Digital Fan Controller Ver 1.1

The latest generation of electric fans are now controlled by PWM signals from the ECU. These fans feature built-in electronics, and the ECU provides a PWM pulse at a specific frequency to regulate speed. For this version, we utilized the Pluto and Pluto2 devices, and are using the ECU software to control the Fan Controller due to the extended development time and capital needed for dedicated software. Below are details on adjusting values for optimal fan control.

Features

- 1x Digital PWM Fan output for variable-speed fans.
- Adjustable fan duty cycle curve, allowing for fast or slow fan response.
- PWM output indication in the software for the PWM-controlled fan.
- 3x Additional On/Off fan outputs for auxiliary fans or alarms.
- Individual adjustable temperature limits and deadband settings for each fan.
- Override input for maximum fan speed during racing conditions.
- Air conditioner input with high/low active setting to control condenser cooling.
- 5x Sensor calibration options for a variety of temperature sensors.
- 2x Analog inputs for standalone or tap-in sensor connections.
- LED indicators on the Pluto case for PWM fan status.

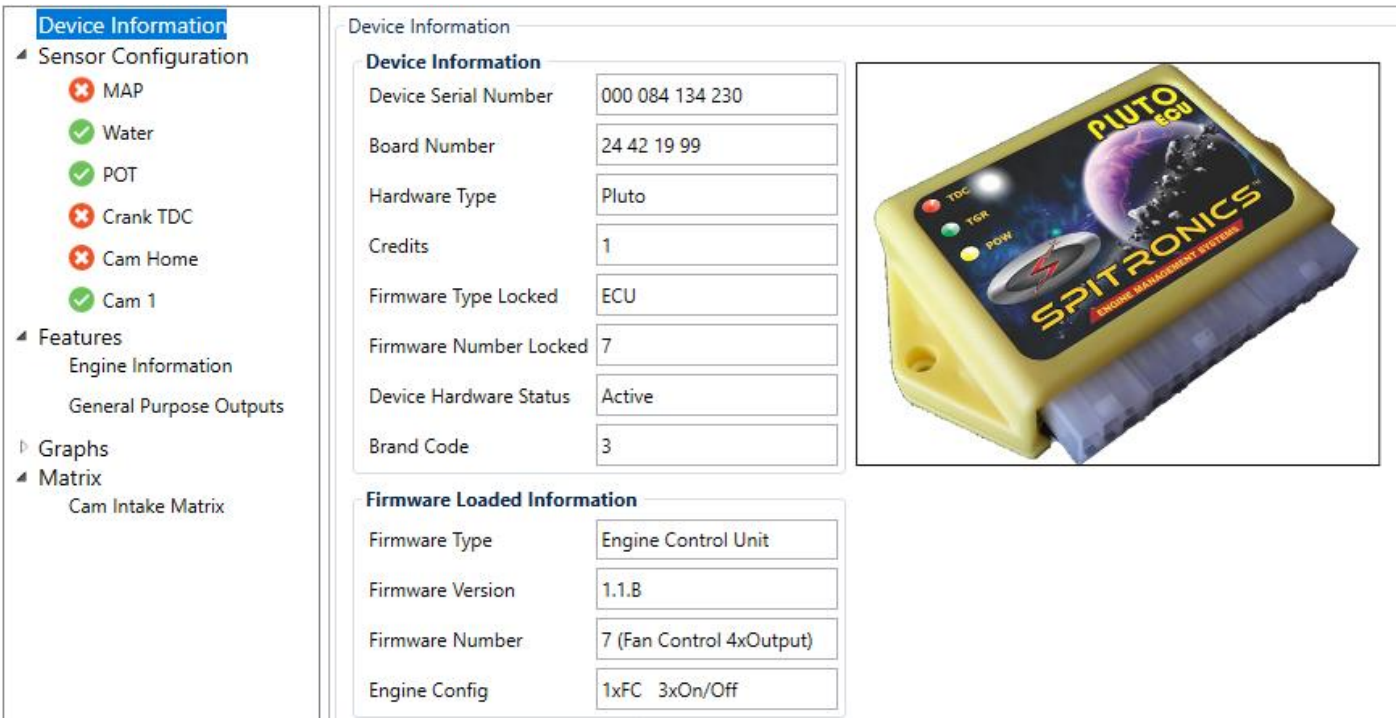
This product will require the Pluto Fan Controller, E37 & E49 Harnesses, Protection Diodes and relays for each On/Off fan, Standard Spitronics USB Cable and the Cosmos ECU Software.
(Note that the USB Cable and relays are not included)

