Nebula Fan Controller Ver 1.2

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 EZ42B hardware, and are using the Cosmos ECU software to control the Fan Controller. 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.
- 2x Analog Water Temperature inputs for standalone or tap-in sensor connections.
- 5x Sensor calibration charts for a variety of temperature sensors.
- LED indicators on the Fan Control case for PWM fan status.

This product will require the Nebula Fan Controller, N10-P1 & N11-P2 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)

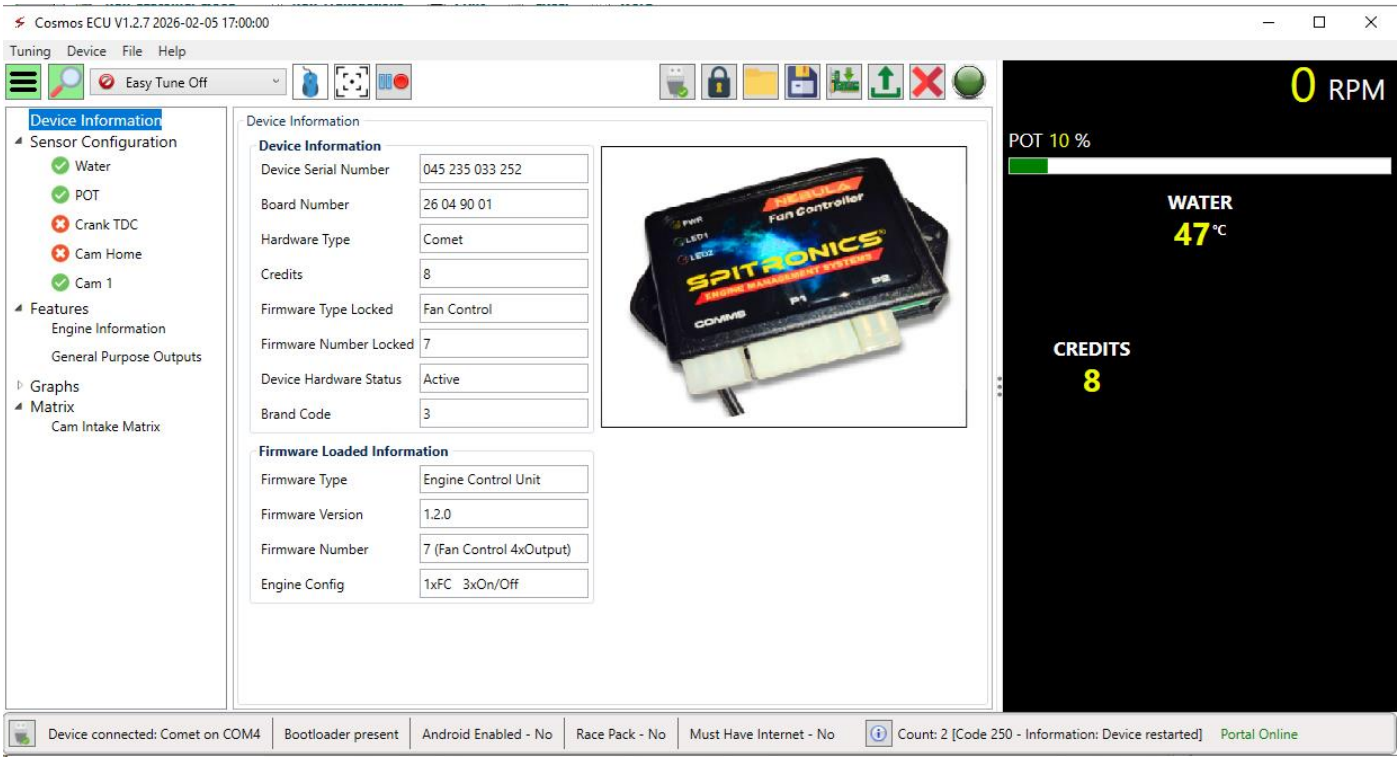
Cosmos Software

This Nebula 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.

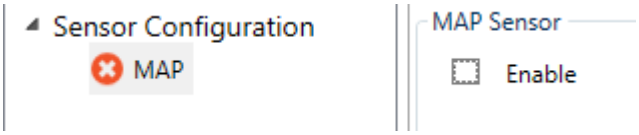
Click on the link or go to www.spitronics.com – Online Manuals – Software – Windows Software – Cosmos Installer

For instructions on this you can download the How to download Spitronics Cosmas Software correctly.

