



CONFIGURING THE WS500 REGULATOR WITH THE WAKESPEED FILE TRANSFER UTILITY



Wakespeed's WS500 Advanced Alternator Regulator provides onboard support for multiple battery technologies, via selectable DIP switches, including standard flooded (thin plate) and deep cycle flooded, Gel, standard AGM, Battle Born Li-Ion, high-density AGM, and LiFePO₄.

In addition, the WS500 offers the ability to upload pre-engineered configuration files for a growing number of battery brands and chemistries, based on the battery manufacturer's charging recommendations by using the Wakespeed File Transfer Utility. This can also be done using the Free Wakespeed Configuration App available on both Android and IOS devices.

With the use of a Windows PC and a Type B USB cable, these configuration files are downloadable from the Wakespeed website or app, and uploaded to the WS500 Regulator. Configuring the regulator does not require that the WS500 is installed in the vehicle or vessel. Software and firmware upgrades can be done anywhere.

The following guide is designed to walk the installer or end user through the upgrade/configuration process.

These items are necessary for the upgrade process:

- Windows-based computer with available USB port
 - Access to the internet to download configuration .ZIP files
 - High-quality Type B USB cable
 - Phillips hand or cordless screwdriver
-



GETTING STARTED

Configuration/firmware upgrade files are included in a .ZIP folder, which may be downloaded from the Wakespeed website, or may be received from your Wakespeed dealer as a link or email.

For the sake of illustration, we'll look at a configuration update file from the Wakespeed website. Configuration files are accessed on the website's Technical page. Under the table header "WS500 Configuration Files" is a list of available files, broken down by manufacturer and product series.

When the desired battery profile is found, click on the hyperlink. A .ZIP folder will be downloaded to your computer. Drag the .ZIP file to your desktop and double-click to extract the folder. Inside that folder will be all of the components required to upgrade your regulator's battery configuration.

Note: Your Windows computer should automatically update the drivers required to support the Wakespeed File Transfer Utility, particularly if you are connected to the internet. If your computer will not allow you to open the utility, it may be necessary to upgrade your driver file. Driver files can be downloaded from Wakespeed's Technical page.

PREPARING THE WS500 REGULATOR

Place the WS500 Alternator Regulator on your work surface and carefully unscrew the four retaining screws on the top of the regulator. The screws don't need to be completely removed from the lid.

When they have been sufficiently loosened, the regulator's lid will lift off. The lid may need to be wiggled as it's lifted to free the sealing gasket.

Remove the regulator's lid and place out of the way.

The open regulator box will provide access to the Type B USB port and RESET button.

The USB connector is scaled for use with a standard Type B USB cable. Use a high quality cable that's as short as possible. Disconnecting other USB cables from the computer will ensure faster configuration.

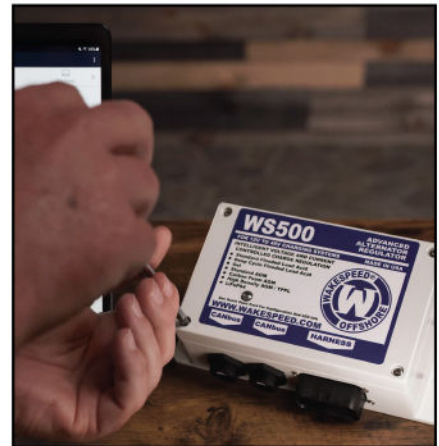


Figure 1 - Unscrewing regulator lid



Figure 2 - Removing the regulator lid



RUNNING THE NEW CONFIGURATION PROGRAM

Once the desired battery configuration profile is found on the Wakespeed website, and is downloaded to your computer, it should be placed on the computer's desktop.

Depending on the Windows system being used, double click the .ZIP file, or right click and select Extract, to provide access to the contents of the Configuration folder.

The Configuration folder shown in this example would be optimized for use with MG Energy LFP-Series batteries. Filenames indicate the brand and battery series, as well as the file revision number.

