PAC-2800BT

ELECTRIC COOLING FAN CONTROLLER

Included components:

PAC-2800BT

394191
BIM cable

RLY-3 70 amp
relay with socket

Optional components sold separately:

- Second 70 amp relay for dual fan or two speed fan operation – **RLY-3**
- Dakota Digital 300ºF temperature sender - **140022**

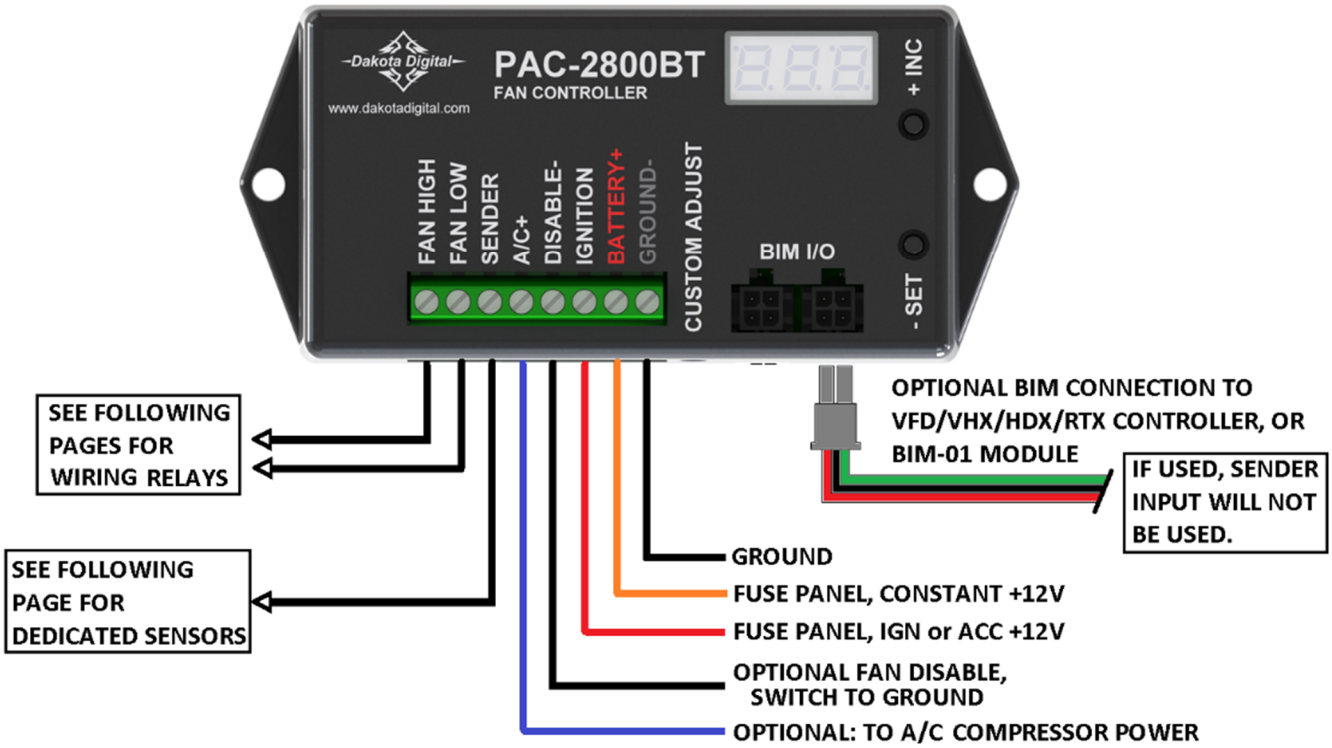
Installation

- Mount ONLY in vehicle cabin. Controller is not designed for engine compartment mounting.
- PAC-2800BT does NOT offer a constant temp display, but locate the module so the LED display can be seen and the built-in programming switches can be reached for initial setup, future adjustments and troubleshooting.
- Settings for several aftermarket temperature gauges are included to make installation easier: Stewart Warner, Classic Instruments, VDO, and Autometer. If your gauge isn't listed, a custom calibration option allows the PAC-2800BT to be calibrated to almost any gauge with clear numerical temp markings. The engine temperature can also be read directly from an OBDII diagnostic port with the use of a Dakota Digital BIM-01-X unit.

Wiring overview

PAC-2800 terminal strip connections:

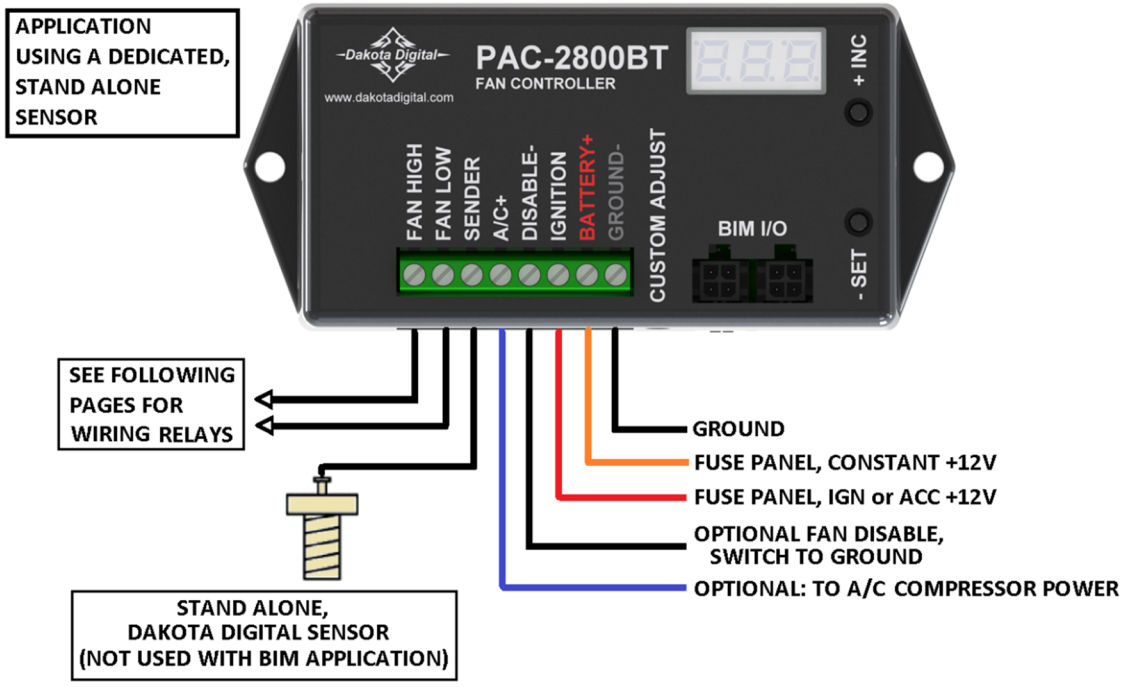
- FAN HIGH — Ground-trigger output; connect to the high fan relay harness white wire. (for single fan applications leave unconnected)
- FAN LOW — Ground-trigger output; connect to the low fan relay harness white wire.
- SENDER — Temperature sender input, connect to the engine temperature sender wire.
- A/C+ — +12V trigger from AC compressor cycle switch. (on systems without air conditioning leave unconnected)
- DISABLE- — Ground trigger input to disable fans. This ignores the temperature input and keeps the fans off. (normally left unconnected)
- IGNITION — Switched +12V input for PAC-2800; key-on hot (ignition power) only. Use a quality 5A fuse.
- BATTERY+ — Constant +12V input for PAC-2800. Use a quality 5A fuse.
- GROUND- — Ground input for PAC-2800; connect to a good chassis ground.
- **IGNITION, GROUND & SENDER will NOT need to be wired if the three wire BIM cable is used**
  - **Ignition, ground & data will be fed from the HDX/RTX/VHX/VFD control box**