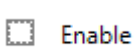
Settings



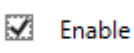
Map Sensor



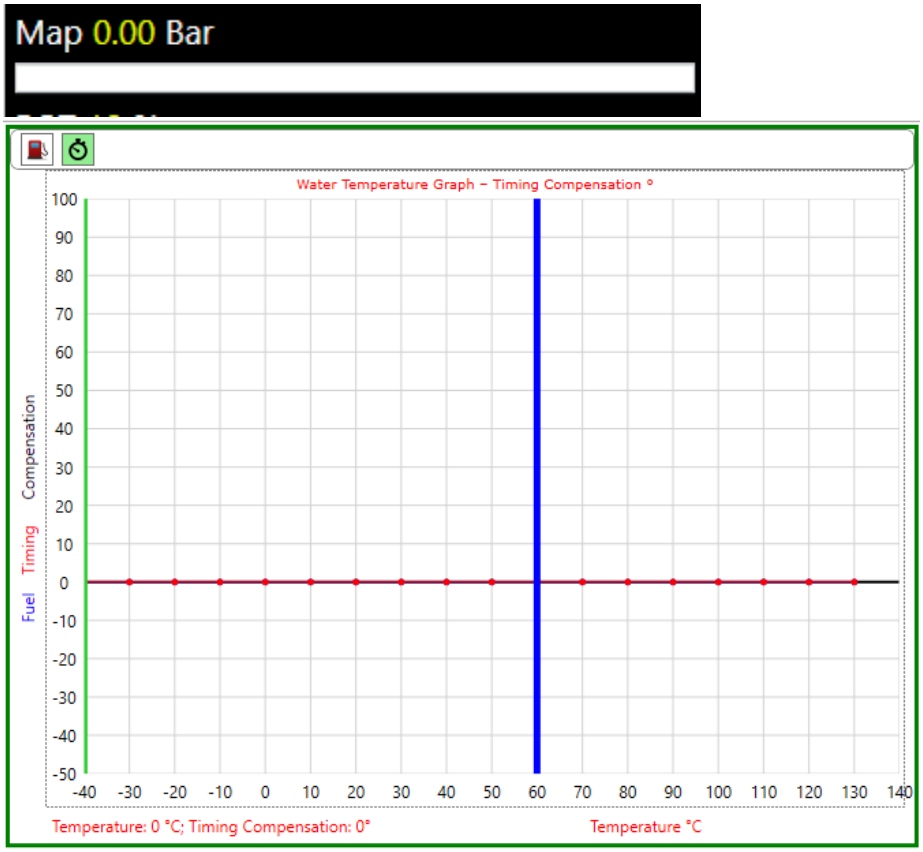
This setting allows you to choose between Standalone Water Temperature Sensor mode and Tap-In mode.



In Standalone mode, the water temperature sensor is wired directly to the Nebula Water Sensor input, where the Nebula provides a 1K pull-up resistor to 5 volts. This sensor is typically mounted on the engine or thermostat housing and has 2 connection points. Earth and Signal.

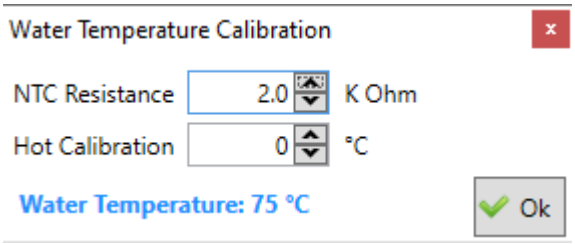


In Tap-In mode, the Nebula connects to an existing sensor on the engine that is monitored by the OEM ECU. In this configuration, the sensor is wired to the Nebula MAP Sensor input without a pull-up resistor. Tap-In mode is only compatible with systems where the OEM ECU also uses a 5-volt reference signal and an internal pull-up resistor. The temperature curves are not always accurate as different pullup resistors may be utilised. Select one closest to your realistic values and use a infrared thermometer to set limits. It may not be visual accurate but it should function correctly. The MAP bar and water graph below can be ignored as it is not used in this Nebula.

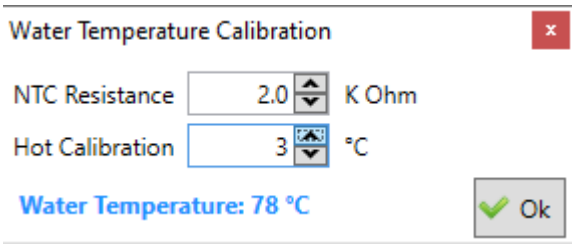


Water Temperature Sensor

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.

