Asian Journal of Electrical Sciences
ISSN: 2249-6297 (P) Vol.4 No.1, 2015, pp.11-13
© The Research Publication, www.trp.org.in
DOI: https://doi.org/10.51983/ajes-2015.4.1.1935

ARM Based Intelligent Soft Starter for Consumer Applications

M. Gowtham[1] and K. Vidhya[2]
[1]PG Student, Department Of Embedded System Technologies, [2]Assistant Professor, Department of ECE,
Sri Ramakrishna Engineering College, Coimbatore, Tamil Nadu, India
E-mail: gowtham.hin@gmail.com, vidhya.k@srec.ac.in

***Abstract* - The main objective of this project is to design a soft starter for consumer application, Gsm technology is used to get the voltage readings through mobile, The power theft also identified here by means of voltage measurement is presented in this paper. Here thyristor is used as soft switch. Three soft switches are used in three phases which is Star, Delta and Main phase. With the help of Gsm technology the motor is controlled through the mobile. The performance resulted from the past fault-tolerant soft starter control has demonstrated reduced motor starting transient torque pulsations as well as reduced motor inrush current magnitude. The present are soft starter for consumer application presented here to demonstrate the soundness and effectiveness of the soft starter for consumer approach and motor can be controlled from remote location.**

***Keywords:* Gsm, induction motor, silicon-controlled rectifier (SCR), Thyristor, Three phase control.**

I.INTRODUCTION

Soft Starter full-featured starters provide many advantages when used instead of electromechanical contactors to control 3-phase AC induction motors. The Soft Starters are fully digital, and use thyristors in all three motor phases for controlled reduced voltage motor starting and stopping. Soft Starter's have an Automatic Application Setup that fully configures the starter for a specific application with one entry. Soft Starter's also have a built-in "Optimizing" mode that reduces energy costs when used on lightly loaded or oversized motors, and external bypass capability for efficient running at rated speed.

Features of Soft Starter

a. Advanced energy-saving Optimizing Mode improves motor efficiency and power factor; Prolongs motor life
b. Can be connected 'in-the-delta', allowing use of a smaller Soft Starter
c. 9–370A@230–460VAC
d. Full three-phase motor control
e. Can be controlled via Local Keypad, Digital Inputs, optional Remote Keypad, or optional Mod bus Communications.
f. 115/230VAC or 12/24VDC control inputs
g. Fault record history of last 5 trips

Conventional Techniques DOL Starting

A medium-voltage (MV) motor startup current is normally smaller in per unit than a low-voltage motor startup current. The ratio of the transient inrush current to the locked rotor current is generally higher for large MV motors compared with low voltage motors (the ratio increases with motor size because of the decreasing locked rotor power factor). It is difficult to manage the effects of the thermal and dynamic (transient inrush current) stresses during startup, especially for large motors in excess of 10MW. Failures during the startup can be prevented by protecting the motor properly. A startup recording of a large MV motor (13.7 MW) is provided. There is a risk of stator end-winding failures (dynamic forces) associated with DOL starting for large older motors, especially those that are frequently started. These failures cannot be prevented by correct protection settings. These forces are proportional to the square of the current (F*a*I2), and only a decrease in the starting current can result in a significant reduction of the dynamic forces.

Conventional Alternative Technologies

Alternative technologies used for starting MV motors include the insertion of reactance, using Korndorfer reduced voltage autotransformer, using autotransformer with capacitor assist, and reducing voltage power electronic starters. The starters can also be used when the driven equipment requires a lower starting torque. The starting current is approximately proportional to the supply voltage, and the torque is proportional to the square of the current; therefore, a reduction in voltage will significantly bring down the torque imposed on the driven equipment. Adjustable Voltage and Frequency Applications Large motors (e.g., >15 MW) cannot be started effectively by any of the previously mentioned methods. A less stressful and a more controllable soft start system is required, e.g., adjustable voltage and frequency starting methods. Traditionally, motor generator (MG) sets were used. However, static frequency converters (SFCs) have become far more popular because of the elimination of rotating parts and the maintenance-intensive mechanical equipment (e.g., the fluid coupling and the associated auxiliaries). Soft-start technology is often defined as a technology that provides adjustable voltage to the motor via power electronic devices [normally silicon-controlled rectifiers (SCRs)]. SFC adjustable- speed drive (ASD) technology is used for optimal soft starting. The load commutated inverter (LCI) technology has been used exclusively for large motor applications (soft starters and ASDs). An example of an 11-kV, 55-MW motor LCI startup recording with low starting current (below rated current) is given.

