LC-1 Installation
Tutorial

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Disclaimer:

Information in this document has not been verified.
Use at your own risk.

Credits:

Portions of this document show screenshots from Innovate Motorsports' LC-1
configuration software.

1. LC-1 Install

Description

This Tutorial will provide general instructions for the installation, programming and integration of the Innovate LC-1 with EFILive Scan Tools and a DynoTune Display. **Please refer to manufacturer's manuals for details, warnings, and other specific information.**

Both Analog outputs ("Analog Out 1"- Yellow wire and "Analog Out 2"- Brown wire) from the LC-1 are programmable. Either can be used for any application or display as long as the application/display uses a linear 0-5 Volt analog signal. The LC-1, EFILive/FlashScan, and DynoTune display must be programmed or calibrated to be compatible with each other.

A typical LC-1 from the manufacturer will have "Analog Out 1" programmed to simulate a narrowband O2 sensor.   The example in this guide reprograms the LC-1 "Analog Out 1" output to send a compatible signal to the FlashScan/EFILive Software. The LC-1's "Analog out 2" is programmed to send a correct signal to the DynoTune Display. The DynoTune Display is precalibrated from the vendor.

Picture 1: LC-1


Picture 2: DynoTune Display

Picture 3: EFILive

Weld Bung into exhaust.

A bung is easy for any exhaust shop to weld into the exhaust pipe (for ~$10 bucks). For naturally aspirated cars, weld the bung before the catalytic converters. If your car does not have catalytic converters, WBO2 Sensor should be at least 2-3 feet from end of tailpipe exit. **Please refer to literature that was included with your LC-1 for details on correct installation.**

The below Picture 1 is of a non-cat car where the WBO2 Sensor is installed under the rear passenger's seat before the exhaust turns up over the rear axle.
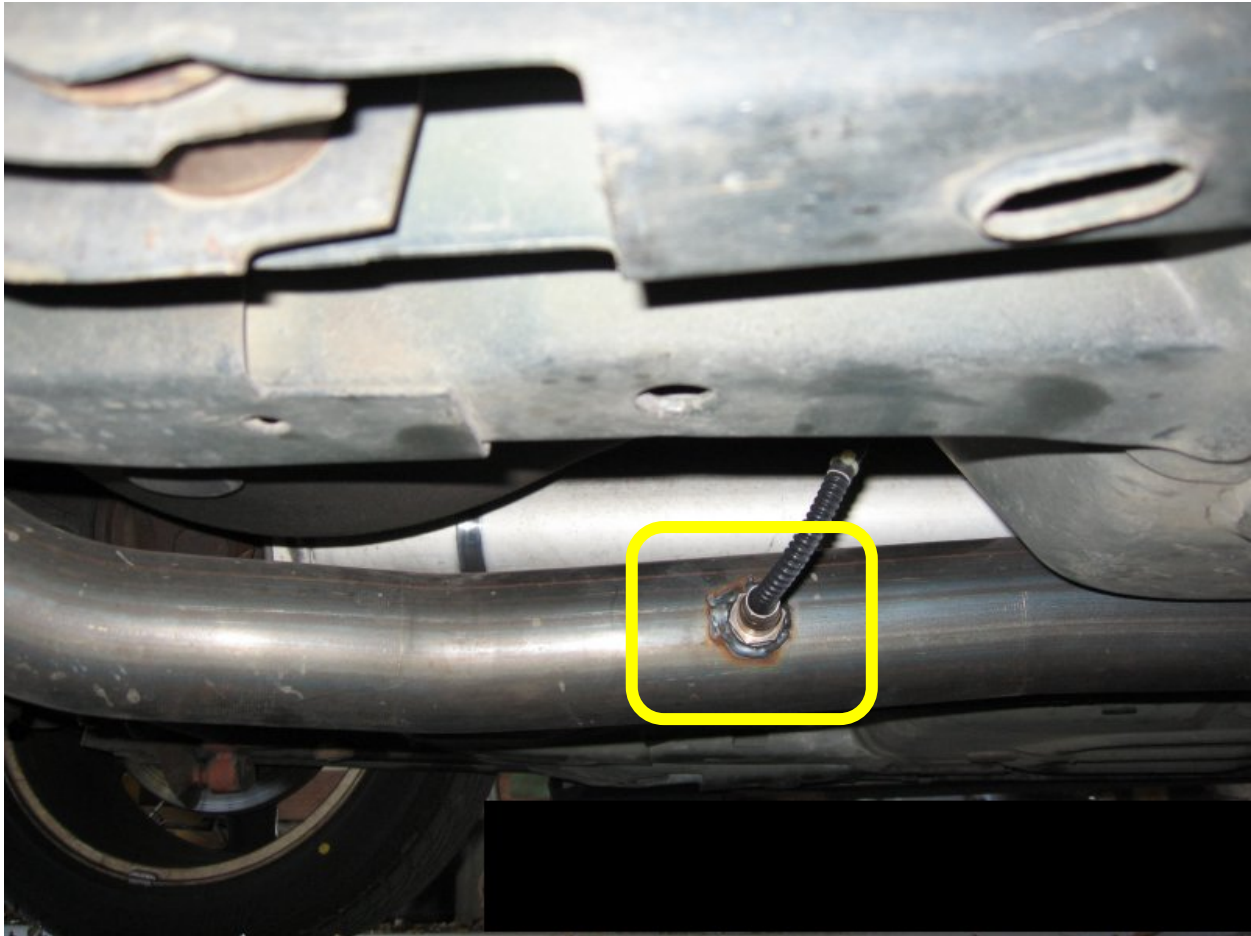
Picture 4: WBO2 Sensor Bung/Installation

