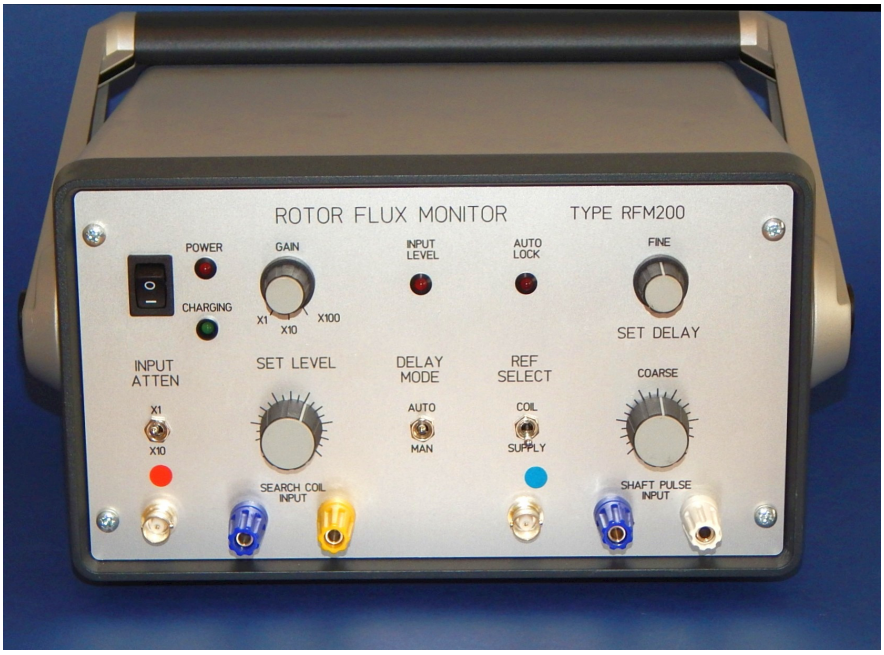
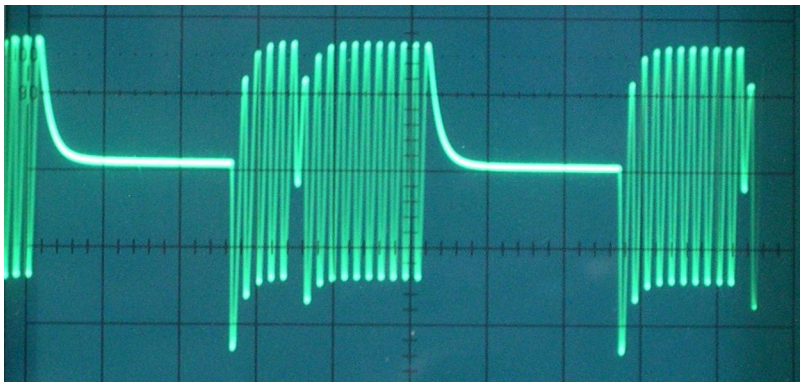
ROWTEST ROTOR SEARCH COIL FLUX MONITOR
TYPE RFM200

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.

The output signal from a search coil installed in the alternator air gap (or a test coil for a rotor in an overspeed pit) is processed by the 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.

