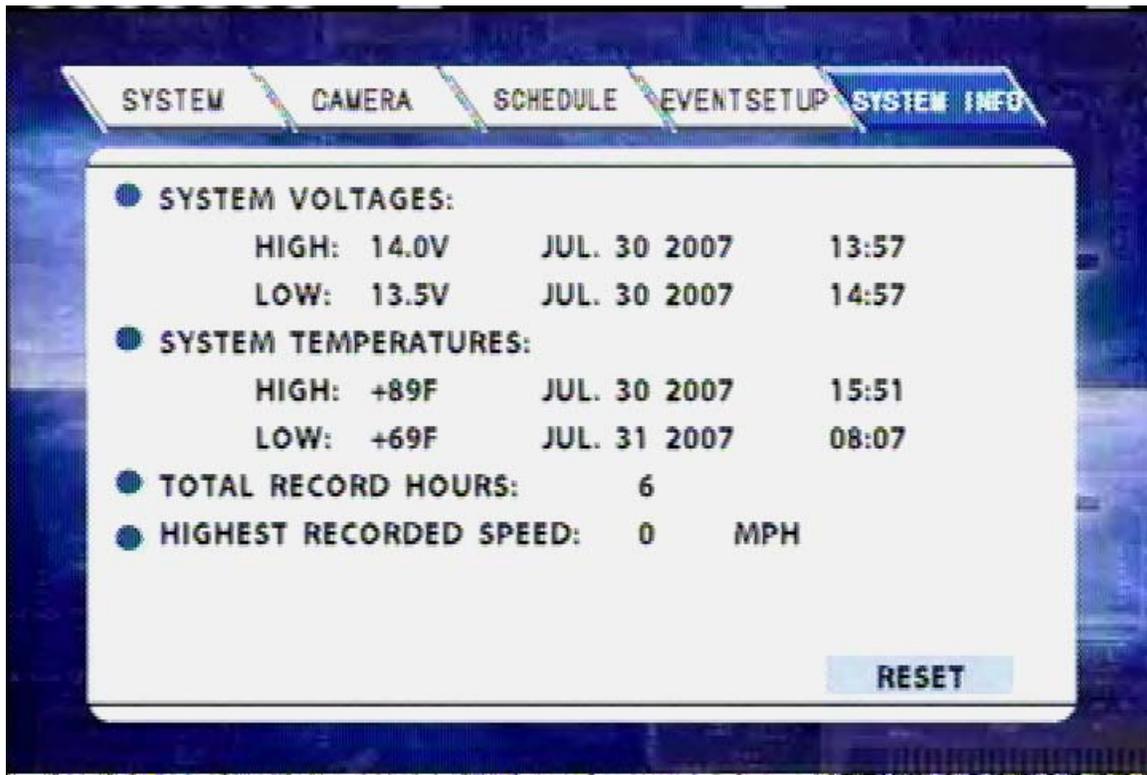
Figure 79: System Information – System Information Screen Shot

The SYSTEM INFO subsection of the SYSTEM INFO section, shown in Figure 79 above, displays information about the DVR's operating environment. The information delineated here: high and low SYSTEM VOLTAGES, high and low SYSTEM TEMPERATURES (inside the DVR enclosure), TOTAL RECORD HOURS for the life of the DVR, and the HIGHEST RECORDED SPEED.

Accelerometer
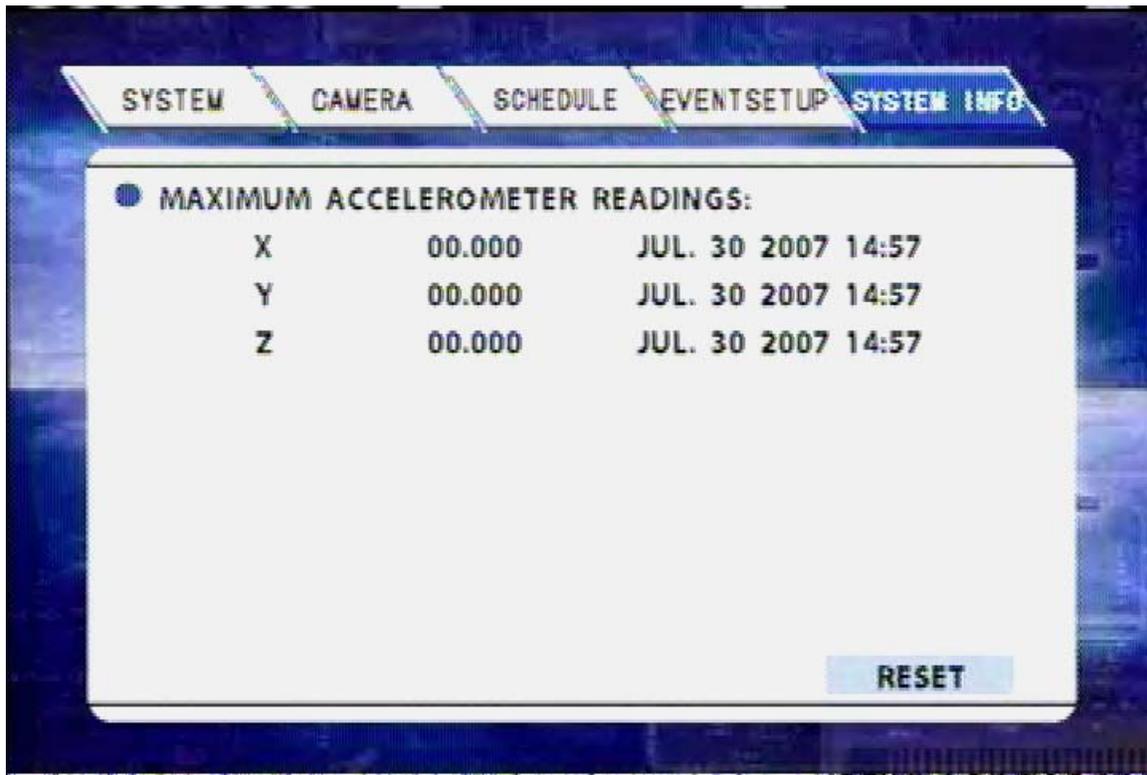
Figure 80: System Information – Maximum Accelerometer Readings Screen Shot

The ACC INFO subsection of the SYSTEM INFO section, shown in Figure 80 above, is used to display information about the DVR operating environment. The information is subdivided into the X, Y, and Z axis. In a proper installation, (reference Figure 17 on Page 27) the X axis is drawn from the back to the front of the bus, the Y axis is drawn from one side of the bus to the other side of the bus, and the Z axis is drawn from the bottom to the top of the bus. The date and time of the maximum readings are associated with the accelerometer data.

