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PortaSens II

Gas Leak Detector

This manual contains information critical to the proper operation and maintenance of your portable gas detector. The reliability of this important piece of safety equipment depends upon personnel performing routine operational checks outlined in this manual. It is important that the information contained in this manual be read and understood by those responsible for the operation and maintenance of this gas detector.

TABLE OF CONTENTS

SPECIFICATIONS

Range:	Dependent on sensor module used
Display:	Back-lit graphics liquid crystal display
Accuracy:	Sensor dependent but generally ± 5% of value (limited by cal. gas)
Sensitivity:	1% of sensor module range
Repeatability:	± 1% of sensor module range
Outputs:	RS-232 output of stored gas values 0-1 VDC analog (requires optional output cable)
Memory:	12,000 data points
Storage Interval:	Programmable for 1, 5, 10, and 15 minute intervals
Typical Capacity:	8 Days at 1 minute storage interval.
Alarms:	Three concentration alarms with adjustable setpoints. Alarms may be set for high, low, or off. Low flow and low battery alarms Alarms displayed on LCD and indicated by audible beeper
Power:	D cell battery, alkaline recommended, 75 hours operation Internal rechargeable Nicad for backup power, 6 hours operation 115 or 220 VAC chargers available
Operating Temp.:	-25º to +55º C
Humidity:	0-95% Non-condensing
Detector Material:	Glass filled nylon, PVC, and stainless steel
Accessories:	10” Sampling wand, Teflon lined Battery charger Three spare filters & Outlet Tube Barbed Fitting Flowmeter RS-232 Output cable (DB9 connector) DataLog PC software on CD ROM Storage case Calibration “T”
Shipping Weight:	3 lbs. (1.4 Kg.)

INTRODUCTION

The Series C16 ***PortaSens II*** is a portable, battery operated instrument designed to measure a variety of gases in ambient air. While C16 detectors can only measure one gas at a time, the unit uses interchangeable smart sensors so that it can be quickly converted to measure another gas. The table below shows the currently available sensor modules and the measurement ranges that can be covered by each module. Note that the C16 detector range can be adjusted by the user for any full scale range between the minimum range and maximum range indicated for each module. For example, with an ammonia module #00-1010 inserted into the unit, the range can be set at anywhere between 0-50 PPM and 0-500 PPM.

OXIDANT GASES				
GAS	SENSOR NO.	MIN. RANGE	MAX. RANGE	RESOLUTION
Bromine	00-1000	0-1 PPM	0-5 PPM	0.01 PPM
	00-1001	0-5 PPM	0-100 PPM	0.1 PPM
Chlorine	00-1002	0-1 PPM	0-5 PPM	0.01 PPM
	00-1003	0-5 PPM	0-100 PPM	0.1 PPM
Chlorine Dioxide	00-1004	0-1 PPM	0-5 PPM	0.01 PPM
	00-1005	0-5 PPM	0-100 PPM	0.1 PPM
Fluorine	00-1006	0-1 PPM	0-5 PPM	0.01 PPM
	00-1007	0-5 PPM	0-100 PPM	0.1 PPM
Hydrogen Peroxide	00-1042	0-10 PPM	0-100 PPM	0.1 PPM
Iodine	00-1036	0-1 PPM	0-5 PPM	0.01 PPM
	00-1037	0-5 PPM	0-100 PPM	0.1 PPM
Ozone	00-1008	0-1 PPM	0-5 PPM	0.01 PPM
	00-1009	0-5 PPM	0-100 PPM	0.1 PPM
GENERAL GASES				
Ammonia	00-1010	0-50 PPM	0-500 PPM	1 PPM
	00-1011	0-500 PPM	0-2000 PPM	1 PPM
Carbon Monoxide	00-1012	0-50 PPM	0-1000 PPM	1 PPM
Hydrogen	00-1041	0-500 PPM	0-2000 PPM	1 PPM
	00-1013	0-1%	0-10%	0.01%
Oxygen	00-1014	0-5%	0-25%	0.1%
Nitric Oxide	00-1021	0-50 PPM	0-500 PPM	1 PPM
Phosgene	00-1015	0-1 PPM	0-5 PPM	0.01 PPM
	00-1016	0-5 PPM	0-100 PPM	0.1 PPM
ACID GASES				
Hydrogen Chloride	00-1017	0-10 PPM	0-200 PPM	0.1 PPM
Hydrogen Cyanide	00-1018	0-10 PPM	0-200 PPM	0.1 PPM
Hydrogen Fluoride	00-1019	0-10 PPM	0-200 PPM	0.1 PPM
Hydrogen Sulfide	00-1020	0-10 PPM	0-200 PPM	0.1 PPM
Nitrogen Dioxide	00-1022	0-10 PPM	0-200 PPM	0.1 PPM
Sulfur Dioxide	00-1023	0-10 PPM	0-500 PPM	0.1 PPM
Acid Gases	00-1038	0-10 PPM	0-200 PPM	0.1 PPM

(List continues on next page)

HYDRIDE GASES				
Arsine	00-1024	0-500 PPB	0-2000 PPB	1 PPB
	00-1025	0-10 PPM	0-200 PPM	0.1 PPM
Diborane	00-1026	0-500 PPB	0-2000 PPB	1 PPB
	00-1027	0-10 PPM	0-200 PPM	0.1 PPM
Germane	00-1028	0-500 PPB	0-2000 PPB	1 PPB
	00-1029	0-10 PPM	0-200 PPM	0.1 PPM
Hydrogen Selenide	00-1030	0-500 PPB	0-2000 PPB	1 PPB
	00-1031	0-10 PPM	0-200 PPM	0.1 PPM
Phosphine	00-1032	0-500 PPB	0-2000 PPB	1 PPB
	00-1033	0-10 PPM	0-200 PPM	0.1 PPM
	00-1034	0-200 PPM	0-2000 PPM	1 PPM
Silane	00-1035	0-10 PPM	0-200 PPM	0.1 PPM
HYDROCARBON GASES				
Ethylene Oxide	00-1039	0-20 PPM	0-200 PPM	0.1 PPM
Formaldehyde	00-1040	0-20 PPM	0-200 PPM	0.1 PPM
Alcohol	00-1043	0-50 PPM	0-500 PPM	1 PPM
	00-0144	0-500 PPM	0-2000 PPM	1 PPM
Acetylene	00-1057	0-50 PPM	0-500 PPM	1 PPM

Each Series C16 is a complete battery-operated measuring instrument containing a sample pump to draw air into the sensor manifold. A graphics liquid crystal display with back-light provides gas concentration display and alarm indication. The basic instrument is sold without a sensor module. Sensor modules must be ordered separately. If only one sensor is purchased, the sensor will be installed in the unit at the time of shipment. If multiple sensor modules are ordered, one sensor is installed in the detector and the rest are packed inside the carrying case or inside the optional sensor keeper if one was ordered. The unit is packaged in a padded plastic carrying case containing all accessories.

UNPACKING

When you receive your C16 Portable Gas Detector, open the carrying case and inspect the contents to be sure that no shipping damage has occurred. The following items should be included inside the case:

1 - Series C16 ***PortaSens II*** Gas Detector
1 - Battery Charger
1 - Sampling Wand
1 - Flowmeter
3 - Replacement filters
1 - Spare "D" cell battery
1 - Outlet Tube Barbed Fitting
1 - RS-232 Cable
1 - DataLog PC software CD ROM
1 –Calibration "T"

In addition to the standard items listed above, any additional sensor modules that were ordered with the unit will be packed inside the carrying case (unless space does not allow due to the quantity ordered). If an accessory sensor keeper assembly was ordered, this item will also be contained in the carrying case. Spare sensors will be stored inside the sensor keeper assembly if ordered.

