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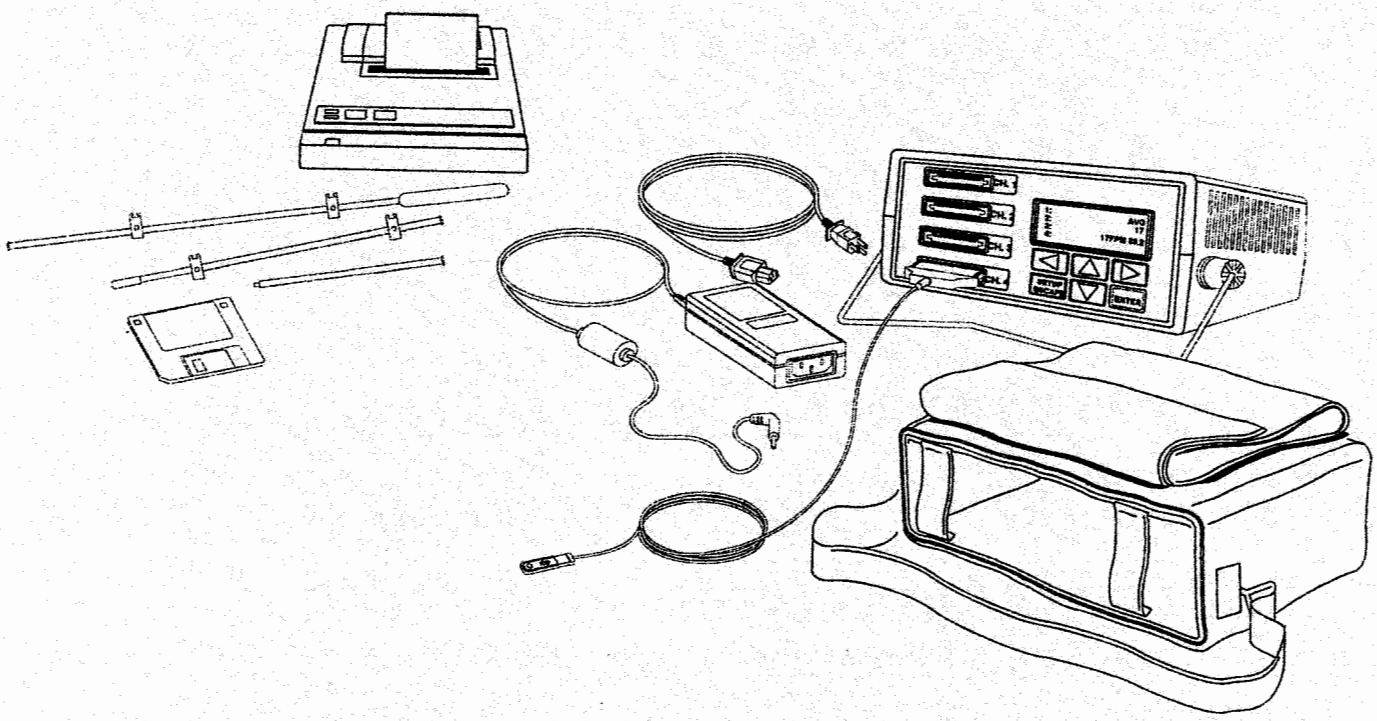
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Cambridge AccuSense

Quattro Flow Air Velocity Analyzer

User Manual



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Patent Information:

Patents pending in U.S.A. and Germany.

The AccuSense Quattro Flow Air Velocity Analyzer and its accessories are CE approved:

CE

For the EU Declaration for Conformity please see Appendix D.

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Foreword

About this Manual

This User Manual provides the information necessary to obtain the maximum benefits from the Cambridge AccuSense ("AccuSense" hereafter) Quattro Flow Air Velocity Analyzers. All operating instructions, functional descriptions, illustrations, and other relevant information are contained in this manual. Descriptions of the system hardware and user-interface operating software (the integral keypad and LCD screen prompts and menus) are included, as is the analyzer's theory of operation plus the AFS sensors it employs. Step-by-step instructions guide you through all installation procedures (Chapter 3), and tables in Chapter 4 identify and describe all software operating menus.

What to Read

Table 1.1 provides assistance in determining which chapter(s) of this manual to read or scan, depending upon your intent.

Table 1.1 Guide to the User Manual

If you wish to...	Refer to Chapter(s)
Learn how to use this User Manual	Foreword
Learn to use the analyzer in routine operation	4
Change the analyzer's operating characteristics or run tests	4
Place the analyzer in service for the first time	2, 3
Determine maintenance requirements	5
Troubleshoot operating problems	5
Learn about the analyzer's and sensor's theory of operation and components	1, 2
Access reference information	A-C

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Starting Out

If you are placing your AccuSense Quattro Flow Air Velocity Analyzer in service for the first time, you must read Chapter 3 (Installation) and Chapter 4 (Operation). Follow the step-by-step instructions provided. You may discover a need for additional expert help at your site as you move through these procedures. You can also contact your regional AccuSense representative or AccuSense's Technical Support for assistance in properly installing and starting up your Quattro Flow Air Velocity Analyzer.

Manual Contents

Information in this manual is organized as follows:

Chapter 1, Overview, provides a general description of Cambridge AccuSense's Quattro Flow Air Velocity Analyzer. Other topics include standard items, required additional equipment (i.e. AFS Sensors), available options, and theory of operation.

Chapter 2, Description, identifies and describes all the key components of the AccuSense Quattro Flow Analyzer, including its panels, soft carrying case, external power supply, power supply cord, sensors, and available options. It also lists the analyzer's specifications.

Chapter 3, Installation, supplies installation information for the Quattro Flow Air Velocity Analyzer, including general responsibilities, environmental requirements, and detailed procedures for setting up the Quattro components and performing an initial power up.

Chapter 4, Operation, explains the routine operation of the analyzer, including how to change default system parameters. Easy-to-use detailed tables identify and describe all software operating menus. Sample menus and screens are provided to amplify text descriptions. A flowchart illustrating the software operating menus is also included.

Chapter 5, Maintenance/Troubleshooting, provides the maintenance procedures applicable to the AccuSense Quattro Flow Air Velocity Analyzer. In addition, a list of "Frequently Asked Questions" contains diagnostic and corrective information about many common system problems.

Appendix A, Parts Lists, supplies part numbers for the AccuSense Quattro Flow Air Velocity Analyzer.

Appendix B, Quattro Firmware Flowchart, shows the main menus of the internal software.

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Appendix C, Customer Service Information, provides information about AccuSense's Customer Service policy, installation policy, and warranty. AccuSense's policies on warranty returns and consumable parts are also explained. To determine which policies apply to your system, consult your authorized AccuSense representative or distributor.

Appendix D, EU Declaration of Conformity, furnishes compliance information for the European Union.

The INDEX is an alphabetical, hierarchical (multi-level) listing of all headings, sub-headings, and important topics contained in this manual.

Design Change Notice

Due to design changes and product improvements, information in this manual is subject to change without notice. AccuSense reserves the right to change hardware and/or software design at any time, which may subsequently affect the contents of this manual.

AccuSense assumes no responsibility for any errors that may appear in this manual. The manufacturer will make every reasonable effort to ensure that this User Manual is up to date and corresponds with your shipped Quattro Flow Air Velocity Analyzer.

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Typographic Conventions

Integral Keypad Entries

Whenever you are instructed to make an entry on the integral keypad, the keys you must press are printed in boldface type enclosed in brackets. For example, the **[ENTER]** (bottom right-most) key on the integral keypad (see Figure 2-1) is referenced as:

[ENTER]

System Menus and Messages

System menus, messages, and prompts (requests for information or explanatory displays) appearing on the LCD screen are printed in a Courier typeface, on separate lines, indented—to distinguish them from other text. An example follows:

```
This is a sample system prompt.
```

The Quattro software operating menus are printed in ruled boxes in the Courier typeface. The Main Menu below is an example:

```
SYSTEM  CONFIG
STORE  DATA
GRID  COMMANDS
PRINT  DATA
```

Types of Messages

Three types of messages may appear in this manual: Warnings, Cautions, and Notes.

Warnings

Warnings indicate situations that could result in the injury of a human operator or bystander. Warnings are printed in all upper case characters in boldface type, between two heavy horizontal rules, as in the following example:

WARNING: NEVER INSTALL OR OPERATE THE ACCUSENSE QUATTRO FLOW AIR VELOCITY ANALYZER WHILE IN CONTACT WITH WATER. IF THE ANALYZER IS BEING POWERED FROM STANDARD ELECTRIC POWER, YOU MAY BE ELECTROCUTED!

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Cautions

Cautions indicate situations that could damage the AccuSense Quattro Flow Air Velocity Analyzer. Cautions are printed in mixed upper- and lower-case characters in boldface type, between two heavy horizontal rules, as in this example:

Caution: Failure to connect the AccuSense Quattro Flow Air Velocity Analyzer to the proper electrical voltage as specified herein (if using standard electric power) could result in damage to the analyzer.

Notes

Notes indicate miscellaneous information. Notes are printed in mixed case characters, in normal type, within a centered box, as in this example:

> **NOTE:** For details on AccuSense customer service policies, refer to Appendix B.

AccuSense Services

Operator Assistance

Should you experience any difficulty in running your Quattro Flow Air Velocity Analyzer, please contact your AccuSense representative. Chapter 5, Maintenance/Troubleshooting, includes a "Frequently Asked Questions" list that discusses many common system problems, possible causes, and corrective operator actions. The information given there is general. Some applications may require additional procedure or equipment modification. AccuSense's Customer Service is available weekdays from 9:00 am to 5:00 pm Eastern time. The Customer Service telephone number is (978) 425-2090. Technical assistance is also available from sales representatives throughout the world.

This is Revision Number 001 of the *AccuSense Quattro Flow Air Velocity Analyzer User Manual*, AccuSense Document Number 100132, with an effective date of September 1998.

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Warnings and Cautions

These are important safety instructions.

- Read them carefully, and save for future use.
- Follow all warnings and instructions marked on the analyzer and in this manual.

WARNING: DO NOT TRY TO REPAIR THE QUATTRO ANALYZER YOURSELF. THERE ARE NO CUSTOMER SERVICEABLE PARTS INSIDE. OPENING THE ANALYZER'S CASE PRESENTS A DANGER OF ELECTRIC SHOCK, AND AFFECTS THE ACCUSENSE WARRANTY.

WARNING: IF ANY OF THE FOLLOWING CONDITIONS OCCURS, TURN OFF THE ANALYZER IMMEDIATELY, UNPLUG THE POWER CORD FROM THE ELECTRICAL OUTLET, AND CONTACT AN ACCUSENSE SERVICE REPRESENTATIVE:

- If smoke, abnormal noise, or any strange odor is present.
- If liquid has been spilled over or into the analyzer.
- If the analyzer has been exposed to heavy rain or water.
- If the analyzer has been dropped or damage is visible.
- When experiencing malfunctions.

CONTINUING TO USE THE QUATTRO ANALYZER IN THE FACE OF ANY OF THE ABOVE CONDITIONS MAY RESULT IN INJURY TO HUMAN OPERATORS AND/OR DAMAGE TO THE ANALYZER!

WARNING: THE INTERNAL RECHARGEABLE BATTERY MAY LEAK, IGNITE OR EXPLODE IF NOT HANDLED PROPERLY. DO NOT USE POWER SUPPLIES OTHER THAN THOSE PROVIDED BY ACCUSENSE. DO NOT DISASSEMBLE. DO NOT DISPOSE OF THE BATTERY IMPROPERLY.

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Caution: Avoid exposing the Quattro analyzer and AFS sensors to dust, rain, and (condensing) water. Water can cause shorts, corrosion, and, at a minimum, inaccurate readings.

Caution: Avoid exposing the Quattro analyzer to direct sunlight or other heat sources. Do not store the analyzer inside a car or trunk exposed to direct sunlight.

Caution: Keep the Quattro analyzer away from magnets, motors, transformers, speakers, and televisions.

Caution: Do not mix up the electric power supplies for the Quattro analyzer and the optional thermal serial printer. Doing so may damage the power supply and the analyzer, and is not covered by the AccuSense warranty.

Caution: Use a power cable that is properly grounded. Always use AC power cords that meet the local safety standards, such as these listed below.

