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
Or by phone: 705-682-0814

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

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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.

FlowTRAX information	
Part Number :	_____
Serial Number:	_____

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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

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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).

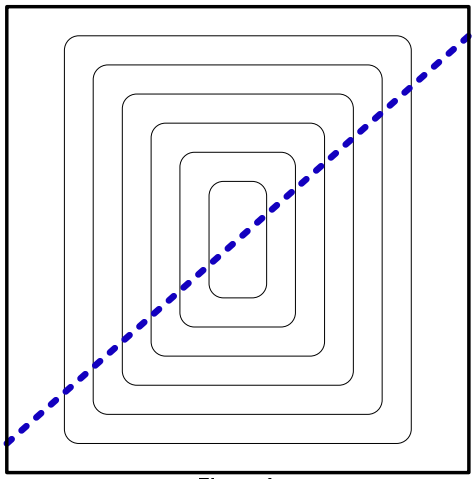

Figure A

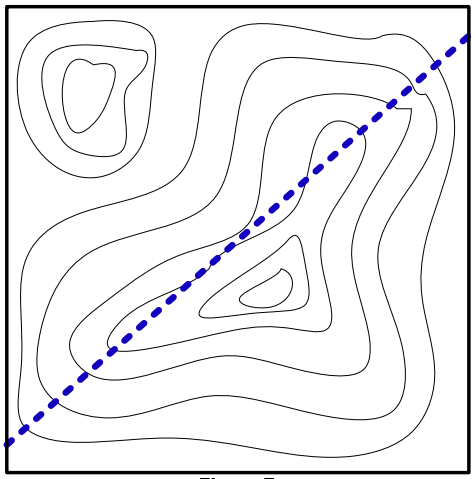

Figure B

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.

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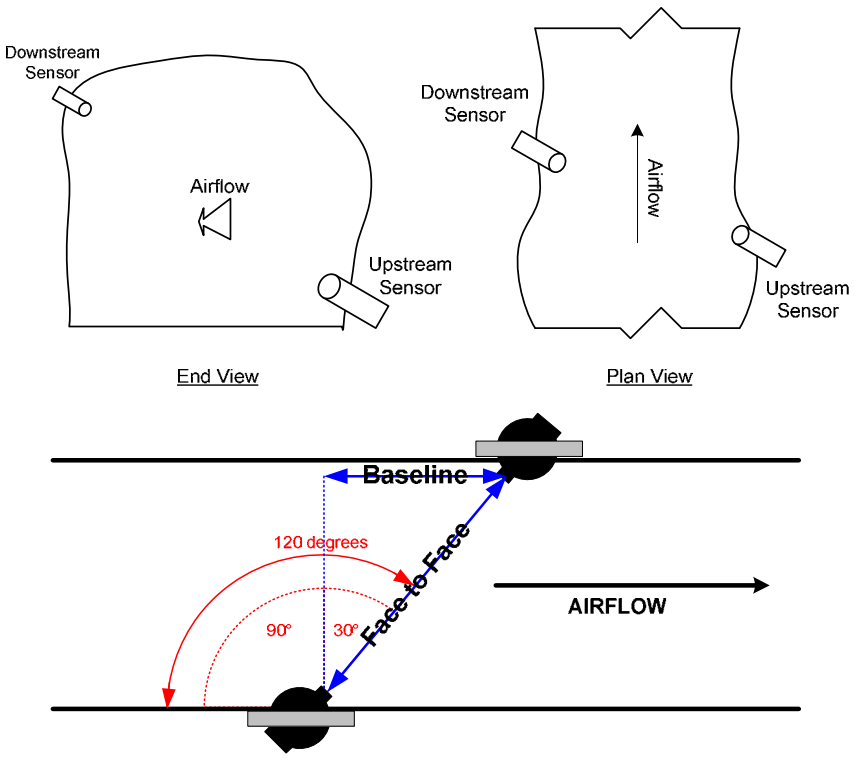
2.3 - Mounting the Sensors

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.

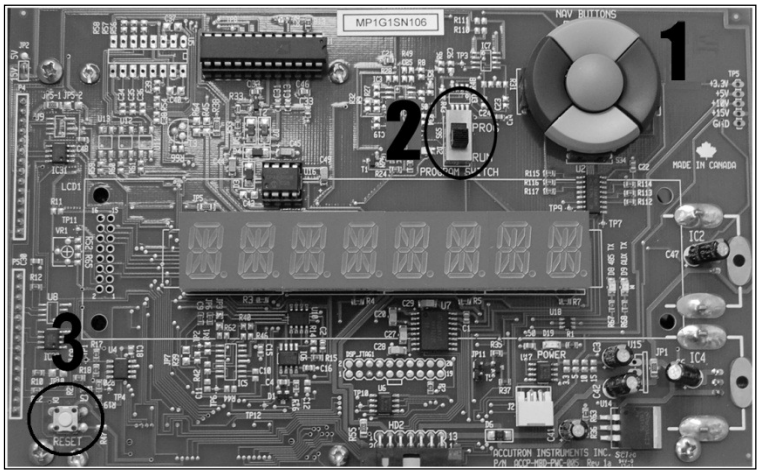
Ultrasonic pulses are sent back and forth between the transducers across the tunnel, traveling through the air current. Let “$\mathbf{T_{A\text{-}B}}$” be the time taken for the signal to travel from Transducer **A** to Transducer **B**, and “$\mathbf{T_{B\text{-}A}}$” be the time taken for the pulse 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 ($\mathbf{T_{A\text{-}B} - T_{B\text{-}A}}$) is directly proportional to the airflow. In the case of no moving air, then $\mathbf{T_{A\text{-}B}}$ equals $\mathbf{T_{B\text{-}A}}$ and there is no time difference because there is no airflow.

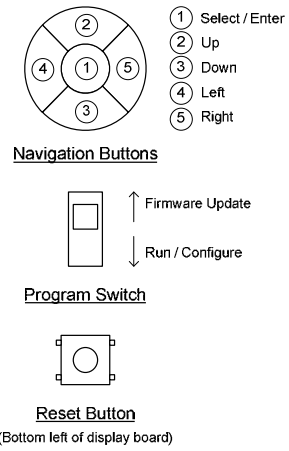
Inherently, the Accutron first internally computes the average velocity of the air in Meters/Second. Then, to obtain air volumes, the area of the drift is entered in (during programming), along with your selection of measurement units. The system then displays air volumes in the units selected. Common 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 ① 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.

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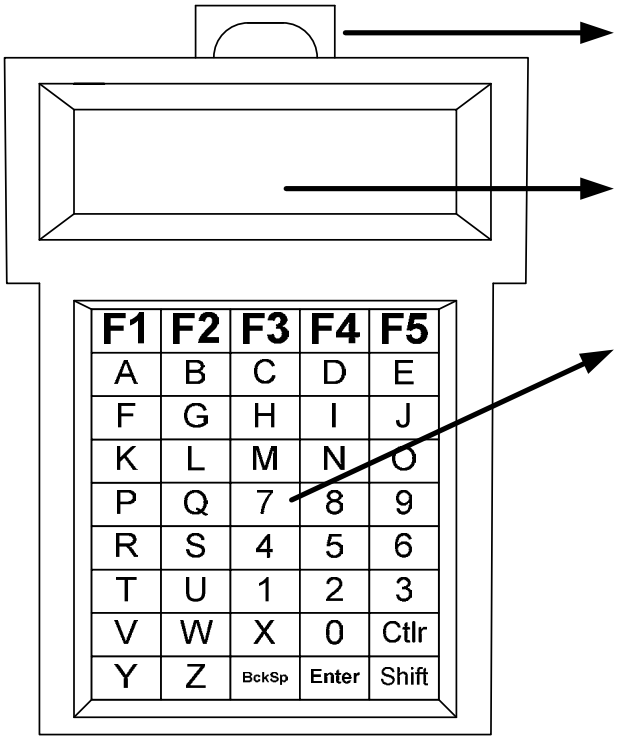
3.2 - Option 2 Using the Handheld Programmer

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 lite 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.



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.

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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.

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

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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".

