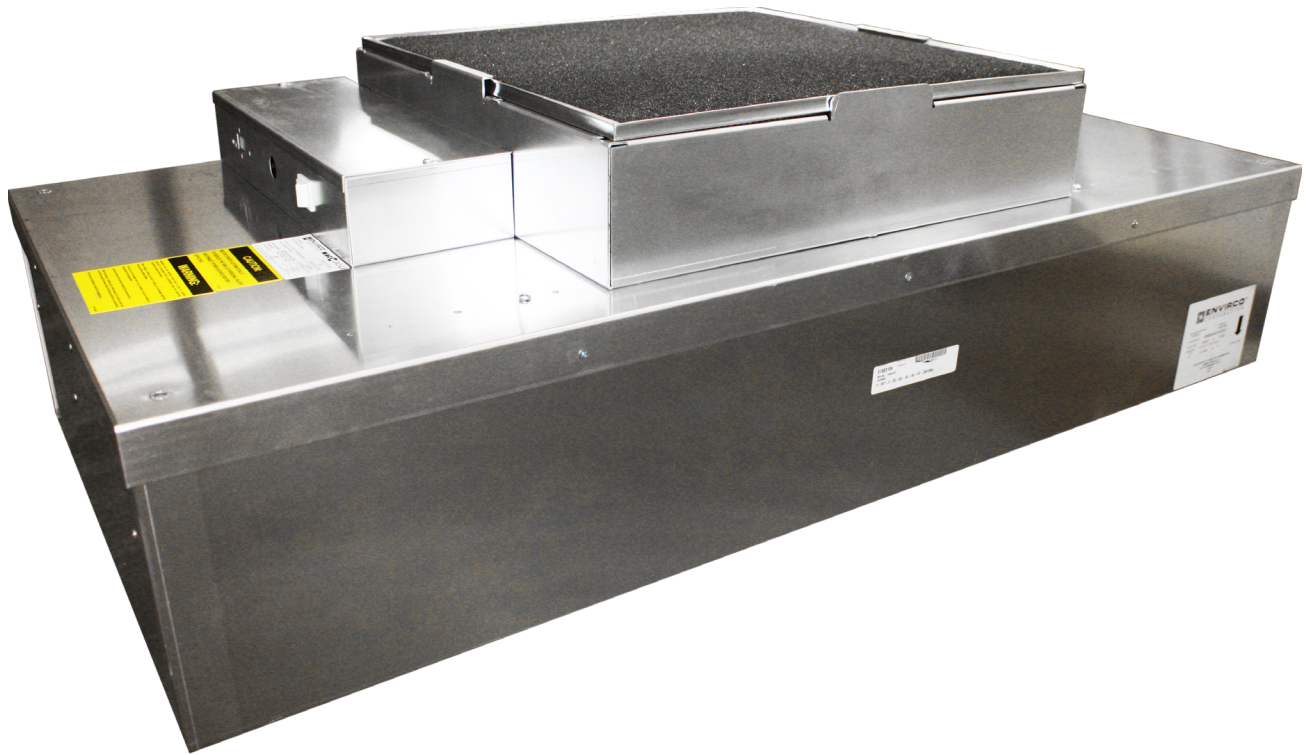


*****READ AND SAVE THESE INSTRUCTIONS*****



MAC 10[®] LEDC
Fan Filter Unit
Standard, RSR, & RSRE Models
OPERATION & MAINTENANCE MANUAL

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For MAC 10 4x4, please see manual form #267278.

For freight damage inquiries, call 800-884-0002 with model and job number available.

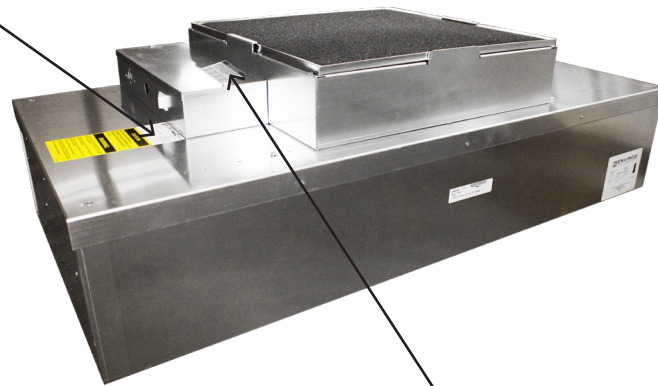
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■ **Critical Operation Conditions of the MAC 10**

1. Touching the HEPA filter will damage it and void 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 lie filter face flat down on a surface always have filter on its side to protect from damage.
2. Prior to powering the unit, verify the voltage on the label and that the unit has been wired to the correct voltage. The serial number label on the top of the Mac 10 unit has the required voltage.
3. To ensure you order the proper replacement parts or complete MAC 10 unit, record the part number and serial number. This information is located on the serial number label, located adjacent to the electrical box. If you can't locate the Sales Order Number, please contact ENVIRCO for this information. Once obtained, record the information for reference.

Order Number:	H899
Serial Number:	120714181A-ES1FH
Unit Model Number:	11202-021
Description:	MAC10 LEDC 2X4 STD 120V HEPA CON4 UL
Date:	07/31/2013

ENVIRCO Innovators in clean air technology	MAC10[®] LEDC
Fan Filter Unit AC: 120v 60 Hz 2.75 ampe	Order Number H899
Covered by one or more of the following patents: nos. 4,580,365 & 5,470,363	Serial Number 120714181A-ES1FH
UL LISTED 2FB2 AIR FILTER E182668	Unit Model Number 11202-021
Enviroco 1-800-884-0002 www.enviroco.com	Date 07/31/2013
SUITABLE FOR COMMERCIAL OR INDUSTRIAL USE ONLY	



■ **Part Numbers Covered by this Manual**

11202-XXX	MAC 10 LEDC 2x4	(600x1210mm) Standard Filter
11203-XXX	MAC 10 LEDC 2x3½	(600x1057mm) Standard Filter
11204-XXX	MAC 10 LEDC 2x3	(600x905mm) Standard Filter
11205-XXX	MAC 10 LEDC 2x2	(600x600mm) Standard Filter
11206-XXX	MAC 10 LEDC 2x4	(600x12101mm) RSR/E Filter
11207-XXX	MAC 10 LEDC 2x3½	(600x1057mm) RSR/E Filter
11208-XXX	MAC 10 LEDC 2x3	(600x905mm) RSR/E Filter
11209-XXX	MAC 10 LEDC 2x2	(600x600mm) RSR/E Filter

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

Units come set in manual mode from the factory. Please review installation requirements and set up with your end user (See page 8 for complete set up instructions).

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■ Warning

TO REDUCE THE RISK OF FIRE, ELECTRICAL SHOCK, OR INJURY TO PERSONS, OBSERVE THE FOLLOWING:

- A. Installation work and electrical wiring must be done by qualified person(s) in accordance with all applicable codes and standards, including fire-rated construction.
- B. When cutting or drilling into wall or ceiling, do not damage electrical wiring and other hidden utilities.
- C. If this unit is to be installed over an area using liquid, such as water or chemical cleaning solutions, it must be marked as appropriate for the application.
- D. Use this unit only in the manner intended by the manufacturer. If you have any questions, contact the manufacturer.
- E. Before servicing or cleaning the unit, switch power off at unit service panel and lock service panel to prevent power from being switched on accidentally.
- F. NOTE – The Mac 10 has not been investigated for use in fire resistance rated construction.
- G. To fulfill our obligations towards Article 33, in accordance to European REACH Regulation No 1907/2006 EC, we hereby inform you that this article contains the following Substances of Very High Concern mentioned on the Candidate list:
Cadmium/ 1,3,5-triglycidyl-s-triazinetrione

ENVIRCO USA

101 McNeill Road
Sanford, NC 27330
Tel: (919) 775-2201
Tel: (800) 884-0002
Fax: (800) 458-2379
Email: info@envirco.com

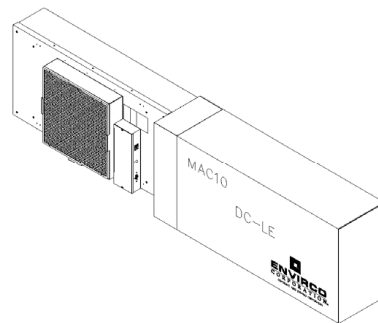
Installation & Service Manual

■ **Installation**

Note: The MAC 10 LEDC Fan Filter Unit is completely assembled at the factory with the exception of the optional 1/4" (0.64 cm)-20 eyebolts that are used when hanging the unit from an engineered support system (eyebolts not included and need to be ordered separately, p/n 222449-001) and installation of the HEPA/ULPA filters for RSR/E units only.

