



## 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.

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## 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. **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 and EFILive/FlashScan 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" will not be used.



Picture 1: LC-1

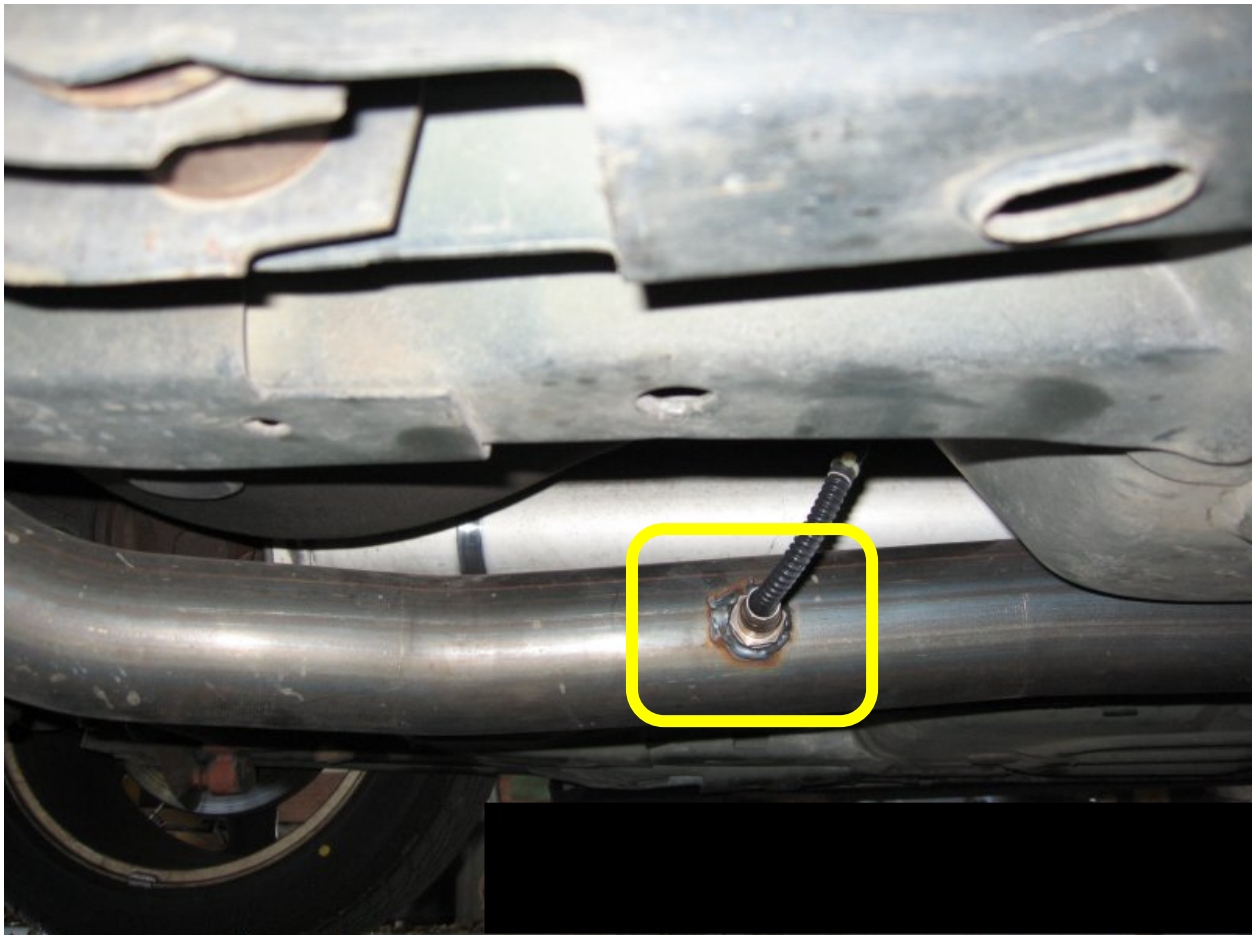


Picture 2: EFILive

***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. The WBO2 Sensor should be oriented between the 10 o'clock and 2 o'clock position, with 12 o'clock being the best position. **Please refer to literature that was included with your LC-1 for details on correct installation.**

The picture below 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 3: 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 4 below.