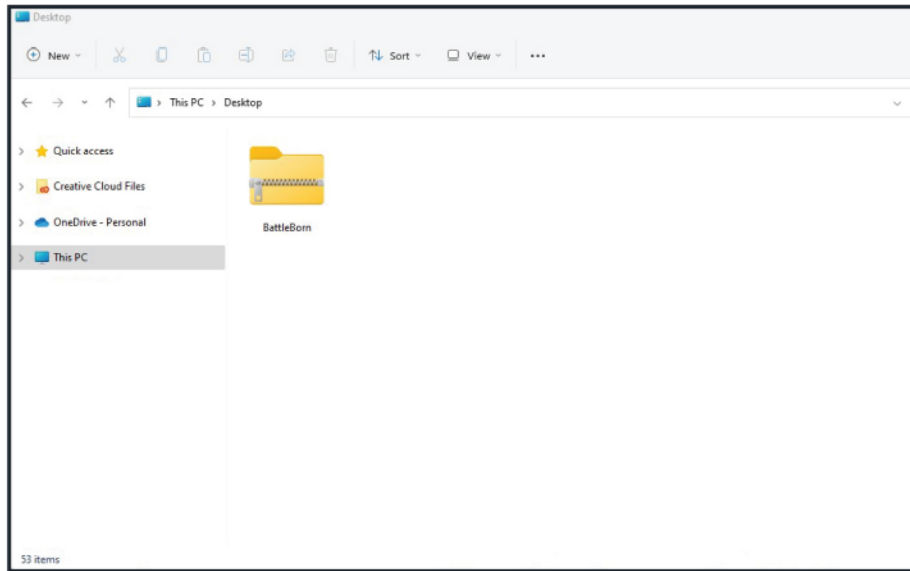


Figure 3 - Shows configuration .ZIP file on Windows

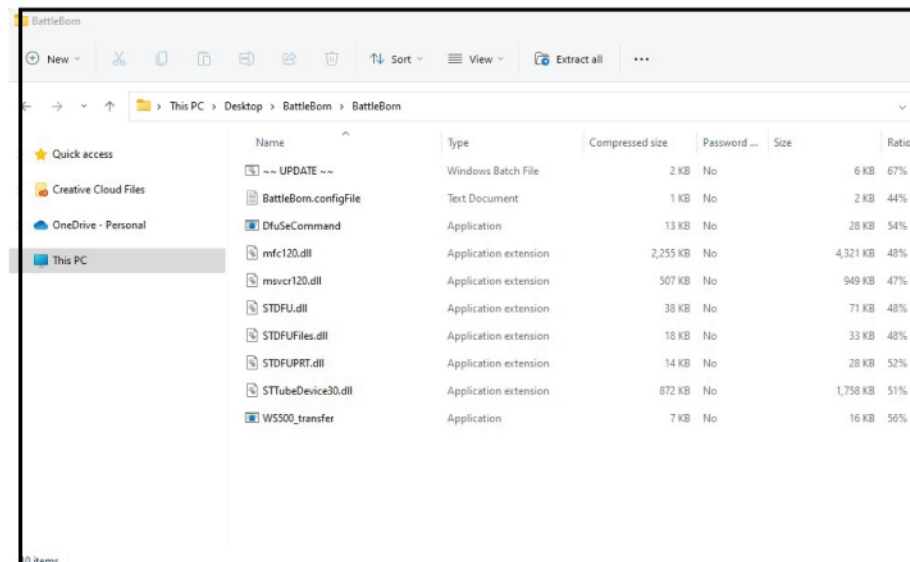


Figure 4 - Shows contents of the configuration folder



RUNNING THE NEW CONFIGURATION PROGRAM

The Configuration folder provides all of the files required to update the regulator's firmware, and customize the battery program profile, CAN configuration for BMS (if used), and alternator configurations.

To begin the configuration process:

1. Double-click the file labeled **Update.bat**. This will open the window which will guide you through the firmware update and upload of the configuration parameters for the battery type selected. In some Windows environments, there may be a message indicating that Windows is not allowing the batch file to be opened. This can be overridden by clicking the "More info" link and clicking on the "Run anyway" button on the next window.



Figure 5 - Type B USB connector & reset button

2. A new window will open on the desktop, providing step-by-step configuration instructions. See Figure 8 on the following page for an example of the configuration window.

3. Carefully connect the Type B USB connector to the USB plug on the regulator's circuit board.

4. See Figure 5 for the location of the USB plug and reset button. The Type B USB cable will provide power for the regulator's processor during the configuration process.



