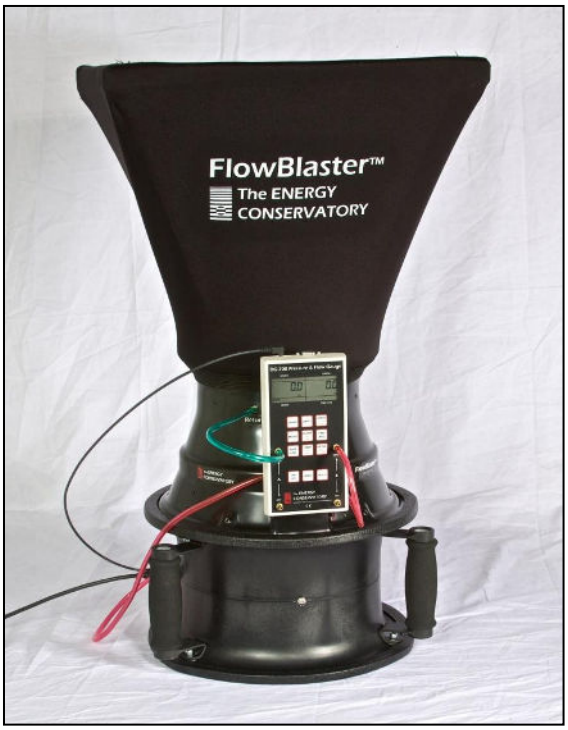
FlowBlaster®

Operation Manual

Attachment for the Minneapolis Duct Blaster® Fan and DG-700 Pressure and Flow Gauge



Performance Testing Tools
612.827.1117 | www.energyconservatory.com

The Energy Conservatory

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Operation Manual

Attachment for the Minneapolis Duct Blaster® Fan and DG-700 Pressure and Flow Gauge

The Energy Conservatory
2801 21st Ave. S., Suite 160
Minneapolis, MN 55407
(612) 827-1117 (Ph)
(612) 827-1051 (Fax)
www.energyconservatory.com
email: info@energyconservatory.com

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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. **Exception:** The warranty period for the Lithium-ion battery contained in the FlowBlaster controller is 12 months.

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 the reason for repair, 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 Safety Information

Equipment Safety Instructions

1. The Duct Blaster® fan is a very powerful and potentially dangerous piece of equipment if not used and maintained properly. Carefully examine the fan before each use. If the fan housing, fan guards, propeller, controller or cords become damaged, do not operate the fan until repairs have been made. Repairs should only be made by qualified repair personnel.
2. Keep people and pets away from the Duct Blaster fan when it is operating.
3. Do not operate the Duct Blaster fan unattended.
4. Do not use ungrounded outlets or adapter plugs. Never remove or modify the grounding prong.
5. Do not operate the Duct Blaster fan if the motor, controller or any of the electrical connections are wet.
6. Disconnect the power plug from the Duct Blaster fan receptacle before making any adjustments to the fan motor, blades or electrical components.
7. The Duct Blaster fan motor is not a continuous duty motor and should not be run for extended periods of time (more than 2 hours at one time).
8. Be sure you have returned the mechanical equipment controls back to their original position before leaving the building.
9. Lithium-ion Battery (located inside the FlowBlaster controller).
    - Use only the charger provided with your FlowBlaster kit to charge the battery powered controller.
    - Do not charge the battery while the controller is on and being used.
    - Do not charge battery powered controller unattended.
    - If at any time you see or smell smoke coming from the battery powered controller, discontinue charging, and or turn off the controller. Do not throw water on a burning lithium-ion battery – you must use a fire extinguisher.
    - Do not place the battery powered controller on or near high temperature locations.
    - Do not expose the battery powered controller to water, salt water or allow the controller to get wet.
    - Do not subject the battery powered controller to strong impacts or shocks.

Chapter 2 Introduction to the FlowBlaster®

Heating, Ventilating and Air Conditioning Systems (HVAC) depend on ductwork to deliver air from the air handler (usually part of a furnace or air conditioner) to individual rooms to provide comfort. The delivery depends, among other things, on duct sizing, construction and leakage. Measuring the air flow at each supply register will provide a way for the HVAC Contractor to determine if the system is supplying the proper flow of air into a given space. The same is true for return air.

Residential systems can be constructed with hard duct, flex duct or duct board and the ductwork is often located between floor joist or wall studs. Sometimes these construction details will affect how air is delivered into the room. Accurately measuring the flow and balancing room to room flow as well as matching supply and return flow help to provide optimal comfort for the home owners.

Commercial Test and Balance Engineers have used devices called capture hoods to measure flow through large registers for many years. The basic idea is to place a hood, usually of fabric around the opening so that no air leaks out. The hood is connected to a measuring section where the air flow is directed over a grid or set of tubes that sample the flow. This flow is then measured by an instrument that converts the sampled value into CFM. This works with well-constructed ductwork.