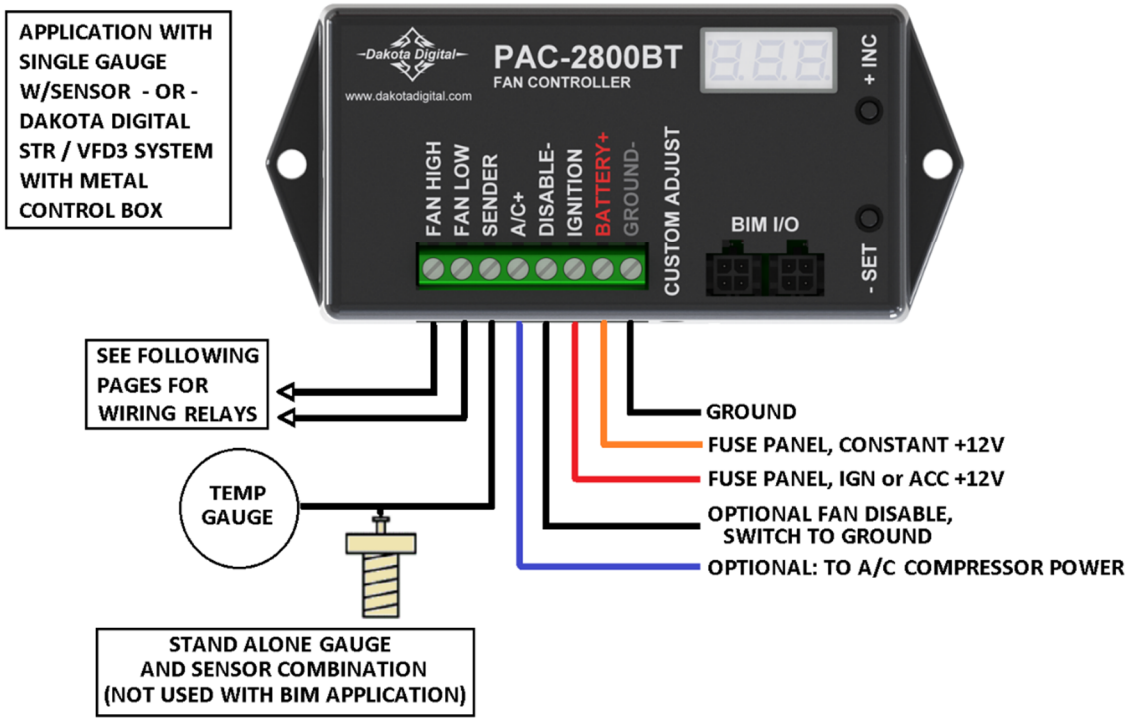


RLY-3 relay wiring

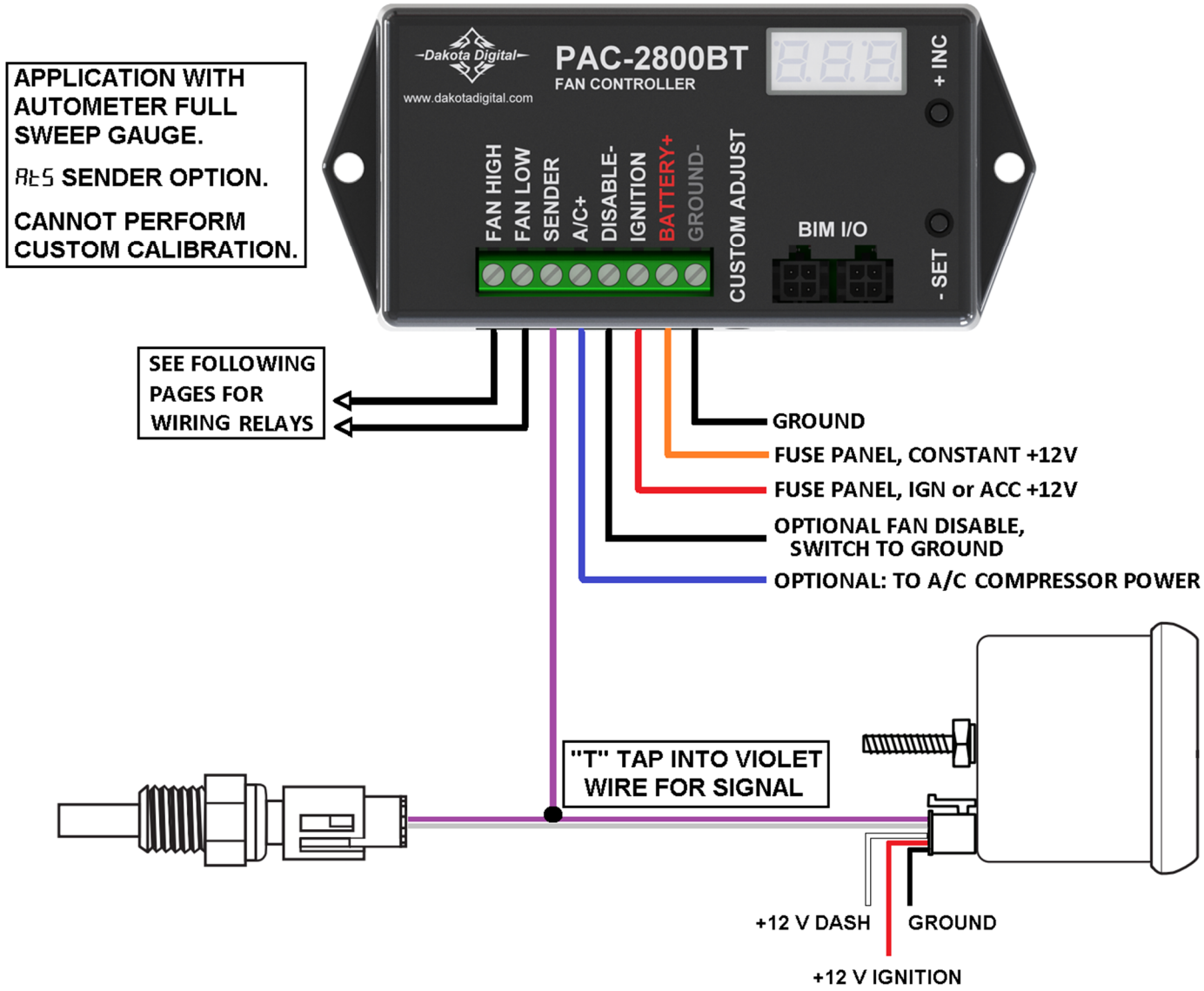
White	Ground-trigger input; connect to PAC-2800 output
Green	Relay input for fan power supply; fused, constant 12V battery input capable of supporting cooling fan AND is SEPARATE from the PAC-2800 +12V inputs
Red	Constant relay power, can share fused +12V battery connection with PAC-2800
Black	Relay output fan power supply; connect to cooling fan