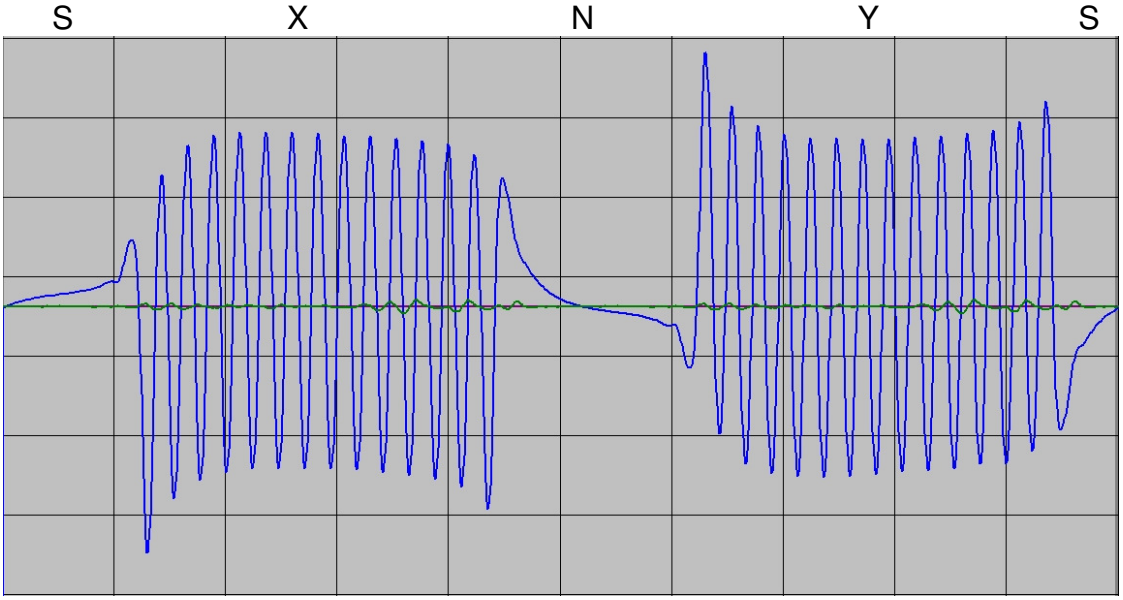


The figure above shows a simulated search coil waveform typical of that for a generator having 8 coil slots per pole, where there are shorted turns in the 6th coil from one pole.

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 blue waveform below, obtained from a fault-free generator, shows the voltage waveform induced in a small search coil, located in the air gap between the generator rotor and stator, for one complete revolution of the rotor. 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 coils 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 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) so the difference waveform should be zero. This is known as the "delay and add" method.

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.

A particularly useful feature of the instrument is that it can reduce any effects caused by residual magnetism in the rotor body, as shown in the next pair of figures showing waveforms obtained for a fault-free rotor (130 MW, 7 coils/pole) excited under test conditions with a restricted current of 27A at 3000 rpm..

In figure 1 below, the search coil waveform for an excitation current of 27A is shown in (**Blue**) The **Green** difference trace is the result of using the delay and add technique described above. Note that this difference waveform has significant amplitude, even though the rotor winding is fault-free. This effect is caused by the residual magnetism in the rotor body.

In figure 2, the residual magnetism signal (obtained by running the rotor with no excitation) has been subtracted from the excited search coil waveform of figure 1. Note that the Green difference trace is now almost perfectly cancelled.