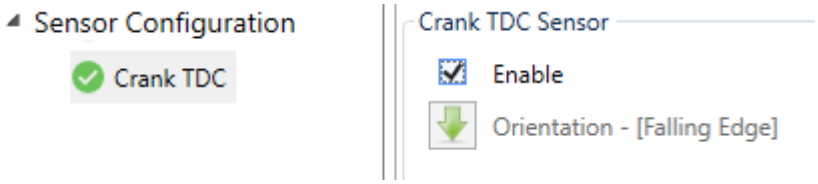


Once the closest curve is selected, fine-tune the calibration at operating temperature, generally above 90°C. Use the Hot Calibration setting to add or subtract degrees from the software reading to align it with the actual engine temperature. This adjustment moves the entire curve up or down, ensuring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

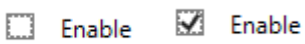
POT Sensor

This setting is locked and cannot be modified. It is enabled by default to display the POT analogue 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.

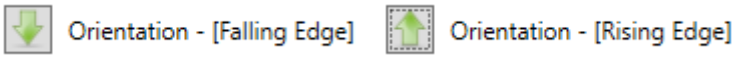


When set to "Off," the feature is disabled if not in use. When "On," an On/Off switch must be wired to the Crank Input of the Nebula (refer to the wiring diagram). The Orientation arrow does not impact this setting, and the jumper for this signal must be configured for Hall mode.

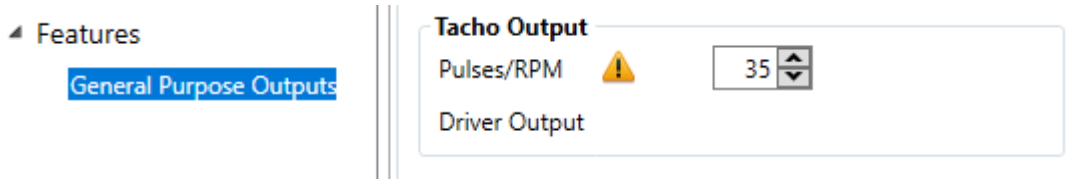
Cam Home – Aircon Override

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 Nebula 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.

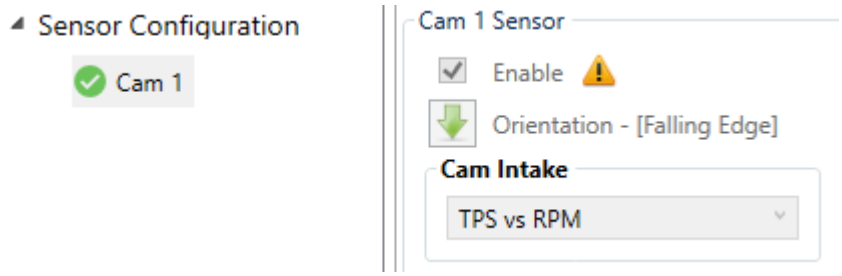


The downward arrow selects activation when the signal is ground (earth). The upward arrow selects activation when the signal is a positive 12V.



This setting on the Features tab specifies the minimum duty cycle percentage at which the fan should operate during A/C activation. Should the engine get even hotter, then the fan control will override this setting and make the fan run faster.

