ISSN 2395-1621

Dynamic Voltage Regulator

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ABSTRACT

The disadvantage of voltage sags and severe impact on sensitive loads is well known. To solve and remove this problem we have proposed, the Dynamic Voltage Regulator is a modern and important custom power device for compensation voltage sags in power distribution systems. The Dynamic Voltage Restorer is fast, flexible and efficient solution to voltage sag problem. The DVR is a series compensator used to mitigate voltage sags and to restore load voltage to its rated value. In this paper, an overview of the DVR, its functions, configurations, components, operating modes, voltage inject ion methods and closed loop control of the DVR output voltage are reviewed along with the device capabilities and limitations.

Keywords: DVR, Protection mode, Standby mode, Injection Mode

ARTICLE INFO

Article History

Received :8th March 2016

Received in revised form :

10th March 2016

Accepted : 12th March 2016

Published online :

15th March 2016

I. INTRODUCTION

Among the power quality problems voltage sags are probably the most severe disturbances. In order to overcome these problems the concept of custom power device has become introduced recently. One of those devices is the Dynamic Voltage Restorer (DVR), which is one of the most efficient and modern custom power device used in power distribution network. A DVR is a series-connected solid-state device that injects voltage into the system in order to regulate the load side voltage. It is normally installed in a distribution system between the supply and a critical load feeder at the so-called point of common coupling (PCC).Its primary function is to rapidly boost up the load-side voltage in the event of voltage sag in order to avoid any power disruption to that load. There are various circuit topologies and control schemes that can be used to implement a DVR.

II. LITERATURE SURVEY

The impact of power quality Power Quality in electric networks is one of today's most concerned areas of electric power system. The power quality has serious economic implications for consumers, utilities and electrical equipment problems are increasingly felt by customers industrial, commercial and even residential. Some of the main power quality problems are sag, swell, transients, harmonic, and flickers etc. [1].

By custom power devices, we refer to power electronic static controllers used for power quality improvement on distribution systems rated from 1 to 38 kV. This interest in the practice of power quality devices (PQDs) arises from the need of growing power quality levels to meet the everyday growing sensitivity of customer needs and expectations. One of those devices is the Dynamic Voltage Restorer (DVR), which is the most efficient and effective modern custom power device used in power distribution networks. Its application includes lower cost, smaller size, and its fast dynamic response to the disturbances. Several research papers and reports addressed the subject of improving power quality in distribution system by the use of custom power devices. The followings present a brief review of the work undertaken so far.

III. PROBLEM STATEMENT

Power quality is one of major concerns in the present. Also, problems of voltage sags and its severe impact on sensitive loads are well known. Power quality problem is an occurrence manifested as a nonstandard voltage, current

frequency that results in a failure of end use equipment .So to solve these problems, power devices are used. Dynamic Voltage Regulator is one of them. It compensates the voltage sags in power distribution system. It protects consumers against sudden changes in voltage amplitude. Dynamic Voltage Regulator is fast, flexible, and efficient solution to voltage sag problem. The Dynamic Voltage Regulator is a series compensator used to mitigate voltage sags and to restore load voltage to its rated value.

IV. PROPOSED SYSTEM

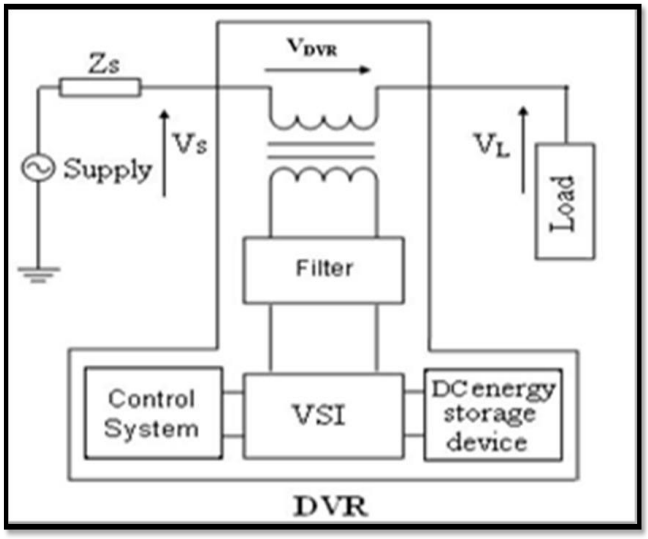

Fig. 1 Block Diagram of DVR

Protection Mode:

If the current on the load side exceeds a permissible limit due to a short circuit on the load or large inrush current, the DVR will be isolated from the systems by using the bypass switches as shown in Figure S2 and S3 will open and S1 will be closed to provide an alternative path for the load current.

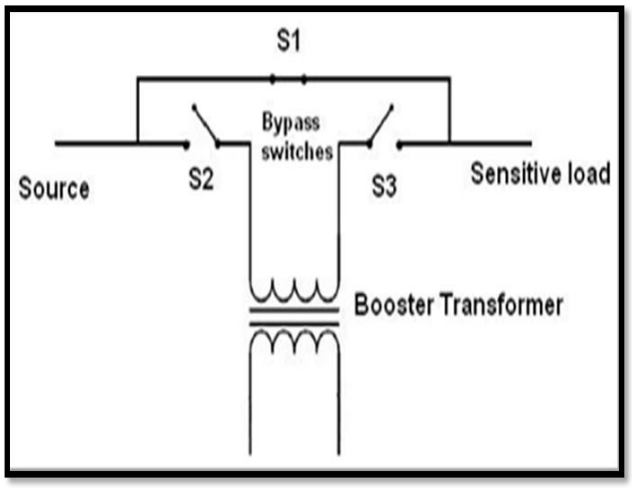

Fig 2. Protection Mode

Standby Mode:

In the standby mode the booster transformers low - voltage winding is shorted through the converter as shown in Figure 6. No switching of semiconductors occurs in this mode of operation and the full load current will pass through the transformer primary.

