DIGITAL AUDIO CLOCKS

All digital audio devices run at a specified sample rate, such as 44.1kHz, or 48kHz. In order to control the sample rate, you need a ***clock***. The clock keeps the sampling rate steady. In an audio CD player, the clock would 'tick' 44,100 times per second. The clock has to be very stable and it must run at the correct sample rate.

Each digital device (DAT machine, ProTools, CD player, etc) has its own internal clock, and normally, it uses its own clock to maintain a steady sample rate. But if a digital device has a SPDIF or AES/EBU input, it can follow the clock in another device.

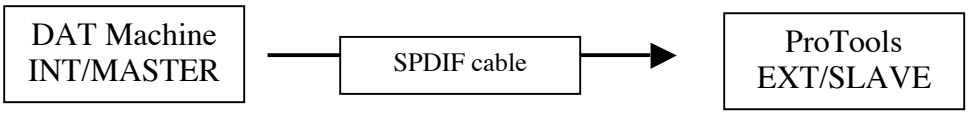
Let's say you use a DAT machine to record a concert. The DAT will use its internal clock whether you record or playback.

Then you go back to your studio to transfer the DAT recording into ProTools. You notice that your DAT has a SPDIF I/O and so does your digital audio interface (ProTools hardware). You're in luck! You can transfer the sound digitally from one to the other, avoid unnecessary D-A or A-D conversions, and keep the clocks in sync!

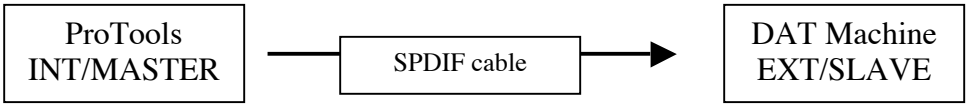
The DAT machine will act as the **master,** running on its own **internal clock,** and outputting the clock on the SPDIF cable; you'll have to set ProTools to **slave**, or **external clock**. Then, when you put ProTools into record mode, it will sit still and wait for the incoming clock from the DAT. When you press 'play' on the DAT machine, it sends out clock as well as audio, and ProTools starts recording, locked to the DAT's clock.

Later, after you finish editing the concert in ProTools, you want to lay it back to the DAT machine. You would reverse the MASTER/SLAVE roles. ProTools will provide the Master clock, and you'll set the DAT to slave, or external clock. And, when you put the DAT machine into record mode, it will wait for ProTools to start playing before it starts to record.

Transferring from DAT to ProTools. ProTools is in 'record' mode, and waits for you to press 'play' on the DAT. You've connected the SPDIF OUT on the DAT machine to the SPDIF IN on the digital audio interface.



Transferring from ProTools to DAT. The DAT is in 'record' mode, and waits for you to press 'play' on ProTools. You've connected the SPDIF OUT on the digital audio interface to the SPDIF IN on the DAT machine.

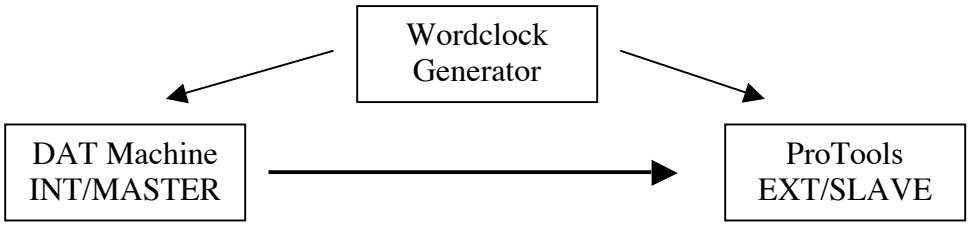


WORDCLOCK

Wordclock is a sort of 'super' clock. Its job is to keep several digital devices in perfect sync. You'll find Wordclock in TV studios, major recording studios, and even smaller studios, especially where video is involved. Digital devices can have unstable clocks, and when you're using several of them at the same time, especially when you're sending your work out to other studios, it's good to guarantee a rock-solid clock.

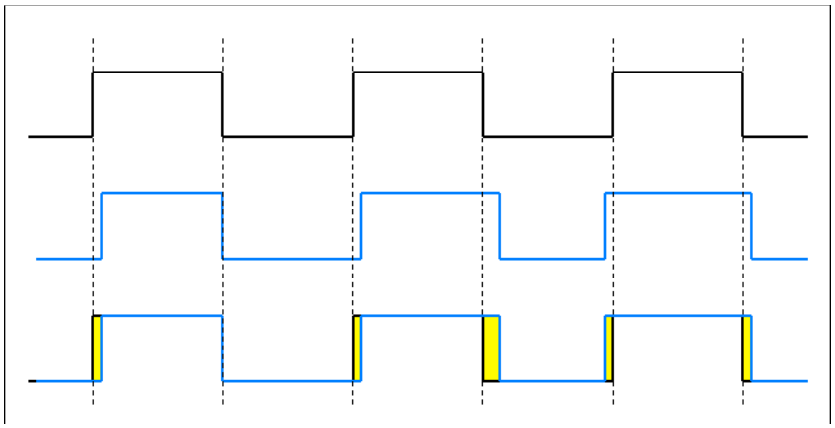
You will often find a **wordclock** input on digital audio equipment, in the form of a BNC connection. If you have a wordclock generator, you can keep all the devices in your system in sync.

Wordclock doesn't involve a master/slave situation. It is just a way of keeping all the internal clocks in your digital gear in perfect sync. You'll still use internal clocks (such as the DAT machine in the previous example) and external clocks (such as the ProTools system).



JITTER

When a digital clock is unstable compared to another clock, you might have a problem called **jitter**. Jitter can sound like crackling and clicking, a sort of digital static. Jitter is a **digital audio artifact**.



The blue and black pulses show the sample clocks of two different devices. If you try to combine these two digital signals without good clock sync, the result is the yellow business you can see in the third, blended clock. This is where the crackling will happen.