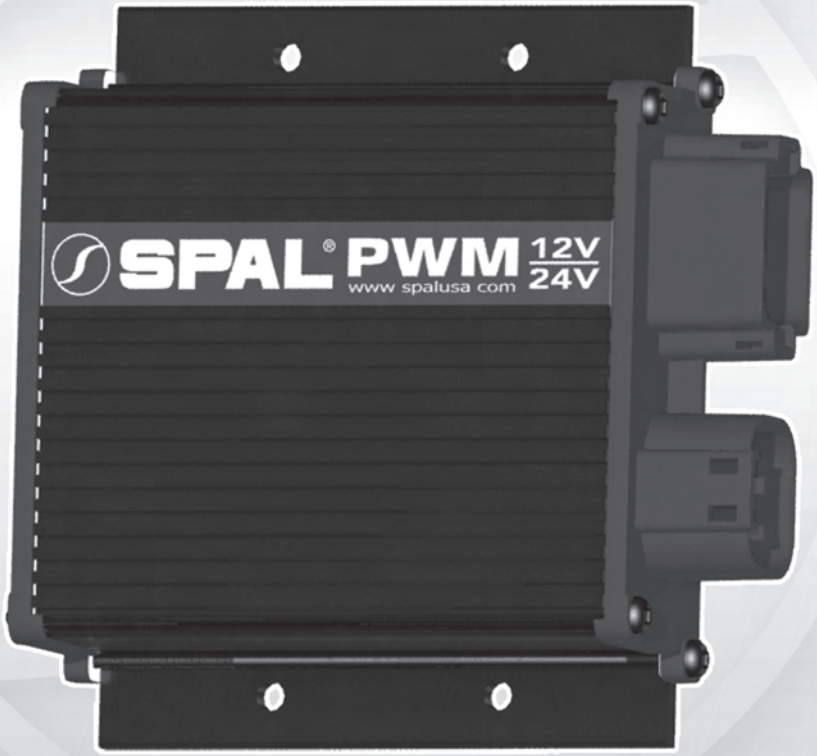
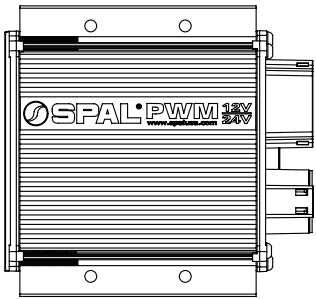
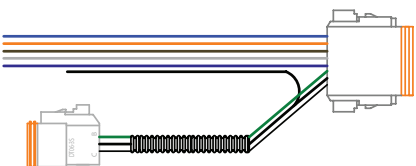
# FAN-PWM-V3
## Instructions



# Parts Included In Kit

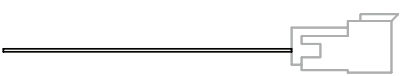



FAN-PWM-V3 Controller (1)

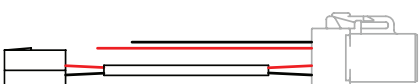


Main Harness (1)

SPAL Temp Sensor Harness (1)



OEM Temp Sensor Harness (1)

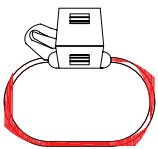


Power Harness (1)

## Hardware Bag

20 Amp Fuse (1)

30 Amp Fuse (1)



Fuse Holder (1)

Yellow Ring Connectors (2)

Blue Ring Connectors (2)

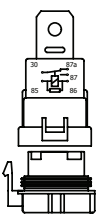


Yellow Butt Connector (1)

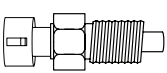
Self Tapping Screws (4)

Zip Ties (12)

## Optional Equipment




FRH
(Fan Relay Harness)



SPAL Sensor

# Suggested Fuse Values

| PULLER # | PUSHER # | DESCRIPTION | RECOMMEDNED FUSE |
|---|---|---|---|
| | | **9"** | |
| 30102061 | 30102053 | 9" High Performance Fan / Paddle Blade | 25 |
| 30100392 | 30100381 | 9" Fan | 10 |
| | | **10"** | |
| 30102057 | 30102058 | 10" High Performance / Paddle Blade | 25 |
| 30100360 | 30100374 | 10" Fan | 10 |
| | | **11"** | |
| 30102052 | ---------- | 11" Dual High Performance Fan / Pull | 30/Per Motor |
| 30102054 | 30102040 | 11" High Performance Fan / Paddle Blade | 30 |
| 30101500 | 30101502 | 11" Medium Profile Fan | 15 |
| 30100364 | 30100365 | 11" Fan | 10 |
| | | **12"** | |
| 30102130 | ---------- | 12" High Performance Dual Fan / Curved Paddle | 30/Per Motor |
| 30102029 | 30102030 | 12" High Performance Fan / Curved Blade | 30 |
| 30102038 | 30102025 | 12" High Performance Fan / Paddle Blade | 30 |
| 30101504 | 30101505 | 12" Medium Profile Fan | 20 |
| 30100375 | 30100384 | 12" Fan | 10 |
| | | **13"** | |
| 30102044 | 30102045 | 13" High Performance Fan / Curved Blade | 30 |
| 30101507 | 30101508 | 13" Medium Profile Fan | 20 |
| 30100398 | 30100399 | 13" Fan | 10 |
| | | **14"** | |
| 30102041 | 30102055 | 14" High Performance Fan / Striaght Blade | 30 |
| 30102042 | 30102056 | 14" High Performance Fan / Curved Blade | 30 |
| 30101509 | 30101510 | 14" Medium Profile Fan | 20 |
| 30100385 | 30100382 | 14" Fan | 10 |
| | | **16"** | |
| 30102113 | ---------- | 16" Extreme Performance Fan / Pull | 30 |
| 30102120 | 30102047 | 16" High Performance Fan / Straight Blade | 30 |
| 30102082 | ---------- | 16" High Performance Fan / Paddle Blade | 30 |
| 30102048 | 30102049 | 16" High Performance Fan / Curved Blade | 30 |
| 30101516 | 30101517 | 16" Medium Profile Fan | 20 |
| 30100400 | 30100401 | 16" Fan | 15 |

