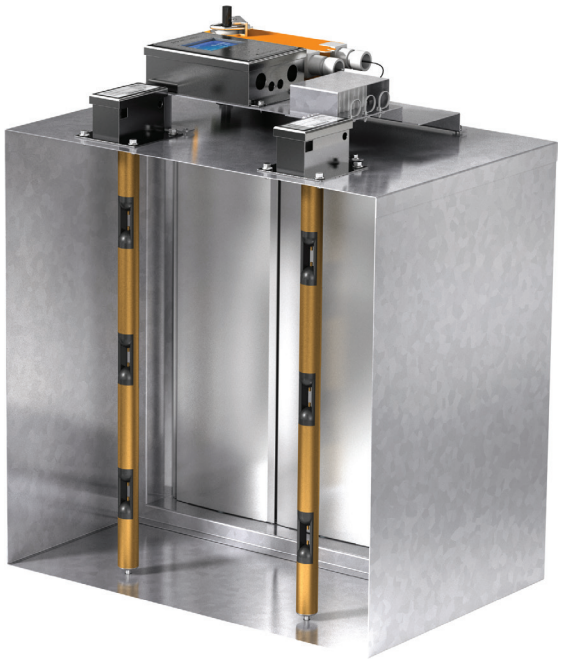
GREENHECK

INSTALLATION INSTRUCTION BOOKLET FOR AMD-TD SERIES (Air Measuring Dampers)



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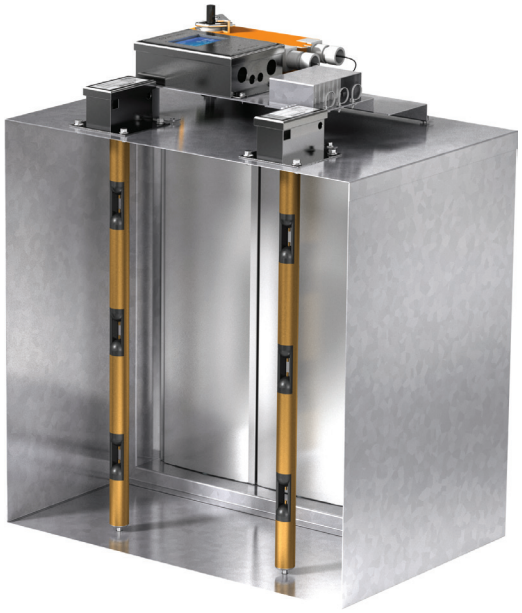
KIT # 482600
AMD-TD Dampers

GREENHECK
Building Value in Air.

Document Number 478799
AMD-xx-TD Series

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 instructions could result in personal injury and/or property damage!



Receiving and Handling

Upon receiving dampers, check for both obvious and hidden damage. If damage is found, record all necessary information on the bill of lading and file a claim with the final carrier. Check to be sure that all parts of the shipment, including accessories, are accounted for.

Dampers must be kept dry and clean. Indoor storage and protection from dirt, dust, and the weather is ideal. Do not store at temperatures in excess of 100°F (37°C).

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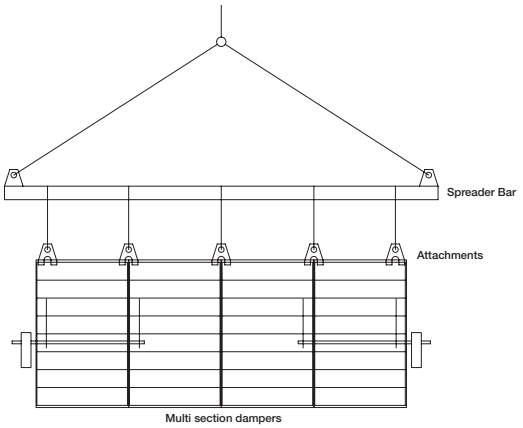
Pre-Installation Guidelines

The basic intent of a proper installation is to secure the AMD-xx-TD series damper into the opening in such a manner as to prevent distortion and disruption of damper operation. The following items will aid in completing the damper installation in a timely and effective manner.

1. Check your schedule for proper damper locations within the building. Visually inspect the damper for damage.
2. When you lift or handle the damper use the sleeve or frame. Do not lift damper using blades, linkage, actuators, probes, or jackshafting. When you handle multiple section assemblies, use sufficient support to evenly lift at each section mullion (see drawing). Do not drag, step on, apply excessive bending, twisting, or racking.
3. Do not install screws in damper frame that will interfere with unexposed blade linkage and prevent damper blades from opening and/or closing.
4. Damper must be installed into duct or opening square and free of twist or other misalignment. Damper must not be squeezed or stretched into duct or opening. Out of square, racked, twisted or misaligned installations can cause excessive leakage and/or torque requirements to exceed damper/actuator design.



Multi section dampers

5. Damper, actuator, and transmitter must be kept clean, dry and protected from dirt, dust and other foreign materials prior to and after installation. Examples of such foreign materials include but are not limited to:
    a) Mortar dust
    b) Drywall dust
    c) Firesafing materials
    d) Wall texture
    e) Paint overspray
6. Damper should be sufficiently covered as to prevent overspray if wall texturing or spray painting will be performed within 5 feet (1.5m) of the damper. Excessive dirt or foreign material deposits on the damper can cause excessive leakage and/or torque requirements and inaccurate airflow measurement to exceed damper/actuator design.
7. ACCESS: Suitable access (actuators maintenance, etc.) must be provided for damper inspection and servicing. Where it is not possible to achieve sufficient size access, it will be necessary to install a removable section of duct.

Electrical Guidelines

All wiring shall be done in accordance with the National Electrical Code ANSI/NFPA-70 latest edition, any local codes that may apply, and wiring diagrams developed in compliance with the job or project design and specifications.

Important!

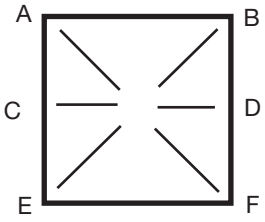
Electrical in put may be needed for this equipment. This work should be performed by a qualified electrician. Verify power before wiring actuator. Greenheck is not responsible for any damage to, or failure of the unit caused by incorrect field wiring. To avoid causing death or serious bodily harm to building occupants, follow all instructions carefully. Dampers must close completely to preserve the integrity of the fire smoke separation.

Connect electrical connection to power strip as shown in drawings on pages 4 and 5.

Installation - Failure to follow instructions will void all warranties

1. Ensure the AMD-XX-TD series dampers is mounted with measurement probes upstream of the damper.
2. Your duct opening or opening square should measure 1/4 inch (6mm) larger than damper dimension and should be straight and level.
3. Use shims between damper frame and duct opening or opening space to prevent distortion of frame by fasteners holding it in place. Brace at every horizontal mullion and vertically brace at every 8 feet (2.4m) of damper width for strength. Dampers in high velocity (2000 fpm [610m per second]) may require more bracing.

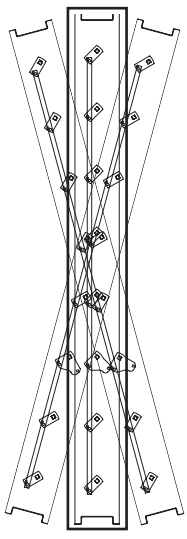
   NOTE: Greenheck dampers are specifically designed and engineered for structural integrity based on model and conditions. Attachment, framing, mating flanges, and anchoring of damper assemblies into openings, ductwork, or walls is the responsibility of the installer. Design calculations for these retaining and supporting members should be determined by field engineers for that particular installation.
4. Individual damper sections, as well as entire multiple section assemblies must be completely square and free from racking, twisting, or bending. Measure diagonally from upper corners to opposite lower corners of each section.
5. Damper blades, axles, and linkage must operate without binding. Before system operation, you can cycle dampers after installation to assure proper operation. On multiple section assemblies all sections should open and close simultaneously.



AF = BE

AB = CD

Do not twist or bow. Mount damper plumb in the opening.

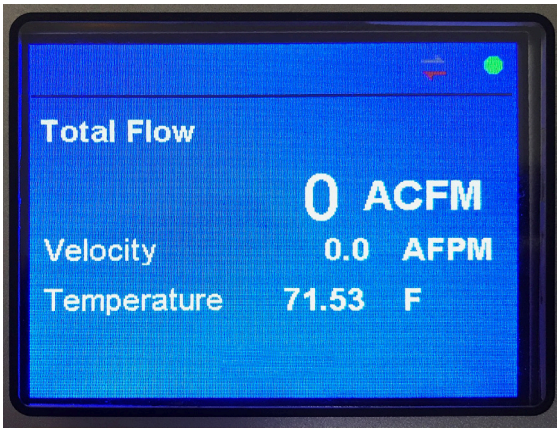


6. **AMD-xx-TD** series more than one section high will be shipped separately in individual sleeves. Using the provided RJ-45 cable connect the bottom probe on the top section to the top probe on the bottom section. The bottom section has the transmitter mounted to it.

