

Enhancing Energy and Compliance

Advanced Ammonium/Nitrate-Based Control for Carousel/Oxidation Ditch Activated Sludge Plants

Challenge

Ineffective DO-Based Control in Carousel ASPs

Conventional control strategies for carousel-type activated sludge plants (ASPs) rely heavily on dissolved oxygen (DO) measurements. However, due to the inherent DO concentration gradient along the carousel, there is no ideal probe location. Operators often observe near-zero DO readings and respond by maximising aeration from site to site, which leads to:

- **Collapse of the anoxic zone**, eliminating the **nitrate oxygen benefit** for COD removal.
- **Degraded sludge settleability**, resulting in elevated **SSVI** values and increased **solids loss risk** in final clarifiers.
- **Excessive energy consumption** and poor adaptability to **dynamic energy tariffs**.

Solution

Ammonium/Nitrate-Driven Aeration Control

This new control strategy eliminates reliance on DO setpoints. Instead, it uses real-time ammonium and nitrate measurements to dynamically manage aeration intensity states.

Key Features:

- **Flexible sensor placement:** Ammonium and nitrate probes can be installed **anywhere in the basin** or on **grouped outlets**, enabling control across multiple lanes.
- **Optimised aeration states:** Ensures **ammonium compliance** while **maximising nitrate value** for COD treatment and **alkalinity recovery**.
- **Preserved anoxic zones:** Maintains a **resilient anoxic environment**, improving **sludge settleability** and reducing **SSVI**.
- **Energy efficiency:** Typically delivers **>25% energy savings**.
- **Enhanced phosphorus control:** Prevents **ortho-phosphate release** by ensuring nitrate is always available as an alternative oxygen source.

Ammonium/Nitrate-Based Control

Benefits at a Glance



DO-independent control

Eliminates probe placement issues



Real-time NH_4^+ NO_3^- data

Reliable, responsive aeration control



Energy savings

>25% typical reduction



Improved sludge quality

Lower SSVI, reduced solids loss risk



Compliance assurance

Minimizes ammonium, total nitrogen, and phosphate risks



Remote site suitability

Low-maintenance filtration system

Technology Package

This proven approach is delivered as a complete package, including:

- **Robust ammonium and nitrate analysers:** Provide accurate and reliable measurements for real-time control.
- **New low-maintenance ammonium analyser & filtration system:** Requires manual cleaning only 4 times per year, making it ideal for remote or unmanned sites.
- **Full service and support:** Ensures reliable operation and long-term performance.

Instrument Details (New Innovations)



Ammonium provided by NH6000sc & FX620

Upgraded from the Amtax sc in 2025

The NH6000sc delivers precision and efficiency with its clog-resistant design and extended six-month reagent replacement interval, minimising maintenance needs. Its robust filtration system ensures reliable performance in demanding environments, while the five-minute measuring interval and outdoor-ready design offer exceptional operational flexibility.

Nitrate provided by NT3100sc

Upgraded from the Nitratax sc in 2022

Improve your experience in nitrate measurement with Hach's NT3100sc sensor. Backed by a legacy of reagent-free UV absorbance technology expertise, Hach's NT3100sc UV Nitrate Sensor is equipped to meet your unique application needs.

Comparing NH6000 with FX620 to Amtax with Filtrax

Annual Events	NH6000sc	Amtax sc
Sample preparation filter screens	4x	12x
GSE electrolyte replacement	2x	4x
Reagent replacement	2x	4x
Total	8x	20x

↑25 %
Aeration savings

↑200 %
Increased filter duty

✓ USP
Enables customer QC samples

↓70 %
Lighter filter with quick release

↓30 %
Reduced reagent consumption

↓50 %
Reduced user maintenance

↓60 %
Reduces 20 activities to 8



Implemented Design at Customer Location

Design Population equivalency	250K
Actual population equivalency	280K
Undesirable compliance risk	3 Years

Hach Real Time Control Software Solution Details

Versions

NH₄-N & NO₃-N control,

Output: Aerated volume (0–100%), Output: 6 stages, 2 VSD

LXZ522.53.A0101 (Single Channel), RTC-SND (1C6Z)

LXZ522.53.A0111 (Double Channel), RTC-SND (2C6Z)

In this variant of the RTC-SND, in addition to the aeration intensity, signals for controlling several aerator elements are also generated. The order in which these aerator elements are achieved can be configured in the RTC-SND.

I/O and Parameter/Channel

RTC-SND Output

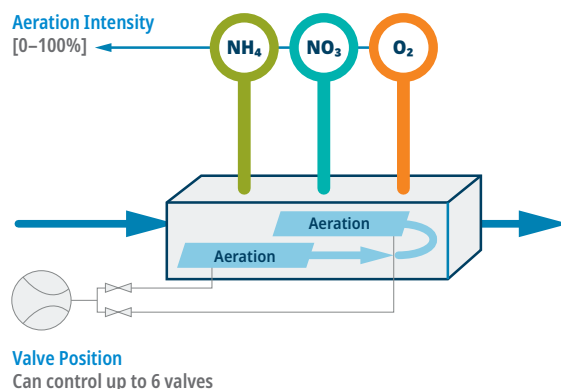
- Aeration intensity (0–100%)
- Surface aeration VSD speed/duty
- Blower / valve stage (1–6)
- Blower frequency (0–100%)
- Controller status signal

RTC-SND Input

- NH₄-N and NO₃-N concentration
- DO concentration
- Option: Flow rate wwtp

RTC-SND Control Parameters

- Target value NH₄-N and NO₃-N
- Weighting factor NH₄-N and NO₃-N
- Min/max DO concentration



Customer Location Map and Instrument Placement



Take Action

If you're facing compliance pressures, rising energy costs, or settling issues at your carousel ASP / oxidation ditch, this innovative control strategy can unlock new levels of performance.

Contact Hach today to explore how this approach can be tailored to your plant and start experiencing the benefits of advanced ammonium/nitrate-based control.

Results Achieved

- ✓ Capex Avoidance, the proposed original solution – **replacement aeration system (saving >£1 million capital cost)**
- ✓ Providing **savings of >£240K per year** (>25% energy savings)
- ✓ Achieving **3 Gwh saving / year**. Significantly contributing to the water companies' internal target of 10 Gwh saving over a 5-year period
- ✓ Careful management of anoxic / aerobic zones has **improved sludge settleability and final tank performance**
- ✓ **Secured compliance on ammonium and BOD5**
- ✓ Improved visibility of plant performance and **increased process understanding of site staff**
- ✓ **Reduced project delivery risk** with established / proven technology
- ✓ **End-to-end service support** to meet customer needs



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