Time/Date Search
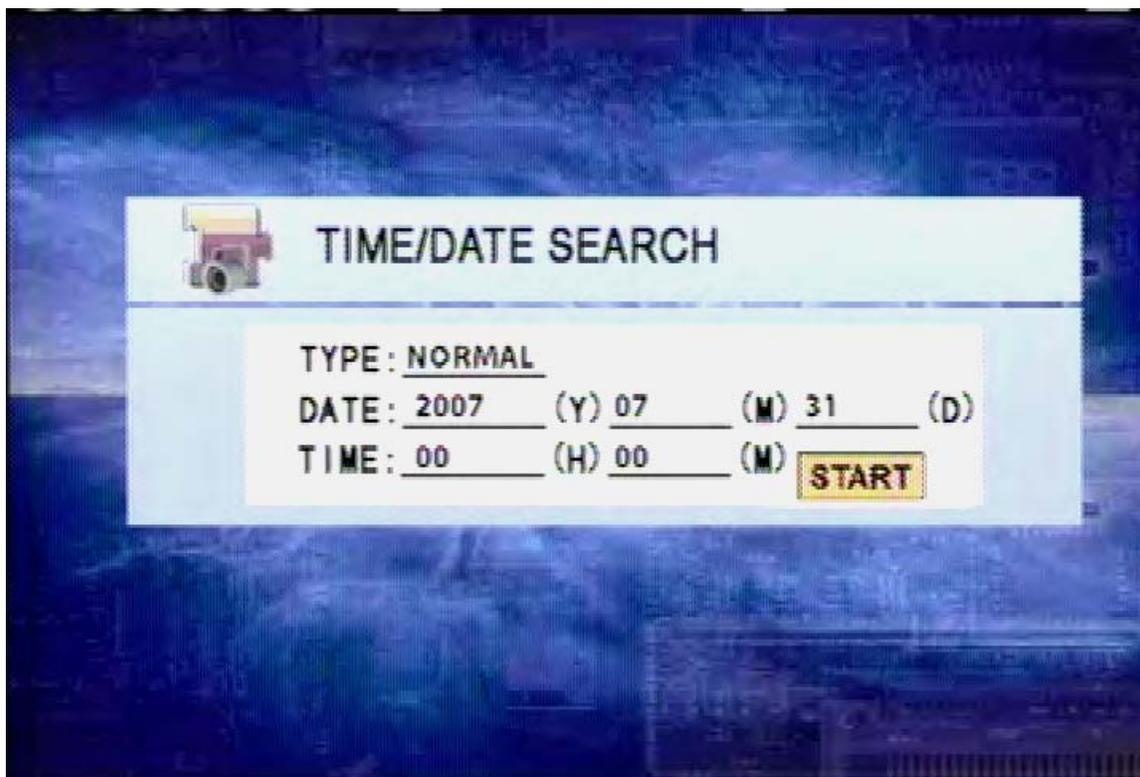
Figure 81: Time/Date Search – Date Selection Screen Shot

The TIME/DATE SEARCH section of the main menu is where the user can go to select a video file that has been recorded to the DVR for playback, as shown in Figure 81 above. These files are selectable (using the arrow buttons, the numeric buttons, and the ENTER key on the remote control) by entering in a date (and optionally a time) of the recorded files that the user wishes to view.

The DVR always records based upon the RECORD MODE settings, as shown in Figure 35 on Page 46, even when playing back video files.

Time/Date Search (continued)
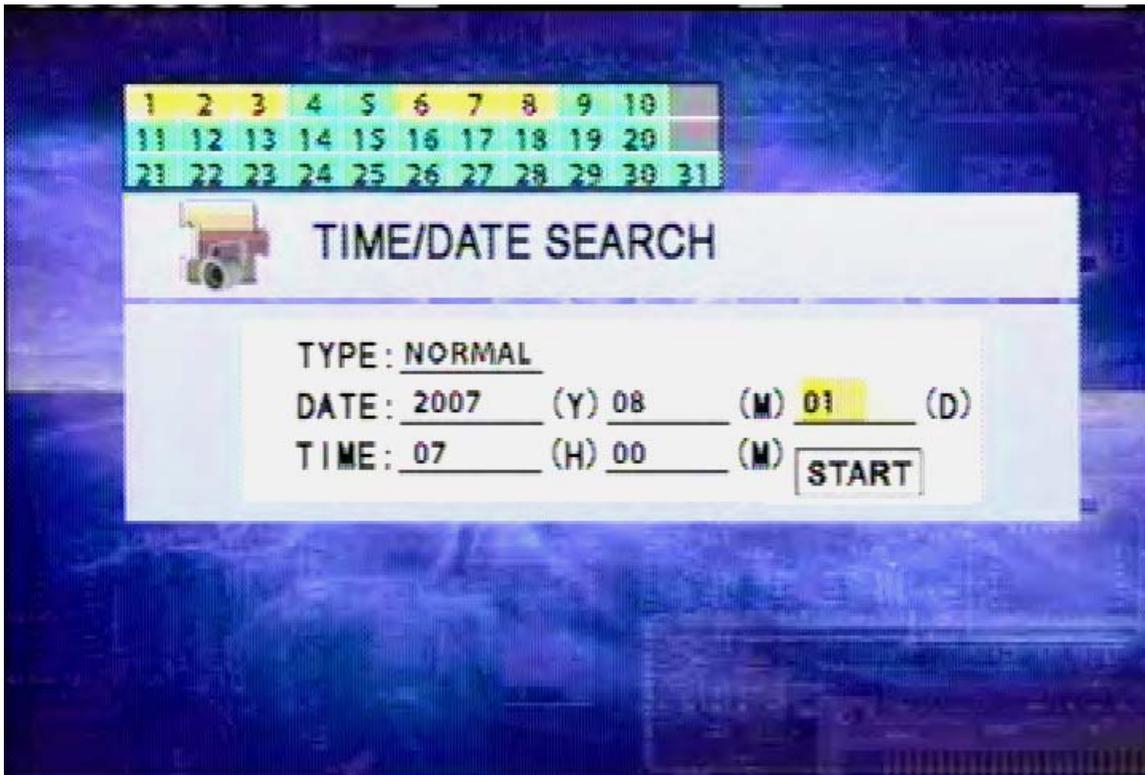
Figure 82: Time/Date Search – Available Video Calendar Screen Shot

