CO SERIES 1000

EXHAUST GAS ANALYZER

OPERATOR'S MANUAL

Blanke
INDUSTRIES INC

This manual provides instructions and precautions for proper and safe use of the CO Series 1000 Exhaust Gas Analyzer. The triangle symbol below is used throughout the manual to indicate important operating procedures and safety information.

CAUTION: Indicates a situation where possible damage to the test equipment or vehicle may occur if the correct procedures are not followed carefully.

WARNING: Indicates a hazard where personal injury may occur, how to avoid the hazard and the probable consequences of not avoiding the hazard.

PRECAUTIONARY INFORMATION

1. Carefully read this operator's manual before using the CO Series 1000 Exhaust Gas Analyzer.
2. To avoid personal injury and property damage, always observe the vehicle and equipment manufacturer's warnings, cautions and service procedures.
3. To prevent a shock hazard, do not expose test equipment to rain or wet conditions.
4. To prevent the risk of fire, do not expose test equipment to open containers of fuel or flammable vapors.
5. Always wear approved eye protection.
6. Keep yourself, clothing and equipment clear of all moving or hot engine parts.
7. Always use extreme care when working around components of the secondary ignition circuit, such as spark plugs and coil terminals.
8. Unless otherwise instructed, set the parking brake, place the gear selector in neutral or park and block the drive wheel(s).
9. Exhaust gas contains deadly poison. When testing a vehicle with the engine running, test in a well ventilated area or route the exhaust gas outside with an appropriate exhaust ventilation system.
10. Always unplug equipment from power sources when not in use.

SAVE THESE INSTRUCTIONS

GETTING ACQUAINTED WITH THE OPERATOR'S MANUAL

This manual is designed to provide all of the information necessary to successfully operate the CO Series 1000. It is divided into two main areas:

General Information: Sections 1 and 2 describe the analyzer, assembly and basic operation of the equipment.

Maintenance: Sections 3, 4 and 5 show how to keep the analyzer running at its best. These sections include calibration procedures, troubleshooting, replacement parts and service information.

There are several ways to find information within this manual. When looking for a specific topic such as replacement filters, check the index at the back of the book. If the topic is more general, for instance operator maintenance, look in the contents at the beginning of the book.

TECHNICAL SUPPORT

For additional technical support or information not found in this manual, call Blanke Industries at 1-847-487-2780 or check our web site at www.blankeindustries.com. Our technical support is available during regular business hours, 8:00 AM to 5:00 PM (Central Time), Monday through Friday.

ABOUT THE CO SERIES 1000 EXHAUST GAS ANALYZER

The CO Series 1000 is designed to measure carbon monoxide (CO) emissions from the exhaust pipe of any internal combustion engine. This includes engines powered by gasoline, propane, natural gas and even diesel fuel*. This portable analyzer is accurate, durable and easy to use.

Monitoring exhaust emissions is not only important to help control pollutants, it also helps maintain optimum fuel efficiency and extend engine life. This tool will let the operator quickly determine the general health of an engine. With the CO Series 1000, any engine can be properly tested and repaired to assure ideal engine performance.

***** Part # WS-755 is required for diesel and/or 2 cycle engine testing (see Optional Accessories on page 18).

UNPACKING THE ANALYZER

The CO Series 1000 includes the following pieces:

- CO analyzer with 6 foot power cable and battery clamps
- 10 foot exhaust sample hose with water separator/particle filter
- Heat shielded handle and 45 degree elbow
- 12 inch flexible probe (½ inch outer diameter)
- Operator's manual (not shown)

ASSEMBLY & POWER

The CO Series 1000 has been calibrated at the factory and comes ready to use. The only assembly required is to connect the 12 inch flexible probe to the 45 degree elbow.

The analyzer requires a 12 volt DC power supply. To turn the analyzer on, connect the battery clamps to a 12 volt DC vehicle battery (red to positive, black to negative). There is no ON/OFF switch.