II. PROPOSED THREE PHASE SOFT STARTERS

A. *Existing System*

In previous studies conducted by these authors, fault-mode behaviors of a soft starter driving an induction motor under two possible types of failure modes, namely short-circuit silicon controlled rectifier (SCR) switch fault and open-circuit SCR switch fault, were investigated . It was discovered by these authors that the short-circuit SCR switch fault produces undesired fault response on motor performance with unbalanced, high motor starting currents, which accordingly result in high motor transient torque pulsations. On the contrary, the open circuit SCR switch fault results in no starting torque from the motor; hence, it constitutes a total failure of motor starting. On the other hand, it does not expose the soft starter elements to the severity of motor current unbalances and the severity of motor torque pulsations. To these authors' knowledge, remedial strategies for continuous soft-starting operation in the event of SCR switch faults are absent from the literature. Hence, a fault-tolerant control of soft starter is proposed in this paper to mitigate the detrimental impact on motor performance as a result of the aforementioned fault cases. The present fault-tolerant control technique can be easily retrofitted into the conventional off-the-shelf three-phase soft starters.

B. *Proposed System*

This proposed project deals with a design of three phase soft starter. Here two types of transformers are used. One is potential transformer and other is voltage transformer. Potential transformer is used to measure the current and voltage transformer is used to measure the voltage. Precision rectifier is used to convert the positive and negative voltages into positive value. The output of the precision rectifier is always a positive voltage .the gsm technology is used to get the voltage and current readings through mobile. Driver circuit is used to drive the relay.

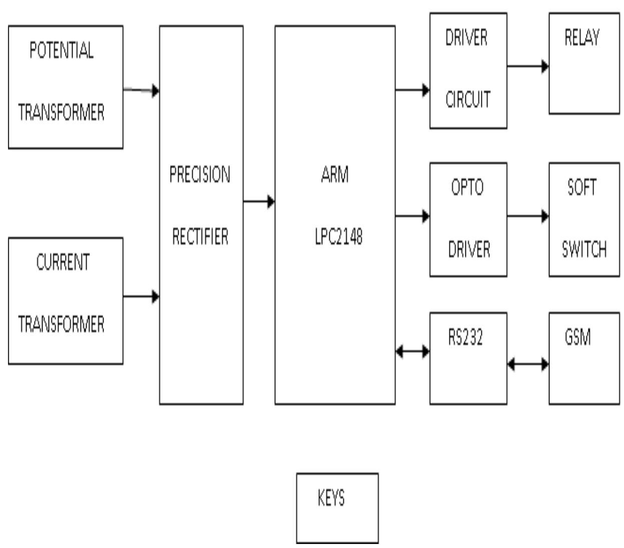

Fig. 1 Block diagram of soft starter

C. *Programming In Keil Ide*

Keil MDK Version 5 is the latest release of our complete software development environment for a wide range of ARM, Cortex-M, and Cortex-R based microcontroller devices. MDK includes the µVision IDE/Debugger, ARM C/C++ Compiler, and essential middleware components. It's easy to learn and use. Keil C51 is the industry-standard tool chain for all 8051-compatible devices, it supports classic 8051, Dallas 390, NXP MX, extended 8051 variants, and C251 devices. The µVision IDE/Debugger integrates complete device simulation, interfaces to many target debug adapters, and provides various monitor debug solutions.

D. *Software algorithm*

Step 1: Include the header files.
Step 2: Initialize the serial communication.
Step 3: Initialize all the variables.
Step 4: Port 0's 15^{th} and 16^{th} pin is declared as input pin
Step 5: Port 0's 12^{th} $13^{th}$and 14^{th} pin is declared as output pin
Step 6: Initialize the LCD display
Step 7: star and main phase will be ON initially
Step 8: Delay.
Step 9: then delta and main phase ON during running condition
Step 10: current and voltage readings will be displayed in lcd.

