

ECM ENGINE CONTROL
AND MONITORING

DJET1000TM Kit
Air-Fuel Ratio Combustion Monitor
Instruction Manual

10/03 Part Number 1000A-23

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Table of Contents

Introduction	1
The DJET1000 Kit	1
DJET1000 Kit Components List	1
Important Operation Notes	2
Installing the DJET1000 Kit	3
Connecting the DJET1000 to an ECM AFRecorder	8
Connecting the DJET1000 to an ECM Lambda Pro	8
Connecting the DJET1000 to an ECM G100 Gauge	8
Using the DJET1000 Kit	9
Application Notes	11
Troubleshooting	12
Safety Warnings	13
Warranty and Disclaimers	14

Introduction

The DJET1000 Kit

The ECM DJET1000 kit allows you to get accurate and repeatable measurements of Air-Fuel Ratio (AFR) using the industry-standard AFM1000 module (included) and to bring these measurements into your Dynojet™ stack system. AFR can be displayed and graphed by the Dynojet software along with RPM and horsepower.

The DJET1000 kit comes with a tailpipe probe; however, the AFR sensor can be removed from the probe and mounted into a 18mm x 1.5mm boss in the engine's exhaust. The DJET1000 adapter module can also accept AFR information from other ECM products such as: AFRecorder, Lambda Pro, and a G100 gauge.

DJET1000 Kit Components List

The following items are included with the DJET1000 kit:

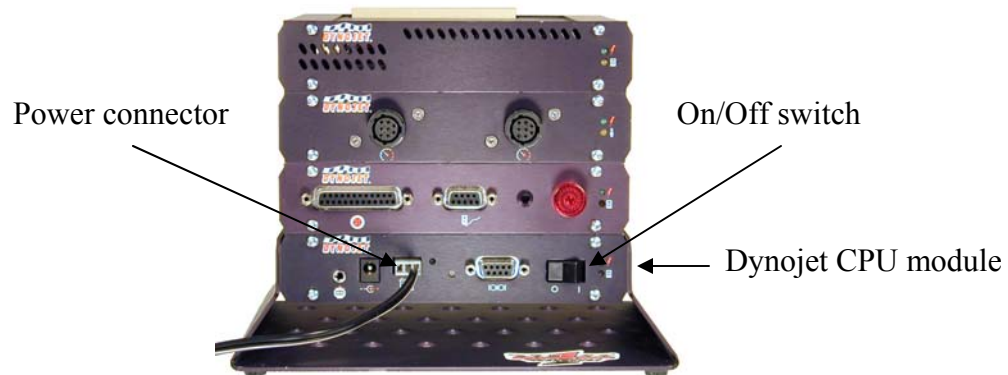
Item No.	Description	Part Number
1.	AFM1000 Control Module	1000A-1
2.	DJET1000 Adapter Module	1000A-20
3.	AFR Sensor	1000A-2
4.	AFR Sensor Shields (2 installed on Sensor)	2400A-41
5.	Tailpipe Probe	1000A-21
6.	Wiring Harness	1000A-3d
7.	AFR Sensor Cable, 20'	2400E-2
8.	Calibration Screwdriver	1000A-4
9.	Tie Down Kit (Velcro and 2 Cable Ties)	1000A-22
10.	AFM1000 Instruction Manual	1000A-6
11.	DJET1000 Instruction Manual	1000A-23