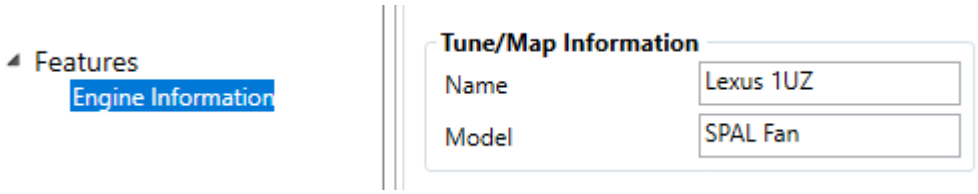
Cam1



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

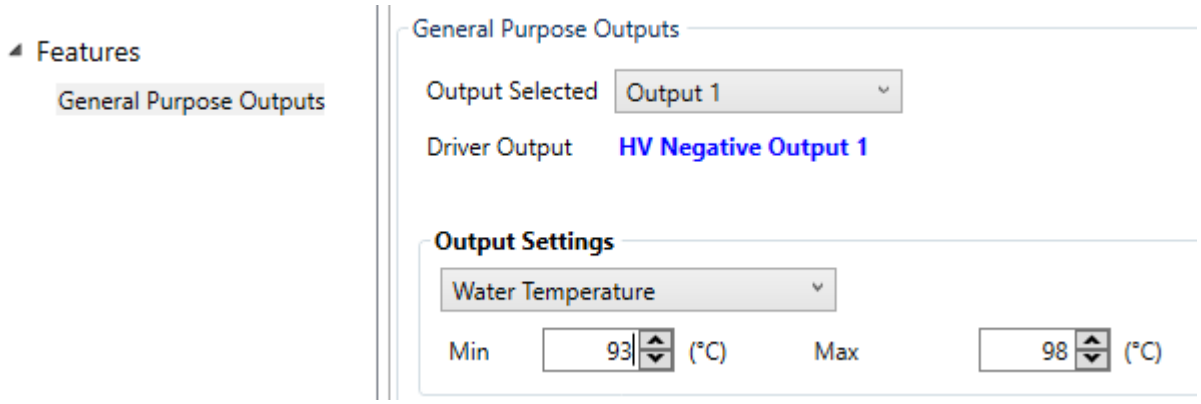
Features

Engine Information

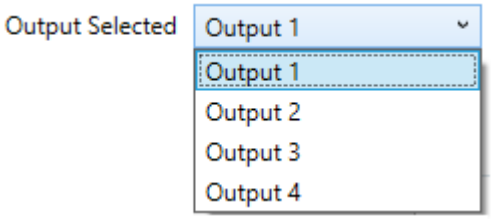


These features are purely for reference and do not impact operation. The tuner can add notes in the map, such as the customer's name and engine model, for future reference.

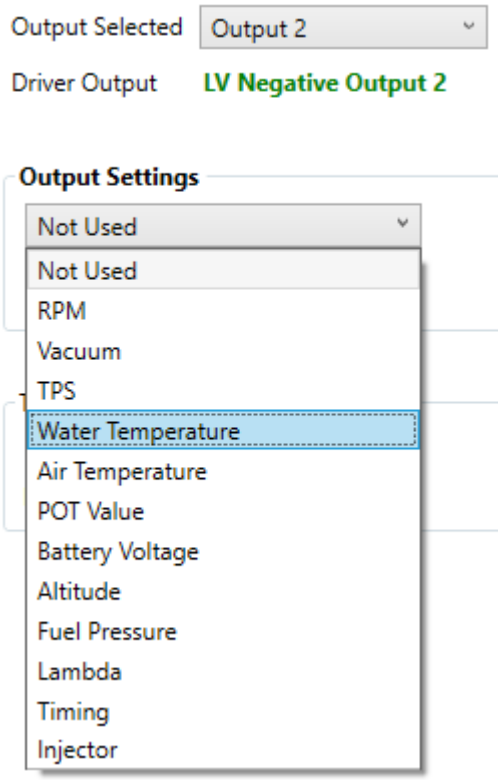
General Purpose Outputs



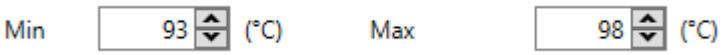
This page is used to set up the temperature limits for all four fans. Each fan output activates when the temperature exceeds the Max setting, in this example, 99 degrees. The fan will switch off when the temperature drops below the Min setting, here set to 92 degrees. This creates a deadband to either 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.



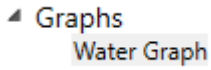
Select either Water Temperature or Not used for this Output.



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.

