

## T8 SENSOR | PERIMETER

Multipurpose system of technological monitoring and critical facilities protection



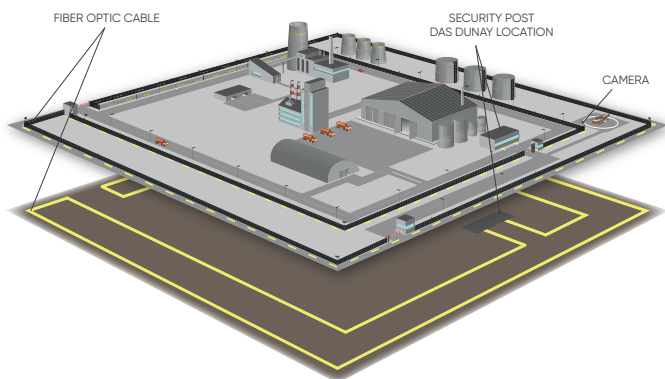
## DAS DUNAY | PERIMETER

The global market for perimeter security systems is growing at 10 % per year and is projected to reach \$30 billion by 2025.

Traditional perimeter protection means such as cameras, unmanned aerial vehicles and security teams require 24/7 monitoring of the entire length of the line, so the main task of the security service is not the physical protection of the object, but the timely detection of an intruder and the prevention of possible adverse events.

Distributed acoustic sensor Dunay (DAS Dunay) manufactured by T8 Sensor, based on Distributed Acoustic Sensor (DAS) technology, provides real-time monitoring and detection of perimeter security threats, including:

- attempts to enter the territory of the protected object
- activity in the security zone near the perimeter
- damage to the integrity of the perimeter fence



Perimeter security system

## EVENT RECOGNITION

Any mechanical impacts near the perimeter, such as human steps or vehicle movement, have a unique vibro-acoustic trace, which is captured by the sensor cable and recorded by DAS Dunay.

Using neural network algorithms, the system can be trained to classify additional types of events, with high accuracy



Dunay unit in 3U format for a telecommunications rack

**DAS technology is used to protect the perimeters of such objects as:**

- airports and seaports
- large industrial and regime enterprises
- specially protected zones of cultural heritage
- state institutions
- pipelines and other extended objects
- landfills for various purposes

**The multifunctional system of technological monitoring and protection of critical facilities is used to solve the following tasks:**

- timely detection of the intruder and informing the duty services about the fact of the violation (penetration to the protected object)
- fixation of time and place of violation (geographical coordinates and distance to pickets / control objects)
- the possibility of detecting an intruder before crossing the line (fixing attempts to climb the barrier, break it, dig it)
- recognition of the type of intruder, in some cases such as determination of the direction and speed of his movement, location and nature of the impact on the perimeter fence
- remote monitoring of the state of the boundaries of monitored objects, the actions of violators and duty services
- documentation of identified events in automatic mode

and minimal error probability, necessary for each customer and specific object.

To ensure the operation of the neural network, both the computer built into DAS Dunay and an external server can be used.

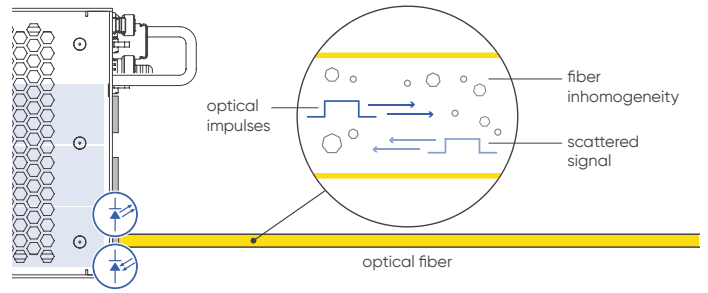
## WORK PRINCIPLES

The distributed acoustic sensor makes it possible to detect acoustic vibrations at a distance of up to several tens of kilometers from the location of DAS Dunay along the optical cable.

DAS Dunay consists of an emitter and signal receiver unit, data processing system and software. The classification of each event (violation class) occurs using neural network algorithms.

The sensing element is a cable-sensor with a standard telecommunication single-mode fiber (G.652, G.655, G.657), the service life of which is more than 25 years. One of the fibers of the sensor cable is connected to DAS Dunay, which continuously monitors vibro-acoustic events along the fiber optic cable, which makes it possible to detect incidents in real time.

