Auto Fan Control System™ with Energy Saver
Installation, Operation, and Maintenance Instructions

Description:
The Larkin Auto Fan Control System™ with Energy Saver is a fully modulating energy saving system with up to a 50% turn down ratio and automatically starts the fans per IMC code 507.2.1.1 and modulate the fans based on temperature. The supply and exhaust fans are controlled proportionally or by building pressure. (Optional)

System Components:
The Larkin Industries AFCS-ES (Auto Fan Control System™ with Energy Saver) consists of two separate components and includes the following:

Component #1 Control Panel
- Wall mounted 12” x 18” x 6” stainless steel enclosure with hinged door and tamper resistant latch. Enclosure may be recessed mounted (with optional trim ring) or hood mounted in utility cabinet.
- Door mounted light switch, pilot lighted fan switch, temperature dial, illuminated 100% override button, and green L.E.D. for system power indication.
- Exhaust and supply fans are interlocked and fire suppression system activated, supply fan(s) shut down and exhaust fan(s) continuous operation at 100% and lights off in fire.
- (2) Auxiliary dry contacts (fire system actuated).
- 50’ of shielded 6 conductors plenum cable (for connecting the control panel component #1, to VFD cabinet component #2).
- Temperature sensor(s) factory mounted in hood(s).

Component #2 VFD Cabinet
- Wall mounted 18” x 24” x 8” stainless steel VFD (Variable Frequency Drive) cabinet for 1 to 3 drives or 24”x24”x10” for 4 to 6 drives.
- (1) VFD per fan mounted inside VFD cabinet. (6 VFD max. per system)
- The VFD Cabinet can be mounted in a remote location up to 150’ away from the control panel (50’ of 6 conductor shielded plenum cable is provided with system).

Important Notice To Electrician
This system will not operate properly without a dedicated Control circuit and two fire suppression micro switches.

See wiring diagram and installation instructions (page3) for wiring requirements.

For technical support contact Larkin Industries, Inc. 1-800-322-4036
Component #1 Mounting Options

Hood Mounted:

- For hood mounted AFCS-ES, the control panel will be mounted in a utility cabinet & switches will be located on the face of the utility cabinet. (see Figure 1)

Wall Mounted:

- For wall mounted AFCS-ES, the control panel will be housed in a 12” x 18” x 6” stainless steel enclosure and should be secured to a fixed wall near the exhaust hood it controls. Enclosure may be recess mounted with optional trim ring. (see Figure 2)

Figure 1         Figure 2
Wall Mounted VFD Cabinet

Component #2

The VFD cabinet may only be wall mounted and is housed in a stainless steel cabinet with an open top for proper ventilation of drives. The VFD cabinet may be located in any suitable location (kitchen area or equipment room suggested, 50’ of plenum cable to connect control panel and VFD cabinet is provided.) A good location is next to the supply power breaker panel, as the power wiring for the fans only has to be pulled from the breaker panel to the VFD’s and then to the fans. (see Figure 3)

Figure 3

Electrical Connection Required for System

Component #1: S/S 12” x 18” x 6” AFCS-ES, hinged door and switches

A - Low Voltage to hood sensor.
B - Lights in hood (120V 1 Phase 20 AMP).
C - Low voltage to VFD cabinet (6 conductor shielded cable) 50ft. provided.
D - Fire suppression micro switches.
E - 2 separate circuits from breaker panel:
   (1) 120VAC 15AMP for control voltage
   (1) 120VAC 20AMP for hood lights

Component #2: S/S VFD cabinet

F - 1 or 3 phase power from breaker panel to VFD’s. Separate circuit for each VFD (see wiring diagram.)
G - 3 phase from VFD’s to fans (3 phase only see wiring diagram.)
C - Low voltage control wiring to auto fan control box (6 conductor shielded cable) 50ft. provided.
H - * (1) 120V control voltage (only if tempered make up air is provided.) *
Hood Mounted Temperature Sensor

When the Larkin AFCS-ES is ordered with a Larkin Industries hood model the temperature sensor is factory mounted in each hood, no field installation required. AFCS-ES ordered for non-Larkin hoods or Retro-fit application the temperature sensor will have to be field installed in each hood controlled by the system. A 1-1/8” diameter hole must be cut in the top of the hood and the compression seal and sensor installed as shown in (Figure 4).