There are several characteristics of residential HVAC systems that make it difficult to measure register flows accurately with traditional flow capture devices. One is that the flow exits the registers in a small diameter jet that can partially miss the flow sensors in a larger flow capture hood. In addition, the duct construction, especially the short boots and short radius turns, cause large variations in velocity within this jet, making it more difficult to sense an average velocity in the jet. To solve the problem some type of flow conditioning is necessary to smooth out the flow so that the flow profile is better known. But flow conditioning causes pressure losses that can significantly change the flow that we are trying to measure, especially in residential systems where pressures are low and small changes in pressures can cause large flow changes.

The FlowBlaster works by adding the necessary conditioning so that the flow can be accurately measured, and then compensating for the pressure loss of the flow conditioners by precisely adjusting the speed of the Duct Blaster Fan to remove the pressure loss through the conditioners. The FlowBlaster™ System was designed specifically for use with residential air flow systems. The FlowBlaster can measure flows down to 10 CFM and up to 300 CFM. The unique, patent-pending design compensates for variations of construction and is able to measure the flow more accurately than commercial capture hood devices that have been used in the residential market.

Chapter 3 Components

The FlowBlaster is an attachment to the Minneapolis Duct Blaster® System and requires the use of a Duct Blaster Fan and Flow Rings, and a DG-700 Digital Pressure and Flow Gauge. The FlowBlaster® Kit consists of the following components:

- FlowBlaster Carrying Carrying Case
- FlowBlaster Housing
- FlowBlaster 16x16 Hood Assembly
- Handles for Duct Blaster® Fan
- Battery-powered Controller, Holster and Battery Charger
- Coiled Cord (Power and Communication)
- Plastic Tubing and Fan Connect Trim
- FlowBlaster Manual

3.1 FlowBlaster Housing

The FlowBlaster housing consists of a one-piece tapered black cylinder with three stainless steel pressure sensing rings. The largest diameter ring, located in a recess of the FlowBlaster housing, serves as the reference pressure for the Duct Blaster Fan when measuring Supply airflow. A two-ring assembly, called the zero pressure sensor assembly is located at the narrowest part of the housing: a 5″ diameter ring for Supply airflow and 3″ diameter ring for Return airflow. The pressure at this location is used to detect when the Duct Blaster Fan has been adjusted to cancel out the resistance added by the addition of the FlowBlaster assembly. The three sensing rings are connected to three pressure taps, visible on the outside of the housing and labeled **Fan Reference (Supply)**, **Supply** and **Return**.

Additional elements inside the FlowBlaster housing are two flow conditioning components and four pole pockets. A fabricated metal “X” and 1-inch thick perforated foam disc together straighten and distribute airflow through the FlowBlaster housing to improve accuracy of airflow measurements. Four pockets on the narrow end of the housing hold four flexible poles that form part of the hood assembly.

An adjustable gauge mounting plate on the outside of the FlowBlaster housing holds a DG-700 digital pressure gauge via Velcro fastening strips that mate with loop strips on the back of a DG-700 pressure gauge. The gauge mounting plate can be adjusted for easy viewing of the gauge display while taking air flow measurements. A friction hinge holds the gauge in any position in the range of rotation of the gauge plate.

3.2 FlowBlaster 16x16 Hood Assembly

The FlowBlaster hood assembly consists of four gasketed aluminum frame pieces, four flexible poles, and an elastic cloth skirt. The four frame pieces connect together to create a 16" x 16 " frame that forms the open end of the hood assembly. Velcro on the frame pieces connect to tabs on the elastic cloth skirt to hold the skirt in place on the frame. The round elastic collar on the other end of the skirt fits over the narrow end of the black housing. The FlowBlaster is shipped in the carrying case with the elastic skirt already installed on the black housing and attached to the assembled 16" x 16" frame.

To complete the hood assembly, you will need to insert the four flexible poles into the pole pockets on the inside of the black housing. Once this is done, the assembled frame and skirt will need to be lifted up and the corners of the frame installed on the ends of the flexible poles. See Chapter 4 for more detailed assembly instructions.

3.3 Battery Powered Controller, Battery Charger and Cables

3.3.a Battery Powered Controller

A battery powered fan controller is used along with a DG-700 pressure gauge to control the Duct Blaster Fan. The lithium-ion battery pack inside the controller contains safety and power management circuits to protect the battery from over charge, over discharge, accidental shorting and reverse polarity. In addition, a removable fuse is located on the rear end plate of the controller enclosure. The controller is packaged and shipped with the fuse removed to comply with safety and shipping regulations. The fuse must be inserted into the controller prior to usage.

NOTE: For best performance, recharge the battery after each use or every two months in storage.

The following items are located on the front end plate of the controller*:*

On/Off Rocker Switch	*Turns controller on and off*
Lo Bat LED	*Lights RED to indicate low battery power*
Manual Control Knob	*Manual control of Duct Blaster Fan speed*
Fan Receptacle	*Connection for coiled cord*
Charging Port	*Connection for battery charger cable*

The controller fuse and fuse holder is taped to the side of the controller box (along with an extra fuse). Place the fuse into the fuse holder and insert into the rear of the controller. The fuse holder is locked in place by rotating the fuse holder clockwise. A cloth holster with a 2″ wide web belt and quick connect buckle can be used to secure the controller around your waist. Two thin fastening straps secure the controller inside the holster.