# New Features of 3rd Generation PWM

- Ability to reset to any one of 3 preset temperature ranges when using FAN-PWM-TS sensor
- Smart fan diagnostics detects stalled or over current fans to prevent module damage
- New 16 bit MCU for increased resolution on temperature sensor input
- Primary fan low power starts to reduce the current spike on electrical system
- Onboard status LED and status output for vehicle interior status light
- Quality Deutsch IPD connectors on the premium harness made in USA
- Silicone rubber button membrane and case seals for improved durability
- Improved AC input timing to minimize fan operation during defrost cycles
- Single unit capable of use with both 12VDC and 24VDC systems

## **WHY THIS MAY BE IMPORTANT FOR YOU**

In an effort to add features and improve quality of the FAN-PWM the functionality of the unit may impede previous 'creative' installations of FAN-PWM's.

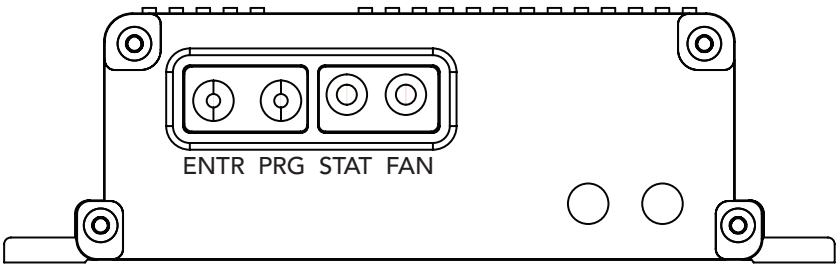
- A brushed DC motor MUST be connected to the fan output or the unit will report an error code. Possible use with very low power (<4A) fans and non SPAL products may also cause fan not found error code. SPAL USA will not guaranty this products functionality with NON SPAL fans as too often specifications are unknown.
- Over current protection means that the output will SHUT DOWN if the measured fan continuous run current increases above 30A for extended periods. If running a fan approaching this amount of current draw (>25A), SPAL USA recommends that the installation also include a status light so the operator will be aware of fan status. See page 8 for status light wiring.
- Because of timing sequences on the AC input wire when using a manual override switch there will be a delay before the fan turns on/off with the switch.

Congratulations on your purchase of the SPAL FAN-PWM! Due to the various installation configurations, please carefully read the entire manual before installing the FAN-PWM. This SPAL Electric Fan Controller (FAN-PWM) will vary the speed of the fan based on engine temperature by using Pulse Width Modulation technology. A second fan can be added but requires the use of an additional relay to control the secondary fan (SPAL part number FRH). The secondary fan will not be variable speed; it will be ON/OFF only.

Because the FAN-PWM was designed to alter the speed of the fan, SPAL USA suggests setting the High 10° to 20° above the thermostat rating and setting the Low at least 10° below the High.

**Instruction Manual Highlights**


| | |
|---|---|
| Wiring | 15 - 19 |
| Programming | 11 - 14 |
| Trouble Shooting | 21 - 24 |
| Frequently Asked Questions (FAQ) | 25 - 26 |




Front View of PWM

The FAN-PWM is equipped with 2 LED's: a **'STAT' LED** and a **'FAN' LED**. **'STAT' LED** will be lit when the unit is powered on, system checks are OK, and the fans are not running.

The 3 color **'FAN' LED** indicates when the fan output is active, and is also used during programming. Each color represents the following: AMBER for temperatures above LOW, RED for temperatures above HIGH, and GREEN when the A/C input has been activated.

When the Low temperature setting is reached, the **'FAN' LED** will light AMBER, and the fan will run at 50% or ½ speed. The fan will then gradually increase in speed as the engine temperature rises. If the high temperature setting is reached, the **'FAN' LED** will light RED, and the fan will now be running at full speed. (continued next page)

When the **'FAN' LED** lights RED, a negative output will be sent on the gray wire. This gray wire can be used to trigger a fan relay, an indicator light, etc. If you are using dual fans with the recommended wiring setup (refer to pages 18/19) your 2nd fan will turn on full speed at this time.

