

Lingenfelter VSFM-002 Variable Speed DC Brushless Fan & Pump Controller Instructions



PN: L460320002

Parts List

Lingenfelter VSFM-002 Variable Speed DC Brushless Fan & Pump Controller (PN: L460320002)

#	Description	Part number
1	Variable speed control module	VSFM-002
2	Hook & loop tape	
2	Self-tapping screw	AV16037
1	LPE decal	L920010000
1	Instructions	

Tools & Materials Required

- Phillips head screwdriver
- Wire crimping tool

Optional Items

Description	Part number
LPE technician's screwdriver	L950050000

Description:

The Lingenfelter VSFM-002 is designed to provide the PWM speed control signal needed to operate variable speed OEM and aftermarket DC brushless cooling fans and fluid circulation pumps. The speed can be controlled based on a temperature input signal (e.g. Resistive Temperature Detector (RTD) or Thermistor) or a simple switched input for on/off type control. The VSFM-002 also has a relay control output to control a warning light or auxiliary device.

- Works with OEM and aftermarket IAT, ECT, EGT, TFT sensors including (more on page 12):
 - GM IAT (12160244/12614717)
 - ECT (12608814/12636612)
 - TFT (12458118)
 - Oil temperature sensors (15326388)
 - Bosch 2780071435, 2782569739, 2782650379, 2782610059, 0280130039
 - AEM 30-2012 and other similar fluid temperature sensors
- Works with OEM and aftermarket EGT & platinum RTD sensors, including (more on page 12):
 - AEM 30-2050
 - GM 12636612
 - ACDelco 213-4695
 - Bosch PT 200E
 - Sensata TS200-A
 - PT200 RTD
- Works with OEM and aftermarket DC brushless electric fans & coolant pumps made/ sold by:
 - GM, Bosch, Cooper Industries, Pierburg, and others to be added.
 - Works with SPAL OEM and aftermarket NUOVA DC brushless fans, including the "Standard Series" and the newer "Plus Series" fans.

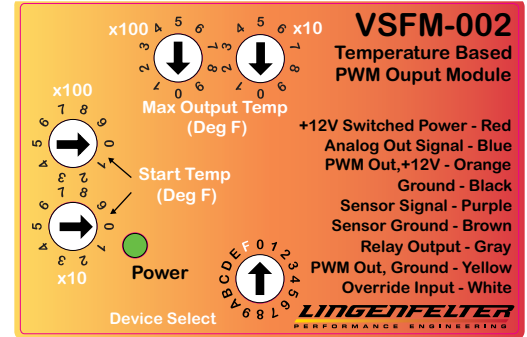
The VSFM-002 can replace the following SPAL sensors: SBL-TS01, SBL-TS02, SBL-TS03, SBL-TS215P, SBL-TS185P, SBL-TS165P.

Specifications

- Two sets of easily adjustable device control switches
 - "Start Temp" sets the initial on temperature for the device(s)
 - "Max Output Temp" sets the temperature for the maximum device speed.
 - The VSBM-002 provides a linear output speed control between these two settings
 - The same switches are also used to set speed% in direct device speed control mode.
- Can be used to control multiple devices (all devices must be the same input type)
- Available output types:
 - Outputs have a self protect feature and will turn OFF in case of direct short or over current condition.
 - Two frequency based output wires (1-250 Hz)
 - Push-pull +12V peak output
 - Open drain ground control type output
 - Relay Output - The relay control output will output a ground signal when the fan is operating at maximum speed. The relay control output is intended to control a warning light or auxiliary device, such as an additional fan.
 - Output rated for up to 0.75 Amps.
 - Analog Output signal
 - Output an analog, 0-5 Volts, signal based on temperature or fan/pump speed %.
 - Send temperature or fan/pump speed to an ECM, data acquisition system, or a gauge.
- One input manual override/activation wire available (AC related activation, manual override, etc.):
 - Input signal impedance: 100k Ohms.
 - +12V or ground activation signal wire determined by a DIP switch inside the back cover.
 - The DIP switch enables and disables a pull-up resistor
 - Pull-up enabled - ground activation
 - Pull-up disabled - +12V activation
- Operating voltage range: 9.0 to 18.0 volts.
- Current draw: (max 4 amps) 0.1 amp plus current draw of device being controlled
- **The temperature switch settings can be adjusted in 10 degree increments from 0 to 990 degrees.**
 - **IAT, ECT, and TFT (thermistor) sensors are in Fahrenheit (F)**
 - **EGT/platinum RTD sensors, due to the larger temperature range, are in Celsius (C).**
- Custom molded high temperature glass filled Nylon 6 enclosure.
- Fully encapsulated (potted) construction for increased durability.
- One year warranty (from date of purchase).

