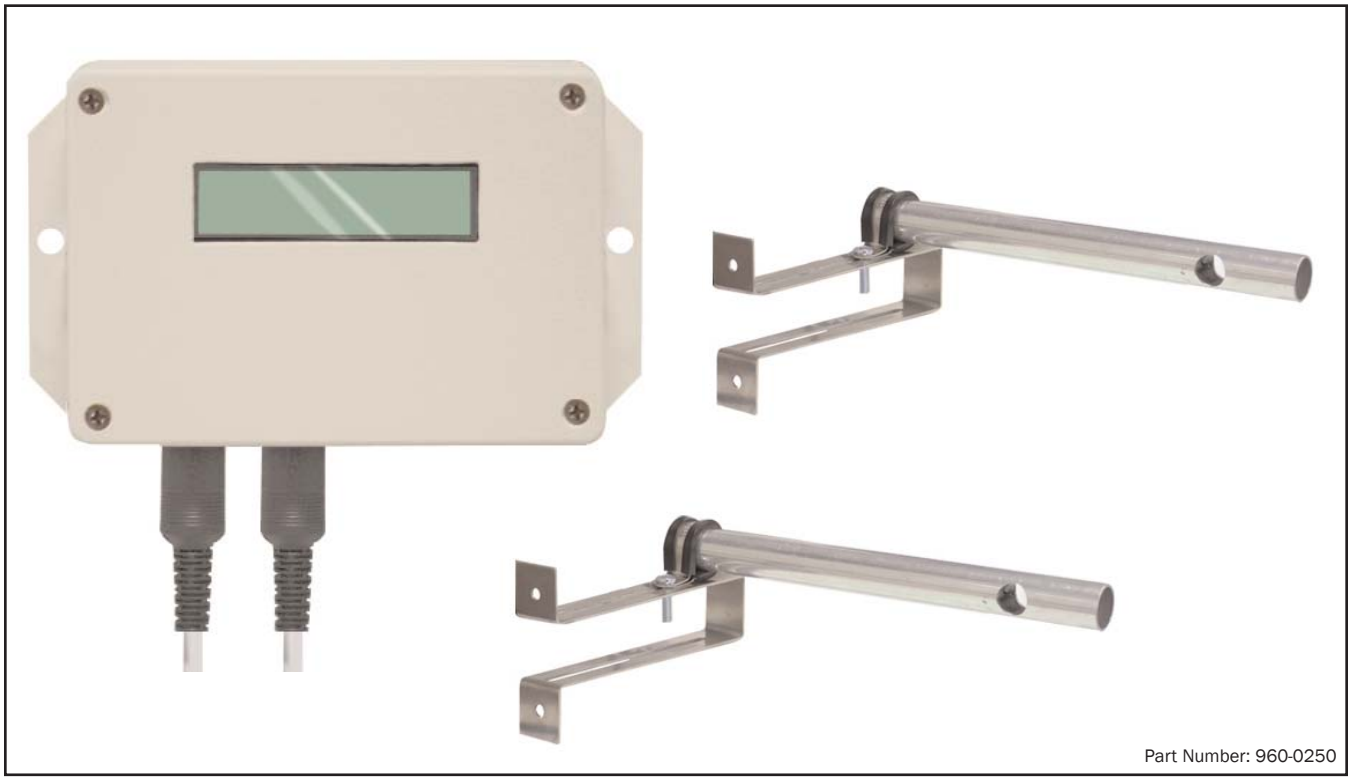
Greentrol Automation, Inc.

Installation, Operation and Maintenance Technical Manual

GF-2200-A

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

Document Name: TM_GF-2200-A_R1D



Part Number: 960-0250

TM_GF-2200-A_R1D

OEM PRODUCT NOTICE

This product is manufactured for specific and approved OEM applications only. The information contained herein is provided only for the intended application for use by the specified OEM. Questions regarding this product and its application should be directed to the OEM for resolution.

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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Insert latest changed pages (**in bold text**); remove and dispose of superseded pages.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 **22.**

Page No	Revision *	Description of Change	Date
1, 2	R1D	Updated revision from R1C to R1D.	08/26/2010
5, 9, 10, 13	R1D	Added missing references to 0-5VDC analog output option	08/26/2010
5	R1C	Changed sensor accuracy spec; corrected probe dimensions	06/23/2010
7	R1C	Corrected probe dimensions	06/23/2010
1 through 22	R1B	Re-released as revision R1B for updated units of measure, alarm output descriptions, and setup menus for consistency among products	04/14/2010
1 through 22	R1A	Initial document release.	04/12/2010

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OVERVIEW

Model GF-2200-A is a high quality economical programmable dual-probe, dual-output airflow/temperature measurement and control solution with options for analog air flow, temperature, alarm, and corresponding PID control outputs for control of airflow set points. It is designed for installation in specified critical OEM applications where precise air flow and temperature measurement (down to zero flow) at two locations, and available corresponding PID controls for air flow set point are required. The instrument includes two factory calibrated probes and an advanced microprocessor controlled transmitter/controller with sensor accuracy of 3% of reading typical (4% maximum)* from 0 - 2,000 FPM.

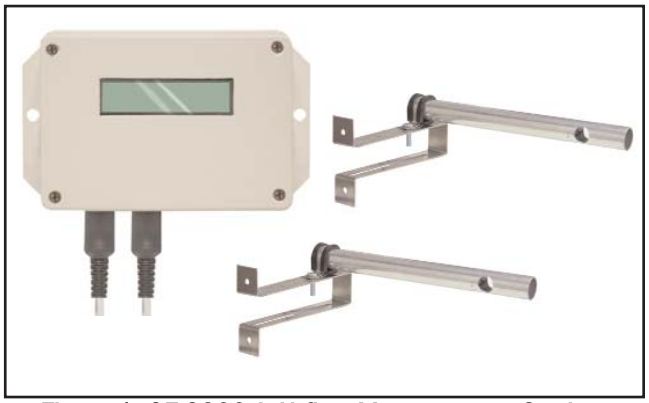

Figure 1. GF-2200-A Airflow Measurement Station

Sensor probes are equipped with high reliability bead-in-glass heated thermistor elements factory calibrated to NIST traceable standards from zero flow to 2,000 FPM. The transmitter is fully independent of the probes and does not require field matching to them. 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 the 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 GF-2200-A transmitter provides an analog output with selectable 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 UL94-5VA 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 Probes

- Probe Construction: Type 6063 aluminum
- Mounting Brackets: Standard brackets and custom designed mounting solutions available
- Probe Dimensions: 0.75 in [19.05 mm] diameter
- Standard Size: 8 inches [203.2 mm]
- Probes / Sensing Nodes: 2 probes / 2 sensing nodes per probe max.
- Probe/Transmitter Interconnection: Cable with circular DIN plug (Cable options are available for PVC or durable FEP plenum-rated jacket and cable 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% of full scale
- 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 (N.O.) contacts, 30VDC/24VAC 3 Amps maximum, or direct LED drive (15 mA typical)

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

OEM Warranty

- 12 months from shipment to OEM only.

* 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.

