

Gewerbestr. 15
CH-4123 Allschwil
Tel: 061-483 19 65
Fax: 061-483 19 66
E-Mail: eng@eipm.ch

EIPM TECHNICAL NOTE No. 121

Replacement of programmable logic controllers (PLC) by Web-IO SIGMA

Ver. 1

Septembre 2007

Total: 4 pages

This technical note describes the implementation of a traceability system in the production lines of a manufacturer of pressure sensors using NetCube WebIO intelligent device servers and the SIGMA 'Zero Code' program generator

1. Initial situation

Our client is a Swiss enterprise that designs, makes and sells components for the measurement of pressure as a physical value.

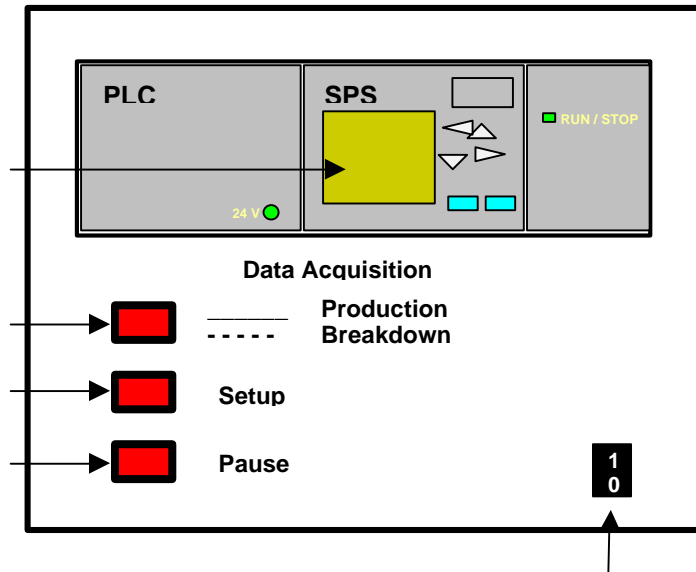
With its highly specialized, innovating and high quality products, the enterprise is in continuous growth.

Currently, it has 9 fully automated production lines at its disposal. They work in three eight-hour shifts. Two more are planned for the first semester of 2007.



Two years ago, the enterprise decided to implement a production traceability system.

For that purpose, the automation department mounted a small programmable logic controller (PLC), on each line, with an integrated 3-line LCD display and 3 push buttons with lights in a totally independent command box.



For each of the shift teams, the PLC was delivering the following informations :

1. Total production time
2. Number of sensors made
3. Total set up time
4. Total pause time
5. Total breakdown time
6. Number of breakdowns

The decision not to modify the machines main commands for the traceability tasks had a number of advantages:

- Completely automatic input of data
- It was not needed to implement the logics of entering the data in the cycle of production command
- Independence of the installation provider
- Easy adaptation of the particularities of the various processes of each line

Nevertheless, three operations were still manual:

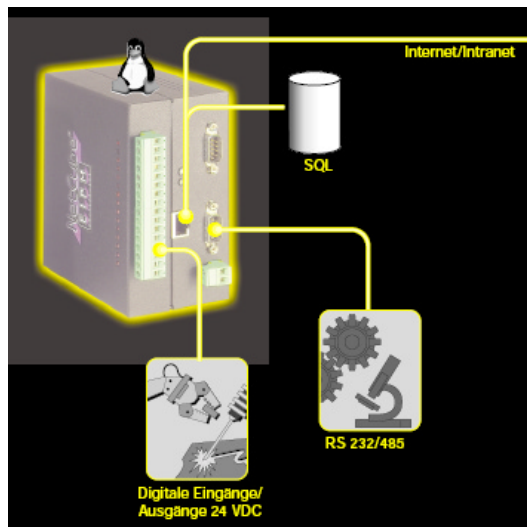
1. At the end of each shift, the operator wrote on a form the 6 values that he read from the LCD displays (18 values per day, per line)
2. The forms were gathered and transmitted each day to the supervising agent
3. Each Friday this agent entered the 810 weekly values in the production department database.

