

Dear SCRA Member

As Many problems have arisen using fixed tunes with the factory computers, the SCRA board has decided that a programmable ECU will give you all the flexibility needed for tuning your engine to suit your requirements.

Due to the unmatched value for money and the knowledge of numerous EMS customer's success stories in motor racing, the SCRA board chose the EMS 4424 ECU.

We here at EMS are proud to be involved with all of you and this exciting Class of racing.

The following literature has been put together specifically for your cars. Some of you may be experienced with using programmable ECU's but there are others that may have never come across one. Due to this, we wrote the following with the novice in mind.

We would like to take this opportunity to congratulate you and wish you success in your Saloon Car Racing.

Installation

The ECU must be mounted somewhere in the passenger compartment of the car. Try and find a position where it wont get wet if racing in a down pour.

Due to high levels of vibration, EMS recommends that the ecu be mounted using small soft rubber mounts. This helps isolate the ecu from vibration and shock.

The ecu has a built in barometric pressure sensor so that it can compensate for changes in atmospheric pressure due to altitude and weather changes. Although the ecu will be making small changes from track to track, Bathurst is a track that has a large altitude change in each lap.

Take the vacuum / pressure hose from the ecu to the engine.

See drawing No. 1

The vacuum hose connects an important sensor to the engine, ensure that the hose is not kinked in its route.

If tuning(mapping) via TPS the vacuum hose should be left unconnected under the bonnet, or connected between the air filter and the throttle body. This way we are sensing pressure where it counts, at the engine.

NOTE. Connect the hose before you tune the engine.

Leaving the hose disconnected would result in compensation of cabin pressure changes.

At 200 km/h the pressure in the engine pipe and in the cabin are NOT the same.

If tuning (mapping) via vacuum / pressure the hose must go to the inlet manifold, between the throttle body and the engine. Do not position the hose off 1 intake runner. Put it on the main plenum.

Wiring

Although it is possible to make a plug in loom Adaptor, it is not the best way to connect. The adaptor plug pins are not very strong and can suffer from mechanical fatigue, causing an undesirable failure.

We believe that making good solder connections behind the original ecu loom plug using heat shrink tubing as insulation would suffice. Make sure that the loom is in good condition or else replace it.

IMPORTANT

Poor power and grounds are almost guaranteed to create problems. Ensure that the battery has a heavy ground to the chassis and from the chassis to the engine.

NOTE. Solid mounting of the engine as the ground strap is not good enough.

Tuning

Holden and Ford ecu's DO NOT interchange. There is a slight difference to suit each car's ignition system. Your ecu has a start up map to suit your car. The car should start and run ok after you have zeroed and spanned your tps. This is a starting point and due to many small differences, you must tune your car from here.

The laptop should be a Pentium 1 or greater. (P2 300mhz or higher is recommended)
Running windows 95 or greater (windows 2000 professional is best)

Laptop Program Installation

Once the laptop is up and running, make sure you haven't started any other programs.

CD install

Click START.
Go to RUN.
Floppy disk install

Click START.
Go to RUN.
Type A:\setup.exe
Click OK.

Once the software is loaded you must first establish communication between the laptop and the ecu. Most laptops have a 9 pin serial (RS232) port. Connect the coms cable between this serial port and the ecu.

Some newer laptops don't have a serial port. They have USB (Universal Serial Bus) ports. These USB ports are not directly compatible with the RS232 serial cable. In this case you must purchase a USB to serial adaptor from your local computer shop eg, Harvey Norman, Dick Smiths', etc. Follow instructions to install the adaptors software.

In either case, once the cable is connected it is time to start the SCRA software. You should see an Icon on the main laptop screen, named SCRA (it looks like a tachometer).

Double click the Icon and wait for the software to start up. It is a large program so on slower laptops this could take up to 30 seconds.

Once the program has booted up you should be at what we call the file page. You should see "No ECU Attached" in red, bottom left of screen. Turn on the cars ignition, ie, ecu power on. "No ECU Attached" will disappear, now a warning will be displayed.

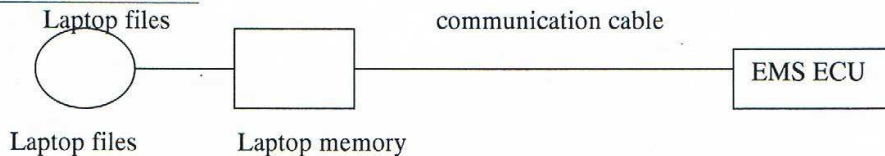
Click OK.