Setup and Operation for AMD-xx-TD Series Damper

All AMD-xx-TD's are supplied with a Vari-Green® airflow rate transmitter that is factory wired to one or more Vari-Green airflow measurement probe(s). The transmitter has been configured at the factory with customer supplied parameters. For normal applications the transmitter's configuration should not need to be modified in the field. However, if field configuration is necessary please reference the Vari-Green transmitter Installation, Operation, and Maintenance Manual available at ***www.greenheck.com.***

Once electrical power is applied, the transmitter will go through a standard start-up sequence during which it will identify and enable each airflow sensor. This will take approximately 25 seconds. Once the start-up sequence has been complete, the transmitter's display will show the measured volumetric airflow rate, velocity, and ambient air temperature (see below). Under normal operation, a blinking green dot in the upper right corner of the display signifies that the processor is functioning correctly, and two flashing arrows indicate that the sensor(s) and transmitter are communicating normally.



You can order AMD-xx-TD's with or without a factory supplied controller. When a factory supplied controller is ordered, the controller can be configured for either analog operation or operation via a BACnet MS/TP connection. Setup and operation for these different options are described on the following pages.

AMD-xx-TD Series Damper Without a Factory Supplied Controller

Units ordered without a factory supplied controller are supplied with a standard modulating actuator. The Vari-Green transmitter and actuator are wired to a factory supplied terminal block. **Figure 1** shows the field wiring side of the terminal block.

The 0-10 VDC analog output at terminals 3 and 4 comes from the Vari-Green transmitter and is proportional to the velocity going through the AMD-xx-TD. A 10 VDC signal represents the maximum velocity that was selected at the time the unit was ordered. The selected maximum velocity and the area of the AMD-xx-TD are listed on a label adjacent to the terminal block. An example of how you can determine the velocity and/or cfm going through the unit is shown below.

AMD-42-TD
Sales Order 7398379 Line 20
Prod. Order 64240081
Width 28.000 in. Height 42.000 in.
Area = 8.00 ft^2 Max Velocity 3,000 fpm
Qmax = 24,500 cfm
Controller Type = ANALOG

$$Q = \frac{V}{10} * Qmax$$

Q: Airflow (cfm)
V: Measured Voltage from Transmitter

ADS481148

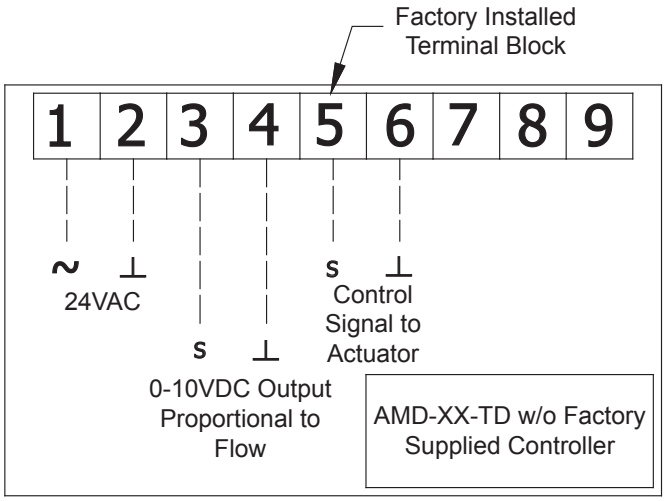
Example 1:

Determine the CFM from a 24 in. x 24 in. AMD-xx-TD (area of 4 ft^2) with a selected maximum velocity of 2,000 fpm and a voltage reading across terminals 3 and 4 of 3.5 VDC.

Measured Velocity = Max Velocity * (Measured Voltage / 10)
Measured Velocity = 2,000 * (3.5 / 10)
Measured Velocity = 700 fpm

and

Measured CFM = Measured Velocity * Area
Measured CFM = 700 fpm * 4 ft^2
Measured CFM = 2,800 cfm



*** On multiple section high dampers, the actuators on the sections without the terminal block will need to be field wired into Terminals 1, 2, & 5 ***

Figure 1

AMD-xx-TD Series Ordered with a Factory Supplied Controller

When you order a factory supplied controller, it comes with a Greenheck exclusive VAF24-BAC-GTD actuator which has the controller integrate inside of it. The actuator/controller is configured by the factory at the time the unit was ordered for either analog or BACnet operation. This selection is made by setting the Setpoint Source datapoint to Local AI or BACnet. A complete list of all the BACnet datapoints is listed in Table 1 (page 7).

AMD-xx-TD Series Damper with an Analog Factory Supplied Controller

Figure 2 shows field wiring for an AMD-xx-TD ordered with a factory supplied controller configured for analog operation.

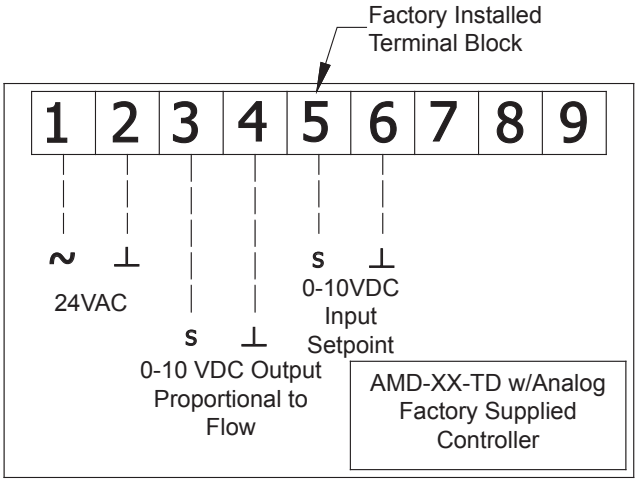


Figure 2

The controller is designed to modulate the AMD-xx-TD series damper such that it maintains a desired cfm setpoint. The setpoint is supplied via a 0-10 VDC analog input (terminals 5 and 6) that is proportional to that setpoint. The Vari-Green transmitter will output a 0-10 VDC signal (terminals 3 and 4) proportional to the actual cfm being measured by the unit. For both the desired cfm setpoint and the cfm output, a voltage reading of 10 VDC represents the **maximum** velocity that was selected at the time the product was ordered. The selected maximum velocity and the area of the AMD-xx-TD are listed on a label adjacent to the terminal block. Example 2 shows how to determine the voltage corresponding to the desired cfm setpoint.

Example 2:

Determine the voltage setpoint that should be sent to terminals 5 & 6 to achieve a flow of 4,800 CFM on a 24 in. x 24 in. AMD-xx-TD (area of 4 ft^2) with a selected maximum velocity of 2,000 fpm.

Maximum CFM = 4 ft^2 * 2,000 fpm = 8,000 cfm

Voltage Setpoint = 10 * (Desired CFM Setpoint / Maximum CFM)

Voltage Setpoint = 10 *(4,800 / 8,000) = 6.0 VDC

See example 1 on how to convert the transmitter voltage output (terminals 3 & 4) to cfm.

AMD-xx-TD Series Damper with a BACnet Enabled Factory Supplied Controller

Figure 3 shows field wiring for an AMD-xx-TD ordered with a factory supplied controller configured for BACnet MS/TP connection.

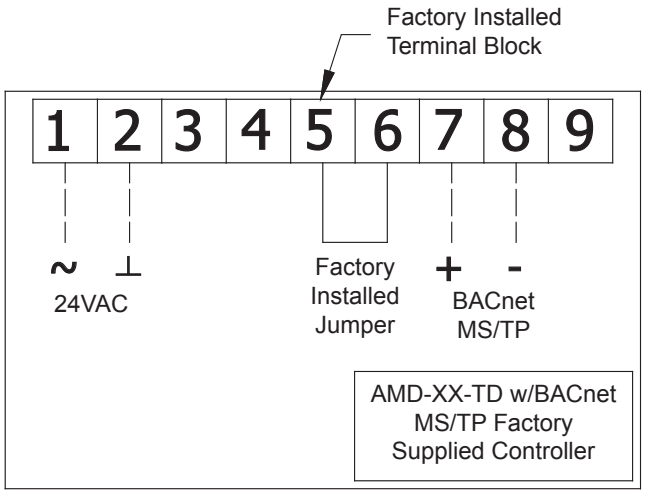


Figure 3

This controller is designed to modulate the AMD-xx-TD series damper such that it maintains a desired cfm setpoint. The setpoint is established by the *BACnetSetpoint* datapoint. Table 1 lists all of the BACnet datapoints. The *BACnet Setpoint* is a percentage of the *MaxCFMSetpoint* datapoint, which is set at the factory based on the maximum velocity which is selected at the time the unit is ordered.

Example 3: Determine the BACnet setpoint for a 24 in. x 24 in. AMD with a maximum velocity of 2,000 fpm and a target flow of 6,000 cfm.

MaxCFMSetpoint = 8,000 cfm (4 ft2 x 2,000 fpm)
BACnet Setpoint = (Target CFM / Maximum CFM)
BACnet Setpoint = (6,000 / 8,000) = 75%

With a *BACnet Setpoint* of 75% the actuator/controller will position the damper to allow 6,000 cfm through it.

