PortaSens II

Portable Gas Leak Detector
Model C16

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PRODUCT WARRANTY

Analytical Technology, Inc. (Manufacturer) warrants to the Customer that if any part(s) of the Manufacturer's equipment proves to be defective in materials or workmanship within the earlier of 18 months of the date of shipment or 12 months of the date of start-up, such defective parts will be repaired or replaced free of charge. Inspection and repairs to products thought to be defective within the warranty period will be completed at the Manufacturer's facilities in Collegeville, PA. Products on which warranty repairs are required shall be shipped freight prepaid to the Manufacturer. The product(s) will be returned freight prepaid and allowed if it is determined by the manufacturer that the part(s) failed due to defective materials or workmanship.

        This warranty does not cover consumable items, batteries, or wear items subject to periodic replacement including lamps and fuses.

        Gas sensors carry a 12 months from date of shipment warranty and are subject to inspection for evidence of misuse, abuse, alteration, improper storage, or extended exposure to excessive gas concentrations. Should inspection indicate that sensors have failed due to any of the above, the warranty shall not apply.

        The Manufacturer assumes no liability for consequential damages of any kind, and the buyer by acceptance of this equipment will assume all liability for the consequences of its use or misuse by the Customer, his employees, or others. A defect within the meaning of this warranty is any part of any piece of a Manufacturer's product which shall, when such part is capable of being renewed, repaired, or replaced, operate to condemn such piece of equipment.

        This warranty is in lieu of all other warranties (including without limiting the generality of the foregoing warranties of merchantability and fitness for a particular purpose), guarantees, obligations or liabilities expressed or implied by the Manufacturer or its representatives and by statute or rule of law.

        This warranty is void if the Manufacturer's product(s) has been subject to misuse or abuse, or has not been operated or stored in accordance with instructions, or if the serial number has been removed.

        Analytical Technology, Inc. makes no other warranty expressed or implied except as stated above.

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SPECIFICATIONS

Gas Sensor   Accepts H10 "Smart Sensor" gas sensor modules (not included)

Range   Sensor dependent (see Smart Sensor Modules on page 50, or contact ATI)

Display   Backlighted, graphics LCD

Accuracy   Sensor dependent (typically ± 5% of value, limited by cal. gas)

Sensitivity   1% of sensor module range

Repeatability   ± 1% of sensor module range

Input/Output   RS-232 for transfer of logged gas readings
                      0-1 VDC analog (requires optional cable)

Data Logger   1, 5, 10, and 15 minute intervals
                      12,000 samples **(**8 days@1 minute interval)
                      C16Log application for transferring data (CD and Online)

Alarms   Three level alarms, configurable for high or low alarm (or disable)
                      Low battery alarm
                      Low flow rate alarm
                      Alarm notifications provided by LCD and beeper

Power   Primary: D-cell battery, alkaline recommended, 75 hours operation
                      Backup: Internal, rechargeable battery, 6 hours operation
                      115VAC (std.) battery charger (220VAC avail.)

Operating Temp.   -25º to +55º C

Humidity   0-95% Non-condensing

Construction   Glass filled nylon, PVC, and stainless steel

Accessories   10" Flexible Wand, Teflon lined
                      Battery Charger
                      (3) Intake Filters
                      Outlet Barbed Fitting
                      Flow Meter
                      RS-232 Cable (DB9 Female)
                      CD (C16Log downloader)
                      Storage case
                      Bypass-T Fitting (for calibration)

Shipping Weight   3 lbs. (1.4 Kg.)

INTRODUCTION

PortaSens II

　　　　The *PortaSens II* is a rugged, hand-held device used to detect leaks of toxic gas, and also to detect oxygen displacement or deprivation. It adapts quickly to measure different gasses by inserting the appropriate gas sensor module. The modules retain all of the calibration and configuration settings for the target gas, such as the full scale range and alarm settings.

　　　　The device features a battery powered intake pump with a flexible wand for sampling. Readings and settings are presented on a backlighted, graphics LCD, with four "soft keys", and a beeper to notify you about alarms and other events.

　　　　Readings may be recorded and transferred to a PC using a supplied application, C*16Log.* The program outputs ASCII csv files for importing into applications, like Microsoft Excel®. The application operates on Microsoft Windows ® 98,XP, 2000, and Windows 7 & 8. For more information, see C16Log on page 41.

　　　　Power is provided from one primary (non-rechargeable), D-cell battery, and switches automatically to a secondary (rechargeable) battery when the primary is removed, or its power drops below an acceptable level[1].

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[1] The internal secondary battery should be charged prior to use if it has been more than three weeks after leaving the factory.

Package Contents

The following items are included.
- o *PortaSens II* Gas Leak Detector (Figure 1)
- o Sampling Wand (Figure 2)
- o Outlet Tube Barbed Fitting (Figure 2)
- o Sensor Keeper[2] (Figure 6)
- o Flow Meter (Figure 7)
- o Storage Case
- o Spare Alkaline D-Cell battery
- o Battery Charger
- o RS-232 Cable
- o C16Log CD ROM (PC version, only)
- o Calibration "T"

Reference Drawings
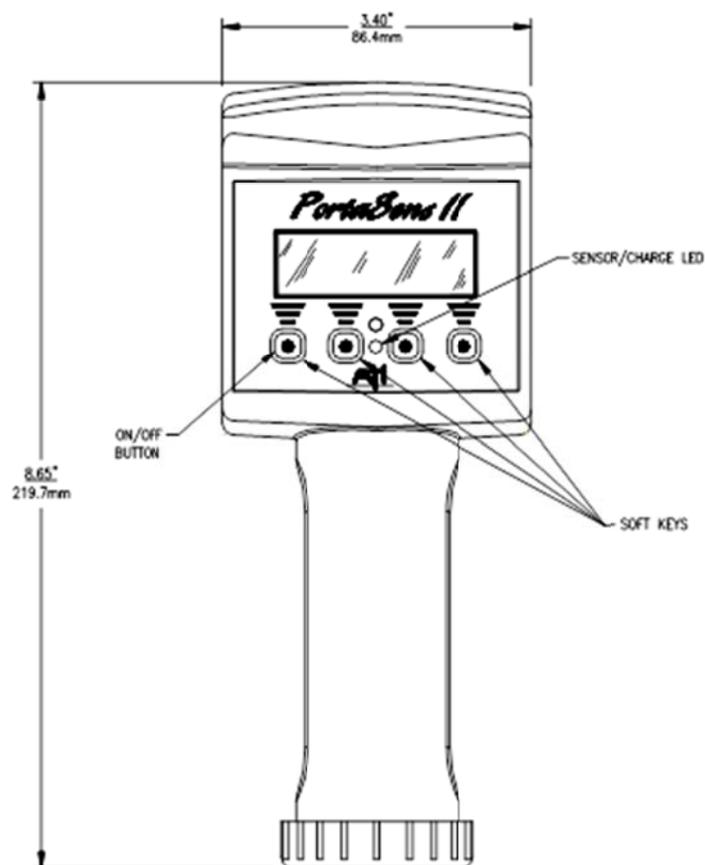
Figure 1. PortaSens II, Front View (ATI-0401)

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[2] H10 sensors are normally ordered separately.
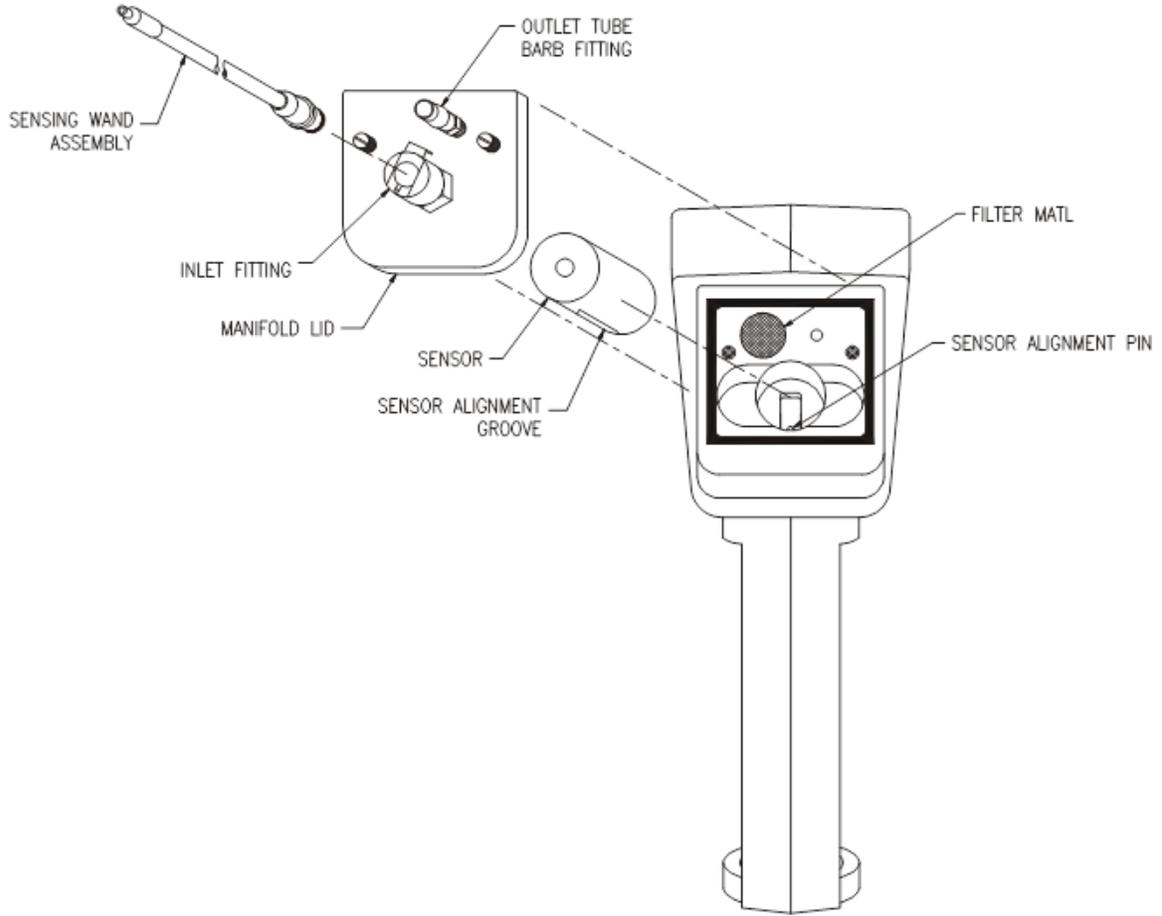
Figure 2. PortaSens II,Rear View (ATI-0403)

