New from Control Resources

SmartFan® Nimbus, AC Fan Control

PRELIMINARY 091602 PRELIMINARY

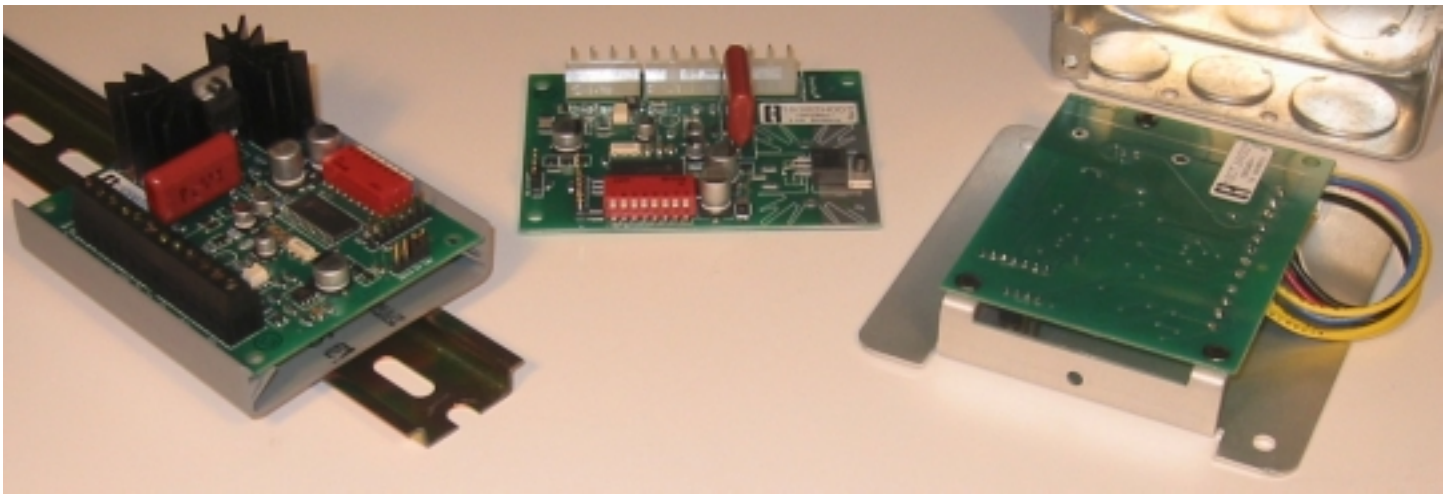

Fig. 1: CRI #240B6T00 with DIN350 DIN rail mount kit sold separately.

Fig. 2: CRI #240B2H00

Fig. 3: CRI #240BJW00 with 4x4 Job Box (not supplied) in background.

SmartFan® Nimbus is a compact, TRIAC based fan control designed for the HVAC, electronics and industrial controls markets. The Nimbus can automatically control nearly any single phase AC fan used in applications such as; humidity control, clean room pressurization, equipment cooling, ceiling fans, exhaust ventilators, duct fans & blowers. The Nimbus regulates fan speed from a 0-20mA control signal, 0-10VDC control signal or up to 3 remote temperature sensors. Automatic voltage and frequency detection, current ratings up to 7.5A and 3 mounting and connection configurations, including DIN rail mount and "4x4 job box" mount, make this microprocessor based design extremely flexible and economical. **Benefits of using SmartFan include acoustical noise reduction, environmental (humidity, temperature or pressure) regulation, greater product reliability, increased fan life, improved safety and energy savings.**

FEATURES & OPTIONS

Features

- Controls fan speed based on:
  - ✓ 0-20mA control signal or
  - ✓ 0-10VDC control signal or
  - ✓ Remote temperature sensors (supplied separately)
- Power source: 95 – 265VAC, automatically detected.
- Frequency: 50-60Hz, automatically detected.
- Fan On/Fan Off threshold selectable by DIP Switch.
- AC Motor Type Compatibility: PSC or Shaded Pole, Automatically detected.
- Full voltage start pulse
- ULc recognition pending.

