

METROSONICS
aq-501 Air Quality Monitor
and
ms-936 Metrosoft
MANUAL

METROSONICS, INC. P.O. BOX 23075 ROCHESTER, NY 14692
PART NUMBER 936-200-003 REV. C

WARRANTY CLAUSE

METROSONICS, INC. warrants each new instrument manufactured and sold to be free from defects in material, workmanship and construction, except for batteries which may be contained therein, and that when used in accordance with this owner's manual will perform to applicable specifications for a period of one year after shipment.

If examination by METROSONICS, INC. discloses that the product has been defective, then our obligation is limited to repair or replacement, at our option, of the defective unit or its components. METROSONICS, INC. is not responsible for products which have been subject to misuse, alteration, accident or for repairs not performed by METROSONICS, INC.

The foregoing warranty constitutes METROSONICS, INC. sole liability, and is in lieu of any other warranty, of merchantability or fitness. METROSONICS, INC. shall not be responsible for any incidental or consequential damages arising from any breach of warranty.

SERVICE INFORMATION

In the event the aq-501 needs repair or service, or ms-936 Metrosoft appears defective, call the METROSONICS Service Department at (716) 334-7300. The service department will determine the cause of the apparent malfunction and provide the necessary support to correct the problem. In some cases, problems can be corrected over the telephone. Therefore, before returning a piece of equipment to the factory for service, discuss all problems with the Service Department.

EQUIPMENT RETURN

Prior to returning any equipment, obtain a Return Authorization number from the METROSONICS Service Department (716-334-7300). Each shipment must have a packing slip which includes:

1. A Return Authorization number.
2. A list of all items enclosed with applicable serial numbers.
3. Reason for returning equipment (e.g. recalibration, or malfunction; describe the malfunction in detail).
4. Billing and shipping address for return of the equipment.

Equipment must be returned properly packaged with transportation charges prepaid to METROSONICS, INC.; return transportation charges will be F.O.B. factory. Return equipment to:

Metrosonics, Inc.
201 Scottsville - West Henrietta Rd.
West Henrietta, New York 14586
Attention: Service Department

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APPENDIX A: SOFTWARE REVISIONS

Chapter 1 INTRODUCTION

The aq-501 Air Quality Monitor was developed to address the on going problem of Tight Building Syndrome. In this one instrument, air temperature, relative humidity and carbon dioxide are accurately measured and recorded. Two extra channels are provided to monitor additional parameters, such as air velocity, particulates, etc., plus a variety of gases using Metrosonics gas sensors.

The aq-501 is available in two enclosure types. A portable instrument case is available for surveys or temporary monitoring. The fixed mounting enclosure is designed for long term monitoring where power and RS-232 communications can be hard wired to the unit.

The operator interface is controlled by four push buttons on the front panel. Information and data are displayed in a user friendly format on a 2-line by 16-character Liquid Crystal Display (LCD).

Using ms-936 Metrosoft, the aq-501 can be programmed, remotely controlled or data collected and archived, ms-936 is available for an IBM PC or compatible computer.

Fully formatted reports can be sent directly to a printer from the aq-501.

Chapter 2 SPECIFICATIONS

INPUTS:

Carbon Dioxide:	Range: 0 to 5000 PPM Accuracy: $\pm 3\%$ of Full Scale @ 25°C (77°F) Resolution: 1 PPM Detector: NDIR (non-dispersive infrared)										
Relative Humidity:	Range: 0 to 100% Accuracy: $\pm 3\%$ @ 25°C (77°F) Resolution: 0.1% Detector: Capacitive										
Temperature:	Range: 0° to +60°C (+32° to +140°F) Accuracy: $\pm 0.5^\circ\text{C}$ ($\pm 0.9^\circ\text{F}$) Resolution: 0.1° Detector: RTD										
Extra Channels:	<u>Linear Channel:</u> Linear DC voltage range: 10mv, 100mv, 1 v or 5v Resolution: 0.1% <u>Toxic Gas Channel:</u> Display Resolution: 0.1 or 1 ppm, depending on sensor Full Scale: <table border="0" style="margin-left: 20px;"> <thead> <tr> <th style="text-align: left;">GAS TYPE</th> <th style="text-align: left;">FS ppm</th> </tr> </thead> <tbody> <tr> <td>Carbon Monoxide (CO)</td> <td>1000</td> </tr> <tr> <td>Hydrogen Sulfide (H2S)</td> <td>200</td> </tr> <tr> <td>Sulfur Dioxide (SO2)</td> <td>200</td> </tr> <tr> <td>Chlorine (Cl2)</td> <td>20</td> </tr> </tbody> </table>	GAS TYPE	FS ppm	Carbon Monoxide (CO)	1000	Hydrogen Sulfide (H2S)	200	Sulfur Dioxide (SO2)	200	Chlorine (Cl2)	20
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Carbon Monoxide (CO)	1000										
Hydrogen Sulfide (H2S)	200										
Sulfur Dioxide (SO2)	200										
Chlorine (Cl2)	20										

DATA STORAGE: Standard: 16,000 total samples
Optional: 32,000, 64,000, 128,000 total samples

DISPLAY: 16-character by 2-line LCD

REAL TIME CLOCK: 0.01% accuracy

PERIOD: 1,5,15 minutes or 1 hour samples or averages

COMMUNICATIONS: Format: RS-232, 1 start, 8 data, 1 stop bit, no parity
Baud Rate: 150 to 9600

PRINTER OUTPUT: Separate reports for each logging session indicating minimum, maximum and time of occurrence, elapsed time and average per session, and complete time history

INTERNAL POWER: Rechargeable sealed lead acid battery
Operational Life @ 25°C: 8 hours
Data Retention: 30 days in the event of a low battery

EXTERNAL POWER: 115/230 VAC $\pm 10\%$ (50/60 Hz)

TEMPERATURE: Operating: 0° to +50°C
Storage: -20° to +60°C

2.1 PROGRAMMABLE FEATURES

TEMPERATURE SCALE: °C or °F

UPPER AND LOWER ALARM LIMITS: CO2: 0 to 5000 PPM
Temperature: 0 to 50°C
Relative Humidity: 0 to 100 %

EXTRA CHANNELS: Linear Channel:
Range: 10mv, 100mv, 1v and 5v
Units: user supplied
Alarm: upper and lower over operating range
Calibration: 2-point Y=mX+b
Toxic Gas Channel:
Gas Type: CO, SO2, H2S, Cl2
Alarm: Upper and lower over valid range for sensor

SYSTEM: Printer Baud Rate: 150 to 9600
Report Type: Complete or Summary
Period: Average: 1, 5, 15 min and 1 hour
Sample: 1, 5, 15 min and 1 hour
Record on Alarm: On or Off
Auto Stop Recording and Length

Chapter 3

ACCESSORIES

al-501	Alarm Relay (24VAC, 1A contact rating)
ca-371	RS-232 Printer/Computer Interface Cable
ca-501-10	10 Foot Sensor Extension Cable
dp-426	Portable InkJet Printer
mm-501-32K	32,000 Sample Memory
mm-501-64K	64,000 Sample Memory
mm-501-128K	128,000 Sample Memory
pc-1000	Portable Lap Top Computer
sg-C02-1000	Replacement bottle of span gas for CO ₂ calibration at 1000 ppm
sg-C02-5000	Replacement bottle of span gas for CO ₂ calibration at 5000 ppm
sg-N2-0	Replacement bottle of span gas for zero scale N ₂ calibration
sk-1000	Calibration kit containing 1000 ppm CO ₂ in air and N ₂ span gases
sk-5000	Calibration kit containing 5000 ppm CO ₂ in air and N ₂ span gases
ca-7710	Extension Cable (10 ft.)
ca-7725	Extension Cable (25 ft.)
cl-7700	Calibrator Adaptor
fc-7700	Filter Cover
fl-7700	Filter Element
gs-7701	CO Gas Sensor Assembly
gs-7702	H ₂ S Gas Sensor Assembly
gs-7703	SO ₂ Gas Sensor Assembly
gs-7704	Cl ₂ Gas Sensor Assembly
gs-CO-200	200 ppm CO replacement gas
sg-H2s-20	20 ppm H ₂ S replacement gas
sg-S02-35	35 ppm SO ₂ replacement gas
sg-Cl2-10	10 ppm Cl ₂ replacement gas
sk-7701	Calibration kit with 200 ppm CO gas
sk-7702	Calibration kit with 20 ppm H ₂ S gas
sk-7703	Calibration kit with 35 ppm SO ₂ gas
sk-7704	Calibration kit with 10 ppm Cl ₂ gas

Chapter 4

aq-501 OPERATION

Three push buttons control unit operation. The fourth button turns power on and off. These buttons perform independently except for clearing data.

