DFM-R

Digital high performance fluxmeter for driftfree integrating flux measurement of magnets with additional rotor analysis functions

10 years after introduction of world's first digital integrating fluxmeter DFM 1, ECKEL Magnet Test Equipment now presents the new DFM-R, allowing more simple, more exact and new types of measurements that were not possible before.

ECKEL DFM-R

The DFM-R offers extreme resolution and accuracy. 24-bit A/D conversion and 64-bit integration on a signal processor allow a **6 digit display** of the result. The result is shown with floating point. Thus always 6 valid digits are visible.

Helmholtz coil

Measurement range covers pVs up to 1000 Vs with auto range function. For Helmholtz coils the magnetic moment Am^2 is displayed. A change from SI to CGS units is possible.

Input amplification starts with divisor 64 (+/- 320V) and increases up to amplification 16384 (+/- 305 µV). Input signal must be potential free.

At input overload as well as insufficient load the DFM-R automatically changes input amplification and after error message a repeat of measurement with correct input amplification is proposed.

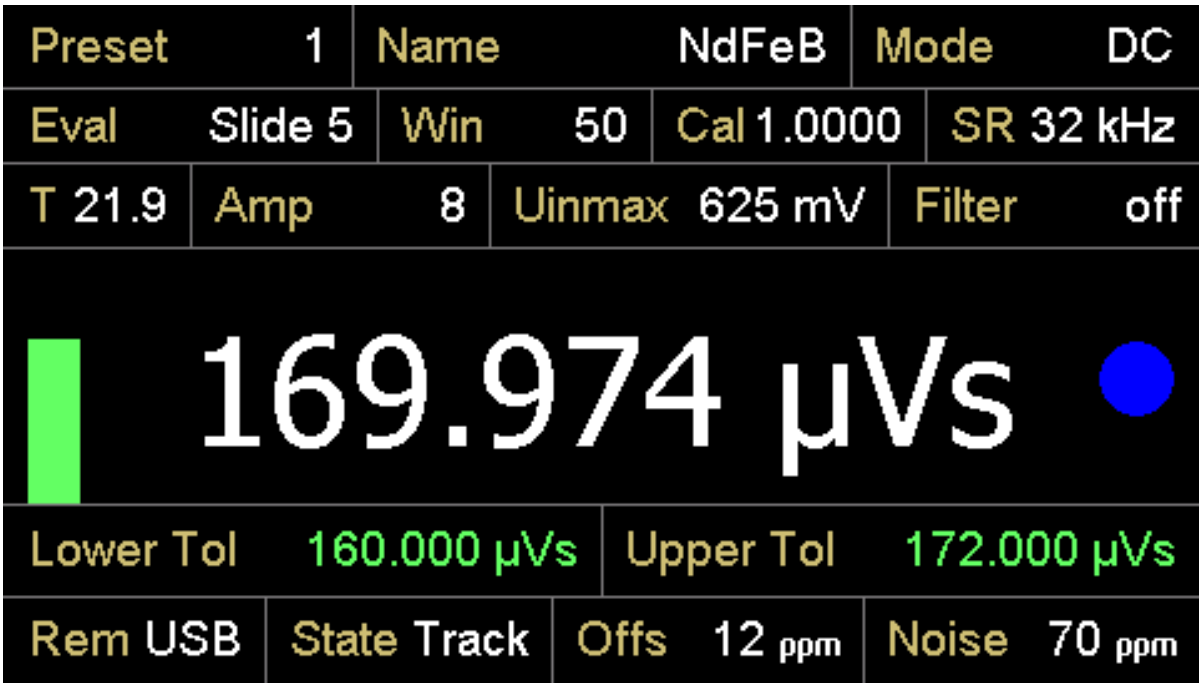
Result can be scaled for 1 up to 99999 **coil windings** as well as to a free **scaling factor** from 0.1000 to 9.9999. For a Helmholtz coil the K-factor of the coil is entered instead of number of windings.

The result can be compared to upper and lower limits and if not in range it is possible to send an **alarm** to PC. The range between upper and lower limit can be divided in up to **3 classes**.
The DFM-R automatically adapts to all slowly changing distortions, displays and compensates them. After sudden changes the algorithm can be restarted manually.

