

AMP

ENGINE MANAGEMENT



DRIVE-BY-WIRE CONTROLLER

Version 1.01

1. Introduction	3
1.1 Overview	3
1.1.1 Warning Labels	4
1.1.2 Technical Support	6
1.1.3 Copyrights	7
1.2 QuickStart Instructions	8
2. AMP EFI DBW Hardware	10
2.1 Overview	10
2.2 Enclosure Mounting	10
2.3 Supply Voltage Limits	10
3. Installing the Software	11
3.1 TunerStudio	11
3.2 Adding DBW to your Project	13
4. Wiring	15
4.1 Throttle Connection Examples	16
4.2 Pedal Connection Examples	20
4.3 Brake and Clutch Connection Examples	24
4.4 TPS Connection Example	26
5. Setup and Tuning	27
5.1 Configuration	27
5.1.1 Throttle Settings	27
5.1.2 Throttle Blip	29
5.1.3 Calibration	31
5.2 Throttle Curves	33
5.3 Communication	36
5.3.1 CANbus Configuration	36
5.3.2 Standard CAN Addressing – Inbound Messages	37
5.3.3 Standard CAN Addressing – Outbound Messages	38
5.4 Gauges	39
6. Fault Codes and Status Bit Fields	41
6.1 Flash Codes	41
6.2 Status Bit Fields	41
6.3 Fault Definitions	42
7. Firmware Updates	43
Firmware Loader	43

1. Introduction

1.1 Overview

The Drive-by-Wire (DBW) system represents a significant advancement in vehicle control technology, replacing traditional mechanical linkages between the driver and key vehicle systems with an electronic throttle and pedal. This product is designed to deliver high precision, faster response times, and advanced control capabilities that enhance both performance and safety.

This manual provides detailed instructions for safe installation, configuration, operation, and maintenance of the DBW system. Users must familiarize themselves with the contents of this manual to ensure safe and effective use.

Purpose of the System

The primary function of the DBW system is to electronically manage the throttle—eliminating the need for physical cables, rods, or hydraulics between the driver's controls and the vehicle's mechanical systems. Instead, sensors read driver inputs and transmit commands to actuators via the control unit.

The benefits of this system include:

- Enhanced vehicle responsiveness
- Tuning flexibility
- Reduced mechanical complexity and weight

1.1.1 Warning Labels

Safety Warnings and Precautions

This Drive-By-Wire (DBW) system is a critical component of vehicle control. Improper installation, use, or maintenance can lead to serious injury, death, or property damage. All users, installers, and service personnel must read and understand this manual before interacting with the system.

Signal Word Definitions

The following signal words are used throughout this manual to indicate the severity of potential hazards:

- **WARNING:** Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury
- **CAUTION:** Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury
- **NOTICE:** Indicates important information that is not hazard-related but should be followed for optimal operation

General Warnings

Installation and Maintenance

- **WARNING:** Installation and maintenance must be performed by qualified personnel familiar with DBW systems. Proper wiring and connector terminations are a requirement for safe operation and should be performed by qualified personnel.
- **WARNING:** Do not modify or alter the DBW system or its components in any way not specified in this manual.
- **CAUTION:** Avoid routing the DBW harness near high-voltage or "noisy" components to prevent electromagnetic interference.
- **NOTICE:** During diagnostics follow appropriate safety procedures.

Operational Precautions

- **WARNING:** Ensure the accelerator pedal returns to the idle position upon release and is free from any obstructions.
- **CAUTION:** Regularly inspect the system for wear or damage and contact an authorized dealer if any issues are observed.
- **Note:** Ensure the throttle body is clean and free of carbon, coking, and oil deposits before installation. Check for buildup and contamination on regular service intervals.

Emergency Procedures

- **WARNING:** In the event of a system malfunction, the DBW controller will automatically enter “**limp-home**” mode, drastically reducing throttle response to allow the vehicle to be driven to a safe stopping location. Once stopped, inspect the system and contact an authorized dealer before further operation.
- **WARNING:** To safely disengage Drive-by-Wire in an emergency.
 - **Manual Transmission:** Depress the clutch pedal fully, brake to slow and steer the vehicle to a safe stopping point.
 - **Automatic Transmission:** Shift the gear selector into **Neutral**, then apply the brake and coast to a secure location.
 - Once stopped, switch off the ignition to cut power to the DBW controller. Contact an authorized dealer before restarting or operating the vehicle further.

1.1.2 Technical Support

We are committed to providing you with expert support to ensure your Drive-by-Wire (DBW) system performs reliably and safely in your application. If you experience any issues during installation, configuration, or use, please reach out to our technical support team.

You can contact AMP EFI technical support using the following methods:

- **Email:** support@ampefi.com
- **Website:** www.ampefi.com
- **Phone:** 678-261-8789 (Available Monday – Friday, 9:00 AM – 5:00 PM EST)

When reaching out, please have the following information ready to help us assist you quickly:

- Order Number
- Throttle and Pedal Manufacturer
- Detailed description of the issue
- Any diagnostic codes or LED indicators
- Relevant photos or videos (if applicable)
- Configuration/tune file
- Datalog file as appropriate

Troubleshooting Steps Before Contacting Support

Before reaching out, we recommend performing the following basic checks:

1. **Verify All Connections**

Ensure every connector is fully seated and all wiring is free of damage or corrosion

2. **Check Power Supply**

Confirm that the system is powered up and communicating with the tuning software.

3. **Review the Manual**

Double-check wiring diagrams, installation steps, and any calibration procedures outlined in this manual. Also see section 6, 'Troubleshooting'.

4. **Update Firmware (if applicable)**

Visit www.ampefi.com/downloads to ensure your system firmware is current

5. **Observe Indicator LED**

Refer to the Diagnostics section for interpretation of any LED fault indicator on the DBW Control Unit

1.1.3 Copyrights

This manual, including all associated content, images, schematics, and software, is the intellectual property of AMP EFI and is protected under United States and international copyright laws. No part of this publication may be copied, reproduced, modified, distributed, or transmitted in any form—whether electronic, mechanical, photocopy, or otherwise—without the express written permission of AMP EFI, except for brief quotations used for educational or non-commercial purposes with appropriate citation.

Trademark Acknowledgment

AMP EFI™, the AMP EFI logo, and all related product names, graphics, and branding are trademarks or registered trademarks of AMP EFI in the United States and other jurisdictions. Any other trademarks, service marks, or company names mentioned are the property of their respective owners.

Intended Use

This product is designed and sold exclusively for **off-road use, closed-course racing, or sanctioned competition vehicles**. It is **not legal for use on public roads or street vehicles**, and **any such use is strictly prohibited** under the **United States Environmental Protection Agency (EPA) Clean Air Act (42 U.S.C. § 7522)**.

WARNING: Use of this product on vehicles driven on public roads or highways may violate federal emissions laws and can subject the user to civil penalties. It is the sole responsibility of the installer and end user to ensure compliance with all applicable local, state, and federal laws.

AMP EFI assumes no liability for misuse, illegal installation, or operation of this product in violation of the law.

1.2 QuickStart Instructions

This section gets your Drive-By-Wire (DBW) system powered, connected, calibrated, and ready to tune with minimal steps.

Minimum Wiring (to power up and move the throttle)

- **Pin 14 – 12V+ (ignition switched)**
- **Pin 15 – Ground (clean chassis/engine ground)**
- **Throttle Connection** — connect the ETB per the **Throttle Connection Examples** ([see Section 4.1](#))
- **Pedal Connection** — connect the APP/PPS per the **Pedal Connection Examples** ([see Section 4.2](#))

Recommended: While [TPS](#) and [Idle](#) inputs aren't strictly required to move the throttle, we **highly recommend** wiring them for full functionality, diagnostics, and safety features.

Tips

- Fuse the +12 V feed.
- Keep sensor/signal grounds separate from chassis ground except where specified in the wiring section.

Connect to Laptop (Serial) or ECU (CAN)

- **Serial (for setup/cal):** Use the included **M8 serial cable**. We recommend a [USB to Serial adapter](#) (available from AMP EFI). This connection is **required** for calibration. See [Section 3 — Installing the Software](#).
- **Optional CAN to MS3Pro:** You may connect DBW over **CANbus** to integrate with MS3Pro and tune both from one interface. See the **CAN Integration** section for wiring and setup (base ID, termination, and receive mappings).

Calibrate Pedal and Throttle (key ON, engine OFF)

Before starting the engine, run the automated calibration:

1. **Pedal Calibration:** Capture **Closed** and **WOT** ADC values
2. **Throttle Calibration:** Start the routine and allow two full sweeps to complete.
See [Section 5.1.3 — Calibration](#) for step-by-step instructions.

If calibration is started and then stopped/interrupted, **all throttle calibration data is cleared**. Repeat the full procedure.

Verify Operation

- In the software, confirm **Pedal %** changes smoothly with pedal movement
- Confirm **Throttle Position** follows commanded targets without faults
- Check that **Fault Response** and safety limits behave as expected (e.g., minor vs. major fault behavior)

Start Tuning

With wiring validated and calibration complete, you can begin exploring settings (limits, idle strategy, PID parameters, blip options) and refine to your application. Save your configuration and keep an eye on supply voltage, temperature, and alarms during initial testing.

2. AMP EFI DBW Hardware

2.1 Overview

The AMP EFI DBW Package consists of the DBW Controller (with integrated 26-pin Super Seal connector), the DBW Wiring Harness with mating 26-Pin connector and flying lead wires, M8 serial cable.

2.2 Enclosure Mounting

The controller enclosure and connector are sealed with gaskets and therefore water resistant. It can be mounted either inside the vehicle or in the engine bay, provided it is kept away from direct exhaust heat.

2.3 Supply Voltage Limits

Working range: 7–20 V

Designed for continuous operation within this window. Performance and protection features are validated here.

Absolute range: 5–35 V

Electrical limits. **Not for continuous use.** Operation outside the working range may result in degraded performance, reset, or shutdown; operation beyond absolute limits can cause permanent damage.

3. Installing the Software

The AMP DBW utilizes the following programs, available from <https://www.ampefi.com/downloads/>:

- **TunerStudio** This is the main program you'll use to connect to the DBW. It is used to configure settings, tune, and record data logs on the laptop.
- **MegaLogViewer** This is an analysis program which can play back data logs and display the data in both line graph and scatter plot format. It can also modify tune files based on information recorded in data logs.
- **Firmware loading utility** This is used to update firmware or for certain diagnostics. Download the installers from the above link and follow the installation prompts, and the software should install in just a couple minutes. The tuning software can run on most versions of Windows, as well as Linux and Mac OS.

3.1 TunerStudio

Ensure the serial cable and USB adapter are connected, and the unit is on.

3.1.1 Start Screen

Once TunerStudio opens, you will be presented with the start screen as shown below.

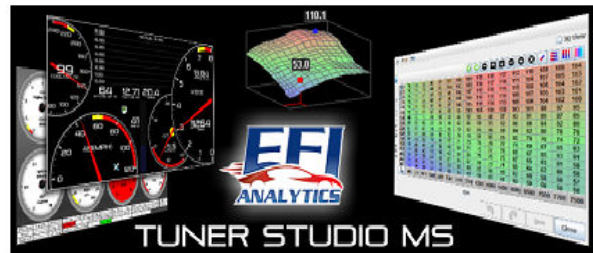
TunerStudio 3.2.05.10

[Create New Project](#) - A project is required to connect to your ECU

[Open Last Project](#) (AMPEFI E30)

Open other recently used Projects:

- [AMPEFI E30](#)
- [Mike Taylor](#)
- [Mini test](#)
- [97GT Auto](#)
- [Coyote Test Mule](#)



At this point, you'd normally use the screen to create a project or open one; this will set up TunerStudio with the configuration it needs to communicate with your ECU or allow you to view tune files offline. You can create or open a new project under the **file menu**, or use this menu to open a new tune for offline viewing. There are also command links to **create a new project** or **open a recent project**.

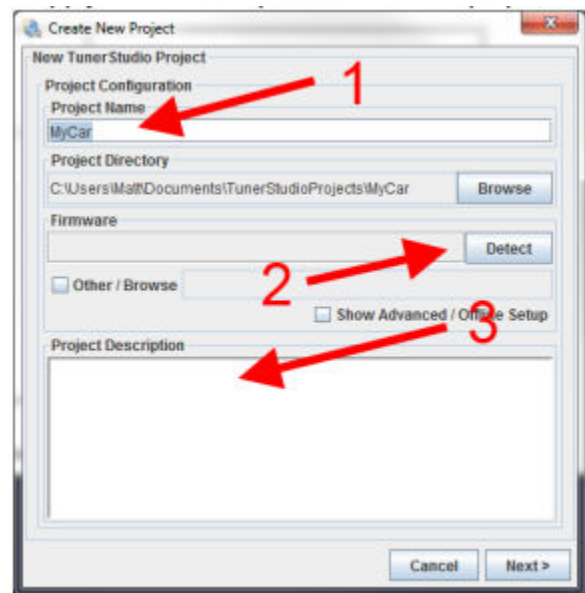
Note that if you open a tune file from this screen, it will go into a temporary project and TunerStudio will not connect to the DBW until you create or open a project for connecting to the DBW.

3.1.2 Creating a Project

For a how-to video, see here: [creating a project](#)

Selecting "New Project" from the File menu opens a wizard to create a new project. It will bring up a screen like the one below. At this point, you will want to have the DBW powered up (see section 4 for wiring details) and connected to the laptop with a RS232 cable. The DBW will need to be powered through the 12 volt supply; it cannot be powered off the laptop.

