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Fault Current Limitation Using Thyristor Based Devices

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ABSTRACT

The most common ways to limit fault currents are the costly replacement of substation equipment or imposition of changes in the configuration splitting power system that may lead to decreased operational flexibility and lower reliability. This project presents analysis, and experimental results of short circuit current limiters, the Thyristor Inserted Reactor. A novel idea is to use Fault Current Limiters (FCLs) to reduce the fault current to lower, acceptable level so that the existing switchgear can still be used to protect the power grid. The purpose of the fault current limiters is to reduce the overstress of circuit breakers provoked by the network expansion and the consequent increase in fault currents. The experimental prototype results demonstrate the effectiveness of these devices to limit fault currents, deferring significantly the replacement of circuit breakers with surpassed fault current interruption capacity.

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I. INTRODUCTION

The continuous growth of power generation and network interconnection in today's power systems result in higher fault currents. The short circuit faults are the most destructive ones among the numerous faults occurring in power distribution systems. Sometimes the short-circuit faults generate over current more than 20 times the rated current. The normal power flow is interrupted by the protection relays. The results are voltage interruption and other power quality problems to the end-users.

Power equipment is normally dimensioned for the tremendous stress under fault conditions. The maximal short-circuit current is one of the most important dimensioning parameter and it is directly linked to the price of the equipment. The downsizing of the existing equipment, such as transformers, lines, bus-bars and circuit-breakers is possible by decreasing the maximum fault current.

The traditional devices used for fault current limitation are Fuses are simple, reliable and are usually used in low voltage and in middle voltage distribution grids. The main disadvantages are the single-use and the manually replacement of the fuses; Circuit-breakers are commonly used reliable protective devices. The circuit breakers for high current interrupting capabilities are expensive and have huge dimensions. They require periodical maintenance and have limited number of operation cycles.

With the continuous progress and cost reduction of the solid-state devices, the limitation of fault currents through Fault Current Limiters (FCL) appear as one of the most economical solutions compared to the complete upgrade of exceeded capacity installations, with the additional advantage of easier implementation

II. BLOCK DIAGRAM AND DISCRIPTION

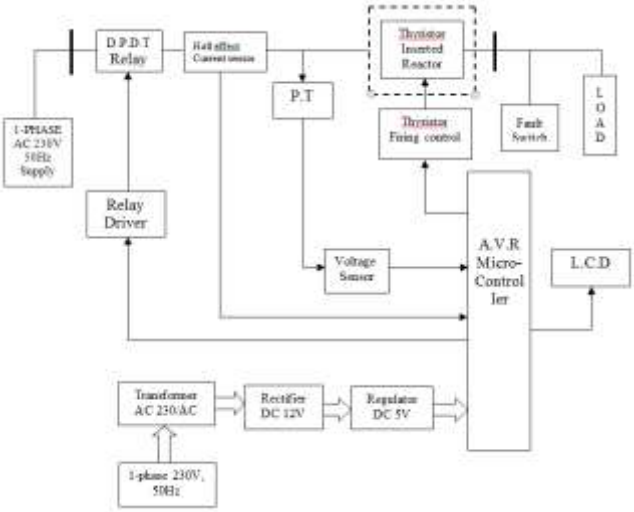

Fig.1 Block diagram of Fault Current Limitation using Thyristor Inserted Reactor.

A. 5V DC Power Supply:-

In general, we use an AC supply of 230V 50Hz, but this power has to be changed into the required form with required values or voltage range for providing power supply to different types of devices. 230V AC power is converted into 12V AC (12V RMS value wherein the peak value is around 17V), but the required power is 5V DC; for this purpose, 17V AC power must be primarily converted into DC power then it can be stepped down to the 5V DC.

B. Potential Transformers:-

A potential transformer is typically expressed in primary to secondary voltage ratio. For example, a 600:120 PT would mean the voltage across secondary is 120 volts when primary voltage is 600 volts.

