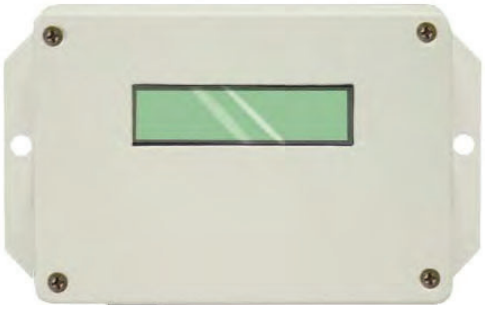
Greentrol Automation, Inc.

Installation, Operation and Maintenance Technical Manual

GF-A2100
GF-A2200

Dual Analog Output Air Flow Measurement with PID Control and Programmable Alarm Options

Document Name: TM_GF-A2100_2200_R1B



GF-2000 Transmitter

Adjustable Insertion Mount Probes

Universal Mount Probes

S-110 Air Flow Sensor Probes
Model GF-A2100 (Supplied with One Probe)
Model GF-A2200 (Supplied with Two Probes)

Part Number: 960-0220

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LIST OF EFFECTIVE AND CHANGED PAGES

Insert latest changed pages (**in bold text**); remove and dispose of superseded pages.
Total number of pages in this manual is **28.**

Page No	Revision *	Description of Change	Date
1, 2	**R1B**	**Changed revision to R1B**	**05-07-2014**
5, 6	**R1B**	**Corrected enclosure flame rating to 94V-0 (was 94-5VA)**	**05-07-2014**
1-28	R1A	Initial document release	03/06/2014

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OVERVIEW

Models GF-A2100 and GF-A2200 are high quality economical programmable dual-output airflow/temperature measurement and control instruments with options for analog air flow, temperature, alarm, and corresponding PID control outputs for control of airflow set points. They are designed for installation in specified critical applications that require precise measurement of air flow (down to zero flow) and temperature, with available PID control for air flow set point. The instrument includes factory calibrated probes (one with GF-A2100, two with GF-A2200) and an advanced microprocessor controlled transmitter/controller with typical sensor accuracy of 3% of reading (4% maximum)* from 0 - 2,000 FPM.

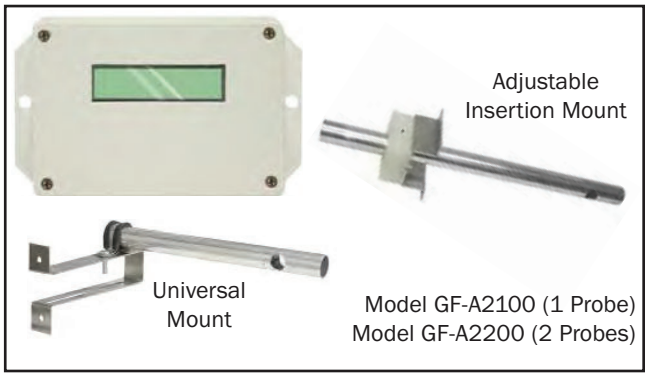

Figure 1. GF-A2100/GF-A2200 Airflow Measurement Station

Each sensor probe is equipped with a high reliability bead-in-glass heated thermistor element, factory calibrated to NIST traceable standards from zero flow to 2,000 FPM. The transmitter is fully independent of the probe and does not require field matching to the probe. An advanced microprocessor processes the raw probe signals and provides versatile programmable airflow measurement and alarm options with direct LED drive or N.O./N.C. relay dry contacts, and selectable analog output signal options. A powerful variable input signal integration option can be engaged to reduce the effects of transient input signal variations, and an innovative Field Calibration Wizard allows for simple, automated field adjustment of the instrument if required. A 16 character LCD display indicates airflow, temperature, system status and is also used for configuration and diagnostics. Field configuration is accomplished using a simple four-button user interface. Individual airflow and temperature measurements can be displayed for use in HVAC system diagnostics.

An input signal filter with variable buffer integration can be engaged for transient flows, and a process low limit can be set to force the output to zero when the airflow rate falls below a low limit. Both features are beneficial on outside air intakes affected by transient wind gusts at low airflow rates. A simple to use Field Calibration Wizard permits one or two point field adjustment to factory calibration for installations that require field calibration or adjustment. The transmitter provides two independent programmable analog outputs with full scale ranges of 0-10VDC, 0-5VDC or 2-10VDC.

SPECIFICATIONS

System:

- Sensor Accuracy*: ± 3% of reading typical (4% maximum)
- Calibrated Range: 0 to 2,000 fpm [10.16 m/s]
- Operating Temperature: Transmitter: -20 to 120°F [-28.9 to 48.9°C]
  Sensor: -20 to 160°F [-28.9 to 71.1°C]
- Operating Humidity Range: 0 to 99% non-condensing and protected from exposure to precipitation.
- Power Requirements: 24 VAC (22.8-26.4 VAC) at 8VA maximum

Transmitter Enclosure

- Enclosure Material: Durable UL94V-0 rated electronic housing and removable cover
- Transmitter Dimensions:
  3.570 x 5.002 x 1.502 in (HxWxD) [90.68 x 127.05 x 38.15 mm], with two integral 0.502 [12.75 mm] mounting flanges. Overall width with flanges 6.006 [152.55 mm]
- Transmitter Mounting: Two 0.190 in [4.76 mm] diameter holes on left/right mounting flanges

Sensor Probe

- Probe Construction: Type 6063 aluminum standard
- Mounting Brackets: Universal mounting brackets or adjustable insertion mounting brackets
- Probe Dimensions: 0.75 in [19.05 mm] diameter
- Standard Sizes: 8 and 16 inches [203.2 and 406.4 mm]
- Probes / Sensing Nodes: GF2100: 1 probe / 1 sensing node max.
  GF2200: 2 probes / 1 sensing node max.
- Probe/Transmitter Cable: Standard 10 ft [3.05m] durable FEP plenum-rated jacket with circular DIN plug; Optional length up to 50 ft [15.24m]

Output Interface

- Analog Output: Non-isolated 0-10, 0-5 or 2-10 VDC (20 mA max.)
- Output Resolution: 0.021% FS: 0-10/2-10VDC; 0.42% FS: 0-5VDC
- Output Load: 500 ohm minimum (20 mA max)

Programmable Output Alarm Options:

- Airflow Low limit, High limit, Dead Band alarm/control output (% above or below a specified flow) or System Trouble Alarm
- Alarm type: Selectable dry relay contacts, 30VDC/24VAC 3 Amps maximum or direct LED drive (15 mA typ) and local LCD

Programmable PID Control and Input Filter Options:

- Output can be configured as a PID control for air flow set point
- Powerful input signal filter with variable integration buffering

Field Cal Wizard:

- Automated menu-driven field adjustment of factory calibration if required

System Diagnostics

- Sensor/transmitter diagnostic mode with notification

Warranty

- 12 months from shipment

* Sensor accuracy is the calibrated accuracy of the individual sensor. The installed accuracy of the overall airflow station is application-dependent on the resulting sensor density; typically better than 15% of reading.

FEATURES

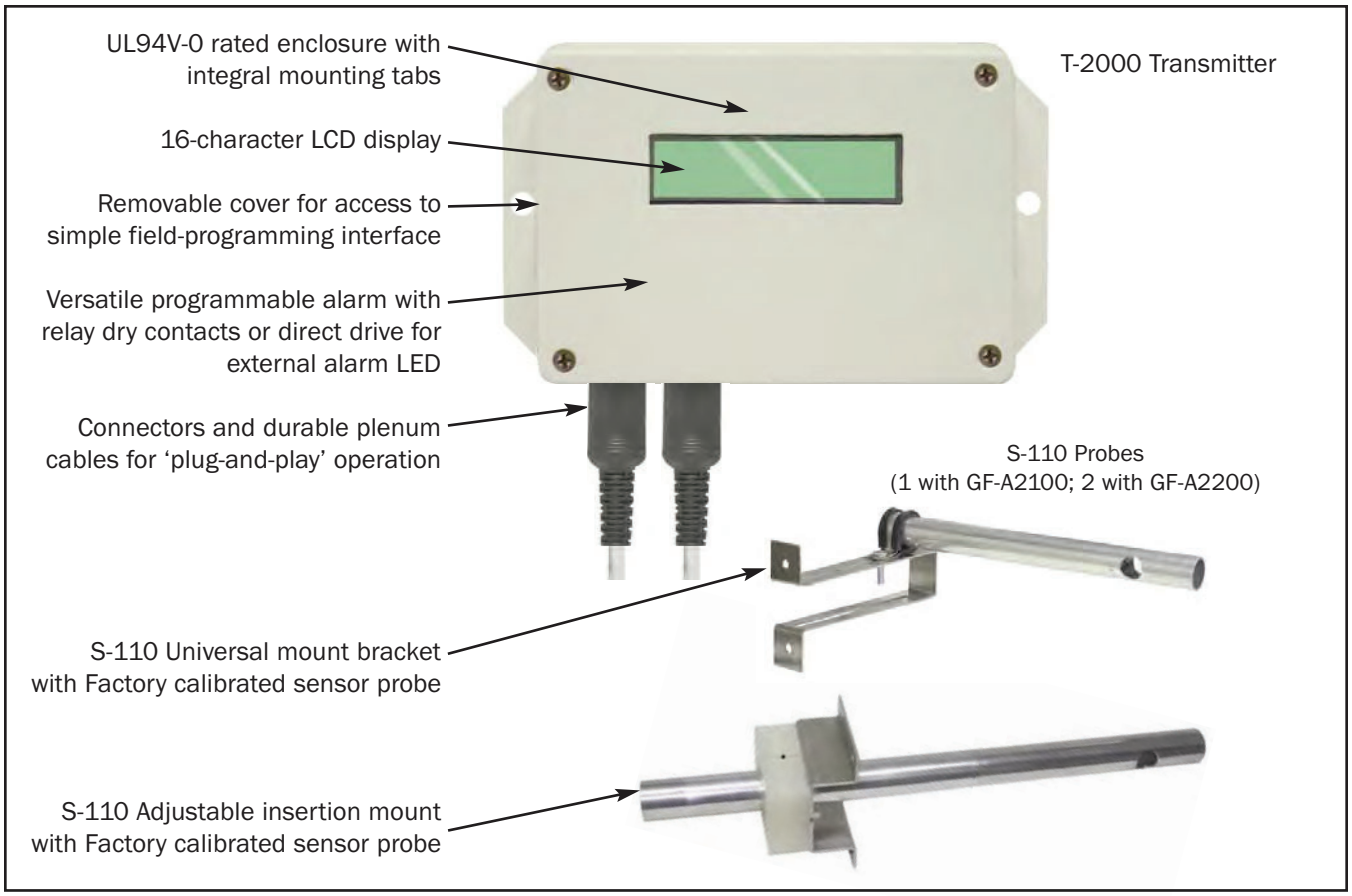

Figure 2. GF-A2100/GF-A2200 Features

INSTALLATION

Installation consists first of installing the sensor probe(s), then installing the transmitter, and last, installing the power and analog signal wiring to the airflow station. The following paragraphs detail the individual procedures and steps required for installation of the single probe GF-A2100 and dual probe GF-A2200. Convenient check boxes are included at each step.

Preparation for Installation

1. ☐ Determine the GreenTrol factory specified location for the GF-A2100/GF-A2200 airflow measuring station transmitter and probe as indicated on the engineer's plans. Ensure that the cable supplied with the probe is of sufficient length to reach the planned transmitter installation site. It is recommended that the probe be installed first to ensure that the included cable will reach the transmitter after allowance for routing and securing the cable.
2. ☐ Carefully unpack the GF-A2100/GF-A2200 and inspect the transmitter and probe(s) for damage. If damage is noted, immediately file a claim with carrier. Proceed to install the GF-A2100/GF-A2200 sensor probe(s) as outlined in the appropriate procedures that follow for Universal Mounting Brackets or for Insertion Mounting Brackets.

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Universal Mounting Bracket Probe Installation

The installation objective is to install probes so that the probe sensor center line is located at the exact position in the duct/plenum as shown in Figure 4.

1. ☐ Sensor probes must be installed at the factory-specified location using the integral universal bracket attached as shown in Figure 3. The universal bracket consists of a rubber probe clamp that is attached to the bracket using the included hardware. Probes can be rotated within the clamp, and the clamp can be rotated and mounted at any point along the 4-inch slot on the mounting bracket, thus providing complete mounting flexibility and adjustment. Assemble probe to the clamp and bracket so that when mounted, air flow is through the probe sensor opening, and in the same direction printed on the probe label.
2. ☐ Using the engineer's plans, mark the two mounting holes for each probe bracket at the GreenTrol factory-specified location where the probe(s) will be installed.
3. ☐ Drill holes suitable for the hardware that will be used to secure the bracket at two locations.
4. ☐ Carefully align the bracket mounting holes with the holes prepared in the previous step.
5. ☐ Secure each probe bracket and probe in two places through each bracket using suitable hardware. Adjust each bracket mount and/or probe clamp so that the airflow arrow printed on the probe is oriented in the direction of actual airflow.
6. ☐ Route each sensor probe cable to the planned transmitter site and install transmitter as outlined in the TRANSMITTER INSTALLATION procedure that follows.

