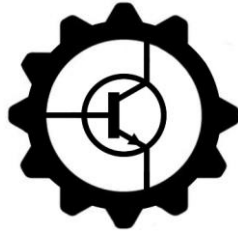


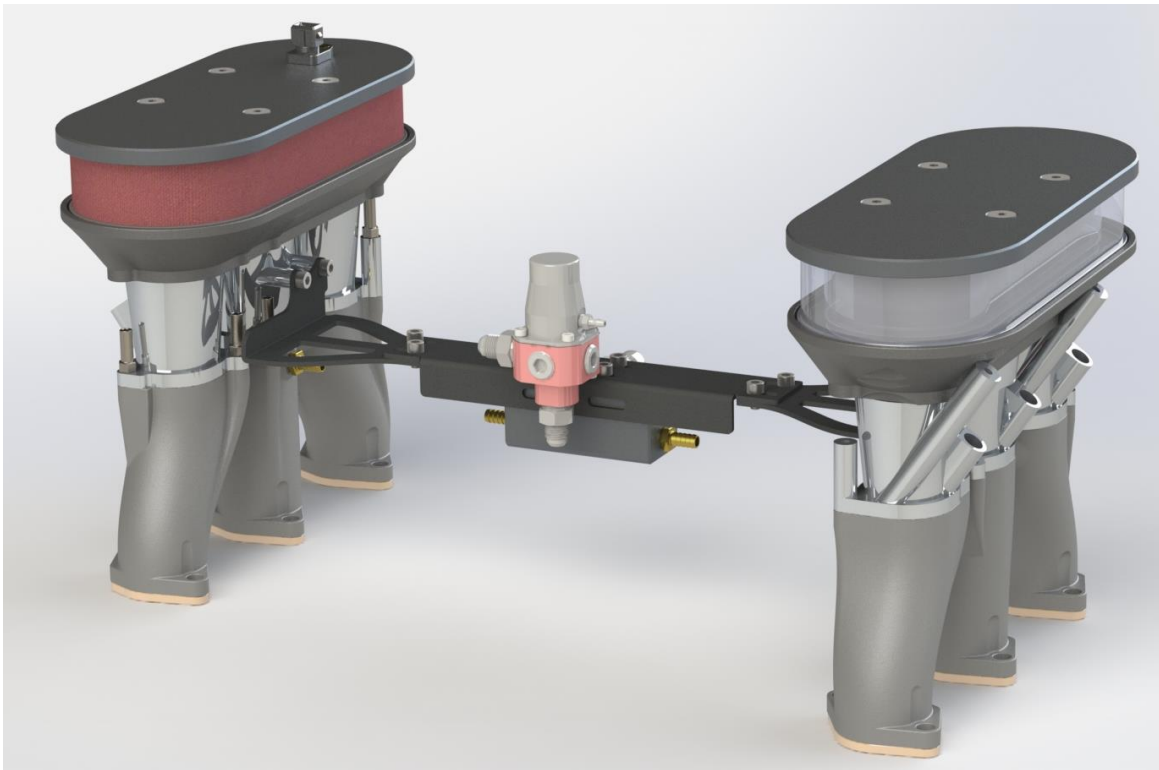
Porsche 911 eITB & EFi-kit

By

Tmbryhn engineering



Revision: a



Disclaimer of liability
Introduction & Technical details
Bill Of Materials
Schematics
Assembly guide



DISCLAIMER OF LIABILITY:

All parts are sold for OFF ROAD and ground-vehicle use only, or vehicles that pre-date any governmental emissions control requirements. Aftermarket EFI systems are not for use on pollution controlled vehicles. Your country may have specific rules restricting tampering with your vehicle's emissions system and violation of such guidelines or rules can lead to substantial fines or penalties. Race parts are inherently dangerous and may cause injury or damage if improperly modified or altered before use. The publisher of this manual will not be held liable for and will not pay you for any injuries or damage caused by misuse, modification, redesign, or alternation of any of our products. The publisher of this manual will not be held in any way responsible for any incidental or consequential damages including direct or indirect labor, towing, lodging, repair, medical, or legal expense in any way attributable to the use of any item in our catalog or to the delay or inconvenience caused by the necessity of replacing or repairing any such item.

Introduction

This ITB kit has been designed with daily drivers in mind with emphasis on drivability, reliability and esthetics. It features 47mm or 50mm electronically controlled individual throttle bodies (eITB), a robust coil-on-plug ignition system and a crank trigger + simplified camshaft trigger setup.

The most significant advantage are the eITBs controlled and kept in perfect sync by the ECU.

The solution eliminates the need for periodical inspection, adjustments and synchronization of throttle linkages, springs and joints etc. Another benefit the eITB system offers over a conventional mechanical implementation is the customizable non-linear relationship between the electronic pedal input and the throttle blade angle at any given RPM point. Tuned properly, this feature can provide a significant improvement in drivability and the engines street manners – especially in low speed/RPM conditions eg. during city driving.

All kits are delivered in a complete plug & play-fashion and includes the following items:

- ECU: TMB ECU Pro-8
- Plug & Play wiring harness with labels
- Intakes, ITBs, air filter housings, threaded velocity stacks and air filters
- Fuel injectors, rails, pre-assembled vacuum & fuel manifold with hoses + quick connectors
- Coil-on-plug ignition coils / Wasted spark coil packs (multi-spark engines)
- Bolt-on crank & camshaft trigger kit
- Sensors: Cylinder head temp, intake air temp, fuel pressure and knock
- Electronic accelerator pedal & bolt-on mounting hardware



Technical details

ECU: The TMB ECU Pro-8 is an in-house developed controller based on the open source software platform RusEFI. It supports a substantial set of features, and is a cost-effective match for controlling all of the functions required without the need for any external modules. Some of the features used in this implementation includes but are not limited to:

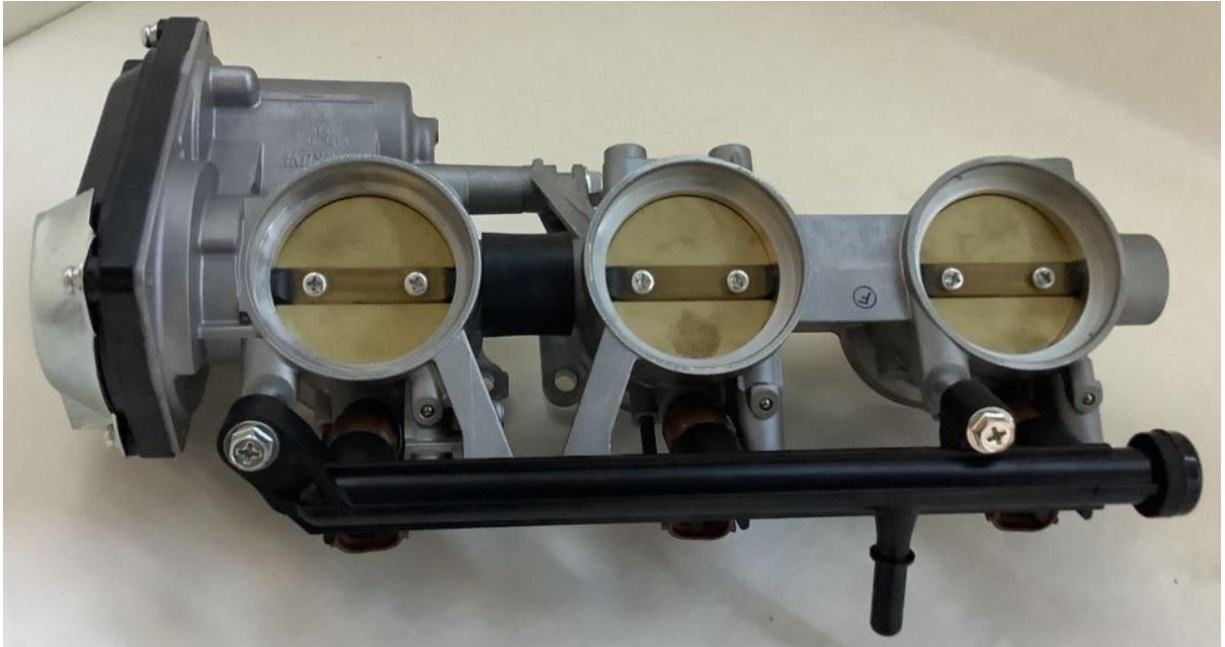
- 6x Passive coil channels using the internal ignition amplifiers
- Knock sensor input & digital signal processing: Real-time per-cylinder knock analysis and control
- 2x ETB outputs controlling the two electronic throttle bodies
- Dedicated VR- and digital sensor inputs for the crank- and camshaft sensors
- Analog voltage and temp inputs for various sensors
- Integrated MAP and Barometric sensors
- On-board SD card: Automatic offline data logging