The operation of the system is based on the principles of coherent reflectometry and Rayleigh scattering. Optical pulses are periodically injected into the fiber, part of the



DAS technology principle of operation

light is scattered by the inhomogeneities of the fiber and propagates in the opposite direction.

With fiber micro deformations caused by vibro-acoustic effects and temperature fluctuations, the parameters of the scattered signal change.

Analyzing changes in the interference pattern of the backscatter signal, DAS Dunay makes it possible to determine the place and nature of the impact in the sensitivity zone of the cable sensor.

## BENEFITS AND CAPABILITIES

DAS Dunay provides operators with many opportunities to detect vibro-acoustic events. When installing the system, T8 Sensor specialists carry out individual configuration of the system, taking into account the characteristics of each object.

There are a number of advantages that distinguish DAS Dunay from other systems:

### Range

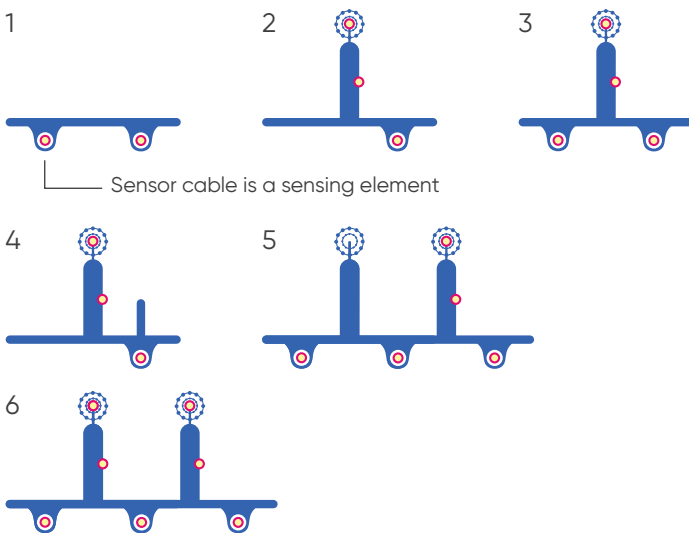
- up to 100 km when laying the sensor cable underground
- up to 50 km when laying the cable-sensor along the

fence (latticed fence made of welded wire with a bar diameter of 27 mm; three-dimensional and flat reinforced barbed tape / wire; chain-link mesh stretched over a metal frame).

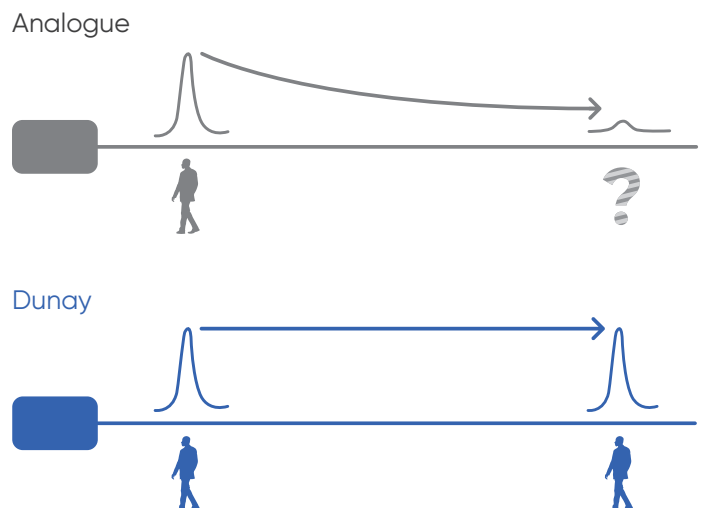
To determine the direction and speed of the intruder, it is recommended to organize several security lines.

### System response linearity

Stable signal shape for 1 km, 20 km, 50 km and more due to the use of a coherent phase-sensitive reflectometer; no fading zones.



Options for building monitoring boundaries



Linearity of the system response over the entire length of the sensor cable

### Using the Hidden Line Part

A passive sensor cable buried in the ground does not allow detecting the boundary either visually or by measuring electromagnetic field fluctuations, since the sensor cable is a passive element of the system that is not a source of electromagnetic radiation. The use of hidden cable-sensor laying makes it difficult for potential violators to conduct reconnaissance of the area, allows you to preserve the landscape appearance of the monitoring object and use the system in specially protected areas of cultural heritage.