GF-2200-A FEATURES

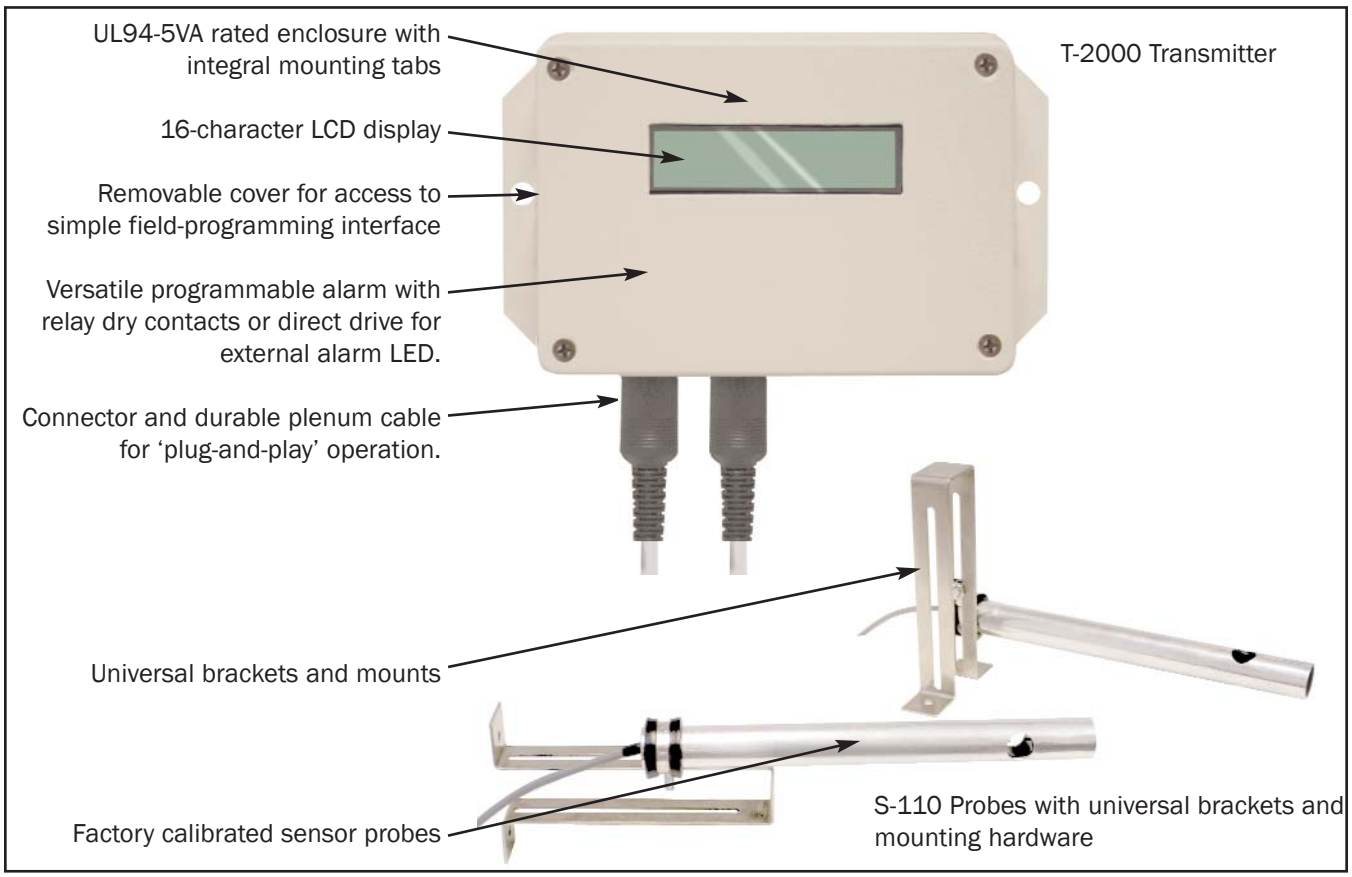

Figure 2. GF-2200-A Features

GF-2200-A INSTALLATION

Installation of the GF-2200-A consists first of installing the sensor probes, then installing the transmitter, and last, installing the power and analog signal wiring to the airflow station. The following paragraphs detail each of the individual procedures required for installation of the GF-2200-A. Convenient check boxes are included to ensure that each step is completed.

PREPARATION FOR INSTALLATION

1. ☐ Determine the GreenTrol factory specified location for the GF-2200-A airflow measuring station transmitter and probes as indicated on the engineer's plans. Ensure that the cable supplied with the probes 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 cables will reach the transmitter after allowance for routing and securing the cable.
2. ☐ Carefully open the GF-2200-A package and inspect transmitter and probes for damage. If damage is noted, immediately file a claim with carrier. Proceed to install the GF-2200-A sensor probes as follows:

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GF-2200-A Sensor Probe Installation

1. ☐ The sensor probes will be installed at the GreenTrol factory specified locations using the integral universal brackets attached as shown in Figure 3. The universal brackets consists of a rubber probe clamp that is attached to the bracket using the included hardware. The probe 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 the probes to the clamps and brackets 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 of the two probes brackets at the GreenTrol factory specified locations where the probes will be installed.
3. ☐ Drill holes suitable for the hardware that will be used to secure each bracket at two locations.
4. ☐ Carefully align the bracket mounting holes with the holes prepared in the previous step.
5. ☐ Secure the probe end brackets and probe in two places through each bracket using suitable hardware. Adjust the bracket mount and/or probe clamp so that the airflow arrows printed on the probes are oriented in the direction of actual airflow.
6. ☐ Route the sensor probe cable to the planned transmitter site and install transmitter as outlined in the TRANSMITTER INSTALLATION procedure that follows.

PROBE AND BRACKET MECHANICAL DETAIL

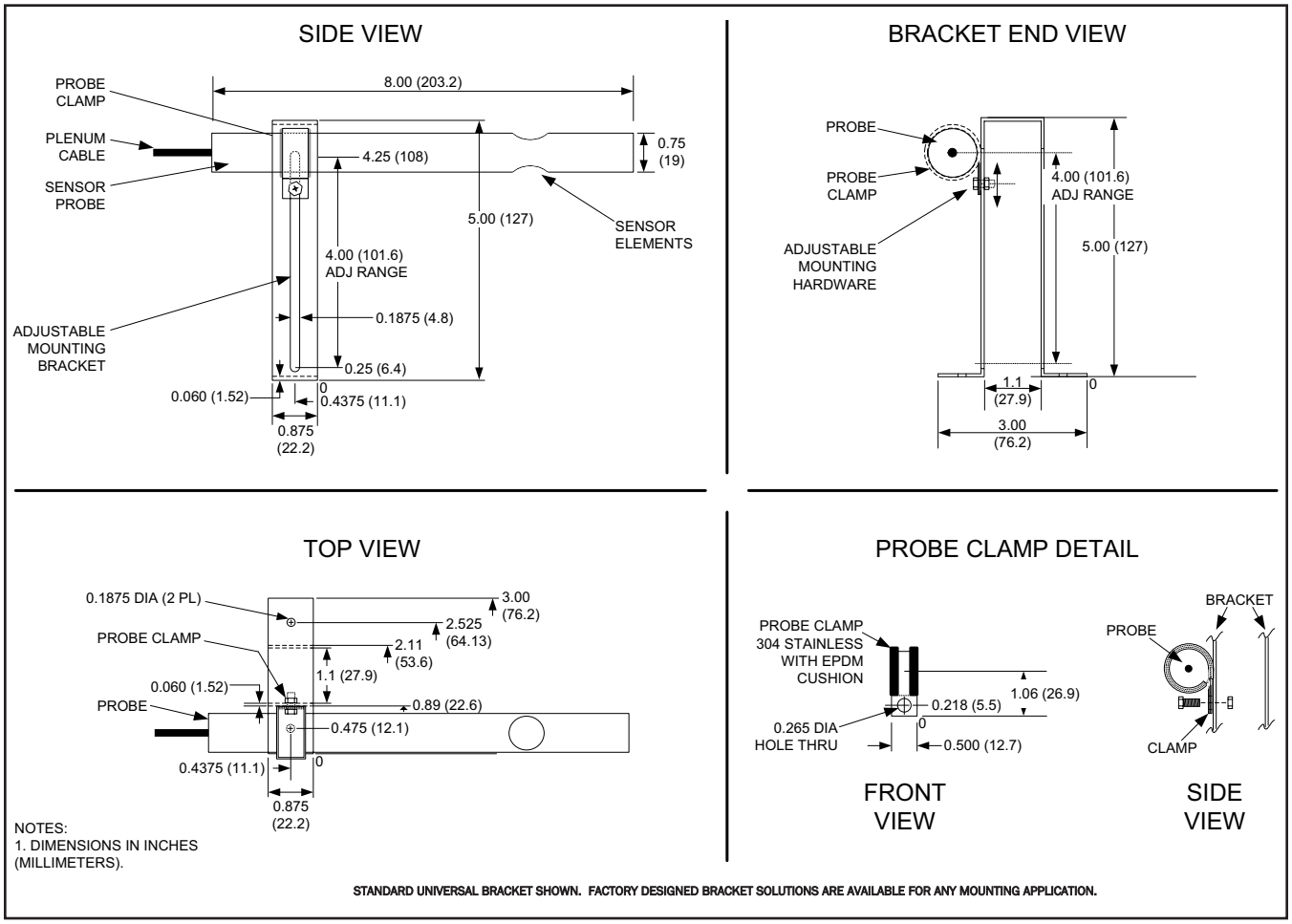

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Figure 3. GF-2200-A Sensor Probe Mechanical Detail

GF-2200-A TRANSMITTER INSTALLATION

The GF-2200-A 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-2200-A transmitter.

