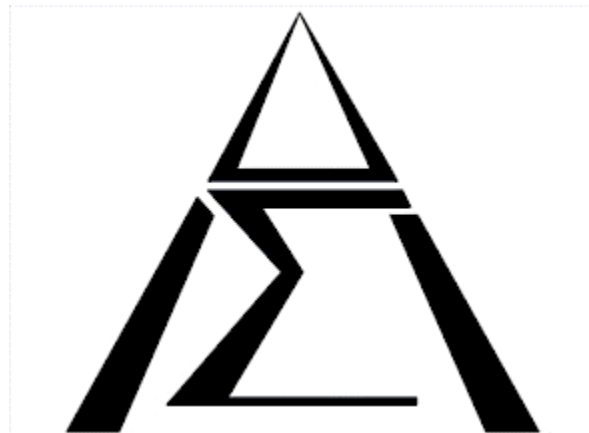


MOLDiagnositics

Technical Manual



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NOTICE & DISCLAIMER

This monitoring device measure various air parameters that, when properly operated, provides an indication of air data conditions that potentially can support the growth of mold in various areas of a facility. This device does not measure water intrusion events. This device does not sample or analyze air for the content of mold, fungal material or microbes of any kind. This device, when properly used along with an operations, maintenance and mitigation program that includes visual facility inspection, can provide responsible parties with air related data, that when managed properly, reduce the potential for conditions that may give rise to mold growth.

DISCLAIMER

Applied Data Sciences reserves the right to make design changes or modifications to any product to improve performance or incorporate new functions. The material in this document is for informational purposes and is subject to change without notice. Applied Data Sciences assumes no responsibility for any errors that may appear in this document.

CALIBRATION

This product has been factory calibrated. Recalibration should be performed on a twelve months schedule. If any changes are required, the unit should be returned to Applied Data Sciences.

The only calibration required by the user is the adjustment for local Barometric Pressure. Refer to page 11 of this document **UNIT SETUP** to make this simple adjust

Warranty information is presented on the last page of this document

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MOLDiagnosics

Operating instructions:

The **MOLDiagnosics** is a hand held, battery powered, weather sensor device. It contains a Barometer, Thermometer, Hygrometer, Oxygen Sensor, Carbon Dioxide Sensor, Real Time Clock, and battery level monitor. The functions for these sensors are accessible from the 24-key keypad on the **MOLDiagnosics**. Each key has an abbreviated description of what it does. Some keys contain symbols and others contain words. Some keys are used in conjunction with other keys, while some are not. The following information describes the keys and the functions they perform.

Detailed operating instructions are provided in another manual entitled *MOLDiagnosics OPERATING INSTRUCTIONS*. Document number: 0900135

Free running mode (no keys pressed):

The **MOLDiagnosics** will boot sampling. This means that when it is turned on, it starts sampling and will continue sampling until interrupted by a key being pressed. In this free running mode it runs in a loop; sampling all of the sensors and the clock at a rate of about 8 Hz. Within this loop it will also make comparisons and determine the minimum and maximum values of each sensors sampled and will keep these values in memory to be displayed later (using the STATS key). Also in this free running mode, the data from the sensors is sent out over the RS-232 link. You can connect the COM port on the **MOLDiagnosics** to a computer and collect the data using the **MOLDiagnosics**' Windows Terminal Software. You can also use other programs to take readings from **MOLDiagnosics**, such as HyperTerminal.

Set the serial link parameters in the program to: *19200 baud, 8 data bits, no parity, and 1 stop bit.*

Sensors Sampled in Free Running Mode:

In the free running mode there are 5 sensors and clock that are sampled.

- ❑ The Barometer (BP) is the first sensor on the free running mode screen. It is read in inches of mercury adjusted for altitude by the barometer DC offset subroutine (see Unit Setup). The offset will allow you to adjust the barometer to the local altitude so your barometric pressure readings will match that of the local geographic area.
- ❑ The next sensor is Air Temperature (AT). It is displayed in whole degrees Fahrenheit (°F).
- ❑ Next is the Relative Humidity (RH) sensor. Its reading is measured in a percentage from 0 to 99 percent. 0 being as dry as the scale gets and 99 being as moist as the scale gets.
- ❑ The Oxygen Sensor (OXY) is a galvanic sensor, which detects oxygen by a chemical reaction, which creates a voltage that is proportional to the amount of oxygen it is exposed to.

This is the only sensor on the **MOLDiagnos**tics that will require a simple calibration (See the section called O₂ Cal.)