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**

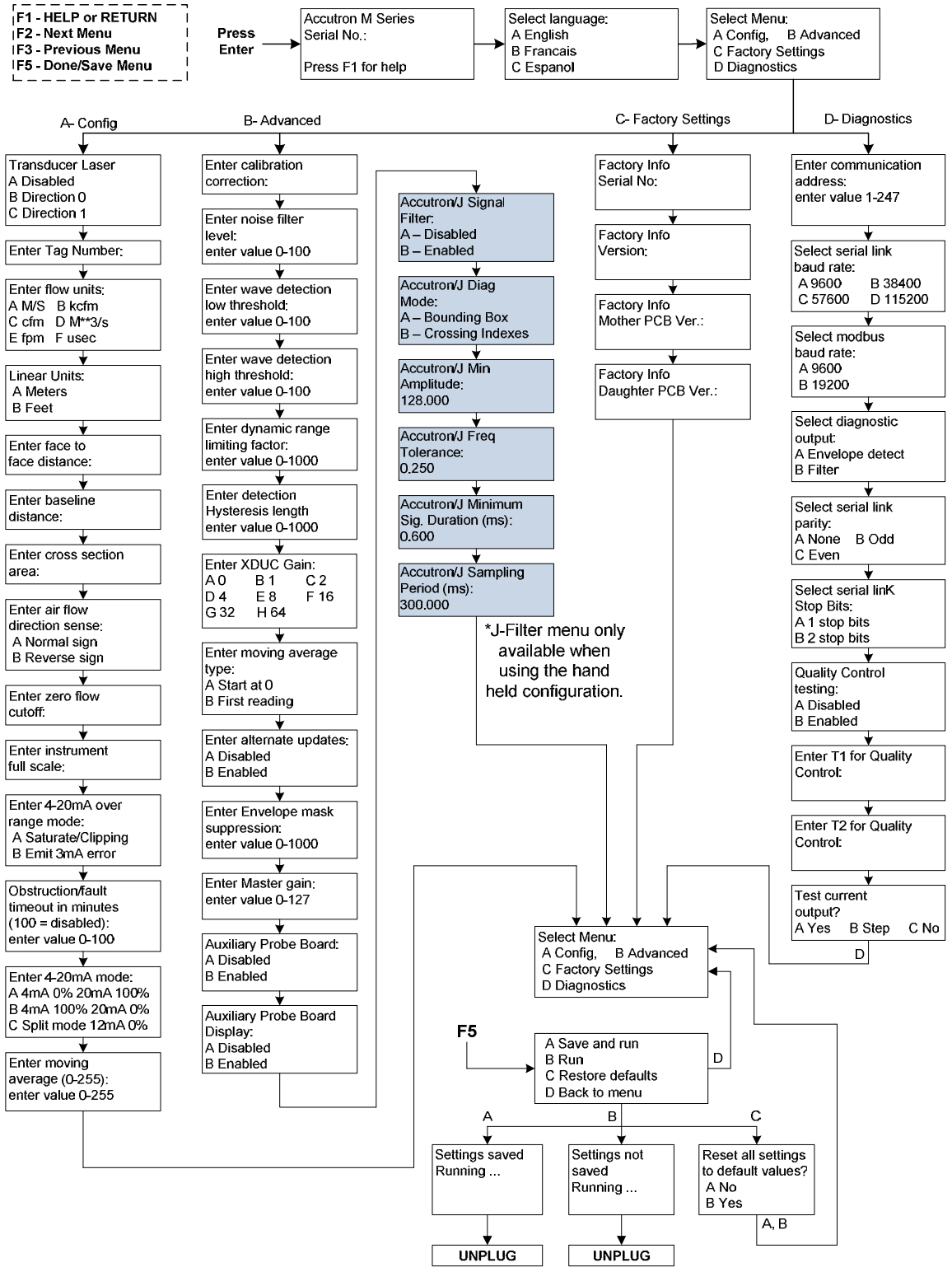
10. Press **Enter** until you see the handheld screen show “Enter 4-20mA mode” and select the parameter you want. By default, the output will be A (4mA = 0 and 20mA = full scale)

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



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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 B kcfm C cfm D M**3/s E fpm F usec	Press the letter that corresponds with the desired unit. M/S (meters per second) is the default.

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[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.

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[1I] Enter 4-20mA over range mode: A Saturate / Clipping B Emit 3mA error	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.
[1J] Obstruction/fault timeout in minutes (100 = disabled): 100	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.
[1K] Enter 4-20mA mode : A 4mA 0% 20mA 100% B 4mA 100% 20mA 0% C Split mode 12mA 0%	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.
[1L] Enter moving average (0 - 255) : 15	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.)

[2A] Enter calibration correction: 1.0	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.
[2B] Enter noise filter level: 0 value (0-100)	The noise filter is a provision for dealing with extreme noise. Normally it is set to 0.

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[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.

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[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.

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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.

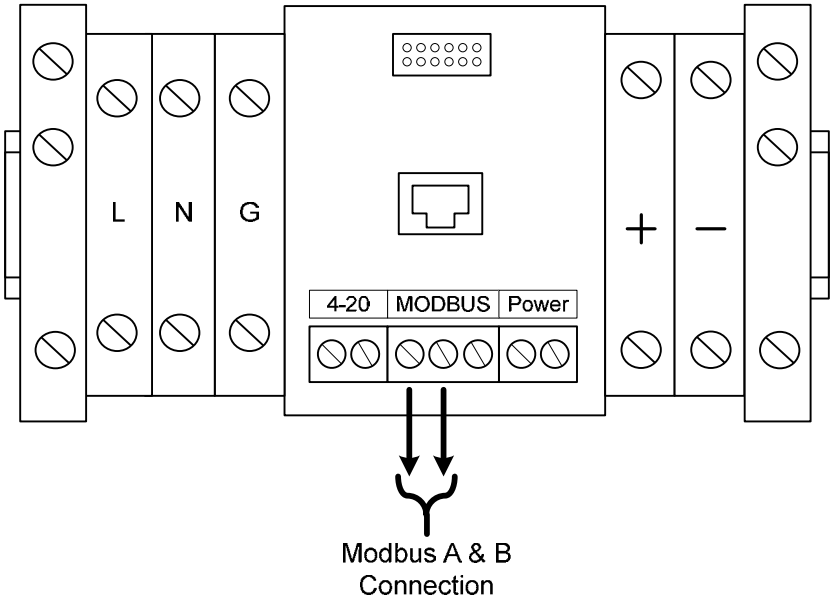
Miscellaneous

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+)

Register	Description	Type	
40001 & 40002	Airflow Reading	Float32	
40003 & 40004	Temperature	Float32	
40005 & 40006	Humidity	Float32	
40007 & 40008	Pressure	Float32	
40009 & 40010	Wetbulb	Float32	
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)

Register	Description	Type	
41001	Tag char #1, 2	String	
41002	Tag char #3, 4	String	
41003	Tag char #5, 6	String	
41004	Tag char #7, 8	String	
41005	Tag char #9, 10	String	
41006	Tag char #11, 12	String	
41007	Tag char #13, 14	String	
41008	Tag char #15, 16	String	
41009	Tag char #17, 18	String	
41010	Tag char #19, 20	String	

Tuning Parameters – Read/Write

Register	Description	Type	Value
41011	Flow Units	Int16	0= m/s |1= kcfm |2= cfm |3= m³/s |4= fpm |5= usec
41012	Linear Units	Int16	0 = Meters, 1 = Feet
41013 & 41014	Face to Face Distance	Float32	
41015	Face to Face Distance Integer	Int16	
41016	Face to Face Distance Fraction	Int16	
41017 & 41018	Baseline Distance	Float32	
41019	Baseline Distance Integer	Int16	
41020	Baseline Distance Fraction	Int16	
41021 & 41022	Cross Section Area	Float32	
41023	Cross Section Area Integer	Int16	
41024	Cross Section Area Fraction	Int16	
41025	Airflow Direction	Int16	0 = Normal 1 = Reverse
41026 & 41027	Zero Cutoff	Float32	
41028	Zero Cutoff Integer	Int16	
41029	Zero Cutoff Fraction	Int16	
41030 & 41031	Full Scale	Float32	
41032	Full Scale Integer	Int16	
41033	Full Scale Fraction	Int16	
41034	4-20 Over Range Mode	Int16	0= Saturate 1= Emit 3mA Error
41035	Obstruction Timeout	Int16	0-100
41036	4-20 Range Setup	Int16	0=4mA 0% 1=4mA 100% 2=Split 12mA 0%
41037	Moving Average	Int16	0 - 255
41038 & 41039	Calibration Correction	Float32	
41040	Calibration Correction Integer	Int16	
41041	Calibration Correction Fraction	Int16	
41042	Noise Filter	Int16	0 - 100
41043	Wave Detection Low Threshold	Int16	0 - 100
41044	Wave Detection High Threshold	Int16	0 - 100
41045	Dynamic Range Limiting Factor	Int16	0 - 1000
41046	Hysteresis Length	Int16	0 - 1000
41047	Transducer Gain	Int16	0=0 |1=1 |2=2 |3=4 |4=8 |5=16 |6=32 |7=64
41048	Moving Average Type	Int16	0= Start at 0, 1= First Reading
41049	Alternate Updates	Int16	0 = Disabled, 1 = Enabled
41050	Envelope Mask Suppression	Int16	0 - 1000
41051	Master Gain	Int16	0 - 127
41052	Modbus Address	Int16	1 - 240
41053	Serial Link Baud Rate	Int16	0=9600 1=38400 2=57600 3=115200
41054	Modbus Baud rate	Int16	0 = 9600, 1 = 19200
41055	Diagnostic Output	Int16	0 = Envelope Detection, 1 = Filter
41056	Auxiliary Probe Board Enable	Int16	0 = Disabled, 1 = Enabled
41057	Display Auxiliary Probe Values	Int16	0 = Disabled, 1 = Enabled

Program Version – Read Only (String of 20 Characters)

