1.1 SYSTEM OVERVIEW

The Molecular Analytics (MA) AirSentry Ion Mobility Spectrometry (ASIMS,) is depicted on the block diagram in Figure 1.1. **This manual covers only the analyzer component. For specific information and system parameters, and interconnect diagram see Appendix E "Customer Specific Information". The analyzer may or may not have been supplied with various internal options such as: on-board calibration (OBC), stack sample system, air cleanup unit (ACU). Please refer to the separate manuals supplied with these external devices (if supplied) for greater detail. Some systems may be supplied as an integrated package, with various options. Please refer to the interconnection diagrams in Appendix E prior to installation.**

Special Note

All references to NH3 or ammonia in figures or in the body of the text may be replaced with amines.

The analyzer is the system component that monitors the concentration of a target chemical. The technology of this analyzer is Ion Mobility Spectrometry (IMS). A basic description of the analyzer, including performance and operational features, is included in this section. Appendix A provides more detailed specifications for the analyzer.

1.2 ANALYZER UNIT PRINCIPLES OF OPERATION

The analyzer detects and quantifies the concentration of the target chemical(s). A pictorial of the analyzer is shown on Figure 1.2. Figures 1.3, 1.4, 1.5 and 1.6 show the major components and block diagrams for the analyzer electronics and pneumatics respectively. This analyzer contains 2 separate cells, each with a different dopant. This allows two compounds to be quantified specifically. The front panel display always indicates concentrations for each gas. However, certain information on the main screen pertains only to the gas selected (indicated with the > sign next to the gas). The screens must be toggled by use of the "Display Mode" button on the front panel to obtain information on both gases, and before changing parameters in the menu.

The principle of operation is Ion Mobility Spectrometry (IMS), which operates in a similar mode to an atmospheric pressure time of flight mass spectrometer. The detection is effected through an IMS cell which allows indirect ionization of the sample through an internal Ni63 ring (beta ionization source) and the use of dopants. The resultant ion clusters are separated in the presence of an electric field to yield a spectra that is interpreted in real time through the use of a software algorithm. A resident microprocessor and associated electronics process the

spectral data and correlate it to actual measurements with calibration data and other relevant parameters stored in non-volatile memory, thus generating a local readout an isolated 4-20 mA output signal proportional to the concentration of the chemical of interest, as well as an RS 232 port which can be used to log concentrations and other data. The output signals are updated every second. The analyzer makes use of a fault relay to indicate faults. Fault codes are indicated on the front panel of the analyzer.

The analyzer also includes an integral 4 point sampling system. This permits sampling up to 4 points sequentially (auto mode) or staying on one channel (manual mode). Sample is constantly being pulled into the analyzer from each of the points, to assure sampling lines stay at equilibrium. The 3 points not being sampled by the analyzer are drawn by an eductor and simply vented. The active channel is pulled through a pump, and sent to both cells for analysis. The active channel concentrations are shown on the main display.

There are 4 additional relays which can be configured in two ways. In "Alarm Mode" the relays provide a contact closure to indicate that one or both of the gas concentrations has exceeded a user set parameter for that channel (1 through 4). In "Status Mode", the relays are used to provide a binary description of which channel is being sampled at any point in time. In "Status Mode", the analyzer provides no alarms other than fault. If used in this mode, alarms must be by an external device.