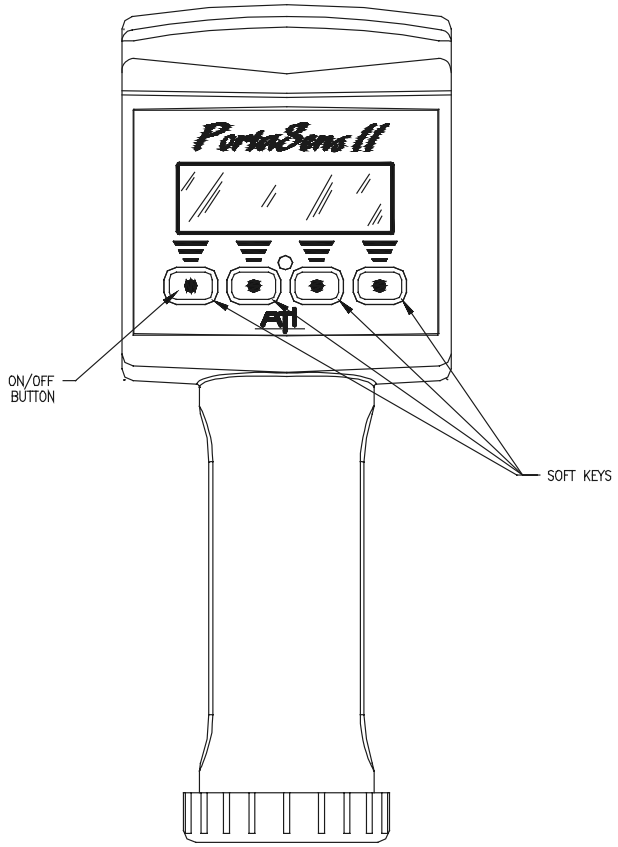


FIGURE 1 – FRONT PANEL OVERVIEW (ATI-0401)

OPERATION

The C16 Leak Detector is shipped ready to use directly out of the box. No adjustments of any kind are necessary. Simply remove the instrument from the storage case and press and release the green button below the display. The audible horn will beep once and the internal pump will begin to pull sample into the flow manifold.

CAUTION: For the instrument to work properly, the INLET and OUTLET ports on the back of the instrument must not be blocked or obstructed.

When power is first applied, the LCD display will scroll through a number of different start-up displays. The meaning of these displays will be explained in later sections of this manual. However, these displays will not affect the use of the instrument in making gas measurements as soon as power is turned on. Let the start-up displays cycle through until the display stops at the main display (or press the SKIP key). The unit will indicate gas concentration in large numbers, with the gas symbol and units of measure to the right of the number. Figure 2 shows how the main display will look initially.

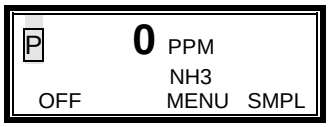


FIGURE 2 - MAIN DETECTOR DISPLAY

To use the detector immediately, remove the sampling wand from the carrying case and plug it into the mating connector on the back of the flow manifold. The internal sample pump will draw gas samples through the wand and display the concentration on the LCD. No adjustments are needed. However, you should run a response test as described on the next page, prior to using the instrument.

When you have finished using the detector, press and hold the green switch (marked Off on the LCD) until the LCD indicates the message “POWER DOWN”. Release the switch and the unit will shut off.

RESPONSE TEST

Prior to using the detector for field measurements, it is recommended that the unit first be tested for gas response. A response test simply means drawing a sample from some type of container that will give off the type of gas you are looking to measure. The following are examples of materials that can be used for a quick response test. Contact ATI if you have any questions about this matter.

Sensor Type	Quick Test Material
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	Two 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.
Hydrocarbon Gases	Rubbing alcohol

CAUTION: When running response check using any type of liquid solutions, do not draw liquid into the wand. Make sure that you only sample the gaseous head space over the liquid.

Many of these materials can produce fairly high gas levels in closed containers, so it is best when running a response check to approach the mouth of the bottle slowly with the tip of the sampling wand. This will reduce the possibility of a large gas exposure to the sensor. While a high exposure will do no harm, it can take quite a few minutes for some sensors to recover to zero from high level exposure. The intent of the response check is simply to insure that the sensor is responding to the intended gas.

SAMPLE INLET OPTIONS

The ***PortaSens II*** is shipped with a quick disconnect inlet fitting connected to the sample inlet port. A flexible extension wand is supplied in the kit for use in probing around mechanical equipment to determine the source of a gas leak or for pulling sample from a confined area without entering the area. The extension wand plugs into the quick disconnect fitting on the flow manifold at the back of the detector. Please note that the extension wand is lined with Teflon, which is inert to most gases and vapors.

It is possible to use flexible tubing on the inlet to extend the sample point even further than the wand. If this is done, it is important to use a non-reactive plastic. Fluorocarbon based tubing has proven to be the best and is the only alternative for many reactive gases when trying to measure low concentrations. Other materials may be used for high range measurements where accuracy is not a major concern, or where the user is only looking for major leakage sources.

No matter what material is used for inlet extensions, the internal walls must be kept dry. Water on the walls of the inlet tubing can absorb reactive gases due to solubility. If the inside of the tubing gets wet, simply allow the unit to pump non-condensing ambient air for 10 or 15 minutes to dry it out.

An outlet tube fitting is also supplied on the flow manifold. Ordinarily, allowing the small amount of sampled gas to vent at the back of the unit will do no harm. However, if sampling for high concentrations of gas, or if the instrument is being used in an enclosed space, you may wish to connect a longer vent line to the outlet so that sampled gas can be vented to a safe location.

DISPLAY RESOLUTION

Model C16 detectors display gas concentration with a resolution that depends upon the range of the unit. Full scale ranges of 0-4.99 or below will provide resolution of 0.01. Ranges from 0-5.0 up to 0-49.9 will provide resolution of 0.1. Full scale ranges above 50 will have a resolution of 1.

RESPONSE TIME

The response time for the gas sensors varies depending on the particular type of sensor. The following table shows the typical response times for sensor modules available for the C16 detector. The table provides typical time constants to 66% and 90% of exposure. This data should be used to determine how long you need to measure in a particular location to be sure you have a representative reading.

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

INTERFERENCES

Individual gas sensors respond to other gases or vapors in various ways. Some sensors are very specific, exhibiting very little cross-sensitivity with other gases. Other sensors are not as selective, and will respond to a variety of gases if present. Refer to the tables on the following pages for data on the response of ATI gas sensors to other gases that might be present. Sensors are listed across the top of the table with the relative response listed below. For example, an SO_2 sensor exposed to 1 PPM of HCN would produce a reading of 0.15 PPM. See notes at the end of the interference tables for other comments.

		SENSOR TYPE								
		NH_3	**Cl_2**	**O_3**	**HF**	**HCl**	**HCN**	**H_2S**	**SO_2**	**CO**
	NH_3	--	N	N	-0.05	N	N	N	N	N
	CO	0.05	N	N	N	0.005	N	0.002	N	--
	H_2	0.02	N	N	N	0.01	0.01	0.001	0.005	0.1
I	NO	N	N	N	N	1.5	3	0.4	0.04	0.1
N	O_2	*	N	N	N	*	*	*	*	*
T	Cl_2	-0.1	--	0.7	1	N	N	N	-0.1	N
E	O_3	-0.1	1.5	--	1	N	N	N	-0.1	N
R	HCl	N	N	N	0.5	--	N	N	N	N
F	HCN	N	-0.08	-0.05	-0.1	0.01	--	N	0.15	0.1
E	HF	N	N	N	--	N	N	N	N	N
R	H_2S	0.3	-0.1	-0.07	-0.3	3	N	--	N	N
E	NO_2	N	0.2	0.15	0.2	0.2	0.5	0.1	-0.08	N
N	SO_2	N	-0.01	-0.01	1	0.5	2	0.1	--	N
C	Hydride	0.5	N	N	N	1.5	4	0.5	2	N
E	SiH_4	0.5	N	N	N	1.5	4	0.5	2	N
	CO_2	N	N	N	N	N	N	N	N	N
	CH_4	N	N	N	N	N	N	N	N	N
	CH_3SH	N	-0.04	-0.03	-0.1	1	N	0.3	N	N
	C_2H_2	0.03	N	N	N	N	0.04	0.01	0.02	0.1
	C_2H_4	N	N	N	N	N	N	N	N	0.1
	C_2H_6O	0.01	N	N	N	0.01	0.02	0.005	0.05	N

		SENSOR TYPE								
		H_2	**H_2O_2**	**O_2**	**NO**	**NO_2**	**Hydride**	**SiH_4**	**$COCl_2$**	**H-C**
	NH_3	N	N	N	N	N	N	N	N	N
	CO	0.1	0.005	N	N	0.001	N	N	N	0.5
	H_2	--	0.01	N	0.001	0.001	0.00002	0.001	N	0.05
I	NO	N	1.5	N	--	N	N	0.3	-0.1	0.8
N	O_2	*	*	--	*	*	*	*	N	*
T	Cl_2	N	N	N	N	0.5	N	N	0.1	N
E	O_3	N	N	N	N	0.65	N	N	N	N
R	HCl	N	0.1	N	N	-0.3	N	N	0.05	0.2
F	HCN	N	0.1	N	N	-0.07	N	N	0.5	0.1
E	HF	N	N	N	N	N	N	N	N	N
R	H_2S	N	4	N	N	-2.5	N	N	N	2
E	NO_2	N	0.2	N	N	--	N	N	-1	0.1
N	SO_2	N	1	N	N	-1	N	N	0.2	0.4
C	Hydride	N	2	N	1	-2	--	1	N	2
E	SiH_4	N	2	N	1	-2	1	--	N	2
	CO_2	N	N	N	N	N	N	N	N	N
	CH_4	N	N	N	N	N	N	N	N	N
	CH_3SH	N	1.3	N	N	-0.8	N	N	N	1
	C_2H_2	0.1	0.1	N	0.05	N	0.00005	0.005	N	1.2
	C_2H_4	0.1	N	N	N	N	N	N	N	1
	C_2H_6O	N	0.02	N	0.001	0.001	0.00001	0.01	N	2

Interference Table Notes:

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. The sensor column marked “H-C” stands for hydrocarbon sensors. These include ETO (ethylene oxide), formaldehyde, alcohol, and acetylene sensors.
5. Data presented in this table represent exposure of gas sensors 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.