UNIVERSAL MOUNT PROBE AND BRACKET MECHANICAL DETAIL

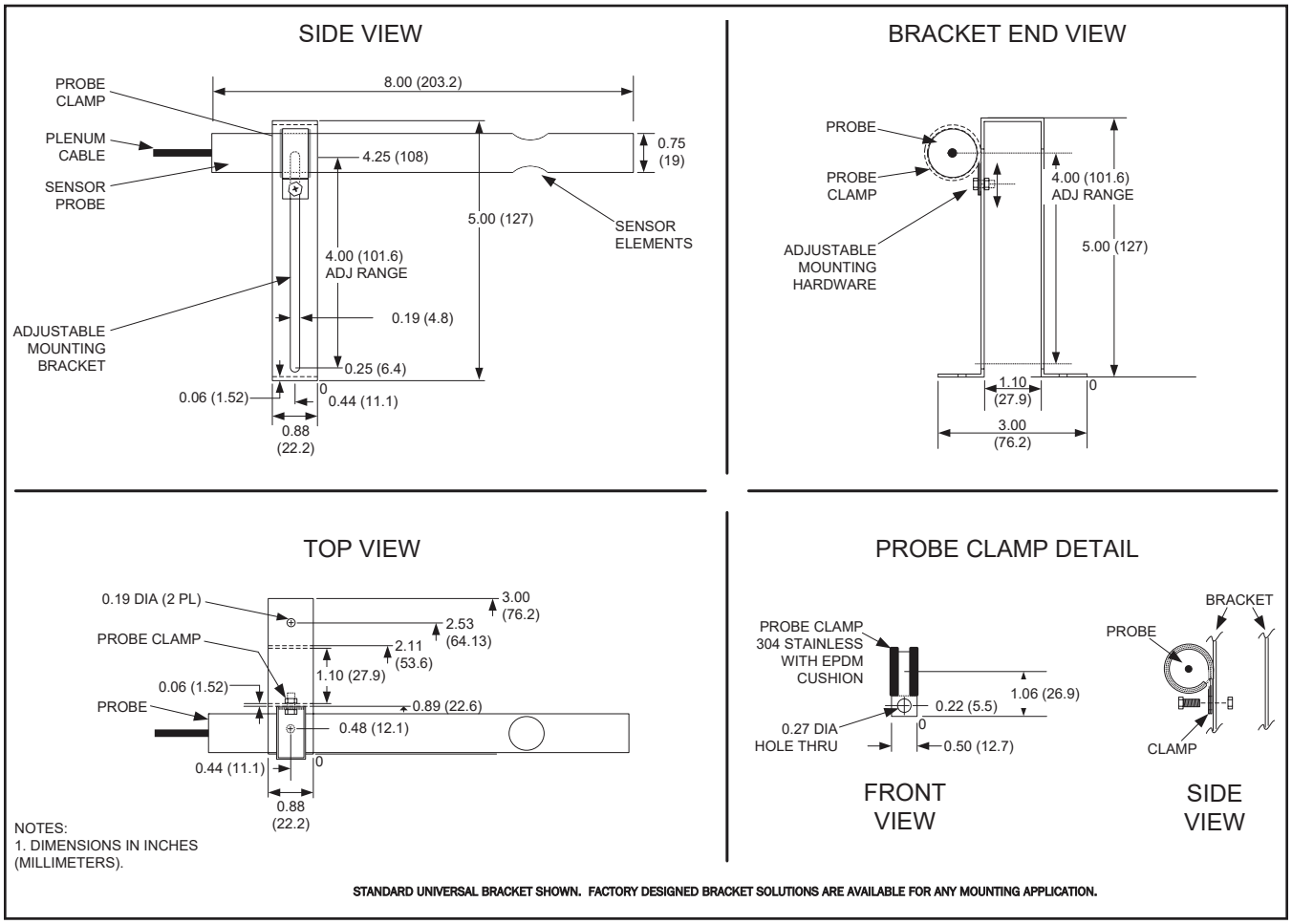

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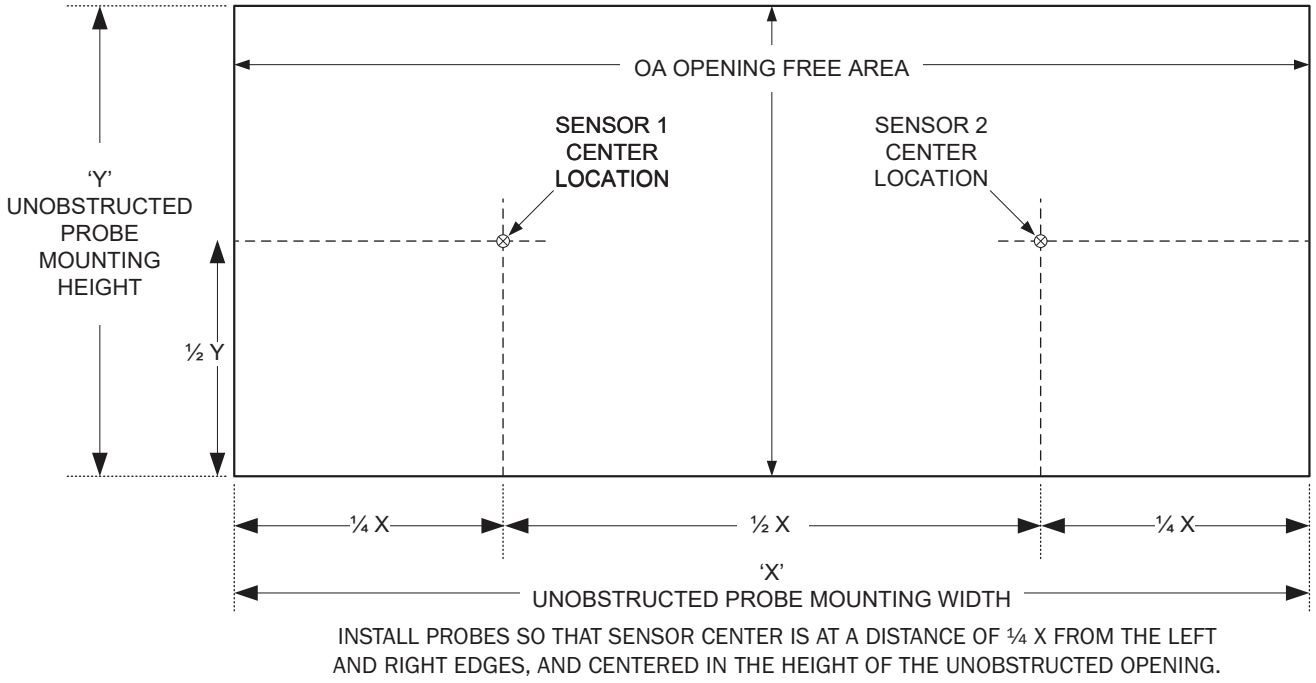
Figure 3. Universal Mount Probe and Bracket Mechanical Detail

Universal Mounting Bracket Probes for Unit Ventilator and OA Damper Hood Applications

Figure 4 details the two probe model GF-A2200 installation in typical Unit Ventilator and OA Hood applications. Install probes as outlined in the previous Universal Mounting Bracket Probe Installation procedure.

Universal Mount Probe Applications

GF-A2200 (two probe) Unit Ventilator Application



GF-A2200 (two probe) OA Damper Hood Application

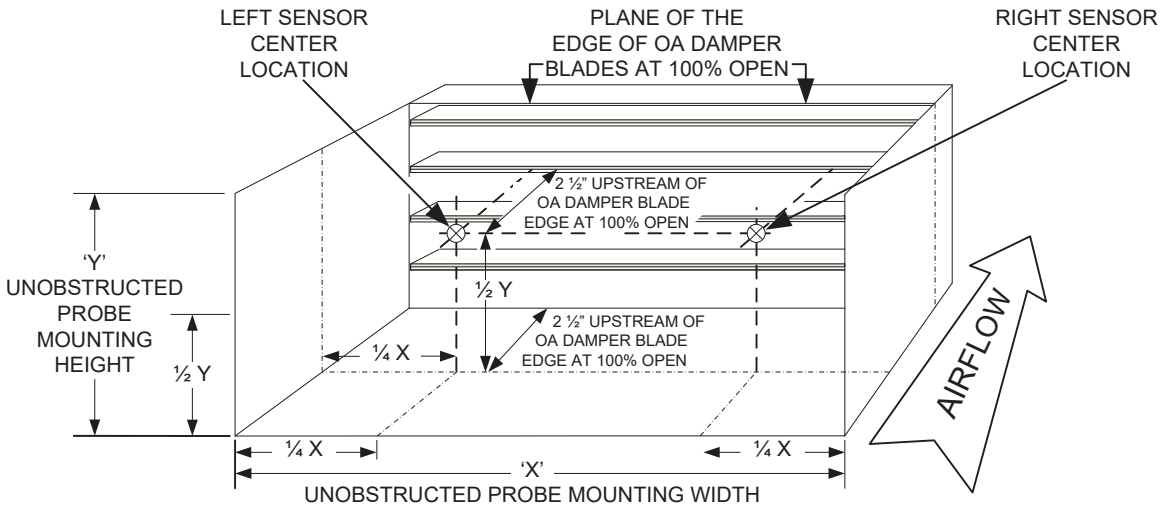


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Figure 4. Universal Mount Probe Detail for Unit Ventilator and OA Damper Hood Applications

Insertion Mounting Bracket Probe Installation

The installation objective is to install probes so that the probe sensor center location is at the exact position in the duct/plenum as shown in Figure 6 (for single probe model GF-A2100) or Figure 7 (for two-probe model GF-A2200).

1. ☐ For the duct/plenum probe insertion point mark, measure and record the duct/plenum height at the side where the probe is to be installed as shown in Figures 5 through 7. At 1/2 of the measured duct/plenum height, mark the probe insertion point on the duct/plenum to ensure that when the probe is inserted, its sensor center location will be at the exact position in the duct/plenum as shown in Figure 6 (for GF-A2100) or Figure 7 (for GF-A2200)
2. ☐ **For single probe model GF-A2100:**
   For the probe insertion depth mark, refer to Figures 5 and 6. Calculate and record the sum of (**1/2** of dimension 'D' + 3 inches {76.2 mm} + insertion wall insulation thickness). Measure from the non-cabled end of the probe and mark the probe across the factory score line at this point. This will serve as the probe insertion mark.

   OR

   ☐ **For two probe model GF-A2200:**
   For the probe insertion depth mark, refer to Figures 5 and 7. Calculate and record the sum of (**1/4** of dimension 'D' + 3 inches {76.2 mm} + insertion wall insulation thickness). Measure from the non-cabled end of each probe and mark each probe across the factory score line at this point. This will serve as the probe insertion mark.
3. ☐ Prepare the probe insertion hole(s) (one for the GF-A2100, two holes for the GF-A2200) at the location(s) marked in step 1 using a 0.875 inches (22.2 mm) hole saw.
4. ☐ Temporarily slide the probe and bracket through the hole prepared in step 3 so that the airflow label on the bracket is parallel to and in the same direction of duct/plenum airflow. Mark the four mounting bracket hole locations for each probe.
5. ☐ Remove probe from duct/plenum and then prepare suitable mounting holes for the field supplied hardware that will be used to secure the mounting bracket.
6. ☐ Slide the gasket seal down the probe body to the bracket. Carefully position the probe in the insertion hole prepared in step 3 so that the airflow label on the bracket is aligned with the actual airflow in the duct/plenum. Insert the probe so that the probe insertion depth mark (step 2) is just visible at the insertion mark target on the nylon bracket block. Secure the probe at this location using the setscrew on the mounting bracket nylon block. (Refer to Figures 5 and 7 for detail).
7. ☐ Ensure that the edge of the probe mounting bracket is parallel to the edge of the duct, and that the airflow arrow printed on it is oriented in the same direction as duct/plenum airflow. Secure the probe mounting bracket at the four holes prepared in step 5 using suitable hardware.
8. ☐ For two probe model GF-A2200, repeat steps 4 through 7 for the remaining probe supplied.
9. ☐ Route the sensor probe cable(s) to the transmitter location.
10. ☐ Install transmitter as outlined in the TRANSMITTER INSTALLATION section of this document.