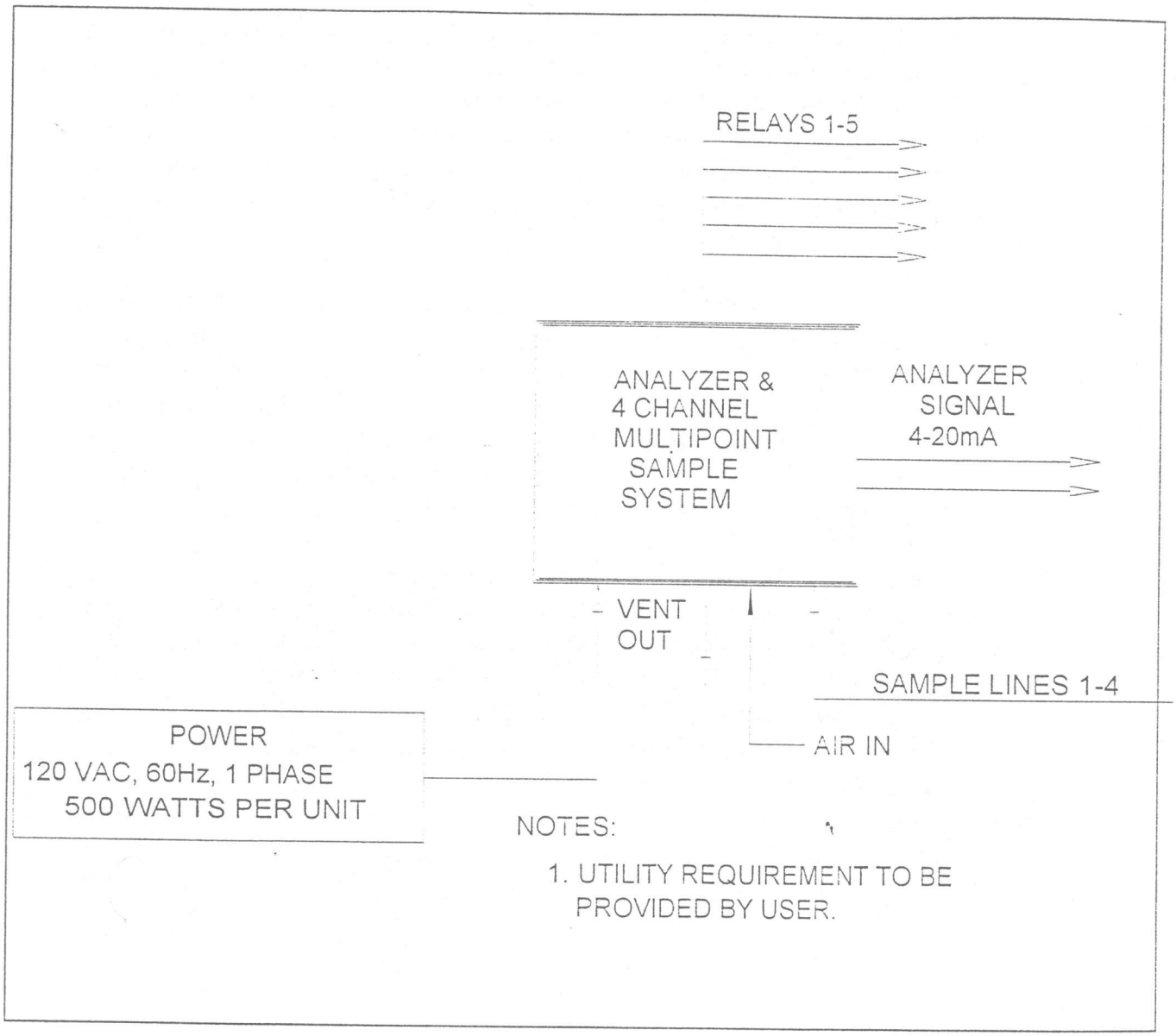


Figure 1.1 BLOCK DIAGRAM OF AS-IMS SYSTEM

APPENDIX A
SYSTEM GENERAL SPECIFICATIONS

A I ANALYZER

General Specifications: This analyzer has been certified to meet the following UL, CSA, and EN standards for electrical equipment:
UL standard 3101-1. CSA standard C22.2 # 1010-1 for 120VAC systems only.
EN standard 61010-1 for 230VAC systems only

An outline is shown in Figure A-1 and a block diagram in Figure A-2.

A II Physical Configuration:

Dimensions	24"H x 24"W x 8.8"D SINGLE. NEMA 4X. Enclosure.
Weight	Approximately 90 pounds.
Mounting Requirements	See Figure A-1 page62
Orientation Sensitive	No
Output:	Two 4-20 mA self-powered. isolated current loop. RS-232 port

A III Local Indicators:

LCD Display

A IV Relay Output:

Alarm Relays are user programmable

- 4 Relays SPDT; 12A. 250 VAC; 5A. 30 VDC.
- FAULT SPDT; 12A. 250 VAC. 5A. 30 VDC.
- Screw terminal block accepts 12-22g. AWG wire. solid or stranded.
-

A V Calibration:

Factory set calibration user adjustable

A VI Environmental Data:

Operating Environment — NEMA 4 and 4X enclosure allows indoor/outdoor all weather operation. UL/CSA/EN rated for indoor operation only per UL standard 3101-1. CSA standard C22.2 #1010-1, and EN standard 61010-1.

Operation Temperature Range:	-40°F to 113°F (-40°C to 45°C)
Storage Temperature Range:	-4°F to 122°F (-20°C to 50°C)
Start-Up Temperature Range:	-40°F to 122°F (-40°C to 50°C)
Humidity Range:	0-100% RH (Long term storage requires non-condensing humidity)
Altitude:	0-10,000 feet (Consult factory for higher altitude)
Environmental Restrictions:	Unit must operate at atmospheric pressure. Unit must be re-zeroed if atmospheric pressure changes more than +/- 4%

A VII Utility Requirements:

Power:	120 VAC, 5A Max. 50/60 Hz.
Instrument Air:	Clean, dry air @ -40°C or lower DEW point. Free of oil, dust, and chemical contamination. 20-120 psi, 50 LPM max.
	Nitrogen may be used for NH3 and NMP analyzers. **Special safety precautions must be used to prevent oxygen deprivation if nitrogen is used.**
	Restrictions: DO NOT use inert gas in lieu of instrument air unless specifically instructed to do so since this may cause erroneous readings.

