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.

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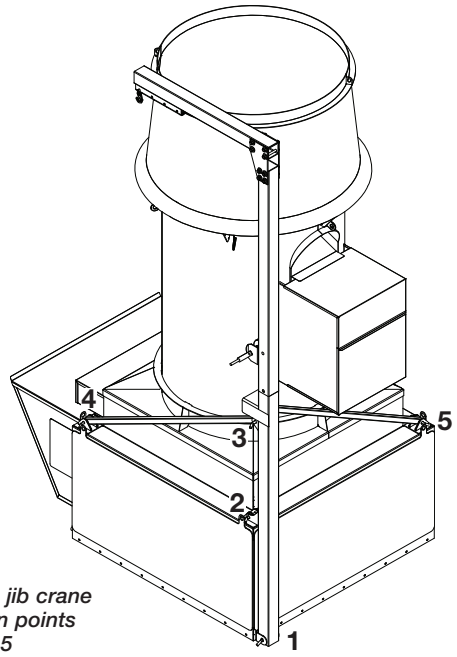
Assembly Instructions

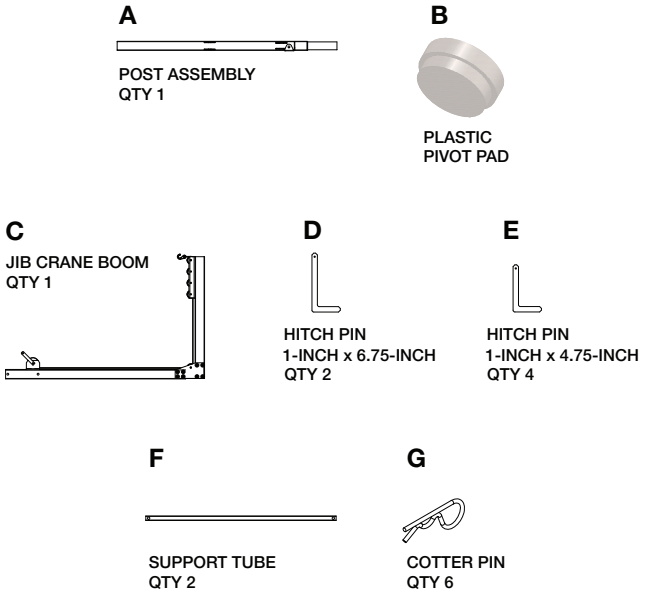


Reference jib crane connection points 1 through 5

NOTE

If jib crane is being installed on a belt drive fan system, the location of the motor cover on each fan must be on the same side as the crane/post assembly. This will allow the jib crane to reach the motor as needed.

PARTS LIST



NOTE

Belt drive model shown. Procedure is identical for direct drive models.

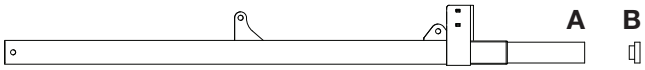
NOTE

Multiple fan systems will have more than one set of connection sockets. Mount jib crane to socket set nearest motor to be replaced.

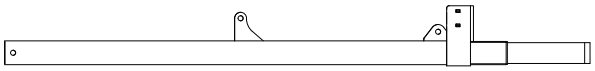
NOTE

Observe all warning labels on Post Assembly and Jib Crane Boom parts.

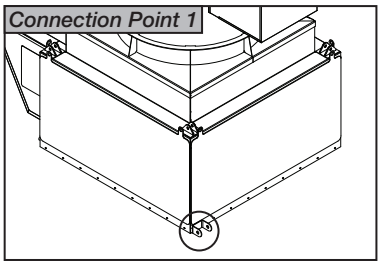
Step 1: Slide pivot pad (B) into end of post (A).

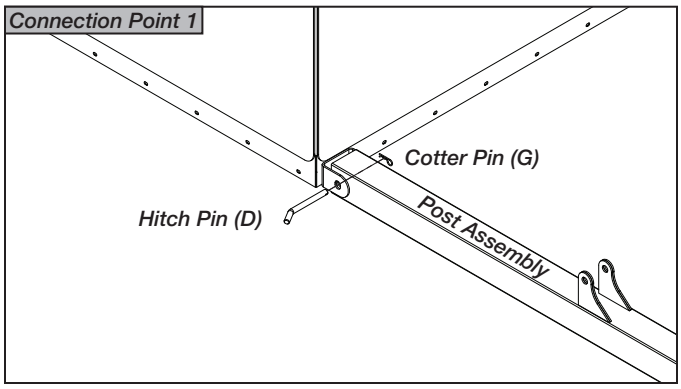


Slide pivot pad into end of post

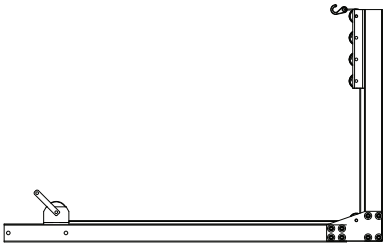


Step 2: With the crane post bracket facing up, insert the assembled post into connection point 1 on the plenum. Attach the jib crane assembly to plenum using the 1 x 6.75 inch hitch pin (D) to secure the post end of the jib crane to plenum. Lock hitch pin in place with cotter pin (G).

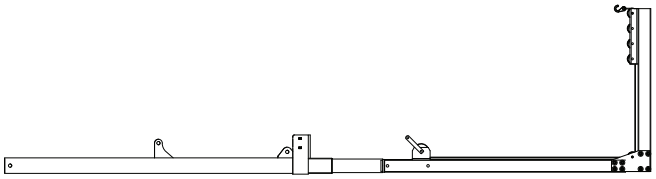


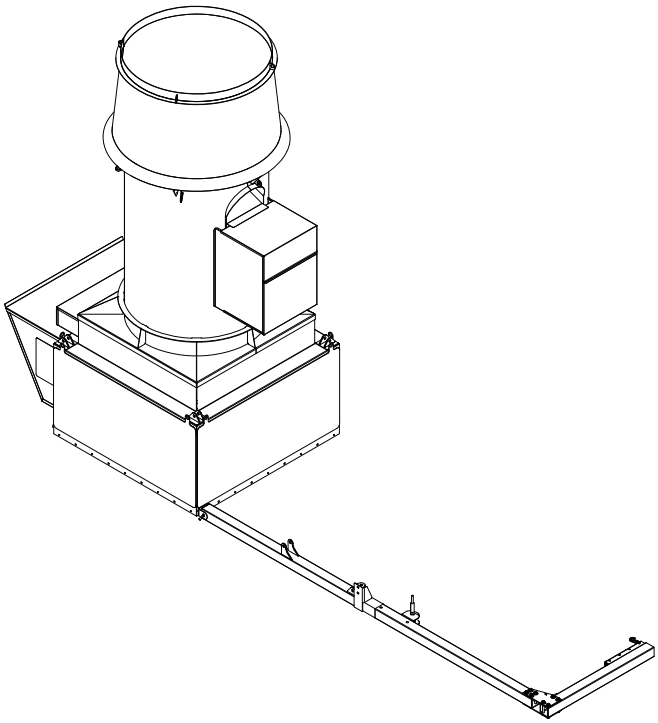


Step 3: Insert boom (C) over pivot pad inserted into post.



Insert boom over assembled post/pivot pad.





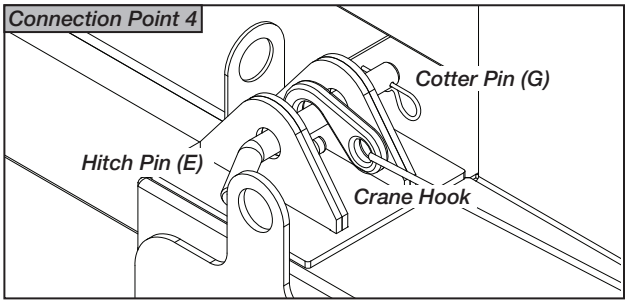
Step 4: Rotate jib crane boom straight up from the roof deck. Temporarily install one 1 x 4.75 inch hitch pin (E) into connection point 4 on the plenum. Lock hitch pin in place with cotter pin (G). Secure jib crane cable to now installed hitch pin located in plenum connection point 4 with crane hook.

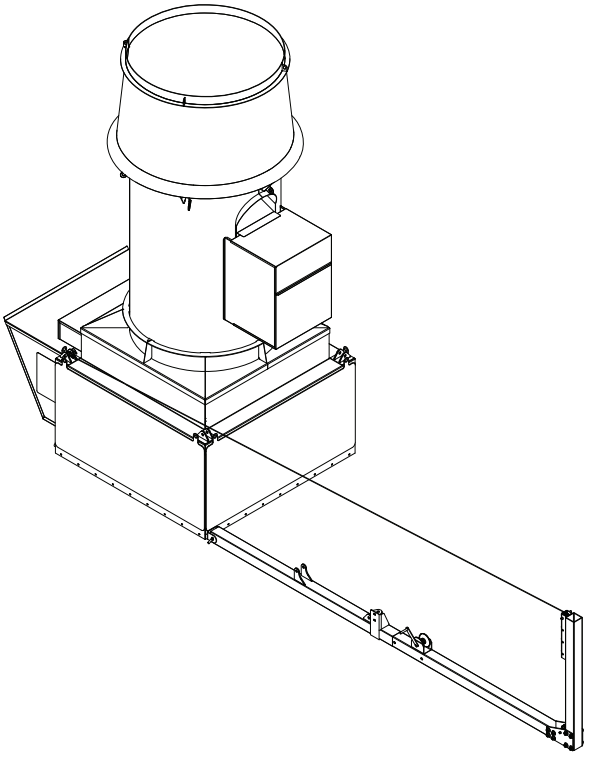
WARNING

Do not attach cable to windband lifting lug or to access door lifting point on plenum.

NOTE

Cable on Vektor size 36 through 40 will require five feet additional strapping (size 44 and larger will require 15 feet) attached to the Crane Hook to raise the jib crane assembly into position.





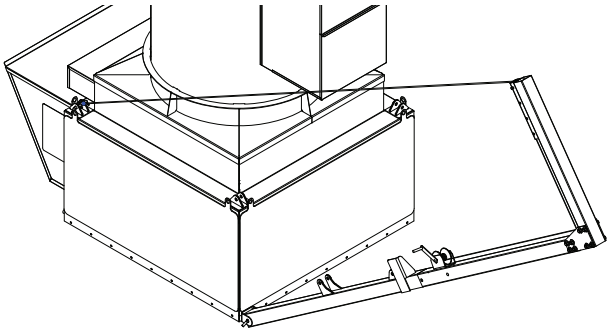
Step 5: Raise jib crane assembly by hand-lifting and using jib crane hand winch until fully erect.

NOTE

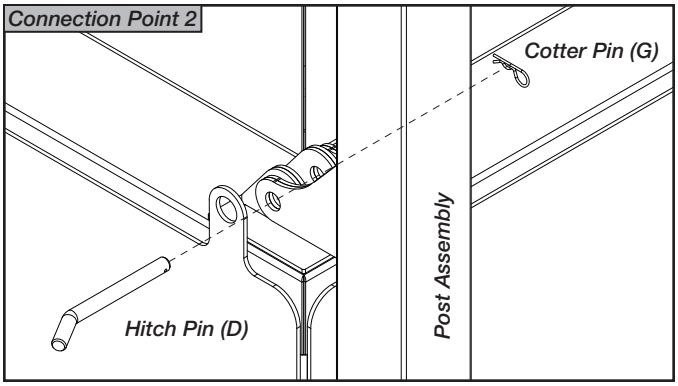
Hand winch equipped with self-activating automatic brake.

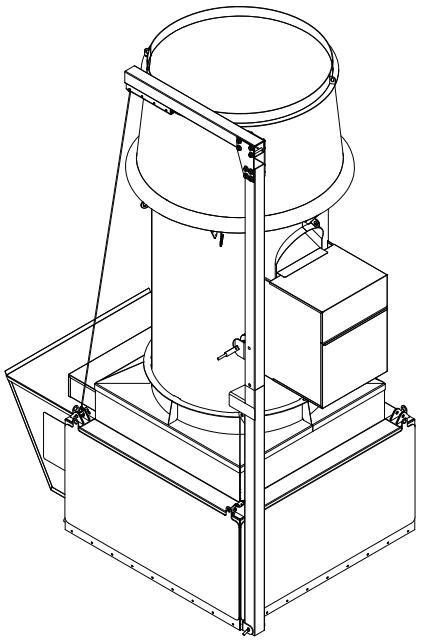
CAUTION

Do not stand under the jib crane as it is being raised or lowered. Slack in the wound cable could cause crane assembly to suddenly drop downward and cause serious injury or death.

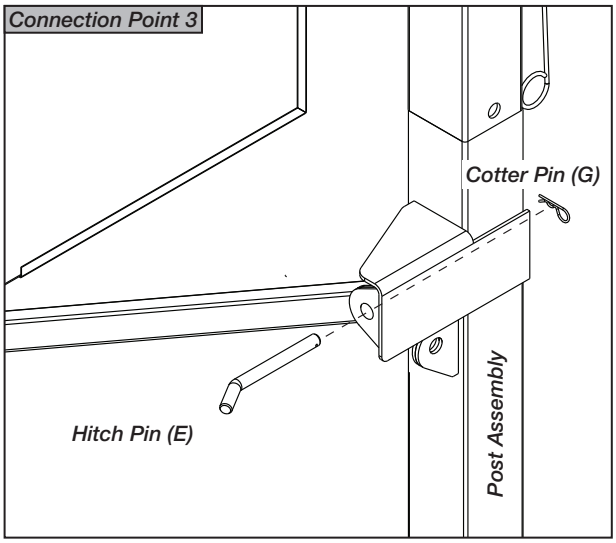


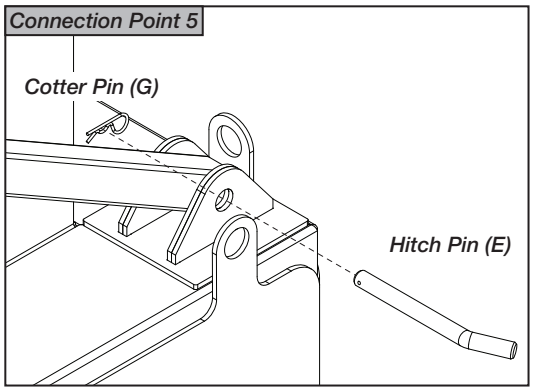
Step 6: Secure jib crane assembly to plenum at connection point 2 using one 1 x 6.75 inch hitch pin (D). Lock hitch pin in place with cotter pin (G). Make sure jib crane is firmly attached to plenum.

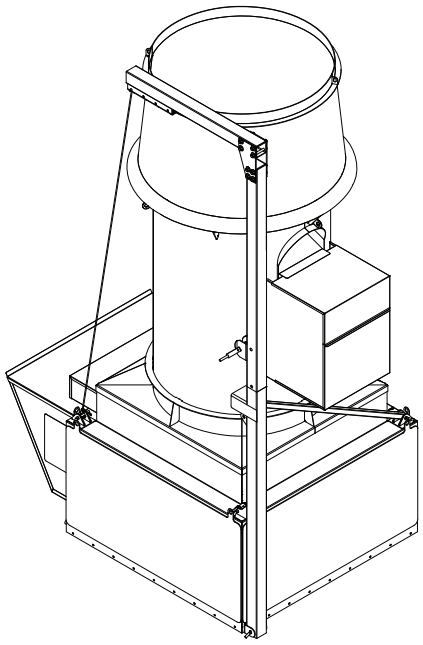




Step 7: At bracket connection point 3 and facing connection point 5, attach one support tube (F) at connection point 3 on jib crane using one 1 x 4.75 inch hitch pin (E). Lock hitch pin in place with cotter pin (G). Spread support tube out and attach the loose end to matching plenum connection point 5. Secure end with 1 x 4.75 inch hitch pin (E). Lock hitch pin in place with cotter pin (G).





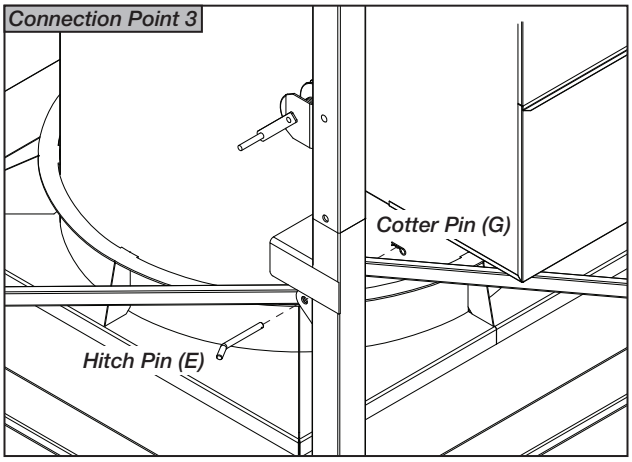


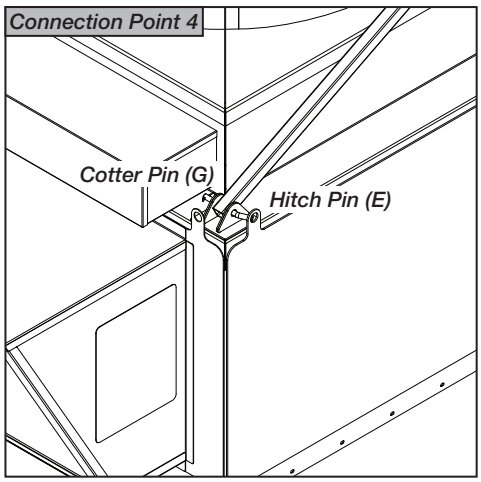
Step 8: Detach cable from hitch pin located at connection point 4 and remove hitch pin from connection point.

NOTE

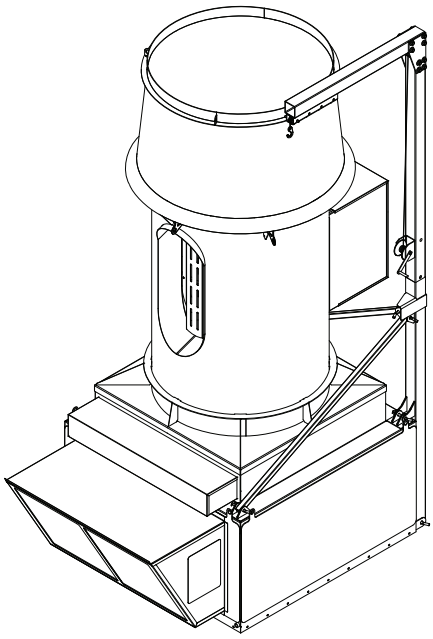
It is recommended that moderate tension be kept on the cable while it is wound onto the spindle to prevent the cable from being tangled.

Step 9: Attach remaining support tube (F) to bracket located at connection point 3 on jib crane facing connection point 4. Use 1 x 4.75 inch hitch pin (E) to secure. Lock hitch pin in place with cotter pin (G). Spread support tube out and attach the end of one tube to the plenum connection point 4. Secure end with 1 x 4.75 inch hitch pin (E). Lock hitch pin in place with cotter pin (G).





Jib crane assembly is now fully secured to the plenum. Refer to Vektor Installation, Operation and Maintenance Instruction for motor replacement procedure.



Disassembly of jib crane should be performed in reverse order of assembly instructions. Do not disassemble while motor is connected to jib crane hoist.

NOTE

Cable on Vektor sizes 44 and larger with roof curbs over 12 inches in height will require additional strapping attached to the Crane Hook to lower and raise the motor to the roof deck level. Reference Vektor-MD IOM for motor removal and installation procedure.

CAUTION

Do not stand under jib crane as it is being raised or lowered. Slack in the wound cable could cause the subassembly to suddenly drop downward and cause serious injury or death.

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.

The fan monitoring system is designed to provide live access to key operating metrics as well as routine maintenance notifications. The fan monitoring system ultimately can assist in both reducing the operating cost of your system as well as helping avoid costly shut downs.

General Safety Information

This instruction manual provides installation, operating, maintenance, and replacement parts information for the Fan Monitoring System.

WARNING

Improper installation, adjustment, alterations, service or maintenance can cause injury and property damage, as well as possible voiding of factory warranty. No person may install, operate, or maintain the fan monitor controller and transmitters 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.

Fan Monitoring System Features:

- NEMA-4 and IP56 Enclosure Rating
- Factory calibrated, plug and play wiring
- 120-240 Vac or 24 Vac/Vdc input voltage
- Two analog sensor inputs using any of the following:
  - 4-20 mA
  - 0-10 Vdc
  - 2-10 Vdc
- Available system monitoring
  - Airstream Temperature
  - Bearing Temperature
  - Motor Current
  - Motor Vibration
  - Motor Speed
  - Fan Vibration
  - Motor Vibration
  - Static Pressure
  - Differential Pressure
- One resistive temperature input (not used)
- Three selectable isolated outputs matched to inputs
  - 4-20 mA
  - 0-10 Vdc
  - 2-10 Vdc
- LCD display with user-friendly touch panel interface
- English or Metric readings
- Simple Installation

Table of Contents

Installation

WARNING

When wiring the instrument, you must follow industry standard practices for control and protection against electrostatic discharge (ESD). Failure to exercise good ESD practices may cause damage to the controller

1. Mount the monitor in the vertical plane using four #8-32 screws. Open the front cover by unscrewing the two captive thumb screws to gain access to the four mounting locations pictured at right.

   Note: Mount the controller within 100 feet of the fan being monitored.

2. Disconnecting switch or breaker is required for the installation. It also must be suitably located and easily reached to remove power to the controller and must be marked as being the disconnecting means for the controller.

3. Remove terminal block TB1 and perform wiring for the pins listed below. For liquid tight applications, use only 1/2-inch liquid tight conduit.

   Terminal Block TB1: Input Power
   Pin 1 = Line (+)
   Pin 2 = Neutral (-)
   Pin 3 = Ground

   Note: All field wiring to be in ordinance with equivalent national standard. All wiring to be copper and 75°C rated minimum.

4. Wire TB2 accordingly. See wiring details for all sensor input(s), scaled output(s), and alarm signal.

   Note: Signal isolator may be required when two or more output signals share a common connection at the PLC/controller.

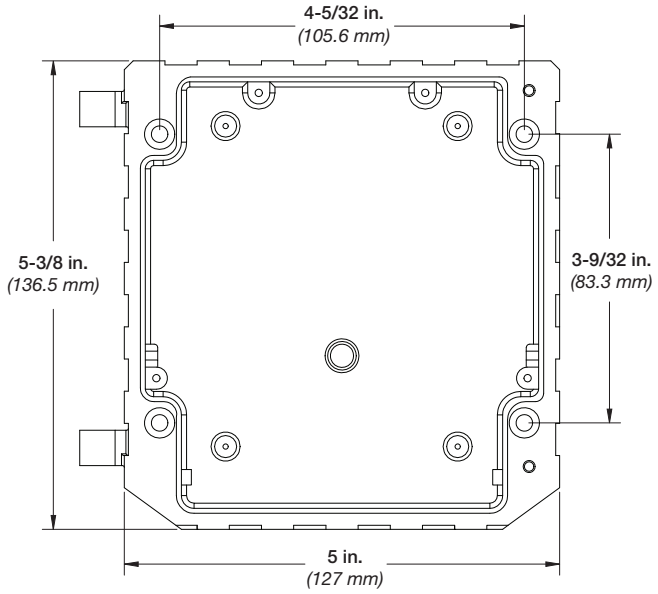
5. For resistive temperature sensor (by others): Only use Honeywell Industrial Temperature sensor part number 6655-90980004. Caution must be taken at install to not short sensor terminals or permanent damage may occur.

6. Provide power to the monitor to turn it on.

7. The monitor is factory programmed per sensor selections. Verify settings menu and adjust to meet installation requirements. (Refer to Display Setting Options and Setup section for details).

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

Dimensions and Mounting Patterns



Label and Order Information

Unit specific label is located on the inside cover of the controller.

CONFORMS TO
UL STD 61010-2-030
CERTIFIED TO
CAN/CSA STDC22.2 #61010-2-030

Intertek
E3192905

Equipment For Measurement

WARNING!
Maximum Sensor Loop Power: DO NOT EXCEED 24Vdc @ 100mA Per Sensor Input

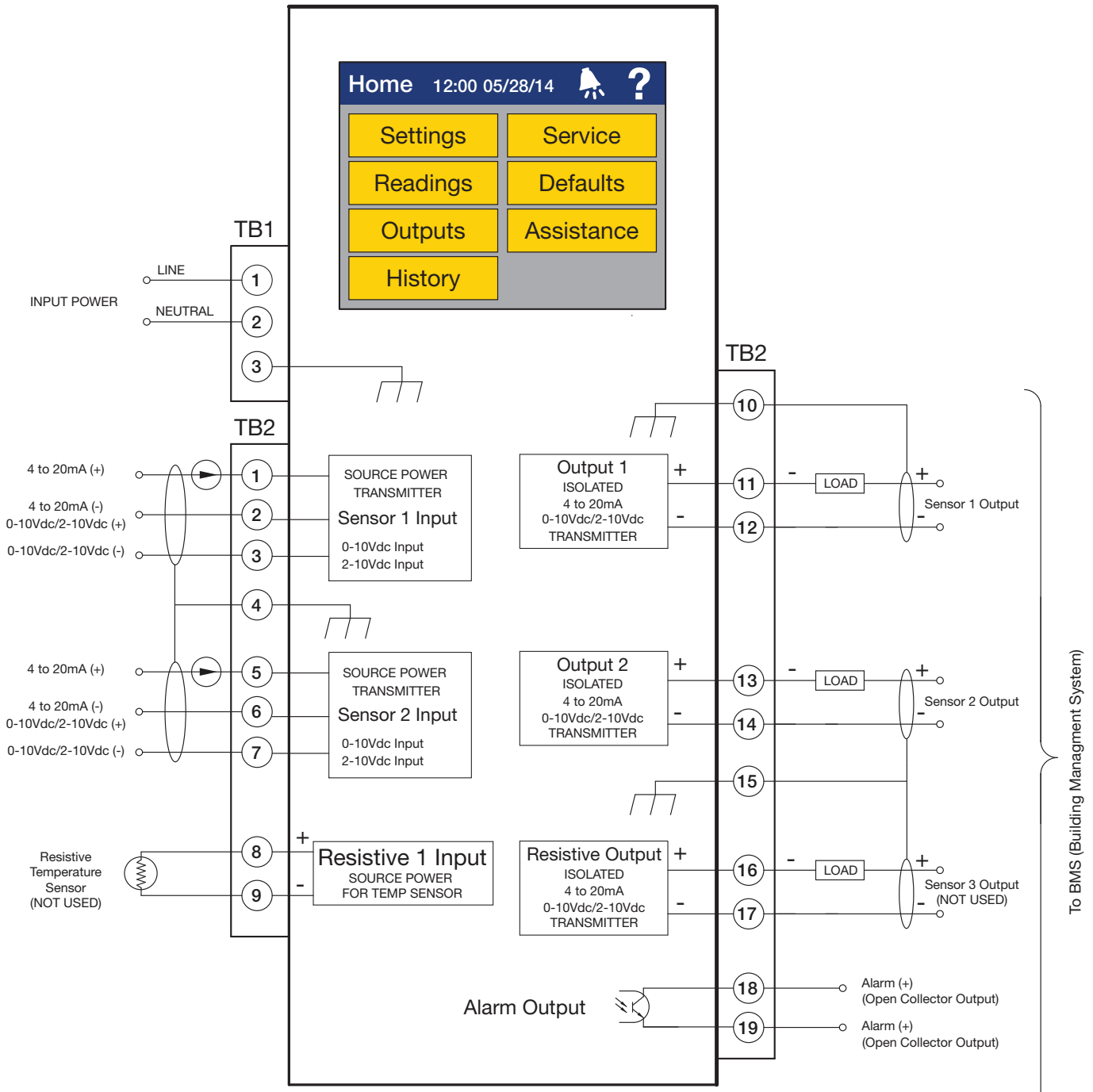
Description: Fan Monitoring System
Input Power: 24Vac/dc, 10VA, 50/60Hz
P/N: 5550123
Tag Mark: EF-1 **Sales Order:** 6606573
Agent Order #: K1543 **P.O.#** 597728 **Date Code:** 10/14

Fan Size: 24F17
Fan Model: VADS
Sensor 1: Pressure
Sensor 2: RPM
Sensor 3: Resistive

GREENHECK Schofield, WI 54476 U.S.A.

Wiring and System Components

Wiring Diagram



NOTE: UNIT IS NOT WATER TIGHT UNTIL AFTER UNIT AND CONDUIT CONNECTION ARE SEALED BY CUSTOMER AFTER WIRING.

WARNING: BEFORE APPLING INPUT POWER, CHECK FOR PROPER INPUT VOLTAGE. REFER TO DOOR LABEL FOR DETAILS.

Airstream Temperature Sensor Kit

Sensor used to detect system process temperature. Temperature sensor kit is provided with one temperature probe and transmitter. Fan monitor can provide a system fault alarm for high or low temperature and current status reading.

Ratings:

Enclosure: NEMA-4X (IP 66) with supplied mounting enclosure

Temperature Range:

Temperature Probe: -148° to 212°F *(-100° to 100°C)*

Transmitter: -4° to 158°F *(-20° to 70°C)*

Input Voltage: 24 Vdc

Output Signal: 4-20 mA

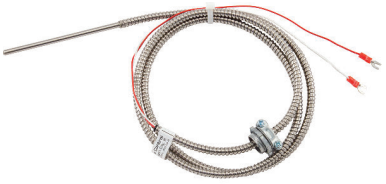
Accuracy: ±0.9°F *(±0.5°C)*

WARNING

Turn fan off and lock out power prior to mounting any sensors or running connection wiring.

Kit includes:

- J type thermocouple probe with wiring, 4 ft. *(1.2 m)* length
- Temperature transmitter
- Transmitter enclosure



Thermocouple Probe with Wiring

Temperature Transmitter

1/2-inch FNPT Transmitter Enclosure

Hardware not included:

- Signal wiring between transmitter enclosure and fan monitor
- Mounting fasteners for transmitter housing
- Mounting fasteners for temperature probe bracket

Thermocouple Probe and Transmitter Installation

Thermocouple Probe Mounting:

At location to have temperature measured, secure provided mounting bracket to ductwork or other fixture. Attach mounting bracket in desired orientation. If needed, drill 5/16 inch *(6.3 mm)* diameter hole at location where the temperature probes would pass through ductwork. Secure probe to mounting bracket. Note the thermocouple section of probe should not touch bracket as this will give false temperature reading.

Transmitter and Enclosure Mounting:

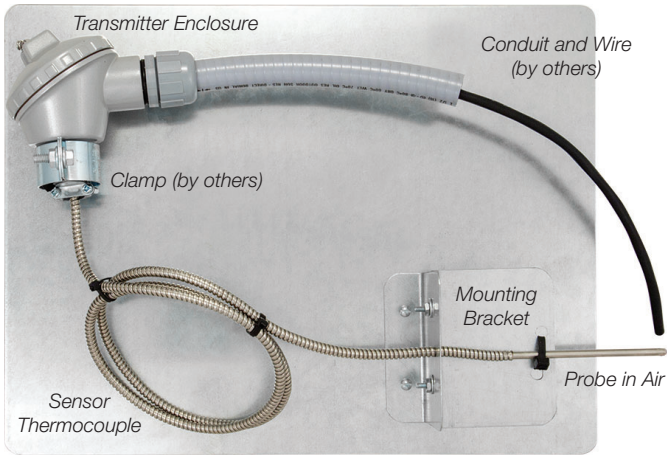
The mounting location of the temperature transmitter enclosure should be near the probe mounting location. Note that the maximum distance between transmitter and fan monitor is 100 feet *(30 m)*. Mount temperature transmitter enclosure using conduit and fittings. Lower connection stem has offset collar to accept conduit clamp.

Install temperature transmitter in enclosure using supplied screws, located inside of enclosure.

Temperature Probe and Signal Wire Connection:

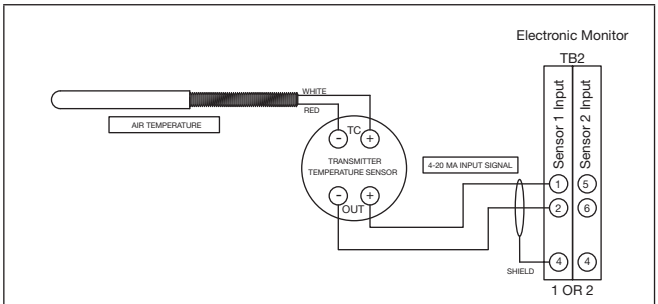
Bring temperature probe wiring in through bottom stem of transmitter enclosure. See Temperature Sensor Interconnect Wiring Diagram (below) for terminal connection locations. Final connection wiring from transmitter to fan monitor is brought through side stem center opening of the temperature transmitter.

Mock Assembly Detail



Sensor Wiring and Point Connection:

- Wiring size: 18/22 AWG (by others) to fan monitoring system
- Wiring Type: 2w shield
- Wiring diagram / connection:



NOTE: Shield cable required from sensor to electronic monitor.

Temperature Sensor Interconnect Wiring

Factory Fan Monitor Default Settings for Airstream Temperature Sensor(s):

Type: Temperature
Signal: 4-20 mA
Scale Min: -148°F *(-100°C)*
Scale Max: 212°F *(100°C)*
Alarm Low: No
Alarm Low Value: None
Alarm High: No
Alarm High Value: None
Output Signal: 4-20 mA

Custom Range Settings:
Refer to fan monitor section for adjustments in range or default settings.

Bearing Temperature Sensor Kit

Sensor used to detect bearing temperatures. Each bearing temperature sensor kit is provided with one thermocouple terminal ring and temperature transmitter. Fan monitor provides a system fault alarm for high temperature and analog outputs for current status reading.

Ratings:

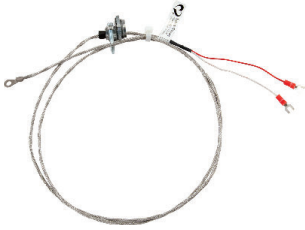
Enclosure: NEMA-4X (IP 66) with supplied mounting enclosure
Temperature Range:
Temperature Terminal Ring: 32° to 482°F *(0 to 250°C)*
Transmitter: -4° to 158°F *(-20 to 70°C)*
Input Voltage: 24 Vdc
Output Signal: 4-20 mA
Accuracy: ±0.9°F *(±0.5°C)*

WARNING

Turn fan off and lock out power prior to mounting any sensors or running connection wiring.

Kit includes:

- J type thermocouple terminal ring with wiring 4 ft. *(1.2 m)* length
- Packet of epoxy adhesive
- Temperature transmitter
- Transmitter enclosure



Thermocouple Probe with Wiring

Epoxy Adhesive

Temperature Transmitter

1/2-inch FNPT Transmitter Enclosure

Hardware not included:

- Signal wiring between transmitter enclosure and fan monitoring system
- Mounting fasteners for transmitter housing
- Tie downs and zip ties

Temperature Ring and Transmitter Installation

Terminal Ring Mounting:
The thermocouple terminal ring is mounted on the bearing housing. For best results, install terminal ring near the bearing grease zerk or bearing insert. Do not install on bearing feet or directly on the insert.

Prepare surface where sensor will mount by removing any dust or oils with a dry cloth or with alcohol wipe.

Follow directions on epoxy packaging to activate adhesive. Mix until a uniform color is achieved. Apply epoxy adhesive to one surface. Press terminal ring into place and hold for five to ten minutes to achieve holding bond. Allow 24 hours for bond to fully cure.

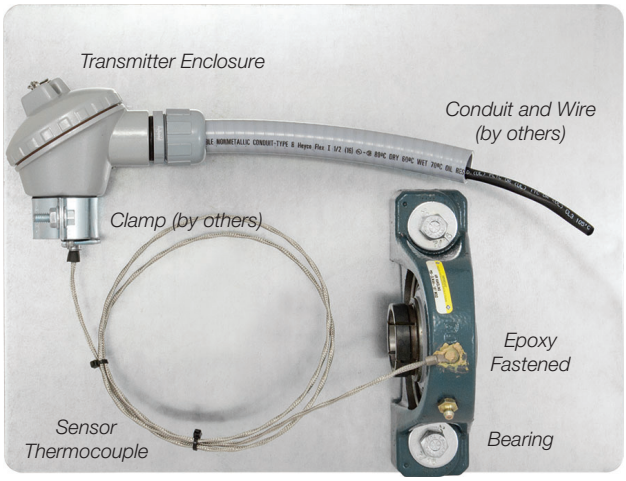
Bring wiring out of fan and away from any moving components. Care should be taken to ensure wiring is not interfering with moving components. Tie downs and zip ties are recommended to secure wiring.

Transmitter and Enclosure Mounting:
Install temperature transmitter enclosure near terminal ring mounting location, either on fan or remotely. Note the maximum distance between transmitter and fan monitor is 100 feet *(30 m)*. Mount enclosure using conduit and fittings. Lower connection stem has offset collar to accept conduit clamp.

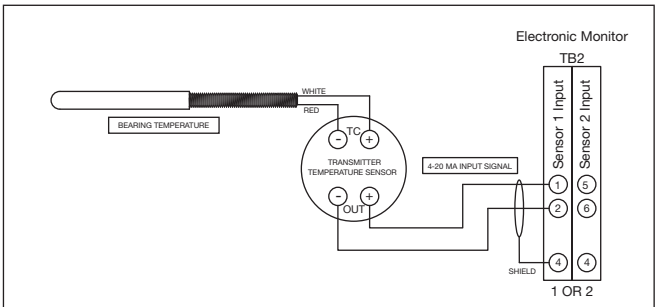
Install transmitter in enclosure using supplied screws, located inside of enclosure.

Terminal Ring and Signal Wire Connection:
Bring terminal ring wiring in through bottom stem of transmitter enclosure. See the Temperature Sensor Interconnect Wiring diagram (below) for terminal connection locations. Final connection wiring from transmitter to fan monitor brought through side stem center opening of transmitter.

Mock Assembly Detail



Sensor Wiring and Point Connection:
- Wiring size: 18/22 AWG (by others) to fan monitor
- Wiring Type: 2w shield
- Wiring diagram / connection:



NOTE: Shield cable required from sensor to electronic monitor.

Bearing Sensor Interconnect Wiring

Factory Fan Monitor Default Settings for Bearing Temperature Sensor(s):

Type: Temperature
Signal: 4-20 mA
Scale Min: 32°F (0°C)
Scale Max: 482°F (250°C)
Alarm Low: No
Alarm Low Value: None
Alarm High: No
Alarm High Value: None
Output Signal: 4-20 mA

Custom Range Settings:
Refer to fan monitor section for adjustments in range or default settings.

Vibration Sensor Kit

Sensor used to detect vibration on fan shaft bearing or motor bearing. Fault setting for alarm or trend indicating future failure. Fan monitoring system is available with one or two bearing vibration sensors. Single vibration sensor kit systems can monitor a single vibration point either on a fan shaft bearing or the motor depending which is more critical. Two vibration sensor kit systems can monitor both fan shaft bearings or one shaft bearing and motor.

Ratings:

Enclosure: NEMA-4 (IP 67)
Temperature Range: -40° to 185°F *(-40° to 85°C)*
Input Voltage: 10 Vdc minimum, 30 Vdc maximum
Output Signal: 4-20 mA
Accuracy: 5% transverse sensitivity, ±2% repeatability

WARNING

Turn fan off and lock out power prior to mounting any sensors or running connection wiring.

Kit includes:

- One vibration sensor
- Sensor mounting base
- Packet of epoxy adhesive
- Connection cable

Vibration Sensor

Sensor Mounting Base

Epoxy Adhesive

Connection Cable

Hardware not included:

- Tie downs and zip ties

Vibration Sensor Assembly

Bolt sensor into threaded hole in mounting base, use breakable thread lock if necessary for a stronger connection.

Positioning:

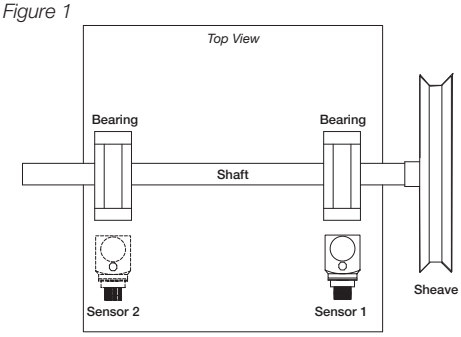
Vibration sensor detects vibration in a single plane parallel to sensor base. The orientation of the vibration sensor determines which axis is measured.

If single vibration sensor is being connected or if two vibration sensors are used with second vibration sensor for motor vibration detection, place first sensor between the fan shaft bearings, but closer to the drive bearing, nearer to the fan drive sheaves or motor.

Fan Shaft Bearing Monitoring:

Align the sensor to the shaft as shown in Figure 1. Vibration sensor positioned to detect vibration in the horizontal direction. Orient sensor with wiring pin connection in the direction cable will run. Position sensor and wiring not to interfere with moving components (belts, shafting, sheaves). Mark sensor mounting location prior to applying epoxy adhesive.

Figure 1

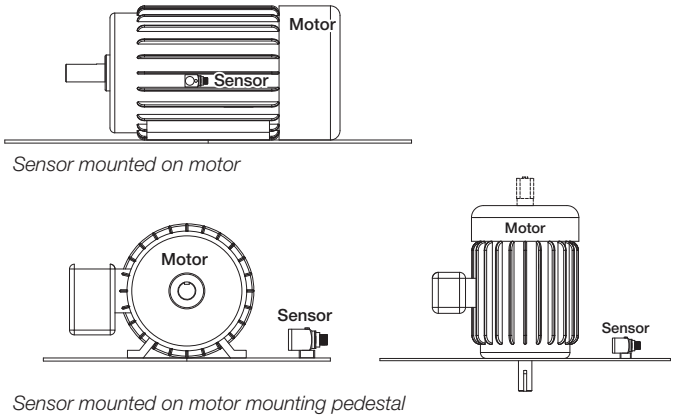


One sensor per kit is provided.