Route wires

1. Suggestion: Wrap the wires/cables with wire loom and wrap tape around loom for protection.

2. Use tie wraps to secure the cables sufficiently.

3. One option is to run the cables up through the shifter rubber boot into the console. See Picture 5 below.

Picture 5: LC-1 Cable Routing (Cables in Wire Loom)

Electrical Connections

LC-1 Interface and power cables with 7 wire version:

   a. Red   12V supply
   b. Blue   Heater Ground
   c. White   System Ground
   d. Yellow   Analog out 1
   e. Brown   Analog out 2
   f. Green   Analog Ground
   g. Black   Calibration wire

Connecting DynoTune Display

1. 12V supply:

   Connect the LC-1 Red Wire and Display's Brown wire to a switched 12V supply from your car. It must turn on (12V) when the ignition switch is ON and turn off (0V) when the ignition switch is turned OFF.

2. Signal Ground:

   Connect the LC-1 Green (Analog Ground) and White (System Ground) Wires to the DynoTune Display's Blue Ground Wire and ground them to the vehicle.

3. System Ground:

   The LC-1 Blue (System Ground) wire should be connected to a chassis' ground separate from the Signal ground location.

4. Analog Out 2:

   Connect the LC-1 Brown (Analog Out 2) Wire to the DynoTune Display's Black Wire.

Note: *Reference LC-1 manufacturer's manual and display instructions for warnings and further details on installation.*

Connecting to EFI Live External Connector

The FlashScan External Pin-outs are listed below in Picture 6.

FlashScan Pin-outs

Pin	(PID)	Description
A	{EXT.EGT}	Alumel lead of type-k thermocouple
B		Chromel lead of type-k thermocouple
C	{EXT.AD2}	Analog voltage 0 to 4.8 volts only
D	-	Analog voltage common ground
E	{EXT.AD1}	Analog voltage 0 to 4.8 volts only

Picture 6: FlashScan Pin-Outs

1. LC-1 Analog Out 1:
   Connect the LC-1 Yellow to either the C or E location of the FlashScan External connector. C and E are on the outside locations of the three-wire connector.
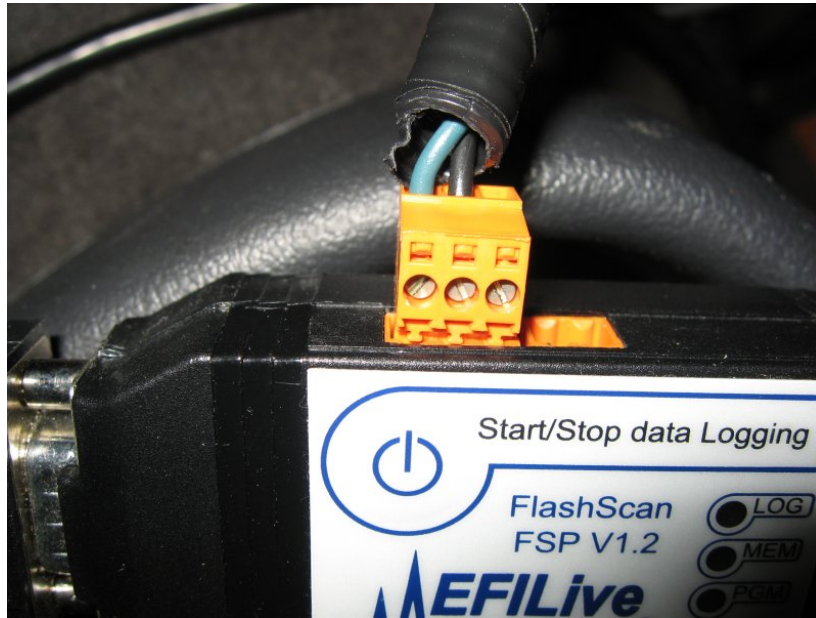
2. Signal Ground:
   Connect a wire from the LC-1 Green and White Wire's ground connection to the

D location of the EFILive External connector. D is in the middle of the 3-wire connector.

