



BrightSign®
HARDWARE MANUAL

HD222, HD1022

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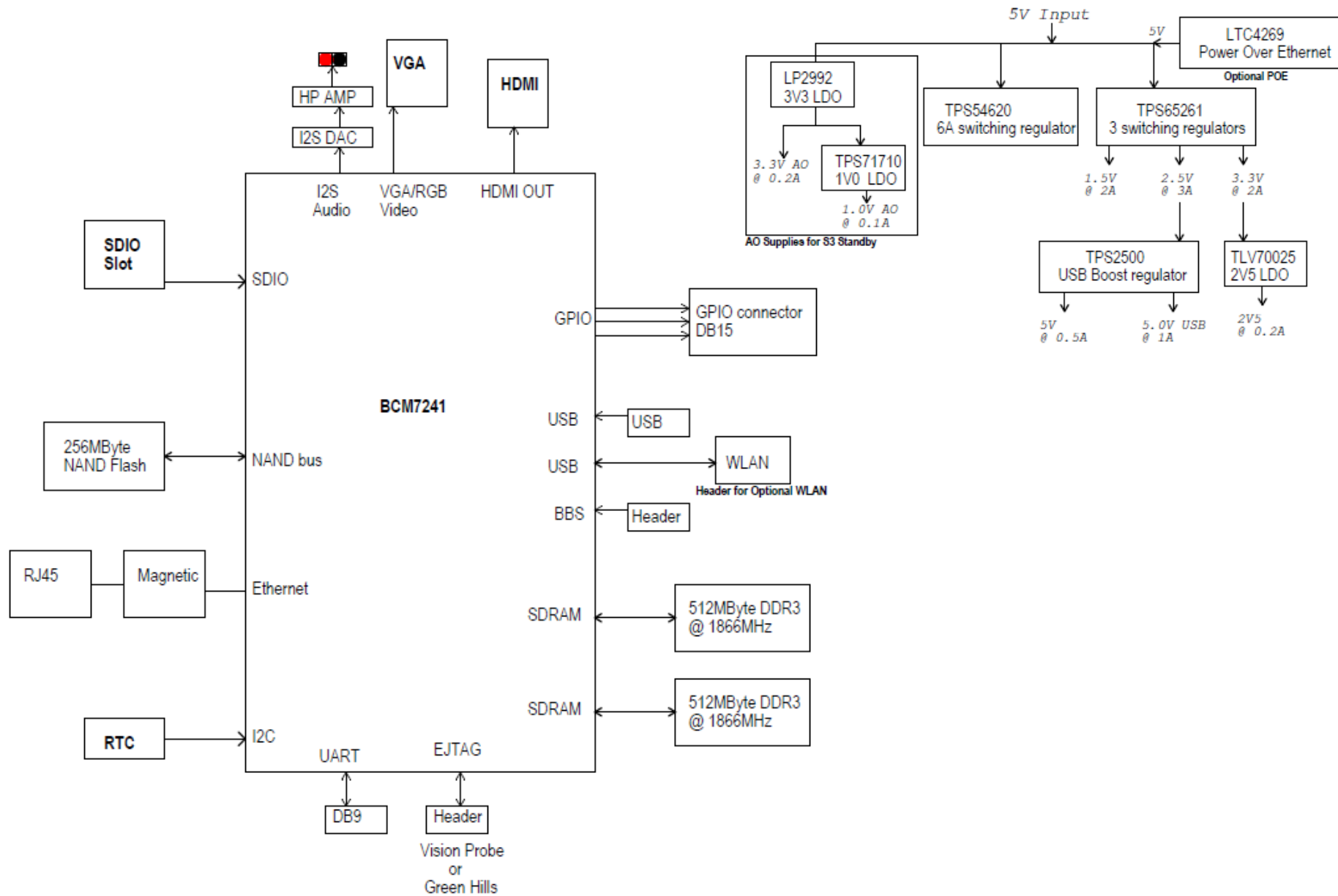


OVERVIEW

The BrightSign HD222 and HD1022 media players can be used to decode images, audio, and video (at resolutions up to 1920x1080x60p) for digital-signage and kiosk applications. In addition to driving audio/video devices, these players can be controlled with various networked and built-in interfaces.

