MHD+ Tuning Guide

Revision 1.10 • 6/28/2022

Table of Contents

Introduction

MHD+ is the overall encompassing name of our suite of custom features we have added to the DME in order to improve and expand upon its functionality. Currently we offer MHD+ support for the following vehicles:

- **E-Series (MSD8x DME):** N54
- **F-Series (MEVD DME):** N13, N55 (PWG and EWG), S55
- **F/G-Series (MG1 DME):** B58 gen1

We are working to actively expand MHD+ support to more engines and platforms, both newer and older, so stay tuned! Additionally, the list of MHD+ features will be expanded going forward as well, and we have quite a few exciting additions both planned and in the works.

The MHD+ feature set currently includes the following:

- Antilag
- CAN based Ethanol Content Analyzer (ECA) integration
- Motiv Re|Flex integration
- On-the-fly map switching
- FlexFuel
- New / Custom tables
- MHD+ specific custom DTC error codes

For information and tuning help related to the various features, please see their respective sections below.

NOTE:

The empty CAL area we are using for new tables can be set to 0xC3, 0x00, or some other junk data in OEM form (depending on the DME type and ROM version). Please be aware of this. You may start with one of our pre-filled MapSwitchBase bins that will have friendlier values in the tables, or you may copy those changes over to your bin in TunerPro.

Platform Specific Notes

There are some small differences in MHD+ between platforms. This can include the tables provided, axis orientation, implementation details, etc. Also, some platforms needed special conditions added in order to circumvent their unique limitations (like the ~22psi boost cap on N54).

We have done our best to comprehensively detail these differences, exceptions, etc in this document. In each of the below sections, a **PLATFORM NOTES** comment will expand upon these details. Please feel free to reach out to us if there is something you have a question about or notice it is not covered / detailed, and we will be more than happy to assist.

Antilag

This feature is enabled by setting the **Enable Antilag** table to 1, while appropriately tuning the below tables. Antilag is then activated in the car (once operating conditions are within the configurable safety limits) by pressing and holding one of the following buttons below, while applying throttle:

- **E-Series:** pull cruise control stalk in **TOWARD** you, or hold steering wheel **VOL DOWN**
- **F/G-Series:** hold either the cruise control **RES** button, or the cruise control **DOWN** rocker switch (both first and second indent work)

PLATFORM NOTES:

- **MG1 DME:** provides the ability to **Enable Antilag** per map slot.

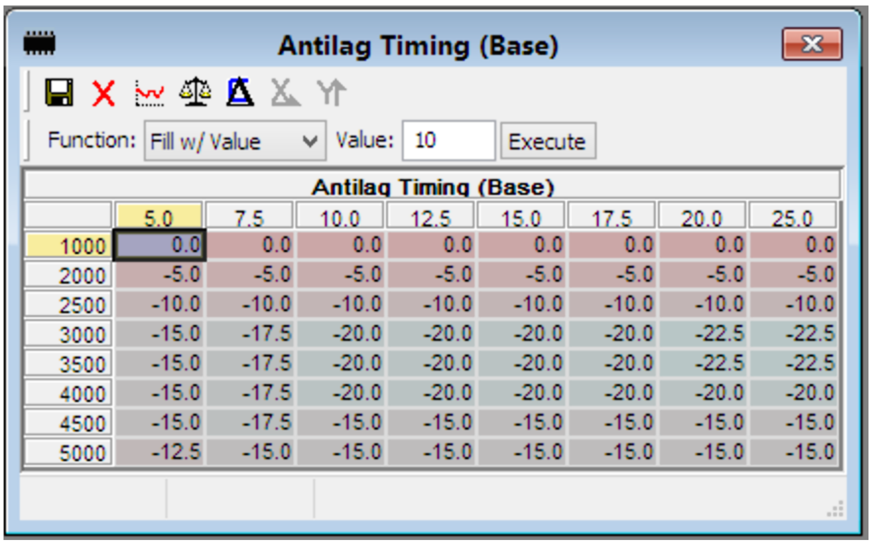
Main Tables

Tuning of these tables can greatly vary from car to car due to the exhaust setup, turbo, fuel, etc. The values and screenshots below are meant to be a general guide / starting point. Always log and validate per vehicle.

Antilag Timing (Base)

Timing retard is the main driver in generating exhaust gas energy and heat to get your turbo spooled up. The goal is to retard timing enough to greatly reduce or eliminate the forward acceleration of the vehicle (for rolling use cases, stopped / launch use cases can disregard), while also providing sufficient energy to get the turbo spooled. Similar amounts of timing retard can likely be used for various boost target columns as the DME can regulate boost with WGDC and throttle position as well. While antilag is active, this timing table becomes the new main timing table.

- **X-axis**: Boost Target (psi, relative)
- **Y-axis**: RPM



Antilag Timing (Base)

	5.0	7.5	10.0	12.5	15.0	17.5	20.0	25.0
1000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2000	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0
2500	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0
3000	-15.0	-17.5	-20.0	-20.0	-20.0	-20.0	-22.5	-22.5
3500	-15.0	-17.5	-20.0	-20.0	-20.0	-20.0	-22.5	-22.5
4000	-15.0	-17.5	-20.0	-20.0	-20.0	-20.0	-20.0	-20.0
4500	-15.0	-17.5	-15.0	-15.0	-15.0	-15.0	-15.0	-15.0
5000	-12.5	-15.0	-15.0	-15.0	-15.0	-15.0	-15.0	-15.0

