



## **BigStuff3 - GEN3**

1st Gear Spark Retard with Spark Retard Traction Control System (SR<sup>2</sup>)

Rev 1.0

12-09

## System Description

**1st Gear Spark Retard with Spark Retard Traction Control System (SR<sup>2</sup>)** - SR<sup>2</sup> uses two independent timing retard systems to control driveshaft speed. Both systems are triggered and function simultaneously when 12V is applied to the Timer Enable wire (12V redirected from the trans-brake or clutch). The first gear timing retard system also has “Time-out” and “Blend” features. The “Time-out” feature helps to eliminate “sticking” the tire. The “Blend” feature ramps the retard timing back to zero. Both features are user configurable.

The second timing retard system works in conjunction with the 1<sup>st</sup> Gear retard system and can intervene at any time. The second timing retard system controls driveshaft speed for an eight (8) second time period. The system compares the driveshaft speed sensor input to the user desired driveshaft curve to control the driveshaft speed. The driveshaft speed is managed by the ECU using a user defined Driveshaft Error table. Driveshaft error is the difference between the desired driveshaft speed and the actual driveshaft speed. If the actual driveshaft speed exceeds the desired speed, the ECU applies the timing retard value from the user defined Driveshaft Error table. In order to start the timers, the minimum TPS and RPM criteria must be satisfied (under Boost Parameters). The MSD or equivalent ignition system must be used for the 2-Step/3-Step functionality, since the SR<sup>2</sup> system does not include the BS3 ETM module. There are no restrictions on the type of MSD ignition system that can be used with the SR<sup>2</sup> System.

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## What the System Includes and its Capabilities

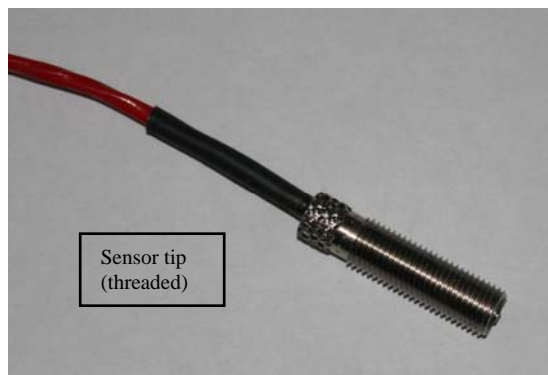
- The (SR<sup>2</sup>) wire harness – This harness allows a driveshaft speed sensor to be incorporated into the system.
- Embedded control software to control ignition timing retard, including user defined control and configuration tables. The functionality of these tables will be explained later in this manual.

The SR<sup>2</sup> system also includes the “Extended Replay” data acquisition option, which can log data from eighteen (18) seconds to approximately five (5) minutes.

## What Else is Needed?

- A driveshaft speed sensor
- A four (4) magnet pickup ring
- A relay to redirect the 12V signal from the trans-brake or clutch to the Timer Enable wire

BigStuff3’s SR<sup>2</sup> system requires, but does not include provisions to mount a driveshaft speed sensor. If you purchased the GEN3 system with transmission control for the GM 4L60E or 4L80E automatic transmissions, a driveshaft speed sensor is not required. For all other applications, provisions for detecting the driveshaft speed will need to be made. BigStuff3 offers a driveshaft speed sensor assembly under part number JMI-007-014 (see photo below). See the Driveshaft Speed Sensor wiring section at the bottom of this manual for step-by-step instructions on how to wire the driveshaft speed sensor into the system.



In addition to the driveshaft speed sensor, a pick-up wheel and sensor mounting bracket are required. BigStuff3 suggests using Mark Williams’ four (4) magnetic (driveshaft) ring. This is the link to the suggested part - <http://www.markwilliams.com/driveshaftPickups.aspx?CategoryID=266>.

**Note:** Make sure all of the magnets in the magnetic ring are all installed in the **SAME** direction. A .080” - 0.100” air gap between the sensor and magnetic ring is recommended. A sensor mounting bracket will need to be purchased or fabricated to mount the sensor.

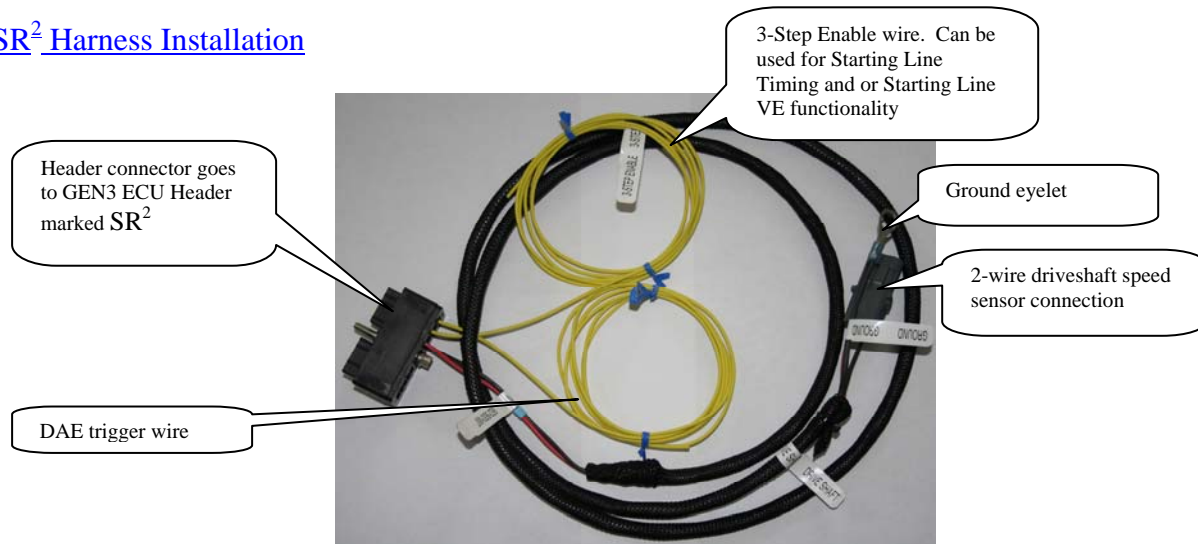
**If using a MSD8 CD ignition box, a pullup resistor needs to be installed between the ignition (+12V) post and Mag + post on the side of the MSD8 ignition box! A minimum of a 900 Ohm to 1K**

**maximum and a .125 Watt min (to 2 Watt max) resistor is needed. A resistor is not required with the MSD Super 8 ignition system.**

Installation of the relay will be addressed later in this manual.

## How to Install the SR<sup>2</sup> System

### The SR<sup>2</sup> Harness Installation



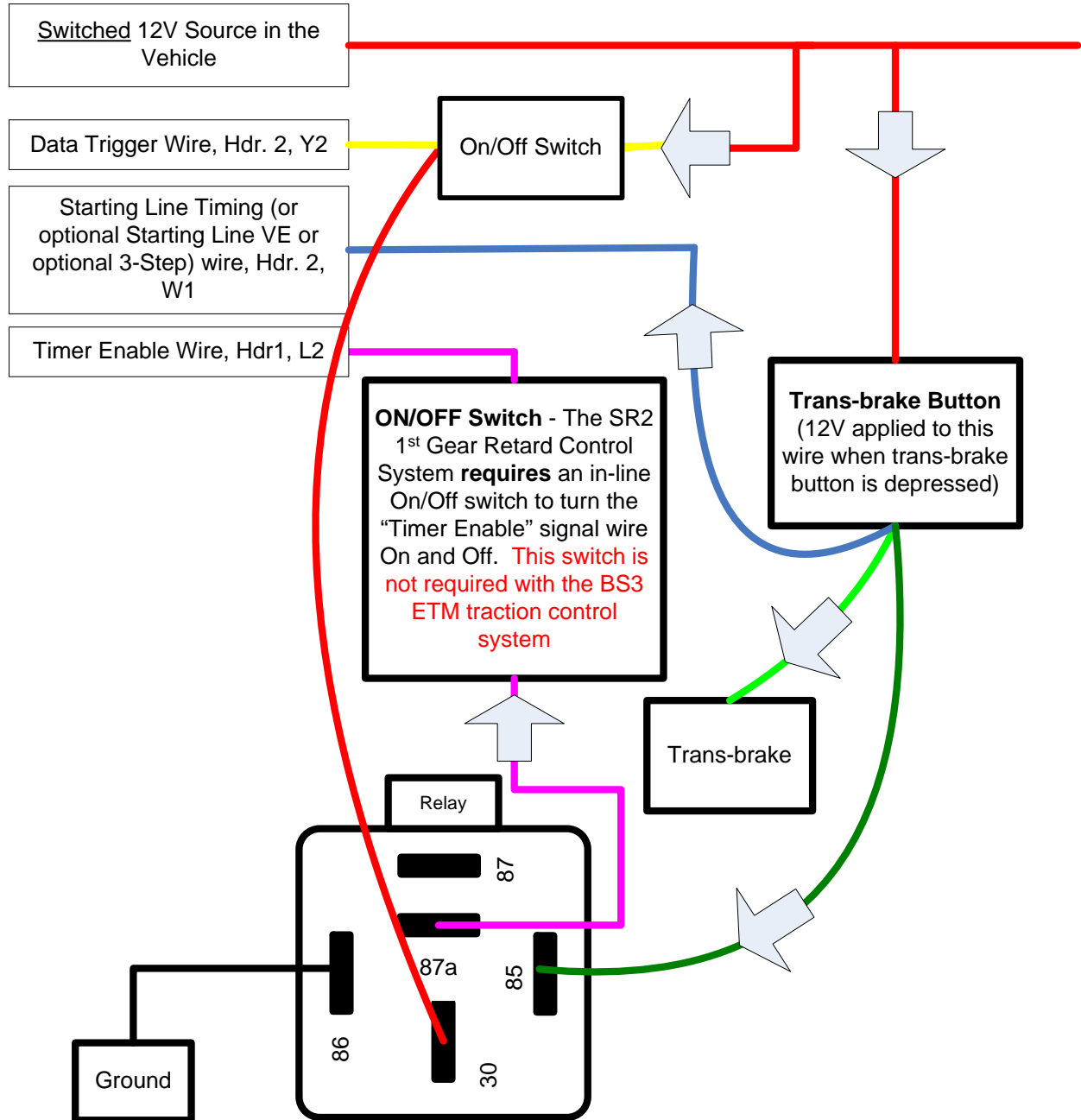
- Connect the SR<sup>2</sup> harness header connector to the GEN3 ECU header connector marked “SR<sup>2</sup>”. Tighten the harness side header bolt to 15 inch lbs.
- Connect the two-way connector labeled “Driveshaft” to the driveshaft speed sensor (not supplied with the system, but available from BS3). See the “What else is Needed” section above for more details. Install the 2 way Metri-Pack Packard connector PN 12103784 (w/terminals PN 12089188) onto the driveshaft sensor and plug it into the SR<sup>2</sup> harness.
- Connect the “Ground” wire to the frame near the driveshaft speed sensor along with the sensor ground.
- Connect the “Data (DAE) Trigger” Wire (from ECU header connector Hdr2 Y2) to a 12V switched source on the vehicle dash (see the relay wiring diagram in the next section).
- Connect the “Timer Enable” wire (Hdr. 1, L2) to a relay, with its own On/Off switch after the relay and before the timer enable input to the ECU. The relay will invert the trans-brake signal (see the relay wiring diagram in the next section). This wire must have 12 Volts applied to it once the trans-brake/footbrake/clutch is released to start the timers in the ECU. **The Timer Enable On/Off switch must not be turned on until after the water burnout.**
- If using the Starting Line Timing and/or Starting Line VE functionality, connect the “3-Step Enable” wire (Hdr. 2, W1) to the trans-brake or clutch pedal (see the relay wiring diagram in the next section).