Settings on the front face of the VSFM-002:

- Single sixteen position switch for selecting the type of device to be controlled.
- Two ten position switches for selecting the temperature* at which the fan/pump is at its minimum speed.
 - Start Temp (Deg F) x100**
 - Start Temp (Deg F) x10**
- Two ten position switches for selecting the temperature* at which the fan/pump is at its maximum speed.
 - Max Output Temp (Deg F) x100**
 - Max Output Temp (Deg F) x10**
- Max Output Temp MUST BE GREATER THAN Start Temp when in TEMPERATURE CONTROLLED PWM mode.



*When in User Controlled Fan/Pump Speed % Mode, the dials set percentage.

**When using EGT/ RTD sensors, the dials are in Degrees Celsius (see table 3 for Celsius/Fahrenheit Conversion)

Wire Color	Label Notes	Notes
Red	+12V Switched Power	Connects to a switched and fused +12V source.
Blue	Analog Out	This wire provides a variable 0-5 V output based on fan/pump speed or temperature.
Orange	PWM Out, +12V	This wire provides a +12V push-pull peak output.
Black	Ground	Connects to a vehicle ground.
Purple	Sensor Signal	Connects to output of Sensor
Brown	Sensor Ground	Connects to ground of Sensor
Gray	Relay Output	Connects to the ground side of the device you wish to control (rated 0.75 Amps).
Yellow	PWM Out, Ground	This wire provides open drain ground control.
White	Override Input	This connects to a device that will provide a +12V or ground signal to activate the module.

Settings inside the rear cover of the VSFM-002:

- Five two position DIP switches (the location of these switches are shown in the image below).
 - **Sensor Selection**
 - DIP switch #1 and #2 selects the temperature sensor (**more information relating to sensors is located on page 11**).

Sensor Type (see Table 3)	DIP Switch	
	#1	#2
GM/ECT/IAT/TFT (Type 1)	↓	↓
AEM ECT (Type 2)	↓	↑
GM EGT RTD (Type 3)	↑	↓
Bosch ECT/IAT (Type 4)	↑	↑



- **Control Mode Selection**
 - DIP switch #3 selects the desired fan/pump control mode.

Fan/Pump Control Mode	DIP Switch
	#3
Temperature Controlled PWM mode	↓
User Controlled Fan/Pump Speed % mode	↑

- **Override Input Activation Polarity Selection**
 - DIP switch #4 and #5 selects the Override Input Activation polarity.

Activation Polarity	DIP Switch	
	#4	#5
+12V Activation	↓	↓
GND Activation	↑	↑

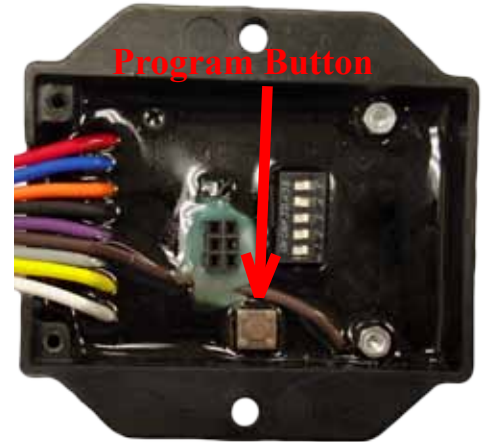
- **If DIP switch #4 and #5 are not in the same positions as one of the combinations listed above, you WILL NOT get the output you expect unless you are using the advanced settings.**
 - Advanced settings are located in Appendix A.
- One push-button is used for Programming Mode (selects the Analog Out output type).

Push-Button Programming Mode:

Programming mode is used to program the Analog Out output on the VSFM-002. There are two options for the Analog Out output. The VSFM-002 can output an analog voltage based on either temperature or fan/pump speed.

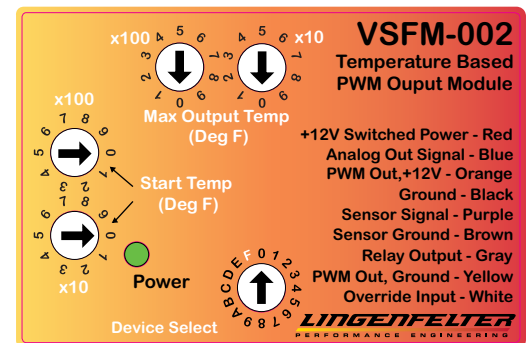
If you are not planning on using the Analog Out output, you do not need to program this feature.

