



## IMPORTANT SAFETY INSTRUCTIONS READ AND SAVE THESE INSTRUCTIONS

<p><b>Proprietary Notice</b></p> <p>This manual pertains to proprietary devices manufactured by Terra Universal, Inc. Neither this document nor any portion of it may be reproduced in any way without prior written permission from Terra Universal.</p>	<p><b>Safety Notice</b></p> <p>A thorough familiarity with all operating guidelines is essential to safe operation of the product. Failure to observe safety precautions could result in poor performance, damage to the system or other property, or serious bodily injury or death. The following symbols are intended to call your attention to two levels of hazard involved in operation.</p>	
<p>Terra Universal makes no warranties applying to information contained in this manual or its suitability for any implied or inferred purpose. Terra Universal shall not be held liable for any errors this manual contains or for any damages that result from its use.</p>	 CAUTION	<p><b>Cautions are used when failure to observe instructions could result in significant damage to equipment.</b></p>
	 WARNING	<p><b>Warnings are used when failure to observe instructions or precautions could result in injury or death.</b></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	2'x4', 2'x3', 2'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	304 stainless steel
Velocity	90 FPM or higher
Noise Level	50 dBA (measured at 30" from filter face)
Weight	76 lbs., 58 lbs., 49 lbs.
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.



### Replacing the Filters

The Room-Side Replaceable FFU is designed so that the HEPA or ULPA filter can be replaced from inside the cleanroom without breaching the controlled environment. The filter assembly is separate from the fan module, which stays in place in the ceiling grid. Follow these instructions to replace the filter.

- A) First, you must remove the stainless steel screen covering the filter that is held in place with friction catches (Photo 1). This screen protects the filter from damage and enhances airflow uniformity.



Photo 1: Friction catches hold the screen to the fan module housing.

- B) Next, rotate the metal tabs that help hold the HEPA filter in place (see Photo 3).



Photo 3: Filter-face grille's metal tabs.

- C) Gently let the used filter drop down, and set aside. The filter assembly is surrounded by a channel containing gel seal. Wipe any residual gel from the knife-edge of the fan module still in the ceiling to prepare for the replacement filter. Position your new filter carefully before pushing into place; the knife-edge of the fan module should be centered in the channel (equal amounts of gel on both sides). Photo 4 shows the gel-filled channel of the RSR filter.

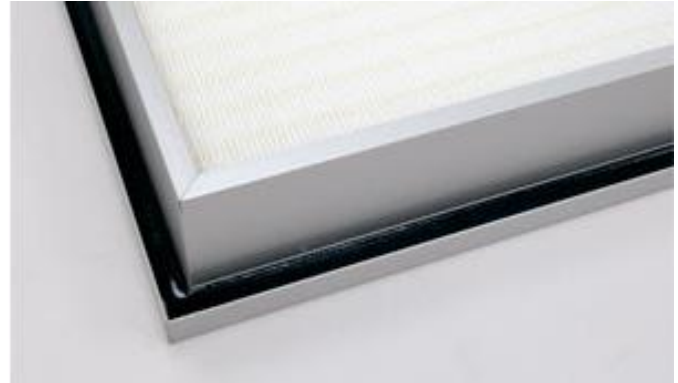


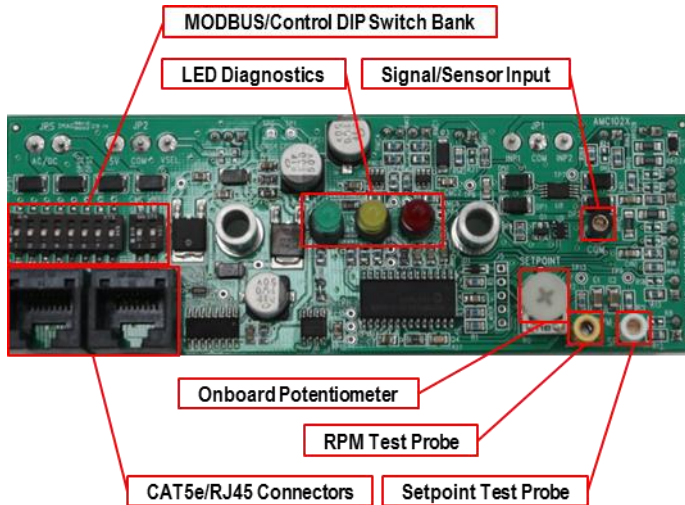
Photo 4: Gel-filled channel of RSR filter.