## Relay Wiring Using a Bosch 40 Amp Relay

**Important Note:** The SR<sup>2</sup> 1<sup>st</sup> Gear Retard system **allows only one Timer Enable activation.** To eliminate the potential of activating the Timer Enable wire during the pre-stage burnout, put the Timer enable wire on its own On/Off switch. After the burnout, turn on the switch. If the Timer Enable wire is inadvertently activated, the ignition must be cycled off, then on again (for more information, see the relay wiring diagram in the next section).

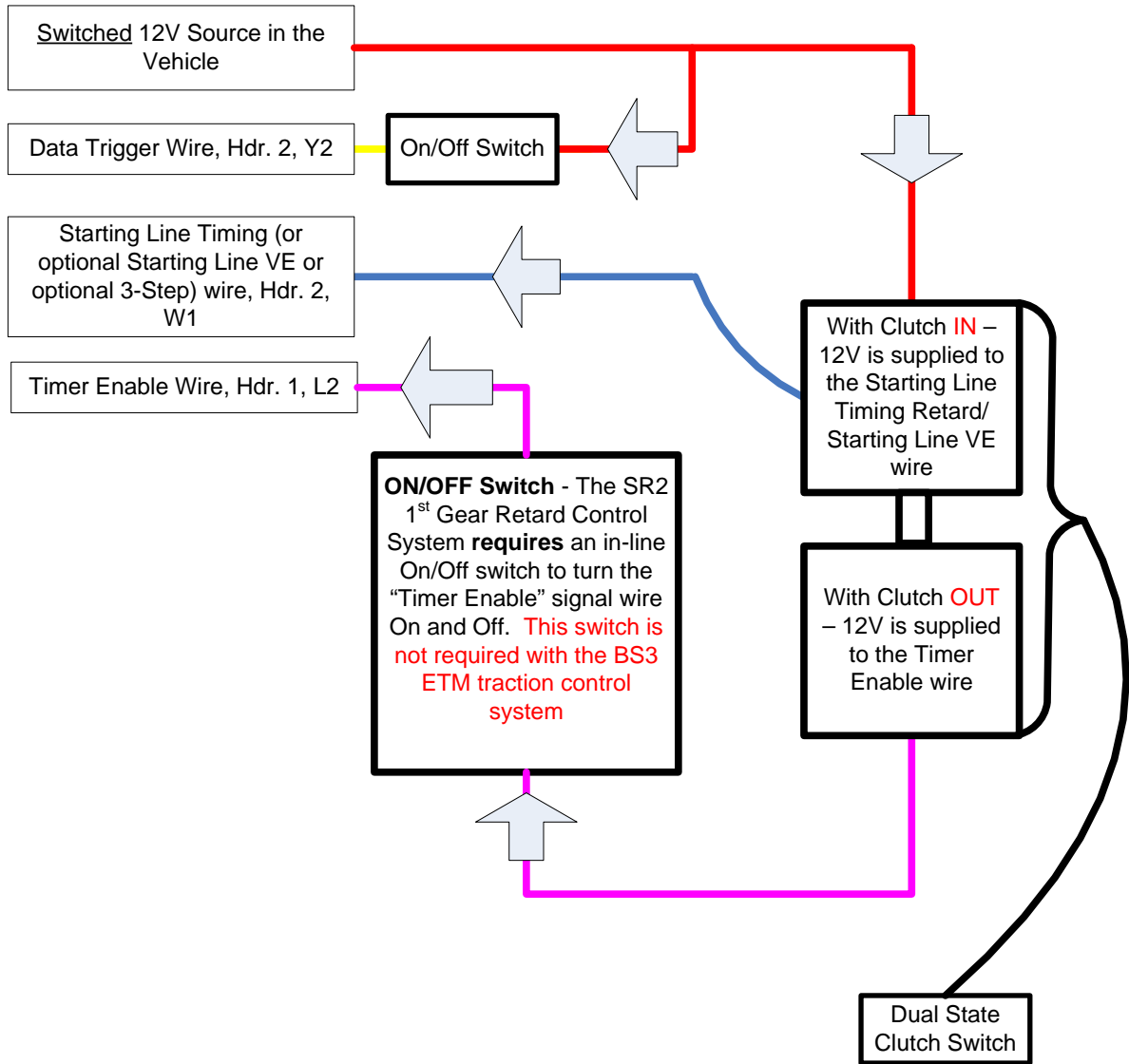
# BigStuff3 – SR2 Wiring Diagram Using a Trans-Brake

## 2 & 3-Step via the MSD Ignition



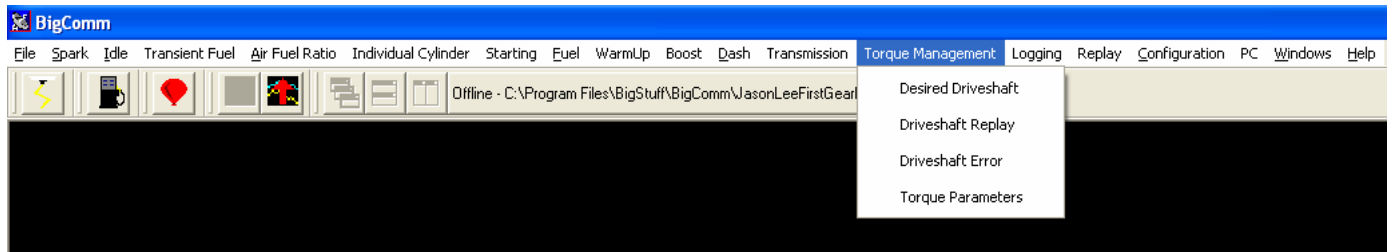
# BigStuff3 – SR<sup>2</sup> Wiring Diagram for a Clutch Car

## 2 & 3-Step via the MSD Ignition System

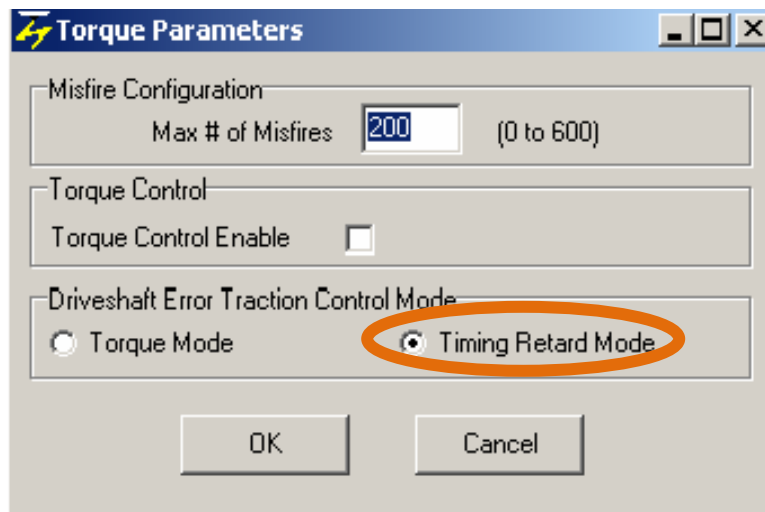


## Setting up the 1<sup>st</sup> Gear Retard System

The next step is to configure the 1<sup>st</sup> gear Retard system. The “Torque Management” configuration screens can be accessed from BigComm’s main tool bar as shown below.



From the Torque Management drop down, select “Torque Parameters”. The screen below will open. Select “Timing Retard Mode”.



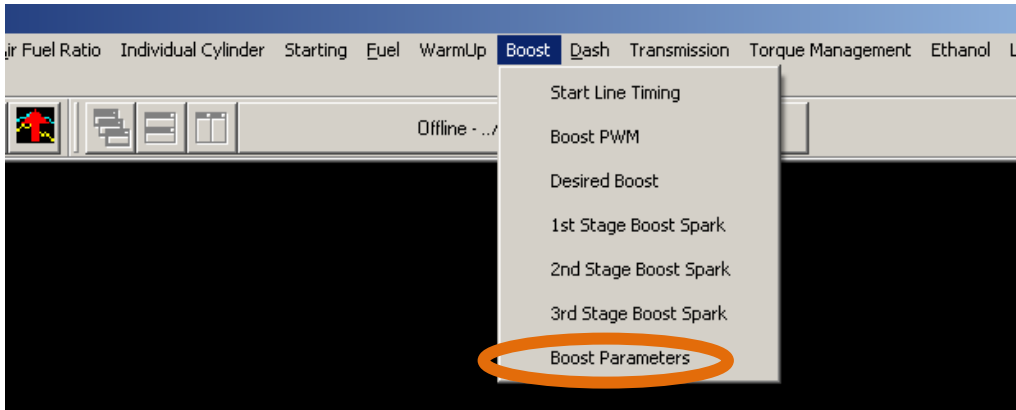
### *Misfire Configuration*

This function is not active with the SR<sup>2</sup> system.

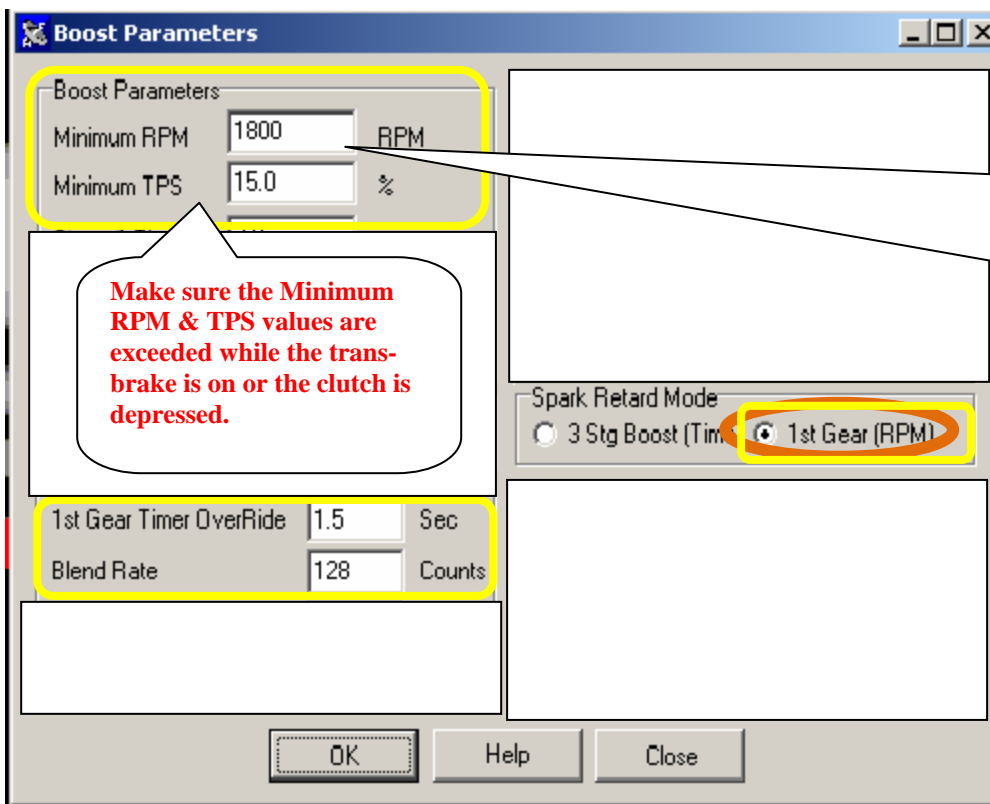
### *Torque Control (enable/disable)*

When this box is unchecked, the SR<sup>2</sup> system is not active. At this time, make sure the “Torque Control Enable” check box is not checked.

Next, go to “Boost” along the main BigComm toolbar, as shown below. Click on “Boost Parameters” in the drop down.