Position Control Mode

Example 3 applies when the actuator/controller is in its factory default operating mode called “Flow Control Mode”. However, for certain applications it may be desirable to operate the AMD-TD as a standard modulating damper. This can be accomplished by changing the *DamperMode* BACnet data point (see **Table 1**) from *CurrentAirflow* to *DamperPosition*. In “Position Control Mode” a *BACnet Setpoint* of 75% will drive the damper 75% open instead of finding a position that supplies 75% of the maximum airflow.

Safety Override of the BACnet Setpoint

If your application requires the ability to locally close the damper, the factory installed jumper wire should be removed and replaced with a normally closed “safety switch”. When the safety switch is closed the damper will track the *BACnet Setpoint* as if the jumper wire was left in place. When the safety switch is open the actuator will power the damper closed. Interlocking the damper with a fan such that the damper closes when the fan shuts down is an example of when the safety switch feature may be utilized.

Setting the Actuator/Controller's BACnet Configuration

The actuator's BACnet configuration including the device instance, MAC address, and baud rate can be accessed through its Ethernet port.

Connecting to the Actuator

1. Using an Ethernet cable, connect the CAT 5 Ethernet port on your computer to the CAT 5 port on your actuator.
2. Go into your computer's Control Panel and access the Local Area Connection

Windows 7 or 8

- Access the Network and Internet settings then the Network Sharing Center
- Click on Change adapter settings then right click on the Local Area Connection and select Properties

Windows XP

- Open Network Connections
- Right click on the Local Area Connection and select Properties

Access IP Address Settings

1. Select Internet Protocol

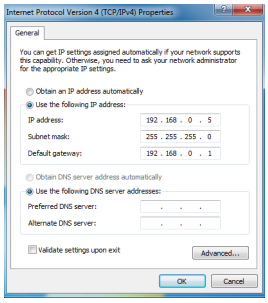
Windows 7 or 8

Select Internet Protocol Version 4 (TCP/IPv4) the click on Properties

Windows XP

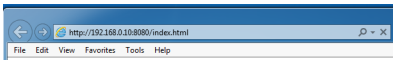
Select Internet Protocol (TCP/IP) the select Properties

2. Change the IP Address to the value shown below. Then hit the Tab key and the Subnet mask will populate. Then click OK.

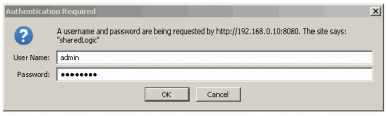


Access the Actuator

1. Open Internet Explorer and enter the following address: **http://192.168.0.10:8080/index.html**

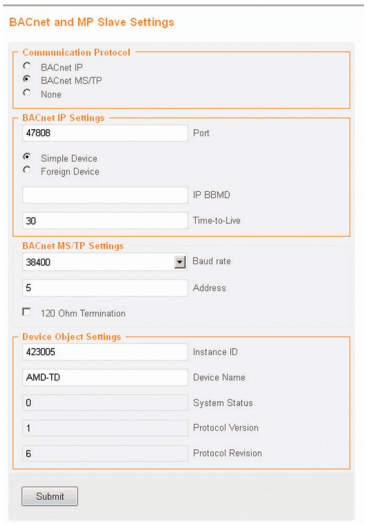


2. Enter "amdsetup" as the User Name and "gfcamd" as the password.



Entering the BACnet Settings

1. Click on BACnet/MP settings.
2. Select MS/TP as Protocol
3. Configure the desired baud rate and MAC address
4. Choose unique Instance ID
5. Enter desired Device Name (optional)
6. Click Submit button



BACNet Data Point List

Table 1 lists and describes all of the BACnet data points associated with the controller inside the actuator of BACnet enabled AMD-TD series dampers.

Name	Type	#	Access	Description
Greenheck AMD-TD	AI	1	C	Displays the application version
AirflowSetpoint	AI	2	C	Displays the real-time setpoint in cfm
CurrentAirflow	AI	3	C	Displays the real-time volumetric airflow rate in cfm
AirVelocity	AI	4	C	Displays the real-time air velocity in fpm
DamperPosition	AI	5	C	Displays the real-time damper position as a percentage (0% - fully closed; 100% fully open)
MaxCFMSetpoint	AI	6	C	Displays the maximum volumetric airflow rate in cfm. This value is a function of the value selected for "Maximum FPM". (Max CFM Setpoint = Damper Area * Maximum FPM).
DamperArea	AV	1	C	Represents the nominal damper face area in square feet. Set by the factory.
MinimumFPMSetpoint	AV	2	C	Represents the minimum allowable velocity setpoint in fpm. If the actuator receives a setpoint below the "Minimum FPM Setpoint" the setpoint will be set to zero. The factory default value is 100 fpm.
BACnet Setpoint	AV	3	C	When the Setpoint Source is set to BACnet this variable establishes the unit's setpoint. When the Damper Mode is set to Flow the BACnet Setpoint is a percentage of the MaxCFM Setpoint. When the Damper Mode is set to Position the BACnet Setpoint is the percentage the damper is open. When the Setpoint Source is set not set to BACnet this variable has no impact on controlling the damper.
SafetyStatus	BI	1	C	Represents the status of the safety circuit. Inactive = Open/Failure; Active = Closed/OK
MaximumFPM	MV	1	C	Represents the maximum setpoint velocity in fpm. The value this variable is set to corresponds to a 10 VDC input to the actuator. This value is set at the factory based on maximum velocity that was selected at the time the unit was ordered. 1 = 500 fpm; = 1000 fpm; 3 = 1500 fpm; 4 = 2000 fpm; 5 = 2500 fpm; 6 = 3000 fpm; 7 = 3500 fpm; 8 = 4000 fpm
DamperMode	MV	2	C	Establishes the mode of operation for the actuator. When in flow control mode the actuator will view the setpoint as a target cfm to maintain. When in position control mode the actuator will view the setpoint percentage as a position to drive to (0% fully closed, 100% fully open). Whether the actuator is in Flow or Position control mode the source of the setpoint will be determined by the Setpoint Source variable. 1 = Flow; 2 = Position
SetpointSource	MV	3	C	When set to BACnet the actuator uses the BACnet variable as the setpoint. When set to Local AI it uses the actuator's second analog input (S2) as the setpoint. When set to Zth the actuator uses a handheld Zth module to establish the setpoint. 1 = BACnet; 2 = Local AI; 3 = ZTH

AI - Analog Input
AO - Analog Output
AV - Analog Value
BI - Binary Input
BO - Binary Output
BV - Binary Value
MI - Multi-State Input
MO - Multi-State Output
MV - Multi-State Value
R - ReadOnly
W - Writable
C - Commandable (Contains Priority Array)

Protocol Implementation Conformation Statement - PICS

General Information

Date:	11. April 2014
Vendor Name:	BELIMO Automation AG
Vendor ID:	423
Product Name:	VAFB24-OP GTD
Product Model Number:	N/A
Applications Software Version:	1.34.0
Firmware Revision:	1.0.3
BACnet Protocol Revision:	1.6

Product Description:

The device is an air damper control actuator with the added benefit of a built-in programmable controller. Free programming environment allows handling of a wide range of HVAC control applications. MP-Bus master capabilities allow this device to monitor and control up to 15 additional slave devices that contain Belimo MP-Bus technology, affording significant expandability. BACnet server functionality allows easy integration in standard building automation systems. The commissioning of the device (BACnet Device Address, IP Address settings, MS/TP Address …) is done via the integrated web-server.

BACnet Standard Device Profile:	BACnet Application Specific Controller (B-ASC)
BACnet Interoperability Building Blocks supported:	
	Data Sharing - ReadProperty-B (DS-RP-B)
	Data Sharing - ReadPropertyMultiple-B (DS-RPM-B)
	Data Sharing - WriteProperty-B (DS-WP-B)
	Device Management - DynamicDeviceBinding-B (DM-DDB-B)
	Device Management - DynamicObjectBinding-B (DM-DOB-B)
	Device Management - DeviceCommunicationControl-B (DM-DCC-B)
Segmentation Capability:	No
Data Link Layer Options:	BACnet IP, (Annex J)
	BACnet IP, (Annex J), Foreign Device
	MS/TP master,
	baud rates: 9'600, 19'200, 38'400, 76'800, 115'200
Device Address Binding:	No static device binding supported
Networking Options:	None
Character Sets Supported:	ANSI X3.4

Standard Objects

The device provides datapoints for common operation as well as datapoints for parameterization using the following object types:

- Analog Input
- Analog Output
- Analog Value
- Binary Input
- Binary Output
- Binary Value
- Device
- Multi-State Input
- Multi-state Output
- Multi-state Value

Object Processing

Object Type	Optional Properties	Writeable Properties
Analog Input	Description	
Analog Output	Description	Present_Value
Analog Value	Description	Present_Value
Binary Input	Description Active_Text Inactive Text	
Binary Output	Description Active_Text Inactive_Text Relinquish_Default[1)] Priority_Array[1)]	Present_Value
Binary Value	Description Active_Text Inactive_Text Relinquish_Default[1)] Priority_Array[1)]	Present_Value
Device	Description Location	Object_Identifier Object_Name Location APDU_Timeout Number_Of_APDU_Retries Max_Master [2)] Max_Info_Frames[2)]
Multistate Input	Description State_Text	
Multistate Value	Description State_Text Relinquish_Default[1)] Priority_Array[1)]	Present_Value
Multistate Output	Description State_Text Relinquish_Default[1)] Priority_Array[1)]	Present_Value

1) Only if object is commandable.

