

## Process Support with WAGO Ethernet Controllers at the IBM Plant in Mainz

### Tank farm with Ethernet technology? It really works!

As the number of Ethernet applications is steadily increasing in the field of industrial installations, WAGO I/O SYSTEM 750 Ethernet controllers are making expensive PLC units redundant even in the safety critical control system of a tank farm.



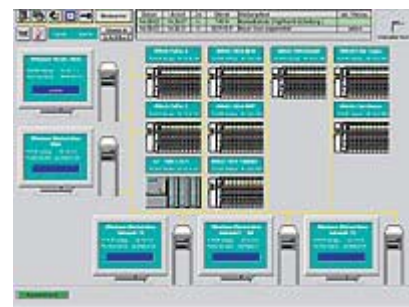
IBM plant, Mainz

■ The IBM facility (84 acres) in Mainz, Germany, is Europe's unique manufacturing site for storage technology which is certified under the EC eco-audit scheme. The plant mainly produces high-tech magnetic disks and heads to supply the production of storage systems for IBM and OEM partners.

M+W Zander, a leading company in the field of basic environmental technology, have been providing supply and disposal systems to the IBM factory since 1996. The company employs some 6,000 people and offers building management services ranging from site selection support and planning, to technical, infrastructural, and trading facility management. Process support (i.e. supply and disposal of process media) is one of the services provided by M+W Zander at the Mainz plant. The media used in the production are mainly corrosive and oxidising chemicals, such as solvents, which require careful handling. In a tank farm built in 1986, chemicals are delivered via pipe bridges and buffer stations from 20 m<sup>3</sup> central tanks to the production installations. The tanks are filled directly by tankers and the process machines can be supplied without manual handling of barrels. Supply and disposal automation systems are not only more economical, but they make human error almost impossible. Under normal operating conditions, the buffer tanks supply the machines at night and over the weekend, when the main tanks are turned off. Production continues, controlled via buffer tank controllers, even in the event of a central tank failure. If necessary, the buffer tanks can even be switched into barrel supply operation mode. Maximum productivity, cost effectiveness and operating safety can therefore be guaranteed. The whole installation is subjected to protection regulations, such as Article 19 of the German Water Management Act, requiring both certified equipment and specific personnel training. Moreover, the IBM plant is subjected to a full scope explosion protection audit every three years.



The IBM FASt500 Storage Server is a typical application for the products manufactured at the Mainz plant



Monitoring the tank farm processes

### ► Under lock and key

Safety equipment makes up the larger portion of all control operations. Tank filling is performed using a sophisticated control system. Franz Matera, IBM eco-counsellor, reports: "The tank filling unit can only be opened using a key-operated switch. By removing a particular key from the central board, the corresponding tank will get unlocked, while all other tanks including all valves and inlet pipes get locked. Extensive control of tank filling also includes electric potential equalisation. Therefore, the time spent by the operator on manual handling can be considerably reduced."

New technical standards were set when the tank farm was opened in 1986. In the late nineties, the number of failures was increasing rapidly as the upper limit of the life expectancy of the control system was reached. Recalling past experience, Thomas Theuring, M+W Zander building control engineer, reports: "Connection problems were inevitable taking into account the high number of data points wired in parallel. We had to work to repair faults overnight, at least twice a week, spending hours just looking for a single loose connection." As a result, the company resolved to implement a new control system. Jürgen Bieser, head of M+W Zander's Facility Management in Mainz, adds: "With our 'total facility solutions' strategy and the technical knowledge of our engineers, we were able to find an economical and sophisticated solution, and we finally decided to implement a redundant network architecture." Each relevant nodal point has several terminals offering an alternative route in the event of a transmission line failure. The reason why the alternative "safety bus" solution was rejected, is that each program modification would have required an expensive TÜV inspection. Safety relays controlled by WAGO Ethernet controllers guarantee the safe operation of all tank and pump installations. Devices such as valve controllers and level indicators only make up a small part of all installation operations. Safety systems need much more processor performance compared to the former control system. Due to data rates of 8 or 16 bit/sec. and reaction times up to 20 seconds, parallel wiring was required for critical installation parts. With transmission speeds up to 10 Mbit/sec., the Ethernet technology is ideally suited to this application.



Nr Clearing-up: drilled mounting holes and unused mounting rails demonstrate how the switchgear cabinet was packed out with equipment. Connecting the entire installation can now be done using a fieldbus node equipped with Ethernet controller (see the left side of the picture).

### ► Centrally controlled distributed controllers

Über About 100 analogue inputs, and 20 analogue outputs, as well as 4000 digital inputs, and 600 outputs are controlled by more than 20 controllers. Using decentralised PCs instead of many LED displays and luminous control panels, the number of outputs is far smaller than the number of inputs. Although the installation could have been designed with a smaller number of controllers, Thomas Theuring chose to focus on high system availability when he decided to distribute the controllers according to the different types of media. As a result, potential failures can be limited to a single type of media. Thomas Theuring reports: "The controllers can both interact with the process control system and work as independent control units ensuring tank operation even in the event of a network failure. During the retrofit work, it was possible to keep the installation running via the independent controllers. Small sections of the installation were running at night and over the week-end. If we had

used a central control unit we would have had long and expensive production shutdowns.“ Indeed, the plant normally operates 365 days a year. Renewal of the control system was made incrementally, starting from the buffer stations and finishing at the tank farm. Interruptions in production lasting only a few hours were avoided via use of the buffer tanks, and the retrofit work was performed without any problem. The new control system is far more flexible and better designed than the previous one. In the switchgear cabinets, the high number of PLC modules and controller boards have been replaced by a single fieldbus node. The unused mounting rails and drilled mounting holes show how the switchgear cabinet was packed out with equipment. The advantages of the WAGO I/O SYSTEM 750 are particularly obvious regarding analogue signals. A switchgear cabinet can generally be equipped with a very small number of analogue inputs and outputs and a single 2-channel fieldbus module will usually be enough. In comparison, an expensive 16-channel controller board is required when using a PLC, which means that 14 channels are left unused.

### ► Proving new technology

A special feature of the Mainz based installation is the close connection between the process control system and the controllers. Thomas Theuring can program the controllers from any workstation within the large installation network, and a hierarchical password system enables him to do his job independent of the control room location. As a result, he no longer wastes time walking or driving across the manufacturing site. Furthermore, in the event of a failure or leakage, the reaction time between alarm and intervention can be minimised via highly flexible and easily programmable controllers. Alarm information is transmitted both to the central station and to the operator near the defective installation. This advantage is actually not safety critical, since a tank will immediately be switched off in the event of a failure. Moreover, leakage damage can be avoided using a dual surge tank system. However, switching off the tank can impede operations, especially if one of the buffer stations close to the machine is affected.

Over the last one and a half years, the intelligent fieldbus nodes have been working reliably while continually expanding their application area. Small installations such as pump stations can be completely controlled using fieldbus nodes. “Implementing a complete pump station control system, including power unit control, with the WAGO components is cheaper than spending money on authorisation fees,” says Thomas Theuring, obviously satisfied.

Weitere Infos: [WD 2/2002-9](#)

### Conclusion

Ethernet in conjunction with programmable fieldbus controllers has proved very successful. Connecting the installation to the process control system is made very easy and economical using the universal Ethernet protocol. Installation productivity is improved, since all critical equipment remain in service in the event of a network or central control failure. Last but not least, Ethernet will help meet the increasing demand for intergrating field devices on information networks.