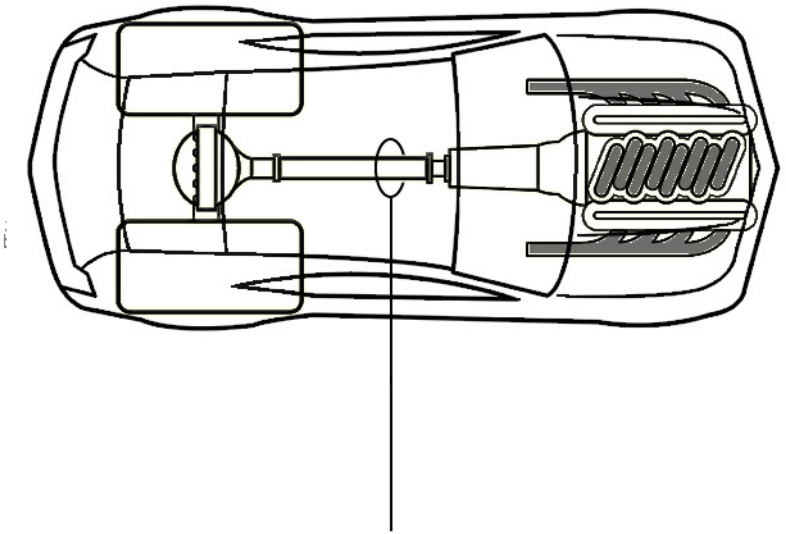
Haltech
ENGINE MANAGEMENT SYSTEMS



Advanced Torque Management Functionality

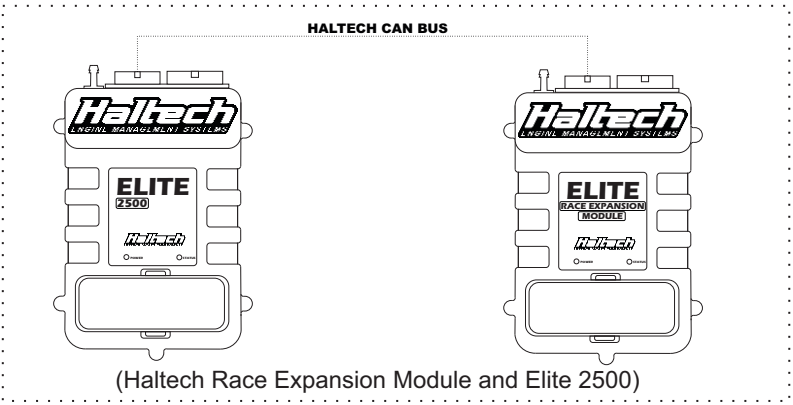
Quick Start Guide

What is Torque Management?

The Torque Management function is designed for drag racing applications, managing engine torque in order to maintain optimal wheel speed, resulting in optimized grip, acceleration and ultimately race times.

This function allows you to program a desired ‘’Driveshaft Target RPM’’ verses a range of different operating conditions. If the Driveshaft goes above the ‘’Driveshaft Target RPM’’user defined value, an extremely fast control system reduces engine torque by retarding the ignition timing and/or cutting individual cylinders until the Driveshaft RPM speed falls below the user defined value target.
The amount of ignition retard, as well as when to use cylinder cut is determined from the user-configurable tables in the ESP software. Additional torque reduction can be achieved by reducing boost or delaying a stage of nitrous. It is important to note that Torque Management will never advance the ignition timing past your ignition base table. If there are pre-programmed timed ignition retards active and driveshaft speed falls below the target, the torque management can override these pre-programmed timed ignition retards.

The Torque Management function is available with the Elite 2500T and Race Expansion Module. The Race Expansion Module must be connected to the Elite 2500 ECU through Haltech CAN in order for Torque Management to function.



(Haltech Race Expansion Module and Elite 2500)

OR

(Elite 2500T)

Driveshaft RPM Sensor Setup

The driveshaft rpm sensor is used to measure driveshaft rpm. This information can be used to adjust engine parameters including, but not limited to: fueling, ignition timing and boost control. The Driveshaft RPM is also critical in the use of the Driveshaft RPM control when using the Haltech Torque Management function.

The Driveshaft RPM sensor bracket is typically mounted using a pinion support bolt, or threaded directly into your aftermarket differential carrier / pinion support.
This sensor detect the number of pulses. It is mounted in the driveshaft split collar which is fitted on the round section of the tail-shaft yoke. You will need to measure the outside diameter (OD) of your tail-shaft yoke in order to determine what size driveshaft collar you will need. The most common sizes are 1.875" and 2.125".

Driveshaft collars are available with different numbers of magnets mounted in them. The minimum number of magnets recommended is 2, while 8 to 12 will offer the best resolution when using the driveshaft control strategy.
Driveshaft collars are available for purchase via your local Haltech dealer.