Note: Mount sensor in top of hood approximately 2” from seam close to filters and as close to center of hood left to right. CAUTION: If sensor is located too close to a light fixture, the heat generated can activate the system. Sensor must be centered between lights. On large hoods 12’ to 16’ avoid any dead areas (work tables, refrigerators, ovens ect.)

Figure 4

Wiring Instructions

The Larkin AFCS-ES components are all prewired. The field wiring required to connect the control panel to the hood and VFD cabinet should be made in accordance with the wiring diagram provided with these instructions, and the NEC (National Electrical Code) requirements.

WARNING! Disconnect power before installing or servicing the system. High voltage electrical input is needed for this system. A qualified licensed electrician should only perform this installation.
1. Check the power source to see if it is compatible with the requirements of the provided system. The AFCS-ES wiring diagram list the proper phase, voltage, and amp load.
2. Verify input power voltage before connecting to VFD. Must have separate circuit for each VFD.
3. Do not connect input power to the output terminals U/T1, V/T2, and W/T3! Severe damage to the drive unit will result.
4. **Only connect the input power to the VFD terminals L1, L2, and L3** on the right hand side of the VFD.

![Diagram of VFD terminals](image)

**Note:**
5. All drives are not 1 Phase and 3 Phase input compatible (check drive voltage on name plate before wiring.)
6. 460 volt input and output power can only be used on drives specifically designed for 460 volt (verify drive voltage on name plate before wiring.)

**WARNING!**
Verify input power voltage before connecting to terminals L1, L2 and L3 on VFD. **DO NOT** connect input power to terminals U/T1-V/T2-W/T3! **Severe damage to the drive unit will result.**

7. Connect output power to proper fan from VFD terminals U/T1, V/T2, and W/T3 on left side of the VFD.
8. All fan motors must be **3 Phase** and the proper voltage listed on the AFC-ES wiring diagram. If all three power lines are not used to wire motor, damage to the motor will result.
9. Check rotation of fans, exhaust fans will move some air in reverse (See rotation arrow on fan). To correct rotation of fans reverse any two leads from the VFD to the fan.
10. When wiring output power from VFD to a Larkin Industries tempered make-up unit, a separate 115 VAC 1 Phase control circuit must be connected from breaker panel to the tempered make-up unit for control voltage or the unit will not operate. (See Heated Unit wiring diagram)

**Field Wiring Requirements for component #1**
(12”x18” control panel)

**Light Circuit:** 120 VAC 1 Phase 20 AMP to terminals - #1 (Hot) and #2 (Neutral) from breaker.

![Diagram of Light Circuit](image)
**Control Circuit:** 120 VAC 1Phase 15 AMP to terminals – CH (Hot) and CN (Neutral) from breaker. (Control circuit should not be wired to a shunt trip breaker.)

**NOTE:** When using a Larkin Industries tempered make-up air unit, a separate 120 VAC 1 Phase 15 AMP control circuit must be connected from the breaker panel to the tempered make-up air unit. Tempered make-up air unit will not operate if this connection is not completed.

**Hood Lights:** Field wire hood light to terminals #2 (Neutral) and #3 (Hot) in the control panel.

**Hood Sensor(s):** To field-wire, connect low voltage wiring from the hood sensor terminals located in a junction box on end of hood, to sensor terminals S1 & S2 located in control panel. For a system controlling more than one hood, connect hood sensor #2 to S3 & S4, hood sensor #3 to S5 & S6, and hood sensor #4 to S7 & S8. A system can have up to four sensors. Sensors must be wired separately. Use conduit when making this connection.
HOOD SENSOR WIRING INSTALLATION INSTRUCTIONS FOR SINGLE HOOD APPLICATION

HOOD SENSOR IS PRE-WIRED TO JUNCTION BOX ON END OF HOOD. SENSOR MUST BE FIELD WIRED TO TERMINAL S1 AND S2 IN THE CONTROL PANEL FOR HOOD.
HOOD SENSOR WIRING INSTALLATION INSTRUCTIONS FOR END-TO-END CONFIGURATION

HOOD SENSOR IS PRE-WIRED TO JUNCTION BOX ON END OF HOOD. SENSORS MUST BE FIELD WIRED TO TERMINALS S1 AND S2 FOR SENSOR #1 AND S3 AND S4 FOR SENSOR #2 IN THE CONTROL PANEL.