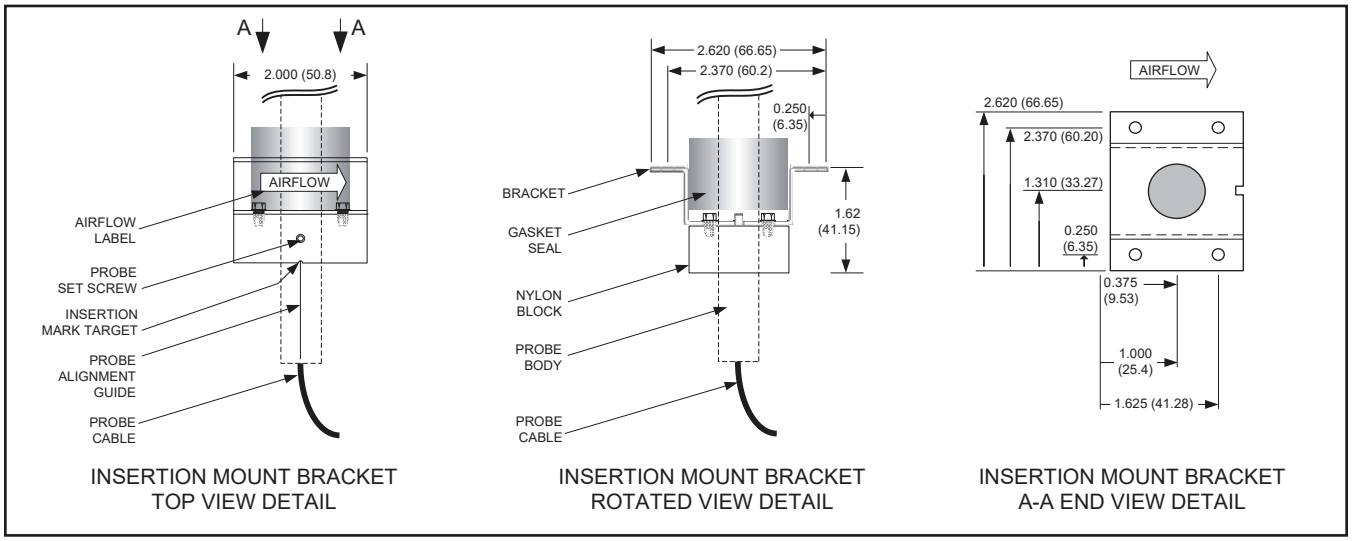

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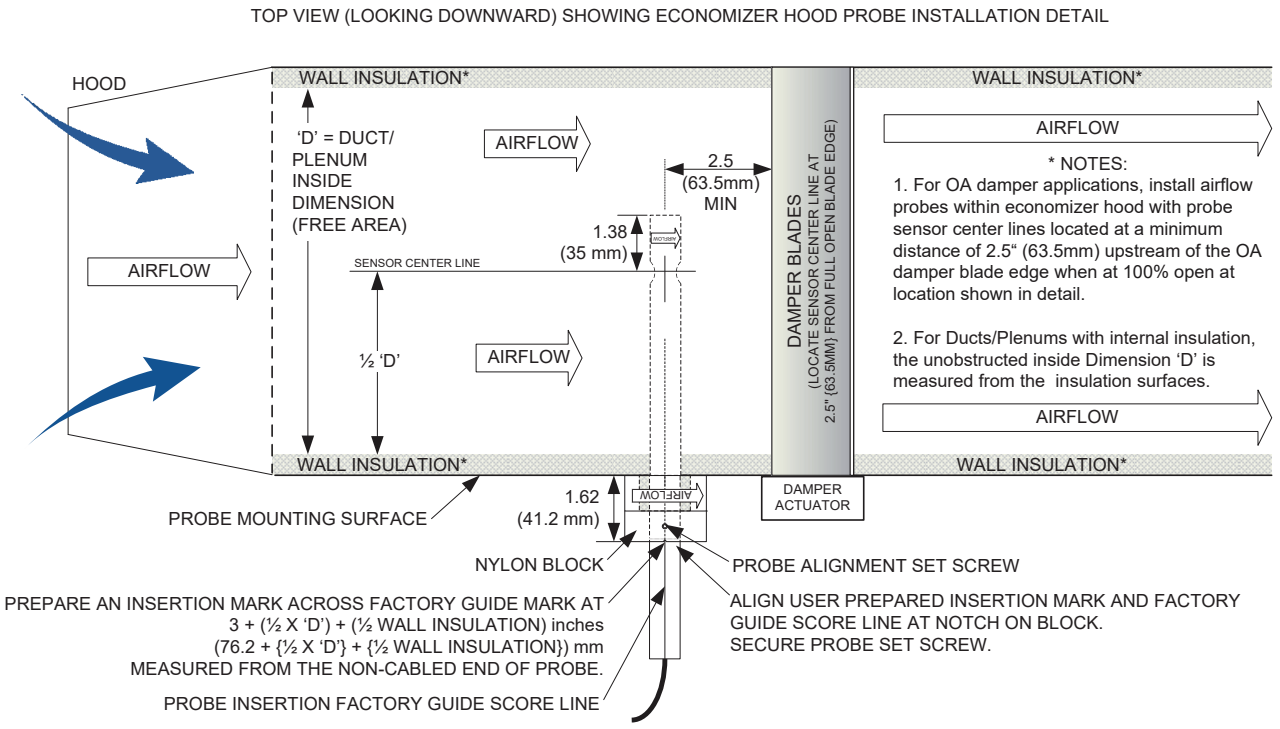
Figure 5. Insertion Mount Probe and Bracket Mechanical Detail

GF-A2100 (Single probe) Economizer Hood Application



GF-A2100 (Single probe) Ducted Application

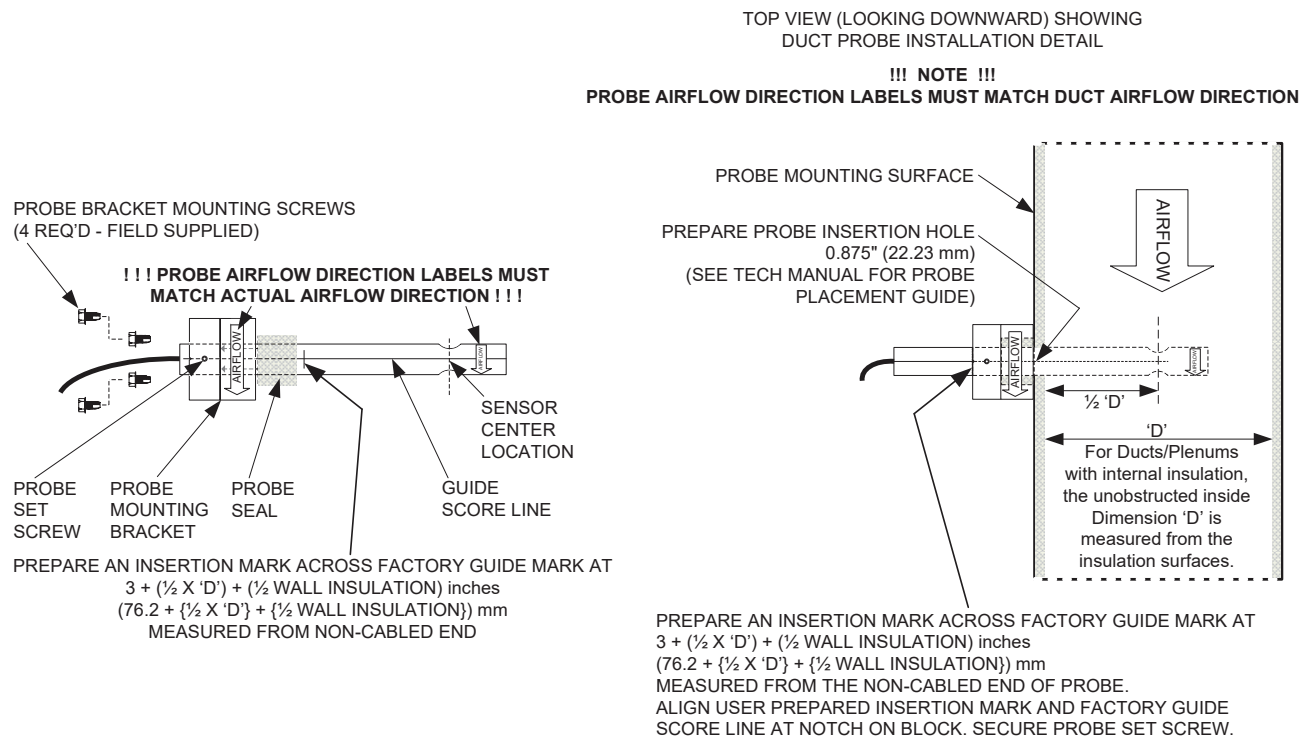


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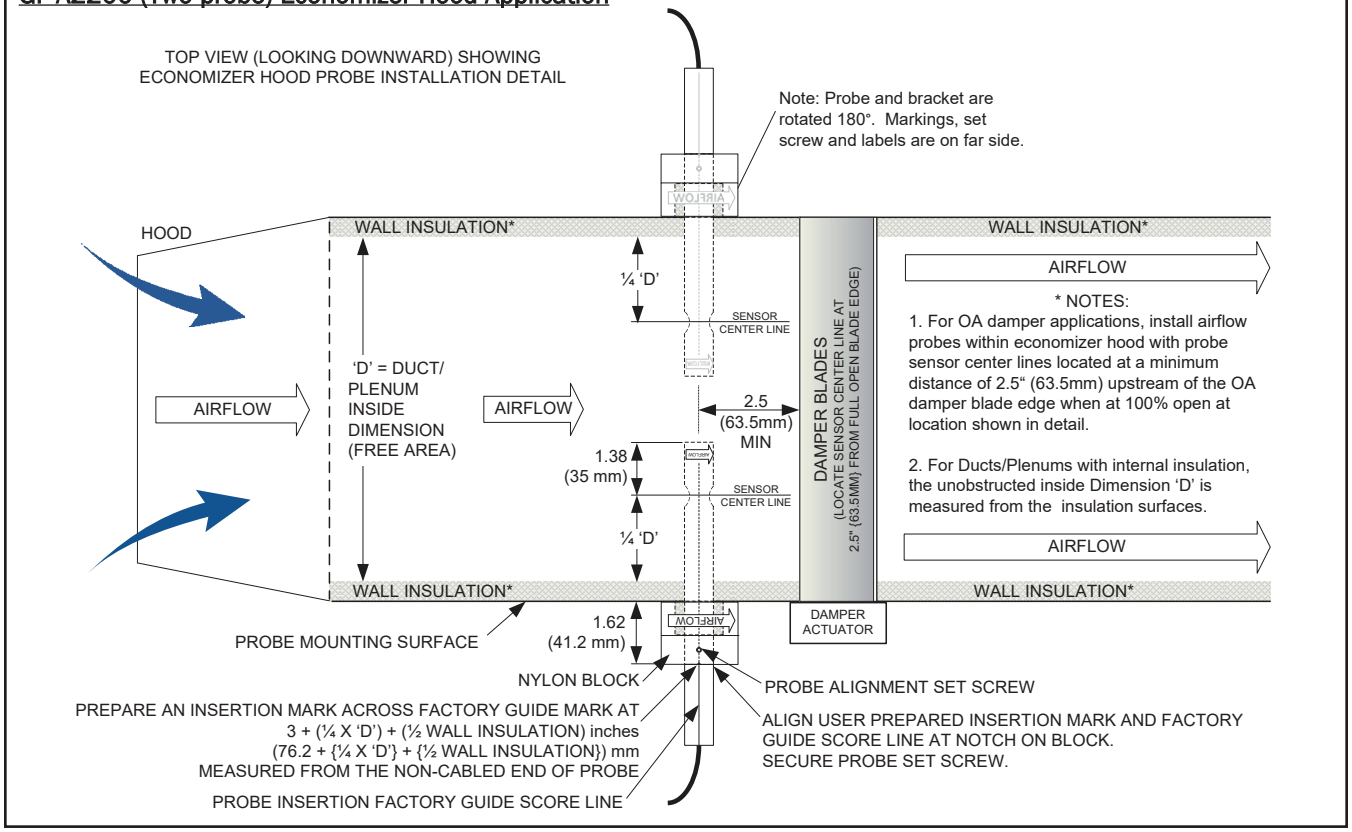
Figure 6. GF-A2100 Single Probe Insertion Mount Detail for Economizer Hood and Duct Applications

GF-A2200 (Two probe) Economizer Hood Application



GF-A2200 (Two probe) Ducted Application

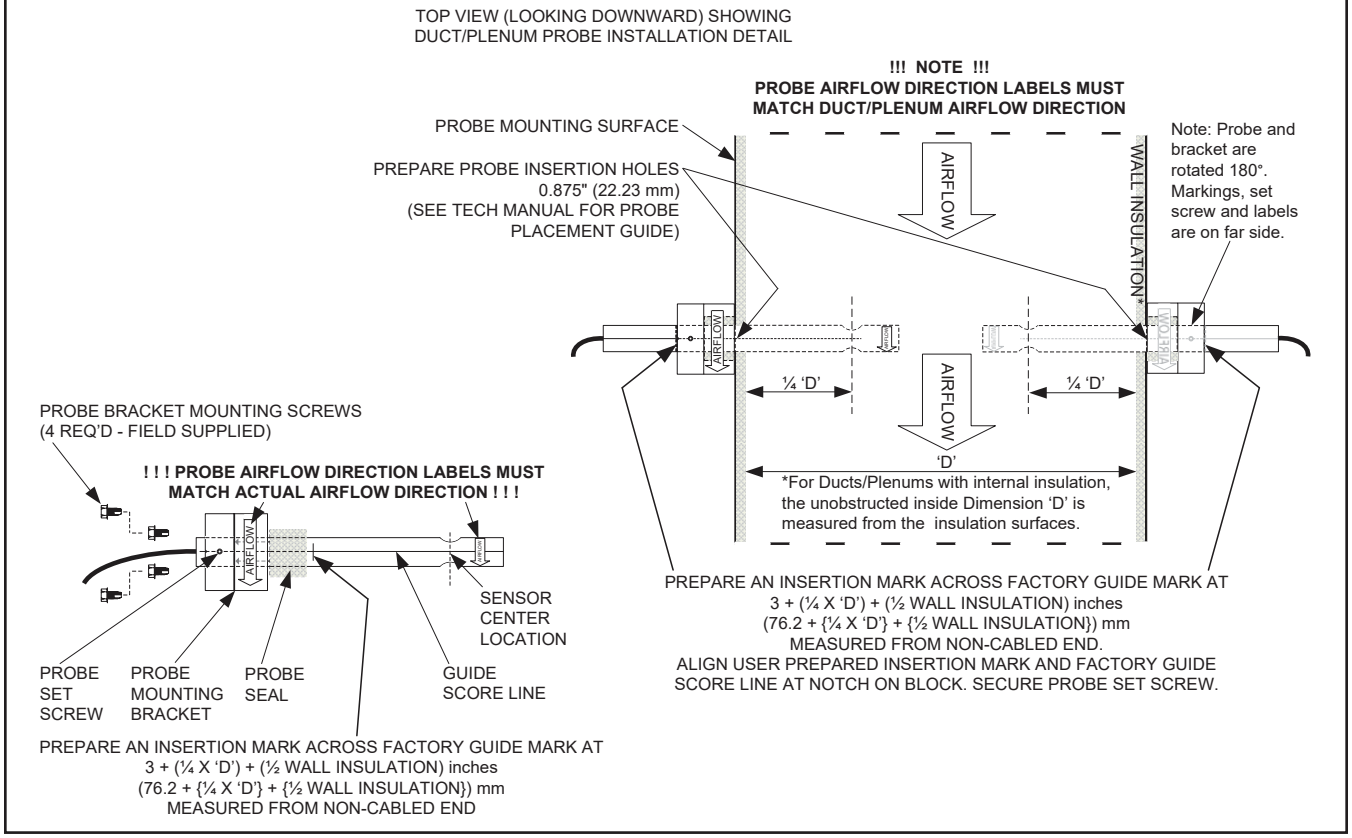


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Figure 7. GF-A2200 Two Probe Insertion Mount Detail for Economizer Hood and Duct Applications

Transmitter Installation

The transmitter is designed for use in an environment between -20° F to 120° F *(-28.8° C to 48.8° C)* where it will not be exposed to rain or snow. In locations where precipitation may be encountered, a NEMA-4 enclosure must be provided to enclose the GF-A2100/GF-A2200 transmitter.

