

DESIGN AND DEVELOPMENT OF 3 ELEMENT CONTROL OF BOILER

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ABSTRACT

The purpose of this paper is to present a programmable logic controller (PLC) control system that is applied to the water tube boiler which will increase high quality and greater efficiency. This system monitors boiler's temperature and pressure and volume via different sensors which provide input to PLC. The output of PLC controls the boiler temperature and pressure and gives out the user required volume of steam. All pressure and temperature variations are shown on SCADA screen and are controlled through SCADA. Different automated check valves are used to release pressure and to inform the concerned authority through alarm in case of an emergency.

Keyword: - PLC, SCADA, Boiler, Automation, Elements, Control, Ladder diagram.

1. INTRODUCTION

Over the years the demand for high quality, greater efficiency and automated machines has increased in the industrial sector of power plants. Power plants require continuous monitoring and inspection at frequent intervals. There are possibilities of errors at measuring and various stages involved with human workers and also the lack of few features of microcontrollers. Thus this paper takes a sincere attempt to explain the advantages the companies will face by implementing automation into them.[1]

1.1 Present System:

Previous days, Steam was apply to the boiler process is not periodically. It provides uncontrolled steam to the boiler for heating. Therefore, wastage of steam is more.

1.2 Proposed System:

So far, the steam generator is controlled only by manually. Now the process is fully automatic and analysis of status obtained in SCADA. Applying Steam is controlled by PLC. So, efficiency of heating the boiler by use of steam is to be high.

1.3 Control Parameters In Boiler

1. Level Control
2. Pressure Control
3. Flow Control
4. Temperature Control

2. BOILER

Boiler is defined as a closed vessel in which steam is produced from water by the combustion of fuel. Generally, in boilers steam is produced by the interaction of hot flue gases with water pipes which is coming out from the fuel mainly coal or coke. In boilers, chemical energy of stored fuel is converted into the heat energy and this heat energy is absorbed by the water which convert them into a steam. [1][2]

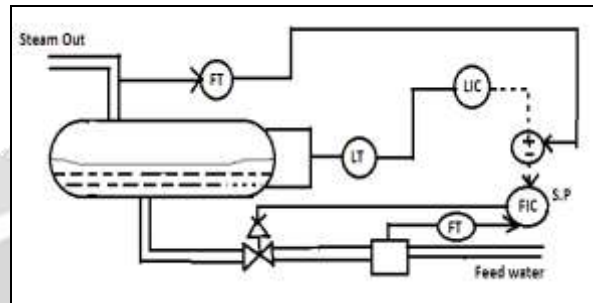


Fig1. Block diagram of element control

2.1 Boiler Operation

Water plays a major part in the generation of steam. Inlet water to the steam drum should be in purified form. Feed water pump is switched ON by using feed water pump switch. The water from the de-aerator tank is allowed to pass through two parallel pipes. Thus the failure of any one pipe does not affect the boiler operation. The water is passed through economizer, thus the heat in the outgoing gases is recovered, by transferring its heat to the water. Then the heated water is made to flow through steam and water drum. In this, water should be maintained at least at 50%. For sensing water level we use PID controller. When the level is lesser than or greater than 50%, PID controller senses the level change and sends the appropriate control signal to the feed water valve. Thus, in spite of any changes in disturbance variable, the water level can be maintained at 50% by proper tuning of PID controller. This water is circulated back to steam and water drum, due to difference in temperature, high amount of steam is generated.

The generated steam temperature may be greater or lesser than the desired temperature. So depending on the situation the generated steam is then passed through primary heater followed by secondary heater. The secondary temperature is monitored.[1][2]

3. AUTOMATION

Delegation of Human Control to technical Equipment aimed towards achieving.

Advantages:

- Higher productivity, Superior quality of end product,
- Efficient usage of raw materials and energy, Improved safety in working condition.
- Reduced space requirements, energy saving, less maintenance and hence greater reliability.
- Implementation of changes in the control logic as well as reducing the project lead-time was not possible.

[4]

In this, instead of achieving desired control and automation through physical wiring of control devices, it is achieving through program say software.[3]

