OPTIMEX 64

Advanced Optical Analyzer of Explosive Processes

OPTIMEX 64 is an advanced scientific instrument which uses multiple fiber optic probes to record light intensity signals generated by explosives in time. It is useful for determination of various detonation parameters of all kinds of explosive materials. OPTIMEX 64 presents next generation of VOD-815 device with completely redesigned optoelectronic acquisition system and advanced data evaluation features based on extensive research of explosives' light output. The optic probes principally provide full resistance against humidity and electromagnetic disturbances which allows the instrument to be used together with any other instrumentation.

Applications

OPTIMEX 64 is used for measurements of detonation or nonreactive shock propagation in research and development of energetic materials. With high number of fiber probes, the instrument's capabilities resemble those of high speed streak camera. OPTIMEX 64 records full light intensity-time profiles generated at specific places within an explosive charge. Analysis of light emission profiles makes evaluation of such signals robust and reliable for all existing samples including non-ideal explosives. Explosive's translucency, low light emissivity, afterburning, etc. will no longer spoil the measurement results. The typical OPTIMEX 64 tasks may include:

- **Detonation velocity**: Tracking the detonation wave by a series of optic fibers perpendicular to the charge axis allows determination of detonation velocity using distance of the probes and time differences between signals' arrival. The detonation velocity can be measured in multiple charges within one shot.

- **Detonation wave curvature**: Fiber optic probes placed perpendicular to the explosive charge end surface can be used to sense detonation wave as it emerges from the explosive.

- **Shock velocities in inert materials**: The shock which is generated in inert material by explosion of attached explosive charge can be used to estimate detonation pressure of the explosive.

- **Cylinder expansion velocity**: Cylinder filled with high explosive expands radially when the explosive is detonated. Expanding cylinder produce flashes of light when it hits glass optical fibers. Cylinder widening may therefore be tracked by a series of fiber optic probes in the same way as it was historically done using electrical contact pins.

- **Process of initiation of explosives** by means of shock to detonation or deflagration to detonation transitions can be observed and analyzed with great confidence about the phenomena.

Instrument description

OPTIMEX 64 light recording system is encased in a metallic box with a set of fiber optic modules, each containing 8 measurement channels. The fiber optic cables which are used as light probes can be connected directly to sockets in the front panel of the instrument. The instrument can be used as tabletop or it can be mounted in a shockproof rack case.

Light emission profiles obtained by all the probes are saved to a USB flash drive. The results can be viewed on a 7 inch capacitive touchscreen LCD display and evaluated using dedicated software

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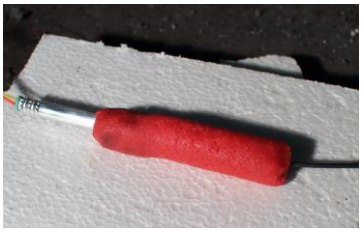
which allows automatic or manual data evaluation. Internal backup flash memory prevents any data loss. Optional WiFi module allows controlling the instrument remotely.

The fiber optic modules accept both plastic and glass fiber optic probes. OPTIMEX 64 may accommodate up to 8 modules according to the customer's preferences so the overall maximum number of measurement channels is therefore 64. There are also Aux-In and Aux-Out connectors which allow various options of triggering when OPTIMEX 64 is used in cooperation with another devices.

The plastic fiber optic probes are first choice option for detonation velocity measurements. They allow maximum amount of light to be captured and thus are best suited for explosives with low light emission such as emulsion explosives, liquid explosives, etc. The plastic fibers are robust and easy to work with. The recommended probe-to probe distance is 10 mm or more.

The glass fiber optic probes are small in diameter which allows better precision of their placement compared to the plastic probes. Virtually single grain of explosive is captured by the probe which is useful in testing the smallest charges. Distances of more than 500 m between the explosive charge and OPTIMEX 64 device can be used thanks to low signal transport losses. Compared to the plastic fibers, the glass fibers are more fragile and a bit more difficult to handle. The recommended probe-to-probe distance is 5 mm or more, but it can be as small as 1 mm in a specific cases.