### Ease of operation of the linear part

- no need for power and equipment at the far end of the line (power is supplied at the installation site of the equipment)
- immunity to electromagnetic interference
- insensitivity of the system to external disturbances – industrial disturbances, air, railway and motor transport noise, tree wind and movement of small animals

### Deployable on existing fiber infrastructure

#### Integration through open interfaces (APIs)

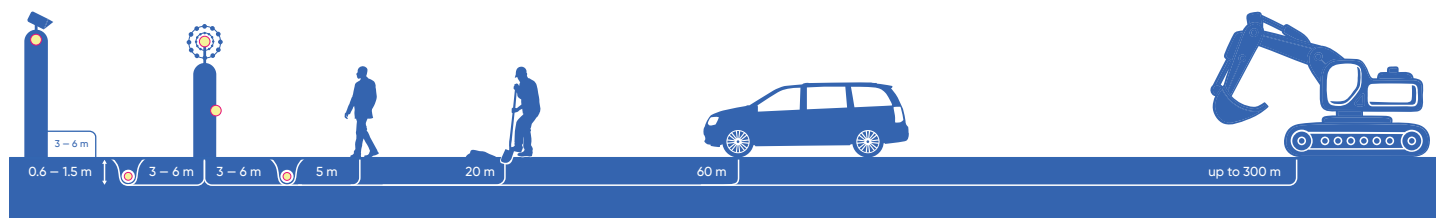
with other installed monitoring, activity control and video surveillance systems

#### Early event detection

Classification of the source of exposure before the intersection of the sensing element and the security line:

- human steps – 5-10 m from the cable
- manual digging – 15-30 m from the cable
- car movement – 50-60 m from the cable
- movement and digging of heavy equipment – 50-300 m from the cable

#### Preservation of system operability in the event of a break in the sensor cable with localization of the event site



Maximum distance from the fiber-optic cable for registration and classification of vibroacoustic effects

### Specifications

System parameters	
Optical fiber type	G.652, G.655 or G.657 (ITU), single mode
Fiber length (sensing element)	75 km (up to 100 km depending on configuration)**
Spatial resolution	10 m
Optical parameters	
Wavelength	1550 nm
Scanning frequency	0.5 – 20 kHz
Strain sensitivity	from 0.14 nstrain
Dynamic range	30 dB
Maximum power	10 mW
Connector type	LC / APC
Embedded PC	
Processor	Intel Core i7 *
RAM	HDD 8 GB / 2 TB *
Protocols	TCP / IP, UDP
Interfaces	SFP, RG45, USB 2.0, DVI-D, Display Port
Variants	
Power supply	110–127 V / ~200–240 B, 50–60 Hz
Power consumption (OTDR / server)	300 W (100 / 200 W)
Dimensions	497 mm x 345 mm x 137 mm (3U version)
Weight	17.5 kg

\* Dependent on operating conditions, subject to change

\*\* Depending on delivery configuration

# SYSTEM FUNCTIONS

## Visualization of recognized events

During commissioning, T8 Sensor specialists perform “mutual binding” of the sensor cable and pipeline (monitored object) to any public mapping platform (Google Maps, Yandex.Maps), or to an individual map format used by the customer.

The company’s engineers customize the system interface according to the customer’s requirements. Display of information about detected events is displayed on the operator’s screen in graphical form (on a map-scheme) and in textual (tabular) form. The operator can filter aggregated events for each category of severity (alarms).

## Integration

The maximum efficiency of the monitoring system is achieved when it is used in conjunction with other sets of technical means:

- life support
- power supply
- access control
- emergency protection system
- emergency / security warning system

T8 Sensor is working on the integration of the monitoring system and unmanned aerial vehicles (UAVs). API for integration is carried out through xml, json, modbus.

