

 BRAMMO TECHNICAL SERVICE BULLETIN	Title: TSB –Sevcon Motor Controller Wire Routing inspection	
	Document No: TSB – Recall 13V-208	
	Revision No: A.00	Issue Date: 06/12/13

1. PURPOSE & SCOPE

Brammo Inc. has determined that five (5) 2013 Empulse R models are suspect of having an improperly installed cable on the motor controller and have been recalled with NHTSA. This TSB will identify the correct cable routing and will also identify the steps required to replace any potentially compromised components due to the improperly routed cable and satisfy the requirements of Recall Number 13V-208.

2. RESPONSIBILITY

- An Authorized Brammo Dealer will ensure that all specified Empulse R models identified below will be serviced as per this TSB – Recall 13V-208 as soon as possible.
 - 51RUB5560DA000020
 - 51RUB5563DA000013
 - 51RUB5566DA000023
 - 51RUB5568DA000024
 - 51RUB5562DA000021

3. BILLABLE LABOR TIME

- Inspection = **0.75 Hours** is the billable labor time allowed for the inspection portion of this TSB.
 - Steps 4 – 5.
- Component Replacement = **2.0 Hours** is the billable labor time allowed for the inspection and component replacement if items identified in this TSB are found to be compromised.
 - Steps 6 – 11.

Be sure to reference the Service Bulletin Document number **TSB – Recall 13V-208** when filling out a warranty claim form

REQUIRED TOOLS and PARTS

- Allen Wrench – 4mm & 5mm
- T25 Torx
- 13mm socket
- Sockets – 13mm, 14mm, 17mm.
- Torque wrench - Nm (lbf-in)
- Small scissor lift or other type of small jack and a couple blocks of wood that can be used for support.
- Rear wheel stand.
- Loctite 243

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- Replacement Motor Controller Assembly and Cables – (only needed if components are identified to be compromised) components will be sent by Brammo Inc.

4. **PROCESS - Inspection**

4.1. Place motorcycle on a lift and use a rear wheel stand.

4.2. Remove the seat, both upper body panels and the upper radiator cover.



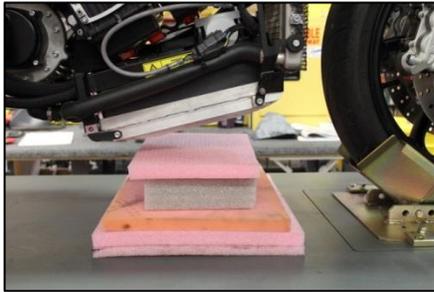
4.3. Disconnect the main power disconnect as shown below.



4.4. Remove the lower cowling covering the motor controller.

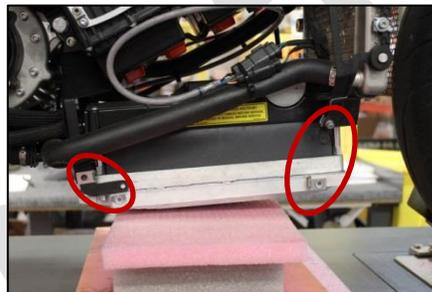
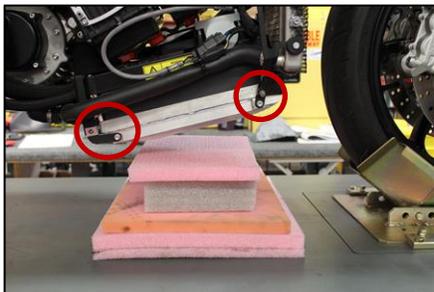


