MoTeC

M142 SUBARU WRX FA24DIT

This kit provides a complete replacement for the factory Subaru ECU. It utilizes the existing vehicle wiring and sensors to deliver plug-in convenience. Using an integration patch harness and MoTeC M142 ECU the kit delivers fully programmable engine control to the platform while maintaining stock vehicle systems functionality. The M1 ECU is supplied with firmware preloaded and is based on the MoTeC USA Drag DI package with additional features unique to the 2022 Subaru WRX and motorsport demands.

The kit comprises of the M142 ECU, adapter patch harness, MoTeC LTC and LSU 4.9 lambda sensor.

Along with fuel, ignition and camshaft control this kit also supports other OE ECU features, including:

- **Push button start**
- **Air conditioner control**
- **Variable speed fan control**
- **Fuel lift pump control**
- **Cruise control**
- **Alternator control**

The supplied start file contains all the calibrations and settings for the sensors, direct fuel injectors, ignition coils, knock control, throttle servo, camshafts, alternator control and fuel lift pump control. Settings for fuel delivery, ignition timing and camshaft phasing have been calibrated to a vehicle using common "bolt on" parts.

This saves a significant amount of time by shortcutting the setup process. Users can begin tuning to their desired power and modifications right away with the assurance of a safe base tune. **Note:** Factory tumble generator valves (TGVs), Eye-Sight, Hill Start, VDC and CVT are not supported. The TGVs are required to be locked open prior to the installation of this kit. Monitoring of the position of the valves is possible with the M1 ECU.

Included are many ancillary features commonly found on race cars such as anti-lag, rolling launch, driver switches, gearbox control, knock control, intercooler spray-bars, launch control, coolant pumps, and traction control.

The product fully integrates with other MoTeC devices, providing pre-defined CAN messaging for all current Displays/Loggers, LTC's, E888, VCS, GPS, ADR, BR2, PDMs and SLMs.

▶ KIT CONTENTS (SUBARU WRX 2022)

Hardware

- **M142 –** M142 ECU
- **RG.HN.0210.01 –** Adapter loom
- **RG.DV.0255.01 –** RaceGrade 2CH Switch
- **M LTC –** LTC LSU 4.9
     * LTC NTK may be specified at time of order
- **M 0258 001 –** Bosch Motorsport LSU 4.9 sensor
- **Assorted Mounting Hardware**

Licenses

- **#23707 –** M1 LIC – SUBARU WRX FA24DIT

The license is required to run the Subaru WRX FA24DIT package in the M142 ECU.

▶ FEATURES

- Configurable Launch Control with anti-lag containing tables for engine speed, throttle limit, boost aim and closed loop ignition timing control as well Spool Mode to optimize turbocharger response at the starting line.
- Pre-stage setting for Launch Control.
- Traction Control. Closed loop system featuring the ability to use alternate wheel speed inputs for differential ground speed control. Ability to control engine torque using ignition timing, fuel cut, ignition cut and drive by wire throttle using a flexible user-configurable strategy.
- Pre-configured OE coolant fan control.
- Pre-configured OE alternator control.
- Pre-configured OE fuel lift pump control.
- Pre-configured air conditioner control.
- Pre-configured Gear detection with simplified Gear Estimate table.
- Gearbox shift support with ignition cut, fuel cut, throttle blip and engine speed matching in forward gears.
- Transmission pump output with differential temperature threshold and hysteresis control.
- Pre-configured Drive by Wire throttle servo control.
- Pre-configured Throttle Pedal sensor with translation table based on stability control mode (On, Track, Off).
- Configurable driver switches for various systems.
- Vehicle speed limiting (pit speed control).
- Gauge hijack for the factory Accelerator Pedal gauge allowing display of Throttle Pedal, Throttle Position, Flex Content, Oil Temperature and Oil Pressure.
- Mode switching via factory cruise control dial using the engine speed read out as the mode indicator.
- Configurable pulsed tachometer output.
- Pre-configured vehicle speed measurement using wheel speed sensors.
- Setting to double the resolution of the factory Boost Pressure gauge.
- Downshift Rev Matching feature utilizing factory sensors and standard 6 speed manual transmission.
- Adjustable fuel economy gauge calibration
- Pre-configured No Lift Shift ignition timing and cut based strategy for the stock 6 speed manual gearbox.
- Differential pump output with differential temperature threshold and hysteresis control.
- Pre-configured warning system that activate the factory MIL indicator on the dash.
- Test settings for most outputs, including injection and ignition outputs for easier setup.
- Exhaust Pressure based engine efficiency compensation table.