Mount the transmitter upright in a field accessible location with sufficient service clearance to permit cover removal. The enclosure (Figure 4) 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 the sensor probe cables to reach the receptacles 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 4 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.

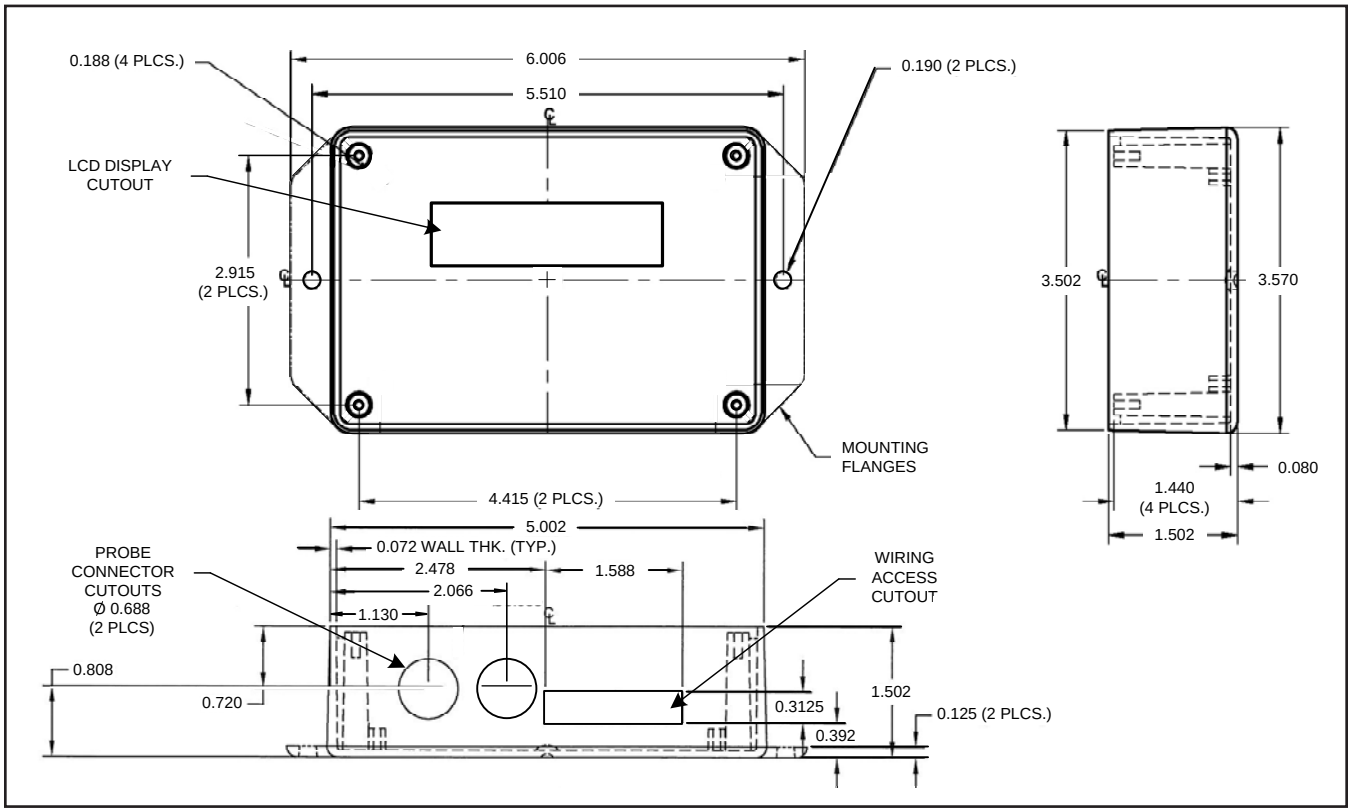


Figure 4. GF-2200-A Transmitter Mechanical Detail Drawing

GF-2200-A TRANSMITTER WIRING

Transmitter wiring consists of connecting the 24VAC input power, the analog output signal wires and optional alarm output wires at the GF-2200-A. Refer to Figures 5 and 6 for additional detail. Following installation, the airflow measurement station is ready for operation. Custom setup options (other than the default values) can be entered as outlined in the transmitter Setup Procedure.

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 5.
2. ☐ Remove cover from the transmitter enclosure. Observe the following precautions when wiring the GF-2200-A:

CAUTION

⚠ **To prevent damage to the GF-2200-A, 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 output signal grounds at terminal 2. If an isolated output is required, a dedicated isolation transformer must be provided to power the GF-2200-A.**

⚠ **The GF-2200-A 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, pin 7 24VAC power to other device power), or independent isolation transformers must be provided for each non-isolated device.**

⚠ **The GF-2200-A 24VAC ground and analog output signal returns are common. Therefore it is recommended that the analog output to the BAS control interface be connected using TWO separate twisted shielded pairs 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 5 and 6, observing the previous wiring precautions.

Analog Output Connections

The GF-2200-A provides two analog output signals that can be configured as 0-10VDC, 0-5VDC or 2-10VDC and are capable of driving up to 20mA (maximum). The 24VAC return ground connection is shared with the analog output signal ground (GND). If the analog outputs must be isolated from the 24VAC return, a dedicated isolation transformer must be provided to power the GF-2200-A.

⚠ **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 output signal wire at terminal 3, and the signal ground at terminal 2 as shown in Figures 5 and 6 while observing the previous wiring precautions.
5. ☐ Connect OUT2 analog output signal wire at terminal 1, and the signal ground at terminal 2 as shown in Figures 5 and 6 while observing the previous wiring precautions.

Alarm Output Connections

The GF-2200-A provides an alarm output that can be configured as relay dry contacts, or as direct drive (15 mA typical) for an external LED indicator. The alarm output type is set using the LED PWR jumper on the GF-2200-A circuit board as shown in Figure 5. With the LED PWR jumper on, 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, alarm output is set to provide relay dry contacts between terminals 4 and 5 (contacts rated at 30VDC/24VAC 3 amps maximum). Alarm can be set as contact close or open on alarm as detailed in the Setup menu later in this manual.

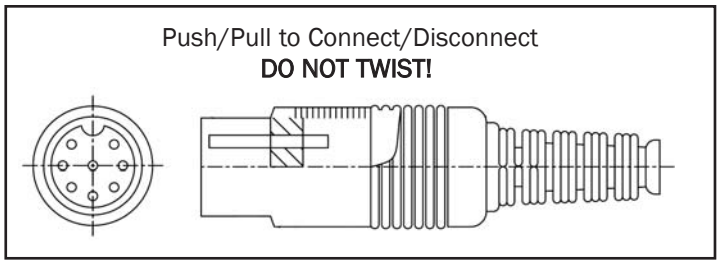
☐ For external LED drive alarm output, ensure that the LED PWR jumper is installed, and connect the LED anode (+) to terminal 4, and cathode (-) at terminal 6.

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 by pushing it into the keyed circular receptacle (as shown below) located at the bottom of the GF-2200-A 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 probes 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-2200-A will initiate a brief self-test, indicated by dashed lines on the LCD, and then will automatically display airflow and temperature. Refer to the Set up menu detail and descriptions later in this manual for a complete description of optional GF-2200-A programming features.

