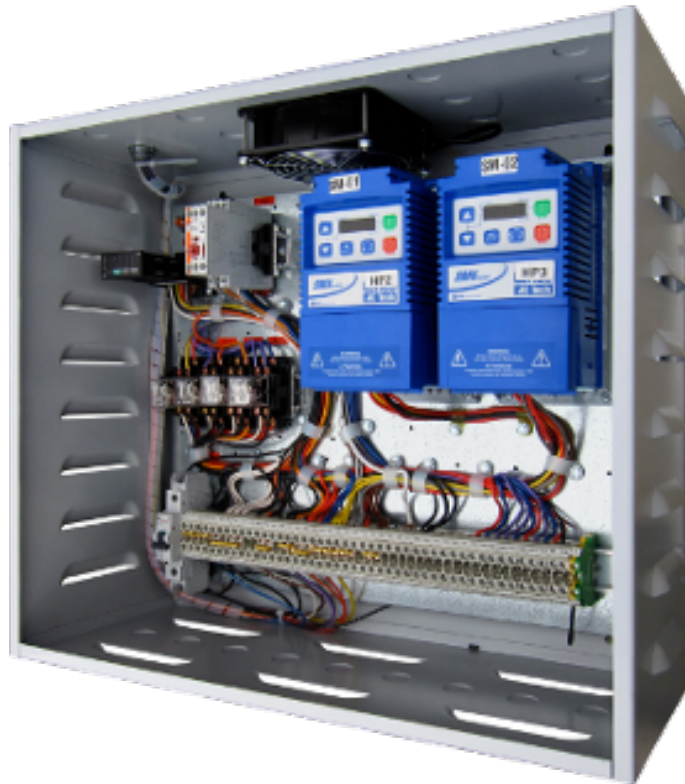


ENERGY MANAGEMENT CONTROL SYSTEM

QUICK START GUIDE



Required Tools

- Standard hand tools
- Standard electrical tools
- Volt meter
- Amp meter
- Tachometer
- Drill
- 1-1/4 drill bit for stainless steel
- Level
- Ladder
- Fire System cocking tool

Required Equipment

- Ventilation Hood
- Fire System
- EMS Control Panel
- Exhaust Fan(s)
- Supply Fan(s)

Required Materials

- Electrical Conduit & Wire
- Fire System Supplies
- Exhaust Ductwork
- Supply Ductwork
- Temperature Sensor or Sensors

INSTALLATION

1 EMS Panel

The EMS Panel comes in different size boxes. These boxes can be installed inside the hood utility cabinet or wall-mounted.

WARNING

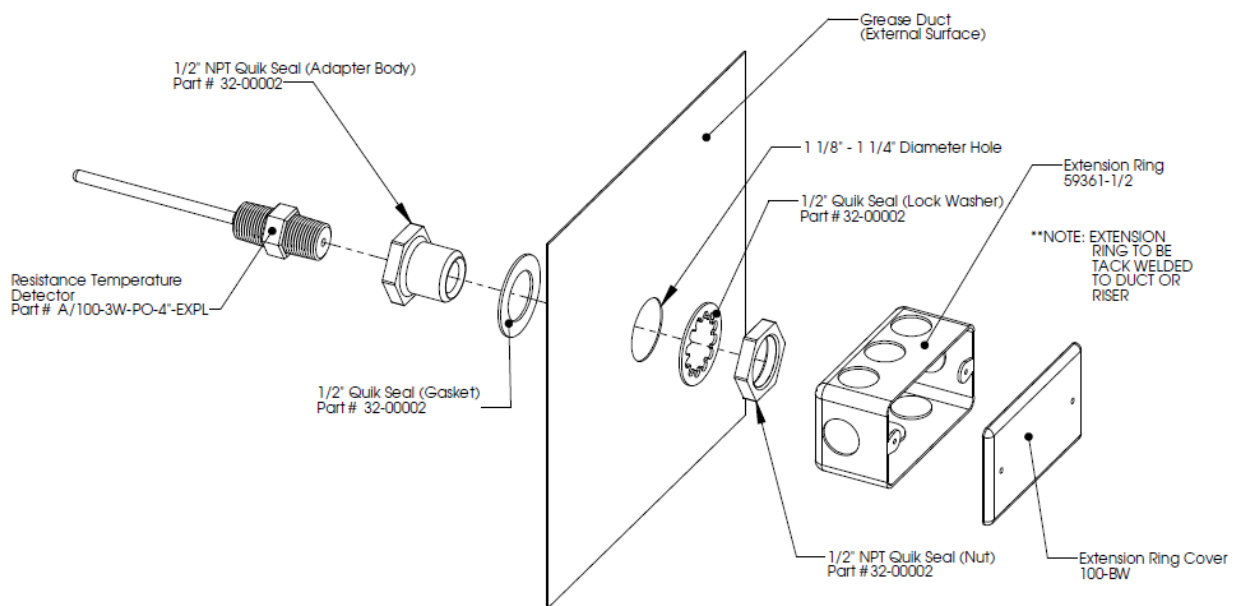
Do NOT mount the entire EMS box recessed into a wall. Without sufficient airflow, the VFDs could overheat and sustain damage.

