

24 Bit Data Monitoring and Data Logging System

DLM24 GradMag[®]

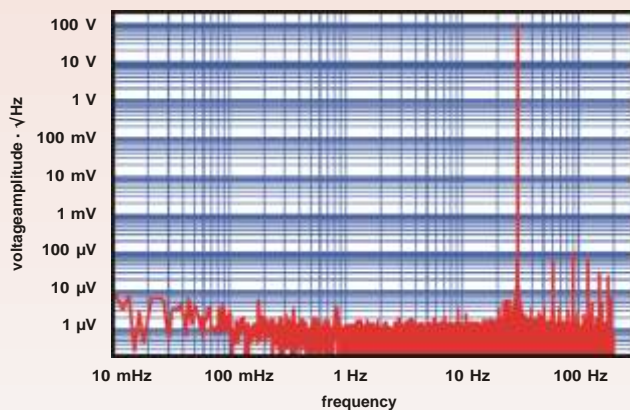
The Data Logging and Monitoring System **DLM24** is a very flexible multi-channel measurement system for a variety of applications. It combines a precise **7 decades** data acquisition with the **GB memory capacity** of today's SDRAM boards. **Battery operation**, its fast **fibre-optic interface** (BiFOC) additional to the RS232 standard interface, and the full **support of GPS** data for global time and position synchronization are features to match complex measurement tasks especially outside the lab environment. The DLM24 system can be controlled by a **notebook** due to a **PCMCIA** card supporting up to 4 of the 20 MBit/s fibre-optical interfaces. A unique phase synchronized fibre-optic network enables **simultaneous triggering** of several units with sub-microsecond accuracy. Delta-Sigma converters are used to provide the **huge dynamic range** and **high linearity**.

Acquisition Unit DLM24-Cx



Type	DLM24-C4	DLM24-C8	DLM24-C12	DLM24-C16
Differential Inputs	4	8	12	16

The **DLM24-Cx** offers 4, 8, 12, or 16 simultaneously triggered true differential inputs (+/- 10 V) for data acquisition with its 24 bit ADCs. The sampling rate may be selected from 0.1 Hz to 10 kHz. Built-in digital filters can be chosen and complemented with user defined transfer functions. As an example a low pass filter with 120 dB attenuation within 12% of the sample rate is possible. While fully digital, the filtered signals can still be monitored as analog signals in real-time with an oscilloscope using the 4 built-in 16 bit ADC outputs to be connected to any of the inputs allowing free scaling and offset compensation. While optimized for the frequency range up to 300 Hz the DLM24-Cx can be operated up to 4 kHz with a 10 kHz sample rate.



Noise spectrum of the DLM24-Cx . The input signal is generated by a low distortion signal generator operating at 30 Hz.
sample rate : 400 Hz, bandwidth : 100 Hz, 2¹⁹ data points

Memory Unit DLM24-Mx

The memory unit DLM24-Mx offers 1 or 4 optical data inputs and 4 memory slots for SDRAM modules of 128, 256 or 512 MB size covering up to 2 GB or 500 million data points. Each fibre-optic interface is capable of a 2 MB/s data rate resulting in a maximum speed of 8 MB/s. The DLM24-Mx is able to serve up to four DLM24-Cx units and permits autonomous measurement control and data acquisition without a computer. The SDRAM modules are buffered by an internal rechargeable battery. In a fibre-optic network the DLM24-Mx synchronizes the clock and serves as a router. Complex simultaneously triggered networks with over 1000 units can be operated in a cascaded structure with up to 5 levels. Global time and co-ordinates are offered when combined with a GPS or DGPS system. Global time synchronization with microsecond accuracy is supported using the 1 PPS signal of a GPS receiver.



Type	DLM24-M1	DLM24-M4
optical inputs	1	4

Versatility

The high flexibility of the DLM24 system is the result of combining **24 bit ADC** operation, real-time 16 Bit DAC **analogue monitoring** and event generation, **battery** operation, **fibre-optical** data transmission, **notebook** access using the **PCMCIA** fibre-optic interface, today's **mass storage** capabilities, **GPS** or **DGPS** support, digital filtering and intuitive software to form a simultaneously triggered **multi-channel** and even multi-device measurement **system network**. A variety of application specific conversion modules adapted to the 24 bit performance of the DLM24-Cx is under preparation. These add-on modules are interfaced by the 19-pin input connector of the DLM24-Cx featuring 4 true differential inputs, stabilized bipolar 12 V power source, high precision reference voltage, digital I/O, and one of the 4 DAC outputs, all of them accessible by the customer. Available components are **ultra low noise pre-amplifiers** with noise < 360 pV/ Hz, DAC modules, high precision AC or DC current sources, lock-in amplifiers, or multiplexers.

