
Pantera Electronics Radiator Fan Controller Installation Manual

RFC-02, Gen 2B

IMPORTANT: *Radiator Fan Controller Theory*

It is necessary to understand the theory of the Radiator Fan Controller (RFC will be used throughout the document) in order to realize the importance of following the installation instructions. The RFC is a closed loop controller, this means the temperature sensor converts coolant temperature to an electrical signal that is compared to a reference and operates the fans at a proportional speed to lower the temperature of the coolant.

- The slowest fan speed is 50% of maximum speed and is initialized approximately 130F (54C). The 130F (54C) is the reference temperature that the RFC regulates the coolant leaving the radiator. The RFC will continually monitor and adjust the fan speed regardless of the external factors to maintain the 130F (54C) coolant. When the coolant is less than 130F (54C) the fans will be completely off.

When the fans operate at 50% of maximum speed the current is low and the fan speed is slow and may not be noticeable. Fan motors have brushes internally that are consumed with use but the 50% operation reduces brush wear considerably.

Since the coolant temperature is 130F (54C) maximum entering the engine, the engine thermostat will control the engine temperature at 180F (82C). It's important that the engine has coolant below the 180F (82C) so that the thermostat can regulate the engine temperature and not exceed 180F(82C). Engine temperatures exceeding the thermostat temperature would be an engine temperature that is not regulated and can cause pre-ignition detonation if the timing is optimally set for best performance.

Radiator Fan Controller Specifications

Recommended Fans:

- (2) Spal part# 30102029 (Suction) Type# VA10-AP70/LL-61A.

Fans with higher operating current can be operated, see page 15 and 17.

Fan current output - 25 Amps maximum per fan, both fans 50 Amps max. total.

Controller input power - 0.1 Adc, 11 Vdc Min, 18 Vdc Max.

Fan input voltage - 18 Vdc Maximum.

Air conditioner input control current - 0.01 Adc, 9 Vdc Min. 17 Vdc Max.

Radiator Coolant Flow

Determine which radiator tube is the inlet and outlet of the radiator. The direction of coolant enters the drivers' side water pump inlet and exits from the thermostat housing, it is logical to fill the radiator from the bottom to the top. That would mean that the coolant leaving the engine would be connected to the lower radiator connection. This is the best arrangement because it also forces the air out of the radiator by this flow direction. The original de Tomaso radiator was modified by Ford dealers to convert it from the conventional radiator flow to a cross-flow design. The cross flow design can be recognized by the spit in the end tank where the inlet and outlets are located. Sometimes the tank is portioned internally and only a solder joint across the end tank is visible. Many after market including Fluidyne radiators designed for the Pantera are also the cross flow design. The RFC needs to monitor the coolant leaving the radiator after the heat was removed by the fans, **therefore it is imperative that the temperature sensor is installed in the position where the coolant exits the radiator**, this would be in the radiator tank near the upper radiator outlet or a in-line TEE connection near the outlet.

Radiator Condition and Antifreeze

The radiator should be in good condition, free of any sludge, radiator sealant or tube damage. Standard Ethylene Glycol (green) anti-freeze mixed at a 50/50 ratio with water should always be used and changed at regular intervals. The heat transfer characteristics of the 40% Ethylene Glycol antifreeze to 60% water is optimal, additional antifreeze **will move less heat and can cause cooling problems**. Antifreeze contains wetting agents and **does not need additional wetting agents**, additional additives upset the proportion of water to antifreeze and will change heat transfer characteristics. Do not use any additional additives.

The temperature sensor used in the Pantera Electronics system is electrically isolated and **does not** introduce electrical potentials to the cooling systems. The RFC operates optimally with either Copper/Brass or Aluminum constructed radiators, and will adjust automatically for the type radiator even if the radiator is changed at a later time.

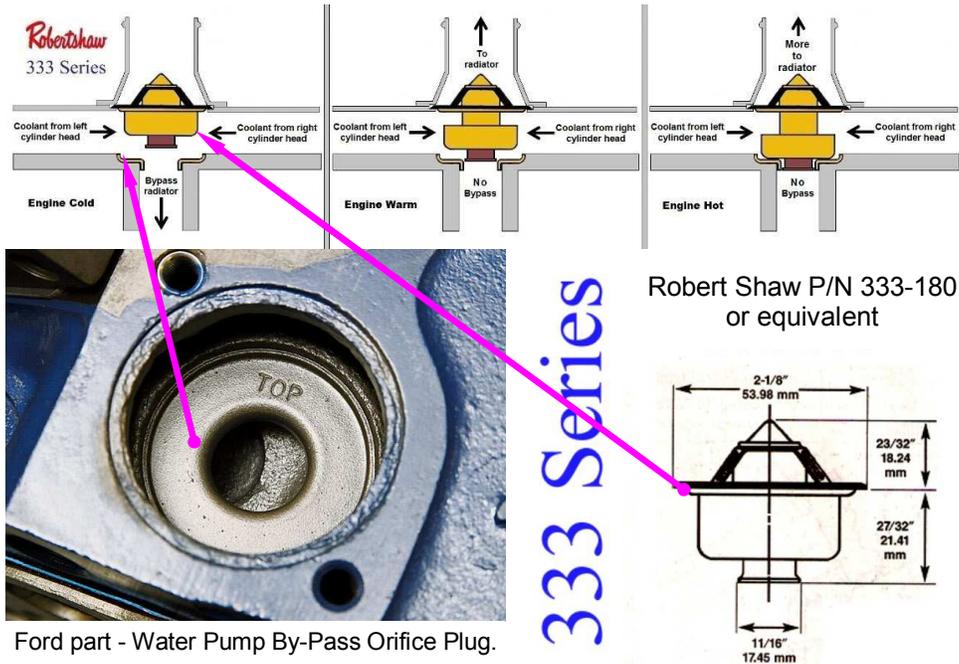
Water Pumps

The Ford 351 Cleveland factory water pump should be replaced with a water pump with an enclosed impeller, this design is more efficient and will pump more coolant for the same engine RPM than the factory water pump.

The recommended water pump for the Ford 351 Cleveland is:
FlowKooler, P/N-1648.

Thermostat

Use the proper thermostat, the Ford 351 Cleveland requires a particular thermostat. The factory Ford water by-pass orifice plug is necessary to complete the by-pass valve.



Fans, Shrouds and Grills

Cutting holes in the front hood to install grills does *NOT* improve air flow and provides no cooling advantage. The Panteras' unibody was designed to extract the air from the back of the radiator to the bottom of the car via the tunnel geometry of the trunk floor. Cutting holes in the front hood defeats the original design.

Fan shrouds are not required for the Pantera engine cooling application and it is recommended *NOT* to use them. Shrouds add air resistance and don't allow augmented air flow. If your radiator presently has a fan shroud it is not necessary to remove it.

Fans are available from many sources but the best quality and most efficient fans are manufactured by Spal. These are the optimal fan to use with the RFC, and all thermal and electrical testing was preformed with Spal fans.

Spal USA
1731 SE Oralabor Road
Ankeny, IA. 50021
(800) 654-7725
www.spalusa.com

Spal part number: 30102029,
Type VA10-AP70/LL-61A (suction)
12" Fan blade diameter, (305mm)
3.5" deep, (87mm)
13.5 Amps @ 13.0 volts

Workmanship

Wiring and connections have to be of high quality and quality workmanship. Do not twist bare wires together and tape as a connection, use only crimp terminals and the proper crimp tool. Wire should be the proper size for the current handling in the application. Soldering the wires by an experienced person and using insulation is an optional way to make connections. Generally automotive fans capable of requiring 10 to 15 amps each mandating a wire size of 14 AWG per fan. Use tie wraps to keep wiring organized and retained in position.

