Installing and setting up Haltech Sprint 500 on my daily driven Protege5.
By Alberto Perez
01/09/13   AP123 on Mazdas247.com

Part 1

Signal modifiers like the very popular Split Second are fine for bolt on mods but for many of us who have upgraded turbos, and forged internals it really limits what we can do when it comes to power. The amount you can modify the signal is limited and you will reach a point were all you are going to get is the check engine light. Stand alone system will allow you to change and control just about anything you can think of. You will have to choose an EMS according to your goals, number of accessories you want to run, and features you want the EMS to support. Things like anti lag, boost by gear, closed loop idle control. Such features may not be supported depending on ecu.

I decided to go with Haltech Sprint 500, the most simple ECU of the Platinum series. It does have its limitations but for most of us it should be plenty but again it all depends on what you have in mind. Its best to wire it in parallel to the stock PCM. That way you can still run all accessories like AC and speedometer.

Wiring can be done a few different ways. My installation process worked best for me and for my needs, this doesn't mean its the best option for you. I needed to install Haltech in a way it will be easily reversible to stock ecu. I wanted to minimize that amount of soldering. I wanted to be able to change wiring around without having to cut and re-solder.

Before we jump into the installation process:
With the correct preparation installing this system is very straight forward. but I am assuming you meet these requirements.
1. Basic knowledge of how electricity works.
2. Know how to test electrical circuits for continuity.
3. Able Read wiring diagrams and pin outs.
4. Some experience diagnosing, and repairing electrical faults in cars.
5. Own/have access to tools.
6. Own/have access to a laptop able to run the Haltech Software
7. Willing/able to take the time to learn and do your own additional research

Basic Shopping list:

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16 gauge wire, you will need quite a bit its a good idea to get
 a roll of black and a roll of red wire.

Coolant Temp Sensor, sealed GM threaded temperature sensor
 w/connector: DIYautotune

Intake Air Temp Sensor, Open GM threaded temperature sensor
 w/connector: DIYautotune

MAC Valve (used for electronic boost control).
35AaaaDDBA1BA
You will also need, tubing and fittings if not included.

Wide Band Oxygen sensor System for your choosing,
I got a PLX system.

Painless wiring relayed fuse block 3 circuits. # 70113

Deutsch DT connectors: wirecare
        3X 12pin plug
        5X 12pin receptacle
        Purchase Plugs and Receptacles as needed you'll need quite a few. Its up to you to get what you
        need.
        sealing plugs, purchase as needed

Deutsch connectors make life much easier, the amount of soldering you'll have to do is minimized.
They are also very high quality, sealed against the elements and heat resistant allow for safe to use in
the engine bay. They are easily assembled and disassembled. Its incredibly easy to go back and make
changes to the wiring. The connectors can purchased kits or separate components. It is not a bad idea to
get connectors in different colors. Color coding the wiring makes it easier if you need to work on the
wiring again. People also use pcm jumper wire harness which is a perfectly good option as well. But
felt like its too expensive and unfriendly to work with

Before starting make sure:
You have already gone through this a head of time a few times and other sources as well.
Have plenty of time to complete the installation. Installation is not something that should be done in a
rush. Wiring should take less then a day but you'll still need to set the Haltech up. Setting up is the
tricky part.
Have the following papers printed and in hand:
PCM Pin out
Haltech Quick start guide
Painless 70113 instructions and wiring diagram
Wideband instructions
626 Charging diagram, if installing 626 alternator
Wideband instructions

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Lets begin!

Disconnect the battery

Disassemble the PCM compartment. You may remove the PCM
if it makes it easier for you to work. Its not required.

Running wiring, installing sensor and accessories:
Before starting to cut into the original harness first run the wires and have everything in place. Well get to connecting things up at the very end. Remember its ok to cut wires long, you can always cut them down to size later.