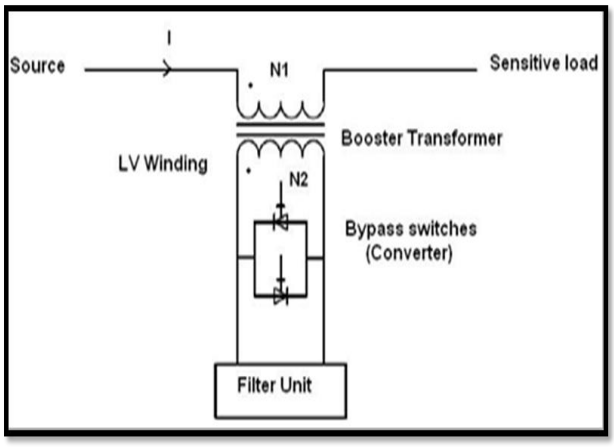

Fig 2. Standby Mode

Injection Mode:

In the Injection/Boost mode the DVR is injecting a compensating voltage through the booster transformer after the detection of a disturbance in the supply voltage**.**

Voltage Injection Methods of DVR

The way in which the dynamic voltage restorer (DVR) is used during the voltage injection mode depends upon several limiting factors such as: DVR power rating, load conditions, and voltage -sag type. For example, some loads are sensitive to phase-angel jumps, some others are sensitive to a change in voltage magnitude and some others are tolerant to all these disturbances. Therefore the control strategies to be applied depend upon the load characteristics. There are four different methods of DVR voltage injection.

There are four different methods of DVR voltage inject ion.

1. Pre -sag/dip compensation method.
2. In -phase compensation method.
3. In -phase advanced compensation method.
4. Voltage tolerance method with minimum energy inject ion.

1. Pre-Sag/Di p Compensation Method (PDC)

The pre-sag method tracks the supply voltage continuously and if it detects any disturbance in that voltage it will inject the difference voltage between the sag or voltage at the PCC and the ideal pre -fault condition. In this way, the load voltage can be restored back to the pre -fault conditions. Compensation of voltage sags in both phase - angle and an amplitude sensitive load has to be achieved by pre-sag compensation method. In this method, the active power injected by the DVR cannot be controlled and it is determined by external conditions such as the type of faults

and the load conditions.

2. In- Phase Compensation Method (IPC)

This is the most straight-forward method. In this method the injected voltage is in phase with the PCC voltage regardless of the load current and pre -fault voltage. The phase angles of the pre -sag and load voltage are different but the attention is placed on maintaining a constant voltage magnitude on the load. One of the advantages of this method is that the amplitude of DVR inject ion voltage is minimum for a certain voltage sag in comparison with other strategies. Practical application of this method is in loads which are not sensitive to phase-angle jumps.

3. In- Phase Advance d Compensation Method (IPAC)

In this method the real power spent by DVR is minimized by decreasing the power angle between the sag voltage and the load current. In the two previous cases, namely pre-sag and in-phase compensation, active power is injected into the system by the DVR during disturbances. Morever, the active power supplied is limited to the stored energy in the DC link and this part is one of the most expensive parts of the DVR. The minimization of injected energy is achieved by making the injection voltage phasor perpendicular to the load current phasor. In this method the values of load current and voltage are fixe d in the system so one can change only the phase of the sag voltage.

4. Voltage Tolerance Method with Minimum Energy

Injection Generally voltage magnitudes between 90%-110% of the nominal voltage and phase angle variations between 5% -10% of the normal state will not disturb the operation characteristics of loads. This compensation method will maintain the load voltage within the tolerance area with small change of voltage magnitude.

V. ADVANTAGES AND APPLICATIONS

Advantages:

It can be used to improve power quality.
It is most efficient method.
Low cost.
Compact in size.

Applications:

It can be used in substations.
It can be used in distribution system.
It can be used in transmission system.

VI. CONCLUSION

In electrical design, the features and functions of the electrical components are required to determine the system requirement. Unto this level, we have studied the basic block diagram and the circuitry of our project. We had designed the PCB required, and also fabricated power supply circuitry. We had taken the PCB layout of overall circuit and mounted some components. Also we have studied the components used and its specifications.

REFERENCES

[1]R. Ibrahim, A. M. Haidar, M. Zahim "Effect of DVR Location for Enhancing Voltage Sag" Proceedings of the 9th WSEAS International Conference on Applications of Electrical the Engineering, pp. 92-98.

[2]Shazly A.Mohammad , Aurelio G.Cerrada, Abdle-MOamen M.A and B. Hasanin "Dynamic Voltage Restorer(DVR)System for compensation of voltagesag,state-of-the-art Review"International Journal Of Computational Engineering Research ,Jan2013,Vol.3 Issue.1

[3]R. Ibrahim, A.M. Haidar, M.Zahim "The Effect of DVR Location for Enhancing Voltage Sag" Proceedings of the 9th WSE.

[4]V.S.Mallela, P.S.Solanki, and A. Chaturvedi "Role of a Dynamic Voltage Restorer Communication, Computer & Power (ICCCP'05), Feb. 2005, pp.161-166.