Picture 4: 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

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 5.

#### 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 5: FlashScan Pin-Outs

#### 1. 12V supply:

Connect the LC-1 Red 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.

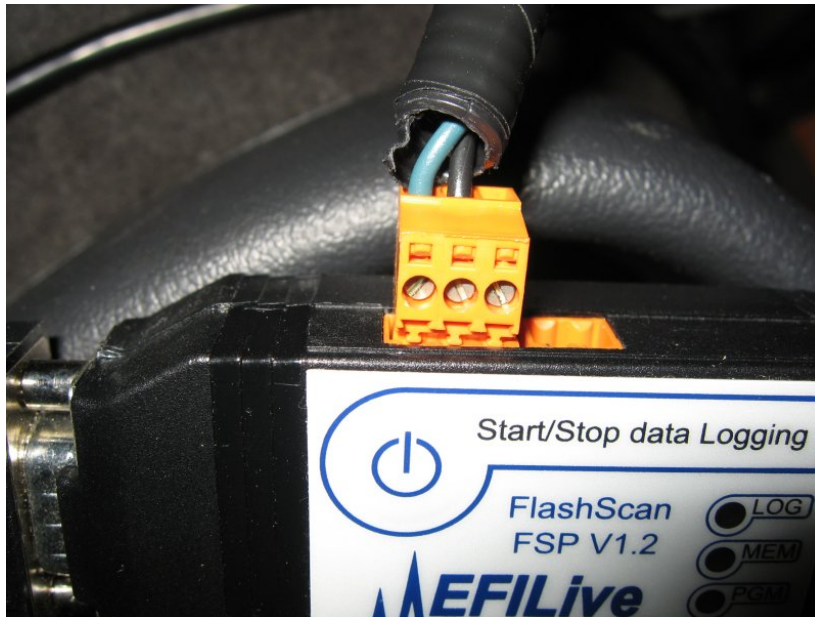
#### 1. LC-1 Analog Out 1:

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 Grounds:

Connect the LC-1's Blue, Green, and White wires ground connection to the D location of the EFILive External connector. D is in the middle of the 3-wire connector.





Picture 6: 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 (Blue, Green, White wire) and is connected to the FlashScan Pin D “Common Analog Ground”.

## 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.

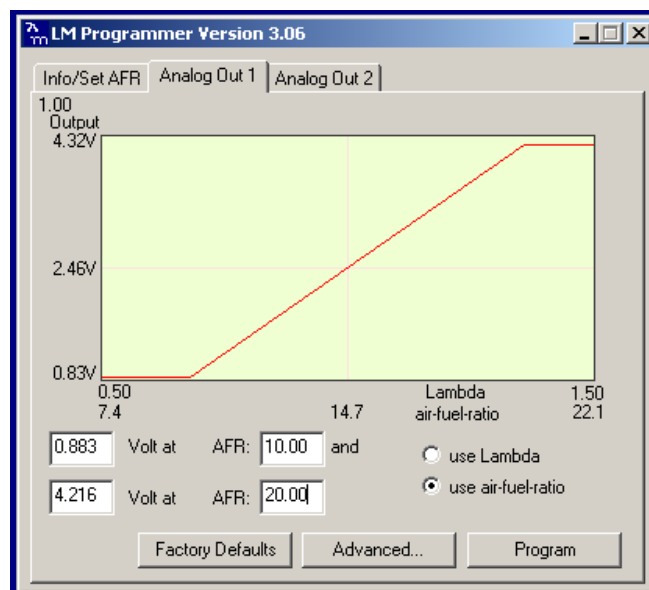


Figure 3: "use air-fuel-ratio"



7. Click the “Program” button. When the LC-1 is programmed, the “Program” button will be greyed 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.