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

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



Note: When ordering RSR and RSRE units, the HEPA filters may be shipped separately to be installed into units after the fan box has been installed.

Figure 1: Unboxing

Step 2. If using rigidly supported grid (usually 2" (50 mm) 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 engineered support system with s-hooks and chain. Screw the four eyebolts into the nutserts on the lid assembly before lifting into an overhead position (see Figure 2).

Note: Confirm fan dimensions to match T-grid dimensions.

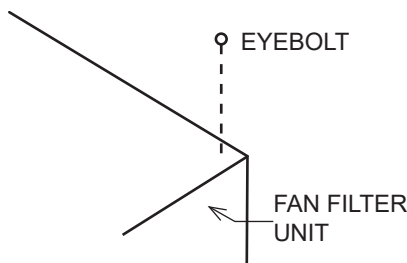


Figure 2: Hanger Supports

Step 2.1. If using a support grid, continue...

Step 3. Raise the unit and secure it into place using the chosen support system method suspended from a structural support bracing.

Step 4. Have an electrician wire the unit to the appropriate voltage, according to the wiring diagram (page 17), and all national and local electrical codes. All units are equipped with a three position terminal block for field connection. Verify correct single-phase power, before energizing units.

Step 5. Turn on the power using the rocker switch (ON/OFF) located on the electrical box. For RSR/E units, let the unit run for a few hours to purge off particulate (if filters are shipped loose) that may be adhered 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 separately. Controls have been shipped separately.

■ Unit Control Box

2.1. ON/OFF Switch - Speed/Airflow Adjustment

All MAC 10 LEDC units are equipped with a two-position rocker switch (ON/OFF), which is located on the front side of the electrical box, on top of the unit. All units are furnished with a Universal Control Card to enable adjustment of airflow or be set to your means of communication. (see Page 7 for Universal Card Card Set Up).

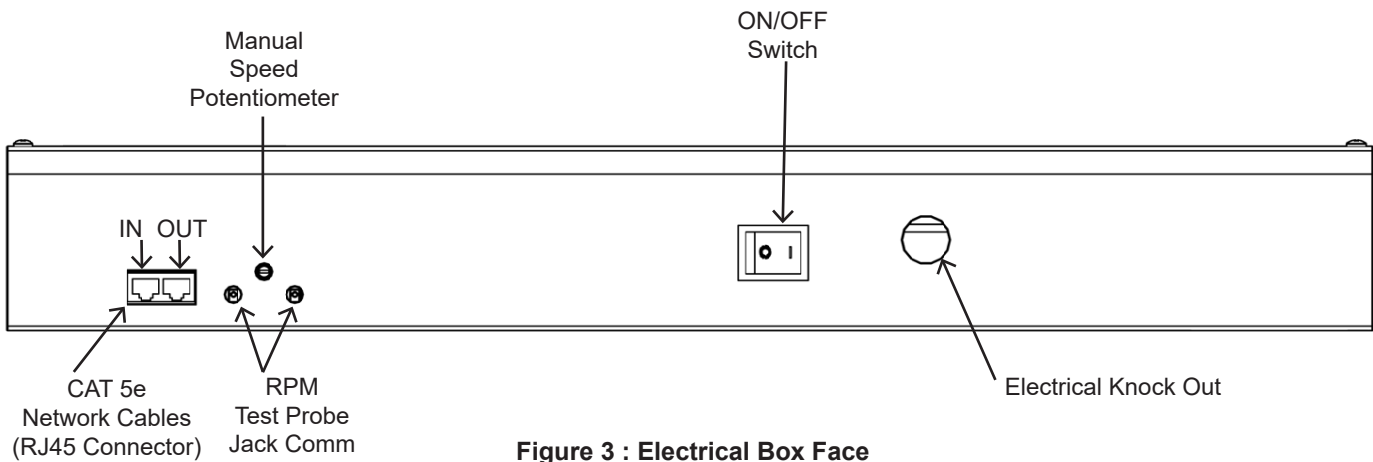


Figure 3 : Electrical Box Face

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

Installation & Service Manual

■ **Universal Control Card Setup**

PRODUCT OVERVIEW

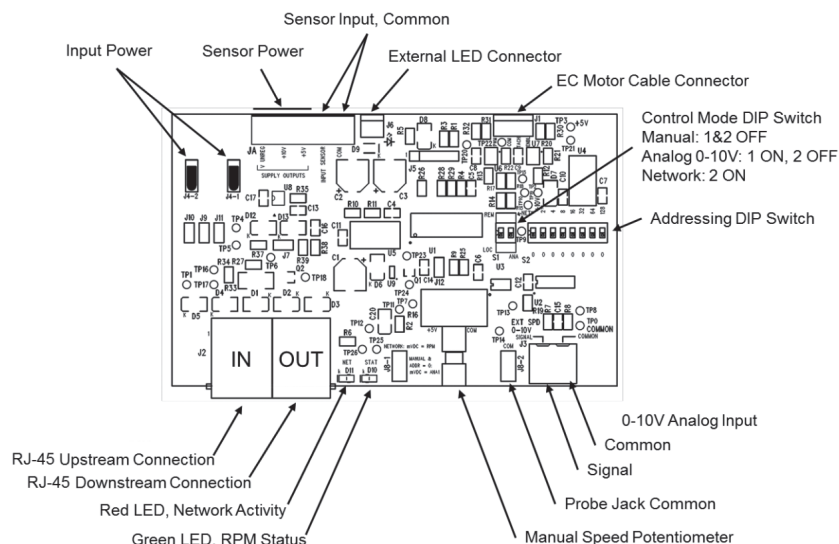
The ENVIRCO Universal Control Card, version 2 (UCC2) provides control capability for ENVIRCO electronically commutated motor (ECM) based fan filter units (FFUs). UCC2 was developed to be a running change as a complete going-forward replacement for the legacy UCC. While the UCC2 has new capabilities over the legacy UCC, it maintains the mechanical, electrical, and software compatibility with the legacy UCC.

There are two additional capabilities optionally available with the UCC2. The first is auto-addressing, which is a new mode that is initiated and managed from a properly equipped ENVIRCO control console. Auto-addressing eliminates the need to uniquely set address IDs of each FFU independently. Instead, the control console sequences through and automatically assigns an address into FLASH memory for each properly daisy-chained network connected FFU.

The second UCC2 new capability is a new sensor interface allowing the UCC2 to directly connect to a plenum-based air pressure sensor without the need for an additional voltage transformer. Instead, the UCC2 has both AC and DC voltage output for activating an external sensor.

FEATURES

- Networkable via an RJ45 serial bus with MODBUS RTU protocol
- Supports auto-addressing when connected to an ENVIRCO auto-addressing capable control console
- Has AC and DC output power available connecting to and for activating external pressure sensors
- 0-10 VDC analog control
- Manual control via onboard potentiometer
- Simple connections
 - Two RJ45 connections for daisy-chain network connections
 - Screw terminals for analog control
 - Text probe jacks for DC mV signal output of RPM and motor control set points
- LED diagnostics
 - Support for external LED (10mA) remote status notification via 2-pin MTA connector
 - Onboard green LED for board status notification
 - Onboard red LED for network traffic
- Powered from network or local supply



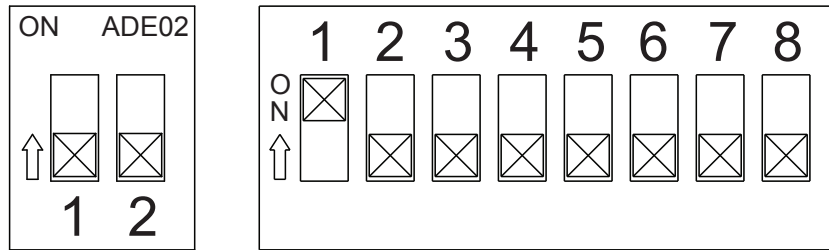
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CONTROL MODES

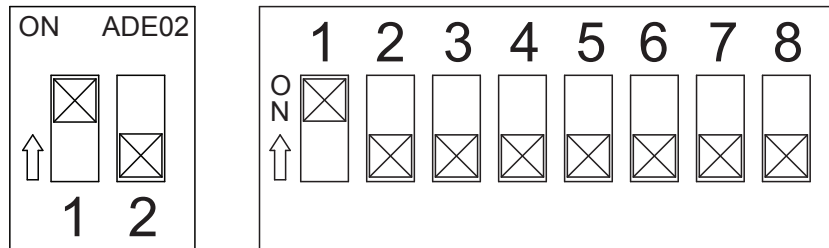
The UCC2 operates in one of three selectable modes. The Mode is selected using DIP Switch S1.

