AIRFLOW METERING SYSTEMS

Technical / Operations

Manual

V2016.11.30

Auxiliary Fans          Drift/Tunnel          Primary Fans

For more information on our products visit www.accutroninstruments.com
Contact us by email: info@accutroninstruments.com
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Section 1.0 – General Information

1.1 - The Manual

Refer to this manual for proper installation, operation and maintenance of the Accutron FlowTRAX Instrument.

Special attention must be paid to warnings and notices highlighted from the rest of the text by gray boxes.

**Warning:** indicates failure to observe the necessary precautions can result in death, serious injury, and/or considerable material damage.

**Note:** indicates important information about the actual product or that part of the operating manual.

- These instructions do not claim to cover all details or variations in equipment, or to provide for every possible contingency that may arise during installation, operation, or maintenance.
- For further information or to resolve issues not covered in the manual, consult your Accutron representative.
- The contents of the manual shall not become part of or modify any prior or existing agreement, commitment or relationship. The sales contact contains the entire obligation of Accutron Instruments. The warranty contained in the contract between the parties is the sole warranty of Accutron Instruments Inc.

**IMPORTANT:** All specifications are subject to change without notice. Please ensure that any safety-related information is confirmed with a qualified Accutron Instruments representative.
1.2 - Safety Guidelines

Warning notices must be observed to ensure personal safety as well as that of others, and to protect the product and the connected equipment. These warning notices are accompanied by a clarification of the level of caution to be observed.

This device/system should only be set up and operated in conjunction with this manual. Qualified personnel are only authorized to install and operate this equipment in accordance with established safety practices and standards.

**Warning:** This product can only function properly and safely if it is correctly transported, stored, installed, set up, operated, and maintained.

**Note:** Always use the product in accordance with specifications.

1.3 - Information about Your System

When you first open your Accutron FlowTRAX unit, be sure to record the following. If you need to contact Customer Service, this information will help give you better service.

<table>
<thead>
<tr>
<th>FlowTRAX information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part Number:</td>
</tr>
<tr>
<td>Serial Number:</td>
</tr>
</tbody>
</table>
1.4 - Accutron FlowTRAX Specifications

Connections: Screw terminal block type
Transducers: Drift 3.5” [88.9mm] diameter X 8.5” [215.9mm] Length
Display Readout: 8-digit alphanumeric LED display.
Each digit is 0.75” (H) X 0.5” (W)
Power Supply: Switching type with International Approvals (CUL, UL, CE)
Power Consumption: < 10 watts
Input Power: 110 VAC to 240 VAC, 50/60 Hz
24 VDC (optional)
Display Units: M/S, CFM, KCFM, M**3/S, FPM
Temperature range: -40° to +60° Celsius
Accuracy: 2% Full Scale or ± 0.10 M/S (whichever is greater)
Output type: 4-20mA, Modbus RS-485
Optional: Modbus TCP/IP or Ethernet IP
Output modes: Normal, reverse, or split (used for bi-directional measurements)
Max loop resistance: 700 ohm
Over Range alarm: 3.0mA
Time out alarm: 3.5mA
Enclosure: Nema 4X – non corrosive, IP68
Sensor cables: 100 feet standard (sensor-to-display enclosure) custom cables
are available
Connectors: Stainless steel, with o-ring seals, IP68 rated
Sensor Mounting: Industrial CATV pan and tilt mount.
Drift Tunnel Sizes: Maximum face-to-face distance of 60 feet.
Programming: Handheld terminal or navigation buttons can be used to program
and configure the Accutron. Optionally a web browser can be
used with the Modbus TCP option.
Max Airflow: 0 to 40 m/s and higher (essentially no practical upper limit) bi-
directional
Section 2.0 – Installation

2.1 - Choosing a Location

The best location to install the instrument is in a straight section of tunnel that is at least 3 tunnel widths long. In such a section, the airflow distribution will be well behaved with a maximum airflow in the center and minimum airflow on the sides (Figure A). We should try to avoid locations where the airflow is concentrated in one of the corners (Figure B).

The imaginary line between the Accutron sensors works like a “virtual pitot tube” and all flow measurements occur along this line. In practice, best results are displayed when this “imaginary line” passes through the center of the tunnel, slicing through the airflow distribution profile in a representative way.

It is also a good idea to carry out and record a 9-point manual airflow survey to verify the airflow distribution and identify it as a suitable location.

Note: Sometimes there are cases when we need to measure the airflow in a less-ideal location. In this case, we may need to manually adjust the calibration correction factor to give accurate flow readings. In this case, the instrument would be calibrated against a handheld anemometer.

2.2 - Mounting the Transmitter

When planning to mount the control unit, you must take into consideration the availability of the power source, Ethernet CAT5 cable and the 4-20mA output signal, i.e. PLC connection.
2.3 - Mounting the Sensors

When planning a mounting location for the wall mount sensors, we recommend mounting one near the ceiling of the drift and the other located near the bottom downstream from the first sensor on the opposite side, with an “imaginary line” between them intersecting the airflow at a typical angle of 120 degrees.

Illustration of typical mine drift installation

Once the mounts are installed, thread the sensors onto the mounts and point them at each other using the pan/tilt adjustment on the mount. Once power is run to the unit these sensors can be aligned properly using the laser alignment found in the configuration menu of the transmitter.

2.4 - Connecting the Sensor Cables

A common mistake made is improperly installing the sensor cables. These cables must be threaded all the way to ensure proper functionality. If the cable will not thread onto the sensor or transmitter ensure that the pins are lined up properly.
2.5 - System Explanation

The Accutron airflow sensors are compact and reliable instruments specially designed for measuring airflows in mine environments. Each system consists of an indicating Transmitter, two sensor cables and two “ultrasonic sensor” assemblies.