WARNING: Batteries produce strong electrical outputs and can cause electrical shock. Use extreme caution when connecting test equipment to a battery. Electrical shock can cause injury.

FLEXIBLE PROBE

A 12 inch flexible probe is provided with the CO Series 1000 so the probe tip can be inserted deep enough into the exhaust system where the exhaust gas is not diluted with air. When sampling exhaust gas, the flexible probe should be inserted at least 12 inches into the exhaust system. At this depth, no air will be mixed with the exhaust sample.

WARNING: Exhaust pipe and probe assembly can be very hot. Always use the heat shielded handle when handling the probe assembly. A hot exhaust pipe and/or probe assembly can cause injury.

CAUTION: This analyzer has a CO range of 0-4%. Exposure to levels over 4% will temporarily disable the analyzer. Limit CO exposure to less than 4%.

DISPLAY & CONTROLS

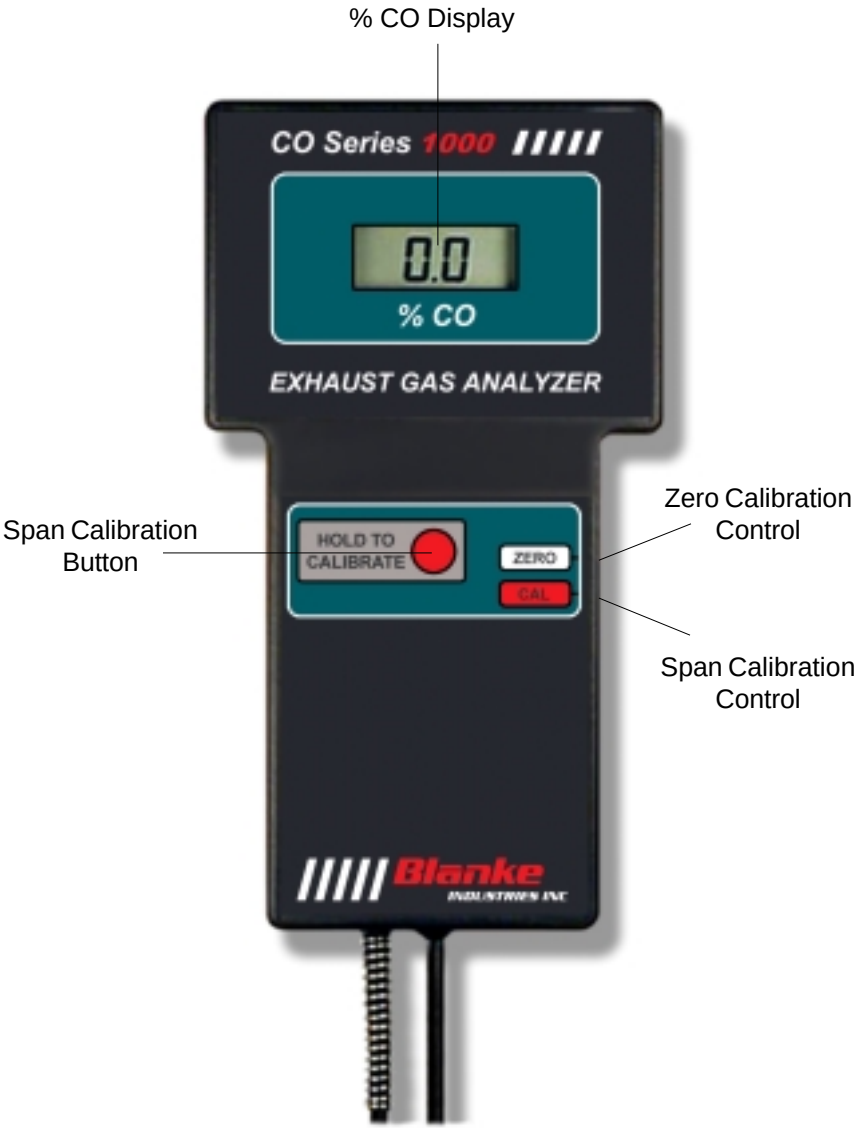
The CO Series 1000 has a digital display and simple controls designed to make the analyzer easy to operate.