To enable Driveshaft RPM Sensor in the ESP software:

1. Press F4 on the keyboard to access Main Setup menu.

2. Select Driveshaft RPM Sensor function from ‘’Functions’’ menu located on the left.

3. In the **Wiring** tab select **Edit Connection.**

4. Select available SPI channel.

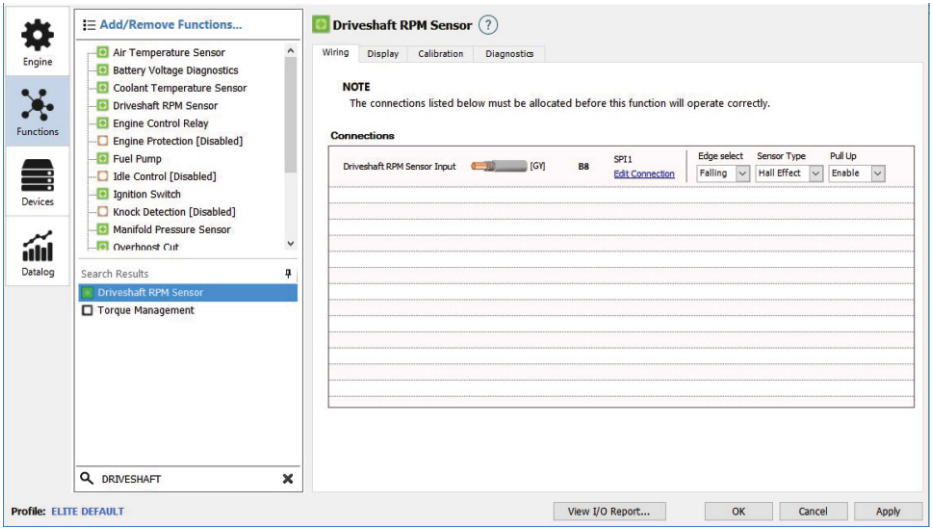


Figure 1 - Driveshaft RPM Sensor setup page

Display Tab

The display maximum is used to scale the display in the ESP software.
A typical value would be 10,000RPM.

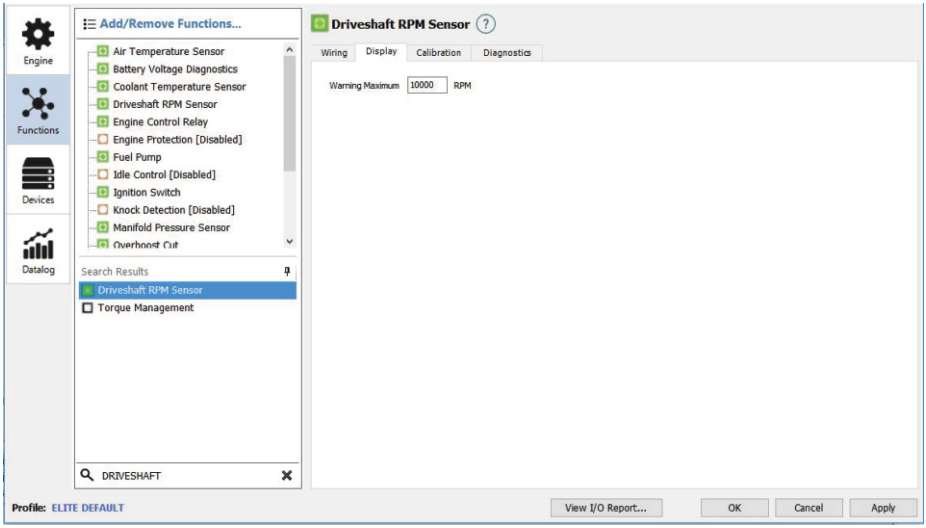


Figure 2 - Driveshaft RPM Sensor Display page

Calibration Tab

The Calibration tab allows user to enter the number of magnets in the driveshaft collar that will be detected each time the driveshaft makes a full rotation.
(Typically 2, 8 or 12 magnets).