If the cooling system is able to lower the coolant temperature approximately 5° below the High setting, the **'FAN' LED** will turn from RED to AMBER and the fan will slow in speed; at this time the second fan output will stop as well. If the cooling system is able to continue to lower the coolant temperature to approximately 5° degrees below the low setting, the **'FAN' LED** will turn off, the **'STAT' LED** will light GREEN, and the fan will stop completely.

## Mounting

The SPAL FAN-PWM is water resistant and can be mounted in the engine bay or inside the vehicle. Keep the controller away from high heat sources such as the engine exhaust. Above the wheel well, on the radiator support, or firewall are good examples of proper locations.

# Temperature Sensor Connection

***Note: Both large and small gauge ground wires must be grounded.***

**Single Fan:** Please see SINGLE FAN WIRING instructions on Page 16 and 17.

**Dual Fan:** A dual fan set-up requires a Fan Relay Harness (SPAL part number FRH) to power the secondary fan. Please see DUAL FAN WIRING instructions on Page 18 and 19

## Connecting To A Factory OEM Temperature Sensor

The FAN-PWM can be used with most vehicle's original temperature sensor circuits and aftermarket electric temp gauges. This eliminates the need for an additional sensor. Some older cars' sensors (as those circa the 1970's) may not work. If you experience problems, please call our technical support line for assistance 1-800-454-7725.)

Vehicles With known issues:

- Ford modular engine's coolant/head temp (4.6/5.4L) range switching @ ~200 degrees
- GM Duramax (could be other new GM also) multi range switching @ ~160 degrees

With these sensors the same voltage will exist at multiple temperatures. If you set the controller above the switching point of the sensor range it will technically work. The problem is that the fan will turn on at cold startup initially, turn off, before coming on again at the proper temperature.

- Please see the PROGRAMMING section on pages 11-14.
- If using this type of sensor, the SPAL FAN-PWM must be programmed to your desired temperature points as the default settings will not be properly calibrated.

## SPAL Temperature Sensor (FAN-PWM-TS)

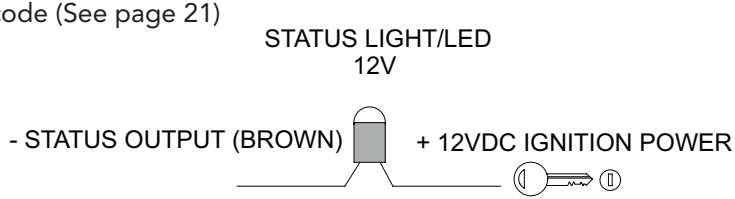
If your vehicle is not equipped with an OEM temperature sensor, you can purchase a SPAL temperature sensor (SPAL part number FAN-PWM-TS) that plugs directly into the fan controller harness. This sensor should be located in the engine for optimal performance.

- When using the SPAL temperature sensor, the fan controller has a factory preset with a Low setting of ~190° and High setting of ~205°.
- If different settings are required, please see the PROGRAMMING section on pages 11-14.

## Optional Status Output

The FAN-PWM provides a negative output for an external device such as a LED (not provided) to be used to remotely show the status of the system. With the vehicle's ignition on, the status output will indicate the following:

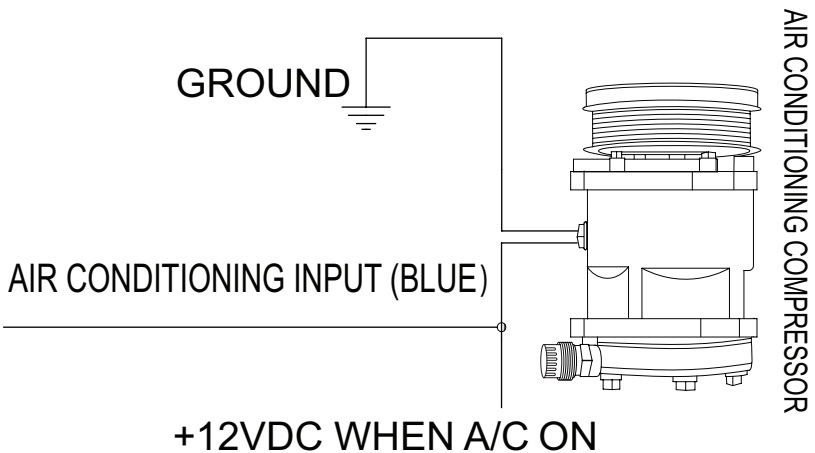
- **No output:** All checks OK, fan not running
- **Output on:** Fan output is active (fan could be running low to high speed)
- **Blinking output:** Indicates an error code; watch 'STAT' LED on module for error code (See page 21)



