# ECT Display Driver – Installation for AP1 Module

## Overview

The ECT Display Driver is a small module with a removable wire harness that mounts behind the driver's foot well cover. All wiring connections are near the ECM and only 4 wires are needed for basic operation:

- +5v power from the ECM (T-tap)
- Ground – available at ECM mounting bolt
- ECT sensor wire (T-tap at ECM)
- Dash temperature gauge wire (must cut at ECM)

If you want to use the optional Alarm Output feature 3 more wires are needed:

- Ground (must be run separate from the module's power ground)
- Module output (negative) to your alarm device (sounder or indicator light, not included)
- +12v ignition or accessory power wired directly to your alarm device

## Installation Details: refer to the photos and wiring diagram at the end of this manual

1. Remove the driver's side doorsill trim and the driver's foot well trim. (if you don't know how to do this you probably shouldn't be doing this modification)
2. Locate the connectors and wires you will be using, see photos at the end of this manual.
    a. Temperature gauge wire (**Yellow/Green**) – Easily seen at the top left of connector A on the ECM.
    b. Power wire for +5v (**Yellow/Blue**) – This is on the rear-most row of wires on connector C, in the 'middle' section of the connector. You will have to remove connector C from the ECM to locate this wire
    c. ECT Sensor wire (**Red/White**) – This is also on the rear-most row of wires on connector C, in the 'middle' section of the connector.

3. Attach crimp connectors to the ECM wires as detailed below.
    a. Using a pair of pliers, clamp one of the red T-taps around the **Yellow/Blue** wire in connector C, making sure the wire goes into the metal slot of the T-tap. If you have strong fingers you can squeeze the T-tap on the wire to hold it temporarily, then use the pliers to clamp it shut. Or, you can position the T-tap in the pliers' jaw, then clamp it on the wire.
    b. Crimp another T-tap around the **Red/White** wire in connector C.
    c. Now cut the **Yellow/Green** wire a few inches away from the ECM and strip about ¼" of insulation from each end.
    d. Using a crimp tool, crimp a female spade connector on the end of the **Yellow/Green** wire that comes from the ECM.
    e. Next crimp a male spade connector on the other end of the **Yellow/Green** wire (the end going into the wire bundle).
    f. Note that the ends of the **Yellow/Green** wire have opposite connectors. If you ever have to remove the ECT Module you simply plug these connectors together and the temperature gauge will work like normal.

4. Attach crimp connectors to the ECT wire harness.
    a. One ring terminal (each) for the **Black** and **Brown** wires .
    b. The male spades crimp on the **White** and **Yellow** wires.
    c. The female spade crimps on the **Green** wire.

5. Connect the ECT harness wires to the car wiring.
    a. Plug the ECT **Yellow** wire into the T-tap on the **Yellow/Blue** wire from connector C. This is +5v power.
    b. Connect the ECT **White** wire into the T-tap on the **Red/White** wire from connector C. This is the ECT sensor wire.
    c. Connect ECT **Green** wire to the **Yellow/Green** wire that's going into the wire bundle. This is the output to the dash temperature gauge.
    d. Leave the **Yellow/Green** wire going into ECM connector A hanging loose, it's not needed.
    e. Connect the **Black** and **Brown** wires to a good ground, either at the ECM mounting bolts or the hood release latch.

**Testing:**

Turn the ignition to ON and observe the LED on the module to make sure it is blinking. Blink rates will vary from once every 2 seconds (engine cold) to about 5 blinks a second (engine overheated), with normal coolant temperatures causing about 1 to 1.5 blinks per second.

If the LED does not blink then the module is either bad or is not receiving power, so check the +5v (**Yellow wire**) and power ground (**Black wire**) connections. The Black wire MUST be grounded. Grounding only the **Brown** wire will NOT provide a power ground to the module. Also, accidentally connecting the **Yellow** wire to a +12v source instead of +5v ECM power will instantly and permanently damage the module.

**Testing with car warmed up** - If the car is already warmed up you should observe between 2 and 2 segments illuminated on the dash temperature gauge and the LED should be blinking about 1 to 1.5 times a second. If there is no gauge activity after the ignition is on for 20 seconds and the LED is blinking correctly, there is likely a problem with the module's **Green** wire connection to the temperature gauge wire. If the gauge is not reading AND the LED is blinking slow (one blink every 2 seconds) then you probably don't have a good connection to the ECT sensor wire.