GF-2200-A Operating Modes

The GF-2200-A provides two 12-bit (4096 discrete states) linear analog outputs. Outputs can be configured as follows:

MODE	OUTPUT 1	OUTPUT 2
FLOW + TEMP	OUT1=PROBE 1+2 AVG FLOW	OUT2=PROBE 1+2 AVG TEMP
FLOW + PID	OUT1=PROBE 1+2 AVG FLOW	OUT2=PID CONTROL SIGNAL FOR PROBE 1+2 AVG FLOW
FLOW + FLOW	OUT1=PROBE 1 FLOW	OUT2=PROBE 2 FLOW
ERV	OUT1=OA (Outside Airflow)	OUT2=EA (Exhaust Airflow)
PID + PID	OUT1=PID SIGNAL FOR PROBE 1 FLOW	OUT2=PID SIGNAL FOR PROBE 2 FLOW

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

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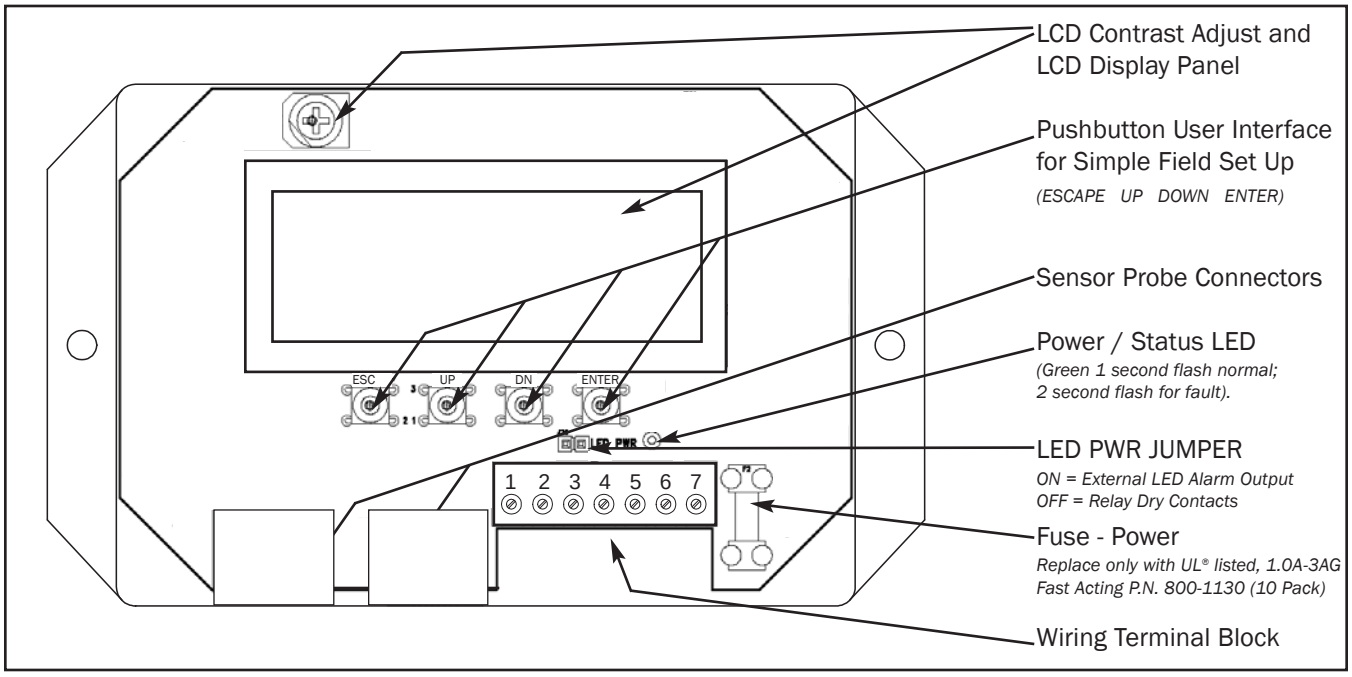
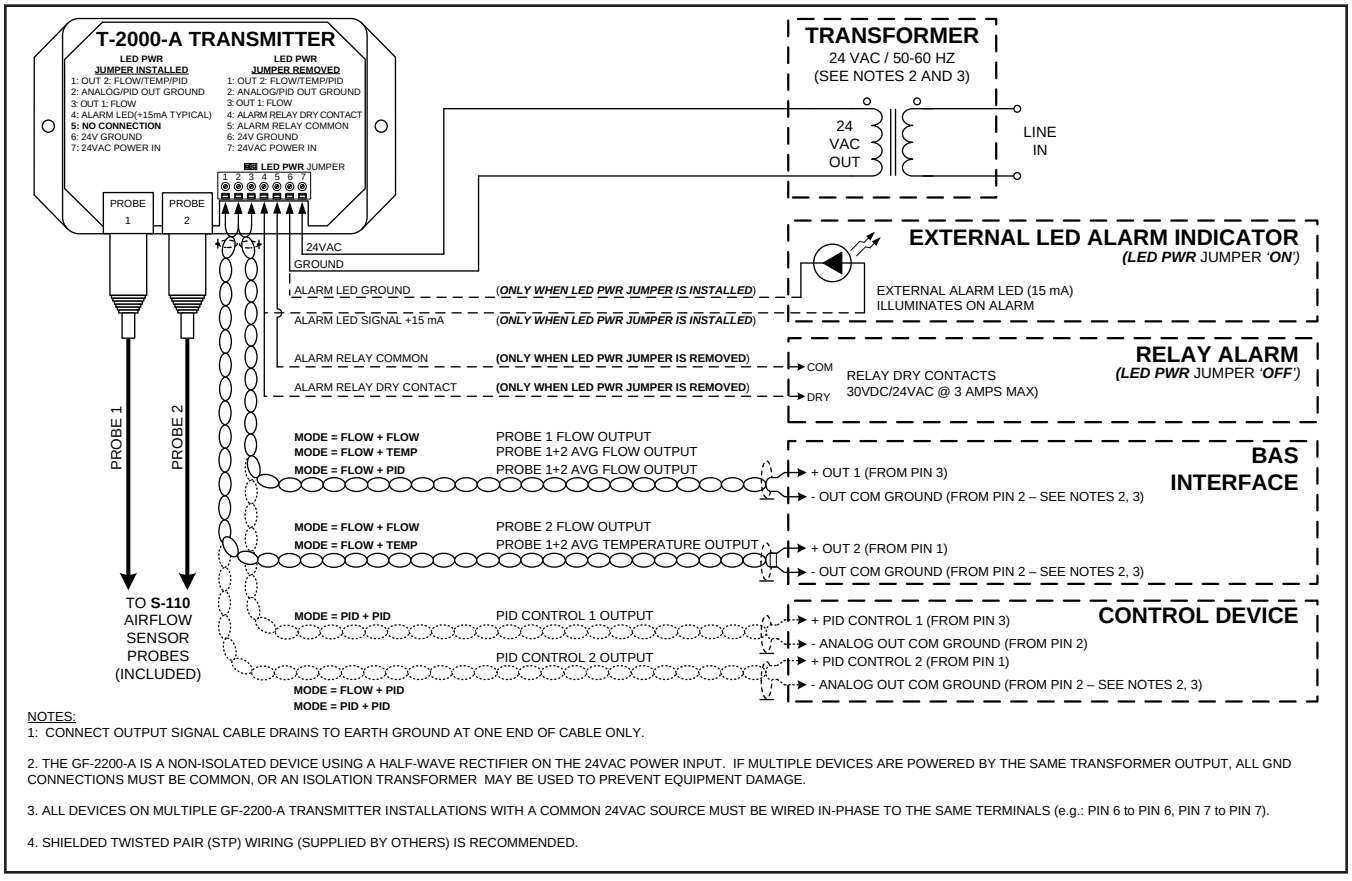


Figure 5. GF-2200-A Main Circuit Board Detail



NOTES:

1: CONNECT OUTPUT SIGNAL CABLE DRAINS TO EARTH GROUND AT ONE END OF CABLE ONLY.