2) Only if MS/TP is the selected data link layer type

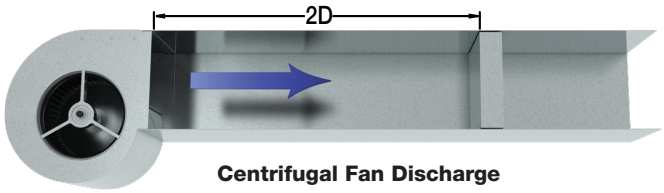
- The properties Object_Name and Location of the Device Object support up to 255 characters (all other character strings are read-only).
- The device does not support the CreateObject and DeleteObject service.

Service Processing

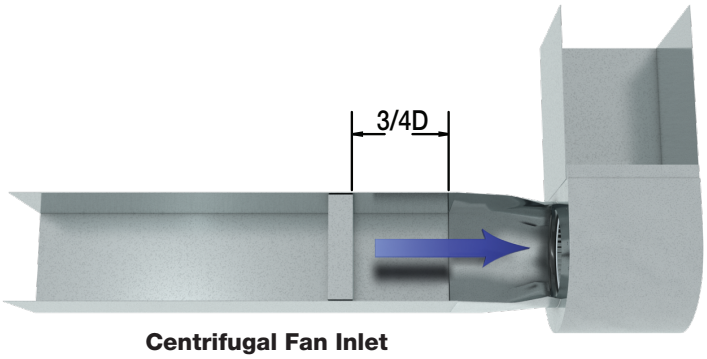
- The device supports DeviceCommunicationControl service. No password is required.

Optimal Placement for AMD-xx-TD Damper Series

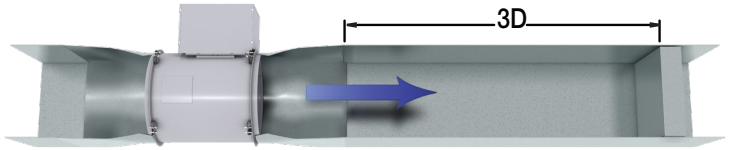
Fans



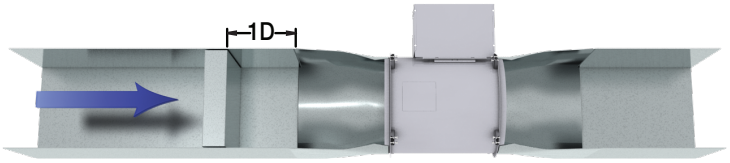
Centrifugal Fan Discharge



Centrifugal Fan Inlet

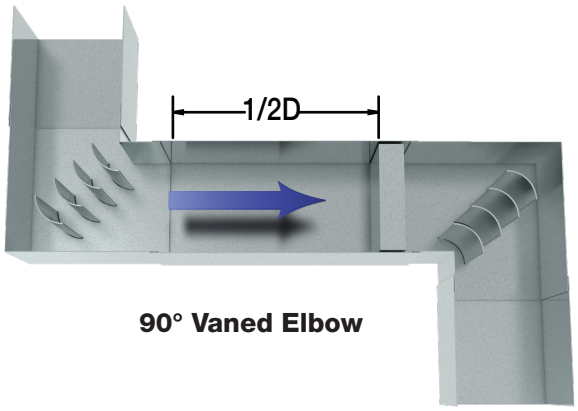


Vane Axial Fan Discharge

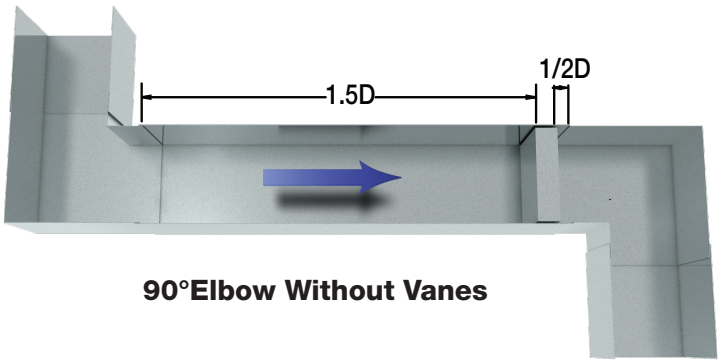


Vane Axial Fan Inlet

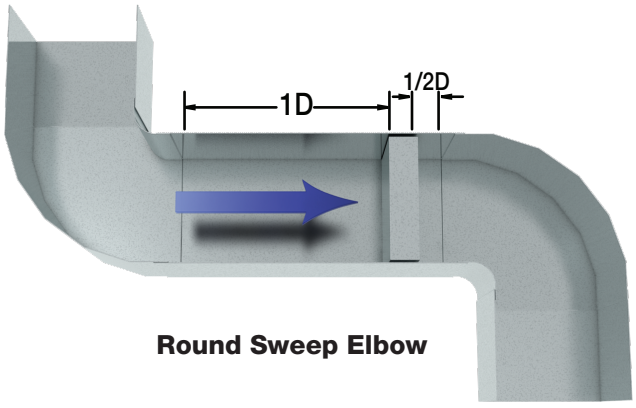
Elbows



90° Vaned Elbow



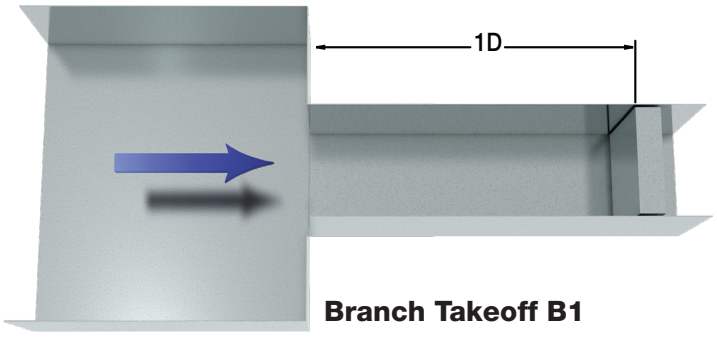
90°Elbow Without Vanes



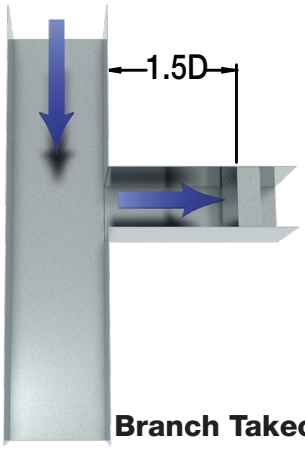
Round Sweep Elbow

Optimal Placement for AMD-xx-TD Damper Series

Takeoffs

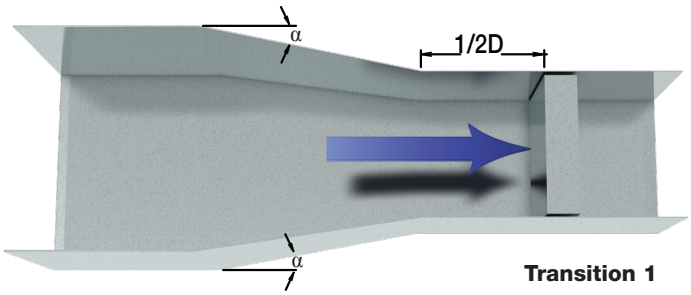


Branch Takeoff B1

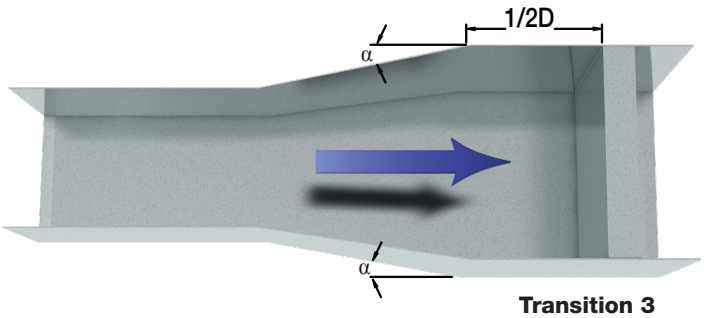


Branch Takeoff 2

Transitions

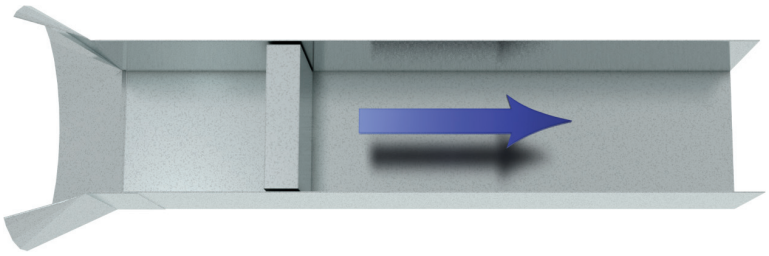


Transition 1



Transition 3

Bellmouth Inlets



Rectangular Duct: $D = \sqrt{\frac{4 \times \text{Width} \times \text{Height}}{\pi}}$

Circular Duct: D = Duct Diameter

Damper Maintenance

Greenheck's dampers are designed to be trouble free and hassle free under normal operation. Dampers are to be installed square and straight so as to prevent binding during operation. The following annual damper maintenance suggestions will help to insure proper damper operation and increase the life expectancy of the damper.

