



### General

The 865-3AA Series installation instructions are limited to three phase direct connected, propeller type, condenser fan motor applications. These applications require Special Purpose Slip Tolerant/Ventilated (HS/V), 850/1150 RPM, direct drive, vertical shaft designed motors as furnished and approved by HCC or approved by motor manufacturer.

The installation start-up and servicing of the Electronic Motor Speed Controller (EMSC) and the Special Purpose motor can be hazardous due to the technical scope and magnitude of the electrical/mechanical components encountered.

A qualified technician with knowledge and experience in controls and refrigeration will be required. All safety precautions, instructions, labels, and tags on the items being installed as well as those of the equipment manufacturer should be observed.

### Application

The EMSC typically controls special purpose HS/V condenser fan motor(s). Two identical condenser motors, of same manufacturer, type, model, RPM and identical propeller fans, may be controlled by one Controller. In either case, the 8 amp rating of Controller should not be exceeded.

A properly applied EMSC control may be used to extend the operating range of A/C or refrigeration systems, permitting operation at lower outdoor ambient temperatures. EMSC controls are usually used in conjunction with unit manufacturer's standard fan sequencing controls or with the HCC 861-ASQ Series Fan Sequencer and/or 851-MS Series Multiple Sensor (compressor) Selector Controllers.

The EMSC is offered in two basic configurations:

- **Open Design** — OEM installation inside a unit ventilated control panel or within a protected environment.
- **Enclosed Design** — A factory assembled NEMA 3R rainproof controller for field installation in the weather/ambient.

### Design Specifications

OEM P/N	Field P/N	Volts	HZ	Amps	NEMA 3R Enclosure
702-0183-055	865-3AA	208-230/460/600	50/60	8	No
702-0183-065	865-3AA	208-230/460/600	50/60	8	Yes
545-0193-017	865-3AA Kit	Weatherproof Kit 3R Enclosure, if required			
100-0016-001	Sensor Cable Kit, if required				
510-0027-000	Adjustable Sensor Simulator Kit, if required				

### Controller/Motor Operation

The EMSC is factory calibrated to optimize the throttling range of the special purpose HS/V motors for air-cooled condenser applications.

**Recalibration of EMSC factory calibrated settings should not be necessary. If recalibration is required, see the 865-3AA Series Head Pressure Controller Recalibration Instructions.**

The Controller is designed to maintain synchronous (full) speed for all liquid line temperatures above 80°F. At 80°F liquid temperature, (60°F ≈ ambients) the Controller initiates phase proportioning by reducing motor speed to approximately 1000 RPM. Speed reduction continues as liquid temperature decreases down to a minimum speed which occurs at 50°F (25°F ≈ ambient).

Further reduction in liquid line sub-cooling will remove (disconnect) the motor from the line and the motor will cycle "Off". The motor will restart at 53°F, 3°F differential at approximately 100 RPM above where the motor cycled OFF, and modulates back to the Minimum speed. OFF time will increase as Ambients continue to fall until liquid line temperature remains below 50°F. This feature also allows the EMSC to be "Off" at start-up when the ambient and liquid line are below 50°F. Conversely, the EMSC controls the motor speed functions in reverse as previously described as temperatures increase.

A 1—10VDC or 2—20mA optional signal input is available. These inputs may be used when pressure transducers or other analog outputs are preferred.

## Field Pre-Installation

Before field installation of the EMSC, or the HS/V motor, the installer should carefully evaluate the physical requirements for installing the new motor and Controller. The check list below will cover the basic requirements of a field installation.

### Motor Installation Checklist

1. Will the existing motor's bracket/support accept the NEW HS/V Special Purpose 56 frame (6 1/2") diameter motor?
2. Will the existing fan blade accept the NEW Special Purpose motors 5/8" diameter shaft?

### Controller Installation Check List

Will the EMSC be located:

1. Inside a ventilated control panel?

#### CAUTION



865-3AA Series Head Pressure Controllers are not suitable for mounting inside a totally enclosed or non ventilating control panel that exceeds 160°F (70°C).

