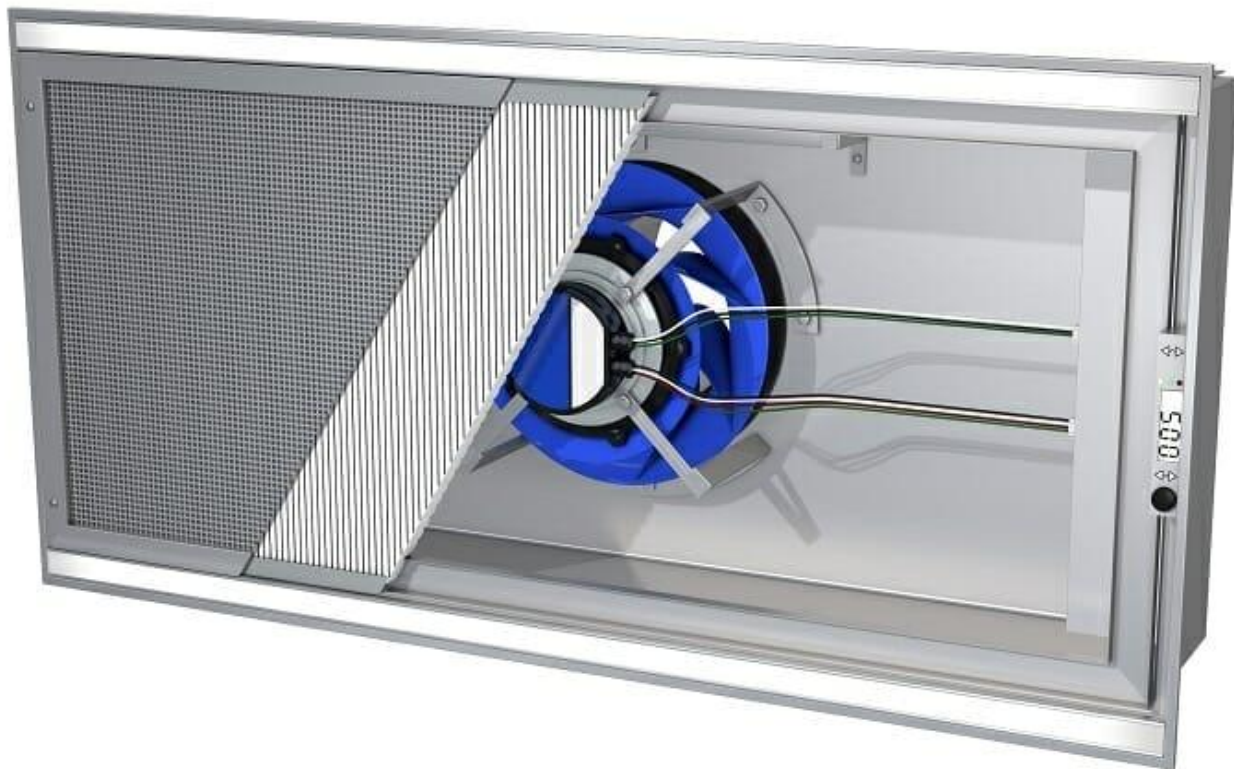# INSTALLATION, OPERATION, AND MAINTENANCE MANUAL
FOR
Fan Filter Unit
SSLFHFD-FFU

Retain instructions with unit and maintain in a legible condition.

FAN FILTER UNIT

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YOU HAVE RESPONSIBILITIES TOO

This installation, operation and maintenance manual cannot cover every possibility, situation or eventuality. Regular service, cleaning and maintaining the equipment is necessary. If you are not capable of performing these tasks, hire a qualified technician. **Failure to perform these duties can cause property damage and/or harm to the building occupants and will void the manufacturer's warranty.**

Installing and servicing a FAN POWERED DIFFUSER can be hazardous due to system pressure and integral electrical components. Only trained and qualified technicians should install or service a FAN POWERED DIFFUSER.

Untrained personnel can perform basic maintenance, such as cleaning the system and replacing filters. All other operations should be performed by qualified technicians.

Follow all safety codes. Wear appropriate PPE safety glasses and work gloves for your protection.

This equipment shall be carefully installed in accordance with the standards of the National Fire Protection Association (National Electrical Code).

Before installing or servicing the system, always turn off, 'lockout', the main power to the system. There may be more than one disconnect switch. Electrical shock can cause personal injury or death. Always disconnect and lock out power before servicing.

The installer is responsible for providing qualified, trained personnel to install and operate the equipment. Consult all local building codes, occupational safety, electrical, gas and any other codes applicable to the installation of this equipment.

Authorities having jurisdiction should be consulted prior to installation of this equipment to verify local codes and installation procedures.

INTRODUCTION

AJ Manufacturing provides high quality products designed and manufactured for many years of trouble-free operation. We recommend that this manual be read thoroughly to ensure proper installation, efficient operation and proper maintenance of this equipment. The submittal record shall be considered an integral part of this Installation, Operation and Maintenance Manual.

The AJ Fan Filter Unit is a laminar flow air delivery system which may contain integral lighting and filtration all built into a stand-alone unit at the factory. AJ Manufacturing's products incorporate aseptic design details within a

FAN FILTER UNIT

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laminar airflow system for optimized contamination control. Review this entire Installation and Maintenance Manual as well as the entire Submittal Record prior to installing your equipment.

RECEIVING, UNPACKING, AND INSPECTION

AJ's FFUs are boxed and wrapped in the factory unless other packing is required by specification. Shipped loose hardware is not wrapped unless otherwise specified. Do not un-wrap units outdoors or in a dirty environment.

Carefully inspect all parts, after receiving them from the transporting agent, for any damage that may have occurred in transit. If shipping damage has occurred, notify freight carrier and AJ Manufacturing immediately and report the damage by providing photographs of the damage and a list of components affected. Isolate the damaged equipment in a separate holding area to prevent it from being installed, freight carrier may also choose to inspect the damage.

Compare parts with the shipping documentation to make sure your shipment is correct, free of damage and complete. Your signature verifies that you have received all equipment in satisfactory condition.

IDENTIFICATION

The unit's model, electrical information, and serial number can be found on the inside vertical face of the installation frame by removing the face. This information can help ensure you get accurate service and parts when contacting the rep or AJ Manufacturing.
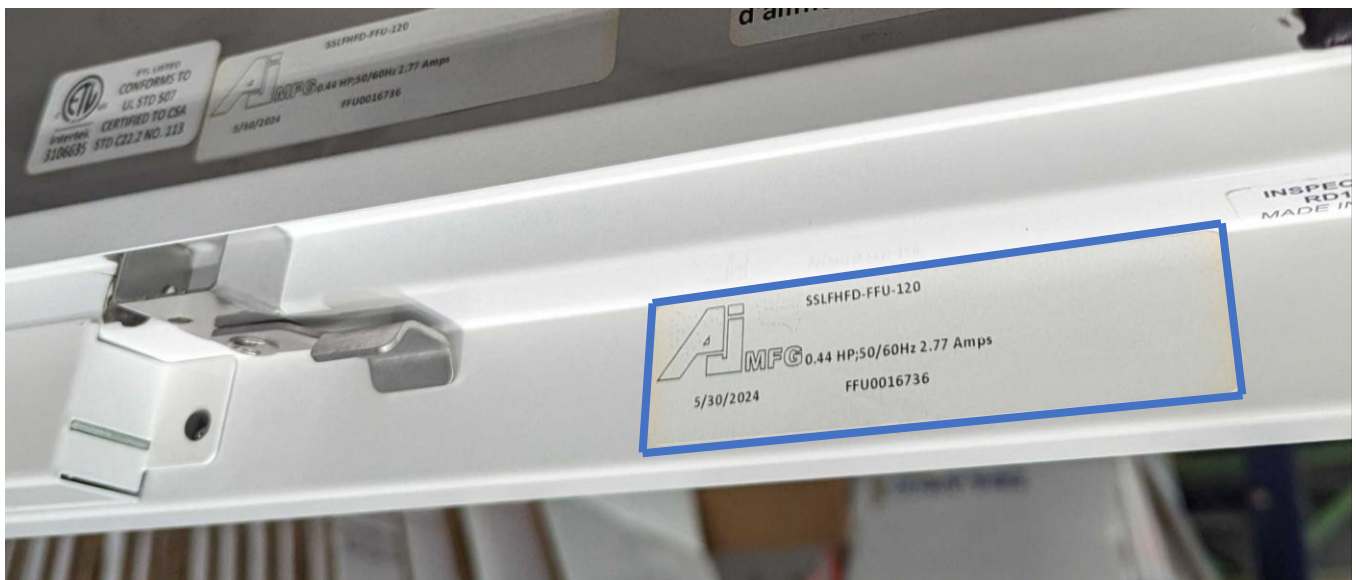
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PRE INSTALLATION CHECKLIST

- o   DO NOT install HEPA filter until AFTER fan operation and communication have been verified.
- o   Prepare the installation site with appropriate power, data cabling, support structure, and openings as required by system design and regulatory requirements.
- o   Unbox and inspect the units.
- o   Install the fan unit into the ceiling. Support its weight from the structure.
- o   Connect ductwork to fan unit (if applicable).
- o   Verify incoming power matches the rating plate then connect main power wiring.
- o   Connect control wiring (if applicable).
- o   Run the unit and/or upstream air device to flush out construction debris.
- o   Install the pre-filter (if applicable).
- o   Seal the fan filter unit to the ceiling using gasketing and caulking.
- o   Install the HEPA/ULPA filter.
- o   Turn unit on and configure settings and adjust airflow to design CFM.
- o   Turn on the upstream airflow device.
- o   Balance the system to design requirements.
- o   Calibrate airflow sensor, if equipped, to balancer's flow hood.
- o   Leak test the fan unit and filter per site procedures and regulatory requirements (if applicable).
- o   Install the perforated face screen.

UNIT INSTALLATION

AJ FFUs will be delivered completely assembled with the exception of the HEPA filter. Filters will ship separately in their own carton. Filters should not be installed until after electrical and function tests are completed and ductwork has been verified as clean and clear. Ideally this would be just prior to balancing of the system.

⚠️ Supporting structure and mounting hardware must be sufficient to support the full weight of the unit and any additional load that may be placed on it. The following unit weights are for reference and may not be precise for the configuration of units you receive.

Approx. unit weight with2" filter		
Size	**Pounds**	**Kilograms**
48" x 24"	75	34
36" x 24"	61	28
24" x 24"	48	22

NOTE: Some installations require custom mounting. In those cases, be sure to seal the unit to the ceiling and seal all penetrations through the plenum walls.

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Mount Unit [Lay- In Application]

    Remove unit from shipping carton and inspect for damage

    Raise unit through opening in grid at an angle.

    Lower unit onto the back of grid tee.

    Secure unit to overhead structure from hurricane tabs on top of unit.