ON/OFF

Turn the aq-501 on or off.

RECORD

Toggle the aq-501 between start and stop recording.

PRINT

Initiate an output report to a serial RS-232 printer.

STATUS

Display a list of system parameters.

4.1 ON/OFF

When the unit is turned on, the message TIME AND DATE NOT PROGRAMMED may be displayed. This indicates that the real time clock has not been set for the correct time and all data will be time annotated with elapsed time relative to the start of the test. The time and date can be programmed with ms-936.

The aq-501 next displays the input levels measured with the sensors. Initially there is a settling period for the different sensors to converge on a stable operating point.

The unit may be turned off at any time by pressing the ON/OFF button unless a test is in progress.

4.2 RECORD

Once the aq-501 is turned on, recording may begin. If RECORD is pressed immediately after turn on, the message PURGING is displayed. This indicates that the unit is still in its settling period and will begin recording after this time has elapsed.

Each time a recording session is started a new incremental test number is automatically assigned to the data.

During a recording session, the aq-501 periodically samples the sensors and updates its memory based on current levels. The programmed period length (from 1 minute to 1 hour) determines the frequency at which data is stored in memory. Either single samples for all input channels, or average readings for the entire period's duration are saved, based upon the aq-501 programming.

Once every 5 seconds the message RECORDING or NOT RECORDING is displayed.

Press the RECORD button while the aq-501 is recording to conclude the present test.

4.3 PRINT

The PRINT button starts a complete or summary report sent at the baud rate programmed from ms-936. The report may be terminated prematurely by pressing the PRINT button a second time.

While the report is being transmitted to the serial printer, the aq-501 display reads OUTPUT BUSY.

4.4 STATUS

The STATUS button provides the operator with information on the unit's present condition. Battery voltage, which should be greater than 12.0 volts, is the first item in the list. Available memory (in percent and recording time) is displayed next, followed by the current date and time, and finally the test number and elapsed time of the test.

Press the STATUS button once to start an automatic sequence of scrolling through these screens. Press the STATUS button repeatedly to step through the screens quickly. Hold the STATUS button down to keep a particular screen on the display until the button is released.

4.5 CALIBRATION

The humidity and temperature sensors cannot be calibrated in the field. The aq-501 and the sensor assembly should be returned to the factory for yearly recalibration.

4.5.1 CO₂ SENSOR

The CO₂ sensor may be calibrated in the field if a supply of calibration gas is available. The recommended gases are nitrogen, for setting the zero, 1000 or 5000 PPM CO₂ in air mixture, for setting the span.

To calibrate the CO₂ sensor:

1. Turn the aq-501 on, and let it stabilize.
2. Attach the regulator to the N₂ bottle and the aq-501.
3. Open the valve on the regulator.
4. After the reading settles, slowly turn the ZERO adjustment until the reading varies around zero. Note that negative readings are produced to help in this adjustment.
5. Turn the regulator off and remove it from the N₂ bottle. Install the regulator on the CO₂ bottle and connect to the aq-501.
6. Open the valve on the regulator.
7. After the reading settles, slowly turn the SPAN adjustment until the reading varies around the value printed on the span gas bottle.

Because of the interaction between the zero and span adjustments, it may be necessary to repeat the above procedure.

Other concentrations of CO₂, in the range of the unit, may be used for the purpose of calibration.

4.5.2 TOXIC GAS SENSOR

The gs-77xx series of toxic gas sensors are based on well established electrochemical sensor technology. The three electrode toxic gas cells are maintenance free and stable for long periods of use.

The sensors are easily calibrated using a cl-7700 calibrator adaptor and the appropriate sk-77xx calibration kit. For best performance calibration should be verified on a regular basis.

INTERFERENCE GASES/CROSS SENSITIVITY

This table illustrates the cross-sensitivity to a range of commonly encountered gases, expressed as the reading of the sensor, when exposed to 100 ppm of the interfering gas at 20°C.

GAS	SENSOR	INTERFERING GAS								
		CO	H ₂ S	SO ₂	NO	NO ₂	H ₂	Cl ₂	HCN	C ₂ H ₄
CO	gs-7701	100	<10	<10	≈30	≈40	<40	N/D	N/D	N/D
H ₂ S	gs-7702	<7	100	<20	0	≈20	<5	≈20	0	0
SO ₂	gs-7703	0	≈200	100	0	≈140	0	≈15	<30	≈180
Cl ₂	gs-7704	0	≈20	<0.5	0	≈105	0	100	<1	0

NOTE: All sensors show no response to either CH₄ or CO₂. N/D = No data available yet.

All items necessary for proper calibration are the cl-7700 calibration adaptor, the appropriate sk-77xx calibration kit with flow regulator, and gs-77xx replacement calibration gases.

Due to the presence of toxic gas during the calibration, appropriate safety procedures should be followed. The validity of this calibration is directly related to the accuracy of the calibration gas, and the care taken during the calibration procedure.

• ZERO ADJUSTMENT

Remove the filter cover and dust filter from the front of the sensor assembly. This is accomplished by rotating the filter cover 1/8 turn, then lifting the cover straight from the sensor housing. Place the calibration adaptor on the sensor housing by locating the tab on the cl-7700 in the slot on the side of the sensor, then press the opposite side of the adaptor onto the sensor.

The regulator supplied in the calibration kit has been set for a 200 ml/minute flow rate. This regulator should be used for all calibrations.

Attach the regulator to a bottle of pure Nitrogen (Sg-N₂). Attach the regulator to the calibration cap with the tubing supplied. Turn on the logger and the gas supply. Let the unit sit until the reading settles, approximately 2 minutes. Now, adjust the potentiometer labeled Z for a reading of 0.0 ppm. Notice that negative numbers are displayed to help accurately locate a zero setting. Turn off the gas supply when this procedure is complete.

An alternate approach to zero adjustment may be used if the ambient air is free of toxic gases. Turn on the logger and let the unit sit until the reading settles, approximately 2 minutes. Adjust the potentiometer labeled Z for a reading of 0.0 ppm.

NOTE: The calibration cap, cl-7700, should not be on the sensor during this procedure.

- **SPAN ADJUSTMENT**

Attach the regulator to the bottle of calibration gas and the calibration cap. Turn on the gas supply and wait for the reading to settle, approximately 2 minutes. Now, adjust the potentiometer labeled S for the reading indicated as the concentration on the calibration gas bottle. Turn off the gas supply when this procedure is complete.

4.6 CLEARING DATA

To erase previous test data, simultaneously press the PRINT, STATUS and ON/OFF buttons. The display will show:

CLEAR DATA ?
1

The unit will count to 5 and then display:

ALL DATA
ERASED

If the buttons are released before the aq-501 counts to 5, data will not be erased.

Data can also be erased using ms-936 Metrosoft.

4.7 INTERNAL LEAD ACID BATTERY

The aq-501 is provided with a sealed 12 volt lead acid battery. The battery provides power for programming and data retention. It may also be used as the unit power for short duration tests.

A battery with sufficient charge to operate the unit properly must have a voltage over 12.0 volts. If the battery drops under 12.0 volts while the unit is operating, all operations cease and the unit will perform an orderly shut down to protect any data already present in memory.

To recharge the battery, plug the aq-501 into a standard AC outlet for a few hours. Complete recharge takes approximately 12 hours. Under normal conditions this will not occur because the unit is intended to operate while connected to the AC line.

4.8 PRINTER/COMPUTER INTERFACE

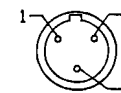
There are only six communication requirements for any computer or printer to work with the aq-501 Air Quality Monitor:

1. Serial RS-232 communications using at least the transmit (TX pin 2), receive (RX pin 3) and common ground (GND pin 7) lines.
2. Accept XON/XOFF software handshaking, also known as DC1 /DC3 or Ctrl-S/Ctrl-Q.
3. Accept a baud rate between 150 and 9600 baud.
4. Data format of 1 start bit, 8 data bits, 1 stop bit and no parity.
5. Accept the standard ASCII character set.
6. Support 80 column printouts.

4.9 EXTRA LINEAR CHANNEL

The extra linear channel is a non-isolated, differential input which accepts bipolar signals up to 5 volts. Turning the channel on and selecting its operating range and calibration points is accomplished using ms-936. The input connector is designated as follows:

- pin
1 Ground
2 Signal Low
3 Signal High

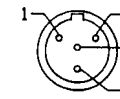


4.10 ALARM RELAY (optional)

The alarm relay (Metrosonics #al-501) is programmable for contact closure on high or low level exceedances. Any or all channels may control the alarm status, depending upon which alarms are on at active channels (set up using ms-936). The alarm relay contacts are rated at 24 VAC and 1 amp.

