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AIRFLOW–TEMPERATURE MONITOR

ATM-24

(For Firmware Rev 3.4 and up)

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1. INTRODUCTION

The Airflow-Temperature Monitor (ATM-24) is an instrument designed for measuring airflow and temperature at multiple locations simultaneously, to aid the design process of electronic products such as computers and telecommunications equipment. The application of the ATM-24 extends to other industries including process control, HVAC, medical, and food processing.

The ATM-24 has several advantages over traditional methods. The two most important features which make the ATM-24 unique are the ability for simultaneous multi-point measurements and the low profile, interchangeable CAFS Series of probes.

1.1 Technology

The CAFS probes utilize the time-tested technology of hot thermistor anemometry. Each probe has a temperature sensor and a cooling rate sensor. The signals from these are used to compute the airflow and temperature. The ATM-24 can measure signals from up to 24 of these sensors. The data formatted by the ATM-24 is displayed or is available for on line analysis of the thermal environment.

1.2 Components

The supplied kit should contain the following:
ATM-24 Instrument
AccuTrac Software (PC version only) or Kermit (Mac versions only)
5V Universal Power Supply with AC power cord
RS-232 cable
Carrying case
Plastic mounting clips for CAFS sensor
CAFS probes (as ordered)

1.3 Requirements

Users need an IBM compatible PC, with a COM port or a Macintosh computer.

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1.4 Handling

The ATM-24 and CAFS probes are delicate and sensitive devices. Avoid directly touching the thermistor beads on the CAFS probes for it could disrupt their accuracy. When not using the ATM-24 and probes, cover the units to avoid dust gathering in the units. Do not disassemble the ATM-24 or CAFS probes at any time as it will void the warranty.
Like other laboratory test equipment, we recommend recalibration of the ATM-24 and CAFS probes once a year. Please contact us to arrange for recalibration.

2. HARDWARE INSTALLATION

Connect the Power Supply to the ATM-24 at Location 1 (see Fig. 2.1) and plug Power Supply into an appropriate wall unit.

Plug in the RS-232 interface at Location 2 on the ATM-24. (see Fig. 2.2) Then plug in opposite end into the appropriate PC communication port.

Plug the probes in the desired locations on ATM-24 (Location 3). Please note that it does not matter which locations are used. You are not required to place the probes in sequential location or fully populate the ATM-24.