Register	Description	Type	
42001	Program Version char#1, 2	String	
42002	Program Version char#3, 4	String	
42003	Program Version char#5, 6	String	
42004	Program Version char#7, 8	String	
42005	Program Version char#9, 10	String	
42006	Program Version char#11, 12	String	
42007	Program Version char#13, 14	String	
42008	Program Version char#15, 16	String	
42009	Program Version char#17, 18	String	
42010	Program Version char#19, 20	String	

Serial Number – Read Only (String of 20 Characters)

Register	Description	Type	
42011	Serial Number char#1, 2	String	
42012	Serial Number char#3, 4	String	
42013	Serial Number char#5, 6	String	
42014	Serial Number char#7, 8	String	
42015	Serial Number char#9, 10	String	
42016	Serial Number char#11, 12	String	
42017	Serial Number char#13, 14	String	
42018	Serial Number char#15, 16	String	
42019	Serial Number char#17, 18	String	
42020	Serial Number char#19, 20	String	

Factory Info – Read Only (String of 20 Characters) *Currently Not Implemented

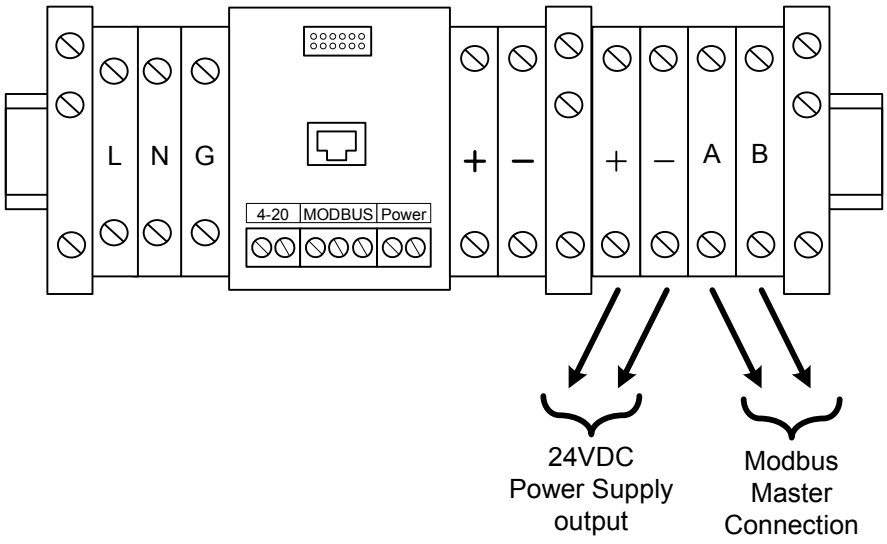
Register	Description	Type	
42021	Factory Info char#1, 2	String	
42022	Factory Info char#3, 4	String	
42023	Factory Info char#5, 6	String	
42024	Factory Info char#7, 8	String	
42025	Factory Info char#9, 10	String	
42026	Factory Info char#11, 12	String	
42027	Factory Info char#13, 14	String	
42028	Factory Info char#15, 16	String	
42029	Factory Info char#17, 18	String	
42030	Factory Info char#19, 20	String	

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?

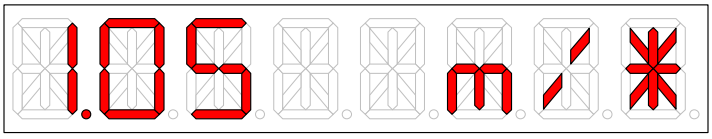
We recommend setting the full-scale to twice the maximum amount expected, but you have the option to enter whatever value you think is right.

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.

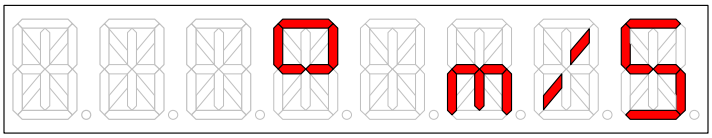
G) What does the star (*) mean at the end of my display?

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.

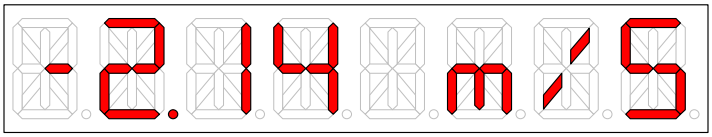


H) What does the square (donut) mean in the middle of the display?
The donut means that the instrument is rejecting readings acquired because there is a problem, could be an obstruction like a vehicle parked between both sensors.

- 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

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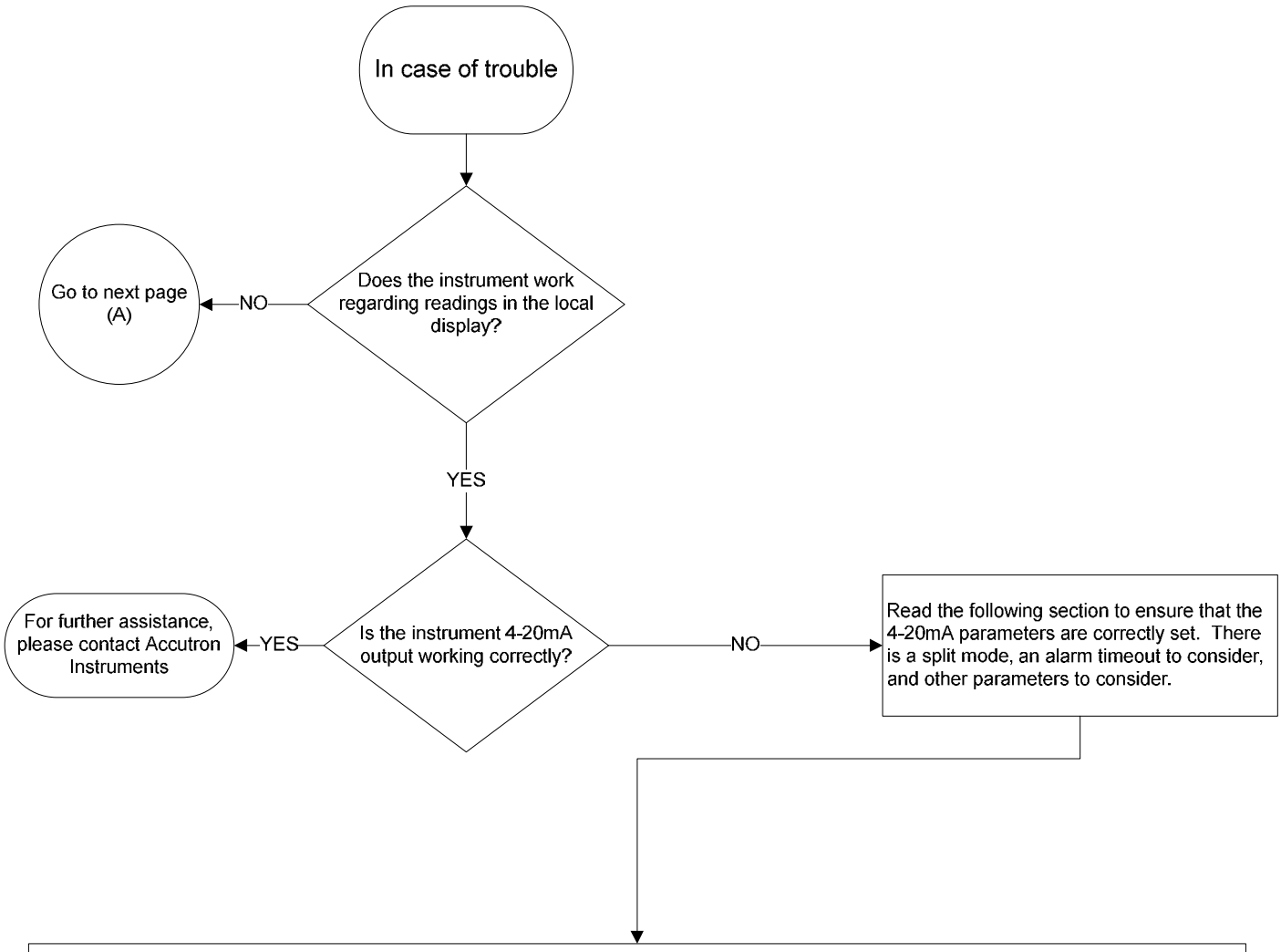
5.2 - Troubleshooting Flowchart



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.