Motor Monitoring

Vibration sensor can be positioned to detect vibration in either the horizontal or axial direction. Align the sensor to the shaft as shown in Figure 2. Sensor can be mounted on motor or on motor mounting pedestal. Orient with wiring pin connection in the direction cable will run. Position sensor and wiring not to interfere with moving components (belts, shafting, sheaves). Mark sensor mounting location prior to applying epoxy adhesive.

Figure 2



Sensor mounted on motor

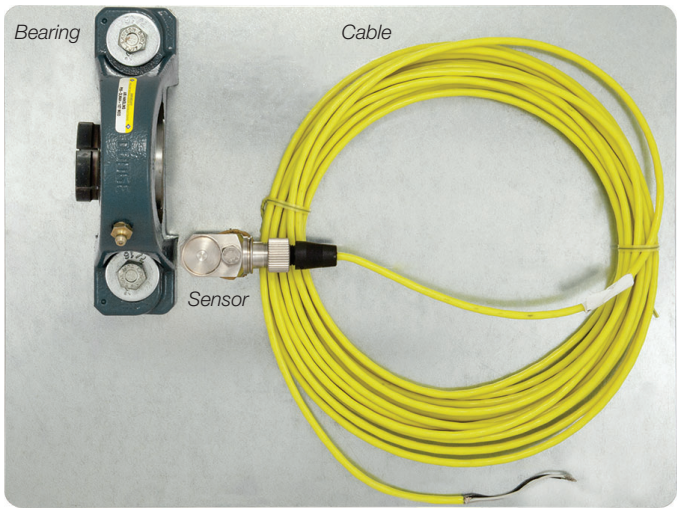
Sensor mounted on motor mounting pedestal

Vibration Sensor Mounting:

Prepare surface where sensor will mount by removing any dust or oils with a dry cloth or with alcohol wipe. Follow directions on epoxy packaging to activate adhesive. Apply epoxy adhesive to one surface. Press sensor into place and hold for five to ten minutes to achieve holding bond. Allow 24 hours for bond to fully cure.

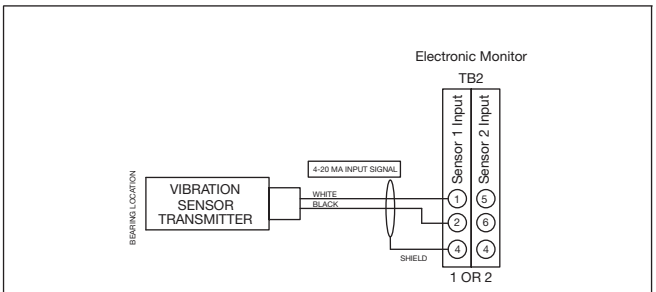
Connect wiring cable and run out of fan and away from any moving components. Care should be taken to ensure wiring is not interfering with moving components. Tie downs and zip ties are recommended to secure wiring.

Mock Assembly Detail



Sensor Wiring and Point Connection:

- Wiring size: 18 AWG
- Wiring Type: 2w shield
- Wiring diagram / connection:



NOTE: Shield cable required from sensor to electronic monitor.

Vibration Sensor Interconnect Wiring

Factory Fan Monitor Default Settings for Vibration Sensor(s):

Type: Vibration
Signal: 4-20 mA
Scale Min: 0 IPS (inches per second) [0 mm/sec]
Scale Max: 1.66 IPS [42.2 mm/sec]
Alarm Low: No
Alarm Low Value: None
Alarm High: Yes
Alarm High Value: 0.65 IPS [16.5 mm/sec]
Output Signal: 4-20 mA

Custom Range Settings:

Refer to fan monitor section for adjustments in range or default settings.

Current Sensor Kit

Sensor used to detect current (amps) usage of motor. Fan monitor provides fault setting for alarm, run time value for maintenance and power usage.

Ratings:

Enclosure: NEMA-4/4X, (IP 66/67) with supplied mounting enclosure
Temperature Range: 5° to 104°F *(-15° to 40°C)*
Input Voltage: NA
Output Signal: 0 to 10 Vdc
Maximum Motor Current: 0 to 50 amps or 0 to 100 amps
Maximum Distance from Fan Monitor: 100 feet *(30 m)*
Accuracy: ±1%, 2 to 100% FSO

WARNING

Turn fan off and lock out power prior to mounting any sensors or running connection wiring.

Kit includes:

- Current sensor
- Polycarbonate mounting enclosure

Current Sensor Inside Enclosure

Polycarbonate Mounting Enclosure

Hardware not included:

- Mounting fasteners for enclosure
- Signal wire between sensor and fan monitoring system

Current Sensor Installation

Enclosure Mounting:

Current sensor enclosure can be installed on the fan or remotely. Do not exceed maximum distance between current sensor and fan monitor. Final wiring to primary system transmitter is the responsibility of others.

Install enclosure to desired mounting location using the four (4) through holes in the back of the enclosure. See Figure 3 or Figure 4 on next page.

Figure 3: 0 to 50 amps

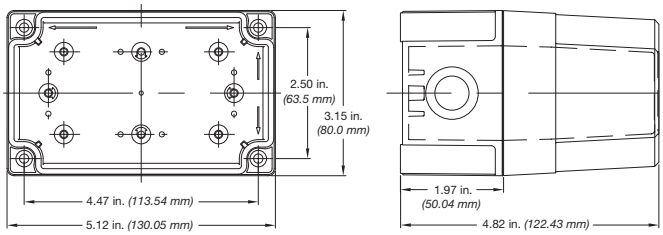
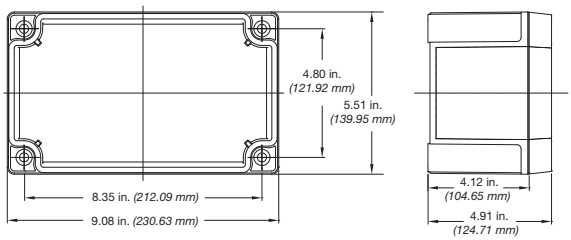


Figure 4: 0 to 100 amps



Current Sensor Connection:

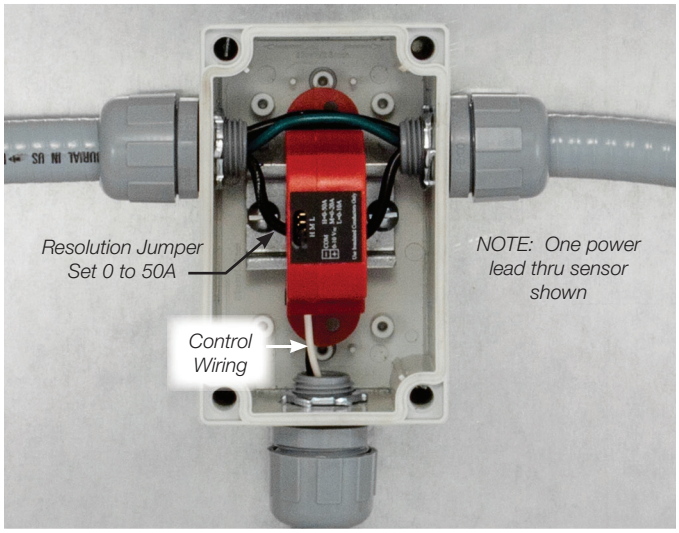
- Remove current sensor from enclosure
- Remove required knock-outs on enclosure for installation.
  Main power wiring is run through the sides and control wiring can be run through the bottom.
- Install any connector fitting into knock-out locations as necessary
- Feed control wiring in through enclosure housing
- Connect control wiring to current sensor, see Mock Assembly Detail Image #1 and the Current Sensor Interconnect Wiring Diagram.
- Mount current sensor back into enclosure
- Run main power wiring in through corresponding knock-out holes. See Mock Assembly Detail #1 and #2 for wire placement.

NOTE

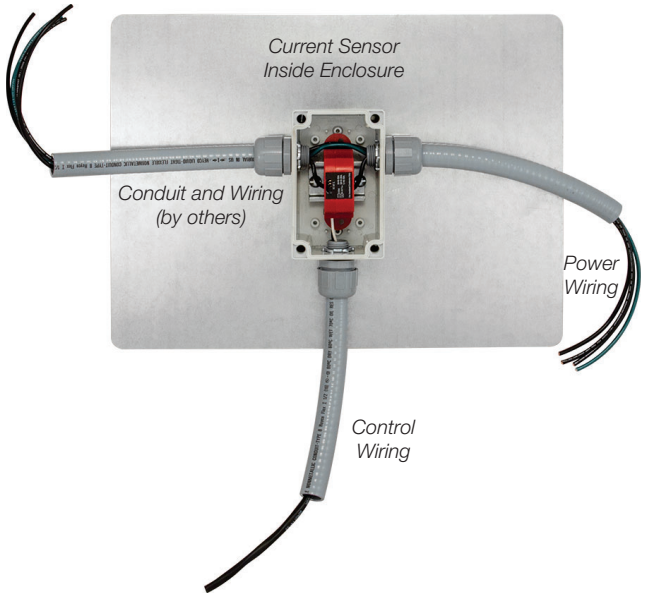
All local electrical codes and proper wiring techniques are to be followed during installation. Liquid tight conduit is required to maintain enclosure rating.

Mock Assembly Detail #1

- Only one lead thru sensor, single and three phase

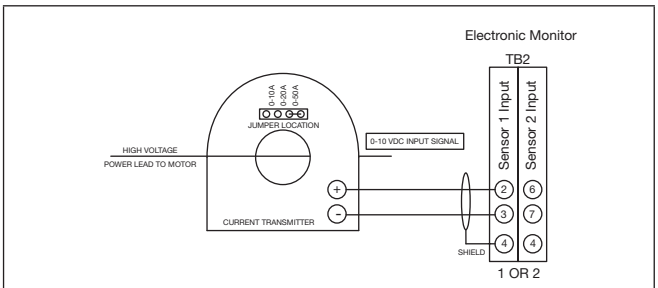


Mock Assembly Detail #2



Sensor Wiring and Point Connection:

- Wiring size: 18/22 AWG (by others) to fan monitoring controller
- Wiring Type: 2w shield
- Wiring diagram / connection:



NOTE: Shield cable required from sensor to electronic monitor.

Current Sensor Interconnect Wiring

Factory Fan Monitor Default Settings for Current Sensor:

Type: Current
Signal: 0 to 10 Vdc
Scale Min: 0 amps
Scale Max: 50 or 100 amps
Alarm Low: No
Alarm Low Value: None
Alarm High: Yes
Alarm High Value: Fan mark specific, factory set at motor nameplate FLA x 1.15
Output Signal: 0 to 10 Vdc

Custom Range Settings:
Refer to fan monitor section for adjustments in range or default settings.

Pressure Sensor Kit

Pressure sensor used to detect system pressure or pressure differential. Each pressure sensor kit is provided with two pressure probes and a pressure transmitter. For static pressure reading relative to atmosphere a single pressure probe is necessary. For pressure differential measurements two pressure probes are required. Fan monitor can provide a system fault for alarm or current status reading.

Ratings:

Enclosure: NEMA-4X (IP 66) with supplied mounting enclosure
Temperature Range: 0° to 150°F *(-18° to 66°C)*
Input Voltage: 10 to 35 Vdc
Output Signal: 0 to 10 Vdc
Accuracy: ±1%

WARNING

Turn fan off and lock out power prior to mounting any sensors or running connection wiring.

Kit includes:

- Two (2) pressure probes with integral mounting bracket and gasketing
- Pressure transmitter

Pressure Probes

Pressure Transmitter

Hardware not included:

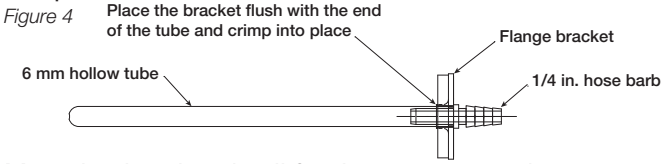
- 3/16 inch *(4.8 mm)* inner diameter tubing required for connection between probe(s) and transmitter
- Mounting fasteners for transmitter housing
- Mounting fasteners for pressure probe(s)

Pressure Probe and Transmitter Installation

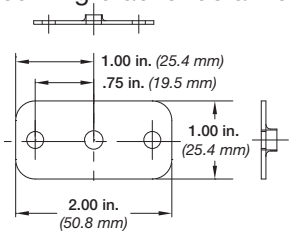
Pressure Probe Mounting:

Drill 5/16 inch *(6.3 mm)* diameter hole at location where pressure measurement is desired. Insert pressure probe into hole. Secure probe using pre-punches holes until bracket is flush with mounting location and gasket is compressed.

Figure 4



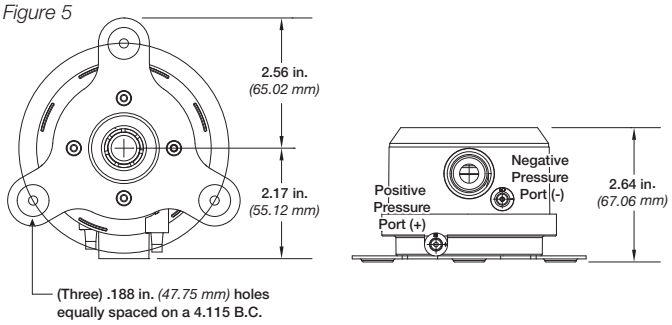
Mounting bracket detail for the pressure probe.



Transmitter Mounting:

Install pressure transmitter in a location near pressure probe(s) mounting location(s). Note maximum distance between pressure transmitter and primary system transmitter is 100 feet *(30 m)*. Mount pressure transmitter with pressure ports and electrical connection downwards.

Figure 5



Pressure Probe Connection:

Connect pressure probe(s) to transmitter using round tubing. Actual tubing length required varies based on distance between probes to transmitter mounting location.

Static pressure - single probe

Negative static pressure measurement. Connect the pressure probe to the negative (-) port, as indicated on the transmitter. Leave positive (+) port open to atmosphere.

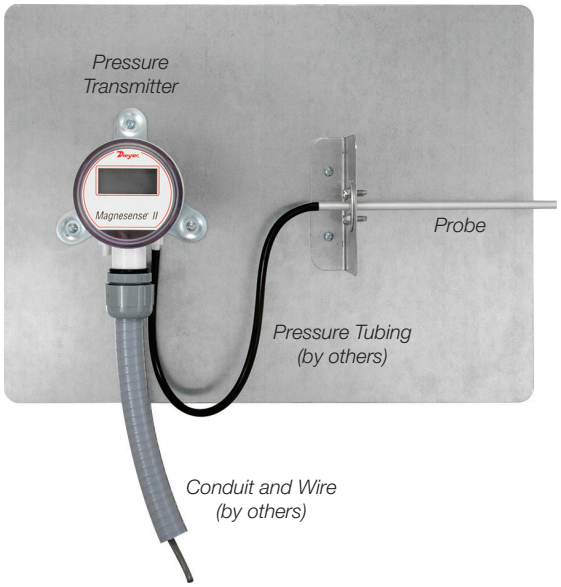
Positive static pressure measurement. Connect the pressure probe to the positive (+) port, as indicated on the transmitter. Leave negative (-) port open to atmosphere.

Figure 6

Differential pressure – two probes

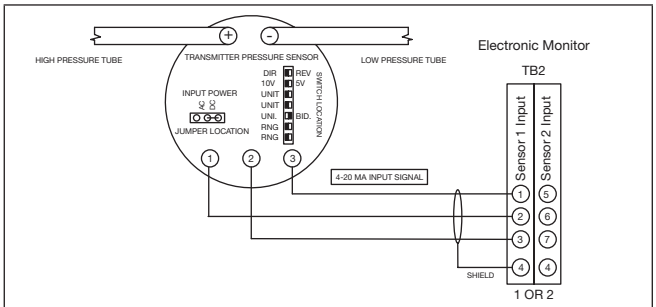
Connect each probe to the corresponding port on the transmitter. If measured results are opposite, then switch tubing into opposite port.

Mock Assembly Detail



Sensor Wiring and Point Connection:

- Wiring size: 18/22 AWG (by others) to fan monitor
- Wiring Type: 2w shield
- Wiring diagram / connection:



NOTE: Shield cable required from sensor to electronic monitor.

Pressure Sensor Interconnect Wiring

Factory Fan Monitor Default Settings for Pressure Sensor(s):

Type: Pressure
Signal: 0 to 10 Vdc
Scale Min: -28 inches wg (-6.9 KPa)
Scale Max: 28 inches wg (6.9 KPa)
Alarm Low: No
Alarm Low Value: None
Alarm High: No
Alarm High Value: None
Output Signal: 0 to 10 Vdc

Custom Range Settings:
Refer to fan monitor section for adjustments in range or default settings.

RPM Sensor Kit

Sensor used to detect rpm of fan. Fan monitor provides the ability to edit alarm settings for maximum RPMs and minimum RPMs. There are alarm settings for bearing lubrication, motor lubrication and belt replacement time intervals. Actual run time can also be monitored.

Ratings:

Enclosure: NEMA-4X, (IP 67) proximity sensor and supplied transmitter enclosure
Temperature Range: 32° to 120°F *(0° to 50°C)*
Input Voltage: 9 VCD minimum, 32 Vdc maximum
Output Signal: 4-20 mA
Maximum Distance from fan monitor: 100 feet *(30 m)*
Accuracy: ±0.1%

WARNING

Turn fan off and lock out power prior to mounting any sensors or running connection wiring.

Kit includes:

- Proximity sensor
- Polycarbonate enclosure
- Wiring between sensor and rpm transmitter
- Transmitter

Proximity Sensor

Polycarbonate Enclosure with Mounted Transmitter

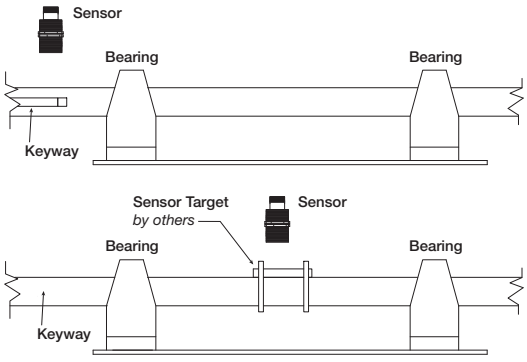
Wiring

Hardware not included:

- Signal wiring from enclosure to fan monitor
- Sensor target
- Mounting fasteners for mounting bracket
- Mounting fasteners for transmitter enclosure
- Tie downs and zip ties
- Adapter bracket
- Sensor mounting bracket

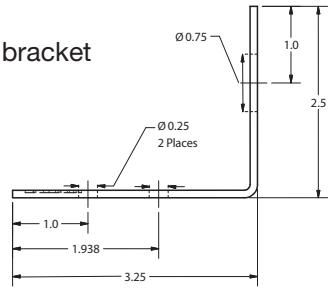
Installation of RPM Sensor

Proximity Sensor Mounting:
Determine location of sensor mounting. The sensor will require a field fabricated mounting bracket with a 0.75 inch hole. Sensor needs to be mounted near fan shaft to detect rotation. Maximum distance between sensor and target is .20 inch *(5 mm)*; this distance may vary depending on the target used.



Remove one adjustment nut from sensor and slide proximity sensor into mounting bracket (mounting bracket by others). Thread nut back on sensor to secure the sensor to the bracket. Final adjustments to proximity sensor location can be made through loosening and tightening of threaded nuts. Attach wiring to end of sensor. Locate mounting position of bracket and mark location. Remove sensor and wring from bracket and secure bracket to fan at location marked. Bracket can be secured using self-taping screws or using an epoxy adhesive. Reinstall sensor and wiring in mounting bracket. Secure sensor wiring avoiding any rotating components. Tie downs and zip ties are recommended to secure wiring.

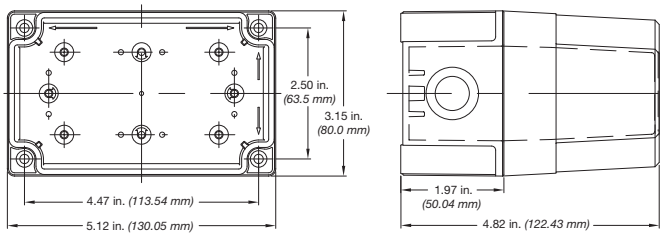
Example of mounting bracket (provided by others)



Transmitter Enclosure Mounting:
Transmitter enclosure can be installed on the fan or remotely. Do not exceed maximum distance of 100 ft. *(30 m)* between transmitter and electronic monitor. Wiring to electronic monitor is the responsibility of others.

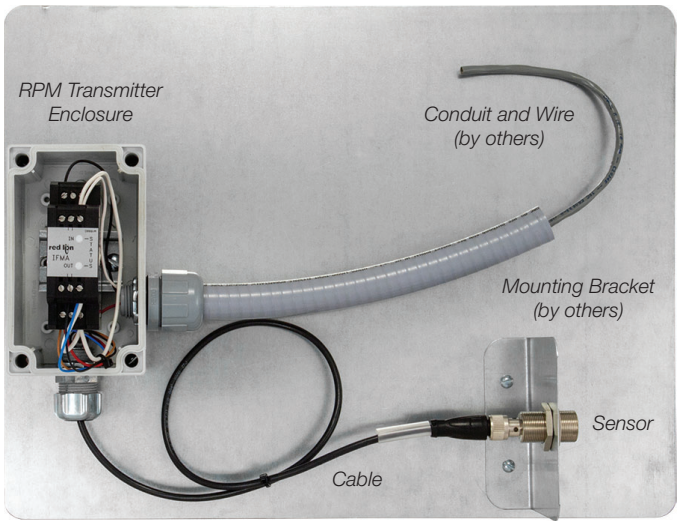
Install enclosure to desired mounting location using the four (4) thru-holes in the back of the enclosure. See Figure 8.

Figure 8



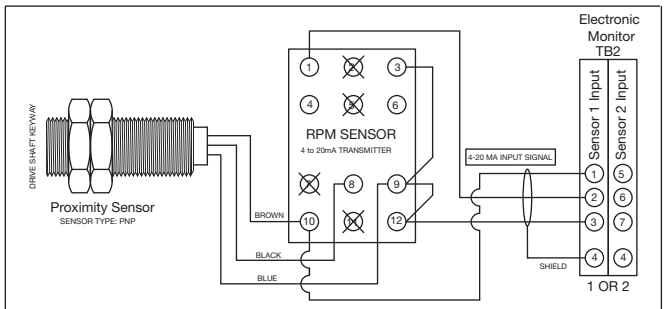
Connect proximity sensor wiring cable to transmitter. Make final connection between transmitter enclosure and fan monitor.

Mock Assembly Detail



Sensor Wiring and Point Connection:

Wiring size: 18 AWG
Wiring Type: 3w shielded
Wiring diagram / connection:



NOTE: Shield cable required from sensor to electronic monitor.

RPM Interconnect Wiring

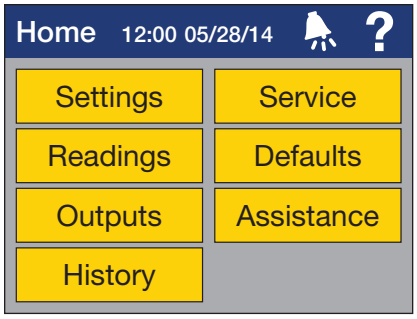
Factory Fan Monitor Default Settings for RPM Sensor(s):

Type: RPM
Signal: 4-20 mA
Scale Min: 0 RPM
Scale Max: 4200 RPM
Alarm Low: No
Alarm Low Value: None
Alarm High: Yes
Alarm High Value: Nameplate fan RPM x 1.02
Output Signal: 4-20 mA

Custom Range Settings:
Refer to fan monitor section for adjustments in range or default settings.

Monitor Settings, Options and Setup

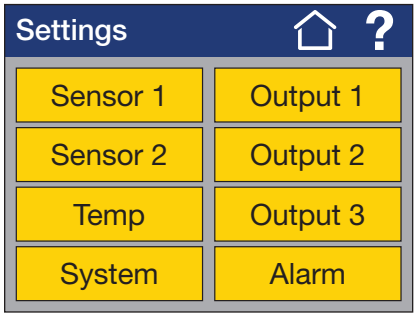
Navigation		
	Input	Yellow – Menu; Grey – Name; Green – Reading/Entry, status ok; Red – Reading, Alarm value
	Alarm	White Alarm icon system ok; Red Alarm icon flashing or solid color system in alarm
	Select	Green – Control item selected; Red – Alarm item selected
	Not Select	Green – Control item is not selected; Red – Alarm item is not selected
Back	Back	Move back one screen to previous page
Next	Next	Move forward one screen to the next page
	Home	Quick button to go directly back to the home screen
	Help	Quick button to the help screen



Home Screen

Settings: System settings menu screen(s) selection.
Readings: Sensor inputs real-time readings from system.
Outputs: System output analog real-time readings to building management system.
History: System history for sensors and alarms.
Service: Maintenance functions and set up.
Defaults: Reset to factory defaults or save user defaults.
Assistance: General assistance to Greenheck Fan Corporation.

The screen is a LCD touch screen. Pressing any of the yellow bars will take you into the menu for that portion of the monitoring system. Touching the alarm icon will show you the alarm history and the question mark will take you to the help information for that screen.

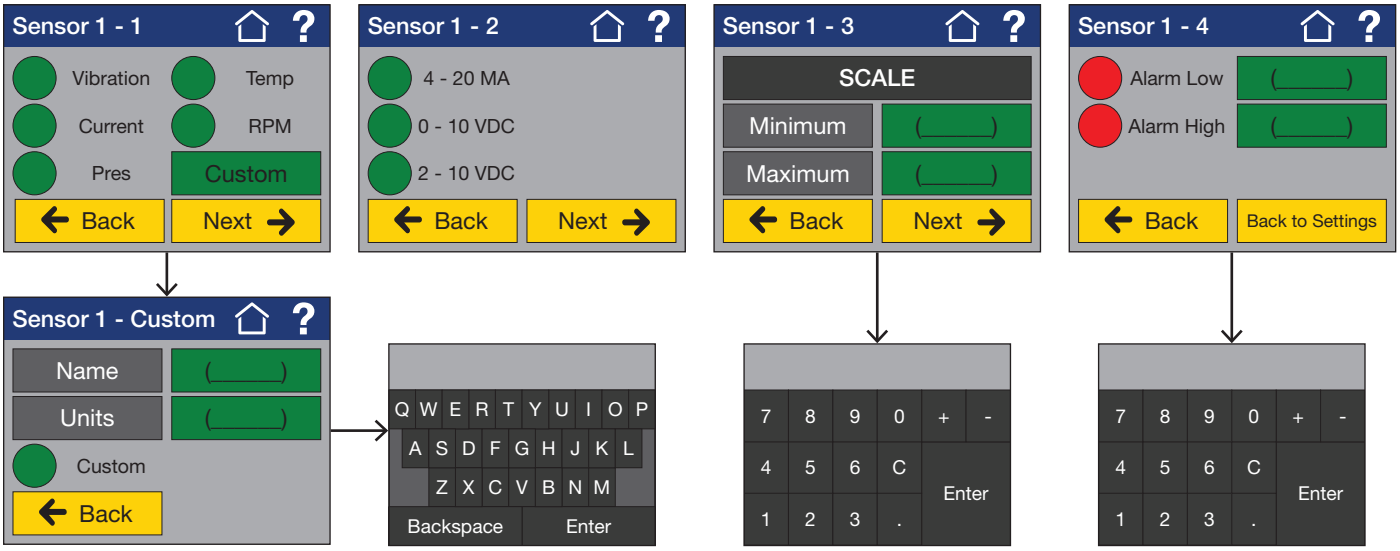


Settings Main Screen

Sensor 1: Settings screen(s) access for Sensor #1
Sensor 2: Settings screen(s) access for Sensor #2
Temp: Setting screen(s) access for Resistive Temperature
System: Setting screen(s) access for general system settings
Output 1: Settings screen(s) access for Output #1
Output 2: Settings screen(s) access for Output #2
Output 3: Settings screen(s) access for Output #3
Alarm: Settings screen(s) access for system Alarm

The screen is a LCD touch screen. Pressing any of the yellow bars will take you into the menu for that portion of the monitoring system. Touching the home icon take you back to the home screen and the question mark will take you to the help information for that screen.

Settings – Sensor 1 and Sensor 2 setup screen information



Custom sensor name and units
Touch green box, enter value, press enter key

Value entry for sensor
Touch green box, enter value, press enter key

Settings – Sensor 1 and Sensor 2

Sensor (1 or 2) -1: Sensor selection (Vibration, Current, Pressure, Temperature, RPM, Custom)

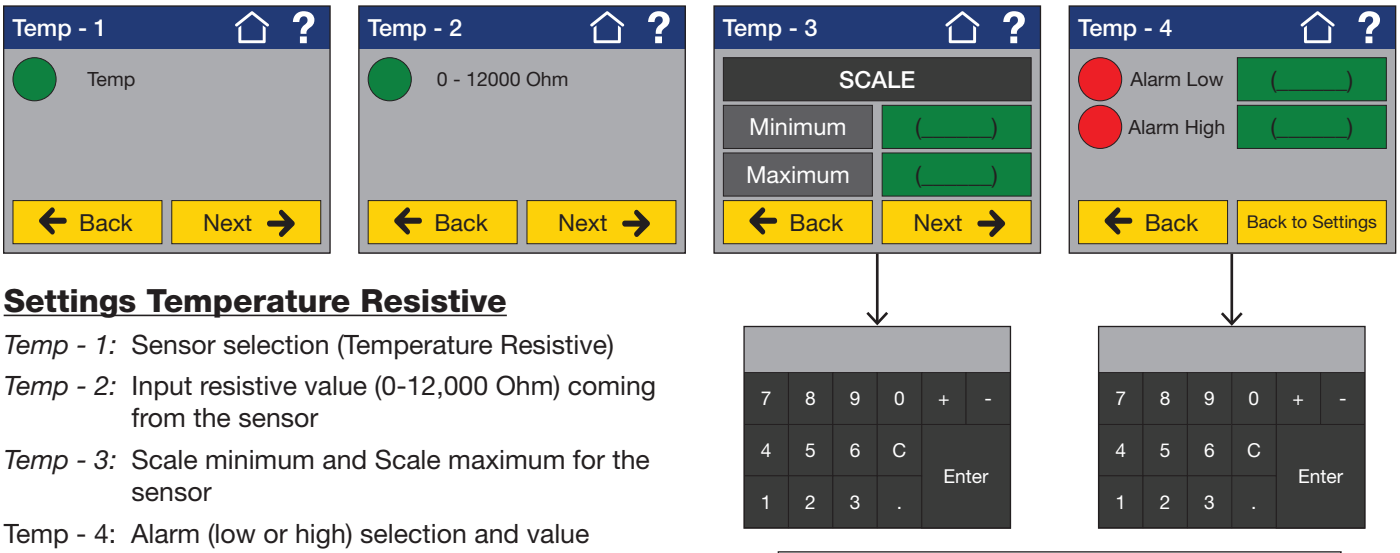
Sensor (1 or 2) -2: Input analog (4-20 mA, 0-10 Vdc, 2-10 Vdc) signal coming from the sensor

Sensor (1 or 2) -3: Scale minimum and Scale maximum for the sensor

Sensor (1 or 2) -4: Alarm (low or high) selection and value

Note: Sensor 1 and Sensor 2 are similar settings screens. System is set up with factory defaults for the sensors ordered, but they can be changed or added available features selected by customer.

Settings – Temperature Resistive setup screen information



Settings Temperature Resistive

Temp - 1: Sensor selection (Temperature Resistive)

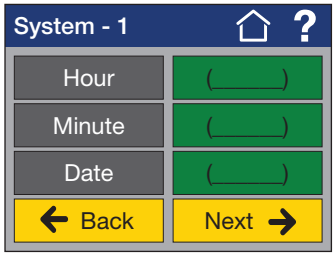
Temp - 2: Input resistive value (0-12,000 Ohm) coming from the sensor

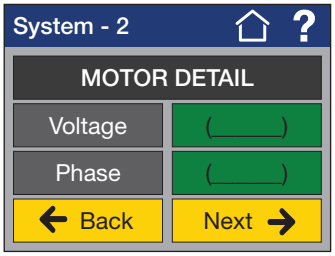
Temp - 3: Scale minimum and Scale maximum for the sensor

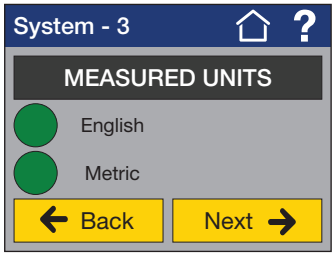
Temp - 4: Alarm (low or high) selection and value

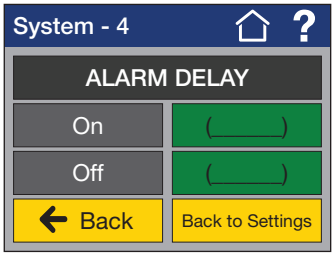
Value entry for sensor
Touch green box, enter value, press enter key

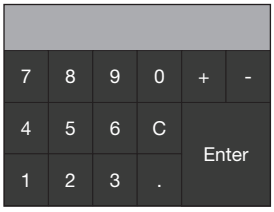
Settings – Systems setup screen information











Value entry for system inputs
Touch green box, enter value, press enter key

Settings System General

System - 1: Time (Military) and Date (MM/DD/YY)

System - 2: Motor Detail information, voltage and phase (with current sensor)

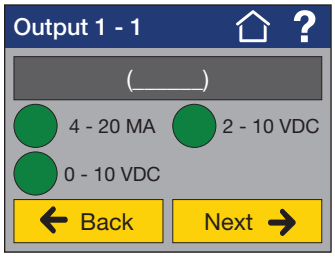
System - 3: Measurement unit (English or Metric) for readings and values (see below)

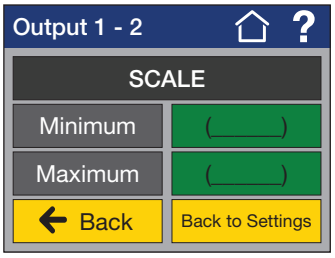
a. Vibration: English (in/sec) or Metric (mm/sec)
b. Pressure: English (in-wg) or Metric (Pa)
c. Temperature: English (°F) or Metric (°C)
d. Current: English and Metric (Amps)
e. RPM: English and Metric (RPM)

System - 4: Alarm delay for On and Off (seconds)

Note: System is setup with factory defaults but they can be changed or added available features selected by customer.

Settings – Output 1, Output 2, Output 3 setup screen information





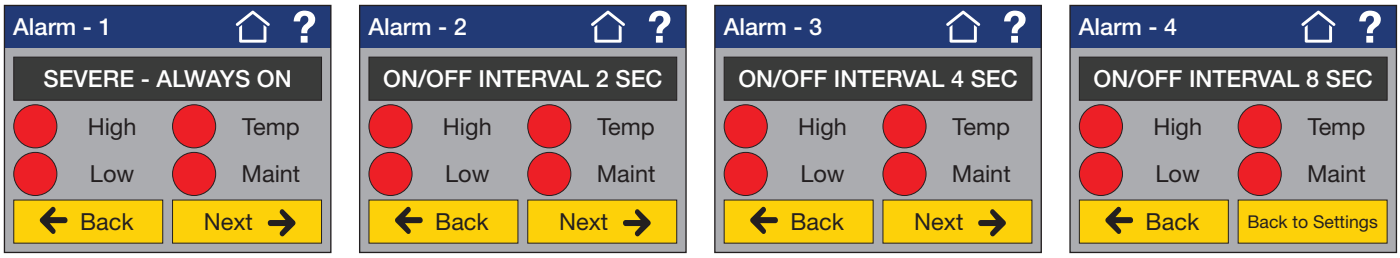
Settings Output 1, Output 2, Output 3

Output (1,2,3) - 1: Output analog (4-20 mA, 0-10 Vdc, 2-10 Vdc) signal from monitor

Output (1,2,3) - 2: Output scale automatic from appropriate input sensor. Read only value for reference and can be changed at sensor input only.

Note: Output 1 is programmed to follow Sensor 1. Output 2 is programmed to follow Sensor 2. Output 3 is programmed to follow Sensor 3. System is set up with factory defaults. Only output signal is changed, if scale is incorrect changes are made at the appropriate sensor input setting screen.

Settings – Alarm setup screen information



Settings Alarm Relay Output

Alarm - 1: Select (High, Low, Temperature Resistive, Maintenance) Category 4 (Severe Closed)

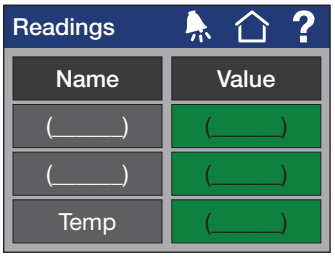
Alarm - 2: Select (High, Low, Temperature Resistive, Maintenance) Category 3 (Pulse 2 sec.)

Alarm - 3: Select (High, Low, Temperature Resistive, Maintenance) Category 2 (Pulse 4 sec.)

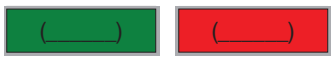
Alarm - 4: Select (High, Low, Temperature Resistive, Maintenance) Category 1 (Pulse 8 sec.)

Note: System is set up with factory defaults but they can be changed or added available features selected by customer. All maintenance alarms are selected and the responsibility of the installer. Each alarm type can only be selected once. Will shade out in other screens once selected.

Home - Readings screen information



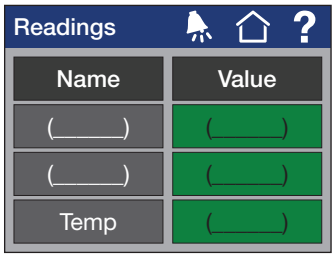
Sensor settings will automatically fill in name
Value will be active reading from sensor with units
All boxes are read-only



Value box will change from green to red during an alarm

Note: System is set up with factory defaults and changes to these screens are done at the settings level of the monitor. Items for this screen will automatically change depending on the sensor settings.

Home - Output screen information:

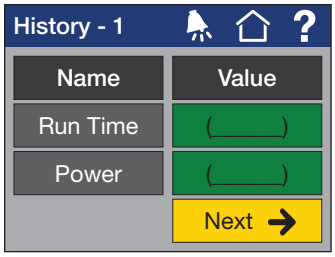


Output settings will automatically fill in name
Value will be active reading from output with units
All boxes are read-only

Value box will always be green and are not programmed to an alarm

Note: System is set up with factory defaults and changes to these screens are done at the settings level of the monitor. Items for this screen will automatically change depending on the output settings.

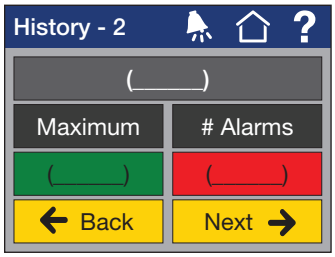
Home - History screen(s) information



History - 1

Live readings tracking run time and motor power. No values will display if these sensors are not installed.

1. *Run time is tracked with Current or RPM sensor*
2. *Power is determined by current sensor, then settings for the motor voltage and phase.*

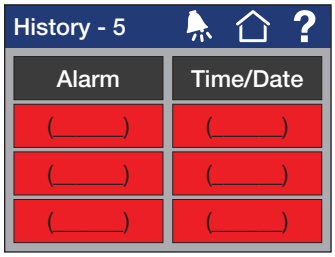


History - 2, - 3, - 4

Screens are similar, History 2 (Sensor 1), History 3 (Sensor 2), History 4 (Resistive)

1. *Name is automatically entered with sensor settings*
2. *Maximum value is history of the highest sensor reading over time*
3. *Number of alarms are tracked over time*
4. *Reset of maximum value and alarm count by factory password*

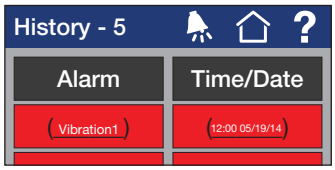
Touching the alarm icon will launch the History - 5 screen



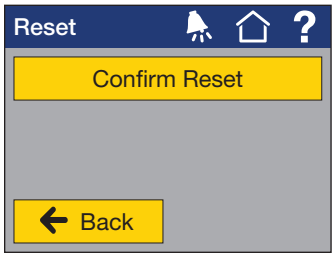
History - 5

Live history of the past three alarms present in the system

1. *Alarm is the type of alarm (High, Low, Temp, Service)*
2. *Time and date stamp of the recorded alarm*



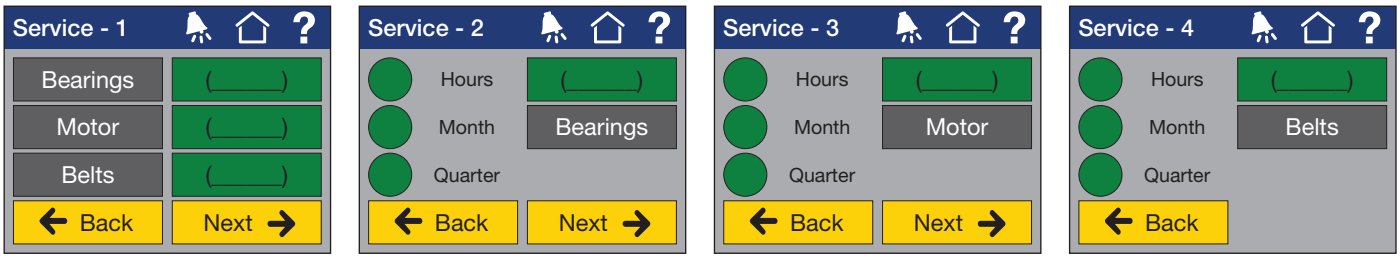
Touch red box to reset alarm(s)



Reset confirmation to show alarm history line to be reset

Note: History is set up with factory defaults and changes to these screens are done at the settings level of the monitor unless noted. Items for this screen will automatically change depending on the system settings.