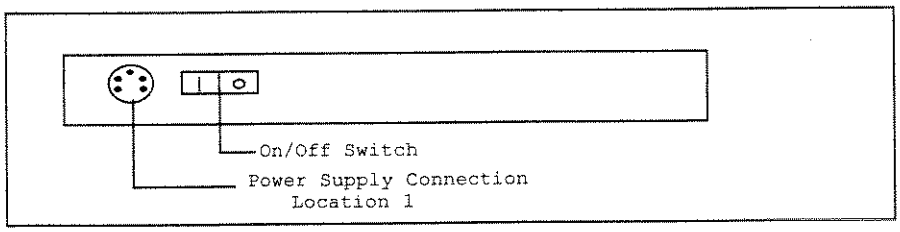


Figure 2.1 Power connection to the ATM-24

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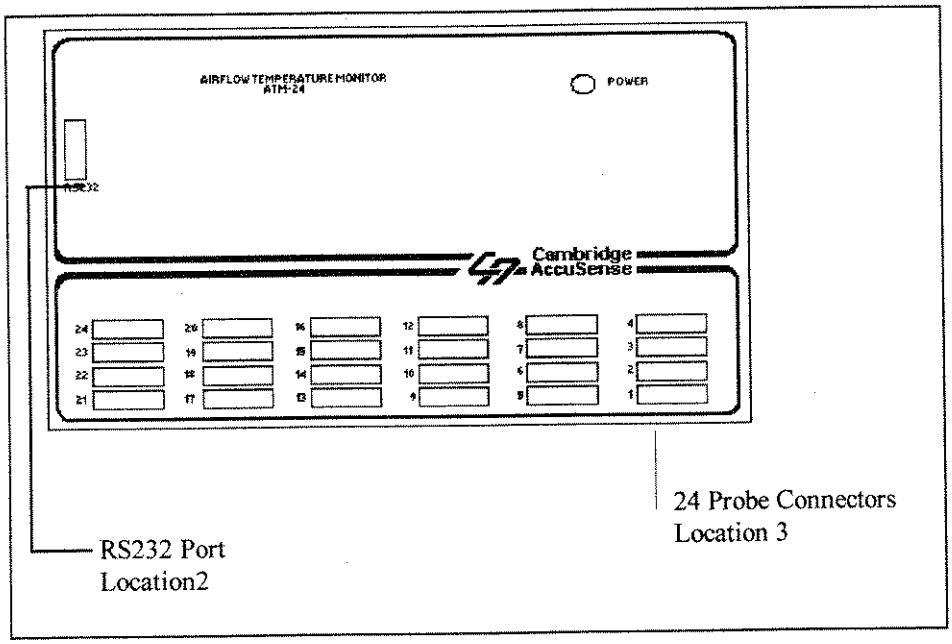


Figure 2.2 Connector locations of the ATM-24

3. RUNNING THE ATM-24

Once the ATM-24 is connected to the PC it is ready for measurements. Load the AccuTrac software according to the accompanying operating instructions.

3.1 Using the ATM-24 with AccuTrac®

Please follow the directions in the AccuTrac manual to set up and run the ATM-24.

3.2 Setting up the ATM-24 for Terminal Emulator

- Start the terminal program in AccuTrac. Please follow the directions in the AccuTrac manual to run the ATM-24. When using a terminal emulator such as Kermit, make sure the settings are as follows: 19200 baud, no parity, 8 stop bits, and assign the correct COM port. Power on the ATM-24. Hit the space bar several times to obtain the setup screen as seen in the Figure 3.1.

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```
=====================================================
Cambridge AccuSense, Inc.,
ATM-24: Setup Selection (Rev 3.0)
=====================================================
Present settings:
     Unit of display          : FPM and deg C
     Measurement period (sec):    1
     Display format           : Ignore data from
                                unused locations.
     No. of Samples/Meas      : 200
=====================================================
       1. Change display units
       2. Set measurement period in seconds
       3. Change display format
       4. Change data format
       5. Change sample size per measurement

Type Selection or ENTER to continue :
```

Figure 3.1 The Setup Screen

The setup menu allows users to change display units, sampling period, display format, and data format.

- **To change display units**, type **1:** This choice is used to change the unit of measurement (Fig. 4.2). When the display unit is changed, the setup screen will refresh with the new choice.

```
      1. mm/s and deg C
      2. FPM and deg C
      3. FPM and deg F
      Type Selection or ENTER to skip :
```

Figure 3.2 Display Unit Selection

- **To change the measurement period**, type **2:** The measurement period is the time between two consecutive measurements. The measurement period is entered in seconds. For example, a measurement period of 50 millisecond may be entered as 0.05. To operate the ATM at the fastest possible speed enter a value 0 (zero) as the measurement period. The minimum measurement period accepted is 0.01 sec (10 mS). The maximum speed achieved depends on the number of sensors connected and the number of samples per measurement. When the desired measurement period is entered, the setup screen will automatically refresh.

```
   Measurement time may be a fraction of a Second.
   Measurement time of zero runs ATM at maximum speed.
   Type in measurement period in sec and
   press ENTER :
```

Figure 3.3 Changing Measurement Period

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- **To change the display format**, type **3:** The data locations from the unused sensor positions may be filled by 0 (zero) or can be left unfilled.
  This feature may be useful if the displayed data is also logged for loading into a spreadsheet. Since each data record has either a measurement or zero at every field, the record length will always be the same.
  It is advantageous to ignore data from unused locations as it will improve data transfer rate and reduce the disk space needed for logging data. See Fig. 3.4 for the menu.