2. THE GF-2200-A IS A NON-ISOLATED DEVICE USING A HALF-WAVE RECTIFIER ON THE 24VAC POWER INPUT. IF MULTIPLE DEVICES ARE POWERED BY THE SAME TRANSFORMER OUTPUT, ALL GND CONNECTIONS MUST BE COMMON, OR AN ISOLATION TRANSFORMER MAY BE USED TO PREVENT EQUIPMENT DAMAGE.

3. ALL DEVICES ON MULTIPLE GF-2200-A TRANSMITTER INSTALLATIONS WITH A COMMON 24VAC SOURCE MUST BE WIRED IN-PHASE TO THE SAME TERMINALS (e.g.: PIN 6 to PIN 6, PIN 7 to PIN 7).

4. SHIELDED TWISTED PAIR (STP) WIRING (SUPPLIED BY OTHERS) IS RECOMMENDED.

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Figure 6. GF-2200-A Wiring Diagram Detail

GF-2200-A Alarm Options and Description

The programmable alarm feature consists of a user selectable alarm output type (relay dry contacts or LED drive) that can be configured in the Setup menu as an airflow alarm or system trouble alarm. The alarm output type, either external LED driver (15 mA typical), or relay dry contacts, is determined by the LED PWR jumper on the GF-2200-A transmitter circuit board (Figure 5).

As an airflow alarm, the alarm can be set to activate when airflow is outside of a user preset high or low limit, or outside of a programmed operating range (dead band). An alarm hysteresis setting is used to establish alarm activity as a percentage above and/or below the alarm setpoint value (default hysteresis value is 15%).

As a system trouble alarm, the alarm can be set to activate in the event of a fault detected in the sensor or transmitter. The alarm output type, either external LED driver (15 mA typical), or relay dry contacts, is determined by the LED PWR jumper on the GF-2200-A transmitter circuit board (Figure 5).

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

ALR TYP=DEADB	Sets alarm as Deadband type, where airflow outside of the range established by ASP= and ALRM HYS= settings activates the alarm. Alarm resets when airflow returns to a value within this range.
ALR TYP=HI	Sets alarm as Hi Limit type, where airflow above the ASP= value activates the alarm. Alarm resets when airflow decreases below the value of ASP minus ALRM HYS.
ALR TYP=LO	Sets alarm as Low Limit type, where airflow below the ASP= value activates the alarm. Alarm resets when airflow increases above the value of ASP plus ALRM HYS.
ALR TYP=TRBL	Sets alarm mode to monitor the transmitter and sensor probe, and activate the alarm in the event of a fault.
ALR TYP=OFF	Alarm output is disabled (OFF).
ASP=	Alarm setpoint airflow value that establishes alarm activity in conjunction with the other alarm options.
ALRM HYS=	Sets airflow range expressed as a percentage of ASP value. For DEADB alarm type, airflow outside of this range will trigger the alarm. For HI (and LO) alarm types, ALRM HYS value sets the range below (or above) the ASP value where the alarm remains active once triggered.
ALRM DEL=	Delay period (in seconds) that the alarm condition must exist before the alarm is activated.
ALRM POL=NO/NC	Sets relay dry contact configuration at GF-2100 terminals 3 and 4; NO= Normally Open/Contacts close on alarm; NC= Normally Closed/Contacts open on alarm.

The absolute airflow alarm setpoint value and hysteresis are set in separate sub-menus. In addition, to prevent spurious and nuisance alarm triggers, an alarm delay option permits setting a time period that the alarm condition must exist before the alarm output is activated. An alarm polarity sub-menu sets the relay dry contact alarm type, either contacts open or contacts close on alarm.

The accuracy of the GF-2200-A is “percent of reading”, and is therefore not dependent upon the full scale output range selected. However, if desired, factory default full scale output range setting can be reconfigured in the field (see: CHANGING FACTORY DEFAULT SETTINGS).

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Converting the Analog Output Volumetric Flow to Airflow Velocity

The GF-2200-A analog output (and LCD display) indicate airflow volume in CFM/litres per second. At each power up, the transmitter will check to see if the free area has already been set in the setup menu (*AR=____SQF). If it has not been set (or if it is set to the default value of 0.00 SQF), the user is prompted to input the area. When the area is set to 1 square foot (AR=1.00 SQF), the LCD display and analog output will indicate equivalent airflow velocity in FPM. Table 1 shows analog output scaling and conversions for velocity and volumetric flow.

Table 1. GF-2200-A Analog Output Conversion

TO CONVERT ANALOG OUTPUT TO	ANALOG OUTPUT SCALING		
	0-10 VDC	0-5 VDC	2-10 VDC
Flow Rate (CFM/LPS)	Analog Output x FS x 0.1	Analog Output x FS x 0.2	(Output Voltage - 2) x FS x 0.125
Velocity (FPM)	Analog Output x FS x 0.1 / Area (SQF)	Analog Output x FS x 0.2 / Area (SQF)	(Analog Output - 2) x FS x 0.125 / Area (SQF)
Velocity (MPS)	Analog Output x FS x 1000 x 0.1 / Area (SQM)	Analog Output x FS x 1000 x 0.2 / Area (SQM)	(Analog Output - 2) x FS x 1000 x 0.125 / Area (SQM)

NOTES:
FS is the output full scale analog output value set in the SETUP MENU (**FS=**).

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 2-10VDC) can be provided by the GF-2200-A 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, simultaneously press and release the "**ENT**" and "**ESC**" buttons within 10 seconds of application of 24VAC power. Use the "DOWN" arrow button until "***TESTOUT=0%**" is displayed. 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-2200-A will now provide the selected analog output value. To cancel the Test output, press the "ESC" button to return to normal operation.

GF-2200-A 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.

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-2200-A.

At initial power up following self-test, the GF-2200-A transmitter prompts for the measurement mode be used for the two probes and two outputs (FLOW/TEMP, FLOW/PID, FLOW/FLOW, ERV or PID/PID). Once the mode is selected, the user is then prompted to enter the free area where each probe is located (AR=____SQF). No additional field configuration is necessary unless the measurement mode or output signal type is changed. The default analog output signal type is set to 0-10VDC. The GF-2200-A must be properly wired and configured based on the BAS system network protocol. Review the previous sections for specific wiring instructions and precautions that must be observed.

Transmitter Initialization Mode

The GF-2200-A 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 Mode*. Transmitter initialization should only be engaged if one of the menu items shown in Figure 7 requires change. To engage the *Initialization Mode*, simultaneously press and release the "ENTER" and "ESC" buttons during the first 10 seconds of transmitter power-up (indicated by "- - - - - - - -"). Navigate through the menus as shown in Figure 7.

