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Mitigate Power Quality Disturbances In Sensitive Loads

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ABSTRACT: The power quality disturbances due to voltage swell and sag are reduced by using series voltage controller. This is placed between the source voltage and load. here sensitive loads causes power quality problems like voltage swell, voltage sag and transients etc. this may leads more losses and generate disturbances. In order to prevent these power quality problems or disturbances on the system, series voltage controller using in distribution network. The simulations are performed using MATLAB/SIMULINK by version 2009b.

KEYWORD: Distribution System, Voltage source Converter (VSC), Voltage Swells and Sag, Series Voltage Controller

I. INTRODUCTION

In many load centres are connected to the transmission and distribution networks. In this distribution network include mostly the non-linear loads. Due the presence of non-linear loads, affected by the quality of the power and also the sinusoidal voltage gets disturbed. In order to enhancement of power quality there is a need of some power quality improvement alternative that provides us better solution. One of the major solutions to power quality problems are use of compensating type devices which comes under Custom Power Devices. All compensating type devices have their own benefits and drawbacks. But Series voltage controller is chosen because of low cost, high efficiency, low losses and less maintenance. [9]. The family of custom power controllers originally included three basic devices: the Solid-state Breaker (SSB), the Static Compensator (DSTATCOM) and the Dynamic Voltage Restorer (DVR). DVRs are a class of custom power devices for providing reliable distribution power quality. They employ a series of voltage boost technology using solid state switches for compensating voltage sags/swells. The DVR applications are mainly for sensitive loads that may be drastically affected by fluctuations in system voltage. Reliability is expanded to include power quality goals: no power interruptions, tight voltage regulation, low harmonic distortion, and low phase unbalance. But the DVR has plenty of applications in distribution systems aimed to improve the quality and reliability of the power supplied to the end-user. It can be used to prevent non-linear loads from polluting the rest of the distribution system. The rapid response of the DVR makes it possible to provide continuous and dynamic control of the power supply including voltage and reactive power compensation, harmonic mitigation and elimination of voltage sags and swells.

II. PROPOSED CONFIGURATION OF SERIES VOLTAGE CONTROLLER

Series voltage controller works on remove voltage swell, voltage sag problems has been identified which is caused by three phase faults. In order to improve the quality of power by mitigating the level of voltages a custom power device called series voltage controller or dynamic voltage Restorer has been considered. This Paper presents that the power quality problems in low voltage distribution systems like voltage swell can be mitigated by using a new compensation voltage control scheme which was proposed in this paper. The proposed method i.e., the dynamic voltage restorer can protect the consumer's equipment from potential voltage swells.

Dynamic voltage restorer is a series compensating device. That's why the device is called series voltage controller. It is used to inject voltage in series in order to balance the voltage in the system. DVR is used not only for

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compensating the voltage.DVR consists of injection transformer, filter, voltage source converter, energy storage devices and control system are shown in Fig. 1

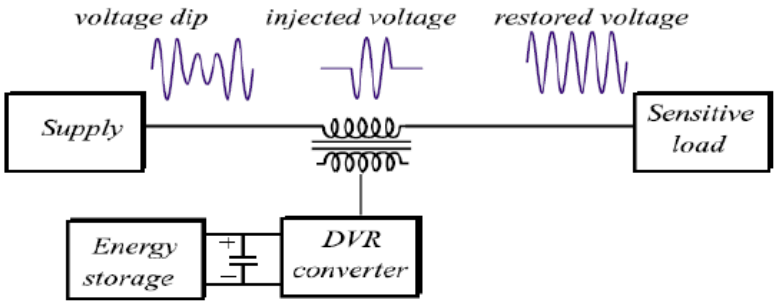

Fig. 1 Basic DVR with its Component

A). the components of DVR

1) Injection Transformer:

The Injection/Booster transformer is a specially designed transformer that attempts to limit the coupling of noise and transient energy from the primary side to the secondary side. Its main tasks are: connects the DVR to the distribution network via the HV-windings and transforms and couples the injected compensating voltages generated by the voltage source converters to the incoming supply voltage. In addition, the Injection/ Booster transformer serves the purpose of isolating the load from the system. It is one unit three phase construction.

2) Harmonic Filter:

The main task of harmonic filter is to keep the harmonic voltage content generated by the voltage source converters to the permissible level. It has a small rating approximately 2% of the load MVA connected to delta-connected tertiary winding of the injection transformer.

3) Voltage Source Converter:

A VSC is a power electronic system consists of a storage device and switching devices, which can generate a sinusoidal voltage at any required frequency, magnitude, and phase angle. In the DVR application, the VSC is used to temporarily replace the supply voltage or to generate the part of the supply voltage which is missing.

4) Storage Devices:

The purpose is to supply the necessary energy to the VSC via a dc link for the generation of injected voltages. The different kinds of energy storage devices are superconductive magnetic energy storage (SMES), batteries, and capacitance.

5) Capacitor:

DVR consists of a capacitor having large rating. In addition, it is used for stiff DC voltage for the input of an inverter.

