Digitizing Logs

12/8/22/JPR

Introduction

The log digiting program is used to scan raster log images and extract the depth and value information for a selected, colored curve. In addition, the program will accommodate logs that aren't perfectly vertical as well as logs in which the vertical scale is not constant.

Step 1. Scan & Colorize the Log

If the log has not already been scanned, it must be converted into a raster image (e.g., PNG, BMP, JPEG) by using a continuous scanner (Figure 1). Prices start at 120 US$.

Figure 1

There are many programs that can be used to colorize curves within raster images by essentially tracing the curves with a virtual colored pen. Examples include the Microsoft Paint program (included with Windows), PaintShop Pro, Corel Canvas, PhotoShop, etc.

Tracing/colorizing curves with a mouse is tedious. A drawing tablet (Figure 2) is much easier and faster. These tablets are essentially monitors with a stylus, in which the drawing program is displayed on the tablet and the stylus is used in place of a mouse. Prices start at 150 US$.

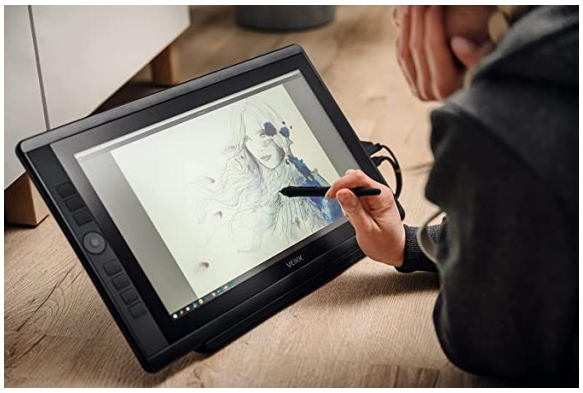

Figure 2

When coloring the log, it is important to make sure that each curve is traced with a unique color. This includes "overruns" (curves that change scale and "wrap" when they extend beyond the data column).

<u>Remember: All curves, including overruns, must have unique colors.</u>

Upon completion of the colorization, the raster image should look something like Figure 3. Notice how the gamma (red) curve overruns have a different color (purple).

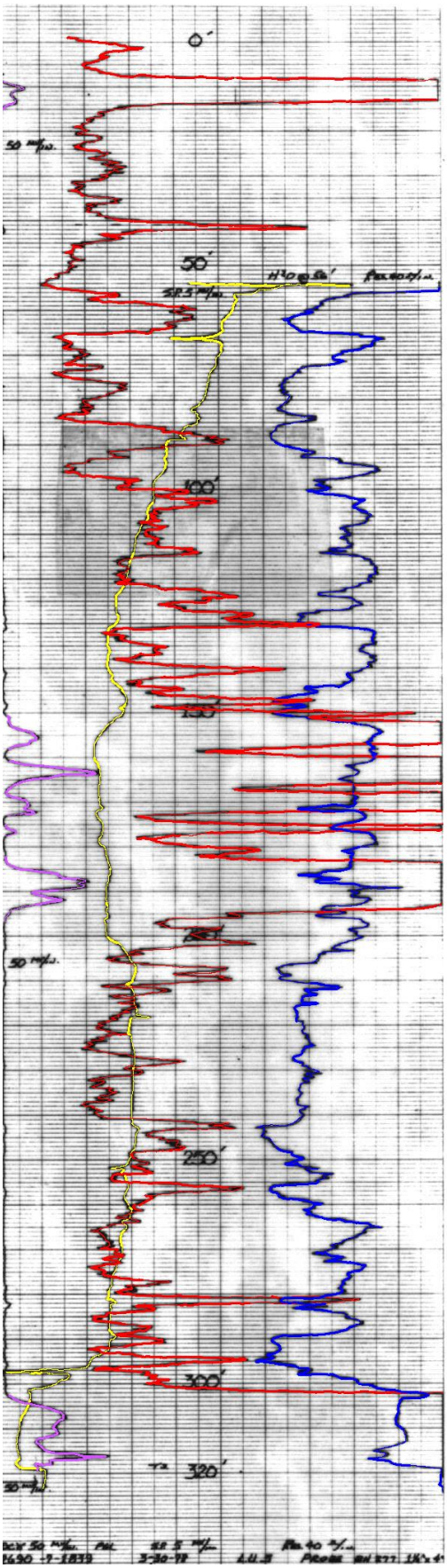

Figure 3

Step 2. Load the Digitizing Program

Select the *Graphics / Images / Digitize Raster Log* option (Figure 4).

