

# INSTALLATION, OPERATION & MAINTENANCE

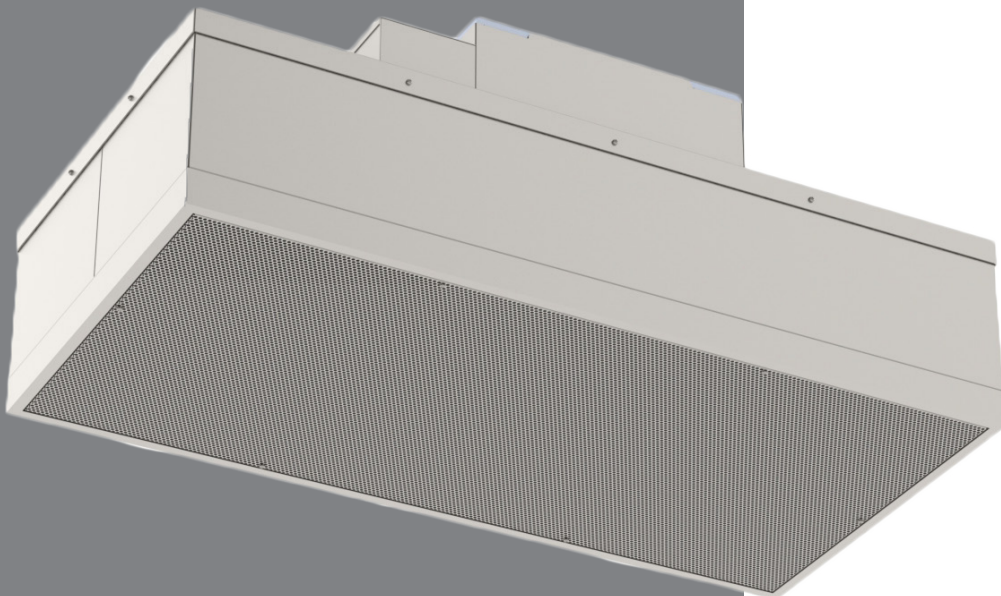
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Fan Filter Units  
CRFF-E, CRFF-E-ARS,  
& CRFF-E-ARSM

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ECM Motors

Revision: 02.01.17



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## Critical Operation Conditions of the CRFF-E, CRFF-E-ARS and CRFF-E-ARSM

1. Touching of the HEPA filter could damage it, voiding the warranty on the filter. The screen is only to protect against an accidental 'touch' of the filter. Never place a hand or tool on the filter. Never lay the filter face flat down on a surface always have filter on its side or back to protect from damage
2. Prior to powering the unit, verify that the unit has been plugged into the correct voltage. The serial number label on the top of the CRFF-E, CRFF-E-ARS and CRFF-E-ARSM unit has the required voltage.
3. For reorder purposes the CRFF-E, CRFF-E-ARS and CRFF-E-ARSM model number, configuration code and serial number should be recorded. This information is located on the product and serial number labels, located adjacent to the electrical box. If you cannot locate the FO# please contact Krueger for this information.

### Read and Save These Instructions





**To reduce the risk of fire, electrical shock, or injury to persons, observe the following**

1. Installation work and electrical wiring must be done by qualified person(s) in accordance with all applicable code and standards, including fire-rated construction
2. When cutting or drilling into wall or ceiling, do not damage electrical wiring and other hidden utilities.
3. If this unit is to be installed over a tub or shower, it must be marked as appropriate for the application.
4. Use this unit only in the manner intended by the manufacturer. If you have any questions, contact the manufacturer:
5. Before servicing or cleaning unit, switch power off at service panel and lock service panel to prevent power from being switched on accidentally.

*Note: Units come set in manual mode from the factory. Please review installation requirements and set up with your end user (See page 7 for complete set up instructions).*

### IMPORTANT

YOUR FAN FILTER UNIT HAS THREE MODES OF OPERATION. IT IS YOUR RESPONSIBILITY AS THE INSTALLER TO SET THE MODE AS REQUIRED. IF UNSURE CONTACT YOUR PROJECT MANAGER OR CONTROLS COMPANY.  
THE MODES ARE SET BY SETTING THE 2 PIN DIP SWITCH.

MANUAL MODE	ANALOG MODE	NETWORK MODE	NETWORK MODE
1 OFF 2 OFF	1 ON 2 OFF	1 OFF 2 ON	1 ON 2 ON
			



## Installation

The CRFF-E Series Critical Room Fan Filter Units are completely assembled at the factory with the exception of the optional ¼" (0.64 cm)-20 eyebolts, which can be used when hanging the unit from an overhead structure.

1. Carefully remove the unit from the shipping carton and inspect for any damage that may have occurred during transportation. (See Figure 1)

*Note: When ordering CRFF-ARS and CRFF-ARSM units, the HEPA filters may be shipped separately to be installed into units after the fan box has been installed.*

*Recommendation: Review mode settings at this time as specified for installation (see page 7 for controls).*

2. If using rigidly supported grid (usually 2" or wider), raise unit through ceiling and lower onto the gasketed grid. If using a flexible grid (typically supported with wires) the unit must be secured to an overhead structure with eyebolts, s-hooks and chain. Screw the four eyebolts into the nutserts on the lid assembly before lifting into an overhead position (see Figure 2)
3. Have an electrician wire the unit to the appropriate voltage (115V, 220V, 277V AC), according to the wiring diagram and all national and local electric codes. All units are equipped with a three position terminal block for field connection. Verify correct single phase power, before energizing units.
4. Turn on the power using the two position rocker switch (ON/OFF) located on the electrical box. For the CRFF-ARS and CRFF-ARSM units, let the unit run for a few hours to purge off particulate (if filters are shipped loose) that may adhere to the inside of the unit before installing the filters. Do not run fan at full speed as this may cause overload condition.

*Note: Your fan filter may have been shipped separate. Controls have been shipped separately.*

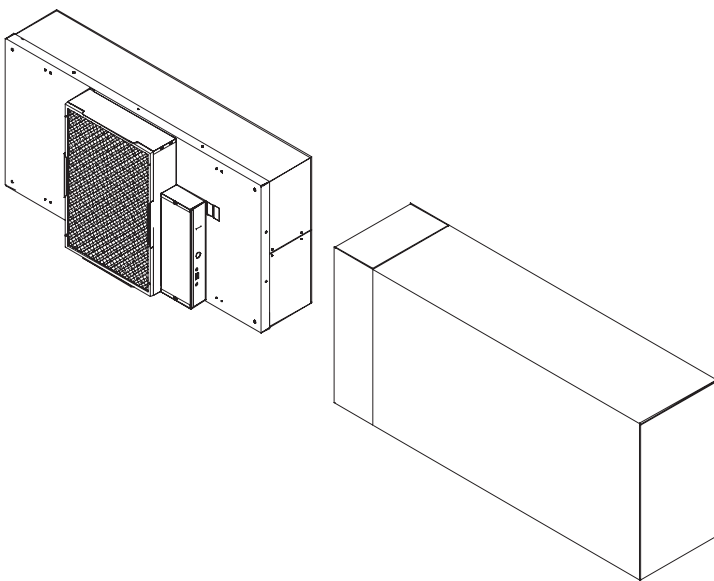


FIGURE 1 - UNBOXING

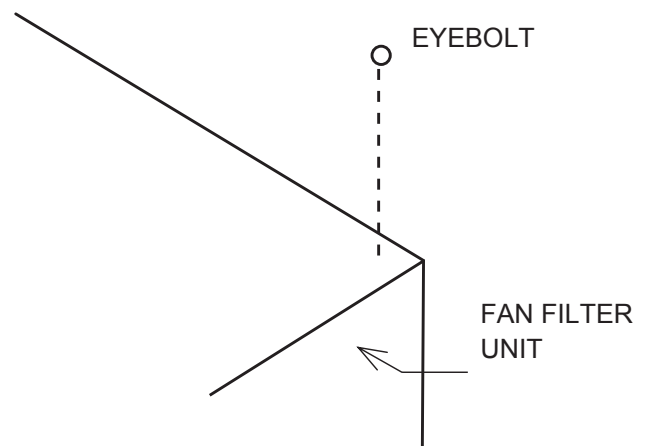


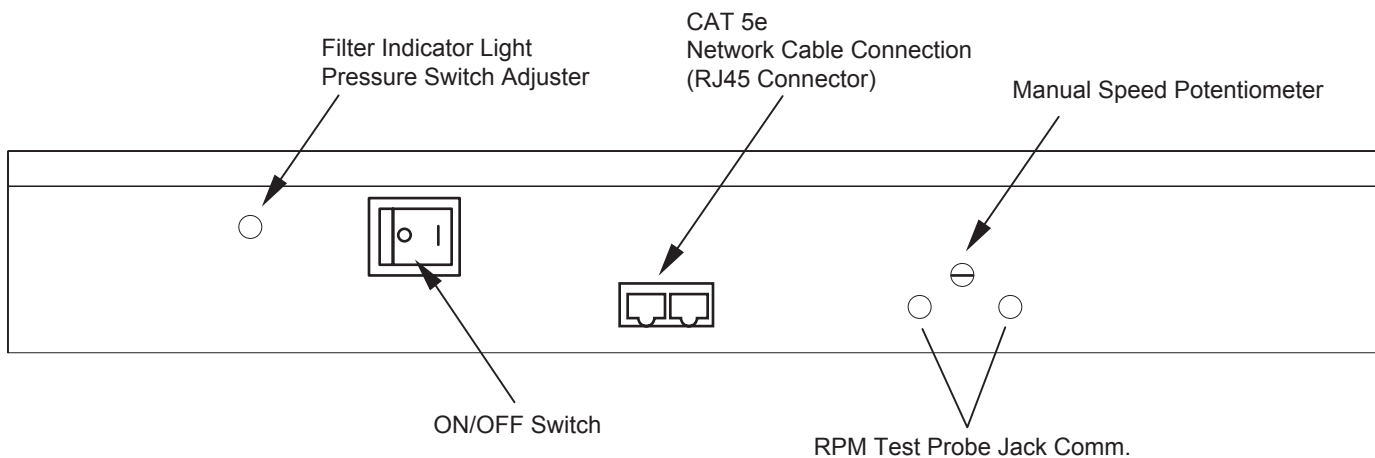
FIGURE 2 - HANGAR SUPPORTS



## ON/OFF Switch - Speed/Airflow Adjustment

All CRFF-E series units are equipped with a two-position rocker switch (ON/OFF), which is located on the side of the electrical box, on top of the unit. Unless otherwise specified, units are furnished with a Universal Control Card to enable adjustment of airflow or set to preferred communication mode.