4.5. Place a support device under the Motor Controller.

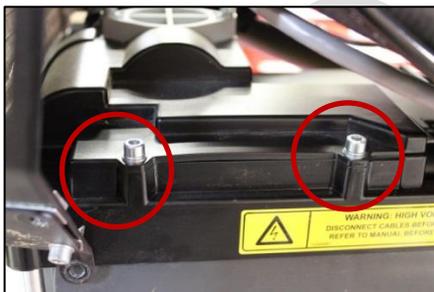


4.6. Lower the motor controller out of the support brackets by removing the four (4) (two on each side) 4mm Allen bolts.

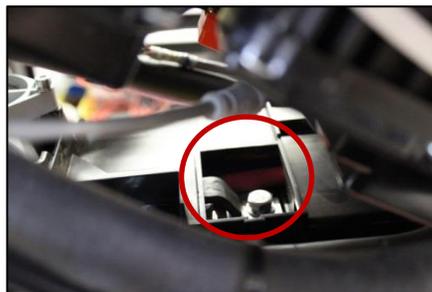
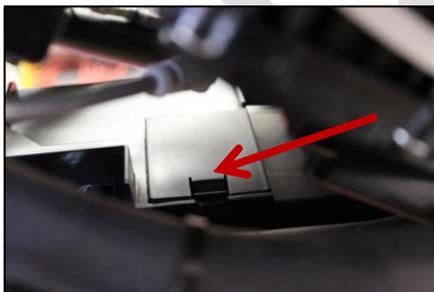
NOTE: be sure the motor controller is supported from below to ensure it does not fall.



4.7. Remove the first access cover on the left side of the motor controller cover two (2) 4mm Allen bolts.



4.8. Remove the second access port covering the Busbar bolt by using a flat blade screw driver to pop the cap off. Insert screw driver from the left side of the motorcycle and press in on the tab.



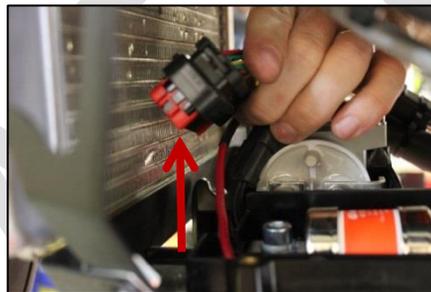
4.9. Using a 13mm socket, remove the busbar bolt.



4.10. Unplug the main harness motor controller connection.

- You will find the release tab for the plug on the front of the motor controller. Slide your finger under the tab and pull out. Then the plug can be pulled out from the top.

NOTE: Use extreme care when removing the harness connector to ensure you do not pull any of the wires out of the main plug.



4.11. With the busbar bolt removed and them main harness plug removed, we can now remove the four (4) corner 5mm Allen bolts holding the motor controller cover to the motor controller.

NOTE: when these four bolts are removed, be careful not to let the motor controller separate from the heat sink. This could tear the conducting material between the motor controller and the heat sink.



4.12. With the motor controller lowered down, the cover can be lifted up (or controller lowered down further) for cable alignment inspection.



CORRECTLY installed B- cable. Terminal is located **between** the dividers



INCORRECTLY installed B- cable. Cable is riding the divider that separates B- and the M1 Cable.



4.13. If the B- cable is found to be incorrectly installed, loosen, adjust and **re-torque to 11 Nm (97 lbf-in)**. Thoroughly inspect the area for signs of contact, worn terminal coating on the B- cable and the busbar surface which is located on the underside of the motor controller cover.

4.14. If no visual damage or incorrectly installed cables are found, reinstall all of the components starting with **STEP #5**. If damage is present precede **STEP #6**.

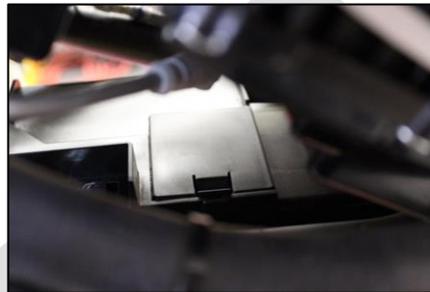
5. PROCESS - Motor Controller Assembly re-install.

5.1. Carefully lower the cover or raise the Motor Controller to reconnect the two pieces.

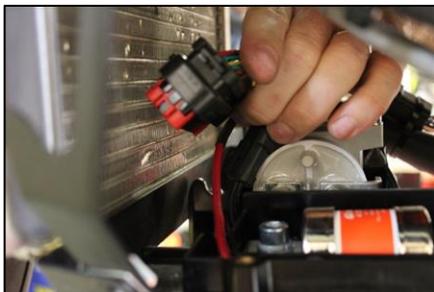
- Install the four (4) corner 5mm Allen bolts. Apply Blue Loctite 243 and **Torque to 11 Nm (97 lbf-in)**.