- Data acquisition of numerous factory sensors off the factory CAN Bus, including Longitudinal Acceleration, Yaw Rate, Steering Angle, Wheel Speeds, Brake Pressure.
- Pre-configured calibrations for Original Equipment sensors.
- Pre-configured reference mode for engine synchronization.
- Pre-configured physical settings for engine displacement, fuel density, stoichiometric ratio, fuel pressure and injector characterization which allows for simplified engine start-up prior to tuning.
- Pre-configured settings for ethanol fuel density, ethanol stoichiometric ratio to allow fuel blending ("flex fuel").
- Powerful Efficiency Model based on AlphaN with boost using inlet manifold pressure, inlet air temperature, exhaust pressure and boost pressure allowing for a wide array of modifications from single throttle body with intake plenum to boost over trumpets.
- Pre-configured Engine Efficiency map that allows for quick and easy tuning.
- Pre-configured secondary (port injector) fuel control with tuneable balance table. **Note:** Only saturated (high-ohm) secondary injectors are supported.
- Optional Flex Fuel using an ethanol composition sensor allows for ethanol composition blending including integration of the Fuel Temperature reading provided by the sensor.
- Optional Water/Methanol injection system with fail-safes to provide additional fueling.
- Pre-configured throttle rate of change based transient fuel for simplified transient fuel tuning.
- Engine Load Average channel with tables for engine speed limit, ignition trim, fuel mixture aim and throttle limit.
- Pre-configured ignition output and coil settings.
- Pre-configured individual cylinder knock system with multiple knock level control modes, non-linear decay, ability to mask out noise on initial knock detection (to help filter noise) and a retained knock level that can be used to apply a global knock trim to compensate for fuel quality.
- Pre-configured camshaft control of inlet and exhaust cams.
- Pre-configured engine start fuel, idle and ignition settings.
- Pre-configured Closed Loop Idle control systems using ignition and drive by wire actuation, including active adjustments for coolant and air conditioning activation.
- Pre-configured boost control via factory boost servo and factory turbocharger.
- Boost control system with targets based on Engine Speed, Gear, Flex Content, Throttle Position, Driver Mode Switch, Coolant Temperature, Engine Load Average, Exhaust Temperature, Race Time, Inlet Air Temperature and Vehicle Speed.
- Configurable turbocharger bypass control for the OEM bypass valve..
- Intercooler temperature and spray control.
- Supports nitrous with four stages and additional fuel pumps, bottle heater control and pressure sensor.

▶ FEATURES

- Race time system with tables for ignition trim, fuel mixture aim and throttle limit.
- Engine run time total for engine hour logging.
- GPS acquisition and logging via CAN or RS232.
- Support of MoTeC devices: ADR, E8XX, PDM, SLM, VCS.
- ECU CAN Receive from other MoTeC devices.
- ECU CAN Transmit of most common channels using standard MoTeC CAN templates.
- Configurable security for multiple users with differing access options.
- Support for the RaceGrade IMU.
- Turbocharger Speed, Inlet and Outlet Temperature.
- Wastegate Pressure and Position.
- Wheel Speed (preconfigured).

▶ **OPERATION**

Reference Mode
The M1 Reference Mode in this Package is locked to the Subaru WRX DIT pattern.

ECU Power
The M1 ECU will be powered only when the ignition switch is on via the Key On relay in the patch harness.

Driver Switches
Various in-car dials and switches are acquired over the CAN Bus and assigned to Firmware resources to allow for mode switching in the ECU. See the Help for the main Subaru group in M1 Tune.

Staged Injection (Port Injectors)
The M1 ECU supports the addition of 4 port injectors. An injector loom will need to be constructed. There are 4 outputs (INJ LS 1-4) available for. Installation of the port injection fuel pressure is highly recommended to leverage the full potential of the M1 ECU.

RaceGrade 2 Channel Switch
This must be plugged into the harness before the ECU will receive power at key on.