Connector designations are as follows:

- pin
1 no connection
2 no connection
3 contact
4 contact



Chapter 5

ms-936 METROSOFT SOFTWARE PACKAGE

This version of ms-936 is compatible with logger configuration files and test data files saved using older versions. It also functions fully with all versions of the aq-501. Older loggers did not have a 5th toxic gas channel, used with Metrosonics gas sensors. Previous versions of ms-936 (V1.0 and V1.1) will not function properly with an aq-501 equipped with the 5th toxic gas channel.

5.1 MINIMUM COMPUTER REQUIREMENTS

1. IBM PC, XT, AT, or true compatible computer.
2. 256K RAM.
3. MS-DOS or PC-DOS version 2.0 or later.
4. A Color Graphics Adapter or other CGA-compatible graphics interface board.
5. A monochrome monitor.
6. An Asynchronous Communication Adapter or other serial interface board.
7. Dual floppy drives, or one floppy drive and one hard disk.
8. A parallel or serial printer, with IBM/Epson or HP compatible graphics commands.

5.2 COPYING THE METROSOFT MASTER DISK(S)

Metrosoft sent from the factory should be backed up prior to use. This involves copying all information on the one 3½" or two 5¼" master disk(s).

- UPDATING AN OLD VERSION OF ms-936

Before copying ms-936 to a work disk (floppy or hard), delete all old ms-936 program files (.EXE) and the Metrosoft configuration file (CONFIG.MET). You will need to reconfigure ms-936 (for your printer, data drive, etc.) after the new version has been transferred to the work disk.

- COPYING METROSOFT ON A DUAL FLOPPY DISK SYSTEM:

1. Put your disk operating system (DOS) disk in drive A.
2. Put a blank disk in drive B.
3. Format two 5¼" or one 3½" disk(s) using the DOS FORMAT command.

4. Remove the DOS disk from drive A and replace it with the Metrosoft SYSTEM DISK. Type the following command:

```
COPY A:*.* B:
```

This transfers all files on the Metrosoft SYSTEM DISK to the working copy disk.

5. If Metrosoft is on 5¼" disks remove the Metrosoft SYSTEM DISK from drive A and replace it with the Metrosoft DATA ANALYSIS DISK. Remove the working copy of the SYSTEM DISK from drive B and replace it with the other blank formatted disk. Type The following command:

```
COPY A:*.* B:
```

This transfers all files on the Metrosoft DATA ANALYSIS DISK to the working copy disk.

6. You now have a working copy of Metrosoft. Store the master disk(s) in a safe place.

- **COPYING METROSOFT ON A HARD DISK SYSTEM:**

The following discussion assumes that the hard disk is designated drive C and contains the operating system.

1. If you wish, create a subdirectory from which to run ms-936. This is done in the root directory with commands similar to the following:

```
MD\MS936  
CD\MS936
```

2. Insert your Metrosoft SYSTEM DISK in drive A and type the following command:

```
COPY A:*.* C:
```

This transfers all files on the Metrosoft SYSTEM DISK to the hard disk.

3. If Metrosoft is on 5¼" disks, insert your Metrosoft DATA ANALYSIS DISK in drive A and type the following command:

```
COPY A:*.* C:
```

This transfers all files on the Metrosoft DATA ANALYSIS DISK to the hard disk.

4. You now have a working copy of Metrosoft on the hard disk. Store the master disk(s) in a safe place.

5.3 FILES ON THE METROSOFT DISK(S)

The two 5¼" or one 3½" master Metrosoft program disk(s) contain several compiled QuickBASIC program files with an EXE extension. Each file performs a specific menu task. When the operator makes a choice from a menu, the required EXE file is loaded into memory and is executed. BRUN45.EXE is the BASIC run-time library file, which is required to run any QuickBASIC compiled program.

When Metrosoft is run on 5¼" disks, begin ms-936 with the SYSTEM DISK (see Section 5.7). You will be prompted to insert the DATA ANALYSIS DISK when archived data files are viewed.

The file CONFIG.MET contains the current Metrosoft configuration. All selections made in the Metrosoft configuration screen (F2 in the MAIN MENU) are saved in this file. This file is updated when the user makes configuration changes, and chooses to write these changes to CONFIG.MET. Never delete or modify this file.

A sample set of data (5011.*) is included with Metrosoft. You are free to examine this data set to familiarize yourself with Metrosoft's graphing and report-creation capabilities.

MSHERC.COM must be loaded into memory before Metrosoft is run if your computer has a Hercules graphics card. Without this RAM-resident "graphics driver", Metrosoft cannot display graphics on a Hercules monitor. To load the driver into memory, simply type MSHERC<Enter> at the DOS prompt.

5.4 USING DATA DISKS

ms-936 stores logger test data and logger configuration files onto a "data disk", which may be a separate floppy disk or a data sub-directory on the hard disk. The Metrosoft SYSTEM or DATA ANALYSIS disks are ordinarily not used for this purpose. Configure Metrosoft for your particular data archiving requirements (i.e. drive and sub-directory).

Prior to storing any information onto a data disk, it must be initialized using the operating system's FORMAT command.

5.5 PREPARING THE aq-501

When you wish to communicate with the aq-501 using Metrosoft, a few simple steps are required:

1. Make sure that ms-936 is configured for 9600 baud. This is the only rate at which the aq-501 communicates with the computer.
2. Connect the RS-232 cable to the serial port of the computer (COM1 or COM2, with ms-936 configured accordingly).
3. The RS-232 cable may have a two-position slide switch at the 25-pin serial connector. If so, the switch must be correctly positioned to communicate with the aq-501. If unable to communicate, move the switch to the other position.
4. Verify logger communication by selecting F6 in the ms-936 MAIN MENU (see Section 5.8.5). Refer to Chapter 6 if having trouble communicating with the aq-501.

You are now ready to remotely communicate with the aq-501, which may even be left off or in the midst of a test. It is inadvisable to press keys at the aq-501 while the computer is interrogating it; this may cause unexpected results, ms-936 will automatically command the logger to perform the desired task.

5.6 METROSOFT CONVENTIONS

1. All menu choices are made by pressing the "function keys" F1 through F10.
2. Press F1 to pop up the on-line Help Window. Esc removes the Help Window.
3. Press F10 to return to the previous screen/menu.
4. The bottom line of the screen is reserved for error messages in yellow on red (or reverse video), or user prompts.
5. Metrosoft beeps after finishing a task or when an error is detected. A softer beep is sounded for invalid keypresses.

6. When ms-936 requests some information, such as a filename, you may press Esc to abort.
7. Screens with several user input fields utilize a fill-in-the-form programming technique. Move between fields via the Enter and Esc keys, or the ↑ and ↓ keys. Enter information within a field either by typing a number, a string of characters, or the → and ← keys. The latter keys scroll through a list of choices for a field (such as printer types). Numeric and alphanumeric fields have full editing capabilities as follows:
 - a. Back Space: delete the character to the left of the cursor.
 - b. Delete: delete the character at the cursor.
 - c. Insert: toggle between insert and over-strike modes (normally over-strike mode is active).
 - d. → and ← move the cursor one character right and left respectively.
 - e. Home: move the cursor to the beginning of the field.
 - f. End: move the cursor to the end of the field.

5.7 STARTING ms-936

When using floppy disks, insert the Metrosoft SYSTEM DISK into the current default drive. When running Metrosoft on a hard disk, change to the subdirectory containing the ms-936 program files (.EXE).

Start ms-936 by typing the letter M followed by Enter while at the DOS prompt. When the program begins, it displays the Metrosonics LOGO for a few seconds (unless a key is pressed), followed by the MAIN MENU. The latest Metrosoft configuration is read from CONFIG.MET.

5.8 THE MAIN MENU

The MAIN MENU gives you access to all features available in ms-936, as described in subsequent sections.