- **The default Analog Out output is temperature based.**
- When the temperature option is selected, the Analog Out will output a 0-5 V (+/- 0.02 V) linear analog signal dependent on the temperature sensor you have chosen (more information on page 11 and 12).
 - GM ECT/IAT/TFT, AEM ECT, and the Bosch IAT/ECT sensors:
 - 0.02 V \approx 1.4 Deg F
 - 0-350 Deg F
 - 0.00 V = 0 Deg F
 - 5.00 V = 350 Deg F
 - GM/AEM/Bosch/Sensata EGT Platinum RTD sensors:
 - 0.02 V \approx 5 Deg C (9.1 Deg F)
 - 0-1275 Deg C
 - 0.00 V = 0 Deg C (32 Deg F)
 - 5.00 V = 1275 Deg C (2327 Deg F)
- When the speed option is selected, the Analog Out will output a 0-5 V (+/- 0.02 V) linear analog signal dependent on the current speed (0-100%) of the fan/pump. Analog Out will output 0.00 V at 0%, and Analog Out will output 5.00 V at 100%.



To enter Programming Mode:

- Ignition off (VSFM-002 power off)
- Set all four 10 position switches to 0 and the 16 position switch to 0. The "Start Temp" setting switches should be pointing to the right, the "Max Output Temp" setting switches should be pointing down, and the "Device Select" 16 position switch should be pointing up. See illustration on the right for switch positions.
- Ignition on
- The LED should now blink green.
- Press the brown PROGRAM button on the back of the VSFM-002 to toggle between the different Analog Out options:



Analog Out	LED
Temperature	Blinking GREEN
Speed	Blinking RED

- After you have selected the correct Analog Out option, press and hold the brown PROGRAM button on the back of the VSFM-002 until the LED begins blinking RED and GREEN (approximately 3 seconds).
- To exit Programming Mode, turn off the unit (ignition off) and while the VSFM-002 is powered off set the front cover switches to the desired settings.

Device Select:

Table 2 below lists the current fans/pumps that the VSFM-002 can operate. The table is not limited to the mentioned devices. If your device has the same parameters as the ones listed in Table 2, you can use the VSFM-002 to control your device. The table definitions are listed below:

- Device Select - selects the fan/pump you wish to control. Located on the front of the VSFM-002 (0-F 16 position switch).
- Polarity:
 - Positive - your device reads the high voltage side of the PWM signal.
 - Negative - your device reads the low voltage side of the PWM signal.
- Frequency (Hz) - the frequency at which your device operates.
- Off Duty % - the duty cycle your device needs for your device to be off.
- Min Duty % - the duty cycle your device needs to run at minimum speed.
- Max Duty % - the duty cycle your device needs to run at maximum speed.
- Failure Duty % - Your device will run at this duty cycle when the VSFM-002 recognizes that a temperature sensor is not connected when in TEMPERATURE CONTROLLED PWM mode.

Fan/Pump	Device Select	Polarity	Frequency (Hz)	Off Duty %	Min Duty %	Max Duty %	Failure Duty %
SPAL NON PLUS SERIES C7 CORVETTE OEM FAN*	0	NEGATIVE	100	5	15	90	90
SPAL PLUS SERIES FAN*	1	POSITIVE	100	5	15	90	90
COOPER & VARIMAX PUMP	2	POSITIVE	2	10	20	80	80
C6 CORVETTE FAN CONTROL MODULE PN: 10377609 (GM)	4	NEGATIVE	128	5	10	90	90
BOSCH GM CK TRUCK FAN	5	NEGATIVE	100	5	10	90	90
PIERBURG CWA50/200 PUMP	6	POSITIVE	100	9	13	85	85
PIERBURG CWA100/ BOSCH PUMP PN: 0 392 024 058	7	POSITIVE	100	9	13	93	93
PIERBURG CWA400 PUMP	8	POSITIVE	100	9	13	86	86
BOSCH FAN PN: 0 130 706 816	9	POSITIVE	50	5	15	85	85
PROTECHNIC PN: MGT1724UB-W51	A	POSITIVE	50	5	16	100	100

*For more information regarding SPAL fans, see APPENDIX B (page 14).

Temperature Controlled PWM Mode:

To enter Temperature Controlled PWM Mode, DIP switch #3 must be in the DOWN position.

Device operation:

The Temperature Controlled PWM mode is controlled by temperature. The speed of the fan/pump will increase linearly with input temperatures between Start Temp and Max Output Temp. When the input temperature is less than Start Temp, the fan/pump will be off. When the input temperature is equal to Start Temp, the fan/pump will operate at minimum speed. When the input temperature is greater than or equal to the Max Output Temp, the fan/pump will operate at maximum speed.

When the Override Input is activated, the fan/pump will operate at maximum speed. If the VSFM-002 recognizes that a temperature sensor is not connected, the controller will go into failure mode. Failure mode will cause the fan/pump to run at maximum speed.

Relay Output Wire - The relay control output will output a ground signal when the fan is operating at maximum speed. The relay control output is intended to control a warning light or auxiliary device.