- MANUAL control, on-board potentiometer
- ANALOG control, Remote 0-10 VDC
- NETWORK control, MODBUS RTU

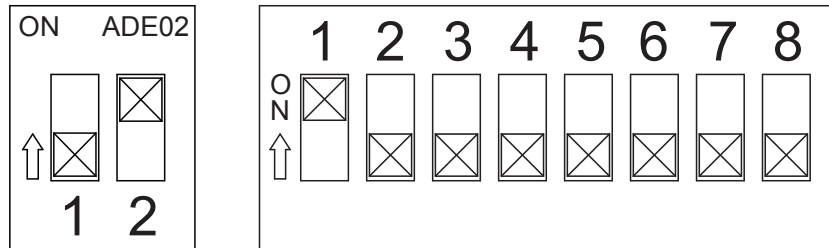
Manual Mode = 1 OFF 2 OFF



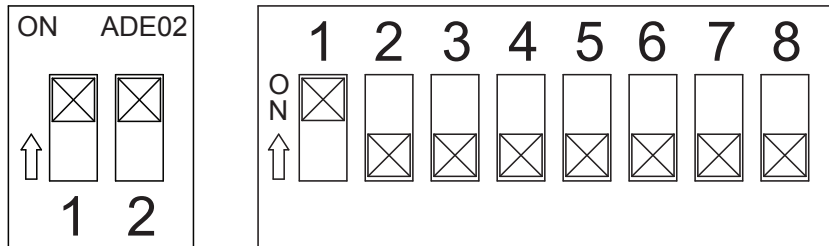
Analog Mode = 1 ON 2 OFF



Network Mode = 1 OFF 2 ON



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.

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Manual Control Mode:

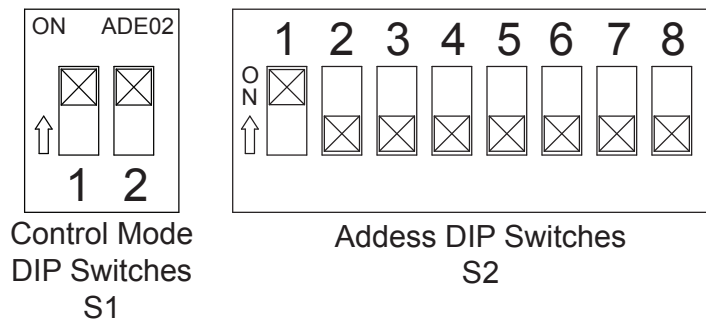
In Manual control mode, the motor speed is set using the onboard potentiometer. Onboard potentiometer rotation is CW to increase the motor output.

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 UCC2 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 bank (S2). A maximum of 200 UCC2 devices is recommended per local area network(LAN). If an ENVIRCO 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 UCC2 at power-up. Power must be cycled (OFF/ON) before any changes take effect.

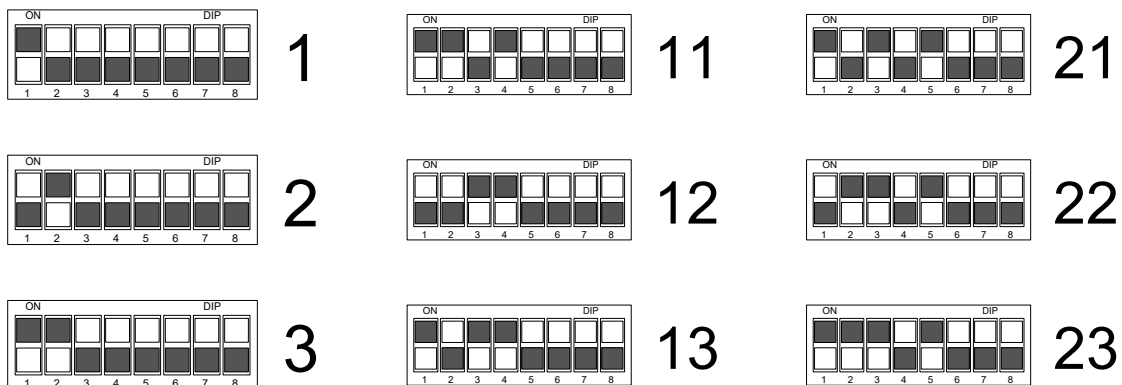


Note: Network mode can be configured using either DIP switch setting shown above. DIP switch pictorials are for reference and may be labeled differently by the manufacturer.

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 UCC2.

(R/W) = Read/Write, (R) = Read Only



Example of binary S2 switch settings

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Automatic Addressing Mode:

On legacy UCCs, the board addressing was set using the 8-position dip switch. The UCC2 has a new capability called auto-addressing. Auto-addressing is conducted and managed from a properly configured ENVIRCO console controller. The controller sequences through all of the UCC2-equipped FFUs and electronically programs them with a unique sequential 8-bit address. There are three specific requirements for auto-addressing:

1. Each FFU to be controlled must be loaded with a UCC2
2. The system must contain a specialized ENVIRCO FFU control console
3. Each FFU to be addressed must be properly daisy-chain networked

Daisy-chain networking connection overview:

1. The overall control console's RJ45 downstream control cable is connected to the "IN" marked RJ45 connector of the first FFU in the group, to be noted as FFU #1.
2. Then, a CAT5 network cable is connected from FFU #1's RJ45 "OUT" connector to FFU #2's "IN" connector.
3. All of the subsequent UCC2-equipped FFUs will be daisy-chain connected as noted in steps #1 and #2 above.
4. The final FFU in the system to be controlled will have no cable connected to its "OUT" connector.

ELECTRICAL SPECIFICATIONS

Control and Interface Signals:

1. External Speed 0-10V Input
 - Input impedance 20k Ohms.
 - 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.
2. External LED Output
 - 10mA regulated
 - LED forward voltages up to 5V
3. 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)
 - RPM Accuracy: +/- 3%

Electrical and Environmental Specifications:

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

Test Probe Jacks Points:

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

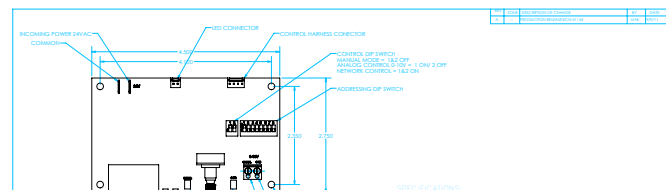
- In Manual or Analog Control Mode with an Address setting of 1 or greater, the test probe jacks output 0-2000 mVDC representing motor RPM. By changing the address DIP switches to 0, the test probe jacks will output 0-1000 mVDC representing 0-100% demand signal to the motor. The address may be changed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

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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. This Onboard Status LED will flash when PWM signal is sent to the motor but no RPM is reported by the motor.
- **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.

Net LED Status Definition	
LED OFF	Power Lost or No Communications
LED Flickering	Network Data Traffic In Progress
LED ON	A/B network wires are swapped



RJ45 Network Cable Connections:

1	2	3	4	5	6	7	8
Bus Power Pass Through	0V (GND)	RS485				0V (GND)	Bus Power Pass Through
		+	NC	NC	-		

COMMUNICATION SPECIFICATIONS

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 MODBUS Register Summary Table
- **DO NOT USE Crossover Cables. THIS MAY DAMAGE THE CONTROL CARD OR RENDER IT NON-OPERATIONAL.**

MODBUS Register Specifications:

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	
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

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

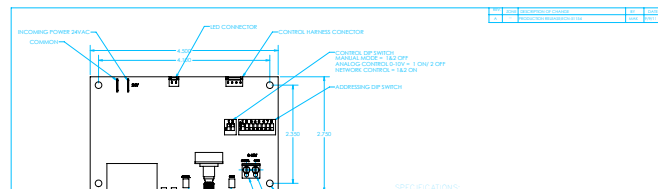
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■ Troubleshooting

Mode Choice:

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

Net LED Status Definition	
Red LED OFF	Power Lost or No Communications
Red LED Flickering	Network Data Traffic In Progress
Red LED ON	A/B network wires are swapped



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:

Step 1. Check incoming power supply for proper voltage (120,208-240,277/24).