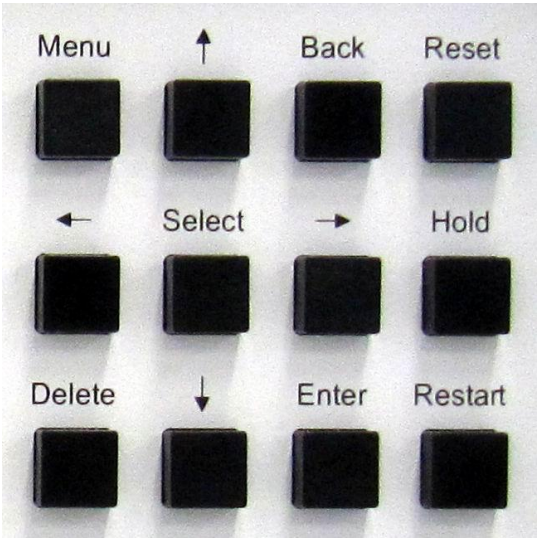
In Track mode the offset is continuously tracked. This offset is compensated during measurement. Accuracy of this compensation is **30 ppt** (part per trillion) of full range. Thus real drift is far below display resolution during any realistic measurement time.

In Track mode also measurement start detection is continuously adjusted to actual noise level.

For high amplifications or noisy input signals the DFM-R offers six different **analog filters** with time constants from 0.1 to 33 ms as well as corresponding digital filters.



Display DFM-R



Keyboard

The DFM-R offers a large **color display**, showing all parameters at same time, as well as menu-guided intuitive input functions.

The DFM-R can operate as **standalone unit or connected to a PC**. If connected to a PC all samples are transmitted to the PC in real time. Thus they can be displayed, stored or exported to **Excel**. Sample rate for transmission can be adjusted from 1 to 32 kHz. Also all parameters can be set or read by PC.

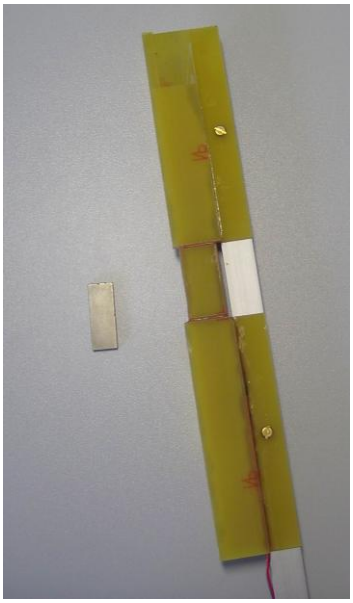
The DFM-R is connected to the PC via **USB 2.0**. Necessary software is included in the DFM-R package.

At the touch of a button or fully automatically a result can be sent to the PC and thus entered directly to a quality assurance system.

The DFM-R **automatically can detect** 16 different measurement devices and load appropriate parameters. Alternatively **256 sets of parameters** can be stored and loaded manually.

For standard integrating measurement the magnet is taken out of a coil. This can be a Helmholtz coil or a coil fitting to the magnet shape. Also a coil can be pulled out of the magnet field.

Except standard simply integrating flux measurement the DFM-R offers several **fully automatic measurement procedures** not offered by any other producer.



Slide with coil in the center

Slide Mode

In slide mode the magnet glides on a slide and passes a coil that fits to magnet shape.

Start and end of measurement are detected automatically. Also the difference between maximum flux and end of measurement is evaluated automatically, sent to PC and there entered to a list.

Neither the fluxmeter nor the PC needs a manual input. Thus time between measurements can be very short. A 100% test becomes possible.

Error measurements by stray fields during external magnet movement are eliminated by adjustable limits.

Rotor Mode

For rotor measurements, where the rotor or pole housing is turned, different evaluations are available.

For measurements with unknown number of poles only display of difference between strongest North Pole and strongest South Pole is available (MaxDiff).

With known number of poles the corresponding mode is selected (Rot 2 to Rot 16). Thus the DFM-R knows when a full turn has been completed. This allows additional evaluations:

4-pole motor

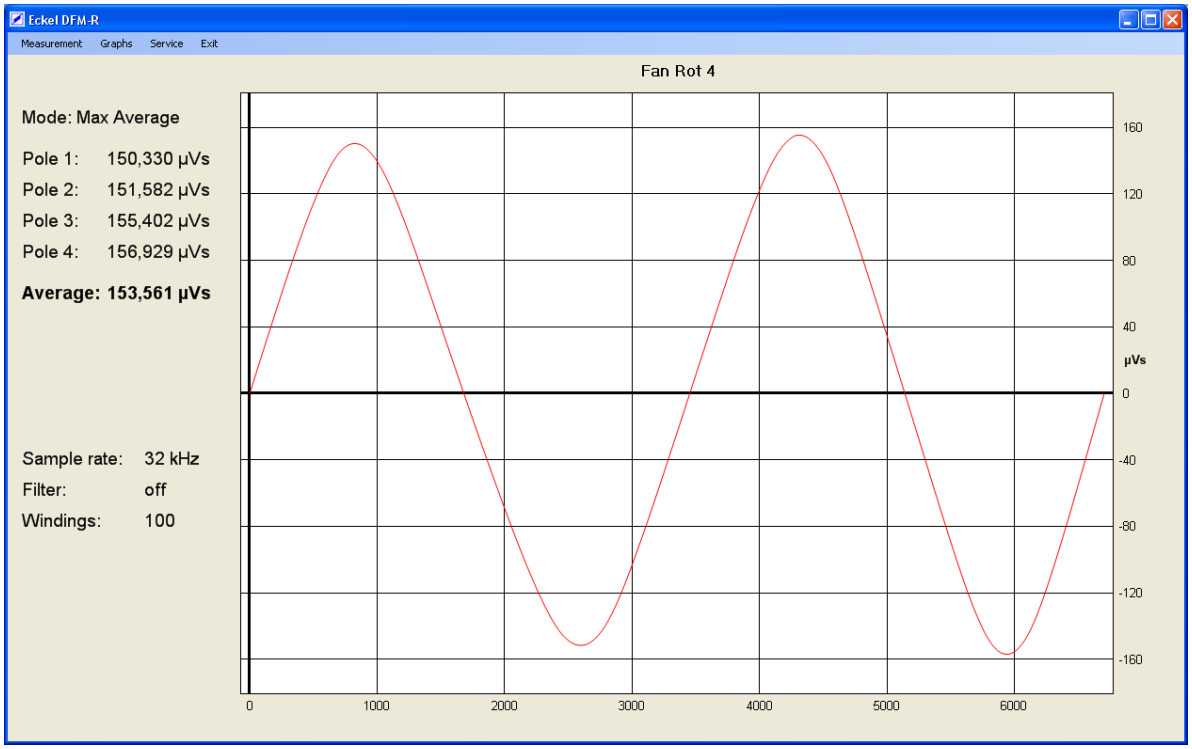
- Display of all pole flux values (Pol)
- Average of absolute values of all poles (PolAver)
- Variance of the poles relative to average (VarPol)
- Absolute and relative difference from strongest to weakest pole (AbsDiff + RelDiff)

Also for these measurements an automatic transmission of results to PC is possible. But a new start must be controlled by hardware, hand or PC.

A higher number of poles can be implemented on demand.

If an exact angle corresponding evaluation is needed, turning the rotor or pole housing must be driven by a constantly turning motor. This motor can be controlled by PC and DFM-R software or by the DFM-R itself. Thus more exact evaluations regarding pole positions and pole widths are possible.

All evaluations that need the complete flux curve can only be executed by PC.