Cosmos Software

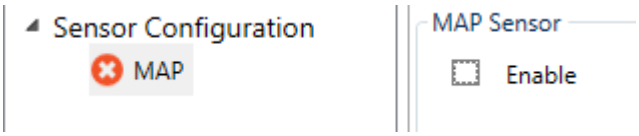
This Fan Control use the lates Cosmos Software from Spitronics. It uses the ECU software which has the graphical presentation of the matrix to make explanation easier. You can download the Cosmos Installer and from there download the ECU software.

Click on the link or go to www.spitronics.com – Online Manuals – Software – Windows Software – Cosmos Installer

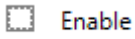
Settings



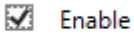
Map Sensor



This setting allows you to choose between Standalone Water Temperature Sensor mode and Tap-In mode.



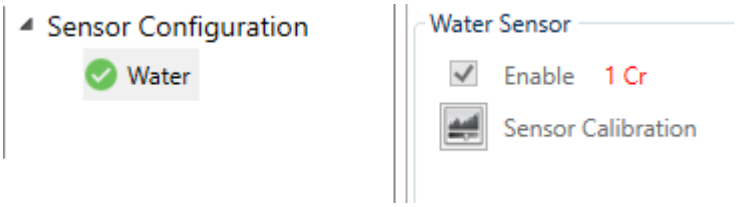
In Standalone mode, the water temperature sensor is wired directly to the Pluto Water Sensor input, where the Pluto provides a 1K pull-up resistor to 5 volts. This sensor is typically mounted on the engine or thermostat housing.



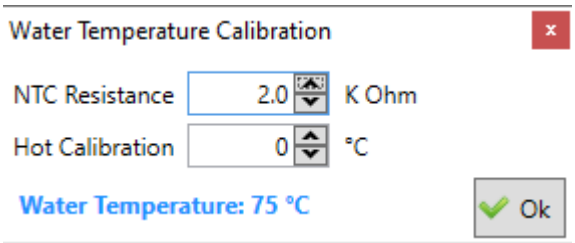
In Tap-In mode, the Pluto connects to an existing sensor on the engine that is monitored by the OEM ECU. In this configuration, the sensor is wired to the Pluto MAP Sensor input without a pull-up resistor. Tap-In mode is only compatible with systems where the OEM ECU also uses a 5-volt reference signal and an internal pull-up resistor. In this mode, the Sensor Calibration option is

visible but serves no functional purpose and can be disregarded. These temperature curves are not always accurate as different pullup resistors may be utilised.

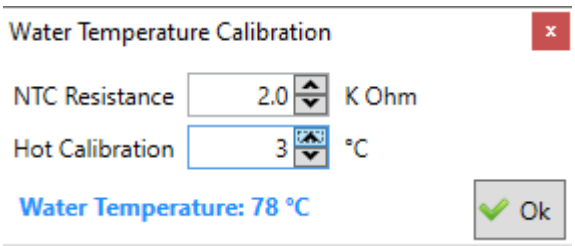
Water Temperature Sensor



This is the primary sensor of the product and cannot be disabled. Water temperature readings can be obtained either through the Water Sensor input or the MAP sensor input, depending on MAP sensor selection (see the previous topic for details).

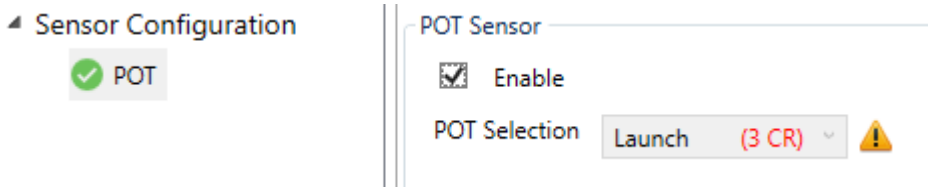


The water sensor includes five logarithmic NTC resistance curves, calibrated for various sensors with resistance values of 1k, 2k, 2.5k, 3k, and 4k. Selecting a different curve using the up and down arrows will prompt the software to refresh and load the new calibration curve. To find the closest match, set Hot Calibration to 0. Measure the engine temperature when it's hot, then scroll through the sensor options to find the one closest to the actual temperature. This reading can be checked at the bottom of the calibration box or on the real-time display.