Step 2. Verify that rotation of the manual speed potentiometer does not change the RPM. If rotating does nothing, remove the electrical box cover, then remove the 4-pin motor connector from the control board and reinstall 180 degrees rotated. Also insure that the 4-pin connection wires are pushed down securely onto connector pins. Again adjust the knob to verify proper fan operation. Note: The 4 pin connector is on the 1/8" white cable from motor.

Low Air Velocity:

Step 1. Check incoming power supply for proper voltage (120,208-240,277/24).

Step 2. Check to be sure that the manual speed potentiometer is set correctly.

Step 3. Examine the HEPA filter.

High Air Velocity:

Step 1. Check incoming power supply for proper voltage (120,208-240,277/24).

Step 2. Check to be sure that the air flow settings are correct.

Filter Issues:

Non-Laminar Flow and/or Excessive Contamination:

Step 1. Insure that no large obstructions are upstream of airflow pattern.

Step 2. Determine that no other air-moving devices are operating in or around clean room which disrupt room's airflow pattern.

Step 3. Check air velocity and if low, conduct the "Low Air Velocity" procedure outlined above.

If failure continues, contact ENVIRCO Technical Support at 800-884-0002.

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Infrared Speed Control (Optional)

The Flow-Set is a handheld infrared remote control configured to adjust the ENVIRCO Mac 10 LE-DC unit.

An EVO/ECM-IRC control sends the 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 Motor. (See Figure 10). 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 $\uparrow\downarrow$ 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 $\uparrow\downarrow$ 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 IQ 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 units 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 shorts.
- A flow index of 89 flashes 8 longs, then 9 shorts.
- 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 $\uparrow\downarrow 10$ 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 $\uparrow\downarrow 1$ button to increase the index. The $\uparrow\downarrow 1$ and $\uparrow\downarrow 10$ 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-Handheld Controller. (See Figure 10). 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- Handheld Controller 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.



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■ Cleaning the LEDC Pre-filter (foam)

Tools Required: None.

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

Step 1. To gain access to the prefilter, remove the ceiling panel next to the unit, if applicable.

Step 2. Switch the ON-OFF switch to the off position.

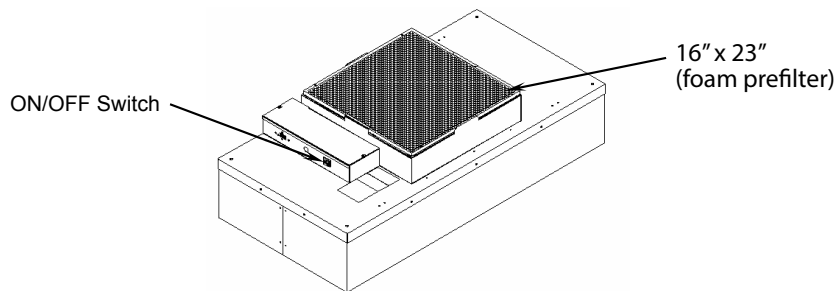
Step 3. Remove the 20"x20" prefilter from the snap-in frame. (See Figure X)

Step 4. Clean the prefilter by hand washing in water with a mild detergent or by using a vacuum cleaner. Allow prefilter to dry completely before replacing.

Step 5. Reassemble by reversing the above steps.

WARNING

DISCONNECT THE UNIT FROM THE ELECTRICAL POWER SOURCE BEFORE ATTEMPTING ANY SERVICE



■ Changing the LEDC Pre-filter (pleated)

Tools Required: None.

Note: To keep the filter in top operating condition replacing the pleated prefilter is recommended every twelve months or sooner.

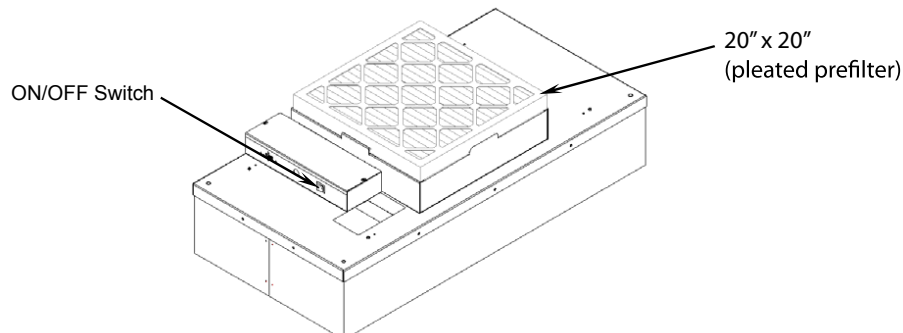
Step 1. To gain access to the prefilter, remove the ceiling panel next to the unit, if applicable.

Step 2. Switch the ON-OFF switch to the off position.

Step 3. Remove the prefilter from the snap-in frame. The beverage frame has slots that have to be depressed to release the filter from the prefilter housing (See figure below)

Step 4. After removing the new G4 pleated prefilter from the box, remove the die cut slots from the beverage board frame and install on prefilter bracket.

Step 5. Reassemble by reversing the above steps.



Installation & Service Manual

■ **Service: Removal and Replacement of Standard HEPA/ULPA Filters**

WARNING

DISCONNECT THE UNIT FROM THE ELECTRICAL POWER SOURCE BEFORE ATTEMPTING ANY SERVICE

WARNING

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.

Note: All filters should be visually inspected for freight damage before installation. It is necessary to use two workers when removing the filter and for installation to avoid twisting or separation of the media seals. Handle the filter only by the frame and never place anything on the upstream filter side of the filter. Additionally, it is important to keep the filter level to prevent any shearing force on the media itself.

For Standard Filters:

Tools Required: Phillips Head Driver, Battery Operated Drill with 5/32 drill bit, Rivet Hand Tool, Ø5/32 aluminum rivet grip range .126-.187

Step 1. Remove unit from ceiling.

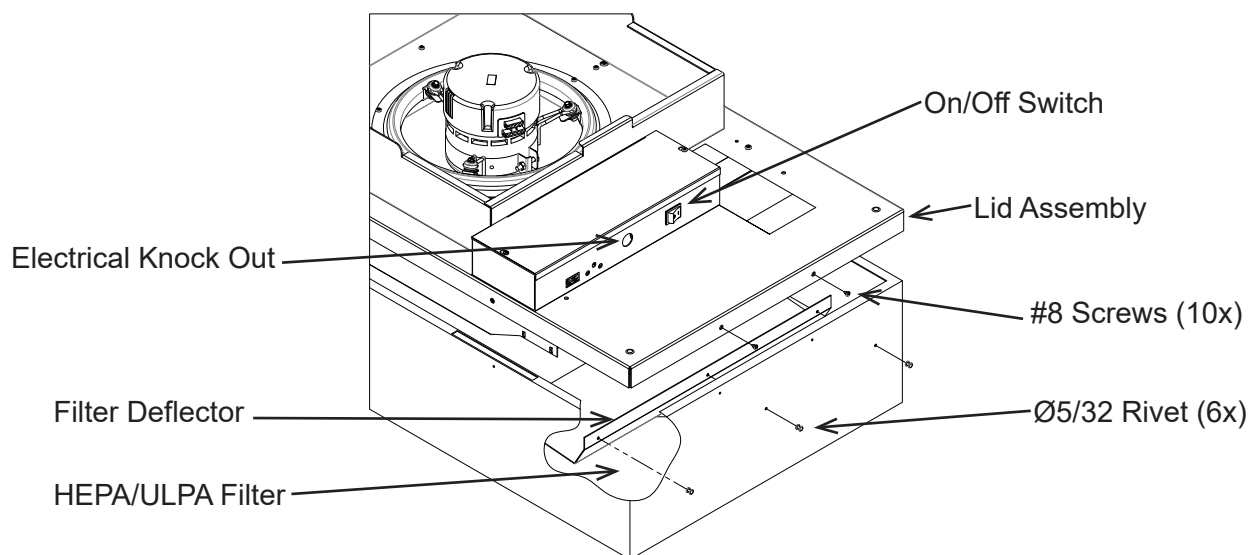
Step 2. Remove the 10 screws holding the HEPA/ULPA filter to the lid assembly.

Step 3. Lift the lid assembly off the HEPA/ULPA filter (see Figure). 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.

Step 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.

Step 5. To replace 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.

Step 6. Restore power and verify proper operation of FFU.