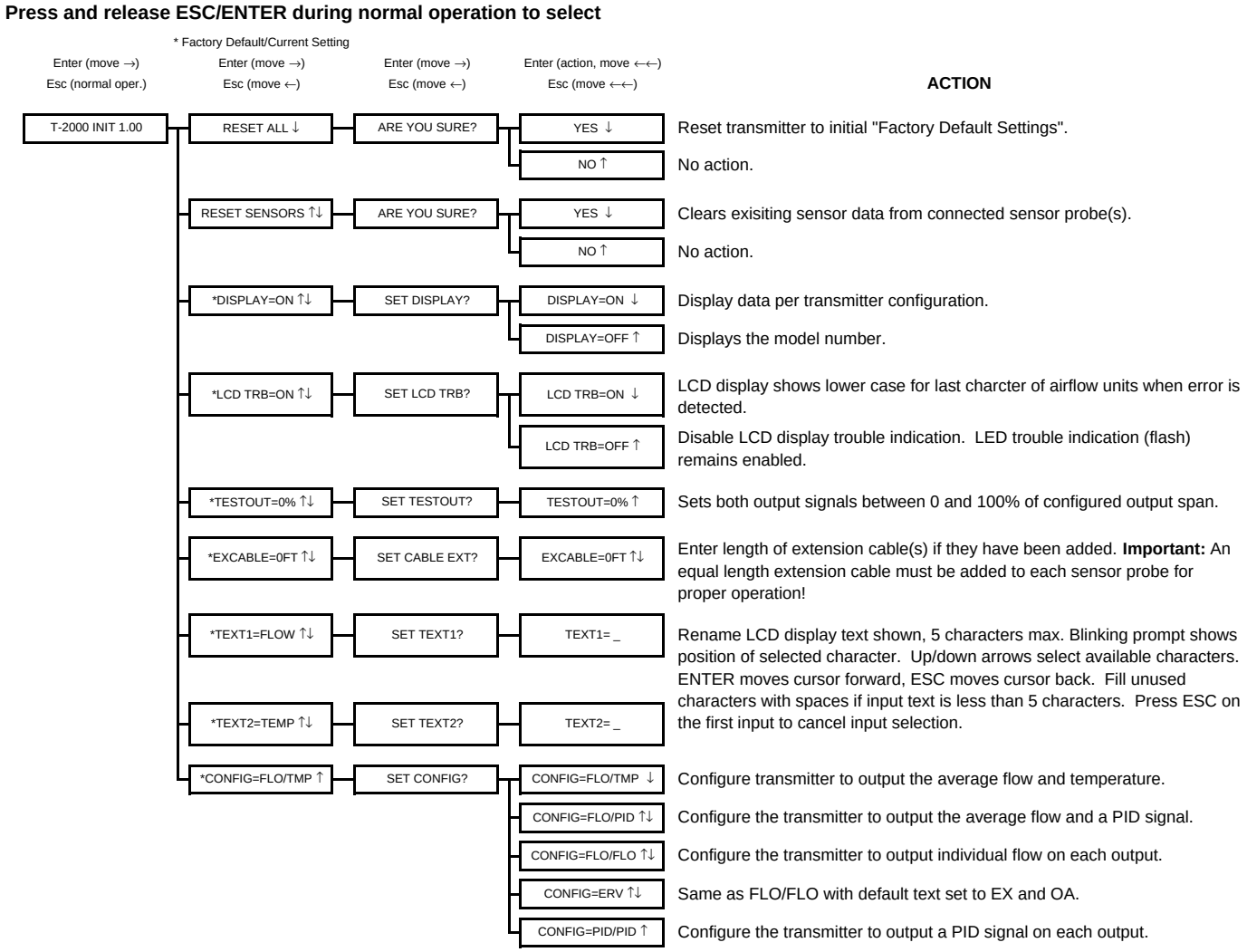

Figure 7. Transmitter Initialization Menu

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Changing the System of Units

The GF-2200-A 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 DOWN arrow, scroll until "IP/SI UNITS" is indicated on the LCD display. Figure 8 shows the System of Units sub-menu. 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 the Setup Menu is shown in IP System Of Units. When SI System of Units is selected, the units of measure abbreviations shown in the menus changes 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	"SI" System of Units LCD Display	Description
FPM	Feet per minute	MPS	Meters per second
CFM	Cubic feet per minute	LPS	Liters per second
SQF	Square feet	SQM	Square meters
F	Fahrenheit	C	Celsius

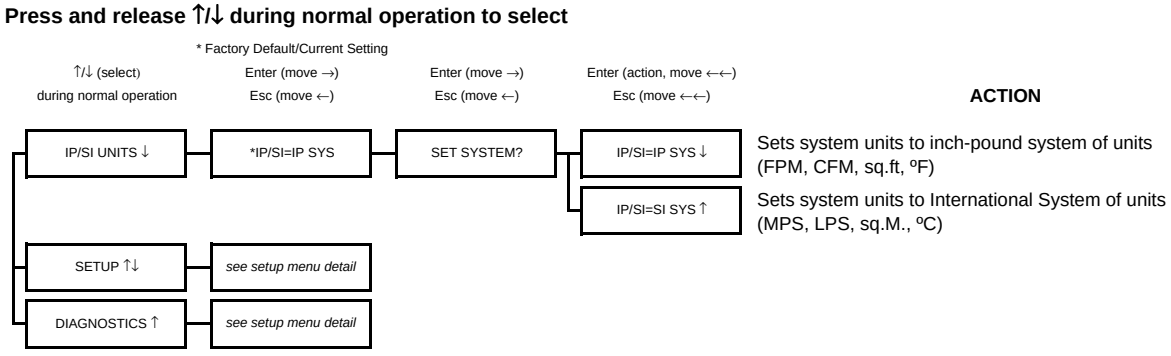

Figure 8. System of Units Menu

GF-2200-A LCD Display Notifications and Features

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

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

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

All characters are shown in lower case on LCD Display (Field Cal Wizard Engaged)

If all characters of the flow rate units on the LCD display are shown in lower case (for example cfm), this indicates that the transmitter is operating in the Field Calibration Wizard mode (see the FIELD ADJUSTMENTS - Field Calibration Wizard section of this manual).

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 10). Depending on the operating mode, the LCD will alternately display the other probe's readings in between these alarm notifications. Alarm notifications will cease when the alarm condition is cleared. For complete alarm information, refer to the **GF-2200-A Alarm Options and Description** section of this manual.

LCD Scrolling Feature

When the transmitter mode is set to indicate the two probe outputs, the display will scroll readings between readings for the two probes. The scrolling feature can be halted at any time to display any reading simply by depressing any of the momentary pushbuttons (ESC/UP/DN/ENTER). To resume scrolling, simply hit any button once again.

Factory Default Settings

The GF-2200-A 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-2200-A. To change the Factory Default Settings, see: CHANGING FACTORY DEFAULT SETTINGS.

Table 3. Factory Default Menu Settings

Display	Description	IP Units	SI Units
*AR=	Duct free area (sq. ft.) where probe is located	0.00 SQF	0.000 SQM
*OUT1=	Analog output signal range	0-10VDC	0-10VDC
*FS=	Output signal full scale value	5,000 CFM	25 LPS
*LL=	Low limit cutoff	0 CFM	0 LPS
*OFF-GAIN=	Output Offset-Gain On/Off	OFF	OFF
*O-GMODE=	Output Offset-Gain Mode	1 (direct entry)	1 (direct entry)
*GAIN=	Output Gain factor	1.000	1.000
*OFFSET=	Output Offset factor	0.000 FPM	0.000 MPS
*FILTER=	Output Digital Noise Filter	0 (off)	0 (off)
*FLOW BUF=	Number of samples used to perform flow calculation (3 to 150)	10	10
*INT TIM=	Time between integration updates	1S	1S
*INT NUM=	Number of integrations to be acquired	1	1
*ALR TYP=	Enable and select Alarm feature	OFF	OFF
*ASP=	Alarm set point value	0 CFM	0 LPS
*ALRM HYS =	Operating range in % above and below the *ASP value, which when exceeded results in alarm activation.	15%	15%
*ALRM DEL =	Time Alarm condition exists before Alarm output is activated.	5S	5S
*ALRM POL =	Alarm relay contact configuration (normally open/normally closed)	NO	NO

PID Output Setup Menu Default Values

*AR=	Duct free area (sq. ft.) where probe is located	0.00 SQF	0.000 SQM
*SP=	PID Set Point value.	0	0
*DIV=	PID Gain Divisor.	1000	1000
*INTRVL=	PID Update interval (seconds)	1s	1s
*DEADB=	Deadband range (expressed as a percentage of Set Point value)	10%	10%
*ACTION=	Set PID control action: **Direct**=Measurement and PID output change directly proportional. **Reverse**=Measurement and PID output change are inversely proportional.	Direct	Direct
*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%

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TRANSMITTER CALIBRATION

The GF-2200-A uses high quality industrial grade components and is designed for years of trouble-free operation. Periodic recalibration of the transmitter is neither required nor recommended. Transmitter field calibration verifiers are available for purchase for installations requiring periodic validation of instrumentation. Contact factory for additional information.