Country	Safety Standard
USA	UL
Canada	CSA
Germany	VDE
Switzerland	SEV
Britain	BASEC/BS
Japan	Electric Appliance Control Act

For other countries, check your local safety standards.

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Caution: The Quattro analyzer is designed for room air velocity measurement only. Air containing chemicals (for example, hazardous gases) may damage the AFS sensor head. Note: Chemicals may change the heat capacity of the air so that the calibration of the AFS sensor is no longer accurate.

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Chapter 1: Overview

Chapter 1 provides a general description of AccuSense's Quattro Flow Air Velocity Analyzer. Other topics supplied include standard items, sensors, available options, and theory of operation.

1.1 General Description

AccuSense's Quattro Flow Air Velocity Analyzer is a sophisticated, portable, self-contained instrument designed for accurate, cost-effective multipoint evaluation of air velocity and air temperature measurements. Simultaneous, multi-point measurements are supported, up to a maximum of four AFS sensors.

Flash memory of 128 kb, which protects against data loss due to power loss, is standard. Approximately 40% of flash memory is used by the firmware. The remaining memory can store about 2,000 records, with each record consisting of 4 air velocities, 4 temperatures, and the time.

The analyzer's portability allows for real-time data collection and analysis of air velocity and air temperature data in the laboratory or other industrial setting or in the field. The Quattro Analyzer can take measurements much quicker than can conventional, single-point measuring instruments.

The Quattro Flow Air Velocity Analyzer embodies the proven accuracy, reliability, and versatility that are characteristic of all AccuSense airflow analysis systems and provides them for a low financial investment. Other important integrated features include:

- "Density-Compensation" up to 10,000 feet, which means that the Quattro Flow Air Velocity Analyzer does not under-read at higher elevations as is typical with most other systems.
- The ability to display, save, view, and print Air Velocity and Air Temperature measurement data without having to export the data to another software program or instrument.
- The avoidance of frequent returns and field re-calibration since the user can easily verify operation and accuracy of any one AFS airflow sensor (and its channel) by comparing it against the other three AFS sensors (and their channels) built into the Quattro Analyzer.

Figure 1-1 illustrates a "typical" Quattro Flow Air Velocity Analyzer.

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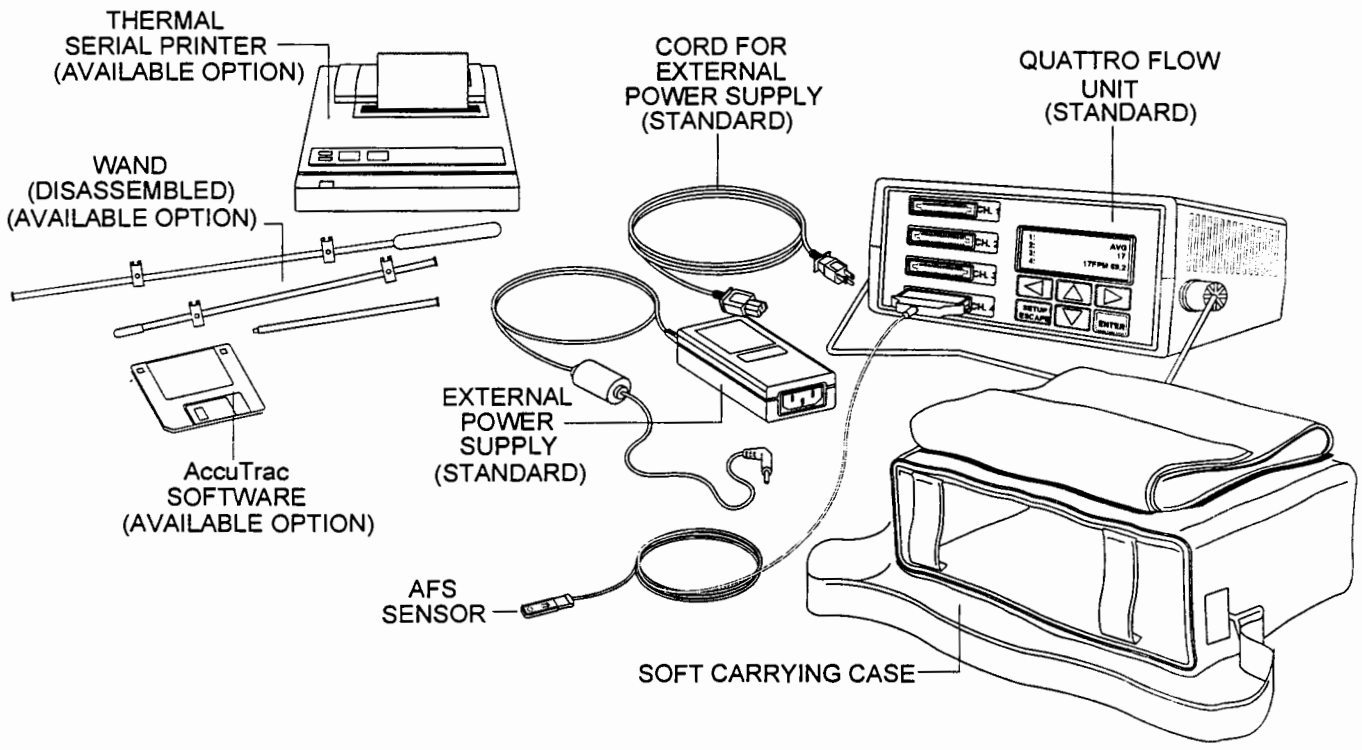


Figure 1-1 AccuSense Quattro Flow Analyzer

1.1.1 Applications

The Quattro Flow Air Velocity Analyzer can be employed in a wide range of applications and industries. Some examples follow:

- Electronics Cooling Design
- Cleanroom Operations
- Fume Hood and Biosafety Cabinet Design and Testing
- HVAC (Heating Ventilating Air Conditioning) Room Balancing and Duct Testing
- Whether used alone or in conjunction with optional AccuSense AccuTrac software, the Quattro Flow Air Velocity Analyzer meets the needs of thermal designers, certifiers, and field support personnel, reliably and efficiently.

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1.1.2 Electrical Power

Electrical power is supplied to the Quattro Flow Air Velocity Analyzer in two ways:

(1) from standard household (or better) electrical power outlets via an AccuSense-supplied external power supply

(2) from the analyzer's internal rechargeable battery pack

For your convenience, the analyzer can be "hot-swapped" between standard household and internal rechargeable battery power with the analyzer remaining turned ON during the swap.

1.1.3 Measured Parameters

The Quattro Flow Air Velocity Analyzer measures these two parameters:

- Airflow velocity
- Temperature of airflow

1.2 Standard Items

For both U.S. and international customers, standard items supplied with the Quattro Flow Air Velocity Analyzer include:

- **Quattro Unit**, which is a ruggedized plastic enclosure that houses the analyzer's printed circuit boards, integrated keypad, sensor channel connectors, internal rechargeable battery pack, Liquid Crystal Display (LCD) screen, and various front and rear panel controls and switches. Also built into the unit is a multi-position external carrying/positioning handle.
- **Soft Carrying Case**, which protects the Quattro unit and allows for easy field use, from inside the case.
- **External Power Supply**, which permits the analyzer to obtain electrical power from standard electric power.
- **Power Supply Cord**, which connects the analyzer to a standard electrical outlet.
- **User Manual**

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1.3 AFS Sensors

AccuSense Airflow Sensors (AFS) are required for Quattro Flow Air Velocity Analyzer operation, but are sold separately. Users may already have AccuSense-specific sensors that they purchased with other AccuSense systems or individually.

All AFS sensors measure these two parameters: (1) **airflow**, which is stated in velocity and can be feet per minute or meters per second (this is calibrated internally by AccuSense, and specified by the user in the System Configuration Menu, see section 4.5), and (2) **air temperature**, which is measured in degrees F or C over a wide range as stated in the individual sensor's literature. ("F" or "C" is also user-selectable; see section 4.5).

> **NOTE: LOW AIR VELOCITIES**—Air velocities below 30 fpm do not provide sufficient heat transfer, resulting in convection at the heated sensor bead. This is why the Quattro Analyzer shows a reading even when there is no airflow. For this reason, readings below 30 fpm should not be considered accurate.

AccuSense AFS Sensors have different measuring ranges, corresponding to the airflow velocity and air temperature parameters the user needs to measure. Regardless of AFS sensor model, most AccuSense AFS sensors appear identical physically, with only minor differences among some models. For details, see the "Description" chapter.

> **NOTE:** For details on available AFS sensors, contact AccuSense.

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1.4 Available Options

These purchasable options are available for use with the AccuSense Quattro Flow Air Velocity Analyzer:

- **Wands**, which are lightweight stainless steel rods that permit users to employ multiple AFS sensors at one time. Users can clip AFS sensors on a wand at user-determined intervals as required for a particular measuring application. AccuSense wands are available in two different versions:
  - **Marked in Inches.** 4 sections, total lengths 42 inches, with markings in 1-inch increments.
  - **Marked in Centimeters.** 4 sections, total length 105 cm, with markings every 2 cm.

  If additional sections or wands are required, they can be bought directly from AccuSense.
- **Thermal Serial Printer**, which can provide paper ("hard copy") reports of real-time Quattro data or data stored inside the Quattro Analyzer; all Quattro data is printed in an easy-to-read and understand format (see Figures 4-1, 4-2). The printer comes equipped with its own external power supply, printer cable, internal rechargeable battery pack, and a roll of thermal paper. For additional rolls of paper please contact AccuSense's Sales Department.
- **AccuSense AccuTrac 4.0 Data Analysis and Graphing Software for Windows 95 and NT.** This easy-to-use software allows you to transfer real-time or stored Quattro data to the AccuTrac software and then analyze and graph it in a variety of ways. All data is saved in Microsoft Excel format. The AccuTrac software is useful for long-term use, transforming the Quattro Analyzer into a benchtop laboratory instrument that lets you manipulate data easily and create a variety of graphs and charts.

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1.5 Theory of Operation

The Quattro Flow Air Velocity Analyzer is a portable four-channel air velocity and air temperature measuring instrument or Anemometer. Its internal rechargeable battery pack allows it to be carried easily to places where electric power is not available or where power cord access or use would be a hindrance.

Users employ the Quattro Analyzer to take readings of air velocity and air temperature at a maximum of four different locations simultaneously. The readings are displayed in real-time on the LCD screen, and can be stored in an internal memory, printed out on an optional thermal serial printer, or transferred to a user-supplied personal computer (PC) running optional AccuSense AccuTrac graphing and data analysis (Windows 95/NT) software. The readings taken by an AFS sensor are compared with each sensor's internal calibration information and then displayed on the LCD screen.

Internal software lets a user set up the analyzer for individual needs, such as intervals for automatic saving or printing of measurement data, setting up a grid, or calculating average flows and volume flows.

1.5.1 AFS Sensor Theory of Operation

As illustrated in Figure 1-2 below, a typical AccuSense AFS sensor has two thermistors (or thermal resistors) mounted to each sensor. The small thermistor (or "bead") on the left detects and measures airflow while the larger thermistor (or "bead") on the right detects and measures air temperature.

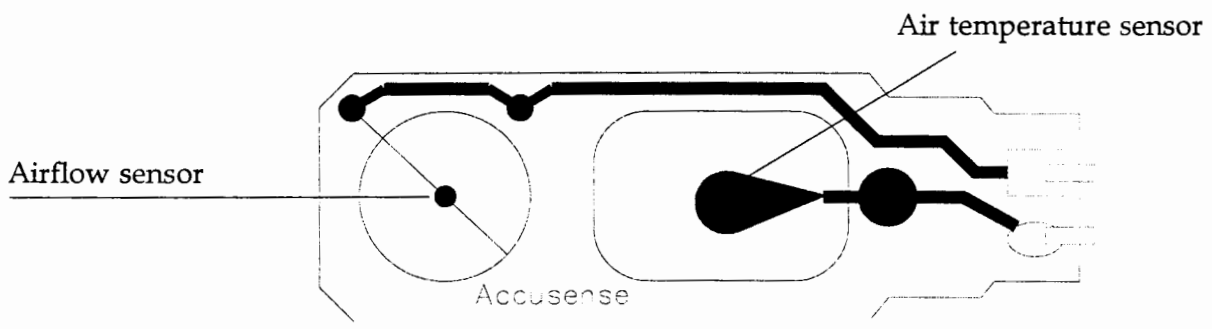


Figure 1-2 AFS Sensor Thermistors

The airflow thermistor is heated to a constant temperature of 150° C. The amount of power required to maintain the airflow thermistor at this constant temperature is equivalent to the heat that is lost to the airflow passing by the terminal. The AFS sensor then uses this amount of power to calculate the velocity of the passing air.

