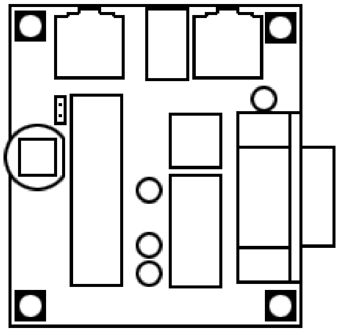
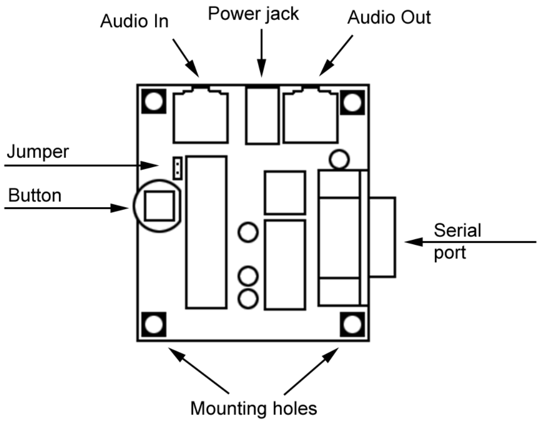
CD2Serial v2.0



The Buffington Effects CD2Serial unit allows you to convert specially encoded audio from a CD player or magnetic tape into RS232 data. Standard baud rates of up to 9600 baud and non-standard rates up to 14700 baud can be achieved.

This product is primarily intended to be used in conjunction with a servo controller such as the Buffington Effects RC servo controller but could be used with anything that has a serial port. The CD2Serial unit was developed to allow users to play back animations created in Servo Animator without the need for an expensive and bulky computer.

To use the CD2Serial unit, you will need to connect the line out or headphone jack of your CD player to the audio jack on the left side of the CD2Serial device using a double-ended 1/8” stereo headphone cable. If your animation has audio that syncs to it then you should connect a set of amplified speakers that have a volume adjust to the audio jack on the right side of the CD2Serial unit. The CD2Serial unit comes with a power adapter that plugs into the power jack that is between the two audio jacks. If you are using the CD2Serial unit in a location that does not have wall power then you can connect 6 to 24 volts to the CD2Serial unit. Make sure that you supply it with the proper polarity or you stand a good chance of destroying the unit. On the right side of the circuit board is a DB9 serial connector. Use this to connect to your servo controller or serial device.



When your CD2Serial unit is shipped it will be uncalibrated. You will need to do this yourself. To calibrate the unit, place a CD that has specially encoded data into your CD player and hit play. When you are sure that the CD has actually started playing, press and hold the white button for one second and then release it. You will have just calibrated your unit. This calibration data is stored in the CD2Serial unit and will stay there until it is calibrated again in the future.

If your CD2Serial unit is not outputting good data then you should try the following: Adjust the volume on your CD player and calibrate again. The CD2Serial unit prefers higher volume levels. Sometimes you may get some distortion at the highest volume level so it is recommended that you start out at about 70% of maximum volume. Try removing the jumper. Some CD players invert the audio waveform. Removing the jumper will invert the outputted data so that it is good again. The problem may be that your CD player is reproducing distorted audio. This is a problem that cannot be remedied except by getting another CD player. Below is a list of compatible CD players when tested at 9600 baud. Models change every few months so this document may be out of date. You can often find older models online at places like Buy.com or refurbdepot.com

Last updated September 27, 2003.

With jumper on:
Sony D-EJ621
Sony D-NE718CK
Sony D-NE510
Sony D-NF610

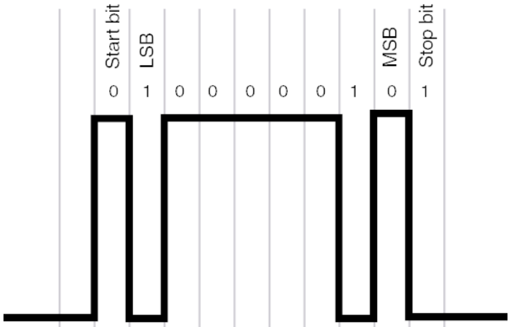
With jumper off:
Sony D-FJ210

Buffington Effects in no way is endorsing Sony products. They just happen to currently be the only ones that reproduce an accurate waveform.

Technical info

This section is meant to provide you with the information that you need if you are planning on writing your own software to use with the CD2Serial unit.

RS232 data format



The letter "A" as serial data

First let's go over what a RS232 data stream looks like. In all, each byte of data sent through a serial line takes ten bits. There are eight bits of data and two extra bits which are the start and stop bits. The RS232 line is held low when no data is being transmitted. The start bit is always high and it is what signals your computer, modem, or whatever you have connected to your serial line that it is time to start receiving data. After the start bit are eight bits of data. The data is inverted and is sent with the least significant bit first. Finally the stop bit, which is always low, is sent. There is no pause between consecutive bytes if multiple bytes are being transmitted.

Encoding your data

Encoding data to a CD is almost as easy as writing high and low values. If your data is a constant stream then you can go ahead and encode it as described above. If it is intermittent though, you need to do something slightly more complex. CD players do not put out the exact waveform that you request. They put out a fair approximation of it. If you were to encode the idle state of the serial line as low, the output of your CD player would gradually settle back to 0 volts which is not what you want because any high bit will then be twice as high as it should be, and ringing of low bits could cause problems. Instead what you should do is to encode a median value so that the average over time of the waveform stays right around 0 volts. One more thing that you need to know is that you should have a short leader of the median value before you start encoding your data at the beginning of a track. This gives the output of your CD player some time to settle. One second works great but the actual amount of time needed may be much less. If you are using audio then you should encode it to the left channel of your audio file. If you decide that you do not need to use audio, then you can encode data to both audio channels. To decode both channels of audio, connect one CD2Serial unit up as described previously and then run a double-ended 1/8" stereo headphone jack from the right audio jack of your first unit to the left audio jack of a second unit. To encode a 0, write the value 32767 to the audio file, to encode a median value, write 0, to encode a 1, write – 32767 to your audio file.

CD players sample their sound data at 44100 Hz. Because of this you cannot achieve a perfect baud rate. To encode serial data at 9600 baud you will need to encode several samples per bit as well as to vary how many samples represent each bit. As long as the average is close to your desired baud rate you should be OK. Realistically the fastest standard baud rate that you should attempt to achieve is 14400. This may not work on all of the listed CD players since, as the frequency of a sound gets higher, their amplifiers are typically not able to drive their outputs through the full range of volume levels. Here is an example of how a byte is encoded at 9600 baud. The numbers shown are the number of samples that you must encode for each bit. (5,4,5,4,5,5,4,5,4,5)