There may be times when the user is not sure what dates worth of video are present on the drive. By pressing the SETUP button on the remote control, calendars of available video pop up to help the user pick the right date, as shown above in Figure 82. The dates that have video present are highlighted in yellow, and the dates that do not have any video files are highlighted in green.

Time/Date Search (continued)
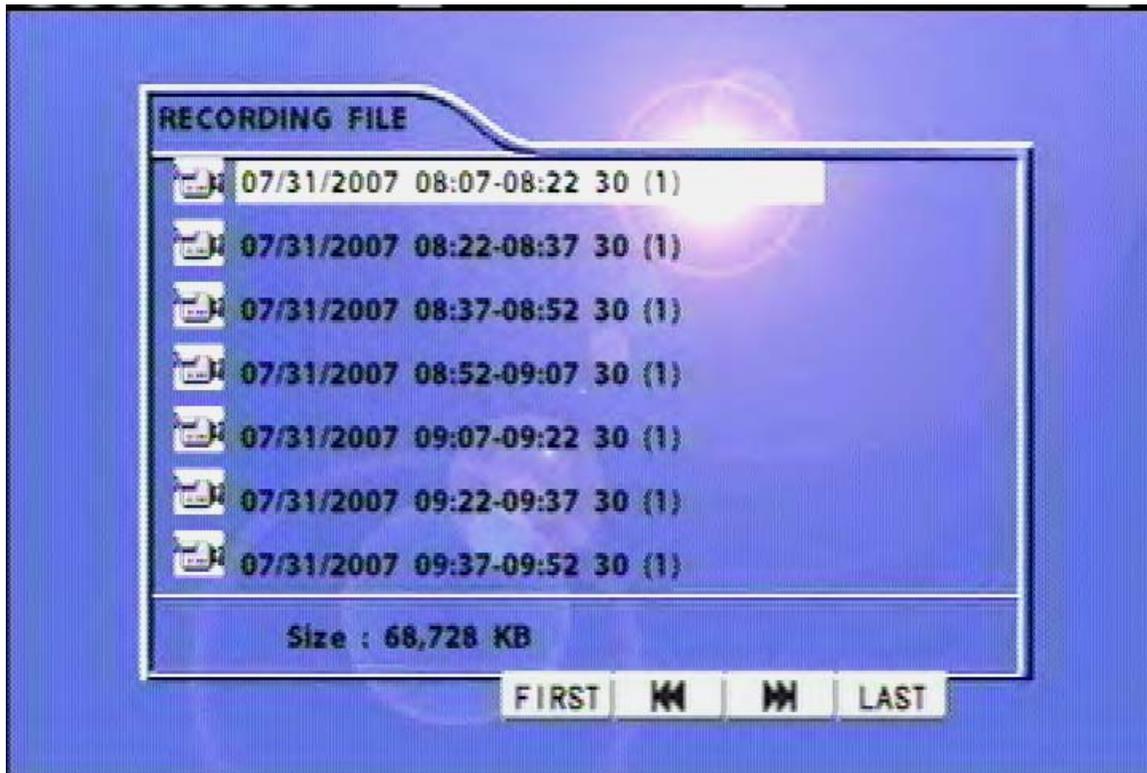
Figure 83: Time/Date Search – File Selection Screen Shot

After the correct date has been chosen, a list of record files appears for video file selection, as shown in Figure 83 above. The size of the video file is determined by the RECORD FILE SIZE, as shown in Figure 35 on Page 46.

Use the arrow buttons and the ENTER key on the remote control to select and activate a video file playback. The DVR always records based upon the RECORD MODE settings as shown in Figure 35 on Page 46, even when playing back video files.