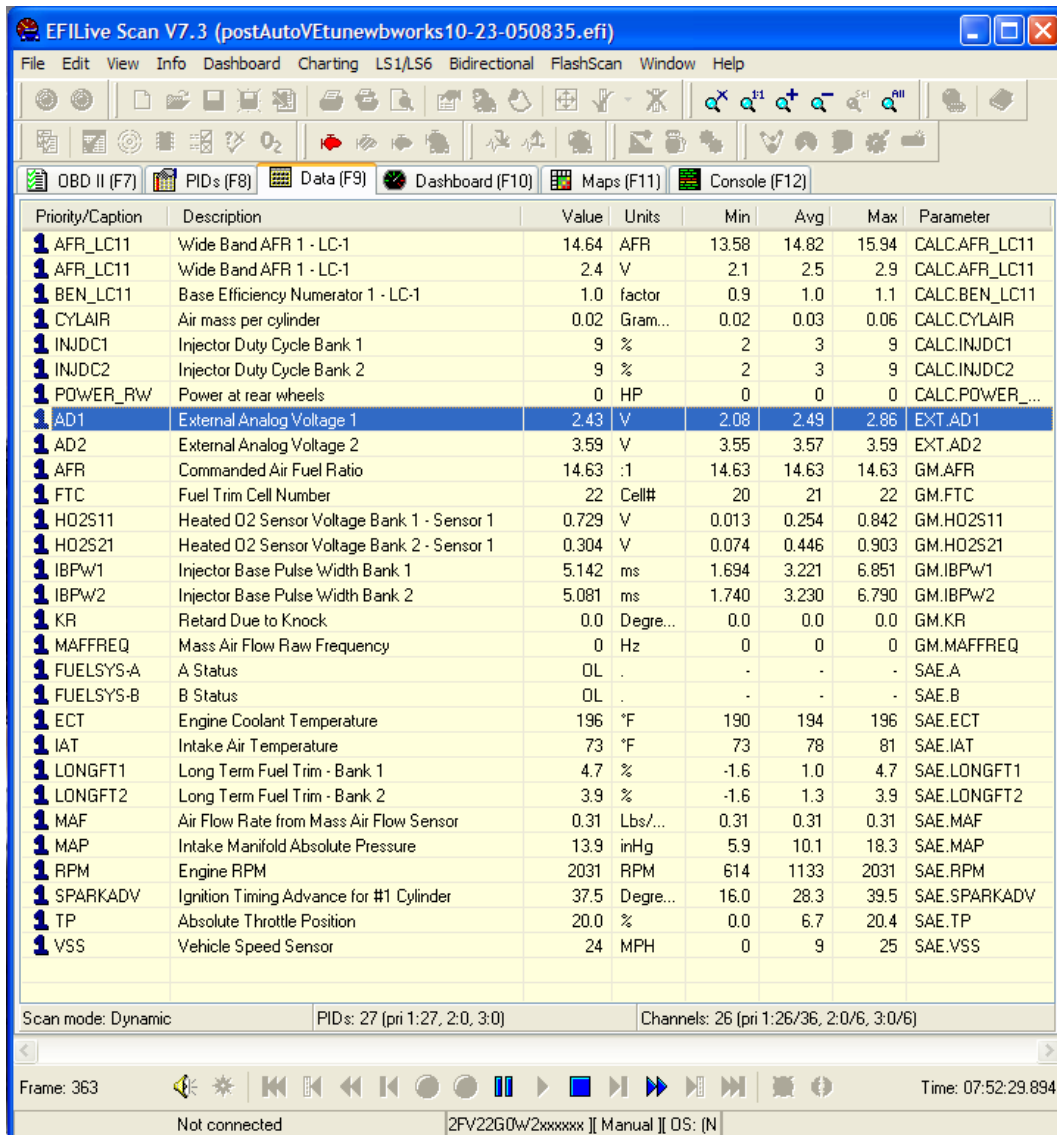


Figure 4: Sample Data Log

As seen during 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.