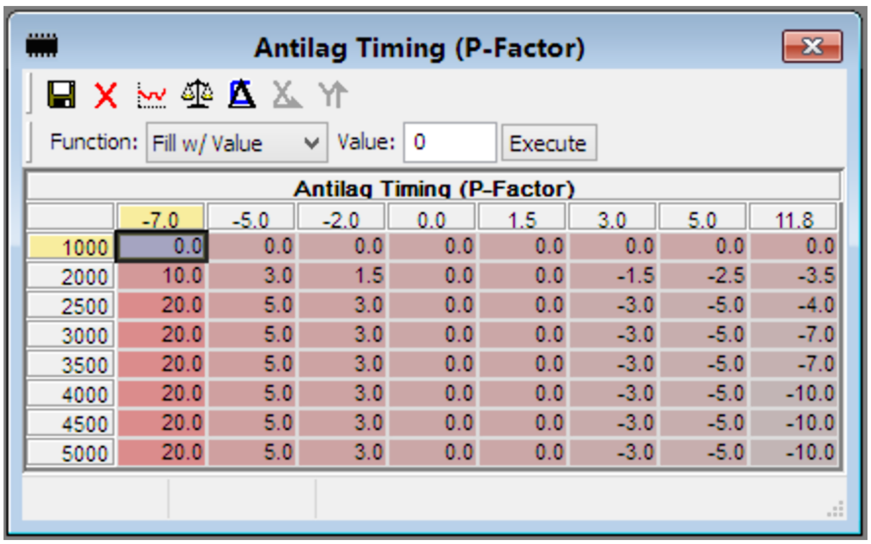
PLATFORM NOTES:

- **MSD8x DME:** the boost target axis features dynamic scaling (when also using the 3-cell TMAP scaling), to allow entering actual boost values past 22psi.
- **MG1 DME:** the X and Y axis are swapped

Antilag Timing (P-Factor)

This is a simple P-factor table whose output is added to the result of the Timing (Base) table above. Its purpose is to help provide enough timing retard to attain the boost target (for large positive boost deviations), while also providing a safety net to add positive timing in the result of an overboost (negative deviation).

- **X-axis**: Boost Deviation (psi, relative)
- **Y-axis**: RPM



Antilag Timing (P-Factor)

	-7.0	-5.0	-2.0	0.0	1.5	3.0	5.0	11.8
1000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2000	10.0	3.0	1.5	0.0	0.0	-1.5	-2.5	-3.5
2500	20.0	5.0	3.0	0.0	0.0	-3.0	-5.0	-4.0
3000	20.0	5.0	3.0	0.0	0.0	-3.0	-5.0	-7.0
3500	20.0	5.0	3.0	0.0	0.0	-3.0	-5.0	-7.0
4000	20.0	5.0	3.0	0.0	0.0	-3.0	-5.0	-10.0
4500	20.0	5.0	3.0	0.0	0.0	-3.0	-5.0	-10.0
5000	20.0	5.0	3.0	0.0	0.0	-3.0	-5.0	-10.0

PLATFORM NOTES:

- **MSD8x DME:** this table is not provided due to free CAL space restrictions
- **MG1 DME:** the X and Y axis are swapped

Antilag Timing Ramp Rates

The instant antilag is disengaged, ignition timing starts blending back to the values of whichever main DME timing table is currently active (spool, path 1, path 2, etc). These two single cell tables determine that rate. While ignition timing is still negative, the **Timing Ramp Rate (°crk < 0)** table is used. Once it reaches 0, then the **Timing Ramp Rate** table is used.

- **Timing Ramp Rate**: suggested value of 1.5 (°crk/10ms)
- **Timing Ramp Rate (°crk < 0)**: suggested value range of 5 - 10 (°crk/10ms)

Antilag Boost Target

While antilag is active, this acts as a ceiling to boost target. Therefore if the user is only slightly pressing the throttle, it is possible to have a lower target than what is set in this table. The table units are **psi, relative**.

PLATFORM NOTES:

- **MSD8x DME:** this table features dynamic scaling (when also using the 3-cell TMAP scaling), to allow entering actual boost values past 22psi.
- **MG1 DME:** provides configuration boost targets per map

Antilag Fuel Target

While antilag is active, this table becomes the active AFR target for fuel banks 1 (and 2 if appropriate). Leaner values can give even quicker spool, while richer will help keep the EGT cooler. If you are using this to try and keep EGT under the safety value, be sure to log our **EGT pre-turbo** parameter. While its exact value is not necessarily accurate, the trends are and this is one of the fastest responding EGT parameters the DME has.

Turbine I-Factor

While antilag is active, we selectively enable the I-Factor applied to turbine power (kW). There are three single cell tables: the minimum and maximum bounds of the integration constant sum, and the actual integration constant (amount added or subtracted every 10ms). The intent of these tables is to help with overboosting during antilag, so we recommend setting the **Maximum** to 0. The **Minimum** and **Constant** can be set to 0 if not desired, or tuned accordingly to help keep antilag boost in check.

PLATFORM NOTES:

- **MSD8x DME:** this table is not provided (was not deemed necessary)
- **MG1 DME:** this table is not provided (was not deemed necessary)

Antilag Compressor Base / P-factor

These tables are provided to give better boost control during antilag on MG1 DME vehicles. To enable these tables, set the **Enable Antilag Compressor Map and P-Fac Tables** table to 1, and then fill the **Antilag Compressor Map… and Antilag WGDC P-Fac** tables accordingly. If you are using our custom WGDC boost control scheme on a supported platform (detailed in the New / Custom tables section of this document), that will override the values in these tables.

PLATFORM NOTES:

- **MSD8x DME:** these tables are not provided (were not deemed necessary)
- **MEVD DME:** these tables are not provided (were not deemed necessary)

Safeties

Currently, the following tables are provided in order to ensure a relatively safe usage of antilag. They may be expanded in the future.

- **Antilag Coolant Safety (Min / Max)**: antilag will only activate if the engine coolant temp is inside these values. Once active, if the max is exceeded antilag will disengage.
- **Antilag EGT Safety (Max)**: antilag will only activate if the parameter **EGT pre-turbo** is less than this value. Once active, if the max is exceeded antilag will disengage.
- **Antilag Cooldown Timer**: this is the time duration in seconds that must pass before being able to use antilag again.
- **Antilag Timeout**: this is the time duration in seconds that antilag can remain active for during one use. Once active, if the time expires antilag will disengage.
- **Antilag Start Delay**: this is the time delay in seconds which determines how long one of the “activation condition” buttons / levers must be pressed / held before antilag activates.
    - **E-Series:** pull CC stalk **TOWARD** you or **VOL DOWN**
    - **F/G-Series:** hold **RES** or **CC Down**

If you are looking for a starting point for these values, we use the following for our OTS flash option config:

- Coolant Min = 70*C
- Coolant Max = 115*C
- EGT Max = 1050*C
- Cooldown Timer = 12s
- Timeout = 5s
- Start Delay = 0.3s

Map Switching

This feature is enabled by first setting the **Enable Map Switch** table to 1. Next, you must set the number of map slots you have tuned and wish to be selectable. You can enter a value from 1-4 in the table **Active Map Slots**. Values greater than 4 are treated as 4. Both of these are in the **MHD+ Config** section of tables.

