

# Solar based motorized control of 11kv isolator (GOS) with RF module

Dr. J P Sridhar <sup>1</sup>

<sup>1</sup>Associate Professor, Dept. of Electrical & Electronics Engineering  
S J B Institute of Technology, Bengaluru

Manjunath K S<sup>2</sup>, Sachin G<sup>3</sup>, Shashidhar B K<sup>4</sup>, Yogesh D<sup>5</sup>

<sup>2</sup>Undergraduate student, Dept. of Electrical & Electronics Engineering

<sup>3</sup> Undergraduate student, Dept. of Electrical & Electronics Engineering

<sup>4</sup> Undergraduate student, Dept. of Electrical & Electronics Engineering

<sup>5</sup> Undergraduate student, Dept. of Electrical & Electronics Engineering

SJB Institute of Technology  
Bengaluru

**Abstract:** Currently 11 KV lines, the Group Operating Switch (GOS) is adopted manually for opening and closing of the circuit. These isolators are located at remote locations which are not easily accessible in rainy seasons. Sometimes these isolators are fails to open and close manually, hence the operating the GOS manually can be harmful for the person working in that field. To avoid this problem the automatic operation of GOS can be performed by the design of solar based motorized control. A DC motor is used for automatic operation of 11 KV GOS. For isolator operation, the motor needs the DC auxiliary power supply, which can be providing by solar panels. These solar panels are converting solar energy in to electrical energy and charge the battery through the solar charge controller. The battery output can be used for control operation of GOS. The power control unit consists of two-way selector switch for forward and reverse operation for opening and closing of GOS through auxiliary contactors. The limit switches are inserted at bottom of the GOS arm and when it completes the switching operation the limit switches will send the feedback signal to the auxiliary contactors. The indicators are also provided in the control unit to ensure the isolator operating position. This project overcome the manual operation of 11KV GOS and provides safety to the lineman. This paper gives the design and implementation of complete control setup of solar based motorized control of 11 KV Isolator. In addition, with this we are using RF technology for operation of GOS which can be operated within the 200 metres distance.

**Keywords:** Group operated switch (GOS), Solar panel, Motorized control, RF Technology

## 1. INTRODUCTION

11KV isolators are used widely in the power distribution system, both at the Generation sub stations and also in the distribution networks across all cities and towns. These isolators are double break air as the opening media, usually operated through a rotating handle brought down from the top of the structure to the ground level. 11KV isolators are normally provided with earth switch, and is suitable interlocked mechanically. The main isolator switch with 3 poles for R, Y, B can be operated only of the earth switch is kept open, and vice versa. Thus, any accidents due to wrong operation are avoided. Earthing switches are mounted on the base of line side isolator. Usually, earthing switches are broken vertically. Only when the primary contacts of the isolator's primary contacts are in the open position can the earthing arms of the isolator be closed. As there is no load existing, an electrical circuit is opened using isolator switches. It is not recommended to open it when the line is carrying current. Normally, these are used on both ends of the circuit breaker, making it simple and danger to repair the circuit breaker. At present, these Isolators are operated manually for both closing and opening

through the down rod. While this sort of operation is very dangerous, as heavy sparking is observed both during opening and closing operation. Also these isolators are located at an isolated remote location, which are not easily accessible during rainy seasons, and sometimes these may fail to operate. To avoid these problems, we have proposed an remote operated wireless mode of GOS opening and closing system by using motorized GOS and RF modules for wireless communication.

## 2. LITERATURE SURVEY

- Yash Abhang "Automation of electrical isolators/disconnects using electric motors and gear box" published in year March In this paper the author describes "electrical isolators are physical switches that are in place to ensure that complete connection or disconnection to whole circuit is made. "This electrical isolator used in substations is manually handled to operate isolator to avoid this electric motor can be used".
- Aravindh Vignesh "Design of motor-controlled Air Break Disconnecter" published in year March 2015. In this paper the author describes "Air brake disconnectors used in power station is primarily used for isolation purpose" "In a small prototype motor which is operated horizontal air break disconnecter.
- Goji Nakagawa "For large-scale switch systems, a compact polarization-insensitive array isolator with a built-in safe operating area gate array switch module is accessible" released in June of 2009. The author of this essay writes "For large-scale switch systems, a compact polarization-insensitive array isolator with a safe operating area gate array switch module had been used to provide excellent optical coupling characteristics with insertion losses.
- Digvijay Mahajan "Implementation of an electrical disconnecter switches using electric motor and gear box" published in year March 2019. In this paper the author describes "implementation and development of isolators switches using electric motor and with mechanism