Variable Speed Fans
Subaru equipped the vehicle with dual variable speed radiator fans. The M1 will run both fans at the same speed and if the harness is plugged in but the ECU is offline, the fans will run at full speed. Unplugging the adapter harness from the OEM loom will stop the fans.

▶ M142 PINOUT

M142 Connector A – 34 Way

A1	AT5	Analogue Temperature Input 5	Cruise Button
A2	AT6	Analogue Temperature Input 6	-
A3	AV15	Analogue Voltage Input 15	TGV 1
A4	AV16	Analogue Voltage Input 16	TGV 2
A5	AV17	Analogue Voltage Input 17	-
A6	INJ_D1A_NEG	Direct Injector 1A-	Injector 1
A7	INJ_D1A_POS	Direct Injector 1A+	Injector 1
A8	INJ_D1B_POS	Direct Injector 1B+	-
A9	INJ_D1B_NEG	Direct Injector 1B-	-
A10	SEN_5V0_C	Sensor 5.0V C	-
A11	LA_NB1	Lambda Narrow Input 1	-
A12	LA_NB2	Lambda Narrow Input 2	-
A13	KNOCK3	Knock Input 3	-
A14	KNOCK4	Knock Input 4	-
A15	DIG2	Digital Input 2	Cruise Switch
A16	DIG3	Digital Input 3	Neutral Switch
A17	DIG4	Digital Input 4	Oil Level Switch
A18	SEN_5V0_C	Sensor 5.0V C	-
A19	SEN_5V0_B	Sensor 5.0V B	Sensor 5VB
A20	LIN	LIN Bus	Alternator/Battery Current Sensor
A21	RS232_RX	RS232 Receive	-
A22	RS232_TX	RS232 Transmit	-
A23	DIG1	Digital Input 1	-
A24	BAT_NEG	Battery Negative	Ground
A25	BAT_NEG	Battery Negative	Ground
A26	SEN_0V_C	Sensor 0V C	-
A27	SEN_0V_C	Sensor 0V C	-
A28	CAN3_HI	CAN Bus 3 High	OEM CAN 1
A29	CAN3_LO	CAN Bus 3 Low	OEM CAN 1
A30	CAN2_HI	CAN Bus 2 High	OEM CAN 2
A31	CAN2_LO	CAN Bus 2 Low	OEM CAN 2
A32	BAT_NEG	Battery Negative	Ground
A33	SEN_0V_B	Sensor 0V B	Sensor 0VB
A34	SEN_0V_A	Sensor 0V A	-

▶ M142 PINOUT

M142 Connector B – 26 Way

B1	HB9	Half Bridge Output 9	Boost Servo
B2	HB10	Half Bridge Output 10	Boost Servo
B3	UDIG8	Universal Digital Input 8	Brake Switch 2
B4	UDIG9	Universal Digital Input 9	-
B5	UDIG10	Universal Digital Input 10	-
B6	UDIG11	Universal Digital Input 11	-
B7	UDIG12	Universal Digital Input 12	-
B8	INJ_LS5	Low Side Injector 5	Lift Fuel Pump Control
B9	INJ_LS3	Low Side Injector 3	-
B10	AV9	Analogue Voltage Input 9	DI Rail Pressure 2
B11	AV10	Analogue Voltage Input 10	Boost Servo Position
B12	AV11	Analogue Voltage Input 11	-
B13	BAT_POS	Battery Positive	Battery Positive
B14	INJ_LS6	Low Side Injector 6	Accessory Cut
B15	INJ_LS4	Low Side Injector 4	-
B16	AV12	Analogue Voltage Input 12	-
B17	AV13	Analogue Voltage Input 13	-
B18	AV14	Analogue Voltage Input 14	-
B19	BAT_POS	Battery Positive	Battery Positive
B20	HB7	Half Bridge Output 7	HPFP
B21	HB8	Half Bridge Output 8	HPFP
B22	INJ_D2A_NEG	Direct Injector 2A-	Injector 2
B23	INJ_D2A_POS	Direct Injector 2A+	Injector 2
B24	INJ_D2B_POS	Direct Injector 2B+	-
B25	INJ_D2B_NEG	Direct Injector 2B-	-
B26	SEN_5V_A	Sensor 5.0V A	-

