CRD7410-BA User's Guide

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Contacting Cirrus Logic Support

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Chapter 1

CRD7410-BA Board Architecture

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1.1 Overview

This document describes a reference design platform for the Cirrus Logic CS7410, known as the CRD7410-BA. It is an evaluation platform for a mid-range portable CD player. The CRD7410-BA platform provides a low-cost yet complete solution for today's popular digital music formats (CDDA, MP3, WMA, VCD, AVCD, and SVCD). The platform also supports today's popular music plylist formats such as MP3, M4U, PLS, B4S, and RMP. The system's small size, light weight, and low power consumption allow designers to integrate powerful features into an inexpensive portable device. The design is also easily adapted to small bookshelf systems.

All components necessary for a portable CDDA/MP3/WMA/VCD/AVCD/SVCD application, including a 3-line LCD display, are incorporated into a single PCB. Debug capability is provided adjacent to the main circuitry. In a final design, the I2C debug and Romulator ports would be eliminated, leaving only the circuitry required for the application.

In addition, the LCD display and control buttons are laid out in a manner which allows that circuitry to be moved easily to a separate front panel PCB. The CRD7410-BA also supports a wired remote controller. Refer to Figure 1-1.

Cirrus Logic provides the system as a complete solution. Schematics and Gerber data files for the PCB are available.

1.1.1 Main Subsystems

The CRD7410-BA has seven main subsystems. They are:

- Decoder
- Audio
- User Interface Subsystem
- CD Loader
- Power
- Debug Interface
- Jumpers and Switches

Figure 1-1. Main Board, Top View
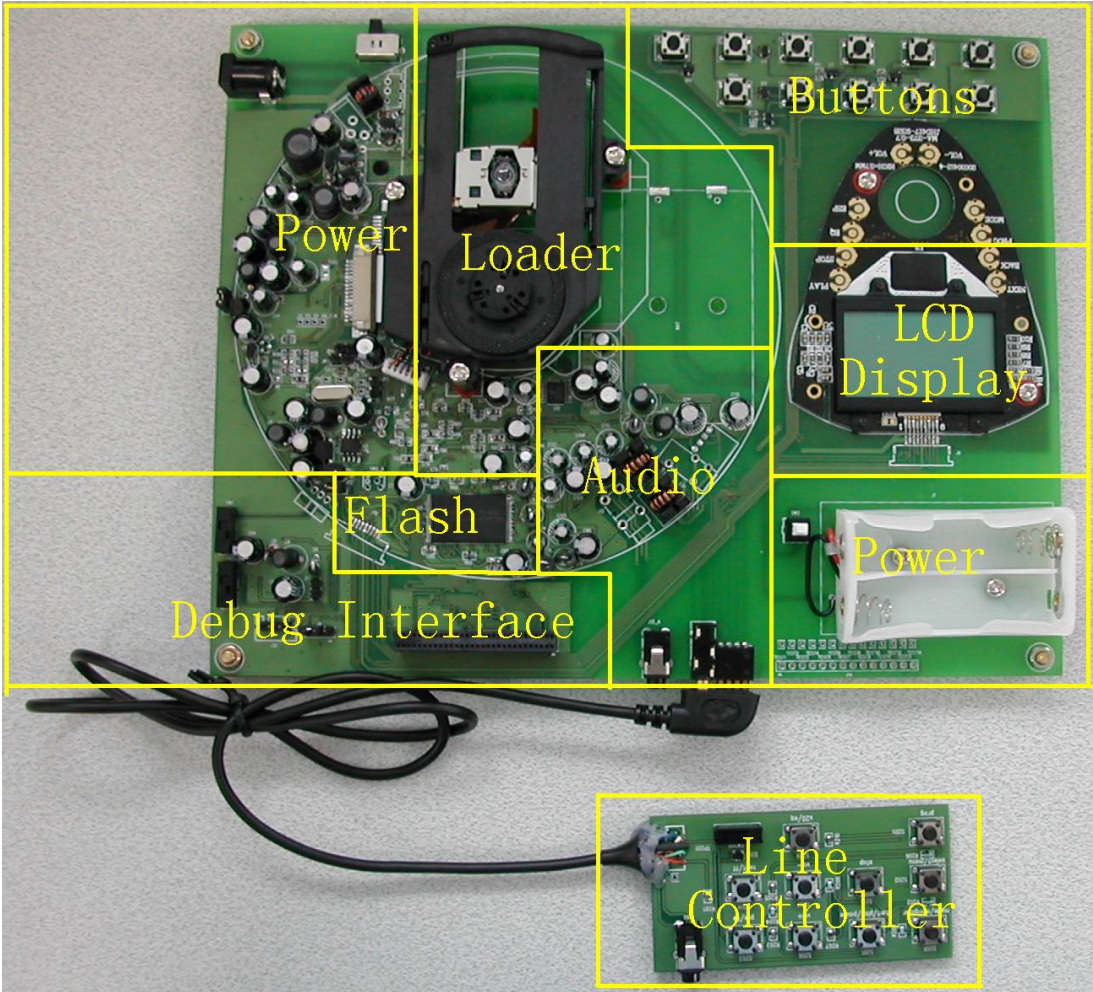
Figure 1-2. Main Board, Bottom View
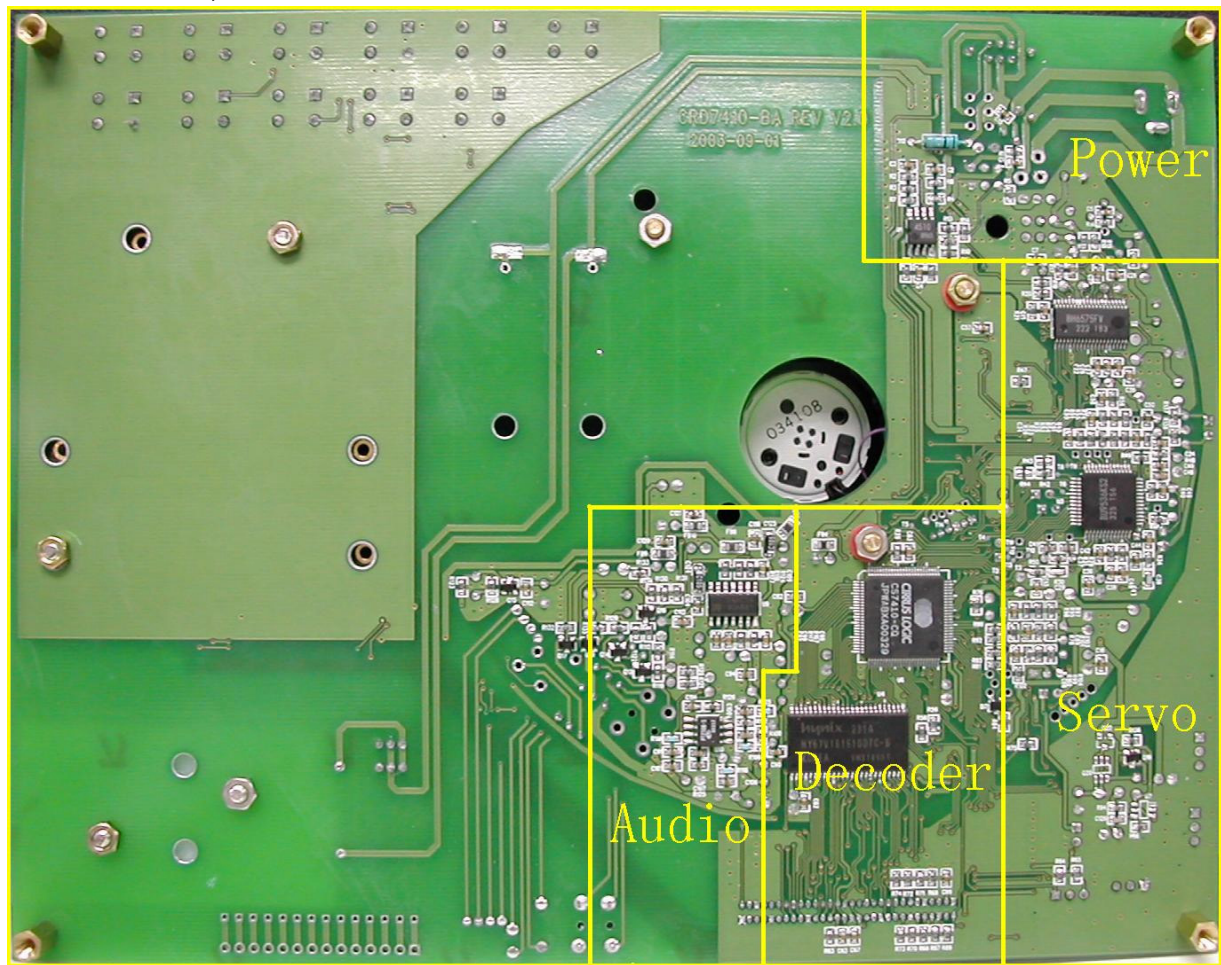
1.2 Main Subsystems

1.2.1 Decoder Subsystem

This system uses the Cirrus Logic CS7410 for main control and audio decode. (See U6 in Figure 1-3, below.)

