

Installation, Operation and Maintenance Manual

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with these instructions will result in voiding of the product warranty and may result in personal injury and/or property damage.



Sure-Aire™ Electronics Features:

- LCD display with user-friendly touch panel interface
- NEMA-4/IP56 enclosure rating
- Factory calibrated
- Programmable elevation
- English or metric readings
- 24 VAC/DC or 100-240 VAC 50/60 Hz input voltage
- Part numbers and pressure ranges:
 - 386719 – 0-4.15 in. wg
 - 386720 – 0-8.30 in. wg
 - 386721 – 0-22.14 in. wg
 - 386722 – 0-41.52 in. wg
 - 386723 – 0-83.14 in. wg
 - 386724 – 0-138.40 in. wg

Pressure ranges reflect differential pressures between the fan inlet and inlet cone, not system static pressure.

- Isolated output, linear to differential pressure or volume
 - 4-20 mA
 - 2-10 VDC
- Communication protocols
 - BACnet MSTP
 - Modbus
- Temperature compensation for air density

Tools Required

- Four (4) #8-32 screws
- 1/4-inch nylon tubing (length dependent on distance between fan and Sure-Aire electronics, maximum 75 feet (23 m) each line)
- Sensor wiring for temperature sensor (if temperature sensor is being used)

Flow Accuracy – +/- 3.0% of actual flow

Transducer in Electronics

- Accuracy +/- 0.5% of full scale at 77°F (25°C)
- Pressure limit: 70 psi (1938 in. wg)
- Thermal effects: 0.015%/°F (0.027%/°C) from -13° thru 185°F (25° thru 85°C)

WARNING

Improper installation, adjustment, alterations, service or maintenance may cause injury and / or property damage, as well as possibly void the factory warranty. No person may install, operate, or maintain a Sure-Aire™ electronics without first being fully trained and qualified in the installation, operation and maintenance, and carefully reading and understanding the contents of this manual. If you have any questions about these instructions, contact your local representative.

CAUTION

Risk of electrical shock! More than one disconnect switch may be required to de-energize the equipment before servicing.

Label Information

CONFORMS TO
UL STD 51510-2-030
CERTIFIED TO
CAN/CSA STD C32.2 #1010-2-030
Intertek
3192905
Equipment For Measurement

Description: CNTRL, V2 SURE-AIRE, 0-22.14"
Fan Model: 450-APD Fan Size: 450.0000
K Factor: 536.0000 Elevation: 784.0000
P/N: 386721 Tag Mark: SF-1
Sales Order: 8317009 Agent Order #: 7PWP000896
P.O. #: 6896281/4501840282

Input power 100-240VAC 50/60Hz
OR
Input power 24 VAC or DC 6VIA MAX

35A 250vac WEIRUM LAG TB1
Line ①
Neutral ②
Earth Ground ③
F1
TB2
24 Vac or dc ④
24 Vac or dc ⑤
SIG BLU/Y
TB3
RX (+)A ①
RX (+)B ②
TX (+)Z ③
TX (+)Y ④
SIGND ⑤
Load Resistance ⑥
4-20mA (+) ⑦
2-10Vdc (-) ⑧
200-500 Ohms
Shield ⑨
Temperature Sensor ⑩

GREENHECK
Schofield, WI 54476 U.S.A. Date Code: 8/20

General Information

This instruction manual provides installation, operating, maintenance, and other information for the Sure-Aire™ electronics.

Receiving

Upon receiving the electronics, check to ensure all items are accounted for by referencing the packing list. Inspect each crate or carton for shipping damage before accepting delivery. Alert the carrier of any damage detected. The customer will make notification of damage (or shortage of items) on the packing list and all copies of the bill of lading which is countersigned by the delivering carrier. If damaged, immediately contact your local sales representative. Any physical damage to the unit after acceptance is not the responsibility of the manufacturer.

Unpacking

Verify that all required parts and the correct quantity of each item have been received. If any items are missing, report shortages to your local representative to arrange for obtaining missing parts.

Storage

Electronics are protected against damage during shipment. If the electronics cannot be installed and operated immediately, precautions need to be taken to prevent deterioration during storage. The user assumes responsibility of the electronics and any accessories while in storage. The manufacturer will not be responsible for damage during storage. These suggestions are provided solely as a convenience to the user.