Home - Service screen information



Settings System General

Service - 1: Current maintenance status for equipment components.

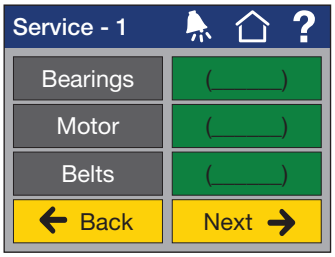
Service - 2: Bearing maintenance schedule, 24/7 or Actual Time (with Current or RPM sensor)

Service - 3: Motor maintenance schedule, 24/7 or Actual Time (with Current or RPM sensor)

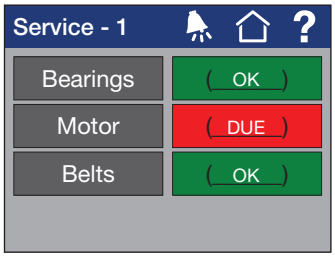
Service - 4: Belts maintenance schedule, 24/7 or Actual Time (with Current or RPM sensor)

Note: System is set up with factory defaults and changes to these screens are done at the settings level of the monitor. Items for this screen will automatically change depending on the output settings.

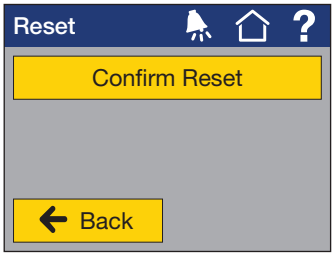
Value in green box will be either "OK" or "Due" for service. Maintenance function will need to be active in Systems settings. Each function is separate from each other so sequence can be different.



Value box will change from green to red during an alarm



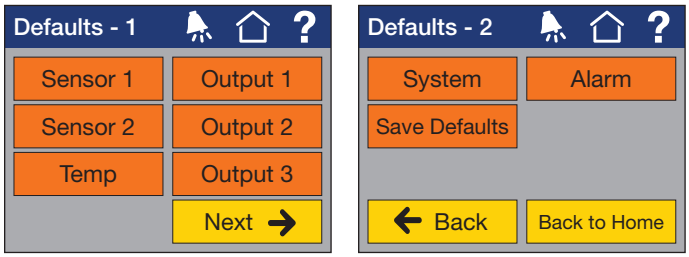
Touch "DUE" red box to reset alarm back to "OK"



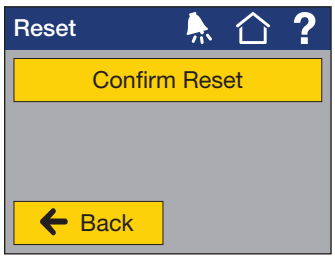
Reset confirmation to show service has been completed and system is now "OK"

Note: Remove service alarm from history

Home - Default screen information



Touch orange box to reset to defaults



Reset confirmation to verify that the saved default setting for a sensor or the system are required by the user

Note: System is set up with factory defaults. However, the customer can make changes to the settings. If the original defaults are needed to be recovered, each specific component or the entire system can be set back to defaults. The customer can also create their own defaults and save them, this will override the factory settings and they will not be able to be recovered.

Home - Assistance screen information

Note: Assistance with the monitoring system can be obtained by calling Greenheck Fan Corporation at the phone number shown. Additional information regarding the monitoring system is found on our website.

Specifications

Service:	Air and non-combustible, compatible gases
Enclosure Rating:	NEMA-4 and IP56
Dimensions:	5 x 5-3/8 x 2-1/2 inches (127 x 136.5 x 63.5 mm)
Mounting:	Mount unit in vertical plane with #8-32 screws (4 hole locations)
Thermal Effects:	0.015% / °F (0.027% / °C) from -13° thru 185°F (25° thru 85°C)
Stability:	< ±1% per year
Temperature Range:	-4° to 140°F (-20 to 60°C)
Power Requirements:	100 to 240 Vac at 50/60 Hz or 24 Vac/24 Vdc
Power Consumption:	Power = 21 VA at 120 Vac
Output Signal:	User selectable. 4-20 mA (900 ohms max.) or 0-10 Vdc or 2-10 Vdc
Connections:	Euro-type removable or push button terminal block and 1/2 inch watertight conduit fittings.
Fusing:	A 250 Vac MEDIUM LAG fuse required.
Zero/Span Adjust:	Accessible via touch screen menu.
Display Type:	2.8 inch 320 x 240 TFT color backlight LCD display with touch panel.
Resistive Temp:	Honeywell Industrial Temp sensor part number 6655-90980004
Weight:	Less than 3 lbs.
Agency Approvals:	ETL

Wiring Notes

1. **Input power:** Two versions of this controller are available; Verify requirements prior to applying power.
2. **High Voltage Input:** Apply 100 to 265 Vac to terminals TB1-1 (line), TB1-2 (Neutral), and TB1-3 (Earth Ground).
3. **Low Voltage Input:** Apply 24 Vac or 24 Vdc to terminals TB1-1 (+ or ~), TB1-2 (- or ~), and TB1-3 (Earth Ground).
4. **4-20 mA Sensors:** Controller provides loop power for sensor (24 Vdc at 100 mA max.) See wiring diagram for hookup. The configuration can be verified via the LCD touch screen menu. Changes to factory sensor defaults can be adjusted as required in settings.
5. **0-10 or 2/10 Vdc Sensors:** Controller provides loop power for sensor (24 Vdc at 100 mA max.) See wiring diagram for hookup. The configuration can be verified via the LCD touch screen menu. Changes to factory sensor defaults can be adjusted as required in settings.
6. **Resistive Sensor:** Use only Honeywell Temperature sensor part number 6655-90980004. See wiring diagram for hookup. The configuration can be verified via the LCD touch screen menu. Changes to factory sensor defaults can be adjusted as required in settings.
7. **Output 1:** Optically isolated, will track readings from Sensor 1 input. See wiring diagram for hookup. The signal output can be verified via the LCD touch screen menu. Changes to factory output defaults can be adjusted as required in settings.
8. **Output 2:** Optically isolated, will track readings from Sensor 2 input. See wiring diagram for hookup. The signal output can be verified via the LCD touch screen menu. Changes to factory output defaults can be adjusted as required in settings.
9. **Output 3:** Optically isolated, will track readings from Temp Resistive input. See wiring diagram for hookup. The signal output can be verified via the LCD touch screen menu. Changes to factory output defaults can be adjusted as required in settings.
10. **Alarm Output:** Optically isolated open collector output. Maximum collector emitter voltage is 80 Vdc at 50 mA.

Maintenance

WARNING

Disconnect all electrical power and secure to the "OFF" position prior to inspection or servicing. Failure to comply with this safety precaution could result in serious injury or death.

The following list is recommended preventive maintenance of the controls system. All of these items should be done before initial power up of the system and then done on a routine maintenance schedule.

It is also recommended to follow the component manufacturer maintenance recommendations which are stated in their Installation, Operation and Maintenance (IOM) document(s).

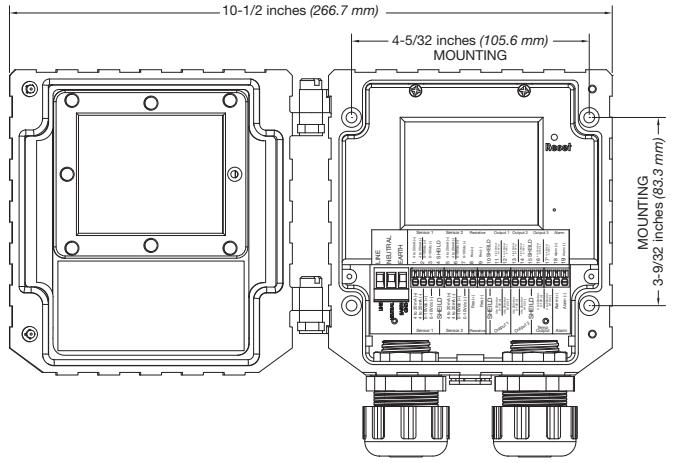
Description	Action	Occurrence
Inspect System Wire	Look for cracked, frayed, bare wiring. Replace as necessary	Quarterly
Inspect System Conduit	Look for loose fittings and cracked or broken down seal tight. Replace as necessary	Quarterly
Inspect Wiring Terminations	Look for loose or broken terminals. Tighten to required torque for each or replace as necessary.	Quarterly
Inspect Weather Proof Gaskets	Inspect all gaskets and look for moisture. Replace if necessary.	Quarterly
Inspect Electrical Enclosures	Inspect all enclosures and look for broken hardware. Replace as necessary	Quarterly

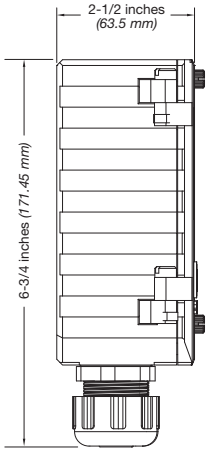
Finally, it is recommended to follow the fan IOM document for recommended service and also routine maintenance on the mechanical components of the remaining items in the system.

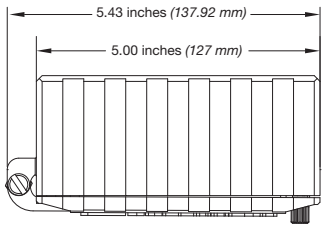
Replacement Parts

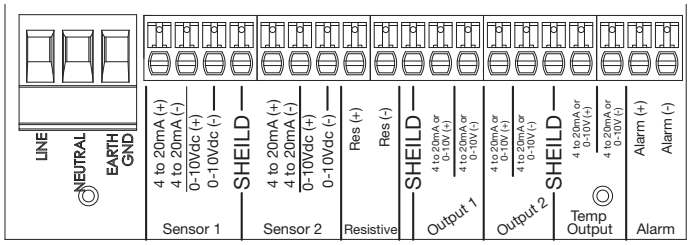
Description	Mfg.	Manufacturer Part Number
Fan Monitor System	As required	Consult Factory
Sensor, Vibration Transmitter	Wilcoxin	PC420VR-20
Cable, Vibration Transmitter	Wilcoxin	R6W-0-J9TA-32
Mounting Pad, Vibration Transmitter	Wilcoxin	SF8-2
Epoxy Kit	Wilcoxin	VERSIL406
Sensor, Current Transmitter	ACI	A/CTV-50
Enclosure, Outdoor NEMA-4X	Fibox	PCM100/125G
Enclosure, Mounting Rail	Fibox	MIV-5
Sensor, RPM Transmitter	Red Lion	IFMA0035
Switch, RPM Proximity PNP	Square D	XS518B1PAM12
Cable, RPM Proximity Switch	Pepperl+Fuchs	V1-G-BK5M-PVC-U
Sensor, Pressure Transmitter	Dwyer	MS2-W103-LCD
Tap, Static Pressure Probe	Dwyer	A-489
Sensor, Air Temperature Transmitter	Dwyer	659TC-JI-200C
Sensor, Bearing Temperature Transmitter	Dwyer	659TC-JM-250C
Probe, Air Temperature	Dwyer	122095-06
Probe, Bearing Temperature	Dwyer	122095-32

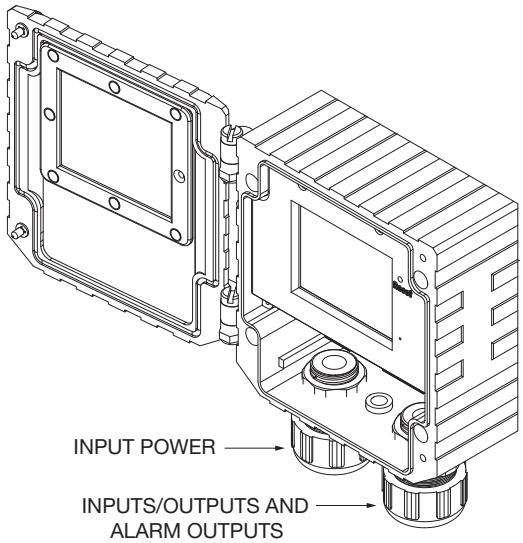
Dimensions


10-1/2 inches (266.7 mm)
4-5/32 inches (105.6 mm)
MOUNTING
MOUNTING
3-9/32 inches (83.3 mm)
Reset


2-1/2 inches
(63.5 mm)
6-3/4 inches (171.45 mm)


5.43 inches (137.92 mm)
5.00 inches (127 mm)


LINE
NEUTRAL
EARTH GND
4 to 20mA (+)
4 to 20mA (-)
0-10Vdc (+)
0-10Vdc (-)
SHEILD
Sensor 1
4 to 20mA (+)
4 to 20mA (-)
0-10Vdc (+)
0-10Vdc (-)
Sensor 2
Res (+)
Res (-)
Resistive
SHEILD
4 to 20mA or 0-10V (+)
4 to 20mA or 0-10V (-)
Output 1
4 to 20mA or 0-10V (+)
4 to 20mA or 0-10V (-)
SHEILD
Output 2
4 to 20mA or 0-10V (+)
4 to 20mA or 0-10V (-)
Temp Output
Alarm (+)
Alarm (-)
Alarm


INPUT POWER
INPUTS/OUTPUTS AND
ALARM OUTPUTS

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
Building Value in Air.

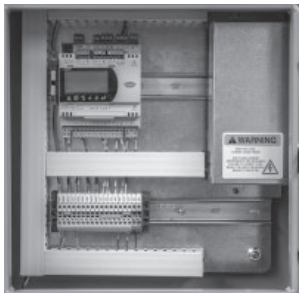
Phone: 715.359.6171 • Fax: 715.355.2399 • Parts: 800.355.5354 • E-mail: gfcinfo@greenheck.com • Website: www.greenheck.com

GREENHECK
Building Value in Air.

Document 481885
Vektor® Laboratory Exhaust with Variable Geometry Nozzle (VGN) Technology Electrical Controls Information

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.



Single Fan
VGN Controller

Multiple Fan
VGN Controller

General Safety Information

Only qualified personnel should install this unit. Personnel should have a clear understanding of these instructions and should be aware of general safety precautions. Improper installation can result in electric shock, possible injury due to coming in contact with moving parts, as well as other potential hazards. Other considerations may be required if high winds or seismic activity are present. If more information is needed, contact a licensed professional engineer before moving forward.

1. Follow all local electrical and safety codes, as well as the National Electrical Code (NEC), the National Fire Protection Agency (NFPA), where applicable. Follow the Canadian Electrical Code (CEC) in Canada.
2. Do not allow the power cable to kink or come in contact with oil, grease, hot surfaces, or chemicals. Replace cord immediately if damaged.
3. Verify the power source is compatible with the equipment.

DANGER

Always disconnect power before working on or near a unit. Lock and tag the disconnect switch or breaker to prevent accidental power up.

CAUTION

When servicing the unit, variable frequency drives (VFD) may be hot enough to cause pain or injury. Allow motor to cool before servicing.

Table of Contents

Receiving

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

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. Sometimes it is not possible that all items for the unit be shipped together due to availability of transportation and truck space. Confirmation of shipment(s) must be limited to only items on the bill of lading.

Handling

Handle in such a manner as to keep from scratching or chipping the coating. Damaged finish may reduce ability of unit to resist corrosion.

Storage

Units are protected against damage during shipment. If the unit cannot be installed and operated immediately, precautions need to be taken to prevent deterioration of the unit during storage. The user assumes responsibility of the unit and 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.

INDOOR - The ideal environment for the storage of units and accessories 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°F *(-1°C)* and 110°F *(43°C)* (wide temperature swings may cause condensation and “sweating” of metal parts). All accessories must be stored indoors in a clean, dry atmosphere. Remove any accumulations of dirt, water, ice, or snow and wipe dry before moving to indoor storage. To avoid “sweating” of metal parts, allow cold parts to reach room temperature. To dry parts and packages use a portable electric heater to eliminate any moisture build up. Leave coverings loose to permit air circulation and to allow for periodic inspection. The unit should be stored at least 3½ in. *(89 mm)* off the floor on wooden blocks covered with moisture proof paper or polyethylene sheathing. Aisles between parts and along all walls should be provided to permit air circulation and space for inspection.

Inspection and Maintenance during Storage

While in storage, inspect equipment once per month. Keep a record of inspection and maintenance performed. If moisture or dirt accumulations are found on parts, the source should be located and eliminated.

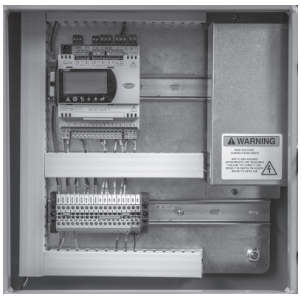
Removed From Storage

As units are removed from storage to be installed in their final location, they should be protected and maintained in a similar fashion, until the equipment goes into operation. Prior to installing the unit and system components, inspect the unit assembly to make sure it is in working order.

1. Check all fasteners, and accessories for tightness.

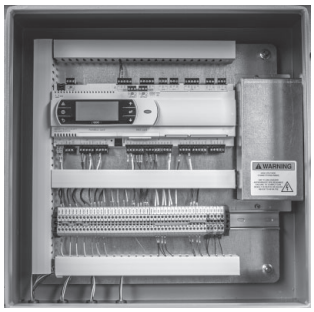
Variable Geometry Nozzle (VGN) Control System Components

System Components



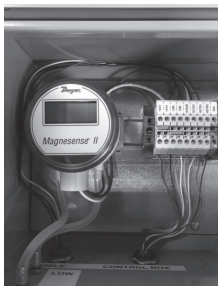
Single Fan
VGN Controller

The single fan nozzle controller is used to control one fan system.



Multiple Fan
VGN Controller

The multiple fan nozzle controller is used to control two to four fan systems.



Pressure Transducer Box
Factory-mounted on fan

5 Pin Cables, 1 per fan
Shipped in Pressure Transducer Box

8 Pin Cables, 3 per fan
Shipped in VGN Control Box

Adhesive Cable Clips and Zip Ties
Qty. 12

Customer-Supplied System Components

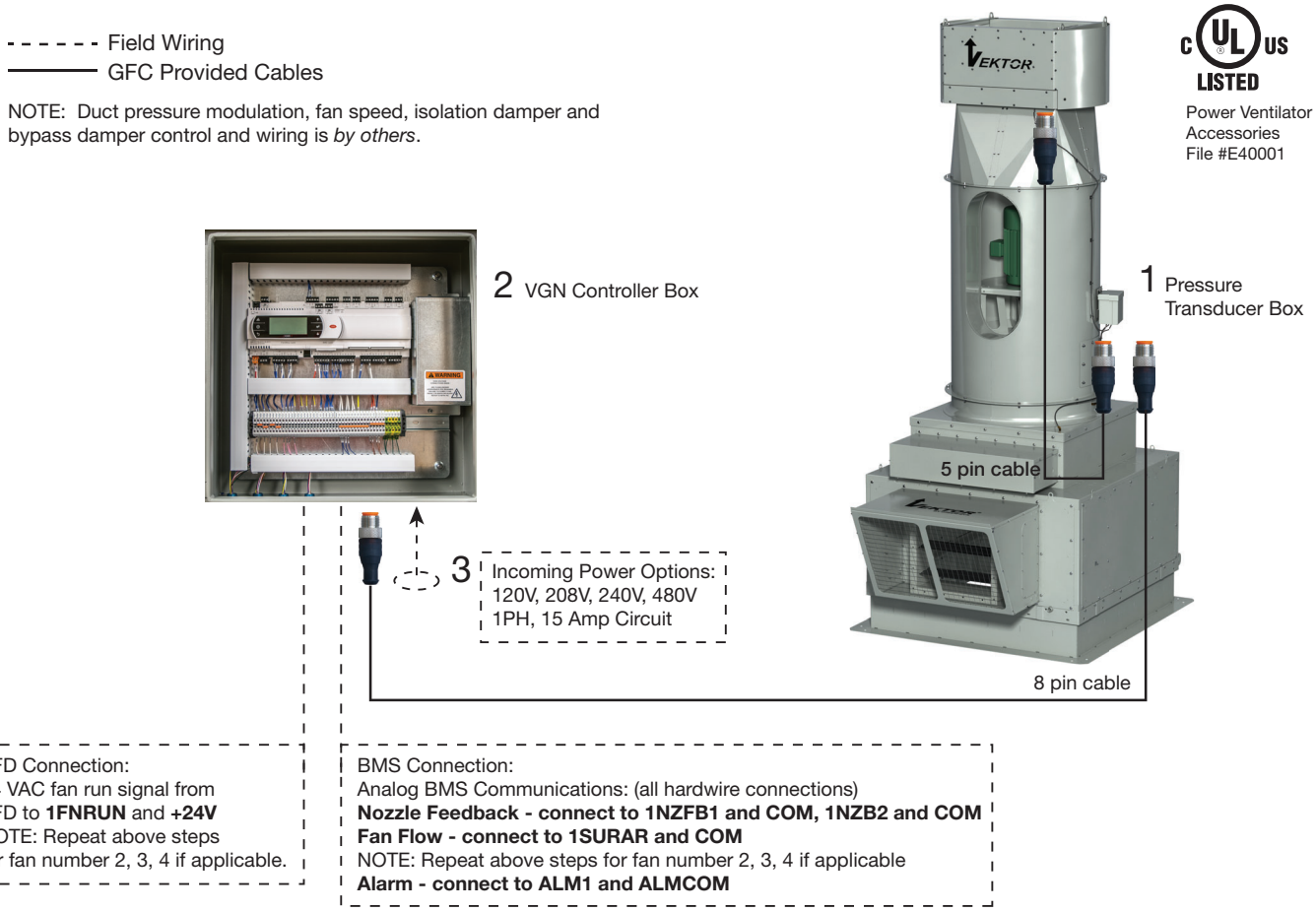
Quantity	Description
Varies	Wiring, conduit, miscellaneous fittings
1	Building Management System (BMS) with required communication wiring and shielding
Varies	Pressure transducer for duct pressure
1 to 4	Fan motor VFD

Quick Installation Guide

Mount VGN controller box upright with connectors *down* on structural support within 20 feet from center of fan plenum.

Connections:

1. Connect 5 pin cable from nozzle to factory mounted pressure transducer box (repeat step for number of fans installed). Mount provided adhesive cable clips every 12 inches down fan stack and secure cable.
2. Connect 8 pin cable from pressure transducer box to VGN control box. Repeat step for number of fans installed and connect as labeled 1, 2, 3, 4 for corresponding fan. Each fan is provided with (3) 10 meter cables; use as required.
3. Run power wiring in conduit to VGN controller box.
   - 24 VAC fan run contact
   - BMS communications
   - Proper incoming power
4. All wiring by others per local codes



Variable Geometry Nozzle (VGN) System Function Overview

The VGN system uses a variable geometry nozzle to maintain desired nozzle outlet velocities. The VGN system is controlled by a pre-programmed VGN controller. The VGN controller powers the factory mounted pressure transducer and the variable geometry nozzle. The VGN controller receives a signal from the pressure transducer and converts that signal into a fan flow. It then calculates the appropriate nozzle opening and sends a signal to the nozzle to adjust it to the proper size opening to maintain desired nozzle outlet velocity. The VGN controller does not operate the isolation or bypass damper and it does not control duct pressure; those parameters are controlled by the BMS.

Mounting of VGN Controller

Mount VGN controller upright with connectors down on structural support within 20 feet from center of fan plenum. Cables and wiring will be connected to the bottom of the box so it must have a minimum of 12 inches of clearance from any obstructions. The VGN control box is a NEMA-3R enclosure suitable to be mounted indoors or outdoors.

Nozzle to Pressure Transducer Box Quick Disconnect Wiring Instructions

Connect the factory supplied 5 pin cable (shipped in the pressure transducer box mounted on the fan) to the 5 pin threaded bulkhead on the bottom of the nozzle; connect the other end to the 5 pin threaded bulkhead on bottom of the pressure transducer box that is mounted on the fan. Mount provided adhesive cable clips every 12 inches down the fan stack and secure cable using zip ties.

NOTE: Repeat this step for fan number 2, 3, 4 if applicable.

VGN Controller to Pressure Transducer Box Quick Disconnect Wiring Instructions

Connect the factory supplied 8 pin cable (shipped in the VGN controller) to the 8 pin threaded bulkhead on bottom of the VGN controller; connect the other end to the 8 pin threaded bulkhead on bottom of the pressure transducer box that is mounted on the fan. Each fan is provided with (3) 10 meter cables that can be connected together to extend the length; use as required per fan. Based on the location of the VGN controller, each fan may require a different number of cables to reach the controller; it is not necessary to match the number of cables used on each fan.

NOTE: Repeat this step for fan number 2, 3, 4 if applicable. Make sure the numbering of the fans is consistent during the entire wiring installation; fan 1 will require wiring specific to fan 1, fan 2 will require specific wiring, along with fans 3 and 4 if applicable

Variable Geometry Nozzle (VGN) Controller to VFD and BMS Hardwiring Instructions

NOTE
All field installation and wiring of electrical equipment must be done to meet NEC, CEC and local codes.
Be sure to use appropriately sized wire for the full load amp draw.
Once the following hardwiring is complete, please refer to the BMS Communication Programming section for details on programing the BMS to communicate with the VGN controller via the hard wire connections.

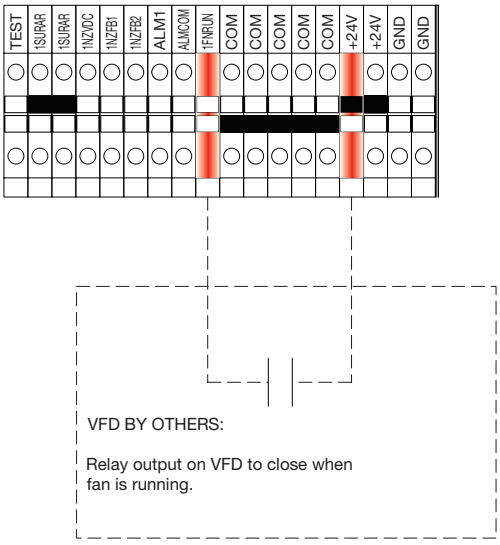
Make sure the numbering of the fans is consistent during the entire wiring installation; fan 1 will require wiring specific to fan 1, fan 2 will require specific wiring, along with fans 3 and 4 if applicable.

Fan Run Signal (hard wire connections)

The VGN controller requires a 24 VAC fan run input signal to communicate to the VGN controller that the fan is running. The VGN controller will supply the 24 VAC voltage required, but it will need to be switched on and off by the Building Management System (BMS) or Variable Frequency Drive (VFD) based on the fan run status. Use a relay contact controlled by the VFD or BMS to control the fan run signal; the contact should be closed when the fan is running. Connect the +24V terminal in the VGN controller to the input of the relay contact. Connect the normally closed (NC) switched side of the relay contact to the 1FNRUN terminal in the VGN controller. The VGN controller will not function without the 24 VAC fan run signal.

Wire Landing Points

- Fan 1: +24 V and 1FNRUN on the terminal strip
- Fan 2: +24 V and 2FNRUN on the terminal strip, *if applicable*
- Fan 3: +24 V and 3FNRUN on the terminal strip, *if applicable*
- Fan 4: +24 V and 4FNRUN on the terminal strip, *if applicable*



BMS Communication (hard wire connections)

Nozzle Feedback will report the position of the nozzle during operation. It is necessary to maintain minimum required nozzle outlet velocity. Each nozzle has two feedback outputs, one for each blade of the nozzle. Connect BMS to 1NZFB1 and COM. Connect BMS to 1NZFB2 and COM.

Wire Landing Points

- Fan 1: 1NZFB1 and COM and 1NZFB2 and COM on the terminal strip
- Fan 2: 2NZFB1 and COM and 2NZFB2 and COM on the terminal strip, *if applicable*
- Fan 3: 3NZFB1 and COM and 3NZFB2 and COM on the terminal strip, *if applicable*
- Fan 4: 4NZFB1 and COM and 4NZFB2 and COM on the terminal strip, *if applicable*

Fan Flow This feature is not required for system operation. This feature allows the BMS to record and display the CFM of the fan during operation. Connect BMS to 1SURAR and COM.

Wire Landing Points

- Fan 1: 1SURAR and COM on the terminal strip
- Fan 2: 2SURAR and COM on the terminal strip, *if applicable*
- Fan 3: 3SURAR and COM on the terminal strip, *if applicable*
- Fan 4: 4SURAR and COM on the terminal strip, *if applicable*

Alarm will notify the BMS of issues with the VGN control system by closing a dry relay contact within the VGN Carel controller. Connect BMS to ALM1 and ALMCOM.

Wire Landing Points

- Entire System: ALM1 and ALMCOM on the terminal strip

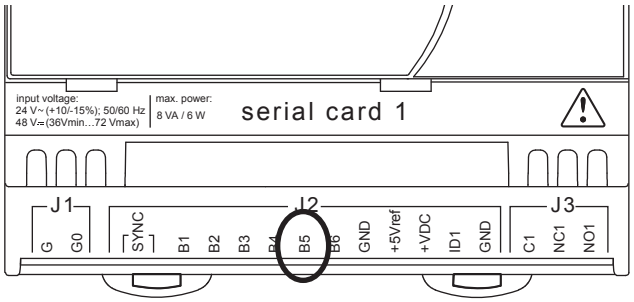
NOTE: There is only one alarm contact for the entire VGN control system regardless of the number of fans.

Variable Geometry Nozzle (VGN) Controller to VFD and BMS Hardwiring Instructions (continued)

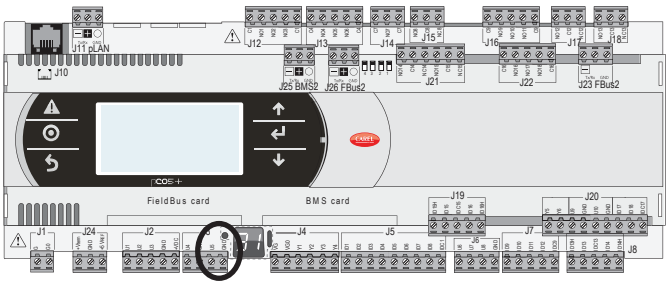
Outlet Velocity: On the Fly Unoccupied Adjustment This feature is not required for system operation. This feature allows the user to adjust the nozzle outlet velocity remotely while the fan is running with the use of a 0-10 VDC signal sent from the BMS to the VGN controller. Connect the BMS directly to the proper input (see below) on the Carel PLC unit and COM on the terminal strip.

Wire Landing Points

- Single Fan Entire System: B5 on Carel PLC and COM on the terminal strip



- Multifan Entire System: U5 on Carel PLC and GND on the Carel PLC



NOTE: There is only one on the fly unoccupied nozzle velocity adjustment for the entire VGN control system regardless of the number of fans; one BMS signal commands all the nozzles to the same outlet velocity.

VGN Controller Incoming Power Wiring Instructions

Incoming Power (hard wire connections)
The VGN controller will function on 120, 208, 240, or 480V single-phase 50/60 Hz AC. Remove the metal cover located on the right side of the VGN controller to access the terminal strip for incoming power (reference Wire Diagram for details on terminal strip landing points). Once the wiring is complete reinstall the metal cover. Each VGN controller will draw a maximum of 2 amps.

BMS Communication Programming

The VGN controller uses analog and digital communications that are hard wired to the BMS to communicate with the BMS.

Fan Run Signal can be switched by the BMS or VFD. The VGN controller requires a 24 VAC fan run input signal from BMS or VFD to communicate to the VGN controller that the fan is running. Use a switching relay contact controlled by the VFD or BMS to control the fan run signal; the contact should be closed when the fan is running. Multiple fan systems will require a separate fan run signal for each fan which corresponds to each fan number.

Nozzle Feedback will report the position of the nozzle during operation. It is necessary to maintain the minimum required nozzle outlet velocity. Each nozzle has two feedback outputs, one for each blade of the nozzle. The output from the nozzle feedback is a 2-10 VDC voltage. To properly maintain required nozzle outlet velocity the minimum allowable nozzle feedback voltage is 2.1 VDC. If the nozzle feedback drops below this voltage the fan speed must be increased to maintain the required nozzle outlet velocity. Modulation of the bypass damper may be required to maintain proper duct pressure while maintaining required nozzle outlet velocity.

Fan Flow This feature is not required for system operation; this feature allows the BMS to record and display the CFM of the fan during operation. Each fan has one 0-10 VDC output for fan flow.

To calculate the fan flow and display it on the BMS use the following calculations:

$$CFM = K\text{-}Factor \bullet \sqrt{\frac{\Delta P}{\rho}}$$

a. ΔP is calculated with the following equation: ((SURAIR Voltage)/10))*15

b. $\rho$is air density which is job site specific; a universal number to use is .075 lbm/ft^3

c. K-Factor is listed on a data plate located on the fan body or refer to the charts below; each fan type and size have a unique K-Factor number.

	Vektor-CS (VK-C-XX)
Fan Size	K-Value
12	296
15	431
18	542
22	805
24	982
27	1184
30	1464
33	1770
36	2168
40	2630
44	3220

	Vektor-HS (VK-H-XX)
Fan Size	K-Value
9	248
10	202
12	296
13	351
16	440
18	542
22	804
24	971
30	1463
36	2167

	Vektor-MS (VK-M-XX)
Fan Size	K-Value
15	526
18	787
20	955
22	1161
24	1436
27	1729
30	2116
33	2581
36	3154
40	3825

NOTE: Repeat steps above for fan 2, 3, and 4 if applicable.

Alarm The alarm will notify the BMS of issues with the VGN control system by closing a dry relay contact within the Carel controller. There is only one alarm contact for the entire VGN control system regardless of the number of fans. The Carel controller located in the VGN control box will display the alarm history to help diagnose the issue; no alarm history will be transmitted to the BMS.

The alarm contact will close due to the following issues:

The fan run signal shows the fan running but the 0-10 VDC signal from the pressure transducer is not within the expected range. This could be due to wiring issues, failed pressure transducer, closed isolation damper, water in the pressure transducer tubes, or the fan motor is not spinning.

Outlet Velocity: On the Fly Unoccupied Adjustment This feature is not required for system operation. This feature allows the user to adjust the nozzle outlet velocity remotely while the fan is running with the use of a 0-10 VDC signal sent from the BMS to the VGN controller. This feature is used to reduce energy costs during unoccupied or low use lab times. It can also be used with real time wind wake study data to optimize energy consumption. Lower nozzle velocity will equate to lower plume height and lower system restriction; it is the responsibility of the user to determine what nozzle velocity is required.

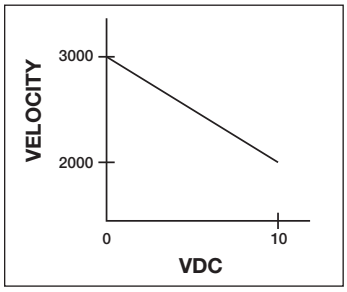
In the "User Settings" menu of the Carel menu, the user can set the nozzle outlet velocity maximum and minimum settings.

USER SETTINGS	
ELEVATION:	0 FT
MAX OUT VEL:	3000 FPM
MIN OUT VEL:	2000 FPM
ACTIVE STPT:	3000 FPM
FOR TEST/BALANCE PRESS DOWN ARROW	

Sending 0 VDC to the B5 input on single fan or U5 input on multifan of the Carel controller will default the nozzle velocity to the maximum outlet velocity set by the user.

Sending 10 VDC to the B5 input on single fan or U5 input on multifan of the Carel will adjust the nozzle velocity to the minimum outlet velocity set by the user.

Sending a DC voltage between 0 and 10 VDC will adjust the nozzle outlet velocity linearly.



DC Voltage to Velocity Relationship

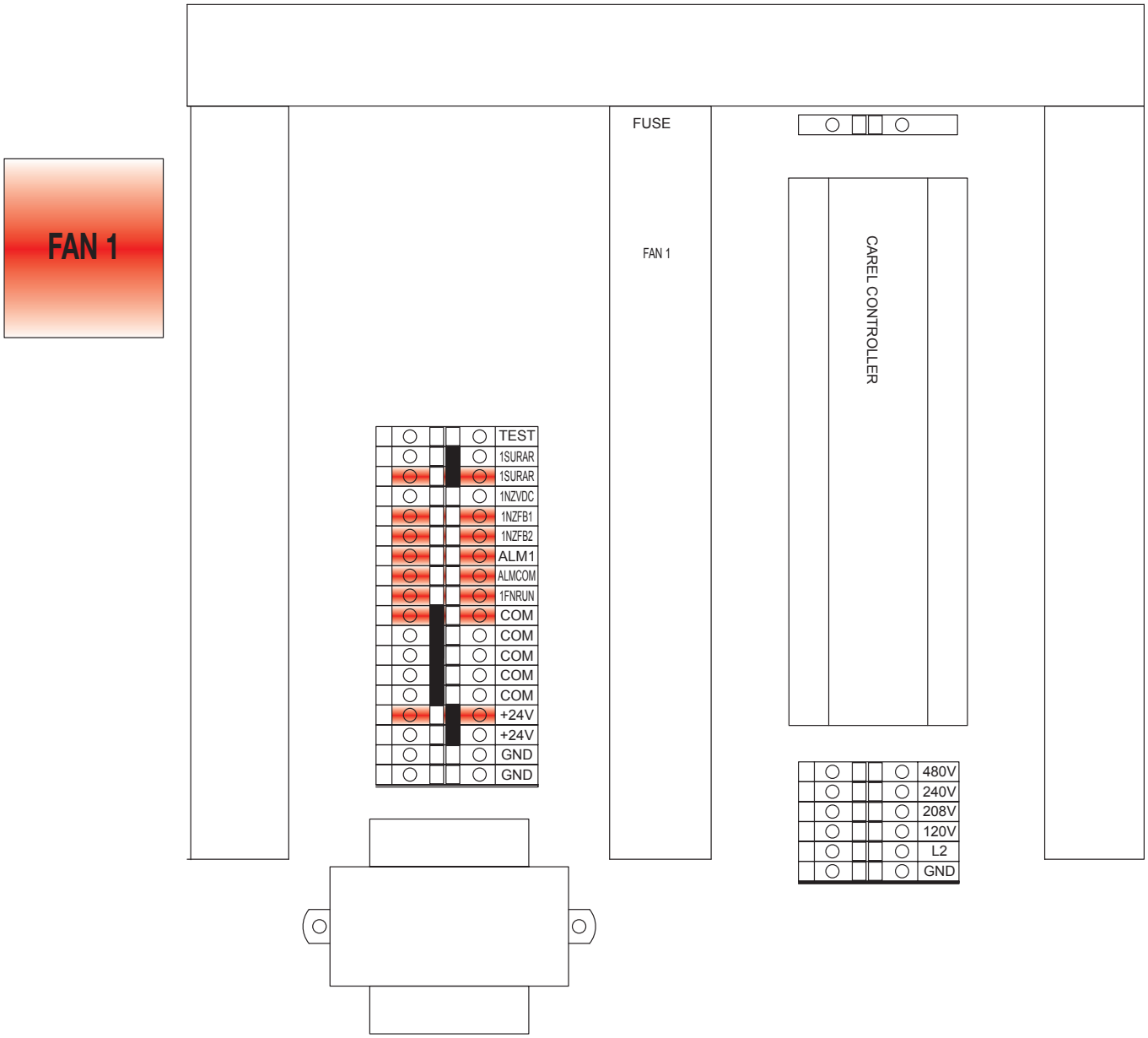
Outlet Velocity: On the Fly Unoccupied Adjustment Example

The following is an example of the user setting a 3000 FPM maximum and 2000 FPM minimum nozzle outlet velocity and then using the BMS to send a DC voltage to the Carel controller to control the nozzle outlet velocity. The user can set the maximum and minimum nozzle velocities anywhere between 2000 to 4000 FPM and use the BMS to adjust the nozzle outlet velocity.