Power/ground:
Find a place to install the the Painless fuse block assembly under your steering column.
Pull the the output wires (yellow,blue,purple) to the passenger footwell.
Cut 2 long wires that will be used for grounding. they will need to be long enough to reach from the passenger footwell to the drivers footwell and up to the battery.
Run the thick red/pink wire from the fuse block along with 2 grounding wires you just cut through the existing hole on the driver side, up through the wheel well and to the battery. Make sure the 2 grounds reach the negative terminal. Secure the wires to the original harness running along side.
To make it easy remove the wheel well liner.
Use your multimeter to find the wire that only gets power when you turn the key to ignition on your steering column. Tap the thin pink signal wire from the fuse block to it.
Tap one of the wires you will be using as a ground and attached the ground wire from the painless.
Pull the two grounds to the passenger foot well

Haltech ecu:
Find a place mount it. I put mine under the cup holder.
Cut the Haltech harness so it will reach the passenger footwell and there isn't much extra wire in the way. The harness is labeled so do not cut the wires so far back that you'll cut the labels off.

MAP Sensor:
If you are planning to using the internal 2.5bar(22psi of boost) MAP sensor you need to to run a hose from the intake manifold to the ECU, if you already have a hose for your boost gauge just T the existing hose.
To use an external MAP senor just find a place to mount it and run 3 wire into the engine bay from the passenger footwell. Connect the sensor refer to diagram/instructions included with your sensor.

EGR Valve:
Disconnect the valve.
Its recommend to make a block off plate and remove it all together.

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Temperature sensors.
Its necessary to use separate sensors for this. They are extremely important, the engine will not run right with out them.
You will need a 3/8 NTP tap

Run 4 wires into the engine bay two will need to be routed to the water inlet, the other two to where you decide to mount the air temperature sensor. I had enough wire left over from the original harness to reach. So I was able to use the color coded wires.
Assemble the connectors make sure you do not get the signal and ground sides mixed up. Refer to page 3-4 on the Quick start guide.

Air temperature sensor.
You have two options, tap the intake manifold, or tap/ weld on a bung on the intercooler pipe close to the throttle body. I went the intercooler pipe route.

Coolant temperature sensor.
Haltech needs this sensor to be tapped before the thermostat because it doubles as a fan switch.
Remove the water inlet and make the thread. Make sure you tap the thread so the sensor does not interfere with the thermostat or you will have to buy a new one try again. Its not a bad idea to weld on an aluminum bung for this.

MAC valve boost controller:
Find a place to mount the valve near the wastegate actuator.
For internally wastegated systems:
The valve has three ports they are numbered 1 to 3.
Take the hose from the turbo and connect it to port 3 on the mac valve.
Connect a hose on the mac valve from port 2 and connect the other end to the wastegate actuator
Port 1 is left open. Some times fittings are included with the valve and it will include a filter fitting to cover port 1.

Run two wires from the passenger footwell to the Mac valve. Again you can use left over wire from the Haltech harness.
 Ether join the wires for the mac valve directly or you can use a connecter. Connector is recommended if you ever need to remove or replace the valve. Wires can go ether way doesn't matter.

PLX wide band system:
Get an O2 sensor bung installed ahead of time. Its recommend to be place after the turbo.
I installed the gen2, they have different versions so refer to the instructions included with your kit.
Find a place to mount the Wide band module. Again I placed mine under the cup holder.
Assemble the plug according to the instruction included with the the wide band. If your kit calls for it install the resistor(included with the kit if needed) on the power and ground wires of the PLX module. Follow the instructions included its very simple.
Run the power, ground and signal sensor(thin gray wire) wires to the passenger footwell
Find a place to mount the AFR gauge. Run the and connect the wires for the gauge to the wideband module. These are the power/ground and signal wire that looks like an audio wire.
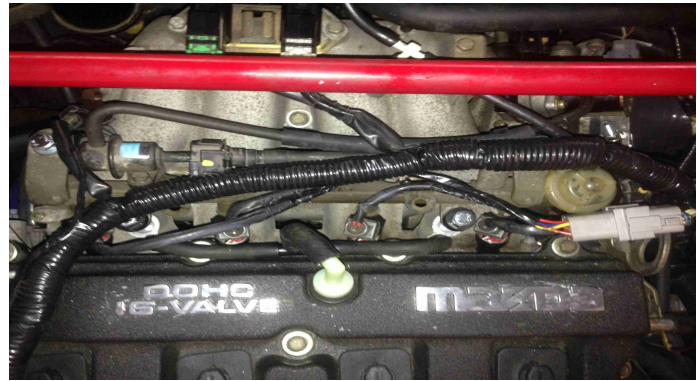Install the wideband oxygen sensor. Connect the Sensor wire to the oxygen sensor and run it into the cabin and connect it to the wideband module