... which represented each year, for the 9 lines in service, 40,500 manual inputs !

2. Integration of a traceability system using Web IO® NetCube

EIPM S.A., founded in 1990 and located at Allschwil in Switzerland, develops, makes and sells embedded industrial computers for machines and the intelligent NetCube peripheral servers.

The NetCube of the WebIO type comprises an i386 processor, 8 MB of RAM and a maximum of 512 MB flash memory. It offers two RS 232 or RS 485 serial ports, 8 inputs and 8 outputs that are opto-coupled 24 V DC. Its Debian GNU/Linux operating system is totally transparent to the user, thanks to the integrated SIGMA "zero code" program generator.



The SIGMA WebIO NetCube

3. Installation of the SIGMA NetCube WebIO

After they analyzed the costs and the possible savings, the direction decided upon was to replace all of the input PLCs with SIGMA WebIO NetCube in order to fully automate the processes that were still manual, while keeping existing functionality.

The installation of the NetCube boxes and the individual configuration of each Sigma has been accomplished in two days.

The limited size of the NetCube allowed them to be installed in the existing command boxes.

The front plate has been replaced with a panel including a luminous switch, three push buttons ("switch on", "setup", and "pause"), and three lamps ("L1", "L2" and "L3"), each of which is connected to the WebIO NetCube Input/Outputs.

Besides that, two of its inputs have been attached to two proximity detectors mounted in the lines: "IN1" signaled the beginning of the production of an item and "IN7" the finished item.

The SIGMA was configured for the existing tasks:

- Total production time
- Number of sensors made
- Total time of set up preparation
- Total pause time
- Total breakdown time
- Total number of breakdowns

The new tasks have also been implemented:

- Adding a time stamp for each data set
- Writing the information continuously to a CSV file (Comma Separated Values)
- Making the file available for download from an FTP server internal to the NetCube.
- as well as configurable administration functions (backup and cleanup schedules).

4. Programming the SIGMA NetCube

The setup of the Ethernet and serial ports, including DHCP activation, is defined with a few mouse clicks by means of the dialog boxes of the NetCube general setup page.

All the declarations and definitions of the application in the SIGMA environment are made by means of web pages (forms) that can be accessed from any client on the network.

The three main forms are:

- "Variables management"
- "Modules management"

- "Relationships between variables"

In the first form, all the variables of the automation cycle and of the data processing part are declared.

In the second one, the actions are defined by means of the available standard modules (Digital input/outputs, Counters, Clocks, COM port, TCP/IP, FTP, Calculation, Tests, Report generation Planning, MSSQL-RPC, and Mail). Their respective scenarios are then defined through the editing pages.

Finally, the application is tested in the third form that displays the cycle. The programmer assigns different values to the input variables, and the output variables are immediately modified accordingly. Furthermore, the involved input and output variables are displayed in yellow, which allows the application logics to be controlled.

For the client's application, 12 modules have been created : 6 test modules and 6 modules of multiple actions.

The 6 test modules read as input the buttons of the command panel; when a button is pushed, the related module activates the output variable corresponding to one of: "Production", "Item being made", "Item finished", "Breakdown", "Pause", "End of work".

Each of the 6 modules of multiple actions receives as input one of the states and generates as output the corresponding multiple actions.

For example, the "Inputting breakdown" module, when activated, causes a lamp to begin flashing to indicate the breakdown, activates the breakdown clock, and increments the "Breakdown counter" module.

At the end of each shift, the operator pushes the "Production" button, which provokes in the "End of work" module the following multiple actions:

1. All the counters and clocks are stopped.
2. The various times of each of the seven states are added, the counters recorded
3. The various values are put in the correct format and transmitted directly to the enterprise MS-SQL server into the corresponding database.

Allschwil, September 2007