- ❑ The Carbon Dioxide Sensor (CO₂) uses infrared technology to detect small concentrations of carbon dioxide up to 2000 parts per million.
- ❑ Finally the Battery (BT) fuel gauge will tell you how much life is left in the 9-volt battery. When a new fully charged battery is installed, the gauge will read approximately 98 percent. The scale is linear down to approximately 25 percent. The recommended replacement of the battery is at 25 percent, however the unit will continue working down to 0 percent on the fuel gauge, with diminished accuracy. When using the wall transformer power supply the battery fuel gauge will read 99%.

Front Panel keypad

As the **MOLDiagnos**tics is collecting data in free running mode, it will accumulate the minimum and maximum values for each atmospheric sensor. The values for each of these sensors will be displayed by pressing the respective **Stats** key.

All Stats buttons have expanded text to allow easier user understanding. Press **ESC**(escape) to cancel and return to the root screen.

Note for buttons: Temp, Humi, Baro, O₂, and CO₂

The minimum and maximum values for these buttons are stored in RAM and will be lost when the unit is turned off. There is no way to store these values. These values are cleared with the **Clear Stats** Button.

The front panel keypad buttons, shown in FIGURE 1.0 below, are described in the following sections.



FIGURE 1.0
KEYPAD

Temp Stats

Temp Stats will display the minimum and maximum temperature the unit has been subjected to since the unit has been turned on. Please be advised that subjecting your **MOLdiagnostics** to temperatures greater than 150° Fahrenheit can permanently damage the unit, and subjecting the unit to temperatures below 0° Fahrenheit can cause the unit to stop functioning temporarily.

The temperature sensor can sense temperatures between 32°F and 212°F degrees accurately, and can sense outside that range with diminished accuracy. To sense temperatures above 150°F, it is recommended that a remote temperature sensor module be used.



As with the **Temp Stats** the Relative Humidity also has its minimum and maximum values held in memory to be displayed when this button is pressed. The range of Relative Humidity is 0% to 99%. The **Humi Stats** button will display the minimum and the maximum Relative Humidity the unit has recorded since it was turned on.

Do not expose to or immerse the unit in water



Also like the **Temp Stats** the Barometric Pressure minimum and maximum pressures are held in memory to be displayed when this button is pressed. These measurements are read in inches of mercury and have an accuracy of hundredths of an inch of mercury.



This key will clear the minimum and maximum fields for the Temperature, Humidity, Barometer, Oxygen and Carbon Dioxide stats. This will allow the user to reset the **Stats** fields without having to turn the unit off to clear these fields. There are two reasons why the **Clear Stats** button is necessary to clear out erroneous values.

1. First, there is a new feature in the analog front end of this device. A second order low pass digital filter has been added to smooth out the input signals to the processor. It takes time (about 2 seconds) for the filters to acquire enough data to work properly. This will cause erroneous values in the Stats screens.
2. The second reason for the **Clear Stats** button is that the Carbon Dioxide sensor requires time (about 2 minutes) to warm up. The user can Watch for the CO2 sensor to stabilize, or just wait a few minutes, then Press the **Clear Stats**. This action will clear the

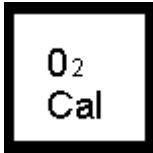
erroneous value and the Stats screens will contain true values. There is no noticeable effect, on the Screen, by pushing this button. It only requires one press and you can check the results, if you must, by pressing one of the stats buttons.



The **MOLDiagnos**tics uses a galvanic oxygen sensor to detect how much oxygen is dissolved in the mixture we call air. A galvanic sensor depends on a chemical reaction, which produces a voltage that is proportional to the amount of oxygen it is exposed to. The sensor output is a very small voltage level and requires amplification to be read by the processor. Subsequently we need an amplifier to adjust the sensor output to the scale of the analog to digital converter. That is why it requires calibration--see section called **O₂ Cal**. This sensor is read as a percentage of air, for example if the reading is 20.9%, this means that 20.9 percent of the air is oxygen. The min and max stats also are read in this manner.



The carbon dioxide sensor in the **MOLDiagnos**tics uses infrared technology to measure small quantities of carbon dioxide. The range of the sensor is 0 to 2000 parts per million (or 2 parts per thousand). Therefore, the maximum concentration that this sensor can measure is 2000 PPM. This is **NOT** the maximum concentration that can exist in the modern world. You must exercise caution when using this meter to measure concentrations of carbon dioxide in an enclosed space. If the reading is maxed out at 2000 PPM, the real concentration can be much higher. **CARBON DIOXIDE CAN KILL YOU! DO NOT PLAY WITH IT!** This is the reason why all animals, including humans, need a supply of fresh air. When animals respire they consume oxygen and exhume carbon dioxide, a waste product of respiration. If the supply of fresh air, including oxygen, is not present the level of carbon dioxide will become toxic and eventually kill the animal. The normal level of Carbon Dioxide in outside air is between 0.03% and 0.07% (300 to 700 parts per million). This meter can read up to 0.2% (2000 parts per million), however if the reading is maxed then the real level of carbon dioxide can be much greater. It is advisable to ventilate any area that causes the reading to go to maximum.