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Fuel injector harness:

Chances are if you are using aftermarket fuel injectors and they wont be compatible with the stock plugs. You can ether buy plug and play clips but they're too expensive IMO. A simple and cheaper solution is to make interchangeable harnesses. Most of the aftermarket injectors use the same injector clips as OBD1 Hondas.
Cut the harness far back on the the donor car.
On you car cut back the insulation and tape on the wiring for the injector. Find a good place to cut the wires Keep the paired wires for each sensor together and organize.
Install the plug on engine side and install the receptacle on the injector side of the wiring.
Cut the harness from the donor car down to size and install the receptacle so the wires match up the same as the other harness.
Additional Items needed:
1x 8Pin Plug
2x 8Pin Receptacle

Aux Rev limiter:
Aux rev limiter (2 step) is used to help launch. it will let you place the accelerator to floor and it will hold the engine at a set RPM. Haltech provides the wires so you can wire different types of sensors and switches.
I wired it to a simple button switch:
Find a place to mount the button switch a location that is easy for you to reach and passengers cant.
Run the two wires from the switch to the passenger footwell.
Home(camshaft sensor) and Trigger(crankshaft sensor):
You have two options and depending on the option you will need additional items.

Option one:
Using stock cam and crankshaft sensors
No additional items needed. No actions needed at this point.

Be warned, I had issues using the stock variable reluctor sensors I was never able find the cause of the problem. It appears like the original wiring is prone to interference. The majority of the time it would run great. But some times i'd get random miss fires, rpm spikes in the signal, and when its cold it wouldn't start, rising miss counter. Randomly I would also get a back fire when I turn the key and it would blow vac lines off the manifold. Im not the only one thats experienced these issues ether. It just made the car unreliable.

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Option two (recommended) :
Switching to Hall effect sensors