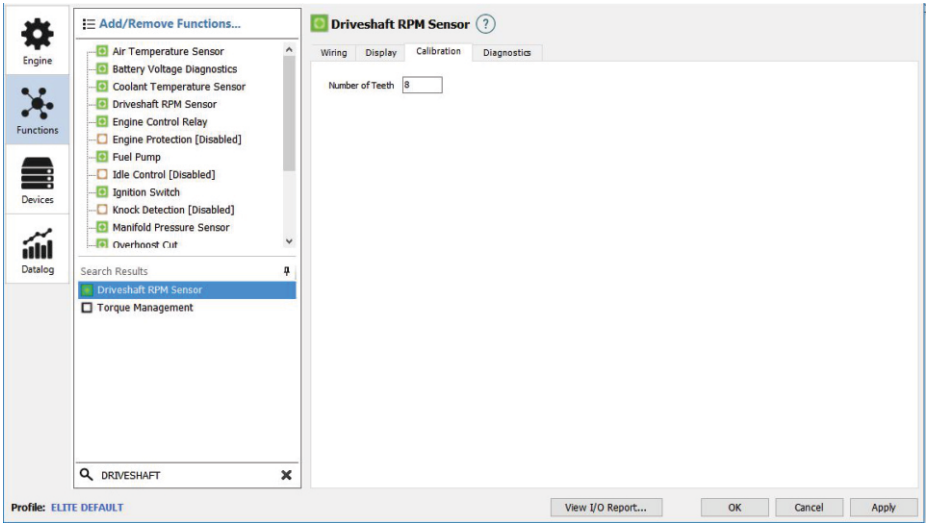


Figure 3 - Driveshaft RPM Sensor Calibration page

Diagnostics Tab

Allows user to setup min/max RPM conditions for DTC warning.

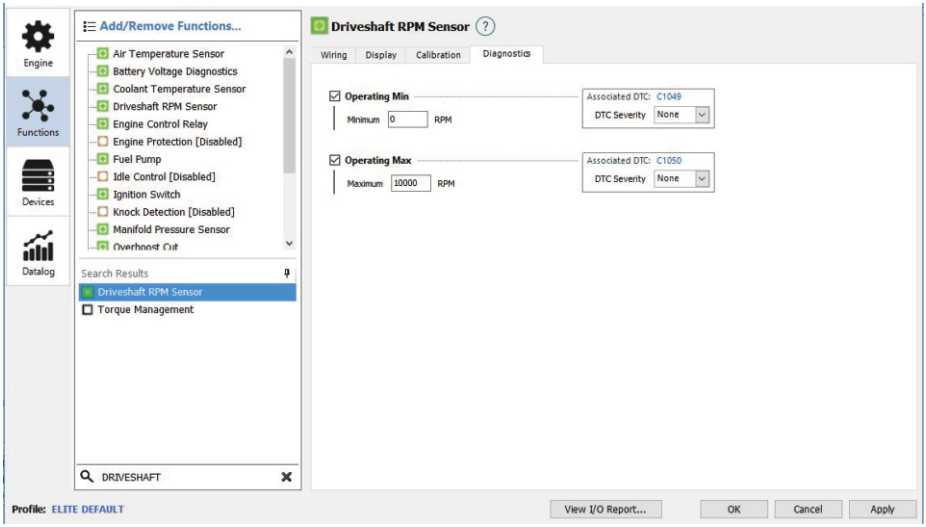


Figure 4 - Driveshaft RPM Sensor Diagnostics page

Torque Management Function Setup

To enable Torque Management function in ESP software :

1. Click F4 button to access Main Setup menu.

2. Select Torque Management function from the list on the left.

3. Click on **Wiring** tab

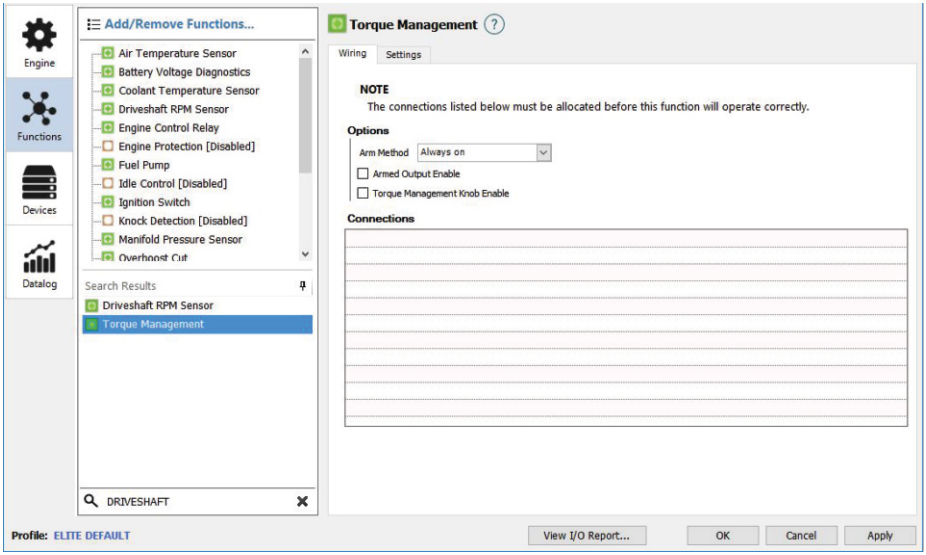


Figure 5 - Torque Management setup page

Arm Method

Select from the following:

- Always on: Torque Management will always be on.
- Switch: Allows the user to turn Torque Management on or off with a switch.
- Race Timer: This function requires a "Race Timer" to be setup in the software. The Race Timer would typically be triggered from a Transbrake release or Clutch release. The "Driveshaft RPM Target" would then be mapped verses the "Race Time". This is the most common use for this function.