CHARGER JACK

RS232 COMMUNICATION
PORT & ANALOG OUTPUT

CHARGER JACK/
COMM PORT COVER

ALKALINE
D-CELL BATTERY

BATTERY RETENTION
CAP
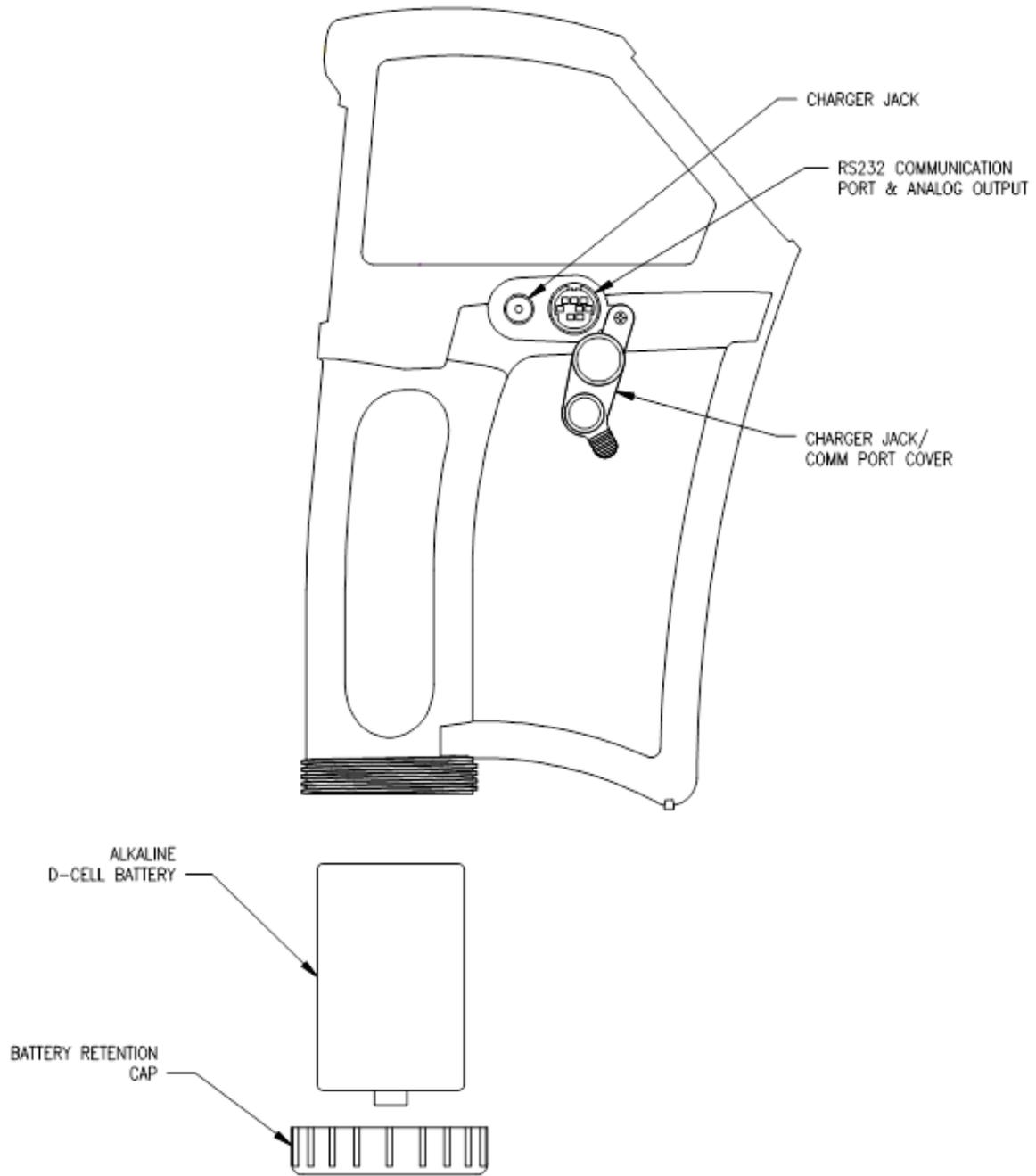
Figure 3. PortaSens II, Side View (ATI-0402).
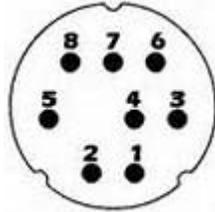
Figure 4. C16 Port (8-position MINI-DIN, female receptacle)

Pin No.	Signal	I/O	Description	DB9 Pin on Cable 03-0201
1	/CTS	Input	Clear to send - assert to suspend device output.	7
2	/RTS	Output	Request to send – asserted by device before transmit.	8
3	RX	Input	Receive data - device receives data on this pin.	3
4	Sig. Com.		Signal common (note: same as AOut Com.)	5

Table 1. C16 Port Pin Assignments

5	TX	Output	Transmit data – device transmits data on this pin.	2
6	AOut	Output	Analog output – 0-1 VDC output, proportional to gas concentration reading: AOut = gas_rdg/sensor_range * 1.0 VDC	N/C
7	N/C		Not connected.	N/C
8	AOut Com.		Analog output common (note: same as Sig. Com.)	N/C

Figure 5. H10 Gas Sensor Module (not included)
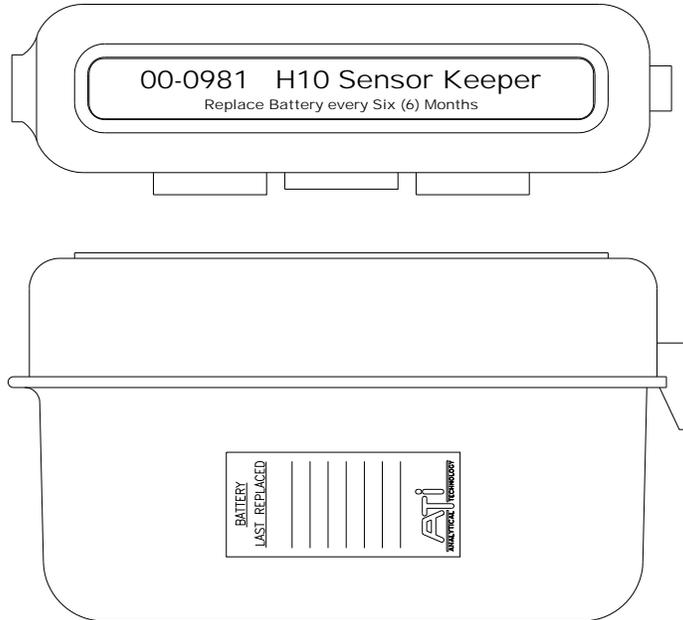
Figure 6. Sensor Keeper
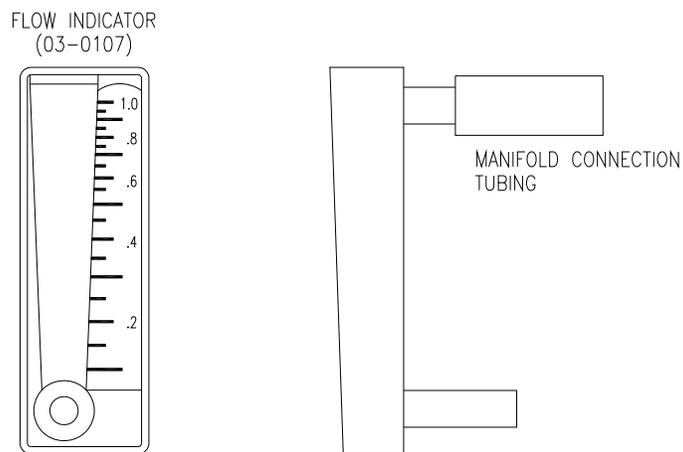
Figure 7. Flow Meter

SMART SENSOR

The *PortaSens II* measures gas concentration levels using "Smart Sensor" modules, which store their calibration and configuration settings, such as, zero, span, range, and alarm levels. This allows them to be quickly changed to detect leaks of different toxic gasses, or to detect oxygen displacement or deprivation.

The modules are calibrated before leaving the factory and require only routine calibration, which may be performed by trained personnel on site using traceable gas standards and methods. A more economical solution may be to return them periodically to the factory for certified calibration. Contact ATI for details about the "Calibration Certification" program for Smart Sensor modules.

Figure 8. H10 "Smart Sensor" module.

Four modules may be kept in the battery-powered, "Sensor Keeper" (Figure 6 on page 11), which maintains the electro-chemical sensor cell, "on bias", and ready for use (recommended). Gas sensor modules must be ordered separately. For a complete list of modules and their operating range, see Smart Sensor Modules (Model H10) on page 50.

Note

> *Sensors may take up to 12 hours to stabilize (bias) if not stored in the Sensor Keeper, or not installed in the device.*

Changing the Sensor

Referring to Figure 2 on page 7, loosen the two thumb screws and remove the flow manifold lid on the rear of the device. If a sensor module is already installed, grab the sides with your index finger and thumb, and pull straight up. Slide the new module into the recess, connector first, and rotate it to align the groove on the sensor with the guide in the recess. Press down on the sensor to seat the connector. The face of the sensor module should be flush with the outer surface of the recess.

Replace the manifold lid and hand-tighten the thumb screws. Start the device and verify air flow through the sampling wand using the supplied flow meter. See Figure 7 on page 11.

If power is on when the sensor is removed, the device displays "SENSOR MISSING". At startup, and when the sensor is reinstalled with power applied, it displays the entire startup sequence, as detailed in the Startup Sequence on page 17.

Sensor Response Times

The table below lists the time required to obtain readings of 66%, and 90%, of an instantaneous exposure to various gasses. The times listed are for the sensor only, and do not include travel time through the wand or tubing, or digital damping by the device. They are provided only for estimating the sampling period required for a representative reading.

Table 2. Gas Response Times

SENSOR TYPE	66% RESPONSE	90% RESPONSE
Oxidant Sensors (except H_2O_2)	20 seconds	60 seconds
Hydrogen Peroxide	40 seconds	120 seconds
Ammonia	30 seconds	120 seconds
Carbon Monoxide	10 seconds	30 seconds
Hydrogen	20 seconds	60 seconds
Oxygen	15 seconds	45 seconds
Nitric Oxide	10 seconds	20 seconds
Phosgene	70 seconds	300 seconds
Hydrogen Chloride	50 seconds	240 seconds
Hydrogen Fluoride	50 seconds	240 seconds
Hydrogen Cyanide	40 seconds	120 seconds
Hydrogen Sulfide	20 seconds	60 seconds
Nitrogen Dioxide	10 seconds	40 seconds
Sulfur Dioxide	10 seconds	40 seconds
Hydride Gases	30 seconds	70 seconds
Hydrocarbon Gases	40 seconds	90 seconds

Gas Interferences

Some sensors exhibit a minor sensitivity to non-target gases and vapors. Table 3 lists the cross-sensitivity factors of sensors to various, "interference" gases. To use the table, find the sensor type along the top, and then scan down the column for the factor corresponding to one of the interference gases listed on the left. Multiplying the factor times the concentration of the interference gas produces the reading that would be displayed by the device. For example, an SO_2 sensor exposed to 1 PPM of HCN would produce a reading of 0.40 PPM. See notes following the table for additional comments.