Figure 6 - Type B USB cable connected

Name	Date modified	Type	Size
UPDATE.bat	9/30/2022 10:11 AM	Windows Batch File	6 KB
BattleBorn.configFile	9/30/2022 10:11 AM	Text Document	2 KB
DfuSeCommand	9/30/2022 10:11 AM	Application	28 KB
mfc120.dll	9/30/2022 10:11 AM	Application extension...	4,321 KB
msvcrt120.dll	9/30/2022 10:11 AM	Application extension...	949 KB
STDFU.dll	9/30/2022 10:11 AM	Application extension...	71 KB
STDFUFiles.dll	9/30/2022 10:11 AM	Application extension...	33 KB
STDFUPRT.dll	9/30/2022 10:11 AM	Application extension...	28 KB
STTubeDevice30.dll	9/30/2022 10:11 AM	Application extension...	1,758 KB
WS500_transfer	9/30/2022 10:11 AM	Application	16 KB

Figure 7 - Close-up of contents in the configuration folder

5. The configuration program will update the regulator's firmware before installing the configuration files. To start the firmware upgrade, press and hold the reset button for five seconds and release.

6. Press any key on the computer's keyboard after releasing the reset button. This will begin to test and install the newest version of the regulator firmware.

7. The batch file window (as shown in Figure 10) will upload firmware to the regulator, and verify the upload.

8. If the configuration window indicates that the firmware has been successfully loaded and verified, press and release the regulator's reset button.

9. Count to five, then press any key on the computer's keyboard to load the configuration file for your battery type.

10. As shown in Figure 11, the program will upload the ASCII commands into the regulator's processor. When the new configuration is successfully loaded into the regulator, the batch file window will indicate "Finished". Note that in Figure 11, the computer tried multiple ports before successfully connecting with the regulator.

Disconnecting any unused USB devices from the computer will minimize these error messages. Press any key to exit the program.

11. Carefully disconnect the Type B USB connector from the regulator.

```

This single batch file will upgrade your above Advanced Alternator regulator's firmware
and load a configuration into it. You will need to remove the big issue of the
regulator and connect this computer via a cable to the USB port on the regulator's board.

The Regulator will update the firmware to version: 00100-00002.1.1
and be loaded with the configuration contained in: REG_1.0.0.config\file.txt

First the Firmware will be updated.
Connect a USB cable to target regulator and computer.
(If it is best if the regulator is the ONLY device connected to
this computer. If you receive errors, try removing any other
device plugged into a USB port and restarting this update batch file)

Then press-and-hold the RESET button on the regulator for 5 seconds

Once that is done
Press any key to continue . . .

Uploading firmware
(If you receive a "Missing scf\bin.dll" error message, please download and install
the Microsoft SC Runtime package from here:
https://www.microsoft.com/en-us/download/details.aspx?id=48704 )

(Initiate) Found 1
Device [1]: STM Device in RSP Mode, having [2] alternate targets
Target 00: Upgrading - Download Phase (100)...Duration: 00:00:00
Upgrade successful 1
Target 00: Uploading (100)....
Verify successful 1

Finished.

Verify upgrade completed without errors.

Now the configuration will be loaded into the regulator.
Press-and-release the RESET button on the regulator to return to normal mode.

Once that is done, count to 5 and then
Press any key to continue . . .

```

Figure 10 - Batch file window. Showing firmware update.

```

C:\Users\james\Documents>
naming configuration.

canning i2c ports, looking for the regulator.

going to try uploading to port COM0:

file from the w5500 file transfer utility

sending ASCII file: M03_1.0.0.configfile.txt
to regulator using a USB connection via the COM0 port.
USB port was opened successfully.
sorry, seems the regulator is not listening at the moment. Please check connections and try again.

[BACK] EXIT: failing to try uploading to port COM0:

file from the w5500 file transfer utility

sending ASCII file: M03_1.0.0.configfile.txt
to regulator using a USB connection via the COM0 port.
USB port was opened successfully.
sorry, seems the regulator is not listening at the moment. Please check connections and try again.

[BACK] EXIT: failing to try uploading to port COM0:

file from the w5500 file transfer utility

sending ASCII file: M03_1.0.0.configfile.txt
to regulator using a USB connection via the COM0 port.
USB port was opened successfully.

sending: TX0A: 0,100,0,70,0,50,0,0,0,10000,0,0,0,0,0
sending: TX0B: 14,3,50,0,0,0
sending: TX0C: 0,0,0,0,0,0,0,0,0,0
sending: TX0D: 11,1,0,0,0,0,0,0,0,0,0,0,0,0
sending: TX0E: 15,5,15,0,0,0,0,0,0,0,0,0,0,0,0,0
sending: TX0F: 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
sending: TX0G: 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
sending: TX0H: 0,0,0,1,0,0,0,0,0,0,0,0,0,0,0,0

[! done] Resetting the regulator
thank you for using the w5500 file transfer utility.

[exited,

verify the configuration completed without errors and once done
W5500 file transfer utility