The ideal environment for the storage of electronics is indoors, above grade, in a low humidity atmosphere which is sealed to prevent the entry of blowing dust, rain or snow. Temperatures should be evenly maintained between 30° to 110°F (-1° to 43°C). Wide temperature swings may cause condensation and “sweating” of metal parts. All accessories must be stored indoors in a clean, dry atmosphere.

Removing from Storage

As electronics are removed from storage to be installed in their final location, they should be protected and maintained in a similar fashion until the control goes into operation. Environmental Operation Range: -4° to 140°F (-20° to 60°C).

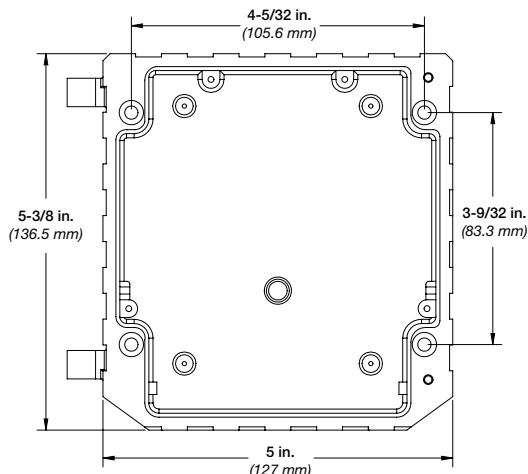
Installation

WARNING

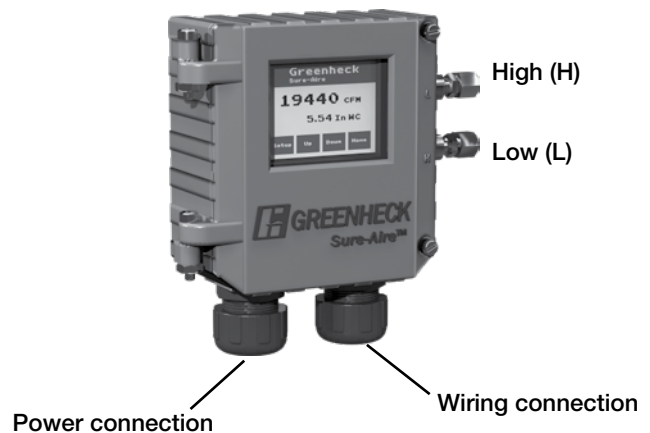
When wiring the electronics, you must follow industry standard practices for controls and protect against electrostatic discharge (ESD). Failure to exercise good ESD practices may cause damage to the electronics.

1. Mount the electronics in the vertical plane using four (4) #8-32 screws, field supplied. Open the front cover by unscrewing the two captive thumb screws to gain access to the four mounting locations.

Note: Mount the Sure-Aire™ electronics within 75 feet of the fan.



2. Use 1/4-inch nylon tubing to connect the corresponding High (H) and Low (L), 1/4-inch quick connect, pressure ports of the Sure-Aire™ electronics to the high and low pressure ports on the fan.



3. **Connect supply power:**
Two input power options are available: 24 VAC/DC or 100-240 VAC. The wiring for each can be seen on page 4. Use 1/2-inch liquid tight conduit to meet full IP rating.

Installation (continued)

4. Optional Wiring Connections:

4.1 Analog Output Signal:

Both 4-20mA and 2-10VDC are available. Connect signal wire into corresponding terminals on block TB3. If using 4-20 mA, a load resistor between 200 and 900 ohms is required, field supplied. If two or more outputs share a common connection, a signal isolator may be required.

Update settings within electronics (see page 7): Use the touch screen to select the 4-20 mA or 2-10 VDC output signal via the setup menu.

4.2. Network Protocol:

Both BACnet MSTP and Modbus RTU are enabled. Connect appropriate wiring to block TB3. Adjust switch, SW1, to 2-wire (left) or 4-wire (right) as required. Reference network protocol section for more information.

