



# Earth Fault Resistance Monitor (EFREM)

Continuous On-Line Monitoring  
Resistance Trending for Ground Fault Generator/Motor Rotor Protection

## Applications

- Rotor protection through condition based maintenance
- Predictive maintenance for large generators and motors

## Highlights

- Continuous online monitoring of faults while rotating or at standstill
- Fault resistance trending
- Fault location indicator
- Continuously monitors field excitation voltage
- Alarm relay contact outputs

## Earth Fault Resistance Monitor (EFREM) provides:

- Quantitative values of fault severity (continuous resistance measurements)
- Continuous monitoring for faults (always operational, while rotating or at standstill)
- Fault location indicator for ease of diagnosis and repair
- Field excitation voltage level monitoring
- Alarm relay contact outputs



In the picture above, the EFREM transmitter is mounted to the end of the generator shaft, a flat plate is used to mount the stationary pickup coil.

The Earth Fault Resistance Monitor (EFREM) provides continuous wireless monitoring of insulation fault resistance and field voltage on brushless exciter generator/motor field windings, combining advanced ground fault measurement techniques with the latest innovations in digital telemetry.

## Introduction:

Building on a long track record of innovation in generator and motor rotor protection, Accumetrics provides the EFREM for highly effective rotor field ground fault detection and trending for brushless machines.

## Overview:

The detection of field ground faults on generators or synchronous motors with brushless exciters has always been difficult. Conventional field ground detectors may detect the occurrence of faults but provide no advance warning or indication of the fault's severity. The severity at the detection threshold may vary by several orders of magnitude, depending on fault location.

By combining a new generation of 16 bit digital rotor telemetry technology for generator ground fault measurements, Accumetrics overcomes these limitations. Measurement of actual resistance allows users to monitor trends over time and track the progression of ground faults from their onset. This provides an early warning of impending failure and allows for predictive maintenance of a machine. The severity of ground faults can be used in making operational and maintenance decisions.



**Mid-shaft EFREM**



**End of shaft EFREM**



**EFREM Receiver**

<b>AT-8000 Series Technical Specifications</b>		
Field Voltage	Measurement Range	0 to 500 VDC. (Contact factory for other ranges)
	Maximum Transient without damage	1000 Volts for 5 seconds
Resistance Measurement	Measurement Range	0 to 80 MegOhms
	Accuracy (readings through digital interface)	Sum of $\pm 250$ Ohms and $\pm 0.5\%$ of reading over the range of 0 to 500K Ohms (exclusive of the effects of AC content and noise from the excitation system)
Earth Fault Location Factor	Range	0 to 100% representing ratio of potential at fault to total field voltage (0 at negative terminal and 100% at positive terminal)
	Accuracy (readings through digital interface)	$\pm 1\%$ for a 10K Ohms fault. Computation of location factor of field voltage accuracy is specified for $\geq 25$ V
Receiver Alarm Outputs	Earth Fault	Two independent alarm resistances, user selectable via computer interface from 500 Ohms to 1M Ohms
	Malfunction	Active upon detection of a malfunction in Monitor operation or loss of receiver power.
	Alarm interfaces	Form C relay; 6A/250VAC
Receiver Analog Outputs	Analog outputs option	Option: Dual analog outputs Field V and Log Resistance (4-20 mA) Note: this adds $\pm 0.25\%$ full scale current loop inaccuracy
Receiver Digital Interface	Computer interfaces	RS232, Ethernet
	Output Data	Earth Fault Resistance, Field Voltage, Location Factor when faults occur, Alarm and error conditions
	User Settings	Alarm Resistance Thresholds, Dwell Times, Network Settings
	Software	EFREM view data display and .CSV format PC data archiving
Environment	Ambient Temperature	32-185°F/0-85°C at Rotor Module 32-122°F/0-50°C at Receiver Unit
	Rotor Speed	0 to 3600 RPM for center-line and mid-shaft mounting ( $\leq 16"$ Outer Diameter) Call factory for larger shaft diameters or specialized mounting
Receiver Power		85 to 250VAC 50/60Hz, <20W
Transmitter Weight		2.2lbs./1kg for shaft end mounting
Rotor Connections		Field Positive Terminal Field Negative Terminal Rotor Earth/Ground



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**About Accumetrics:**

Accumetrics Inc., was founded in 1992, and became a part of the PCB Group in 2013. The company designs and assembles digital telemetry systems that transmit sensor data from rotating structures using wireless techniques, preserving the integrity of the data even in environments with high levels of electromagnetic interference.

We can provide a range of solutions from single channel products, such as strain gage torque measurements, to advanced multichannel systems that transmit data from hundreds of sensors.

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