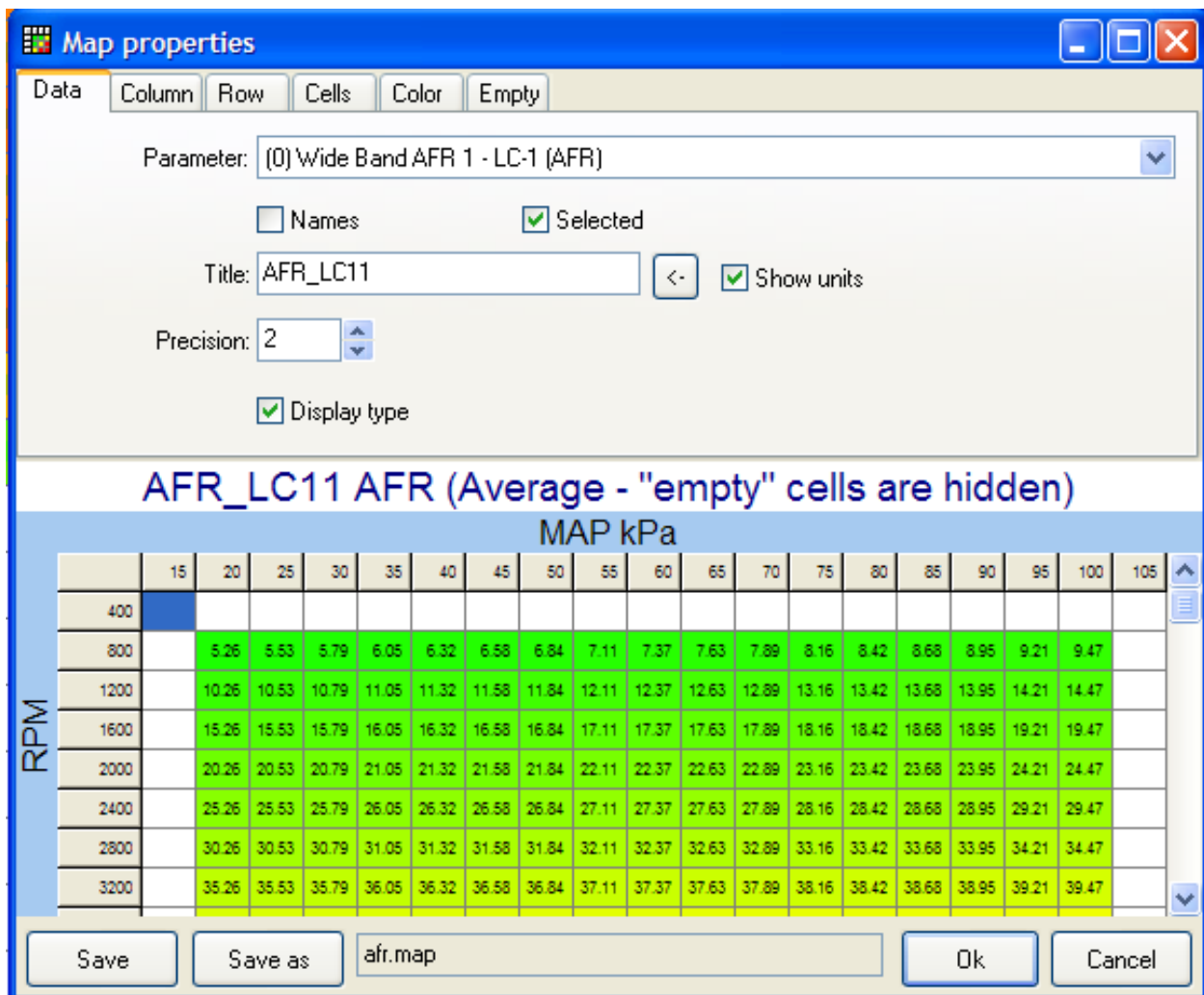


Figure 5: AFR Map Creation – Data

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