**Testing with cold engine** - If the engine is not warm, go ahead and start it and operate the vehicle long enough to warm it up. You should observe the gauge respond to increasing coolant temperature, and if you have the 'default' programming you should see 3 segments (exactly half the gauge) illuminated when the engine is fully warm. Fully warm might require you wait till the radiator fans go through 2 on/off cycles.

# ECT Display Driver – Operational Notes

**Notes on the stock temperature gauge**

The stock temperature gauge uses the temperature settings shown on the left and the default programming of the ECT module will re-calibrate the gauge as shown on the right.


Most owners are used to seeing 3 segments all the time, which is not surprising once you know that the 3rd segment covers a temperature range from 160° to 230°F. I can only guess that Honda did this to provide consistent gauge readings and reduce questions about gauge fluctuations.

As you can see, the Modifry display lights the second segment at 160°, the traditional "OK to VTEC" temperature. With standard programming, normal engine temperatures will be displayed as 3 bars most of the time with an occasional 4th bar showing in hot weather or stop-n-go driving.

The gauge has considerable averaging built into it, which results in delayed gauge response. In my testing I've seen a 10-second delay between when the coolant temperature sensor voltage changes and the gauge responds. If I suddenly change the input voltage enough to cause 2 additional segments to light up, it takes about 10 seconds for the next segment to light and an additional 10 seconds for the second segment. This delay occurs during falling temperatures also.

The only time there is no delay in the gauge response is when you first turn the ignition ON. Honda must have specifically designed the system to check the coolant temperature and immediately display the correct reading on the gauge. That way you don't get into a warm car and think the engine is still cold because of a slow-responding gauge.

**Diagnostic Mode**

Diagnostic Mode can be helpful when trying to verify programming changes you have made or if you are using an after-market engine management system. Diagnostic Mode is activated by pressing the tiny push button on the module until the LED gives a one-second flash and will remain active until reset by turning the ignition OFF.

Diagnostic Mode causes the module LED and Alarm Output to activate each time the coolant sensor voltage crosses one of the set points. The LED and Alarm Output blink out the number of gauge segments that should be lit. In addition, it blinks fast for a rising temperature and slow for a falling temperature. This is easier to understand with an example:

Assume you have activated Diagnostic Mode and the car is warming up and reaches the set point for the third segment on the gauge. As soon as that threshold is reached the LED will

flash 3 short blinks, indicating the temperature is rising and 3 segments should be displayed on the gauge (after the 3-4 second delay). If the temperature cools down below the 3 segment threshold you will see 2 long blinks, indicating a falling temperature and after a few seconds you will see a new gauge reading of 2 segments.

Diagnostic mode works best if a small piezo sounder is connected to the Alarm Output so you can hear the beeps rather than having to watch the LED.

If you do any testing in Diagnostic Mode and monitor the ECT voltage with a meter you may notice the gauge transitions differ from your set points by 1 to 3 millivolts. This is usually caused by the ECM voltage (the 5v supply for the module) being slightly different than exactly 5 volts. These errors in supply voltage are somewhat self-corrected by the module since the voltage reference used for the A-D converter is tied to the 5v supply, but it's not perfect. If you find the self-correction is not accurate enough, just tweak your programmed set points slightly until the transitions are exactly where you want them.

**Alarm Output**

The Alarm Output feature can be used to activate a light or sounder when the programmed sensor voltage is reached. I can think of a few uses for this:

1. Overheat warning – to get your immediate attention in case you don't check the gauge frequently.
2. OK to VTEC indicator – if you decide to change the temperature ranges you may lose the 160℉ gauge segment, so you could use a separat e indicator to tell you when the engine was sufficiently warmed up for VTEC operation.

The Alarm Output provides a ground when active so you will need to run a separate +12v wire to your light or sounder and use the module to provide the ground. It can provide up to ½ amp of current, but be careful because there is no internal fuse. Connecting it to a device that draws more than an amp will damage the module, so if you need more current you will need to install a relay.

The output will rapidly pulse 4 or 5 times when it first activates, then it stays on until the ECT voltage rises above the alarm threshold, indicating the temperature has dropped. If the temperature goes up again, the pulsing/steady cycle will repeat.

