Digital TrueFlow® Grid
HVAC System Air Flow Meter

Operation Manual

T·E·C
THE ENERGY CONSERVATORY

The Energy Conservatory
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ENERGY CONSERVATORY WARRANTY

EXPRESS LIMITED WARRANTY:

Seller warrants that this product, under normal use and service as described in the operator's manual, shall be free from defects in workmanship and material for a period of 24 months, or such shorter length of time as may be specified in the operator's manual, from the date of shipment to the Customer.

LIMITATION OF WARRANTY AND LIABILITY:

This limited warranty set forth above is subject to the following exclusions:

- **a)** With respect to any repair services rendered, Seller warrants that the parts repaired or replaced will be free from defects in workmanship and material, under normal use, for a period of 90 days from the date of shipment to the Purchaser.
- **b)** Seller does not provide any warranty on finished goods manufactured by others. Only the original manufacturer's warranty applies.
- **c)** Unless specifically authorized in a separate writing, Seller makes no warranty with respect to, and shall have no liability in connection with, any goods which are incorporated into other products or equipment by the Purchaser.
- **d)** All products returned under warranty shall be at the Purchaser's risk of loss. The Purchaser is responsible for all shipping charges to return the product to The Energy Conservatory. The Energy Conservatory will be responsible for return standard ground shipping charges. The Customer may request and pay for the added cost of expedited return shipping.

The foregoing warranty is in lieu of all other warranties and is subject to the conditions and limitations stated herein. No other express or implied warranty IS PROVIDED, AND THE SELLER DISCLAIMS ANY IMPLIED WARRANTY OF FITNESS for particular purpose or merchantability.

The exclusive remedy of the purchaser FOR ANY BREACH OF WARRANTY shall be the return of the product to the factory or designated location for repair or replacement, or, at the option of The Energy Conservatory, refund of the purchase price.

The Energy Conservatory's maximum liability for any and all losses, injuries or damages (regardless of whether such claims are based on contract, negligence, strict liability or other tort) shall be the purchase price paid for the products. In no event shall the Seller be liable for any special, incidental or consequential damages. The Energy Conservatory shall not be responsible for installation, dismantling, reassembly or reinstallation costs or charges. No action, regardless of form, may be brought against the Seller more than one year after the cause of action has accrued.

The Customer is deemed to have accepted the terms of this Limitation of Warranty and Liability, which contains the complete and exclusive limited warranty of the Seller. This Limitation of Warranty and Liability may not be amended or modified, nor may any of its terms be waived except by a writing signed by an authorized representative of the Seller.

TO ARRANGE A REPAIR: Please call The Energy Conservatory at 612-827-1117 before sending any product back for repair or to inquire about warranty coverage. All products returned for repair should include a return shipping address, name and phone number of a contact person concerning this repair, and the purchase date of the equipment.

Table of Contents

Chapter 1 Introduction

The total air flow through residential HVAC systems is an important variable in estimating and optimizing the performance of heat pumps, air conditioners and furnaces. Numerous field studies of installed heating and cooling systems around the United States have found that often air flow is not properly set to maximize performance across the indoor coil is an extremely common problem. Low air flow can lead to decreased heating and cooling system capacity, increased energy use and comfort problems.

The most widely used methods for estimating the air handler flow rate, (the temperature rise method, static pressure and fan curve method, and the DuctBlaster® isolated return method) have been found to be either problematic or time-consuming to perform. The Energy Conservatory's Digital TrueFlow® Grid is designed to provide a simple and accurate measurement of air flow through residential air handlers rated from 1 to 5 tons. The TrueFlow® Grid can be used in various ways inside the typical air handler system to gather data when following the manual for the airflow measurements procedures.

Note: If the return duct system is very airtight, the air flow through the central return will be very close to the total air handler flow.

Extensive field testing of the TrueFlow® Grid has shown that it:

- Is easy and fast to use in the field. The TrueFlow® Grid provides direct CFM readings in approximately 5 to 10 minutes without extensive calculations or setup.

- Can be used in a wide range of applications and air handler fan configurations. Accessories of the TrueFlow® Grid allows it to fit most if not all applications.

- Has a flow accuracy of +/ 5% for most applications if there are 6 inches upstream and 2 inches downstream from the grid free from obstructions

- Can only be used with a TEC DG-8 or DG-1000 Bluetooth pressure gauge which has a resolution of 1 Pascal or 0.005 inH_2O or better.

Chapter 2 System Components

The Digital TrueFlow® Flow Meter consists of the following components:

- 1 digital Grid
- 1 static pressure probe.
- 10 feet of blue tubing and 10 feet of green tubing.
- QR scan operation manual.
- Carrying case.
- USB-C charger.
- 1 to 8 adapter plate(s) which allow the grid to be used in multiple filter sizes
- A DG-8 Bluetooth digital pressure gauge (Optional purchase) or a DG-1000 Bluetooth blower door pressure and flow gauge (Optional purchase)

2.1 Grid

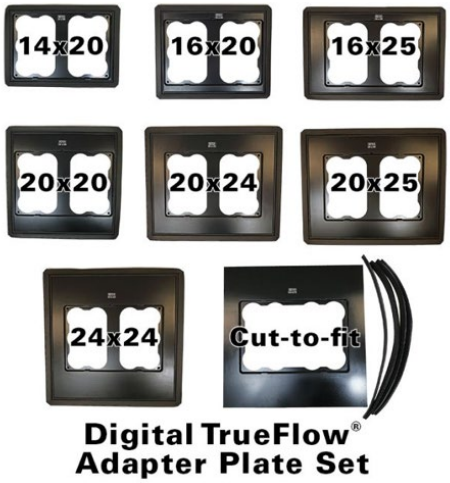
The TrueFlow® Grid is constructed from durable plastic with a series of round metering holes, a flow sensor and Bluetooth transceiver.

The Grid is generally intended to be installed in place of the system air filter but can be used anywhere in the return where it can capture total system air flow. The front side of the Grid, as shown in Figure 1, should be facing into the direction of the airflow stream and will be labeled as “AIR IN”.

Figure 1: Front Side of Grid (should face into air flow)

2.2 Adapter Plates

The TrueFlow® Grid can be installed in various adapter plates; each adapter plate consists of a stamped plastic plate with integrated locking tabs for the digital Flow Grid. Along the outer edge of each plate is a gasket to ensure a proper seal for no airflow bypass.
The Grid has optional adapter plates available for purchase and custom plates are available for order upon request.



2.3 Static Pressure Probe

The TrueFlow® Grid comes with one static pressure probe. During the air flow measurement procedure, the operator will need to measure the operating pressure in the duct system, both with the existing filter in place and with the TrueFlow® Grid in place. These two operating pressure measurements are used to adjust the measured air flow through the Grid for differences in resistance between the existing filter and the TrueFlow® Grid. Multiple locations can be used to make the static pressure measurements. Details of these locations are shown in appendix C.

