



Centralized Control Room Design Using Loop Controller and Supervisory Control & Data Acquisition System (Scada): A Case Study

KEYWORDS

Process Control, Loop controller, SCADA (Supervisory Control and Data Acquisition System),

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ABSTRACT This paper describes the application of process control using single loop controller and SCADA (Supervisory Control and Data Acquisition System). Now a day all middle class companies are using numbers of single loop controller for process control. All single loop controllers can be connected with computer using SCADA for plant visualization and all trends record for whole plant. Total system of plant visualization and easy computer controller can be generated with very small investment.

Introduction

Now a day mostly middle class companies are going to develop center control room for all loop controllers. The central control room is improving process reliability and efficiency including the following benefits:

- Flexible, prioritized workflow
- Better management of plant operations in critical situations such as emergencies or startups/shutdowns
- Improved safety due to better transparency
- Opportunities for optimization in the future with the new functionalities available
- Improved communication among Plant operators

In this paper, the control room is designed room using SCADA and controllers. All loop controllers are connected with computer using Scada. Basic block diagram of system is shown in fig.1.

Here, the pressure loop control is only discussed using single loop controller (Make: West) and Scada (Make: Citect). This concept can be use for many loop controllers.

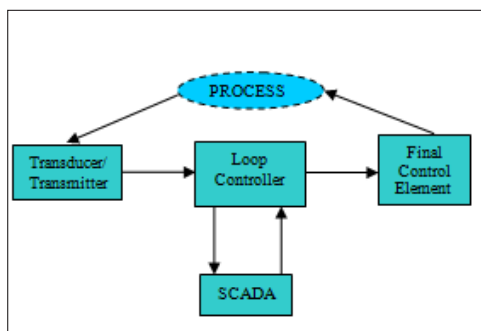


Fig.1 Actual process plant, controller and PC (install with scada) is as fig.2.



Fig.2

Emergence of SCADA system

Supervisory Control and Data Acquisition (SCADA) is a Computer-based system for gathering and analyzing real time data and making suitable decisions based on the analysis. One could develop a relatively inexpensive Supervisory Control and Data Acquisition System (SCADA) package for the personal computer platform and integrate it with these general-purpose shrink-wrap software packages, and one could have a very cost-effective alternative to DCS (Distributed Control Systems). These packages include Relational Database Management, Spreadsheet packages, Statistical process control capabilities, Expert Systems, Computer-based process simulation.

Design SCADA:

Citect HMI/SCADA is conceptually divided into two distinct parts:

1) The Configuration Environment:

The configuration environment consists of a set of tools (applications) that are used to build the runtime system. The configuration environment is centered around the Citect Explorer, which is used to create and manage projects. Projects are used to organize your configuration data into logical, well organized, groups. The configuration environment consists of the Citect Explorer, Project Editor, Graphics Builder, and Cicode Editor.

2) The Runtime System:

The runtime system is the application. it will use to control and monitor your specific plant. The project is configured using above tool, & compile it. Now, the run time system

is ready for specific application. At runtime, the CitectHMI/SCADA will continuously communicate with your I/O devices, process alarms, animate levels and symbols etc...continues.

Project design consideration:

The first and most important step in any system development is design. Good design ensures that the system (1) performs the control and monitoring tasks that are required, (2) is implemented with minimal interruption to the application, and (3) achieves the best possible performance. Poor design often results in substantial rework, major disruption to the organization, poor performance, or all three.

A Citect SCADA project consists of three major elements:

- 1) **Graphics Pages:** display on your computer screen(s), and usually display the status or condition of the plant. Graphics pages can also contain controls and command buttons that enable an operator to control the processes in the plant.
- 2) **Configuration Databases:** Databases store configuration information (about the plant) that is used in the runtime system to control and monitor the plant. Some databases are linked to specific graphics pages.
- 3) **Cicode Files:** store your custom Cicode functions. Cicode is used to perform commands and actions and extend the functionality of your system.