Basic Wiring with Stand Alone Sender or Gauge

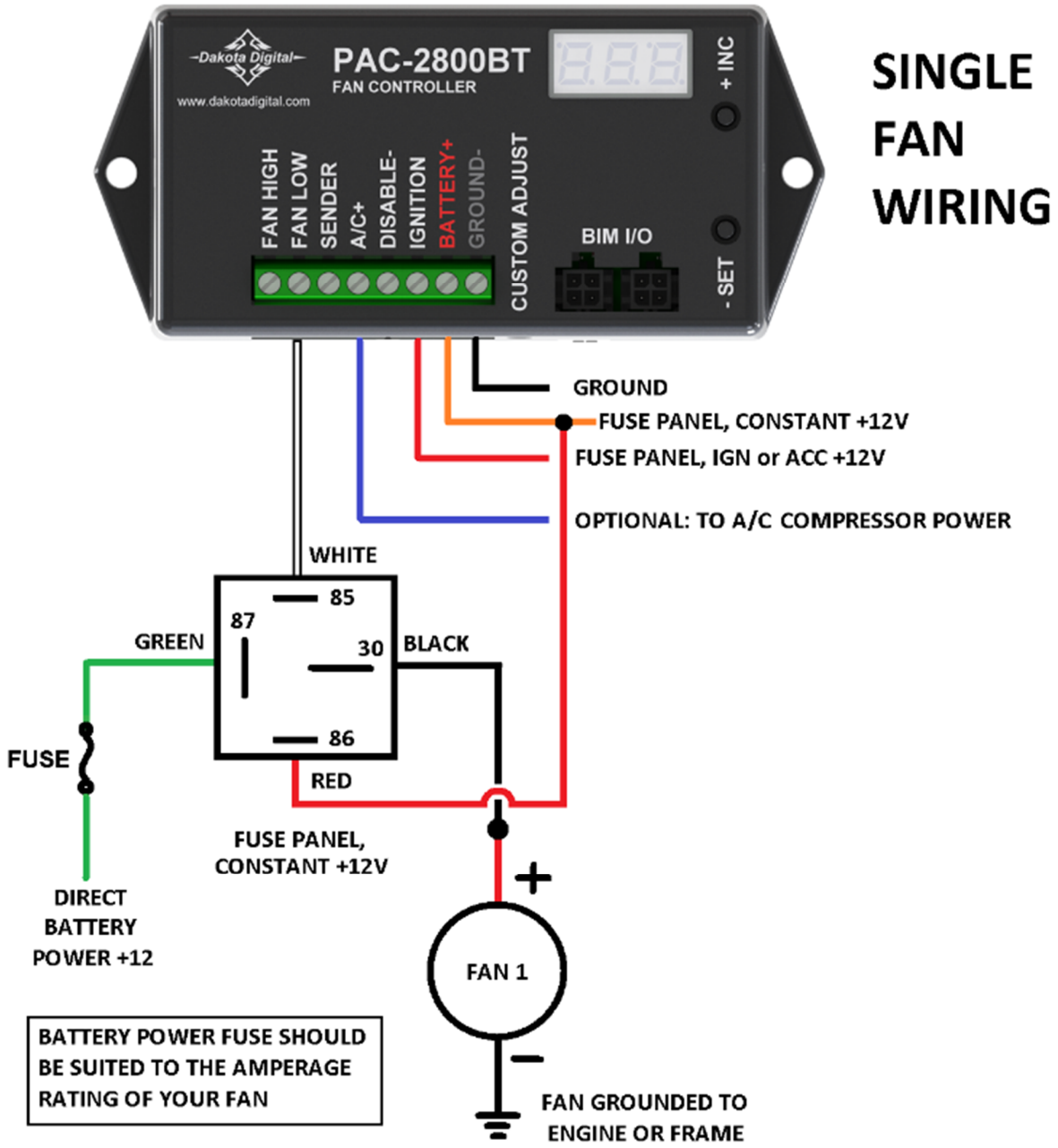




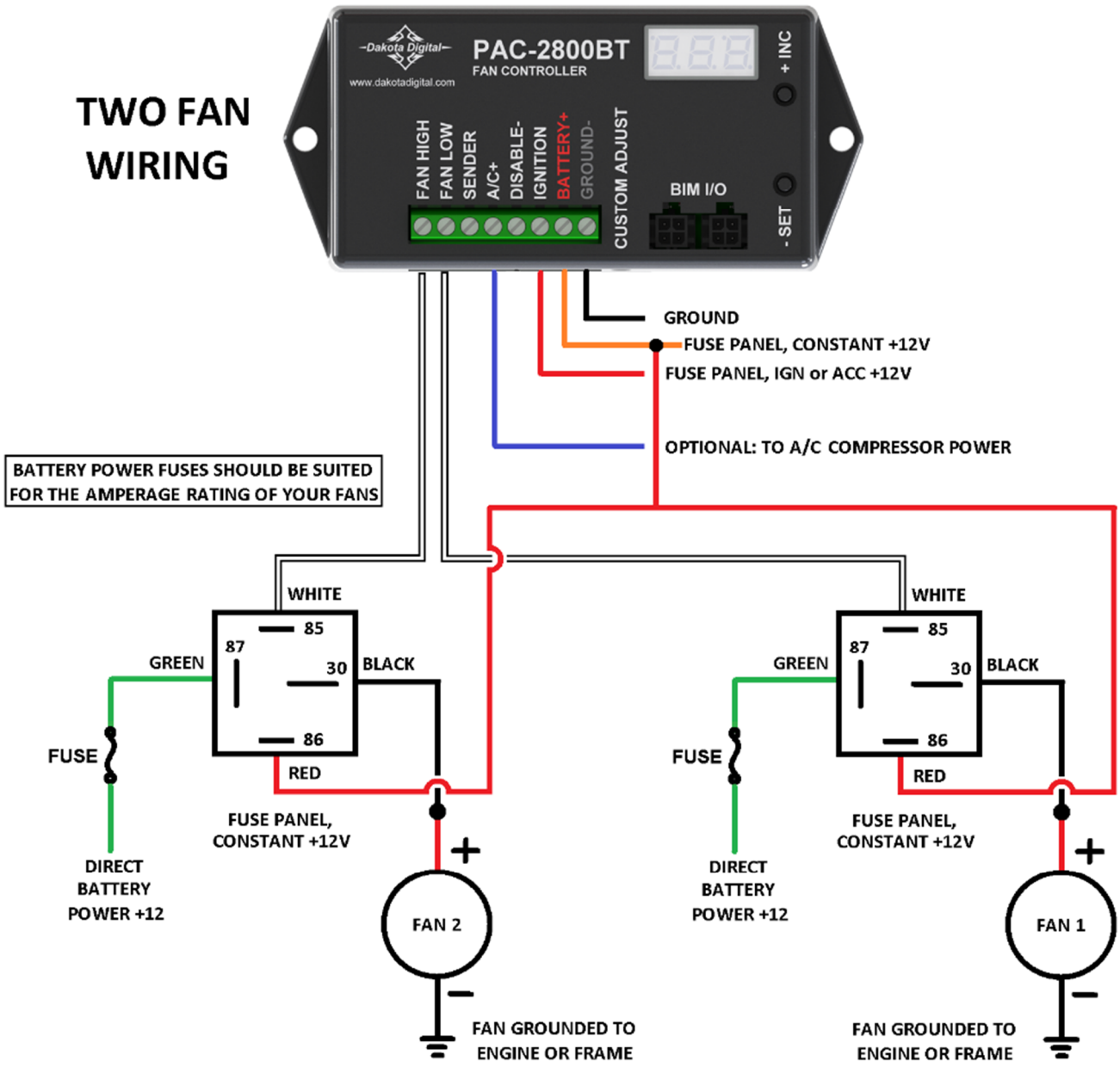
Basic Wiring with Autometer Full Sweep Water Temp Gauge