Mount the transmitter upright in a field accessible location with sufficient service clearance to permit cover removal. The enclosure (Figure 8) is designed to accept signal and power wiring at the bottom-right of the enclosure. Ensure that the planned location of the transmitter will allow each sensor probe cable to reach the receptacle at the bottom-left of the transmitter enclosure.

1. ☐ Using the engineer's plans, locate where the transmitter will be installed.
2. ☐ Refer to Figure 8 and mark the two mounting holes located on each of the side flanges of the transmitter.
3. ☐ Drill two holes suitable for the hardware that will be used to secure the transmitter.
4. ☐ Secure the transmitter in two places using suitable hardware.
5. ☐ Connect wiring to transmitter as outlined in the following procedure.

CAUTION

In locations exposed to direct rain and/or snow, the transmitter must be enclosed in a NEMA4 enclosure.

Provide sufficient clearance around the transmitter to permit cover removal and to allow for heat dissipation.

Locate the transmitter in a location that can be reached by the connecting cable from the sensor probe.

Do not drill into the transmitter enclosure since doing so may damage the electronics.

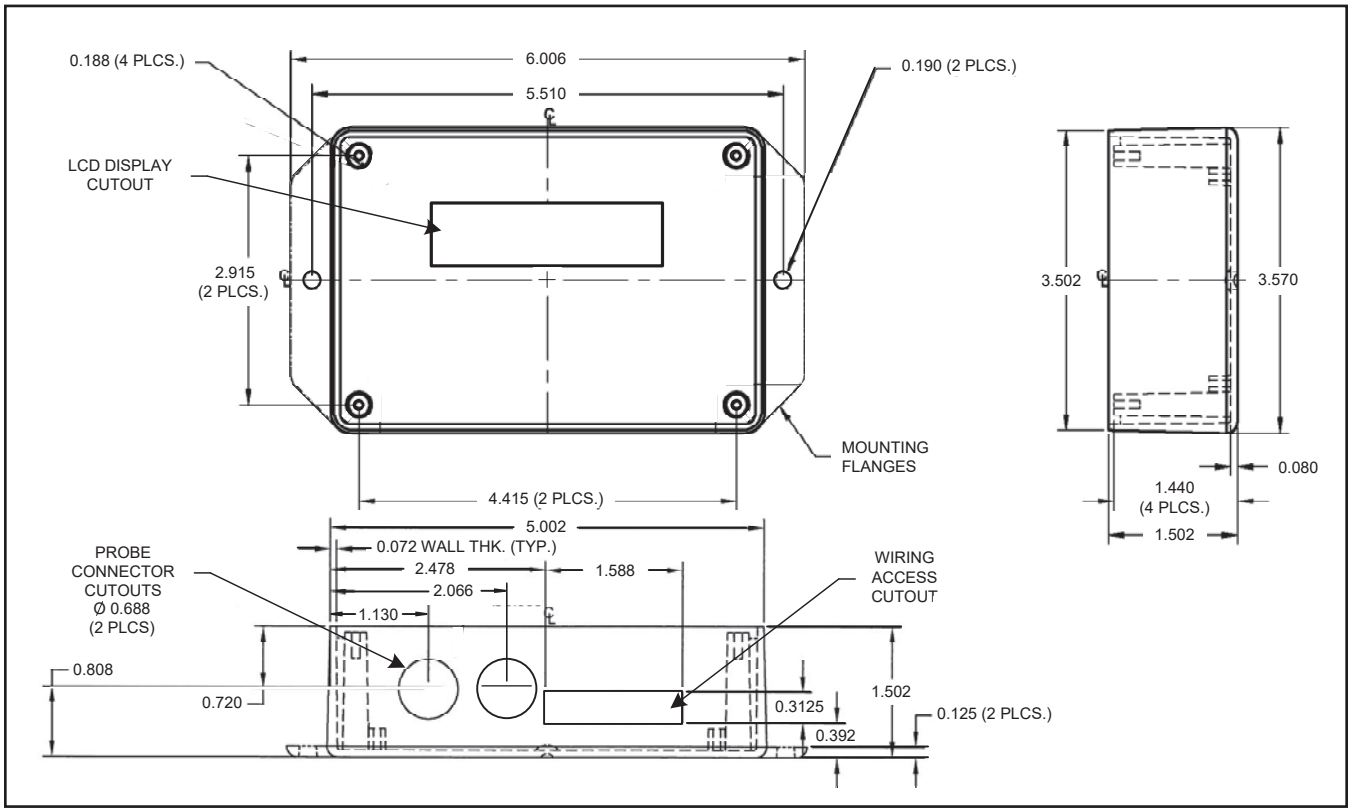

Figure 8. GF-A2100/GF-A2200 Transmitter Mechanical Detail Drawing

Transmitter Wiring

Transmitter wiring consists of connecting the 24VAC input power, the analog output signal wires and optional alarm output wires at the GF-A2100/GF-A2200. Refer to Figures 9 and 10 for additional detail. Following installation, the airflow measurement station is ready for operation. Custom setup options (other than the default values) can be entered in the GF-A2100/GF-A2200 Transmitter Setup procedure detailed later in this document.

Power Transformer Considerations

Select a 24 VAC transformer based on the maximum power requirements of the transmitter (8VA) to ensure that the operating supply voltage to the transmitter (when powered "ON" with probe connected) is not less than 22.8 VAC or greater than 26.4 VAC.

Power Connections

1. ☐ Remove the four cover retaining screws at each corner of the transmitter cover in order to gain access to the transmitter Wiring Terminal Block on the main circuit board shown in Figure 9.
2. ☐ Remove cover from the transmitter enclosure. Observe the following precautions when wiring the transmitter:

CAUTION

⚠ **To prevent damage to the GF-A2100/GF-A2200, deactivate 24 VAC power source until all connections to the instrument are complete.**

⚠ **The 24 VAC input ground (GND) connection at terminal 6 is shared with the Analog/PID Output signal grounds at terminal 2. If an isolated output is required, a dedicated isolation transformer must be provided to power the GF-A2100/GF-A2200.**

⚠ **The GF-A2100/GF-A2200 is a non-isolated device with a half-wave rectifier on the 24VAC power input terminal at pin 7. Therefore, to prevent equipment damage, multiple devices that are powered by a common 24VAC transformer output must use common device connections (e.g. pin 6 {ground} to other device ground, and pin 7 {24VAC power} to other device power), or independent isolation transformers must be provided for each non-isolated device.**

⚠ **The GF-A2100/GF-A2200 24VAC ground and Analog/PID Output signal returns are common. Therefore it is recommended that the Analog/PID Outputs to the BAS control interface be connected using two separate twisted shielded pair in order to eliminate potential voltage drop on the common (from the 24VAC return) that would otherwise cause inaccurate readings.**

3. ☐ Connect 24 VAC power to terminal 7, and the 24V ground at terminal 6 of the wiring terminal block as shown in Figures 9 and 10, observing the previous wiring precautions.

Analog/PID Output Connections

The GF-A2100/GF-A2200 provides two Analog/PID Outputs that can be configured as 0-10VDC, 0-5VDC or 2-10VDC and are capable of driving loads of up to 20mA (maximum). The 24VAC return ground connection is shared with the Analog/PID Output signal grounds (GND). If the Analog/PID Outputs must be isolated from the 24VAC return, a dedicated isolation transformer must be provided to power the GF-A2100/GF-A2200.

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⚠ **Form a "drip loop" with the the sensor probe cable at the transmitter if there is a potential for water runoff or condensation.**

4. ☐ Connect OUT1 Analog/PID Output signal wire at terminal 1, and the signal ground at terminal 2 as shown in Figures 9 and 10 while observing the previous wiring precautions.
5. ☐ Connect OUT2 Analog/PID Output signal wire at terminal 3, and the signal ground at terminal 2 as shown in Figures 9 and 10 while observing the previous wiring precautions.

Alarm Output Connections

The GF-A2100/GF-A2200 provides an alarm output that can be configured as relay dry contacts, or as direct drive (15 mA typical) for an external LED alarm indicator. The alarm output interface is set using the LED PWR jumper on the main circuit board as shown in Figure 9. With the LED PWR jumper on, the alarm output is set to provide an external LED drive (15 mA typical) at terminal 4, with ground return at terminal 6. With the LED PWR jumper OFF, the alarm output is set to provide relay dry contacts between terminals 4 and 5 (contacts rated at 30VDC/24VAC 3 amps maximum). The Alarm can be set as contacts close or contacts open on alarm as detailed in the Transmitter Setup menu later in this manual.

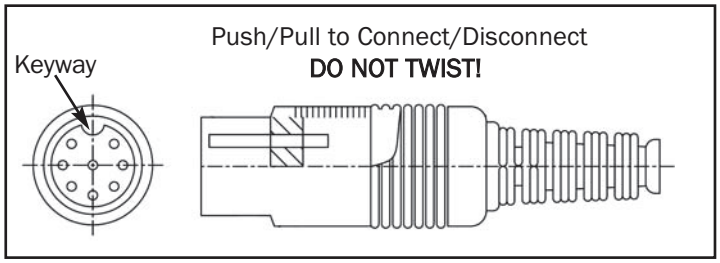
☐ For external LED drive alarm output, ensure that the LED PWR jumper is installed, and connect the LED anode (+) to terminal 4, and cathode (-) at terminal 6.

OR

☐ For relay dry contact alarm output, ensure that the LED PWR jumper is removed, and connect the alarm wires to terminals 4 and 5. Contact rating is 30VDC/24VAC 3 amps maximum.

Sensor Probe Connection

☐ With 24VAC power OFF, connect each sensor probe cable plug to the transmitter by pushing it into the keyed circular receptacle (shown below) located at the bottom of the transmitter enclosure. Do not twist the connector.



Sensor probe cable plugs are "keyed". Line up the connector plug with the transmitter receptacle and push straight on. DO NOT TWIST. Squeeze cable plug "ribs" towards receptacle when removing. Forcing the cable plug in or out of the receptacle will damage the connectors and void warranty.

Sensor probe must be connected to the transmitter before application of 24VAC power in order to properly "flash" sensor calibration data to the transmitter.

Initial Power Up

Upon application of 24VAC power, the GF-A2100/GF-A2200 will initiate a brief self-test, indicated by dashed lines on the LCD, and then will automatically engage the Start Up Menu to prompt the user through menus that configure the transmitter for the specific installation/application. The Start Up menu will also be engaged each time power is applied and the required area for any of the connected probes has not been set (*AR1(and/or AR2)=0.00 SQF). Refer to the Start Up Menu and Set Up menu details and descriptions later in this manual for a complete description of programming options and features.

Operating Modes

The GF-A2100/GF-A2200 provides two independent 12-bit (4096 discrete states) linear analog outputs. Each output can be independently enabled, disabled and configured within the Set Up Menu as follows:

Set as Standard flow or Temperature output from Flow 1 (and Flow 2) probes.
Set as a PID Control output signal (with advanced PID control options available)
Set as an airflow alarm status output (to indicate Hi limit, Low limit or Deadband with hysteresis conditions)
Set as a temperature alarm output (to indicate Hi limit, Low limit or Deadband with hysteresis conditions)
Set as Differential flow output to indicate the difference between Flow 1 and Flow 2 probes (GF-A2200 only)

In addition, the text displayed for each output on the GF-A2100/GF-A2200 LCD display panel can be renamed to suit your specific requirements (5 characters max). Analog outputs are field selectable for 0-10VDC, 0-5VDC or 2-10VDC to permit simple integration with virtually all building automation systems. Refer to the Set up menu details and descriptions later in this manual for a complete description of analog output and PID control output options.

