

DATA SHEET



ONYX™ Sensing Unit Hardware Features and Technical Specification

Industry Leading Distributed Acoustic Sensing System

ONYX™ represents an evolution of Distributed Fiber Sensing. It provides distributed acoustic data over long fiber lengths with high detection sensitivity and high spatial resolution in a compact, low power unit.



A new approach to Distributed Fiber Optic Sensing

Continuing Sintela's mission to provide the highest performing Distributed Fiber Sensing Solutions, ONYX™ is our highly cost-effective, long-range fiber-optic Distributed Acoustic Sensing (DAS) system, with industry leading levels of performance.

The ONYX™ Sensing Unit (OSU) has been developed to represent the next phase in the advancement of distributed fiber-sensing technology, and addresses the limitations commonly found in other DAS systems, namely:

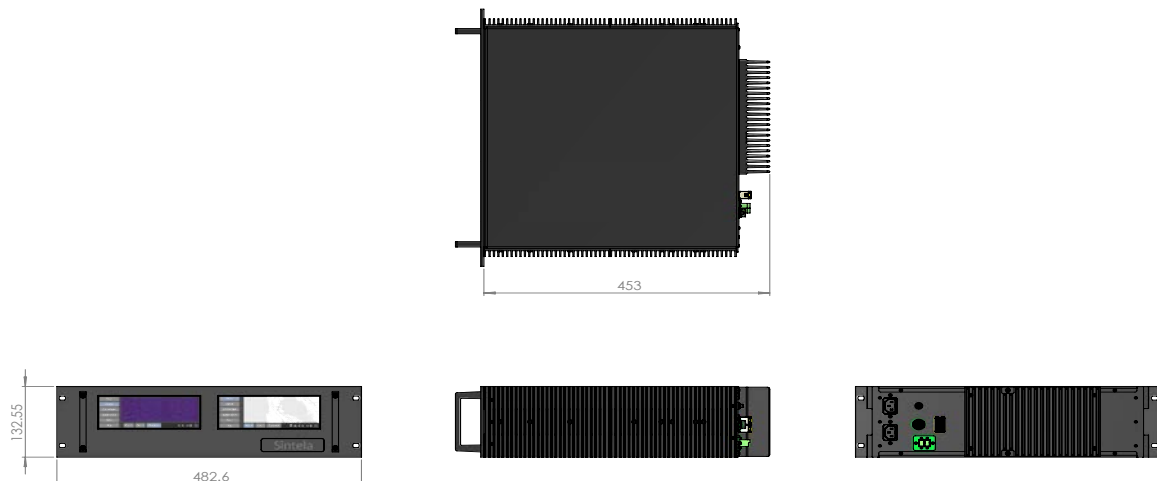
- **Integrated Design:** A single OSU integrates the optical sensing components and functions of processing hardware and engineering displays into a single 3U ONYX™ Sensing Unit. This considerably reduces the space, power and heat dispersion requirements. Furthermore, the OSU has been designed with an internal modular design, allowing for quick and easy maintenance for individual modules.
- **Up to 130 km range:** Each OSU contains two optical modules each simultaneously interrogating two sensing fibers – up to 65 km length. This represents 130 km range for one unit. This long-range capability results in significantly less equipment being required and lower cost per kilometer of monitoring. Longer ranges are also possible depending upon the application.
- **Quantitative Measurements:** ONYX™ makes coherent quantitative measurements of sound and vibration using optical IR methods over 130 km. This enables the implementation of sophisticated signal processing techniques – significantly improving the detection and classification of events, thereby improving the probability of detection whilst reducing the nuisance alarm rate. This also allows machine learning algorithms to be used reliably on the system. In comparison, conventional DAS systems typically have a qualitative response, which is unable to measure sound/vibration quantitatively.
- **Distributed Architecture:** The ONYX™ system has been designed to be fully distributed. A distributed architecture has no single point-of-failure, minimizing downtime and increasing system availability. Administration and control functions are distributed across OSU's, providing the system with a high degree of fault tolerance.
- **Class 1 Laser Safety:** Class 1 lasers are eye-safe under all operating conditions, which makes the ONYX™ system inherently safe for use, lowers the HSE burden for end clients, and increases the life span of the optical components. This also eliminates the need for costly interlock safety switches and physical keys to operate the equipment.
- **Automatic Setup with integrated fiber characterization:** The ONYX™ system has an integrated fiber characterization mode and automated installation process, simplifying the setup, commissioning and testing stages of system implementation. This results in lower manpower costs and simplifies maintenance and administrative tasks for support by local engineers; specialist engineers are not required as often for straightforward tasks. The integrated fiber characterization enables the fiber health to be monitored and is extremely useful in mitigating faults caused by engineering works carried out on the telecoms network.

