

ECM

Air-Fuel Ratio Analyzers



For Engine Calibration, Testing,

Air-Fuel Ratio (alternatively defined as Lambda or Equivalence Ratio) is the most influential parameter affecting the emissions, efficiency, and driveability of spark ignition engines. The accurate and tight control of AFR is mandatory in optimizing an engine's performance. With all that riding on this single parameter, a high-quality air-fuel ratio analyzer is a necessary component of any engine calibration, testing, development, or maintenance program.

ECM offers six high-quality AFR analyzers to meet your needs. All six analyzers measure AFR using UEGO (Universal Exhaust Gas Oxygen) sensors. The UEGO sensor has revolutionized AFR measurement because of its wide range, fast response, and ease-of-use. The sensor consists of a spark plug sized electrochemical cell which is placed directly in the engine's exhaust. The cell acts on O₂, CO, H₂, and UHCs in the exhaust to determine AFR, Lambda, Equivalence Ratio, and %O₂ for fuels of any composition (i.e. H:C, O:C, and N:C ratios, including H₂).



Dual AFR Meter • Rackmount • AC

The AFRRecorder Model 4800 combines dual channel, fast response air-fuel ratio measurements with extensive computational capabilities. The Model 4800 displays the AFRs of each sensor, their simultaneous difference, their average, and each sensor's AFR deviation. The AFR deviation is the real-time variation of AFR and indicates engine roughness or misfire. Linearized programmable analog outputs and full analyzer control via RS-232 make for easy integration with data acquisition systems. Other features include: PC software, recording with built-in statistics, and programmable

simulated exhaust gas oxygen sensor (SEGO) outputs. SEGO outputs allow you to move the engine's control point off stoichiometric. This feature is useful for engine calibration or catalytic converter testing.



Dual AFR Meter • Benchtop • AC/DC

The AFRRecorder Model 4800 is available in a rackmount (4800R) or benchtop (4800P) form. The Model 4800P can be powered by AC (line) or DC (vehicle battery). A variety of cabling options is available for the Model 4800.



AFR Meter • Spark Timing • Engine Speed
Manifold Pressure • Benchtop • AC/DC

The AFRRecorder Model 2400 combines a single channel of AFR measurement with measurements of spark timing, manifold pressure, and engine speed. The combination of these four engine parameters in a single portable package has made the Model 2400 a popular tool with engine calibrators. Spark timing and engine speed can be measured with the supplied probes or by using signals from production sensors or the engine control module. Manifold pressure is measured using a sensor inside the AFRRecorder. Linearized programmable analog outputs, RS-232 control, PC software, recording with built-in statistics, programmable alarms, a programmable SEGO, and AC or DC operation are other Model 2400 features.

Development, and Maintenance



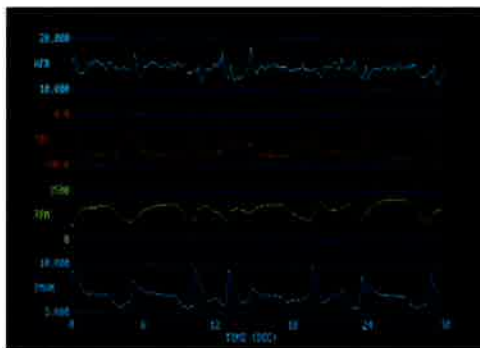
AFR Meter • Benchtop • AC/DC

The AFRRecorder Model 2000 is a single-channel AFR analyzer. The Model 2000 is the standard for high-quality AFR measurement in a package suitable for dynamometer and in-vehicle work. Features include: linearized programmable analog output, RS-232 control, PC software, recording with built-in statistics, programmable alarms, a programmable SEGO, and AC or DC operation.



AFR Meter • Handheld • DC

The AFRRecorder Model 1200 is a highly integrated full-featured AFR analyzer designed for in-vehicle applications. Although it is only about the size of an unfolded wallet, the Model 1200 packs features such as a linearized programmable analog output, RS-232 control, PC software, data recording, and a programmable SEGO. The Model 1200 is DC powered and comes with an external AC/DC adapter.



AFRremote Software Standard with any AFRRecorder



AFR Meter • Handheld • DC

Lambda Pro is the simplest to use of all ECM's AFR analyzers. Lambda Pro has many of the features of the Model 1200, but with less programmability. But don't let this fool you, Lambda Pro has "big meter" features such as a linearized analog output, max/min AFR recording, and a stoichiometric SEGO.



