

SmartFan[®] Nimbus-HP

Speed Control for AC Fans, Pumps and Motors



SmartFan Nimbus-HP is a TRIAC based fan, pump and motor control designed for OEM applications in HVAC, electronic and industrial control markets. The Nimbus-HP automatically controls single phase motors that have been approved for voltage control by the motor manufacturer. Nimbus-HP regulates motor speed from a control signal (2-10 VDC, 4-20 mA) or up to three remote temperature sensors (thermistor). Typical applications include: humidity control, clean room pressurization, equipment cooling, heat exchangers, exhaust ventilators, pumps, duct fans & blowers. On-board programming allows the setting of many parameters providing maximum flexibility.

SPECIFICATIONS

- Power source: 85 to 300 VAC, automatically detected
- Frequency: 47 to 64 Hz, automatically detected
- Output power rating at 65°C: 18 Amps
- Motor type: Induction either permanent split capacitor (PSC) or shaded pole motors that have been approved for voltage control by the motor manufacturer
- Input power and motor connections: 1/4" quick connects
- Control signal, sensor and alarm connections: Terminal Block
- Full voltage start pulse
- Both input lines are fused at 25 Amps
- Storage temperature: -40°C to 125°C
- Operating temperature: -20°C to 65°C
- Temperature accuracy and hysteresis: 2°C
- Weight: 1.25 lb.. (567 grams)
- Weight with cover: 1.90 lb.. (862 grams)
- RoHS (6/6) compliant
- Agency approvals pending

FEATURES

- Controls fan/motor speed based on:
 - 4-20 mA control signal
 - 2-10 VDC control signal
 - UP to three remote temperature sensors (supplied separately)
 - Dual control option (i.e. temperature and humidity)
- Programmable temperature control mode options:
 - Four full speed temperature settings
 - Two control temperature slopes
 - Four idle speed settings
- Programmable fan/motor turn off at idle
- 64 fixed speed settings
- Remote alarm signal to indicate loss of control signal or over temperature condition
- Optional steel cover

SmartFan® Nimbus-HP

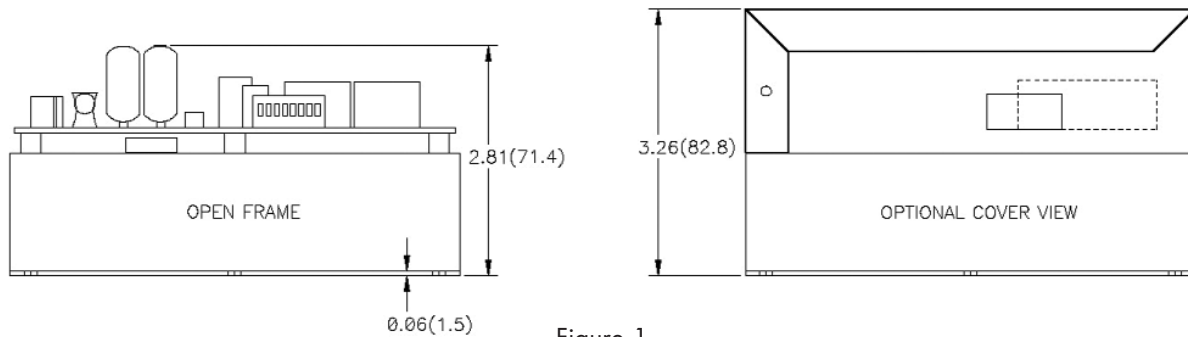
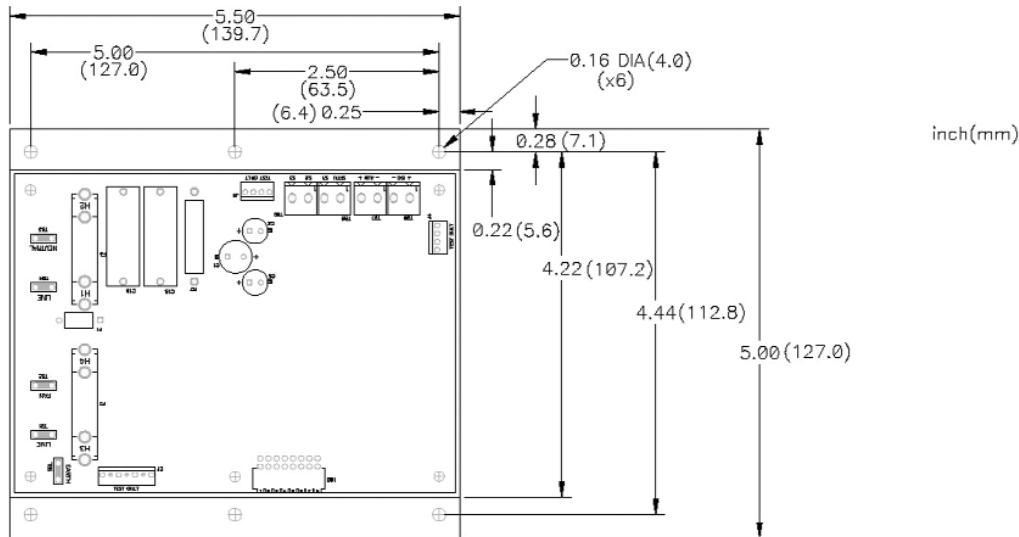