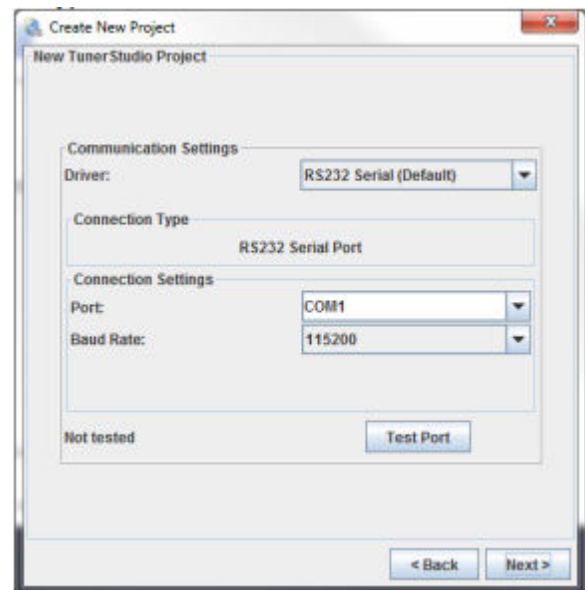
You can enter a name for the project in (1). Next, click the Detect button (2). TunerStudio will detect what firmware is on your DBW. If TunerStudio does not have a definition file, it will prompt you to download one from the Internet, which TunerStudio will handle automatically for any standard release version of the DBW firmware. You can also enter notes about this project in (3). Clicking Next will bring up a screen where you can select project specific settings.



The exact settings will depend on the firmware.

Clicking next will bring up the communications test screen. This allows you to select what port is used and what driver type to use.

Select the driver type you want to use. The DBW normally communicates at a 112500 baud rate

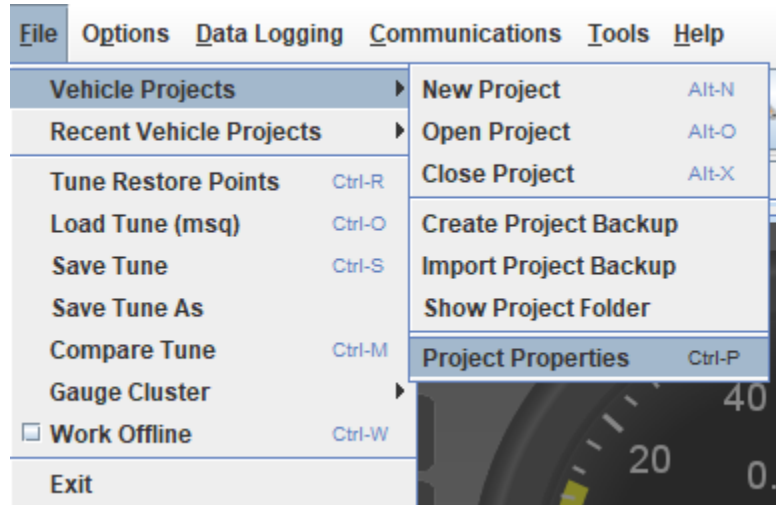


3.2 Adding DBW to your Project

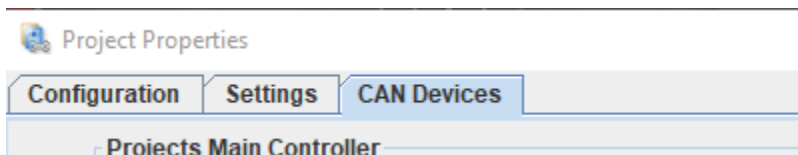
Open your existing MS3 project

Navigate to project properties

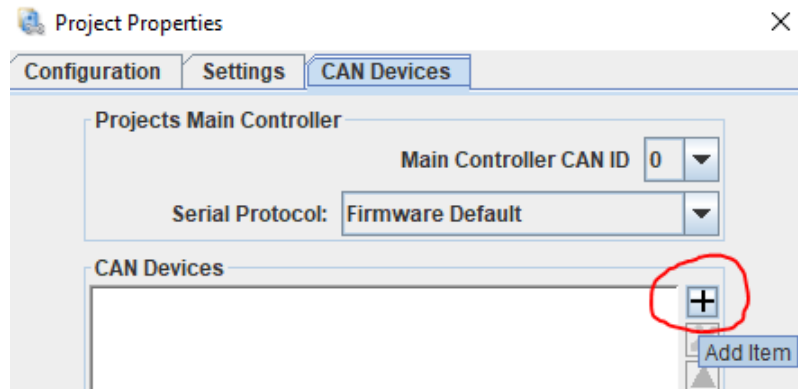
- File > Vehicle Projects > Project Properties
- Or hot key Ctrl+P



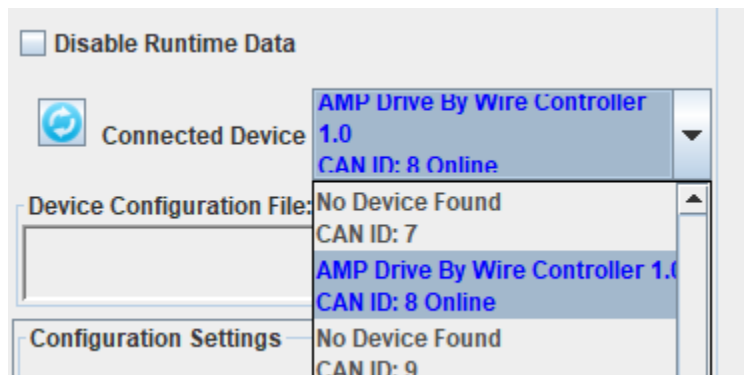
Navigate to the CAN Devices tab



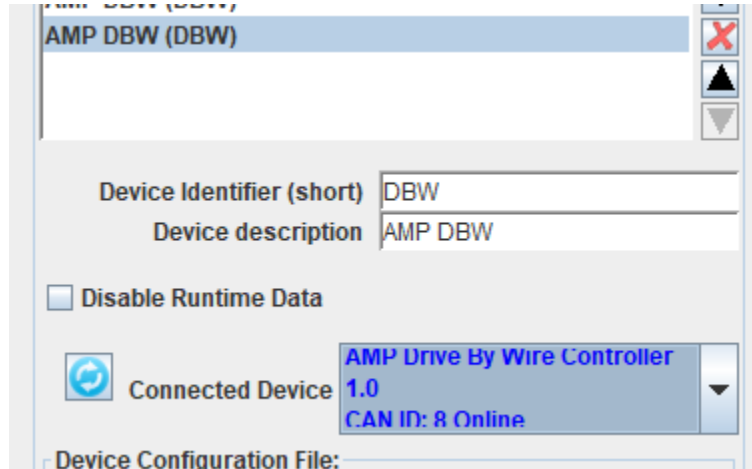
Under CAN Devices select the Add Item button



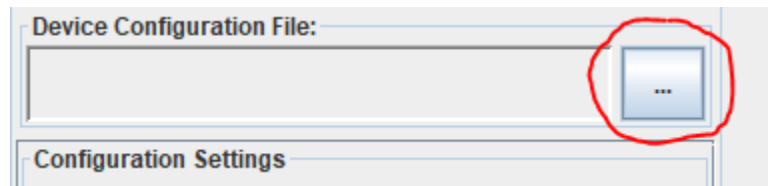
If your DBW is online and connected via CANbus it should appear in the list highlighted in Blue



Input your Device Identifier and Device description



Select your Device Configuration File

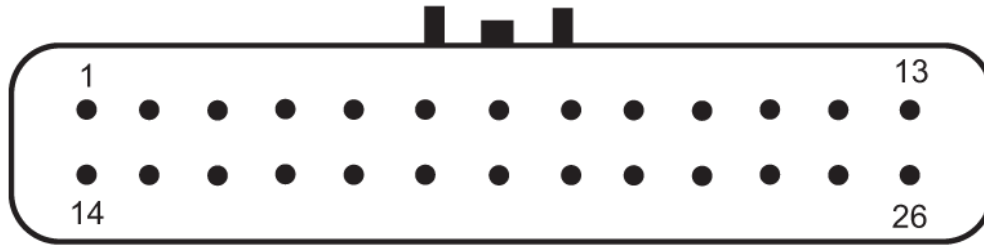


The device configuration file is the .INI file, find the latest .INI file on AMPEFI.com under Support/ Firmware



4. Wiring

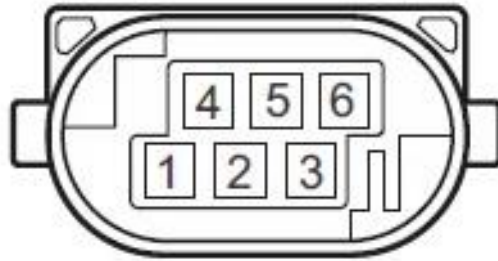
DBW Hardware Pinout



Pin	Function	Wire Color	Description
1	Motor Out +	Pink/Red	Positive-polarity drive output to the throttle motor actuator
2	Motor Out –	Pink/Black	Negative-polarity drive output to the throttle motor actuator
3	CAN H	Tan	CANbus High line for vehicle-network communication
4	Fault Light	Yellow	Open-drain (Ground) output for Fault light
5	FREQ Input 1	Purple/Blue	Configurable input: hardware idle control or RPM pickup
6	FREQ Input 2	Purple/Yellow	Second configurable input: idle control or RPM
7	Brake Input	Purple/Orange	Brake-switch input; required for the throttle-blip function
8	Pedal 2 Ground	Lt.Blue/Black	Ground reference for pedal-2 sensor; keep isolated from other grounds
9	Pedal 2 Position	Lt.Blue/Yellow	Analog input from the secondary pedal-position sensor
10	Pedal 2 VREF	Lt.Blue/Grey	Reference-voltage supply for pedal-2 sensor; keep isolated from other VREF lines
11	TPS 2 VREF	Lt.Green/Grey	Reference-voltage supply for throttle-position sensor channel 2; keep isolated from other VREF lines
12	TPS 2 Position	Lt.Green/Yellow	Analog input from throttle-position sensor channel 2
13	TPS 2 Ground	Lt.Green/Black	Ground reference for throttle-position sensor channel 2; keep isolated from other grounds
14	12V+ Switched In	Red	Ignition-switched +12 V supply for the ECU. Protect with a 10Amp Fuse
15	Power Ground	Black	Main chassis ground for ECU power
16	CAN L	Tan/Red	CANbus Low line for vehicle-network communication
17	TPS Out VREF	Grey	Reference-voltage supply from the ECU for the throttle-position feedback output
18	TPS Out SIG	Lt.Blue	Analog output of the current throttle-position reading (for ECU, datalogging, or tuner display)
19	TPS Out Ground	Black/White	Ground reference for the throttle-position feedback output; keep isolated from other grounds
20	Clutch Input	Purple/Green	Clutch-switch input; required for the throttle-blip function
21	Pedal 1 Ground	Dk.Blue/Black	Ground reference for pedal-1 sensor; keep isolated from other grounds
22	Pedal 1 Position	Dk.Blue/Yellow	Analog input from the primary pedal-position sensor
23	Pedal 1 VREF	Dk.Blue/Grey	Reference-voltage supply for pedal-1 sensor; keep isolated from other VREF lines
24	TPS 1 VREF	Dk.Green/Grey	Reference-voltage supply for throttle-position sensor channel 1; keep isolated from other VREF lines
25	TPS 1 Position	Dk.Green/Yellow	Analog input from throttle-position sensor channel 1
26	TPS 1 Ground	Dk.Green/Black	Ground reference for throttle-position sensor channel 1; keep isolated from other grounds

4.1 Throttle Connection Examples

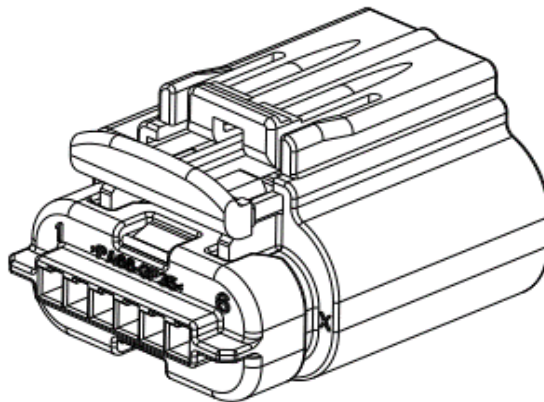
Bosch Throttle



Looking into connector on electronic throttle body

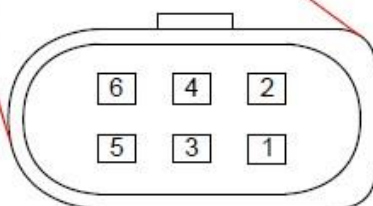
DBW Connection	DBW Pin #	Throttle Pin #
Motor Out -	2	1
Throttle 1 Ground	26	2
Throttle 1 VREF	24	3
Motor Out +	1	4
Throttle 2 (TPS 2)	12	5
Throttle 1 (TPS 1)	25	6

Ford Throttle - Coyote



DBW Connection	DBW Pin #	Throttle Pin #
Motor Out +	1	1
Motor Out -	2	2
Throttle 1 (TPS 1)	25	3
Throttle 1 Ground	26	4
Throttle 1 VREF	24	5
Throttle 2 (TPS 2)	12	6