You may wonder why there is a separate ground wire (Brown) for the Alarm Output. The module measures the ECT sensor voltage relative to ground. That means it looks at the voltage difference between the White wire and the Black wire *where they connect to the module*. Any voltage drop on the Black wire between the ground connection and the module will cause an erroneous reading. Since the module draws very little current(<10ma) the normal operating voltage drop is insignificant. But if ½ amp of alarm current were to pass through the Black wire the voltage drop would be large enough to cause errors in the ECT voltage measurement, and a corresponding error in the gauge output. We can't have that, so a separate ground is used for the Alarm Output circuit.

The Alarm Output software has some hysteresis built in so that you don't get "on-off-on-off" cycling of the output. That could be annoying if you connect a sounder to the module and the

ECT voltage is exactly at the alarm transition point. Minor fluctuations in the sensor voltage could cause the Alarm to cycle ON and OFF rapidly. To prevent this I have programmed the module to go into alarm exactly at your programmed set point, but not to turn off unless the voltage rises at least 5mv (.005volts) above the threshold. Bear that in mind if you do any Diagnostic Mode testing with a voltmeter on the ECT input.

## Tables of coolant temperatures and corresponding ECT voltages

Use these voltage values if you decide to change the default programming of your ECT module. See the programming instructions following these charts. You should use the "Coolant temp" column as your temperature because it is the most accurate. The "OBD Temp" is the temperature indicated by my car's OBDII system, which in most cases was 2-5 degrees high. I only included it here for reference in case any of you are using an OBDII tool.

**Every 5 degrees F**

| Coolant temp | Stock Voltage | AEM Voltage | OBD Temp |
|---|---|---|---|
| 110 | 1.944 | 1.512 | 115 |
| 115 | 1.824 | 1.407 | 119 |
| 120 | 1.710 | 1.308 | 124 |
| 125 | 1.600 | 1.215 | 128 |
| 130 | 1.495 | 1.127 | 131 |
| 135 | 1.394 | 1.043 | 138 |
| 140 | 1.300 | 0.966 | 144 |
| 145 | 1.211 | 0.895 | 147 |
| 150 | 1.127 | 0.828 | 154 |
| 155 | 1.050 | 0.767 | 158 |
| 160 | 0.978 | 0.711 | 162 |
| 165 | 0.908 | 0.657 | 167 |
| 170 | 0.848 | 0.611 | 174 |
| 175 | 0.789 | 0.567 | 180 |
| 180 | 0.734 | 0.525 | 183 |
| 185 | 0.683 | 0.487 | 189 |
| 190 | 0.638 | 0.453 | 194 |
| 195 | 0.595 | 0.422 | 199 |
| 200 | 0.555 | 0.392 | 203 |
| 205 | 0.516 | 0.364 | 207 |
| 210 | 0.482 | 0.339 | 214 |
| 215 | 0.451 | 0.317 | 221 |
| 220 | 0.423 | 0.296 | 225 |
| 225 | 0.395 | 0.276 | 228 |
| 230 | 0.369 | 0.257 | 235 |
| 235 | 0.347 | 0.242 | 239 |
| 240 | 0.324 | 0.225 | 243 |
| 245 | 0.304 | 0.211 | 246 |
| 250 | 0.286 | 0.198 | 261 |
| 255 | 0.269 | 0.187 | 273 |

**Every 2 degrees F**

| Coolant temp | Stock Voltage | AEM Voltage | OBD Temp |
|---|---|---|---|
| 130 | 1.495 | 1.127 | 131 |
| 132 | 1.451 | 1.090 | 135 |
| 134 | 1.415 | 1.060 | 136 |
| 136 | 1.373 | 1.026 | 138 |
| 138 | 1.335 | 0.995 | 142 |
| 140 | 1.300 | 0.966 | 144 |
| 142 | 1.263 | 0.937 | 145 |
| 144 | 1.228 | 0.908 | 147 |
| 146 | 1.195 | 0.882 | 149 |
| 148 | 1.159 | 0.853 | 151 |
| 150 | 1.127 | 0.828 | 154 |
| 152 | 1.095 | 0.802 | 154 |
| 154 | 1.066 | 0.780 | 156 |
| 156 | 1.036 | 0.756 | 158 |
| 158 | 1.008 | 0.734 | 160 |
| 160 | 0.978 | 0.711 | 162 |
| 162 | 0.949 | 0.689 | 165 |
| 164 | 0.924 | 0.669 | 167 |
| 166 | 0.897 | 0.649 | 171 |
| 168 | 0.873 | 0.630 | 172 |
| 170 | 0.848 | 0.611 | 174 |
| 172 | 0.823 | 0.592 | 176 |
| 174 | 0.800 | 0.575 | 180 |
| 176 | 0.777 | 0.558 | 181 |
| 178 | 0.756 | 0.541 | 183 |
| 180 | 0.734 | 0.525 | 183 |
| 182 | 0.714 | 0.510 | 187 |
| 184 | 0.693 | 0.494 | 189 |
| 186 | 0.674 | 0.480 | 190 |
| 188 | 0.656 | 0.467 | 192 |