Armed Output Enable

Ticking this box will add the "Armed Output" pin assignment to the Connections list. The purpose of the "Armed Output" is to provide a visual indication, such as LED light to the driver that the Torque Management function is armed and will function as configured.

Torque Management Knob Enable

Ticking this box will add the "Torque Management Knob Input" pin assignment to the Connections tab.

By wiring a Trim Knob (Rotary Switch) to an analogue input you can adjust the "Driveshaft RPM Target" to choose up to 8 different driveshaft curves. This makes adjusting the driveshaft curve very quick and easy when you are sitting at the start line and notice the racetrack has improved or gone off from the run before you. This is accomplished by using the knob position as one of the input axes of whichever Torque Management tables the tuner desires.

Knob Calibration Tab

Below is an example of the Knob Calibration table. Note that the calibration table may have more output positions than your knob's range.

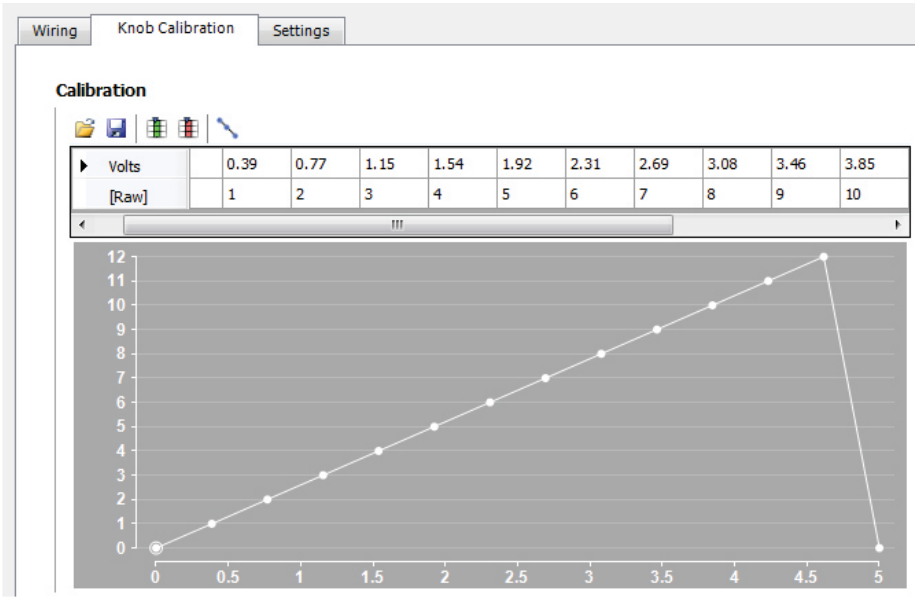


Figure 6 - Knob Calibration page

Settings Tab

Cut Method

This determines which type of cylinder cut to use in order to limit engine torque when the driveshaft rpm exceeds it's target too much for ignition retarding to control by itself.

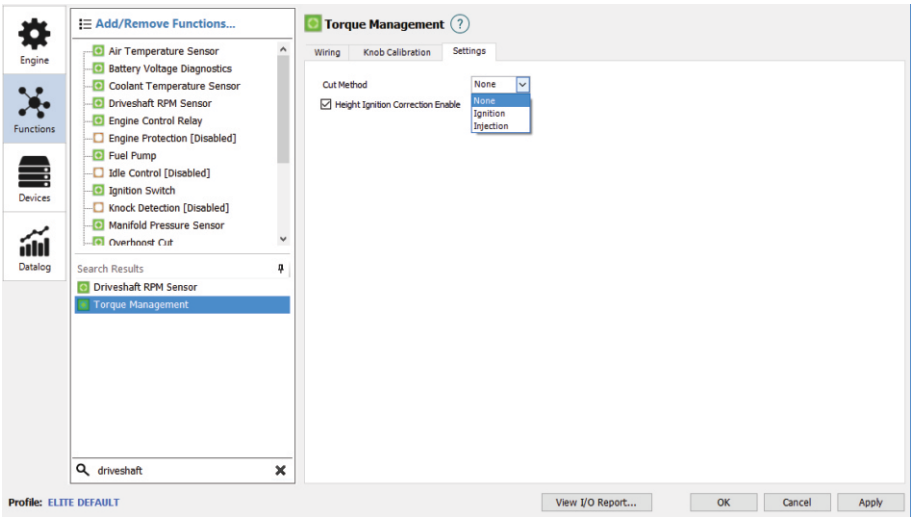


Figure 7 - Torque Management Settings page

Height Ignition Correction Enable

- This setting enables Height Ignition Correction table. This table is intended to retard ignition timing if the front wheels are lifting off the ground, based on the input data received from Shock Travel or Ride Height sensors.

Race Timer

The Race Timer is commonly used in drag racing applications, as functions like boost control and ignition timing have to vary as the race progresses. However, there's nothing to stop it being used for circuit racing or other purposes.

The Race Timer outputs to the race time channel, which shows in seconds with millisecond resolution.

