RailPro Speed Table and
Steam Locomotive Chuff Rates

How To Set Up The RailPro Speed Table
To Help Synchronize The Steam Locomotive Chuff Rate
With the Rotation of the Driving Wheels

Ver. 1.0

By Doug (MtRR75 on the RailPro User Group Forum)

In this document, Section Headings are in Yellow, Buttons to push in Blue, and Important Notes are in red.

NOTE: This information is based on just one steam locomotive. I have 2 others to run through this procedure (and more yet to be converted from DC), but I won't get to them for a while. As I learn more I will update this document.

Before the Speed Table was added to the RailPro Software, the chuff rate could only be set to one value. If you set the chuff rate to synchronize with the wheel rotations at, say 25 MPH, the synchronization would significantly off at higher and lower speeds – enough that it was clearly noticeable.

Once you set up this speed table, then set the chuff rate at one speed, you will find that the chuff rate is much better in synch with the driving wheels at almost all speeds.

The locomotive that I used was an old Mantua 4-6-2 with an updated motor. The locomotive has an LM-3S module running software version 2.03. I am using the Heavy Steam sound. My controller is an HC-2, running software version 2.03. These were the latest software versions available when I started working with the Speed Table.

 (1) START SPEED & TOP SPEED vs. SPEED TABLE: The RailPro speed table is linked by the Start Speed and Top Speed settings. If your Start Speed is 0 and your Top Speed is 100 (the defaults), the Speed Table initially shows a straight line from 0 to 100). When you change the Start and Top speed settings (for example: 10% & 70%, respectively), RailPro automatically fills in the speed table with a straight line going from your Start Speed setting to your Top Speed setting (for example from 10% for an X value of 0 to 70% for an X value of 100).

IMPORTANT: If you modify the speed table (as described later in this document, then change either the Start Speed or Top Speed settings, your custom speed table is erased and replaced with the straight line table that is dictated by your Start and Top speeds. So the Start and Top Speeds should always be set BEFORE working with the Speed Table.

(2) MEASURING SCALE SPEED: In order to use the speed table, you need a way to measure your locomotive's speed – in scale MPH. Using a speedometer is the easiest way, but if you don't have a speedometer (I don't), you can use a stopwatch (or a stopwatch phone app) to measure time that it takes for your locomotive to traverse a given track segment. Then you can calculate the scale speed. Section (3) steps you through how to get the scale speed data by measuring time and distance.

NOTE: If you have a speedometer, skip this section, and go to Section (4)

(3a) SETTING UP A SPEED TRACK: I marked a segment of my layout that turned out to be a little less than 10 feet long. It included about half straight and half curved track – which is about what my layout consists of. I measured the length of the speed track in inches. For the curved section, I fitted a curved wire to the center of the track, then straightened the wire to measure it.

NOTE: You can use any length of speed track. But the longer the track, the more time it takes to collect the data. If the track is too short, the times at high speeds will be very small and thus more prone to measurement errors. My 10-ft. section turned out to be a good compromise distance.

(3b) DETERMINING TIMES FOR DIFFERENT SPEEDS: For setting up the Speed Table, you need to know the exact times that it takes for your locomotive to run through your speed track for each 5 MPH increment (5, 10, 15, etc.).

First convert the length of your track segment from inches to scale miles using the following formula:

Scale Miles = (Inches / (12 x 5280)) x 87.   OR   Scale Miles = Inches / 728

Make a Time Table that has MPH (in increments of 5) in the first column and Time (in seconds) in the second column. For each MPH, use the following formula to calculate the number of seconds it will take for your locomotive to pass through the speed track.

Seconds = (Scale Miles / MPH) x 60 x60   OR   Seconds = (Scale Miles / MPH) x 3600

Now, you are ready to work with the Speed Table.

NOTE: Your Time Table will be good for all of your locomotives, unless you change the length of your speed track

(4) RAILPRO SPEED TABLE TOUR: The RailPro Speed Table (found under Locomotive Setup) is labeled in a confusing way. The Y-axis units relate to the speed dial and are in %. The X-axis units are not specified, but go from 0 to 100 in increments of 5. It turns out that these units are MPH.
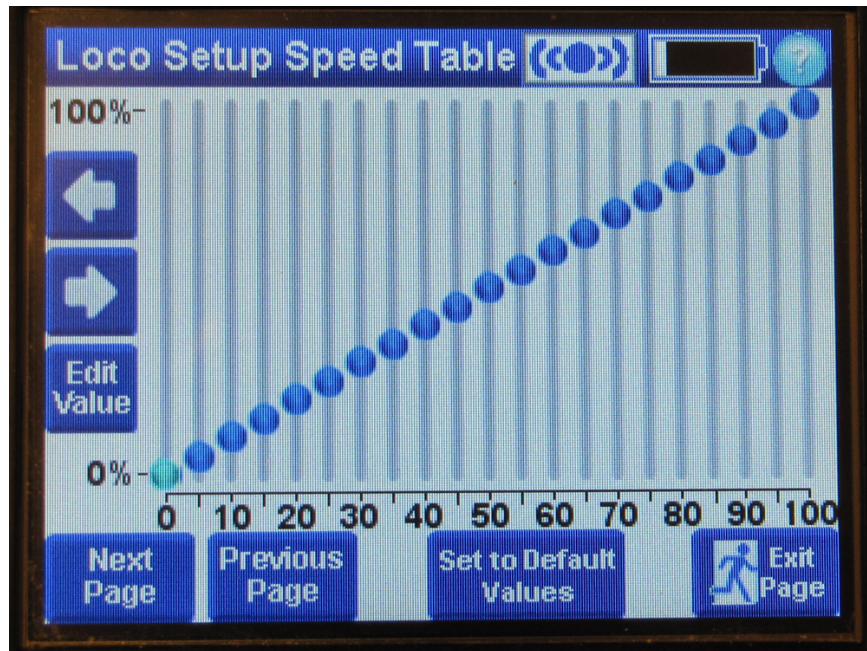
Fig. 1. Speed Table with Default Values.