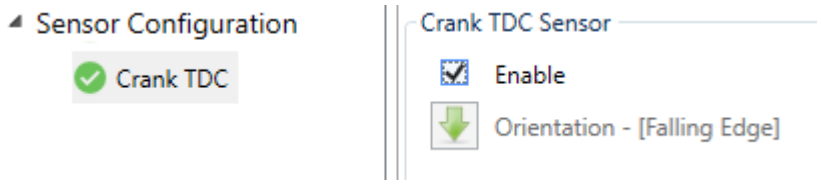
Once the closest curve is selected, fine-tune the calibration at operating temperature, generally above 90°C. Use the Hot Calibration setting to add or subtract degrees from the software reading to align it with the actual engine temperature. This adjustment moves the entire curve up or down, ensuring accurate readings at the critical temperature points for fan activation.

POT Sensor



This setting is locked and cannot be modified. It is enabled by default to display the POT analog bar, indicating the percentage duty cycle output to the fan, which is particularly useful for diagnostics.

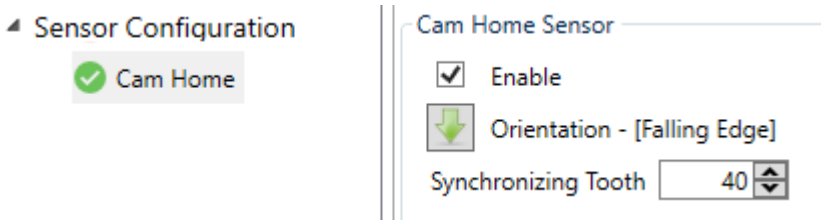
Crank – Manual Override



This setting activates the override feature, allowing the driver to manually switch the fan to maximum speed during racing or spinning to prevent the engine from reaching peak temperature before the fan would automatically engage.

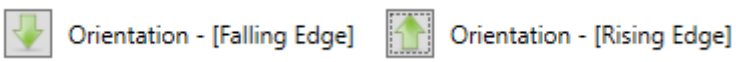
When set to "Off," the feature is disabled if not in use. When "On," an On/Off switch must be wired to the Crank Input of the Pluto (refer to the wiring diagram). The Orientation arrow does not impact this setting, and the jumper for this signal must be configured for Hall mode.

Cam Home – Aircon Override

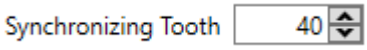


This setting configures the air conditioning (A/C) system to activate the PWM fan. When enabled, the A/C can override the fan to operate at a minimum duty cycle sufficient to cool the condenser radiator. However, if the fan is already running at a higher speed due to temperature requirements, the A/C override is disregarded.

When set to "Off," the feature is inactive. When set to "On," a signal from the A/C circuit must be wired into the Cam Home Input of the Pluto device (see wiring diagram). There are two wiring options depending on the A/C signal type, which could be either 12V when active or ground when active.

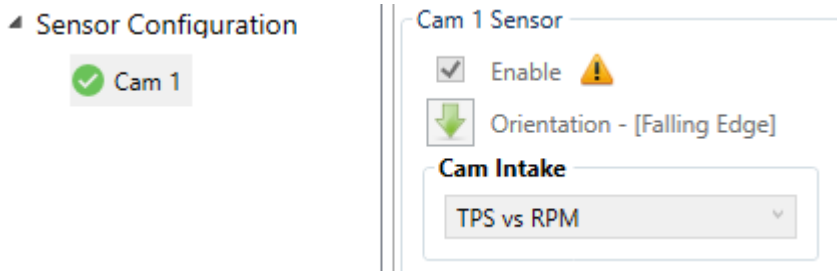


The downward arrow selects activation when the signal is ground (earth). The upward arrow selects activation when the signal is a positive 12V.



This setting also specifies the minimum duty cycle percentage at which the fan should operate during A/C activation.