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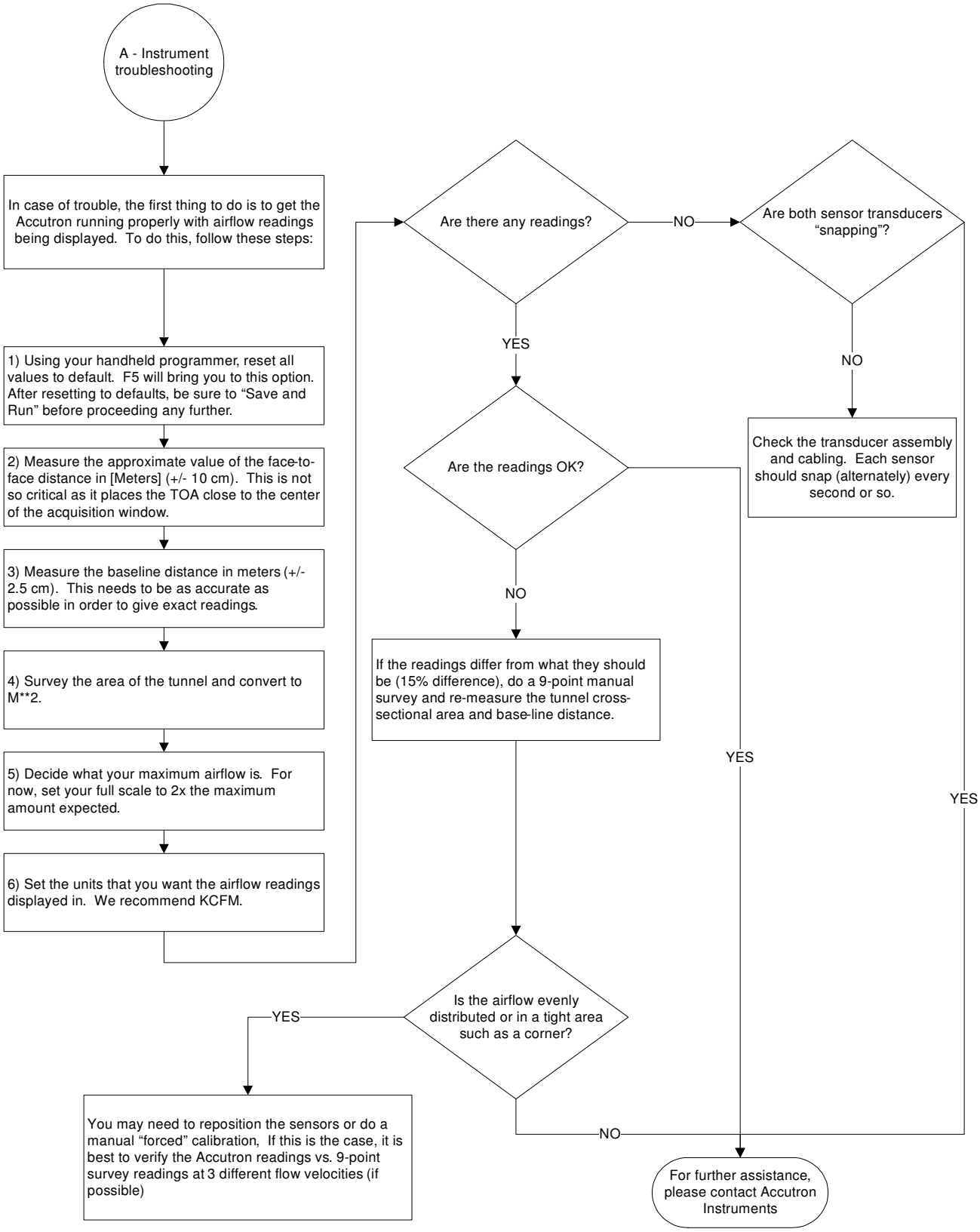

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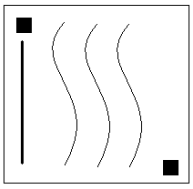
Appendix A

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.

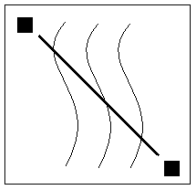
Baseline distance: The distance of the two sensors in the direction of the airflow. (Top view of two sensors)



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.

M3/S:** Cubic meters per second.

M2** Square Meters

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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.

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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
(Probe fitted to control transmitter. 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

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Accutron Drift/Tunnel Airflow Monitor – Parts List

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

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Accutron Mine Surface Fan Airflow Monitor – Parts List

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

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Accutron Industrial Duct Monitor – Parts List

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

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)

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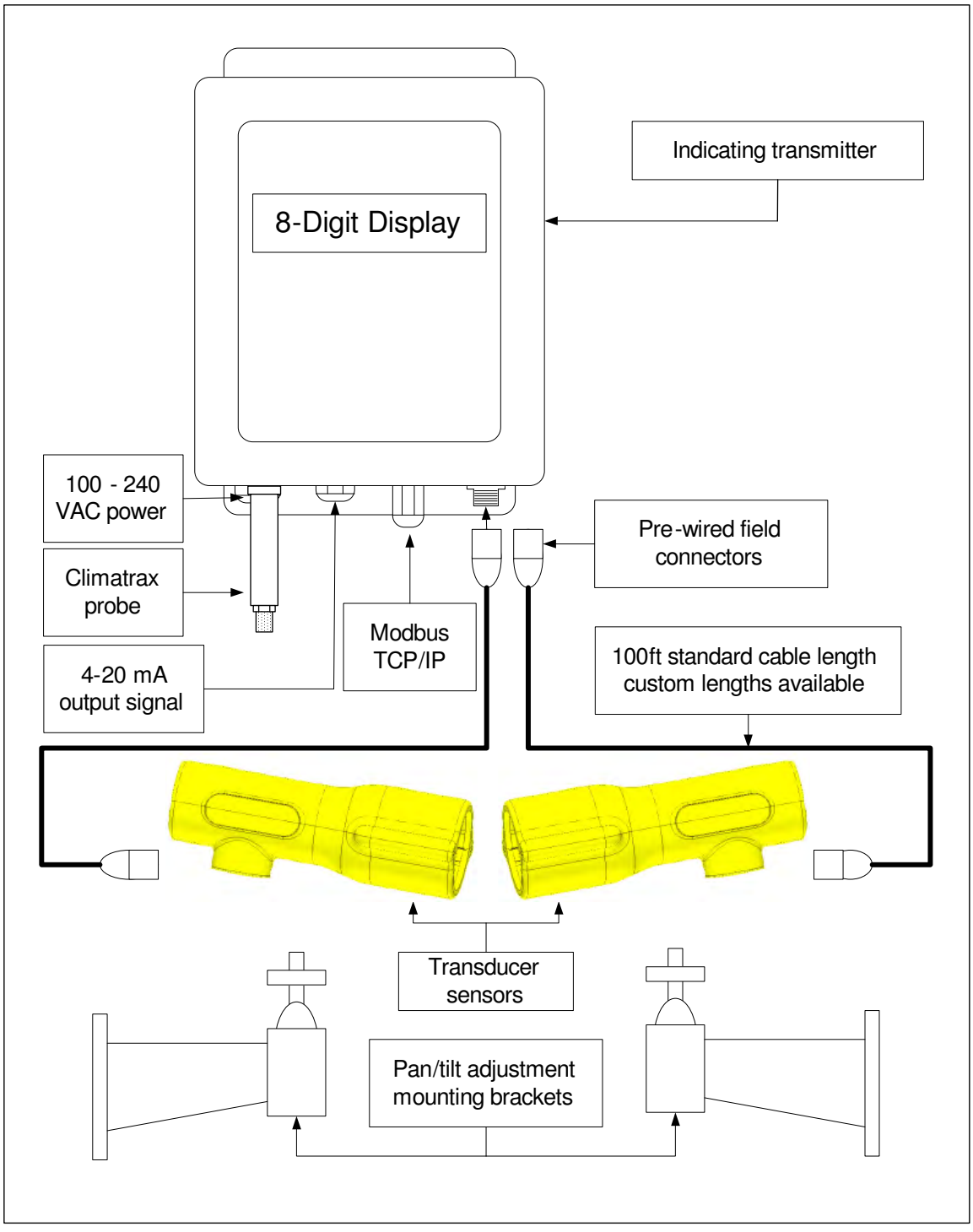
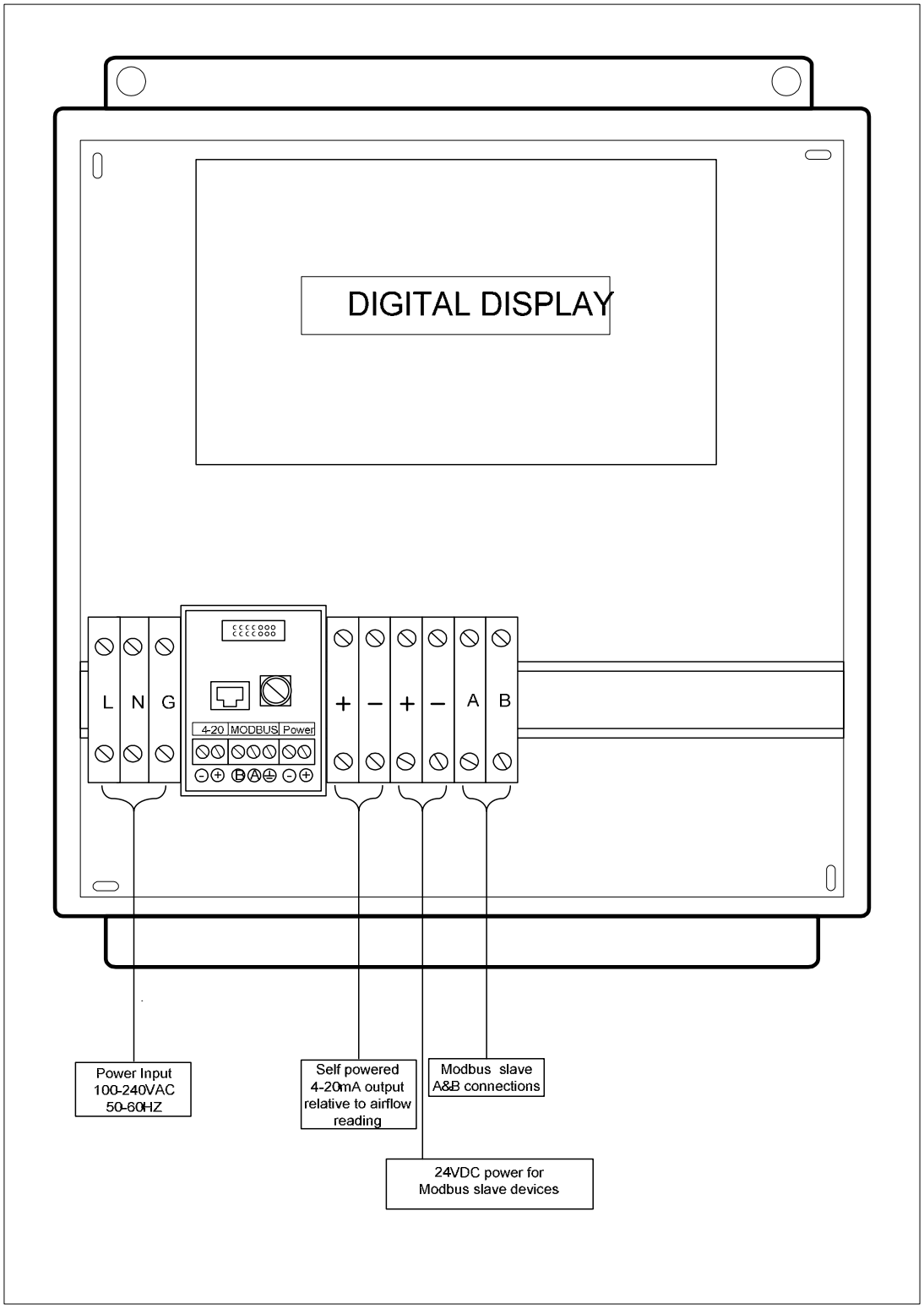
Appendix B - Diagrams