3. System Ground:

The LC-1 Blue wire should be connected to a chassis' ground separate from the Signal ground location.

Picture 7: External Connection to EFILive.

Note: The green wire used in Picture 7 is connected to Yellow wire "Analog Out 1" from LC-1 and is connected to the FlashScan Pin E {EXT.AD1}. The black wire is connected to same Signal ground location as the LC-1 (Green, White wire) and is connected to the FlashScan Pin D "Common Analog Ground".

Programming LC-1 to work with EFI Live

Programming LC-1 for the DynoTune display.

The LC-1 must be programmed to match the calibration of the display. The LC-1 display from DynoTune (www.dynotunenitrous.com) is calibrated for the following analog signal:

1.00 Volt at AFR: 10.00

2.00 Volts at AFR: 20.00

Note: Different displays may be calibrated for very different settings. Adjust your settings according to your display literature. **Please refer to the LC-1 Manual for further details on programming the LC-1.**

1. Connect the PC's serial connection to the serial OUT of the LC-1. The terminator plug should be connected to the serial IN of the LC-1.

   Note: If your computer does not have a serial connection, you can use a USB-to-Serial adapter from any RadioShack or electronics store.

2. Turn the ignition switch to ON to power the LC-1.

3. Open the LM Programmer. The window, shown in Figure 1, should be displayed when it establishes communications. If it does not connect, check your COM Port settings.
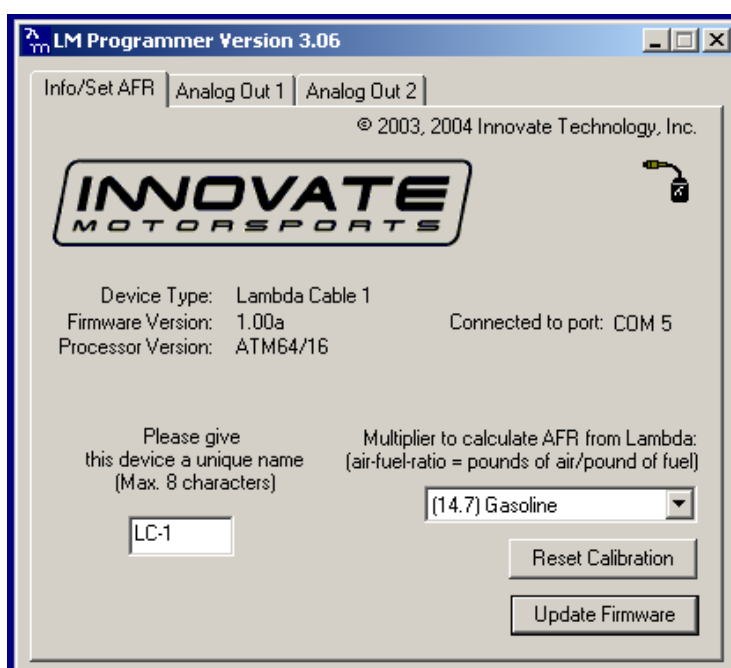

