

A low-power data logger system for 1 second INTERMAGNET data

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Geomagnetic observatories are currently facing requirements that cannot be easily implemented with most existing observatory data logger systems. These include real-time data transmission even from remote locations, high sampling rates and digital filtering, and delivery of data according to the INTERMAGNET 1 second standard. We believe that these challenges can best be handled in a community effort, and present the current state of an open-source data logger system.

Introduction. The design criteria of the data logger system include modularity and flexibility for use with different observatory settings, low power consumption for operation at remote locations, and the use of mostly standard low-cost hardware components. It consists of an open-source software package that runs on POSIX-compatible systems, and a Raspberry Pi platform [1]. We see this system as a good basis to address current challenges regarding geomagnetic observatory data acquisition, and we encourage international participation in further development, improvement, and usage. For this purpose, the software is open-source and freely available at a Git repository [2].

Software. The software includes functionality for serial port communication, digital filters, accurate timestamping, and drivers for common geomagnetic sensors and A/D converters (e.g. GEMSystems, ObsDAQ).

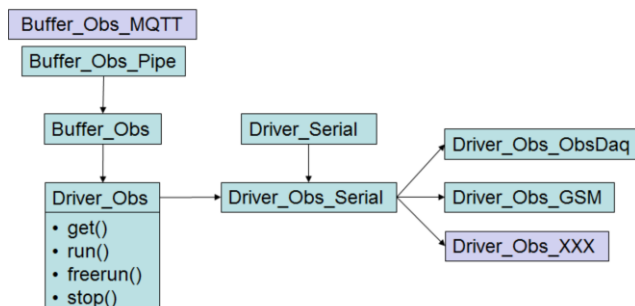


Figure 1: Example class diagram for instrument drivers and communication of the C++ datalogger software.

The datalogging software is developed in C++ using the object-oriented approach. This allows to run the software on many platforms, and makes the code modular and flexible. For example, as shown in Fig. 1, a generic abstract class <Driver_Obs> defines some interface methods for taking single or continuous measurements, and for storing calibration constants. For serial communication, the class <Driver_Obs_Serial> is available that implements <Driver_Obs> and that can be expanded to work with different geomagnetic instruments.

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Hardware. Our implementation of the data logger system is built around a RaspberryPi embedded platform. However, we note that the software package is independent from this hardware solution, and can easily be adapted to work with an alternate system. Fig. 2 shows the hardware components including USB to serial port adapters for communication with most geomagnetic instrumentation, a fibre-optical media converter (FMC) for transmitting the data, and a real-time clock and GPS module for accurate time synchronization.

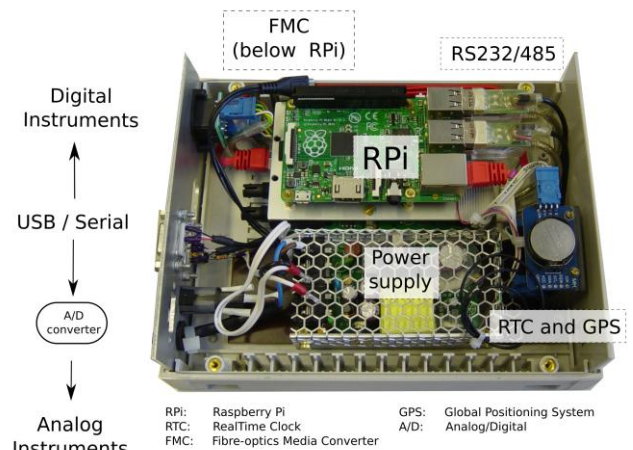


Figure 2: Layout of the RaspberryPi datalogger system as installed, e.g., at the observatories of Tatuoca (TTB) and Tristan da Cunha (TDC). Main hardware components and interfaces are labeled.

Outlook. The RaspberryPi datalogger hardware as shown in Fig. 2 has been successfully installed at the geomagnetic observatories of Wingst (WNG), Tatuoca (TTB) and Tristan da Cunha (TDC). The software package is under continuous development, and we invite the community for testing and contributing [1]. In the near future, we plan to add more precise timestamping and support for a wider range of instruments.

References:

[1] A. Morschhauser, J. Haseloff, O. Bronkalla, C. Müller-Brettschneider, J. Matzka, A low-power data acquisition system for geomagnetic observatories and variometer stations, Geosci. Instrum. Method. Data Syst., 6, 345-352, 10.5194/gi-6-345-2017, 2017.

[2] <https://gitext.gfz-potsdam.de/mors/GeomagLogger/>

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