



Analytical Industries Inc.

Technical Specifications *

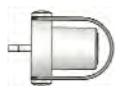
Application:	Measure Helium in Oxygen and/or Nitrogen and Oxygen in Nitrogen and/or Helium and compute balance gas
Accuracy He, O₂ :	< ±2% of FS range under constant conditions < ±5% of FS range at constant pressure over operating temperature range of 0-45°C (0-113°F)
Analysis Range:	0-100% Helium, 0-100% Oxygen
Calibration:	Dual mode: Ambient air or span gas
Compensation:	Normal use: Temperature and barometric pressure Calibration: O ₂ sensor corrected for temperature, barometric pressure and relative humidity; He sensor corrected for differences in thermal conductivity of oxygen and nitrogen
Connections:	1/8" push-on fitting
Controls:	Water resistant keypad with simple to use one touch keys for Power ON/OFF; Backlight ON/OFF; Cal O ₂ /Zero He
Display:	Graphical backlit LCD 2.5 x 2.5"; backlight 30 sec auto OFF % Helium, % Oxygen, % Balance Gas Temperature, relative humidity, barometric pressure Imperial or Metric units MOD - Maximum Operating Depth @ PO2 1.4 ATA Low battery warning
Enclosure:	Watertight IP65, 221 x 190.5 x 96.5 mm (8.7 x 7.5 x 3.8")
Pressure/Flow:	Very low (<5 psi, 1-2 lpm); open tank slowly until gas is heard to be hissing out of tank outlet
Power:	Rechargeable battery with 15 minute auto OFF 9 VDC power adapter from 110/220 VAC Approximately 16 hrs continuous use from a 2 hr full charge
Resolution:	0.1% Helium, 0.1% Oxygen, 0.1% Balance Gas
Response Time:	90% of final FS reading < 10 seconds
Sample System:	Flow manifold shown, 1/8" tubing, A-3609 adapter 
Sensor Model:	He: AII-41-100, O ₂ : AII-11-75D, Environmental: AII-E3
Sensor Life:	He: 10 yrs; O ₂ : 60 mos in air at sea level and 25°C (77°F)
Temp. Range:	Operating: 0-45°C (32-113°F), Storage: 0-50°C (122°F)
Warranty:	Analyzer 12 mos; Sensors: He 12 mos, O ₂ 36 mos prorated

* Specifications subject to change without notice

Optional Equip: 9 VDC cigarette lighter adapter (PWRS-1019)



Adapter, BC with Restrictor to 1/8" Tube (A-3673)



Adapter, DIN to 1/8" Tube (A-3677)



Adapter, A-Yoke to 1/8" Tube (A-3678)



AII 4001 Helium Oxygen Trimix Analyzer

Analyze Dive Mixes . . . learn more back page

Proprietary algorithms and sensors compensate:

Oxygen value for environmental factors

Helium value for thermal differences in gases

Accurate calibration + readings = safe dive

Displays MOD PO2 @ 1.4 ATA of gas mix sampled

Large backlit LCD is easily read in poor conditions

Rechargeable battery - 16 hours continuous use

Operates while recharging battery

Built-in battery protection

ISO 9001:2008 Certified
INTERTEK Certificate No. 485





AII 4001 Helium Oxygen Trimix Analyzer

The most advanced analyzer available . . .

Analyze dive gas mixes confidently, proprietary algorithms* and sensors provide extremely accurate one touch calibration and precise accuracy.

Eliminate possible errors from chart conversion calculations or environmental influences. Did you know failure to account for environmental factors can produce up to 6.7% error.



O₂

- ◆ The Oxygen value is compensated for temperature, barometric pressure and relative humidity.

He

- ◆ The Helium value is compensated for differences in the thermal conductivity of Oxygen and Nitrogen enabling the analyzer to precisely measure any combination of Helium, Oxygen and Nitrogen. Also, the Helium value is automatically zeroed every time the analyzer the oxygen sensor is calibrated with air or 100% oxygen.

The large backlit LCD is easily read even in low light condition and provides additional information to the user:

- ◆ Temperature, barometric pressure and relative humidity values of the sample gas.
- ◆ For added safety, the Maximum Operating Depth (MOD) PO₂ @ 1.4 ATA of the gas mix being sampled
- ◆ Imperial or Metric units at a touch

Rechargeable battery powers the AII 4001 for 16 hours of continuous use.