Figure 1

Table 1: PART NUMBERING

Part No.	Power Source	Output Power Rating at 65°C	Enclosure
TRC1800-F	85 to 300 VAC	18 Amps	No
TRC1800E-F			Yes



CONFIRM FAN/MOTOR COMPATIBILITY

Confirm TRIAC (voltage control) compatibility with the fan/motor manufacturer before installation. Attempting to control a motor that is not compatible could cause excessive heating and permanent damage.

SETTING CONTROL MODES (switches #7, 8)

Unless otherwise specified, the Nimbus-HP is factory set to control fans in the Temperature Control mode. To control via a current or voltage source, remote powered transducer or fixed speed setting, set switches 7 and 8 as shown below, then refer to the control mode section you have selected to customize the Nimbus-HP for your application.

Control Via	DIP switch	
	7	8
Current or Voltage	ON	OFF
Remote Powered Transducer	OFF	ON
Temperature	OFF	OFF
Fixed Speed	ON	ON

USING CURRENT OR VOLTAGE CONTROL MODE

Unless otherwise specified, the Nimbus-HP is factory set to control fans in the "Temperature Control" mode. To switch to controlling fan speed via a "Control Signal", refer to table 2. Select the type of control signal you are using [**I** for 0-20mA (30mA Max.) or **V** for 0-10VDC (12VDC max.)] using the jumper on header J2. The Nimbus-HP can also be customized to accept other control schemes, contact customer service for details.

Setting Idle Speed (switch #2, 3)

The idle speed is the minimum voltage (as a % of supply voltage) supplied to the fan. The Nimbus-HP is factory set for idle speeds of 30, 40, 50 and 60% by setting DIP switches 2 and 3. The default idle setting is 50%. Other idle speeds can be supplied, contact customer service for details.

% of supply Voltage	DIP switch	
	2	3
30%	ON	OFF
40%	OFF	ON
50%	OFF	OFF
60%	ON	ON

Fan On / Fan Off Feature (switch #1)

To turn fan(s) off below the set idle speed (see table 3), set switch #1 to the ON position. To keep fans running at idle speed below the set idle speed, set switch #1 to the OFF position.

Control Signal Loss Options (switch #6)

If the control signal is lost, (less than 4mA in **I** mode, less than 2VDC in **V** mode) when switch 6 is OFF, fans will continue to idle or remain off. To send fans to full speed if the control signal is lost, set switch 6 to the ON position.

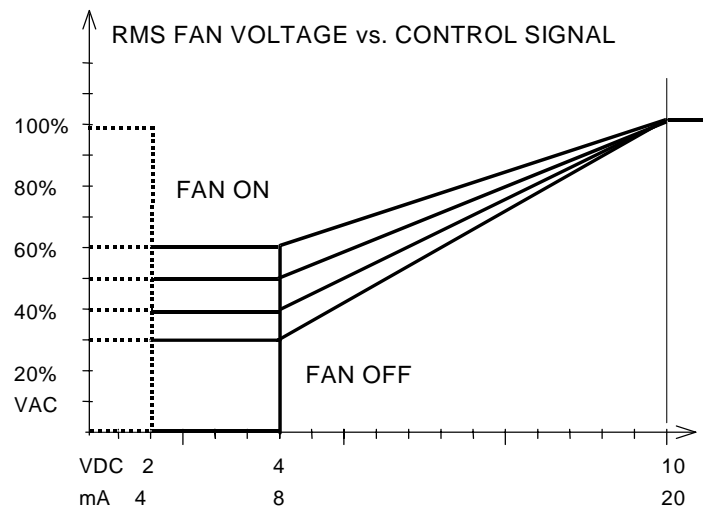


Figure 2

USING TEMPERATURE CONTROL MODE

The Nimbus-HP can automatically control temperature (air, liquid or surface) by proportionately increasing or decreasing fan speed as required. Up to 3 sensors can be used to sense temperature. When more than one sensor is used, the hottest sensor will control fan speed. To set the Nimbus-HP to temperature control mode refer to table 2.