2.4 Gauge Options

To use the TrueFlow® Grid, the operator will need a TEC digital Bluetooth pressure gauge with a resolution of 1 Pascal (or 0.005 In. H_2O) minimum. The TrueFlow Meter can be purchased with any of The Energy Conservatory's Digital Pressure Gauges (Models DG-8 and DG-1000). **See Figure 2 for more details.**

2.4.a DG-1000 Digital Pressure Gauge:

The DG-1000 is a digital dual channel manometer. This meter is shipped in a separate padded case along with a charging cable with various 110V adapters, tubing, and a static pressure probe. With the integrated magnets on the back of the gauge, this meter allows for easy mounting to any metallic surface. The DG-1000 gauge provides an air flow measurement accuracy of +/- 5% when used with the TrueFlow® Grid and corresponding TrueFlow® app with Bluetooth connectivity.

2.4.b DG-8 Digital Pressure Gauge:

The DG-8 capable pressure gauge has a single pressure sensor with the option to switch from inches of water column to pascals with the press of a button. The digital gauges are shipped in a separate padded case and has integrated magnets on the back of the gauge to allow for easy mounting to any metallic surface. The DG-8 provides an air flow measurement accuracy of +/- 5% when used with the TrueFlow® Grid and corresponding TrueFlow® app while Bluetooth connectivity.

2.5 Equipment Charging

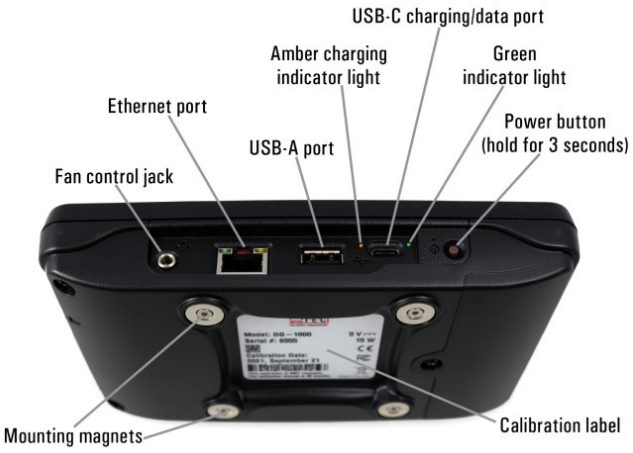
The Grid, DG-1000, and DG-8 have rechargeable capabilities.

2.5.a Charging the Grid

The Grid is equipped with a USB-C charging port located at top center of the Grid. The Grid is also equipped with a green led indicator representing charging connection and a yellow led representing…

2.5.b Charging the DG-8 and DG-1000:

The DG-8 and DG-1000 have a USB-C charging port located at top of the gauge



Chapter 3 TrueFlow Test Procedure

The flow metering process using the Digital TrueFlow® Grid is completed following the free TrueFlow® app, available in IOS and Android. The app provides a step-by-step workflow for taking the total system air flow measurement with detailed process aligned to the specific system being measured.

To measure total system air flow, it is best practice to install the TrueFlow® Grid in a filter slot as close to the blower fan as possible to minimize the impact of duct leakage on the measurement.

A TrueFlow® Grid can be installed in the return duct system using the filter slot, filter grille or through other accessories which allow the grid to capture the total air flow in the return.

In a system with multiple grille returns, an accepted practice is to block off the smaller return(s) and use the TrueFlow® grid on the largest return, ensuring all the system airflow is passing through the grid. The TrueFlow® app will complete the corrected flow calculation and inform the user if this calculated air flow is within accepted range to meet stated accuracy specifications. If it is outside the accepted range, it will alert the user and an alternate workflow can be pursued.

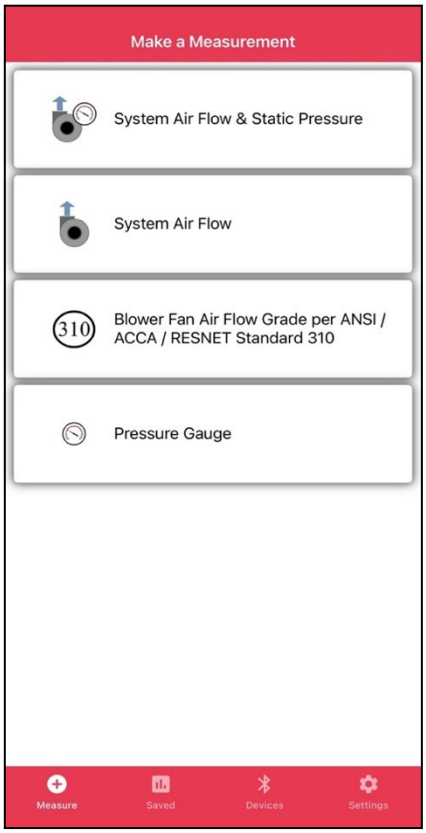
There are four workflows supported in the TrueFlow App.

System Air Flow & Static Pressure is the most commonly used and provides a detailed analysis of the entire HVAC system, including the ability to diagnose issues within the entire ducted system.

System Air Flow is a workflow focused on only capturing the system air flow.

Blower Fan Air Flow Grade per Standard 310 also measures air flow, but with a specific process and report aligned to ANSI/ACCA/RESNET standard 310 for grading new HVAC installations.

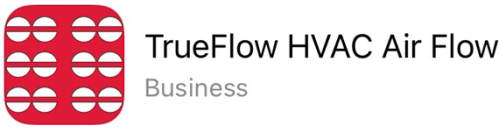
Pressure Gauge is a workflow which allows the user to capture static pressure readings in the app



3.1 Outline of TrueFlow® Measurement Using TrueFlow® app

Following the TrueFlow® app:
See Appendix A for sample of flow & pressure workflow
See Appendix B for sample of ANSI/ACCA/RESNET 310 workflow

1. Install and open TrueFlow® app from IOS or Android store.



2. Power up the digital TrueFlow® Grid and DG-8 gauge by holding the power button (white button on the left of the devices) until the green light flashes. If using a DG-1000 hold down the power button on top of the gauge.
3. Select a workflow from the measure screen.
    a. System Air Flow & Static Pressure
    b. System Air Flow
    c. Blower Fan Air Flow Grade per Standard 310
    d. Pressure Gauge
4. Select Grid and digital gauge from the device screen.
    a. Select the + to connect, Select the – to disconnect from a device.
5. Select the proper indoor unit type.
6. Select the orientation of indoor unit installation.
7. Choose applicable system detail selections
8. Read test instructions and if necessary, prepare indoor system for test.
9. Follow TrueFlow® app prompts and capture static pressure measurement(s) as directed by illustrations on TrueFlow app. See appendix B for more details on taking static pressure measurements.
10. TrueFlow app will prompt user to remove filter and install TrueFlow® Grid with chosen accessory. See appendix C for more details on installing the TrueFlow® Grid in various system locations.
11. Save test
12. Select the create report icon at the bottom of the system performance screen.
    a. On the create report screen enter customer information, address, user/company info.
    b. Once create report is selected, the next following screen will show a document of all the collected and input data specific to the task at hand. By clicking the share button, the user can send this document via email. Selecting close will default back to the create report screen.

