Control system Pcs7 and M.I.S. together for the complete automation of the process in the sugar beet factory of Co.Pro.B. – Minerbio – Italy

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Abstract

The need to completely renovate the control systems of the production plants of Co.Pro.B. sugar-beet factory in Minerbio lead to the decision to install the new Simatic PCS7 system produced by Siemens.

The decision was made after carefully evaluating the technical characteristics and the know how offered by this system.

The renovation project was developed over three years and took place by gradually extending the devices of the new system to all the production plants of the factory.

All the process control and plant supervisor software has been developed and implemented by engineers of Co.Pro.B Sugar-beet factory.

An extremely customised software perfectly suitable for the type of plants in Co.Pro.B. combined with the remarkable stability of the hardware and software components of the new system has increased standards of management reliability and security, consequently leading to considerable economic savings considering the reduced frequency of anomalies or system breakdowns.

The data processing system "M.I.S." integrated perfectly with the world of PCS7, proves to be an essential tool to be able to fully optimise the management and exploitation of the production plants.

Keywords

PCS7 - Process Control System 7   M.I.S. - Management Information System
AS - Automation System   O.S. - Operator Station   E.S. - Engineering Station

1. Introduction

The rapid increase in the mechanisation and automation indexes in the production of materials and consumables over the last ten years has imposed the need to control the production processes more meticulously and efficiently.
Co.Pro.B. realised the importance to be up to date with a reality in continuous and rapid evolution, way back in the 80's and has always paid much attention to these requirements, by continuously improving its plants and making wide use of automated systems to control the process in the aim to increase and efficiency and performance.

2. Control system Teleperm M by Siemens

The first process control system installed at Co.Pro.B dates back to 1982 when the company built the first centralised control room and automated all vacuum pans of the B and C Product, utilising the process control system denominated FOX 3 produced by Foxboro.
Following this initial positive experience, in 1985 when a new 5.000 Ton BMA diffuser was installed, a second centralised control room was built to control the whole Beet House and the first process control system Teleperm M by Siemens was implemented.
In the following three year period from 1986 to 1988, the Teleperm M system was also implemented in all the remaining departments of the Beet and Sugar House.
With the exception of some modifications and updates made to the CPU's, this structure remained more or less unaltered for the following ten years (90's) and we reached the beginning of this millennium when Siemens put the PCS7 system on the market without any problems.

3. Replacement of the Teleperm M system with the PCS7 system

During the inter-campaign period 2001-2002 and considering the incumbent obsolescence of the equipment of the Teleperm system, the decision was made to renew all the factory control systems and to thus switch over to the PCS7 control system.

Why did we choose the PCS7 system? This was our first question to which we found a relatively simple answer.

One reason is because of the very strong relationship of mutual trust that CO.PRO.B has established for many years with Siemens of Erlangen; we have worked with this company since 1985 up-to-date with great results and absolute satisfaction on both parts.

Another reason is because, after much evaluation, we realised that the PCS7 system was certainly the ideal solution for our business, considering its peculiar characteristics.

PHASE 1 – 2001-02 AUTOMATION OF THE VACUUM PANS OF PRODUCT "B" AND "C"

The first phase provided the application of the new system on seven discontinuous vacuum pans of Product "B" and two of Product "C", the construction of a new and unique centralised control room to replace the existent ones and a new equipment room under the new control room.

The architecture of the project was quite simple and rational and Network Servers were not necessary considering the small number of data processed, but just an ES station to develop the engineering software and two Operator Station to view and manage the two cooking plants.
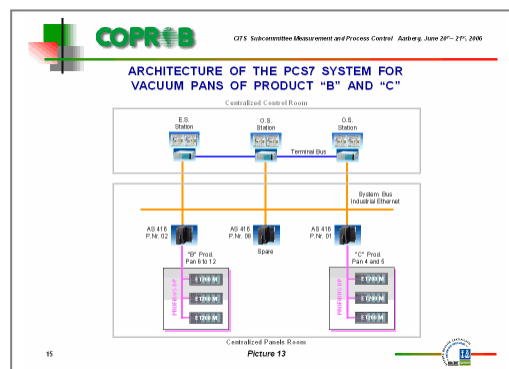

Figure no. 1 – Architecture of the PCS7 system of the cooking plants B and C

Figure no. 1 shows the architecture of the control system where you can see three Simatic controllers S7-400 with CPU 416, of which two are used to control the cooking plants and one is spare.

Inside the top box, which represents the new centralised control room, you can also see the first nucleus of the part of system that illustrates the Engineering Stations and the two Operator Stations used to supervise the process.

PHASE 2 – 2002-03 COMPLETION OF THE AUTOMATION OF THE SUGAR-BEET FACTORY PLANTS

Following this initial and extremely positive experience, and also widely satisfying thanks to the great results obtained by the new system, the second renovation phase of the control systems of Co.Pro.B commenced in the inter-campaign period 2002 – 2003 when we applied the PCS7 control system on all the remaining production plants of the Sugar House.

In this second phase, the areas involved in the automation process were much larger compared to the previous year and consequently also the architecture of the project started to become more complex.

