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PLC BASED RUBBER MIXER CONTROL USING SCADA AND HMI WITH DATALOG

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ABSTRACT

Most of the systems are operated on automation therefore automotive systems are most efficient. Automation means use of Programmable Logic Controller (PLC) & Supervisory Control And Data Acquisition (SCADA) instead of electromechanical devices. PLC & SCADA based distribution monitoring & control means use of automotive system in electrical distribution system for monitoring the electrical parameters (like voltage, temperature, power factor, etc) & controlling if any fault occurs in electrical system with the help of personal computer (PC). Main concept is data acquisition & controlling by using SCADA software. Here PLC is a medium between electrical system & Personal Computer for SCADA to take input and output bits. The model is designed with SCADAfor continuous monitoring and controlling technology, so that the time taken for recording temperature is 300ms.According to the function of the device, the graph for power, temperature and timer is plotted. The controlling actions will be taken by the operator by using SCADA.

Keywords: Automation, Data Acquisition, Programmable Logic Controller, SCADA, Supervisory control

I. INTRODUCTION

Now a days there are various electronic equipment available for remote operation of power distribution system control. However, the main disadvantage of these systems is that they can be operated only from short ranges and also less reliable. Here the PLC works as a mediator between rubber mixing unit and PC. PLC will collect data related to electrical power and build a link with the consumer side.

SCADA (Supervisory Control And Data Acquisition) applications are created as a main tool for performing management, required by technical reengineering of an industrial company. In modern manufacturing and industrial processes, public and private utilities, leisure and security industries, control systems are often needed to connect equipment and systems separated by large distances. These systems are used to send commands, programs and receives monitoring information from these remote locations. SCADA refers to the combination of control systems and data acquisition.

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PLC based control using SCADA monitoring system is used to record the electrical parameters such as voltage, temperature and power factor, and can be monitored in Computer (PC) by using SCADA Software. Supervisory Control and Data Acquisition (SCADA) systems consisting of SCADA hosts, Remote Terminal Units (RTUs) and field devices monitor and control process equipment and systems from multiple locations and exchange data from various distributed control systems along the local and wide area networks. Main concept is Data Acquisition and Control using PC. By the use of PLC and SCADA the electrical data can be read.

1.1 Block diagram

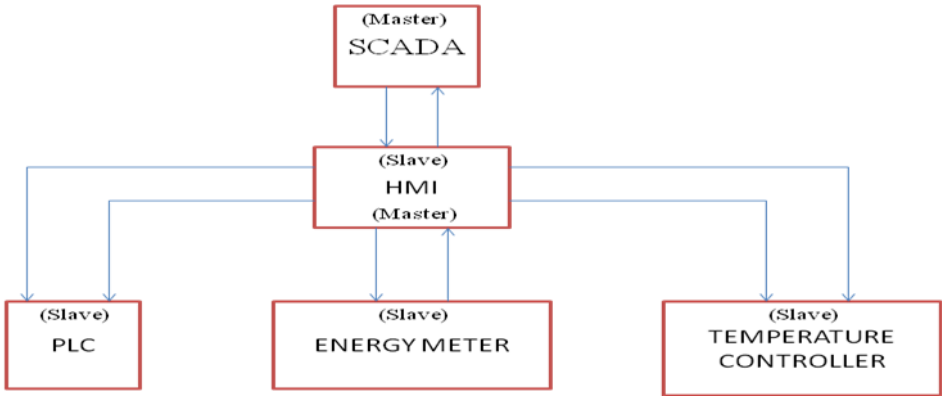

Fig 1.1: Block diagram

SCADA (supervisory control and data acquisition) is system operating with coded signals over communication channels so as to provide control of remote equipment (using typically one communication channel per remote station). It acts as a master for the entire system as shown in Fig 1.1. It mainly consists of SCADA host, field device monitor and control process equipment and systems from multiple locations and exchange data from various distributed control systems along the local and wide area networks. The control system may be combined with a data acquisition system by adding the use of coded signals over communication channels to acquire information about the status of the remote equipment for display or for recording functions.

The HMI is usually linked to the SCADA system's databases and software programs, to provide trending, diagnostic data, and management information such as scheduled maintenance procedures, logistic information, detailed schematics for a particular sensor or machine, and expert-system troubleshooting guides.

The HMI package for the SCADA system typically includes a drawing program that the operators or system maintenance personnel use to change the way these points are represented in the interface. These representations can be as simple as an on-screen traffic light, which represents the state of an actual traffic light in the field, or as complex as a multi-projector display representing the position of all of the elevators in a skyscraper or all of the trains on a railway. Alarm conditions can be explicit - for example, an alarm point is a digital status point that has either the value NORMAL or ALARM that is calculated by a formula based on the values in other analogue and digital points - or implicit: the SCADA system might automatically monitor whether the value in an analogue point

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lies outside high and low limit values associated with that point. Alarm indicator is to draw the operator's attention to the part of the system 'in alarm' so that appropriate action.