Performance ^[1]				
Measurement type		Quantitative ^[2] – Heterodyne optical phase measurement		
Number of fibers		Two [Independent, 100% duty cycle (not multiplexed)]		
Standard operating wavelength ^[3]		1550.12 nm 193,400 GHz ITU CH34		
Sensing range @ 6.4 m Gauge Length ^[4]		Standard range up to 50 km (31 miles) per fiber. Greater ranges possible using large gauge lengths		
PW – Pulse Width Length [Min Max]		7.8 ns 0.8 m		192.7 ns 19.7 m
GL – Gauge Width Length [Min Max]		8.7 ns 0.9 m		390.6 ns 39.9 m
SP – Sample Interval Pitch [Min Max]		Raw ^[5]	4.3 ns 0.45 m	390.6 ns 39.9 m
		Stacked	5.2 ns 0.53 m	390.6 ns 39.9 m
SR – Sample Rate [Min Max]		250 Hz – 480 kHz		
Maximum output bitrate (raw data) = # Fibers x # Channels x Sample Rate x 16		75 Gbits/s		
Acoustic Frequency Range	Min	< 1 mHz [Arbitrarily selectable]		
	Max	240 kHz @ 200 m	10 kHz @ 5 km	1 kHz @ 50 km
Dynamic range (front of 5 km fiber, using 20 kHz SR, 6.4 m GL) = largest linear signal / noise floor		155 dB @ 1 Hz	135 dB @ 10 Hz	115 dB @ 100 Hz
Noise Floor [NF] ^[4] @ 100 Hz Measured at front end of fiber		5 km @ 20 kHz Using 3.2 m GL	50 km @ 2 kHz Using 6.4 m GL	65 km @ 1.6 kHz Using 9.6 m GL
		-80 dB Rad.Hz ^{-½}	-60 dB Rad.Hz ^{-½}	-57 dB Rad.Hz ^{-½}
Linearity		Harmonic distortion typ. < -40 dB		
Crosstalk isolation		> 80 dB		

Sensing fiber requirement	
Standard fiber types	SMF-28e ITU-T G.652, G.654 or G.655
Maximum fiber attenuation for given specs	0.2 dB.km ⁻¹ at 1550 nm
Maximum acceptable loss budget	18 dB per fiber
Maximum acceptable back reflection	< 2 %

Processing capability	
Built-in processing [For acoustic signal processing and automated event detection, location, and classification]	AI Performance: 2753 Terra OPS GPU: 2048 core Ampere with 64 Tensor Cores CPU: 12 core ARM v8.2 64 bit Memory: 64 GB 204.8 GB/s DL Accelerator: 2 x NVDLA Engines
Data storage	1x 256 GB NVMe SSD (Internal – fixed) Standard: 2 x 2 TB SSD (removable) Optional: 2 x 8 TB SSD (removable)

Network requirements			
Minimum recommended bandwidth		2 Mbits/s ^[6]	
Interfaces			
Optical connections		2 x E2000-PS APC [or user defined]	
Data Interfacing	Electrical or Optical	QSFP28: 100GBASE-CR4, 5 m, Cat6 or 7 twisted pair	
		2 x SFP:	10GBASE-ZR, 100 km, single mode fiber
			10GBASE-T, copper
Data accessibility		Removable SSD's, 2x USB-C, TCP-IP over Ethernet	
Real time data storage formats		Raw binary, HDF5, SEG-Y, Frequency Band Extracted (FBE)	
Timing synchronization		GNSS [Global Navigation Satellite System] ^[7] synchronization of internal reference clock. Providing approx. ±100 ns timing accuracy	
		NTP synchronization, Providing approx. ±10 μs timing accuracy	
External Time Break input		TB input via BNC connector (Software selectable level)	
Size and Weight			
Size	Format	19-inch 3U Enclosure	
	Height	132.5 mm 5.22 in	
	Width	482.6 mm 19 in	
	Depth	453 mm 17.8 in	
Weight		16.5 kg 37 lbs	
Mounting		Slide rails for front and back support	