- ◆ 9 VDC power adapter 110/220 VAC is included, charges the battery in 2 hours
- ◆ The adapter can safely remain connected for bench top operation
- ◆ Optional 9 VDC cigarette lighter adapter is available

Automatically conserves and protects battery life.

- ◆ The backlight turns off after 30 seconds and
- ◆ The AII 4001 completely powers itself off after 15 minutes of non-use
- ◆ The automatic turn-off features are disabled when externally powered
- ◆ The analyzer turns off 2-3 hours after the LOW BATTERY warning is displayed to prevent complete discharge and permanent damage to the battery

The AII 4001 and accessories are packaged in a rugged waterproof plastic enclosure designed specifically for hostile diving conditions. The unmistakable bright red color stands out in the shop, on the boat or in the water. Patent pending



AI Analytical Industries Inc.



Owner's Manual



AI-4001 Helium Oxygen Trimix Analyzer



ISO 9001:2008 Certified
Certificate No. 485

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www.aii1.com

Not to be reproduced in whole or in part without
the written consent of Analytical Industries Inc.

urchased the most advanced portable gas analyzer
provides unmatched sophisticated performance in a
provides users with significant advantages:

ixes in any environment without charts. Proprietary
provide extremely accurate one touch calibration.
r environmental factors can produce up to 6.7%

d for temperature, barometric pressure and RH.
the oxygen is calibrated with air or 100% oxygen.

t Helium value for differences in the thermal con-
rogen enabling the AII-4001 to precisely measure
Oxygen and Nitrogen.

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* Patent pending

1.1 Contents

Open the red case containing the AII-4001 and confirm you have received the standard accessories and any optional equipment ordered:

- 1) AII-4001 Helium Oxygen Trimix Analyzer
- 2) Flow Manifold (A-3582)
- 3) Adapter, Dome to 1/8" Tube (A-3609)
- 4) Tubing, 1/8" x 3 ft. (TUBE-1018)
- 5) Adapter, 9 VDC 110/220 VAC (PWRS-1003-1)
- 6) Owner's Manual



Certification

Order _____

on Oxygen Analyzer S/N _____

xygen Sensor S/N _____

um Sensor S/N _____

mental Sensor Module S/N _____

sembly, Main Software Ver _____

anifold _____

; Dome to 1/8" Tube _____

ing 1/8" x 3 ft _____

Charger 9VDC 110/220 VAC Adapter _____

ual _____

screws, sensors and connectors secured _____

plied to case _____

/2 digits _____

r 3 seconds after power-up _____

r 15 seconds after key press _____

OW BATTERY" displays in reverse background

lower right hand corner when the battery icon

splays < 30% charge _____

splays solid black when fully charged _____

y: "CHARGING" displays in lower right hand

corner when the charge plug is connected

to the analyzer and the adapter plugged into

a 110/220 VAC outlet _____

Test (cont'd)

Temperature: within 2°F of EXTECH RH300 Digital Psychrometer
at ambient conditions _____

Relative Humidity: within 3% of EXTECH RH300 Digital
Psychrometer at ambient conditions _____

Barometric Pressure: within 1 KPa of Accu Cal Plus Digital
Precision Test Gauge _____

Calibration O2 Sensor: ±10-30% FS in ambient air _____
>98% in 100% oxygen _____

Zero He Sensor: ±1% FS in 100% oxygen _____
>98% in 100% helium span gas _____

O2 Sensor: within 0.5% of ambient air calibration value _____

Overall Appearance: clean, no physical defects _____

Part Number & Description _____ Qty _____

Options: PWRS-1019 Adapter, 9VDC Cigarette Lighter _____

A-3673 Adapter, BC with Flow Resistor to 1/8" Tube _____

A-3677 Adapter, DIN to 1/8" Tube _____

A-3678 Adapter, A-Yoke to 1/8" Tube _____

Notes:

Delivery:

Safety

Users must familiarize themselves with the instructions and use of this symbol.

