

ROWTEST ROTOR SEARCH COIL FLUX MONITOR TYPE RFM200

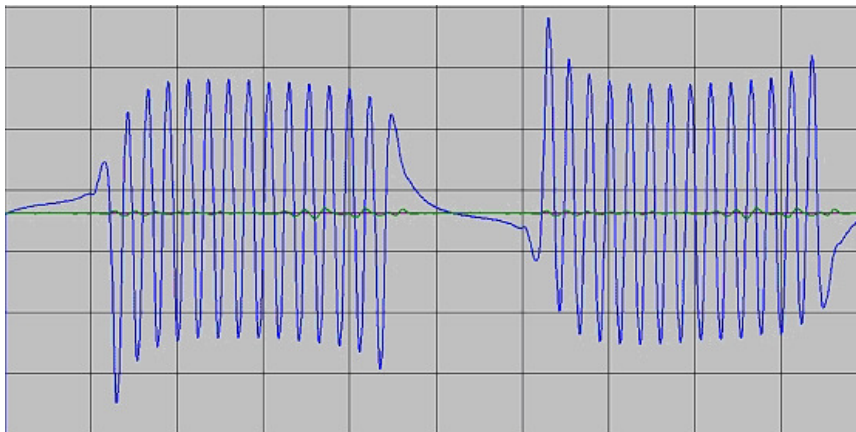
For use with power system generators having search coils in the air gap

OVERVIEW



The Rowtest **Rotor Flux Monitor (RFM)** is an updated version of the original **RFM100** instrument, previously supplied by **Convex Design Ltd (CDL)**. It is used to monitor the rotor (magnetic field) windings of large power system generators and check for **current-carrying inter-turn and double earth faults**. It is suitable for use with most typical flux probe installations.

The output signal from a **magnetic flux probe** (a small search coil) installed in the **alternator air gap** is processed by the RFM unit to produce a nulled waveform for a sound generator. However, a field winding with a current-carrying inter-turn fault will display a series of peaks in the “nulled” waveform, corresponding to the position of the faulty coil slot.

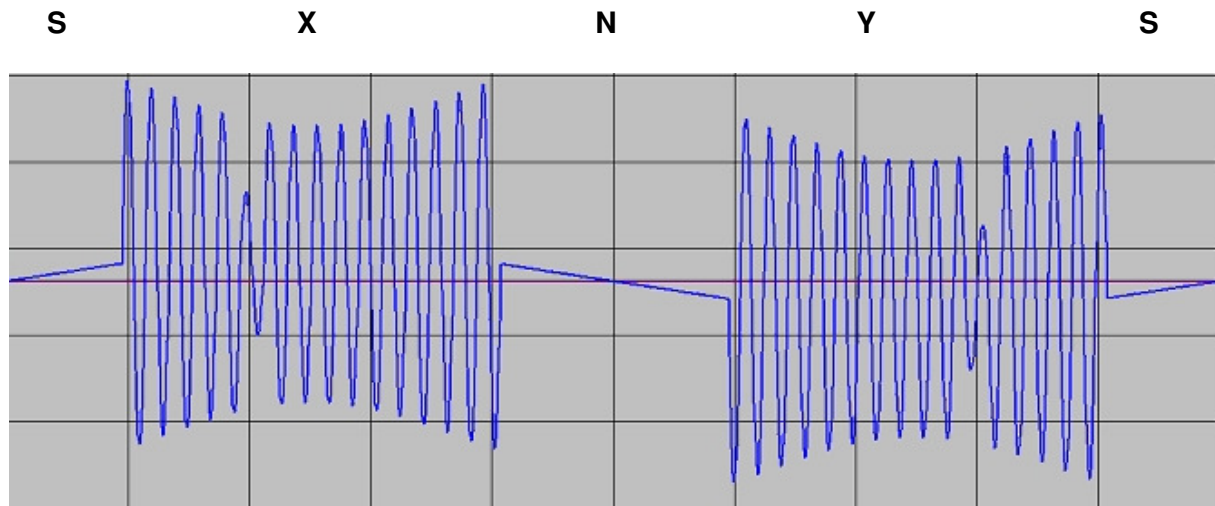


The blue waveform in the figure above shows a measured search coil waveform typical of that for a fault-free generator having 7 coil slots per pole. The green waveform is the result of using the delay and add nulling technique and is an almost straight horizontal line, as would be expected for a **sound rotor winding**.