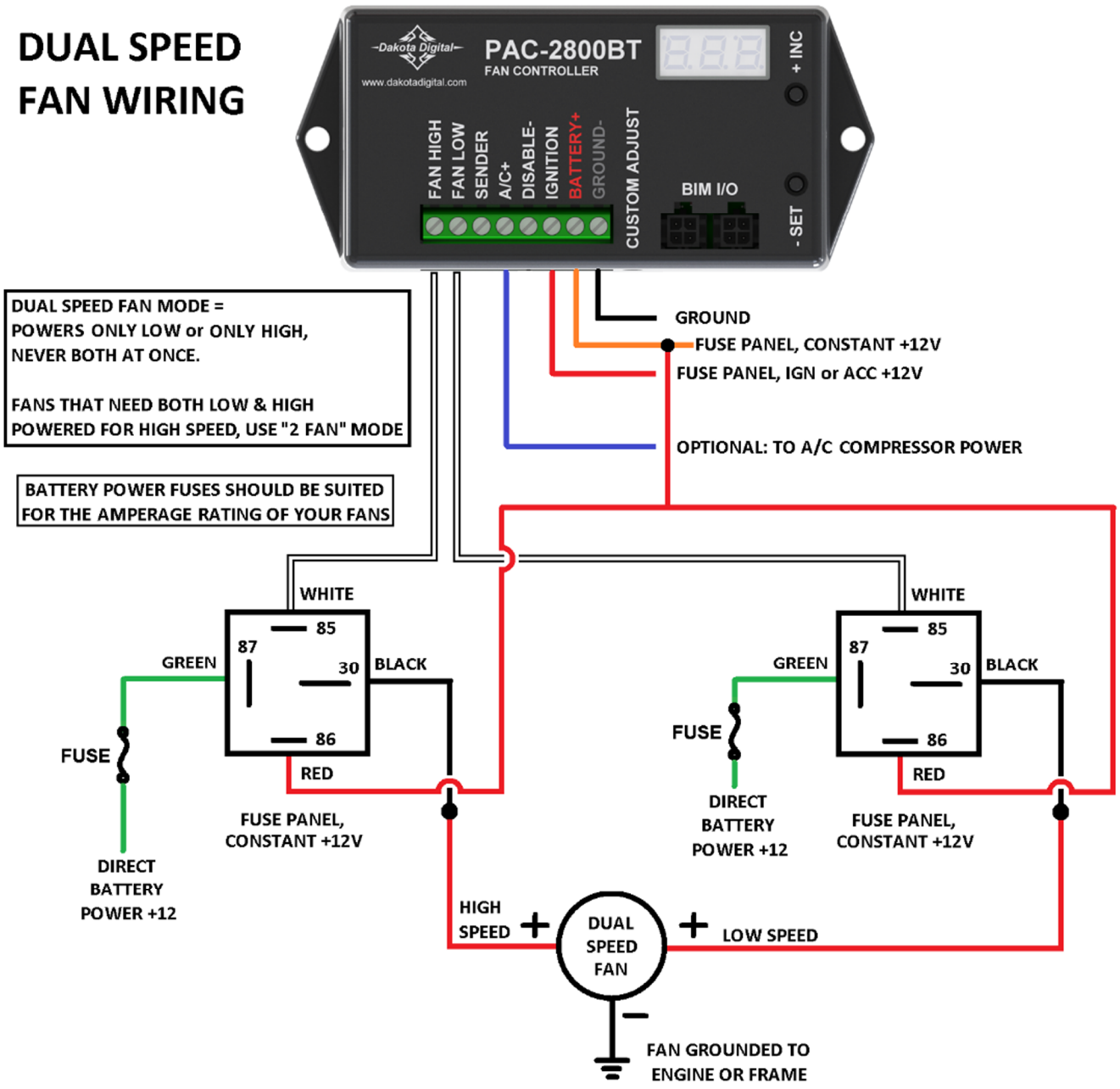
Wiring Relay for a Single Fan



Wiring Relays for Two Fans



Wiring Relays for a Dual Speed Fan



Operation

This electric cooling fan controller provides a way to run up to two electric engine cooling fans or one two speed cooling fan. (A second relay, sold separately, is required for two speed or dual fan operation). The controller monitors the engine temperature using a dedicated sender, a gauge and its sender, or directly from a Dakota Digital BIM connection.

When the engine temperature goes above the user-adjustable set point, the fan is turned on with a relay. When the engine has cooled below the user-adjustable off-temperature, the fan is shut off. Separate on and off temperatures can be set for the high and low fan outputs.

The controller will also run the fan when the air conditioner requires, by detecting when the air conditioning clutch is engaged. When the temperature information is provided by a Dakota Digital BIM connection, a high speed shut-off is also available to disable the fans from turning on once the vehicle is above a user-adjustable speed.

The unit can be set to keep the fan running (if the engine is hot enough) after the key is turned off. Several delay times are available from no delay to five minutes. The display will countdown the seconds left before the fan is turned off. If the battery voltage drops too low, the fan will be turned off and a "Lo bAt" message will display for the remainder of the time.

**** WARNING ****

As a fail-safe, the fan will turn on and run continuously if the sender is disconnected. Always keep clear of the fan unless the battery is disconnected. When entering setup mode in a VHX or VFD3 instrument system with the PAC-2800 connected via BIM cable, the fan will begin running continuously after a two-minute delay.

-IMPORTANT INSTALLATION NOTES-

- *If pairing this unit with a gauge, always ensure that your gauge is working properly. If the gauge is not reading correctly, the fan control unit will not have correct temperature information and cannot be guaranteed to properly control the fan, possibly leading to overheating and engine damage.*
- *If a gauge is not used, ONLY a Dakota Digital 300ºF sender should be used (Dakota Digital part SEN-04-1, SEN-04-2, SEN-04-4, SEN-04-5, SEN-04-6, SEN-04-7, or SEN-04-8). Other senders may not give a correct reading to the control unit.*
- *Custom gauge calibration requires numerical marks, stock "C-NORMAL-H" type gauges cannot be accurately calibrated to.*

Factory Presets

This controller comes preset to use a dedicated sender as follows:

- Dakota Digital Sender only (no gauge, see note above for 300ºF sender options)
- One single speed fan (FAN LOW only)
- 205ºF on temperature
- 200ºF off temperature
- 30 second key-off run time (delay)

If the factory settings don't fit your application, follow the setup procedure on page 10.

- At anytime during the setup procedure, the key may be turned off and the settings up to that point will be saved.

Setup menu overview

To simplify the setup procedure, please download out IOS or Android app 'Dakota Digital Accessory'
Setup is entered by holding the SET switch while turning the key on. The INC switch is used to change selections and the SET switch is used to save or select.