BMW Throttle



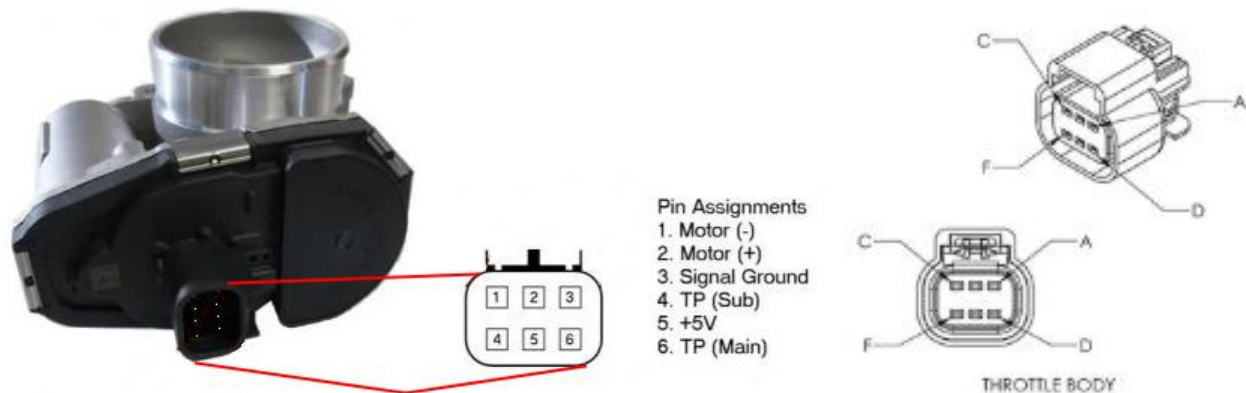
(Looking into throttle body plug)

Pin Assignments

- 1. TPS(Main)
- 2. +5V
- 3. Motor +
- 4. TPS(Sub)
- 5. Motor -
- 6. Sensor Ground

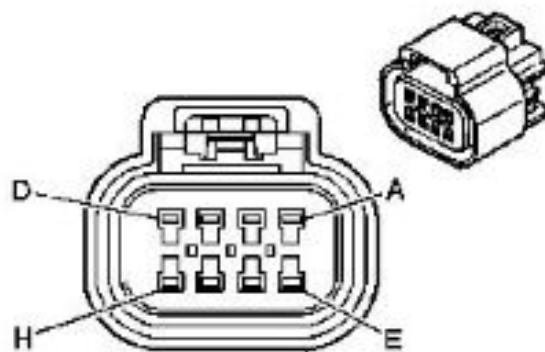
DBW Connection	DBW Pin #	Throttle Pin #
Throttle 1 (TPS 1)	25	1
Throttle 1 VREF	24	2
Motor Out +	1	3
Throttle 2 (TPS 2)	12	4
Motor Out -	2	5
Throttle 1 Ground	26	6

GM Throttle 6 pin

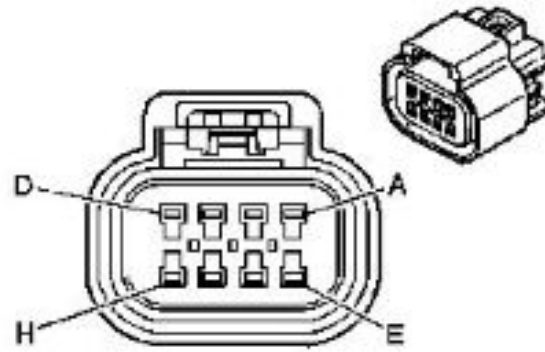


DBW Connection	DBW Pin #	Throttle Pin #
Motor Out -	2	1 - A
Motor Out +	1	2 - B
Throttle 1 Ground	26	3 - C
Throttle 2 (TPS 2)	12	4 - D
Throttle 1 VREF	24	5 - E
Throttle 1 (TPS 1)	25	6 - F

GM Throttle 8 pin



DBW Connection	DBW Pin #	Throttle Pin #
Throttle 2 Ground	13	1 - A
Throttle 2 (TPS 2)	12	2 - B
Throttle 2 VREF	11	3 - C
Motor Out -	2	4 - D
Motor Out +	1	5 - E
Throttle 1 VREF	24	6 - F
Throttle 1 (TPS 1)	25	7 - G
Throttle 1 Ground	26	8 - H



DBW Connection	DBW Pin #	Throttle Pin #
Motor Out +	1	1 - A
Throttle 2 Ground	13	2 - B
Motor Out -	2	3 - C
Throttle 1 Ground	26	4 - D
Throttle 2 VREF	11	5 - E
Throttle 2 (TPS 2)	12	6 - F
Throttle 1 (TPS 1)	25	7 - G
Throttle 1 VREF	24	8 - H

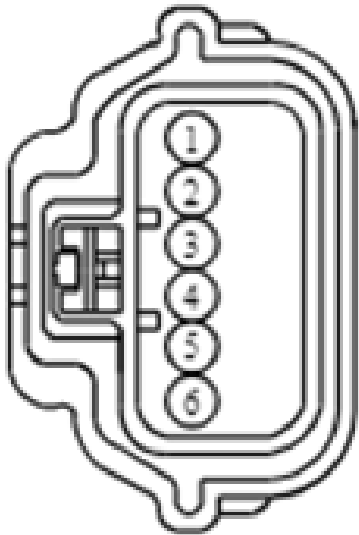
4.2 Pedal Connection Examples

BMW Pedal E46



DBW	DBW Pin #	Pedal Pin #
Pedal 2 Ground	8	1
Pedal 1 Ground	21	2
Pedal 2 VREF	10	3
Pedal 1 Position	22	4
Pedal 1 VREF	23	5
Pedal 2 Position	9	6

Ford Coyote



DBW Connection	DBW Pin #	Pedal Pin #
Pedal 1 VREF	23	1
Pedal 1 Position	22	2
Pedal 1 Ground	21	3
Pedal 2 Ground	8	4
Pedal 2 Position	9	5
Pedal 2 VREF	10	6

Honda Fit Pedal



DBW Connection	DBW Pin #	Pedal Pin #
Pedal 1 VREF	23	1
Pedal 1 Ground	21	2
Pedal 1 Position	22	3
Pedal 2 VREF	10	4
Pedal 2 Ground	8	5
Pedal 2 Position	9	6

Honda Cable to DBW



DBW Connection	DBW Pin #	Pedal Pin #
Pedal 1 VREF	23	1 - A
Pedal 1 Ground	21	2 - B
Pedal 1 Position	22	3 - C
Pedal 2 Position	9	4 - D
Pedal 2 Ground	8	5 - E
Pedal 2 VREF	10	6 - F

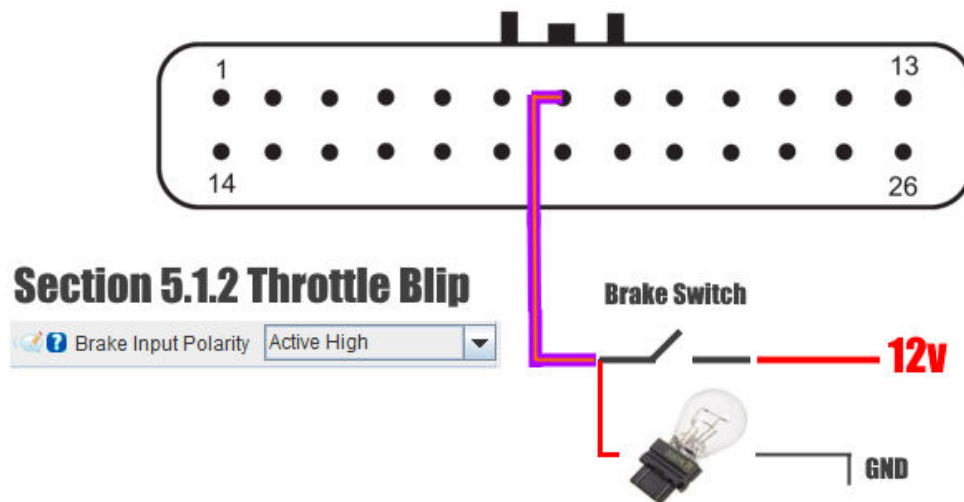
4.3 Brake and Clutch Connection Examples

Brake Switch example Active High

In this example the brake input is held LOW through the brake light bulb until the brake pedal is pressed. When the brake pedal is pressed the brake input is Active High.

This is the most common wiring method for the brake input.

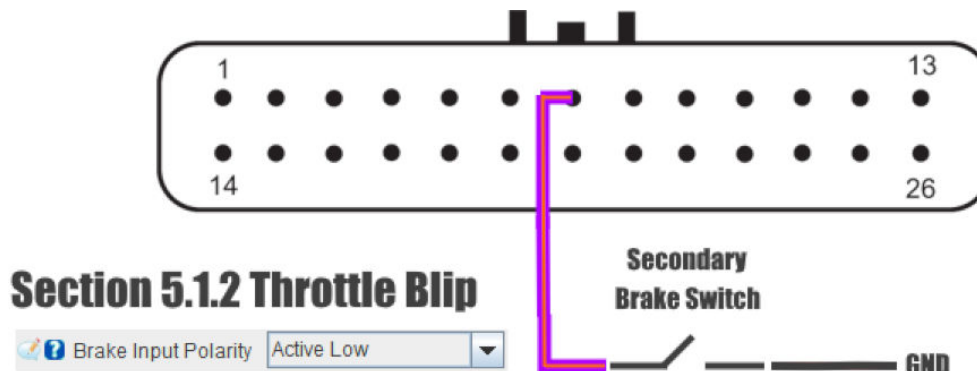
Note: LED brake lights may cause unforeseen problems and may require a separate switch to wire the brake input.



Brake Switch example Active Low

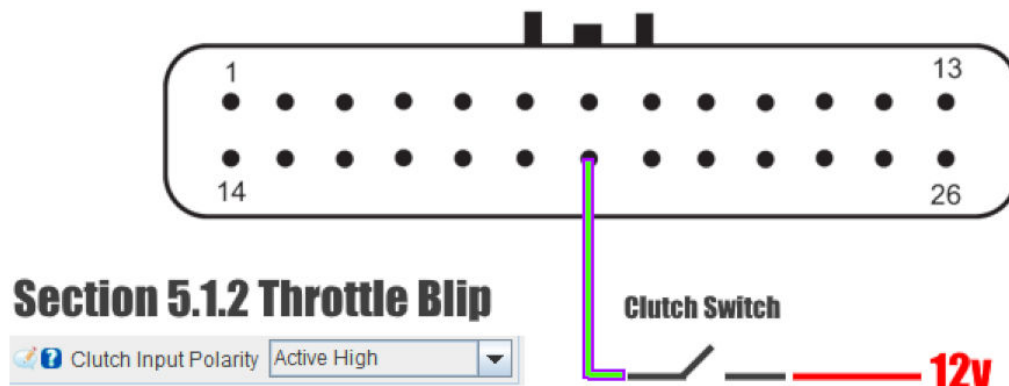
In this example the brake input is triggered by grounding the input. When the brake pedal is pressed the brake input is Active Low.

This is achieved by adding a second switch on the brake pedal that is not tied into the brake lights.



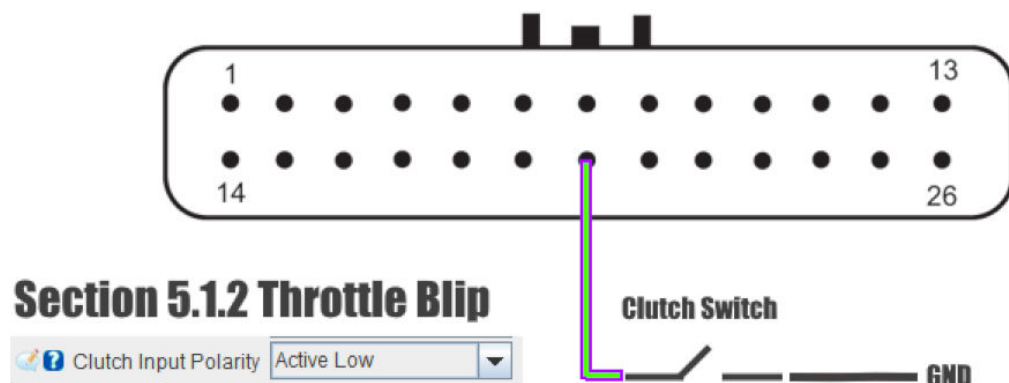
Clutch Switch example Active High

In this example the clutch input is switched to battery voltage when the clutch pedal is pressed. When the clutch pedal is pressed the clutch input is Active High.