T-Bar
Ceiling Grid

Gasketing Applied
to Ceiling Grid
Between Unit & Tee

Hanger Tabs
To Support Unit
Above the Ceiling
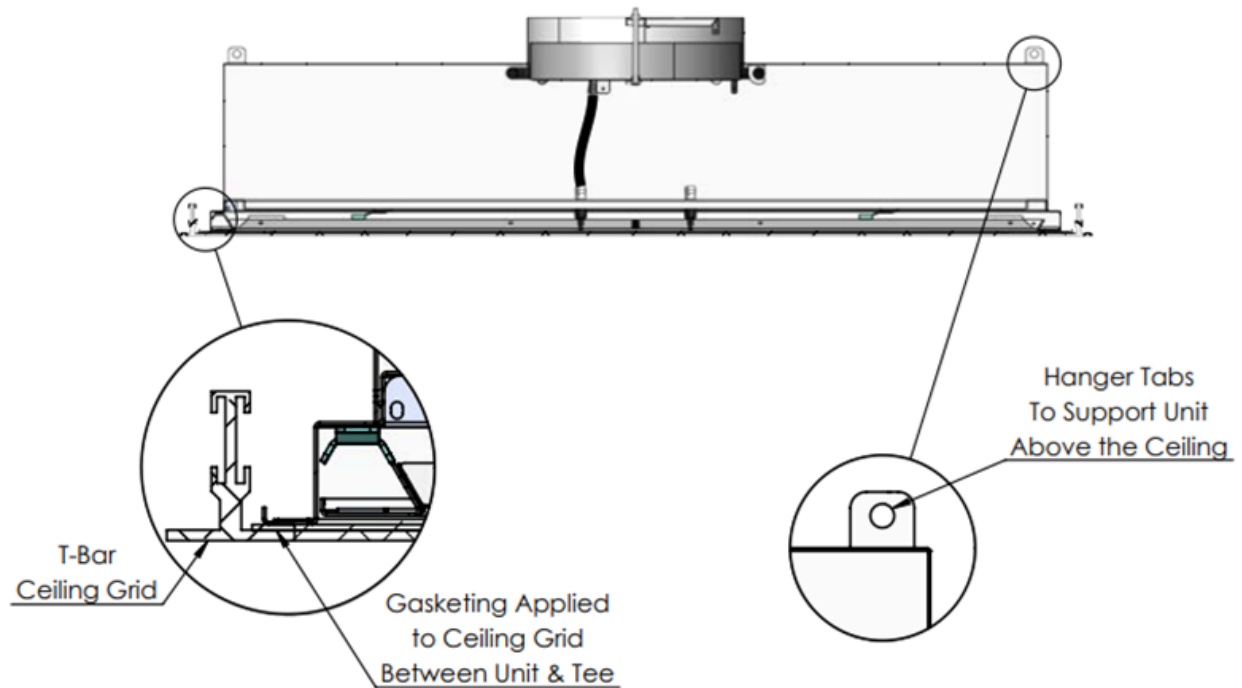
FAN FILTER UNIT

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Mount Unit [Hard Ceiling Application]

Remove unit from shipping carton and inspect for damage

Remove perforated face screen from FFU.

Raise unit into framed opening in ceiling

Attach screw through FFU frame and into the framed opening in ceiling

Secure unit to overhead structure from hurricane tabs on top of unit.

Seal FFU to ceiling by applying caulk to mating perimeter edge.

2x4 Wood or Equivalent Steel Studs

Ceiling Example

Height 22.60

Width 46.60

CEILING CUTOUT EXAMPLE

Drill Through Plaster Frame On all 4 Sides

Self-drilling screws (Provided by Others)

Hanger Tabs To Support Unit Above the Ceiling

Plaster Frame (Seal to Ceiling)

Quarter-Turn Fasteners Typ

Removable Face Frame

CEILING INSTALL EXAMPLE
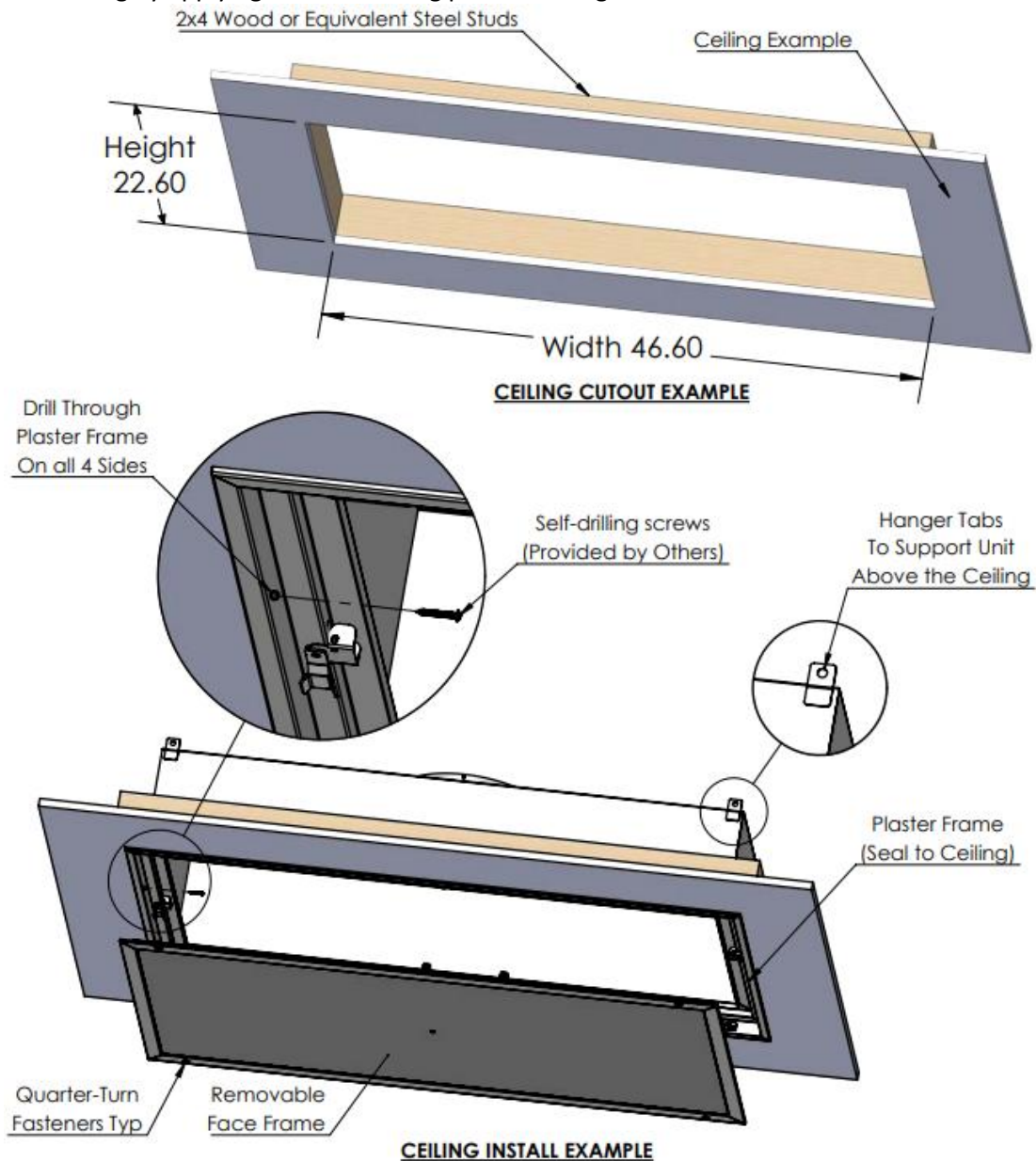
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ELECTRICAL CONNECTIONS

FFUs are pre-wired with a terminal block connection for line power. If the unit is equipped with lighting there is a second electrical box with its own connections for the lighting components so they can be run on a separate electrical circuit.

A pass-through grommet is provided for external signal wires to be brought into the control board. Be sure all wiring and circuits are correctly sized and meet all site and regulatory requirements. Unit Full Load Amps vary by line voltage. Use the rating label on the unit or the chart below for circuit sizing calculations.

*FLA data for **Ziehl-Abegg** 280mm fan units and Mean Well IRM-30 power supply*

AC Voltage	Max. Motor Wattage	Full Load Amps
120	330	3.6
208	290	2.2
240	290	2.0
277	290	1.43

*FLA data for **EBM-Papst** 280mm fan units and Mean Well IRM-30 power supply*

AC Voltage	Max. Motor Wattage	Full Load Amps
120	330	3.6
208	315	2.3
240	315	2.1
277	315	1.52

- These connections should only be performed by a licensed electrician and must follow all applicable electrical codes.
- Because the fan units and lighting are INTERTEK (ETL) labeled prior to leaving the factory, any field modifications are the responsibility of the installation agent. Field modifications to the electrical fixtures may be separately listed with INTERTEK (ETL) at the installation agent's expense.
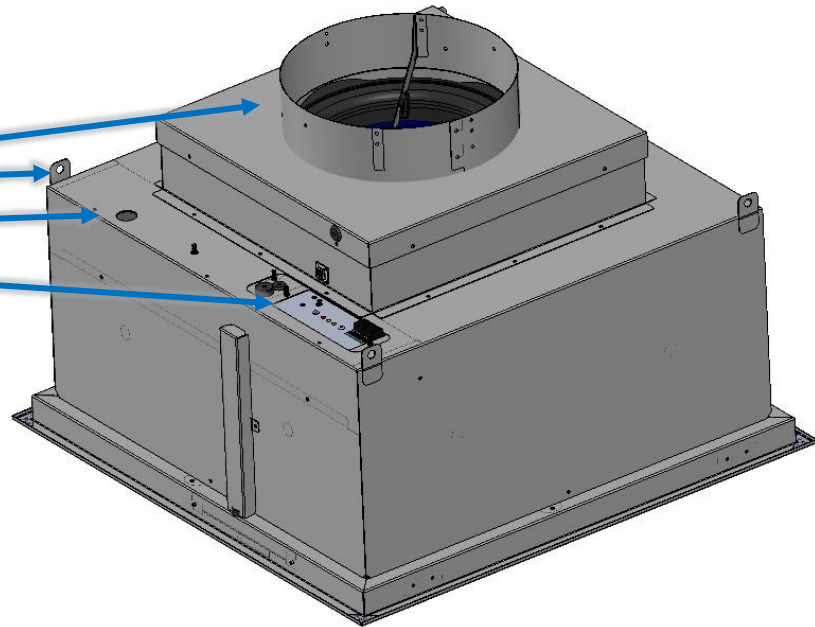
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FEATURES

Overview

1) Duct connection kit (factory installed).
2) Hanger tab.
3) Line power access (7/8" hole).
4) Control board.

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Face Display and Controls

1) *Start / Stop* button. Short press toggles fan operation. Hold for 5 seconds to access display menus and change between local and external setpoints. Hold for 10 seconds to restart the controller.
2) *Setpoint adjustment* buttons. Display will temporarily show setpoint when used. Hold to change setpoint more rapidly. These buttons are slightly recessed and need a small tool to press such as a pen or screwdriver.
3) *Numeric Display*. Can show CFM or RPM or turned off. Can be changed from display menu. See the Numeric Display Mode section for details.
4) *Indicator lights*: Yellow = Fan Stopped, Green = solid: Fan Running, flashing: fan told to run but no RPM feedback, Red = Filter Alert, Blue = Setpoint controlled at display (local control).
5) *Calibration Adjustment* buttons. Changes CFM offset so displayed CFM can be set to match flow hood used for test and balance. These buttons are slightly recessed and need a small tool to press such as a pen or screwdriver.