Appendix A

Process and options for measuring static pressure

a) Locate the air handler system filter and replace if dirty,

Locate the air handling system filter and if it is dirty, replace with a new one. A dirty filter can significantly reduce air flow through the air handling system.
Note: If you wish to measure the air flow with the dirty filter, leave the dirty filter in place.

b) Open all registers and outside window.

Make sure all supply and return registers are open. Open a window or door between the building and outside to prevent pressure changes in the building during the test. If the air handler fan is installed in an unconditioned zone (e.g., crawlspace, attic), open any vents or access doors connecting that zone to the outside (or to the building) to prevent pressure changes in the zone during the test.

c) Options for location of static pressure measurements for compensating TrueFlow measurements

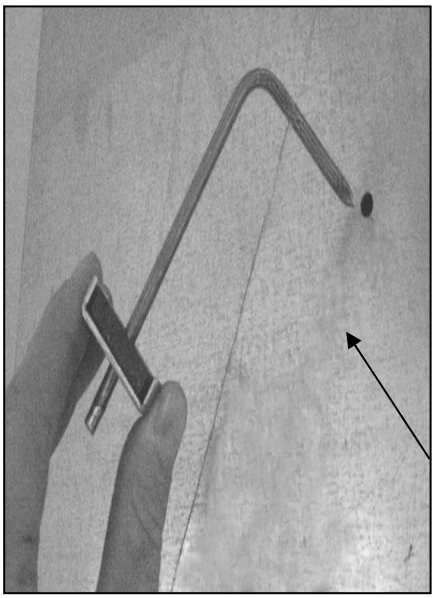
Install the static pressure probe into the ductwork according to the TrueFlow® app workflow selection (the operator will typically need to drill or punch a small hole in the ductwork in order to insert the static pressure probe):

- Insert the static pressure probe into the side surface of the supply plenum. The static pressure probe should point into the airstream.

- Or, insert the static pressure probe in the side surface of the return plenum. The side of the return plenum chosen should **not** have a trunk line, return duct or return register connected to it. The static pressure probe should point into the airstream.

  Note: If the Grid will be installed at a remote filter grille, the static pressure probe may not be installed in the return plenum (i.e. install it in the supply plenum).

- Or, insert the static or total pressure probe in the supply register approx. 2.5 inches upstream of the grille. In this mode, the app will ensure the pressure reading is high enough to provide an accurate calculation of flow to accuracy of 7% or better (vs. 5% or better for other locations). If the app is not seeing high enough pressure, it will alert the user and suggest trying another register or measure in the supply plenum.



d) Connect the static pressure probe to a pressure gauge.

Connect one end of the static pressure probe to the 10-foot length of tubing. Now connect the remaining end of the tubing to the positive (+) end of the pressure gauge. **Note:** If you are using the "dead-end" corner location, you may simply insert the end of the tubing into the "dead-end" corner and not use a static pressure probe.

- **DG-1000**

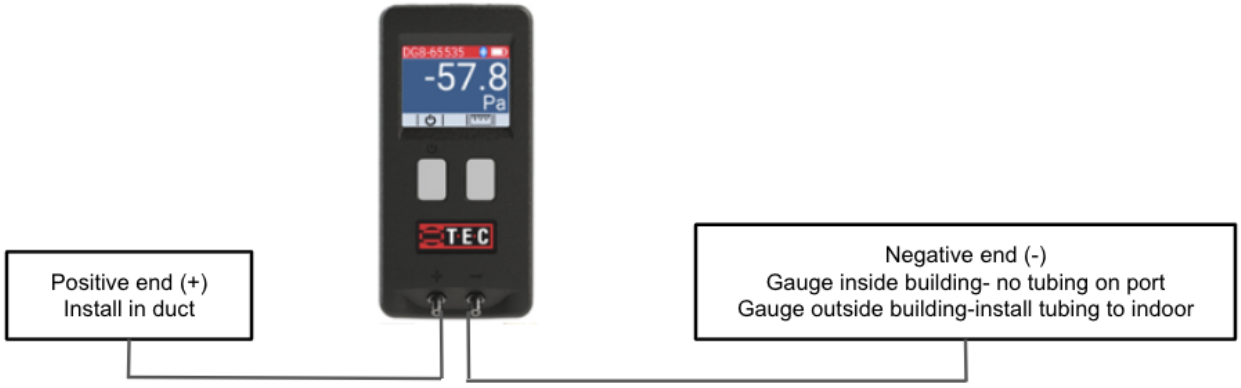
If using a DG-1000 digital pressure gauge, connect the end of the blue tubing to the “INPUT” end of **Channel A** pressure tap. If the pressure gauge is located inside the house, leave the **Channel A Reference** tap on the gauge open (we want to measure the system operating pressure with reference to the house). If the pressure gauge is not located in the house (e.g., it is in the crawlspace, garage, or attic), run the 30-foot piece of clear tubing from the **Channel A** Reference “REF” tap to inside the house. **See figure 5.**

Figure 5: Connecting the Static Pressure Probe to a DG-1000

- **DG-8**

If using the DG-8 digital pressure gauge, connect the end of the blue tubing to the positive end (+) input pressure tap. If the pressure gauge is located inside the house, leave the negative end (-) reference tap on the gauge open (we want to measure the system operating pressure with reference to the house). If the pressure gauge is not located in the house (e.g., it is in the crawlspace, garage, or attic), run the 30-foot piece of clear tubing from the negative end (-) reference tap to inside the house. See figure 6.

Figure 6: Connecting the Static Pressure Probe to a DG-8



Appendix B

Installation Options of The Grid

Installation Notes

- Obstructions within 6 inches upstream or 2 inches downstream of the Grid that are blocking air flow through any of the metering holes may reduce the accuracy of the device.
- If there is an obstruction, try to install the Grid in one of our other various acceptable locations.

Installing at a Filter Slot:

If using in place of filter, remove the existing filter and slide the TrueFlow® Grid with the corresponding adapter plate completely into the empty filter slot. Install the Grid so that the front side of the plate is facing into the air flow (front side has the wording “AIR IN” in the middle of the plate). The adapter plate gasket should provide a seal around the cabinet - all the air flow should pass through the Grid and not around the plate. If you wish to install the Grid in a blower compartment and there is no filter slot built into the compartment, it is sometimes possible to temporarily tape the Grid into the compartment for the test procedure. In this case, be sure that the tape is not blocking any of the metering holes in the plate. Close the filter access opening. Temporarily seal around the filter slot cover with masking tape to prevent air leakage and to direct all air flow through the Grid.