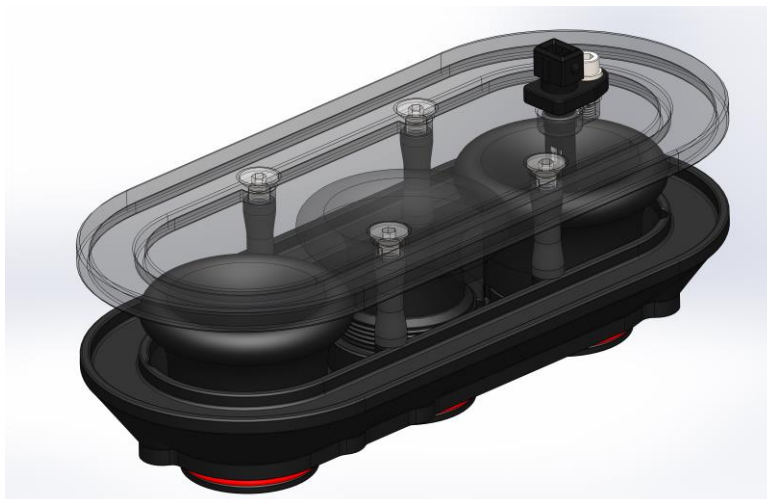
Intakes, thermal spacers and seals: The intakes are 3D printed from PA-CF, sealed with a clear polyurethane coating and are designed to fit the specially selected eITBs to a wide variety of Flat-6 air-cooled Porsche engines. Every set of intakes are manufactured to order and match ported in CAD to the given engine model or specific intake port shape. The thermal spacers are CNC machined from PEEK, incorporates Viton O-rings on both sides for a perfect seal, and protects the intakes from the potential extreme cylinder head temperature due to the air-cooled nature of the Flat-6 engine.



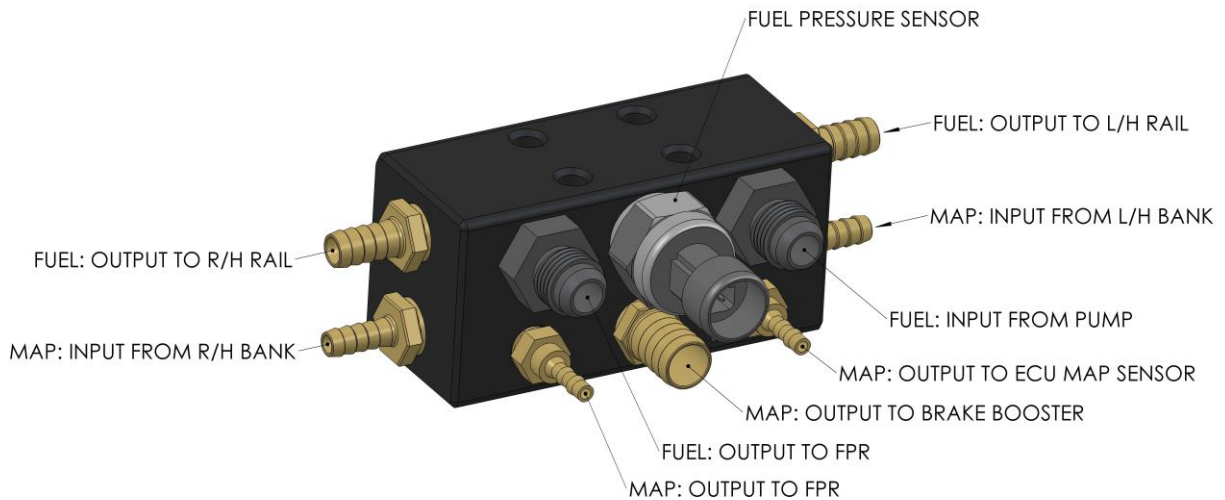
Throttle bodies & Injectors: The OEM Mikuni throttle bodies are manufactured to the highest standard of quality and can be provided in 47mm or 50mm sizes. The assembly contains the fuel injectors and a common fuel rail equipped with a quick-disconnect fitting. Injectors of different sizes can be fitted according to specific application. The Drive-By-Wire e-throttle solution is implemented by conventional means and incorporates an electric motor, gearbox and dual TPS outputs (Throttle Position Sensor) in order to meet the industry standard for safety.



Air filter housing & Velocity stacks: 3D printed from PET-CF, the air filter assembly houses a washable mesh filter and threaded velocity stacks that can be detached and swapped with stacks of different lengths in a matter of seconds. The solution allows for a simple way to approach resonance tuning on the dyno. Attachment to the throttle body are done by the means of extended nuts and bolts, and Viton O-rings forms radial seals against the throttle body. The left side air filter lid contains the IAT sensor (Intake Air Temperature) that lets the ECU adjust fuel quantity based on variable charge air density.



Vacuum & Fuel manifold: A compact and tidy means to collect all vacuum, power brake and fuel lines to a central point hidden underneath the cross-beam connecting the two intake stacks. The manifold comes pre-assembled with fittings, hoses and fuel pressure sensor but can also be set up with various types of 1/4 or 1/8 NPT based fittings to accommodate personal preferences.

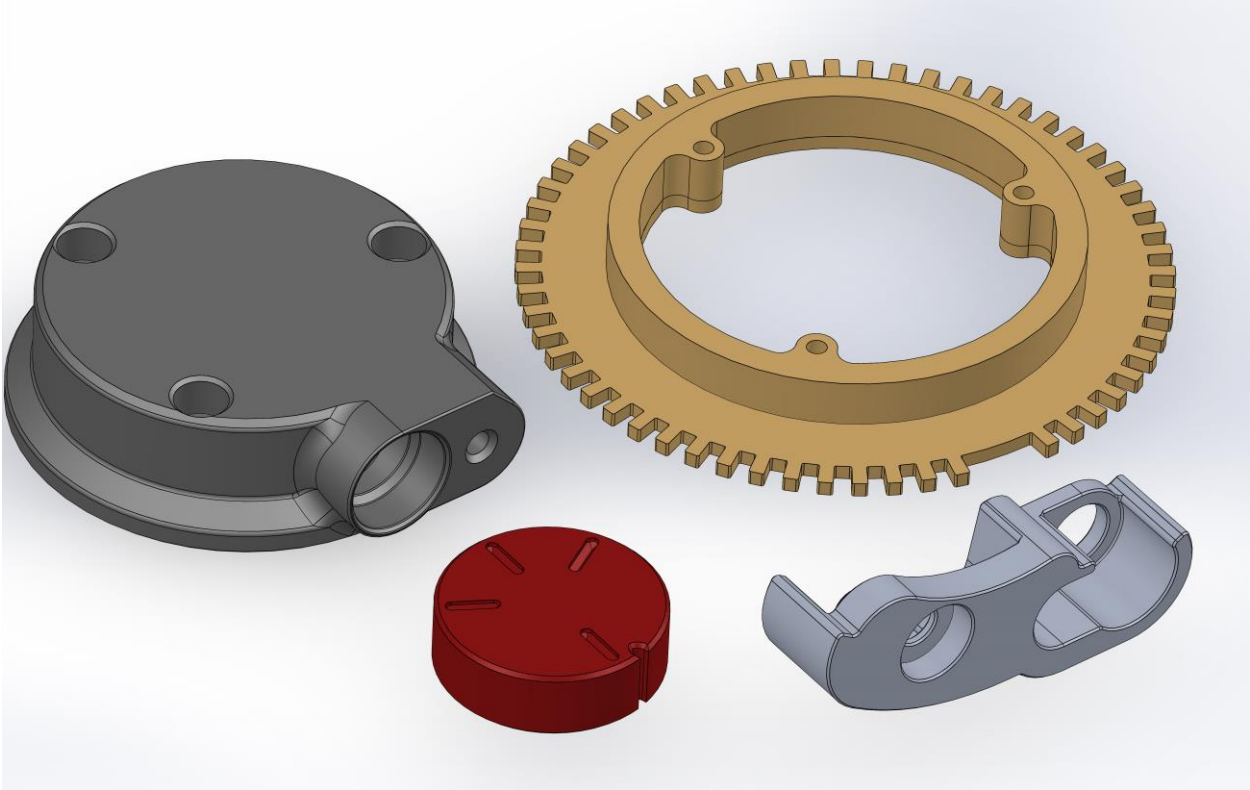
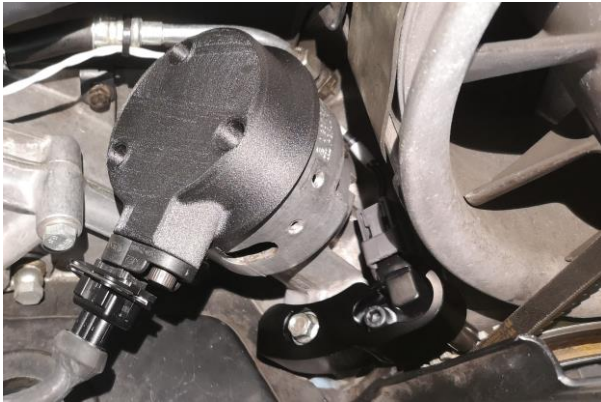