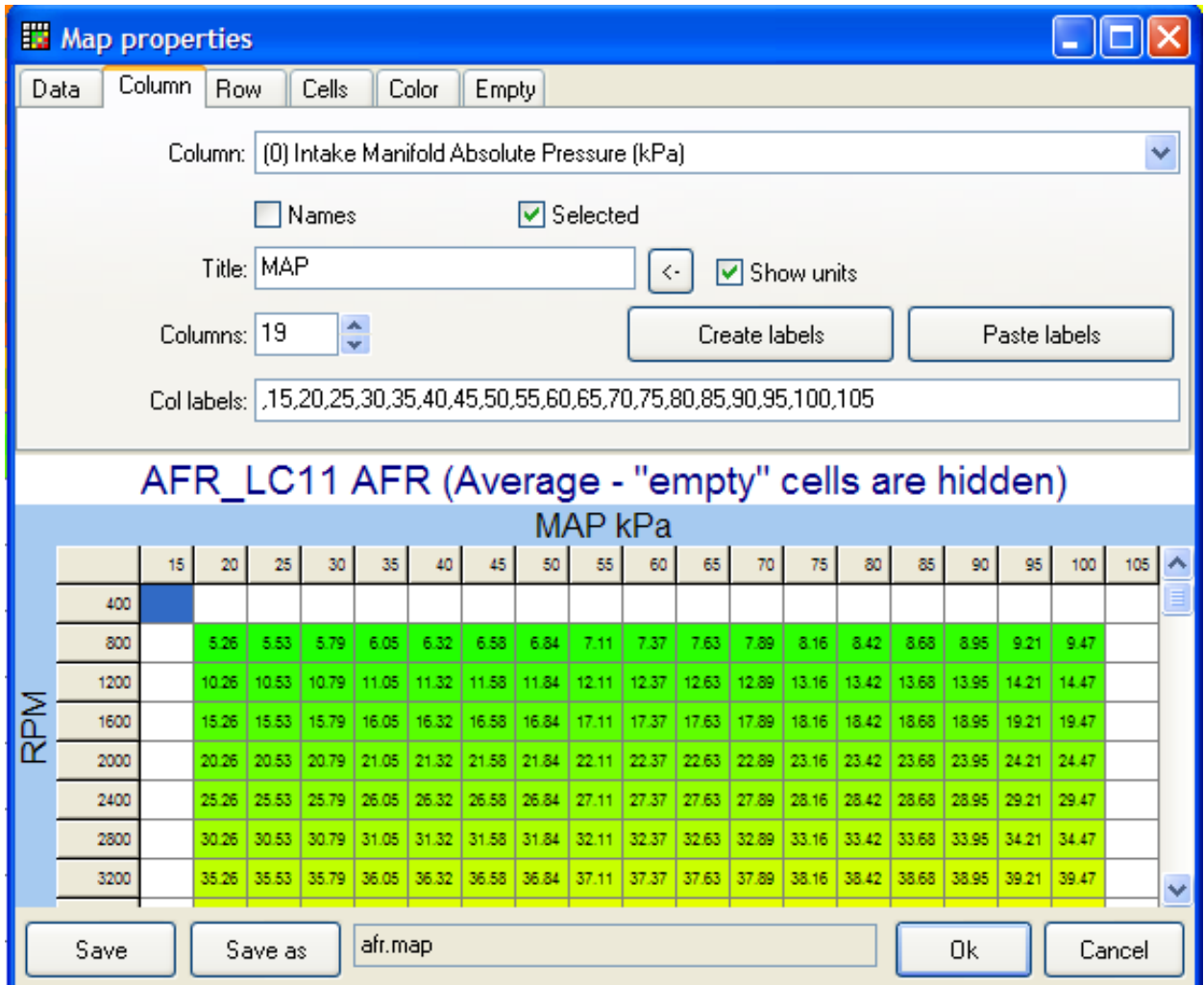


Figure 6: AFR Map Creation – Column

6. Select "Row" Tab.