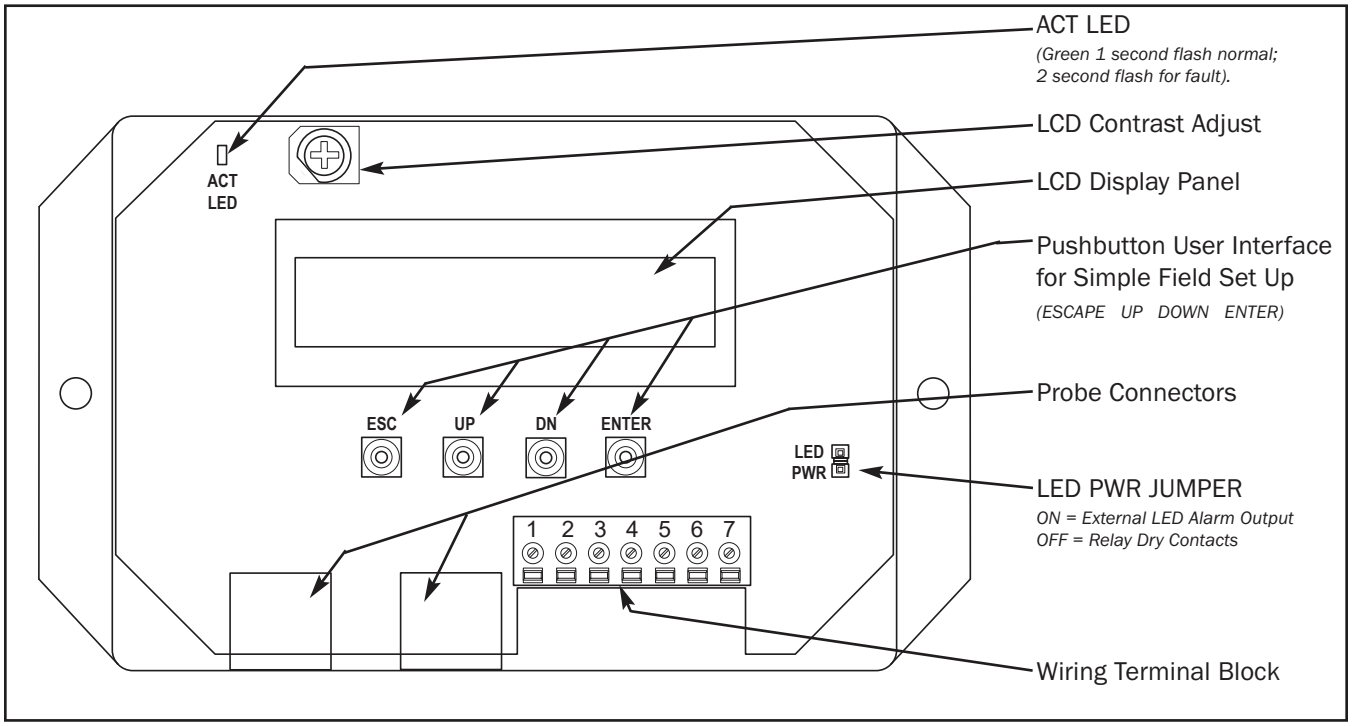


Figure 9. GF-A2100/GF-A2200 Main Circuit Board Detail

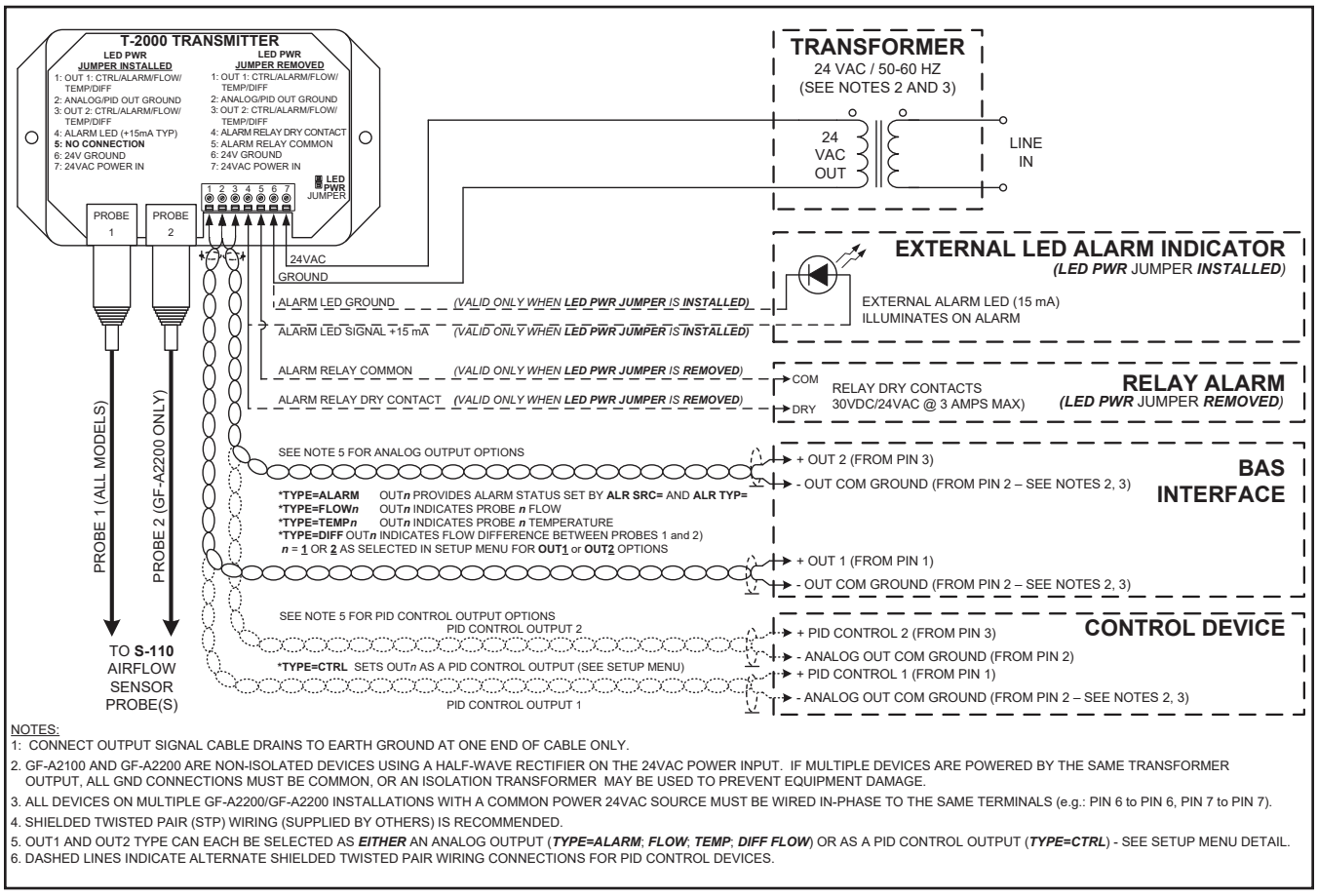


Figure 10. GF-A2100/GF-A2200 Wiring Diagram Detail

Alarm Interface, Options and Descriptions

The programmable alarm permits user selection of the alarm interface, alarm source and alarm type as follows:

Alarm Interface (LED PWR Jumper)

The alarm interface can be configured as relay dry contacts (30VDC/24VAC 3 amp maximum either N.O. or N.C.) or as direct LED drive output (15 mA typical) using the LED PWR jumper on the transmitter circuit board shown in Figure 9.

Alarm Source (ALR SRC=)

The alarm source can be programmed within the Setup menu to monitor Probe 1 or Probe 2 airflow (**ALR SRC=FLOW**), temperature (**ALR SRC=TEMP**), or the difference in flow between Probes 1 and 2 (**ALR SRC=DIFF**). It can also be set to monitor the overall health/status of the transmitter and probe (**ALR SRC=TRBL**)to activate an alarm in the event of a fault detected in the sensor or transmitter.

Alarm Type (ALR TYP=)

The alarm type can be set to monitor airflow or temperature and activate an alarm when airflow or temperature are above a preset High Limit value (**ALR TYP=HI**), below a preset Low Limit value (**ALR TYP=LO**), or outside of a preset Deadband operating range (**ALR TYP=DEADB**). The alarm hysteresis (**ALRM HYS=**) value is used to establish a range as a percentage above and below the alarm setpoint value.

The following alarm types are available in the Setup menu (refer to Setup Menu detail later in this document):

ALR TYP=DEADB	Sets alarm as Deadband type, where measurement outside of a range defined by the setpoint value (**ASP=**) plus or minus the hysteresis (**ALRM HYS=**) value causes alarm activation. The alarm is reset when the measured value returns within this range.
ALR TYP=HI	Sets alarm as a Hi Limit type, where measurement above the **ASP=** value causes alarm activation. The alarm is reset when measurement decreases below the **ASP=** value minus the **ALRM HYS=** value.
ALR TYP=LO	Sets alarm as a Low Limit type, where measurement below the **ASP=** value causes alarm activation. The alarm is reset when measurement increases above the **ASP=** value plus the **ALRM HYS=** value.
ASP= (value)	Sets the alarm setpoint measurement value that establishes alarm activity in conjunction with the other alarm options.
ALRM HYS= (value)	Sets the alarm range expressed as a percentage of the **ASP=** value. For **ALR TYP=DEADB**, measured values outside of this range will trigger the alarm. For **ALR TYP=HI** (and **LO**), the **ALRM HYS=** value sets the range above or below the **ASP=** value where the alarm remains active once triggered.
ADEL= (value)	Sets the delay period (in seconds) that the alarm condition must exist before the alarm output is activated.
ALRM POL= (value)	Sets the relay dry contact configuration at terminals 4 and 5; For **ALRM POL=NO**, contacts are normally open and close on alarm; For **ALRM POL=NC** contacts are normally closed and open on alarm.

The accuracy of the GF-A2100/GF-A2200 is “percent of reading”, and is therefore not dependent on the full scale output range selected. However, if desired, the factory default full scale output range setting can be reconfigured in the field (see: CHANGING FACTORY DEFAULT SETTINGS).

Converting Analog Output Signal Values for Airflow and Temperature

The GF-A2100/GF-A2200 analog outputs can be configured to display individual air flow, differential air flow, velocity or temperature. Units are selected in the System of Units menu for SI or IP units of measure. Table 1 shows analog output scaling and conversions for airflow, volumetric flow and temperature. For example, when the transmitter is set for normal airflow (CFM/LPS) and AR1/AR2 area is set to 1 square foot (**AR1/AR2=1.00 SQF**), the LCD display and the analog output will both indicate equivalent airflow velocity in FPM. Note that for Differential airflow measurement, zero flow is indicated at 1/2 of the output range selected in order to permit positive and negative relative flow values.

Table 1. GF-A2100/GF-A2200 Analog Output Flow and Temperature Conversion

CONVERT ANALOG OUTPUT TO	ANALOG OUTPUT SCALING CONVERSION FORMULAE		
	0-10 VDC	0-5 VDC	2-10 VDC
Flow Rate [1] (CFM/LPS)	Analog Output x **FS** x 0.1	Analog Output x **FS** x 0.2	(Analog Output - 2) x **FS** x 0.125
Differential Flow Rate [2] (CFM/LPS)	(Analog Output - 5) x **FS** x 0.2	(Analog Output - 2.5) x **FS** x 0.4	(Analog Output - 6) x **FS** x 0.25
Velocity [1] (FPM)	$\frac{\text{Analog Output x FS x 0.1}}{\text{Area (SQF)}}$	$\frac{\text{Analog Output x FS x 0.2}}{\text{Area (SQF)}}$	$\frac{\text{(Analog Output - 2) x FS x 0.125}}{\text{Area (SQF)}}$
Velocity [1] (MPS)	$\frac{\text{Analog Output x FS x 1000 x 0.1}}{\text{Area (SQM)}}$	$\frac{\text{Analog Output x FS x 1000 x 0.2}}{\text{Area (SQM)}}$	$\frac{\text{(Analog Output - 2) x FS x 1000 x 0.125}}{\text{Area (SQM)}}$
Temp [3] (°F,°C)	[{Analog Output x (**FS** - **MS**)} x 0.1] + **MS**	[{Analog Output x (**FS** - **MS**)} x 0.2] + **MS**	[(Analog Output - 2) x {(**FS** - **MS**) x 0.125}] + **MS**

NOTES:
1. Setup menu for flow measurement (**OUT TYPE=FLOW**).
2. Setup menu for temperature measurement (**OUT TYPE=DIFF**).
3. Setup menu for temperature measurement (**OUT TYPE=TEMP**).
4. FS is the full scale analog output value in the Setup Menu (**FS= ____**).
5. MS is the minimum scale analog output value in the Setup Menu (**MS= ____**).

Sending a Test Output Signal to the Host Control System

A test output signal between 0 and 100% of the selected full scale output (0-10 VDC, 0-5VDC or 2-10 VDC) can be provided by the GF-A2100/GF-A2200 to verify proper conversion of the output signals from the transmitter at the host control system. To set a fixed output signal for airflow and temperature, enter the Initialization Menu (Figure 12) and navigate to the "***TESTOUT=0%**" menu item. Press the "ENTER" button, and then use the "UP" and "DOWN" arrow buttons to select an output between 0 and 100% of the full scale value. Press the "ENTER" button to set the output percentage. The GF-A2100/GF-A2200 will now provide the selected analog output value. To cancel the Test output, press the "ESC" button to return to normal operation.

GF-A2100/GF-A2200 TRANSMITTER SET UP

General

To ensure successful start-up, verify that the airflow measuring station transmitter and probe are installed in accordance with recommended installation and placement guidelines.

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Check the physical installation, power connections and wiring prior to application of power to the instrument.

Activate 24VAC power to the instrument. The transmitter executes a complete self-check (that takes approximately 10 seconds) each time power is applied. Verify that the readings at the host control system return an output that matches the output of the GF-A2100/GF-A2200.

Start Up Menu

At the initial (first) power up following self-test, and at each start up when an area value has not been input (when AR1=0 and/or AR2=0), the GF-A2100/GF-A2200 transmitter will guide the user through a series of prompts for system configuration. Figure 11 shows the Initial Start Up Menu. The user will enter the type of airflow measurement configuration (either averaged reading for single or dual probe models; or independent readings for dual probe models) and the free area measurement where probes are located.

Additional field configurable options are available within the transmitter Initialization Menu and within the Set Up menus as detailed in the following paragraphs.