Event Search
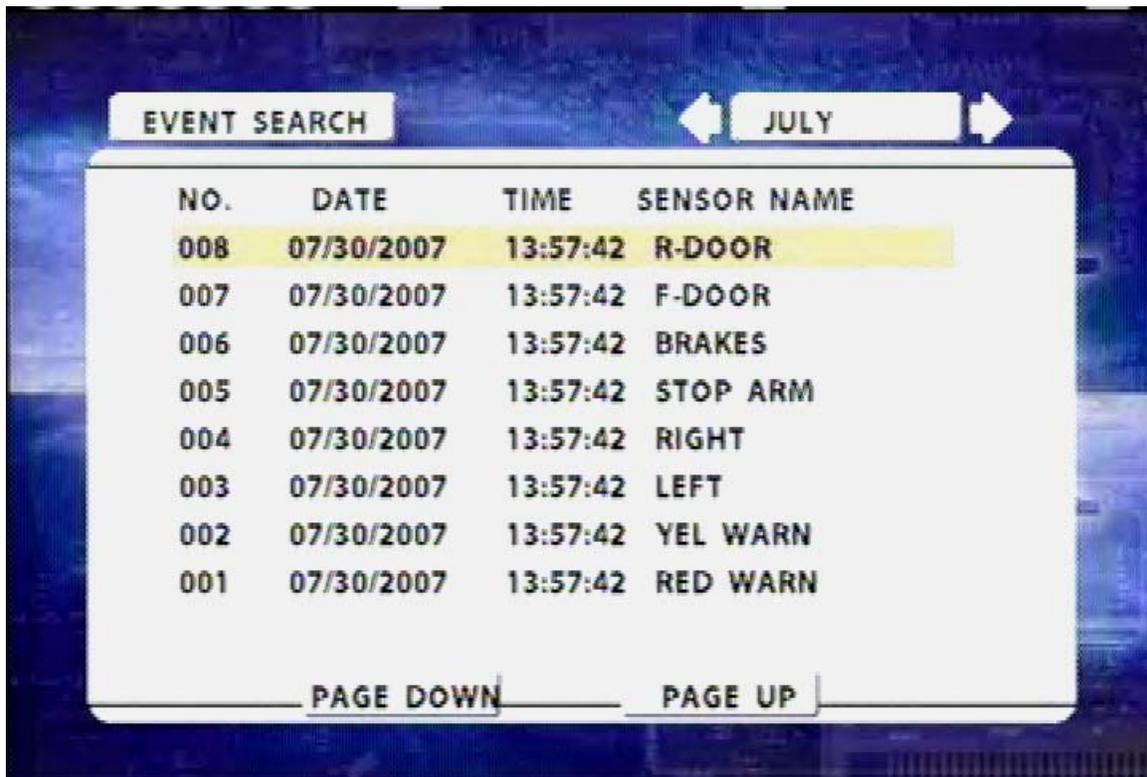
Figure 84: Event Search Screen Shot

The Event Search section of the main menu is where a user goes to select a video file that has been associated with an alarm event for playback, as shown in Figure 84 above. These files are derived when the DVR senses an input signal that has been set up previously, such as in the EVENT SETUP subsection of the main menu; reference Figure 75 on Page 74.

Use the arrow buttons and the ENTER key on the remote control to select and activate a video file playback. The DVR always records based upon the RECORD MODE settings as shown in Figure 35 on Page 46, even when playing back video files.

Advertising
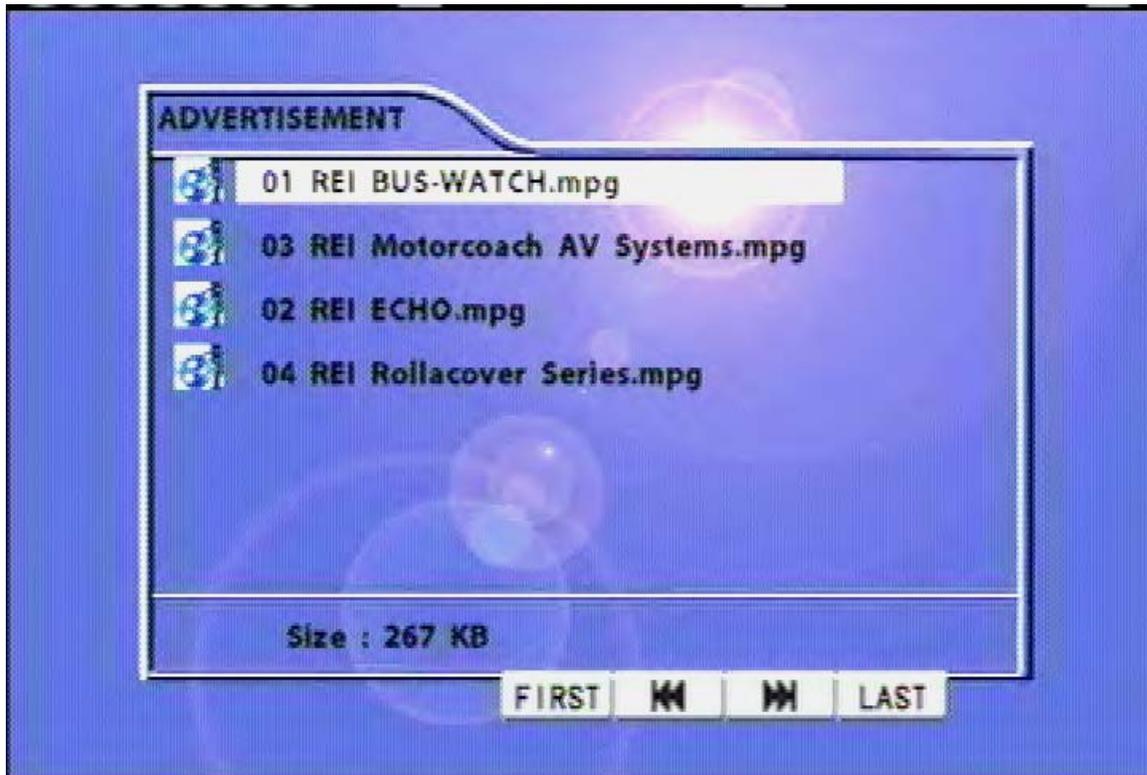
Figure 85: Advertisement Screen Shot

The REI R1001 and R4001 both come equipped with stereo DVD quality audio/video playback functions. The DVRs have A/V outputs on the rear of the DVR for connection of video monitors and stereo equipment for advertising, education, or informational purposes. These added features are ready to work with REI's extensive lines of motorcoach audio/video entertainment systems, LCD and CRT monitors, amplifiers and speakers.

The advertising section of the main menu is where a user goes to view the advertising files on the DVR, or select an advertising file to manually playback, as shown in Figure 85 above. The video files must be in MPEG2 format. The advertising files must be put on the hard drive in the ads directory through the USB flash drive upload or manually by using Windows Explorer. The DVR always records based upon the RECORD MODE settings, as shown in Figure 35 on Page 46, even when playing back audio or video. The video files placed in this directory will automatically loop play in the order as shown on the screen. An ADS log file is also created for accounting purposes. Press EXIT on the remote control to access the menus during advertising playback.

It is the end user's responsibility to ensure that all copyright protection laws are not violated.