% CO Display: The analyzer indicates the CO concentration in exhaust on a liquid crystal display (LCD). The LCD reports the CO in tenths of a percent within a range of 0.0% to 4.0%.

Zero Calibration Control: Periodically, the display of the analyzer must be set to zero. Adjusting the zero calibration control is discussed in the Operator Maintenance section on pages 9 and 10.

Span Calibration Control: To maintain the best measurement accuracy, occasional span calibrations should be performed with a calibration gas. Adjusting the span calibration control is discussed in the Operator Maintenance section on pages 11-14.

Span Calibration Button: The span calibration button is used with the span calibration control when performing a span calibration. Using the span calibration button is discussed in the Operator Maintenance section on pages 11-14.


% CO Display
CO Series 1000
0.0
% CO
EXHAUST GAS ANALYZER
Span Calibration Button
HOLD TO CALIBRATE
ZERO
CAL
Zero Calibration Control
Span Calibration Control
Blanke

The CO Series 1000 is designed to operate with very little maintenance. Maintenance is limited to only three areas;

- Water separator/particle filter
- Zero calibration
- Span calibration

WATER SEPARATOR/PARTICLE FILTER

Water is a by-product of the combustion process. Water leaves the engine as a vapor. As the hot exhaust is cooled, the water vapor condenses into a liquid. When testing emissions, this condensation collects in the exhaust sample hose.

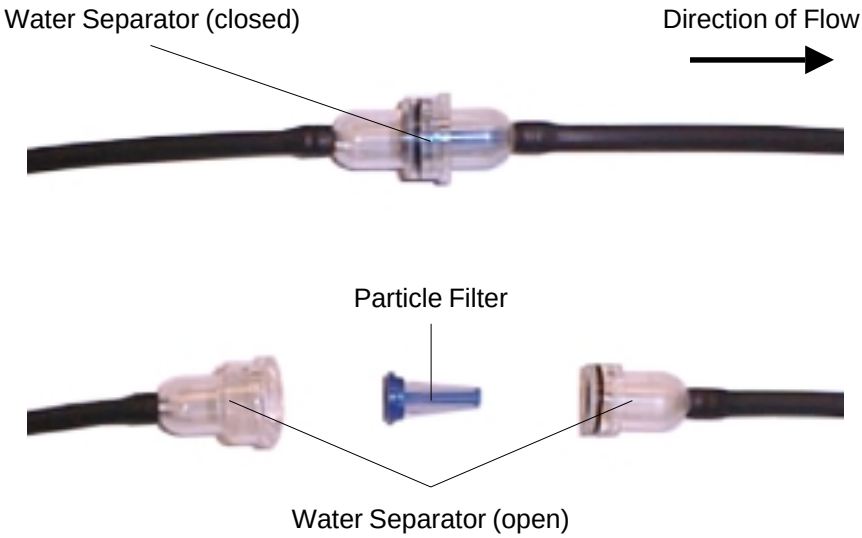
To prevent damage to the analyzer, the sample hose is equipped with an in-line water separator/particle filter. For best results, position the water separator so it hangs vertically below the analyzer. Always keep the hose lower than the analyzer. If the hose is higher than the analyzer, water in the hose can run into the analyzer.

An arrow on the water separator indicates the proper direction of flow.

CAUTION: Water in the analyzer can damage the internal components. Always keep the hose lower than the analyzer. Never allow the water separator to fill more than half way.

DRAINING THE WATER SEPARATOR

After prolonged testing, the water separator may begin to fill with water. To open and drain the water separator, gently push the two halves together and twist counterclockwise. To close the water separator; align the posts and slots, then gently push the two halves together and twist clockwise until they lock.



CLEANING/REPLACING THE PARTICLE FILTER

Over time, the particle filter which is mounted in the water separator will need to be cleaned or replaced. The filter can be cleaned with soap and warm water. The filter should be cleaned when it becomes significantly discolored. When the filter is beyond cleaning, replacement filters are available. Replacement filters are discussed in the Warranty & Service section on pages 17 and 18.

