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Vehicle Info
2002 Ford Ranger

Bragging Rights

0-60	10.7 sec
HP	180
Weight	3900 lbs

Modifications

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Custom Intake
Dynomax Exhaust
Custom Engine Comps.
Bosch Ignition
Rancho Shocks
Custom Strut Bars

Car Audio & Video
Jensen Speakers
Bazooka Subwoofers
Kenwood Video
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Interior
AC Autotechnic Gauges

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John Griggs's Ford Ranger: "Edge"

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The Ford Explorer Electronic Automatic Temperature Control (EATC) Mod

The next about 5 or 6 or whatever pages (as I write this it's not complete) will describe in detail the retrofit of an Explorer EATC to a late model Ford Ranger. Any Ranger from 1995 on should be able to be wired, though the how-to is focused on 1998 and later. I've decided to be rather verbose about this to make sure it's well understood what we're up to. I really don't mean to scare anyone with the number of pages -- I just want to get as much information in your hands as I can reasonably (or have the patience) to do.

General Information and History

N3ELZ's 2002 Ford Ranger

First, let me say that this may be one of the more pain-in-the-neck (literally for me as I have spinal arthritis, lol) mods you may ever do electrically. It involves some rewiring, refitting, and minor cutting, drilling and sanding. I know my keypad mod requires you to cut a hole in the door; but this mod requires much more WORK. Still, I'd say it's well worth it for the look, but especially for how comfortable it is. It can end fights with your significant other over the heater (though maybe not entirely). It maintains a constant temperature very nicely, blowing only as much air as needed to maintain it which keeps the sound level under control also. That's my unit to the right.

The units below are pictures of two others I put in. The one on the right IS a Ranger, but it has a custom center bezel.

The EATC first appeared in the Explorer in 1995. The original unit received input from 3 sensors: outside air (ambient) temperature, cabin (interior) temperature, and "sun load". The sun load sensor tells the EATC how bright the sun is shining in on the dashboard so it can anticipate heat load in the front of the cabin. It also had auxilliary control modules to control fan speed over an "infinite" range of speeds, and to control the blend door (which controls the discharge temperature of the air blown into the cabin). It can also control where the air is sent -- defroster vent, panel vents, floor vents, etc. in any combination.

In order to ensure that the cabin temperature is accurately sampled, a vent was placed above and to the left of the glove compartment, high on the face of the dashboard. Placement is only part of the issue -- you have to ensure that the sensor sees that actual air temperature of the cabin. Ford made an "aspirator" that draws air through the sensor assembly using suction from the intake side of the blower motor. This creates a continual "draw" of air past the sensor that comes through the vent from the cabin, helping the EATC to better know the "real" temperature of the cabin.

Using the temperatures and sun load information, the EATC anticipates required heating and cooling requirements, and continually adjusts fan speed, discharge temperature, and where the air is sent. It makes very good decisions about how to keep the occupant comfortable, but the driver can override it and manually direct the air and fan speed.

In 1996 the ODB-II vehicle emissions standard specified an in-vehicle network for data communication between control modules. Ford added an OBD-II network connection to the EATC in 1996 to take advantage of this. The ODB-II connection allows the EATC to query the PCM for engine coolant temperature and vehicle speed. Using this information, the EATC can provide extra comfort features like not blowing air in the winter until the heater can produce heat, and anticipating drafts and extra cooling that may occur when the vehicle is in motion.

In 1998 Ford changed the design slightly and used that design all the way to 2001. It changed the pinout of the connectors somewhat, but not what the unit does. What this means is that 1995-1997 units and 1998-2001 units are NOT plug compatible, even though the plugs fit -- rewiring is required.

2002 units have a completely new design for the head unit and there is NO COMPATIBILITY AT ALL with the earlier units.

In addition, in 1998 the blend door actuator changes and uses a slightly different connector which once again FITS but is WRONG between the two year ranges. Also, Ford changed the connector on the fan speed controller to reduce corrosion in 1998 or so. When you pull pieces from the junkyard, MAKE SURE YOU GET THE PART AND THE HARNESSES WHICH GO WITH IT.

The 1995, 1996, and 1997 units all have blue displays and lighting. They also share a common connector

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pinout that is different than later units, as I've already noted. The 1998 and up units have green displays ang lighting. I'll provide a page describing the differences between the two year ranges in another page.

One final note: the units used in Taurus, Sable, Crown Vic, Marquis, and Lincolns are different and I'm not going to describe them. They are not as desirable for our purposes. In addition, Lincoln Navigators have the same system as the Lincoln automobile which uses PWM fan control which is not compatible with the analog control units -- except that the analog ones can be modified if you are willing to do surgery on the EATC "head unit". I may make a page on how to do this. I like the Lincoln fan controller much better -- it doesn't get hot, doesn't mount in the ductwork, and may last forever.

That summarizes the basics on the EATC unit. Go to the next page for information about what you need to do this mod.

Some additional references

Page describing swapping EATC into a CrownVic -- good for information on the general system and peripherals but not all the details of a Ranger install. Still, these pages were INVALUABLE for helping me understand what was involved and I'm indebted to the author. I've emailed him thanking him but never received a response -- I bet he gets a lot of emails, lol!

Ryan Hooks' site with information on EATC -- Ryan is a fellow experimenter and contributed to this how-to.

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EATC: Getting what you need

Let's face it -- this mod could cost a BUNDLE if you don't do it "right" -- and "right" in this case means mostly junkyard ("JY") parts. We're going to do this mod in the style of the overhead console and just get parts with "pigtails" and splice together our own wiring harnesses. This is WAY simpler than trying to get the full harness out of an Explorer and retrofitting it to our Rangers -- and it takes a lot less time as well.

Blend Door Actuator/Motor

There is ONE part you may wish to consider buying, and it's about $60. It's the blend door actuator (which I sometimes call a servo -- because it is). It's the most "moving" part in the system and the most prone to breakdown. Mine is partly "new", partly not. It's the electronics from an Explorer 1997 EATC actuator, and the gears and motor from a Ranger 2003 manual actuator. The result is a "rebuilt" actuator that should be reliable. We'll see! That's a trick you can use on your own if you have a year Ranger that doesn't have manual cables to control the blend door. 2001 and 2002 DO have cables. Prior years and 2003 and later MOSTLY do not have cables but instead have manual servos -- but count on nothing.

You can get the one for an Explorer from a Ford dealer. Go in and ask for a "blend door actuator for a 2001 Explorer with EATC". When you get the part, open it up and look at it. It should have "EATC" or "ATC" stamped on it. If it has "MAN" stamped on it, don't buy it and make them find the correct one. It will have an additional plastic bracked underneath the actuator and you'll have to remove it. It just "clips" onto the drive unit with split pegs. You can either cut the pegs or compress them and push them through. I usually cut them.

Here's the two parts next to each other. Don't depend on the color of the casing to define it. Notice the unit on the left says "ATC". Get as new a unit as you can find as it presumably has less wear. Very early units had weak gears that stripped easily. The one on the right was the one I took out of a truck I modified for a friend, and I used his old one as the source of the housing and gears for my "hybrid" rebuilt actuator which is working fine. These units are about 3 to 4 inches square, and about an inch thick not counting the drive shaft which protrudes from the bottom.

AGAIN PLEASE NOTE: MAKE SURE YOU GET THE CONNECTOR YOU SEE PLUGGED INTO THE ATC/EATC unit. It resembles the connector used on manual ones, but the wires are on different pins and it won't work without modification -- best to just get the correct one!

Where is the actuator motor? Up under the dash on the passengers side. Open the glove compartment of the donor vehicle and push in the sides of it until it drops down. Looking in, you will see a horizontal black plastic duct, and above it some grey plastic structures and more ducts. In between the duct and upper structures is a gap. The servo is mounted towards the left side, on top of the lower duct, as shown here.

There are typically a total of three 5/16 (or 8 mm) hex-head, self-threading screws. It requires a "cut down" or fairly short socket and a small 1/4" drive ratchet to remove it. First, unplug the connector. Then I take the rear screw out FIRST. The reason for this is so the servo doesn't move when you are getting that back screw out. It's a real pain and if you drop a tool back there, you need a magnetic retriever to get it back. Take your time!

The "approved" procedure for removing/replacing these is to TAKE THE DASH APART!!! That's too much work and though this part is a real pain in the neck, it's worth it for the time saved. Don't forget to GET THE CONNECTOR AND AS MUCH HARNESS AS YOU CAN FROM THE DONOR VEHICLE. 4 to 6 inches of harness is fine -- but if you can get more, fine. You can also see if you can unlace the wrappings all the way back to the EATC head unit if you're getting it from the same vehicle and then you won't have to splice this piece back in later. I usually just cut it, but it's up to you. It's more work in the JY, but less work at install time, or vice versa depending on what you choose to do.

By the way, 1995 through 1997 have SEVEN wires on the connector, and 1998 through 2001 have FIVE. Both of them can be used but get the newer one if possible, or put the gears from a newer manual one in the old EATC one. Either unit will work, though.

One final note on these: ones from the cars generally won't work. They have the connector coming out the TOP of the unit and not the side and there would be no room for that in our trucks.

Fan Speed Controller

These units are also sometimes "iffy" when salvaged due to corrosion. They are close to $100 new though, so salvage is still the best way to go. Later, I'll explain how you can test all your acquired pieces as a system to determine if they will work or not. Basically, you will just hook up all the pieces before you install them.