4. DELTA PLC

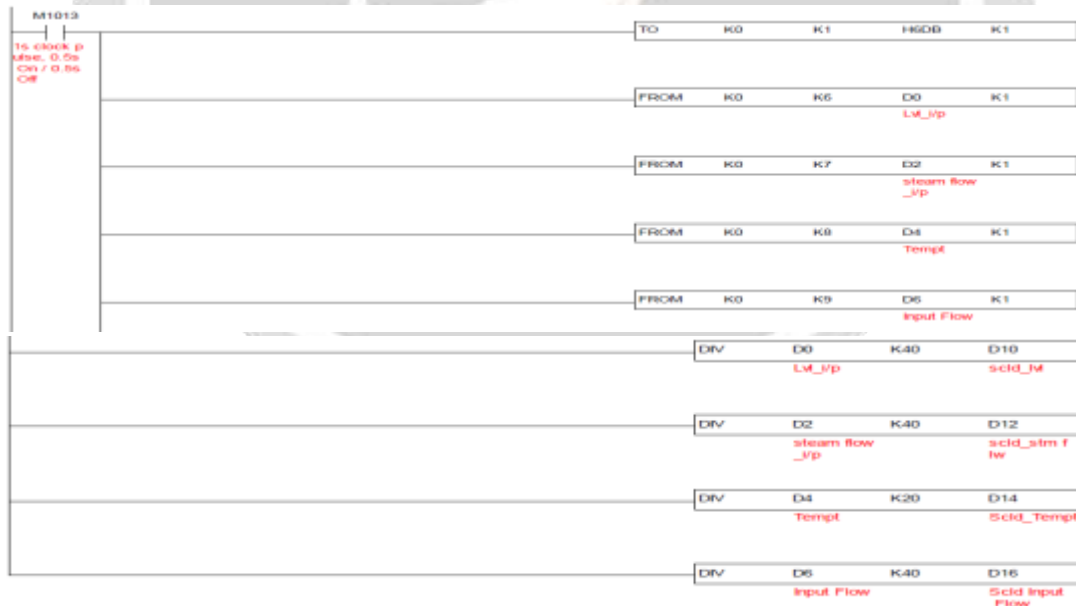
We choose DELTA's PLC DVP of series 04ADS. The analog input module receives external 4-point analog signal input (voltage or current) and converts it into 14 bits' digital signal. The analog input module of DVP04AD-S series can read/write the data of analog input module by using commands FROM / TO via DVP-PLC SS/SA/SX Series MPU program. There are 49 CR (Control Register, each register has 16-bit) in each module. The software version of DVP04AD-S analog input module can be updated via RS-485 communication. Power unit and module are separate. Size is small and easy to install. Users can select input from voltage or current via wiring. Voltage input range is ±10V DC (resolution is 1.25 mV). Current input range is ±20 mA (resolution is 5 µA).[3]