Ultrasonic pulses are sent back and forth between the transducers across the tunnel, traveling through the air current. Let \( T_{A-B} \) be the time taken for the signal to travel from Transducer A to Transducer B, and \( T_{B-A} \) be the time taken for the pulse to travel from Transducer B to A. The control unit accurately measures the time-of-flight for each direction. The difference between the measured times \( (T_{A-B} - T_{B-A}) \) is directly proportional to the airflow. In the case of no moving air, then \( T_{A-B} \) equals \( T_{B-A} \) and there is no time difference because there is no airflow.

Inherently, the Accutron first internally computes the average velocity of the air in Meters/Second. Then, to obtain air volumes, the area of the drift is entered in (during programming), along with your selection of measurement units. The system then displays air volumes in the units selected. Common units used in mining applications are KCFM and M**3/S, other units may also be displayed (Meters/sec, Feet/Min).

After installation the following measurements are made: “Area”, “Baseline distance”, “Face-to-face distance”. Then, using the handheld programmer, these parameters are entered into the unit, along with the selection of “Display Units” and “4-20mA output characteristics”. These parameters are retained in non-volatile flash memory in the Accutron. When the Accutron starts up from a power cycle the information is automatically reloaded. The handheld programmer is easy to use, the settings can also be entered using the navigation buttons located on the main circuit board see section 3. The system can easily measure airflows in excess of 1,000,000 cfm with a precision better than any other conventional methods. In addition, since the system is able to sample across the entire tunnel it provides an averaged reading more representative than “single point” measurements. The Accutron therefore takes into account the fact that there is a “distribution profile” for the airflow through the tunnel, making it superior to other types of measurement methods for fixed installations.
Section 3.0 – Programming

3.1 - Option 1 Using the Navigation Buttons

1. Navigation buttons
2. Programming switch (for firmware updating only)
3. Reset button (reboot device, no settings lost)

- To change the settings in the instrument simply press the Select/Enter button.
- The LED display will show NAV MENU.
- Use the Up and Down buttons to select which menu or option you want. Then press the
  Select button to enter the specific setting.
- To change a value, press Select to enter edit mode. Once there, use your arrow keys to
  change the value. UP/DOWN will increment or decrement your value. LEFT/RIGHT will
  let you shift the cursor to the side. The numbers cycle through 0-9 including a period for
  decimal values. Press the Select/Enter button again to exit the edit mode.
- To save and run, keep navigating through the menu until you reach the main menu.
  There, you will be able to select either SAVE/RUN or UNDO/RUN. Press the select
  button on the option you want. You will now be back in Run mode.
- Selecting the Reset option in the menu will reset all settings values to their defaults.
3.2 - Option 2 Using the Handheld Programmer

The handheld terminal is a universal device, for Accutron airflow products only; it allows the user to input the settings during set-up.

To use this device:

1) Ensure the instrument is powered and running.
2) Insert the Handheld programmer connector into the RJ-11 socket, which is located on the din rail circuit board directly below the main circuit board. The Handheld display should light up.
3) Press the ENTER key on the Handheld to activate it.

Once activated, you will hear a noise and the display will show menu options.

![Handheld Terminal Diagram]

**Hanging Bracket:** A retractable hanging bracket for optional use.

**LCD Display:** 4 row, 20-character backlit LCD display

**Key Pad**

[F1] HELP = This key brings you to the Help menu which can be accessed at any time during the configuration.

[F2] FWD = This key takes you to the next parameter in the configuration menu. The Enter key has the same function.

[F3] REV = This key brings you back to the previous parameter in the configuration menu.

[F4] N/A = Currently, this key has no function.

[F5] RUN = This key takes you to the **Run Options** menu which can be accessed at any time during the set-up, except while running the “Transducer Alignment Testing” function. Once finished entering the desired settings, use the F5 key to allow you to select the “Save and Run” option. The display will indicate to return the switch into “Run” mode.
### 3.3 - Programming Datasheet and Default Settings

While programming the instrument, it is a good idea to write down the parameters in the following form. This form should also be filed for future reference.

<table>
<thead>
<tr>
<th>Configuration Menu</th>
<th>Menu Option</th>
<th>Default Setting</th>
<th>New Setting Entered</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Transducer Laser</td>
<td>A disabled</td>
<td></td>
</tr>
<tr>
<td>(1A)</td>
<td>Flow units</td>
<td>A (M/S)</td>
<td></td>
</tr>
<tr>
<td>(1B)</td>
<td>Linear units</td>
<td>A (Meters)</td>
<td></td>
</tr>
<tr>
<td>(1C)</td>
<td>Face to face distance</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>(1D)</td>
<td>Baseline distance</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>(1E)</td>
<td>Cross section area</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>(1F)</td>
<td>Air flow direction</td>
<td>A (Normal sign)</td>
<td></td>
</tr>
<tr>
<td>(1G)</td>
<td>Zero flow cutoff</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>(1H)</td>
<td>Instrument full scale</td>
<td>1000.0</td>
<td></td>
</tr>
<tr>
<td>(1I)</td>
<td>4-20mA over range</td>
<td>A (Saturate/Clipping)</td>
<td></td>
</tr>
<tr>
<td>(1J)</td>
<td>Obstruction/fault timeout in minutes</td>
<td>100 (disabled)</td>
<td></td>
</tr>
<tr>
<td>(1K)</td>
<td>4-20mA mode</td>
<td>A (4mA 0% 20mA 100%)</td>
<td></td>
</tr>
<tr>
<td>(1L)</td>
<td>Moving average</td>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>

#### Advanced Menu

| (2A)               | Calibration Correction | 1.0                        |                     |
| (2B)               | Noise filter           | 0                          |                     |
| (2C)               | Wave detection low threshold | 20                        |                     |
| (2D)               | Wave detection high threshold | 70                        |                     |
| (2E)               | Dynamic range limiting factor | 10                        |                     |
| (2F)               | Hysteresis length     | 10                        |                     |
| (2G)               | XDUC Gain             | D (4)                     |                     |
| (2H)               | Moving average type   | B (First reading)         |                     |
| (2I)               | Alternate updates     | B (Enabled)               |                     |
| (2J)               | Envelope Mask         | 0                         |                     |
| (2K)               | Master Gain           | 127                       |                     |
| (2L)               | Auxiliary probe board | No default setting, retains the last setting entered | |
| (2M)               | Auxiliary probe board display |                     |                     |