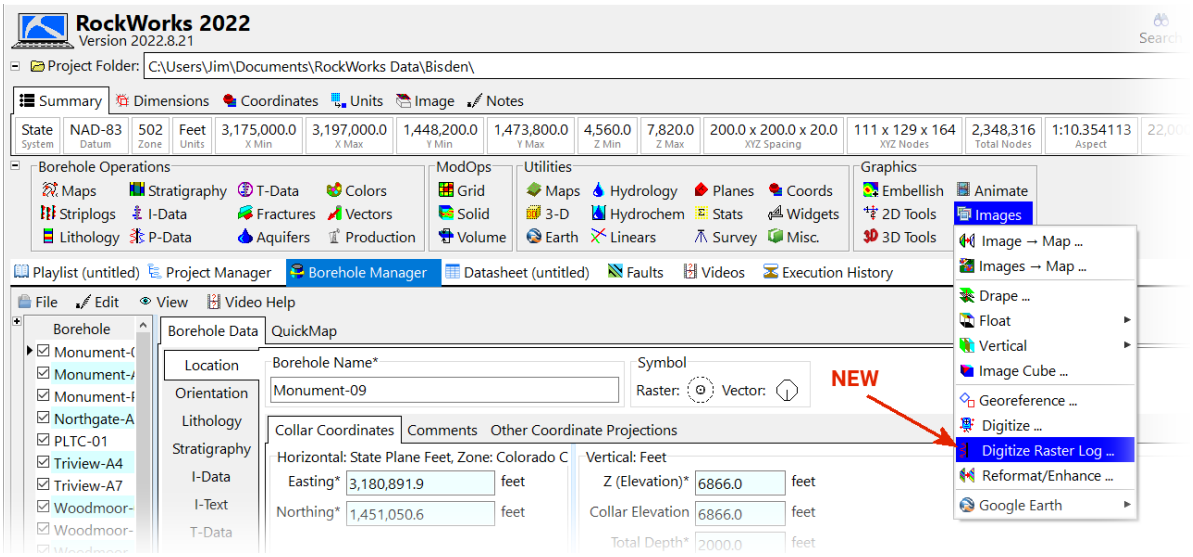

Figure 4

Step 3. Load Raster Image & Select Track Color

- Select the name of the raster image that contains the scanned log. This can be a PNG, BMP, JPG, etc. It cannot be a PDF, in which case, the PDF must be converted to a raster image. We recommend PaintShop Pro for converting PDFs because it's inexpensive (~80 US$) and provides control over the output resolution. 200DPI (Dots Per Inch) is recommended.

- Once the image has been displayed, use the *Size* option (Figure 5) to enlarge an area of interest.

