Scientific Journal of Impact Factor (SJIF): 4.14

e-ISSN (O): 2348-4470
p-ISSN (P): 2348-6406

International Journal of Advance Engineering and Research Development

Volume 3, Issue 7, July -2016

IMPLEMENT OF PLC AND SCADA TO HEAT TREATMENT PLANT

Joel Suhas[1], Dr. C Mallikarjuna[2]

[1]*Student,Industrial Automation Engineering, VTU Post Graduation Center, Regional Office Campus, Mysuru.*
[2]*Associate Professor, Industrial Automation Engineering, VTU Post Graduation Center, Regional Office Campus, Mysuru.*

Abstract - *To improve mechanical properties such as tensile strength, impact resistance, ductility, machinability, wear, abrasion, corrosion, magnetic properties, electrical properties etc., different types of heat treatment processes are carried out in the industries today. In heat treatment methods there are some Proportional-Integral-Derivative (PID) controllers to control the temperature of different zones. Continuous monitoring of heating and cooling rate and also the soaking time during the heat treatment process in the furnace is necessary. This paper is an automation proposal / demonstration to M/s XYZ Ltd., for their heat treatment furnaces automation so that, real time monitoring and controlling of the heat treatment plant becomes easy. In place of master-slave PID controllers, PLC and SCADA will be the best solution to improve the quality of the heat treatment processes.*

Keywords *–SCADA system, Heat Treatment, Gas Carburizing Furnace (GCF), Tempering Furnace (TF), Quenching, Ladder Diagram (LD) Programming, Simulation software*.

I. INTRODUCTION

Majority of the engineering materials that are used today are made up of ferrous alloys and thus the study of this is very important. This ferrous material can be used in wide applications just by subjecting it to heat treatment. During the heat treatment process, the microstructure of the metal changes. Thus the metal has to be heated to the exact temperature for specific alteration in the microstructure and hence properties as required.

1.1 Steps in heat treatment plant

A. Heating the metal or alloy to the required temperature, considering the heating rate, i.e.Heating Time.
B. Maintaining the metal at specific temperature for a specified time, i.e. Soaking Time.
C. Cooling of the metal at the required rate and required medium, i.e. Cooling Time.

II. SYSTEM COMPONENTS

As the Heat Treatment process comprises of 4 main furnaces/tanks, it is necessary to develop a system that simulates the entire process.

1. Gas carburizing furnace
2. Tempering furnace.
3. Quenching tank.
4. Washing.

This paper mainly considers Gas carburizing furnace and Tempering furnace.

2.1 Gas Carburizing Furnace

After loading the components into the Gas Carburizing Furnace (GCF), note down the details in the white board and HT Log book.After reaching furnace temperature of 780deg C, allow 0.1-0.2 LPH of carburizing fluid flow into the furnace.When the furnace reaches Hardening temperature 890-960deg C, set the flow rate 0.3 to .05 LPH.Note down the soaking start time in the HT Log book. Soak the components for about 45min to 1.5hrs.Monitor the temperature and flow rate every hour and note down the actual reading in the Log book. After completion of stipulated soaking time, take out the first sample and check it for TCD. If it is ok, reduce to Quenching temperature and close the supply of carburizing fluid.

Figure1: Gas Carburizing Furnace.

2.2 Tempering Furnace

It is a process in which the components that are previously hardened are again heated to a temperature which is below lower critical value of the material and then cooled slowly at a desired rate. The tempering is primarily done to enhance ductility and toughness of the material. The grain size and mechanical properties can be altered as required. Tempering can also be done to relieve stresses and decrease the hardness that is developed during welding, forming and machining.

Figure 2: Tempering furnace

III. IMPLEMENTATION METHODOLOGY

In the present project work, the conditions of controlling and monitoring Gas Carburizing Furnace and Tempering Furnace has been made.