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Chapter 2: Description

Chapter 2 identifies and describes all the key components of the Quattro Flow Analyzer, including its panels, soft carrying case, external power supply, power supply cord, required options, and available options. It also lists the analyzer's specifications.

2.1 Quattro Flow Analyzer

AccuSense's Quattro Flow Air Velocity Analyzer is a sophisticated, portable, self-contained instrument designed for accurate, cost-effective multipoint evaluation of air velocity and air temperature measurements. Simultaneous, multi-point measurements are supported, up to a maximum of four AFS sensors.

The analyzer's portability allows for real-time data collection and analysis of air velocity and air temperature data in the laboratory or other industrial setting or in the field. The Quattro Analyzer can take measurements much quicker than can conventional, single-point measuring instruments.

The Quattro Flow Air Velocity Analyzer embodies the proven accuracy, reliability, and versatility that are characteristic of all AccuSense airflow analysis systems and provides them for a low financial investment. Other important integrated features include:

- "Density-Compensation" up to 10,000 feet, which means that the Quattro Flow Air Velocity Analyzer does not under-read at higher elevations as is typical with most other systems.
- The ability to display, save, view and print Air Velocity and Air Temperature measurement data without having to export the data to another software program or instrument.
- The avoidance of frequent returns and field re-calibration since the user can easily verify operation and accuracy of any one airflow sensor (AFS) (and its channel) by comparing it against the other three AFS sensors (and their channels).

2.1.1 Carrying / Positioning Handle

The external Carrying/Positioning Handle on the outside of the Quattro unit lets you use the analyzer in several different positions. These are described below and illustrated in Figure 3-1. Figure 3-2 depicts the proper method of sliding the Quattro Unit into its soft carrying case.

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Handle Position	Use
DOWN	Permits the Quattro Analyzer to be used as table-top instrument.
HANDLE	Allows the Quattro Analyzer to be carried easily, by the handle.
STORAGE	Lets you slide the Quattro Analyzer into its soft carrying case. NOTE: To slide the Quattro Analyzer into its case correctly, the handle must be in this position (see Figure 3-2).

2.1.2 Internal Rechargeable Battery

An Internal Rechargeable Battery Pack (Nickel metal hydride) supplies up to 8 hours of power for continuous use per full charge, depending on the number of AFS sensors being used. It fully charges within 60 minutes. Before the battery power falls below a critical level, an alarm sounds. Loss of battery power DOES NOT mean loss of data as the analyzer is equipped with flash memory for data storage protection without power. A specific software screen illustrates current battery usage; for details, see the System Configuration Menu, section 4.5. The internal battery pack allows the Quattro Analyzer to be employed for field use, or in areas where access to standard electric power is difficult.

2.1.3 Front Panel

The Front Panel on the Quattro Unit, illustrated in Figure 2-1, contains the important items identified and described in subsections A-C below.

A. Sensor Channel Connectors

The left side of the Quattro unit's front panel has four sensor channel connectors into which the AFS sensors are inserted. From top to button, the four sensor channel connectors are labeled from "CH 1" to "CH 4."

> **NOTE:** Please remember that the Quattro Analyzer has "hot-swap" capability. This means that you can insert the AFS sensors into the sensor channel connectors either before or after turning on the power. Moreover, you can change the active sensor configuration as desired while power is on.

B. LCD Screen

The Liquid Crystal Display (LCD) screen furnishes real-time display of measurement data from all four sensor channels (or average data if selected) and default and current operating parameters in an easy-to-read format. Users can select from Metric or English units of measurement as desired in the System Configuration Menu (see section 4.5). It also displays all the software menus and system prompts, and, in conjunction with the integral keypad, lets you navigate the software menus and make selections.

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C. Integral Keypad

The six-key Integral Keypad provides simplified operation and con-

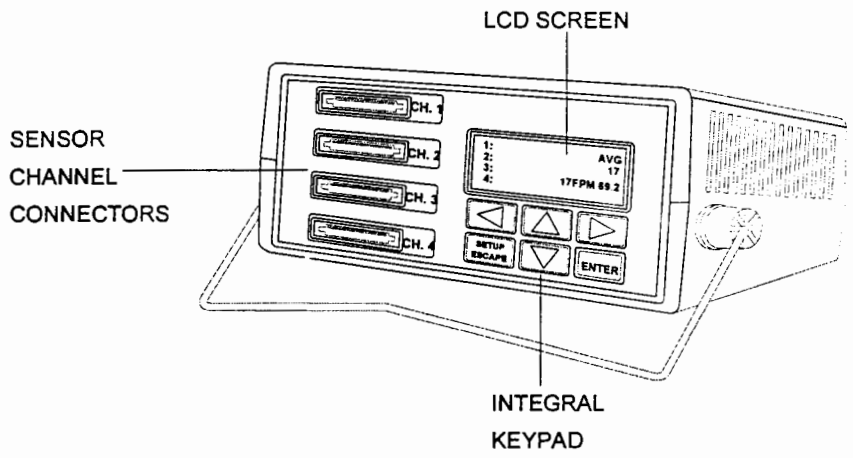


Figure 2-1 Quattro Unit Front Panel

trol of the analyzer. The keys, when pressed, provide tactile feedback. The keys are identified and described below.

Key	Function
[LEFT]	Works as a "toggle" key to make selections in the operating software. Pressing the key once selects the current item; selecting it again deselects that item and cycles to the next item. Also moves the cursor one item to the left for each press of the key.
[UP]	Allows you to move the cursor up through the operating software. Moves the cursor up one item for each press of the key.
[RIGHT]	Works as a "toggle" key to make selections in the operating software. Pressing the key once selects the current item; selecting it again deselects that item and cycles to the next item. Also moves the cursor one item to the right for each press of the key.

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Key	Function
[SETUP/ESCAPE]	This is a dual-function key, which the analyzer understands automatically. The setup function accesses the setup mode where you can view or change the default or current operating parameters (see section 4.5). The escape function permits you to escape from the current menu level or action.
[DOWN]	Allows to move the cursor down through the operating software. Moves the cursor down one item for each press of the key.
[ENTER]	Signals your acceptance of an option or operating setting to the Quattro unit.

2.1.4 Rear Panel

The Rear Panel on the Quattro unit contains the following important items identified and described in subsections A-F. Figure 2-2 illustrates the Rear Panel.

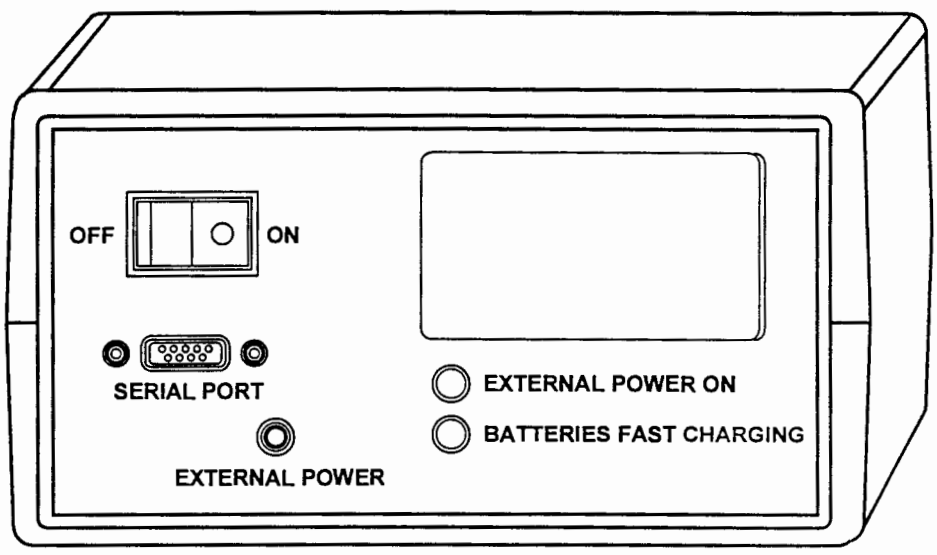


Figure 2-2 Quattro Unit Rear Panel

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A. Company/Model/Serial/Calibration Information

This information, which is useful for troubleshooting purposes or when ordering parts, is in the upper right side on the rear panel.

B. EXTERNAL POWER ON LED

This LED lights upon startup when electrical power to the Quattro Analyzer is supplied via the external power supply. If supplied from the internal rechargeable battery pack, this LED does not light.

C. BATTERIES FAST CHARGING LED

The "BATTERIES FAST CHARGING" LED lights steadily when the internal rechargeable battery pack is recharging. The internal battery pack recharges when electrical power is supplied to the analyzer via the external power supply. It fully charges within 60 minutes.

D. OFF/ON Power Switch

The "ON/OFF" power switch turns power ON and OFF to the Quattro unit. It works the same whether power is being supplied from the internal rechargeable battery pack or from the external power supply.

E. SERIAL PORT

The 9-pin female serial port (RS-232 or COM-port) lets you connect the Quattro unit to an optional thermal serial printer for printing of real-time or stored measurement data, or to a user-supplied personal computer for storage or additional processing of Quattro measurement data.

The optional printer connects to the Quattro unit via an AccuSense-supplied RS-232 male-male cable arranged in a null-modem configuration. The Null modem connector on the printer cable connects to the serial port on the printer, and the standard connector connects to the serial port on the Quattro unit. For more information on connecting the optional printer, see section 3.3.5.

If connecting the Quattro unit to a personal computer use a standard RS-232 cable (female-male). The operation of the Quattro Analyzer with a PC requires the optional AccuTrac 4.0 software. Please contact AccuSense's Sales Department for a free limited time license.

F. EXTERNAL POWER Connector

This connector permits you to operate the Quattro Analyzer using standard electric power via the AccuSense-supplied external power supply. For details on attaching the external power supply, see section 3.5.

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2.2 Soft Carrying Case

The specially designed lightweight Soft Carrying Case helps protect the Quattro unit from damage and allows for full use of the Analyzer from inside the case. Properly positioned, the two velcro flaps in the front allow full viewing of the LCD screen, use of the integral keypad, or insertion or "hot-swapping" of AFS sensors into the sensor channel connectors.

The Velcro flap in the rear provides access to ports and switches on the rear of the Quattro unit. A storage pocket with velcro fastener is also provided on the side of the case to enclose the external power supply. A padded shoulder strap is furnished to allow the analyzer to be carried comfortably.

Sliding the Quattro unit inside the case properly is illustrated and described in section 3.3.1.

2.3 External Power Supply

An External Power Supply allows the Quattro Analyzer to be powered from standard electric power (50/60 Hz, 110/240 VAC). Attaching the External Power Supply to the Quattro unit via the AccuSense-provided power supply cord is described in section 3.5, step 3.

2.4 Power Supply Cord

This AccuSense-provided power supply cord supplies standard electric power to the Quattro unit via the external power supply.

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2.5 AFS Sensors

AccuSense airflow Sensors (AFS) are required for Quattro Flow Air Velocity Analyzer operation, but have to be purchased separately. Users may already have AccuSense-specific sensors that they bought with other AccuSense systems or may want to purchase different calibration ranges.

AccuSense AFS sensors are thermistor-based, interchangeable sensors that overcome the weaknesses of traditional single-point probes. On-line circuitry normalizes the performance of each sensor, providing a unique advantage: if sensors need to be removed, another sensor can be plugged in immediately, and measurements can continue without any field calibration or reconfiguration. One end of the sensor has a special connector with the sensor's calibration information electrically stored within the sensor in an EEPROM.

Section 1.3 provides a general description of AccuSense sensors; section 1.5.1, the sensor's theory of operation.

> **NOTE:** For details on available AFS sensors, contact AccuSense.

The solid-state construction of these glass-encapsulated sensors ensures ruggedness and reliability at all times. The sensors are resistant to the rigors of laboratory or field use without loss of accuracy. A low-profile probe design allows access to hard-to-reach locations such as printed circuit boards inside electronic enclosures. AFS sensors in the clip-on version can be attached to an optional grid or affixed at user-determined intervals to an optional wand for efficient measurement of airflow in fume hoods or Biosafety cabinets.