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The unit can be found on the donor vehicle (and will mount on your vehicle) in the engine compartment, just below and to the right of the fan motor as shown. You have to remove the speed control servo to get to this location. It just mounts with one bolt on the top of the fender on the passenger side, then drop it down a bit and pull it out. Unplug the electrical connector, and set it out of the way. What is the speed control servo? If you have cruise control, it's the thing blocking your access to the fan motor area! The fan controller shown here is actually mounted in a Ranger, prior to wiring, but it's the same location in both vehicles.

Just remove the two mounting screws (and keep them) and pull it straight out of the housing. You may find it mounted with torx (T-10) or with more conventional fasteners.

Note which way the heat sink faces (up or down). I've been mounting them heat sink DOWN so the fins don't collect condensation.

The controller shown is "analog" -- that is to say, it has a big transistor that just acts as a resistor to control the fan speed. This means it gets HOT. That's why it mounts on the intake side of the fan and you MUST mount it there. I'm using a cool-running PWM digital speed controller from a Lincoln but that's a more complicated mod if you want to use an Explorer/Mountaineer control head unit. I may cover this mod in the future for those who are interested.

These pictures of the fan controller were generously contributed by Ryan Hooks, whose site is here on CarDomain. He is a fellow experimenter on this mod and offered things from his write up to be used here. This is REAL nice because I was a MORON and forgot to photograph the fan controller! I don't use this type in my truck, so I don't have one to photograph now and the two trucks I've already modifed other than mine are far away! You can see other diagrams and information that may be helpful on his site.

Sensors

There are three sensors you need: interior, exterior, and sun load.

The **interior sensor** is located in the dash, behind the center panel and to the right. It's clipped in place immediately behind the oval louvered vent to the right of the radio. It just pries away from the inside of the dash -- it's not screwed or glued in or anything. Below are two views of it. Again: GET THE HARNESS.

You may wonder what the white hose is for: well if you read the previous page, it's the "aspirator" that draws air into interior sensor. Get the hose and all fittings that go with it, including any part that goes through the firewall (if present). If you can't get the hose, or it's no good, then 3/4" corrugated plastic "bilge hose" from a hardware store will work.

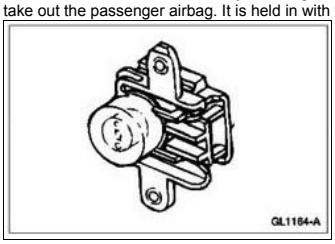
We'll be hooking it up a bit differently than the Explorer, and it's easier. However the hose needs to reach all the way to the right of the passenger compartment and you may not be able to salvage enough. Generally, it takes two pieces to make it with the white salvaged hose.

The **exterior sensor** (the "ambient" temperature) is mounted up on the radiator bulkhead in the front of the engine compartment. It may be one of two sensors if the donor vehicle also has on overhead console. The two sensors shown are ones for an overhead console, but represent the design of the sensor you're looking for. The OHC and EATC sensors are virtually identical in appearance except for the wire colors and they are electrically different. The one you want for this mod has

wires that are PK/BK (pink with black stripe) and RD/OR (red with orange stripe). GET SOME OF THE HARNESS! Leave about 6" or so of wire on the sensor if you can. No LESS than 2".

The location is up around the drivers side headlight, mounted on the radiator bulkhead. They can be hard to reach. If you are going to do an OHC (overhead console) then also get that sensor while you're at it.

And finally, the **sunload sensor** is a simple photocell that detects the level of sunlight entering the vehicle. It also mounts using clips and has no screws or other fasteners. The diagram to the left is once again courtesy of Ryan Hooks. Below right you can see where the sensor is located under the top of the dashboard. If you look at your Ranger, at the black part of the top of the dashboard around the defroster vents, you'll see an enigmatic round hole on the passenger side that has no apparent purpose. That hole is for this sensor. Isn't it nice that your Ranger already has a place for it? To get to the area you have to take out the passenger airbag. It is held in with two bolts accesible by dropping the glove compartment.



MORE TO COME -- PAGE BUILDING IN PROGRESS!!!

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Head Unit Details

(To the right is my unit at night, a blue lighted 1997.) As I've mentioned already, the control heads come in several "flavors" and the only one we're concerned with here is the Explorer/Mountaineer version. Navigators and automobile head units are different and though they can be adapted, it's too much to describe in a simple how-to. If you're the experimental type like myself and they offer you an advantage, then give them a try -- particularly if you have prints on the wiring to verify that the color codes match the truck units. The connector pinouts are DEFINITELY different.

The first thing you can do to get the proper head unit is to take it from the proper donor vehicle! But sometimes deals come along and we aren't the one who pulled the unit. To help you identify which kind you're dealing with, here's some information:

1. Explorer style units have a button on the upper left of the console that says "REAR FAN OFF". On automobile units it says "OUTSIDE TEMP".

2. 1995 to 1997 units have blue displays (because of a blue display filter window). You can shine a flashlight into the display window to see what color it is. 1998 through 2001 units have a green display filter.

3. 1995 units lack two wires towards the end of the black harness connector. They are TN/OR (tan/orange stripe) and PK/LB (pink/light blue stripe). These are the ODB-II network wires which were not present in 1995.

4. Pin 23 is unused on controllers intended for analog fan control units and there is no wire there. On units intended for digital PWM fan controllers, pin 23 has a TN/OR wire on it. (See connector views below). For this mod you do NOT want a PWM fan control model.

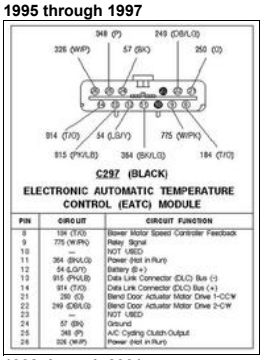
5. 1998 and later head units have a yellow wire completely lacking in earlier years. This wire is for the steering wheel controls for the radio and heater found on later Explorers. To use it would require changing both your steering wheel and "clockspring" mechanism (which feeds signals to/from the wheel so it can turn) to those of an Explorer. If you want to try this part of the mod, you definitely need a 1998 to 2001 unit.

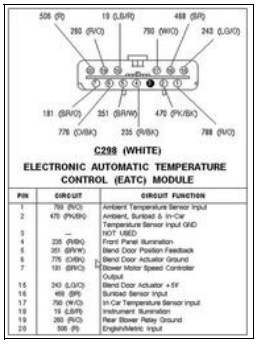
6. 1998 and later units have a YE/BK wire to control power to the blower by switching the fan relay on or off. Previous years simply jumped "hot in run" 12 volts to the fan relay, turning it on whenever the key was on. However, if the fan controller were to fail to "full on" (likely possible failure mode), then your fan would run full blast whenever you started the vehicle. With the relay control line, the head unit can turn off the fan when you hit the "OFF" button.

In the connector diagrams below, what is called the "white" connector is usually more of a gray color.

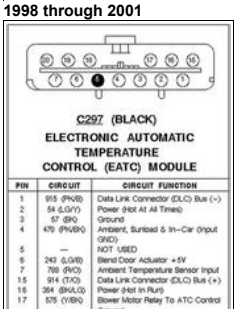
Here's the pinouts of the connectors. Note that the connectors for 1995 do NOT have the DLC/SCP data bus (ODB II communication wires). These wires are easily distinguishable because they are twisted together to make a "twisted pair".

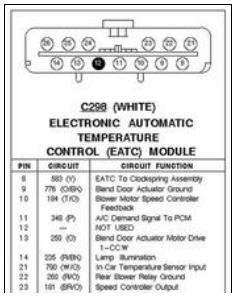
1995 through 1997





1998 through 2001





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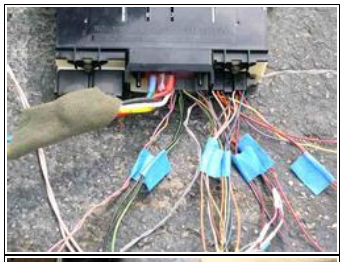
IMPORTANT NOTE: The pinout shown above for the 1998-2001 BLACK connector has an error. Pin 6 shows a LG/B wire and it is in fact LG/OR. The schematic, and actual observation of units confirms that it should be LG/OR. Thank you, Bob, for pointing out that Ford's diagram was in error!

What to get with the controller

You MUST get the harness connectors and at least 6" or so of wire if you possibly can. If you don't, then you must try to get the harness off a similar year vehicle because of the wiring differences. Besides that you REALLY MUST get the vacuum harness. Explorers and Rangers use the same basic heater ducting and control setup. The "doors" to direct the air are all vacuum controlled. The EATC controller has vacuum valves built into it to electronically control the routing of air inside the ducts.

The vacuum harness is screwed to the back of the controller and does NOT need to be removed from it. You can see it with all it's multi-colored tubes in the center of the back of the controller in this picture.

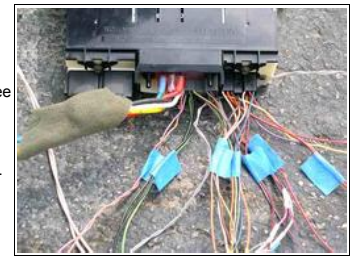


It should be unplugged from the ductwork where it connects behind and to the left of the glove compartment. 2 white tabs hold the blue rubber end connector of the vacuum harness in place. You don't need the white piece. You can see where it plugs in at the lower left of this picture. DO NOT REMOVE THE INDIVIDUAL TUBES. The tube harness is clipped to the dash frame in a couple of places so pull those nylon retainer pegs loose and when it's free you can pull it out with the controller when you remove it from the donor vehicle.