AFR Sensor Simulator

All of ECM's AFR analyzers can perform field calibration of the AFR sensor using ambient air. To verify accurate operation of the analyzer's electronics, ECM offers its AFR Sensor Simulator. The AFR Sensor Simulator is connected to the analyzer in place of the AFR sensor. The simulator tests the analyzers' sensor heater control circuit and the analyzer should display the AFR associated with the simulator's switch position. The simulator is a calibrated device that can be returned to ECM for scheduled calibration verification. With the AFR Sensor Simulator, you can perform a quick checkout of your analyzer at your site.

For over ten years, thousands of engine calibrators, testers, developers, and maintenance personnel world-wide have selected an ECM AFR analyzer. With six choices available, there's an ECM AFR analyzer ready to work for you.

Specifications

<u>Model</u>	<u>Range</u>	<u>Accuracy</u>	<u>Resp. Time</u>	<u>Calc. Time</u>	<u>Fuel Type</u>	<u>Analog Out</u>	<u>RS-232</u>	<u>SEGO</u>	<u>Recording</u>	<u>Statistics</u>	<u>Alarms</u>	<u>Power</u>	<u>Size</u>
AFRecorder 4800R (Dual AFR)	6 to 150 AFR 0.4 to 10 λ 0.1 to 2.5 ϕ 0 to 22% O ₂	$\pm 0.6\%$ @ stoich. $\pm 0.9\%$ elsewhere	< 150 ms	1 ms	H:C, O:C, N:C, and H ₂ can be specified	0 to 5 V, Linearized, Prog.	Yes, with software included	Yes Prog- Dual	Yes	Avg, Max, Min, SD	No	AC	19"x 3.5"x 14"
AFRecorder 4800P (Dual AFR)	6 to 150 AFR 0.4 to 10 λ 0.1 to 2.5 ϕ 0 to 22% O ₂	$\pm 0.6\%$ @ stoich. $\pm 0.9\%$ elsewhere	< 150 ms	1 ms	H:C, O:C, N:C, and H ₂ can be specified	0 to 5 V, Linearized, Prog.	Yes, with software included	Yes Prog- Dual	Yes	Avg, Max, Min, SD	No	AC/ DC	10.2"x 4.6"x 13.3"
AFRecorder 2400 (Single AFR)	6 to 150 AFR 0.4 to 10 λ 0.1 to 2.5 ϕ 0 to 22% O ₂	$\pm 0.6\%$ @ stoich. $\pm 0.9\%$ elsewhere	< 150 ms	1 ms	H:C, O:C, N:C, and H ₂ can be specified	0 to 5 V, Linearized, Prog. for all four parameters	Yes, with software included	Yes Prog.	Yes	Avg, Max, Min, SD	Yes	AC/ DC	10.2"x 4.6"x 13.3"
<i>and</i> Spk. Timing RPM Manifold Pr.	-60 to 30 deg. 100 to 9,999 0.0 to 35.0 Psia	± 1 degree ± 10 RPM $\pm 1\%$ FSO											
AFRecorder 2000 (Single AFR)	6 to 150 AFR 0.4 to 10 λ 0.1 to 2.5 ϕ 0 to 22% O ₂	$\pm 0.6\%$ @ stoich. $\pm 0.9\%$ elsewhere	< 150 ms	1 ms	H:C, O:C, N:C, and H ₂ can be specified	0 to 5 V, Linearized, Prog.	Yes, with software included	Yes Prog.	Yes	Avg, Max, Min, SD	Yes	AC/ DC	10.2"x 4.6"x 13.3"
AFRecorder 1200 (Single AFR)	6 to 150 AFR 0.4 to 10 λ 0 to 22% O ₂	$\pm 0.6\%$ @ stoich. $\pm 0.9\%$ elsewhere	< 150 ms	1 ms	H:C, O:C, N:C, and H ₂ can be specified	0 to 5 V, Linearized, Prog.	Yes, with software included	Yes Prog.	Yes	Avg, Max, Min, SD	No	DC/ AC	7.5"x 4"x 1.2"
Lambda Pro (Single AFR)	8.0 to 25.5 AFR 0.55 to 1.75 λ	$\pm 1\%$ @ stoich. $\pm 2\%$ elsewhere	< 150 ms	2 ms	Lambda, Gasoline, Methanol (others avail.)	0 to 5 V, Linearized	No	Yes Stoic. only	Yes Max, Min Only	Max, Min	No	DC	7.5"x 4"x 1.2"

