

PRODUCT SPECIFICATION

Introduction

The PRISMIC R10 is an electronic unit designed to provide a brushless generator with an alarm in the event of a rotor earth fault.

General practice on generators with brushless excitation is for the rotor (main field) winding to be fully isolated from earth so that, in the event of a single earth fault, the generator could continue running. However, a second earth fault would short circuit part of the winding, necessitating an immediate shutdown and corrective action.

Detection of a single earth fault allows the generator to be taken out of service for investigation and repair at the earliest opportunity, usually as part of a planned maintenance programme.

Description

To continuously monitor the condition of the rotor winding, the BRUSH PRISMIC R10 rotor earth fault monitor (REFM) uses an electronic unit to detect a single earth fault. This dispenses with the need for brushes and sliprings, resulting in enhanced reliability and reduced maintenance costs.

The detector comprises a rotating transmitter, connected to the rotor winding, which transmits an infra red signal to a stationary receiver.

Transmitter

The transmitter has three electrical connections to the rotor; to earth, rotor positive and rotor negative. The rotor voltage provides the power supply for the unit, from which it generates its own isolated dc source, which is used as the earth fault detection supply. The negative of this isolated source is tied to ground, the positive to the rotor negative. During healthy conditions, the current flowing from the isolated dc source is negligible and the transmitter produces a high frequency signal that is detected by the receiver aerial and the receiver indicates no fault.

Any earth fault on the rotating assembly, either on the armature or the rotor winding, will cause a current to flow from the dc source. This current is detected and used to remove the transmitted high frequency signal. By removing the signal the detection system becomes "fail-to-safe", in that a loss of transmitted signal is detected as an earth fault condition.

Receiver

The transmitted signal is sensed by an aerial and fed, via screened cable and amplifier, into a "phase locked loop" within the receiver. This device locks on to the transmitted signal and serves to decode the pulse signal as well as filter out any background noise caused by external sources. The decoded signal is used to hold off the output alarm relay after an amplification and time delay stage. In the event of an earth fault condition the alarm relay becomes energised after a short time delay (incorporated to suppress "nuisance" alarms) thereby giving external indication of the fault condition.

The power supply required by the receiver is normally provided by the excitation controller power source (usually a permanent magnet generator). During run up on excitation controller over flux control, or during normal off load transients, the available rotor voltage may be too low to ensure correct transmitter operation. To overcome this, a circuit is incorporated in the receiver to inhibit output relay energisation on either low exciter field voltage or low auxiliary ac supply voltage. A time delay stage within this circuit allows the rotor voltage to build up prior to giving a permissive output.