Foreign Matter Over the course of time, dirt and grime may collect on damper surfaces. The damper surfaces should be cleaned to prevent hindrance to airflow.

Moving Parts Make sure that parts such as linkage, bearings, blades, etc. that are intended to move freely, can do so. Lubricating these components can prevent possible rusting and unnecessary friction increase. Use only a moli-spray oil or similar graphite based oil as regular lubricating oil will attract dirt.

Bearings: Synthetic, oil impregnated, and ball bearings (without grease fittings) do not require lubrication. Ball bearings with grease fittings require only minimal grease.

Closure Remove foreign materials that may be interfering with blade closure or effective sealing of the blades with each other or with the frame.

Operation While operating the damper through its full cycle, check to see that the blades open and close properly. If there is a problem, check for loose linkage, especially at the actuator. Tighten the linkage where required.

Our Commitment

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

Specific Greenheck product warranties are located on greenheck.com within the product area tabs and in the Library under Warranties.

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 Number 482599

Vari-Green® Transmitter

VARI-GREEN®

Transmitter

Version 1.0X

Thermal Airflow & Temperature Measurement System

Installation, Operation and Maintenance Manual

Regarding this manual

- This manual should be passed on to the end user.
- Before use, read this manual thoroughly to comprehend its contents.
- The contents of this manual may be changed without prior notice.
- All rights reserved. No part of this manual may be reproduced in any form without Greenheck's written permission.
- Greenheck makes no warranty of any kind with regard to this material, including, but not limited to, implied warranties of merchantability and suitability for a particular purpose.
- All reasonable effort has been made to ensure the accuracy of the contents of this manual. However, if any errors are found, please inform Greenheck.
- Greenheck assumes no responsibilities for this product except as stated in the warranty. If the customer or any third party is harmed by the use of this product, Greenheck assumes no responsibility for any such harm owing to any defects in the product which were not predictable, or for any indirect damages.

Purpose of this manual

This manual provides information regarding the installation, operation and maintenance of your thermal airflow measurement system. This is NOT, nor is it intended to be an electrical or HVAC trade manual.

This manual is the basic reference tool for the Vari-Green® Transmitter, including its mains power connection and associated outputs. The complete system consists of the transmitter and associated probe array or stations. Refer to supplemental documents for additional information.

Safety Precautions

The following general safety precautions must be observed during all phases of installation, operation, service, and repair of this product. Failure to comply with these precautions or with specific WARNINGS given elsewhere in this manual violates safety standards of design, manufacture, and intended use of the product. Greenheck Fan Corporation assumes no liability for the customer's failure to comply with these requirements. If this product is used in a manner not specified in this manual, the protection provided by this product may be impaired.

TABLE OF CONTENTS

Technical Support:

E-mail: dampers@greenheck.com or

Phone: 1-800-717-6540

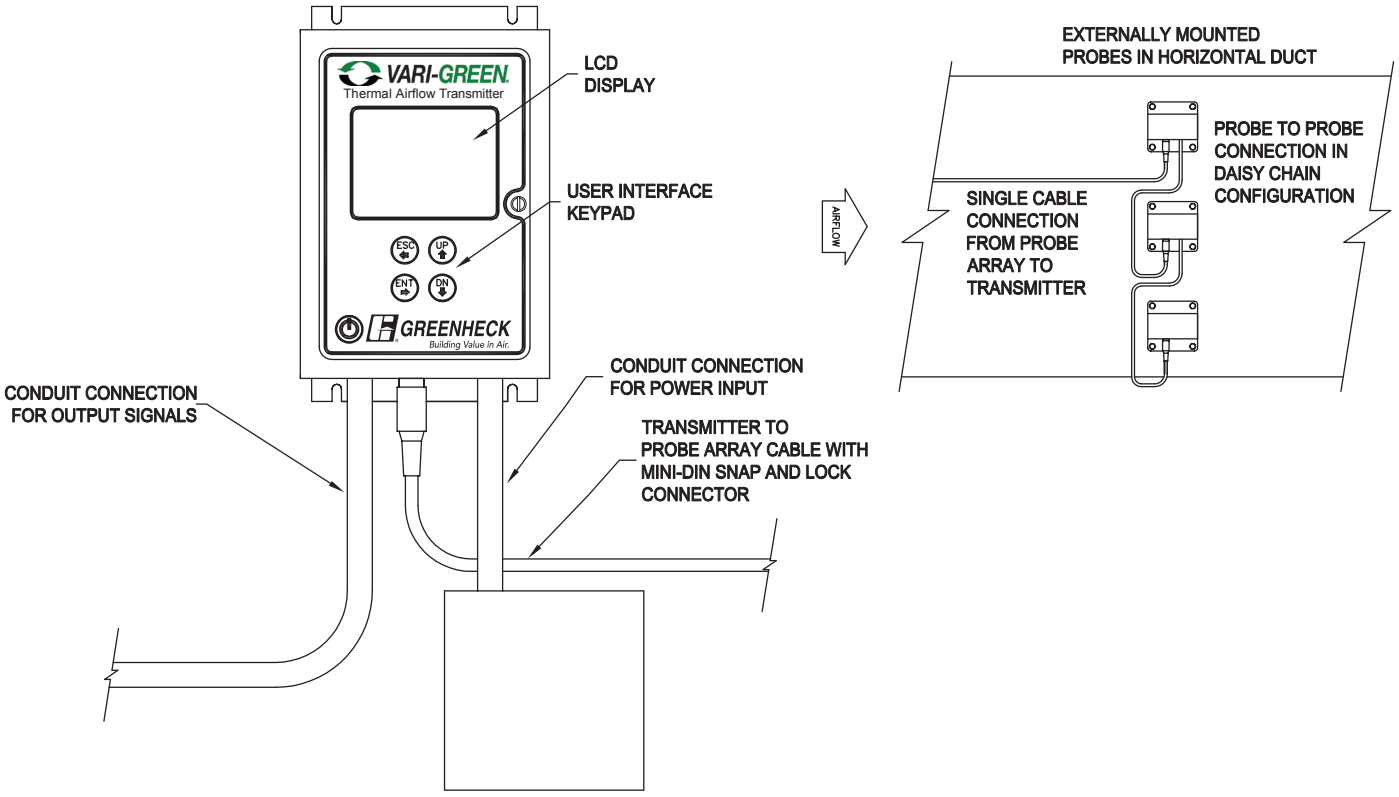
SECTION 1.0: General Information

1.1 TYPICAL THERMAL AIRFLOW MEASUREMENT SYSTEM INSTALLATION

Greenheck's Vari-Green® system accurately measures the average velocity of flowing air by means of thermal dispersion at the sensor locations in the duct. Temperature is also measured via these sensors. The Vari-Green transmitter can receive up to 32 individual flow sensors measuring airflow in a single duct, and it generates the outputs, including network and analog signals, which are conveyed to a local controller or BMS.

Physical installation details for the probe array or flow stations can be found in Greenheck's Installation Instructions.

Typical Vari-Green Installation



SECTION 2.0: Specifications

2.1 PROBE ASSEMBLY

INDIVIDUAL SENSOR ACCURACY

Velocity: ±2% of reading from 0-5000 FPM

Temperature: ±0.1° F

Multi-point NIST traceable calibration of both temperature and velocity

SENSOR TYPE

Hermetically sealed, precision matched thermistors with laser trimmed resistive heating element mounted in flow conditioning aperture.

Max number of sensors per probe: 8

Max number of sensors per transmitter: 32

SENSOR SIGNAL PROCESSING

Sensor signal processing at the probe with RS-485 communication to the transmitter

MOUNTING

Insertion probe mounting via 4 in. x 4 in. aluminum plate, ¼ in. closed cell neoprene gasket and end support stud for probes longer than 18 in.

MATERIALS OF CONSTRUCTION

1.125 in. diameter anodized aluminum probe with aluminum probe connection box

ELECTRICAL CONNECTIONS

Probe-to-probe connection via plenum rated cable with mini-DIN Snap & Lock connector for signal and power

Probe-to-transmitter connection via a single plenum rated cable with mini-DIN Snap & Lock connector

Cable Length: 10 ft. typical, up to 100 ft. optional (cables can be field terminated to length)

PROBE SIZE RANGE

8 in. to 120 in. dimension length

2.2 VARI-GREEN® TRANSMITTER SERIES

SENSOR DENSITY

Maximum number of sensors per transmitter is

32 total sensors per probe array or measurement station

DISPLAY

Backlit ¼ VGA Color TFT LCD display, 2.75” X 2.0”

Configuration Access:

Field programmable menu driven user interface accessed via four button membrane keypad. Field selectable in U.S. or S.I. units for flow, velocity and temperature.