LED operation:

- Solid RED indicates that the fan/pump is off.
- Solid GREEN indicates that the input temperature is between Start Temp and Max Output Temp (fan/pump operating range).
- Blinking GREEN indicates that the input temperature is greater than or equal to Max Output Temp (fan/pump max speed).
- Blinking RED and GREEN indicates that the Override input is active (fan/pump max speed).
- Blinking RED indicates that Start Temp is greater than or equal to Max Output Temp, or there is no temperature sensor connected to the VSFM-002.

User Controlled Fan/Pump Speed % Mode:

To enter User Controlled Fan/Pump Speed % Mode, DIP switch #3 must be in the UP position.

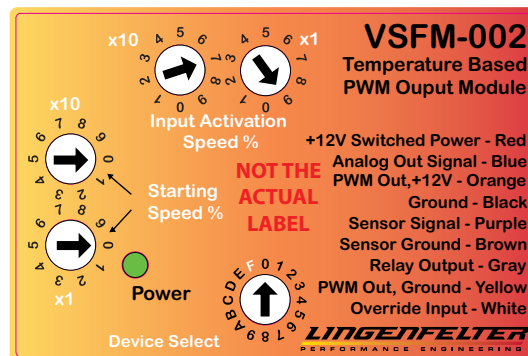
Note - You will only need a temperature sensor in this mode if you are using Analog Out to output a 0-5 V signal based on temperature. The temperature sensor does not control the speed of the fan.

Speed Control:

- 0% is off.
- 1% is minimum speed.
- 99% is controller output maximum speed.
- Actual speed percentage is +/- 1%.

Device operation:

The User Controlled Fan/Pump Speed % is controlled by user input. In this mode, the Start Temp dials function as the Starting Speed %, and the Max Output Temp dials function as Input Activated Speed %. The conversion from Temperature to Speed % is as follows: **10 Degrees in Temperature Controlled PWM Mode = 1% in User Controlled Fan/Pump Speed % Mode. An EXAMPLE LABEL* for the USER CONTROLLED FAN/PUMP SPEED % Mode is shown in the image below.**



***Note: this is not the actual label of the VFSM-002. This label is used here for the sole purpose of showing how the module operates when in the User Controlled Speed % Mode.**

In the example shown above, the starting speed %

The Fan/Pump speed percentage pertains to the fan/pump device select chart (Table 2).

0% = Off Duty %

1% = Min Duty %

99% = Max Duty %

When the VFSM-002 is powered on, the fan/pump will begin to operate at the Starting Speed %. Once the VFSM-002 Override Input is active, the fan/pump will operate at the Input Activated Speed %.

If you want the pump/fan off when the Override Input is not active, set Starting Speed % to 0. Then set Input Activation Speed % to the desired activation speed %.

NOTE: Starting Speed % does not have to be less than Input Activation Speed % in this mode.

LED operation:

- Solid GREEN indicates Override Input activation is inactive.
- Solid RED indicates Override Input activation is active.

LINGENFELTER

PERFORMANCE ENGINEERING

Installation:

1. Disconnect the negative battery terminal.
2. Connect the black wire of VFSM-002 to a suitable vehicle ground. **Failure to fully secure the ground wire to a vehicle ground source could result in malfunction of the module.**
3. Connect the red wire to a **switched and fused** +12 volt DC source. A 5-10 amp fuse should be sufficient.
4. Connect the gray Relay Output wire to the ground side of the device you wish to control.
 - A relay should be used if the relay control output will be controlling a device that pulls more than 0.75 amps.
5. Configure the DIP switch settings behind the back cover of the VFSM-002.
6. Connect the Purple and Brown Wire to a temperature sensor.
7. Connect the white wire to a desired activation source if using the Override Input.
8. Connect the PWM signal wire to the fan/pump you will be controlling (see Table 2 on page 7).
 - If the fan/pump you are connecting to has an internal pull-up resistor, connect the yellow PWM Out, Ground, to the PWM input on the fan/pump.
 - If the fan/pump you are connecting to does not have an internal pull-up resistor, connect the orange PWM Out, +12V, to the PWM input of the fan/pump.
9. Secure the VFSM-002 using the supplied hook and loop tape or using the supplied self-tapping screws.
10. Adjust the dials on the front of the VFSM-002 to desired settings.
11. Reconnect the negative battery terminal.