Note that these functions are also available through the menus on the main board.
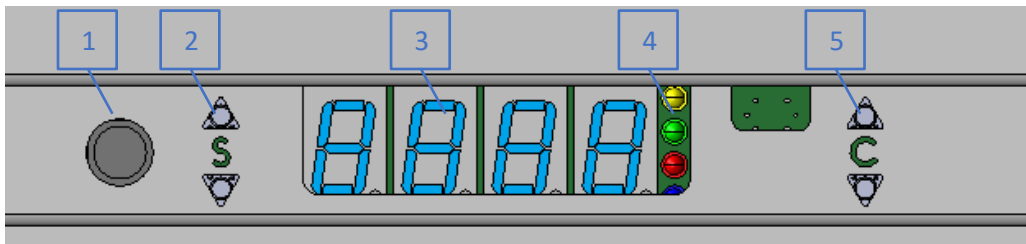
Electrical Box

1) Face display with controls.
2) Main power switch. **Safety Note:** *can still be live wires in electrical box when switched off.*
3) Terminal Block.
4) Power Supply. 85-277 Volt AC to 24 Volt DC.
5) Control Board for motor and sensors.
6) Motor Line Voltage Connection, 3 pin.
7) Motor Data Low Voltage Connection 4 pin.
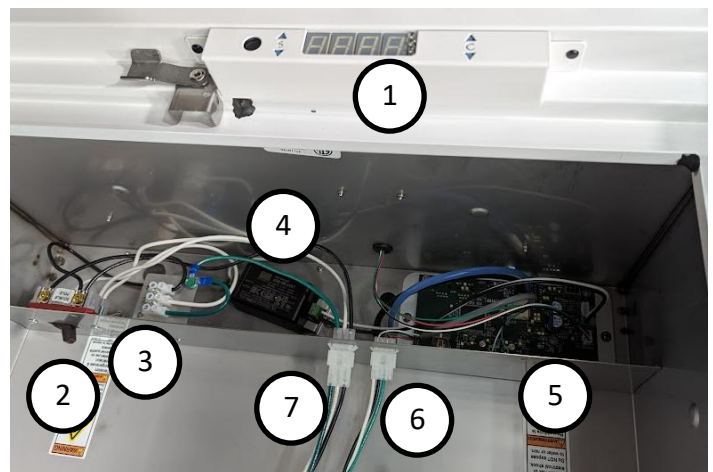
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Control Board

STATUS

Off: Fan not commanded to run.

Flashing green: Commanded to run but fan not yet reporting at least 50 RPM.

Solid green: Normal operation with fan running.

STOPPED

Solid Yellow: Fan stop command in effect.

Off: Normal operation.

FILTER ALARM

Off: Normal Operation

Solid Red: Filter alarm conditions met, check system airflow and operation.

Buttons: BACK, ENTER, UP, DOWN are used to navigate the menus on the control board side screen.

ETHERNET: Ethernet ports for MODBUS or BACnet IP communications. In development. Not currently used.

RS485: A, B, GND, and DIP switch. Connections for MODBUS RTU, or BACnet MS/TP communications. Switch is to activate End of Line Terminating Resistor for the last device in an RS-485 daisy chain.

USB: USB-A plug for updating firmware and system settings. Only use at the direction of manufacturer with manufacturer provided files to ensure correct operation. Maximum flash drive capacity 32 GB, larger flash drives cannot be read. Drives must be formatted FAT32 (Windows default).

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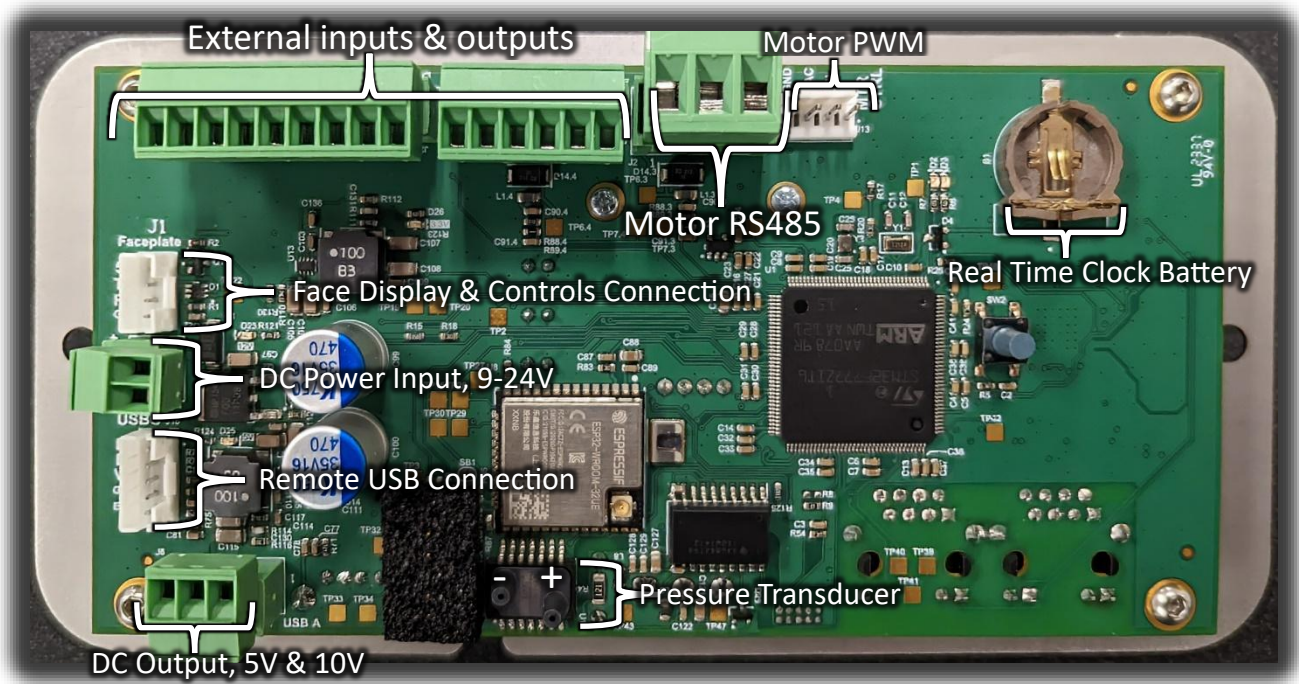
Eternal inputs and outputs in development. Not currently used.

Motor RS485 is used to communicate with the EC Motor for control and feedback.

Motor PWM is for legacy support of motor systems which do not support RS485 communication.

Real Time Clock battery is for support of future functionality. Not currently used.

Face Display and Controls connection is used for power and communication with the face control board and is standard.

Remote USB connection is for future functionality and not currently used.

DC output, 5V and 10V can be used to power supplemental sensors.

Pressure Transducer – and + are used in conjunction with a crossflow sensor to directly read CFM flowing through the unit. If no crossflow sensor is used it can be also plumbed for directly measuring differential pressures of up to 2 inches of water column.

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FILTER INSTALLATION

Filters are the most delicate part of the system and proper handling is an absolute requirement. Filters should NOT be stacked flat. Filters must be stored indoors and in a conditioned space prior to being installed. Filters are packaged for single or double staging. This is determined by the customer specification. Single stage filters are bagged once and then boxed individually. Double stage filters are bagged twice and then boxed individually or separated by cardboard sleeves. Double staging adds one more step to the particle free process both in the packaging and staging procedures. This enables the installer to have the assurance of a cleaner product when properly staged. When installing a filter, do NOT handle or place any objects on the media of the filter. Doing so may damage the filter which could cause it to fail certification.

Inspect each filter prior to installation for any damage. Always follow the original filter manufacturer's handling instructions. DO NOT rack or twist the filter frame or put pressure on the filter media at any time. AJ Manufacturing recommends that two people install each filter and only handle the frame of the filter.

- **Bottom Load Filters:** Shall be loaded from the room side, centered on the knife edge and between the filter clips, and lifted into place. Once in place, rotate the filter clips ¼ turn to lock the filters into position.
- **Filter Removal:** Reverse the appropriate installation instructions. Removing filters may take some finesse. This process must be done slowly to keep the GEL from being pulled out of the filter frame through.

⚠ **WARNING:** The following diffusion screen installation procedure must be followed for secure installation of the diffusion screens.

DIFFUSION SCREEN INSTALLATION: On each diffusion screen you will find ¼ turn screws on the long sides of the screen. Place the ¼ turn screws over the screen clips that are factory installed within the ceiling flush grid. Securely fasten the diffusion screen by turning each screw a ¼ turn. Each diffusion screen has a safety cable attached to two sides to eliminate diffusion screens being dropped. Make sure these safety cables have been properly connected to screen clips prior to final installation. Inspect the diffusion screen to make sure that all the ¼ turn screws are properly seated. **DIFFUSION SCREEN REMOVAL:** To remove, gently put a hand on the diffusions screen and reverse the ¼ turn screw opposite of the installation instructions. If the diffusions screen needs to be removed completely, make sure that all safety cables have been disconnected before lowering the screen from the ceiling system.

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CONFIGURATION

OPERATING MODES

Constant CFM – Fan RPM modulates to maintain CFM setpoint. As filter loads over time, RPM will increase to maintain consistent airflow. (*default*).
Constant RPM – Fan runs at constant speed, without changing. Setpoint is from 0-100%, with 100% corresponding to maximum motor speed of 2450 RPM.

Using the menus to change to *Open Loop* operation will convert the system to hold *constant RPM* instead of constant CFM. When operating in Open Loop the setpoint will be shown as a percentage of fan speed and the *Filter Alarm* will come on if CFM drops below 200. This CFM value can be changed in the *systems_settings.json* file and updated with a USB flash drive.

The room side numeric display will show measured CFM by default. This can be changed from the display menu to **CFM**, RPM, or Off depending on customer preference or if RPM needs to be checked for troubleshooting and the display on the main board is not accessible.

A detailed listing of default and valid values can be found in the *user_settings.json* and *system_settings.json* shown tables later in this manual.

Local or External Setpoint

The blue LED indicator shows if the setpoint is set at the local display control or from an external source. If lit blue it indicates it is set at the local display. If off it is using an external signal to control it, either from an electrical signal or over a BMS network.

To change from the display hold the *Start/Stop* button for 5 seconds and it should then display: *LOCL*. [RW1]

A short press of the *Start / Stop* button will enter the setpoint source menu and it will show the current setting, ***On*** or ***OFF*** . Use the up and down setpoint buttons to select the desired setting and then short press the Start / Stop button to save the change. The blue light should change to show the current setpoint source status.

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To change from the display on the control board use the **UP** and **Down** buttons to go to the *General Status* menu.

Press Enter to go down to the next menu level and use the **UP** and **Down** buttons to *EDIT: LOCAL CONTROL* and press Enter. The **UP** and **Down** buttons should now toggle the value between *Local* and *External*. When the desired setting is shown press the *Enter* button to save the change.

Note for BMS integration: In either setting the BMS can still monitor all data points from the unit but will only be able to make setpoint and start / stop changes if the unit has the Local setting set to Off, or False as seen in the BMS.

Numeric Display Mode

To change the displayed information hold the Start/Stop button for 5 seconds and it should then display: *LOCL*.

Pressing the Setpoint down button will change this to *diSP* . A short press of the Start/Stop

button will bring up the current display setting on the display, *CFn* , *rPn* , or *OFF* .

CFn = measured CFM display

rPn = measured motor RPM

OFF = only status lights, no numeric display.

Use the setpoint up and down buttons to change to the desired display mode and press the Start / Stop button to save the setting. It will then exit the menu and enter the selected display mode.