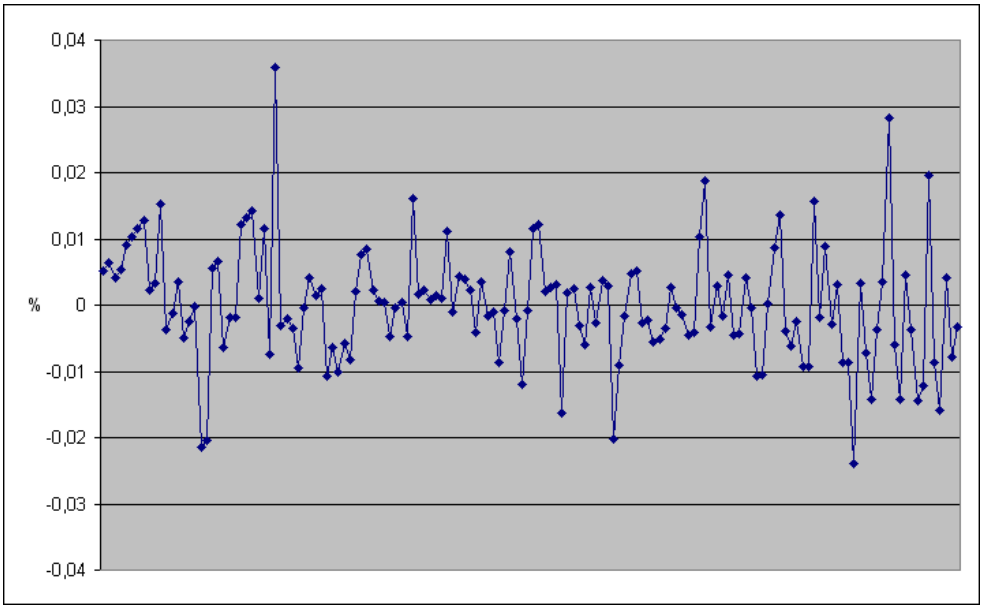


Evaluation on PC

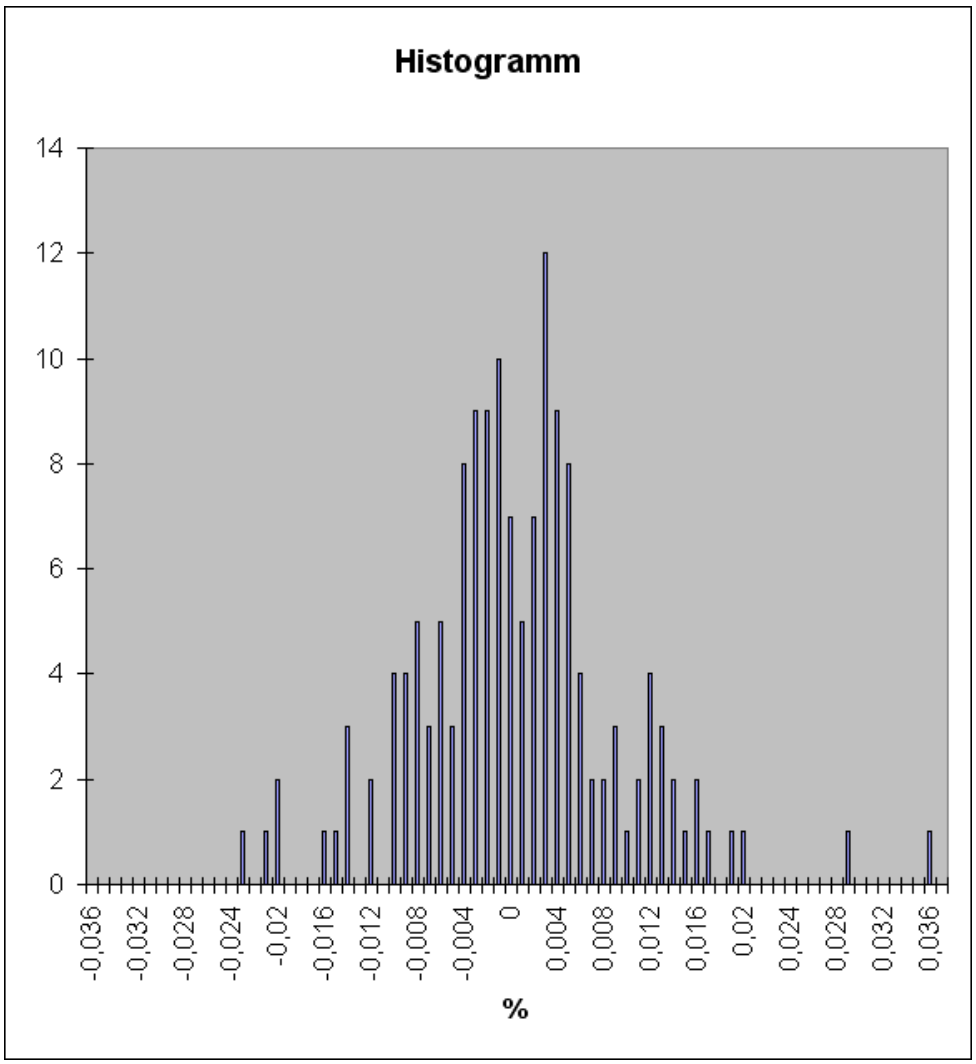
The DFM-R includes a high accurate **room temperature measurement** by external Pt1000 sensor.
Thus optionally the result can be temperature compensated to 20 ℃.
The temperature correction factor can be entered manually or selected from a list of magnet materials.

The DFM-R offers a **General Purpose I/O port** with 7 configurable in- or outputs.
Here hardware like relays, switches or light barriers can be connected.
For a useful program execution a chargeable programming according to customers' requirements is necessary.
Alternatively a default setting is selectable with Reset and Hold as input and Status (Track/Measure), Overflow, Underload, result in tolerance and result out of tolerance as automatic output.

Due to its high resolution the DFM-R is **extremely accurate**. At 150 measurements of the same magnet in Slide Mode with a mean value of 85 µVs, we got the following typical deviation in percent:



Deviation from mean value in percent



Result statistics around mean value in percent

Standard deviation for this manual measurement was 0.00879 % = **87.9 ppm**.

In general it must be considered that accuracy of measurement depends on type of measurement, external noise fields, temperature changes of the magnet and repeatability of mechanical procedure.

User interface and operating manual of the DFM-R are in **English**.

By evaluating data via software the DFM-R benefits permanently from performance enhancements which are provided by **software updates**. Also firmware of the DFM-R can be updated by the user. Adequate programs will be provided at our website free of charge. Individual software modules for motor control or connection to a special quality assurance system will be charged.

Updates for operating manual will be provided for download on our website too.

The DFM-R is self-calibrating at all input amplifications and has a **reference signal output** to perform an external calibration and certification using any calibrated multimeter.

The DFM-R is 26 x 26 x 12 cm wide and can be connected to all usual mains voltages and frequencies.
The unit benefits from a 2 year guarantee and 10 year service guarantee.

Eckel GbR, Magnet Test Equipment, Am Teich 5, D-19348 Berge GT Grenzheim, ☎ +49 38785 60910, Fax: +49 38785 60911
E-mail: info@eckelgbr.com, Internet: http://www.eckelgbr.com