Additional Notes and Warnings:

- Changes to the switch settings must be done with the VFSM-002 powered off.
 - The switch positions are only read on start up (initial device power up).
- The low Temperature Setting (Start Temp) must be less than the high Temperature Setting (Max Output Temp) when in Temperature Controlled PWM Mode.
- The VFSM-002 will not work on fans/pumps that require more than 250 Hz or less than 1 Hz for the PWM signal.
- Make sure that the VFSM-002 ground wire is properly secured to a vehicle ground. Failure to fully secure the VFSM-002 ground wire to a vehicle ground source could cause the VFSM-002 to malfunction.
- Do NOT submerge the module in liquid or directly wash the unit with liquid of any type. The switches on the VFSM-002 are sealed but are NOT rated for high pressure washing, use caution if power washing near the VFSM-002 module.
- Do NOT mount the VFSM-002 directly on top of the engine or near the exhaust manifolds due to heat concerns.
- Do NOT mount the VFSM-002 in the line of site of high temperature objects such as exhaust manifolds, turbine housings, etc... If needed, install a heat shield in between the heat source and the module to protect the plastic case.
- Do NOT install within 6" of nitrous solenoids or other devices with strong magnetic fields.
- Do NOT install near the spark plugs or the spark plug wires (or other potential strong sources of electrical noise).
- LPE recommends the use of resistor type spark plugs and RFI (radio frequency interference) and EMI (Electromagnetic Interference) suppression spark plug wires on all EFI engines and any vehicle that has electronic control modules on board (including the VFSM-002). Failure to do so may result in erratic operation of electronic device

Table 3: Temperature Sensor Resistance vs. Temperature					
Temperature		Temperature sensor type			
		(Sensor Type 1)	(Sensor Type 2)	(Sensor Type 3)	(Sensor Type 4)
		GM ECT/IAT/TFT (DIP Switch 1: Down DIP Switch 2: Down)	AEM / Autometer 1/8 NPT (DIP Switch 1: Down DIP Switch 2: Up)	GM / AEM / Bosch / Sensata EGT Platinum RTD (DIP Switch 1: Up DIP Switch 2: Down)	Bosch IAT/ECT Sensor Group (DIP Switch 1: Up DIP Switch 2: Up)
°C	°F	Resistance values measured in Ohms			
-40	-40	100700	402000	170	45,313
-30	-22	52700	210000	178	26114
-20	-4	28680	114000	185	15462
-10	14	16180	64300	193	9397
0	32	9420	37500	201	5896
10	50	5670	22500	208	3792
20	68	3520	14000	216	2500
30	86	2238	8900	224	1707
40	104	1459	5800	231	1175
50	122	973	3900	239	834
60	140	667	2700	246	596
70	158	467	1900	254	436
80	176	332	1300	261	323
90	194	241	965	268	243
100	212	177	710	276	187
110	230	132	531	284	144
120	248	100	403	291	113
130	266	77	309	299	89
140	284	60	241	306	71
150	302	47	189	313	57
200	392	-	-	349	-
300	572	-	-	420	-
400	752	-	-	488	-
500	932	-	-	554	-
600	1112	-	-	618	-
700	1292	-	-	679	-
800	1472	-	-	738	-
900	1652	-	-	795	-
1000	1832	-	-	849	-

