## JB7 - How it Works

I am working on this guide to help JB7 owners and potential customers. Its not meant as an overview - more a nitty gritty guide for owners and potential customers who have specific questions or troubleshooting. The guide is work in progress but I am publishing it as I write so that it can benefit from your feedback. Please let me know if something needs clarification or if something is not covered martin@brennan.co.uk

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Block Diagram
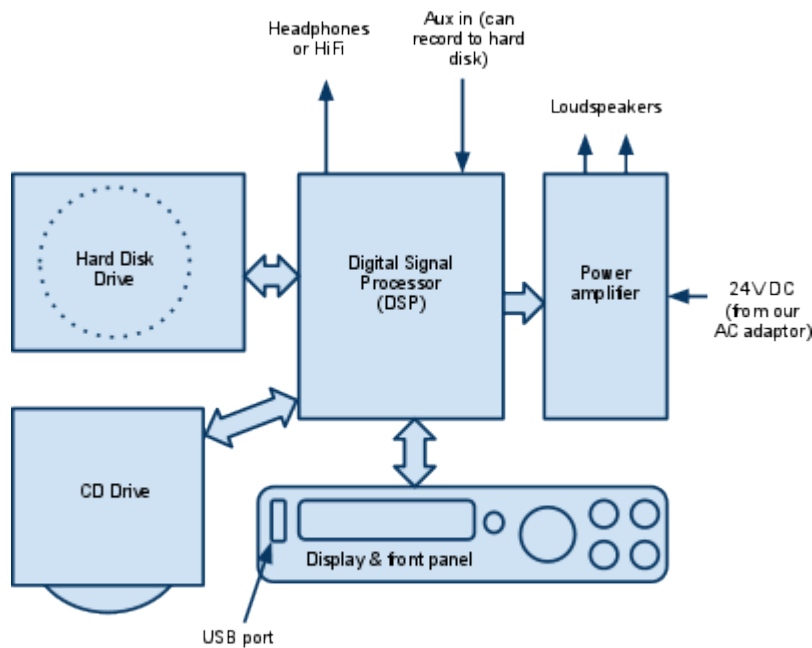
JB7 Block Diagram

CDs and MP3s

JB7 loads CDs as quickly as possible and with the minimum of button presses. That means when the CD is first loaded it is an exact copy of the CD without any MP3 compression. MP3 compression is a relatively slow process and would slow down the CD load. Therefore CDs get compressed afterwards when the JB7 would otherwise go into standby after five minutes of inactivity.

When you press the INFO button on the remote control you get a useful summary of how full the disk is. It shows how many CDs and tracks you have loaded, how many have been

converted into MP3, how much space has been used and how much is free. Its also a quick way to find out the size of the hard disk. Please note that we use computer scientist gigabytes 1,073,741,824 not 1,000,000,000 so the numbers are 7% smaller than the decimal value.

You will notice that when you first load the CDs the space goes down quickly but re-appears after the tracks have been compressed in standby.

What is MP3? You don't really need to know what MP3 is. In fact very few people using the term have any idea where it comes from or what it means. For most people its just a handy label for music tracks that don't take so much space on hard disks or memory sticks. If you really want to know it comes from "MPEG 2 Part 3 Layer 3" - its part of an international standard describing how to compress moving pictures and sound. The process is highly mathematical and its always a surprise to me that anything musical can emerge.

The only other thing you might like to know is that the compression and quality are determined by something called the bit rate. The bit rate is the number of ones and zeroes used to represent one second of music.

MP3 can have quite few bit rates but JB7 uses just three. The normal setting 192,000 bits per second (or 192k) gives you good quality and compresses the music by a factor of six. High quality and high compression settings use 320k and 128k. There is a trade off between quality and how many CDs you can get on the disk.

	80G	160G	320G
128k	1200	2500	5000
192k	800	1600	3200
320k	500	1000	2000
Uncompressed	105	210	420

The compressed figures are for typical CDs. The uncompressed figures are worst case full length CDs.

If you load a CD with compression turned off then that CD will not be compressed. When you see the album in browse albums it has a little letter "p" next to the number. You can think of of it as protected or perfect.

If compression has been enabled JB7 compresses any uncompressed unprotected CDs at the current bit rate setting. Say you wanted to store some classical CDs at 320k and your pop CDs at 128k.