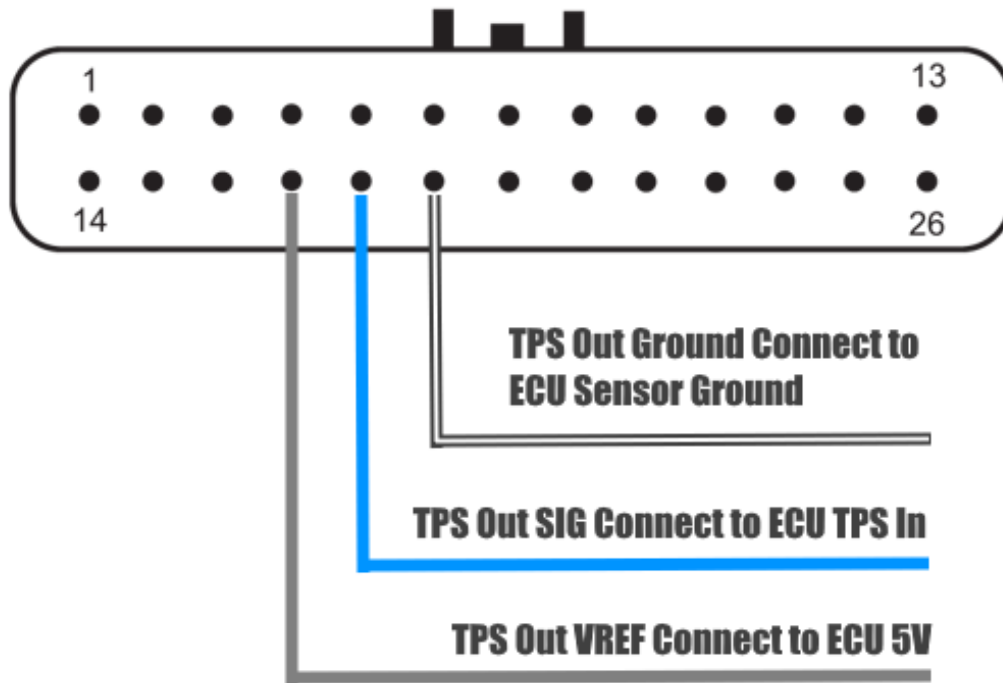


Clutch Switch example Active Low

In this example the clutch input is switched to ground when the clutch pedal is pressed. When the clutch pedal is pressed the clutch input is Active Low.



4.4 TPS Connection Example



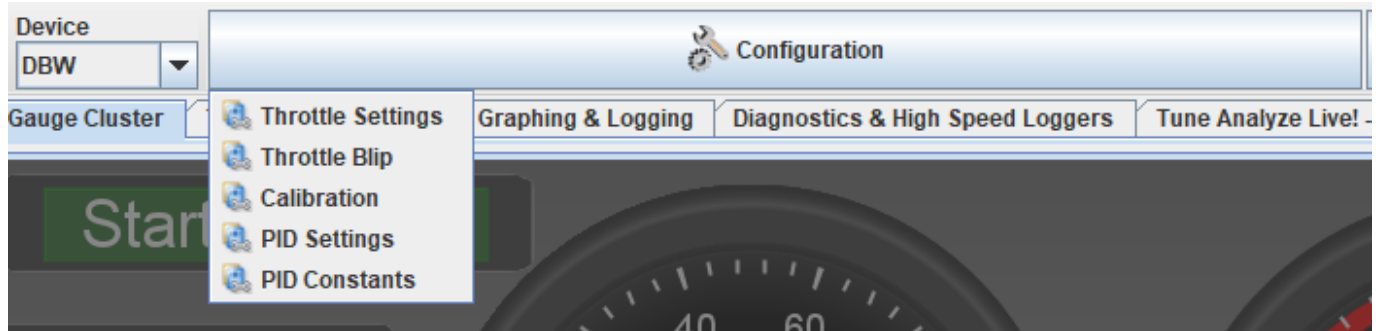
DBW to ECU Pin Connectivity Chart for TPS

Pin Usage	AMP DBW	Wire Color	MS3Pro Mini	MS3Pro EVO+/HC	AMP Competition
5V VREF	17	Grey	2	8	1A
TPS	18	Lt. Blue	28	9	3A
Sensor Ground	19	Black / White	21	18	10A

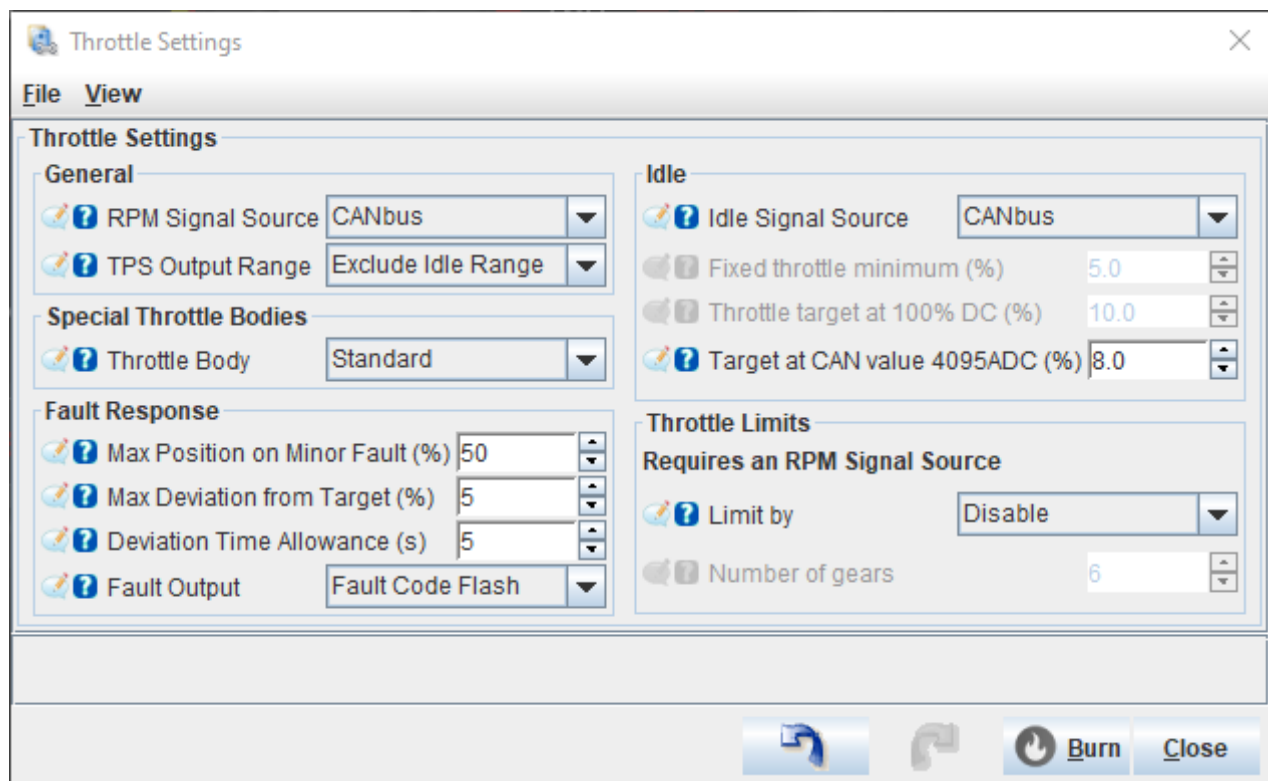
Pin Usage	AMP DBW	Wire Color	MS3/MS3X	MS2	AMP'd & Classic Microsquirt
5V VREF	17	Grey	26	26	28
TPS	18	Lt. Blue	22	22	27
Sensor Ground	19	Black / White	7	7	18

5. Setup and Tuning

5.1 Configuration



5.1.1 Throttle Settings



General

RPM Signal Source: Select how engine speed is measured

- **CANbus RPM** — Uses an RPM message from the CANbus
- **PWM Frequency Input** — Uses a tach/frequency signal wired to the controller

TPS Output Range: Defines how throttle position is reported to the ECU/logger

- **Full Range** - Sends actual throttle position (0–100%)
- **Exclude Idle Range** - Forces the reported value to 0% at idle, then scales above idle for on-throttle operation

Special Throttle Bodies

Throttle Body

- **Standard** – Throttle with two full scale TPS values. Select this when **TPS 1** and **TPS 2** each sweep the full range (e.g., reference span) across the throttle travel
- **Ford Half-Scale** – One channel is **half-scale** (0-50%) while the other is **full-scale (0-100%)**. Select this when either TPS signal only sweeps half the normal span, and the companion channel sweeps the full span.

Fault Response

Max Position on Minor Fault (%): Sets the temporary throttle limit applied when a non-critical fault is detected. The controller will cap the commanded throttle to this percentage until the fault clears

Max Deviation from Target (%): Defines the maximum allowed difference between the commanded throttle and the measured position before a fault condition is flagged

Deviation Time Allowance (s): Specifies how long the deviation may persist beyond the limit above before the controller sets a fault. Use this to avoid nuisance trips from brief transients

Fault Output: Assigns a digital output to indicate a DBW fault (e.g., to drive a warning lamp or “check engine” input)

Idle

Idle Signal Source: Determines how idle airflow/throttle is commanded

- **Fixed Throttle Minimum** - Holds the throttle at a fixed minimum opening
- **PWM Output** - Uses a PWM control signal to command idle airflow
- **External CANbus Input** - Follows an idle command received over CANbus

Fixed Throttle Minimum (%): Sets the constant minimum throttle opening (in percent) used when Idle Signal Source = Fixed Throttle Minimum

Throttle Target at CAN Value 4095 ADC (%): Defines the throttle opening applied when the **CANbus idle input** reaches its **maximum value (4095 ADC)**. Use this to set the upper limit of throttle commanded by an external CAN idle request

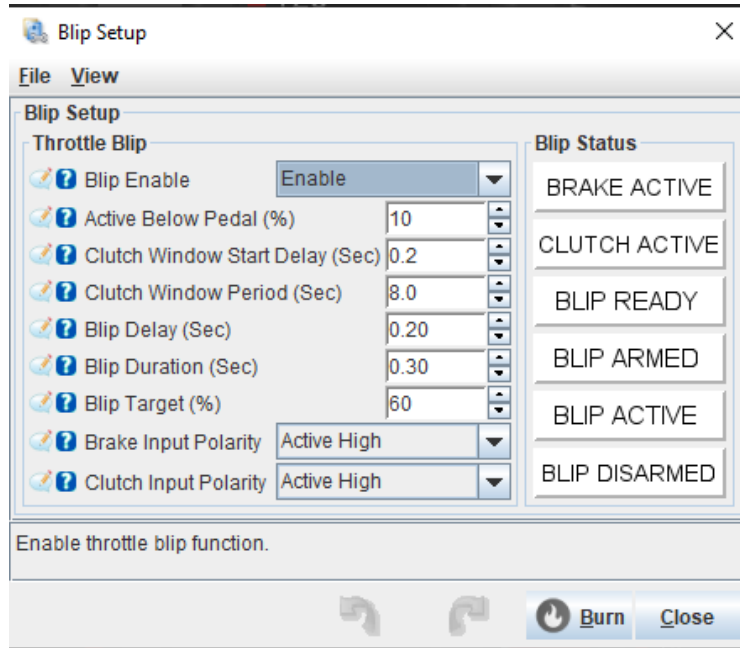
Throttle Limits

Limit By: Choose how maximum throttle is capped

- **RPM**: Uses a single curve of Max Throttle (%) vs RPM
- **Gear**: Uses individual curves per gear (up to 6) to set Max Throttle (%) by gear

Number of Gears: When Limit By = Gear, specify how many gears (1–6) you will define.

5.1.2 Throttle Blip



Blip Enable: Turns the auto-blip function on or off

Active Below Pedal (%): Auto-blip is only eligible when the throttle pedal is at or below this percentage (Above this value, blip is disabled)

Clutch Window Start Delay (s): Time after the feature arms before the system begins watching for a clutch press

- If the clutch is pressed **during this delay**, any pending blip is canceled

Clutch Window Period (s): “Ready” window during which a clutch press will initiate a blip

- If the clutch is pressed **within this window**, the blip will fire at the end of the **blip delay**

Blip Delay (s): Additional delay between detecting a valid clutch event and starting the blip.

- Applied after the window logic above (from the end of the **Clutch Window Period** “ready window”)

Blip Duration (s): How long the throttle blip is held

Blip Adder (%): Amount added to the base throttle target during the blip.

- Example: If base is 2% and Blip Adder is 50%, the commanded blip target is ~52%

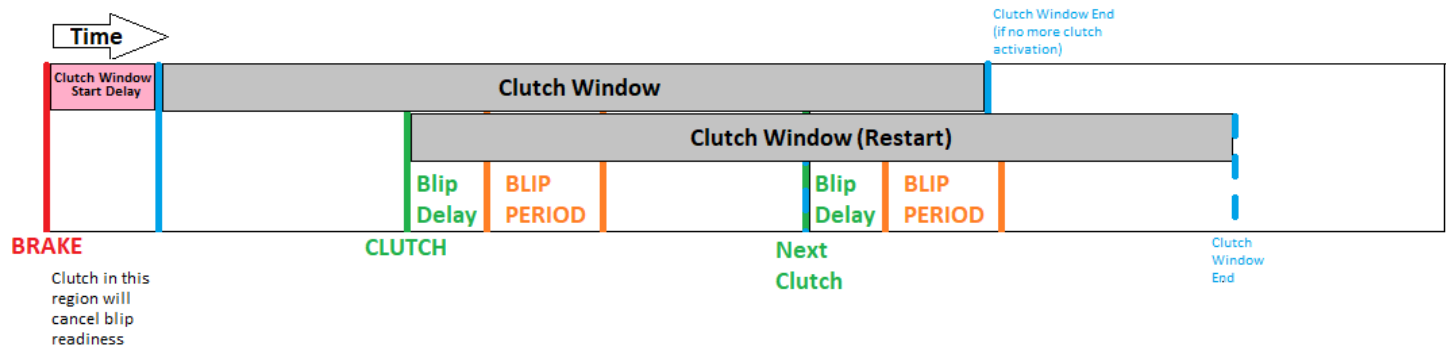
Brake Input Polarity: Defines how the brake input is recognized

- **Active Low:** Input is “on” when grounded.
- **Active High:** Input is “on” when ≥ 5 V.