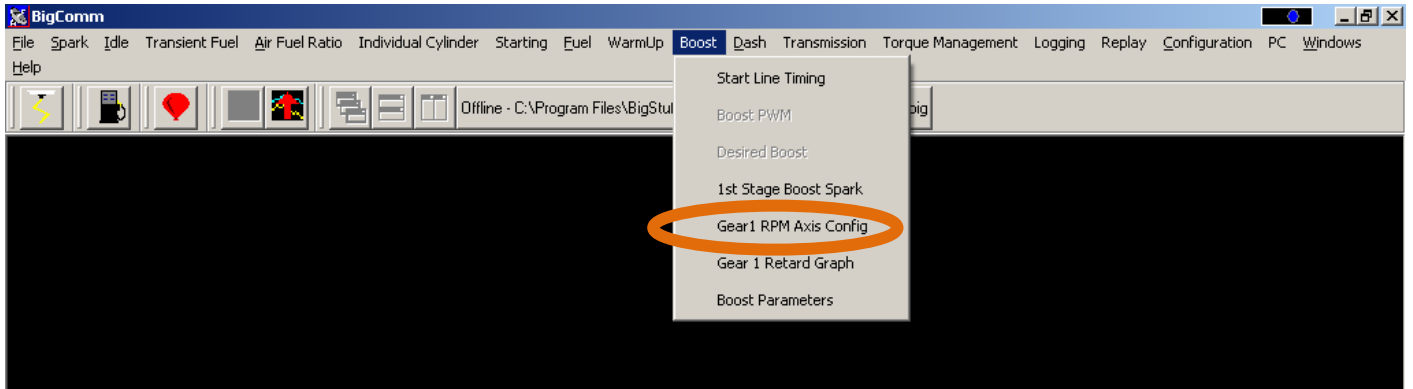
The screen below will open. Only the sections of the “Boost Parameters” table, enclosed with a yellow ring below, are applicable with the SR<sup>2</sup> system. Each section will be discussed in the paragraphs below. Under “Spark Retard Mode”, select “1<sup>st</sup> Gear (RPM)”.



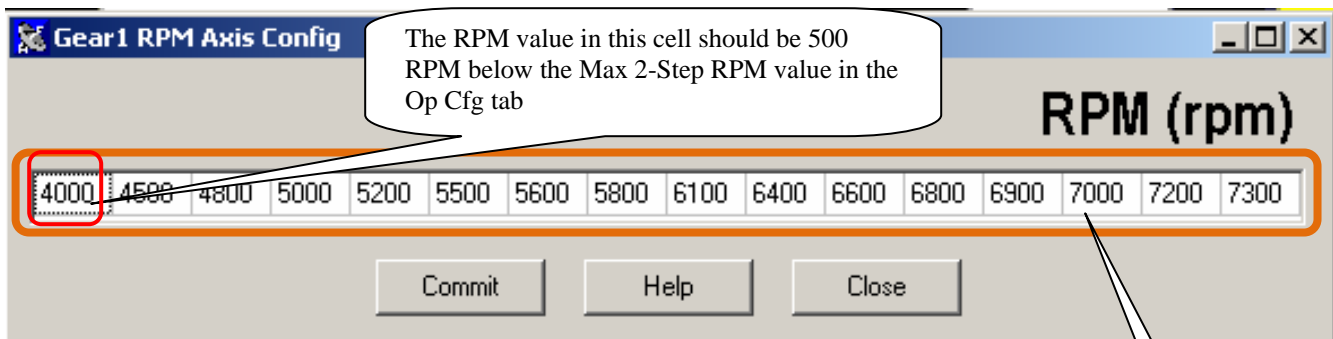
**Note:** The three “Boost Spark Retard Tables “are not functional with the SR<sup>2</sup> system.

Next, go back to the main tool bar and select “Boost”. In the drop down select “Gear 1 RPM Axis Config” as shown below.

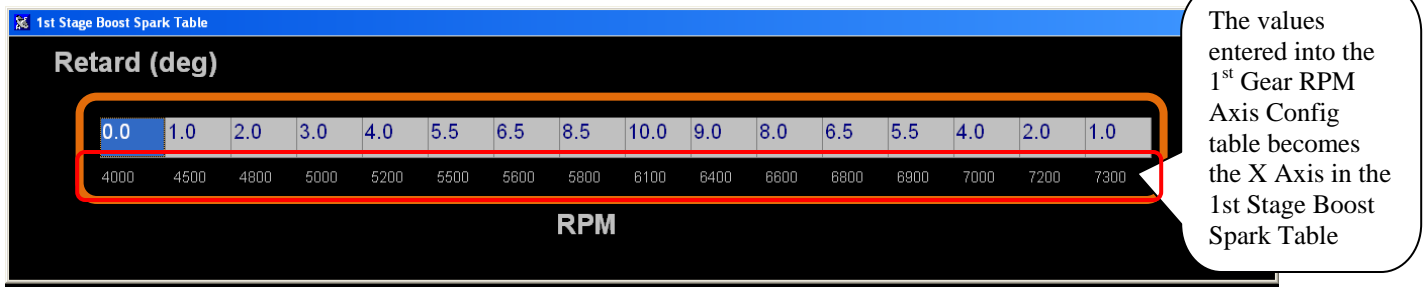




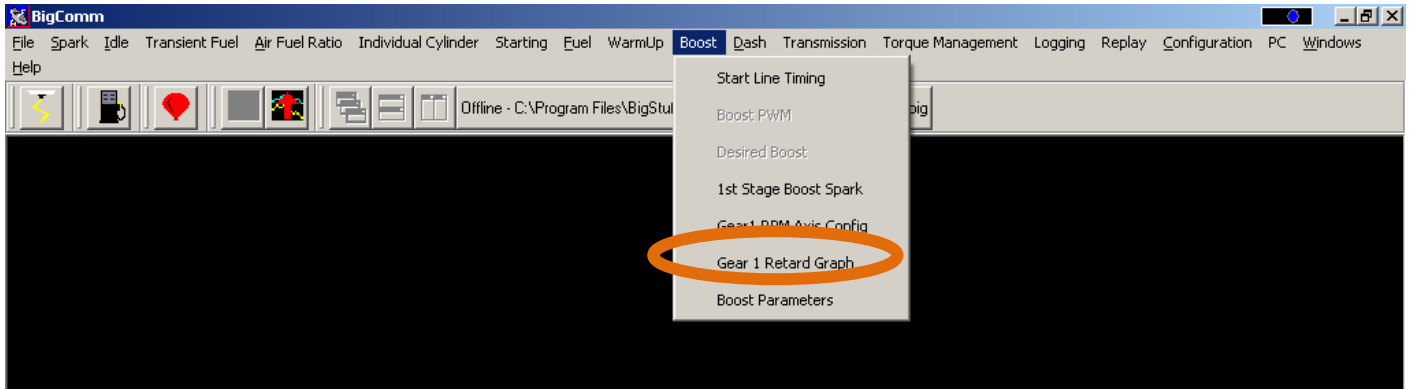
Configure the 1<sup>st</sup> Gear Retard system, which has a dedicated RPM table. This table will be the basis for the amount of timing retard that will be applied, as a function of RPM, before the 1<sup>st</sup> Gear retard “times-out”. The RPM values entered into the “1<sup>st</sup> gear RPM Axis Config” table will become the X axis of the table



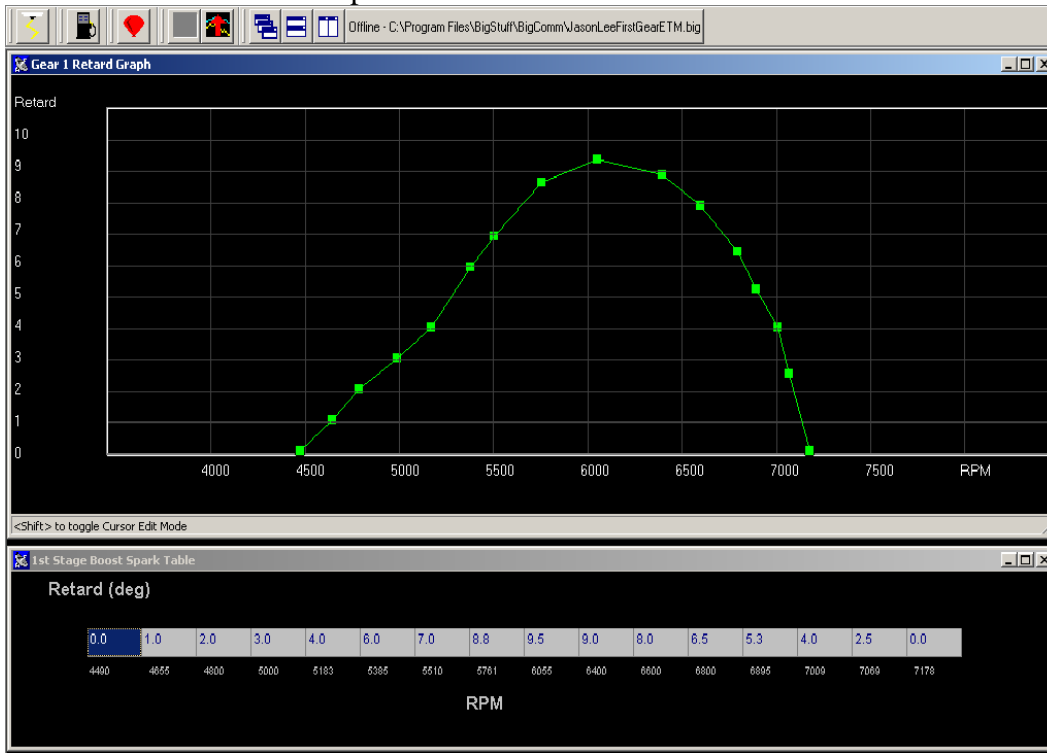
Next, go back to the main tool bar and select “1<sup>st</sup> Stage Boost Retard”. The screen below will open. The amount of timing retard applied, by the GEN3 ECU at each RPM point, is determined using the “1<sup>st</sup> Stage Boost Spark Table” shown below.



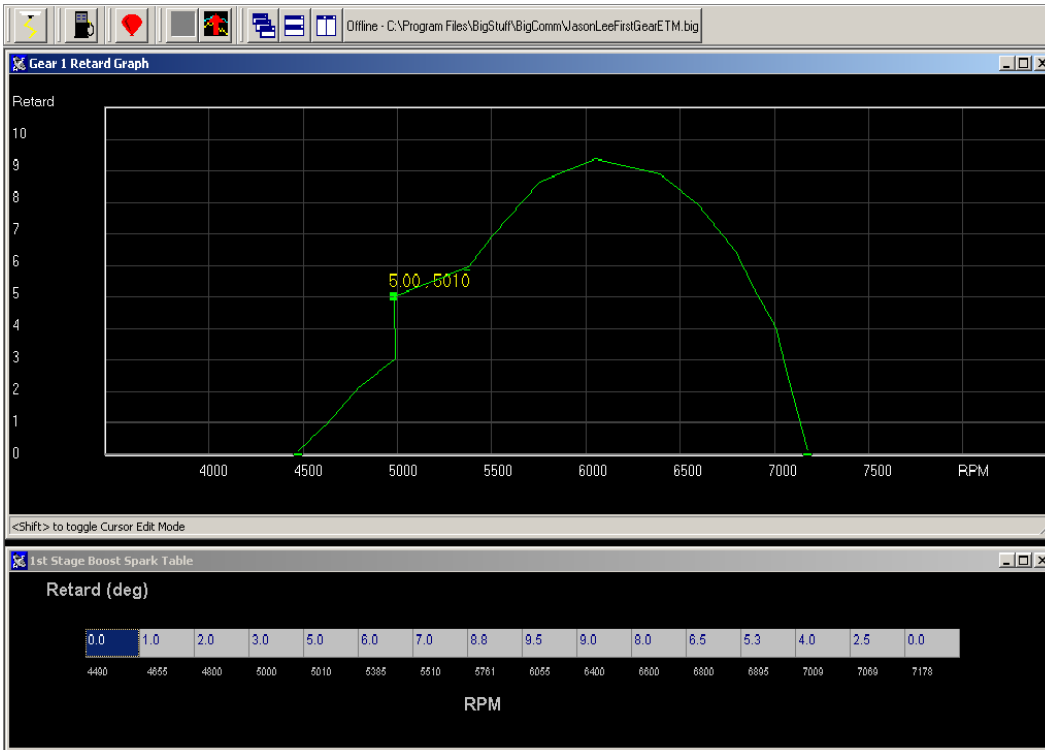
Once the initial RPM and Spark Retard tables have been configured, all subsequent modifications can be made using the “Gear 1 Retard Graph”. To open the “Gear 1 Retard Graph”, go to main BigComm tool bar and select “Boost” and then “Gear 1 Retard Graph” as shown below.