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2.6 Available Options

This section describes the purchasable options available for use with the AccuSense Quattro Flow Air Velocity Analyzer.

2.6.1 Wands

Wands are lightweight stainless steel rods that permit users to connect up to 4 AFS sensors at one time. Users can clip AFS sensors on a wand at user-determined intervals as required for a particular measuring application. AccuSense wands are available in two different versions:

- **Marked in Inches.** 4 sections, total length 42 inches, with markings in 1-inch increments.
- **Marked in Centimeters.** 4 sections, total length 105 cm, with markings every 2 cm.

Assembling an optional wand is explained in section 3.3.3; attaching sensor heads to the wand in section 3.3.4. If additional sections or wands are required, they can be bought directly from AccuSense.

2.6.2 Thermal Serial Printer

An optional 40-character Thermal Serial Printer is available for use with the Quattro unit. For customers ordering the optional Thermal Serial Printer from AccuSense, it is supplied pre-configured for use. This factory configuration should be adequate for most users; it is discussed in detail in section 3.3.5. Figure 3-5 shows the default AccuSense Required Printer Switch Configuration page.

A "printer" kit supplied with the optional printer includes the external printer power supply, the printer, an internal rechargeable battery pack, a roll of thermal paper, and the printer cable.

Cabling and set up information for the printer is supplied in section 3.3.5.

2.6.3 AccuTrac 4.0 Data Analysis and Graphing Software

This easy-to-use software allows you to transfer real-time or stored Quattro data to the AccuTrac software and then analyze and graph it in a variety of ways. All data is saved in Microsoft Excel format. The AccuTrac software is useful for long-term use, transforming the Quattro Analyzer into a benchtop laboratory instrument that lets you manipulate data easily and create a variety of graphs and charts.

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2.7 Specifications

Both a Soft Carrying Case and an External Universal Power Supply are supplied as standard items with the Quattro Analyzer. AFS Sensors, AccuTrac Data Analysis and Graphing Software, Thermal Serial Printer, Wand and Grid can be purchased separately.

Quattro Flow Analyzer Series Operating Information

Parameter	Technical Data
Input voltage	90-265 VAC, 50-60 Hz
Power consumption	60 Watt max
Operating temperature range	0 to +70° C
Storage temperature range	-20 to +100° C
Readout	16 x 4 Character LCD screen
Weight	1.00 kg (2.20 lb)
Dimensions	15.5 cm L x 15.5 W x 8.5 cm H
Keypad	6-key touchpad with audible indicator
Density compensated from 0-10,000 ft AMSL	
Battery type	Nickel Metal Hydride
Internal memory	128 kb Flash

AFS Series Airflow Sensors Information

Parameter	Technical Data
Available in various airflow ranges	
Acceptance range	± 25° typical
Standard shielded cable length maximum available cable length	2 meters 10 meters
Operating temperature range (note the accuracy)	0 to +70° C
Storage temperature range	-20 to +100° C

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Chapter 3: Installation

Chapter 3 supplies installation information for the Quattro Flow Air Velocity Analyzer, including general responsibilities, environmental requirements, and detailed procedures for setting up the Quattro components and performing an initial power up.

3.1 General Responsibilities

3.1.1 Customer's Responsibilities

When your Quattro Flow Air Velocity Analyzer arrives, you are required to:

1. Check the exterior of the shipping container(s) for any exterior damage, then the interior of the container(s)
2. If any damage is found, immediately notify both the carrier and AccuSense on the straight bill of lading (supplied by the carrier), both verbally and in writing; you may also request an inspection by the carrier. Such requests must usually be made within a specified time period from date of shipment.
3. Follow any instructions AccuSense and/or the carrier may supply about possible damage.
4. If no damage is found, or upon instructions from AccuSense, install and set up the analyzer as described in this chapter.

   AccuSense is not responsible for damage to equipment occurring during shipping, and only furnishes replacement parts against a written purchase order. It is the customer's responsibility to file a claim with the carrier.
5. If no damage is found, compare the contents of the Inventory List against the contents of the shipping container(s), to ensure receipt of all components.

3.1.2 AccuSense's Responsibilities

An AccuSense service engineer is available via telephone, fax, or e-mail to assist customers in performing the initial installation of the Quattro Flow Air Velocity Analyzer.

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3.2 Environmental Requirements

This section describes the environmental requirements for humidity and temperature that are essential for proper functioning of the Quattro Flow Air Velocity Analyzer.

Excessive moisture in the air might affect the analyzer's performance by changing the electrical conductivity on the surface of the electrical components and circuit boards. Relative humidity in the operating environment between 5% and 95% (non-condensing) is acceptable.

Avoid placing the Quattro Flow Air Velocity Analyzer near heating outlets or other hot devices. Acceptable temperatures in the operating environment are between 0 and 70°C (32-158°F). Don't store the instrument in a car or trunk on a hot summer day.

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3.3 Setting Up the Quattro Analyzer

3.3.1 Positioning the Quattro Unit

The external carrying/positioning handle on the Quattro unit affords several positions of use. These are described below and illustrated in Figure 3-1. Figure 3-2 depicts the proper method of sliding the Quattro Unit into its soft carrying case.

Handle Position	Use
DOWN	Permits the Quattro Analyzer to be used as table-top instrument.
HANDLE	Allows the Quattro Analyzer to be carried easily, by the handle.
STORAGE	Lets you slide the Quattro Analyzer into its soft carrying case. NOTE: To slide the Quattro Analyzer into its case correctly, the handle **must** be in this position.

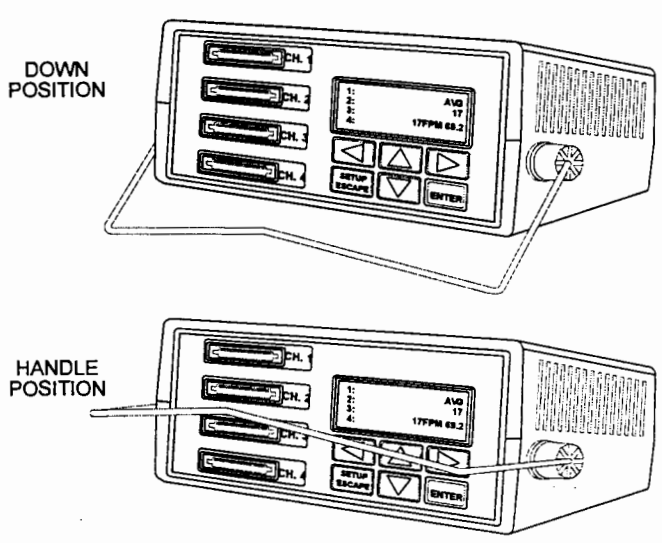


Figure 3-1 Positions of Carrying/Positioning Handle

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Sliding the Quattro Unit into the Soft Carrying Case

Ensure that the soft carrying case is oriented with its pouch on top before sliding the Quattro unit into the case and that the handle is in the "Storage" position.

Otherwise, either the unit will not fit inside the case properly, or easy access to the unit's ports and switches through the velcro flaps on the case will not be provided.

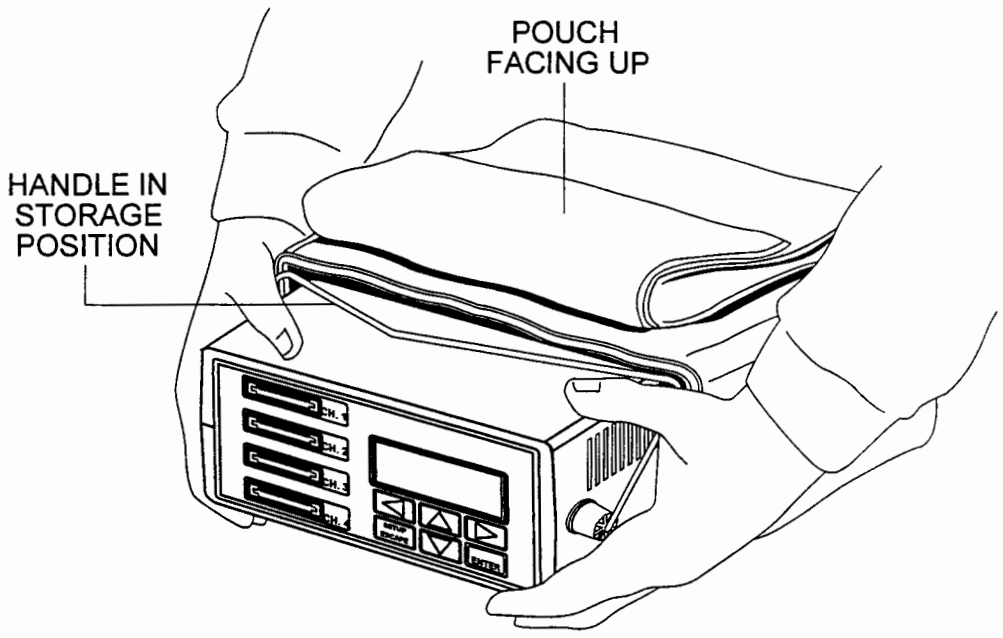


Figure 3-2 Sliding Quattro Unit into Case

3.3.2 Changing Default Operating Parameters

To change units of measure, screen views of data, or more sophisticated operating parameters, refer to the System Configuration Menu, section 4.5.

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3.3.3 Assembling Optional Wands

The sections that make up the optional wands that can be used with the Quattro Analyzer must first be assembled. Figure 3-3 illustrates this assembly.

1. Pick up the "handle" end wand section and hold it securely with one hand (any orientation that is comfortable for you is fine, vertically, horizontally, or diagonally).
2. Pick up the middle section of the wand with your other hand and attach its open (or hollow) end to the recessed end of the "handle" wand section as shown in the top portion of Figure 3-3. Apply sufficient force to snap the wand section into position.
3. Align the small rectangular cut-out section of the wand being attached with the "ball-spring" on the handle wand section and snap securely into position as illustrated.

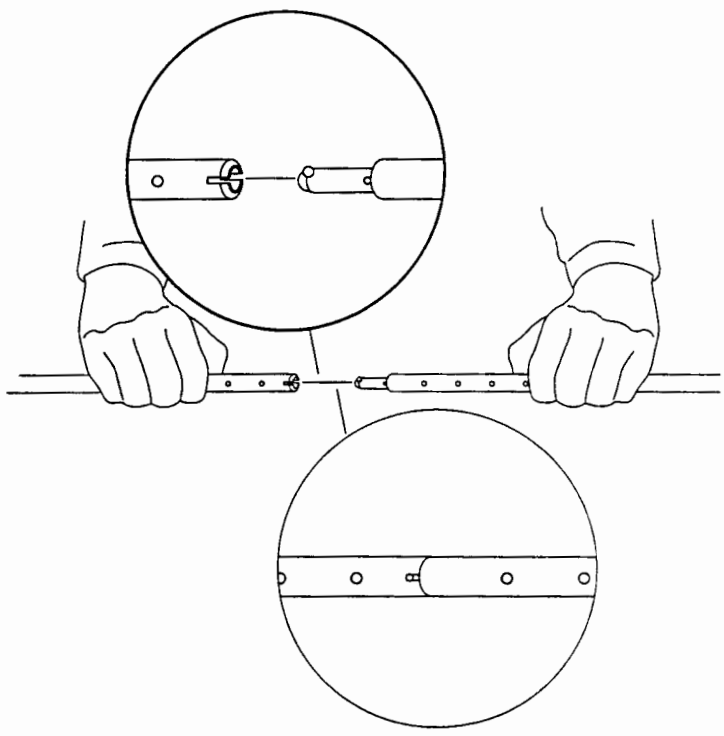


Figure 3-3 Assembling an Optional Wand

4. Repeat steps 2-3 for all wand sections being assembled.

After assembling the wand sections correctly, you can attach AFS sensor heads to the wand as described in the next section.

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3.3.4 Attaching AFS Clip-On Sensor Heads to Wand

AccuSense supplies two models of AFS sensors, depending on customer and analytical requirements. (For details, see Appendix A) The clip-on version allows to attach the sensors to the optional wand at intervals you determine, and then position (or attach) the wand in its intended measuring area, such as a fume hood or flow duct. Figure 3-4 illustrates the procedure how to attach an AFS sensor to a wand clip.