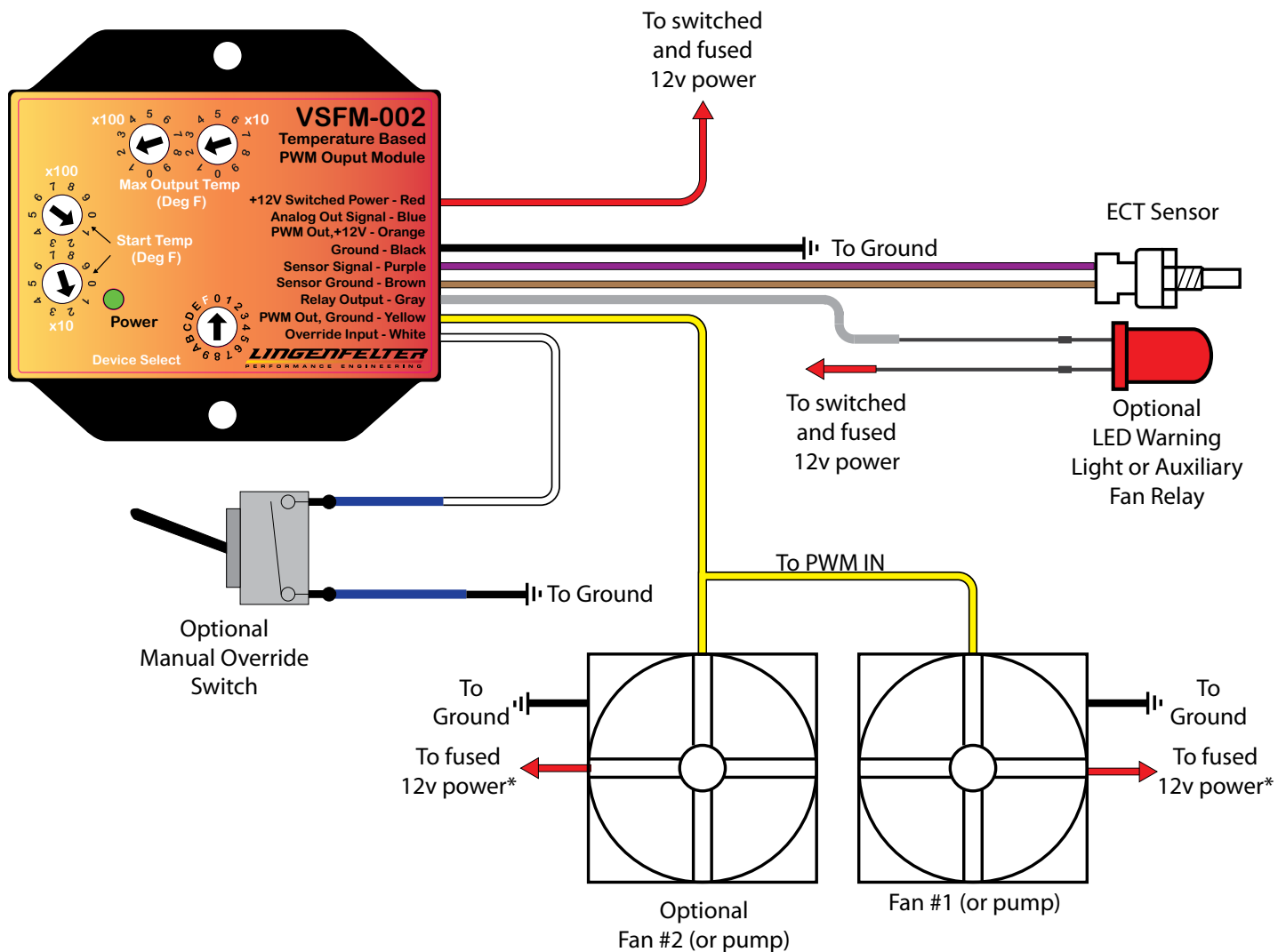
- All resistance values shown above are approximate and will be different based on which specific temperature sensor you use. Also keep in mind that most of these sensors are rated to within +/- 3% to 5% variation from sensor to sensor so the above tables are not exact.

Table 4: Common IAT, ECT & Other Fluid Temperature Sensors

Description	Sensor Type (Table 3)	Make	PN	Alternate PN	Thread Size	Mating Connector	Terminals	GM Service Harness	ACDelco Service Harness
Differential Temp. Sensor	Type 1	GM	20837545	N/A	M12 x 1.5	15449028	15326266	88987993	PT1798
Differential Oil Cooler Temp. Sensor	Type 1	GM	20907436	N/A	M12 x 1.5				
Manual TFT Sensor	Type 1	GM	12458118	N/A	M21 x 1.75	15449028	15326266	88987993	PT1798
ECT Sensor	Type 1	GM	12608814	213-4333	M12 x 1.5	15449028	15326266	88987993	PT1798
IAT Sensor, fast response	Type 1	GM	12614717	213-4405	M14 x 1.5 taper pipe	12162197	12089290	12102620	PT307
IAT Sensor, fast response	Type 1	GM	12160244	213-243	Press-in 14 mm	12162197	12089290	12102620	PT307
Ambient Air Temp. Sensor	Type 1	GM	15936931	213-4190	Press-in	12052641	12048074	12101856	PT248
ECT Sensor	Type 1	GM	12146312	213-928	3/8" - 18 NPTF	15449028	15326266	88987993	PT1798
ECT Sensor	Type 1	GM	15326388	213-953	M12 x 1.5	15449028	15326266	88987993	PT1798
ECT Sensor	Type 1	GM	1795138	N/A		15449028	15326266	88987993	PT1798
ECT Sensor	Type 1	GM	1924495	N/A		15449028	15326266	88987993	PT1798
IAT Sensor	Type 1	GM	12110446	N/A	3/8" - 18 NPTF	12162197	12089290	12102620	PT307
IAT Sensor	Type 1	GM	12146830	N/A	3/8" - 18 NPTF	12162197	12089290	12102620	PT307
IAT Sensor, fast response	Type 1	GM	25036751	213-190	3/8" - 18 NPTF	12162197	12089290	12102620	PT307
IAT Sensor, fast response	Type 1	GM	25037225	213-190	3/8" - 18 NPTF	12162197	12089290	12102620	PT307
IAT Sensor, fast response	Type 1	GM	25037034	213-190	3/8" - 18 NPTF	12162197	12089290	12102620	PT307
ECT Sensor	Type 2	AEM	30-2012	N/A	1/8" NPT				
EGT Sensor	Type 3	AEM	30-2050	N/A	M14 x 6H				
EGT Sensor	Type 3	GM	12636612	213-4695	M14 x 1.5	13510099	15326268	88987860	PT1703
EGT/RTD Sensor	Type 3	Bosch	10754551947	PT 200E	M14 x 1.5	F 02U 000 229-01			
EGT/RTD Sensor	Type 3	GE	920-569A-LR	N/A	M14 x 1.5	AMP 282080-1	AMP 282403-1		
EGT/RTD Sensor	Type 3	Sensata	TS200-A	N/A					
EGT/RTD Sensor	Type 3	Sensata	TS200-C	N/A					
RTD Sensor	Type 3	Sensata	TS200-F	N/A					
RTD Sensor	Type 3	Sensata	TS200-G	N/A					
IAT Sensor	Type 4	Bosch	2780071435	N/A	Press-in 18 mm	D 261 205 336-01			
IAT Sensor	Type 4	Bosch	2782650379	N/A	M12x1.5	D 261 205 288-01			
IAT Sensor	Type 4	Bosch	0280130039	N/A	M12x1/5	D 261 205 288-01			
ECT Sensor	Type 4	Bosch	2782569739	N/A	M12x1.5	D 261 205 288-01			
ECT Sensor	Type 4	Bosch	2782610059	N/A	M12x1.5	D 261 205 288-01			