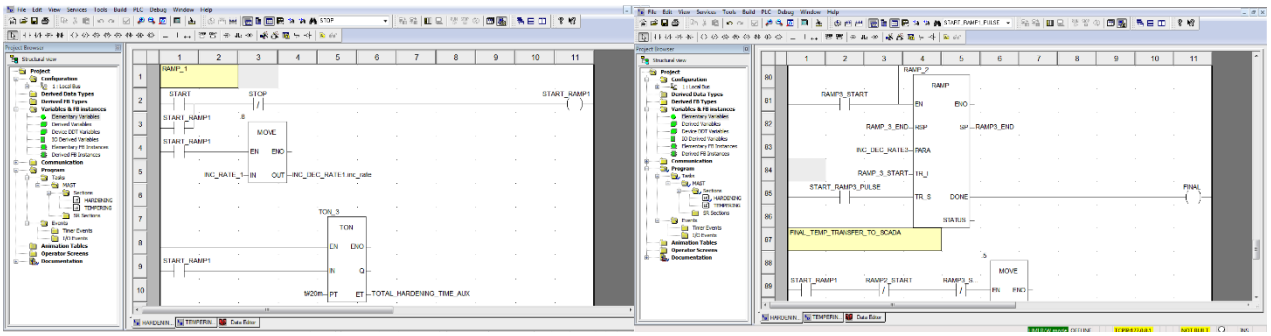


Figure 3: Ladder diagram program of controlling GCF

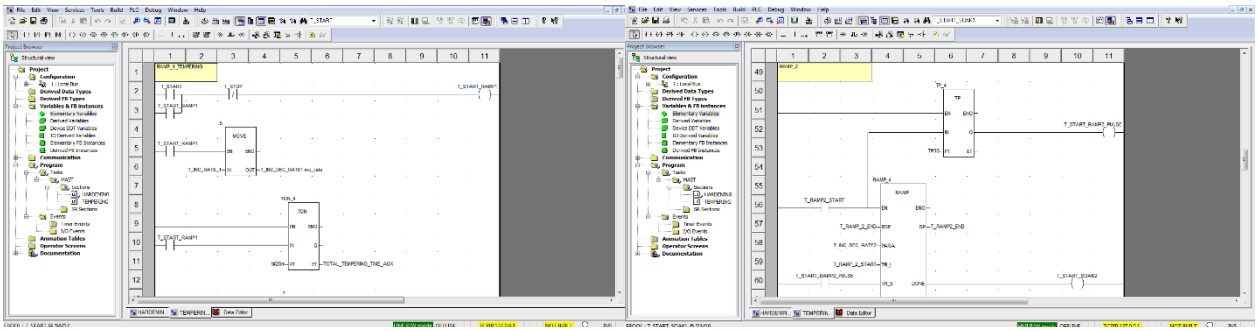


Figure4: Ladder diagram program of controlling Tempering

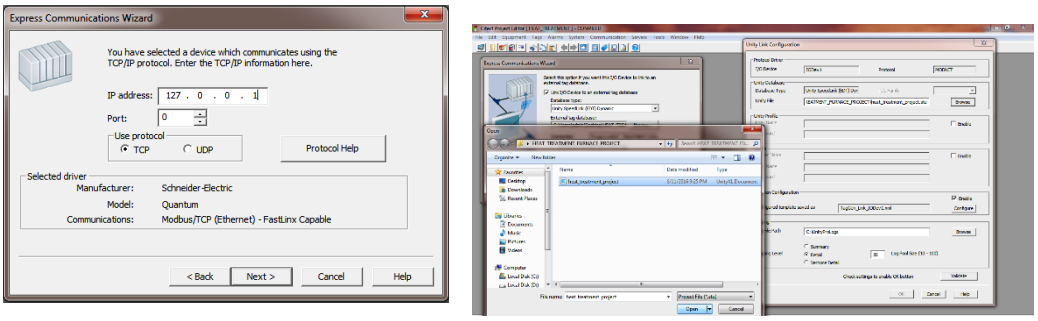
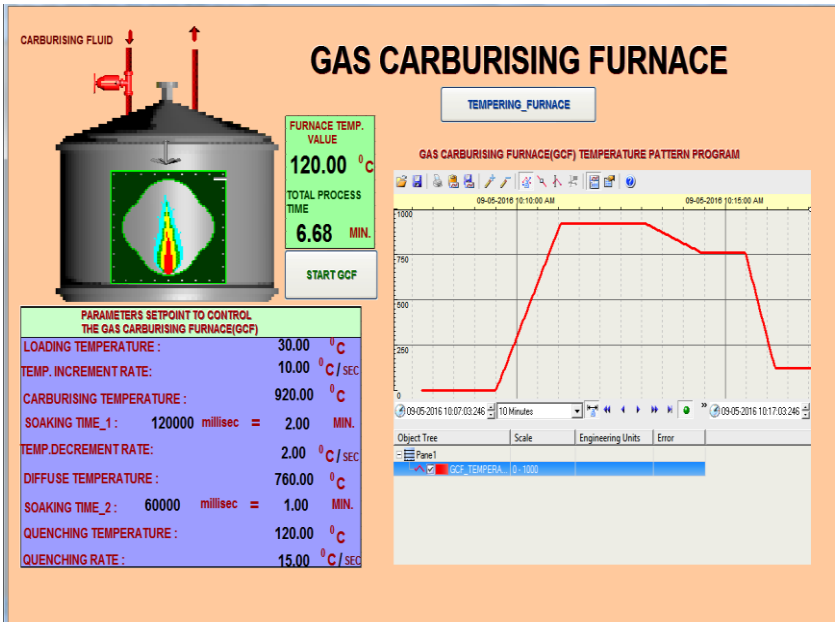


