Communication of Heat Exchanger Process through Modbus TCP/IP Protocol through MATLAB

Pritesh Shah,Prof Sudhir Agashe,
Sadik Tamboli, Rupesh Thoraiet

Department of Instrumentation & Control Engineering,
College of Engineering, Pune
Department of Electronics and Telecommunication,
Symbiosis Institute of Technology, Pune

Outline

About Plant

Communication

MODBUS

MATLAB Code and Results

Tools Used

Abstract

Title: Communication of Heat Exchanger Process through Modbus TCP/IP protocol through MATLAB for data analysis and control purpose

- ▶ A heat exchanger process is connected to the PLC and PLC has a Modbus Ethernet port.
- ▶ A Modbus TCP/IP protocol is communicated successfully through MATLAB product Instrument Control Toolbox.
- ▶ After this communication, we are able to do data analysis of process and setup for the research experiment purpose.

Boiler and Heat Exchanger Plant Specifications

- ▶ Type of Heat Exchanger: Pipe in pipe counter current type
- ▶ Boiler Heat Capacity: 30 Kg/hour
- ▶ Boiler Operating Range: 3.5 bar and 147^0C
- ▶ Boiler Type: Electrical Heater (18KW)
- ▶ PLC Used: Mircologix 1400 (Allen Bradly)

Boiler and Heat Excahnger Plant

Figure: Boiler and Heat Exchanger Pilot plant

Control Room

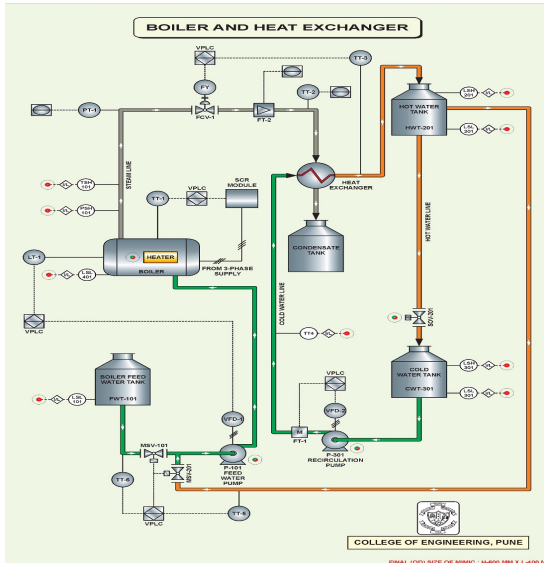Figure: Control Room for Boiler and Heat Exchanger Plant

Figure: Mimic Diagram of Boiler and Heat Exchanger Plant

MODBUS

- ▶ MODBUS is an application-layer messaging protocol, positioned at level 7 of the OSI model.
- ▶ It can be implement by following ways
    1. MODBUS RTU (Remote Terminal Unit)
    2. MODBUS TCP/IP
- ▶ MODBUS TCP/IP protocol can be connected through many points compared where in RTU protocol can be connected to only one point.

Communication with Plant

- ▶ Boiler and hear exchanger plant are connected through PLC to MATLAB sofware through TCP/IP Modbus protocol.
- ▶ Modbus protocol has mainly two different kinds of approaches namely serially connection and Ethernet connection.
- ▶ In our experimental set up, plant is connected through Modbus TCP/IP protocol.
- ▶ Initially, we faced some problem in serial Modbus.
- ▶ Advantage of TCP/IP Modbus protocol over serial Modbus protocol is that connection of hardware can be made from any computer which is in the same network.

Topology of Communication
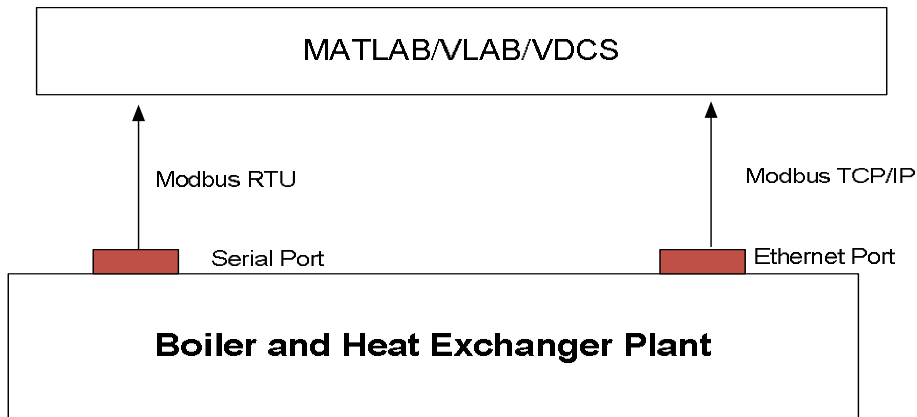
Figure: Topology of Communication
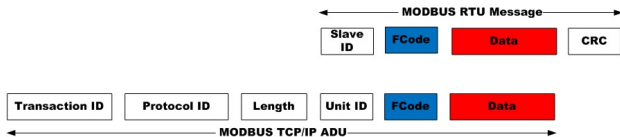
Message Structure Modbus