Using the VSFM-002 to activate one or two fans or pumps based on ECT sensor output

Using the wiring diagram below, the speed of the fan(s) is based off of temperature. The fan(s) will turn on when the ECT sensor reads a temperature equal to the "Start temp." The fan(s) will run at maximum speed when the ECT sensor reads a temperature equal to or greater than "Max Output Temp." (There is a linear relationship between fan speed and the "Start Temp"/"Max Output Temp" window). If using a manual override switch, a ground signal is sent to the "Override Input" when the override switch is activated. This will cause the fan(s) to run at maximum speed. When the fan/pump is operating at maximum speed "Relay Output" is active. "Relay Output" can be connected to an LED warning light or an auxiliary cooling fan.



*Some Brushless PWM controlled fans/pumps may require a switched power source. Without a switched power source, the fan/pump may run at full speed or drain the battery when a pwm signal is not present (e.g. VSFM-002 is powered off). Other fans/pump do not require a switched power source, and will go into a low power mode when a pwm signal is not present. Check your fan/pump documentation to determine if your fan/pump requires a switched power source.

LINGENFELTER

PERFORMANCE ENGINEERING

APPENDIX A

Advanced Settings:

The advanced settings affect the Temperature Controlled PWM mode and the User Controlled Fan/Pump Speed % Mode.

When DIP switch #4 and #5 ARE NOT positioned in the same direction, the Override Input logic is reversed.

- Instead of the fan/pump operating at max speed (Temperature Controlled PWM Mode) or Input Activation Speed % (User Controlled Fan/Pump Speed % Mode) when there is an Override Input Activation signal present, the fan/pump will operate at full speed or Input Activation % when an Override Input Activation signal is not present.
- The tables below show the corresponding outputs depending on the different input combinations.

Temperature Controlled PWM mode (Page 8):

Activation Polarity	Input		Override Input Present	Output	
	DIP Switch			Fan/Pump Speed	LED
	#4	#5			
+12V Activation	↓	↓	NO	Normal Operation	
			YES	Max Speed	Blinking RED/GREEN
	↓	↑	NO	Max Speed	Blinking RED/GREEN
			YES	Normal Operation	
Ground Activation	↑	↑	NO	Normal Operation	
			YES	Max Speed	Blinking RED/GREEN
	↑	↓	NO	Max Speed	Blinking RED/GREEN
			YES	Normal Operation	

User Controlled Fan/Pump Speed % Mode (Page 9):

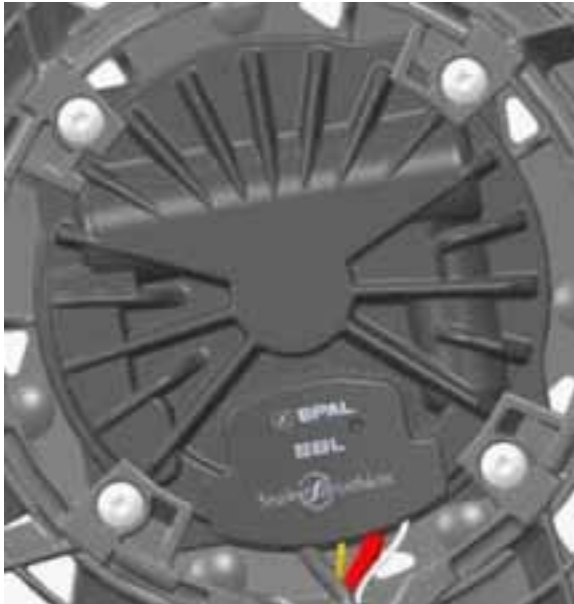
- (Speed1 %) refers to (Starting Speed %), and (Speed2 %) refers to (Input Activation Speed %).