Important Operation Notes

1. Before installing the AFR sensor, apply a small amount of non-lead containing antiseize compound to its threads. Do not get the compound on the sensor's tip.
2. Do not operate an engine with the tailpipe probe or AFR sensor in the exhaust for more than three minutes without the AFM1000 control module powering the sensor. If the sensor is off in a running engine for a longer period, soot and water will condense in the sensor and may reduce its life.
3. Do not use the probe or AFR sensor in exhaust systems in which water is sprayed into the exhaust. Water striking the sensor may thermally shock the sensor and cause permanent sensor damage.
4. Start the engine in the vehicle to be tested and run it until no visible water vapor or liquid water is coming out of the exhaust. This is to minimize the chance of liquid water striking and thermally shocking the AFR sensor.
5. Do not put the probe or AFR sensor into the exhaust of a heavily sooting or oil-burning engine.
6. Use of the probe or AFR sensor with leaded fuels over time may reduce the life of the sensor.
7. Do not use the probe or AFR sensor in a location where the temperature is greater than 950 deg. C (1742 deg. F) or if the pressure is not between 0.8 to 1.3 atm (23.9 to 38.9 inches Hg, 81 to 132 kPa).
8. Route and cable-tie all cables away from hot or moving objects, ignition wires, and where people walk.
9. Do not remove or attach the AFR sensor from the AFR cable when the AFM1000 control module is powered.
10. Do not drop the AFR sensor onto a hard surface.
11. Do not expose the AFR sensor to flammable substances.
12. Do not attempt to wash the AFR sensor with any solvent or compressed air.

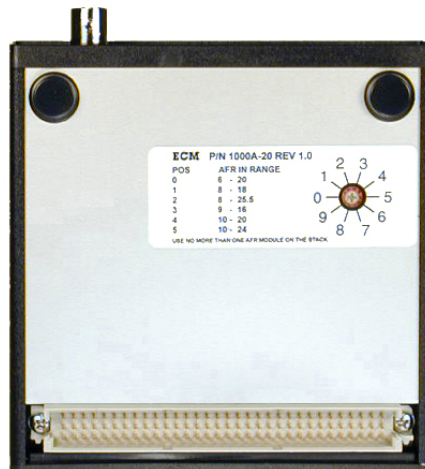
Installing the DJET1000 Kit

1. Turn off the power to the Dynojet CPU module and remove the power connector.

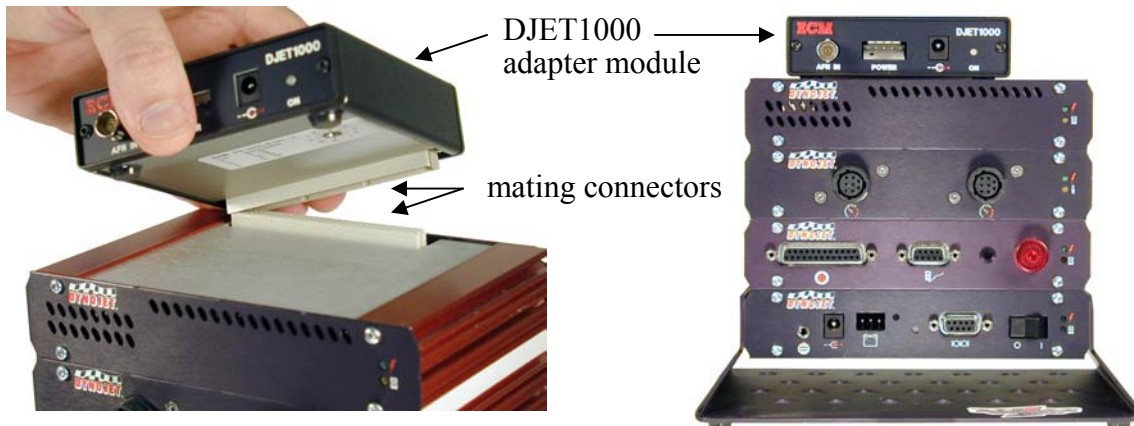


2. Remove the Dynojet Air Fuel Ratio module if one is installed on the stack. You cannot use the Dynojet Air Fuel Ratio module and the DJET1000 Kit at the same time.
3. On the bottom of the DJET1000 adapter module is a label and access to a rotary switch. The rotary switch must be turned to the position ("POS") for the "AFR IN RANGE" of the device connected to the "AFR IN" BNC connector on the DJET1000.