NOTE: HOOD SENSOR ON HOOD SEC. #2 MUST BE CONNECTED TO THE TERMINAL STRIP ON HOOD SEC. #1.
Micro Switches: The Larkin AFCS-ES requires two (2) micro switches. Micro Switch #1, for exhaust on in fire, should be field wired to terminals NC1 (brown), C1 (red), and NO1 (black) in the control panel from the fire suppression system. Micro switch #2, for supply fan shutdown in fire, should be field wired to terminals NC2 (brown), C2 (red), and NO2 (black) in the control panel from the fire suppression system.

Control Panel to VFD Cabinet: Field wire low voltage 6-conductor shielded plenum cable (50’ provided) from control panel to the VFD cabinet terminal strip. (See terminal strip wiring diagram for proper connections.)

The LARKIN AFCS-ES contains two auxiliary contacts on terminals NC3, C3, NO3 and NC4, C4, NO4. They are fire system actuated (reversed) and may be utilized for fire alarms, equipment shut down, etc.
Installation Check List

- Control panel is mounted next to the exhaust hood it controls.
- VFD cabinet is mounted in suitable location (utility room or kitchen).
- Hood sensor(s) are connected from hood(s) to control panel (one sensor per hood or hood section).
- Two separate circuits (115VAC 15AMP control & 115VAC 20AMP hood lights) have been connected from breaker panel to control panel. Ground wire is connected!!
- Hood lights have been connected from control panel to hood(s).
- Two Ansul micro switches are wired to control panel from fire suppression system.
- Low voltage control wire (6 conductor shielded plenum cable, 50’ provided) from control panel to VFD cabinet is connected.
- Separate input power of proper Phase & Voltage from breaker panel is connected to each VFD terminals L1, L2, L3 & ground.
- Output power (3 Phase Only) from VFD terminals U/T1, V/T2, & W/T3 & grounds are connected to the proper fans on the roof (Exhaust to Exhaust, Supply to Supply).

**WARNING!**
Power remains present for up to 3 minutes on power input terminals (L1, L2 and L3) and output terminals (U, V and W) even when the disconnect switch is in the OFF position. Remove input power ahead of the drive and wait 3 minutes before removing the terminal cover.

**WARNING!**
If the cable connection between the drive and the motor has an in-line disconnect switch the drive must be stopped prior to opening/closing the contacts. Failure to do so may result in Overcurrent trips and/or damage to the inverter.

- Fan(s) rotation have been checked by looking at rotation arrow on fan(s)

**Optional Equipment:**
- If tempered make up air is used, it must be Larkin, or other manufactures with variable volume, variable kitchen unit with external VFD by others, capable of 50% air volume turn down. Some manufacturers units may not operate properly!!
- * A separate115VAC 1 Phase control circuit is connected from breaker panel to tempered make up air unit.*
- Ensure hose from air pressure transducer is not kinked and is connected to the outside air sensor (only if equipped with building pressure option).

For technical support contact Larkin Industries, Inc. 1-800-322-4036
**SYSTEM WIRING EXAMPLE**

**WARNING!**
Power remains present for up to 3 minutes on power input terminals (L1, L2 and L3) and output terminals (U, V and W) even when the disconnect switch is in the OFF position. Remove input power ahead of the drive and wait 3 minutes before removing the terminal cover.

**WARNING!**
If the cable connection between the drive and the motor has an in-line disconnect switch the drive must be stopped prior to opening/closing the contacts. Failure to do so may result in Overcurrent trips and/or damage to the inverter.
System Startup

1. Turn on all breakers that power the fan VFD, control panel power, hood lights, tempered make-up air unit control power (If tempered unit is used). Check with a voltage meter for proper voltage at all VFD terminals L1, L2, L3. VFD’s should be displaying stop unless the temperature sensor in the hood is warmer than the temperature adjustment dial on the control panel. The factory setting on dial is for a room temperature of 80 Deg. F. Move dial to warmer if fans are operating.