Selectable Options

- Current ratings: 2.5A, 6A, 7A, 7.5A (at 40°C still air)
- Mounting Options: PCB mount, DIN Rail mount, 4x4 electrical job box mount.
- Connections: Terminal Block, Header, 18 AWG wires.
- Selectable control temperatures, 30˚C(86˚F), 35˚C(95˚F), 40˚C(104˚F), 45˚C(113˚F) standard, other temperatures available.
- Temperature alarm.
- Accepts up to 3 temperature signals
- Keyed mounting holes
- Selectable idle speeds and control temperature slope

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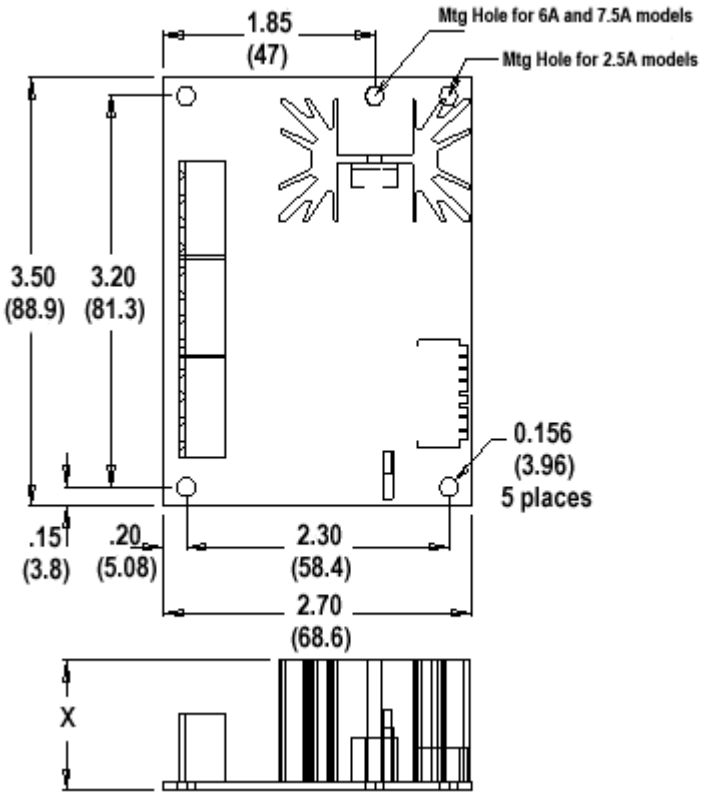
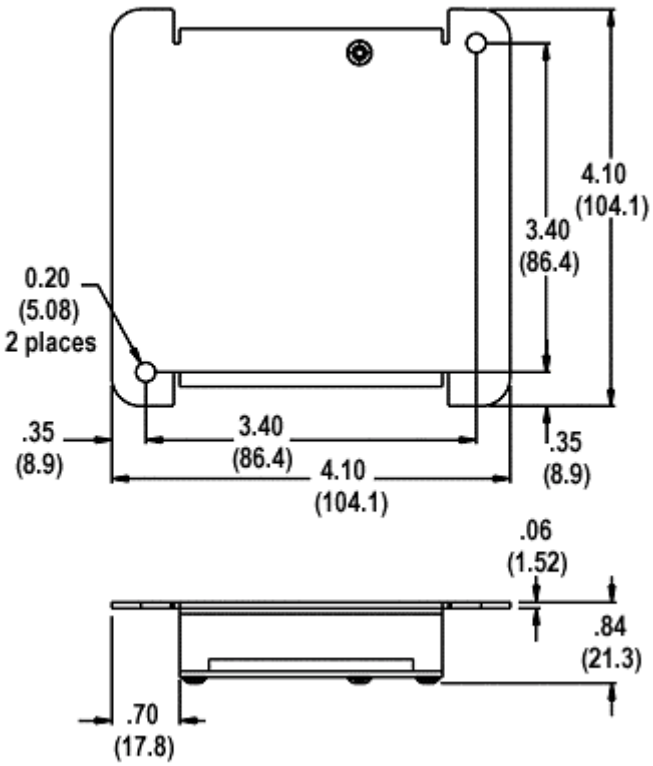


