Enclosure Heating and Heater Selection

Why Heat an Enclosure?

Today's miniaturization of enclosure components results in high packing densities, which in turn results in higher temperatures within the enclosure. These high temperatures are harmful to electronic components. In response, cooling systems have become standard in many applications. However, just as critical and widely underestimated, are failures caused by the formation of moisture.

Under certain climatic conditions, moisture can build up not only in outdoor or poorly insulated enclosures, but also in highly protected and well-sealed enclosures.

Moisture and Failure

Moisture, especially when combined with aggressive gases and dust, causes atmospheric corrosion and can result in the failure of components such as circuit breakers, busbars, relays, integrated circuit boards and transformers. The greatest danger lies in conditions where electronic equipment is exposed to relatively high air humidity or extreme variations in temperature, such as day-and-night operation or outdoor installation. Failure of components in such cases is usually caused by changing contact resistances, flashovers, creepage currents or reduced insulation properties.

Eliminate Moisture

Moisture and corrosion will remain low if relative air humidity stays below 60%. However, relative humidity above 65% will significantly increase moisture and corrosion problems. This can be prevented by keeping the environment inside an enclosure at a temperature as little as 9°F (5°C) higher than that of the ambient air. Constant temperatures are a necessity to guarantee optimal operating conditions. Continuous temperature changes not only create condensation but they reduce the life expectancy of electronic components significantly. Electronic components can be protected by cooling during the day and heating at night.

Thermal Management

Modern enclosure heaters are designed to protect against condensation. They heat the air inside enclosures, preventing water vapor from condensing on components while providing the greatest possible air circulation and low energy consumption.

Other heating element technology improvements include:

- Longer operating life
- Greater energy efficiencies
- Quick wiring options
- Easier mounting
- Fan heaters should be considered for larger enclosures to ensure that the entire enclosure is heated uniformly

Heater Location

Ideally, most heaters will perform optimally when mounted near the bottom of an enclosure and used in conjunction with a control device, thermostat, and/or hygrostat. The control device may be a separate device, or it may be integral to the heater. With the controller located in an area of the cabinet that is representative of the average temperature or humidity requirement, the heater should then be placed in a position near the bottom of the enclosure. If a separate control device is used, the heater should not be located directly beneath the controller to ensure that the controller is not influenced by direct heat from the heater.

Heater Calculation

Follow Steps 1-5 to determine the heating requirement of an enclosure (US units - left column, metric - right)

STEP 1: Determine the Surface Area (A) of your enclosure which is exposed to open air.

Enclosure Dimensions:

height =_____feet _____meters

width =_____feet _____meters

depth =_____feet _____meters

Choose Mounting Option from next page, and calculate the surface area as indicated

A = _____ ft2 or _____ m2

STEP 2: Choose the Heat Transmission Coefficient (k) for your enclosure's material of construction.

painted steel = 0.511 W/(ft2K) 5.5 W/(m2K)

stainless steel = 0.344 W/(ft2K) 3.7 W/(m2K)

aluminum = 1.115 W/(ft2K) 12 W/(m2K)

plastic or insulatedstainless = 0.325 W/(ft2K) 3.5 W/(m2K)

k = _____W/(ft2K) or _____ W/(m2K)

STEP 3: Determine the Temperature Differential (ΔT).

A. Desired enclosure interior temp. = ___oF ___oC

B. Lowest ambient (outside) temp. = ___oF ___oC

Subtract B from A = Temp. diff. (ΔT) = ___oF ___oC

For these calculations, ΔT must be in° Kelvin (K). Therefore, divide ΔT (oF) by 1.8. ΔT = _____ K

STEP 4: Determine Heating Power (PV), if any (generated from existing components, i.e. transformer).

PV = _____ W or _____ W

STEP 5: Calculate the Required Heating Power (PH) for your enclosure based on the above values.