Engine Settings

Engine idle speed can have a large effect on proper engine temperature when idling for long periods. Even if the engine can idle at 600 to 700 RPM the volume of coolant moving is insufficient to maintain the proper engine temperature.

An idle speed of 900 to 1000 RPM is necessary to regulate the proper engine temperature.

Items needed in addition to the Radiator Fan Controller

Adapters are needed for mounting the temperature sensor to a particular radiator type.

The original factory radiator requires an adapter with 3 mounting holes with a center hole taped 3/8 NPT. This adapter is available from Pantera Electronics, see website.

The Fluidyne radiator and the "HALL" radiator requires a threaded bushing with 22 mm x 1.5 threads on the outside and 3/8 NPT threads on the inside. This adapter is available from Pantera Electronics, see website.

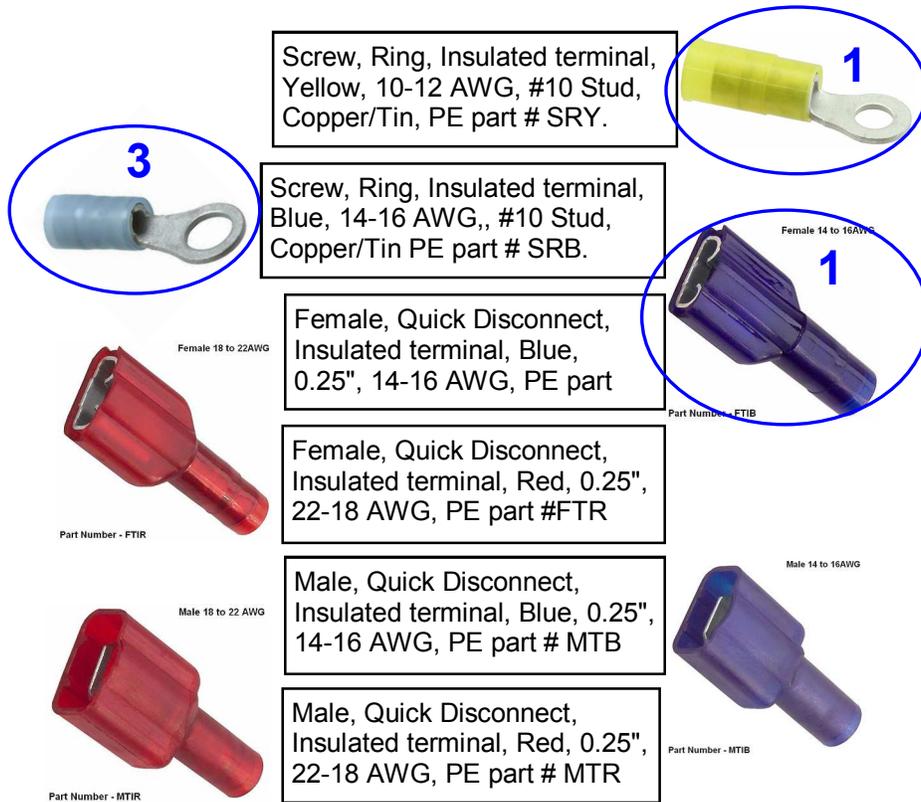


This fuse holder harness will be needed to connect from the source of power to the RFC. It can be fabricated or can be purchased as an option from Pantera Electronics.

Pantera Electronics part # IFH harness with fuse holder circuit breaker for the high current connection from (+) battery or (+) ammeter terminal to RFC.

This harness is rated for 30 amps, if higher current is required consult factory.

1) Wire Terminals (Note: Blue circled items are included with the RFC)



2) Ring lug with hole size for connection to battery and 5mm stud, use #10 yellow screw ring terminal.

3) TXL or GXL insulated wire **Do not use solid wire, it is not designed to flex or vibrate, use fine stranded electronics grade wire only.** Wire size 14 AWG for 10 -15 amps, 12 AWG for 16 - 20 amps and 10 AWG for 25 - 30 amps.

4) Fuse and fuse holder suitable for supporting the current consumption of both fans. Pantera Electronics part # IFH or equivalent. (see page 4)

5) For factory radiator adapter plate only - Permatex Blue RTV Silicon Gasket Maker 6B.

6) For factory radiator adapter plate only - Qty (3) Stainless steel Nylock nuts, thread M4 x 0.7.

7) Teflon tape.

Re-use the Nylock nuts from the factory relays or purchase qty (2) Stainless steel Nylock nuts, thread M5 x 0.8.

Installation for Temperature Sensor

- 1) Install the up-grade fans and wires for the fan motors, use the same color wires for each fans polarity.
Example: RED for (+) and BLACK for (-) on each fan motor.
- 2) If using the factory radiator, remove three screws that retain the top temperature switch.
- 3) Disconnect original wiring and remove original relays, save the hardware.
- 4) Remove 3 screws or 3 nuts that retain the factory upper thermal switch from the radiator. Clean the mounting flange of any gasket and sealant.
- 5) Install the temperature sensor plate using the gasket and Permatex Blue RTV Silicon Gasket Maker 6B or equivalent high temperature sealant. Use the sealant on the screw threads and torque the 3 screws or nuts equally.
- 6) If installing temperature sensor in a Fluidyne radiator, install 22mm adapter into the top radiator position **without** Teflon tape, the **O-ring seals the fitting.** (the adapter has straight threads, not pipe threads) **The metal ring supports and controls the amount of compression of the “O” ring. Do not remove the metal ring.**
- 7) Wrap Teflon tape about 2 turns around the temperature sensor threads, and install the temperature sensor. Do not over-tighten, the Teflon tape will seal the threads.

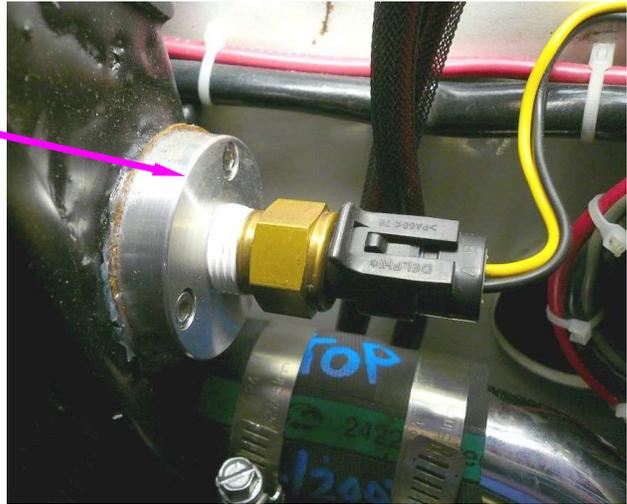
The factory sensor switch can be left installed as a “plug” for the lower sensor port. In this picture a custom blocking plate was fabricated.