GAS CONCENTRATION ALARM FUNCTIONS

The ***PortaSens II*** Leak Detector contains both visual and audible gas concentration alarm functions. Three alarm levels are provided, with adjustable set points (SP) for each alarm. The alarms are designated as CAUTION, WARNING, and ALARM. The Caution setting is normally adjusted to alarm if the installed gas sensor exhibits excessive negative zero drift. The Warning and Alarm levels are set to specific gas values to provide an indication of high concentrations. Note that the Caution, Warning, and Alarm functions are only active when the C16 is operating in the normal mode. When in Calibrate or Sampling modes, the alarms are disabled.

When the gas detector is in operation, the measured gas concentration is always being compared to the alarm set points. When the concentration exceeds the Warning set-point for 2 seconds, the LCD display will flash the message "WARNING" and the audible beeper will sound intermittently. If the Alarm set-point is exceeded, the display will flash the "ALARM" message and the audible beeper will sound continuously. If excessive zero drift is detected, the Caution message will flash, indicating that the sensor zero should be checked and adjusted if necessary. The Caution alarm will not activate the internal horn. To silence the alarm horn and stop the display flash, press the ACK key. Note that the alarm acknowledge key (ACK) will only appear during an alarm condition. All alarm set points can be changed by the user or can be turned off if desired. Refer to the instructions on page 21 for the proper adjustment procedures.

PUMP TROUBLE ALARM

An internal diaphragm pump continuously delivers an air sample to the flow manifold containing the gas sensor. In normal operation, the flow rate is approx. 400 cc/min. Blockage in either the inlet or outlet will increase the sample transport time to the analyzer, resulting in a much slower response time. Should the pump fail during normal operation, the LCD display will indicate the message "PUMP TROUBLE" and the internal audible horn will sound intermittently.

The internal pump will generally not be damaged by short term operation with the flow blocked. It is possible for the pump motor to run, even when there is no air being pumped through the system. This condition can occur if the pump is filled with water or if the filter becomes completely blocked. A flowmeter is included in the ***PortaSens II*** kit to allow quick verification of proper flow. Turn the instrument on and connect the sampling wand. Place the tip of the sampling wand into the tubing adapter attached to the flowmeter. Hold the flowmeter in the vertical position and verify that the flowrate is above 250 cc/min. **Proper flow should always be verified before using the PortaSens for leak testing.**

BATTERY POWER SUPPLY

The C16 is powered by two separate batteries. The primary battery supply comes from a standard "D" cell located in the handle of the detector. This battery will operate the unit for about 75 hours of continuous use. A standby rechargeable NiCad battery is also provided. Should the primary battery become discharged, the standby battery will supply power to operate the detector for another 6 hours. A charger is supplied for the NiCad battery, with the charger jack located under the rubber seal on the side of the detector.

While the instrument is in operation, a small battery symbol can be seen in the upper left hand corner of the display. This battery symbol will contain either a “P” or an “S”, indicating that the unit is currently drawing power from either the Primary or Standby battery. When the primary battery is low, the battery symbol will flash about an hour before it switches over to the standby battery. The battery symbol will again flash about an hour before the standby battery is discharged. When both power sources are too low, the instrument will simply shut off and will not restart until a new “D” cell is installed or the standby battery is recharged.

The battery charger supplied with each unit is designed for standard 120 VAC outlets. A 220 VAC charger is available as an option. The special charger is listed on the parts list at the end of this manual and may be ordered from ATI or your local dealer. **NEVER USE A CHARGER OTHER THAN THE ONE SUPPLIED BY ATI FOR USE WITH THIS INSTRUMENT**. Connecting another type of charger may result in permanent damage to the battery or other instrument components. See Figure 3 on Page 15 for location.

The C16 may be operated continuously from the battery charger. When operating from the charger, the battery symbol on the display will be replaced by an AC plug symbol. While operating from the charger, the internal NiCad battery will also be charged. When operating on battery, power will be drawn from the “D” cell first, and from the NiCad once the “D” cell has been depleted.

RS-232 COMPUTER INTERFACE

The ***PortaSens II*** is equipped with an on-board data logger, which can be used to store gas concentration readings over time and transfer the data to a PC. The data logging function is enabled in units with firmware version 2.00 and higher. See DATA LOGGING section of this manual for details on the data storage function.

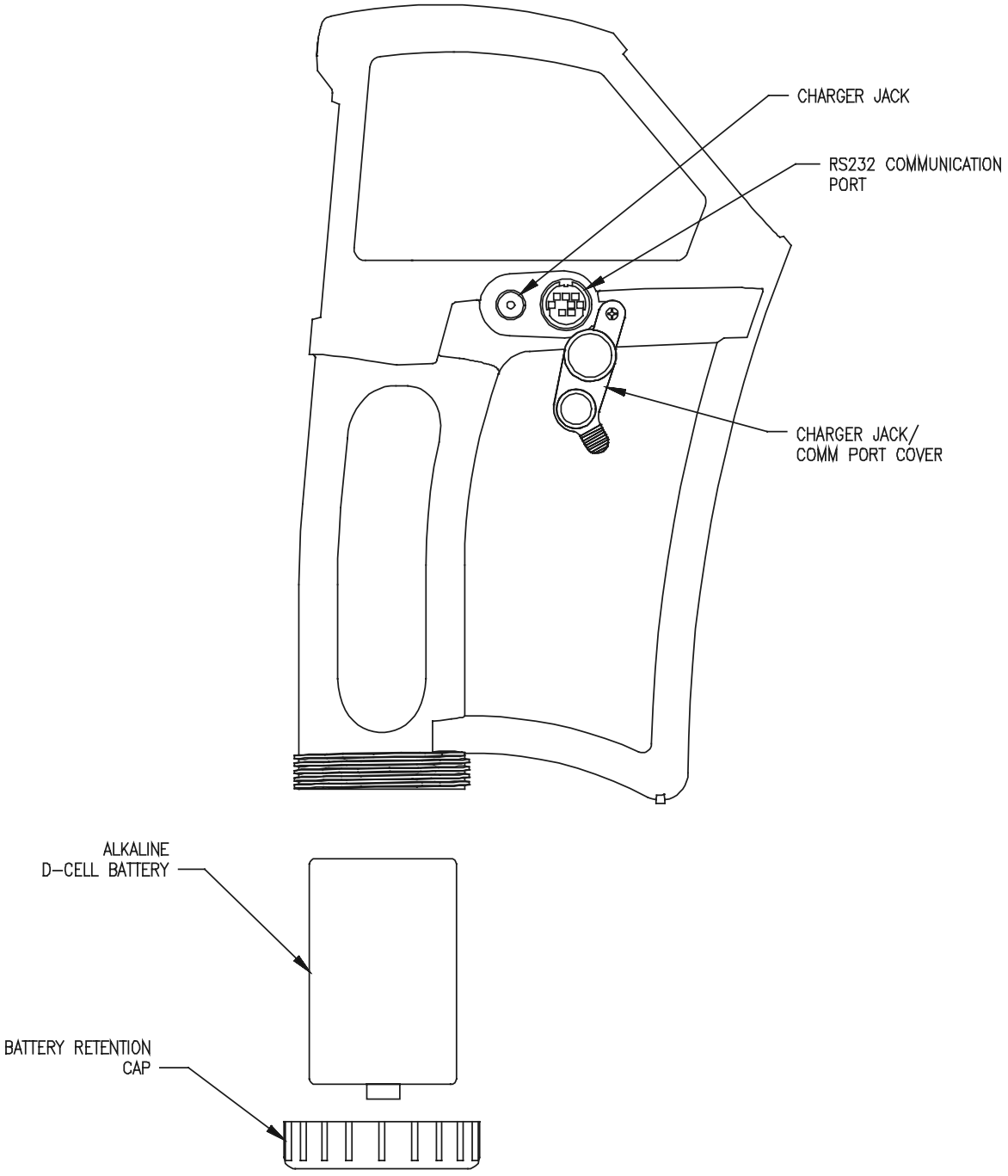


FIGURE 3– CHARGER JACK / COMM PORT ORIENTATION (ATI-0402)

START-UP SEQUENCE

When the C16 power switch is activated, a number of messages are sequentially displayed. Note that the display always has a row of text across the bottom. The four switches on the front panel are called “soft switches” because they have different functions depending on what mode of operation the unit is in. The text just above each switch indicates what that switch will do when pressed. The following is the display sequence at startup. The sample displays use ammonia as an example, but the gas symbols, range, and setpoint information will depend on what sensor module is installed. Pressing the NEXT key will step to the next display. Pressing the SKIP key will jump directly to D9. Holding down the HOLD key will stop the scroll at the current display.