Clutch Input Polarity: Defines how the clutch input is recognized

- **Active Low:** Input is “on” when grounded.
- **Active High:** Input is “on” when ≥ 5 V.

Blip Timeline



Braking (*brake is depressed and held*)

The blip function is only active during braking. If at any time the brake is released the blip function will become inactive. When braking begins, the “Clutch Window Start Delay” timer is started.

Clutch Window Start Delay (*red bar*)

Immediately after a blip completes (or after brake is initially pressed), the system enters the *start-delay* period. Any clutch activation during this time is ignored—and in fact will reset this delay timer—so that you don’t get premature or “spurious” blips.

Clutch Window (*light-blue bracket + grey bar*)

Once the start delay expires, the *clutch window* opens. Only clutch presses that occur within this window can arm a blip. If no clutch press arrives before the window’s end, the system returns to “ready state” and you must go through another start delay.

Clutch Window (Restart) (*grey bar extends from a clutch event*)

If you do press the clutch while the window is open, two things happen simultaneously:

- A blip sequence is armed (see below).
- The clutch-window timer *restarts* from the moment of that press. This lets a fresh window begin each time you hit the clutch, so repeated presses can continue to trigger blips without waiting for the full original window to elapse.

Blip Delay (*green bar under the grey bar*)

As soon as a qualifying clutch press is detected, the *blip-delay* countdown begins. This small pause lets the clutch engagement settle before throttle is opened.

Blip Period (*orange bar under the grey bar*)

When the blip-delay timer expires, the controller commands the throttle open for the configured *blip-period*. At the end of this interval, throttle returns to its base position.

How they work together

- **Initial Brake** application → starts a delay timer before any clutch activation can arm a blip sequence.
- **Start-delay** → prevents early clutch presses from triggering.
- **Clutch window** → fixed timeframe for valid clutch presses; restarts on each clutch press.
- **Blip delay** → brief wait after clutch press, before opening throttle.

- **Blip period** → actual duration of throttle opening.

5.1.3 Calibration

THE ENGINE MUST BE OFF BEFORE STARTING THE CALIBRATION PROCESS

The pedal calibration is a two-step process where the controller measures the **closed (idle)** and **full (WOT)** pedal limits and linearly interpolates between those points.

Important: If a throttle calibration is **started and then stopped/canceled/interrupted**, **all throttle calibration data—previous and current—will be cleared.** You must complete a full calibration before throttle control will be enabled.

Step 1: Prepare

Engine OFF is required for all calibration steps. The controller must be powered (key-on/ignition power), but **do not run the engine.**

- Park the vehicle safely; transmission in neutral/park and parking brake set.
- Ensure the controller and pedal/throttle body are wired and connected.

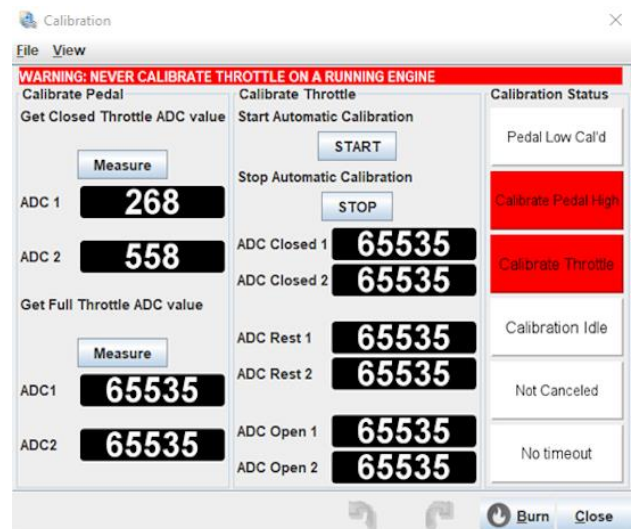
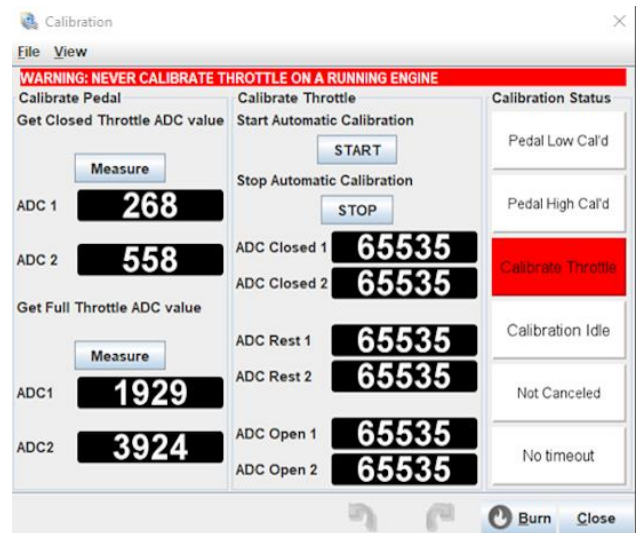
Step 2: Calibrate Pedal (Closed & WOT)

Closed Pedal (Idle)

- Do not press the pedal
- In the calibration screen, under Get Closed Throttle ADC value, click **Measure**
- Verify ADC1 and ADC2 populate with low-position voltages

Full Pedal (WOT)

- Fully depress and hold the pedal
- Under Get Full Throttle ADC value, click **Measure**
- Verify ADC1 and ADC2 populate with high-position voltages
- Release the pedal.



Step 3: Calibrate Throttle Body (Automated)

- Verify the vehicle is safe and **engine remains OFF**
- Click **START** to begin **Calibrate Throttle**
- The **Calibrating Throttle** indicator turns on
- Allow the ECU to **run two full closed-to-open sweeps** automatically. **Do not** press the pedal or cycle power during this process - **no further input is needed**
- When both sweeps complete successfully, the indicator turns off and the calibration is saved.

The screenshot shows the 'Calibration' software window. A red warning banner at the top reads 'WARNING: NEVER CALIBRATE THROTTLE ON A RUNNING ENGINE'. The interface is divided into three main sections: 'Calibrate Pedal', 'Calibrate Throttle', and 'Calibration Status'.
- **Calibrate Pedal**: Includes a 'Measure' button and displays 'Get Closed Throttle ADC value' (ADC 1: 268, ADC 2: 558) and 'Get Full Throttle ADC value' (ADC1: 1929, ADC2: 3924).
- **Calibrate Throttle**: Includes 'START' and 'STOP' buttons. It displays 'Start Automatic Calibration' and 'Stop Automatic Calibration'. Below these are two sweeps of data: ADC Closed 1 (437), ADC Closed 2 (3623), ADC Rest 1 (597), ADC Rest 2 (3468), ADC Open 1 (3809), and ADC Open 2 (295).
- **Calibration Status**: A vertical panel on the right showing 'Pedal Low Cal'd', 'Pedal High Cal'd', 'Calibrate Throttle' (highlighted in red), 'Calibrating Throttle' (highlighted in yellow), 'Not Canceled', and 'No timeout'.
At the bottom right are 'Burn' and 'Close' buttons.

If Calibration Fails or Is Interrupted

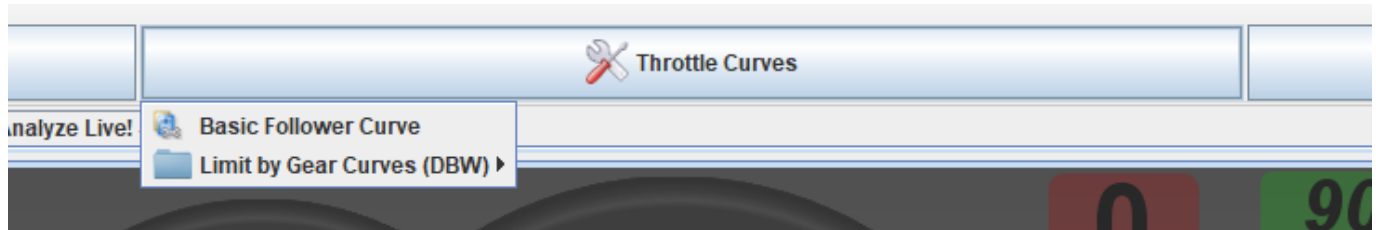
If the Calibration fails at any point no data is saved

Important: If calibration is started and then stopped/canceled/interrupted, all throttle calibration data—previous and current—will be cleared.

Correct any issues (power, wiring, movement of pedal, etc.) and repeat Step 3 until successful.

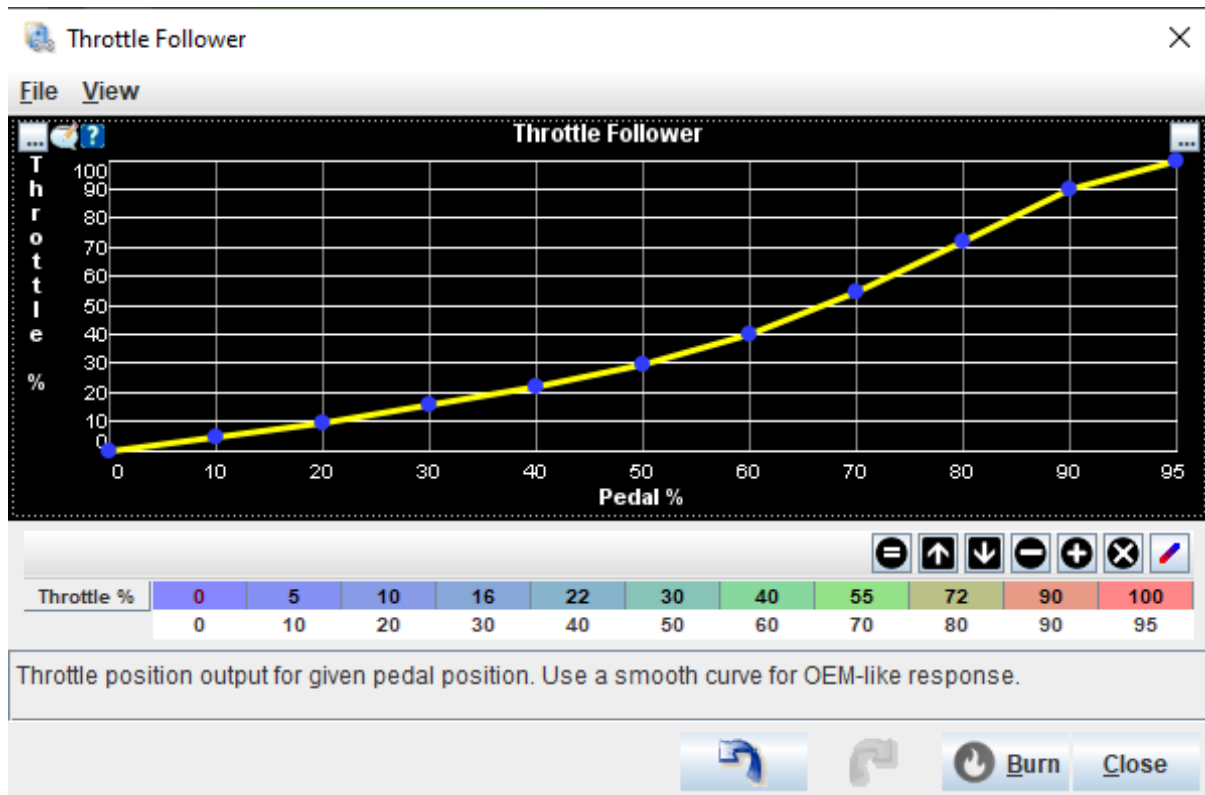
This screenshot shows the 'Calibration' software window after the throttle calibration process. The layout is identical to the previous screenshot, but the 'Calibration Status' panel on the right now shows 'Throttle Cal'd' and 'Calibration Idle'. The 'Calibrate Throttle' section still displays the same ADC data as before. The 'Burn' and 'Close' buttons remain at the bottom right.