Coil-on-plug ignition system: By having individual coils directly situated on top of each spark plug, potential weak links in the ignition system such as spark plug leads, distributor cap and rotor are eliminated. This vastly increases engine reliability over time, and the direct-spark method ensures headroom for optimal dwell/charge time for the coils and subsequent consistent spark energy all the way up to redline. The pre-loaded ECU base-map is configured to provide multi-spark in the lower RPM range which improves engine starting and idling quality – especially during cold and rich conditions.



Crank & Camshaft position: The ECU keeps track of crankshaft rotational speed and position through the crankshaft position sensor that reads the 60-2 trigger wheel bolted to the OEM crank pulley. The crankshaft position sensor bracket attaches directly to the distributor retaining bolt without any modifications and locks the distributor in place meanwhile acting as a solid anchor point for the sensor bracket ensuring a reliable trigger wheel reading.

In order to run direct spark and fully sequential fuel delivery, a camshaft position input is required and realized by replacing the distributor cap and rotor with a sensor disc and cap that clips onto the OEM distributor. The camshaft position sensor input lets the ECU keep track of which cylinder is in the compression stroke throughout a full 4-stroke cycle of 720 crank°.



Sensors:

WBO2/Lambda (Wideband Oxygen): Reads the O2 content in the exhaust stream as a proxy for air/fuel ratio relative to $\lambda = 1$. Mounted down-stream of the exhaust collector. Used during calibration/tuning and closed loop fuel correction.



CHT (Cylinder Head Temperature): Used during warm-up for idle and cold start enrichment and for engine protection. 1/8-27 NPT threads and mounted in the left center cylinder head (cylinder #2).



IAT (Intake Air Temperature): Reads the intake charge temperature as a proxy for air density. Allows the ECU to perform adjustments to the injected fuel quantity as air density changes. Mounted in the left air filter cover.



Fuel pressure: Monitors static pressure in the fuel manifold & rails. Allows the ECU to perform corrections to the injected fuel quantity due to minor pressure fluctuations. Also useful for diagnostics.



Knock sensor: Provides the ECU with a sonic input of the engines operational characteristic. The sound is filtered and processed in real-time by the DSP (digital signal processing) algorithm on a per-cylinder basis. Any sound level with a pre-determined frequency above set threshold will be interpreted as ignition knock, and the ECU can dynamically adjust the ignition timing for the specific cylinder until the knock disappears.



Accelerator pedal: The OEM floor mounted accelerator is attached to the original accelerator fixture location by means of a bolt-on adapter bracket, and incorporates two analog sensors in accordance with automotive safety standards for e-throttle systems.



Bill Of Materials

Sorted by the order of appearance throughout the assembly procedure.

Assembly
Sub-assembly / individual parts
Zip-lock bag or Box
Non-packaged

Step 2 - Sensors		
Name	Qty.	Part#
Sensor, CHT 1/8NPT	1	SEN_CHT_1/8NPT
Knock sensor kit		KIT_KNOCK_911
- Sensor, Knock	1	SEN_KNOCK
- Knock sensor adapter bushing	1	
- Bolt, M8x50 Allen	1	
- Washer, M8, Steel	1	
Electronic pedal kit (pre-assembled)		
- Pedal, BMW	1	SEN_BMWPPS
- Adapter, E-pedal Porsche 911	1	
- Bolt, M6x12	1	
Step 3 - Wiring harness installation		
Name	Qty.	Part#
TMB ECU Pro-8	1	ECU_TMBPRO-8
Plug&Play wiring harness	1	WIR_PNPPORSCHE911_EITB
Harness installation split ring, 51-54mm	1	
Cable clamp, 10mm	2	
Cable clamp, 6mm	3	
Bolt, M6x16 Allen	5	
Washer, M6, Steel	5	
Connector, 3-way male GP inc. seals & pins	1	
Zip tie, small	5	
Zip tie, medium	5	
Step 4 - Crank trigger & Cam position sensor		
Name	Qty.	Part#
Cam sensor kit (pre-assembled)		KIT_CAMSENSOR_911
- Sensor cap	1	
- Sensor disc	1	
- Cam sensor	1	
- Bolt, M6x20 Allen	1	
- Washer, M6, Steel	1	
Crank trigger kit (pre-assembled)		KIT_60-2_911
- Cranktrigger_Part_A_trigger disc-60-2	1	
- Cranktrigger_Part_B_trigger disc-60-2	1	
- Crank sensor mount	1	
- Crank sensor	1	
- Bolt, M6x20 Allen	1	
- Washer, M6, Steel	2	
- Nut, M6 nyloc, black low-profile	1	
- Nut, M8, 10mm hex	1	
- Washer, M8, Steel	1	
Zip tie, small	4	