Operation

Map switching is then performed in the car by first:

- **E-Series:** press and hold the **TIP** button on the cruise control stalk for 2 seconds, or pressing **VOL DOWN** and **CH DOWN** on the wheel at the same time.
- **F/G-Series:** press and hold either the cruise control **SET/LIM** button or the **BC** button for 2 seconds.

You will see the RPM needle jump to whichever map slot number you have currently selected and the CEL will start blinking slowly.

Now to adjust the desired map selection you will:

- **E-Series:** use the cruise control stalk **UP/DOWN**, or **CH UP/DOWN** on the wheel
- **F/G-Series:** use the cruise control **UP/DOWN** rocker

To apply the selection (after which RPM needle will return to normal operation and the CEL will stop blinking):

- **E-Series:** press and hold the **TIP** button on the cruise control stalk for 2 seconds, or pressing **VOL DOWN**.
- **F/G-Series:** press and hold either the cruise control **SET/LIM** button or the **BC** button for 2 seconds.

The currently selected map slot is persisted in the DME's **EEPROM** and will still be saved even after the car goes to sleep. After a DME flash, the current map is reset back to 1.

Table Overview

The collection of current tables provided per map was developed in cooperation with many of our partners and pro-tuners. We feel they give a solid foundation to create flexible tunes across all map slots. If you feel strongly that a necessary table is missing, please feel free to contact us. Our implementation is designed to facilitate quick and easy addition of tables as needed.

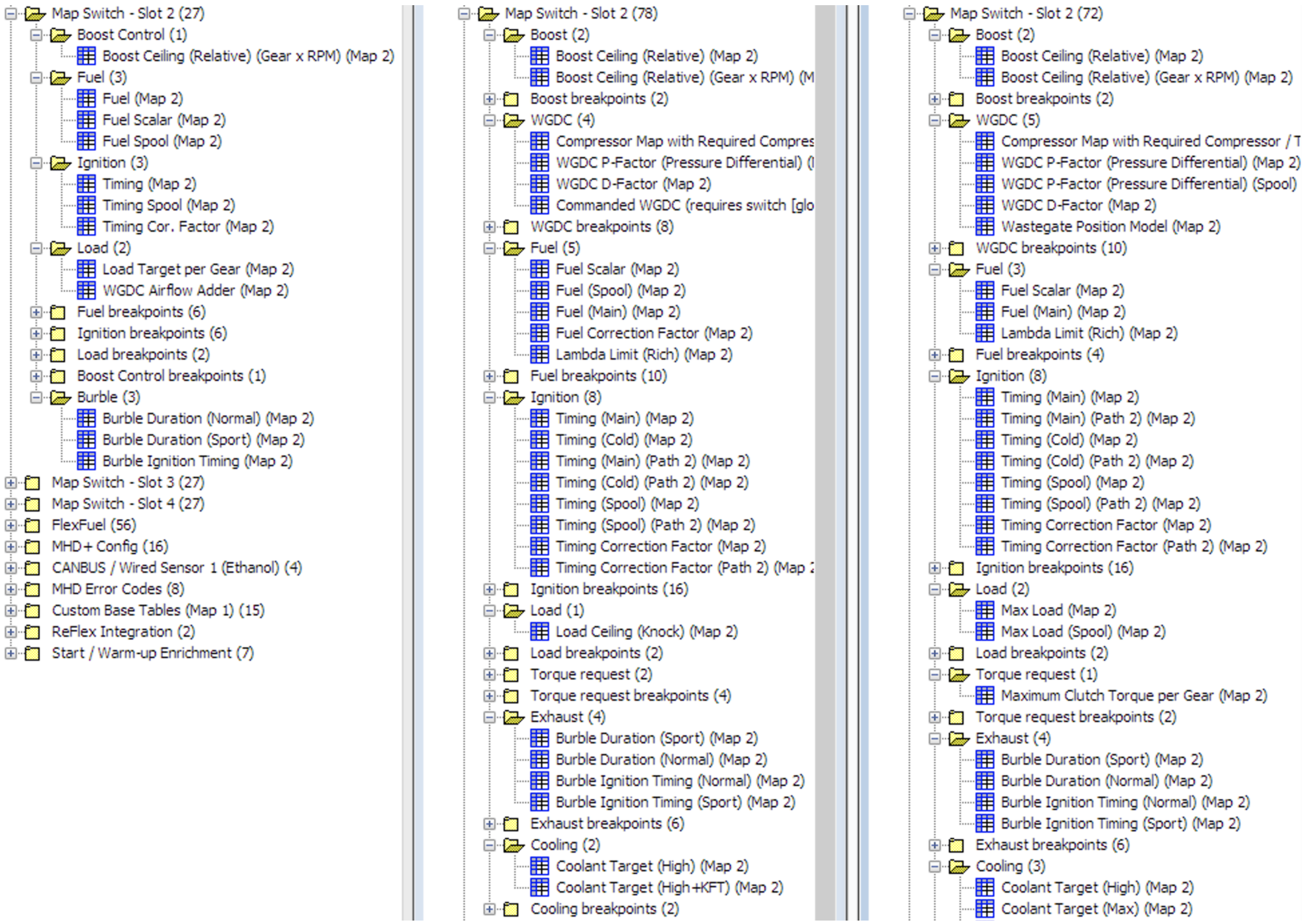
On the next page, there are screenshots of the available tables for each DME's MHD+ implementation. There are inherent differences due to how each is commonly tuned. If you think something was missed, please reach out to us and we can easily add it.

The "base" or original DME versions of all tables (the ones you have been tuning all along) are active for map slot 1. The tables available per map slot then replace or override those when that map slot is selected via map switching.

If a table does not have a map switch copy, then its base table will always be used. We will call them **global** tables as they are used regardless of which map slot is selected. An example of this would be the **Commanded WGDC** table on MEVD (which requires a switch in order to be used), that the switch itself is a global table. Setting it to 1 would cause the Commanded WGDC table to be used across all map slots.