The laptop will read all the ecu data into its memory. You will see this quite a lot. Each time communication is lost and regained the laptop will want to retrieve the ecu data. In normal usage click OK and let the laptop refresh its memory. This ensures no erroneous data can sneak in.

If the "No ECU Attached" text remains, we have no communication. We must check to see if this software is configured to the correct com port.

In the top left Click "File" then "communication Setting" a dialog box will open allowing you to change the communication settings. Change only the com port number to suit your laptop. Once you have entered your com port number you must exit this program and re-start it by again double clicking on the SCRA Icon. This will make the new selection active. If it fails to communicate, keep changing the com number until you find the correct com number. It is most unlikely to go past com port 6.

Files and Memories



The first step is to understand the block diagram of all the memories involved.

ECU Memory

The ECU has EEPROM memory where it stores all the settings and tune up. This memory is Non volatile memory ie. it will remain stored without power for 100 years.

The only way to change the ECU memory is via tuning with the laptop or by doing a write to ECU with the laptop. The only time you should do a write to ECU is when a previously stored tune needs to be completely installed into the ECU.

Note: When you do a "Write to ECU" the laptop will write to ECU whatever is in its Memory at that time, and overwrite the ECU memory.

All current data in the ECU will be over written by the laptop memory. Data that was in the ECU previously will be lost.

Laptop Memory

The Laptop memory is made up of 2 parts. The Ram which is where all the current settings you can see on the screen is stored.

The second part is the Hard Disk Memory. When you make a file and save the laptop memory to file, it saves this data to the hard disk.

Summary

When you first power up the laptop, it's memory is blank. To put data in the laptop memory, you can click on a previously saved file and then read from file or power up the ECU and allow the laptop to retrieve ECU data.

When you make a file and save to file the laptop will save the current laptop memory to the highlighted file.

In normal operation, (laptop communicating with ECU), any changes that are made will change both the laptop memory and the ECU memory in real time. There is no need to perform a "Write to ECU".

The Bottom Line

Read from file, read data from highlighted file in the hard drive into laptop memory.

Save to file, writes laptop memory data to highlighted file stored to hard drive.

Read from ECU, reads data (tune & settings) from ECU memory into laptop memory.

Write to ECU, (NOT normally used).

Writes data from laptop memory to ECU memory.

File Page

When the software was installed, a base file for Ford, and for Holden were installed also. These files are a good starting point. Do not save to these files. Make new files specific to your car.

Making Files

Bottom center, press "Add File". In the file name field, type the name of the new file. This name can be anything that means something to you.

Documentation is important for long term success. Put your notes in engine and notes fields. eg. Fuel pressure 40 psi, new cyclone exhaust, xyz injectors.

Once you have done this you press "Save File" button. You can always go back and add more details at any time.

TUNING

Main Map for Fuel & Ignition

The main tuning maps are like a matrix of RPM Vs Load.

There is 11 load points every 500 Rpm all the way to 6000 Rpm.

Depending on how you have selected the function mode in the ECU set up page "Vacuum Map" Or "TPS Map", will depend on how the tuning maps look.

The load points will be 0 – 100% TPS in 10% increments (if tuned in TPS mode) or –80 Kpa to 0 Kpa in 10 Kpa increments (if tuned in vacuum mode). The +75 Kpa and +150 Kpa are boost points. The 150 Kpa does no effect, but the 75 Kpa can mildly affect if in strong atmosphere.

For a text book tune, whatever is in the 0 Kpa site, multiply by 1.75 and store into +75 Kpa site, for that rev. eg. if at 3000 Rpm 0 Kpa, 8 mS is tuned, see below.

$$8 \text{ mS} \times 1.75 = 14 \text{ mS}$$

Put 14mS in 3000 Rpm at the +75 Kpa site. Do this all the way up the rev range.

Which way should I tune?

Different engine builders/tuners like to tune differently. Tuning via TPS gives a better overall result for throttle response/smoothness., etc. But is also harder to tune and the TPS sensor is not as reliable. If tuning via TPS take at least 1 spare TPS sensor to the track. Also if you move or change your TPS sensor, at any time you must recalibrate the TPS sensor in the ECU set up page.

Remember if tuning via TPS, this becomes the primary load sensing sensor.

90% of EMS off road racers, rally cars, sprint cars and power boats tune our systems via Map. This is because they are looking for the ultimate reliability.

Note: The Position of vacuum hose on the engine is different for TPS and vacuum tuning. With the start up maps provided, these engines were tuned with the vacuum hose left in the Engine bay.