DON'T BUY A UNIT WITHOUT WIRING AND VACUUM HARNESS UNLESS YOU ARE DESPERATE!

Organizing the "Rat's Nest"

For me, especially when colors are duplicated in a harness, I like to group wires by function. It helps me to organize the terminations and make fewer mistakes by terminating one sub-system at a time. You may find this helpful as well and so I'll share what I did. As you can see from the photo to the right, there are a lot of wires -- but they become more manageable when you break them down into groups. I just use masking tape and mark something on each "flag" to identify what bundle is what.



So here's how I usually group them:

Power and ground:
BK - ground
RD - English/Metric (+12 volts = English, ground = Metric)
BK/LG - "hot in run" (switched +12 volts)
WH/PU - "hot in run" (1995-1997 only)
LG/YE - "always hot" (constant +12 volts)

Blend door actuator/servo motor
OR - Blend door drive 1 (CCW)
DB/LG - blend door drive 2 (CW)
BR/WH - blend door position feedback
OR/BK - blend door ground
LG/OR - blend door +5 volts

Fan relay and speed control
WH/PK - "High speed" bypass signal to speed control
BR/OR - blower speed controller input signal
TN/OR - blower speed feedback (do not confuse with other TN/OR)
YE/BK - blower motor relay control (1998 up only)

Sensors
PK/BK - ground (common) for all sensors
RD/OR - ambient (outside) temperature sensor
BR - sunload sensor input
WH/OR - in car (cabin) temperature sensor

Miscellaneous
YE - steering wheel controls (1998 up only)
LB/RD - dimmer input
RD/BK - dimmer input
RD/OR - rear fan relay (we'll use to disable A/C compressor)
PU - A/C compressor demand signal
TN/OR and PK/LB - twisted pair for network tie in (1996 up only)

Please note: There are two RD/OR wires, and two TN/OR wires. You MUST ensure you put them all in the correct groups. Use the connector pinout diagrams for your year console to sort out which one is which.

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Initial wiring and testing

You may be saying, "John, what do you mean initial wiring?" Well, the idea is to get a 12 volt power supply that can do 4 amps at or more, wire this thing up on a workbench or table INDOORS, and test all your JY finds. It's really a good idea to make sure everything works BEFORE you whack off cable connectors in your truck (which you will be doing). When you install this thing -- it's not so easy to go back again.

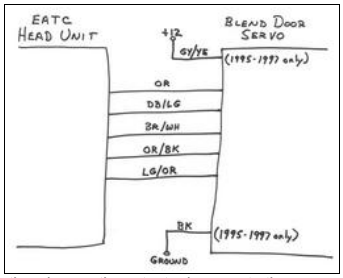
Mainly what we will do is break down the harness into wiring "groups" (see previous page) and then terminate those groups.

The one thing we can terminate in a finished form is the blend door servo. You just need about 18" to 24" of wire from the head unit to easily reach the servo location when installed.

Servo harness construction

You have several options for making this harness. You can go all out and make it by soldering it and putting heat shrink on the splices, or you can just use small crimp on "butt splices" or just about any method to make this small section of harness. I DO NOT recommend the "twist and tape" method. That's going to be a dead end -- don't do it. We will do that for out temporary hookups; but for this particular bit, lets do it right.

However you choose to do it, get 5 pieces of 12" long wire in about 18 to 22 gauge. Your color choices are optional. If you have a 1995 to 1997 actuator (which I don't recommend the old ones unless you're going to rebuild them) you will need two additional 24" wires in the same gauge. These should be colored in a way that clearly says "ground" and "power" to you so you don't get confused later.



Now, for all actuators, use one piece of the 12" wire to join the wires on the actuator harness to the matching color wire on the head unit in the group you separated. There should be 5 wires in this color scheme:

OR - Blend door drive 1 (CCW)
DB/LG - blend door drive 2 (CW)
BR/WH - blend door position feedback
OR/BK - blend door ground
LG/OR - blend door +5 volts

The same wire colors should exist on both the servo and the head unit. If not, you've got something messed up, go back and check to be sure.

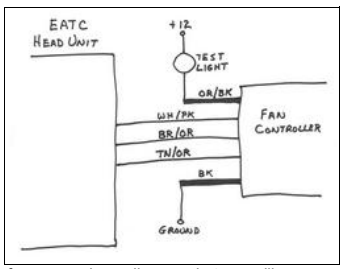
When all 5 wires are terminated/insulated at both ends, bind the whole bundle together to make a neat but flexible harness. For example, small spiral tubing, split loom, tape and tie wraps are all suitable methods and maybe you have more ideas.

If you have an older 1995-1997 actuator, you still have 2 wires on it you haven't joined. Splice the 24" pieces onto them. The GY/YE wire is the "hot" or 12 volt wire, and the black wire is the ground so use the appropriate wire color from the two wires you selected. DO use two different colors so you don't get confused when we connect them later.

You've now connected the actuator and it's ready to test, but lets get everything else wired first.

Fan speed controller

We're going to do a "temporary" job of hooking this part up. In addition to the parts, you need some kind of 12 volt lamp you can wire up. It could be a 12 volt test lamp, or whatever you like. We're going to watch it brighten and dim to show how the fan speed controller is working (or not working).



Whatever you use, make sure it doesn't draw more than a few amps, depending on what you will use as a power supply. You can test off your vehicles battery, but keep the load low for this. An old brake light, dome light something like that is ideal.

If you grouped teh "fan control" wires together, then you have these wires to work with. We'll use all of them except the YE/BK wire in this phase.

WH/PK - "High speed" bypass signal to speed control

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BR/OR - blower speed controller input signal
TN/OR - blower speed feedback (do not confuse with other TN/OR)
YE/BK - blower motor relay control (1998 up only)

Make a connection between the wires above (except YE/BK) and the matching color wires on the fan controller unit. Tape or otherwise temporarily insulate the connections so they can't short out.

There are two additional wires on the fan controller, larger ones (10 gauge) that we will be using as well.

OR/BK - "load" connection to fan
BK - ground, connects to chassis

Take the black wire from the fan controller and twist it in with the black "ground" wire from the head unit. If you have an old blend door actuator the ground wire from it should also be tied in here. These three wires spliced together temporarily are the connection where you will attach -12 volts from your power supply when you test.

The OR/BK wire from the fan controller goes to one wire on your test light, the other wire from your test light goes to +12 volts with other wires which will be described further down.

Okay, you've wired the fan controller. Now we wire the sensors in, set up the power wires for test, and we'll be ready to power up the unit! Isn't this exciting! I was psyched the first time I powered one up -- but hey, that's just me.

Sensor wiring

Each sensor has a pair of wires. On each sensor you have one PK/BK wire, and a wire of another color. They match these wires on the head unit. See the diagram below in the power wire section.

PK/BK - ground (common) for all sensors
RD/OR - ambient (outside) temperature sensor
BR - sunload sensor input
WH/OR - in car (cabin) temperature sensor

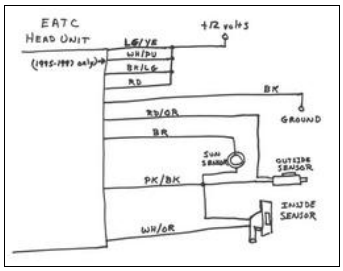
So, now just take the PK/BK wires from all three sensors and twist them together with the PK/BK from the controller head unit and tape them.

Then, match each remaining wire on a sensor to it's color match on the controller and twist and tape them as well.

Now the sensors are wired!

Power wiring

Now we connect together all the wires which will receive +12 volts. The sensor wires are also on this diagram.



On the head unit/controller you should have created this bundle of wires:

BK - ground
RD - English/Metric (+12 volts = English, ground = Metric)
BK/LG - "hot in run" (switched +12 volts)
WH/PU - "hot in run" (1995-1997 only)
LG/YE - "always hot" (constant +12 volts)

Just take all the wires above EXCEPT the BK one (you finished the black wire earlier), and twist them together with the other wire from your test light. If you have an older actuator, connect the wire you extended from the GY/YE wire to this bundle as well.

Remember the WH/PU wire only is present on pre-1998 controllers.

Now you should have two wire points to connect, a ground (-12 volts) consisting of 2 to 3 wires, and a power (+12) consisting of 4 to 6 wires, depending on what equipment you salvaged. The RD wire is a line to control the display for either fahrenheit or celsius display. I have you connecting it to 12 volts (fahrenheit) -- but if your local units are customarily in celsius you may connect it to ground instead.

We're ready to test! (Insert drum roll here...) ;-)

Testing the EATC "offline"

Now we're going to connect power to this "mess" and see if it works. I know I said originally "test indoors"; but you can test out at your truck if you want.

Part of the reason for this phase of testing is to test the fan controller -- it's not tested by the more advanced self-tests we'll do later. Also, you can check for bad bulbs in the face illumination in this phase before you put it in your truck.

If you're going to test outside, then set the test-wired unit on a table near your truck and bring some kind of jumpers over from your battery. I recommend a 10 amp fuse in the +12 volt line between your truck and the unit to protect your equipment from catastropic shorts.