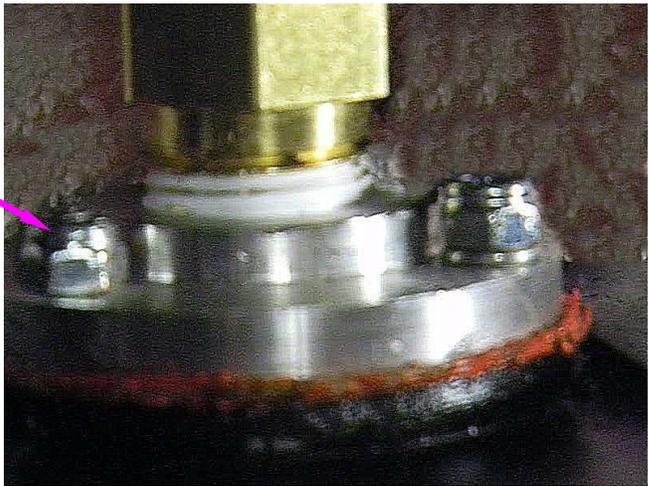
Adapter for factory radiators. P/N - TSA-1



Factory radiator with sensor plate installed for temperature sensor. In this image the factory sensor had screws.



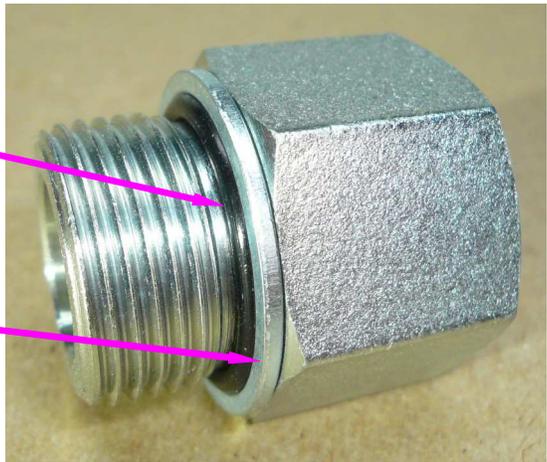
Factory radiator with sensor plate installed for temperature sensor. In this image the factory sensor had studs with nuts.



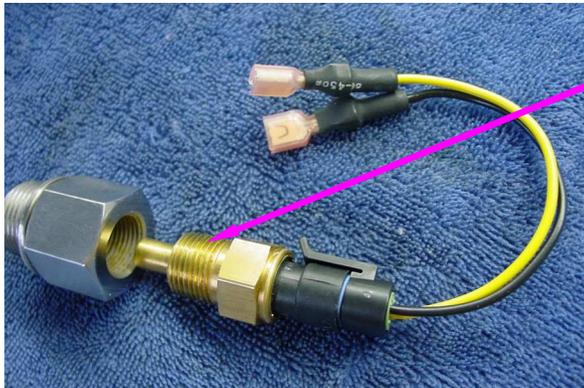
P/N - 32mm-22-6 Adapter for Fluidyne radiators.

Note the 22mm threads are straight and sealing is accomplished by the "O" ring. No need for sealing tape

The metal ring controls the amount of compression of the "O" ring. Do not remove the metal ring.



Fluidyne radiator adapter installed for temperature sensor.



Use Teflon tape on the threads of the temperature sensor to seal in the adapter.

Fuses and Circuit Breakers for the RFC

ATO fuses are fast opening automotive type fuses, a 30 amp fuse will open in 1/2 second at 70 amps.

A fan motor current is rated at full speed, in the case of the Spal specified fan current is 13.5 amps. Start-up current for a fan motor is approximately 8 to 10 times the rated current. A 13.5 amp fan will require 108 for approximately 1/2 to 1 seconds to reach full speed. This is enough time and current to open a ATO fuse. In most cases the RFC ramps the speed of the fan slow enough to allow the fuse to survive the high current at start-up.

There are many things that can vary in an after-market installation of high power electric fans that can effect the fuse survival at start-up.

An option is to use a ATC circuit breaker which has a long time constant before tripping. The ATC circuit breaker that Pantera-Electronics provides can withstand start-up current in hundreds of percent great than the rated current for 10's of seconds. A 30 Amp ATC circuit breaker is included with the Pantera Electronics part # IFH harness kit and is a good solution for random fuse openings yet still provide a safety mechanism for the RFC and fans.

Remove factory relays or upgraded relays

Factory radiator fan relays mounted on 5mm studs in factory location. Remove the factory relays and carefully disconnect the wires.

Drivers side fan relay

Passengers side fan relay



The PINK wire connects to fuse #11 or #12

The YELLOW or RED connects to speedometer "FAN" amber light.

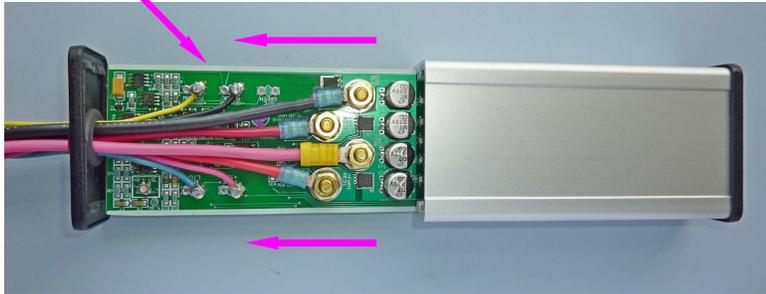
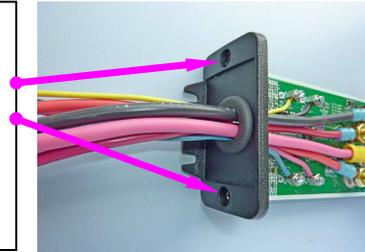
Note, early 1971 Panteras have the relays in the relay box in the passenger foot well. The colors of those wires can be different from 1972 through 1974 Panteras.

Many 1974 Panteras may not have the wire for the "FAN" light even though the lamp socket is in the tachometer. In this case a wire can be added to make the light operational.

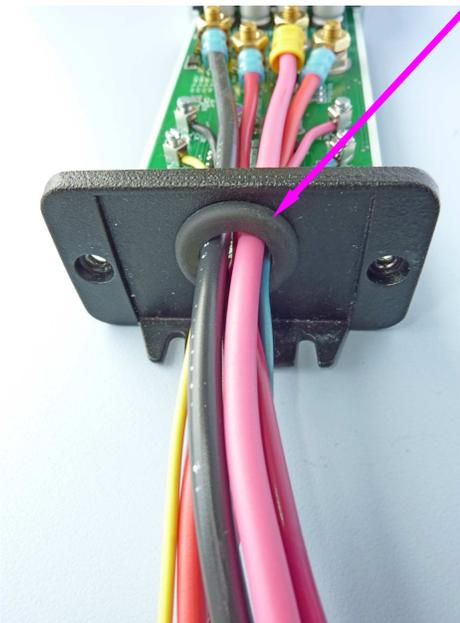
Disassembling the RFC Housing

Remove (2) screws from the end plate with the wire grommet.

Slide out the control board.



RFC Power Capability and Wire Gauge Size



The size of the grommet on the end plate was made to the largest dimension possible.

This allows the wires of a typical and correct installation of 2 Spal fans rated at 15 amps.

This requires "+BAT RED" wire and "GND BLK" wire is 16 AWG with automotive GXL or TXL insulation.

This requires both "+FAN1 RED1" and "+FAN2 RED2" wires are 14 AWG with GXL or TXL automotive insulation.

The "+12 PINK", "LITE BLUE", "SNSR YLW" and "SNSR BLK", "A/C GRN" wires should be AWG 18 wire with automotive GXL or TXL insulation.

