



Implementation Of Generator Grounding Parameters Through Distribution Transformer Using Labview

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ABSTRACT

Keywords
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Determination of the generator neutral grounding system through a distribution transformer can be done through manual calculations. Many parameters are considered in the calculation to obtain the appropriate result there is the possibility of repeated calculations. This is very difficult and causes a large difference in the calculation results. Therefore, a computer-based computing system is needed to overcome these problems. Several papers have developed the calculation of the required generator neutral grounding quantity which considers the voltage level, short circuit fault current, and protection system against ground faults. This paper makes modeling in designing a neutral ground generator using the LabView Graphical User Interface (GUI) application. The goal is to make it easier, faster, and more accurate. As the implementation of the modeling used data from std C62.92.2TM-2017.

1. Introduction

The grounding system is divided into two categories, namely neutral grounding of the power system and equipment grounding [1], [2]. Generators need a grounding system that not only aims to protect the body of the equipment or installation that is protected through a grounded conductor but also must pay attention to the danger of ground fault currents that can harm and damage the equipment. The available generator capacities are different, so an appropriate and standardized medium or grounding method is needed to overcome the occurrence of excessive ground fault currents. Types of generator neutral grounding methods include direct and effective grounding, grounding through resistance, grounding through reactors, and grounding through distribution transformers [3].

The generator neutral grounding system through the distribution transformer is where the transformer primary is connected to the generator secondary, and the transformer secondary is connected to a resistor [4], [5]. The secondary resistor is usually selected for a single-phase to ground fault at the generator terminals, the resistor dissipating power equal to or greater than the reactive volt-amperes voltage in the zero-order capacitance of the transformer winding connected to the generator terminals. The goal is that if there is a disturbance at the secondary end of the transformer, the disturbance will be eliminated through high resistance grounding which is connected through the transformer secondary. The generator neutral grounding system through a distribution transformer uses a high resistance ground (High Resistance Grounding) [6], [7] to limit the single-phase fault current to ground with a maximum fault current limit of 3-25 amperes [8], [9].

2. Method

Grounding using a distribution transformer with a primary voltage value equal to or greater than the line to neutral voltage value from a generator with a secondary voltage rating of 120 V or 240 V. The distribution transformer must have sufficient overvoltage so that no phase to ground fault occurs with the engine is operated at an initial voltage of 105% [10].



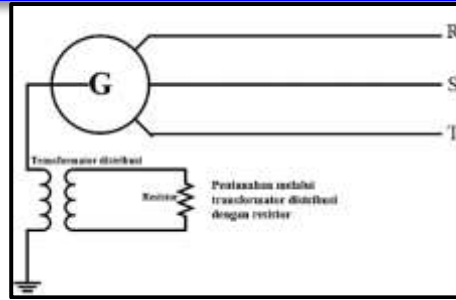


Fig 1. Grounding With Distribution Transformer

This research was conducted by making computer-based application programming. This application is used for instrument design and simulation of equipment grounding systems on generators. The design of this application can process data from the type of grounding method through the impedance used. Applications that have been designed are analyzed and validated to ensure the accuracy of the design results. The comparisons used are from literature studies [11] and IEEE standards in 2017 [10].