Control Temperature (switch #4, 5)

The control temperature is the point above which fans will run at full speed (T_C). The Nimbus-HP is factory set to control fans at 30, 35, 40 or 45°C by setting DIP switches 4 and 5 (see table 4). The default setting is 35°C. Other temperature setting can be supplied, contact customer service for details.

Control Temperature (T_C)		DIP switch	
T_C ($^{\circ}C$)	T_C ($^{\circ}F$)	4	5
30	86	OFF	ON
35	95	OFF	OFF
40	104	ON	OFF
45	113	ON	ON

Setting Idle Speed (switch #2, 3)

The idle speed is the minimum voltage (as a % of supply voltage) supplied to the fan. The Nimbus-HP is factory set for idle speeds of 30, 40, 50 and 60% by setting DIP switches 2 and 3, see table #3. The default setting is 50%. Other idle speeds can be supplied, contact customer service for details. See figure 3.

Temperature Slope (switch #6)

The temperature slope (T_S) is the temperature difference between idle speed and full speed. The slope can be set at $4^{\circ}C$ or $10^{\circ}C$ by using DIP switch #6. The default setting is $4^{\circ}C$. Other slopes can be supplied, contact customer service for details. See figure 3.

Temp. Slope (T_S)		DIP switch
T_S ($^{\circ}C$)	T_S ($^{\circ}F$)	6
4	7	OFF
10	18	ON

Fan On / Fan Off Feature (switch #1)

To turn fans off automatically when temperatures drop below the set idle temperature ($T_C - T_S$), set switch #1 to the ON position. To keep fans running at idle speed below the set idle temperature, set switch #1 to the OFF position. See figure 3.

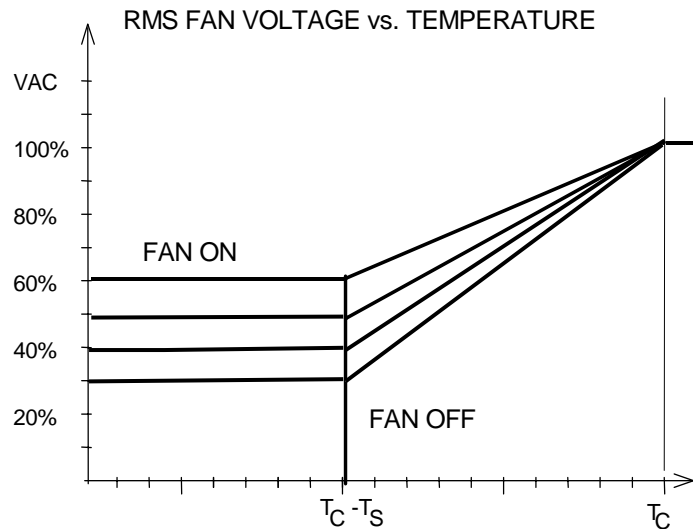


Figure 3

USING REMOTE POWERED TRANSDUCER MODE

When used in the remote transducer mode, the Nimbus-HP can power and control from most 0-5VDC transducers (humidity, pressure, flow etc.) with a maximum supply current of 5mA. To set the Nimbus to remote transducer mode, see table 2.

Setting Control Parameters (switch #3, 4, 5, 6)

To customize the control slope to your transducer, use DIP switches 3 & 4 to set idle or minimum speed voltage, use switches 5 & 6 to set full speed control voltage. See table 6 and figure 4 for details.