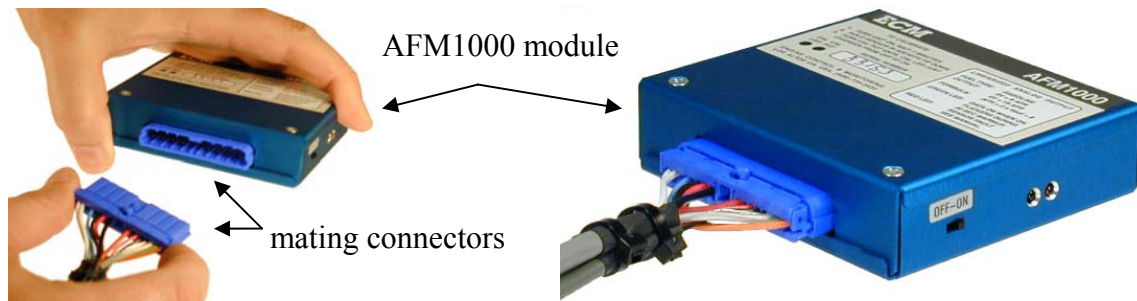
The range (for gasoline) for most AFM1000s is 8 AFR (for a voltage output of 0) to 18 AFR (for a voltage output of 5). Therefore for these AFM1000s, the little arrow on the switch should point to the "POS" number for an "AFR IN RANGE" of "8 – 18". Check the label on your AFM1000 to see its AFR range (for gasoline). Use the supplied calibration screwdriver to turn the switch to the appropriate "POS". Note that even if the device connected to the DJET1000 adapter module can read outside the AFR range of 10 to 18, the Dynojet stack will not display these AFRs. Therefore, if the engine is running richer than 10 AFR (i.e. 9), the Dynojet software will be pinned at 10. If the engine is running leaner than 18 AFR (i.e. 19), the Dynojet software will be pinned at 19. If a device other than an AFM1000 is connected to the DJET1000 (i.e. AFRecorder, Lambda Pro, G100, etc), refer to the appropriate section in this manual.



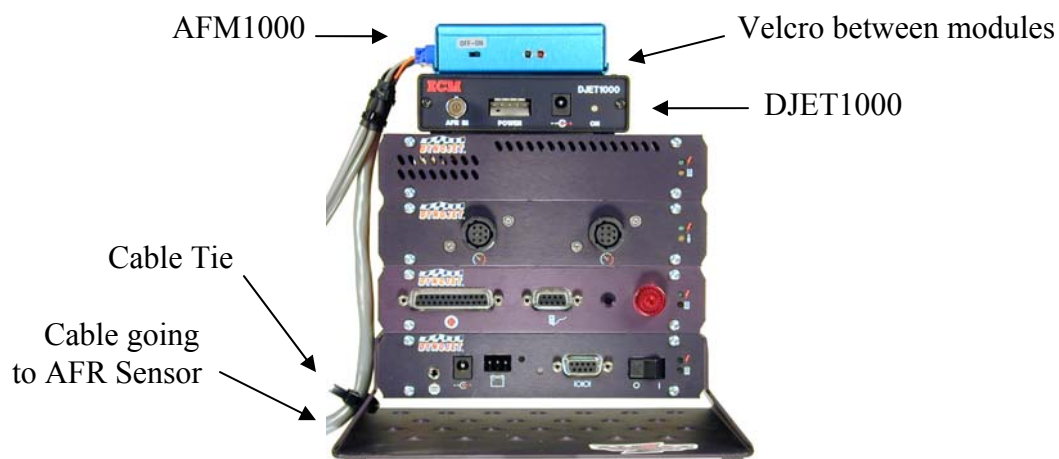
4. Plug the DJET1000 adapter module into the top of the stack. Make sure the pins in the connector engage properly and push it in straight.



5. Plug the wiring harness into the AFM1000 control module. Make sure the pins in the connector engage properly and push it in straight.