D#	DISPLAY	EXPLANATION OF DISPLAY CONTENTS
D1	Self Check	Indicates the unit is performing electronic checks
D2	Self Check Passed	Indicates startup checks successfully completed
D3	**100** PPM NH3 HOLD NEXT SKIP	Indicates programmed full scale range. Bottom line indicates switch functions.
D4	C **20** PPM ↓ NH3 HOLD NEXT SKIP	Indicates the Caution setpoint. The minus sign under the C indicates that the caution is set at -20 PPM and the ↓ indicates the alarm will activate on a falling signal.
D5	W **25** PPM ↑ NH3 HOLD NEXT SKIP	Indicates the Warning setpoint. The current setpoint is 25 PPM and the ↑ indicates that the alarm will activate on a rising signal.
D6	A **50** PPM ↑ NH3 HOLD NEXT SKIP	Indicates the Alarm setpoint. The current setpoint is 50 PPM and the ↑ indicates that the alarm will activate on a rising signal.
D7	Range 50 PPM to 500 PPM HOLD NEXT SKIP	Indicates the minimum and maximum full scale range for the sensor module currently installed in the detector.
D8	Firmware Rev x.xx Sensor Rev x.xx HOLD NEXT SKIP	Indicates the revision levels for the firmware in the C16 detector and the sensor module currently installed.
D9	P **0** PPM NH3 OFF MENU SMPL	Indicates the current gas concentration. This is the normal operating display. The battery symbol in the upper left corner indicates which battery is currently providing power.

OPERATING MODES

Look at the display D9 on the previous page. Along the bottom line you will see the key functions OFF, MENU, and SMPL. To turn the unit off, press and hold the OFF key as previously described. If you do nothing, the LCD will indicate instantaneous gas concentration as samples are drawn into the sensor manifold by the pump. This is the normal mode of operation.

Pressing the SMPL key activates an optional measuring mode that can be useful to insure that measurements are done the same way every time. SMPL stands for “Sample Mode”, and is a predefined series of steps resulting in a single measurement. In sample mode, the detector will draw sample for a fixed period of time, then measure for a fixed period of time, and then display the average value calculated during the measuring time. At the end of the measurement, press the CLEAR button to prepare for another measurement. If the concentration has not dropped below a preset limit, the display will show the message “CLEARING” until the value falls back to that limit. The instrument will emit a “beep” when the sampling and measuring times are completed.

The sampling time, measuring time, and clearing limit are all programmable variables. Refer to the programming section of this manual for details on adjusting these variables.

Pressing the MENU key places the instrument in the menu mode. In menu mode, three softkeys are display as shown below.

M1	P **0** PPM NH3 LOG INFO DONE	Menu Mode display for access to information screens and logging functions.

Pressing the INFO key from this display will allow you to review the information display D3 through D8 explained on the previous page. This is useful if you need to review the values of the programmed alarm setpoints.

Pressing the LOG key provides access to data logging variables. These adjustments are explained in detail in the DATA LOGGING section of this manual beginning on page 27.

Pressing the DONE key will return you to the main display. If no key is activated within 30 seconds, the unit will revert to the main display automatically.

SENSOR MODULE EXCHANGE

The versatility of the ***PortaSens II*** leak detector stems from its ability to use a variety of sensor modules. These interchangeable modules allow one instrument to measure a wide variety of gases with extended range capabilities as described in the Introduction section.

Exchanging one sensor module for another is a simple procedure. On the back of the instrument are two stainless steel thumb screws which hold the flow manifold in place. Loosen these two screws and remove the manifold lid. The installed sensor is a black cylinder with white membrane in the cavity recess. To remove, simply grab the sides of the sensor module and pull it straight back. The sensor is held in place with a miniature connector for easy removal.

To insert a new sensor module, place the module connector first into the recess and rotate as needed until the module key lines up with the guide on the bottom of the recess. The sensor module can then be pressed in place, fully engaging the connector. When fully inserted, the face of the sensor module will be flush with the outer surface of the cavity.

Replace the manifold lid and tighten the thumb screws securely (hand tight is sufficient). After a module change, verify the flow through the sampling wand using the flowmeter supplied with the unit. See Figure 4 on Page 19.

The detector can be on or off during a sensor module change. If the power is on during a change, the display will indicate “SENSOR MISSING” when the sensor module is removed. When the module is replace or a new one is inserted, the display will display a “LOADING” message, indicating that sensor module data is being transferred from the sensor module into the detector.

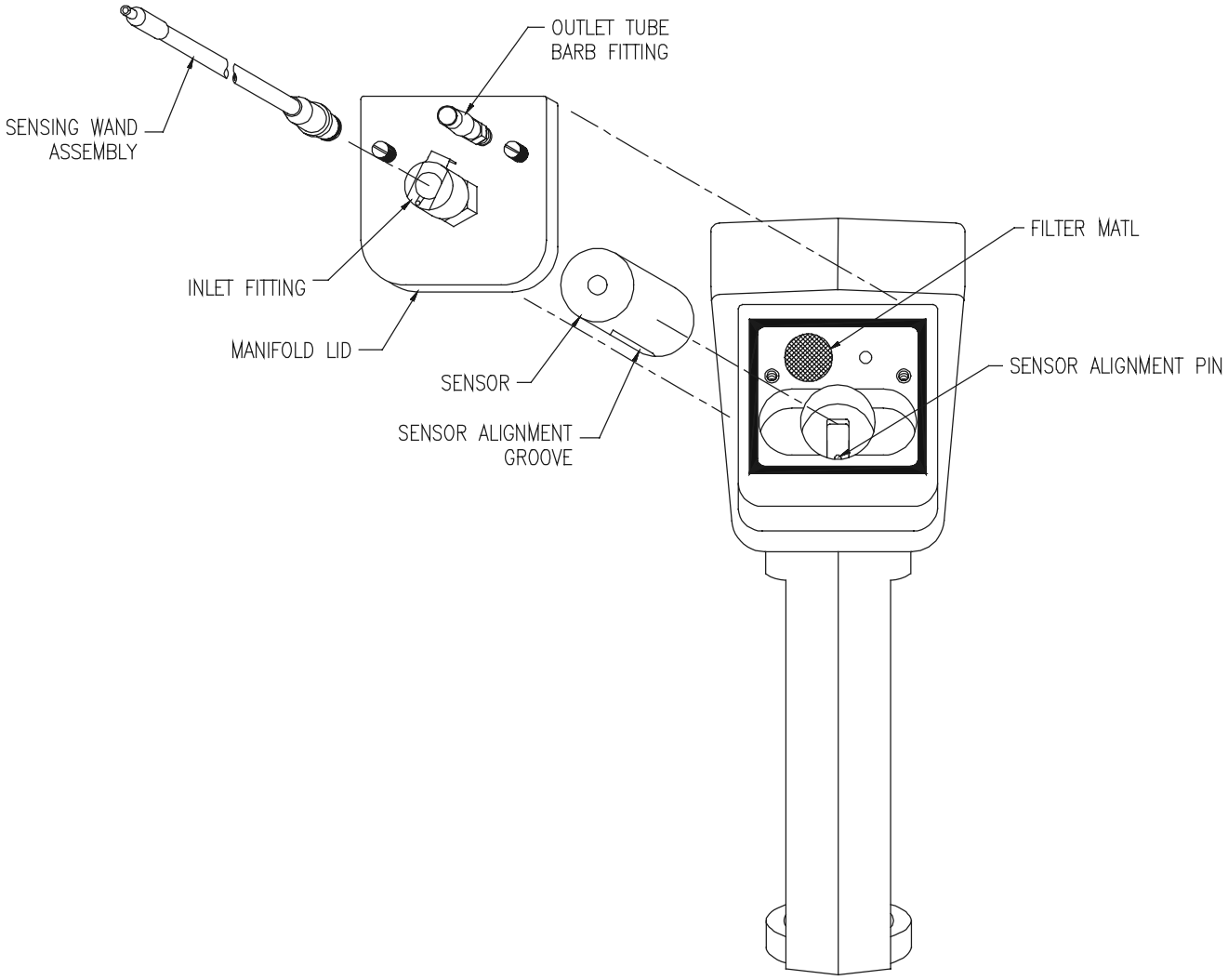


FIGURE 4 – MANIFOLD ASSEMBLY EXPLODED VIEW (ATI-0403)

PROGRAMMING

As previously mentioned, the C16 is ready to operate when received. However, there are a number of operating variable such as range, alarm setpoints, display damping, and sample mode timing that can be programmed. In addition, sensor module zero adjustment and calibration can be done from the programming menu.

