

Overview

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The Nano-THERM Series (platform NT220, with the NTIR220 infrared variant and the VT200 vibration-isolation/dark-box option) is Microsanj's non-contact temperature measurement system for active semiconductor devices. It is a benchtop precision analysis tool for static and transient thermal imaging on a millimeter-to-micron scale. The system is built around the EZ-THERM ("General Purpose Thermal Analyzer") controller platform, also referred to in places in the source manual as EZ500A.

What it measures. The system measures temperature non-contact using two physical techniques:

- **Thermoreflectance (TR) imaging** — a highly sensitive lock-in technique that measures the relative change in a sample surface's reflectivity as a function of temperature, per pixel. The relationship is approximated to first order as:
$$\Delta R(x,y,\lambda) / R(x,y,\lambda) = C_{th}(x,y,\lambda) \cdot \Delta T$$
where C_{th} (the thermoreflectance calibration coefficient, also called C^{tr}) is typically on the order of 10^{-3} to 10^{-5} per °K and depends on sample material, illumination wavelength, angle of incidence/surface roughness, and sample composition. The technique is sensitive to shifts and thermal expansion at length scales of 580 nm at 20x magnification.
- **Infrared (IR) emission imaging** — using a longwave infrared (LWIR) camera, requiring an emissivity (E) coefficient for accurate temperature readings (emissivity must be recalibrated per sample, unlike the thermoreflectance coefficient, which is largely material-dependent and does not require per-device calibration).

Hardware family / major components. Any system shipped to a customer consists of:

1. Optical Microscope
2. Camera (Visible, Infrared, Near-IR, and/or InGaAs, depending on configuration)
3. Standard Rack Models (electronics rack housing the control modules)
4. Probe Station (option)

Rack-level modules include SanjSCOPE (power control), SanjSOURCE (illumination), SanjCONTROLLER+ (integrated desktop computer running SanjVIEW), 4D Nano Align (thermal stage + piezo controller housing), the Piezo Controller for AF-100, and the 600W rack-mount chiller. See "Setup and Installation" for a description of each module.

Software. All hardware is operated through **SanjVIEW 7.0**, embedded on the SanjCONTROLLER+. SanjVIEW's modules are: Project Manager, Transient Thermoreflectance, Movie Mode, FA (Failure Analysis) Mode, Calibration, SanjANALYZER (post-acquisition analysis), and an Output Module for device biasing signals.

Safety Precautions

- **WARNING — high temperature:** do not touch the thermal plate when it is in operation; contact can cause severe burns.
- **WARNING:** there are no user-serviceable parts inside the EZ-THERM controller. Do not remove covers. Exposed AC power can be present even with the power switch off. To avoid accidental shock, turn off the power and unplug the line cord before checking or replacing the fuse. Only use the specified fuse value; do not attempt to bypass or repair the fuse.
- **WARNING — shock hazard:** use extreme care when handling output connections.
- **WARNING — UV radiation exposure:** there are no regulatory UV exposure limits. The ACGIH (American Conference of Governmental Industrial Hygienists) publishes Threshold Limit Values (TLVs), wavelength-dependent, ranging from 3 mJ/cm² to 100,000 mJ/cm²:
 - UV-A (315–400 nm): 1.0 J/cm² for exposures under 1000 seconds; 1.0 mW/cm² for exposures over 1000 seconds.
 - UV-B: 3.4 mJ/cm² at 280 nm; 500 mJ/cm² at 313 nm.
 - UV-C: 250 mJ/cm² at 180 nm; 3.1 mJ/cm² at 275 nm.

Personal Protective Equipment (PPE)

If engineering/administrative controls cannot protect personnel from UV exposure, use PPE: UV safety goggles, UV face shields, long-sleeved tightly woven clothing covering most of the body, and gloves. Sunscreen with SPF > 15 against UV-A/UV-B may provide some protection, but UV skin blocks alone are considered inadequate against high-irradiance man-made UV sources. For eye protection, polycarbonate safety glasses or a polycarbonate face shield are generally sufficient; wear this eyewear whenever there is potential for ongoing UV exposure. Contact EH&S for guidance on appropriate UV protective eyewear. Any equipment emitting UV radiation, and its work area, must have appropriate UV warning labels posted (there is no standard label format).

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