▶ M142 PINOUT

M142 Connector C – 34 Way

C1	HB2	Half Bridge Output 2	Throttle Servo
C2	SEN_5V_A	Sensor 5.0V A	Sensor 5.0V A
C3	IGN1	Low Side Ignition 1	Coil 1
C4	IGN2	Low Side Ignition 2	Coil 2
C5	IGN3	Low Side Ignition 3	Coil 3
C6	IGN4	Low Side Ignition 4	Coil 4
C7	IGN5	Low Side Ignition 5	Radiator Fan1 & Fan2
C8	IGN6	Low Side Ignition 6	Bypass Valve
C9	SEN_5V_B	Sensor 5.0V B	-
C10	NEG1	Battery Negative	Ground
C11	NEG2	Battery Negative	Ground
C12	IGN7	Low Side Ignition 7	Tachometer
C13	IGN8	Low Side Ignition 8	Starter Relay
C14	AV1	Analogue Voltage Input 1	Throttle Pedal Main
C15	AV2	Analogue Voltage Input 2	Throttle Pedal Tracking
C16	AV3	Analogue Voltage Input 3	Manifold Pressure
C17	AV4	Analogue Voltage Input 4	DI Rail Pressure 1
C18	HB1	Half Bridge Output 1	Throttle Servo
C19	INJ_D3A_POS	Direct Injector 3A+	Injector 3
C20	INJ_D3B_POS	Direct Injector 3B+	
C21	INJ_D4A_POS	Direct Injector 4A+	Injector 4
C22	INJ_D4B_POS	Direct Injector 4B+	-
C23	INJ_LS1	Low Side Injector 1	-
C24	INJ_LS2	Low Side Injector 2	-
C25	AV5	Analogue Voltage Input 5	-
C26	BAT_POS	Battery Positive	Battery Positive
C27	INJ_D3A_NEG	Direct Injector 3A-	Injector 3
C28	INJ_D3B_NEG	Direct Injector 3B-	Clutch Switch
C29	INJ_D4A_NEG	Direct Injector 4A-	Injector 4
C30	INJ_D4B_NEG	Direct Injector 4B-	Start Request Switch
C31	HB3	Half Bridge Output 3	Right Intake VTC
C32	HB4	Half Bridge Output 4	Left Intake VTC
C33	HB5	Half Bridge Output 5	Right Exhaust VTC
C34	HB6	Half Bridge Output 6	Left Exhaust VTC

▶ M142 PINOUT

M142 Connector D – 26 Way

D1	UDIG1	Universal Digital Input 1	Crankshaft Position
D2	UDIG2	Universal Digital Input 2	Right Intake Camshaft Position
D3	AT1	Analogue Temperature Input 1	Inlet Air Temperature
D4	AT2	Analogue Temperature Input 2	Coolant Temperature
D5	AT3	Analogue Temperature Input 3	Airbox Air Temperature
D6	AT4	Analogue Temperature Input 4	Oil Temperature
D7	KNOCK1	Knock Input 1	Right Knock Sensor
D8	UDIG3	Universal Digital Input 3	Left Intake Camshaft Position
D9	UDIG4	Universal Digital Input 4	Right Exhaust Camshaft Position
D10	UDIG5	Universal Digital Input 5	Left Exhaust Camshaft Position
D11	UDIG6	Universal Digital Input 6	-
D12	BAT_BAK	Battery Backup	-
D13	KNOCK2	Knock Input 2	Left Knock Sensor
D14	UDIG7	Universal Digital Input 7	Brake Switch
D15	SEN_0V_A	Sensor 0V A	Sensor 0V A
D16	SEN_0V_B	Sensor 0V B	Sensor 0V B
D17	CAN_HI	CAN Bus 1 High	LTC CAN
D18	CAN_LO	CAN Bus 1 Low	LTC CAN
D19	SEN_6V3	Sensor 6.3V	-
D20	AV6	Analogue Voltage Input 6	Throttle Servo Position Main
D21	AV7	Analogue Voltage Input 7	Throttle Servo Position Tracking
D22	AV8	Analogue Voltage Input 8	-
D23	ETH_TX+	Ethernet Transmit+	WHITE/ORANGE
D24	ETH_TX-	Ethernet Transmit-	ORANGE
D25	ETH_RX+	Ethernet Receive+	WHITE/GREEN
D26	ETH_RX-	Ethernet Receive-	GREEN