```

Figure 11 - Batch file window. Showing configuration update.

MODIFYING THE CONFIGURATION PROGRAM

While the downloaded .ZIP file is designed to fit a broad range of applications, there may be certain values that the installer or user may want to modify. The following instructions are intended to provide guidelines for some of the more commonly changed values, additional information is provided in the **Communication and Programming Guide** that's available on the Wakespeed website.

In most instances, the installer/user will consider adjusting four main values in the configuration code:

- The alternator temperature set point
- The duration of the warm up delay
- The percentage of alternator de-rate
- The actual capacity of the batteries being charged

ACCESSING THE CONFIGURATION FILE

Within the .ZIP file is the folder containing the data and Wakespeed File Transfer Utility required to update the regulator's firmware and charging profiles. Within the folder is a .txt file which contains the ASCII strings required to control the regulator's behavior.

The .txt. can be opened with a standard text editing application . To access the text file:

1. Open the folder extracted from the .Zip file downloaded from the Wakespeed Configuration table on the Wakespeed website.
2. Using your preferred text editing or terminal console, open the file in the folder with the .txt suffix.

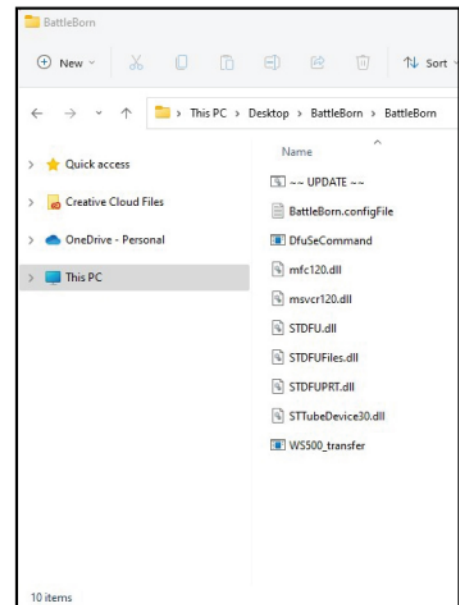


Figure 12 - Location of .txt file in configuration folder.

MODIFYING A CONFIGURATION FILE

The configuration text file contains a string of command lines; each that modifies the behavior of the WS500 to optimize control of the alternator to match the needs of the batteries and charging system.

The .txt file shown in Figure 11 is a good example of a typical configuration file. In most cases, the file will provide all the settings the regulator requires to provide a safe, effective profile for charging.

On the following several pages, we'll look at the actual text file for a Lifeline AGM battery, and consider some of the values that the user may want to alter to best support his or her specific application. Note that in most cases, the only values which may need modification are battery capacity, target alternator temperature, percentage of alternator de-rate, and the duration of the start delay and charge ramp. Other configuration values should be modified with caution.



Note that configuration files are carefully designed, based on testing and manufacturer charging recommendations. Improper modifications can result in damage to the batteries, regulator and alternator. DO NOT attempt to modify the configuration file if you are not familiar with this process. Failure to properly follow guidelines may void your warranty and damage your system.

The configuration file broken down in the next several pages is intended to provide a generalized look at how the code is laid out. Note that different battery types, different alternator types, battery capacity, and additional components like battery BMS units may require command lines not shown in this example.

The Wakespeed Communication and Configuration Guide, which can be downloaded from the Technical Page at www.wakespeed.com, provides a complete list of available command lines, which can be used to modify the behavior of the WS500 Alternator Regulator.

If your battery, BMS, or alternator type are not supported by an existing command line, you may find a configuration file for a similar application and modify it to support your needs. For additional assistance, contact support@wakespeed.com.