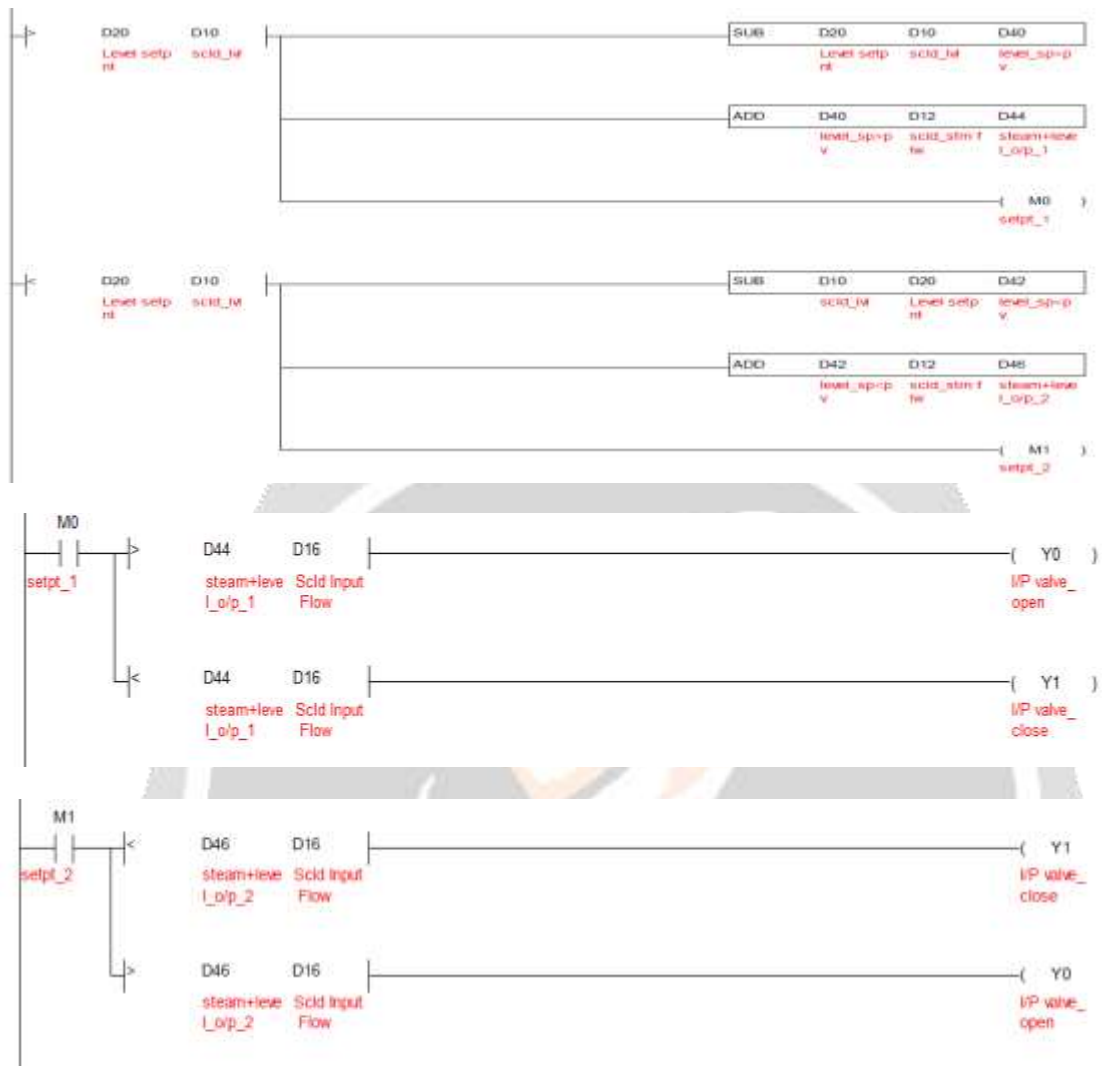
4.1 PLC Working

At the beginning of each cycle the CPU brings in all the field input signals from the input signals from the module and store into internal memory as process of input signal. This internal memory of CPU is called as process input image (PII).

User program (Application) will be available in CPU program memory. Once PII is read, CPU pointer moves in ladder program from left to right and from top to bottom. CPU takes status of input from PII and processes all the rungs in the user program. The result of user program scan is stored in the internal memory of CPU. This internal memory is called process output image or PIQ. At the end of the program run i.e., at the end of scanning cycle, the CPU transfers the signal states in the process image output to the output module and further to the field control.[3]

5. LADDER DIAGRAM





6. SCADA

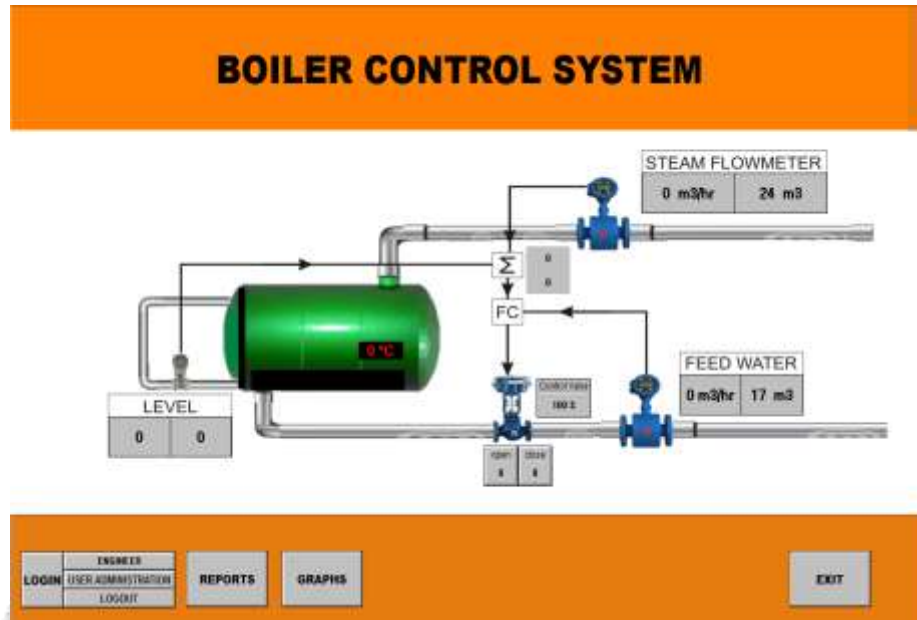
Stands for Supervisory Control And Data Acquisition. As the name indicates, it is not a full control system, but rather focuses on the supervisory level. As such, it is a purely software package that is positioned on top of hardware to which it is interfaced, in general via Programmable Logic Controllers (PLCs), or other commercial hardware modules.[4]

FUNCTIONALITY OF SCADA:

1. Access control
2. Trending
3. Alarm handling
4. Logging
5. Automation
6. Report generation

Ellipse Software is proud of presenting this powerful tool for the development of supervision systems and process control. Ellipse SCADA allies high performance and strong versatility, represented by its several features, which facilitate and speed up the task of developing your application. Totally configurable by the user, it allows the monitoring of variables in real time through graphs and objects related to the physical variables in the field.

It is also possible to make activations and to send or receive information from data acquisition equipment.



7. CONCLUSIONS

The most important aspect of any power plant is the boiler control. Several techniques can be implemented but, the method that has to be used relies on varied objectives like superior quality, increased efficiency, high profit depending upon the purpose of the company that implies it.

The ceaseless changes that are relentlessly taking place in the contemporary scenario of the industrial segment. Emphasis has been given to the automation process that is now rapidly taking its place in all the power plants across the globe.

The Paper has furnished itself to study the integral parts of the entire process involved, their implementation and the problems that may show up have also been given their due importance.

8. REFERENCES

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