This screen is used for the calibration of the oxygen sensor. The **MOLDiagnos**tics uses the galvanic oxygen sensor in concert with an operational amplifier with adjustable gain to derive the oxygen percentage reading. This combination of electronic components requires calibration to adjust the gain of the operational amplifier and to adjust its output to the scale of the analog to digital converter on the microcontroller. This calibration requires the use of a calibrated oxygen mixture that is 20.9% oxygen and 79.1% nitrogen. This mixture is available at most gas supply stores. The calibration gas should be used with an isolation cup to apply the gas to the localized area of the oxygen sensor.

Calibration Procedure:

1. Press the **O₂ Cal.** button on the **MOLDiagnos**tics.
2. Prepare the calibration gas, open the supply valve, and place the calibration fixture over the oxygen sensor on the **MOLDiagnos**tics.
3. Watch for the sensor number to settle; may take 30 seconds or so.
4. Adjust the oxycal potentiometer (R8) to read 0209 on the **Sensor ADC#** reading.
5. Close the valve on the oxygen bottle and remove the calibration cup.
6. Press **ESC** escape on the **MOLDiagnos**tics to return to Free Running Mode.

Make sure the calibration gas bottle is turned off to conserve your expensive calibration gas.



This button displays the Unit Model number, the Unit Serial Number and Firmware Revision. The warranty is determined by the serial number. Also displayed is the web site location where you can inquire about the warranty information. The screen will automatically return to the main screen after ~ three seconds.



The **MOLDiagnos**tics has the ability to log samples of data over time. This button allows the user to set the delay between samples. The default value is 5 minutes. The value is adjustable in minutes from 1 minute up to 60 minutes (1 hour.) At a rate of 1 sample per minute the logger EEPROM memory will be filled after 11 days. At a rate of 1 sample every 1 hour the logger memory will be filled after 1.8 years.

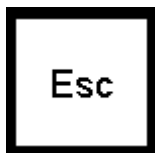
Use the + and - buttons to increase or decrease the delay. Use **Enter** to save the number, or **Esc** to exit without recording any change in the value.



This button is used to set the date and time in the Real Time Clock for the **MOLDiagnos**tics. It presently works in military time only (i.e., 0 – 24 for the hours reading). Pressing this button will start a sequence of adjustments, which will allow you to set the time date. The Real Time Clock has a “super cap” backup, which will allow the unit to retain the time without power for several weeks.

When the button is first pressed the cursor is automatically placed on the hours field and the user can use the + and – buttons to adjust the value. When the desired value is displayed, press the **Time Set** Button again and the routine will move to minutes. Again use the + and – buttons to adjust the displayed value until the desired value is displayed and then press the **Time Set** button again to set the value.

This sequence continues through “*hours, minutes, seconds, month, date, and year*”. When the user sets the year the routine will set the Real Time Clock and write protect it so that bogus values cannot be accidentally set into the Real Time Clock.



This button is used to escape from several subroutine screens without saving the information.



This button uses an algorithm to produce an alarm sound. Currently this button is used to enable or disable the beeper. Press **Enter** to disable the beeper or **Esc** to enable the beeper.



This button is used in conjunction with other buttons. Its primary function is to set values such as the sample delay time and the set time sequence.



This button is used to set the DC offset for the barometric pressure sensor. The unit will display the current barometric pressure reading and prompt the user to press + or – to adjust the value. The offset value is stored in the EEPROM and will be recalled for adjustment. The user can then adjust the number using the + and – buttons to adjust the displayed barometric pressure to the local value.

Once the desired value is displayed the user can press the **Enter** button to write the value to the EEPROM and exit from the unit setup screen. The **ESC** button can be pressed to exit without changing the value.



By depressing this key, you can view the logged records that are stored in the **MOLDiagnos**tics' EEPROM Memory. Press the + and – buttons to scan through the logged data. The Address counter, located in the upper right hand corner, is incremented by 2 when you press the + button. This is because the logged sample is 16 bytes, which is two 8-byte addresses. When through viewing the data, press **ESC** to exit and return to the free running loop.

The screen uses the following abbreviations:

- CO2 = Carbon Dioxide
- OXY = Oxygen
- B = Barometric pressure
- T = Temperature
- H = Relative Humidity
- P = Battery Power Level

The Date and Time of the respective sample is shown on the bottom line.



