



IMPORTANT SAFETY INSTRUCTIONS READ AND SAVE THESE INSTRUCTIONS

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	 WARNING	<p>Warnings are used when failure to observe instructions or precautions could result in injury or death.</p>
<p>The information presented here is subject to change without notice.</p>		

1.0 Introduction

This manual documents the operational guidelines for Terra Universal's Smart WhisperFlow™ EC (Electronically Commutated) Motor Fan/Filter Unit.

The Smart WhisperFlow™ ECM FFU provides uniform, laminar flow HEPA-filtered air to the area below the mounted unit. This unit incorporates Whisperflow™ advanced baffling technology to reduce noise and ensure uniform airflow.

The Smart WhisperFlow™ ECM Fan/Filter Unit uses an integrated control module referred to in this manual as the EC Motor Control Card. The Control Card features can be accessed at the EC Motor Control panel located on the motor housing, above the HEPA filter housing.

1.1 Fan/Filter Unit Specifications

FFU Specifications	
Size Options	Standard FFUs: 2'x4', 2'x3', 2'x2' Narrow FFUs: 1.3'x4', 1.3'x3', 1.3'x2'
Housing	White powder-coated cold-rolled steel or 304 stainless steel
HEPA Filter	99.99% efficient on removal of particles 0.3 microns and larger
Pre-Filter	20" x 20" x 1" – 30% efficient ASHRAE rated
Impeller	Forward-curved centrifugal type factory balanced. Entire motor/blower assembly is removable from top of housing for service
Face Grille	Perforated anodized aluminum or 304 stainless steel
Velocity	90 FPM or higher
Noise Level	50 dBA (measured at 30" from filter face)
Weight	76 lbs. shipping weight
Power Options	1/3 HP motor; 120V/1/60Hz, 4.2 Amps 220V/1/60Hz or 240V/1/50Hz, 2.7 Amps

2.0 Operation

The unit consists of a 1/3-HP electronically commutative motor driving a forward-curved centrifugal impeller. Air is drawn into the unit through a pleated pre-filter and in turn to an insulated chamber where it is then directed to an exit HEPA filter with a built-in diffuser.

The unit can also be equipped with a 3/8"-diameter challenge port, which can be used to take differential pressure measurements to monitor filter performance or insert aerosols for leak-test certification. Port is capped when not in use.

3.0 Installation

The Fan/Filter Unit is designed to fit on top of a Terra standard 2' x 4' clean room ceiling grid. It includes a threaded fixture at each corner to accommodate four eye-bolts (not provided) that can be used to assist in positioning the unit.

- WARNING: To reduce the risk of fire, electric shock, or injury to persons, observe the following:**
- Use this unit only in the manner intended by the manufacturer. If you have questions, contact the manufacturer.
 - Before servicing or cleaning unit, or replacing a filter, switch power OFF at the service panel and lock the service disconnecting means to prevent power from being accidentally switched on. When the service disconnecting means cannot be locked, securely fasten a prominent warning device, such as a tag, to the service panel.
 - When the removal/disconnection of either filter is required due to service or component replacement, the replacements are to be remounted as previously installed.
 - Installation work and electrical wiring must be done by qualified person(s) in accordance with all applicable codes and standards, including fire-rated construction. All metal components must be properly grounded.
 - When cutting or drilling into a wall or ceiling, do not damage electrical wiring and other hidden utilities.

4.0 Initial Start-up

- WARNING: Keep unit disconnected from power supply during inspection.**

Prior to providing power to the unit, check that no damage has occurred during shipping. This can be accomplished via a visual check to make sure there are no visible dents or penetrations. If the unit is intact, remove the pre-filter and fan guard screen.

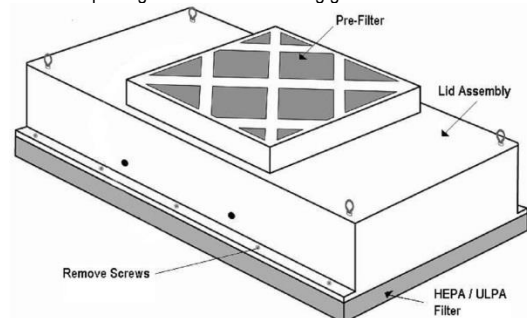
Manually rotate the fan wheel to make sure it is not in contact with any stationary parts and that there are no visible loose screws or bolts obstructing the wheel's rotation. After installation, with power applied, the fan will rotate and filtered air will exit the HEPA filter.

5.0 Cleaning and Maintenance

- WARNING: Disconnect from power supply before servicing unit or replacing filters. When servicing or replacing either filter, the new filter is to be installed in the same manner as the filter it replaces.**

The scheduled maintenance of the unit depends on the installed location and consists of cleaning or changing the pre-filter and the HEPA filter. It is recommended that the pre-filter be inspected and cleaned every three months or sooner depending on the cleanliness of the external environment. The HEPA filter cannot be cleaned and must be replaced when the air velocity falls below 70 feet/min.