Larger fans with higher current will need larger AWG wire size and may be challenging to pass through the grommet. An additional hole can be added to the end plate for larger wires but only if absolutely necessary.
Consult with factory to consider options before adding holes.

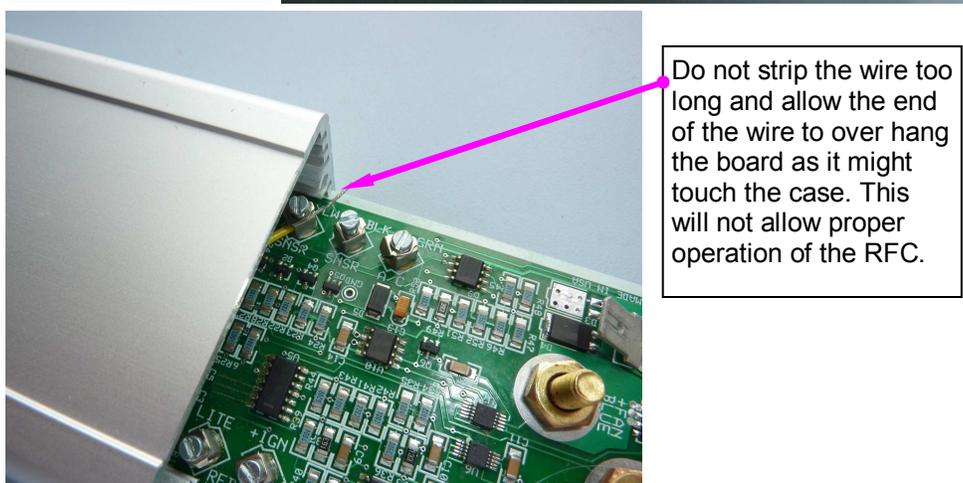
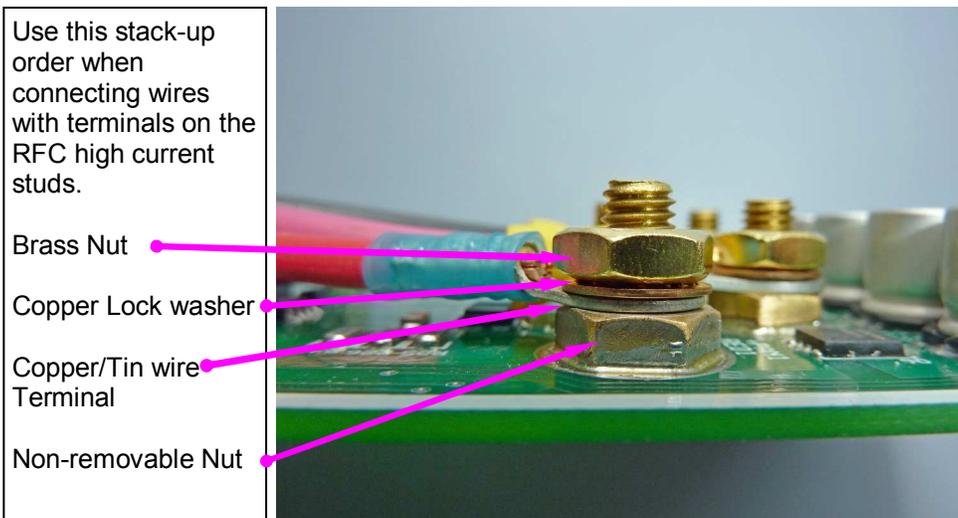
Enclosure IP65 Rating

Silicon adhesive or RTV sealant can be used around the wires into the grommet to improve water resistance. The recommend mounting position in this installation is intentionally placed close to the fender wall to avoid direct water impact. The reason is to not require the RTV sealant used to seal the wires in the grommet.

Enclosures that are considered “sealed” have the problem of condensation that is difficult to avoid and will lead to early failure of electronics.

It is of the opinion and experience of Pantera Electronics engineering that vented enclosures offer a long term life for electronics.

Adding RTV sealant to the wire grommet is the installers option based on the final enclosure location and use of the vehicle.



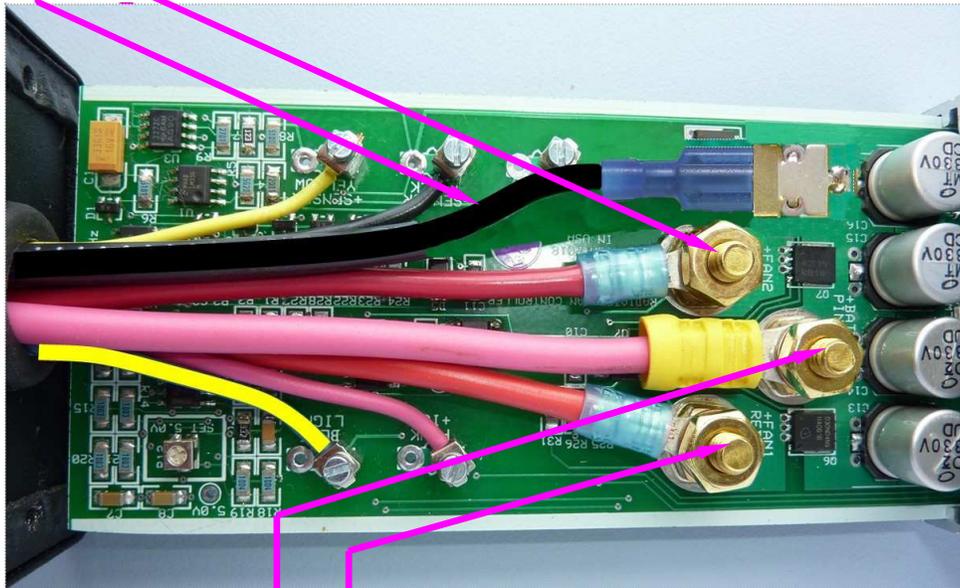
Connecting wires to the RFC

It is best to connect all wires directly from the Pantera wire harness to the RFC board but this is not always possible.

When the present wires are not long enough extensions can be made and connected to the RFC board.
(this can be done working on a bench which makes the job easier)

“GND BLK” is the power ground wire and connects to the chassis.
Use a 16 AWG wire, crimp on a blue ring terminal.

“FAN2 RED2” connect to the driver side +fan YELLOW (or GREY) wire.
(It was a 14 AWG YELLOW wire in the factory wire harness)
Use a 14 AWG wire, crimp on a blue ring terminal.



“FAN1 RED1” connect to the passenger side +fan BLUE wire.
(It was a 14 AWG BLUE wire in the factory wire harness)
Use a 14 AWG wire, crimp on a blue ring terminal.