To access the programming menu, turn on the detector and wait until the main display appears (Display D9 - see page 16). Note that one of the keys has no designation above it on the function line of the display. Press and hold the unmarked key and then press and hold the key marked MENU. Hold both keys down for approximately 5 seconds. The display will go blank, at which time you should release both keys. The display should now appear like the display in PD1 below. Press the MORE key to toggle between display PD1 and PD2.

PD1	P **0** PPM NH3 MORE SENS ALRMS DONE	Initial display for access to calibrating sensor modules or programming alarm setpoints.
	↓M ↑ ↓ M↑	
PD2	P **0** PPM NH3 MORE DISP SMPL DONE	Second display for access to programming display variables or adjusting “Sample Mode” timing functions.

These displays are your starting point for specific programming functions. Pressing the SENS key from PD1 provides access to sensor zeroing and spanning functions. Pressing the ALRMS key from PD1 provides access to the routines for adjusting alarm setpoints. Pressing the DISP key from PD2 allows adjustment of display variables. Pressing the SMPL key from PD2 allows adjustment of the timing variables used in the “Sample Mode” of measurement outlined on page 24 of this manual.

Sensor modules shipped with the C16 have been factory calibrated. No adjustments should be made to the calibration settings unless you have the necessary gas standards to perform such adjustments. Sensor adjustments are described in the last section of this programming section.

ADJUSTING ALARM SETPOINTS

The C16 contains three alarms, one for Caution, one for Warning, and one for Alarm. In the C16 as shipped from the factory, the Caution setpoint is programmed to detect negative drift of the sensor zero. Therefore, this setpoint will initially be programmed with a negative setpoint and will activate on a decreasing sensor signal. The Warning setpoint and the Alarm setpoint are set for positive values and activate on an increasing signal. The only exception to this is oxygen, where the Caution alarm is set at 25% and activates on an increasing signal while the Warning and Alarm functions activate on a falling signal.

The initial settings for these setpoints are somewhat arbitrary, and you can review these setting from the INFO screens. To change the setpoints and other alarm functions, press the ALRMS key from PD1. The display will change to display AD1 below, which allows access to the Caution, Warning, and Alarm setpoints. Press the switch for the alarm setpoint you wish to adjust and the display will change to one of the three displays shown below AD2.

AD1

```
P

CAUT  WARN ALRM  DONE
```

AD2

```
C      20 PPM
↓        NH3
      S.P.  FUNC  DONE
```

```
W      25 PPM
↑        NH3
      S.P.  FUNC  DONE
```

```
A      50 PPM
↑        NH3
      S.P.  FUNC  DONE
```

From these displays, you can adjust two variables, the setpoint (S.P.) and the function (FUNC) of the alarm. The alarm function refers to whether the alarm is a high or a low and is indicated by either an up arrow or a down arrow. For most gases, alarms activate on an increasing signal (high alarm), but for oxygen, a decreasing signal (low alarm) activates the alarm. Press the S.P. key to adjust setpoint value as shown in AD3 below. Press the FUNC key to set the alarm direction as shown in AD4 below. Note also that the alarms can be set to OFF in the FUNC routine.

AD3

```
A      50 PPM
↑        NH3
 ABORT   INC  DEC  SAVE
```

Display during setpoint adjustment. Use INC and DEC keys to raise and lower the value. Press SAVE when done. Press ABORT to return to AD2 without saving changes.

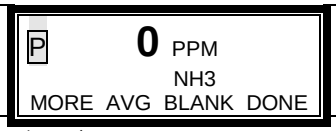
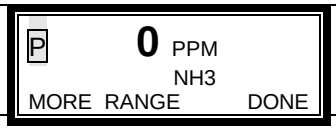
AD4

```
A      50 PPM
↑        NH3
 ABORT      SELECT  SAVE
```

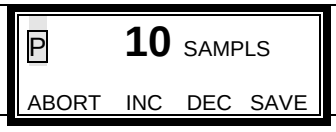
Display during alarm direction adjustment. Use SELECT to change the alarm function between high, low, or off. Press SAVE when done or ABORT to return to AD2.

SETTING DISPLAY VARIABLES

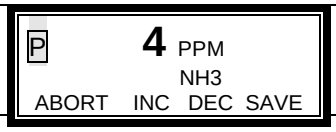
Three display variables may be adjusted on the ***PortaSens II***. The adjustments include display averaging, display blanking, and display range. To adjust display variables, start from display PD2 (see page 20). Press the key marked DISP. The display will change to VD1 below. Pressing the MORE key will toggle back and forth between VD1 and VD2, your starting point for adjusting the three display variables.

VD1		Initial display for adjustment of display averaging and blanking.
	↓M ↑ ↓ M↑	
VD2		Second display for adjustment of display range.

Display averaging is done to dampen out some of the normal variations in sensor readings, resulting in a more stable display value. The lower the averaging value, the faster the display will change and the more display variability will be observed. The higher the averaging value, the slower the display will change and the more display stability will be observed. Press the AVG key and follow the instructions in VD3 below to set the desired averaging. The gas concentration is calculated 20 times a second using a running average. The number set in the averaging routine represents the number of measurements averaged to obtain the displayed value.

VD3		Use the INC key to increase and the DEC key to decrease the number of samples. Press SAVE to change or ABORT to return to VD1.

Display blanking refers to the lowest value shown on the display. The C16 allows you to adjust the blanking if you wish to eliminate values close to zero that have no real significance. Normally, blanking values less than 2% of full scale simply eliminates the display of low values that are just as likely to be sensor noise as they are real gas values. For example, when using an ammonia detector over a range of 0-200 PPM, displaying values below about 4 PPM results in the display of meaningless numbers because the ammonia sensor zero is only stable to about 2 PPM. To adjust the blanking, press the BLANK key and follow the instructions in VD4 below.

VD4		Adjust the blanking value using the INC key to increase and the DEC key to decrease the blanking value. Press SAVE when done. Press ABORT to return to VD1.

The measuring range of the C16 detector depends on the sensor module installed. Display D7 (page 16) in the information displays shows the minimum and maximum full scale range for the sensor currently installed. Keep in mind the fact that the full scale range you set in this routine will only affect the voltage output, data logging functions, and sampling mode recovery setpoint. The display will still cover the entire operating range of the sensor. For example, when using an ammonia detector with a sensor range of 0-50 PPM minimum and 0-500 PPM maximum, the unit will always measure concentrations up to 500 PPM.

Changing the range can affect the display sensitivity for some sensor modules. For example, if an ozone sensor is installed with a range of 0-5 minimum and 0-100 maximum, setting a range of 0-20 would provide display resolution to 0.1 PPM while setting a range of 0-100 PPM would provide resolution of 1 PPM.

To change the range, start from display VD2 and follow the directions in VD5 below.

VD5	P **200** PPM NH3 ABORT INC DEC SAVE	Adjust the range using the INC key to increase and the DEC key to decrease the full-scale range. Press SAVE when done. Press ABORT to return to VD2.

SETTING SAMPLE MODE VARIABLES

As previously explained, the C16 detector provides the capability of measuring gas concentrations using a predefined measuring cycle. The measuring sequence used in "Sample Mode" measurements include the following sequence.

1. Draw sample for a predefined sampling time.
2. Measure gas concentration for a predefined measuring time. Calculate and average value for this measuring time.
3. Allow the measured value to recover below a predefined recovery value before allowing another cycle to start.

The sampling time, measuring time, and clearing limit are adjustable functions. To adjust Sample Mode variables, start at display PD2 and press the SMPL key. The display shown below will appear.

SD1	P SAMP MEAS CLEAR DONE

Press the SAMP key and the sampling time adjustment display will allow adjustment of the sampling time. Press the MEAS key to adjust the measuring time, and the CLEAR key to adjust the gas concentration below which the detector must fall before another measurement cycle can be initiated.

