ABB MEASUREMENT & ANALYTICS | APPLICATION NOTE

Recording & Control

Aeration control in Waste Water plants – accurate and fast control of aeration process

Great energy savings and quick return on investment

Measurement made easy

Clearing the water of harmful substances

Introduction

Waste water, or raw sewage, is water that drains from toilets, sinks, showers, baths, dishwashers, washing machines and liquid industrial wastes.

Raw sewage contain chemicals, biological contaminants, suspended solids and gases that must be removed before the water can be re-used or passed to a receiving environment such as the sea, rivers , lakes or canals.

A typical waste water treatment consists of 3 major stages:

1. Primary – pre-treatment
2. Secondary – sedimentation and aeration
3. Tertiary – filtration and disinfection

Of these three stages, secondary treatment is the most crucial part as this is where aerobic bacteria is allowed to consume the organic matter in the sewage through a process called aeration.

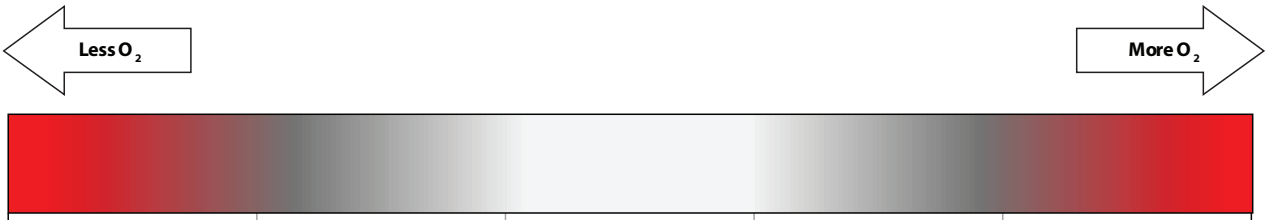
The process

Most modern waste water treatment plants use an activated sludge system, which uses a culture of bacteria and other organisms to feed on the organic materials in the sewage.

Aeration in an activated sludge process is based on pumping air into aeration basins, which promotes the bacteria and microorganisms to growth in the wastewater. These bacteria and microorganisms use dissolved oxygen to burn or break down organic waste into carbon dioxide, water and energy, clearing the water of harmful substances.

Aeration in waste water treatment plants accounts for around 66 % of energy use in wastewater treatment processes. Many treatment plants aerate 24/7 maintaining a higher dissolved oxygen level than necessary amounting to wasted energy and higher energy costs.

The efficiency of the aeration process purely relies on dissolved oxygen levels being controlled as closely and accurately as possible.



Very low O_2 supply	Low O_2 supply	Optimum O_2 supply	High O_2 supply	Very high O_2 supply
Insufficient air to support bacterial life so bacteria dies	Slow bacterial growth resulting in incomplete treatment	Complete treatment with high energy efficiency	Complete treatment with poor energy efficiency	Too much bacterial growth so bacteria starves and dies

Healthy and efficient treatment process

Poor and inefficient treatment, process can be rectified without complete stoppage