**Every 2 degrees F**

| Coolant temp | Stock Voltage | AEM Voltage | OBD Temp |
|---|---|---|---|
| 190 | 0.638 | 0.453 | 194 |
| 192 | 0.621 | 0.441 | 196 |
| 194 | 0.604 | 0.428 | 199 |
| 196 | 0.586 | 0.415 | 201 |
| 198 | 0.569 | 0.403 | 201 |
| 200 | 0.555 | 0.392 | 203 |
| 202 | 0.539 | 0.380 | 205 |
| 204 | 0.524 | 0.370 | 207 |
| 206 | 0.509 | 0.359 | 208 |
| 208 | 0.496 | 0.349 | 208 |
| 210 | 0.483 | 0.340 | 214 |
| 212 | 0.470 | 0.330 | 217 |
| 214 | 0.457 | 0.321 | 217 |
| 216 | 0.447 | 0.313 | 221 |
| 218 | 0.434 | 0.304 | 225 |
| 220 | 0.423 | 0.296 | 225 |
| 222 | 0.411 | 0.288 | 228 |
| 224 | 0.400 | 0.280 | 228 |
| 226 | 0.390 | 0.272 | 232 |
| 228 | 0.379 | 0.265 | 232 |
| 230 | 0.369 | 0.258 | 235 |
| 232 | 0.359 | 0.251 | 235 |
| 234 | 0.351 | 0.245 | 239 |
| 236 | 0.342 | 0.238 | 239 |
| 238 | 0.333 | 0.232 | 243 |
| 240 | 0.324 | 0.226 | 243 |
| 242 | 0.316 | 0.220 | 243 |
| 244 | 0.308 | 0.214 | 246 |
| 246 | 0.301 | 0.209 | 246 |
| 248 | 0.292 | 0.203 | 261 |
| 250 | 0.286 | 0.198 | 261 |

# ECT Display Driver - Programming

### Overview

The ECT Display Driver comes with default programming as described in the previous page but can be re-programmed for custom temperature ranges with the use of the included programming cable and a laptop equipped with a serial port and communications software such as HyperTerminal. Here are the basic steps:

- Set up HyperTerminal for 9600, 8,N,1 (9600 baud, 8 data bits, no parity, 1 stop bit)
- With the ignition ON, connect the programming cable between the laptop and the module
- Transmit a text file containing the new programming values to the module
- Verify the module has accepted the programming

### Detailed steps for programming:

1. Copy the HyperTerminal session file and sample data files from my web site: http://www.modifry.com/products/ect/ap1.zip

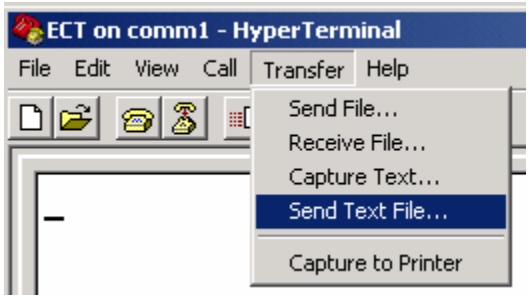
    a. I would suggest using the default data files for your first programming attempt. Once you do a successful download and prove your laptop serial port is working, then edit the data file and download your new set points.

2. Start HyperTerminal on your laptop by double-clicking the **ECT on Comm1.ht** file that you downloaded from my web site.

3. With the ignition ON, connect the programming cable from the laptop serial port to the ECT module. The module can only be programmed when powered up.