2 EMS Sensor

Install the EMS sensor or sensors into the exhaust risers. See detail below.

WARNING

If there are multiple risers connected to one fan, the sensor must be installed where the ducts come together before the fan unless an EMS with “**Multi-Stat**” is used. These sensors may ship factory installed if the risers are factory installed and there is only one fan per riser or an EMS with “**Multi-Stat**” is used.



3 Single / Three Phase Power Input



DANGER! Hazard of electrical shock!
Circuit potentials up to 600 VAC are possible. Capacitors retain charge after power is removed. Disconnect power and wait at least three minutes before servicing the drive.



STOP!

- Verify mains voltage before connecting to drive.
- Do not connect mains power to the output terminals (U,V,W)! Severe damage to the drive will result.
- Do not cycle mains power more than once every two minutes. Damage to the drive will result.

Wire the input power to the VFD using the Li, Lj, and Lk detachable terminal blocks on the din rail.

Before reattaching removable part of the terminal to its main block, turn power ON and verify correct voltage is used. Turn power back OFF before reattaching the terminal.

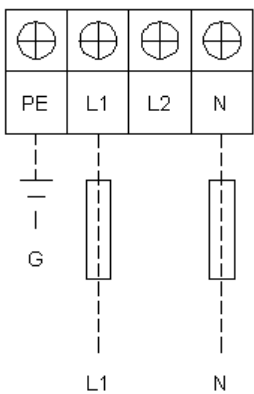


If the drive is NOT mounted inside the EMS enclosure, wire the input power directly to the VFD using the L1, L2, and L3 terminals on the right hand side of the VFD.

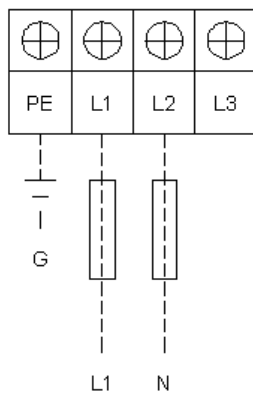
Also wire the ground from the breaker panel to the PE terminal on the drive.

WARNING

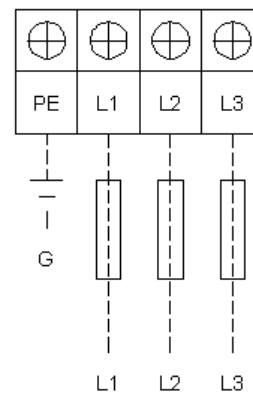
Wiring the input power to the output will severely damage the VFD. Check that the correct power source is supplied to the VFD and that the L1, L2, and L3 terminals are used.



**120V 1PH
POWER INPUT**



**208/230V 1PH
POWER INPUT**



**208/230/460V 3PH
POWER INPUT**

ENERGY MANAGEMENT CONTROL SYSTEM

4 Three Phase Power Output



DANGER! Hazard of electrical shock!