X = 0.86(21.8) at 2.5A
X = 1.06(26.9) at 6A
X = 2.06(52.3) at 7.5A
Figure 4



Electrical job box mount style CRI# 240xJWxx
Figure 5

Table 1: Part Numbering System				
Max. Voltage	**[1]Control Mode**	**[3]Current Rating / Packaging**	**Connector**	**Special Features**
240	V = [2]Signal T = [2]Temperature B = Both Temp & Signal present	2 =.15 to 2.5A 6 =.50 to 6.0A 7 =.50 to 7.5A J =.50 to 7A / Job Box	T = Terminal Block H = Header W = 18awg wires	00 = standard

Stock Product:
240B2T00
240B6T00 (Fig. 1)
240B2H00 (Fig. 2)
240BJW00 (Fig. 3)

1. When used in the temperature control mode, a temperature sensor (sold separately) is required. Choose an air, surface or liquid sensor, P1 – P9 from the CRI catalog or website at www.controlres.com.
2. A minimum order of 50 units is required to supply V or T models.
3. 40°C, still air, max current rating. Note: some motors draw higher current at less than maximum voltage. Contact motor manufacturer for details.

DIN Rail Option (Fig 1):

Units supplied in circuit board form; 2.5A, 6A and 7.5A may be mounted on a DIN rail using **DIN rail kit CRI #DIN350**.

USING CONTROL SIGNAL MODE (switch #7)

The Nimbus is factory set to control fans in the "Temperature Control" mode. To switch to controlling fan speed via a "Control Signal", place switch #7 in the ON (down) position. Select the type of control signal you are using [**I** for 0-20mA (30mA Max.) or **V** for 0-10VDC (15VDC max.)] with the jumper on header J1. The Nimbus 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 is factory set for idle speeds of 30, 40, 50 and 60% by setting DIP switches 2 and 3. The default setting is at 50%. Other idle speeds can be supplied, contact customer service for details.

Table 2: Idle Speed DIP Switch Settings

% of supply Voltage	DIP switch SW1	
	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 above), set switch #1 to the ON (down) position. To keep fans running at idle speed below the set idle speed, set switch #1 to the OFF position.

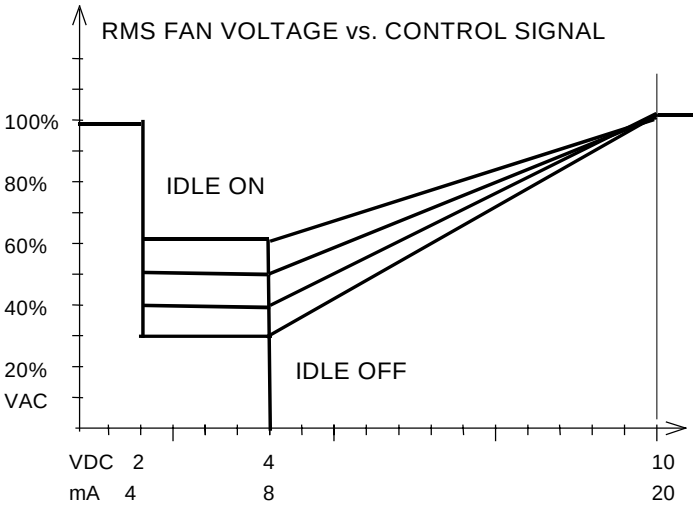


Figure 6

USING TEMPERATURE CONTROL MODE (switch #7)

The Nimbus can automatically control fan speed by sensing temperature (air, liquid or surface) and increase or decrease fan speed proportionatly. 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 control fans using one or more temperature sensors, place SW1 switch #7 in the OFF (up) position.

Control Temperature (switch #4,5)

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

Table 3: Control Temperature DIP Switch Settings

Control Temperature (T_C)		DIP switch SW1	
T_C (˚C)	T_C (˚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 is factory set for idle speeds of 30, 40, 50 and 60% by setting DIP switches 2 and 3, see table #2. The default setting is at 50%. Other idle speeds can be supplied, contact customer service for details. See figure 7.

Temperature Differential (switch #6)

The temperature differential (T_D) is the temperature difference between idle speed and full speed. The differential can be set at 4˚C or 10˚C by using DIP switch #6. The default setting is 4˚C. Other differentials can be supplied, contact customer service for details. See figure 7.