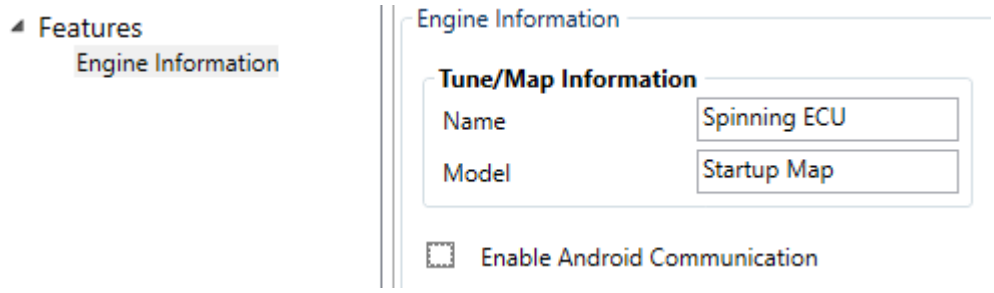
Cam1



This setting does not impact operations but only activates the Cam Matrix block for tuning purposes. It cannot be modified.

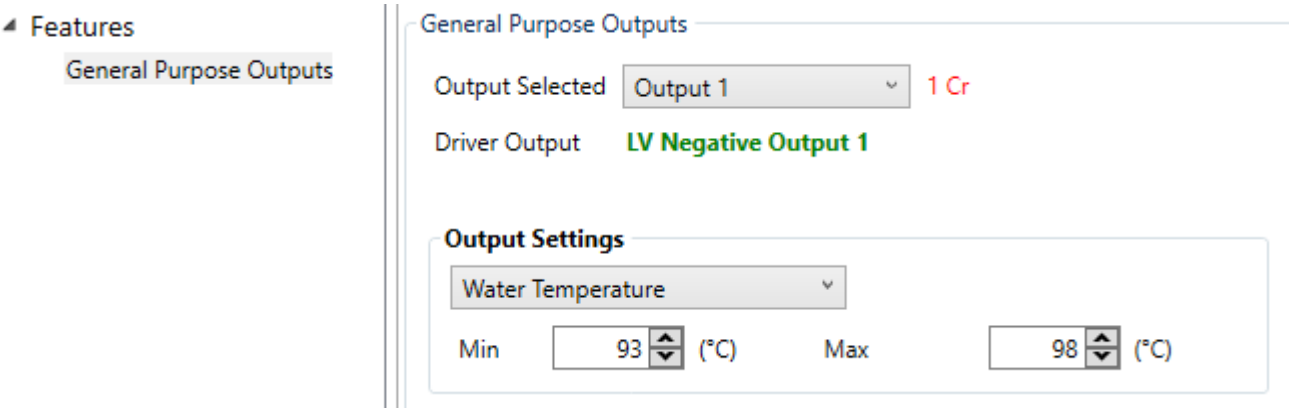
Features

Engine Information

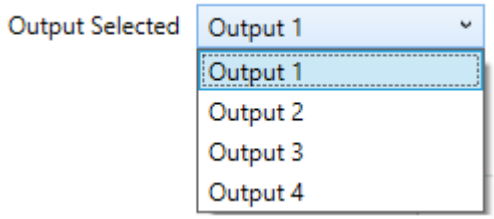


These features are purely for reference and do not impact operation. The tuner can add notes in the map, such as the customer's name and engine model, for future reference. If the Android operations box is selected, the Enable Android Communication block will be checked. This feature is activated by the manufacturer upon request and may incur an additional fee.

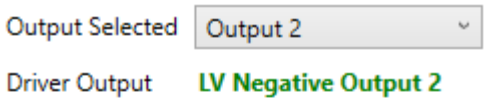
General Purpose Outputs

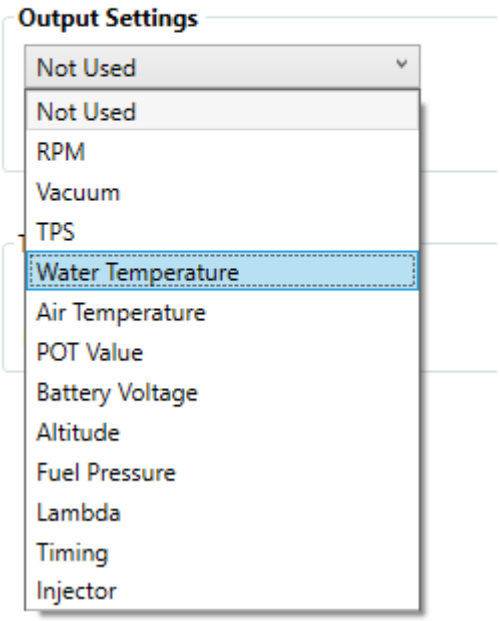


This page is used to set up the temperature limits for all four fans. Each fan output activates when the temperature exceeds the Max setting, in this example, 99 degrees. The fan will switch off when the temperature drops below the Min setting, here set to 92 degrees. This creates a deadband to either keep the fan running within a specified range to cool the system or to prevent the fan from switching on and off erratically at the activation temperature.