▶ M142 PINOUT

M142 DTM-4S (Lambda To CAN)

Pin	Function
1	Ground
2	CAN1 Low
3	CAN1 High
4	Switched 12v Power

M142 DTM-4S (2CH Sw)

| Pin	Function
1	Ground
2	Main Relay
3	Ignition Switch
4	N/C

MoTeC USA 2022 Subaru WRX Installation Manual

➢ **INSTALLATION**

0. Parts included in the kit:

1. As shown, bolt the ECU to the bracket using the supplied 5mm bolts, washers, and nuts. The order should be as follows: place a washer on the bolt, feed the bolt through the top of the ECU as shown, place another washer on the bolt once it has passed through the ECU and bracket, and tighten the nut to the bolt. It needs to be tight but do not over-tighten.

2. Using the provided M3 bolts, nuts, and washers, installed the LTC on the opposite side of the bracket as shown. The direction the fasteners are facing is critical to clear the fuse box. The same layout for installing the bolt, washer, and nut should be followed from Step 1.
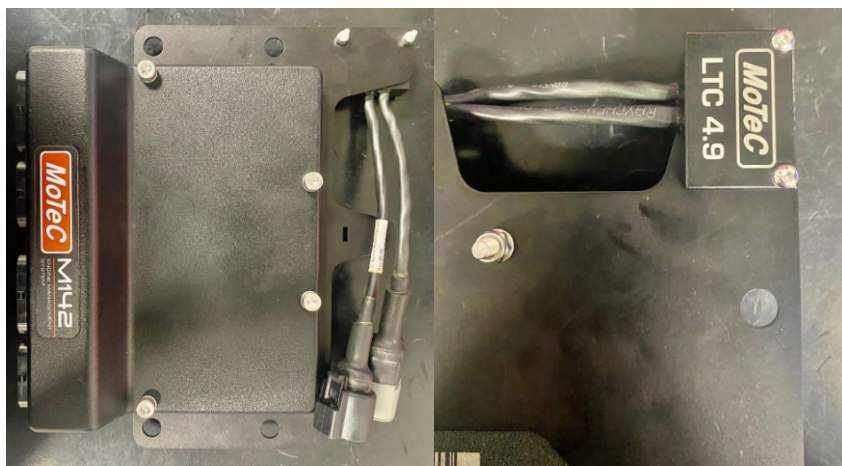

Left Picture: Front side of the bracket   *Right Picture*: Back side of the bracket