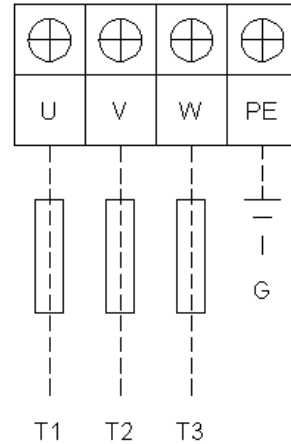
Circuit potentials up to 600 VAC are possible. Capacitors retain charge after power is removed. Disconnect power and wait at least three minutes before servicing the drive.



STOP!

- Verify mains voltage before connecting to drive.
- Do not connect mains power to the output terminals (U,V,W)! Severe damage to the drive will result.
- Do not cycle mains power more than once every two minutes. Damage to the drive will result.

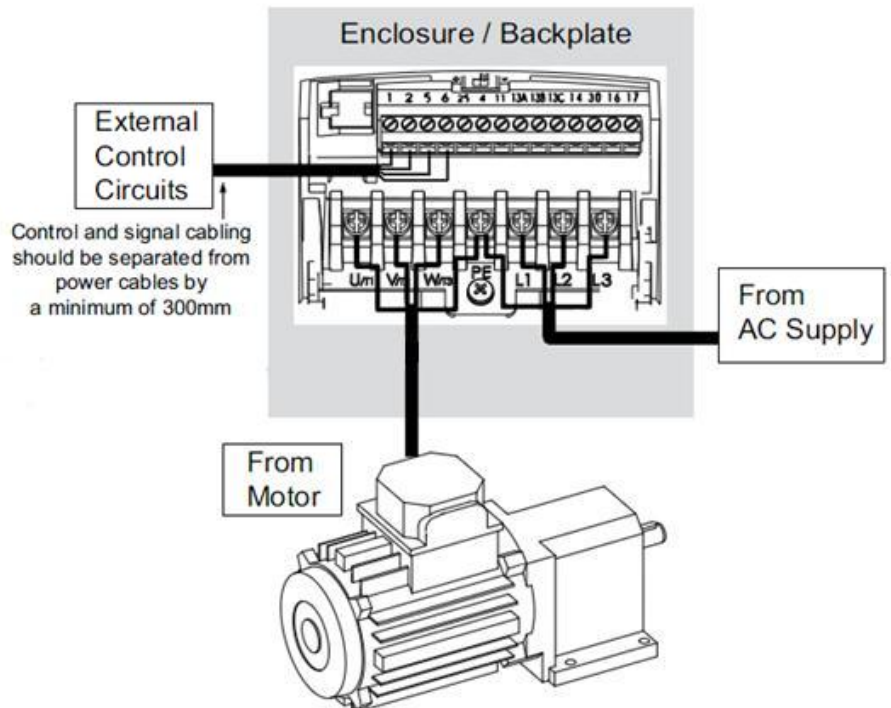
Wire the output power from the VFD to the exhaust or supply fans using the Ui, Vi, and Wi detachable terminal blocks on the din rail terminals.



POWER OUTPUT



If the drive is NOT mounted inside the EMS enclosure, wire the output power to the exhaust and supply fans from the VFD terminals U, V, and W on the left hand side of the VFD.



5

VFD Installation Instructions

Input AC Power

1. Circuit breakers feeding the VFDs are recommended to be thermal-magnetic and fast acting. They should be sized as 1.5 times the input amperage of the drive. Refer to ACTECH SMV VFD Cross Reference table in “Installation, Operation, and Maintenance Manual.”
2. Each VFD should be fed by its own breaker. If multiple VFDs are to be combined on the same breaker, each drive should have its own protection measure (fuses or miniature circuit breaker) downstream from the breaker.
3. Input AC line wires should be run in conduit from the breaker panel to the drives. AC input power to multiple VFDs can be run in a single conduit if needed.
4. The VFD should be grounded on the terminal marked PE.