Update settings within electronics (page 7):

Switch SW1: 2-Wire/4-Wire

Select:

- Left Position = 2-Wire
- Right Position = 4-Wire

4.3. Temperature Density Compensation:

Temperature compensation can adjust airflow calculation based on changing airstream temperatures. If temperature compensation is not used, the air density value will be a function of standard air (70°F/21°C).

The supplied sensor measures the exterior temperature of the ductwork, only screw holes are required.

Mount the sensor in contact with the ductwork.

Wire the temperature sensor into corresponding terminals on block TB3 (wiring supplied by others).

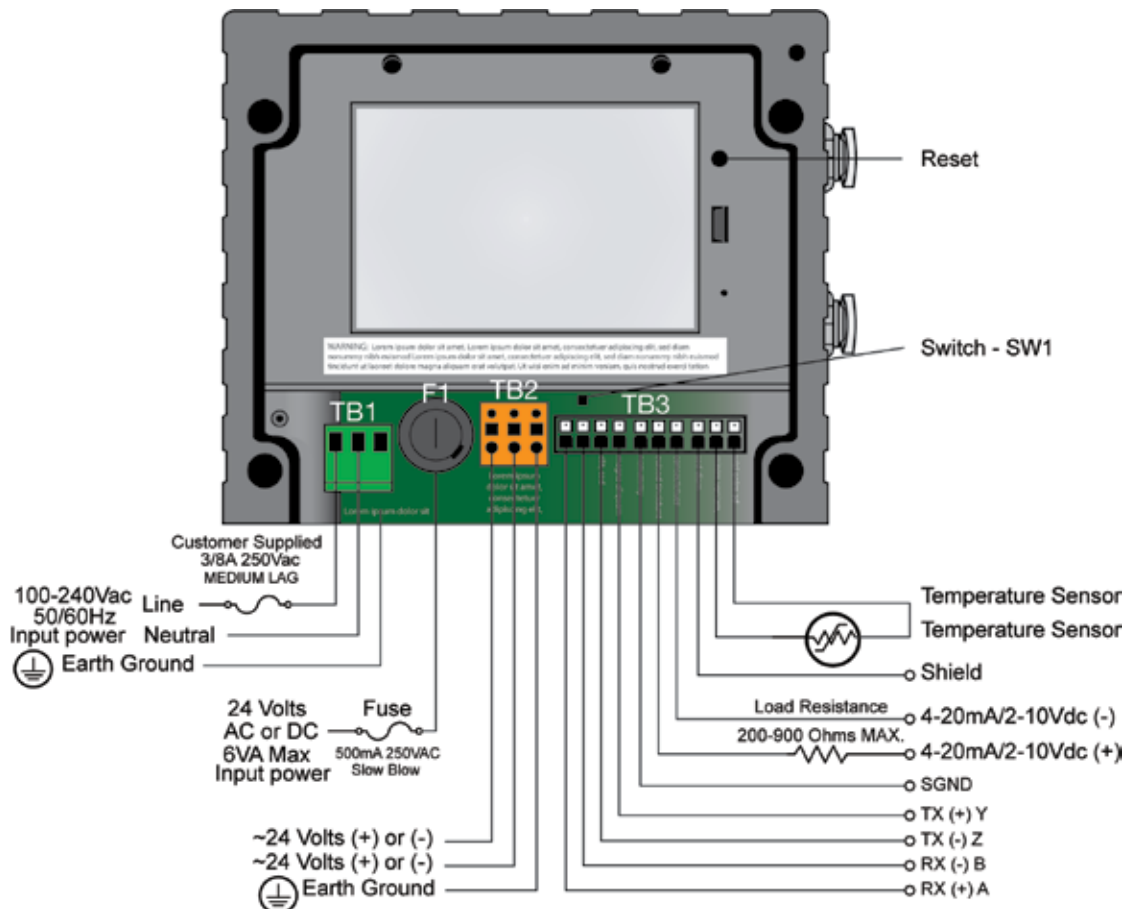
Update settings within electronics (page 5): In the setup menu change Temperature Compensation to “Yes”.

Confirm that this is set to “Yes”.

5. Close and tighten screws on cover:

When the required preceding steps are complete, make sure the front cover is properly aligned to the housing and the two captive thumb screws are securely tightened.