Figure 1: LM Programmer Main Menu

4. Click on the "Analog Out 2" tab.

5. Select "use air-fuel-ratio" option.

6. Set the "Analog Out 2" to the following:
   a. 1.00 Volts at AFR: 10.00
   b. 2.00 Volts at AFR: 20.00

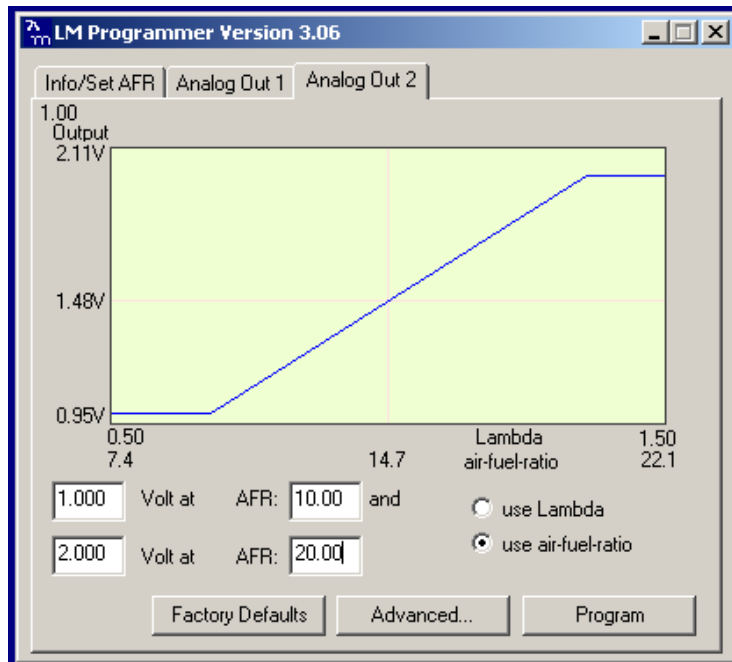The window should look similar to Figure 2:"use air-fuel-ratio".

Figure 2: "use air-fuel-ratio"

7. Click the "Program" button to program these values into the LC-1. When the LC-1 is programmed, the "Program" button will be grayed out.

Programming LC-1 for EFI Live

EFILive version 7.3 has an LC-1 calculation in the "sae_generic.txt" file. The LC-1's programmable settings in this section are based on these calculations. If your file is different, different input values will be needed for the LM Programmer.

```
# Innovate LC-1 WBO2
# ========================
*CLC-00-926
V                    0.0           5.0          .1   "{EXT.AD1}"
AFR                 10.0          20.0          .2   "({EXT.AD1}*3)+7.35"
*CLC-00-927
factor               0.0           2.0          .1   "{CALC.AFR_LC11.AFR}/{GM.AFR}"

*CLC-00-928
V                    0.0           5.0          .1   "{EXT.AD2}"
AFR                 10.0          20.0          .2   "({EXT.AD2}*3)+7.35"
*CLC-00-929
factor               0.0           2.0          .1   "{CALC.AFR_LC12.AFR}/{GM.AFR}"
```

1. Connect the PC's serial connection to the serial OUT of the LC-1. The terminator plug should be connected to the serial IN of the LC-1.
2. Turn the ignition switch ON to power the LC-1.
3. Open LM-1 Programmer.
4. Select the "Analog Out 1" tab.
5. Select "use air-fuel-ratio" option.
6. Set the Analog Out 1 to the following:
    a. 0.88333 Volts at AFR: 10.00
    b. 4.21667 Volts at AFR: 20.00
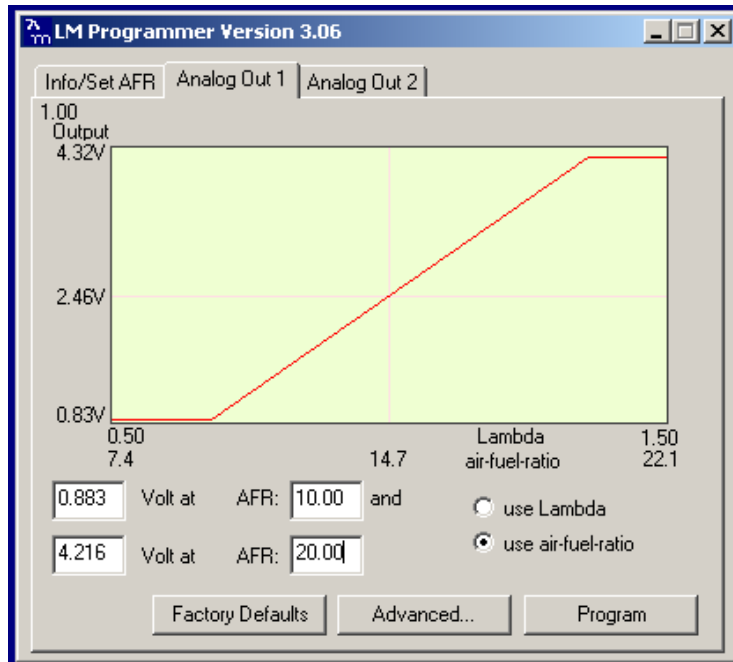   The Window should look similar to the Figure 3.

Figure 3: "use air-fuel-ratio"

7. Click the "Program" button. When the LC-1 is programmed, the "Program" button will be grayed out.

Verifying EFILive LC-1 Operation

Selecting PIDs

Please Reference the EFILIVE AutoVE Tuning Tutorial for PID selection.