CHANGING FACTORY DEFAULT SETTINGS

Setup Menu Options

The GF-2200-A transmitter is configured at the factory to be fully operational when the sensor probes are 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 10 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-2200-A can be changed by entering the setup menu through item *FS= setting (as shown in Figure 10).

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 the defined lock code is entered 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* requires a code to be entered, and then verified. Figure 9 details the Lock menu.

Press and release Escape/↑ during normal operation to select

* Factory Default/Current Setting

Esc/↑ during normal operation	Enter (move →) Esc (move ←)	Enter (move →) Esc (move ←)	Enter (normal operation) Esc (move ←←←)	ACTION
*LOCK=OFF	ENABLE LOCK?	ENT CODE= OFF ↑	VER CODE= ↑	Enter a code from 1 to 9999 to lock configuration settings without code entry. WARNING: Configuration cannot be accessed without the code. Record and save in a safe location!

Figure 9. 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.

VIEWING SENSOR DATA

Detailed data from the sensors can be displayed locally on the LCD from the diagnostic mode as detailed in Figure 10.

Setup Menu Options (Part 1 of 2)

(Refer to Table 2 for "SI" Standard International Units of Measure)

Press and release ↑/↓ during normal operation to select

* Factory Default/Current Setting

Enter (move →) Esc (normal oper.)	Enter (move →) Esc (move ←)	Enter (move →) Esc (move ←)	Enter (action, move ←←) Esc (move ←←)	ACTION
SYSTEM SETUP ↓	*IP/SI=IP SYS ↓	SET SYSTEM?	IP/SI=IP SYS ↓	Sets system units to Inch-Pound units (FPM, CFM, sq.ft, °F)
			IP/SI=SI SYS ↑	Sets system units to International System of Units (MPS, LPS, sq.M, °C)
	*FLOW BUF= 20 ↑↓	SET FLOW BUF ?	BUFF SIZE = 20 ↑↓	Set the number of calculations used in the average (3-150).
	*INT NUM= 1 ↑↓	SET INT NUMBER?	INT NUMBER= 1 ↓	Number of integrations taken on the sensor calculation. (1-500)
	*INT TIM= 1S ↑↓	SET INT TIME?	INT TIME= 1S ↑	Sets the amount of time between updating the integration (0.1-120s).
	*ALR TYP=OFF↑↓	SET ALARM TYPE?	ALR TYP=OFF ↓	
			ALR TYP=DEADB ↑↓	
			ALR TYP=HI ↑↓	
			ALR TYP=LO ↑↓	
			ALR TYP=TRBL ↑	
Visible only when ALR TYP=DEADB, HI, LO	*ASP= 0FPM ↑↓	SET ALARM SP?	ALRM= 0FPM ↑	Alarm set point flow. (Also see "ALRM HYS= " next step.)
Visible only when ALR TYP=DEADB, HI, LO	*ALRM HYS= 15% ↑↓	SET HYSTERESIS ?	ALRM HYS= 15% ↑↓	Alarm Hysteresis % above and below the "ASP= " value (prior step).
Visible only when ALRM TYP not disabled	*ALRM DEL=5S ↑↓	SET ALARM DELAY?	ALRM DEL= 5S ↑↓	
Visible only when ALRM TYP not disabled	*ALRM POL= NO ↑	SET ALARM POL?	ALRM POL= NO ↓	Set alarm relay polarity to be normally open.
			ALRM POL=NC ↑	Set alarm relay polarity to be normally closed.
Flow Output Setup (FLOW/TEMP, FLOW/PID and for dual probe models only, FLOW/FLOW)				
SETUP FLOWx ↑↓	*OUTx=0-10V ↓	SET OUTx ?	OUTx=0-10V ↓	
			OUTx=0-5V ↑↓	
			OUTx=2-10V ↑	
	*AR=0.00 SQF ↑↓	SET AREA?	AR=0.00 SQF ↑↓	Set area between 0.00 and 999.99 sq.ft. Affects LCD display and output.
	*FS=5000CFM ↑↓	SET FS?	FS=5000CFM↑↓	Set full scale analog output for airflow at 1 CFM increments.
	*LL=0CFM ↑↓	SET LL?	LL=0CFM ↑	Set low limit flow, below which the output is forced to zero (does not affect calibration).
	*OFF-GAIN=OFF ↑↓	SET OFF-GAIN?	OFF-GAIN=OFF ↓	Offset/Gain adjustments and menus for airflow are disabled
			OFF-GAIN=ON ↑	Offset/Gain adjustments and menus for airflow are enabled
Visible only when OFF-GAIN=ON	*O-G MODE=1 ↑↓	SET O-G MODE ?	O-G MODE=1 ↓	Mode 1 displays offset/gain values when adjusting output.
			O-G MODE=2 ↑	Mode 2 displays airflow rate (real time) when adjusting output.
Visible only when OFF-GAIN=ON	*GAIN=1.000 ↑↓	SET GAIN?	GAIN=1.000 ↑↓	Adjust ↑↓ to set gain when O-G Mode 1 is selected .001 to 99.999.
			airflow u/m (+/-)	Adjust ↑↓ while viewing airflow rate when O-G Mode 2 is selected. +/- indicates direction of adjustment from initial value.
Visible only when OFF-GAIN=ON	*OFFSET= 0 ↑↓	SET OFFSET ?	OFFSET=0 ↑↓	Adjust ↑↓ to set offset when O-G Mode 1 is selected.
			airflow u/m (+/-)	Adjust ↑↓ while viewing airflow rate when O-G Mode 2 is selected. +/- indicates direction of adjustment from initial value -9999 to 9999.
	*FILTER= 0 ↑	ADJUST FILTER?	FILTER=0 ↑	Adjust dampening filter value from 0 (off) to 99%.

TO PART 2

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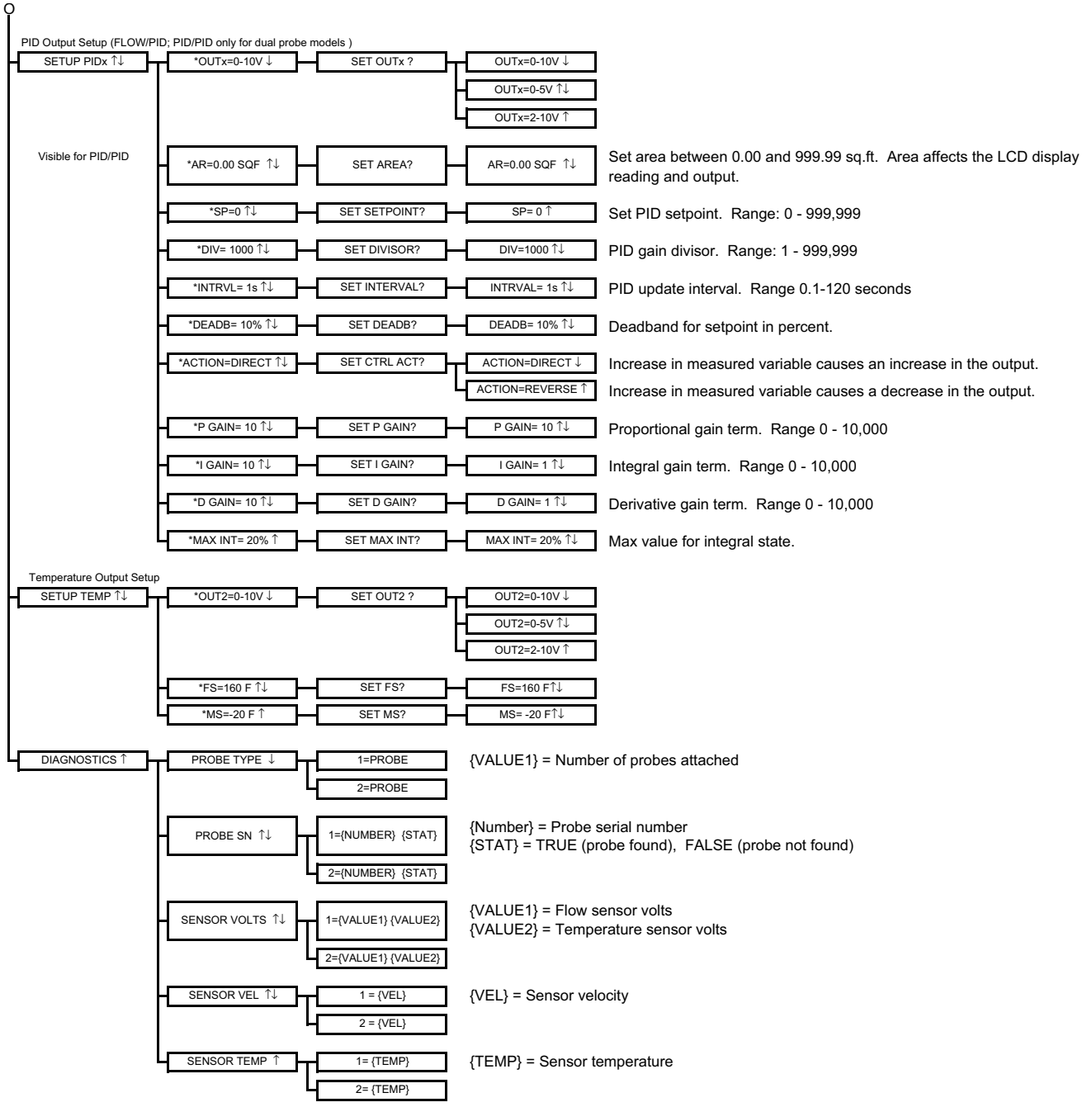
Figure 10. GF-2200-A Setup Menu Option ("IP SYS")