Accutron Drift Illustration – System Drawing

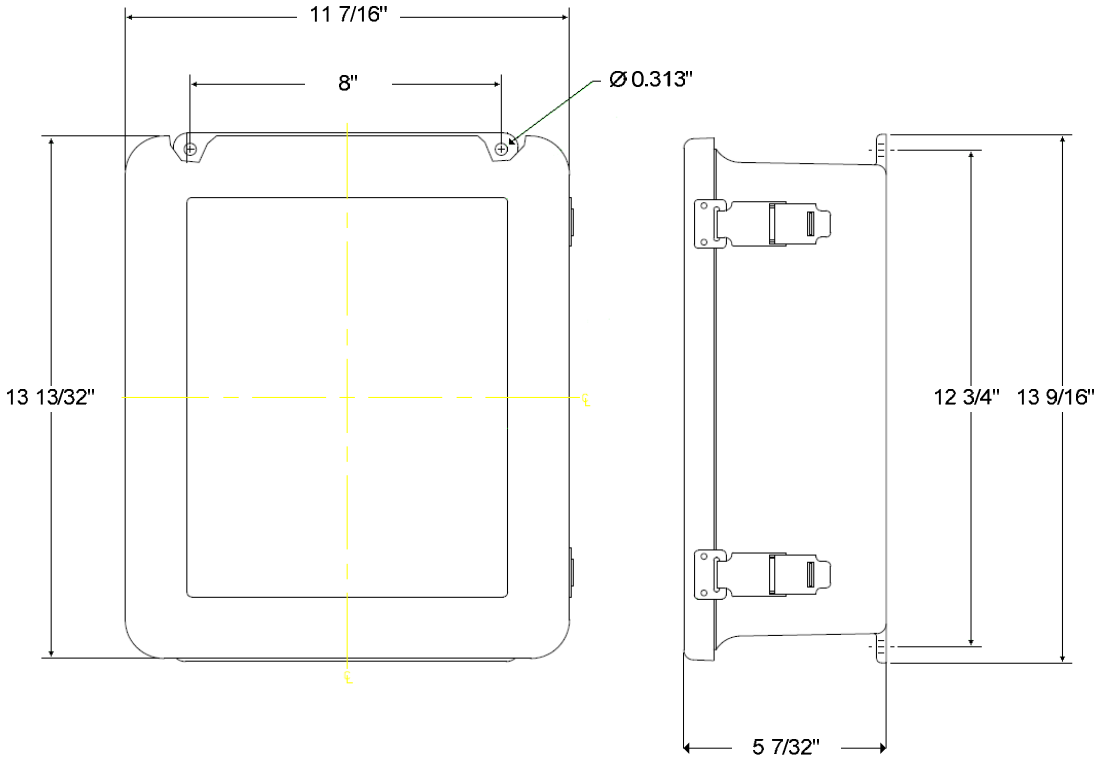


Wiring Diagram



Control Box Dimensions

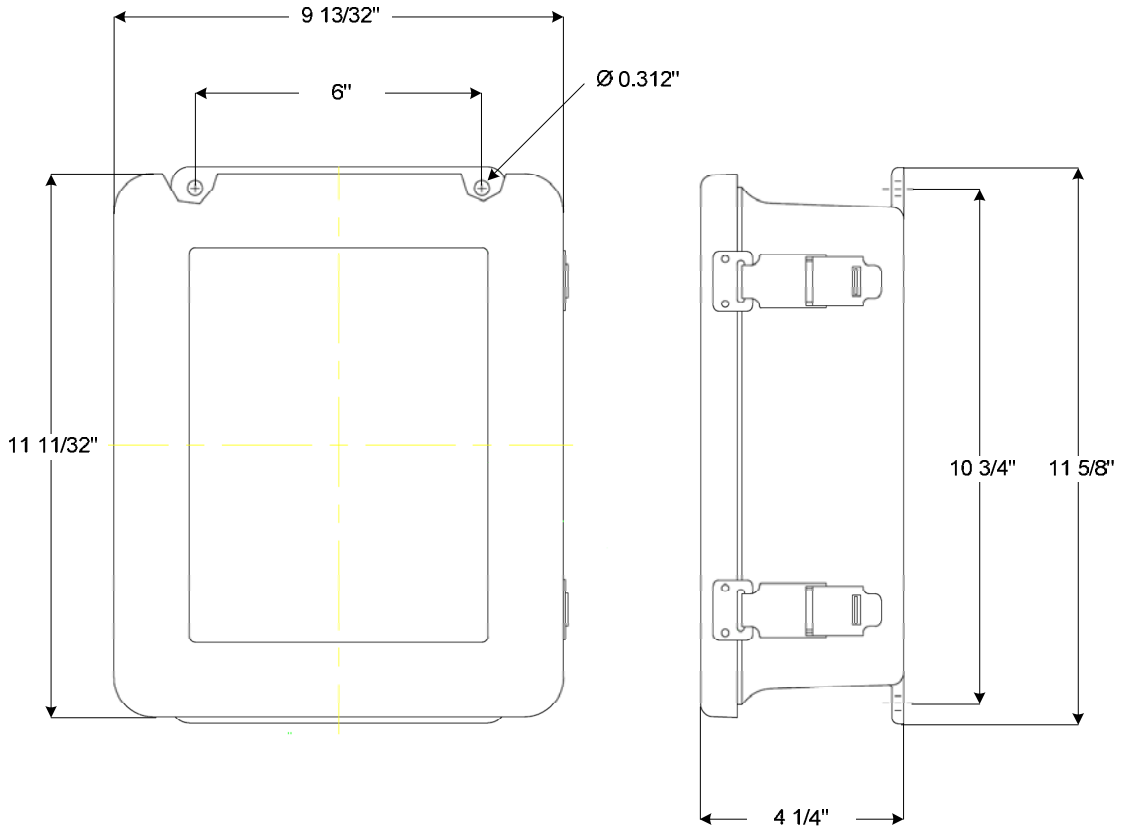
Airflow control box dimension with added options. (with Modbus TCP or Ethernet/IP)
PN: ACC5-XXX-XXX-100000