DIP switch		VDC (min)	Dip Switch		VDC (max)
3	4		5	6	
OFF	OFF	0.5	OFF	OFF	3.0
ON	OFF	1.0	ON	OFF	3.5
OFF	ON	1.5	OFF	ON	4.0
ON	ON	2.0	ON	ON	4.5

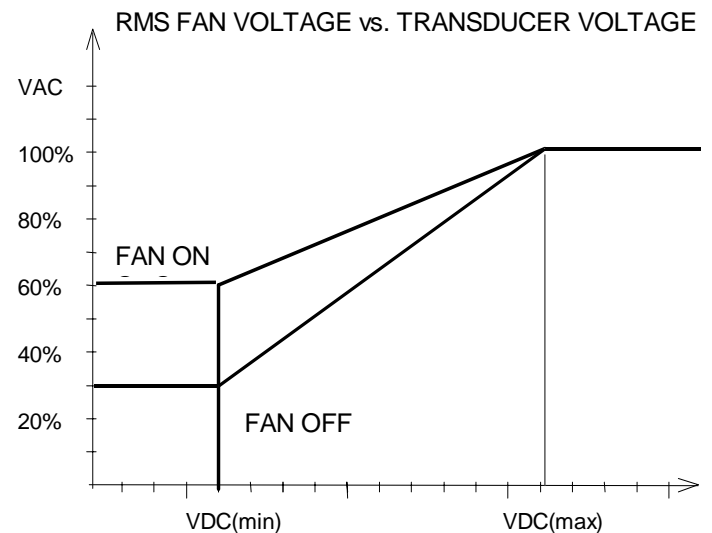


Figure 4

Fan On / Fan Off Feature (switch #1)

To turn fans off automatically when transducer voltage drops below VDC (min), set switch #1 to the ON position. To keep fans running at idle speed below the VDC (min), set switch #1 to the OFF position. See figure 4.

Setting Idle Speed (switch #2)

The idle speed is the minimum voltage (as a % of supply voltage) supplied to the fan. When used in the remote transducer mode, the Nimbus-HP can be set for idle speeds of 30% by setting DIP switch #2 to OFF or 60% by setting DIP switch #2 to ON. Other idle speeds can be supplied, contact customer service for details. See figure 4.

USING FIXED SPEED MODE

Automatic speed control can be overridden in the fixed speed mode. To set the Nimbus-HP to fixed speed mode, see table 2. In the fixed speed mode, the user can select motor voltages from 27% to 99% (in 1% or 2% increments) of supply voltage using DIP switches 1 through 6, see table 7 below.

% voltage	DIP switch settings					
	1	2	3	4	5	6
27%	OFF	OFF	OFF	OFF	OFF	OFF
28%	ON	OFF	OFF	OFF	OFF	OFF
30%	OFF	ON	OFF	OFF	OFF	OFF
32%	ON	ON	OFF	OFF	OFF	OFF
33%	OFF	OFF	ON	OFF	OFF	OFF
35%	ON	OFF	ON	OFF	OFF	OFF
36%	OFF	ON	ON	OFF	OFF	OFF
37%	ON	ON	ON	OFF	OFF	OFF
39%	OFF	OFF	OFF	ON	OFF	OFF
40%	ON	OFF	OFF	ON	OFF	OFF
41%	OFF	ON	OFF	ON	OFF	OFF
42%	ON	ON	OFF	ON	OFF	OFF
43%	OFF	OFF	ON	ON	OFF	OFF
44%	ON	OFF	ON	ON	OFF	OFF
45%	OFF	ON	ON	ON	OFF	OFF
47%	ON	ON	ON	ON	OFF	OFF
48%	OFF	OFF	OFF	OFF	ON	OFF
49%	ON	OFF	OFF	OFF	ON	OFF
50%	OFF	ON	OFF	OFF	ON	OFF
51%	ON	ON	OFF	OFF	ON	OFF
53%	OFF	OFF	ON	OFF	ON	OFF
54%	ON	OFF	ON	OFF	ON	OFF
55%	OFF	ON	ON	OFF	ON	OFF
56%	ON	ON	ON	OFF	ON	OFF
57%	OFF	OFF	OFF	ON	ON	OFF