*Note: The CAT5e/RJ45 network ports are non-directional (in or out). Be sure to examine your cabling to insure that there is no cross-over wired cables.*



## Filter Indicator Light Option

The pressure switch for the filter indicator light option is set at 0.60 in wc from the factory. The set point for the pressure switch can be adjusted between 0.50 in wc and 3.00 in wc by turning the set screw, accessible for the front of the control enclosure. Counterclockwise rotation will increase the set point differential for switching; clockwise rotation will reduce the set point.

The process to adjust this for a specific application is detailed below:

1. Adjust fan to highest setting
2. Measure and note initial pressure differential between ceiling plenum and unit plenum (downstream of the fan and upstream of the filter)
3. Restrict discharge airflow incrementally to increase differential pressure until measured value matches filter loading requirements for the project
  - a. If no specific filter loading requirements are specified a general recommendation is to use twice the pressure differential measured in step 2
4. With the unit discharge blocked, adjust the set point of the pressure switch
  - a. If the indicator light is illuminated, increase the set point of the pressure switch (CCW rotation) until the light dims
  - b. If the indicator light is still dim, slowly decrease the set point of the pressure switch (CW rotation) until the light illuminates
5. Remove obstruction(s) from the unit discharge
6. Adjust fan speed to operational set point

## Universal Control Card Set Up (ENV1028)

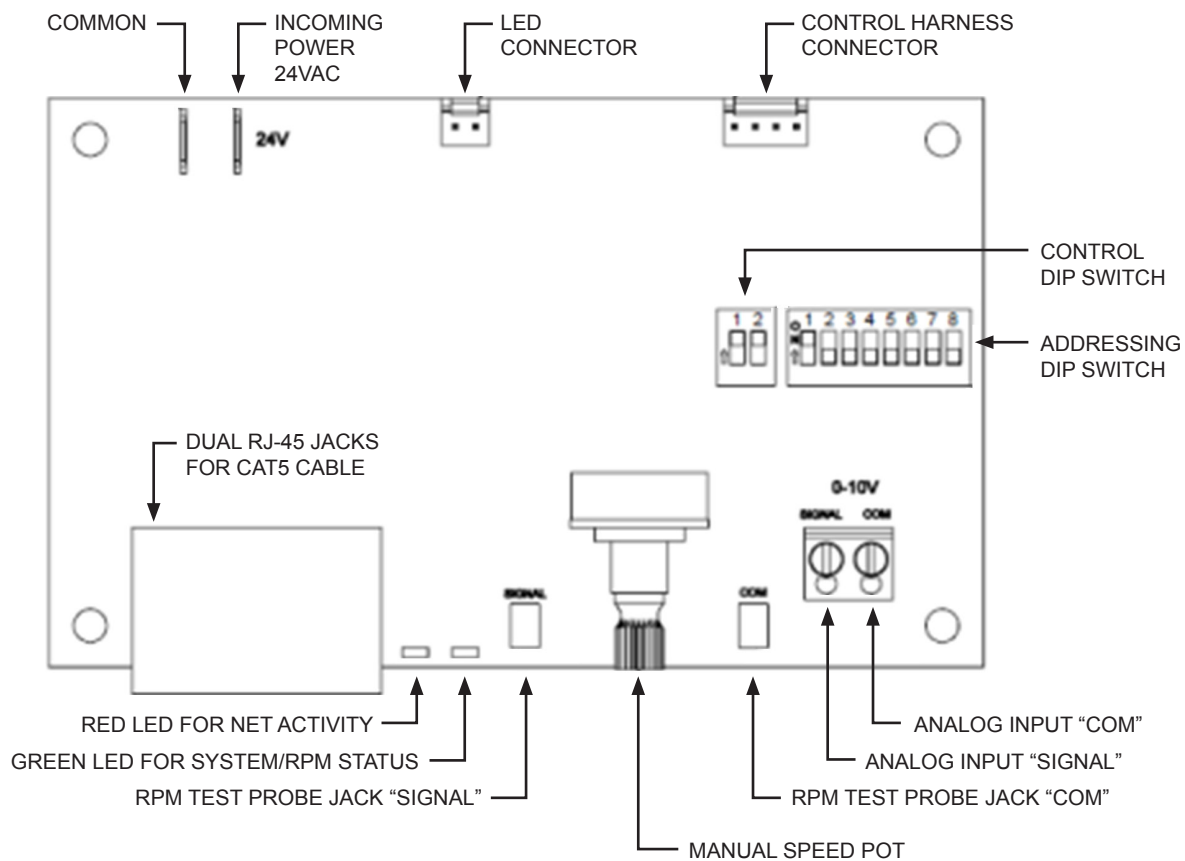
### CON4 UNIVERSAL CONTROL CARD - OVERVIEW

Krueger's ENV1028 Universal Control Card provides MODBUS network and analog control capabilities to a Krueger Fan Filter Unit equipped with an electrically commutated motor. Three different control modes provide installation versatility by allowing the FFU to be controlled via MODBUS RTU network, analog 0-10 VDC control signal, or by adjusting the on-board potentiometer. The ENV1028 Universal Control Card is fully compatible with all of Krueger's plug & play System Control Consoles using MODBUS RTU. Additional details of the controls modes are provided on page 7.

### FEATURES

- + Networkable Via MODBUS RTU
- + 0-10 VDC Analog Control
- + Manual Control Via Onboard Potentiometer
- + Simple Connections
  - RJ45 For Networking Connection
  - Screw Terminals For Analog Control
  - Test Probe Jacks For DC mV Signal Output Of The Following:
    - RPM
    - Motor Control Set Point
- + LED Diagnostics
  - Support for external LED (10mA) remote status notification via 2 Pin MTA connector
  - On-board green LED for Board Status notification
  - On-board red LED for Network Traffic
- + Powered from Network or Local Supply

**FIGURE 7: UNIVERSAL CARD OVERVIEW**



## Control Modes

The ENV1028 operates in one of three selectable modes. The Mode is selected using the control DIP switch; MANUAL control (on-board potentiometer), ANALOG control (Remote 0-10 VDC), NETWORK control (MODBUS RTU). The ENV1028 is shipped from the factory in NETWORK control mode.

### Manual Control Mode

In Manual control mode, the motor speed is set using the onboard potentiometer. Onboard potentiometer rotation is CW to increase the motor output.

### Analog Control Mode

In ANALOG control mode, the motor output is set using an external 0-10 VDC demand signal.

### Network Control Mode

In NETWORK control mode, the motor output is set using MODBUS Register 2. Motor output is specified as a value from 0 to 100 representing a percentage of motor torque output. Each ENV1028 in a MODBUS network must be set to a unique address. The address value is set in binary using the eight DIP switches of switch band (S2). A maximum of 200 ENV1028 devices is recommended per local area network (LAN).

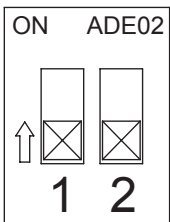
### Network Control Mode (cont)

If a Krueger ACC Control Console is the MODBUS master, then addresses should be assigned within the address range supported by the Control Console. Address zero should not be used as it is reserved for global commands. Address switch settings are only checked by the ENV1028 at power-up. Power must be cycled (OFF/ON) before any changes take effect.

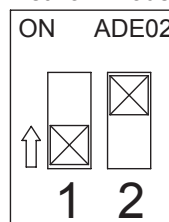
Registers relevant to this mode:

- Register 1 “Start/Stop” (R/W)
  - To enable motor, write a value of 1; To disable motor, write a value of 0
- Register 2 “Motor Set Speed” (R/W)
  - Motor Target speed value. Values may be written from 0 to 100
- Register 6 “RPM” (R)
  - Motor RPM. Read from the motor
- Register 12 “Actual Motor Speed Instruction” (R)
  - Speed control signal applied to the motor by the ENV1028. (R/W) = Read/Write, (R) = Read Only

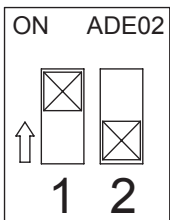
Manual Mode = 1 OFF 2 OFF



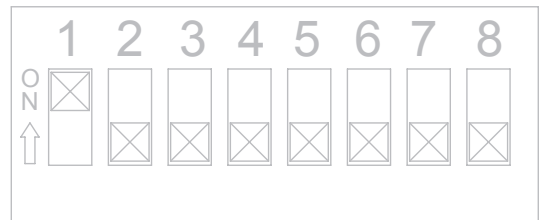
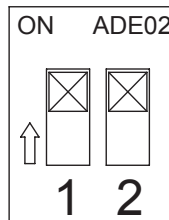
Network Mode = 1 OFF 2 ON



Analog Mode = 1 ON 2 OFF

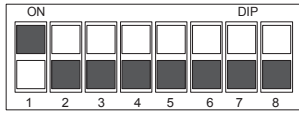


Network Mode = 1 ON 2 ON

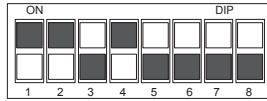


Note: Network mode can be configured using either DIP switch setting shown above. DIP switch pictorials are for reference and may be labeled differently by the manufacturer.