This search coil technique has the advantage over alternative methods in that continuous on-load monitoring of the generator is possible and only current carrying winding faults are detected. Furthermore, a double earth fault (which is an extreme case of an inter-turn fault) will be detected directly if significant fault current flows.

PRINCIPLE OF OPERATION

The waveform in the figure below is an example of the voltage that would be induced in a magnetic flux probe (small search coil), located in the air gap between the generator rotor and stator, for one complete revolution of a rotor winding containing 8 coil slots per pole. The low signal regions N and S correspond to the North and South poles of the rotating electromagnet where the magnetic field is approximately constant



Waveform regions X and Y (containing higher-frequency ripple signals) correspond to the rotor field coil slot-pairs located either side of the magnetic poles. The waveform sequence **S-X-N-Y** repeats once per revolution of the generator rotor (nominally 3000rpm for a 2-pole rotor generating a 50Hz output). The waveform shown above simulates the case where there are shorted turns in the 6th coil slot-pair counting from the south pole (S).

The **RFM** digitises and compares the search coil waveforms for the X and Y regions and displays the difference between them on the screen of a laptop PC. For a perfect winding, the X and Y waveforms should be similar (although of opposite polarity depending on the type of search coil in use) so the difference or sum waveform should be zero. This is known as the "delay and add" method and results in the nulled waveform shown in red below.



A set of gain controls on the front panel of the instrument is used to adjust the search coil output amplitude to a suitable level for processing. Once this has been done, most of the remaining functionality of the RFM is controlled by a **laptop PC** which is connected to the RFM via a USB lead.

Custom **Rowtest SCPlot** software displays the live and nulled search coil waveforms on the PC screen. These waveforms can be saved to a file for further processing by other software or converted to standard image files as required.

THE RFM200 SYSTEM HARDWARE

The **RFM200 Monitor** is housed in a two-tone grey metal case with adjustable carrying handle and is supplied in a padded carrying case. The complete **RFM system** includes the **RFM monitor**, A **Control (Laptop) PC**, running custom **Rowtest SCPlot** software and a comprehensive **instruction manual** containing many examples of search coil waveforms. An optional **waveform generator** is also available for test and calibration purposes.



RFM200 Front Panel

The **RFM200** is mains-powered and has the following inputs and controls:

CONNECTORS ON FRONT PANEL

Flux probe input (Search coil) input : LHS BNC connector. Signal is internally-limited to +/- 15V peak.

External reference (eg Shaft pulse) input: RHS BNC connector. Signal is internally-limited to +5V peak.

CONNECTORS ON REAR PANEL

Optical shaft sensor connector: 4-way DIN connector for **Stick** reflective optical sensor.

USB B connector for connection to **Control PC**.

IEC mains input connector panel. (110-240V AC)

CONTROLS ON FRONT PANEL

Input attenuation/gain.

Attenuation switch X1/X10 (miniature toggle)

Gain switch X1/X10/X100 (Rotary switch)

Input Level Pot. Used to adjust level control until **Green Level LED** is just lit to set correct signal levels for internal ADC.

Lock LED lights after **level LED**. Correct level setting occurs when **lock LED** is lit and **level LED** is just lit.

OPERATING MODES

The RFM samples the search coil waveform in synchronism with the rotation frequency of the rotor. The sampling frequency is 1024 x the rotation frequency, so for a 50Hz rotor, the sampling frequency is 51200Hz. This is achieved by locking the sampling clock to a 50Hz signal which can be derived from one of 3 sources, selected by the 3-way **Ref select switch**

1. A shaft reference pulse connected to the Reference input.
2. A 50Hz signal derived internally from the local mains frequency for generators which are synchronised to the local mains network.
3. A signal derived from the search coil waveform itself.

Note that option 1 is preferred as it allows the faulty coil to be located to either the N or S pole half-windings.

SCPLOT SOFTWARE

The **SCPlot software** allows the search coil and nulled waveforms to be captured and displayed on the **Control PC**.

The waveform data is also stored in a file suitable for processing on other software (eg Excel).

For further information, please contact us **at enquiries@rowtest.com**.