If enclosure is located inside:

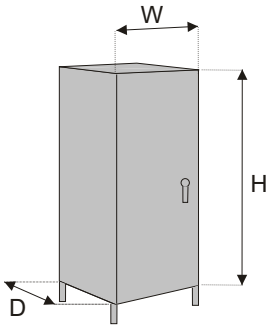
PH = (A x k x ΔT) - PV = _____ W

If enclosure is located outside:

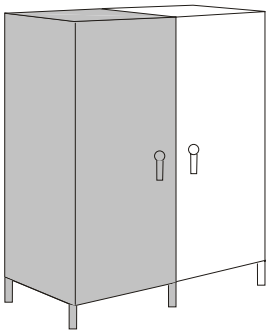
PH = 2 x (A x k x ΔT) - PV = _____ W

Enclosure Mounting Types and Surface Area Calculations

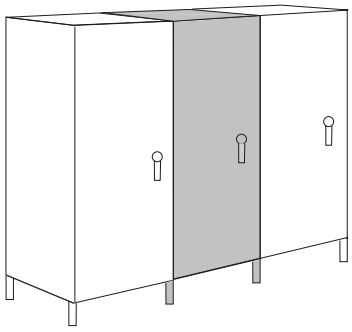
1. Free-Standing



Area (A) =1.8ft³ [0.05m³] (H x W) + 1.8 (H x D) +1.8ft³ [0.05m³] (W x D)

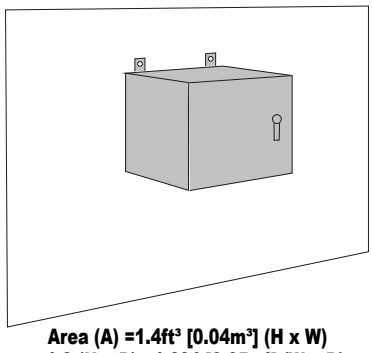


Area (A) =1.8ft³ [0.05m³] (H x W) + 1.4 (H x D) +1.8ft³ [0.05m³] (W x D)

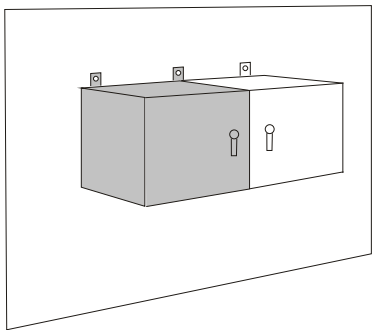


Area (A) =1.8ft³ [0.05m³] (H x W) + (H x D) +1.8ft³ [0.05m³] (W x D)

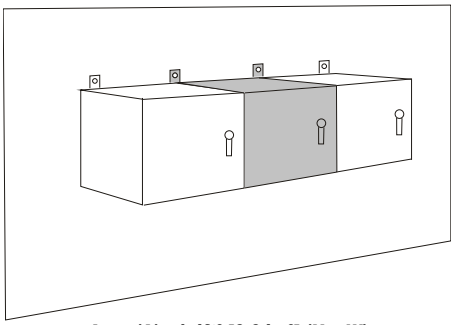
2. Wall-Mounted



Area (A) =1.4ft³ [0.04m³] (H x W) + 1.8 (H x D) +1.8ft³ [0.05m³] (W x D)

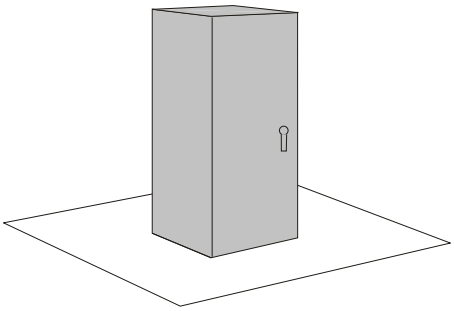


Area (A) =1.4ft³ [0.04m³] (H x W) + 1.4 (H x D) +1.8ft³ [0.05m³] (W x D)