Figure5: Interlinking PLC and SCADA

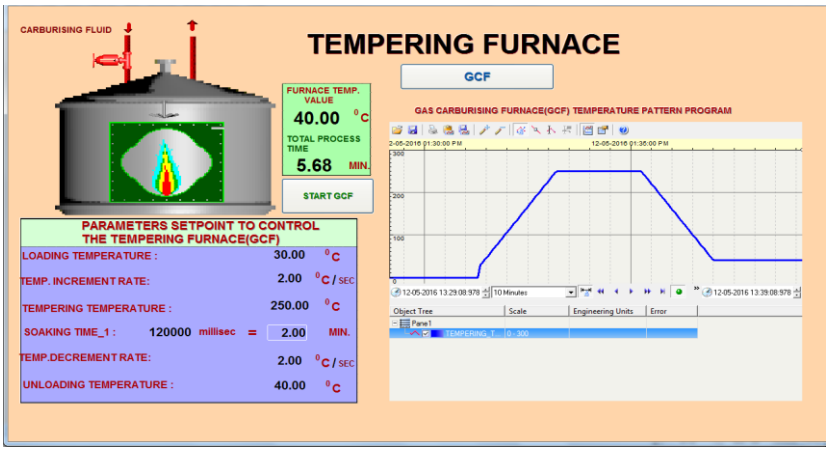
IV RESULTS AND DISCUSSIONS

4.1 GAS CARBURISING FURNACE



In the GCF screen, a representation of the furnace is made. The fan inside the furnace and the heating coil along with flame is shown. The parameters considered are *Loading temp, Temp increment rate, Carburizing temp. Soaking time 1, Temp decrement rate, Diffuse temp, Soaking time 2, Quenching temp, and Quenching rate.* These parameters can be entered by the operator and the furnace works according to the values given. The graph displays real-time values of the GCF.

4.2 TEMPERING FURNACE



The TF screen is very similar, in operation, to GCF screen.In the TF screen, a representation of the furnace is made.. The graph displays real-time values of the TF. By pointing the cursor at the required position on the graph, the values at that particular time in the TF will be displayed. The present *furnace temperature* and *total process time* will also be displayed on the screen.

There is a button provided, to shift between the GCF screen and TF screen. The faults that may occur in the furnace during operation or any variations in the furnace will be displayed in the graph. From this data the operator can attend to any troubleshooting in the process or in the furnace and can take necessary steps to eliminate it. Thus the real time monitoring and control of GCF and TF is made in the present project work.

V CONCLUSIONS

Real time monitoring and control of the HT process can be done by observing the Trending Graph that is displayed on the SCADA screen. By placing the cursor at the required point on the graph, the values at that particular time will be known. Maintaining the required cycle time for each batch of components will be done by keeping the record of start of cycle time for each batch and checking for any variations.Reduction of idle time of the HT furnace can be achieved by loading batch of components regularly without any delays. This can be done by keeping track of HT process through SCADA.Easy fault detection can be achieved by comparing the furnace values with the given set of values. Any variations beyond tolerable limits indicate the faults in the process. These faults can be rectified and corrected easily.All the data of the process and SCADA screen will be stored for further reference and also to maintain it as a record, thus helping in documentation.

VI REFERENCES

[1] 'SCADA system for oil refinery control', ImanMorsi , LoayMohy El-Din, Arab Academy for Science and Technology, Faculty of Engineering, Electronics and Communication Department, Alexandria, Egypt. I. Morsi, L.M. El-Din / Measurement 47 (2014) 5–13.

[2] 'SCADA applications in thermal power plants', M. N. Lakhoua, Laboratory of Analysis and Command of Systems, ENIT, BP 37, Le Belvedere 1002 Tunis, Tunisia. International Journal of the Physical Sciences Vol. 5(6), pp. 1175-1182, June 2010.

[3] 'Simulation of Boiler Control using PLC & SCADA', Shital S. Chopade, PradhumanVerma, PrashantVerma, International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-3, Issue-3, December 2013.

[4] 'Automation of Chemical Process Plant based on PLC & SCADA', PriyankaR.Patela, DrashtiD.Patelb, Amardeep Singh Bunet, GEC/GTU Bharuch, Gujarat, India, International Journal of Innovative and Emerging Research in Engineering Volume 2, Issue 3, 2015.

[5] 'Optimization of Energy for Industrial Heater Using PLC and SCADA', RoshanBhaiswar, PravinKshirasagar, International Journal of Computer Technology and Electronics Engineering (IJCTEE) Volume 2, Issue 1.

[6]'Application of SCADA system in Steel Industries', Deepak Kumar Agrawal, Takshshila Institute of Engineering & Technology, Jabalpur (M.P.) International Journal of Scientific and Research Publications, Volume 5, Issue 6, June 2015 1 ISSN 2250-3153