Inside or out, arrange the stuff so that there are no short circuits, so that you can see your test light, and so you can see the head unit display. Position the blend door servo with the shaft facing up so you can observe it's rotation.

Connect the ground first, then the +12 volts. The display on the head unit will briefly light up everything on the display, then go dark. This is normal initial power on testing.

At this point, you may see the shaft of the blend door actuator moving. It has a about 90 degrees or so of travel and it will hunt all the way to one extreme, then the other to test itself. If you don't see this happening, that's a bad sign.

You should NOT have your test light lit. If it is lit, you have either made an error in wiring, or your fan speed controller is defective. Verify your wiring before proceeding.

Now press the AUTOMATIC button on the head unit controller. The display should light up with a temperature (usually 65 degrees) and the word AUTO.

You may observe motion again on the blend door servo. Whether you do or not is not significant at this point.

After a few moments, your test light should begin to glow. It will probably go to full brightness slowly. As

long as it's responding at all, that's good!

Next, use the wheel on the right hand side of the head unit to change the fan speed in "manual". The light should brighten and dim. If it does, your fan controller appears to be fine and you can use it.

Finally, if you want to, connect both the BL/RD and RD/BK wires to +12 volts. This will light up the buttons and you can see if all the bulbs work and arrange to replace them before installing.

If any are bad, you can carefully pry up the tabs holding the faceplate on to the main unit and pull the faceplate off and replace the bulbs. If you have the wrong color, carefully peel the silicone rubber caps off the old bulbs and install them on the new bulbs if you need to.

Advanced self-test mode

The EATC has an advanced self-diagnostic test mode. A great description of it can be found here on the P71 interceptor site I mentioned previously. What he's posted is a direct "cut and paste" from the Ford service manual. I'll paraphrase here and add some additional codes you may see not mentioned in that document.

Basically, what you do is press and hold the OFF button on the head unit, then press FLOOR while still holding down OFF. Now quickly release both buttons and press the AUTOMATIC button.

At this point a little line will appear to rotate in the middle of the display. This indicates testing is in progress.

The test can take what seems to be a long while when you're waiting for it! Just let it run and don't worry.

At the end, the display will begin flashing numbers, or it will simply light up everything on the display and halt.

If only "888" appears for the number, and everything else on the display is lit up, then you have passed the advanced self-test! Congratulations! You can now proceed with the installation.

If there are numbers, write them down as they appear. Here's what they mean:

022, 024 - Blend door actuator shorted

025 - Blend door actuator not responding properly

030 - cabin temp sensor shorted (either wiring or bad sensor)

031 - cabin temp sensor not connected or failed (open circuit)

040, 042 - outside (ambient) sensor shorted (wiring or bad sensor)

041, 043 - outside (ambient) sensor not connected or failed (open circuit)

050, 052 - solar radiation sensor shorted

115, 125 - bad/no data from vehicle network (you'll get this always testing outside the vehicle)

There may be others depending on the year, particularly network ones -- but these are the main ones you have to deal with.

Whatever happens, press the DEFROST button to clear the codes, then activate self test again.

If you got numbers, they may be the same ones, or some may be missing. Sometimes the first self-test is misleading which is why we're doing it again.

Based on the numbers, troubleshoot your wiring and sensors.

If all you get are 1xx codes, and your fan controller worked in the first tests, then you are good to go! You can proceed to the next phase -- installation!

Press DEFROST to clear the codes, disconnect the power, and unhook all your temporary connections. If you had problems, get them fixed and try again!

N3ELZ's profile on CarDomain

Vehicle Owner
Member ID: N3ELZ
Location: Kennett Square, Pennsylvania

Login to Message Login to Add Friend

N3ELZ's profile on CarDomain

Vehicle Owner
Member ID: N3ELZ
Location: Kennett Square, Pennsylvania
Login to Message Login to Add Friend

Vehicle Info

2002 Ford Ranger

Bragging Rights

0-60	10.7 sec
HP	180
Weight	3900 lbs

Modifications

Performance Parts
Custom Intake
Dynomax Exhaust
Custom Engine Comps.
Bosch Ignition
Rancho Shocks
Custom Strut Bars

Car Audio & Video
Jensen Speakers
Bazooka Subwoofers
Kenwood Video
Jensen Tweeters

Interior
AC Autotechnic Gauges

Exterior Styling
Custom Body Kit
Mickey Thompson Wheels
Mickey Thompson Tires
Custom Lighting

Ratings
Overall Rating
Overall
Interior
Login to rate

Login to Favorite
Login to Nominate for Showoff
Forward to a Friend
Report Abuse

John Griggs's Ford Ranger: "Edge"

Last updated: May 11, 2008
Hits: 188,003

Overall Rating: login to rate

Installing the EATC Unit - Phase 1

First, I have to say I'm tremendously impressed with some of you! I've barely had this how-to started and I've gotten emails from people who have all the parts. One (Bob) has already done the bench test and verified his hardware and is ready to install!!! Bob also did some "proofreading" and found an error in the Ford documentation that I missed. You folks are on the ball!

So, with that in mind I'm starting the install document, though it will get better and have more pictures over time as I refine it. I feel like I need to get something there for the intrepid people who are ready and almost ready to install already.

The way it's going to work is that this page can be used to either do some preliminary work BEFORE the final install, or you can consider it the first page of the full installation. Phase 1 can be done without disabling your existing climate controls. However, once you start Phase 2, there is no going back -- at least, not easily.

A choice you may need to make

First of all, Between 1995 and at least 2003 (the last year I have any kind of tech data for), the Ranger used two different methods of engaging power for the blower motor. In addition, there are two different variants of the head unit, and the result is that you may have to make a choice about how to wire your blower power relay. I will cover ALL methods of wiring in this how-to.

1995 to 2000 Rangers -- no choice

From 1995 to 2000 the fan relay control works just like an Explorer! That is to say, we ground the relay to engage it. For 1995 to 2000 Rangers, no relay is required and we can put the EATC in with just a few wiring tricks and no additional relays.

So, for those of you with 1995 to 2000 trucks, and a 1998 or later EATC head unit (green display), your wiring is easy, and you have no choice to make.

However, 1995 to 1997 EATC head units (blue display) have NO main blower control output. This means that if you have a 1995 to 2000 truck and a 1995 to 1997 head unit, you will need an extra relay. You have no choice either. You need two relays total.

2001+ Rangers -- choose a method

If you have a 2001+ truck, and a 1995 to 1997 head unit as I have, you also have only one choice and no additional relay is required.

Finally, if you have a 2001+ truck and a 1998+ head unit, then you can choose to control the fan with or without a relay.

There are two ways to wire the fan power relay if you have a 1998 or later console and a 2001+ truck. You can control the relay with the EATC head unit, or you can just have it energize whenever the key is on.

The advantage of having the EATC control it is that you can turn off the fan even if the fan speed controller fails to "full on". Other than that there is no particular advantage.

The disadvantage of EATC control is that the Ranger and Explorer fan power relays work differently. The Explorer needs a ground to activate and that's how the EATC unit is wired. The Ranger needs +12 volts to activate the relay. So an ADDITIONAL relay is required to make it work this way.

On the other hand, the key-on fan power activation is simple, and requires no additional relay in the Ranger. I have mine wired this way; but the first two I did I put in a relay.

The disadvantage of the key-on method is if the fan speed controller fails, the fan will run at full speed every time you turn on the truck until you replace the speed controller. Not a big deal -- but it's your call.

What you need besides the EATC pieces

First, you need normal hand tools, a drill, etc. "End nippers" are nice for trimming the excess plastic tabs off the fan housing -- but you can always do something.

You will need a BUNCH of butt splices in all three sizes: yellow, blue and red. I never counted how many, but have at least a dozen of each of the red and blue, and a half dozen or so of the yellow ones on hand to be on the safe side. Also about a dozen "blue" insulated female spade connectors. Get the kind that have the insulation all the way down, not just on the crimp area. In the picture at the right are examples of all these things. The spade connectors are on the left side, butt splices in the middle, and tap splices on the right. For the spade lugs, get the type like on the top, not the ones with bare metal like the bottom. They will be used to connecto to the relays.

You will also need some of the "tap connectors" of the blue variety to tap the vehicle network and unswitched power from the radio.

You will need at least 1 automotive relay. Just an SPST 20 or 30 amp relay will be fine. If it has a mounting tab, remove it. We're going to stick it to the back of the controller with double sided adhesive and the tab will interfere when we mount the controller. This first relay is

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for the air conditioning compressor override. We will use the "rear fan off" control to let us switch off the A/C compressor when we want something like defrost without running the compressor. What we want is those small, plastic encased relays that are a cube about an inch on a side. Anything much bigger is hard to fit on the back of the head unit. Fortunately, this is the most common type. Here you can see two of them stuck to the back of the head unit. These particular ones have are "SPDT" types with an extra terminal called "87a" in the very center of the relay. You do NOT need this type, I just happened to have some around. Both are the same size/shape but the SPST type lacks the 87a terminal.

"SPST" and "SPDT" refer to the configuration of the relay -- "Single Pole Single Throw" and "Single Pole Double Throw". It's not a brand name or anything. I thought I'd throw that in for those of you who don't do a lot of this stuff.

The second relay will be required if you need to control the fan power relay with the EATC head unit. This relay will turn on and off when you turn the EATC unit on or off. Use the same kind of relay as the first one I mentioned. Radio Shack sells one, and they are available at most auto parts stores. Prices run from $5 to $15 generally.