A Flash/ROM is used for application code. (See U5 in Figure 1-3, below.)

An SDRAM is provided for Electronic Shock Protection (ESP). (See U4 in Figure 1-3, below.)

Figure 1-3. Detail Views of the Decoder Subsytem

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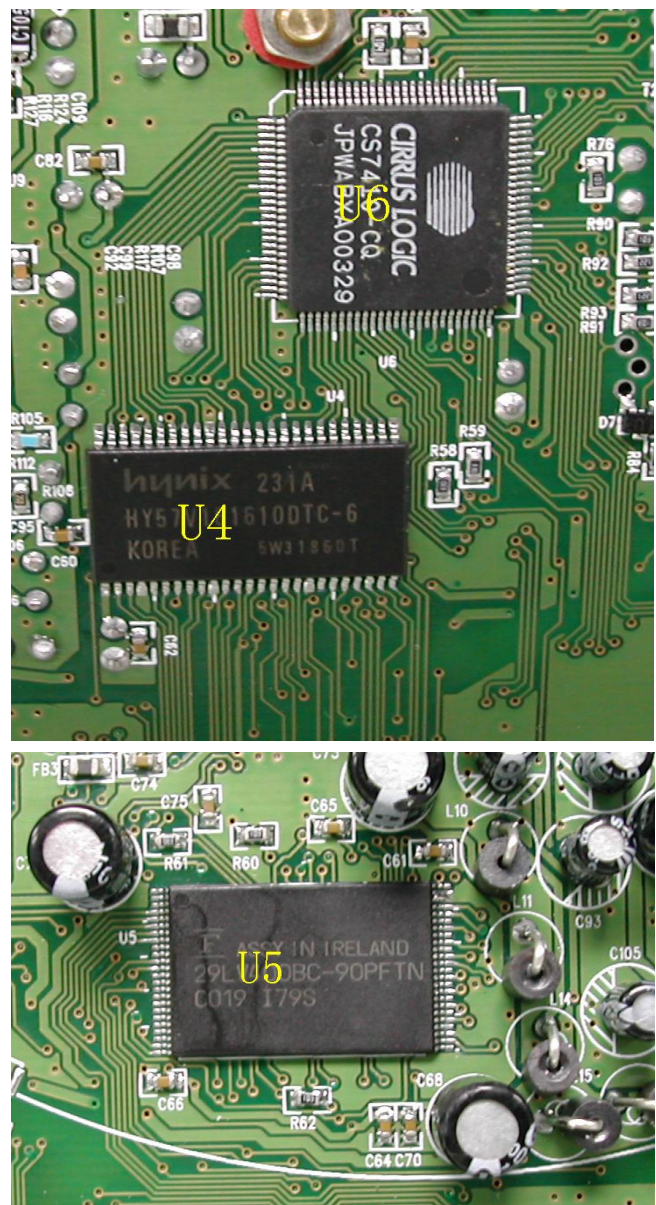
1.2.2   Audio Subsystem

1.2.2.1   Internal DAC

An integrated Sigma-Delta based DAC (Digital-to-Analog-Converter) allows the designer to build a low cost DAC with a simple RC integration circuit.

1.2.2.2   External DAC

This system also provides audio data in serial format, to support the use of an external DAC. Shown in Figure 1-4, below, U12 is a CS43L43.

1.2.2.3   Subsystem Design Details

Figure 1-4 shows the details of the implementation of this subsystem design. This list below defines the semiconductor devices and connectors used in this subsystem, and the function of each.

- U9 - Dual D-Type positive-edge triggered Flip-Flop - 74AC74
- U10 - Headphone Amplifier - PT2308
- U12 - Audio DAC - CS43L43
- J11 - Headphone Out and Line Controller Output Jack
- J13_A - Line Out Jack

Figure 1-4.   Detail View of the Audio Subsystem
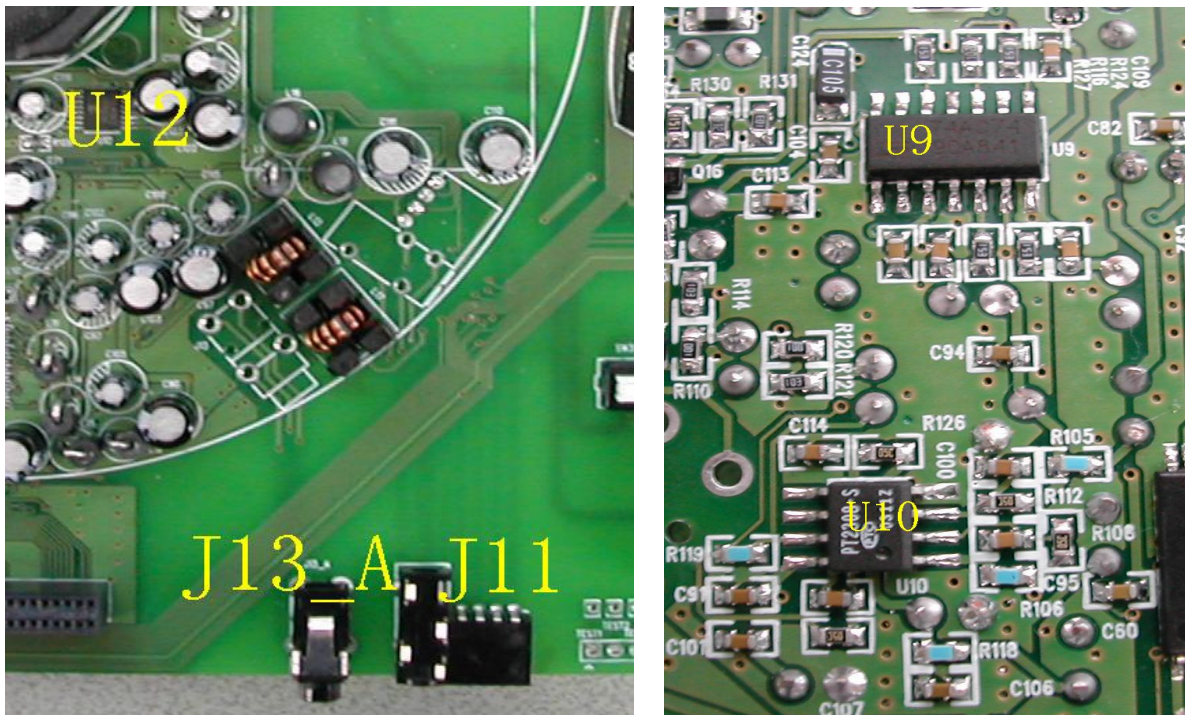
1.2.3   User Interface Subsystem

The User Interface Subsystem has three sections: the LCD (Liquid Crystal Display), the Button Matrix and the Line Controller. (See Figure 1-5, Figure 1-6 and Figure 1-7, below, for details.)

1.2.3.1   LCD Display

Figure 1-5 shows a close-up view of the LCD, which is part of the User Interface Subsystem.

The LCD display (reference designator - DSP1) is a 24 x 60 pixel display. For a dot matrix character size of 8 x 5, this gives 12 characters per line, by 3 lines per display.

Figure 1-5.   Detail View of the LCD

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1.2.3.2 Button Matrix

Figure 1-6 shows a close-up view of the Button Matrix, which is part of the User Interface Subsystem.

User inputs are implemented with 11 push buttons.

Table 1-1 shows the functions of the pushbuttons shown in Figure 1-6.