This manual specifies the hardware interfaces and operational theory of the HD222 and HD1022.

Block Diagram



HD222

Front

- 3.5mm audio out
- DA15 GPIO

Left

- GPIO service button

Right

- SDHC/SDXC flash card slot
- Status/error LED (red)
- Update LED (yellow)
- Power LED (green)
- SD activity LED (green)

Back

- 3.5mm audio out
- GPIO reset button
- VGA out
- HDMI out
- RJ45 Ethernet
- 5V@3A barrel power connector

HD1022

Front

- 3.5mm audio out
- DA15 GPIO
- DE9 RS232 serial (male)

Left

- GPIO service button
- USB 2.0

Right

- SDHC/SDXC flash card slot
- Status/error LED (red)
- Update LED (yellow)
- Power LED (green)
- SD activity LED (green)

Back

- GPIO reset button
- VGA out
- HDMI out
- RJ45 Ethernet
- 5V@3A barrel power connector

HARDWARE INTERFACES

This section describes the characteristics and operation of all connectors on the HD222 and HD1022.

Power Connector

The power connector for the HD222 and HD1022 is rated for 5V @ 3A. The plug for the connector is a standard, center-positive 5.5mm plug with a 1.65mm center pin hole.

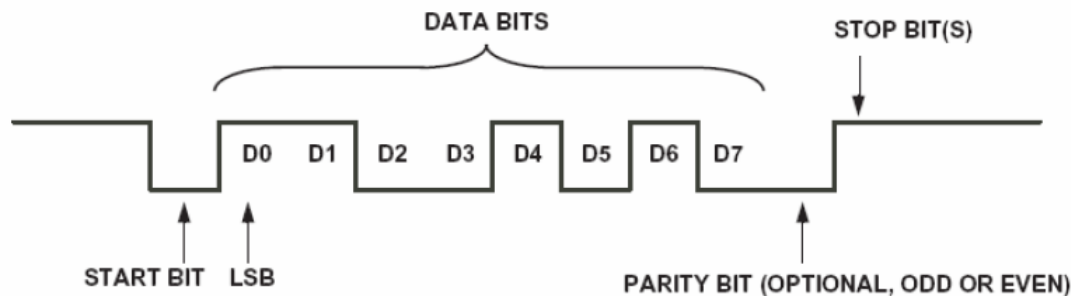
DE9 RS-232 Serial

The RS-232 interface is a male DE9 connector. The HD1022 player is a DTE device, similar to a PC. The input to the chip accepts a range between +25V and -25V, so it is compatible with +12V/-12V signaling.

The baud rate of the RS-232 interface (which is controlled by system software) is 115200, with no parity, 8 data bits, and 1 stop bit. The RS-232 interface supports RTS/CTS hardware flow control, but no software flow control. The maximum cable length is 50 meters, and the total cable capacitance is 2500pF.

Note: A lower capacitance cable allows you to use cable lengths beyond 50 meters.

The following diagram illustrates the behavior of the TX and RX signal:



The following table illustrates the pinout of the DE9 serial connector on the HD1022:

pin	Description	pin	Description
1	NC	2	Receive data into the device
3	Transmit data out of the device	4	Available 5V@500mA
5	Ground	6	NC
7	RTS	8	CTS
9	NC	--	--

DA15 GPIO

The GPIO switch/led connector is a DA15 female. This connector is used to allow the player to control external LEDs or other devices requiring 24mA of current or less.

Connect the LED outputs to the LED ANODE and connect the LED CATHODE to the ground. If you want to connect another device, then the output is capable of sourcing or sinking up to 3.3V at 24mA, but there is a series resistor of 100Ω in each line.

The connector also allows the connecting of external contact closures to the ground. In order to connect a switch, connect one side of the switch to the switch input, and connect the other side to one of the ground pins on the DA15 connector. The connector can also supply 3.3V at up to 500mA to an external device. The 3.3V output is polyfuse-protected and can source up to 500mA.

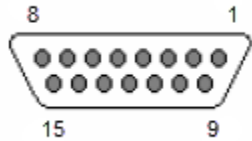
If one BrightSign player is driving the inputs on another BrightSign player, then you can drive at most three inputs from one output. The following calculations explain this limitation:

Note: The GPIO outputs have 100Ω series resistors; the GPIO inputs have 1K pullup resistors to 3.3V; and the input threshold on the 541 chips is 2V high and .8V low. The high voltage is not problematic, but the low voltage can be if there are too many inputs connected to one output.