SD2	P SAMPLING 00:30 ABORT INC DEC SAVE	Adjust the sampling time using the INC key to increase and the DEC key to decrease the amount of sampling time. Press SAVE when done. Press ABORT to return to SD1.
SD3	P MEASURING 00:30 ABORT INC DEC SAVE	Adjust the measuring time using the INC key to increase and the DEC key to decrease the amount of measuring time. Press SAVE when done. Press ABORT to return to SD1.
SD4	P **15** PPM NH3 ABORT INC DEC SAVE	Adjust the clearing value limit using the INC key to increase and the DEC key to decrease the gas value. Press SAVE when done. Press ABORT to return to SD1.

When sample mode variables have been programmed press DONE as needed to return to the main display.

CALIBRATION

Calibration of a ***PortaSens II*** is a little different than calibrating many other types of detectors. While the procedure you will follow is similar to other detectors, the result of the calibration is storage of calibration constants in the sensor module, not in the detector. The C16 can use a broad range of sensor modules, and the calibration constants for each module are loaded into the detector as soon as the sensor is plugged in and the unit is turned on.

A primary advantage of this calibration data storage method is that sensor module calibration is independent of the detector being used. This means that sensor modules can be calibrated separately and simply plugged in to any C16 detector. Sensor modules can be removed from the detector and sent to ATI for factory calibration using special gas generation equipment unavailable to most users. Because stable gas standards for many gases are not readily available or are very expensive, this factory calibration technique can be much more economical in the long run. Contact ATI or your ATI representative for details on factory calibration service for sensor modules.

While factory calibration of sensor modules is a good alternative, many users may wish to perform their own calibrations, or at least be able to verify proper calibration. Calibration of the ***PortaSens II*** is recommended approx. every 6 months in normal use. If the unit is used very infrequently, yearly calibration should be sufficient. This can be done easily provided that the user has a reliable gas standard to use for the calibration procedure. If calibration gas is available, adjust the sensor zero and span as described below. Even if the user does not intend to perform span adjustments, it is a good idea to periodically check the sensor zero and reset to correct for any minor zero drift. Checking the zero every few months is recommended.

ZERO ADJUSTMENT

Proper adjustment of instrument zero is essential for accurate measurement. **ZERO ADJUSTMENT SHOULD ALWAYS BE DONE PRIOR TO MAKING SPAN ADJUSTMENTS**. A proper zero is set by exposing the sensor to an air sample know to be free of the target gas or any interfering gases, and adjusting the LCD display to a value of zero. Because the C16 is a portable instrument, exposing the sensor to a zero air sample is often very easy. Many (probably most) indoor working areas are likely to be free of the types of gases normally measured. However, background concentrations of a few gases such as CO, oxides of nitrogen, or ozone can be found in many areas, especially on smoggy summer days. An air conditioned office area will normally be free of most interferences. If in doubt, use zero air for setting the zero.

Supplying zero air and span gas to a C16 detector requires the use of a bypass “T” fitting inserted into the manifold as shown in Figure 5 on Page 26. The internal sample pump draws approximately 400 cc./min. through the sensor manifold. Zero and calibration gas cannot be fed into the pump under pressure, so it is necessary to flow gas through the bypass “T” at a rate that is higher that the internal pump is using. A lower flow rate will result in low values due to dilution. Zero air and span gas must flow through the bypass at a rate of 500 cc./min. or higher.

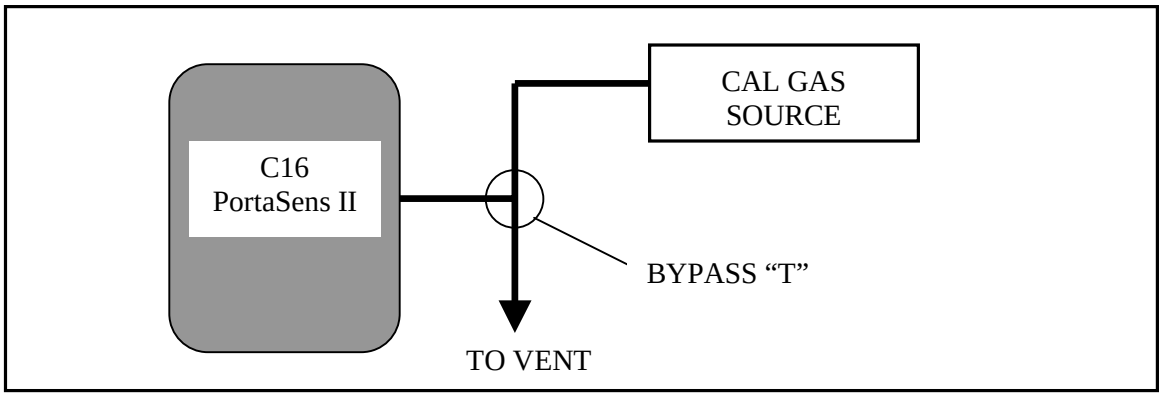


FIGURE 5 - CALIBRATION FLOW SCHEMATIC

To zero the detector, start at display PD1 and press the SENS key. The display CD1 will appear.

CD1	P **0** PPM NH3 ZERO SPAN DONE	Initial display for access to zero and span functions. Press ZERO to automatically store sensor zero. Press SPAN to adjust sensor span value. Press DONE to exit.

To adjust the zero, press the ZERO key and display CD2 will appear. Be sure that the unit is drawing in air free of the target gas or any interferences. Adjust as described in CD2 below.

CD2	P **0** PPM NH3 ABORT SAVE	Zero the unit by pressing the SAVE key. Any offset will be stored automatically and the display set to zero. Press ABORT to return to CD1 without saving the new zero.

To adjust the span of the sensor module, press the SPAN key and display CD3 will appear. At this point, it will be necessary to feed span gas through the bypass "T" connected to the manifold. Turn on span gas flow at a minimum of 500 cc./min. and allow to flow for 10 minutes. Span gas cylinders will be marked with the concentration of the specific gas on the label. After 10 minutes, adjust the display to the indicated span gas value as described in CD3.

CD3	P **50** PPM NH3 ABORT INC DEC SAVE	Adjust the display value to the span gas value using the INC key to increase and the DEC key to decrease the value. Press SAVE when done. Press ABORT to return to CD1.

When calibration is complete, press DONE as needed to return to the main display.

DATA LOGGING

The data logging function in the C16 is provided to allow collection and storage of gas concentration data over variable time periods. The data logger will store instantaneous gas values every 1, 5, 10, or 15 minutes. The logging interval is user selectable, and the logging is started and stopped using the keys on the instrument.

To set up the data interval, start the logger, and stop the logger, you must access the LOG menu. Beginning from the main display, press the MENU key to get to the display shown below.

M1	P **0** PPM NH3 LOG INFO DONE	Menu Mode display for access to information screens and logging functions.

Press the LOG key and the display will change to:

L1	01 Minute Interval 007 Days 20 Hrs Free CLEAR INT START DONE	Logger menu for clearing data, changing log interval, starting and stopping logger.

From this menu, the data logger can be cleared of accumulated data, the logging interval "INT" can be adjusted, and the logging can be started or stopped. The L1 display shown above may not always contain all of the softkeys shown. If the logger has recently been cleared, the CLEAR key will not be shown. If the logger is already running, the display will look like L2 below.

L2	01 Minute Interval 007 Days 20 Hrs Free STOP DONE	Alternate display to L1 above which appears if the logger is already running when this display is selected.

To clear the data logger, the logging function must be stopped. Be sure that the data you are clearing has previously been transferred to a computer, or that you want to simply discard the data. Once cleared, you cannot retrieve the data. When ready, press the CLEAR key and hold it for a few seconds. When the data has been cleared, the Days/Hrs Free numbers will reset to their maximum storage values.

To adjust the storage interval, press the INT key until you have selected the desired interval. You may select 1, 5, 10 or 15 minute intervals. Note that the Days/Hrs Free line will change when you select a different interval. This line tells you how long you can log data at the selected storage interval before the memory is full.

To start the data logger, press and hold the START key for a few seconds until the display switches to the main display. You will note that a logging active symbol appears on the display. This symbol (L^g) appears just above the OFF key on the display. If you watch this symbol carefully, you will see it change to an "s" each time a data point is stored.

To stop the logger, press and hold the STOP key for a few seconds until display L1 appears.

DATA LOGGER SOFTWARE

Your ***PortaSens II*** gas detector is supplied with "DataLog" software used to transfer stored data to a computer running Windows 95, Windows 98, or Windows 2000. The software is supplied on a CD ROM for installation.

Installing Software

To load the software on to your computer, place the disk in you CD drive, click the Start button, and run "setup". During the setup program, you will be prompted to answer a few questions regarding the location in which you want to store program and data files. Accepting the default values is recommended for most installations. Simply follow the prompts as they appear on your display. At the end, click FINISH. The setup will complete and your PC will restart.