NOTE:

If you wish to use a map slot for an ethanol mix / full ethanol tune (with or without input from a CAN ECA (additionally DMTL wired ECA on N54), you will see that the fuel start / restart / warmup enrichment tables are omitted here. This is by design [as we greatly simplified that aspect of tuning.] It is detailed below in the **FlexFuel** section.



NOTE:

From left to right: **MSD8x**, **MEVD**, **MG1**

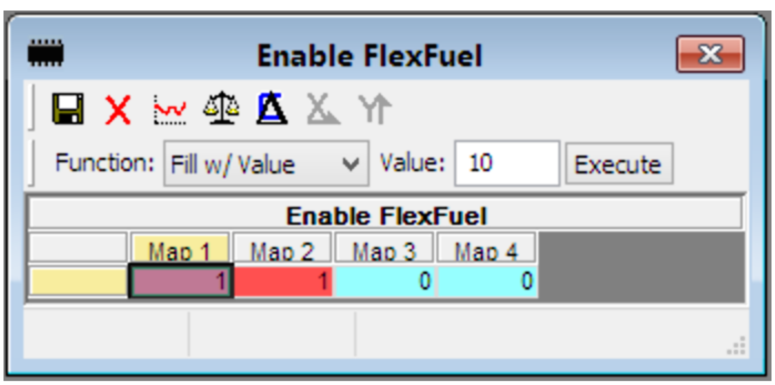
FlexFuel

For our FlexFuel implementation, we have created what we believe is the most **flexible** (hah!) setup available. Separate copies of all the above Map Switch tables are provided, along with a few additional tables. Blending / interpolation per table "grouping" is configurable per map slot, and the main blending functionality can be used with or without a CAN ECA installed (additionally DMTL wired ECA on N54). There are quite a few platform specifics regarding FlexFuel (***especially on N54, so please read!**), so they will be detailed in their own subsection here vs. Platform Notes comments per section.

Enabling (with ECA)

In order to use FlexFuel with a CAN based ECA like our [MHD Quick Install ECA](), you first must have that ECA preset selected either in the app's Flash Options, or in the **Sensor Preset Selection** table in the XDF. That gets the DME reading the Ethanol Percentage over CAN. You can monitor that reading with the Ethanol Content (CAN) parameter via our logging.

Now to enable FlexFuel blending, simply set the **Enable FlexFuel** table to 1 for the map slots where you want it to be active. This table can be found in the **MHD+ Config** folder. Below you can see a sample where FlexFuel is enabled for Map 1 and 2, but not for 3 or 4.

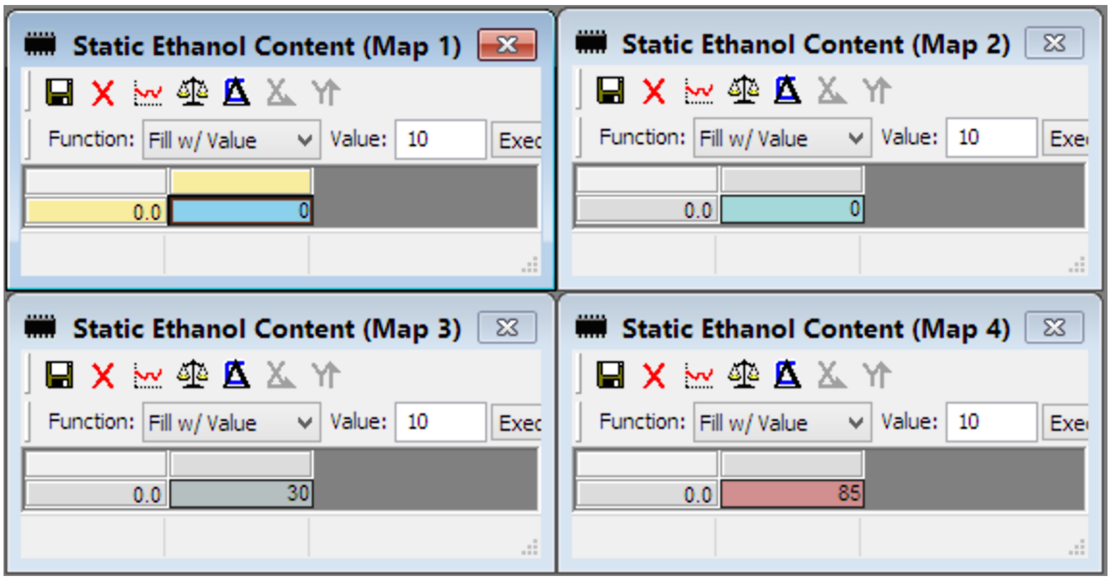


PLATFORM NOTES:

MSD8x DME: there is an additional ECA preset option, value 04 - Motiv FlexFuel ECA (DMTL Wired). If used, the **Ethanol Sensor Conversion (DMTL Wired)** table must be populated like on previous / legacy N54 FlexFuel tunes.

Enabling (without ECA)

The FlexFuel blending can easily be used if the vehicle does not have an ECA installed. This is done by setting a static ethanol content for a given map slot. Found in the **MHD+ Config** folder, there is one table per map slot, as seen here.



In this screenshot, only Map 3 and 4 would be using the FlexFuel blending, while feeding values of 30 and 85 to the interpolation tables (detailed in the next section). A value of 0 means the table is ignored.

IMPORTANT!

It is important to note that a value greater than 0 in these tables will **override** the ethanol percentage from the ECA for that map slot. The value coming from the ECA will still be loggable in the **Ethanol Content (CAN)** parameter (or **Ethanol Content (Wired)**) in case of Motiv DMTL Wired ECA), however an additional parameter **Ethanol Content (Active)** shows the actual percentage being fed to the interpolation tables. When the CAN value is not being overridden, Active will show the same exact value.

If you do not have an ECA installed and are just using the static values, **Ethanol Content (CAN)** will log as 0, while **Ethanol Content (Active)** will show the ethanol percentage as calibrated in your current map slot.