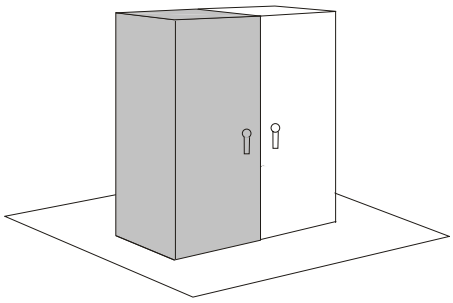


Area (A) =1.4ft³ [0.04m³] (H x W) + (H x D) +1.8ft³ [0.05m³] (W x D)

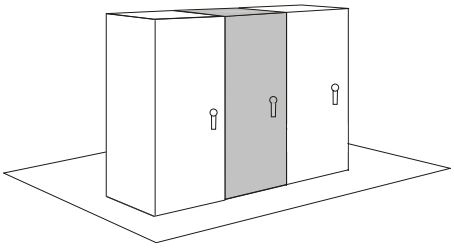
3. Ground



Area (A) =1.8ft³ [0.05m³] (H x W) + 1.8 (H x D) +1.4ft³ [0.04m³] (W x D)

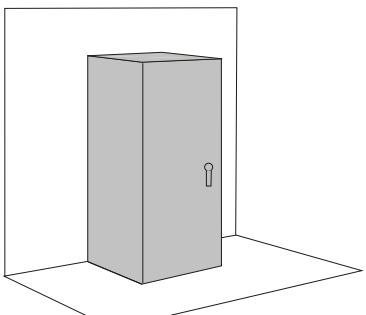


Area (A) =1.8ft³ [0.05m³] (H x W) + 1.4 (H x D) +1.4ft³ [0.04m³] (W x D)

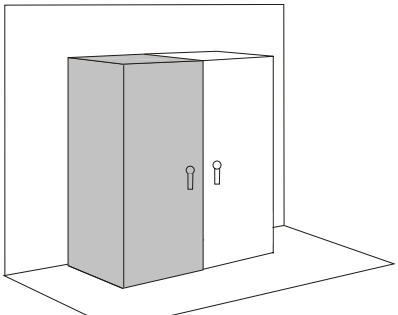


Area (A) =1.8ft³ [0.05m³] (H x W) + (H x D) +1.4ft³ [0.04m³] (W x D)

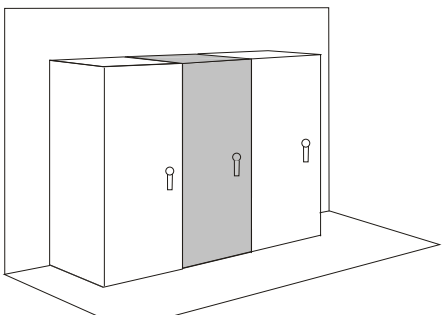
4. Ground and Wall



Area (A) =1.4ft³ [0.04m³] (H x W) + 1.8 (H x D) +1.4ft³ [0.04m³] (W x D)



Area (A) =1.4ft³ [0.04m³] (H x W) + 1.4 (H x D) +1.4ft³ [0.04m³] (W x D)



Area (A) =1.4ft³ [0.04m³] (H x W) + (H x D) +1.4ft³ [0.04m³] (W x D)

950W Fan Heaters

Foot Mounted Fan Heaters

Panel or DIN Rail Mounted

To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page at www.automationdirect.com

Applications

These fan heaters are designed to prevent the formation of condensation and ensure an evenly distributed interior air temperature in enclosures. These fan heaters are available with an integrated thermostat for temperature control, pre-set hygrostat for humidity control, or without integral controls.