```
1. The data from the unused sensor positions
     will  be ignored.
2. The data from the unused sensor positions
     will  be 0(zero).
Type Selection or ENTER to skip :
```

Figure 3.4 Display Format Selection

- **To change the data format**, type **4:** The ATM-24 can transmit data in two formats, the Display format and Text format:
  - In the Display format the screen shown in Figure 3.6 is created by the ATM-24 where the measurement data is placed at different locations on the screen. The data sent by the ATM-24 contain several undisplayed video control characters to format the screen.
  - In the Text format the ATM-24 sends the measurements in ASCII format without any control characters. In this mode each line contains time data (hr., min., sec. of measurement), and the airflow and temperature data from each sensor delimited with "SPACE" character (ASCII 32). The end of each line will have "Carriage Return" (ASCII 13), "Line Feed" (ASCII 10) and "NULL" (ASCII 0) characters.

  Selection 4 in the setup menu brings up the question in Figure 3.5. Pressing **Y** here changes the data format to Text format. *This mode must be activated when using AccuTrac.*

```
The ATM-24 can be set to send characters in ASCII
 without video control.
 Do you want to change data format (y/[n]) :
```

Figure 3.5 Data Format Selection

- **To change the number of samples per measurement,** type **5:** For each measurement that the ATM-24 makes, it takes several samples of the analog signals from the sensors, computes the mean and then calculates the airflow and temperature. The number of samples taken differ with applications. For an experiment that measures transients and turbulence in the flow, fewer samples (e.g., 10) per measurement will be suitable. And for steady state flow measurements with minimum influence of turbulence, a large number of

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samples (e.g., 200) may be used. The number of samples per measurement also affects the measurement period. The maximum speed achieved for a given configuration will require a smaller number of samples per measurement.

Once the ATM-24 has been set up, the settings will remain the same until they are changed. The settings may be changed during power up or while the system is operating.

- To return to Display format or to change your system settings, power on the ATM-24 and press any key within the first three seconds. This action will open the setup screen and change the data format back to the Display mode. Note: If you are only changing the sampling period or display units and wish to use the Text data format, the data format option must be selected again.
- The settings may also be changed online. Refer to Section 3.3 for online control commands.

3.3 Displaying the airflow and temperature measurements with a terminal emulator program

Once the ATM-24 setup has been completed as in Section 4.1, the measurements can be displayed by pressing **Enter**. The screen in Figure 4.6 will be seen, and the measurement data will be refreshed periodically according to the selected measurement time. To change the settings or the number of probes, restart the ATM-24 by powering it down and up again.

```
                Airflow Temperature Monitor (ATM-24)
============================================================
Channel No.  :    1     2     3     4     5     6     7     8
Airflow (FPM):
Temp.(Deg C) :


Channel No.  :    9    10    11    12    13    14    15    16
Airflow (FPM):
Temp.(Deg C) :


Channel No.  :   17    18    19    20    21    22    23    24
Airflow (FPM):
Temp.(Deg C) :