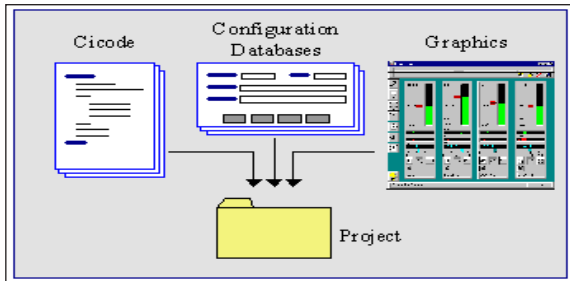


Fig.3

Visualization of SCADA

The SCADA visualization is shown in below figures. Signal display can be making in one screen with all combine windows with zoom button. Four figures are for separate specific application.

Fig.4 → Process Diagram for pressure loop

The actual process and instrumentation diagram for pressure control loop is shown in this window.

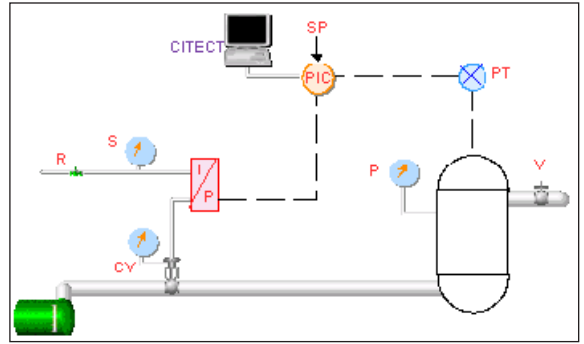


Fig.4

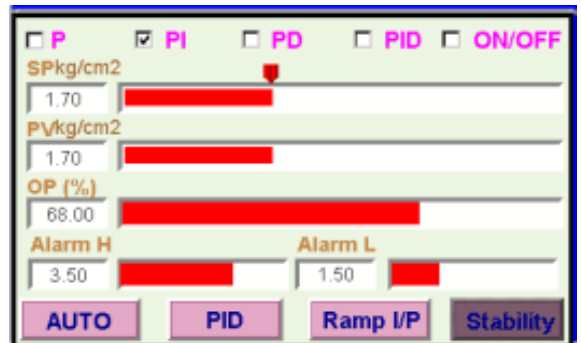


Fig.5

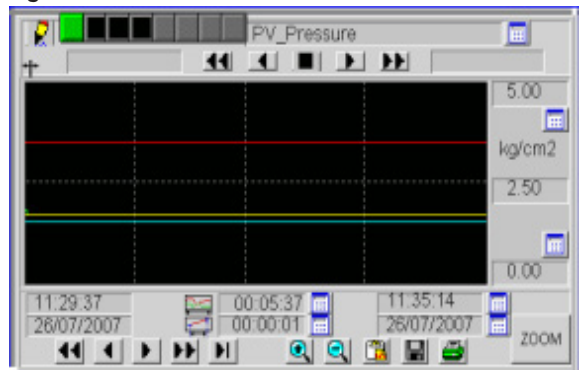


Fig.6

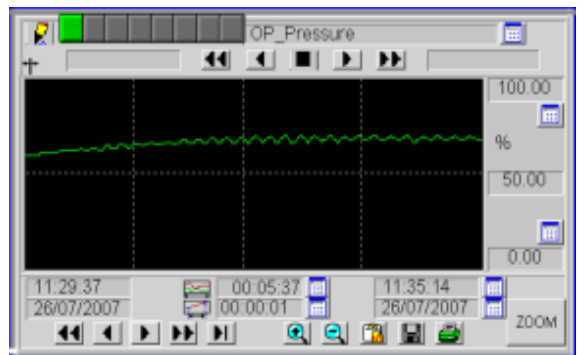


Fig.7

Fig.5→ Parameters setting window

This window is having display of Process Parameters such as Set Point (SP), Process Value (PV), Output (OP) and Alarm Limits. User can select any one type of control mode Proportional (P), Proportional Integral (PI), Proportional Derivative (PD), Proportional Integral Derivative (PID) or ON/OFF mode. User can also enter values for SP, OP and Alarm Limits using keyboard. For that, focus on displayed value, enter new value and press Enter.

Fig.6→ Trends display window

This is a Trend window for Present pressure, Set pressure, Low alarm value, high alarm value Trends. Trends are zoomed in a full screen in this window.

Fig.7→ Output pressure trend display window

Designing steps and all components help are available in Citect help manual.