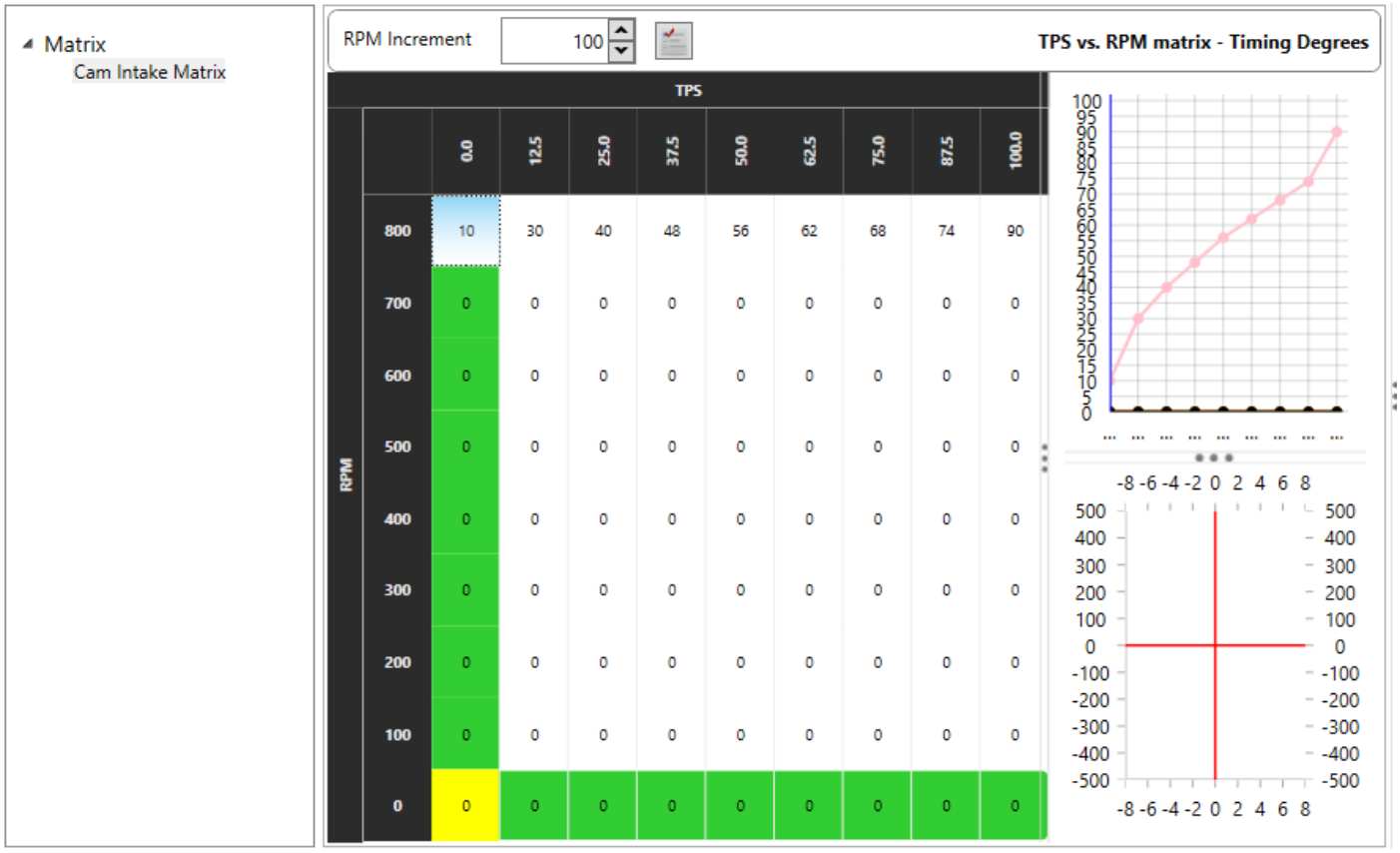
Graphs



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

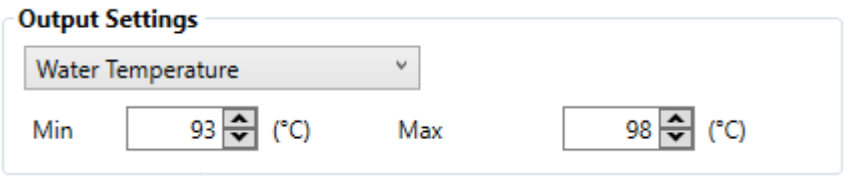
Matrix

Cam Intake Matrix



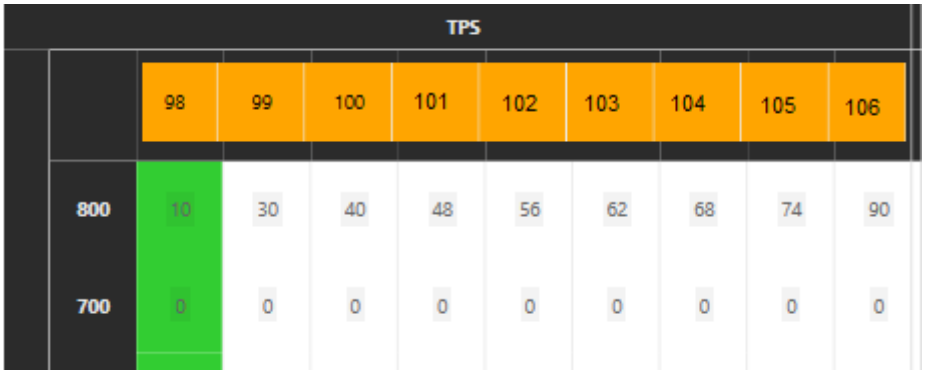
The cam matrix is used as a graphical input to facilitate understanding. This software can display matrix values in graphical form, as shown on the right side. First, you need to understand how these fans operate. The two popular types are BMW and Spal fans. BMW fans require a 0% duty cycle to be off. 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.

Note that the TPS is on the top Y-Axis and RPM is on the X-Axis. IF your is not so it will still work but the values will sit on the right-hand side. You can correct the Axis in the Tuning Tab under Settings.
For explanation purposes, the fan limits were set as follows:



This means the fan will start at 99° and stop at 92°. However, the fan speed must be adjusted accordingly to increase airflow as the engine temperature rises above 98°. The fan in the test sample adjusts from 10% to 90% PWM where 10% is off and 90% is maximum speed. Note that other fans my use different slopes like SPAL that start high duty for slow speed and end low duty for fast fan speed.