Logging Periods

Each time the data logger is started and stopped, the data stored during that interval is separated into a separate data log within the C16 memory. That data is stored along with information about which sensor was used to gather the data and the range over which data was logged. When this data is transferred to a computer, each of the logging periods is separated so that stored data can be easily identified.

As explained later in this manual, the transferred data may be stored with separate files for each logging period or with all periods combined into one file. Either way, the data is easily identified as to the gas sensor used, and the data is converted to engineering units.

Starting the DataLog Program

Connect the C16 to your PC using the RS-232 cable supplied and turn on the C16. From your computer's "START" menu, select "PROGRAMS", "C16 Data Logger", "C16Log". As soon as you start the DataLog program, your computer will try to establish a connection to the detector. For this reason, it is a good idea to plug the RS-232 cable into your computer and into the C16 prior to starting the program. There is no harm in starting the program without the cable connected, but you will immediately get a communication error message. If so, simply connect the RS-232 cable to the C16, turn on the C16, and click "RETRY".

CAUTION: Plugging the communication cable into the C16 and starting communications with the DataLog software program will automatically stop the logging function. Do not connect the cable if you want to continue a logging session that has already been started.

Once the program is running, the program window will contain 2 tabs, one marked "Download" and one marked "Configure". Select the "Configure" tab if not already selected. Your window should look like Figure 6 below.

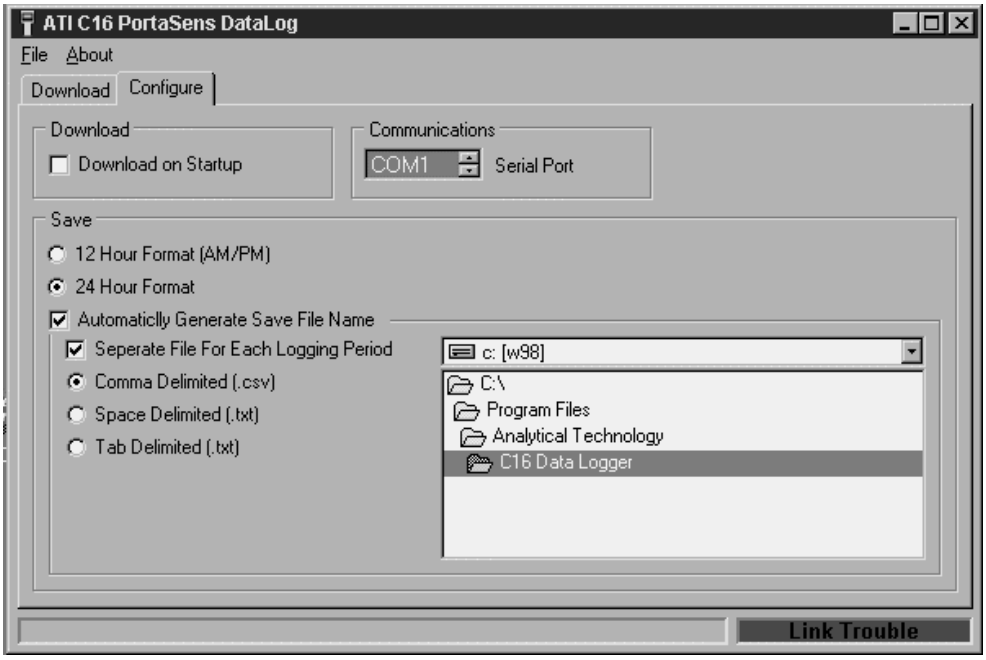


FIGURE 6 - CONFIGURE TAB IN DATALOG SOFTWARE

In the configure tab, you can select certain parameters that affect data transfer and storage. These selections include:

1. Download data automatically as soon as the program is started. If you check the "Download on Startup" box, data will automatically be read into your computer from the C16 as soon as the DataLog software is started (assuming your cable is connected, of course). If you want to download on command, leave that box unchecked.

2. Communication port selection. The default communication port is set to COM1. If you connect the C16 to a different serial port, simply scroll to the port using the down key next to the COM1 designation and click the port name when displayed.

3. Time format for the logged data. Data saved in the C16 contains a time stamp that can be in either a 12 or 24 hour format. Select the format that you want for the data stored in your computer. The default is 24 hour format.

4. Automatically generate the save file name. When data is downloaded to your computer from the C16, that data is stored in a data file in the C16 folder. The name for that file can be generated automatically, or the user may provide whatever file name is desired. If left unchecked, you will be prompted for a file name, a file type, and the location for the save file. When the "Automatically Generate Save File Name" box is checked, the program will automatically assign a filename. The file format will be "Log, XX, mm-dd-yyyy" in which XX will be replaced by the gas symbol for the sensor used in that logging period (for example: CO if a carbon monoxide sensor were used). The mm-dd-yyyy is the month-day-year in which the log was downloaded to the computer. If the C16 contains more than one log, the additional files will have a number appended to the end of the file name to indicate sequential files downloaded at the same time (for example: Log,CO,02-10-2000,1 followed by Log,CO,02-10-2000,2 etc.).

NOTE: Items 5, 6, and 7 below apply only if you checked "Automatically Generate Save File Name" box.

5. Separate file for each logging period. As explained on page 28, each logging period generates a data log in the C16. Each log can be stored in a separate file on your computer. If you prefer, data from a number of logging periods can be saved to a single Log file. The default for this function is "Separate File for Each Logging Period". If you prefer on file for multiple periods, uncheck this box.

6. File type generated during download. When data is received by the DataLog program, that data can be stored in one of 3 file types; comma delimited, space delimited, or tab delimited. The selection of which type of file to generate depends on what software is to be used to analyze and display the data. Comma delimited files are importable into most common spreadsheet programs such as Excel or Lotus 123. Other data handling programs may handle space or tab delimited formats more easily. The selection of file type is up to the user. The default is comma delimited.

7. Data storage location. Next to the selections for file types, you will find the path to the folder where your data is stored. If you wish to store data in another location, simply change the path to the desired location on this screen.

After you have adjusted your configuration to the desired settings, click the “Download” tab next to the configure tab. The display in Figure 7 will appear.

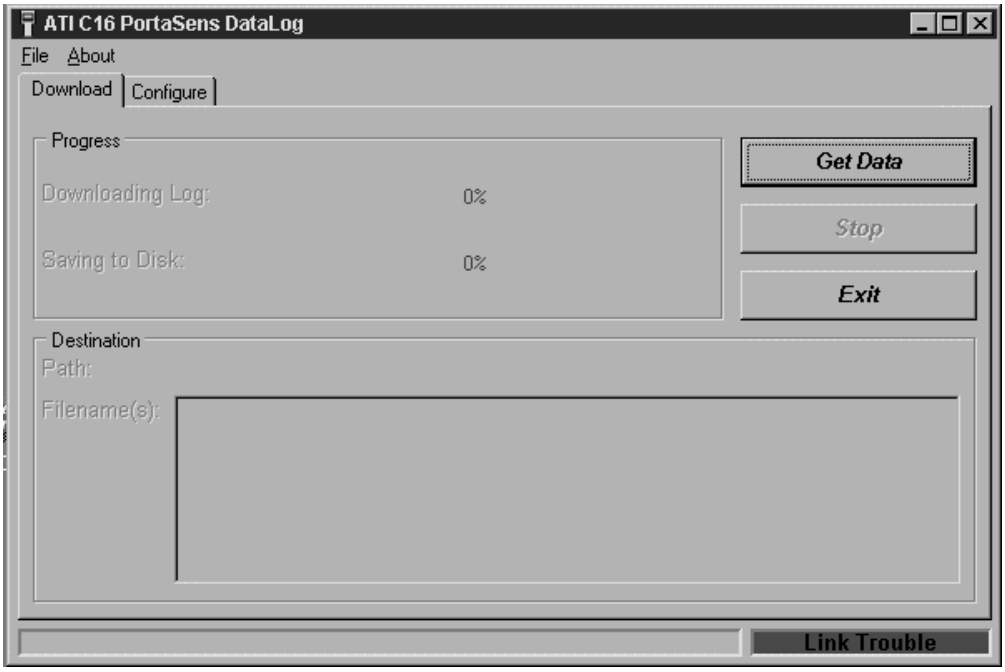


FIGURE 7 - DOWNLOAD TAB IN DATALOG SOFTWARE

This tab is provided to initiate the transfer of data from the C16 to your computer. The RS-232 cable must be connected from your computer serial port to the C16 data port in order to transfer data. The C16 must be running. In the lower right corner of this tab is a communication link status block. If the computer is communicating properly, the block will be green and indicate “Link OK”. If proper communication is not established, the block will be red and indicate “Link Trouble”. Link trouble can be caused by either selection of the wrong Com port in the Configure Tab, improperly connecting the RS-232 cable, not turning on the C16, or a faulty cable assembly. Contact ATI for assistance if this problem persists.