1 out driving 1 in	$V=3.3*100/(100+1,000)=0.3$
1 out driving 2 in	$V=3.3*100/(100+500)=0.55$
1 out driving 3 in	$V=3.3*100/(100+333.3)=0.76$
1 out driving 4 in	$V=3.3*100/(100+250)=.94$ (This is too high, so 1 output driving 3 inputs is the maximum)

The following table illustrates the pinout of the DA15 on the HD222 and HD1022:

pin	Description	pin	Description
1	IR blaster input	2	Ground
3	Button 6 I/O	4	Button 5 I/O
5	Button 3 I/O	6	Ground
7	Button 1 I/O	8	+3.3V output at 500mA
9	Ground	10	Button 7 I/O
11	Ground	12	Button 4 I/O
13	Button 2 I/O	14	Ground
15	Button 0 I/O	--	--



Here is the DA15 female as viewed from the front of the HD222 and HD1022:

A button/LED/IR board can be used to demonstrate the GPIO and IR functions on a BrightSign player. This board is built by a third-party manufacturer and can be purchased upon request.

RJ45 Ethernet

The HD222 and HD1022 have an RJ45 connector for 10/100 base-T Ethernet. The maximum Ethernet-cable length is 100 meters.

The following table illustrates the pinout of the RJ45:

pin	Description	pin	Description
1	TX+	2	TX-
3	RX+	4	RC to ground
5	RC to ground	6	RX-
7	RC to ground	8	RC to ground

USB

The HD1022 has a single USB 2.0 port, which is capable of transfer speeds up to 480 Mbit/s. The maximum length for a USB cable is 5 meters. The following tables illustrate the pinout of the USB 2.0 host ports:

pin	Description	pin	Description
1	VBUS	2	D-
3	D+	4	Ground

3.5mm Audio Connector

The HD222 and HD1022 have a single 3.5mm female audio connector, which transmits an analog stereo signal. The full-scale voltage output of the audio is 2V RMS. The minimum load impedance of the audio connector is 32Ω.

Note: *The BrightSign expansion module allows you to drive up to three sets of 5Ω headphones directly.*

The audio connector has the following pinout:

- **Tip:** Left audio
- **Ring:** Right audio
- **Sleeve:** Ground for audio signal

VGA Output

The VGA output is a DE15 connector that is able to transmit RGB video. The following table illustrates the pinout of the DE15 VGA connector:

pin	Description	pin	Description
1	Red Analog video output	2	GREEN analog video output
3	Blue analog video output	4	NC
5	Digital ground	6	Analog ground
7	Analog ground	8	Analog ground
9	+5V DDC supply	10	Digital ground
11	NC	12	DDC SDA

13	HSYNC output	14	VSYNC output
15	DDC SCL	--	--

HDMI Output

The HDMI-out connector is used to send digital video and audio to HDMI-enabled sink devices. This connector is compatible with HDMI 1.4 devices, capable of outputting a maximum video resolution of 1920x1080x60p.

The following table illustrates the pinout of the HDMI connector:

pin	Description	pin	Description
1	TX2p	2	Ground
3	TX2n	4	TX1p
5	Ground	6	TX1n
7	TX0p	8	Ground
9	TX0n	10	TXCp
11	Ground	12	TXCn
13	CEC	14	NC
15	DDC SCL	16	DDC SDA
17	Ground	18	+5V DDC
19	HPD (Hot Plug Detect)	--	

ENVIRONMENTAL AND POWER USAGE

The HD222 and HD1022 are designed to be used between 0°C and 40°C, at 90% maximum relative humidity, non-condensing.

The power supply for the HD222 and HD1022 is 15W and 5V @ 3A. The device will use approximately 1A of power when playing a 720p or 1080i source file.

An additional 2A of power is available for peripherals connected to the player. The user should not connect any combination of peripherals that will exceed 2A draw. If more than 2A is drawn, the external power supply may shut down due to over-current conditions. The unit will not be damaged, but it may reboot or not operate properly until the overload is removed.