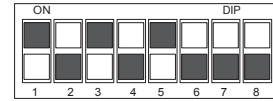
**Control Modes (continued)**



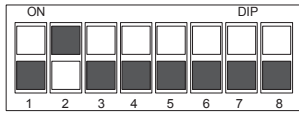
**1**



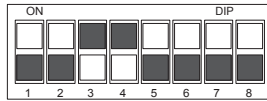
**11**



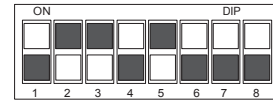
**21**



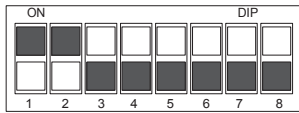
**2**



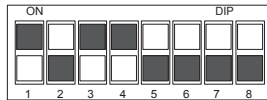
**12**



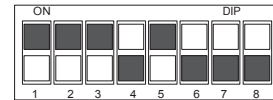
**22**



**3**



**13**



**23**

**Example of binary S2 switch settings**

## Electrical Specification

### Control and Interface Signals

#### External Speed 0-10V Input

- Input impedance 20kOhms.
- MIN ON-to-OFF threshold: 190mV\*
- MAX OFF-to-ON threshold: 240mV\*
- ON (-215mV) to 9.89V linearly scales 1 to 99% speed.
- 9.89V or more deadbands to 100% speed.

#### RPM Signal

- Signal Value: mVDC = RPM
- Ex: 900mV = 900RPM
- RPM Output Range: - 0, 5 to 2000 RPM (0, 5mV to 2000 mV DC)
- RPM Output Resolution: 5RPM (zero, 400 steps from 5 to 2000 RPM inclusive)

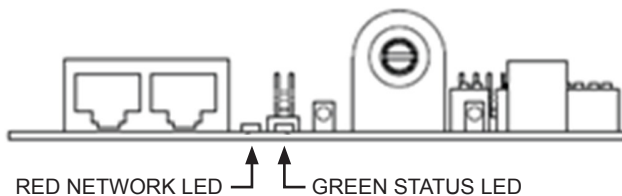
### Test Probe Jack Points

The test probe jacks may be used to measure the motor rpm or the PWM signal that is being output to the motor.

- In Manual or Analog Control Mode with an Address setting of 1 or greater, the test probe jacks output 0-2000 mVDC representing motor RPM. By changing the address DIP switches to 0, the test probe jacks will output 0-1000 mVDC representing 0-100% demand signal to the motor. The address may be changed without interrupting power to the control card.
- In Network Control Mode, 0-2000 mVDC always represents RPM.

Net LED Status Definitio	
Green LED OFF	Power lost or no communications.
LED Flickering	Network data traffic in progress
Green LED ON	A/B network cables are swapped.

**FIGURE 9: LED LIGHT LOCATIONS**



Specificatio	Min	Typical	Max	Units
Input Voltage	22	24	42	VAC
Supply Frequency	50	50 / 60	60	Hz
Input Power Consumption	n/a	n/a	0.5	VA
Ambient Operating Temperature	0	25	50	C

#### External LED Output

- 10mA regulated.
- LED forward voltages up to 5V.

### LED Indicators

- Onboard Status LED:  
The Onboard Status LED is software controlled by the unit microcontroller. The Status LED is solid ON when RPM reported by the motor is greater than zero and OFF when RPM reported by the motor is zero.
- External Status LED:  
Support for an external Status LED (10mA current-controlled driver), via a 2-pin MTA connector, for remote system status notification. The external Status LED operates in the same manner as the Onboard Status LED.
- Onboard Net LED:  
The Onboard Net LED is driven directly by the receive data signal. The NET LED shows all network traffic on a 2-wire network. The NET LED is intended to confirm low-level network connectivity, independent of microcontroller or firmware functionality. If A/B network wires are swapped, the NET LED will be normally on, providing quick diagnostics of this common condition.

R 5 Networ Cable Connections						
	2	3		5		
Bus Power Pass Through	0V (GND)	RS-485			0V (GND)	Bus Power Pass Through
		+	NC	NC		

## Communication Specification

### Overview

- MODBUS RTU protocol over RS485 (serial).
- 9600 baud rate, word length is 8, parity is none(n), stop bits=1.
- 255 unique address values selectable by DIP switch settings. (Recommended network node capacity 200 nodes.)
- Slew rate limited transceivers for improved network performance.

**Do not use crossover cables. This may damage the control card or render it non-operational.**

**MODBUS REGISTER SUMMARY TABLE**

Register	Name	R/W	Values & Defaults	Units	Origin	Comments
1	RUN/STOP	RW	0,1	1	RAM	power up from REG 14
2	DEMAND	RW	0-100	%	RAM	power up from REG 10
6	SPEED	R	0,5-2000	RPM	LIVE	
7	ANA1	R	0-1000	-	LIVE	Onboard Pot 0-1000=0-100%
9	STATUS	R	see detail	-	LIVE	
10	DEFAULT SPEED	RW	0-100	50	EEPROM	applies to network only
12	CURRENT SPEED	R	0-100	-	LIVE	
14	DEFAULT RUN/STOP	RW	0,1	1	EEPROM	applies in network mode only
24	ANA2	R	0-1000	-	LIVE	0-10V input 0-1000=0-10VDC

To reset non-volatile registers to factory default values, write 170 (AA hex) to Register 14, then cycle power.

*Note: Register 24 may be read in network mode to determine the value of 0-10VDC signal that may be connected. For example, a pressure transducer may be connected to indicate unit static pressure*

## Troubleshooting

### Mode Choice

Verify mode setting choice to DIP switch S1 (Control Mode), which is manual mode and then retry.

### Motor Issues in Manual Mode

(If you are in a network or analog mode, contact your controls contractor for troubleshooting assistance; if you continue to need assistance, contact the factory.)

### Unit is Not Adjustable

Verify that rotation of the knob does not change the RPM or Flow Index display on the unit. If rotating does nothing, remove the electrical box cover and remove the 4-pin connector from the Visual Speed control and install in 180 degrees rotated. Again adjust the knob. The 4 pin connector is on the 1/8" white conductor.

### Low Air Velocity

1. Check pre-filter media; replace or clean as necessary.
2. Adjust visual speed control for higher blower output.
3. Check power supply for proper voltage, amperage and distribution frequency.
4. Replace HEPA filter if the air velocity remains low.

### High Air Velocity

1. Adjust visual speed control for lower blower output.

### Non-Laminar Flow and/or Excessive Contamination

1. Ensure that no large obstructions are upstream of airflow pattern
2. Determine that no other air-moving devices are operating in or around clean room which disrupt room's airflow pattern
3. Check air velocity and if low, conduct the "Low Air Velocity" procedure outlined above.
4. Conduct smoke and photometer test on HEPA filter. Seal or replace HEPA filter as necessary.

## CRFF Series Replacement Parts

Replacement parts are available through your authorized Krueger representative.

Please visit the Krueger website at [www.krueger-hvac.com](http://www.krueger-hvac.com) to find your local Krueger representative

## Warranty

Please reference the Krueger website for Warranty information located in the Terms and Conditions of Sales document or click on the following link,

<http://www.krueger-hvac.com/pdf/terms.pdf>



## Infrared Speed Control (Optional)

The Flow-Set is a handheld infrared remote control configured to adjust the Krueger CRFF-E and CRFF-E-ARS units.

An EVO/ECM-IRC control sends the ECM motors a FLOW INDEX and a GO signal. The motor sends back a status signal that is connected to a red lamp. The control includes an infrared remote receiver.

The Flow-Set handheld remote sends infrared remote commands to the EVO/ECM-IRC control, allowing remote adjustment of the ECM motor. Using the Flow-Set, you can turn the motor ON/OFF, adjust the flow index from 1-100 and read the current settings.

Point the Flow-Set at the Flow-Set target (red lamp if the motor is on) on the equipment. Operate the ON/OFF button or any of the four buttons. The green lamp near the Flow-Set target lights, indicating you are in an adjustment session. Continue to operate the on/off button or any of the four buttons to achieve the desired settings.

Press the Enter button to save your new settings and exit the adjustment session. Press the Clear button to delete your new settings, revert to the ECM settings and exit the adjustment session. If you enter an adjustment session and do not make any adjustments for 15 minutes, the adjustment session automatically clears.

Use the Clear button to read the current settings. Point the Flow-Set at the Flow-Set target and press the Clear button. A green lamp begins to flash indicating the signal was received. The flash sequence indicates the current flow index. The sequence occurs in two sets. The tens (1st) set uses long flashes to indicate the tens digit. The units (2nd) set uses short flashes to indicate the unit's digit. An extra long flash in the tens set or the units set indicates the value of the corresponding digit is zero.

- A flow index of 24 flashes two longs, then 4 short
- A flow index of 89 flashes 8 longs, then 9 short
- A flow index of 30 flashes 3 longs, then an extra long
- A flow index of 04 flashes an extra long, then 4 short
- A flow index of 100 flashes 10 longs, then an extra long

Use the ON/OFF button to turn the motor on or off. Point the Flow-Set at the Flow-Set target on the equipment and press the ON/OFF button. If you press Enter while the motor is off, the motor stays off, even through a power ON/OFF cycle.

Adjust the flow index using the  $\uparrow\downarrow$  buttons. The  $\uparrow\downarrow$  button pair on the left adjusts the index  $\uparrow\downarrow$  10. The  $\uparrow\downarrow$  button pair on the right adjusts the flow index  $\uparrow\downarrow$  1. Using the  $\uparrow\downarrow$  10 pair, you can quickly move the index up and down. Using the  $\uparrow\downarrow$  1 pair, you can precisely set the index to achieve the desired flow. During an adjustment session, the green lamp blinks each time you make a valid entry. If the flow index is already 100, and you try to increase the flow index, the green lamp does not blink, and the increase does not occur. If the flow index is at 91 and you press the  $\uparrow$ 10 buttons, the green lamp does not blink and the increase does not occur because your entry would take the index above 100. When the flow index is greater than 90, use the  $\uparrow$ 1 button to increase the index. The  $\downarrow$ 1 and  $\downarrow$ 10 keys respond in a like manner when you try to set the flow index below 1. (Zero is not a valid flow index)

## Batteries

Two AA batteries power the EVO/IRC-Masters. Remove the sliding door on the back of the unit to expose the battery compartment. Remove the old batteries. Insert the new batteries in the position indicated by the battery pictures molded into the bottom of the battery compartment. The battery spring clips are difficult, so you may need to use a small screwdriver to "shoehorn" the batteries into place.