THE MAIN MENU	
OPTION	RESULT
F1	HELP
F2	CONFIGURE METROSOFT
F3	VIEW STORED TEST RESULTS
F4	VIEW STORED LOGGER CONFIGURATION FILES
F5	CREATE NEW LOGGER CONFIGURATION FILE
F6	VERIFY LOGGER COMMUNICATION
F7	GET/VIEW TEST RESULTS FROM LOGGER
F8	REMOTEY CONTROL LOGGER
F9	TERMINAL EMULATION MODE
F10	EXIT

5.8.1 CONFIGURE METROSOFT [F2]

Press F2 in the MAIN MENU to change or view the current Metrosoft configuration.

```

08-20-1990 at 09:43:29      CONFIGURE METROSOFT      Logger Type:  aq-501
  
```

SYSTEM SETUP	DATA ANALYSIS SETUP
Communications Port.....COM1	Temperature Scale.....*F
Baud Rate [Logger uses 9600]..9600	Graph Line Types.....Dashed
Disk Drive for Recorded Data...C:	Draw Grid Lines on Graph...Yes
Directory...NMS936\DATA	Graph Scaling.....Automatic
Print Mode....Parallel	
Printer Type...HP Laser Jet	
Monitor Type...Monochrome	
	GRAPH CHANNEL GRAPH RANGE:
	FROM TO
CO2.....Yes	0ppm 5000ppm
Temperature...Yes	32.0°F 140.0°F
Humidity.....Yes	0.0% 100.0%
Linear Input...Yes	0 5
Toxic Gas....Yes	0ppm 1000ppm

```

  [F1] HELP                    [F2] UPDATE CONFIGURATION FILE                    [F10] EXIT
  PRESS → OR ← TO SELECT YOUR CHOICE
  
```

You may now set any of the following parameters:

1. The communications port to use with an aq-501 or a serial printer. Press → or ← to choose COM1 (default) or COM2.
2. The communications port baud rate. The aq-501 uses only 9600 baud, so there is no reason to change this unless you use a serial printer at a different rate. Press → or ← to select the desired baud rate.
3. The disk drive onto which aq-501 data and programming files are to be stored. Type in any letter from A (default) to Z. Normally A and B are floppy drives, and C is the hard disk.
4. The subdirectory into which aq-501 data and programming files are to be stored. Type in the name of the subdirectory (if any); ms-936 will bracket (...) the name if necessary. Invalid subdirectory name characters (spaces, periods, and some special symbols) are beeped.
5. The mode of printing. Press → or ← to choose parallel (default) or serial. Port 1 (LPT1) is always used for parallel printing. Serial printing requires the additional selection of COM port (choice 1 above) and baud rate (choice 2 above), ms-936 prints serially with 1 start bit, 8 data bits, 1 stop bit, and no parity. Software handshaking (XON/XOFF) is used to control the flow of characters to a serial printer.
6. The printer type. Press → or ← to choose from a wide variety of supported printers. If your printer is not listed, refer to the printer manual and choose one that it is compatible with. Printer selection is unimportant except when the graph of test data is printed, at which time the "driver" for the selected printer is activated.

NOTE: Okidata Printers

Okidata printers must have either "Plug-n-Play" (IBM Version) or "Okigraph" (standard version) PROMs installed for the graph to print.

Optionally, you may purchase GRAFPLUS if ms-936 does not directly support your printer. Call the Metrosonics Sales Department at (716) 334-7300 if you are interested in this option.

GRAFPLUS is a memory resident screen printing software program. ms-936 automatically uses GRAFPLUS to print the graph of test data if:

- ms-936 has been configured for an EXTERNAL PRINT DRIVER
- GRAFPLUS has been loaded into memory prior to running ms-936

GRAFPLUS supports hundreds of printers which ms-936 does not have drivers for, including many color printers and laser printers. GRAFPLUS has options for graph sizing (to any dimensions), location on the paper, printing shades of gray, and printing only part of the screen (called "clipping"). Additionally, screen images may be saved to disk to be printed later (or even imported into many word processor and desktop publishing programs).

To use GRAFPLUS, simply tell it what type of printer you have (e.g. IBM Color Printer), and which options you want. All of this may be typed into a single command line from the operating system (DOS), or even placed in a batch file. For example, the command "GRAFPLUS != 13" loads and configures GRAFPLUS for an IBM Color Printer with portrait (horizontal) mode and extended clipping enabled. Refer to the GRAFPLUS manual for details.

GRAFPLUS can be loaded into memory in one of four ways:

- Interactively. Type GRAFPLUS <Enter> and answer a series of questions (printer type, etc).
 - From the command line. Enter the options (printer type, etc.) after GRAFPLUS (e.g. "GRAFPLUS != 13").
 - From a batch file. Place the command (e.g. "GRAFPLUS != 13") in a batch file. Optionally, automatically execute ms-936 also in the batch file:

```

GRAFPLUS! = 13
M

```

This file would typically be called ms-936.BAT.
 - From your AUTOEXEC.BAT File. Place the command (e.g. "GRAFPLUS != 13") in your AUTOEXEC.BAT File. GRAFPLUS will then be loaded when your computer is turned on or reset.
7. The type of monitor (or display) used on your computer. Press → or ← to choose between monochrome (default) or color. The type of graphics card in the computer is closely related to this selection, although you need not select the graphics mode used, ms-936 automatically detects the type of graphics card installed, and supports the Monochrome Display Adapter (MDA), Color Graphics Adapter (CGA), Enhanced Graphics Adapter (EGA), Video Graphics Array (VGA), Multi-Color Graphics Array (MCGA), and Hercules. The graph of aq-501 data cannot be shown with an MDA, and MSHERC.COM must be loaded in memory with Hercules (see Section 5.3).
 8. The scale to use for the aq-501 temperature channel. Press → or ← to choose between °F (default) and °C. This applies to graphs and reports of saved test data.
 9. Options for the graph of saved aq-501 test data. Any of these choices may be overridden for individual graphs when data analysis is performed.
 - a. Graph all data with solid lines or use different dashed lines for each line graphed. Press → or ← for either dashed or solid.
NOTE: If solid lines are used it is impossible to distinguish which lines correspond to which data on a monochrome or on a printed graph.
 - b. Automatically draw horizontal and vertical grid lines on the graph. Press → or ← for either yes or no.
 - c. Set the amplitude (Y) axis scaling to be based upon each channel's data range, or upon user-selected data ranges. Press → or ← to choose automatic (default) or manual. To compare data from different tests, manual scaling may be desirable.

- d. Select which channels are to be graphed. Press → or ← for either yes or no.
- e. Enter the data range for each graphed channel. This applies only when manual scaling is employed.

Configuration changes are remembered only for the current session of Metrosoft unless F2 is pressed to save the configuration in CONFIG.MET.

5.8.2 VIEW STORED TEST RESULTS [F3]

Press F3 in the MAIN MENU to view a list of saved aq-501 data files. Based upon search criteria, this list may be specific or general. When data is read from the aq-501, it is tied to test identification fields (test location, employee name, etc.) entered by the user (see Section 5.8.6).

VIEW STORED TEST RESULTS LAST FILE VIEWED: None

DEFINE SEARCH CRITERIA

Filename (e.g. 5011).....
 Test Date (mm/dd/yy)..... / /
 Test Time (hh:mm:ss)..... : :
 Serial Number.....

Test Location.....
 Employee Name..... Jones, Tom
 Employee Number.....
 Department.....

Comment Field 1.....
 Comment Field 2.....

Numeric Code #1..... #2... #3... #4... #5...

F1 HELP **F2** BEGIN THE SEARCH **F3** VIEW LAST FILE **F4** PRINT DIRECTORY **F10** EXIT
 TYPE IN ANY STRING

Data is selectively recalled via specific search criteria, such as "Jones, Tom" for the employee name. Searches are case-insensitive, although the match must be exact (e.g. a search criteria of "Jones, Thomas" will not match files saved under "Jones, Tom"), unless double dots (..) appear before and/or after the search criteria.

If a search field is left blank, it by default matches all archived data files. A match is based only on the non-blank characters entered for the search criteria. For example, a search criteria of "Jones, T" for employee name lists all files saved under "Jones, Thomas", "Jones, Tom", "Jones, Thelma", etc.

Also, you may search for embedded strings by placing two periods (..) before and/or after phrase:

<u>Search Criteria</u>	<u>Meaning</u>
..text..	Find text anywhere within a field
..text	text must be at the end of a field
text..	The field must begin with text
text	The field must exactly match text

In addition to the test identification fields, you may search on filename, test date, test time, and logger serial number.

When ready to begin the search, insert a data disk (if appropriate) and press F2. ms-936 remembers the name of the last file viewed in this session; press F3 to view it again. Press F4 to print a directory of all files matching the specified search criteria.

When F2 is pressed, ms-936 lists all files on a data disk which match the search criteria. The listing is presented in reverse chronological order, with the most recently saved data file shown first. The total number of saved files is shown near the bottom of the screen. Information on each matching file appears on three lines (the filename, logger serial number, test date and time, test location, etc.).