PLC is a digital computer [1] used for automation of typically industrial electromechanical processes. Programs to control machine operation are typically stored in battery-backed-up or non-volatile memory. A PLC is an example of a hard real-time system since output results must be produced in response to input conditions within a limited time, otherwise unintended operation will result.

The main function of the energy meter [2] is to maintain the power factor which is of 0.8v for industries. The EM1200 series is a single phase, multifunction, watt hour meter providing a low cost solution for the vast majority of demand and time-of-use related tariffs. With the very fast download times of the AMPY Metering proprietary protocol (90 days of ½ hour intervals in less than 5 seconds) the meter will meet the current and future needs of a continually changing power industry.

When using master-slave control, the master controller takes the signal from its own thermocouple and delivers power to its heater in the normal way until the temperature comes to set point. The slave controller takes the signal representing the temperature difference from the two thermocouples connected back-to-back.

II. DESIGN METHODOLOGY

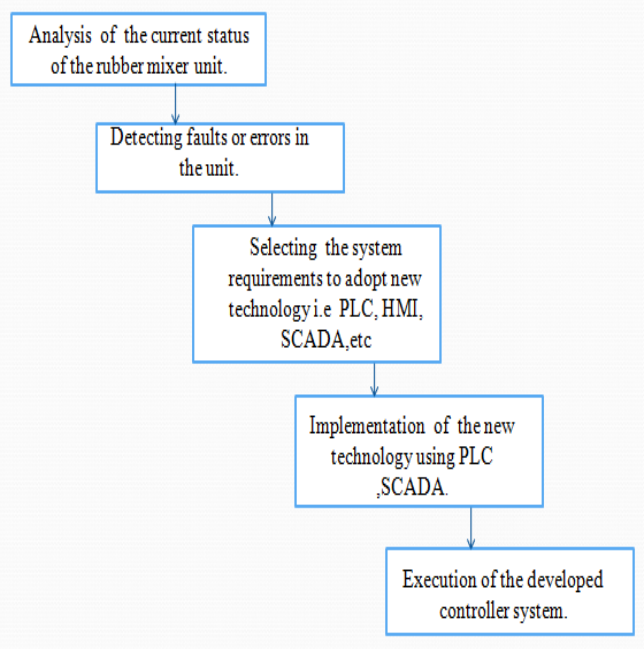

Fig 2.1: Hardware requirements

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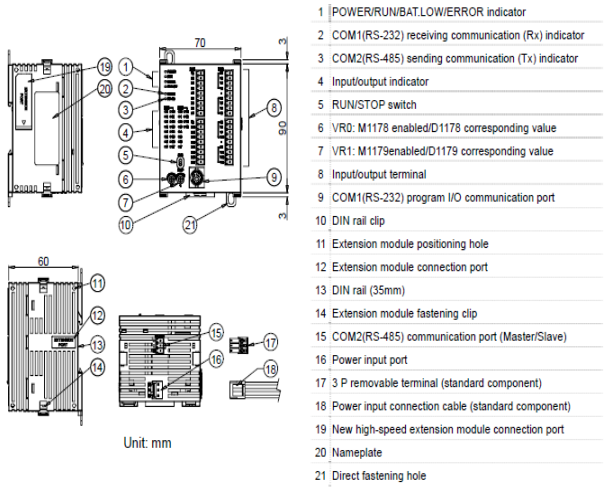
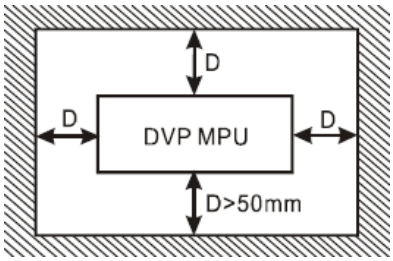
2.1 PLC



1	POWER/RUN/BAT.LOW/ERROR indicator
2	COM1(RS-232) receiving communication (Rx) indicator
3	COM2(RS-485) sending communication (Tx) indicator
4	Input/output indicator
5	RUN/STOP switch
6	VR0: M1178 enabled/D1178 corresponding value
7	VR1: M1179enabled/D1179 corresponding value
8	Input/output terminal
9	COM1(RS-232) program I/O communication port
10	DIN rail clip
11	Extension module positioning hole
12	Extension module connection port
13	DIN rail (35mm)
14	Extension module fastening clip
15	COM2(RS-485) communication port (Master/Slave)
16	Power input port
17	3 P removable terminal (standard component)
18	Power input connection cable (standard component)
19	New high-speed extension module connection port
20	Nameplate
21	Direct fastening hole

To install the PLC [3] in an enclosure with sufficient space around it to allow heat dissipation.