Not to Scale

Control Box Dimensions

Airflow control box dimension with no added options. PN: ACC5-XXX-XXX-000000



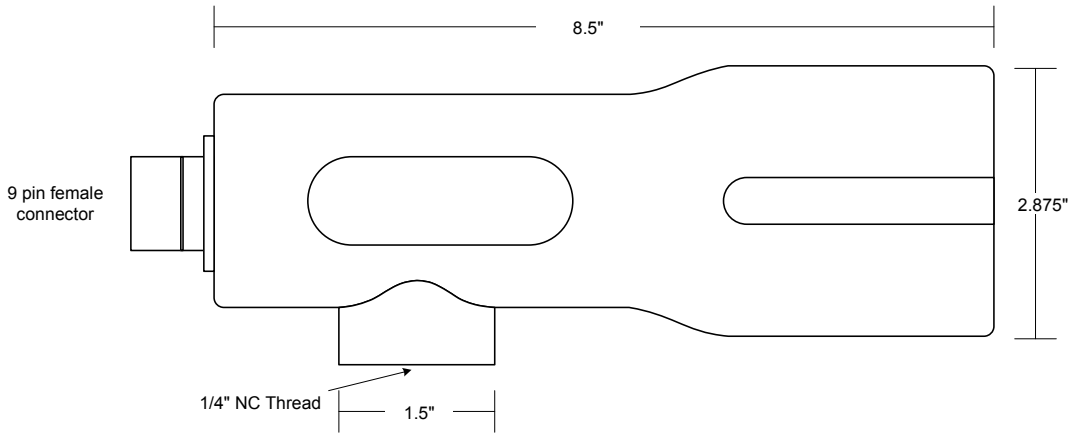
Front View

Side View

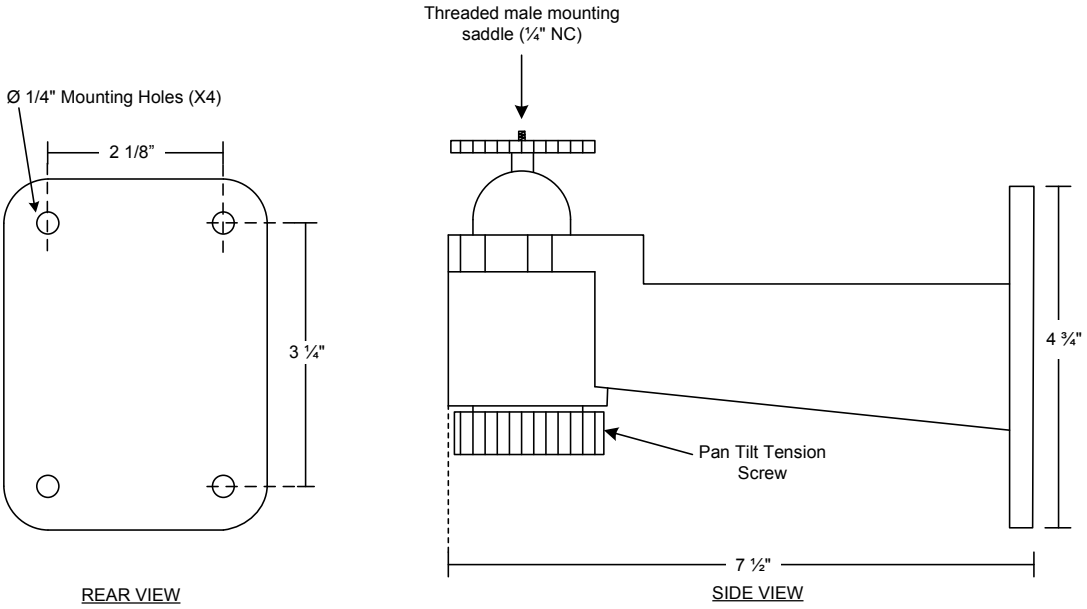
Not to Scale

Accutron Drift Dimensions

Sensor



Mount



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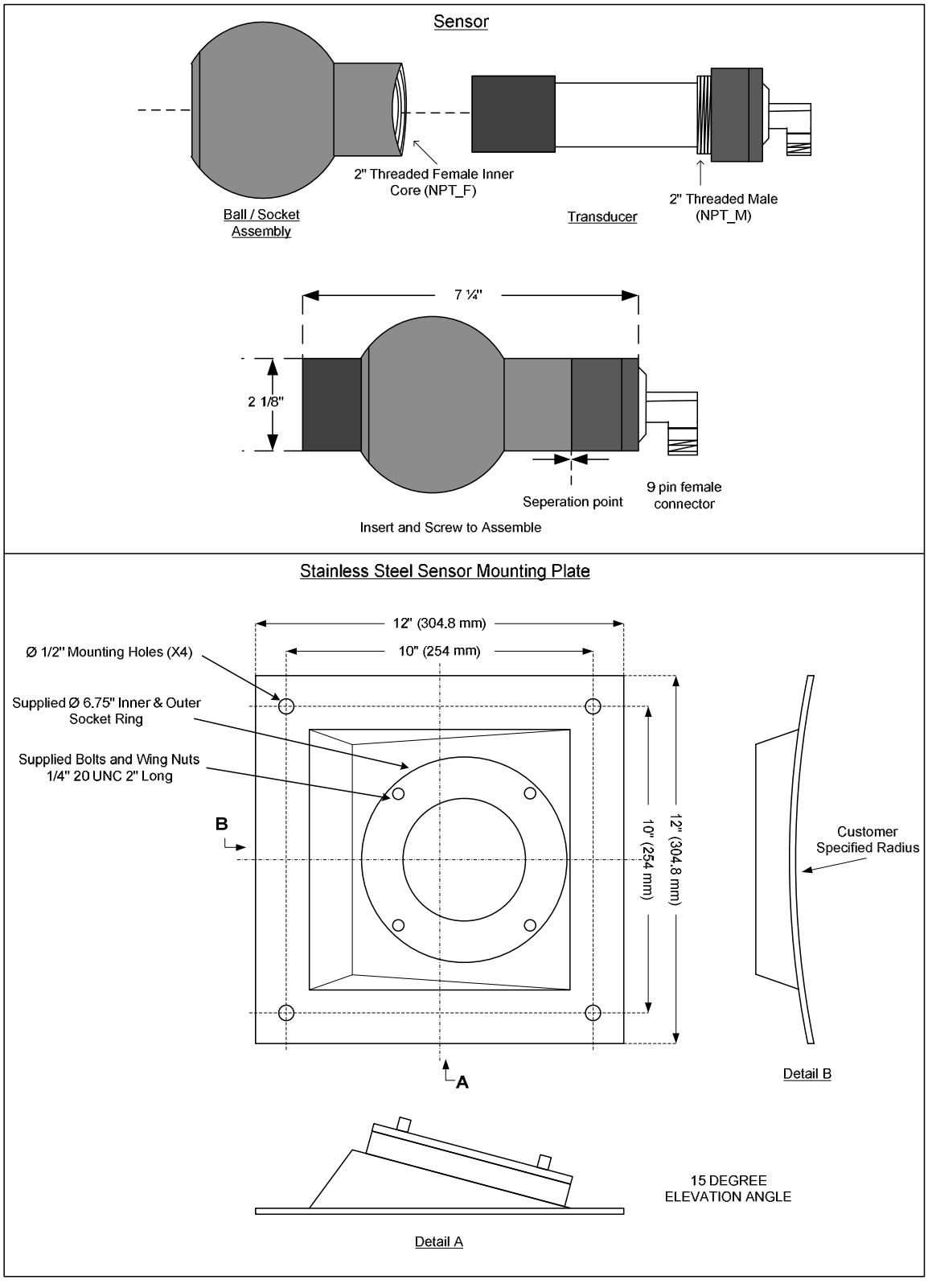
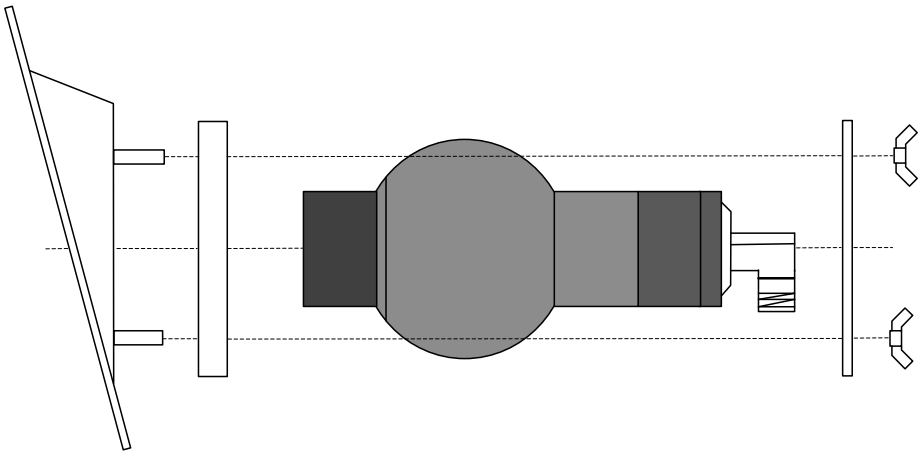
Accutron Fan Dimensions 1 of 2