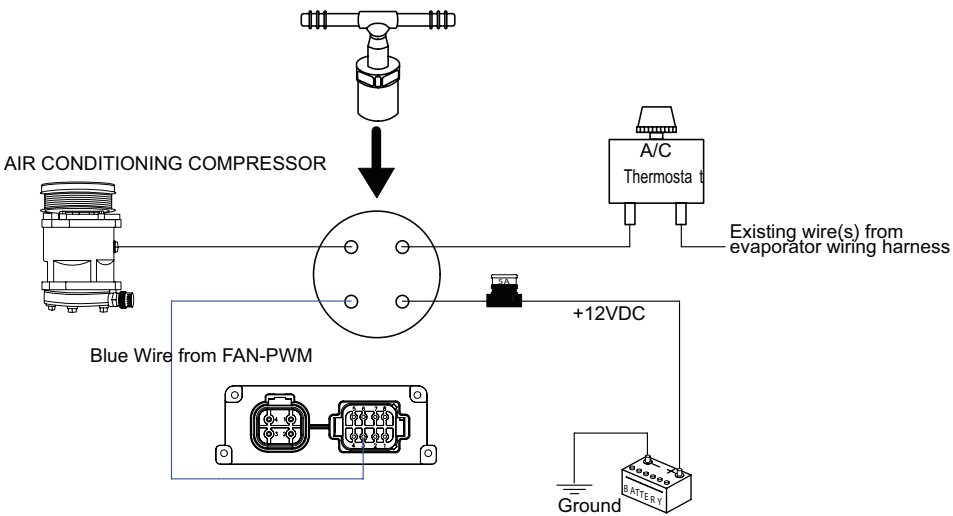
# Air Conditioning Input

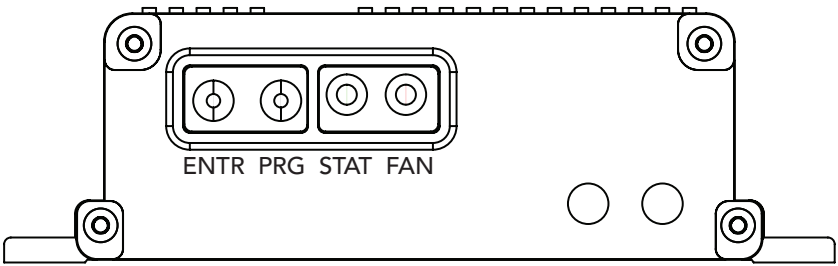
The FAN-PWM has a built in 15 second delay for ON and a 30 second delay for OFF with the Air Conditioning Input. After the A/C compressor has turned ON, the fan will not go to HIGH until after a 15 second delay. After the A/C turns off, the fan will stay on HIGH for 30 seconds before resuming normal operation.

1. If your A/C system ***does not*** have a trinary switch, connect the Blue wire directly to the +12V wire of the air conditioning compressor or a wire within your HVAC system that is powered only when the A/C is engaged. As a result any time the compressor is engaged and or the A/C is activated, the fan(s) will run at 100% with 'FAN' LED lit GREEN.



2. If your A/C system has a trinary switch, you may use it to trigger your cooling fans. This is the preferred way to control your cooling fans as the fan operation is based on the pressure of the coolant in the A/C system. Though the A/C pump may not be running, the pressure of the A/C system may require operation of the cooling fans to properly cool the A/C condenser.






## 'Stat' LED (Green):

- On when FAN-PWM is powered from the ignition input. Fan(s) are not on.
- Blinking indicates an error code. See page 21 for error codes.

## 3 Color 'Fan' LED:

- **RED**: High temperature setting has been reached.
- Fan(s) run at High speed.
- **AMBER**: Low temperature setting has been reached.
- Fan starts at half-speed and increases until High temperature setting is reached.
- **GREEN**: Indicates Air Conditioning has been powered ON.
- Fan(s) run at full speed.

When programming the FAN-PWM the ***fan will turn off*** automatically to allow quicker warm-up of coolant temperature. If at anytime you enter programming mode by mistake, repeatedly press the **PRG** button until the unit returns to normal status.

## Setting Both The Low & High Temperature

1. Press and Hold down **PRG** button for 5 seconds.
2. Fan will stop running and the **'FAN' LED** will be slowly blinking **AMBER**.
3. Warm engine up to desired LOW temperature and press **ENTR** button to program LOW.
4. The **'STAT' LED** will blink once and the 'FAN' LED will turn **RED** and be blinking slowly.
5. Warm engine up to desired HIGH temperature and press **ENTR** button to set HIGH.
6. The **'STAT' LED** will blink once then **'FAN' LED** will turn **GREEN** and be blinking slowly.
7. Press the **PRG** button once to EXIT programming.

## Setting The **Low Temperature Only**

1. Press and Hold down **PRG** button for 5 seconds.
2. Fan will stop running and the **'FAN' LED** will be slowly blinking **AMBER**.
3. Warm engine up to desired LOW temperature and press **ENTR** to set LOW.
4. The **'STAT' LED** will blink once and the **'FAN' LED** will turn **RED** and be blinking slowly.
5. Press **PRG** button 2 times to EXIT programming.