7. Select as data shown below:

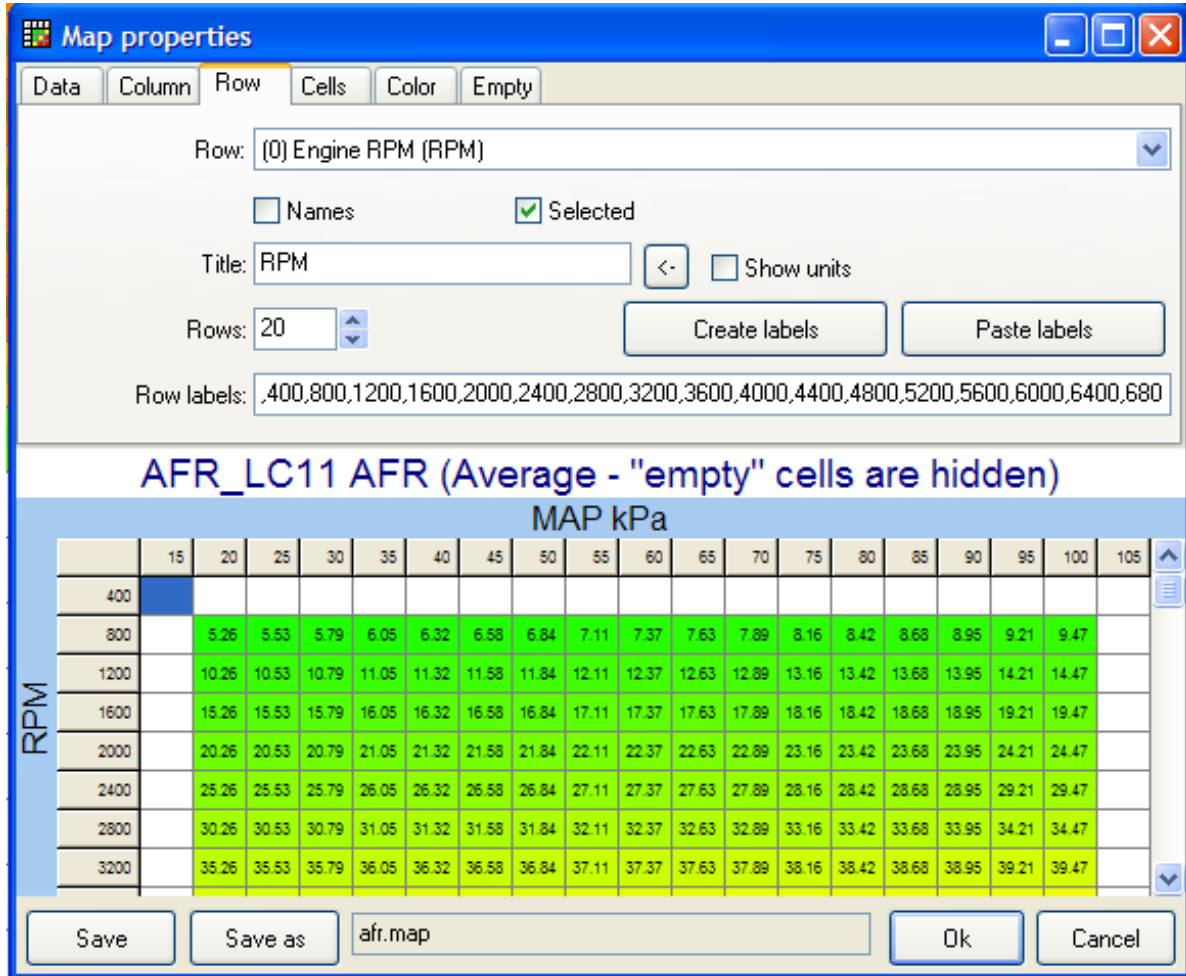


Figure 7: AFR Map Creation – Row