The basic operation of the race timer is that it will be off when the ECU turns on. It will then check the start conditions and begin timing from when the start conditions are met. It will pause if the pause conditions are met. It will unpause if the pause conditions are no longer met and it will stop and reset to 0 if the reset conditions are met.
Note that if both the start and reset conditions are met at the same time, the Race Timer will remain stopped. A stopped race timer is indicated by the Race Timer having a value of 0.

To enable Race Timer function in the ESP software :

1. Click F4 button to access Main Setup menu.

2. Select Race Timer function from the list on the left.

3. Click on **Start** tab

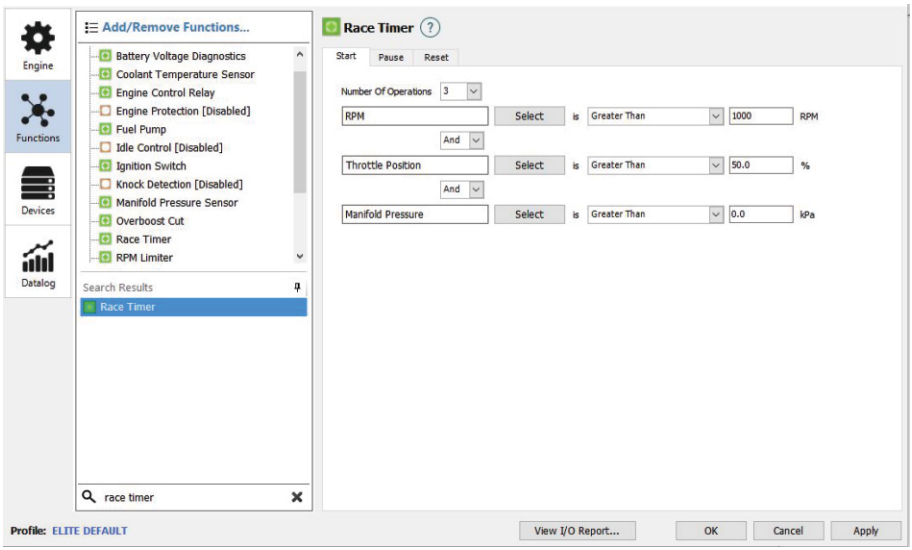


Figure 8 - Race Timer setup page

Number of Operations

These are the possible operational conditions which are checked to start the Race Timer.
Changing this will grey out any unused operations.

Clicking **Select** will open up a channel search window showing all available channels.

The following channel condition selections available are:

- Equal To
- Not Equal To
- Greater Than
- Less Than
- Greater Than Or Equal To
- Less Than Or Equal To

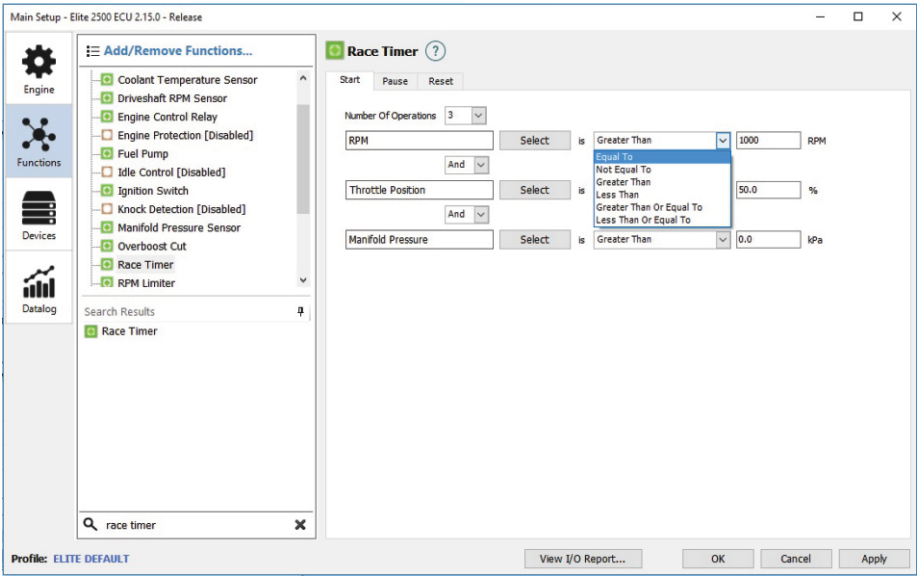


Figure 9 - Race Timer channel conditions

Pause Tab

Enable Pause Condition tick box

Ticking this box will enable condition/s to pause the race timer.

Number of operations

These are the possible operational conditions, which are checked to pause the Race Timer.
Changing this will grey out any unused operations.

The following channel condition selections available are:

- Equal To
- Not Equal To
- Greater Than
- Less Than
- Greater Than Or Equal To
- Less Than Or Equal To

Reset Tab

Number of operations

These are the possible operational conditions, which are checked to reset the Race Timer.
Changing this will grey out any unused operations.