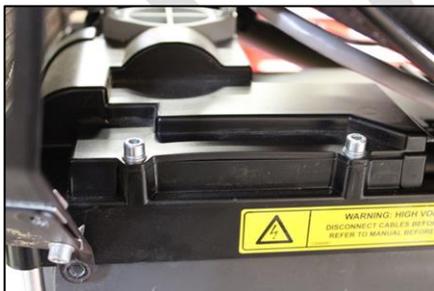
5.2. Install the 13mm busbar Allen bolt, **Torque to 11 Nm (97 lbf-in)** and install the plastic cover.



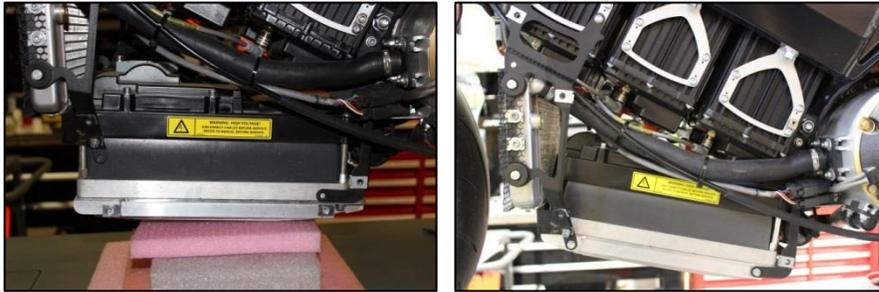
5.3. Reconnect the main harness connector.



5.4. Install the secondary motor controller cover.



5.5. Raise the motor controller and install the four (4) 4mm Allen bolts. Use Blue Loctite 243 and **Torque to 3.4 Nm (30 lbf-in)**.



5.6. Reconnect the main power and cycle the key on and enter drive mode to ensure proper motor controller operation.

5.7. Install the previously removed body work, finish work order and warranty claim form.

6. PROCESS – Component replacement

6.1. If a short did occur you will see something similar to this when the motor controller cover is removed, damage should be very apparent.



6.2. All damaged or visibly worn parts need to be replaced.

- Start by removing the remaining connecting cables on the back of the motor controller and remove the old motor controller.

NOTE: be careful not to damage the heat sink contact sheet as this will be reused



- The following parts should be replaced if damage is present;
NOTE: the motor controller heat sink and mounting hardware will be reused.

	Title: TSB –Sevcon Motor Controller Wire Routing inspection	
	Document No: TSB – Recall 13V-208	
	Revision No: A.00	Issue Date: 06/12/13

- 87511689 (Controller Cover Assembly)
- 39727072 (Controller)
- 70687930 (B- Cable) long
- 79152417 (B+ Cable) short
- **3-phase motor power cable assembly (contains the parts below as one unit)**
 - 98335283 (CABLE, MOTOR, M1)
 - 94625647 (CABLE, MOTOR, M2)
 - 14287682 (CABLE, MOTOR, M3)
 - 76633402 (ASSY, CABLE, SHIELD, B NEG)
 - 59450637 (SLEEVING, CABLE, MOTOR)
 - 38731251 (SHIELD, LINK)
 - 19071229 (SHIELD, HOUSING)
 - 15473787 (SHIELD, HOUSING, THD)

6.3. Remove the remaining three (3) connection points from the top of the motor controller cover and remove the cover and remove the cover.



6.4. Disconnect the cables from the back of the motor controller and remove the motor controller.

6.5. Loosen the two main mounting bolts on the left side peg mount.



6.6. Using a small scissor jack or other type of lift/support device, support the gearbox from underneath.



6.7. Remove the front bolt securing the motor to the frame. Once that has been removed, loosen (**do not remove**) the swing arm pivot screw.



DO NOT
 remove this,
 just loosen.

6.8. Clip the two zip ties securing the wires as shown.



6.9. Using the scissor lift or jack slowly lower down the gearbox/motor assembly about 50mm.

6.10. Remove the two screws on top of the motor cable access panel and remove the pannel.

NOTE: you do NOT need to remove the side cover on the motor.