If the device is being powered by the power supply, the 2A can be shared in any way among the following connectors:

Connector	Maximum Power Usage
Ethernet	Approx. 180mA (when transferring data)
USB 2.0	500mA (on each connector)
DE9 5V	500mA
DA15 3.3V	500mA
HDMI 5V	500mA

THEORY OF OPERATION

This section describes how specific components operate on the HD222 and HD1022.

BCM7241 CPU

The HD222 and HD1022 utilize a BCM7241 CPU. The CPU is reset by the RESET_L signal from the low voltage reset circuit going into the RESET_IN pin on the CPU. When the RESET_IN pin goes from low to high, the CPU will boot from the NAND flash.

Built-in Flash

The boot code in the BCM7241 instructs it to continue the boot process by reading additional code from the onboard NAND flash, which can be updated in the field, either from a SDHC/SDXC flash card or a USB mass-storage device. Part of the NAND flash is also used to hold non-volatile parameters. The contents of the boot flash are copied into the SDRAM. The CPU then jumps to the boot code.

SDRAM

The HD222 and HD1022 contain a single bank of DDR SDRAM, consisting of two 16x256MB chips (1GB total). When the CPU boots, it will copy the code from the NAND flash device into the SDRAM and then execute the code from the SDRAM. The SDRAM runs at a clock rate of 933MHz, with a data rate of 1866MT/s.

Serial Port

The HD1022 has a built-in UART that communicates with the RS-232 level shifter. The MAX232 uses a capacitive voltage switcher to create valid RS-232 voltage levels for the transmit pin.

Audio Outputs

The HD222 and the HD1022 each have a single high quality audio DAC device, which takes in digital audio signals from the CPU in an I2S audio format. The AUD_LRCIN is the framing signal for the audio and runs at the frame rate of the audio source (usually either 44.1KHz or 48KHz). The AUD_BITCLK signal is typically 32 times higher than the AUD_LRCIN.

The audio output is fed through an amplifier and sent directly to the audio output jack. It can drive a 32Ω load with a 2V RMS signal.

On-Board LEDs

There are four on-board LEDs that indicate the following:

LED	Indication	
Green power (Pwr)	Displays when the board is powered up and not in reset mode.	
Green file-system activity (Bsy)	Flashes any time there is file-system activity (on any storage device)	
Yellow update (Upd)	Flashes when the board is being upgraded.	
Red status (Err)	Flashes a certain number of times to indicate which error is occurring. The flash codes are described below.	
	2	Unspecified error
	3	Network recovery script is preparing to run on a device configured for network recovery.
	4	No upgrade file found.
	5	Failed to load kernel module.
	6	Board is not capable of running the current firmware version.
	7	A piece of on-board hardware is not working correctly.
	8	Problem related to the storage device (either the USB drive or SD card)
	9	Problem related to the registry/NAND

	10	The autorun script encountered a load/run error.
	11	WiFi-related error (mainly, WiFi not found on USB)
	12	Unable to find a bootable image.

On-Board Switch

The on-board switch is connected to the GPIO02. The GPIO02 is pulled low when the service (SVC) button is pressed. Conversely, a pull-up on the button normally sets the GPIO02 to be pulled high.

Reset Switch/GPIO Button

The on-board switch is connected to the reset circuit. Pressing down the reset button will send an initial signal to the system software, and holding the reset button low for approximately 4 seconds will cause a hard reset.

SDHC/SDXC Slot

The HD222 and HD1022 series has one SDHC/SDXC slot capable of transferring a 25 Mbit/sec video stream, one 5.1 AC3 stream (pass-through), and three stereo PCM tracks simultaneously. There is no inherent limit on the storage capacity of SD cards used with the player.

NAND Flash

BrightSign players have a built-in NAND flash. All the code for the player is stored on the NAND flash. It may also be possible to store some content on the NAND flash, which is connected directly to the CPU.