The following channel condition selections available are:

- Equal To
- Not Equal To
- Greater Than
- Less Than
- Greater Than Or Equal To

Setting up Tables

Under ECU Navigator>Torque Management select **Timed Ignition Correction**

Axis selection and changing values

This table is intended to be used with the Race Time set as the first (left to right) axis and Torque Management Knob as the second (bottom to top) axis, though these axes are user configurable to use any ECU channel.

Changing the axis values can be accomplished by pressing F3 when the table is selected, then either editing an existing value or adding a new value. Note that if you edit an axis site value, the overall table values will be adjusted so that the shape of the table is unchanged.

Tuning

The purpose of this table is so the traction tuner can tell the ECU how much to retard ignition timing, based on the time since the start of the race. This allows the car to leave the start line with full engine power and get "on-top" of the tire, then retard the ignition timing to prevent wheel-spin. The map would then re-introduce the ignition timing as road speed increased and the tire can handle the extra power.
This helps to prevent the wheel spin before it happens.

As a general rule, this table should be tuned so that the feedback system only has to make minor corrections. This is accomplished by adjusting this table close to the logged values for the "Torque Management Combined Ignition Correction" channel, synchronised to Race Time.

An example in Figure 10 shows what this table should roughly look like: (If you wish to remove the coloured columns from the 2D view (second one): Right click on the "2D" display and select "Hide Columns")

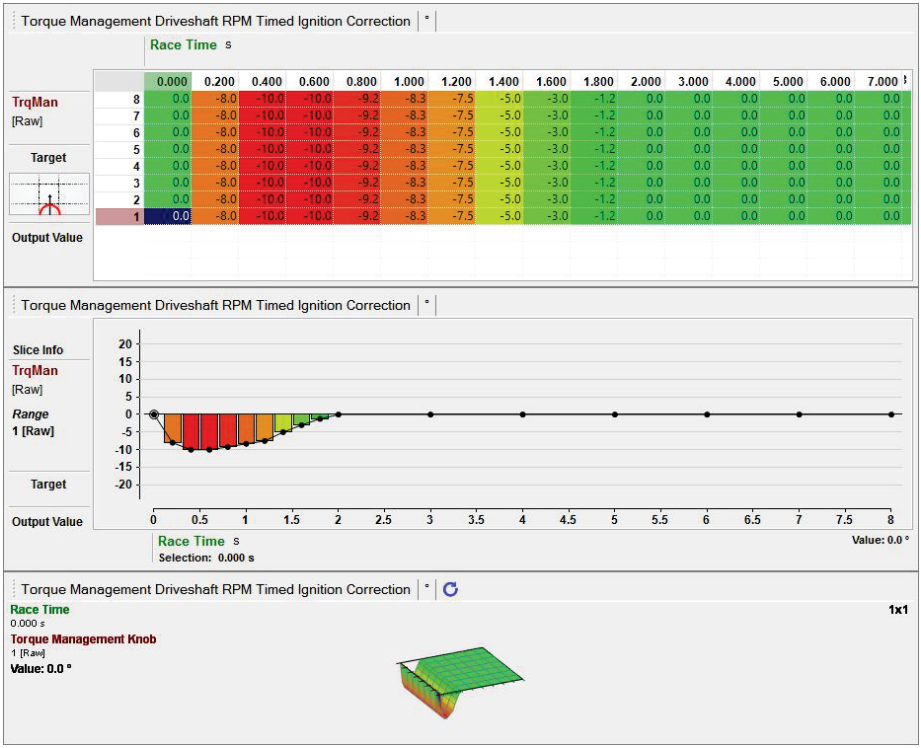


Figure 10 - Timed Ignition Correction table

Driveshaft RPM Target

Axis selection

This table is intended to be used with the Race Time set as the first (left to right) axis and Torque Management Knob as the second (bottom to top) axis, though these axes are user configurable to use any ECU channel by pressing F3 when the table is selected.

Changing the axis values can be accomplished by pressing F3 when the table is selected, then either editing an existing value or adding a new value. Note that if you edit an axis site value, the overall table values will be adjusted so that the shape of the table is unchanged.

Tuning

The purpose of this table is to contain the curve of the ideal Driveshaft RPM over the course of the race. The Driveshaft RPM Target Error channel is the difference between the actual Driveshaft RPM and the Driveshaft RPM Target.
A positive error means that the driveshaft is spinning too fast.

To get a starting point for this table, copy Driveshaft RPM data from datalogs of the car's previous races, or by racing the car with the driveshaft control off and logging the Driveshaft RPM. It is recommended to start by only tuning one row (e.g. Knob at position 5). Then, as you get the Torque Management tuned better, you'll want to tune the different rows for 8 different levels of track condition. E.g. Knob position 8 is best possible conditions and knob position 1 is worst possible conditions.

This table should be tuned with Driveshaft RPM values which gives the best acceleration at a given point.