POWER SUPPLY

24 VAC (20-28 VAC) or 24 VDC (20-40 VDC), isolated and fused with reverse polarity protection

16-50 VA, varies based on the quantity of sensors

(1-32) in the probe array or station

OUTPUT SIGNALS PROVIDED

Dual analog outputs, field selectable via menu for 0-5 VDC, 0-10 VDC, or 4-20 mADC

Field adjustable analog output scaling of airflow velocity and temperature

Velocity Range:

0 to 5,000 FPM in Ducted Applications

Temperature Range: -20° to 140° F

AMBIENT CONDITIONS

Temperature Limits: –20° F to 180° F Storage, -20° to +140° F Operating

Humidity: 0 to 99.9% RH, non-condensing

ENCLOSURE

NEMA 1 aluminum with hinged cover

APPROVALS

UL 60730 PENDING

BTL

FCC Part 15 Subpart B, Class A Device

SECTION 3.0: Installation

3.1 INSPECTION

Carefully remove the Vari-Green probe(s) or station and transmitter from the shipping container and inspect for any damage.

IMPORTANT: All Vari-Green transmitters are factory configured with the application specific duct size and flow rate information. The transmitter and probes or flow station are tagged with matching ESID and/ or customer specific identification. Matching the systems as configured by the factory will reduce the installation and start-up labor required.

Review the Factory Set-Up Information Sheet provided separately and verify that the W.O. # and serial # match those on the Vari-Green system. Verify that the configuration recorded on the Factory Set-Up Information Sheet is correct for your application. If any damage has occurred in transit or the factory set-up configuration is incorrect for your application, please contact Greenheck at 1-800-717-6540.

3.2 INSTALLATION LOCATION GUIDELINES

The standard version of the Vari-Green transmitter and probe connection heads have a NEMA 1 enclosure rating suitable for clean and dry indoor locations. For additional protection, an enclosure with an adequate NEMA rating may be required.

The ambient temperature of the selected mounting location must be between -20°F and 140°F. Consideration should be given to units exposed to direct sunlight.

The selected mounting location should be rigid and free of vibration.

3.3 TRANSMITTER PLACEMENT AND MOUNTING

For placement of transmitter, see instruction manual at www.greenheck.com, 478799 AMD-XX-TD IOM.

3.4 POWER and SIGNAL CONNECTIONS

NOTE: The Vari-Green transmitter terminal connections for power and signal wire are labeled on the board for installation convenience. Power wiring is located at terminal strip J4. Signal wiring is located at terminal strip J1.

The REMOVABLE* terminal strips for power and signal are located in the lower portion of the transmitter and are accessible by opening the hinged cover. (See figure below for the exact location of the terminal strips.) Two conduit openings are provided in the bottom of the transmitter enclosure; one for power and one for signal wiring.

Recommended wire gauge (14 AWG is the maximum wire gauge - no more than two wires recommended per terminal):

Power wire = 14 AWG to 18 AWG
Signal wire = 14 AWG to 22 AWG

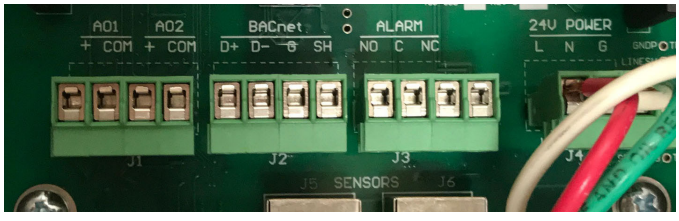
* To aid in the wiring of both power and signal wires, J1 and J4 are removable by pulling the terminal strip straight up and off the circuit board. Once wiring has been completed, replace the terminal strip by aligning it with the receptacle and inserting firmly.

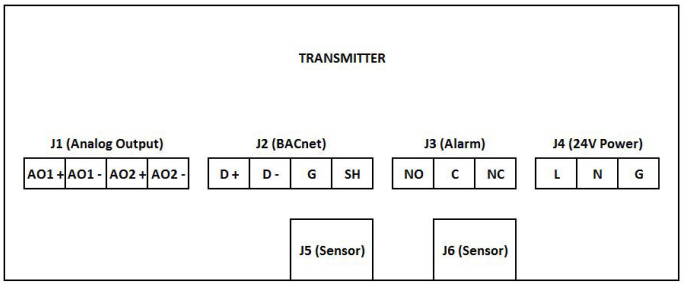
WARNING: The Vari-Green transmitter is a low voltage device (24V AC/DC). Connecting the transmitter to high voltage power (e.g. 110 VAC) may cause damage and will void the warranty.

Power Connections: Terminal J4, pin 1 for Line, pin 2 for Neutral and pin 3 for Ground. See figure below for details. The Vari-Green can be powered by either 24VAC providing 20-28VAC or 24VDC providing 20-40VDC.

CAUTION: The earth ground is required on all Vari-Green transmitter installations. Omitting the connection to earth ground could result in poor performance and may void the warranty.

Analog Outputs: Terminal J1; AO1 pins 1 and 2; AO2 pins 3 and 4. Pins 2 and 4 are for the common wire of the respective output. See figure below for details.





Section 4.0: Configuration

4.1 CONFIGURATION

All device configuration is done using the four button membrane keypad on the transmitter cover. Individual key functions depend on specific menu selection. The basic key functions include:

ENT: Enters menu item from main or service menu; moves cursor to next item when in submenu

ESC: Exits current page or submenu item

UP Arrow: Moves cursor “up” through main and service menu; changes character in submenu items

DOWN Arrow: Moves cursor “down” through main and service menu; changes character in submenu items

MAIN MENU OR SERVICE MENU: ENT opens the highlighted submenu. UP and DOWN move the selection cursor between submenus.

Submenu: ENT moves selection cursor to the next item. UP and DOWN change state of item or change characters in writable fields.

Density Compensation	Select density compensation type for flow output (Actual or Standard CFM)
Select System of Units	Select system of units (US or SI)
Flow Configuration	Select and configure flow and application parameters
Display Configuration	Select parameters of display screen
Analog Output Configuration	Configure analog output type, value and averaging filter
Display Averaging Filter	Configure display averaging filter
Zero Lockdown	Adjust zero lockdown (below a FPM set point, drives display and output to zero)
Alarm/Alert Configuration	Configure alarm type, upper and lower limits
Network Configuration	Configure network type, baud rate and address information
Field Characterization	For information on field characterization, please see section below

Password Configuration	Enable/disable and change password
Total System Scan	Displays sensor enabled/disabled status
Sensor Control	Enable or disable system sensors
Sensor Data Scan	Displays individual sensor data
Sensor Alert Scan	Displays alert codes for each sensor
Custom ID	Configure ID (tag) of unit
Restore Factory Setting	Restores display settings to original factory setup
Product Information	Displays product information (Serial number, Work Order #, etc.)

MAIN MENU

Density Compensation - Density compensation can be selected to be actual flow or corrected to standard conditions. Default factory setting is for actual conditions. The Vari-Green also allows for inputting the site elevation, which will add density compensation for average atmospheric pressure based upon elevation above sea level.

Select System of Units - US or SI units can be selected. US units will display in CFM and degrees Fahrenheit. SI units will display in L/S and degrees Celsius.

NOTE: When changing between US and SI units, the flow configuration information will need to be converted and updated. This is not done by the transmitter. The user must convert and input.

Flow Configuration

The flow configuration menu provides access to modify the application specific parameters.

NOTE: All transmitters are factory configured for the intended application – Changes to the factory configuration should not be required. A Factory Set-Up Sheet is provided with each transmitter and provides the details for all factory configured parameters.

The **measurement type** for all Greenheck Vari-Green applications will be selected as ducted. One transmitter accepts up to 32 sensors.

Ducted:

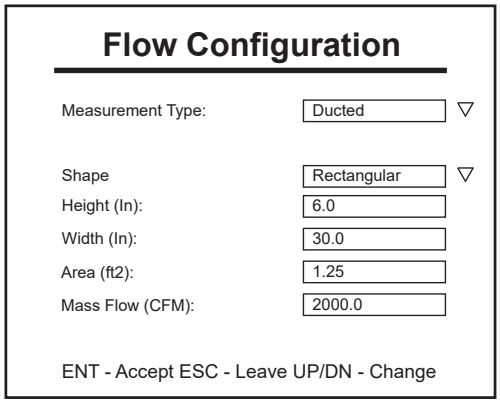
Select the proper duct shape

(Rectangular, Flat Oval or Circular).

Enter the duct dimensions (inches or millimeters).

Area (cross-sectional duct area) is automatically calculated.

Enter the Max Flow (maximum airflow) in CFM or L/s.