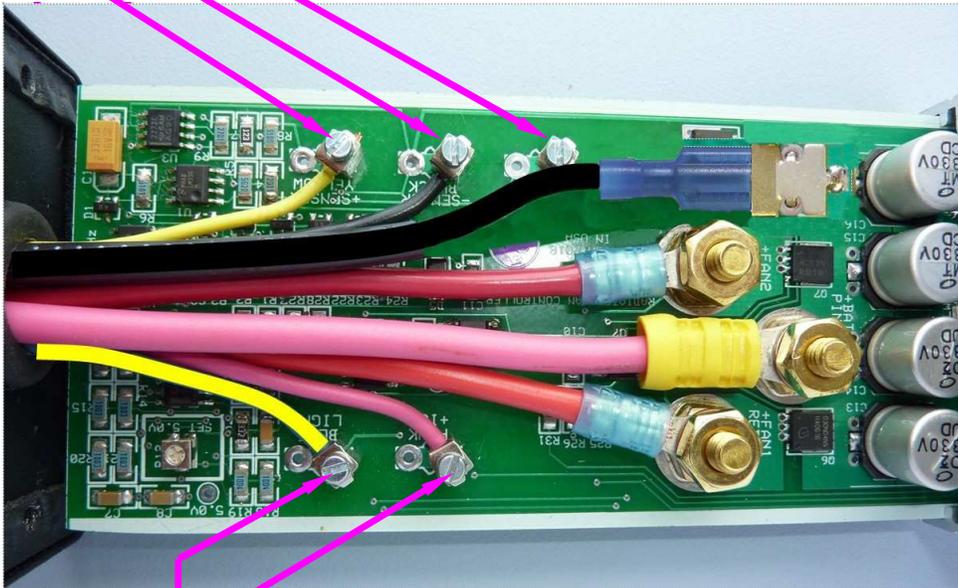
“+BAT PINK” is the power (+) wire and connects to a fuse and then to the battery or ammeter. Use a 10 AWG wire, crimp on a yellow ring terminal.

Connecting wires to the RFC, Continued

“SNSR YELLOW” is one of the temperature sensor wires, it does not matter which wire of the temperature sensor. Use a 18 AWG wire, strip and insert into the terminal.

“SNSR BLACK” is one of the temperature sensor wires, it does not matter which wire of the temperature sensor. to Use a 18 AWG wire, strip and insert into the terminal.

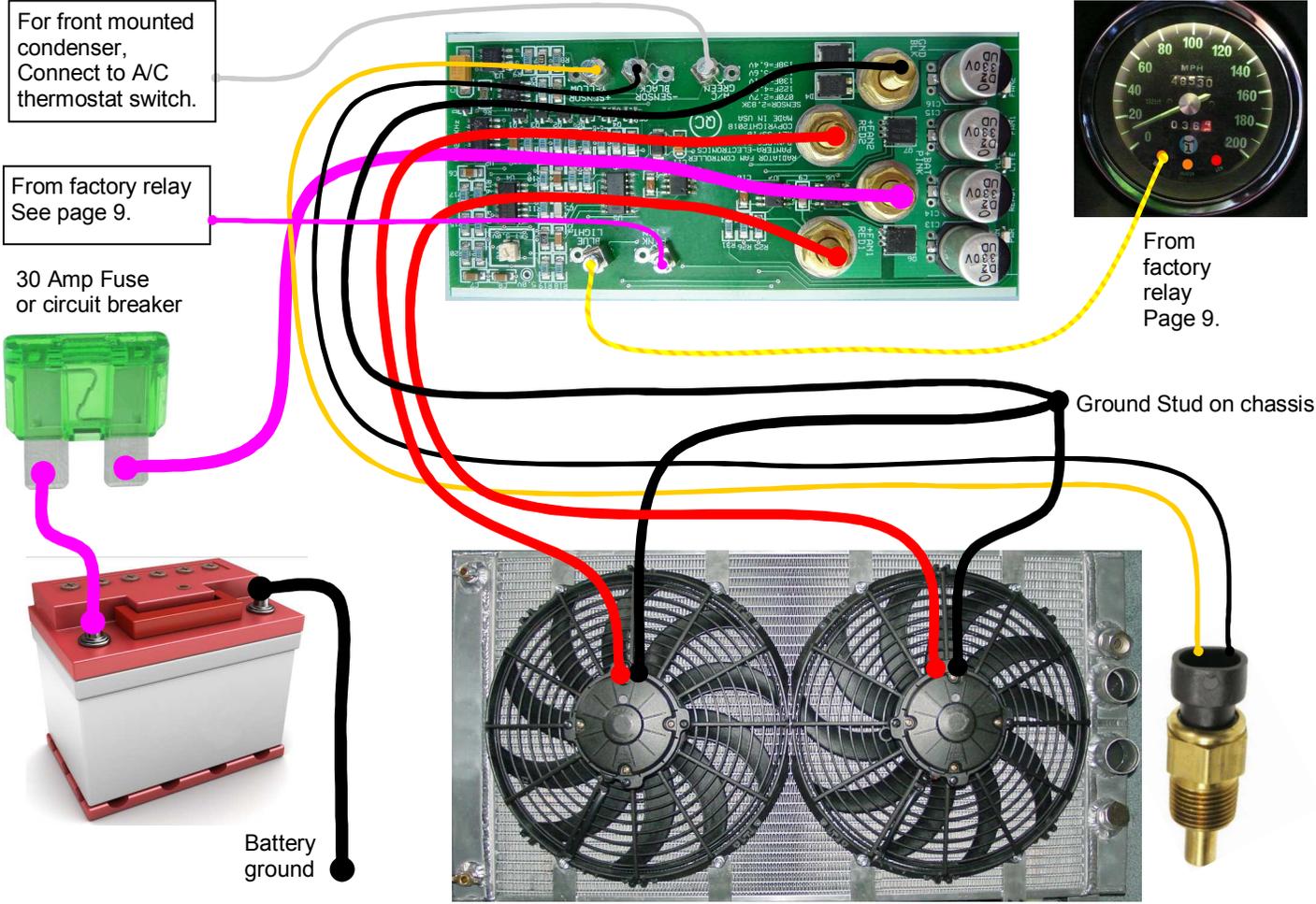
“A/C GRN” is the over-ride function that forces the RFC to operate the fans at maximum speed. Connect to the A/C thermostat if the Pantera has a FRONT mounted A/C condenser, Use a WHITE wire 18 AWG wire, strip and insert into the terminal and connect to the A/C thermostat switch on the same terminal that the factory WHITE/BLACK is connected. The other end of this wire is connected to a relay on the relay plate and is easier to connect at that end.
Do NOT connect for rear condenser.



“+IGN PINK” connects to the PINK wire that connects to the fuse panel on fuse #11 or fuse #12. It is a 18 AWG wire and there may be 2 use either PINK wire. to Use a 18 AWG wire, strip and insert into the terminal.

“LITE YLW” is the “FAN” light wire in the speedometer, Use a 18 AWG wire, strip and insert into the terminal.

**Radiator Fan Controller Wire Diagram, Standard Connection for
(2) Fans at 15 amps each maximum. (Preferred upgrade)**



For front mounted condenser, Connect to A/C thermostat switch.

From factory relay See page 9.