In addition you need about 20 feet or so of 18 or 20 gauge twisted pair wire (shielded or unshielded doesn't matter). We'll use this wire to run to the sensors and the vehicle network. You don't want someting with real thick insulation on the individual wires in the pair though. With the sensors we will be combining 3 wires into one side of a splice and if they are too thick it makes it difficult. You will also need probably a foot or so of 10 gauge wire to ground the blower speed controller in the engine compartment.

A 3/4" "spade" boring bit (wood bit) to make the hole in the ductwork for the aspirator fitting.

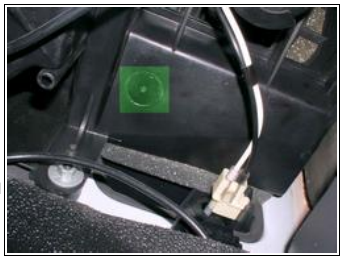
Cable ties are a must to get the wiring under control and can be used to mount the outside temperature sensor as well.

Some silicone adhesive/sealant type stuff or gasketing of some sort to make sure the fan speed controller seals to the housing. If you're truly ambitious, you can cut your own gasket from sheets of gasket material.

Some prep work you can do

The following items can be done in advance of the full installation to save some time, or on the day of the installation, as you wish.

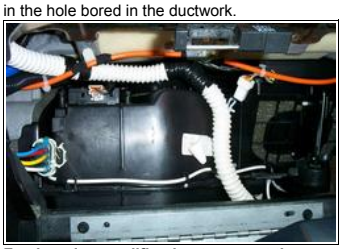
Aspirator connection



We need a place to tie in a tube for the aspirator that will draw air through our internal air sensor. If you slide your passenger seat back a bit, and get down in the footwell and look up under the dashboard, you'll see this view. This is towards the right side of the vehicle, looking up at the ductwork. In the Rangers I've seen, this area is generally the same. You won't see the green square I'm showing here as a highlight, but you will see that round "dimple" in the middle of it embossed on your ductwork. This is where you will drill a 3/4" hole using a spade wood boring bit. Take your time and don't heat up the plastic -- it doesn't take long to get through. If you are doing this in advance of the full install, just put a piece of duct tape over it to seal it until final installation.

If you recovered some stock tubing with the "elbow" it attached to, the tapered end of the elbow friction fits PERFECTLY into a 3/4" hole. You can use a little PVC pipe cement if you're not satisfied with the friction fit -- but it's pretty tight and none have fallen out yet. If you don't have the factory tubing, you should be able to cram some 3/4" I.D. bilge tubing in there and get it to stay, or improvise some kind of fitting. However, this location for the tap is important because it's on the suction side of the fan.

Below you can see two views contributed by the mysterious "Bob" (who doesn't want his full name used). I didn't get pictures of the aspirator connection and he took these of his. He's completed his installation now. Way to go, Bob! To the left you see the tubing run along the back behind the glove compartment hole. Note also that you can see the vacuum connection in the lower left, and his old actuator harness secured in the upper right. In the right hand picture you can see the salvaged factory "elbow" fitting used in the hole bored in the ductwork.



Fan housing modification to accept the speed controller

This is the fan housing which you can get to pretty easily once you remove the cruise control servo (which is one bolt). Here, the two screws which hold in the stock resistor in your truck have been removed and the resistor taken out of the way. Notice beneath the hole are two "tabs" that stick out. They are molded with right angles in them, and they are just below the hole to the left and right ends. These must be removed which can be done with cutters and then you can use a razor blade or whatever to shave them flat. These "rejection bosses" keep the wrong resistor from being mounted. Since we WANT to mount the wrong unit, it's necessary for us to get them out of the way.

Once you've removed them, you can test fit your speed controller. As you look at it in the picture, the left screw of the new speed controller will not line up with the old hole and you'll have to drill a suitable "pilot" hole in the housing. A 1/16 or 3/32 drill bit is usually good for this.

If you're not doing the whole install, then put the original hardware back in place when the prep work is completed.

If you are going to continue the install, you can mount the unit with the two original screws from your

stock unit. Put a gasket on the unit or run a bead of sealant around the outer flange of the mount to seal the unit tight. We don't want water sucked in that will accelerate corrosion of the speed controller.

External (ambient) temperature sensor wiring

Run a pair of wires about 10 feet long from inside the cab to the front of the truck around the headlight area. The end in the cab should be run up into the center console where the EATC head unit will be installed. There should be about 6" of slack (at least) at that location so the wires will come out far enough to be spliced during the final install.

I bring the wires through a tiny slit cut in the periphery of the rubber grommet the parking brake cable comes through. You can get it through the firewall however you please; but whatever you do take care how you route it in the cab. You don't want it getting hung up in moving parts under the dash, or dangling down and catching your foot as you go for the brake. I run it DOWN from the hole and under the mat over to the center and then up to dash to prevent problems.

The other end should end up around the front headlight area. This end will be tied into the ambient sensor. Here we see the ambient sensor clipped into the body work below the headlight on the drivers side. This view is looking up from under the truck. There are some extra wires here because this guys truck had extra lighting, etc. If you can, get the little white nylon clip that holds the sensor in place on the donor vehicle. There are spots on the body sheet metal up front under the headlight where it can simply be clipped in place. This location is fairly well out of the engine heat, which is desirable. No matter where you choose to mount it, keep that in mind. There are several possible spots, but stay away from radiated engine heat and wash from the engine cooling fan.

If you don't have the original mounting piece, just tie wrap it or tape it to something. Keep the little tip clear and don't have it laying against anything so that it measures the temperature of the air and not the thing it's touching.

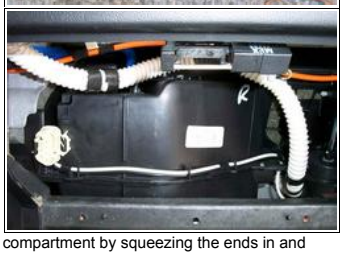
Go ahead and splice the sensors wires to the wire pair using red butt splices. The sensor has no "polarity" so it matters not which wire on the sensor you connect to which on the pair you ran. You can use a product called "liquid electrical tape" to seal the splices when you're done. It's not absolutely necessary, but it will make the connections last longer and prevent signal errors if you get road salt and water or sea water (both conductive) on the connections. You can do all this whether you're going to finish the install that day or not.

Interior (cab) sensor

Before you begin, extend the wiring harness of the interior sensor using red butt splices. You need about a foot or so. You don't need to seal these splices. Like the exterior sensor, this one has no polarity and it doesn't matter which wire is which. Usually these sensors come with VERY short harness stubs on them.

Remove the radio and the center bezel from the dash, exposing the area above your current heater controls. Just to the right of this area is the little oval vent on the soft part of the dashboard.

This sensor mounts to existing posts on the back of the dash right behind that vent. The hose can be removed to make it easier, but it's not necessary. If you can't get the sensor to stay on the posts, remove it and squeeze the spring clips on the sensor that go over the posts a little tighter. Not too tight though or it's hard to slide the sensor over the post. The sensor mounts with the hose connection facing DOWN.



If you like, you can route the hose up along the metal bracket above the glove compartment and over to the far right side of the truck and down to the hole you drilled in the ductwork. The picture to the right shows a typical installation. You will need either two pieces of the original white hose, or some of the 3/4" plastic bilge hose. You need about 4 feet or so of hose altogether, but buy 5 or 6 feet, at least. You can connect the end of the hose to the hole in the ductwork using a factory style angle fitting as discussed previously, or make something of your own.

Note that to run the tubing you will have to drop the glove compartment by squeezing the ends in and pulling it out and down. In the picture above, Bob removed the glove compartment completely, but it's not required. Depending on how you route it, you may need to remove the airbag also. There are two bolts over the glove compartment area that hold it in, then one connector to pull off.

IMPORTANT SAFETY CONSIDERATION: Airbags are explosive devices. There is a danger in handling and connecting them. Proceed at your own risk. When disconnecting and connecting it, hold it so it's at a right angle to your face. Then if it blows, it will blow to the side and cause you less injury. I do not know of any ever blowing -- but it's better to be safe.

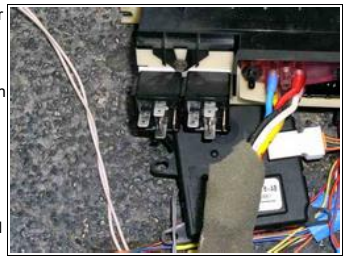
Sunload sensor

If you haven't already done so to run the aspirator tube, drop the glove compartment door and remove the airbag, paying attention to the warning above.

Like the interior sensor, you need to extend the wires. Make these extensions about 2 feet long and splice them with red butt splices.

This sensor also has little spring clips that attach it to existing posts on the underside of the dashboard -- more specifically the black plastic piece that surrounds the defroster vents at the base of the windshield. Here you can see it clipped in place. You can remove the CSM (central security module), the white box dominating the left hand side of the picture. You don't have one if you don't have power locks. It comes out with two screws so if it's in the way it's easy to move. Once the sensor is snapped in place, route the harness down and into the central dash area.

