

# HYDRA Ammonium & HYDRA Nitrate Analyzers



Presented by:  
Steve Rupert  
Sr. Product Manager  
January, 2010



**ELECTRO-CHEMICAL DEVICES**



# HYDRA Overview

- ❖ The HYDRA Analyzers are a Family of Nitrogen Analyzers
  - C22 Controller with three interactive measurement channels
  - Single Integrated Sensor with multiple measurements
- ❖ Measurement of Nitrogen as Ammonium or Nitrate
  - HYDRA-NH4
    - Ammonium as Nitrogen,  $\text{NH}_4^+\text{-N}$
  - HYDRA-NO3
    - Nitrate as Nitrogen,  $\text{NO}_3^-\text{-N}$





# HYDRA Overview

## ❖ Suggest Applications

- Municipal Waste Water
  - Primary Clarifier
  - Aeration Basins
  - Secondary Clarifiers
  - Denitrification
  - Final Effluent
- Environmental waters
  - Lakes and Streams
  - Agricultural Runoff





# HYDRA Overview

## ❖ The HYDRA Simplifies the Real Time Measurement of Ammonium and Nitrate ions

- One Single Integrated Sensor
- Signal Conditioners for trouble free transmission
- Easily replaced Electrodes
- Built in Spray Cleaner reduces maintenance time
- Analyzer performs corrections for interfering ions and pH compensation
- All of these features provide the lowest Total Cost of Ownership





# What is the HYDRA-NH4?

## ❖ HYDRA-NH4 Sensor

- Measures the Nutrient Load of Waste Water
- Rugged PVC Housing
- (3) S10s in one body
  - Ammonium ISE
  - Potassium ISE
  - pH Electrode
  - Temperature sensor
  - Signal Conditioners
- Integral Spray Cleaner
- LED Indicator Lights





# What is the HYDRA-NH4?

## ❖ HYDRA-NH4 Analyzer

- Potassium, pH and Ammonium Channels
  - % mA Output (NH<sub>4</sub>-N) and Temperature (°C or °F)
- Automatic pH Compensation for Total NH<sub>3</sub>/NH<sub>4</sub> calculation
- Corrects for Potassium Ion Interference
- Controls Spray Cleaning Cycle
  - Internal Timers and a Relay
- Configurable Hi/Lo Alarm Relay
- (2) 4-20 mA Outputs







# What is the HYDRA-NO3?

## ❖ HYDRA-NO3 Sensor

- Tracks Nitrification Progress,  $\text{NH}_4 \rightarrow \text{NO}_3$
- De-Nitrification,  $\text{NO}_3 \rightarrow \text{N}_2$
- Rugged PVC Housing
- (3) S10s in one body
  - Nitrate ISE
  - Chloride ISE
  - Optional pH Electrode
  - Temperature sensor
  - Signal Conditioners
- Integral Spray Cleaner
- LED Indicator Lights





# What is the HYDRA-NO3?

## ❖ HYDRA-NO3 Analyzer

- Nitrate, Chloride and pH Channels
  - % mA Output (NO<sub>3</sub>-N) and Temperature (°C or °F)
- Corrects for Chloride Ion Interference
- Provides pH for additional Process Information
- Controls Spray Cleaning Cycle
  - Timers and Relay
- Configurable Hi/Lo Alarm Relay
- (2) 4-20 mA Outputs







# Where is the HYDRA Used?

## ❖ Municipal Waste Water Treatment Plants

- Primary Clarifier
- Aeration Basins
- Secondary Clarifier
- De-Nitrification
- Effluent



## ❖ Environmental Waters

- Lakes, Streams, Rivers
- Agricultural Runoff





# Primary Clarifier

## ❖ Primary Clarifier

- Nitrogen in municipal waste water is primarily Ammonia/Ammonium
- The HYDRA-NH4 measures the Total amount of  $\text{NH}_3/\text{NH}_4^+$ , the Nutrient Load, going to the Aeration Basin
- Nutrient Load determines the
  - Aeration requirement of the basin
  - Activated Sludge requirement of the basin





# Aeration Basin

- ❖ The **Nitrification Process** changes Ammonium,  $\text{NH}_4^+$  into Nitrate,  $\text{NO}_3^-$
- ❖ The Microbes that perform this oxidation chemistry are suspended in the **Activated Sludge**
  - Adding Activated Sludge adds capacity
  - Increases Turbidity (TR8)
- ❖ Nitrification is an Aerobic process
  - High  $\text{O}_2$  yields High Nitrification
  - The microbes respire and perform the oxidation
  - Adding Nutrient or Sludge increases the  $\text{O}_2$  demand (DO8)







# Aeration Basin

## ❖ Optimize the Nitrification

- Real time  $\text{NH}_4^+ \rightarrow \text{NO}_3^-$
- High Nutrient Load infers a High  $\text{O}_2$  requirement
- The Nitrification rate is proportional to the  $\text{O}_2$  ppm
- Adding  $\text{O}_2$  uses more power but lowers the time needed for Nitrification

## ❖ Use Hydra-NH4 to control aeration

- Low  $\text{NH}_4^+$ : minimal aeration even though  $\text{O}_2$  is Low
- Higher  $\text{NH}_4^+$ : aeration under  $\text{O}_2$  Sensor control