- **Direct Mounting:** Use M4 screw according to the dimension of the product.
- **DIN Rail Mounting:** When mounting the PLC to 35mm DIN rail, be sure to use the retaining clip to stop any side-to-side movement of the PLC and reduce the chance of wires being loose. The retaining clip is at the bottom of the PLC. To secure the PLC to DIN rail, pull down the clip, place it onto the rail and gently push it up. To remove the PLC, pull the retaining clip down with a flat screwdriver and gently remove the PLC from DIN rail.
- **Wiring:**Use 22-16AWG (1.5mm) single or multiple core wire on I/O wiring terminals. See the figure in the right hand side for its specification. PLC terminal screws should be tightened to 1.90 kg-cm (1.65 in-lbs) and please use only 60/75ºC copper conductor.

The power input of DVP-SS2 is DC. The power is connected to two terminals, 24VDC and 0V, and the range of power is20.4 ~ 28.8VDC. If the power voltage is less than 20.4VDC.There are 2 types of DC inputs, SINK and SOURCE.

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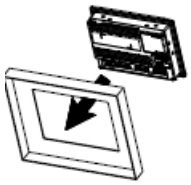
2.2 HMI

Installation procedure:

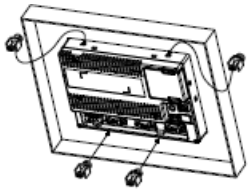
Step 1:

Ensure to put waterproof gasket into HMI and then insert the HMI into the panel cutout.



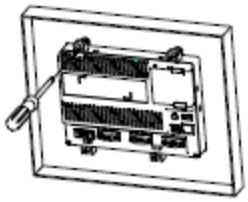
Step 2:

Ensure to insert fasteners into the HMI's insertion slots and turn the screw till screws touch panel cutout.



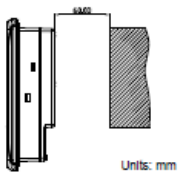
Step 3:

Turn the screw with less than torque 0.7N.M to avoid damage to plastic box. Torque: 6.17lb-inch (0.7N-M)



Step 4:

Keep at least 60mm distance from rear of HMI product to the wall, installation surface or the other controllers for heat dissipation.



2.3 Temperature controller

The modularized DTC series saves wiring and the parallel modules are able to monitor many temperature points. The flexible output methods enable the user to plan the output modes according to the actual needs. The built-in password protection prevents improper operation or damages caused by the operation staff.

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The main function of the temperature controller is used to take the readings.The input to this is temperature which is sensed by the thermocouple sensor inside the rubber mixing machine.The output is displayed on the HMI for further processing.

2.4 Energy meter

The main function of the energy meter is to maintain the power factor which is of 0.8v for industries. The EM1200 series of meter is available in two main variants the EM1210 and EM 1200 variant which is as per the Em1210 except it does not have load profile or a remote communication port, and is only available in configuration 200.

2.5 Relay

A relay is usually an electromechanical device that is actuated by an electrical current. The current flowing in one circuit causes the opening or closing of another circuit.

This is the schematic representation of a relay. The contacts at the top are normally open (i.e. not connected). When current is passed through the coil it creates a magnetic field that pulls the switch closed (i.e. connects the top contacts). Usually a spring will pull the switch open again once the power is removed from the coil.

2.6 Software Requirements

2.6.1 WPL Soft

WPL Soft is a program editor of Delta DVP series PLC [4] for WINDOWS computers. In addition to general PLC programming and WINDOWS editing functions (e.g. Cut, paste, copy, multi-window display, etc.), WPL Soft also provides various comment editing as well as other special functions (e.g. register editing and settings, file accessing and saving, contacts monitoring and setting, etc.).

Communication setup is as shown in figure below,

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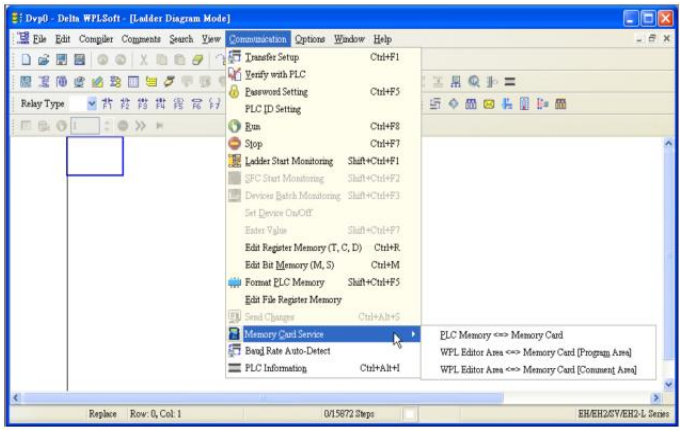

2.6.2 DOP Soft

The DOP Soft is the brand new software interface launched by the HMI interface (HMI) department of Delta Electronics. In addition to integrating the components and functions of conventional screen editors [5], it delivers greater convenience to use, quicker response, and more flexible component planning for users to plan multifunctional HMIs more easily and in simpler ways.