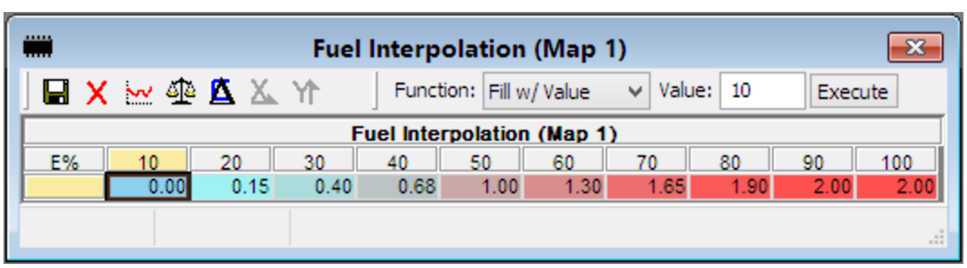
Blending / Interpolation

FlexFuel will automatically blend between two tunes based on a given ethanol content. When combined with an ethanol sensor in the fuel line, this takes all guesswork out of the equation. However, as stated above this blending logic can also be taken advantage of by those without a sensor and/or for a specific map the user wishes to always target a static ethanol percentage (ex. when using a consistent local pump, tune perfected for one specific blend, etc).

Table Groupings

How one table is blended against its FlexFuel variant is determined by the four categories of interpolation tables. Again, these interpolation tables are provided per map slot, so different map slots blend more or less aggressively, or not at all! The categories and the tables tied to them are as follows:

- **Load Interpolation**: Boost Ceiling (Relative), Boost Ceiling (Relative) (Gear x RPM), Compressor Map with Required Compressor / Turbine Power, WGDC P-Factor (Pressure Differential), WGDC D-Factor, Commanded WGDC, Load Ceiling (Knock), Maximum Clutch Torque per Gear
- **Fuel Interpolation**: Fuel (Scalar), Fuel (Spool), Fuel (Main), Fuel Correction Factor
- **Fuel Scalar Interpolation:** Fuel (Scalar), if applicable per platform
- **Timing Interpolation**: Timing (Main) (Path 1 / 2), Timing Cold (Path 1 / 2), Timing (Spool) (Path 1 / 2), Timing Correction Factor (Path 1 / 2)
- **Knock Interpolation**: Knock Factor (Cyl 1 - 6) on MEVD and MG1



E%	10	20	30	40	50	60	70	80	90	100
	0.00	0.15	0.40	0.68	1.00	1.30	1.65	1.90	2.00	2.00

Above is a sample of the **Fuel Interpolation** table. As you can see, the value range is from 0.00 - 2.00. This is a very important distinction with our MHD+ implementation vs. a more basic 0.00 - 1.00 range in that it allows us to give you **TWO** sets of FlexFuel tables, detailed in the next section.

Main FF vs. FF2

If you open the updated XDF and expand the folders inside FlexFuel, you will see two of each table, the second of which contains (FF#2) at the end of the name. Those are considered the second set of FlexFuel tables.

The interpolation tables are factors used to blend between two tables. Which tables are used depends on what range the value is in. There are two possibilities:

- **Factor values from 0.00 - 1.00 (Map Slot X → Main FF)**

  This is the traditional use case, where we are blending **from** the current map slot's tables **to** the main FF tables. An interpolation factor of 0.00 would fully trace the map slot tables, while an interpolation factor of 1.00 would fully trace the main FF tables (and gradually in between, math shown in next section).

- **Factor values from 1.00 - 2.00 (Main FF → FF#2)**

  This is our new use case, where we are blending **from** the main FF tables **to** the FF#2 tables. An interpolation factor of 1.00 would fully trace the main FF tables (same as above), while an interpolation factor of 2.00 would fully trace the FF#2 tables (and gradually in between, math shown in next section).

  This is particularly useful if vehicle's fuel system cannot support full E85, as you can setup the main FF tables for their max power ethanol blend, while using the FF#2 tables for E85. Sure, this can also be done by tapering back down the interpolation factors for the higher ethanol percentages (and you can do this if you wish), but providing the second set of tables gives much more precision and flexibility.

It is worth noting that you can have one table grouping (like Timing) blending from Map Slot → Main FF, while another grouping (like Fuel) is blending from Main FF → FF#2. Each interpolation grouping is separate from the others, as well as separate per map slot.

Show the Math!

For these examples, we will reference the fuel interpolation table pictured in the Table Groupings section. Let's assume for the current rpm / load, the Fuel (Spool) table is targeting:

- **Current Map Slot**: 12.5 AFR
- **FF**: 13.0 AFR
- **FF2**: 14.67 AFR

If our Ethanol Content (Active) is 20%, we would have a blend factor of 0.15 from the fuel interpolation table. The math for the actual output from Fuel (Spool) would be:

((13.0 - 12.5) * 0.15) + 12.5 = **12.575 AFR**

If our Ethanol Content (Active) is 45%, we would have a blend factor of 0.84 (the factor tables interpolate between cells as well). This gives the following Fuel (Spool) output:

((13.0 - 12.5) * 0.84) + 12.5 = **12.92 AFR**

Finally, if our Ethanol Content (Active) is 80%, we would have a blend factor of 1.90. This puts us in the second range, where we blend from FF to FF2. We first subtract 1 from the blend factor before using it in the equation. Here we get the following Fuel (Spool) output:

((14.67 - 13.0) * 0.90) + 13.0 = **14.5 AFR**

As you can see, there are two equations based on the interpolation factor itself. They work properly for all table types (signed, unsigned, one byte, two byte, etc).

Factors 0.00 - 1.00: ((FF - Map Slot) * Factor) + Map Slot

Factors 1.01 - 2.00: ((FF2 - FF) * (Factor - 1)) + FF

Enable Individual FF#2 Blending

This toggle table is provided for those who wish to implement something like two different FlexFuel aggressiveness levels for one map slot vs. another, or for one map slot to be FlexFuel and another be FlexFuel + Meth, etc.

Setting this table to 1 will blend from map slot to FF#2 for ipol factors greater than 1.0. Any other value keeps the default functionality (as detailed in above previous sections) where ipol factors greater than 1.0 blend from FF to FF#2.