IMPORTANT: The following information is provided to describe the numerous user-configurable features available in the WS500 regulator. We have highlighted the four most commonly adjusted values in the example. Those values are displayed in RED. For more information about advanced user configurations, please refer to the Wakespeed Communication and Configuration Guide, which can be downloaded in PDF format from the Technical Page at www.wakespeed.com.



TRANSLATING THE .TXT PROFILE

When opened in a terminal program or text editor, the Lifeline Standard AGM program will appear as follows:

```
#
# Lifeline AGM config file
#
# Based on details in: Lifeline Technical Manual, rev E
#
# Date: 3/17/2020
#
# Lifeline standard
# 100c alternator
#
# Lifeline AGM
$SCA: 0,100,1.00,0.75,0.50,0,0,0,10000,0,0,30,0@
$CPA:7 14.3,360,3,0@
$CPO:7 0, 0, 0.0, 0@
$CPF:7 13.3, -1, 0, 0, -50, 12.5, 0@
$CPE:7 15.5,25,600,0@
$CPP:7 0,0,0,0,0,0@
$CPB:7 0.022, -30, -40, 71, 0.0, -99, -99, 15, 2000@
$SCN: 0,Lifeline,1234@
$SCO: 0,0,0,0@
```

IMPORTANT: The following information is provided for reference, and is intended to provide guidance required to tailor the configuration profile to your system. Commonly adjusted settings are highlighted in RED. Please refer to the Wakespeed Communications and Configuration Guide for detailed configuration instructions.

Each line of the .txt file provides commands and values specific to various aspects of the charge program. The first line of code, designated as \$SCA, changes the parameters of the alternator in the table of system configurations. Meanings for the values are as follows (note that values are delineated by commas):

\$SCA: 0,100,1.00,0.75,0.50,0,0,0,10000,0,0,30,0@

1. Factory use only
2. Alternator target temperature (°C) – Temperature regulator will attempt to maintain at alternator temperature sensor. Contact your alternator manufacturer for recommended temperature setting and sensor location. For added system safety, consider setting your value 10-20 degrees below the manufacturer's recommendation.
3. Alternator Derate (Normal) – When no derate modes are selected.
4. Alternator Derate (Small Alternator Mode) – When DIP Switch #8 is selected.
5. Alternator Derate (Half Output) – Selected when alternator temperature sensor wires are shorted.
6. Pull Back Factor (PBF) – Reduces field at idle (Set "0" to disable) (Set "1" to enable).
7. Amp Cap – (-1 - 500) Allows maximum amperage limit if current shunt is connected.
8. System Watts Cap – (-1 - 20000) Limits maximum wattage.
9. Amp Shunt Ratio – Indicates the current shunt's ratio (Amps/mVolts) Default setting is for a 500A/50mV shunt (500/0.050=10000)



10. Shunt Reversal – Allows user to compensate if a shunt is installed backward. “0” is normal polarity. “1” will reverse the polarity of the readings.

11. Idle RPMs – Used in conjunction with Pull Back Factor (PBF). Determined in whole numbers (0 - 1500). Default zero setting enables regulator to automatically determine idle RPM.

12. Warmup Delay – Determined in whole numbers (15 - 600), controls the number of seconds the regulator will wait before moving into ramp mode.

13. Required Sensors – Determined in whole numbers (0 - 255) controls regulator response to missing alternator temperature, battery temperature and current sensors. Default value is “0”. See Communication and Configuration Guide for detailed programming instructions.

The second line of code, designated as \$CPA, updates the parameters of the ACCEPT (and BULK) portions of the charge profile. Meanings for the values are as follows (note that values are delineated by commas):

\$CPA: 7,14.3,360,3,0@



1. Charge Profile Table Entry – Identifies the Profile number being modified by the new configuration. Select 7 or 8.

2. VBat Set Point – Identifies the voltage set point that the regulator will use during the Acceptance phase of charging. Value is a floating point number, and is entered for a normalized 12V system.

3. Exit Duration – Value represents the timer duration between entry into acceptance and exit to over-charge phase. Setting the value at “0” will disable time-based exiting and will activate current-based monitoring. Range is 0 - 600 (10 hours).

4. Exit Amps – Represents the minimum amperage allowed before regulator advances from acceptance to over-charge. Range is whole numbers -1 - 200. See Communication and Configuration Guide for details on special settings.