Standard Filter Change

Installation & Service Manual

■ Service: Removal and Replacement of RSR/E Filters

WARNING

DISCONNECT THE UNIT FROM THE ELECTRICAL POWER SOURCE BEFORE ATTEMPTING ANY SERVICE

WARNING

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.

Note: All filters should be visually inspected for freight damage before installation. It is necessary to use two workers when removing the filter and for installation to avoid twisting or separation of the media seals. Handle the filter only by the frame and never place anything on the upstream filter side of the filter. Additionally, it is important to keep the filter level to prevent any shearing force on the media itself.

For RSR/E Filters:

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

Step 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.

Step 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.

Step 3. Carefully clean plenum assembly knife edge surface of residual gel material.

Step 4. Inspect filter for visible damage, if damaged set aside for replacement or repair.

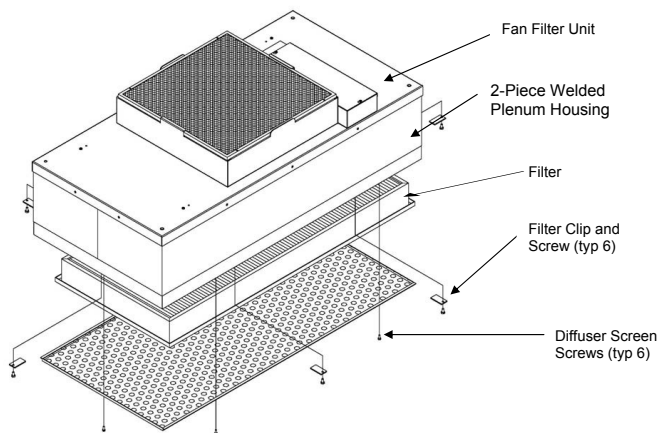
Step 5. Inspect the gel seal, if reinstalling the removed filter. Determine if the gel has lost its ability to seal (i.e. the gel should reform to cover the track without voids or openings), if so repair the gel material or consider replacement of filter.

Step 6. Place the filter evenly against the filter-sealing surface of the RSR unit. Reposition filter clips and screws. The clips should be rotated and angled into place. It is recommended that 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.

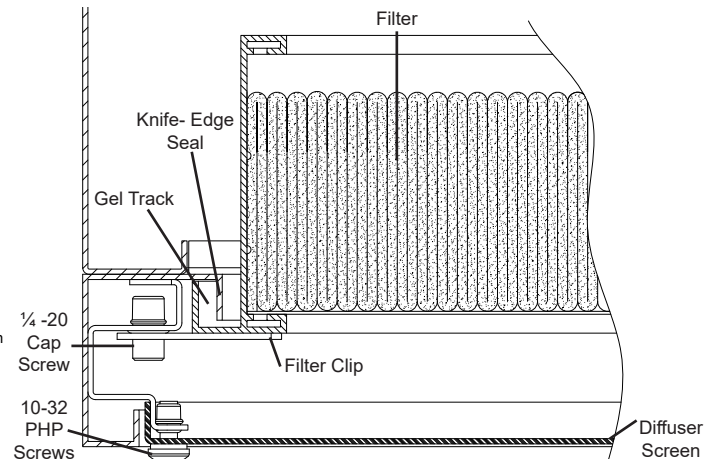
Step 7. Reinstall diffuser screen by hand-tightening the screws.

Step 8. Determine if recertification or testing of replacement is required.

Step 9: Restore power to FFU and verify proper operation of FFU.



RSR/E Filter Change



RSR/E Sheet Metal Filter Replacement

Installation & Service Manual

■ Service: Standard and RSR Motor Removal and Installation
WARNING

DISCONNECT THE UNIT FROM THE ELECTRICAL POWER SOURCE BEFORE ATTEMPTING ANY SERVICE

WARNING

ELECTRICAL SERVICE SHOULD ONLY BE PERFORMED BY A LICENSED OR QUALIFIED ELECTRICIAN.

Tools Required: Phillips Head Driver, Battery Operated Drill, (2) 8" adjustable wrenches, 10 mm hex head wrench, #2 screwdriver, and slip joint pliers

Step 1. To gain access to the motor, remove the ceiling panel next to the unit, if applicable.

Step 2. Switch the ON-OFF switch to the off position.

Step 3. Loosen the electrical box cover screws (2), and slide/lift off cover.

Step 4. Make note of all wire routing and locations for later reinstallation.

Step 5. Disconnect motor wire harnesses from the electrical box housing and remove the tubing for test port, if installed.

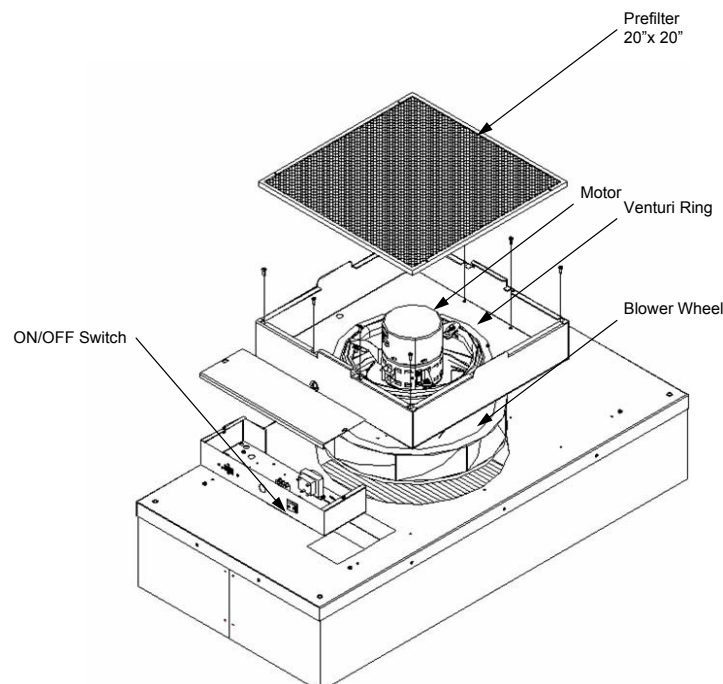
Step 6. Remove the eight mounting screws to free the motor/blower assembly from the lid assembly. If using power drivers, set the unit to a low torque setting to avoid stripping the sheet metal screws. Carefully remove housing assembly, paying attention to wire routing.

Step 7. Using an adjustable wrench loosen the two set screws that attach the blower wheel to the motor shaft.

Step 8. Mark the location of the motor support bracket (belly band), then loosen the bolt just enough to allow the motor support bracket to slid off the motor.

Step 9. Using the removed motor, mark the new motor with the location of the motor support bracket.

Step 10. 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.



Motor/Electrical Removal

Installation & Service Manual

■ Service: RSR/E Motor Removal and Installation

WARNING

DISCONNECT THE UNIT FROM THE ELECTRICAL POWER SOURCE BEFORE ATTEMPTING ANY SERVICE

WARNING

ELECTRICAL SERVICE SHOULD ONLY BE PERFORMED BY A LICENSED OR QUALIFIED ELECTRICIAN.

Note: Minimum 2 person project.