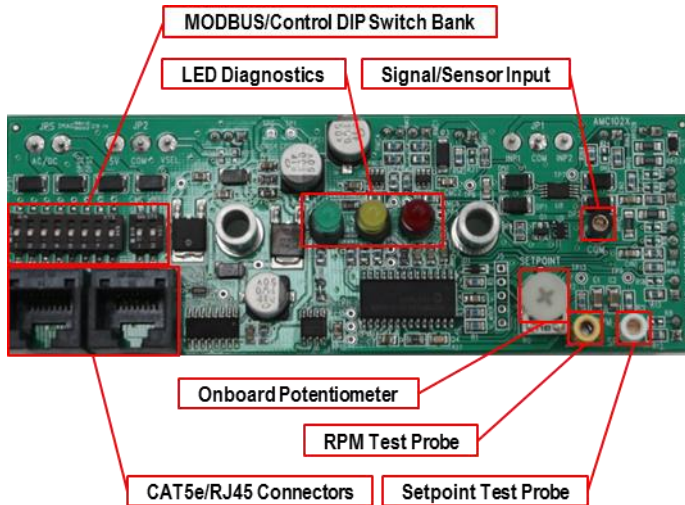
Changing the HEPA filter requires removal of the unit from the ceiling grid. Place the unit on a flat work surface and remove the 10 sheet metal screws that hold the HEPA filter to the case. Replace the filter with a new one and secure it to the case with the same screws before placing it back onto the ceiling grid.



6.0 EC Motor Control Card Set-up

6.1 Overview

The EC Motor Control Card is a variable-speed controller designed for brushless DC (BLDC), electrically-commutated (EC) motors. The control card features industry standard MODBUS® networking, precision speed control (1-100%), and closed-loop control capability that supports a variety of sensors such as air pressure, air flow, and particle counts. The EC Motor Control panel provides access to LED diagnostics, manual speed adjustment, test probe jacks, CAT5e ports, the Control Mode DIP Switch, and the MODBUS® Address DIP Switch Bank.



EC Motor Control Card

- Operating Temperature: 0 – 40°C
- Open-frame PCB with standoffs; Panel-mounted
- 12-24V DC Power Supply (or network power)
- Two non-directional CAT5e/RJ45 connections for networking
- Motor Tachometer RPM Control

Analog Control Options

- 5-10V from controlled voltage source
- 4-20mA signal from a sensor or potentiometer
- Internal Closed-Loop Control
- Manual Speed Adjustment

PWM Speed Command Signal

- 10V, 80Hz

TACH Motor Speed Input

- 10V @ 1mA needed switched to ground
- Maximum 5000 RPM measured
- Minimum 60 RPM measured

Industry Standard MODBUS® Networking

- RTU Protocol
- RS485 9600,8,n,1

6.2 Control Modes

The EC Motor Control Card offers three different control modes for operating the FFU: MODBUS® RTU networking, 0-10 VDC analog control, or manual control through an onboard potentiometer.

Manual Control Mode:

The onboard potentiometer can be manually adjusted at the EC Motor Control Panel using a Philips-head screwdriver. Clockwise rotation increases the motor output, and counterclockwise rotation decreases the motor output.

Analog Control Mode:

Two terminals located on the EC Motor Control Card are designed to receive either a 0-10 VDC demand signal or 4-20mA sensor signal to regulate the motor output.

Network Control Mode:

Each EC Motor Control Card in a MODBUS® network must be assigned a unique address set in **binary format** using the eight DIP switches in the Address DIP Switch Bank.

Control Mode DIP Switch Configurations	
	Manual Control Mode DIP Switch Bank S1: SWITCH #1 OFF SWITCH #2 OFF
	Analog Control Mode DIP Switch Bank S1: SWITCH #1 ON SWITCH #2 OFF
	Network Control Mode DIP Switch Bank S1: SWITCH #1 OFF SWITCH #2 ON
	Closed-Loop Feedback Network Control Mode DIP Switch Bank S1: SWITCH #1 ON SWITCH #2 ON
Example Addresses in Network Mode	
	MODBUS® Address Value = 1 DIP Switch Bank S2: SWITCH #1 ON
	MODBUS® Address Value = 21 DIP Switch Bank S2: SWITCHES #1,3,5 ON

NOTE: Address zero should not be used as it is reserved for global commands.

NOTE: The EC Motor Control Card must be power-cycled for any address changes to take effect.

7.0 Test Probe Terminals

The test probe terminals are provided on the EC Motor Control Card to measure the motor RPM or check for a PWM signal using a multimeter.