Movies
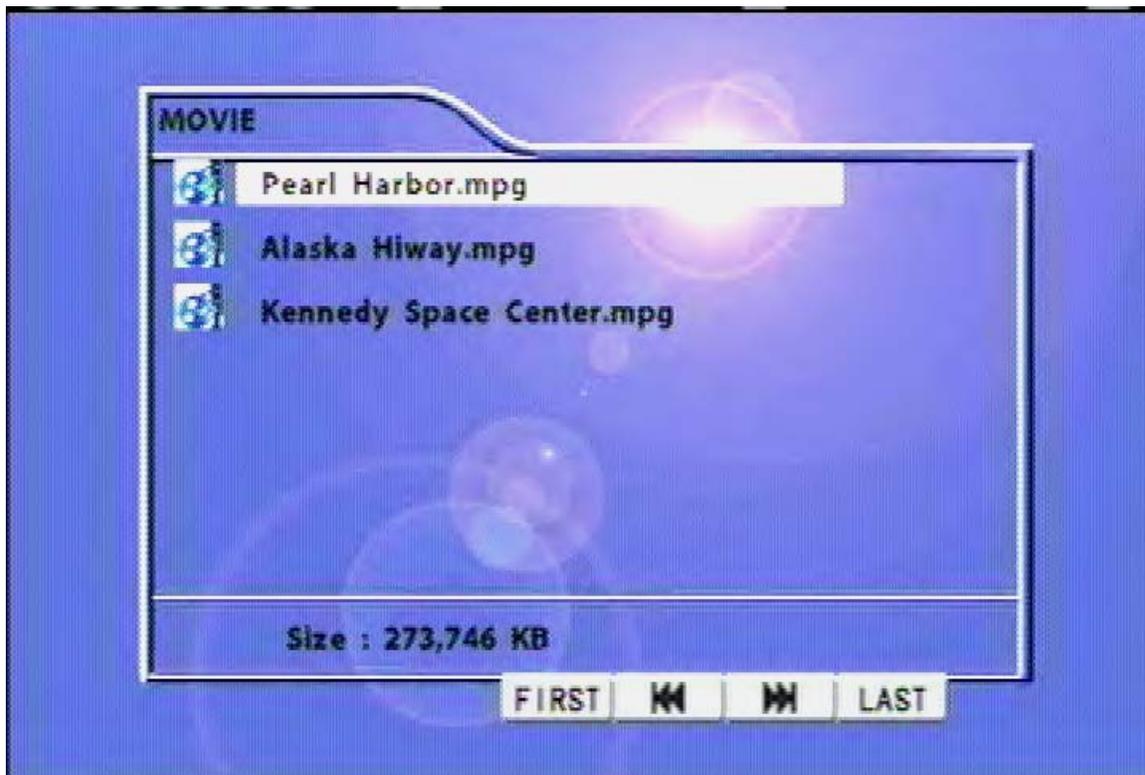
Figure 86: Movie Playback Screenshot

The Movie section of the main menu is where a user goes to select a video file to playback. The video files must be in MPEG2 format. The video files must be put on the hard drive through the USB flash drive upload or by using Windows Explorer to manually put the files in the movie directory. The DVR always records based upon the RECORD MODE settings, as shown in Figure 35 on Page 46, even when playing back audio or video.

It is the end user's responsibility to ensure that all copyright protection laws are not violated.

Music
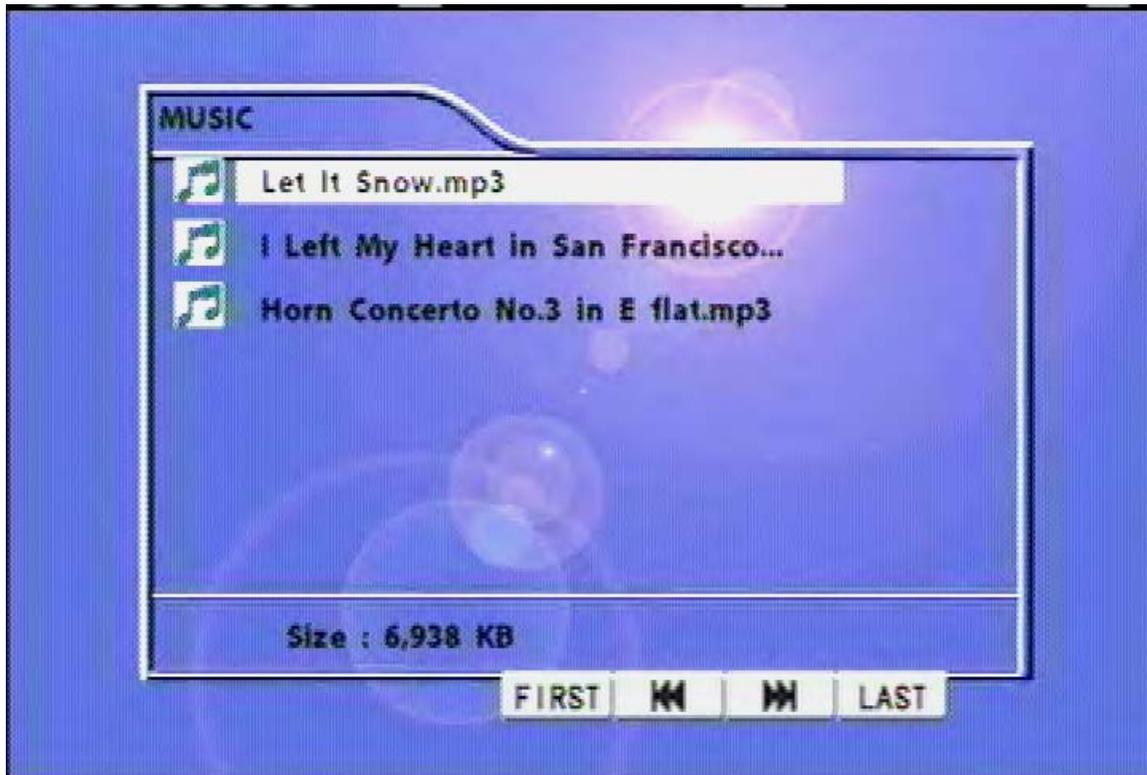
Figure 87: Music Playback File Selection Screen Shot

The Music section of the main menu is where a user goes to select a music file to playback, as shown in Figure 87 above. The audio files must be in MP3 format. The music files must be put on the hard drive through the USB flash drive upload or by using Windows Explorer to manually put the files in the music directory. The DVR always records based upon the RECORD MODE settings, as shown in Figure 35 on Page 46, even when playing back audio or video.