STOP!: DO NOT connect incoming AC power to output terminals Ui, Vi, Wi. Severe damage to the drive will result.

Output Power

1. Motor wires from each VFD to its respective motor MUST be run in a separate steel conduit away from control wiring and incoming AC power wiring to avoid noise and crosstalk between drives.
2. If the distance between the VFD and the motor exceeds 300 FT, an output reactor should be used between the VFD and the motor. The output reactor should be sized accordingly.
3. If the distance between the VFD and the motor is between 500 and 1000 FT, a dV/dT filter should be used.
4. No contactor should be installed between the drive and the motor. Operating such a device while the drive is running can potentially cause damage to the power components of the drive.
5. When a disconnect switch is installed between the drive and motor, it should only be operated when the drive is in a STOP state.

Programming

1. The Drive should be programmed for the proper motor voltage. P107 is set to 0 (Low) if motor voltage is 120 VAC, 208 VAC or 400 VAC. P107 is set to 1 (High) if motor voltage is 230 VAC, 480 VAC or 575 VAC.
2. The Drive should be programmed for the proper motor overload value. P108 is calculated as Motor FLA x 100 / Drive Output Rating (available in ACTECH SMV VFD Cross Reference table in “Installation, Operation, and Maintenance Manual”).

Refer to “Installation, Operation, and Maintenance Manual” for instructions on how to access the Program mode of the VFD.

3. P500 parameter provides a history of the last 8 faults on the drive. It can be accessed without getting into PROGRAM mode.

WARNING

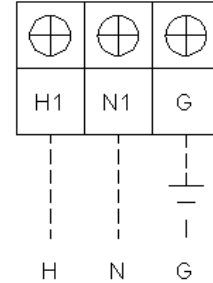
All field wiring must be completed before starting the unit for proper operation.

6 120V Control Power & Ground

The EMS panel requires a separate 120 volt power source for the lights, controls and micro switch. The 120 volt power source should be wired to terminals H1, N1.

The ground should also be run and wired to the GND terminal. It should be sized for the total load of the panel: Controls (5 amp) + Lights + all drives load. Refer to table attached.

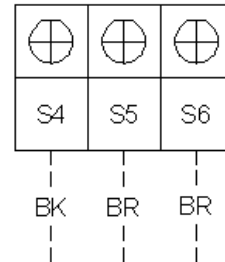
GROUND Wires THHN, THWN, THWN-2	
Total load	Wire Size
15	14 AWG
20	12 AWG
60	10 AWG
100	8 AWG



120V INPUT

7 Temperature Sensor Wiring

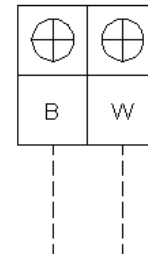
The temperature sensors will need to be field wired to terminals Si, Sj, and Sk where i, j and k have different values depending on the location of the sensor. Refer to the installation drawings for exact terminal names. The wires should be run into the panel using conduit.



TEMP SENSOR

8 Hood Light Wiring

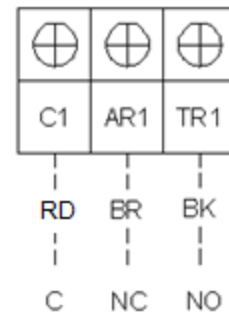
The hood lights will need to be field wired to terminals **B** and **W** or between **LS** and **W** if the panel has the Lights out in Fire option. The wires should be run into the panel using conduit.



HOOD LIGHTS

9 Micro Switch Wiring

The hood fire system micro switch should be wired to terminals C1, AR1, and TR1. The wires should be wired into the panel using conduit.