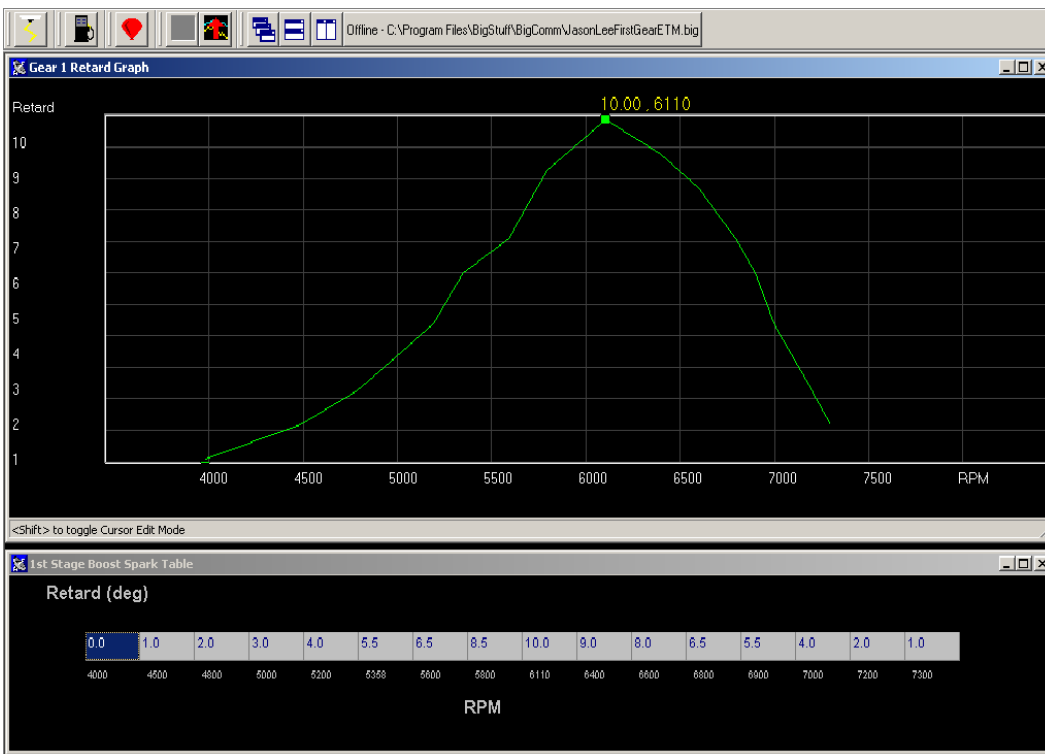
The graph and related table below will open.



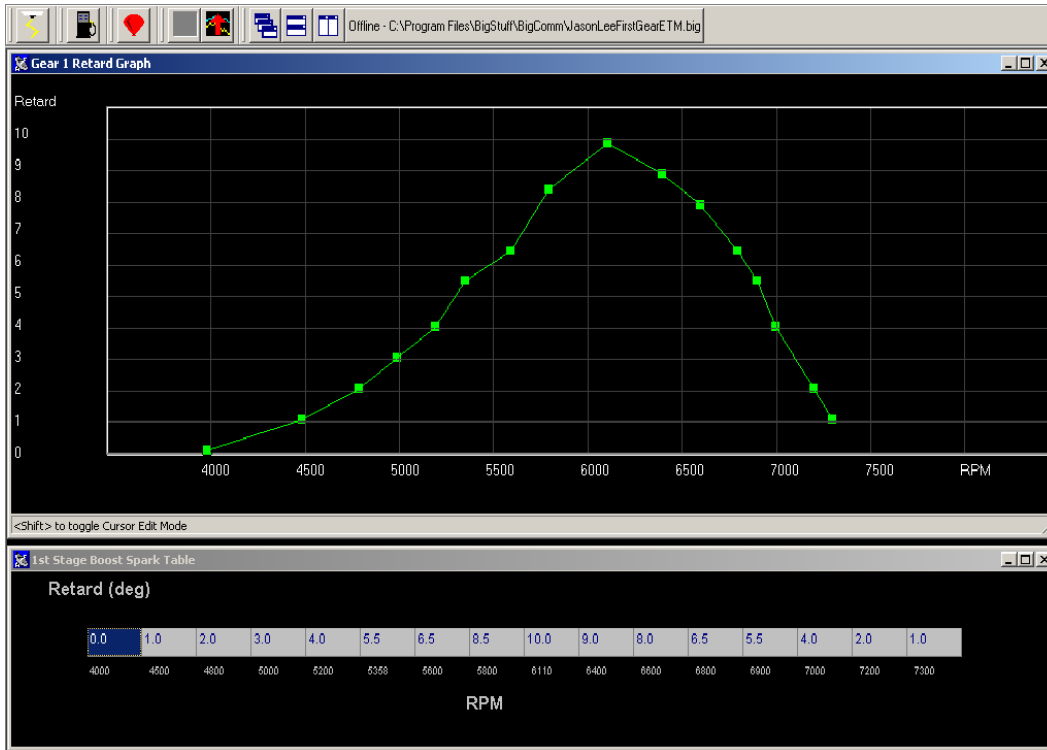
Use the mouse to drag the green line to the desired Retard and/or RPM value. The new Retard and RPM value will be displayed and the table below the graph will be updated with the new values once the mouse button is released, as shown below.



The Retard and/or RPM values can be extended beyond the values shown in the graph by simply dragging the green line to the left or right margins of the graph (to increase or decrease the RPM values) or to the top margin of the graph to increase the Retard values, as shown below.



When the mouse is released the graph will automatically rescale itself and the values in the table will be automatically updated as well, as shown below.



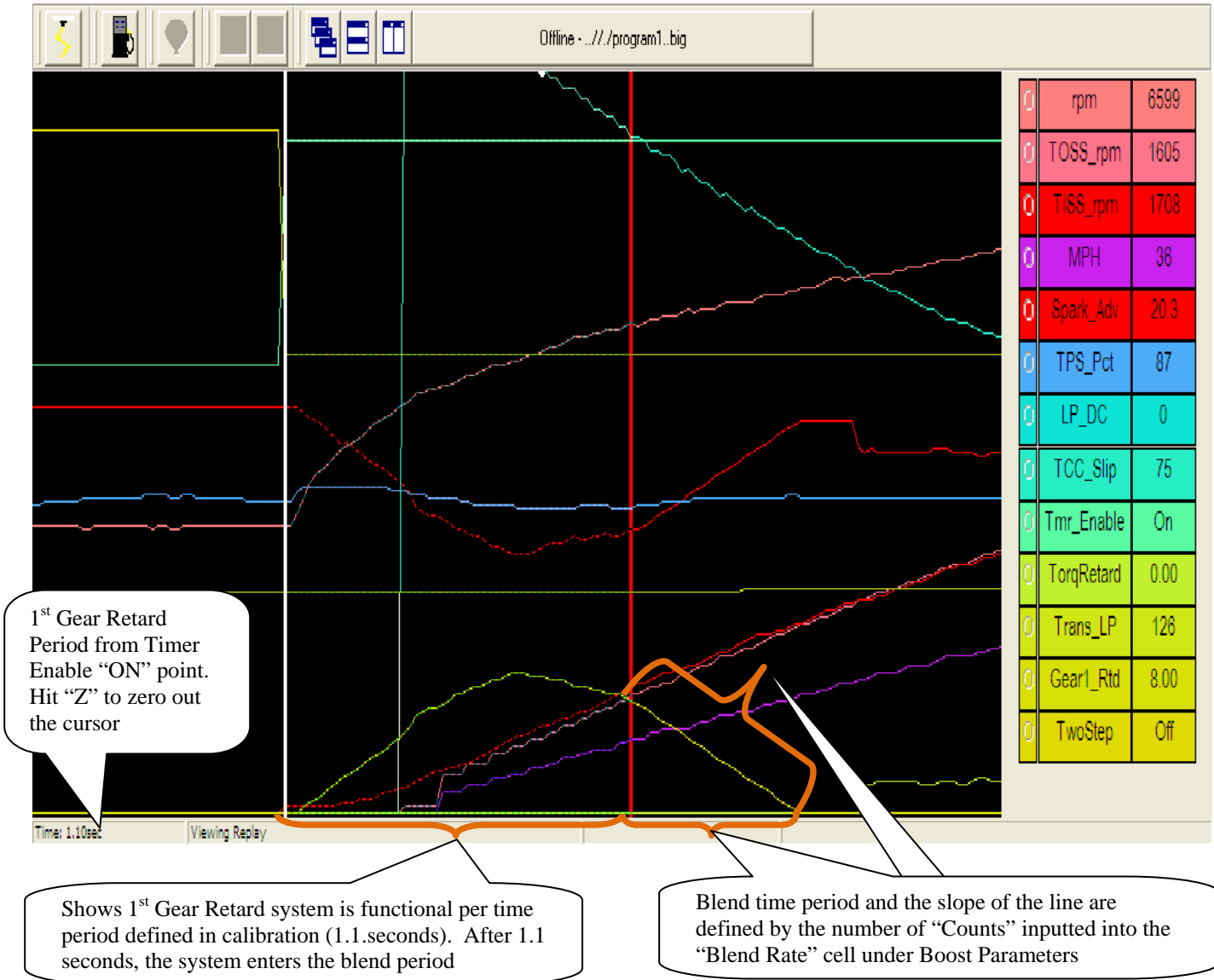
Next, configure the 1<sup>st</sup> Gear Timer Override and Blend Rate cells. The length of time that the 1<sup>st</sup> Gear Retard system remains active is defined by the user in the cell titled “**1<sup>st</sup> Gear Timer OverRide**” shown below. Once the 1<sup>st</sup> Gear Retard system times-out (from the point when the trans-brake or clutch are released), the system transitions to a zero retard value (back to the timing in the spark map) using the blend feature. The blend rate is defined by the user in the cell titled “**BlendRate**” shown below. There are a maximum of 255 counts available.

Note: 255 counts will make the software blend slowly, 1 count blends quickly. Use any number between 1 and 255 to achieve the desired blend rate.

1st Gear Timer OverRide	1.1	Sec
Blend Rate	128	Counts

The Replay below illustrates the following:

- The 1<sup>st</sup> Gear Timing Retard curve developed from the “1<sup>st</sup> gear RPM Axis Config Table” and “1<sup>st</sup> Stage Boost Spark Table” described above.
- The amount of time the GEN3 ECU allows the 1<sup>st</sup> Gear Retard system to remain active, based on the value inputted into the “1<sup>st</sup> Gear timer OverRide” shown directly above.
- The blend Rate (the slope of the line and time) the GEN3 ECU uses to bring the retard values back to zero (back to the based spark map values).



**Important Note:** To ensure that the 1<sup>st</sup> Gear Retard system becomes active when the trans-brake or clutch are released (the point in time when the Timer Enable wire is supplied 12V), make sure the Minimum RPM & TPS values are exceeded while on the MSD 2/3-Step when the trans-brake is on or the clutch is depressed.