1. Set the compression to 320k
2. Load the classical CDs
3. Wait for them to compress.
4. Set compression to 128k
5. Load the pop CDs
6. Wait for them to compress.

Typically you can load 30 CDs in an evening and they will have compressed by the following day. You can interrupt compression at any time by pressing any button or turning the knob. You can halt compression by holding the stop button.

Names and album organisation

I tried to keep the music organisation simple. Tracks belong to albums as shown here.
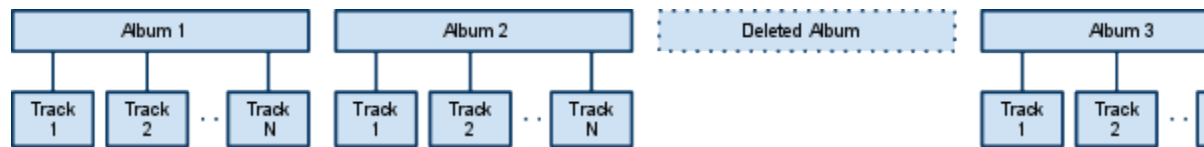
Albums are stored in the order they are loaded. You can delete tracks or albums. If you delete an album it leaves a gap that will be filled when you load the next CD.

Albums and tracks both have names up to 64 characters - including spaces. There is no formal structure for extra information like artist, genre, year, composer but you can put anything you want in the album and track names and edit them as many times as you want - you don't just get once chance.

Typically you load music from a CD and the album and track names come from the CD database. The CD database is stored on the JB7 hard disk and currently has the album and track names for 2,700,000 CDs. The database is derived from the database at www.freedb.org. The database has been built and maintained by voluntary effort so there are omissions and misspellings. Typically JB7 owners find that 95-97% of their CDs are in the database. There are odd omissions - sometimes one CD from a multi CD set is missing - I have read that this may be caused by different pressings of the collection.

It is odd that the album and track information is not stored on CDs. There is space on a CD and there is even a standard for recording text on a CD but it is rarely used by the music publishers. What we do instead is create a kind of digital fingerprint of each CD. The fingerprint is derived from the track lengths and is almost unique. When you insert a CD into JB7 it searches the CD database for matches. You then need to choose from the shortlist of matches.

If your CD is not in the database - pick Other - and you can use a temporary name created by JB7 along the lines of Album 123 - or you can edit the proposed name to something more memorable. At this stage the tracks will be called track 1, track2 and so on. You can edit the names once they have loaded.

When you make recordings from the Aux In connector - typically when recording from vinyl or a radio - each recording is saved in an album called "recordings". The recordings are given names in the sequence aux1, aux2, aux3 and so on. You should then edit the name of the "recordings" album to reflect what it is you recorded and subsequent recordings will be put in a new "recordings" album.

You can load music from a USB memory device in several ways.

1) Upload Albums - this loads all the MP3s on a USB device and uses the folder names to create albums on the JB7 hard disk.
2) Upload Album - this loads one specific folder of MP3s on the USB device. You need to select the album/folder first.

3) Load MP3s - loads all the MP3s on an USB device into one new album. You get to make a name for the new album.

How Upload Albums works
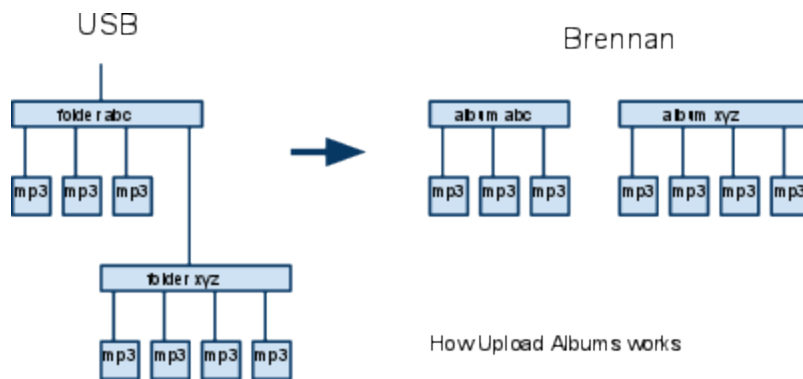
When you load music from a USB memory the tracks are loaded in the order they appear in the directory on the USB device and that will be the play order. The order they appear in the directory will depend on how they were copied to the USB device. If you use Windows for instance the tracks may be listed in one order on your computer (alphabetical or by date for instance) but actually be stored in a different order. You can force the order tracks appear in a directory by copying one at a time.

