# A Clean Profit


## Summary

*During the last years Environmental Industry has changed a lot because of the application of European legislation. To fulfill these law regulations all treatment plants have to increase the efficiency of the pollutant removal to stick to the new effluent limits. Most of these plants are already built and consequently need to increase their efficiency keeping a strong eye on operating cost reduction. This is possible applying measurement and control technology from a supplier offering the whole basket of instruments. This will enable operation, supervision, servicing, repairing of the equipment from a single supplier having in the meanwhile state of the art measuring, monitoring and controlling plant functionalities.*


## Background

The wastewater treatment company operates in Liguria region (Italy), in the associated municipalities of Cairo Montenotte, Carcare, Dego and Altare and in the affiliated municipalities of Cosseria, Plodio, Bormida, Mallare and Pallare, for a total area of approximately 200 km².

The consortium water treatment plant serves as the foundation for initiatives to restore and conserve the environment in this area, where current industrial activities have been built on long standing traditions and have survived to this day as a result of a long and laborious process of evolution.

## Description

The urban and industrial sewage treatment plant is based on the activated sludge process having in place also the sludge treatment process in addition to the water treatment process.

Currently they serve an equivalent population of approximately 35,000 inhabitants partly generated by the contribution of effluent from industrial districts. They annually treat over 3 million cubic meters of effluent and generates 1400 tons of sludge produced by the anaerobic digestion process.

Nowadays new funding are available to extend the main sewage, to build new storm water basin to minimize flow overload events that are very frequent phenomenon and to upgrade the treatment process to reuse water for agriculture. These funds permit also to implement a new control system architecture based on the latest generation of technologies, including analytic and electromechanical control installed at each machine/process in the plant.

## The Control System

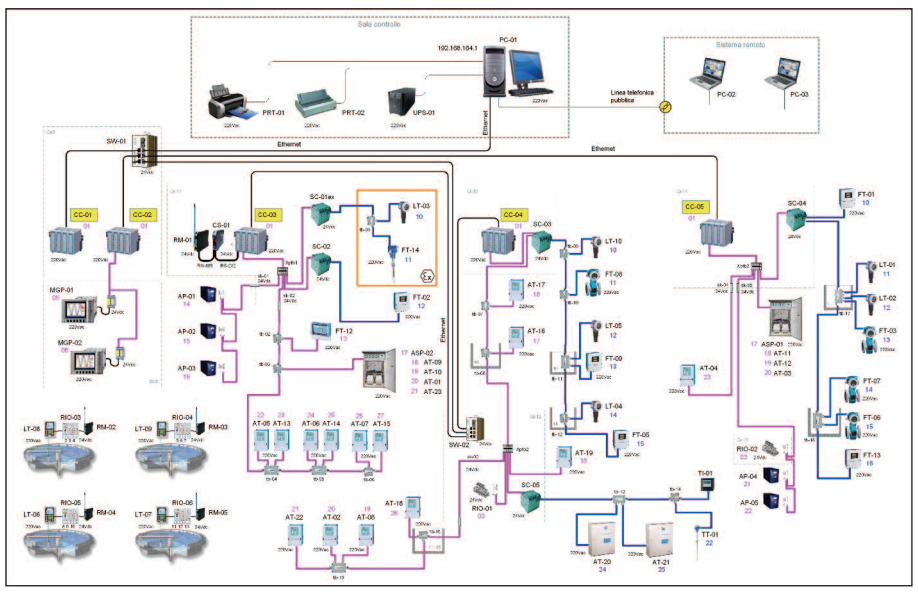
The water treatment plant control system has been designed for maximum distribution of control functions, using architecture based on the ControlCare Field Controller by Endress+Hauser. The distribution of functions allows a more rationalized management of process resources and networks.

The process monitoring and servo control systems are integrated into a digital field network.

The E+H ControlCare Field Controller is completely compatible with the IEC61131-3 standard via the "flexible function block" already included in the Foundation Fieldbus standard. The advantage of this architecture is that the IEC61131-3 sequence management functions are perfectly integrated into the function block management typical of process control. The monitoring system integrates with the control system via an OPC based communication architecture (OLE for Process Control).

## Architecture

The control system is based on a completely open architecture based on the ControlCare Field Controller (FC) by Endress+Hauser. The system may be expanded in future whenever necessary without decreasing performance, while maintaining the same prerequisites for




functional simplicity. Thanks to the use of standard Foundation Fieldbus function block technology, the FCs form a single distributed control architecture based on an HSE (High Speed Ethernet) network.

The function blocks are interconnected via links constituting the central nervous system for control.

Each FC deploys a Profibus DP local digital network (integrated Master PFB DP) and manages the discrete utility signals on local I/O boards. Furthermore, the Profi bus DP and PA network extends locally into each zone (cell) of the plant to manage data from digital monitoring instruments.

The data made available by Profibus digital instrumentation are typically primary and secondary measurements (where available) and the diagnostic status of the instrument. Motor (inverter) function is also controlled. The inverter functions are managed via the bus by sending parameters to given memory addresses of the device. A number of status and diagnostics data are also available.

## The Control System

In addition to the units described above, the automatic sampling machines, which may be programmed via bus and provide information on sampling status and malfunctions, and the discrete data acquisition boards (remote I/O) are also managed. A Modbus RTU Wireless network based on radio-modems is managed by one of the FCs in native mode (master Modbus RTU) for data acquisition from the bridge crane (in constant, slow rotation) level sensor.

## Devices

The treatment plant is completely outfitted with intelligent sensors and measurement instruments using Profibus technology to perform the following functions:

- On line analytical measurements (pH, Redox, Oxygen, Turbidity)
- Flow rate measurements using Mag meter and US flowmeters
- Ultrasonic and hydrostatic level measurements
- Temperature measurements
- Inlet / outlet automatic sampler
- Pump and blower control by inverters

## Functions.

The primary functions of the control system are as follows:

- Plant inlet lifting system control by lift pumps PID motor regulation
- Bypass management
- Fine screening
- Management of tankered sludge and septic receiving station
- Oxygen control in the biology
- 3 PID blower controls for speed regulation
- Fine filtration management at the outlet
- Sampling machine control
- Acquisition of process measurements, instrument diagnostic status and 50 service motors status

On the basis of this architecture, a monitoring and local management system was created which is open to remote management. The functions of the monitoring system are as follows:

- monitoring of the plant, subdivided into graphic video screens representing each functional cell
- configuration of parameters for control and regulation functions log and trend data management
- alarm management
- event management
- report management

In addition to the above there are intelligent instrumentation maintenance management and asset management functions.

The latter of these deserves a chapter in its own right as, in addition to illustrating the innovation introduced into this system by the use of FDT/DTM technology, it is also a modern, web-oriented instrument for the comprehensive and effective management of problems related to the documentation, maintenance and asset management of the plant. Today this is available from a single source of supply.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