When using the battery powered controller, the total run-time of the Duct Blaster Fan will vary depending on the flow rates being measured. Typical total run times on a fully charged battery will vary from 25 minutes at high fan speeds to 60 minutes at low fan speeds. Once the RED Lo Bat light is on consistently at the flow rate you are trying to measure, you should turn off the controller and charge the battery.

Note: It is also possible to manually operate the FlowBlaster with a standard Minneapolis Duct Blaster Fan speed controller that is plugged into wall power and the Duct Blaster Fan. If the Duct Blaster controller is a newer unit with a fan control communication jack, then the **Cruise** feature on the DG-700 can also be used.

3.3.b Charger

CAUTION: Use only the charger provided for charging the FlowBlaster battery. Read the Operating Instructions provided with the charger before using and charging the battery. Do not operate the FlowBlaster controller while the battery is charging.

The battery charger provided is specifically designed for efficient and safe charging of the Lithium-Ion battery pack inside the FlowBlaster controller. The charger comes with a three-pronged AC cord for use with 110V power outlets. The charging cable has a barrel connector that plugs into the charging port on the front end plate of the controller. A small indicator light on the top of the charger will show RED/ORANGE when connected to a battery that needs charging. When the charger light turns GREEN the battery is charged and ready to use. A fully discharged battery will require approximately 3 hours on charging time in order to provide a full charge.

3.3.c Coiled Cord and Fan Control Cable

The coiled cord conveys both power from the battery to the Duct Blaster Fan and a digital signal from the DG-700 pressure gauge to the controller. The controller end of the coiled cord has one circular male power connector that screws onto the mating circular power receptacle on the front end plate of the controller. On the other end of the coiled cord, a circular female power connector screws onto the Duct Blaster Fan and a fan control cable connects to the fan control jack on the DG-700 pressure gauge.

3.3.d Gauge Tubing

Plastic tubing is provided to connect the FlowBlaster and Duct Blaster Fan to the DG-700 gauge for supply or return airflow measurements as follows.

Length	Color	Use
30 inches	Red	Connect Duct Blaster Fan to **Channel B Input** tap on DG-700.
12 inches	Green	Connect **Supply** or **Return** taps on FB housing to **Channel A Input** tap on DG-700.
12 inches	Clear	Connect **Fan Reference** (**Supply**) tap on FB housing to **Channel B Ref** tap on DG-700.

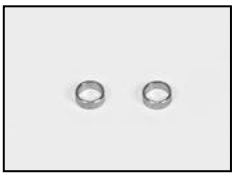
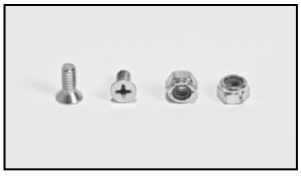
3.4 Duct Blaster Fan Handles and Handle Hardware

The FlowBlaster kit includes two black handles that can be attached to your Duct Blaster Fan to make it easier to hold the hood and fan assembly over a register or grille when making measurements. The handles and attachment hardware are in a plastic bag inside the carrying case. Instructions for installing the handles can be found in Chapter 4.

Chapter 4 FlowBlaster™ Set-up

4.1 Attaching Handles to Duct Blaster Fan

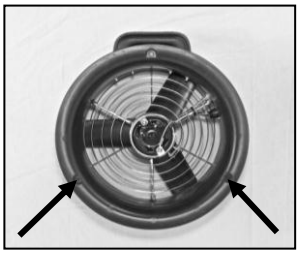
Two black gripped handles are provided for using the FlowBlaster with a Minneapolis Duct Blaster Fan. The handles are attached to the Duct Blaster Fan using both existing hardware on the Duct Blaster Fan, and new hardware provided (new hardware includes two round metal spacers, and two 5/8" long bolts with lock nuts).

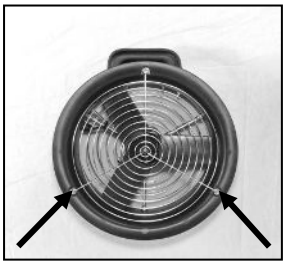
You will need the following tools to install the handles.

- Phillips screw driver
- Needle nose pliers, or 3/8" open end wrench
- Drill and 3/16" drill bit

1) Set Duct Blaster Fan on a flat surface, fan exhaust guard side down.
2) Locate the three bolt bosses on the Duct Blaster Fan inlet flange.
3) Using the 3/16" drill bit, drill holes into the center of the two bosses shown in the figure to the right.




4) Turn fan over and remove the two 1/2" long fan exhaust guard bolts and lock nuts shown in the figure to the right (keep the bolts and nuts – they will be used in Step 8 below).