2. The power indicator light on the control panel should be illuminated.

3. Turn on the fan switch. VFD should now power up to low speed (Approx. 30Hz). The fan switch should illuminate. This indicates the fans are operating.

**Important!!!** The low speed Hz is based on the temperature dial setting and hood sensor temperature. Low speed will vary.

4. Check the rotation of the fans. (Note: The exhaust fan will exhaust some air while rotating backward. You must check the direction arrow on the fans. To reverse rotation, change any 2 leads connected to U/T1, V/T2, or W/T3 at the VFD.

5. For proper fan start up refer to the fan or the tempered makeup unit installation and start up instructions.

   **WARNING!**
   Power remains present for up to 3 minutes on power input terminals (L1, L2 and L3) and output terminals (U,V and W) even when the disconnect switch is in the OFF position. Remove input power ahead of the drive and wait 3 minutes before removing the terminal cover.

   **WARNING!**
   If the cable connection between the drive and the motor has an in-line disconnect switch the drive must be stopped prior to opening/closing the contacts. Failure to do so may result in Overcurrent trips and/or damage to the inverter.

6. Turn on the light switch to energize the hood lights.
   If lights are not working:
   A. Verify that the bulbs are installed.
   B. Verify that the fire suppression micro switches are connected and armed.
   C. Verify that all connections to hood(s) have been made.

7. Press the 100% airflow override button. The button’s green LED should illuminate, and all VFD’s should ramp up to high speed (approx. 60 Hz). The fans will operate at high speed for a factory preset 30 minutes. After the time expires, the fans will return to low speed. (This timer is adjustable on the temperature controller. See system adjustment section.)

   **Note:** The system will stay in 100% air flow override mode for 30 minutes even after the fan switch is turned off, unless system is reset by turning off the control power breaker and VFD drive power for 30 seconds. Allow timer to expire or reset system.

8. The start up is now complete, and the system should properly modulate during cooking operation. To test the systems fire suppression interlock and auto fan control for IMC 507.2.1.1 compliance, follow the test procedures in the next section. For operation information and system adjustments, see system operation section.
Test Procedures

**Test #1** - Testing of the system for IMC 507.2.1.1 compliance:

1. Place the fan switch in the off position.
2. Set the temperature adjustment dial to the factory-preset position or the closest to the actual room temperature. (See Figure 5, next page)
3. Conduct the test by turning on the cooking equipment or applying heat to the hood sensor located in the center of the hood, just in front of the grease filters. For multiple hood systems, when any of the sensors heat above the set point, the auto fan control system will energize the fans. **Note:** It does not require much heat, the palm of your hand or hot water should be sufficient. **DO NOT USE A PROPANE TORCH!**

After the heat source is removed and the hood sensor cools below set point on the dial, the fans will de-energize. (For multiple hood systems, all sensors must cool.) It will take a few minutes for fans to de-energize.

**Test #2** - Testing the fire system interlock. The system is designed to shut down the supply fan(s) and run the exhaust fans at 100% and turn off the lights. To conduct the test with the fan and light switches in the on position, simply trip the micro switches. The exhaust fan will ramp up to 60 Hz, the supply fan will shut off, and the lights will turn off. After test, place the micro switches back to the normal position. The lights will come back on and supply fan will re-start.

**Note:** The system will stay in 100% air flow override mode for 30 minutes even after the fan switch is turned off unless system is reset by turning off the control power breaker and VFD drive power for 30 seconds. Allow timer to expire or reset system.

**Notice:** After the test and inspection is complete, remove the timer jumper wire in the control panel (Terminals J2 and J3). This activates the 30-minute cool down timer for normal operation.
System Operation

To comply with the International Mechanical Code 507.2.1.1 the fans must energize automatically as cooking operation commences. This means that the Auto Fan Control System™ with Energy Saver must over ride the fan switch anytime the hood sensor detects heat. Any temperature (including room temperature) over the preset mark of 80 deg on the dial located on the control panel will activate the fans.