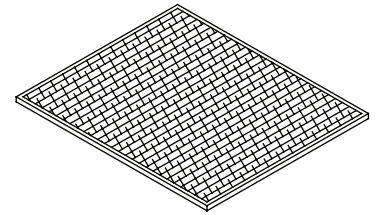
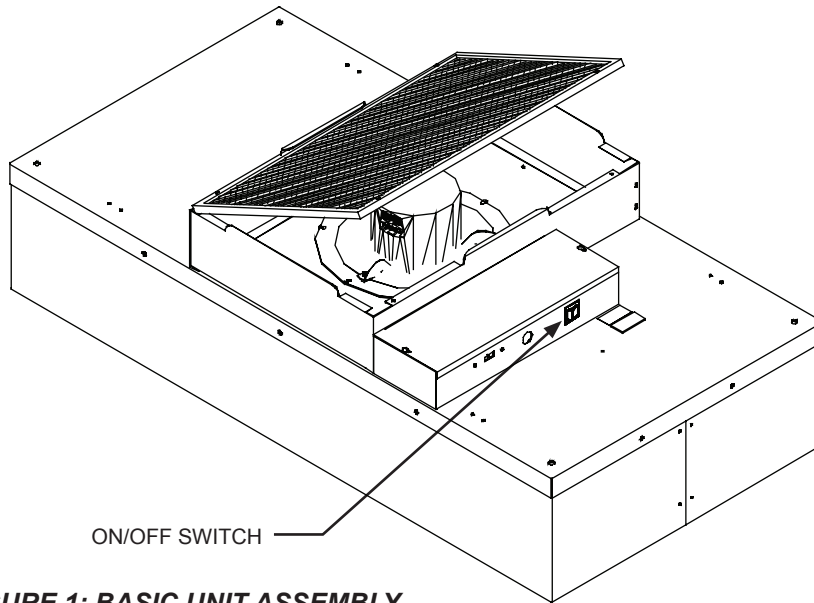
For maximum battery life, store the EVO/IRC-Masters so the buttons are not pressed. While current drain is minimum when the unit is not sending infrared signals, some battery current is drawn to sense the pressed key.



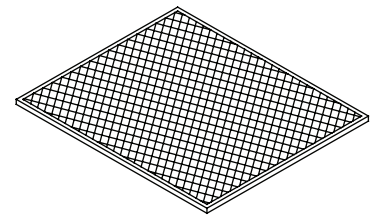
**INFRARED REMOTE**



## Cleaning the CRFF-E Prefilter



PREFILTER SURFACE ON TOP SIDE



SUPPORT SCREEN ON BOTTOM SIDE

**FIGURE 1: BASIC UNIT ASSEMBLY**



**Disconnect the unit from the electrical power source before attempting any service.**

**Tools Required: None**

**Filter Dimensions: 23.25" x 16"**

1. To gain access to the prefilter, remove the ceiling panel next to the unit, if applicable.
2. Switch the ON/OFF switch to the OFF position.
3. Remove the prefilter from the snap-in frame (See Figure 1)
4. Clean the prefilter by hand washing in water with mild detergent or by using a vacuum cleaner. Allow prefilter to dry completely before replacing
5. Reassemble by reversing the above steps.

*Note: To keep the filter in top operating condition, washing the foam prefilter is recommended every three to six months.*

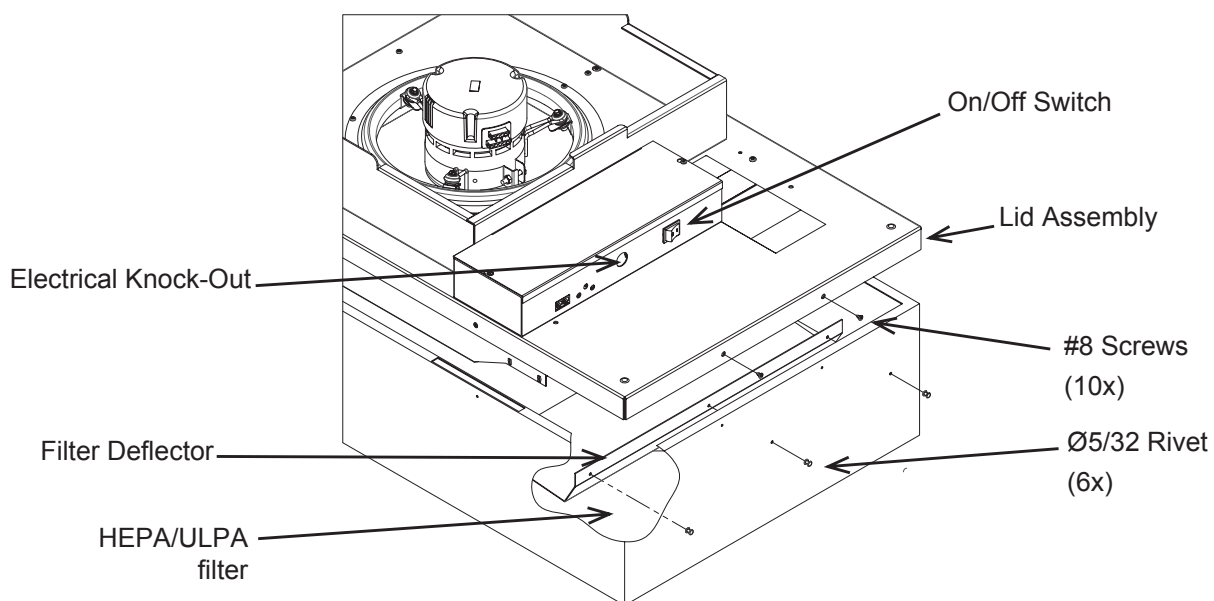
## Removal and Replacement of the HEPA/ULPA Filter (CRFF-E Type Units)



**Disconnect the unit from the electrical power source before attempting any service. The standard filter is protected with an expanded metal face screen. This is never to be used to handle the filter. It is only for protection against an accidental touch of the filter. Only handle the filter by the frame**

**Tools Required:** Phillips Head Driver, Battery Operated Drill with 5/32 drill bit, Rivet Hand Tool, 5/32 aluminum grip range .126-.187

1. Remove unit from ceiling.
2. Remove the 10 screws holding the HEPA/ULPA filter to the lid assembly.
3. Lift the lid assembly off the HEPA/ULPA filter. (See Figure 1) Remove filter deflectors using 5/32 drill bit. Keep filter deflectors to install in new filter. Discard the used filter as per requirements of the applicable regulations. Carefully install the filter deflectors into the new filter using the 5/32 rivets. Do not touch or place the filter deflectors on the HEPA/ULPA media pack. This could cause tears in the filter pack.
4. Before replacing with the new filter, carefully inspect the new filter for any visible damage. Also inspect the gasket and the T-Bar to insure a tight seal. Replace if necessary.
5. To replace a filter, raise the filter and rotate into position in the ceiling grid (with power off), then lower the plenum housing into place. Reconnect wiring and hardware from previous steps that have been removed.
6. Restore power and verify proper operation of CRFF-E.



**Figure : Standard Filter Change**

## Removal and Installation of the Access Room Side Gel Seal Filter – Extruded Aluminum Housing (CRFF-E-ARS Type Units)

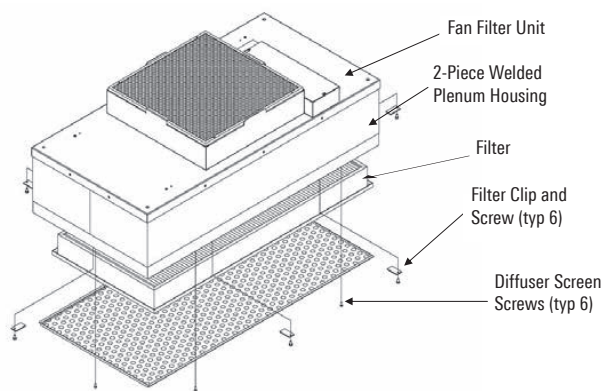


**Disconnect the unit from the electrical power source before attempting any service.**  
**The ARS filter is protected with an expanded metal face screen. This is never to be used to handle the filter. It is only for protection against an accidental touch of the filter. Only handle the filter by the frame**

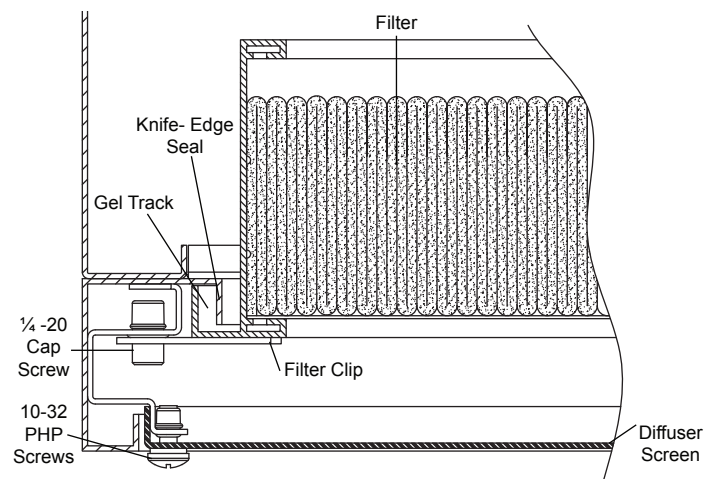
**Tools Required:** Phillips Head Driver, Battery Operated Drill, 3/16” hex head ball driver (2ea)

**Manpower Required:** 2

1. With the power off, remove the diffuser screen by removing the 6 each 10-32x1/2 screws, then carefully place in a safe location.
2. Loosen the six 1/4x12 socket head screws far enough to rotate the eight filter clips 90°. The filter may be loose enough to drop during this operation. If not, slowly pull the filter away from the knife-edge seal, taking care not to touch the filter face during this operation. It is important to pull the filter slowly away from the seal, so that the gel remains in the filter gel track.
3. Carefully clean plenum assembly knife edge surface of residual gel material.
4. Inspect filter for visible damage, if damaged set aside for replacement or repair.
5. Inspect the gel seal, if reinstalling the removed filter. Determine if the gel has lost its ability to seal (i.e. the gel should reform to cover the track without voids or openings), if so repair the gel material or consider replacement of filter.
6. Place the filter evenly against the filter-sealing surface of the unit. Reposition filter clips and screws. The clips should be rotated and angled into place. It is recommended that four workers work on each corner of the filter simultaneously, holding the filter seated into the track. Hand tighten clips from opposite corners evenly until all clamps are tightened.
7. Reinstall diffuser screen by hand-tightening the screws.
8. Determine if recertification or testing of replacement is required.
9. Restore power to FFU and verify proper operation of FFU.