Below are two simplified examples to demonstrate the effect of this toggle. For more details on FF blending, please review the previous sections **Main FF vs. FF2** and **Show the Math!**

Example with toggle set to 0:

- ipol factors 0 - 1.0 blend from map slot to FF1
- ipol factors 1.01 - 2 blend from FF1 to FF2

Example with toggle set to 1:

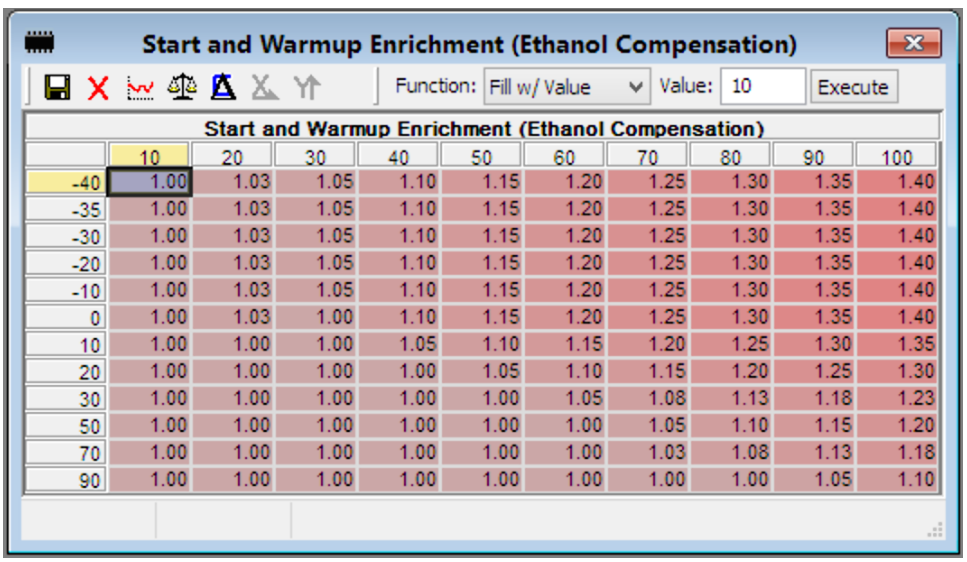
- ipol factors 0 - 1.0 blend from map slot to FF1
- ipol factors 1.01 - 2 blend from map slot to FF2

Fuel Start and Warmup Enrichment

As mentioned earlier, we decided not to include the fuel start, restart, and warmup tables per map slot. This was done in order to simplify the tuning process for these aspects of fueling. Instead, we have provided a single table (in the FlexFuel > Fuel folder): **Start and Warmup Enrichment (Ethanol Compensation)**. Its output is a multiplication factor that gets applied to the appropriate variables behind the scenes to provide enrichment compensation for ethanol during start up and warm up.

To use this table, simply enable FlexFuel or set a static ethanol content for a given map slot. It functions the same as the Fuel Scalar table, offering a factor range of up to 2.00. You should likely only use values > 1.0 where appropriate, while using 1.0 for the regions you do not wish to add any additional fuel compensation. Additionally, you can now leave the base tables (global) for these aspects 100% stock.

- **X-axis**: Ethanol Content (Active)
- **Y-axis**: Engine Temp (°C)


Start and Warmup Enrichment (Ethanol Compensation)

Function: Fill w/ Value Value: 10 Execute

Start and Warmup Enrichment (Ethanol Compensation)

	10	20	30	40	50	60	70	80	90	100
-40	1.00	1.03	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40
-35	1.00	1.03	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40
-30	1.00	1.03	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40
-20	1.00	1.03	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40
-10	1.00	1.03	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40
0	1.00	1.03	1.00	1.10	1.15	1.20	1.25	1.30	1.35	1.40
10	1.00	1.00	1.00	1.05	1.10	1.15	1.20	1.25	1.30	1.35
20	1.00	1.00	1.00	1.00	1.05	1.10	1.15	1.20	1.25	1.30
30	1.00	1.00	1.00	1.00	1.00	1.05	1.08	1.13	1.18	1.23
50	1.00	1.00	1.00	1.00	1.00	1.00	1.05	1.10	1.15	1.20
70	1.00	1.00	1.00	1.00	1.00	1.00	1.03	1.08	1.13	1.18
90	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.05	1.10

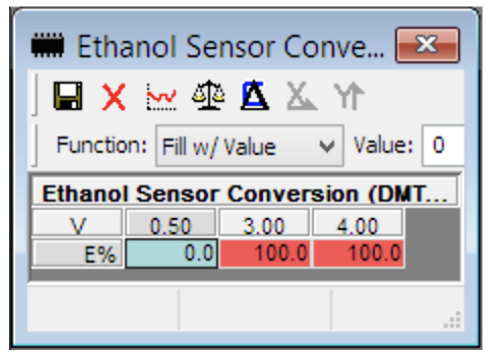
NOTES:

- Factor values < 1.0 can be used to reduce fueling during start / warmup.
- This table is always used when FF or static E is set for a map slot.
- This table is not affected by the Fuel Interpolation tables per map slot.

N54 Specific FlexFuel Details

Since N54 FlexFuel has existed in a basic form for some years now, it had to be handled a little differently to maintain backward compatibility with those previous tunes. Additionally, MSD8x is restricted by its available CAL space, so that places limits on what we can offer. The key differences are as follows:

- N54 only has one set of FlexFuel tables available. Unfortunately there is not enough CAL space to provide the FF vs. FF#2 implementation available on MEVD and MG1. Also related to this, the N54 FF interpolation tables go from 0 to 100%, with 0 fully tracing the current map slot, and 100% fully tracing the FF table. For intermediate math, please see the **Show the Math!** section above.
- N54 now supports both CANBUS based ECA as well as the traditional Motiv FlexFuel ECA which was wired into the DMTL pin. Those of you with a Motiv Re|Flex are encouraged to utilize the CANBUS integration for sending E% to the DME, as you gain the benefit of the two-way integration with PI failsafe / limp, logging of Re|Flex data right in MHD, CANBUS WGDC control, etc. If still using the DMTL wired method, that table should be filled as shown to the right.



- Separate FF Knock tables are not provided due to CAL space constraints. If there end up being many use cases where this would be necessary (along w/ Knock Interpolation blending tables), let us know and we can evaluate the feasibility of adding them.
- Fuel Start and Warmup compensation are still separated off from the main FF tables (to allow utilization of these tables for a Static E% map slot), but instead of one new 3D table, there is a copy of both **Fuel (Start)** and **Warm-up Enrichment Factor**. These tables are used along with the separate **Start and Warm-up Enrichment Interpolation** which determines how to blend between the main Fuel (Start) and Warm-up Enrichment Factor tables and their E85 table copies for a given E%. Remember, that E% can come from a CANBUS ECA kit, the Motiv DMTL wired kit, or a Static E% table for a given map slot (for a hard-coded E% map).