To eliminate the problem of fans energizing automatically in warm or hot kitchen environments (over 80 deg) or not energizing quick enough in a cool environment the Auto Fan Control System™ is fully adjustable by means of the dial on the control panel. The dial has a factory preset mark at 80 deg, a cooler, normal and warmer setting. In a conditioned space (72 deg – 77 deg) the preset to normal settings should work well. The illustration below (Figure 5) shows the actual temperature of the settings on the 7-position dial at which the hood sensor must reach to energize the fans.

**Important Notice:** The fans will de-energize when the hood sensor cools 1 ½ deg below the set temperature. The fan switch can energize the fans at any time, however, the fan switch can only de-energize the fans if the hood sensors have cooled and the 30 minute timer has expired. The system cannot de-energize the fans unless the fan switch is in the Off position.

After cooking equipment is turned off the fans will continue to operate until the hood sensor cools 1 ½ deg below set point. However, the residual heat from griddles, char-broiler grates or fryer grease will reheat the hood sensor causing the fans to cycle on and off. This shortens the life of the contactors and fan motors. To eliminate this problem the Larkin Auto Fan Control System™ with Energy Saver has a built in cool down timer of 30 minutes. This timer can be adjusted if needed. The timer is removed from the system with a jumper wire at the factory for testing and inspection purposes. It is important to remove the wire located in the control panel marked jumper after any test & inspections are complete to eliminate fan cycling.

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**Figure 5**

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**AUTO FAN CONTROL ADJUSTMENT**
The Auto Fan Control System™ with Energy Saver is also a fully modulating energy management system. The system is plug & play, and requires little or no adjustments. The system is controlled by a solid-state temperature controller that is factory preset. The temperature controller sends a signal to Variable Frequency Drives (VFD’s) that are used to speed up or slow down the fans based on the cooking temperature. As the temperature increases due to cooking activity, the fans begin to increase in speed. The temperature range in which the fans ramp up from idle (50%) to full speed is factory preset. If more modulation is desired (less fan speed), simply adjust the 7 position dial warmer. All kitchen environments, cooking types and loads are different and constantly changing. With the 7 position temperature dial, it should be easy to find a setting that will work well in any kitchen environment. (A good rule of thumb is, as the kitchen environment warms, adjust the dial warmer, as it cools, adjust the dial cooler.)

The system also includes a 100% air flow override button. This can be used any time 100% air flow is desired. Once the button is pressed, the fan will stay at high speed for 30 minutes.
Adjustments

It is not recommended to adjust this system except in extreme cases. The solid-state temperature controller contains 4 adjustments.

1. Modulation range. (Temperature above dial setting when fans are high speed. 2deg.F – 20 deg. F)
2. Cool down timer. (10 min. – 60 min.)
3. 100% air flow over ride timer. (10 min. – 60 min.)
4. Fan start temperature. (Temperature above dial setting that will start fans. 1 deg. F – 8 deg. F)

The VFD’s contain factory programmed EPM Modules and cannot be field adjusted without Factory assistance. **TEST AND BALANCE MUST BE PERFORMED ON HIGH SPEED** (100% OVER RIDE MODE). It is recommended to balance the system with the fan pulley adjustments first. If more adjustment is needed, contact the factory for a replacement EPM Module and a list of factory setting recommendations.
Maintenance

**WARNING!** Do not attempt maintenance, repairs, or adjustments on this system until all electrical power has been completely disconnected.

- **WARNING!**
  Power remains present for up to 3 minutes on power input terminals (L1, L2 and L3) and output terminals (U, V and W) even when the disconnect switch is in the OFF position. Remove input power ahead of the drive and wait 3 minutes before removing the terminal cover.

- **WARNING!**
  If the cable connection between the drive and the motor has an in-line disconnect switch the drive must be stopped prior to opening/closing the contacts. Failure to do so may result in Overcurrent trips and/or damage to the inverter.

- The Control panel door should be securely closed after opening to avoid tampering or electrical shock.

- The control panel is a type1 electrical enclosure and is not watertight. Do not spray, soak or submerge with water. Panel should only be cleaned with a mild cleaner and damp cloth.

- VFD cabinet should be kept clear of clutter and well ventilated.

- Hood temperature sensor(s) should be cleaned weekly to prevent grease build up and ensure a quick response to temperature changes. Sensor(s) should be cleaned with a mild cleaner to remove grease.