#### Diagnostics Menu

| (3A)               | Modbus address       | 1                         |                     |
| (3B)               | Baud Rate            | D (115200)                |                     |
| (3C)               | Modbus baud rate     | A (9600)                  |                     |
| (3D)               | Parity               | None                      |                     |
| (3E)               | Stop Bits            | 2 Stop Bits               |                     |
| (3F)               | Diagnostic output    | A (Envelope detect)       |                     |
3.4 - Auto Range Feature

The Accutron FlowTRAX has a unique feature called auto ranging. It is a quick and easy way to determine the face-to-face distance. To use this feature, you must do the following:

1. Ensure that all cables and wires are connected and threaded properly.
2. Ensure that the Accutron is powered.
3. To start the auto range function, enter a value of 0 as the “face-to-face” parameter using the handheld terminal or navigation keys. Once you have exited the menu using the “save and run” option, the Accutron will begin auto ranging.
4. Unplug the handheld and restart the system.
5. Upon boot up, the display will read “Accutron”, followed by software version.
6. The display will now read “RGx – x.xx” while the sensors communicate. The display will change depending on the distance.
7. Once the distance has been determined, the display should now display the airflow readings. The baseline distance will need to be manually measured and entered.
   a. If the sensors do not find the distance after 5 minutes, it is possible to manually enter the distance with the handheld. (See quick start section for instructions)

Note: The auto range feature works best in non-gusty conditions

3.5 - Quick Start Programming (Using handheld)

These step-by-step instructions show you how to quickly program the Accutron unit. For a more detailed setup refer to the flow chart and detailed menu setup on the following pages.

1. Plug the handheld in and press Enter.
2. Press Enter until the “Select Menu” menu appears.
3. Press A for the Configuration menu
4. Press Enter to skip “Transducer Laser” and press Enter again to skip “Enter Tag Number”.

Made in Canada
5. Press B for KCFM

6. On the next screen, select the unit of measurement you will be physically working with by pressing A meters or B feet.

7. In the “Enter face-to-face distance”, enter the measured distance (in the measurement units selected in step 6) between both sensors. This may already be present from the auto ranging function. Press Enter to continue

8. The “baseline distance” value will be automatically entered as the same value as the “face-to-face distance” (This value cannot be greater than the face-to-face distance). The baseline distance must be physically measured; it is the horizontal distance between the two sensors which will be less than the face-to-face distance. Press Enter to continue

9. Enter your measured/calculated value (in square units of measure selected in step 6) for the cross section area and press Enter

10. Press Enter until you see the handheld screen show “Enter 4-20mA mode” and select the parameter you want. By default, the output will be A (4mA = 0 and 20mA = full scale)

11. Press F5 to view the Options menu and select “Save and Run”

12. The display on the Handheld will say saving then go blank. Unplug the Handheld when its blank.”

The Accutron should now run properly with the above conditions. For a more detailed explanation regarding the setup, refer to the next section “Detailed Menu Setup”.
3.6 - Handheld Menu Flow Chart

**A - Config**
- Transducer Laser: A - Disabled, B - Direction D, C - Direction 1
- Enter Tag Number:
- Enter flow units: A - M³/s, B - cfm, C - m³/min, D - l/s
- Linear Units: A - Meters, B - Feet
- Enter face to face distance:
- Enter baseline distance:
- Enter cross section area:
- Enter air flow direction sense: A - Normal, B - Reverse
- Enter zero flow cutoff:
- Enter instrument full scale:
- Enter 4-20mA over range mode: A - Saturate/Clipping, B - Error
- Obstruction fault timeout in minutes (100 = disabled): enter value C-100
- Enter 4-20mA mode: A - 4mA, B - 20mA, C - 100%
- Auxiliary Probe Board: A - Disabled, B - Enabled
- Enter moving average (C-255): enter value C-255

**B - Advanced**
- Enter calibration correction:
- Enter noise filter level: enter value 0-100
- Enter wave detection: low threshold: enter value 0-100
- Enter wave detection: high threshold: enter value 0-100
- Enter dynamic range limiting factor: enter value 0-1000
- Enter detection: Hysteresis length: enter value 0-10000
- Enter XDUCA Gain: A0, B1, D2, 34, 58, F16, 32, H54
- Enter moving average type: A - Start at D, B - First reading
- Enter alternate updates: A - Disabled, B - Enabled
- Enter Envelope mask suppression: enter value 0-1000
- Enter Master gain: enter value 0.127
- Auxiliary Probe Board Display: A - Disabled, B - Enabled

**C - Factory Settings**
- Accutron M Series Serial No.:
- Press F1 for help
- Select language: A - English, B - French, C - Spanish
- Select Menu:
  - A - Config, B - Advanced
  - C - Factory Settings
  - D - Diagnostics
- Factory Info Serial No.:
- Factory Info Version:
- Factory Info Mother PCB Ver.:
- Factory Info Daughter PCB Ver.:

**D - Diagnostics**
- Enter communication address: enter value 1-247
- Select serial link baud rate: A - 9600, B - 38400, C - 57600, D - 115200
- Select modbus baud rate: A - 9600, B - 19200
- Select diagnostic output: A - Envelope detect, B - Filter
- Select serial line parity: A - None, B - Odd, C - Even
- Select serial l/K Stop Bits: A - 1 stop bit, B - 2 stop bits
- Quality Control testing: A - Disabled, B - Enabled
- Enter T1 for Quality Control:
- Enter T2 for Quality Control:
- Test current output? A - Yes, B - Step, C - No
- **F5**
  - A - Save and run
  - B - Run
  - C - Restore defaults
  - D - Back to menu

**Settings saved**
- Running...

**Settings not saved**
- Running...

**Reset all settings to default values?**
- A - No
  - B - Yes

UNPLUG

- A
  - B

UNPLUG
3.7 - Detailed Menu Setup

Plug in the Handheld programmer and hit Enter.