## Scaling

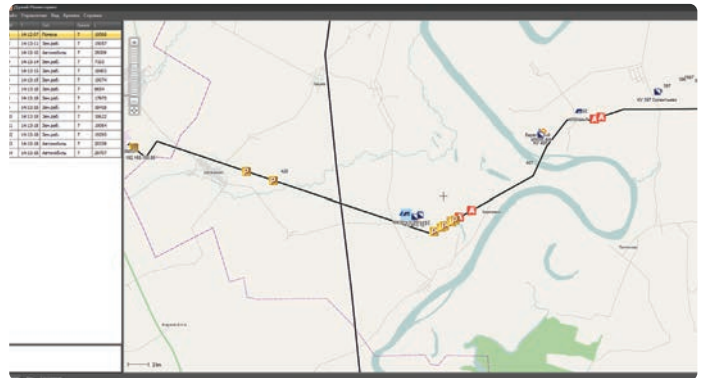
The developed architecture of the system makes it possible to automatically combine up to 20 devices into a single complex, which makes it possible to cover more than 1500 km.

The number of connected devices is limited only by the computing power of dedicated aggregation servers, which allow operators to work with the system remotely.

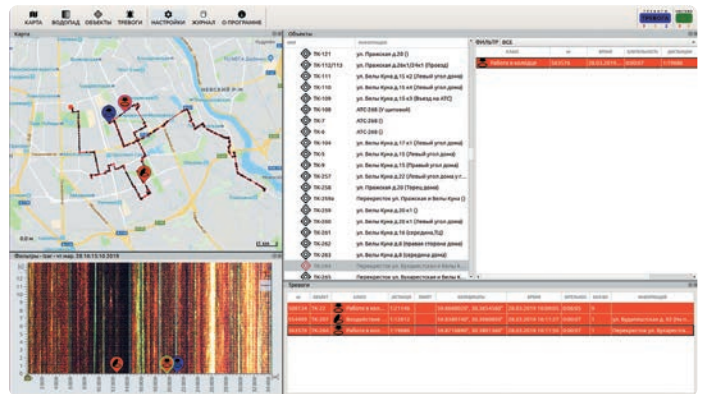
Each device DAS Dunay can act as a server for five other systems. In addition, the system allows you to divide any monitoring object into an arbitrary number of zones with different customizable monitoring parameters.



JSON or XML / User Interface



System operator window showing a map and a list of events at the turn



User interface with event log

## T8 SENSOR | DAS SYSTEMS

T8 Sensor is a Russian developer and manufacturer of fiber optic sensor systems. Main activities: scientific research in the field of photonics and development of multifunctional systems for technological monitoring and protection. T8 Sensor LLC is part of the T8 Group of Companies and is a resident of the Skolkovo Foundation.

T8 Sensor conducts research and development activities. All developments are protected by patents valid on the territory of the Russian Federation and on the territory of the Eurasian Patent Convention.

Part of the research is carried out by the company's specialists in the interests of the telecommunications equipment manufacturer T8 LLC.

Distributed acoustic sensor Dunay is the main development of the company with a wide range of applications: monitoring of transport infrastructure facilities (railways, metro, runways, bridges, tunnels, highways), perimeter security, pipeline monitoring, vertical seismic profiling, and monitoring state of the optical infrastructure of telecom operators.

Currently, DAS Dunay is successfully operated at the facilities of the fuel and energy complex, the oil and gas industry, auto and air transport infrastructure, and telecom operators.

## GEOGRAPHY OF APPLICATION



## COMPLETED PROJECTS



### GAZPROM TRANSGAZ | UFA

Number of systems: 2  
Total length: 89 km (37 km + 52 km)  
Launch year: 2015



### SC «ROSATOM»

Number of systems: 1  
Total length: 20 km  
Launch year: 2020



### KAZTRANSOIL | KAZAKHSTAN

Number of systems: 2  
Total length: 86 km  
Launch year: 2020

### LIMPOPO NATIONAL PARK | South Africa

Number of systems: 2  
Total length: 80 km (40 + 40 km)  
Launch year: 2020



### GAZPROM TRANSGAZ | Ukhta

Number of systems: 1  
Total length: 100 km  
Launch year: 2018



### SARATOV REFINERY

Number of systems: 2  
Total length: 10 km  
Launch year: 2019



### KAZTRANSOIL | KAZAKHSTAN

Number of systems: 1  
Total length: 40 km  
Launch year: 2021

### GKU RB «ECONOMIC DEPARTMENT NO. 2» | UFA

Number of systems: 1  
Total length: 5 km  
Launch year: 2021



## **T8 SENSOR I DAS SYSTEMS**

T8 Sensor is a Russian company for the development and production of fiber optic sensor systems

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