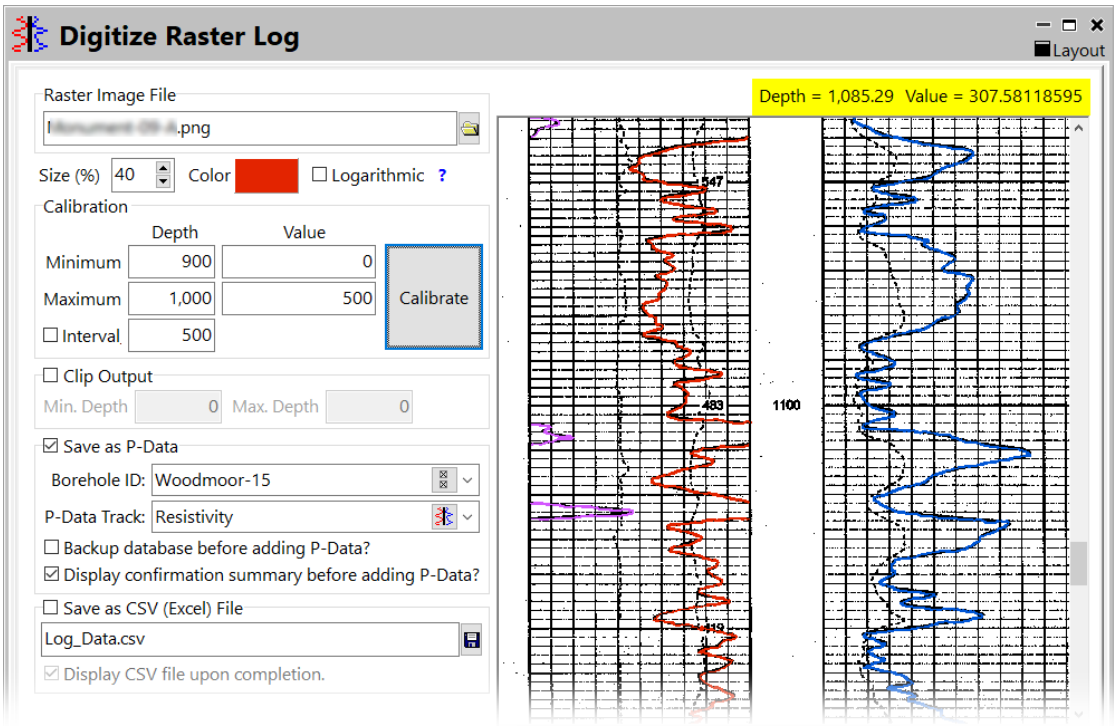

Figure 5

- Click the *Color* button and then click on the colored track to be digitized. The Color button should now correspond to the color of the track that was just selected.

Step 4. Calibration

- Check the *Logarithmic* option if the horizontal axis for the curve that is to be digitized is logarithmic.

- If the log is short and it can be assumed that the vertical scale does not vary, the calibration can be made with just four points. Clicking on the *Calibrate* button will prompt the user to digitize the following points;

    - The upper-left point that corresponds to the specified *Minimum Depth* and *Minimum Value*.
    - The upper-right point that corresponds to the specified *Minimum Depth* and *Maximum Value*.
    - The lower-left point that corresponds to the specified *Maximum Depth* and *Minimum Value*.
    - The lower-right point that corresponds to the specified *Maximum Depth* and *Maximum Value*.

  As these points are digitized, a red cross-hair symbol and a red-on-yellow label will be superimposed on the display showing the depths and values (Figure 6).