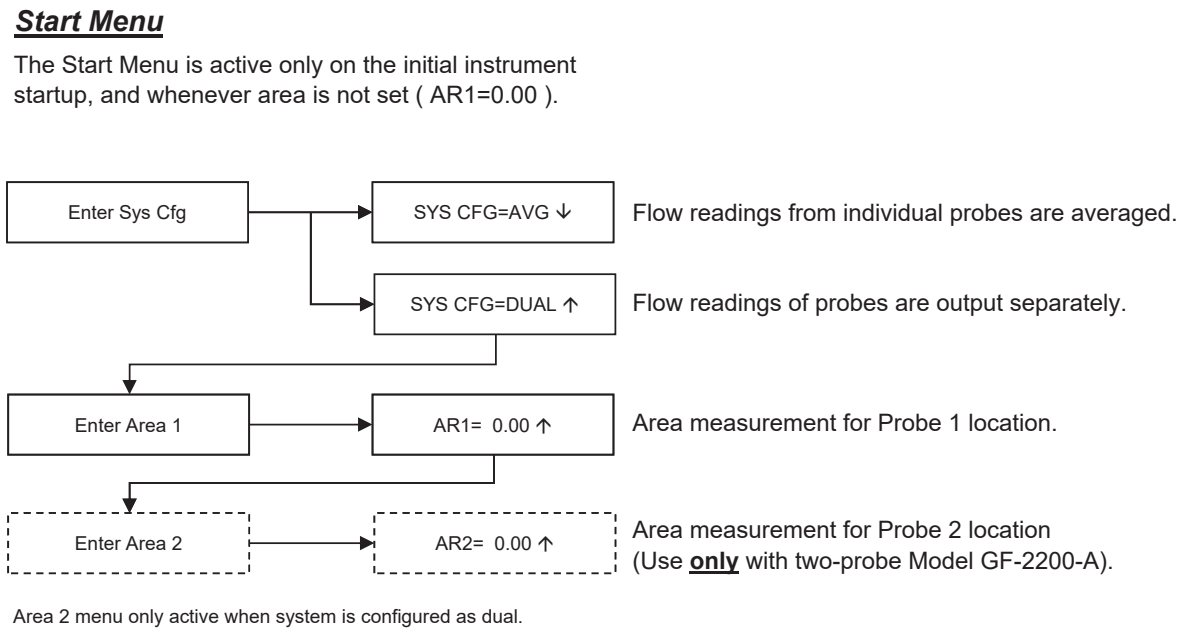

Figure 11. Transmitter Start Up Menu

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Transmitter Initialization Menu

The GF-A2100/GF-A2200 transmitter automatically initializes at power-up and conducts a self test with full system diagnostics. Under normal conditions, it is not necessary to enter the *Initialization Menu*, however the *Initialization Menu* can be engaged if one of the menu items shown in Figure 12 requires change. To engage the *Initialization Menu*, simultaneously depress and release the "ENTER" and "ESC" buttons during the first 10 seconds after transmitter power-up delay is completed (indicated by "- - - - - - - -"). Alternatively, you may enter the *Initialization Menu* after power up by simultaneously depressing and ***holding*** the "ENTER" and "ESC" buttons for 5 seconds - and then releasing them. Navigate through the menu as shown in Figure 12.

During Power-Up (approximately 10 seconds), simultaneously depress and then release ESC/ENTER keys to select,

OR

During normal operation, simultaneously depress and hold the ESC/ENTER keys for 5 seconds to select.

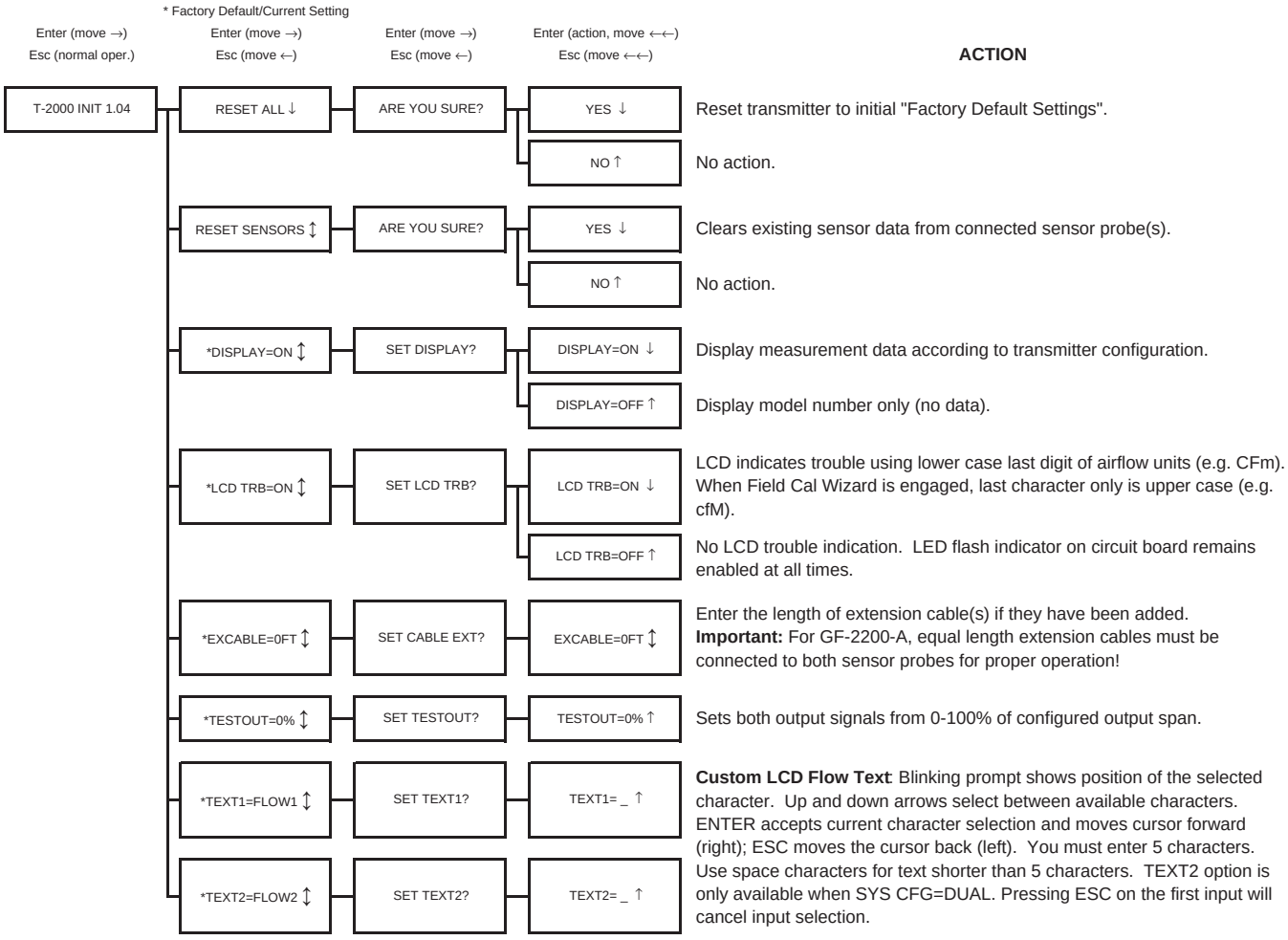

Figure 12. Transmitter Initialization Menu

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Changing the System of Units

The GF-A2100/GF-A2200 transmitter is shipped with the system of units set to US inch-pound units (IP), and will display units of measure as shown in the IP column of Table 2. To change to standard international (SI) units, simultaneously press and release the "UP" and "DOWN" arrow pushbuttons during normal operation to enter the SETUP menu. Then, using the ENTER button, navigate into the SYSTEM SETUP menu to the System of Units sub-menu as shown in Figure 13. Press "ENTER" to proceed to the right (three times), and then use the "UP" and "DOWN" arrow buttons to select the system of units desired. Press the "ENTER" button to save the changes, and then press "ESC" twice to move left and return to normal operating mode. Note that all Menu illustrations are shown in IP System Of Units. When SI System of Units is selected, the menu units of measure abbreviations change as shown in the SI column of Table 2.

Table 2. Standard "IP" and "SI" Menu System of Units Abbreviations

"IP" System of Units LCD Display	Description
FPM	Feet per minute
CFM	Cubic feet per minute
SQF	Square feet
F	Fahrenheit

"SI" System of Units LCD Display	Description
MPS	Meters per second
LPS	Liters per second
SQM	Square meters
C	Celsius

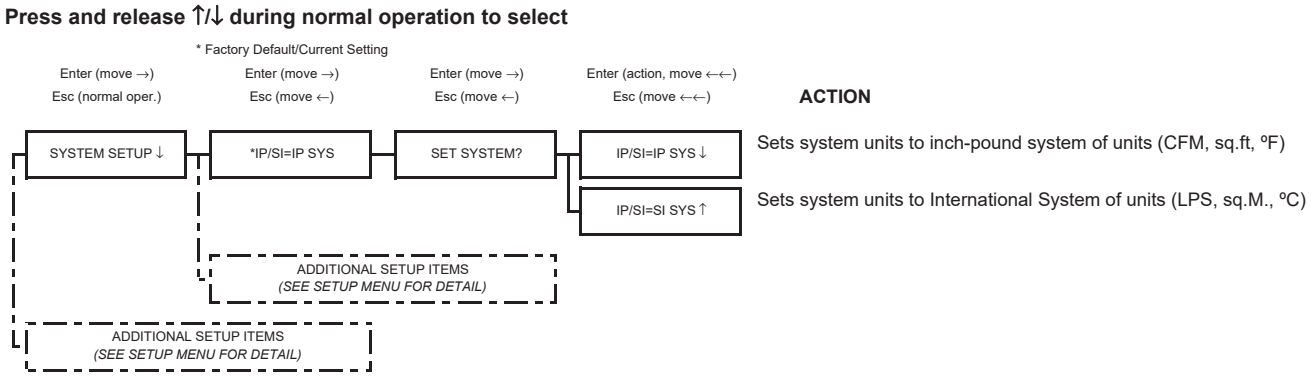

Figure 13. System of Units Menu

Factory Default Settings

The GF-A2100/GF-A2200 transmitter is "plug and play" and does not require additional setup unless an optional feature is selected that requires configuration. Table 3 shows the factory default settings for the GF-A2100/GF-A2200. To change the Factory Default Settings, see CHANGING FACTORY DEFAULT SETTINGS section in this document.

GF-A2100/GF-A2200 LCD Display Notifications and Features

Following a brief initialization at power up, the LCD will automatically display airflow and temperature as all upper case (caps) characters. The LCD display provides additional information on system status and alarm conditions as follows:

LCD Scrolling Control Feature (SYS CFG=DUAL)

When the GF-A2200 is configured for two probes (SYS CFG= DUAL), the LCD display will scroll to indicate the readings for each probe. To stop the scrolling, simply depress either the "ENTER" or "ESC" keys. In this mode with scrolling stopped, the LCD will display an asterisk (*) as the right most character, and depressing the "UP" or "DOWN" key will permit you to cycle and hold the display at each individual reading.

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Table 3. Factory Default Setup Menu Values

SYSTEM SETUP SUB-MENU			
Display	Description	IP Units	SI Units
*AR*x* =	Probe *x* duct free area (sq. ft.) where probe *x* is located (*x* =1 or 2)	0.00 SQF	0.000 SQM
*FLOW BUF=	Number of samples used to perform flow calculation (1 to 500)	10	10
*INT TIM=	Time between integration updates (0.1s - 15min)	1.0S	1.0S
*ALT=	Altitude for flow correction	0 ft	0 m
*FILTER*x* =	Output *x* Digital Noise Filter (*x* =1 or 2)	0 (off)	0 (off)
*OFF-GAIN*x* =	Output *x* Offset-Gain On/Off (*x* =1 or 2)	OFF	OFF
*O-GMODE*x* =	Output Offset-Gain Mode (*x* =1 or 2)	1 (direct entry)	1 (direct entry)
*GAIN*x* =	Output Gain factor (*x* =1 or 2)	1.000	1.000
*OFFSET*x* =	Output Offset factor (*x* =1 or 2)	0.000 FPM	0.000 MPS
ALARM SETUP SUB-MENU			
Display	Description	IP Units	SI Units
*ALR SRC=	Alarm Enable/Disable and Alarm Source selection	OFF	OFF
*ALR TYP=	Alarm type (Deadband, Hi Limit or Low Limit) selection	DEADB	DEADB
*ASP=	Alarm set point value selection	0 CFM	0 LPS
*ALRM HYS =	Alarm Hysteresis (range in percentage) above and below the *ASP value that results in alarm activation.	15%	15%
*ADEL =	Alarm Delay sets the time period that the Alarm condition must be present before the Alarm is activated.	5S	5S
*ALRM POL =	Alarm relay contact configuration (NO for normally open or NC for normally closed)	NO	NO
OUTPUT*x* SETUP SUB-MENU (*x* =1 or 2)			
Display	Description	IP Units	SI Units
*OUT*x* =	Analog output *x* signal range (*x* =1 or 2)	0-10VDC	0-10VDC
*TYPE=	Analog output 1 and 2 Type (sets configuration of Analog Outputs)	FLOW1	FLOW1
*FS=	Analog Output full scale value	5,000 CFM	25 LPS
*LL=	Analog Output Low limit cutoff	0 CFM	0 LPS
*MS=	Analog Output Minimum Scale for Temperature	-20 F	-20 C
*CTRL=	Sets Control Loop strategy; to follow flow output 1 flow, output 2 flow or the flow difference between them	FLOW1	FLOW1
*SETP=	PID Set Point flow value	0 CFM	0 LPS
*INTRVL=	PID Update interval (seconds)	1.0s	1.0s
*ACTION=	Set PID control action: **Direct**=Measurement and PID control are directly proportional **Reverse**=Measurement and PID control are inversely proportional	Direct	Direct
*DEADB=	Deadband range (expressed as a percentage of *SETP= value)	10%	10%
*ON DEL=	Delay after power-up before the PID control output is active	30.0s	30.0s
*DIVISR=	PID Gain Divisor	1000	1000
*P GAIN=	Proportional gain term	10	10
*I GAIN=	Integral gain term	1	1
*D GAIN=	Derivative gain term	0	0
*MAX INT=	Maximum value for Integral state	20%	20%

LCD Display Last character is an asterisk * (Scrolling Feature Engaged)

(See LCD Scrolling Feature)

LCD Display Last character is shown in lower case (Probe Malfunction)

The last character of the flow rate units on the LCD display is shown in lower case (for example **CFm**) to indicate that an improper or malfunctioning probe is connected to the transmitter. (See Table 4 for additional troubleshooting details).

LCD Displays All Characters of Flow Rate Units in Lower Case (Field Cal Wizard Engaged)

When all characters of the flow rate units are displayed in lower case (for example cfm) the transmitter is operating in the Field Calibration Wizard mode (see the FIELD ADJUSTMENTS - Field Calibration Wizard section of this manual). In addition, while in the Field Calibration Wizard mode, an upper case last character indicates a probe malfunction. (Refer to Table 4 for additional troubleshooting details.)