6.11. Remove the three (3) bolts securing the motor phase cables using a 13mm socket. Remove the damaged cables and install the new set of motor phase cables.

Torque to 15.8 Nm (140 lbf-in).



6.12. Remove the B- battery cable.

- Loosen the two (2) screws and relieve the tension on DC/DC cover that binds the B – battery cable.



- Remove the top cap on the battery B- terminal.



- Remove the battery B- cable, install the new cable **Torque to 18.4 NM (163 lbf-in.)** and reinstall the orange terminal cap.



6.13. Using the scissor lift or jack, raise the motor back into place and reinstall mounting hardware.

- DC/DC mount - **torque to 4.8 Nm (42 lbf-in.)**.
- Front Motor mounting bolt – **torque to 35 Nm (310 lbf-in.)**.
- Swing arm pivot bolt – **torque to 14 Nm (124 lbf-in.)**.

	Title: TSB –Sevcon Motor Controller Wire Routing inspection	
	Document No: TSB – Recall 13V-208	
	Revision No: A.00	Issue Date: 06/12/13

- 6.14. Reinstall the new motor controller and connect the motor phase cables, **torque to 11 Nm (97 lbf-in).**

NOTE: the new assembly will have a “drain” wire and needs to be routed as seen below.



- 6.15. Reinstall all of the motor controller components and cover as per **STEP #5.**
- 6.16. Reinstall the two (2) main mounting bolts on the left hand foot peg bracket.
- **torque to 18 Nm (163 lbf-in).**
- 6.17. Reconnect the main power and move to **STEP #7.**

!! WARNING – DO NOT TRY TO RIDE OR APPLY ANY THROTTLE UNTIL AFTER YOU HAVE COMPLETED STEP #7 !!

7. Encoder Alignment.

- 7.1. An Encoder Alignment must be performed anytime a new motor controller or motor has been installed.
- 7.2. Follow the steps below to perform the Encoder Alignment.

SEVCON MOTOR CONTROLLER – ENCODER ALIGNMENT:

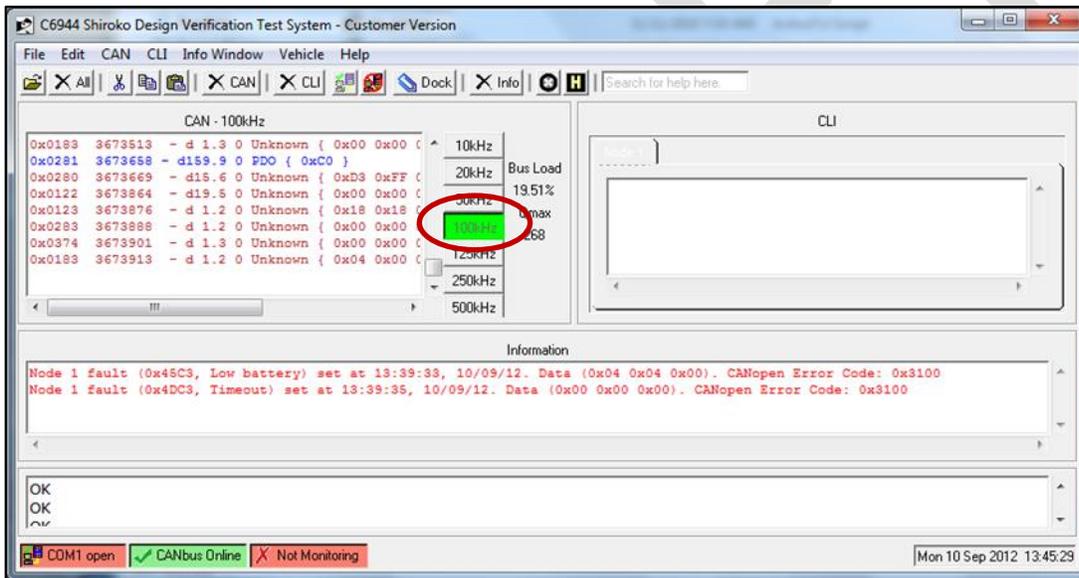
WARNING! NEVER ATTEMPT TO RIDE OR OPERATE A MOTORCYCLE WITH A NEW SEVCON MOTOR CONTROLLER THAT HAS NOT HAD THE ENCODER ALIGNED. THE BIKE COULD GO IN REVERSE OR FORWARD AT FULL THROTTLE CAUSING SEVERE INJURY OR DEATH TO THE RIDER OR OPERATOR.