CAUTION: Particles in the exhaust sample can damage the internal components of the analyzer. Never sample exhaust without the particle filter installed. The filter should be maintained regularly.

ZERO CALIBRATION

Zero calibration eliminates measurement errors caused by changes in temperature. The analyzer should be zeroed to display 0.0% each time the unit is turned on. The unit should also be zeroed before each emission test.

The zero calibration control is found behind a rubber plug on the side of the analyzer. A small flat head screwdriver is required when adjusting the zero calibration control.

The following steps describe how to perform a zero calibration:

1. Connect the battery clamps to a 12 volt DC power supply/vehicle battery.

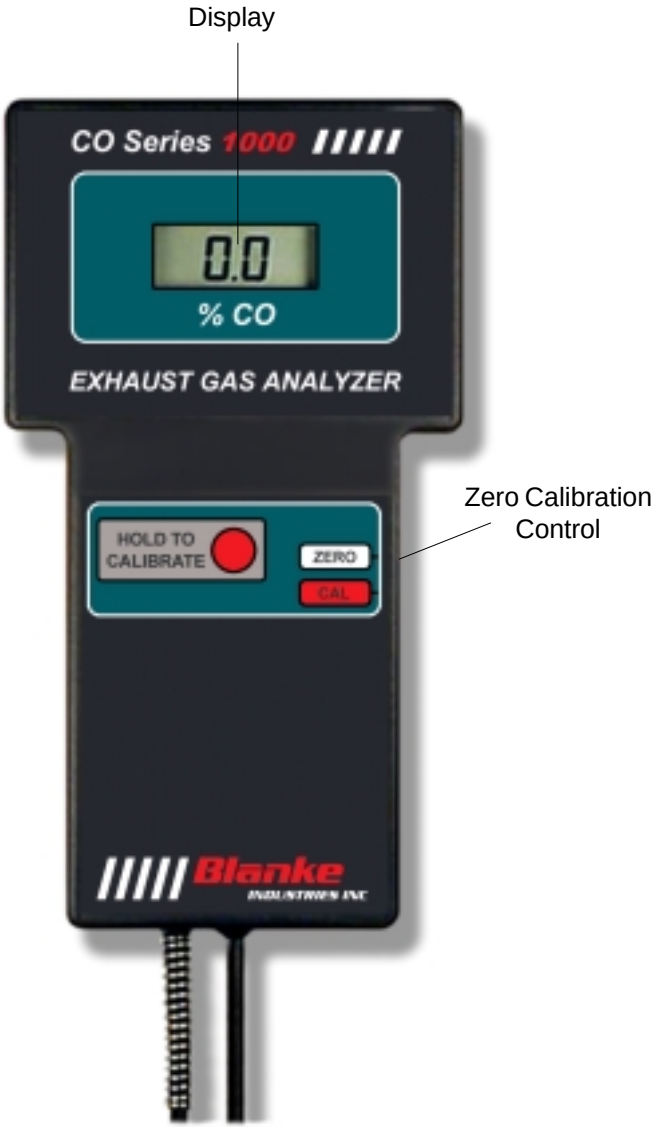
2. Wait for approximately 30 seconds, or until the readings on the display stabilize.

3. Remove the rubber plug which covers the zero calibration control.

4. Adjust the zero calibration control so the display reads 0.0%.

5. Replace the rubber plug which covers the zero calibration control.

WARNING: Batteries produce strong electrical outputs and can cause electrical shock. Use extreme caution when connecting test equipment to a battery. Electrical shock can cause injury.


Display
CO Series 1000
0.0
% CO
EXHAUST GAS ANALYZER
HOLD TO CALIBRATE
ZERO
CAL
Zero Calibration Control
Blanke

SPAN CALIBRATION

Span calibration eliminates measurement errors caused by large changes in ambient temperature and barometric pressure as well as long term changes in the analyzer's electrochemical sensor cell. To help maintain the best measurement accuracy, monthly span calibrations with a calibration gas are recommended.