LCD Blinks ** LOW ALARM **, ** HIGH ALARM ** or ** TRBL ALARM **

The LCD will alternately flash to indicate that an alarm condition has been detected based on the type of alarm that has been set in the Set Up menu (Figure 15). Alarm notifications will cease when the alarm condition is cleared. For complete alarm information, refer to the **GF-A2100/GF-A2200 Alarm Options and Description** section of this manual.

CHANGING FACTORY DEFAULT SETTINGS

Setup Menu Options

The GF-A2100/GF-A2200 transmitter is configured at the factory to be fully operational when a sensor probe is connected and power is applied. Factory settings can easily be changed in the field through the Setup Menu, selected by simultaneously pressing and releasing the “UP” and “DOWN” buttons while the transmitter is in its normal operating mode (see Figure 15 for detailed flow chart of the Setup menu). Changes made in the Setup menu take effect immediately. The following are common field changes to the factory default settings.

Output Scaling

Sensors are individually calibrated in wind tunnels (traceable to the National Institute of Standards and Technology [NIST]) between 0 and factory default full scale. Sensors are independent and produce “percent of reading” accuracy. Decreasing the full scale does not alter (or improve) the accuracy of the device. Factory default output scaling for the GF-A2100/GF-A2200 can be changed by entering the setup menu through item *FS= setting (as shown in Figure 15).

Locking the Configuration Settings

Using the *Lock Menu*, transmitter configuration settings can be secured by entering a user defined lock code from 1 to 9999. Once locked, user defined settings can only be altered after entering the defined lock code in the *Initialization, IP/SI Units* or *Setup* Menus. To enter the *Lock Menu*, press the “ESCAPE” and “UP” arrow simultaneously at any time. To enable the *Lock Menu* a code must be entered, and then verified. Figure 14 details the Lock menu.

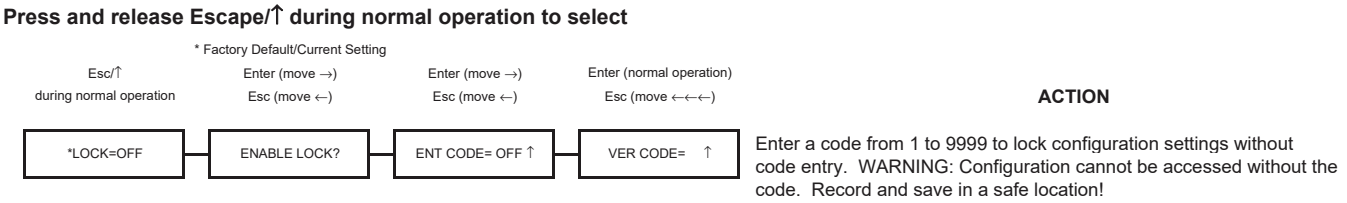

Figure 14. Factory Default Lock Menu Settings

When LOCK is enabled, user defined settings can only be changed after entering the user defined LOCK CODE. STORE THE LOCK CODE IN A SAFE LOCATION! To ensure security, lock codes can only be disabled by returning the transmitter to the factory.

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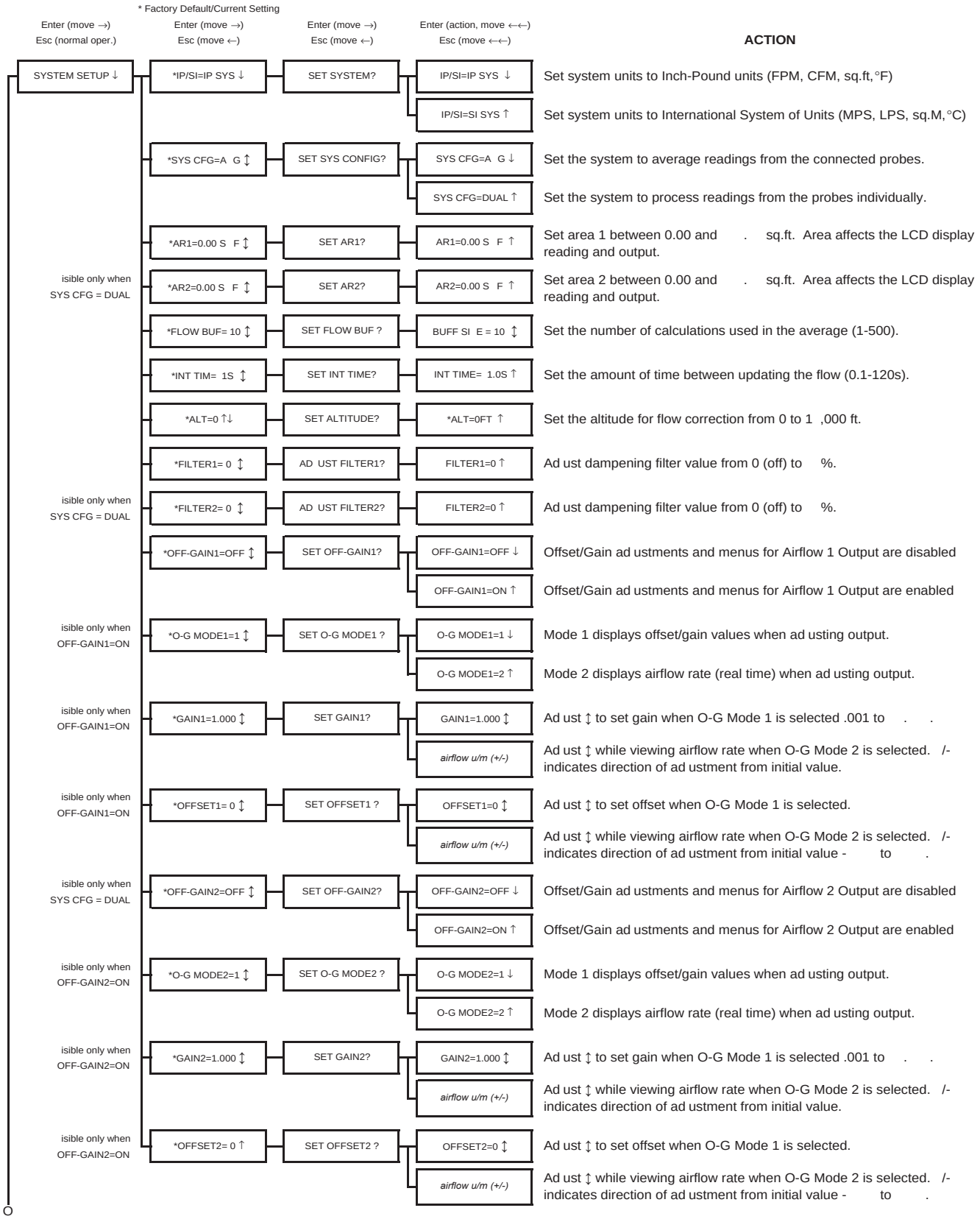
VIEWING SENSOR DATA

Data from the sensors can be displayed locally on the LCD from the Diagnostic sub-menu as detailed in Figure 15.

Setup Menu Options (Part 1 of 3) *(Refer to Table 2 for "SI" Standard International Units of Measure)*

Press and release ↑/↓ during normal operation to select



TO PART 2

Figure 15. GF-A2100/GF-A2200 Setup Menu Option ("IP SYS")

Setup Menu Options (Part 2 of 3) *(Refer to Table 2 for "SI" Standard International Units of Measure)*

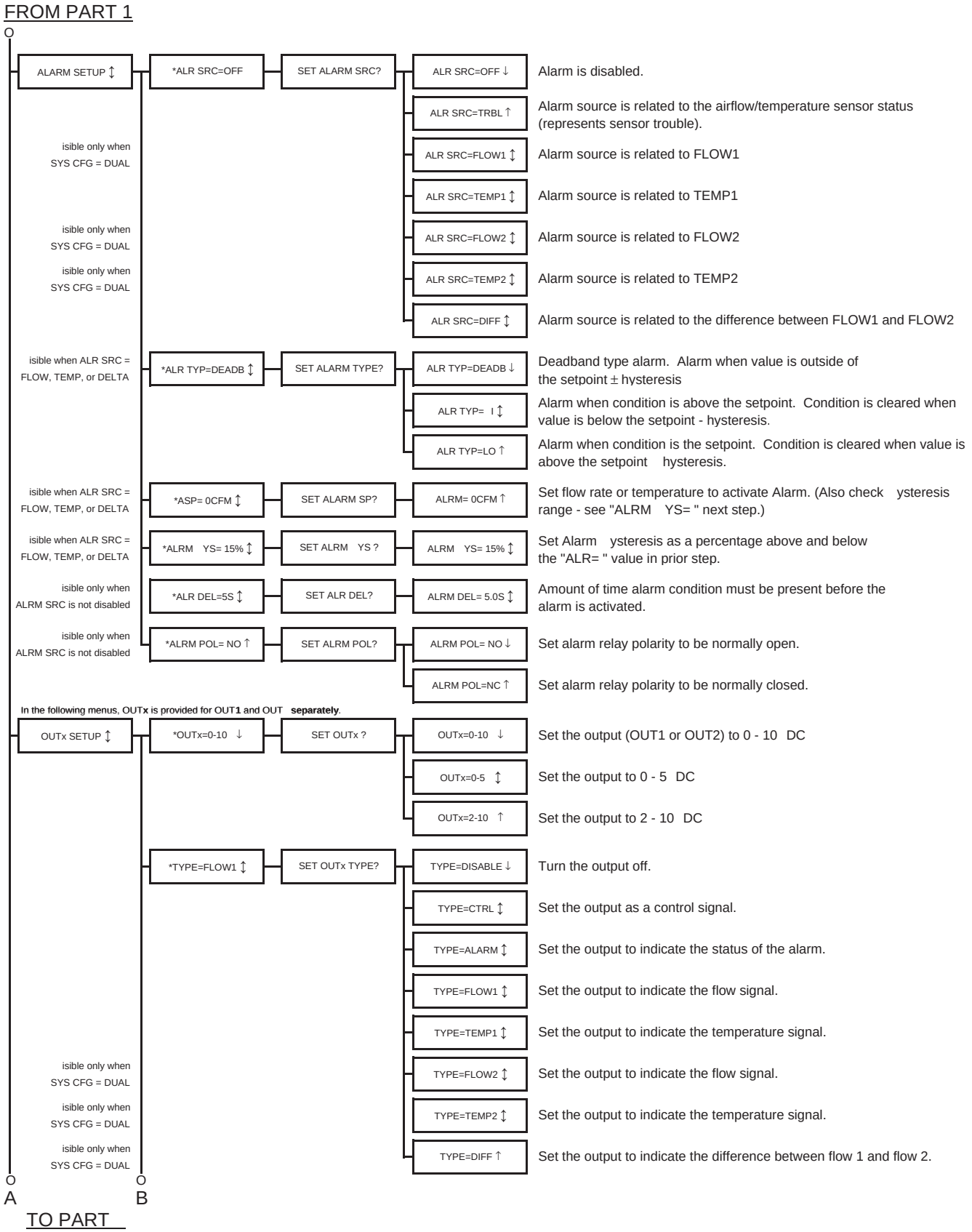


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Figure 15. (part 2 of 3) GF-A2100/GF-A2200 Setup Menu Option ("IP SYS")

Setup Menu Options (Part 3 of 3) *(Refer to Table 2 for "SI" Standard International Units of Measure)*

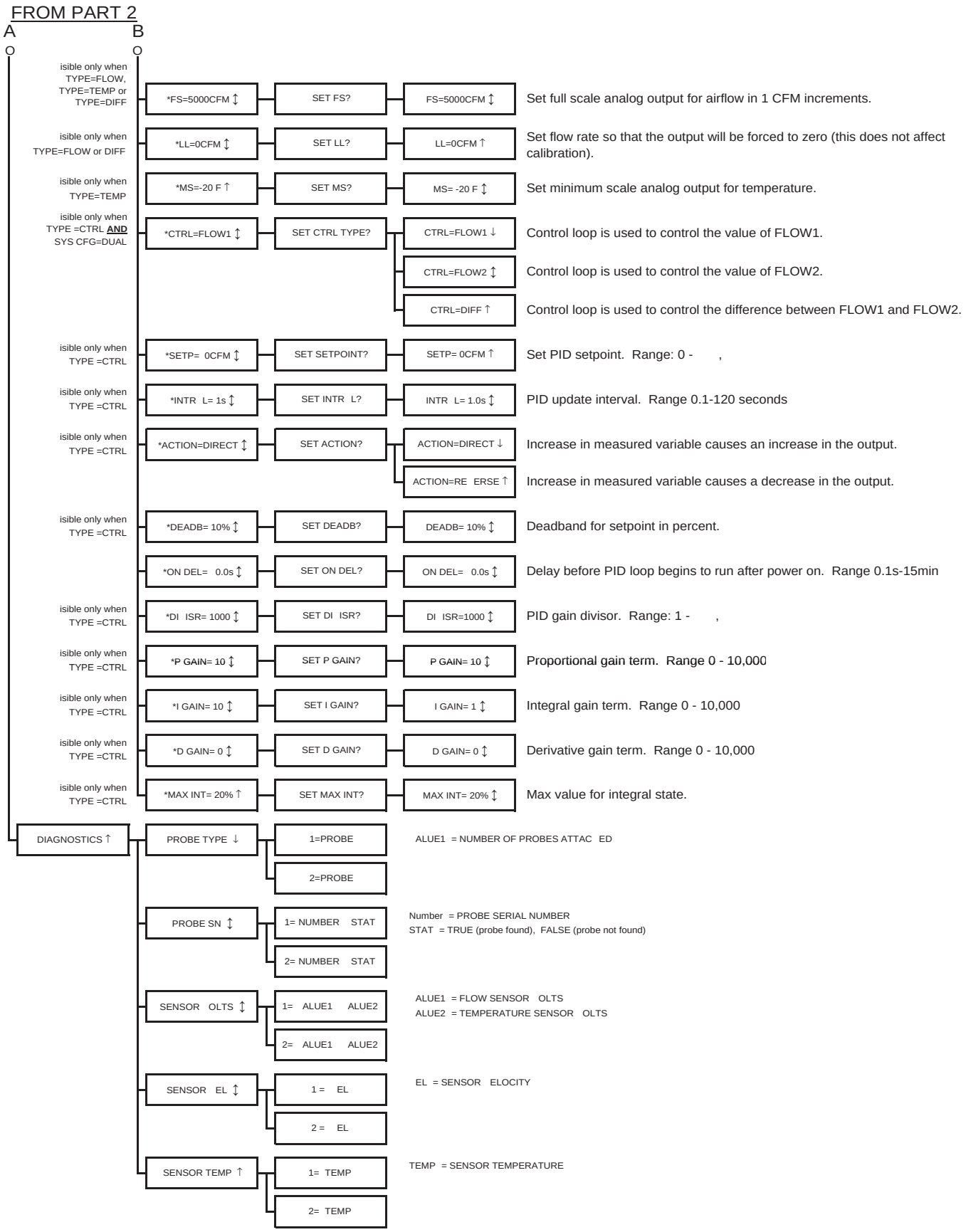

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Figure 15. (part 3 of 3) GF-A2100/GF-A2200 Setup Menu Option ("IP SYS")

TRANSMITTER CALIBRATION

The GF-A2100/GF-A2200 uses high quality industrial grade components and is designed for years of trouble-free operation. Periodic recalibration of the transmitter is not required or recommended. Transmitter field calibration verifiers are available for purchase for installations requiring periodic validation. Contact factory for additional information.