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

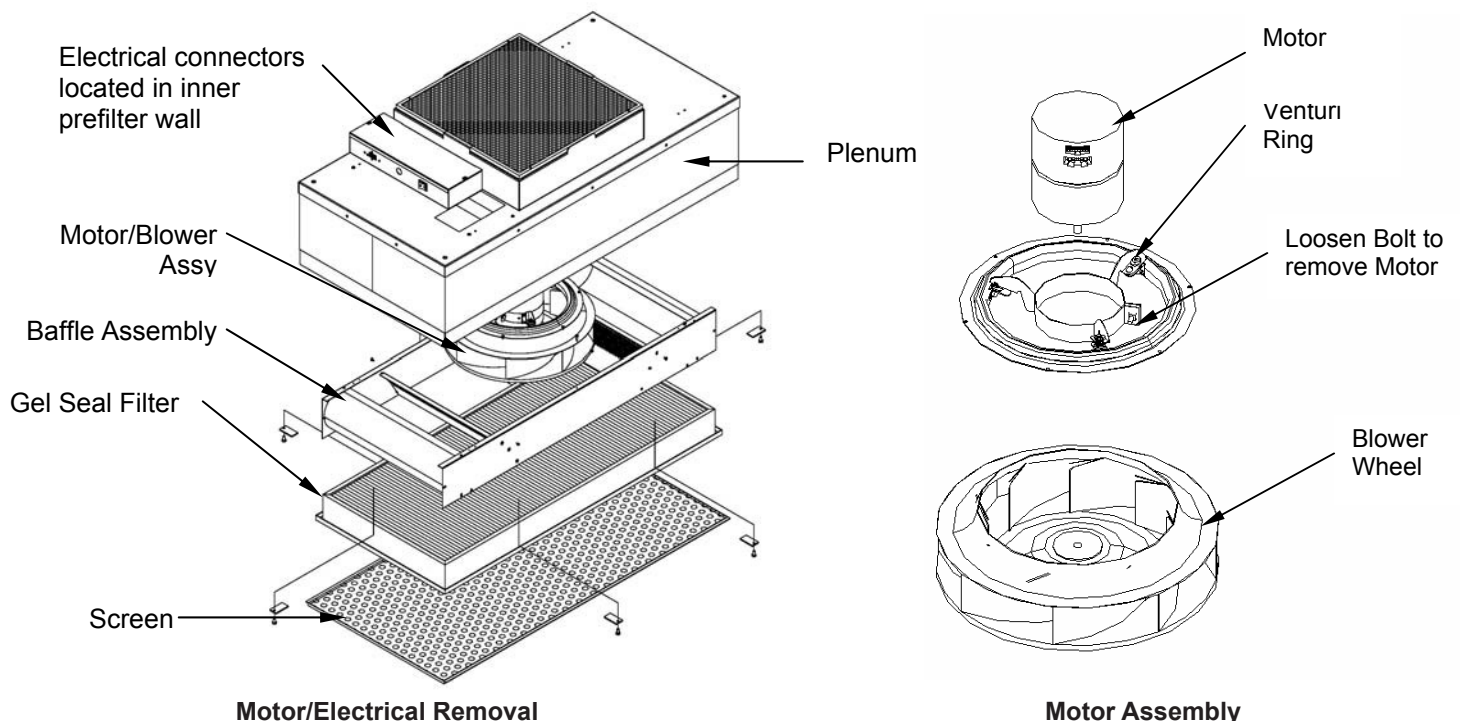
Step 1. To gain access to the motor, remove the gel seal filter.

Step 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 both cable pin connectors from the motor.

Step 3. While supporting the motor blower assembly from below, remove the six screws on the underside of the venturi ring and lower the assembly. (See Figure 7). Note the baffle does not have to be removed to remove the motor/blower assembly.

Step 4. Before removal of the motor mount bracket, measure the precise location of the bracket on the motor. Remove the bracket.

Step 5. 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.



TN1004

Changing from GE to Nidec Motors in the Field

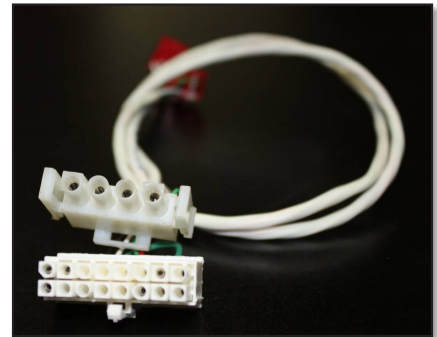
TECHNICAL NOTE

■ **Changing out from GE 2.3 to Nidec PerfectSpeed DC Motors in the field**

The ENVIRCO DC 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.



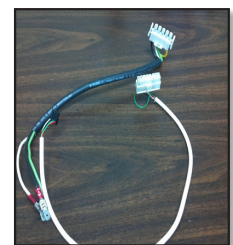
New Cable Style

■ **Nidec Part References**

18 in Standard Build	63751-015
12 in RSRE Build	63751-016
15 ft Whip	63751-017

■ **Old Cable References**

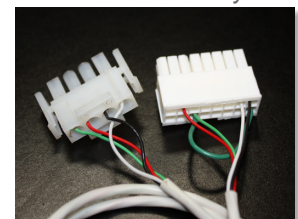
The power cable, has remained the same for the new motor and will be reused. The rest of the fit and function will be a direct replacement. Follow the procedure in the IOM for motor swap for your particular FFU.



Old Cable Style

■ **Contact Us**

Contact ENVIRCO sales or technical team for any assistance needed.



Old Cable Style

Note: GE 2.3 motors are obsolete.

TN1004

Changing from GE to Nidec Motors in the Field

TECHNICAL NOTES

■ MAC 10 Motor Cable Configurations

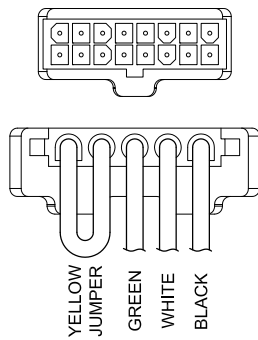


FIGURE 1
120V GE Motor
(with yellow jumper)

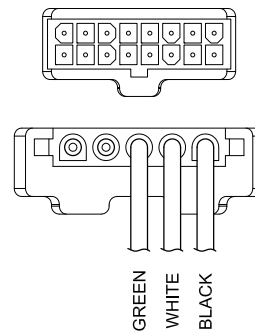


FIGURE 2
208-240V or 277V GE Motor
(without yellow jumper)

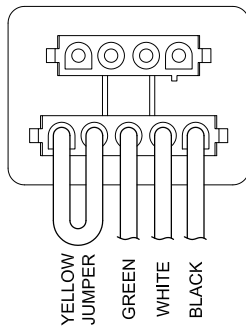


FIGURE 3
120V Nidec Motor
(with yellow jumper)

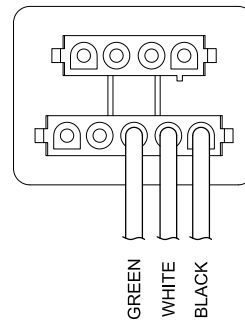


FIGURE 4
208-240V or 277V Nidec Motor
(without yellow jumper)

TN1002MAC10[®] Design with VAV Boxes

TECHNICAL NOTE

■ MAC 10 designs with Duct Collar, VAV or constant air box and fan coils

For applications requiring powered fan filter units and a ducted connection our recommendations would be to use the MAC10 LEDC (ECM motor) or Mac10 Original (PSC motor)

■ Feature

- » MAC10 LEDC
- Power conservation and high airflow
- » MAC10 Original
- Lower unit cost

■ Caution

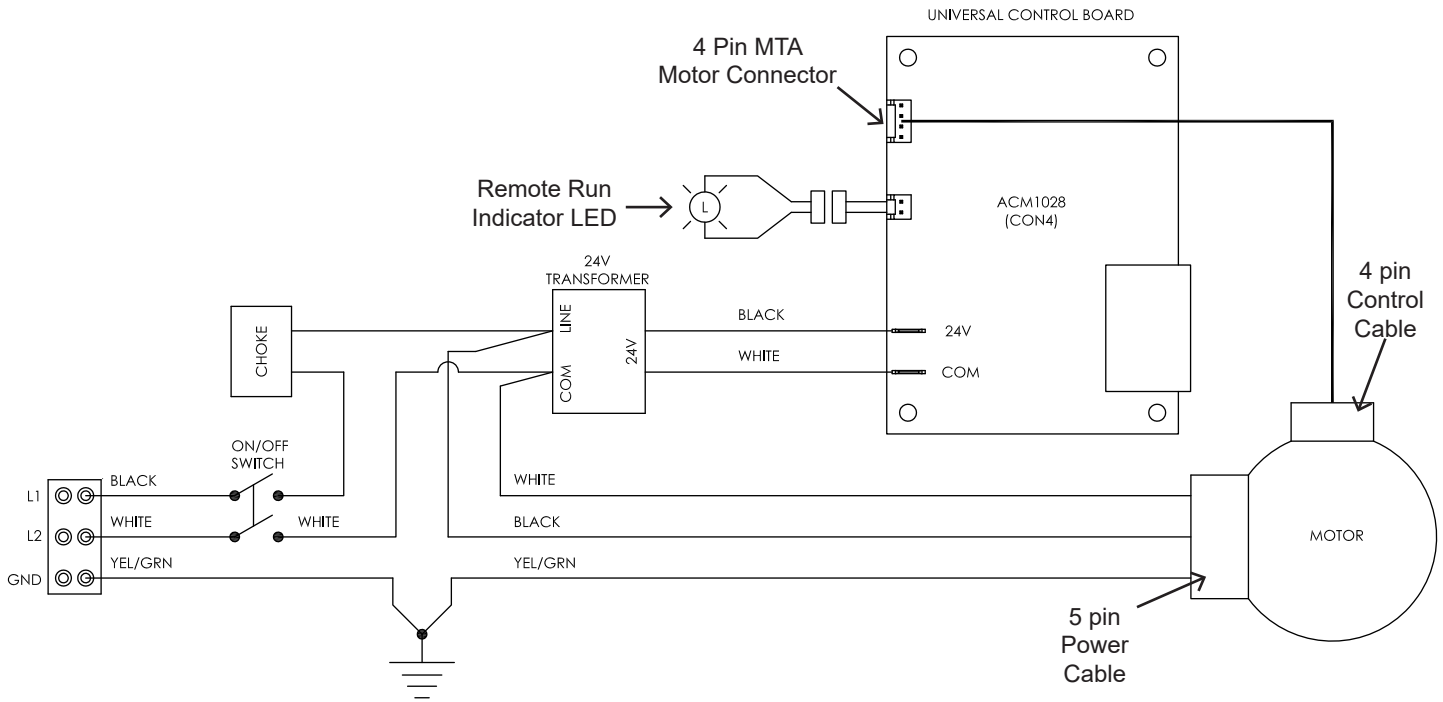
- » MAC10 IQ is not recommend for the above design

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 ENVIRCO beforehand for assistance. The ECM motors used in the IQ design 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.