## Setting The **High Temperature Only**:

1. Press and Hold down **PRG** button for 5 seconds.
2. Fan will stop running and **'FAN' LED** will be slowly blinking **AMBER**.
3. Press **PRG** button once.
4. **'FAN' LED** will be slowly blinking **RED**.
5. Warm engine up to desired HIGH temperature and press **ENTR** button to set HIGH.
6. The **'STAT' LED** will blink once then the 'FAN' LED will be slowly blinking **GREEN**.
7. Press **PRG** button once to EXIT programming.

The FAN-PWM has 3 default programs for use with the SPAL temperature sensor (FAN-PWM-TS).

| |
|---|
| Preset 1 has a LOW temp of 170° and a HIGH temp of 185°. |
| Preset 2 has a LOW temp of 190° and a HIGH temp of 205°. |
| Preset 3 has a LOW temp of 205° and a HIGH temp of 220°. |

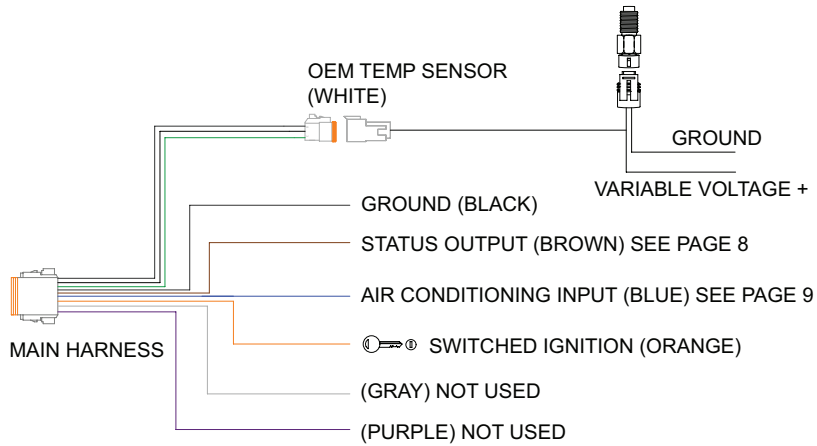
## Selecting The Desired Preset

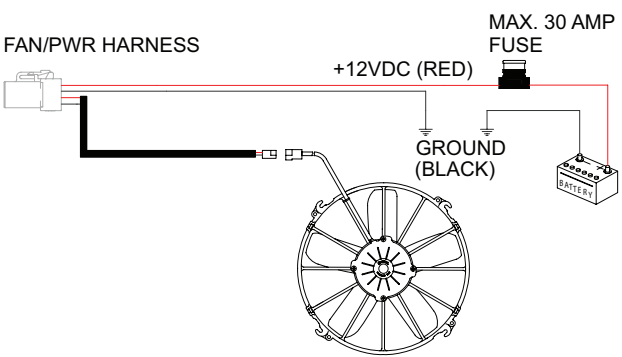
1. Hold down **PRG** button for 5 seconds.
2. FAN will stop running and **'FAN' LED** will be slowly blinking **AMBER**.
3. Press **PRG** button 2 times.
4. **'FAN' LED** will slowly blink **GREEN**.
5. Press **ENTR** button once for Preset 1. **'STAT' LED** will flash once.
   Press **ENTR** button again for Preset 2. **'STAT' LED** will flash twice.
   Press **ENTR** button again for Preset 3. **'STAT' LED** will flash three times.
6. Once desired preset has been reached Press PRG button to exit programming mode.