Loop controller

The West 6100+ is a new generation of '+' Series controller that takes flexibility and ease of use to new levels. The expanded '+' Series platform of 1/4, 1/8 and 1/16 DIN model controllers incorporates numerous product specification, communication, display interface and configuration software improvements that surpass competitive offerings in ease of use, delivery and value per-dollar. By adding more versa-

tile features and user-friendly functionalities – like remote set point inputs, digital inputs, plug-in output modules, a customisable operator/HMI menu, jumper less and auto-hardware configuration, and 24VDC transmitter power supply – the new generation 6100+ Series controller transforms the complicated into the simple while saving you time (as much as 50% on product set-up), reducing inventory stock and virtually eliminating the likelihood of operator errors. Making things complicated is easy – the clever trick with the new generation 6100+ Series controller from West is to make it simple.

Technical features:

Control Types: Full PID with Pre-tune, Self-tune, manual tuning, or On-Off control. Heat only or heat & cool

Auto/Manual: Selectable from front panel or via digital input, with bump less transfer

Output Configuration: Up to 3 possible, for control, alarm, 24VDC transmitter power supply or retransmit of process value or set point

Alarm 1 & 2: Types Process high, process low, SP deviation, band, logical OR / AND. Also 1 loop alarm for process control security. Process alarms have adjustable hysteresis.

Human Interface: 4 button operation, dual 4 digit 10mm & 8mm high LED displays, optional choice of colours, plus 5 LED indicators

PC Configuration: Off-line configuration from PC serial port to dedicated config socket using Windows 98 or higher.

Measuring and control process

The telemetric system is basically structured on three main

Levels:

a) **Local level** – plant transducers, final control elements, I to P converters, all control valves, all controlling and sensing equipment (Process);

b) **Process and data acquisition equipment level** – implemented of plant automation system, by single loop controller which senses data from plant and required output gives to final control element (West Controller);

c) **Process computer / workstation level** - data acquisition connection and communication level structured on the computing system resources, attached to the lower level using an industrial serial data communication network RS 485, this level provides the HMI, data logging, events recording, process parameters plotting (SCADA).

Data Communication and protocol

Citect SCADA can communicate with any control or monitoring I/O Device that has a communication port or data highway including PLCs (Programmable Logic Controllers), loop controllers, bar code readers, scientific analyzers, remote

terminal units (RTUs), and distributed control systems (DCS). You can connect any number of I/O Devices - the only limitation is the size of your computer. High speed serial boards are available for RS-232, RS-422, or RS-485 communication. If you have several I/O Devices from the same manufacturer, and these I/O Devices support multi-drop communication, you can connect them to an RS-422 or RS-485 high speed serial board installed in your computer. Citect SCADA provides a variety of support options to help you get the most from this product.

The GENERIC protocol is a special pseudo-protocol supported by Memory I/O Devices and Disk I/O Devices. So we are generating communication between computer and single loop controller using GENERIC protocol. It supports the basic data types, providing a convenient and consistent way to represent memory and disk data. The following are the list of data types for the Generic Protocol:

Data type	Address format	Short format	Where # is	Range
Digital	Digital#	D#	0 to 64000	0 or 1
Integer	Int#	I#	0 to 32752	-32,768 to 32,767
Long	Long#	L#	0 to 16376	-2,147,483,648 to 2,147,483,647
Real	Real#	R#	0 to 16376	-3.4E38 to 3.4E38
String	String#	S#	0 to 510	128 bytes (256 ASCII characters)

Budgets Scope

We feel very grateful automation in industries for entrusting such an important task to us. Here, we have tried our best to use our knowledge to make good engineering decisions keeping in view cost/benefit ratio. In all middle class companies are using numbers of single loop controllers for precise control. The very useful visualization of whole plant (loop diagram with parameters setting facility, and all parameter trends in soft as well as in hard copy by print) can be implemented by small budget SCADA.

Summary and Future works

Domain analysis in perspective of SCADA systems is the Central theme of the paper. We have tried to document these engineering decisions in this paper. The implementation of the scada is still underway and some new challenges may crop up in the meantime (wireless and fibre optic communication between controller and SCADA).

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