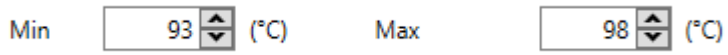


Select the fan or output you wish to adjust.





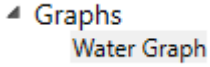
Select either Water Temperature or Not used for this Output.



Select minimum and maximum temperatures for this output.

Note that the output is low current outputs and cannot drive fans directly. It must be used with a Relay for the On/Off type fans. There is also a freewheel diode on each Relay. See the wiring diagrams.

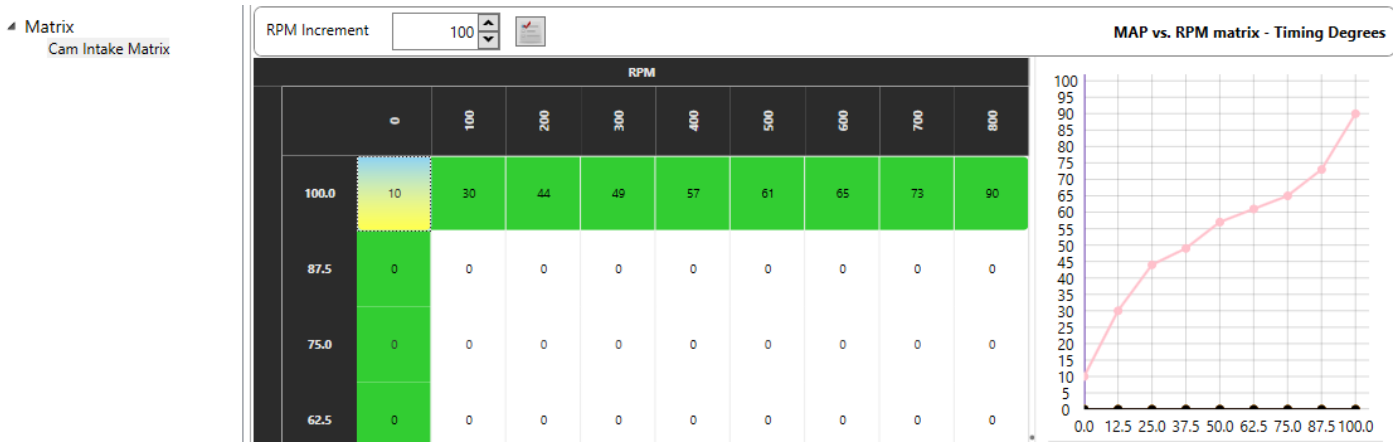
Graphs



This setting does not affect operation but will show because the water sensor is activated. You can ignore it or the graph settings.

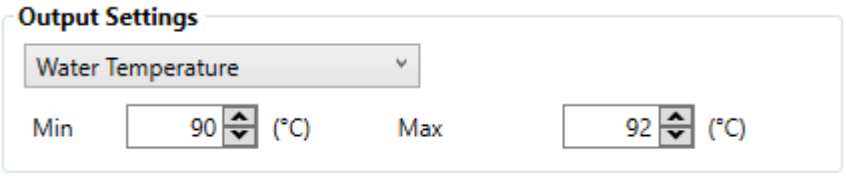
Matrix

Cam Intake Matrix



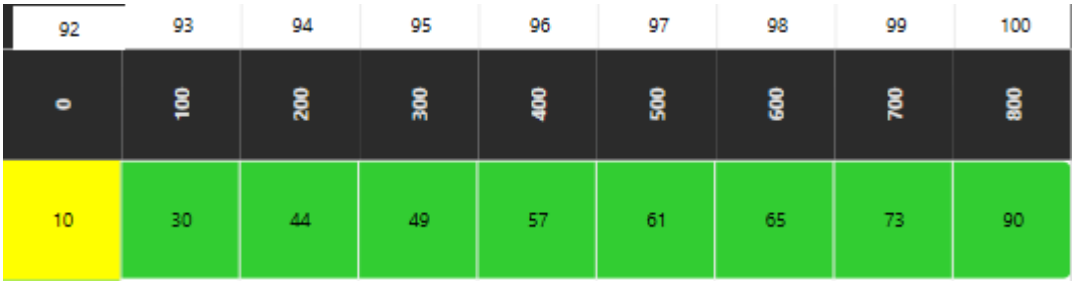
The cam matrix is used as a graphical input to facilitate understanding. This software can display matrix values in graphical form, as shown on the right side. First, you need to understand how these fans operate. The two popular types are BMW and Spal fans. BMW fans require a 0% duty cycle to be off. As the duty cycle increases, the fan will spin faster until it reaches a maximum value of x%. In contrast, Spal fans require a 90% duty cycle to be off. As the duty is reduced, the fan will increase in speed until it reaches a maximum speed at approximately 10% duty. Thus, one fan exhibits a positive slope, while the other exhibits a negative slope. The duty cycles mentioned are not necessarily accurate but have been observed from customer tunes.