Regarding the communication setting, the user can set the model number of controller,select COM Port or Ethernet as the communication port, and communication Parameterbetween the HMI and controller, as shown in Figure above.

2.6.3 Astra SCADA

This application has two constituents: Configuration Mode and Run Mode[6]. The Configuration Mode allows you to configure the process. It is the Run Mode that is involved in the actual data acquisition, processing, monitoring and controlling.

To configure a process following steps has to be done:

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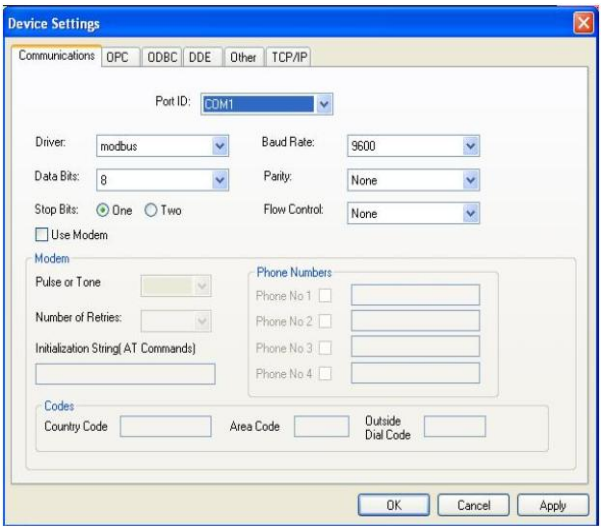
- Start a project with some basic settings
- Draw a mimic
- Animate a mimic
- Insert data monitoring tools

This menu gives an option for consolidated basic settings ofcommunication parameters of application.

Using this, we can configure / Update the setting of Serial Port, Modem, DDE, ODBC and OPC.



The communication configuration is used to communicate with device connected directly to PC communication port at the run time. To view serial port settings, click tab in communication Parameter Settings dialog box.

1. Port ID: Select the COM Port through the drop down list.
2. Enter the settings regarding the Driver, Baud Rate, Parity, Data Bits, Stop Bits and Flow Control in the appropriate fields.
3. Use Modem: Enable this check box if user wants to use modem.
4. Enter or select the settings required for the modem.

Click OK button to accept the settings.

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III RESULTS AND DISCUSSIONS

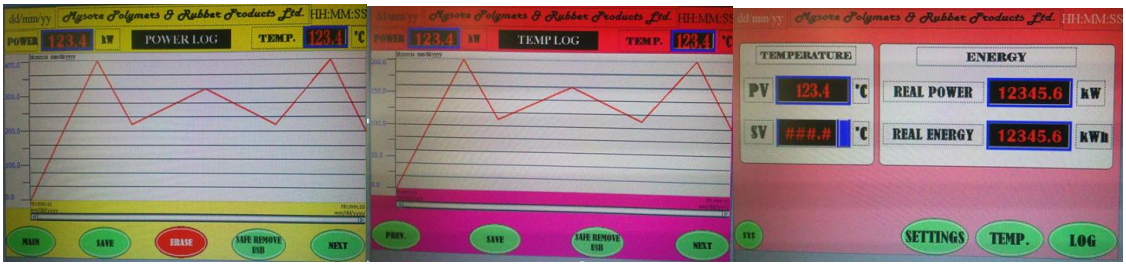

Fig 3.1: Result displayed in HMI

Output is displayed on HMI as shown in fig 3.1,

- The model reads the electrical parameters through HMI by the use of PLC and SCADA.
- The entire data should be displayed on SCADA and also HMI. The temperature and automatic closing and opening of the wall of mixer are to be controlled.
- According to the function of the device, the graph for power, temperature and timer is to be plotted. The controlling actions are to be taken by the operator by using SCADA .

The previous system used was 'Honeywell eZtrendQXe' monitoring model, where in the model records only the current temperature inside the rubber mixing machine. The temperature was controlled manually by the operator. The time taken for recording temperature was 600ms. The system can be replaced with the model consisting of PLC, HMI to overcome the disadvantages. The model is designed with SCADA for continuous monitoring and controlling technology, so that the time taken for recording temperature is reduced to 300ms.

IV. CONCLUSIONS

The model reads the electrical parameters through HMI by the use of PLC and SCADA. The entire data should be displayed on SCADA and also HMI. The temperature and automatic closing and opening of the wall of mixer are to be controlled. According to the function of the device, the graph for power, temperature and timer is to be plotted. The controlling actions are to be taken by the operator by using SCADA .

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