Application

The brand **GradMag®** indicates that the DLM24 series has been developed to get high resolution magnetometer data to form magnetic gradients by software algorithms. This requires high precision and linearity together with simultaneous triggering. Eight magnetometer channels are sufficient to calculate the full magnetic **gradient tensor** and to build a system for **localizing magnetic dipoles**. In cases where analogue signal subtraction is still used because of its precision the digital alternative is now available. It is especially suited for the dynamic signal calibration when using complex calibration coefficients together with the time derivative of the signals. 6 decades of signal cancellation can be achieved.

Ground loops especially between instrumentation and computer interfaces are history. Data acquisition inside magnetically shielded rooms or **EMC** measurements are easily done without any 50 Hz or 60 Hz interference. Simultaneous triggering of any DLM24-Cx unit connected to the fibre-optic data transmission network is guaranteed by a special master / slave concept locking the phase of all the network's 20 MHz fibre-optic signals serving as clock references for all individual units. The large semiconductor based memory of up to 500 million data points (with 4 modules of 512 MB) combined with small power consumption allow for 24 hours of autonomous data collection with e.g. 16 channels at 400 Hz sample rate. Much longer unattended data acquisition (e.g. 180 days, 8 channels, 4 Hz sample rate) is possible when using e.g. a conventional solar panel in connection with the battery. Together with a **GPS** or **DGPS** system any data point can be globally synchronized with microsecond accuracy and tracked down according to UTC co-ordinates. Due to the BiFOC's **2 MB/s data rate** the measured data are transferred into the computer in reasonable time. The built-in real-time clock permits time-controlled measurement protocols even involving the DACs as event generators. As an option additionally to the 4 on-board DACs, the 24 Bit ADCs can be replaced by 16 Bit DACs thus supporting up to 20 DAC channels or transforming the DLM24-Cx into a multi-channel function generator. With the **PCMCIA** fibre-optic interface card the power of the DLM24 system is combined with the flexibility of a notebook computer. Glass fibres can be chosen instead of the PMMA fibres in cases where a long range interconnection is of the essence. (e.g. long **under water sensor chains**).

Software

The DLM24 system comes with its **GradMag®** software currently running under Linux and WinNT / Win2000. Other operating systems may be supported on request.

Basic Version as Delivered with the DLM24 System

- remote measurement control of all functions of the DLM24 system up to one (optional up to 5) cascading level (1 DLM24-Mx, max. 4 DLM24-Cx, max. 64 channels) in the fibre-optic network
- visualization of data in time or frequency domain for max. 16 channels
- "data microscope" to magnify and scale a graphically selected part of the plot. This feature is mandatory to deal with the high dynamic range of the system
- system configuration and user specific information are saved together with data
- data are stored in ASCII or binary format (IEEE compatible, 32 bit signed integer)
- public file / data format allowing other software to interact via file interface
- support of digital real-time filters
- comprehensive documentation of all features (online-help, CDROM)

Optional Extensions

- FFT vs. time representation with color encoded amplitude to display spectral variations in time (waterfall)
- calculation of auto-correlation, cross-correlation and transfer-function
- digital filters for off-line data analysis
- generation of arbitrary digital filters
- simultaneous display of more than one data window
- external triggering of the system
- support of the function-generator mode for the DACs
- script control for fully autonomous measurements
- support of multi-level cascaded systems in a network

Specifications

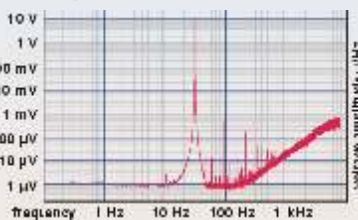
Acquisition Unit DLM24-Cx

resolution ADC	see table and figure
noise level	< 1 μ V/ Hz
input voltage range	+/- 10 V
cross-talk	< -120 dB
bandwidth	filter dependent, max. 4 kHz
sample rate range	< 0.1 Hz - 15 kHz
DAC	4 \times 16 Bit, 100 kS/s
no. of channels	4, 8, 12, 16 *)
interfaces	BiFOC, RS-232
power consumption	2 - 4 W
dimensions [mm]	205 \times 145 \times 90
weight	1.3 - 1.5 kg

*) true differential inputs

Noise Spectrum

with low noise signal generator at 30 Hz
sample rate: 15625 Hz, bandwidth: 4 kHz



Memory Unit DLM24-Mx

memory slots	maximum 4
SDRAM	64 - 512 MB modules
no. of channels	1 4
interfaces	2 5 BiFOC, RS-232
input data rate	2 8 MB/s
output data rate	2 MB/s
power consumption	< 2W
dimensions [mm]	205 \times 145 \times 50
buffer time	> 5h (512 MB)
weight	ca. 0.8 kg

Fibre-Optic Interface

BiFOC

baud rate	20 MHz
data rate	2 MB/s
protocol	hand-shake
type of fibre	duplex (PMMA, glass)
max. fibre length	40 m (PMMA)