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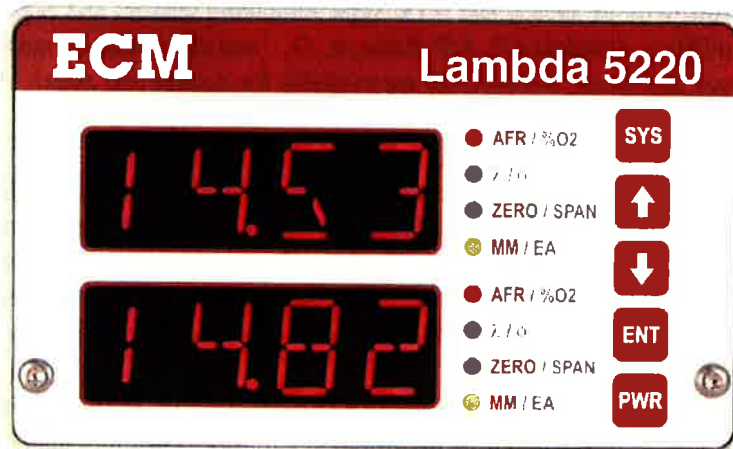
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ECM Lambda 5220

Lambda Analyzer

Fast measurements of Lambda, A/F Ratio, ϕ , and O₂

For
Laboratory
and
In-Vehicle
Use



→ Analog Out

↔ CAN

↔ USB

↔ RS232

actual size

Single Channel • Dual Channel • 2, 4, 6, 8 Channel Rack Mount



Direct-Insertion Wideband Lambda Sensor



Bosch and NTK Sensor Compatible

ECM's Lambda 5220 is a powerful, "next generation" wideband Lambda and O₂ analyzer. In addition to providing outstanding measurement range and accuracy, the Lambda 5220 addresses the two principle sources of error with wideband sensor use: sensor aging and exhaust pressure. All wideband sensors supplied are factory-calibrated and this calibration is stored in a memory chip in the sensor's connector. However with use, sensors can age and when this occurs, the calibration will no longer be accurate. To restore accuracy, the Lambda 5220 can be used to recalibrate the sensors and this new calibration will be stored in the same memory chip. Pressure compensation (P-COMP™) improves accuracy at non-stoichiometric (i.e. $\lambda \neq 1$) and non-atmospheric (i.e. $P \neq 101$ kPa) conditions. For example, a pressure increase of only 34 kPa can cause an error of 0.58 λ at $\lambda = 3$. The Lambda 5220 includes a pressure sensor that measures the exhaust gas pressure to avoid this error.

The Lambda 5220 will work with all Bosch and NTK-type wideband sensors and is programmable for all fuel types (H:C, O:C, N:C, and H₂). Lambda (λ), A/F Ratio, ϕ , O₂, and all sensor parameters including pumping current, cell resistance, sensor age factor, and pressure are available for display and output. A second lambda channel can be added.

The Lambda 5220 is suited for both dynamometer and in-vehicle work. With six analog outputs, CAN, USB, and RS232 communication, the Lambda 5220 can be integrated into any data acquisition system. Distances of up to 100 meters between the sensor and analyzer are possible. To simplify in-vehicle use, the Lambda 5220 can be turned on and off with a signal from the vehicle's ignition switch. This feature along with the analyzer's CAN communication capability make it possible to use the Lambda 5220 in the loop of a real-time emissions control strategy.

Lambda is the most important parameter influencing the emissions, fuel economy, and drivability of combustion engines and it is imperative that it be measured accurately. For more than ten years, ECM has been producing precision Lambda instrumentation for vehicle and engine developers. ECM's Lambda 5220 represents the pinnacle in Lambda and O₂ measurement technology.