4. Click the connect icon  in the tool bar.

5. On the tool bar click **Transfer**, then **Send Text File**




    a. Browse to where the data file is located and highlight the file. Do not double-click it at this time. You will transfer the file in the next step.

b. Observe the LED on the ECT module as you hit the **<Enter>** key.
    1. The LED should light during the file transfer ( 5-10 seconds)
    2. The LED will go out as the new data is programmed into the module's EEPROM memory.
    3. The LED will flash 2 slow one-second blinks to indicate the transfer and load were successful.
6. Unsuccessful downloads can be caused by:
    a. Invalid text file – usually caused by missing brackets [ ] or deleting lines at the beginning of the file. Look for this if you do not get 2 slow blinks.
    b. Wrong voltage parameter used, (not 3 characters in length). Look for this type of error if the module gives 5 quick blinks after the download.

That's it, the module is programmed and ready to operate.

**Editing the data file**

The data file is a simple text file that can be edited with any text editor, such as Notepad. I suggest you do not use Word or other word processing programs because they can leave invisible non-ASCII characters in the file that may interfere with the download process or cause the module to operate in an unexpected manner.

The data file uses actual ECT sensor voltage values to set the activation point for each gauge segment. By using voltage instead of temperature the module is more flexible and can work on both stock and after-market engine management systems.

The value in the brackets [ ] defines the transition point between gauge segments. For example, the stock data file looks like this (partial):

```
[910] millivolts - 2nd bar lights at 160 degrees
[730] millivolts - 3rd bar lights at 175 degrees
[590] millivolts - 4th bar lights at 190 degrees
```

The first line indicates that the second gauge segment will light when the sensor voltage drops to 910 millivolts (0.910 volts) and will go out if the voltage rises above 910 millivolts. If the voltage continues to drop to 730mv (or below) the third gauge segment will illuminate.

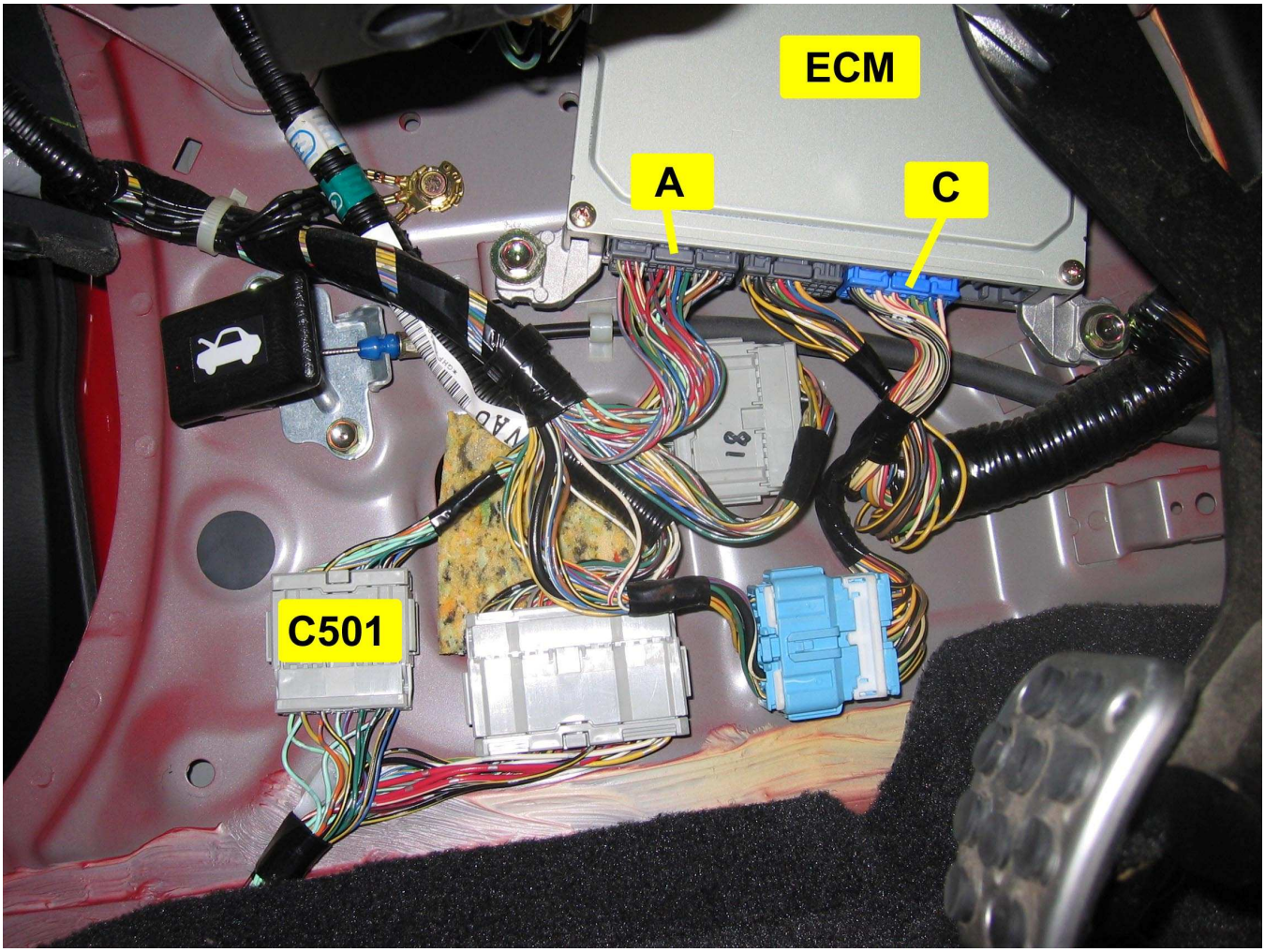
Please note that the text after the brackets is a comment and has no effect on the module programming. It is only there to remind you what the settings mean. If you change the voltage values in the brackets for different temperature settings it's a good practice to edit the comment to indicate the temperature you are using for that value, but it's not required.