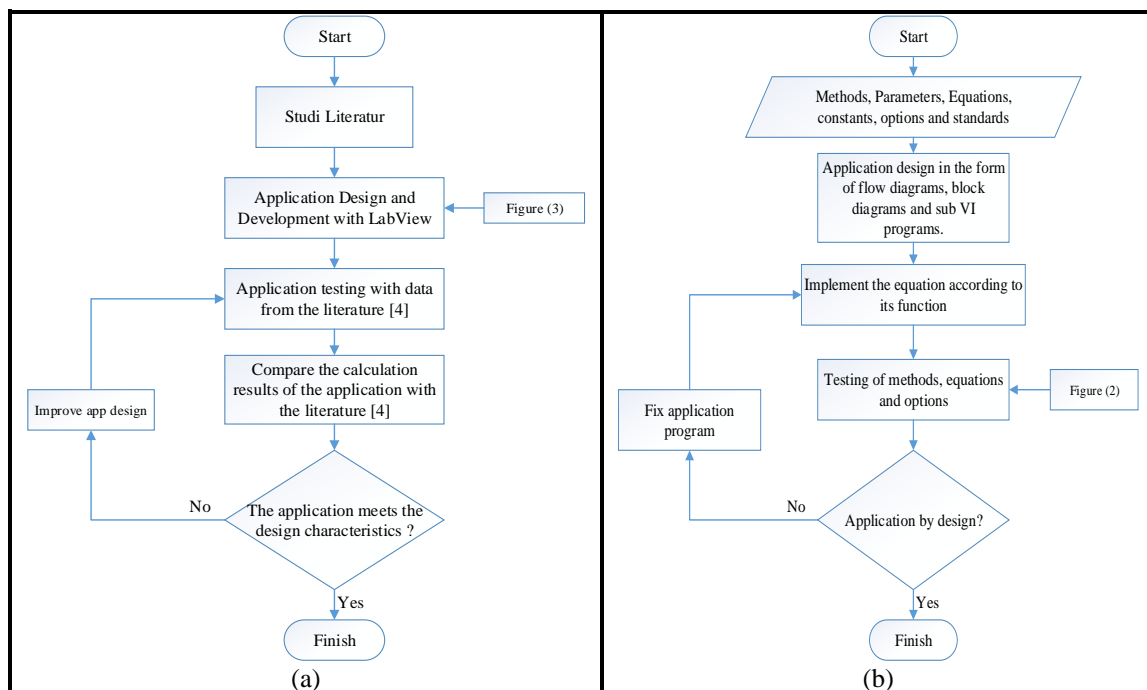


Fig 2. a) Research Flow Chart, b) Flowchart Of Application Design And Manufacture

The design and application stages identify all generator neutral grounding data, the value of the resistance, the type of grounding method to be used, the limitations and characteristics of the grounding method, as well as other necessary settings. Application designs in the form of panels are then grouped according to their functions and sub-VIs. Implements all equations into the LabView GUI programming block.

3. Results and Discussion

The result of the application design that is made is called the generator neutral grounding application (APNG 1.0). This generator neutral grounding application (APNG 1.0) can run independently on the Windows Main screen which does not depend on the LabView software [12], [13]

Generator neutral grounding type (JPNG) for the type of grounding through distribution transformers uses many parameters, namely the power rating and voltage rating of the distribution transformer, the transformer reactance capacitance value, the value of the neutral resistor, the resistance value on the secondary side of the transformer, the current on the secondary side of the



transformer, large transformer rating in KVA, the duration of the disturbance in KVA, the value of the current addition system and the current on the primary side of the transformer. The results of the implementation of the calculation of grounding parameters through a distribution transformer are displayed in the form of a front panel, which can be seen in Fig. 3.

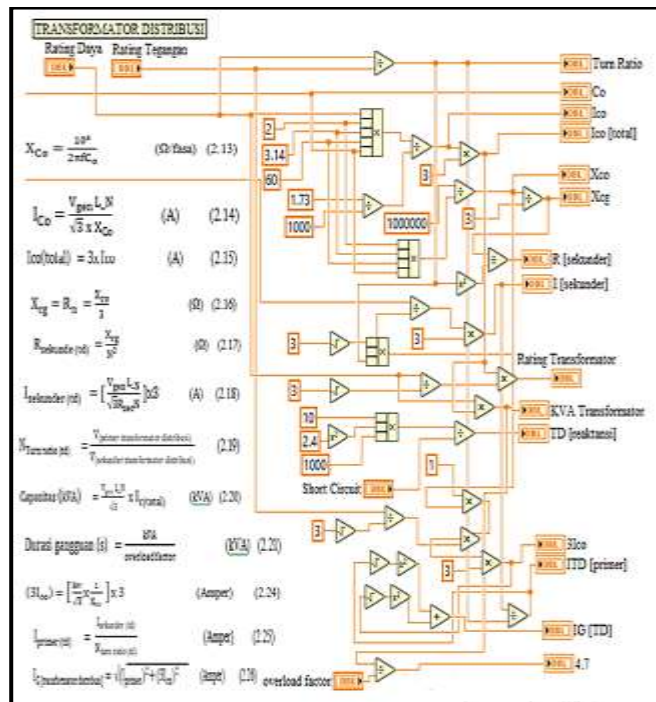


Fig 3. Grounding Type Section Panel Through Distribution Transformer

The results of data validation through the generator neutral grounding application (APNG 1.0) for the type of grounding through distribution transformers are displayed in the form of panels, the results of data validation can be seen in Fig. 4.

