



Telemetry for the highest level of plant reliability

Reliability is a key aspect of **control systems**. It can provide **cost effective operating cost** or can ensure **compliance with limit values**. The control system for the addition of external carbon at the sewage treatment plant in Radolfzell on Lake Constance has to do both! In order to carry out these two tasks, process measuring instruments supply the control system continuously with readings and signal their operational readiness by means of **telemetry**. Non-compliance with the limit values has been reduced significantly and the savings in added carbon amount to up to € 8,000 each year.



Author:

Uwe Karg

- "Diplom-Ingenieur", chemistry
- Application process measurement technology, HACH LANGE



LANGE 

“Safety belt” for the control system: NITRATAX sc + SC 1000 with telemetry

Radolfzell sewage treatment plant in figures

Design capacity	80,000 PE
Utilisation level	40,000 PE
Method	Four channels, each with upstream denitrification; downstream phosphate elimination
Carbon source	Ethylene glycol
Measurement technology	4 × LDO, 5 × NITRATAX plus sc, 3 × SC 1000 probe module, 1 × display module with GSM



Fig. 1: NITRATAX plus sc nitrate probe (bypass), mounted in the sampler unit

The Radolfzell sewage treatment plant

It was designed for a population equivalent of 80,000 and the current utilisation level is only 50 %. Wastewater from the primary settlement tank flows into four channels, each with two longitudinal-flow tanks. After passing through an upstream denitrification stage and then a nitrification stage, the wastewater arrives at six secondary settlement tanks. The treatment is completed by the less frequently encountered downstream phosphate precipitation stage.

As a consequence of the steady decrease in the proportion of industrial wastewater, the nutrient ratio in the wastewater is highly unfavourable. It was decided that a change in the treatment technology, making the primary settlement tank into an additional denitrification zone, would help to compensate for the lack of carbon in particular. The change brought about a rapid improvement, but filamentous bacteria and the resulting floating sludge soon caused the concept to fail.

Reliable nitrogen degradation

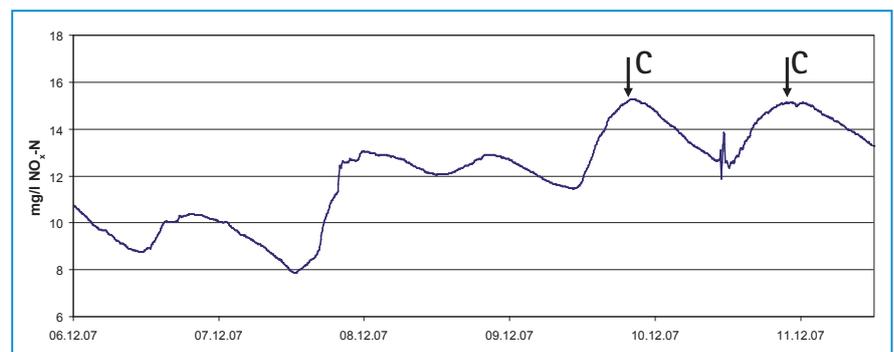
Ethylene glycol has now been used successfully for three years as the external source of carbon. It enables the nutrient ratio to be optimised and denitrification efficiency to be maintained, especially during the weekend.

External carbon used to be added from Friday to Monday morning, but this non-targeted addition soon proved to be too costly. Today a bypass-mounted NITRATAX sc probe (Fig. 1) continuously monitors the nitrate content at the end of the denitrification stage and, when necessary, initiates the addition of ethylene glycol (Fig. 2). The measurable success: a reduction of up to 40 % in the added quantity, equal to 7,000–8,000 € lower costs per year!

Reliable nitrogen measurement

Important as a uniform supply of carbon is for the denitrification process, the reliable operation of the instruments that provide the measurement data to the process control system is equally important. For this reason, the SC 1000 controller system is linked via GSM to the central input server in the Düsseldorf network of the HACH LANGE Service department (Fig. 3). As soon as the internal operating counter of a wear part of a process measuring instrument counts down, or a warning message is generated, or an error occurs, this is reported automatically. The telemetry team then immediately provides technical support, either by phone or through a service technician on site.

Fig. 2: NO_x-N one-week time course curve (outflow from aeration tank). Without added carbon, reliable compliance with the nitrogen limit value of 18 mg/l cannot be assured. The targeted addition of carbon (arrow) results in annual savings of up to €8,000.



In Radolfzell, one of these messages from probe no. 1154775 (documented in the activity report) resulted in a technician call-out to the plant (see service report). Before the operation of the instrument could be impaired, seals and a wiper profile were replaced. At the customer's request, all instrument messages can also be sent to a laptop and a mobile phone. Plant safety at the highest level!