30 Amp Fuse or circuit breaker

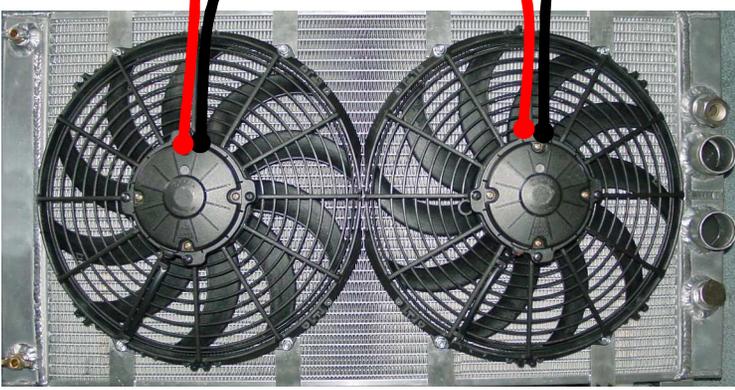


Battery ground



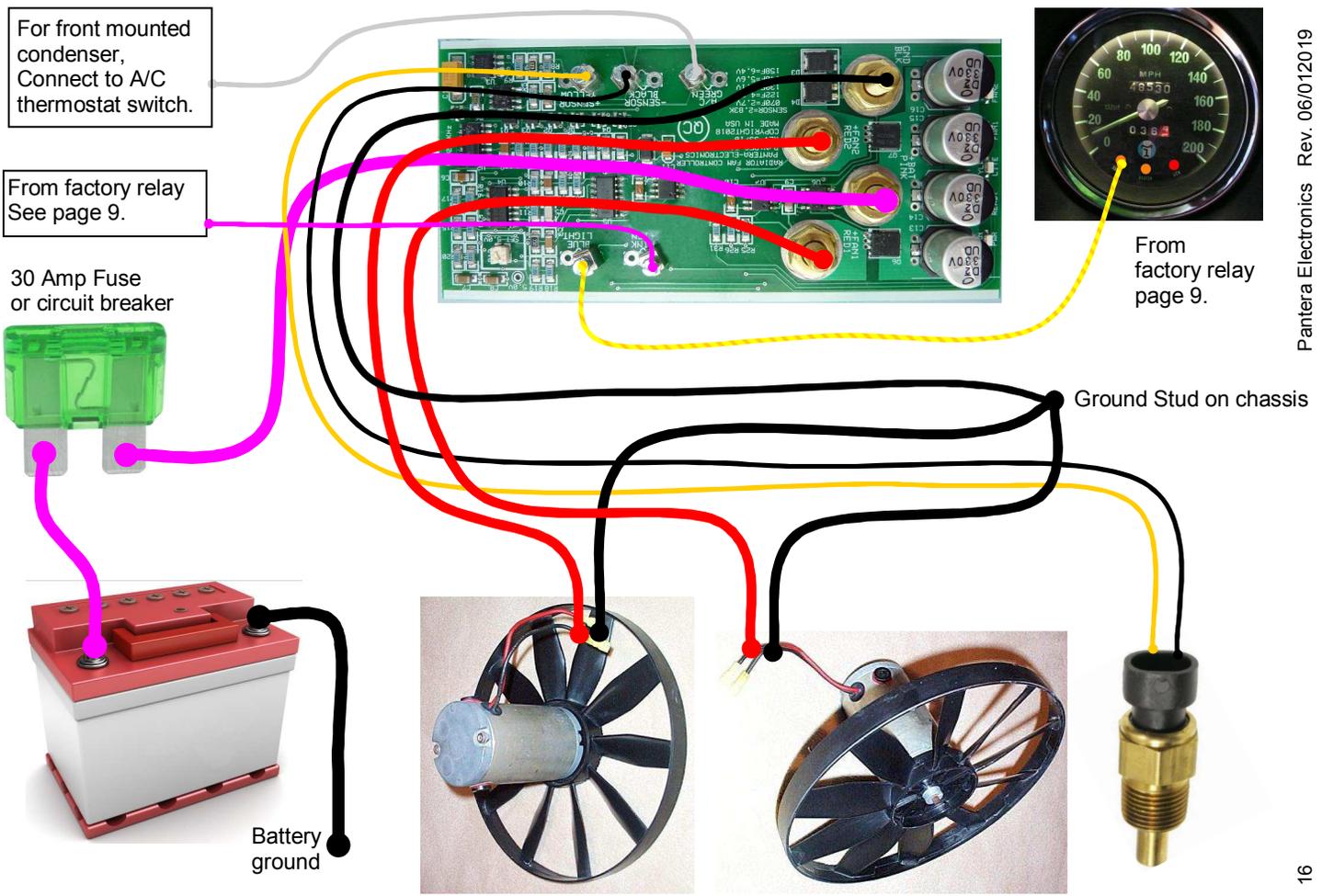
From factory relay, page 9

Ground Stud on chassis



Radiator Fan Controller Wire Diagram Connection for (2) Fans at 20 Amps each Maximum. (Excessive upgrade)

Radiator Fan Controller Wire Diagram
 Connection for (2) Mirriah Fans



For front mounted condenser, Connect to A/C thermostat switch.

From factory relay See page 9.

30 Amp Fuse or circuit breaker



Battery ground



From factory relay, page 9.

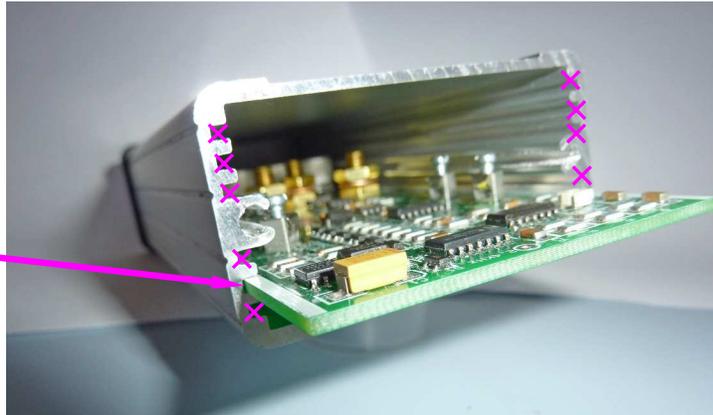
Ground Stud on chassis



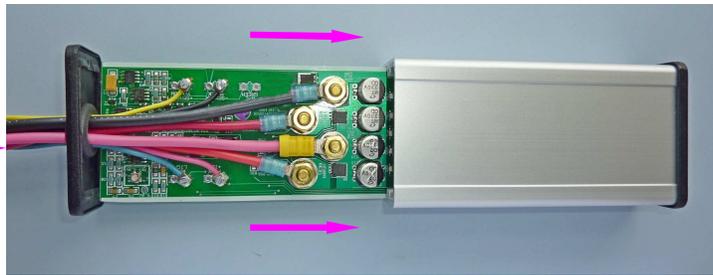
Radiator Fan Controller Wire Diagram Connection for (1) Fan at 40 Amps Maximum

Assembling the RFC Housing

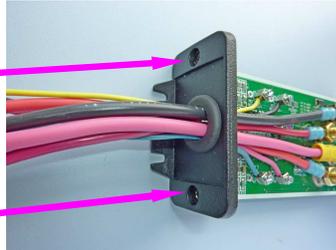
Align the control board to **only** this slot.



Slide the control board until it seats.



Insert (2) screws from the end plate with the wire grommet and tighten the screws.



Fan Ground Connections

The stud that was used to support the factory relays is used for the common ground connection and mounting plate.

If using the mounting plate use the stud closest to the fender wall, it will act as a spacer to mount the case parallel to the support beam.



Stack the hardware on the stud to create the proper level so that when the mounting plate is in place it's parallel to the support beam.

This may require 5mm flat washers in addition to the 5mm lock washer and 5mm nut.

Connecting the RFC to the Wire Harness

Crimp a male blue quick disconnect on one end of the 14 AWG wire that is connected to the RFC, "FAN1 RED1". Connect the passengers side fan wire, this can be a BLUE wire that was connected to a factory relay. (see page 9)

Crimp a male blue quick disconnect on one end of the 14 AWG wire that is connected to the RFC, "FAN2 RED2". Connect the drivers side fan wire, this can be a YELLOW or GREY wire that was connected to a factory relay. (see page 9)

Connect the "+BAT PINK" to the fuse and battery.

