

Advanced LEMI magnetometers, compatible with the 1-second INTERMAGNET standard, deployed at Conrad Observatory

Andriy Marusenkov

The Conrad Observatory is a unique place, in terms of low anthropogenic electromagnetic noise and high temperature stability, for performing high-quality geomagnetic measurements. The important part of these measurements is a continuous registration of the Earth magnetic field variations. The brief information about the modern flux-gate variometers LEMI-025 and LEMI-036 installed at Conrad Observatory is given below.

The fluxgate magnetometers LEMI-025 and LEMI-036 were specially developed for the super sensitive measurements of 3 components of Earth magnetic field induction and its variations in accordance with the new 1-second INTERMAGNET standard (Table 1).

Table 1: Magnetometers parameters vs. INTERMAGNET One-second Data Specifications.

General specifications	Intermagnet requirements	LEMI-025 & LEMI-036
Time-stamp accuracy	0.01 s	< 0.0001s
Phase response	±0.01 s	±0.01 s max
Max. filter width	25 s	17 s
Amplitude Range	≥±4000 nT	±4000 nT
Data resolution	1 pT	1 pT
Pass band	DC to 0.2 Hz	DC to 0.5 Hz
Max. component orthogonality error	2 mrad	0.5 mrad *
Max. Z-component verticality error	2 mrad	0.5 mrad *
Pass Band Specifications [DC to 8 mHz (120 s)]		
Noise level	≤100 pT RMS	< 20 pT RMS
Max. offset error	±2.5 nT	±2 nT *
Max. scaling & linearity error	0.25%	0.2% scaling 0.01% linear.
Pass Band Specifications [8 mHz (120 s) to 0.2 Hz]		
Noise level	≤10 pT/Hz ^{1/2} at 0.1 Hz	7 pT/Hz ^{1/2} at 0.1 Hz
Max. gain/atten.	3 dB	0.6 dB atten.

* after calibration

In order to realize this design major attention was paid to principal characteristics and parameters such as frequency response and sampling synchronization accuracy as well as thermal and temporal stability and noise level. To fulfil such mutually contradictory requirements as small phase response delay and deep

suppression of industrial noise, the specific combination of analogue and digital filters was realized in these instruments.

Both instruments are based on the same electronic units and fluxgate sensors. However, LEMI-036 was specially developed for the Conrad Observatory to be installed in an empty borehole with a diameter 0.2m or more. The fluxgate sensor is fixed at the suspended platform in order to automatically keep the horizontal level.



Figure 1: Flux-gate magnetometer LEMI-036.

References:

Turbitt C. et al. (2013) An Instrument Performance And Data Quality Standard For Intermagnet One Second Data Exchange, Proceedings of the XVth IAGA Workshop on Geomagnetic Observatory Instruments and Data Processing, BOLETIN ROA № 3/2013, p. 186-188.

Author:

A. Marusenkov¹

1) Lviv Centre of Institute for Space Research NASU and SSAU, Lviv, Ukraine

Corresponding author:

Andriy Marusenkov

Lviv Centre of Institute for Space Research NASU and SSAU

5A Naukova St., 79060 Lviv, Ukraine

Tel.: +380 32 254 0 266

e-mail: marand@isr.lviv.ua