Data Drive / Directory... C:\MS936\					
NO.	FILENAME	S/N	TEST DATE	TEST TIME	TEST LOCATION
5	5011	1000	2/12/90	12:11:51	BUILDING A
COMMENT FIELD 1 COMMENT FIELD 2					
3	5013	1000	1/08/90	21:10:53	SOUTH WING
EMPLOYEE NUMBER					
2	5012	1000	1/07/90	20:03:30	BUILDING A
CD 1 CD 2 CD 3 CD 4 CD 5					
1	5015	1000	12/30/89	10:34:09	MAIN OFFICE
155-66-7777					
5 data files found					

F1 HELP **F2** DOWN **F3** UP **F4** VIEW **F5** DELETE **F6** COPY **F7** EDIT **F8** NEW DISK **F10** EXIT
 LAST MATCHING DATA FILE FOUND

At most six matching files fit on the screen at one time; press F2 to list the next six, or F3 to list the previous six. When the first or last file are listed, F2 and F3 are ignored. To begin the same search on another data disk (or to restart the search on the same data disk), press F8, insert another data disk, and press Enter.

A specific data file may be viewed, deleted, copied to another data disk or edited by pressing F4, F5, F6 or F7 respectively. You are prompted to enter the file number (read from the left-most column in the listing). Refer to the next section on viewing stored test results (F4). Press F7 to edit the test identification fields (test location, employee name, etc.).

To copy a data file, enter the drive and directory (if any) of the form d:\{directory\} (e.g. c:\ms936\data\ or simply a:). A filename for the copied file is assigned automatically by ms-936. After the file is copied, the original file remains and a copy of it now exists on another data disk.

5.8.2.1 ANALYSIS OF TEST DATA

After searching archived test data (see the previous section) or reading in data from an aq-501 (see Section 5.8.6), you may examine data recorded at an aq-501 both graphically and in report form.

VIEW TEST DATA 5016

OPTION	RESULT
F1	HELP
F2	DISPLAY GRAPH OF TIME HISTORY DATA
F3	DISPLAY TIME HISTORY REPORT
F4	PRINT TIME HISTORY REPORT
F5	SAVE TIME HISTORY REPORT TO DISK
F10	EXIT

5.8.2.1.1 GRAPH OF TEST DATA [F2]

Press F2 to display a graph of time history data. Choose which channels to graph, the range of each channel, the graph title and scaling, grid lines status, and solid or dashed line types. Only channels which actually recorded data may be graphed. Except for the graph title (which is the test location by default), all graph parameters default to the current Metrossoft configuration (see Section 5.8.1).

GRAPH TEST DATA		Filename: 5016	
INFORMATION ON TEST NUMBER 1 OF 1			
First Reading 12/20/89 at 16:11:07			
Total Length 3 days 18:27:00			
Total Periods: 5427			
Period Length: 1 minute sample			
GRAPHING OPTIONS			
Graph Line Types.....Dashed			
Draw Grid Lines on Graph...Yes			
Graph Scaling.....Automatic			
Graph Title.....MAIN OFFICE			
MANUAL GRAPH RANGE			
GRAPH CHANNEL		FROM	TO
CO2 (ppm).....Yes		0	5000
TEMP (deg C).....Yes		0.0	60.0
HUMIDITY (%).....Yes		0.0	100.0
F1 HELP F2 VIEW GRAPH F3 NEXT TEST F10 EXIT TYPE IN ANY STRING			

If data from several tests is saved in the same data file, press F3 to graph subsequent tests.

A single data file may hold information recorded for several tests. Each test may contain continuously logged time history data, or data recorded on an alarm condition. In the former case, the total test length and number of equal-length periods is shown. In the latter case, individual alarm events within a test may be viewed in separate graphs; because of the discontinuity of time, multiple alarm events cannot be graphed simultaneously.

F4, which appears only when the aq-501 has been set up to record on alarm, allows you to graph data from subsequent alarm events.

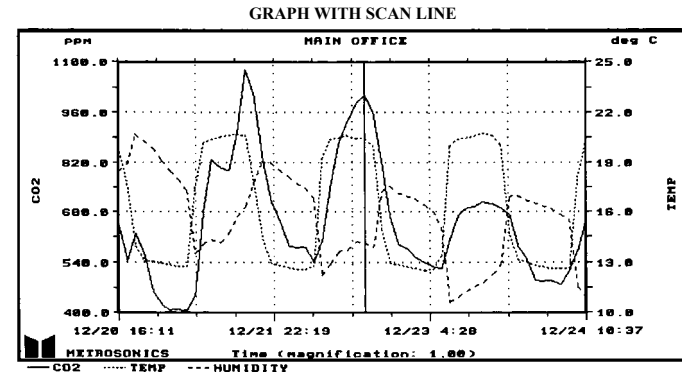
When at the test or alarm event of interest, press F2 to graph its data. Before the graph is shown, ms-936 reads into memory all data recorded during the test or event; this may take several seconds (press Esc to abort). Initially, an entire test's or event's data is graphed, although you may explode any portion of the data.

Color (EGA, VGA or MCGA only) and dashed line-types (if selected) are used to distinguish the different graphed lines. The scale of the first graphed line is shown on the left Y-axis, and the scale of the second graphed line is shown on the right Y-axis. If more than two channels are graphed, view their scales by pressing F4 (left axis) or F5 (right axis).

A "scan line" is drawn at the origin (along the left Y-axis), with the test time and recorded values shown under the graph. Move the scan line ahead and back in time by pressing → and ← hold down Ctrl with these keys to jump through the data in 10% steps.

Zooming into a specific section of a test is extremely easy to do. Press F2 to explode the left 2/3 of the current graph, or press F3 to explode the right 2/3 of the graph. Hold down Alt with either F2 or F3 to reverse the action of the last zoom (i.e. to zoom back out to a wider time window). As you zoom in via F2 and F3, the graph magnification increases. At any magnification level, you may scroll through the data by holding down Ctrl and F2 or F3. This maintains the same time window on the graph, but slides the time window ahead and back. To quickly return the magnification to 1 (i.e. view the entire test again), press Home.

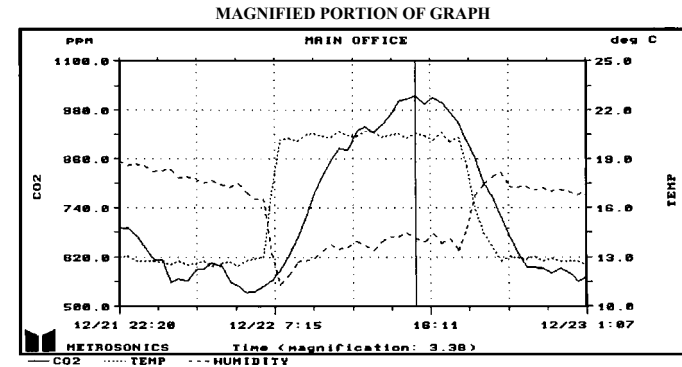
It is useful to locate the scan line within the time window of interest as an aide in zooming. The scan line remains at the same relative location during successive zooms, unless the scan line is moved by pressing -* or <-. Should the scan line fall outside of the zoomed in time window, it can be easily redisplayed by scrolling through the data or zooming out until it reappears.



12/22/88 15:01:07: 1008ppm 20.5deg C 22.8%

F2 ZOOM LT F3 ZOOM RT F4 LT RX18 F5 RT RX18 F8 PRINT F10 EXIT

← SCAN LEFT → SCAN RIGHT



12/22/89 15:05:07: 1017ppm 20.6 deg C 22.8%

F2 ZOOM LT F3 ZOOM RT F4 LT AXIS F5 RT AXIS F6 PRINT F10 EXIT

← SCAN LEFT → SCAN RIGHT

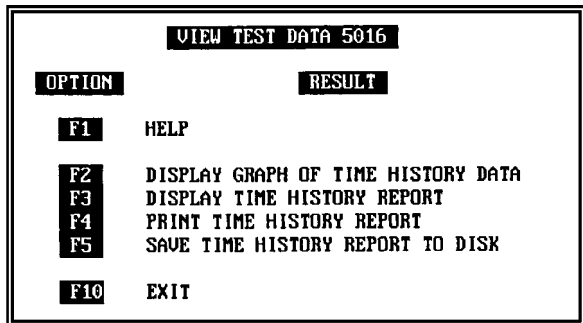
Pressing F6 prints the current graph, at any level of magnification. Metrosoft must be configured for your printer so that the correct graphics driver is used. Refer to Section 5.8.1. The printout may take a few minutes to complete; press Esc to abort.

NOTE: If solid lines are used it is impossible to distinguish which lines correspond to which data on a monochrome or on a printed graph.