Stand this manual before using the AII-4001 Helium

the MOD or maximum operating depth @ 1.4 ATA of
To prevent oxygen toxicity or even death, do not
diving

an accurate mix:
manifold and all three (3) sensors must be free of
to calibrate or use the AII-4001
which may cause inaccurate readings
lean air for several minutes to vent previous mix
as described in section 5.4

elines for allowing the mix to cool after each trans-
n.
open. Liquid, exposure to direct sunlight, the envi-
tures can damage the electronics.

ump soft cloth and a mild cleaner.

able of absorbing abuse, however, the electronics
amage from the excessive shock of being dropped.

c oxygen sensor contains a mildly caustic clear
slick to the touch. If you should come in contact
area immediately with large amounts of water and
to Section 10 MSDS for additional information.

he battery symbol on the LCD becomes empty and
is displayed. To prevent complete discharge and
battery, the analyzer turns off automatically 2-3
the LOW BATTERY warning.

low pressure and flow rates (or regulate the pres-
he flow rate to 1-2 lpm using optional equipment)
s and damage to the sensors. For example, when
d tubing supplied, open the tank very slowly until

4 Specifications *AII-4001 He O₂ Trimix Analyzer*

Application: Measure Helium in Oxygen and/or Nitrogen and Oxygen in Nitrogen and/or Helium and compute balance gas

Accuracy: < ±1% of FS range under constant conditions
< ±5% of FS range at constant pressure over operating tem-
perature range of 0-45°C (0-113°F)

Analysis Range: 0-100% Helium, 0-100% Oxygen

Calibration: Dual mode: Ambient air or span gas

Compensation: Normal use: Temperature and barometric pressure
Calibration: O₂ sensor corrected for temperature, barometric pressure and relative humidity; He sensor corrected for differ-
ences in thermal conductivity of oxygen and nitrogen

Connections: 1/8" push-on fitting

Controls: Water resistant keypad with simple to use one touch keys for
Power ON/OFF; Backlight ON/OFF; ZERO He/CAL O₂

Display: Graphical backlit LCD 2.5 x 2.5", backlight 30 sec auto OFF
% Helium, % Oxygen, % Bal Gas
Temperature, relative humidity, barometric pressure
MOD - Maximum Operating Depth @ PO2 1.4 ATA
Low battery warning

Enclosure: Watertight IP65, 221 x 190.5 x 96.5 mm (8.7 x 7.5 x 3.8")

Pressure/Flow: <5 psi/1-2 lpm or open tank slowly until hissing is heard

Power: Rechargeable battery with 15 minute auto OFF
9 VDC power adapter from 110/220 VAC or
9 VDC cigarette lighter adapter for continuous use
Approximately 16 hrs continuous use from 2 hr full charge

Resolution: 0.1% Helium, 0.1% Oxygen, 0.1% Balance Gas

Response Time: 90% of final FS reading < 10 seconds

Sensor Model: He: AII-41-100, O₂: AII-11-75D, Environmental: AII-E3

Sensor Life: He: 10 yrs; O₂: 60 mos in air at sea level and 25°C (77°F)

Temp. Range: Operating: 0-45°C (32-113°F), Storage: 0-50°C (122°F)

Warranty: Analyzer 12 mos; Sensors: He 12 mos, O₂ 36 mos prorated

with a waterproof membrane type panel that contains
in keys for operating the analyzer.

the RED key to turn the unit ON or OFF

key has two functions:

release it to turn the backlight ON or OFF

hold the YELLOW key for 3 seconds to switch the
/ between Imperial and Metric units

release the GREEN key to calibrate the oxygen
ero the helium sensor and compute the balance
mix being sampled.

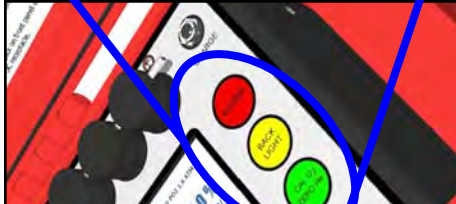
AI1-4001 automatically:

ter 15 minutes of non-use

HT after 30 seconds.

ropriate RED or YELLOW key to reactivate.

ures are disabled during charging and when exter-



5.2 Power

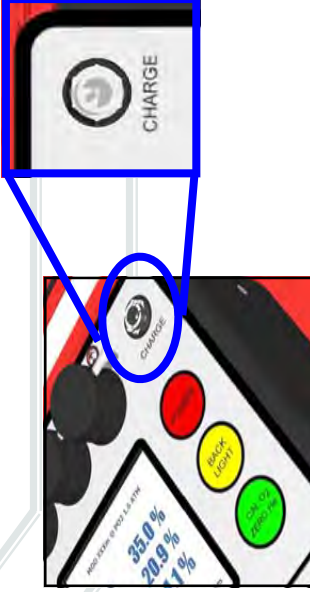
The AI1-4001 is equipped with a rechargeable battery that provides approximately 16 hours of continuous from a 2 hour full charge. It is supplied with a 9 VDC power adapter 110/220 VAC for charging the battery and operating the analyzer from external power. An optional 9 VDC cigarette lighter adapter is available.