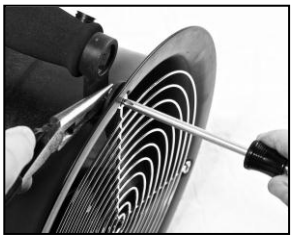


5) Lift the fan guard away from the housing slightly and insert the two metal spacers into the holes you just removed the bolts from (this will reduce the diameter of the holes from 1/4" to 3/16").
6) Place one of the handles along the side of the Duct Blaster Fan housing and line up holes in the handle with one set of holes in the inlet flange and exhaust flange.

7) Insert one of the 5/8" long bolts provided through the hole in the exhaust flange and handle and install the lock nut onto the end of the bolt (tighten finger tight).

8) Insert one of the existing 1/2" long bolts through the hole in the inlet flange and handle and install the lock nut. Fully tighten both lock nuts.

9) Repeat steps 6 through 8 with the other handle.



4.2 Assembling the Capture Hood

1) Remove housing, frame and skirt assembly from carrying case and place unit on a flat surface.

2) Insert the four flexible poles into the pole pockets inside the black housing. The poles should bottom out in pocket. Rotate poles if needed to seat in pocket – check pockets for debris if poles do not bottom out.

3) The frame and skirt will need to be lifted up and the corners of the frame installed on the ends of the flexible poles. <u>The bottom corners of the assembled frame contain small round sockets into which the ends of the flexible poles are inserted.</u> It is easiest to first insert poles on two opposite sides of the frame, and then complete the remaining two poles. Be careful to not tear the elastic skirt with the ends of the flexible poles.

4.3 Assembling FlowBlaster for Return Airflow Measurements

4.3.a Attach Duct Blaster Fan to FlowBlaster Housing

1) Position FlowBlaster housing assembly so that the hood is facing <u>down</u>.

2) Place Duct Blaster Fan on FlowBlaster housing with the fan exhaust guard side <u>down</u> (fan inlet facing <u>up</u>).

3) Orient the Duct Blaster Fan so that the gauge mounting plate on FlowBlaster housing is centered between the new handles on Duct Blaster Fan.

4) Secure the exhaust flange on the Duct Blaster Fan to the FlowBlaster housing flange using black connecting trim.

5) Choose the appropriate Duct Blaster Flow Ring for the flow range you will be measuring (**Note**: for flows between 80 and 125 CFM using Ring 2 will provide longer battery run times because the fan be will running at a slower speed.)

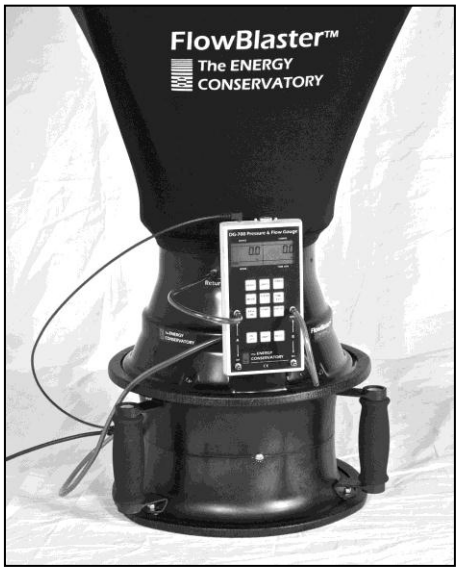
- Ring 3: 10 - 125 CFM
- Ring 2: 80 – 300 CFM

6) Place the Flow Ring on the Duct Blaster Fan inlet flange with the Ring nozzle pointing inward towards the fan motor. Secure the Flow Ring to the Fan using black connecting trim.

4.3.b Attach Coiled Cord to Controller and Duct Blaster Fan

1) Be sure both the power switch and manual speed control knob on the battery powered controller are set to **Off**.
2) Attach the male circular connector on the cord to the female connector on the battery powered controller. Attach the female circular connector on the cord to male connector on the Duct Blaster fan.

4.3.c Set up Digital Gauge



1) Attach a DG-700 gauge to the gauge mounting plate on the FlowBlaster housing using the Velcro strips on the gauge and mounting plate. The gauge can be facing up or down, whichever is most convenient for the location of registers being measured.
2) Insert the fan control cable from the end of the coiled cord into the fan control jack on the DG-700 gauge.
3) Attach one end of the12" **Green** tubing to **Channel A Input** tap and the other end to the tap on the FlowBlaster housing. labeled **Return**. **Channel A** is now setup to measure the "return zero pressure".
4) Attach one end of the 30" **Red** tubing to the **Channel B Input** tap and the other end to the pressure tap on the Duct Blaster Fan. **Channel B** is now setup to measure airflow through the Duct Blaster Fan.

4.4 Assembling FlowBlaster for Supply Airflow Measurements

4.4.a Attach Duct Blaster Fan to FlowBlaster housing

1) Position FlowBlaster housing assembly so that the hood is facing down.
2) Choose the appropriate Duct Blaster Flow Ring for the flow range you will be measuring (**Note**: for flows between 80 and 125 CFM using Ring 2 will provide longer battery run times because the Fan will be running at a slower speed.)
    - Ring 3: 10 - 125 CFM
    - Ring 2: 80 – 300 CFM
3) Place Flow Ring on the FlowBlaster housing with the Ring nozzle facing up.