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 orange row is fictional to explain what the values below it represents according to your limits. The blocks will add degrees from 98 which is your top limit for a range of 8 degrees above that temperature so that you can adjust fan speed gradually if you want to. In this case it will go up to 106°C.



The green value 10 represents the off-duty cycle to ensure the fan is off. Some fans use this 10% as a limp-mode function in case the signal gets lost. If there is no PDM then the fan will go to full speed. During this phase when the temperature is above the maximum limit, the green and red LED's will be off unless an override is being activated.

Once the temperature reaches 99° then the fan will switch on at 30% PWM. This is also the retaining duty once the fan falls below 98 until it goes lower than 93°. Only then will the fan switch off. and go back to 10%. During this phase when the temperature is above the maximum limit, the green LED will be illuminated only.

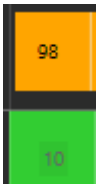
Block 100 to 106 will keep increasing duty according to your settings. If you reach 103° the duty will be 62% and so on. If you want the fan to reach maximum in 3° overshoot then adjust block 101 to 106 the same maximum value of 90% in this example. Maximum speed is not necessary 100% duty as some fans also need to see a certain duty for limp mode to verify that the controller is still active. In this case 90%

Block 106 represent maximum fan speed at 90% and must be filled in so that temperatures higher than 106° will keep this duty cycle.

Once the temperature falls below 99° then the fan will stick on the 30% duty till the temperature falls below 93°. This will give the fan a deadband so that it does not switch on erratically. It will also give the engine a bit more time to cool to lower levels without keeping the fan on maximum. During this phase when dead band is working, the red LED will be illuminated only.

Off Duty %

When the temperature falls below 93 then the fan will switch off at 10% and the LED's will switch off.



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, this 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 required for the Nebula Fan Controller to operate.

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.

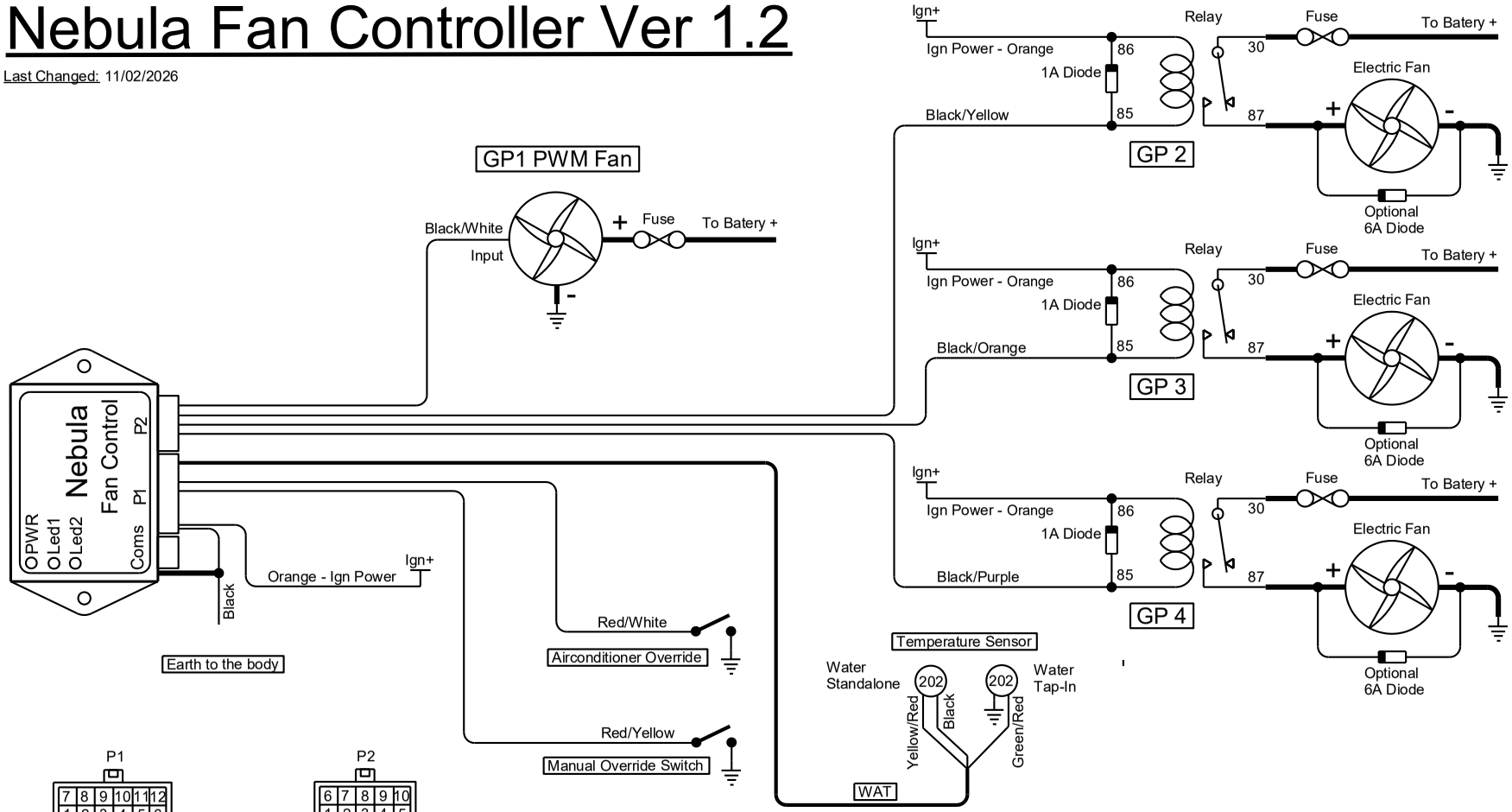
Power is on. PWM Fan may controlling but and override button or aircon is activated.