For explanation purposes, the fan limits were set as follows:



This means the fan will start at 93° and stop at 89°. However, the fan speed must be adjusted accordingly to increase airflow as the engine temperature rises.

To adjust the different duty cycle values for the fan output, we use only the top row in the matrix, which contains 9 values. The top white row is included to indicate what the values represent according to your limits. The maximum value is indicated in black at the 0 RPM mark. The fan will only switch on at 93°. This corresponds to the 100 RPM block. The green value represents the duty cycle percentage for the output.

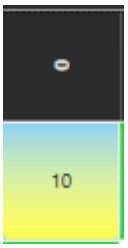


n this scenario, the duty cycle will be 30%. If the temperature increases to 94 degrees, a 44% duty cycle will be sent to the fan. As the temperature rises, the fan will receive increasingly higher values until it reaches 90%, which is the fan's maximum duty cycle. If you want the fan speed to

increase more dramatically over a smaller temperature change, you can make the steps larger so that 90% can be reached within 3 or 4 degrees. The remaining blocks must then be set to 90% to maintain this speed if the temperature continues to rise. During the phase when the temperature is above the maximum limit, the green LED will be illuminated.

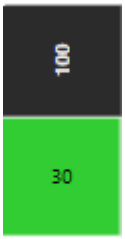
When the temperature decreases, the duty cycle will be reduced to 30% at 93°. This will be the deadband duty, and the fan will maintain this value until the temperature drops below the lower limit of 90°. Consequently, the fan will switch off at 89°. During this deadband phase, where the temperature is below the maximum and above the minimum limit, the red LED will be illuminated.

Off Duty %



This block represents the off-duty cycle. For BMW fans, it may be set to 0%, while for Spal fans, it may be 90%. Your fan may differ, and you will need to adjust this value until the fan stops working. You should perform this adjustment when the car is cold or below the specified temperature.

Deadband Duty



This deadband duty represents the fan speed between the specified limits. You need to choose a high enough value to ensure that the fan can effectively cool the engine down to below the low limit; otherwise, the fan will run continuously. It is advisable to make this adjustment on a hot day. During the deadband phase, the green LED will be off, and the red LED will be on. If any of the override features are activated, both LEDs will illuminate.

Maximum Duty

This block represents the full speed of the fan. If the temperature exceeds this point, the duty cycle will remain active on the output.

Real-Time values

This is the actual temperature from the sensor on the engine.

This is the actual duty % value on the output of the PWM fan.

This is the activation status of the Pluto.
1 – Normal mode
2 – Normal mode plus Android mode.

Not used – Ignore

Not used – Ignore

LED Indication

Power is on. PWM Fan is off.

Power is on. PWM Fan is controlling above the maximum temperature limit.

Power is on. PWM Fan is controlling in the deadband between Min and Max limits.