# Wiring

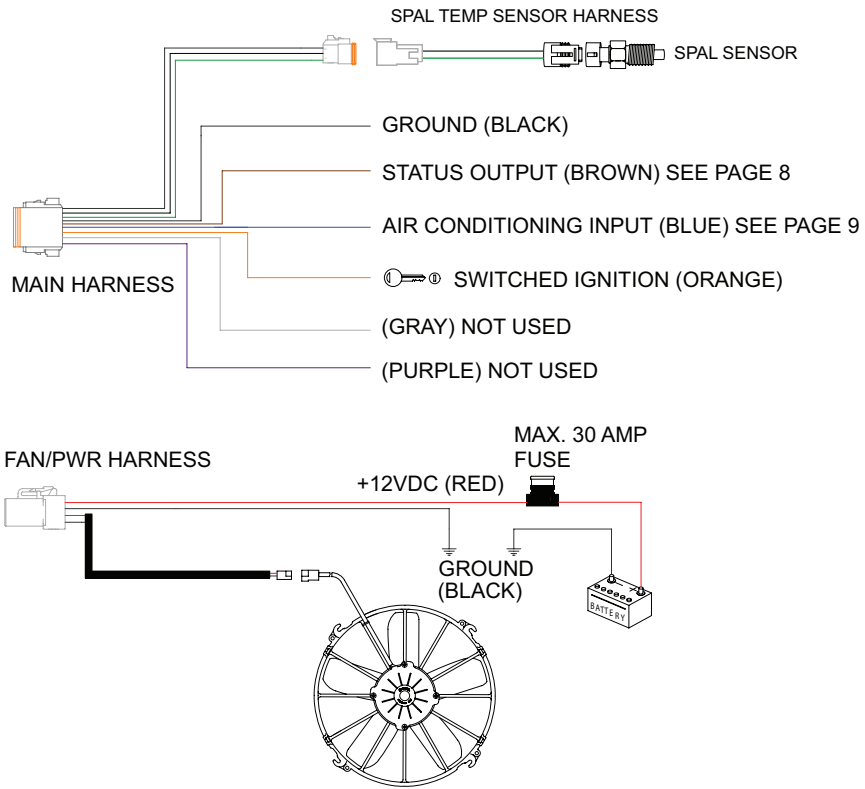
| Wire Color | Harness | Wire Connection |
|---|---|---|
| RED | FAN/PWR | Fan Positive with Fan Connector to Primary Fan |
| WHITE | FAN/PWR | Fan Negative with Fan Connector to Primary Fan |
| RED | FAN/PWR | +12VDC Power Directly to Battery |
| BLACK | FAN/PWR | Ground |
| PURPLE | MAIN | Not Used |
| ORANGE | MAIN | Switched Ignition (+12VDC when vehicle is running) |
| GRAY | MAIN | Secondary Fan Output (negative trigger for relay) |
| BLUE | MAIN | Air Conditioning Input (+12VDC when A/C compressor is ON |
| BROWN | MAIN | Status Output (negative output for Light/LED) |
| WHITE | OEM SENSOR HARNESS | OEM Temperature Sensor (Variable Voltage 0-5 VDC) |
| BLACK | SPAL SENSOR HARNESS | SPAL Temperature Sensor with connector |
| GREEN | SPAL SENSOR HARNESS | SPAL Temperature Sensor with connector |
| **Optional Second Fan Relay (FRH)** | | |
| YELLOW | FRH | +12VDC Directly to Battery |
| RED | FRH | Secondary Fan Positive |
| GRAY | FRH | PWM Secondary Fan Output (Gray wire from FAN-PWM) |
| ORANGE | FRH | Switched Ignition (+12VDC when vehicle is running) |
| BLACK | FRH | Chassis Ground |

