Application Note #007
High-Power Load, Resistor, and Attenuator Mounting Instructions

This series of parts is available with two types of metal mounts. The first is a stud mounted plate and the second is a one or two hole flange. The metal mount provides a convenient mechanism for making the proper thermal and, in some cases, electrical connections to the unit. You must connect the mount to a heat sink designed to provide the specified cooling for the device used. The power handling capability of each device is valid only if the heat sink is at or below the specified temperature.

The heat generated in these parts is due to I^2R losses. This heat must be carried away from the device in order to keep the part temperature within its recommended operating range. Cooling occurs in three ways: convection (natural and forced), conduction, and radiation. You can determine the amount of cooling required by finding the thermal resistance of the heat sink and then calculating the temperature rise for a given power dissipation. Thermal resistance equations for a flat metal plate are as follows:

Θ (conduction) = d / (4.186 K A) °C/Watt
- d = length of thermal path (cm)
- K = thermal conductivity [cal/(cm sec°C)]
- A = area (cm^2)

Θ (convection) = 916 / [A_1 (L * V)$^{1/2}$]
- A_1 = total cross sectional area (in^2)
- L = length of heat sink (in)
- V = air velocity (LFM) (Use 57.2 LFM for Natural Convection)

Θ (radiation) = [(1793 x 10^8) (Tm - Tamb)] / [A_1 E (Tm^2 - $Tamb^2$)]
- E = emissivity (unitless)

The temperature rise across the heat sink is given by:
- T2-T1 = P [Θ (conduction) + Θ (convection) + Θ (radiation)]
- P = Power dissipation required

Predicting Thermal Performance

The primary heat transfer mode for these devices is conduction through the metal mount and into a heat sink.
The type and rate of cooling for the heat sink determines the minimum size required for a particular application. Typically, natural or forced convection in air is used. You can follow a few basic guidelines when designing a heat sink. First, the surface area of the heat sink should be maximized and the surface finish should have an emissivity factor near unity (a flat black finish is typical). Finally, the thermal conductivity of the heat sink should be large to minimize thermal gradients across the heat sink itself.

Both the flange mount and stud mount devices are normally attached to a heat sink with metal screws. Use a thermal grease or thermally conductive gasket to achieve the proper heat transfer. When attaching the stud mounted units, limit the nut torque to 3 inch-pounds. Secure the flange mount units with small pattern flat and lock washers to protect the surface finish.

Mounting Instructions for Stud Mount Units

Preparation

We supply all units with a 6-32 threaded stud for mounting. Request the applicable drawing to determine the correct dimensions for the stud location. Drill a clearance hole in the heat sink for a 6-32 thread (0.61" diameter recommended). You may use a closer fit clearance hole if you provide a counterbore or countersink for the 0.61" diameter. This size allows clearance for the small radius present on the unit where the stud joins the base and permits the base to sit flat against the heat sink for maximum heat transfer. The heat sink in the area of the stud must be thin enough to permit sufficient engagement of a 6-32 nut for securing the unit. When using thermal mounting compound (such as Wakefield #120-2), coat the heat sink with a thin layer of compound before mounting the unit.

Mounting

Locate the unit in place, lining up the tab or tabs with the mating circuitry. Thread the nut on the stud and tighten until the unit is snug against the heat sink. Realign the tabs if necessary. While maintaining the proper alignment, torque the nut to 2 inch-pounds maximum. Then solder the tab or tabs to the circuitry.