Specific Use Cases

1. **I have a map already perfected for a certain ethanol percentage and don't want that one specifically to have to blend (want to trace the tune's tables exactly).**
    a. Copy that map's table data to whichever map slot you want it to be. Set the static E content for that map to the appropriate blend, while making sure to tune the new Fuel Start and Warmup Enrichment table. Set all interpolation factors for that map slot to 0.00.
2. **I <u>only</u> want to take advantage of the new 3D Boost Ceiling table, nothing else.**
    a. Set the enable toggle to 1, and tune the base copy in Custom Base Tables accordingly. Disable mapswitch and FF, and set all static E contents to 0.
3. **I <u>only</u> want to take advantage of the simplified Fuel Start / Warmup Compensation, nothing else.**
    a. Without ECA: Set the static E content for map 1 to the appropriate blend, while disabling mapswitch and FF.
    b. With ECA: Enable FF for map 1, set static E content to 0, and set all interpolation factors to 0.00.
4. **I want to use FlexFuel but I'm limited by my fuel system.**
    a. Enable FF for the appropriate map slot(s). Tune the FF tables for the max power ethanol the fuel system can support, and tune the FF#2 tables for full ethanol. Use blend factors 0.00 - 1.00 for E0 - Max Power E, and then 1.01 - 2.00 for Max Power E - Full E.
    b. Alternatively: Enable FF for the appropriate map slot(s). Tune the FF tables for the max power ethanol the fuel system can support, while padding Fuel Scalar to support full E. Use blend factors 0.00 - 1.00, but taper them back down at least for Load Interpolation to limit power / stay within the limitations.
5. **I <u>only</u> want to use Map Switch.**
    a. Enable mapswitch, set the active map slots to a of value 1-4 (and tune each slot appropriately), make sure the Enable FlexFuel table is set to all 0, and each static E content is set to 0. You can now ignore all the FF and FF#2 tables.

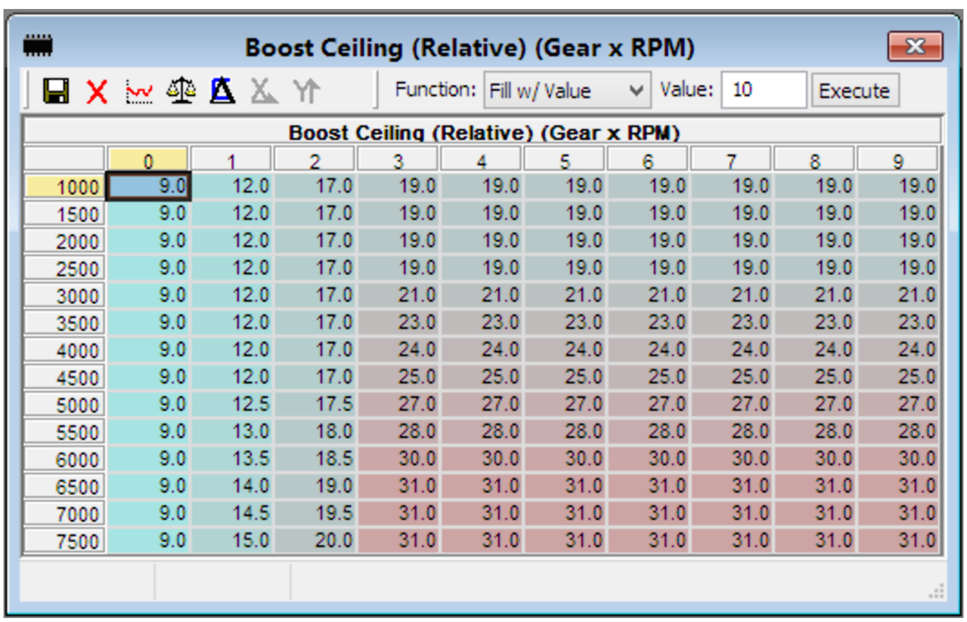
New / Custom Tables

Boost Ceiling (Relative) (Gear x RPM)

This new table is for those who wish to be able to set a more exact boost curve per gear. This table technically functions as a ceiling, so lower throttle inputs will still function properly as-is. This table is provided per map slot, as well as FF and FF#2 copies. As this table does not exist in the stock DME, the “base” or map slot 1 copy of this table is found in the new **Custom Base Tables** folder.

To enable it, in **MHD+ Config** set **Enable Custom 3D Boost Ceiling Table** to 1. Once enabled, it becomes active in all utilized map slots as well as FF and FF#2 if they are being utilized.

- **X-axis**: Gear
- **Y-axis**: RPM
- **Z-data**: Boost (psi, relative)



Boost Ceiling (Relative) (Gear x RPM)

	0	1	2	3	4	5	6	7	8	9
1000	9.0	12.0	17.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
1500	9.0	12.0	17.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
2000	9.0	12.0	17.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
2500	9.0	12.0	17.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
3000	9.0	12.0	17.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
3500	9.0	12.0	17.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0
4000	9.0	12.0	17.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
4500	9.0	12.0	17.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
5000	9.0	12.5	17.5	27.0	27.0	27.0	27.0	27.0	27.0	27.0
5500	9.0	13.0	18.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0
6000	9.0	13.5	18.5	30.0	30.0	30.0	30.0	30.0	30.0	30.0
6500	9.0	14.0	19.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0
7000	9.0	14.5	19.5	31.0	31.0	31.0	31.0	31.0	31.0	31.0
7500	9.0	15.0	20.0	31.0	31.0	31.0	31.0	31.0	31.0	31.0

PLATFORM NOTES:

- **MSD8x and MG1 DME:** the X and Y axis are swapped (and 6 gear rows for N54)

N54 Specific Boost Ceiling Details

Similar to the **Antilag Timing** “boost target” axis, **WGDC Base (Custom)** “boost target” axis, and **Antilag Boost Target** tables, this is a simple table with a lot of tricks going on behind the scenes. On the surface, this table functions as a ceiling to the “boost target” that the DME calculates. However, when used in combination with our 3-cell TMAP scaling table, you can enter the real PSI values you wish to cap / create your boost curve with. All of the scaling is dynamic and handled behind the scenes. There are a few caveats / things to note though:

1. If the single cell **Boost Ceiling** table is left at 1.28bar and you are not using 3-cell TMAP scaling, values greater than ~18psi in this table are treated as 18psi.

