ELMAR - the **EL**ectro**MA**gnetic **R**ecorder

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SUMMARY

For many years, the Geophysical Instrument Pool Potsdam (GIPP) of the German Research Centre for Geosciences (GFZ) has provided the international research community with geophysical and in particular Magnetotelluric (MT) instruments to conduct field experiments around the world. The instruments are provided free of charge, but with the obligation to archive and eventually publish the data. In total, recording equipment and sensors can be provided for about 50 broadband and 30 long-period MT stations. The most important workhorse in recent years has been the S.P.A.M. Mk IV data logger, which provides recordings in the frequency range from DC to about 10 kHz (max. 25 kHz sampling rate), with a typical power consumption of 6 – 8 W (no sensors connected).

Here we introduce ELMAR - the **El**ectro**ma**gnetic **R**ecorder - a new generation of data loggers designed and developed by the GIPP. The main advantages over existing systems are: a wider frequency range (max. 256 kHz sampling rate), lower power consumption (1.5 – 3 W), a wide range of supply voltages (8 – 36 V DC, Power over Ethernet, USB-C PD) and overall reduced dimensions and weight. User interaction is based on the *http* protocol, which means that ELMAR systems can be controlled from any web browser. A graphical user interface is provided to enter the required site information, check system status, monitor power consumption, voltages, and most importantly, the incoming data.

The analogue section provides software-controlled amplification (or attenuation) with variable gains. Gain control can be manual or automatic. All analogue inputs are differential with high impedance inputs (GΩ range). Optionally, a DC offset can be subtracted before the gain, e.g. to compensate for self-potentials of the electrical dipoles. Analogue-to-digital conversion is with 24-bit resolution.

The digital time series data can be filtered in a cascade decimation scheme, using a range of low-pass and high-pass filter settings. All data streams are continuous. Time series data, (calibrated) Fourier spectra, and MT transfer functions can be monitored (virtually) in real time. A comprehensive scheduler allows simultaneous acquisition of data streams with continuous data or pre-set (periodically recurring) intervals. An accurate time base is provided by a (dual) GNSS receiver and a voltage-controlled oscillator. The time series data is stored on SD cards.

The ELMAR recorder has a programmable test signal generator, which is used for self-testing the analogue electronics, but also for measuring contact resistances between the electrodes without polarizing them or for feeding a test signal into the induction coils.