It was now indeed necessary to use a pair of Servers in redundant configuration to be able to manage the increased quantity of data and Operator Stations to supervise the plants.
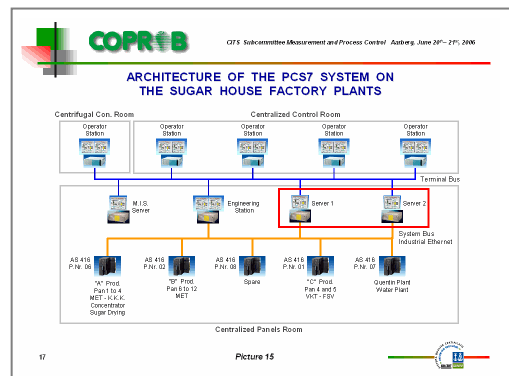

Figure no. 2 – Architecture of the PCS7 Sugar systems on the Sugar House

Figure no. 2 shows the complete architecture of the control system of the Sugar House factory.

As you can see, the centralised systems "AS416" used are now five, of which four control all the plants of the sugar-house factory and one is spare.

The Operator Supervisor Stations obviously also increased, again becoming five, of which one decentralised in the mass quite centrifugation plant.

In the middle of the picture, you can see the Engineering Station already present in the previous structure and the two network Servers previously mentioned are included.

In this type of structure, the network Servers become extremely important, because they are the devices that manage communications between the DCS's and the O.S.'s station so they must therefore not just offer high efficiency and performance but must also be remarkably stable to be able to guarantee continuous and reliable operating efficiency.

We all know how important these requirements are, especially when working with continuous processes such as in the sugar industry indeed.

PHASE 3 – 2004-05 AUTOMATION OF THE SUGAR BEET HOUSE

The third and last renovation phase of the control systems in Co.Pro.B took place during the 2004-2005 inter-campaign period when the PCS7 system was also implemented on all the remaining production plants of the Beet House and the Teleperm M system whose completely substituted.
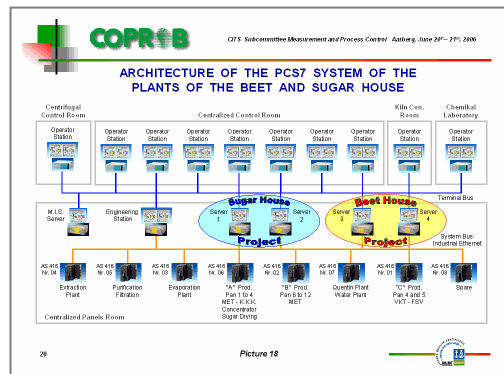

Figure no. 3 – Architecture of the PCS7 plants of the Beet and Sugar House

Figure no. 3 shows the schematic diagram of the current architecture of our PCS7 control system with the two pairs of network Servers which each manage the two separate projects (Beet House and Sugar House).

M.I.S. – Management Information System

During the renewal phases, also the M.I.S system has become integral part of our automation systems in Minerbio performing very important tasks like:
- Acquire information in real time deriving from process data, analytic data from the various lab, data from sugar beet receiving plants and so on, allowing all users to rapidly and objectively analyse abnormal conditions, and make corrections in order to optimise production.
- Provide assistance in reaching production, economic targets etc.
- Optimize production quality and maximise production performance minimising production costs related to: energy consumptions, materials and products used, chemicals, maintenance, etc.

The M.I.S. Server is connected to the company administration network (which is physically separated from the industrial network by a hardware firewall) and it sends the data to all the areas and users involved.

Below are moreover highlighted in Figure no. 4 some photos that illustrate the inside of the new centralised control room of the PCS7 system.
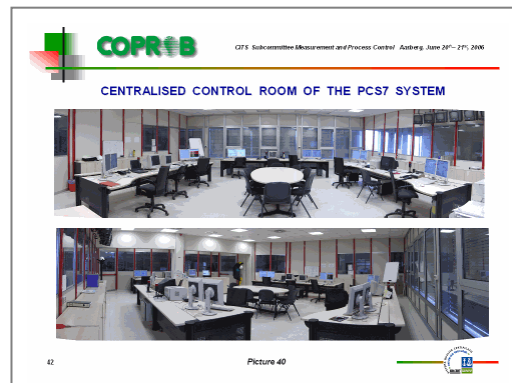

Figure no. 4 – Centralised control room of PCS7 system

4. Conclusions

We can definitely confirm that the renovation jobs carried out on our automation plant by installing the new Simatic PCS7 system produced by Siemens has allowed very good results, just as we expected when preparing the project.

The extreme functional completeness and the management simplicity of the new graphic interfaces of the WinnCC system enabled the operators to work in total safety and without particular difficulties right from the beginning.

The process control and plant supervisor software has been basically 100% developed by our own engineers, with the exception of the first year when we entrusted the job to specialists of Siemens – Erlangen (DE).

This means that we have implemented extremely customised software, perfectly suitable for our types of plants and containing all the improvement solutions compared to the past thanks to the new functions offered by the PCS7 system.

Furthermore, the remarkable stability of the hardware and software components of the new system has further contributed in increasing the standards of reliability and management security of our production plants; it has also added considerable economic savings considering the reduced possibility of anomalies or system shut-downs.

The Management Information System also fully met out expectations, proving to be an essential and dare I say indispensable tool to be able to fully optimise the management and exploitation of our production plants.

The great potentials of this system and its perfect integration with the world of PCS7 played a leading role also in the training of all plant personnel.