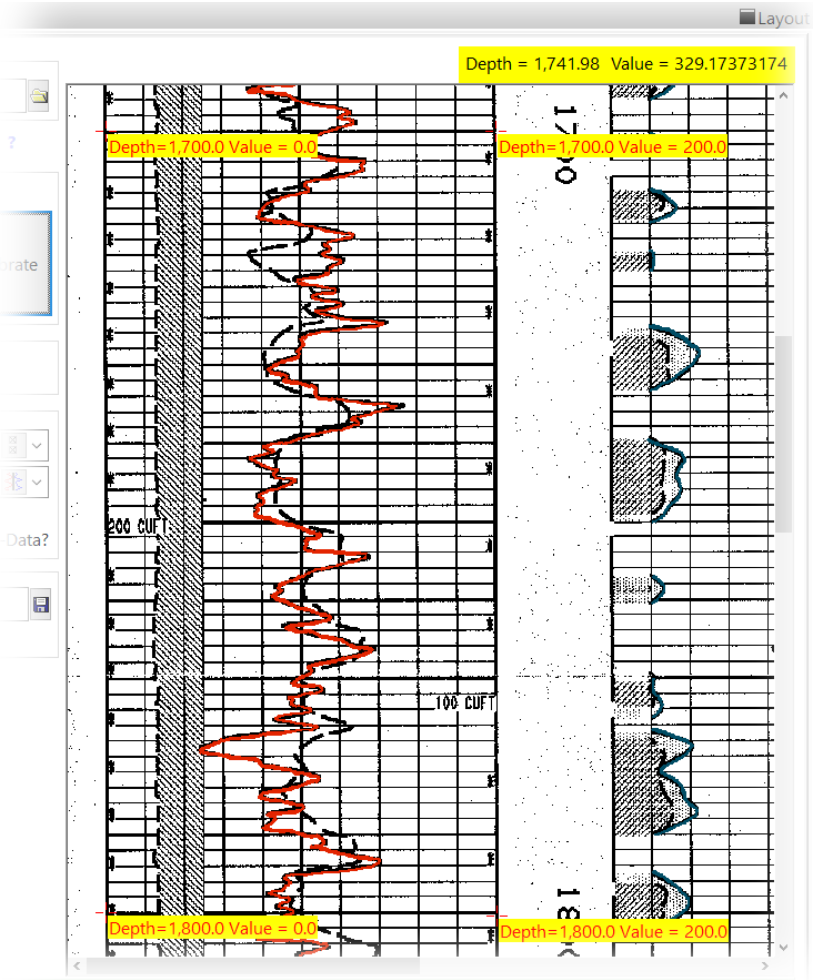

Figure 6

Immediately after digitizing the four calibration points, it's a very good idea to move the cursor around the log and compare the cursor location within the Depth and Value listing within the upper-right corner of the dialog box to make sure that the log was correctly calibrated.

<u>Remember: After calibration, move the cursor to known points to check the calibration accuracy.</u>

- If the log is long and/or distorted and/or the vertical scale varies, the log should be calibrated using more than four points in which case the **Interval** option should be checked. The value specified for the calibration interval will determine the number of calibration points that the program will prompt for (Figure 7).