When you are ready to transfer data from the C16 to your computer, click the “Get Data” button. Bar graphs on the computer display will show the progress of the download and of the file saving operations. When complete, the file names assigned to each logging period and the save location will be displayed in the lower half of the DataLog window. If files were defined as comma delimited, a file extension of .CVS will be added to the file name. If files are stored as space or tab delimited, an extension of .TXT is used.

Display and Graph of Data

The DataLog program supplied with the C16 is designed only to transfer data and put it in a form that can be handled by standard spreadsheet programs. It is up to the user to import the data into whatever spreadsheet is to be used, and to generate reports and graphs using the tools supplied in the spreadsheet program. Programs such as Lotus 123 and Excel are very powerful and can provide data summaries in many different formats.

MAINTENANCE

Series C16 gas detectors require little maintenance. Sensors do not have a regular service requirement other than calibration, and pumps are sealed and permanently lubricated. The only item in the instrument that requires periodic maintenance is a filter that protects the pump against particulate that might cause it to stall. Check the filter at least monthly and replace when dirty.

The filter is a small disk of filter fabric that is located in the sensor recess behind the flow manifold. Unscrew the two captive screws holding the flow manifold in place and remove the manifold. The filter is just above the sensor and is simply pressed into the filter cavity. Remove the old filter disk and put a new one in its place. A bag of filters is supplied with the instrument and additional filter disks are available from ATI.

TROUBLESHOOTING

The ***PortaSens II*** is a self contained instrument that does not require regular service. Only periodic calibration should be necessary to maintain proper operation. Should a problem arise with the unit, there are a few tests that can be done to determine the source of the problem.

A: DETECTOR DOES NOT START WHEN SWITCH IS PRESSED

1. Check to see that a fresh battery is installed. Both the primary and secondary batteries must be discharged for this problem to occur. Plug the charger into the connector. Wait 5-10 minutes and then retry. If the instrument still doesn't start, contact ATI for service.

B: LOW BATTERY WARNING OCCURS QUICKLY AFTER EXTENDED CHARGE

1. Check battery charger under load by connecting an 12 ohm resistor across the charger and measuring the voltage. Voltage should be approximately 6 volts.

2. If charger is OK, battery is defective. The unit may be operated off the primary "D" cell without an operational NiCad. Unit must be returned to ATI for NiCad replacement.

C: DETECTOR DOES NOT RESPOND TO GAS

1. Run the Response Test outlined in this manual. If the instrument does not respond, the sensor is either depleted or has become fouled. Replace sensor or return to ATI for service.

D: PUMP TROUBLE ALARM DISPLAYED ON THE LCD

1. The pump trouble alarm will occur if the pump motor stops or if an internal pressure sensor detects blockage in the inlet. The cause might be a plugged inlet filter or inlet wand. If an extension is used, check that the tube is clear. Replace inlet filter as needed.

E: CONCENTRATION ALARM REMAINS ON FOR AN EXTENDED PERIOD

1. If the sensor has been exposed to a very high gas concentration (% levels), it can take a relatively long time to recover to zero. Simply leave the unit running for a few hours and the condition should clear itself. If the condition does not clear after 6 hours of operation, the sensor may have been damaged. Replace the sensor or contact ATI for service.

F: EXTERNAL FLOWMETER INDICATES NO FLOW, EVEN WITH PUMP RUNNING

1. Check filter assembly and replace if clogged.

2. Check that the manifold screws are secure and that the inlet fitting screwed into the manifold is tight. A loose manifold or fitting could cause air to be drawn into the pump from around the manifold without flowing through the inlet wand.

F: UNIT DOES NOT RESPOND WHEN KEYS ARE PRESSED.

1. Press and hold all four front panel keys for 5 seconds. This will reset the C16. Turn the C16 on by pressing the green key. If the C16 still does not operate, contact ATI for service.

SPARE PARTS LIST

PART NO.	DESCRIPTION
28-0015	Charger, 110 VAC
28-0016	Charger, 220 VAC
34-0137	Front panel Overlay
00-1088	Calibration "T"
44-0096	Quick Disconnect Inlet Fitting
05-0038	Spare filter disks, package of 10
03-0176	Extension Wand
03-0107	Flow Indicator with tubing adapter
90-0009	Carrying case with foam insert
43-0005	Charger & RS-232 connector dust cap
92-0063	Dust cap retaining screw (#4 x 5/16, ss pan head, type B)
03-0194	Battery compartment cap assembly
44-0123	Outlet Tube Barbed Fitting

SENSOR MODULES

Part Number	Smart Module
00-1000	Bromine, 0-1/5 PPM (2 PPM Standard)
00-1001	Bromine, 0-5/100 (20 PPM Standard)
00-1002	Chlorine, 0-1/5 PPM (2 PPM Standard)
00-1003	Chlorine, 0-5/100 (20 PPM Standard)
00-1004	Chlorine Dioxide, 0-1/5 PPM (2 PPM Standard)
00-1005	Chlorine Dioxide, 0-5/100 (20 PPM Standard)
00-1006	Fluorine, 0-1/5 PPM (2 PPM Standard)
00-1007	Fluorine, 0-5/100 (20 PPM Standard)
00-1008	Ozone, 0-1/5 PPM (2 PPM Standard)
00-1009	Ozone, 0-5/100 PPM (20 PPM Standard)
00-1010	Ammonia, 0-50/500 PPM (200 PPM Standard)
00-1011	Ammonia, 0-500/2000 PPM (1000 PPM Standard)
00-1012	Carbon Monoxide, 0-50/1000 PPM (200 PPM Standard)
00-1013	Hydrogen, 0-1/10% (4% Standard)
00-1014	Oxygen, 0-5/25% (25% Standard)
00-1015	Phosgene, 0-1/5 PPM (2 PPM Standard)
00-1016	Phosgene, 0-5/100 PPM (100 PPM Standard)
00-1017	Hydrogen Chloride, 0-10/200 PPM (20 PPM Standard)
00-1018	Hydrogen Cyanide, 0-10/200 PPM (20 PPM Standard)
00-1019	Hydrogen Fluoride, 0-10/200 PPM (20 PPM Standard)
00-1020	Hydrogen Sulfide, 0-10/200 PPM (20 PPM Standard)
00-1021	Nitric Oxide, 0-50/500 PPM (200 PPM Standard)
00-1022	Nitrogen Dioxide, 0-10/200 PPM (20 PPM Standard)
00-1023	Sulfur Dioxide, 0-10/500 PPM (20 PPM Standard)
00-1024	Arsine, 0-500/2000 PPB (1000 PPB Standard)
00-1025	Arsine, 0-10/200 PPM (10 PPM Standard)

Part Number	Smart Module
00-1026	Diborane, 0-500/2000 PPB (1000 PPB Standard)
00-1027	Diborane, 0-10/200 PPM (10 PPM Standard)
00-1028	Germane, 0-500/2000 PPB (1000 PPB Standard)
00-1029	Germane, 0-10/200 PPM (10 PPM Standard)
00-1030	Hydrogen Selenide, 0-500/2000 PPB (1000 PPB Standard)
00-1031	Hydrogen Selenide, 0-10/200 PPM (10 PPM Standard)
00-1032	Phosphine, 0-500/2000 PPB (1000 PPB Standard)
00-1033	Phosphine, 0-10/200 PPM (10 PPM Standard)
00-1034	Phosphine, 0-200/2000 PPM (1000 PPM Standard)
00-1035	Silane, 0-10/200 PPM (10 PPM Standard)
00-1036	Iodine, 0-1/5 PPM (2 PPM Standard)
00-1037	Iodine, 0-5/100 PPM (20 PPM Standard)
00-1038	Acid Gases, 0-10/200 PPM (20 PPM Standard)
00-1039	Ethylene Oxide, 0-20/200 PPM (20 PPM Standard)
00-1040	Formaldehyde, 0-20/200 PPM (20 PPM Standard)
00-1041	Hydrogen, 0-500/2000 PPM (2000 PPM Standard)
00-1042	Hydrogen Peroxide, 0-10/100 PPM (20 PPM Standard)
00-1043	Alcohol, 0-50/500 PPM (200 PPM Standard)
00-1044	Alcohol, 0-500/2000 PPM (2000 PPM Standard)
00-1057	Acetylene, 0-50/500 PPM (0-200 PPM Standard)