Factory Configuration & System Modes

By default, the system operates in **constant CFM (Closed Loop) mode**, controlled by a crossflow sensor at the motor inlet. This setting can be changed in the field if it causes system instability.

Switching to **Open Loop mode** via the menu sets the system to maintain constant RPM instead. In Open Loop, the setpoint is displayed as a percentage of fan speed, and the **Filter Alarm** will activate if CFM drops below 200 (adjustable in system_settings.json via USB update).

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Display Options

By default, the room-side display shows **measured CFM**. Users can change this in the menu to **CFM, RPM, or Off** for troubleshooting or preference. Refer to user_settings.json and system_settings.json for all default and valid values.

To Change the Display Mode:

1. **Hold** Start/Stop for **5 sec** → Displays LOCL.
2. **Press** Setpoint Down → Changes to diSP.
3. **Press** Start/Stop → Select current display setting:
   - **CFn** = Measured CFM
   - **rPn** = Motor RPM
   - **OFF** = Status lights only
4. **Use** Up/Down buttons to adjust.
5. **Press** Start/Stop to save.

Setpoint Control (Local vs. External)

The **blue LED** indicates setpoint control:

- **Lit** → Local display control
- **Off** → External source (BMS or electrical signal)

To switch setpoint control from the display:

1. **Hold** Start/Stop for **5 sec** → Displays LOCL.
2. **Press** Start/Stop → Enter setpoint source menu (ON or OFF).
3. **Use** Up/Down buttons to select.
4. **Press** Start/Stop to save. The LED updates accordingly.

To change from the control board:

1. **Navigate** to **General Status**.
2. **Enter** LOCAL CONTROL menu.
3. **Use** Up/Down to toggle **Local/External**.
4. **Press** Enter to save.

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BMS Integration Note: Regardless of setting, BMS can monitor all data points but can only modify setpoints and start/stop commands if **Local is Off (False in BMS).**

Setpoint Control (0-10V)

Connect 0-10V signal to VI1 and GND on the 9-pin terminal block as seen in the following photo.

Edit gain value in system_settings.json file. *See Section "USB Drive Applied Settings" for instruction on uploading system_settings.json*

- The "ana10V_1_gain": value = max_xxxx_loop_setpoint value / max signal voltage
  IE: If in open loop 0-100% and a 5 volt input then 100/5=20
  If in closed loop 0-1500 CFM and a 10 volt input then 1500/10=150
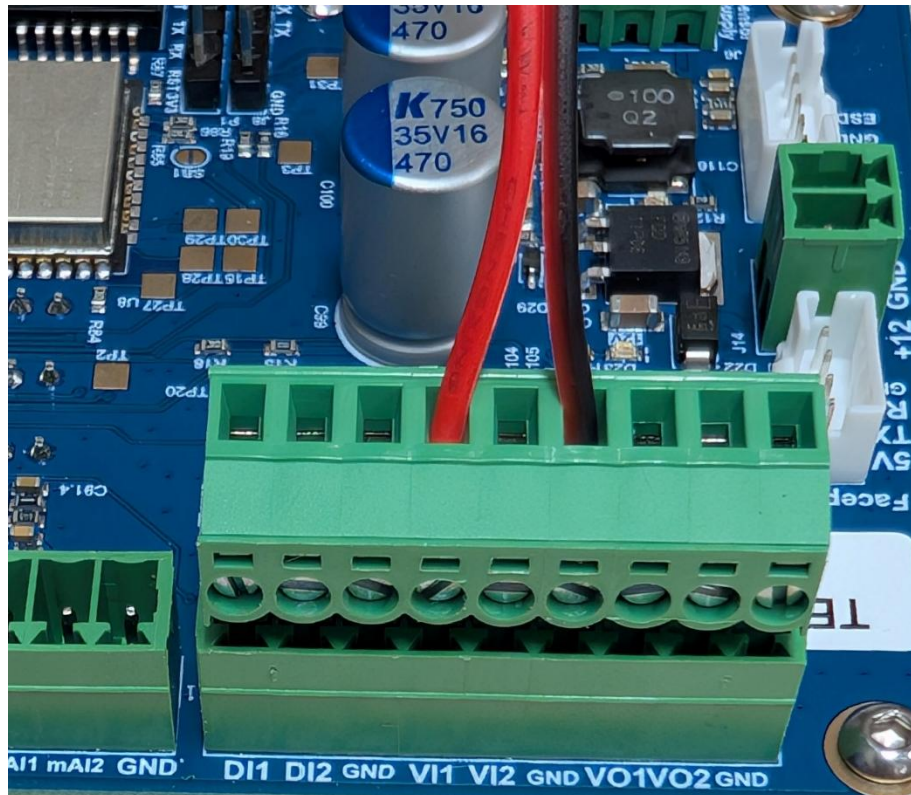
Control Board OLED Screen Menu Navigation

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Indented menus are reached by pressing **ENTER**. Use **BACK** to return to the previous level. Use **UP** and **Down** to move between the menu items. Press **ENTER** to edit a value, **UP** and **Down** to change the value, and ENTER again to make the change. This will typically return you to the previous menu. Some changes require resetting the unit. Once all changes are made it is best practice to do a reset to verify that the unit functions as intended.

Menu Tree

GENERAL STATUS STATUS : RUNNING SETPOINT: 99.0 CFM : 11.0 RPM : 0.0 →STOP ↑↓	Shows basic operational parameters. **STATUS**: BOOTING, STOPPED, IDLE, RUNNING **SETPOINT**: Shows currently active setpoint value. **CFM**: Shows current CFM feedback from currently configured source. Typically, a crossflow sensor connected to the onboard pressure transducer. **RPM**: Current motor RPM.
START/STOP FAN: OLD: START NEW: STOP →EXIT →NEXT ↑↓	Sets the run condition of the fan motor.
EDIT: LOCAL CONTROL OLD: ENABLED NEW: DISABLED →EXIT →NEXT ↑↓	**ENABLED** uses the setpoint set with the face controls or the **LOCAL SETPOINT** menu. **DISABLED** uses the external NETWORK setpoint or an incoming signal value into one of the on-board inputs as configured in the *system_settings.json* file loaded from the USB port.
EDIT: LOCAL SETPOINT OLD: 99 NEW: 90 →EXIT →NEXT ↑↓	This value will be in CFM if in Closed Loop mode from 50 to 1200. In Open Loop mode this value will be in % of maximum RPM, 0-100.
SETPOINT SOURCE LOCAL : DISABLED EXTERNAL: ANALOG VI1 THRESH : 10.0 SETPOINT: 0.0 SP RAW : 0.00 V →EDIT ↑↓	Shows current setpoint configuration and information. Thresh is the minimum value to change from STOPPED status to RUNNING status. Setpoint is the currently used Setpoint value. SP RAW is the analog input used to calculate the current SETPOINT in external mode. If using a BMS to control setpoint in External mode the THRESH and SP RAW are not used.
EDIT: LOCAL CONTROL OLD: DISABLED NEW: ENABLED →EXIT →NEXT ↑↓	Toggles between LOCAL and External control methods. LOCAL refers to a setpoint configured on the controller's menu system or set using the face display controls. External will use the signal source parameters configured in the *system_settings.json* and *user_settings.json* files.

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Screen	Description
EDIT: START/STOP THRESHOLD OLD: 10 NEW: 7 →EXIT →NEXT ↑↓	Only used for external analog setpoint input. Sets the setpoint value used to change the unit to the STOPPED state. The default value of 10 is intended to be used with a percentage setpoint. If used with a CFM setpoint the value should be raised to 50 or above for reliable shut-off.
CONTROL SCHEME MODE : CFM CONTROL FBK SIG : PRESSURE FEEDBACK: -6.3 FBK RAW : -0.07 IWC →EDIT ↑↓	Shows current control type, feedback source for CFM closed loop control, and current values to help with troubleshooting.
EDIT: CONTROL MODE OLD: CFM CONTROL NEW: RPM CONTROL →EXIT →NEXT ↑↓	Sets between CFM CONTROL (closed loop) and RPM CONTROL (open loop) operation. When in CFM control the valid setpoint values will be determined by the unit's maximum airflow capacity (typically 1200 CFM for a 24x48 FFU). In RPM mode the setpoint will be a percentage of RPM. Setpoint will need to be adjusted into a valid range after making the change. A reset or power cycle may also be needed.
PRESSURE TRANSDUCER PRESSURE: -0.1 IWC CFM : -5.2 CFM ADJ : 0.0 →EDIT ↑↓	Shows current values from onboard pressure transducer and the resulting CFM if equipped with a crossflow sensor. Displays the offset entered to adjust for differences between the onboard readings and a flow hood.
EDIT: CFM ADJUST OLD: 0 NEW: 43 →EXIT →NEXT ↑↓	Allows the adjustment of the CFM reading so it can be matched to an external sensor such as a balancer's air flow hood.
COMMUNICATION PROTOCOL: NONE →EDIT →INFO ↑↓	For BMS integration setup go to the appropriate section for the protocol being used. BACNET MSTP, MODBUS RTU.
BOARD INFO AJ MANUFACTURING UNIT MANAGER FIRMWARE: 0.10.3 HARDWARE: 2 →RESET ↑↓	Shows current firmware version, hardware generation, and has the soft reset menu.
RESET? OLD: NO RESET NEW: RESET DEVICE →EXIT →NEXT ↑↓	Restarts board equivalent to cycling power.

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USB Drive Applied Settings

Basic setup and operation of the FFU can be achieved through the OLED screen. Advanced settings can be configured by accessing the .json programming files.

If a blank flash drive is installed in the USB port on the control board it will write the current board configuration to files on the flash drive. Note, the flash drive must be formatted in the FAT file system (the Windows default). The configuration files which will be saved to the flash drive will be named:

- *old_system_settings.json*
- *old_user_settings.json*
- *current_system_settings.json*
- *current_user_settings.json*

If present, files named *system_settings.json* and *user_settings.json* will be written to the settings in the control board the next time the flash drive is inserted or the controller is reset with the drive inserted. The *old_* files store the original settings on the controller when the flash drive is inserted. The *current_* files are a verification of the settings saved after the *system_settings.json* and *user_settings.json* values are copied to the controller's internal storage.

Unless directed by the manufacturer it is generally recommended that these files not be altered. Contact AJ Manufacturing technical support for assistance if you feel changes would be helpful. Any standard text editor such as **Notepad** can be used to view and change the files.

These files can be a convenient way to record the configuration of one unit and apply it to others in a system. By installing a flash drive in a correctly configured unit the *current_* prefixed files can have that prefix removed to make them the files that write to subsequent units. When using this method to copy settings it is best practice to start with a blank flash drive so that there are no existing files to overwrite the good settings on the sampled unit. Some settings require a reset or the cycling of power to the unit to take effect. It is best practice to reset the controller or cycle power to the unit after any updates.

Details of the settings in each file are given in the tables below for reference.