It is the end user's responsibility to ensure that all copyright protection laws are not violated.

DVR Firmware Upgrading

Due to improvements in technology and the availability of new features, the R1001/R4001 series of DVRs comes with the ability to have the firmware (DVR operating system) be easily upgraded in the field. There are several ways this can be done: through the Ethernet connection, through the front panel USB connection, or through the removable hard drive module USB connection.

Removable Hard Drive Module USB Firmware Upgrade

To upgrade the firmware on the DVR, you must put the upgrade file in the ads directory on the hard drive. The DVR will recognize this file and automatically perform the upgrade, as shown in Figure 88 below. Once the DVR has finished upgrading itself, a success message will appear (as shown in Figure 89 on Page 88) and a bootstrap algorithm will restart the DVR.
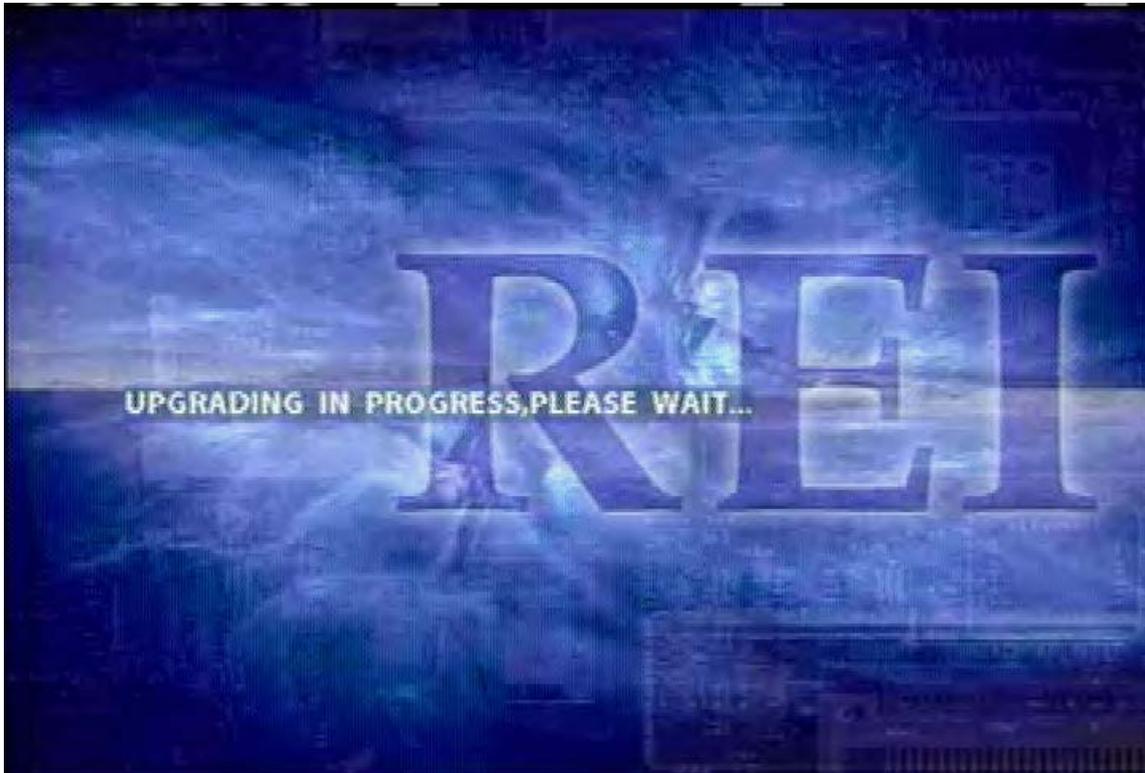
Figure 88: Firmware Upgrading In Progress Screen Shot

Hard Drive USB Firmware Upgrade (continued)

Figure 89: Firmware Upgrade Success Screen Shot

Front Panel USB Firmware Upgrade

PC - Put the upgrade file in the ads directory on the hard drive; reference Figure 49 on Page 53. The DVR will automatically upgrade upon exiting the menu system.

Flash Drive - Put the upgrade file in the ads directory on the hard drive; reference Figure 50 on Page 54. The DVR will automatically upgrade upon exiting the menu system.

Ethernet Firmware Upgrade

When using the REI R1001/R4001 PC software to upgrade the firmware, please reference the REI RMS PC software users manual (REI P/N 640372).

Systems Related Part Numbers

Digital Video Recording Units & Protective Enclosures

710131   BUS-WATCH® Single Channel DVR, R1001
710134   BUS-WATCH® 4 Channel DVR, R4001
710133   BUS-WATCH® Decoy, Lock Box-R1001/R4001

Hard Drives

710128   Hard Drive, 80 GB, R1001/R4001
710129   Hard Drive, 100 GB, R1001/R4001
710130   Hard Drive, 120 GB, R1001/R4001
710132   Hard Drive, 160 GB, R1001/R4001