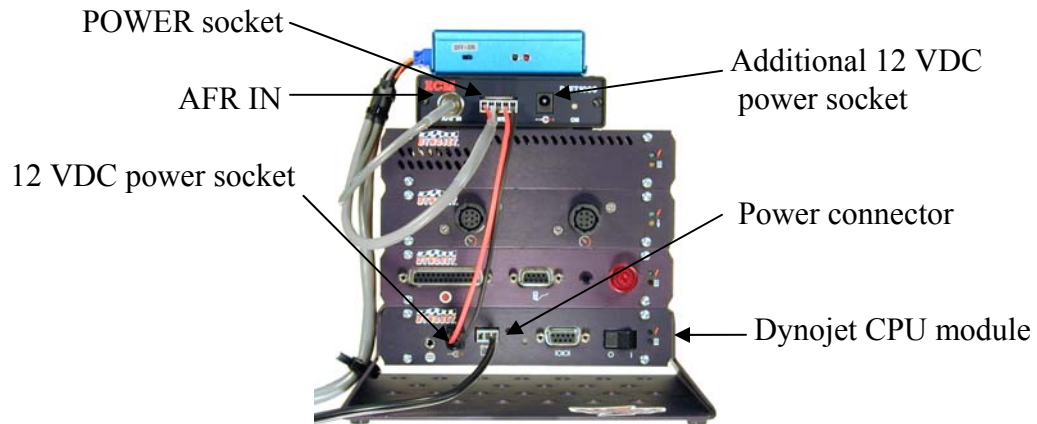


6. Sit the AFM1000 control module on top of the DJET1000 adapter module so that the AFM1000's ON-OFF switch is facing forward. Use the supplied velcro between the modules to hold them together. Use one of the supplied cable ties to tie the cable on the harness going to the AFR sensor to the base of the stack.