5.2 Throttle Curves



Note: only Basic Follower Curve will be available unless additional features are enabled under [Throttle Limits](#)

Throttle Follower Curve

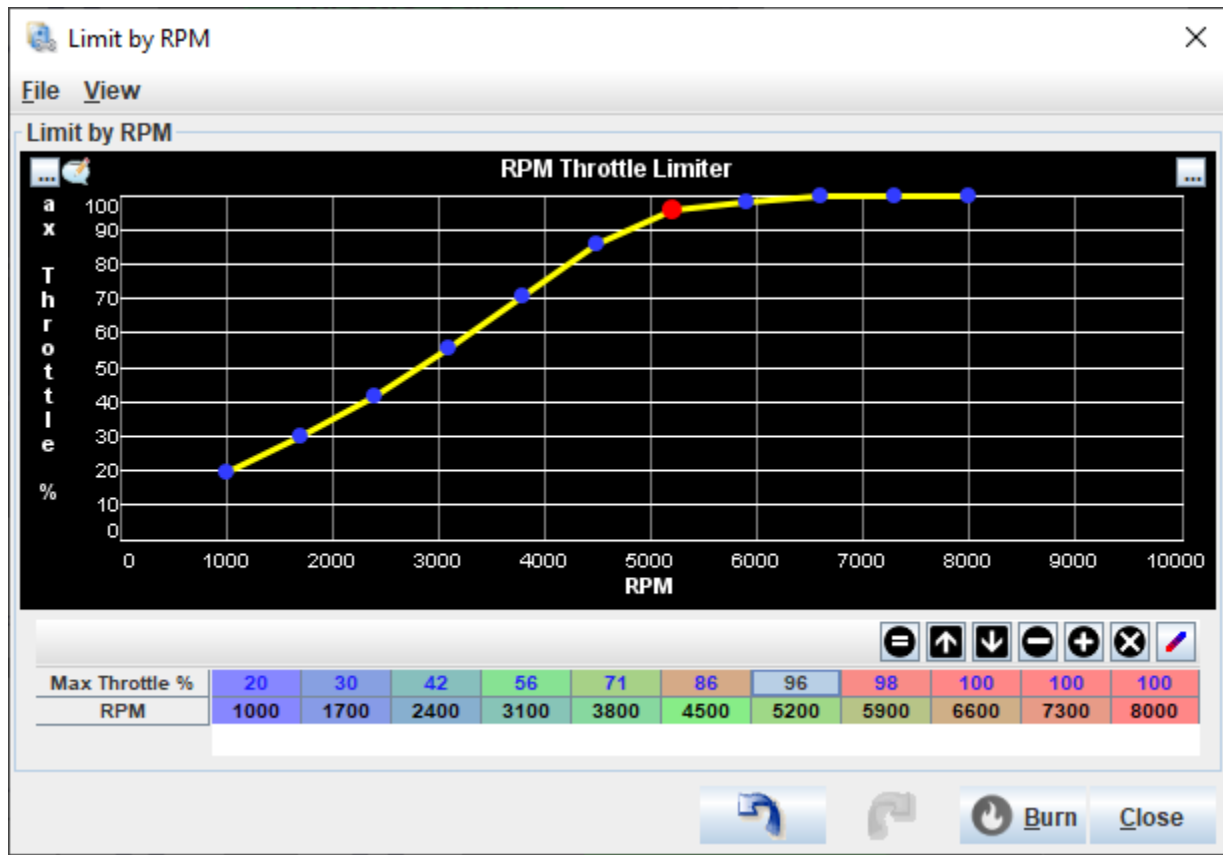


The Throttle Follower defines how your DBW controller translates pedal input into actual throttle-body opening. On the horizontal axis is pedal position, and on the vertical axis is commanded throttle blade opening. For an OEM like response and good pedal modulation we suggest the following.

- **Baseline opening (0 % pedal → 0 % throttle)**
The first bin for both rows **MUST REMAIN ZERO**
- **Low-range “soft” response (10→30 % pedal → 5→16 % throttle)**
The first third of pedal travel yields very gentle throttle increases for fine modulation around idle
- **Mid-range linear ramp (30→70 % pedal → 16→55 % throttle)**
Pedal inputs in this region are roughly proportional to throttle opening, giving predictable response

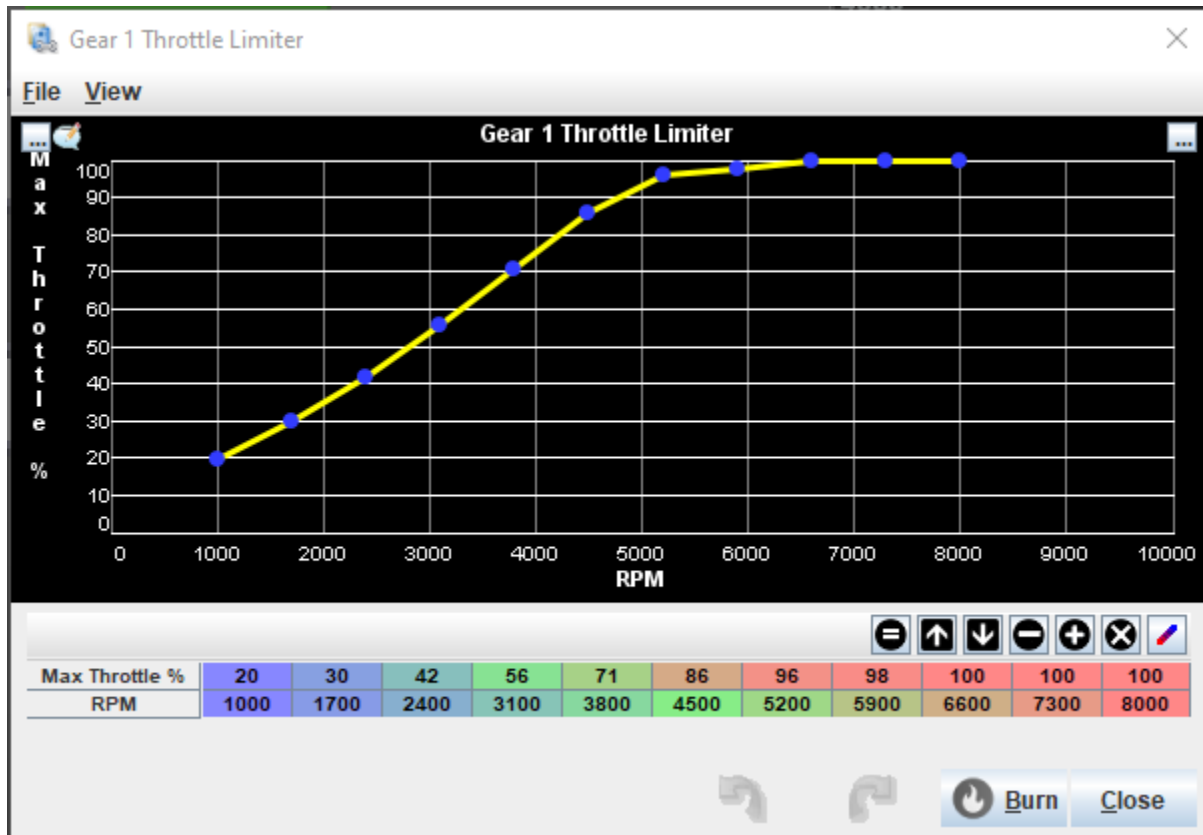
- **High-range “power” ramp (70→95 % pedal → 55→100 % throttle)**
Beyond 70 % pedal, the curve steepens so that near-full pedal travel quickly approaches 100 % throttle

Limit by RPM Curve



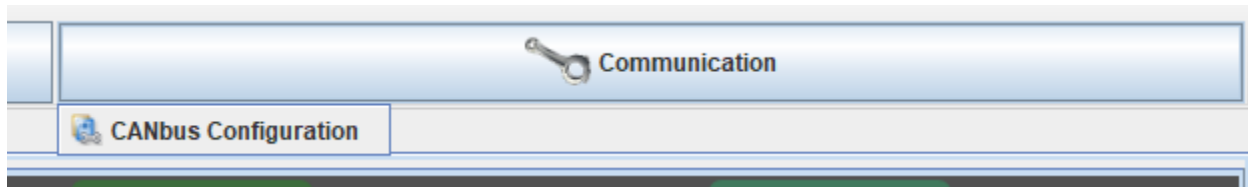
The Limit by RPM curve caps the maximum throttle opening at each engine speed. By defining a Max Throttle opening for key RPM breakpoints, you shape how much power the engine can deliver throughout the rev range.

Limit by Gear Curve(s)



The Limit by Gear curve caps the maximum throttle opening at each engine speed. By defining a Max Throttle opening for key RPM breakpoints, you shape how much power the engine can deliver throughout the rev range. You can define up to 6 different gear curves to help with torque management in lower gears.

5.3 Communication



5.3.1 CANbus Configuration

The screenshot shows the 'CANbus Configuration' dialog box. It has a menu bar with 'File' and 'View'. The 'CANbus Settings' section includes checkboxes for 'Baud', 'Termination Resistor', '11-bit Messaging', '29-bit MSCAN', 'MSCAN ID', and 'CAN Polling Interval (mS)'. The 'Baud' is set to 500k, 'Termination Resistor' is Off, '11-bit Messaging' is Enable, '29-bit MSCAN' is Enable, 'MSCAN ID' is 8, and 'CAN Polling Interval (mS)' is 250. The 'Predefined Standard Addressing - Inbound Messages Selector' section has a dropdown for 'Select your ECU' set to 'MS3pro'. Below this is a table for 'Standard CAN Addressing - Inbound Messages' with columns for Message, ID (dec), Offset, Multiply, Divide, and Add. The messages are RPM (ID 1520, Offset 6, Multiply 1, Divide 1, Add 0), Gear (ID 1553, Offset 6, Multiply 1, Divide 1, Add 0), VSS (ID 1562, Offset 0, Multiply 1, Divide 10, Add 0), and Idle (ID 1526, Offset 6, Multiply 16, Divide 1, Add 0). Below the table are four large buttons labeled '0' for 'CAN RPM (RPM)', 'CAN Gear (Gear)', 'CAN VSS', and 'CAN Idle Target (ADC)'. The 'Standard CAN Addressing - Outbound Message' section has four entries for Message 1 to 4, each with an ID (dec) and a description. Message 1 ID is 256, Message 2 ID is 257, Message 3 ID is 258, and Message 4 ID is 259. At the bottom, there is a note 'Set CANbus baud rate. MegaSquirt uses 500K.' and buttons for 'Burn' and 'Close'.

CANbus Settings

Baud: Set the CANbus baud rate. MegaSquirt and DBW controller default to 500 kbit/s

Termination Resistor: Enable or disable the on-board 120 Ω terminator. Enable only if this device is at the physical end of the CAN bus

11-bit Messaging: Enable use of standard 11-bit CAN identifiers for inbound messages

29-bit MSCAN: Enable support for 29-bit (extended) CAN IDs. Required for MegaSquirt passthrough (tuning over CANbus connected devices)

MSCAN ID: The CAN ID used by the DBW controller in extended (29-bit) mode. Default is 8

CAN Polling Interval (mS) How often (in milliseconds) the controller sends 11-bit messages on the bus when using 11-bit polling

5.3.2 Standard CAN Addressing – Inbound Messages

Message	ID (dec)	Offset	Multiply	Divide	Add
RPM	CAN message ID for engine speed	Byte offset in payload where RPM begins	Scale factor to apply to raw RPM	Divisor for RPM scaling	Final offset added to RPM value
Gear	CAN message ID for Gear position	Byte offset in payload where gear data resides	Scale factor for gear data	Divisor for gear scaling	Final offset added to gear value
Idle	CAN message ID for idle-position ADC	Byte offset where idle ADC appears	Scale factor for idle ADC	Divisor for idle ADC	Final offset added to idle ADC

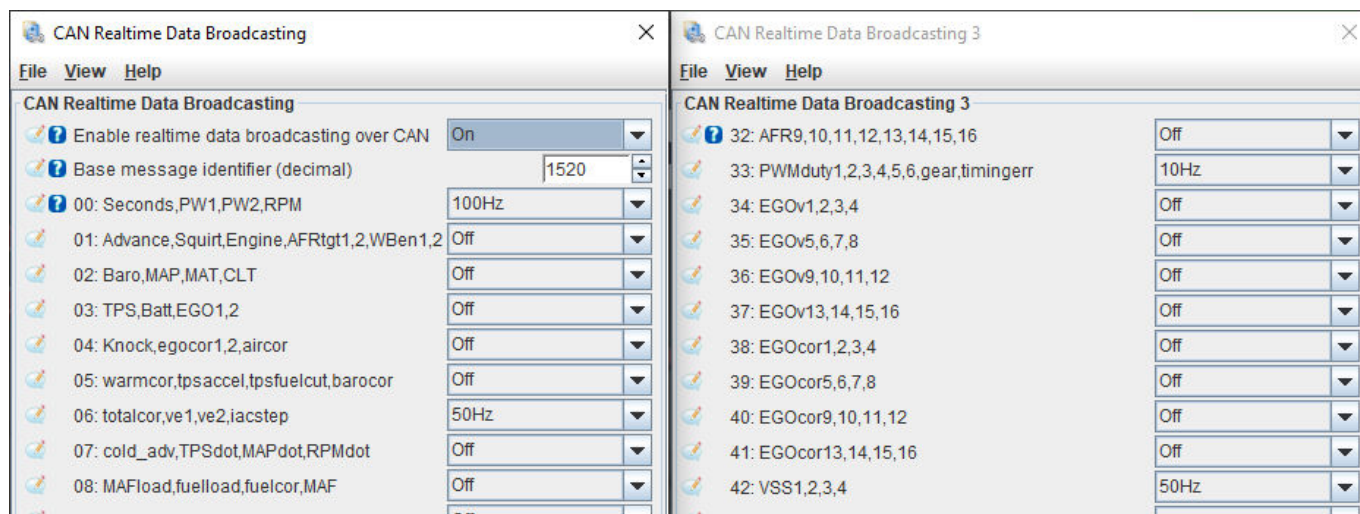
MegaSquirt CAN Real-Time Data Broadcasting

Select **MS3pro** from the **Predefined Inbound Messaging** dropdown to automatically configure these CAN message settings.