There are limits on the number of tracks and albums that the JB7 can address. At the time of writing JB7 is limited to 5,000 albums and 50,000 tracks on the internal hard disk and 3,000 albums and 30,000 tracks on an external USB drive. There are other limits like the disk capacity and the space used by the track names - what I am saying is that even if the your disk is big enough or you only keep a few tracks from each album the limits above still apply.

Play Modes and Playlists

In Normal mode the JB7 plays tracks in the order they appear on the CD and plays the CDs in the order they were loaded.

When you pick an album - using Browse Albums or Find Album - then the JB7 assumes you want to listen to the tracks in order and selects Normal mode.

In Random mode the JB7 plays tracks from any album on the hard disk (and on the USB if something is plugged in). I occasionally get asked about the random algorithm. In fact it is not quite random in the mathematical sense. The JB7 first picks a random track - using a random number generator - then checks if it has been played recently. If it has been played recently it tries again.

If you press the Play/Stop button the JB7 will resume where it stopped.

If you press the Next button when it is stopped then the JB7 will turn on Random mode and play something at random.

A Playlist is a list of tracks and/or albums. You can play a playlist in order or randomly. Press the Random button on the remote to change the setting.

Compression and Quality

I am often asked about MP3 quality. I have been listening to MP3 files for a decade and I have pretty good ears when it comes to high frequencies or detecting interference or distortion. *In general* I cannot tell when music has been compressed. Sometimes I think I must be listening to the original and I find it has been compressed. Sometimes I think I have heard compression and it turns out to be the original.

Thats not meant to be a challenge like we bet you can't tell the difference between Butter and Margarine. It may be that I switch off my critical faculties when I'm enjoying music but I don't generally notice MP3 compression on the JB7.

There are some tracks on some CDs where I can tell that it has been compressed and I can tell the difference. Sometimes in quiet passages with Piano or Harp if the original had some tape hiss then I can hear it.

My recommendation is that if you do encounter a CD that does not respond well to MP3 compression then reload that CD with compression disabled. It will overwrite the previously compressed version - you don't have to delete it.

Many customers with a few hundred CDs buy the biggest capacity JB7 and load their entire CD collection uncompressed to guarantee the sound quality. Some customers load their classical music uncompressed and their pop music compressed.

Connecting to Loudspeakers, a HiFi or a Radio

This photograph shows the back of a Brennan wired to a pair of loudspeakers. The JB7 was designed for 8 ohm loudspeakers - like our BSP50s - but JB7 owners have used the JB7 with

hundreds of different loudspeakers without problems. The BSP50s are matched to the power and physical size of the JB7. If you are looking for higher quality loudspeakers then you need to think about spending more than £200.

If you want to feed the JB7 into a HiFi you will probably need the lead shown. It has a 3.5mm stereo jack on one end and twin phono (RCA) plugs on the other. You can plug the jack into the Headphone output or the Line Out but we recommend the headphone because it turns off the internal power amplifier, it allows you to adjust the level and it has a lower impedance so can give better quality. I measured a signal of 2.3V peak to peak on the headphone out.

You can get cables at www.cabling4less.co.uk. You can buy similar at Currys but a bit more expensive.

JB7 owners use the JB7 with hundreds of different amplifiers and systems and the only difficulty reported so far has been getting the right connector for some ancient B&O equipment that used 7 pin DIN.

Some customers want to use the JB7 in more than one room. One simple solution is to let the JB7 drive the loudspeakers in one room and feed the JB7 line out to an amplifier in the other room.

We are often asked about audio quality. The JB7 was designed as a consumer as opposed to an audiophile product but we have heard from a number of JB7 owners who use it in conjunction with HiFi equipment in the range £14,000-£18,000. What they say is that the JB7 isn't as good (it would be odd if it was) but "it holds its own" in use with high end equipment.