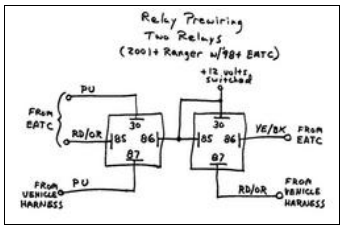
Wiring the relays



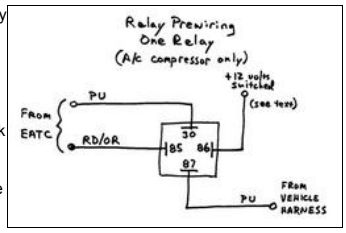
As previously discussed, you will be sticking either one or two relays to the back of the EATC head unit with double sided adhesive as shown here. I have the relays aligned differently relative to the way the diagrams are drawn below, but for no particular reason. It doesn't matter which way you have them on there as long as you get the numbering correct! Don't worry, it's marked on the relay. I didn't show it as different in my diagram, but terminal 30 is the terminal that is rotated relative to the others in the middle row, the left hand terminal on each relay, as shown here. If you are good with wiring, then you know you can rearrange even the terminals to some extent and you're welcome to do so. If you're not savvy, it's probably best to just set it up to match the diagrams below.

One note: all the diagrams contain a reference to "switched 12 volts" and what that means is that the wire on that terminal will be connected to either of two wires in your existing vehicle harness. Those wires are GY/YE and BK/LG. You will also be using one of those wires from your truck to supply switched (that is, hot when the key is on) power to the EATC head.

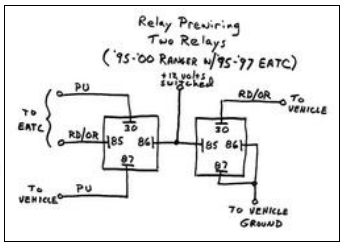
Here's how they will be wired.



This diagram applies ONLY to 2001+ Rangers with '98+ EATC head units. In this phase, you will not be connecting the purple or red/orange wires from the vehicle harness. Crimp female spade lugs on each of the PU, and RD/OR wires (from the "Miscellaneous" group); and YE/BK wires (from the "Fan relay and speed control" group) coming from the EATC harness and slide them onto the correct terminal on each relay. Check first to make sure the wires can REACH the terminals of the relays and extend them if you have to. Then cut 2 pieces of wire 2" long, and one piece a foot long. Strip the ends of all three pieces about 1/4" to 3/8". Place one end of each of the 2" wires in a single spade lug and crimp them in place. Crimp a spade lug onto the other end of one of the 2" wires. Now take the remaining 2" wire end, and one end of the foot long wire and crimp them into a single spade lug. Now put this assembly on the relay terminals as shown so that 86 is connected on the left relay, and 85 and 30 on the right one. The foot long wire should dangle free.

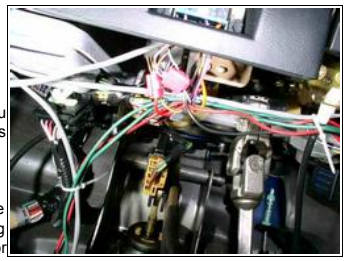


Here is what you will be doing if your vehicle requires only one relay (the one for the A/C compressor override). If you require only one relay, that means we are using another method to control the fan power relay. This diagram applies to any truck from 1995 on with a 1998+ EATC head. With 2001+ trucks it may be you've chosen not to use a relay. In older trucks, we can control the truck directly without a relay. In both these cases, you will be using this diagram, and we'll cover the fan control final wiring in the second part of the how-to. Simply put female spade connectors on the PU wire and the RD/OR wire (from the "Miscellaneous" group) and place them on the correct terminals on the relay. Make a 1 foot 18 to 22 gauge jumper and put a female spade connector on one end and attach it. The other end remains unterminated until we do the final install.



And finally, here is what you do if you are using the older style pre-1998 EATC with a '95-'00 truck. Like the other diagrams, you won't be terminating the wires which go to the truck. Cut 1 piece of black 18 to 22 ga wire about 2" long, and another about a foot long. Strip all of them about 1/4" to 3/8". Put one end of each of the wires into a female spade connector and crimp them tightly. Now crimp another on the end of the 2" wire. Now slide the spade lugs over the appropriate ground terminals (86 and 87) of the fan power relay (the one on the right). Make an identical wire and lug assemble from a different color wire and put it on terminal 86 of the compressor relay (left relay here), and the fan control relay (right). Put lugs on the PU wire coming from the EATC, and the RD/OR wire (from the "Miscellaneous" wire group) and put them on the correct terminals on the fan control relay.

Tapping the vehicle OBD-II network



In this view, we are crouched down, looking up at the area under the dash directly below the steering column. At the very top center, is the OBD-II connector used for scan tools and the wires we want attach to it. We need to tap the TN/OR and PK/LB wires in this bundle and you can see here that I've done that using red tap splices. You can use blue also (I was out of blue). I'm not sure which is SUPPOSED to be used, but they both work. Besides the position you have to work in, you have to separate these two twisted-together wires enough to tap them both and it's a pain -- literally -- to do. What you need to do is make a connection using a 2 foot pair of wires to these, keeping track of which wire is which. The pair wire like we used for the sensors is good for this. If your wire is 20 or 22 gauge use red taps, but for 18 you can really use either.

One thing: when you are done, route the wire up into the center dash area near the existing heater controls and MAKE SURE THE ENDS ARE TAPED OFF AND CANNOT SHORT TOGETHER OR TO OTHER THINGS. The reason is that this network can be important to vehicle operation and you don't want it shorted out.

Also, write down somewhere which wire goes to which color on the wires under the steering wheel. It's important to get them hooked up correctly when you do the final install.

Last, if you have a 1995 EATC unit it doesn't have the vehicle network connection so don't bother!

This concludes Phase 1 of the installation.

N3ELZ's profile on CarDomain

Vehicle Owner
Member ID: N3ELZ
Location: Kennett Square, Pennsylvania
Login to Message Login to Add Friend

Vehicle Info

2002 Ford Ranger

Bragging Rights

0-60	10.7 sec
HP	180
Weight	3900 lbs

Modifications

Performance Parts
Custom Intake
Dynomax Exhaust
Custom Engine Comps.
Bosch Ignition
Rancho Shocks
Custom Strut Bars

Car Audio & Video
Jensen Speakers
Bazooka Subwoofers
Kenwood Video
Jensen Tweeters

Interior
AC Autotechnic Gauges

Exterior Styling
Custom Body Kit
Mickey Thompson Wheels
Mickey Thompson Tires
Custom Lighting

Ratings
Overall Rating
Overall Interior
Login to rate

Login to Favorite
Login to Nominate for Showoff
Forward to a Friend
Report Abuse

John Griggs's Ford Ranger: "Edge"

Last updated: May 11, 2008
Hits: 188,119

Overall Rating: login to rate

Phase 2 Installation

NEWS! The how-to is completed. I will update/revise over time but what you need is here!

This how-to will help you because both Ryan and Bob went to WAY more trouble than is necessary to get their install done because they didn't have the shortcuts. Unnecessary things they did are take loose the ENTIRE dashboard and run separate wires for the fan controller, including in one case drilling through the firewall and adding a grommet!

Although these are WONDERFULLY ambitious (and successful!) efforts that got them ahead of everyone else doing this (well, but me anyway) -- there are easier ways.

The following tricks will be revealed:

1. Painless installation of the blend door servo (relatively). There are some problems you can run into and I've got it nailed to where you won't be taking long at all to do it -- and you won't have to move the dashboard.

2. Reusing the old resistor wiring for the new fan speed controller. This means you run NO extra wires to the front other than what I've had you do in Phase 1 of the install and you DEFINITELY need not drill the firewall. There are some "gotcha's" doing this so wait for the how-to -- particularly if you have a pre-2001 truck. But even newer ones have a junction that must be cut near the fan to keep from a short circuit. It's easy and painless as long as you know you have to do it!

Again, my sincere congratulations and appreciation to Ryan and Bob for their outstandingly agressive pursuit of this install! Still, I have some tricks to make it easier if some of you want to wait a LITTLE bit longer! ;-)

PLEASE NOTE: As you begin this phase, you must continue to the end or you will have no heating/air conditioning. Also, if you skipped the "bench testing" procedure on page 17 you are taking a chance of ending up with something that doesn't work. Again, I recommend you test everything before installing it. Also, it is wise to unhook your battery. I don't do it, and perhaps you'll choose not to -- but if you do you'll need to be very careful when working in the dash, and you must not turn your key on until the ENTIRE install is completed. Turning on the power with things only partially installed could damage EATC components.

Fan Controller Wiring

As I said, it is possible to wire the fan controller using existing wires. What stands in our way is the way wires have been spliced together in the harness -- but it's fairly easy to remedy.

Begin by removing the cruise control servo again in order to make room to work. Unplug the electrical harness from it so that you have plenty of slack to work with it and place the cruise servo over the intake manifold somwhere. If you've not done the preliminary work for this, consult the phase 1 installation instructions. Below left is the servo installed and the red arrow points to the bolt to remove. Below left is the servo placed out of the way on the intake manifold. Note that you don't need to remove the cable that goes to the throttle, just the electrical connector.

N3ELZ's 2002 Ford Ranger N3ELZ's 2002 Ford Ranger

Basically, there are three parts of this: wiring the controller to the existing harness, wiring the fan to the controller and grounding the controller to the truck.

2001+ wiring

Really, pretty simple. There are three wires that go from behind the dash to the existing fan in your truck and they can be used to run the three signals we need out to the fan speed controller. One branches to both the fan and the resistor, but we're going to remedy that.