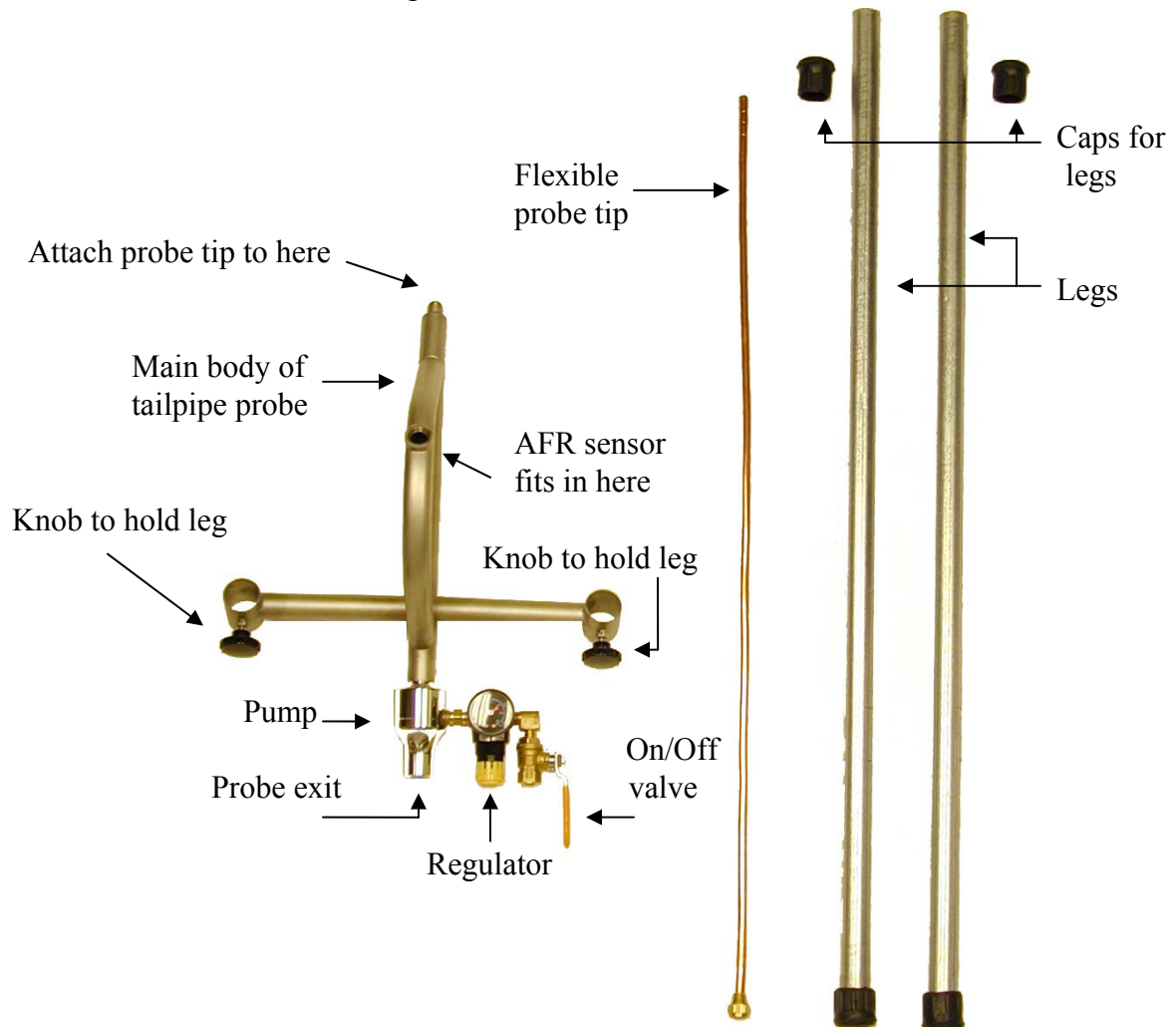


7. Plug the power connector on the wiring harness into the "POWER" socket on the DJET1000 adapter. Plug the black plug on the harness into the 12 VDC power socket on the Dynojet CPU module (the one with the little "+" sign in the middle of its label). Plug the BNC connector on the harness into the "AFR IN" BNC connector on the DJET1000

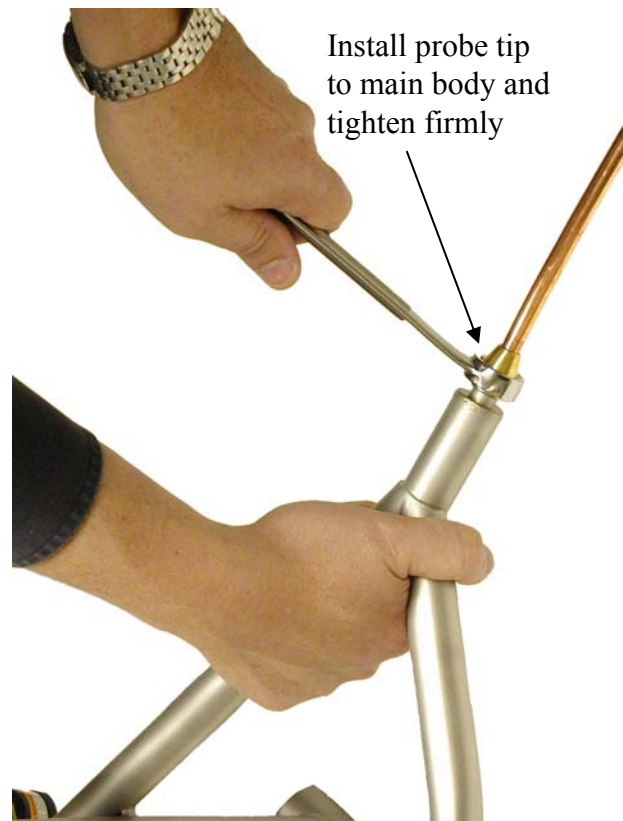
adapter. Note that the DJET1000 provides an additional 12 VDC power socket. Do not plug the black plug into that socket, plug it into the one on the stack. Plug the power connector back into the Dynojet CPU module.



8. Attach the AFR sensor cable to the wiring harness. Once the AFR sensor is mounted in the tailpipe probe, you will attach the other end of the AFR sensor cable to the sensor.
9. Unpackage and lay out the parts for the tailpipe probe. The copper flexible probe tip is delivered inside one of the legs.