Installation & Service Manual

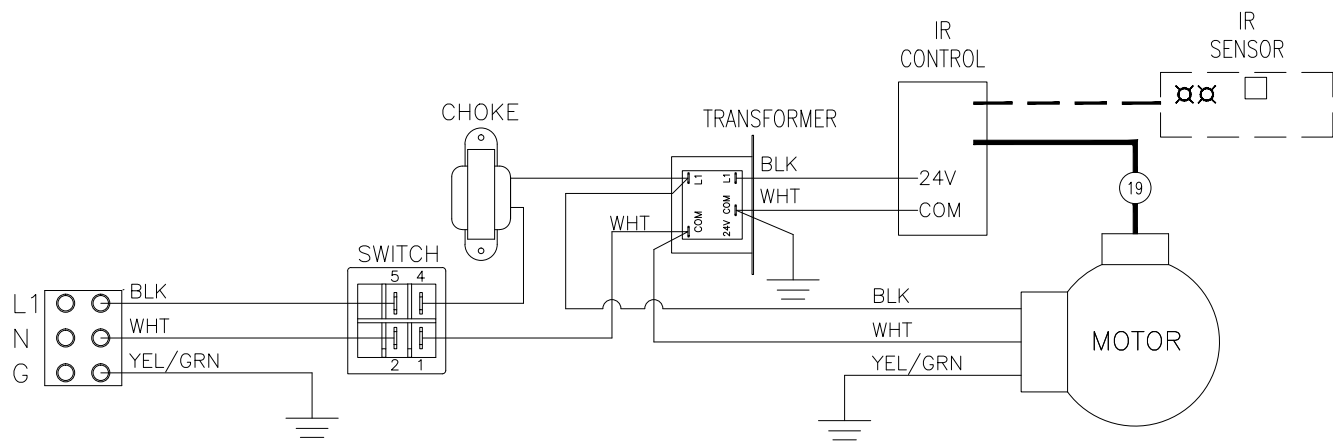
■ Wiring Diagrams



Universal Card Wiring Diagram

Installation & Service Manual

■ **Wiring Diagrams**



Infrared Control

Installation & Service Manual

■ Replacement Parts List

Model	Part Number	Description
MAC 10 LEDC 2X2 1/3HP	24397-003	Motor - ECM 1/3 HP (Program Installed) 120V / 220V
	24397-004	Motor - ECM 1/3 HP (Program Installed) 277V
MAC 10 LEDC 2X4 1/3HP	24397-012	Motor - ECM 1/3 HP (Program Installed) 120V / 220V
	24397-013	Motor - ECM 1/3 HP (Program Installed) 277V
MAC 10 LEDC STD	24504-001	Motor Blower 2X4 120V
	24504-001	Motor Blower 2X4 220V
	24504-001	Motor Blower 2X4 - CE 220V
	24504-002	Motor Blower 2X4 277V
	24397-012	Motor 2X4 120/240
	24397-013	Motor 2X4 277V
	24397-003	Motor 2X2 120/240V
	24397-004	Motor 2X2 277V
	63720	Choke 3.0AMPS 120V
	63667	Transformer 120V
	63666	Transformer 220V - CE 24VAC
	63666	Transformer 208-240V
	63665	Transformer 277V 24VAC
	38511-001	Motor Mount Clip
	62964	Venturi Ring
	64015	Blower Wheel
	63751-015	Motor Harness, 18" (Standard build)
	63751-016	Motor Harness, 12" (RSRE only)
	63751-017	Motor Harness, 15 FT
	63759-001	IR Sensor Harness
	63758	IR Sensor Harness without Sensor
	63951-002	Visual Control Unit - EVO
	62981-038	Foam Prefilter 20 X 20 X .5 - MERV 4
	64125-001	30/30 Prefilter 20 X 20 X 20 - MERV 8
	63970	MODBUS Card 1004/4
	63970-003	MODBUS Card 1014.1.32 REV
63415-003	Pressure Switch	
265888	Universal Card CON4	
MAC 10 LEDC / NIDEC	S266587-007	2x4 Motor Asm 120/240V - Nidec
	S266587-008	2x4 Motor Asm 277V - Nidec
	S266587-009	2x3 Motor Asm 120/240V - Nidec
	S266587-010	2x3 Motor Asm 277V - Nidec
	S266587-017	2x4 RSRE Motor Asm 120/240V - Nidec
	S266587-018	2x4 RSRE Motor Asm 277V - Nidec
	S266587-019	2x3 RSRE Motor Asm 120/240V - Nidec
	S266587-020	2x3 RSRE Motor Asm 277V - Nidec
MAC 10 IQ	63739-002	Switch, Rocker Dpst Wht/Wht
	63752-001	IQ Motor Harness, 5-pin 120v 15" LONG (W/ YEL JUMPER), STD, RSR
	38532-001	Deflector - Filter, 2x4
	62968	Gasket, Neop .125x.5
	63388	Grommet 5/8 Id 1 1/8 Od
	94800-001	Carton, MAC10
94801-014	Insert, Cardboard	

Installation & Service Manual

REP: 69600S	DESCRIPTION: INDICATION REBUILDING-SCHEM	REV: 001	DATE: 7/26/13
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SIZE: SEE CHART

MEDIA:

- [H] HEPA 99.99%
- [4] HEPA 99.995%
- [U] ULPA 99.9995%
- [S] ULPA 99.99999%

CONSTRUCTION:

- [A] ALUMINUM
- [P] PAINTED
- [S] STAINLESS

SCREEN:

- [P] PAINTED
- [S] STAINLESS
- [U] PLASTIC
- [Z] PAINTED ALUMINUM

INDICATOR LIGHT:

- [U] INDICATOR LIGHT
- [X] NONE

CHALLENGE PORT:

- [C] CHALLENGE PORT
- [X] NONE

CODE	NOMINAL SIZE	DIM. "A"	DIM. "B"
[001]	2X4	23.625	47.625
[002]	2X3.5	23.625	41.625
[003]	2X3	23.625	35.625
[004]	2X2	23.625	23.625
[005]	2X4	23.125	47.125
[006]	2X3.5	23.125	41.125
[007]	2X3	23.125	35.125
[008]	2X2	23.125	23.125
[009]	2X4	23.000	47.000
[010]	2X3.5	23.000	41.000
[011]	2X3	23.000	35.000
[012]	2X2	23.000	23.000
[013]	585X1185	23.032	46.654
[014]	585X1035	23.032	40.748
[015]	585X885	23.032	34.843
[016]	585X585	23.032	23.032

NOTES:

1. FILTER MEDIA: MICROGLASS FIBER WITH ACRYLIC LATEX BINDER
2. FILTER DEPTH: 3" OR 53 MM PLEAT
3. EFFICIENCY:
 - H= HEPA = 99.99% EFFICIENT @ 0.30µm (EST-RP-C007)
 - 4= HEPA = 99.995% EFFICIENT @ 0.20µm (EST-RP-C007)
 - U= ULPA = 99.9995% EFFICIENT @ 0.12µm (EST-RP-C007)
 - S= ULPA = 99.9999% EFFICIENT @ 0.12µm (EST-RP-C007)
 - 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)
4. RESISTANCE: PER MANUFACTURER'S SPEC
5. SEPARATOR MATERIAL: ANODIZED ALUMINUM
6. FRAME MATERIAL: EXPANDED METAL PAINTED WHITE
7. GRILLE MATERIAL: FIRE RETARDANT TWO-PART URETHANE
8. SEALANT MATERIAL: HEPA = TYPE J FILTER (EST-RP-C034)
9. EFFICIENCY TEST: ULPA = TYPE F FILTER (EST-RP-C034)
10. FIRE RATING: GRADE 4 UL-900