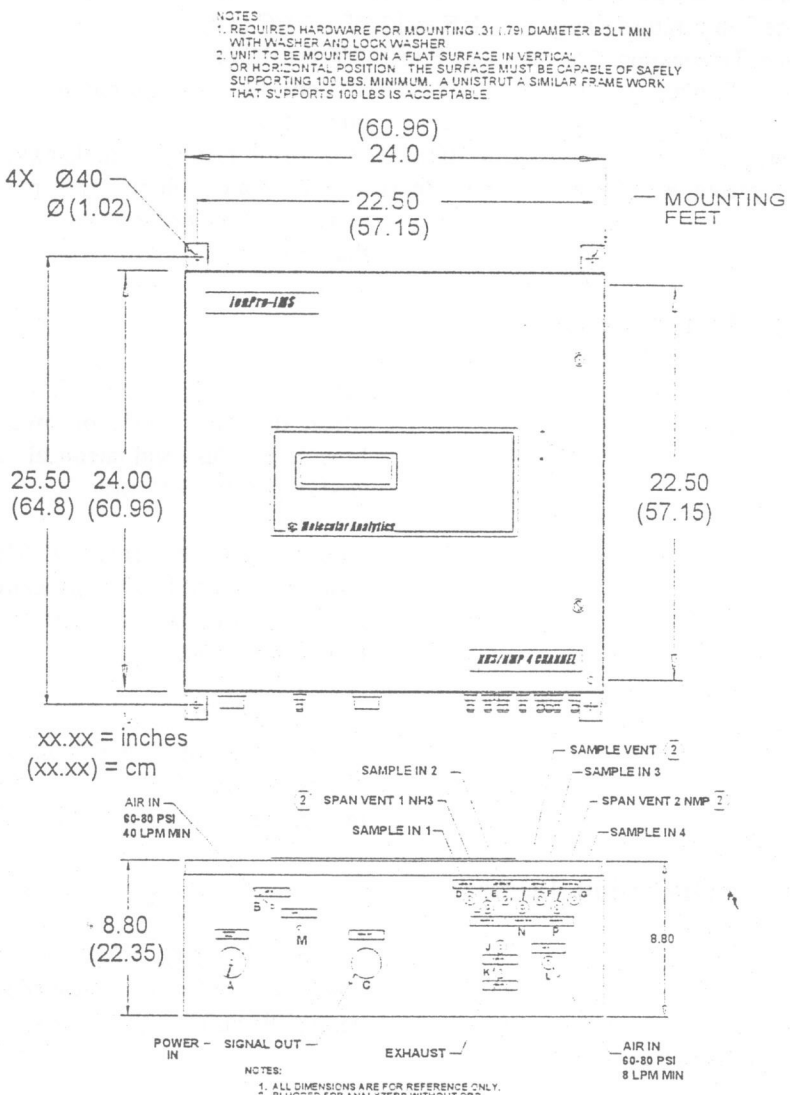
A VIII Detector Operational Data:

Ionization Source:	2 each Ni63 Beta ionization source. 10mC nominal. 15mC max. Sealed source. Meets general licensing requirements.
Dopant Chemistry:	Yes
Sensor Life:	In excess of 10 Years

A IX Service Suitability:

- Field Serviceable Unit
- Power MUST be removed before maintenance
- Contains IMS cell that is field replaceable but repairable at the factory ONLY
- Training on system operation, maintenance, and repair is strongly recommended
- Repair by trained qualified personnel ONLY

Molecular Analytics



ID	FUNCTION	SIZE	NOTE
A	POWER IN 120 VAC 50/60Hz 1 PHASE 500 W MAX	3/4 FEMALE NPT	POWER CABLE PROVIDED STANDARD
B	AIR IN	.25 DIA TUBING	60-80 PSI 8 LPM MIN
C	4-20mA SIGNAL RELAY OUT	3/4 FEMALE NPT	
D	SAMPLE IN 1	.25 DIA TUBING	
E	SAMPLE IN 2	.25 DIA TUBING	
F	SAMPLE IN 3	.25 DIA TUBING	
G	SAMPLE IN 4	.25 DIA TUBING	
H	SPAN VENT 1 (NH3)	.25 DIA TUBING	2
J	EXHAUST 1	.25 DIA TUBING	
K	EXHAUST 2	.25 DIA TUBING	
L	AIR IN	.25 DIA TUBING	60-80 PSI 40 LPM MIN
M	VENT		
N	SAMPLE VENT	.25 DIA TUBING	2
P	SAMPLE IN 1		2

Figure A- 1 ANALYZER UNIT OUTLINE DRAWING

ANALYZER

IMS - ELECTRONICS

- Multifunction Microprocessor Boards
- AC Control Circuits
- AC/DC Supply 120 or 230 vac to 12vdc
- High Voltage Circuits
- User Interfaces:
  - Operator Display & Switches
  - 4-20 mA Loop
  - RS232 output
  - Relay Contact Outputs:
  - Fault Alarm
  - Two User Setable Concentration Alarms
- Detector Interface
- Temperature Sensing and Control
- Enclosure Heater

IMS-DETECTOR (CELL) AND PNEUMATICS

- IMS Cells
- Dopan tDispenser(s)
- Air Scrubber Kit
- Pressure Regulators
- Pressure Switch
- Fan
- Enclosure Heater
- Cell Flow Controls
- Span gas oven, metering valve, and teflon solenoid valves; On-Board Calibration (OBC) units only.

Figure A- II ANALYZER UNIT MAJOR COMPONENTS