Wiring Diagram

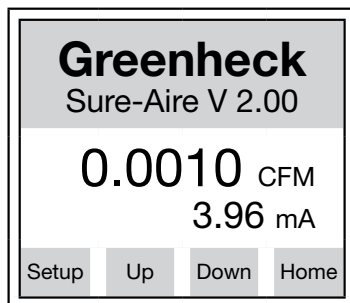


Display Setting Options and Setup

Navigation Buttons

The electronics is equipped with a touchscreen LCD display. There are 4 navigation buttons on the bottom of the screen. Button names will change based on the parameter you are in (i.e. "Setup" will change to "Home" and "Home" will change to "Edit").

Home Screen



To view settings use the "Up" and "Down" buttons to scroll through the list. To adjust settings, press "Setup" and scroll through the settings. Below is information on the adjustable settings.

Settings Menu

Home Screen: Top/Bottom View: Press "Edit" to change Main Display Value. Press "Prev" or "Next" to adjust what reading displays on the Home screen, then press "Enter" to store the value.

- Flow (default top display)
- Pressure
- Temperature
- Air density
- Output signal (default bottom display)
- Velocity
- None

Measurement System: Press "Edit" to change the measurement system units. Press "Prev" or "Next" to adjust, then press "Enter" to store the value.

- English (default)
- Metric

K-Factor: Press "Edit" to change K-Factor. Press "Inc" or "Dec" to adjust, then press "Enter" to store the value.

- 200 to 30,000
(Factory set to fan model and size)

Elevation: Press "Edit" to change elevation. Press "Inc" or "Dec" to adjust, then press "Enter" to store the value.

- 0 - 10,000 ft
(0 ft default)

Outlet Area: Press "Edit" to change the stack outlet area. Press "Inc" or "Dec" to increase or decrease the area, respectively. Then press "Enter" to store the value.

- 0-10 Ft²

Display Brightness: Press "Edit" to change brightness. Press "Inc" or "Dec" to adjust, then press "Enter" to store the value.

- 10 - 100%
(80% default)

Air Flow Units: Press "Edit" to change Air Flow Units. Press "Prev" or "Next" to adjust, then press Enter to store the value.

- CFM (default)
- m³/hr
- m³/min

Pressure Units: Press "Edit" to change pressure units. Press "Prev" or "Next" to adjust, then press "Enter" to store the value.

- In. wg (default)
- Ft wg
- mm wg
- cm wg
- PSI
- In. Hg
- mm Hg
- mBar
- Pa
- kPa - kilopascals (1kPa = 1000 Pa)
- hPa - hectopascals (1hPA = 100 Pa)
- Oz. In.

Temperature Compensation: Press "Edit" to change Temperature Compensation. Press "Prev" or "Next" to adjust, then press "Enter" to store the value.

- Yes (default)
- No

Note: If temperature compensation is set to "No", the air density will be a function of standard temperature (70°F/21°C).

Analog Output Signal: Press "Edit" to change Output Signal type. Press "Prev" or "Next" to adjust, then press "Enter" to store the value.

- 4-20 mA (default)
- 2-10 VDC

Linearize By: Press "Edit" to change the linearization settings. The electronics will linearize the electronics output with respect to this setting.

- Flow (default)
- Pressure

Note: The maximum measurable flow rate will automatically calculate based on the electronics settings. The maximum flow rate is displayed on the screen.

WARNING

Due to load resistance change from product to product, it may be necessary to recalibrate the 4-20 mA electronics. See 4-20 mA transducer calibration procedure.

Display Setting Options and Setup (continued)

Network Protocol: See page 7. Select the appropriate protocol, baud rate and network address.

Defaults

Load Factory Defaults: Press “Edit“ to load factory defaults. Press “Prev“ or “Next“ to select “Yes“, then press “Enter“.

- No (default)
- Yes (changes all settings to factory default)

Load Customer Defaults: Press “Edit“ to load customer defaults. Press “Prev“ or “Next“ to select “Yes“, then press “Enter“.

- No (default)
- Yes (loads all customer default settings)

Save Customer Defaults: Press “Edit“ to save current electronics settings as the customer default. Press “Prev“ or “Next“ to select “Yes“, then press “Enter“.