See drawing No. 1

Before you start tuning, you must be sure that your TPS (Throttle Position Sensor) is tuned in the ECU (calibrated). This means that we must tell the ECU the closed throttle position and the full throttle position. From this calibration the ECU will then be able to calculate the 0 →100% throttle position.

To calibrate the throttle, follow the steps below.

1. Boot up the SCRA program and connect to ECU.
2. Make sure the ignition is on and communication is OK.
3. Allow the laptop to read the ECU Data.

4. Go to the "ECU Set up" page, on the bottom right corner you will see the TPS calibration buttons.
5. With your foot off the accelerator (throttle closed) press the (Read closed throttle)button.
6. Fully press the accelerator (throttle open) and press the (Read open throttle) button.
7. Now press the calibrate button.
8. Now you must check to see if the throttle position gauge follows your foot pressing actions. Go to the tuning page and press the throttle. Make sure it reads 0 →100% each time.
9. Complete. If it doesn't read properly, repeat steps 4 to 8. If it still doesn't work properly check wiring and sensor. Replace sensor if necessary.

Note: 1 If you adjust your throttle idle screw or change your TPS sensor at any time, you must repeat the calibration procedure.

Note: 2 In the future, if for any reason you decide to "Write to ECU" an old file that you may have used in the past, double check the TPS calibration after the "Write to ECU" is complete.

STATIC TIMING CHECK

Before tuning your engine, the static timing must be adjusted correctly.

The static timing adjustment tells the ECU where the crank angle sensor is adjusted to.

Normally we set the crank angle to 10° BTDC. The static timing adjustment is found in the "ECU Set up" page.

There are a few ways to do this adjustment and both Holden and Ford would normally be checked differently. Due to this, we will explain 1 method that can be performed on both cars.

- 1 Start the engine and make sure it is running faster than 500 RPM.
- 2 Go to the ignition tuning page (Map) and change the timing to 15° BTDC on the 0% and 10% TPS sites for 0 to 2000 RPM.
- 3 Get a timing light with NO Adjustment knob or adjustment facility, as it will be wrong on the wasted spark of the Holden.
- 4 We set the maps to 15° BTDC, so we should read 15° with the timing light.
- 5 If it is not 15° BTDC, change the static timing in the set up page then press enter until you see 15° with the timing light.
- 6 Static timing is now done. DO NOT change this setting unless you move your Crank angle sensor.

Note: With the Fords only, the crank angle sensor (dissy) is moveable.

After completing procedures 1-6, the static timing settings should be between 5° and 12° BTDC. 10° is the target number in the static timing field (factory) for Fords.

If this number finds itself out of these parameters, the rotor phasing will be incorrect.

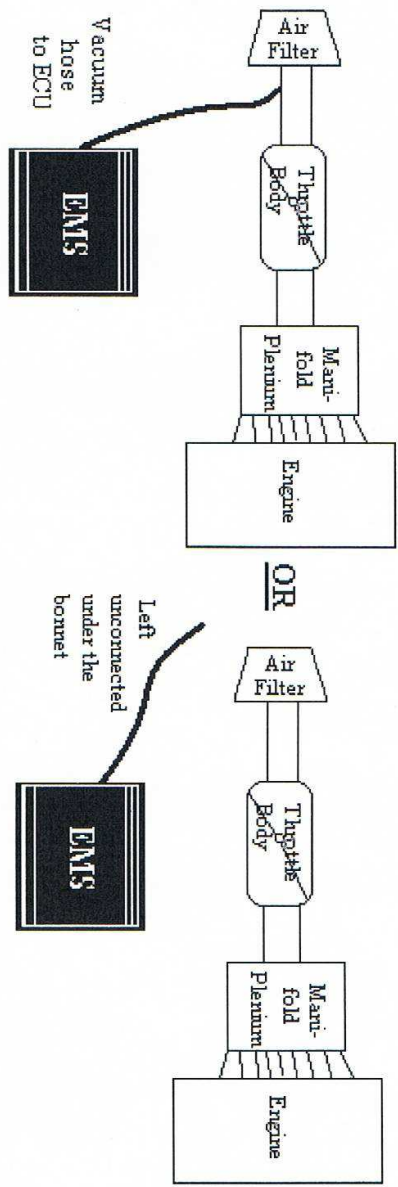
In this case, move the dissy until the above parameters are met.