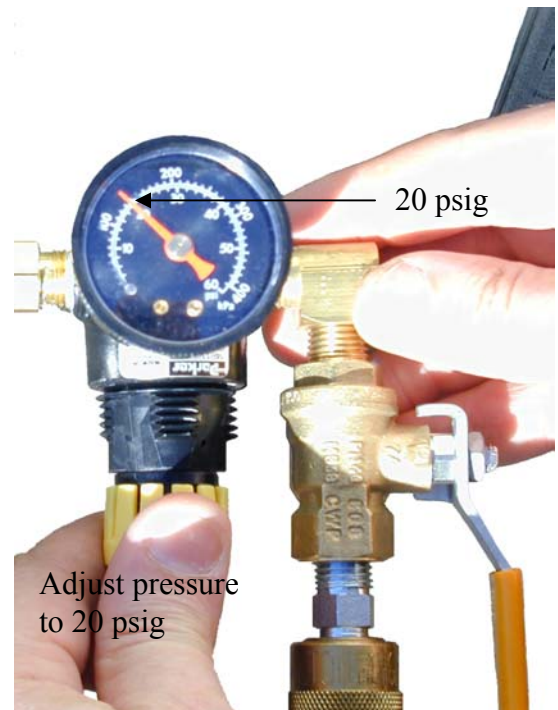


10. Assemble the tailpipe probe. You will need to get the proper fitting to match the one on your compressed air hose. The below pictures show important details of the assembly process.



11. Attach the AFR sensor to the AFR sensor cable.
12. Turn on the Dynojet CPU module. The LED on the front of the DJET1000 adapter module should glow green. In the "Make Run" window of the Dynojet software, make sure that the AIR/FUEL Module is "ON". If it is "OFF", double click on top of "OFF" to turn it "ON". Then click on the "MAKE RUN" button. The LED on the front of the DJET1000 adapter module should change to red. This indicates that power is being sent to the AFM1000 module.
13. Turn the AFM1000 module's power on using the ON-OFF switch on its side and calibrate the module according to the instructions written on the module. Keep the ON-OFF switch "ON" at all times.
14. Connect an air hose from your air compressor to the tailpipe probe. Open the On/Off valve on the probe and adjust the regulator to deliver 20 ± 3 psig to the pump. Do not increase the pressure in an attempt to "speed up" the response of the system; it will not help and will result in inaccurate readings. The air from your compressor creates a suction on the exhaust and draws exhaust past the AFR sensor. The air should be on when measuring AFR from the tailpipe but should not be on when calibrating the AFM1000. Close the On/Off valve when the probe is not being used.

You are now ready to use your DJET1000 kit.



Connecting the DJET1000 to an ECM AFRecorder

The DJET1000 adapter module will accept the analog output from any AFRecorder. Turn off the power to the Dynojet CPU module and remove the power connector. Remove the DJET1000 adapter module from the stack. On the bottom of the module is a label and access to a rotary switch. Using the supplied calibration screwdriver, turn the switch to the “POS” number for a “SOURCE AFR RANGE” of “8 – 18”. Reinstall the DJET1000 adapter module. Attach the Dynojet CPU module’s power connector and turn it back on. Program the analog output of the AFRecorder to output 0 volts at 8 AFR and 5 volts at 18 AFR and connect the analog output of the AFRecorder to the “AFR IN” BNC connector on the front of the DJET1000 adapter module.

Connecting the DJET1000 to an ECM Lambda Pro

The DJET1000 adapter module will accept the analog output from any Lambda Pro. Turn off the power to the Dynojet CPU module and remove the power connector. Remove the DJET1000 adapter module from the stack. On the bottom of the module is a label and access to a rotary switch. Using the supplied calibration screwdriver, turn the switch to the “POS” number to match the AFR range of the Lambda Pro. The range for most (but not all) Lambda Pros is “8 – 25.5”. Reinstall the DJET1000 adapter module. Attach the Dynojet CPU module's power connector and turn it back on. Connect the analog output of the Lambda Pro to the “AFR IN” BNC connector on the front of the DJET1000 adapter module.