Figure 1-6.   Detail View of the Button Matrix
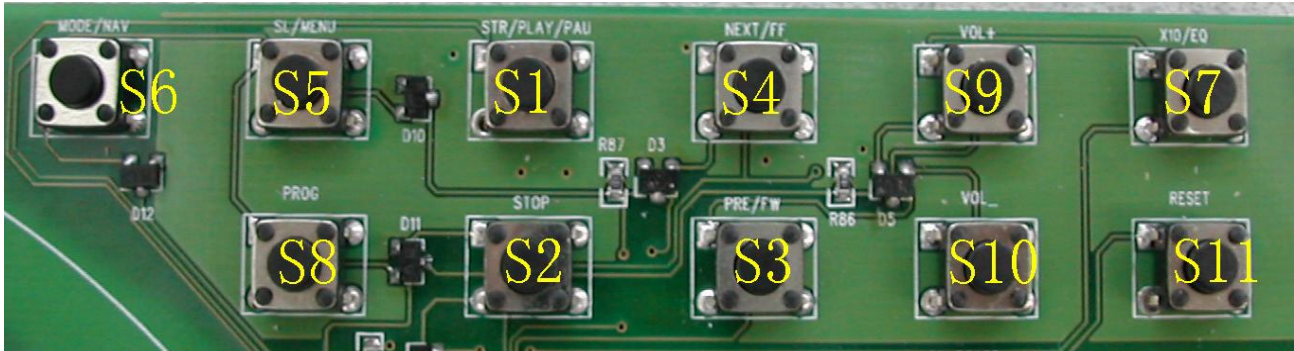
Note: When the power is on, pushbutton S1 must be pressed to activate the system.

Table 1-1:   Button Matrix

S1: Play/Pause/Up	S2: Stop/Down	S3: Rewind/Left	S4: Fast Forward/Right
S5: Mode	S6: Navigator/Menu	S7: Eq/Select	S8: A->B/Program
S9: Vol+	S10: Vol-	S11: Reset	

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1.2.3.3 Line Controller

Figure 1-7 shows a close-up view of the Line Controller, which is part of the User Interface Subsystem.

User inputs are implemented with 10 push buttons, one switch and one headphone output.

Table 1-2 shows the functions of the pushbuttons and switch shown in Figure 1-7.

Figure 1-7. Detail View of the Line Controller
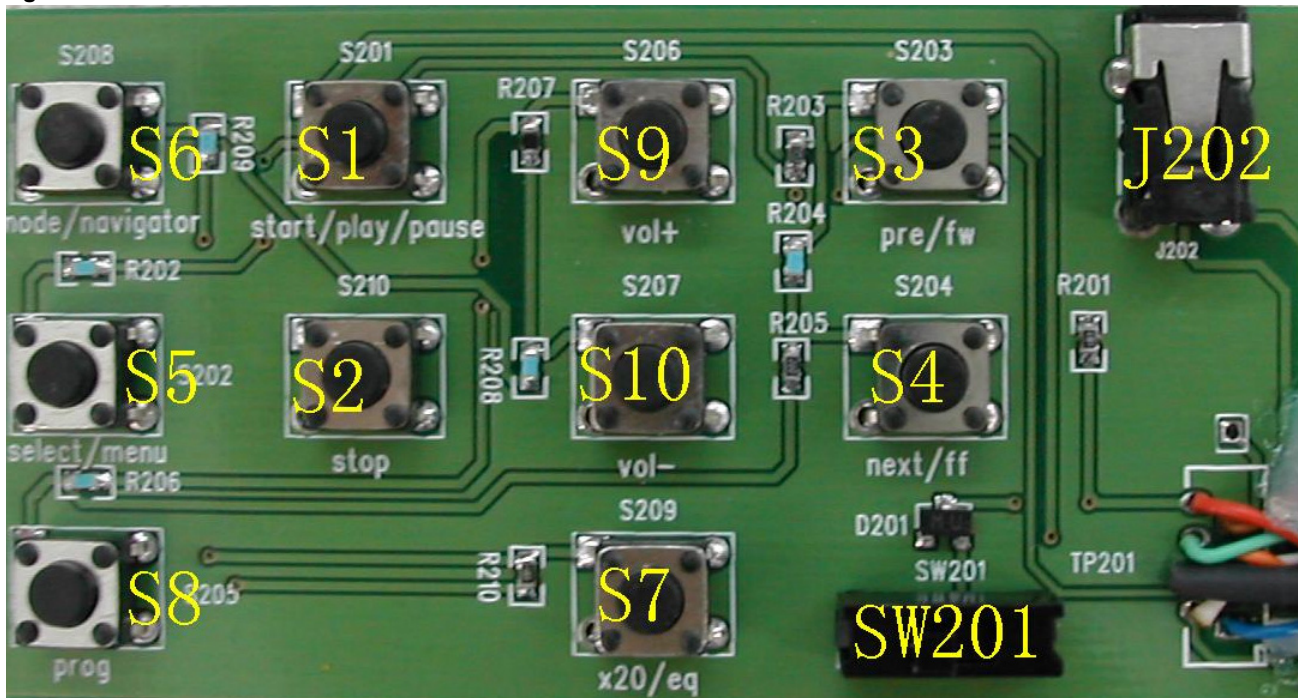
Note: When the power is on, pushbutton S1 must be pressed to activate the system.

Table 1-2: Line Controller

S1: Play/Pause/Up	S2: Stop/Down	S3: Rewind/Left	S4: Fast Forward/Right
S5: Mode	S6: Navigator/Menu	S7: Eq/Select	S8: A->B/Program
S9: Vol+	S10: Vol-		
SW201	Button Hold		
J202	Headphone Output Jack		

1.2.4 CD Loader Subsystem

The CRD7410-BA provides direct support for the Rohm chipset, including:

- BU9536KS2 - A servo signal processor complete with built-in pre-servo amplifier - U3 (see Figure 1-8).

- BH6575FV - Power control and driver - U2 (see Figure 1-8).

It also supports the KSM-1000BBC - Loader Mechanism.

This design implements a power-save-mode circuit, maximizing battery life.

Because of the capabilities built into the CS7410, no separate microcontroller is needed.

Figure 1-8. Detail Views of the CD Loader Subsystem
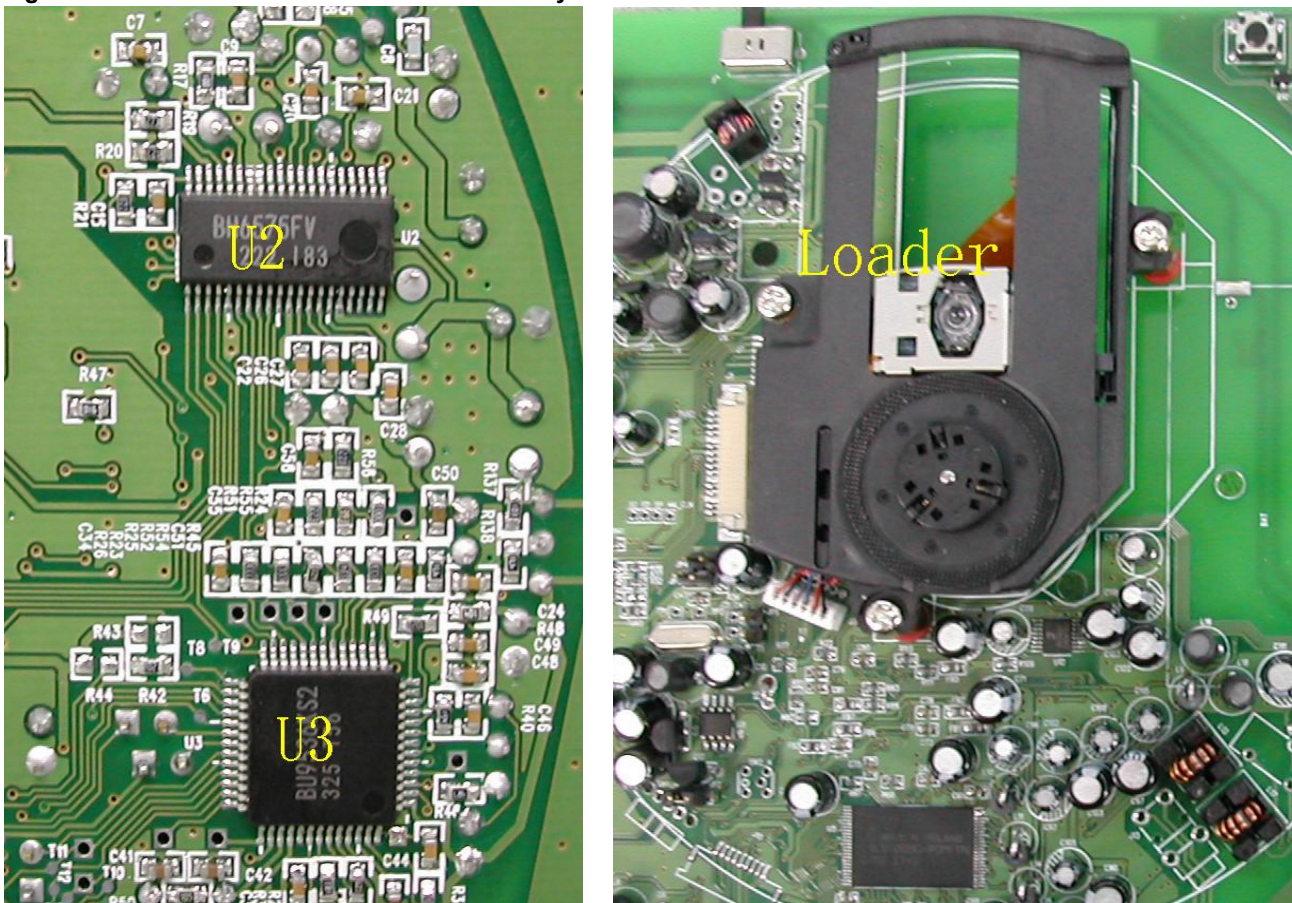
1.2.5 Power Subsystem