Table 4: Temperature Differential DIP Switch Settings

Temp. Differential (T_D)		DIP SW1
T_D (˚C)	T_D (˚F)	6
4	7	OFF
10	18	ON

Fan On / Fan Off Feature (switch #1)

To turn fan off automatically when temperatures drop below the set idle temperature ($T_C - T_D$), set switch #1 to the ON (down) position. To keep fans running at idle

speed below the set idle temperature, set switch #1 to the OFF position. See figure 7.

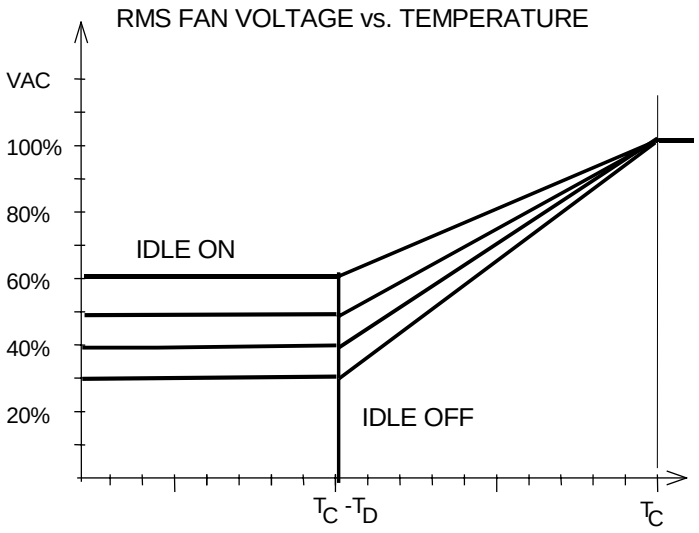


Figure 7

MOUNTING

Electrical "job box" mount

The Nimbus can be supplied in circuit board form or ready to mount in a standard 4x4x1.5 electrical job box. When supplied in the job box form, part number 240_JW__ , connections are made through 4.0" (10cm), 18AWG wires. Wires should be terminated using wire nuts (not included) according to local electrical codes. See Figure 3 and Figure 5.

Circuit board form

When supplied in the circuit board form; 2.5A, 6A and 7.5A, a spacing of ¼" (6.3mm) should be maintained between the circuit board and chassis ground and 5/16" (8mm) to any uninsulated secondary circuits to satisfy safety agency requirements. See Figure 4.

DIN Rail Option (Fig 1):

Units supplied in circuit board form; 2.5A, 6A and 7.5A may be mounted on a DIN rail using **DIN rail kit CRI #DIN350**.

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 control to permit fail-safe removal of power before making adjustments or connections. Connect line power (white) to location N. Connect line power (black) to location L. For electrical "job box" mount version (240_JW__) secured ground (green) wire to steel electrical box or consult local electrical code.

Fan Connections

Connect fan or fans to positions marked F (red) and L (black). Any number of fans may be controlled in parallel from one unit as long as the current total does not exceed the current rating. See table 1 and figure 8.

Temperature Sensor Selection and Connection

The Nimbus will accept signals from up to 3 temperature sensors and control fan speed based on the hottest sensor. Choose P11 air sensor, P3 or P8 surface sensor or P7 liquid sensor from the CRI catalog or website at www.controlres.com. Each sensor, T1, T2, T3 shares a common return marked T-. **CAUTION: T- is a non-isolated input; consult local electrical codes if installing temperature sensors in a dwelling**. When fewer than 3 sensors are used, sensors may be hooked up to T1, T2 or T3. If no sensors are connected (when switch #7 is in "Sensor mode") or all sensors read below -25°C, fans will run at full speed and the temperature alarm is activated. Nimbus can also be supplied with a board mount sensor, contact customer service for details. See wiring diagram, figure 8.

Temperature & Signal alarms

When used in the temperature control mode (switch 7 off), an over-temperature alarm can be triggered by connecting to –ALM+. In Control Signal mode (switch 7 on) a "lose of signal" alarm is triggered 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 temperature goes 10˚C (18˚F) above the control temperature (T_C) or below -25°C, 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 8.