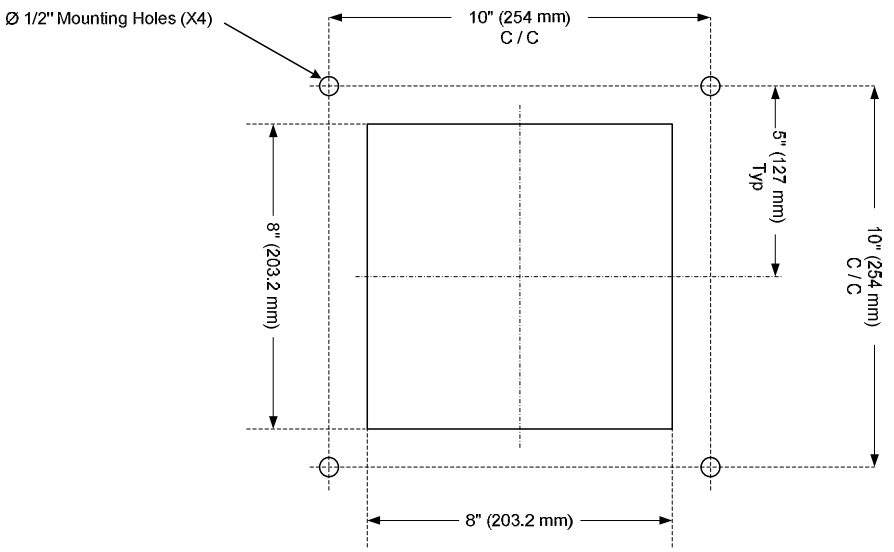


Accutron Fan Dimensions 2 of 2

Fan Sensor Assembly



Recommended Duct Cutout



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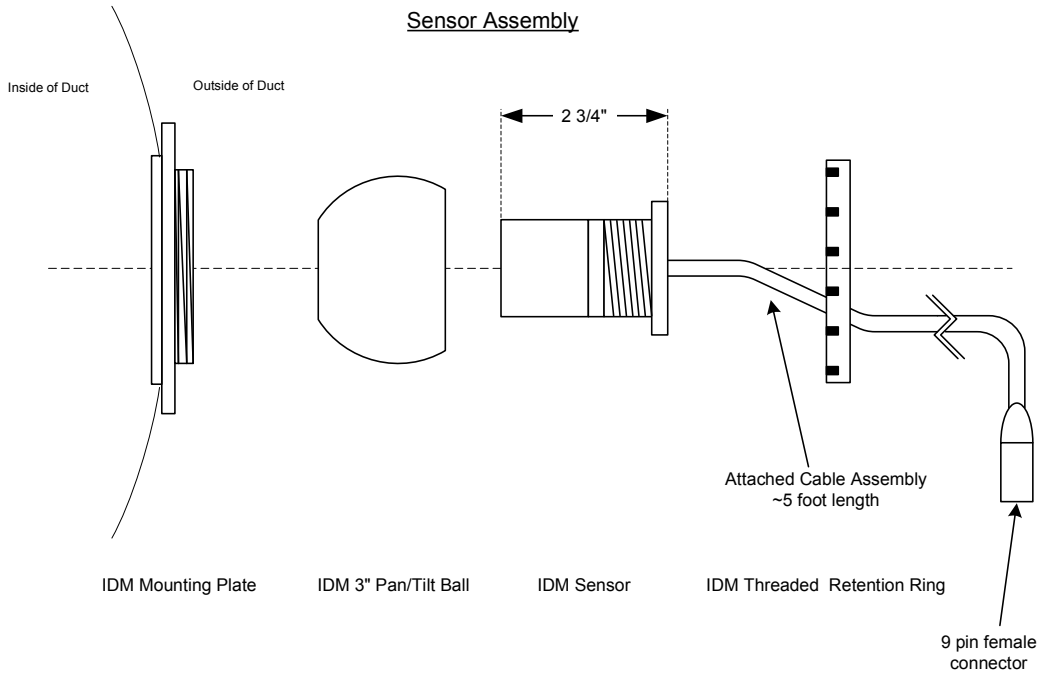
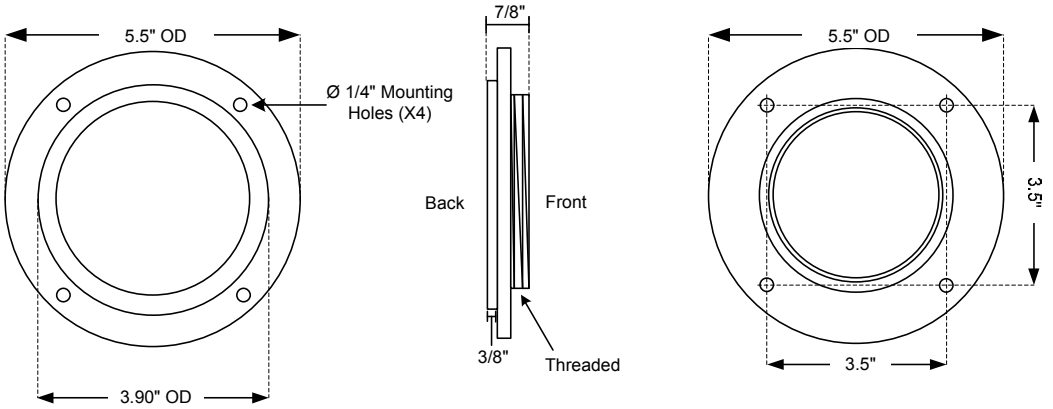
Accutron IDM Dimensions

Sensor Assembly



Sensor Mounting Plate



Note: Duct cut out size is 4 inches

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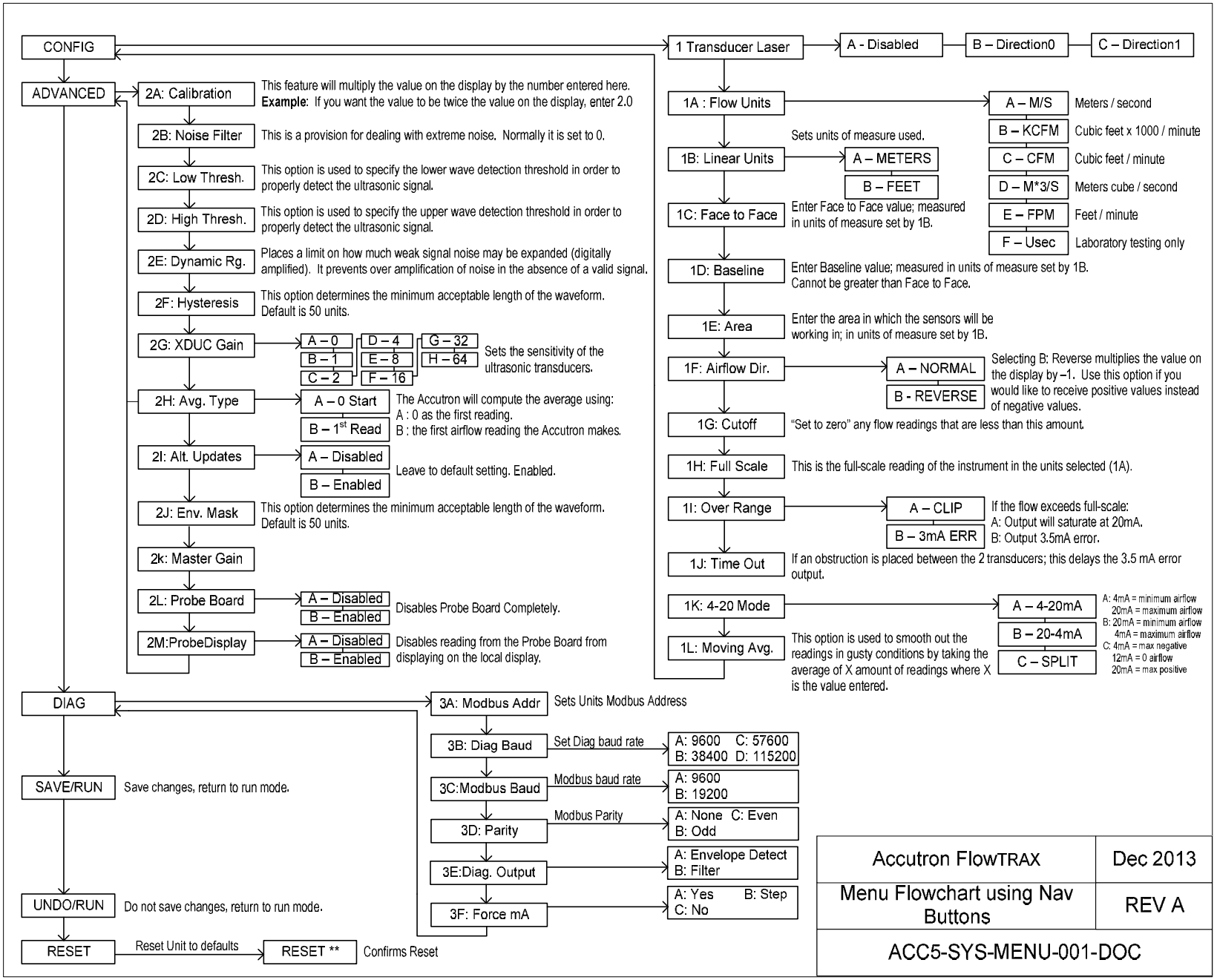
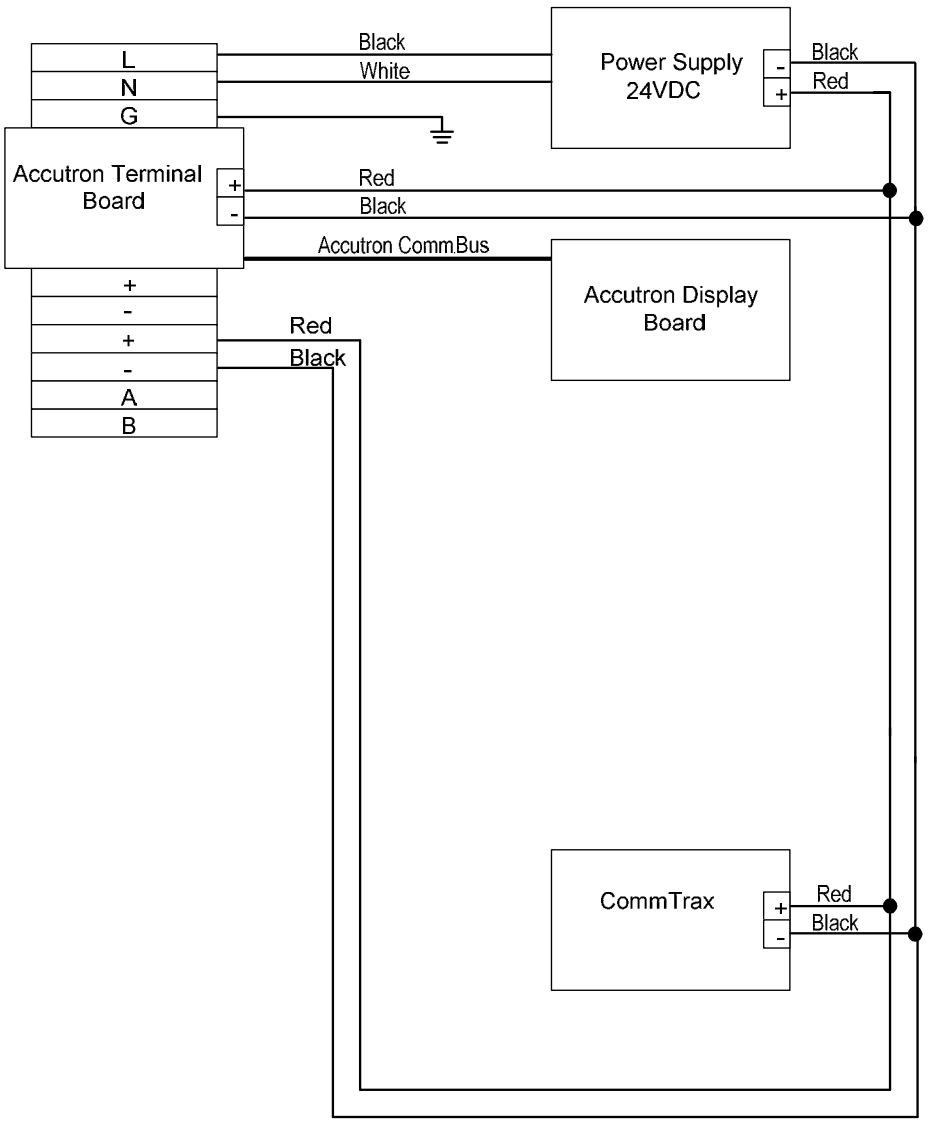