Features

- Compact design
- Available with integrated adjustable thermostat, fixed hygrostat or withoutintegral controls
- Double insulated plastic housing
- Built-in overheat protection

950W Fan Heaters Specifications	
Heating Element	High-performance cartridge
Overheat Protection	With automatic reset and second-tier one shot fuse
Heater Body	Extruded aluminum
Axial Fan, Ball Bearing	Service life 50,000h at 77°F [25°C]
Connection	2-pole terminal with strain relief 16 AWG [1.5 mm²] max. solid wire or stranded wire with wire end ferrules,0.8 N·m max.clamping torque
Housing	Plastic, UL 94V-0, black
Mounting - Footed	M5 screws (not included)
Mounting - Panel or DIN Rail	Clip for 35mm DIN rail, EN 60715 or M6 screws (not included)
Mounting Position	Horizontal only
Recommended Mounting Distance	Sides: 0.79in [20 mm] Bottom: 0.91in [23.1mm] Above: 3.94in [100 mm]
Operating / Storage Temperature[1]	-49 to 158°F [-45 to 70°C]
Operating / Storage Humidity	Max. 90% RH (non-condensing)
Protection Class	II (double insulated)
Protection Type	IP20
Approvals	CE, UL Recognized File No. E234324, RoHS 2 compliant
Note: [1] Operating temperature of heater with integrated hygrostat: +32° to +140°F [0° to +60°C]	

950W Foot Mounted Fan Heater

Part Number	Price	Heating Capacity	Operating Voltage	Max Inrush	Setting Range[1]	Air flow,free blowing	Weight (approx.)
030599-00	$263.00	950W	120V AC, 50/60 Hz	8.0 A continuous	32 to 140°F	94 cfm[160 m³/h]	49.6 oz[1406g]
030510-00	$263.00		230V AC, 50/60 Hz	4.0 A continuous	0 to 60°C		

Note: [1] Switching difference 12.6 °F ± 7°F tolerance [7K ± 4K]

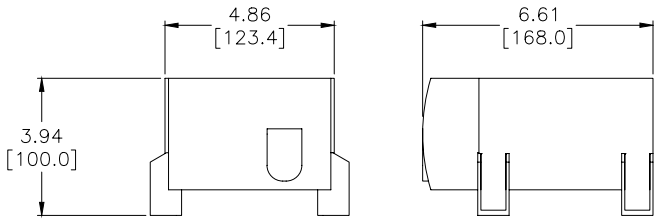
950W Panel or DIN Rail Mounted Fan Heaters

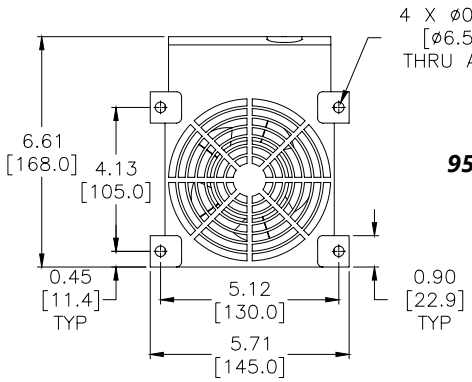
Part Number	Price	Heating Capacity	Operating Voltage	Max Inrush	Setting Range[1]	Air flow,free blowing	Weight (approx.)
130599-00	$277.00	950W	120V AC, 50/60 Hz	8.0 A continuous	32 to 140°F	94 cfm[160 m³/h]	49.6 oz[1406g]
130599-02	$272.00				none (no integrated controls)		
130510-00	$290.00		230V AC, 50/60 Hz	4.0 A continuous	0 to 60°C		
130510-03	Retired	Please consider 130510-00 for a comparable replacement.					

Note 1: Switching difference 12.6 °F ± 7°F tolerance [7K ± 4K]