% voltage	DIP switch settings					
	1	2	3	4	5	6
58%	ON	OFF	OFF	ON	ON	OFF
60%	OFF	ON	OFF	ON	ON	OFF
61%	ON	ON	OFF	ON	ON	OFF
62%	OFF	OFF	ON	ON	ON	OFF
63%	ON	OFF	ON	ON	ON	OFF
64%	OFF	ON	ON	ON	ON	OFF
65%	ON	ON	ON	ON	ON	OFF
67%	OFF	OFF	OFF	OFF	OFF	ON
68%	ON	OFF	OFF	OFF	OFF	ON
69%	OFF	ON	OFF	OFF	OFF	ON
70%	ON	ON	OFF	OFF	OFF	ON
71%	OFF	OFF	ON	OFF	OFF	ON
72%	ON	OFF	ON	OFF	OFF	ON
74%	OFF	ON	ON	OFF	OFF	ON
75%	ON	ON	ON	OFF	OFF	ON
76%	OFF	OFF	OFF	ON	OFF	ON
77%	ON	OFF	OFF	ON	OFF	ON
78%	OFF	ON	OFF	ON	OFF	ON
79%	ON	ON	OFF	ON	OFF	ON
80%	OFF	OFF	ON	ON	OFF	ON
81%	ON	OFF	ON	ON	OFF	ON
82%	OFF	ON	ON	ON	OFF	ON
83%	ON	ON	ON	ON	OFF	ON
84%	OFF	OFF	OFF	OFF	ON	ON
85%	ON	OFF	OFF	OFF	ON	ON
86%	OFF	ON	OFF	OFF	ON	ON
87%	ON	ON	OFF	OFF	ON	ON
88%	OFF	OFF	ON	OFF	ON	ON
89%	ON	OFF	ON	OFF	ON	ON
90%	OFF	ON	ON	OFF	ON	ON
91%	ON	ON	ON	OFF	ON	ON
92%	OFF	OFF	OFF	ON	ON	ON
93%	ON	OFF	OFF	ON	ON	ON
94%	OFF	ON	OFF	ON	ON	ON
95%	ON	ON	OFF	ON	ON	ON
96%	OFF	OFF	ON	ON	ON	ON
97%	ON	OFF	ON	ON	ON	ON
98%	OFF	ON	ON	ON	ON	ON
99%	ON	ON	ON	ON	ON	ON

MOUNTING

The Nimbus-HP is supplied with six 0.16" D mounting holes suitable for #6 screws. Use at least 4 screws to mount the Nimbus-HP. See figure 1.

CONNECTIONS

WARNING: Dangerous voltages are present on the circuit board when connected to the power line. Power must be removed before making any connections or adjustments to avoid electrical shock or damage to the unit.

Power Connections

It is recommended that an adequately sized circuit breaker be connected between the power service and the Nimbus-HP to permit fail-safe removal of power before making adjustments or connections.

Power connections are made through ¼" x .032" spade lugs (TB3, TB4) located on the circuit board. Use insulated quick connects to connect to the spade lugs. When installing Nimbus-HP with the enclosure, connect fan and power wires through the 0.813" D hole in the side of enclosure and secure with a strain relief.

The Nimbus HP is not compatible with Uninterruptible Power Supplies (UPS) that generate a square wave.

Fan Connections

Fan connections are made through ¼" x .032" spade lugs (TB1, TB2) located on the circuit board. Use insulated quick connects to connect to the spade lugs. Any number of fans may be connected in parallel as long as the total current does not exceed the output power rating. See table 1.

When installing Nimbus-HP with the enclosure (TRC18XXE-F), connect fan and power wires through the 0.813" D hole in the side of the enclosure and secure with a strain relief.

Temperature Sensor Selection and Connection

The Nimbus-HP will accept signals from up to 3 temperature sensors and control fan speed based on the hottest sensor. Choose an air, surface or liquid temperature sensor from the CRI catalog or website at www.controlres.com. Each sensor, S1, S2, S3 shares a common return marked SRTN. **CAUTION: SRTN is a non-isolated input; use CRI sensor P11-F (jacketed cable) if the sensor is accessible.**

Connect the sensor wires through the 0.813" D hole in the side of the enclosure and secure with a strain relief. When fewer than 3 sensors are used, sensors may be hooked up to S1, S2 or S3. In "Temperature Mode", if no sensors are connected or all sensors read below -25°C, fans will run at full speed and the temperature alarm will activate.

The Nimbus-HP can also be supplied with a board mount sensor, contact customer service for details.

Remote Powered Transducer Connections

When used in the remote transducer mode, the Nimbus-HP can power and control from any 0-5VDC transducer (humidity, pressure, flow etc.) with a maximum supply current of 5mA. Connect the + lead to SRTN, connect - to S1, connect Vout to S2.

Refer to "USING REMOTE POWERED TRANSDUCER MODE" section to set control parameters for your transducer.