1. Hold the AFS sensor head to be attached in a vertical orientation.
2. While holding at a 45° angle, position the bottom, narrower cut-out portion of the AFS sensor with the horizontal cut-out in the wand clip and apply sufficient force to "snap" the sensor into position.

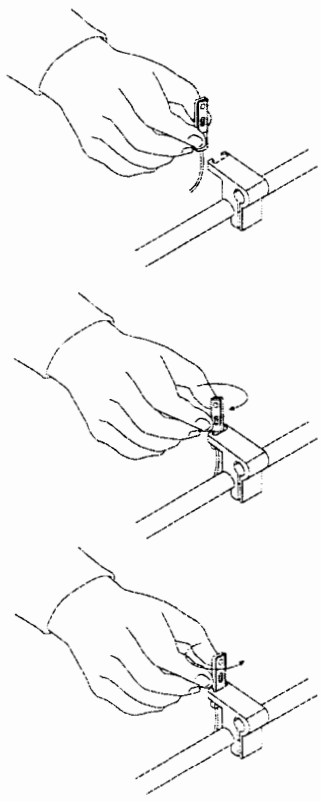


Figure 3-4 Attaching AFS Sensors to optional Wand (Clip-On version only)

AccuSense supplies optional wands with incremental markings every 1 inch (Wand F) or every 2 cm (Wand C). Please contact AccuSense Customer Service to order.

CAUTION: Do not put anything into an AFS sensor head that would break or damage the sensor beads, such as the tip of a pen. Touching the sensor head with your hands, however, is acceptable.

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3.4 Setting Up the Optional Thermal Serial Printer

The thermal serial printer from AccuSense is supplied pre-configured for use. This factory configuration should be adequate for most users. If you must change a particular setting (for example, changing a baud rate), you **must** go through and verify the AccuSense-established default Required Printer Switch Configuration. The procedure for doing this is explained in the supplied separate printer manual. Figure 3-5 shows the default AccuSense Required Printer Switch Configuration page.

> **NOTE: THIRD PARTY PRINTERS—** Other printers besides the AccuSense supplied Seiko 40-character Thermal Serial Printer (ASCII-format) might also work, but users **are urged to** first contact AccuSense for verification and cabling instructions.

The optional printer kit includes the printer, the power supply, the re-chargeable battery, a roll of thermal paper, and the RS-232 null-modem cable.

> **NOTE:** For details about the printer, refer to the separate printer manual.

The optional thermal serial printer contains its own power supply, and attaches to the Quattro unit via an AccuSense-supplied RS-232 male-male cable arranged in a "null" modem configuration.

> **NOTE: STANDARD RS-232 PRINTER CABLE—** Using a standard RS-232 cable to connect the Quattro unit to the thermal serial printer **will not** work. For other cable configurations, contact AccuSense. If connecting the Quattro unit to a personal computer, a standard RS-232 cable is needed.

The Quattro unit can send either real-time or stored measurement data to the optional thermal serial printer, or to a personal computer if connected properly, but not to both devices simultaneously.

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```
[ DIP SW setting mode ]

Dip SW-1
  1 (OFF) : Input = Serial
  2 (ON ) : Printing Speed = High
  3 (ON ) : Auto Loading = ON
  4 (OFF) : Auto LF = OFF
  5 (ON ) : Setting Command = Enable
  6 (OFF) : Printing
  7 (ON ) :   Density
  8 (ON ) :   = 100 %
Dip SW-2
  1 (ON ) : Printing Columns = 40
  2 (ON ) : User Font Back-up = ON
  3 (ON ) : Character Select = Normal
  4 (ON ) : Zero = Normal
  5 (ON ) : International
  6 (ON ) :   Character
  7 (ON ) :   Set
  8 (OFF) :   = U.S.A.
Dip SW-3
  1 (ON ) : Data Length = 8 bits
  2 (ON ) : Parity Setting = No
  3 (ON ) : Parity Condition = Odd
  4 (OFF) : Busy Control = XON/XOFF
  5 (OFF) : Baud
  6 (ON ) :   Rate
  7 (ON ) :   Select
  8 (OFF) :   = 19200 bps



Continue ? : Push 'On-line SW'
Write ?    : Push 'Paper feed SW'
```

Figure 3-5 Factory Default Required Printer Switch Configuration

Figure 3-5 shows the DIP Switch Setting of the AccuSense supplied Seiko printer. To print these settings hold down the On-Line button while powering on the printer. To change the settings please refer to the printer manual.

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3.5 Performing Initial Power Up

After assembling the Quattro components as described earlier in this chapter, you are ready to turn on the power.

1. Determine the source of electric power to the Quattro Analyzer, either from the internal rechargeable battery pack (which supplies up to 8 hours of power between charges, depending on the number of AFS sensors being used and the state of the pack's charge), or from the external power supply. This is automatically adjusting for voltages between 110-230V_{AC}.
2. If using the internal rechargeable battery pack, simply turn the OFF/ON power switch on the rear of the Quattro unit to the "ON" position, then continue to Step 4.
3. If using standard household (or better) electric power, attach the AccuSense-supplied external power supply and power supply cord as follows:
   a. Attach the small plug end of the external power supply to the "EXTERNAL POWER" connector on the rear of the Quattro unit.
   b. Plug the female end of the power supply cable into the male end of the external power supply.
   c. Plug the male end of the same power supply cable into an appropriate standard electrical outlet.
   d. Turn the OFF/ON power switch on the rear of the Quattro unit to the "ON" position, then continue to step 4.
4. Attach the desired number of AFS sensors to the Quattro unit by inserting the sensor connectors into the sensor channel connectors on the unit's left front panel. The label identifying the AFS sensor model must be on top. Firmly hold both sides of the AFS sensor connector with fingertips when inserting or removing.

   The four sensor channel connectors are labeled (top to bottom) from "CH 1" to "CH 4".

> **NOTE:** Please remember that the Quattro Analyzer has "hot-swap" capability. This means that you can insert the AFS sensors into the sensor channel connectors either before or after turning on the power. Moreover, you can change the active sensor configuration as desired while power is on.

5. Refer to Chapter 4, Operation, for details on operating the Quattro Analyzer.

> **NOTE: CHECKING CALIBRATION**—The calibration of the Quattro Analyzer and AFS Sensors should be checked yearly, as AccuSense guarantees calibration for one year. For details, please contact AccuSense.

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Chapter 4: Operation

Chapter 4 explains the routine operation of the Quattro Flow Air Velocity Analyzer, including how to change default system parameters. Easy-to-use detailed tables identify and describe all software operating menus. Sample menus and screens are provided to amplify text descriptions.

4.1 Describing the Integral Keypad

Table 4-1. Integral Keyboard Keys

Key	Function
[LEFT]	Works as a "toggle" key to make selections in the operating software. Pressing the key once selects the current item; selecting it again deselects that item and cycles to the next item. Also moves the cursor one item to the LEFT for each press of the key.
[UP]	Allows you to move the cursor UP through the operating software. For each press of the key the cursor moves one item.
[RIGHT]	Works analogous to the LEFT arrow key.
[SETUP/ESCAPE]	This is a dual-function key, which the analyzer understands automatically. The SETUP function accesses the setup mode where you can view or change the default or current operating parameters (see section 4.5). The ESCAPE function permits you to escape from the current menu level or action without changes being saved.
[DOWN]	Allows you to move the cursor DOWN through the operating software. For each press of the key the cursor moves one item.
[ENTER]	Signals your acceptance of an option or operating setting to the Quattro unit.

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4.2 Powering up the Analyzer

A detailed step-by-step procedure for performing an initial power up for the Quattro Analyzer, including determining the power source and attaching AFS sensors, is provided in section 3.5.

After the OFF/ON power switch on the rear of the Quattro unit is turned to the ON position, the unit beeps, then displays on the LCD screen its identification number, number of grid records, and firmware version number. This is followed by temperature and airflow measurement data for the currently attached AFS sensors, resulting in the normal operating screen shown below. If no AFS sensors are attached, only the channel numbers 1-4 appear on the left side of the LCD screen.

4.2.1 Normal Operating Screen

The Normal Operating screen appears after the analyzer is powered up. It displays real-time air temperature and airflow measurement data for the currently attached AFS sensors. In the sample shown below, four AFS sensor are attached. This is the default operating screen, which can be changed to the Average Operating screen as explained in the System Configuration Menu, Screen option information (section 4.5).

```
1:      45FPM    85.7F
2:      32FPM    85.4F
3:      92FPM    79.1F
4:      22FPM    89.6F
```

The measurement units shown above (feet per minute=FPM or meters per second=MPS for air velocity; degrees Fahrenheit (°F) or degrees Celsius (°C) for temperature) can also be changed in the System Configuration Menu, section 4.5.

4.2.2 Average Operating Screen

The Average Operating screen is the alternative screen to the Normal Operating screen. The Average display shows the individual airflow readings for each of the sensors and the average airflow and average temperature measurement data (for all installed AFS sensors) in the specified unit of measure. This is useful for operation with the optional wand. An example is shown below.

```
1:      45FPM    AVG
2:      69FPM     61
3:      99FPM    88.2F
4:      32FPM
```


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4.3 Navigating and Selecting Software Options

Using the Quattro Analyzer software is easy and straightforward. The software menus are hierarchical in nature, and can be accessed and exited in a consistent manner. This section explains how to move around in the software menus, how to make selections, and perform other day-to-day actions, such as changing default system parameters. Please refer to Appendix B (page A-4) for a graphic overview of the software menus.

4.3.1 Noting Your Current Position

To note your current position in the Quattro software, a "right arrow cursor" is placed to the left of the current menu item or system parameter. An example of this cursor is depicted below.

▶

4.3.2 Making a Menu Selection

To make a menu selection, from any of the Quattro software menus, press either:

[LEFT]

or

[RIGHT]

4.3.3 Accessing the Main Menu

From either the "Normal" or "Average" screen (depending on what you have selected), press:

[SETUP/ESCAPE]

The Main Menu appears on the LCD screen as illustrated below.

```
SYSTEM  CONFIG
STORE  DATA
GRID  COMMANDS
PRINT  DATA
```

4.3.4 Changing a System Parameter

To change a default system parameter, such as the unit of measurement or the method employed for printing/storing data, follow these steps.

1. Select the **System Configuration** option from the Main menu. (Make sure the cursor is to the left of "System Config" and then press **[LEFT]** or **[RIGHT]**). The System Configuration menu displays as shown below; for details, see section 4.5.

```
TEMPERATURE:
SPEED  UNIT:
BATTERY:
SCREEN
```


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2. Use **[UP]** or **[DOWN]** to toggle to the menu item or system parameter requiring modification and then press **[LEFT]** or **[RIGHT]** to toggle to the desired setting.

   For example, to change the unit of measurement used for the "Temperature" parameter, ensure that the cursor is to the left of "Temperature" and then press **[LEFT]** or **[RIGHT]**.

   The current unit of measurement toggles between degrees Fahrenheit (°F) to degrees Celsius (°C). (Other system parameters can be changed in a similar fashion; for details on the System Configuration menu, see section 4.6.)

4.3.5 Saving Changes

Whenever you make a change to a Quattro system parameter, to save the change, press:

[ENTER]

The system displays the message "Changes Saved" followed by the Operating screen.

4.3.6 Disregarding Changes

To disregard software changes or a menu selection, press:

[SETUP/ESCAPE]

The device displays the message "No changes".

4.3.7 Auto-Repeat Function

To initiate the auto-repeat function, simply hold down the desired key.

4.4 Describing Quattro Menus

The Quattro software is composed of five major menus, the Main Menu and four subsidiary menus selected from the Main Menu. The Main Menu appears on the LCD screen after **[SETUP/ESCAPE]** is pressed, and is shown below:

```
SYSTEM  CONFIG
STORE  DATA
GRID  COMMANDS
PRINT  DATA
```

The four Main Menu choices above are explained in detail in sections 4.5-4.8.

Figure 4-3 at the end of this chapter provides a graphic overview of the Quattro software menus.

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4.5 System Configuration Menu

The System Configuration menu contains four system parameters that you can change as desired. Table 4-2 below identifies and describes these parameters in detail.