Select the PIDs from the AutoVE tutorial, also add PIDs {EXT.AD1} and {EXT.AD2}.

By logging both {EXT.AD1} and {EXT.AD2}, you can verify correct voltage readings from the LC-1 are being recorded in EFILive. The unconnected {EXT.ADx} may show a voltage, but it will not change as much as the {EXT.ADx} that the LC-1 is connected. After verifying which {EXT.ADx} is used, delete the unused {EXT.ADx} from PID selection.

Logging and Checking Data from LC-1

1. Connect the LC-1 to FlashScan via the external connector and connect the FlashScan to your car.

2. Start and drive car: For the first few miles, your LC-1 will read very lean due to the AIR injecting air into the exhaust. Drive ~5 miles to bring the car up to operating temperature and to get past the AIR before recording data.

3. Start Logging.

4. Click the "Data" tab and see which {EXT.ADx} is connected. See Figure 4 for example.
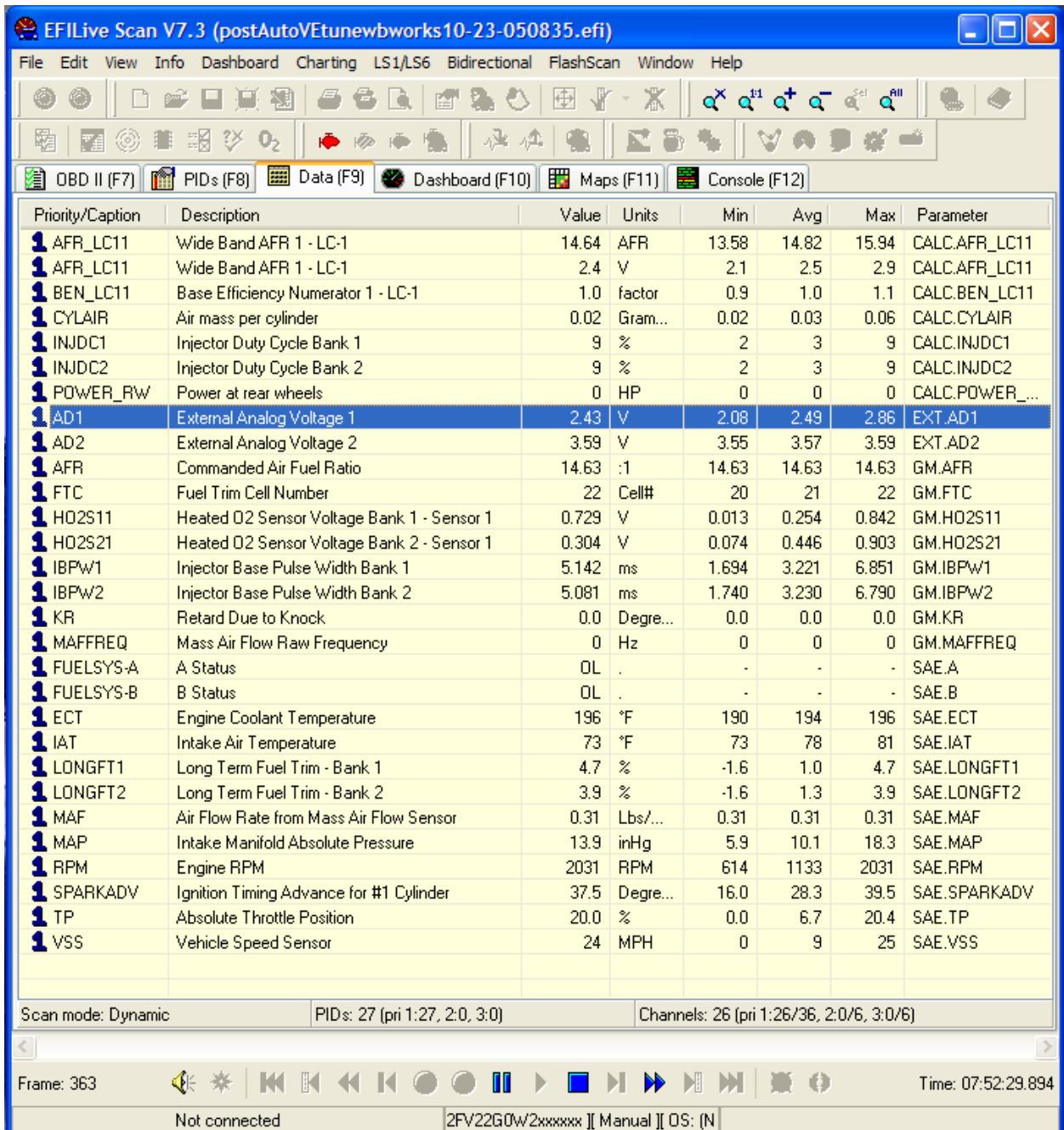
Figure 4: Sample Data Log

As seen in the data log above, {EXT.AD1} is logging values that are changing and reflected in the {CALC.AFR_LC11} value of 14.64. Look at the values to verify that it matches the DynoTune display or Logworks software monitored values. {EXT.AD2} is showing a voltage, but it is not changing significantly during drive. {EXT.AD2} is not connected and can be deleted from the PID selection.