Specifications

Ranges	λ 0.4 to 25, A/F 6 to 364, ϕ 0.04 to 2.5, O ₂ 0 to 25%, Pressure 0 to 414 kPa
Accuracies	λ 0.005 (at 1 λ), ± 0.008 (0.8 to 1.2 λ), ± 0.009 (elsewhere) A/F ± 0.1 (at 14.6 A/F), ± 0.2 (12 to 18 A/F), ± 0.5 (elsewhere) $\phi \pm 0.005$ (at 1 ϕ), ± 0.008 (0.8 to 1.2 ϕ), ± 0.009 (elsewhere) %O ₂ ± 0.2 (0 to 2% O ₂), ± 0.4 (elsewhere) Pressure ± 5.2 kPa
Response Time	Less than 150 ms
Fuel Type	Programmable H:C, O:C, and N:C ratios, and H ₂
Analog Outputs	6 channels, 0 to 5V linearized and programmable for λ , A/F, ϕ , O ₂ , pressure, etc
CAN	Programmable communication protocol
USB, RS232	Data transfer and control
Power	11 to 28 VDC, AC/DC (optional)
Sensor	18mm x 1.5mm thread (lambda), 1/4" NPT (pressure)
Size and Cable	105mm (W) x 64mm (H) x 165mm (D), 10m cable (std), up to 100m (optional)
Operating Temp.	- 40 to +85°C
Options	Second λ /AFR/ ϕ /%O ₂ channel, Rackmount Kit (holds up to 4 analyzers/8 channels), λ sensor simulator, AC/DC Power Supply

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ECM AFM1000 Air-Fuel Ratio Monitor



- Wide AFR Measurement Range
- Fast Response
- Multiple Fuels Capability
- Linearized Analog Output
- Easy Calibration in Air
- Compact

The ECM Air-Fuel Ratio Monitor (AFM1000) is a tool for the calibration, monitoring, and closed-loop operation of fuel-injection and carburetor systems. The AFM1000 uses a wide-range UEGO (Universal Exhaust Gas Oxygen) sensor that is mounted in the exhaust of the engine. Exceedingly simple to hook-up and operate, the AFM1000 comes complete with sensor, harness, module, operator's manual, and an exhaust boss and plug. The 0 to 5V analog output is linearized in AFR and can be connected to any data acquisition or engine control system. The AFM1000 provides unmatched measurement range, accuracy, and speed-of-response in a compact, lightweight package and is an essential tool for any in-vehicle powertrain development program.

Specifications

Measurement Range: 8.0 to 18.0 AFR
Accuracy: 1.5%
Voltage Output: 0 to 5V linear with AFR
Sensor Mounting: 18 mm x 1.5 mm
Size, Weight: 4" x 3.5" x 1", 160 gm

Power: 11 to 28 VDC
Calibration: Hold sensor in air
Included: Control module, UEGO sensor, 3', 10', or 20' harness, manual, exhaust boss and plug

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ECM IN-VEHICLE, WIDE-RANGE, AIR-FUEL RATIO MEASUREMENT

We have it all...

SENSORS & SIMULATOR



P/N 1000A-2, 1001A-2
NTK/ECM WIDE-RANGE
(UEGO) AFR SENSORS

or use

EXISTING NTK SENSORS
YOU MAY ALREADY HAVE

P/N AFRSIM200

SIMULATE SENSOR TO VERIFY
SYSTEM PERFORMANCE

HARNESSES



P/N 1000A-3/a/b/c,
1001A-3/a/b/c

3', 10' and 20' HARNESSES

or use

EXISTING NTK HARNESSES
YOU MAY ALREADY HAVE
(P/N TH-2009-W1)

or

USE OUR CUSTOM HARNESSES
SERVICES TO BUILD THE
IDEAL HARNESSES

CONTROLLERS

Pin-compatible upgrades for old NTK controllers



AFM1000 CONTROLLER (P/N 1000A-1)

- LINEAR VOLTAGE OUTPUT FOR AFR
- "AIR-CALIBRATION" FEATURE

F/A1000 CONTROLLER (P/N 1001A-1)

- LINEAR VOLTAGE OUTPUT FOR F/A
- "AIR-CALIBRATION" FEATURE

AFM1500 CONTROLLER (P/N 1500A-1)

- LINEAR VOLTAGE OUTPUT FOR AFR
- "AIR-CALIBRATION" FEATURE
- SERIAL MEASUREMENT (SMB) PORTS

F/A1500 CONTROLLER (P/N 1501A-1)

- LINEAR VOLTAGE OUTPUT FOR F/A
- "AIR-CALIBRATION" FEATURE
- SERIAL MEASUREMENT (SMB) PORTS

Complete kits or parts!

ORDERING INFORMATION

ECM offers complete kits or components.

Kits come complete with the control module, UEGO sensor, 3', 10', or 20' harness, exhaust boss and plug, and instruction manual.

To Order a Complete Kit:

Simply specify the type of control module (i.e. AFM1500, AFM1000, F/A1500, or F/A1000) and the harness length (i.e. 3', 10', or 20').