Table 3. Cross-sensitivity Factors

Sensor Type

	NH3	Cl_2	O_3	HF	HCl	HCN	H_2S	SO_2	CO	H_2	H_2O_2	O_2	NO	NO_2	Hydride (4)	SiH_4	$COCl_2$	H-C
NH_3	--			-0.05			-0.005											
CO	0.01				0.005		0.01	0.01	--	0.1	0.05			-0.05	(0.05)	0.08		0.3
H_2	0.002				0.01	0.01	0.0003		0.1	--	0.03			-0.06		0.014		0.05
NO	0.08			1.5			0.4	0.08	0.1		0.09		--		(0.04)	2.0	-0.1	0.8
O_2	*				*	*	*	*	*	*	*	--	*	*	*	*		*
Cl_2	-0.5	--	1	2			-0.05	-0.2			-0.4			1.0	-0.01 (-0.1)	-0.2	0.1	
O_3		0.05	--	1			-0.05	-0.2			-0.4			1.0	(-0.1)	-0.2		
HCl	-0.5			0.5	--		-0.005	0.02						-0.06	(-0.01)		0.05	0.2
HCN	0.1	-0.08	-0.5	-0.1	0.01	--		0.4	0.1					-0.2	0.05 (0.2)	0.2	0.5	0.1
HF				--														
H_2S	1.0	-0.1	-0.1	-0.3	3		--				6			-5.0			2	2
NO_2	0.08	0.2	0.15	0.2	0.2		0.01	-0.3			-0.1			--	-0.001 (-0.1)	0.04	-1	0.1
SO_2	-0.1	-0.01	-0.01	1	0.5	0.4	0.08	--			0.42			-0.8	(0.5)	0.1	0.2	0.4
Hydride					1.5	0.2	0.1	1			6			-3.5	--	5		2
SiH_4					1.5	0.2	0.1	0.3			6			2	0.005 (0.5)	--		2
CO_2																		
CH_4																		
CH_3SH	0.3	-0.04	-0.03	-0.1	1		0.3				2			-1.5				1
C_2H_2						.0005	0.002	1.7	0.1	0.1	0.02		0.005	-0.02	0.0001 (0.5)	0.05		1.2
C_2H_4							0.002	0.3	0.1	0.1				-0.01	(0.1)	0.02		1
C_2H_6O	0.015				0.05	0.02	0.015	0.015			0.1			-0.07	(0.02)	0.1		0.7
$COCl_2$																	--	

Interference Gas (row axis label)

Notes on Interference Table:

1. Sensors marked with an asterisk (*) in the oxygen column are 3 electrode sensors that require a minimum of 5% oxygen to operate properly. Hydrogen sensors require oxygen levels at least two times the maximum percent hydrogen value to be measured.

2. The data on the chlorine sensor also applies to bromine, chlorine dioxide, fluorine, and iodine sensors.

3. Data on the hydride sensor refers to arsine, phosphine, diborane, hydrogen selenide, and germane sensors. Response is not exactly 1:1 for all hydrides. Contact ATI for details if exact response is needed.

4. Data in ( ) refers to PPM versions of the hydride sensors relative to phosphine. Response is not exactly 1:1 for all hydrides. Contact ATI for details.

5. The sensor column marked "H-C" stands for hydrocarbon sensors. These include ETO (ethylene oxide), formaldehyde, alcohol, acetylene, and vinyl chloride sensors.

6. Data in this table represents exposures to low PPM levels of the interfering gas. Very high concentrations of any interfering gas may cause either short term or long term response from a sensor.

7. Interference factors may vary over sensor lifetime. Calibration with interference gas is not recommended in most cases. Contact factory for more information.

8. Empty cells in table indicate insignificant cross-sensitivity.

OPERATION

Quick Start

The *PortaSens II* is simple to operate. After removing the device from the storage case, install a gas sensor module (see Changing the Sensor on page 12) and plug the sampling wand into the inlet port of the manifold (Figure 2 on page 7).

Note

> *The "INLET" and "OUTLET" ports on the manifold must not be blocked.*

To start the device, press and release button 1 (the green button below the display). You should hear a beep, and the internal pump should begin run. If a sensor is installed, the device reads the sensor memory, performs an internal test, and presents the sensor configuration on a number of review displays, before reaching the main display. Otherwise, the pump motor is turned off, and the display appears as that shown in Figure 10, below. During the startup sequence, you may press the Skip button to advance directly to the main display (the sequence is shown in Startup Sequence on page 17).

The Main Display appears at the end of the startup sequence, and is depicted in Figure 9, below. The gas concentration reading appears in large, numeric digits, with the units of measurement on the right, and the gas symbol just below it. The example below shows an ammonia sensor is installed, but the units and symbol depend on the installed sensor. The display also indicates which battery is currently powering the device (see Batteries on page 19 for details about this indication).

```
┌──────────────────────────────┐
│ P                      PPM    │
│                   0    NH3    │
│                               │
│  OFF           MENU    SMPL   │
└──────────────────────────────┘
```

Figure 9. Main display with ammonia sensor installed.

Figure 10 shows the display when a sensor is not installed. If a sensor is installed at this point, the device will present the startup sequence, as described above (and detailed in Startup Sequence on page 17).

```
┌──────────────────────────────┐
│ P                             │
│            SENSOR             │
│              MISSING          │
│  OFF                          │
└──────────────────────────────┘
```

Figure 10. Sensor missing display.

Note

> *A response test is recommended prior to use in the field (see Response* Test *on page 21).*

Startup Sequence

The startup sequence for a typical device with an ammonia sensor is shown in the table below. The gas symbol, range, and alarm settings will vary according to the installed sensor.

No.	Display	Description
D1	LOADING SENSOR	Uploading sensor configuration and calibration settings.
D2	SELF CHECK	Testing hardware and software.
D3	SELF CHECK PASSED	Tests completed successfully.
D4	100 PPM NH3 HOLD NEXT MENU SKIP	Range setting (full scale). The "Soft Keys" appear along the bottom line (see Soft Keys on page 18).
D5	C – ↓ 20 PPM NH3 HOLD NEXT SKIP	Caution set point. The line under C indicates the caution level is set at -20 PPM; the symbol, ↓, indicates the alarm activates at, *or below*, the set point. Alarm operation is detailed on page 23.
D6	W ↑ 25 PPM NH3 HOLD NEXT SKIP	Warning set point. The set point is 25 PPM, and the symbol, ↑, indicates the alarm activates at, *or above*, the set point. Alarm operation is detailed on page 23.
D7	A ↑ 50 PPM NH3 HOLD NEXT SKIP	Alarm set point. The set point is 50 PPM, and the symbol, ↑, indicates the alarm activates at, or above, the set point. Alarm operation is detailed on page 23.
D8	Range 50 PPM to 500 PPM HOLD NEXT SKIP	Minimum and maximum range of the sensor.
D9	Firmware Rev x.xx Sensor Rev y.yy HOLD NEXT SKIP	Device and sensor revision levels.
D10	P 0 PPM NH3 OFF MENU SMPL	Main Display shows current gas concentration, units of measure, and gas symbol. The symbol in the upper left indicates which battery is providing power.

Gas Concentration Reading

The gas concentration reading appears on the device display with the units of measure, and the gas symbol. The *range* setting of the device determines the resolution of the reading, as shown in the table on the right, and is independent of the units of measure. It is not used to limit, or "clip", readings, but does limit other settings.

Range	Resolution
0.00 to 4.99	0.01
5.0 to 49.9	0.1
50 and above	1

Averaging is used to stabilize the reading, and   *Blanking* is used to filter small reading fluctuations near zero, and suppress negative readings. See Display Settings on page 31 for details about the operation and configuration of these settings.

Soft Keys

The four push buttons on the front panel are context sensitive, which means their function changes according to the requirements of the user interface. The device normally displays a label just above the button to indicate the function that will be performed when the button is pushed[3]. The button, with its displayed label, is referred to as a "soft key". Throughout this manual, the term "key" is used most often to refer to the labeled button, and "button" is used when no label appears above it.

For example, during the startup sequence above, button 1 (the left most button) is labeled "HOLD". It is referred to as the "HOLD key" and is used to halt the display sequence. Button 2 is labeled "NEXT". It is referred to as the "NEXT key" and is used to advance to the next display. Finally, button 4 (the right-most button) is labeled "SKIP". It is referred to as the "SKIP key" and is used to advance directly to the Main Display.

Shutdown

To turn off the device, press and hold the OFF key on the Main Display, D10, until the device displays, "POWER DOWN", then release the key.

No.	Display	Instructions
D10	P ___ O PPM NH3 ___ OFF MENU SMPL	Press and hold the OFF key until the display changes to D11 (approximately 3 seconds).
D11	POWER DOWN	Release the key when this display appears.

---

[3] Exceptions to this are starting the device (the display is not yet active) and entering Configuration mode (no label appears above the button).

Batteries

       The primary battery is a standard, alkaline D-cell. It is housed in the handle of the device and will operate the device continuously for approximately 75 hours. If the primary battery becomes discharged, or disconnected, a secondary (rechargeable) battery will supply power for up to 6 hours.   The device indicates which battery is currently supplying power by the symbol that appears in the upper left corner of the display.

   …primary battery

   …secondary battery

   …battery charger is connected

       Power is drawn from the primary battery first. When the primary battery is low, the 'P' symbol will flash for about one hour. The device will eventually begin to beep once per minute, before switching over to the secondary battery. When the secondary batter is low, the 'S' symbol will flash for about an hour, and again the device will beep once per minute, before the secondary battery is discharged. When both batteries are discharged, the instrument will shut off and not restart until one or both of the batteries have been restored.

       It is not unusual for power to switch between batteries for a period of time. The primary battery recovers after being switched off, and eventually, recovers enough to be switched back on. This process repeats for some time, until the primary battery is fully discharged.

       An A/C charger is supplied for the secondary battery. The jack is located under the rubber seal on the side of the device (see Figure 3 on page 8). When charging, the LED will light steady. The device may be operated continuously while charging.

Warning
       Use only the battery charger supplied by ATI for this device. Connecting a different charger may result in permanent damage to the battery or other electronic components.

LED Indicator

The LED on the panel indicates battery status. It lights steady when the charge cable is connected. When the cable is disconnected, the LED flashes once every six seconds to indicate the device is capable of starting (one, or both, batteries are ready). If the LED is off, both batteries are discharged, and the device will not start.   In this condition, any sensor installed in the device may lose bias, and will require several hours to stabilize after restoring battery power. Table 4 summarizes the battery status indications.

Table 4. LED Battery Status Indicator

✩	On (steady)	• Device is off • Charge cable connected • Secondary battery charging
✩ ○ ✩	Flashing	• Device is off • Charge cable disconnected • Battery power is available for start up
○	Off (steady)	• Device is on, or, • Device is off, charge cable is disconnected, and no battery power is available.

Reminder
   Keep the sensor modules in the Sensor Keeper when not in use.

Response Test

A response test is recommended before each use. Table 5 lists methods for generating gas that are appropriate for a target gas. Contact ATI for details on other methods.

Table 5. Gas Generation Methods.

Target Gas	Quick Test Material and Method
Oxidant Sensors (except H_2O_2)	Dry calcium hypochlorite or liquid bleach
Hydrogen Peroxide	Sodium bisulfite in plastic bottle
Ammonia Sensor	Household ammonia solution
Carbon Monoxide	Cigarette smoke
Hydrogen	No simple test. Must test with cylinder hydrogen
Oxygen	Unit should read air levels
Nitric Oxide	No simple test. Must test with nitric oxide
Phosgene	No simple test. Must test with phosgene
Hydrogen Chloride	(2) drops of conc. HCl in plastic bottle
Hydrogen Fluoride	Dry calcium hypochlorite or liquid bleach
Hydrogen Cyanide	Sodium bisulfite in plastic bottle
Hydrogen Sulfide	Sodium sulfide in plastic bottle
Nitrogen Dioxide	Dry calcium hypochlorite or liquid bleach
Sulfur Dioxide	Sodium bisulfite in plastic bottle
Hydride Gases	No simple test. Must test with hydride gas.
Hydrogen Peroxide	30% Hydrogen Peroxide solution
Hydrocarbon Gases	Rubbing alcohol

Many of these methods produce high gas levels in closed containers. It is best to approach the opening of the container, slowly, with only the tip of the wand, to reduce the level of exposure at the sensor. While a high exposure will not harm the sensor, it may take several minutes for it to recover.