Pin Layout & Drawings

		Nebula Fan Control					
Wire Colors	**Software**	**EZ42B Layout**				**Software**	**Wire Colors**
	Priority1					Priority1	
N10-P1		**P1 - 12 Way Input**					**N10-P1**
Yellow/Red	2 Pin Water Sensor	Water Temp	7	1			
			8	2			
		.+5 Volt Out	9	3	MAP	Water Tap-In	Green/Red
Orange	Ignition In	.+12 Volt Ign	10	4	GND	Water Temp GND	Black
Red/Yellow	Aircon Override	TDC Sensor	11	5			
Red/White	Manual Override	Crank Sensor	12	6			
N11-P2		**P2 - 10 Way Output**					**N11-P2**
Black/Purple	GP1 - On/Off Fan 4	LV Negative 2	3	1	LV Negative 1	On/Off Fan 3 - GP3	Black/Orange
Black/Yellow	GP2 - On/Off Fan 2	HV Negative 2	4	2	HV Negative 1	Fan Control - GP1	Black/White
USB		**6 Way USB**					**USB**
			4	1			
Yellow		Receive	5	2	Transmit		Green
Red		.+5 Volt Out	6	3	GND		Blue

Nebula Fan Controller Ver 1.2

Last Changed: 11/02/2026



P1

Harness Pin View

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

Connector Pinouts

P2

Harness Pin View

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

Connector Pinouts

Ign+ Ignition Power

Earth Earth

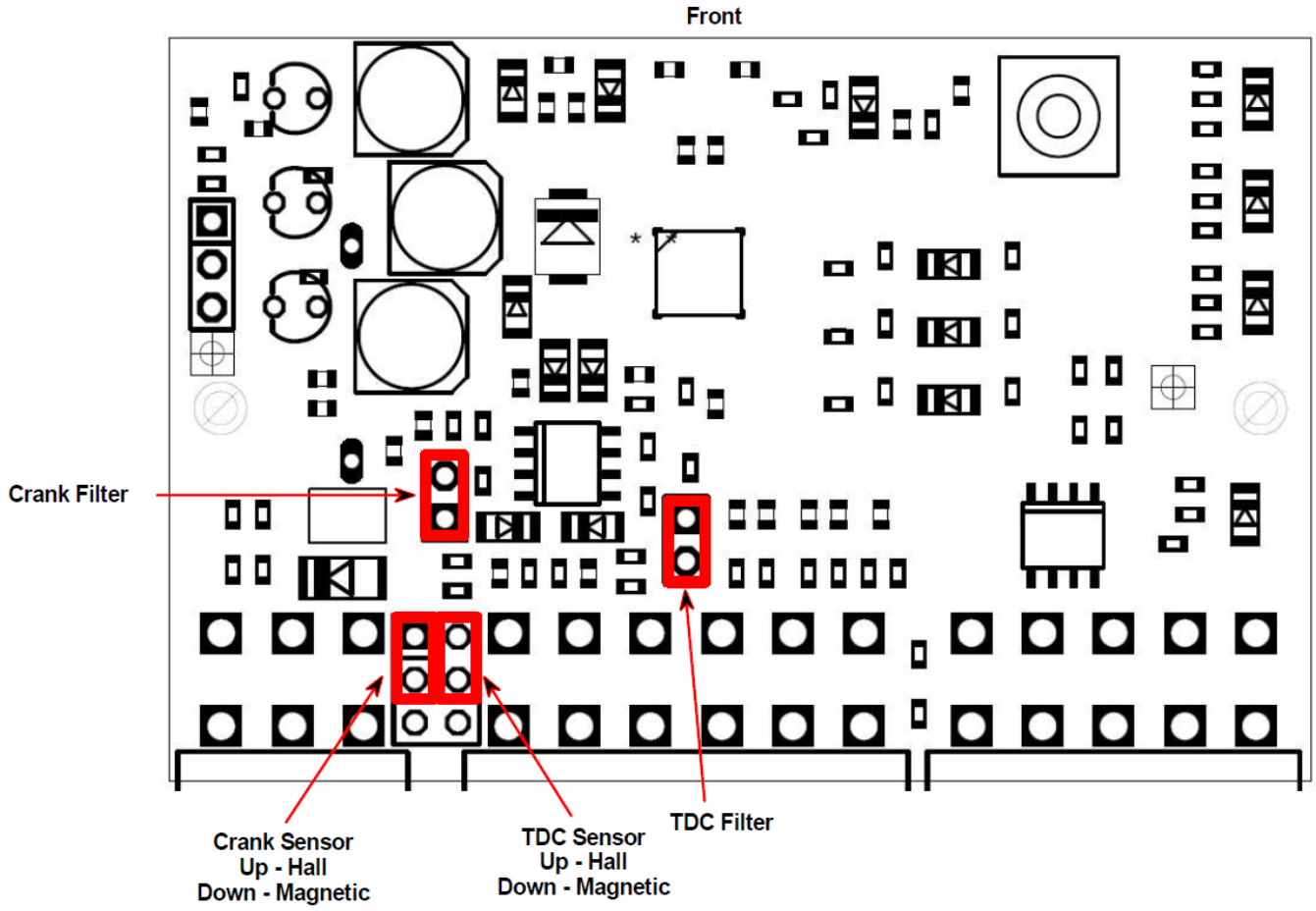
Terminal Connections with the same name are tied together

