

Auto Transfer Switch (ATS) System on PLN and Genset Using DSE 4520 MKII Module

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Abstract- Electrical energy is the main energy used in almost all activities and human life, both in the housing, office and industrial sectors. The more use of electrical energy, of course there will be various problems with the electricity supply. Problems that often occur are related to the continuity of electricity services and the poor quality of power supplied to consumers. Therefore, this tool aims to overcome if the electrical energy supply is interrupted or goes out by using the DSE 4520 MKII. With the Auto Transfer Switch (ATS) system, you can backup power if the power supply is interrupted. With the main power source from PLN and Genset as a backup if PLN experiences interference. The results of making this tool show that the ATS system can work well and can operate automatically or manually.

Keywords: Auto Transfer Switch (ATS), PLN, Genset, DSE 4520 MKII

I. INTRODUCTION

Electrical energy is the main energy used in almost all activities and human life. Electricity is a basic human need; it can be seen from the pattern of human life that always depends on electricity. For example, when the lights go out it will be pitch black and people will look confused in the dark. All household or office and industrial equipment has now been made in a modern way and to run it must use electricity. Continuity of electrical energy services is a classic problem that always occurs in industry, government buildings, hospitals, and communication service providers. In addition to the problem of continuity of electrical energy services, other problems that arise are the poor quality of electrical energy distributed to consumers such as under voltage, over voltage, under frequency, over frequency and one missing phase [1]. In order to maintain the continuity of electrical energy supply services, it is necessary to have an equipment that can automatically switch services from the main electric power supply to the backup power supply, namely Genset. With the Auto Transfer Switch (ATS) system that uses the DSE 4520 MKII, it aims to back-up power automatically or manually [2]. So that if PLN experiences a disturbance or blackout, it does not interfere with all activities that use electrical energy [3].

II. METHODS

DSE 4520 MKII is an electromechanical equipment that can be controlled and programmed and is used to move the position of the power source from PLN to the generator when the PLN electricity supply goes out. In other words, this module can be used as an Auto Transfer Switch (ATS) to switch the power source from PLN to Genset automatically [2]. The DSE 4520 MKII has 32

ports with a source voltage of 8 volts to 35 volts DC. DSE 4520 MKII can be seen in figure 1.



Figure 1. DSE 4520 MKII

Contactors are components that function as a connector/contact with a large capacity using minimal power [4]. A contactor consists of a coil, some Normally Open (NO) and some Normally Closed (NC) contacts. The contactor used for the main switch. The contactor can be seen in figure 2.



Figure 2. Contactor

A relay is an electronic switch that can open or close a circuit using control from another electronic circuit. It has 2 types of contacts, namely normally open and normally closed, using coil voltage 12VDC and 220 VAC. The relay can be seen in figure 3.



Figure 3. Relay

The auto-manual selector or so-called is a switch that is operated by turning[5]. This switch is used when more than 2 selected positions are required such as automatic or manual. This auto-manual selector has three conditions, namely auto, off and manual. The auto-manual selector can be seen in figure 4.



Figure 4. Auto-Manual Selector

A timer is a device that uses an electromagnet to operate a set of switch contacts, often called a timer relay or timeout delay relay. The timer uses an input voltage of 220V with 8 pins 2 NO and 2 NC Used as a delay time for ON PLN, ON generator and return delay[6]. The timer can be seen in figure 5.



Figure 5. Timer

The battery charger is a component used to charge the generator battery. With a working system when PLN is on, the battery is charged by PLN and when PLN goes out the generator will turn on so that the battery is charged by the generator itself. The input voltage is 220 VAC and the output is 12 VDC[8]. The battery charger can be seen in figure 6.



Figure 6. Battery Charger

Push button switch is a simple device / switch that serves to connect or disconnect the flow of electric current with a working system press unlock (not lock). The push button used has 1 NO pole for ON and 1 NC pole for OFF. Push button switch is used to ON/OFF load supply in manual mode. The push button switch can be seen in Figure 7.