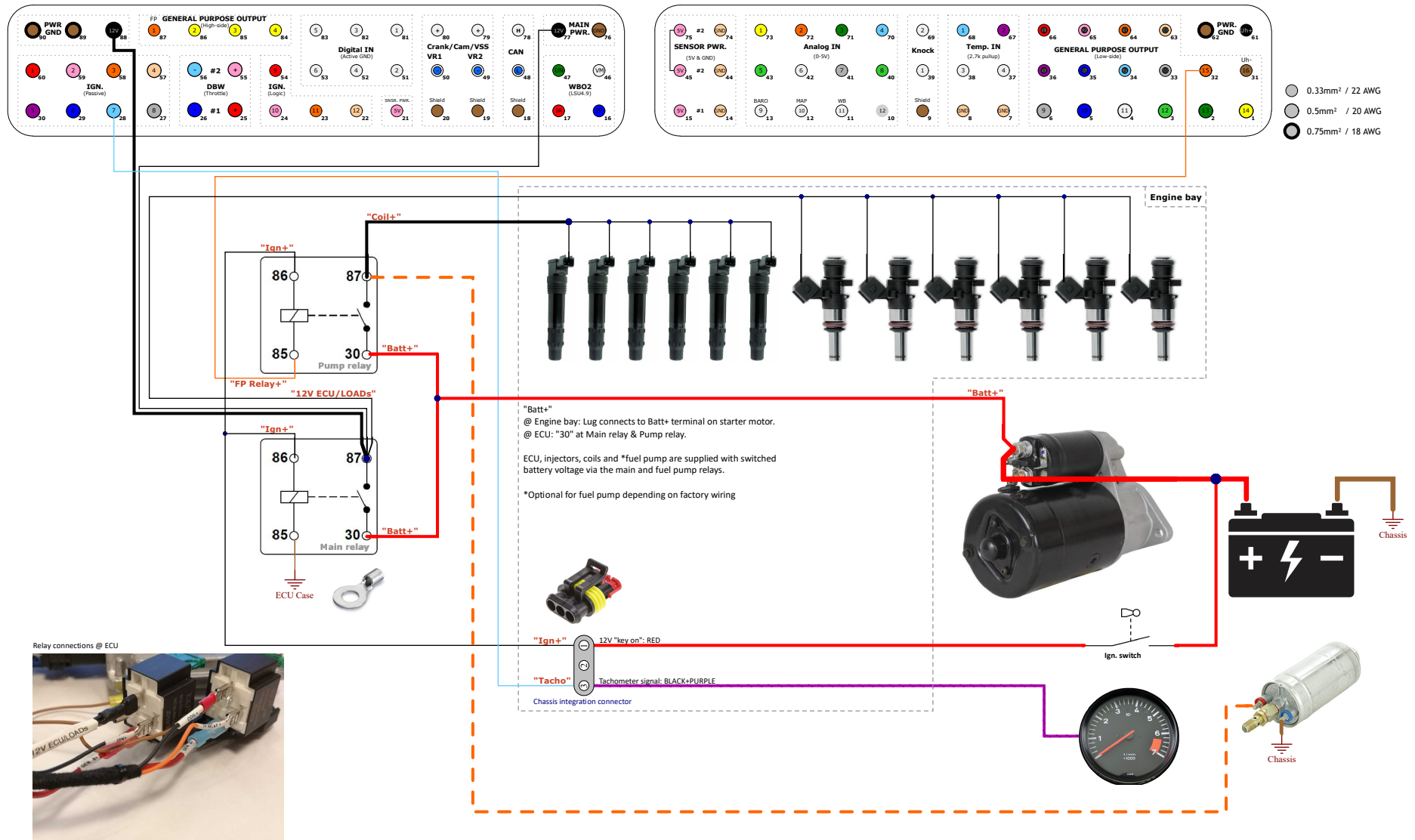
Step 5 – Intakes, TBs, fuel/vacuum, & air filter housings		
Name	Qty.	Part#
Thermal spacer kit		
- Spacer, thermal Porsche 911, 34/39mm	6	
- O-ring, viton 46mm int-Ø (pre-installed)	12	
- Bushing, thermal, M8 PEEK	12	
Intake manifold kit (pre-assembled)		
- Part A (cyl# 3 & 4)	2	
- Part B (cyl# 2 & 5)	2	
- Part C (cyl# 1 & 6)	2	
- Stud, M6x40 (pre-installed)	10	
- Stud, M6x80 (pre-installed)	2	
- Fitting, 1/4 NPT, 6mm BRASS, MALE (pre-installed)	2	
Cross pipe kit		
- Cross pipe	4	
- O-ring, viton 12mm int Ø (pre-installed)	8	
Throttle body, electronic - 3x 47mm	2	TB_47T
- Nut, M6 extended (25.5mm)	12	
- Washer, M6, Steel	12	
Intake mounting kit		
- Flange plate, 911 eITB	12	
- Washer, M8, Steel	12	
- Washer, M8, PEEK	12	
- Loctite 243, 10ml	1	
Crossbeam kit		KIT_CROSSBEAM_911EITB
- Center bracket, TB mount, 911 eITB	2	
- Center bracket, cross beam, 911 eITB	1	
- Bolt, M6x16 Allen	8	
- Washer, M6, Steel	12	
- Nut, M6 nyloc, black low-profile	4	
Fuel & Vacuum manifold kit (pre-assembled)		KIT_MNFLD_FUEL&VAC_911EITB
- Vacuum & fuel manifold	1	
- Pressure sensor, 100 PSI	1	SEN_PRESS100
- Fitting, 1/4 NPT, 4mm BRASS, MALE	2	HW_NIPPLE_BRBD_1/4NPT_4MM
- Fitting, 1/4 NPT, 6mm BRASS, MALE	2	HW_NIPPLE_BRBD_1/4NPT_6MM
- Fitting, 1/4 NPT, 8mm BRASS, MALE	2	HW_NIPPLE_BRBD_1/4NPT_8MM
- Fitting, 1/4 NPT, 12mm ALLOY, MALE	1	
- Fitting, 1/4 NPT, AN-6, MALE	2	
- Fitting, AN-6 FEMALE - Push-On MALE, 90deg	3	
- Hose, R9 7.9mm, xxx mm (feed - manifold)	1	
- Hose, R9 7.9mm, yyy mm (manifold - regulator)	1	
- Hose, R9 7.9mm, zzz mm (manifold - rails)	2	
- Hose, R9 5.6mm, aaaa mm (manifold - intake vacuum)	2	
- Quick connector, 7.89 ID6 FEMALE 90deg	2	
- Hose clamp, Ø12,8–15,3 mm "153" (fuel hoses)	7	
- Bolt, M6x50 Allen	4	
- Washer, M6, Steel	4	
Fuel pressure regulator kit (pre-assembled)		
- Fuel pressure regulator	1	
- Fuel pressure regulator bracket	1	
- ORB - AN-6 (pre-installed)	2	
- Fitting, AN-6 FEMALE - Push-On MALE, 90deg (return)	1	

- Hose, R9 7.9mm, xxx mm (fuel, return line)	1	
- Hose clamp, Ø12,8–15,3 mm "153" (fuel return fitting)	1	
Air filter housing kit		
- Velocity stack, threaded, 50mm (pre-assembled)	6	
- Stud, M8x30 (pre-installed)	8	
- Air filter housing	2	
- Air filter lid	2	
- Air filter	2	
- Filter standoff	8	
- Bolt, M6x16 Allen	2	
- Bolt, M6x50 Allen	10	
- Bolt, countersunk, M8x20 Allen	8	
IAT sensor kit		
- Sensor IAT, VAG	1	SEN_VAGIAT
- Bolt, M6x20 Allen	1	
- Washer, M6, Nylon black	1	

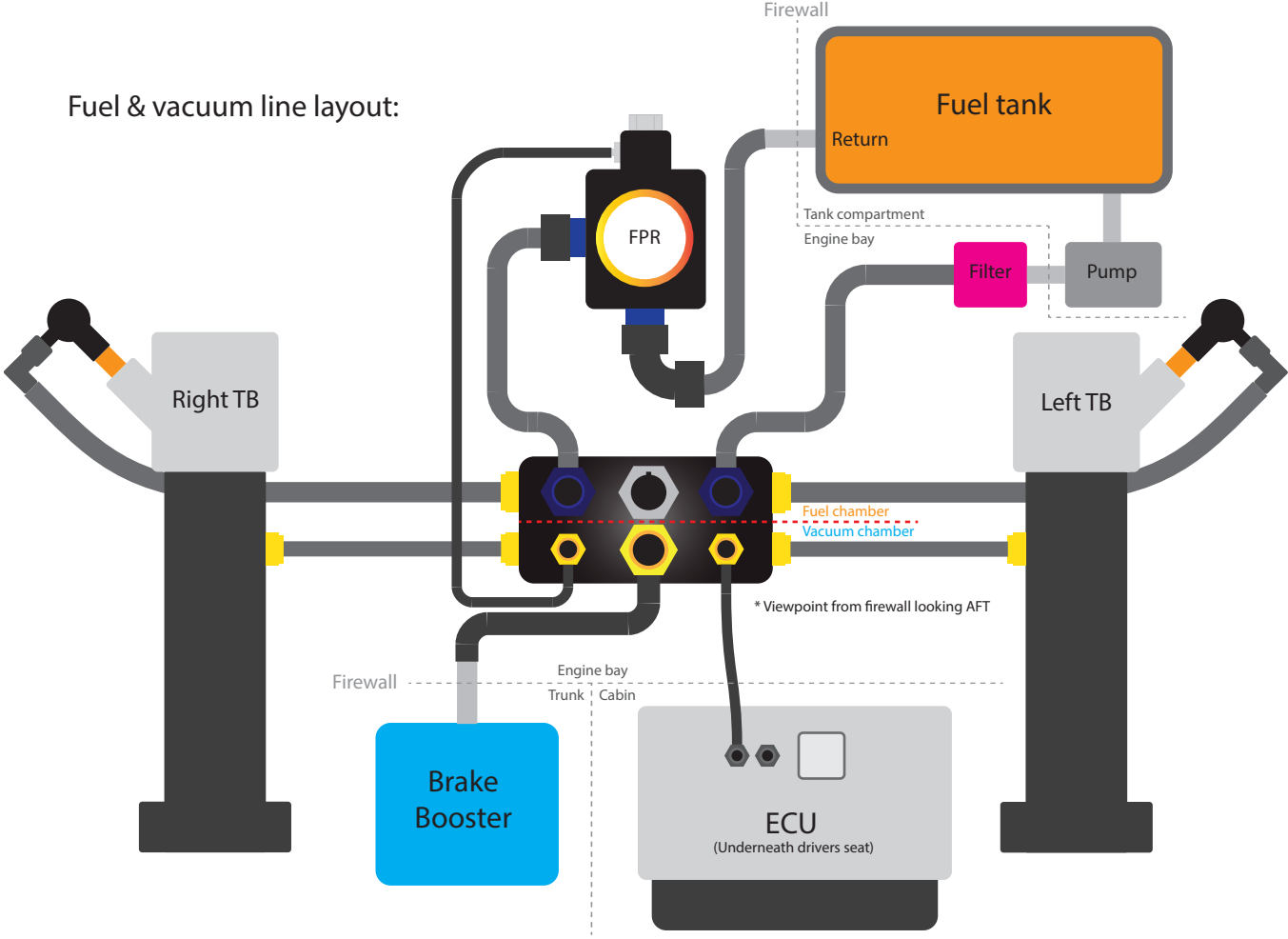
	Name	Connector Pin #	Size (AWG)	Description	Function
INPUT					
Power	12V, ECU	77	20	ECU Power & GND	Main power relay "87"
	GND, ECU	76	20		Chassis/Batt GND
	GND, PWR	62, 89, 90	16		Chassis/Batt GND
CAN	CANH	78	TP	CAN-bus Shielded twisted pair	
	CANL	48	TP		
	Shield	18	22		
Sensor	GND	7, 8, 14, 44, 74	22	Sensor GND return	PPS=74 - TPS=14 - FuelPress = 44
	5V	21, 15, 45, 75	22	Sensor 5V power	PPS=75 - TPS=15 - FuelPress = 45
	Analog Temp 1	68	22	Internal 2.7k pullup	CLT/CHT
	Analog Temp 2	67	22		IAT
	Analog Temp 3	38	22		
	Analog Temp 4	37	22		
	Analog Volt 1	73	22	0-5V	PPS-A
	Analog Volt 2	72	22		PPS-B
	Analog Volt 3	71	22		TPS #1A
	Analog Volt 4	70	22		TPS #1B
	Analog Volt 5	43	22		Fuel press
	Analog Volt 6	42	22		
	Analog Volt 7	41	22		TPS #2A
	Analog Volt 8	40	22		TPS #2B
Analog Volt 9	13	22	Int. 4 bar #1		MAP
Analog Volt 10	12	22	Int. 4 bar #2		BARO
WBO2	IP	16	22	Heater GND (N-FET) Heater 12V	LSU-Pin 1
	VM	46	22		LSU-Pin 2
	Uh-	31	22		LSU-Pin 3
	Uh+	61	22		LSU-Pin 4
	IA	17	22		LSU-Pin 5
	UN	47	22		LSU-Pin 6
Crank/Cam/VSS	VR 1+	80	TP	VR sensor Shielded twisted pair	Crank position sensor signal+
	VR 1-	50	TP		Crank position sensor signal-
	VR 2+	79	TP		
	VR 2-	49	TP		
	Shield	20, 19	22		Crank position sensor shield
Digital	Digital 1	81	22	Active GND	Cam position sensor signal
	Digital 2	51	22		
	Digital 3	82	22		
	Digital 4	52	22		
	Digital 5	83	22		
	Digital 6	53	22		
Knock	Channel 1	39	22	Sensor "+" input	Knock sensor signal
	Channel 2	69	22	Shield / Sensor "-" input	Knock sensor GND + Shield
	Shield	9	22		

