SST-TRAP-C and SST-TRAP-D: Silicon Optical Trap Detectors

Precise, High Quantum Efficiency, Calibration Transfer Standards.

We have designed a series of large aperture, high quantum efficiency optical TRAP detectors based on a unique concept developed at NIST Boulder (National Institute of Standards and Technology. We offer two models; **SST-TRAP-C** and **SST-TRAP-D**. The first is best suited for collimated or low divergence sources (<+/-10°) while the second is optimized for both collimated and divergent sources (<0.24 NA or +/-16°).

Optical TRAP detectors are intended for use in optical calibration of FO power meters, laser power meters and optical detectors. The Current Responsivity of our TRAP is determined from "physical constants" and is therefore, accurate to better than 1% from 450 to 980 nm (see "Calibration Uncertainty" in the table below). Compare this to the typical calibrated single element detector at +/-3%.

These detectors are designed into an EMI immune housing with a front bezel that includes a 1.035-40 threaded opening (THORLABS™ SMI) and is set to take a variety of Fiber Optic connectors, optics or alignment aids. The TRAP can be easily mounted to an optical bench with the 1/4-20 inch threaded mounting hole.

Use our SST TRAP Detector with our SST Power/Current Meter to create a complete, stand-alone, precision optical power meter.

Features

- ✔ ***Wavelength Range 0.20 to 0.98µm***
- ✔ ***Low calibration uncertainty:***
  - ***0.20 to 0.26 µm < 1.5%***
  - ***0.27 to 0.40 µm < 5.0%***
  - ***0.41 to 0.98 µm < 1.0%***
- ✔ ***Responsivity ~ 0.505 A/W@0.63 µm***
- ✔ ***Power resolution < 0.1 nW***
- ✔ ***Spatial Non-Uniformity < 0.02%***

SST Silicon Optical Trap: Precise, high Quantum Efficiency, calibration transfer

	SST-TRAP-D	SST-TRAP-C	Units	Conditions
Specification (@25°C)	Divergent	Collimated		
Useable Aperture (diameter)	7	7	mm	
Detector Area	1.0	1.0	cm2	
R_I, Current Responsivity	0.505	0.505	A/W	Calculated from physical constants @ 632.8 nm
Calibrated Spectral Range	400-950	400-950	nm	For minimum uncertainty
Quantum Efficiency	> 99	> 99	%	From 400 to 950 nm
Calibration Uncertainty				
0.29-0.26µm	< 1.5	< 1.5	%	
0.27-0.40µm	< 5.0	< 5.0	%	
0.41-0.98µm	< 1.0	< 1.0	%	
Minimum Measureable Power	0.1	0.1	nW	
Maximum Power Density	1.0	1.0	mW/cm^2	
Field of View	+/- 14	+/- 10	degrees	2 mm diameter beam or smaller
Maximum Source Divergence (NA)	0.24	0.12		
Spatial Non-Uniformity	< 0.02	< 0.02	%	Scanned with 1 mm beam @632.8 nm

Spectrum Detector Inc.

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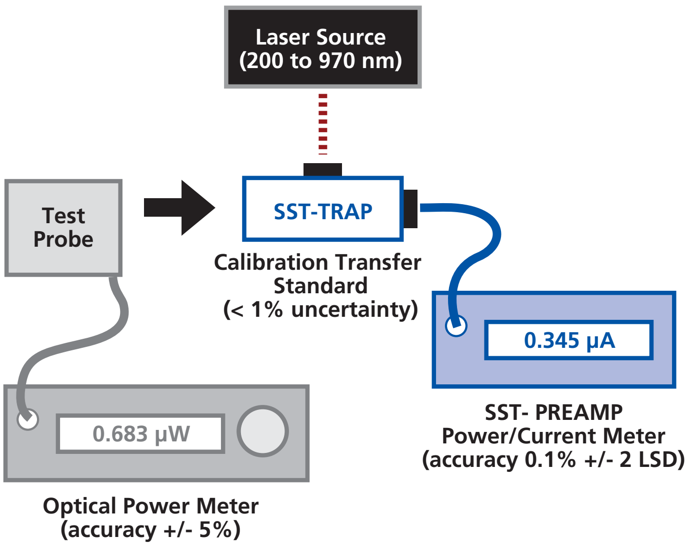
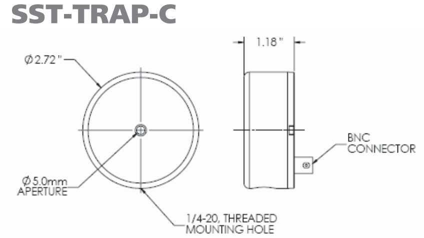
Typical Substitution Calibration Set-up.

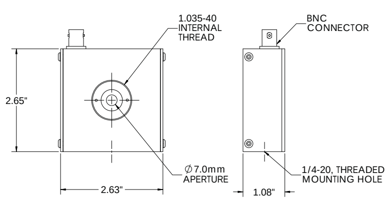
Assumes laser instability <1%

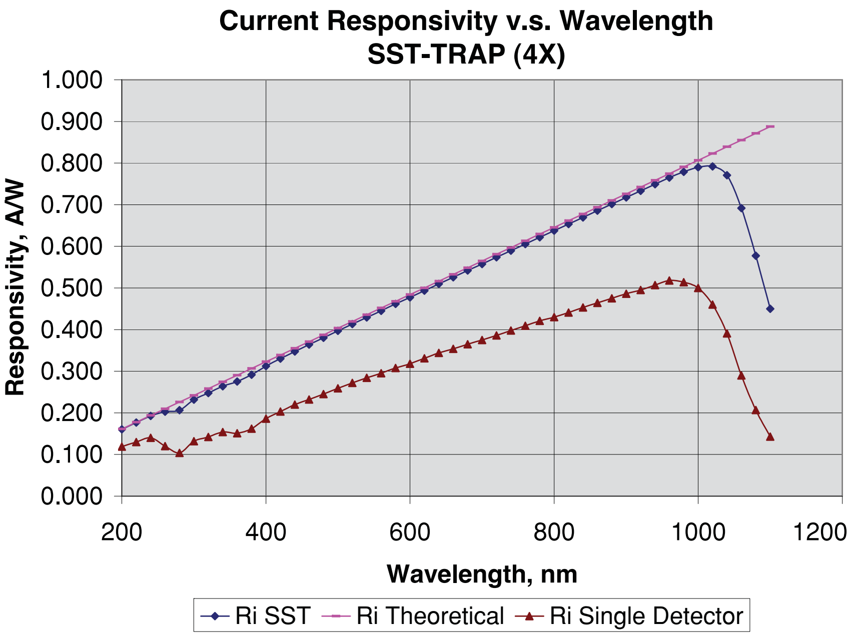


SST-TRAP-C



SST-TRAP-D





Theory of Operation:

By combining several high Quantum Efficiency photodiodes and a large, concave, broadband mirror in a multi-bounce optical configuration we can TRAP 99% of the light in the spectral range from 400 to 950 nm. The current responsivity at a particular wavelength for such a device is determined from physical constants in the equation: $R_I = q\nu\lambda / hc$

Where: q is the "charge of an electron"
ν is the "quantum efficiency"
λ is "wavelength in m"
h is "Planck's constant"
c is "speed of light"

It can be simplified for everyday use to:

$R_I\,(A/W) = \nu\lambda / 1239.5$

Where: ν is Quantum Efficiency
λ is wavelength in nm
1239.5 is determined from physical constants (electron charge, planks constant, speed of light)

Here's an example of how you would calculate the R_I for our SST-TRAP at 632.8 nm:
R_I @ 632.8nm = 0.99 x 632.8 / 1239.5

$R_I = 0.505$ A/W

The graph at the left compares the Current Responsivity (Ri) vs. Wavelength for our high Quantum Efficiency SST-TRAP, a 100% QE device and a single element photodiode.

Note the extremely close correlation between our TRAP and the theoretical curve. The spectral response of a single detector can vary greatly and can only be calibrated to about +/- 3% accuracy. The calibration uncertainty of our TRAP can be as low as 0.5% (see Calibration Uncertainty in the specification table on the reverse side).