CONFIG
ADVANCED
2A: Calibration
This feature will multiply the value on the display by the number entered here.
Example: If you want the value to be twice the value on the display, enter 2.0
2B: Noise Filter
This is a provision for dealing with extreme noise. Normally it is set to 0.
2C: Low Thresh.
This option is used to specify the lower wave detection threshold in order to properly detect the ultrasonic signal.
2D: High Thresh.
This option is used to specify the upper wave detection threshold in order to properly detect the ultrasonic signal.
2E: Dynamic Rg.
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: Hysteresis
This option determines the minimum acceptable length of the waveform. Default is 50 units.
2G: XDUC Gain
A – 0
B – 1
C – 2
D – 4
E – 8
F – 16
G – 32
H – 64
Sets the sensitivity of the ultrasonic transducers.
2H: Avg. Type
A – 0 Start
B – 1st Read
The Accutron will compute the average using:
A : 0 as the first reading.
B : the first airflow reading the Accutron makes.
2I: Alt. Updates
A – Disabled
B – Enabled
Leave to default setting. Enabled.
2J: Env. Mask
This option determines the minimum acceptable length of the waveform. Default is 50 units.
2k: Master Gain
2L: Probe Board
A – Disabled
B – Enabled
Disables Probe Board Completely.
2M:ProbeDisplay
A – Disabled
B – Enabled
Disables reading from the Probe Board from displaying on the local display.
1 Transducer Laser
A - Disabled
B – Direction0
C – Direction1
1A : Flow Units
A – M/S
B – KCFM
C – CFM
D – M*3/S
E – FPM
F – Usec
Meters / second
Cubic feet x 1000 / minute
Cubic feet / minute
Meters cube / second
Feet / minute
Laboratory testing only
1B: Linear Units
Sets units of measure used.
A – METERS
B – FEET
1C: Face to Face
Enter Face to Face value; measured in units of measure set by 1B.
1D: Baseline
Enter Baseline value; measured in units of measure set by 1B.
Cannot be greater than Face to Face.
1E: Area
Enter the area in which the sensors will be working in; in units of measure set by 1B.
1F: Airflow Dir.
A – NORMAL
B - REVERSE
Selecting B: Reverse multiplies the value on the display by –1. Use this option if you would like to receive positive values instead of negative values.
1G: Cutoff
"Set to zero" any flow readings that are less than this amount.
1H: Full Scale
This is the full-scale reading of the instrument in the units selected (1A).
1I: Over Range
A – CLIP
B – 3mA ERR
If the flow exceeds full-scale:
A: Output will saturate at 20mA.
B: Output 3.5mA error.
1J: Time Out
If an obstruction is placed between the 2 transducers; this delays the 3.5 mA error output.
1K: 4-20 Mode
A – 4-20mA
B – 20-4mA
C – SPLIT
A: 4mA = minimum airflow
20mA = maximum airflow
B: 20mA = minimum airflow
4mA = maximum airflow
C: 4mA = max negative
12mA = 0 airflow
20mA = max positive
1L: Moving Avg.
This option is used to smooth out the readings in gusty conditions by taking the average of X amount of readings where X is the value entered.
DIAG
3A: Modbus Addr
Sets Units Modbus Address
3B: Diag Baud
Set Diag baud rate
A: 9600 C: 57600
B: 38400 D: 115200
3C:Modbus Baud
Modbus baud rate
A: 9600
B: 19200
3D: Parity
Modbus Parity
A: None C: Even
B: Odd
3E:Diag. Output
A: Envelope Detect
B: Filter
3F: Force mA
A: Yes B: Step
C: No
SAVE/RUN
Save changes, return to run mode.
UNDO/RUN
Do not save changes, return to run mode.
RESET
Reset Unit to defaults
RESET **
Confirms Reset
Accutron FlowTRAX
Dec 2013
Menu Flowchart using Nav Buttons
REV A
ACC5-SYS-MENU-001-DOC

Power Distribution



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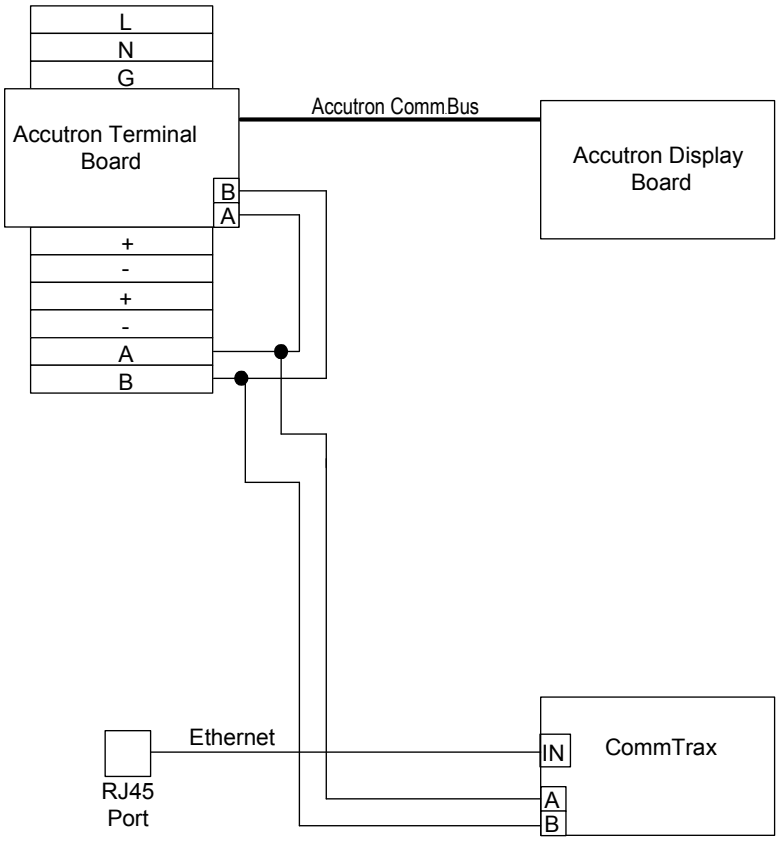
Communication Wiring



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