**CRFF-E-ARS & CRFF-E-ARSM Filter Change**



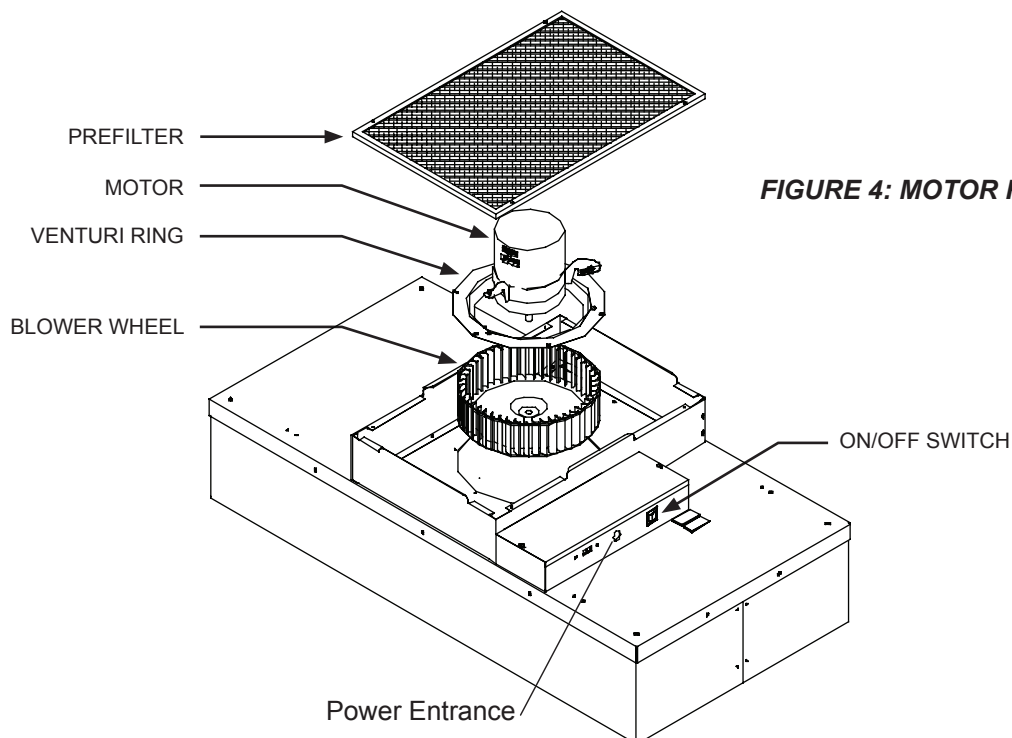
**RSR/E Sheet Metal Filter Replacement**

## Removal and Installation of the Motor (CRFF-E and CRFF-E-ARS Models)

 **Disconnect the unit from the electrical power source before attempting any service.**  
**Electrical service should be performed by licensed electricians or authorized KRUEGER service technicians.**

**Tools Required:** Phillips Head Driver, Battery Operated Drill, (2) 8 adjustable wrenches, 3/8" (10mm) Hex Head Wrench, Pliers, and #2 Screwdriver

1. To gain access to the motor, remove the ceiling panel next to the unit, if applicable.
2. Switch the ON-OFF switch to the off position.
3. Remove the prefilter of the prefilter frame. (See Figure 4)
4. Loosen the electrical box cover screws (2), and slide/lift off cover. (See Figure 4)
5. Make note of all wire locations for re-installation later.
6. Disconnect 5-pin and 16-pin wire harnesses from the electrical box housing and remove tubing for test port, if installed.
7. Remove the eight mounting screws to free the motor/blower assembly from the lid assembly. If using power drivers, set the unit to a low torque setting to avoid stripping the sheet metal screws. Carefully remove housing assembly, paying attention to wire routing. (See Figure 4)
8. Using an adjustable wrench loosen the two set screws that attach the blower wheel to the motor shaft.
9. Mark the location of the motor support bracket (belly band), then loosen the bolt just enough to allow the motor support bracket to slide off the motor.
10. Using the removed motor, mark the new motor with the location of the motor support bracket.
11. Replace with the new motor and reassemble by reversing the above steps 1-8. Set the spacing at 0.25" (6.35 mm) clearance between the blower and the upper motor plate/prefilter frame. This will give a 0.11" overlap between the venturi ring and the blower.



## Removal and Installation of the CRFF-E-ARSM with Access Room Side Motor

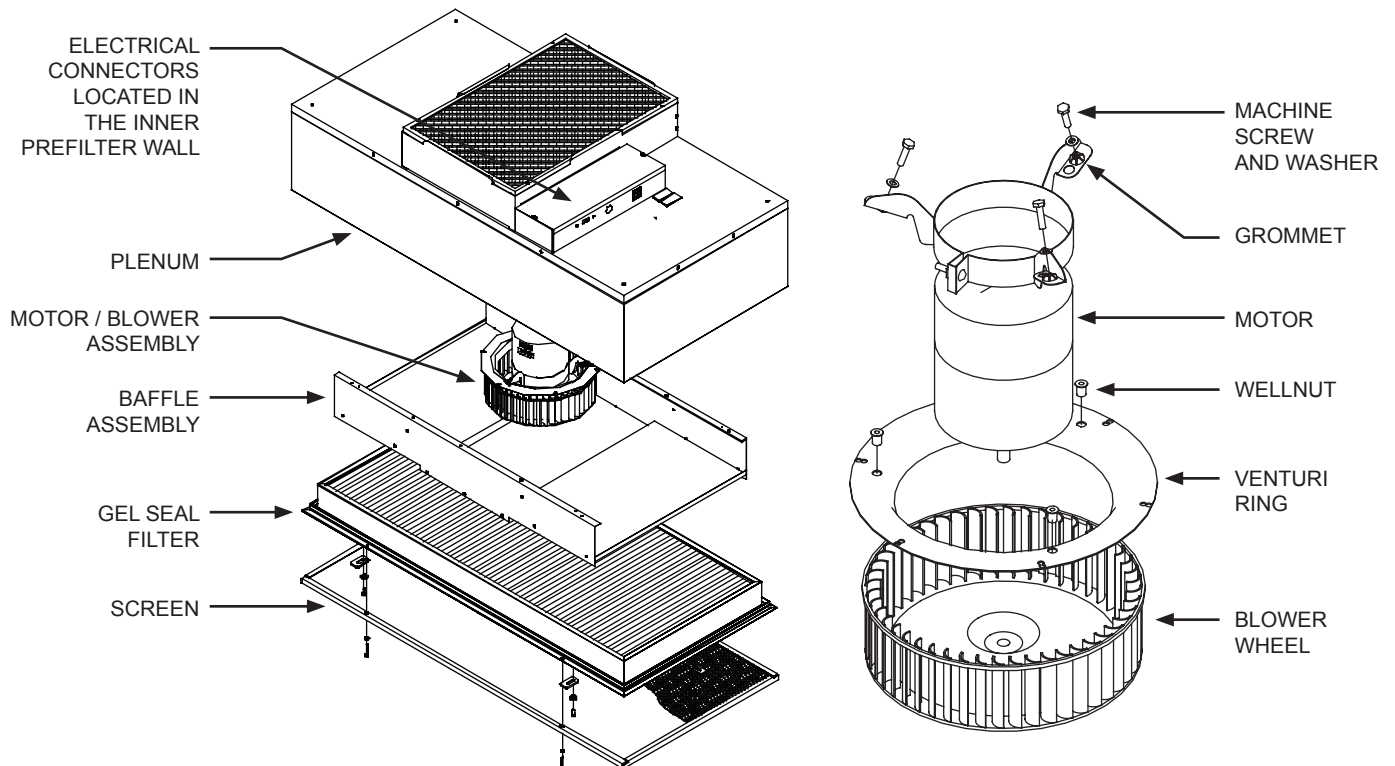


**Disconnect the unit from the electrical power source before attempting any service. Electrical service should be performed by licensed electricians or authorized KRUEGER service technicians.**

**Tools Required:** 3/16" Ball Driver, Phillips screw bit, Head Driver, Battery Operated Drill, (2) 8" adjustable wrenches, 3/8" (10 mm) hex head wrench, #2 standard screwdriver, and pliers.