Time (h:m:s) :    0:00:01
============================================================
                      CAMBRIDGE ACCUSENSE, INC.
                         Shirley, MA 01464
                          (508) 425-2090
============================================================
```

Figure 3.6 ATM-24 Display Screen

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3.4 Online Control Commands

The ATM-24 accepts commands from the host computer while performing measurement and data transfer. This feature enables the host computer to change settings of the ATM-24 without having to power down and up the instrument. All the commands start with the asterisk character "*" except the reset command "~". The ATM-24 could be programmed to echo the command characters back to the host to confirm receipt of the command.

The commands are as follows.

- ~ : Hard Reset: : ATM-24 is re-initialized. This is equivalent to power-up.
- ***I:** Identify: When several instruments are connected to COM ports of a computer, it is necessary to identify if the instrument is an ATM-24 or a TCM-24. This command initiates a response of character "A" from the ATM-24 and "T" from the TCM-24.
- ***C:** Initialize Sensor Probes: Checks for sensors at all channels and updates the lists of channels that are used. This command is necessary if sensors have been added or removed.
- ***X:** Measure Airflow and Temperature and Transmit data: This command initiates an airflow and temperature measurement in the ATM-24. The results are transmitted to the host. This command may even be issued between scheduled measurements to get an instant reading.
- ***x:** Transmit Data from Last Measurement: This command is similar to the previous one except that the data transmitted is from the last measurement. This feature may be used for retransmission of the previous measurement data.
- ***P:** Change Measurement Period: The time (in seconds) between measurements can be set using this command. Example: *P1.25<ENTER> for a measurement period of 1.25 sec.
- ***S:** Number of Samples per Measurement: This parameter may be changed using this command. Example: *S200<ENTER> for 200 samples per measurement.
- ***R:** Retrieve Configuration Register: The ATM-24 sends the configuration register as a response to this command. The configuration byte will be sent as two ASCII characters representing the number in HEX format. E.g., E2 = 1110 0010.
- ***T:** Reset Internal Timer of ATM: The ATM-24 will re-initialize the internal timer and send out one set of data with time = 0.

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Configuration Register

bit[0]
- 0 => Data format: Text (used by AccuTrac)
- 1 => Data format: Display

bit[1] 0 => No Echo for commands received
- 1 => Echo commands

bit[2] 0 => Display all channels data. 0 if absent
- 1 => Display data only from channels present

bit[3] 0 => Airflow Unit mm/s
- 1 => Airflow Unit FPM (used by AccuTrac)

bit[4] 0 => Temp Unit deg. F
- 1 => Temp Unit deg C (used by AccuTrac)

bit[5] 0 => Mute mode: no data transmitted unless queried
- 1 => Normal data transfer

bit[6] 0 => Transmit only Airflow data
- 1 => Transmit both Airflow and Temperature data

bit[7] 0 => Configuration not set
- 1 => Configuration recorded

- ***MODE COMMANDS*** These are commands to change the mode of operation. They start with "*M" character sequence.
  - ***MD:** Set data to DISPLAY format.
  - ***Md:** Set data to TEXT format.
  - ***ME:** Echo on. The command characters sent by the host are echoed back to the host. This feature may be used to ensure proper transmission of commands.
  - ***Me:** Echo off. The echo feature is turned off.
  - ***MS:** Ignore data from sensor positions that are not used.
  - ***Ms:** Data from sensor positions that are not used are set to 0(zero). This feature may be used to have a constant record length for the data sent from the ATM-24 that is independent of the number of sensors connected.
  - ***MI:** Imperial units for airflow (Feet Per Minute).
  - ***MM:** Metric unit for airflow (millimeter per sec).
  - ***MC:** Temperature in degree Celsius (°C).
  - ***MF:** Temperature in degree Fahrenheit(°F).
  - ***MN:** Normally timed data transfer as per user selected measurement period.

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- ***MQ:** Quiet mode where the ATM-24 sends measurement data only to "*X" commands. This mode is useful if the host wants to control the timing of measurement.
- ***MA:** Transmit Airflow measurements only. This feature may be used when improved throughput is required and temperature information is not important.
- ***MB:** Transmit both Airflow and Temperature measurements.

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APPLICATIONS NOTES: ATM-24/TCM-24

COMMON QUERIES:	ACCUSENSE ANSWERS:
HARDWARE	