Treatment no longer possible, process must be restarted

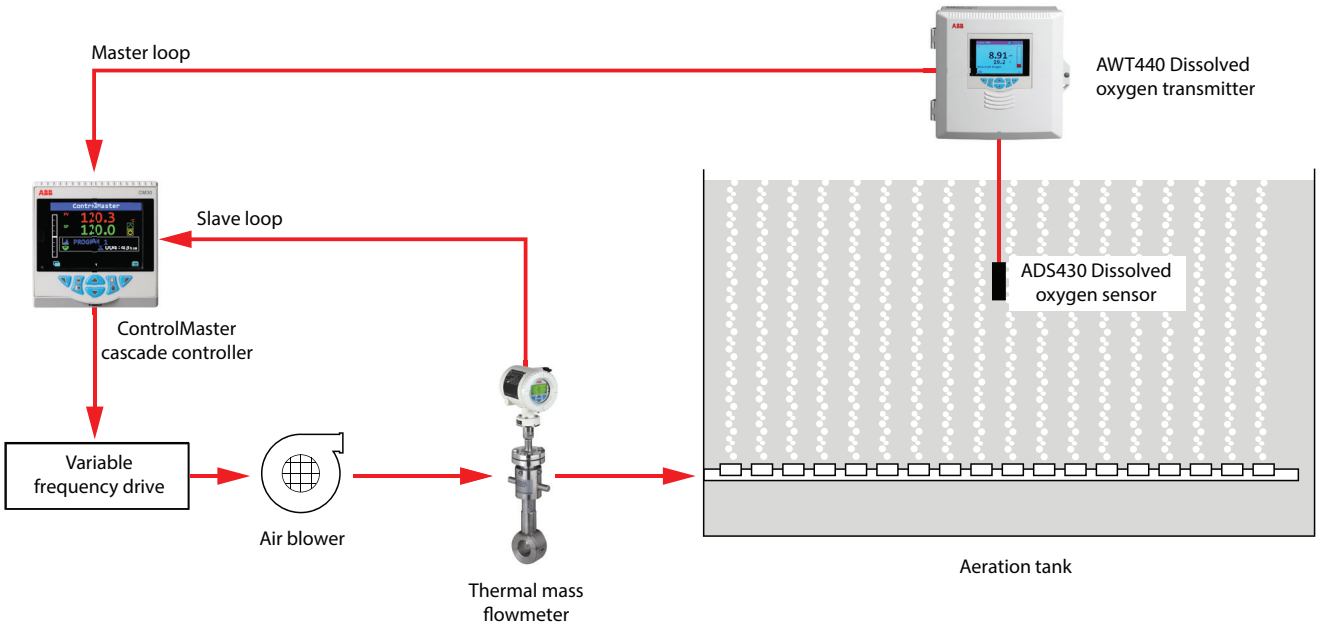
Under ideal conditions, dissolved oxygen levels should be maintained at between 1.5 to 2 ppm. If not enough dissolved oxygen is available, the aeration basins will be deprived of the oxygen needed for effective bacterial growth, negatively affecting the rate of sewage breakdown and impairing treatment process efficiency. If even less air is introduced, or no air at all, the bacteria will consume all the DO in the basin and die. In this case, the sewage treatment process stops until the process is restarted and bacteria is built up again, a procedure that can take up to few weeks.

Too much dissolved oxygen can also have a detrimental impact. With aeration processes accounting for over half of a plant's energy costs, it is vital that their efficiency is optimized as much as possible. Failing to ensure tight control of dissolved oxygen greatly increases the risk of operators incurring excessive energy costs.

Moreover, if excessive air is injected into the basins, bacteria will grow beyond acceptable limits, organic matter in the basin will be consumed too quickly, and the bacteria will starve and die, also halting the process.

ABB's measurement and control products offers great energy savings by optimizing the aeration process. ABB's dissolved oxygen sensing system coupled with ControlMaster PID controller and a flowmeter will deliver enhanced levels of accuracy and reliability in controlling your aeration process.

Precision control of the aeration process is achieved by connecting inputs from two loops i.e. air flow and DO to ControlMaster Cascade controller. ABB's controllers comes with preconfigured cascade templates which makes it easier to setup and commission. The cascade template connects two PID loops together in order to enhance the control of a Master loop (DO) by manipulation of a slave loop (Air Flow). ControlMaster's cascade feature helps optimize the air flow and significantly reduces the power consumption, lower operational and maintenance cost.



What ABB products are suitable?

ABB optical DO system with EZLink

Comprising the ADS430 sensor and AWT440 multi-channel transmitter, the system utilizes the latest developments in optical measurement technology. Consistent, reliable and accurate, it can help operators to realize significant savings through reduced energy consumption and maintenance. ABB's EZLink plug and play technology automatically connects the transmitter and sensor, with no need for wiring or complicated configuration.

Available in 2- or 4-channel versions, the AWT440 universal transmitter can be connected to up to 4 ABB 400 digital sensors, enabling monitoring at multiple points without purchasing and installing separate transmitters.

ControlMaster Controllers

Available in panel mount (CM10, CM30 and CM50) and field mount versions (CMF310), ABB's ControlMaster range of controllers is ideal for controlling the aeration process. ControlMaster's simple-to-use user interface delivers clear text prompts that make installation, commissioning and operation quick and easy.

Customizable full-color TFT display
With their full-color TFT displays, all controllers in the ControlMaster range provide operators with a clear and comprehensive overview of their aeration process.

Flexible communications
With a choice of either Ethernet© or Modbus© communications, ControlMaster controllers can be easily integrated into your control system. Ethernet communications can provide automatic notification of critical process events via email or remote monitoring of the aeration process via the ControlMaster's integrated webserver by simply addressing it in a standard web server.

Full environmental protection
With fully-sealed IP66 and NEMA 4X enclosures, our ControlMaster products offer full protection against water and dust ingress, enabling them to be used in even the most arduous operating conditions.

Historical trending
Short-term trending capability provides valuable information during commissioning as well as for drilling into the history of unattended processes.

Diagnostics
ControlMaster's diagnostic functions clearly display messages detailing fault conditions, abnormal process status and maintenance requirements. There is also the option of switching to an alarm and diagnostic status display to view any active messages.