- No (default)
- Yes (saves current settings as the customer default)

Network Protocol - Optional

Greenheck’s Sure-Aire™ electronics has the ability to connect to a Building Automation System (BAS) through the on-board RS-485 port. The electronics can be configured as either BACnet MS/TP or Modbus RTU Slave. When in the display menu, scroll through the options until the Network Protocol screen. Pressing edit will permit changing the network protocol type and associated data. This information should be set to match the BAS.

BACnet MS/TP Server

When the electronics is configured for BACnet, it will expose a total of eight (8) objects on the network.

BACnet MS/TP Server Device Settings	
Setting	Value
Baud Rate	Set to match BMS
Parity	No Parity (1 Stop Bit)
APDU Timeout (ms)	1000
Number of APDU Retries	3
Max Master Address	127
Max Info Frames	1

BACnet MS/TP Server Objects			
Object Name	Object Type	Data Type	Units
Sure-Aire™	Device Object	N/A	N/A
K-Factor	Analog Input	16-Bit Unsigned	None
Elevation	Analog Input	16-Bit Unsigned	None
Outlet Area	Analog Input	32-Bit Floating Point	None
Flow Temperature	Analog Input	16-Bit Signed	None
Pressure	Analog Input	32-Bit Floating Point	None
Volume	Analog Input	32-Bit Floating Point	None
Velocity	Analog Input	32-Bit Floating Point	None

Modbus RTU Slave

When the electronics is configured for Modbus, it will expose a total of seven (7) registers on the network. The Modbus RTU Slave settings and list of registers can be seen below.

Modbus RTU Slave Device Settings	
Setting	Value
Baud Rate	Set to match BMS
Parity	No Parity (1 Stop Bit)
Timeout (ms)	0
Response Delay (ms)	0

Modbus RTU Slave Registers			
Register Name	Register Type	Data Type	Units
K-Factor	Input Register	16-Bit Unsigned	None
Elevation	Input Register	16-Bit Unsigned	None
Outlet Area	Input Register	16-Bit Unsigned	None
Flow Temperature	Input Register	16-Bit Unsigned	None
Pressure	Input Register	16-Bit Unsigned	None
Volume	Input Register	16-Bit Unsigned	None
Velocity	Input Register	16-Bit Unsigned	None

NOTE

All of the objects/registers that are exposed on the network do not have a unit associated with them. The units of the values exposed on the network will be based on the units that are selected on the Sure-Aire™ electronics.

Analog Output Signal - Optional

Greenheck's Sure-Aire™ differential pressure electronics provides either a 2-10 VDC or 4-20 mA analog output signal. The output signal can be configured linearly proportional to either the pressure range or the flow within the setup. The ranges for Greenheck's Sure-Aire™ electronics are listed by model on cover.

Voltage and Amperage Signal

If using the analog signal linear to flow, the max flow is automatically calculated based on the pressure range and K-factor input into the electronics. The max value is displayed in the setup menu.

If output signal is linear to pressure, the corresponding equations are used to calculate the flow.

Calculating flow for 2-10 VDC output signal:

$$CFM = K \sqrt{\frac{(V - 2) P_{\max}}{8\rho}}$$

K	Constant dependent on fan model and size (see page 9)
P _{max}	Maximum pressure of electronics (in. wg)
ρ	Air density (lb/ft ³ °F) [0.075 at 70°F and 0 ft elevation]
V	Output voltage of 2-10 VDC signal
mA	Output current of 4-20 mA signal

Calculating flow for 4-20 mA output signal:

$$CFM = K \sqrt{\frac{(mA - 4) P_{\max}}{16\rho}}$$

Calculation Using Manual Pressure Gauge or Third Party Transducer

Flow Rate Equation

The volumetric flow through the fan (cfm) can be calculated from the equation:

$$CFM = K \sqrt{\frac{\Delta P}{\rho}}$$

where K is the K-Factor for the specific fan model and size, ΔP is the measured differential pressure across the inlet cone (in. wg), and ρ is the density of air (lb/ft³ °F).