The Power Subsystem provides power to all system components. It consists of:

- The 5 Volt power input connector (J2).

- The AA battery supply mounts (J1) and Battery Supply On/Off switch (SW3).

- A Rohm BH6575FV DC-to-DC converter, to generate the main system voltage (3.0 V).

- The potentiometer and a comparator circuit for Power Subsystem battery monitoring (U1 - Dual Comparator - BA4510).

- A Battery Charge On/Off switch (KEY1).

- Voltage regulators to generate the 1.7 V levels needed for the CS7410 core (U8 - Voltage Regulator - LM393M).

Figure 1-9.   Detail Views of the Power Subsystem
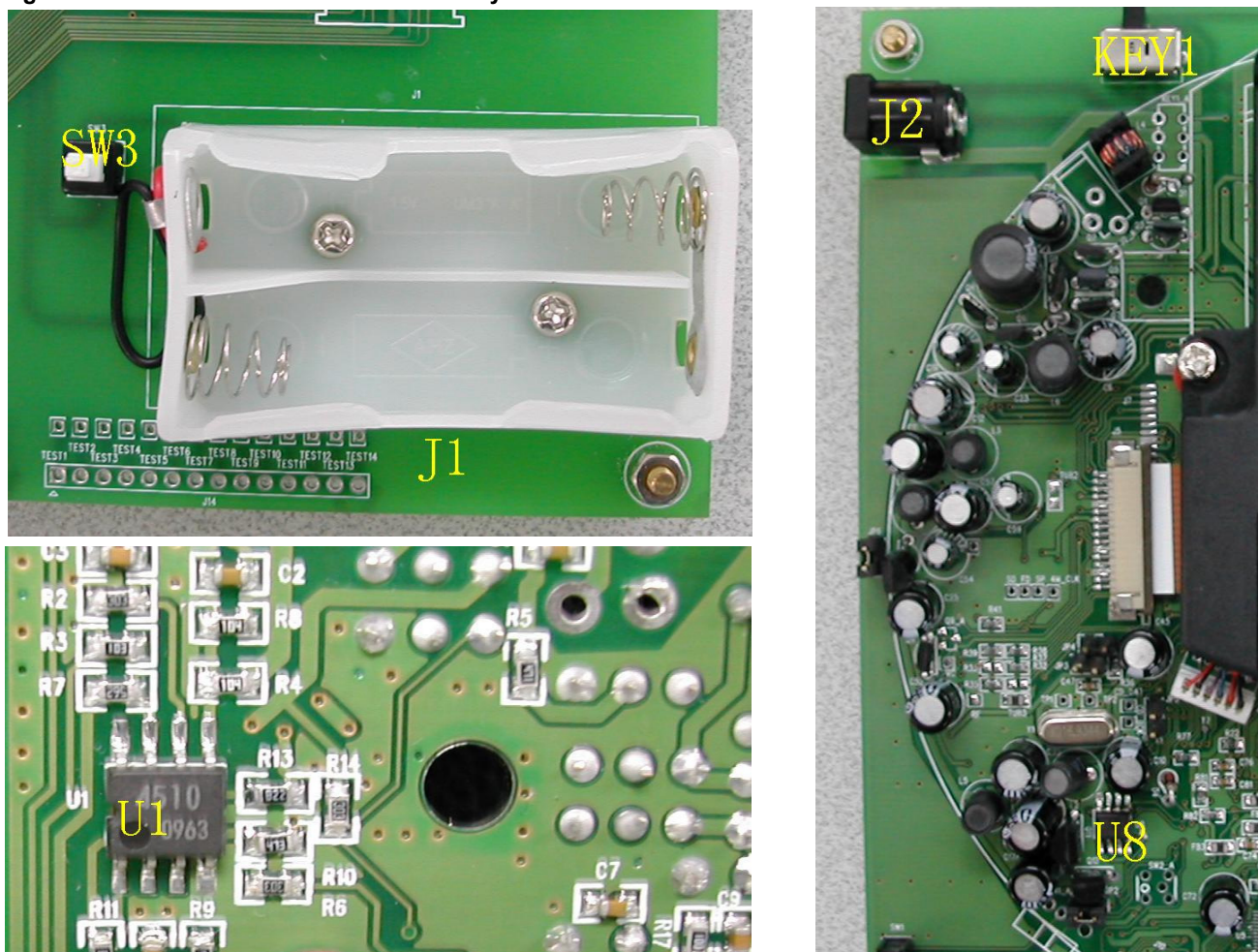
1.2.6 Debug Interface

There is a debug interface and Romulator connector to provide test and debug facilities.

The following connectors are provided (see Figure 1-10, below):

• J12 - I2C debug (be sure to match pin 1 to pin 1 (as indicated by arrows) when connecting the I2C debug cable from the Romulator to J12).

• J8 - Romulator connector (be sure to match pin 1 to pin 1 (as marked on the connectors) when connecting the buffer card connector from the Romulator to J8).

• J9 - Romulator select (install a jumper between pin 1 and pin 2 to select Flash mode, or install a jumper between pin 2 and pin 3 to select Romulator mode)

Figure 1-10.   Detail View of the Debug Interface
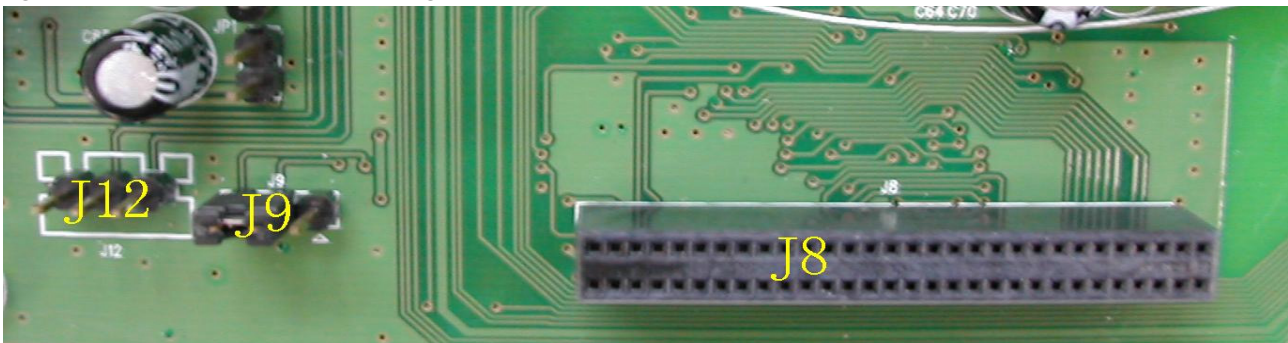
1.2.7 Jumpers and Switches

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Switches

- SW1 - Button Hold.

- SW2 - Lid Open/Close emulation.

Jumpers

- JP1 – When closed and jumper JP2 is open, the PWM switchable DC-DC converter will supply system power.

- JP2 - When closed and jumper JP1 is open, the LDU DC-DC will supply system power.

- JP3, – when closed, U33 pin 32 can be connected to the main chip GPIO (Default = open).

- JP4, – when closed, U3 pin 32 can be connected to the main chip GPIO (Default = open).