Press F10 to select new graph parameters (channels to graph, ranges, grid lines, scaling, title) at any time, ms-936 will maintain the current zoom magnification and scan line location when the data is re-graphed.

5.8.2.1.2 REPORTS OF TEST DATA [F3-F5]

Press F3, F4, or F5 after choosing to view test data to create a fully formatted and Lotus-compatible output report.



The tabular time history report presents the overall minimum, average, and maximum readings recorded for all channels on during a test, followed by data recorded over evenly spaced time intervals on a per channel basis. This report may be viewed on the display (F3), printed (F4), or stored in a separate disk file (F5).

If a data file encompasses several tests, you are prompted to choose the test for the report (or press Enter for all tests).

When viewed, the report is displayed one screen at a time. Press the Space Bar to view more of the report (or press Esc to abort).

The report is printed parallel (LPT1) or serial (COM1 or COM2), based on the current Metrosoft configuration (see Section 5.8.1).

If another application program needs access to a formatted report, press F5 and choose a filename; the extension is always PRN. The report will be saved in this file on the current data drive and directory, ms-936 lists only archived aq-501 data files, not formatted report files (see Section 5.8.2).

SAMPLE TIME HISTORY REPORT

```
"METROSONICS aq-501 SN 1080 V1.3 11/89"
"REPORT PRINTED 08/16/90 AT 08:12:11"
"PERIOD: 1 minute sample" "ALARM LOGGING STATUS: Off"

"Filename.....5016"
"Test Location....BUILDING A"
"Employee Name....JONES, TOM"
"Employee Number...155-66-7777"
"Department.....MEDICAL CENTER"
"Comment Field 1...MAIN OFFICE"
"Comment Field 2...VERIFY AIR QUAL COMPLAINT"
"Numeric Code #1...1469 #2...3075 #3...1458 #4...9996 #5...
```

"« OVERALL STATISTICS FOR TEST NUMBER 1 »"

```
"TEST STARTED 12/20/89 AT 16:11:07"
"TEST DURATION: 3 DAYS 18:27:01"
```

```
"CARBON DIOXIDE:"
"ALARMS: LOWER: 0 ppm UPPER: 5000 ppm"
"MINIMUM: 393 ppm OCCURRED 12/21/89 AT 3:15:07"
"AVERAGE: 656 ppm"
"MAXIMUM: 1166 ppm OCCURRED 12/21/89 AT 17:24:07"
```

```
"TEMPERATURE:"
"ALARMS: LOWER: 0.0 deg C UPPER: 60.0 deg C"
"MINIMUM: 11.8 deg C OCCURRED 12/23/89 AT 6:19:07"
"AVERAGE: 16.2 deg C"
"MAXIMUM: 22.0 deg C OCCURRED 12/23/89 AT 14:05:07"
```

```
"RELATIVE HUMIDITY:"
"ALARMS: LOWER: 0.0 % UPPER: 100.0 %"
"MINIMUM: 19.7 % OCCURRED 12/24/89 AT 8:23:07"
"AVERAGE: 23.8 %"
"MAXIMUM: 27.5 % OCCURRED 12/20/89 AT 16:13:07"
*****
```

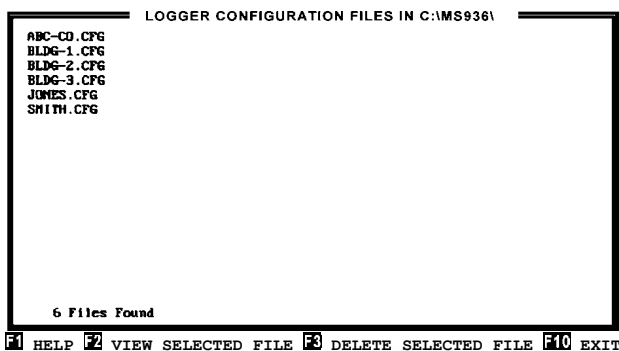
"<< TIME HISTORY DATA FOR TEST NUMBER 1 >>"

"TIME"	"CO2"	"TEMP"	"R.H."
" "	"ppm"	"deg C"	"%"
"12/20/89"			
"16:11:07"	906	20.2	25.4
"16:12:07"	912	19.3	26.9
"16:13:07"	831	19.1	27.5
"16:14:07"	809	19.1	27.1
"16:15:07"	776	19.2	27.0
"16:16:07"	781	19.2	26.8
"16:17:07"	843	19.3	26.8
"16:18:07"	821	19.4	26.7
"16:19:07"	814	19.4	26.7
"16:20:07"	851	19.4	26.5
"16:21:07"	831	19.4	26.5
"16:22:07"	858	19.3	26.6

5.8.3 VIEW STORED LOGGER CONFIGURATION FILES [F4]

The aq-501 is programmed, or configured, directly from the computer using ms-936 (see the next section). An often used configuration setup may be saved to disk for easy recall and programming.

Press F4 in the MAIN MENU to list all aq-501 configuration files saved on a data disk. Press ↑, ↓, → or ← to highlight the file you want, and then press F2 to view it or F3 to delete it.



5.8.4 CREATE NEW LOGGER CONFIGURATION FILE [F5]

The default aq-501 programming setup is shown when F5 is pressed in the MAIN MENU, or a saved programming setup file is shown when F4 is pressed in the MAIN MENU (see the previous section).

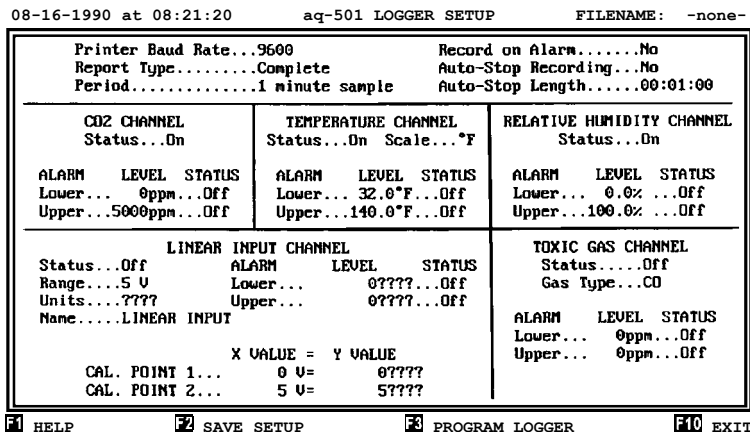


TABLE 1: PROGRAMMABLE aq-501 PARAMETERS

PARAMETER NAME	VALID CHOICES/RANGE	DEFAULT
PRESENT DATE AND TIME	N/A	COMPUTER'S CLOCK
PRINTER BAUD RATE	150,300,600,1200,2400,4800,9600	9600
REPORT TYPE	COMPLETE, SUMMARY	COMPLETE
PERIOD LENGTH	1 MINUTE, 5 MINUTE, 15 MINUTE OR 1 HOUR SAMPLE; 1 MINUTE, 5 MINUTE, 15 MINUTE OR 1 HOUR AVERAGE	1 MINUTE SAMPLE
RECORD ON ALARM	NO, YES	NO
AUTO-STOP RECORDING	NO, YES	NO
AUTO-STOP LENGTH	ANY LENGTH FROM 1 SECOND TO 24 HOURS, IN 1 SECOND INCREMENTS	1 MINUTE
CARBON DIOXIDE CHANNEL:		
· RECORDING STATUS	ON, OFF	ON
· LOWER ALARM LEVEL	0 TO 5000 PPM	0 PPM
· LOWER ALARM STATUS	ON, OFF	OFF
· UPPER ALARM LEVEL	0 TO 5000 PPM	5000 PPM
· UPPER ALARM STATUS	ON, OFF	OFF
TEMPERATURE CHANNEL:		
· RECORDING STATUS	ON, OFF	ON
· TEMPERATURE SCALE	°F, °C	°F
· LOWER ALARM LEVEL	32 TO 140°F	32.0°F
· LOWER ALARM STATUS	ON, OFF	OFF
· UPPER ALARM LEVEL	32 TO 140°F	140.0°F
· UPPER ALARM STATUS	ON, OFF	OFF
HUMIDITY CHANNEL:		
· RECORDING STATUS	ON, OFF	ON
· LOWER ALARM LEVEL	0 TO 100%	0%
· LOWER ALARM STATUS	ON, OFF	OFF
· UPPER ALARM LEVEL	0 TO 100%	100%
· UPPER ALARM STATUS	ON, OFF	OFF
LINEAR INPUT CHANNEL:		
· RECORDING STATUS	ON, OFF	OFF
· INPUT RANGE	10mV, 100mV, 1V, 5V	5V
· USER UNITS	ANY 4 CHARACTERS (E.G. PSI)	????
· CHANNEL NAME	ANY 15 CHARACTERS	LINEAR INPUT
· LOWER ALARM LEVEL	±110% OF CALIBRATED RANGE	0
· LOWER ALARM STATUS	ON, OFF	OFF
· UPPER ALARM LEVEL	±110% OF CALIBRATED RANGE	0
· UPPER ALARM STATUS	ON, OFF	OFF
· FIRST CAL POINT:		
· X VALUE (V OR mV)	±110% OF FULL SCALE	0V OR 0mV
· Y VALUE	±110% OF FULL SCALE	0
· SECOND CAL POINT:		
· X VALUE (V OR mV)	±110% OF FULL SCALE	FULL SCALE
· Y VALUE	±110% OF FULL SCALE	FULL SCALE
TOXIC GAS CHANNEL:		
· RECORDING STATUS	ON, OFF	OFF
· GAS SENSOR TYPE	CO, H ₂ S, SO ₂ , Cl ₂	CO
· LOWER ALARM LEVEL	0 TO 1000 PPM	0 PPM
· LOWER ALARM STATUS	ON, OFF	OFF
· UPPER ALARM LEVEL	0 TO 1000 PPM	1000 PPM
· UPPER ALARM STATUS	ON, OFF	OFF