Over Temperature and Loss of Signal Alarm Connection

When used in the temperature control mode, (see table 1) an over-temperature alarm can be triggered when the temperature goes 10°C (18°F) above the control temperature (T_c) or below -25°C. When used in the Voltage or Current signal mode a "loss of signal" alarm can be triggered when DIP switch #6 is in the ON position. Alarm connections are made at -ALM+

The alarm output is a normally open, optically isolated MOS Relay. When no alarm condition is present, the relay is closed and can conduct up to 100 mA (AC or DC) of load current. When the alarm is triggered, the relay opens, and can support up to 300 Volts (AC or DC) across its terminals. Other alarm trigger points can be supplied, contact customer service for details. See figure 5, 5a, 5b or 5c for possible alarm configurations.

Current or Voltage Control Signal Connections

When used in the current or voltage control mode (see table 1), connect a 0-10VDC or 0-20mA control signal to -ISO+ as shown in figure 5

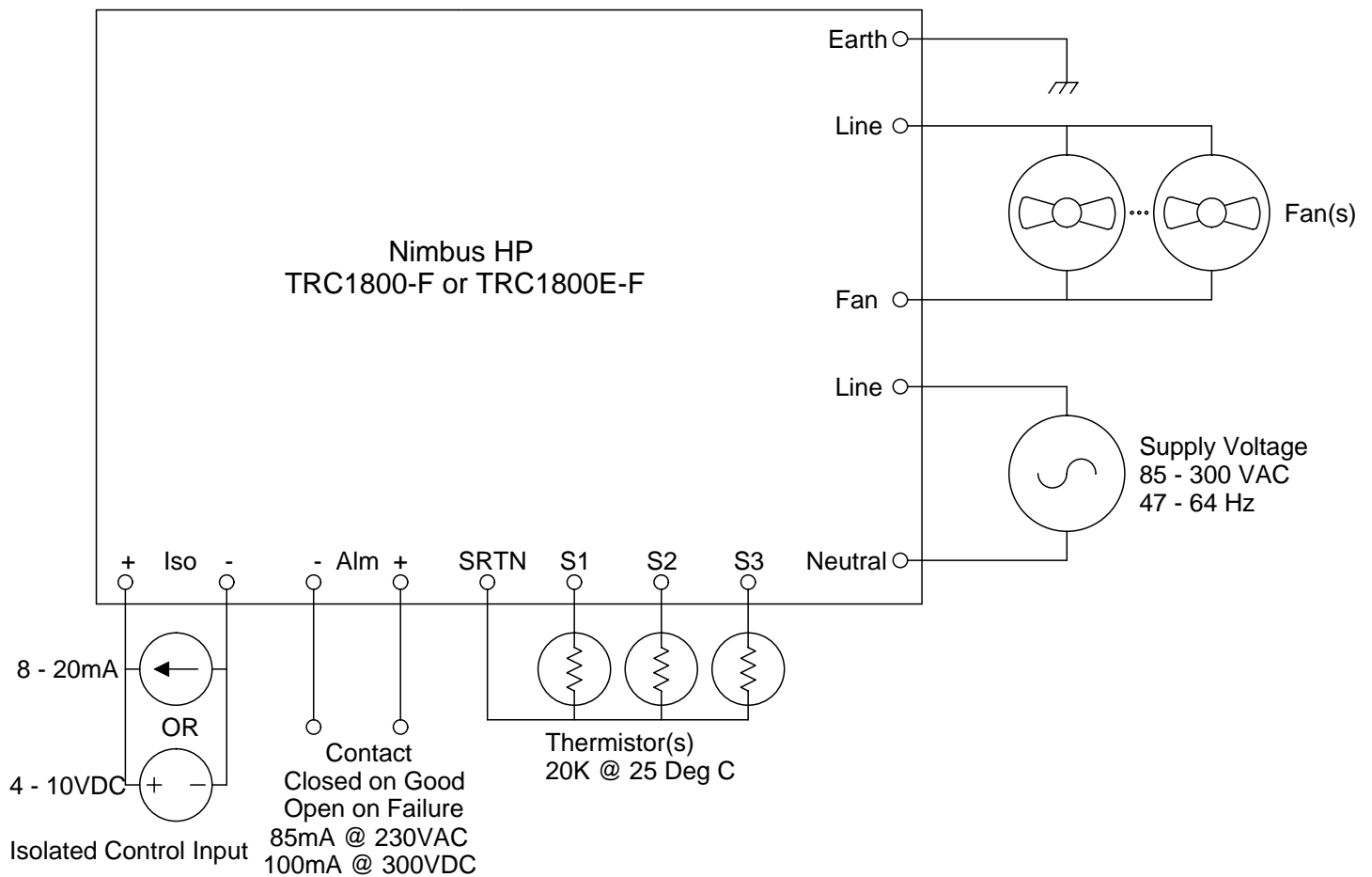


Figure 5: Wiring Diagram

Pin-out		
Board Reference	Description	
L: TB3	Line Power	¼" X .032" Spade Lug
N: TB4	Line Power	
L: TB1	Fan	
F: TB2	Fan	
SRTN-: TB5 (pin 1)	Sensor (return)	Terminal Block 14 – 24 AWG Screw Clamp
S1: TB5	Sensor #1	
S2: TB5	Sensor #2	
S3: TB5	Sensor #3	
- ALM: TB6 (pin 1)	- Temp. Alarm	
ALM +: TB6	+ Temp. Alarm	
- ISO: TB6	- Control Signal	
ISO +: TB6	+ Control Signal	

TESTING & TECHNICAL DATA

Fan/Motor Compatibility: The Nimbus-HP is compatible with many PSC (Permanent Split Capacitor) and shaded pole motors. The Nimbus-HP is not compatible with capacitor start motors. **Confirm TRIAC controllability with the motor manufacturer before installation or contact CRI customer service for testing recommendations. Attempting to control a motor that is not compatible could cause excessive heating and could permanently damage the motor.**

Control Accuracy and Hysteresis: The standard Nimbus-HP is accurate to within $\pm 1.5^{\circ}\text{C}$ in the temperature control mode and $\pm 0.4\text{VDC}$, $\pm 0.8\text{mA}$ in the control signal mode. If your application requires greater accuracy, contact customer service. For most single-phase AC fans, there is direct correlation between speed and voltage. For some fans however, this will not be the case. To prevent fans (using fan ON/OFF feature) and alarms from cycling on and off, a certain amount of hysteresis has been built in to the Nimbus-HP. That is, fans will shut off 2-3% below the set point and turn back on 2-3% above the set point. Alarms will turn on at the set point and turn off 1-2 $^{\circ}\text{C}$ below or 5% above the set point.