Figure 7. Push Button Switch

The pilot lamp is an indicator light that indicates if the pilot lamp is lit, then there is an electric current entering the electrical circuit. As a marker or ON / OFF indicator on the side of PLN and generators. The pilot lamp has an input voltage of 220V, with green and red colors[7]. The pilot lamp can be seen in figure 8.



Figure 8. Pilot Lamp

MCB or stands for Miniature Circuit Breaker is a component in residential electrical installations that has a very important role. This component functions as a protection system in electrical installations in the event of overload and short circuit (short circuit)[9]. MCB is used as a safety control circuit on the ATS. The MCB used is 16A 1 pole. MCB can be seen in figure 9.



Figure 9. Miniature Circuit Breaker

The design stage of this tool starts from a literature study by searching for and reading journals or books as a reference for making this ATS, then proceeds with component requirements analysis, followed by making designs, wiring, hardware and programming[10].

The following is the number of components used as an ATS system.

Table 1. Auto Transfer Switch (ATS) Components

Components	Amount
DSE 4520 MKII	1
Contactor	2
Relay 12V LY2N	2
Relay 220V LY2N	2
Relay 220V LY4N	1
Auto-Manual Selector	1
Timer	3
Battery Charger	1
Push Button ON (Green)	2
Push Button OFF (Red)	2
Pilot Lamp	3
Miniature Circuit Breaker	2

The components that have been planned, then proceed with the design, namely the ATS system which is designed by a free-standing trainer so that it is easy to understand how the ATS works.

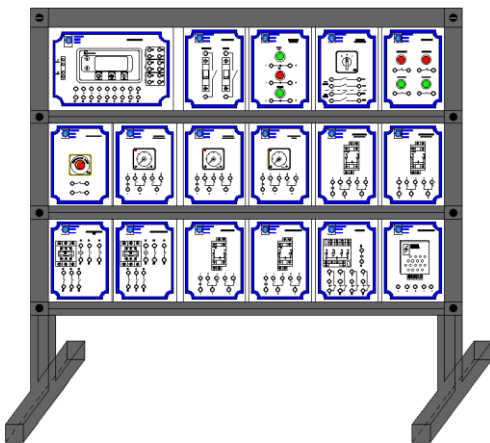


Figure 10. Design of Trainer Free Standing Auto Transfer Switch (ATS) System

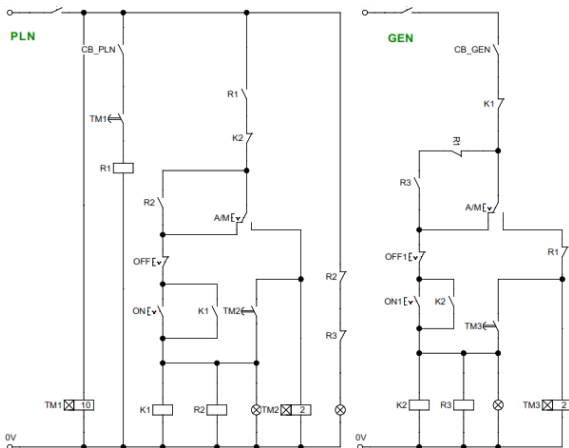


Figure 11. Wiring Diagram

Based on the flowchart above, this tool works using two inputs, namely mains PLN and generator. There are two operating modes that can be used, namely manual and auto. DSE 4520 MKII will sense the mains PLN and Genset to produce output in the form of breaker close PLN or breaker close Genset which will be used to supply the load.