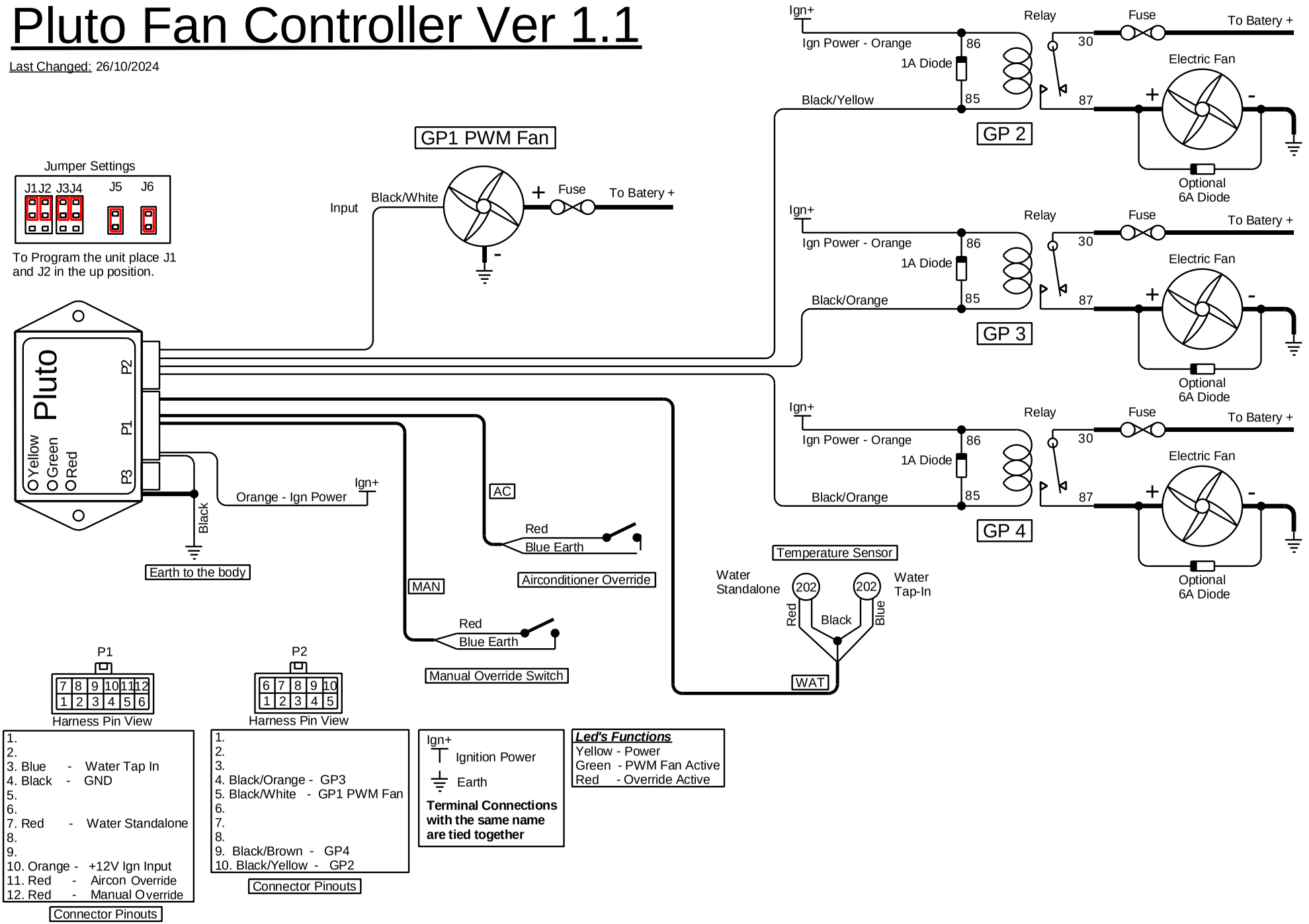
Power is on. PWM Fan may controlling but and override button or aircon is activated.

Pin Layout & Drawings

		Fan Control					
Wire Colors	**Software**	**Pluto /2 Input / Outputs**				**Software**	**Wire Colors**
	Priority1					Priority1	
E37		**12 Way Input**					**E37**
Red	Water Stand Alone	Water Temp	7	1	Air Temp		
		Lambda	8	2	TPS		
		.+5 Volt Out	9	3	MAP	Water Tap In	Blue
Orange	Ignition	.+12 Volt Ign	10	4	GND	Water Earth	Black
Red	Aircon Override	TDC Sensor	11	5	TDC Power		
Red	Manual Override	Crank Sensor	12	6	Crank Power		
E39		**10 Way ECU**					**E39**
		N1 Ground	6	1	N2 Ground		
		N3 Ground	7	2	N4 Ground		Black/Orange
		N5 Ground	8	3	N6 Ground		Black/White
Black/Brown	GP4 Fan4	RPM Out	9	4	Relay Out	GP3 Fan3	Black/Orange
Black/Yellow	GP2 Fan2	GP2 Out	10	5	GP1 Out	GP1 Fan1 Control	Black/White
USB		**6 Way USB**					**USB**
N/C	Jumper Select	Programmer 2 (Tuning Pot)	4	1	Programmer 1 (Dual Map Sw)	Jumper Select	N/C
Yellow		Receive	5	2	Transmit		Green
Red		.+5 Volt Out	6	3	GND		Blue