```
TEMPERATURE:
SPEED  UNIT:
BATTERY:
SCREEN
```

Table 4-2. System Configuration Menu

Parameter	Description	Acceptable Range
TEMPERATURE	Specifies the unit of measurement to use for temperature.	°C or °F
SPEED UNIT	Specifies the unit of measurement to use for airflow readings.	FPM or MPS
BATTERY	Shows state of charge for the internal rechargeable battery. An alarm sounds below 7.2 Volts.	Not Applicable
SCREEN	Specifies the measurement configuration to use on the LCD screen, "Normal" or "Average." The "Normal" screen shows all four sensor channels with airflow and temperature readings. The "Average" display shows the individual airflow readings for each sensor and the average airflow and average temperature data for all installed AFS sensors in the specified unit of measure. This is useful for operation with the optional wand.	Normal or Average
PNT AVG	This feature enables the user to specify a period of time that is used for averaging. The display of the Quattro Analyzer will show the average air velocity and air temperature over the specified time. Example: if "PNT AVG" is set to 5 sec, the Quattro Analyzer displays the average over the last 5 seconds. This enables the user to smoothen the curve and eliminate turbulence.	0.1 - 10.0 seconds

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Figure 4-2. System Configuration Menu (continued)

Parameter	Description	Acceptable Range
CONTRAST	Specifies the Contrast screen setting to use, which is user-selectable in increments of 4%. Adjusting Contrast is similar to adjusting contrast and brightness on a computer monitor. "Contrast" controls the blackness of the reading appearing on the LCD screen.	0 - 100% F 52% is the default
BACKLIGHT	Specifies the Backlight screen setting to use, which is user-selectable in increments of 4%. "Backlight" controls the amount of light appearing behind the LCD screen. Increasing this setting increases the amount of light, decreasing it decreases the light. **NOTE: less backlight makes the battery last longer.**	0 - 100% F 52% is the default
POWER DN (power down)	Specifies the number of minutes before BOTH the backlight power and AFS sensor probe power shut off when the keypad is not touched. This is a power saving feature for the internal battery. When enabled, the setting appears; when disabled, dashes appear instead.	0 - 90 minutes
BCKLIGHT (backlight)	Specifies the number of minutes before the backlight power to the AFS sensor probes shuts off when the keypad is not touched. This is a power saving feature for the internal battery. When enabled, the setting appears; when disabled, dashes appear instead.	0 - 90 minutes
INTERVAL	Specifies how often the LCD screen is updated, regardless of the earlier PNT AVG setting.	0.2 - 10.0 seconds; 0.2 s is the default

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4.5.1 Pressure Menu

This feature allows the user to select or deselect the automatic pressure/altitude compensation. Changing barometric pressure due to different altitude or weather conditions may affect the accuracy of air velocity readings. The Pressure Menu is accessible from the bottom of the System Configuration menu. It shows the current barometric pressure reading, and the status of the automatic pressure compensation. It is illustrated below.

```
PRESSURE      CORRECT
AIRFLOW:      YES
     14.45    PSIA
       996    MBAR
```

Table 4-3. Pressure Menu

Parameter	Description	Available Options
PRESSURE CORRECT	Prompts you to enable or disable the automatic pressure/altitude compensation.	YES or NO
PSIA	Shows the current barometric pressure reading in Pounds per Square Inch (Atmosphere).	Not applicable
MBAR	Shows the current barometric pressure reading in Millibar metric units.	Not applicable

AccuSense recommends to keep the barometric pressure compensation enabled at all times.

NOTE: BAROMETRIC PRESSURE READINGS - The accuracy of the barometric pressure readings is not meant for detecting barometric pressure.

Pressing **[ENTER]** when finished viewing or changing the Pressure Menu causes the software to display the rest of the System Configuration Menu items listed in the continuation of Figure 4-2, beginning with "Contrast."

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4.6 Store Data Menu

The Store Data Menu contains options that let you enable/disable the store data mode; specify manual or timed data storage; set the timing interval, if manual data storage is chosen; and set the interval, if timed data storage is chosen.

The Quattro Analyzer permits you to save measurement data to the internal memory, print real-time data to an optional thermal serial printer, print stored data to the printer, and transmit real-time or stored data to the optional AccuTrac software. The Store Data Menu is depicted below.

```
**  STORE DATA   **
Mode:        ENABLED
Method:      TIMED
Time:        0:23:19
```

Table 4-4. Store Data Menu

Parameter	Description	Acceptable Range
MODE	Specifies if the store data feature is turned on (enabled) or not (disabled). If "Store Data" is enabled, Quattro airflow measurements and temperature measurements are written into an EEPROM either manually or in a timed manner as specified by the user below under "Method."	ENABLED or DISABLED
METHOD	Specifies the method as shown to use for storage of Quattro measurement data. Two choices are available, "Manual" and "Timed." "Timed"for automatic storage of data at timed intervals. "Manual" for storage by pressing **[ENTER]**.	MANUAL or TIMED
TIME	Time is stored together with the sensor readings. Displays the period of time in hours, minutes and seconds that the analyzer has been turned on. Reset Timer by pressing **[LEFT]** or **[RIGHT]**.	Variable
INTERVAL	Only available if "Timed" is selected for storage method. Allows you to specify the interval to use for the analyzer to take and save an automatic timed measurement.	0 seconds - 60 minutes

Every time you press **[ENTER]** the current readings are logged to the memory of the instrument. The capacity of the Quattro Analyzer allows to store approximately 3,000 sets of readings (4 air velocities, 4 temperatures and the time).

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4.7 Grid Commands Menu

The Grid Commands Menu has these four menu choices: List Records, Create Grid, Print Records, and Delete Records.

Available options let you specify the "grid" to be used for data storage (using traditional X's for horizontal positions and Y's for vertical positions). Specifying storage locations so precisely allows particular user groups to match the storage location to the measurement output of a particular AFS sensor probe. Each grid is represented by a record number.

If you select the "Grid Commands" option from the Main Menu and measurement data is currently stored in the Quattro Analyzer, this prompt displays:

```
   If you proceed
   you will lose
   X data rec's
ESC: No    ENTER: OK
```

Pressing **[SETUP/ESCAPE]** returns you to the Normal Operating screen; pressing **[ENTER]** (for OK) results in an "Erase Database" message appearing followed by the Grid Program Menu shown below.

```
* GRID PROG MENU   *
  List Records
  Create Grid
  Print Records
  Delete Records
```

In Grid mode, the manner in which the Quattro Analyzer handles Grid procedures reflects how it stores measurement data for the grid being created. In normal, non-Grid Quattro data storage, both airflow AND temperature measurement data are stored. In Grid mode, the airflow reading at each point is stored plus the average temperature measurement for the entire grid.

Sections 4.7.1 - 4.7.4 explain the four Grid Program options in detail.

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4.7.1 List Record Option

The List Record option tells you which record number (#) is associated with labels. Consequently, if you wish to modify or change a record, it is easy to identify the applicable record number. This option is also useful in determining which grid record should print.

```
REC  LABEL
(UNUSED  1-511)
```

Pressing **[ENTER]** or **[SETUP/ESCAPE]** returns you to the Normal Operating screen.

4.7.2 Create Grid Option

The Create Grid option allows you to establish a grid, in a traditional X (horizontal) and Y (vertical) coordinate format, to use for storage of Quattro measurement data.

This concept of precisely mapping specific data storage record numbers to particular measurement areas (fume hoods, for example) lets you take a reading and store the Quattro measurement data in a specific record location. At a later date the data can be printed out to an optional thermal serial printer, be modified or changed.

After you select the Create Grid option from the Grid Program Menu, the following Record Label screen appears:

```
REC     LABEL
-------------------
001
  (SET  REC  +  LABEL)
```

A. Entering Record Label Information

1. The instrument automatically chooses the first available number as record number. To enter or change a record number, e.g. to edit an earlier recorded log, move the cursor by pressing [RIGHT] or [LEFT] to the position you want to change. To move through the list of available characters (A-Z, 0-9, dash, slash, blank) press [UP] or [DOWN].
2. To enter or change a Label Text, use **[RIGHT]** to move the cursor to the first position under "Label." Press **[UP]** or **[DOWN]** to display the desired character. Use the same technique to enter the other 11 Label description characters.
3. When finished entering a Label description, press [ENTER].

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The Location screen displays.

```
LOCATION
_____________________

_
(SET  then  ENTER)
```

B. Entering Location Information

1. Enter (or change) the optional Location information as explained at step 3 on the previous page. The Location is the description of where the measurement data/reading is originating. An example might be "Hood A" or "Room 12."
2. When finished entering (or changing) a Location description, press **[ENTER]**.

   The Clock Data screen displays.

```
MMM   DD   YEAR  TIME
JAN   01   1998  0000

(Set  DATE  +  TIME)
```

   The Quattro Clock Data feature is year 2000-compliant. The above example shows the system's default values on the second line. You can change these values as explained in subsection C.

C. Entering Clock Data

Enter (or change) the Clock Data as described below.

- To enter or change the month, position the cursor on the month field, then press **[UP]** or **[DOWN]** as appropriate.
- To enter or change the day (DD), position the cursor in the DD field, then press **[UP]** or **[DOWN]** as appropriate.
- To enter or change the year, position the cursor in the YEAR field, then press **[UP]** or **[DOWN]** as appropriate.
- To enter or change the time, position the cursor in the minute field, then press **[UP]** or **[DOWN]** as appropriate; next, change the seconds as explained for minutes, if required.
- When finished entering Clock Data, press **[ENTER]**.

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The Select Y Probes screen displays.

```
SELECT Y     PROBES
CH1: Yes     CH3: Yes
Ch2: Yes     Ch4: Yes
```

D. Entering Select Y Probes Information

The Select Y Probes screen permits you to determine which AFS sensor probes are used in the Y (vertical) orientation. The default setting for the four channels (CH1- CH4) is ON (or YES), but you can change this to OFF (or NO). These are the channels used for taking Quattro measurement data.

For example, if a 3 x 7 grid is being created, channel 4 should be changed to "NO," allowing you to create 7 columns with each column having 3 rows of data.

1. To turn a channel OFF or ON, move the cursor to the specific channel by pressing **[UP]** or **[DOWN]**, and then use **[UP]** or **[DOWN]** as necessary to change the value.
2. When finished viewing or changing channels, press **[ENTER]**.

The Volume Dimensions screen displays as shown below.

E. Entering Volume Dimensions Information