Voltage Loss: For a typical fan, expect a voltage drop to the fan of about 4-10% at full voltage.

Changing Control Settings: With the exception of the “fixed speed mode”, the Nimbus-HP will not recognize any changes in switch or jumper settings made with power applied. Power must be turned OFF before changing any switch or jumper settings.

Minimum Motor currents: Motors may not control properly if the total current draw is less than 1 Amp.

Maximum Motor currents: Some motors draw higher current at less than maximum voltage. Contact motor manufacturer for details.

Start Pulse: Some fans that run at lower voltages will not start at these voltages; therefore the Nimbus-HP will start at full voltage for 2 seconds before regulating to the appropriate control speed.

EMI: The amount of electrical noise emitted by the Nimbus-HP increases as speed decreases. The amount of noise emitted is motor dependant. If the electrical noise is an issue, an AC Input Line Filter can be used. CRI recommends the following line filters from www.filterconcepts.com or equivalent.

Emissions class	120/230 VAC	277 VAC
EN55011, class A	Not Required	Not Required
EN55011, class B	LE Series	LH Series
FCC 47CFR part 15, class B	LX Series	LH Series

Specifications:

- **Power source: 85 to 300 VAC**
- **Frequency: 47 to 64 Hz**
- **Maximum current rating: 18 Amps**
- **Minimum load required: 1 Amp**
- **Fusing: 25 Amps at both inputs**
- **Operating temperature: -25 $^{\circ}\text{C}$ to 65 $^{\circ}\text{C}$**
- **Storage temperature: -40 $^{\circ}\text{C}$ to 125 $^{\circ}\text{C}$**
- **Relative humidity: 95% non-condensing**
- **Weight (no cover): 1.25 lb (567 grams)**
- **Weight (with cover): 1.90 lb (862 grams)**
- **RoHS (6/6) compliant**
- **Agency approvals pending**

Control Resources has been a leading provider of off-the-shelf and custom fan controls and alarms since 1984. Control Resources can offer DC Speed Controls, Fan Alarms, AC Speed Controls, Fan Trays and Power Supplies. With in-house ISO 9001 design and manufacturing capabilities, CRI is the One-Stop-Shop for all your thermal design needs. For information on other CRI products, see our website at www.controlres.com or contact Control Resources, Inc.