Warning
Do not draw liquid into the wand - only sample the air space just above the liquid.

Inlet and Outlet Extensions

The inlet port is located on the manifold lid and features a quick-disconnect fitting (see Figure 2 on page 7). The fitting permits connection of the flexible wand, for probing around mechanical equipment, and sampling confined spaces without entering. The wand is lined with Teflon, which is inert to most gases and vapors.

You may use flexible tubing on the inlet port to sample beyond the reach of the wand. Fluorocarbon-based tubing is strongly recommended for measuring low concentrations of reactive gases. Other materials may be used for high range measurements, where the adsorption of gas by the tubing is negligible, or where you are probing for significant leaks.

The internal walls of the wand and inlet tubing must be kept dry. Water collecting on the walls may absorb reactive gases, due to solubility. If the inside of the tubing gets wet, allow the device to sample dry air for 10 to 15 minutes.

The outlet port is also located on the manifold lid. If sampling high concentrations of gas, or if the device is being used in an enclosed space, you may connect it to tubing to vent gas outdoors, or to an appropriate location.

Note
The INLET and OUTLET ports must not be closed or blocked.

Analog Output

The device features 0 to 1 VDC output, which is exposed on the communication connector shown in Figure 3 on page 8. The output voltage is linear (proportional) to the gas concentration reading, where 0 volts corresponds to a gas reading of 0, and 1 volt corresponds to the configured full-scale range. An optional cable is available connecting to the output (see SPARE PARTS on page 49).

Operating Modes

The four operating modes of the device are Normal, Sample, Configuration, and Calibration mode. The mode affects how, and when, the gas concentration reading is updated on the display. The operating mode also determines if alarms are enabled or disabled (*inhibited*). Table 6 below details the behavior of the device in each mode.

Table 6. Operating Modes

Mode	Reading Update	Reading Blanked	Alarms Enabled
Normal	Continuous	Yes	Yes
Sample	Periodic	Yes	No
Configuration	Continuous	Yes	No
Calibration	Continuous	No	No

The device is in Normal mode at the conclusion of the startup sequence, while displaying Main Display, D10. Pressing the SMPL key puts the device into Sample mode. Pressing the MENU key to view or change the configuration places the device into Configuration mode. Entering the Zero or Span calibration menu puts the device into Calibration mode.

```
┌────────────────────────────────┐
│ P                          PPM  │
│              O             NH3  │
│                                 │
│   OFF            MENU    SMPL   │
└────────────────────────────────┘
```

Sample Mode

Sample mode presents a consistent reading that is sampled and averaged over two configured intervals. During the first interval, the device pumps a fixed volume of gas to the sensor. During the second interval, it collects readings and averages them. At the conclusion of the second interval, it displays the average value. The device displays the reading until the CLEAR button is pressed, and then displays, "CLEARING", until the reading falls below a configured limit value. The table below details this operation. Refer to Sample Mode Settings on page 33 for configuration details.

No.	Display	Description
D10	![P OFF MENU SMPL O PPM NH3]	Press the SMPL key on the Main Display, D10. The display will change to SM1.
SM1	P SAMPLING 00:30 ABORT	The device displays the time remaining in the first interval while it pumps a fixed volume of gas to the sensor. When 00:00 is reached, the device beeps and continues with display SM2. ABORT – ends Sampling mode and returns to the Main Display, D10, and resumes Normal mode.

SM2	**P**
	
	    MEASURING
	    00:30
	           ABORT
		The device displays the time remaining in the second interval while it collects readings and averages them. On expiration, the device beeps and continues with display SM3.
		
		ABORT – ends Sampling mode and returns to the Main Display, D10, and resumes Normal mode.

SM3	**P** PPM
	     4 NH3
	           CLEAR
		The device displays the result of averaging.
		
		Press the CLEAR key to continue. If the result is below the limit setting, the device returns to the Main Display, D10, and resumes Normal mode. Otherwise, the display continues with SM4 below.

SM4	**P** CLEARING	The device displays "CLEARING" until the reading falls below the configured limit value.

Alarms

The device features three level alarms designated as Caution, Warning, and Alarm, in order of increasing severity. The levels are stored in the H10 sensor memory, and are read at startup, and when a sensor is installed. Alarms are enabled when the device is operating in Normal mode, and are inhibited each of the other modes (see Operating Modes on page 23). A description of each alarm follows.

Note
The following descriptions apply to the default settings.

Caution Alarm
When Caution becomes active, the device will flash "CAUTION" on the display. Caution does not activate the internal beeper. To end the display, press the ACK key.

Toxic gas sensors: Caution is normally a low (falling) alarm, and its level is set to -10% of the full scale range. This is intended to indicate *excessive* negative sensor drift, a condition which should be corrected. The alarm becomes active when the gas concentration reading is *at or below* this level for 2 seconds.

Oxygen sensors: Caution is normally a high (rising) alarm and the level is set to 23% O_2. It is intended to indicate an uncommon condition that should be corrected, if it persists. Note that it is normal for an O_2 sensor to produce high a high reading when it has been, "off bias" (out of the keeper), for a few hours.

Warning Alarm
When Warning becomes active, the device will flash "WARNING" on the display, and beep intermittently. To end the display and silence the beeper, press the ACK key.

Toxic gas sensors: Warning is normally a high (rising) alarm and its level is set to the TLV (threshold limit value) of the gas. The alarm becomes active when the gas concentration reading is *at or above* this level for 2 seconds.

Oxygen sensors: Warning is normally a low (falling) alarm and its level is set to 19.5%. The alarm becomes active when the gas concentration reading is *at or below* this level for 2 seconds.

Alarm
When Alarm becomes active, the device will flash "ALARM" on the display, and beep continuously. To end the display and silence the beeper, press the ACK key.

Toxic gas sensors: Alarm is a normally a high-high alarm, set approximately 2-3 times higher than the Warning level, and becomes active at, or above, this level.

Oxygen sensors: Alarm is normally a low-low alarm, and its level is set to 16% O_2, and the alarm becomes active at, or below, this level.

More Information
The ACK key appears only when alarms are active. Alarms may be changed or permanently deactivated through the user interface (see Alarm Settings on page 28).

Low Flow Alarm ("Pump Trouble")

The device contains an internal diaphragm pump, which forces a continuous sample stream of gas to the sensor at a rate of approximately 400 cc/min. A blockage in the inlet or outlet port causes the pump motor to stall, and the device compensates by increasing the pump motor speed. The pump will not be damaged by operating with a blockage for a short time, but this may increase the transport time of gas to the sensor.

When a blockage occurs, or if the pump or motor fails, the device displays, "PUMP TROUBLE", and beeps intermittently. The figure below illustrates this behavior.

```
P
            PUMP  TROUBLE
P
   OFF              ACK    SMPL
```
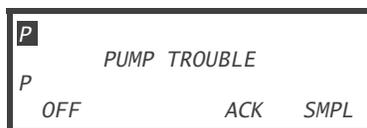
A flow meter is included in the device kit to verify the flow rate. To use it, turn on the device and connect the sampling wand. Push the flow meter's tubing adapter onto the wand, and hold the meter vertical. Verify the flow rate exceeds 250 cc/min (**0.5 SCFH**). If the flow rate cannot be achieved, inspect the wand and manifold for blockages.
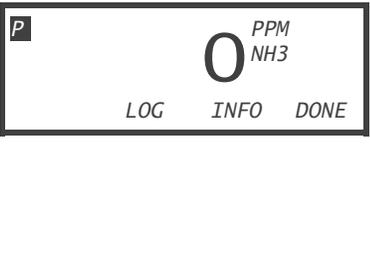
Note:
Proper flow should be verified before using the device for leak testing.

DEVICE CONFIGURATION

The PortaSens II configuration is the combined user and calibration settings stored in the device and H10 sensor memories. Some settings are considered critical to the safe operation of the device, and require a special key press sequence to change them. This is done to help prevent inadvertent or unauthorized changes. Other settings, such as those required for data logging, are not considered critical, and do not require a special access method.
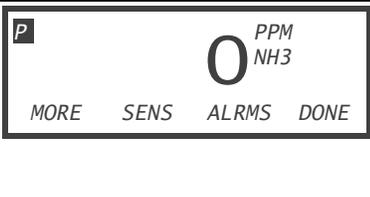
Viewing the Configuration

Several device settings are presented during the Startup Sequence, which can be initiated by following the instructions in the table below.

D10	P PPM O NH3 OFF MENU SMPL	From the Main Display, press the MENU key to display menu M1 below.
M1	P PPM O NH3 LOG INFO DONE	Press the INFO key to initiate the Startup Sequence beginning at display, D4, and return to the Main Display, D10 (above). See Startup Sequence on page 17 for details about the device settings. If the DONE key is pressed, or no key is activated within 30 seconds, the device will return to the Main Display.

Changing the Configuration

To prevent inadvertent or unauthorized changes to critical settings, a special key press sequence is required to access the configuration change menus.

While viewing the Main Display, D10, press and hold the MENU key and the unmarked key (button 2) for approximately 5 seconds. When the display is cleared, release both keys. The device will present menu PD1, below.

PD1	P PPM O NH3 MORE SENS ALRMS DONE	Press one of the following keys. MORE Selects menu, PD2 (below) SENS Selects Sensor Calibration menu, CD1 (pg. 35) ALRMS Selects Alarms menu, AD1 (pg. 28) DONE Returns to Main Display, D10 (above)	
PD2	P PPM O NH3 MORE DISP SMPL DONE	MORE Returns to menu PD1 (above) DISP Selects Display Settings menu, VD1 (pg. 31) SMPL Selects Sample Mode menu, SD1 (pg. 33) DONE Returns to Main Display, D10 (above)	

Alarm Settings

The device features three alarms named, Caution, Warning, and Alarm. Each alarm has the settings shown below, which may be configured by following the instructions listed in Table 7, below.

Set Point   The set point setting determines the level at which the alarm activates. When
(S.P.)   adjusting the setting, keep in mind that negative concentration settings are indicated by a line appearing below the alarm symbol on the left side of the display. The set point for toxic gas sensors can typically be adjusted between -20% and 120% of the range. The set point is adjusted by pressing the S.P. key on the alarm's AD2 display, below.

Function   The function setting determines if the alarm is a *high* alarm (active at or *above*
(FUNC)   the set point), a *low* alarm (active at or *below* the set point), or OFF (permanently disabled). The settings are indicated as follows.

↑	*High* alarm, active at or *above* the set point
↓	*Low* alarm, active at or *below* the set point
OFF	Alarm is permanently disabled

Table 7. Alarms menu.

No.	*Display*	*Description/Instructions*
D10	P 0 PPM NH3 OFF MENU SMPL	While viewing the Main Display, D10, press and hold the MENU key and the unmarked key (button 2) for approximately 5 seconds. When the display is cleared, release both keys. The device will present menu PD1.
PD1	P 0 PPM NH3 MORE SENS ALRMS DONE	Press the ALRMS key.
AD1	P 0 PPM NH3 CAUT WARN ALRM DONE	Press one of the following keys. CAUT Selects Caution settings menu (Table 8 below) WARN Selects Warning settings menu (Table 9 below) ALRM Selects Alarm settings menu (Table 10 below) DONE Returns to menu PD1 above

Table 8. Caution settings menu.