Control Signal

When used in the "control signal" mode (switch #7 on), connect 0-10VDC or 0-20mA signal to –ISO+ as shown in figure 8. If the control signal is lost (below 2VDC or below 5mA), fans will run at full speed.

Figure 8: NIMBUS Wiring Diagram

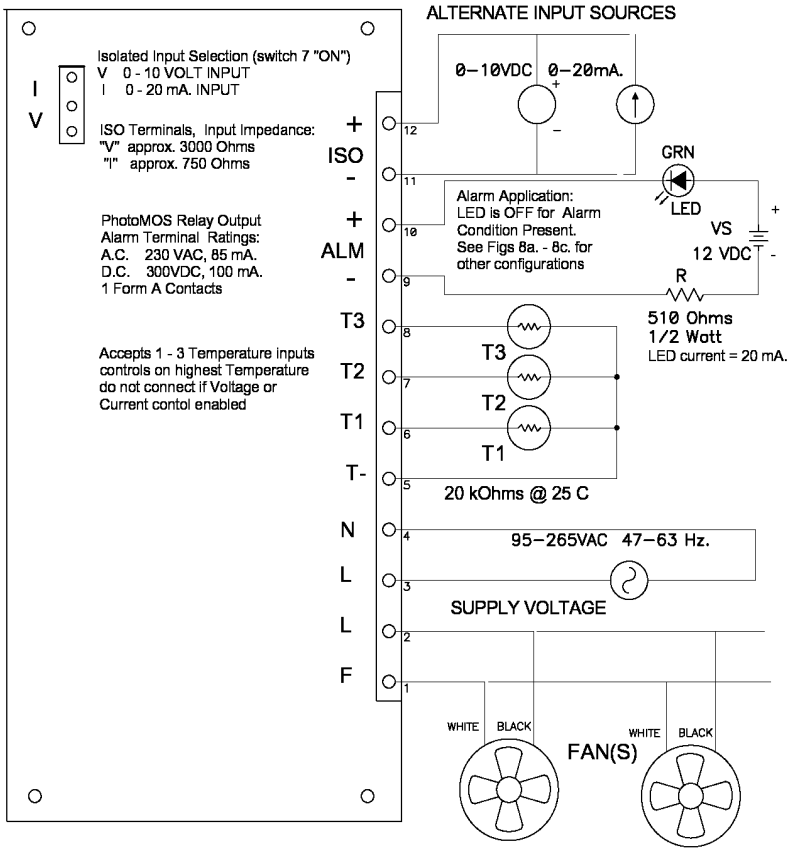


Figure 8: Wiring Diagram

Figures 8a. - 8c. : Examples of Alternate Alarm Configurations

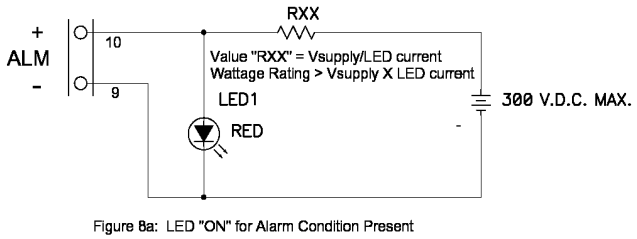


Figure 8a: LED "ON" for Alarm Condition Present

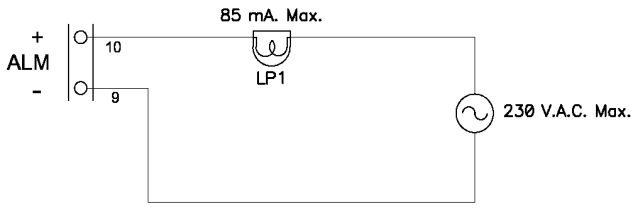


Figure 8b: A.C. Lamp "OFF" for Alarm Condition Present

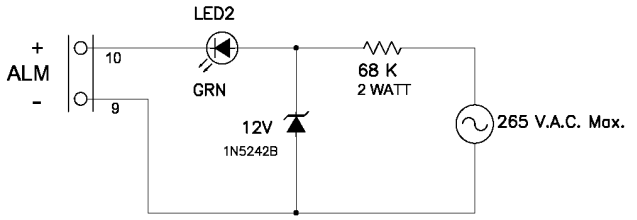


Figure 8c: High Voltage AC Driving LED, "OFF" for Alarm Condition Present

Table 5: Pin-out and Connection Options

Pin-outs		Connection Options		
Board Reference	Description	Terminal Block (T)	4"(100mm) Wire (W)	Header (H)
F:TB1 (pin 1)	Fan	14 – 24 AWG Screw Clamp	18 AWG Red	4 pin .200" Pitch Molex 10-32-1041
L: TB1	Fan		18 AWG Black	
L: TB1	Line Power		18 AWG Black	
N: TB1	Line Power		18 AWG White	
T-: TB2 (pin 1)	Thermistor (common)		18 AWG Brown	4 pin .200" Pitch Molex 10-32-1041
T1: TB2	Thermistor #1		18 AWG Orange	
T2: TB2	Thermistor #2		18 AWG Orange	
T3: TB2	Thermistor #3		18 AWG Orange	
- ALM: TB3 (pin 1)	- Temp. Alarm		18 AWG Blue	4 pin .200" Pitch Molex 10-32-1041
ALM +: TB3	+ Temp. Alarm		18 AWG Yellow	
- ISO: TB3	- Control Signal		18 AWG Violet	
ISO +: TB3	+ Control Signal		18 AWG Gray	

TESTING & TECHNICAL DATA

Fan Compatibility: Not all AC fans are phase (TRIAC) controllable. Confirm controllability with the fan manufacturer before installation or contact CRI customer service for testing recommendations. Attempting to control a fan that is not compatible could cause excessive heating and could permanently damage the fan motor.