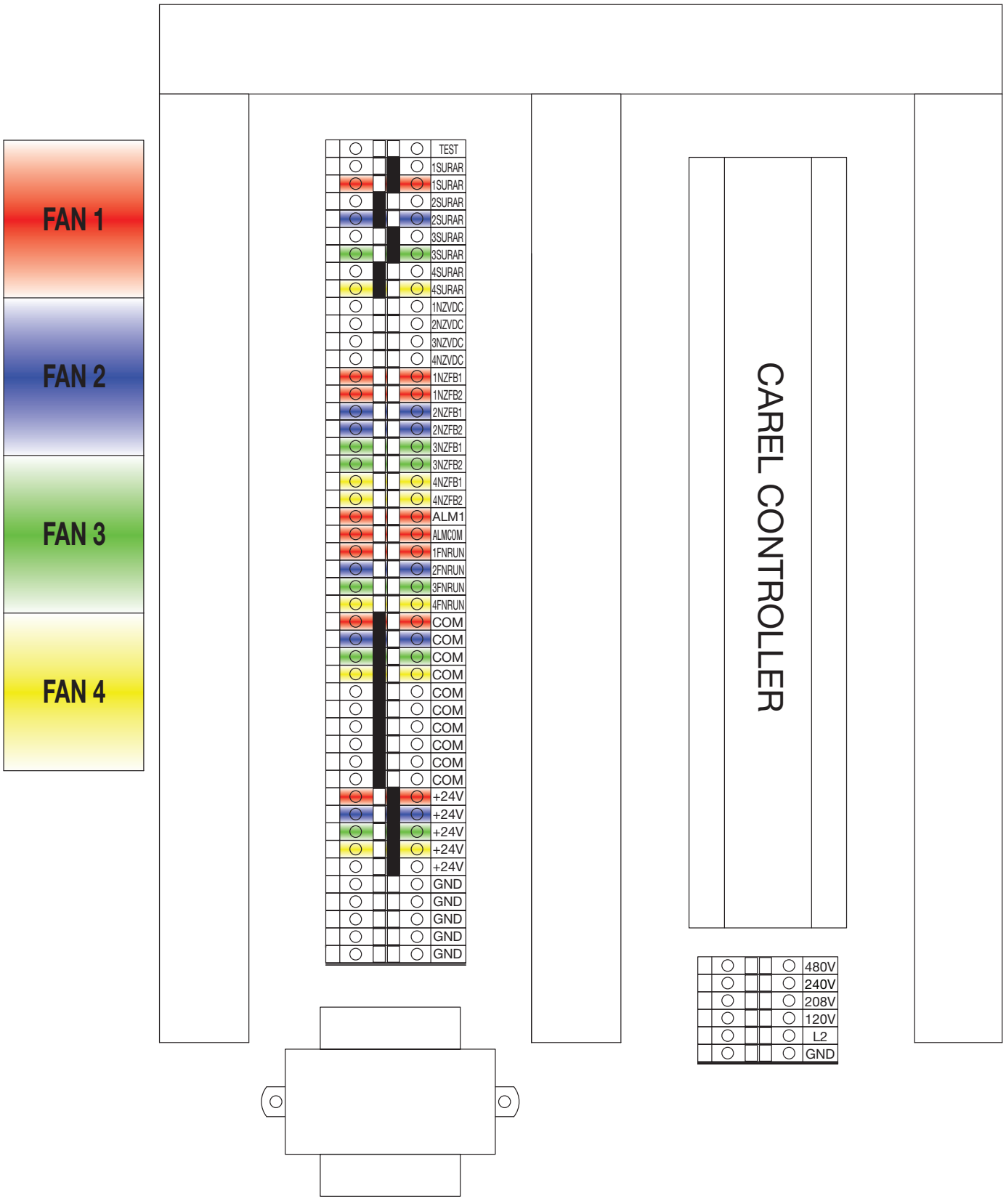
User Set Maximum Outlet Velocity: 3000 FPM
User Set Minimum Outlet Velocity: 2000 FPM

VDC sent to Carel Controller from BMS	Nozzle Outlet Velocity
0 VDC	3000 fpm
1 VDC	2900 fpm
2 VDC	2800 fpm
3 VDC	2700 fpm
4 VDC	2600 fpm
5 VDC	2500 fpm
6 VDC	2400 fpm
7 VDC	2300 fpm
8 VDC	2200 fpm
9 VDC	2100 fpm
10 VDC	2000 fpm

Wiring Diagram - Single Fan



Wiring Diagram - Multiple Fans



Start-Up Procedure

Prior to starting and testing the VGN, it is suggested that the following check list be complete. If the fan system is not operating properly, the nozzle will not function as designed. During the testing of the VGN it will require the fan to operate within its designed CFM range; if the CFM is too low the nozzle will not actuate.

Mechanical Component System Verification

For detailed descriptions to complete these operations, see equipment Installation, Operation and Maintenance Manual (IOM).

- ☐ Fan assembly and installation completed.
- ☐ Check all fasteners for tightness, as they have loosened during shipping.
- ☐ All control enclosures and devices mounted in the appropriate locations.
- ☐ Verify fan wheel alignment.
- ☐ Complete motor pulley adjustments as required.
- ☐ All duct connections complete and sealed.
- ☐ All fume hoods installed and operational.
- ☐ All duct VAV control devices installed and operational.

Electrical Control Components System Verification

For detailed descriptions to complete these operations, see equipment Installation, Operation and Maintenance Manual, National Electrical Code and local electrical code.

- ☐ Verify fan wheel rotates the proper direction when electrical power is applied.
- ☐ Verify that the isolation damper opens when the fan is turned on.
- ☐ Verify that the by-pass damper operates properly to safeguard against pressurization damages within the system.
- ☐ Service feeder(s) to all controls completed and tested.
- ☐ Control wiring to all devices completed and tested.
- ☐ All field electrical connections complete and tested.
- ☐ Communication wiring to Building Management System completed and tested.

System Start-Up Preparation for VGN

- It is suggested that the Mechanical Component System Verification and the Electrical Component System Verification check list be complete prior to VGN start-up.
- It is very helpful to have the test and balance contractor, electrical contractor, and BMS/VFD programmer/operators on-site during VGN startup.
- During the startup procedure the fan speed will be increased, decreased, and there will be periods of time when the entire fan system will be shut down; prior arrangements must be made with the lab to accommodate these times of shut down. Opening and closing of fume hoods and dampers will be required during this start-up.
- It is useful to have multi-meter ready for diagnostics.

System Start-Up for VGN

1. Apply input electrical power to the VGN controller to turn it on.
2. Open the VGN control box and confirm that the Carel controller is powered on. The Carel controller is pre-programmed specific to each job site and fan. Test and balance adjustments are the only adjustments that may be required; refer to test and balance section of this manual for details.
3. Open the pressure transducer box mounted on the fan body to confirm that the pressure transducer display is powered on. The numbers on the display may be changing even with the fan off; this is normal operation. **The pressure transducer is very sensitive; do not attempt to adjust or zero the pressure transducer as this will void warranty.**
4. Adjust the fume hoods and dampers in the building such that the fan system can flow 100% of its designed CFM and static pressure.
5. Confirm the bypass dampers are fully functional.
6. Turn fan 1 on to 100% of its designed flow and static pressure with the VFD.
7. Confirm the nozzle blades on fan 1 move when the fan is powered up. When a fan is turned on the VGN controller will open the nozzle to 100% for 60 seconds to allow the fan to ramp up to full operating speed quickly. After the 60 second time period elapses the nozzle will adjust to the proper opening size to maintain required nozzle velocity. The nozzle blades movement can be viewed from the ground by looking at the outside edges of the nozzle.
8. Confirm that the Carel displays that “FAN1” run status is “ON”. The Carel unit should also be displaying the “FLOW” and “NOZ” % which is nozzle opening percentage. If the Carel is not showing a “FAN1” run status as “ON” none of the above data will be displayed; to diagnose that issue first confirm that the fan 1 is truly running. If fan 1 is running then check that the “1FNRUN” terminal has a 24 VAC signal to it from the BMS or VFD.

System Start-Up for VGN, continued

9. Reduce the fan speed to 50% of the designed CFM.
10. Confirm that the “FLOW” and “NOZ” numbers are reduced from the 100% fan speed.
11. Confirm that the nozzle blades have closed slightly from the 100% fan speed position.

    NOTE: Repeat above steps for additional fans if applicable.
12. If the VGN control system operates properly the VGN system is ready for test and balance.

Test and Balance for VGN

Test and balance mode on the VGN controller allows the user to lock the nozzle in one fixed position during a test and balance of the fan system; it also allows the user to adjust the K value for the CFM displayed on the Carel to match the CFM of the fan while actively performing a test and balance procedure. Please refer to the Test and Balance section on page 16 for details on accessing the test and balance mode on the Carel.

1. Verify that the “System Start-Up for VGN” has been completed.
2. Adjust the fume hoods and or dampers to the desired positions.
3. Turn on the desired fan.
4. Use the Carel controller Test and Balance mode to lock the nozzle to 100% open; refer to the Test and Balance section on page 15 for details on accessing the test and balance mode on the Carel.
5. Perform desired test and balancing procedures.
6. Upon completing the test and balance of the fan system, turn the Test and Balance mode off in the Carel.

   NOTE: Test and Balance mode will time out after 120 minutes.

Calibrating Carel CFM Display with Test and Balance Procedure

The CFM displayed by the Carel unit can be offset to match a desired test and balance procedure. It can be offset to match a CFM output by a BMS or a real-time pitot tube.

1. Verify that the “System Start-Up for VGN” has been completed.
2. Adjust the fume hoods and or dampers to the required positions to run the fan at 100% of designed CFM. Do not allow any inlet conditions to change during the remainder of this procedure.
3. Turn on the desired fan to 100% of designed CFM. Only run one fan at a time during this entire procedure.
4. Use the Carel controller Test and Balance mode to lock the nozzle to 100% open. Refer to the Test and Balance section on page 15 for details on accessing the test and balance mode on the Carel.
5. Perform desired test and balance procedure.
6. Use Test and Balance mode K Value Adjustment on the Carel to adjust the CFM displayed by the Carel to match the desire test and balance procedure.
7. Upon completing this procedure turn the Test and Balance mode off in the Carel.

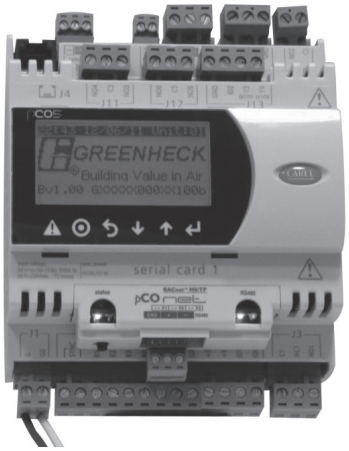
   NOTE: Test and Balance mode will time out after 120 minutes.

Variable Geometry Nozzle (VGN) Controller

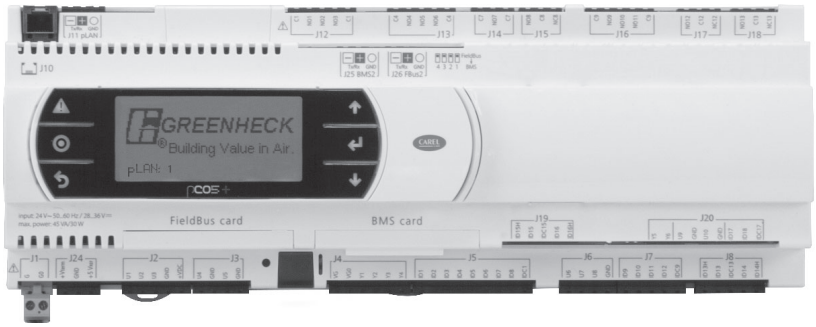
Controller Introduction and Tutorial

The VGN Controller is located in the main control panel. The controller has factory set points that can be modified to configure the system for job specific functions. The controller introduction and directions for the setup screens are shown in this section.

The face of the controller has six buttons, allowing the user to view unit conditions and alter parameters. The controller is pre-programmed with easy to use menus.



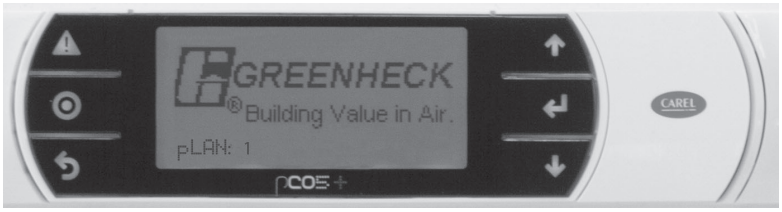
Single Fan



Multiple Fan

Operator Interface and Keypad Navigation

Single Fan



Multiple Fan

Keypad Navigation		
↩	Escape	Allows the user to exit the current menu, jumping to the Main Menu.
↑ ↓	Up | Down	The arrow buttons allow the user to scroll through different screens and adjust parameters.
⚠	Alarm	Button will blink red, indicating an alarm condition. Press to review current alarms. To review previous alarms, access the DATA LOGGER through the main menu.
↵	Enter	A. In screens with adjustable parameters, pressing the Enter button moves the cursor from the upper left corner of the screen to the parameter. The arrow buttons can then be used to adjust the parameter. B. To move to the next parameter on the same screen, press the Enter button. C. To save the change, press the Enter button until the cursor moves back to the upper left corner of the screen.
◎	Program	Pressing the Program button allows the user to enter the Main Program Menu.

10:27			05/12/16
	RUN	FLOW	NOZ
FAN1	ON	1465CFM	47%
FAN1	ON	1465CFM	47%
FAN1	ON	1465CFM	47%
FAN1	ON	1465CFM	47%
H4-10			v0.1

Status page - main

The main status page provides a brief summary of all fans. The number of fans displayed is dependent on the configuration, 1 through 4 fans.

Time/Date are displayed in the title bar of the screen.

Fan Status is the summarized data for each fan. This includes the run input status, fan flow and nozzle position.

Fan Type/Number/Size On the lower left corner, the fan type and number is displayed. Fan type is displayed as C, H or M and number 1 through 4. In addition the fan size will be displayed.

Version Number The major/minor software version number is displayed in the bottom corner of the screen.

FAN1 SUMMARY		
FAN RUN:	ON	
FLOW:	1465	CFM
U1 INPUT:	2.7	VDC
NOZZLE POS:	47	%
NOZZLE OUT:	2.9	VDC
VEL ALARM:	NORMAL	
CFM ALARM:	NORMAL	

Status page - Fan 1 Summary

Separate status pages are provided for each fan, 1 through 4. A fan summary screen is presented only if the fan is defined in the configuration.

Fan Run reports the on/off status of the fun run input.

Flow represents the volumetric airflow of the fan.

U1 Input is the DC voltage measured at universal input 1, associated with Fan 1.

Nozzle Position indicates the position of the variable geometry nozzle. 0% is reported at the minimum position, while 100% is reported at the maximum.

Nozzle Output is the DC voltage sent from the controller output to the nozzle actuator.

Velocity Alarm indicates the status of the alarm reported if the nozzle velocity is zero while the run input is on.

CFM Alarm indicates the status of the alarm reported if the fan flow is zero while the run input is on.

Status Page - Fan 2 Summary, Fan 3 Summary and Fan 4 Summary same as above if applicable.

ALARM SUMMARY	
ALARM RELAY:	NORMAL

Status page - Alarm Summary

Alarm Relay display the status of alarm relay (NO1). If any alarm on any fan is true, the alarm output is controlled on and the status is reported as alarm.

On/Off Unit

STATUS
END
STATUS LOOP MASK

ON/OFF UNIT

Because no content exists under the On/Off Unit menu, only the end screen is displayed.

NOTE: END LOOP screen will display anytime there is no content for menu selection.

Set Points

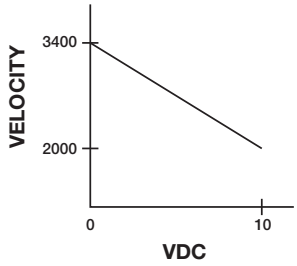
USER SETTINGS	
ELEVATION:	0 FT
MAX OUT VEL:	3400 FPM
MIN OUT VEL:	2000 FPM
ACTIVE STPT:	3000 FPM
FOR TEST/BALANCE PRESS DOWN ARROW	

USER SETTINGS

Elevation allows the user to input the proper elevation for their specific region. The elevation is used to more accurately compute the density of the air, a component in determining the volumetric airflow of the fan.

Maximum Output Velocity defines the desired output velocity of the variable geometry nozzle under normal operating conditions.

Minimum Output Velocity defines an alternate (reduced) output velocity based on the hard wired 0-10 VCD input dedicated to that function. For this function, 0 VDC represents the normal output velocity setpoint while 10 VDC represents the alternate setpoint with a linear relationship between 0-10 VDC.



T&B FAN 1	
FAN 1 MODE:	TEST
FAN 1 FLOW:	1465 CFM
NOZZLE 1 POS:	100 PCT
K VALUE ADJ:	0

TEST AND BALANCE - FAN 1

From the **User Settings** screen, access the **Test and Balance** screen(s) by pressing the down arrow.

IMPORTANT: The fan must be ON in order to begin the test and balance procedure.

Fan 1 Mode is used to place Fan 1 into TEST mode. Press enter to advance the cursor to the fan mode, then use the arrow keys to switch modes. Press enter. Upon entering the TEST mode, the user is able to override the nozzle position for that fan and apply a K VALUE ADJUSTMENT, resulting is a modified flow reading. The fan flow reading adjustment will only update once the K VALUE ADJUSTMENT is complete (by pressing enter). The mode will automatically return to AUTO after 120 minutes. In the AUTO mode, only the fan mode and fan flow are displayed. To display/edit the nozzle position and K value, enter the TEST mode.

Fan 1 Flow represents the volumetric flow for Fan 1. The flow reading will be updated as the K VALUE ADJUSTMENT is applied.

Nozzle 1 Position is the overridden position of the nozzle during testing. The user may edit this position as needed during the test mode.

K Value Adjustment allows the user to apply an offset (+/-) to the factory K Value. The result of such an offset is a modified volumetric flow reading, intended to match the desired number from the test and balance procedure.

The displayed CFM on the control screen should match the measured CFM of the fan while actively performing Test & Balance.

Test and Balance - Fan 2, Fan 3, Fan 4 same as above if applicable.

Clock/Scheduler

Clock	
14:57:50	05/04/16
Date:	05/04/16
Hour:	14:57
Day:	Wednesday

Clock/Scheduler

Date allows the user to edit the month, day and year as needed. Press the enter key to advance the cursor. Then use the arrow keys to adjust the value. Press enter.

Hour allows the user to adjust the hour and minutes as needed. Press the enter key to advance the cursor. Then use the arrow keys to adjust the value. Press enter.

Day will be adjusted automatically based on the **Date** field.

Clock	
DST:	ENABLE
Transition time:	60min
Start:	LAST SUNDAY
in MARCH	at 2.00
End:	LAST SUNDAY
in October	at 3.00

DST allows the user to enable/disable daylight savings time. Press the enter key to advance the cursor. Then use the arrow keys to adjust the setting. Press enter.

Additional fields are provided that allow the user to enter the specifics pertaining to daylight savings time adjustment.

Inputs/Outputs

Analog Input	
Pressure1 (AIN1)	
Input 0001:	27.0

Analog Inputs

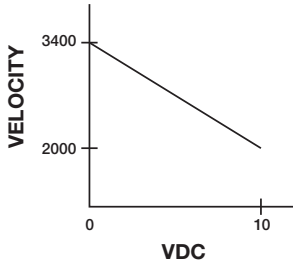
AIN1 reports the status of Pressure Sensor 1 on analog input 1, 0.0 to 100.0 (0.0 to 10.0 VDC). So 27.0 equates to 2.7 VCD.

AIN2, AIN3, AIN4 same as above if applicable.

Analog Input	
VelocitySetpt (AIN5)	
Input 0005:	0.0

AIN5 indicates the field-provided signal for the alternate (unoccupied) nozzle velocity setpoint, 0.0 to 10.0 VDC.

For this function, 0 VDC represents the normal output velocity setpoint while 10 VDC represents the alternate setpoint with a linear relationship between 0-10 VDC.



Digital Input		
On / Off (DIN1)		
DI	1 Status:	Closed

Digital Inputs

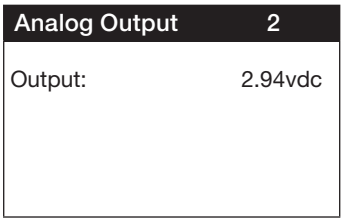
DIN1 indicates the open/closed status of digital input 1, the run status of fan 1.

DIN2, DIN3, DIN4 same as above if applicable.

Relay Output		
Title (DOUT 1)		
Relay	1 Status:	OFF

Relay Outputs

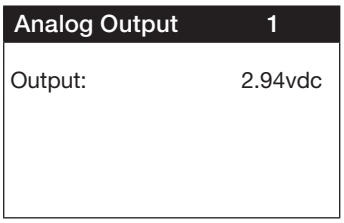
DOUT1 reports the on/off status of digital output 1, the alarm relay (off = normal, on = alarm).



Analog Outputs

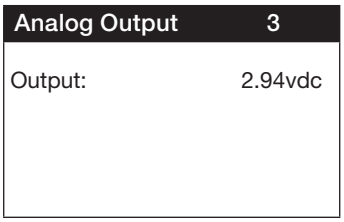
Analog Output 2 indicates the signal being sent to Nozzle 1, 0.00 to 10.00 VDC

IMPORTANT: Nozzle 1 is connected to analog output 2, while Nozzle 2 is connected to analog output 1.

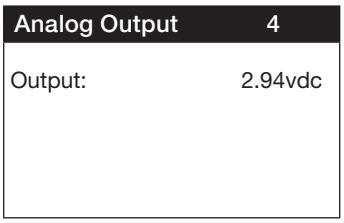


Analog Output 1 indicates the signal being sent to Nozzle 2, 0.00 to 10.00 VDC

IMPORTANT: Nozzle 1 is connected to analog output 2, while Nozzle 2 is connected to analog output 1.

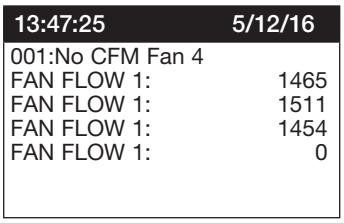


Analog Output 3 indicates the signal being sent to Nozzle 1, 0.00 to 10.00 VDC.



Analog Output 4 indicates the signal being sent to Nozzle 1, 0.00 to 10.00 VDC.

Alarm History



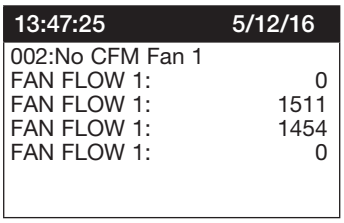
Alarm History

The alarm history records and displays the alarms that have occurred. Additional information is available for each alarm. Use the arrow keys to scroll through all recorded alarms.

Time/Date is recorded and displayed for each alarm.

Alarm Number and **Description** is also provided for each alarm.

Fan Flow is recorded at the time of the alarm for each fan in this configuration.



Information
GREENHECK FAN CORP
Code:
Version: 0.1.000
Date: 09/06/15
Bios: 6.27 09/07/04
Boot: 5.00 09/07/04

Technician Information

In rare circumstances, the factory may request additional information pertaining to the operational performance of the controller. Several screens are provided with low-level firmware information.

Information	
Board type:	pCO5+
Board size:	Medium
Total flash:	2048KB
RAM:	1024KB
Built-In type:	
Main cycle:	
9.5cycle/s	105ms

Information
Power Cycle Status
Last Off Time
5/05/16 10:54:45
Last On Time
5/05/16 16:03:37
Length Time Off
Days: 0 Hrs: 5 Min: 8

Alarm History Reset
This will clear the Alarm history
Continue? No

User Save

Alarm History Reset is used to clear the historical record of alarms. Press enter to advance the cursor. Then press the arrow buttons to toggle the no/yes state. Press enter.

NOTE: When changed to YES, the field will automatically revert to NO after a few seconds.

BMS Config

Because no content exists under the BMS Configuration menu, only the end screen is displayed.

Service Settings

Working Hours Set
Because no content exists under the Working Hours Set menu, only the end screen is displayed.

Probe Adjustment
Because no content exists under the Probe Adjustment menu, only the end screen is displayed.

Control Loops
Because no content exists under the Control Loops menu, only the end screen is displayed.

Manual Management

Analog Inputs
Because no content exists under the Analog Inputs menu, only the end screen is displayed.

Digital Inputs
Because no content exists under the Digital Inputs menu, only the end screen is displayed.

Relay Outputs
Because no content exists under the Relay Outputs menu, only the end screen is displayed.

Analog Outputs
Because no content exists under the Analog Outputs menu, only the end screen is displayed.

Manufacturer password

Insert manufacturer password(PWS): z000

Manufacturer Password

In order to edit any of the factory parameters, the user must first provide the manufacturer-provided password. Contact the factory for further assistance.

Factory Save

Save? No
Restore? No
Auto Restore? No

Initialization

The software includes a set of default parameters to configure the controller. However, once the controller is configured for a specific fan system, it is beneficial to save the 'as shipped' configuration in case changes are made in the field.

Save is used to store the editable parameters to non-volatile memory. Press enter to advance the cursor. Then press the arrow buttons to toggle the selection to YES. Press enter. The value will automatically return to NO after a few seconds.

Restore is used to retrieve the factory settings from memory and overwrite the current configuration.

Auto Restore is not used and should remain as NO.

Factory Delete

CLEAR ALL SAVED DATA
FACTORY+USER No

Though almost never used, the **Factory Delete** feature allows the current configuration to be erased. The resulting configuration is the software default configuration which MUST be edited to match the fan model and size.

Troubleshooting

General		
Issue	**Possible Cause**	**Recommended Action**
Fan is running but no pressure is being created in the duct.	Isolation damper not open.	Check power at isolation damper and determine if it is open.
	Bypass damper maybe open.	Verify bypass damper is closed.
Nozzle actuator is not responding to fan speed changes.	Sure-Aire transducer not reading air flow.	Inspect pressure tubing to transducer and verify voltages.
	No power at the nozzle actuator.	Verify power and signal at the actuator.
	Low CFM due to laboratory hoods being closed.	Open all laboratory hoods to verify nozzle operation.
Unstable fan conditions. Fan is not balancing the system and keeps changing speed.	BMS PID timing is incorrect.	Increase time functions in the system.
	BMS PID overlap is incorrect.	Create an increased dead band between PID for fan and bypass.
System has a positive pressure condition.	Isolation damper not open.	Check power at isolation damper and determine if it is open.
	BMS fan control not working properly.	Check BMS control and determine if condition is occurring at full speed and bypass is closed.
	Duct pressure transducer failure.	Verify power and signal at duct pressure transducer(s).
	Broken fan belt.	Check fan belt for failure.
	Bypass damper maybe open.	Verify bypass damper is closed.
	Access panel is missing on fan or bypass air plenum.	Replace missing access panels.
	Nozzle is not operating and is at minimum area.	Check actuator power and signal.
System has an unfavorable negative pressure condition.	BMS fan control not working properly.	Check BMS control and determine if condition is occurring at fan low speed and bypass full open.
	Duct pressure transducer failure.	Verify power and signal at duct pressure transducer(s).
	Bypass damper operation.	Verify bypass damper operation.
CFM reading is low or at zero even though fan is operating.	Isolation damper is not open.	Check power at isolation damper and determine if it is open.
	Sure-Aire tubing leak or blockage.	Inspect tubing and blow out tubing with air.
	Sure-Aire tube lines hooked up backwards.	Flip the high and low tube lines.
	Sure-Aire transducer for system is bad.	Test voltage with meter for 24V and output signal.
	Laboratory hoods are closed in the building	Open all laboratory hoods and verify operation.

VGN Nozzle Controller Customer-Supplied VFD		
Issue	**Possible Cause**	**Recommended Action**
Alarm contact on nozzle controller is “Active”	Velocity is below the required preset value	Fan speed is too low. Not creating enough airflow. Speed up fan.
	Fan is shown as running, but no flow is being created.	Airflow not present. Check flow station and components.

General System Failure Mode
If the 2-10 VCD signal is lost from the controls and the 24V power is still present, the nozzle actuators will move to the minimum area position.
If the 24V power is lost from the controls but the 2-10VCD signal is still present, the nozzle actuators will stay in place at the moment when 24V power was lost.

VGN Technology Maintenance

WARNING

Disconnect all electrical power and secure to the "OFF" position prior to inspection or servicing. Failure to comply with this safety precaution could result in serious injury or death.

The following list is recommended preventive maintenance of the controls system. All of these items should be done before initial power up of the system and then done on a routine maintenance schedule.

It is also recommended to follow the component manufacturer maintenance recommendations that they have stated in their IOM document(s).

Description	Action	Occurrence
Inspect System Wire	Look for cracked, frayed, bare wiring. Replace as necessary	Quarterly
Inspect System Conduit	Look loose fittings and cracked or broken down seal tight. Replace as necessary	Quarterly
Inspect Wiring Terminations	Look for loose or broken terminals. Tighten to required torque for each or replace as necessary.	Quarterly
Inspect Weather Proof Gaskets	Inspect all gaskets and look for moisture. Replace if necessary.	Quarterly
Inspect Electrical Enclosures	Inspect all enclosures and look for broken hardware. Replace as necessary	Quarterly
Inspect Nozzle Moving Components	Inspect all nozzle components. Remove any obstructions or replace any worn components.	Monthly

Finally, it is recommended to follow the fan IOM for recommended service and also routine maintenance on the mechanical components of the remaining items in the system.

VGN Technology Electrical Replacement Parts

Description	Part Number
Controller, PCO5 Compact	Consult factory
Controller, PCO5+ Medium	Consult factory
Pressure Transducer, multiple range, VDC	385394
Actuator, 2-position 24 VAC (Isolation)	Consult Factory
Actuator, modulating 2-10 VDC 24 VAC (Nozzle)	384631
Actuator, modulating 0/2-10 VDC 24 VAC (Bypass)	Consult factory
Transformer, multi-tap 120 VAC to 24 VAC	385220

Our Commitment

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

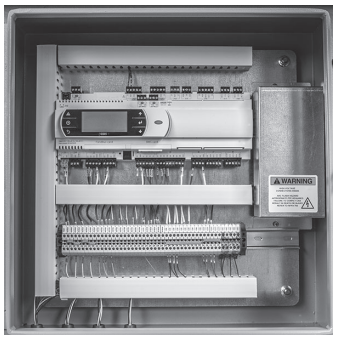
Product warranties can be found online at Greenheck.com, either on the specific product page or in the literature section of the website at Greenheck.com/Resources/Library/Literature.

GREENHECK
Building Value in Air.

Phone: 715.359.6171 • Fax: 715.355.2399 • Parts: 800.355.5354 • E-mail: gfcinfo@greenheck.com • Website: www.greenheck.com

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.



Control Box

Variable Frequency Drive (VFD)

Pressure Transducer

Table of Contents

General Safety Information

Only qualified personnel should install this unit. Personnel should have a clear understanding of these instructions and should be aware of general safety precautions. Improper installation can result in electric shock, possible injury due to coming in contact with moving parts, as well as other potential hazards. Other considerations may be required if high winds or seismic activity are present. If more information is needed, contact a licensed professional engineer before moving forward.

1. Follow all local electrical and safety codes, as well as the National Electrical Code (NEC), the National Fire Protection Agency (NFPA), where applicable. Follow the Canadian Electrical Code (CEC) in Canada.
2. Do not allow the power cable to kink or come in contact with oil, grease, hot surfaces, or chemicals. Replace cord immediately if damaged.
3. Verify the power source is compatible with the equipment.

DANGER
Always disconnect, lock and tag power source before installing or servicing. Failure to disconnect power source can result in fire, shock or serious injury.
CAUTION
When servicing the fan, motor may be hot enough to cause pain or injury. Allow motor to cool before servicing.
CAUTION
Precaution should be taken in explosive atmospheres.
DANGER
Pour écarter les risques d'incendie, de choc électrique ou de blessure grave, veiller à toujours débrancher, verrouiller et étiqueter la source de courant avant l'installation ou l'entretien.
ATTENTION
Lors de toute intervention sur la soufflante, le moteur peut être suffisamment chaud pour provoquer une douleur voire une blessure. Laisser le moteur refroidir avant toute maintenance.
ATTENTION
Faire preuve de précaution dans les atmosphères explosives.

Receiving

Upon receiving the components, check to ensure all items are accounted for by referencing the delivery receipt or packing list. Inspect each crate or carton for shipping damage before accepting delivery. Alert the carrier of any damage detected. The customer will make a notation of damage (or shortage of items) on the delivery receipt 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. Sometimes it is not possible that all items for the unit be shipped together due to availability of transportation and truck space. Confirmation of shipment(s) must be limited to only items on the bill of lading.

Handling

Handle in such a manner as to keep from scratching or chipping the coating. Damaged finish to parts may reduce ability of unit to resist corrosion.

Storage

Units are protected against damage during shipment. If the unit cannot be installed and operated immediately, precautions need to be taken to prevent deterioration of the unit during storage. The user assumes responsibility of the unit and 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.

INDOOR - The ideal environment for the storage of units and accessories 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°F *(-1°C)* and 110°F *(43°C)* (wide temperature swings may cause condensation and “sweating” of metal parts). All accessories must be stored indoors in a clean, dry atmosphere. Remove any accumulations of dirt, water, ice, or snow and wipe dry before moving to indoor storage. To avoid “sweating” of metal parts, allow cold parts to reach room temperature. To dry parts and packages use a portable electric heater to eliminate any moisture build up. Leave coverings loose to permit air circulation and to allow for periodic inspection. The unit should be stored at least 3-1/2 in. *(89 mm)* off the floor on wooden blocks covered with moisture proof paper or polyethylene sheathing. Aisles between parts and along all walls should be provided to permit air circulation and space for inspection.

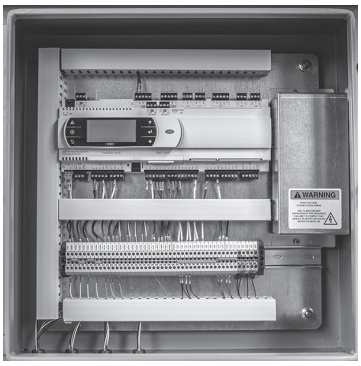
Inspection and Maintenance during Storage

While in storage, inspect equipment once per month. Keep a record of inspection and maintenance performed. If moisture or dirt accumulations are found on parts, the source should be located and eliminated.

Removed From Storage

As units are removed from storage to be installed in their final location, they should be protected and maintained in a similar fashion, until the equipment goes into operation. Prior to installing the unit and system components, inspect the unit assembly to make sure it is in working order. Check all fasteners and accessories for tightness.

Vektor System Control (VSC) Components



Control Box (1 per fan system)

Variable Frequency Drive (VFD) (1 per fan)

Pressure Transducer

5 Pin, 5 meter cable (2 per fan)
8 Pin, 10 meter cable (3 per fan system)

Customer-Supplied System Components

Quantity	Description
Varies	Wiring, conduit, miscellaneous fittings
1	Static pressure probe
Varies	Tubing to connect static pressure probe to pressure transducer

Variable Frequency Drive Operation

For operation with a variable frequency drive (VFD) always check motor amps when adjusting the operating frequency. Motor may be sized for the original selected operating speed under 60 Hz. Bypassing the VFD or increasing the speed from this original selection, even if less than 60 Hz, may cause motor to overload or fail. Consult factory with fan serial number before increasing the upper limiting frequency.

Always check the fan RPM when adjusting the operating frequency. Do not exceed maximum class fan RPM of the wheel.

NOTE

It is the responsibility of the installing body to perform coast-down tests and identify any resonant frequencies after the equipment is fully installed. These resonant frequencies are to be removed from the operating range of the fan by using the “skip frequency” function in the VFD programming. Failure to remove resonant frequencies from the operating range will decrease the operating life of the fan and void the warranty.

Quick Installation Guide

System Mounting & Wiring

Steps may need to be repeated for multiple fan systems.

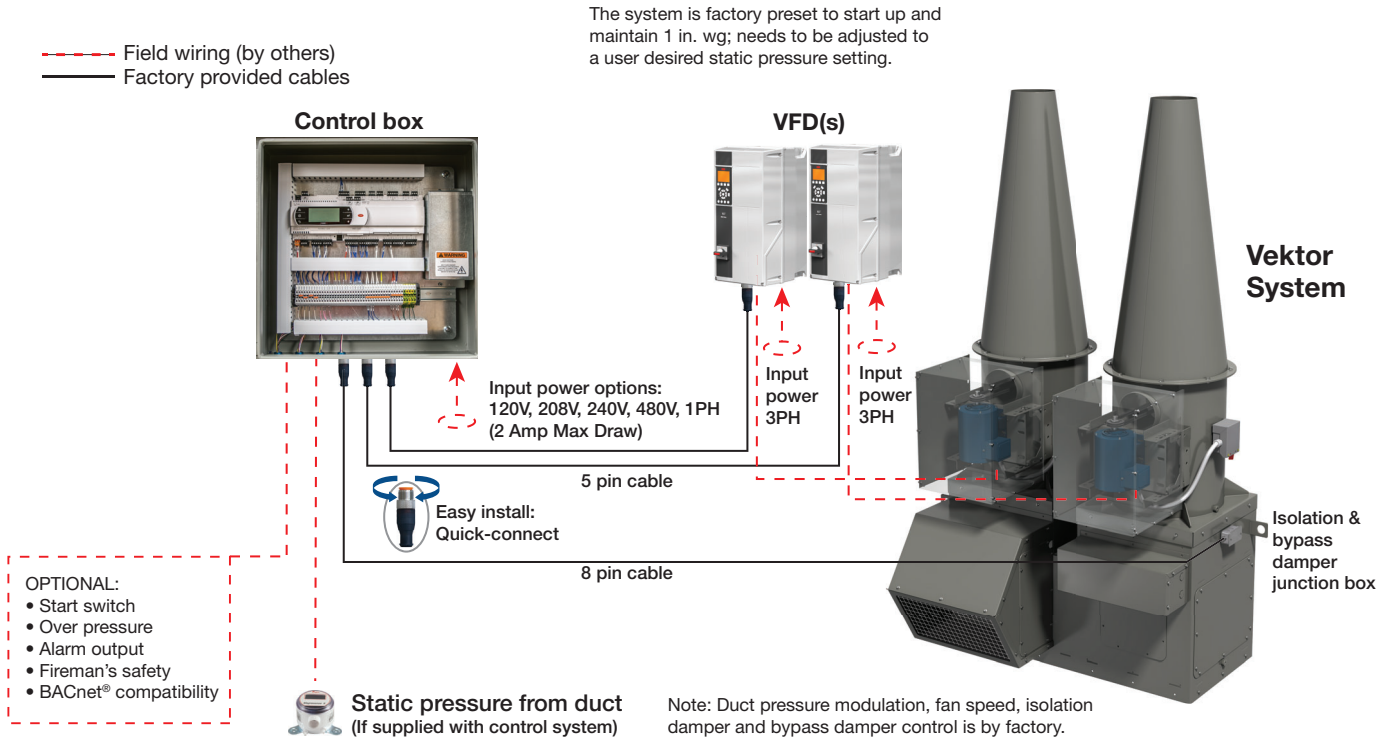
All wiring done by others to be per local code (see figure 1).

1. Mount control box upright with connectors down on structural support within 50 ft *(15.2 m)* of fan plenum.
2. Mount Variable Frequency Drive(s) (VFD) within 20 ft *(6.1 m)* of control box.
3. Connect 5 pin cable from VFD1 to control box VFD1.
4. Connect 8 pin cable from damper junction box on fan plenum to control box.
5. Wire static pressure sensor to control box. Plumb pressure probe to transducer.
6. Wire optional connections on terminal strip.
7. Wire incoming power to VFD1. Wire incoming power to control box.
8. Wire from VFD1 to motor on fan 1.

Start-up:

1. Apply power to VFD(s).
2. Turn on disconnect located on VFD(s).
3. Press the Auto On button on the VFD(s) keypad.
4. Apply power to the control box.
5. Confirm pressure transducer is powered on; the digital display on the pressure transducer will illuminate.
6. Using Carel keypad located in control box, use up and down arrows to navigate to On. Press enter button to turn the system on.
7. The system is factory preset to start up and maintain 1 in. wg; this will need to be adjusted to the user desired static pressure setting.

Figure 1

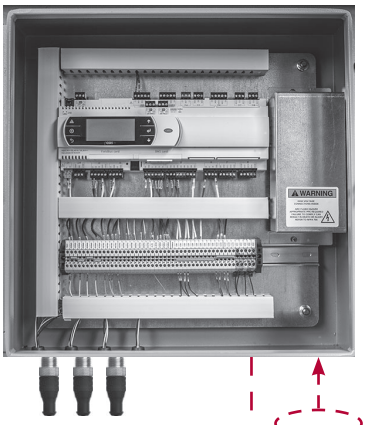


Vektor System Control (VSC) Function Overview

Vektor System Control (VSC) is a complete factory controls package for use in controlling the dampers and motors on a Vektor fan system. Hardware includes a control box, pressure transducer, and variable frequency drive(s) (VFD) for field mounting. The system operates by receiving an input signal from a duct static pressure sensor and depending on the relation to the set point, adjusts the fan speed and dampers. This system can control up to one bypass and one isolation damper per fan.

Each VSC package will come with one control box that is preprogrammed, ready to control the fan system it was ordered with (see figure 2). A multi-tap transformer will accept single phase 120V, 208V, 240V or 480V input power field wired to a terminal strip. The connections to the VFD(s), isolation damper(s), and bypass damper(s) are made easy with quick disconnect cables. The pressure transducer connection will be field wired to the terminal strip located in the control box. Systems may not have isolation or bypass dampers; the control box will be programmed accordingly.

Figure 2



Input Power Options: 120V. 208V, 240V, 480V 1PH

Pressure Transducer

Field Wiring (by others)

Quick Connect Cabling

Each VSC package will come with one VFD per fan that is preprogrammed to communicate with the control box, ready to control the fan motor it was ordered with (see figure 3). Incoming power and output power to the fan motor will be field wired. The connection from the control box to the VFD is made easy with a quick disconnect cable.

Figure 3

Input Power 3PH

Output Power to Fan Motor

Field Wiring (by others)

Each VSC package will come with one pressure transducer that is preprogrammed, ready to control the fan system it was ordered with (see figure 4). Three wires will be field wired from the control box terminal strip to the pressure transducer terminal strip. The pressure transducer will receive power from the control box, no additional power source is required. A static pressure probe and tubing to connect the probe to the pressure transducer is field supplied.