Parameter	CAN ID	Offset	Multiply	Divide	Add
RPM	1520	6	1	1	0
Gear	1553	6	1	1	0
Idle	1526	6	16	1	0

In your MS3Pro you will need to navigate to

CAN-bus / Testmodes > CAN Real-Time Data Broadcasting



Enable broadcasting for groups 0, 6, 33, and 42. Since not every group requires a high update rate, we recommend using the data-rate settings shown

5.3.3 Standard CAN Addressing – Outbound Messages

Each outbound message sends an 8-byte payload starting at **byte offset 0**, using the 11-bit CAN ID you configure. By default, the four messages are:

Outbound Messages	Offset 0	Offset 2	Offset 4	Offset 6
Outbound Message 1 → ID 256 dec (0x100) Mult 10, Div 1, A0	Pedal	TPS absolute value	TPS relative value (exclude idle range) this will show 0% throttle position at idle	Blip Status
Outbound Message 2 → ID 257 dec (0x101) Mult 10, Div 1, A0	I/O reference voltage 1 (5VREF)	I/O reference voltage 2 (5VREF)	Supply Voltage to controller	Throttle Motor Current
Outbound Message 3 → ID 258 dec (0x102) Mult 1, Div 1, A0	General Fault	Processor Fault	Hardware Fault	
Outbound Message 4 → ID 259 dec (0x103) Mult 1, Div 1, A0	Pedal 1 Fault	Pedal 2 Fault	TPS 1 Fault	TPS 2 Fault

All data are sent as big-endian, unsigned.

5.4 Gauges

Pedal – Raw, Normalized, Difference

Pedal 1 Raw – Pedal circuit 1 unconditioned reading, range 0–4095 ADC counts.

Pedal 2 Raw – Pedal circuit 2 unconditioned reading, range 0–4095 ADC counts.

Pedal Difference Percent – Difference between Pedal circuits 1 and 2, range 0–100%; this should remain small.

Pedal 1 Normalized (ADC) – Pedal circuit 1 normalized reading, range 400–3600 ADC counts.

Pedal 1 (%) – Pedal circuit 1 normalized percentage, range 0–100%.

Pedal 2 Normalized (ADC) – Pedal circuit 2 normalized reading, range 400–3600 ADC counts.

Pedal 2 (%) – Pedal circuit 2 normalized percentage, range 0–100%.

TPS (Throttle Position) – Raw, Normalized, Difference

TPS 1 Raw – Throttle Position Sensor circuit 1 unconditioned reading, range 0–4095 ADC counts.

TPS 2 Raw – Throttle Position Sensor circuit 2 unconditioned reading, range 0–4095 ADC counts.

TPS Difference Percent – Difference between TPS circuits 1 and 2, range 0–100%; this should remain small.

TPS 1 Normalized (ADC) – TPS circuit 1 normalized reading, range 400–3600 ADC counts.

TPS 1 (%) – TPS circuit 1 normalized percentage, range 0–100%.

TPS 2 Normalized (ADC) – TPS circuit 2 normalized reading, range 400–3600 ADC counts.

TPS 2 (%) – TPS circuit 2 normalized percentage, range 0–100%.

Idle Target

Idle Target Normalized (ADC) – Commanded idle position, range 400–3600 ADC counts.

Idle Target (%) – Commanded idle position, range 0–100%.

Throttle Drive & Calibration (PWM/Duty)

Throttle Motor Duty Cycle Out – Calculated duty cycle driving the throttle motor, range 0–100%.

Cal: PWM Closed – Fully closed duty cycle determined during throttle calibration.

Cal: PWM Moving Closed – PWM value where the throttle begins to move closed from rest (calibrated).

Cal: PWM Moving Open – PWM value where the throttle begins to move open from rest (calibrated).

Cal: PWM Open – Fully open duty cycle determined during throttle calibration.

Power & Electrical

I/O Ref Voltage 1 – Voltage supplied to sensor bank 1, typically near 5.0 VDC.

I/O Ref Voltage 2 – Voltage supplied to sensor bank 2, typically near 5.0 VDC.

Battery Voltage – Controller supply voltage (vehicle battery).

Supply Current – Controller/motor supply current in Amperes.

Time / Execution

Free Running Timer – Accumulator that increments every 1 millisecond.

Loop Timer – Processor loop execution time (microseconds).

Watchdog Timer – Accumulator that increments each time the watchdog is serviced.

RPM / Vehicle / CAN

RPM – Engine speed referenced from the configured source.

CAN RPM – Engine speed as received from the CANbus.

CAN Gear – Gear value as received from the CANbus.

CAN VSS – Vehicle speed as received from the CANbus (units per ECU setup).

CAN Idle Target – Idle target in ADC counts as received from the CANbus.

PID Control – Target/Feedback/Error

Control Target – Commanded throttle plate position, range 400–3600 ADC counts (reported on a 0–4095 channel).

Control Position – Actual throttle plate position, range 400–3600 ADC counts (reported on a 0–4095 channel).

Control Position Error – Difference between commanded and actual throttle positions; should remain small.

PID Coefficients (Calculated)

Calculated P Coefficient – Controller’s computed proportional gain.

Calculated I Coefficient – Controller’s computed integral gain.

Calculated D Coefficient – Controller’s computed derivative gain.

Diagnostics – Calibration Values

Cal: Pedal 1 Min ADC – Stored minimum ADC value for Pedal 1 (calibration).

Cal: Pedal 1 Max ADC – Stored maximum ADC value for Pedal 1 (calibration).

Cal: Pedal 2 Min ADC – Stored minimum ADC value for Pedal 2 (calibration).

Cal: Pedal 2 Max ADC – Stored maximum ADC value for Pedal 2 (calibration).

Cal: TPS 1 Min ADC – Stored minimum ADC value for TPS 1 (calibration).

Cal: TPS 1 Rest ADC – Stored rest ADC value for TPS 1 (calibration).

Cal: TPS 1 Max ADC – Stored maximum ADC value for TPS 1 (calibration).

Cal: TPS 2 Min ADC – Stored minimum ADC value for TPS 2 (calibration).

Cal: TPS 2 Rest ADC – Stored rest ADC value for TPS 2 (calibration).

Cal: TPS 2 Max ADC – Stored maximum ADC value for TPS 2 (calibration).

Status / Alarm Words

Status: TPS 1 Word – Bitfield status for TPS 1 diagnostics.

Status: TPS 2 Word – Bitfield status for TPS 2 diagnostics.

Status: Pedal 1 Word – Bitfield status for Pedal 1 diagnostics.

Status: Pedal 2 Word – Bitfield status for Pedal 2 diagnostics.

Status: Processor Word – Bitfield status for processor-level faults.

Status: System Word – Bitfield status for system-level faults.

Status: Hardware Word – Bitfield status for hardware-level faults.

Status: CAN Word – Bitfield status for CAN communication state.

Misc / Test

test – General-purpose test/debug gauge.

6. Fault Codes and Status Bit Fields

6.1 Flash Codes

- Flash codes are displayed by the on-board LED, but can be displayed by an external lamp connected to the fault output pin.
- Each flash code is represented by a long pulse followed by a short pulse. The long pulse represents the tens digit of the code. A short pulse represents the ones digit. For example, a fault code of 21 would be presented as 2 long pulses followed by one short pulse. If multiple fault codes exist, a long pause will be presented between groups. A zero is not represented by any flashes. For example, code 30 would be three long flashes and code 3 would be represented by three short flashes. The tens digit of the flash code denotes in which Bank the error resides and the ones digit is the bit offset.

6.2 Status Bit Fields

Blip Status Register

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Blip Disarm	Blip Active	Blip Armed	Blip Ready	--	--	Clutch On	Brake On

General Fault Register

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
---	---	CAN Timeout	--	--	Alms Paused	Major Fault	Minor Fault

Processor Faults Register

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
---	---	Cal CRC Flt	No Cal	Mem OOR	Compare Flt	Write Fault	Erase Fault

Hardware Fault Register

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 8	Bit 8
---	---	TPS Slope Eq	PdI Slope Eq.	Motor Reversed	Driver Inhibit	Off Target	Motor Stuck

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Motor Short	Motor Open	Battery High	Battery Low	Vref2 High	Vref2 Low	Vref1 High	Vref1 Low

Sensor Fault Register

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
--	Calibration Fault	Tracking Fault	Short High	Short Low	Span Fault	Out of Range Low	Out of Range High

Configuration Fault Register

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
--	--	--	--	--	--	PWM In 2 Multiple Assignment	PWM In 1 Multiple Assignment

CANbus Fault Register

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
--	--	--	Off Bus	TX Passive Fault	RX Passive Fault	TX Active Fault	RX Active Fault

6.3 Fault Definitions

Blip Disarm – Preconditions not met to start blip timers.

Blip Active – Throttle is currently opening for a blip.

Blip Armed – Preconditions satisfied; a blip can occur.

Clutch On – Clutch input active.

Brake On – Brake input active.

CAN Timeout – Expected CAN data not received. Check IDs, baud, wiring, device power.

Alms Paused – User requested 5minute pause on all faults (PID calibration aid).

Major Faults – Any single bit set in **Hardware Faults**, **Processor Faults**, or **Configuration Faults**.

Effect: Triggers DBW fault output and enforces the system's major fault behavior (see *Fault Response*).

Minor Faults – Any single bit set in the **sensor fault registers: PPS1, PPS2, TPS1, TPS2**.

Effect: Apply "Max Position on Minor Fault (%)" and log/diagnose per *Fault Response* settings.

Cal CRC Flt – Calibration CRC mismatch.

No Cal – No calibration present. Perform pedal/throttle calibration.

Mem OOR – Memory out of range. Reload defaults; reflash if persistent.

Compare Flt – Memory compare failure.

Write Flt – Flash write fault. Check power stability; try reflash.

Erase Flt – Flash erase fault. Reflash firmware; service if persistent.

TPS Slope Eq – TPS channels' normalized slopes don't match. Verify wiring; recalibrate.

PdL Slope Eq – Pedal (PPS) channels' normalized slopes don't match. Verify wiring; recalibrate.

Motor Reversed – Motor wiring reversed. Swap motor leads.

Driver Inhibit – H-bridge disabled (watchdog). Investigate watchdog/reset cause.

Off Target – Commanded vs actual position deviates beyond limit. Check friction/bind, tune PID, verify supply voltage.

Motor Stuck – Mechanical stall. Inspect throttle body, linkage, contamination.

Motor Short – Electrical short in motor circuit. Inspect harness/connector; repair short.

Motor Open – Open circuit in motor wiring. Check continuity, pins, crimps.

Battery High – Battery over-voltage (≈ 20 V). Check alternator/regulator.

Battery Low – Vehicle battery voltage is low (≈ 7 V). Charge/replace; check grounds.

Vref2 High/Low – 5 V reference 2 out of range (≈ 5.2 V / 4.8 V). Check sensor loads/shorts.

Vref1 High/Low – 5 V reference 1 out of range (≈ 5.2 V / 4.8 V). Check sensor loads/shorts.

Calibration Fault – The sensor(s) calibration encountered a fault. Repeat calibration procedure.

Tracking Fault – Sensor slopes don't track. Check wiring; recalibrate.

Short High – Sensor voltage shorted to upper rail. Inspect wiring.

Short Low – Sensor voltage shorted to ground. Inspect wiring/ground pin.

Span Fault – Sensor normalized range does not match the limits. Recalibrate.

Out of range low – ADC below the lower normalized limit. Check sensor, wiring, calibration.

Out of range high – ADC above the upper normalized limit. Check sensor, wiring, calibration.

PWMIn1 Multiple Assignment - PWMIn1 assigned to more than one function.

PWMIn2 Multiple Assignment - PWMIn2 assigned to more than one function.