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USER_SETTINGS.JSON

Setting ID	Type	Default	Description
default_start_stop	Boolean	FALSE	`true`: Default-start-stop enabled. `false`: Default-start-stop not enabled.
network_setpoint	Float	0.0	Setpoint for network mode.
manual_setpoint	Float	0.0	Setpoint for manual mode.
cfm_adjust	Float	0.0	This value is added to the measured CFM value as a calibration adjustment.
modbus_rtu_address	Integer	10	Slave address of the controller when accessed through the BMS.
bacnet_device_address	Integer	103	The device address for the BACnet protocol.
bacnet_mstp_address	Integer	2	The mstp address for the BACnet protocol.
bacnet_max_master	Integer	127	The max master address for the BACnet protocol.
bacnet_max_info_frames	Integer	2	The max info frames for the BACnet protocol.
communication_protocol	Integer	1	0=None, 1=MODBUS RTU, 2=BACnet MS/TP.
rs485_baud_rate	Integer	9600	Determines the baud rate used for the BMS RS485 Modbus. Must be a common rate: 9600, 19200, 38400, 57600, 115200, etc.
local_control_en	Boolean	TRUE	`true`: indicates the local control is active. `false`: indicates local control is not active.
open_loop_display_name	STRING	RPM CONRTOL	Replaces OPEN LOOP in the controls menus for clarity.
closed_loop_display_name	STRING	CFM CONTROL	Replaces CLOSED LOOP in the controls menus for clarity.

SYSTEM_SETTINGS.JSON

Setting ID	Type	Default	Description
ana10V_1_gain	Float	10.0	When setpoint is SETPOINT_SELECT_ANA10V_1, this is the gain applied to the 0-10V analog input channel 1 to get the setpoint value. [setpoint] = [input]*[gain] + [offset].
ana10V_2_gain	Float	1.0	When feedback is FEEDBACK_SELECT_ANA10V_2, this is the gain applied to the 0-10V analog input channel 2 to get the feedback value. [feedback] = [input]*[gain] + [offset].
ana10V_3_gain	Float	1.0	No function.
ana10V_4_gain	Float	1.0	No function.

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Setting ID	Type	Default	Description
ana20mA_1_gain	Float	10.0	When setpoint is SETPOINT_SELECT_ANA20MA_1, this is the gain applied to the 0-20mA analog input channel 1 to get the setpoint. [setpoint] = [input]*[gain] + [offset].
ana20mA_2_gain	Float	1.0	When setpoint is FEEDBACK_SELECT_ANA20MA_2, this is the gain applied to the 0-20mA analog input channel 1 to get the feedback. [feedback] = [input]*[gain] + [offset].
ana10V_1_offset	Float	0.0	When setpoint is SETPOINT_SELECT_ANA10V_1, this is the offset applied to the 0-10V analog input channel 1 to get the setpoint. [setpoint] = [input]*[gain] + [offset].
ana10V_2_offset	Float	0.0	When feedback is FEEDBACK_SELECT_ANA10V_2, this is the offset applied to the 0-10V analog input channel 2 to get the feedback. [feedback] = [input]*[gain] + [offset].
ana10V_3_offset	Float	0.0	No function.
ana10V_4_offset	Float	0.0	No function.
ana20mA_1_offset	Float	0.0	When setpoint is SETPOINT_SELECT_ANA20MA_1, this is the offset applied to the 0-20mA analog input channel 1 to get the setpoint. [setpoint] = [input]*[gain] + [offset].
ana20mA_2_offset	Float	0.0	When setpoint is FEEDBACK_SELECT_ANA20MA_2, this is the offset applied to the 0-20mA analog input channel 1 to get the feedback. [feedback] = [input]*[gain] + [offset].
analog_setpoint_on_off_threshold	Float	10.0	This is the threshold for turning the motor on or off when using external analog setpoints - eitherana20mA_1(`mAI1label on PCB) orana10V_1(`VI1label on PCB). The units for the parameter should be in scaled setpoint units, so either % for open loop or CFM for closed loop.
setpoint_select	Integer	2	Determines what setpoint will be used in the control. (SETPOINT_SELECT_ANA10V_1 =0`, SETPOINT_SELECT_ANA20MA_1 =1`, NETWORK =2`)
feedback_select	Integer	2	Determines what feedback will be used in the control. (FEEDBACK_SELECT_ANA10V_2=0`, FEEDBACK_SELECT_ANA20MA_2=1`, PRESSURE =2`, TACH =3`)
min_open_loop_setpoint	Float	0.0	Minimum manual limit in Open Loop Control Mode. Units in percentage 0% to 100%.
max_open_loop_setpoint	Float	100.0	Maximum manual limit in Open Loop Control Mode. Units in percentage 0% to 100%.
min_closed_loop_setpoint	Float	0.0	Minimum manual limit in Closed Loop Control Mode. Units in CFM.
max_closed_loop_setpoint	Float	1200.0	Maximum manual limit in Closed Loop Control Mode. Units in CFM.

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Setting ID	Type	Default	Description
display_feedback_select	Integer	0	0\`: The faceplate feedback is displayed as RPM.1\`: The faceplate feedback is displayed as CFM.2\`: The faceplate feedback display is off.
hepa_has_pressure_minimum_rpm	Float	0.0	The minimum threshold that the RPM has to exceed for the pressure okay green LED to be active.
hepa_closed_loop_blocked_motor_percent	Float	90.0	Fan drive percent threshold that the needs to exceed to trigger a blocked filter warning (red LED) in Closed Loop Control Mode.
hepa_open_loop_blocked_pressure_in_h2o	Float	0.2	Differential pressure (inches of H2O) that needs to be exceeded to trigger a blacked filter warning (red LED) in Open Loop Control Mode with no crossflow sensor installed.
hepa_open_loop_blocked_pressure_cfm	Float	200.0	Minimum CFM threshold that when crossed indicates a blocked filter warning (red LED) in Open Loop Control Mode with a crossflow sensor installed.
cross_flow_sensor_installed	Boolean	TRUE	Indicates if the crossflow sensor is installed.
motor_pwm_frequency	Integer	200	When output setting selects PWM motor interface, this is the frequency of the PWM signal. After settings change, device must reboot / power cycle to take effect.
output_select	Integer	1	Determines what output mode will be used. (PWM =0\`, MODBUS =1\`)
min_output	Float	0.0	Sets the minimum output value for the fan (0% to 100%). Units are percent (%).
max_output	Float	100.0	Sets the maximum output value for the fan (0% to 100%). Units are percent (%).
closed_loop	Boolean	FALSE	Determines if the device is operating in closed loop mode. (Closed Loop =true\`, Open Loop =false)
kp	Float	0.0	Proportional gain for the fan control algorithm.
ki	Float	0.05	Integral gain for the fan control algorithm.
kd	Float	0.0	Derivative gain for the fan control algorithm.
cfm_mapping	Array of Objects	[{"motor":0, "inh20":0, "cfm":0}]	This provides the mapping to convert between motor drive percent, inches of H20, and CFM.
embpapst_maximum_speed_rpm	Integer	0	The maximum speed of the EBM-Papst motor in rpm (0 - 64000).
embpapst_rampup_time_ms	Integer	10	The amount of time for the set value to increase 256 steps in milliseconds (0 - 2550).
embpapst_rampdown_time_ms	Integer	10	The amount of time for the set value to decrease 256 steps in milliseconds (0 - 2550).

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Setting ID	Type	Default	Description
embpapst_limit_speed_rpm	Integer	0	The limit speed for the safety function "limit speed" (0 - 65536).
ebmpapst_relay_dropout_delay_s	Integer	1	In the event of a fault, the relay drops out after a delay equal to the time specified here.

WIRING for RS-485 Communication

BACnet MS/TP and MODBUS RTU require RS-485 serial communications which are supported with the RS-485 3-pin terminal block plug on the Unit Manager. The plug has been sized large enough for two 18 AWG wires on each connection for daisy-chain wiring. This allows the connection to remain even if the plug is disconnected.

There is an integrated terminal resister controlled by the DIP switch next to the plug and can be turned on if the unit is the last one in the daisy chain.

Best practice is to address the units in the order they appear on the daisy-chain and to turn on the terminating resistor of the last device in the daisy-chain. Star or other wiring configurations are not recommended.

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MODBUS RTU CONFIGURATION

Configuration for use with a MODBUS RTU management interface can be done using the USB to update the *system_settings.json* and *user_settings.json* to the required values or the values can be adjusted using the onboard menus.

user_settings.json values for MODBUS RTU

Setting ID	Type	FOR MODBUS	Description
modbus_rtu_address	Integer	Unique value	Slave address of the controller when accessed through the BMS.
rs485_baud_rate	Integer	Match MODbus interface	Determines the baud rate used for the BMS RS485 Modbus. Must be a common rate: 9600, 19200, 38400, 57600, 115200, etc.
local_control_en	Boolean	FALSE	`true`: indicates the local control is active. `false`: indicates local control is not active.

system_settings.json values for MODBUS RTU

Setting ID	Type	FOR MODBUS	Description
setpoint_select	Integer	2	Determines what setpoint will be used in the control. (SETPOINT_SELECT_ANA10V_1 =0`, SETPOINT_SELECT_ANA20MA_1 =1`, NETWORK =2`)

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Set Modbus Address and Baud Rate

COMMUNICATION PROTOCOL: MODBUS RTU ADDRESS : 10 BAUD RATE : 9600 →EDIT →INFO ↑↓	Cycle through the menus until you get to the **COMMUNICATION** menu and hit the **BACK** button on the controller to **EDIT** the current value if it not already set to MODBUS RTU.
EDIT: PROTOCOL OLD: MODBUS RTU NEW: NONE →EXIT →NEXT ↑↓	Select **MODBUS RTU** from the menu and press **ENTER** to save and take you to back to the **COMMUNICATION** menu then press ENTER again to go to the **MODBUS RTU INFO** menu.
MODBUS RTU INFO ADDRESS : 10 BAUD RATE : 9600 ACTIVE : IDLE →EXIT →EDIT	Press **ENTER** again to **EDIT** the settings.
EDIT: DEVICE ADDRESS OLD: 102 NEW: 102 →EXIT →NEXT ↑↓	Adjust value with **UP** and **DOWN** to the required unique address and press **ENTER** to save and take you to the next setting menu.
EDIT: RS485 BAUD RATE OLD: 9600 NEW: 9600 →EXIT →NEXT ↑↓	Use the **UP** and **DOWN** arrows to adjust the baud rate to match the interface. Press **ENTER** to save and return to the **MODBUS RTU INFO** menu.
BOARD INFO AJ MANUFACTURING UNIT MANAGER FIRMWARE: 0.10.3 HARDWARE: 2 →RESET ↑↓	Press **BACK** to return to the root menu and use the **UP** and **DOWN** arrows to come to the **BOARD INFO** screen and use **ENTER** to go to the **RESET** menu.
RESET? OLD: NO RESET NEW: RESET DEVICE →EXIT →NEXT ↑↓	Press **UP** or **DOWN** to choose to reset the board and **ENTER** to confirm. Communication changes will not take effect until after the board as been reset or power has been cycled.