Figure 4

1-V out
2-COM
3-V in

Field Wiring (by others)

Component Mounting

Mounting the Vektor System Control (VSC) Box

- Mount VSC box upright with connectors down on structural support within 50 ft *(15.2 m)* from center of fan plenum.
- Cables and wiring will be connected to the bottom of the box. It must have a minimum of 12 in. *(305 mm)* of clearance from any obstructions.
- VSC control box is a NEMA-3R enclosure suitable to be mounted indoors or outdoors.

Mounting of Variable Frequency Drive(s) (VFD)

- The mounting hole pattern can be found in the manual supplied with the VFD.
- Place the VFD within 20 ft *(6.1 m)* of the VSC control box.
- Place the VFD as near to the motor as possible, keeping the motor cables as short as possible. Maximum motor cable length to be less than 100 ft *(30.5 m)*.
- Mount the VFD vertically to a solid structure; always use the provided sheet metal backing plate.
- A minimum clearance of 9 in. *(229 mm)* above and below, 3 in. *(76 mm)* on each side is required.
- If mounting outdoors, installation of the weathershield is required.

Mounting VFD weathershield:

- Weathershield attaches to the top of the VFD using M6x1 fasteners (supplied).

VFD Weathershield Mounting

The weathershield is only required if the VFD is mounted outdoors.

1. Slide the bracket between the VFD mounting surface and the back of the VFD (see figure 5).
2. Tighten the upper mounting bolts to secure the bracket and VFD.
3. Slide the shield onto the bracket (see figure 6).
4. Fasten the shield to the bracket with supplied screws.

Figure 5

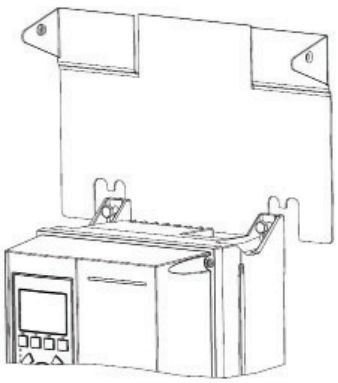
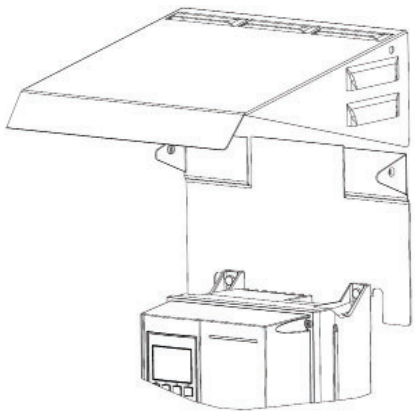


Figure 6



Pressure Transducer Mounting

- The pressure transducer is housed in a NEMA-4X rated enclosure suitable to be mounted indoors or outdoors.
- Locate the pressure transducer within 200 ft *(61 m)* of the VSC control box. Two hundred feet is the maximum control wire length for this pressure transducer.
- The pressure transducer should be mounted on a flat vertical surface with the connections directed down to prevent moisture from entering either the pressure ports or the electrical cable entry. The diaphragm must be vertical to minimize gravity effects on the diaphragm.
- The pressure transducer should be mounted higher than the static pressure probe to ensure that any moisture or condensation drains back into the duct.
- Pressure transducer plumbing options:

  Negative static pressure measurement.

  Connect the pressure probe to the negative (-) port, as indicated on the transmitter. Leave positive (+) port open to atmosphere.

  Positive static pressure measurement.

  Connect the pressure probe to the positive (+) port, as indicated on the transmitter. Leave negative (-) port open to atmosphere.

Component Hardwiring

System Wiring

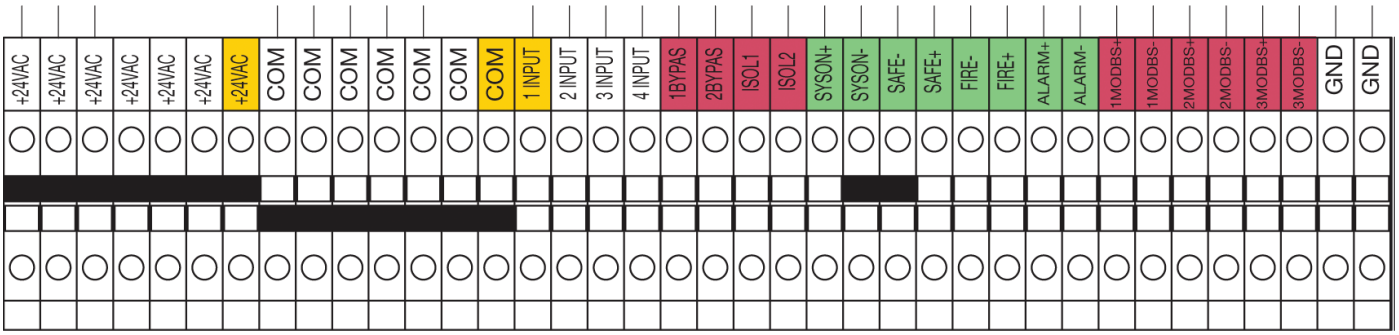
Greenheck supplied cable connections

- Programmable Logic Controller (PLC) box to fan plenum
  - 1 cable per system
  - 8 pin
  - Qty. 3, 30 ft (*10 m*) each. Daisy chain to the length required.
- PLC box to VFD
  - 2 cables per VFD
  - 5 pin
  - Qty. 1, 16 ft (*5 m*) each

Contractor supplied cable / connections

- To VFD and Motor
  - Power to each VFD (selected motor voltage), grommet location in bottom of VFD.
  - Power from VFD to motor/disconnect on fan.
- Power to PLC box
  - PLC box has built-in transformer for 24v power to PLC, sensors and actuators.
  - Contractor to drill hole in PLC box and connect conduit per installation location and local codes.
  - To power connect 120v, 1-phase or 1 leg of 3-phase power.
    - (Accepts: 120v, 208v, 230v or 460v)
- Control wiring
  - Recommend using 18-20 ga. wire. Local codes/standards may require other gauge.
  - Contractor to drill hole in PLC box and connect conduit per installation location and local codes.
  - Required (yellow highlights on terminal strip image)
    - Duct static pressure sensor to PLC box. Transducer provided by Greenheck.
    - 24 volt power from PLC box transformer.
  - Optional hardwire connections (green highlights on terminal strip image)
    - BACnet MSTP or BACnet IP to Building Management System (BMS)
    - System on/off
    - Pressure safety switch (pressure switch by others)
    - Fireman's override (field configured for either ON or OFF)
    - System alarm
  - DO NOT connect to red highlights on terminal strip image.

PLC box wiring terminal strip:



NOTE
All field installation and wiring of electrical equipment must be done to meet NEC, CEC and local codes.
Be sure to use appropriately sized wire for the full load amp draw.
Once the following hardwiring is complete, please refer to the Building Management System (BMS) Communication Protocol Setup section on pages 10-12 for details on programming the BMS to communicate with the VGN controller via the hard wire connections.

Make sure the numbering of the fans is consistent during the entire wiring installation; fan 1 will require wiring specific to fan 1, fan 2 will require specific wiring, if applicable.

Control Box Incoming Power

(hard wire connections)

The control box will function on 120, 208, 240 or 480V single-phase 50/60 Hz AC. Each control box will draw a maximum of 2 amps. Remove the metal cover located on the right side of the control box to access the terminal strip for incoming power (reference wire diagram for details on terminal strip landing points). Once the wiring is complete, reinstall the metal cover.

Control Box to VFD Quick Disconnect

Connect the factory supplied 5 pin cable (shipped in the control box) to the 5 pin threaded bulkhead on the bottom of the control box; connect the other end to the 5 pin threaded bulkhead on bottom of the VFD. Each fan is provided with two (2) - 10 meter cables that can be connected together to extend the length; use as required per fan.

NOTE
Repeat this step for fan 2, if applicable.

Control Box to Damper Junction Box

Connect the factory supplied 8 pin cable (shipped in the control box) to the 8 pin threaded bulkhead on bottom of the control box; connect the other end to the 8 pin threaded bulkhead on the damper junction box that is mounted on the fan plenum. Each fan is provided with three (3) - 10 meter cables that can be connected together to extend the length; use as required.

Control Box to Pressure Transducer

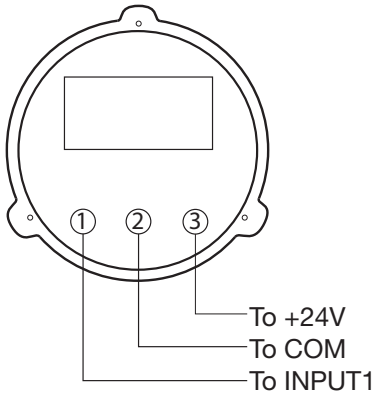
(hard wire connections)

Keep control wires as short as possible [100 ft (30.5 m) or less] and separate from high power cables to minimize interference.

Remove the face cover of the pressure transducer by rotating the face cover counterclockwise and pulling outward to access the wiring terminals.

- Connect INPUT1 on the control box terminal strip to terminal 1 on the pressure transducer.
- Connect COM on the control box terminal strip to terminal 2 on the pressure transducer.
- Connect +24V on the control box terminal strip to terminal 3 on the pressure transducer.

Pressure Transducer



VFD to Motor Wiring Procedure

(hard wire connections)

Danfoss FC102 3R:

Remove the eight fasteners on the cover of the VFD using T20 Torx® or flat head screwdriver. An extension may be needed to reach the fasteners. Remove the cover.

- Connect incoming 3-phase AC input power to terminals T1, T2 and T3 on the master disconnect.
- Connect ground cable to the nearest grounding terminal located on the body of the enclosure. Connect the 3-phase motor wiring to terminals 96 (U), 97 (V) and 98 (W).
- Connect ground wire to the nearest grounding terminal located on the body of the enclosure.
- Use a cable clamp to relieve pressure from connections.
- Replace VFD cover reusing fasteners.

Optional Hard Wire Connections Digital Input Hard Wiring

NOTE
All field installation and wiring of electrical equipment must be done to meet NEC, CEC and local codes.
Be sure to use appropriately sized wire for the full load amp draw.
Once the following hardwiring is complete, please refer to the BMS Communication Protocol Setup section on page 11 for details on programming the BMS to communicate with the Vektor System Control via the hard wire connections.

Remote Enable/Disable (on/off) Switch

(Customer supplied switch; hard wire connections)

A switch can be wired to the control box to remotely enable or disable the Vektor System Control (VSC). Wiring this switch is optional; if remote enable/disable is not required, no action is required and the system can be enabled and disabled on the Programmable Logic Controller (PLC) in the control box.

Wiring remote switch:

- Connect SYON+ on the control box terminal strip to one side of the remote switch.
- Connect +24V to the other side of the remote switch.
- Connect SYON- on the control box terminal strip to COM on the terminal strip.
- See Digital Input Programming section of this manual for details on enabling this feature.

Remote Safety Enable/Disable (on/off) Switch

(Customer supplied switch; hard wire connections)

A safety switch can be wired to the control box to remotely enable/disable the VSC. This feature is primarily used for emergency stop buttons or duct static pressure safety switches; if the static pressure in the duct work is too high, the switch will open or close to disable the fan system. Wiring this switch is optional; if remote safety enable/disable is not required, no action is required.

Wiring remote safety switch:

- Connect SAFE+ on the control box terminal strip to one side of the remote safety switch.
- Connect +24V to the other side of the safety switch.
- Connect SAFE- on the control box terminal strip to COM on the terminal strip.
- See Digital Input Programming section of this manual for details on enabling this feature.

Fireman Override

(Customer supplied switch; hard wire connections)

A fireman override switch can be wired to the control box to remotely adjust the fan speed. In the event of a fire, the VCS can receive an input from the fireman override switch and force the fan system to a user adjustable setpoint between 0 and 100%. Wiring this switch is optional; if fireman override is not required, no action is required.

Fireman override switch:

- Connect FIRE+ on the control box terminal strip to one side of the fireman override switch.
- Connect +24V to the other side of the fireman override switch.
- Connect FIRE- on the control box terminal strip to COM on the terminal strip.
- See Digital Input Programming section of this manual for details on enabling this feature.

Alarm Output

(Hard wire connections)

If a component of the VSC triggers an alarm, a relay within the Carel will close or open (user adjustable) a dry contact to alert the Building Management System (BMS). The alarm can be diagnosed on the Carel PLC in the control box; BACnet can also be used to diagnose the issue.

Wiring alarm output:

- Connect ALRM+ on the control box terminal strip to BMS.
- Connect ALRM- on the control box terminal strip to BMS.
- See Digital Input Programming section of this manual for details on enabling this feature.

BACnet

(Hard wire connections)

BACnet IP and BACnet MS/TP are both supported by the VSC.

BACnet IP:

- Use CAT-5 STP shielded cables
- The PLC has two Ethernet ports that are connected internally, making it easy to daisy-chain units together.
- See the BMS Setup and BACnet Objects section of this manual for additional details.

BACnet MS/TP:

- The J25 BMS2 connector on the PLC is used to connect the BACnet MS/TP.
- To improve immunity against electromagnetic interference, the serial connection cable should be a 3-wire shielded twisted pair.
- Connect the twisted pair wires to the J25 BMS2 connector - and + on the PLC to the appropriate BMS connections.
- The third wire of the shielded twisted cable should be used to connect the J25 BMS2 GND connection to the BMS RS485 ground reference.
- The shielding on the twisted pair 3-wire cable should only be connected to ground on one end of the cable; the green/yellow GND terminal in the VSC box is a suitable location to ground the shielding of the cable.
- See the BMS Setup and BACnet Objects section of this manual for additional details.

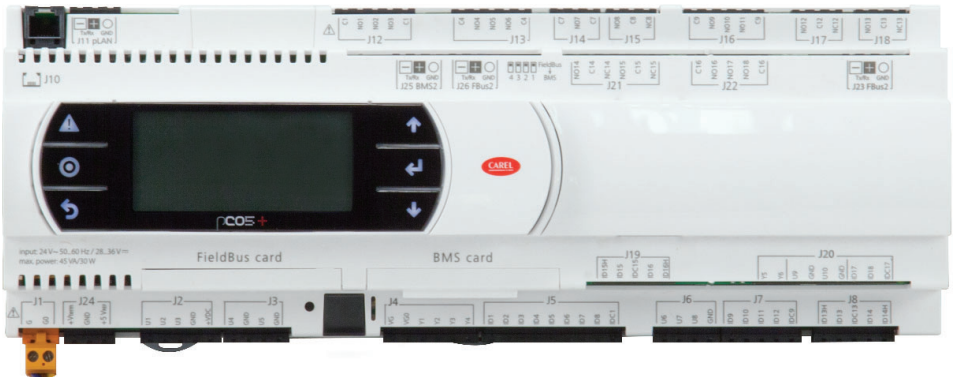
NOTE
This PLC does not contain any internal terminating resistors.

Digital Input Programming

Controller PLC Introduction and Tutorial

The VSC Programmable Logic Controller (PLC) is located in the main control panel. The PLC has factory set points that can be modified to configure the system for job specific functions. The directions for the setup screens are shown in this section.

The face of the controller has six buttons, allowing the user to view unit conditions and alter parameters. The PLC is pre-programmed with easy-to-use menus.



Operator Interface and Keypad Navigation

Digital Input Programming (continued)

Keypad Navigation		
	Escape	Allows the user to exit the current menu, jumping to the Main Menu.
	Up | Down	The arrow buttons allow the user to scroll through different screens and adjust parameters.
	Alarm	Button will blink red, indicating an alarm condition. Press to review current alarms. To review previous alarms, access the DATA LOGGER through the main menu.
	Enter	A. In screens with adjustable parameters, pressing the Enter button moves the cursor from the upper left corner of the screen to the parameter. The arrow buttons can then be used to adjust the parameter. B. To move to the next parameter on the same screen, press the Enter button. C. To save the change, press the Enter button until the cursor moves back to the upper left corner of the screen.
	Program	Pressing the Program button allows the user to enter the Main Program Menu.

Log In

The PLC requires a log in code to access the menu structure. Adjustments should only be made be qualified personnel.

1. Press the *Program* key.
2. Use the *Up* and *Down* arrows to highlight Log-in.
3. Press the *Enter* key.
4. Use the *Up* and *Down* arrows to enter in the password: 9998.
5. The PLC will return to the Main Menu.
6. Press the *Escape* key to return to the Status home screen.

Turning Fan System On and Off

The PLC does not require a log-in to turn the fan on or off

1. Press the *Program* key.
2. Use the *Up* and *Down* arrows to highlight “Unit On Off”.
3. Press the *Enter* key.
4. Use the *Up* and *Down* arrows to highlight On or Off.
5. Press the *Enter* key.
6. The controller will return to the Main Menu after executing the command.
7. Press the *Escape* key to return to the Status home screen.

Adjusting the Static Pressure Set Point

The PLC will arrive with a factory preset static pressure of 1 in. wg.

1. Log in (See above).
2. Use the *Up* and *Down* arrows to highlight “Test & Bal”.
3. Press the *Enter* key to enter the Test and Balance menu.
4. Press the *Enter* key to highlight the “Press 1 set point”.
5. Use the *Up* and *Down* arrows to select the desired set point.
6. Press the *Enter* key.
7. Press the *Escape* key to return to the Main Menu.
8. Press the *Escape* key to return to the Status home screen.

System Fine Tuning

Test and Balance can be used to fine tune the system operation to enable the fan to start at a set speed, this will allow the system to stabilize faster at start up. The fans minimum and maximum speed can also be adjusted in the Test and Balance menu to aid in system stabilization and minimize fan speed hunting. Prior to adjusting these parameters, the systems minimum and maximum fan speed will need to be determined along with the most common steady state fan speed. These settings are very useful for systems that do not fluctuate widely or run at a steady speed.

1. Log in (See page 10).
2. Use the *Up* and *Down* arrows to highlight “Test & Bal”.
3. Press the *Enter* key to enter the Test & Balance menu.
4. Use the *Up* and *Down* arrows to access the “Fan Start %” menu.
5. Press the *Enter* key to highlight the “Fan Start %”.
6. Use the *Up* and *Down* arrows to select the desired set point.
7. Press the *Enter* key to advance to “Min Fan %”.
8. Use the *Up* and *Down* arrows to select the desired set point.
9. Press the *Enter* key to advance to “Max Fan %.
10. Use the *Up* and *Down* arrows to select the desired set point.
11. Press the *Enter* key.
12. Press the *Escape* key to return to the Status home screen.

Building Management System (BMS) Communication Protocol Setup

BACnet IP, BACnet MS/TP, Modbus RTU and Modbus TCP are all supported by the Vektor System Control.

1. Log in (See page 10).
2. Use the *Up* and *Down* arrows to highlight “BMS Settings”.
3. Press the *Enter* key.
4. Use the *Up* and *Down* arrows to access the “Protocol Type” menu.
5. Press the *Enter* key to enter the Protocol Type menu.
6. Use the *Up* and *Down* arrows to select the desired protocol type.
7. Press the *Enter* key.
8. Use the *Up* and *Down* arrows to select the desired BMS units of measure.
9. Press the *Enter* key.
10. Use the *Up* and *Down* arrows to select the desired device instance number.
11. Press the *Enter* key.
12. Pressing the *Down* arrow again will access the menu to adjust the device address and baud rate.
13. To adjust the address press *Enter*.
14. Use the *Up* and *Down* arrows to select the desired address number.
15. Press *Enter* (this will save the address and advance the cursor to baud rate).
16. Use the *Up* and *Down* arrows to select the desired baud rate.
17. Press the *Enter* key three (3) times.
18. Press the *Escape* key to return to the Main Menu.
19. Press the *Escape* key to return to the Status home screen.

BACnet Objects

The following objects are available through BACnet.

Type	Instance	Name	Read (VSC to BMS) Write (BMS to VSC)	Description [Units]
AnalogInput	1	Pressure1_Program	Read Only	Static Pressure 1 [IN H2O]
	2	Pressure2_Program	Read Only	Static Pressure 2 [IN H2O]
	3	Pressure3_Program	Read Only	Static Pressure 3 [IN H2O]
	4	Pressure4_Program	Read Only	Static Pressure 4 [IN H2O]
	5	BypassDampFB1.Val	Read Only	Not Used
	6	BypassDampFB2.Val	Read Only	Not Used
	7	BypassDamp1.Val	Read Only	Bypass Damper 1 Position [0-100%]
	8	BypassDamp2.Val	Read Only	Bypass Damper 2 Position [0-100%]
	9	Fan1_Aout.Val	Read Only	Fan 1 Speed [0-100%]
	10	Fan2_Aout.Val	Read Only	Fan 2 Speed [0-100%]
	11	Fan3_Aout.Val	Read Only	Fan 3 Speed [0-100%]
	12	Fan4_Aout.Val	Read Only	Fan 4 Speed [0-100%]
	13	FiremanInputPct	Read Only	User Defined Speed of Fan When Fireman's Override is Enabled [0-100%]
	14	AllPressuresInAlarmPct	Read Only	User Defined Speed of Fan When All Pressure Transducers are in Alarm [0-100%]
	15	NumberOfPressTrans_REAL	Read Only	Number of Press Transducers [1-4]
	16	NumberOfFans_REAL	Read Only	Number of Fans [1-4]
	17	NumberOfPrimaryFans_REAL	Read Only	Number of Primary Fans [1-4]
	18	NumberOfBypassDampers_REAL	Read Only	Number of Bypass Dampers [1-4]
	101	Fan_Msk[1].Power_KW	Read Only	Fan 1 Power [KW]
	102	Fan_Msk[1].Power_HP	Read Only	Fan 1 Power [Hp]
	103	Fan_Msk[1].MotorVolt	Read Only	Fan 1 Motor Voltage [V]
	104	Fan_Msk[1].MotorCurrent	Read Only	Fan 1 Motor Current [A]
	105	Fan_Msk[1].Freq	Read Only	Fan 1 Frequency [HZ]
	106	Fan_Msk[1].Freq_Perc	Read Only	Fan 1 Frequency Percent [%]
	107	Fan_Msk[1].Speed_RPM	Read Only	Fan 1 Motor Speed [RPM]
	108	Fan_Msk[1].Torque_Nm	Read Only	Fan 1 Torque [Nm]
	109	Fan_Msk[1].Torque_Perc	Read Only	Fan 1 Torque Percent [%]
	110	Fan_Msk[1].DCLink_Volt	Read Only	VFD 1 DC Link Voltage [V]
	111	Fan_Msk[1].HeatsinkTemp	Read Only	VFD 1 Heatsink Temp [C]
	112	Fan_Msk[1].InvNomCurrent	Read Only	VFD 1 Inv Nom Max [A]
	113	Fan_Msk[1].InvMaxCurrent	Read Only	VFD 1 Inv Max Current [A]
	114	Fan_Msk[1].ControllerCardTemp	Read Only	VFD 1 Controller Card Temp [C]
	201	Fan_Msk[2].Power_KW	Read Only	Fan 2 Power [KW]
	202	Fan_Msk[2].Power_HP	Read Only	Fan 2 Power [Hp]

Type	Instance	Name	Read (Unit to BMS) Write (BMS to Unit)	Description [Units]
AnalogInput	203	Fan_Msk[2].MotorVolt	Read Only	Fan 2 Motor Voltage [V]
	204	Fan_Msk[2].MotorCurrent	Read Only	Fan 2 Motor Current [A]
	205	Fan_Msk[2].Freq	Read Only	Fan 2 Frequency [HZ]
	206	Fan_Msk[2].Freq_Perc	Read Only	Fan 2 Frequency Percent [%]
	207	Fan_Msk[2].Speed_RPM	Read Only	Fan 2 Motor Speed [RPM]
	208	Fan_Msk[2].Torque_Nm	Read Only	Fan 2 Torque [Nm]
	209	Fan_Msk[2].Torque_Perc	Read Only	Fan 2 Torque Percent [%]
	210	Fan_Msk[2].DCLink_Volt	Read Only	VFD 2 DC Link Voltage [V]
	211	Fan_Msk[2].HeatsinkTemp	Read Only	VFD 2 Heatsink Temp [C]
	212	Fan_Msk[2].InvNomCurrent	Read Only	VFD 2 Inv Nom Max [A]
	213	Fan_Msk[2].InvMaxCurrent	Read Only	VFD 2 Inv Max Current [A]
	214	Fan_Msk[2].ControllerCardTemp	Read Only	VFD 2 Controller Card Temp [C]
	301	Fan_Msk[3].Power_KW	Read Only	Fan 3 Power [KW]
	302	Fan_Msk[3].Power_HP	Read Only	Fan 3 Power [Hp]
	303	Fan_Msk[3].MotorVolt	Read Only	Fan 3 Motor Voltage [V]
	304	Fan_Msk[3].MotorCurrent	Read Only	Fan 3 Motor Current [A]
	305	Fan_Msk[3].Freq	Read Only	Fan 3 Frequency [HZ]
	306	Fan_Msk[3].Freq_Perc	Read Only	Fan 3 Frequency Percent [%]
	307	Fan_Msk[3].Speed_RPM	Read Only	Fan 3 Motor Speed [RPM]
	308	Fan_Msk[3].Torque_Nm	Read Only	Fan 3 Torque [Nm]
	309	Fan_Msk[3].Torque_Perc	Read Only	Fan 3 Torque Percent [%]
	310	Fan_Msk[3].DCLink_Volt	Read Only	VFD 3 DC Link Voltage [V]
	311	Fan_Msk[3].HeatsinkTemp	Read Only	VFD 3 Heatsink Temp [C]
	312	Fan_Msk[3].InvNomCurrent	Read Only	VFD 3 Inv Nom Max [A]
	313	Fan_Msk[3].InvMaxCurrent	Read Only	VFD 3 Inv Max Current [A]
	314	Fan_Msk[3].ControllerCardTemp	Read Only	VFD 3 Controller Card Temp [C]
	401	Fan_Msk[4].Power_KW	Read Only	Fan 4 Power [KW]
	402	Fan_Msk[4].Power_HP	Read Only	Fan 4 Power [Hp]
	403	Fan_Msk[4].MotorVolt	Read Only	Fan 4 Motor Voltage [V]
	404	Fan_Msk[4].MotorCurrent	Read Only	Fan 4 Motor Current [A]
	405	Fan_Msk[4].Freq	Read Only	Fan 4 Frequency [HZ]
	406	Fan_Msk[4].Freq_Perc	Read Only	Fan 4 Frequency Percent [%]
	407	Fan_Msk[4].Speed_RPM	Read Only	Fan 4 Motor Speed [RPM]
	408	Fan_Msk[4].Torque_Nm	Read Only	Fan 4 Torque [Nm]
	409	Fan_Msk[4].Torque_Perc	Read Only	Fan 4 Torque Percent [%]
	410	Fan_Msk[4].DCLink_Volt	Read Only	VFD 4 DC Link Voltage [V]
	411	Fan_Msk[4].HeatsinkTemp	Read Only	VFD 4 Heatsink Temp [C]
	412	Fan_Msk[4].InvNomCurrent	Read Only	VFD 4 Inv Nom Max [A]
	413	Fan_Msk[4].InvMaxCurrent	Read Only	VFD 4 Inv Max Current [A]
	414	Fan_Msk[4].ControllerCardTemp	Read Only	VFD 4 Controller Card Temp [C]

Type	Instance	Name	Read (Unit to BMS) Write (BMS to Unit)	Description [Units]
AnalogValue	101	Pressure1_BMS	Read Only	Pressure 1 From BMS [0-15 IN H2O] - Depending upon the settings in the Binary Values, this pressure may be used for pressure 1 rather than the analog input.
	201	Pressure2_BMS	Read Only	Pressure 2 From BMS [0-15 IN H2O] - Depending upon the settings in the Binary Values, this pressure may be used for pressure 2 rather than the analog input.
	301	Pressure3_BMS	Read Only	Pressure 3 From BMS [0-15 IN H2O] - Depending upon the settings in the Binary Values, this pressure may be used for pressure 3 rather than the analog input.
	401	Pressure4_BMS	Read Only	Pressure 4 From BMS [0-15 IN H2O] - Depending upon the settings in the Binary Values, this pressure may be used for pressure 4 rather than the analog input.
BinaryInput	502	AI_Prb_Pressure1.Active	Read Only	Alarm/OK
	503	AI_Prb_Pressure2.Active	Read Only	Alarm/OK
	504	AI_Prb_Pressure3.Active	Read Only	Alarm/OK
	505	AI_Prb_Pressure4.Active	Read Only	Alarm/OK
	506	AI_Prb_DamperFB1.Active	Read Only	Alarm/OK
	507	AI_Prb_DamperFB2.Active	Read Only	Alarm/OK
	508	AI_SafetyInput.Active	Read Only	Alarm/OK
	509	AI_Device_Test.Active	Read Only	Alarm/OK
	510	AI_VFD1_Offline.Active	Read Only	Alarm/OK
	511	AI_VFD2_Offline_2.Active	Read Only	Alarm/OK
	512	AI_VFD3_Offline_3.Active	Read Only	Alarm/OK
	513	AI_VFD4_Offline_4.Active	Read Only	Alarm/OK
BinaryValue	1	OnOffUnitMng.BmsOnOff_Enabled	Read Only	Disable/Enable - If enabled, the BMS On/Off variable must be ON for the unit to start.
	2	OnOffUnitMng.BmsOnOff	Read Only	Off/On
	3	BMSPressures	Read Only	No/Yes - If yes, the next variables are used to say whether the pressures are coming from and analog input or from the BMS
	101	Pressure1FromBMS	Read Only	No/Yes
	201	Pressure2FromBMS	Read Only	No/Yes
	301	Pressure3FromBMS	Read Only	No/Yes
	401	Pressure4FromBMS	Read Only	No/Yes

Type	Instance	Name	Read (Unit to BMS) Write (BMS to Unit)	Description [Units]
MultiStateInput	1	UnitStatus	Read Only	1 = Unit on 2 = Unit switched off due to alarm 3 = Unit switched off by BMS 4 = Unit switched off by schedule 5 = Unit switched off from the local keypad 6 = Fans rotating 7 = Unit off by digital input 8 = Unit off by safety input 9 = Operating in FIREMAN OVERRIDE 10 = Operating in FAILSAFE
	101	FanStateProg[1]	Read Only	1 = OFF 2 = Startup 3 = Rotation at Minimum 4 = Rotating in, ramping 5 = Running 6 = Rotating out, ramping down 7 = Rotating out, at minimum 8 = Shutdown 9 = Off by alarm
	201	FanStateProg[2]	Read Only	1 = OFF 2 = Startup 3 = Rotation at Minimum 4 = Rotating in, ramping 5 = Running 6 = Rotating out, ramping down 7 = Rotating out, at minimum 8 = Shutdown 9 = Off by alarm
	301	FanStateProg[3]	Read Only	1 = OFF 2 = Startup 3 = Rotation at Minimum 4 = Rotating in, ramping 5 = Running 6 = Rotating out, ramping down 7 = Rotating out, at minimum 8 = Shutdown 9 = Off by alarm
	401	FanStateProg[4]	Read Only	1 = OFF 2 = Startup 3 = Rotation at Minimum 4 = Rotating in, ramping 5 = Running 6 = Rotating out, ramping down 7 = Rotating out, at minimum 8 = Shutdown 9 = Off by alarm

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.

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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.

Table of Contents

General Safety Information

Only qualified personnel should install this unit. Personnel should have a clear understanding of these instructions and should be aware of general safety precautions. Improper installation can result in electric shock, possible injury due to coming in contact with moving parts, as well as other potential hazards. Other considerations may be required if high winds or seismic activity are present. If more information is needed, contact a licensed professional engineer before moving forward.

1. Follow all local electrical and safety codes, as well as the National Electrical Code (NEC), the National Fire Protection Agency (NFPA), where applicable. Follow the Canadian Electrical Code (CEC) in Canada.
2. Do not allow the power cable to kink or come in contact with oil, grease, hot surfaces, or chemicals. Replace cord immediately if damaged.
3. Verify the power source is compatible with the equipment.

DANGER
Always disconnect, lock and tag power source before installing or servicing. Failure to disconnect power source can result in fire, shock or serious injury.
CAUTION
When servicing the fan, motor may be hot enough to cause pain or injury. Allow motor to cool before servicing.
CAUTION
Precaution should be taken in explosive atmospheres.
DANGER
Pour écarter les risques d'incendie, de choc électrique ou de blessure grave, veiller à toujours débrancher, verrouiller et étiqueter la source de courant avant l'installation ou l'entretien.
ATTENTION
Lors de toute intervention sur la soufflante, le moteur peut être suffisamment chaud pour provoquer une douleur voire une blessure. Laisser le moteur refroidir avant toute maintenance.
ATTENTION
Faire preuve de précaution dans les atmosphères explosives.

Receiving

Upon receiving the components, check to ensure all items are accounted for by referencing the delivery receipt or packing list. Inspect each crate or carton for shipping damage before accepting delivery. Alert the carrier of any damage detected. The customer will make a notation of damage (or shortage of items) on the delivery receipt 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. Sometimes it is not possible that all items for the unit be shipped together due to availability of transportation and truck space. Confirmation of shipment(s) must be limited to only items on the bill of lading.

Handling

Handle in such a manner as to keep from scratching or chipping the coating. Damaged finish to parts may reduce ability of unit to resist corrosion.

Storage

Units are protected against damage during shipment. If the unit cannot be installed and operated immediately, precautions need to be taken to prevent deterioration of the unit during storage. The user assumes responsibility of the unit and 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.

INDOOR - The ideal environment for the storage of units and accessories 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°F *(-1°C)* and 110°F *(43°C)* (wide temperature swings may cause condensation and “sweating” of metal parts). All accessories must be stored indoors in a clean, dry atmosphere. Remove any accumulations of dirt, water, ice, or snow and wipe dry before moving to indoor storage. To avoid “sweating” of metal parts, allow cold parts to reach room temperature. To dry parts and packages use a portable electric heater to eliminate any moisture build up. Leave coverings loose to permit air circulation and to allow for periodic inspection. The unit should be stored at least 3-1/2 in. *(89 mm)* off the floor on wooden blocks covered with moisture proof paper or polyethylene sheathing. Aisles between parts and along all walls should be provided to permit air circulation and space for inspection.

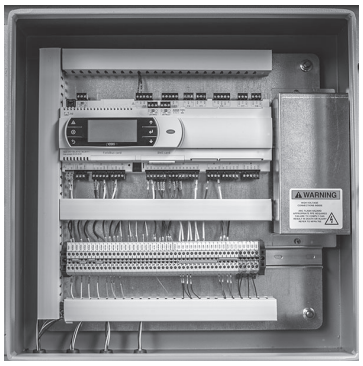
Inspection and Maintenance during Storage

While in storage, inspect equipment once per month. Keep a record of inspection and maintenance performed. If moisture or dirt accumulations are found on parts, the source should be located and eliminated.

Removed From Storage

As units are removed from storage to be installed in their final location, they should be protected and maintained in a similar fashion, until the equipment goes into operation. Prior to installing the unit and system components, inspect the unit assembly to make sure it is in working order. Check all fasteners and accessories for tightness.

Vektor System Control (VSC) Components



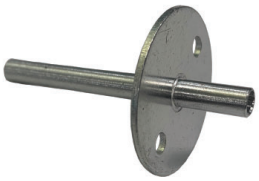
Programmable Logic Controller (PLC)
Control Box
(1 per fan system)

Variable Frequency Drive (VFD)
(1 per fan)

VFD Brand and Model may vary from image.

Pressure Transducer
(1 per fan system)

Pressure Tubing
(25 feet)



Pressure Probe
(1 per fan system)

5 Pin, 16.4 feet *(5 meter)* cable
[2 per fan]
8 Pin, 32.8 feet *(10 meter)* cable
[3 per fan system]

Customer-Supplied System Components

- Control wiring and conduit from pressure transducer to control box
- Mounting hardware for all components
- Power wiring and conduit to controller box, VFD(s) and from VFD(s) to motor(s).

Variable Frequency Drive Operation

For operation with a variable frequency drive (VFD) always check motor amps when adjusting the operating frequency. Motor may be sized for the original selected operating speed under 60 Hz. Bypassing the VFD or increasing the speed from this original selection, even if less than 60 Hz, may cause motor to overload or fail. Consult factory with fan serial number before increasing the upper limiting frequency.

Always check the fan RPM when adjusting the operating frequency. Do not exceed maximum class fan RPM of the wheel.

NOTE

It is the responsibility of the installing body to perform coast-down tests and identify any resonant frequencies after the equipment is fully installed. These resonant frequencies are to be removed from the operating range of the fan by using the “skip frequency” function in the VFD programming. Failure to remove resonant frequencies from the operating range will decrease the operating life of the fan and void the warranty.

Quick Installation Guide

System Mounting & Wiring

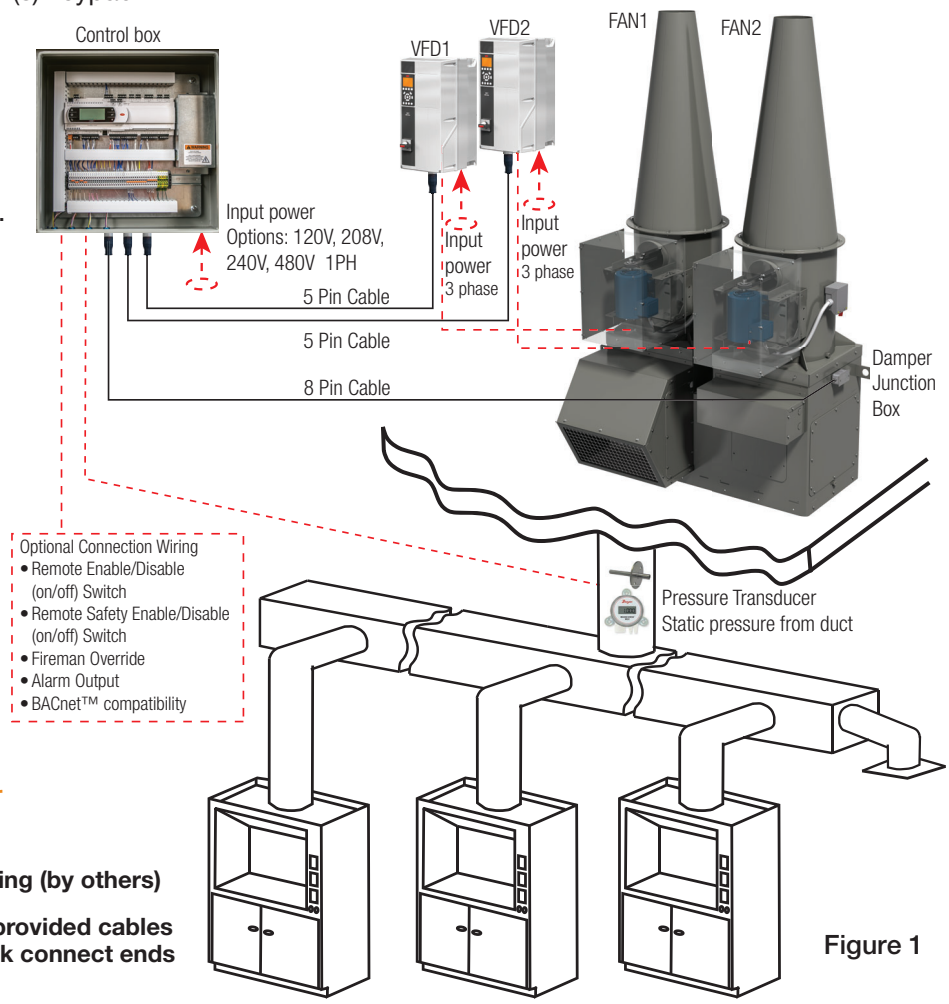
Steps 2, 3, 7 and 9 need to be repeated for multiple fan systems.

All wiring done by others to be per local code (see figure 1).

1. Mount control box upright with connectors down on structural support within 50 ft *(15.2 m)* of fan plenum.
   Note: control box is labeled with a fan mark. This must match the fan mark on the fan system being connected.
2. Mount Variable Frequency Drive(s) (VFD) within 20 ft *(6.1 m)* of control box (1 per fan).
   Note: VFD is labeled with a fan mark. This must match the fan mark on the fan system.
3. Connect 5 pin cable from VFD1 to control box VFD1. Maintain 12 inches from all high power cables when routing.
4. Connect 8 pin cable from damper junction box on fan plenum to control box connection labeled Plenum.
5. Wire static pressure transducer to control box. Plumb pressure probe to pressure transducer-port.
6. Wire optional connections on terminal strip, see **Optional Hardwire Connections Digital Input** section.
7. Wire incoming power to VFD1.
8. Wire incoming power to control box.
9. Wire from VFD1 to motor on FAN1.