No.	Display	Description/Instructions
AD2	C – ↓ 20 PPM NH3 S.P. FUNC DONE	This displays the settings for the Caution alarm, as indicated by the C symbol on the left side. The numeric digits represent the set point. The line below C indicates the setting is a negative value, so the set point is actually -20 PPM. The down arrow, $\Downarrow$, indicates the alarm functions as a low alarm, that is, it is active at or below -20 PPM. Press one of the following keys. S.P.　Selects the Set Point edit display AD3 below FUNC　Selects the Function edit display AD4 below DONE　Returns to AD1 above
AD3	C – ↓ 20 PPM NH3 ABORT INC DEC SAVE	Press one of the following keys to edit the **Caution Set Point**. ABORT　Restores the previous value and returns to AD2 INC　Increases the alarm set point DEC　Decreases the alarm set point SAVE　Saves the new value and returns to AD2
AD4	C – ↓ 20 PPM NH3 ABORT SELECT SAVE	Press one of the following keys to edit the **Caution Function**. ABORT　Restores the previous value and returns to AD2 SELECT　Changes Function to the next value SAVE　Saves the new value and returns to AD2

Table 9. Warning settings menu.

No.	Display	Description/Instructions
AD2	W ↑ 25 PPM NH3 S.P. FUNC DONE	This displays the settings for the Warning alarm, as indicated by the W symbol on the left side. The numeric digits represent the set point. The up arrow, $\Uparrow$, indicates the alarm functions as a high alarm, that is, it is active at or above 25 PPM. Press one of the following keys. S.P.　Selects the Set Point edit display AD3 below FUNC　Selects the Function edit display AD4 below DONE　Returns to AD1 above
AD3	W ↑ 25 PPM NH3 ABORT INC DEC SAVE	This display is used for editing the <u>set point</u>. Press one of the following keys. ABORT　Restores the previous value and returns to AD2 INC　Increases the alarm set point DEC　Decreases the alarm set point SAVE　Saves the new value and returns to AD2
AD4	W ↑ 25 PPM NH3 ABORT SELECT SAVE	Press one of the following keys to edit the **Warning Function**. ABORT　Restores the previous value and returns to AD2 SELECT　Changes Function to the next value SAVE　Saves the new value and returns to AD2

Table 10. Alarm settings menu.

No.	Display	Description/Instructions
AD2	A **50** PPM NH3 ↑ S.P. FUNC DONE	This displays the settings for Alarm, as indicated by the A symbol on the left side. The numeric digits represent the set point. The up arrow, ↑, indicates the alarm functions as a high alarm, that is, it is active at or above 50 PPM. Press one of the following keys. S.P. Selects the Set Point edit display AD3 below FUNC Selects the Function edit display AD4 below DONE Returns to AD1 above
AD3	A **50** PPM NH3 ↑ ABORT INC DEC SAVE	This display is used for editing the <u>set point</u>. Press one of the following keys. ABORT Restores the previous value and returns to AD2 INC Increases the alarm set point DEC Decreases the alarm set point SAVE Saves the new value and returns to AD2
AD4	A **50** PPM NH3 ↑ ABORT SELECT SAVE	Press one of the following keys to edit the **Alarm Function**. ABORT Restores the previous value and returns to AD2 SELECT Changes Function to the next value SAVE Saves the new value and returns to AD2

Display Settings

The settings listed below affect the displayed gas concentration reading, which may be adjusted by following the steps detailed in Table 11 below.

Range (RANGE)	The Range setting determines the 100% full scale reading of the device, which corresponds to the 1v analog output signal. The setting does not limit the displayed reading [4], but does limit alarm levels and blanking value (below). It is also used by data logging, and for computing the Sampling mode recovery set point. The setting is stored in the H10 sensor memory so that every device using it is configured with the same value.

The setting also determines the resolution of the displayed reading.   The table on the right details how the device uses it to configure the best reading resolution possible.

Range	Resolution
0.00 to 4.99	0.01
5.0 to 49.9	0.1
50 and above	1

Normally, the range setting is set to the highest exposure level expected. Limits for the setting vary by sensor, and are displayed during the startup sequence (see Startup Sequence, pg. 17), and by selecting INFO from the menu, M1 (see Viewing the Configuration, pg. 27).

Blanking (BLANK)	*Blanking* refers to the method by which the device filters out small reading fluctuations near zero. The method also suppresses negative readings, which stem from the physical nature of most sensors[5]. It works by forcing the displayed reading to 0 when it is at, or below, the Blanking setting. "Un-blanked" readings are not suppressed in any way, and may be displayed as negative values.

The blanking value is expressed in the units of measure of the target gas, typically PPM. It is normally 2% of the range, and adjustable up to 10% (see Display Settings on pg. 31).

As an example, the blanking value for a 100 PPM Ammonia sensor is normally set to 2 PPM. A reading of 1 PPM or below, *including negative values*, are reported as 0 PPM.

Averaging (AVG)	The gas concentration reading is computed 20 times per second and is *digitally* damped to suppress noise. The amount of damping is controlled by the *Averaging* setting, a unit-less value that ranges from 0 to 100, where higher values correspond to higher damping. The value represents the number of measurements averaged to obtain the displayed reading. The default is normally 5-15, depending on the gas type.

Note: *this value should not be confused with the averaging period that takes place in Sample mode (see Sample Mode on page 23).*

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[4] Readings are restricted by the maximum range of the sensor, displayed during the Startup Sequence.
[5] The Caution alarm will normally activate if the reading drifts below its negative set point.

Table 11. Reading display settings.

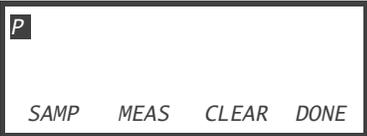| No.	Display	Description/Instructions
D10	P 0 PPM NH3 *OFF MENU SMPL*	While viewing the Main Display, D10, press and hold the MENU key and the unmarked key (button 2) for approximately 5 seconds. When the display is cleared, release both keys. The device will present menu PD1.
PD1	P 0 PPM NH3 *MORE SENS ALRMS*	Press the MORE key.
PD2	P 0 PPM NH3 *MORE DISP SMPL DONE*	Press the DISP key.
VD1	P 0 PPM NH3 *MORE AVG BLANK DONE*	Press one of the following keys. MORE Selects the next display VD2 below. AVG Selects the Averaging edit display VD3 below. BLANK Selects the Blanking edit display VD4 below. DONE Returns to display PD2 above.
VD2	P 0 PPM NH3 *MORE RANGE DONE*	Press one of the following keys. MORE Selects the previous display VD1 above. RANGE Selects the Range edit display VD5 below. DONE Returns to display PD2 above.
VD3	P 10 PPM NH3 *ABORT INC DEC SAVE*	Press one of the following keys to edit the **Averaging** value. ABORT Restores the previous value and returns to VD1. INC Increments the value DEC Decrements the value SAVE Saves the edited value and returns to VD1.
VD4	P 4 PPM NH3 *ABORT INC DEC SAVE*	Press one of the following keys to edit the **Blanking** value. ABORT Restores the previous value and returns to VD1. INC Increments the value DEC Decrements the value SAVE Saves the edited value and returns to VD1.
VD5	P 200 PPM NH3 *ABORT INC DEC SAVE*	Press one of the following keys to edit the **Range** value. ABORT Restores the previous value and returns to VD2. INC Increments the value DEC Decrements the value SAVE Saves the edited value and returns to VD2.

Sample Mode Settings

Sample mode uses the following settings, which can be adjusted by following the steps detailed in Table 12 below.

Sampling Time (SAMP)   *Sampling Time* is the interval in which the pump is allowed to run, in order to draw a consistent volume of gas. The interval is expressed in units of mm:ss.

Measuring Time (MEAS)   *Measuring Time* is the interval in which the device accumulates an average gas concentration reading. The interval is expressed in units of mm:ss.

Clearing Limit (CLEAR)   *Clearing Limit* is the value which the gas concentration reading must fall below before enabling another sampling cycle.

Table 12. Sample mode settings.

No.	*Display*	*Description/Instructions*
D10	P 0 PPM NH3 OFF MENU SMPL	While viewing the Main Display, D10, press and hold the MENU key and the unmarked key (button 2) for approximately 5 seconds. When the display is cleared, release both keys. The device will present menu PD1.
PD1	P 0 PPM NH3 MORE SENS ALRMS	Press the MORE key.
PD2	P 0 PPM NH3 MORE DISP SMPL DONE	Press the SMPL key.
SD1	P SAMP MEAS CLEAR DONE	Press one of the following keys. SAMP Selects the Sampling time edit display SD2 below. MEAS Selects the Measuring time edit display SD3 below. CLEAR Selects the Clearing time edit display SD4 below. DONE Returns to menu PD2.
SD2	P SAMPLING 00:30 ABORT INC DEC SAVE	Press one of the following keys to edit the **Sampling time**. ABORT Restores the previous value and returns to SD1. INC Increments the value DEC Decrements the value SAVE Saves the edited value and returns to SD1.
SD3	P MEASURING 00:30 ABORT INC DEC SAVE	Press one of the following keys to edit the **Measuring time**. ABORT Restores the previous value and returns to SD1. INC Increments the value DEC Decrements the value SAVE Saves the edited value and returns to SD1.

| SD4 | P **15** PPM NH3 ABORT INC DEC SAVE | Press one of the following keys to edit the **Clearing** time.
ABORT — Restores the previous value and returns to SD1.
INC — Increments the value
DEC — Decrements the value
SAVE — Saves the edited value and returns to SD1. |

SENSOR CALIBRATION

The *PortaSens II* sensor calibration is a two-step process referred to as Zero and Span. Each calibration adjusts settings that are used to compute the gas concentration reading. Since the settings reside in the sensor module, modules may be calibrated separately, and used in any device.

Zero Calibration (ZERO)	*Zero* is the term applied to the gas sensor output in the absence of the target gas. Over time, the chemistry of the sensor may change, and cause the output to decrease, resulting in a slightly negative gas concentration reading. Zero calibration corrects the reading by updating the associated values in the sensor memory. Zero calibration is recommended to be performed, or checked, once every 2-3 months, and should always be done before Span calibration.
Span Calibration (SPAN)	*Span* is the term applied to the gas sensor output in the presence of the target gas, and is a measure of its "sensitivity". Over time, the sensitivity may decrease, as a result of changes in the cell chemistry, to produce a slightly lower reading than expected. Span calibration corrects the reading by updating the associated values in the sensor memory. Span calibration and is recommended to be performed, or checked, once every 6 months. This period may be extended to year if the sensor is used infrequently.

Note
Zero calibration should be done before Span calibration.

Gas sensor modules may be sent to ATI for calibration, where they are calibrated using specialized gas cylinders, blenders, generators, and other traceable standards that might not be available to most users (most typically for Span calibration). These standards tend to be expensive to acquire and maintain, which might make ATI factory calibration more economical in the long run. Contact ATI, or your ATI representative, for details on the factory calibration service for gas sensor modules.

Customers who wish to perform, or verify, the sensor's calibration should have the appropriate, traceable, gas standard(s) to use for the Zero and Span calibration methods below. Atmospheric air may be used for Zero calibration, if it is known with certainty to be free of the target and interference gases. Note that indoor Carbon dioxide levels may be higher in winter, when doors and windows are closed. Levels of Carbon monoxide (CO), oxides of nitrogen, and ozone may be higher in summer, due to smog. When in doubt, use bottled zero air, or Nitrogen (required for O_2 sensors), when performing this procedure.