Connect the "GND BLK" to the chassis ground.

Crimp a male red quick disconnect on one end of the 18 AWG wire that is connected to the RFC, "+IGN PINK". Find the PINK from the wire, this a PINK wire that was connected to a factory relay. (see page 9)

Crimp a male red quick disconnect on one end of the 18 AWG wire that is connected to the RFC, "LITE YLW". Find the RED or YELLOW from the wire, this a RED or YELLOW wire that was connected to a factory relay. (see page 9)

Connect both the temperature sensor wires to terminals, "SNSR YELLOW" and "SNSR BLACK".

If installing in a Pantera with the A/C condenser in front connect the "A/C GRN" wire to the factory A/C thermostat switch. (WHITE/BLK) The other end of this wire is connected to a relay on the relay plate and is easier to connect at that end.

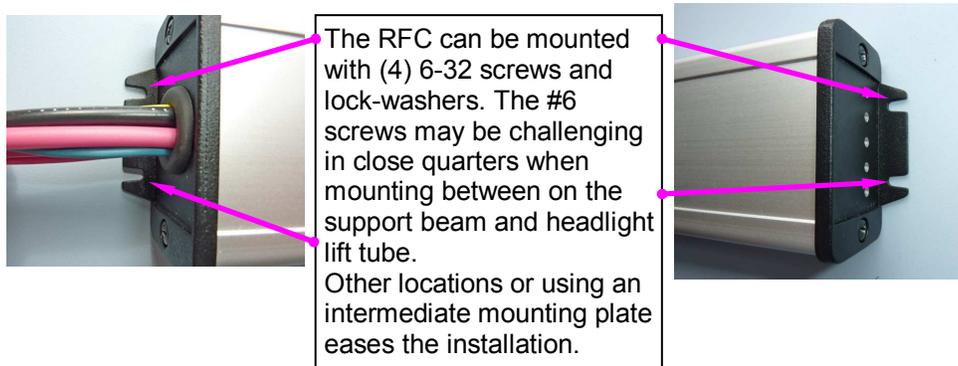
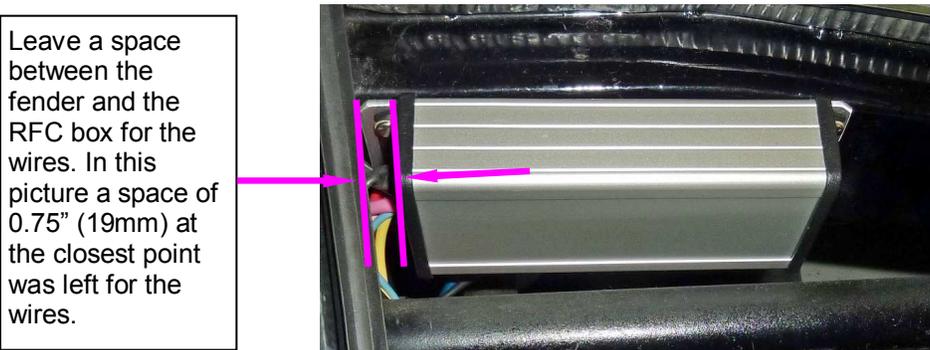
Mounting the Radiator Fan Controller

Mounting of the RFC near the fans is the best location so that the fan wires are not excessively long, this minimizes electrical losses and electrical noise. High power fans over 15 amps each mandate mounting in the RFC in the position behind the fans or radiator in the location of the original of the fan relays is best. The box size is designed to fit behind the headlight actuator tube and the horizontal support beam.

The RFC box should be mounted with the grommet close to the left side of the fender but still must allow for the wires to exit.

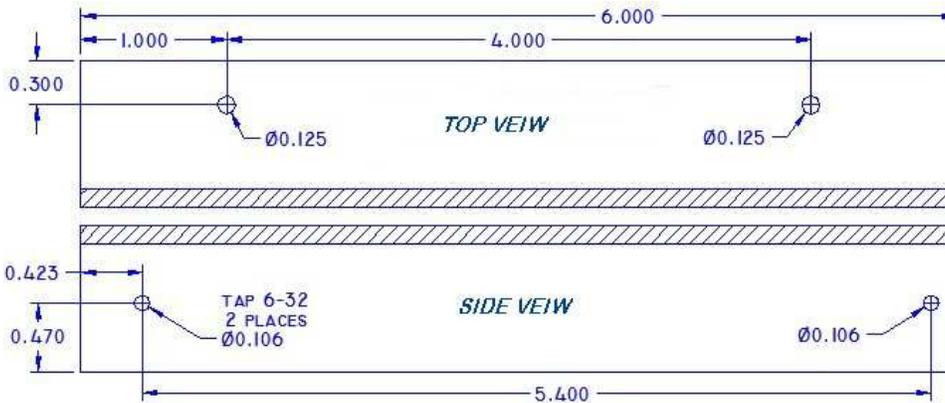
Other mounting places can be used but the RFC box should not be exposed to direct water pressure such as a hose or intense rain as the wire grommet is not sealed. Inside the trunk is a possible location as well but consider drilling holes into the trunk wall is not desirable.

In order to use the relay mounting studs install all of the ground connections first. The RFC ground 10 AWG BLACK wire and both fans BLACK wires. Crimp the proper size ring terminal on the wires and install on the stud. Make sure the stud is free from corrosion, dirt and paint. There should be exposed metal for the terminals to be in contact. After the terminals and the nut tightened use silicon electrical grease to protect the connection.



An easy way to mount the RFC is to use a mounting bracket that adapts the RFC housing to the support beam.
 Only the top 2 holes in the RFC case for the 6-32 screws and lock-washers.
 2 additional holes are used to mount to the bracket to the support beam with self-tapping screws. The drawing below is the design for such a mounting bracket.

Pantera Electronics can also provide this finished aluminum mounting bracket available for purchase. Consult with factory. See page22.



The mounting holes in the "Top View" are 0.125" and should be used a pilot holes to locate the holes in the support beam. The drilling does not have to be completely through just enough to guide the drill bit.