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

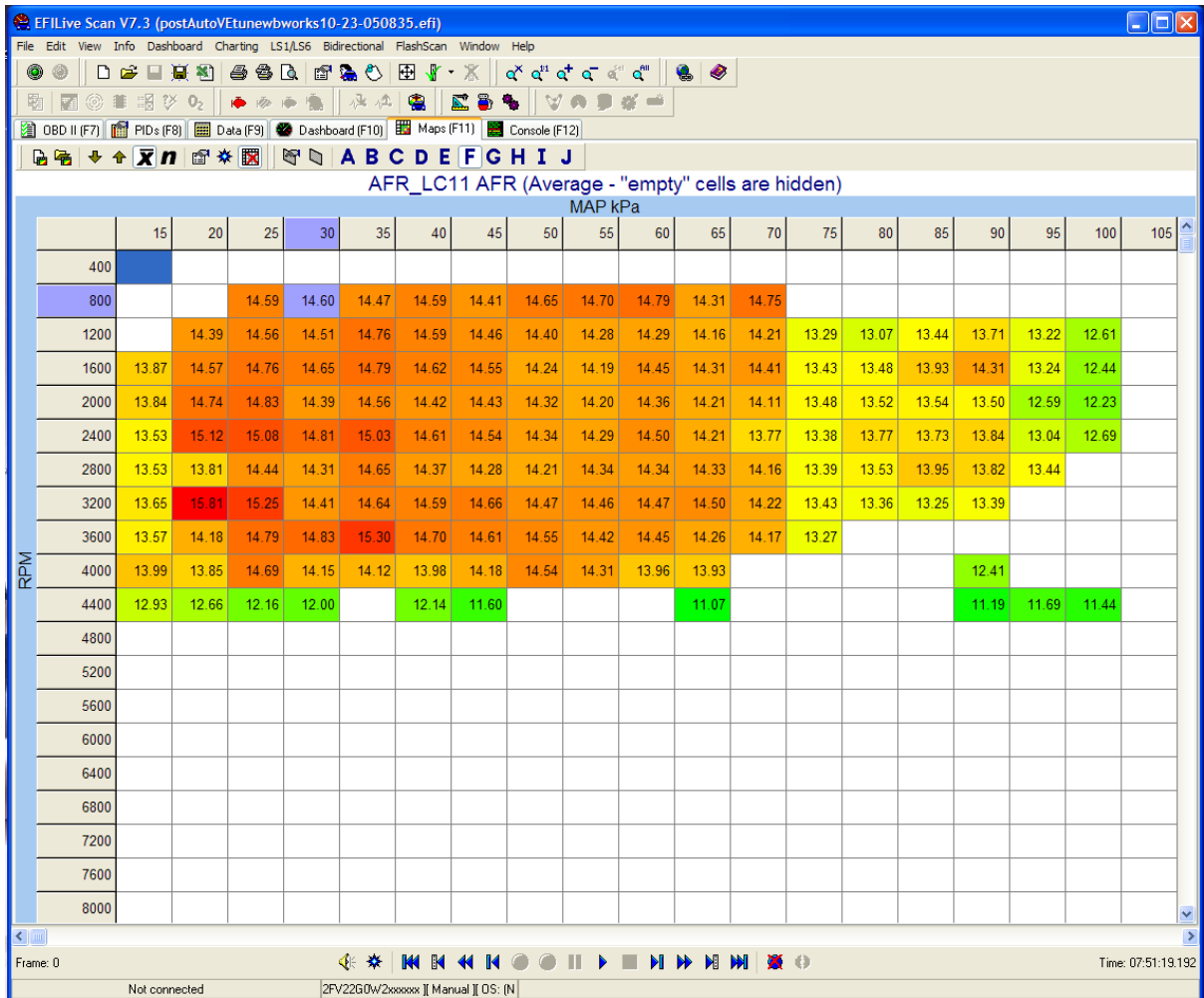


Figure 8: AFR Map