

Microclimate Cave Monitoring System

Microclimate Cave Monitoring System aim is a detail measurement, recording and storing of data of selected natural parameters of cave environment.



Cave Monitoring System is a unique integrated system consisting of permanent and mobile data loggers, communication network, data collection and central database and management system.

The core of monitoring system are installed loggers where the measured data are ingested. All loggers in the cave are connected to the common communication bus. The outside logger with the GSM signal coverage is used for all collected data transmission. Mobile monitoring systems are portable stations with loggers and sensors. They are intended for short time measurements or for measurements on site without wiring. These stations works as autonomous systems with a local data storage on batteries.

The central system automatically collects data from all loggers and database provides quality control and easy access to measured data.



Compact design



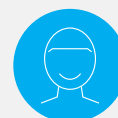
Data logger remote configuration, monitoring and software update



Battery equipped data loggers as the ensurance of continuous operation



Easy data access through the web interface



Easy manipulation [interchangeable loggers]

The system components

Data logger	AMS 111 II (mobile / permanent installation)
Sensors	according to requirements
Remote PC	according to requirements
Software	AMS 111 II data logger SW, Data Collection System, AWS Explorer, Network manager, EnviDB

Data logger AMS 111 II parameters

The AMS 111 II data logger board is running the MicroStep-MIS multitasking real-time executive. The add-on compact flash card with data capacity 512 MB is sufficient for the several months in the typical applications.

Analog inputs

- 22 x precise differential inputs - range 0.0 - 2.5 V
- Resolution: 24 bit (16 bit optional)
- Accuracy: better than 1 uV
- 5 x additional analog inputs 0 - 5 V / 0 - 2.5 V (optional)

Digital inputs

- 12 x digital input, 0 - 20 V
- (log0 < 6.2 V log1 > 7.1 V) or 0-5 V TTL (optional)

Digital outputs

- 4 x digital output, open collector

Power outputs

- 4 x switching power supply

Power supply

- 230 V / battery (voltage: 3.5 - 18 V)
- Consumption: 180 mW (15 mA @ 12 V without modem and display)
- In sleep mode: 400 uW (30 uA @ 12 V without modem and display)

Memory and RTC

- Internal 512 kB Flash memory
- Internal 1 MB SRAM memory
- External Compact Flash card up to 512 MB
- Real time clock (backup with Lithium battery)

Communication I/O ports

- RS-232 port; RS-485 port; UART in 3,3 V

IP 65

- Meets all cave condition requirements

Touchscreen display

Monochrome graphic display (128 x 64 px) - with 32-button touch screen matrix for previewing of measured values, adjusting system time, setting system variables and much more - directly on the logger.

- Power consumption: 102 mW (17 mA @ 6 V)
- In sleep mode: 180 uW (30 uA @ 6 V)

Operation

The system can be operated in two modes simultaneously:

Climatic mode:

- 10 min. measurement interval for permanent loggers
- 60 min. for mobile stations running on battery only

Micro mode:

- 10 second for permanent loggers
- 60 seconds for mobile stations

The measured data is stored in local memory card for login periods and the remote collection system downloads the data via GSM / GPRS and RS-485 communication.

The data can be also transmitted to the notebook, or PDA via Bluetooth or service cable.

Sensors

Wide range of sensors can be connected to each logger. Following (and more) parameters can be easily monitored:

- Air temperature
- Relative humidity
- CO₂
- 2D, 3D Wind speed/direction
- Wind speed/direction
- Rock temperature
- pH
- Water temperature
- Water conductivity
- NO₃⁻, Cl⁻
- Water level
- Rain gauge
- Global radiation
- Evaporimeter

Collection and database

The measured data are collected automatically over GPRS VPN network. The collection software is installed in the HQ building. The data are collected automatically and on-line every 10 minutes.

The collection software allows view of all data loggers installed within the caves. The user can see current status of communication.

The downloaded data are stored in the central database.