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BACnet MS/TP CONFIGURATION

Configuration for use with a BACnet MS/TP management interface can be done using the USB to update the *system_settings.json* and *user_settings.json* to the required values or the values can be adjusted using the onboard menus.

user_settings.json values for BACnet MS/TP

Setting ID	Type	For BACnet	Description
bacnet_device_address	Integer	Unique value	The device address for the BACnet protocol.
bacnet_mstp_address	Integer	Unique value	The mstp address for the BACnet protocol.
bacnet_max_master	Integer	127 typical	The max master address for the BACnet protocol.
bacnet_max_info_frames	Integer	Match interface	The max info frames for the BACnet protocol.
communication_protocol	Integer	2	0=None, 1=MODBUS RTU, 2=BACnet MS/TP.
rs485_baud_rate	Integer	Match interface	Determines the baud rate used for the BMS RS485 Modbus. Must be a common rate: 9600, 19200, 38400, 57600, 115200, etc.
local_control_en	Boolean	TRUE	`true`: indicates the local control is active. `false`: indicates local control is not active.

system_settings.json values for BACnet MS/TP

Setting ID	Type	FOR BACnet	Description
setpoint_select	Integer	2	Determines what setpoint will be used in the control. (SETPOINT_SELECT_ANA10V_1 =0`, SETPOINT_SELECT_ANA20MA_1 =1`, NETWORK =2`)

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Configuring settings through the onboard menus

COMMUNICATION PROTOCOL: MODBUS RTU ADDRESS : 10 BAUD RATE : 9600 →EDIT　　→INFO　↑↓	Cycle through the menus until you get to the **COMMUNICATION** menu and hit the **BACK** button on the controller to **EDIT** the current value if it not already set to MODBUS RTU.
EDIT: PROTOCOL OLD: MODBUS RTU NEW: NONE →EXIT　　→NEXT　↑↓	Select **MODBUS RTU** from the menu and press **ENTER** to save and take you to back to the **COMMUNICATION** menu then press ENTER again to go to the **MODBUS RTU INFO** menu.
MODBUS RTU INFO ADDRESS　 : 10 BAUD RATE : 9600 ACTIVE　 : IDLE →EXIT　　→EDIT	Press **ENTER** again to **EDIT** the settings.
EDIT: DEVICE ADDRESS OLD: 102 NEW: 102 →EXIT　　→NEXT　↑↓	Adjust value with **UP** and **DOWN** to the required unique address and press **ENTER** to save and take you to the next setting menu.
EDIT: RS485 BAUD RATE OLD: 9600 NEW: 9600 →EXIT　　→NEXT　↑↓	Use the **UP** and **DOWN** arrows to adjust the baud rate to match the interface. Press **ENTER** to save and return to the **MODBUS RTU INFO** menu.
BOARD INFO 　AJ MANUFACTURING 　　UNIT MANAGER FIRMWARE: 0.10.3 HARDWARE: 2 　　　　→RESET ↑↓	Press **BACK** to return to the root menu and use the **UP** and **DOWN** arrows to come to the **BOARD INFO** screen and use **ENTER** to go to the **RESET** menu.
RESET? OLD: NO RESET NEW: RESET DEVICE →EXIT　　→NEXT　↑↓	Press **UP** or **DOWN** to choose to reset the board and **ENTER** to confirm. Communication changes will not take effect until after the board as been reset or power has been cycled.

OPERATION

Targeting 50% of maximum capacity as a design setpoint will give the best balance of sound and power consumption. If used for recirculation the noise levels will be higher since both sides of the motor are connected to the space and the duct losses will add to the load on the fan. Designing to maximize filter area in the space

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will help reduce sound levels, power consumption, and extend time between filter changes.

As standard equipment a crossflow sensor at the inlet provides air station functionality for the fan filter units. This allows for controlling airflow from real time measurements to compensate for filter loading and other changes to the system conditions. This reading can be adjusted to match the test and balance airflow hood using the calibration buttons on the room side face display or from the menus on the main control board.

Constant CFM operation (*Closed Loop*) can cause conflicts with other flow control devices. See airflow troubleshooting for details. During design it is recommended to minimize the number of dynamic inputs to improve system stability. See the troubleshooting section for more information on possible conflicts and resolutions.

The default configuration for the filter alert is to alarm by turning on the red light on the face display and control board when the fan is operating at 90% of maximum RPM or above to meet the setpoint CFM. This is intended to give some headroom before the unit can no longer support the set airflow and maintenance can be scheduled. This can be changed with other values through a BMS connection or using the *system_settings.json* file and a USB flash drive. It can be lowered to alarm sooner and reduce power consumption and sound levels but this will require more frequent maintenance intervals.

If operating in Constant RPM (*Open Loop*) mode the filter alarm will function based on a minimum CFM value. The default value for this function is 200 CFM. This value can be adjust using the *system_settings.json* file and a USB flash drive.

Setpoints and start/stop status are retained in the case of a power loss. If a face display board fails or BMS communication is lost units will continue to operate at their last received settings.

If more active control than continuous operation is required for the space, such as set-back for power savings when the space is not in use or shut-down for emergencies, such as fire, it is recommended to integrate the units into the BMS and apply the required functionality with that system.

MAINTAINENCE AND TROUBLESHOOTING

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Prefiltering Supply Air

Prefilters at the inlets of the FFUs are optional but require plenum side access to maintain. The best practice to extend HEPA filter life is to have all supply air filtered before reaching the unit. The best practice to reduce sound levels and power consumption is to inspect these filters regularly and clean or replace them as needed.

Filter installation and Changes Overview

Filters should be changed according to site and regulatory requirements. HEPA and ULPA filters will filter particulates as well or better loaded as when they are new. They will however have more pressure drop requiring more power and generating more sound as they load. Ideally an engineering study should be done to determine the best schedule of replacements that balance cost of performing a filter change versus operating costs within the regulatory constraints.

Filter Change Procedure

A video example of a filter change is available on YouTube. https://www.youtube.com/watch?v=BgHpVaflZ-c

1) Using a flat screwdriver, release the face frame by rotating the quarter-turn fasteners counterclockwise.
2) Unhook the face safety cables from the unit. Set the frame aside in a safe location.
3) Shut off airflow to the unit and stop the fan using the enabled controls.
4) USE TWO PEOPLE TO SUPPORT THE FILTER and rotate the filter clips until the clip is clear of the filter.
5) Allow gravity to pull the filter away from the unit. If there is too much adhesion for it to fall away under its own weight after 15 seconds you may need to pull gently and evenly to promote release of the filter.
6) If installing a new filter discard the used filter in accordance with site and regulatory requirements.
7) Inspect the knife edge for adhered gel seal and clean using products and materials permitted in the space to ensure a good seal on the fresh gel. If any chemicals are used allow them to fully dry before installing the replacement filter.
8) Unpack the new filter and inspect for shipping damage or quality control issues. If damage or faults are found, do not install into the unit; call the rep, salesperson, or manufacturer for replacement arrangements.
9) Using two people, raise the filter into place assuring the seal edge is approximately in the center of the gel channel. The spacers beneath the filter clips will help align the filter.
10) While supporting the filter by its frame, rotate the filter clips so that the clips are supporting the filter frame. Wait at least 30 minutes before performing any challenge testing or returning to operation to allow the gel to fully adhere to the knife edge.
11) Restart fan on the unit and supply air.

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12) Raise the face frame back into place, re-attach the safety chains and secure quarter-turn fasteners.

Airflow Troubleshooting

The fan filter units are designed to provide enough pressure to overcome the initial filter pressure drop and some additional filter loading with a small margin for short runs of recirculation duct. These units are equipped with backward inclined fans which allow for minimizing power consumption and noise by providing more duct or plenum pressure thereby reducing load on the FFU fan.

If the red Filter Alarm light is on the unit should be checked for correct airflow. If in Closed Loop mode the light will come on any time the fan is running over 90% of max RPM in order to achieve setpoint airflow. This is a general indication of too much load on the motor. A dirty filter, insufficient supply air, closed dampers, debris, a very high setpoint, and system design can all contribute to pressure drop causing the excess load.

If there is another control system in the duct branch such as a VAV, Phoenix Valve, or constant CFM air handler it can cause the system to continuously change fan speed to try to find equilibrium. Also commonly called "hunting". If the other device is controlling a room condition such as pressure, temperature, or humidity it usually requires changing the fan filter unit to Open Loop mode so that it runs at a stable fan speed and the other device can control as needed without rapidly changing duct conditions. If the supply device is only controlling total flow it is recommended to maximize its supply to the units to minimize the fan load to reduce noise and power consumption.

If operating in Open Loop mode, we recommend changing the setpoint to 50% at the FFUs and adjust as needed to balance to the specified airflow requirements on that duct branch. For instance, units closer to the air source generally need less fan speed than ones further away to achieve equal airflow to overcome duct losses. Note that in Open Loop mode the individual units will not increase fan speed to overcome filter loading. The supply device that is in control will need to adjust for filter loading. It is best practice to monitor the controlling device for when it approaches maximum capacity so that filter changes can be scheduled before the system goes out of specification.

There may be some cases where a unit with very low airflow is ducted with a unit with very high airflow. In these cases, a damper may be needed to keep the high flow unit from "starving" the lower flowing unit.

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Minimizing Sound Levels

The fans used in the AJ Manufacturing FFUs are industry leaders in sound performance. Most environments that FFUs are specified for are not similar to the ASHRAE Standard 70 conditions for sound testing which are intended for office environments. Because of this measured sound energy in an installed space is generally much higher than manufacturer supplied lab test values. The most effective ways to minimize sound come in the design stages of a project but there are some things that can be done in the field to minimize sound levels.

These units will not suffer from high duct pressures like a forward inclined fan, so the noise levels can be reduced by increasing the supply air and reducing restrictions. A best practice is to ensure any manual dampers are fully open and use the FFU setpoints to control balance between units on a duct. In the case of systems with multiple control devices the FFUs can ramp up to reach their setpoints while the other devices reduce their flow to maintain their setpoint causing high sound levels and power consumption. Refer to Airflow Troubleshooting.

Control Board Fails to Power On

- Check line voltages to the unit and that the main power switch on the electrical box is in the ON position. Verify 24V DC output from the Power Supply to the control board plug.
- Verify plug connection into the control board and wires into the plug are secure and making good contact.
- Disconnect the Display Board plug and recheck. If the control board starts up check the display board at the face for issues. It is possible it could be damaged or have bad wiring causing it to ground out to the chassis.
- Try a known good display board from spares or a working unit to verify wiring.
- If the display board is found to be faulty contact the sales representative or AJ Manufacturing for a replacement.
- Disconnect the EC Motor plug from the unit control board. If it powers up check both the control signal and line wiring between the control board and the motor. You can verify the wiring by installing a spare motor or one from a known good unit.
- If all these conditions are good or corrected and the controls still do not power on try connecting a spare control board or a board from a known good unit to the power supply to see if the issue follows the board or the power supply.
- If the spare board powers up contact the sales representative or AJ Manufacturing for a replacement control board. If the spare board also fails to function correctly contact AJ Manufacturing for further troubleshooting.

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Unit Has Power but Fan Fails to Run

- Verify the main power switch on the electrical box is in the ON position.
- Verify that the unit is not in Stop mode. The yellow status light should be off for normal operation. Use Start/Stop button to enable as needed.
- Verify that the airflow reading is at or below the setpoint. If the setpoint is less than the measured airflow the fan may not run as it has satisfied the setpoint requirement.
- Check electrical connections for correct voltages between Line, Neutral, and Ground and that they agree with the installed motor rating plate.
- For the Ziehl-Abegg equipped units view the witness hole at the center of the fan motor for a red indicator light and reference the blinking pattern with the following chart:
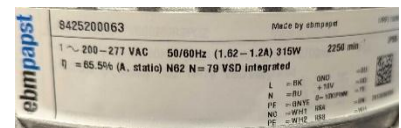
Code	Cause
Off	Main voltage failure
On	Normal operation without fault
1	No Enable signal (Off)
2	Temperature management active
3	HALL-IC error
4	Line failure (3 phase motors only, does not apply)
5	Motor blocked, check for obstructions.
6	IGBT failure
7	Intermediate undervoltage
8	DC link overvoltage
9	IGBT cooling down period
11	Error motor start
12	Line voltage too low
14	Erro peak current
17	Temperature alarm

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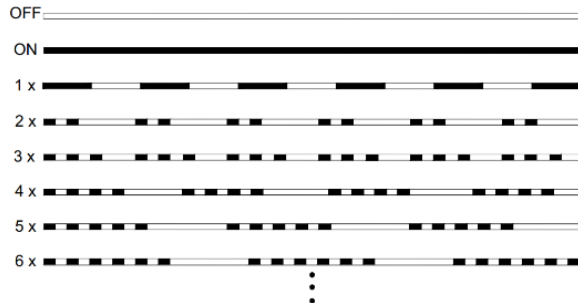
- If the error codes are Off, 1, or 12, check continuity of wiring between the terminal block and electrical motor. If a fault is still not found check the internal motor wiring and verify it matches the image below and is making good connections.
- EBM-Papst motors have a factory potted connection with lead wires and are not field serviceable internally. There is no need to check the wiring connections at the motor side while troubleshooting.