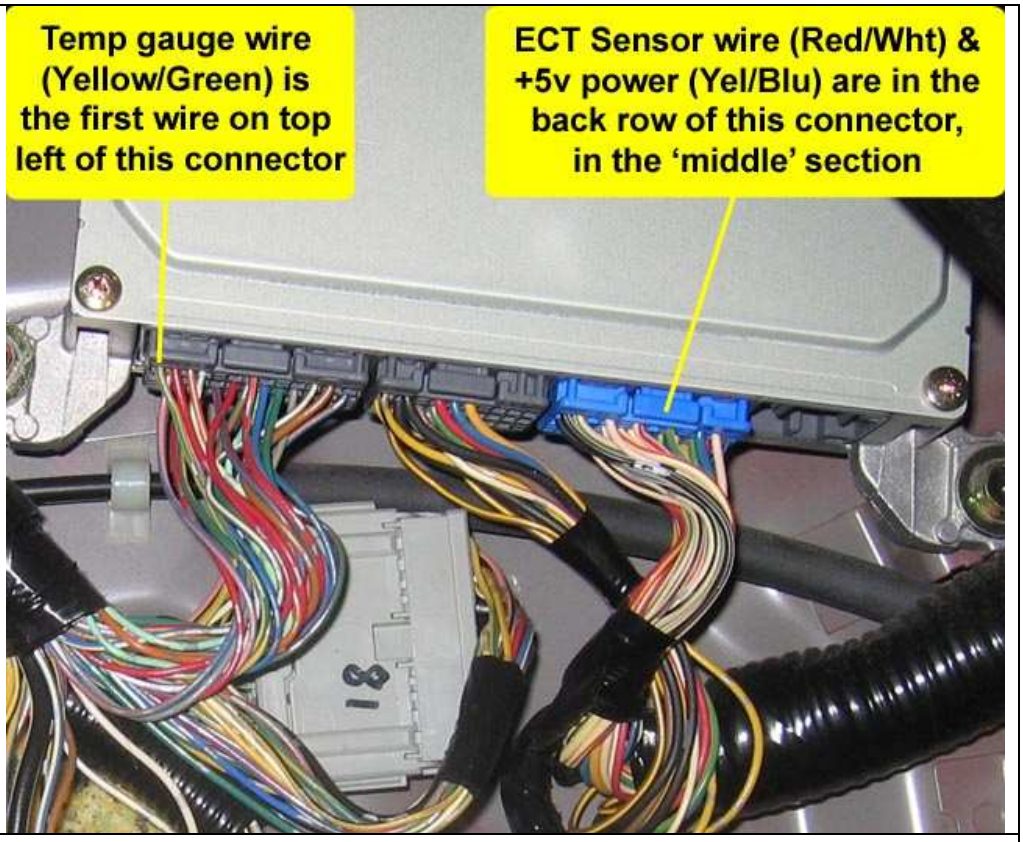
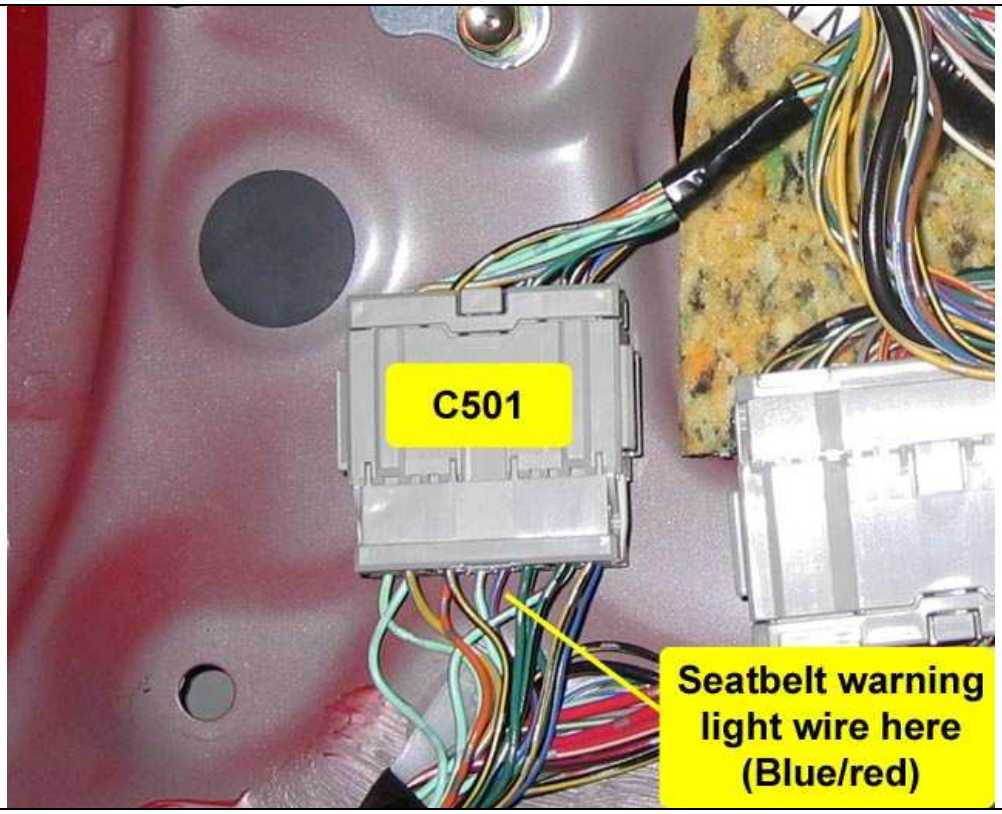
Here are some rules for editing the text file:

1. Do not edit or delete any lines above the bracketed [ ] data values.
2. Data values must be enclosed in brackets [ ] and be exactly 3 characters long. Voltages less than 100mv must use preceding zeros - 85mv should be entered as [085].
3. You are free to edit the comments after each data value, just keep it short.
4. The voltage values must always be in the specified "segment" order – 2$^{nd}$ segment, 3$^{rd}$ segment, 4$^{th}$ segment, etc, with the alarm set point last.
5. Feel free to add/edit/delete any of the text AFTER the section with the data values.

**Photos to be used with Installation Instructions**

**Photo 1 – view of the ECM and the various connectors you will be using. C501 is only shown in case you decide to connect the optional Alarm Output to the seatbelt warning light as I have done in my car.**



| | |
|---|---|
| **Photo 2 –**<br><br>**Close-up view of ECM connectors A and C** |  |
| | |
| **Photo 3 –**<br><br>**Close-up of C501 and optional connection to seatbelt warning wire.**<br><br>**I connected my alarm output to the seatbelt light – it does a good job of getting my attention if it lights up.** |  |

# ECT Display Driver Wiring Diagram