Start-up screen

Accutron FlowTRAX
Serial No: xxxxxxxxx
New
Press F1 for Help

Press the [F2] or [Enter] key to continue.

Select Language
A  English
B  Francais
C  Espanol

Press the letter that corresponds with your preferred language

Select Menu :
A  Config, B Advanced
C  Factory Settings
D  Diagnostics

The Accutron main menu has 4 options. Configuration, Advanced, Factory Settings, and Diagnostics

Configuration menu

Transducer Laser
A  Disabled
B  Direction 0
C  Direction 1

Enable the Transducer Laser for alignment of the sensors once mounted

Enter Tag Number :

Enter the Tag Number desired. This option is mostly used if you want to identify which unit you are working with. It is simply text information.

[1A] Enter flow units :
A  M/S
C  cfm
E  fpm

B  kcfm
D  M**3/s
F  usec

Press the letter that corresponds with the desired unit. M/S (meters per second) is the default.
[1B] Linear Units:
A  Meters
B  Feet

Choose the desired unit of measurement. “Meters” is selected by default. If “Feet” is selected, then every option will be calculated in feet.

[1C] Enter face to face distance:
0.0 Feet

This is the distance between the faces of the two sensors. By default, the distance is 0.0. This causes the instrument to enter the “auto range” mode when it is first powered on. This value can also be physically measured and entered manually.

[1D] Enter baseline distance:
0.0 Feet

This is the horizontal distance between the two sensors. By default, this value is the same as the face-to-face. This value is physically measured and will always be less than the face to face distance.

[1E] Enter cross section area:
0.0 Square Feet

Enter the cross sectional area of the section between the two sensors.

[1F] Enter airflow direction sense:
A  Normal sign
B  Reverse sign

Selecting the Reverse sign multiplies the value on the display by −1. Use this option if you would like to receive positive values instead of negative values.

[1G] Enter zero flow cut off:
0.0 kcfm

Zero flow cut off allows you to select a specific range of measurements. For example if you are working in kcfm and enter a value of 100, and your full scale setting is 500, your measurement range will now be 100-500 kcfm as opposed to 0-500 kcfm.

[1H] Enter instrument full scale:
1000 kcfm

This is the full-scale reading of the instrument in the units selected. Flow readings greater than this will result in a “*” to appear in the display indicating that you have exceeded your full scale range.
Selecting A, if the flow exceeds full-scale, the 4-20mA output will saturate at 20mA. Selecting B, if the flow exceeds full-scale, the instrument will output 3.0mA indicating that the full scale or max airflow has been exceeded.

Obstruction/fault allows the instrument to output the last known good reading in the event there is something blocking the signal between the two sensors for example a large vehicle. The value can be selected from 0-99 minutes. Once the time has elapsed the unit will output a 3.5mA error.

A (Normal mode) 4mA corresponds to minimum airflow. 20mA max
B (Reverse mode) 4mA corresponds to maximum airflow. 20mA min
C (Split mode) 12mA corresponds to 0 airflow, 4mA to max negative, and 20mA to max.

In most cases the measured airflow is slightly turbulent, by averaging the readings, the analog output will behave in a smoother rate of change allowing for a better representation of airflow in the measured area.

Advanced menu (Please consult your Accutron representative before changing any of the following, other than calibration correction.)

The calibration correction allows for a correction factor to be entered in the case of difficult applications. It is calculated by dividing the expected reading / actual reading.

The noise filter is a provision for dealing with extreme noise. Normally it is set to 0.
[2C] Enter wave detection low threshold:
20 value (0-100)

This option is used to specify the lower wave detection threshold in order to properly detect the ultrasonic signal. In almost all cases this value should be left at 20.

[2D] Enter wave detection high threshold:
70 value (0-100)

This option is used to specify the upper wave detection threshold in order to properly detect the ultrasonic signal. In most cases this value should be left at 70.

[2E] Enter dynamic range limiting factor:
10 value (0-1000)

Places a limit on how much weak signal noise may be expanded (digitally amplified). It prevents over amplification of noise in the absence of a valid signal.

[2F] Enter detection hysteresis length:
10 value (0-1000)

This option determines the minimum acceptable length of the waveform. Default is 10 units.

[2G] Enter XDUC Gain:
A 0 B 1 C 2
D 4 E 8 F 16
G 32 H 64

This option sets the Transducer signal gain. In cases where the two sensors are separated by a long distance the gain should be set higher. The default gain is 4 = 0-20ft separation. 8 = 20-30ft, 16 = 30-40ft, 32 = 40-50ft and 64 = 50-60ft.

[2H] Enter moving average type:
A – Start at 0
B – First Reading

Upon powering up this will select whether to start the averaging at 0, (the airflow reading will slowly ramp up to the actual reading) or using the first reading registered by the instrument.

[2I] Enter alternate updates:
A – Disabled
B – Enabled

Do Not Change. Consult an Accutron Representative before changing. Default is Enabled.
[2J] Enter Envelope mask suppression:
0
(0 – 1000)
Consult an Accutron Representative

[2K] Enter Master gain:
127
(0 – 127)
Consult an Accutron Representative

[2L] Auxiliary Probe Board:
A – Disabled
B – Enabled
This option enables or disables the Probe completely.
The Probe reads Humidity, Temperature, Wet-Bulb and Pressure.

[2M] Auxiliary Probe Board
Display:
A – Disabled
B – Enabled
This option enables or disables the Probe Readings from showing on the local display.
The Probe will still function as normal, and the reading are still visible through Modbus or Modbus TCP.

Accutron/J Signal Filter:
A – Disabled
B – Enabled
This option enables or disables different signal processing. This can be used in noisy environments.

Accutron/J Diag Mode:
A – Bounding Box
B – Crossing Indexes
Diagnostics PC display option.

Accutron/J Min Amplitude:
128.000
Filter amplitude adjustment (128 to 400)

Accutron/J Freq Tolerance:
0.250
Frequency tolerance adjustment.
Accutron/J Minimum
Sig. Duration (ms):
0.600
Minimum valid signal duration.