2. Externally in ambient (exposed to the weather) on the unit adjacent to the existing motor/control panel?

**NOTE:** 3R Raintight Weatherproof Kit (Part No. 545-0193-017) required.

3. To allow access to wiring connections and calibration adjustments?

### Instruments/Tools Required

- True RMS Digital Volt Meter
- Amp Meter
- 1/8" Screw Driver
- Digital Temperature Indicator

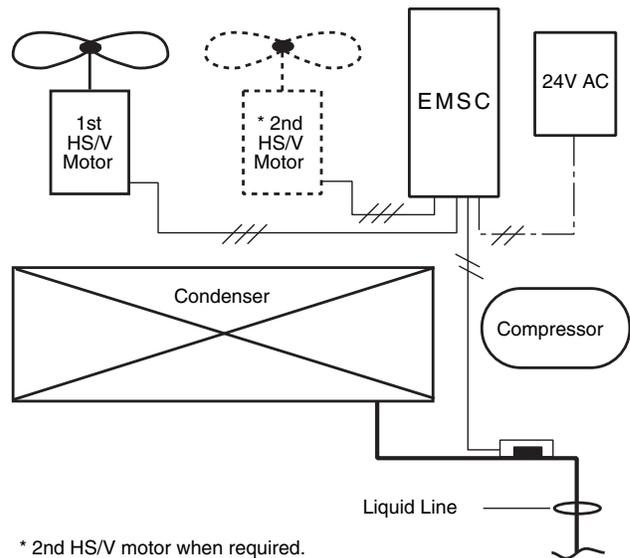
## Installation Instructions

These instructions describe field installation procedures for applications using the special purpose liquid line sensor. The use of optional input signals is described in the 865-3AA Series Electronic Head Pressure Product Data and Recalibration Instructions.

Controllers should be installed vertically; extruded fins vertical, with panel conduit/wiring opening at the bottom. A 1/2" and 3/4" conduit fitting opening and a bushing for sensor or input cable is provided. A factory furnished sensor/hardware kit includes:

- One (1) 60" cable assembly and sensor.
- One (1) Special sensor installation tape.

**NOTE:** Conduit connectors are not included.



\* 2nd HS/V motor when required.

Typical Unitary A/C Unit

## Installation Steps

- Step 1** Disconnect all power, line, and control voltage from equipment.
- Step 2** Disconnect control circuit to all compressor relay/contactors, disabling compressor(s).
- Step 3** Install only special purpose High Slip / Ventilated direct drive motors. Motors must be furnished by HCC or approved by motor manufacturer when used with the 865-3AA-Series Head Pressure Controller.

#### IMPORTANT NOTICE

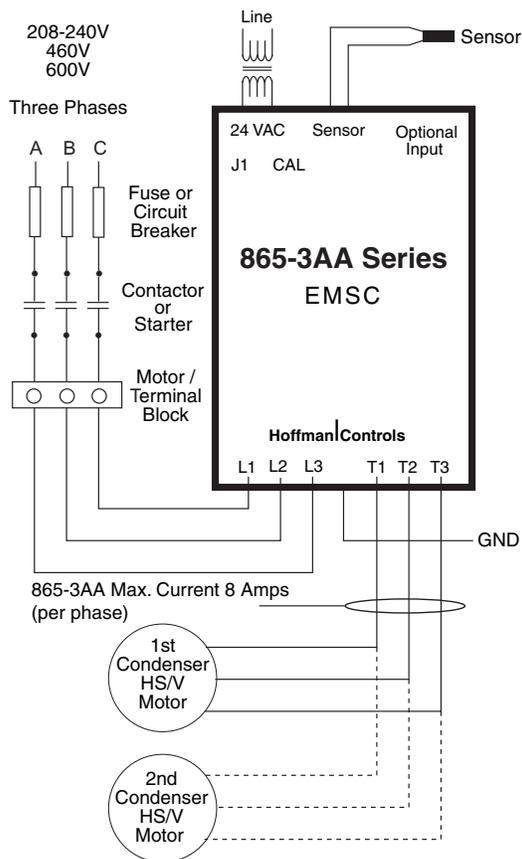
Controller manufacturer's warranty will be void when three phase motors other than those approved or furnished by HCC are used.