Control Board Replacement

Prior to opening the electrical box verify the unit has been isolated from line power at the disconnect. The main power switch (2) in the unit will still leave live wires inside the electrical box at the power switch. Follow the instructions for the unit for removing a filter. Confirm power is not being supplied to the unit.

Open the electrical box by removing the two Phillips head screws and removing the lid. It is not permanently attached so be careful not to drop the lid. Once the lid is removed the control board (5) will be exposed.
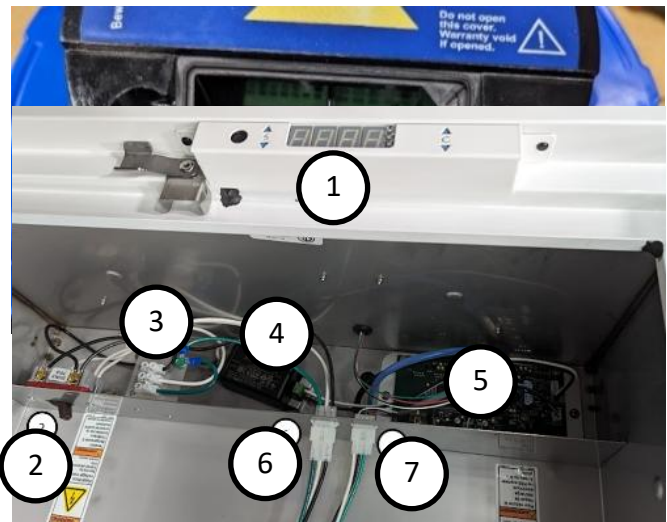
Make note of wiring configuration and crossflow sensor hose locations, a photo is recommended if possible. Carefully remove the hoses connected to the pressure transducer by gently twisting and pulling together. Carefully remove the plugs for all wire connections to the control board. Remove the two retaining Phillips head screws. The board should now be free to remove from the unit. Note any connections on the face of the control board and the position of the DIP switch if it has an RS-485 connection. Label if needed then disconnect from the control board.

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Installation is reverse of removal, install any face connections, verify dip switch setting matches if connected to MODBUS RTU or BACnet MS/TP system on the RS-485 connection, install screws, carefully install the hoses onto the pressure transducer barbs, insert plugs on the interior of the electrical box, reinstall electrical box cover.

Verify and adjust as needed the configuration and setpoints for the unit. Check functionality of the unit. Once verified fully functional, the filter and face can be reinstalled.

Face Display Replacement

Turn off power at the disconnect or turn off main power switch if accessible. Remove the face and set aside.

Reusable Plastic Rivet
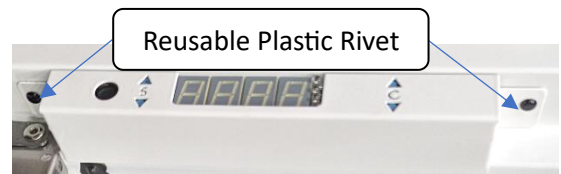
Carefully release and remove one of the two plastic rivets retaining the face display bracket. The bracket can then swing away around the other rivet providing access to remove the display board by sliding it out of the retaining slots.

Disconnect the wiring by squeezing the release clip and pulling. Install the plugs on the new display board and then insert it into the bracket slots so that the buttons and display align with the openings in the bracket.

In the hole where the plastic rivet was removed add a small amount of sealant to prevent leaks from the interstitial space into the conditioned space. Tuck loose wire under the board and swing back into position on the face and re-install the plastic rivet.

Restore power and function test. The face can then be reinstalled on the unit.

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Motor Replacement

Follow the filter removal process to get access to the motor and electrical box. Shut off main power switch (2) and then disconnect fan motor plugs, (6), (7). The plug style differs between the Ziehl-Abegg and EBM motors, but the process is the same. The Ziehl-Abegg and EBM motors are not interchangeable.

Support the motor while removing the 8 bolts securing the motor mounts to the plenum using a 7/16" socket. Once free remove from the unit. If the replacement motor does not have mounting brackets installed, transfer the four socket cap screws and brackets from the old motor to the replacement fan motor assembly using an M5 hex wrench.
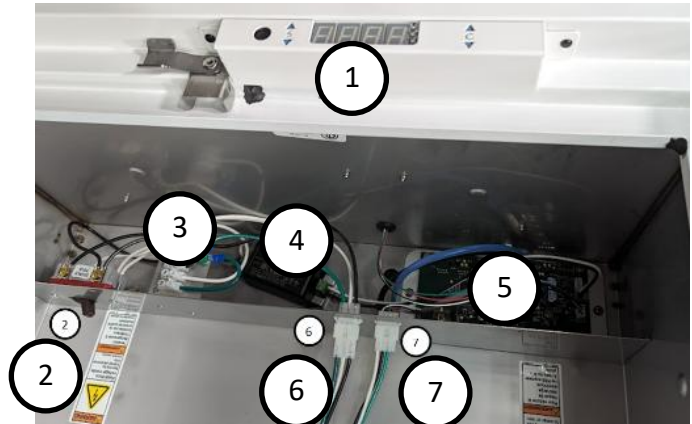
Start all screws and bolts by hand to prevent cross threading. It is recommended to fully tighten fasteners only after all have been started to ensure good alignment and make hand starting easier. Once installed, and it is verified the motor is centered in the opening, torque all motor fasteners to 65 in-lbs.

Reconnect motor plugs and ensure wiring is routed clear of moving components and the filter. Secure as needed to prevent rubbing through the insulation on the motor mounts. From the factory theses are attached with nylon ties.

Turn the main power switch back on and check functionality. Once correct operation has been verified the filter and face can be reinstalled.
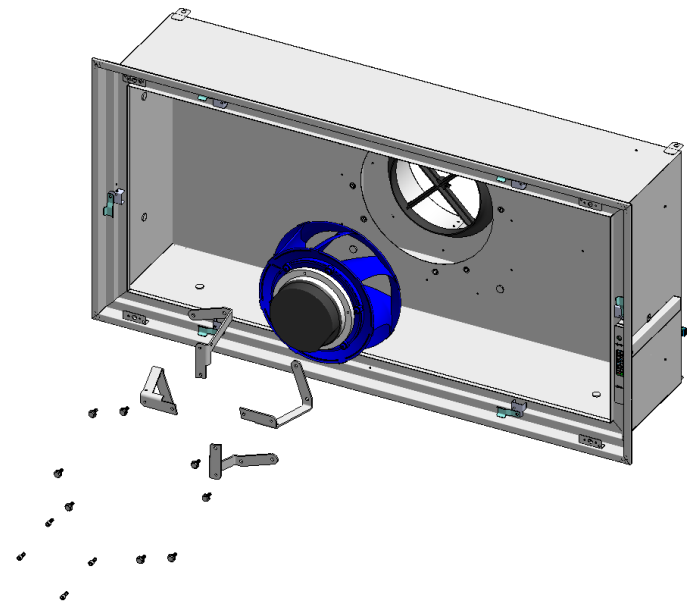
Power Supply Replacement

Prior to opening the electrical box verify the unit has been isolated from line power at the disconnect. The main power switch in the unit will still leave live wires inside the electrical box at the power switch. Follow the instructions for the unit for removing a filter. Confirm power is not being supplied to the unit.

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Open the electrical box by removing the two Phillips head screws and removing the lid. It is not permanently attached so be careful not to drop the lid. Once the lid is removed the power supply (4) will be exposed. There are terminal blocks on either end, each with two small flat head screws. Make note of wiring locations and polarity, a photo is recommended if possible. Loosen these 4 screws and move the wires out of the way.

This will expose the 2 Phillips head screws that hold the power supply bracket. The power supply can be removed by loosening both screws about a quarter of an inch. One bracket can then be swung over the terminal block and out of the way.

Install the replacement power supply in the same orientation and tighten the screws for the clamps. Reinstall the wiring being sure the DC terminals are connecting to the correct polarity on the control board. Be careful not to overtighten the terminals as it is possible to damage them or the solder joints that connect them to the power supply. Reinstall the electrical box lid and test the unit for proper function. Once verified it is in working order the filter and face can be reinstalled.

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Appendix: Building Management System Data Points

Modbus Registers

NOTE: Certain register values are mapped to a range where noted. For example, the input register for the Sonboard pressure sensor has a register value of [0 – 2000], this is mapped and interpreted by the Modbus master as [0 – 2] inH2O range. Such that a register value of 1154 represents 1.154 in H20.

Holding Registers (R/W)

Name	Number	Address Offset	Type	Data	Notes
Start-Stop Fan	40001	0000	DI	0 or 1	Indicates whether unit is actively running.
Setpoint	40002	0001	AI	Closed loop:value= range: [0 - 1200] CFM. Open loop:value= range: [0-100]%	
Reset Device	40003	0002	DI	0 or 1. On power up,valueis 0. If 1 is written to this register the device resets	Ex: may be used after changing modbus address to reboot using the new address.
Default Start-Stop	40004	0003	DI	0 or 1	User setting:default_start_stop`
Default Setpoint	40005	0004	AI	Closed loop:value= range: [0 - 1200] CFM. Open loop:value= range: [0-100]%	User setting:network_setpoint`
CFM Adjust	40006	0005	AI	range: [-32768 - 32767]	Should be read as a signed 16 bit integer. User setting: cfm_adjust
Analog1 10V Gain	40011	0010	AI	Gain =value/ 100	Ex:value of 12000 equals a gain of 12000/100 = 120. So input of 10V: 10V*120 = 1200. System setting: ana10V_1_gain`
Analog1 10V Offset	40012	0011	AI	Offset =value/ 100	System setting: ana10V_1_offset
Analog2 10V Gain	40013	0012	AI	Gain =value/ 100	System setting: ana10V_2_gain
Analog2 10V Offset	40014	0013	AI	Offset =value/ 100	System setting: ana10V_2_offset
Analog3 10V Gain	40015	0014	AI	Gain =value/ 100	System setting: ana10V_3_gain
Analog3 10V Offset	40016	0015	AI	Offset =value/ 100	System setting: ana10V_3_offset
Analog4 10V Gain	40017	0016	AI	Gain =value/ 100	System setting: ana10V_4_gain
Analog4 10V Offset	40018	0017	AI	Offset =value/ 100	System setting: ana10V_4_offset
Analog1 20mA Gain	40019	0018	AI	Gain =value/ 100	System setting: ana20mA_1_gain
Analog1 20mA Offset	40020	0019	AI	Offset =value/ 100	System setting: ana20mA_1_offset
Analog2 20mA Gain	40021	0020	AI	Gain =value/ 100	System setting: ana20mA_2_gain
Analog2 20mA Offset	40022	0021	AI	Offset =value/ 100	System setting: ana20mA_2_offset
BMS Modbus Address	40031	0030	AI	BMS slave address (1 - 247) =value	User setting: modbus_rtu_address
BMS Modbus RS485 Baud Rate	40032	0031	AI	Value mapping: 0 = 1200, 1 = 2400, 2 = 4800, 3 = 9600, 4 = 19200, 5 = 38400, 6 = 57600, 7 = 115200	User setting: modbus_rtu_address