Main Menu	Sub Menu		Description
F-C			select temperature and speed units
FAn	1		one single speed fan
	2		two fans
	SPd		dual speed fan
on or L-n			low speed on temperature (150F-250F) (on = 1 fan)
oFF or L-F			low speed off temperature (oFF = 1 fan)
H-n	(only 2 fan or dual speed)		high speed on temperature
H-F	(only 2 fan or dual speed)		high speed off temperature
d IS	(only available if "bUS" is selected as sender type)		
	OFF, 3 1-74 MPH		vehicle speed to disable fans
dLY	OFF,0.5,0.7, 1.0,2.0,3.0,5.0		fan delay after key off time in minutes
Snd	no		no gauge, dedicated Dakota Digital sender only
	dd 1		Dakota Digital individual gauge with sender
	dd2		Dakota Digital instrument system with control box
	StE		Stewart Warner gauge and sender
	CLS		Classic Instruments gauge and sender
	UdO		VDO gauge and sender
	AtO		Autometer gauge and sender
	At5		Autometer gauge and sender (wide sweep 5V sender)
	bUS	AtO	BIM connection with automatic selection of bus operation
		SL 1	BIM to RTX, HDX, VHX, VFD3 (SE47 &up), VFD3X (SE56 &up)
		SL2	BIM to VFD3 (SE46 or earlier), VFD3X (SE55 or earlier)
		PAC	PAC-2800 is master connected to BIM-01-X only
	CUS		Custom calibrated gauge
	CAL	AdJ	Set 4 – 6 temperature points for custom setup
tSt	In		use pot to raise temperature reading and turn on fans
	OUt	OFF	fans off
		On or LO	ON for single fan on, LO for 2 fan or dual speed
		H 1	high speed for 2 fan or dual speed
bLU	4 digit ID code		INC scroll the Bluetooth ID across the display
	SEt		select to allow changes only while in setup
	ALL		select to allow anytime
	bAC		saves and exits Bluetooth menu
UEr			show software revision for tech support assistance
rSt			reset PAC-2800 to factory default values
End			exit setup

Setup

To enter setup mode, press and hold the SET switch, then turn the key on. The display will show "SEt".
Release the SET switch, the display will show "F-C", as the first item in the menu list.
Tapping the INC switch will step through the menu list to the desired menu item you may need to alter.
Tapping the SET switch will enter the menu option displayed.
Once done with that menu option, saving by tapping the SET will move you onto the next menu item in the list.

Temperature unit

1. Tap the SET switch. The display will show the current unit, F for F & MPH and C for C & km/h.
2. Tap the INC switch to change the selection. Tap the SET switch to save it.

Fan type

1. Tap the INC switch until "FAn" is displayed.
2. Tap the SET switch. The display will show the current setting:either 1, 2, or SPd.
    a. 1 is for a single fan
    b. 2 is for two fans
    c. SPd is for a dual speed fan
        i. If the dual speed fan requires two powers at the same time for high speed, select 2
3. Tap the INC switch to change the selection. Tap the SET switch to save it.

Fan on and fan off temperatures

1. Tap the INC switch until the desired setting is displayed

Display 1 fan	Display (2/SPD)	Option
on	L-n	fan low speed on / 5° F steps (150F-250F)
oFF	L-F	fan low speed off / 1° F steps (30F-2F below low on)
	H-n	fan high speed on / 2° F steps (2F above low on – 250F)
	H-F	fan high speed off / 1° F steps (30F-2F below high on)

2. Tap the SET switch. The display will show the current temperature setting.
3. Tap the INC+ switch to increase the temperature.
4. Tap the SET- switch to decrease the temperature
5. Press and HOLD either switch until "- " to save the temp setting.
6. The display show the next temp option until all temp options are set
    a. One may skip past part of the temp settings by tapping the INC switch

Driving speed fan disable (only available with a BIM connection)

1. Tap the INC switch until "d IS" is displayed.
2. Tap the SET switch. The display will show "OFF'' or the current speed setting.
    OFF, 3 1-74 MPH
3. Tap the INC switch to change the setting. Tap the SET switch to save it.

Fan remains running time after the key is turned off

This will set a time for the fan to run for a selected time after the ignition is turned off

1. Tap the INC switch until "dLY" is displayed.
2. Tap the SET switch. The display will show OFF or the current delay in minutes.

Display	Option
OFF	Fan will turn off when the key is turned off.
0.5	30 seconds
0.7	45 seconds
1.0	1 minute
2.0	2 minutes
3.0	3 minutes
5.0	5 minutes

3. Tap the INC switch to change the setting. Tap the SET switch to save it.

Temperature reading source

1. Tap the INC switch until "Snd" is displayed.
2. Tap the SET switch. The display will show the setting.

Display	Option
no	No gauge, dedicated Dakota Digital sender only
dd 1	Dakota Digital individual temp gauge with sender
dd2	Dakota Digital instrument cluster with control box
StE	Stewart Warner gauge and sender
CLS	Classic Instruments gauge and sender
UdO	VDO gauge and sender
AtO	Autometer gauge and sender
AtS	Autometer gauge and sender (wide sweep 5V sender)
bUS	Dakota Digital BIM connection
CUS	Custom calibrated gauge
CAL	Custom calibration (for gauge sets not listed above) - see 'Custom Calibration' section below.

3. Press and release the INC switch to change the setting. Press and release the SET switch to save it.
4. If bUS is selected, another set of options appear to help the bus to communicate correctly.