- JP5 – when closed, U3 pin 34 can be connected to the main chip GPIO (Default = open).

- JP6 – When closed, the main chip will not control the servo power.

Chapter 2

User Menu Selections

2.1 Overview

This document describes the user interface for the CRD7410-BA firmware. The user interface supplies the required interaction for easy to understand operations.

2.2 User Interface

The hardware available for use by the user interface consists of eleven push buttons, two switches, and an LCD (which is twelve columns by three rows of text).

The eleven push buttons are used for the following functions:

play/pause/up: This button is used to start or pause playback of the current track. When displaying a menu, this button is used to move up. When the player is in soft power-down mode, pressing this button will power on the player and commence playback.

stop/down: This button is used to stop playback of the current track. When displaying a menu, this button is used to move down. When held, this button will put the player into soft power-down mode.

previous/left: This button is used to skip to the beginning of the current track, or to the beginning of the previous track if already at the beginning of the current track. Holding this button while playing will seek backwards within the track. Holding this button while stopped will repeatedly skip to the previous track. When displaying a menu, this button is used to move left. When entering the mode of skip forward/backward 10 tracks, this button will be used to skip backward 10 tracks.

next/right: This button is used to skip to the beginning of the next track. Holding this button while playing will seek forward within the track. Holding this button while stopped will repeatedly skip to the next track. When displaying a menu, this button is used to move right. When entering the mode of skip forward/backward 10 tracks, this button will be used to skip forward 10 tracks.

navigator/menu: Pressing this button will enter/leave the file system navigator menu. Holding this button will enter/leave the settings menu.

mode: This button is used to cycle among the various playback modes, such as repeat all, shuffle all, etc.

A->B/program/10+/-: Pressing this button while playing sets the A point for the A->B repeat mode. Pressing it again will set the B point and enable the A->B repeat mode. Pressing it a third time will cancel the A->B repeat mode. Pressing this button while stopped will enter/leave the playlist menu. Holding this button will enter or exit the skip forward/backward 10 tracks mode.

eq/select: This button is used to cycle among the various equalizer settings or to select items when displaying a menu and playlist.

vol+: Pressing this button will turn the volume up by one. Holding this button will repeatedly turn the volume up.

vol-: Pressing this button will turn the volume down by one. Holding this button will repeatedly turn the volume down.

reset: Pressing this button will reset the player.

The two switches are used for the following functions:

lid open: This switch is used to detect whether the lid of the CD player is opened or closed.

hold: This switch is used to disable the buttons. When enabled, the player will ignore the twelve buttons.

The LCD is used to provide status information to the user. Normally, the LCD will display information about the track currently being played. Various menu modes exist which will overlay the status information with a menu, allowing settings to be changed, play lists to be loaded, etc. Additionally, these menu modes change the meanings of some of the buttons.

2.2.1 Start-up

When the player is first powered on, it will initialize the LCD and display the following screen:

Figure 2-1. Power-on Screen
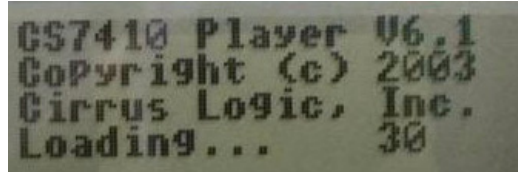
The number at the end of the last line is the number of tracks currently read from the disc. Every 0.5 seconds, the number of tracks is updated.

Once the disc scan has completed, the player will check for update files. If any are found, it will display the following screen:

Figure 2-2. Checking for Update Files Screen
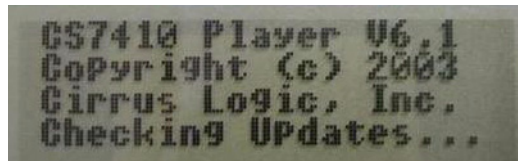
If an update file is found that is newer than the current firmware, the player will display the following screen:

Figure 2-3. Loading Updated Firmware Screen
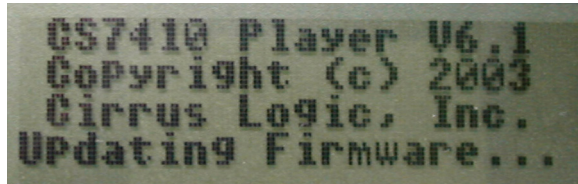
When the firmware has been updated, the player will restart and the new firmware will be run.

If there is a problem with the disc, the player will report that fact to the user interface. In this case, an appropriate message will be displayed on the LCD for 5 seconds, after which the player is powered off. The following is an example screen for the case where a bad disc is found:

Figure 2-4. Bad Disc Screen
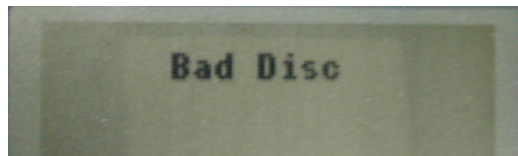
If the disc has been recognized and scanning has been completed, the normal screen will then be displayed:

Figure 2-5.   Normal Operation Screen
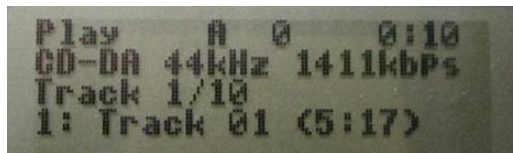
2.2.1.1   Default Start-up Mode

The default mode of the player at power on is play.

Figure 2-6.   Display Screen Format - Default Mode

The "MMM" field corresponds to the current playback mode, which can be one of the following values:

Value	Meaning
" A"	All tracks on the disc are played in the order encountered. When the last track has been played, the player stops. This is the default playback mode.
" 1"	Only the current track is played. When the track has been played, the player stops.
" D"	Only the tracks in the same directory as the current track are played. When the last track in the directory has been played, the player stops.
" S"	Only tracks in the specified directory, and all its subdirectories, are played. When the last track in the list has been played, the player stops.
"RA"	All tracks on the disc are played in the order encountered. When the last track has been played, the player continues by playing the first track.
"R1"	Only the current track is played. When the track has been played, the player replays the current track.
"RD"	Only the tracks in the same directory as the current track are played. When the last track in the directory has been played, the player continues by playing the first track in the directory.

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"RS"   Only tracks in the specified directory, and all its subdirectories, are played. When the last track in the list has been played, the player continues by playing the first track in the list.

"SA"   All tracks on the disc are played in a random order. When all tracks have been played, the player stops.

"S1"   Only the current track is played. When the track has been played, the player stops. Skipping to the next or previous track will go to a random track.

"SD"   Only the tracks in the same directory as the current track are played, but in a random order. When all tracks in the directory have been played, the player stops.

"SS"   Only tracks in the specified directory, and all its subdirectories, are played, but in a random order. When all tracks in the list have been played, the player stops.

"RSA"   All tracks on the disc are played in a random order. When all tracks have been played, they will all be played again in a different random order.

"RS1"   Only the current track is played. When the track has been played, the player replays the current track. Skipping to the next or previous track will go to a random track.

"RSD"   Only the tracks in the same directory as the current track are played, but in a random order. When all tracks in the directory have been played, they will all be played again in a different random order.

"RSS"   Only tracks in the specified directory, and all its subdirectories, are played, but in a random order. When all tracks in the list have been played, they will all be played again in a different random order.

"IA"   The first portion of all tracks on the disc are played. When all tracks have been played, the player stops.

"IS"   The first portion of all tracks in the specified directory, and all its subdirectories, are played. When all tracks in the list have been played, the player stops.

"HA"   A portion from the middle of all tracks on the disc are played. When all tracks have been played, the player stops.

"HS"   A portion from the middle of all tracks in the specified directory, and all its subdirectories, are played. When all tracks in the list have been played, the player stops.

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"a "	A->B repeat mode has been enabled, but only the "A" point has been selected. During this time, the player is set to play all tracks on the disc in non-shuffled mode.
"ab"	The "B" point has been selected and the player seeks back to the "A" point whenever the "B" point is encountered.

2.2.2 Display

The "L" field is an indicator that is set to "L" when the player is using a custom playlist. The custom playlist can either be one loaded from a playlist file on the disc or one created by the user. When playing from the default playlist, this indicator will be blank.

The "K" field is an indicator that is set to "L" when the hold switch is on, causing the buttons to be ignored by the user interface. When the hold switch is off, this indicator will be blank.

Figure 2-7. Display Screen Format - Default Mode

The user interface will automatically start playback after the player finds a good disc.