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Setpoint Select	40033	0032	AI	Value mapping: 0 = Analog1 10V, 1 = Analog1 20mA, 2 = Network	System setting: setpoint_select
Feedback Select	40034	0033	AI	Value mapping: 0 = Analog2 10V, 1 = Analog2 20mA, 2 = Pressure sensor, 3 = Tachometer	System setting: feedback_select
Closed Loop	40035	0034	AI	Value mapping: 0 = open loop control (OLC), 1 = closed loop control (CLC)	System setting: closed_loop
Local Control Enable	40036	0035	AI	Value mapping: 0 = disabled, 1 = enabled	User setting: local_control_en
ebmpapst Motor Max Speed	40061	0060	AI	value= range: [0 - 64000] RPM	System setting: embpapst_maximum_speed_rpm
ebmpapst Motor Ramp-up Time	40062	0061	AI	value= range: [0 - 2.55] seconds	System setting: embpapst_rampup_time_ms
ebmpapst Motor Ramp-down Time	40063	0062	AI	value= range: [0 - 2.55] seconds	System setting: embpapst_rampdown_time_ms
embpapst Motor Limit Speed	40064	0063	AI	value= range: [0 - 65536] RPM	System settings: embpapst_limit_speed_rpm
embpapst Motor Relay Dropout Delay	40065	0064	AI	value= range: [0 - 255] seconds	System settings: ebmpapst_relay_dropout_delay_s
Self Test Start-Stop	40101	0100	DI	0 - self test on, 1 = self test off	

Input Registers (Read Only)

Name	Number	Address Offset	Type	Data
Running	30001	0000	DI	0 or 1 (Indicates whether unit is actively running.)
RPM Feedback	30002	0001	AI	value= range: [0 - max] RPM
CFM Feedback	30003	0002	AI	value= range: [0 - 1200] CFM
On board Presure	30004	0003	AI	value: [0 - 2000] to range: [0 - 2] inH20
Analog1 10V	30005	0004	AI	value: [0 - 1000] to range: [0 - 10] V
Analog2 10V	30006	0005	AI	value: [0 - 1000] to range: [0 - 10] V
Analog3 10V	30007	0006	AI	value: [0 - 1000] to range: [0 - 10] V
Analog4 10V	30008	0007	AI	value: [0 - 1000] to range: [0 - 10] V
Analog1 20mA	30009	0008	AI	value: [0 - 20000] to range: [0 - 20] mA
Analog2 20mA	30010	0009	AI	value: [0 - 20000] to range: [0 - 20] mA
Sensor Digital Inputs	30011	0010	DI	Each bit represents digital input. Input 1:0b0000 0000 0000 0001Input 2:0b0000 0000 0000 0010
Filter Alarm Blocked	30021	0020	AI	0 = no alarm. 1 = filter blocked alarm.

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Self Test Status	30041	0040	DI	0 = not active. 1 = in progress. 2 = finished
Self Test Result	30051	0050	DI	0 = test failed. 1 = all tests passed.
Ethernet Test Result	30052	0051	DI	0 = test failed. 1 = test passed.
RS485 Test Result	30053	0052	DI	0 = test failed. 1 = test passed.
NOR SPI Flash Test Result	30054	0053	DI	0 = test failed. 1 = test passed.
ESP32 Test Result	30055	0054	DI	0 = test failed. 1 = test passed.
USB Flash Test Result	30056	0055	DI	0 = test failed. 1 = test passed.
3V Rail Test Result	30057	0056	DI	0 = test failed. 1 = test passed.
5V Rail Test Result	30058	0057	DI	0 = test failed. 1 = test passed.
12V Rail Test Result	30059	0058	DI	0 = test failed. 1 = test passed.
Pressure Sensor Test Result	30060	0059	DI	0 = test failed. 1 = test passed.
Modbus Motor Type	30100	0099	AI	0 = No modbus motor. 1 = ECblue motor. 2 = ebmpapst motor.
ECblue Motor Holding Register Start	30101	0100	AI	Register indexes 0100 to 0149 are 50 holding registers from motor (motor reg index 0-49).
ECblue Motor Input Register Start	30151	0150	AI	Register indexes 0150 to 0199 are 50 input registers from motor (motor reg index 0-49).
ebmpapst Actual Speed	30201	200	AI	value= range: [0 - max] RPM.
ebmpapst Motor Status	30202	201	AI	Specifies errors currently detected in the fan.
ebmpapst Warning	30203	202	AI	Specifies warnings currently active on the motor.
ebmpapst Module Temperature	30204	203	AI	A signed integer that specifies the temperature of the module in Celsius.
ebmpapst Motor Temperature	30205	204	AI	A signed integer that specifies the temperature of the motor in Celsius.
ebmpapst Interior Electronics Temperature	30206	205	AI	A signed integer that specifies the temperature of the interior electronics in Celsius.
ebmpapst Rotation Direction	30207	206	DI	value: 0 = counter-clockwise. 1 = clockwise.
ebmpapst Set Value	30208	207	AI	In closed-loop speed control: value= range: [0 - max] RPM. In open-loop PWM control: value= range: [0 - 100]%.
ebmpapst Current Power	30209	208	AI	The current power in watts.
Reserved	30210 - 30220	209 - 219	AI	Reserved for adding more ebmpapst input registers.
ebmpapst Operating Hours	30221	220	AI	The number of hours the fan has run.
ebmpapst Operating Minutes	30222	221	AI	The number of minutes the fan has run.
ebmpapst Preferred Running Direction	30223	222	DI	value: 0 = counter-clockwise. 1 = clockwise.
ebmpapst Maximum Permissible Speed	30224	223	AI	value= range: [0 - 65536] RPM (set by factory).

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Name	Number	Address Offset	Type	Data
ebmpapst Maximum Permitted Power	30225	224	AI	The maximum permitted power in watts (set by factory).
ebmpapst Number of Start Attempts	30226	225	AI	The number of startup attempts.
ebmpapst Maximum Power	30227	226	AI	The maximum power allowed in Watts (set by customer).
ebmpapst Fail Safe Running Direction	30228	227	AI	value: 0 = counter-clockwise. 1 = clockwise. 2 = none (remains unchanged).
Name	**Number**	**Address Offset**	**Type**	**Data**
ebmpapst Fail Safe Function On/Off	30229	228	DI	value: 0 = Inactive. 1 = Active.
ebmpapst Fail Safe Set Value	30230	229	AI	value= range: [0 - max] RPM.
ebmpapst Fail Safe Dropout Delay	30231	230	AI	value= range: [0 - 25.6] seconds.
ebmpapst Error Indicator	30232	231	AI	Specifies the address of the last error detected in error history.
ebmpapst First Error	30233	232	AI	Stores the first error that is detected in the service life of the fan.
ebmpapst First Error Timing	30234	233	AI	Stores the time of the first detected error.
ebmpapst Error History	30235 - 30260	234 - 259	AI	Stores the history of the last 13 errors on the fan.
ebmpapst Serial Number	30261 - 30262	260 - 261	AI	Stores the serial number of the fan.
ebmpapst Serial Number	30263	262	AI	Stores the production date of the fan.
ebmpapst Serial Number	30264 - 30269	263 - 268	AI	Stores the Fan Type information.

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BACnet Objects

Name	Object Type	Data	Notes
Start-Stop Fan	Binary Output	0 = stop fan, 1 = start fan.	
Setpoint	Analog Output	Closed loop: value = range: [0 - 1200] CFM. Open loop: value = range: [0-100]%	
Default Start-Stop	Binary Value	0 = fan stopped on startup, 1 = fan starts on startup.	User setting:default_start_stop
Default Setpoint	Analog Value	Closed loop: value = range: [0 - 1200] CFM. Open loop: value = range: [0-100]%	User setting:network_setpoint
CFM Adjust	Analog Value	value: [-32768 - 32767]	User setting:cfm_adjust
Analog1 10V Gain	Analog Value	value: [0 - 10] V	System setting: ana10V_1_gain
Analog1 10V Offset	Analog Value	value: [0 - 10] V	System setting: ana10V_1_offset
Analog2 10V Gain	Analog Value	value: [0 - 10] V	System setting: ana10V_2_gain
Analog2 10V Offset	Analog Value	value: [0 - 10] V	System setting: ana10V_2_offset
Analog3 10V Gain	Analog Value	value: [0 - 10] V	System setting: ana10V_3_gain
Analog3 10V Offset	Analog Value	value: [0 - 10] V	System setting: ana10V_3_offset
Analog4 10V Gain	Analog Value	value: [0 - 10] V	System setting: ana10V_4_gain
Analog4 10V Offset	Analog Value	value: [0 - 10] V	System setting: ana10V_4_offset
Analog1 20mA Gain	Analog Value	value: [0 - 10] V	System setting: ana20mA_1_gain
Analog1 20mA Offset	Analog Value	value: [0 - 10] V	System setting: ana20mA_1_offset
Analog2 20mA Gain	Analog Value	value: [0 - 10] V	System setting: ana20mA_2_gain
Analog2 20mA Offset	Analog Value	value: [0 - 10] V	System setting: ana20mA_2_offset
MS/TP Network Port	Network Port		User_settings: bacnet_device_address`,bacnet_mstp_address`, bacnet_max_master`, bacnet_max_info_frames
Setpoint Select	Multi-state Output	values: Ana10V_1, Ana20mA_1, Network	System setting:setpoint_select
Feedback Select	Multi-state Output	values: Ana10V_2, Ana20mA_2, Pressure, Tach	System setting:feedback_select
Closed Loop	Binary Value	0 = open loop control, 1 = closed loop control	System setting:closed_loop
Local Control Enable	Binary Output	0 = local control disabled, 1 = local control enabled	User setting:local_control_en
Running	Binary Input	0 = not running, 1 = running.	
RPM Feedback	Analog Input	value = range: [0 - max] RPM	
CFM Feedback	Analog Input	value = range: [0 - 1200] RPM	
On board Pressure	Analog Input	value = [0 - 2] in H20	
Analog1 10V	Analog Input	value = [0 - 10] V	
Analog2 10V	Analog Input	value = [0 - 10] V	

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Analog3 10V	Analog Input	value = [0 - 10] V	
Analog4 10V	Analog Input	value = [0 - 10] V	
Analog1 20mA	Analog Input	value = [0 - 10] V	
Analog2 20mA	Analog Input	value = [0 - 10] V	
On board Pressure	Analog Input	value = [0 - 10] V	
Digital Input 1	Binary Input	0 or 1	
Digital Input 2	Binary Input	0 or 1	
Filter Alarm Blocked	Binary Input	0 = not blocked, 1 = blocked	

FAN FILTER UNIT

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