Start-up:

1. Confirm incoming voltage and motor nameplate data match the VFD(s) label.
2. Confirm the fan mark on the VFD(s) and control box match the fan mark on the fan.
3. Apply power to VFD(s).
4. Turn on disconnect located on VFD(s) and/or local fan disconnect(s).
5. Set the VFD Modbus address for Fan 1 to 1 and for Fan 2 to 2. See **System Startup and Testing** section.
6. Press the *Auto On* button on the VFD(s) keypad.
7. Apply power to the control box.
8. Confirm pressure transducer is powered on; the digital display on the pressure transducer will illuminate.
9. Configure optional wire connections. See **Optional Hardwire Connections Digital Input** for details.
10. Confirm the system can be turned on safely without damage to duct work.
11. Using CAREL® keypad located in control box, use *Up* and *Down* arrows to navigate to System *On/Off*. Press *Enter* button to turn the system on.
12. Follow the System Startup and Testing section to properly start and test the system.
13. **The system is factory preset to start up and maintain 1 in. wg; this will need to be adjusted to the user desired static pressure setting.**



Field wiring (by others)

Factory provided cables with quick connect ends

Figure 1

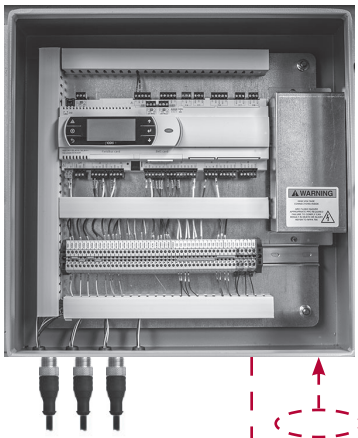
Vektor System Control (VSC) Function Overview

Vektor System Control (VSC) is a complete factory controls package for use in controlling the dampers and motors on a Vektor fan system. Hardware includes a control box, pressure transducer, and variable frequency drive(s) (VFD) for field mounting. The system operates by receiving an input signal from a duct static pressure sensor and depending on the relation to the set point, adjusts the fan speed and dampers. This system can control up to one bypass and one isolation damper per fan.

Each VSC package will come with one control box that is preprogrammed, ready to control the fan system it was ordered with (see figure 2). A multi-tap transformer will accept single phase 120V, 208V, 240V or 480V input power field wired to a terminal strip. The connections to the VFD(s), isolation damper(s), and bypass damper(s) are made easy with quick connect cables. The pressure transducer connection will be field wired to the terminal strip located in the control box. Systems may not have isolation or bypass dampers; the control box will be programmed accordingly.

Figure 2

Control Box



Input Power Options: 120V. 208V, 240V, 480V 1PH

Pressure Transducer

Field Wiring (by others)

Quick Connect Cabling

Each VSC package will come with one VFD per fan that is preprogrammed to communicate with the PLC, ready to control the fan motor it was ordered with (see figure 3). Incoming power and output power to the fan motor will be field wired. The connection from the control box to the VFD is made easy with a quick connect cable.

Figure 3

VFD

Input Power 3PH

Output Power to Fan Motor

Field Wiring (by others)

Each VSC package will come with one pressure transducer that is preprogrammed, ready to control the fan system it was ordered with (see figure 4). Three wires will be field wired from the control box terminal strip to the pressure transducer terminal strip. The pressure transducer will receive power from the control box, no additional power source is required. A static pressure probe and tubing to connect the probe to the pressure transducer is factory supplied.

Figure 4

Transducer

VAC
VDC
COM
V out

Field Wiring (by others)

Component Mounting

Mounting the Vektor System Control (VSC) Box

- Mount VSC box upright with connectors down on structural support within 50 ft *(15.2 m)* from center of fan plenum.
- Cables and wiring will be connected to the bottom of the box. It must have a minimum of 12 in. *(305 mm)* of clearance from any obstructions.
- VSC control box is a NEMA-3R enclosure suitable to be mounted indoors or outdoors.

Mounting of Variable Frequency Drive(s) (VFD)

- The mounting hole pattern can be found in the manual supplied with the VFD.
- Place the VFD(s) within 20 ft *(6.1 m)* of the VSC control box.
- Place the VFD(s) as near to the motor as possible, keeping the motor cables as short as possible. Maximum motor cable length to be less than 100 ft *(30.5 m)*.
- Mount the VFD(s) vertically to a solid structure; always use the provided sheet metal backing plate.
- A minimum clearance of 9 in. *(229 mm)* above and below, 3 in. *(76 mm)* on each side is required.

VFD Weathershield Mounting

The weathershield is only required if the VFD is the Danfoss brand and mounted outdoors.

- Weathershield attaches to the top of the VFD using M6x1 fasteners (supplied).

1. Slide the bracket between the VFD mounting surface and the back of the VFD (see figure 5).
2. Tighten the upper mounting bolts to secure the bracket and VFD(s).
3. Slide the shield onto the bracket (see figure 6).
4. Fasten the shield to the bracket with supplied screws.

Pressure Transducer Mounting

- The pressure transducer is housed in a NEMA-4X rated enclosure suitable to be mounted indoors or outdoors.
- Locate the pressure transducer within 200 ft *(61 m)* of the VSC control box. Two hundred feet is the maximum control wire length for this pressure transducer.
- The pressure transducer should be mounted on a flat vertical surface with the connections directed down to prevent moisture from entering either the pressure ports or the electrical cable entry. The diaphragm must be vertical to minimize gravity effects on the diaphragm.
- The pressure transducer should be mounted higher than the static pressure probe to ensure that any moisture or condensation drains back into the duct.
- Pressure transducer plumbing options:

  Negative static pressure measurement.

  Connect the pressure probe to the negative (-) port, as indicated on the transmitter. Leave positive (+) port open to atmosphere.

Figure 5

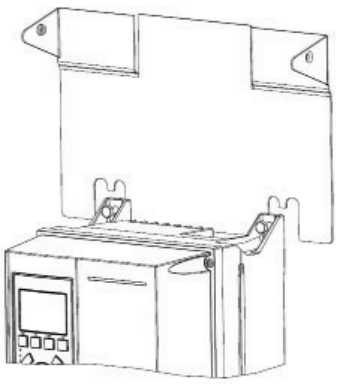
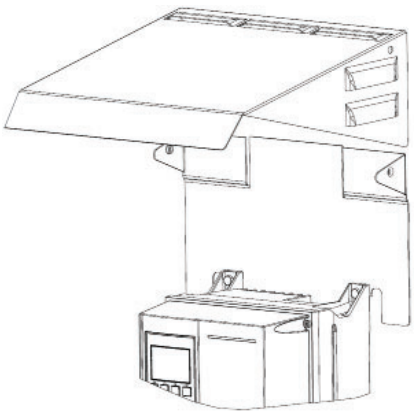


Figure 6



Component Hardwiring

System Wiring

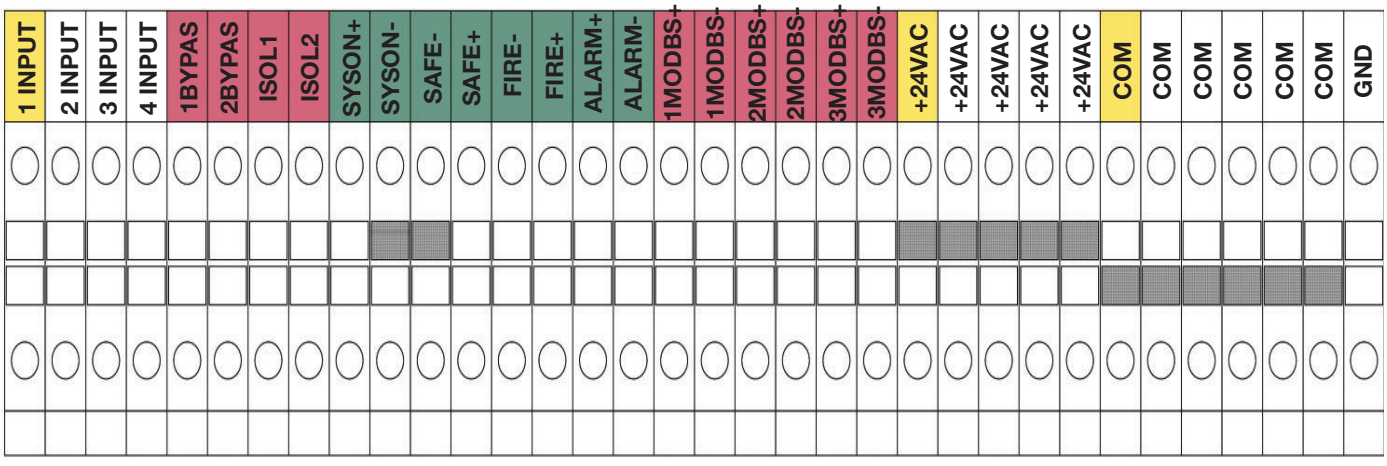
Greenheck supplied cable connections

- Control box to fan plenum
  - 8 pin cable
  - Qty. 3, 32.8 ft (*10 m*) each. Daisy chain to the length required.
- Control box to VFD(s)
  - 5 pin cable
  - Qty. 2, 16.4 ft (*5 m*) each. Daisy chain to the length required.

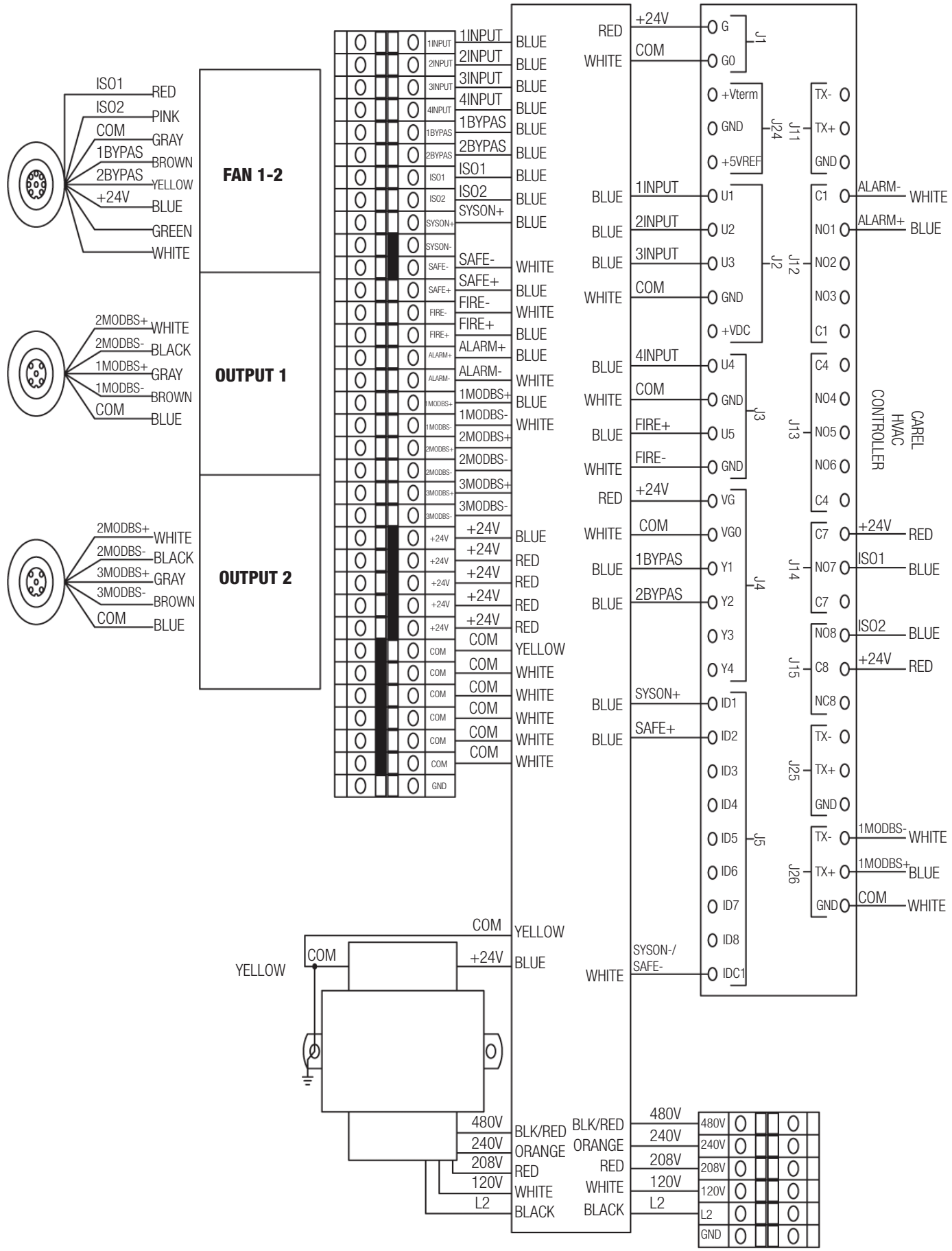
Contractor supplied cable/connections

- To VFD and Motor
  - Power to each VFD (selected motor voltage), grommet location in bottom of VFD.
  - Power from VFD to motor/disconnect on fan.
- Power to control box
  - Control box has built-in transformer for 24V power to PLC, sensors and actuators.
  - Contractor to drill hole in PLC box and connect conduit per installation location and local codes.
  - To power connect 120V, 1-phase or 1 leg of 3-phase power.
    - (Accepts: 120V, 208V, 230V or 460V)
- Control wiring
  - Recommend using 18-20 ga. wire. Local codes and standards may require other gauge.
  - Contractor to drill hole in the control box and connect conduit per installation location and local codes.
  - Required (yellow highlights on terminal strip image)
    - Duct static pressure sensor to control box. Transducer provided by Greenheck.
    - 24 volt power from control box transformer.
  - Optional hardwire connections (green highlights on terminal strip image)
    - Remote enable/disable (on/off) switch (switch by others)
    - Remote safety enable/disable (on/off) switch (switch by others)
    - Fireman's override (switch by others) Field configured for either ON or OFF.
    - Alarm Output
    - BACnet™ MSTP or BACnet™ IP to Building Management System (BMS)
  - DO NOT connect to red highlights on terminal strip image.

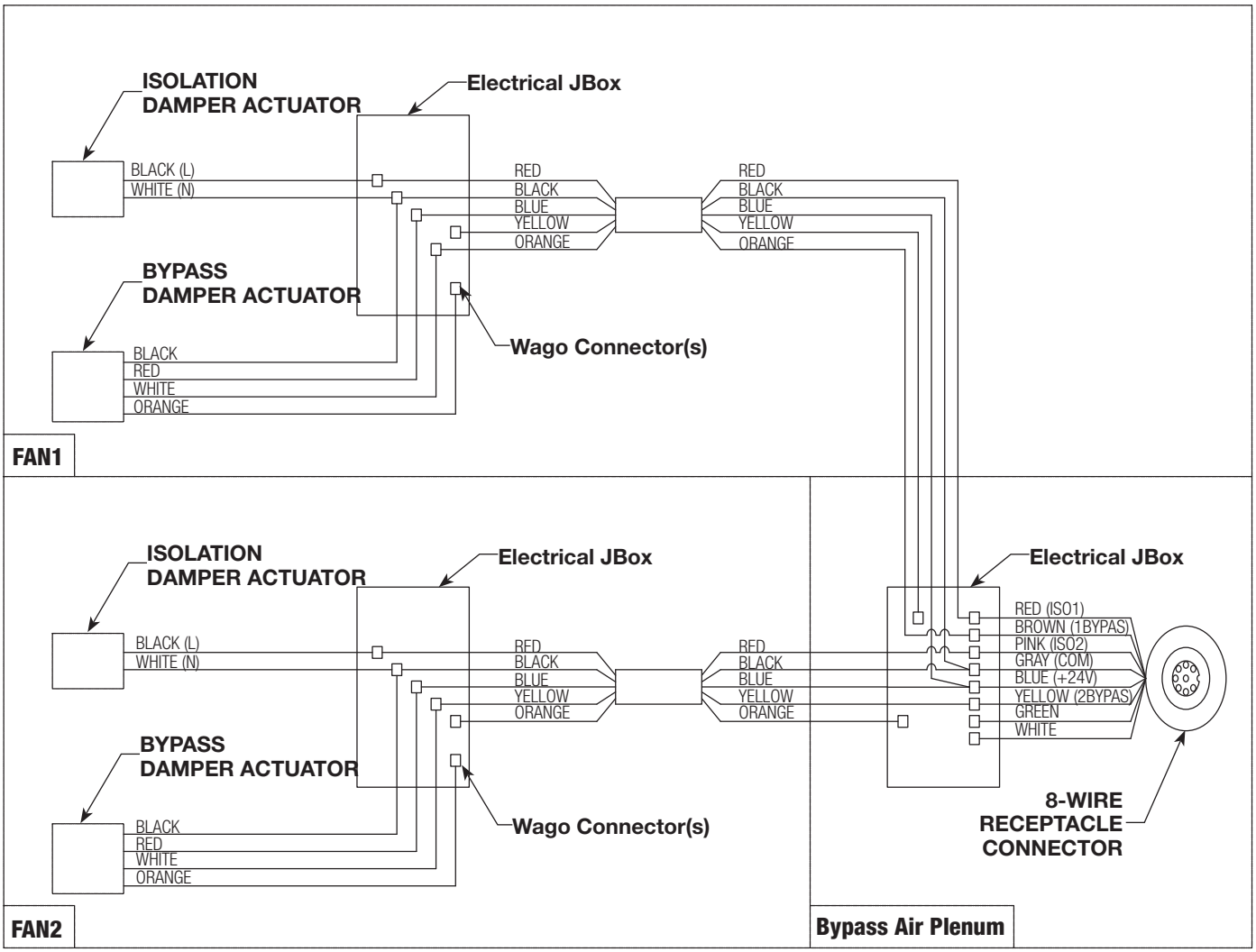
Control box wiring terminal strip:



Control box wiring diagram:



Damper junction box wiring diagram:



NOTE
All field installation and wiring of electrical equipment must be done to meet NEC, CEC and local codes.
Be sure to use appropriately sized wire for the full load amp draw.
Once the following hardwiring is complete, please refer to the **Building Management System (BMS) Settings** menu for details on programming the BMS to communicate with the Vektor System Control via the hardwire connections.

Make sure the numbering of the fans is consistent during the entire wiring installation; fan 1 will require wiring specific to fan 1, fan 2 will require specific wiring, if applicable.

Control Box Incoming Power

(hardwire connections)

The control box will function on 120, 208, 240 or 480V single-phase 50/60 Hz AC. Each control box will draw a maximum of 2 amps. Remove the metal cover located on the right side of the control box to access the terminal strip for incoming power (reference wire diagram for details on terminal strip landing points). Once the wiring is complete, reinstall the metal cover.

Control Box to VFD Quick Connect

Connect the factory supplied 5 pin cable (shipped in the control box) to the 5 pin threaded bulkhead on the bottom of the control box; connect the other end to the 5 pin threaded bulkhead on bottom of the VFD(s). Each fan is provided with two (2) – 5 meter cables that can be connected together to extend the length; use as required per fan.

NOTE
Repeat this step for fan 2, if applicable.

Control Box to Damper Junction Box

Connect the factory supplied 8 pin cable (shipped in the control box) to the 8 pin threaded bulkhead on bottom of the control box; connect the other end to the 8 pin threaded bulkhead on the damper junction box that is mounted on the fan plenum. Each fan is provided with three (3) - 10 meter cables that can be connected together to extend the length; use as required.

Component Hardwiring (continued)

Control Box to Pressure Transducer

(hardwire connections)

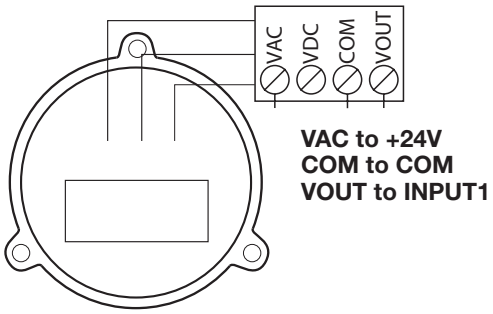
Keep control wires as short as possible [100 ft (30.5 m) or less] and separate from high power cables to minimize interference.

Remove the face cover of the pressure transducer by rotating the face cover counterclockwise and pulling outward to access the wiring terminals.

Remove the display by pulling outward noting the orientation of the display. If the display is reinstalled upside down, the numbers will be upside down.

- Connect INPUT1 on the control box terminal strip to the VOUT on the pressure transducer.
- Connect COM on the control box terminal strip to the COM terminal on the pressure transducer.
- Connect +24V on the control box terminal strip to the VAC terminal on the pressure transducer.

Pressure Transducer



VFD to Motor Wiring Procedure

(hardwire connections)

Danfoss FC102 3R:

Remove the eight fasteners on the cover of the VFD using T20 Torx® or flat head screwdriver. An extension may be needed to reach the fasteners. Remove the cover.

- Connect incoming 3-phase AC input power to terminals T1, T2 and T3 on the master disconnect.
- Connect the 3-phase motor wiring to terminals 96 (U), 97 (V) and 98 (W).
- Connect ground wire to the nearest grounding terminal located on the body of the enclosure.
- Use a cable clamp to relieve pressure from connections.
- Replace VFD cover reusing fasteners.

NOTE

Repeat this step for fan 2, if applicable.

VFD to Motor Wiring Procedure

(hardwire connections)

ABB ACH580:

Remove the cover of the VFD to access the terminal strips.

- Connect incoming 3-phase AC input power to terminals L1, L2 and L3 on the master disconnect.
- Connect the 3-phase motor wiring to terminals T1/U, T2/V and T3/W.
- Connect ground wire to the nearest grounding terminal located on the body of the enclosure.
- Use a cable clamp to relieve pressure from connections.
- Replace VFD cover reusing fasteners.

NOTE

Repeat this step for fan 2, if applicable.

Optional Hardwire Connections Digital Input

NOTE
All field installation and wiring of electrical equipment must be done to meet NEC, CEC and local codes.
Be sure to use appropriately sized wire for the full load amp draw.
Once the following hardwiring is complete, please refer to the **BMS Settings** menu for details on programming the BMS to communicate with the Vektor System Control via the hardwire connections.

Remote Enable/Disable (on/off) Switch

(Customer supplied switch; hardwire connections)

A switch can be wired to the control box to remotely enable or disable the Vektor System Control (VSC). Wiring this switch is optional; if remote enable/disable is not required, no action is required and the system can be enabled and disabled on the Programmable Logic Controller (PLC) in the control box.

Wiring remote switch:

- Connect SYON+ on the control box terminal strip to one side of the remote switch.
- Connect +24V to the other side of the remote switch.
- Connect SYON- on the control box terminal strip to COM on the terminal strip.
- See the **Digital Input Programming** menu section of this manual for details on enabling this feature.

Remote Safety Enable/Disable (on/off) Switch

(Customer supplied switch; hardwire connections)

A safety switch can be wired to the control box to remotely enable/disable the VSC. This feature is primarily used for emergency stop buttons or duct static pressure safety switches; if the static pressure in the duct work is too high, the switch will open or close to disable the fan system. Wiring this switch is optional; if remote safety enable/disable is not required, no action is required.

Wiring remote safety switch:

- Connect SAFE+ on the control box terminal strip to one side of the remote safety switch.
- Connect +24V to the other side of the safety switch.
- Connect SAFE- on the control box terminal strip to COM on the terminal strip.
- See the **Digital Input Programming** menu section of this manual for details on enabling this feature.

Fireman Override

(Customer supplied switch; hardwire connections)

A fireman override switch can be wired to the control box to remotely adjust the fan speed. In the event of a fire, the VSC can receive an input from the fireman override switch and force the fan system to a user adjustable setpoint between 0 and 100%. Wiring this switch is optional; if fireman override is not required, no action is required.

Fireman override switch:

- Connect FIRE+ on the control box terminal strip to one side of the fireman override switch.
- Connect FIRE- on the control box terminal strip to other side of the fireman override switch.
- See the **Digital Input Programming** menu section of this manual for details on enabling this feature.

Alarm Output

(Hardwire connections)

If a component of the VSC triggers an alarm, a relay within the CAREL will close or open (user adjustable) a dry contact to alert the Building Management System (BMS). The alarm can be diagnosed on the CAREL PLC in the control box; BACnet™ can also be used to diagnose the issue.

Wiring alarm output:

- Connect ALRM+ on the control box terminal strip to BMS.
- Connect ALRM- on the control box terminal strip to BMS.
- See the **Digital Input Programming** menu section of this manual for details on enabling this feature.

BACnet™

(Hardwire connections)

BACnet™ IP and BACnet™ MS/TP are both supported by the VSC.

BACnet™ IP:

- Use CAT-5 STP shielded cables
- The PLC has two Ethernet ports that are connected internally, making it easy to daisy-chain units together.
- See the **BMS Settings** menu section of this manual for additional details.

BACnet™ MS/TP:

- The J25 BMS2 connector on the PLC is used to connect the BACnet™ MS/TP.
- To improve immunity against electromagnetic interference, the serial connection cable should be a 3-wire shielded twisted pair.
- Connect the twisted pair wires to the J25 BMS2 connector - and + on the PLC to the appropriate BMS connections.

- The third wire of the shielded twisted cable should be used to connect the J25 BMS2 GND connection to the BMS RS485 ground reference.
- The shielding on the twisted pair 3-wire cable should only be connected to ground on one end of the cable; the green/yellow GND terminal in the VSC box is a suitable location to ground the shielding of the cable.
- See the **BMS Settings** menu section of this manual for additional details.

NOTE
This PLC does not contain any internal terminating resistors.
Do not connect BACnet to VFD(s); all BACnet communication is transmitted through the CAREL® controller.

Vektor System Control Menu Tree

System Overview
Home Screen
System Setup
System On/Off

→

Login
Insert Password:
9998

→

Main Menu		
System Set	Remote On/Off	
	Fireman Input	
	Safety Input	
	Alarm Output	
	Alarm Failsafe	
	Fan Rotation	
	Rotation Phase	
BMS Settings	Protocol	
	Settings	
Test & Balance	Test & Balance On/Off	
	Fan Test & Balance	
	Input Calibrate	
Factory Setup **Note:** The Factory Setup menu is read only.	Factory Setup	
	VFD Select	
	Info – software	
	Factory Settings - Save/Restore	
	Advanced	Step Control
		Damper/Fan Settings
		Start-up Settings
		Shutdown Settings
		Fieldbus to VFD
Alarm Logs	Data Logger	
Utilities	Date/Time	Date/Time change
		Timezone
	Language	Language
	Unit of Measure	Unit of Measure
	Initialization	Alarm Initialization
		Default Initialization
		Info – software
		Info – board
		Info – memory
		Info – run hours
		Info – blackout
	Parameters	Import/Export
		Alarm Export

Digital Input Programming

Programmable Logic Controller (PLC) Introduction and Tutorial

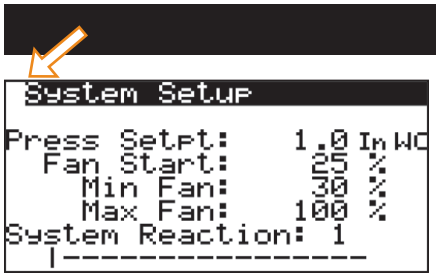
The VSC Programmable Logic Controller (PLC) is located in the main control panel. The PLC has factory set points that can be modified to configure the system for job specific functions. The directions for the setup screens are shown in this section.

The face of the controller has six buttons, allowing the user to view unit conditions and alter parameters. The PLC is pre-programmed with easy-to-use menus.

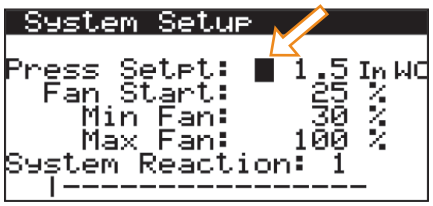
Operator Interface and Keypad Navigation

Keypad Navigation		
↩	Escape	Allows the user to exit the current menu, jumping to the Main Menu.
↑ ↓	Up | Down	The arrow buttons allow the user to scroll through different screens and adjust parameters.
⚠	Alarm	Button will blink red, indicating an alarm condition. Press to review current alarms. To review previous alarms, access the DATA LOGGER through the main menu.
↵	Enter	A. In screens with adjustable parameters, pressing the Enter button moves the cursor from the upper left corner of the screen to the parameter. The arrow buttons can then be used to adjust the parameter. B. To move to the next parameter on the same screen, press the Enter button. C. To save the change, press the Enter button until the cursor moves back to the upper left corner of the screen.
◎	Program	Pressing the Program button allows the user to enter the Main Program Menu.

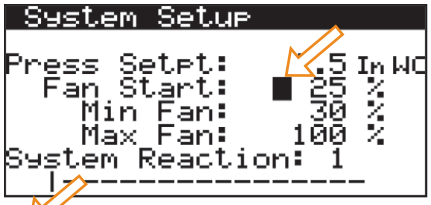
Parameter Adjustment



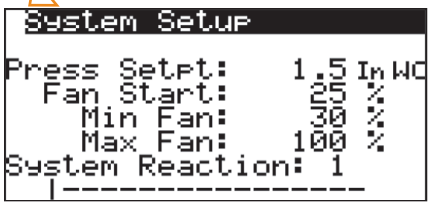
The cursor begins in the upper left corner of the display and will be blinking. Press the *Enter* button to advance the cursor down to make a change to a setting.



Once the cursor has reached the desired setting to be changed, use the arrow keys to adjust the value. Press *Enter* to save the value.



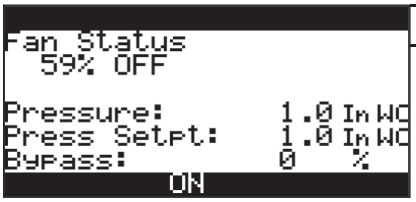
Continue to press *Enter* to advance the cursor through the remaining settings.



Stop pressing *Enter* when the cursor is back in the upper left corner. If *Enter* is not pressed after making a change, the change will not be saved.

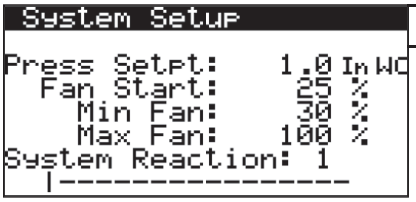
System Overview

The controller will revert to a default main menu loop. This loop includes several screens to view the operating conditions and status of the system and fans. Scroll through the menu screens with the up and down arrows.



Home Screen

The initial menu will display the overall system status and main operating conditions. Fan speed percentage, measured pressure, pressure setpoint, bypass percentage open, and overall unit status are shown.



System Setup

The system setup menu will display and will allow changing of values for common operational values.

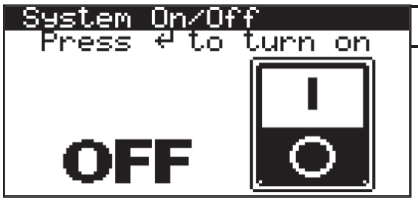
Press Setpt - duct static pressure system is to monitor and maintain.

Fan Start % - provides an initial speed setting for fans when starting up.

Min Fan % - minimum fan speed. If pressure is higher than setpoint as the fans are at the minimum speed, the bypass dampers (if equipped) will begin to open.

Max Fan % - maximum allowable speed that the fan will operate at.

System Reaction - used to tune the system response to changes. 1 is slower response, 9 is a faster response.



System On/Off

To turn the system and fans to ON, press the *Enter* button to change to ON. The system will start up after a 10 second delay. Use the *Enter* button to turn the system off.

Main Menu

The controller is equipped with several menus to help guide users with operating the system and altering parameters. The following menus can be accessed by pressing the ⊙ button. To enter the desired menu, press the enter button.

Login — The Login menu allows access to additional menus for parameter adjustments.

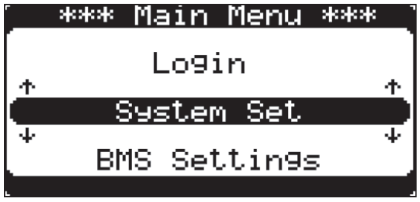
Press the ⊙ button to access the Login menu and press *Enter*.

Note: To see the menu options, one must login.

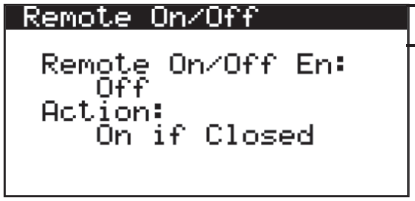
Login

Using the *Up* and *Down* arrows and *Enter* to advance the cursor, enter the service level password of 9998. This will provide read/write access to the additional menus with the exception of the Factory Setup menu, which will be read only. Consult the factory if Factory Setup changes are required.

System Set — The System Set menu allows the user to configure I/O, alarms, and fan rotation.



Press the ⊙ button, login with the password 9998, and scroll to the System Set menu and press *Enter* to access it.



Remote On/Off

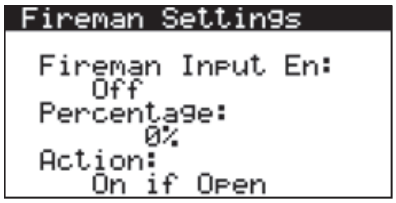
To utilize a hardwired remote on/off switch, enable the functionality by changing Off to On via the Enter and arrow keys. Select the desired switch action.

Note: In order for the digital remote input to turn the system on, the System On/Off must be turned to On, otherwise Off by Keypad will be displayed in the main unit status line of the home screen.

On if Open = remote On when switch is open
On if Closed = remote On when switch is closed

Refer to the **Component Hardwiring** section to make wiring connection needed for the remote On/Off switch. On the terminal strip wire:

- From 24 VAC to connection on On/Off switch.
- From SYSON+ to second connection on On/Off switch
- Jumper from SYSON- to COM



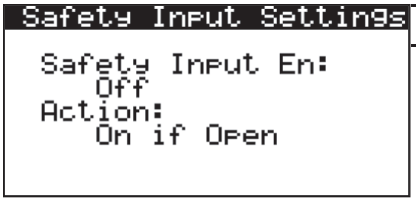
Fireman Settings

To utilize a fireman's override switch, enable the functionality by changing OFF to On via the Enter and arrow keys. Select the desired fan speed percentage and switch action. Factory default is 0%.

On if Open = fireman override speed is active when switch is open
On if Closed = fireman override speed is active when switch is closed

Refer to the **Component Hardwiring** section to make wiring connection needed for the Fireman switch. On terminal strip wire:

- From Fire+ to connection on switch.
- From Fire- to second connection on switch



Safety Input Settings

To utilize a hardwired safety switch, enable the functionality by changing Off to On via the enter and arrow keys. Select the desired switch action.

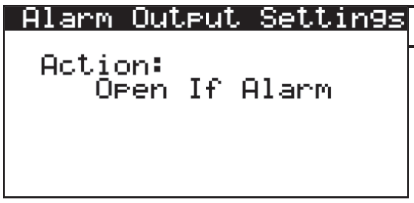
On if Open = safety is on/active (system is off) when switch is open
On if Closed = safety is on/active (system is off) when switch is closed

Refer to the **Component Hardwiring** section to make wiring connection needed for Safety switch. On terminal strip wire:

- From 24VAC to connection on safety switch.
- From SAFE+ to second connection on safety switch
- Jumper from SAFE- to COM

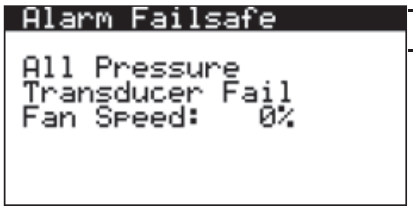
NOTE

It is highly recommended a static pressure safety switch be used to measure fan plenum static pressure and wired to this Safety Input to prevent accidental damage to ducts due to over pressurization.



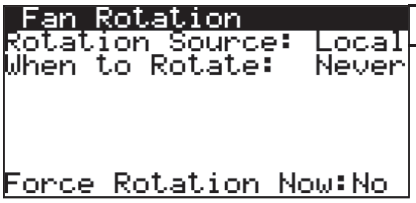
Alarm Output Settings

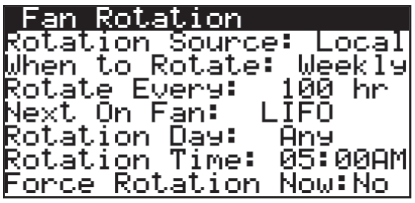
To utilize a dry contact for alarm notification, wire to ALRM- and ALRM+ on the terminal strip. Select the desired contact action when an alarm triggers.

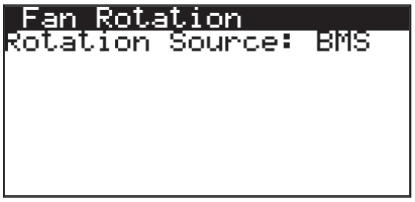


Alarm Failsafe

This screen sets the fan(s) speed in the case of a pressure transducer failure. Upon transducer failure or loss of signal, the fan will be commanded to the Alarm Failsafe percentage. Factory default is 0%.







Fan Rotation

Fan Rotation is the switching of the primary fan when operating a system with a standby fan so that equal run is achieved on both fans. Note: Fan rotation is only available when a standby fan is present.

The fan rotation source can be set to Local or BMS.

When to Rotate can be set to Never, Weekly, or Daily. A rotation can be manually forced by changing Force Rotation to Yes.

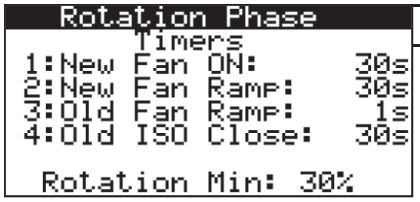
With When to Rotate set to Daily or Weekly, additional settings appear. The duration, rotation type, day, and time of the rotation can be set.

Once the fan that is scheduled to rotate out accumulates the user adjustable rotation hours, the system will wait until the user adjustable time. If set to *Daily*, it will rotate at the time set in the controller. If set to *Weekly*, it will rotate at the time and day set in the controller.

When rotation source is Local, the Next On Fan rotation type can be set to:

- LIFO (last in, first out),
- FIFO (first in, first out), or
- Lowest hrs.

With Rotation Source set to BMS, send a value of 1 to Binary Value 4, FanRotation_ForceRotate, when you want to rotate the fans. With BMS as the source for fan rotation, the BMS controls when to force rotate the fans and is not scheduled in the controller.



Rotation Phase

New Fan On: New fan is at rotation minimum fan speed for this time with isolation damper closed. After this timer expires, the new fan isolation damper is commanded open.

New Fan Ramp: New fan will ramp from rotation minimum fan speed for this duration while old fan maintains static pressure using PID control. At the end of this timer, PID control is transferred to the new fan and the old fan enters the old fan ramp timer.

Old Fan Ramp: Time for old fan to ramp down from current speed to rotation minimum fan speed.

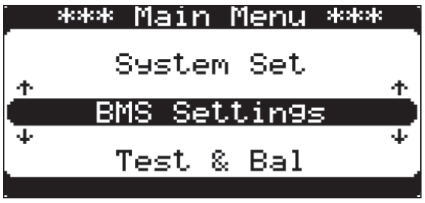
Old ISO Close: This is the time the old fan continues to run after its isolation damper is commanded to close account for the time for the damper to close.

Rotation Min: Minimum fan speed that can occur during a fan rotation. Adjusting the Rotation Min to 20% less than the normal operating percentage will provide optimal performance.

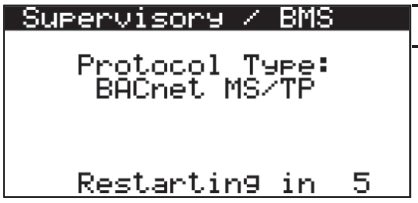
End of Menu

BMS Settings

The BMS Setting menu is where BMS communications are configured.



Press the ⊙ button, login with the password 9998, and scroll to the BMS Settings menu and press *Enter* to access it.

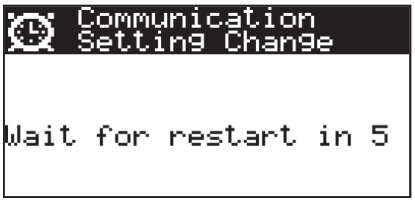


Supervisory/BMS

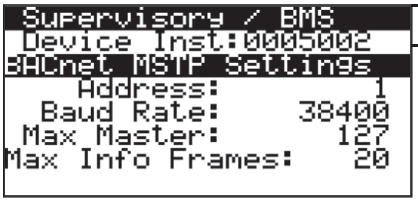
The communication protocol is selected here. Options exist for:

- BACnet™ MS/TP
- None
- BACnet™ IP

After making a change to the protocol, press *Enter* to accept the change.



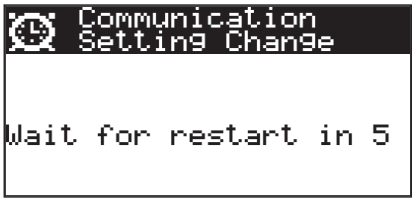
The controller will automatically restart to implement the changes. After restart, the service level password will need to be re-entered to access the menus.



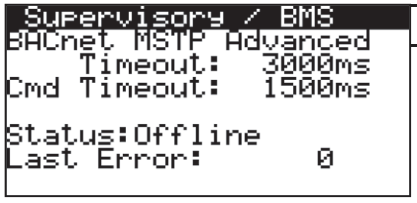
Supervisory/BMS – BACnet™ MSTP Settings

The Device Instance is displayed on this screen and is adjustable. Address, Baud Rate, Max Master, and Max Info Frames information is displayed here and is adjustable.

Note: The settings shown here are the default settings for BMS communications.

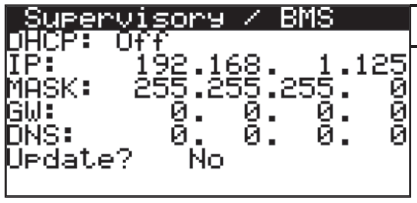


The controller will automatically restart to implement the changes. After restart, the service level password will need to be re-entered to access the menus.



Supervisory/BMS – Advanced BACnet™ MSTP

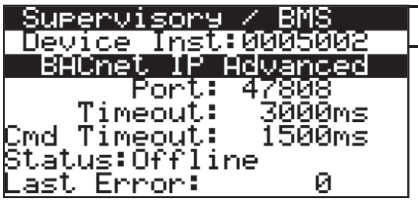
Timeouts are displayed on this screen and are adjustable. Error status is displayed.



