

Description



uSense is an all-in-one raster-scan submillimeter 3D imaging system designed specifically for scientific applications. It offers unique features and remarkable performance, enabling volumetric control of the structural integrity of any dielectric object.

Highly versatile, uSense can be adapted to numerous studies: detection of cracks, delamination, metallic or wet foreign bodies, extraction of permittivity, optical indices, and even provide density information.

Features

- Four radar-equipped sensors each with their own unique bandwidth :
 - 57.4 → 63 GHz ; 113.9 → 135.9 GHz ;
 - 222.5 → 267.5 GHz ; 287 → 328.5 GHz
- Different sets of lenses with focal length of 25, 50, 75, 100, and 125 mm. 100 mm focal lenses feature laser pointers for easier set-up
- Height adjustment using manual translation stage screw with a precision down to 10 μm
- Scanning area of 595 mm x 295 mm using software controlled motorized stages with a pitch down to 100 μm in each direction
- Optional features for enhanced user experience :
 - Tactile tablet
 - Dielectric permittivity measurement toolkit

Applications

- See-through non-intrusive imaging for foreign body detection such as wet spots, delamination, glue, metallic or plastic objects or knots in wood
- Thickness measurement
- Material properties characterization in research and development
- Process validation and quality control
- Practical exercises for STEM students in universities, schools and/or laboratories

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Electrical specifications

Parameter	Symbol	Min.	Typ.	Max.	Unit	Comment
Grid voltage	V_{eff}	100	230	240	V	uSense is compatible will all different types of
Grid frequency	f_{grid}	50	50	60	Hz	electrical grids around the world ¹ .
Power draw	P_{in}	-	49	305	W	Including optional tablet ² . May be lower in practice.
Battery life ²	t_{batt}	-	9	16	h	Battery life only applies to the optional tablet ² .

Notes :

¹Default uSense features CEE 7/7 plugs, compatible with type E and type F sockets. Adaptations to other types of plugs, such as American NEMA 1-15P or NEMA 5-15P, or Japanese JA1-15P or JA5-15P, is possible on demand. In each case, uSense provides an outlet strip with up to eight sockets onto which user can connect other devices.

²Default uSense connects to a user-provided computer. A tactile tablet can be provided as an option for a fee. The tablet is typically connected to the outlet strip of the uSense. The battery provides energy to the tablet for users to save their data in case of grid power loss but cannot be used to power the motorized stages of the uSense.

Mechanical specifications

Parameter	Symbol	Min.	Typ.	Max.	Unit	Comment
Length ¹	L	-	-	1.15	m	
Width	W	-	-	0.6	m	
Height ²	H	-	-	0.7	m	
Weight ¹	m	-	-	54	kg	

Notes :

¹Dimensions and weight including the optional tablet. May be less in practice.

²Height can be adjusted using the threaded rubber feet.

Optical performance

Parameter	Symbol	Min.	Typ.	Max.	Unit	Comment
Scanning length ¹	L_{scan}	-	-	595	mm	-
Scanning width ¹	W_{scan}	-	-	295	mm	-
Acquisition rate	f_{acq}	32	-	64	Hz	-
Lengthwise resolution	R_{XY}	0.1	1	10	mm	-
Depth resolution ²	R_Z	1	7	-	mm	Typ. measured on the 120 GHz chip.
Signal to Noise Ratio	SNR	40	50	60	dB	Different for each chip. Max. at 120 GHz.-
Optical power ³	P_{opt}	-	-1.375	7	dBm	Different for each chip. Max. at 60 GHz.
Working distance ⁴	WD	25	-	100	mm	HDPE lenses have an index of 1.53.
Focal length ⁴	F	25	-	125	mm	-
Numerical Aperture	NA	0.2	-	0.51	-	-

Notes :

¹Custom length and width are possible on demand for an additional fee.

²Depends on the bandwidth of each radar. In-depth resolution is inversely proportional to bandwidth such that : $R_Z = \frac{c_0}{2n_i BW}$ where c_0 is the speed of light, n_i is the index of the optical path from the chip antennas to the $n^{\text{o}}i$ interface, and BW is the bandwidth.

³Maximum power transmitted by an antenna among all provided chips. Typ. power averaged from all Typ. values of all chips. For reference, -1.375 dBm \approx 0.729 mW, and 7 dBm \approx 5 mW.

⁴Working distance is set by lenses and are available in 25 mm steps focal lengths : 25, 50, 75, 100, and 125 mm. Due to its different geometry, the 125 mm focal lens limit the working distance to 100 mm.



Computer requirements

The user computer should meet the following requirements in order to control the uSense and run the included software adequately :

- Operating system : Windows 11 with administrative privileges
- Memory : At least 8 GB of RAM
- Storage : At least 2 GB for the software, with 120 GB recommended for storing the scan images (a full-size scan with a lengthwise resolution of 1 mm typically weighs 40 MB)
- Connectivity : at least one USB-C port with USB 3.0 capability or better
- Monitor size : for a better experience, it is recommended to use a monitor with at least a 1920x1080 resolution

Others

Parameter	Symbol	Min.	Typ.	Max.	Unit	Comment
Humidity	HR	40	-	50	%	Non-condensing.
Operating temperature ¹	T _{op}	0	-	35	°C	-
Storage temperature ¹	T _{sto}	0	-	35	°C	-

Note :

¹Temperature with the optional tablet. Default uSense without tablet can operate or be stored at up to 50°C.

For more information, please contact Optikan at : support@optikan.com.