Quad Video Processors & Camera Switch Devices

700483   12V Black & White Quad Processor
700848   12V Color Quad Processor

710030   Mode Selectable 2 Camera Solid State Switch Device
710082   Time Selectable 2 Camera Solid State Switch Device

Digital BUS-WATCH® System Harnesses

512001   Power Cable, 35 Feet
512002   Power Cable, 16 Feet
512209   Vehicle Sensor Options Cable, 20 Feet
512208   Vehicle Sensor Options Cable, 50 Feet
511986   External Record Indicator / Event Mark Cable, Aftermarket, 20 Feet
512023   External Record Indicator / Event Mark Cable, Aftermarket, 40 Feet
512024   External Record Indicator / Event Mark Cable, OEM, 20 Feet
512025   External Record Indicator / Event Mark Cable, OEM, 40 Feet
512086   RCA Cable, Stereo Male/Male (3x), 10 Feet
512196   USB 2.0 Type 'A' Male / Type 'A' Male Cable, 6 Feet (DVR to PC)
530062   USB 2.0 Type 'A' Male / Type 'B' Male Cable, 10 Feet
530068   Network Crossover Cable CAT5E, 3 Feet
530070   USB Type 'A' Male / Type 'A' Male / Type 'B' Male Cable, 3 Feet
710143   Accelerometer Module, 3 Feet
710144   GPS Antenna Module, 16 Feet
750086   BUS-WATCH® Magnetic Pickup Vehicle Speed Sensor Kit
710095   Covert Microphone

Digital BUS-WATCH® Camera Harnesses

512014	BUS-WATCH® Camera Cable, 1 Foot
512166	BUS-WATCH® Camera Cable, 6 Feet
511158	BUS-WATCH® Camera Cable, 12 Feet
512167	BUS-WATCH® Camera Cable, 15 Feet
511965	BUS-WATCH® Camera Cable, 20 Feet
512168	BUS-WATCH® Camera Cable, 25 Feet
511966	BUS-WATCH® Camera Cable, 30 Feet
511967	BUS-WATCH® Camera Cable, 35 Feet
512169	BUS-WATCH® Camera Cable, 40 Feet
510993	BUS-WATCH® Camera Cable, 50 Feet
512170	BUS-WATCH® Camera Cable, 60 Feet
510804	BUS-WATCH® Camera Cable to Camera Cable Connector, 5 Feet
511344	BUS-WATCH® Decoy Camera Live Microphone 'Y' Cable
511918	BUS-WATCH® Cable, Disable Camera Audio
512150	BUS-WATCH® Covert Microphone 'Y' Cable
512151	BUS-WATCH® Voice Band Pass Filter
511667	Rear Observation Camera to BUS-WATCH® Cable, 2 Feet

Digital Bus-Watch® II to Digital Bus-Watch® R1001/R4001 Transfer Harnesses

512015	BUS-WATCH® Vehicle Sensor Options Transfer Harness, BW to DBW4
512017	BUS-WATCH® Power Transfer Harness, BW to DBW4
512018	BUS-WATCH® External Record Signal Transfer Cable, DBW2 to DBW4
512026	BUS-WATCH® Event Signal Transfer Cable, DBW2 to DBW4

Cube Cameras

710086	Black & White 6mm Fixed Iris
710080	Black & White 8mm Fixed Iris
710084	Color 4mm Fixed Iris
710096	Color 6mm Fixed Iris
710081	Color 8mm Fixed Iris

Box Cameras

690321	Exterior Rear Observation B/W Camera (requires 511667)
690457	Exterior Rear Observation Color Camera (requires 511667)
710135	HR Series 2.8mm IR Day/Night with Audio
710137	HR Series 4mm IR Day/Night with Audio
710138	HR Series 6mm IR Day/Night with Audio
710139	HR Series 8mm IR Day/Night with Audio

Digital BUS-WATCH® R1001 / R4001

Dome Cameras

710009	Dome Camera, Black & White 2.9mm
710004	Dome Camera, Black & White 4mm
710008	Dome Camera, Black & White 8mm
710059	Dome Camera, Color 2.9mm
710054	Dome Camera, Color 4mm
710127	Dome Camera, Color 6mm
710058	Dome Camera, Color 8mm
710023	Dome Camera, Color Dual Lens - 4mm & 8mm
710029	Dome Camera, Color Dual Lens - 4mm & 4mm
710041	Dome Camera, Black & White Dual Lens - 4mm & 8mm

Exterior Wedge Cameras – Roadside Rear Facing / Curbside Front Facing

710064	Exterior Wedge Camera, Color 4mm
710066	Exterior Wedge Camera, Color 6mm
710068	Exterior Wedge Camera, Color 8mm
710001	Exterior Wedge Camera, Black & White 4mm
710034	Exterior Wedge Camera, Black & White 6mm
710036	Exterior Wedge Camera, Black & White 8mm
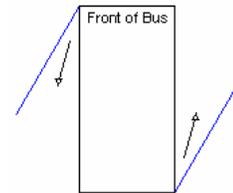
Exterior Wedge Cameras – Roadside Front Facing / Curbside Rear Facing

710063	Exterior Wedge Camera, Color 4mm
710065	Exterior Wedge Camera, Color 6mm
710067	Exterior Wedge Camera, Color 8mm
710002	Exterior Wedge Camera, Black & White 4mm
710033	Exterior Wedge Camera, Black & White 6mm
710035	Exterior Wedge Camera, Black & White 8mm
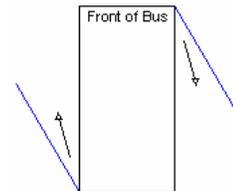
Replacement Keys

170100	Lock Box & Slide Bracket Keys
170102	Hard Disk Drive Module USB Keys
170103	DVR Face HDD Module Keys

Replacement Handheld Remote Controls

690555	Rx001 Remote Control

Digital BUS-WATCH® R1001 / R4001

PC Software & Documentation

621005 CD, R1001/R4001 BUS-WATCH® SOFTWARE

640369 R4001 EXPANDED SYSTEM DIAGRAM
640370 R1001/R4001 USER MANUAL & INSTALLATION GUIDE
640371 R1001/R4001 PC SOFTWARE INSTALLATION GUIDE
640372 R1001/R4001 PC SOFTWARE USERS MANUAL