4) Place the inlet of the Duct Blaster Fan on top of the Flow Ring (the Fan motor will be centered in the Ring nozzle). Orient the Duct Blaster Fan so that the gauge mounting plate on FlowBlaster housing is centered between the new handles on the Duct Blaster Fan. **Note:** The exhaust guard on the Duct Blaster Fan will be facing up.

5) Secure the Flow Ring and the inlet flange of the Duct Blaster Fan to the FlowBlaster housing flange using black connecting trim.

4.4.b Attach Coiled Cord to Controller and Duct Blaster Fan

1) Be sure both the power switch and manual speed control knob on the battery powered controller are set to **Off**.

2) Attach the male circular connector on the cord to the female connector on the battery powered controller. Attach the female circular connector on the cord to male connector on the Duct Blaster Fan.

4.4.c Set Up Digital Gauge

1) Attach a DG-700 gauge to the gauge mounting plate on the FlowBlaster housing using the Velcro strips on the gauge and mounting plate. The gauge can be facing up or down, whichever is most convenient for the location of registers being measured.

2) Insert the fan control cable from the end of the coiled cord into the fan control jack on the DG-700 gauge.

3) Attach one end of the12" **Green** tubing to **Channel A Input** tap and the other end to the tap on the FlowBlaster housing labeled **Supply**. **Channel A** is now setup to measure the "supply zero pressure".

4) Attach one end of the 30" **Red** tubing to the **Channel B Input** tap and the other end to the pressure tap on Duct Blaster Fan.

5) Attach one end of 12" **Clear** tubing to **Channel B Reference** tap and the other end to the tap on the FlowBlaster housing labeled **Fan Reference (Supply)** – located underneath the gauge mounting plate. **Channel B** is now setup to measure airflow through the Duct Blaster Fan.

Chapter 5 Using the FlowBlaster

5.1 Measuring Return Airflow with the FlowBlaster

This section assumes that the FlowBlaster is setup for **Return** airflow measurements (see Section 4.3 above).

5.1.a Turn on DG-700 and Choose Gauge Settings

Turn **On** the DG-700 gauge and put the gauge in the **PR/ FL** mode by pressing the **MODE** button once. Now press the **DEVICE** button four times to select **DB B** as the indicated device on the gauge. Press the **CONFIG** button until the Configuration shown on the top right section of the gauge display matches the Flow Ring installed on the Duct Blaster Fan (Ring 3 = **C3**, Ring 2 = **B2**). **Note**: For flows between 80 and 125 CFM using Ring 2 will provide longer battery run times because the Fan will be running at a slower speed.

- Ring 3: 10 - 125 CFM
- Ring 2: 80 – 300 CFM

5.1.b Set-up the Controller

1) Turn the Manual Speed Control knob to **Off**.
2) Press the power switch to the **On** position – (red showing). **Note:** Fan may slowly turn for 1 second when power switch is activated – this is normal.

5.1.c Set the DG-700 Cruise Control Feature

Press the **Begin Cruise (ENTER)** button once to enter Cruise setup. Press the **Cruise Target (CONFIG)** button twice to select the **+0** (plus zero) cruise target pressure.

5.1.d Begin Return Airflow Measurement

1) Press the **Start Fan (START)** button on the DG-700 - the Duct Blaster Fan may turn very slowly.
2) Position the FlowBlaster hood over the **Return** grille (center the hood over the grille as much as possible.
3) The Duct Blaster Fan will automatically speed up until the "return zero sensor" reading on **Channel A** is close to zero.
4) Once pressure on **Channel A** reads "0" (within 0.2 Pa), read the airflow on **Channel B**. This is the measured **Return** airflow.
5) Remove the FlowBlaster hood from the **Return** grille. **Note:** The Duct Blaster Fan will continue to run after removing from the grille. Simply place the hood over another **Return** grille to make another measurement.

When you need to turn the Duct Blaster Fan **Off**, you have the following two options;

- Press the **Stop Fan (CLEAR)** button on the DG-700 gauge to turn off the Fan and put the gauge back into the Cruise setup state. You can simply press **Start Fan (START)** again to make another measurement.
- Press the power switch on the battery powered controller to the **Off** position.

If you place the open end of the hood down on the floor or other flat surface while the fan is running, the Fan will slow down. If the Fan is running very fast when the hood is set on the floor, the fan may automatically shut down and the DG-700 gauge will go into the Cruise setup state (just like hitting the **Stop Fan (CLEAR)** button). If this happens, you will need to press **Start Fan (START)** to make another measurement.

Note: Pressing the **HOLD** button also causes the Fan to shut down and freezes the gauge display. Pressing **Start Fan (START)** will allow you to make another measurement.

5.2 Measuring Supply Airflow with the FlowBlaster

This section assumes that the FlowBlaster is setup for **Supply** airflow measurements (see Section 4.4 above).

