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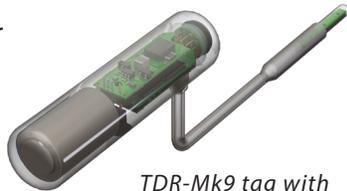
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TDR-MK9 ARCHIVAL TAGS PRODUCT SHEET

The smallest of the Wildlife Computers family of archival instruments is the TDR-Mk9 archival tag. It is designed to study seals, penguins, large pelagic fish and other diving marine animals. The TDR-Mk9 measures depth, temperature, and light-level, and also differentiates wet or dry conditions. It is suitable for both external attachment and internal implantation.



TDR-Mk9 tag with optional sensor stalk, designed for implantation

The standard TDR-Mk9 configuration has the depth, temperature, light-level, and wet/dry sensors mounted on the body of the tag. Optionally, the light level and/or a second temperature sensor can be mounted on a sensor stalk.

Size, weight and pressure resistance

The standard external configuration is 68mm long by 17mm by 17mm, weighing 30g or less (in air). The standard implant configuration is 72mm long by 19mm in diameter, weighing 34g or less (in air). These configurations will withstand up to at least 1000m of pressure. Other configurations are available for both implantation and external application for depths to 2000m. Actual dimensions and weights are subject to change, so should be verified at the time an order is placed.

Surface materials

The main body of the instrument is hydrolytically stable and non-biologically reactive.

Memory and data retention

64 MB of non-volatile Flash memory for data storage allows the TDR-Mk9 to store 32 to 64 million samples (sensor readings). Each sample occupies either one or two bytes of memory, depending upon the resolution selected. Over 8 years of data can be stored when

sampling depth, tag temperature, stalk temperature and light-level every 30 seconds at full resolution. Data are maintained in memory for more than 25 years even if the battery is exhausted.

Battery life

Efficient power management is attained by using a low-voltage micro-controller and flash memory. Actual battery life is dependent upon the sampling regime and temperature conditions. Under most deployment conditions, the battery can be expected to provide enough power to fill memory at least 5 times. Batteries can be replaced for extended instrument life.

Sensors

The TDR-Mk9 is configured with multiple sensors.

Depth — A 12-bit analog-to-digital converter is used, which provides highly-accurate measurements from -40 to +1000m, with 0.5m resolution and an accuracy of $\pm 1\%$. In addition, measurements from 1000 to 1500m are made with a lesser degree of accuracy. Measurements can be recorded throughout the range at full resolution. Two bytes of memory are required to store depth readings in this uncompressed mode.

Temperature — A 12-bit analog-to-digital converter is used, which provides an actual measured range of -40° to +60°C, with 0.05°C resolution and an accuracy of $\pm 0.1^\circ\text{C}$. Measurements can be recorded throughout the range at full resolution. Two bytes of memory are required to store temperature readings in this uncompressed mode.



TDR-Mk9 with protected external fast-response thermistor

TDR-Mk9 Archival Tags Product Sheet – continued

Both depth and temperature sensor readings can be compressed to fit into one byte of memory.

Light Level — The light sensor measures blue light on a logarithmic scale. It is a relative measurement of light intensity with bright sunshine reading approximately 225. Tests have shown that we can determine dawn/dusk events from light readings taken by this sensor as deep as 300m in clear ocean waters.

Wet/Dry — The TDR-Mk9 can be configured with a sensor which allows the user to set the tag to sample only when wet and to keep track of the time when it is dry.

Communication

Wildlife Computers provides an interface to the TDR-Mk9 that runs on a PC. This interface allows the user to set up the tag for deployment, and download the data after recovery.

User-programmable sampling protocols

Sampling is controlled by a user-specified sampling protocol. The user programs the rate at which each sensor is sampled, and whether or not sampling is suspended when the wet/dry sensor reads dry.

Controller features

The operating code of the TDR-Mk9 can be upgraded. This means you can always have the most up-to-date version of on-board software, regardless of when the tag was purchased. The low-voltage design minimizes power consumption to extend battery life. The onboard clock is temperature corrected over the range -20°C to +50°C to provide high time accuracy throughout the deployment. Clock correction is active even when the Mk9 is in stand-by mode.

Tag activation

The TDR-Mk9's can be turned on and off with a magnet. The LED flash sequence indicates whether the tag is in standby mode or deployed.

Data decoding and analysis

Wildlife Computers-designed PC-based software is available to aid in the analysis of the data.

Geolocation using light-level

Wildlife Computers has developed software, WC-GPE, that calculates daily longitude and latitude from recorded light level curves. Longitude accuracy can be as good as ± 0.5 degrees. Latitude accuracy depends upon both the latitude and time of the year. Best accuracies (± 1 degree) are achieved at high latitudes near the solstices, and worst (± 10 degrees, where and when latitude can be calculated) occur near the equator near the equinoxes.

TDR-Mk9 tags built-to-order

Stress testing and sensor calibration are performed after the instrument is cast, and each unit is bench-tested prior to shipment to confirm sensor calibration and proper functioning.

Tag customization

Custom modifications, including changes to the sensors and shape of the packaging may be available. As an example, the TDR-Mk9 can be custom-configured to support up to three temperature sensors. It can also be configured to accept input in the 0 to 2.5V range from a user-supplied sensor.

For custom orders, please contact Wildlife Computers to determine availability. Lead times for such orders are significantly longer than standard.