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- [54] SYSTEM FOR CALIBRATING A LINE ISOLATION MONITOR
- [75] Inventors: Donald R. Janke, Milwaukee; James A. Rodrian, Grafton, both of Wis.
- [73] Assignee: Square D Company, Palatine, Ill.
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5,363,047 11/1994 Dresti et al. 324/510

OTHER PUBLICATIONS

“A PC Based Ground Impedance Measurement Instrument”, pp. 1095-1106, Meliopoulos et al., IEEE Trans. on Power Delivery, Jul. 1993.

Primary Examiner—Emmanuel T. Voeltz
Assistant Examiner—Patrick J. Assovad
Attorney, Agent, or Firm—Michael J. Femal; Richard J. Graefe; Larry I. Golden

[57] ABSTRACT

A line isolation monitor (LIM) indicates the maximum hazard current of an ungrounded polyphase power distribution system. The LIM is microcontroller based and continuously monitors a fault impedance for each phase of the distribution system. The fault impedance is determined by the LIM by injecting a continuous sine wave measurement current into a ground terminal to generate a measurement voltage across the fault impedance. Using the measurement voltage and current, the LIM calculates the fault impedance and, using this impedance, calculates the hazard current based on the maximum line to ground voltage of the ungrounded system. The LIM has means for self-calibration and self-testing while on-line and during a power-up sequence. These tests compare measured and theoretical values of circuit parameters of voltage and current sensing circuits. During this calibration check, the monitoring circuits of the LIM are removed from the isolated system and known voltage and current signals are injected internally to the monitoring circuits to verify the component parameters. If the calibration parameters are outside tolerances by a first, low level, the LIM annunciates a warning, but will continue to monitor the hazard current. If the deviation is greater than a second, higher level, the LIM will indicate a fault and remove itself from service.

[56] References Cited

U.S. PATENT DOCUMENTS

| | | | |
|-----------|---------|------------------------|---------|
| 3,969,711 | 7/1976 | Ahnholz | 340/255 |
| 3,971,007 | 7/1976 | Borkovitz et al. | 340/255 |
| 3,976,987 | 8/1976 | Anger | 340/255 |
| 3,978,465 | 8/1976 | Goode | 340/255 |
| 3,983,554 | 9/1976 | Goode | 340/413 |
| 4,066,950 | 1/1978 | Rumold et al. | 324/51 |
| 4,200,933 | 4/1980 | Nickel et al. | 364/571 |
| 4,206,398 | 6/1980 | Janning | 324/51 |
| 4,472,676 | 9/1984 | Eichmann et al. | 324/51 |
| 4,528,497 | 7/1985 | Arato | 324/51 |
| 4,723,220 | 2/1988 | Smith-Vaniz | 364/492 |
| 4,779,446 | 10/1988 | Rowland | 73/1 R |
| 4,827,430 | 5/1989 | Aid et al. | 364/510 |
| 4,991,105 | 2/1991 | Pim et al. | 364/483 |
| 5,012,667 | 5/1991 | Kruse | 73/1 R |
| 5,043,666 | 8/1991 | Tavernetti et al. | 324/326 |
| 5,066,920 | 11/1991 | Supitz | 324/544 |
| 5,101,160 | 3/1992 | Barjonnet et al. | 324/510 |
| 5,151,866 | 9/1992 | Gloser et al. | 364/483 |
| 5,174,884 | 12/1992 | Shimada et al. | 204/406 |
| 5,190,017 | 3/1993 | Cullen et al. | 123/571 |
| 5,195,009 | 3/1993 | May | 361/44 |
| 5,272,440 | 12/1993 | Weynachter et al. | 324/522 |

13 Claims, 10 Drawing Sheets