1. To gain access to the motor, remove the gel seal filter (See Figure 5)
2. Prior to removing motor/blower assembly, remove blower wheel to expose motor connectors on motor. Using an adjustable wrench loosen the two set screws that attach the blower wheel to the motor shaft. Disconnect the two brown wires from the capacitor, using a pair of pliers. Disconnect 5-pin and 16-pin wire harnesses from the electrical box housing and remove the tubing for test port, if installed.
3. While supporting the motor/blower assembly from below, remove the six machine screws that secure the venturi ring to the bottom face of the lid.
4. Using a 5/32" (0.40 cm) Allen wrench, remove the blower wheel from the motor shaft. Remove motor from the venturi ring by removing the three # 10 bolts.
5. Before removal of the motor mount bracket, measure the precise location of the bracket on the motor. Remove the bracket.
6. Replace with the new motor and reassemble by reversing the above steps. Set the location of the motor mount bracket as measured (see above Step 6). Set the spacing at 0.25" (6.35 mm) clearance between the blower and the upper motor plate/prefilter frame creating a 0.11" (2.80 mm) overlap between the wheel and the venturi ring. When reinstalling the assembly, align the plate to insure that the leads will reach the electrical box.

**FIGURE 5: CRFF-ARSM WITH ROOM SIDE ACCESSIBLE MOTOR REPLACEMENT**



## Technical Notes

Changing out from GE 2.3 to Nidec PerfectSpeed DC Motors in the field. The Krueger family of Fan Filter Units has previously used the GE 2.3 motor that was purchased by Regal Beloit. The older models have GE 2.3 motors that have become obsolete and are replaced with the new Regal Beloit model EON. The EON motor is currently being evaluated and you will be receiving a new manufactured motor named Nidec PerfectSpeed.

When you order a replacement motor they will be a form and fit replacement, except for the cable that connects to the control board and the motor. The new Nidec motor will require you to replace the cable. The old cable was a sixteen pin connector while the new motor cable will have a four pin connector as shown in the photo to the right.

Please use the new cable with the new four pin connector to connect your new motor. The cable number will be determined by the build style of your unit.



New Cable Style



Old Cable Style

### Nidec Part References

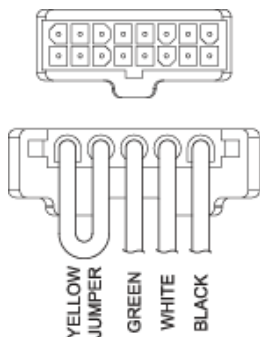
- 18 in Standard Build 63751-015
- 12 in CRFF-E-ARSM Build 63751-016
- 15 ft Whip 63751-017

### Old Cable References

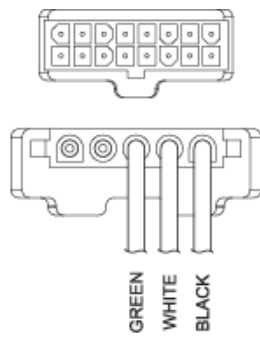
The power cable, has remained the same for the new motor and will be reused. The rest of the fit and function will be a direct replacement. Follow the procedure in the IOM for motor swap for your particular FFU.



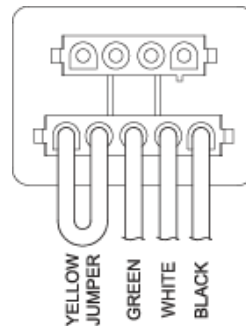
Old Cable Style



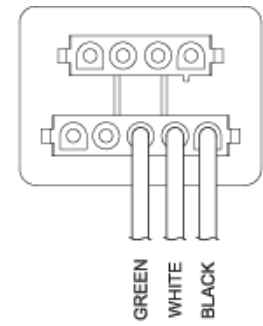
**FIGURE 1**  
120V GE Motor  
(with yellow jumper)



**FIGURE 2**  
208-240V or 277V GE Motor  
(without yellow jumper)



**FIGURE 3**  
120V Nidec Motor  
(with yellow jumper)



**FIGURE 4**  
208-240V or 277V Nidec Motor  
(without yellow jumper)



## Technical Notes (continued)

### Designs with Duct Collar, VAV or constant air box and fan coils

For applications requiring powered fan filter units and a ducted connection our recommendation would be to use CRFF, CRFF-ARS, or CRFF-ARSM units equipped with PSC motors.

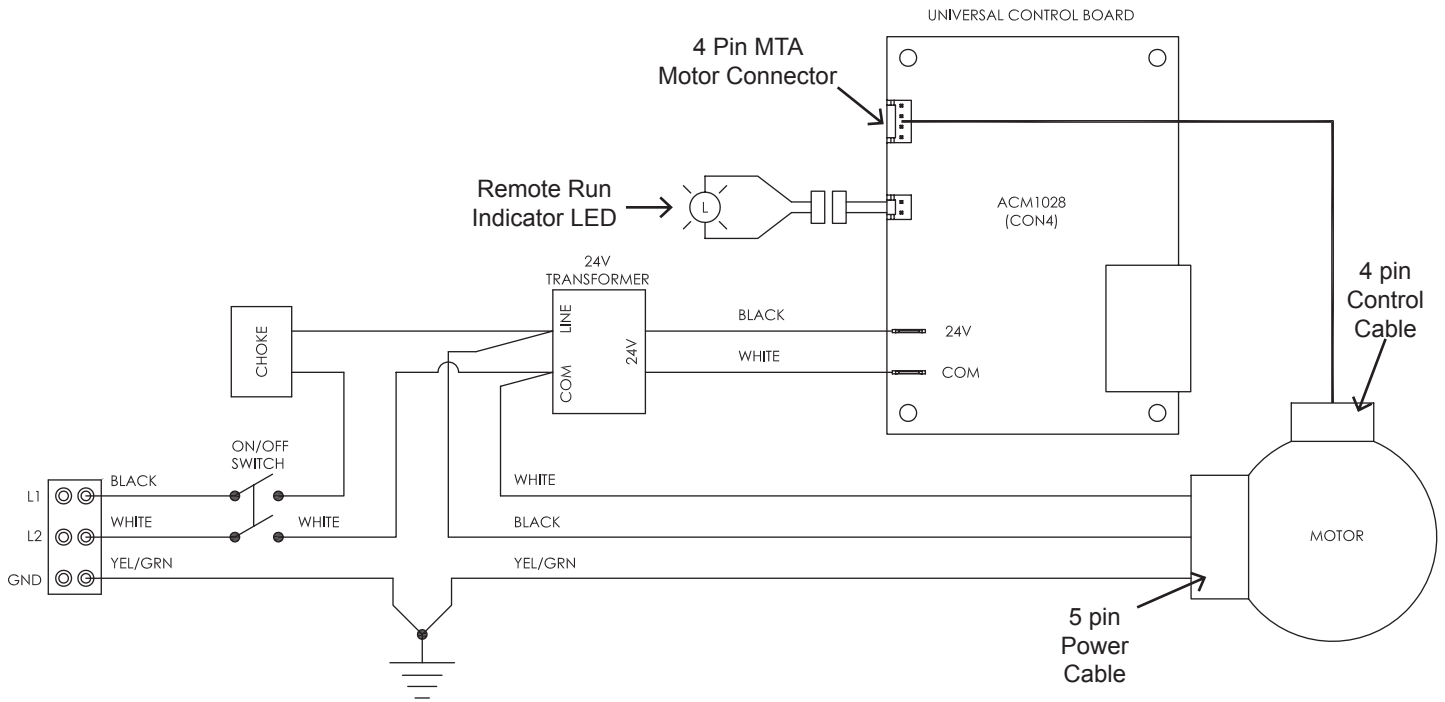
### Caution

CRFF-E, CRFF-E-ARS, and CRFF-E-ARSM units are not recommend for use with ducted systems, and cannot operate with inlet static pressure exceeding 0.30 in wg.

For applications when you use a VAV box or Constant Airflow Terminal, Duct Collars or Fan coils. The design engineer must advise the contractor or air balancer that the air supply needs to be balanced. If you do not balance the air supply properly you have the potential to starve or over feed the fan with air causing the motor to stall which can damage the fan motor. This also can be minimized by notifying Krueger beforehand for assistance. The ECM motors used in the CRFF-E, CRFF-E-ARS, and CRFF-E-ARSM designs are a Microprocessor controlled motor and are designed to maintain a constant air volume. When two controllers are compensating the air volume at the same time, the motor microprocessor is unable to stabilize the airflow and will shut itself down if it cannot find a stable operating point.

In addition to properly balancing the airflow to the Fan, you should prepare a sequence of operations turning on FFU's prior to energizing the Air Handler to prevent potential backward rotation of the blower wheel which can prevent motor rotating in the proper direction and will reduce airflow and cause eventual shutdown. The drive components inside the ECM motors are self-testing and sized for the motor being used inside the unit they can't compete with the airflows from a duct blower motor.