The span calibration control is found behind a rubber plug on the side of the analyzer. A small flat head screwdriver is required when adjusting the span calibration control.

CALIBRATION GAS

A cylinder of calibration gas and the appropriate calibration kit are required to perform the following span calibration procedure. Ordering information for these accessories is discussed in the Warranty & Service section on pages 17 and 18.

For best accuracy, span calibration should be performed at or near the CO emissions level expected from a particular engine application. Two concentrations of calibration gas are available for use with the analyzer; a 1.0% CO blend and a 4.0% CO blend.

To determine which calibration gas should be used, check the proper CO emissions standards for your engine application. Choose the CO blend which is closest to the emissions standards for your application.

The calibration gas cylinders contain 8 cubic feet of compressed gas. One cylinder of gas will provide approximately 120 minutes of use at the proper flow rate of 4.0 SCFH. The cylinders are nonrefillable.

HYDROGEN CROSS-SENSITIVITY

The CO sensor in this analyzer has a cross-sensitivity to hydrogen gas. This means when the sensor is exposed to hydrogen, it produces a signal as if it were reading CO. Hydrogen happens to be a by-product of the combustion process. To keep the readings accurate, the hydrogen cross-sensitivity is filtered out electronically by a special circuit in the analyzer.

There is no hydrogen in the cylinder of calibration gas. Therefore, while the unit is being span calibrated, the electronic filter must be temporarily disabled. Pushing and holding the span calibration button disables or turns off the filter.

When performing the span calibration procedure, the value on the display will be lower if the calibration button is released and the electronic filter is operating. This is how the analyzer is designed to operate.

SPAN CALIBRATION (continued)

The following steps describe how to perform a span calibration:

1. Connect the flow meter to the cylinder of calibration gas.
   Note: Mount the flow meter vertically to insure proper operation.

2. Follow steps 1 through 4 of the zero calibration procedure on page 9.

3. Remove the rubber plug which covers the span calibration control.

4. Disconnect the exhaust sample hose from the sample port on the analyzer.

5. Open the valve on the cylinder of calibration gas and adjust the flow rate to deliver approximately 4.0 SCFH (the ball will bounce slightly).