When playing or paused, the following screen will be displayed:

Figure 2-8. Pause Screen - CDDA
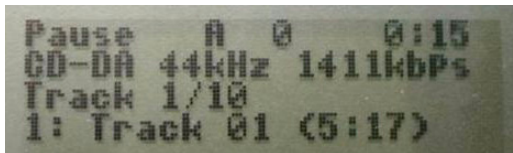
Figure 2-9. Pause Screen - MP3

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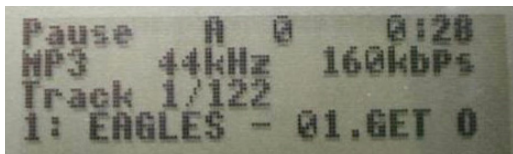
Figure 2-10. Screen - VCD
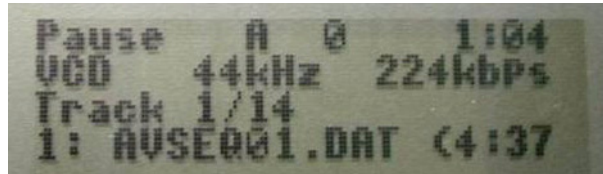
The time in the upper right corner of the screen is the current playback time.

The second line of the display indicates the format (of the audio on the disc: "CDDA", "MP3", "WMA", "VCD", "AVCD", or "SVCD"), the current track number within the current playlist, along with the total number of tracks in the current playlist.

The third line contains a scrolling string providing track information. When the player plays MP3 or WMA formats, the desired format of this string is "TrackNum: Artist - Song (Length)", where "TrackNum" is the number of the track on the disc, "Artist" is the name of the artist, "Song" is the name of the song, and "Length" is the length of the track in minutes and seconds (i.e. "xx:xx"). If the artist name is not known, just the song name will be used. If the song name is not known, the file name will be substituted for the song name. If neither is known, the file name will be used in place of the artist name and song name (i.e. "TrackNum: Filename (Length)"). This string will not be scrolled if it is short enough to fit on the display without scrolling.

When the player plays VCD, AVCD, or SVCD formats , the desired format of this string is "TrackNum: Song (Length)", where "TrackNum" is the number of the track on the disc, "Song" is the name of the song, and "Length" is the length of the track in minutes and seconds (i.e. "xx:xx"). If the song name is not known, the file name will be substituted for the song name. If neither is known, the file name will be used in place of the artist name and song name (i.e. "TrackNum: Filename (Length)"). This string will not be scrolled if it is short enough to fit on the display without scrolling.

When the player plays CDDA, the desired format of this string is "--Track xx --", where "xx" is the number of the track on the disc.

During normal operation, these two variants of the screen are all that will be seen. When settings are changed, though, the screen will be modified (or replaced) to provide feedback of that change. When the volume is changed (via the "Vol+" and "Vol-" buttons, the bottom line will be replaced with the volume indicator:

Figure 2-11. Volume Changing Screen
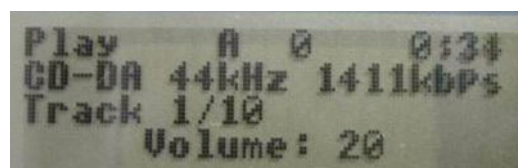
The top two lines will continue to operate as before, with the bottom line indicating the current volume setting. Once the volume has remained unchanged for a period of time, the volume indicator goes away and the normal display returns.

When the "eq" button is pressed to change the equalizer settings, the bottom two lines will be replaced with the current equalizer setting indicator:

Figure 2-12. Equalizer Setting Screen
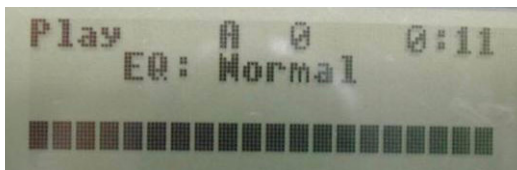
The first time the "eq" button is pressed, the current equalizer setting will be displayed. Subsequent presses of the "eq" button while the equalizer is displayed will cycle between the various equalizer settings. The first line of the indicator is the name of the equalizer setting. The bottom line is blank. Once the EQ has remained unchanged for a period of time, the equalizer indicator goes away and the normal display returns.

Pressing the "navigator/menu" button will enter navigator mode and the following screen is displayed:

Figure 2-13. Navigator Mode Screen
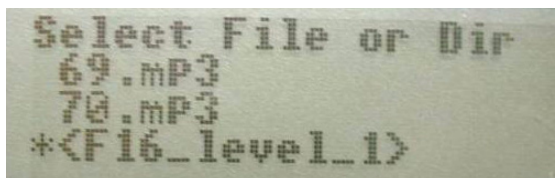
The arrow buttons can be used to highlight a file, which is then selected by pressing the "eq/select" button. Selecting a file will cause it to be played back, and the playback mode set to " A". Similarly, a directory can be highlighted and selected by pressing the "select" button. Selecting a directory will cause its contents to be played back and the playback mode set to " S". If in navigator mode with no button activity for a period of time, the screen reverts to normal mode.

If the "A->B/program" button is pressed while the player is stopped, the playlist selection mode will be entered and the following screen displayed:

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Figure 2-14. Playlist Selection Mode Screen
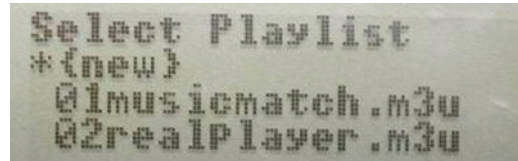
The arrow buttons can be used to highlight a playlist, which is then selected by pressing the "eq/select" button. Selecting a playlist will cause the contents of that playlist to be loaded as a custom playlist, playback started, and the playback mode set to " A". If in playlist selection mode with no button activity for a period of time, the screen reverts to normal mode.

When a playlist file is selected, the following screen is displayed while the contents of that file are being read and inserted into the custom playlist (with "<name>" replaced with the name of the playlist file):

Figure 2-15. Playlist Loading Screen
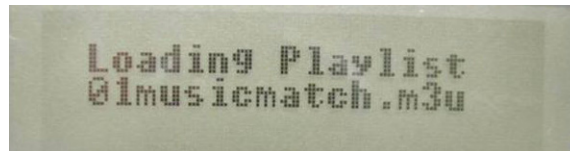
After the playlist has been read from the playlist file, the playback mode is set to " A", playback commenced, and the screen reverted to normal mode.

Selecting the "{new}" item enters the playlist creation mode, and the following screen is displayed:

Figure 2-16. Playlist Creation Mode Screen
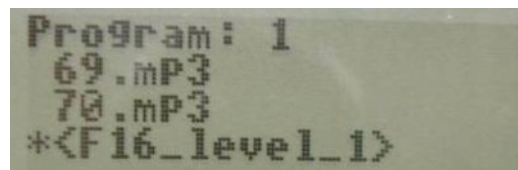
The number on the first line is the playlist index of the track currently being programmed. Like in navigator mode, files are selected with the arrow buttons. Pressing the "select" button will add the file to the custom playlist. Pressing the "A->B/program" button will complete the custom playlist, return the screen to normal mode, set the playback mode to " A", and start playback of the custom playlist.

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2.2.3 Main Menu

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Holding the "navigator/menu" button will enter menu mode and display the following screen:

Figure 2-17. Main Menu Screen
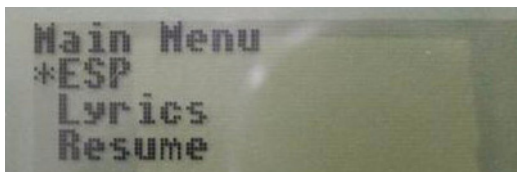
The "up" and "down" buttons will highlight a menu item. Pressing the "eq/select" button will enter the setting screen for that item.

The following is a list of the items in the main menu:

 • Electronic Shock Protection (ESP) (None, High Quality (No ADPCM + ESP), or Extra Long (ADPCM + ESP))

 • Lyrics

 • Resume (On, Off)

 • Scrolling (On, Off)

 • Shut off time (0-15 minutes)

 • Sleep timer (0-120 minutes in 15-minute increments)

 • 3D Effect (Off, On)

 • Order Tracks (Normal, By dir, By art-trk, By alb-trk, By art-alb-trk

 • Firmware Version

The order of the menu items can be changed, and items can be added or removed. Selecting the "ESP" item will display this screen:

Figure 2-18. Electronic Shock Protection (ESP) Submenu Screen
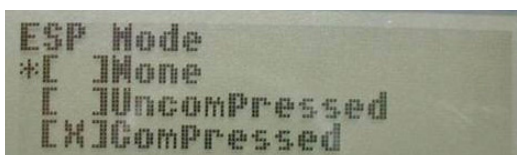
The "∗" in the box indicates the current setting of the "ESP" item. Highlighting a different setting and pressing the "right" button will change the setting. Pressing the "eq/select" button will go back to the parent menu. The anti-shock time will be respectively ~11 and ~45 seconds.