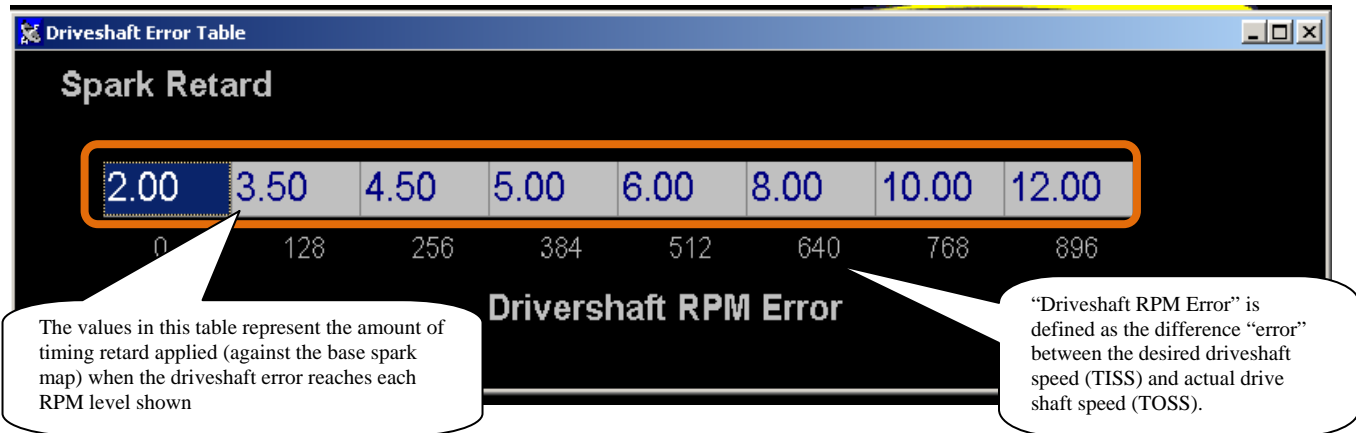
## Setting up the Timing Retard Traction Control System

The first step in setting up the Timing Retard Traction Control System is to configure Driveshaft Error Table. The other necessary parameters were configured, while setting up the "1<sup>st</sup> Gear Retard" system.

### Driveshaft Error Table Configuration

The difference between the "actual" and "desired" driveshaft speed is called "Driveshaft Error". The GEN3 ECU uses a "Driveshaft Error" table to determine how much spark retard to apply for a given level of driveshaft error. The driveshaft RPM error range in the table goes from zero (0) RPM error to 896 RPM error. Each cell represents 128 RPM of driveshaft error. A linear interpolation is used by the GEN3 ECU between rpm cells.

The GEN3 “Replay” data acquisition system will graph of the amount of timing retard used during any given pass. The timing retard variable displayed in the replay is called “**TorqRetard**”. The GEN3 ECU uses the timing retard values in the Driveshaft Error Table below to apply timing retard as a function of driveshaft error. For example, if the GEN3 ECU determines (from driveshaft sensor used in the system) that the driveshaft error is 896 rpm, based on the table below, the ECU will apply 12 degrees of timing retard until the driveshaft error is brought back to zero.



In order for the SR<sup>2</sup> system to operate the following conditions must be met.

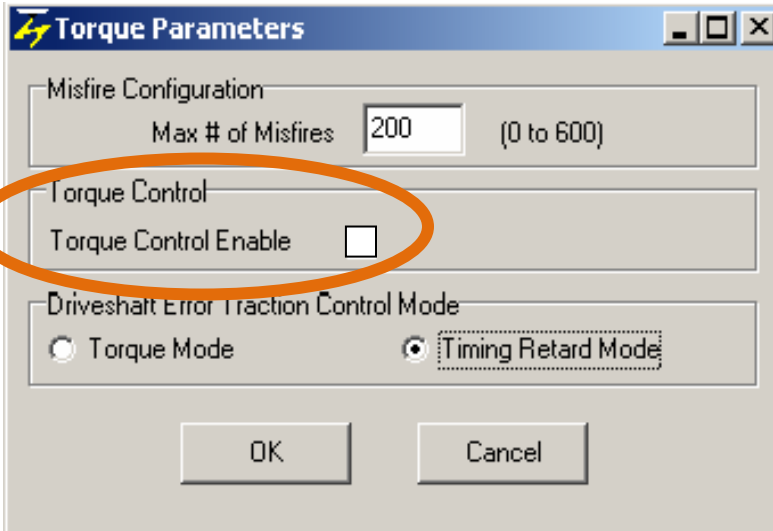
- The minimum RPM and TPS values in the “Boost Parameters” section above must be met.
- The timer enable wire must have 12V applied to it exactly when you want to start the timing sequence. This can be accomplished by inverting the signal from the trans-brake or clutch switch.
- The SR<sup>2</sup> system requires that the timer enable and DAE trigger wires be on separate On/Off switches.

**Note:** The Timer Enable sequence will be reactivated, every time the throttle is closed and then opened again (if you get off and then on the throttle again during a pass), until the “Blend” feature is active.

## Developing the Desired Driveshaft Curve

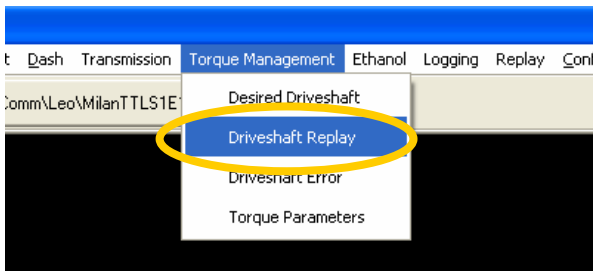
The best method for developing a desired driveshaft curve is to make a pass and record the driveshaft speed. Ideally, try to make the most aggressive pass possible without spinning the tires. Ensure that the following items are in place before attempting a pass:

- Make sure the driveshaft speed sensor is installed and functioning correctly. If the sensor output is erratic, switch the wires and/or check the sensor air gap, which should be between .080” and .100”.
- **Disable the Torque Management** system by un-checking box titled “Torque Control Enable”, in the Torque Parameters table shown below.

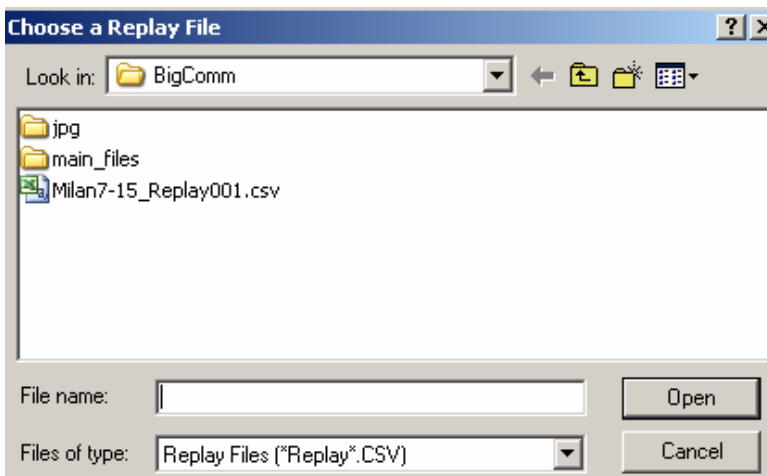


- With the system disabled, use the Replay function to collect data from a pass.

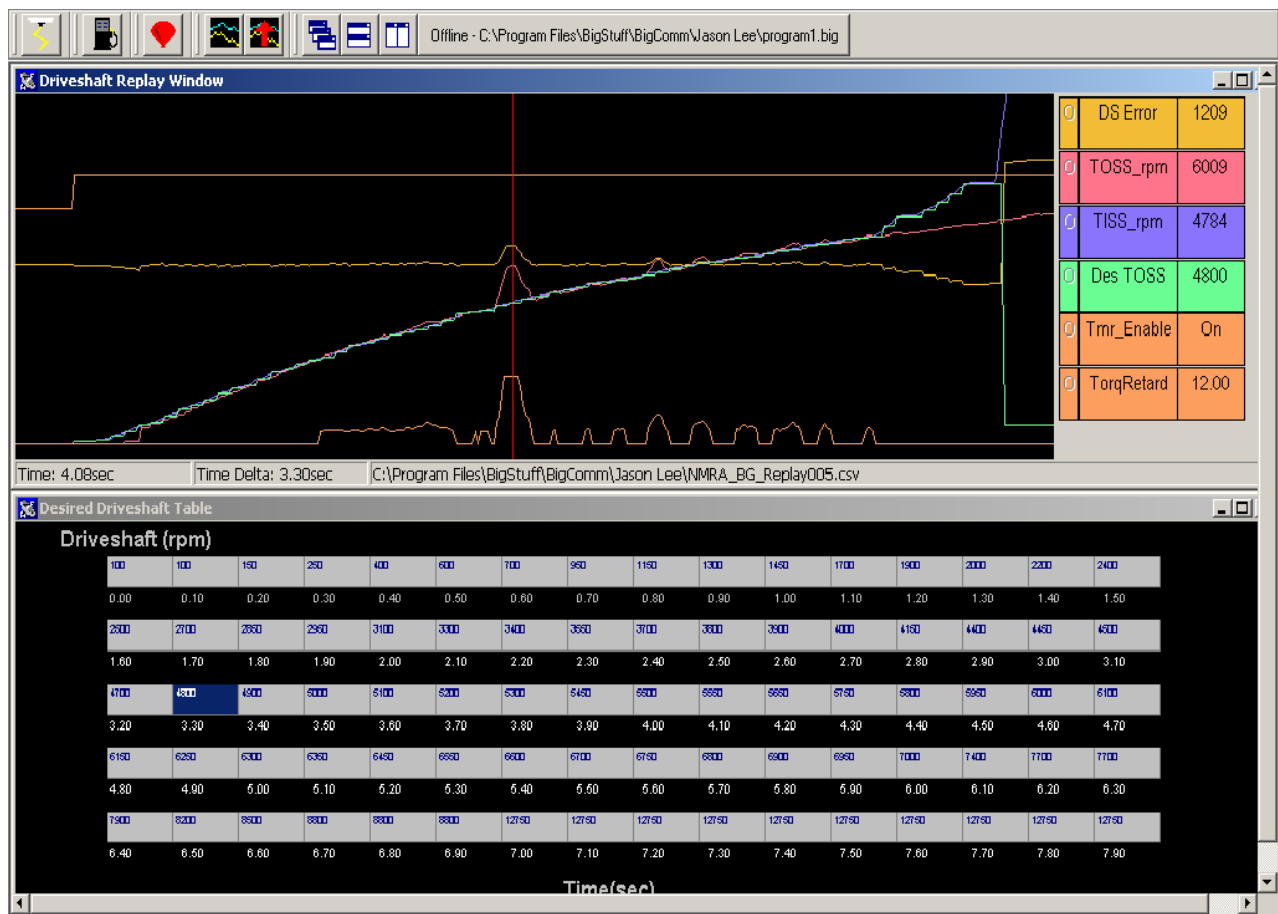
Once a “good” pass has been recorded using the “Replay” internal data logger, go to the “Torque Management” drop down screen from the main BigComm tool bar and select “Driveshaft Replay” as shown in the screen print below.



The following screen will open allowing you to choose the Replay you want to use to set up your “Desired Driveshaft Curve”.



Double left click on the preferred Replay and the screen below will open. The screen on top is the Replay selected, with only six (6) torque management related variables displayed. Below the Replay graph is the “Desired Driveshaft Table” which will be used to develop the Desired Driveshaft Curve.



