

Nail Those BPMs



Essential mixing tool, or lazy DJ's toy? Whatever you think about BPM counters, they look set to stay...

Time signatures and tempo have existed almost as long as music itself. Allegro, andante, adagio and presto are some of the terms that have been used throughout the ages to describe the tempo or speed of a passage of music.

These terms give the performer or conductor of the orchestra an indication as to the pace of the piece, whether it is to be played slowly, at a walking pace, or quickly for example. Time signatures tell the musician how many beats there are per bar of music. Counting the number of beats played in one minute gives us the tempo in beats per minute or 'BPM'.

Simply put, if you tap your foot in time to the beat of a record and count the number of taps against a stop watch for exactly one minute, that will tell you the BPM. Calculating the BPM of your records gives an instant indication of which are similar in tempo and therefore most likely to mix together easily.

The pitch control on your turntable, CD or Minidisc player enables you to change the BPM by making the track faster or slower. By calculating the BPM and making a note of it on the record label or sleeve, you will have an instant indication of how to set the pitch control in relation to BPM.

If, for example, one record is 132 BPM and the other 128 BPM, to mix them together keeping them as close to their original pitch as possible, you would slow the first track down by two BPM and speed the second one up by two BPM. Both would then be running at 130 BPM and would be matched in terms of tempo. I often hear DJs mixing records using extreme varispeed to the point where the track sounds much too fast or slow. This is because the BPM of the two records they're trying to mix together has not been calculated and they're having to use extreme varispeed to match the tempo. This can sound sometimes sound quite amateurish.

Pure maths

Calculating the BPM in the early days of mixing was achieved by the rather boring and time consuming manual foot-tapping method mentioned above. I have spent many hours with a tally counter in one hand and a stopwatch in the other, calculating the BPM and labelling records! Various other methods were tried like hitting '1' on a calculator then tapping the 'constant' key in time for 15 seconds and multiplying the result by 4!

Needless to say, due to human error, the results were often wildly inaccurate. It soon became apparent to the DJ electronics industry that somebody needed to invent a method of calculating BPM simply, accurately and quickly.

Most of the early BPM calculation devices were of the manual 'tap and read' variety. Assuming that the operator tapped the button in time, they were fairly accurate. The problem with these units however, was that they worked on the principal of looking at how many times the button was tapped over a very short period of time, just seconds.

Teething problems

A simple internal calculation was then made to ascertain BPM. If the operator was imprecise when trying to tap the button in time to the beat, the error was magnified and the result could be way out. So, what was clearly needed was some kind of device capable of 'listening' to the audio and calculating the BPM automatically. This was no simple task. The reasons for this are many and varied.

Firstly a computer does not have ears as such. It has to analyse the audio electronically and look at the 'waveform' of the music. It then has to identify the bass drum and snare, time the distance between them and translate that information into BPM. Simple (not)! Secondly, many records do not have a regular 'four-to-the-floor' constant beat. In fact, when the first automated devices were being designed, hip-hop and electro music was prevalent in clubs. The rhythm of both these genres of music was far from constant, making the waveform complex and so it was difficult to ascertain the true BPM.

The BPM is usually constant within a track. It is the rhythm that you would tap your foot in time to. On a straightforward 4/4 house track the main 'beat' of the track is also the loudest point of the waveform, creating visible peaks. This is why meters on a mixer appear to move up and down in time to the beat. They show the peaks and dips in volume. For this style of music it would be a fairly simple matter of electronically detecting these peaks and timing the distance between them to give an accurate BPM calculation. Unfortunately, drum fills and rhythmic patterns in music also create peaks around the main beat making it difficult for the analyser to detect which is the main beat pulse and which are fill or rhythm-created.

A record shop in London, called Spin-Offs used to sell a device called the Synchro-beat which was one of the first mixing aids to look at the audio signal. In common with most of the other devices of that time, it was not terribly good at identifying the main beat, and the cost of RAM memory made it very expensive.

Human traits

It was Numark, who had the idea of combining the 'eyes' of the computer and the 'ears' of a human to come up with an idea to solve the problem. First, they took a processor capable of looking at an audio waveform to read the peaks in level. Then they added a button they called 'beat assist'. This rather ingenious device was a kind of manually set 'gate'. The DJ simply hit a button in time with the main beat several times. This set a 'window' at regular intervals either side of the portion of the waveform where the button was tapped. The auto analysis part of the machine then concentrated on that window to look for peaks, which meant that other peaks created by fills and rhythm sounds were outside the window and therefore ignored. The result: a far more effective BPM counter.

The first Numark product to become commercially available implementing this technology was the Beatkeeper BCM115. It was a 1U rack-mounted unit and was placed in the audio chain between the source and the input. The input stage accepted anything from phono to line input levels and passed the signal straight through to the units output at the same level as the input. This meant that whatever the source, it was still connected to the usual inputs of the mixer as though the beatkeeper were not there. This made it very easy to connect without redirecting inputs. It could also be very simply connected to insert points on mixers without regard to level.

The BCM115, featured two red bar LED read-outs, one for each deck, displaying the BPM. The two sides of the unit were electronically linked inside so that comparisons of BPM could be made. 'Tempo Difference' and 'Beat Offset' displays indicated when the BPM was the same on both sides. Unfortunately, the internal processor employed was very slow and took far too long to react to changes in tempo. Hence the BCM115 was virtually useless as a mixing aid. It was however a very good automatic BPM counter and I still use one at home for that purpose. Nowadays, with the availability of faster and cheaper processors, these automatic readers are getting far more responsive and accurate.

Many BPM calculators and mixing aids, effects units and DJ mixers now employ audio analysing circuitry. Their effectiveness can largely be assessed by the speed at which they calculate an accurate BPM. Take a track with a known BPM, if you don't know for sure, check it manually by tapping your foot in time to the beat against a stop watch for exactly 60 seconds. Start the watch exactly on a beat. The next beat is counted as beat one, then two, three, four etc. The number of times you tap your foot in one minute is the BPM. Then use the BPM calculator to see if it gets the same reading. A modern counter worth its salt should only take a second or two to come up with the correct answer.

If it cannot make up its mind and the reading jumps around or gives an incorrect BPM, then it should not be relied upon.

Last word

A BPM calculator will not turn you into Carl Cox overnight. It is an aid, nothing more. Keeping your tunes sorted in BPM order is a great way to catalogue your collection and will help you see more easily which records are likely to mix together. The musical key, vocals, mix points and feel of the tracks you are mixing together all matter just as much as getting one beat in time with the other.

When you are mixing, you are effectively taking two different pieces of music, played by different musicians, probably recorded in different studios in different parts of the world and you are trying to make them all play together in time! It is no wonder it sometimes sounds a mess!

Numark's Beatkeeper, with its Tempo and Beat difference display is the only one mentioned here which goes some way toward helping you to mix, but skill is still required as Numark very honestly point out in the operating manual. Do not be influenced by claims of accuracy to decimal places, as such degree of accuracy is not necessary.

The nearest beat is good enough to set a mix up, the minor adjustments must still be done by ear. At the end of

the day there is no substitute for practice.

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