8. Connect the IXXAT USB-to-CAN adapter to the motor controller CANbus connector.

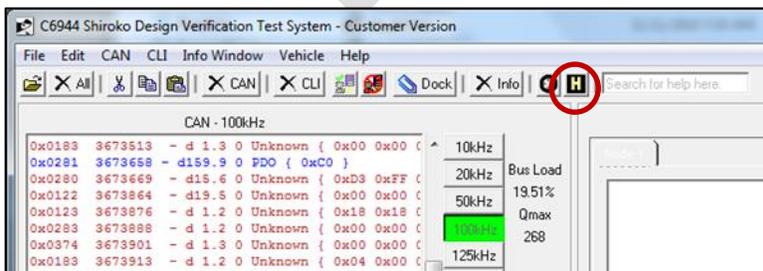
- 8.1. This connector is located behind the lower front body panel, on the right side of the vehicle. Note that there are two 3-pin CANbus connectors at this location. For the purposes of this document, you want the one labeled “M/C CAN”.



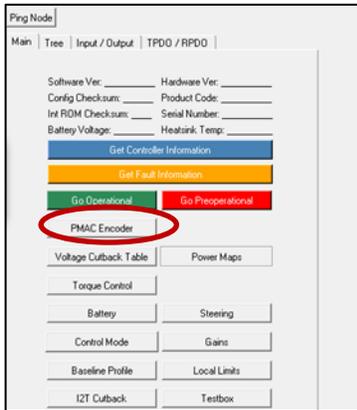
9. **Make sure the vehicle is securely positioned on a rear stand, with the rear wheel off the ground or on a Dyno.**
 - 9.1. Make sure the bike is in 4th gear.
10. **Perform the Coarse Encoder Alignment using the Sevcon DVT software.**
 - 10.1. Turn on the Empulse and start the motor controller by pressing the start button.
 - 10.2. Launch the Sevcon DVT software. You will know that your connection to the vehicle is good if you see CANbus data packets scrolling in the left-hand portion of the DVT window. If your connection is not good, make sure you have selected the 100kHz baud rate button.



- 10.3. Launch the "Helper" by clicking on the "H" button in the DVT software.



10.4. Click the button labeled “PMAC Encoder”.



10.5. **WARNING!** - With your thumb positioned on the kill switch, turn the throttle to about the 10% throttle position. If the Encoder Alignment is far off, the wheel may spin at full speed in forward or reverse.

BE PREPARED TO HIT THE KILL SWITCH IF NECESSARY.

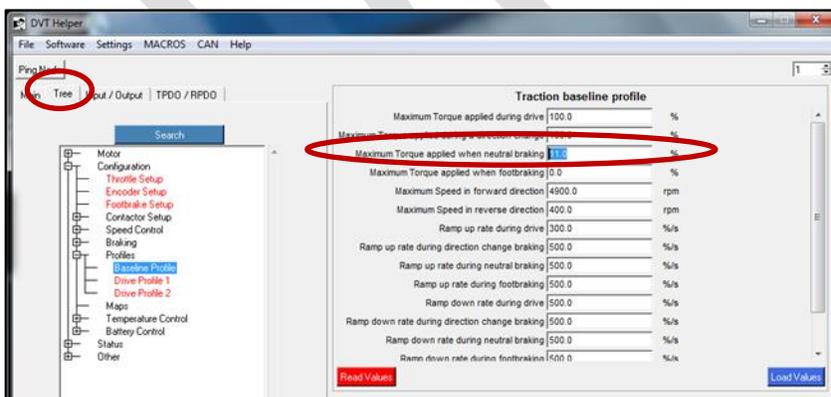
10.6. If the wheel spins forward and will spin up to 30mph, move on to the Fine Encoder Alignment **STEP 11.**

10.7. If the wheel spins in reverse or does not spin at all, change the encoder alignment number in 30 degree increments (up or down) until you find an alignment that allows you to spin the wheel up to 30 mph in the forward direction.