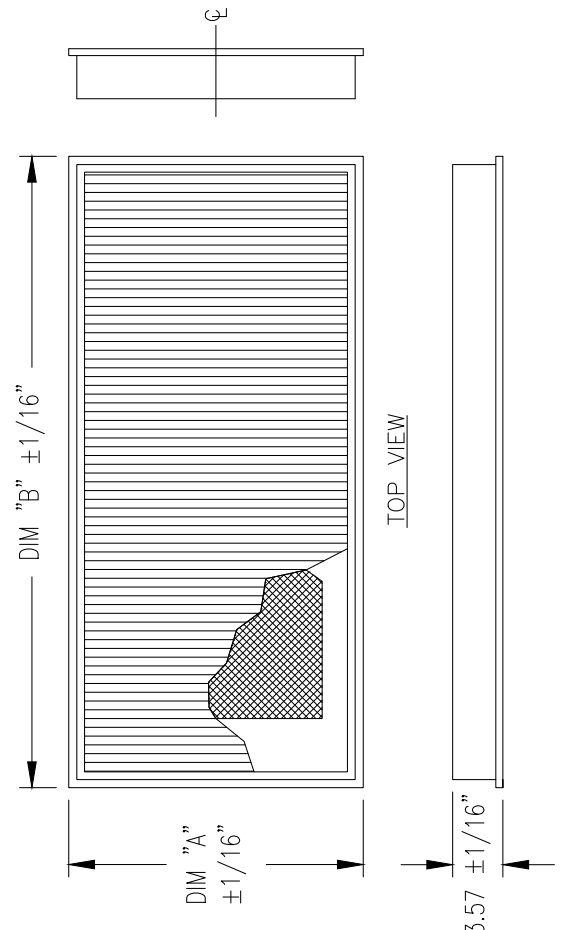
Installation & Service Manual

69601 - XXX X X	REV. DESCRIPTION REV. 1 MODIFICATION REVISION-SC002	REV. DATE REV. 1 7/29/13
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SIZE:
SEE CHART

MEDIA:
[H] HEPA
[U] ULPA

PAINTED FRAME:
[P] PAINTED
[] UNPAINTED



CODE	NOMINAL SIZE	DIM. "A"	DIM. "B"
[001]	2X4	21.000	45.000
[002]	2X3.5	21.000	39.000
[003]	2X3	21.000	33.000
[004]	2X2	21.000	21.000
[005]	2X4	20.500	44.500
[006]	2X3.5	20.500	38.500
[007]	2X3	20.500	32.500
[008]	2X2	20.500	20.500
[009]	22.50X46.50	19.880	43.880
[010]	23.63X46.50	21.000	43.880
[011]	22.50X22.50	19.880	19.880

NOTES:

1. FILTER MEDIA: MICROGLASS FIBER WITH ACRYLIC LATEX BINDER
2. PLEAT DEPTH: 3" PLEAT OR 53MM
3. EFFICIENCY: H= HEPA = 99.99% EFFICIENT @ 0.30um (TEST-RP-C007)
U= ULPA = 99.9995% EFFICIENT @ 0.12um (TEST-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 (TEST-RP-C034)
ULPA = TYPE F FILTER (TEST-RP-C034)
10. FIRE RATING: GRADE 4 UL-900

Installation & Service Manual

■ Limited Warranty

LIMITED WARRANTY: Unless otherwise expressly stated in ENVIRCO's published specifications for the Goods, ENVIRCO warrants that Goods are free from defects in material and workmanship, except for services which are warranted to be performed in a competent and diligent manner in accordance with any mutually agreed specifications. The foregoing warranty shall apply for eighteen (18) months from the date of shipment from ENVIRCO's facility, except for services for which the warranty shall apply for ninety (90) days from the date of performance (the "Warranty Period"). Provided Buyer informs ENVIRCO in writing of any breach of warranty prior to the expiration of the applicable Warranty Period, ENVIRCO shall, as its sole obligation and Buyer's sole and exclusive remedy for any breach of this warranty, repair or replace/re-perform the Goods which gave rise to the breach or, at ENVIRCO' option, refund the amounts paid by Buyer for the Goods which gave rise to the breach. Any repair, replacement or re-performance by ENVIRCO hereunder shall not extend the applicable Warranty Period. The parties shall mutually agree on the specifications of any test to determine the presence of a defect. Unless otherwise agreed upon by ENVIRCO in writing, Buyer shall bear the costs of access, de-installation, re-installation and transportation of Goods to ENVIRCO and back to Buyer. These warranties and remedies are conditioned upon (a) the proper storage, installation, operation, and maintenance of the Goods and conformance with the proper operation instruction manuals provided by ENVIRCO or its suppliers or subcontractors, (b) Buyer keeping proper records of operation and maintenance during the applicable Warranty Period and providing ENVIRCO access to those records, and (c) modification or repair of the Goods only as authorized by ENVIRCO. ENVIRCO does not warrant the Goods or any repaired or replacement parts against normal wear and tear or damage caused by misuse, accident, or use against the instructions of ENVIRCO. Any modification or repair of any of the Goods not authorized by ENVIRCO shall render the warranty null and void. EXCEPT AS EXPRESSLY SET FORTH HEREIN, ENVIRCO MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY, NON-INFRINGEMENT OR FITNESS FOR A PARTICULAR PURPOSE WHICH ARE HEREBY DISCLAIMED TO THE EXTENT PERMITTED BY APPLICABLE LAW.

■ Testing

Each MAC 10 LEDC filter unit is thoroughly tested at the factory before shipment. However, because of the "rigors" of shipping, ENVIRCO encourages its re-test after installation.

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

HEPA filters (Type J) are tested to IEST-RP-00034. ULPA filters are tested to (Type F) IEST-RP-00034. All filters are UL 900 recognized. Your filters may have special requirements, please see original engineering specifications for you specific project.

All units that are airflow tested at ENVIRCO are tested using a Shortridge Airdata Multimeter 870 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 reading evenly spaced along the four foot side, then repeat these reads three additional times. This gives a total of 8 reading to test the unit. All advertised data is based on using the Velgrid with 8 readings (128 velocity points). ENVIRCO recognized the using 8 reading during a cleanroom start-up may be time consuming and recommends using 4 Velgrid readings taken on each 2x2 filter section will approximate the same as 8 readings.

Additional independent testing on the ENVIRCO Mac 10 2x4, 2x2, 2x3, and 2x3½ shows that using one-2x4 or two-2x2 hoods simultaneously give airflow data (cfm) with 5 percent of a duct traverse using 10 diameters of straight duct upstream of the fan intake.

Clean air solutions built for you.

MORE INFORMATION AVAILABLE AT WWW.ENVIRCO.COM

Industrial

Cleanroom Products

- » MAC 10® Original
- » MAC 10® IQ™
- » MAC 10® IQ™ LAF
- » MAC 10® LEAC™
- » MAC 10® LEAC2™
- » MAC 10® LEDC™
- » Ducted Ceiling Module:
DCM & RSR
- » AC or DC Control Systems
- » MAC-T Ceiling Grid System

Hospital & Healthcare

Hospital & Healthcare

- » IsoClean® and IsoClean
with Ultraviolet Light
 - » AirCeil®
 - » Hospi-Gard® Room
Pressure Monitor
- ### Enviramedic Products
- » HOR Horizontal Flow
Enclosure
 - » HCF Horizontal Flow
Surgery Room
 - » VOR Vertical Flow Surgery
Isolator

Pharmaceutical

Pharmaceutical & Medical Device

- » Unimodule M2 Vertical
Laminar Flow Workstation
- » METD 100% Exhausted
Vertical Flow Workstation
- » Laminar Downflow Module

Laboratory & Research

Laboratory & Research

- » 100-Plus Horizontal or
Vertical Flow Clean Bench
- » Unidirectional Flow
Horizontal Flow Bench (LF)
- » TT Table Top Horizontal
Flow Clean Bench
- » EnviraLab Sterility Module:
ESM