MICRO SWITCH

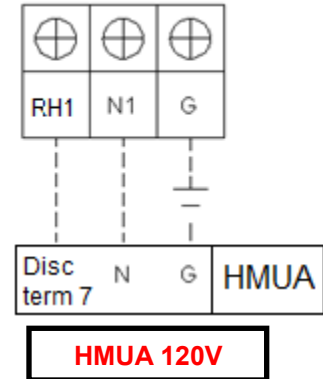
ENERGY MANAGEMENT CONTROL SYSTEM

WARNING

All field wiring must be completed before starting the unit for proper operation.

10 120V Control Power to Heated Make-up Air

If the EMS panel controls a Heated Makeup Air Unit (HMUA), the control power to the HMUA has to be fed from the EMS panel. 2 wires should be run from RH1 and N1 inside the EMS to the terminal 7 on the disconnect and terminal block N inside the HMUA.



INSTALLATION CHECKLIST

- EMS Sensor(s) mounted into the hood risers
- Exhaust VFD 3 (or 1) phase input to detachable terminals Li, Lj, and Lk
- Exhaust VFD 3 phase output from detachable terminals Ui, Vi, Wi to exhaust fan(s)
- Supply 3 (or 1) phase input to detachable terminals Li, Lj, and Lk
- Supply VFD 3 phase output from detachable terminals Ui, Vi, Wi to Supply fan
- 120V Circuit to H1, N1
- Ground wire from breaker panel to EMS panel
- EMS Sensors wired to Si, Sj, and Sk
- Hood Lights wired to B and W
- ANSUL microswitch wired to C1, AR1, and TR1

START UP

1 Power

- Turn the fan switch to the Auto position. Make sure the control circuit breaker inside the panel is OFF.
- Make sure Fire System is armed.
- Turn the breakers feeding the VFDs and the Controls ON. All VFD should display STOP. On older EMS, exhaust VFD will go to 60 Hz and supply VFD will display STOP. If you see an error on the drives, refer to the troubleshooting manual.
- Verify proper voltage at VFD terminals L1, L2, and L3
- Verify 120 volts between terminals H1 and N1.
- Turn ON the control circuit breaker inside panel
 - The Power light should illuminate
 - All VFD display should read STOP (unless any temperature controllers reading above 85 deg in which case the VFD will ramp up to 48 Hz or more).



2 Hood Lights

- Turn the light switch to the ON position
- Verify all lights are in working order

3 Fan Test

- Turn the fan switch to the ON position
- The fans will gradually accelerate
- All VFD will accelerate to 48 Hz
- The Fan ON light should illuminate
- Check for correct fan rotation
- Check for proper belt tension
- Record any changes to the fan pulleys or belts



Note: If fan is spinning in wrong direction, switch any of the two leads on the output of the VFDs, for example the wires on Ui and Vi.

4

100% Airflow

- With the fan switch in the ON Position, press the 100% Airflow button:
- All VFD will accelerate to 60 Hz and stay there for the factory setting of 30 minutes
- The 100% Airflow light should illuminate
- After the 30 minute period the VFDs will go back to speed dictated by the temperature sensors.



5

100% Airflow Timer

The 100% Airflow timer is factory set at 30 minutes. There is a small and large dial that are used to set the time. The small indicates the type of time; 1, 3, 10 or 60 seconds / minutes / hours. The larger dial sets the percentage of the small dials time. Example: small set to 1 HR /z large set to 0.5 = 30 minutes.

WARNING

The red switch on the right side of the face of the timer should not be adjusted and is factory set to the bottom position (on delay).



6 Temperature sensor Fan Trigger

- With the fan switch in the Auto position, heat up any Temperature sensor in a hood riser with a lighter or a heat gun and verify the fans start up automatically.