Accutron/J Sampling
Period (ms):
300.000
Signal sampling period.

Diagnostics menu

[3B] Select diagnostic port
baud rate:
A - 9600    B - 38400
C - 57600   D - 115200
Select the baud rate for diagnostic output on the COM port when using PC Diagnostics.

Select diagnostic output:
A – Envelope Detect
B – Filter
This option selects the diagnostic mode. While running, a PC can be used to display the sonic-analog signals showing quality, amplitude, and noise for troubleshooting.

[3F] Test current output?
A - Yes    B - Step    C - No
This option is used to test the 4-20mA outputs. “Yes” will prompt you for a desired output while “Step” will test every output from 0-20mA.

Miscellaneous

A  Save and run
B  Run
C  Reset to defaults
D  Back to menu
To reach this menu, press F5.
Important: This is the only way to get the Accutron back into “Run Mode”.
Section 4.0 Modbus

4.1 - Modbus Slave Connection
If Modbus TCP/IP or Ethernet/IP option installed, see section 4.3.

Supported Modbus RTU protocols are:

8 data bits / 1 stop bit / Even parity
8 data bits / 1 stop bit / Odd parity
8 data bits / 1 stop bit / No parity
8 data bits / 2 stop bits / No parity

Supported baud rates:

9600 baud
19200 baud
### 4.2 - Modbus Registers

#### Process Variables – Read-Only (Version 3.14+)

<table>
<thead>
<tr>
<th>Register</th>
<th>Description</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>40001 &amp; 40002</td>
<td>Airflow Reading</td>
<td>Float32</td>
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<tr>
<td>40003 &amp; 40004</td>
<td>Temperature</td>
<td>Float32</td>
</tr>
<tr>
<td>40005 &amp; 40006</td>
<td>Humidity</td>
<td>Float32</td>
</tr>
<tr>
<td>40007 &amp; 40008</td>
<td>Pressure</td>
<td>Float32</td>
</tr>
<tr>
<td>40009 &amp; 40010</td>
<td>Wetbulb</td>
<td>Float32</td>
</tr>
</tbody>
</table>
| 40011 & 40012 | 4-20mA Reading     | Float32      | Airflow’s 4-20mA Output
| 40013     | Exception          | Int16        | 0 = Sensor OK, 10 = Sensor signal loss |
| 40014     | Heartbeat          | Int16        | Increments every sec. up to 65535 |
| 40015     | Probe Diagnostics  | Int16        | As of V3.38; 0 = bad com, 1 = good com |
| 40016     | Reserved 1         | Int16        |
| 40017     | Reserved 2         | Int16        |
| 40018     | Airflow reading (Integer) | Int16 |
| 40019     | Airflow reading (Fraction) | Int16 | Divide by 10000 for fraction |
| 40020     | Temperature (Integer) | Int16 |
| 40021     | Temperature (Fraction) | Int16 | Divide by 10000 for fraction |
| 40022     | Humidity (Integer)  | Int16        |
| 40023     | Humidity (Fraction) | Int16        | Divide by 10000 for fraction |
| 40024     | Pressure (Integer)  | Int16        |
| 40025     | Pressure (Fraction) | Int16        | Divide by 10000 for fraction |
| 40026     | Wetbulb (Integer)   | Int16        |
| 40027     | Wetbulb (Fraction)  | Int16        | Divide by 10000 for fraction |
| 40028     | 4-20mA Reading (Integer) | Int16 |
| 40029     | 4-20mA Reading (Fraction) | Int16 | Divide by 10000 for fraction |

#### Unit Tagname – Read/Write (String of 20 Characters)

<table>
<thead>
<tr>
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</tr>
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<td>41003</td>
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<td>41004</td>
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<td>Tag char #9, 10</td>
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<td>Flow Units</td>
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<td>Linear Units</td>
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<td>Zero Cutoff</td>
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<td>Wave Detection Low Threshold</td>
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<td>Wave Detection High Threshold</td>
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<td>Dynamic Range Limiting Factor</td>
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<td>Hysteresis Length</td>
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<td>Transducer Gain</td>
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<td>Moving Average Type</td>
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<td>Alternate Updates</td>
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<td>Display Auxiliary Probe Values</td>
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<tr>
<td>42030</td>
<td>Factory Info char#19, 20</td>
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</table>
### 4.3 Modbus Master Option

(This option only available when equipped with Modbus TCP/IP or Ethernet IP module)

The Modbus RTU of the FlowTrax comes pre connected to the Modbus TCP/IP or Ethernet IP module. Four extra terminal blocks are supplied inside the enclosure to allow the connection of other Modbus RTU slaves. Two terminal blocks for supplying 24VDC to the slave devices, and two terminal blocks for the A and B Modbus RTU lines for connecting your slave devices.

Modbus RTU slave devices connected to these terminal blocks can be converted from Modbus RTU to either Modbus TCP/IP or Ethernet IP, depending on the module installed, alongside with the airflow readings. This data is then available to your SCADA system.
Section 5.0 – Troubleshooting

5.1 - FAQ (Frequently Asked Questions)

A) Why am I not seeing anything on the display?
   • Check power connections. When the instrument is turned on, it should read “ACCUTRON” followed by the code version before entering run mode.
   • Ensure that the Accutron was not damaged in any way during shipping. If this is the case, please contact your supplier.

B) The Accutron turns on but I am not getting any readings.
   • Make sure all cables are connected.
   • Make sure both transducers are aligned, and are alternately snapping (making a slight clicking sound every second).

C) Both transducers are not snapping, what could the problem be?
Make sure each transducer is attached to the main unit via the cables and tightly connected and that they are properly in line with each other.

D) Why is the auto range face-to-face value different from what I measured?
This is not a problem. Sometimes the unit may be off by +/- 6 inches. This places the incoming waveform close to the center of the acquisition window for digital processing. Differences in this measurement (+/- 10cm or greater) have no effect on accuracy or the reading. If the unit does not function properly, then manually enter your measurement.