When the battery is in need of charging the LCD displays an empty battery symbol and a warning that reads LOW BATTERY as shown below:



Recharge the battery when the battery symbol on the LCD becomes empty and the LOW BATTERY warning is displayed. To prevent complete discharge and permanent damage to the battery, the analyzer turns off automatically 2-3 hours after the LCD displays the LOW BATTERY warning.

To charge the battery or operate the AI1-4001 from external power, insert the male plug into the CHARGE jack located in the upper right hand corner of the front panel and connect the adapter to the appropriate AC outlet or DC receptacle.



3 Zero

etary maintenance free long life Helium and Oxygen sensor is automatic. The Oxygen sensor is automatic calibration for temperature, relative humidity and the need for conversion charts. The Helium sensor is a six point linearization curve. Further, the Helium sensor is in thermal conductivity of Oxygen and Helium is ambient air or compressed gas, the AII-4001 automatically calibrates the Oxygen sensor and zero the touch. The result is the most accurate analysis of

Ambient Air:

old, if necessary, as illustrated below.
ambient air for several minutes.
ZERO He key.

Span Gas:

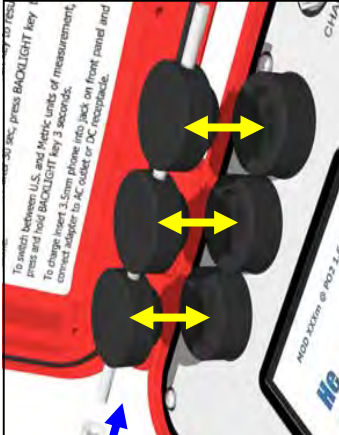
manifold and all three (3) sensors must be free of liquid before attempting to calibrate or use the AII-4001. Avoid high flow rates which may cause inaccurate readings. Expose the sensors to clean air for several minutes to vent previous mix. Calibrate the AII-4001 as described in Section 5.3. Follow established guidelines for allowing the mix to cool after each transfer of helium and oxygen.

Span Gas: manifold and all three (3) sensors must be free of liquid before attempting to calibrate or use the AII-4001. Avoid high flow rates which may cause inaccurate readings. Expose the sensors to clean air for several minutes to vent previous mix. Calibrate the AII-4001 as described in Section 5.3. Follow established guidelines for allowing the mix to cool after each transfer of helium and oxygen.

Span Gas: manifold and all three (3) sensors must be free of liquid before attempting to calibrate or use the AII-4001. Avoid high flow rates which may cause inaccurate readings. Expose the sensors to clean air for several minutes to vent previous mix. Calibrate the AII-4001 as described in Section 5.3. Follow established guidelines for allowing the mix to cool after each transfer of helium and oxygen.

several minutes.

2 ZERO He key.

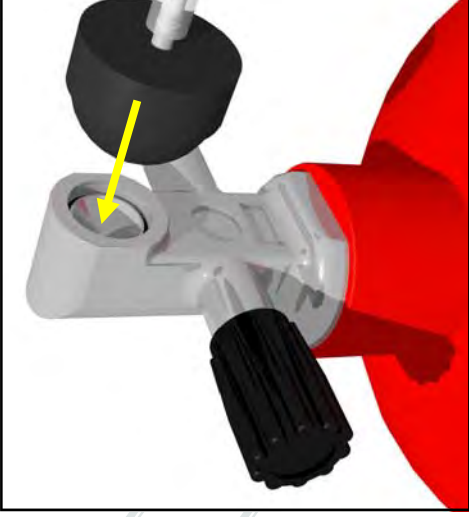


5.4 Analysis

Recommendations to ensure an accurate mix:

- Adapters, tubing, flow manifold and all three (3) sensors must be free of liquid before attempting to calibrate or use the AII-4001
- Avoid high flow rates which may cause inaccurate readings
- Expose the sensors to clean air for several minutes to vent previous mix
- Calibrate the AII-4001 as described in Section 5.3
- Follow established guidelines for allowing the mix to cool after each transfer of helium and oxygen.