7 Temperature Calculation

LOW TEMPERATURE

- Turn the cooking appliances ON and let them come up to the normal idle temperature.
- The low temperature set point is factory set at 85 degrees
 - This temperature should be set at 5 degrees above the kitchen ambient temperature

Kitchen Temperature	Temperature Offset	Low Set-Point Temperature
75	+5 Degrees =	80

- Make a note of the new low temperature for programming the temperature controller in a couple steps

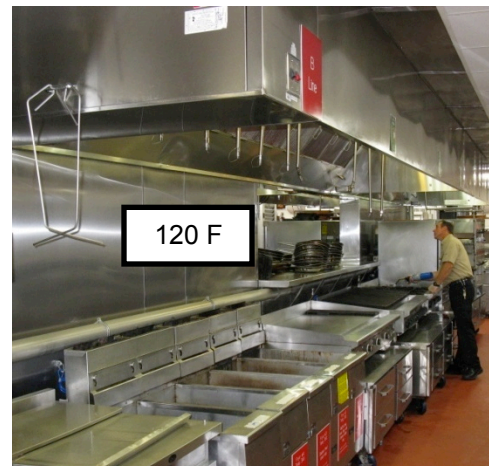


HIGH TEMPERATURE

- Observe the temperature on the temperature controller during cooking load.
- The high temperature set point is factory set at 90 or 130 depending on the appliances used in the hood
 - This temperature should be set at 5 degrees above the observed cooking load temperature

Cooking Temperature	Temperature Offset	High Set-Point Temperature
120	+5 Degrees =	125

- Make a note of the new high temperature for programming the temperature controller in a couple steps



8 Temperature Settings

Complete the two calculations to the right and use the temperature controlling programming instructions and charts in the next step for the low and high temperature settings.

Kitchen Temperature	Temperature Offset	Low Set-Point Temperature
	+5 Degrees =	

Kitchen Temperature	Temperature Offset	Low Set-Point Temperature
	+5 Degrees =	

9 Ramping P Calculations

When the low and high temperatures must be changed, the ramping P setting will be changed as well. See the formula below.

$$P = 100 \times (\text{High Temp} - \text{Low Temp}) / 200$$

Example:

$$P = 100 \times (125 - 80) / 200$$

$$P = 100 \times (45) / 200$$

$$P = 4500 / 200$$

$$P = \underline{22.50}$$

10 Temperature Controller Programming

The temperature controller must be programmed with the EMS panel energized. The parameters are listed to the right.

- To change the SV parameter press SEL button once and use the up and down arrows
- To change the A1-H and AL2 parameters press and hold the SEL button for one second. This will bring up the A1-H parameter. Press the SEL button once and use the up and down arrows to change the setting. Press the SEL button when complete. Then use the down arrow to access the AL2 parameter.
- To change the P parameter press and hold the SEL button for 3 seconds. This will bring up the P parameter. Press the SEL button once and use the up and down arrows to change the setting. Press the SEL button when complete.
- To change the SV-L and SV-H parameter press and hold the SEL button for 5 seconds. This will bring up the SV-L parameter. Press the SEL button once and use the up and down arrows to change the setting. Press the SEL button when complete. Then use the down arrow to access the SV-H parameter.
- Turn the circuit breaker off and on to reset the temperature for normal operation.

WARNING

If the display reads UUUU or LLLL the temperature sensor is either not wired to terminals S4, S5, and S6 or the sensor is open.

Parameter	Factory Setting
SV	Set Value
A1-H	Alarm 1 Set Value
AL2	Alarm 2 Set Value
P	Proportional Band
SV-L	Set Value Lower Limit
SV-H	Set Value Upper Limit



NORMAL



ERROR



ERROR

11

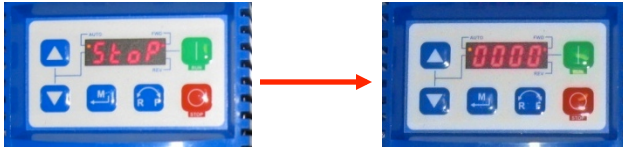
VFD Adjustments & Programming

The VFD is used to modulate the hertz to the exhaust and supply fans. The VFDs operate at 60 Hz at high speed and 48 Hz at low speed. When the test and balance is completed on the air flow for the hood the high and low speed hertz setting can be adjusted instead of changing pulleys and belts.

Only parameters P103, P132, P133, P136, P140, P144, P152, P160, and P161 should be manipulated. All others should be left at the factory settings.