E) What should I set the full-scale setting to?
We recommend setting the full-scale to twice the maximum amount expected, but you have the option to enter whatever value you think is right.

F) Why am I getting readings that differ from what they should be?
   • Re-measure the tunnel cross-sectional area and the baseline distance and verify that it matches with the values inside the Accutron settings.
   • Check to see if the sensors are placed on a bend or a corner. (Placing the sensors on a corner can cause inaccuracies with the readings)
   • The calibration correction, in the Advanced Menu, may be used to make any adjustments according to a 9 point manual survey.

G) What does the star (*) mean at the end of my display?
The star indicates that the reading is currently over the full-scale limit. You may want to verify if this is the case. If so, you can adjust the full-scale limit to a higher value.
H) What does the square (donut) mean in the middle of the display?
The donut means that the instrument is rejecting readings acquired because there is a problem, could be an obstruction like a vehicle parked between both sensors.

- Check to see if there is an obstruction between both sensors.
- Make sure both sensors are aligned properly.
- Make sure both transducers are attached to the main unit with cables.
- Check to see if the cables are tightly connected.
- Make sure the face to face value is correct.

I) What does the negative sign (-) mean on the display?
One of the important features of the Accutron is the ability to measure bi-directional airflows. A negative sign at the far left hand side of the 8-digit display indicates this. Also, the 4-20mA split mode can be used to pass this information to a PLC. In the configuration menu this can be changed to show a positive value. This can be changed in the menu under the airflow direction setting.

J) What is the difference between the 4-20mA normal/reverse/split mode?
Normal: Airflow of 0 will output 4mA while airflow reaching instrument full-scale will output 20mA.
Reverse: Airflow of 0 will output 20mA while airflow reaching instrument full scale will output 4mA.
Split: Airflow of 0 will output 12mA (half the distance between 4mA and 20mA). Positive airflow reaching instrument full-scale will output 20mA while the negative value of instrument full-scale will output 4mA.

K) Why am I getting a 4-20mA output of 3.5mA?
A 3.5mA output indicates an obstruction between the two transducers.

L) How do I disable the 3.5mA alarm output?
To disable this feature, go to the Configuration menu using your handheld and find the 4-20mA alarm timeout and set this value to 100 to disable it. Setting this value to 0 will send a 3.5mA output immediately; entering a value of 10 will have the Accutron wait 10 minutes before sending 3.5mA.

For more help go to www.accutroninstruments.com
5.2 - Troubleshooting Flowchart

The 4-20mA instrumentation output transmits the instrument reading on the 4-20mA output. The full scale for the 4-20mA is the “instrument full scale” setting programmed via handheld terminal.

The 4-20mA also has the following features:

**4-20mA alarm timeout**: This is used to give an alarm output if the instrument stops giving valid airflow readings. An alarm is indicated by sending a 3.5mA output current (less than 4mA) and care must be taken not to confuse this as a “zero airflow” condition.

Faults can be due to the following:
1) Sensor misalignment (Sensor was bumped or moved)
2) Vehicle or other obstruction in the ultrasonic beam
3) Actual airflow is greater than the full-scale setting
4) Fault with the Accutron (possibly a damaged transducer)

**ON/OFF selection via handheld programmer**: The 4-20mA alarm timeout time is settable in minutes. If a “100 minute timeout” is specified, this feature is “turned off” and the behaviour is:

The Accutron transmits whatever reading is on the 4-20mA. In case of fault, the last reading is transmitted on the 4-20mA.
In case of trouble, the first thing to do is to get the Accutron running properly with airflow readings being displayed. To do this, follow these steps:

1) Using your handheld programmer, reset all values to default. F5 will bring you to this option. After resetting to defaults, be sure to “Save and Run” before proceeding any further.

2) Measure the approximate value of the face-to-face distance in [Meters] (+/- 10 cm). This is not so critical as it places the TOA close to the center of the acquisition window.

3) Measure the baseline distance in meters (+/- 2.5 cm). This needs to be as accurate as possible in order to give exact readings.

4) Survey the area of the tunnel and convert to M**2.

5) Decide what your maximum airflow is. For now, set your full scale to 2x the maximum amount expected.

6) Set the units that you want the airflow readings displayed in. We recommend KCFM.

Are there any readings? NO
Are both sensor transducers “snapping”? NO
Check the transducer assembly and cabling. Each sensor should snap (alternately) every second or so.

Are the readings OK? NO
If the readings differ from what they should be (15% difference), do a 9-point manual survey and re-measure the tunnel cross-sectional area and base-line distance.

If the readings differ from what they should be (15% difference), do a 9-point manual survey and re-measure the tunnel cross-sectional area and base-line distance.

Is the airflow evenly distributed or in a tight area such as a corner? NO
You may need to reposition the sensors or do a manual “forced” calibration. If this is the case, it is best to verify the Accutron readings vs. 9-point survey readings at 3 different flow velocities (if possible).

For further assistance, please contact Accutron Instruments.
Appendix A

Glossary

Autorange: An automatic function that measures the face-to-face distance. This distance should be accurate to ±6 inches and does not affect the accuracy of the instrument.

Baseline distance: The distance of the two sensors in the direction of the airflow. (Top view of two sensors)

CFM: Cubic feet per minute.

Dynamic range limiting: In normal operation, analog signals are processed mathematically to produce the “math curve”. The math curve represents the envelope of the total received acoustic energy.

Face-to-face distance: The distance between the two sensors facing each other. (Top view of two sensors)

FPM: Feet per minute.

Hysteresis: The lag between making a change, such as increasing power to the transducers, and the response or effect of that change.

KCFM: Cubic feet per minute X 1000.

M/S: Meters per second.

M**3/S: Cubic meters per second.

M**2 Square Meters
Snapping: In operation, the sensor transducers are energized alternately to transmit an ultrasonic pulse. You can hear a “click” when it does this. We refer to this as “snapping”

Transducer: The sensor that sends and receives ultrasonic signals. Using two transducers will help determine bi-directional airflow.

Ultrasonic: Of or relating to acoustic frequencies above the range audible to the human ear.

