

ExpoM - ELF

Magnetometer and Data Logger

3-Axis; DC – 100 kHz



Applications

- Tracking personal exposure to Extremely Low Frequency magnetic fields
- Long-term monitoring at home and at work
- Monitoring of magnetic field generated by power lines and transformers

Key Features

- Frequency range: DC to 100 kHz (continuous)
- High sensitivity: $<5 \text{ nT}/\sqrt{\text{Hz}}$
- Three-Axis sensor for accurate and orientation independent measurements
- Large dynamic range: $> 100 \text{ dB}$
- High field strength mode up to $\pm 45 \text{ mT}$
- Smartphone App with real-time data streaming (available soon)
- Built-in GPS
- Data export to Google Earth
- Integrated data logger ($> 250\text{k}$ measurements)
- Easy to use, light weight (300g) and small size (16 x 8 x 3.5 cm)

Specifications

1. Frequency Bands and Measurement Range

Detection method	Time-domain sampling (4096 samples) with digital processing and filtering
Sensors	Tree axis TMR sensor; Hall sensors
Measurement interval	User-selectable; from 4 seconds to 6000 seconds in steps of 0.25 second

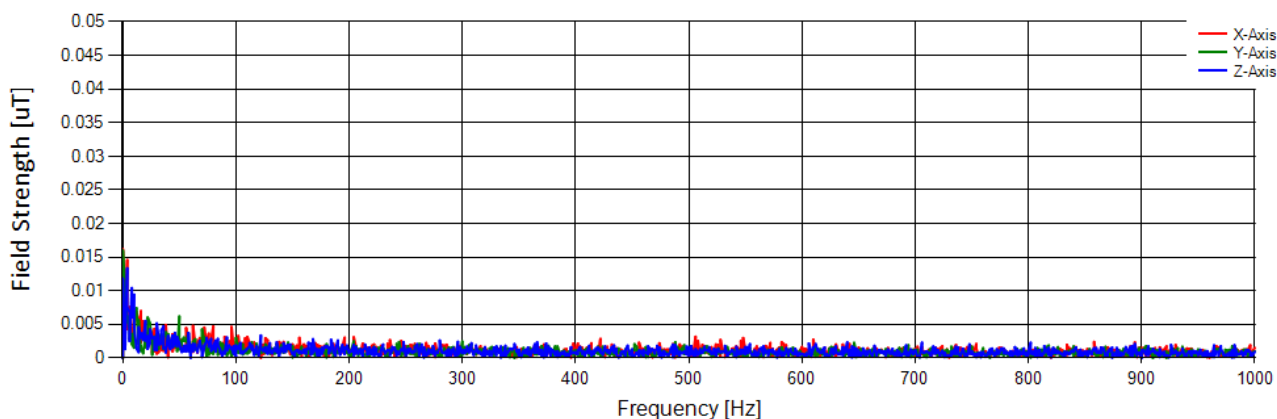
2. Bandwidth and Resolution

The measurement range of the device is subdivided into four bands: Three high sensitivity ranges with variable frequency resolution cover the frequency range from DC to 1 kHz, 10 kHz, and 100 kHz, respectively. An additional high field strength mode allows measurement up to 30 mT (RMS) from DC to 1 kHz.

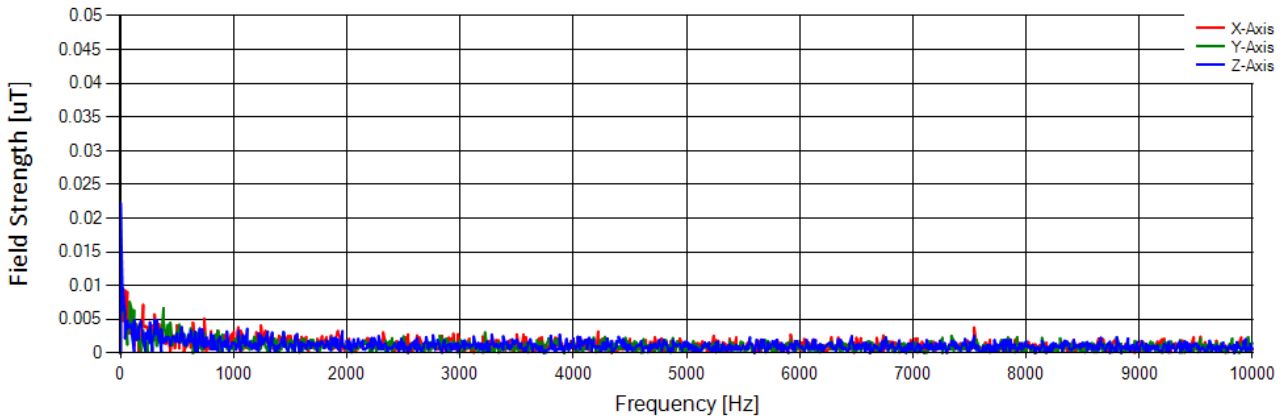
Band Name	Bandwidth	Resolution Bandwidth	Maximum Field Strength
LF (high resolution)	DC – 1 kHz	1 Hz	1000 μ T (RMS)
MF	DC – 10 kHz	10 Hz	1000 μ T (RMS)
HF (high bandwidth)	DC – 100 kHz	100 Hz	1000 μ T (RMS)
High-B	DC – 1 kHz	1 Hz	30 mT (RMS)