MOLDiagnostics has the ability to record log samples incrementally over time or manually at the press of a button. The time between recorded samples can be set in the **Delay Set** subroutine. Some users will wish to hand log samples. The **LOG Sam** button will force the unit to record a sample from each of the five atmospheric sensors and the clock every time it is pressed, up to 16,384 samples. The record will be written into non-volatile EEPROM memory. This manually logged sample is in addition to the samples that are being automatically logged. These records can be accessed using a Desktop Computer and the **Dump LOG** button.



This button will dump the EEPROM memory contents via the RS232 port so it can be transferred to an external device such as a Personal Computer. The logged information can be transferred from the **MOLDiagnosics** by using the supplied Terminal Program or by using a generic software package like HyperTerminal. The port settings for the Desktop Computer's serial port are: *"19200 baud, 8 bit data, 1 stop bit, and no parity"*. This function will transmit all the valid data and end the routine when it detects that the last sample has been sent or the user forces a stop.

When using the **MOLDiagnosics** Terminal Software, the Dump Log Routine will start automatically when the user presses the Data Logger button in the terminal software. When the last sample is detected the Terminal Software will automatically produce a **"Save As"** dialog box for saving the logged data to a file. The data is stored as a comma delimited database so it can be easily imported to a spreadsheet for analysis. Each sample is separated from other samples with a carriage return/line feed. The actual format of the data is presented in the section of this document entitled **Output Data Format**.



This button clears the EEPROM memory that is used to store log samples. The EEPROM holds stored samples when the power is turned off or when the battery is depleted. The **Clear Log** button will reinitialize these memory locations to all zeros. When the **Clear Log** button is pressed the unit will give the user a choice of clearing the EEPROM or Exiting without clearing the EEPROM.

Pressing **Esc** key will cause the program to exit from the clear log utility screen without clearing the EEPROM.

Pressing **Enter** key will start clearing values at zero and count up to 32867 addresses (the end of the EEPROM).

As it is clearing the memory sequentially, the user can stop this function at any time by pressing **Esc** and only those addresses specified will have been set to all zeros.



This function displays the calculated values for Density Altitude (**DA**) and Air Density (**AD**) data. These numbers have a tolerance of:

- $\pm 10\%$ for the Density Altitude and
- $\pm 1\%$ for the Air Density.

Press **ESC** to exit and return to the free running loop.



This function provides the calculated value for Saturated Water Vapor Pressure and the Water Vapor Pressure. Because of the mathematical limitations of the processor, the Saturated Water Vapor Pressure (SWVP) is obtained from a lookup table. The Water Vapor Pressure is then computed from the SWVP relative to the Relative Humidity. The firmware has a look-up table that provides the SWVP from 32 degrees Fahrenheit to 108 degrees Fahrenheit. When the temperature is outside of this range the numbers are erroneous.

Press the **ESC** key to exit and return to the free running loop.



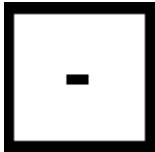
NOTE: This function not incorporated at this time.



The Back Light Button is a toggle switch to turn on the backlight. Press it once to turn on the backlight and press it again to turn off the backlight. Using the backlight will cause the unit to warm up, thus causing erroneous temperature readings. It is our recommendation that the backlight stay off most of the time, not just to conserve battery power, but also to prevent erroneous temperature readings.



This button is used in conjunction with other buttons to allow the user to adjust the time and delay setting. Its function increases the indicated value.



This button is used in conjunction with other buttons to allow the user to adjust the time and delay setting. Its function decreases the indicated value.

Output Data Format

The output data is a standard ASCII data string. Output via the RS-232-C port when the unit is in the continuous (free running) mode is:

Free Running Sample

A typical sample (record) has this format:

aaa.aa,bb.bb,cc.cc,dd.dd,eee.ee, f.ff, gg.gg,hh.hh,ii.ii,jj.jj,kk.kk,ll.ll,mmmm.mm

aaa.aa	Temperature in °F
bb.bb	Barometric pressure in InHg
cc.cc	Humidity in %
dd.dd	Oxygen in %
eee.ee	Carbon Dioxide in PPM
f.ff	Water Vapor Pressure
gg.gg	Dew Point Temperature in °F
hh.hh	Hour
ii.ii	Minute
jj.jj	Second
kk.kk	Month
ll.ll	Day
mmmm.mm	Year

NOTE: The number of digits required will be dynamically adjusted. Leading zeros (0) will be dropped.