Transducer Recalibration Procedure

The electronics are calibrated per order at the factory. Under certain circumstances, there may be a discrepancy of calibration once installed on site. The following procedure is used to re-calibrate the pressure transducer within the electronics. In the event an error occurs trying to re-calibrate, the transducer parameters can be re-set to factory settings using “Load Factory Settings” within the setup menu.

Equipment

Digital multimeter.

Vacuum pressure device with gauge (only needed if calibrating upper range).

200-900 ohm resistor (only needed if calibrating using 4-20 mA).

NOTE

Setup can be changed to 2-10 volts for calibration and then back to 4-20mA.

Procedure

1. Remove power to the electronics.
2. Remove any wires connected on the analog outputs.
3. Remove tubing from Sure-Aire™ electronics box, box uses push-to connect fittings. Push in on plastic ring and pull on tubing to remove.
4. Connect multimeter to analog points on terminal strip. If calibrating using 4-20 mA, a series load resistor between 200 and 900 ohms is required.
5. Set multimeter to the correct measurement units, VDC or mA.
6. Apply power to the Sure-Aire™ electronics.
7. Press the “Setup“ button on the LCD panel.
8. Verify the analog signal is setup for your measurement and that the signal is linear to Differential Pressure.
9. Go to the “Trans Min/Trans Max” screen. Record the values for each. It is correct that the trans min value is higher than the trans max value.
10. Press “Enter/Edit”.
11. With all tubing removed, adjust the trans min value up/down until the multimeter reads either 2 VDC or 4 mA.
12. Press “Next”. If only calibrating low value, press “Enter” to complete.
13. To calibrate upper range, apply the pressure device to the high port and pull vacuum to maximum pressure on Sure-Aire™ label.
14. Adjust the trans max value up/down until the multimeter reads either 10 VDC or 20 mA.
15. Press “Enter” to store the new value.
16. Press “Exit” to return to the main screen.
17. Go to “Save Customer Defaults” and save for future resetting to the changes.

K-Factors

Size	APD	Size	APH / APM HPA	AFDW / BIDW	FJI	QEI / QEID	USF-500 & Vektor-C series	Vektor-H series	Vektor-M series
315	257	7	not applicable	not applicable	179	not applicable	179	not applicable	not applicable
355	329	8	not applicable	not applicable	179	not applicable	179	not applicable	not applicable
400	406	9	not applicable	not applicable	179	408	179	248	not applicable
450	536	10	not applicable	not applicable	179	not applicable	179	202	not applicable
500	652	12	355	592	244	408	244	296	not applicable
560	847	13	not applicable	701	not applicable	not applicable	296	351	not applicable
630	1053	15	355	861	366	603	366	not applicable	526
		16	421	1062	not applicable	724	443	531	634
		18	517	1083	542	897	542		787
		20	617	1301	651	1088	651	not applicable	955
		22	759	1610	805	1321	805		1161
		24	913	1964	976	1631	976		1436
		27	1105	2369	not applicable	1962	1186	not applicable	1729
		30	1355	2928	not applicable	2400	1464		2116
		33	1625	3540	not applicable	2923	1771	not applicable	2581
		36	1967	4336	not applicable	3576	2167		3154
		40	2361	5259	not applicable	4331	2635	not applicable	3825
		44	2854	6440	not applicable	5318	3220	not applicable	4698
		49	3411	7808	not applicable	6525	3905	not applicable	5766
		54	4121	9571	not applicable	7891	4786	not applicable	6975
		60	4972	11707	not applicable	9648	5855	not applicable	not applicable
		66	5960	14166	not applicable	not applicable	7084	not applicable	not applicable
		73	7276	17330	not applicable	not applicable	8667	not applicable	not applicable

Our Commitment

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

Product warranties can be found online at Greenheck.com, either on the specific product page or in the literature section of the website at Greenheck.com/Resources/Library/Literature.

Greenheck's Sure-Aire™ Flow Monitoring System catalog provides additional information describing the equipment, fan performance, available accessories, and specification data.

AMCA Publication 410-96, Safety Practices for Users and Installers of Industrial and Commercial Fans, provides additional safety information. This publication can be obtained from AMCA International, Inc. at www.amca.org.