Installing with multiple Filter Slots:

If using in place of filter, remove the existing obvious main filter and slide the TrueFlow® Grid with the corresponding adapter plate completely into the empty filter slot. Install the Grid so that the front side of the plate is facing into the air flow (front side has the wording “AIR IN” in the middle of the plate). The adapter plate gasket should provide a seal around the cabinet - all the air flow should pass through the Grid and not around the plate. If you are installing the TrueFlow® Grid at the filter grille of a multiple return duct system, when the TrueFlow® app prompts the user to remove filter and install the Grid, the user should install the Grid in the most obvious main return and blank off the additional return(s), ensuring all system air flow passes through the Grid. If you wish to install the Grid in a blower compartment and there is no filter slot built into the compartment, it is sometimes possible to temporarily tape the Grid into the compartment for the test procedure. In this case, be sure that the tape is not blocking any of the metering holes in the plate. Close the filter access opening. Temporarily seal around the filter slot cover with masking tape to prevent air leakage and to direct all air flow through the Grid.

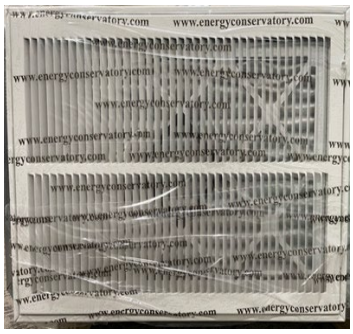
Note: If the TrueFlow® app registers low flow, then the operator may need to use another method to obtain more system air flow through the plate.

Installing at a Single Central Return:

If you are installing the TrueFlow® Grid at the filter grille of a single return duct system, simply push the plate into the empty filter rack when prompted by the TrueFlow app. Install the Grid so that the front side of the plate is facing into the air flow (front side has the wording “AIR IN” in the middle of the plate). The adapter plate gasket should provide an airtight seal around the filter grille housing - all the air flow should pass through the Grid and not around the plate. Keep the filter grille door open during the remainder of the test.

Installing with Multiple Central Returns:

If you are installing the TrueFlow Grid at the filter grille of a multiple return duct system, when the TrueFlow app prompts the user to remove filter and install the Grid, the user should install the Grid in the most obvious main return and blank off the additional return(s), ensuring all system air flow passes through the Grid. Install the Grid so that the front side of the plate is facing into the air flow (front side has the wording “AIR IN” in the middle of the plate). The adapter plate gasket should provide an airtight seal around the filter grille housing - all the air flow should pass through the Grid and not around the plate. Keep the filter grille door open during the remainder of the test.



Note: If the TrueFlow® app registers low flow, then the operator may need to use another method to obtain more system air flow through the plate.

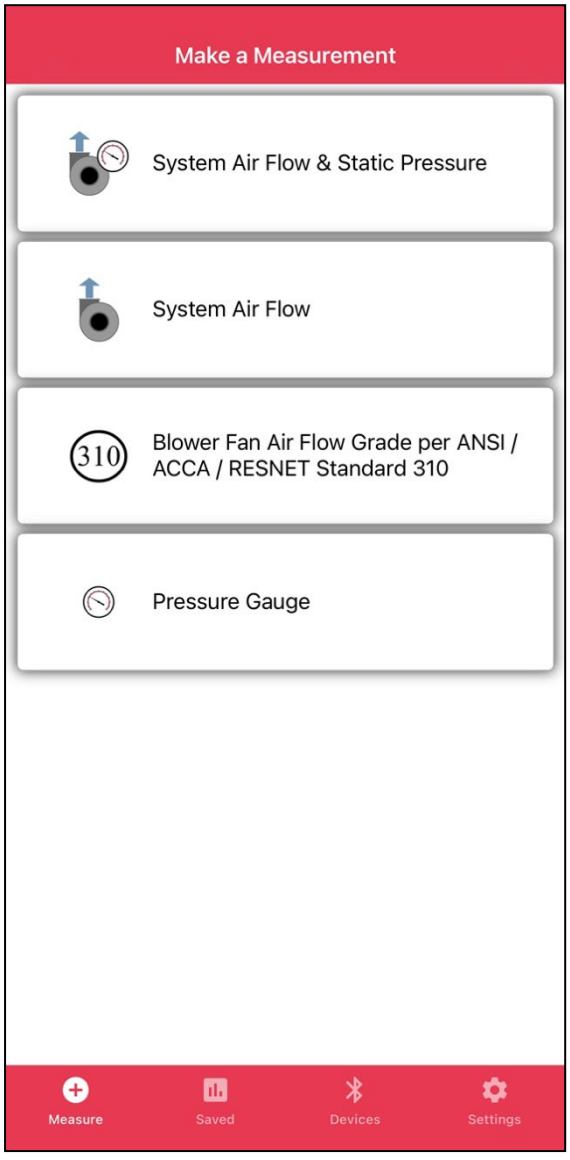
Installing in a Capture Accessory:

If you are installing the TrueFlow® Grid at the filter grille of a single return duct system or multiple return duct system, simply install the Grid into the capture accessory and press capture hood over most obvious main return. Other additional return(s) will need to be blanked off at the same time as capture hood measurement is taking place. Install the Grid so that the front side of the plate is facing into the air flow (front side has the wording “AIR IN” in the middle of the plate). The capture hood gasket should provide an airtight seal around the filter grille housing - all the air flow should pass through the Grid and not around the plate.

Note: If the TrueFlow® app registers low flow, then the operator may need to use another method to obtain more system air flow through the plate.

Appendix C: Sample of System air flow & Static Pressure Analysis

Select Workflow **Description**



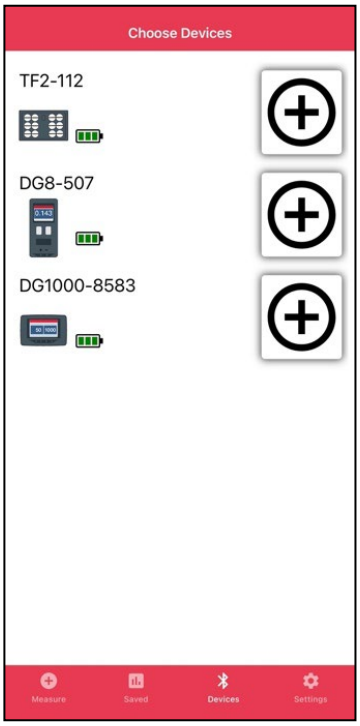
*Provides air flow and pressure diagnostics