Setup Menu Options (Part 2 of 2)

(Refer to Table 2 for "SI" Standard International Units of Measure)

FROM PART 1



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FIELD ADJUSTMENTS

The GF-2200-A is factory calibrated and should not require adjustment 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-2200-A when determining volumetric flow rates.

Adjusting the Low Limit Cutoff

The low limit cutoff forces the output signal for the airflow rate to zero whenever the airflow rate calculated 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 and are a result of air movement in the intake plenum (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 the Setup menu and set "*LL={desired value in FPM (MPS in SI units)}" as shown in Figure 10.

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 filtering, enter the Setup menu and set "*FILTER={desired value}" as shown in Figure 10.

Field Calibration Wizard - Adjustment of Factory Calibration

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.

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-2200-A 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-2200-A 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-2200-A if the difference between the transmitter and the field reference measurement is less than 10%.

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 11 provides details of the FIELD CAL WIZARD menu its use in applications for one or 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. To disengage the Field Calibration Wizard, simultaneously depress the "DOWN" and the "ENTER" buttons at any time during normal operation and set Field Calibration Wizard OFF as shown in Figure 11.

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MAINTENANCE

When transmitter and probe 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 10) and by proceeding through the following troubleshooting guide that follows (Table 4).

Navigating through the Field Calibration Wizard Menu

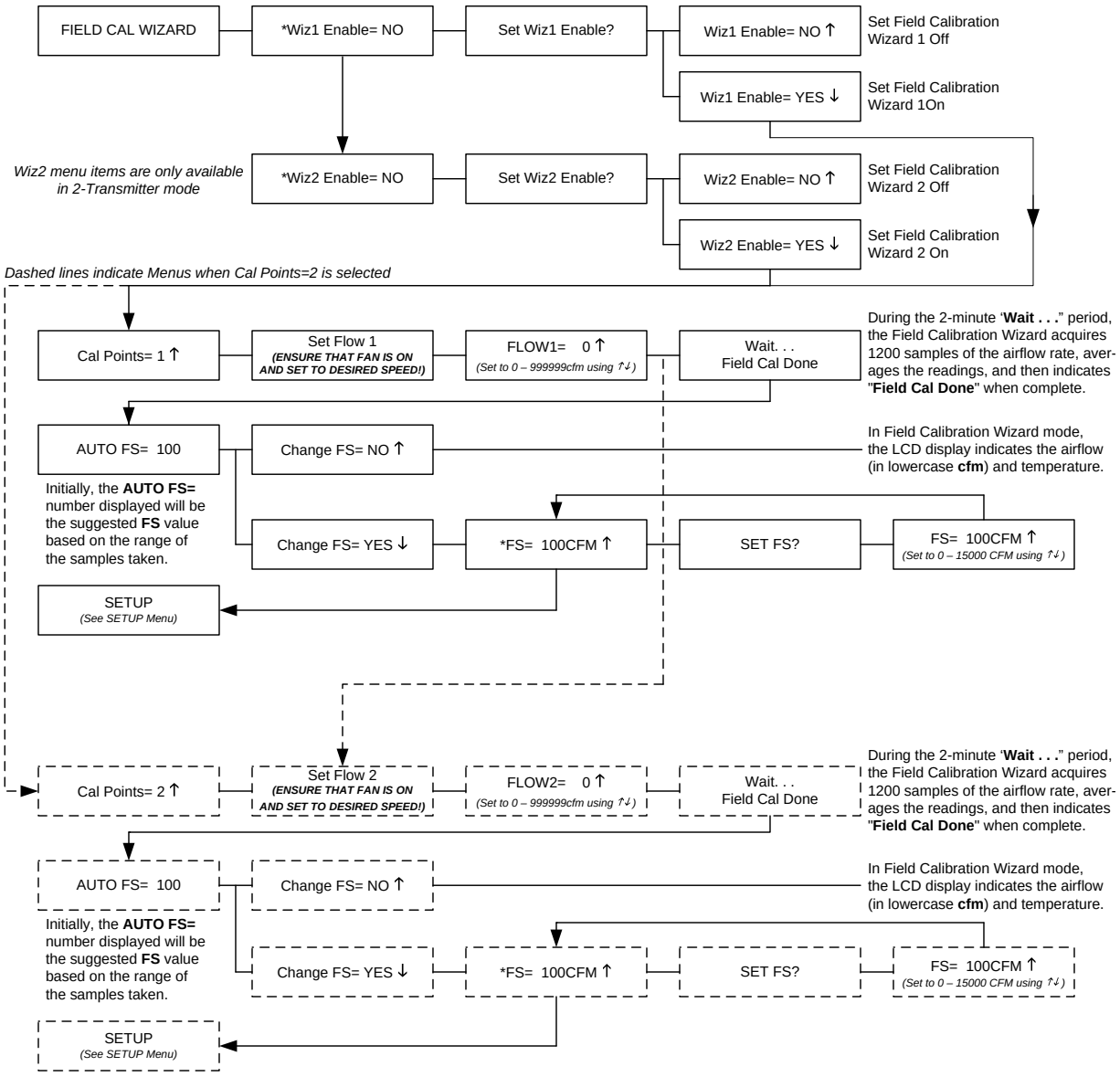

Figure 11. Field Calibration Wizard Menu (all System of Units)

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Troubleshooting

Table 4. Troubleshooting

Problem	Possible Cause	Remedy
No LCD display indication and the green Power/status 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 the voltage with the power applied to the transmitter 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 with a 1.0 amp, fast-acting fuse after the problem has been identified and corrected.
No LCD display indication and the green Power/status 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 digit of the flow rate unit is displayed as a lower 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 Power/status LED on the main circuit board is steady "ON", not flashing.	Transmitter microprocessor not running.	Cycle 24VAC power "OFF" and then back "ON" to the transmitter.
The green ‘ACT’ transmitter status LED on the main circuit board is flashing at 1-second intervals.	No problem, normal operation.	No remedy required.
The green Power/status 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.

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GREENTROL OEM STANDARD LIMITED PARTS WARRANTY

Greentrol OEM Products are warranted for 12 months from shipment to the original equipment manufacturer only. Product will be repaired/replaced free of charge as described in the Terms and Conditions of Sale.