Figure: MODBUS Message Structure

- ▶ Transaction Identifier: 2 bytes set by client
- ▶ Protocol Identifier: 2 bytes set by client (always 00 00)
- ▶ Length: 2 bytes, number of bytes in the message to follow
  (Depending upon Reading and writing operation)
- ▶ Unit Identifier: 1 byte (Slave ID)
- ▶ FCode: Function code (1 byte) for MODBUS operation e.g. read
  analog register (03)

MATLAB Code

- ▶ Function for reading data: *gen_pdu_read_TCP.m*
- ▶ Fetch process data from received data
- ▶ Function for writing data *gen_pdu_write_TCP.m*
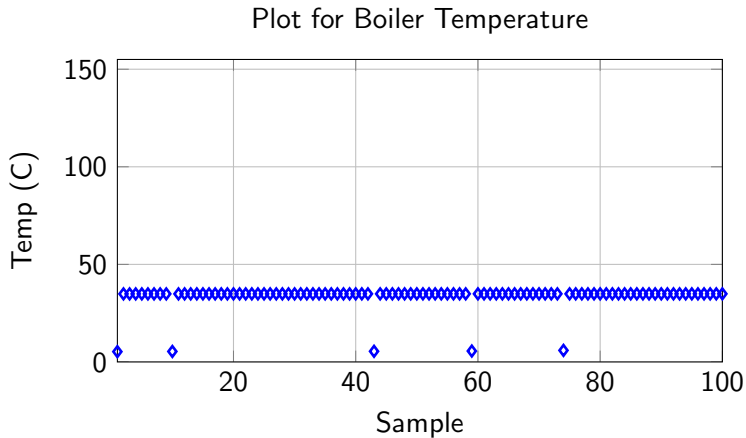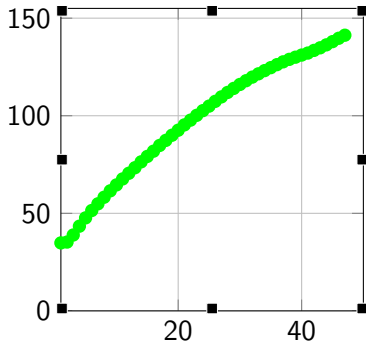
Data Drop in MATLAB

Figure: Data Dropuout in MATLAB

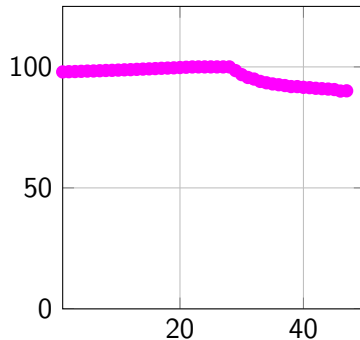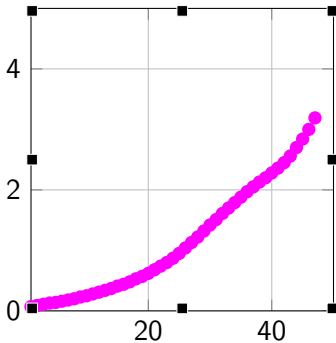# Boiler and Heat Exchanger Data

Figure: Boiler and Heat Exchanger Data

Boiler and Heat Exchanger Data

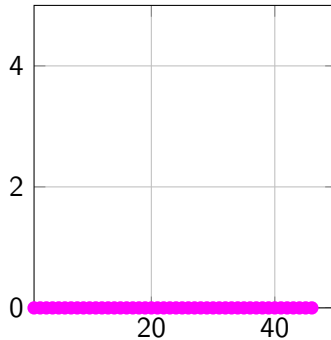Plot for Boiler Pressure (bar)   Plot for Steam Flow

Figure: Boiler and Heat Exchanger Data
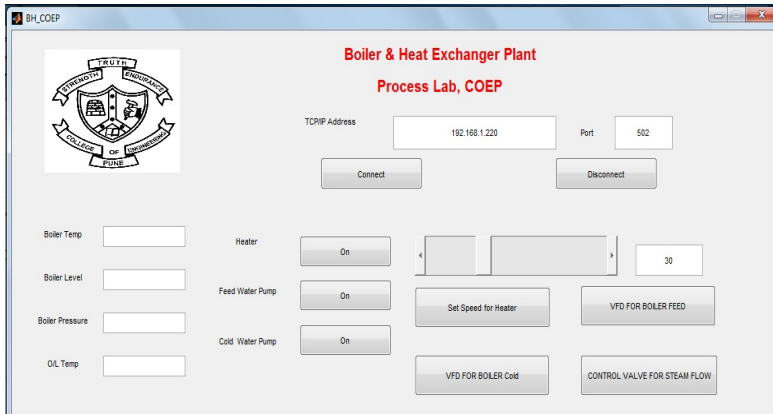
Graphical User Interface

Figure: GUI for Communication

Problem Faced

- ▶ Continuous Data refresh in GUI
- ▶ Fetching Data with 0.1 sec sampling time
- ▶ Random Data in between (See figure of Data Drop)

Tools used for MODBUS Protocol

- MATLAB
- Instrument Control Toolbox
- MATLAB GUI

THANK YOU
pritesh.ic@gmail.com