Additional items:
2x Cherry GS100502 sensors
wire sleeving, optional
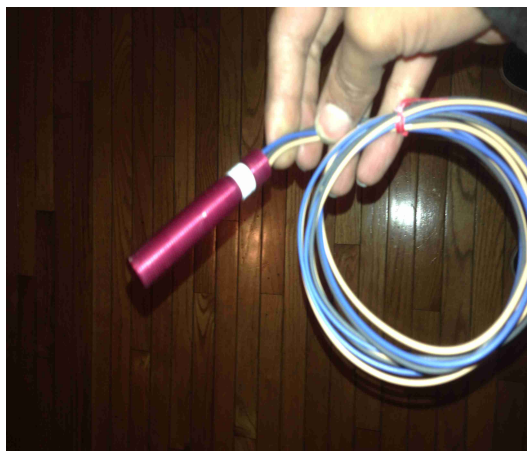2x 3pin male connectors, optional
2x 3pin female connectors, optional
Last gen 2.0l Mazda 626 alternator
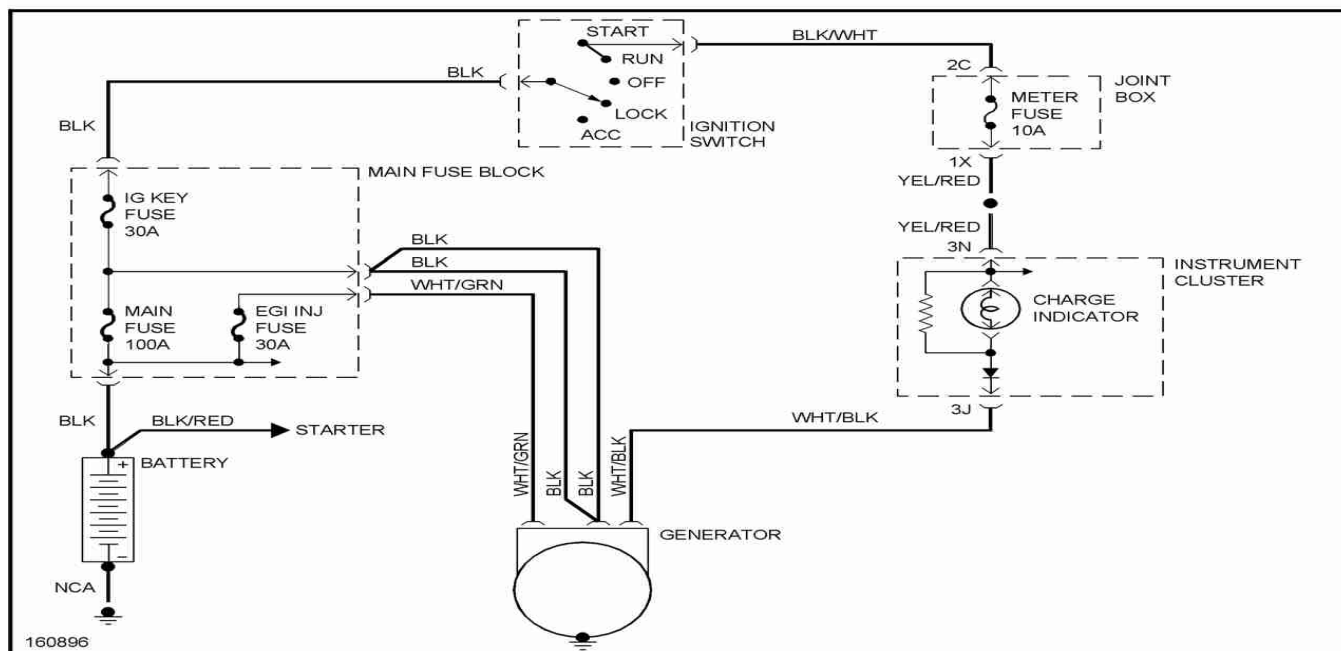30amp inline fuse.
10amp inline fuse.
14guage wire

Alternator:
Its necessary to switch to a internally regulated alternator. The stock alternator will not run without the cam and crankshaft sensors. Best option is to switch to a 626 alternator. I got mine at the junk yard for 30 bucks. Take the pig tail as well you'll need it make sure you cut two inches of wiring with the connector.

On the connector you'll find two wires.
The thicker white/green wire, it needs to connect directly to the battery+ . Run a wire from the battery with a 30 amp inline fuse to this wire. Use a thicker 14guage wire for this.
The thinner wire needs an ignition key switched power source. Tap the same power wire used for the wideband, its already fused. All this does is switch on the regulator so it doesn't draw much energy. Connect the original output wires to the alternator and you're done. You will have a battery light on. The PCM doesn't like that that the original connector is disconnected. A way around this would be to set up a waring light on the Haltech and connect it to the battery warning light on your dash to the output you've used. But the way I have it wired there aren't enough outputs to setup the warning light

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Cherry Hall effect sensors, you pick these things up for 20-30bucks a piece, a lot cheaper than the stock sensors if they ever need to be replaced. The GS100502 are excellent because the work with the stock trigger wheel and the magnets on the stock camshaft gear. The most difficult part of switching to hall effect sensor is mounting them. The wire mounted on the sensor is long enough to reach from the passenger footwell. Makes installation very easy.