Led's Functions

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

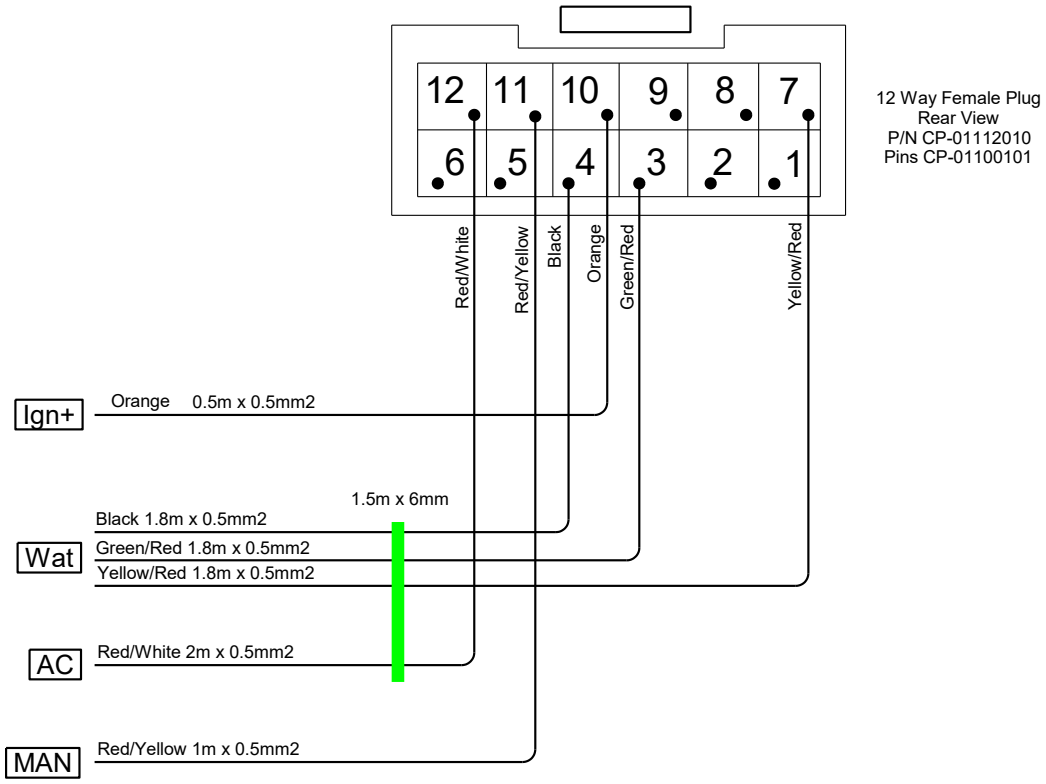
EZ42B Jumper Settings

Last Changed: 10/03/2025



N10-P1 Fan Control Input Harness

Last Changed: 11/02/2026



N11-P2 Fan Control Output Harness

Last Changed: 11/02/2026