First, unplug the connector from the fan motor. Next, untape the branch of the harness that feeds the fan all the way back to where it joins the rest of the wiring harness. Usually, it's easier to carefully slit it with a sharp knife or razor. You will expose two wires: WH/PK and OR/BK. Now, cut the OR/BK wire where it joins the main harness leaving as much wire on the fan connector as possible. DO NOT CUT THE WH/PK WIRE. Wrap some electrical tape or use liquid tape to insulate the end of the cut wire in the main harness.

Remove your old resistor from the fan housing. Unplug it and set it aside. It will sone be a useless thing and you can just throw it away unless you know someone who needs one.

Now, brace yourself -- cut off the plug from the resistor harness right at the plug leaving no wire on the plug. When I did this on Carl's truck (the first guy I did this for), he was worried because we had nothing left to splice the resistor connector back in if it didn't work! Oh, faithless people! We will make this work IF you tested all your hardware and it worked. We had tested his.

If necessary, peel down, unwrap or slit the harness taping to expose enough wire to work with.

You now have 4 wires free. One is 12 gauge (OR/BK), and the other three are 14 gauge. Here's what you have:

OR/BK - 12 gauge (thicker) wire
YE/RD - 14 gauge wire
LG/WH - 14 gauge wire
(2001 up only) BK - 14 gauge wire (we won't be using this one, it's too thin for a full ground for the speed controller)
('95-'00 only) RD/OR - 14 gauge wire (similar to the 2001+, we won't be using this wire either. Make sure it's taped off.)

Now take a 2 foot piece of 10 gauge wire and using a yellow butt splice, connect it to the black wire coming out of the speed controller. On the other end of this wire, crimp a yellow "ring terminal". This is a terminal with a hole in it. You need one with about a 1/4" hole to go on an existing ground lug. Route this wire to the passenger side fender, and you will find a ground lug with a strap already attached on the fender next to the blower motor housing. Remove the nut and put this terminal on the stud, then replace and tighten the nut. I realize I show the controller mounted in this photo, but you don't need to have it mounted as you do this and it is easier to NOT have it mounted. Below left is the splice of the wire to the controller, and below right you can see the ground bolt. In most trucks it's tinted green and the green arrow is pointing to it. It's shown with the servo still in place (black bracket in the foreground).

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Using blue butt splices (or solder and sleeve if you're ambitious), connect the wires from the harness to the wires of the fan speed controller as follows:

OR/BK (truck) --> BR/OR (controller)
YE/RD (truck) --> TN/OR (controller)
LG/WH (truck) --> WH/PK (controller)

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The picture above shows all the wires terminated, but it's just for illustration. I think I also used a different combination of wires on that unit -- but use the combinations I'm giving you here. I was sort of "winging it" on the early installs, but I've standardized what wire combinations are used with this how-to.

When you terminate the trucks 12 OB/BK wire, you may have a problem getting it into the blue splice. If so, peel back and cut a few strands of the wire so that you have a smaller bundle to insert in the crimp. Test all crimps by tugging on them sharply. If they do no hold, they were bad and you must redo them.

Plug the blower motor connector back into the motor. We're going to connect the OR/BK wire from the fan to the heavy 10 gauge OR/BK wire (or just OR on some units) coming out of the speed controller. However, we need to check if the wires reach or not so hold the speed controller in place in the fan housing and see if the OB/BK wire from the fan and the OR/BK wire from the speed controller will reach each other. If not, extend one or the other using a yellow butt splice.

Finally, tie the speed controller OR/BK wire to the fan OR/BK wire (or extension) using a yellow butt splice.

N3ELZ's 2002 Ford Ranger

If you offroad especially, it's a good idea to seal all these splice ends with liquid electrical tape (best), or wrap each one very tightly with electrical tape. You can neaten up the harness however you like. There's a black wire we didn't use for a ground because it's too thin and you can just cut it back and tape or seal the end up.

Mount the speed controller in the housing using a gasket or some kind of sealer. Replace the cruise control servo (don't forget to plug it back in) and you're done!

1995 through 2000 wiring

Basically the same as the 2001+ wiring except that:

A) You have no black wire on your resistor. It's RD/OR and you must insulate it from shorting to anything else because it's a "dual function" wire and we'll be using the other end inside the truck to control the fan relay.

B) There may not be a ground lug in the same position as the one in the 2001+ trucks. If there is not, simply find another good nearby ground that you can put the lug on and secure it well. If it's not intended to be a ground point, remove the paint directly under where the lug will go so that it makes good contact.

Wasn't that all MUCH easier than drilling and running a new wire? I think so! I'm fundementally lazy, so I'm always looking for an easy way out!

Mounting the Blend Door Servo

First, remove the original servo. You need a small 1/4" ratchet and a 5/16" or 8mm socket. The socket needs to short enough to allow the screw to come all the way out because the gap is VERY small. Note in this picture the two sockets. One is a cheapy that is shorter (right) than the better socket (left) and it worked well. You can also take an old socket and cut it down since you're on a hex head screw and not on a nut with a shaft sticking out of it. However, don't cut it down TOO much as you have to come into the rear screw over the servo and you need enough length to reach the head of the screw.

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Those of you with 2001 and 2002 Rangers may have a cable controlled blend door. You can still do this mod, no worries. But taking out your old actuator is a bit different. Here you can see the climate controls and the two thin cables that go to the rotary actuator at the bottom of the picture. That actuator just clips onto a baseplate mounted in the same spot the servos would be. Push the tabs on the base plate out away from the rotary piece and it just pops off. Then you will remove the baseplate just as if it were a motor actuator -- only you've got a bit more room. Sorry, no picture of the baseplate -- I don't know what happened to it.

N3ELZ's 2002 Ford Ranger

Okay, now here's the deal: this EATC servo can be a real dog to mount. Getting the shaft into the hole in the blend door seemed impossible -- and it was. It turns out that it has to be turned a little because the servo has more travel than the blend door. Also, the blend door has a tendency to keep "falling" because of gravity and turning the keyed hole where the shaft has to go in. It helps to take the servo apart and preset the position of the shaft. This is not at all hard to do. If you're lucky enough to have everything end up where it should be and you can just drop it in -- great. But otherwise you're going to need the following procedure.

To the right is a picture of a special servo I put together using parts from a white and black one to highlight the tabs that hold it together. Start on a corner and pry the tabs on either side of the corner away and slightly separate the two housing halves. Work you way all the way around and lift off the top (white half) of the servo carefully, leaving all the parts in the black half.

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What you'll end up with is more-or-less illustrated in the pictures below. These are leftover pieces from when I built my "hybrid" servo before and yours won't look quite like this one. Notice the position of the arc-shaped gear on the right of each picture. In the left hand picture it is tight against the case. In the right hand picture it has been rotated to make about a 1/4" gap between it and the housing. Just lift the center gear piece up a little bit, and you can rotate the drive shaft the protrudes outside the case to turn the arc gear. Once it's in place push the middle gear back in and snap the case back together carefully.

N3ELZ's 2002 Ford Ranger N3ELZ's 2002 Ford Ranger

Now put the servo down and reach up between the ducts where the servo mounts and find the circular area where the shaft will go in. You'll find that by sticking the end of your finger on it you can turn it this way or that. What you want to do is turn it fully counterclockwise (as if you were viewing it from the top). This will put it in the correct position to mount the servo.

Once you've done that, position the servo up over the duct. Orient it shaft down so that the side with 3 mounting tabs (at the top of the pictures above) is towards the fire wall and the side with two mounting tabs is towards the seats. Rotate it around a bit after you get the shaft into the hole and it should drop in. Great! Now put the screws in starting with the ones closest to you. Don't tighten them completely, but enough so the servo doesn't rock around. Finally, carefully get the remaining screw farthest from you (it goes into the center tab back there) into place and tighten it. Tighten the other screws. DONE!

Recapping where we are at this point

Right. You've passed the point of no return (when you started cutting connectors off) and we are now REALLY committed to this, like it or not!

What you've done (or should have done) so far is:

A) Installed all 3 sensors and brought the wires to the dash center (Phase 1)

B) Installed and connected the aspirator tubing (Phase 1)

C) Prepared the fan housing to accept the speed controller (Phase 1)

D) Tapped into the vehicle network and brought that pair into the dash center (Phase 1)

E) Pre-wired the auxiliary relays and mounted them on the head unit (Phase 1) -- Note: For some older truck configurations I have not completed the drawings for the relays. Specifically, how to use a 1995-1997 head unit with a 1995-2000 truck. Don't worry, I'll get to it!

F) Mounted the fan controller and completed the under-hood wiring (Phase 2)

G) Mounted the EATC version of the blend door servo (Phase 2)

Final wiring in the dashboard

This means we're ready for the most exciting part, and the part where you could most easily make an error -- wiring the heat unit into the vehicle! This will turn into quite a "rat's nest" or maybe even a "bird's nest" as you do it! But you can clean it up when you're done and don't let it dismay you. We deliberatedly segregated our wiring groups on the head unit harness to help us take a systematic approach and not get confused. In particular, we will wire it so that the unswitched 12 volts, then switched 12 volts are the last things connected. This is particularly important if you leave the battery connected when you do this install. If you disconnect the battery, you can connect the wire groups in any order you please.