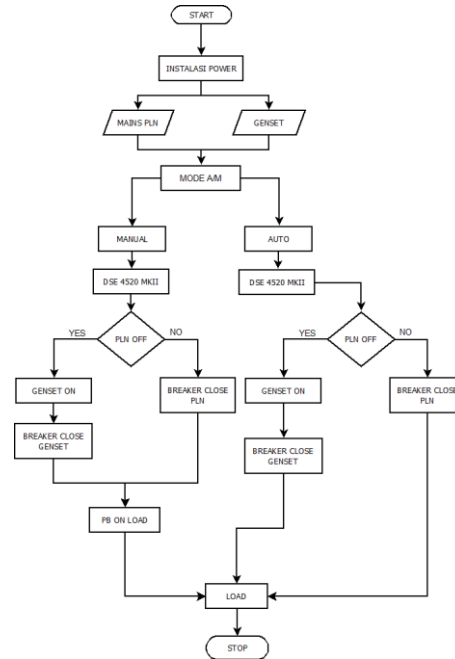


Figure 12. System Diagram Flowchart

Manual mode can be used when doing maintenance on loads, for example if you want to do maintenance, the power source can be turned off by pressing the OFF push button on the PLN and Genset side without having to turn off the MCB. While in auto mode, the operation is carried out automatically without the operator having to press a button as in manual mode.

III. RESULT AND DISCUSSION

The results and discussion on the manufacture of Auto Transfer Switch (ATS) presents the final results and data covering the ATS work system, switching switching and auto/manual operation.

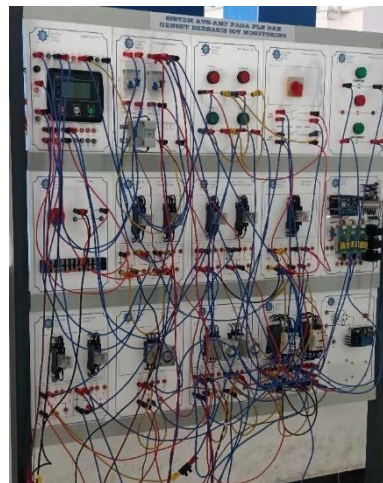


Figure 12. Auto Transfer Switch (ATS) Trainer

The Auto Transfer Switch (ATS) system is wired based on the wiring design that has been made. After completing the wiring, the Auto Transfer Switch (ATS) test is carried out.

1. ATS Work System

The purpose of testing the work system of the Auto Transfer Switch (ATS) is to find out whether the Automatic Transfer Switch (ATS) system is running normally or not.

Testing of the working system is carried out using the input voltage from PLN and the generator, the first test is carried out by simulation using the MCB as if PLN is on and the generator is still off. Meanwhile, the second test was carried out by simulation using the MCB as if the PLN went out and then the generator turned on.

a. Condition of PLN ON and Generator OFF

Table 2. Condition of PLN ON and Generator OFF

Voltage	Freq	Current	Power	Cos Phi	Load
225V	50,1Hz	1A	195W	0,87	PLN

b. Condition of PLN OFF and Generator ON

Table 3. Condition of PLN OFF and Generator ON

Voltage	Freq	Current	Power	Cos Phi	Load
224V	51,5Hz	1A	199W	0,89	Genset

Based on the tests that have been carried out and the data that has been obtained, the test is carried out with two conditions, namely first, when PLN is ON, the generator will be OFF because the main source uses PLN. Furthermore, the second condition is as if PLN goes out or OFF, when PLN goes out the generator will turn on or ON as a replacement source for PLN or as a back-up to the load.

2. Switching Displacement Test

The switching displacement test is carried out when PLN goes out, so that the generator turns on and when PLN comes back on. Through this experiment, data will be taken on how long the switching between PLN and the generator will take. The purpose of testing the switching displacement from the Auto Transfer Switch (ATS) is to find out the length of the transfer from the PLN side to the generator and vice versa from the generator to PLN.

Table 4. Switching Test

Condition	Time	Load
When PLN goes out and the contactor moves to the generator side.	8 s	Genset
When the PLN turns on again and the contactor switches to the PLN side.	12 s	PLN

Based on the switching test that has been done and the data obtained, the test is carried out in two conditions. First, when PLN goes out, the generator will automatically

turn on and the contactor will move to the generator side. So that the load is supplied by the generator, the duration of the transfer from PLN to the generator is 8 s. Second, when the generator is on and suddenly PLN turns on again, the duration of the generator transfer to PLN is 12 s and the load is supplied by PLN. 12s because there is a return delay system for the protection system.