## Single Fan OEM Sensor

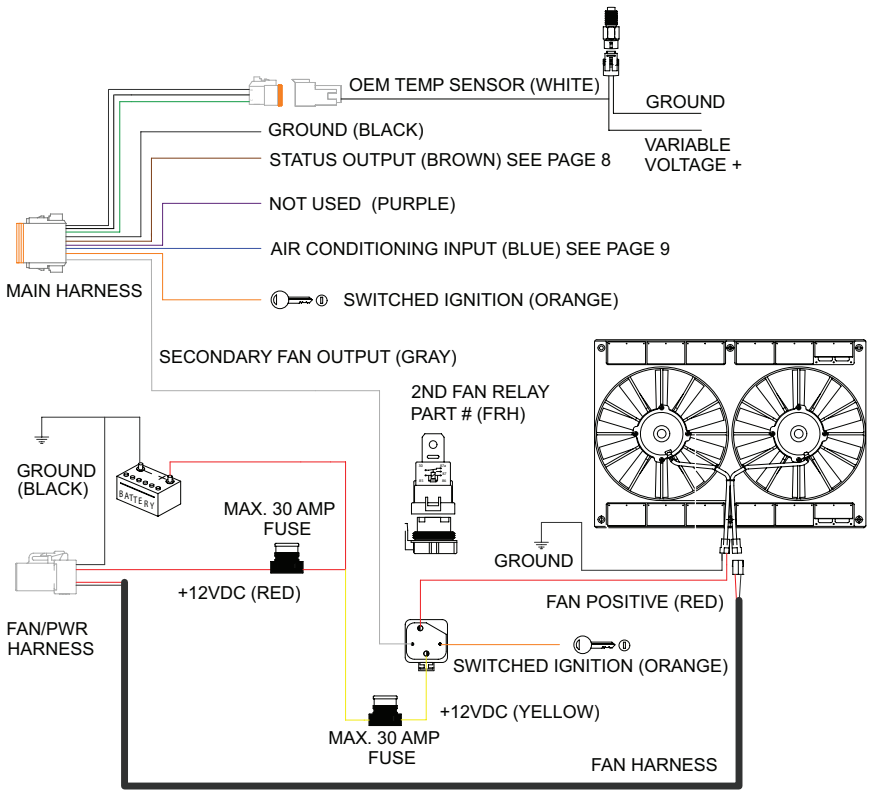


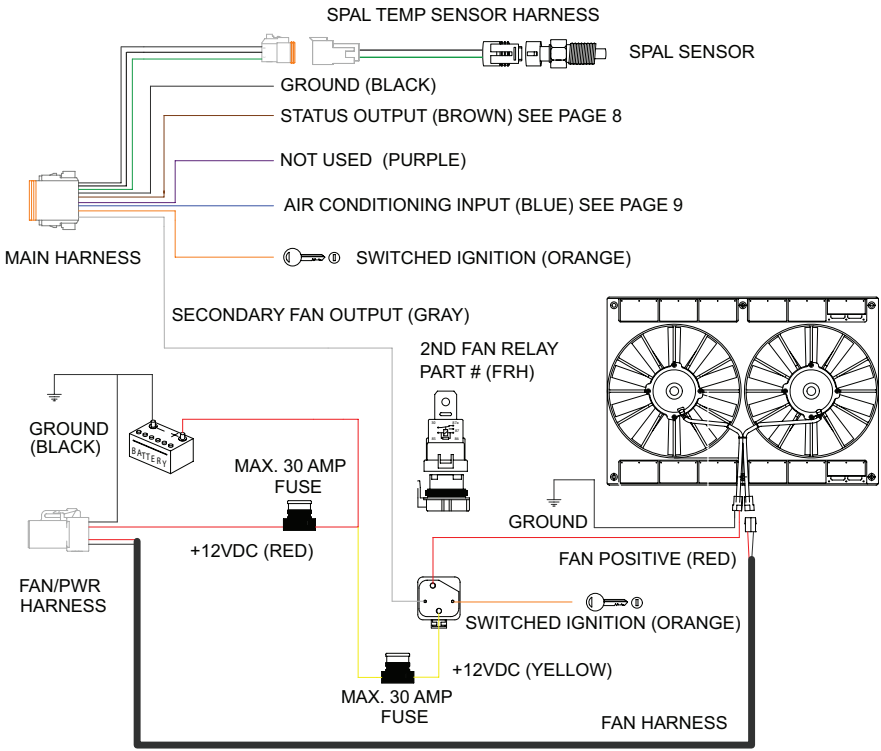
# Single Fan SPAL Sensor



# Dual Fan OEM Sensor



# Dual Fan SPAL Sensor

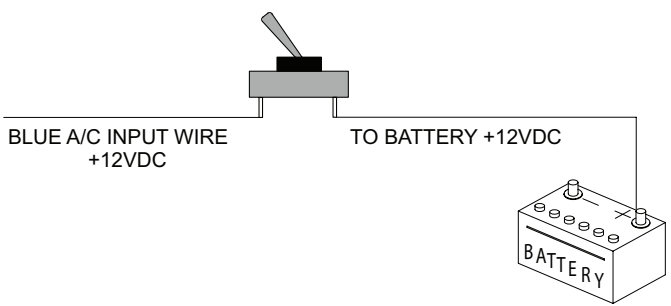


This will allow your cooling fan to run anytime the override switch is ON.

**WARNING:** There is a 15 second delay after you flip the switch ON and a 30 second delay after you flip the switch OFF. After you turn the switch ON the FAN(s) will go to Full speed after the 15 second delay. The FAN(s) will stay on high until the 30 second delay is complete. If the switch is turned ON and OFF repeatedly the delay will restart after the last time the switch was turned ON or OFF.

****SPAL USA suggests this override switch also trigger the electric water pump relay. This will allow a single override switch to control both the fan and electric water pump.****

Note: 1. The fan will continue to run indefinitely if the switch is not shut off.
2. When running for extended periods of time, the voltage should be monitored as to not overly discharge the vehicle's battery.



## Resetting Or Restoring FAN-PWM Back To Factory Defaults

To reset or restore the FAN-PWM back to its original settings, press and hold both the **ENTR** and **PRG** buttons down for 10 seconds. The **'STAT' LED** will blink 5 times

## Blinking LED Code Explanations

| Number of Blinks on 'Stat' LED | Error Description |
|---|---|
| 1 | Code 1: |
| 2 | Code 2: |
| 3 | Code 3: |
| 4 | Code 4: |

## CODE 1: Sensor Input Not Found

The FAN-PWM is not sensing a connection to a temperature sensor. Verify connections to the temperature sensor. If using an OEM sensor, verify correct temperature sensor wire is being tapped. See info under High and Low Program Data Error for more information on sensor issues. If using SPAL sensor did you cut the sensor harness connector off? If the sensor connector is cut off then you have to splice the white wire to the green wire. If you have hooked the system to a switch instead of a gauge type sender this error will occur once the switch reaches its activation temp. Primary and secondary fan will run during this error condition.

## CODE 2: Fan Not Found Or Fan Speed Error

The FAN-PWM is not sensing a fan or the fan is not functioning properly. Verify the connections and operation. A brushed DC motor MUST be connected to the fan output or the unit will report an error code. Possible use with very low power (<4A) fans and non SPAL products may also cause Fan Not Found Error code. SPAL USA will not guarantee this product's functionality with non SPAL fans as too often specifications are unknown.

## CODE 3: High & Low Program Data Error

You will need to reprogram the High and Low temperature settings on the FAN-PWM. If you are using the SPAL temperature sensor then you can reprogram using one of the default settings. Temperature sensor issues are addressed as follows.

1. Using a SPAL Temperature Sensor (FAN-PWM-TS)
   a. Your LOW and HIGH settings are too close in temperature, either move your LOW lower or the HIGH higher. A MINIMUM of 10° AT THE SENSOR between the two points is recommended.
   b. Possible bad wire connection. Double check all connections and repeat the programming sequence.