The aq-501 has several programmable test parameters specified via simple fill-in-the-form programming:

1. Printer baud rate: The aq-501 outputs a formatted report to a serial printer when the PRINT button is pressed. Press → or ← to choose the rate at which this report will be printed. This baud rate has no effect upon communication between ms-936 and the aq-501 (9600 baud is always used).
2. Report type: Press → or ← to choose the type of report the aq-501 outputs when its PRINT button is pressed. Normally this is a complete report, which includes the time history of all data recorded. If desired, only the one-page summary report may be output. This choice has no effect upon the information sent from the aq-501 to ms-936 when recorded data is retrieved (see Section 5.8.6).
3. Period length and recording type: The aq-501 may be programmed to take a snapshot of current readings every so often, or maintain and save running averages over a fixed time period. This is referred to as a time history of samples in the first case, or of averages in the second case. In either case, the time history period length may be 1 minute, 5 minutes, 15 minutes or 1 hour. Press → or ← to make your choice.
4. Record data on alarm: Typically, the aq-501 continuously records data at the end of each time history period (every minute, 5 minutes, etc.) while in "recording" mode, controlled by the RECORD button. If the aq-501 is set up to record on alarm, however, data is stored only when a parameter exceeds or falls below an alarm level. In conjunction with turning alarm logging on, you should also enable an alarm at an active channel, and set the level appropriately.
5. Auto-stop recording status and duration: This is valid only when alarm logging is off. Press → or ← to select yes if auto-stop recording is required, and then choose the duration of the logging session (from 0:00:01 to 23:59:59). When this much time has elapsed, the test at the aq-501 will automatically terminate.
6. Channel status: Select which channels to record during the test.
7. Alarm levels: In conjunction with recording on alarm, set the desired alarm levels, and turn the necessary alarms on.
8. Temperature scale: Press → or ← to choose either °F (default) or °C for the temperature channel.
9. Range, units, name, and calibration points for the linear input channel. This optional channel requires several unique parameters:
 - a. Select the linear sensor range (in mV or V) by pressing → or ←.
 - b. Enter the test units, any 4-character string (e.g. ppm).
 - c. Enter the channel name, any 15-character string.
 - d. Define two points on the calibration line. These are used to fit a $Y=mX+b$ equation, where X is in mV or V, and Y is in test units.
10. Type of gas sensor to be used with the toxic gas channel: Press ++ or <- to make your choice. Older aq-501 loggers do not have this channel.

Special checks are made for the following invalid conditions, and an appropriate error message is issued:

1. All channels' recording status is off.
2. Record on alarm has been selected, yet no alarm is on at an active channel.
3. Auto-stop recording cannot be used in conjunction with record on alarm.
4. The calibration points for the linear input channel cannot be the same.
5. The upper alarm must exceed the lower alarm for all channels.

After specifying the desired programming, you may either save the setup to disk or program the logger.

Saving a logger configuration to disk allows you to recall a specific programming setup and easily program several data loggers in precisely the same way. Press F2 and you are prompted to enter a filename (without the extension, which is always CFG). The file is created on the current data drive and directory. If the file already exists, you may overwrite it or choose another filename.

Please note that Metrosoft synchronizes the real time clock (RTC) of the logger to the current time at your computer. Make sure that your computer's clock has been set to the correct time before using Metrosoft to program the aq-501.

Press F3 to program the aq-501. Connect the logger's RS-232 cable and then press Enter. All prior test results must first be erased before the aq-501 can be programmed. Programming takes only a few seconds, after which you may disconnect the aq-501, carry it to the test site and begin the test.

5.8.5 VERIFY LOGGER COMMUNICATION [F6]

Press F6 in the MAIN MENU as a simple means of verifying that the computer and the logger are properly connected prior to attempting to program it or retrieve data from it.

VERIFY LOGGER COMMUNICATION

Connect the logger to the computer's serial port.

Press Enter when ready to verify communication between the computer and the logger, or press Esc to abort.

Connect the logger's RS-232 cable, and press Enter when ready. If the aq-501 fails to respond to the computer's inquiry within a few seconds, a help window appears. Refer to Chapter 6 if communication cannot be established.

Once ms-936 verifies that the logger is responding properly, you will be able to communicate with the aq-501 even if it turns off after five minutes while not recording.

5.8.6 GET/VIEW TEST RESULTS FROM LOGGER [F7]

After a test has been completed at the aq-501, normally all recorded data is transferred to the computer, aq-501 test data can even be sent in the middle of a test. Pressing F7 in the MAIN MENU does this. First, specify the "test identification fields" which will be used when later searching for saved test data (see Section 5.8.2), and then press F2 to retrieve test data from an aq-501.

TEST IDENTIFICATION FIELDS				
Test Location....	BUILDING A			
Employee Name....	JONES, TOM			
Employee Number...	155-66-7777			
Department.....				
Comment Field 1...				
Comment Field 2...				
Numeric Code #1...	#2...	#3...	#4...	#5...

[F1] HELP [F2] RETRIEVE LOGGER DATA [F3] VIEW LAST SAVED DATA [F10] EXIT
TYPE IN ANY STRING

While reading in and saving data, ms-936 displays the number of lines read, ms-936 performs checksums on each line of data read to ensure proper transmission. The data is saved as an ASCII memory dump, which Metrosoft interprets to create reports and graphs. Metrosoft automatically assigns a filename of the form 501 nnnn.ext, where nnnn is the file number, starting with 1, and ext is the file extension (BIN, STR, and TIM). A complete data transfer may take a few minutes, depending upon the length of the test and your computer's speed.

NOTE: If you commonly get a DATA TRANSFER ERROR (INCORRECT CHCKSUM), try removing any RAM resident programs (TSR's) which may be interfering with serial communication, and try to read data again.

After all data has been read from the aq-501 and saved on a data disk, you may immediately examine it by pressing F3 (see Section 5.8.2.1).

5.8.7 REMOTELY CONTROL LOGGER [F8]

You may remotely control and monitor current conditions at the aq-501 by pressing F8 in the MAIN MENU.

LOGGER STATUS	PRESENT READINGS												
BATTERY VOLTAGE: 12.1 volts MEMORY FREE: 86 % REMAINING LOGGING TIME: 3 days 7:01:00 TEST: 2 STATUS: RECORDING ELAPSED TIME: 0 days 0:00:30	CARBON DIOXIDE 698 ppm Status: on												
	TEMPERATURE 78.7 deg F Status: on												
	RELATIVE HUMIDITY 44.5 % Status: on												
<table border="1"> <thead> <tr> <th>OPTION</th> <th>RESULT</th> </tr> </thead> <tbody> <tr> <td>[F1]</td> <td>HELP</td> </tr> <tr> <td>[F2]</td> <td>CLEAR TEST RESULTS AT LOGGER</td> </tr> <tr> <td>[F3]</td> <td>START LOGGING</td> </tr> <tr> <td>[F4]</td> <td>STOP LOGGING</td> </tr> <tr> <td>[F10]</td> <td>EXIT</td> </tr> </tbody> </table>	OPTION	RESULT	[F1]	HELP	[F2]	CLEAR TEST RESULTS AT LOGGER	[F3]	START LOGGING	[F4]	STOP LOGGING	[F10]	EXIT	
OPTION	RESULT												
[F1]	HELP												
[F2]	CLEAR TEST RESULTS AT LOGGER												
[F3]	START LOGGING												
[F4]	STOP LOGGING												
[F10]	EXIT												

The screen is updated in real-time (about every 2 seconds), showing the logger's battery voltage, remaining memory and logging time, the test number and its length, and the current readings at all channels (the linear input and toxic gas channels appear only when turned on). The logging time and test length update only when a test is in progress.