5.   Click the [Map] tab. If your previous map selections from the AutoVE Tutorial is using the correct {EXT.ADx}, the map should be logging the average values of the AFR. The AutoVE tutorial's Map should show correct AFR values and can be used with confidence.

AFR Average Map

Please Reference the EFILIVE AutoVE Tuning Tutorial for Map creation.

The following map can help when the comparing the dynotune display or LC-1 Logging software AFR values to the EFILive AFR scanned values.

1. Click on an empty map in EFILive Scan.

2. Click on "Data" Tab.
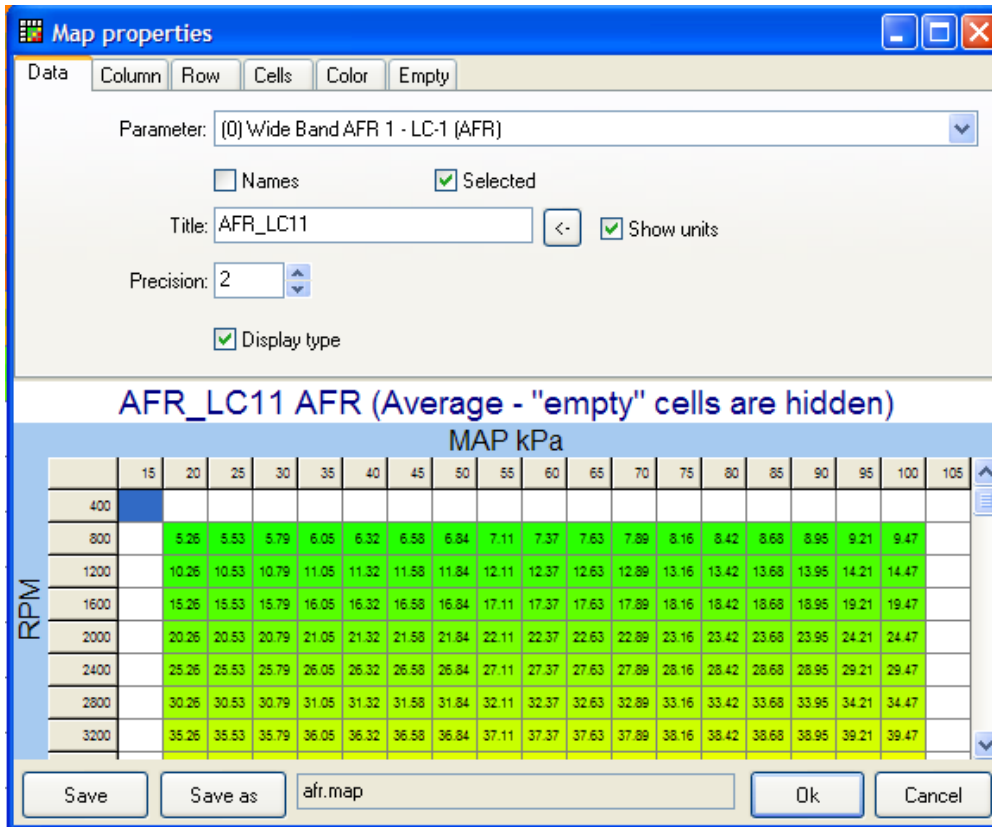
3. Select as data shown in Figure 5.

Figure 5: AFR Map Creation – Data

4. Click on "Column" tab.
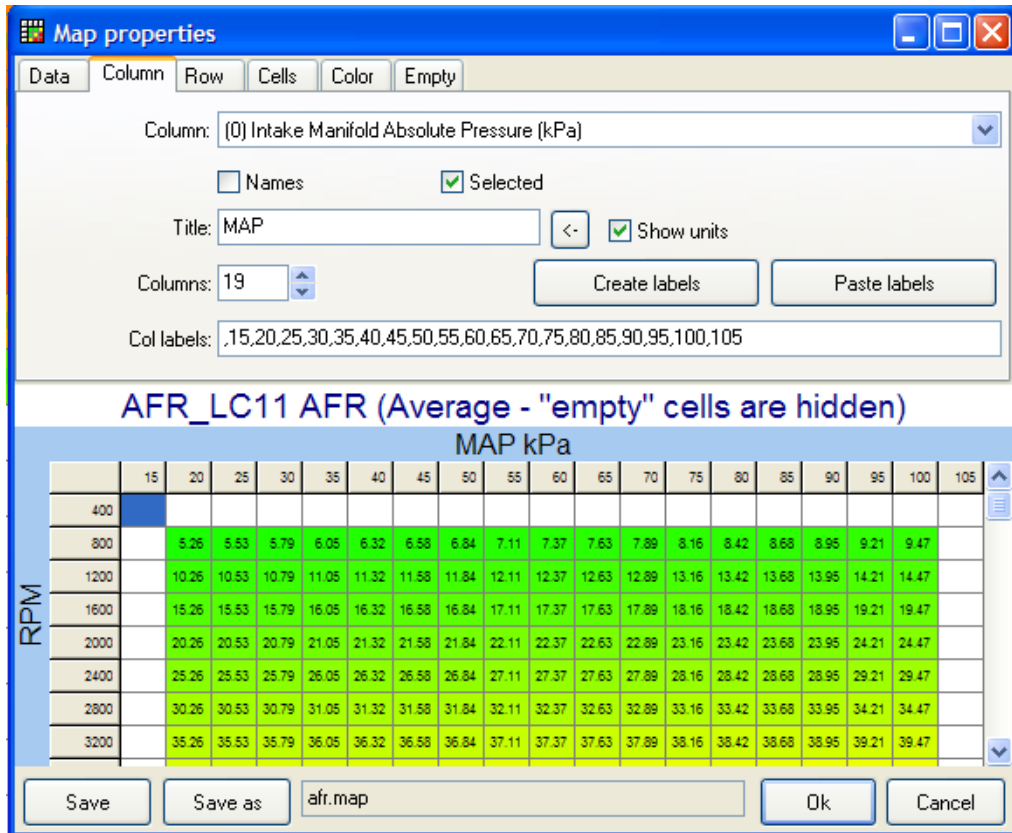
5. Select as data shown in Figure 6.

Figure 6: AFR Map Creation – Column

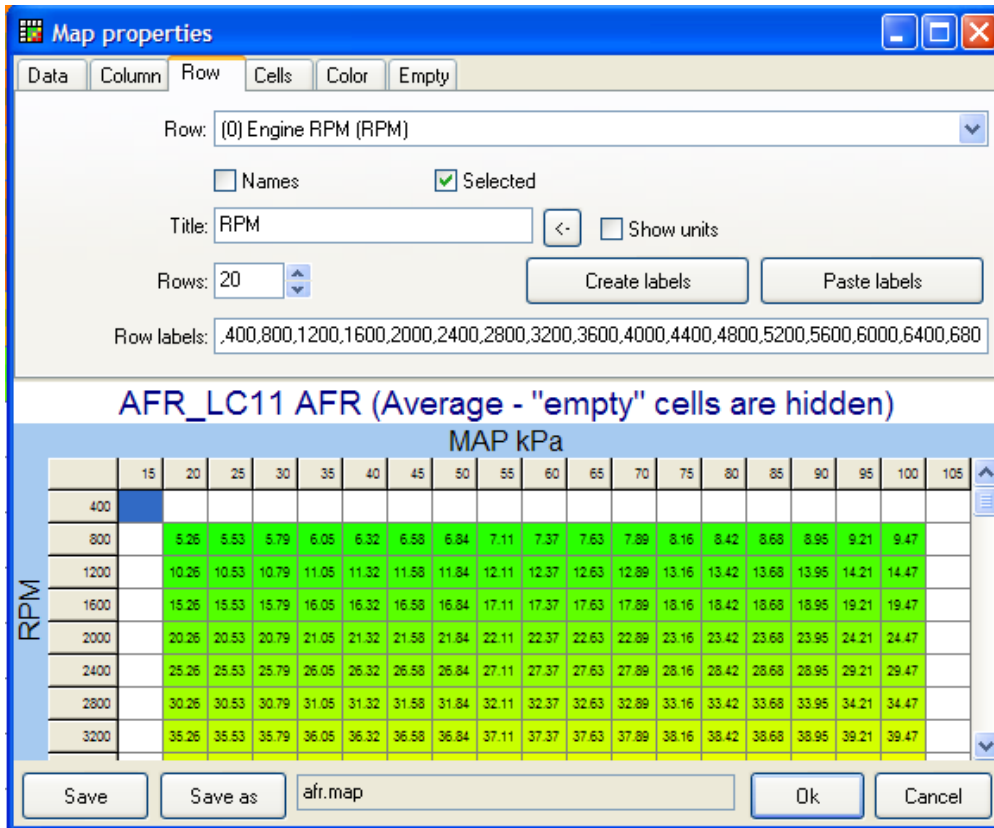6. Select "Row" Tab.