3. Install the rubber grommets into the bracket as shown, circled in red (the orientation does not matter here).
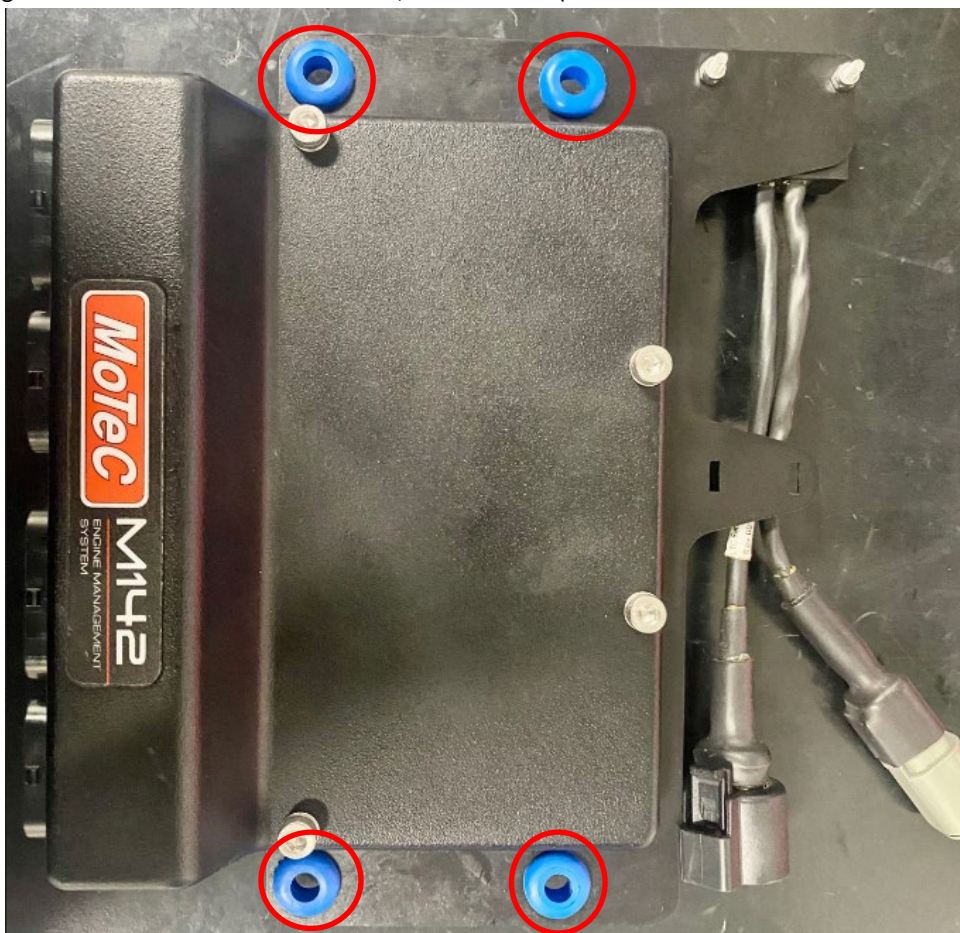
4. Using the provided zip tie, connect the harness to the ECU and secure it to the bracket as shown. Feed the zip tie through the below zip tie tab before laying the wiring harness over the bracket.
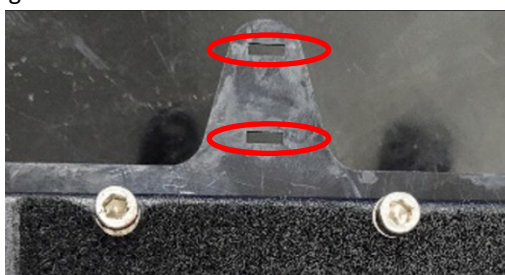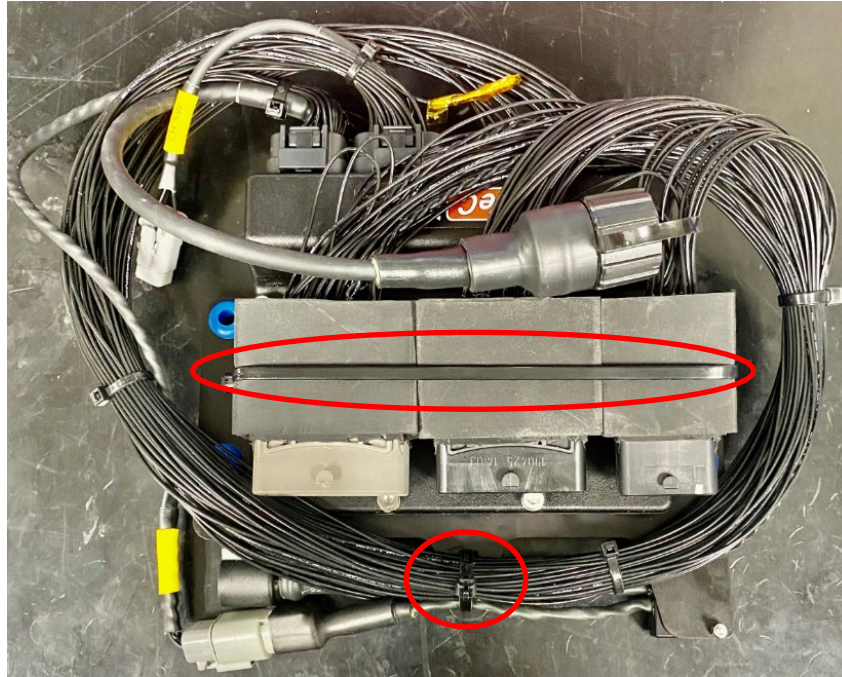
Note: Secondary zip ties can be used to hold the harness in place for ease of installation (the allocated spot for the ECU/Harness is very tight). R*oute the wires as shown above for ease of installation. A large zip tie was used to hold the harness connectors in place for installation, but it was unnecessary.*

5.   Disconnect the negative battery cable from the battery located in the driver-side front of the engine bay (This is held in place by a 10mm bolt).