...What ABB products are suitable?

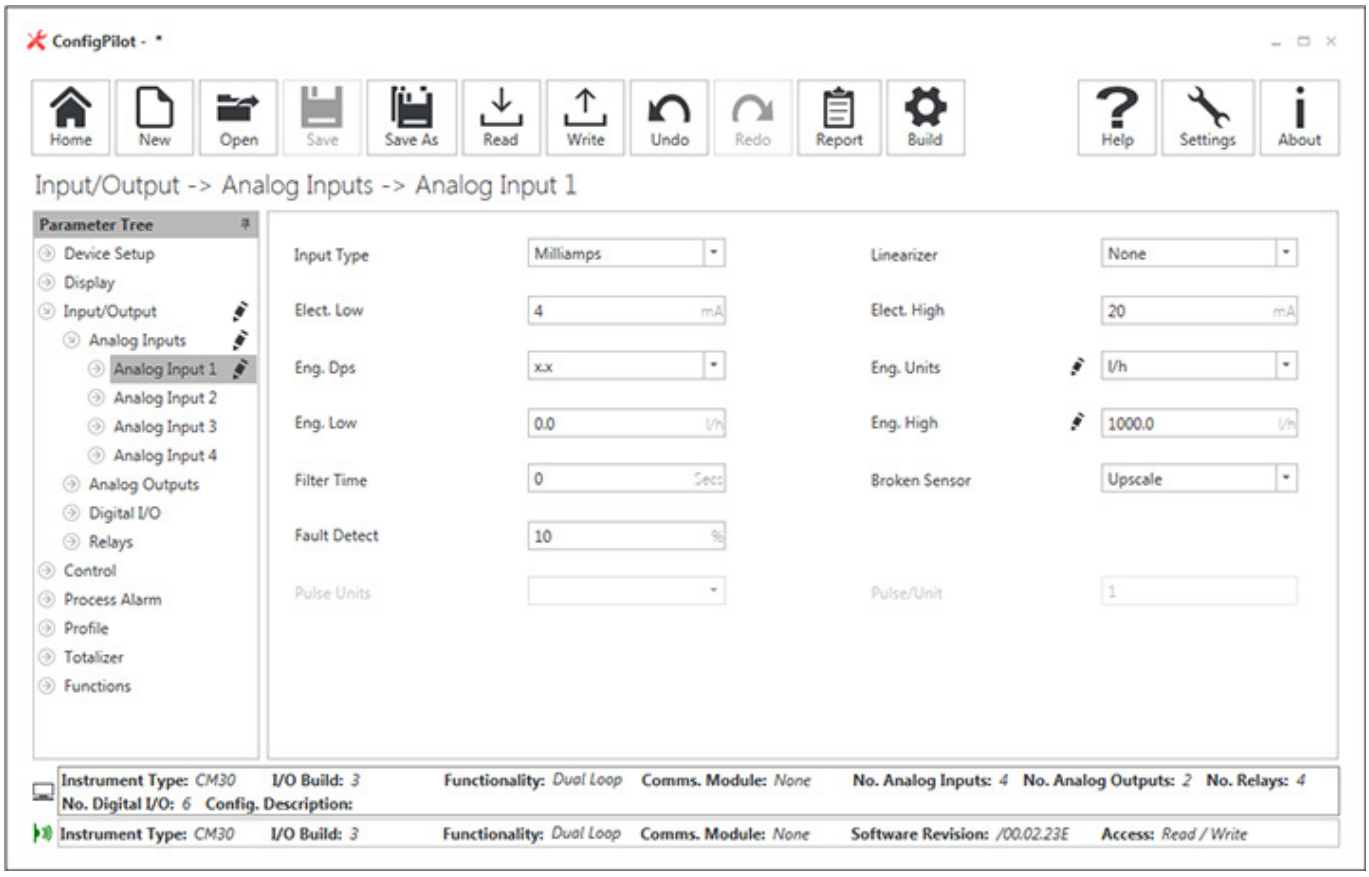
ConfigPilot

ConfigPilot is the PC configuration platform for ABB's ControlMaster range of controllers. With an identical menu structure to the ControlMaster, ConfigPilot is instantly familiar. Configurations can be created from scratch off-line or read from a ControlMaster device.

ConfigPilot simplifies the use of advanced functionalities in Graphical displays for complex configuration items such as profile control and display customization make configuration quick and easy.

Once complete a configuration can be written to a ControlMaster via its front panel IrDA port or saved for future use.

In addition ConfigPilot's report generation capabilities in Word, Excel or PDF format hugely simplifies the creation of documentation. All of these powerful features are available for free and can be downloaded from abb.com/recorder.



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