? Which should I use, an ATM or a TCM?	♦ The ATM-24 measures air velocity and air temperature. The TCM-24 uses thermocouples to measure surface temperature.
? Can I put my CAFS probe(s) into any slot (1-24) of the ATM?	♦ **YES.** The AccuTrac Software looks for the presence of a probe or probes and then numbers them appropriately in sequential order. For example, if you were using two CAFS probes and they were located in Slot #7 and Slot #15, the AccuTrac Software would treat them as Probe #1 and Probe #2, respectively.
? Can I damage a CAFS probe if I apply it in an application that is out of the probe's calibrated velocity range?	♦ Not likely. The probe will continue to sense airflow, but the readings may be inaccurate.
? Are the probe heads small circuit boards?	♦ **YES.** Sensor heads have thermistors mounted on small printed circuit boards, with flexible cable that permits access to very tight and difficult-to-reach locations.
CALIBRATION	
? Can I calibrate the ATM/TCM and probes myself?	♦ **NO.** The product must be returned to the factory for recalibration.
? Are ATMs and CAFS sensor probes calibrated together?	♦ **NO.** Each product is calibrated individually so that the sensors can be purchased separately or at a later date and still be compatible.
? How will I know if the devices are calibrated?	♦ Each product has a label affixed that indicates that the product has been calibrated. Also, a dated calibration certificate traceable to NIST accompanies each device sold.
? Is there an annual calibration program?	♦ **YES.** Cambridge AccuSense offers an annual recalibration package that costs $650 for one ATM-24 and 24 CAFS probes (excluding additional charges for broken CAFS probes). To recalibrate an ATM-24 or TCM-24 alone, the cost is $150/each. To recalibrate individual CAFS probes, the cost is $25/each. *Note: Recalibration includes latest firmware revision, except for ATMs with firmware 2.4 or earlier & TCMs w/Rev. 2.1 or earlier, which involves hardware upgrades.*
FIRMWARE	
? Is there a firmware upgrade program?	♦ Typically, firmware upgrades are handled during the recalibration process. However, if a firmware upgrade is required prior to the annual recalibration, AccuSense will work with each customer individually to assess their needs and make recommendations. Consult factory for details.
SOFTWARE **AccuTrac (Revs 3.0.3 & 3.0.3.4) will work with Windows 3.1/3.11, Windows 95, and Windows NT 4.0.**	
? Can I get a multi-user or site license for situations where multiple parties need access to separate software packages on several machines?	♦ AccuSense does not offer a "site license" arrangement. However , we realize that more than one user may need a copy of the software. The cost for one additional package is $650. If you need 3-6 packages, the cost is $350 each. For more than six, consult the factory.

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DATA MANIPULATION

? How do I plot data?

♦ To plot data, the Plot icon must be selected. This puts you in the plot screen mode. To see live data, you must manually select the probes that you want to plot. These probes can be found on the upper right-hand side of the plot chart and can be selected by highlighting each probe. After the selections are made, the chart begins to plot data.

? Can the Software export data to Excel?

♦ YES. AccuTrac Software saves data in an Excel (.xls) format. The software also has a built-in spreadsheet program so you can add formulas and do more analyses within AccuTrac without having to export it to Excel. However, you may open the files in Excel without a problem.

? Can I change or customize charts and tailor them to my specific application?

♦ **YES.** To modify or create a new chart, you must first select the Plot Icon to open the chart. Then, with the mouse in the chart mode, click on the "right" mouse button to access the programming functions to create/modify a chart.

? Can I take a snapshot of data and print it?

♦ **YES.** Make sure that the information you want to print is in the plot chart. Make sure that the Auto-Refresh command is OFF. Click on the "right" mouse button to access a pop-up screen. You can then select "print" to print your document.

? I have saved data in an **.xls** extension file, which contains temperature data programmed to be in degrees Celsius. I now want to change that data to read in degrees Fahrenheit. Can I do this?

♦ **YES:** As long as the data were saved in the Data Spreadsheet (.xls). If that is so, you may add a temperature conversion formula to an open column in the spreadsheet to provide the information you desire. Double-click the right mouse button on the data spreadsheet to access spreadsheet menu.

? Can I save a chart as a separate document?

♦ **YES.** Make sure that the information you want saved is in the plot chart. Make sure that the Auto-Refresh command is OFF. Double-click on the "right" mouse button to access a pop-up screen. You can then select "save as" to save your chart.