Supervisory/BMS – BACnet™ IP Settings

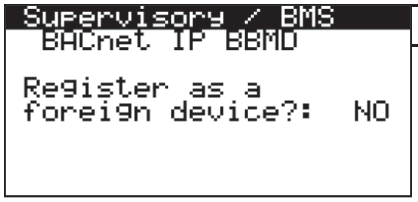
If BACnet™ IP is selected as the protocol, this screen will allow for setting of the address and subnet mask.

After making changes, change Update to Yes.



Supervisory/BMS – BACnet™ IP Settings

If BACnet™ IP is selected as the protocol, timeouts are displayed on this screen and are adjustable. Error status is displayed.

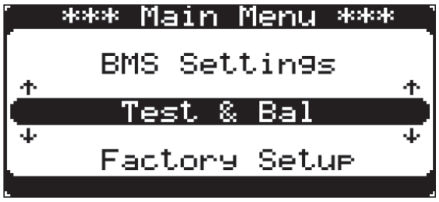


Supervisory/BMS – BACnet™ IP Settings

If BACnet™ IP is selected as the protocol, BACnet™ Broadcast Management Device is setup on this screen.

End of Menu

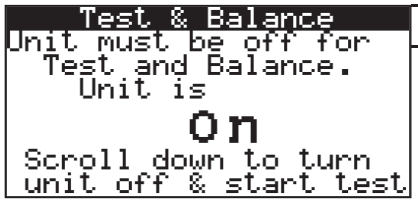
Test & Bal — The Test & Bal menu allows for overrides for testing and transducer calibration.



Press the ⊙ button, login with the password 9998, and scroll to the Test & Balance menu and press *Enter* to access it.

NOTE

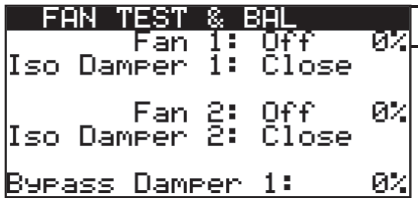
Running the VFD(s) in hand mode will not open the fan's isolation damper. Use the Test&Bal feature in the Carel to operate the fans.



Test & Balance

To enter Test & Balance mode, the unit must be off. This screen will be displayed if the controller is currently ON.

To start Test and Balance mode, press *Enter* to change TEST OFF to TEST ON.

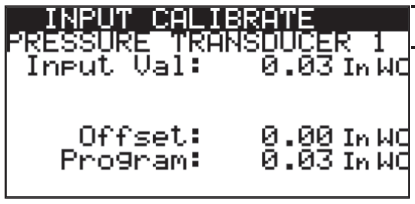


Fan Test & Balance

CAUTION

Fan and system will operate as set in this screen regardless of duct pressure. Damage may occur if fan/system is commanded to incorrect speed or incorrect operation.

Fan operation, fan speed and damper positions can be manually overridden. Press *Enter* to advance the cursor and use the *Up* and *Down* arrows to make changes. Press *Enter* to accept the changes. Changes to command operation will occur immediately after pressing *Enter*.

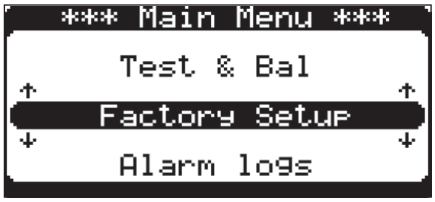


Input Calibrate

This screen allows for a positive or negative offset to be applied to the input value for the duct static pressure sensor to ensure accurate readings at the controller. Adding a negative offset would offset a high input value and a positive offset would offset a low input value.

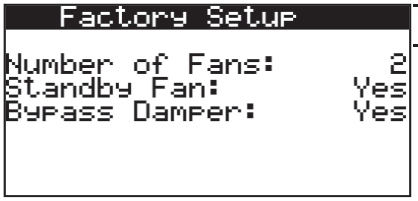
End of Menu

Factory Setup — The Factory Setup settings can only be viewed with the service password.



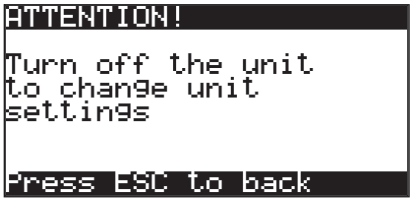
Press the ⊙ button, login with the password 9998, and scroll to the Factory Setup menu and press *Enter* to access it.

Note: The Factory Setup menu can only be viewed with the service level password. Consult the factory for changes to the Factory Setup.

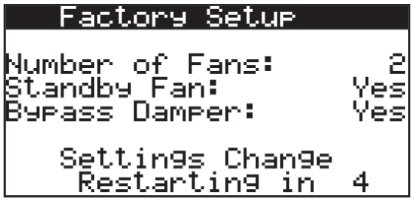


Factory Setup – Fans

This screen is used to set the number of fans in the system and to configure the system for use of a standby fan and/or bypass dampers.



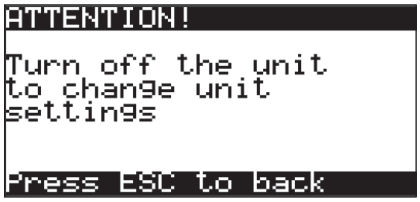
Note: Unit must be off to make changes.



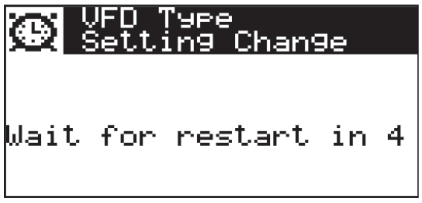
Note: System will automatically reboot after a change is made.

VFD Select

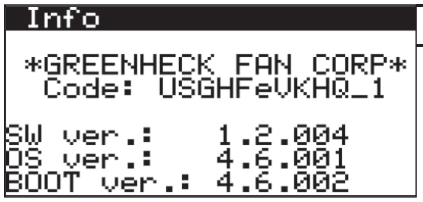
This screen is used to set the VFD model that is being used for the fans.



Note: Unit must be off to make changes.

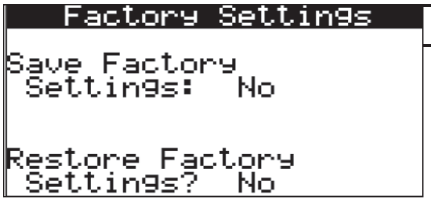


Note: System will automatically reboot after a change is made.



Info

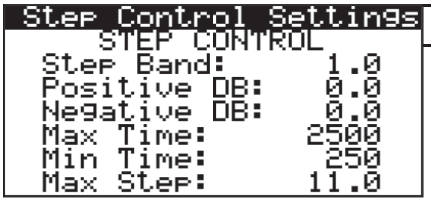
This screen displays software information. The SW ver. is the software version installed in the controller.



This screen is used to save and restore factory settings

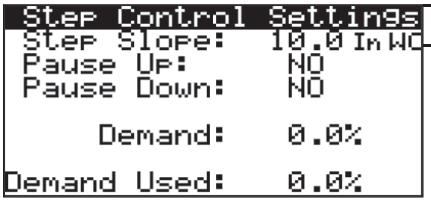
Advanced Settings

The menus under the Advanced Settings set the parameters for the control of the system and should only be changed under the direction of the factory. Improper settings may result in unstable and erratic fan behavior.



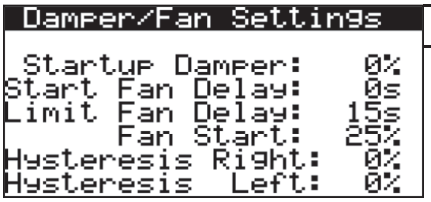
Step Control Settings

For factory use only.



Step Control Settings

For factory use only.



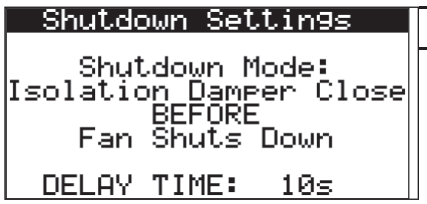
Damper/Fan Settings

This screen sets the initial bypass damper position during startup, fan delays, fan start speed and hysteresis.

Note: This screen is only displayed when the system has a bypass damper.

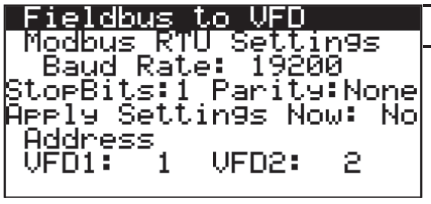
Start-Up Settings

This screen configures the isolation damper operation during start-up. The isolation damper can start After or When the fan starts with an adjustable delay.



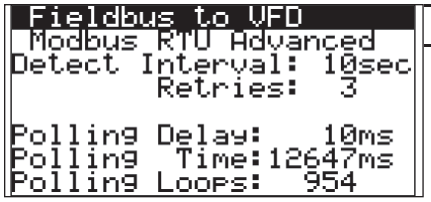
Shutdown Settings

This screen configures the isolation damper operation during shutdown. The isolation damper can start Before or When the fan starts with an adjustable delay.



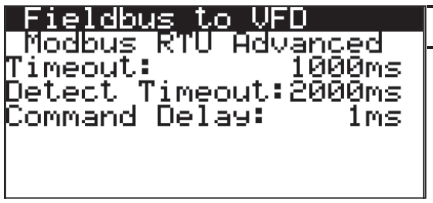
Fieldbus to VFD

This screen configures the Modbus® communication to the VFDs.



Fieldbus to VFD

This screen configures the Modbus® communication to the VFDs.



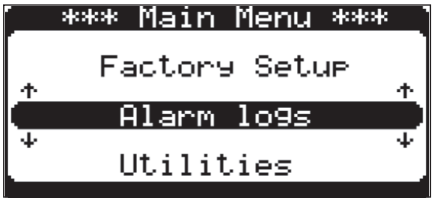
Fieldbus to VFD

This screen configures the Modbus® communication to the VFDs.

End of Menu

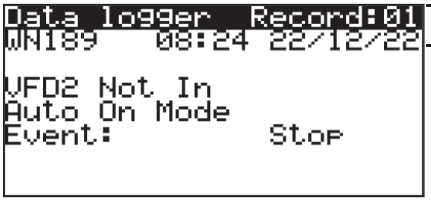
Alarm Logs

The Alarm Logs menu displays historical alarm information.



Press the ⊙ button, login with the password 9998, and scroll to the Alarm logs menu and press *Enter* to access it.

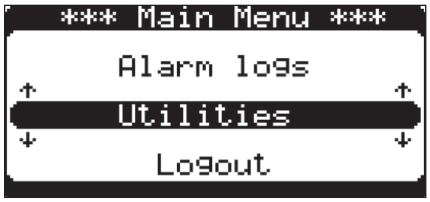
Note: After entering the menu, pushing the *Down* arrow will scroll through the most recent alarms.



Data Logger Recording

This screen will display the alarm number, date and time of the alarm, a verbal description of the alarm, and the resulting event impact to the system.

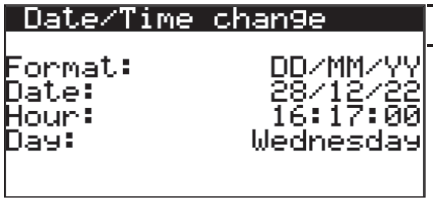
Utilities	The Utilities menu allows the user to configure various controller attributes.



Press the ⊙ button, login with the password 9998, and scroll to the Utilities menu and press *Enter* to access it.

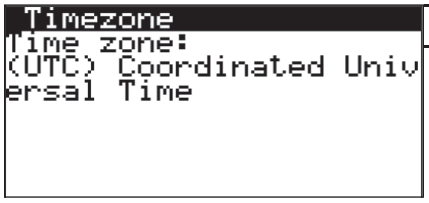
Note: The Utilities menu has sub-menus under it, each with their own setup screens. After entering the menu, pushing the *Down* arrow will scroll through the available sub-menus.

Date/Time sub-menu



Date/Time Change

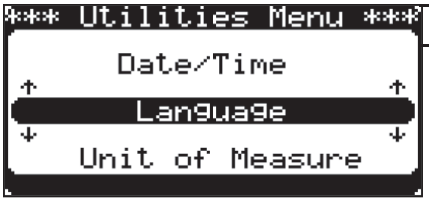
This screen is used to set the format, date, time and day for the controller.



Timezone

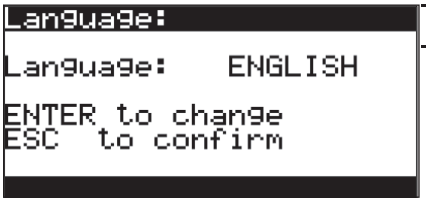
This screen is used to set the local time zone.

End of Menu



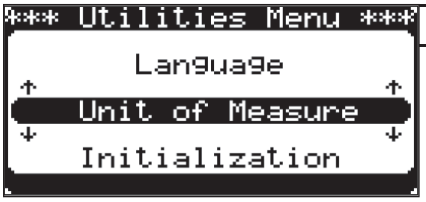
Language – sub-menu

The language displayed on the controller can be changed in this sub-menu.



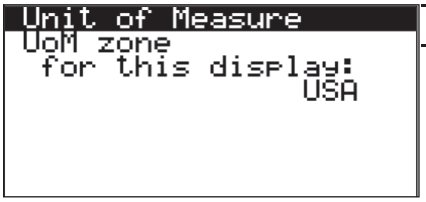
Language

Use this screen to change the language displayed.



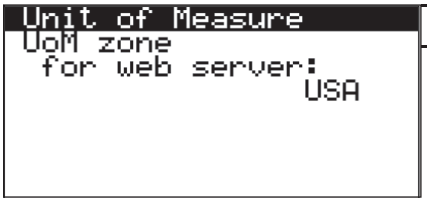
Unit of Measure

This sub-menu set the unit of measure.



Unit of Measure

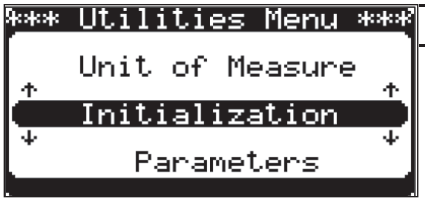
Unit of measure zone for the display.



Unit of Measure

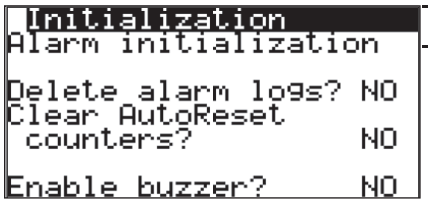
Unit of measure zone for the web server.

End of Menu



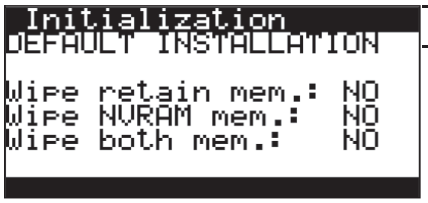
Initialization – sub-menu

This sub-menu is used for hardware/software information and memory resets.



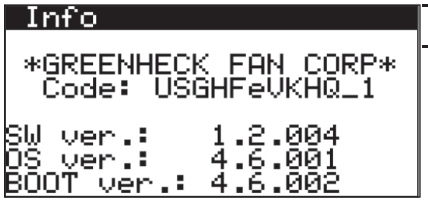
Initialization – Alarms

This screen allows for deletion of alarm logs, clearing auto-reset counters, and enabling a buzzer on the controller when in alarm.



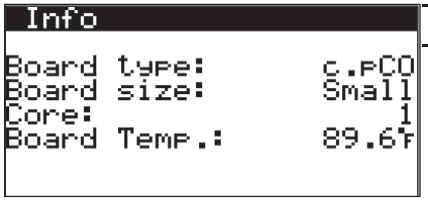
Initialization – Default Installation

This screen is used for clearing various memory within the controller.



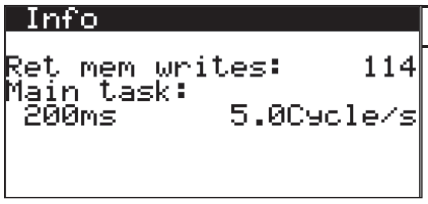
Info

This screen displays the controller code number and software versions.



Info – Board

This screen displays the controller hardware and controller temperature.

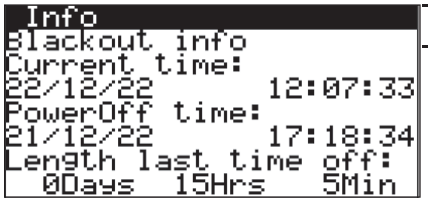


Info

This screen displays the memory writes and timing.

Work Hours

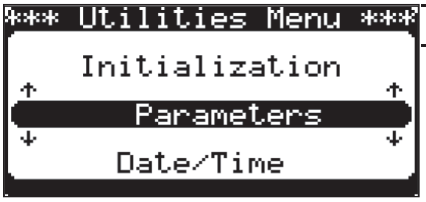
This screen displays the fan run time.



Info

This screen records the last loss of power event.

End of Menu



Parameters – sub-menu

This sub-menu is used for importing or exporting information from the controller.

Unit Configuration – Import/Export

This screen is used to import/export unit configuration parameters.

Unit Configuration – Alarm Export

This screen is used to export the alarm log to a USB.

Unit Configuration – Log Export

This screen is used to export the data log to a USB.

End of Menu

System Startup and Testing

The System Startup and Testing section of this manual will provide a step-by-step procedure to set up the VFD(s) Modbus address, incoming power and fan wheel rotation direction. This system can be ordered with an ABB VFD or a Danfoss VFD. Use the instructions for your specific model VFD. Also included in this section is the setup of the bypass damper(s) and isolation damper(s). There is a check list at the end of this section that can be filled out to document the settings and proper function of the VSC components.

Wire and Configure Optional Connection Wiring:

Prior to applying power to the Vektor System Control (VSC) components review the **Optional Hardwire Connections Digital Input** section of this manual. The optional hardwire connections are not required to operate the VSC; BMS is not required to run the VSC.

NOTE

It is highly recommended that a static pressure safety switch be installed in the plenum of the fan system, and wired to the Remote Safety Enable/Disable (on/off) Switch terminals on the terminal strip. This safety switch should open the electrical connection in the event that the static pressure is too high in the fan plenum; this will turn the fan system off prior to damaging the duct work. If the switch is installed, see the **Digital Input Programming** section of this manual for details on enabling this feature.

1. Optional Connection Wiring include:
   - Remote Enable/Disable (on/off) Switch
   - Remote Safety Enable/Disable (on/off) Switch
   - Fireman Override
   - Alarm Output
   - BACnet™
2. See **Digital Input Programming** section of this manual for details on enabling these features.

System Startup Prechecks:

Prior to applying power to the Vektor System Control (VSC) components perform the following checks to avoid damage to the components:

Confirm the following:

1. Incoming voltage and motor nameplate data match the VFD(s) label.
2. Fan Mark on the VFD(s) and the Control Box match the Fan Mark on the fan.
3. 5 and 8 pin cables have been connected.
4. 5 and 8 pin cables are routed at least 12 inches from power cables.
5. Pressure transducer has been wired and plumbed.
6. System can be turned on safely without damage to the duct work. If the duct system is closed off completely and the fan system is turned on, the duct work may be damaged.

VFD Setup

Danfoss VFD Model:

1. Apply power to the VFD(s).
2. Turn on disconnect located on VFD(s) and/or local fan disconnect(s).
3. Complete the following steps for optimal system performance and to avoid startup issues:

NOTE
The fan farthest from the Damper Junction Box with the quick connect on the fan plenum is Fan 1; trace the wire connection from the fan motor to the VFD to confirm which VFD is Fan1.
Skip Modbus Address Setting for one fan systems.

Danfoss FC102 Modbus Address Setting:

1. Press *Quick Menu* key
2. Use *Up* and *Down* arrows to display My Personal Menu
3. Press *OK* key
4. Use *Up* and *Down* arrows to display 8-31 Address
5. Press *OK* key
6. Use *Up* and *Down* arrows to set the address to 1 for Fan 1
7. Press *OK* key
8. The address is now set, press *Status* key
9. Repeat for Fan 2 with the exception that the Modbus address will be 2 for Fan 2

Danfoss FC102 Motor and Incoming Power Settings:

1. Press *Quick Menu* key
2. Use *Up* and *Down* arrows to display My Personal Menu
3. Press *OK* key
4. Use *Up* and *Down* arrows to display the following parameters. Edit any parameters that are not correct:
   a. 1-21 Motor Power [HP]
   b. 1-22 Motor Voltage
   c. 1-23 Motor Frequency
   d. 1-25 Motor Nominal Speed
5. The VFD is now configured for the motor and incoming power, press *Status* key
6. Repeat for Fan 2

Danfoss FC102 Automatic Motor Adaptation:

NOTE
Running the Automatic Motor Adaptation will tune the VFD for the specific motor connected to the VFD. This can make the system more efficient, and in some cases, solve motor run issues.

1. Press *Quick Menu* key
2. Use *Up* and *Down* arrows to display My Personal Menu
3. Press *OK* key
4. Use *Up* and *Down* arrows to display 1-29 Automatic Motor Adaptation (AMA)
5. Press *OK* key
6. Use *Up* and *Down* arrows to select [1] Enable complete (AMA)
7. Press *OK* key
8. Follow the on-screen instructions. The test runs automatically and will indicate when it is complete.
9. The VFD will take several minutes to perform the AMA. The motor will not turn during AMA.
10. Some motors may be unable to run the complete AMA version of the test. If the complete AMA fails, select [2] Enable reduced AMA and run the reduced AMA.
11. The VFD is now optimized for the motor, press *Status* key.
12. Repeat for Fan 2.

ABB VFD Model:

1. Apply power to the VFD(s).
2. Turn on disconnect located on VFD(s) and/or local fan disconnect(s).
3. Complete the following steps for optimal system performance and to avoid start up issues:

NOTE
The fan farthest from the Damper Junction Box with the quick connect on the fan plenum is Fan 1; trace the wire connection from the fan motor to the VFD to confirm which VFD is Fan 1.
Skip Modbus Address Setting for one fan systems.

ABB ACH580 Modbus Address Setting:

1. Press Menu key.
2. Use *Up* and *Down* arrows to highlight Parameters.
3. Press *Select* key.
4. Press *Select* key to select the complete list.
5. Use *Up* and *Down* arrows to highlight 58 Embedded fieldbus.
6. Press *Select* key.
7. Use *Up* and *Down* arrows to highlight 58.03 Node address.
8. Press *Edit* key.
9. Use *Up* and *Down* arrows to set the address to 1 for Fan 1.
10. Press *Save* key.
11. Repeat for Fan 2 with the exception that the Modbus address will be 2 for Fan 2.

ABB ACH580 Motor and Incoming Power Settings:

1. Press Menu key.
2. Use *Up* and *Down* arrows to highlight Parameters.
3. Press *Select* key.
4. Press *Select* key to select the complete list.
5. Use *Up* and *Down* arrows to highlight 99 Motor data.
6. Press *Select* key.
7. Use *Up* and *Down* arrows to highlight 58.03 Node address.
8. Use *Up* and *Down* arrows to display the following parameters; edit any parameters that are not correct:
   a. 99.06 Motor nominal current
   b. 99.07 Motor nominal voltage
   c. 99.08 Motor nominal frequency
   d. 99.09 Motor nominal speed
   e. 99.10 Motor nominal power
9. The VFD is now configured for the motor and incoming power. Press *Back* and *Exit* to return to the Main Menu.
10. Repeat for Fan 2.

System Component Set:

When the system arrives, there will be factory default parameters that will need to be edited to configure the system to properly function. Perform the following steps to ensure proper function of the entire system.

1. With the fan off, remove fan wheel inspection cover. The fan rotation will be checked during this procedure.
2. Apply power to the VFD(s).
3. Turn on disconnect located on VFD(s) and/or local fan disconnect(s).
4. Press *Auto* button on VFD(s).
5. Apply power to the Control Box. Do not start the fans.
6. Complete the following steps for optimal system performance and to avoid start up issues:

Confirm Fan Wheel Rotation Direction and Isolation Damper Function:

1. Start at the Home Screen. Press the ⓞ on the CAREL® keypad.
2. Press *Enter* key to Log in.
3. Use *Up* and *Down* arrows to change number. Use *Enter* key to cycle to the next number; enter in password: 9998.
4. Press *Enter* key.
5. Use *Up* and *Down* arrows to highlight “Test & Bal”.
6. Press *Enter* key.
7. Press *Enter* key to change TEST OFF to TEST ON.
8. Press *Down* arrow.
9. Confirm the system can be turned on safely without damage to duct work. If the duct system is closed off completely and the fan system is turned on, the duct work may be damaged.
10. Press *Enter* key multiple times to highlight Fan 1: “%”. Use *Up* and *Down* arrows to set it to 30%.

NOTE

The fan speed must be above the Min Fan speed %. Factory default Min Fan speed is 30%.

11. Press *Enter* key multiple times to cycle back to Fan 1: OFF.
12. Use *Up* arrow to toggle it to ON. Fan 1 will begin to spin.
13. Confirm fan wheel rotation matches the rotation noted on the fan.
    a. If fan wheel rotates in the correct direction, use *Down* arrow to turn fan OFF and proceed to the next step.
    b. If fan is rotating backwards, use *Down* arrow to turn the fan OFF. Follow proper electrical lock out tagout procedures to ensure electrical power is off and flip flop two of the motor wires in the VFD. Repeat the above steps to ensure the fan is rotating the correct direction.
14. Press *Enter* key multiple times to cycle to Iso Damper1: “Close”.
15. Use Up arrow to toggle it to “Open”. Fan 1 isolation damper will begin to open.
16. Confirm that the isolation damper opened for the Fan 1 (the fan just tested for wheel rotation).
    a. If the correct isolation damper opened, use *Down* arrow to close the isolation damper and continue to next step.
    b. If the isolation damper opened for the opposite fan, use the Down arrow to close the isolation damper and then flip flop the Modbus addresses in the VFDs to assign the proper VFD to the isolation damper (see **VFD Setup – Address Setting** sections of this manual for details on Modbus addressing). Then restart at step 1 of **Confirm Fan Wheel Rotation Direction and Isolation Damper Function**.
17. Press *Enter* key to cycle to Bypass Damper 1: “%”.
18. Confirm the Bypass Damper 1: is set to 0%.
19. Visually inspect the bypass damper(s) to confirm it (they) are closed.
    a. If the bypass damper(s) are closed, continue to next step.
    b. If the bypass damper(s) are open, measure the DC voltage at the terminal strip between 1BYPAS and COM.
        i. If DC voltage is less than 0.3 VDC, then rotate the reversal switch located on the bypass actuator and continue to the next step.
        ii. If DC voltage is above 0.3 VDC, then contact factory.
20. Use *Up* and *Down* arrows to set Bypass Damper 1: to 100%.

21.Visually inspect the bypass damper(s) to confirm it (they) are open.

NOTE
Bypass damper can take up to 2-1/2 minutes to open from 0 - 100%.

a. If the bypass damper(s) open to 100%, use the *Down* arrow to set Damper 1: to 0%. Press *Enter* key and continue to next step.

b. If the bypass damper(s) are closed, measure the DC voltage at the terminal strip between 1BYPAS and COM.

   i. If DC voltage is above 9 VDC, then trace the wires connecting the 1BYPASS and COM to the actuator.

   ii. If DC voltage is less than 9 VDC, then contact factory.

22.Use *Up* arrow to cycle to Test & Balance screen.

23.Press *Enter* key to change TEST ON to TEST OFF.

24.Press *Escape* key multiple times to return to the Home Screen.

The above steps will ensure the system is set up correctly. It is ready for Test and Balance.

System Setup:

System Setup can be used to fine tune the system operation to enable the fan to start at a set speed. This will allow the system to stabilize faster at start up. The fans minimum and maximum speed can also be adjusted in the System Setup menu to aid in system stabilization and minimize fan speed hunting. System Reaction setting will increase/decrease the rate at which the system reacts to changes in demand. Setting this to 1 is a slower response, 9 is a faster response. Use this to fine tune the reaction time of the system to eliminate fan hunting. Prior to adjusting these parameters, the systems minimum and maximum fan speed will need to be determined along with the most common steady state fan speed.

Recommended starting points for settings:

- Fan start % = Ten percent less than the most common stead state fan speed
- Min Fan % = Ten percent less than the minimum fan speed required to meet system demand
- Max Fan % = Ten percent more than the maximum fan speed required to meet system demand
- System Reaction = 1

1. Start at the Home Screen. Use *Up* and *Down* arrows on the CAREL® keypad, located in Control Box, to navigate to System Setup.
2. Press *Enter* key to highlight Press Setpt.
3. Use *Up* and *Down* arrows to select the desired set point.
4. Press *Enter* key to save and advance to “Fan Start %”.
5. Use *Up* and *Down* arrows to select the desired set point.
6. Press *Enter* key to save and advance to “Min Fan %”.
7. Use Up and Down arrows to select the desired set point.
8. Press *Enter* key to save and advance to “Max Fan %”.
9. Use *Up* and *Down* arrows to select the desired set point.
10. Press *Enter* key to save and advance to “System Reaction”.
11. Use *Up* and *Down* arrows to select the desired set point. 1 is slowest, 9 is fastest.
12. Press *Enter* key to save and return the cursor to top of screen.
13. Press *Escape* key to return to the Home Screen.

Building Management System (BMS) Communication Protocol Setup:

BACnet IP and BACnet MS/TP are supported by the Vektor System Control.

NOTE

Fans must be off to adjust BMS communication protocols. As soon as a BMS variable is edited, the controller will begin to count down from 5 seconds. Selecting and editing another BMS parameter will restart the timer. Once the last parameter has been adjusted and 5 seconds has elapsed, the controller will automatically restart.

1. Start at the Home Screen. Press the ⓞ on the CAREL® keypad.
2. Press *Enter* key to Log in.
3. Use *Up* and *Down* arrows to change the number. Use *Enter* key to cycle to the next number; enter in the password: 9998.
4. Press *Enter* key.
5. Use *Up* and *Down* arrows to highlight “BMS Settings”.
6. Press *Enter* key.
7. Press *Enter* key to edit the “Protocol Type”.
8. Use *Up* and *Down* arrows to set desired protocol type.
9. Press Enter key. The controller will start a 5 second countdown to automatically restart.
10. Use Up and *Down* arrows and *Enter* key to access and edit the parameters required to configure the BMS

BACnet™ Objects

The following objects are available through BACnet™.

Type	Instance	Name	Access	Parameter Notes [Units]
Binary Value	1	OnOffUnitMng.BmsOnOff_Enabled (Binary_Value:1)	Read/Write	Disable/Enable – If enabled, the BMS On/Off variable (BV2) must be ON for the unit to start.
	2	OnOffUnitMng.BmsOnOff (Binary_ Value:2)	Read/Write	Unit On/Off by BMS
Analog Value	102	Setpoint_SP1 (Analog_Value:102)	Read/Write	Static Pressure Setpoint 1 [in w.c.]
Binary Value	4	FanRotation_ForceRotate (Binary_ Value:4)	Read/Write	Force fan rotation - used by BMS for rotating primary fan
AnalogValue	5	System_Reaction_Adjust_REAL (Analog_Value:5)	Read/Write	System reaction - changes fan and damper response time
	13	FanSpeed_Fireman (Analog_Value:13)	Read/Write	User Defined Speed of Fan When Fireman's Override is Enabled [0-100%]
	14	FanSpeed_Pressure_AllAlarm (Analog_Value:14)	Read/Write	User Defined Speed of Fan When All Pressure Transducers are in Alarm [0-100%]
Binary Value	101	Pressure_Source_IO_BMS[1] (Binary_Value:101)	Read/Write	Set true if transducer value is from BMS
Analog Value	101	Pressure1_BMS (Analog_Value:101)	Read/Write	Pressure 1 measurement from BMS [0-15 IN H2O] – BV101 must be set to 1 for this pressure to be used for pressure 1 rather than the analog input. [in w.c.]
AnalogInput	1	Pressure1_AIN.Val (Analog_Input:1)	Read Only	Static Pressure 1 [IN H2O]
	7	BypassDamperCmd1_AOUT.Val (Analog_Input:7)	Read Only	Bypass Damper 1 Position [0-100%]
	9	FanModCmd1_AOUT.Val (Analog_Input:9)	Read Only	Fan 1 Speed [0-100%]
	10	FanModCmd2_AOUT.Val (Analog_Input:10)	Read Only	Fan 2 Speed [0-100%]
	101	Fan_Msk[1].Power_KW (Analog_Input:101)	Read Only	Fan 1 Power [KW]
	102	Fan_Msk[1].Power_Hp (Analog_Input:102)	Read Only	Fan 1 Power [Hp]
	103	Fan_Msk[1].MotorVolt (Analog_Input:103)	Read Only	Fan 1 Motor Voltage [V]
	104	Fan_Msk[1].MotorCurrent (Analog_Input:104)	Read Only	Fan 1 Motor Current [A]
	105	Fan_Msk[1].Freq (Analog_Input:105)	Read Only	Fan 1 Frequency [HZ]
	107	Fan_Msk[1].Speed_RPM (Analog_Input:107)	Read Only	Fan 1 Motor Speed [RPM]
	108	Fan_Msk[1].Torque_Nm (Analog_Input:108)	Read Only	Fan 1 Torque [Nm]
	110	Fan_Msk[1].DCLink_Volt (Analog_Input:110)	Read Only	VFD 1 DC Link Voltage [V]
	114	Fan_Msk[1].ControllerCardTemp (Analog_Input:114)	Read Only	VFD 1 Controller Card Temp [C]
	115	Fan_Msk[1].Power_kWh_Counter (Analog_Input:115)	Read Only	VFD 1 Power kWh Counter
	116	Fan_Msk[1].Speed_Pct (Analog_Input:116)	Read Only	VFD 1 Speed Percentage
	201	Fan_Msk[2].Power_KW (Analog_Input:201)	Read Only	Fan 2 Power [KW]

AnalogInput	202	Fan_Msk[2].Power_Hp (Analog_Input:202)	Read Only	Fan 2 Power [Hp]
	203	Fan_Msk[2].MotorVolt (Analog_Input:203)	Read Only	Fan 2 Motor Voltage [V]
	204	Fan_Msk[2].MotorCurrent (Analog_Input:204)	Read Only	VFD 1 DC Link Voltage [V]
	205	Fan_Msk[2].Freq (Analog_Input:205)	Read Only	VFD 1 Heatsink Temp [C]
	207	Fan_Msk[2].Speed_RPM (Analog_Input:207)	Read Only	VFD 1 Inv Nom Max [A]
	208	Fan_Msk[2].Torque_Nm (Analog_Input:208)	Read Only	VFD 1 Inv Max Current [A]
	210	Fan_Msk[2].DCLink_Volt (Analog_Input:210)	Read Only	VFD 1 Controller Card Temp [C]
	214	Fan_Msk[2].ControllerCardTemp (Analog_Input:214)	Read Only	Fan 2 Power [KW]
	215	Fan_Msk[2].Power_kWh_Counter (Analog_Input:215)	Read Only	Fan 2 Power [Hp]
	216	Fan_Msk[2].Speed_Pct (Analog_Input:216)	Read Only	VFD 2 Speed Percentage
BinaryInput	502	AI_Prb_Pressure1.Active (Binary_Input:502)	Read Only	1 = pressure transducer alarm, operating at failsafe speed, 0 = pressure transducer is ok
	508	AI_Safety_DIN.Active (Binary_Input:508)	Read Only	1 = safety switch is active (system is off), 0 = ok.
	510	AI_VFD1_Offline.Active (Binary_Input:510)	Read Only	1 = VFD1 is offline, 0 = VFD1 is online
	511	AI_VFD2_Offline.Active (Binary_Input:511)	Read Only	1 = VFD2 is offline, 0 = VFD2 is online
AnalogValue	0	FanRotation_Method_REAL (Analog_Value:0)	Read Only	1=FIFO, 2=LIFO, 3=Lowest hrs
	1	Num_Fans_REAL (Analog_Value:1)	Read Only	Number of fans in system
	2	Num_StandbyFan_REAL (Analog_Value:2)	Read Only	1 = standby fan present, 0 = no standby fan
	3	Num_BypassDamper_REAL (Analog_Value:3)	Read Only	1 = bypass damper present, 0 = no bypass damper
	100	SwVer_REAL	Read Only	Software version
	103	RunHours_Act_REAL[1] (Analog_Value:103)	Read Only	Fan1 run hours
	203	RunHours_Act_REAL[2] (Analog_Value:203)	Read Only	Fan2 run hours

MultiStateInput	1	UnitStatus (Multi_State_Input:1)	Read Only	1 = On
				2 = Off by Alarm
				3 = Off by BMS
				4 = Off by Schedule
				5 = Off by Keypad
				6 = Fan Rotation
				7 = Off by Dig Input
				8 = Off by Safety Input
				9 = Fireman Override
				10 = In Failsafe Mode
				11 = On by Test Balance
				12 = Off by VFD Alarm
MultiStateInput	101	FanStateProg[1] (Multi_State_Input:101)	Read Only	1 = Off
				2 = Start
				3 = Rotating In – At minimum speed
				4 = Rotating In – Ramp up
				5 = Running
	201	FanStateProg[2] (Multi_State_Input:201)	Read Only	6 = Rotating Out – Ramp down
				7 = Rotating Out – At minimum speed
				8 = Shutdown
				9 = Alarm
				10 = Offline

Troubleshooting

WARNING
Before taking any corrective action, make certain unit is not capable of operation during repairs.

AVERTISSEMENT
Avant d'entreprendre toute action corrective, s'assurer que l'appareil ne pourra pas fonctionner durant les réparations.

Symptom	Cause	Corrective Action
Display on CAREL controller is not on	No power	Check that control box is wired and upstream disconnect or breaker is on.
		Verify that control box transformer breaker is not tripped; this is located on the transformer under the transformer cover. Prior to resetting, verify the transformer is wired correctly
		Verify that orange J1 plug is seated firmly into CAREL controller.
		Verify that orange J1 plug has 24V AC voltage present.
	Display ribbon cable loose	If the CAREL has power at the J1 plug and the digital display on the bottom of the CAREL is illuminated, the ribbon cables behind the display may be loose. Use a small, flat screwdriver to pry the display from the PLC body. Inspect that both ribbon cables behind the display are correctly seated.
VFD Offline	No Power to VFD	Check that VFD is wired and upstream disconnect or breaker is on.
		Verify VFD disconnect is on.
	5 pin cable not connected	If the VFD is OFF or in Hand mode, it will not communicate with the control box. Verify the VFD is in Auto mode.
	VFD is not in Auto mode	If the VFD is Off or in Hand mode, it will not communicate with the control box. Verify the VFD is in Auto mode.
	Incorrect VFD addressing	Verify that the correct VFD Modbus® address is entered into each VFD. Addresses should be 1 for the VFD connected to fan 1 and 2 for the VFD connected to fan 2. Fan 1 is the fan closest to the 8 pin quick connect box on the plenum. If the addresses are the same neither VFD will communicate with the control box.
	5 pin cable is too close to high power cables	Confirm that the 5 pin cable from the VFD to the control box is at least 12 inches from any incoming power or motor power. High voltage will interfere with Modbus® communication and cause intermittent VFD Offline alarms.
Pressure reading remains at 0.0 on the CAREL display with fan running	Fan Pressure transducer is not wired	Wire transducer.
	Pressure transducer is wired incorrectly.	Correct wiring terminations. If pressure transducer is wired correctly 24VAC voltage should be present between terminals VAC and COM. The pressure transducer will output a 0-10VDC signal to the control box with a linear relationship to the pressure range of the pressure transducer setting.
	Pressure transducer tubing is not connected to duct	Connect transducer tubing to static pressure tap.
Pressure	Pressure transducer tubing is not connected to the correct pressure port on the bottom of the pressure transducer	Connect transducer tubing to correct port.
Pressure reading showing with fans off or incorrect pressure being displayed	Controller out of calibration	Calibrate transducers with offset in Test & Balance menu to calibrate the input.

Symptom	Cause	Corrective Action
Isolation damper does not open	8 pin cable not connected	Connect 8 pin cable from plenum to control box.
Bypass damper does not open	8 pin cable not connected	Connect 8 pin cable from plenum to control box.
Fan is hunting	System response too fast or slow Need to follow System Fine Tuning process outlined in this IOM	On system setup screen of controller, adjust the System Reaction. Increase value for faster response or decrease the value to reduce the system response. See **System Fine Tuning** section of this IOM.
BMS will not communicate with controller	Incorrect addressing	Check MSTP addressing or IP settings.
	Missing wiring	Verify MSTP wiring to J25 plug or IP Ethernet cable to either Ethernet ports on the controller.
Isolation damper is not opening Fans not creating correct pressure or low airflow	Isolation damper is not opening	Confirm the isolation damper for the fan that is operating is open. If the isolation damper is not open, confirm the correct VFD is wired and addressed to that fan; if a nonoperating fan has the isolation damper open, then the VFD Modbus® address might need to be adjusted in the VFDs to synchronize the fan with the correct isolation damper position. Fan 1 is the fan closest to the 8 pin quick connect box on the plenum. The VFD with the Modbus® address of 1 controls fan 1 and the VFD with Modbus® address 2 controls fan 2.
	Isolation damper is not opening	After confirming that the VFD wiring and Modbus® address corresponds to the correct isolation damper measure the AC voltage between terminals ISOL1 and COM for fan 1 or ISOL2 and COM for fan 2 on the terminal strip located in the control box. If no voltage is present, contact factory. If 24VAC is present, there may be an issue with the 8 pin cable connecting the control box to the plenum or wiring in the quick connect box. Please see the quick connect box wiring diagram located in the Component Hardwiring section in this IOM. Confirm the wire connections in the quick connect box are correct. Measure voltage between terminals ISOL1 and COM for fan 1 or ISOL2 and COM for fan 2. If 24 VAC is present, check voltage at actuator. If no voltage, then replace the 8 pin cable with a known good cable.
	Bypass damper is open	Confirm bypass damper is closed. Confirm 8 pin cable between control box and plenum is connected. If bypass damper is open and the 8 pin cable is connected, look at the display to see if the bypass position is 0%. If the CAREL displays 0%, then measure the DC voltage between 1BYPAS and COM or 2BYPAS and COM on the terminal strip located in the control box. 1.8 - 2.3VDC will be present if the CAREL displays 0% Bypass. If it is outside that range, contact factory.
	Fan is rotating backwards	Verify the fan rotation and correct if necessary.
	Excessive duct leakage.	Seal duct work.
	Max fan speed percentage is too low.	Increase max fan speed percentage.