Limit values no longer exceeded

The uniform distribution of the carbon dosage over the four channels brought about a clear reduction of one third in the number of 24-hour mixed samples with values in excess of the limits. To ensure that the limits are never exceeded in future, each channel will be supplied with carbon separately (Fig. 4). A dispensing station is currently under construction, with the following specification:

- Four pumps for four dosing points

- Actuated by four NITRATAX sc probes
- Connected to a SC 1000
- With a telemetry link

Remote configuration

The modular SC 1000 controller also performed another task convincingly. Inductive flow measurements are carried out in an overflow channel near the nitrate measuring point. During heavy rain events, however, water is run off through this channel. "This only occurs a few times each year, but it is of relevance for the licence under the water regulations," explains Regina Eberle, the laboratory manager in Radolfzell. "And as we cannot lay any more cables to this location from the control station, we simply installed an analogue input card for the SC 1000 and connected the flow meter. The configuration was simple to carry out, by email with Düsseldorf. All the settings were then made by remote transmission" (Figs. 5 and 6)



Fig. 4: In future, each channel will have its own targeted carbon supply.

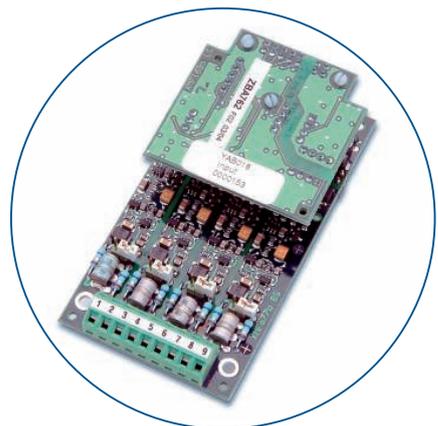


Fig. 5: SC 1000 input card, which enables analogue input signals to be processed.

Aktivitätsbericht

Nitratax plus sc Becken4 # 1154775	
Beschreibung	Code KW 02
Dichtungswechsel	
Austausch Wischer empfohlen	W01

Servicebericht

Gerät: NITRATAX plus sc-Sonde
 Gerätetyp/Gerätenummer: LXG417.00.10000 / 1154775
 Bestellnummer:
 Zubehör:
 Unsere Lieferung/Leistung 17496858 Michael Warmemünz
 Kontaktperson: Frau Eberle - Tel.: 07732/947922

Artikelnr.	Beschreibung
Menge Gesamt	
TSEPLUS030	Service-PLUS-Vertrag
LZX426	Dichtungssatz
LZX303	Trockenmittel

Jährliche Inspektion durchgeführt, Sichtkontrolle, Wischerprofile geprüft/getauscht, Dichtungen und Trockenmittel erneuert, Messfenster gereinigt.

Fig. 3: Activity and service reports make all occurrences transparent and traceable.

MEASURING SITE	UEBERLAUF-WEHR
INSTRUMENT NAME	NIVUS DURCHFLUSS
PARAMETER NAME	UMGEHUNG NK3
PARAMETER	L/S
SHOWN AS	INIT. VALUE
UNIT	freely selectable
FUNCTION	ANALOGUE
DAMPING	10 s
0/4...20 mA	4-20 mA
0/4 mA value	0.0
20 mA value	600.0
WHEN FAULT OCCURS	4 mA
CONCENTRATION	1,801 L/S
LOG INTERVAL	10 min

Fig. 6: All instrument settings can be changed by remote transmission

The process measurement technology used with the telemetry link

Process measurement instruments

NITRATAX plus sc nitrate process probe

Stainless steel process probe for the sample-free determination of the nitrate and nitrite content. UV absorption measurement, reagent-free. Evaluation and operation via SC 100 or SC 1000 controller. For installation in bypass, a flow-through cell is essential.

Measuring range (NO₂₊₃-N): 0.1–100 mg/l.

LDO optical oxygen-sensor

Calibration-free sensor for measuring dissolved oxygen by the luminescence method. Digital transmission of measured values to the controller. No interference by H₂S or reducing or oxidising substances. Evaluation and operation via SC 100 or SC 1000 controller.

Measuring range: 0.1...20.00 mg/l; warranty on sensor cap: 2 years; dimensions: 292 × 60 mm (length × diameter); weight: approx. 1.4 kg.

SC 1000 digital controller

A complete controller system for connecting and operating SC sensors consists of a single SC 1000 display module and one or more SC 1000 probe modules.

Probe module

The probe module can be used to connect up to 8 SC sensors. Several SC 1000 probe modules are connected via the SC 1000 network; field bus capability.

Display module

Portable graphics display module for the operation of the SC 1000 controller system. A SC 1000 probe module is needed to operate and connect the display module. Intuitive user guidance and time course graphs; service interface, slot for multimedia card (MMC).

Triband data telephone to the GSM standard (GSM900, EGSM900, GSM1800, GSM1900) for remote data transmission and remote operation with built-in antenna. A SIM card (to ISO 7816-3 IC, GSM 11.11) is needed to enable the data telephone to be used. SMS and data services must be available.

Telemetry

Always up to date – on site or in the field. The SC 1000 digital controller uses SMS to signal important events registered by the connected process sensors. The message is simultaneously sent to our Teleservice Centre, where it is analysed by professional service personnel. If necessary, incidents can be dealt with directly by phone. A service visit can also be planned efficiently, so that the engineer has all the necessary spare parts with him. You benefit because the SC technology saves a lot of time and ensures reliable plant operation at a previously unattainable level!



NITRATAX plus sc nitrate process probe



LDO optical oxygen sensor



SC 1000 controller with GSM module