Selecting the "Lyrics" item will display this screen:

Figure 2-19. Lyrics Submenu Screen
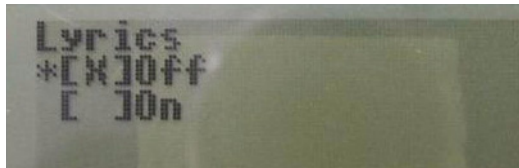
If this option is on, the 4th line on LCD will scroll lyrics information synchronously with music, otherwise, title information will be displayed on the 4th line.

Selecting the "Resume" item will display this screen:

Figure 2-20. Resume Submenu Screen

If Resume feature is enabled, the system can remember track, position, and playing mode when the user stopped the player. After playing other discs, if this disc is played again, the system can play from where the user stopped, and also previous play mode will be restored. However the function only remembers the last five (5) discs that have been played. When the sixth (6th) disc is inserted, the information for the first disc is overwritten. The seventh (7th) disc's information will overwrite the information for the second (2nd) disc, etc.

Selecting the "Scrolling" item will display this screen:

Figure 2-21. Scrolling Submenu Screen
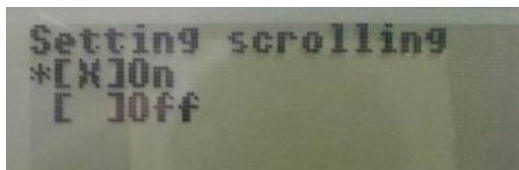
When this feature is enabled from main menu, during playing, if the song's name plus ID3 information is longer than that the LCD can display within a single line. This line will scroll automatically.

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The "Power off time" setting displays this screen:

Figure 2-22. Shut Off Time Submenu Screen
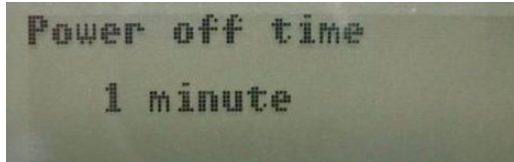
If the power off time is not zero, the player will be put into soft power off mode after the specified number of minutes of inactivity (i.e. no button presses while the player is in stop mode).

The "Sleep timer" setting displays this screen:

Figure 2-23. Sleep Timer Submenu Screen
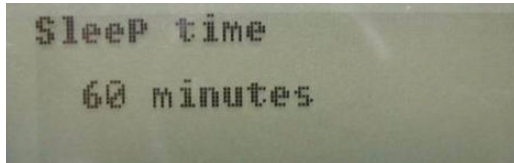
If the sleep timer is not zero, the player will be put into soft power off mode after the specified number of minutes, regardless of activity.

The "3D Effect" setting displays the following screen:

Figure 2-24. 3D Effect Submenu Screen
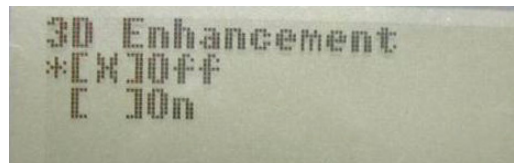
Turns the 3D effect on or off.

The "3D Effect" setting displays the following screen:

Figure 2-25. Order Tracks Submenu Screen
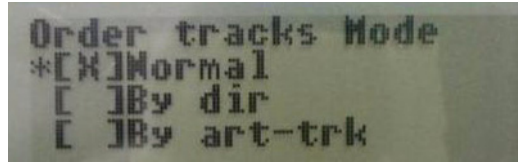
The tracks can be sorted to browse, 4 sort modes are available:

- *By Dir:* This mode is similar to the original mode when the system boots. Files are kept in directory and sorted by filename.

- *By Artist and Track:* This mode is Sort by Artist, if the Artist fields are the same for several songs, they will be sorted by filename. All files listed appear as *Artist.Filename*.

- *By Album and Track:* This mode is Sort by Album, if the Album fields are the same for several songs, they will be sorted by filename. All files listed appear as *Album.Filename*.

- *By Artist, Album and Track:* This mode is Sort by Artist, if the Artist fields are the same for several songs, they will be sorted by Album, if the Album fields are the same for several songs, they will be sorted by filename. All files here appear as *Artist.Album.Filename*.

The "Firmware Version" setting displays this screen:

Figure 2-26. Firmware Version Screen
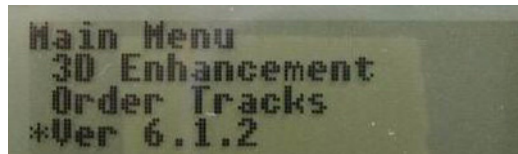
2.2.3.1 Menu Options

Many of the buttons in the user interface have modified/different meanings if they are pressed and released or if they are pressed and held. Some buttons continue to perform their function so long as the button is held. The various button actions that must be detectable by the button handler in the user interface are:

- For a simple button that has a press only function, that function is invoked when the button is pressed.

- For a button that has a press and a hold function, the press function is invoked after the button has been pressed and the released before X ms.

- For a button that has a press and a hold function, the hold function is

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invoked after the button has been pressed and then held for at least X ms.

- For a button that has a repeated hold function, the hold function is invoked after the button has been pressed and then held for at least X ms, and then again every Y ms afterwards until the button is released.

- For a button that has the same press and hold function, the function is invoked when the button is pressed, after the X ms hold period, and then every Y ms afterwards until the button is released.

In all cases, the X and Y time periods can be different for different buttons, and can change based on the mode of the display.

The following is a complete list of the meanings of the buttons by player mode.

2.2.3.1.1 Power-off Mode

- play/pause/up

  - Pressing this button when the lid is closed will power on the player and start playback of the first track. The player will then be in normal mode.

- All other buttons are ignored in this mode.

2.2.3.1.2 Normal Mode

- play/pause/up

  - If the player is stopped, pressing this button will commence playback of the current track.

  - If the player is playing, pressing this button will pause playback of the current track.

  - If the player is paused, pressing this button will resume playback of the current track.

- stop/down

  - If the player is not stopped, pressing this button will stop playback of the current track and set the playback position to the beginning of the track.

  - If the player is stopped and a custom playlist is loaded, pressing this button will cancel the custom playlist and revert to the default playlist.

  - Holding this button for 1 second will put the player into power off mode, stopping playback and reducing power consumption as much as possible.

- previous/left

  - Pressing this button when the player is not stopped and the playback position is less than 3 seconds into the current track will skip to the previous track, maintaining the current playback mode.

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- Pressing this button when the player is not stopped and the playback position is greater than or equal to 3 seconds into the current track will seek back to the beginning of the current track, maintaining the current playback mode.

- Holding this button for 500 ms when the player is not stopped will start seeking backward within the track. Every 250 ms afterwards, another backward seek will occur.

- Holding the button for 500 ms when the player is stopped will skip to the previous track when the button is first pressed, at the 500 ms point, and then every 250 ms afterwards until the button is released.

- next/right

  - Pressing this button when the player is not stopped will skip to the next track, maintaining the current playback mode.

  - Holding this button for 500 ms when the player is not stopped will start seeking forward within the track. Every 250 ms afterwards, another forward seek will occur.

  - Holding this button for 500 ms when the player is stopped will skip to the next track when the button is first pressed, at the 500 ms point, and then every 250 ms afterwards until the button is released.

- navigator/menu

  - Pressing this button will enter menu mode.

  - Holding this button for 500 ms will enter navigator mode.

- mode

  - Pressing this button will advance through the playback modes.

  - Holding this button for 500 ms will advance through the playback modes when the button is first pressed, at the 500 ms point, and then every 500 ms afterwards until the button is released.

- A->B/program

  - If playing, pressing this button will set the A point for the A->B repeat. Pressing it again will set the B point and restart playback from the A point. Pressing it again will cancel A->B repeat mode.

  - If the player is stopped, pressing this button will enter the playlist selection mode.

- eq/select

  - Pressing this button will select the next graphical EQ setting.