OUTPUT					
General Purpose	Low-side 1	66	22 Striped	Active GND (N-FET)	Inj #1
	Low-side 2	65	22 Striped		Inj #2
	Low-side 3	64	22 Striped		Inj #3
	Low-side 4	63	22 Striped		Inj #4
	Low-side 5	36	22 Striped		Inj #5
	Low-side 6	35	22 Striped		Inj #6
	Low-side 7	34	22 Striped		
	Low-side 8	33	22 Striped		
	Low-side 9	6	20		
	Low-side 10	5	20		
	Low-side 11	4	20		
	Low-side 12	3	20		
	Low-side 13	2	20		
	Low-side 14	1	20		
	Low-side 15	32	20		Fuel pump relay GND ("85")
	Low-side 16	31	22		Lambda Heater "-", LSU-Pin 3
	High-side 1	87	22	Active 12V (P-FET)	
	High-side 2	86	22		
	High-side 3	85	22		
	High-side 4	84	22		
Ignition	Ign 1	60	20	Active GND (IGBT)	Coil, passive #1
	Ign 2	59	20		Coil, passive #2
	Ign 3	58	20		Coil, passive #3
	Ign 4	57	20		Coil, passive #4
	Ign 5	30	22		Coil, passive #5
	Ign 6	29	22		Coil, passive #6
	Ign 7	28	22	5V logic	Tacho output signal (12V pullup)
	Ign 8	27	22		
	Ign 9	54	22		
	Ign 10	24	22		
	Ign 11	23	22		
	Ign 12	22	22		
DBW	12V, DBW	88	18	H-bridge	Main power relay "87"
	#1 M+	27	20		TB1_M+
	#1 M-	28	20		TB1_M-
	#2 M+	57	20		TB2_M+
#2 M-	58	20	TB2_M-		

Plug & Play schematic: Power & Signal distribution integration



Fuel & vacuum line layout:



Assembly guide

Step 1 - Isolate the battery:

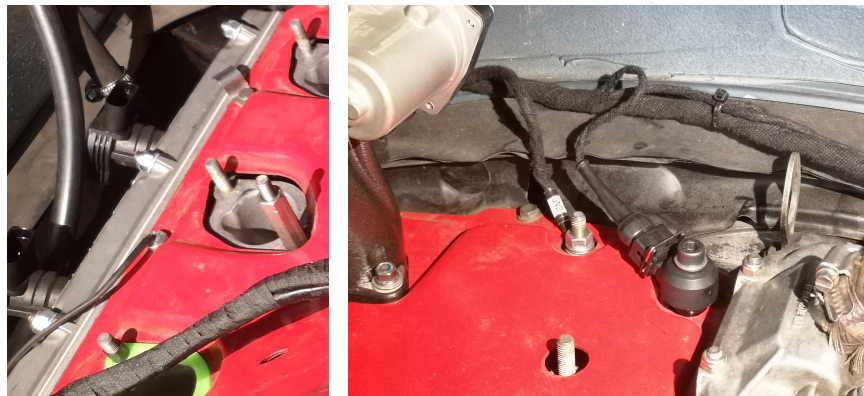
Remove the negative terminal from the battery and make sure it's tucked away securely.



Step 2 - Sensors:

CHT – Cylinder Head Temp.: Prepare the left middle fan shroud mounting hole at cylinder head #2 for the CHT sensor. Use a 9mm drill bit to open up the hole before threading with a 1/8-27 NPT tap. Test fit the CHT sensor regularly while tapping to make sure you don't cut the conical threads too deep.

Knock sensor: Remove the M8 stud and install the knock sensor together with the black knock sensor spacer sandwiched between the sensor body and the crank case. Use the provided washer and M8x50 Allen bolt.



Pedal: Remove the stock pedal and attach the adapter bracket for the pedal to the pedal anchor points. Fasten the electronic pedal using the provided M6x12 Allen bolt.

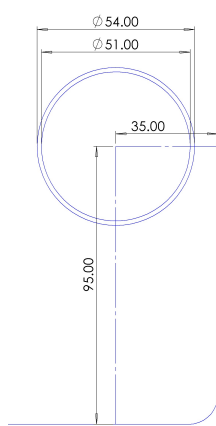


Step 3 – Wiring harness installation:

Use a 51-54mm hole saw to drill a hole in the firewall according to the illustrations below.

WARNING: Take care not to damage the fuel lines running behind the firewall!

Insert the provided split-ring to make sure the harness is protected during installation.



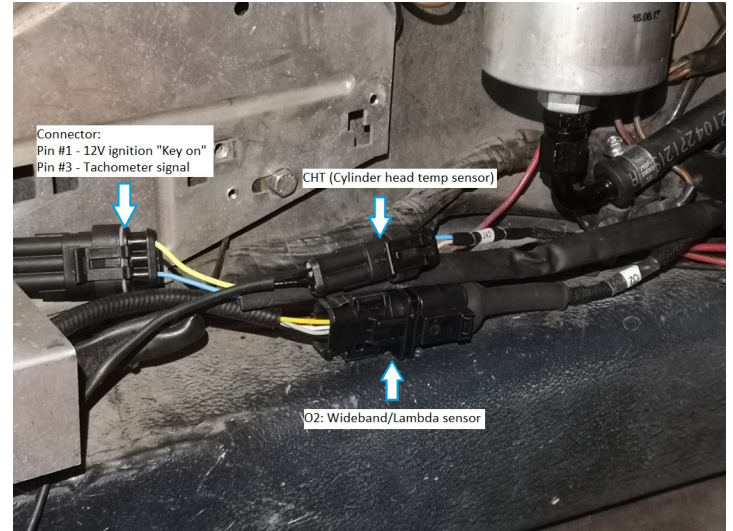
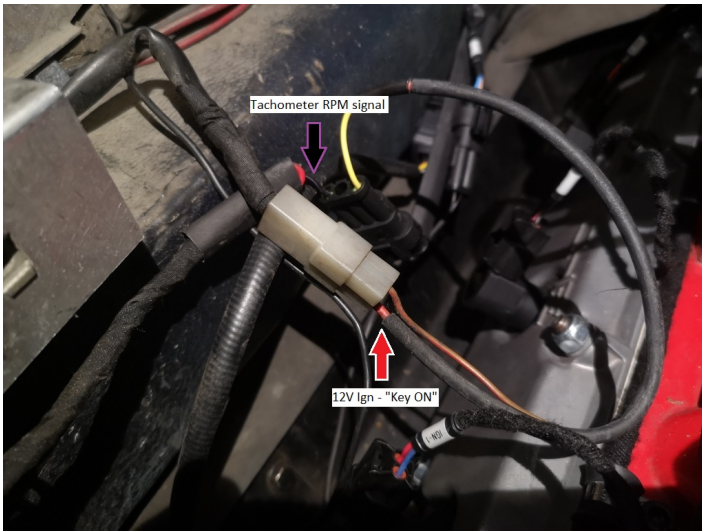
Install the ignition coils and route the two branches of the harness that contains the “Ign” connectors alongside their respective cylinder banks as shown. Use the provided clamps, washers and M6x16 Allen bolts; 10mm clamp closest to the firewall, and 6mm clamps on the remaining fastening points.