10.8. Close the PMAC Encoder Window.

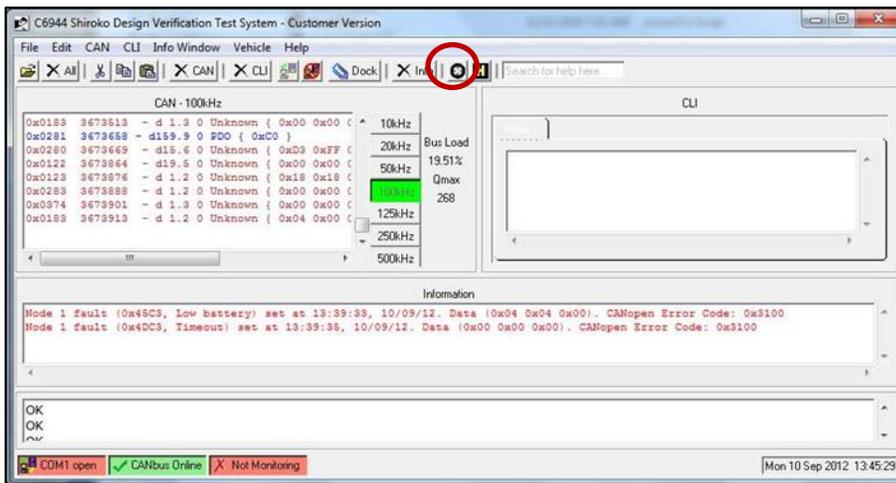
11. Perform the Fine Encoder Alignment using the Sevcon DVT software.

11.1. In the DVT “Helper” window, click on the “Tree” tab.

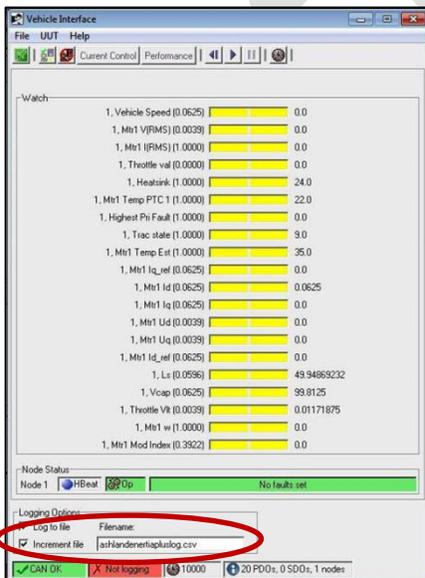


11.2. In the Tree, click on “**Configuration**”, “**Profiles**”, “**Baseline Profile**”

- 11.3. Next to the item labeled **“Maximum Torque applied when neutral braking”**, enter **“0”** and click **“Load Values”**.
- 11.4. Click **“Read Values”** and verify that the value reads back as **“0.0”**.
- 11.5. Then click on **“Drive Profile 2”** and zero out the **“Maximum Torque applied when neutral braking”**.
- 11.6. In the DVT main window, click the **“Vehicle Interface”** button (the icon looks like a wheel).