*Provides air flow diagnostics

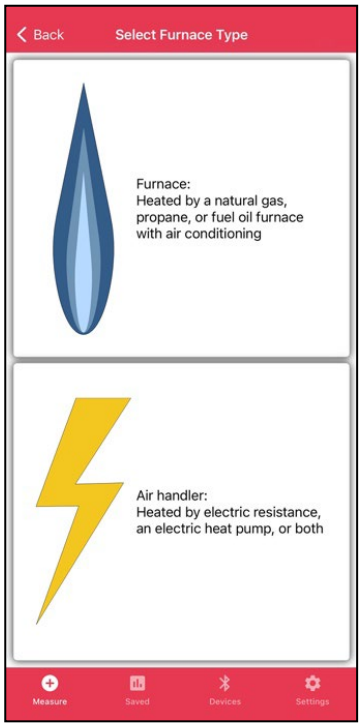
*Provides air flow diagnostics and grading for ANSI/ACCA/RESNET Standard 310 testing

*Provides Pressure readings for diagnostics

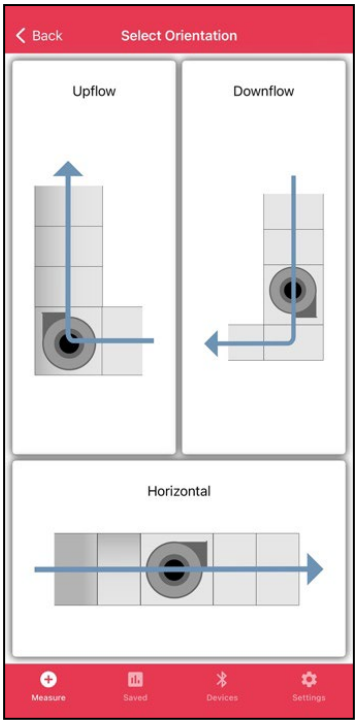
Select Devices



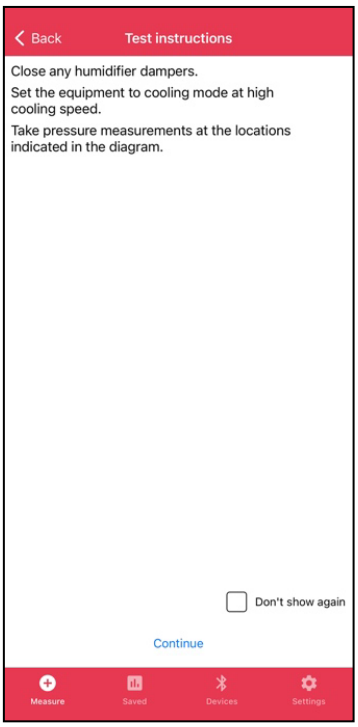
Select Indoor Unit



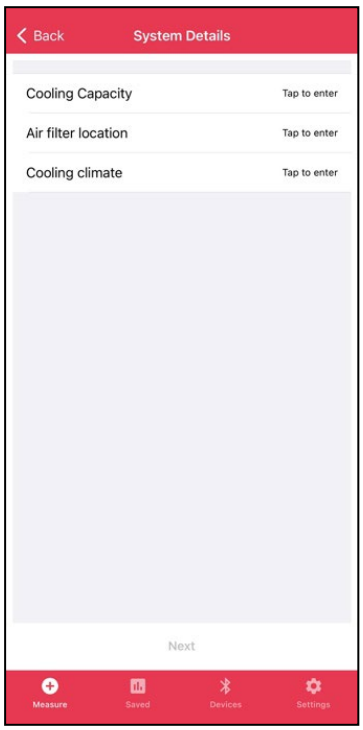
Select Orientation



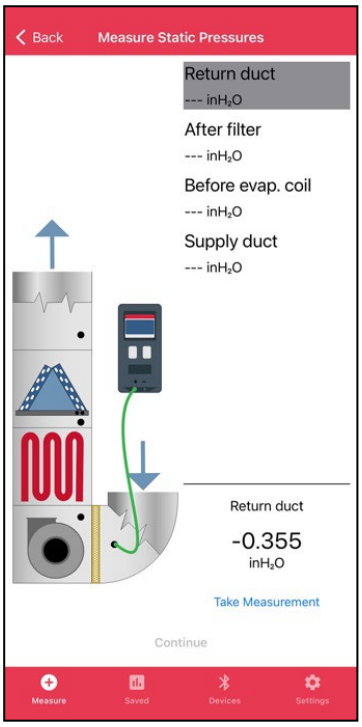
Prepare Indoor Unit



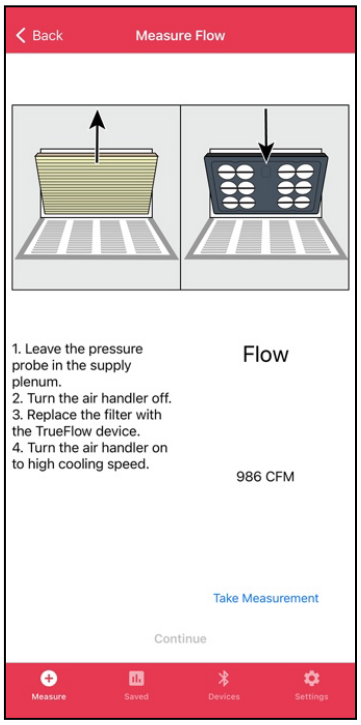
Select System Details



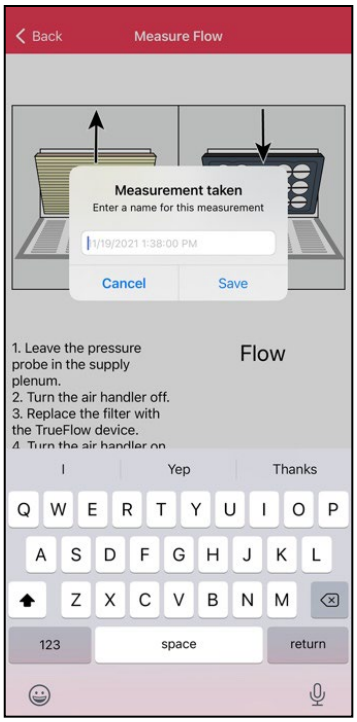
Take Measurements with app



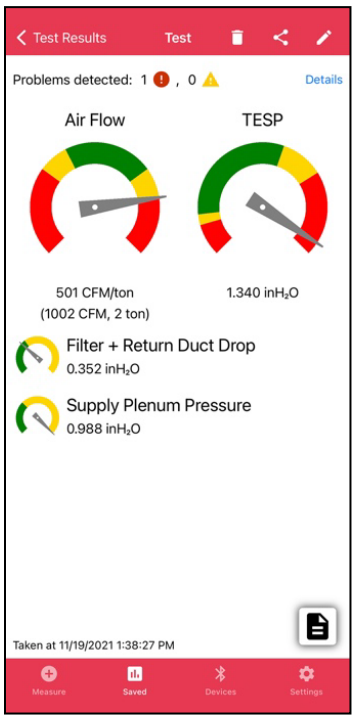
Install Plate in desired location



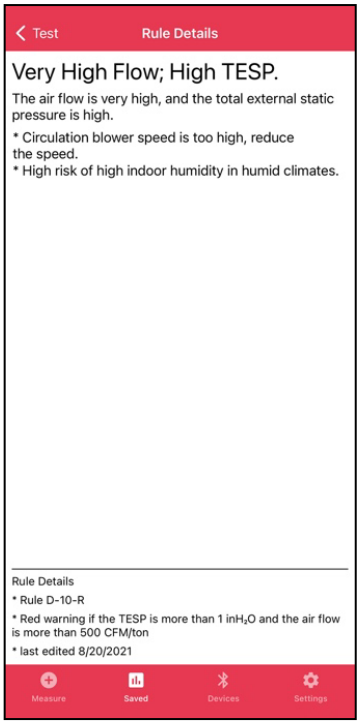
Save Workflow



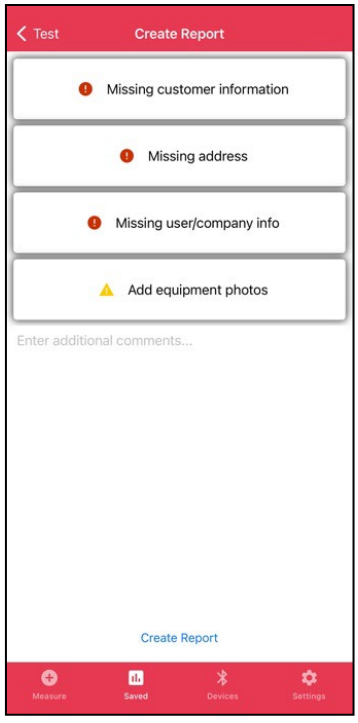
System Performance



Rule Details



Job Information



System report (available for email directly from app)

Tech info
Name: Chris
ID: N/A
Title: HVAC Management
Credentials: N/A
Email: chughes@energyconservatory.c…

Date tested: 11/22/2021

Company info
Name: The Energy Conservatory
Email: chughes@energyconservatory.c..
Phone: N/A

True Flow System Air Flow and Static Pressure Analysis

Air measurements

Total air flow = 774 CFM