? Can I modify the saved chart data?

♦ It is important to understand that when you saved plotted data is a "snapshot" of data in a given time, and would not be modified.

Typically, when saved as a separate document, charts are then used as overheads for presentations or added to reports. The information saved is "stagnant." You can modify the chart legends, titles, and a few other parameters.

*Data that can be manipulated and crunched typically is saved in the Excel spreadsheet. And, if the spreadsheet is saved, then the user can create new charts by clicking "Plot Data."

? When plotting data, can the statistics information such as min., max., mean, std dev., etc. be plotted in the chart?

♦ **YES.**

? Can each statistic be programmed as a separate color?

♦ **NO:** But you can program each statistic to be a different-looking line on the chart by double-clicking the line.

? What is Track Data?

♦ Track Data is found in the data spread sheet at the bottom of the screen. Click on Track Data to select it.

Track Data allows you to monitor the most current information, "live data," as it is displayed in the spread sheet. It will display the information (update) at an interval of time that you have selected. If Track Data is not selected, the spread sheet will fill. The data will continue to update in the background. To see current data at that time, you must use the cursor and manually scroll down the scroll bar to "catch up" with the current data.

? How does the Autosave work?

♦ Autosave allows you to save your program automatically at an interval that you select—for example, every 10 minutes.

? How does Auto Refresh work?

♦ When in the Plot mode, Auto Refresh allows you to plot "live data" at the interval you specified when setting up your initial parameters. This provides an instantaneous picture of what is happening in your application. You always see the most current data.

? How does Refresh work?

♦ When in the Plot mode, Refresh is a manual command that allows you to scroll through your live data at a manual pace. As data is updated, it is updated only until the plot is full and then begins to accumulate behind the scene. It is not continuously updating on your plot screen. To see current data, the scroll bar must be positioned and moved by you to see the data that you want.

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ATM-24 TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
No response when the On/Off switch is turned on	• ATM-24 is not plugged in • No power in wall outlet • Power cable not completely plugged into power supply or ATM	• Set On/Off switch to "Off", plug in the ATM, set the On/Off switch to "On."
The system has power, but no display appears on monitor.	• The terminal or port has not been installed correctly	• Make sure the RS-232 cable is installed properly at both ends. • Set all settings as shown in User Manual.
System loses power during operation; lights on LED are off.	• System has become unplugged. • No power from wall outlet. • Power supply cable has come unplugged.	
Display does not show airflow or temperature readings when all probes are plugged into the ATM.	• The system has been turned on before CAFS probes were plugged into the ATM. • A "bad" CAFS probe is affecting the system operation, e.g., airflow readings are zero, or • the ATM-24 has a faulty channel. ***To identify either a bad probe or bad channel, follow the steps at right:***	• Turn the ATM's On/Off switch "Off," and then "On" to reset STEP 1: With all available CAFS probes plugged into channels in the ATM-24, unplug the probe in the <u>first position</u> and turn On/Off switch "Off" and "On" to reset. ***If no change appears in the readings on the display, then:*** STEP 2: Replace the unplugged probe to its original position STEP 3: Unplug the probe in the <u>second position</u> , turn the ATM "Off" and "On" to reset (as in STEP 1), and observe the readings on the display. If there is no change, replace the second-position probe to its original channel, unplug the probe in the <u>third position</u>, turn the ATM "Off" and "On," and observe the display. ***Follow this procedure for all of the probes, <u>one by one.</u>*** **When a probe has been unplugged and a <u>correct measurement</u> appears on the display, plug that probe into a different channel, reset the ATM, and observe the display readings. If the readings are now incorrect, you have identified a probe that will affect the system on ANY channel—that is, you have identified a "bad" probe, which should be replaced. **However, if that same probe sends data when plugged into any other channel except its original channel, then you have identified a bad channel on the ATM system. The ATM should be returned for repair.

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