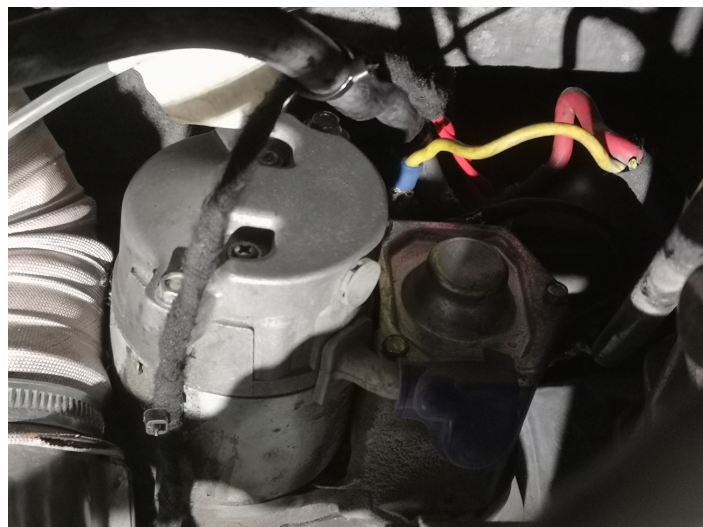
The installation requires integration with the OEM harness that runs along the left side of the engine bay:

12V Ign "Key on" (RED wire) & Tachometer signal (BLACK+PURPLE wire).

Remove the protective cover for the relay box and terminate the two wires to the provided 3-way MALE connector and connect the CHT, WBO2 and the 3-way MALE connectors as shown. Zip-tie loose wires and replace the protective cover.

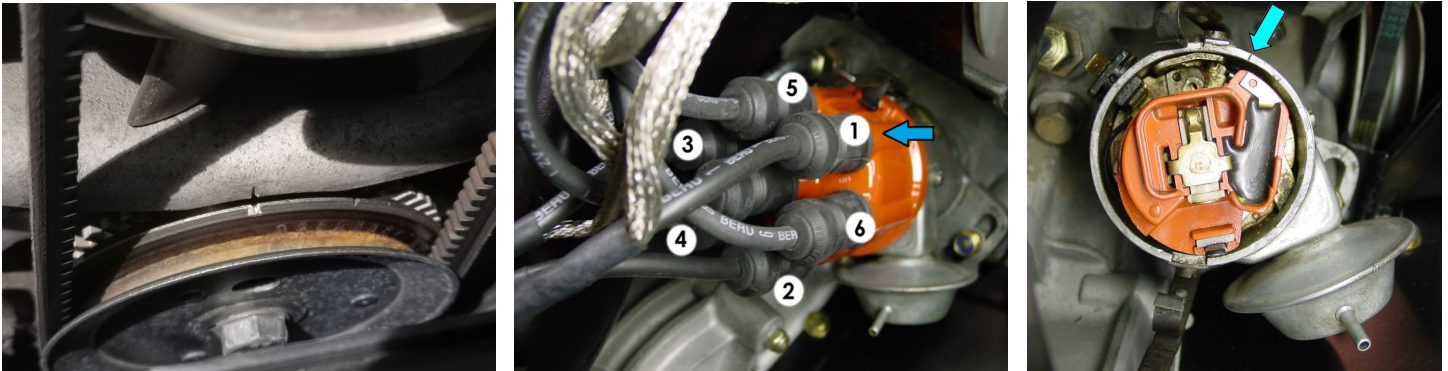


The **RED** main power supply wire for the engine management system labeled "**Batt+**" should be routed through the tiny hole in the middle of the tin facing the lower part of the bulkhead right below the rubber seal lip. The wire should exit right above the starter. Connect the "**Batt+**" wire to the large M8 screw terminal at the top of the starter (Battery positive) and secure the wire with zip ties along the starter body.

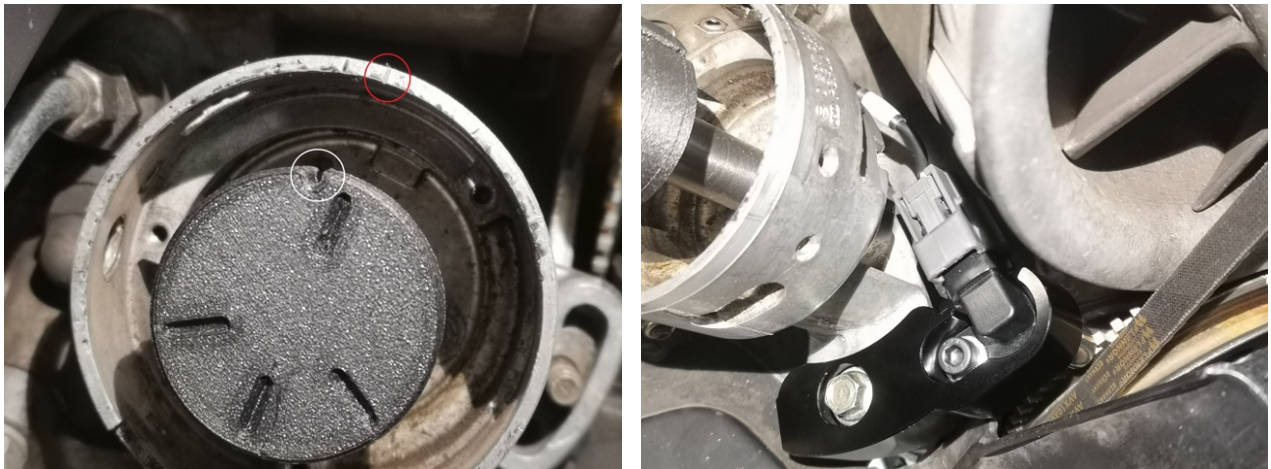


Step 4 – Crank trigger & Cam position sensor

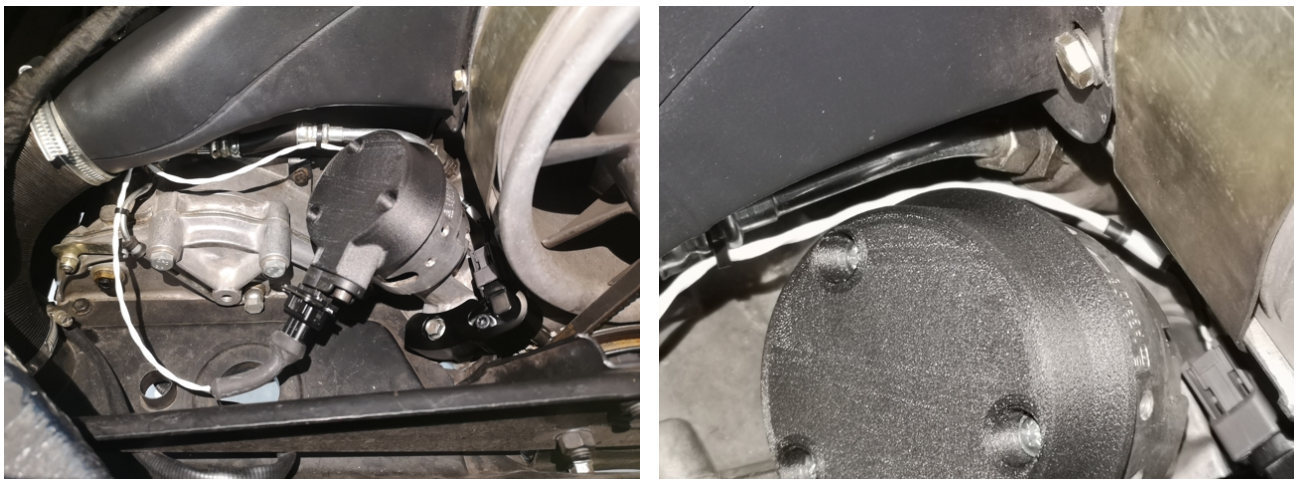
Use a 19mm spanner and turn the crankshaft to the TDC position. Note which terminal on the distributor cap the cylinder #1 spark plug wire is connected to before removing the cap. If the rotor points 180° away from the #1 terminal, turn the crankshaft another 360° until the rotor aligns with the #1 terminal. The crankshaft is now in the TDC position, and the camshafts and distributor are on the cyl#1 compression phase.