Camshaft set up:
Simplest solution is to make a plate. Make a template of the the holes on the valve cover. Use the template the make a plate to mount the sensor on.
Take one of the nuts that was included with the sensor and file it into a circle so it fits snug in the valve cover. This way the sensor is centered in the correct location right over the passing magnets on the camshaft gear. To set the air gap match up the sensor to the stock camshaft sensor. Unless you have cut out valve cover and can get a feeler gauge in there its safest not to try to shorten the gap.
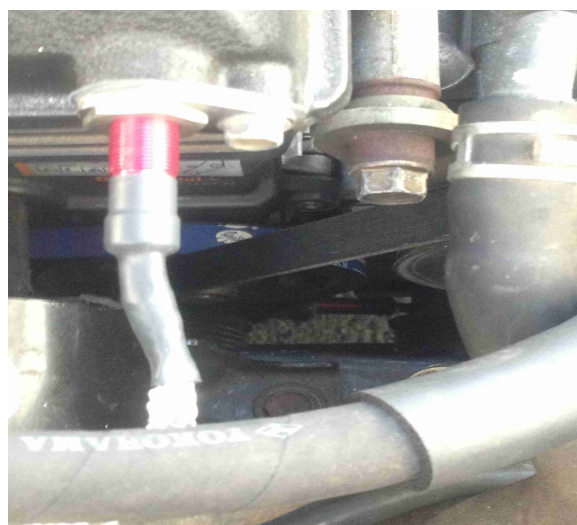
Crankshaft set up:

I couldn't come up with a way to make a mount
I sacrificed and old crank position sensor.
Cut where the wires go into so you end up with a
 flush surface on the back of the sensor. The first
magnet will be removed in the process.
With a drill enlarge hole that was reviled when
the first magnet was removed.
Take a small screw driver and tap remaining magnet
 out from the other end through the hole.
Remove the coiled wire inside the sensor. There
is a lot of it.
Drill out the hole so the sensor can be inserted.
Very important that the hole is straight.
Saw out the center so a nut can be inserted.
To set the air gap use a feeler gauge and adjust as
needed. You want it to be about 1mm

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Battery terminals:
Attach all the wires that have been run to the battery to their corresponding terminal. Its recommended to crimp new terminals but not required.
Keep the battery disconnected until the wiring is done.

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Part 2

Now that all the wires are in the passenger footwell it is very easy
 to connect everything up. It is matter of matching up the wires.
Not all wires will be used, wires not in use can to placed in a
separate connector, taped out the way, or removed from the
harness.

Here is the list of wires that need need to be cut on the harness
to give Haltech control.
Injectors:
The stock wiring will power the injectors.
        INJ 1 to Pin 75
        INJ 2 to Pin 74
        INJ 3 to Pin 100
        INJ 4 to Pin 101
Coils, we will be using the stock waste spark coils, the stock wiring will provide the power.
        Coil 1 to Pin 26
        Coil 2 to Pin 52
Throttle position, stock wiring will provide the power
        TPS Signal to Pin 89
Fuel Pump relay to Pin 80
Open loop Idle control
        DOP 4 to Pin 83
Thermo fan split the wire between Pin 45 and Pin47
If using stock cam and crank position sensor
        +Trigger to Pin 21
        -Trigger to Pin 22
        +Home to Pin 85
        -Home to Pin 86

If using Hall effect sensors Cherry GS100502:
You can ether use 6 pin connection for both sensors or a pair of 3 pin connectors. This is how they are
wired. Make sure not to mixup cam and crank sensor wires.
To wire the sensors:
Haltech Harness to Sensor
Red wire, switched +12 to Brown Wire, VCC
Yellow + wire to Black Wire, output
Blue wire, Ground to Blue Wire, Ground

PLX wideband wiring
This can be placed on a separate 2pin plug/ receptacle or you can add it to one of the main plugs if
there is space.
Wire:
Power to painless Yellow output wire
Ground to One of the Ground wires
The signal wire connected to the Haltech O2 input.

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These are pin outs I made to get you started. Top and bottom
row of each table indicate the slot the wires go into on the
receptacle/pin. They correspond with the slot number on the
actual receptacle/plug. Use this freely as a template, make
any changes you want that will fit your need. Remember the
less plugs you use the cleaner and cheaper the install. You
will end up with wiring that looks similar to the picture on
the right.