Return duct = -0.345 inH_2O
Supply duct = 0.107 inH_2O

System & conditions

System Type: Electric
Orientation: Upflow
Cooling Capacity: 2
Filter Location: InGrille
Cooling Climate Type: Humid
Elevation: 7 m

Summary calculations

Flow		387 CFM/ton
TESP		0.452 inH_2O
Filter + Return Drop		0.345 inH_2O
Supply Plenum		0.107 inH_2O

Summary of Warnings

No warnings.

Customer

Name: Chris
Phone: (612) 827-1117
Email: chughes@energyconservatory.com
Address: 2801 21st Ave S Minneapolis MN 55407 United States

System report continued (available for email directly from app)

Test Equipment

Flow:
TrueFlow®
Serial: TF2-112
Calibrated: 6/3/2021

Pressure:
DG8
Serial: DG8-507
Calibrated: 10/15/2021

Additional Comments

Return air grille is 20x20.

Equipment Photos

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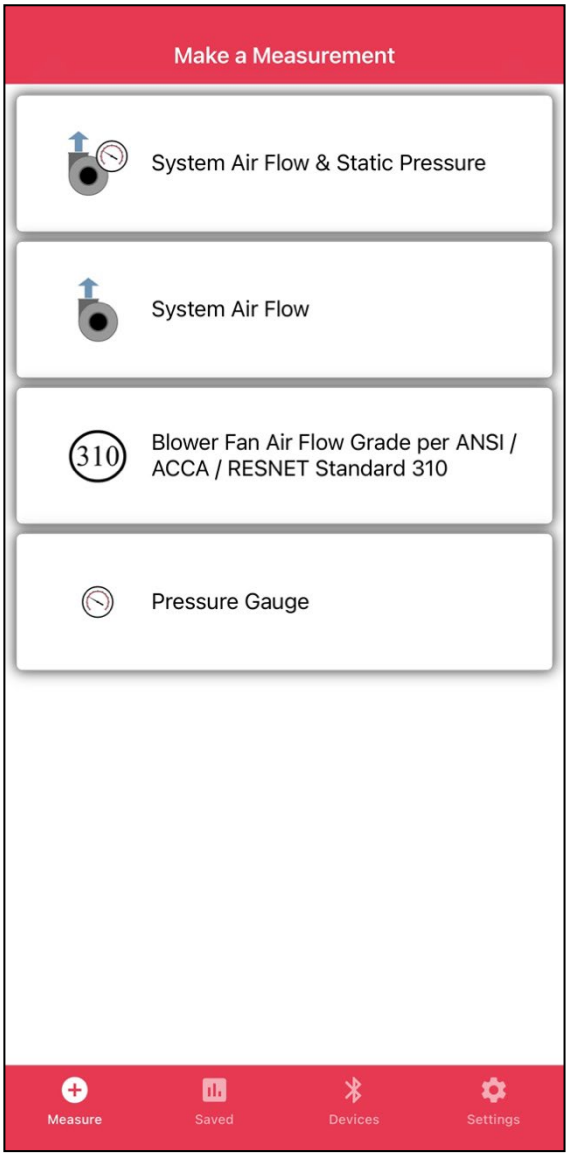
Appendix D

Sample of ANSI / ACCA / RESNET 310 Workflow

Select 310 workflow **Description**



*Provides air flow and pressure diagnostics

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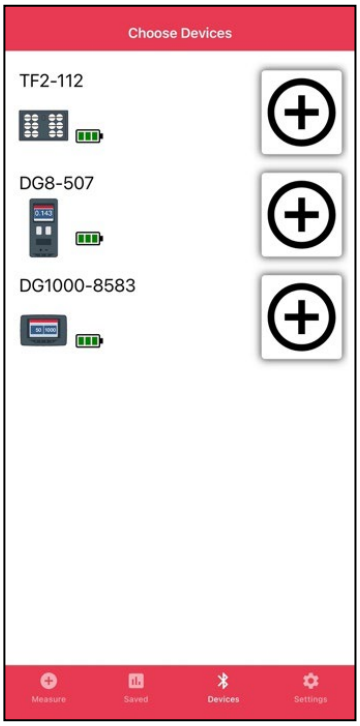
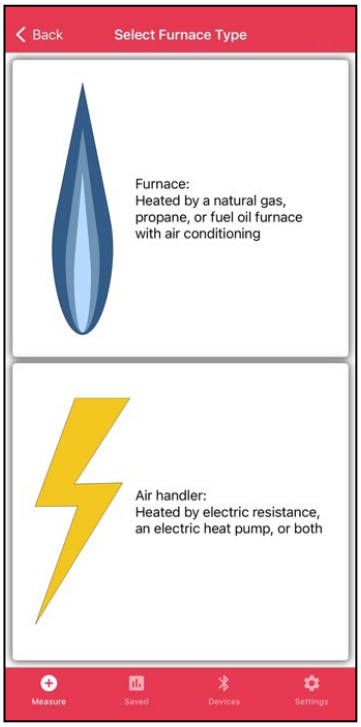
***Provides air flow diagnostics and grading for ANSI/ACCA/RESNET Standard 310 testing**