C. Current Transformers (Hall Effect):-

Hall Effect Sensors are devices which are activated by an external magnetic field. We know that a magnetic field has two important characteristics flux density, (B) and polarity (North and South Poles). The output signal from a Hall Effect sensor is the function of magnetic field density around the device. When the magnetic flux density around the sensor exceeds a certain pre-set threshold, the sensor detects it and generates an output voltage called the Hall Voltage, V_H.

D. Microcontroller ATMEGA328p:-

The high-performance Atmel picoPower 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1024B EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, a 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts.

E. D.P.D.T. Relay:-

DPDT stands for double pole double throw relay. Relay is an electromagnetic device used to separate two circuits electrically and connect them magnetically. They are often used to interface an electronic circuit, which works at a low voltage to an electrical circuit which works at a high voltage. Relays are available in different configuration of operating voltages like 6V, 9V, 12V, 24V etc.

Thyristor Drive Circuit:-

a) Thyristor:-

A thyristor (TYN16-600CT) is a solid-state semiconductor device with four layers of alternating N and P-type material. It acts exclusively as a bistable switch, conducting when the gate receives a current trigger, and continuing to conduct while the voltage across the device is not reversed (forward-biased). Some sources define silicon-controlled rectifier (SCR) and thyristor as synonymous

b) Snubber Circuit:-

It consist of capacitor connected in series with resistor which is applied parallel with thyristor when voltage is applied across the device as well as capacitor suddenly at first snubber circuit behaves like short circuit therefore voltage across device is zero. Gradually voltage across capacitor builds up at a slow rate so dv/dt across thyristor will stay in allowable range, Before turning on thyristor capacitor is fully charged and after turning on thyristor it discharges through SCR. This discharging current can be limited with the help of resistance connected in series with capacitor to keep the value of current and the rate of change of current in a safe limit.

c) Optoisolator:-

The MOC306X-M and MOC316X-M devices consist of a GaAs infrared emitting diode optically coupled to a monolithic silicon detector performing the function of a zero voltage crossing bilateral triac driver. They are designed for use with a triac in the interface of logic systems to equipment powered from 115/240 VAC lines, such as solid-state relays, industrial controls, motors, solenoids and consumer appliances, etc.

d) LCD(16*1):-

All the LCD's performs the same functions (display characters). Their programming is also same and they all have same 14 pins (0-13) or 16 pins (0 to 15). LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines.

III. ADVANTAGES

1. Reduces the stress on C.B.
2. Easier implementation.
3. Reduces the chances of blackout.
4. Fast operation.
5. Economical solution compared to the complete upgrade of exceeded capacity installations.
6. Avoid the equipment damaging.
7. Avoid the equipment replacement.

IV. DISDAVANTAGES

1. It is simply to limit the short circuit current & not to be a line power flow control.
2. Complex Construction

V. APPLICATION

1. Transmission line
2. Distributed Generation
3. At generator side for protection of generator from faulty currents.

VI. CONCLUSION

The use of power electronics based FCLs can be efficient and cost-effective ways to reduce short-circuit current levels. The use of FCLs can delay significantly, or even avoid, the complete substitution of CBs when Short-circuit currents increase due to power system growth. There are many possible locations in power systems where FCLs installation offers technical and economic benefits. The bus-tie position appears to be the most economical option among other alternatives.

In this project we shall analysis & reduces magnitude of current before & after the short circuit condition.

REFERENCES

[1] M. Tarafdar Hagh, M. Jafari, S. B. Naderi "New Series Resonance Type Fault Current Limiter" International Conference on Power Systems Transients (IPST2011) in Delft, the Netherlands June 14-17, 2011.

[2] Georgi Ganev, Krastjo Hinov, Nikolay Karadzhov "Fault Current Limiters – Principles And Application".

[3] L.Karunakar, G.Gantaiah swamy "Thyristor Based Fault Current Limiter to Control Magnitudes of Fault Currents" International Journal of Modern Engineering Research (IJMER) Vol. 3, Issue. 6, Nov - Dec. 2013.

[4] Ganesh Barve "Application Study of FACTS Devices in Indian Power System" International Journal of Computing and Technology Volume 1, Issue 1, February 2014.

