

# Thermal-Clear™ Transparent Heaters

## Overview

Featuring a micro-thin wire heating element laid in a pattern between optical grade polyester sheets, Thermal-Clear™ heaters provide reliable heat without blocking light.

- Custom heater element routing and profiling optimizes the visual clarity of the LCD and prevents “shadowing”
- Tight resistance tolerance provides constant and repeatable wattage output for longer battery life
- Low mass and high watt density offers faster warm up time needed for immediate LCD response in cold weather operation
- Rugged materials prevent costly damage during installation and handling
- Integral temperature sensors optional
- Rectangular, round, or irregular shapes
- Uniform or profiled heat patterns

## Typical applications

- Cockpit displays
- Ruggedized computers
- Portable military radios
- Handheld terminals
- Outdoor card readers
- Portable and vehicular computers
- Camera lens deicing
- Defogging windows in environmental chambers
- Heating microscope stages

## Custom options

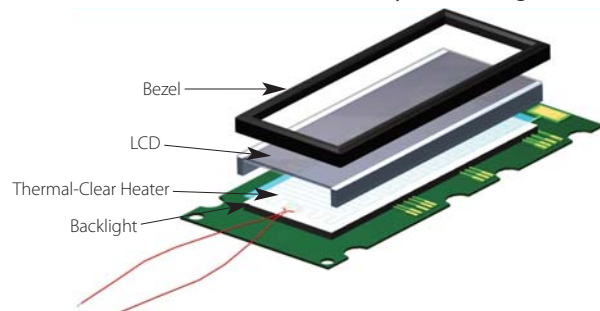
- Integral RTD or thermistor sensors
- Flex circuit terminations
- Rigid materials
- Custom shapes and sizes to 11" × 22" (280 x 560 mm)
- RoHS compliance
- Contact Access: Minco Sales and Support for design assistance



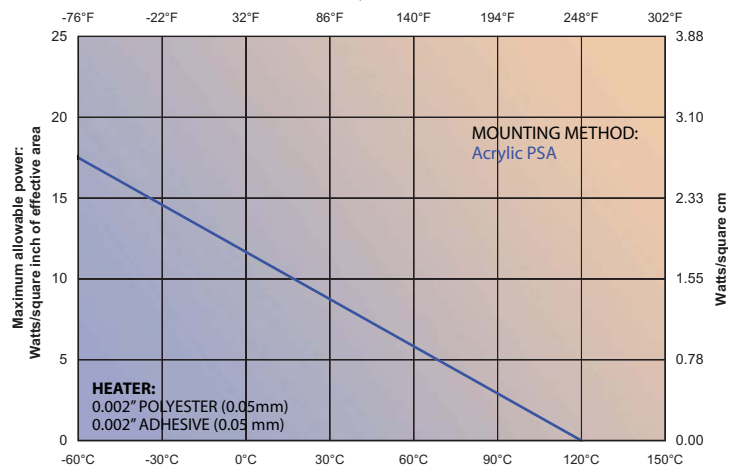
## Thermal-Clear heaters and LCDs

Most dot matrix LCDs lose sharpness and response speed below 0°C. Achieve acceptable performance at much colder temperatures with a Minco Thermal-Clear heater. 1-2 W/in<sup>2</sup> (0.16 - 0.31 W/cm<sup>2</sup>) will keep a typical LCD operating properly in ambients as low as -55°C.

Shown below is a typical installation on a backlit LCD. The heater is sandwiched between the backlight and the LCD. We recommend a light diffuser between the heater and LCD if there is no diffusion coating on the back of the LCD. Diffusion will soften and conceal shadows cast by the heating element.



## Thermal-Clear Heaters Maximum Watt Density



Example: At -20°C, the maximum power for a Thermal-Clear mounted with acrylic PSA is 14 W/in<sup>2</sup> (2.17 W/cm<sup>2</sup>).

Specifications subject to change



# Thermal-Clear™ Transparent Heaters

## Specifications

**Temperature range:** -55 to 120°C (-67 to 248°F).

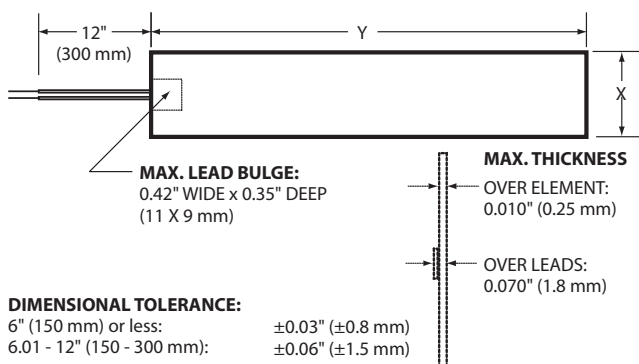
**Insulation:** Optical grade polyester is standard. Glass and polycarbonate materials are available on custom models.

**Transparency:** 82% minimum light transmission over the visible spectrum.

**Heating element:** Resistive wire, diameter 0.0008" to 0.002" (0.02 to 0.05 mm).

**Resistance tolerance:** ±10% or ±0.5 Ω, whichever is greater.

**Leadwires:** PTFE insulated wire is standard. Lead connections are welded and anchored between heater layers for strength. Special terminations are available on custom models.



## Heaterstat™ Sensorless Temperature Controller

Any Thermal-Clear heater will work with the CT198 Heaterstat™ Sensorless Temperature Controller, which directly regulates element temperature without requiring a separate sensor. See the "Sensors and Controllers" section for full specifications and compatibility.