*Provides Pressure readings for diagnostics

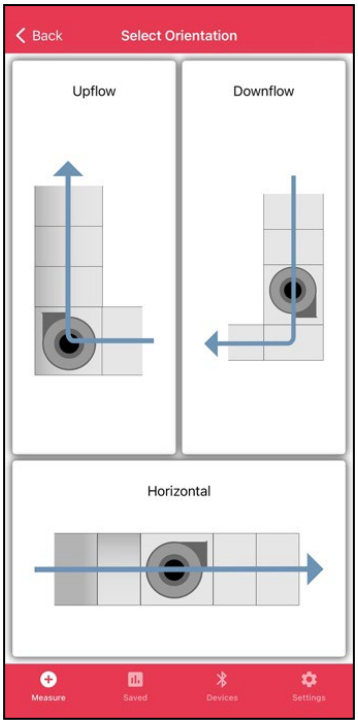
Select Devices



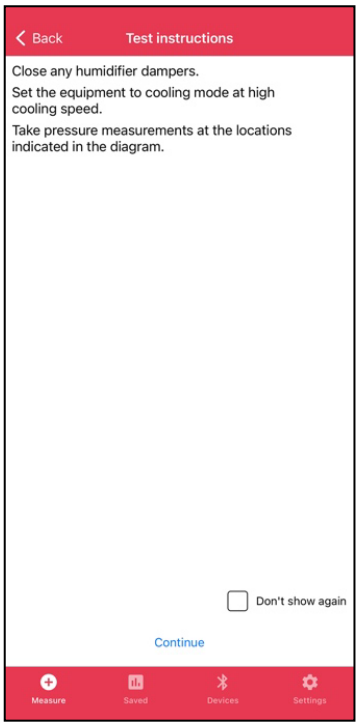
Select Indoor Unit



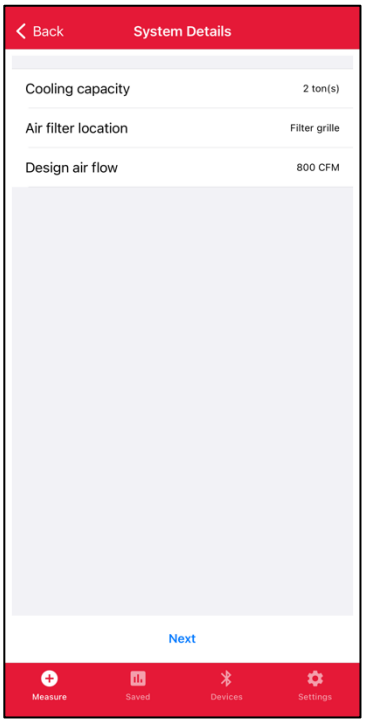
Select Orientation



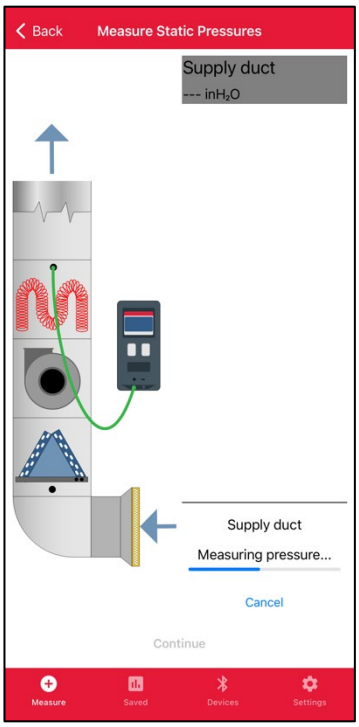
Prepare Indoor Unit



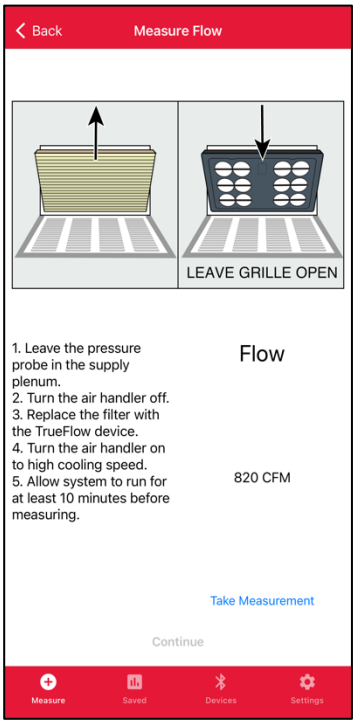
Select System Details



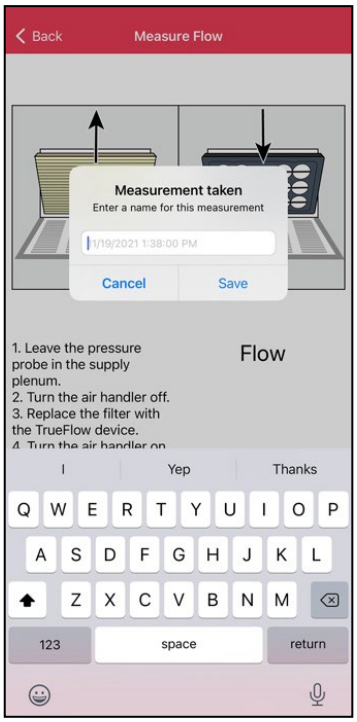
Take Measurements with app



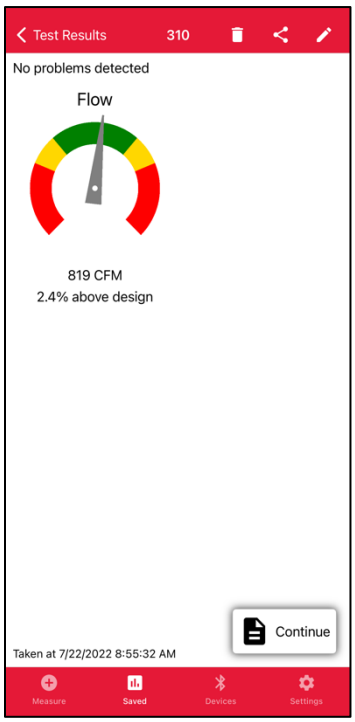
Install Plate in desired location



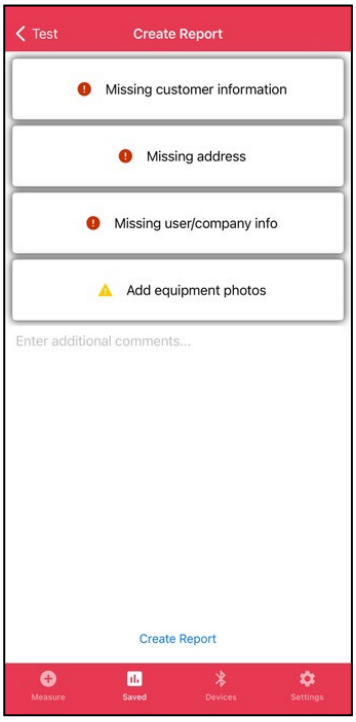
Save Workflow



System Performance



Job Information



System 310 report (available for email directly from app)

Date tested: 7/22/2022
310

Company info
Name: The Energy Conservatory
Phone:
Email: chughes@energyconservatory.com

Tech info
Name: Chris Hughes
ID:
Title: HVAC Management
Credentials:

Air measurements

Total air flow = 819 CFM
Supply duct = 0.151 inH_2O

System & conditions

System Type: Electric
Orientation: Upflow
Cooling Capacity: 2
Filter Location: InGrille
Cooling Climate Type: Moist
Elevation: 26 ft
Design Air Flow: 800 CFM

Summary calculations

Total Air Flow

819 CFM

RESNET / ACCA - 310

GRADE I

deviation: 2%

Grade Designation	Percent Deviation		
I	≤0 and >-15%	or	≥0 and <+15%
II	≤-15% and >-25%	or	≥+15% and <+25%
III	≤-25%	or	≥+25%

Customer

Name: Chris
Phone: (612) 827-1117
Email: chughes@energyconservatory.com
Address: 2801 21st. Ave S Minneapolis MN

System 310 report continued (available for email directly from app)

Test Equipment

Flow:
TrueFlow®
Serial: TF2-344
Calibrated: 11/29/2021

Pressure:
DG8
Serial: DG8-500
Calibrated: 9/23/2021

Additional Comments

2 returns, both are 14x20 with 1" filters

Equipment Photos

7/22/2022 9:33:47 AM

Appendix E TrueFlow Grid Specifications & Installation Instructions

TrueFlow Grid Specifications

Flow Accuracy:	+/- 5% for most applications[1]
Measurable Flow Range:	Grid: 300 cfm to 2,500 cfm[2]
Digital Communication:	Bluetooth® low energy, USB 2.0
Power:	2,000 mAh lithium-ion polymer rechargeable battery USB-C charger/power adapter
Battery Life:	Typically over 24 hours
Auto-off:	30 minutes
Grid Dimensions:	18 inch width x 12 inch height x 0.75 inch depth
Grid Weight:	2.1 LBS
Recommended Calibration Interval:	48 months
Operating Temperature Range:	32°F to 115°F (0°C to 45°C)
Storage Temperature Range[3]:	Less than one month: 15°F to 115°F (-10°C to 45°C) One month to one year: 32°F to 77°F (0°C to 25°C)