5.2.a Turn on DG-700 and Choose Gauge Settings

Turn **On** the DG-700 gauge and put the gauge in the **PR/ FL** mode by pressing the **MODE** button once. Now press the **DEVICE** button four times to select **DB B** as the indicated device on the gauge. Press the **CONFIG** button until the Configuration shown on the top right section of the gauge display matches the Flow Ring installed on the Duct Blaster Fan (Ring 3 = **C3**, Ring 2 = **B2**). **Note**: For flows between 80 and 125 CFM using Ring 2 will provide longer battery run times because the Fan will be running at a slower speed.)

- Ring 3: 10 - 125 CFM
- Ring 2: 80 – 300 CFM

5.2.b Set-up the Controller

1) Turn the Manual Speed Control knob to **Off**.
2) Press the power switch to the **On** position – (red showing). **Note:** Fan may slowly turn for 1 second when power switch is activated – this is normal.

5.2.c Set the DG-700 Cruise Control Feature

Press the **Begin Cruise (ENTER)** button once to enter Cruise setup. Press the **Cruise Target (CONFIG)** button three times to select the **-0** (minus zero) cruise target pressure.

5.2.d Begin Supply Airflow Measurement

1) Press the **Start Fan (START)** button on the DG-700 - the Duct Blaster Fan may turn very slowly.
2) Position the FlowBlaster hood over the **Supply** register (center the hood over the register as much as possible.
3) The Duct Blaster Fan will automatically speed up until the "supply zero sensor" reading on **Channel A** is close to zero.
4) Once pressure on **Channel A** reads "0" (within 0.2 Pa), read the airflow on **Channel B**. This is the measured **Supply** airflow.
5) Remove the FlowBlaster hood from the **Supply** register. **Note:** The Duct Blaster Fan will continue to run after removing from the register. Simply place the hood over another **Supply** register to make another measurement.

When you need to turn the Duct Blaster Fan **Off**, you have the following two options;

- Press the **Stop Fan (CLEAR)** button on the DG-700 gauge to turn off the Fan and put the gauge back into the Cruise setup state. You can simply press **Start Fan (START)** again to make another measurement.
- Press the power switch on the battery powered controller to the **Off** position.

If you place the open end of the hood down on the floor or other flat surface while the fan is running, the Fan will slow down. If the Fan is running very fast when the hood is set on the floor, the fan may automatically shut down and the DG-700 gauge will go into the Cruise setup state (just like hitting the **Stop Fan (CLEAR)** button). If this happens, you will need to press **Start Fan (START)** to make another measurement.

Note: Pressing the **HOLD** button also causes the Fan to shut down and freezes the gauge display. Pressing **Start Fan (START)** will allow you to make another measurement.

5.3 What Happens if You Try to Measure Flows Outside of the Range of the Ring Installed?

5.3.a Register/Grille Flow is Too Large for the Fan Setup

If you are trying to measure an airflow that is too large for the Duct Blaster Fan setup on the FlowBlaster, you will not achieve "zero" pressure on **Channel A** of the gauge. In this case the Fan will simply run as fast as it can and the gauge will emit a beeping sound. If this happens and you have Ring 3 installed on the Duct Blaster Fan, then turn off the Fan and install Ring 2. Be sure to change the configuration setting on the gauge if you change the Flow Ring.

If this happens and you have Ring 2 installed on the Duct Blaster Fan, then you are trying to measure an airflow that is outside of the range of the FlowBlaster system (maximum airflow is 300 CFM).

5.3.b Register/Grille Flow is Too Small for the Fan Setup

If you are trying to measure an airflow that is too small for the Duct Blaster Fan setup on the FlowBlaster, **Channel B** of the gauge will display the letters **LO** (either continuously or alternating with an airflow reading). If **LO** is displayed, you are trying to measure an airflow that is outside the calibrated range of Duct Blaster Fan for the currently installed Flow Ring. If this happens and you have Ring 2 installed on the Duct Blaster Fan, then turn off the Fan and install Ring 3. Be sure to change the configuration setting on the gauge if you change the Flow Ring.

If this happens and you have Ring 3 installed on the Duct Blaster Fan, then you are trying to measure an airflow that is below the minimum range of 10 CFM.

5.4 Measurement Configurations

	Supply Airflow	**Return Airflow**
Duct Blaster Fan Orientation	Fan Inlet and Flow Rings attached to FB Housing	Fan Exhaust attached to FB Housing
Channel A Input tap (**Green** tubing)	**Supply** tap on FB Housing	**Return** tap on FB Housing
Channel A Reference tap	Leave tap open	Leave tap open
Channel B Input tap (**Red** tubing)	Pressure tap on Duct Blaster Fan	Pressure tap on Duct Blaster Fan
Channel B Reference tap (**Clear** Tubing)	**Fan Reference (Supply)** tap on FB Housing	Leave tap open
DG-700 Gauge Mode	**PR/ FL**	**PR/ FL**
Cruise Target Pressure	**- 0**	**+ 0**

5.5 Disassembling the FlowBlaster

1) Disconnect tubing between the DG-700 gauge and the FlowBlaster housing and Duct Blaster Fan.
2) Disconnect the Duct Blaster Fan from the FlowBlaster housing, and remove the DG-700 gauge from the gauge mounting plate.
3) Place FlowBlaster housing on the floor with the the hood facing up.
4) Carefully remove the 4 flexible poles from the housing pole pockets and bottom corner sockets in the frame. This is best accomplished by first pulling one of the flexible poles up and out of a housing pole pocket. Twist and pull down on this pole to remove it from the corner frame socket.
5) Repeat this procedure with the flexible pole diagonally across from the first one removed.
6) Repeat with the third and fourth flexible poles while keeping the frame in a somewhat horizontal position. Return the poles and the housing/hood assembly to the carrying case.
7) The controller is stored in the rear pocket of the carrying case.