Control Settings Reference

Unit Model Number _____

Unit Serial Number_____

Sales Order Number _____

System Setup Settings

Pressure Setpoint_____ in w.c.

Fan Start %_____ %

Min Fan %_____ %

Max Fan % _____ %

System Reaction _____

System Set

Remote On/Off Enabled: ☐ Off ☐ On

Action: ☐ On ☐ Off if Closed

Fireman Input Enabled: ☐ Off ☐ On

Action: ☐ On ☐ Off if Closed

Fireman Input %_____ %

Safety Input Enabled: ☐ Off ☐ On

Action: ☐ On ☐ Off if Closed

Alarm Output:

Action: ☐ On ☐ Off if Alarm

Alarm FailSafe % _____ %

Fan Rotation

Rotation Source _____

When to Rotate_____

Rotate Every _____

Next On Fan _____

Rotation Day _____

Rotation Time _____

Rotation Phase

New Fan ON _____seconds

New Fan Ramp_____seconds

Old Fan Ramp_____seconds

Old Iso Close _____seconds

Rotation Min _____ %

BMS Settings

BMS Protocol

- ☐ BACnet™ MS/TP
- ☐ BACnet™ IP
- ☐ None

BACnet™ MS/TP Settings

Device Instance _____

Address _____

Baud Rate _____

Max Master _____

Max Info Frames_____

Timeout _____ ms

Cmd Timeout _____ ms

BACnet™ IP Settings

DHCP: ☐ Off ☐ On

IP _____–_____–_____–_____

Mask _____–_____–_____–_____

GW _____–_____–_____–_____

DNS _____–_____–_____–_____

Devise Instance _____

Port_____

Timeout _____ ms

Cmd Timeout _____ ms

Foreign Device: ☐ No ☐ Yes

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
Building Value in Air.

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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:

- NEMA-4/IP56 enclosure rating
- Factory calibrated
- 24 VDC/24 VAC 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 transmitter linear to differential pressure or volume
  - 4-20 mA
  - 2-10 VDC
- Communication protocols
  - BACnet MSTP
  - Modbus
- LCD display with user-friendly touch panel interface
- Temperature compensation for air density
- Remote duct temperature sensor
- Programmable elevation
- English or metric readings

Hardware 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 77ºF (*25ºC*)
- 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

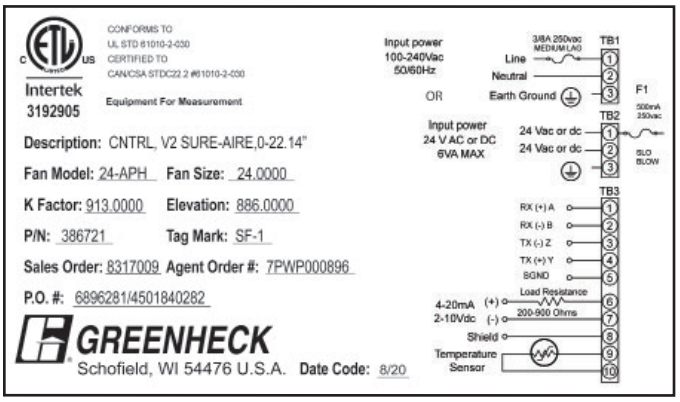
Improper installation, adjustment, alterations, service or maintenance may cause injury and/or property damage, as well as possibly void the factory warranty. No person may install, operate, or maintain a Sure-Aire™ electronics without first being fully trained and qualified in the installation, operation 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.

Table of Contents

Label Information



Match the Tag Mark on the Sure-Aire electronics tag to the Tag Mark on the fan nameplate. Sure-Aire electronics are supplied set-up individually for a specific model and performance. Contact factory if Sure-Aire electronics are being used on a different Tag Mark then specified.

General Information

This instruction manual provides installation, operating, maintenance, and other information for the Sure-Aire™ series differential pressure 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 and Setup

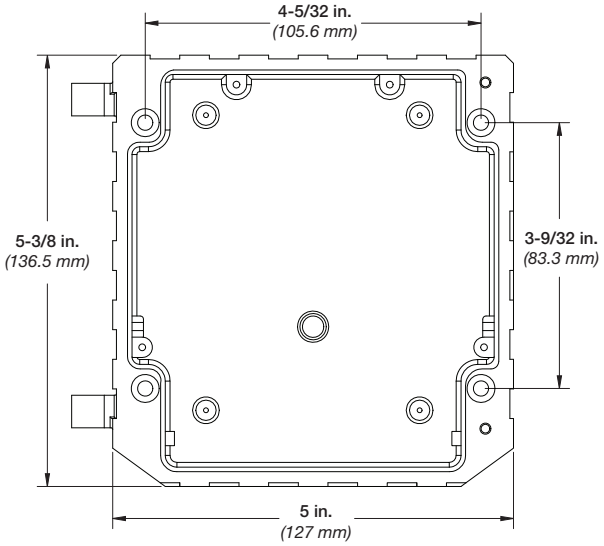
WARNING

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.

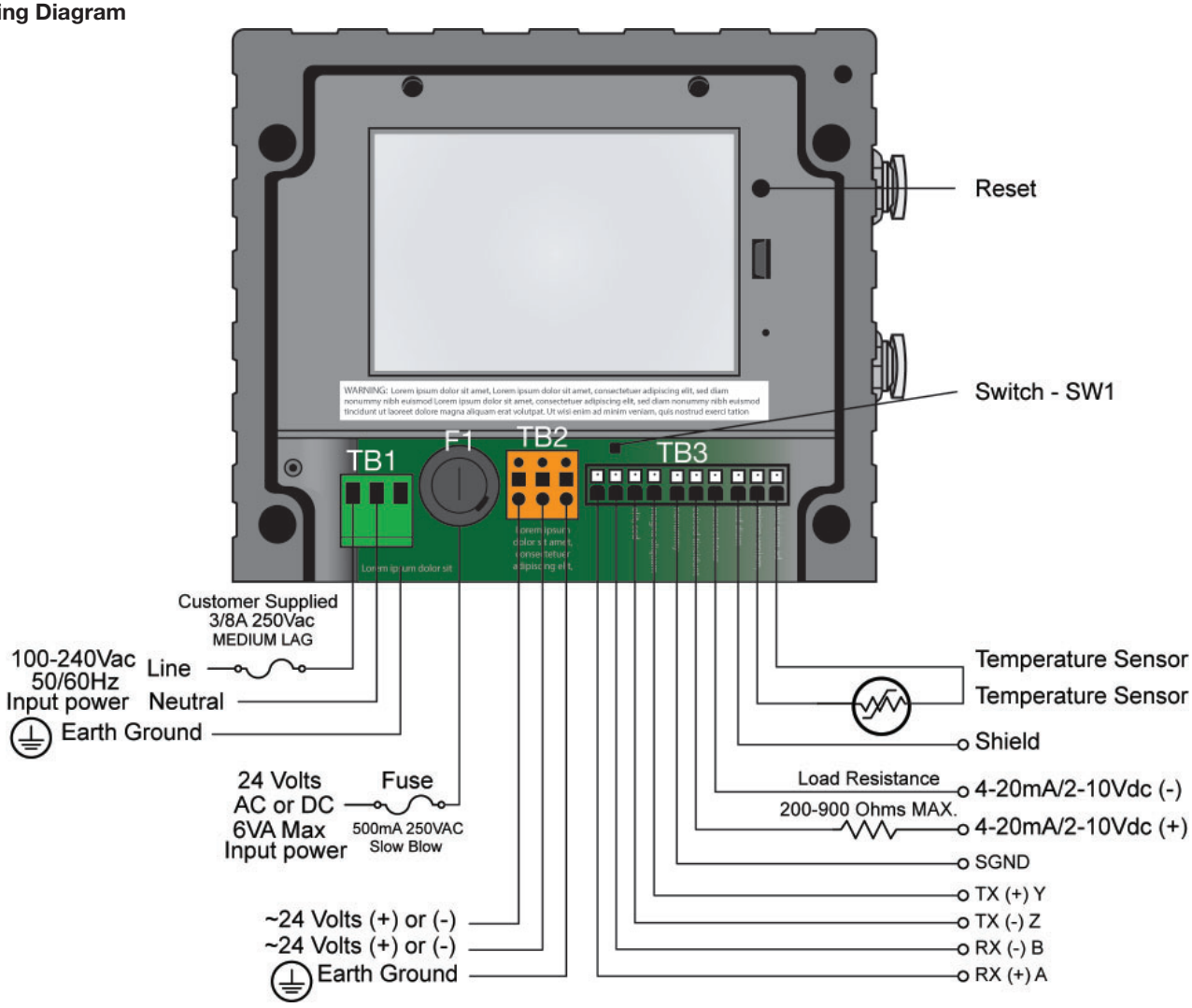
   Note: Mount the Sure-Aire™ electronics within 75 feet of the termination plate on the fan.

Dimensions and Hole Mounting Pattern



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.

Wiring Diagram



3. Remove terminal block TB1 and perform wiring for the pins if you are using AC. If using low voltage AC/DC, plug the wires into TB2. For liquid tight applications, use only 1/2-inch liquid tight conduit.

   Terminal Block TB1: AC Input Power:
   Pin 1 = 100-240VAC Line
   Pin 2 = 100-240VAC Neutral
   Pin 3 = Earth Ground

   Terminal Block TB2: Low Voltage AC/DC Input Power:
   Pin 1 = 24V, AC or DC (+ or -)
   Pin 2 = 24V, AC or DC (+ or -)
   Pin 3 = Earth Ground

4. Provide power to the electronics to turn it on.
5. Select the desired Output Signal of the electronics for the Building Automation System. Use the touch screen to select the 4-20 mA or 2-10 VDC output signal via the monitor's setup menu. (Refer to Setup Menu, Output Signal, page 9).
6. Wire TB3 appropriately for the selected Output Signal in Step 5.

   Terminal Block TB3: Transmitter/Temperature Sensor:
   Pin 6 = 4-20 mA or 2-10 VDC (+) (output)

   Note: 4 to 20 mA requires a load resistor 200-900 ohms
   Pin 7 = 4-20 mA or 2-10 VDC (+) (output)
   Pin 8 = Shield
   Pin 9 = Remote Temperature Sensor (input)
   Pin 10 = Remote Temperature Sensor (input)

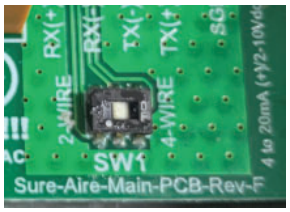
   Note: Signal isolator may be required when two or more output signals share a common connections at the PLC/electronics.

7. Select the desire network protocol of the electronics for the Building Automation System. Use the touch screen to select Modbus/BACnet, baud rate, and the network address of the electronics. This is done via the setup menu. (Refer to Setup Menu, Output Signal, page 9)

8. Wire TB3 appropriately if the networking features of the electronics are being used. There are two wiring options for the network protocol: 2-Wire and 4-Wire. The currently selected option is based on the position of SW1.

   Switch SW1: 2-Wire/4-Wire Select:

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



   Terminal Block TB3: 4-Wire Communication:

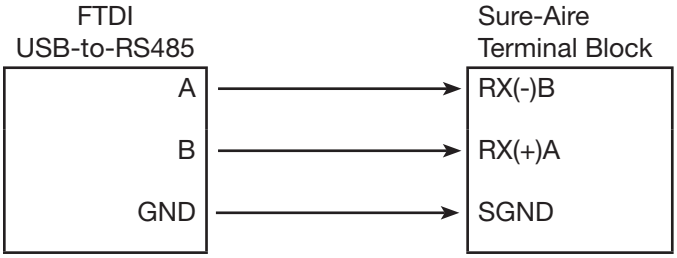
   Pin 1: RX+ (A)
   Pin 2: RX- (B)
   Pin 3: TX- (Z)
   Pin 4: TX+ (Y)
   Pin 5: Signal Ground (SGND)

   Terminal Block TB3: 2-Wire Communication:

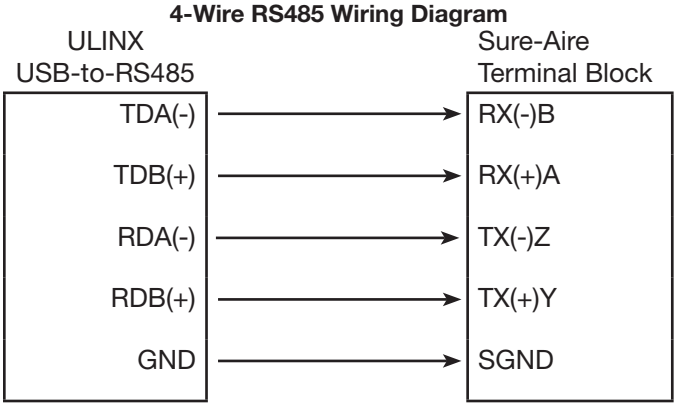
   Pin 1 or Pin 4: RX+ (A)/TX+ (Z)
   Pin 2 or Pin 3: RX- (B)/TX- (Y)
   Pin 5: Signal Ground (SGND)

9. If not using temperature compensation, change Temperature Compensation to “No” via the setup menu. If temperature compensation is desired, mount the provided temperature sensor in contact with the airstream. Wire the temperature sensor into TB3 and confirm Temperature Comp is “Yes” via the setup menu. (Refer to Setup Menu, Temperature Compensation, page 9).
10. When the above steps are completed, make sure the front cover is properly aligned to the housing and the two captive thumbscrews are securely tightened.

2-Wire RS485 Wiring Diagram



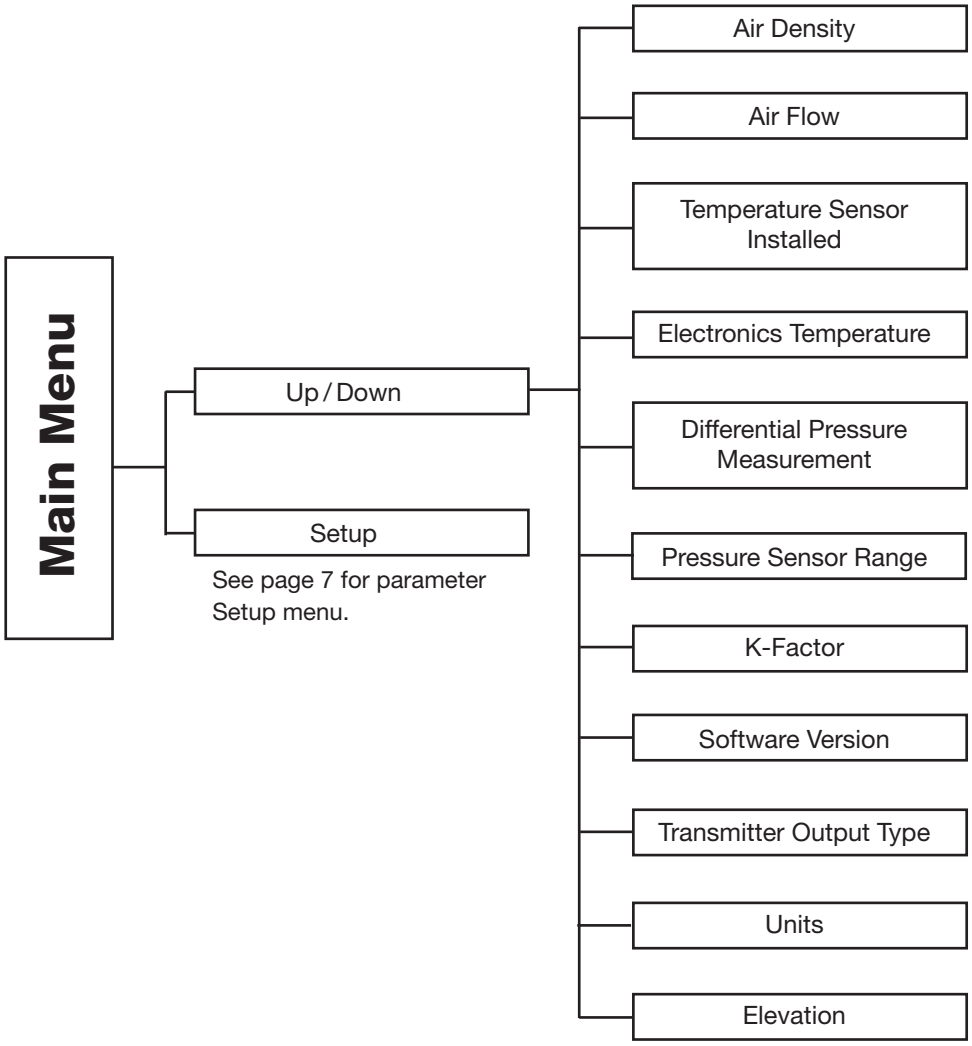
4-Wire RS485 Wiring Diagram

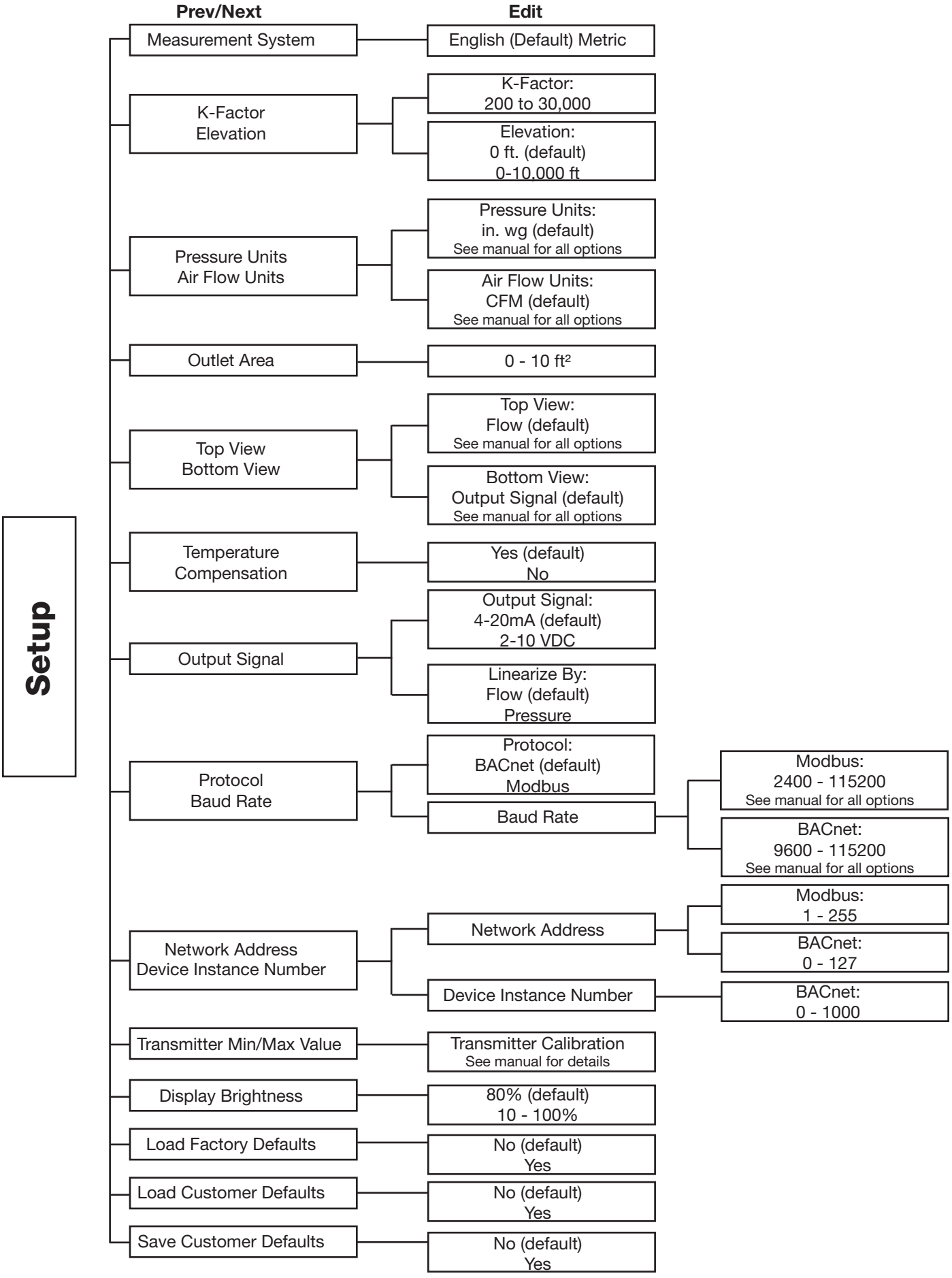


Network Input Register Address

Object Name	Modbus	BACnet
	16-bit address	16-bit address
K Factor	0	0
Elevation	1	1
Outlet Area	3	2
Flow Temperature	2	3
Pressure	4	4
Volume	5	5
Velocity	6	6

Menu Structure



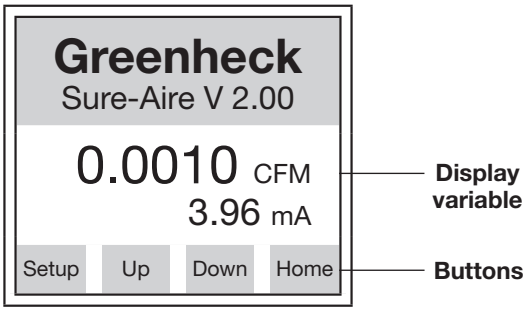

Prev/Next
Edit
Setup
Measurement System
English (Default) Metric
K-Factor
Elevation
K-Factor:
200 to 30,000
Elevation:
0 ft. (default)
0-10,000 ft
Pressure Units
Air Flow Units
Pressure Units:
in. wg (default)
See manual for all options
Air Flow Units:
CFM (default)
See manual for all options
Outlet Area
0 - 10 ft²
Top View
Bottom View
Top View:
Flow (default)
See manual for all options
Bottom View:
Output Signal (default)
See manual for all options
Temperature
Compensation
Yes (default)
No
Output Signal
Output Signal:
4-20mA (default)
2-10 VDC
Linearize By:
Flow (default)
Pressure
Protocol
Baud Rate
Protocol:
BACnet (default)
Modbus
Baud Rate
Modbus:
2400 - 115200
See manual for all options
BACnet:
9600 - 115200
See manual for all options
Network Address
Device Instance Number
Network Address
Modbus:
1 - 255
BACnet:
0 - 127
Device Instance Number
BACnet:
0 - 1000
Transmitter Min/Max Value
Transmitter Calibration
See manual for details
Display Brightness
80% (default)
10 - 100%
Load Factory Defaults
No (default)
Yes
Load Customer Defaults
No (default)
Yes
Save Customer Defaults
No (default)
Yes

Display Setting Options and Parameter Setup

Navigation Buttons

The monitor 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 display variables, use the “Up” and “Down” buttons to scroll through the list. To adjust parameters, press “Setup” and scroll through the settings.

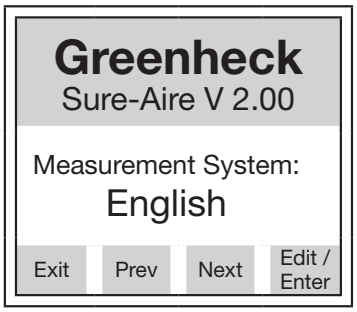
- Air density
- Flow
- Temperature sensor installed
- Electronics temperature
- Differential pressure measurement
- Pressure sensor range
- K-Factor
- Software version
- Transmitter output type
- Units
- Elevation

Press “Home” to return to the main screen.

Setup Menu

Following is information on the adjustable parameters that can be changed in the Setup menu of the electronics.

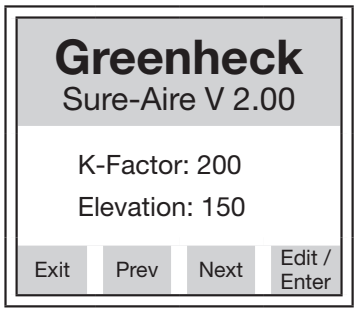
Measurement System



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 and Elevation



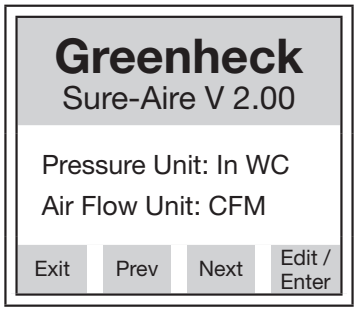
K-Factor: Press “Edit“ to change K-Factor. Press “Inc“ or “Dec“ to adjust, then press “Enter“ to store the value.

- 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)

Pressure and Air Flow Units



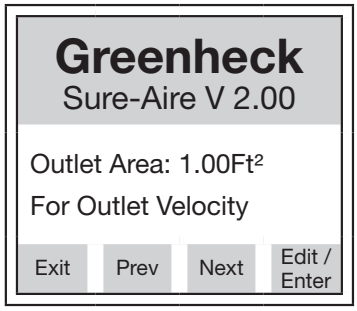
Pressure Units: Press “Edit” to change pressure units. Press “Prev” or “Next” to adjust, then press “Enter” to store the value.

- 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.

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)
- m^3/hr
- m^3/min

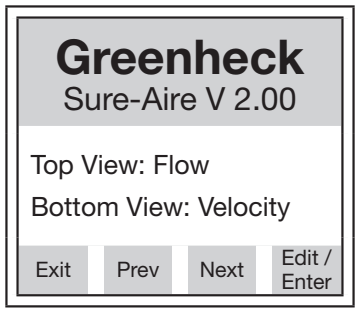
Outlet Area



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

Top and Bottom Views

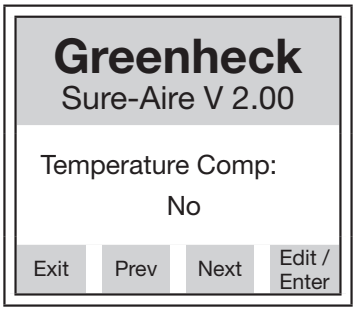


Top View: Press “Edit“ to change Main Display Value. Press “Prev“ or “Next“ to adjust what reading displays on the Home screen, then press “Enter“ to store the value.

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

Bottom View: Press “Edit” to change Secondary Display. Press “Prev” or “Next” to adjust, then press “Enter” to store the value.

Temperature Compensation

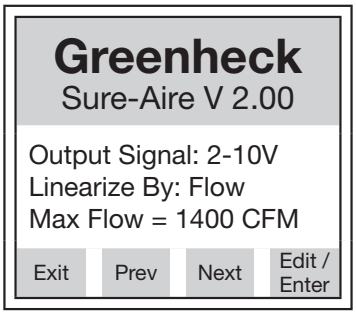


Press “Edit“ to change Temperature Compensation. Press “Prev“ or “Next“ to adjust, then press “Enter“ to store the value.

- 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*).

Output Signal



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 transmitter output with respect to this setting.

- Flow (default)
- Pressure

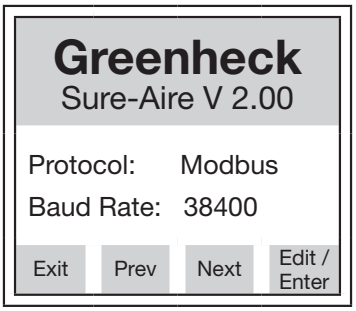
Note: The maximum measurable flow rate will automatically calculate based on the electronics settings. The maximum flow rate is displayed on the screen.

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 Parameter Setup (continued)

Protocol and Baud Rate



Protocol: Press “Edit“ to change the current network protocol. Press “Prev“ or “Next“ to adjust, then press “Enter“ to store the value.

- BACnet (default)
- Modbus

Baud Rate: Press “Edit“ to change the protocol baud rate. Press “Prev” or “Next” to adjust, then press “Enter” to store the value.

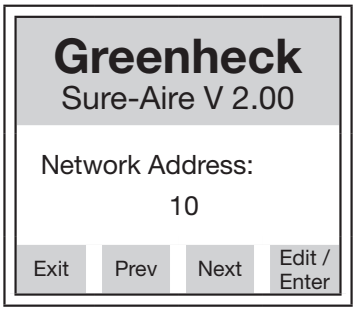
Baud Rate Options (Modbus):

- 2400
- 4800
- 9600
- 19200
- 38400
- 57600
- 115200

Baud Rate Options (BACnet):

- 9600
- 19200
- 38400
- 57600
- 76800
- 115200

Network Address



Press “Edit“ to adjust the network address, then press “Enter“ to store the value.

Network Address Options (Modbus):

- 1 – 255

Network Address Options (BACnet):

- 0 – 127

Note: The protocol and baud rate must be set before the network address can be modified.

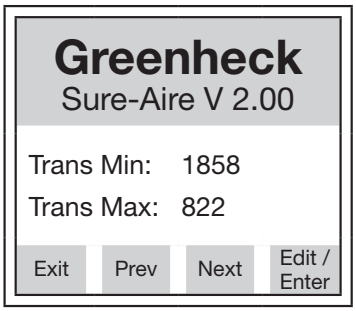
Device Instance Number (BACnet only):

The instance number is an unsigned decimal number that can range from 0 to 4,194,302. Every device on a BACnet network gets an instance number, and two devices must not have the same number.

Press “Edit” to adjust the Device Instance Number, then press “Enter” to store the value.

- 0 - 4,194,302

Transmitter Min/Max Value



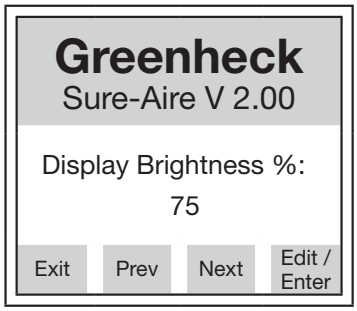
Transmitter Min Value: Press “Edit” to change Transmitter Min Value. Press “Inc” or “Dec” to adjust, then press “Enter” to store the value.

Note: See Transmitter Calibration Section.

Transmitter Max Value: Press “Edit” to change Transmitter Max Value. Press “Inc” or “Dec” to adjust, then press “Enter” to store the value.

Note: See Transmitter Calibration Section.

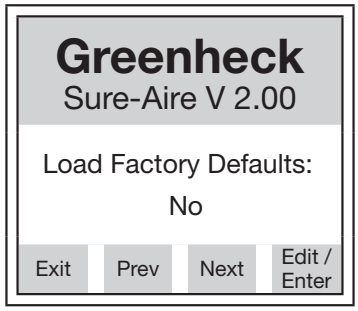
Display Brightness



Press “Edit“ to change brightness. Press “Inc“ or “Dec“ to adjust, then press “Enter“ to store the value.

- 10 - 100%
  (80% default)

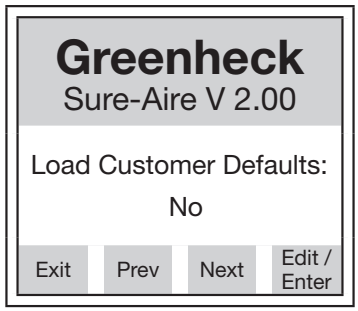
Load Factory Defaults



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)

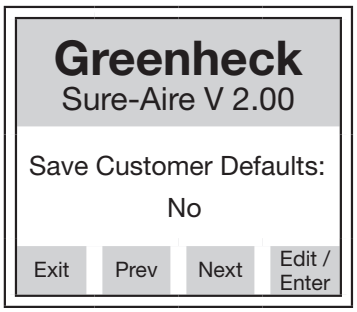
Load Customer Defaults



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)

4-20 mA Transmitter Calibration Procedure

WARNING

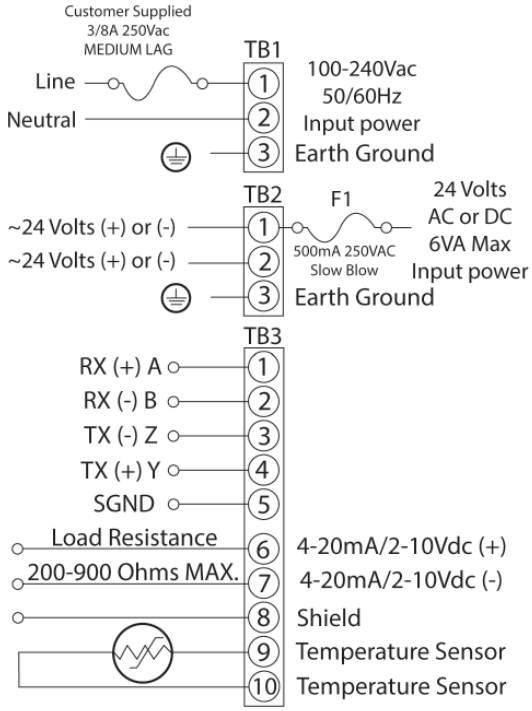
Due to load resistance change from product to product, it may be necessary to recalibrate the 4-20 mA transmitter.

1. Test Equipment

   1.1 Digital multimeter - set multimeter to read mA DC.

   1.2 Load resistor - select a series load resistor between 200 and 900 ohms.

2. Interconnect wiring



   2.1 Validate the electronics is set up for 4-20 mA output signal.

   2.2 Validate the power is OFF on the DC power supply and the Sure-Aire electronics.

   2.3 Validate the multimeter is set to read mA DC.

   2.4 Select a series Load Resistor between 200 and 900 ohms and install one end to TB3-6.

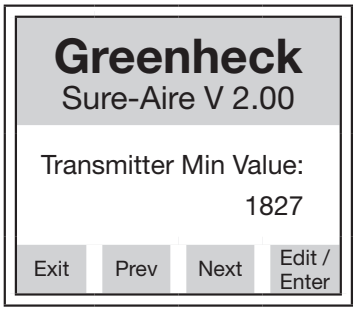
   2.5 Interconnect the multimeter (+) probe to the other end of the load resistor.

   2.6 Interconnect the multimeter (-) probe to TB3-7 to complete the current loop.

   2.7 Apply power to the Sure-Aire electronics.

   2.8 Press the “Setup” button on the touch panel interface.

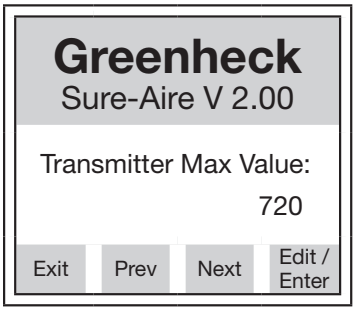
   2.9 Keep pressing the “Next” button until you reach the Transmitter Min Value parameter screen.



   2.10 Press “Edit”, then “Inc” or “Dec” until the digital multimeter reads exactly 4.00 mA.

   2.11 Press “Enter” to store the new value.

   2.12 Press “Next”.



   2.13 On the Transmitter Max Value screen, press “Edit”, then “Inc” or “Dec” until the digital multimeter reads exactly 20.00 mA.

   2.14 Press “Enter” to store the new value.

   2.15 Press “Exit” to return to the main screen.

The 4-20 mA transmitter calibration is complete.

NOTE

Apply a vacuum to the Low Port and the 4-20 mA transmitter to track the span of the pressure range.

For example, the Sure-Aire electronics with a pressure sensor of 0 - 41.51 in. wg installed, 4.00 mA = 0 in. wg, 20.00 mA = 41.52 in. wg.

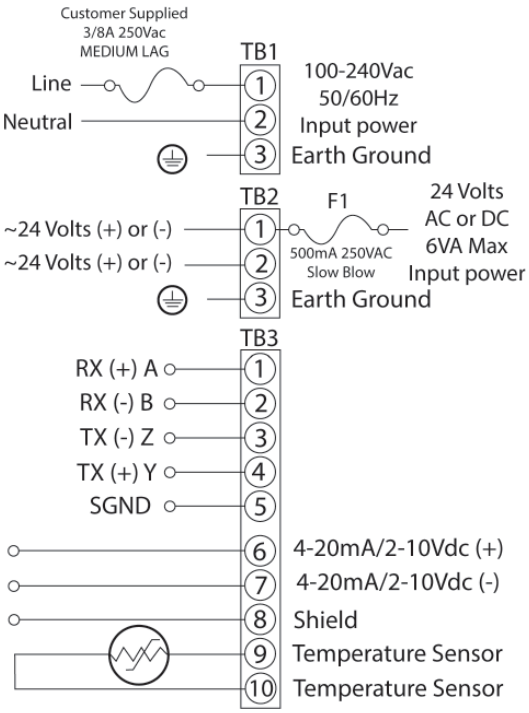
2-10 VDC Transmitter Calibration Procedure

1. Test Equipment

   1.1 Digital multimeter - set multimeter to read DC voltage.

   1.2 Make sure Output Signal type is set to 2-10 VDC.

2. Interconnect wiring



   2.1 Validate the power is OFF on the DC power supply and the Sure-Aire electronics.

   2.2 Validate the multimeter is set to read DC voltage.

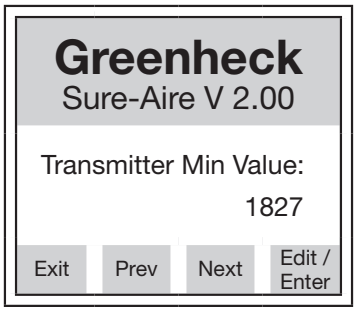
   2.3 Interconnect the multimeter (+) probe to TB3-6.

   2.4 Interconnect the multimeter (-) probe to TB3-7.

   2.5 Apply power to the Sure-Aire electronics.

   2.6 Press the “Setup” button on the touch panel interface.

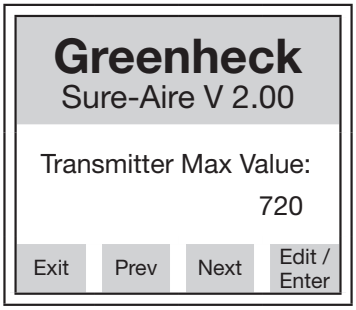
   2.7 Keep pressing the “Next” button until you reach the Transmitter Min Value screen.



   2.8 Press “Edit”, then “Inc” or “Dec” until the digital multimeter reads exactly 2.00 VDC.

   2.9 Press “Enter” to store the new value.

   2.10 Press “Next”.



   2.11 On the Transmitter Max Value screen, press “Enter”, then “Inc” or “Dec” until the digital multimeter reads exactly 10.00 mA.

   2.12 Press “Enter” to store the new value.

   2.13 Press “Exit” to return to the main screen.

The 2-10 VDC transmitter calibration is complete.

NOTE

Apply a vacuum to the Low Port and the 2-10 VDC transmitter to track the span of the pressure range.

For example, the Sure-Aire electronics with a pressure sensor of 0 - 41.51 in. wg installed, 2 VDC = 0 in. wg, 10 VDC = 41.52 in. wg.

Temperature Sensor

Interconnect the remote temperature sensor by connecting the temperature sensor to pins 4 and 5 of TB2. The Remote Temperature Sensor will adjust the air density value in the differential pressure electronics based on the sensor measurement when Temperature Compensation is set to “Yes”. This density compensation will affect the flow rate accordingly. If Temperature Compensation is set to “No”, the air density value will be a function of standard air. (70°F/21°C).

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.

Calculation Using Manual Pressure Gauge or Third Party Transducer

Calculating Flow from Differential Pressure

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). K-Factors for Greenheck models are found on the back cover.

Calculating Flow from Voltage 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)
Pmax	Maximum pressure of electronics (in. wg)
ρ	Air density (lb/ft³ °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:

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

Density Corrections

Air density, ρ, is affected by elevation and temperature. The Sure-Aire differential pressure electronics allows the user to input the elevation for the application. This elevation input automatically updates the density used for the flow calculation.

The Remote Temperature sensor will adjust the air density value in the electronics based on the sensor measurement when Temperature Compensation is set to "Yes". This density compensation will affect the flow rate displayed on the transmitter. If Temperature Compensation is set to "No", the air density value will be a function of standard air (70°F/*21°C*).

The density being used by the Sure-Aire differential pressure measurement can be viewed on the main menu by scrolling up or down through the settings.

K-Factors

Size	APD	Size	APH / APM HPA	AFDW / BIDW	FJI	QEI / QEID	USF-500 & Vektor-C series	Vektor-H Belt Drive	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

Vektor-H Direct Drive

Fan Size	Nozzle Size															
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
10	136	142	150	152	154	157	160	–	–	–	–	–	–	–	–	–
12	161	172	185	188	191	194	195	196	197	–	–	–	–	–	–	–
13	–	–	–	230	233	236	238	239	240	241	–	–	–	–	–	–
14	–	–	–	–	335	339	344	345	346	347	348	–	–	–	–	–
16	–	–	–	–	353	386	422	428	434	435	435	437	440	–	–	–
18	–	–	–	–	–	527	530	535	538	542	545	549	546	543	546	550
20	–	–	–	–	–	616	629	643	648	654	659	666	666	666	665	664

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.

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Maintenance Log

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