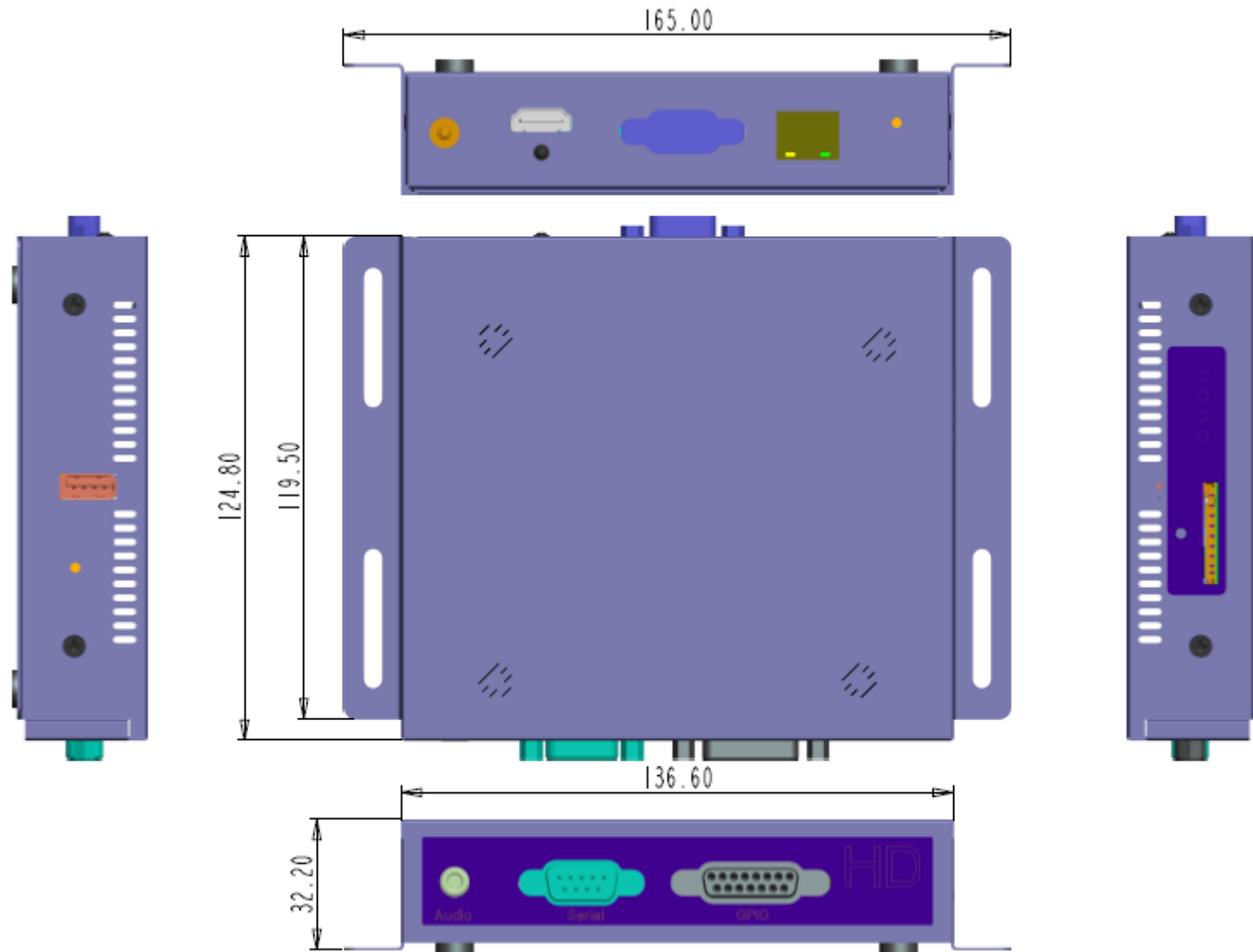
Ethernet

The 10/100 Base-T Ethernet is implemented on the players by directly interfacing with the BCM7241. The player has on-board Ethernet magnetics and termination for the RJ-45 cable.

USB 2.0

The USB 2.0 high-speed host controller is implemented internally on the BCM7241 SOC. The board utilizes over-current protected switches that can be used to turn the power to USB devices on or off (or to detect over-current situations).

DIMENSIONS



MOUNTING PROCEDURE

The HD222 and HD1022 can be mounted on a wall using the brackets attached to each side. It is recommended that you mount the device using four screws (one for each bracket slot). The screws should have a major diameter between 3.5mm and 4.2mm.

Important: *Nails should not be used to mount the device.*