An example in Figure 11 shows what this table should roughly look like: (If you wish to remove the coloured columns from the 2D view (second one): Right click on the "2D" display and select "Hide Columns")

Figure 11 - Driveshaft RPM Target table

Driveshaft RPM Target Error Cut Offset

If the Driveshaft RPM exceeds the "Driveshaft RPM Target" by this amount the ECU will drop the engines next fuel or ignition event (Selected under Main Setup > Functions > Driveshaft RPM Control > Settings > Cut Method).
The ECU will check if the Driveshaft RPM is over the target by this amount after each cylinder event and will re-introduce engine power on the first cylinder to fire once the Driveshaft RPM is within range of the "Driveshaft RPM Target" by this amount.
A typical value for this table is 250RPM

This table can be a single value (e.g. 250 rpm), or have up to 2 input axes (e.g. Torque Management Knob and Driveshaft RPM).

Below is an example what this table might look like:

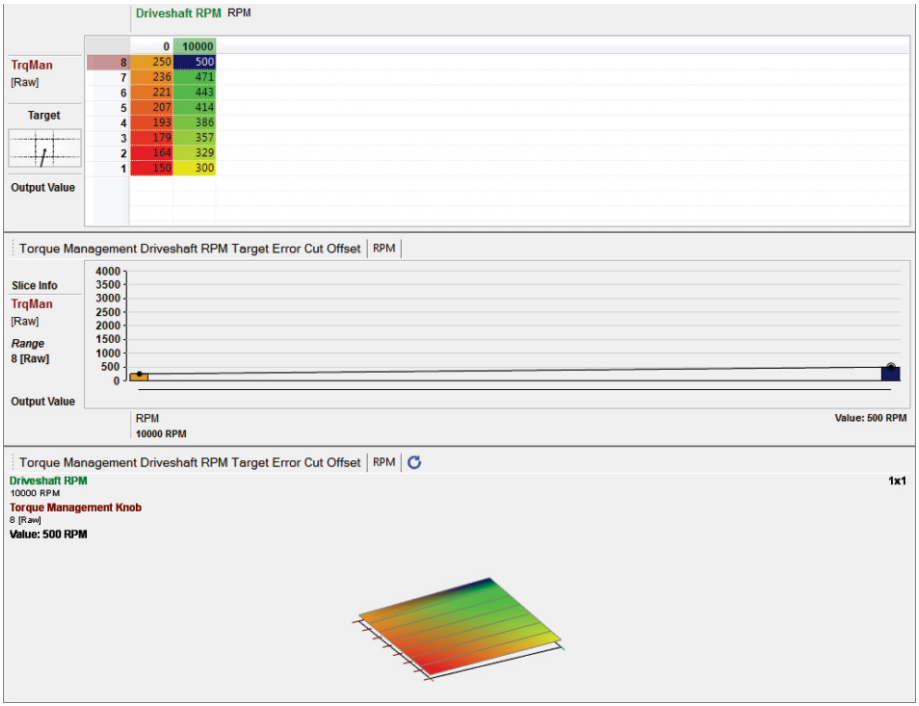


Figure 12 - Driveshaft RPM Target Error Cut Offset table

Driveshaft RPM Target Error Ignition Correction

This is the ignition timing correction to be applied based on the Driveshaft RPM. It is highly recommended that at least one axis of this table is Driveshaft RPM. Popular choices for the other axis include: Race Time, Gear and Engine RPM. Alternatively, you can just disable the second axis.

It's important to note that Torque Management can never advance ignition timing overall, even if individual tables indicate that ignition advance is desired. An example of this is, if the timed ignition correction says to retard 4 degrees, but the Driveshaft RPM is below it's target. In this case, the Driveshaft RPM Target Error Ignition Correction might override the Timed Ignition Correction, but it still can't cause an overall advance.

Below is an example what this table might look like:

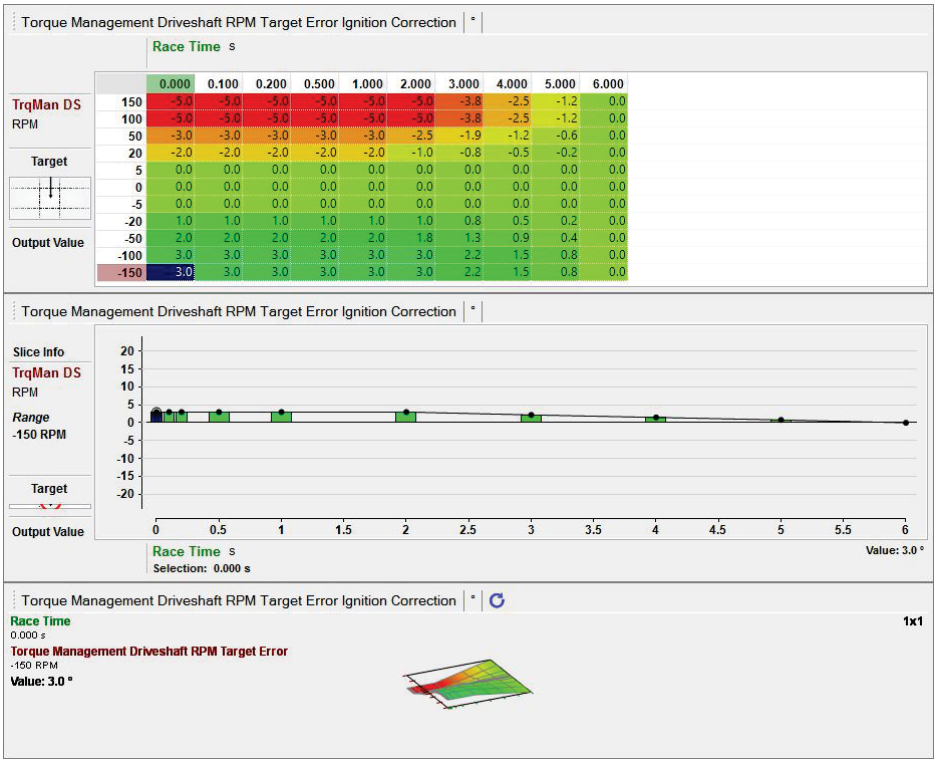


Figure 13 - Driveshaft RPM Target Error Ignition Correction table

Height Ignition Correction

The purpose of this table is to cause an ignition retard if the front wheels start lifting off the ground. This is partially for safety and partly to optimise grip. It is used in conjunction with Shock Travel or Ride Height sensors.

Below is an example what this table might roughly look like:

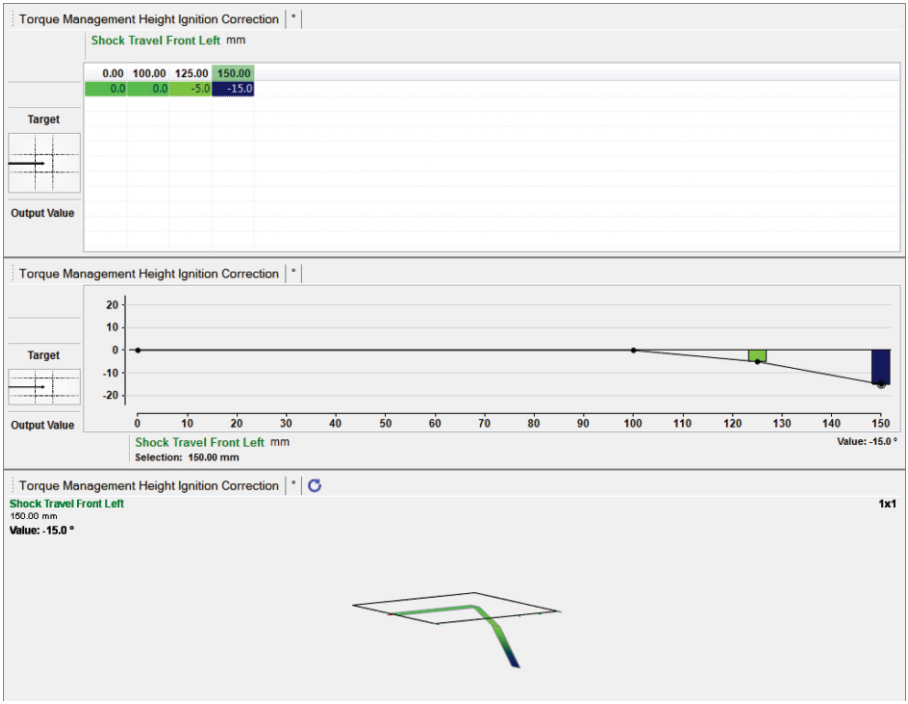


Figure 14 - Height Ignition Correction table

Tuning Tips

It is best if the engine is tuned as well as practical before tuning Torque Management. Bare minimum logged channels for tuning Torque Management are:

- Race Time (or whatever your Torque Management tables use as their primary axis)
- Driveshaft RPM
- Driveshaft RPM Target
- Engine Limiter Active
- Torque Management Combined Ignition Correction

Recommended channels to log for tuning Torque Management:

- Torque Management Knob (or whatever your Torque Management tables use as their secondary axis)
- RPM
- Torque Management Armed State
- Torque Management Driveshaft RPM Limit
- Torque Management Timed Ignition Correction
- Torque Management Target Error
- Torque Management Target Error Ignition Correction
- Torque Management Height Ignition Correction

Helpful channels to log for drag racing:

- Air Temperature
- Coolant Temperature
- Driveshaft RPM
- Engine limiter active
- Fuel Pressure
- Ignition Angle
- Launch Control Input state
- All used Injection stage duty cycles.
- Manifold Pressure
- Oil Temperature
- Oil Pressure
- Race Time
- Throttle Position
- Trigger System Errors
- Wideband O2

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