Display Configuration

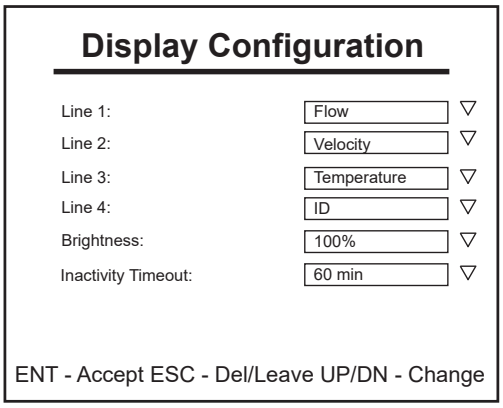
This screen allows the user to set parameters on various lines of the display. There are four display lines on the Vari-Green.

Line 1 - Flow (typical), Velocity or Temperature.
Line 2 - Velocity, Flow or None.
Line 3 - Temperature, Flow or None.
Line 4 - Custom ID or None.

A custom ID can be entered through the Service Menu. It is typically used to describe the transmitter location in the building.

Brightness - Allows the user to set the brightness of the display in real time.

Inactivity Timeout - The time period which holds the display in menu mode. When the timer expires, the display is returned to the main display screen showing the process values.



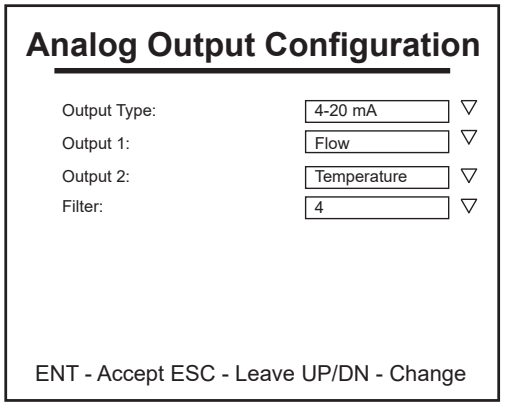
Analog Output Configuration

The Vari-Green transmitter is equipped with dual analog outputs. The Analog Output Configuration menu configures the analog output type, parameter and filter.

Output Type: 4-20 mADC, 0-5 VDC or 0-10 VDC

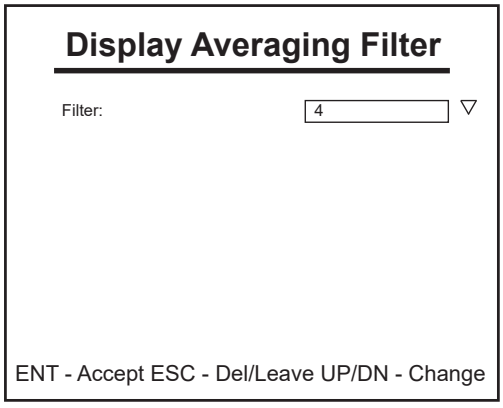
Output 1 and 2: Flow, Velocity or Temperature

The **Filter** has a minimum setting of 0 to a maximum setting of 10. To disable the Filter, select Off.



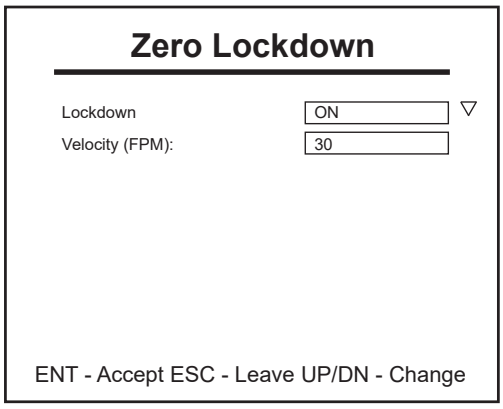
Display Average Filter

The Display Averaging Filter filters the data shown on the display. It affects all elements of the display. The Filter has 1-10 settings - 1 is the lightest filter, and 10 represents the heaviest filter. It also has an 'Off' setting.



Zero Lockdown

Zero Lockdown will drive the displayed flow and velocity, as well as the associated outputs to zero when the velocity is below the set point. As very low air velocities tend to be noisy and unstable, it may be best for control purposes to raise the zero lockdown velocity to an appropriate threshold above that which the velocity is steady and reliable.

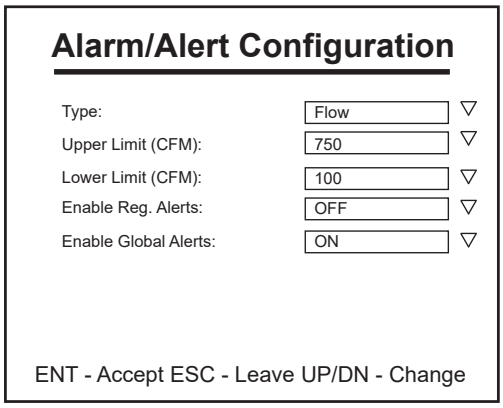


Alarm/Alert Configuration

The Alarm/Alert Configuration menu provides access to select and configure the transmitter alarm and alerts. Alarm type can be either flow or temperature with Upper and Lower limits. The transmitter alarm controls an onboard relay. Alerts are messages possibly indicating issues with sensors or the transmitter.

Alarm Operation: If the process value (Type) exceeds the Upper or Lower Limit, the relay will change state from the default of NO or NC and the Type will change to red. When the process value recovers to be within the Upper and Lower Limits, the relay will return to the default state and the Type will return to black. The Limits Units are shown in parentheses. These units are controlled by the System of Units and the Units of Measure. If the units are US and the flow is CFH, CFH will be the units used in Limits.

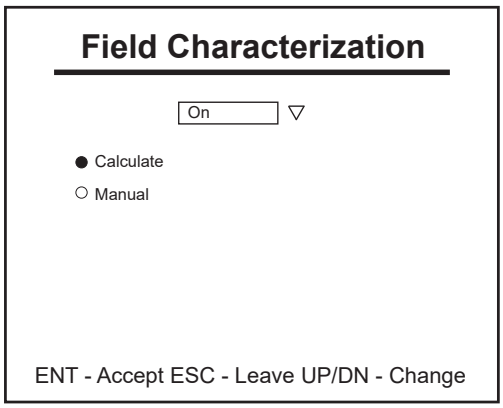
Alert Operation: Enable Reg. Alerts will turn ON / OFF
Enable Global Alerts will turn ON / OFF



Field Characterization

Field characterization (K-factoring) of a flow element is the adjustment of the flow measurement system to match a known reference measurement, (most commonly airflow traverse testing.) Field characterization is typically done when there is insufficient straight duct run or another issue that creates questionable output from the installed measurement system.

A Field Characterization can be developed from one, two or three reference flow rates – more could be used, but are not necessary. One traverse test is required for each flow rate. It is recommended that a minimum of a low and a high flow rate are used to determine a Field Characterization. If there is little to no variance in the normal flow rate, it is feasible to use a Field Characterization developed from a single flow rate test. If a high and low flow rate test are performed and it is found that these readings are substantially different, then a medium flow rate should be considered to ensure a more accurate Field Characterization. For any questions or concerns regarding Field Characterization implementation, please contact Greenheck.



Field Characterization

On enables the Field Characterization and the selection of **Calculate** or **Manual**. The **Calculate** selection will display the on-board calculator that will determine the K-factor (device and reference data must be in-hand and ready to input). **Manual** displays the Exponent and Gain value forms for inputting externally determined Exponent and Gain values.

Calculate

Number of Points is the number of flow reference points. Each point is one reference flow rate (determined by traverse testing or other) and the associated Vari-Green system flow rate. The traverse testing flow rate for these reference points is performed before entering this screen and is written down with the associated Vari-Green point (flow rate). For most applications, a minimum of two points (low and high flow rates) are recommended for an accurate Field Characterization. Three points may be required.

Electra Point refers to the flow rate measured by the transmitter, and Reference Point refers to the flow rate measured externally. Electra Point 1 and Reference Point 1 will be the flow rates for the first test, Points 2 for the second test and Points 3 for the third test. Best practice will be to go from the lowest to highest flow rates when inputting this data. Once all data has been entered and the **ENT** button is pushed for the final Reference Point, the Calculator will display the calculated gain and exponent values.

NOTE: Whenever a system is being retested in order to determine a new Field Characterization (K-factor), the existing Field Characterization should be turned off prior to testing.

Manual

Selecting Manual will allow inputting of externally determined Gain (K) and Exponent (E) values, where:

Flow (corrected) = K x Flow (uncorrected) ^ E

Note: A Gain (K) only Field Characterization (K-factor) can be achieved with an exponent (E) value = 1.0.

SERVICE MENU

Total System Scan

Displays the current status of all of the system sensors, thus allowing the user to quickly verify all is operating properly. Expected (white) and Enabled (green) sensor values should be the same unless sensors have been intentionally Disabled (red). See below for sensor control. If Missing (yellow) is at a value other than zero, the transmitter is not communicating with the associated node.