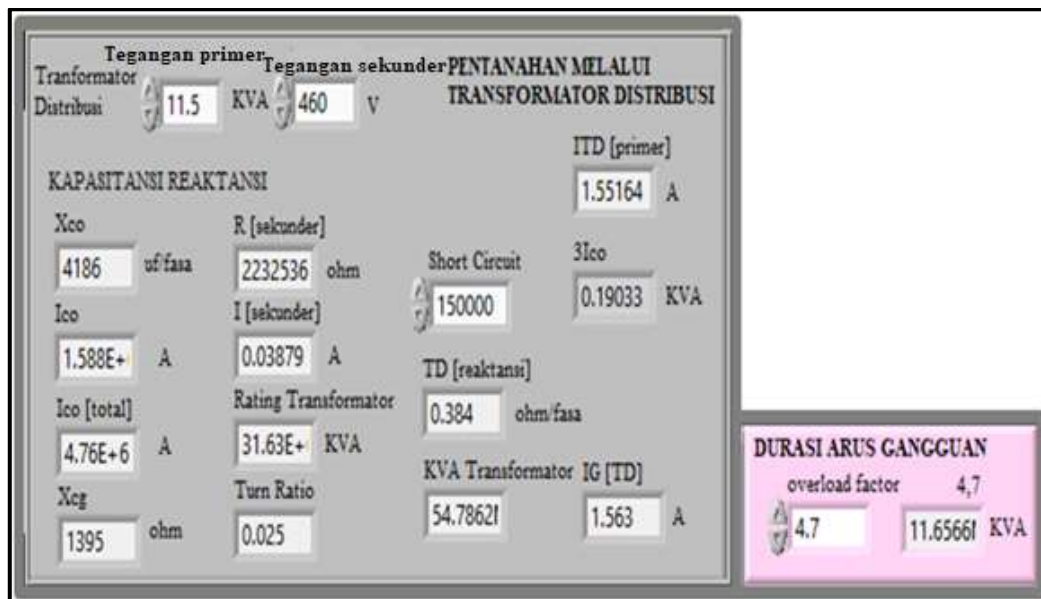


Fig 4. Grounding Type Section Panel Through Distribution Transformer

The results of the calculation of the type of generator neutral grounding through a distribution transformer using the generator neutral grounding application (APNG 1.0) are compared with the results of calculations in the literature [11], the level of difference in value is 0.698 and the difference in numbers is 0.004 % can be seen in Table 1.



Table 1. Comparison of the results of the calculation of the type of grounding through a distribution transformer using a generator neutral grounding application (APNG 1.0) with literature calculations [4].

No.	Description	Grounding Through Distribution Transformer		Difference	
		Literature [10]	APNG 1.0	value	%
1	Impedance reactance (μF)	0,634	0,634	0	0
2	Capacitive reactance (Ω)	4186	4186	0	0
3	Reactance capacitive current (A)	1,58	1,58	0	0
4	Total reactance capacitive current (A)	4,74	4,76	4,2	0,42
5	Neutral resistor (Ω)	1395	1395	0	0
6	Transformer secondary resistance (Ω)	2232	2232	0	0
7	Transformer secondary current (A)	0,357	0,038	-0,31	-0,89
8	Transformer primary current (A)	1,417	1,551	0,09	0,063
9	Transformer turn ratio	0,025	0,025	0	0
10	Current adding system (KVA)	0,197	0,190	-0,007	-0,035
11	Transformer capacity (KVA)	54,51	54,78	4,9	0,49
12	Fault current to ground (A)	1,563	1,563	0	0

The results of the calculation of the type of generator neutral grounding through distribution transformers using data assumptions from the 2017 IEEE standard by performing calculations using the generator neutral grounding application (APNG 1.0). The 2017 IEEE standard data is used to re-assure the accuracy of the application, whereas the APNG 1.0 application is designed to be used on various data assumptions.

4. Conclusion

The computer-based computing system used to design generator neutral grounding is compared with the literature [11] with the name Generator Neutral Grounding Application (APNG) 1.0. The difference in the calculation results of the generator neutral grounding-type on the grounding-type through a distribution transformer is 0.004% with assumptions from the literature [11] and the difference in the calculation results using the 2017 IEEE standard data assumption is -0.00417%. The generator neutral grounding application (APNG 1.0) can save costs by not doing direct testing, whereby entering parameter values and constants, in determining the type of grounding method several things must be considered before the type of grounding method is chosen, including the magnitude of the fault current to the ground.

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