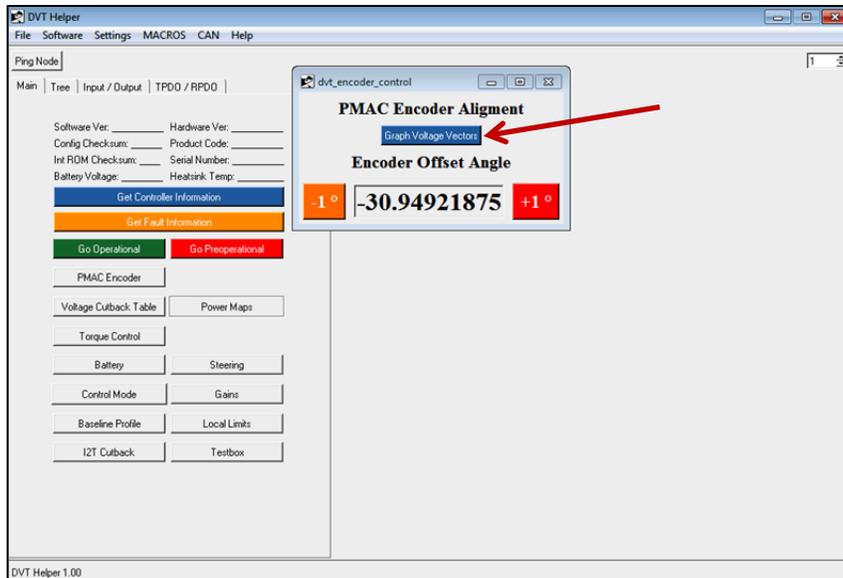


- 11.7. At the bottom of the Vehicle Interface window, enter a descriptive Log File name. Make sure the **“Enable Logging”** check box is checked.

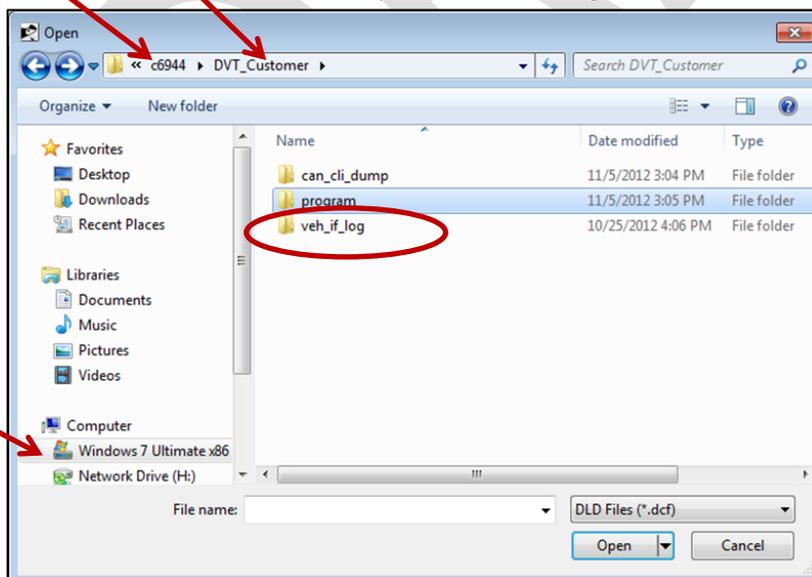


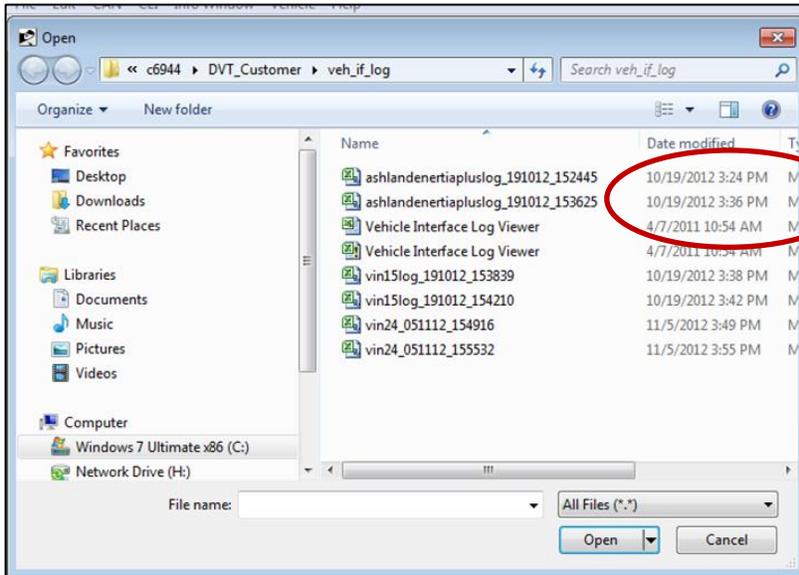
- 11.8. GRADUALLY, apply throttle until the vehicle is operating above 6,000 RPM in 4th gear.
- 11.9. Once full speed or 6,000 RPM’s has been reached, release the throttle and **immediately** click the **“Rewind”** and then the **“Play”** button in the Vehicle Interface window to start recording a log file.