Usec: This is one of the available flow display units, used for laboratory testing only.

Zero flow cutoff: A feature of the Accutron that forces the instrument to “set to zero” any flow readings that are less than this amount.

Equations

4-20mA Calculations:

Normal: mA = 4 + ((Reading of Instrument / Instrument Full Scale) X 16)
Reverse: mA = 20 - ((Reading of Instrument / Instrument Full Scale) X 16)
Split: mA = 12 + ((Reading of Instrument / Instrument Full Scale) X 8)

Calibration correction: Correction = Reading you want / Reading you are receiving.

Error percentage:
In the case of perfect symmetry in the airflow distribution between the two sensors, the accuracy of the Accutron FlowTRAX is dependent on how accurately the transit times can be measured.

The accuracy of the instrument is 2% of full-scale or the instrument reading ± 0.05M/S; whatever is greater.

Example: If full scale is 100 KCFM, the error is 2% X 100 KCFM = 2 KCFM.
Part Number Builder

Accutron 5 – MAQS (Mine Air Quality Station) Platform
ACC5 (Accutron 5) part number flow chart and option description

BASE part number: **ACC5-ABC-XXX-DEFGHI**.................................
*Base model is equipped with 1x 4-20mA output and Modbus RS485 Slave*

**Option ‘A’ – Input Power**
1 = 12-24 VDC
2 = 110-240 VAC
3 = Power over Ethernet

**Option ‘B’ - FlowTrax application**
(type of airflow sensors)
1 = Drift/Tunnel /Raise
2 = Surface Fan
3 = Industrial ducting

**Option ‘C’ - FlowTrax mount type**
1 = Plastic drift mounts
2 = Steel drift mounts
3 = N/A (Surface Fan & Industrial ducting)

**Option ‘XXX’ - FlowTrax sensor cable length**
100 = Standard length
*Change XXX to custom length in feet*

**Option ‘D’ - CommTrax module**
(RTU to Modbus TCP converter with Web Browser and advanced options)
0 = Base, Modbus RTU over RS485
1 = CommTrax, Modbus TCP, web page.
2 = CommTrax, Modbus TCP, web page, Data logging.
3 = Ethernet IP, No web page.

**Option ‘E’ - ClimaTrax module**
(Measures Temperature, Static Pressure, Relative Humidity with Wet Bulb Temp calculation.)
0 = Don’t Add
1 = ADD

**Option ‘F’ - I/OTrax1 Module**
(I/O: 4AI (Isolated), 4DI, 2DO (2 form C Relays))
0 = Don’t Add
1 = ADD

**Option ‘G’ - I/OTrax2 Module**
(I/O: 4AO, 4DI, 4DO (Open Collector))
0 = Don’t Add
1 = ADD

**Option ‘H’ - SS Mounting Back Plate**
(Pre mount and pre configure on stainless steel backplate with canstrut rails. Used with attached gas monitoring)
0 = Don’t Add
1 = ADD
## Accutron Drift/Tunnel Airflow Monitor – Parts List

<table>
<thead>
<tr>
<th>Item</th>
<th>QTY</th>
<th>Part number and Ordering information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>ACC5-D-TXD-ASY&lt;br&gt;Accutron FlowTRAX sensor. Replacement sensor for the Drift Air Flow Meter.</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>ACC5-P-CAB-STD-ASY&lt;br&gt;Standard Accutron 100 foot cable assembly pre-assembled with connectors.</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>ACC5-P-CAB-XXX-ASY&lt;br&gt;Custom cable assembly where XXX is the cable length in feet. Also comes pre-assembled with connectors.</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>ACC5-P-XMT-ASY-001&lt;br&gt;Accutron FlowTRAX Drift indicating transmitter. Standard unit&lt;ul&gt;&lt;li&gt;8 Digit LED display, NEMA 4x enclosure&lt;/li&gt;&lt;li&gt;120 VAC powered (Specify for 24VDC)&lt;/li&gt;&lt;li&gt;4-20mA analog output, Modbus RS-485 outputs&lt;/li&gt;&lt;/ul&gt;</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>ACC-HHTT&lt;br&gt;Handheld programmer. Used to configure the parameters on start up of the Accutron indicating transmitter.</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>ACCMS-P-WALMT-PLA-ASY&lt;ul&gt;&lt;li&gt;Plastic wall mount brackets for transducer.&lt;/li&gt;&lt;li&gt;Pan/tilt&lt;/li&gt;&lt;/ul&gt;</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>ACCMS-P-WALMT-STL-ASY&lt;ul&gt;&lt;li&gt;6” tri-foot steel wall mount&lt;/li&gt;&lt;li&gt;Wrench included&lt;/li&gt;&lt;li&gt;Pan/tilt&lt;/li&gt;&lt;/ul&gt;</td>
</tr>
</tbody>
</table>
## Accutron Mine Surface Fan Airflow Monitor – Parts List

<table>
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<tr>
<th>Item</th>
<th>QTY</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>ACC5-F-BSM-ASY&lt;br&gt;Retractable ball/socket assembly. Used in conjunction with the Accutron Fan Unit. Consists of:&lt;br&gt;• (1) Retractable sensor/transducer&lt;br&gt;• Inner core and outer core assemblies&lt;br&gt;• Ring set assembly and mounting hardware</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>ACC5-F-CAB-STD-ASY&lt;br&gt;Standard Accutron 100 foot cable assembly pre-assembled with connectors.</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>ACC5-F-CAB-XXX-ASY&lt;br&gt;Custom cable assembly where XXX is the cable length in feet. Also comes pre-assembled with connectors.</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>ACC5-F-XMT-ASY-001&lt;br&gt;Accutron FN indicating transmitter (control unit). Standard unit (No Climatrax, No GUI)&lt;br&gt;• 8 Digit LED display, NEMA 4x enclosure&lt;br&gt;• 120 VAC powered&lt;br&gt;• 4-20mA analog output</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>ACCU-HHTT&lt;br&gt;Handheld programmer. Used to configure the parameters on start up of the Accutron indicating transmitter.</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>ACC5-F-MP-FLAT-ASY&lt;br&gt;Flat mounting plate assembly. Mounting plates for the retractable ball and socket sensor assemblies.</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>ACC5-F-MP-15ANG-0OFF-ASY&lt;br&gt;15 degree beveled mounting plate with 0 degree offset.</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>ACC5-F-MP-15ANG-15OFF-ASY&lt;br&gt;15 degree beveled mounting plate with 15 degree offset.</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>ACC5-F-MP-15ANG-45OFF-ASY&lt;br&gt;15 degree beveled mounting plate with 45 degree offset.</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>ACC5-F-MP-15ANG-RXX-ASY&lt;br&gt;15 degree beveled and rolled to specified radius (R**)</td>
</tr>
</tbody>
</table>
### Accutron Industrial Duct Monitor – Parts List