**Traction Control Specific Signals shown in the right margin of the [Driveshaft Replay](#) window**

1. DS Error = Driveshaft Error – Shows the difference between the TOSS\_rpm and the TISS\_rpm. Values will be displayed in positive and negative numbers. Negative numbers indicated that the previously defined curve (the TISS curve) exceeded the Des TOSS curve.
2. TOSS\_rpm = Driveshaft Speed – Shows the actual driveshaft speed recorded.
3. TISS\_rpm – Shows the interpolated curve resulting from the previously entered values into the Desired Driveshaft Curve.
4. DES TOSS – Desired Driveshaft Speed = Shows the desired driveshaft curve as it is created. As values are entered into the Desired Driveshaft Table, the DES TOSS curve will appear in the Replay graph. **WHEN MAKING INDIVIDUAL CELL ADJUSTMENTS, THE “ENTER” KEY MUST BE PRESSED FOR THE CHANGES TO STAY! *The Desired Driveshaft Curve should be 100- 200 RPM above the actual driveshaft curve from the Replay you selected.***
5. TMR Enable – Timer Enable – Shows when the Timer Enable sequence started (when 12V was applied to the Timer Enable wire, Hdr 1, L2).
6. TorqRetard – Torque Retard Value – Shows the timing retard value the GEN3 ECU applied for a given Driveshaft Error RPM to control driveshaft speed.

**Traction Control Specific Signals shown in the right margin of the [Replay](#) window**

With the exceptions of DES TOSS and DS Error, all of the Replay signals outlined above, under the [Driveshaft Replay](#) window, are also internally logged and available for viewing as a Replay. The following additional traction control specific Signal is also available as a Replay.

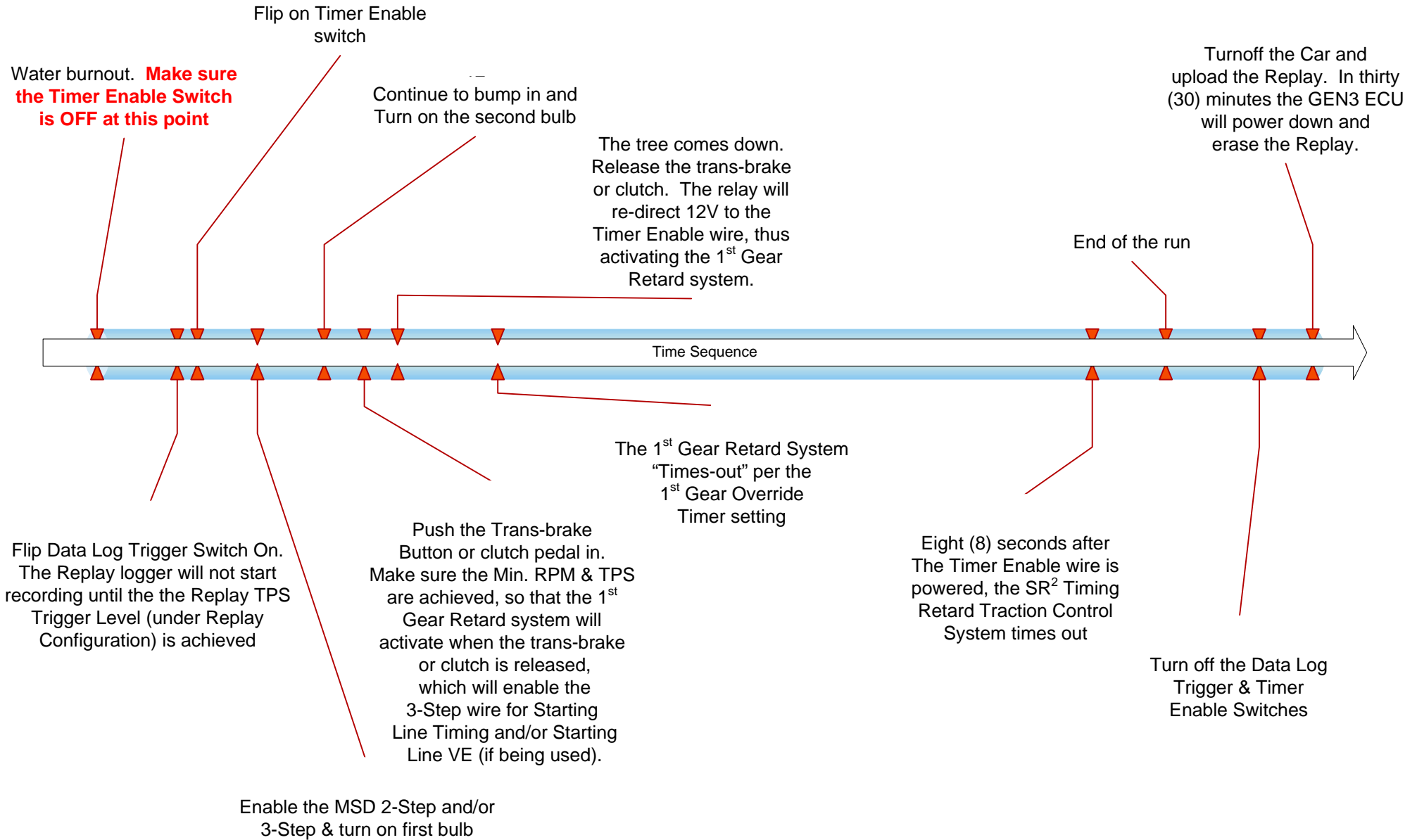




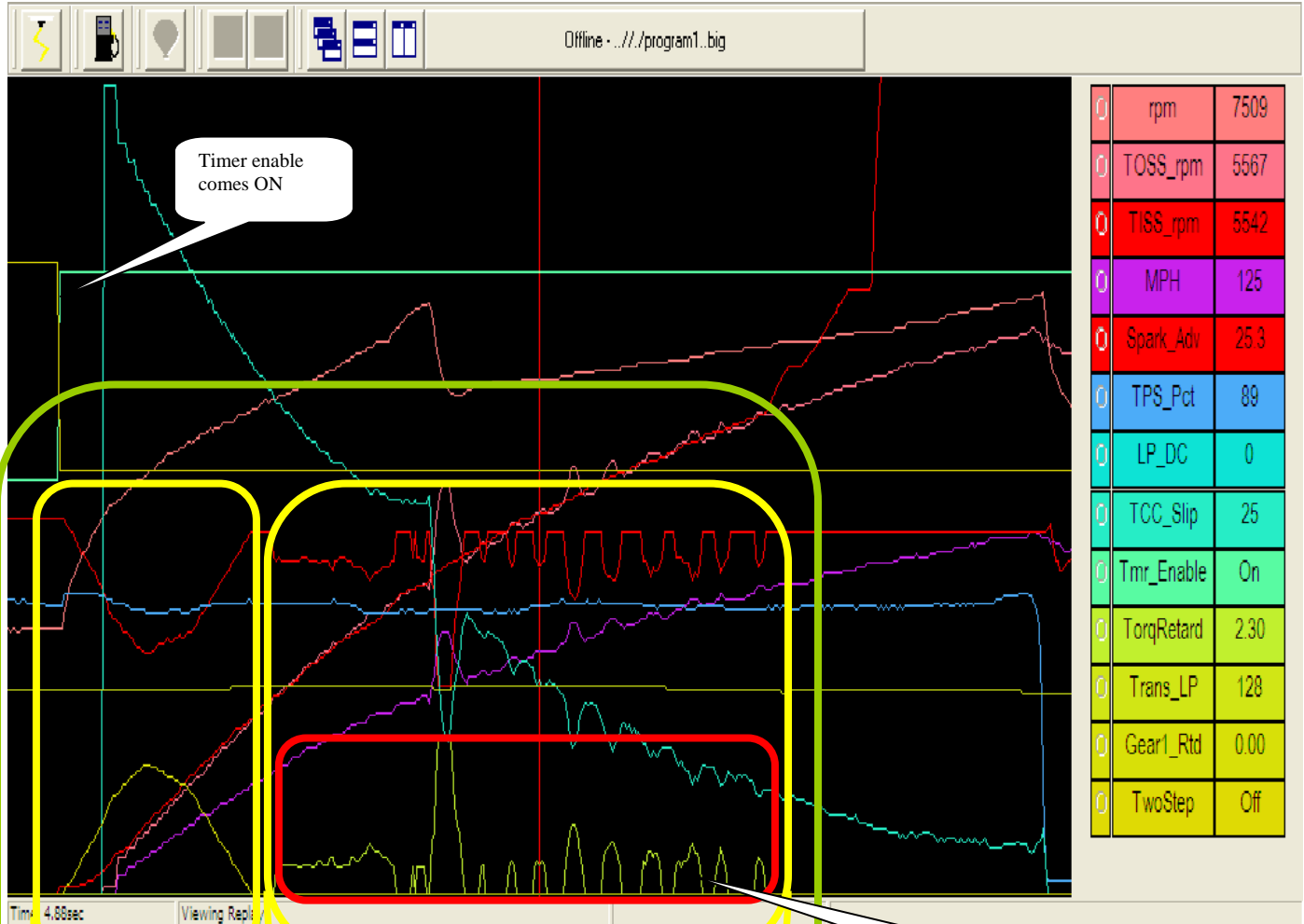
1. Gear1\_Rtd – The amount of timing retard applied at that RPM point, within the “1<sup>st</sup> Gear Timer Override” period

The “Desired Driveshaft Table” represents an eight second (8) time period, broken up into 80 cells each representing 1/10 of a second. In each of the eighty (80) cells, the user can define the desired driveshaft speed. All the usual editing features are employed (Fill, Interpolate, etc...) in the table as well, but only a row at a time. Remember to hit the “Enter” key to guarantee the change takes place if changing the cells independently.

# ¼ Pass – SR<sup>2</sup> System Sequence Time Line



# Interpreting SR<sup>2</sup> Replay Graphs



Shows the timing retard being applied during the pass to control the driveshaft speed to the desired curve

1<sup>st</sup> Gear Timing Retard System. Shows period until blend feature starts

Traction control system, based on timing retard. This system can intervene at any time once the "Timer Enable" wire is activated. It will intervene, if needed, even while the 1<sup>st</sup> Gear Retard system is active.

**Two stand-alone systems combined into a single traction control strategy based on a "Spark Retard" control. Both systems become active at the same point in time, when the "Timer Enable" wire is activated.**



1<sup>st</sup> Gear Retard Period from Timer Enable ON point

Shows 1<sup>st</sup> Gear Retard system is functional per time period defined in calibration (1.1.seconds). After 1.1 seconds, the system enters the blend period

Blend time period and the slope of the line are defined by the number of "Counts" inputted into the "Blend Rate" cell under Boost Parameters

### SR2 EXTENDED REPLAY FIRMWARE - IMPORTANT! PLEASE READ

Prior to the SR2 upgrade, your GEN3 ECU was configured with "Original Replay" internal data logging capability (it recorded for up to eighteen (18) seconds). The SR2 upgrade includes the "Extended Replay" functionality, which increases the number signals recorded and the record time up to five (5) minutes, based on the sample rate selected.