Idle Control

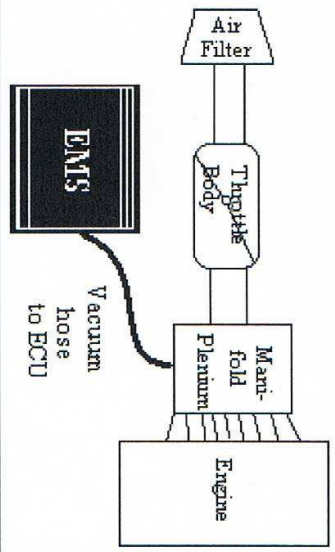
Note: Both Holden and Ford have idle control motors, which are no longer used.

Ford idle control motors need no attention as they are spring loaded and will force close. Holden idle motors will rattle themselves open and the engines will idle higher, due to this the idle air port must be blocked off.

TPS Load Sites ECU Tuning

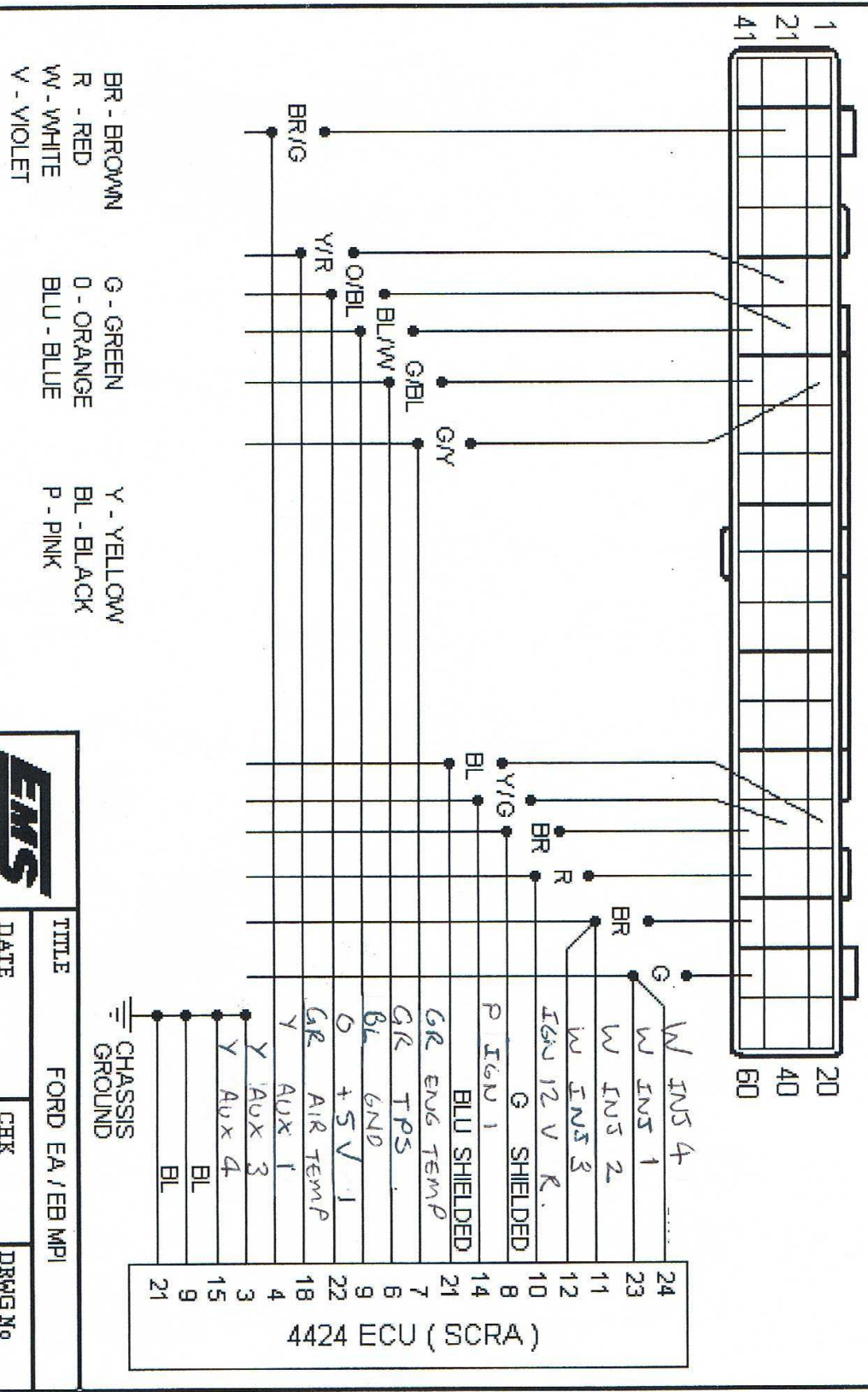