Pluto Fan Controller Ver 1.1

Last Changed: 26/10/2024



P1

7	8	9	10	11	12	
1	2	3	4	5	6	

Harness Pin View

1.
2.
3. Blue - Water Tap In
4. Black - GND
5.
6.
7. Red - Water Standalone
8.
9.
10. Orange - +12V Ign Input
11. Red - Aircon Override
12. Red - Manual Override

Connector Pinouts

P2

6	7	8	9	10	
1	2	3	4	5	

Harness Pin View

1.
2.
3.
4. Black/Orange - GP3
5. Black/White - GP1 PWM Fan
6.
7.
8.
9. Black/Brown - GP4
10. Black/Yellow - GP2

Connector Pinouts

Ign+ Ignition Power

Earth

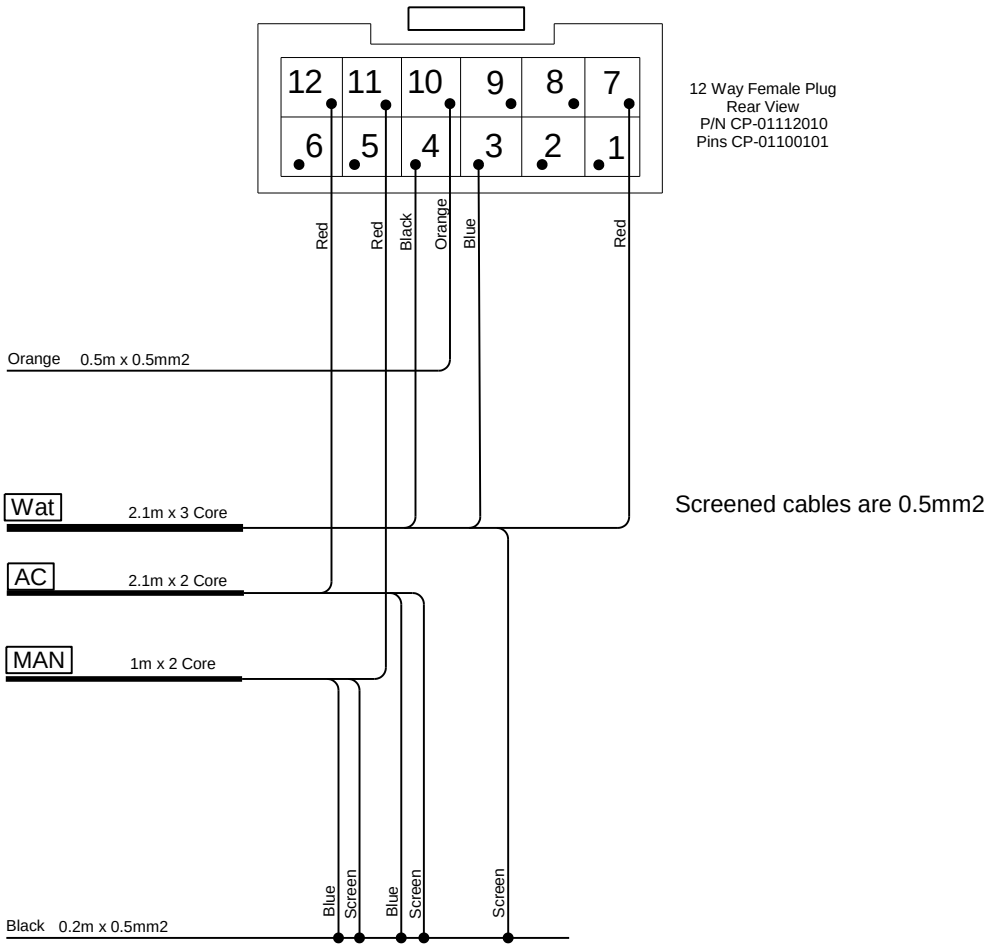
Terminal Connections with the same name are tied together

Led's Functions

Yellow - Power
Green - PWM Fan Active
Red - Override Active

E37 Input Harness

Last Changed: 09/03/2015



E49 Output Harness

Last Changed: 22/10/2024