Also on this screen you may clear test results, start a test, or stop a test at the logger. To prevent accidentally clearing test results, you are asked if you are sure.

5.8.8 TERMINAL EMULATION MODE [F9]

Press F9 in the MAIN MENU to place the computer into terminal emulation mode in which all characters typed are sent as is through the serial port (COM1 or COM2). The characters are sent at the current baud rate (see Section 5.8.1). Only the standard printable ASCII characters are sent.

The device connected to the RS-232 serial port is responsible for interpreting these characters. Nothing will appear on the computer's display unless the remote device echoes what you type, or responds in some other way to your key presses. XON/XOFF software handshaking is used to control the flow of characters to the computer.

Press F2 if you want all characters displayed to be printed also. A printer must be connected to the first parallel port (LPT1). Press F2 a second time to stop printing.

Terminal emulation mode may be employed to log on to a remote computer directly connected to the PC, or to manually communicate with a data logger.

When F10 is pressed to exit to the MAIN MENU make sure that the remote device is not in the midst of sending a string of characters to the computer.

5.8.9 EXIT [F10]

Return to the DOS environment by pressing F10 in the MAIN MENU. Before exiting, you are asked to confirm leaving Metrosoft. Press N to redisplay the MAIN MENU, or Y to exit to the operating system.

Chapter 6

PROBLEM DETERMINATION

Problems often develop when attempting to connect one device with another. This chapter is intended to supply you with solutions to problems commonly encountered.

Some memory resident programs interfere with the normal operation of ms-936. This is especially true of serial mouse drivers. These programs may interfere with serial communication, or cause Metrosoft to lock up. In this case, remove all memory resident programs and rerun Metrosoft.

If the problem cannot be resolved after reading this chapter, call the Metrosonics Service Department at 716-334-7300. Please have the following information handy:

1. Type of software (i.e. ms-936-IBM).
2. Version of software (displayed in the MAIN MENU and printed on the master disk label).
3. List of hardware on which the program is used. Provide as much of the following information as you can:
 - a. Computer type (e.g. IBM/AT).
 - b. Disk drive configuration (e.g. 1 floppy drive and 1 20M byte hard drive).
 - c. Amount of memory installed in the computer.
 - d. Type of graphics adapter used (e.g. IBM Color Graphics Adapter (CGA)).
 - e. Interface adapters (serial and parallel) installed in the computer.
 - f. Type of printer used (make, model and interface type, serial or parallel).
 - g. Type and version of the Basic Input/Output System (BIOS) ROM.
4. Complete description of the problem, including circumstances during which the problem occurs and the exact error message displayed (if any).

6.1 PROBLEMS COMMUNICATING WITH AN aq-501

ms-936 communicates with the Metrosonics aq-501 through the RS-232 port of the computer. If unable to receive data from an aq-501, any of the following could be the cause of your problem:

1. The RS-232 cable is plugged into the wrong port (e.g. you have selected COM2 and plugged the cable into the parallel port or into COM1).
2. The RS-232 cable is not properly plugged into the logger.
3. The RS-232 cable may have a two-position slide switch at the 25-pin end. This is used to switch the transmit and receive lines in the cable. If you cannot communicate with the logger, try putting the switch in the other position.

4. ms-936 is not configured for 9600 baud.
5. The battery at the aq-501 is low. Provide external AC power to charge its battery.
6. The aq-501 was told to stop transmitting data, but never told to resume transmission. This would happen if the aq-501 was sent a Ctrl-S (XOFF), but never sent a Ctrl-Q (XON). Such a condition should not occur; but to ensure that the logger is not in this "wait" state, send an XON to it from terminal emulation mode.

Use terminal emulation mode (F9 in the MAIN MENU) as a simple means of verifying communication with a logger. In this mode, an aq-501 should respond with an exclamation mark (!) for every ASCII Esc sent to it.

6.2 PROBLEMS COMMUNICATING WITH A PRINTER

Graphical and textual printouts of test data may be obtained using ms-936. If ms-936 is unable to print, an appropriate error message is displayed. This could be due to one of several reasons.

1. The wrong printer type has been selected in the Metrosoft configuration. This effects only the printed graph.
2. The print mode is wrong (i.e. serial or parallel), ms-936 prints reports and graphs to either type of printer. Verify that the correct print mode has been selected in the Metrosoft configuration.
3. The baud rate is wrong. This applies only to serial printers. Verify that the printer is set at the same baud rate as that selected in the Metrosoft configuration.
4. The printer is "off line", or completely off. All printers must be placed on line prior to sending information to them.
5. The printer's interface cable is plugged into the wrong port (LPT1, COM1, or COM2) of the computer.
6. The interface cable or the printer itself is faulty.

6.3 PROBLEMS COMMUNICATING WITH A DATA DISK

Test data from an aq-501 is stored onto a data disk (or the hard disk). You should have no trouble writing information to or reading information from a data disk. If you do, more than likely your disk drive requires servicing, or the disk has gone bad.

You may not be able to read from or write to a data disk for one of the following reasons:

1. The disk has not been formatted. You must use the operating system's FORMAT command to format any disk prior to use.
2. The data disk was formatted under a DOS version different from the one used when running the Metrosoft program, or was formatted using a version of DOS before 2.0.
3. You selected the wrong disk drive or sub-directory for storing data in the Metrosoft configuration.
4. The disk is defective. All disks become unusable after a period of time. To prevent loss of information, disks should be backed up periodically.

APPENDIX A

SOFTWARE REVISIONS

<u>Version 1.0 (10/89):</u>	Initial software release.
<u>Version 1.01 (11/89):</u>	Fix minor errors in the graphing routine.
<u>Version 1.1 (11/89):</u>	Several new features and enhancements were added.

V1.1 Feature

Enhancement/New Feature

VIEW STORED TEST RESULTS

- Bi-directional search of stored data files
- Edit a file's test identification fields
- Obtain a printed directory of stored data files
- Press F10 at any time to immediately stop a search

VIEW GRAPH OF DATA

- Display friendly values along the Y axis in automatic scaling
- Unclutter the time (X) axis
- Draw the fourth graphed line with a more unique line type
- Perform data smoothing to eliminate frequent fluctuations in a graphed data set
- Graph multiple channels' data using either dashed or solid lines
- Show the range of all channels in the printed graph

REMOTELY CONTROL LOGGER

- Add a description title to clarify the meaning of the information on this screen
- Show the aq-501 recording status

<u>Version 1.2 (8/90):</u>	The primary purpose of this new version was to handle a fifth toxic gas channel in the aq-501. Also, some new features were added and some minor errors corrected.
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V1.2 Feature

Enhancement/New Feature

CONFIGURE ms-936

- Add an external printer driver for printers not directly supported by ms-936
- Add the Epson RX to the list of supported printers
- Select any drive letter (A...Z) for archived data files
- Set the manual graphing range for the toxic gas channel

VIEW STORED TEST RESULTS

- Fix error when searching on test start time
- Inform the user when edited test identification fields have been saved to disk
- Fix error when F3 (UP) was pressed with only one matching data file
- Fix error when the only stored data file was deleted
- Fix error sorting files year by year
- Search stored test files' ID fields for an embedded string (.text..)
- Default to the most recent (not the first) matching data file number

VIEW GRAPH OF DATA

- Fix problem with the manual graph range for the linear input channel
- While reading data to be graphed from disk to RAM, show the period number
- Draw the Metrosonics LOGO under the displayed graph
- Use blue instead of gray for the axis lines - Gray is hard to read on some color monitors
- Graph the toxic gas channel's data, so that up to five channels' data may be graphed simultaneously
- Speed up the Epson MX/RX/FX printed graph by using single density printing in landscape (vertical) mode
- Add left margins to the printed graph
- Fix a spacing problem on IBM Proprinters and Graphics Printers

VIEW REPORT OF DATA

- <Esc> may be pressed at any time to stop viewing a formatted report
- Show the toxic gas channel's recorded data (if any)

PROGRAM LOGGER

- Pop up a Help Window if logger programming fails
- Set the recording status, gas type, and alarm levels for the toxic gas channel

REMOTELY CONTROL LOGGER

- Show the toxic gas channel's present reading, if this channel has been turned on