## 3. MOTIVATION

- RF mode of wireless communication which we are proposed to use in this project.
- Use of Renewable energy source, so that clean and green power is utilised.
- The same technology can be extended to GSM mode of operation so that the GOS can be operated from any corner of the country.
- Feed back on the status of GOS can also be obtained remotely.
- Local and remote mode of operation can be provided so the more flexibility is provided to the system.
- This system can be adopted in Generating stations, sub stations, Distribution networks, Industrial feeders, commercial feeders etc.

## 4. OBJECTIVES

The main objective of the proposed work is to provide a safe, secure and sure method of operation of GOS. Uniform speed of closing and opening of GOS. Utilisation of renewable energy (solar power) for operation of DC motor. In this work a DC motor is employed for operation so that it can operate in both directions, and its speed can be regulated easily. Remote operation of GOS using RF technology is achieved which increases the life of GOS. In the proposed idea both local (manual) and remote mode of operation is possible and it also enables the status of GOS such as on and off mode.

## 5. SYSTEM COMPONENTS

### A. Dc motor

DC motor, 12 V DC, geared motor to give an output speed of 100 rpm . A DC motor is an electric motor that works on direct current (DC) (unlike an induction motor that operates via an alternating current). DC electrical energy is then converted into mechanical energy by a DC motor. The "Fleming left hand rule" is a theory that controls how DC motors operate. A current-carrying conductor experiences a torque and a tendency to move when it is exposed to electromagnetic field.



Figure 1. DC motor, 12 V DC 100 rpm

### B. Solar panel

A cluster of photovoltaic cells placed in a framework for installation is known as a solar cell panel, solar electric panel, photo-voltaic (PV) module, or simply solar panel. Solar energy can be harnessed by solar panels to provide direct current power. A system of PV panels is known as an array, and a collection of PV modules is known as a PV panel. Electrical equipment is powered by renewable panels from photovoltaic arrays.



Figure 2. Solar Panel - 12V

### C. Solar battery charger

A solar charge controller is a bit of technology that manages the power flow from the solar array into the battery bank. It inhibits power from running back to the solar panels overnight and prevents the deep cycle batteries from being overloaded during the day. Although some charge controllers come with extra features like lighting and load optimization, their basic function is to handle electricity.



Figure 3. Solar charge controller

### D. Battery

One or more electrochemical cells with external connections for powering electrical equipment make up an electric battery, which is a source of electric power. The cathode and anode are the positive and negative terminals of a battery, respectively, while it is providing electricity. The source of the electrons that will go from the terminal labelled "negative" to the terminal labelled "positive" is an external electric circuit.



Figure 4. 12V Battery

### E. RF module

In order to send and/or receive radio signals between two devices, an RF module (radio-frequency module) is a typically tiny electrical device. It is frequently useful to connect wirelessly with some other device in an embedded system. Radio-frequency (RF) communication can be used to carry out this wireless communication.



Figure 5. RF module – 433mhz

### F. SMPS

SMPS stands for switch-mode power supply. Its job is to convert wall-voltage AC power to lower voltage DC power. The term SMPS is defined as when the power supply is involved with the switching regulator to change the electrical power from one form to another form with required characteristics is called SMPS.



Figure 6. Switched mode power supply

### G. GOS structure

The fundamental purpose of the isolator, a sort of switching device, is to ensure that a circuit is not entirely activated in order to carry out the preservation. These can also be identified as isolation switches used to separate circuits. These switches can be used in industrial settings and for power distribution, among other things. In substations, high voltage type isolation switches are used to enable the isolation of equipment like transformers and circuit breakers. Not the transformer from the load, but the substation from the incoming line, is what this switch is intended to do. It resembles a big safety switch that is incapable of breaking a load.