- Step 4** Install Line and Low voltage & Sensor wiring (see Field Wiring Diagram, Page 3).
  - A. Remove wiring from condenser motor(s) at contactor(s) or terminal block and reconnect to EMSC terminals T1, T2, T3.
  - B. Field furnish three (3) #14 or #16 AWG, 90°C wire from condenser fan motor contactor to L1, L2 and L3 on EMSC.
  - C. Connect green GND wire on EMSC to a reliable ground.
  - D. Field furnish control transformer wiring 24V-AC to the EMSC.

#### CAUTION

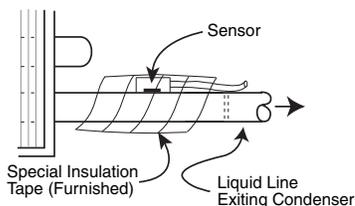


24V AC transformer secondary must not be grounded when inputs other than liquid line sensor are used.



**Field Wiring Diagram**

- E. Install liquid line sensor using hardware Kit at the common liquid line of the condenser (see Sensor Cross Section Diagram).



**Sensor Cross Section Diagram**

Route sensor cable from sensor location to EMSC.

- F. Connect sensor to “sensor input” and install a shorting jumper across the low voltage sensor terminals.

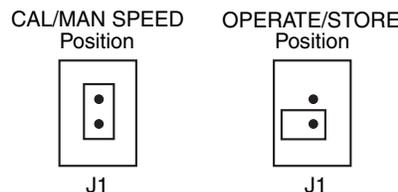
**NOTE:** Shorting the sensor input signal allows motor(s) to start and operate at full speed without concern for sensor temperature.

- G. Verify unit manufacturer has provided fuse or circuit breaker protection for motors being controlled and field wiring (Step 4, A and B, Page 2) did not remove or bypass motor protection.

**Step 5** Install DVM across T1 and T2, amp meter on T1

and Temperature Indicator (insulate) on liquid line.

- Step 6** Verify J1 is installed in OPERATE/STORE position and CAL potentiometer is in the full CW position (full speed).



- Step 7** Phase Sequence Verification

- A. Apply line and control voltage to units observing voltage and current to motor being controlled.
- B. All fan motor(s) should start. Compressor should not start as a result of previous disabling instructions.
- C. If EMSC controlled fan motor(s) start, phases are in sequence. Proceed to Step 8.
- D. If motor(s) does not start:  
L1, L2, & L3 line input to Controller has incorrect phase sequencing:
- “FAULT” LED will be “ON”.
  - Remove power.
  - Reverse line L1 and L2 at terminal block on EMSC and restore power to unit.
  - Motor(s) will start.
  - “FAULT” LED will be “OFF”; “FULL” LED will be “ON”.

- Step 8** Condenser Fan Rotation Verification

- A. Check condenser for proper airflow (CW or CCW motor rotation).
- B. If motor rotation is correct; proceed to Step 9.
- C. If motor rotation is incorrect, remove power and reverse lines T1 and T2 at EMSC terminal block.
- D. Reconnect control circuit that disabled compressor(s) in Step 2, Page 2.
- E. Restore power to unit, compressor and condenser fans will start.

**NOTE**

The completion of Steps 1 through 8 verifies the integrity of the electrical installation.

**NOTE**

The following evaluation in Step 9 will validate the performance of the EMSC and HS/V motor.

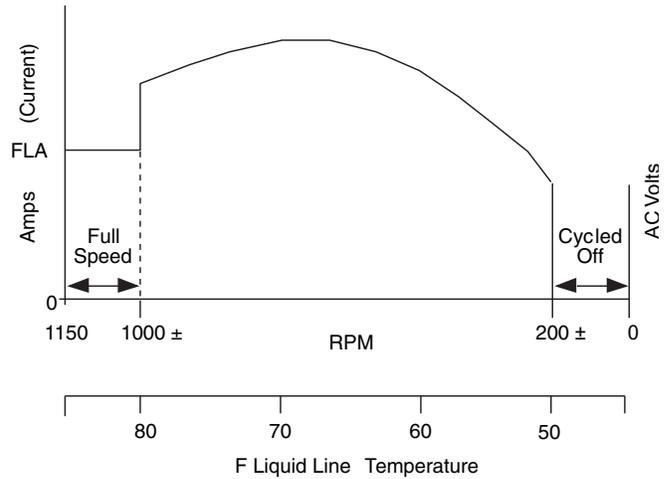
**Step 9** Monitor operation of the EMSC and HS/V motor(s) at full speed (1150 RPM) with shorting clip previously installed across sensor input.