Connecting the DJET1000 to an ECM G100 Gauge

The DJET1000 adapter module will accept the analog output from any G100 Gauge with an analog output. Turn off the power to the Dynojet CPU module and remove the power connector. Remove the DJET1000 adapter module from the stack. On the bottom of the module is a label and access to a rotary switch. Using the supplied calibration screwdriver, turn the switch to the “POS” number to match the AFR range of the G100. The range for most (but not all) G100s is “9 – 16”. Reinstall the DJET1000 adapter module. Attach the Dynojet CPU module's power connector and turn it back on. Connect the analog output of the G100 to the “AFR IN” BNC connector on the front of the DJET1000 adapter module. The red wire of the G100’s analog output is the signal wire and goes to the center of the BNC connector. The black wire of the G100’s analog output is the ground wire and goes to the shell (outside ring) of the BNC connector.

Using the DJET1000 Kit

1. Start the engine in the vehicle to be tested and run it until no visible water vapor or liquid water is coming out of the exhaust. This is to minimize the chance of liquid water striking and thermally shocking the AFR sensor.
2. Adjust the tailpipe probe's legs so that the probe is below the level of the exhaust. The two threaded knobs screw into the legs to hold them in position.
3. Stick the copper flexible probe tip as far up the exhaust pipe as possible. If possible, bend the flexible probe tip so as to move the main body of the probe off center from the exhaust and out of the way of the main exhaust blast.



4. Open the tailpipe probe's On/Off valve and check that the pressure at the probe is 20 ± 3 psig.
5. In the "Make Run" window of the Dynojet software, make sure that the AIR/FUEL Module is "ON". If it is "OFF", double click on top of "OFF" to turn it "ON". Then click on the "MAKE RUN" button. The LED on the front of the DJET1000 adapter module should change to red. This indicates that power is being sent to the AFM1000 module. The ON-OFF switch on the side of the AFM1000 module should always be left on.
6. Make your dyno run. Note that for many exhaust systems, a purge cycle is required to purge trapped air in the exhaust. On a chassis dyno, this can be one full throttle run.

This purges the trapped air. After the purge cycle is complete, make a second dyno run to collect accurate AFR data. If the trapped air is not purged, leaner than actual AFR readings will be read.

7. After the dyno run, remove the probe from the exhaust and close the tailpipe probe's On/Off valve and remove the probe from the exhaust.
8. To view and graph AFR information, click on the "Axis Selection" button when in the "Graph Options" window of the Dynojet software and select "AIR/FUEL" for the right Y axis.

Application Notes

1. The biggest killer of AFR sensors is liquid water in the exhaust. Liquid water strikes the hot sensor and causes it to crack. Before any dyno run, make sure that the exhaust system is well heated and that liquid water cannot be seen coming out of the tailpipe.
2. It is impossible to avoid any liquid water from reaching the AFR sensor when a tailpipe probe is used. So prepare yourself for eventually killing an AFR sensor. Prepare yourself by charging your customers more when the AFR sensor is used (ex. \$25). Your customer should understand that a dyno run without AFR information is a waste (and dangerous for the engine) so paying a little more for AFR information is worth it.
3. Once a week, calibrate the AFM1000 according to the instructions on the module's label.
4. The AFR displayed by a properly calibrated and warmed-up gasoline engine will be between 9 and 16 AFR. Generally speaking, a stoichiometric closed-loop controlled engine will be at approximately 14.6 AFR at all conditions except cold-start, fuel shutoff (during closed-throttle deceleration), and wide-open throttle (WOT) operation.
5. During cold-start, the AFR is always richer than stoichiometric (i.e. less than 14.6) but this may not be seen due to air being pumped into the exhaust upstream of the AFR sensor. This pumping of air will make the AFR pin at 16 AFR and typically stops within 5 minutes of engine start-up. Flick the throttle during this period and you will see the AFR momentarily go below 16 AFR.
6. On some vehicles, the AFR measured during idle with an exhaust tailpipe probe will be lean of stoichiometric (i.e. greater than 14.6) at all times. This is due to air being pumped into the exhaust, by air trapped in the exhaust, or by reversion air from the exhaust's exit.
7. Fuel shutoff is programmed into most if not all modern engine control systems and may come as a surprise to you during a "foot-off-the-gas" deceleration. During fuel shutoff, the AFR will be pinned at 16 AFR (the AFR of air is infinity!). Press the throttle during a fuel shutoff and you will see the AFR come below 16 indicating that the engine is firing again.
8. During WOT operation, the AFR will be programmed between 9 and 14.6. Maximum engine power occurs typically around an AFR of 12 but engines are run richer (i.e. less than 12) for durability reasons. This is common on turbocharged engines where the extra fuel is used to keep the turbocharger from overtemping. Some engine control strategies keep the AFR at about 12 for a while at WOT and then go richer to avoid damaging the engine as it gets hotter. Perhaps the most frustrating AFR that you will see at WOT is stoichiometric (i.e. 14.6). Some modern engine control systems will not go rich at WOT for more power. That's lost horsepower (but cleaner air).
9. The AFR range for most AFM1000s is 8 to 18 AFR. The Dynojet software will only display AFRs between 10 and 18. If you want to measure AFRs less than 10 or greater than 18, you will have to directly tap the analog output of the AFM1000 and use the voltage-to-AFR conversion formula on top of the AFM1000 module.