5. Factory Only

The third line of code, designated as \$CPO, updates the parameters of the OverCharge (or finish) portion of the charge profile. Meanings for the values are as follows (note that values are delineated by commas):

\$CPO: 7,0,0,0.0,0@



1. Charge Profile Table Entry – Identifies the Profile number being modified by the new configuration. Select 7 or 8.

2. Limit Amps – After entering over-charge, the delivered amps will be monitored and regulate to the value set. Range is 0 - 50. Zero setting will disable over-charge mode.

3. Exit Duration – Value represents the timer duration between entry into over-charge and exit to float. Setting the value at “0” will disable time-based exiting and will activate current-based monitoring. Range is 0 - 600 (10 hours).



4. Exit VBat – Represents the minimum amperage allowed before regulator advances from acceptance to over-charge. Range is floating point numbers 0.0 - 20.0. Setting Exit V Bat at zero will disable over-charge mode.

5. Exit Amps – Ranging in whole numbers from 0 - 50, this value will keep the regulator in over-charge until acceptance current falls to or below the set value. A zero setting will disable this option.

The fourth line of code, designated as **\$CPF**, updates the parameters of the **Float** portion of the charge profile. Meanings for the values are as follows (note that values are delineated by commas):

\$CPF: 7,13.3,-1, 0, 0, -50, 12.5, 0@

1. Charge Profile Table Entry – Identifies the Profile number being modified by the new configuration. Select 7 or 8.

2. VBat Set Point – Floating point value (0.0 - 20.0) for target float voltage in a normalized 12V system.

3. Limit Amps – After entering float, the delivered amps will be monitored and regulate to the value set. Range is 0 - 50. Zero setting will disable over-charge mode.

4. Exit Duration – Whole number (0 - 30000) controls timer duration once float stage is started. A "0" will cause the regulator to remain in float until triggered by other exit criteria.

5. Revert Amps – Whole number (-300 - 0). Value of negative current, indicating large system load, will cause regulator to revert to restart charge cycle. "0" will disable feature.

6. Revert Amps-Hours – Whole number (-250 - 0). Indicates accumulated number of amp hours removed from the battery to restart charge cycle. "0" will disable this feature.

7. Revert Volts – Floating point value (0.0 - 20.0) establishes low voltage in float which will cause regulator to revert to restart charge cycle. "0" will disable this feature.

8. Revert SOC – Whole number (0 - 100). Will restart charge cycle from float if BMS or other RBM indicates drop below battery SOC level. "0" will disable this feature.

\$CPE: 7,15.5,25, 600, 0@

1. Charge Profile Table Entry – Identifies the Profile number being modified by the new configuration. Select 7 or 8.

2. VBat Set Point – Floating point value (0.0 - 20.0) for target equalization voltage in a normalized 12V system.

3. Maxs Amps – Whole number (0 - 50). Caps the allowable amps in equalization mode. "0" will disable this feature.

4. Exit Duration – Whole number (0 - 600 (10 hours) controls duration regulator will remain in equalization mode, at which point the regulator will return to float voltage. "0" will disable this feature.

5. Exit Amps – Whole number (0 - 50) Controls minimum delivered current level before regulator exits equalization to float. "0" will disable this feature. Note: operator is required to ensure that engine is kept at sufficient RPM to enable delivery of necessary current



current to complete equalization, prior to returning to float mode.

The sixth line of code, designated as **\$CPP**, updates the parameters of the **Post Float** portion of the charge profile. Meanings for the values are as follows (note that values are delineated by commas):

\$CPP: 7,0,0.0, 0, 0.0@

- 1. Charge Profile Table Entry** – Identifies the Profile number being modified by the new configuration. Select 7 or 8.
- 2. Exit Duration** – Whole number (0 - 30000 (500 hours) controls timer duration once post float stage is entered. When the end of the timed period is reached, the regulator will loop back to bulk mode. Zero value will cause regulator to remain in Post Float until triggered by another exit criteria.
- 3. Revert VBat** – Floating point number (0.0 to 20.0) designates the minimum Post Float voltage, below which the regulator will be triggered to return to bulk mode. 0.0 setting disables this feature.
- 4. Revert Amp-Hours** – Whole number (-250 to 0) determines the accumulated number of amp-hours removed during Post Float which will cause the regulator to return to re-start a charge cycle and return to bulk mode. Setting the value at zero will disable this function.
- 5. VBat Set Point** – Floating point number (0.0 to 20.0) designates the target voltage used during Post Float mode. Setting at 0.0 will disable charging during Post Float mode.