Power		
Power supply	Option 1	110 / 230 VAC nominal (85 - 264 VAC) at 50 - 60 Hz Dual redundant power supplies and cables
	Option 2	24 / 48 VDC nominal (16.8 – 62.4 VDC) Dual redundant power supplies and cables
Power consumption		<100 W
Current rating		1.5 Amp @ 100-240 VAC; 6.3A @ 24-48 VDC

Environmental	
Heat management	Passive cooling (for high reliability)
Storage temperature range	-40 °C to +70 °C -40 °F to +158 °F
Operating temperature range	-5 °C to +50 °C 23 °F to +122 °F
Operating humidity (max)	85% non-condensing
Ingress Protection	IP50 [Protected against dust]
Maximum operating vibration	10 mg.Hz ^{-½} [on any axis]
Maximum non-operational vibration	120 mg.Hz ^{-½} [on any axis]

Safety	
Laser Safety Class	Class 1 (IEC 60825-1, 21CFR1040.10)

Reliability ^[8]	
Mean Time Between Failures [MTBF]	>15 years [95400 Hours]
Failures in Time (FIT) per 10 ⁹ hours	<10482 FIT
Mean Time to Repair (MTTR)	20 minutes to bring back to working state, assuming repair by unit replacement. 1 hour assuming module replacement

Declaration of Conformity	
Cybersecurity	CIS Benchmark compliant
Electromagnetic compatibility (EMC) Compliance	USA (FCC): 47 CFR Part 15 B Canada: ICES-003 2012 EU: CE compliant - 2014/30/EU
Electrical Safety Compliance	EU: CE Compliant - 2014/35/EU USA: UL 62368-1
RoHS (Restriction of Hazardous Substances) Compliance	2011/65/EU and Amending Directive, 2015/863
Laser Safety	Class 1 LASER PRODUCT Complies with IEC 60825: 2014, 21 CFR 1040.10 and 1040.11 except for conformance with IEC 60825-1 Ed 3, as described in Laser Notice No. 56, dated May 8, 2019
Management System	ISO 9001:2015 Certified

Export Conditions	
Export Control Classification Number (ECCN)	ONYX™ Sensing Unit: EAR99 ONYX™ contains components with the following EAR codes: 5A991.b, 5A992.c, 5A991, 3A991D, 7A994, 6A995.b.1.a, 5D992.c each is less than 4% of unit BOM cost
Harmonized Tariff Schedule (HTS)	90275000

Notes	
1	Measurements based upon recommended measurement procedures described in the SEAFOM MSP-02 – D'AS Parameter Definitions and Tests' document and are available upon request
2	Coherent in phase and amplitude across all channels
3	Other wavelengths available upon request
4	All lengths calculated assuming a single mode fiber with an effective refractive index of 1.4685
5	Raw data can be extracted at up to 1.74 ns / 0.18 m sample interval, but data rate would be 25 TB/Hr
6	Full access and control can be achieved over a 4G mobile phone connection
7	Requires the connection of a GNSS antenna
8	Calculated using Telcordia SR332 (Bellcore)

Additional features	
Front panel touch screen	2x 6.8 in diagonal, 1280x480 resolution color touch screens for standalone monitoring and control
Auto optical setup	With optimization checking and auditable storage of the systems setting
Auto fault recovery	On detection of a fault the optical sensing unit can be remotely reset
Built-in fiber characterization	Offline feature for setup and for monitoring damage and long-term degradation to the sensing fibers
Back reflection protection	ONYX™ can tolerate back reflections of 3%
Fiber cut tolerance	The system will continue to function on a fiber which has been cut. Performance on the fiber up to that cut will not be affected.
Status diagnostics	Remote, auto diagnostics
Vibration logging at runtime	Vibration logger included to detect excessive vibration events
Cloud storage of events	If either a single or network of ONYX™ Sensing Units is connected to the internet, alert data can be sent to cloud storage for remote access. In systems on a local intranet a similar approach can be taken using local Network Attached Storage (NAS).

Availability of capabilities and features

Unless otherwise expressly indicated in writing, Sintela products and data sheets relating thereto are subject to change without notice. Users should check for and obtain the latest relevant information and verify that such information is current and complete before placing orders for Sintela products.