Troubleshooting

If the AFM1000 has been calibrated, its red light off and green light on, the probe at least 18" up the exhaust pipe, the tailpipe probe's pressure at 20 ± 3 psig and ejecting exhaust, and the exhaust system has been purged, the AFR measured will be accurate.

If the AFM1000's red light is on or flashing, refer to the AFM1000's Instruction Manual.

If the exhaust probe is not ejecting exhaust, take the pump apart and see if it is plugged inside. If the air from the compressor is dirty, the pump might get plugged.

If the exhaust system has not been purged, or if the probe is not far enough up the exhaust, or if there is a leak in the exhaust, or if the engine control system is putting air into the exhaust then the AFR will read lean of the correct value.

Safety Warnings

In installation and use of this product, comply with the National Electrical Code and any other applicable Federal, State, or local safety codes.

Always wear eye protection when working near engines, vehicles, or machinery.

When installing the DJET1000 kit, it is best to think-out your moves before you make them.

Route and cable-tie all cables away from hot, moving, sharp, high energy (spark), caustic objects, and where people walk.

Operate the engine only in a well-ventilated area and never when you or one of your co-workers is tired.

One measure of professionalism is how much you and your co-workers can accomplish without an injury. Always be at your professional best. Think and act with safety in mind.

Warranty and Disclaimers

WARRANTY

The products described in this manual, with the exception of the UEGO sensor, are warranted to be free from defects in material and workmanship for a period of one year from the date of shipment to the buyer. Within the one year warranty period, we shall at our option replace such items or reimburse the customer the original price of such items which are returned to us with shipping charges prepaid and which are determined by us to be defective. This warranty does not apply to any item which has been subjected to misuse, negligence or accident; or misapplied; or modified; or improperly installed.

The UEGO sensor is considered an expendable part and as such cannot be covered by a warranty.

This warranty comprises the sole and entire warranty pertaining to the items provided hereunder. Seller makes no other warranty, guarantee, or representation of any kind whatsoever. All other warranties, including but not limited to merchantability and fitness for purpose, whether express, implied, or arising by operation of law, trade usage, or course of dealing are hereby disclaimed.

The warranty is void if the control module is opened or the wiring harness is modified.

LIMITATION OF REMEDY

Seller's liability arising from or in any way connected with the items sold and/or services provided shall be limited exclusively to repair or replacement of the items sold or refund of the purchase price paid by buyer, at seller's sole option. In no event shall seller be liable for any incidental, consequential or special damages of any kind or nature whatsoever, including but not limited to lost profits arising from or in any way connected with items sold and/or services provided to buyer, whether alleged to arise from breach of contract, express or implied warranty, or in tort, including without limitation, negligence, failure to warn or strict liability. In no event shall the company's liability to buyer arising out of or relating to the sale of any product or service exceed the purchase price paid by buyer to the company for such product or service.

PRODUCT CHANGES

We reserve the right to discontinue a particular product or to make technical design changes at any time without notice.