The seventh line of code, designated as **\$CPB**, updates the battery parameters of the regulator's charge profile. Meanings for the values are as follows (note that values are delineated by commas):

\$CPB: 7,0.022,-30, -40, 71, 0.0, -99, -99, 15, 0.0@

- 1. Charge Profile Table Entry** – Identifies the Profile number being modified by the new configuration. Select 7 or 8.
- 2. VBat Compensation** – Floating point value (0.0 - 0.1) adjusts a VBat voltages based on measured battery temperature. Normalized 12V system with zero correction at 25°C. "0.0" will disable temperature-based voltage compensation.
- 3. Minimum Compensated Temperature** – Whole number (-40 - 40). Additional voltage compensation will be discontinued when measured battery temperature is below value chosen. Measured in °C.
- 4. Minimum Charge Temperature** – Whole number (-50 - 10). Charging will be discontinued when measured battery temperature is below value chosen. Measured in °C.
- 5. Maximum Charge Temperature** – Whole number (20 - 95). Charging will be discontinued when measured battery temperature exceeds value chosen. Measured in °C.
- 6. RDC Volts** – Floating point value (0.0 - 12.0) regulator will work in Reduced Charge mode where maximum current delivered will be limited to RDC amps. "0.0" will disable this feature.



7. RDC Low Temperature – Whole number (-99 - 20). If battery temperature drops below the set value in °C, the regulator will work in Reduced Charge mode. "-99" will disable this feature.

8. RDC High Temperature – Whole number (-99 - 95). If battery temperature exceeds the set value in °C, the regulator will work in Reduced Charge mode. "-99" will disable this feature.

9. RDC Amps – Whole number (0 - 100). When the regulator is in Reduced Charge mode, acceptance current will be limited to the set number. "0" will disable this feature.

10. Maximum Battery Amps – Whole number (0 - 2000). Maximum current allowed to flow into the battery. This value is set relative to the 12v/500A 'nominal' battery and it is also adjusted by the Battery Capacity Multiplier; so a value of 250 would cause the regulator to limit charging current to a 0.5c rate. "0" will disable this feature.

\$SCN updates the name and password of the regulator. In CANbus communication, the regulator name acts as an identifier of the regulator within the CAN network. Meanings for the values are as follows (note that values are delineated by commas):

\$CPB: 0,Lifeline,1234@



1. Reserved – Set at "0".

2. Regulator Name – Up to 18 characters with no spaces, commas, or "@". This name is used for a CAN ID, and may be used to individual regulators in twin engine or other multi-alternator applications.

3. Regulator Password – Up to 18 characters with no spaces, commas, or "@".

\$SCO overrides the DIP switches for Charge Profile and Battery Capacity settings, and allows the auto-detect for system voltage to be overridden. Values are as follows:

\$SCO: 7,0.0,0.0,0@



1. Charge Profile Index – Whole number (0 - 8). Determines charge profile used. Zero setting allows DIP switches to be used for charge profile selection.

2. Battery Capacity Multiplier Index – Floating point number (0.0 - ±10.0) sets the multiplier for a normalized 500AH battery bank. Multiplier can be determined by dividing actual battery capacity by the normalized value. As an example, if the battery capacity is 750 amp hours, the BC Index should be set at 1.5.

3. SV Override – Floating point number (0.0 - 4.0). This override allows the regulator to be used in other systems not supported by the auto-detect feature. To determine the SV multiplier, divide the system voltage by 12.

(i.e., a 32V system would be $32/12=2.67$)

SV Override must be set at 0.0 to enable auto system voltage detect.



4. Lockout – Whole number (0 - 2). Restricts the ability to perform changes and/or provide input to the regulator which can impact how the alternator charges the batteries. Zero setting disables system lockout. A value of one prevents any configuration changes. A value of 2 creates a lockout level that can only be reversed by reflashing the firmware with a factory-level key. CAUTION: the only way to recover the regulator from this state requires special programming hardware probes.

NOTES:

