

# HIGH SPEED LINEAR TERAHERTZ CAMERA



- ✔ Image acquisition rate: 5 kHz (5000 fps)
- ✔ Scanning speed: up to 15 m/sec
- ✔ Optimized at frequency ~100 GHz
- ✔ Number of pixels (scalable): 256 x 1
- ✔ TeraFast® Viewer software
- ✔ Software Developer's Kit (SDK)

## Description

The High-Speed Terahertz Imaging Scanner is our flagship product. It features both, an unprecedented imaging speed of 5000 frames per second and ease of integration into any industrial process. The Terahertz Imaging Scanner fits most conveyors with a belt speed up to 15 m/s. Its ultrafast linear sensor array is built to satisfy the needs in Non-Destructive Testing (NDT) and Quality Control (QC) for many industrial applications.

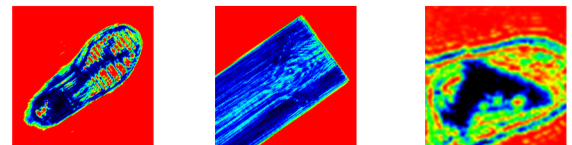
The Terahertz Imaging Scanner system consists of two parts: a linear terahertz imaging camera and a Terahertz generator at 100 GHz. Both parts are optimized and synchronized to each other. THz radiation power is properly delivered from the generator onto the camera sensor. The camera pixel size determines an image resolution of 1.5 mm, which exceeds the requirements of most industrial applications.



Layout for Linear Terahertz Imaging System installation on conveyor

### COMPETITIVE ADVANTAGES:

- ✔ No ionizing radiation
- ✔ Extremely high image acquisition rate (5 kHz)
- ✔ Ease of integration into industrial process
- ✔ CE Certification of Compliance
- ✔ Plug-and-Play design and customized solutions
- ✔ LOW COST



Samples of THz images made by Terasense THz camera

Terasense® technology employs standard semiconductor manufacturing processes for mass-market production, which allows to produce sensor arrays in large quantities, ensure high-performance and claim reasonable price.

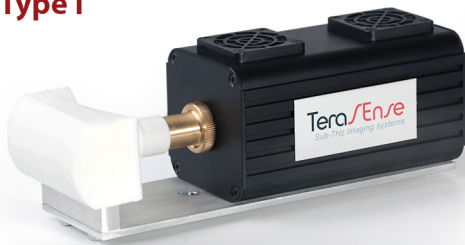
## Specifications

Number of pixels:	256 (256 x 1)	Image acquisition rate:	5000 fps (5 KHz)
Pixel size:	1.5 x 3 mm <sup>2</sup>	Responsivity:	8000 V/W
Imaging area:	384 x 3 mm <sup>2</sup>	Min detectable power/pixel:	100 nW (at 5000 fps) 45 nW (at 1000 fps) 14 nW (at 100 fps)
Dimensions of device:	450 x 160 x 44 mm <sup>3</sup>	Included software:	TeraFast® Viewer
Sync out:	TTL (+5 V)	Power supply:	24 V/ 20 W
Interface:	mini-USB		

# SOURCES FOR THE LINEAR CAMERA

TeraSense offers two types of generators, both based on IMPATT technology. Our Type I generator has a horn antenna with a specially designed PTFE refractive optical system. The configuration of the PTFE lenses ensures proper focusing of the THz beam onto the linear window of the camera. The Type II generator is an upgraded version of the THz source. It utilizes our most recent breakthroughs in THz technology which enables the enhanced performance of the THz imaging scanner. The Type II module includes our novel reflective THz optics based on our specially configured high-gain horn antenna in combination with a metallic mirror. The Type II sources are made from exceptional IMPATT diodes that deliver significantly more power than the average diode. The Type II generator considerably improves the THz imaging capabilities of our linear scanner by increasing the amount of power reaching the sensor array.

## Source Type I



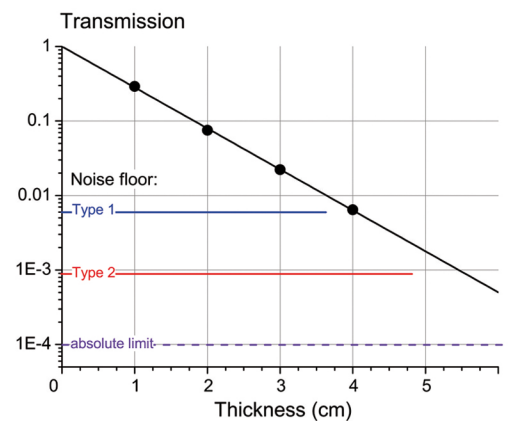
## Source Type II



## Comparison of THz generators

	Type I	Type II
Frequency	100 GHz	100 GHz
Power per pixel	20 $\mu$ W	140 $\mu$ W
Imaging system dynamic range	24 dB	30 dB
Optical system	PTFE optics	Reflection optics
Technology	IMPATT	Super-Hero IMPATT *

\* Selected IMPATT diodes with (30-50)% higher output power

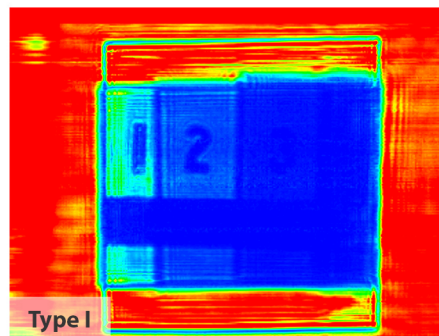


Thz transmission through paper stuck for the generators Type I and Type II

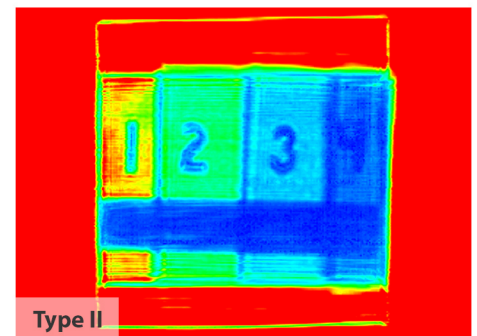
Below are two THz images obtained as a result of comparative imaging test aimed to show the difference in performance between terahertz imaging scanner equipped with Type I and Type II generators. Four flat figures were cut of metallic foil and placed underneath paper stacks of thickness ranging from 1 to 4 cm. Imaging scanner with Type I source can penetrate only paper stacks 1 and 2 and reveal foil figures hidden underneath the paper. The penetration depth of THz imaging setup with Type II source is much deeper. We can discern fairly clear images of the letters hidden under paper stack 3 and even 4.



Paper stacks of varying thickness with flat metallic foil figures underneath



THz images obtained with Type I and Type II generators



# APPLICATIONS

Rapid non-destructive, non-invasive characterization and imaging of objects / defects in uniform materials or under coated surfaces has never been easier and faster than with our high speed camera codenamed TeraFAST. Its record breaking image acquisition rate opens up doors to many industrial applications associated with Non-destructive testing, quality control and process control.

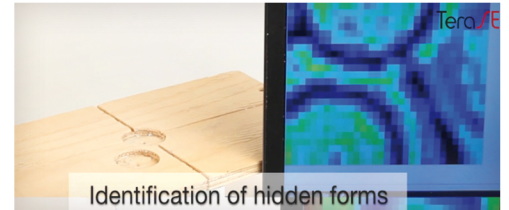


## Pharmaceutical and Cosmetics Industries

Non-destructive testing (NDT) of drugs, medical products and baby's diapers (nappies) at industrial production lines.

## Wood Processing Industry

Detecting concealed hollows, internal forms, shapes and/or defects saves a lot of time on inspections. Wood analysis: checking wood for water / moisture inside.



## Food Industry

Non-invasive technique for monitoring availability / number of hazel nuts inside of chocolate candies already wrapped and packaged; detecting any metal plastic debris, extraneous bodies or inhomogeneous parts (clots) inside ready food products.

## FMCG Packaging

Checking for availability of items inside packages as a process control step; detecting foreign objects inside packaging meant to exclude human error or defective items inside the package.



## Construction Materials and Building Trades

Using THz imaging camera at manufacturing facilities or at construction sites to identify and locate inhomogeneous elements or moisture in concrete, floor screed, plaster, wall paint etc.

## Automotive Industry

Identifying presence or absence of steel objects (viz. wires) or foreign bodies and elements inside of rubber tires. Inspecting fitted tires on wheels to identify special run-flat nylon inserts attached to alloy wheels inside a tire, thereby avoiding time-consuming tire removal for visual inspection.



## Agriculture and Livestock Farming

Potato selection process running on conveyor belt aimed to separate planting-potatoes from mud clumps and stones.

Measuring the thickness of a wool coat on a live sheep.

## Security Screening and Letter Scanning

Homeland security: identification of hidden objects concealed in bags at the airports or check-points.

Checking the contents of envelopes and parcels.