Fig.1 Transmitter fitted to generator rotor



Fig.2 Receiver in IP66 enclosure for generator mounting



Fig.3 Receiver mounted in IP20 enclosure for generator control panel mounting

Technical details

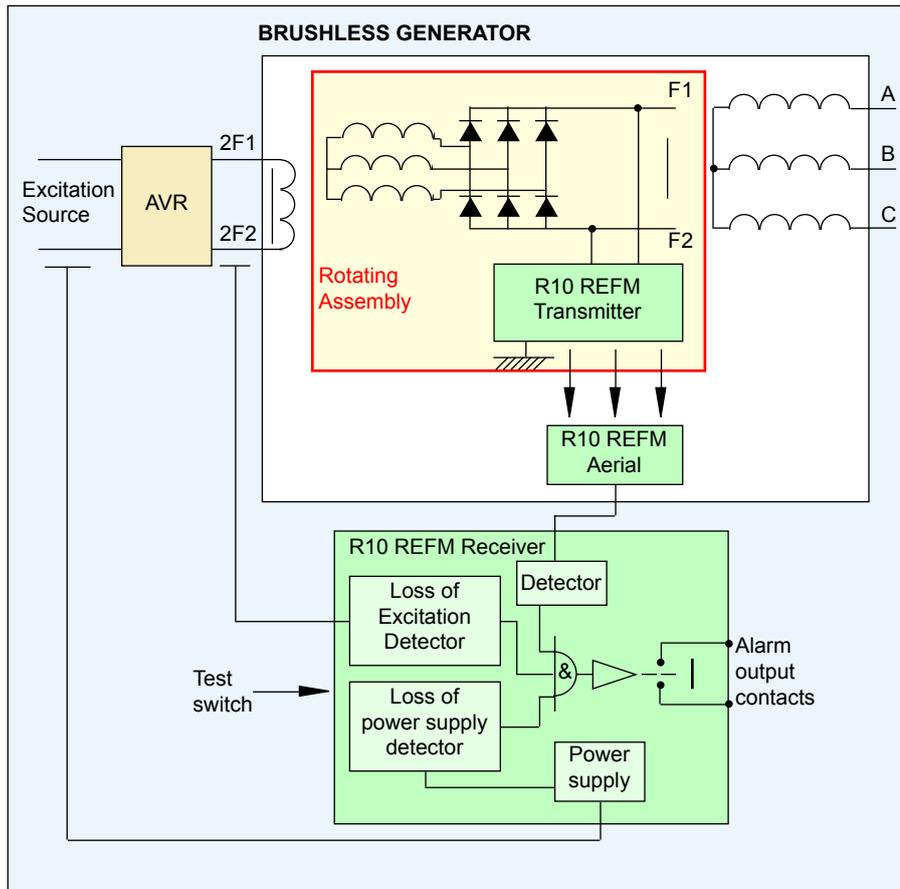


Fig 4. R10 system diagram

Earth Fault Detection Sensitivity

The fault resistance detected by the unit depends on the position of the fault and the rotor voltage.

The system is least sensitive when the fault is present on the negative side of the field and, in this case, the sensitivity is approximately 12k Ω .

Sensitivity is higher on the positive side of the field. Typically, on a machine with a full load rotor voltage of 200V, the sensitivity to a fault on the positive side of the field would be approximately 157k Ω .

Fault sensing current:
Approximately 1.5mA
Time delay on operation: 1s

Output Relay Rating

200VA or 100W (non inductive)
maximum 5A or 250V

Temperature

Receiver:
Operating -25°C to +85°C
Aerial and transmitter :
Operating -25°C to +70°C
Storage -40°C to +100°C

Receiver Auxiliary Supply

110V, 220V, 264V, or 400V, $\pm 25\%$
50Hz to 500Hz, burden 6VA

Transmitter Supply (Rotor Voltage)

Maximum continuous voltage: 200V dc
Maximum 10 second overload voltage:
500V dc
Minimum guaranteed operating voltage:
30V dc.

Loss of Auxiliary Supply

The output relay will be inhibited when the supply falls below 75% of the nominal transformer tap rating.

Low Exciter Field Voltage Inhibit

Adjustment of the exciter field voltage inhibit is from 3V to 25V. Unless the field exceeds this preset voltage the output alarm is inhibited. On build up of exciter field voltage above the preset level, there is a time delay of 3 to 4 seconds before the inhibit is released.

If the exciter field voltage falls below the preset level, the inhibit will be applied instantaneously. The maximum continuous exciter field voltage at this input is 400V dc.

Distance between IR Detector and Receiver

This is limited by the interconnecting screened cable to a maximum of 0.1 μ F per core to screen and the resistance not exceeding 10 Ω per core.

Test Facility

Operation of an external test push-button when the machine is running and excited will simulate an earth fault and produce an alarm signal.

Indication of Circuit Conditions

LED1 on: Low auxiliary supply inhibit is released.
LED2 on: Low exciter field voltage inhibit is released.
LED3 on: Earth fault condition.
LED4 on: Auxiliary supply is present.

Transmitter Centrifugal Force Limit

The transmitter is suitable for mounting on the shaft at a radius of up to 115mm for a continuous speed of 3,600 rev/min. The unit is suitable for an overspeed 4,800 rev/min for 5 minutes duration. The transmitter may be mounted at a larger radius provided the speed is reduced accordingly.

Transmitter Weight

The weight of the transmitter is 710g $\pm 25g$.

Packaging of Receiver

The receiver is supplied either in a steel fabricated box or as a shrouded printed circuit board.



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