[1] In standard installation with no obstruction 2 inches downstream and 6 inches upstream of Digital TrueFlow Grid.

[2] The Digital TrueFlow® Grid is capable of measuring 300 – 2000 CFM directly, however with larger equipment the NSOP / TFSOP adjustment will normally increase the measurement such that equipment flowing 2500 CFM is measured accurately.

[3] Storage limits are based on batteries. Storing outside these limits may require battery replacement.

Appendix E TrueFlow Grid Specifications & Installation Instructions Cont'd

TrueFlow Grid Installation Instructions

Ensuring Accurate Readings

When applied properly, the Digital TrueFlow grid provides air flow measurement at +/- 5%

Installation requirements for TrueFlow

1. The TrueFlow needs a short space of unobstructed duct upstream and downstream to provide accurate readings at +/-5%.
   Upstream = 6 inches, downstream = 2 inches. (See Figure 1A)
2. The TrueFlow should be < 65° from perpendicular. (See Figure 1B)

Other considerations when applying TrueFlow

1. TrueFlow is very accurate at measuring flow going past the grid.
2. When measuring blower fan (system) air flow, it is best to have the TrueFlow grid as close to the blower as possible, so duct leakage between the TrueFlow location and Blower fan is limited. If there is significant duct leakage between the grid and blower, the TrueFlow will read lower by the amount of duct leakage present.
3. This is most common when using a TrueFlow in a filter grille

Figure 1A

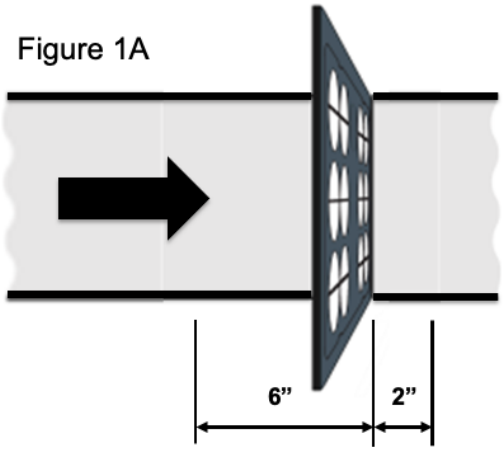
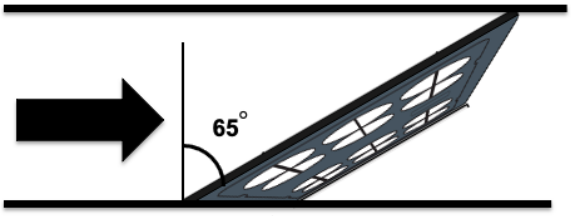


Figure 1B



Appendix F References

D. Parker, 2000, "Summary of Impacts of Refrigerant Charge, Air Flow and Maintenance Issues for Residential Air Conditioning Systems", Proceedings of the ACEEE 2000 Summer Study on Energy Efficiency in Buildings.

D. Parker et al., 1997, "Impact of Evaporator Coil Airflow in Residential Air Conditioning Systems", ASHRAE Transactions, Vol. 103, Pt.2.

M. Blasnik et al., 1996. "Assessment of HVAC Installations in New Homes in APS Service Territory", Proctor Engineering Group.

M. Blasnik et al., 1995. "Assessment of HVAC Installation in New Homes in Nevada Power Company's Service Territory", Proctor Engineering Group.

J. Proctor, 1990, "Pacific Gas and Electric Appliance Doctor Pilot Project", Proctor Engineering Group.