3. Manual Mode Testing

Manual mode testing is done by changing the selector switch M-0-A to manual mode. Thus, the operation between switching PLN to a generator or vice versa is carried out using a manual push button. The purpose of testing the manual mode of the Auto Transfer Switch (ATS) is to find out whether the Auto Transfer Switch (ATS) system can run properly when in manual mode.

Table 5. Manual Mode Test

Condition	PLN	Genset	PLN Indicator ON	Genset Indicator ON	Load
When PLN is on, the PLN ON push button is pressed.	1	0	1	0	PLN
When PLN is on, the PLN OFF push button is pressed.	0	0	0	0	Not Supplied
When the PLN goes out and the generator is on, the Genset ON push button is pressed.	0	1	0	1	Genset
When the PLN goes out and the generator is on, the Genset OFF push button is pressed.	0	0	0	0	Not Supplied

Based on the manual mode test that has been done and the data obtained, the test is carried out in 4 conditions. Based on the tests that have been carried out on the Auto Transfer Switch (ATS), manual mode runs normally.

4. Auto Mode Test

Auto mode testing is done by changing the selector switch M-0-A to auto mode. Thus, the operation between switching PLN to a generator or vice versa is done automatically without the need to use a push button again. The advantage of this system is that when switching between manual to auto or vice versa, the load supply will not go out. The purpose of testing the auto mode of the Auto Transfer Switch (ATS) is to find out whether the Auto Transfer Switch (ATS) system can run properly when in auto mode.

Table 6. Testing Auto Mode

Condition	PLN	Genset	Load
When PLN is ON and Genset is OFF	1	0	PLN
When PLN is OFF and Genset is ON	0	1	Genset

When PLN is on and the generator is off, PLN will automatically be worth 1 (ON) the load is supplied by PLN. The generator contactor and generator indicator will be 0 (OFF). When the PLN goes out and the generator is on, the generator will automatically be worth 1 (ON) and the load is supplied by the generator.

5. Interlock and Priority System Testing

The interlock system is used as a protection system so that the PLN source and the generator do not work

simultaneously. While the priority system prioritizes PLN as the main source rather than generators. The purpose of testing the interlock and priority system of the Auto Transfer Switch (ATS) is to find out whether the interlock and priority work system is working properly.

Table 7. Interlock and Priority Test

System	Condition	PLN	Genset	Load
Interlock	PLN ON and Genset ON	1	0	PLN
Priority	PLN turns on again and the generator is ON	1	0	PLN

Based on the tests carried out and the data obtained, when PLN and the generator are ON, PLN is worth 1 (ON) while the generator is worth 0 (OFF) so that the load is supplied by PLN. From these data it can be seen that the interlock system works well.

When the generator is ON and PLN turns on again, PLN is worth 1 (ON) while the generator is 0 (OFF) so that the load is supplied by PLN. From these data it can be seen that the priority system is working well.

IV. CONCLUSION

The Auto Transfer Switch (ATS) system is built and designed to be a free standing trainer that can be disassembled. As a connector, it uses a female socket and a banana jack. So we can see how the Auto Transfer Switch (ATS) system works using the DSE 4520 MKII. The Auto Transfer Switch (ATS) work system that uses the DSE 4520 MKII runs normally, i.e. when the PLN side goes out or a disturbance it will pass to the generator side and vice versa when PLN turns on again it will pass to the PLN side.

Switching between PLN and Genset has a priority system that functions to make PLN the main source and an interlock system that protects PLN and Gensets from colliding. The length of switching switching is affected by the time we set on the DSE 4520MKII and the external timer.

Manual mode operation on the Auto Transfer Switch (ATS) can run well by utilizing the push button as a control to turn on the load or turn off the load. The benefit is that when carrying out maintenance on the load side, there is no need to turn off the PLN or Genset source. Auto mode operation on Auto Transfer Switch (ATS) works well. This system does not use push button control anymore, but will automatically operate, making it easier for the operator. When switching from manual mode to auto or vice versa will not affect or can turn off the source to the load. So, when the displacement is the load will still be supplied.

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