<table>
<thead>
<tr>
<th>Item</th>
<th>QTY</th>
<th>Part number and Ordering information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>ACC5-D-BSM-ASY&lt;br&gt;Replacement sensor/transducer for the Accutron Industrial Duct Air Flow Meter.</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>ACC5-D-CAB-STD-ASY&lt;br&gt;Standard Accutron 100 foot cable assembly pre-assembled with connectors.</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>ACC5-D-CAB-XXX-ASY&lt;br&gt;Custom cable assembly where XXX is the cable length in feet. Also comes pre-assembled with connectors.</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>ACC5-D-XMT-ASY-001&lt;br&gt;Accutron IDM indicating transmitter. Standard unit (No Climatrax, No GUI)&lt;br&gt;• 8 Digit LED display, NEMA 4x enclosure&lt;br&gt;• 120 VAC powered (specify for 24VDC)&lt;br&gt;• 4-20mA analog, MODBUS RS485 outputs</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>ACC5-D-RSET-ASY&lt;br&gt;Duct mount assembly&lt;br&gt;• Non corrosive, plastic ring set</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>ACC5-D-GASK-ASY&lt;br&gt;Replacement gasket for duct mount assembly&lt;br&gt;• Closed cell neoprene</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>ACC-HHTT&lt;br&gt;Handheld programmer. Used to configure the parameters on start-up of the Accutron indicating transmitter.</td>
</tr>
</tbody>
</table>
Accutron Drift component checklist

- Indicating Transmitter – Qty (1)
- 100’ cables w/ IP68 rated connectors – Qty (2)
- Ultrasonic Transducers with heartbeat LED & Lase – Qty (2)
- Mounting Brackets with Pan & Tilt adjustment – Qty (2)

Accutron Fan component checklist

- Indicating Transmitter – Qty (1)
- 100’ cables w/ IP68 rated connectors – Qty (2)
- Ultrasonic Transducers – Qty (2)
- 15° beveled stainless steel mounting plates w/ Ball & Socket – Qty (2)
- Each Ball & Socket assembly includes:
  - Ball w/ threaded inner core (2”-NPT_F) – Qty (1)
  - Threaded Retractable Sensor (2”-NPT_M) – Qty (1)
  - Inner socket ring – Qty (1)
  - Outer socket ring – Qty (1)
  - Bolts & Wing nuts – Qty (4)

Accutron IDM component checklist

- Indicating Transmitter – Qty (1)
- 100’ cables w/ IP68 rated connectors – Qty (2)
- Ultrasonic Transducers – Qty (2)
- Mounting Brackets with gaskets – Qty (2)
Appendix B - Diagrams

Accutron Drift Illustration – System Drawing

8-Digit Display

Indicating transmitter

100 - 240 VAC power

Climatrax probe

4-20 mA output signal

Pre-wired field connectors

100ft standard cable length custom lengths available

Modbus TCP/IP

Transducer sensors

Pan/tilt adjustment mounting brackets

8-Digit Display
Wiring Diagram

- Power Input 100-240V/AC 50-60Hz
- Self powered 4-20mA output relative to airflow reading
- Modbus slave A&B connections
- 24VDC power for Modbus slave devices
Control Box Dimensions
Airflow control box dimension with added options. (with Modbus TCP or Ethernet/IP)
PN: ACC5-XXX-XXX-100000
Control Box Dimensions
Airflow control box dimension with no added options. PN: ACC5-XXX-XXX-000000

[Diagram showing dimensions of the control box]

Not to Scale
Accutron Drift Dimensions

Sensor

9 pin female connector

1/4" NC Thread

1.5"

8.5"

2.675"

Mount

Threaded male mounting saddle (1/4" NC)

Pan Tilt Tension Screw

REAR VIEW

SIDE VIEW

Ø 1/4" Mounting Holes (X4)

2 1/8"

3 3/4"

4 1/2"

7 1/2"

Made in Canada
Accutron Fan Dimensions 1 of 2

Stainless Steel Sensor Mounting Plate

- Ø 1/2" Mounting Holes (X4)
- Supplied Ø 8.75" Inner & Outer Socket Ring
- Supplied Bolts and Wing Nuts 1/4" 2C UNC 2" Long

Detail A

Detail B

15 DEGREE ELEVATION ANGLE

Customer Specified Radius

Made in Canada
Accutron Fan Dimensions 2 of 2

Fan Sensor Assembly

Recommended Duct Cutout

Ø 1/2" Mounting Holes (X4)

10" (254 mm) C/C

8" (203.2 mm)

1/1 (254 mm)

6" (203.2 mm)
Accutron IDM Dimensions

**Sensor Assembly**

Inside of Duct

Outside of Duct

IDM Mounting Plate

IDM 3" Pan/Tilt Ball

IDM Sensor

IDM Threaded Retention Ring

Attached Cable Assembly ~5 foot length

9 pin female connector

**Sensor Mounting Plate**

5.5" OD

3.90" OD

Ø 1/4" Mounting Holes (X4)

2 3/4"

7/8"

3/8"

5.5" OD

4 1/2"

3.5"

Back View

Side View

Front View

Note: Duct cut out size is 4 inches