3. Sensitivity

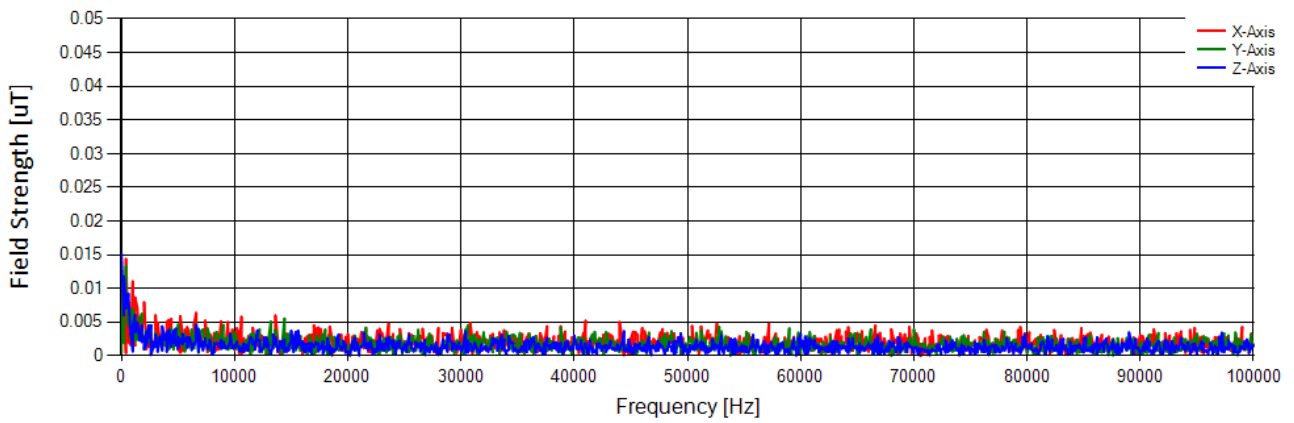
Band	Frequency Range	Spectral Noise Density
LF, MF, HF Band	16 Hz - 150 Hz	< 5 nT / $\sqrt{\text{Hz}}$ (see noise floor spectra below)
LF, MF, HF Band	150 Hz – 100 kHz	< 2 nT / $\sqrt{\text{Hz}}$ (see noise floor spectra below)
High-B Band	DC – 1 kHz	< 0.2 mT / $\sqrt{\text{Hz}}$ (see noise floor spectra below)