6. Push and hold the red span calibration button on the front of the unit.

7. Connect the hose from the calibration gas to the sample port.

8. Wait for approximately 60 seconds, or until the readings on the display stabilize.

9. Adjust the span calibration control so the display reads the CO concentration in the calibration gas cylinder.

10. Disconnect the hose from the calibration gas to the sample port.

11. Release the red span calibration button on the front of the unit.

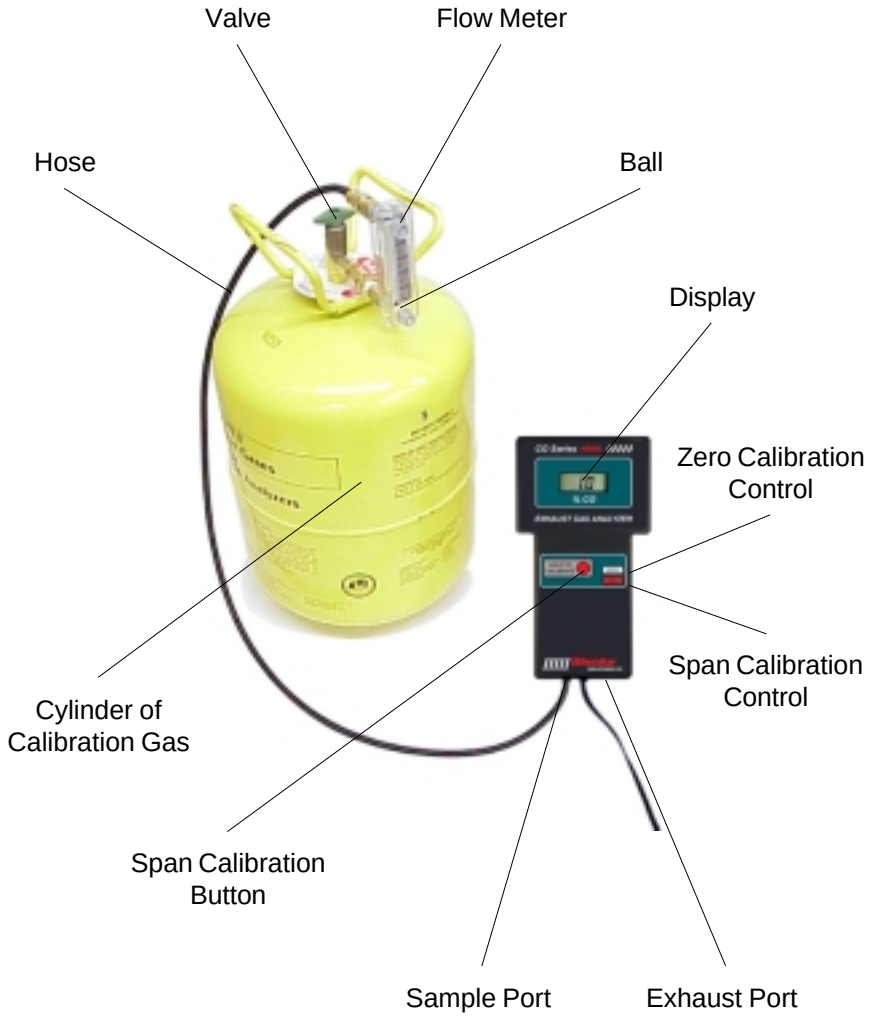
12. Close the valve on the cylinder of calibration gas.

13. Connect the exhaust sample hose onto the sample port.

14. Replace the rubber plug which covers the span calibration control.

15. Repeat steps 4 and 5 of the zero calibration procedure on page 9.

WARNING: Calibration gas contains carbon monoxide (CO). Use calibration gas only in a well ventilated area. Prolonged exposure to CO can cause headache, nausea, dizziness, fatigue or death.



MAINTENANCE SCHEDULE

ACTION	INTERVAL
Drain Water Separator:	Drain after every 10 minutes of sampling or as needed. Draining the water separator is discussed in the Operator Maintenance section on page 8.
Clean Particle Filter:	Clean the particle filter after every 10 hours of testing or as needed. Cleaning the particle filter is discussed in the Operator Maintenance section on page 8.
Replace Particle Filter:	Replace the particle filter every 90 days or as needed. Replacing the particle filter is discussed in the Operator Maintenance section on page 8.
Zero Calibration:	Zero calibration is recommended before every emissions test or as needed. Zero calibration is discussed in the Operator Maintenance section on pages 9 and 10.
Span Calibration:	Span calibration is recommended once a month or as needed. Span Calibration is discussed in the Operator Maintenance section on pages 11-14.
Replace CO Sensor:	Replace the CO sensor approximately every 1-2 years or when the analyzer can no longer be span calibrated with a calibration gas. Replacing the CO sensor is discussed in the Warranty & Service section on pages 17 and 18.

TROUBLESHOOTING GUIDE

SYMPTOM	SUGGESTED SOLUTION(S)
Does not turn on	Check the power cable polarity; RED clamp to positive (+), BLACK clamp to negative (-).
Does not read 0.0% when sampling fresh air	Perform a zero calibration, see pages 9 and 10.
Does not read 0.0% after being exposed to CO levels over 4.0%	Leave the analyzer on and the probe in fresh air until the display returns to zero.
CO readings are unusually low	Make sure the flexible probe is at least 12” into the exhaust system. Drain condensation from the water separator and/or the exhaust sample hose. Check for leaks in the sampling system and/or the exhaust system. Perform a span calibration, see pages 11-14.
Does not span calibrate with calibration gas	Replace CO sensor, see pages 17 and 18.
CO readings change when the calibration button is pushed	This is normal, see hydrogen cross-sensitivity on page 12.