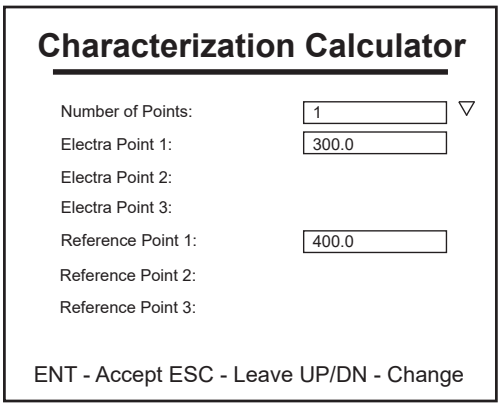
Sensor Control

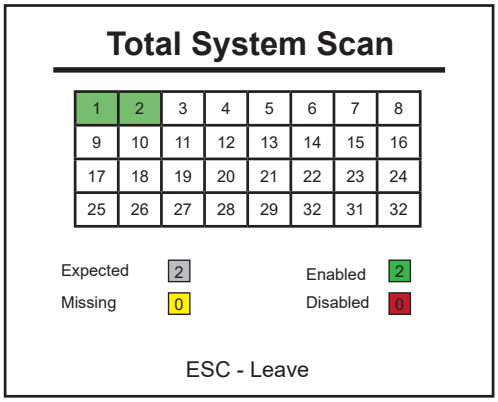
An enabled sensor will report measurement data to the Vari-Green transmitter. This is the default condition after initially powering the system. A disabled sensor will not report measurement data to the Vari-Green transmitter. Disabled sensors may have a malfunction that causes this condition. It may also be desirable to intentionally disable a sensor for troubleshooting purposes. A known bad or suspect sensor can be disabled to remove it from the flow and temperature averages until it can be evaluated and/or repaired if necessary.

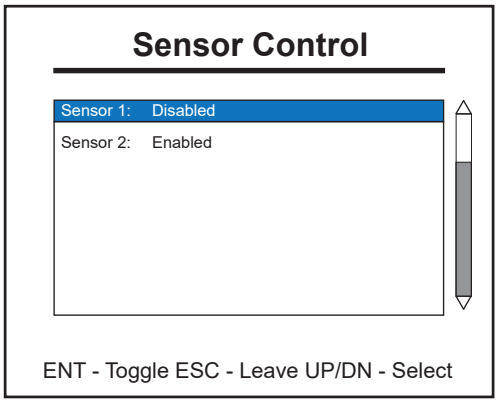
Sensor Data Scan

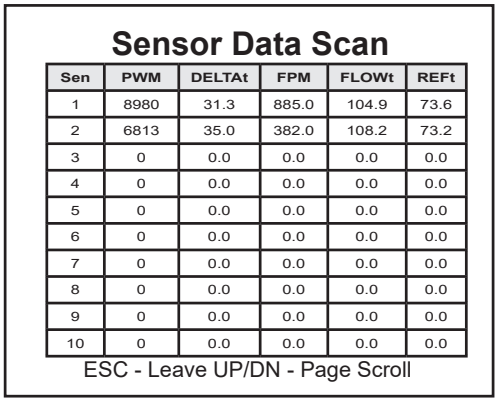
Displays sensor number (Sen), power input to sensors (PWM), temperature difference between flow and temperature sensors (DELTAt), velocity (FPM), flow temperature sensor (FLOWt) and the reference temperature sensor (REFt).

This data display screen can be used to further evaluate and troubleshoot the system performance and the application characteristics; e.g., the individual sensor velocities and temperatures will provide comprehensive data regarding the flow profile measured.









Sensor Alert Scan

Displays alert codes for expected sensors. Sensors operating properly will display NoAlert.

Sensor Alert Scan

SENSOR	ALERT CODE	FREQ
1	Disabled	41
2	NoAlLert	

ESC - Leave UP/DN - Scroll

Other Alert Codes

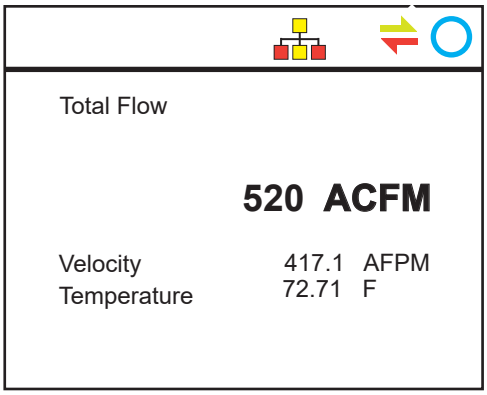
Alert Code	Type	Description	Corrective Action
Missing	ALERT	Transmitter cannot communicate with Sensor	Power cycle system and recheck.
SensA0OR or SensB0OR	ALERT	Sensor fault	Replace sensor. Contact Greenheck.
DeltaOOR	ALERT	Sensor Delta Temperature out of range	Contact Greenheck.
TempOOR	RANGE	Temperature measurement out of range (-20 to 140°F)	Verify application temperature is not outside -20 to 140°F. If Vari-Green appears to be reporting incorrectly, contact Greenheck.
Disabled	ALERT	Sensor resets abnormally	Power cycle system and recheck.
VelOOR	RANGE	Average velocity exceeds 5000 FPM for ducted and 10,000 FPM for Fan Inlet	Verify factory set-up information is correct. If application velocity exceeds 5000 FPM, contact Greenheck.

4.2 START-UP / OPERATION

After power and signal wiring has been verified in accordance with section 3.4, activate the external 24 VAC / 24 VDC power source.

1. Press the power button located on the bottom left corner of the front cover to turn the system ON.
2. The display will show a loading bar. After reaching 100%, the display will indicate which sensors have been discovered for approximately 2 seconds. Then the normal operating screen will be displayed.

The default normal operating screen will display Total Flow on the first process line, Velocity (average of all enabled sensors) on the second process line and Temperature (average of all enabled sensors) on the third process line. Application tagging information is at the bottom of the screen and is customer configurable.



The following icons will always be displayed at the top of the normal operating screen. Press **ENT** to enter menu screens. Follow instructions in section 4.1 to navigate.

Send/Receive arrows flashing indicates the sensor(s) and transmitter are communicating normally

Transmitter processor normal

Field Characterization has been turned on

4.3 ANALOG OUTPUT SIGNALS

Airflow: Available on connector J1, terminals AO1+ and AO1- or AO2+ and AO2-. The full scale output

is equal to Max flow as inputted into the Vari-Green transmitter on the Flow Configuration submenu.

Temperature: Available on connector J1, terminals AO1+ and AO1- or AO2+ and AO2-. The temperature analog output has a fixed scale of -20° F to 140° F.

SECTION 5.0: Maintenance / Inspections / Troubleshooting

5.1 MAINTENANCE / INSPECTIONS

The Vari-Green system has been designed to operate in most HVAC applications without the need for periodic maintenance or calibration. In some applications, it may be necessary to perform a visual inspection of the probe and sensors, and if necessary clean them using a soft, small brush and/or compressed air to remove any accumulated particulate or debris.

5.2 TROUBLESHOOTING

The Vari-Green system is intended to provide long-term, trouble-free operation. In the event there is an issue with the Vari-Green measurement system, or the BMS or the controller ceases to receive valid airflow and/or temperature signals, make certain the following have been checked and confirmed:

- The power wiring is securely connected to the proper terminals and is providing the intended 24V AC/DC power.
- The signal wiring is securely connected to the proper terminals.
- The probe-to-probe and probe-to-transmitter cables and connections are properly connected and secure.
- Power cycles the transmitter.

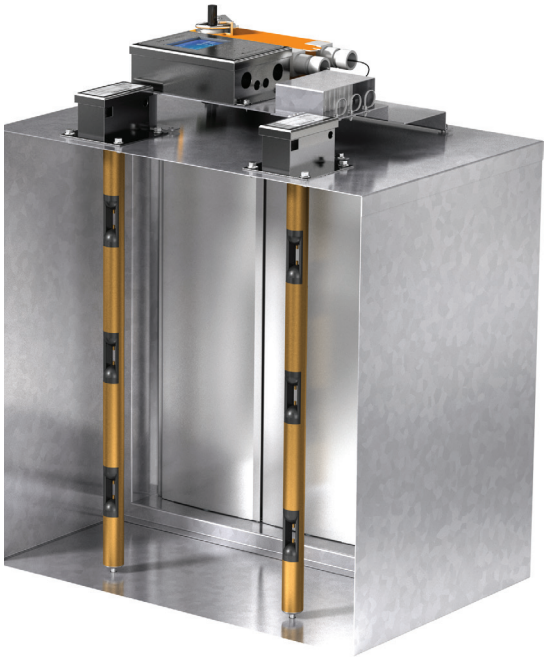
If after following the above troubleshooting steps, the Vari-Green system continues to operate improperly, contact Greenheck for technical assistance.

Our Commitment

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.
Specific Greenheck product warranties are located on greenheck.com within the product area tabs and in the Library under Warranties.

GREENHECK
Building Value in Air.

Phone: (715) 359-6171 • Fax: (715) 355-2399 • E-mail: gfcinfo@greenheck.com • Website: www.greenheck.com



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P.O. Box 410 • Schofield, WI 54476-0410 • 715.359.6171 • greenheck.com

May 2017