Activation Polarity	Input		Override Input Present	Output	
	DIP Switch			Fan/Pump Speed	LED
	#4	#5			
+12V Activation	↓	↓	NO	Speed1 %	GREEN
			YES	Speed2 %	RED
	↓	↑	NO	Speed2 %	RED
			YES	Speed1 %	GREEN
Ground Activation	↑	↑	NO	Speed1 %	GREEN
			YES	Speed2 %	RED
	↑	↓	NO	Speed2 %	RED
			YES	Speed1 %	GREEN

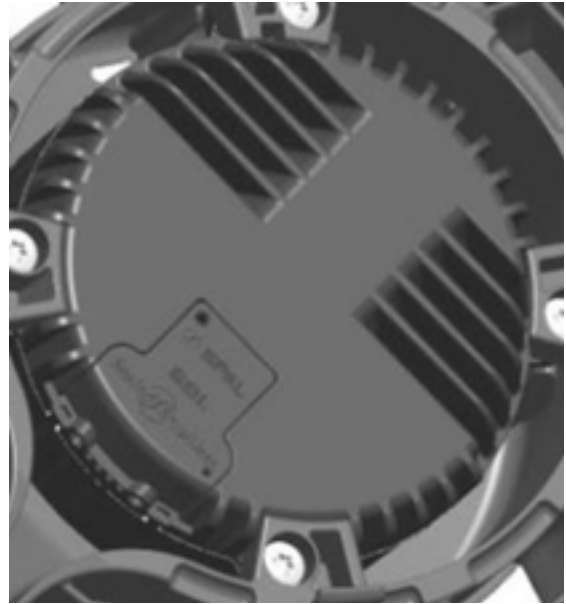
APPENDIX B

SPAL Control Strategy:

SPAL has two different control strategies. If you do not know which SPAL fan "Device Select" option (page 7) to choose, check the fan motor on the backside of the fan.



PLUS SERIES - Choose "Device Select" 1



NON PLUS SERIES - Choose "Device Select" 0

NOTE: SPAL specifies that a device using a SPAL control strategy to control a corresponding SPAL fan will not void the factory warranty. The Lingenfelter Performance Engineering VSFM-002 conforms to SPAL's control strategies.

Troubleshooting:

If you believe your device is not operating at the correct speed, check the following:

- Verify that you have selected the correct device (Table 2, page 7).
- Verify that you have selected the correct temperature sensor (Table 3 and 4, pages 11 and 12).
- Verify that the VSFM-002 is operating in the correct mode (DIP switch #3, pages 8 and 9).

If the Override Input is not working correctly, check the following:

- Verify that the Override Input signal is not activated when the VSFM-002 is powered on.
- Verify that you are using the correct Override Input signal (DIP switch #5, page 5).

NOTICES:

It is the responsibility of the purchaser to follow all guidelines and safety procedures supplied with this product and any other manufacturer's product used with this product.

Lingenfelter Performance Engineering assumes no responsibility for damages resulting from accident, improper installation, misuse, abuse, improper operation, lack of reasonable care, or all previously stated reasons due to incompatibility with other manufacturer's products.

Lingenfelter Performance Engineering assumes no responsibility or liability for damages incurred from the use of products manufactured or sold by Lingenfelter Performance Engineering on vehicles used for competition racing.

It is the purchaser's responsibility to check the state and local laws and sanctioning body requirements pertaining to the use of this product for racing applications. Lingenfelter Performance Engineering does not recommend nor condone the use of its products for illegal street racing.

For additional product installation information and technical support, contact LPE or your LPE products distributor. You can also find technical support and usage discussions regarding this product and many other LPE products in our Internet forums:

http://www.lingenfelter.com/forum_lingenfelter/index.php

Follow us on Facebook!

<http://www.facebook.com/home.php#!/lpehp>

Limited Warranty:

LPE warrants the Lingenfelter VSFM-002 Variable Speed Fan & Pump Controller be free from defects in material and workmanship under normal use and if properly installed for a period of one year from the date of purchase. If the module is found to be defective as mentioned above, it will be replaced or repaired if returned prepaid along with proof of date of purchase. This shall constitute the sole remedy of the purchaser and the sole liability of LPE. To the extent permitted by law, the foregoing is exclusive and in lieu of all other warranties or representations whether expressed or implied, including any implied warranty of merchantability or fitness. In no event shall LPE be liable for special or consequential damages.

Lingenfelter Performance Engineering
1557 Winchester Road
Decatur, IN 46733
(260) 724-2552
(260) 724-8761 fax
www.lingenfelter.com