CONTINUED NEXT PAGE

The output data is a standard ASCII data string. Output via the RS-232-C port when the unit is reading data out of the EEPROM (logged data) mode is:

Logged Sample

A typical sample (record) has this format:

aaa.aa,bb.bb,cc.cc,dd.dd,eee.ee, f.ff, gg.gg,hh.hh,ii.ii,jj.jj,kk.kk,ll.ll,mmmm.mm

aaa.aa	Temperature in °F
bb.bb	Barometric pressure in InHg
cc.cc	Humidity in %
dd.dd	Oxygen in %
eee.ee	Carbon Dioxide in PPM
f.ff	Water Vapor Pressure
gg.gg	Dew Point Temperature in °F
hh.hh	Hour
ii.ii	Minute
jj.jj	Second
kk.kk	Month
ll.ll	Day
mm.mm	Year

NOTE: The number of digits required will be dynamically adjusted. Leading zeros (0) will be dropped.

MOLDiagnositics Terminal Software Installation

Instructions for installing and using the **MOLDiagnositics** Windows software are provided in a separate document. That document is entitled *MOLDiagnositics – Instruction for using the Software*, Document Number: 0900135 and is included with this product.

MOLDiagnosics Product Specifications

Height:	8.5"
Width:	5.5" (display), 3.3" (keypad)
Thickness:	2.9"
Processor:	Microchip - PIC16F877-04/L
Processor Speed:	4 Megahertz
Program Memory:	8192, 14 bit words (14 kilobytes)
Processor RAM:	384 bytes
Processor EEPROM:	256 bytes
Data Logger EEPROM:	256K bytes
Processing Speed:	1 MIPS
Display:	Microtips MTC-S20400XRGHS-5
Oxygen Sensor:	Teledyne Analytical Instruments K1-D
Sensor Range:	0% to 100%
Sensor Accuracy:	+/- 1%
Expected Life:	15 months
Sensor Temp Range:	32°F to 104°F
Carbon Dioxide Sensor:	Telaire Model 6004 Diffusion
Sensor Range:	0 to 2000 parts per million in air
Sensor Accuracy:	+/- 40 ppm + 3% of reading @ 77°F
Sensor Temp Range:	32°F to 122°F
Response Time:	<60 seconds
Pressure Sensor:	Fujikura XFAM-115KPASR
Sensor Range:	4.43" to 33.96" Hg [2.18 Psia to 16.68 Psia]
Sensor Accuracy:	+/-2% FS
Sensor Temp Range:	32°F to 185°F
Temperature Sensor:	National LM34DZ, calibrated in Fahrenheit
Sensor Range:	32° F. to 212° F.
Sensor Accuracy:	+/-1.8% Typical [+/-3% Tested Limit]
Humidity Sensor:	Honeywell HIH-3610
Sensor Range:	0% RH to 99%RH
Sensor Accuracy:	+/-2%
Response Time:	15 seconds in slow moving air at 77°F
Voltage Requirement:	6 to 18 Volts
Battery Size Requirement:	Two Standard 9-Volt Alkaline
Current Requirement:	140 milliamps
Power Consumption:	700 milliwatts
Optional Power Source:	9 Volt, 500 mA, Wall Transformer
Real Time Clock:	Dallas DS1302 RTC
Clock Backup:	220 milliFarad super cap

MOLDiagnositics Limited Manufacturer's Warranty

Applied Data Sciences will honor a limited warranty on this product for a period of one year after the purchase date. This warranty covers manufacturers original parts and workmanship for the period of one year after the purchase date. If this product fails, the manufacturer will repair or replace the unit within a period of one year after the purchase date.

Upgrades are not covered by the warranty, and are treated as purchasing additional parts or software. Out of warranty repair charges are a minimum ½ hour at **\$35 per half hour.

Practices that will void the warranty are:

- ❑ Immersing the **MOLDiagnositics** in water.
- ❑ Exposing the **MOLDiagnositics** to microwave radiation.
- ❑ Exposing **MOLDiagnositics** to temperatures above 150°F while in operating mode.
- ❑ Intentional physical damage.
- ❑ Applying more than 18 volts, or voltage of the wrong polarity to **MOLDiagnositics** power input jack.

In order to maintain your **MOLDiagnositics** warranty use only the power supply which has been provided with your unit. Do not, under any circumstance, put your **MOLDiagnositics** in a hot oven, a microwave oven, a fireplace or a barbecue. **MOLDiagnositics** is not heat proof and excessive heat will destroy it completely, and will void the warranty. Also, **MOLDiagnositics** is not waterproof, Do Not immerse in water or any other liquid; especially flammable liquids.

For Information on repairs, upgrades, or questions contact:

***Repair charges are subject to change without notice*

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