Control Accuracy and Hysteresis: The standard Nimbus is accurate to within ±1.5˚C in the temperature control mode and ±0.4VDC, ±0.8mA 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 fan 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. 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°C below or 5% above the set point.

Voltage Loss: For a typical fan, expect a voltage drop to the fan of about 2-3% at full voltage.

Changing Control Settings: The Nimbus 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 fan currents: Fans may not control properly if the total fan current is less than the minimum published current, see table 1.

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

EMI: The amount of electrical noise emitted by the Nimbus increases as fan speed decreases. The amount of noise emitted is fan dependant. If the electrical noise is an issue, try another fan or request a sample of the Control Resources, AC-VX Fan Control (EMI filter built in).

Current Derating: The Nimbus may be run above 40˚C. However, the maximum current ratings will decline according the chart below.

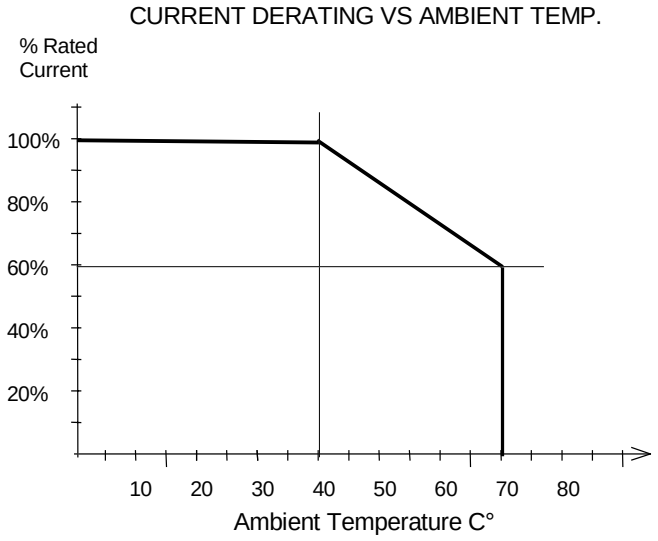


Figure 9

Specifications:

- **Power Source: 95 – 265VAC**
- **Frequency: 47-64Hz**
- **Current Ratings: see table 1**
- **Storage Temperature: -40˚C to 125˚C**
- **Operating Temperature: -25˚C to 70˚C**
- **Humidity: 5 to 95%, Non-condensing**

Control Resources has been a leading provider of off-the-shelf and custom fan controls and alarms since 1984. Control Resources can offer Thermal Analysis Services, DC Speed Controls, AC Speed Controls, Temperature Alarms, Tach Alarms and Fan Trays. 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.

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