Pressurized Gas Sources

Supplying gas to the device from a pressurized source requires a bypass-T to be inserted between the source and the manifold (Figure 11 below). This is required to limit gas pressure on the intake side of the sample pump when the source is open, and prevent the inlet from being blocked when the source is closed. The flow rate into the T must exceed the pump flow rate of 400cc/minute, or the calibration gas may become diluted. A flow rate of 500 cc/min into the T is recommended.
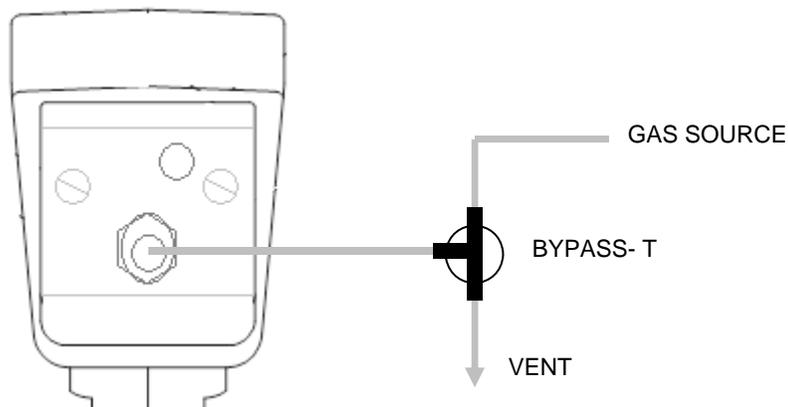

GAS SOURCE

BYPASS- T

VENT

Figure 11. Calibration Flow Schematic

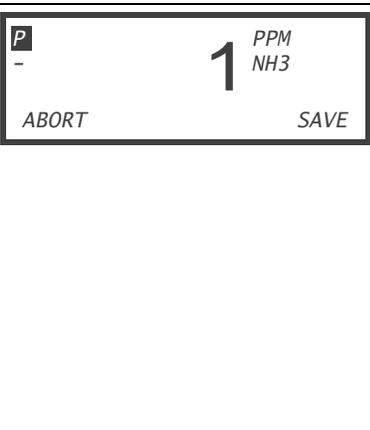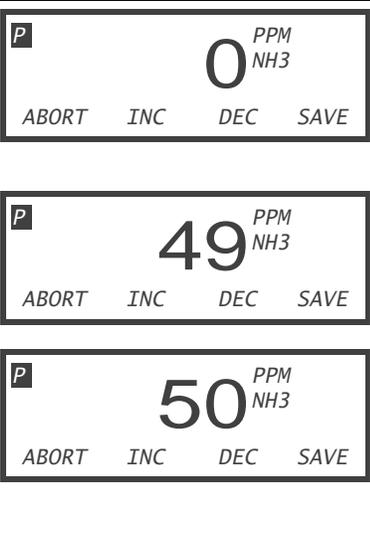## Zero and Span Calibration Steps

The steps required to Zero and Span the device are detailed in Table 13 below. You may elect to perform only the Zero calibration, however, if performing Span, Zero should be performed first.

Zero calibration begins by connecting the inlet to a gas source known to be free of the target gas, or any interfering gases (see Gas Interferences on page 14). For toxic gas sensors, this may be bottled dry air, Nitrogen, or atmospheric air. However, for O_2 sensors, Nitrogen is required. To avoid false alarms, start the gas flow where called out in the table.

When the reading has stabilized at its lowest value, the Zero function is run and the displayed reading becomes 0.

Table 13. Sensor calibration steps.

No.	*Display (example only)*	*Description/Instructions*
D10	P — 1 PPM NH3 OFF MENU SMPL	While viewing the Main Display, D10, press and hold the MENU key and the unmarked key (button 2) for approximately 5 seconds. When the display is cleared, release both keys. The device will present menu PD1.
PD1	P — 1 PPM NH3 MORE SENS ALRMS	Press the SENS key to display menu, CD1.

CD1	P – 1 PPM NH3 ZERO SPAN DONE	Press the ZERO key to display the Zero function, CD2.
CD2	P – 1 PPM NH3 ABORT SAVE	ZERO CALIBRATION If using a pressurized gas source such as Nitrogen, **start the flow.** Wait for the reading to stabilize at its lowest value (usually no longer than 10 minutes), and then press the SAVE key to update the calibration settings and return to menu CD1. You may press the ABORT key at any time to exit without saving, and return to CD1 above. If using a pressurized gas source, **stop the flow**.
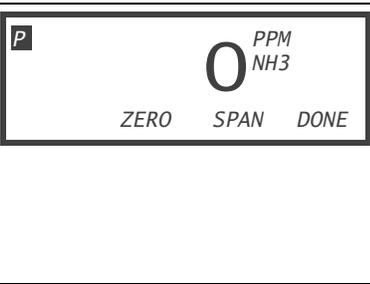
CD1	P
	0 PPM
	NH3
	ZERO SPAN DONE
		The displayed reading should now be 0 (unless the ABORT key was pressed in CD2).
		
		Press one of the following keys.
		  ZERO Returns to the Zero calibration display, CD2.
		  SPAN Selects the Span calibration display CD3.
		  DONE Returns to menu PD1.

CD3	P 0 PPM NH3 ABORT INC DEC SAVE P 49 PPM NH3 ABORT INC DEC SAVE P 50 PPM NH3 ABORT INC DEC SAVE	SPAN CALIBRATION If using a pressurized gas source (very likely for toxic gas sensors), **start the flow**. Wait for the reading to stabilize at its highest value (usually no longer than 10 minutes). Once stabilized, press the INC or DEC keys to adjust the reading to match the concentration of the gas source, then press the SAVE key, and return to menu, CD1. You may press the ABORT key at any time to exit without saving, and return to CD1. If using a pressurized gas source, **stop the flow**.

DATA LOGGER

Data Logger Operation and Settings

The device logs (records) time stamped, gas concentration readings in intervals of 1, 5, 10, or 15 minutes. The logged readings range from 0 to the full scale range; therefore, it is important to adjust the Range setting prior to starting the data logger (see Display Settings on page 31). The device also displays the amount of sampling time remaining, and provides a function for clearing the memory. To begin using the data logger, follow the steps detailed in Table 14 below.

Note

Prior to using the data logging feature for the first time, install the C16Log application and use it to automatically update the device's local date and time. This also applies if both the primary and secondary batteries have been completely discharged and subsequently restored. See C16Log on page 41 for more details about the C16Log application.

Clear (CLEAR)	The Clear function clears the data log memory, which resets the amount of sampling time remaining to its maximum value. Make certain to first download previously logged samples you wish to save, prior to selecting this function.
Interval (INT)	The Interval setting controls the time between samples, 1, 5, 10, or 15 minutes. The maximum sampling capacity at each setting is shown in the table below.

Interval (minutes)	Maximum Storage (days)
1	8
5	40
10	80
15	120

Table 14. Data logger settings.

D10	P O PPM NH3 OFF MENU SMPL	Press the MENU key to display menu, M1.
M1	P O PPM NH3 LOG INFO DONE	Press the LOG key. If the data logger has already been started, menu L2 will be displayed, otherwise menu L1 is displayed.

L1	```P 01 Minute Interval```
	```007 Days 20 Hrs Free```
	
	```CLEAR INT START DONE```
		Press one of the following keys.
		
		CLEAR Hold this key down for two seconds to clear the data log memory, which then removes the label above the button. The label does not appear if the log is already empty.
		
		INT Advances the logging Interval to the next selection (1, 5, 10, or 15).
		START Holding this key down for two seconds starts the data logger. The device then returns to the Main Display, D10, and indicates that data logging is active.
		DONE Exits the menu and returns to the Main Display, D10.

L2	```P 01 Minute Interval```
	```007 Days 20 Hrs Free```
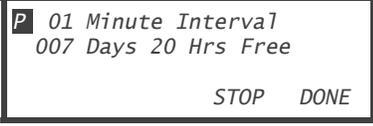	
	``` STOP DONE```
		Press one of the following keys.
		
		STOP Holding this key down for two seconds stops the data logger and returns to menu, L1.
		DONE Returns to the Main Display, D10.

C16Log

C16Log is the application provided for transferring logged gas readings from the device. The program outputs ASCII csv files for importing into applications such as Microsoft Excel®. It also automatically updates the device's date and time using the computer's clock when the application is started (this should be done at least once, before using the data logger, to account for differences in local time).

Installation

The program runs on all versions of Microsoft Windows, on or after Windows 98, including Windows XP, 2000, 7 and 8. The application installs from the CD labeled, "PortaSens II Datalog", which is supplied with the device, and is also available for download (*PortaSensII DataLog.zip*) from the ATI website, at:

http://www.analyticaltechnology.com
(click on Gas Monitors, C16 Portable Gas Leak Detector, Datalog Software)

Installing on Windows 7 & 8
a. Place the CD into the drive. When the AutoPlay form appears, click "Run Setup.exe".
b. When downloading from the website, click the Open button when the download manager form appears (or click Save to install the program at a later time). When the WinRAR form appears, double-click on the "setup.exe" file.

Installing on Windows XP
a. Place the CD into the drive. The C16Log installer will normally start automatically. However, if Autorun is disabled, click the Start button, then click Run. Click browse, and navigate to CD, click Setup.exe, then click the Open button.
b. When downloading from the website, click the Open button when the File Download form appears (or click Save to install the program at a later time). When the WinRAR form appears, double-click on the "setup.exe" file.

Follow the on screen instructions to complete the installation.

RS232-to-USB Adapter
Most laptop computers, tablets, and (newer) desktop computers, purchased with Windows 7 or 8, do not have conventional RS232 ports for communicating with the device. Some older computers, which have been upgraded to Windows 7 or 8 from Windows 2000, or XP, exhibit problems when attempting to use these conventional ports. And lastly, some older systems may be using the RS232 ports, and not have one available for connecting the device.

The solution is to use an RS232-to-USB adapter, preferably one that has a male, DB9 connector. A number of quality adapters are available, including one from "Cables To Go", www.cablestogo.com, part # 26886. For more up to date information, refer to the "Readme" file on the CD, or check the ATI website.

Connecting the Device
Refer to Figure 3 on page 8 and plug the (round) end of the supplied RS232 cable into the corresponding port on the side of the device, and then plug the DB9 female end into the PC. If you are using an RS232-to-USB adapter, plug the supplied RS232 cable into it, then plug the adapter into an available USB port on the computer.

       Most adapters implement the USB CDC class, for which Windows has built in drivers. If this is not the case, the computer may need to download the driver from the internet. If this fails, or if the computer is not connected to the internet, or if you are not running Windows Update, you may need to manually install a driver for the particular adapter you are using.

Starting C16Log

Verify the device is connected and powered on.

Note
> *Starting C16Log will stop the device's data logger, and close the current session.*
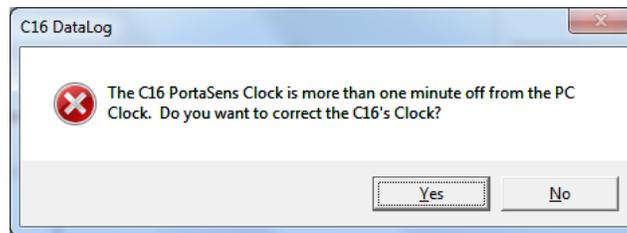
Version 2.0 and Higher
> From the desktop, select "Launch C16Log.exe".

Earlier Versions
> From your computer's "Start" menu, select "Programs", "C16 Data Logger", and "C16Log".