Interface Card

HSCOM

card type	PCI, PCMCIA
baud rate	20 MHz
input data rate	2 MB/s
interfaces	BiFOC
driver	Linux, WinNT/2000/XP
RAM	8 MB

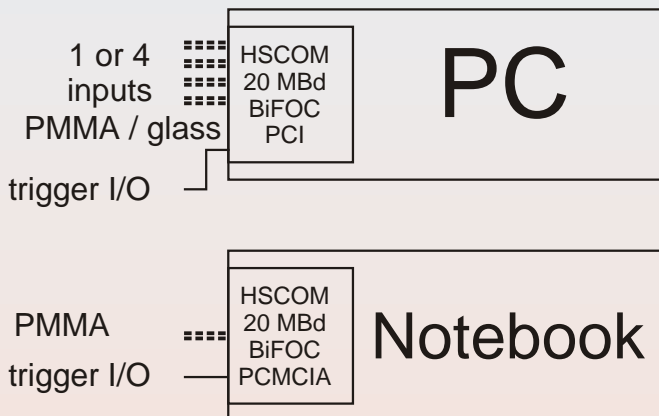
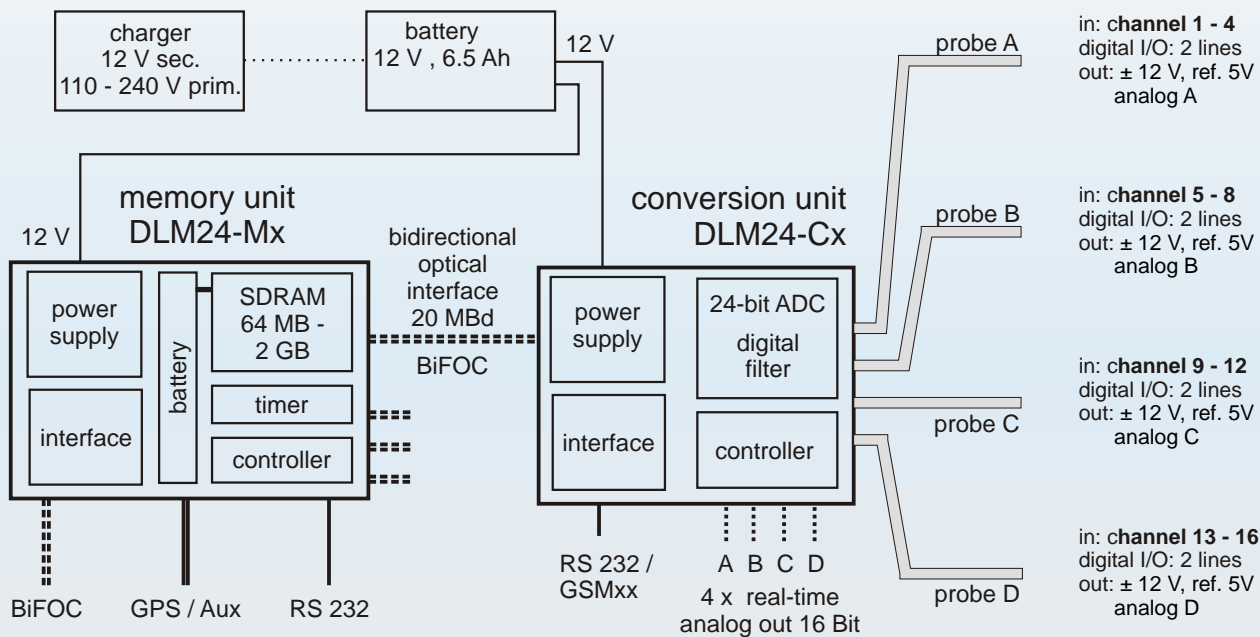
Delivered Items

battery and charger with complete cable set
DLM24-Cx and/or DLM24-Mx
installation CD with basic software
hard- / software documentation
Optional: field case



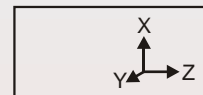
Data Logging and Monitoring - System DLM 24

Overview



Typical Applications

magnetic measurement
fluxgates, AMR,
GMR, Hallsensors



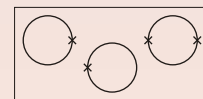
tilt measurement



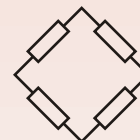
acceleration measurement



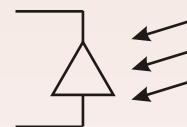
dc-/ rf- SQUID
analog electronics



bridge
measurement



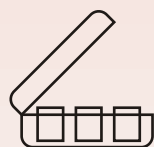
photonics



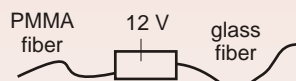
EMC , remote measurement, seismics,
potential differences, vibration, magnetic
signatures, magnetic source localization,
traffic monitoring and control

Accessories

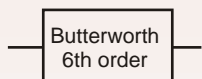
field case



PMMA to glass converter
over 1 km distance



anti-aliasing
filter



connectivity
box