To modify the VFD parameters use the following process;

1. Press the M button



2. Use the up and down arrows to enter the password 225



3. Press the M button



4. Use the up and down arrows to select the desired parameter



5. Press the M button



6. Use the up and down arrows to change the parameter setting



7. Press the M button to store the modified setting

ENERGY MANAGEMENT CONTROL SYSTEM

When the high speed hertz needs to be changed, for air flow balancing reasons, the low speed hertz must also be modified. The low speed hertz should be set to 80% of the high speed hertz.

FORMULA

High speed hertz x 0.80 = Low speed hertz

55 High speed hertz x 0.80 = 44 Low speed hertz

HIGH SPEED PARAMETER SETTINGS

- P103
- P133
- P136
- P161

LOW SPEED PARAMETER SETTINGS

- P160

Parameter P152 is related to the high speed frequency and is a scaling factor. For a supply fan drive, this parameter should be set to the same as the high speed parameter. For an exhaust fan drive, this value should be set to the high speed velocity x the number of exhaust fans.

FORMULA

High speed hertz x number of exhaust fans = P152

55 High speed hertz x 2 fans = 110 Hertz

WARNING

This formula is for the exhaust fan only.

Parameter P132 on the exhaust fan is set for the operating hertz for the optional wash mode and is factory set to 15 hertz. This setting prevents water from leaking through the filters during the wash cycle.

NOTE: The values shown in the tables on the right are for reference only. The parameter values are specific to each EMS model number and can be found on page 2 of the EMS Schematics.

END OF STANDARD START UP

Exhaust VFD Parameters

Parameter #	Factory Setting
P100	Term Strip (01)
P101	Preset #1 (03)
P102	0 Hz
P103	60 Hz
P104	10 Sec.
P105	10 Sec.
P110	Auto Restart (03)
P112	ROT Fwd & Rev (01)
P121	4-20 mA (02)
P122	Preset Speed #2 (03)
P123	Preset Speed #3 (03)
P132	15 Hz
P133	60 Hz(must match P103)
P136	60 Hz(must match P103)
P140	Loss of Load (10)
P144	Inverse P140 (01)
P145	50% (Adjust at Startup)
P146	5 Sec.
P150	0-10 VDC Output (01)
P152	P103 * # of EF drives
P160	48 Hz
P161	60 Hz(must match P103)
P400	No I/O Module (00)

Supply VFD Parameters

P100	Term Strip (01)
P101	Preset #1 (03)
P102	0 Hz
P103	60 Hz
P104	10 Sec.
P105	10 Sec.
P110	Auto Restart (03)
P112	ROT Fwd & Rev (01)
P121	0-10 VDC (01)
P122	Preset Speed #2 (03)
P123	Preset Speed #3 (03)
P132	0 Hz
P133	60 Hz(must match P103)
P136	60 Hz(must match P103)
P140	Run (01)
P144	No Inverse P140 (00)
P145	50% (Adjust at Startup)
P146	5 Sec.
P150	0-10 VDC Output (01)
P152	60 Hz(must match P103)
P160	0 Hz
P161	60 Hz(must match P103)
P400	No I/O Module (00)
P441	Loss of Load (10)

12 Self Cleaning Option

If the panel contains the water wash option, it includes two timers, one that controls the wash cycle length and the other for the surfactant injection time.

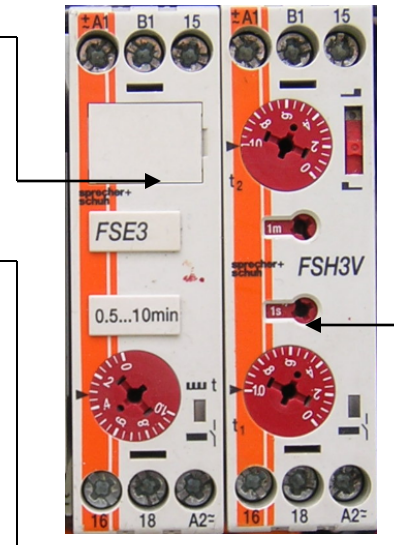
The single dial timer sets the wash cycle time and is factory set to 3 minutes. This timer can be set from 0.50 to 10 minutes and is adjusted by turning the single large dial.