The program checks the device's clock and calendar settings and displays the following form if the settings disagree by more than one minute. Click the Yes button to continue.

Using C16Log

       On startup, the program displays the Main form shown in Figure 12, and attempts to connect to the device. If the connection fails (not unusual on the first try), the program displays "Link Trouble" in the lower right corner. Verify the device is connected, and powered on, and then change the Serial Port (COM port) setting to the next sequentially higher value. Repeat this until the link indicator changes to, "Link OK".

<div style="text-align:center">

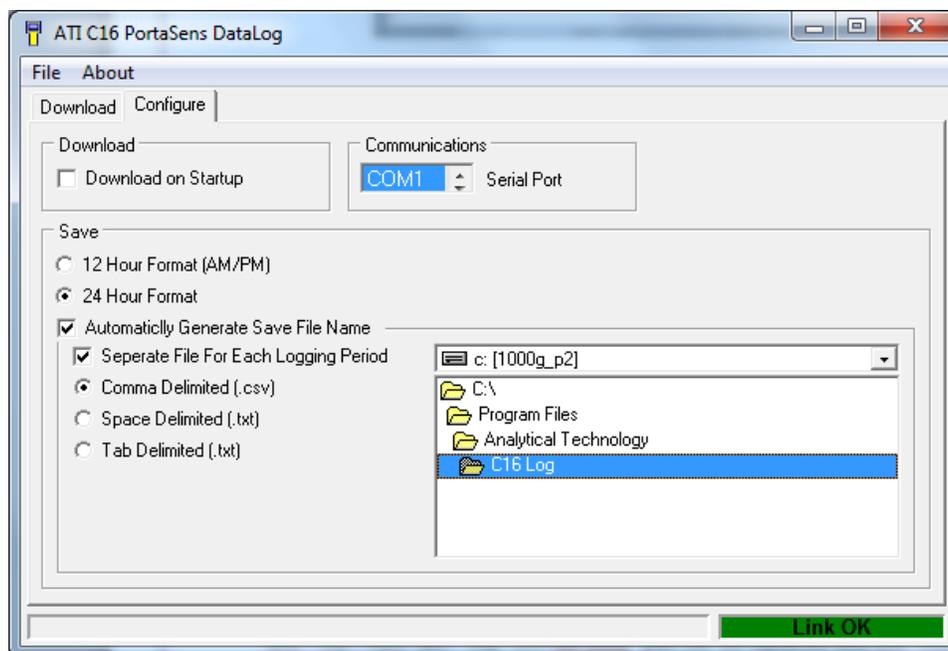**Link Trouble**   **Link OK**

</div>

Figure 12. Main Form, Configure Tab

Configure Tab
   The Configure tab controls the connection, data formats, and automatic data transfer settings.

File Location

   Important Note for Windows, Version 7 and Higher
   The default folder for saving data log files is "C:\Program Files\Analytical Technology\C16Log". Windows, version 7 or higher, will mark these files as hidden, so they will not appear when browsing for them. Since the data may be shared on the same computer with other users, or shared with users over a network, you are urged to create a folder in, "**Public Documents**", such as, "C:\Users\Public\Documents\Analytical Technology\C16Log". It is NOT recommended to change your Windows settings to make hidden files visible. Figure 13 below shows the recommended folder location. You will need to first create this folder before saving files.
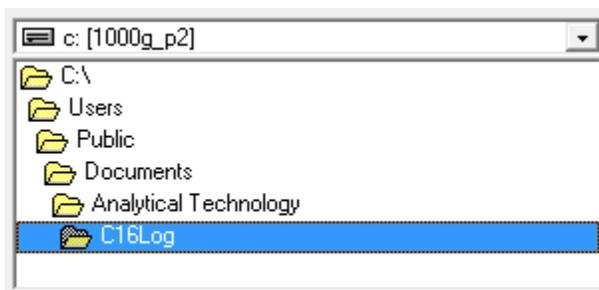

Figure 13. Recommended location for data files.

Automatic File Names
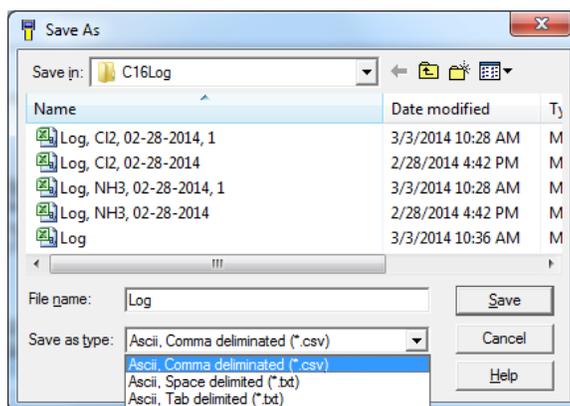
        When selected, files names generated by the program are comma separated strings of the form:

              Log, <gas symbol>,<mm-dd-yyyy>[,n]

        where,

        <gas symbol> is the target gas of the logging session, like, H2S,

        <mm-dd-yyyy> is the month, day, and year the file was created, like 02-28-2014

If the device contains more than one log with the same gas, they are enumerated by an additional field. The file type will depend on the selected field delimiter (see Field Delimiter in the table below).

Examples

        Log,Cl2,02-10-2014.csv   //single Cl2 session

        Log,NH3,02-10-2014,1.csv   //first NH3 logging session

        Log,NH3,02-10-2014,2.csv   //second NH3 logging session

        When automatic file naming is not selected, a form appears that prompts you for a file name and destination folder. The file type selection specifies which field delimiter will be used, as shown in the figure below. If a file with the same name already exists, you will be prompted to overwrite the existing file, append it, or cancel the file save. All sessions will be saved in this single file.

Group	Item	Description
Communications	Serial Port	Click the up/down control to change the setting until "Link OK" appears.
Download	Download on Startup	Check this box to automatically transfer all data from the device as soon as the program is started. If you wish to download on command, leave the box unchecked.
Save	Automatically Generate Save File Name	Check this box to automatically generate a file name when data is downloaded from the device. See Automatic File Names above. If left unchecked, you will be prompted for a file name, file type, and folder, each time you download data.
	File Location (folder)*	*You are urged to change the folder used for data files to, "C:\Users\Public\Public Documents\Analytical Technology\C16Log". Do not store data files in the "Program Files" directory, they may be hidden by Windows (see File Location above).*
	Time Format	Select the time format for the data you wish to store on the computer

(default is 24 hour).

Separate Files for Each Logging Period*	Check this box to save a separate file for each logging session (default). Leave the box unchecked if you prefer to save all sessions to a single file.
Field Delimiter*	Fields within the saved data may be separated by a comma (ASCII 44,default), space(ASCII 32), or horizontal tab (ASCII 9). The selection of which depends on the application used to open the file. Comma delimited files are importable into most spreadsheet programs, such as Excel.

The setting also specifies the file type when the file is saved:
- Comma - saved as .csv file, ie, "Log,CO,02-10-2014.csv"
- Space, Tab - saved as .txt file, ie, "Log,CO,02-10-2014.txt"

*This setting is available only when "Automatically Generate Save File Name" is checked.

Download Tab

The Download Tab is used to manually transfer data from the device. Automatic transfers may be configured on the Configure Tab (above).

To transfer the data, click the "Get Data" button. A progress bar appears while the data is transferring and saving. The destination folder and names of the new files appear in the lower half of the form.
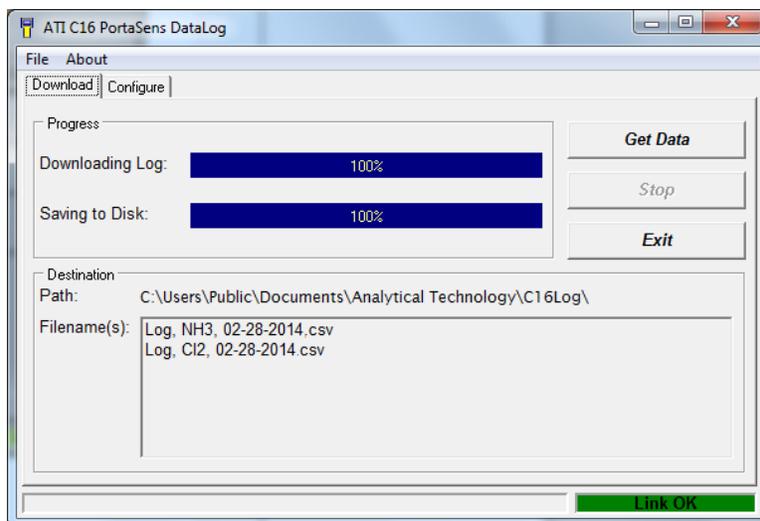

Figure 14. Main Form, Download Tab

Output Files

Output files are ASCII text, beginning with a header, and followed by lines of data records. The header begins with, "C16 PortaSens DataLog Data", and includes the gas symbol, the full scale range, and units of measurement. Data records are printed as one record per line, with a time stamp, in the order and interval they were recorded. Fields within each record are delimited by a, comma, space, or (horizontal) tab, depending on selections made on the form's Configure tab.
The order of the fields is:

                                                <date>,<time>,<rdg>CR,LF

where,

date	…the date of the sample in "mm/dd/yyyy" format	
time	…the time of the sample in 12 or 24 hour format	
rdg	…gas concentration reading in the units of PPM, PPB, or %	
CR	…ASCII carriage control character (ASCII 15)	
LF	…ASCII line feed control character (ASCII 9)	

                   note: commas are shown, but may be spaces (ASCII 32), or tabs (ASCII 9)

An example output file appears in   Figure 15 below.

a. Automatic file name, separate files, 24-hour format, comma separated fields.
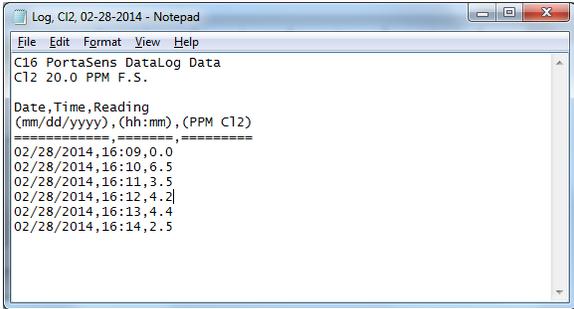

```
Log, Cl2, 02-28-2014 - Notepad
File  Edit  Format  View  Help
C16 PortaSens DataLog Data
Cl2 20.0 PPM F.S.

Date,Time,Reading
(mm/dd/yyyy),(hh:mm),(PPM Cl2)
============,=======,=========
02/28/2014,16:09,0.0
02/28/2014,16:10,6.5
02/28/2014,16:11,3.5
02/28/2014,16:12,4.2
02/28/2014,16:13,4.4
02/28/2014,16:14,2.5
```

