

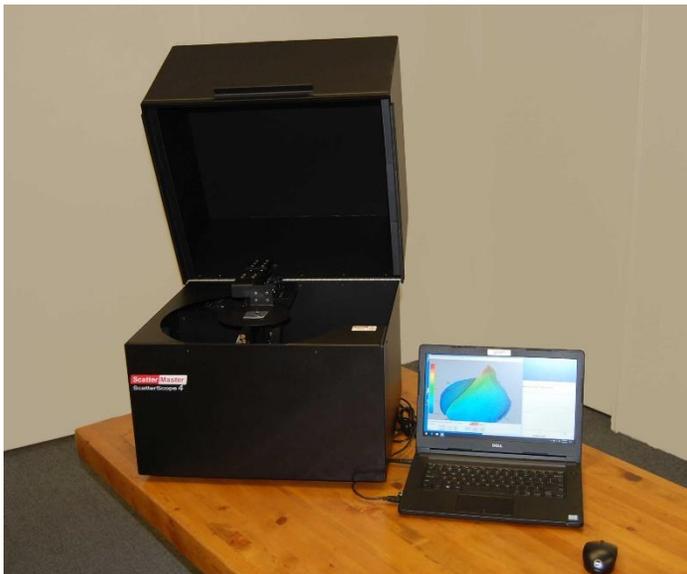
The Scatter Works Inc.

...because scatter works.

An Overview of TSW Scatterometers

The following instruments are offered for sale by The Scatter Works, Inc (TSW). They vary greatly in both price and capability. User choices need to be dictated by user requirements. For example, all of the instruments can be purchased with different wavelength sources. This document is only an overview, but will help you narrow the search. They are organized roughly in order of increasing price and capability. The summary chart on the next page gives you view from 20,00 feet and a price range. Call or email TSW to get more detailed information and/or real quotes.

The **MicroScan II** is a simple single diode laser three detector scatterometer manufactured by TSW. The system measures specular reflectance at an incident angle of 25 degrees and scattered light at angles of 0 and -50 degrees. Under the assumptions that the surface is optically smooth and isotropic, values of the rms roughness from 0.01 to $1.0 \mu\text{m}^{-1}$ is reported in addition to the associated TIS. The noise floor is about $10^{-7}/\text{sr}$. It has been used to monitor the aging of large optics. The price is under \$9,000.



The **ScatterScope4** is a table top instrument manufactured with ScatterMaster LLC in Tucson AZ. It uses multiple silicon detectors that scan 180 degrees to measure hemispherical and incident plane scatter in both reflection and transmission. It can be equipped with as many as three laser diode sources. It does not measure close to the specular beam and the noise floor is limited to the $10^{-5}/\text{sr}$ to $10^{-6}/\text{sr}$ range. It's huge advantages are speed (15-20 seconds per scan) and ease of use. Operators can be trained in a few minutes. It is an ideal instrument for the lighting industry. A single red laser system is priced at about \$55,000. An RGB system is closer to \$100,000. Call for quotes.

John C. Stover - Technical
310 S. Williams, Suite 222
Tucson AZ 85711
(520) 275-2644
john@thescatterworks.com

Fred Houston - Sales
Ventura Precision
(805) 405-2525
fred.houston@gmail.com

Chris Staats - Technical
633 E. Powell Blvd.
Gresham OR 97030
(971) 274-3145
chris@thescatterworks.com

The **CASI** Scatterometer (below left) is a TSW research instrument that can be configured with multiple laser sources ranging from the near UV to the mid-IR. It uses programmable collection apertures and step sizes to allow measurements within 0.1 degrees from the specular beam and it has a noise floor of about 10^{-8} /sr in the visible, which is limited by scatter from air molecules. It takes a linear incident plane scan at a programmable incident angle. It requires a lab with an optical table (not supplied) and benefits from HEPA filter air flow for some applications. Operator training takes about week. The standard red laser system costs about \$195,000.



The **TASC** Scatterometer above right is essentially a CASI that takes hemispherical measurements. UV, visible, mid-IR and broadband systems have been built. A single red laser system is about \$283,000.

The **TMS** Scatterometer (left) is a table top instrument used to scan silicon wafers, and other smooth reflectors, for rms roughness. The results are given as roughness maps - not small surface defect maps. They can soon be ordered with automated wafer handling robots.

The chart below compares the five scatterometers. While there is obviously some duplication in capabilities, they all have unique features and in that sense are not really competitors.

	MicroScan II	Scatterscope4	TMS	CASI	TASC
Incid. Plane Meas.	5 sec	15-20 sec	1-10 min	5-10 min	5-10 min
Hemispherical Meas.	Estimate	15-20 sec	Always	Estimate	1-5 hour
Auto TIS	Estimate	Yes	Yes	Estimate	Yes
Near UV to Near IR	Yes	Yes	Yes	Yes	Yes
Mid IR	No	No	No	Yes	yes
BRDF Visible Noise Floor	$10E-7$ /sr	$10E-6$ /sr	$10E-7$ /sr	$10E-8$ /sr	$10E-8$ /sr
Near Specular Meas.	NA	5 Deg	1 Deg	<0.1 Deg	<0.1 Deg

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