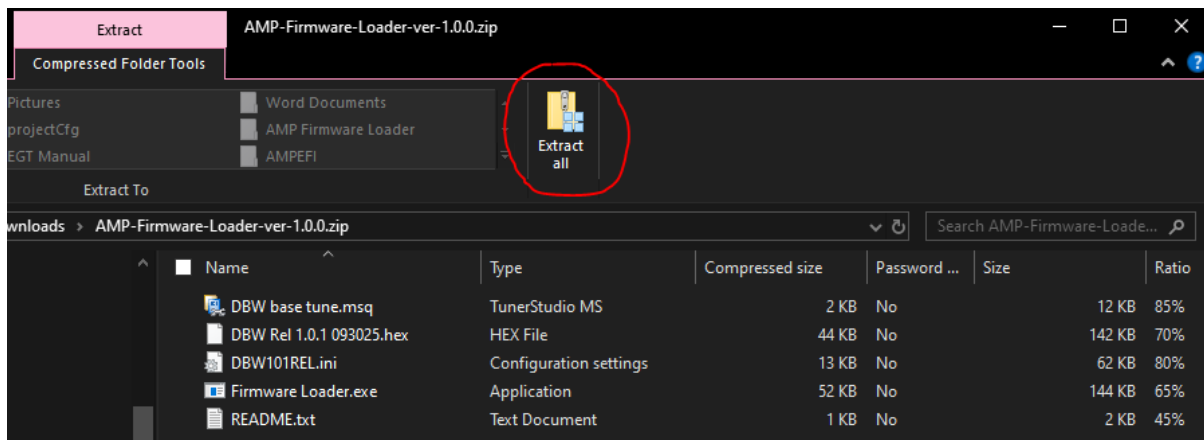
7. Firmware Updates

Firmware Loader

Download from AMPEFI.COM/downloads/

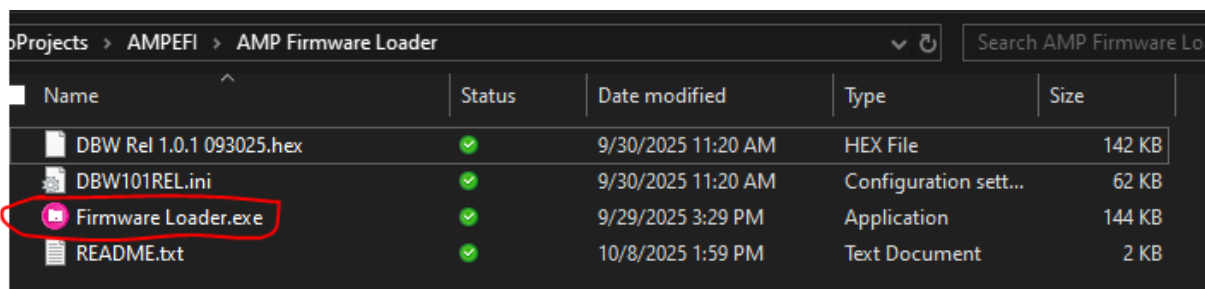


Extract the files



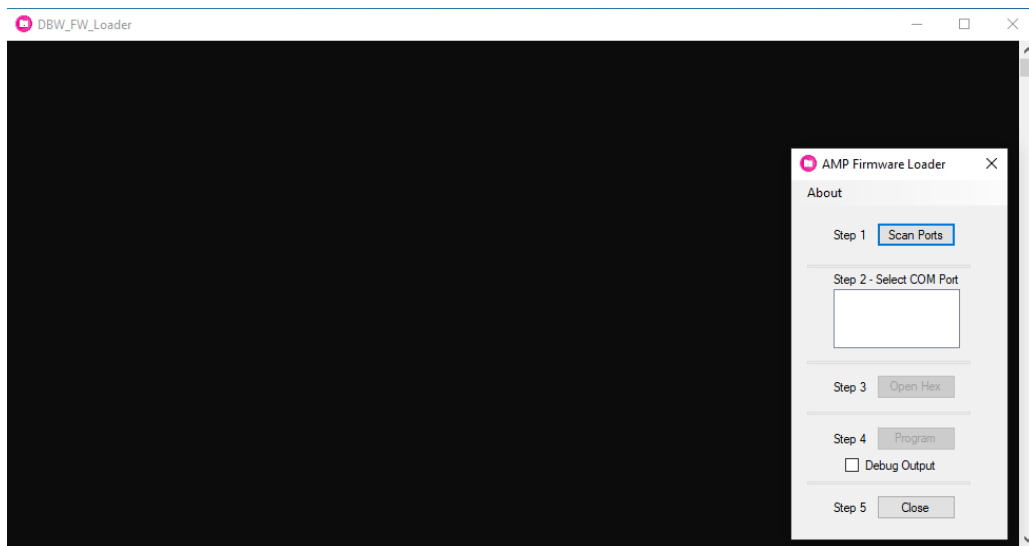
If you do not extract the files, you will not be able to complete the Firmware update

Run program Firmware Loader.exe



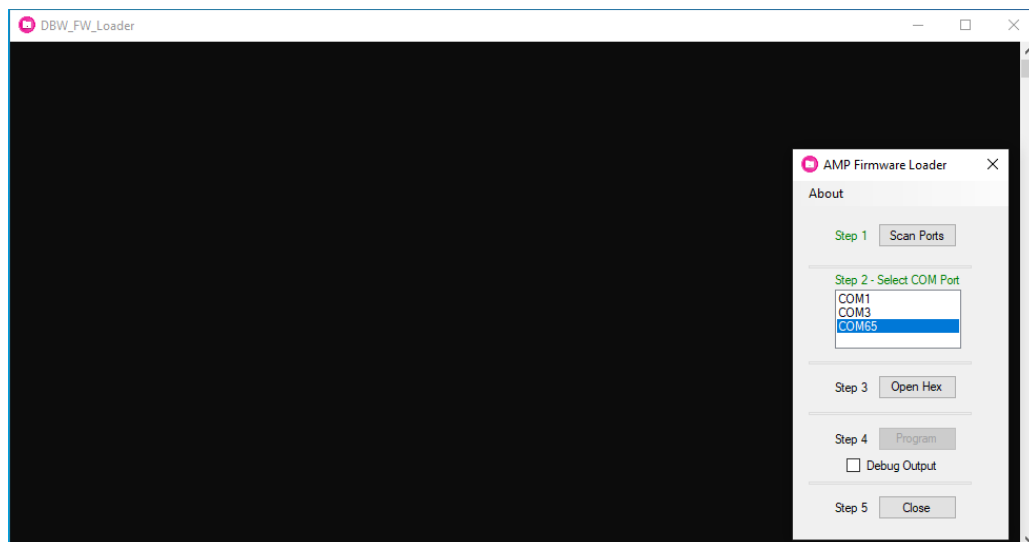
Note: the program has both an application window and a console window that will open

Step 1 - Scan for Ports

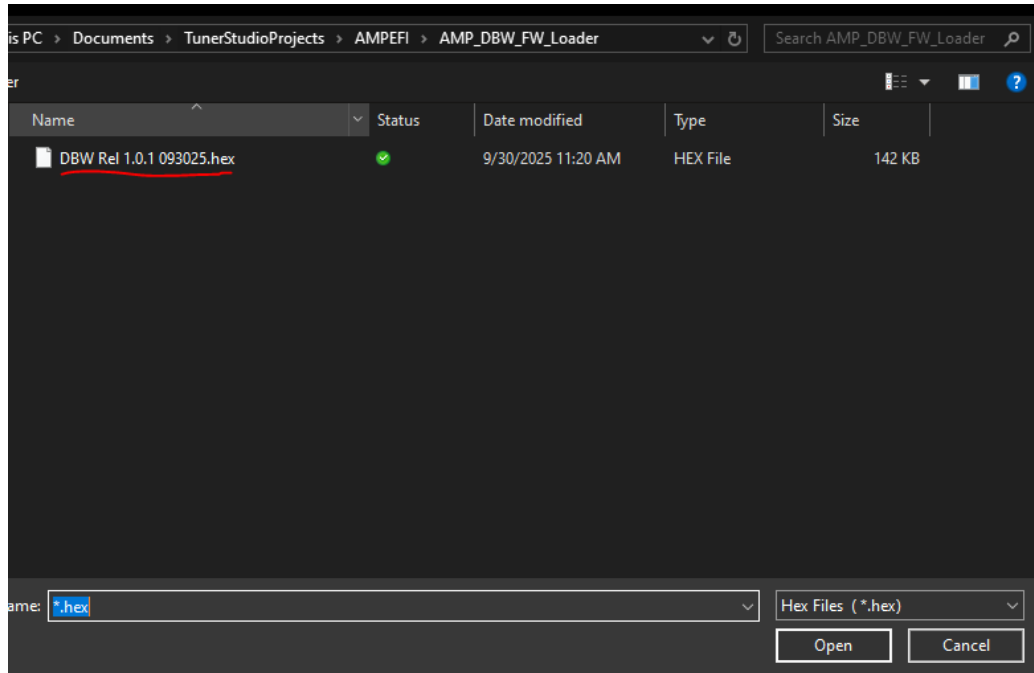


Note: If the desired com port is not available it may be in use by Tuner Studio or another application. If this is the case close the other applications and try again.

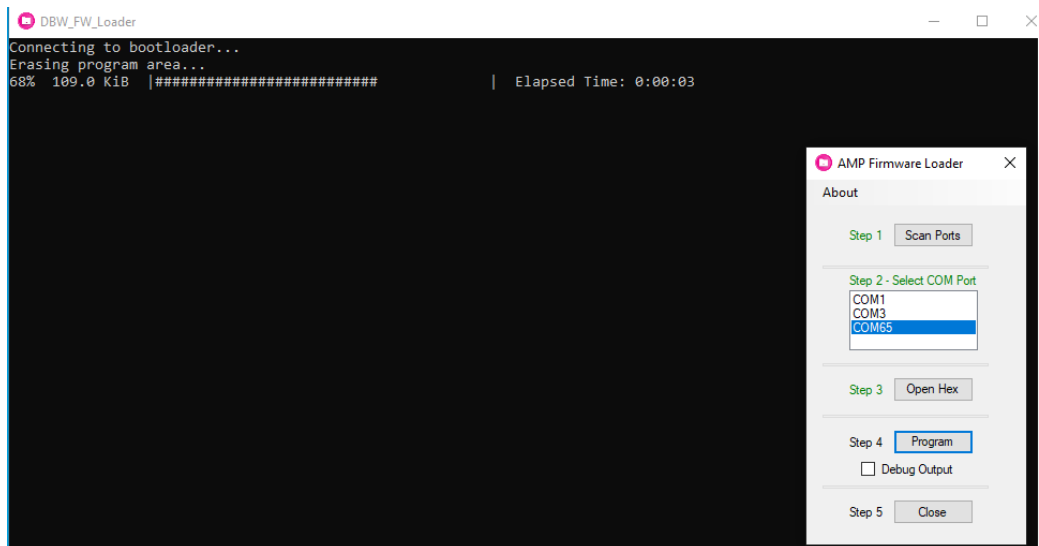
Step 2 - Select your Com Port



Step 3 - Open the Hex File



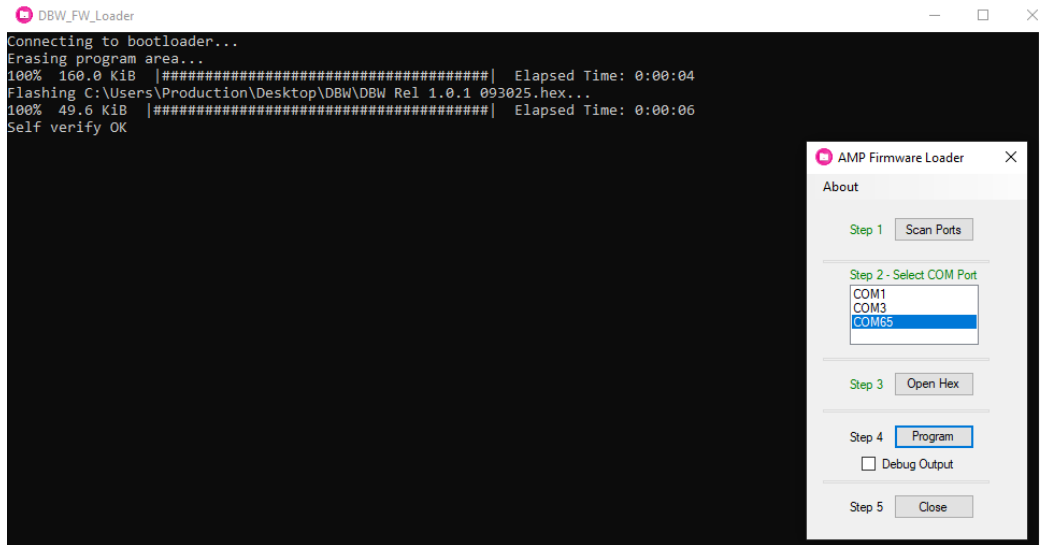
Step 4 - Program



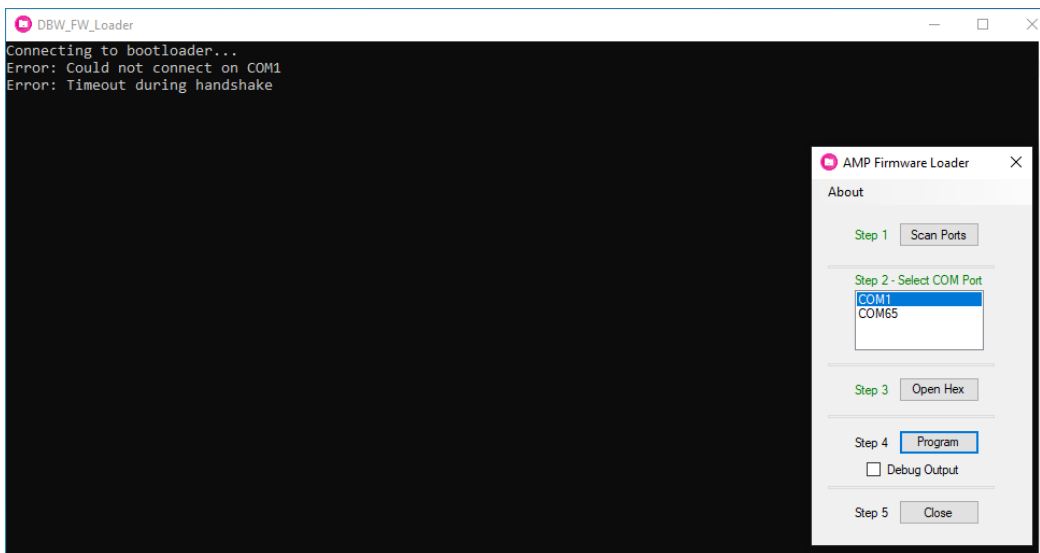
Note: Once the "Program" button is pressed, The LED will rapidly flash until the FW begins to load. Then the LED will respond with a slower flash.

If the FW load fails, the LED will return to a rapid flash to indicate that it is still in boot loader mode.

When completed the FW will report back a self-verification, we can see that this FW loaded properly



If you select the wrong COM Port, the Firmware Loader will report a time out during handshake



Once the Firmware Loading process has been completed follow these steps

- Cycle power on the DBW
- It is best practice to start with the base tune provided.
 - DBW base tune.msq
 - This will ensure that you are starting with a known calibration, we do not suggest trying to write your own calibration from scratch.
- You will need to calibrate the pedal and throttle as described in [section 5.1.3](#)