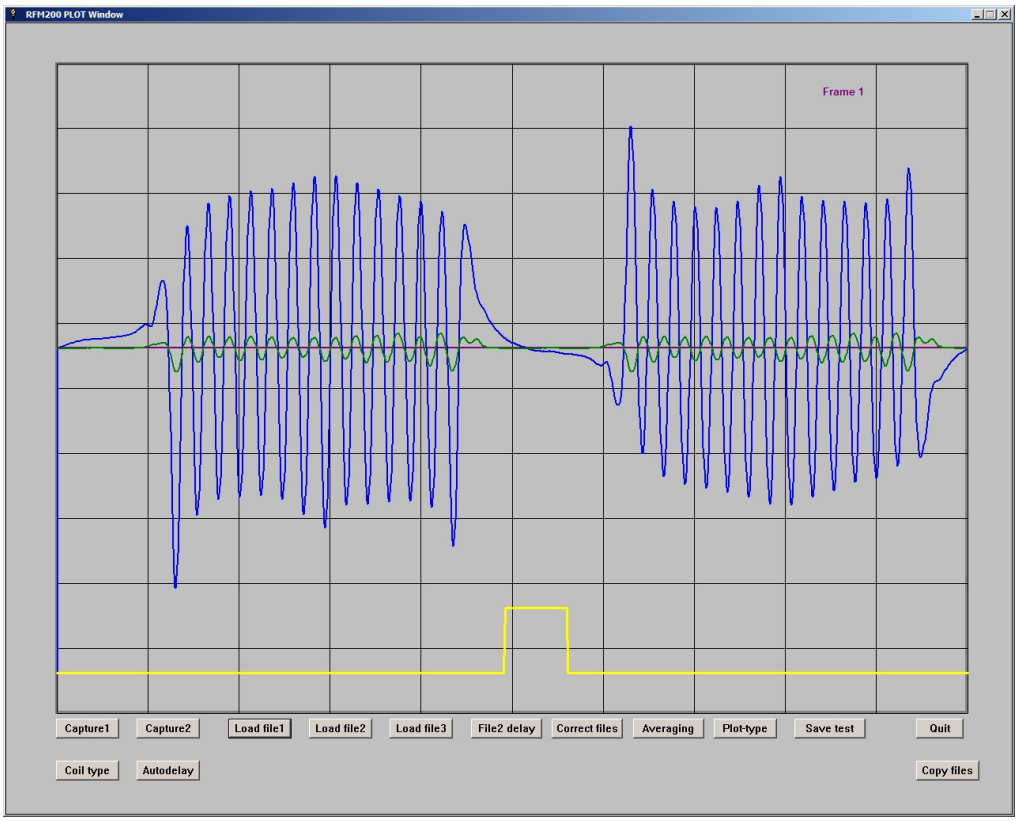


Figure 1. Uncorrected search coil waveforms with 27A excitation.

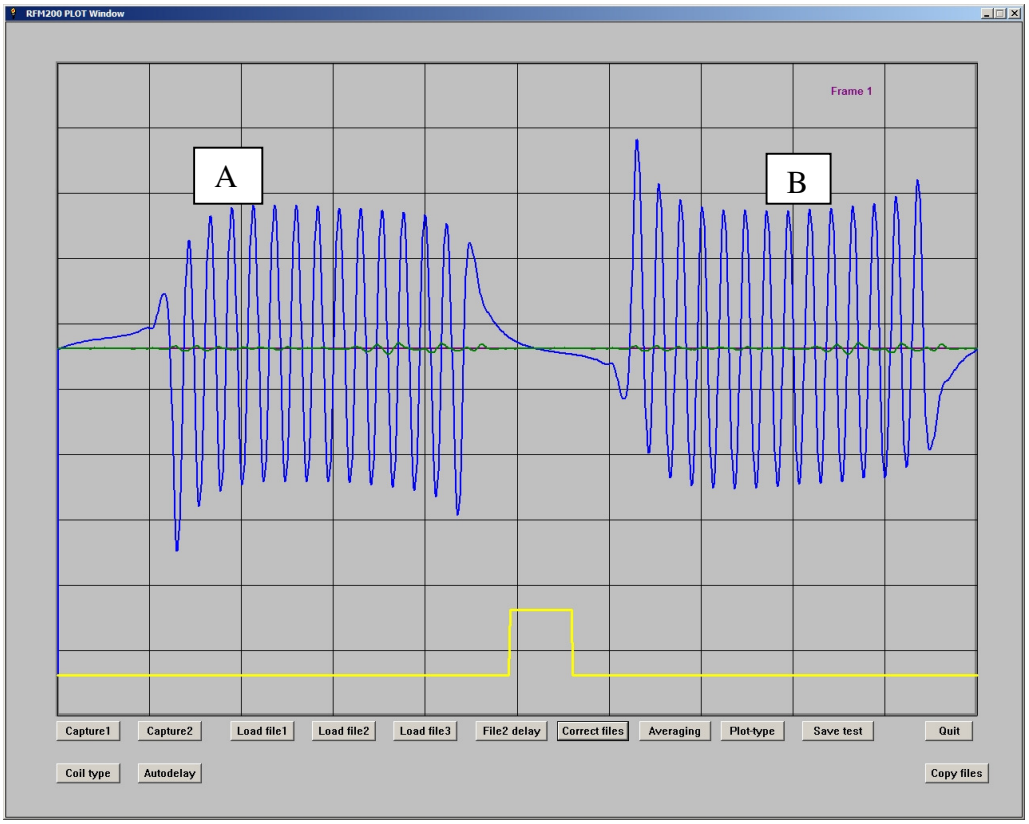


Figure 2. Search coil waveform corrected for residual magnetism

In both figures, the yellow trace is the output from a shaft marker.

The **RFM200** is housed in a two-tone grey metal case with adjustable carrying handle and is supplied in a padded carrying case together with a laptop PC running custom Rowtest **SCPlot** software and a comprehensive instruction manual containing examples of search coil waveforms.

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