b. Automatic file name, separate files, 12-hour format, comma separated fields.


```
Log, Cl2, 02-28-2014, 1 - Notepad
File  Edit  Format  View  Help
C16 PortaSens DataLog Data
Cl2 20.0 PPM F.S.

Date,Time,Reading
(mm/dd/yyyy),(hh:mm),(PPM Cl2)
============,========,=========
02/28/2014,04:09 PM,0.0
02/28/2014,04:10 PM,6.5
02/28/2014,04:11 PM,3.5
02/28/2014,04:12 PM,4.2
02/28/2014,04:13 PM,4.4
02/28/2014,04:14 PM,2.5
```
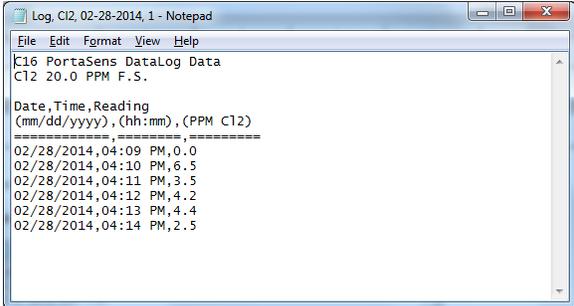
c. Automatic file name, single file, 24-hour format, comma separated fields.

```
Log - Notepad
File  Edit  Format  View  Help
C16 PortaSens DataLog Data
NH3 100 PPM F.S.

Date,Time,Reading
(mm/dd/yyyy),(hh:mm),(PPM NH3)
===========,=======,=========
02/28/2014,15:46,10
02/28/2014,15:47,7
02/28/2014,15:48,6
02/28/2014,15:49,13
02/28/2014,15:50,5




C16 PortaSens DataLog Data
Cl2 20.0 PPM F.S.

Date,Time,Reading
(mm/dd/yyyy),(hh:mm),(PPM Cl2)
===========,=======,=========
02/28/2014,16:09,0.0
02/28/2014,16:10,6.5
02/28/2014,16:11,3.5
02/28/2014,16:12,4.2
02/28/2014,16:13,4.4
02/28/2014,16:14,2.5
```
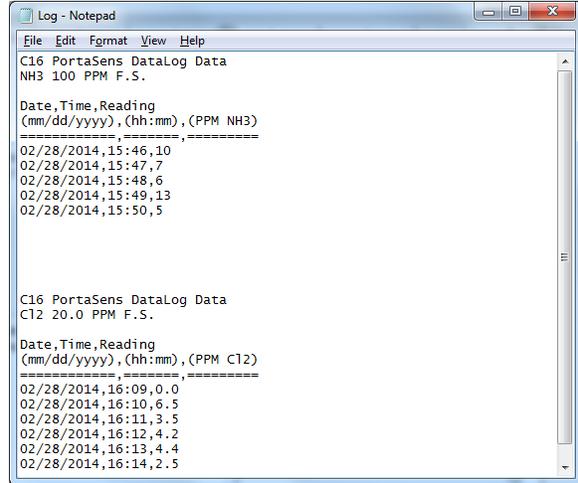
Figure 15. Example output files.

MAINTENANCE

Intake Pump Filter

The intake pump filter is a small disk of fabric that is located under manifold lid (see Figure 2 on page 7). A blocked filter will slow the response of the device, and cause the pump motor to run at a higher rate, thereby discharging the batteries sooner. Check the filter once a month and replace it, if required. The filter is simply pressed into place. Extra filters are supplied in the kit and available from the factory.

TROUBLE

Use the following table to help identify and correct problems that might occur.

Symptom	Possible Cause and Corrective Action
Device Does Not Start (no display, pump motor does not run)	Both batteries may be discharged. Replace the primary D-cell battery, and charge the secondary battery.
Frequent Low Battery Warning	The battery charger or cable may be open. Test the charger using a simulated load by connecting a 12 ohm resistor between the contacts of the charging plug on the end of the cable (NOT THE A/C MAINS!). Verify the voltage across the resistor is approximately 6 volts. If so, the secondary battery may need replacement. Return the device to the manufacturer for replacement of the rechargeable battery.
No Response to Gas	The sensor may be at, or nearing, its normal end-of-life. Replace the sensor with a known good one.
Pump Trouble message persists.	The intake filter, flexible wand, or inlet/outlet tubing may be obstructed. Replace the filter and/or clear any blockages. Keep wand and tubing free of all liquids. Verify the flow rate using the supplied flow meter (see Low Flow Alarm ("Pump Trouble") on page 26 for details).
Level Alarm Slow to Clear	a. The sensor may have been exposed to a high concentration of target gas. If so, it will require an extended period of time for to recover. Leave the device running while sample zero air. If the condition does not clear after 6 hours, replace the sensor or contact ATI Service Department. b. Another possibility (although, uncommon) is that the sensor has been incorrectly calibrated, and the reading is no longer accurate. Verify the readings using certifiable zero and span gas sources.
No Response to Key Presses	Press and hold all four front panel keys for 5 seconds to reset the device. This should turn the device off. The device should start up by pressing the green button.

Symptom	Possible Cause and Corrective Action
Device does not connect to PC	This problem is often caused by a mismatch between the C16Log application's COM port setting, and the actual setting assigned to the port used to connect the device. 1. Older PCs have 9 or 25 pin D-sub connectors on the rear of the chassis which are usually assigned to physical COM1 or COM2 ports. Try each in succession while changing the setting in C16Log. If possible, try another serial device to verify the port operation. Windows 7 (and above) sometimes has problems running on older PCs with physical COM ports. In this case, try using a USB-to-RS232 adapter. 2. Newer PCs lacking physical COM ports must use a USB-to-RS232 adapter to implement a "virtual" COM port. Windows manages the COM port assignment, which may not be obvious, or may get changed after switching to a different USB port, or after adding another device while the C16 is disconnected. In this case, run Device Manager and expand the "Ports" entry. Plug the C16 into the PC and watch for a new entry to appear. When this occurs, right-click on it, then click "Properties", followed by "Port Settings", and then click the "Advanced" button. The COM port should be displayed.
Device connects, but data log files do not appear after download.	1. Newer versions of Windows may hide files written to the install directory. See Important Note for Windows, Version 7 and Higher on page 43. 2. If both the primary and secondary batteries have been discharged, the device real-time clock may have been corrupted. Restore the batteries, then install the C16Log application and connect the device to refresh the time and date.

SPARE PARTS

Description	Part No.
Charger 115 – 240 VAC	28-0015
RS232 Interface Cable	03-0201
Voltage Output Cable	03-0205
Front Panel Overlay	34-0137
Bypass "T"	00-1088
Quick Disconnect Fitting	44-0096
Filter Disks (pkg. of 10)	05-0038
Flexible Wand	03-0176
Flow Meter with Tubing Adapter	03-0107
Carrying Case	90-0009
Charger/RS232 Dust Cap (w/ mounting screw)	03-0206
Battery Compartment Cap Assembly	03-0194
Port Barb Fitting	44-0123

Smart Sensor Modules (Model H10)

The table below lists the part number, gas name, and chemical symbol of the target gas for each H10 module, and groups them by gas type. The table also lists the minimum and maximum values of each sensor's range setting, and the most reading resolution possible.

Table 15. Smart Sensor Modules

Gas Name	Symbol	Min. Range Setting	Max. Range Setting	Default Range Setting	Reading Resolution (Min. Range)	Units	Part No.
			OXIDANT GASES				
Bromine	Br_2	1	5	2	0.01	PPM	00-1000
Bromine	Br_2	5	200	20	0.1	PPM	00-1001
Chlorine	Cl_2	1	5	2	0.01	PPM	00-1002
Chlorine	Cl_2	5	200	20	0.1	PPM	00-1003
Chlorine dioxide	ClO_2	1	5	1	0.01	PPM	00-1425
Chlorine dioxide	ClO_2	1	5	2	0.01	PPM	00-1004
Chlorine dioxide	ClO_2	5	200	20	0.1	PPM	00-1005
Chlorine dioxide	ClO_2	200	1000	1000	1	PPM	00-1359
Fluorine	F2	1	5	2	0.01	PPM	00-1006
Fluorine	F2	5	200	20	0.1	PPM	00-1007
Hydrogen peroxide	H_2O_2	10	100	20	0.1	PPM	00-1042
Hydrogen peroxide	H_2O_2	200	2000	1000	1	PPM	00-1169
Iodine	I2	1	5	2	0.01	PPM	00-1036
Iodine	I2	5	100	20	0.1	PPM	00-1037
Ozone	O_3	1	5	2	0.01	PPM	00-1008
Ozone	O_3	5	200	20	0.1	PPM	00-1009
Ozone	O_3	500	2000	1000	1	PPB	00-1163
Ozone	O_3	200	1000	1000	1	PPM	00-1358
			GENERAL GASES				
Ammonia	NH_3	50	500	100	1	PPM	00-1010
Ammonia	NH_3	500	2000	1000	1	PPM	00-1011
Carbon monoxide	CO	50	1000	100	1	PPM	00-1012
Hydrogen	H_2	1	10	4	0.01	%	00-1013
Hydrogen	H_2	500	2000	2000	1	PPM	00-1041
Nitric oxide	NO	50	500	100	1	PPM	00-1021
NOx	NOx	50	500	50	1	PPM	00-1181
Oxygen	O_2	5	25	25	0.1	%	00-1014
Phosgene	$COCl_2$	1	5	2	0.01	PPM	00-1015

Phosgene	COCl$_2$	5	100	10	0.1	PPM	00-1016

ACID GASES							
Acetic Acid	HAc	100	500	100	1	PPM	00-1045
Acid Gases	Acid	10	200	20	0.1	PPM	00-1038
Hydrogen bromide	HBr	10	200	20	0.1	PPM	00-1455
Hydrogen chloride	HCl	10	200	20	0.1	PPM	00-1017
Hydrogen cyanide	HCN	10	200	20	0.1	PPM	00-1018
Hydrogen fluoride	HF	10	200	20	0.1	PPM	00-1019
Hydrogen sulfide	H$_2$S	10	200	50	0.1	PPM	00-1020
Hydrogen sulfide	H$_2$S	500	1000	1000	1	PPM	00-1469
Nitrogen dioxide	NO$_2$	10	200	20	0.1	PPM	00-1022
Sulfur dioxide	SO$_2$	10	500	20	0.1	PPM	00-1023

HYDRIDE GASES							
Arsine	AsH$_3$	10	200	10	0.1	PPM	00-1025
Arsine	AsH$_3$	500	2000	1000	1	PPB	00-1024
Diborane	B$_2$H$_6$	10	200	10	0.1	PPM	00-1027
Diborane	B$_2$H$_6$	500	2000	1000	1	PPB	00-1026
Germane	GeH$_4$	10	200	10	0.1	PPM	00-1029
Germane	GeH$_4$	500	2000	1000	1	PPB	00-1028
Hydrogen selenide	H$_2$Se	10	200	10	0.1	PPM	00-1031
Hydrogen selenide	H$_2$Se	500	2000	1000	1	PPB	00-1030
Phosphine	PH$_3$	10	200	10	0.1	PPM	00-1033
Phosphine	PH$_3$	500	2000	1000	1	PPB	00-1032
Phosphine	PH$_3$	200	2000	1000	1	PPM	00-1034
Silane	SiH$_4$	10	200	10	0.1	PPM	00-1035
Silane	SiH$_4$	500	2000	1000	1	PPB	00-1285

HYDROCARBON GASES							
Acetylene	C$_2$H$_2$	200	2000	500	1	PPM	00-1057
Alcohol	CxOH	50	500	200	1	PPM	00-1043
Alcohol	CxOH	500	2000	2000	1	PPM	00-1044
Dimethylamine	DMA	100	200	100	1	PPM	00-1450
Ethylene oxide	C$_2$H$_4$O	20	200	20	0.1	PPM	00-1039
Formaldehyde	HCOH	20	200	20	0.1	PPM	00-1040
Formaldehyde	HCOH	500	2000	1000	1	PPM	00-1349
Hydrocarbon vapors	HCV	50	500	100	1	PPM	00-1516