2. If the single cell **Boost Ceiling** table is raised to 1.5bar and you are not using 3-cell TMAP scaling, values greater than ~22psi in this table are treated as 22psi.

3. When using the 3-cell TMAP scaling with a larger than OEM range (2.5bar) sensor, you should set the single cell **Boost Ceiling** table to 1.5bar. That keeps that limit out of the way, and lets you enter 0 - Xpsi into this table to create your boost curve per gear, where X is the max boost that you have scaled for in the 3-cell TMAP scaling table. We have included a **patch** in the XDF that will apply the proper N20 3-cell scaling values to use the full resolution of that sensor. For other sensors, please ensure your math is correct. You can view our post on SpoolStreet for the proper way to go about setting the values in the 3-cell scaling table.

4. In order for this table to apply and “cap” your boost curve as desired, you must have a load target which would give a boost target equal to or higher than the table value. You can also raise your load target out of the way.

5. All z-data values entered into this table are “relative” psi, and therefore the max value you can utilize from your TMAP will be dependent on your ambient pressure (baro).

6. New **MHD+** prefixed logging parameters are available to view the dynamically scaled boost parameters.

Custom WGDC Control

In order to make tuning a bit easier (especially on turbo setups not utilizing the OEM wastegate / actuators), we have implemented our own WGDC control scheme and set of tables. Our simplified control scheme is also especially useful when utilizing the Motiv Re|Flex to control your boost solenoid, as we broadcast WGDC % over the CANBUS to the Re|Flex as part of our 2-way integration. Platform specific implementation details follow below.

N54 Specific Custom WGDC Control Details

To use this control scheme in place of the limited OEM airflow based model, you must set the **Enable Custom WGDC Override** toggle in the MHD+ Config folder to 01. This activates the tables in the Custom Base Tables > WGDC folder, whose output overrides the near final WGDC output (ECT adder is still applied, as well as battery voltage correction which should remain).

The tables, and their flow, is as follows:

1. **WGDC Base (Custom)** [or **WGDC Base (Custom) (Antilag)** if antilag is active] is looked up, with axis inputs of RPM and MHD+ Boost Target.   Here again, the Boost Target axis is special as described in the boost ceiling section. You can enter actual PSI values up to your 3-cell scaled TMAP maximum. The output of this can be seen when logging the **MHD+ WGDC Base** parameter.
2. **WGDC P-Factor (Custom)** is looked up, with axis inputs of RPM and MHD+ Boost Error. The Boost error axis here is also special just like the Boost Target axis of the WGDC Base (Custom) table, except it is signed and can have positive or negative values. The output of this table can be seen when logging the **MHD+ WGDC P-Factor** parameter.
3. **WGDC D-Factor (Custom)** is looked up, with axis inputs of MHD+ Boost Error and MHD+ Boost Error Grad. Both axes here are special just like the Boost Target axis of the WGDC Base (Custom) table, except they are signed and can have positive or negative values. The output of this table can be seen when logging the **MHD+ WGDC D-Factor** parameter.
4. If current Load Actual >= **Min Load Threshold for P/D Factors** table value, the P and D factors are added to the **MHD+ WGDC Base** value, which after the OEM ECT adder and batt volt. correction are applied, can be logged as the normal **WGDC % Bank 1 / 2.**

MG1 Specific WGDC Control Details

To use this control scheme in place of the limited OEM airflow based model, you must set the **Enable Custom WGDC Override** toggle in the Custom Base Tables > WGDC folder to 01. If you also wish to utilize the Custom P and D factor tables, the other toggle **Enable Custom WGDC P and D Factors** must be set to 01 as well. The output of the **WGDC Base (Custom)** table replaces the OEM output of the WGDC Position table (when enabled). The Custo**m P and D Factors** (when enabled) are either added to the output of the custom Base table or the OEM output of the WGDC position table.

The tables, and their flow, is as follows:

1. **WGDC Base (Custom)** [or **WGDC Base (Custom) (Antilag)** if antilag is active] is looked up, with axis inputs of RPM and boost target. The output of this can be seen when logging the **MHD+ WGDC Base** parameter.
2. **WGDC P-Factor (Custom)** [or **WGDC P-Factor (Custom) (Antilag)** if antilag is active] is looked up, with axis inputs of RPM and boost deviation. The output of this table can be seen when logging the **MHD+ WGDC P-Factor** parameter.
3. **WGDC D-Factor (Custom)** [or **WGDC D-Factor (Custom) (Antilag)** if antilag is active] is looked up, with axis inputs of boost deviation and boost deviation gradient. The output of this table can be seen when logging the **MHD+ WGDC D-Factor** parameter.
4. If both toggles above are selected, the final **WGDC % Bank 1** will now be **MHD+ WGDC Base** + **MHD+ WGDC P-Factor** + **MHD+ WGDC D-Factor**; You can extrapolate this out to the other combinations when either of the toggles is individually selected.

Locking Tune Files with MHD+ Features

To ensure your customer does not have any issues with your provided *.mhd locked file, first ensure that you are using the latest version of our MHD Map Encryption tool. The current up-to-date version is **v6.7**. If you need an update, please reach out to us via email.

Next, make sure to update the XDFs used in the locking process with the newly published XDFs containing all the MHD+ table updates from our GitHub. If you have your own XDFs that you customize (separate from our official GitHub publications) that is fine, but you will want to copy over the new MHD+ tables in their entirety to ensure no issues. Additionally, while the existing MHD+ tables are not likely to change, there is a small chance it may be needed, so you would have to clear them from your XDF and re-copy.

Now you should be all set to lock your customer's file as you normally would.

Revision History

Version	Notes	Date	Updated By
1.0	Initial creation	5/13/2021	Jake Y
1.01	Image updates, *.mhd file info, antilag turbine I-fac details	6/16/2021	Jake Y
1.10	Add MSD8x, MEVD, MG1 specific details	6/28/2022	Jake Y