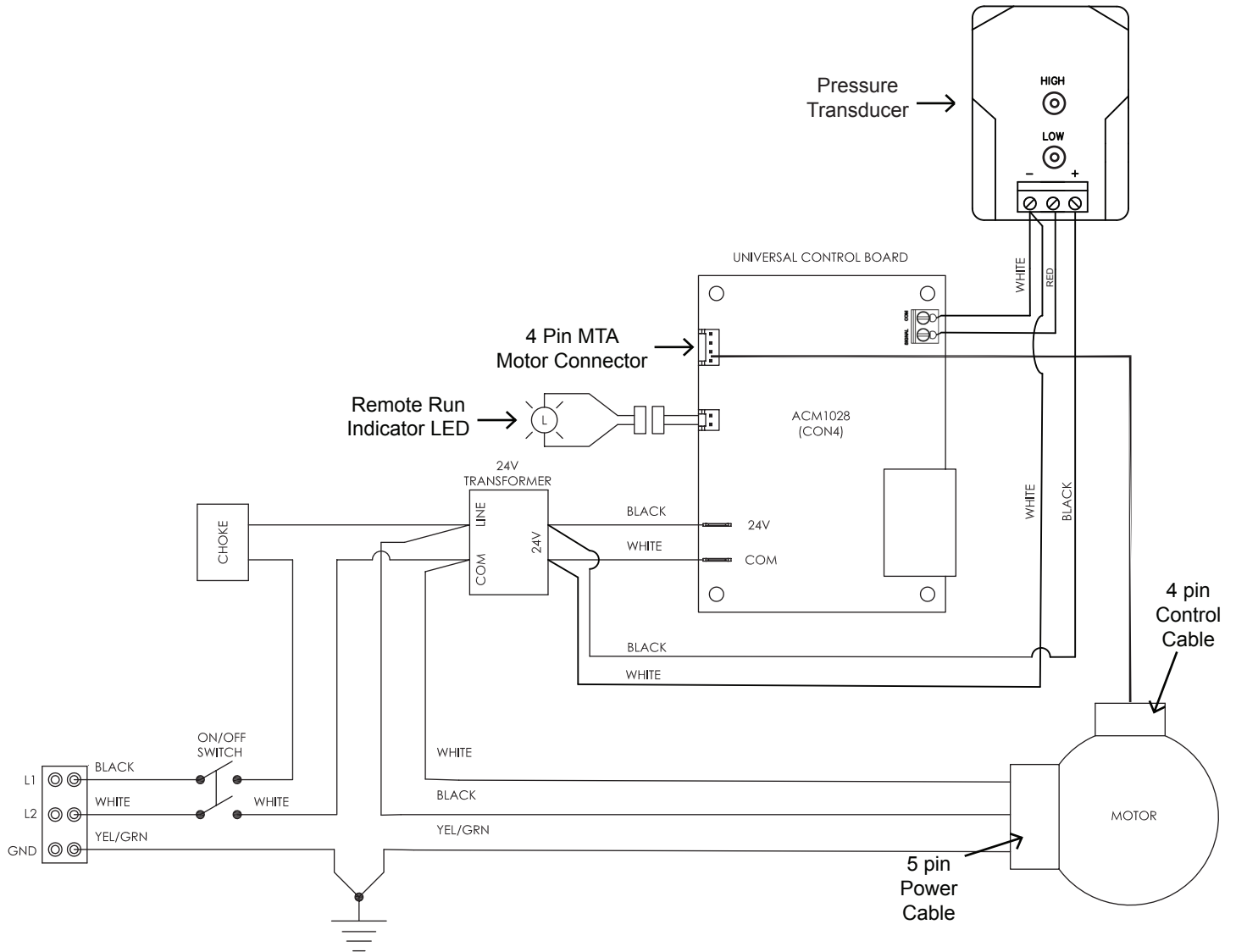
## Wiring Diagrams



**Universal Card Wiring Diagram**



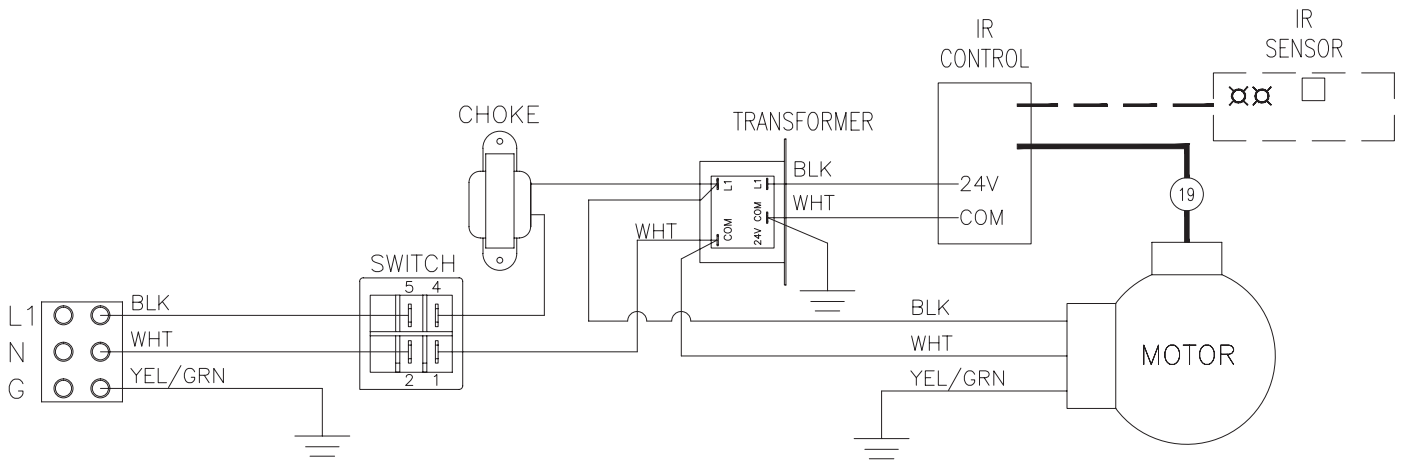
**Wiring Diagrams (continued)**



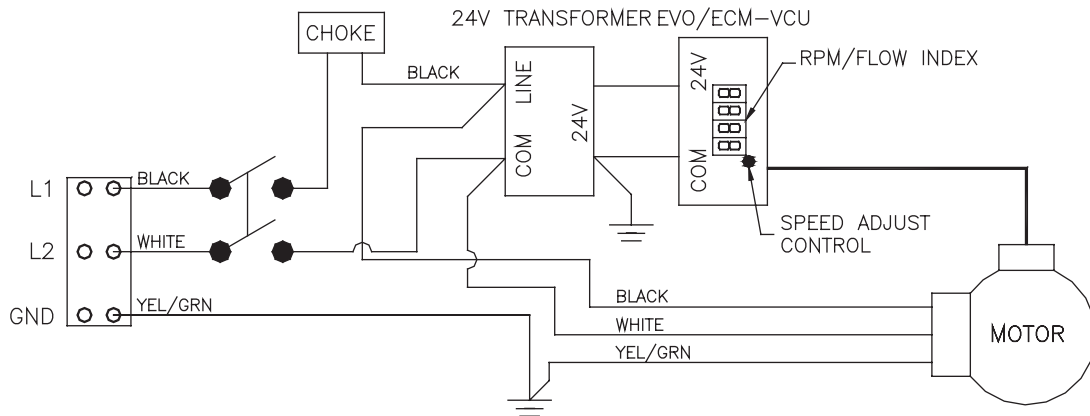
Note: Register 24 may be read in network mode to determine the value of 0-10VDC signal from the pressure transducer connected to indicate unit internal static pressure.

**Universal Card Wiring Diagram w/  
Continuous Filter Monitoring**

**Wiring Diagrams (continued)**



**Infrared Speed Control**



**Remote Mounted Visual Control Unit**

## Replacement Parts List

Model	Size/Voltage	Description	Part Number
CRFF-E CRFF-E-ARS CRFF-E-ARSM	N/A	Disconnect Switch	63739-002
	N/A	Pre-filter (foam)	62981-001
	N/A	Deflector - Filter	38532-001
	N/A	Gasket, Neop .125x.5	62968
	N/A	Grommet 5/8 Id 1 1/8 Od	63388
	N/A	Choke 3.0 Amps	63720
	120V	Transformer 24V	63677
	208V-240V		63666
	277V		63665
	N/A	Blower Wheel	63270
	N/A	Ventiri Ring	62964
	N/A	Universal Control Card (CRFF-E, CRFF-E-ARS, CRFF-E-ARSM)	265888
	N/A	Visual Speed Control Card (CRFF-E, CRFF-E-ARS, CRFF-E-ARSM)	63951-002
	N/A	IR Sensor Harness	63759-001
N/A	IR Sensor without Harness	63758	
CRFF-E CRFF-E-ARS	2x2 - 120V	ECM Motor Assembly (CRFF-E & CRFF-E-ARS)	S266587-005
	2x2 - 208V-240V		S266587-005
	2x2 - 277V		S266587-006
	4x2 - 120V	ECM Motor Assembly (CRFF-E & CRFF-E-ARS)	S266587-001
	4x2 - 208V-240V		S266587-001
	4x2 - 277V		S266587-002
CRFF-E-ARSM	2x2 - 120V	ECM Motor Assembly (CRFF-E-ARSM)	S266587-015
	2x2 - 208V-240V		S266587-015
	2x2 - 277V		S266587-016
	4x2 - 120V	ECM Motor Assembly (CRFF-E-ARSM)	S266587-011
	4x2 - 208V-240V		S266587-011
	4x2 - 277V		S266587-012

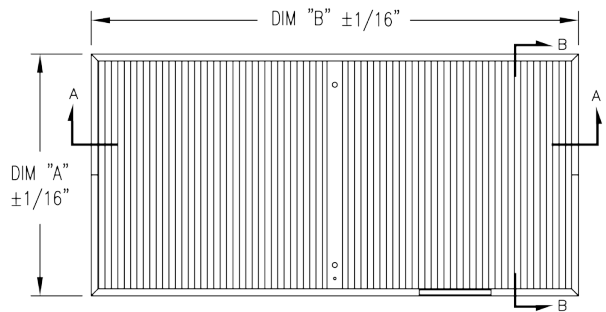
### CRFF-E Filter Drawing

69600S - XXX X X X X X

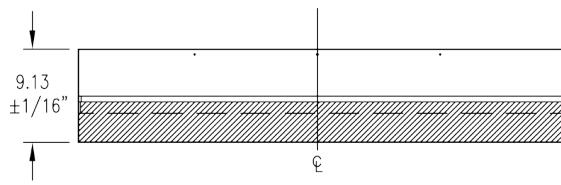
<b>SIZE:</b> SEE CHART	<b>MEDIA:</b> <input type="checkbox"/> [H] HEPA 99.99% <input type="checkbox"/> [U] ULPA 99.9995%	<b>CONSTRUCTION:</b> <input type="checkbox"/> [A] ALUMINUM <input type="checkbox"/> [P] PAINTED <input type="checkbox"/> [S] STAINLESS	<b>SCREEN:</b> <input type="checkbox"/> [P] PAINTED <input type="checkbox"/> [S] STAINLESS <input type="checkbox"/> [L] PLASTIC <input type="checkbox"/> [Z] PAINTED ALUMINUM	<b>INDICATOR LIGHT</b> <input type="checkbox"/> [I] INDICATOR LIGHT <input type="checkbox"/> [X] NONE	<b>CHALLENGE PORT</b> <input type="checkbox"/> [C] CHALLENGE PORT <input type="checkbox"/> [X] NONE
---------------------------	---	---	---	---	---