The timer with four dials on it sets the on/off pattern for the surfactant. The top two dials set the off time. The small indicates the type of time; 1, 3, 10 or 60 seconds / minutes / hours. The larger dial sets the percentage of the small dials time. Example: small set to 1 MIN / large set to 1.0 = 1 minute.

The bottom two dials set the on time. The small indicates the type of time; 1, 3, 10 or 60 seconds / minutes / hours. The larger dial sets the percentage of the small dials time. Example: small set to 1 SEC / large set to 1.0 = 1 second.

WARNING

The red switch on the right side of the face of the timer should not be adjusted and is factory set to the bottom position (beginning of time period).



13 Supply and Exhaust Proving Option

If the panel contains the Supply and Exhaust proving option, Parameter P145 must be set on all drives (factory set to 50%).

To determine the value of P145 for each drive:

- Run the drive at the lowest speed (48 Hz for standard EMS) and measure the current drawn by the motor. Record A1 = ____ amps
- Remove the belts from the fan and measure the current drawn by the motor. Record A2= ____ amps
- Pick the middle value between A2 and A1: Amid = ____ amps
- Find the Output current Aout of the drive from the SMV Drive Manual starting on Page 8. Aout= ____ amps
- Calculate P145 = (Amid/Aout) x 100 = ____%





Program the drive for P145 as show on bullet 11 of this document.



ENERGY MANAGEMENT CONTROL SYSTEM



TROUBLESHOOTING

PROBLEM	CAUSE	CORRECTION
Exhaust fan runs at 60 Hz supply fan VFD is a STOP 	Micro Switch not field wired	Field wire micro switch to C1, AR1, and TR1
	Fire system not armed	Arm fire system and check for 120 volts at terminal AR1
Both fan VFDs are at STOP 	No power to H1 and N1	Provide 120 volts to terminals H1 and N1
	Fan switch in the Auto position and exhaust riser temp is not above low set point	Turn switch to the On position Decrease low temperature set point on the temperature controller
Fans stuck in high speed	Kitchen temperature above high temperature set point	Increase high temperature set point on the temperature controller
Temperature controller reads UUUU or LLLL 	Temperature sensor not field wired	Wire the temperature sensor to the terminal blocks Si, Sj, Sk (refer to EMS installation drawing for exact terminal block numbers).
Fans never go to high speed	Dirty temperature sensor	Clean temperature sensor
	High temperature set point too high	Decrease high temperature set point on the temperature controller
Fans never go to low speed	Low temperature set point too high	Decrease low temperature set point on the temperature controller
Fans ramp up then go to 0.0 (supply) and STOP (exhaust) 	Supply fan not wired	Check the supply fan field wiring and power supply wiring
	Broke fan belt	Replace fan belt
Smoke rollout of hood during high speed operation	High speed set too low	Increase the exhaust and supply fan VFD high speed setting
	Improper hood installation	Check for proper hood overhangs, cross drafts, or improper hood design
Smoke rollout of hood during low speed operation	Low speed set too low	Increase the exhaust and supply fan VFD low speed setting
	Improper hood installation	Check for proper hood overhangs, cross drafts, or improper hood design
Fans spinning wrong direction	VFD output wiring incorrect	Switch any of the two leads on the output of the VFDs
100% Airflow button does not increase air flow	Loose wiring connection	Check override button, timer, and terminal block connections
Water Wash cycle never runs	Improperly set Wash Timer	Timer set to a value greater than 0. Led on face of timer should be blinking
Water Wash hood not staying clean	Surfactant not being injected	Timer set incorrectly. Increase injection time or decrease pause time
	Wash time not set high enough	Timer set to higher for wash time
	Surfactant container empty	Fill the surfactant container