  - Holding this button for 1 second will advance through the graphical EQ settings when the button is first pressed, at the 1 second point, and then every 1 second afterwards until the button is released.

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- select is ignored in this mode.

- vol+

    - Pressing this button will turn the volume up by one setting.

    - Holding this button for 500 ms will turn up the volume by one setting when the button is first pressed, at the 500 ms point, and then every 100 ms afterwards until the button is released.

    - The behavior of this button is not affected by the other modes, other than the fact that the volume indicator is only displayed when in normal mode.

- vol-

    - Pressing this button will turn the volume down by one setting.

    - Holding this button for 500 ms will turn down the volume by one setting when the button is first pressed, at the 500 ms point, and then every 100 ms afterwards until the button is released.

    - The behavior of this button is not affected by the other modes, other than the fact that the volume indicator is only displayed when in normal mode.

- Reset

    - This button will reset the player.

2.2.3.1.3 Navigator Mode

- play/pause/up

    - Pressing this button will move the cursor up the current directory list by one entry. If already at the top of the directory list, pressing this button does nothing.

    - Holding this button for 500 ms will move the cursor up the current directory list by one entry when the button is first pressed, at the 500 ms point, and then every 125 ms afterwards until the button is released or the top of the directory list is reached.

- stop/down

    - Pressing this button will move the cursor down the current directory list by one entry. If already at the bottom of the directory list, pressing this button does nothing.

    - Holding this button for 500 ms will move the cursor down the current directory list by one entry when the button is first pressed, at the 500 ms point, and then every 125 ms afterwards until the button is released or the bottom of the directory list is reached.

- previous/left

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- Pressing this button will move up one level in the directory hierarchy. If already at the root directory, pressing this button does nothing.

- Holding this button for 500 ms will move up one level in the directory hierarchy when the button is first pressed, at the 500 ms point, and then every 250 ms afterwards until the button is released or the root directory is reached.

- next/right

  - If the cursor is currently on a directory in the list, pressing this button will move into the specified directory.

  - While the cursor is on a directory in the list, holding this button for 500 ms will move down the directory hierarchy when the button is first pressed, at the 500 ms point, and then every 125 ms afterwards until the button is released or the current entry is no longer a directory.

  - If the cursor is currently on a file in the list, pressing this button will do nothing.

- navigator/menu

  - Pressing this button will exit navigator mode and return to the normal mode.

- mode

  - This button is ignored.

- A->B/program

  - This button is ignored.

- eq/select

  - If the cursor is currently on a file in the list, pressing this button will commence playback of the currently selected file and return to normal mode.

  - If the cursor is currently on a directory in the list, pressing this button will commence playback of the directory in subdirs mode and return to normal mode.

- Reset

  - This button will reset the player.

2.2.3.1.4 Playlist Selection Mode

- play/pause/up

  - Pressing this button will move the cursor up the list of play lists by one entry. If already at the top of the list, pressing this button does nothing.

  - Holding this button for 500 ms will move the cursor up the list of play

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lists by one entry when the button is first pressed, at the 500 ms point, and then every 125 ms afterwards until the button is released or the top of the list is reached.

- stop/down

  - Pressing this button will move the cursor up the list of play lists by one entry. If already at the bottom of the list, pressing this button does nothing.

  - Holding this button for 500 ms will move the cursor down the list of play lists by one entry when the button is first pressed, at the 500 ms point, and then every 125 ms afterwards until the button is released or the bottom of the list is reached.

- previous/left

  - This button is ignored.

- next/right

  - This button is ignored.

- navigator/menu

  - This button is ignored.

- mode

  - This button is ignored.

- A->B/program

  - If the current playlist is a custom playlist, pressing this button will enter playlist save mode.

  - If the current playlist is not a custom playlist, pressing this button will return to normal mode without changing the current playlist.

- eq/select

  - If the cursor is on the "{new}" entry, pressing this button will enter playlist creation mode.

  - If the cursor is on one of the saved playlist entries, pressing this button will load the saved playlist, commence playback of the first track, and return to normal mode.

  - If the cursor is on one of the on-disc playlist entries, pressing this button will load the selected playlist, commence playback of the first track, and return to normal mode.

- Reset

  - This button will reset the player.

2.2.3.1.5 Playlist Creation Mode

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- play/pause/up

  - Pressing this button will move the cursor up the current directory list by one entry. If already at the top of the directory list, pressing this button does nothing.

  - Holding this button for 500 ms will move the cursor up the current directory list by one entry when the button is first pressed, at the 500 ms point, and then every 125 ms afterwards until the button is released or the top of the directory list is reached.

- stop/down

  - Pressing this button will move the cursor down the current directory list by one entry. If already at the bottom of the directory list, pressing this button does nothing.

  - Holding this button for 500 ms will move the cursor down the current directory list by one entry when the button is first pressed, at the 500 ms point, and then every 125 ms afterwards until the button is released or the bottom of the directory list is reached.

- previous/left

  - Pressing this button will move up one level in the directory hierarchy. If already at the root directory, pressing this button does nothing.

  - Holding this button for 500 ms will move up one level in the directory hierarchy when the button is first pressed, at the 500 ms point, and then every 125 ms afterwards until the button is released or the root directory is reached.

- next/right

  - If the cursor is currently on a directory in the list, pressing this button will move into the specified directory.

  - While the cursor is on a directory in the list, holding this button for 500 ms will move down the directory hierarchy when the button is first pressed, at the 500 ms point, and then every 125 ms afterwards until the button is released or the current entry is no longer a directory.

  - If the cursor is currently on a file in the list, pressing this button will do nothing.

- eq/select

  - If the cursor is currently on a file in the list, pressing this button will add the selected file to the playlist.

  - If the cursor is currently on a directory in the list, this button is ignored.

- navigator/menu

  - This button is ignored.

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- mode

  - This button is ignored.

- A->B/program

  - Pressing this button will commence playback of the created playlist and return to normal mode.

- Reset

  - This button will reset the player.

2.2.3.1.6 Menu Mode, in a Menu List

- play/pause/up

  - Pressing this button will move the cursor up the current menu by one entry. If already at the top of the menu, pressing this button does nothing.

  - Holding this button for 500 ms will move the cursor up the current menu by one entry when the button is first pressed, at the 500 ms point, and then every 125 ms afterwards until the button is released or the top of the menu is reached.

- stop/down

  - Pressing this button will move the cursor down the current menu by one entry. If already at the bottom of the menu, pressing this button does nothing.

  - Holding this button for 500 ms will move the cursor down the current menu by one entry when the button is first pressed, at the 500 ms point, and then every 125 ms afterwards until the button is released or the bottom of the menu is reached.

- previous/left

  - This button is ignored.

- next/right

  - This button is ignored.

- eq/select

  - Pressing this button will display the selected setting screen.

- navigator/menu

  - Pressing this button will return to normal mode.

- mode

  - This button is ignored.

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- A->B/program
    - This button is ignored.
- Reset
    - This button will reset the player.

2.2.3.1.7 Menu Mode, in a Setting Screen

- play/pause/up
    - Pressing this button will move the cursor up the list of settings. If already at the first setting, pressing this button does nothing.
    - Holding this button for 500 ms will move the cursor up the list of settings when the button is first pressed, at the 500 ms point, and then every 125 ms afterwards until the button is released or the first setting is reached.
- stop/down
    - Pressing this button will move the cursor down the list of settings. If already at the last setting, pressing this button does nothing.
    - Holding this button for 500 ms will move the cursor down the list of settings when the button is first pressed, at the 500 ms point, and then every 125 ms afterwards until the button is released or the last setting is reached.
- previous/left
    - Pressing this button will change the setting to the currently selected value.
- next/right
    - This button is ignored.
- navigator/menu
    - Pressing this button will return to normal mode.
- mode
    - This button is ignored.
- A->B/program
    - This button is ignored.
- eq/select
    - Pressing this button will change the setting to the currently selected value.
- Reset

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• This button will reset the player.

The following playback modes are available when playing from the default playlist:
"A", "1", "D", "RA", "R1", "RD", "SA", "S1", "SD", "RSA", "RS1", "RSD", "IA", and "HA", in that order.

If a custom playlist has been loaded, the playback modes available are:
"A", "1", "RA", "R1", "SA", "S1", "RSA", "RS1", "IA", and "HA", in that order.

If subdirectory playback mode has been selected from the navigator, these playback modes are available:
"S", "RS", "SS", "RSS", "IS", "HS", in that order.