Figure 7. GOS Structure

## 6. PROPOSED MODEL

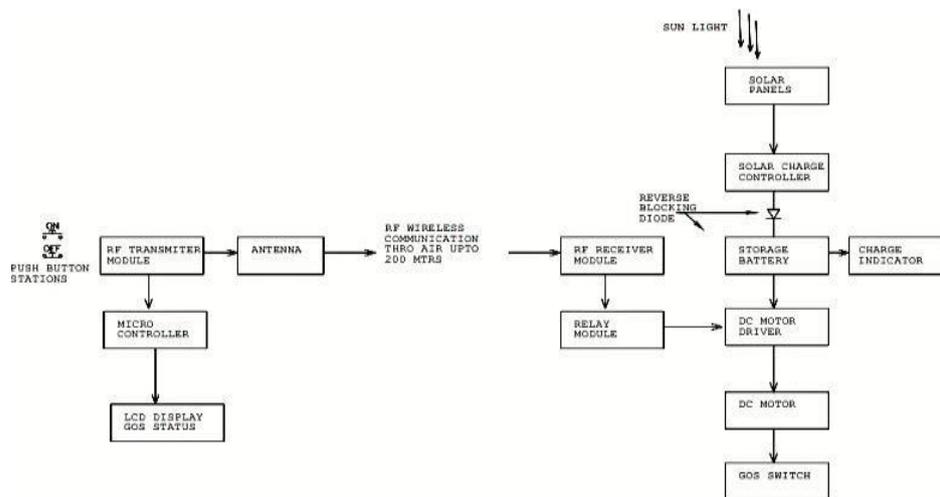


Figure 8. Block Diagram

A DC motor is used for the operation of 11 KV GOS. For GOS operation, the motor needs the DC power supply, which can be providing by SMPS and we are using solar energy as an alternative power supply. When the sunlight falls on the solar panel it stores the energy. Through the solar charge controller, these solar panels charge the battery by converting solar energy to electrical energy. The electricity coming from the solar array into the battery bank is managed by the solar charge controller. The GOS functioning may be controlled using the battery output. When the switching operation is finished, the limit switches, which are installed at the bottom of the GOS arm, will transmit a feedback signal to the relay module. The indicators are also provided in the control unit to ensure the GOS operating position. This project overcome the manual operation of 11KV GOS and provides safety to the lineman. The design and installation of a full control configuration for the solar-powered motorised control of an 11 KV isolator are provided in this study. In addition, with this we are using RF technology for operation of GOS which can be operated within the 200 metres distance.

## 7. RESULT AND DISCUSSION

The proposed this project to setup the lineman / service man or any authorized person security system based on motorized control. This work can be used to ensure the Safety of the maintenance staff from fatal accidents and risk of shock, e.g., Lineman. The 11kV isolator can be open and closed by the line man. This system provides an. Arrangement such that a push button is required to operate the isolator (ON/OFF).and an adding RF technology for remote controlling the GOS. Lineman can operate the isolator in open condition and comfortably with manually and remote operation for repairing purpose, and then close the contacts of isolator by operating the push button and by remote control .Since it has the provision of Interlocking system, only authorized person can operate it.

Thus, by this project the three main outcomes can be expected:

1. This concept enables the safety for operation of group operating switch.
2. This project consumes less time limit during operation of GOS.
3. This concept uses the efficient energy source by solar panel for operation of GOS.

## 8. CONCLUSION

At the moment, feeding and isolation take place in isolators that must be manually opened and closed. This manual process requires both human labour and significant time, both of which are accounted for in the length of a power block. By using a motor to operate the isolator from a suitable place, the idea of saving this precious power block time may be developed and used. This article provides in-depth data on the specification and construction of a motorised isolator. The electrical Isolators once automated can be directly controlled. This enables better power grid control and distribution of power according to the demand. The high voltage substations can now be operated with maximum safety. This project overcome the manual operation of 11KV GOS and provides safety to the lineman. The paper gives the design and implementation of complete control setup of solar based motorized control of 11 KV Isolator.

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