7. Select as data shown below:

Figure 7: AFR Map Creation – Row

8. If everything is setup correctly, you can now interpret a more familiar AFR map…
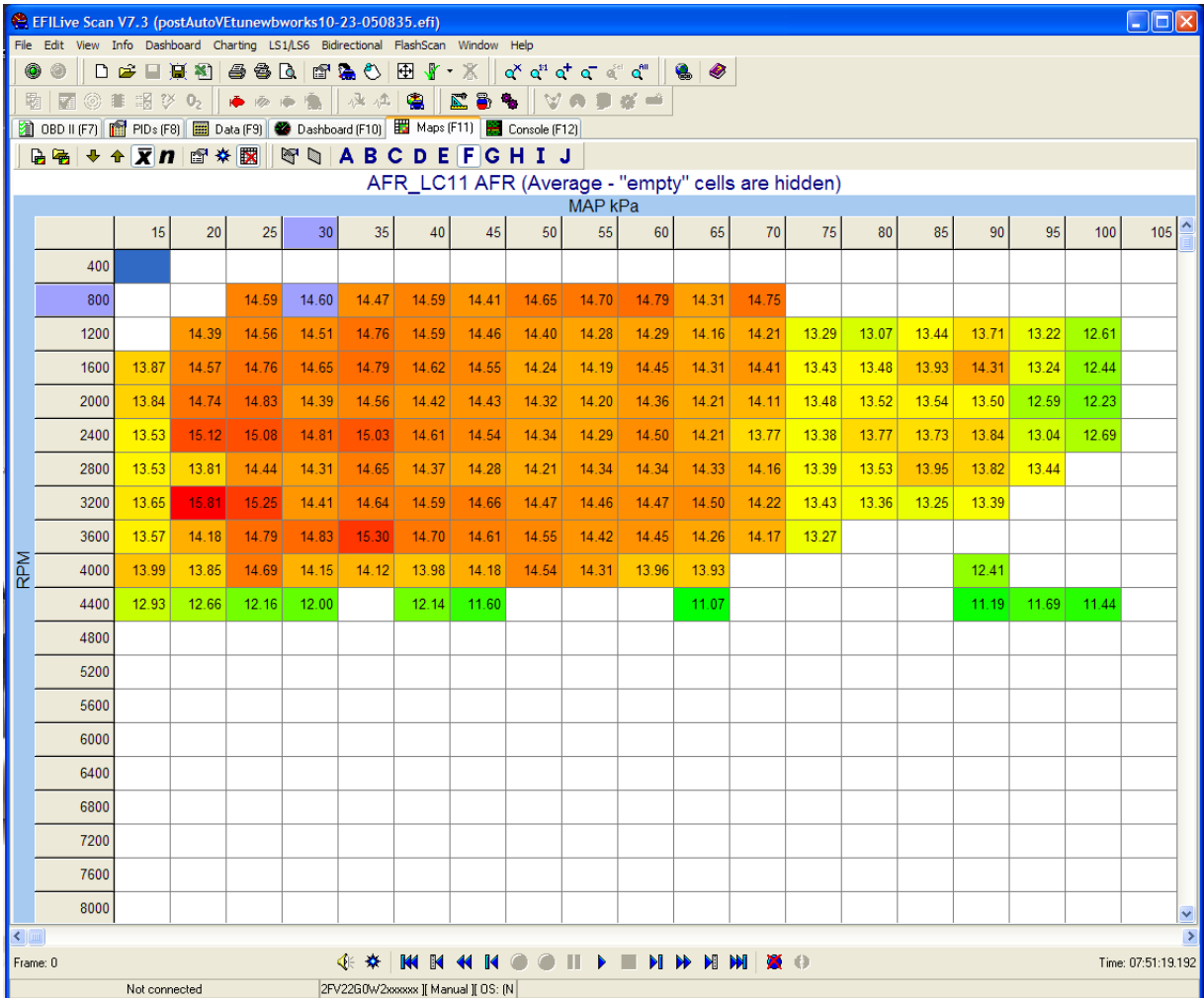

Figure 8: AFR Map