You can feed a Radio tuner into the Aux In connector of the JB7. I like the Sony portable DAB radio model XDR-S55DAB - it is compact and will also run on batteries. You will need a 3.5mm stereo jack to 3.5mm stereo jack lead. Plug one end into the JB7 Aux In and the other into the headphone output of the radio.

One JB7 owner found that turning his NAD power amplifier on/off could cause the JB7 to lock up. He found that various clip on chokes from Maplin would eliminate the problem. The chokes clip on to the audio lead from the JB7 to the Power amplifier and supress the interference. The Maplin parts numbers are N89, N96 or N95.

The power supply - international customers

The Brennan includes a universal AC adaptor that works from 110V to 240V at 50 or 60Hz. It delivers 24V DC to the JB7 and has a detachable mains lead.

Backing up, USB Drives and MP3 Player compatibility

The JB7 has been designed to allow backup to a USB hard disk so that in the event of a breakdown you don't need to load all your CDs again. You can simply reload all the music from the backup disk. Incidentally - if you plug the backup disk into a computer you can play the music on the computer.

The JB7 works with USB Mass Storage Class Devices formatted with FAT16 or FAT32 and operating at 12Mbits.

Thats not very helpful unless you are a computer wizard because many products do not provide this information on the packaging or website. Some USB drives are not compatible because they use a format called NTFS and some USB drives work only at a higher speed 480Mbits. Some USB drives are incompatible with the Philips USB device we use.

If you have an NTFS drive you can convert to FAT32 but only by deleting the previous data on the drive.

The bottom line is that if you are buying a USB drive to backup your JB7 - buy one we have tested. We put the latest drives we recommend on the questions page of the website www.brennan.co.uk/help

We have can supply you with a compatible Freecomm 320G portable drive that is pre-formatted to FAT32.

Here are some tips for diagnosing USB problems.

When you plug a compatible drive into JB7 it will briefly display USB OK and then the display to the right of the clock will change from USB ----- to USB nnnnn where nnnnn is the number of MP3 tracks on the USB device.

If you plug in an incompatible device the JB7 may not be able to detect the device (if it is 480Mbits only). In that case the display will not change. If you plug in an NTFS drive the display will briefly show USB NG and the display to the right of the clock will change to USB P7 (or similar error code)

You can find out if a drive is FAT16, FAT32 or NTFS by plugging it into a PC. You then need to find the drive in Windows Explorer (in My Computer) then right click on the drive and select Properties from the drop down menu.

You can re-format a drive from NTFS using free software. We recommend Easus Partition Manager Home Edition or Swissknife - there are links to the download site from our questions page.

Almost all USB memory sticks work with JB7 so a good way to check the USB is OK is to try it with a memory stick.

If your MP3 player has a colour display and displays photographs and/or videos then it is actually an MP4 player - its a different class of USB device and the JB7 cannot talk to it.

If you get an error after using **export names** then **import names** the error is usually in the album preceding the reported line. You may have inadvertantly deleted a line or introduced a new one. You should wait for all the music to be compressed before using these functions. Try re-exporting the names and import without making any changes to get started.

When you load tracks into JB7 from the USB the order of the tracks is the order they occur in the directory on the USB device. If you drag and dropped many tracks at once using a computer the tracks may not be in play order. One way around this is to copy the tracks one at a time if the track ordering is important.

Sometimes deleted music on a USB memory device appears on the JB7. Thats because it has not been deleted but placed in a hidden folder called something like Recycled. I am grateful to the JB7 owner that drew it to my attention. He gave me this description of how to delete the recycled folder -

"I reconnected it to my PC, clicked on 'Start', 'My computer' and the appointed drive for the Western. I then right clicked on Properties, selected 'general' tab and then 'clean up disk'. It found 4Gb of stuff for the recycle bin! I selected OK and it purged all the rubbish!"

I recently got a Seagate FreeAgent 1Tb drive to work with JB7 but to do it I had to create a FAT32 primary partition using Swissknife and the partition was limited to 512G. I am not an expert and I think it is possible to create further partitions on the drive.

Reliability & Repairability

You may know that failure rates in most goods (from cars to shirts) follows a bathtub curve - there is a high initial failure rate as manufacturing defects surface followed by a long period with a low failure rate then a slow increase as parts wear out. We have been selling the JB7 for 22 months and so far we have not seen any wear out related faults.