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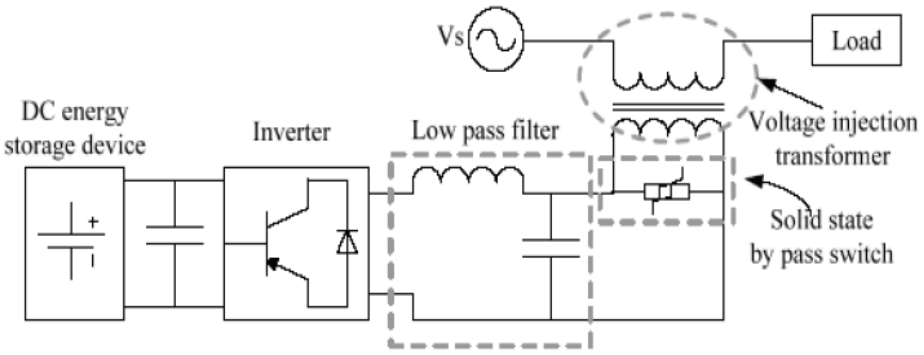

Fig. 2 Equivalent Diagram of DVR

III. WORKING OF SERIES VOLTAGE CONTROLLER

1. **Protection Mode:**

If the over current on the load side exceeds a permissible limit due to short circuit on the load or large inrush current, the DVR will be isolated from the systems by using the bypass switches and supplying another path for current.

2. **Standby Mode (Voltage Injected by DVR is Zero):**

In the standby mode the booster transformer's low voltage winding is shorted through the converter. No switching of semiconductors occurs in this mode of operation and the full load current will pass through the primary.

3. **Injection/Boost Mode:**

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

IV. RESULTS

The MATLAB and SIMULINK Results shows that the power quality problems like voltage swells can be compensated very quickly and smoothly and the source voltage fault can be compensated by series voltage injection transformer.

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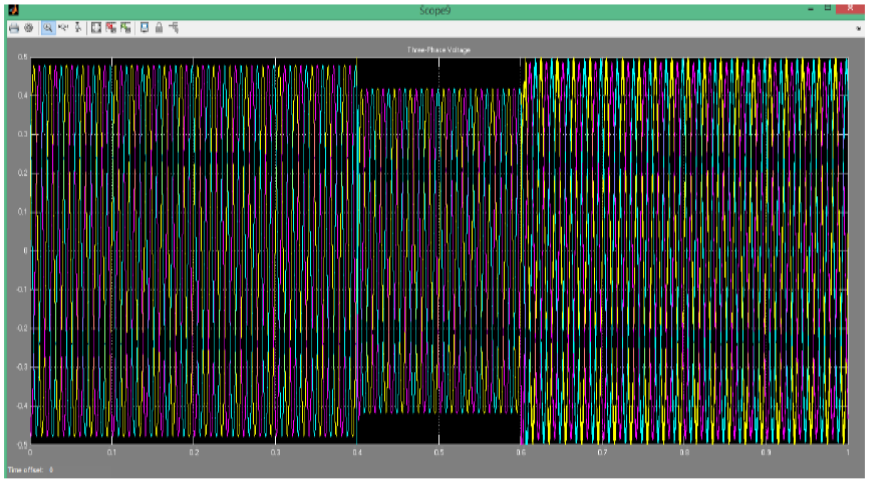

Fig. 3 Load voltage before injection of Series Voltage Controller during three –phase fault

The mitigation of voltage swell by using dynamic voltage restorer or series voltage controller was proved experimentally by using MATLAB Simulation as shown in above fig 3.

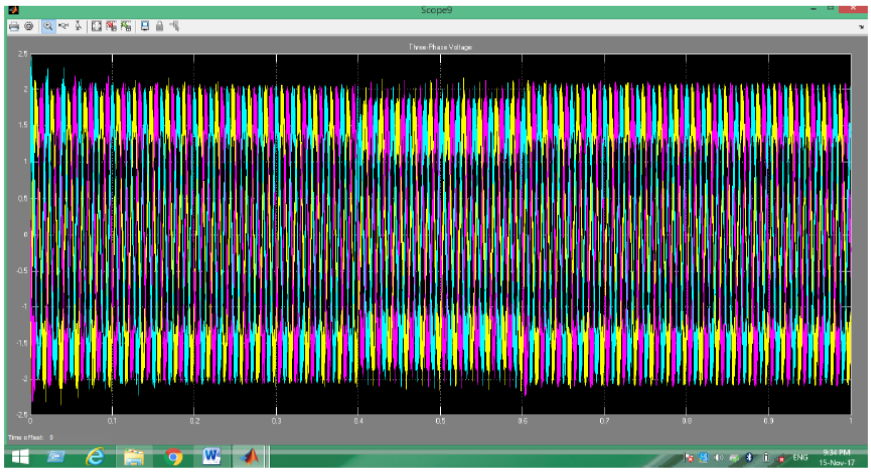

Fig. 4 Load voltage after the Series Voltage Controller injection on three-phase fault

V. CONCLUSION

A compensating type device is used to compensate voltage sag and voltage swell. This device name is dynamic voltage restorer or series voltage controller. So in this paper voltage sag and also load side voltage being compensated to achieve quality of power to end users.

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