Appendix A Calibration and Maintenance

A.1 Duct Blaster Fan

Follow the calibration and maintenance recommendations listed in Appendix A of the Duct Blaster Operation Manual.

A.2 DG-700 Pressure and Flow Gauge

The DG-700 pressure and flow gauge should be calibrated once a year. The sticker on the back of the gauge will have the date of the last calibration. Follow the servicing and maintenance instructions found in Chapter 7 of the DG-700 Operating Instruction manual.

A.3 FlowBlaster Housing

A.3.a Issues Affecting Calibration

The FlowBlaster will maintain its calibration unless physical damage occurs. Conditions which could cause the calibration to change are primarily damaged pressure sensing rings, movement of the pressure sensors relative to the housing, leaks in the hood assembly, and leaks in the tubing running from the pressure sensors to the pressure taps on the housing.

Damaged FlowBlaster Pressure Sensing Rings

The FlowBlaster housing consists of a one-piece tapered black cylinder with three stainless steel pressure sensing rings. The largest diameter ring, located in a recess of the FlowBlaster housing, serves as the reference pressure for the Duct Blaster Fan when measuring Supply airflow. A two-ring assembly, called the zero pressure sensor assembly is located at the narrowest part of the housing: a 5″ diameter ring for Supply airflow and 3″ diameter ring for Return airflow. The pressure at this location is used to detect when the Duct Blaster Fan has been adjusted to cancel out the resistance added by the addition of the FlowBlaster assembly. The three sensing rings are connected to three pressure taps, visible on the outside of the housing and labeled **Fan Reference (Supply)**, **Supply** and **Return**.

Visually confirm that the pressure sensing rings are not broken or bent. Check that the sensing rings are firmly attached to the housing. Next, perform a test for leaks in the plastic tubing connecting the sensor to the pressure tap. Attach a piece of tubing to one of the brass pressure taps on the housing. Leave the other end of the tubing open. Find the intentional sensing holes in the pressure sensor you are testing - they are evenly spaced on the sensor. Temporarily seal the holes by covering them with masking tape. Next, create a vacuum in the pressure tubing by sucking on the open end. A vacuum in the tubing assures that the flow sensor does not leak. There is a vacuum, if by placing your tongue over the end of the tubing, the tubing sticks to your tongue. Make sure that the vacuum persists for at least 5 seconds. If a vacuum cannot be created, contact The Energy Conservatory to further diagnose the sensor leakage problem. Repeat the test on the remaining two pressure sensing rings and their tubing connections. Be sure to remove the tape from the sensing rings when your are finished with your check.

Leaky Tubing between the DG-700 Gauge and the FlowBlaster pressure taps.

It does not happen very often, but leaky tubing can seriously degrade the accuracy of the air flow tests. These leaks can be small enough to go undetected for years but large enough to affect fan calibration.

- Inspect both ends of the tubing to make sure they are not stretched out to the point where they will not make a good seal when attached to a gauge.
- Seal off one end of the tubing by doubling it over on itself near the end.
- Create a vacuum in the tubing by sucking on the open end (make sure the tubing is clean first!). Let the end of the tubing stick to your tongue due to the vacuum. The tubing should stick to your tongue indefinitely if there are no leaks. Waiting for 5 seconds or so is a good enough test. **Note:** A syringe also works for creating a vacuum or a positive pressure. You can feel if the pressure leaks out by noticing the pressure on the syringe's piston that it takes to maintain a pressure.
- If the tubing has a leak, it should be replaced immediately.
- The ends of the tubing will sometimes get stretched out or torn after many uses. Periodically trim 1/4" off the ends of the tubing to remove the damaged end.

A.4 Density Corrections

All Energy Conservatory air flow measuring devices are calibrated to a standard air density of 0.075 lbs/ft3 (1.204 kg/m3). If the density of air going through the FlowBlaster differs from this standard air density, the air flow indicated on an Energy Conservatory gauge will not be the actual volumetric air flow. If the volumetric flow rate, or the standard flow rate (SCFM) going through the FlowBlaster is desired, multiply the indicated air flow on the gauge by the air density factors listed in Tables A.4.1 and A.4.2 on the next page.