(continued next page)

## CODE 3: High & Low Program Data Error (continued)

2. Using Factory Coolant Temperature Sensor (OEM) or Electric Water Temperature Gauge

   a. Sensor profile not compatible with current LOW/HIGH values. Depending on the application a minimum spread of 10°to 15° may not be sufficient. This is more prevalent with older factory water temperature gauges. The voltage difference between the HIGH and LOW temperature settings must be .1 Volt or higher.

   b. White wire not connected to proper wire on vehicle. Typically on a 2 wire coolant temp sensor, one wire will be a chassis ground while the other will vary in voltage with temperature. The white wire must be connected to the wire which varies in voltage.

   c. Connection was made to a temperature SWITCH not a sensor. The FAN-PWM will not function connected to a switch (such as our 185-TS) that is used to turn on a relay or warning light. The sensor type must be for a gauge or a coolant temp sensor for a fuel injection computer.

   d. Wiring from the sensor to the gauge or computer is faulty. The white wire is a passive input and it must be connected in parallel with the original circuitry designed for that specific sensor.

## CODE 3: High & Low Program Data Error (continued)

e. There are some 2 stage computer sensors which vary in voltage in 2 steps. These sensors drop in voltage until they reach a certain temperature (example 200°) then the engine raises the power level suddenly to have another similar drop in voltage. You might be able to program the FAN-PWM to work within ONE of these stages. But as a side effect, it will work also in the other stage which means the fan may operate when not necessarily needed. For complete proper operation in this case you will need to use a SPAL temperature sensor.

## CODE 4: Module Over Current Error

Over current protection means that the output will SHUT DOWN if the measured fan continuous run current increases above 30A for extended periods. If running a fan that is approaching this amount of current draw (>25A), SPAL USA recommends that the installation also include a status light so the operator will be aware of the fan status.

## My Temperature Settings Are Not Staying Programmed.

After programming the Low and High temperature settings make sure you are not pressing the ***ENTR*** button when ***'FAN' LED*** is Blinking ***GREEN***. If the ***ENTR*** button is pressed after programming, the FAN-PWM is set to a factory default setting erasing your previous settings.

## My Fan Stays On All The Time

1. DO NOT ground the "primary" fan to the chassis. If the fan's negative on the first fan is wired to a chassis ground, then the fan will be on. Wire the primary fan's negative to the FAN-PWM fan negative. The FAN-PWM variable speed control is through the negative side.

2. Is the A/C override hooked up? Check the power input to the Blue wire and verify that it is only receiving a + 12 VDC when the A/C is on.

3. Is the small black wired hooked to a good ground source? If there is no ground on that wire the PWM will run on high speed with the red LED on 5 seconds after the ignition is switched on.

## FAN-PWM Dosen't Turn On

1. Check fuses
2. Check battery and ignition wires for power
3. Check both ground connections. Make sure the small and large gauge black wires are connected to ground

## Second Fan Will Not Turn On

1. Check relay wiring
2. Confirm ground signal from FAN-PWM on Gray wire when on High
3. Verify fan is working properly by grounding the gray wire from the relay and turning the ignition on, fan should run at this time.

## Fan Does Not Go Into High Mode Immediately After The A/C or Manual Override Is Turned On

1. After the A/C or manual switch is turned on, there is a 15 second delay before the FAN-PWM will override into High Mode.
2. Verify there is + 12 Volts going to the Blue wire when A/C or switch is turned on.

## Fans Stays In High Mode After Turning Off The A/C Or Switch

1. After the A/C or switch is turned off, there is a 30 second delay before the FAN-PWM will resume its normal variable speed operation.
2. Verify there is no power present on the Blue wire when the A/C or switch is turned off.

For optional wiring diagrams, including 2-speed fans - visit www.spalusa.com, or contact tech support at 1-800-454-7725 - email tech@spalusa.com

# SPAL Limited Warranty

SPAL USA warrants this product to be free from defects in material and workmanship for a period of eighteen (18) months from the date of sale of the original purchaser. SPAL USA will repair this product free of charge if, in the judgment of SPAL USA it has been proven defective within the warranty period. The product should be returned, at the customer expense, to the location of original purchase. This warranty does not cover any expenses incurred in the removal and/or reinstallation of the product.

This warranty does not apply to any product damaged by improper installation, misuse, abuse, improper line voltage, fire, flood, lightning, or other acts of God, or a product altered or repaired by anyone other than SPAL USA.

This warranty is in lieu of other warranties, expressed or implied, including any implied warranty of merchantability. No person is authorized to assume for SPAL USA any other liability concerning the sale of this product.

***IMPORTANT - KEEP YOUR RECEIPT WITH THIS WARRANTY STATEMENT!**

If you have other questions about the installation of the FAN-PWM contact SPAL USA tech support at 1-800-454-7725 or email tech@spalusa.com. Additional information and updates can be found on at www.spalusa.com.



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