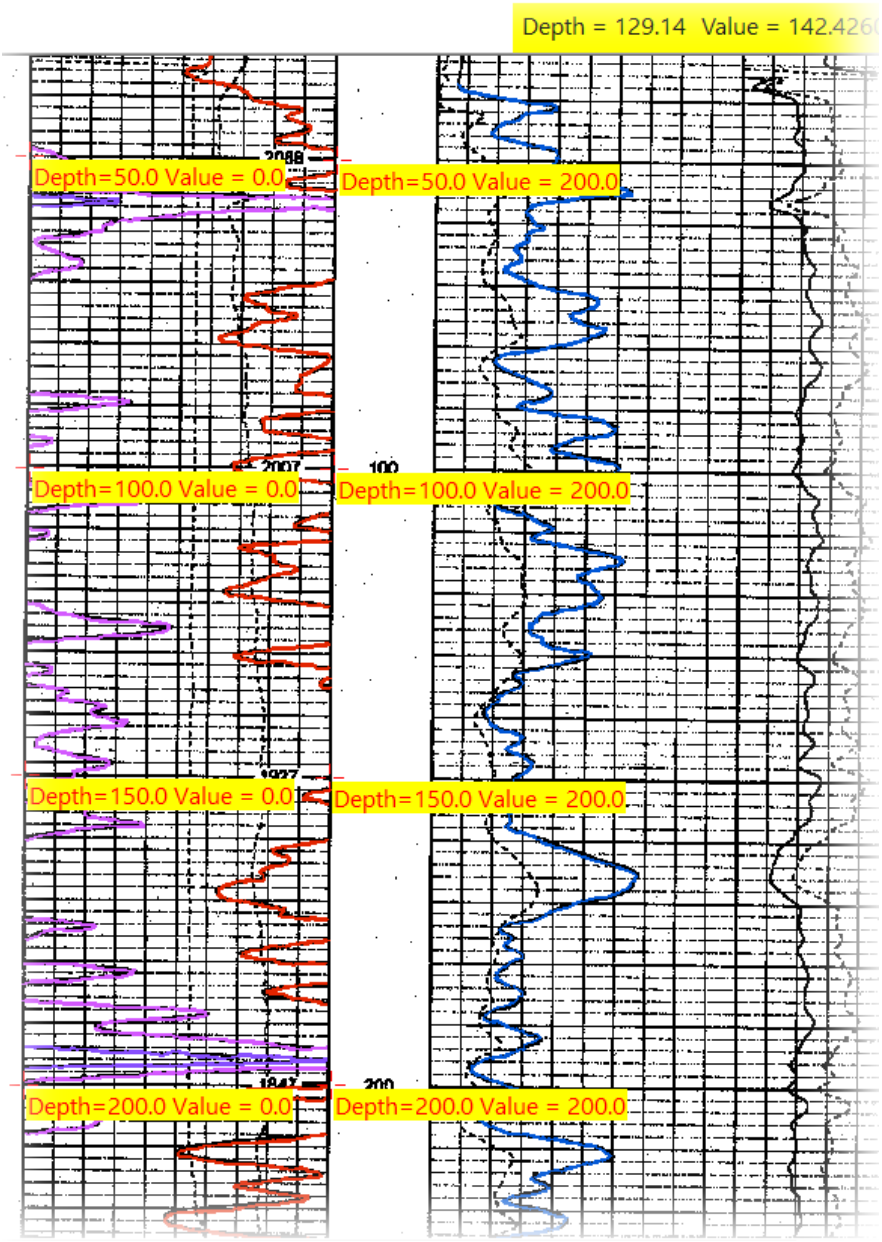

Figure 7

As with the four-point calibration, it is a good idea to move the cursor around the log and compare the cursor location within the Depth and Value listing within the upper-right corner of the dialog box to make sure that the log was correctly calibrated.

- The *Clip Output* option provides a way to only extract points that are within a user-defined depth range.

- The *Save as P-Data* option will convert the pixel locations that correspond to the selected *Color* to their respective depths and values (based upon the calibration) and save these points to the designated *P-Data Track* for the designated *Borehole ID* within the RockWorks borehole database. The option to *Backup* the database is there to serve as insurance just in case one of the following mistakes were made;

    - The wrong *Color* was selected.
    - The *Logarithmic* option was selected even though the horizontal scale was linear or vice-versa.
    - The log was improperly calibrated.
    - The wrong *Borehole ID* was selected.
    - The wrong *P-Data Track* was selected.

In a similar vein, the Display Confirmation option will summarize the settings and provide a last-chance to cancel the export and correct the settings. There are a lot of "moving parts" involved with the conversion of raster logs to P-Data and the potential to make mistakes is high. Pausing and thinking before proceeding will eliminate the tedium of restoring the database from a backup copy.

- The *Save as CSV* option will output the depth and value data into an Excel-compatible file for subsequent import into other programs (e.g., LogPlot).

- The *Sampling Method* (Figure 8) determines how the program will deal with sub-horizontal curve segments that intersect the scanlines ambiguously.

Figure 8

Here's how it works. The program scans each row of a raster image starting from the topmost row and proceeding downward to the bottommost row. For each row, the program scans from the leftmost pixel to the rightmost pixel. If the program encounters a pixel whose color is identical to the specified color of interest, the program keeps track of the left most and rightmost occurrences of that particular color.

- If the *Leftmost* option is selected, the program will convert the leftmost pixels' location to a depth and a value.
- If the *Rightmost* option is selected, the program will convert the rightmost pixels' location to a depth and a value.
- If the *Midpoint* option is selected, the program will convert the midpoint between the leftmost and rightmost pixels to a depth and a value.

These options provide a way to select how the program will handle thick, sub-horizontal line segments within the raster images. In the example shown below (Figure 9), one row of pixels (the green scanline) intersects 12 pixels within the red curve. If the *Leftmost* option is selected, the program will use the leftmost pixel as the depth/value point. The *Rightmost* option will use the rightmost pixel. The *Midpoint* option will use the midpoint between the leftmost and rightmost pixels.

Figure 9

When in doubt, use the *Midpoint* option.