```
  VOL  DIMENSIONS
000.0  IN  x  000.0  IN
        -  OR  -
    000.0  IN  DIAM
```

The Volume Dimensions screen lets you specify how the Quattro Analyzer measures volumetric flow. "Volumetric Flow" in this context is the average airflow velocity times the cross-sectional area, such as an exhaust duct or fume hood, where it is useful to know the volume of air moving through this diameter.

EXAMPLES:
(1) For a 60" x 24" opening with an average velocity of 100 fpm, the volume flow would be 60" x 24" x 100 fpm = 5' x 2' x 100 fpm = 1000 cfm.
(2) For a 100cm x 200cm duct with am average velocity of 5m/s the volume flow would be 1.00 m x 2.00 m x 5m/s = $10m^3/s$ (cubic meters per second).

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NOTE: The unit of measure for these dimensions is based on the airflow unit chosen earlier in the System Configuration Menu (see section 4.5): (1) Metric Units (MPS = meters per second) will show CM = centimeters in this menu. (2) English units (FPM = feet per minute) will show IN = inches at this point.

You have a choice of "Diameter" or "Rectangular" openings.

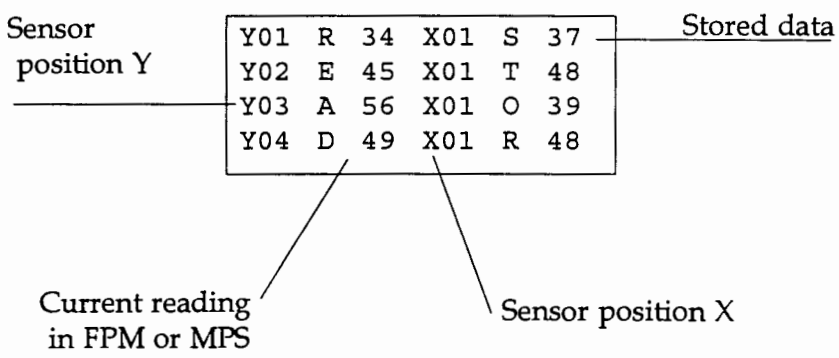
1. Enter or change Volume Dimension information as explained below.

- To enter or change the 3-digit rectangular volume dimensions, position the cursor on the first digit to be entered/changed, then press **[UP]** or **[DOWN]** as appropriate. Each press of the key increases/decreases the displayed digit by 1. Repeat for the other volume digits. The range for volume is 000.0 to 999.9 inches or centimeters.
- To enter or change the bottom 3-digit diameter field, position the cursor in the third field to the left of the decimal point, then press **[UP]** or **[DOWN]** as appropriate to enter numbers. Repeat for the digit to the right of the decimal point. The range is 000.0 to 999.9 inches or centimeters.

2. When finished entering or changing Volume Dimension information, press **[ENTER]**. The Main Grid screen displays. A sample grid is shown below.

F. Entering Main Grid Information

The left side of the Main Grid screen depicts the data storage locations from the sensor channels currently being used in order. The middle of the screen shows the current readings. The right side of the screen shows the corresponding stored data locations.



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An X (horizontal orientation), Y (vertical orientation) grid format is used to specify storage location. Y1, X1 is the top left-most position. In the preceding example, the current four sensor probes are stored at these four separate positions:

Probe	Storage Location on Grid
1	Y1, X1
2	Y2, X1
3	Y3, X1
4	Y4, X1

Several choices are available: (1) pressing **[ENTER]** stores data points using the grid positions specified; (2) pressing **[ENTER]** again overwrites (and deletes) the current data points; and (3) pressing and holding down **[ENTER]** for three seconds erases a data point, allowing you to re-enter.

- The user determines the number of readings taken by stepping over the entire surface that is to be recorded. The grid is limited to Y99 x X99 = 9801 data points.
- To move in Y direction use **[UP]** or **[DOWN]**.
- To move in X direction use **[LEFT]** and **[RIGHT]**.
- When the grid is complete, press **[SETUP/ESCAPE]**. The Grid Average screen then appears.

> **NOTE:** As the instrument calculates the average over all readings you record, a higher number of readings generally improves accuracy of the average and volume flow results.

G. Grid Average Screen

```
GRID  AVG      52FPM
TEMP  AVG      79°F
FLOW  VOL     503CFM
LBL:  EXAMPLE  THREE
```

The Grid Average screen, an example of which is shown above, displays the current average grid measurements. This is a display-only screen. The unit of measurement employed is selected in the System Configuration Menu (section 4.5).

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Field	Description
GRID AVG	Displays the average airflow velocity (in the specified unit of measure, Feet Per Minute or Meters Per Second) for all measurements stored in the grid.
TEMP AVG	Displays the average temperature (in degrees Fahrenheit or Celsius) for all measurements stored in the grid.
FLOW VOL	Displays the volumetric airflow (in Cubic Feet per Minute or Liters per Minute) based on the grid dimensions entered by the user. If no Volume dimensions were entered in the Grid Setup, the Volume Flow equals 0.
LBL	Displays the optional label description for this grid location as entered before.

When you press **[ENTER]** after viewing the Grid Average screen, this prompt displays:

```
PRINT  RECORD?


NO:  ESC  YES:  ENTER
```

If you have an optional serial printer connected to the Quattro Analyzer (e.g. the AccuSense supplied Printer) and wish to print the record, press **[ENTER]**. Otherwise, press **[ESC]**. (You are not required to print now; you may do so later.)

The Normal Operating screen then redisplays as shown in section 4.2.1.

4.7.3 Print Records Option

The Print Records option lets you specify a range of records (or one specific record) to print. When this option is selected, a screen appears listing the range of records available to print (if any). A sample screen follows:

```
PRINT       RECORDS
From:       001
  To:       511
```


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The "From" record is the first or lowest record, the "To" record the last or highest record. Pressing **[LEFT]** or **[RIGHT]** moves between the "From" and "To" fields. Pressing **[UP]** or **[DOWN]** increases or decreases the record value. Specify the desired range of records to print and press **[ENTER]**. A confirmation screen then appears, an example of which is shown below.

```
Really Print
REC 1 to REC xxx

No: ESC Yes: ENTER
```

Pressing **[ESC]** cancels the operation, pressing **[ENTER]** prints the records. The Grid Program Menu reappears.

4.7.4 Delete Records Option

The Delete Records option lets you specify a range of records (or one specific record) to delete. When this option is selected, a screen appears listing the range of records available to delete (if any). This is almost identical to the Print Records screen on the previous page.

Specify the desired range of records to delete and then press **[ENTER]**. A confirmation screen similar to the Print Records option appears.

Pressing **[ESC]** cancels the operation, pressing **[ENTER]** deletes the records. The Grid Program Menu reappears.

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4.8 Print Data Menu

Various options on the Print Data Menu allow you to control how or if Quattro measurement data is printed to the optional thermal serial printer. The menu is shown below, table 4-5 identifies and describes its fields.

```
** PRINT  DATA    **
   Mode:
   Data:
   Time:
```

Table 4-5. Print Data Menu

Parameter	Description	Acceptable Range
MODE	Specifies if the print data feature is turned on (enabled) or not (disabled). If print data is enabled, Quattro airflow measurements and temperature measurements are printed to the optional thermal serial printer (from stored data or as real-time data) as specified below under DATA.	ENABLED or DISABLED
DATA	Specifies the type of Quattro measurement data printed: "Stored" or "RealTime." If "Stored" is selected as the method, the analyzer prints stored data to the printer in intervals specified in the"INTERVAL" setting in section 4.8.1.	STORED or REALTIME
TIME	Displays the cumulative period of time in minutes and seconds that the analyzer has been turned on, or the elapsed time for this session.	Variable

To send the data to the printer, press **[ENTER]**.
If "RealTime" is selected above, the Print Realtime Menu shown below appears.

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4.8.1 Print Realtime Menu

The Print Realtime menu permits you to specify how to print real-time data. This menu appears only if you specify "Realtime" in the Print Data Menu in section 4.8.

```
*  PRINT  REALTIME  *
   Method:
   Time:
   Interval:
```

Table 4-6. Print Realtime Menu

Parameter	Description	Acceptable Range
METHOD	Specifies the method to use when printing real-time data to the printer, "Timed" or "Manual." If "Timed" is chosen, the analyzer prints real-time data to the printer at intervals specified below under INTERVAL below. If "Manual" is chosen, the real-time data prints to the printer whenever you press **[ENTER]**.	TIMED or MANUAL
TIME	Prints the cumulative period of time in minutes and seconds that the analyzer has been turned on, or the elapsed time for this session. Data is taken from the "TIME" setting in the Print Data menu.	Variable
INTERVAL	Specifies the time interval to use for sending real-time data to the printer.	10 seconds - 60 minutes

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```
CAMBRIDGE ACCUSENSE INC.
Timer     0 hrs, 00 min, 00 sec
1:      20FPM  26.1C  2:
3:      16FPM  27.3C  4:     17FPM  26.3C
Average:     18FPM     26.6C

CAMBRIDGE ACCUSENSE INC.
Timer     0 hrs, 00 min, 34 sec
1:      20FPM  26.0C  2:
3:      20FPM  26.8C  4:     17FPM  26.1C
Average:     19FPM     26.3C

CAMBRIDGE ACCUSENSE INC.
Timer     0 hrs, 00 min, 58 sec
1:      20FPM  26.0C  2:
3:      16FPM  26.7C  4:     18FPM  26.0C
Average:     18FPM     26.2C

CAMBRIDGE ACCUSENSE INC.
Timer     0 hrs, 00 min, 01 sec
1:      20FPM  26.1C  2:
3:      18FPM  26.9C  4:     17FPM  26.3C
Average:     18FPM     26.4C

CAMBRIDGE ACCUSENSE INC.
Timer     0 hrs, 00 min, 10 sec
1:      20FPM  26.1C  2:
3:      17FPM  26.8C  4:     18FPM  26.3C
Average:     18FPM     26.4C

CAMBRIDGE ACCUSENSE INC.
Timer     0 hrs, 00 min, 20 sec
1:      20FPM  26.1C  2:
3:      17FPM  26.8C  4:     22FPM  26.2C
Average:     20FPM     26.4C

CAMBRIDGE ACCUSENSE INC.
Timer     0 hrs, 00 min, 30 sec
1:      19FPM  26.0C  2:
3:      17FPM  26.8C  4:     18FPM  26.1C
Average:     18FPM     26.3C
```

Figure 4-1 Sample for Quattro Printout

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4.9 Updating the Firmware

The internal software (or "firmware") of the Quattro Analyzer can be updated easily, via an AccuSense-supplied diskette or AccuSense's World Wide Web site, using a personal computer running Windows 95.

To determine the revision number of your Quattro Analyzer's firmware, watch the display while turning on the instrument. At the bottom it will show the version number.

```
S/N:  981234-567

  7  GRID  RECORDS
    VERSION  1.62
```

Knowing this number contact AccuSense's WWW-site or Customer Service to check if a firmware update is available.

There are different ways to get a firmware update:

1. Download files from AccuSense's WWW-site.
2. Order files by e-mail.
3. Order files on floppy disk.

Procedure to upload files to the memory of your Quattro Analyzer:

1. Required accessories: RS-232 Cable, blank floppy disk.
2. If you received a zipped file, un-zip it to a temporary directory.
3. You should find the following five files:

```
Quattro.bin
Quattro.exe
Qload.bat
Yes
Readme.txt
```

4. Copy the five files to an empty floppy disk, e.g. A:\
5. Connect Quattro to an available serial port of your PC using a standard RS-232 cable. Note the port number (1, 2, 3, or 4).
6. Turn Quattro Analyzer OFF.
7. This procedure requires DOS. Restart PC in MS-DOS mode. (START, SHUT DOWN, Restart in MS-DOS mode.)
8. At the DOS-Prompt enter "`A:\QLOAD N`", where N is your PC's COM Port number. Use "`1`" for COM 1, "`2`" for COM 2, etc.

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9. When the following message appears on the screen, turn the Quattro power ON.

```
WAITING FOR M - REBOOT QUATTRO
```

10. A series of messages will appear on screen to monitor the upload progress. If no messages appear, your connection to the PC is probably bad or not the port number you entered. In this case try again.

11. When the upload is complete, the Quattro Analyzer will come on and beep.

12. Keep the floppy disk as backup.

NOTE: DO NOT attempt to complete this procedure from inside an "MS-DOS window" while still running Windows 95. You must specifically shut down Windows 95 and restart the computer in MS-DOS mode.

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Chapter 5: Maintenance Troubleshooting

Chapter 5 provides the maintenance procedures applicable to the AccuSense Quattro Flow Air Velocity Analyzer. In addition, a list of "Frequently Asked Questions" contains diagnostic and corrective information about common system problems.

Whenever your analyzer experiences difficulty, before calling AccuSense for service, perform the following:

1. Write down the time and date that the problem occurred, or the time and date when you first noticed the problem. Also note what the analyzer was doing (which software operating menu was selected), or what it was supposed to be doing, when the problem occurred or was first noticed.
2. Note all other relevant information, paying particular attention to recent Firmware updates, new or inexperienced operators, or any recent hardware changes to the optional thermal serial printer or user-supplied optional personal computer.
3. Attempt to isolate the problem as "hardware-related" (for example, the optional thermal serial printer is jammed or inoperable) or "software-related" if possible.
4. Refer to the "Frequently Asked Questions" in this chapter. It is designed so that many common problems can be easily diagnosed and corrected by users without AccuSense assistance.
5. Visit AccuSense's WWW-site for latest information on the Quattro Analyzer, firmware upgrades and FAQ.
6. Contact AccuSense for help only if using steps 1-5 above fails to resolve the problem. Make sure that you have a written description of the problem (and any steps you may have taken attempting to remedy the problem) before calling for help. Have the instrument and all the information available when calling AccuSense Technical Support.

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5.1 Frequently Asked Questions

1. *Does the analyzer indicate when the airflow exceeds the calibration range of the AFS sensor being used?*

   The user must compare the readings with the calibration range of the sensors (marked on connector) and make sure it stays within range.

2. *Can I connect AFS sensors with different calibration ranges at the same time?*

   Yes. The analyzer has the capability of detecting each AFS sensor's calibration constants automatically, which are used when calculating readings.