950W Fan Heaters

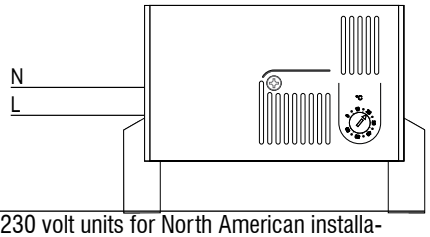
Dimensions





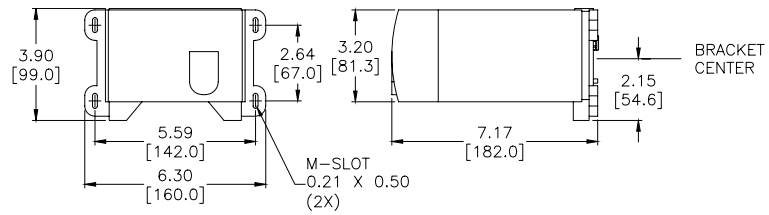
950W Foot Mounted Fan Heaters

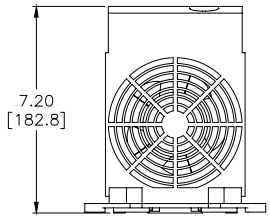
Wiring Diagram



Note: When wiring 230 volt units for North American installations “L” (line) and “N” (neutral) will be used as”L1” (line1) “L2” (line2) respectively with no neutral connection.

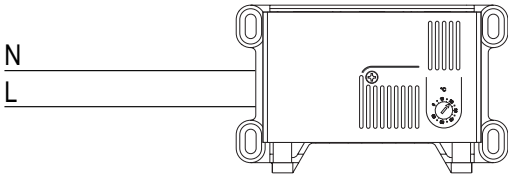
Dimensions





950W Panel or DIN Rail Mounted Fan Heaters

Wiring Diagram



Note: When wiring 230 volt units for North American installations “L” (line) and “N” (neutral) will be used as”L1” (line1) “L2” (line2) respectively with no neutral connection.

1200W PTC Fan Heaters

Foot Mounted PTC Fan Heaters

Panel or DIN Rail Mounted PTC Fan Heaters

Applications

These compact high-performance PTC fan heaters are designed to prevent formation of condensation and provide an evenly distributed interior air temperature in enclosures. These fan heaters were designed as stationary units for installation on the bottom of enclosures.

Features

- Compact design
- Built-in overheat protection
- Double insulated plastic housing
- Integrated adjustable thermostat

1200W PTC Fan Heaters Specifications	
Heating Element	PTC resistor – temperature limiting
Overheat Protection	Built-in temperature limiter
Axial Fan, Ball Bearing	Service life 50,000h at 77°F [25°C]
Connection	2-pole terminal with strain relief 16 AWG [1.5 mm²] max. solid wire or stranded wire with wire end ferrules,0.8 N·m max.clamping torque
Housing	Plastic, UL 94V-0, black
Mounting - Footed	M5 screws (not included)
Mounting - Panel or DIN Rail	Clip for 35mm DIN rail, EN 60715 or M6 screws (not included)
Mounting Position	Horizontal
Recommended Mounting Distance	Sides:1.97in [50 mm] Bottom: 0.91in [23.1mm] Above: 3.94in [100 mm]
Operating / Storage Temperature	-49 to 158°F [-45 to 70°C]
Operating / Storage Humidity	Max. 90% RH (non-condensing)
Protection Class	II (double insulated)
Protection Type	IP20
Approvals	CE, UL Recognized File No. E234324 and E150057, RoHS 2 compliant

Note: To obtain the most current agency approval information, see the Agency Approval Checklist section on the specific part number's web page at www.automationdirect.com

1200W Foot Mounted PTC Fan Heaters

Part Number	*Price*	*Heating Capacity[1]*	*Operating Voltage*	*Max. current (inrush)*	*Setting Range[2]*	*Air flow,free blowing*	*Weight (approx.)*
030609-00	$285.00	1200W	120V AC, 50/60 Hz	16.0 A	32 to 140°F	94 cfm [160 m³/h]	41.6 oz [1179g]
030600-00	$285.00		230V AC, 50/60 Hz	13.0 A	0 to 60°C		

Notes: [1] At 68°F [20°C] ambient temperature
[2] Switching difference 12.6 °F ± 7°F tolerance [7K ± 4K]

