T-Ray® 5000 System Overview

The T-Ray® 5000 Intelligent Terahertz Control Unit (TCU) is the heart of the T-Gauge® Sensor Configuration. The TCU comprises the short pulse laser, time delay rails, data collection electronics and powerful calculation engine. With a waveform acquisition time of 10ms or 1ms, depending on configuration, the Intelligent TCU is the fastest, full-featured time domain terahertz controller available.

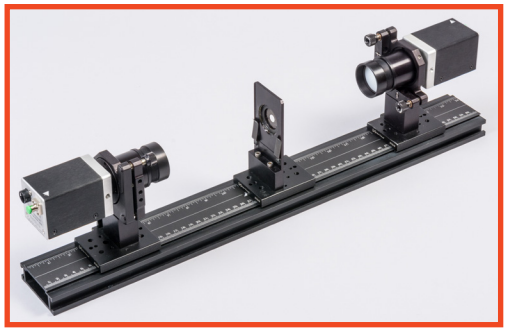
Appropriate for use in both industrial and scientific applications the TCU monitors and controls all aspects of THz generation and detection. It delivers precisely controlled optical signals to the terahertz transmitters and receivers, or the T-Gauge® Sensor Heads, enabling them to generate and receive terahertz signals. Collected waveforms are processed within the Control Unit at a rate of up to 1 KHz, making the T-Ray® 5000 one of the fastest terahertz systems available.

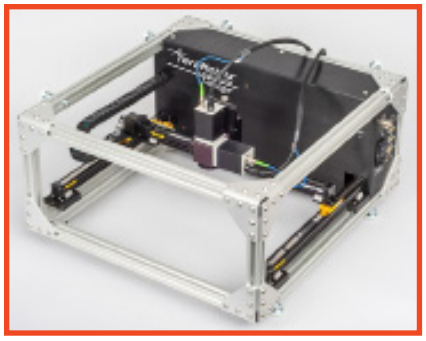
The data generated by the T-Gauge® Sensor Heads and processed by the T-Ray® 5000 Control Unit enable multiple measurements of a product simultaneously. One T-Gauge® Sensor can measure the basis weight, caliper thickness, multi-layer thicknesses, and density of a sample in a single pass.

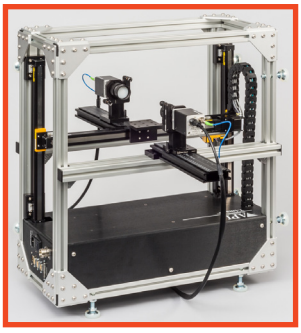
There are currently 4 variations to the TCU, each having different high-speed delays (HSD), which determine waveform lengths and speeds. Making the decision on which TCU configuration best suits your needs can be based on the following factors:

- **Thickness of the sample:** The reflection from both surfaces must be in the time window.
- **Required measurement rate:** If high-speed measurements are required it may be necessary to use a 1000 Hz system.
- **Waveform averaging:** For some difficult measurements it helps to average a few measurements together to improve bandwidth (waveform averaging) or precision (measurement averaging). This may require a 1000 Hz system so that even with averaging a measurement rate of at least 100 Hz will be maintained.
- **Performance Tie Breakers:** Best performance is always found with the shorter HSD time base at a given waveform acquisition rate for the TCU (i.e., 80ps of 1000 Hz and 320ps for 100Hz).

Separate transmitter and receiver modules are available that allow spectroscopic measurements, as is an X-Y rail imaging system that allows both transmission and reflection imaging.







TeraMetrix™
a division of LUNA

Sensors

T-Gauge® Integrated Sensors

TeraMetrix has developed a robust product line featuring a variety of sensors to create systems that have been deployed worldwide for a variety of markets and applications. Deciding which sensor is best suited for your need is based on the thickness of an individual layer and the type of measurement you are seeking (thickness, basis weight or density).

Standard Online Sensor Head (HXC50yn)
The HXC50yn Online Sensor Head is a robust, factory hardened transceiver for the T-Ray® 5000 terahertz system. Reflection measurement of thickness, multi-layer thickness, and basis weight are easily acquired. A variety of lenses are available to adjust the measurement spot size and working distance (1, 3 and 6 inch).

The HXC50yn provides sufficient bandwidth to measure layer thicknesses down to 50 microns.

Online Sensor Head with VRS (HXC51yn)
The HXC51yn Online Sensor Head with VRS adds functionality to the standard online sensor head (HXC50yn) with a virtual reference surface (VRS). The VRS enables non-contact, calibration-less caliper thickness measurement as well as basis weight and density without reducing the open separation between the sensor and the product.

When connected to a T-Ray® 5000 Control Unit, the HXC51yn is capable of providing detailed reflection measurement of layered surfaces.

Online EPG Sensor Head with VRS (HXC53y2)
The HXC53y2 Online Enhanced Performance Gauge (EPG) Sensor Head allows measurement of thinner layers than the standard HXC50yn Online Sensor Head. Higher bandwidth, and higher signal to noise, opens the EPG to new applications to terahertz process control.

When connected to a T-Ray® 5000 Control Unit, the EPG will provide detailed single-sided measurement of layered products. Coatings on metal or composite substrates and free-standing films can be measured down to 10 microns (0.5 mils), while buried layers as thin as 25 microns can be measured.

Class I Div 1 (CID1) Sensor (SCS500n)
If your application exists in an explosive environment, the T-Gauge Explosion Proof Thickness Measurement System (SCS500n) has the ability to operate in flammable atmospheres, such as paint booths or coating facilities. The transmitter and receiver are securely mounted inside a sealed stainless-steel housing and the lens is Teflon coated to resist solvents. All components in the hazardous area meet CID1 standards.

The sensor is designed to be robot mountable and intrinsically safe.

Single Point Gauge (SPG500n)
If your application calls for handheld coating measurement, or defect detection, the SPG500n provides an easy to use tool for coatings down to 25 microns and can display up to 3 selected measurements on the screen at the pull of a trigger.

Single point and continuous measurement modes are available, and the measurement results can be automatically recorded onto a USB key.

Line Scan Gauge (LSG500n)
The LSG expands the utility of the handheld by scanning the beam along a 2 or 3-inch line, providing a real time cross-sectional image (b-scan) of the object under test. The individual waveforms can still be analyzed to provide layer measurements, and individual b-scan images or b-scan videos can be captured. The LSG can measure layers down to 50 microns.