Replace the rotor with the cam position disc. The notch in the disc should point towards the distributor notch or the position for the cyl#1 spark plug wire. Exact alignment is not required and some deviation is to be expected. Mount the crank sensor bracket using the M8 10mm hex nut and washer. **TIP: Connect the sensor before mounting the bracket.**



Attach the camshaft sensor cap and connect the cam position sensor.
Zip-tie the signal cables and make sure the cables are routed away from potential chafing points.



Step 5 – Intakes, TBs, fuel/vacuum, & air filter housings

Put the spacers in place and finger tighten the threaded bushings. The bushings act as thermal barriers between the bolts and intakes and ensures proper port alignment.



Proceed by fitting the cross pipes between the intakes. Apply a coat of silicone on the rubber O-rings to ease the mating process.



Proceed by stacking the TB on top of the intake row. Install washers and finger tighten the extended M6 nuts (loose fit).

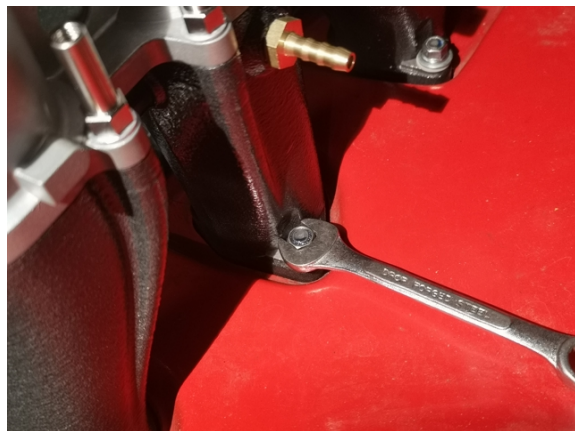
NOTE: Inverted nut on the inner cylinder #3 and #4 position.



Ensuring properly loose nuts, carefully wiggle the intake stack into place, making sure that all three runners are seated over the thermal spacers properly before tightening the extended nuts on the TB.



After the TB has been locked into place, the intake runners can be bolted to the cylinder head. Stack the steel flange, PEEK washer and steel washer as shown before applying a drop of Loctite 243 to the 10mm M8 nuts.



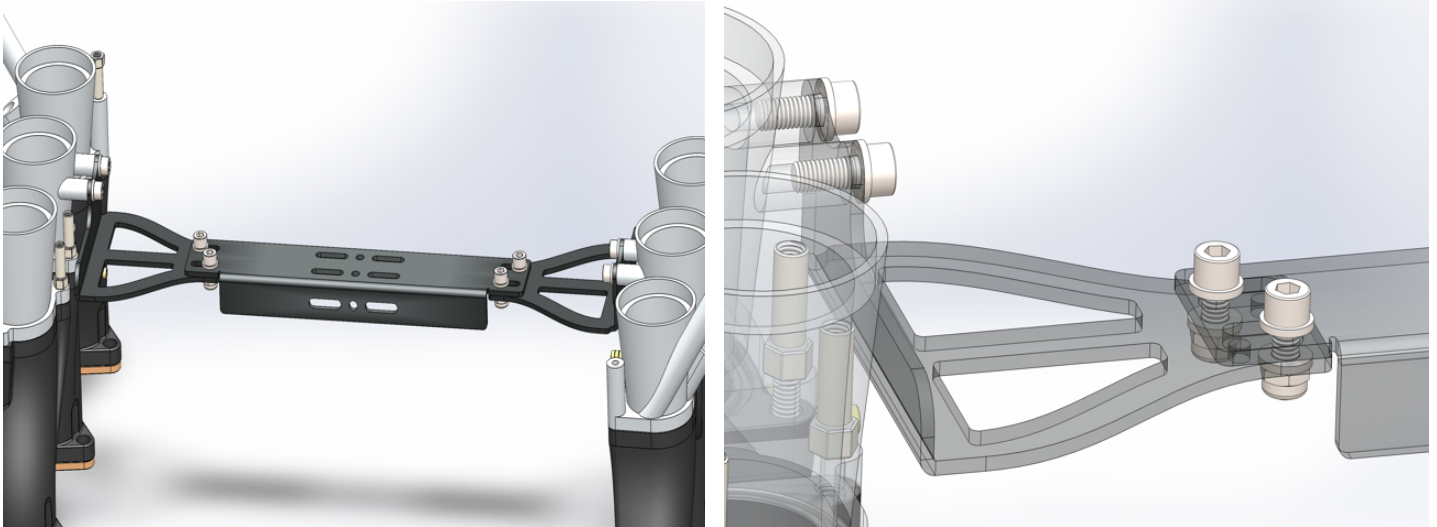
Now that the intakes and TBs are properly secured, you can proceed with the cross beam.

The cross beam secures the intake stack top-end and mitigates bending forces that can lead to cracks.

Attach and tighten the TB brackets on either side using washers and the provided M6x16 Allen bolts.

Place the mid-section on the TB brackets. Install washers and M6x16 Allen bolts and tightening the mid-section bolts.

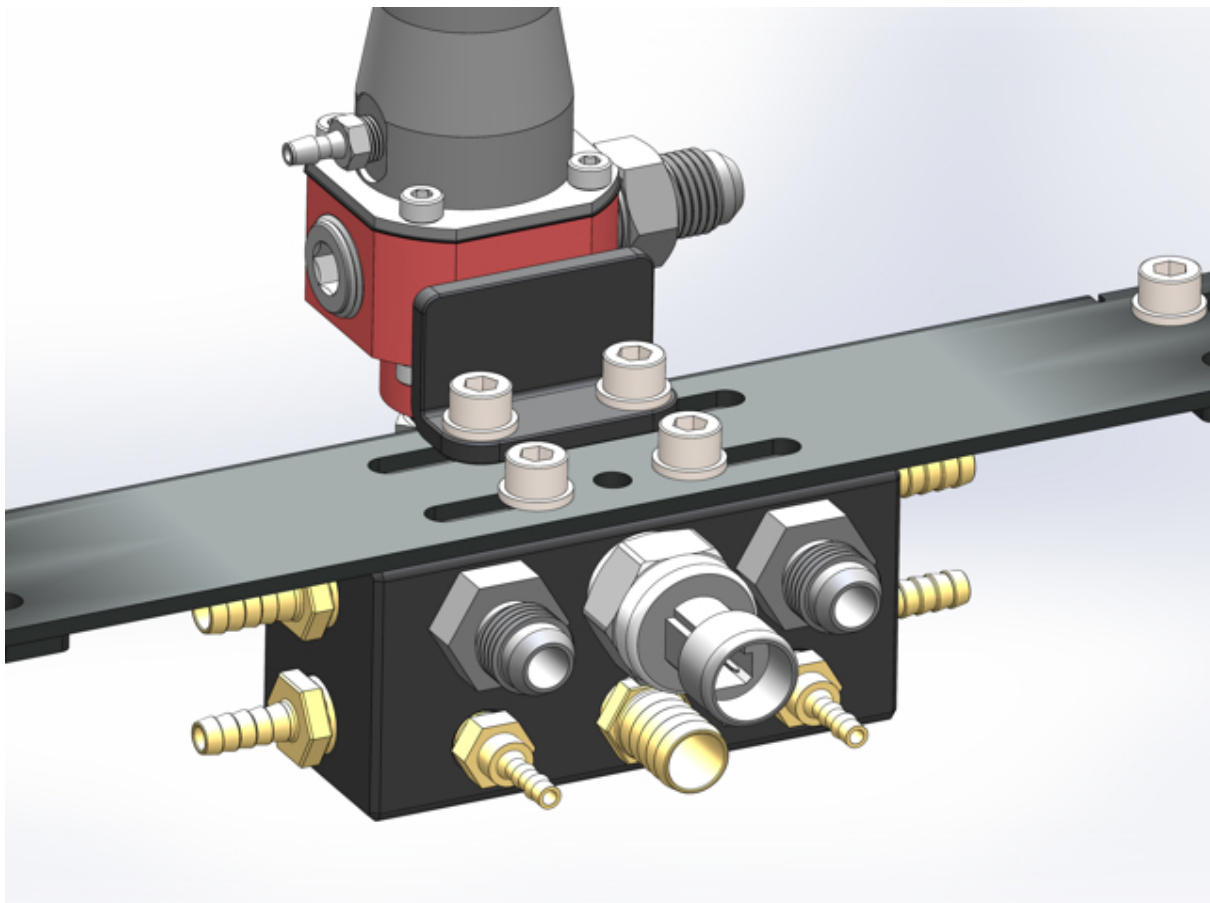
NOTE: Use washers and nuts on the underside for additional fastening of the mid-section per the illustration bellow.