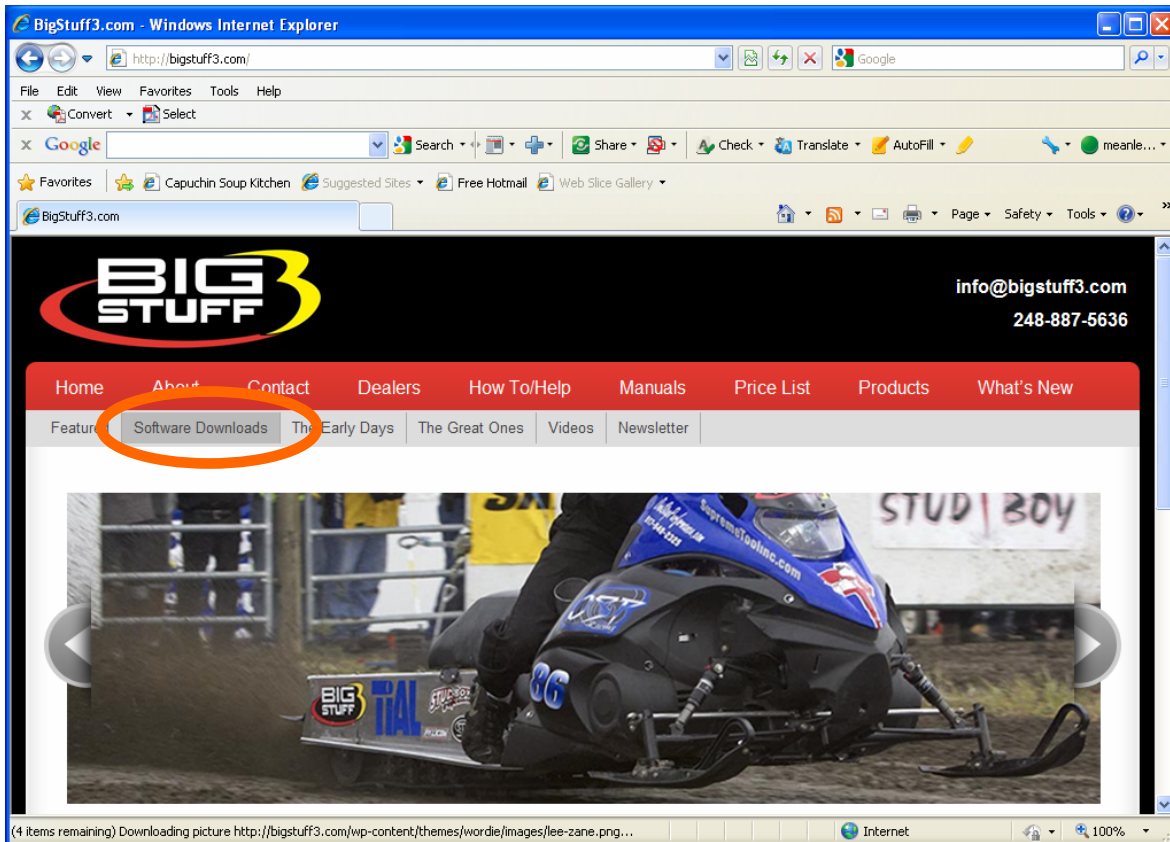
The "Extended Replay" firmware requires that a new folder be created inside of the BigComm folder, so that the internal data logging or "Replay" functionality is not affected.

First, create a new folder inside of the BigComm folder and name it **SR2\_BigComm** so that the file hierarchy is: C:\ProgramFiles\BigStuff\BigComm\SR2\_BigComm. See below.

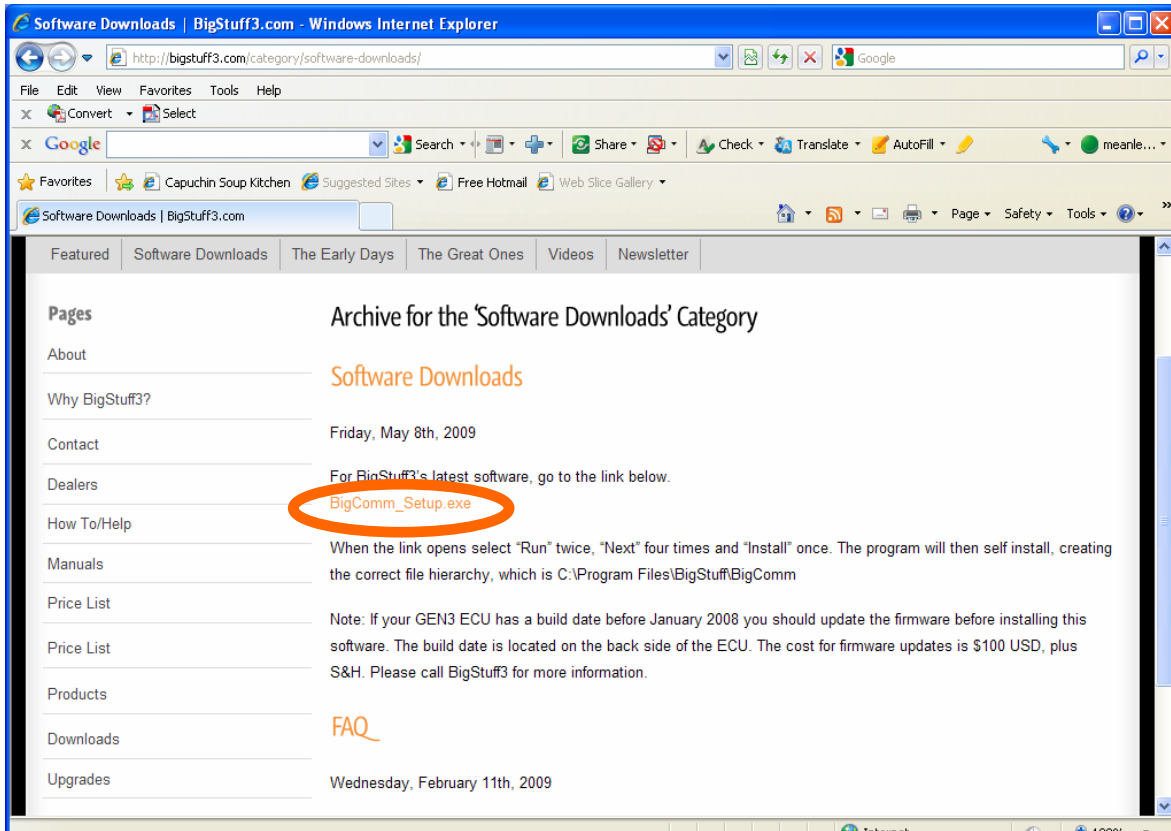


Next, download and then install the latest software into the new SR2\_BigComm folder. The GEN3 system software is available from the BigStuff3 website at [www.BigStuff3.com](http://www.BigStuff3.com). From the website home page, go to “Software Downloads” as shown in the screen print below.

Note: A CD ROM disk is no longer supplied with a CD ROM software Disc, but one can be purchased from BigStuff3.



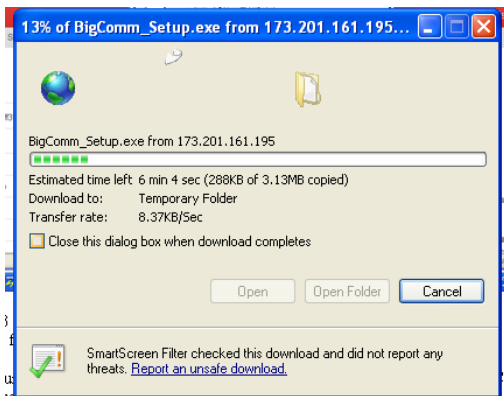
Double click on the [BigComm\\_Setup.exe](#) link shown below.



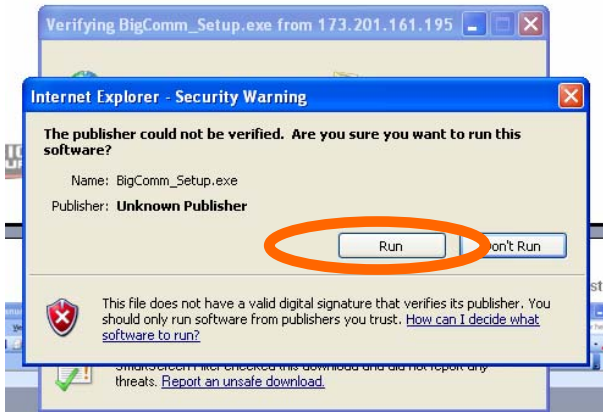
Double click on “Run”.



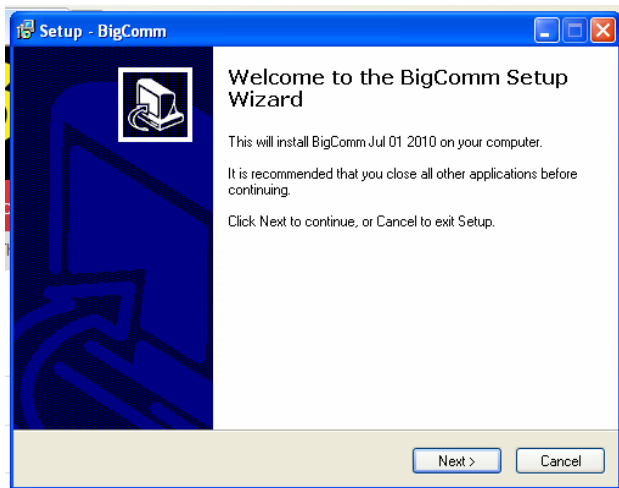
Download progress will be displayed as shown below.



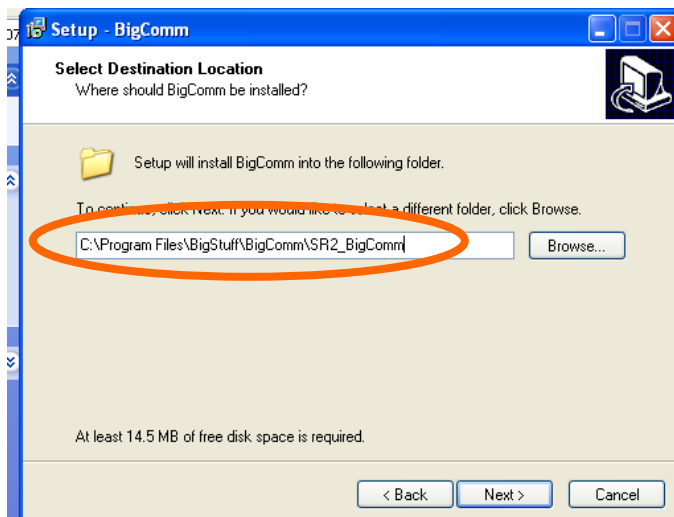
Again, double click on “Run”.



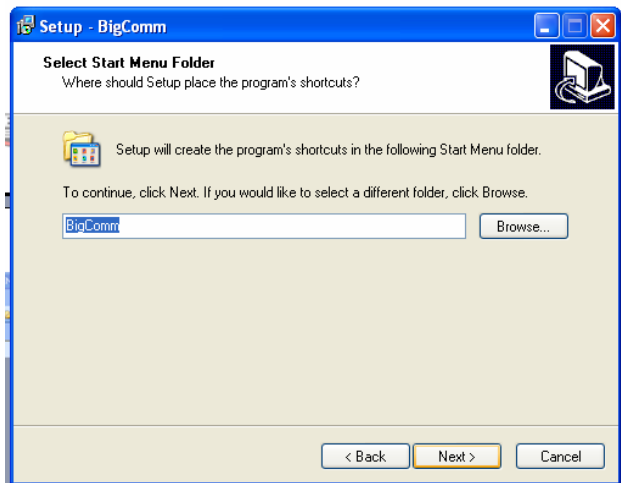
Double click on”Next”.



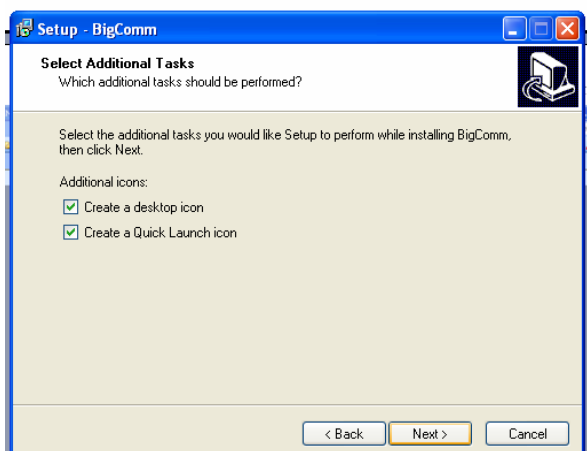
The software will automatically install using the correct file hierarchy, which is C:\Program Files\BigStuff\BigComm\SR2\_BigComm. This file structure is required for the software to work correctly. **Do not change the file location or file hierarchy!! Click “Next”.**



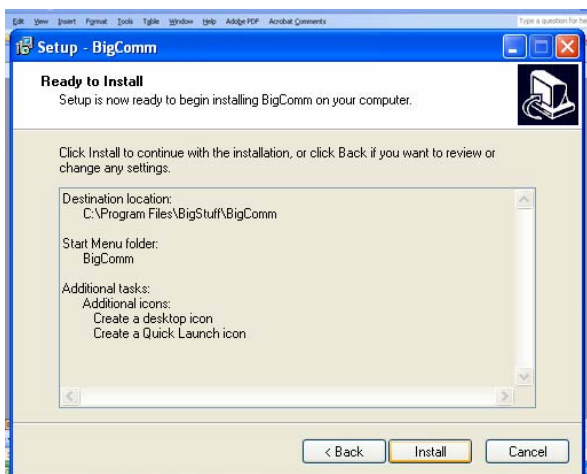
Click “Next” again.