Installer's Equipment

690554 MONITOR 7" COLOR LCD W/BATTERY HOLDER

Optional Advertisement / Media Equipment

LCD Monitors

700990 MONITOR, 10.4" LCD LOW PROFILE, 12V
700995 MONITOR, 10.4" LCD LOW PROFILE, 24V
710024 MONITOR, 15.4" LCD LOW PROFILE, 12/24V

Coaxial Video Cables

511062 COAX CABLE, 15' (M/M) BNC
511160 COAX CABLE, 27' (M/M) BNC
511623 COAX CABLE, 37' (M/M) BNC
511879 COAX CABLE, 40' (M/M) BNC

Amplifiers

690143M AUDIO AMPLIFIERS, 12 VOLT 200 WATT
700887 VIDEO DISTRIBUTION AMPLIFIER - LOW PROFILE

Speakers

231010 SPEAKER ASSEMBLY, 5-1/4" 100W
231005 SUBWOOFER SPEAKER ASSEMBLY
231002 TWEETER SPEAKER ASSEMBLY

Please Visit www.radioeng.com for a complete and current product catalog.

Radio Engineering Industries, Inc.
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Troubleshooting Guide

Troubleshooting, as a rule of thumb, is basically a process of elimination. In a complex electrical system with many components, it can be sometimes difficult to determine exactly why the system is not working the way you want it to. If you only have one DVR system, the maintenance person may need to understand the entire DVR system to logically deduce the exact cause of the problem. If you have multiple systems installed on your vehicles, then troubleshooting is a lot easier. A good way to discover which part of the system is not operating properly is to swap components and see which component the problem follows. For example, if you suspect there may be a problem with a hard drive, you can put the hard drive into a different DVR, and if the drive works in that DVR, then you know it is not the drive.

In most cases, we find the reason the DVR is not doing what the end user wants it to is because the DVR is not configured to operate in that manner. A good example of this is if the DVR was placed in timer mode, and the operator wanted the DVR to go on and off with the ignition.

Radio Engineering Industries has a world-class team of technical support specialists available 24/7 to assist you with getting your system running the way you need. In addition to this valuable service, provided below is a quick guide to help assist you with some common problems.

TROUBLESHOOTING GUIDE		
PROBLEM	POSSIBLE CAUSE	CORRECTION
Not Powering On (No Power LED)	Power Cable Improperly Installed	Check 12VDC on Memory (White Wire), Check Chassis Ground (Black Wire), Check 12VDC on Ignition (Red Wire)
	Incorrect Record Mode Setting	Check Record Mode Setting See Figure 35 on Page 46
	Hard Drive Not Installed and Properly Locked into Place	Install Hard Drive and Lock into Place

TROUBLESHOOTING GUIDE (Continued)		
PROBLEM	POSSIBLE CAUSE	CORRECTION
Not Recording (No Record LED)	Incorrect Record Mode Setting	Check Record Mode Setting See Figure 35 on Page 46
	Hard Drive is Full	See HDD Full LED On In Section Below
HDD Full LED On	Hard Drive is Full of Video	Configure DVR to Overwrite Video See Figure 35 on Page 46
		Remove Some Video Files See Figure 9 on Page 16
		Format Hard Drive See Figure 36 on Page 47
Fault LED On	Camera(s) Not Connected	Verify Camera Connection
Cannot Access Menu	Remote Control Does Not Work	Check Batteries Try a Different Remote
	DVR is in Installers Mode	Exit Installers Mode See Figure 30 on Page 41

TROUBLESHOOTING GUIDE (Continued)		
PROBLEM	POSSIBLE CAUSE	CORRECTION
Ethernet Connection Not Working	Wrong Network Cable Type	Use Crossover Cable (REI P/N 530068)
	DVR IP Settings not Configured Correctly	Configure Network Settings See Figure 40 on Page 49
	PC IP Settings not Configured Correctly	Configure Network Settings (Contact your System Administrator or IT Department)
USB Connection Not Working	DVR in Wrong USB Mode	Change USB Mode See Figure 49 on Page 53
No Video Out	Camera(s) Not Connected	Verify Camera Connection
No Audio Out	Audio Recording Disabled	Enable Audio See Figure 64 on Page 64
	Volume Turned All The Way Down	Use UP ARROW on Remote Control to Increase Volume

<u>Specifications</u>

Mobile DVR
- Recording Medium: 2.5" Removable Hard Disk Drive Module
- Display Capability: On Screen Display and embedded video stream data
- GPS: Time Synchronization, Latitude, Longitude, Speed, Heading & Mapping
- Video Input: 4 Channel Inputs, 1V pp / 75 ohm
- Video Output: 2 x Composite Video, 1x Ethernet, and 2 x USB 2.0
- Image Resolution: 720 (H) x 486 (V)
- Video Compression: MPEG-4 (8 quality settings)
- Frame Rate: 1 to 30fps Selectable
- Audio Input : 4 independent channel inputs
- Recording Modes: Continuous, Ignition, Scheduled & Event Triggered
- Playback: Search by Alarm, Date, Time & Camera
- Video Loss Detection

Advertisement System
- Video Playback Format: MPEG
- Video Out: BNC Out on the back panel, RCA Out on the front panel
- Play List Method: By Sequence & Rolling Message Displaying
- Updating Method: Removable Hard Drive, Ethernet, and USB

Input / Output
- 2 x USB 2.0 Ports (one Host, one Slave)
- 1 x 10/100base-T Ethernet Port
- 8 x Vehicle Sensor Inputs
- 1 x GPS Input
- 1 x Accelerometer Input
- 1 x Transmission Pulse Speedometer Input

Environment
- Relative Humidity: 10%~95% at 40.C, Non-Condensing
- Operating Temp.: -40C ~ +65C
- Shock: 225Gs 2ms (Operating) / 900Gs 1 ms (Storage / Transit)
- Vibration: 1.0G, 5 ~ 500Hz (Operating), 5.0G, 5 ~ 500Hz (Storage / Transit)
- Power Requirement: 12VDC @ 2A / 24VDC @ 1A
- Power Consumption: 24W Maximum
- EMC and Safety: CE, FCC