You can use the left and right arrows to select the point that you want to edit (for example, the point where x = 20). It shows up in a lighter color. Then press Edit Value to edit that point. An Adjust Value screen opens up where you use a slider to change the percent for the selected point. This screen is titled Speed Table 20% (the number relates to the X-axis on the graph).   I think it would be better labeled as Speed Table 20 MPH (just Speed Table 20, since some users may be working in kilometers per hour.)
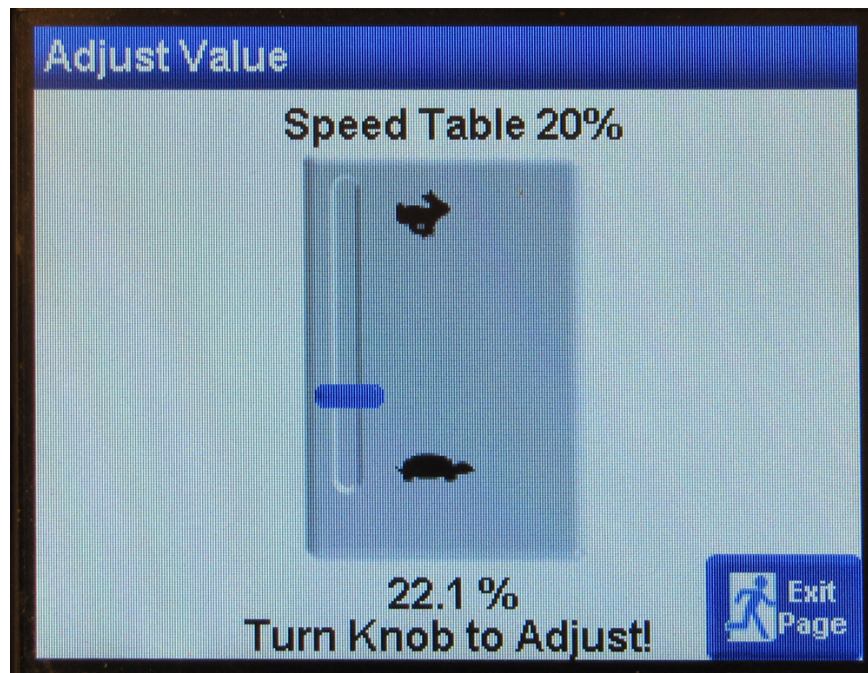
Fig. 2. Adjust Value Screen.

The bottom of the screen gives the Percent for that point (22.1% for my locomotive and settings). The instructions are: "Turn Knob to Adjust!". When I turn the knob, the Percent changes from 22.1% to my new setting. The goal is to turn the knob until the locomotive is traveling at exactly 20 MPH.

(5) SETTING UP THE SPEED TABLE: To set up the Speed Table, you will need to edit each of the points, one at a time. Start with the lowest point and work upwards. You do not need to edit the 0 Point. If your locomotive will not run smoothly at 5 MPH skip that one for now.

Make sure that the locomotive is on your speed track, and the track is powered.

To edit a point (using 20% for example):
(5a) Go the Control Locomotive screen for your locomotive and turn the speed dial to 20%.
     Note that this does NOT necessarily mean that the locomotive is travelling at 20 MPH.
(5b) Go to the Speed Table.
     HINT: The easiest way to do this is: (i) press the Locomotive Setup button once,
     (ii) then press Previous Page twice to get to the Speed Table.
(5c) Use the left and right arrow keys to select the 20 MPH Bar.
(5d) Press Edit Value. The Adjust Value page will open up.

(5e) Turn the knob until the speed of the locomotive is traveling exactly at 20 MPH – as determined by a speedometer. If you do not have a speedometer, use the table that you made in Section (3b) to look up how long a locomotive will take at to pass through the track segment at 20 MPH (it was 29.1 seconds on my track). Then use a stopwatch (or stopwatch phone app) to measure how long it takes your locomotive to traverse the Speed Track. Keep adjusting the slider on the screen until the time that the locomotive takes to traverse the track segment is equal to the number from your table.