Attach the Vacuum & Fuel manifold underneath the cross beam. Use washers and 2x of the provided M6x50 Allen bolts and attach them to the threaded manifold on the row closest to the firewall, leaving room for the regulator bracket.

ONLY connect the vacuum lines coming out the side of the manifold to each intake row.

Mount the FPR to the bracket and attach the bracket to the cross beam with washers and 2x M6x50 Allen bolts.



Loosen but do not remove the fuel rails on each side in preparation for routing the wiring harness.

NOTE: Take care not to lose the metal spacers between the TBs and the fuel rails when removing the bolts.

Route the two branches of the wiring harness that contains the fuel injector connectors in accordance with the illustration below before re-attaching and securing the fuel rails. Connect the connectors to its respective cylinder #.



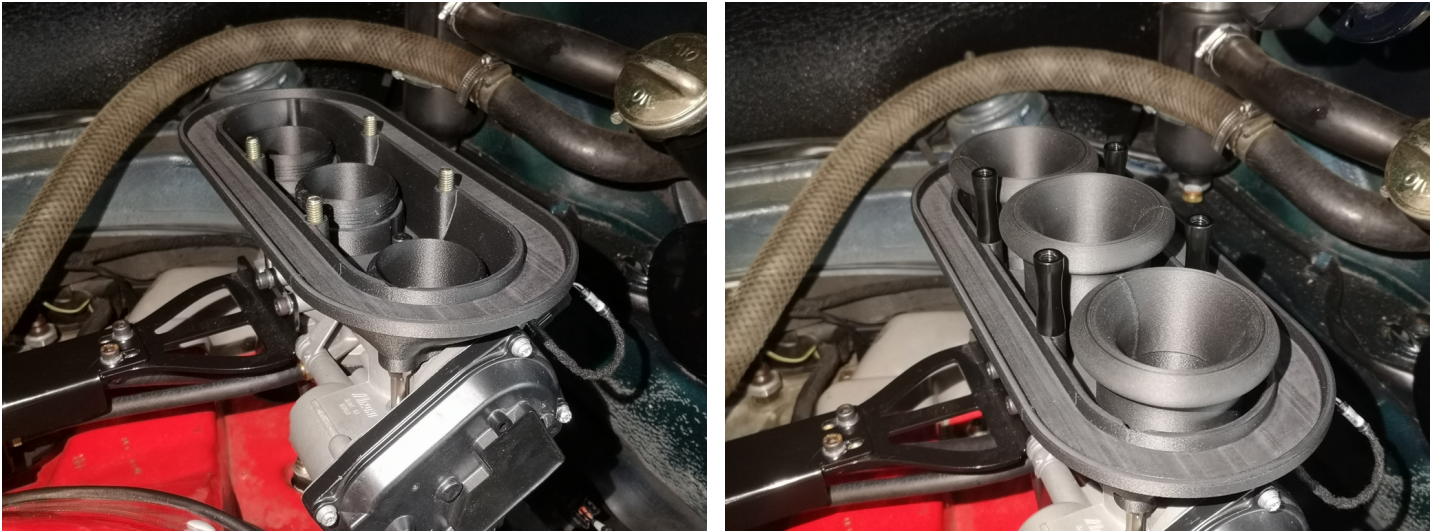
Proceed with mounting the air filter housings.



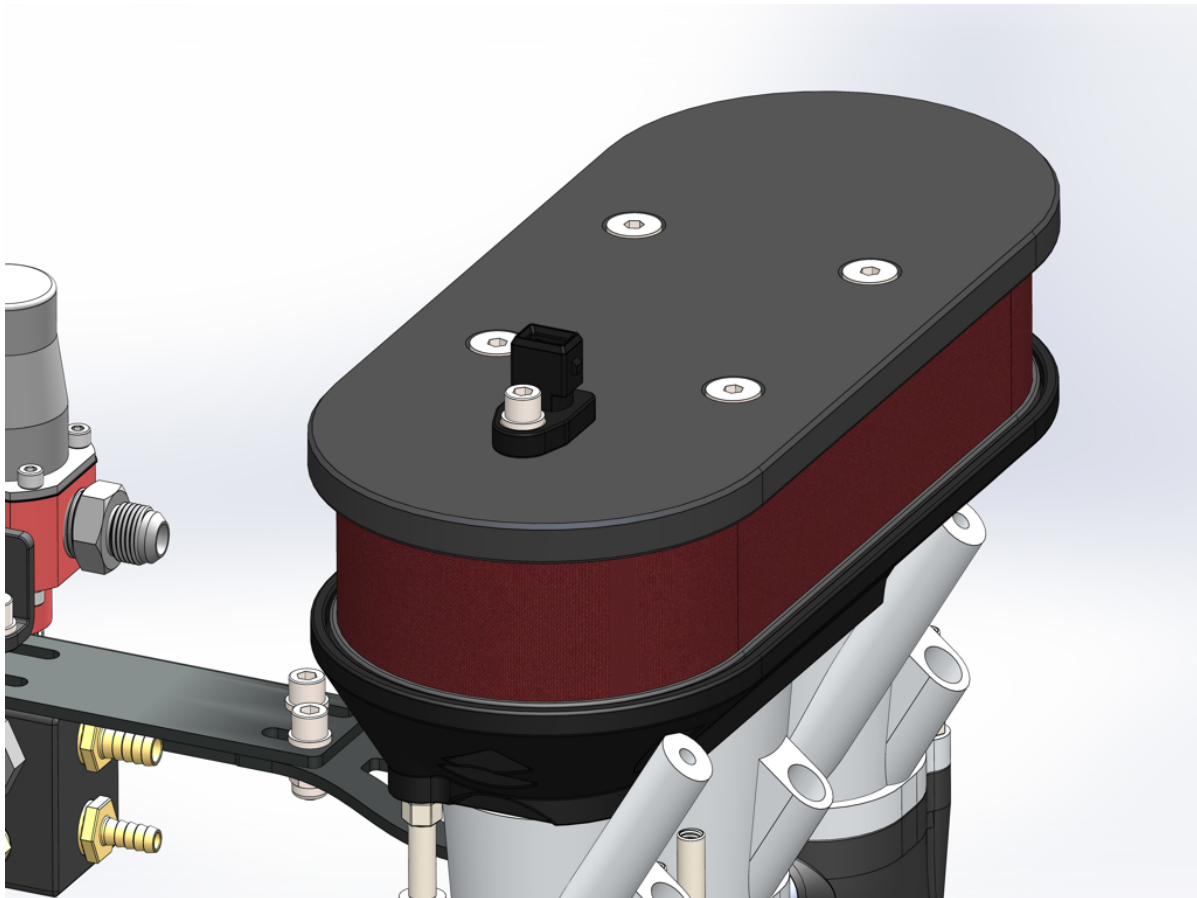
Coat the radial O-rings underneath the housing with silicone before placing the air filter housings on top of the TBs. Apply a drop of Loctite 243 and finger tighten all of the provided M6x16 and M6x50 Allen bolts.

NOTE: Do not use washers when attaching the air filter housings. Do not over tighten the bolts!

Carefully tighten the bolts before attaching the threaded velocity stacks and filter stand-offs.



Mount the air filter and attach the air filter lid with the provided M8x20 countersunk Allen bolts. Install the IAT (Intake air temp) sensor in the left air filter lid using the provided nylon washer and M6x20 Allen bolt.



Proceed with connecting vacuum and fuel in accordance with the 'Fuel & vacuum line layout' schematic.