The hard disk is the most reliable component in the JB7. In the 3,000+ we have sold we have only seen one bad hard disk - it literally came to a grinding halt after an hour or so. I would expect the hard disk to have a very long life in the JB7 because it is not used as hard as in a computer - where a disk is expected to have a ten year life.

We do see individual bad sectors on some hard disks - these are manufacturing defects and the JB7 software can work around them.

Generally a JB7 repair involves swapping one of the three main PCBs or the CD mechanism and the music on the hard disk is untouched. We have on occasions transferred the music from one defective JB7 onto a new JB7. On other occasions we have restored the music on a corrupted hard disk.

We recommend that you backup your music onto an external USB hard disk as an insurance policy. You can plug the USB hard disk into a computer. The USB standard is 12 years old and it is highly likely that USB hard disks will be compatible with computers in ten years time.

Problem CDs

The CD mechanism is a self contained sub-unit designed originally for laptop computers. The mechanism is very compact - just 11mm high - but that sometimes leads to problems with some CDs. The CD mechanism can be noisy and slow to load if a CD is eccentric - there is simply no mass to balance the spinning CD and no place for the wobble to go. Sometimes a damaged or marked CD will stop loading before the end and report Load Incomplete. Many JB7 owner have found that washing a CD by hand with Fairy Liquid, rinsing in cold water and dabbing dry - can turn a noisy unloadable CD into a well behaved CD. If all else fails some owners have made a copy of a difficult CD - using the more tolerant CD mechanism in a desktop PC. Then load the copy onto JB7.

Avoid CDs with paper labels - they can get stuck. Likewise avoid any non standard CDs. We have had to throw away CD mechanisms destroyed by flexible bio-degradable CDs and by "vibration damping rings" stuck to the CD.

Stuck CDs

We buy the mechanisms from three different manufacturers but they sometimes seem to take offense at a particular CD and will not eject it. If this happens we have a technique that usually does the trick. Simply turn the power off and re-apply the power with your finger on the eject button. You can do it by turning off at the wall or pulling out and re-inserting the 24V DC connector. This usually ejects the offending CD but leaves the JB7 in a diagnostic mode so you need to restart normally.

If you load lots of CDs in quick succession the JB7 will warm up quite a bit - thats normal. Some JB7 owners have reported that CDs which were slow or failed to load when the JB7 was warm loaded OK when the JB7 was cool. I have no direct experience of this but semiconductor lasers (used in the CD pickup) are temperature sensitive and have temperature compensation circuits so its possible and something to bear in mind.

CDs with a Video at the end may report Load Incomplete - just check the CD sleeve notes to see if there is a video.

Secret Menu

We developed a couple of utilities for fixing occasional problems - like mistakenly loading all CDs with compression disabled.

These were originally in a hidden menu but we realised thats a bit like not telling the passengers where the lifeboats are - so the most recent JB7s have the functions in the Maintenance menu under Settings.

If you have an older JB7 you can access the hidden menu by putting one finger on the back button and then press the next button (still keeping the finger on the back button).

There are a couple of functions - that we use to tidy up the hard disk - that you might like to know more about.

Cleanup - fairly quick - often sorts out problems after USB load or not compressing or with Browse albums.
Map Disk - very slow >12 hours for a 320G - this will test for and sort out problems caused by bad sectors on the hard disk. We use this if the JB7 ever displays Disk Error.

Miscellaneous

There is a 64 character limit on track and album names. This can cause a problem - especially on Classical CD box sets. These collections tend to have long names and the names differ only after the 64th letter. Typically they end in - disk one, disk two etc. What this means is that the JB7 thinks they are the same CD and will load all the tracks into the same album. That can result in missing tracks and tracks playing in the wrong order.

The solution is to delete the affected album[s] and reload the CDs but edit the album name after each CD - to make it different within the first 64 letters.

We are sometimes asked what Digital to Analogue Convertor (DAC) chip or what power amplifier we use.

The DAC is an Analogue Devices AD1981.
The Power amplifiers are Monolithic Power MP7782.

There is a 50,000 track limit that is a limitation of the DSP memory - as opposed to the hard disk capacity. It is possible to load more CDs but you will get odd behaviour.