3. *What can you tell me about the accuracy of the AFS sensors beyond the calibration range?*

   AccuSense specifies the accuracy of each AFS sensor within the defined calibration range, marked on each sensor's connector. At higher velocities the sensors tend to underread, at velocities below the range readings should not be considered accurate. Velocities below 30 FPM result in convection at the heated sensor and should also not be considered accurate.

4. *Are there any limitations or prohibitions against using the analyzer in noisy environments, such as close to power supplies?*

   AccuSense research to date on the influence of noisy environments on the analyzer and AFS sensors has found little sensitivity to EMI radiation.

5. *Does dust affect the readings?*

   As long as the AFS sensor head is not heavily covered or blocked with dust, the readings should still be accurate.

6. *How about chemicals or other gases in the air?*

   There are two issues worth noting:

   A. The AFS sensor might be damaged by hazardous chemicals like acids or lyes.
   B. AccuSense's Sensors are calibrated for air in human environments only (room air), so the readings may be inaccurate in other environments.

7. *How can I clean a dusty AFS sensor?*

   Use an ultrasonic bath for cleaning AFS sensor heads. Be sure to unplug the sensor before cleaning!

8. *My application requires measurements above 70°C (158°F).*

   The AFS sensor itself should not be damaged when used below 100°C/212°F. But measurement outside the sensor's temperature

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calibration range (15-30°C/59-86°F or -5-+70°C/23-158°F) may cause the reading to be less accurate.

9. *The Quattro Analyzer does not come on when turning the ON switch.* Try to recharge the internal battery of the Quattro Analyzer by connecting the Quattro via power supply to a standard electric power socket. Check all cable and socket connections. Do the 2 LEDs on the back of the Quattro light? If not, there is probably no electricity reaching the instrument.
10. *When uploading Quattro firmware, no data transfer numbers appear after turning on Quattro at the message "Reboot--waiting for M."* This PC cannot establish a connection to the Quattro. Be sure to have the PC rebooted into DOS-mode: A DOS-window from running Windows does NOT work. Check the RS-232 cable connection: If available, try a different cable, but be sure to use a standard RS-232 cable. Check if the COM-port really has the same number as you are using.

5.2 Maintenance Procedures

AccuSense guarantees the calibration of the Quattro analyzer and the AFS sensors for one (1) year starting the day of delivery.

5.2.1 Recalibration

- To ensure that your Quattro analyzer always gives the most accurate readings, AccuSense recommends that the analyzer and AFS sensors be recalibrated once every year.
- To recalibrate, contact AccuSense for an RMA-number and shipping instructions before returning the analyzer.
- To check if an AFS sensor is still accurate, compare the readings to a sensor of the same type. Ensure that the air velocity matches the sensor's calibration range!

WARNING: THERE ARE NO CUSTOMER SERVICEABLE PARTS INSIDE THE ANALYZER OR AFS SENSORS. OPENING THE ANALYZER AFFECTS THE ACCUSENSE WARRANTY AND RISKS ELECTRIC SHOCK!

5.2.2 Cleaning

1. To clean the analyzer or its cables, use a mild detergent applied to a clean cloth.
2. Do not use alcohol or ammonia based solutions.
3. To clean the sensor-heads, use an ultrasonic bath.

Caution: Unplug the sensor before putting it into the ultrasonic bath.

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Appendix A: Parts List

Appendix A shows part numbers and descriptions for the AccuSense Quattro Flow Air Velocity Analyzer.

For ordering please refer to this parts list.

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Quattro Analyzer	Part Number	Description
	Quattro	Quattro Flow Air Velocity Analyzer includes soft carrying case, user's manual, external power supply, power cord
	AFS-Sensors	For available AFS-Sensors and calibration ranges please contact AccuSense.

Accessories	Part Number	Description
	Wand F	3.5 feet long, 4 sections, stainless steel, incremental marking in inches, includes 4 mounting clips
	Wand C	85 cm long, 4 sections, stainless steel, incremental marking in centimeters, includes 4 mounting clips
	100200	Thermal Serial Printer includes internal rechargeable battery, external power supply and power cord, null modem cable, thermal paper
	AccuTrac 4.0	AccuTrac 4.0 for Windows 95/NT Graphing and Analysis Software includes RS-232 cable

Replacement Parts	Part Number	Description
	100131	Quattro Soft Carrying Case
	100132	Quattro User's Manual
	100099	Quattro Power Supply
	WA-305	Power Cord (for power supply 100099)
	HA-376	Self-adhesive Mounting Clips (low-profile sensor only)
	100110	Wand Mounting Clip (clip-on sensor only)
	100201	Power Supply (for printer 100200)
	100202	RS-232 Null-Modem Cable (for printer)
	100203	Thermal Printer Paper (extra rolls)
	100205	Thermal Serial Printer
	CB-001	RS-232 Cable (standard serial PC cable)

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Appendix B: Quattro Firmware Flowchart

The flowchart shows the main menus of the Quattro Analyzer's internal firmware effective Rev. Number 1.62.

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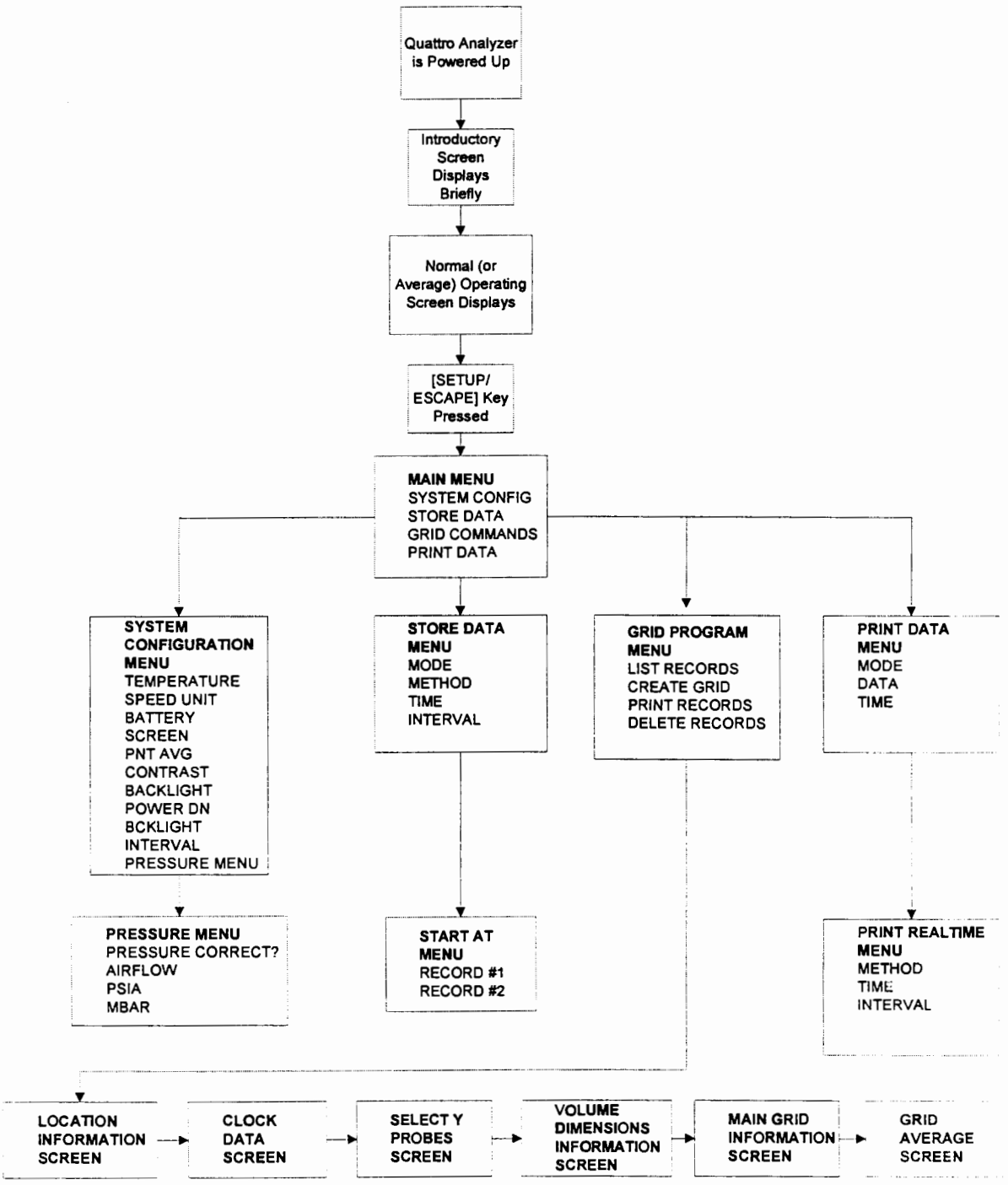


Figure A-1 Quattro Software Operating Menus Overview

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Appendix C: Customer Service Information

Appendix C provides information about AccuSense's Customer Service policy, installation policy, and warranty. AccuSense's policies on warranty returns and consumable parts are also explained. To determine which policies apply to your system, consult AccuSense.

C.1 Customer Service Policy

AccuSense has established a Customer Service department to meet the service needs of its customers. A Customer Service Representative is available from 9:00 a.m. to 5:00 p.m. (EST) to:

- take an order
- track a shipment
- determine availability
- request technical support
- request product and procedure training
- record a problem
- coordinate return of products
- record a complaint or general feedback

For technical assistance contact the Technical Support at AccuSense:

- Telephone troubleshooting with technical experts
- Technical assistance to solve specific application questions

C.2 Warranty Information

AccuSense warrants its products to be free from defects in material and workmanship for a period of one (1) year from date of shipment. This warranty is invalid if the products have been misused, modified, adjusted or otherwise operated outside specifications.

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C.3 Returns

- Within the above time period any part of the goods that prove to be defective in material or workmanship may be repaired or replaced on an exchange basis with a new or functionally operative part free of charge.
- After such warranty period, any labor, travel time, transportation and subsistence expense shall be borne by the Buyer. If preferred, Buyer may return goods to AccuSense's manufacturing plant with shipment both ways at Buyer's expense for repair work.
- Parts returned damaged due to poor or insufficient packaging by the Buyer will not be accepted for service unless otherwise agreed.
- Any time parts are returned where no problems are found, a service/handling charge, which will reflect the labor to test and verify the parts as well as other incurred expenses, will be borne by the Buyer.

In no event shall AccuSense be liable for incidental or consequential damages, including, but not limited to, costs, or removal and reinstallation or such goods, good will, overhead expenses, loss of profit, and loss of use.

The remedies are available only to the original Buyer. Buyer agrees to accept billing for service expense for service call resulting from other than a AccuSense goods failure or other AccuSense fault.

C.4 Service Contract

An optional service contract is available on Air Velocity Instrumentation. Please contact AccuSense for additional information.

C.5 Consumables

Consumables can be ordered from AccuSense or your AccuSense-authorized distributor. Use only AccuSense products or AccuSense-approved products in your Quattro Flow Analyzer. AccuSense shall not be liable for damage to or malfunction of the system which it deems was caused by the use of unauthorized materials. Please refer to the Parts List in Appendix A when ordering.

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Appendix D: EU Declaration of Conformity

Product Category:	Air Velocity Instrument with Sensors
Product Type:	Air Velocity Analyzer
Model Numbers:	Quattro Flow Air Velocity Analyzer with AFS Sensors
Manufacture's Name:	Cambridge AccuSense, Inc.
Manufacture's Address:	1000 Mount Laurel Circle Shirley, Massachusetts 01464, USA
Tel:	(978) 425 2090
Fax:	(978) 425 4062
Web:	www.accusense.com

The before mentioned product comply with the following EU Directive:

> -89/336/EEC."Council Directive of 3 May 1989 on the approximation of the laws of Member States relating to electromagnetic compatibility"

The compliance of the above mentioned products with the Directive and the following essential requirements is hereby confirmed:

55011: 1991	IEC 1000-4-2: 1995	IEC 1000-4-4: 1995
EN50082-1: 1992	IEC 1000-4-3: 1995	IEC 1000-4-5: 1995

The technical files and other documentation are on file with the Regulatory Affairs Department of Cambridge AccuSense, Inc.

As the manufacturer we declare under our sole responsibility that the above mentioned products comply with the above named directives.

Raouf Ismail, President
Cambridge AccuSense, Inc., Shirley, MA USA

6-30-98
Date

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