ECU side of original wiring harness

A 12Pin Receptacle

1	2	3	4	5	6
Pin 74	Pin 101	Pin 52	Pin 21	Pin 85	Pin 80
Pin 75	Pin 100	Pin 26	Pin 22	Pin 86	Pin 89
12	11	10	9	8	7

B 12Pin Receptacle

1	2	3	4	5	6
Pin 2	Pin 47	Pin 48	PLUG	PLUG	PLUG
Pin 83	Pin 45	PLUG	PLUG	PLUG	PLUG
12	11	10	9	8	7

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Engine harness side of original wiring harness

A 12Pin Plug

1	2	3	4	5	6
Pin 74	Pin 101	Pin 52	Pin 21	Pin 85	Pin 80
Pin 75	Pin 100	Pin 26	Pin 22	Pin 86	Pin 89
12	11	10	9	8	7

B 12Pin Plug

1	2	3	4	5	6
Pin 2	Pin 47	Pin 48	Coolant temp signal	Air temp signal	Boost solenoid 1st wire
Pin 83	Pin 45	PLX Signal Output	Coolant temp ground	Air temp ground	Boost solenoid 2nd wire
12	11	10	9	8	7

C 12pin Plug

1	2	3	4	5	6
PLUG or External MAP Signal	PLUG or External MAP +12V	PLUG	Button switch	Painless Blue Wire +Bat volt	1st Ground wire
PLUG or External MAP Ground	PLUG	PLUG	Button switch	Painless Pur. Wire +Bat volt	2nd Ground wire
12	11	10	9	8	7

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Haltech wiring harness
A 12Pin Receptacle

1	2	3	4	5	6
INJ 2	INJ 4	Coil 2	+ Trigger*	+ Home*	Fuel pump Re.
INJ 1	INJ 3	Coil 1	- Trigger*	- Home*	TPS Signal
12	11	10	9	8	7

B 12Pin Receptacle

1	2	3	4	5	6
PLUG	Thermo Fan	Tacho	Coolant temp signal	Air temp signal	DPO 3
DPO4	Thermo Fan	O2 Input	Coolant temp ground	Air temp ground	+12 Switched
12	11	10	9	8	7

C 12Pin Receptacle

1	2	3	4	5	6
MAP Signal	MAP Supply +12	Coil 3	AUX Rev	Switch Ecu +12v Supply	ECU Ground
MAP Ground	Road Speed Input	Coil 4	AUX Ground	Switch Ecu +12v Sensor Supply	ECU Sensor Ground
12	11	10	9	8	7

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If using Hall effect sensors Cherry GS100502:
Remove wires from Haltech wiring receptacle for slots 4,5,8,9 and plug them.
You can ether use 6 pin connection for both sensors or a pair of 3 pin connections and separate each sensor. This is how they are wired. Make sure not to mixup cam and crank sensor wires.

Sensor wires, 3Pin Plug.

1	2
Brown wire, VCC	Black wire, Output
Blue wire, Ground	
3	

Haltech Harness, 3Pin Receptacle

1	2
Red wire, Switched +bat	Yellow Wire, +
Blue, Ground	
3	

Suggested Fuel injector harness wiring:
Do the same thing for the plug and each receptacle.

1	2	3	4
INJ 1 Power	INJ 2 Power	INJ 3 Power	INJ 4 Power
INJ 1 Ground	INJ 2 Ground	INJ 3 Ground	INJ 4 Ground
8	7	6	5

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PLX wideband wiring
This can be placed on a separate plug/ receptacle or you can add it to the main 3 12 pin plugs if there is space.

Plug, car wiring side:

1
Painless Yellow wire
1st or 2nd Ground wire
2

Receptacle, PLX side

1
PLX +12v power
PLX Ground
2

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Part 3

Setting up!
Make sure you download and install the latest version
of ECU Manager. Its also a good idea to install the
Data log viewer.
Once you go online with your ecu (means the ecu is
connected to the laptop) you will need to update it
to the latest firmware.
Now you can ether upload my map and modify it for
you needs make sure you get the right map. I have
one set up for the stock Cam and crankshaft sensors
and one with Hall effect. There are a lot of
differences make sure you get the correct one. You will still need to check the timing is right with a
timing light.
Its a conservative street tuned map done by me. It a volumetric efficiency map. Use at your own risk,
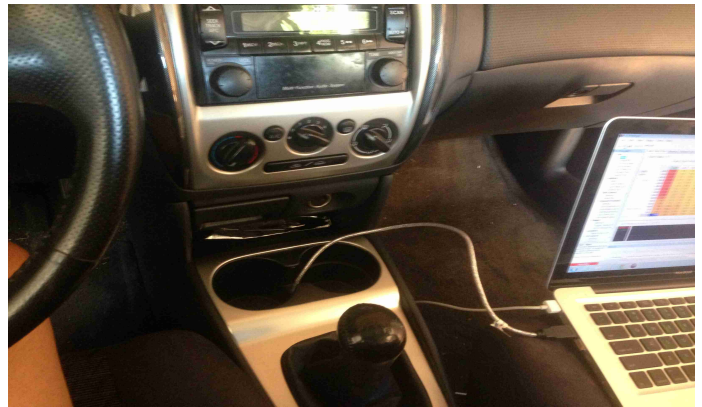they are both set up to be used with;
RC 750cc injectors.
GT3071r WG @ 1 bar of boost if used with a 7psi Watergate actuator.
BKR7E NGK plugs@ .030"
9:1 Compression
Safety boost cut is set at 17psi and turns off at 14psi
Internal MAP sensor

If you want to set it up from scratch here are the "Basic" so you can get it started:

Main tab:
        Tuning method: VE
        Cylinders: 4
        Fuel Load Source: MAP
        Ignition Load Source: MAP
        MAP Source: onboard
        Max Cranking RPM: 400 RPM
        RPM Display Max: 10,000 RPM

        Firing Order:
                #1:1
                #2:3
                #3:4
                #4:2

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Trigger tab:
        Trigger type: Motronic 36-1 +3home
        Trigger angle: 77.0
        Variable angle: NOT CHECKED
        Tooth Offset: 0

IF HALL EFFECT SENSORS:	IF STOCK SENSORS:
Trigger Edge: Falling	Trigger Edge: Rising
Home Edge: Falling	Home Edge: Rising
Trigger Sensor Type: Hall effect	Trigger Sensor Type: Reluctor
Home Sensor Type: Hall effect	Home Sensor Type: Reluctor
Trigger Pull Up: Enable	N/A
Home Pull Up: Enable	N/A
N/A	N/A
N/A	N/A
Trigger Filter Level: None	Trigger Filter Level: None
Home Filter Level: None	Home Filter Level: None
N/A	Trigger -ev GND: CHECKED
N/A	Home -ev GND: CHECKED

Fuel tab:
        Enable injectors: CHECKED
        Injection Mode: Sequential
        Invert Fuel Pump: NOT CHECKED
        Fuel Pump Prime Time: 0s
        Fuel Pressure Type: MAP Reference
        Base Fuel Pressure: 40 psi/inHg

Ignition Tab:
        Spark Mode: Waste Spark
        Spark Edge: Falling
        Dwell Mode: Constant Charge
        Dwell Time: 5.00 ms
        Dwell Duty: N/A
        Ignition Lock: Disabled

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Resources:

Haltech Youtube channel:
http://www.youtube.com/user/haltechecu

Haltech E6X Install Guide by Nick Holinski
http://www.mazdas247.com/forum/showthread.php?123779417-Haltech-E6X-Install-Guide

Setting Up Open Loop Boost Control by Andy Wyatt
http://www.adaptronic.com.au/setting-up-open-loop-boost-control-2/

PCM Pin out sources:
http://www.mazdaspd.com/resources/
http://www.floptical.net/mazda/

Haltech Quick start guide
http://www.haltech.com/wp-content/uploads/2011/01/Quick_Start_Platinum_Sprint_500_V6_website1.pdf

Painless 70113 wiring diagram
http://www.painlessperformance.com/Manuals/70113.pdf

Cherry Sensor information
http://www.cherrycorp.com/english/sensors/pdf/gs1005-gs1007_series.pdf

Hall effect Sensor information:
http://www.megamanual.com/ms2/pickups.htm
http://www.electronics-tutorials.ws/electromagnetism/hall-effect.html