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So, take out your radio, your center dash bezel, and take off the 4 screws that hold in your old climate control panel (save the screws). Unclip and remove the vacuum harness connector, and all the electrical connectors. If you have a cable controlled blend door (2001 and 2002), then pull the cable out of the dash (you unhooked the other end already). It may require two hands and a bit of fishing to get it free. When you're done, you'll have something that looks more or less like this picture. Although the passenger airbag is shown removed, it's not necessary at this point. Most vehicles will have four electrical connectors, but 2001 and 2002 cable units have three.

N3ELZ's 2002 Ford Ranger

Move all connectors but the ones that went to the climate controls to the side and tape or tie them out of the way. Unplug the vacuum harness from the ductwork, accessing it from the glove compartment (you should have the glove compartment "dropped"). Again, don't remove the individual tubes, just pull the translucent blue rubber connector from the white hard plastic connector on the ductwork. There are two small retainer clips or tabs which hold the rubber piece to the white piece. To the right is a detail of the vacuum harness to ductwork connection. Remove the harness from the vehicle and don't forget it's "pegged" in using those white nylon retain pegs and you'll have to pull those loose.

Now, cut the connectors off the wires that went to the climate control. Cut them right at the connector -- you're going to want enough slack to be able to crimp to them easily.

Position the head unit, face down, against the center console with the connectors facing upward. You may want to put some paper over the face and tape it in place to keep it from getting scratched. It's a good idea to find a pillow, small box or something to put under the unit so that the connectors at the back are right at the level of where the unit will eventually mount. Some wires may be very short to reach and this helps.

The two EASIEST connections you'll make are the vacuum connection (already made) and the actuator connections (which we prefabbed before testing). Go ahead and route those two connections through the center dash opening and over to the glove compartment area. If there is sufficient slack, go ahead and plug them in. That's easy, eh?

Grounds

We'll connect the ground first to minimize the possibility of static buildup and the like. There is a heavy black wire that went to the fan speed switch that is the main ground for our application. However, it's a 10 gauge wire so you need a yellow butt splice for it. Crimp on end of the splice onto the big black wire from the trucks harness.

We may be putting several wires in the other end of the splice, but they are not so thick. So when you have to put a small wire in a large splice, strip it back twice as far (1/2" to 5/8") and double it back on itself to leave about a 1/4" bare end. It will crimp more securely that way. You will have to use the blue section of the crimp tool, or even the red, to get the crimp tight enough. If you use the yellow section of the crimper with and undersized wire -- it won't hold.

Take the black wire from the "Power and Ground" group, and combine it with the extra ground from your actuator harness if you have a pre-1998 actuator. Also, if you have a 1995-2000 truck with a pre-1998 EATC head unit, you will have a ground coming from the auxilliary fan relay (see previous page, if I finished the diagrams). Also, if you want a celsius units display, include the red wire from the console as well. Strip all these back longer, double them over, and insert then into the other end of the yellow butt splice and crimp.

If you have a newer actuator and a 1998 or later head unit, you will have only the one wire.

Fan controller wiring

Pretty easy -- we only have 3 wires to terminate. For two of them you will use red butt splices. However, one is pretty big (OR/BK) so you will need to do the doubling over thing because you need a yellow butt splice. Again, it will help ensure a good crimp in the big yellow splice. Sometimes I take a bit wire and trim some strands after it's stripped and fit it into a blue crimp when it's not going to carry current. It's another alternative if you like.

So, this is a lot like what we did under the hood. Connect the EATC wires from the "Fan relay and speed control" bundle as follows:

OR/BK (truck) --> BR/OR (EATC head unit)

YE/RD (truck) --> TN/OR (EATC head unit)
LG/WH (truck) --> WH/PK (EATC head unit)

Vehicle network wiring

Connect the two wires from the vehicle network (they were in the Miscellaneous group) to the wires you used to extend up from the diagnostic connector. Use red butt splices. Remember, you were going to write down which wire color of the ones you extended went to which wire color under the dash. Take care to connect the two wires coming from the head unit so that they match the same color wires under the dash. This is VERY important.

The wires in the head unit harness are usually twisted together and they are:

TN/OR and PK/LB - twisted pair for network tie in (1996 up only)

Dimmer wiring

Take the LB/RD and RD/BK wires from the "Miscellaneous" group, strip them back 3/8" and twist them together. Connect them to the LB/RD wire from the truck harness using a red butt splice. The LB/RD wire in the truck was paired with a black wire which will not be use so you can just tape it off.

Sensor wiring

When you installed the sensors, you ran a pair of wires to each of the 3 sensors. Now we'll bring them together and tie them in.

For all sensors except the sunload, polarity is insignificant (I'm not convinced it's important for the sunload either, but let's act as if it is). What you will do is strip the leads that go to the PK/BK wire on the sunload sensor, and one of the wires from each of the other sensors, and strip the back 3/8". Now twist them together and see if you can get them properly into a blue but splice. Depending on what wire size you use this may be impossible. In that case use a yellow one. Crimp whichever butt splice you select to this junction of the three wires.

Now connect the other end of this splice to the PK/BK wire in the "Sensors" group in the EATC harness. Do the "doubling" think if you used a yellow crimp and crimp it down hard and remember not to use the yellow section of the crimper when crimping undersized wires.

Now tie in the signal wires from each sensor using a red butt splice.

RD/OR - splice to ambient (outside) temperature sensor
BR - splice sunload sensor
WH/OR - splice to in car (cabin) temperature sensor

Tieing in the compressor clutch and fan control wires

For all trucks, you should have a relay for the compressor clutch which was pre-wired. Strip and crimp an insulated female spade terminal on the PU wire coming from the trucks harness and put it on the remaining terminal on your A/C compressor relay.

If you have a 2001+ truck with a 1998+ head unit, you also have another relay for the fan power. Strip and crimp an insulated female spade terminal on the RD/OR wire coming from the trucks harness and put it on the remaining terminal of your fan power relay.

If you have a 1995-2000 truck, and a pre-1998 head unit, you also have a second relay (though it's wired differently) and you should connect your RD/OR wire to your remaining relay the same way.

If you have a 2001+ truck and have a pre-1998 head unit, or have chosen not to use a relay, then connect the RD/OR wire in the truck harness to the GY/YE wire in the truck harness using a red butt splice. This connection doesn't involve any wires from the EATC.

If you have a 1995-2000 truck and a 1998+ head unit then you have only one relay required. Simply connect the YE/BK wire coming from the EATC to the RD/OR wire in the truck harness. This is the only configuration where the trucks existing fan power control relay can be controlled directly.

Switched 12 volts connection

Now you will bring these EATC wires together into one end of of a splice and it may need to be a yellow one if you have a lot of these in your configuration:

RD - English/Metric (only if you want Fahrenheit units)
BK/LG - "hot in run" (switched +12 volts)
WH/PU - "hot in run" (1995-1997 only)
??? - the 12 volt power wire coming from your actuator if you have a pre-1998 actuator
??? - the 12 volt power wire coming from your auxilliary relays

Now crimp the other end to the BK/LG wire coming from the truck harness. Double over and crimp this end appropriately if the butt splice is oversized.

Constant 12 volt power

Finally, the last wire is the constant 12 volt power (LG/YE). Crimp about an 8" extension onto this wire using a red butt splice. Run this wire to the connector that was plugged into the back of your radio.

Now, using a blue tap connector, tie it to the LG/PU wire on the radio harness. You may have to cut/peel back the wraps on the radio connector harness to make enough wire available to put the tap on it. NOTE: THIS WIRE IS ALWAYS HOT! IF YOU HAVE NOT DISCONNECTED THE BATTERY, BE CAREFUL NOT TO SHORT IT TO GROUND WHEN TAPPING.

Now what?

I HIGHLY recommend reviewing what you've done to make sure there are no bad crimps that came apart, bare wires exposed, or wiring errors. If you're sure you did it right, you're ready to test!

Testing, 1-2-3-4...

Place the EATC unit loosely in the dash so you can see the display. Turn the key to the ON position, but don't start the truck yet. The display should flash briefly with everything lit up, then go blank. This is good.

Now start the vehicle. Again, the flash perhaps, then blank. Now press the AUTO button. The display lights up with "Auto" and the default temperature (usually 75 not 72 as I previously stated). The fan will not start instantly. It should ramp quickly up to speed after about a 5 to 10 second delay if it's hot out. It will be longer if it's cold and you are asking for heat.

If the fan does not start, press "MAX A/C" -- it should ramp up to maximum.

Play with the buttons selecting different places for the air to come out and verify that it works. Use the red and blue buttons to change the temperature above and below the air temperature in the vehicle to force it to heat or cool and observe the result. Cycle the wheel to manually change fan speeds. If it all works -- you're good to go!

Finally, do the self test diagnostic I described in preliminary testing. Let the unit go through it and see if there are any error codes. If not, great! If so, troubleshoot your wiring job.

The End

If it all works, neaten up your wiring and mount the head unit using the screws that held your old climate controls in. It will fit tight with the wire bundles in the back resisting it being pushed in, but the screws will tighten it down.

Put your truck back together and enjoy the beauty and function of your exciting new mod!

Check back for edits and revisions -- but you have what you need now. Email me if you really need to and I'll try to help you. Be blessed and best success!

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N3ELZ's profile on CarDomain

Vehicle Owner
Member ID: N3ELZ
Location: Kennett Square, Pennsylvania