Manual or Analog Control Modes:

To measure RPM, set the Address DIP Switches at a value greater than 1. The test probe jacks will output 0-2000 mVDC to represent motor RPM.

Example: 500 mVDC = 500 RPM

To measure demand signal, change the Address DIP Switches to the value of 0.

NOTE: Changing the address will not interrupt power to the Control Card.

Network Control Mode:

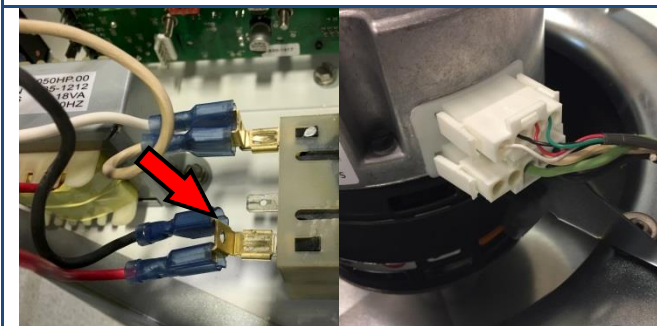
In the MODBUS® network control mode, the test probe terminals will always output 0 - 2000 mVDC to represent motor RPM.

8.0 120V vs. 220V Configuration



120V Configuration

1. Black and Red wires are connected to the same terminal.
2. Yellow Jumper Cable is installed.



220V Configuration

1. Black and Red wires connect to the upper terminal as shown.
2. Yellow Jumper Cable is removed.

9.0 Control Card Electrical Specifications

Electrical Ratings	
Input Voltage, AC, 50/60Hz	12 – 28V ¹ AC
Input Voltage, DC	14 – 30V DC
Operating Current, AC	35 mA AC
Operating Current, DC	30 mA DC
Accessory Current 5V, 10V	50 ³ mA DC
Accessory Current V.RFU ²	100 ³ mA DC
¹ Refers to actual AC voltage values	
² V.RFU is rectified and capacitive-filtered, but is unregulated	
³ Maximum current values stated in support of a single connected load	

“Stand Alone Operation” Power Source Ratings	
Supply Transformer Voltage Rating,	12 – 24V AC
Supply Transformer Power Rating	2 VA
Regulated DC Supply Voltage Rating	14 – 30V DC
Regulated DC Supply Power Rating	2 W

Extended Accessory Output Currents for Stated Input Voltage Condition				
Input Voltage	Accessory Current, DC mA ²			Suggested AC/DC Source Power Rating
	5V	10V	V.RFU	VA
14V DC Regulated	300	300	500	20,20,30
30V DC Regulated	50	50	500	10,10,60
12V AC ¹ Transformer	100	100	100	5,5,5
28V AC ¹ Transformer	50	50	200	10,10,25
¹ AC voltage spec refers to actual AC voltage values , i.e., not transformer ratings, etc.				
² Current values stated in support of a single connected load.				

10.0 EC Motor Specifications

Specifications	
Horsepower	1/3 HP
Voltage	120/240V, 50/60Hz
Speeds	300 – 1250 RPM
Inputs	2 Way Serial Communication & PWM
Frame	NEMA® 48
Enclosure	Continuous Air Over
Mounting	Belly Band
Amperage	4.2/2.7 Amps

11.0 Limited Warranty

Products Manufactured by Terra: Terra Universal, Inc., warrants products that it manufactures to be free from defects for a period of 12 months for parts and 90 days for labor, commencing from the date of shipment. Terra's sole responsibility is to repair or replace, at its option, any part of the product that proves defective or malfunctioning during this time limit. In some cases, components incorporated in Terra Universal products are covered by additional warranties from component manufacturers; obtain specific information from Terra sales representatives. This warranty is void if the equipment is abused or modified by the customer, is operated outside Terra's operating instructions or specifications, or is used in any application other than that for which it is specified. This warranty does not include routine maintenance or service procedures, breakage of quartz baths after 60 days, shipping damage, nor damage from misuse, intentional or unintentional abuse, neglect, natural disasters, or acts of God.

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Generally, customers can improve the chance of collecting on a freight claim by following these procedures: 1) formally requesting that the carrier inspect the shipment immediately upon suspecting damage or shortage to verify condition; 2) notifying the carrier upon discovery of concealed damage and requesting an inspection within 15 days of receipt, both in person or phone and following up via mail; 3) keeping the shipment as intact as possible, including retaining original packaging materials and keeping the product as close to the original receiving location as possible; 4) holding salvage for disposition by the carrier.

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Warranty Returns: All warranty returns must be authorized in advance by Terra Universal and approved under an RMA. Unless approved in advance for good reason, all returns must be in original condition, including all manuals, and must be packaged in original packaging materials. All returned goods are to be shipped to Terra Universal, freight prepaid at customer's expense. See Terra's "Policy and Procedure for Returned Goods."

***Thank you for ordering from
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