The overall number of measurement positions can be further increased by the use of the **Perforated Fiber Probes** which consist of a piece of the plastic fiber optic cable with miniature holes created in its core. The Perforated Fiber Probe is simply placed perpendicular to the charge axis. The detonation wave generates sharp peaks on the light signal as it passes the holes and the detonation velocity is then determined from the distances between the holes and the corresponding peak times. Using this technique, detonation velocity of a single explosive charge can be measured by a single channel.

Technical parameters

- Up to 8 fiber optic modules, each having 8 independent measurement channels which accept both plastic or glass fiber probes
- Sampling rate 8×250 MS/s for each module (up to 16 billion samples per second at 8 modules)
- Maximum time resolution: 4 ns
- Sampling frequency accuracy: 0.01%
- Light intensity resolution: 12 bit (4096 levels)
- Recording length: 520 µs at the maximum sampling rate (131 000 data points)
- Fiber probe active diameter:
  960 µm for POF
  50 µm for glass fibers
- Distance to the test site:
  100 m for plastic optic cables
  >500 m for glass optic cables
- Operating temperature: 0 – 50°C
- Power input: 230 V/50 Hz
- Weight: 14 kg
- Dimensions: 46.4×36.1×22.9 cm

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Standard instrument parts

OPTIMEX64-MUP – Main unit of the instrument with eight slots for up to 8 modules, each having 8 channels.

OPTIMEX64-PCH8 – Fiber optic module with 8 independent measurement channels, accepts both plastic and glass fiber probes

OPTIMEX64-4C200 – Plastic fiber probe cable which is used to make probes. It lasts for up to 800 tests (using 4 channels and ca 500 g charges)

OPTIMEX64-8C250G – 8-core glass fiber optic cable with colored cores. Cable length 250 m. It lasts for up to 800 tests (using 8 channels and ca 500 g charges)

OPTIMEX64-PPS – Probe preparation set which includes fiber connectors and polishing tools

Optional parts

OPTIMEX64-RC – Shockproof protection case which protects the instrument in outdoor use

OPTIMEX64-4CE30 – Four-core cable optical extension including the cable reel

OPTIMEX64-WM – WiFi module for remote control using PC or a smartphone

OPTIMEX64-ATP – Additional tools and accessory set for usage and self-preparation of perforated fiber probes (PFP)

OPTIMEX64-CAL – Calibration check of the instrument using high performance oscilloscope

Consumables

OPTIMEX64-4C200 – Plastic fiber probe cable which is used to make probes. It lasts for up to 800 tests (using 4 channels and ca 500 g charges)

OPTIMEX64-CX500 – 1-core plastic fiber optic cable with colored jacket (X: B-black, R-red, G-green, Y-yellow). Cable length 500 m.

OPTIMEX64-8C250G – 8-core glass fiber optic cable with colored cores. Cable length 250 m. It lasts for up to 800 tests (using 8 channels and ca 500 g charges)

OPTIMEX64-BF – Set of bulkhead feedthroughs (10 pcs)

OPTIMEX64-IHP – Perforated fiber probe (8 pcs) for small sized charges with active length of 0.1 m. The total fiber length is 2 m.

OPTIMEX64-OBS – Optical break screen set (8 pcs, i.e. 1 test with 8 probes) for measurement of shaped charge jet velocity.

OPTIMEX64-PFP1 – Perforated fiber probe set (8 pcs, i.e. 8 tests) for small sized charges with active length of 0.1 m. The total fiber length is 2 m.

OPTIMEX64-PFP2 – Perforated fiber probe set (8 pcs, i.e. 8 tests) for medium sized charges with active length of 1 m. The total fiber length is 8 m.

Training course

2-days course which includes

- Basics of fiber optics technologies

- Practical aspects of fiber optic measurements

- Instrument operation and maintenance

Manufacturing note

The product is manufactured according to relevant EU directives and manufacturing standards.

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