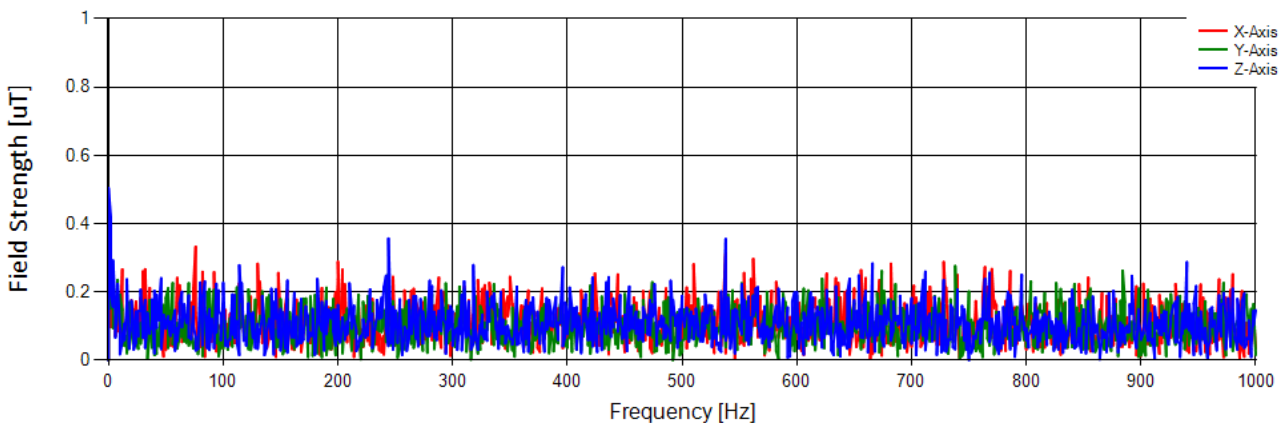
Typical noise floor: LF band (DC – 1 kHz)



Typical noise floor: MF band (DC – 10 kHz)



Typical noise floor: HF band (DC – 100 kHz)



Typical noise floor: High-B band (DC – 1 kHz)

4. Accuracy and Drift

Band	Basic Accuracy 25°C ±10°C	Typical DC Offset 25°C ±10°C	Temperature Drift 0°C to +50°C	Axis Crosstalk
LF	± 3%	± 5 µT	Sensitivity: 0.1% / °C DC Offset: <0.8 µT / °C	< 30 dB
MF	± 3%	± 5 µT		< 25 dB
HF	± 3%	± 5 µT		< 10 dB
High-B	± 3%	± 0.05 mT	Sensitivity: 0.05% / °C Offset: <2.5 µT / °C	< 25 dB

5. Linearity

Total Harmonic Distortion	Band	Test Condition
< -45 dB	LF Band	100 µT RMS; Sinusoidal field at f = 100 Hz
< -45 dB	MF Band	100 µT RMS; Sinusoidal field at f = 1 kHz
< -45 dB	HF Band	100 µT RMS; Sinusoidal field at f = 10 kHz
< -45 dB	High-B Band	1 mT RMS; Sinusoidal field at f = 100 Hz

6. Automatic Data Logging

All measurements performed with the device are automatically stored to the internal memory. The device can be configured to take a measurement on one or multiple bands (see section 2) within one measurement interval. If multiple bands are selected it may be necessary to increase the measurement interval. The recommended minimum measurement interval settings are given in the following table (Table 1).

Measurement Settings	GPS ON	GPS OFF
One band	4 seconds	4 seconds
Two bands	5 seconds	4 seconds
Three bands	6 seconds	5 seconds
All bands (LF + MF + HF + High-B)	7 seconds	6 seconds

Table 1: Recommended minimum measurement interval

Selecting a measurement interval shorter than the recommended value may lead to individual samples being taken at irregular (i.e. longer than expected) time intervals.

7. Connectivity and Data Management

Time	Integrated precision (± 2 ppm) real time clock
Connectivity	USB interface (Micro-USB), Wi-Fi (802.11b/g/n), GPS/GLONASS receiver
Marker	Built-in marker button to highlight specific events
Storage	Internal data logger memory for >250'000 measurements

8. Battery Management

Battery	Built-in rechargeable Li-ion battery
Typical operating time	> 24h (10 sec measurement interval, GPS disabled)
Charging	Micro-USB interface USB compliant chargers are supported ($\geq 1.5A$ recommended) A full charge takes about 2 h.

9. Other

Size	16 cm x 8 cm x 3.5 cm (L x W x H)
Weight	300 g
Operating Conditions	Temperature: $-5^{\circ}C$ to $+50^{\circ}C$ Rel. humidity: 0% to 90% (non-condensing)
Case protection	IP64

10. ExpoM-RF Utility Software

Processor	Dual core processor recommended
Operating Systems	Windows (XP, 7, 8)
Memory	4 GB RAM (very large measurement files may require more memory)
Installation	No installation required – ExpoM RF Utility may be started directly
Download	www.fieldsatwork.ch

Scope of Delivery

- ExpoM - ELF Magnetometer Device
- Hardcase
- USB cable
- Software – Free download for Windows (Windows 7 and higher)