Display	Option
Ato	Automatically select the bus operation mode (HDX and RTX systems).
SL 1	Connect to a VHX, VFD3 (SE47 or higher), or VFD3X (SE56 or higher) system.
SL2	Connect to a VFD3 (SE46 or earlier) or VFD3X (SE55 or earlier) system.
PAc	PAC-2800BT is a master connected to a BIM-01-2 or similar unit

Custom Calibration

Note 1: *If your engine is warm you may need to disconnect the sender wire to get the lower points on the gauge.*

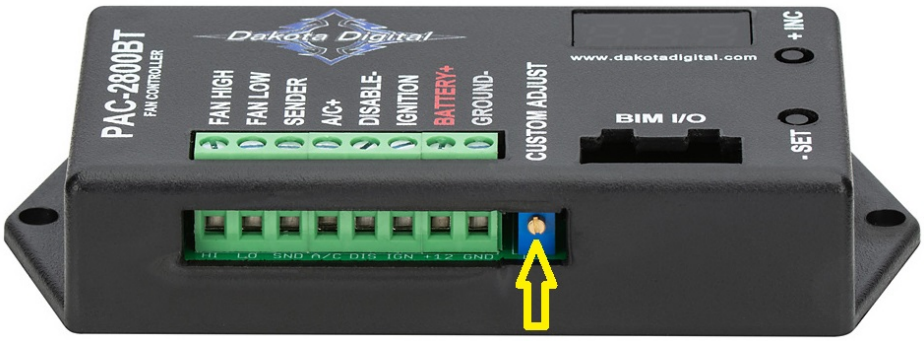
Note 2: *If the key is turned off in custom setup, the previous gauge setting will be used and the custom gauge will not be saved.*

Note 3: *If your gauge does not have defined ticks with numerical temp readings, it is highly recommended to use a dedicated sender as calibration to the gauge is very inaccurate or impossible without temp markings.*

Note 4: *A minimum of four and a maximum of six, reference temperatures are required for a custom calibration.*

1. Tap the INC switch until "CAL" is displayed
2. Tap the SET switch. The display will show "AdJ"
3. Turn the potentiometer on the front of the PAC-2800 (marked CUSTOM ADJUST) with a small flat screw driver. While doing so, watch your temp gauge and line up the needle with the **lowest temperature tick** on the gauge **Custom gauge must be calibrated starting at cold temperatures and moving to hot temperatures**

   Note: Turning potentiometer clockwise increases temperature reading.
4. Tap the SET switch. The display will show a temperature reading. Tap the INC+ switch to increase the reading and tap the SET switch to decrease the reading until the display matches your gauge. Hold either switch to move on to the next temperature.
5. The display will show "AdJ" again. Repeat the previous steps at each tick mark on the gauge to get 4-6 readings saved. When you are finished with at, tap the INC+ switch until "dOn" is shown.
6. **Hold** the SET+ switch until "-" is shown to save and exit.



Test

The test "tSt" mode offers two options " in", "oUt", and "bAc", testing the operation of the fans to a specific temperature and testing to see if the fans will function.

Input test

This unit allows you to mimic normal operating temperatures using the adjustment pot to alter the temperature the PAC-2800BT may see from an actual sender wired to the SENDER input.

This will NOT work if you are using "bUS" as a sender option!

1. When "tSt" is displayed tap the set switch, the display will show " In".
2. Tap the SET switch. CUSTOM ADJUST pot will be connected to the gauge and the display will show the temperature.
3. Turn the CUSTOM ADJUST pot clockwise to increase the gauge reading. The fan should start when the display reads hotter than the set ON temp. It should again shut off when the display reads lower than the OFF temp.
4. You may also look at your water temperature gauge (if unit is using a gauge) and compare the temperature reading of the unit to the gauge. The temperatures should be within a few degrees. If not, the wrong gauge may be selected in the setup routine. If a selection cannot be found that closely matches your gauge, you may have to custom calibrate to your gauge.

Testing Fan operation

A second diagnostic mode allows you to test the fan operation for the mode you have set. This can be used to verify proper wiring of the relays for fan operation without running the engine, regardless of engine temperature. Just follow these steps.

For 1 fan, the "oUt" submenu can step through "oFF", "on"

For 2 fans or dual speed fan, the "oUt" submenu can through "oFF", "Lo" and "HI" with the INC switch

1. Tap the INC switch until "OUt" is displayed
2. Tap the SET switch. The display will show "OFF".
3. Tap the INC switch to change the fan drive state to "on"
   a. 2 fans with toggle between "oFF", "Lo", and "HI"
4. Hold the SET switch to enable the fan(s) when "on", "Lo", or "HI" is displayed
5. Tap the INC to display "oFF". Tap the SET switch
6. When "bAc" is displayed, tap the SET switch to exit

Bluetooth

The Bluetooth options are the ID code / "SEt"/ "All"/"bAc"

Pairing notes:

- Androids MUST be paired first, before opening app
- Apple devices need not be paired before opening the app

View Bluetooth ID

1. Tap the INC until "bLU" is displayed
2. Tap the SET switch. The display will show part of the ID
3. Example: "-C7" is first displayed. Tap INC to display the second half: "bE-"
4. The code will be listed in the app, and as a Bluetooth pairing option in Android settings
5. Tap SET to exit and move to the Bluetooth operation mode

Set Bluetooth operation

1. The display will show the last chosen option of "SEt"/ "ALL" or "bAC"

Display	Option
SEt	The Bluetooth app can only make changes while the PAC-2800 is in setup
ALL	The Bluetooth app can make changes anytime the key is on
bAC	Exits Bluetooth setup

2. Tap the INC switch to change the setting
3. Tap the SET switch to save the selection and exit to the next option

View software version

1. Tap the INC switch until "UEr" is displayed.
2. Tap the SET switch. The display will show software code.
3. The code is split in two parts, the fist may show "-90", tap the INC to show the second half "001".
4. Tap the SET switch to exit.

Factory Reset

1. Tap the INC switch until "rSt" is displayed.
2. Tap the SET switch. The display will show "YES".
3. Tap the SET switch to return the PAC-2800BT for factory default settings.
4. If you do not want to reset, tap INC to display "no", then tap SET to exit.
    a. You may also turn off the ignition to cancel the reset.

Exit Setup

Tap SET when "End" is on the screen to save and exit setup.

Checking the current reading

The current temperature reading can be displayed on the unit at any time during normal operation without going into the diagnostic mode. Simply press and hold the SET switch while the key is on and the PAC-2800 is not in setup or diagnostic mode. The current temperature will be shown on the display until the SET switch is released. If the temperature is not shown and the dot on the display flashes rapidly then the ignition input on the PAC-2800 is not getting power when the key is on. To view the current fan drive state press and hold the INC switch. This will show "A-C" if the A/C input is commanding the fan to run, "OFF" when the fan is not running, "LO" or "On" for low speed fan, and "HI" for high speed fan. If the DISABLE input is grounded the display will continuously flash "OFF".