- D) Rotate the metal tabs so that they lock in the new HEPA filter.
- E) Reinstall the stainless steel screen by pushing up on the friction catches until the screen clicks into place.
- F) To replace the pre-filter located at the top of the fan module, slide the old filter out of the two tracks holding it in place on top of the FFU and then slide in the new pre-filter.

### 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	
	<b>Manual Control Mode</b> DIP Switch Bank S1: SWITCH #1 OFF SWITCH #2 OFF
	<b>Analog Control Mode</b> DIP Switch Bank S1: SWITCH #1 ON SWITCH #2 OFF
	<b>Network Control Mode</b> DIP Switch Bank S1: SWITCH #1 OFF SWITCH #2 ON
	<b>Closed-Loop Feedback Network Control Mode</b> DIP Switch Bank S1: SWITCH #1 ON SWITCH #2 ON
Example Addresses in Network Mode	
	<b>MODBUS® Address Value = 1</b> DIP Switch Bank S2: SWITCH #1 ON
	<b>MODBUS® Address Value = 21</b> 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

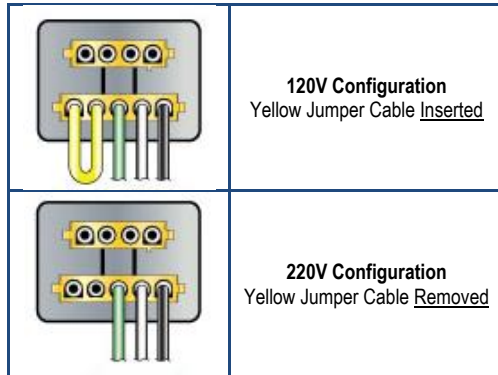
To measure demand signal, change the Address DIP Switches to the value of 0.

**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/220V Conversion



### 9.0 Control Card Electrical Specifications

Electrical Ratings	
Input Voltage, AC, 50/60Hz	12 – 28V <sup>1</sup> AC
Input Voltage, DC	14 – 30V DC
Operating Current, AC	35 mA AC
Operating Current, DC	30 mA DC
Accessory Current 5V, 10V	50 <sup>3</sup> mA DC
Accessory Current V.RFU <sup>2</sup>	100 <sup>3</sup> mA DC
<sup>1</sup> Refers to <b>actual AC voltage values</b>	
<sup>2</sup> V.RFU is rectified and capacitive-filtered, but is unregulated	
<sup>3</sup> 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 <sup>2</sup>			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 <sup>1</sup> Transformer	100	100	100	5,5,5
28V AC <sup>1</sup> Transformer	50	50	200	10,10,25
<sup>1</sup> AC voltage spec refers to <b>actual AC voltage values</b> , i.e., not transformer ratings, etc.				
<sup>2</sup> 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.

**Products Manufactured by Others:** Terra Universal, Inc., warrants that, to the best of its ability, Terra's representations of products that are manufactured by others reflect the manufacturer's representations, subject to change without notice. Sole warranty for these products is the original manufacturer's warranty that is passed forward to the purchaser and constitutes the customer's sole remedy for these products. Detailed warranties for distributed products are available through Terra sales representatives.

**Freight Shortage or Damage:** Upon receipt of any equipment from Terra Universal, Inc., customer shall immediately unpack and inspect for damage or shortage. The customer shall not accept a damaged package or a short shipment until the carrier makes a "damage or shortage" notation on both the carrier's and customer's copy of the freight bill or delivery receipt. Service title passes when the shipment is loaded, so customer is responsible for filing and collecting a freight claim. Any replacement products must be ordered and paid for separately. For Terra's "Policy and Procedures for Returning Goods," see Terra's Internet site: [www.TerraUniversal.com](http://www.TerraUniversal.com).

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.

**All Claims:** Terra Universal expressly disclaims all other warranties, expressed or implied or implied by statute, including the warranties of merchantability or fitness for intended use. Terra Universal is not responsible for consequential or incidental damages arising out of the purchase or use of the products supplied by Terra Universal. Terra Universal is not liable for damage to facilities, other equipment, products, property or personnel of others, or of their agents, suppliers, or affiliated parties, which is caused or alleged to have been caused by products supplied by Terra Universal. In any event or series of events, Terra Universal's total liability for any and all damages whatsoever is limited to the lesser of the actual damages or the original invoice cost of the items alleged to have caused the damage. The customer's sole and exclusive remedy for any cause of action whatsoever is repair or replacement of the non-conforming products or refund of the actual purchase price, at the sole option of Terra Universal. All claims must be made in writing within 90 days of the date the product was shipped. Any claims not made within this time limit shall be deemed waived by the customer. Terra Universal is not responsible for any additional costs of repair caused by poor packaging or in-shipment damage during return.

**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  
Terra Universal!*