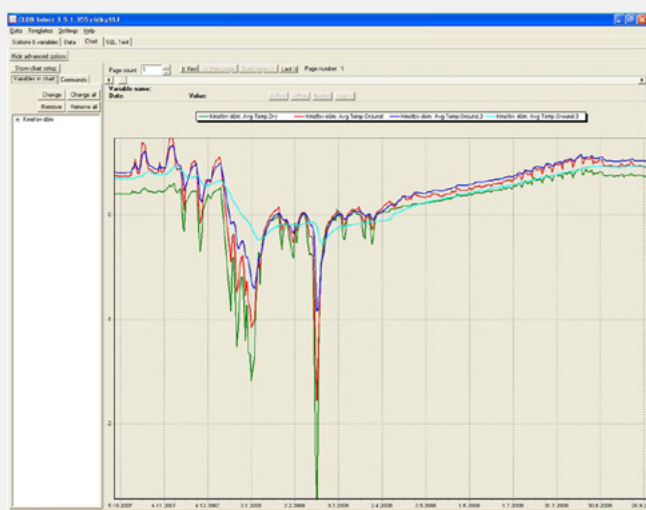
Main purpose of the central database is to:

- Automate procedures for the data management and processing
- Integrate data from collection system
- Provide data storage for environmental data and meta data
- Perform quality control
- Single point of access for end-user services for data provision, distribution and publication

The metadata are inevitable part of climate data itself. The CLDB allows storing various metadata inside the database. Metadata are organized in three groups - station geography, observation description and element description. Data quality control is performed because it is crucial to ensure that only unique, high quality observations are submitted to database processing.

Station	Location	Status	Last Update	Log File	Download	Link
DĚMANOVSKÁ_LADOVA	Stavka	OK	01.06.2009 00:00:18	log01.06.2009 00:00:18	Downloaded 2 new 'log' records.	Link
DĚMANOVSKÁ_LADOVA	Pod vřetácním schodištěm	OK	01.06.2009 00:01:23	log01.06.2009 00:01:23	Downloaded 2 new 'log' records.	Link
DĚMANOVSKÁ_LADOVA	Hrubá chodba	OK	01.06.2009 00:04:10	log01.06.2009 00:04:10	Downloaded 2 new 'log' records.	Link
DĚMANOVSKÁ_LADOVA	Belov dóm	OK	01.06.2009 00:04:10	log01.06.2009 00:04:10	Downloaded 2 new 'log' records.	Link
DĚMANOVSKÁ_LADOVA	Clenna galéria	OK	01.06.2009 00:05:18	log01.06.2009 00:05:18	Downloaded 2 new 'log' records.	Link
DĚMANOVSKÁ_LADOVA	Střevý dóm	OK	01.06.2009 00:05:20	log01.06.2009 00:05:20	Downloaded 2 new 'log' records.	Link
DĚMANOVSKÁ_LADOVA	Velký dóm	OK	01.06.2009 00:05:22	log01.06.2009 00:05:22	Downloaded 2 new 'log' records.	Link
DĚMANOVSKÁ_LADOVA	Krušev dóm	OK	01.06.2009 00:05:15	log01.06.2009 00:05:15	Downloaded 2 new 'log' records.	Link
DĚMANOVSKÁ_LADOVA	První žulová dóm	OK	01.06.2009 00:05:17	log01.06.2009 00:05:17	Downloaded 2 new 'log' records.	Link
DĚMANOVSKÁ_LADOVA	Isotermická dóm	OK	01.06.2009 00:05:19	log01.06.2009 00:05:19	Downloaded 2 new 'log' records.	Link
DĚMANOVSKÁ_LADOVA	Vandálska meteorologická stanice	OK	01.06.2009 00:05:06	log01.06.2009 00:05:06	Downloaded 1 new 'log' records.	Link
DĚMANOVSKÁ_LADOVA	Větrná / vřetácní	OK	01.06.2009 00:05:21	log01.06.2009 00:05:21	Downloaded 1 new 'log' records.	Link
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Installed Cave Systems

The largest cave monitoring system in the world

Czech Republic

- Katerinska Cave

Permanent cave system and mobile cave system – more than 70 sensors and 10 data loggers

Slovenia

- Postojna Cave

Permanent cave system - 10 sensors and 2 data loggers

Slovak Republic

- Domica Cave
- Gombasecka Cave
- Dobsinska Ice Cave
- Demanovska Cave of Liberty
- Demanovska Ice Cave
- Jasovska Cave
- Ochtinska Aragonite Cave

7 Permanent cave systems and 12 mobile systems – more than 300 sensors and cca 75 data loggers