- A. Observe the AC Volts, current, liquid line temperature, and verify the "FULL" LED status indicator is "ON".
- B. Permanently remove shorting clip that is installed across the sensor input.
- C. Depending on the liquid temperature observed, the following performance values should be observed.

**D. Phase Proportioning Characteristics:**

As liquid temperatures decrease (modulates) from 80°F to 50°F:

- Motor speed (RPM) decreases.
- Voltage to motor decreases.
- Current (amps) increases, peaks, then decreases.

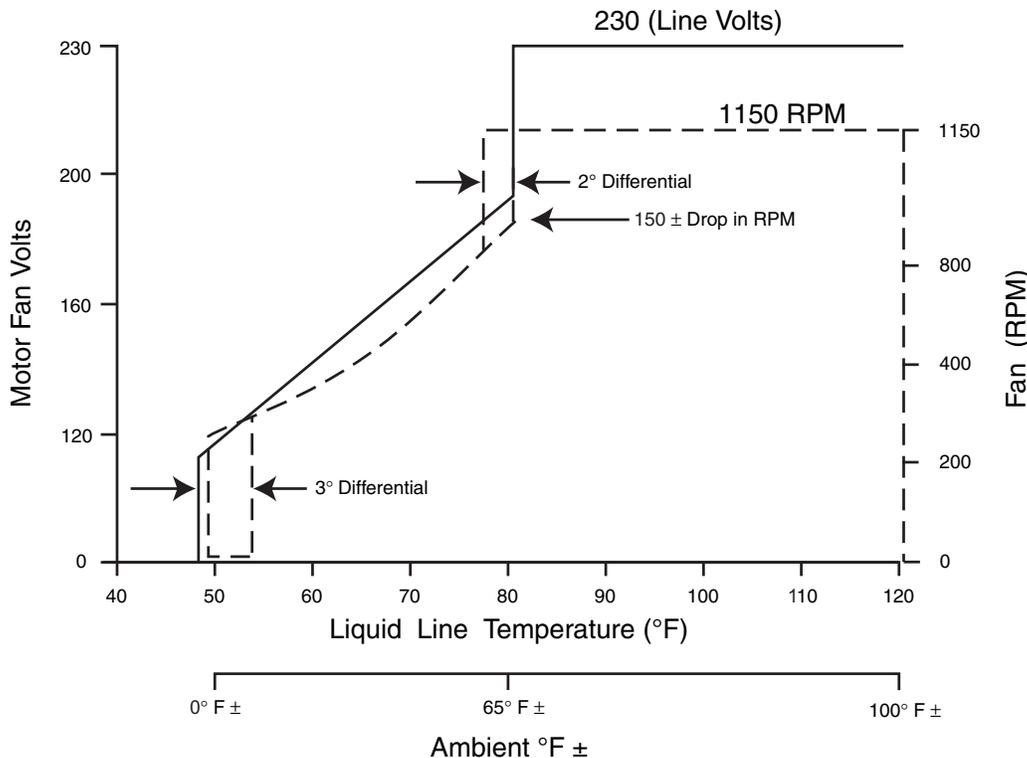


**EMSC Typical Performance Graph**

The 865-3AA Series RECALIBRATION INSTRUCTIONS provides additional information to the technical specialist/installer/user. This information includes:

- Troubleshooting
- Field Recalibration
- Sensor Curves
- Optional Input Signals

Liquid Temperature	Motor Speed (RPM)	LED Status
Above 80°F	1150≈	Full
80°F to 50°F	1000 to 200	Modulate
Below 50°F	Zero	Off



**865-3AA Typical Performance Characteristics, 230V AC**

**Hoffman|Controls**