TROUBLESHOOTING

PROBLEM	CAUSE	SOLUTION
Display reads "---" (shorted sender)	Wrong gauge selected Gauge disconnected from sender (gauge option only) Sender is shorted Unit not connected to sender	Select proper gauge in setup or use CUSTOM CAL if needed. Reconnect gauge to sender. Check sender wire for short to ground, look for pinched sender wire or bare connection touching ground. Connect SENDER terminal on unit to engine temp sender.
Display reads "EEE" (open sender)	Wrong gauge selected Sender not connected to PAC-2800BT	Use setup to select proper gauge, or use CUSTOM CAL if needed. Connect SENDER terminal on unit to engine temp sender.
Display reads "SEt" "Err"	Setup data is out of valid range	Go through setup again, custom cal may be incorrect.
Display reads "Err" "bAt" when entering setup	+12v terminal does not have constant power	Connect +12 BAT terminal to fused battery connection. This terminal should have constant power at all times.
Display alternates between "Lo" and "bAt"	Battery voltage dropped too low during key off extended fan on time	Ensure battery is fully charged. Check and replace weak battery. Shorten fan delay time to prevent excessive battery drain.
Fan turns on early, late, or not at all	Unit has no constant power. (Display is blank) Unit has no keyed power. (dot on display flashes slowly) Broken/shorted wire to sender. Wrong gauge is selected (gauge setup) Wrong sender used (for "no gauge" setup) Wrong bus type set (for BIM gauge setup) On temperature in setup is too high Fan not connected properly Display shows "SPd"/"OFF". Speed shut-off is set too low. Display is flashing "d IS"/"OFF". Disable input is active.	Connect +12 BAT terminal to constant power and GROUND terminal to a good ground. Connect IGNITION terminal to a circuit powered when the key is on. Check wire to sender for breaks or shorts and repair. Hold SW1, if temperature read is lower than expected or doesn't match gauge, redo setup. For sender-only applications, ONLY a Dakota Digital 300ºF sender can be used. Other senders may not give a correct temperature reading. For early VFD3/3X systems select bUS – SL2 to read the temperature correctly. Hold SW1, if temperature read is above the desired on temperature, and fan is not running, redo setup. Remove fan output from unit and short wire to ground. If fan does not run, check relay and fan connections. Turn off or raise the high speed disable setting. Disable input should not be grounded for normal operation.
Fan runs constantly	Controller has an error Fan off temp too low Broken/shorted wire to sender Wrong gauge is selected A/C input is powered.	Check display for error message. Increase off temp in setup. Check wire to sender for breaks or shorts and repair. Select appropriate gauge in setup, or custom calibrate if your gauge is not supported. Make sure this only has power when the A/C clutch is active.
Custom gauge setup displays "Err" and returns to "Snd" setup option	Not enough points used Points not input in correct order Point entered twice	Make sure that at least 4 points of gauge are set. Set gauge points in order from cold points to hot points. Each point set must be different than the point before it.
Fans cycle on-off especially when engine temp is close to ON/OFF set point	+12v for controller taken from same circuit as the fan power +12V (green wire on relays)	Connect the +12V for the controller to a different circuit separate from the circuit connected to fan relays.
Display is flashing bUS	Unit set to BIM input with no BUS data input detected.	Connect BIM cable from Dakota Digital instrument system plastic control box or BIM-01-X or change temperature reading source to the appropriate sender.

PAC-2800 specifications	
SETTINGS	
Minimum Fan On Temp	150° F (65 C)
Maximum Fan On Temp	250° F (121 C)
SUPPLY	
Voltage Input (+12) Range	6.3 to 22 V
Key Off Current (+12)	< 0.001 A
Key On Current (+12)	< 0.075 A
OUTPUTS (to turn on relay)	
Fan Low, High (maximum)	1.5 A
Reverse	10A

Included relay specifications	
Typical Coil Current	0.175 A
Relay Contacts Max Current	70 A (14VDC)

SERVICE AND REPAIR

DAKOTA DIGITAL offers complete service and repair of its product line. In addition, technical consultation is available to help you work through any questions or problems you may be having installing one of our products. Please read through the Troubleshooting Guide. There, you will find the solution to most problems.

Should you ever need to send the unit back for repairs, please call our technical support line, (605) 332-6513, to request a Return Merchandise Authorization number.

Package the product in a good quality box along with plenty of packing material. Ship the product by UPS or insured Parcel Post. Be sure to include the RMA number on the package, and include a complete description of the problem with RMA number, your full name and address (street address preferred), and a telephone number where you can be reached during the day. Any returns for warranty work must include a copy of the dated sales receipt from your place of purchase. Send no money. We will bill you after repair.

Dakota Digital 24 Month Warranty

DAKOTA DIGITAL warrants to the ORIGINAL PURCHASER of this product that should it, under normal use and condition, be proven defective in material or workmanship within 24 MONTHS FROM THE DATE OF PURCHASE, such defect(s) will be repaired or replaced at Dakota Digital's option.

This warranty does not cover nor extend to damage to the vehicle's systems, and does not cover removal or reinstallation of the product. This Warranty does not apply to any product or part thereof which in the opinion of the Company has been damaged through alteration, improper installation, mishandling, misuse, neglect, or accident.

This Warranty is in lieu of all other expressed warranties or liabilities. Any implied warranties, including any implied warranty of merchantability, shall be limited to the duration of this written warranty. Any action for breach of any warranty hereunder, including any implied warranty of merchantability, must be brought within a period of 24 months from date of original purchase. No person or representative is authorized to assume, for Dakota Digital, any liability other than expressed herein in connection with the sale of this product.

⚠**WARNING:** This product can expose you to chemicals including lead, which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov

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