The Cellpro Multi4 Charger
And Custom Fuel Tables
Document Updated 02/03/09

From the FMA Direct website under FAQ:

What is Fuel Gauging and how is it improved on the Multi4?

Fuel Gauging is a technology pioneered by FMA. As a lithium battery charges, the plot of voltage vs. capacity during a charge (or discharge) is very predictable and repeatable. FMA took advantage of this phenomenon to enable our chargers to notify the customer of the capacity that remains in the battery soon after it is connected to the charger. As charging progresses, the charger closely monitors this fuel level and improves the accuracy of the fuel level reading. Additionally, fuel gauging technology is what allows us to offer AUTO charge modes. As the charger monitors the capacity of the battery increasing over the charge process, it can adjust up or down the charge rate to closely match the ideal charge rate selected. For example, if an AUTO charge setting of 1C was initiated on a 2000 mAh battery, the charger will gradually ramp up the current. As it does, it watches the capacity increase by carefully monitoring the battery's voltage. Within 20 minutes or so, the charger knows the capacity of the battery to within about +/- 10% accuracy. So it will charge the 2000 mAh at 2A as it should without the user ever entering a charge rate. The advantage is that if the customer has multiple batteries with varying capacities, or does not know the capacity of the battery, the charger will choose the ideal charge rate automatically. But Fuel Gauging technology has some limitations. As newer lithium batteries began to emerge with newer chemistries and higher C discharge rates, the charge curves began to change. The accuracy of the fuel gauge did not match the single fuel table the older charges held. So, with the Multi4, each preset can be designed and optimized for a specific chemical composition, brand, or C rate discharge. This way, whenever the customer is charging brand X lithium, he calls up the brand X preset and the corresponding fuel gauge readings and AUTO mode charging will be highly accurate. Additionally, by using the CCS to monitor a single charge with a charge rate set manually to 1C and recording the data, the CCS can then "learn" the actual fuel table values for the particular battery type. Using simple tools in the CCS, this fuel table can then be extracted from the data file and imported into the current selected preset. From this point forward, this preset will always charge this type of battery properly in AUTO mode.

Tutorial for creating a custom fuel table and applying it to a newly created preset:

The following instructions assume you own a Cellpro Multi4 charger, the PC interface, and that you have loaded the Cellpro Multi4 Charge Control Software (CCS) onto your Windows based PC. Furthermore, these instructions assume you understand the fundamentals of operating the charger and the CCS. For additional information, please check the following links:

Charger Promo Page:
 http://www.fmadirect.com/new_applications/multi4.html

Cellpro Multi4 Charge Control Software Install Page:
http://www.fmadirect.com/new_applications/software/Multi4_software.html

Cellpro Multi 4 Charger Manual:
http://www.fmadirect.com/support_docs/item_1271.pdf

The following instructions assume you will be using the Charge Control Software exclusively to perform this procedure. Some steps can also be performed at the charger. For this example, we will utilize one of the EMPTY presets in the user bank to create a new preset. We will begin by copying an existing preset which most closely resembles the custom preset we are striving to create.