Table A.4.1: **Air Density Factors to Convert from *Indicated* Flow to *Volumetric* Flow.**

Temp. of air through the Device (F)	Elevation (feet)										
	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
0	0.933	0.950	0.968	0.986	1.005	1.023	1.043	1.062	1.083	1.104	1.125
10	0.943	0.961	0.978	0.996	1.016	1.034	1.054	1.074	1.095	1.116	1.138
20	0.953	0.971	0.989	1.007	1.026	1.045	1.065	1.085	1.106	1.128	1.150
30	0.963	0.981	0.999	1.017	1.037	1.056	1.076	1.097	1.118	1.139	1.162
40	0.973	0.991	1.009	1.028	1.048	1.067	1.087	1.108	1.129	1.151	1.173
50	0.983	1.001	1.019	1.038	1.058	1.077	1.098	1.119	1.140	1.162	1.185
60	0.992	1.010	1.029	1.048	1.068	1.088	1.108	1.130	1.152	1.174	1.197
70	1.002	1.020	1.039	1.058	1.078	1.098	1.119	1.140	1.163	1.185	1.208
80	1.011	1.030	1.049	1.068	1.089	1.109	1.130	1.151	1.174	1.196	1.219
90	1.021	1.039	1.058	1.078	1.099	1.119	1.140	1.162	1.184	1.207	1.231
100	1.030	1.049	1.068	1.088	1.109	1.129	1.150	1.172	1.195	1.218	1.242
110	1.039	1.058	1.078	1.097	1.118	1.139	1.161	1.183	1.206	1.229	1.253
120	1.048	1.067	1.087	1.107	1.128	1.149	1.171	1.193	1.216	1.240	1.264
130	1.057	1.076	1.096	1.117	1.138	1.159	1.181	1.203	1.227	1.250	1.275
140	1.066	1.085	1.106	1.126	1.148	1.169	1.191	1.213	1.237	1.261	1.285
150	1.075	1.094	1.115	1.135	1.157	1.178	1.201	1.224	1.247	1.271	1.296

Volumetric Flow = Indicated Flow x Sqrt (0.075/air density) where air density is the density of air, in lbs/ft^3, going through the Device.

Table A.4.2: **Air Density Factors to Convert from *Indicated* Flow to *SCFM.***

Temp. of air through the Device (F)	Elevation (feet)										
	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
0	1.071	1.052	1.033	1.014	0.995	0.977	0.959	0.941	0.923	0.906	0.889
10	1.060	1.041	1.022	1.004	0.985	0.967	0.949	0.931	0.913	0.896	0.879
20	1.049	1.030	1.011	0.993	0.974	0.957	0.939	0.921	0.904	0.887	0.870
30	1.038	1.020	1.001	0.983	0.964	0.947	0.929	0.912	0.895	0.878	0.861
40	1.028	1.009	0.991	0.973	0.955	0.937	0.920	0.903	0.886	0.869	0.852
50	1.018	0.999	0.981	0.963	0.945	0.928	0.911	0.894	0.877	0.860	0.844
60	1.008	0.990	0.972	0.954	0.936	0.919	0.902	0.885	0.868	0.852	0.836
70	0.998	0.980	0.962	0.945	0.927	0.911	0.894	0.877	0.860	0.844	0.828
80	0.989	0.971	0.954	0.936	0.919	0.902	0.885	0.869	0.852	0.836	0.820
90	0.980	0.962	0.945	0.928	0.910	0.894	0.877	0.861	0.844	0.828	0.813
100	0.971	0.954	0.936	0.919	0.902	0.886	0.869	0.853	0.837	0.821	0.805
110	0.962	0.945	0.928	0.911	0.894	0.878	0.862	0.845	0.829	0.814	0.798
120	0.954	0.937	0.920	0.903	0.886	0.870	0.854	0.838	0.822	0.807	0.791
130	0.946	0.929	0.912	0.896	0.879	0.863	0.847	0.831	0.815	0.800	0.785
140	0.938	0.921	0.905	0.888	0.871	0.856	0.840	0.824	0.808	0.793	0.778
150	0.930	0.914	0.897	0.881	0.864	0.849	0.833	0.817	0.802	0.787	0.772

SCFM = Indicated Flow x Sqrt (air density/0.075) where air density is the density of air, in lbs/ft^3, going through the Device.

Appendix B Technical Specifications

Flow Range:	Ring 2	80 - 300 CFM
	Ring 3	10 - 120 CFM
Flow Accuracy:	+/- 5% of indicated flow or +/- 2 CFM, whichever is greater.	
Power:	Li-Ion Battery Pack	
Battery Life:	Approx. 45 minutes continuous use at 200 CFM, lower flows will result in longer battery life, higher flows will result in shorter battery life	
Recharging Time:	Approx. 3 hours	
Weight:	Without Duct Blaster® fan 3 pounds	
	With Duct Blaster fan 12 pounds	
Dimensions:	Hood - 16” x 16” (inside dimension)	
	Height without Duct Blaster® fan - 22 ½”	
	Height with Duct Blaster fan - 29 ½”	
Operating Temperature Range:	32 F to 120 F	
Storage Temperature Range	20 F to 150 F	