For example, an AFM1500 kit with a 10' harness is ordered as:

“AFM1500 Kit with 10' Harness”

To Order Parts:

Contact us at sales@ecm-co.com, by telephone at (408) 734-3433, or by fax at (408) 734-3432.

ECM LambdaCAN λ / AFR / O₂ Module with Pressure Compensation



- Wide Measurement Range
- Fast Response
- All Fuels Programmable
- CAN Communication
- Can be Field Recalibrated
- Optional Pressure Compensation
- Optional Display Head
- Environmentally Sealed

ECM's LambdaCAN Module is a powerful, "next-generation" wideband Lambda sensor controller with a CAN interface. In addition to providing outstanding measurement range and accuracy, LambdaCAN addresses the two principle sources of error with wideband sensor use: sensor aging and pressure sensitivity. All wideband sensors supplied are factory-calibrated and this calibration is stored in a memory chip in the sensor's connector. For best accuracy over the life of the sensor, calibration can be quickly performed using ambient air. This recalibration is stored in the memory chip and stays with the sensor. Sensors can be tested and recalibrated in a central location and distributed to users, ensuring consistent results throughout a large test facility. Pressure compensation (P-COMP™) improves accuracy at non-stoichiometric (i.e. $\lambda \neq 1$) and non-atmospheric (i.e. $P \neq 101$ kPa) conditions. For example, a pressure increase of only 34 kPa will cause an error of 0.58 λ at $\lambda = 3$. Pressure compensation eliminates this error and enables innovative applications such as %O₂ measurements in intake manifolds. Pressure data is available on the CAN bus.

LambdaCAN will work with all Bosch and NTK-type wideband sensors. It is programmable for all fuel types (H:C, O:C, N:C ratios and H₂). LambdaCAN outputs λ , AFR, %O₂, pressure, and all sensor parameters including pumping current, resistance, and sensor age factor.

Specifications

Inputs	1 Wideband Lambda Sensor, 1 Pressure Sensor (optional)
Ranges	λ (Lambda) 0.40 to 25, AFR 6.0 to 364, %O ₂ 0 to 25 Pressure 0 to 414 kPa, 0 to 60 psia
Accuracies	λ \pm 0.005 (at 1 λ), \pm 0.008 (at 0.8 to 1.2 λ), \pm 0.009 (elsewhere) AFR \pm 0.1 (at 14.6 AFR), \pm 0.2 (at 12 to 18 AFR), \pm 0.5 (elsewhere) %O ₂ \pm 0.2 (0 to 2% O ₂), \pm 0.4 (elsewhere) Pressure \pm 5.2 kPa, \pm 0.75 psia
Response Time	Less than 150 ms
Fuel Type	Programmable H:C, O:C, N:C ratios, and H ₂
CAN	High Speed according to ISO 11898
Configuration	Via CAN Bus with Configuration Software
Module	145mm x 120mm x 40mm, Environmentally Sealed
Operating Temperature	-40 to +85°C
Sensor Cable	0.6m (standard), +1m (optional), +2m (optional)
Power	11 to 28 VDC, AC/DC (optional)
Sensor Mounting	18mm x 1.5mm (wideband), 1/4" NPT (pressure)

Ordering Information

- LCAN-B2** LambdaCAN with Bosch LSU4.2 Sensor, Add "/P" for optional Pressure Compensation
- LCAN-B9** LambdaCAN with Bosch LSU4.9 Sensor, Add "/P" for optional Pressure Compensation
- LCAN-N** LambdaCAN with NTK UEGO Sensor, Add "/P" for optional Pressure Compensation

Note: Any LambdaCAN module can be used with any sensor. All modules are identical.
The wideband sensor's memory chip will tell the module what sensor is attached.

- LC-5/1** Optional 1m wideband sensor extension cable (adds to 0.6m)
- LC-5/2** Optional 2m wideband sensor extension cable (adds to 0.6m)
- LC-6/1** Optional 1m pressure sensor extension cable (adds to 0.6m)
- LC-6/2** Optional 2m pressure sensor extension cable (adds to 0.6m)

- LCAN-DL** Optional One/Two-Channel Programmable Display Head with Analog Outputs
- 5200-RK** Optional Rackmount Panel for up to four Display Heads (3.5", 89mm)
- 5200-AC** Optional AC/DC Supply supporting two Modules and one Display Head

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