- 1) Install the flow manifold (Note: the flow manifold is bi-directional) as illustrated at left on page 7.
- 2) Connect tubing to the dome adapter and the flow manifold. (Note: Dome adapter may be replaced by other optional equipment, in the case regulate pressure to <5 psi and control flow rate between 1-2 lpm.)
- 3) Open the tank valve very slowly until you hear the gas hissing out.
- 4) Press the dome adapter tightly against the tank outlet as illustrated below.
- 5) Allow sufficient time, approximately 30 seconds, for the readings helium, oxygen and balance gas to stabilize.
- 6) Record your readings and close the tank valve.
- 7) For multiple cylinder checks,
 - a. Remove the bi-directional flow manifold.
 - b. Expose the sensors to clean air for several minutes to allow the previous mix to vent into the atmosphere.
 - c. Repeat steps 1 through 7.



moving parts and other than a periodic wipe down once.

um sensor is 10 years and along with the environment last for the life of the analyzer, unless subjected to excessive shock from the analyzer being dropped.

gen sensor is 5 years in air (20.9%) at 25°C (77°F) um sensor life, avoid subjecting the analyzer to analysis of high oxygen concentrations.

easily replaced in the field. Dispose of old sensors with local regulations.

n dry environment.
from the sensors, if neces-

securing the front panel
from the case
n the side panel
the PCB using small thin
e oval illustrated at right
ing the sensor to the front
of the sensor out of the

reverse the steps above

n dry environment.
acement procedure to gain clear access to screws
mp.
in) and charge (3 pin) jacks at the PCB using small
ered oval illustrated above.
crews, yellow oval illustrated above.
p to remove.
, reverse the steps above.

y 50% before charging yields approx 500 cycles.
y 30% before charging yields approx 1,200 cycles.

7 Replacement Parts & Optional Accessories

To maintain optimum performance service the AII-4001 using only OEM parts obtained from Analytical Industries Inc.

Replacement Parts

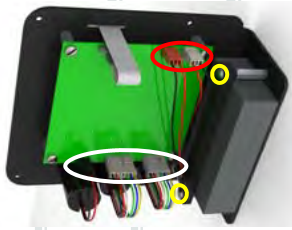
AII-11-75D	Oxygen Sensor
AII-41-100	Helium Sensor
AII-E3	Environmental Sensor
A-1185	PCB Assembly, Main
A-3606	Battery Assembly
A-3582	Flow Manifold
A-3609	Dome Adapter

TUBE-1018

PWRS-1003-1	Sample Tubing 1/8" ID 1/4" OD
MANL-4001	9 VDC Charger 110/220 VAC Adapter
A-3607	AII-4001 Owner's Manual
A-3597	Charger Wiring Assembly
	Case Lid Instruction Panel

Optional Accessories

PWRS-1019	9 VDC Cigarette Lighter Adapter
A-3673	Adapter, BC with Restrictor to 1/8" Tube
A-3677	Adapter, DIN to 1/8" Tube
A-3678	Adapter, A-Yoke to 1/8" Tube



Possible Cause		Recommendation
Unit in auto turn off feature Unit protection auto turn off Connection Component failure		Press red POWER key Charge analyzer for 2 hrs Check battery connection Return to factory
Unit off feature Unit to high temperature Component failure		Press yellow BACK LIGHT key Move the unit to cooler place Return to factory
BATTERY warning		Charge battery
Electrical connection Low BATTERY warning Pressure on sensor Electro-mag interference Sensor nearly expired Sensor faulty		Check connections Charge or replace battery Check pressure, flow and vent (remove any restriction) Move unit away from source Replace O ₂ sensor Check with known He % mix Replace He sensor
Unit in gas path connections Covering sensing areas Low BATTERY warning Temperature change >10°C Sensor nearly expired Sensor faulty		Check connections Remove liquid Replace O ₂ sensor Charge or replace battery Stabilize 30 min at new temp Replace O ₂ sensor Check with known He % mix Replace He sensor
Electrical connection Covering sensing area Oxygen present Unit from being dropped Sensor expired		Check O ₂ sensor connection Remove liquid Expose to air Replace PCB or O ₂ sensor Replace O ₂ sensor
Unit required Sensor fault		Perform CAL O ₂ ZERO He Replace He sensor
Oxygen present Sensor nearly expired Unit from being dropped		Expose to air, repeat Replace O ₂ sensor Replace PCB, sensors
Sensor disconnected Sensor faulty		Check He sensor connection Check with known He % mix