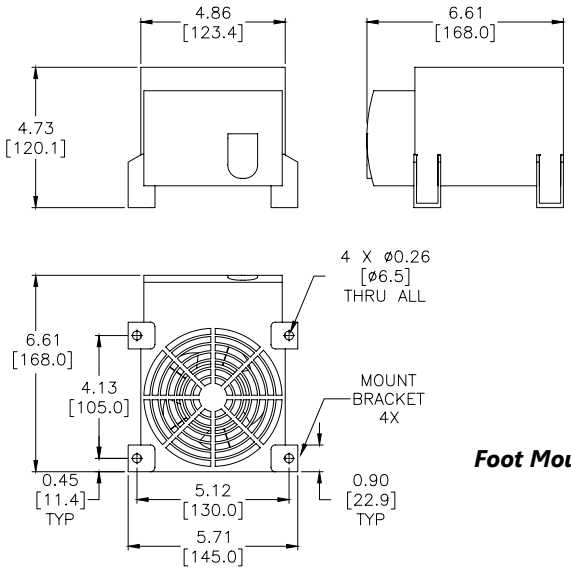
1200W Panel or DIN Rail Mounted PTC Fan Heaters

Part Number	*Price*	*Heating Capacity[1]*	*Max. Current (Inrush)*	*Operating Voltage*	*Setting Range[2]*	*Air flow,free blowing*	*Weight (approx.)*
130609-00	$332.00	1200W	16.0 A	120V AC, 50/60 Hz	32 to 140°F	94 cfm[160 m³/h]	41.6 oz [1179g]
130600-00	$332.00		13.0 A	230V AC, 50/60 Hz	0 to 60°C		

Notes: [1] At 68°F [20°C] ambient temperature
[2] Switching difference 12.6 °F ± 7°F tolerance [7K ± 4K]

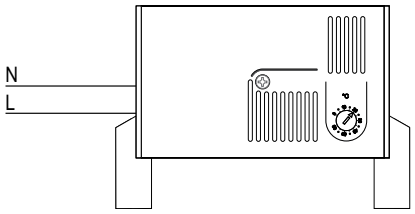
1200W PTC Fan Heaters

Dimensions



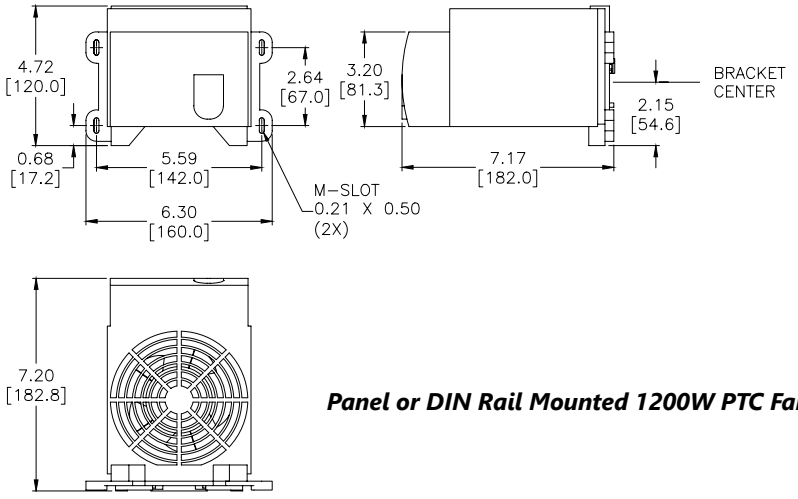
Foot Mounted 1200W PTC Fan Heaters

Wiring Diagram



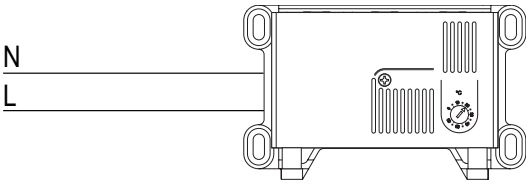
Note: When wiring 230 volt units for North American installations “L” (line) and “N” (neutral) will be used as”L1” (line1) “L2” (line2) respectively with no neutral connection.

Dimensions



Panel or DIN Rail Mounted 1200W PTC Fan Heaters

Wiring Diagram



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