(5f) IMPORTANT: Before you leave this screen WRITE DOWN THE SLIDER SETTING for that MPH. Also add your Start Speed and Top Speed settings to the list of speed settings. Save this information in a safe place. If your speed table gets accidentally reset to the default table, you can quickly reenter the settings without re-measuring the speeds.

You are now done with this point.

(5g) Press Exit Page to return to the graph. You will see that the point has moved up or down from where it was before. Note that while you are adjusting the slider, the train speed will go up or down, but when you return to the Control Locomotive screen, the dial setting will not have changed (it will still be 20%). The locomotive is now travelling at 20 scale MPH when the dial says 20%.

Repeat steps (5a to 5g) for each point. If you never plan to run your locomotive above a certain speed (for example 60 scale MPH), do not bother to edit the points above that limit.

(5h) If you were unable to get your locomotive to run smoothly for 5 MPH, go back to the 5 MPH point, and enter ONE HALF of the 10 MPH setting.

(5i) <mark>IMPORTANT</mark>: After all settings are completed, go to your main locomotive screen, turn the speed knob to 0% and turn off all sounds. Then go to the first Locomotive Setup screen and SAVE YOUR SETTINGS. Of course you can also save them at any point during the construction of this speed table.
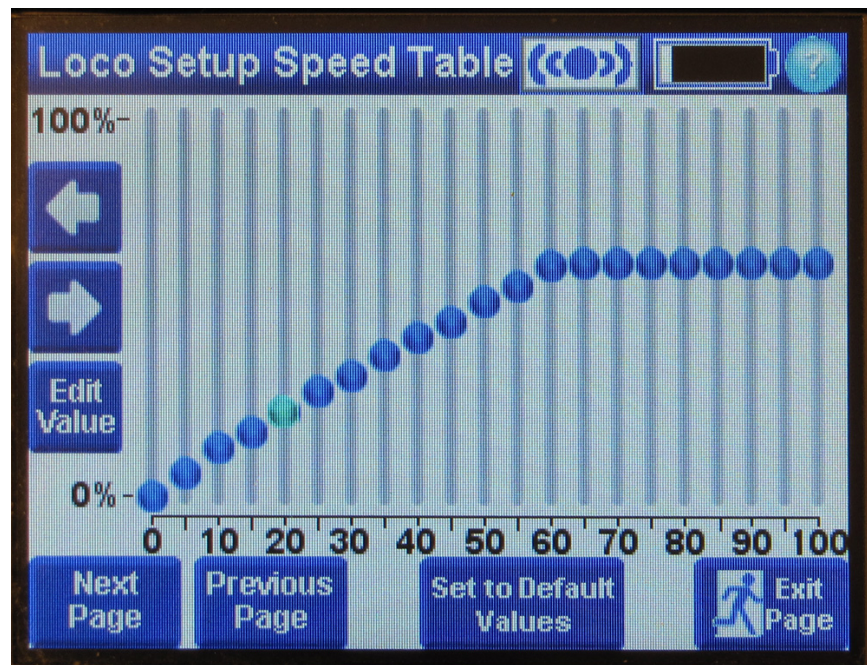
Fig. 3. Speed Table with Adjusted Values.

<mark>(6)</mark> <mark>Setting the Chuff Rate</mark>: Now, go to the Advanced Sound screen (under <mark>Locomotive Setup</mark>) and adjust the chuff rate while the locomotive is running. You only need to do this for one speed. I usually set it at 20 or 25 MPH. I find it easier to watch the combination lever rock back and forth than to watch the bolt on the driver go around.

Once you set the chuff rate, save your settings again, as you did in step (5i)

<mark>(7) RESULTS</mark>: For my locomotive the best synchronization occurred at 149%. Note that this is just 1% below the maximum setting. I hope that I do not run into a locomotive that I can not synchronize.

For what it is worth, the best Chuff Rate setting (149%) was much different than the best Chuff Rate setting that I had been using before I set up the Speed Table (78%)

I set the Chuff rate at 25 scale MPH, then observed the synchronization between 10 and 40 scale MPH. The synchronization was not perfect, but it was MUCH BETTER than before. I had to look very carefully to see a slight slippage of the synchronization. At very slow speeds (below 10 scale MPH), the slippage was a little more obvious, but still MUCH better than before. This is probably due to the high inertia of this locomotive.

(8) Effect of a Consist on the Chuff Rate:

NOTE: This information is based on just the one locomotive for which I have completed the Speed Table.

I added a six passenger car consist to the locomotive. The cars all have power pick-ups that result in a very high rolling resistance. The locomotive will often slip a little during start-up. But once it gets going, it can pull the train without slippage. (I have no grades on my layout.). After adding the consist, I only had to change the Chuff Rate setting down 1% (to 148%) to get the best synchronization. But the synchronization was a little less perfect at the higher and lower speeds, but still MUCH BETTER than before.

It is possible that had I run the speed test with the whole consist, I might have gotten a better fit. I will try this in a future experiment.

(9) Corrections and Updates: Please send any corrections or suggestions via Post or Message to:

MtRR75
at the Rail Pro Users Group at:
https://rpug.pdc.ca/index.php