III. EXPERIMENTAL RESULT

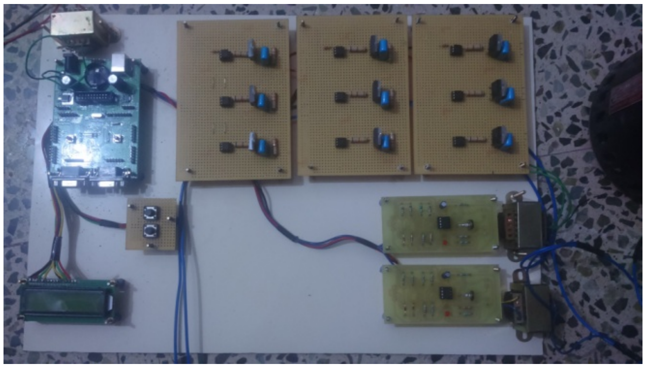

Fig.2 Three Phase Soft Starter

The above figure shows the experimental setup of the three phase soft starter, which is interfaced with the ARM LPC2148.The output of the readings will be displayed in the lcd which is also interfaced with the ARM LPC2148.Three phases are connected to the three ports of the ARM processor.

Fig.3 voltage and current measurement

The above figure shows the voltage and current measurement .The voltage is measured by using potential transformer and current is measured by using current transformer. Here the voltage is measured in terms of voltage and current is measured in terms of milliamps.

IV. CONCLUSION AND FUTURE WORK

Thus the system is used as three phase soft starters for low cost consumer applications .Here gsm technology is used to get the voltage and current measurement through the mobile. Power theft is also identified by means of voltage measurement. the motor can be controlled from the remote location.

In future, the design can be enhanced to inspect the power theft in the agricultural lands. The electricity board receives the voltage readings of the consumers through gsm.

.

REFERENCES

[1] A.K. Jain, S.Mathapati,V. T. Ranganathan, andV. Narayanan, “Integrated starter generator for 42-V powernet using induction machine and direct torque control technique,” *IEEE Trans. Power Electron.*, vol. 21, no. 3, pp. 701–710, May 2006.

[2] S. Kaboli, E. Vahdati-Khajeh, and M.R. olghadri, “Probabilistic voltage harmonic analysis of direct torque controlled induction motor drives,” *IEEE Trans. Power Electron.*, vol. 21, no. 4, pp. 1041–1052, Jul. 2006.

[3] P. T. Cheng, C. C. Hou, and J.S. Li, “Design of an auxiliary converter for the diode rectifier and the analysis of the circulating current,” *IEEE Trans. Power Electron.*, vol. 23, no. 4, pp. 1658–1667, Jul. 2008.

[4] M. A. Juds, K. Lee, M. G. Solveson,W. E. Berkopee, and J. A. Becker, “A coupled thermal and electrical time-domain soft starter system model,” in *Proc. IEEE IAS Annu. Meet.*, 2005, vol. 4, pp. 2607–2614.

[5] D.Maillet, S. Andr´e, J. C. Batsale, A. Degiovanni, and C. Moyne, *Thermal Quadrupoles: Solving the Heat Equation Through Integral Transforms*. New York: Wiley, 2000.

[6] J. C. Batsale, D. Maillet, and A. Degiovanni, “Extension de la notion de quadripole thermique `a l’aide de transformations int´egrales: calcul du transfert thermique au travers d’un d´efaut plan bidimensionnel,” *Int. J.Heat Mass Transfer*, vol. 37, no. 1, pp. 111–127, 1994.

[7] F.Wang, G. Chen, D. Boroyevich, S. Ragon, M. Arpilliere, and V. R. Stefanovic, “Analysis and design optimization of diode front-end rectifier passive components for voltage source inverters,” *IEEE Trans. Power Electron.*, vol. 23, no. 5, pp. 2278–2289, Sep. 2008.

[8] F. Profumo, A. Tenconi, S. Facelli, and B. Passerini, “Instantaneous junction temperature evaluation of high-power diodes (thyristors) during current transient,” *IEEE Trans. Power Electron.*, vol. 14, no. 2, pp. 292–299, Mar. 1999.

[9] T. Bruckner and S. Bernet, “Estimation and measurement of junction temperatures in a three-level voltage source converter,” *IEEE Trans. Power Electron.*, vol. 22, no. 1, pp. 3–12, Jan. 2007.

[10] H. Stehfest, “Algorithm 368: Numerical inversion of laplace transforms,” *Comm. ACM*, vol. 13, no. 1, pp. 47–49, 1970.