- 11.10. When the vehicle’s wheel has stopped spinning, click the **“Pause”** button in the Vehicle Interface window to stop recording the log file.
- 11.11. Close the Vehicle Interface Window and return to the Helper Window.
- 11.12. Click on the button labeled **“PMAC Encoder”**.
- 11.13. Click on the button labeled **“Graph Voltage Vectors”**.



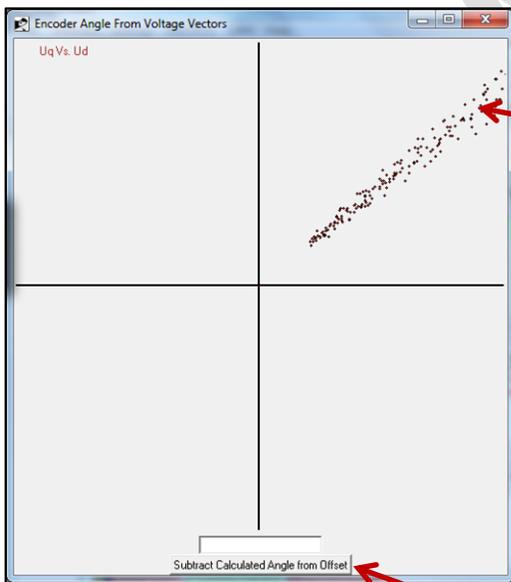
- 11.14. Select the log file you previously saved. Go to **“my computer”**, click on the (C:) drive, then click on **“c6944”**, then click on **“DVT Customer”**, then click on **“veh if log”**. Once you are here, select the log file you previously saved in the “Vehicle Interface” screen at the bottom. Pay attention to the time stamp of the file you are selecting, be sure it is the most current.





Notice the **“Date Modified”**: always select the latest file.

11.15. On the resulting plot (**it may be behind an open window**), click the center of the dot scatter plot, towards the end.



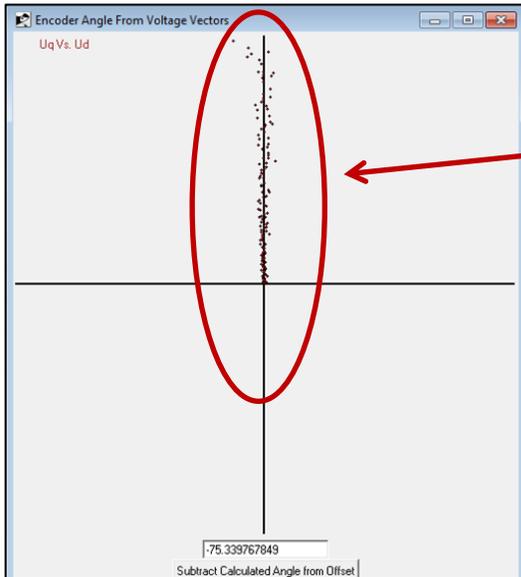
Click here to plot the encoder alignment.

The goal is to click in the middle of the cone $\frac{3}{4}$ of the way to the end.

11.16. Then click on the button labeled **“Subtract Calculated Angle from Offset”**.

NOTE: ONLY CLICK THIS BUTTON ONCE.

11.17. Repeat steps **11.8 – 11.15** to verify that the resulting plot shows perfect encoder alignment.



Perfectly aligned Encoder

- 11.18. Go back to the Helper Window, and click on the Tree tab, and click on "**Configuration**", "**Profiles**", "**Baseline Profile**" set Regen in "Maximum Torque applied when neutral braking" to **18.0**.
- 11.19. Go into "**Drive Profile 2**", set Regen in "Maximum Torque applied when neutral braking" to **9.0**.
- 11.20. and click
- 11.21. Click "Load Values" then "Read Values" and make sure the Regen percentage was set appropriately.
- 11.22. Close all DVT windows and disconnect the diagnostic cabling from the vehicle.
- 11.23. Be sure to test the motorcycle in drive mode while the rear wheel is off the ground to be sure bike functions properly.
 Re-install any connector plugs, and re-install any missing bodywork.

12. End Service Bulletin.

DOCUMENT REVISION TABLE

Revision	Date	Change Description	Initiator
06/3/13	06/3/13	Initial Release	ALL