Vacuum Load Sites ECU Tuning OR TPS with vacuum override ECU Tuning



EMS			
TITLE		Hose Placement Diagram	
DATE		CHK	
DRWG No		sc 1	

loom connector

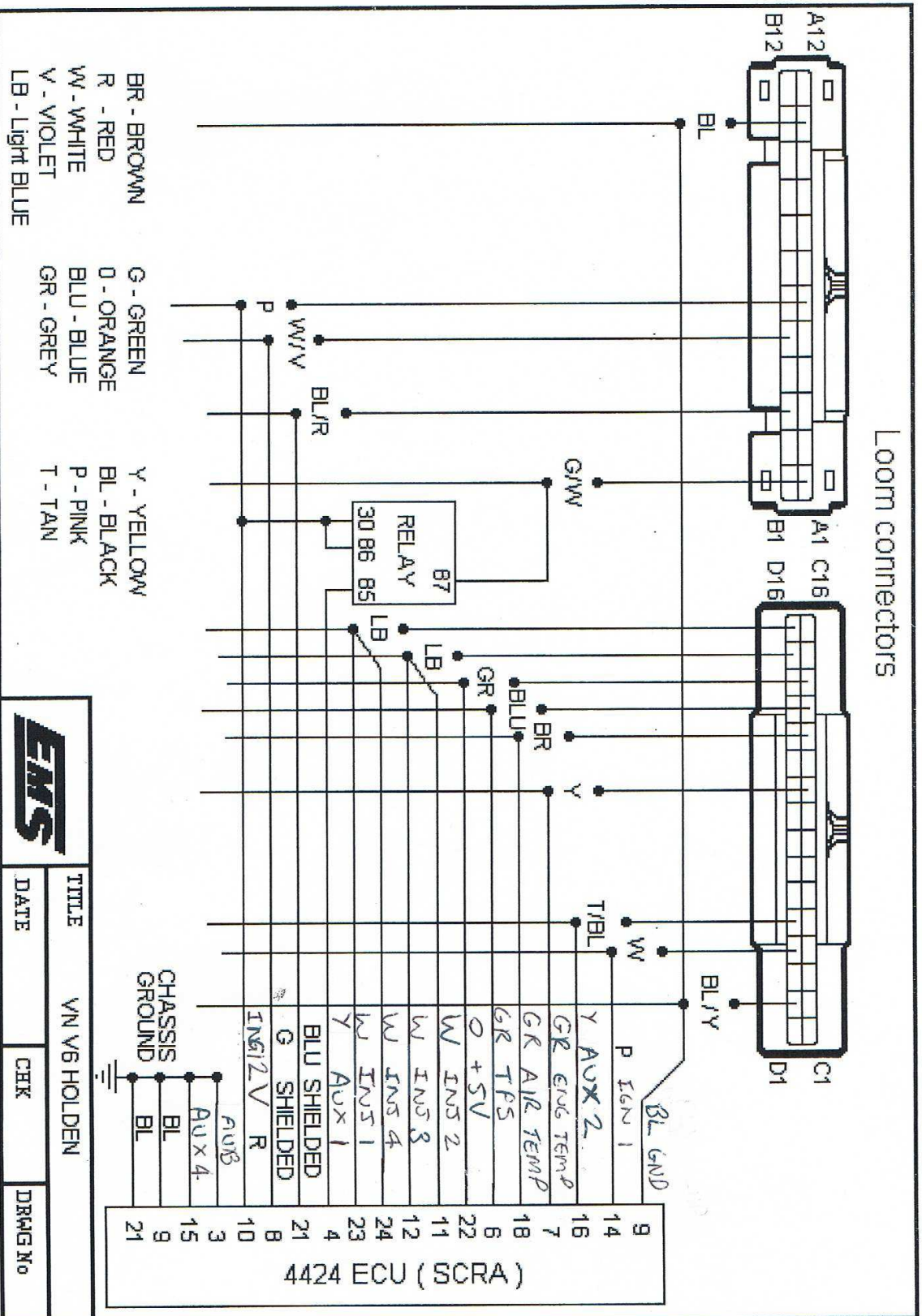


- BR - BROWN
- R - RED
- W - WHITE
- V - VIOLET
- G - GREEN
- O - ORANGE
- BLU - BLUE
- Y - YELLOW
- BL - BLACK
- P - PINK

EMS	
TITLE	FORD EA / EB MPI
DATE	CHEK
	DRWG No

4424 ECU (SCRA)

Loom connectors



TITLE	VN V6 HOLDEN		
DATE	CHK	DRWG No	