FIELD ADJUSTMENTS

The GF-A2100/GF-A2200 is factory calibrated and should not require adjustment (other than the installed altitude) when sensor probes are installed in accordance with factory application installation guidelines. Some installations however, may not meet placement guidelines, or commissioning requirements may necessitate field adjustment. Field adjustment may improve the "installed accuracy" of the GF-A2100/GF-A2200 when determining volumetric flow rates.

Altitude Correction Adjustment

The Altitude Correction Adjustment allows for correction of airflow readings at the installed site altitude and more precise readings regardless on installed altitude. Refer to the Setup Menu Options, "*ALT=" menu item in Figure 15 to set this vale to the installation altitude.

Adjusting the Low Limit Cutoff

The low limit cutoff forces the analog airflow output signal to zero whenever the measured airflow rate falls below the specified Low Limit value. This feature is useful on outside air intakes that often indicate false airflow rates, induced by transient wind gusts or when the intake damper is closed and there is no net flow across the damper. Readings of 100 FPM or more are not uncommon on many outside air intake applications when the intake damper is closed as a result of air movement in the intake plenum and not a malfunction in the airflow measuring device. Setting the low limit to a value significantly below the control setpoint and higher than the threshold flow for false wind readings simplifies control and interpretation of the airflow rate signal on many applications. To set the low limit cutoff, enter Setup menu and set "*LL={desired value}" as shown in Figure 15.

Fluctuations of airflow output signal are normal. Laboratory research indicates that dampening true fluctuations will result in poor control and a larger dead-band of operation. Therefore, the use of the dampening filters in control devices is not recommended.

Adjusting the Digital Output Filter

The digital output filter is useful for dampening signal fluctuations resulting from transient wind gusts on outdoor air intakes or excessive turbulence generated from duct disturbances. The digital output filter range can be set between 0 (OFF) and 99%. Increasing the filter percentage limits the allowable change of the output signal. To change the amount of digital filtering, enter the Setup menu and set "*FILTER={desired value}" as shown in Figure 15.

Field Calibration Wizard - Adjustment of Factory Calibration

Overview of the Field Calibration Wizard

The simple to use Field Calibration Wizard provides a one or two point menu driven field adjustment to factory calibration of the airflow signal. The Field Calibration Wizard is most useful on larger duct sizes where the sensor density is lower, and the installed accuracy uncertainty is greater. The Field Calibration Wizard allows engineers, contractors and owners to use stable and linear flow meters at a more affordable cost, where field adjustment is necessary or acceptable. This feature is especially valuable on outside air intake applications in close-coupled installations.

When evaluating the GF-A2100/GF-A2200 using other reference airflow devices, ensure that the reference measurement device and the technique used to determine the airflow rate in the field are suitable for such measurement. Select a location that is suitable for the reference measurement device, recognizing that this may not be the same location where the GF-A2100/GF-A2200 airflow station is installed. The inherent accuracy of the field reference measurement will not be better than ±5% of reading and measurement uncertainty can often exceed ±10%. Do not adjust the output of the GF-A2100/GF-A2200 if the difference between the transmitter and the field reference measurement is less than 10%. The following paragraphs detail use of the Field Calibration Wizard.

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Engaging and Using the Field Calibration Wizard

To engage the Field Calibration Wizard, simultaneously depress the “DOWN” and the “ENTER” buttons at any time during normal operation. Figure 16 provides details of the FIELD CAL WIZARD menu and its use in applications for one/two point adjustment of factory calibration. Note that the flow rate units of measure will be displayed in lower case letters on the LCD display, indicating that the transmitter is operating with the Field Calibration Wizard engaged. If you wish to disengage the Field Calibration Wizard and return to normal factory calibration, simultaneously depress the “DOWN” and the “ENTER” buttons at any time during normal operation and set Field Calibration Wizard OFF as shown in Figure 16.

NOTE:
Once the airflow station has been calibrated in this manner, the Field Calibration Wizard must remain engaged.

Navigating through the Field Calibration Wizard Menu

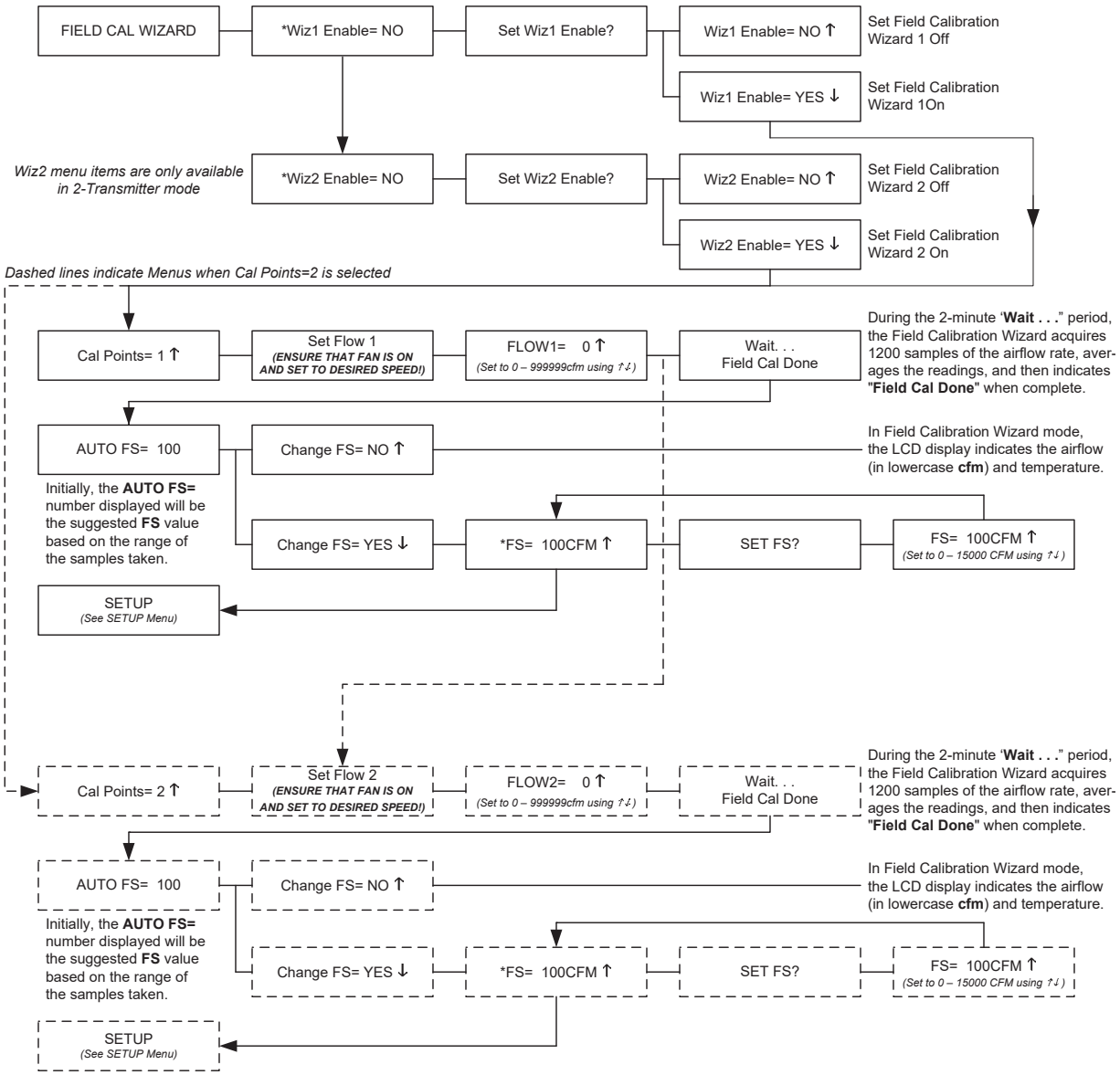

Figure 16. Field Calibration Wizard Menu (all System of Units)

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MAINTENANCE

When transmitter and probe(s) are installed in accordance with recommended guidelines, instrument difficulties are rare. Issues can be easily resolved by viewing Diagnostic data from the Diagnostic Menu (Figure 15) and by proceeding through the troubleshooting guide of Table 4.

Troubleshooting

Table 4. Troubleshooting

Problem	Possible Cause	Remedy
No LCD display indication and the green ACT LED on the main circuit board is not illuminated.	Power is not available at transmitter.	Apply 24VAC power to the transmitter.
	Improper supply voltage to the power input terminal block.	Ensure that 24VAC power is connected at terminal 7 (ground at terminal 6) of the Wiring Terminal Block and that with power applied to the transmitter, voltage is between 22.8 and 26.4 VAC.
	Blown fuse.	Check power wiring. Ensure that multiple devices wired on a single transformer are wired "in-phase". Replace fuse only after the problem has been identified and corrected, using an identical 1.0 amp, fast-acting fuse .
No LCD display indication and the green ACT LED on the main circuit board is flashing.	LCD contrast too low.	Adjust “LCD Contrast” potentiometer on the main circuit board to improve display.
The LCD display is scrambled or there is no LCD display indication after touching the switches, LCD display or circuit board.	Static electricity.	Touch an earth-grounded object, such as a duct, to discharge static electricity then reset the power. Avoid direct contact with the LCD display or circuit board.
The LCD display indicates "No Probes".	Power applied to transmitter before sensor probe was connected.	Cycle 24VAC power "OFF" and then back "ON" to the transmitter.
The LCD display indicates "Too Many Sensors".	Wrong probe connected to transmitter.	Verify proper sensor probe/connection to transmitter.
The last character of the flow rate units is displayed as a lower case letter. (Also, to indicate when the Field Calibration Wizard is engaged, the last character of the flow rate units is displayed as an upper case letter.)	The sensor detection system has detected a malfunctioning or missing sensor.	Check sensor probe cable connection. If connection is OK contact customer service for further assistance.
	Wrong probe connected to transmitter.	Verify proper sensor probe/connection to transmitter.
The green ACT LED on the main circuit board is steady "ON", not flashing.	Transmitter microprocessor is not running.	Cycle 24VAC power "OFF" and then back "ON" to the transmitter.
The green ACT LED on the main circuit board is flashing at 1-second intervals.	No problem, normal operation.	No remedy required.
The green ACT LED on the main circuit board is flashing at 2-second intervals.	The sensor detection system has detected a malfunctioning or missing sensor.	Check sensor probe cable connection. If connection is OK contact customer service for further assistance.
	Wrong probe connected to transmitter.	Verify proper sensor probe/connection to transmitter.
The transmitter indicates airflow when the HVAC system is not operating.	Sensors are sensitive and will measure very low air velocities. If a reading is indicated, there is airflow present where the airflow measuring station is located.	Do not attempt to adjust zero ("offset") since doing so will result in an error in airflow measurement. The Low Limit airflow cutoff value can be set to force the output signal to zero at very low flows.
No analog output signal is measured at Analog Output (terminals 1 and/or 3 +, terminal 2 ground) of Wiring Terminal Block of the transmitter.	Improper output wiring.	Verify that 24VAC power is connected at pin 7, and ground at pin 6 of the Wiring Terminal block. Verify that the other non-isolated devices that are supplied with the same 24VAC power source are wired in-phase (24V power to 24VAC power, ground to ground). The power input of the transmitter is a half wave rectifier, and requires that all common devices be wired with common power and ground connections.
	The Low Limit airflow cutoff value is above the actual airflow reading.	Decrease the Low Limit airflow cutoff value in the Setup Menu until it is below the actual airflow reading.
The analog output signal from the transmitter fluctuates while the airflow and/or temperature readings on the LCD are steady.	Electrical interference from other devices is creating noise in the signal wires to the host control system.	The output signal wiring must be shielded. Individually ground one or more of the following points: the signal wire shield at host controls; signal wire shield at the transmitter, or pin 6 of the Wiring Terminal block of the transmitter.
The LCD display does not match the readings indicated by the host control system.	The scaling in the host control system is incorrect.	Compare the current configuration of the transmitter with that of the host control system. Compare the minimum and full scale settings for each output by navigating through the Setup Menu.

GREENTROL STANDARD LIMITED PARTS WARRANTY

Greentrol products are warranted for 12 months from shipment. Product will be repaired/replaced free of charge as described in the Terms and Conditions of Sale.