- The **Remove Ambiguities** option (Figure 10) is used to fix errors whereby; when curves go off-scale and wrap, spikes may appear within the output due to overlap (i.e., portions of two curves occupying the same row of pixels). As a consequence, erratic spikes may occur within the output inside the overlapping zone.

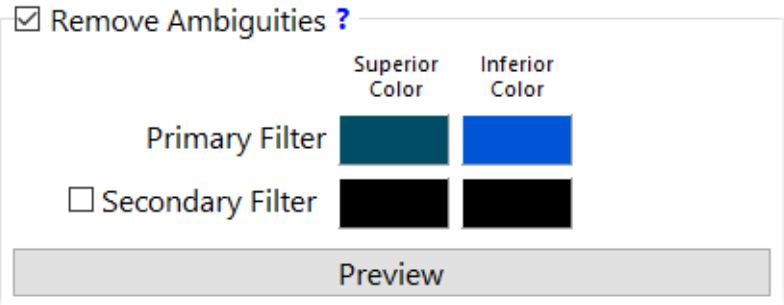

Figure 10

The *Remove Ambiguities* option will temporarily change the overlapping zone within the *Inferior* curve to white (Figure 11) thereby removing the erratic spikes.

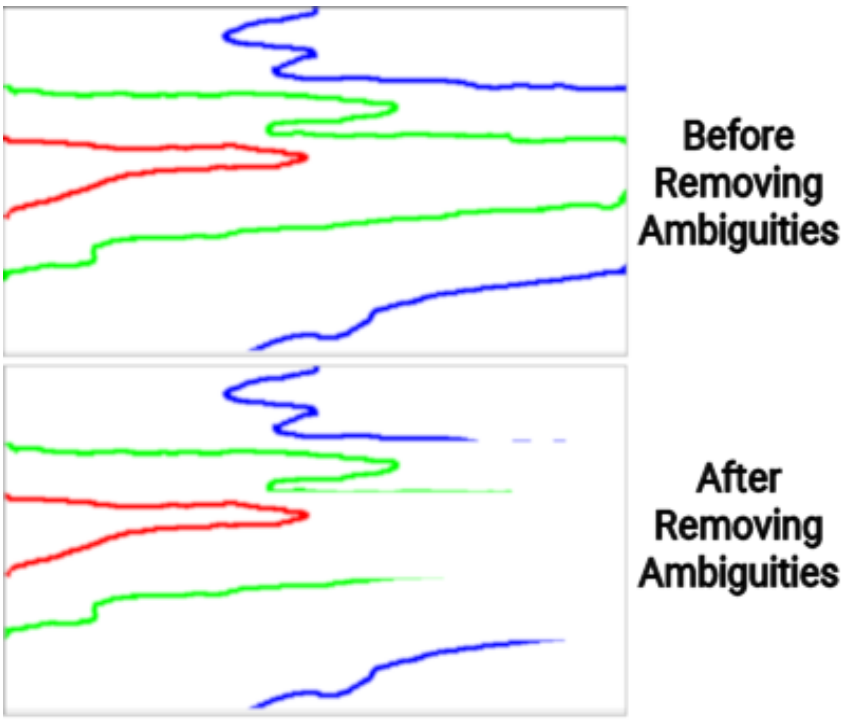

Figure 11

Caveats

- Each curve **must** have a unique color.

- **Most raster logs have non-linear vertical scales**. This is caused by a variety of factors including;

    1. Differential stretching and contraction of the original paper log that was scanned due to humidity and dryness.
    2. Changes in the speed of the rollers on the sheet feeder.
    3. Scanner operator mistakes (e.g., trying to adjust the feeding angle by tugging on a corner of the log).

    As a consequence, it is rarely the case that an entire log can be scanned based on just four calibration points. The solution is to use the Interval-based calibration.

- **REMEMBER!** Test the calibration by moving the cursor and make note of the blue *Cursor Coordinates* located within the upper-right corner of the menu. If they're not correct, then something is wrong and merits investigation.