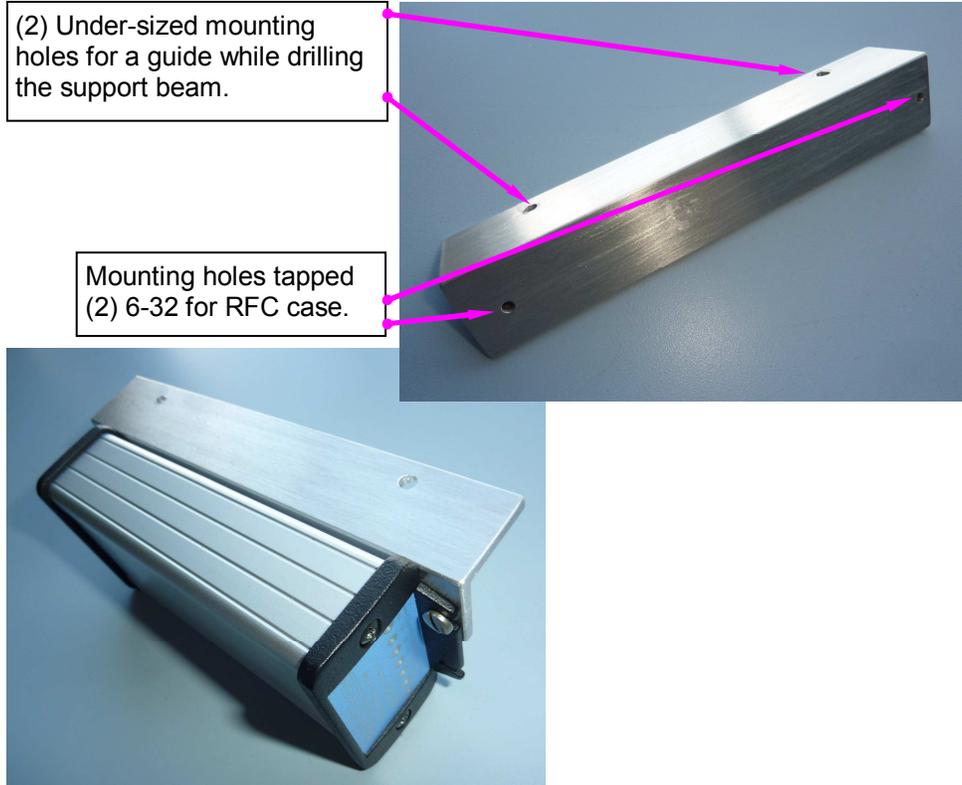
1. Mount the RFC on the bracket with 6-32 screws and lock-washers.
2. Position the bracket with RFC on the support beam and drill through the bracket in the hole closest to the fender.
3. Enlarge that hole in the bracket that was just used a guide to 5/32" (0.156")
4. Install the self-tapping screw and mount the bracket with RFC.
(this keeps the bracket in location while the other hole is drilled)
5. Drill through the bracket in the other hole.
6. Remove the first screw and bracket with RFC.
7. Enlarge that hole in the bracket to 5/32" (0.156").
8. Mount the bracket with RFC using the self-tapping screws and lock-washers.



**Pantera Electronics Aluminum Mounting Bracket Including:
(2) 6-32 screws, (2) #6 Lock-washers and self-tapping #8 screws**

(2) Under-sized mounting holes for a guide while drilling the support beam.

Mounting holes tapped (2) 6-32 for RFC case.

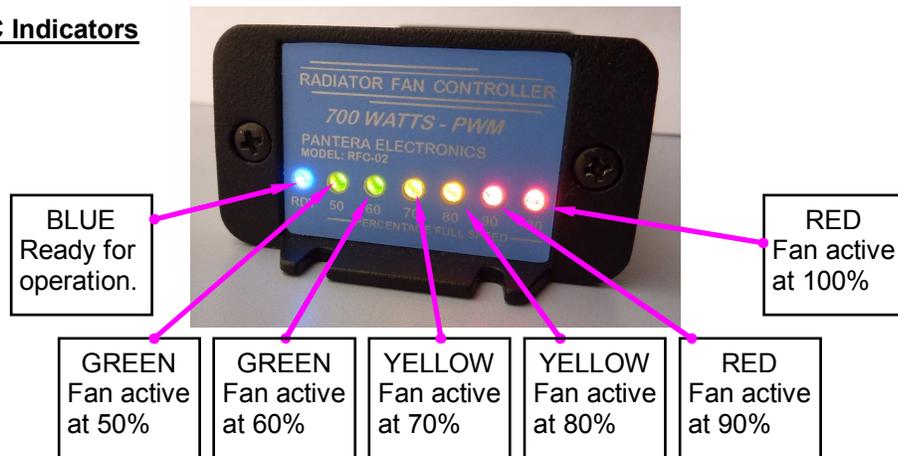


Wiring Behind the Console

The RFC needs to have a fuse connected in line or in series with the (+) battery or (+) ammeter terminal. This fuse value must be equal to the combined current of both fans. The fuse holder should be of high quality and be rated for at least 30 Amps. There are 2 possibilities when connecting to the (+) battery or (+) ammeter, if connected directly to the battery use a large ring terminal and connect to the (+) battery clamp. This connection will not allow the ammeter to indicate the current that the fans are using during high current demand on hot days. Some Pantera ammeters are not in very good condition and connecting the directly to the battery is still the best decision. If the ammeter has been rebuilt or replaced by a modern gauge that can support the additional fan current then it can be used to monitor the current. There are 2 terminals on the ammeter a large cable connects to the battery and the other connection to the wire harness. The RFC can be connected to the terminal that connects to the wire harness allowing the ammeter to display the current consumed by the fans.

NOTE: It's important to keep this installation manual for future reference since revisions to this product change the contents of the installation manual.

RFC Indicators



Power-up Test:

It is assumed at this point that the coolant has been re-filled and all mechanical items are completed.

After checking wiring to confirm correct connections to the RFC, install a fuse in the fuse holder.

- 1) Re-connect negative battery cable and note that there will be a faint spark during this connection. This is normal and this is caused by electrical storage devices in the RFC. These devices do not consume power all of the time, only during initial connection to the battery. When the key is "OFF" none of the indicators on the RFC should be illuminated.
- 2) Turn ignition key switch "ON" wait for approximately 12 seconds then the "READY" BLUE indicator will illuminate.
- 3) After the engine is running but before the *radiator* is hot only the ready indicator will be illuminated. When the radiator reaches 140 degrees a GREEN indicator will illuminate for 50% fan speed.
- 4) As the temperature of the radiator increases the fans will increase in speed to compensate to keep the coolant exiting the radiator no more that 130 degrees.
- 5) As the radiator increases in temperature the fans should increase in speed, indicated by proceeding lights illuminate.
- 6)
- 7) When at idle engine speed poor coolant circulation is due to the water pump is operating slowly. Occasionally increase the engine speed to 1,500 to 1,800 RPM for 1 to 2 seconds this will cause a "slug" of hot coolant to enter the radiator and increase the speed of the fans. The speed of the fans varies slowly and may not be readily apparent but the indicators will react.
- 8) If there is a stone in the radiator fan and causes the 30 Amp fuse to open the all of the percentage indicators will flash 2 times per second. This will also flash the orange indicator in the speedometer. This can be tested by removing the fuse during operation.
- 9) This completes the testing.

Using the RFC Bargraph

The RFC bargraph is a display of fan speed that can be related to heat dissipating capacity. As an example, after the Pantera has been idling and the temperature gauge displays 180 degrees note the bargraph. If all of the cooling components are functioning properly and the ambient are temperature is known the bargraph indicates the speed of the fans so that the coolant leaving the radiator is 140 degrees. If the ambient temperature increases the fans will need to increase speed to maintain 140 degree coolant exit temperature.

If the fan speed is at 80 or 90% and the ambient is 75 degrees it's likely that there isn't enough fan speed to compensate for a day that has an ambient of 85 degrees. The fans would be at 100% and the radiator could not dissipate enough heat to maintain a low enough coolant exit temp to keep the engine temperature stable.

Spal fans are the fans of choice and are easily powered by the RFC. They provide are very high air flow, high quality bearings and low noise blades in a compact envelope. Spal fans installed on factory radiator re-cored to Pantera Electronics specs. More efficient and weighs less than the factory core yet retains the same appearance. This design also outperforms the Fludyne radiator as well.

The Spal fans are mounted on the factory modified radiator with PE design brackets.



The Spal fans are mounted on the Fluidye Radiator with PE design brackets.



Disclaimer

The products from Pantera Electronics have been design and manufactured with the best quality components known to the engineer. The installation instructions have been written to assist the owner in the proper use and installation of the products. Pantera Electronics can not be held responsible or held liable for the interpretation or incorrect implementation of the products.