9 Warranty

Coverage

Under normal operating conditions, the analyzer and sensors are warranted to be free of defects in materials and workmanship for the period specified in the current published specifications. To make a warranty claim, you must return the item properly packaged and postage prepaid to:

Analytical Industries Inc.
2855 Metropolitan Place
Pomona, Ca 91767 USA

Analytical Industries in their sole discretion shall determine the nature of the defect. If the item is determined to be eligible for warranty we will repair it or, at our option, replace it at no charge to you. If we choose to repair your item, we may use new or reconditioned replacement parts. If we choose to replace your item, we may replace it with new or reconditioned components of the same or upgraded design. This is the only warranty we will give and it sets forth all our responsibilities; there are no other express or implied warranties.

The warranty period begins with the date of shipment from Analytical Industries and is limited to the first customer who submits a claim for a given serial number which must be in place and readable to be eligible for warranty. Under no circumstances will the warranty extend to more than one customer or beyond the warranty period.

Exclusions

This warranty does not cover normal wear and tear; corrosion; damage while in transit; damage resulting from misuse or abuse; lack of proper maintenance; unauthorized repair or modification of the analyzer; fire; flood; explosion or other failure to follow the Owner's Manual.

Limitations

Analytical Industries shall not liable for losses or damages of any kind; loss of use of the analyzer; incidental or consequential losses or damages; damages resulting from alterations, misuse, abuse, lack of proper maintenance; unauthorized repair or modification of the analyzer.

Service

Telephone 909-392-6900, fax 909-392-3665 or e-mail diveai@aii1.com between 8:00am and 5:00pm PST Monday thru Thursday or before 12:00pm on Friday. Trained technicians will assist you in diagnosing the problem and determining the appropriate course of action.



Full Safety Data Sheet

ical Galvanic Fuel Cell Oxygen Sensor
ce with protective coverings, normally no hazard
- none; Potassium Hydroxide (KOH), Lead (Pb)
soluble in H ₂ O; evaporation similar to H ₂ O
le, non-flammable
d mixing strong acids, emits fumes when heated
via ingestion - harmful or fatal if swallowed; eye - possible loss of vision; and, skin contact - corrosive, mical burn. Liquid inhalation is unlikely. n to cause birth defects, but contact unlikely
- burning sensation; skin contact - slick feeling
none; eye - safety glasses; hands - gloves
ove Teflon and PCB coverings; do not probe with s; avoid contact with eyes, skin and clothing.
gloves, safety glasses and H ₂ O and flush all sur- edly with liberal amounts of H ₂ O

ld be disposed of in accordance with local regula-

ons prohibit electronic products including the He- nmental sensors from being placed in household

ucts including the Helium and environmental sen- disposed of in accordance with local regulations.

Advantages of the most advanced portable analyzer available ...

Precisely analyze dive gas mixes in any environment without charts.

Proprietary algorithms* and sensors provide extremely accurate one touch calibration.

- Note: Failure to account for environmental factors can produce up to 6.7% error.
- ◆ Oxygen value is compensated for temperature, barometric pressure and RH.
 - ◆ Helium value is zeroed when the oxygen is calibrated with air or 100% oxygen.

Algorithms* compensate the Helium value for differences in the thermal conductivity of Oxygen and Nitrogen enabling the AI1-4001 to precisely measure any combination of Helium, Oxygen and Nitrogen.

The large backlit LCD is easily read even in low light condition and provides additional information to the user:

- ◆ Temperature, barometric pressure and RH values of the sample gas.
- ◆ For added safety, the Maximum Operating Depth (MOD) PO2 @ 1.4 ATA of the gas mix being sampled
- ◆ Imperial or Metric units at a touch

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- ◆ The adapter can safely remain connected for bench top operation
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