To create a link on your desktop, and in the short cut tool bar in the lower right-hand corner of the PC's desktop, put a check box next to both the “Create a desktop icon” and “Create a Quick Launch icon” as shown in the screen print below, then double click “Next”.

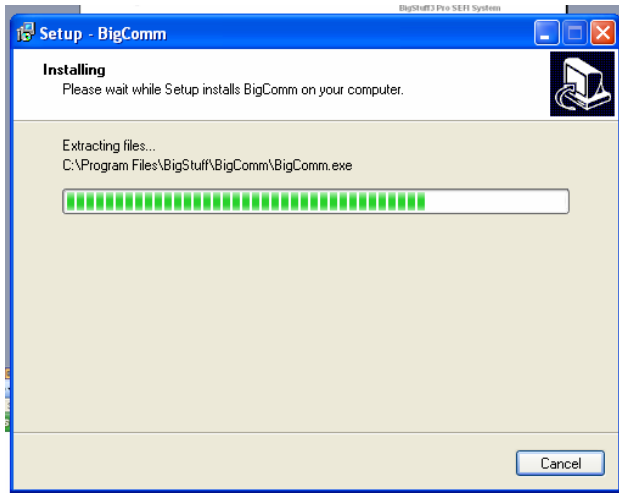


Next, double click “Install”.

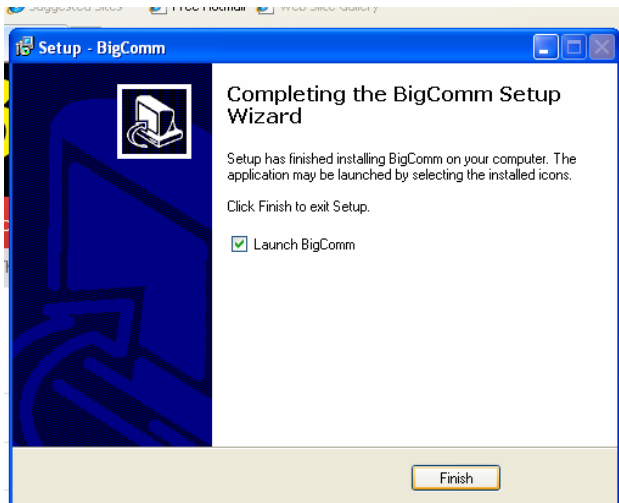




The software will self install on your PC as shown below.

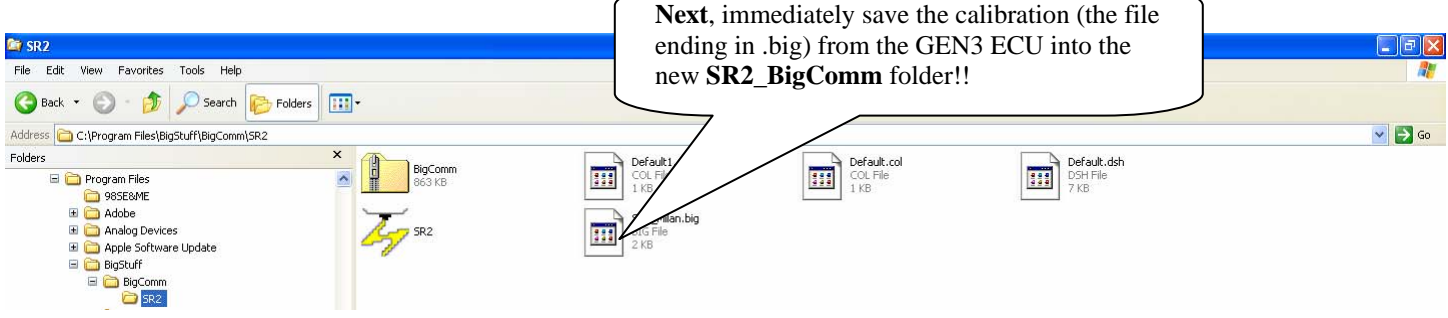
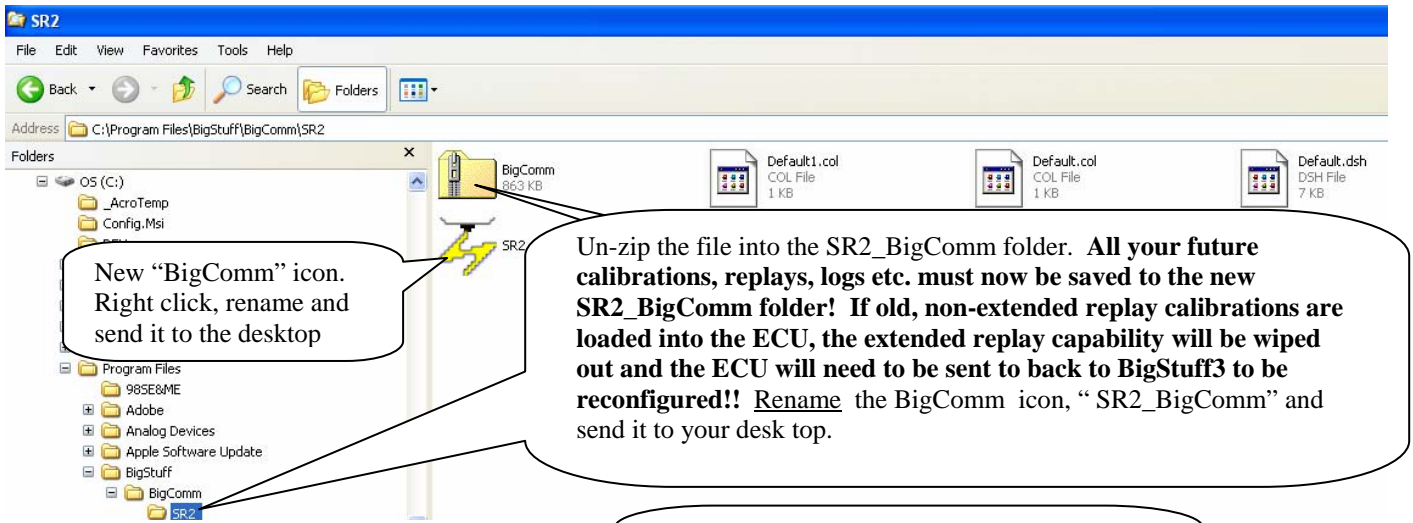
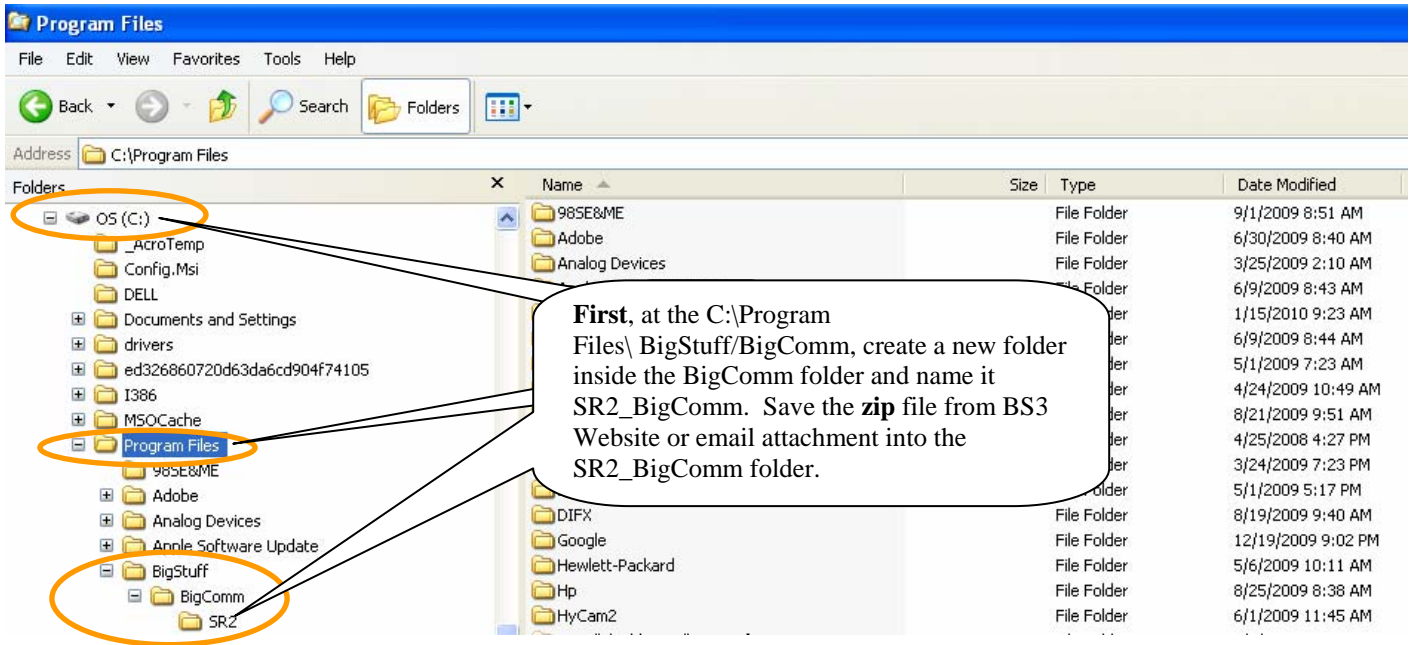


Lastly, if you want to open software put a check mark in the box next to Launch BigComm, as shown below.



Lastly, **(and most importantly)** connect your PC to the GEN3 ECU and immediately save the calibration from the BS3 GEN3 ECU into the new SR2\_BigComm folder! This calibration must be used as your baseline moving forward. Previously created calibrations must not be used or the “Replay” functionality will be affected! If old, non-Extended Replay calibrations are loaded into the ECU, the new extended replay capability will be wiped out and the ECU will need to be sent to back to BigStuff3 to be reconfigured!!

See the screen prints below for the file setup details.



**Important Notes Summary:**

- Rotor phase must be checked when using large retard values in the Driveshaft Error Table.
- The Timer Enable sequence will be reactivated, every time the throttle is closed and then opened again (if you get off and then on the throttle again during a pass). Until the “Blend” feature is active.
- The three “Boost Spark Retard Tables “are not functional with the SR<sup>2</sup> system.
- Make sure all of the magnets in the magnetic ring are all installed in the **SAME** direction.



- If the TOSS\_rpm trace is erratic switch the wires!
- To ensure that the 1<sup>st</sup> Gear Retard system becomes active when the trans-brake or clutch are released, make sure the Minimum RPM & TPS values are exceeded while on the 2/3-Step when the trans-brake is on or the clutch is depressed.
- The SR<sup>2</sup> 1<sup>st</sup> Gear Retard system **allows only one Timer Enable activation**. To eliminate the potential of activating the Timer Enable wire during the pre-stage burnout, put the Timer enable wire on its own On/Off switch. After the burnout, turn on the switch.
- The timer enable wire must have 12V applied to it the moment the trans-brake button or clutch is released. See relay wiring diagrams earlier in this manual.
- The SR<sup>2</sup> system requires that the timer enable and DAE trigger wires be on separate On/Off switches.
- Make sure the “Minimum RPM” in the Boost Parameters section is set 500 RPM below your 2 Step RPM Hi (3-Step) RPM setting under Configuration/Operating Configuration from the main BigComm toolbar