1. Launch the Multi4 CCS and check to see that the software is communicating properly with the charger. "Waiting to Start" should appear at the top of the CCS program window. The presets and options should upload from the charger into the CCS options and presets tabs.
2. Activate the tab "Presets" to see the list of charger user presets and library presets. All of your work will be done in the user preset bank as the library presets can not be altered by the customer unless or until they have been copied into the user preset bank.
3. Click in an empty preset title field from within the 25 user preset bank.
4. Make sure the checkbox titled "Advanced Properties" above the preset list is checked.
5. From the main menu, choose File > FMA Library Presets > Open File to Preset # (where # would equal the preset number of the empty preset you selected).
6. Navigate to the folder that contains the preset most closely resembling the new preset you will create. For example, if you want the most accurate charge possible with a 1C AUTO charge as the default, then locate the preset file "LiPo Generic Accurate Charge" in the folder titled "Generic LiPo". For detailed information about the available user presets that come with the Multi4, check the Cellpro Multi4 manual.
7. In the selected preset title field, highlight and re-name the preset to match the battery which requires a custom fuel table. For convenience, the carrot above the preset name field shows you where the name will be broken on the charger's 2 line, 16 character LCD when the charger scrolls the information.
8. Next, click the Charge tab in the preset parameters pane to the right of the preset list.
9. In order to generate a custom fuel table for the new preset, you must first charge the battery that will utilize the new preset at a manual 1C charge rate. Therefore, click the pull-down next to the parameter titled "Auto Chg. Rate" and select the parameter "Manual Charge".
10. Next, calculate the correct manual charge rate setting for the battery in question. Let's say the battery has a capacity of 2100 mAh. A 1C charge rate for this battery would be equal to (1 x the capacity), but expressed in either milliamps (mA) or amps (A). So in the Charge Amps parameter, pull down and select 2.1A because (2100 mAh x 1 = 2100 mA or 2.1A). There are 1000 mA in 1A. If the exact current is not available, use the next closest value; higher or lower.
11. Click the "Update Charger" button below the preset list. The charger will beep when the preset is saved to the charger and "Saving Presets….done" will appear near the bottom of the CCS program window.
12. Make sure the battery is discharged, then attach it to the charger's output and start the charge. If you do not know how to start a charge, refer to the charger's manual.
13. Once the charge is initiated, the File Save dialog box will open. Choose a name for the data file that you are about to record and save it to your hard drive in a location where you will be able to find it later. During the charge process, you may select other tabs and view information or data graphs as the charge progresses.
14. Allow the charger to finish the manual rate charge on the battery. The charger will display DONE on the LCD. If you do not allow the charge to complete, the procedure will fail when you attempt to import the fuel table data.
15. Make sure that the new preset is highlighted in the preset tab of the CCS.
16. From the CCS main menu, choose File > Import Fuel Table to Preset # (where # would equal the preset number of the newly created preset which is highlighted) > Import Fuel from a

Manual Current 1C Charge Graph… Navigate to the folder where you stored the 1C manual charge data, and select the file.

17. The new fuel data will be derived from the data file you created. The data points are stored in the new preset and can be seen in the Fuel tab. If you receive any errors, click the errors tab, check the error, then double click on the error. The CCS will automatically take you to the parameter which requires adjustments.

18. Return to the Charge tab and choose 1C from the "Auto Chg. Rate" parameter pull-down.

19. Click the Update Charger button to save the new custom preset with custom fuel table to the charger.

20. With the new preset highlighted in the Preset tab, From the CCS main menu, choose File > Save Preset # to File… choose a location on your hard drive to store the preset and choose "Save". This way, if you ever need to restore factory defaults on the charger, you can easily re-load the custom preset you just created.

21. Discharge the battery again and re-charge it using the new preset but this time with AUTO mode selected. Whether AUTO is set for 1C, 2C or 3C, the AUTO mode should now choose the charge rate more accurately than it did using a Generic preset. Fuel readouts should also track better. As long as the chemical composition of the battery is the same among various packs you have, this new preset should handle AUTO charge properly for any capacity pack you attempt to charge. However, bare in mind that just because brand X 800 mAh pack charges great on the new preset, brand X 3200 may come from a different LiPo vendor. The name on the battery does not necessarily mean the chemical composition are the same. For more information about the expected accuracy and charging characteristics, refer to the Multi4 manual.

22. If you need to create other new presets which utilize the custom fuel table you just created, you can also import the fuel table data directly from the new preset you just created as opposed to the original data file. The preset containing the custom fuel table needs to have been previously stored on the computer hard drive as we did in step 20 above. Highlight the preset that you wish to copy fuel table data to, then from the CCS main menu choose File > Import Fuel Table to Preset # > Import Fuel from another Preset File… Locate the preset file containing the custom fuel table data, and choose "Open".

This concludes our tutorial on creating new presets, creating custom fuel table data files, and applying custom fuel table data to presets.