LIMITED WARRANTY AND SERVICE POLICY

Blanke Industries, Inc. warrants the CO Series 1000 Exhaust Gas Analyzer to be free from defects in materials and workmanship for a period of **one year** from date of purchase when used and maintained according to the procedures set forth in this manual. Any product which fails in this period because of defects in material or workmanship, and has not been damaged by abuse, negligence, accident or incorrect use, and is returned to Blanke Industries, Inc., with transportation charges prepaid, will be repaired or replaced, at factory option, free of charge and returned to the sender with the transportation charges prepaid anywhere in the continental United States. Cables, hoses, filters and probe assemblies are not covered by this limited warranty. Unauthorized modifications or repairs will void Blanke Industries' liability under this warranty policy.

Blanke Industries' sole responsibility and buyer's exclusive remedy is limited to repair or replacement of the product as stated above. THERE ARE NO OTHER WARRANTIES EXPRESSED OR IMPLIED INCLUDING THOSE OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AND BLANKE INDUSTRIES SHALL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING FROM THE SALE OR USE OF THIS PRODUCT.

Blanke Industries, Inc. utilizes United Parcel Service (UPS) ground service as a standard means of shipping for both warranty and non-warranty repairs. Any special shipping request over and above the cost of standard UPS ground service will be the responsibility of the buyer.

To make warranty claims, obtain service information, order replacement parts or optional accessories, contact us at:

Blanke Industries, Inc.
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Wauconda, IL 60084-3106

Phone: 847-487-2780
Fax: 847-487-2799
E-mail: info@blankeindustries.com
Web site: www.blankeindustries.com

Customer service is available during regular business hours, 8:00 AM to 5:00 PM (Central Time), Monday through Friday.

REPLACEMENT PARTS

DESCRIPTION	PART #
12” Flexible probe (½” O.D.)	**FP-050**
10’ Exhaust sample hose	**SH-010**
Particle filters, 30 micron (pack of 6)	**PF-630**
Water separator w/ 30 micron particle filter	**WS-030**
CO sensor	**COS-050**
Operator’s manual	**OM-100**

OPTIONAL ACCESSORIES

DESCRIPTION	PART #
Calibration kit (w/o calibration gas)	**CK-050**
Calibration gas cylinder (1.0% CO)	**CG-010**
Calibration gas cylinder (4.0% CO)	**CG-040**
Protective storage case	**SC-100**
12” Narrow flexible probe (¼” O.D.)	**FP-025**
Water separator w/ 2 stage filter: 75 micron particle & 5 micron oil removal (coalescing)	**WS-755**

SPECIFICATIONS

General:	
Power	12 volts DC (external)
Start-up time	Instant “on”, no warm-up
Construction	Rugged, fuel and oil resistant, ABS plastic
Sample flow rate	Approximately 72 in^3/min (1180 ml/min)
Operating temperature	35 to 104°F (2 to 40°C)
Storage temperature	10 to 122°F (-10 to 50°C)
Humidity range	10-90% (non-condensing)
User calibration	Monthly or as needed
CO:	
Sensor type	Electrochemical
Sensor life	Typically 1-2 years
Range	0-4%
Resolution	0.1%
Response time	Less than 30 seconds to 90% of full scale
Accuracy	±10% of reading [(1)]
Repeatability	±10% of reading [(1)]
Physical:	
Dimensions	9.2” L × 5.1” W × 1.2” H
Weight	1.86 pounds (0.84 kg)
Display	3½ digit LCD, ½” digit height
Power cable	6’ L with battery clamps
Probe	12” flexible steel, ½” O.D.
Sample hose	10’ L × ¼” O.D.
Particle filter	30 micron nylon screen

[(1)] Analyzer will meet accuracy and repeatability specifications when zero and span calibrated in the environment of use.
All specifications and features are subject to change without notice.

Manual No. **OM-100**

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