CODE	NOMINAL SIZE	DIM. "A"	DIM. "B"
[001]	2X4	23.625	47.625
[003]	2X3	23.625	35.625
[004]	2X2	23.625	23.625

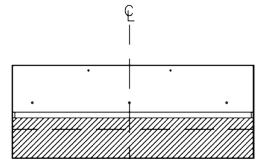
- NOTES:**
- FILTER MEDIA:** MICROGLASS FIBER WITH ACRYLIC LATEX BINDER
  - PLEAT DEPTH:** 3" OR 53 MM PLEAT
  - EFFICIENCY:**
    - H= HEPA = 99.99% EFFICIENT @ 0.30µm (IEST-RP-C007)
    - 4= HEPA = 99.995% EFFICIENT @ 0.20µm (IEST-RP-C007)
    - U= ULPA = 99.9995% EFFICIENT @ 0.12µm (IEST-RP-C007)
    - S= ULPA = 99.99999% EFFICIENT @ 0.12µm (IEST-RP-C007)
  - RESISTANCE:**
    - H= HEPA = 0.45" ±0.02" W.G. AT 100 FPM (715 CFM)
    - 4= HEPA = 0.50" ±0.02" W.G. AT 100 FPM (715 CFM)
    - U= ULPA = 0.52" ±0.02" W.G. AT 100 FPM (715 CFM)
    - S= ULPA = 0.62" ±0.02" W.G. AT 100 FPM (715 CFM)
  - SEPARATOR MATERIAL:** PER MANUFACTURES SPEC
  - FRAME MATERIAL:** ANODIZED ALUMINUM
  - GRILLE MATERIAL:** EXPANDED METAL PAINTED WHITE
  - SEALANT MATERIAL:** FIRE RETARDANT TWO-PART URETHANE
  - EFFICIENCY TEST:** HEPA = TYPE J FILTER (IEST-RP-C034)  
ULPA = TYPE F FILTER (IEST-RP-C034)
  - FIRE RATING:** GRADE 4 UL-900



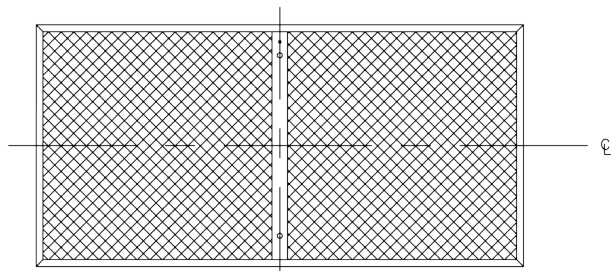
TOP VIEW



SECTION A-A



SECTION B-B



BOTTOM VIEW

## CRFF-E-ARS and CRFF-E-ARSM Filter Drawing

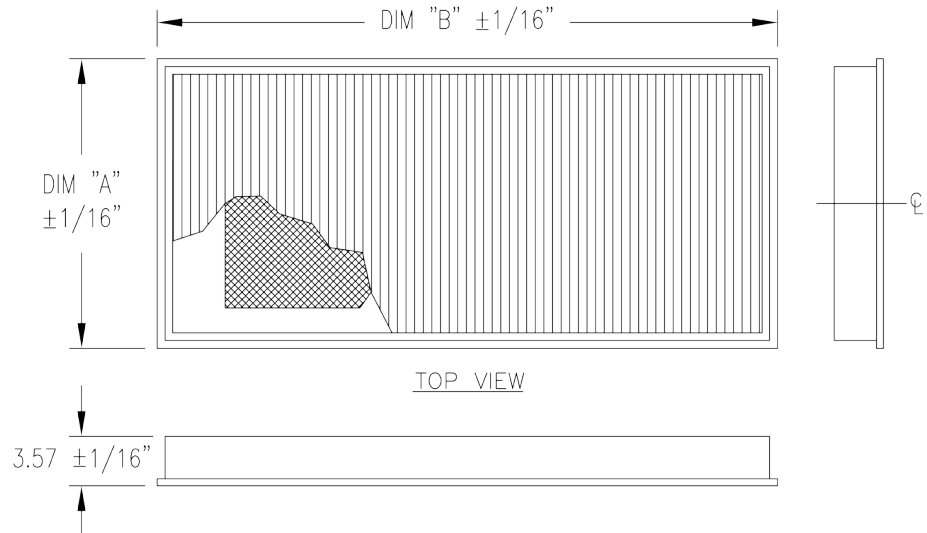
69601 - XXX X

SIZE: SEE CHART	MEDIA: [H] HEPA [U] ULPA
--------------------	--------------------------------

CODE	NOMINAL SIZE	DIM. "A"	DIM. "B"
[001]	2X4	21.000	45.000
[003]	2X3	21.000	33.000
[004]	2X2	21.000	21.000

**NOTES:**

1. FILTER MEDIA: MICROGLASS FIBER WITH ACRYLIC LATEX BINDER
2. PLEAT DEPTH: 3" PLEAT OR 53MM
3. EFFICIENCY:
  - H= HEPA = 99.99% EFFICIENT @ 0.30µm (IEST-RP-C007)
  - U= ULPA = 99.9995% EFFICIENT @ 0.12µm (IEST-RP-C007)
4. RESISTANCE:
  - H= HEPA = 0.32" ±0.02" W.G. AT 100 FPM (560 CFM)
  - U= ULPA = 0.40" ±0.02" W.G. AT 100 FPM (560 CFM)
5. SEPARATOR MATERIAL: PER MANUFACTURES SPEC
6. FRAME MATERIAL: ANODIZED ALUMINUM GEL SEAL
7. GRILLE MATERIAL: EXPANDED METAL PAINTED WHITE
8. SEALANT MATERIAL: FIRE RETARDANT TWO-PART URETHANE
9. EFFICIENCY TEST:
  - HEPA = TYPE J FILTER (IEST-RP-C034)
  - ULPA = TYPE F FILTER (IEST-RP-C034)
10. FIRE RATING: GRADE 4 UL-900



## Testing

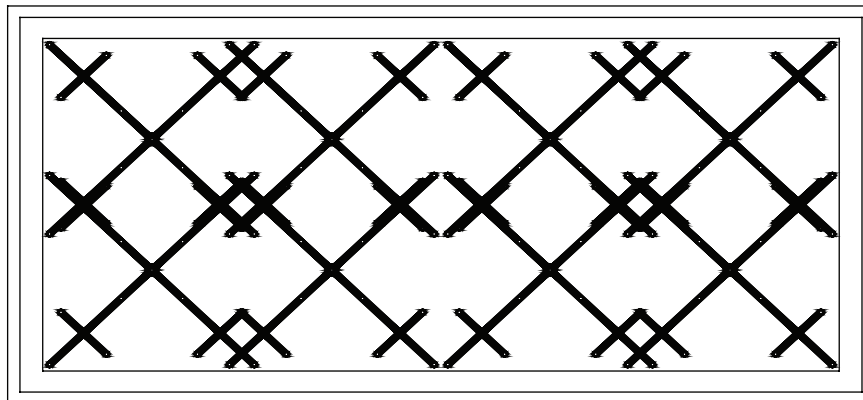
Each CRFF-E series unit is thoroughly tested at the factory before shipment. However, because of the “rigors” of shipping, Krueger encourages its re-test after installation. Additional, for large installations it is recommended to bench test 5% of the units prior to installation.

Krueger recommends that the customer contact an independent organization, with technicians trained and experienced in performance evaluation and maintenance of clean air equipment.

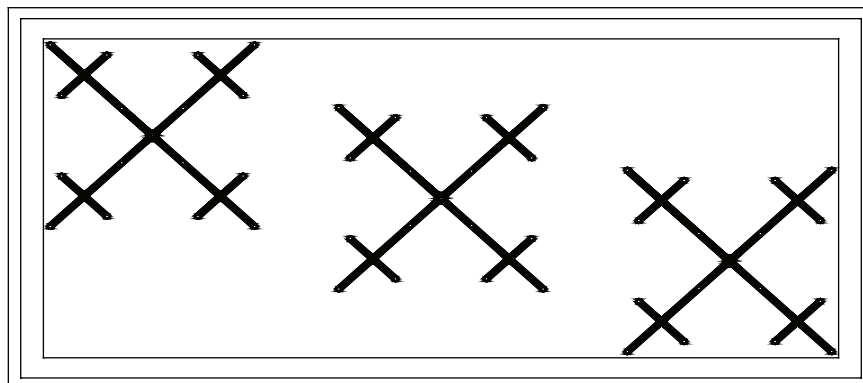
Some of the testing procedures performed on the CRFF-E series units include PSL challenge of HEPA/ULPA filters to assure specified performance, along with air velocity measurement and adjustment tests. No DOP is used on CRFF-E series filters, unless requested

### Recommended Testing

All units that are airflow tested at Krueger are tested using a Shortridge Airdata Multimeter 800 series with a Velgrid head. The recommended method of reading is to place one corner of the Velgrid head 1-1/4” from the corner of the filter face and then take four readings evenly spaced along the four foot side, and then repeat these reads for the other long side. This gives a total of eight readings to test the unit. All advertised data is based on using the Velgrid with eight readings (128 velocity points). Krueger recognized using eight reading during a cleanroom start-up may be time consuming and recommends using three Velgrid readings taken on a diagonal, as shown below.



**FIGURE 17: RECOMMENDED TESTING – 8 POSITION READINGS WITH A VELGRID**



**FIGURE 18: FACTORY APPROVED TESTING – 3 READINGS WITH A VELGRID**