6.   Unplug the factory ECU. The factory harness is plugged into the factory ECU via a plastic connector. The plastic connector has a lock that must be released for easy release. A picture of the connector and lock is circled in red (the lock can be pushed in by applying force horizontally, *not* vertically, in reference to the connector parallel to the ground.)

7.   Remove the four mounting bolts. Two are shown in the picture below, and two more are located directly below the first two on the other side of the ECU. Once these nuts are removed, the ECU can be removed from the car.
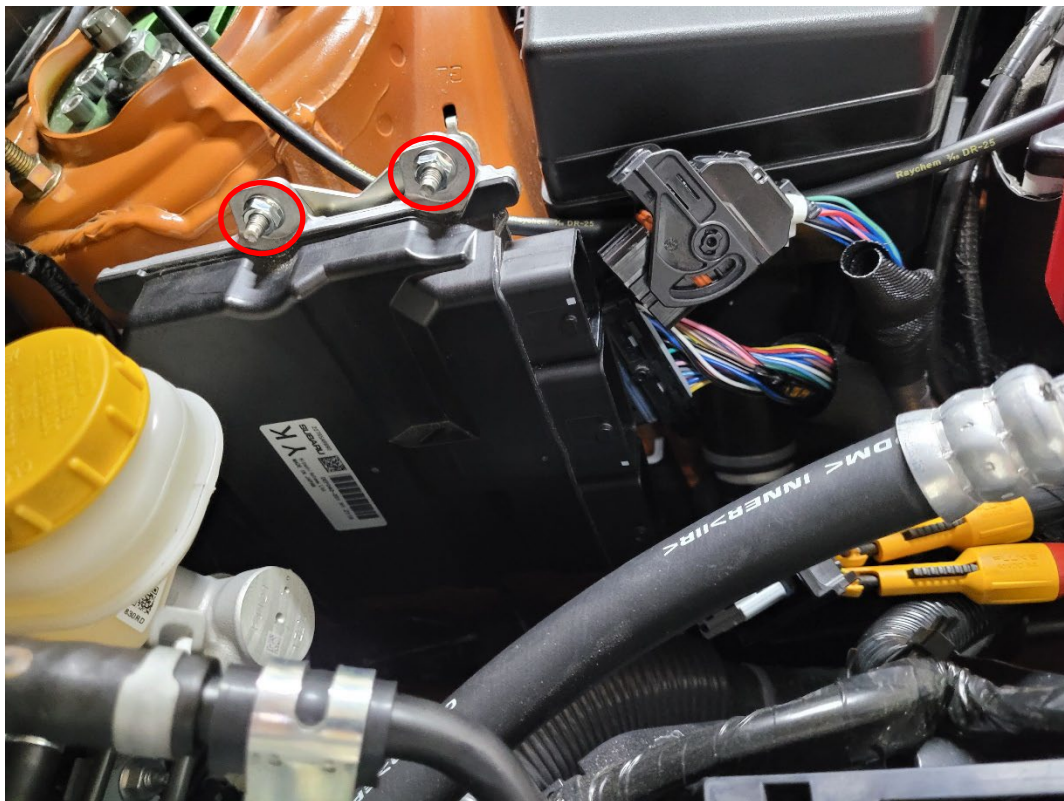
8. Slide the ECU assembly down between the brake booster and the ECU mount onto the four studs. This is a snug fit, so it may be helpful to line up the rear (firewall side) lower stud first. Do not push on the brake booster while installing the mount!

9. Install the four provided washers and lock nuts. Tighten until the nylon lock of the nut engages. DO NOT OVER-TIGHTEN THESE NUTS.

10. Plug in the harness and add wire ties where needed to secure the harness away from any hazards. The plastic connectors are directional and will only go on one way, DO NOT force the connector onto the harness. This can cause pins on the adapter harness side to bend/break. Gently push the connector onto the adapter harness. If the connectors do not mate flush, switch the orientation, and try again. Pull the locking level down once the connectors are flush, and the connectors will lock into place (as shown in red).

11. The final installation of the harness and mount can be seen below.

12. Reconnect the negative battery terminal to the battery.