## ❖ Nitrification Cycle Complete

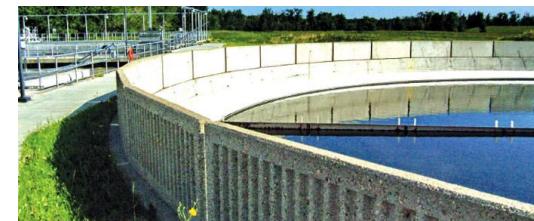
- Reduce the Aeration for Anoxic Denitrification or send to the Clarifier





# Secondary Clarifier

- ❖ Secondary Clarifier
  - All the  $\text{NH}_4^+$  has been converted to  $\text{NO}_3^-$
  - The Activated Sludge (AS) settles out and is either
  - Returned to the Aeration Basin (RAS) or
  - Sent to Waste (WAS)
- ❖ HYDRA-NO3 measures the Nitrate in the Clarifier in preparation of Anaerobic Denitrification
- ❖ In Denitrification the microbes are starved of  $\text{O}_2$  and coerced to metabolize the Oxygen from the  $\text{NO}_3$  releasing Nitrogen gas
  - Anoxic (low  $\text{O}_2$ )
  - Anaerobic (no  $\text{O}_2$ )

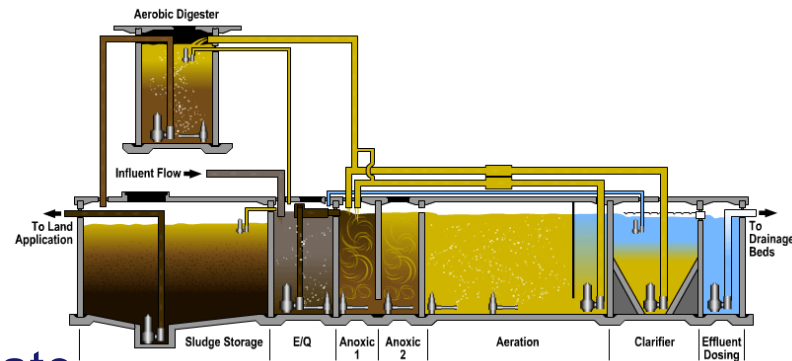
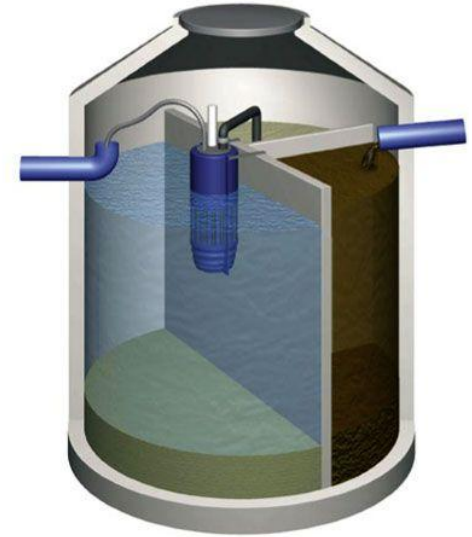




# Anoxic Basin, SBR

## ❖ Sequential Batch Reactor

- SBR cycles between Aerobic → Anoxic → Aerobic, all in one vessel or sequence
- Separate aerator and a mechanical mixer
- HYDRA-NH<sub>4</sub> and HYDRA-NO<sub>3</sub> are both used
- Nitrification (Aerobic)
  - Aeration ON
  - NH<sub>4</sub> ↓ NO<sub>3</sub> ↑
- Denitrification (Anoxic)
  - Aeration OFF, Mixer ON
  - NO<sub>3</sub> ↓ N<sub>2</sub> gas ↑
  - small amount NH<sub>4</sub> ↑
- Nutrient Removal Phosphate
  - Aeration ON
  - Sludge Absorbs PO<sub>4</sub>
  - NH<sub>4</sub> ↓, NO<sub>3</sub> ↓, PO<sub>4</sub> ↓







# Anaerobic Denitrification

- ❖ Nitrate from Secondary Clarifier is reduced to Nitrogen Gas
- ❖ Denitrification requires to zero ppm Oxygen environment
- ❖ Methanol is used as a carbon source to drive the microbes to Denitrify by increasing the COD
- ❖ HYDRA-NO<sub>3</sub> allows feed forward control of the Methanol addition based on Nitrate Concentration and Flow rate.
- ❖ Accurate Methanol dosing saves money





# Final Effluent & Environmental

- ❖ HYDRA-NH<sub>4</sub> and HYDRA-NO<sub>3</sub> can be used to monitor the Total Nitrogen in the effluent.
  - This is not an Approved method for reporting per 40 CFR Part 136 (NPDES, wastewater)
  - SM 4500-NO<sub>3</sub>- D (18, 19, 20th & 2000) is the ISE based Method
  - It requires sampling and the addition of a conditioning reagent to eliminate interferences from Chloride, Nitrite and bicarbonate.
- ❖ The HYDRA-NH<sub>4</sub> can be used to monitor the agricultural NH<sub>4</sub><sup>+</sup> run off into Lakes and Streams





# HYDRA Analyzer Features

- ❖ Primary Measurement ,  $\text{NH}_4$  or  $\text{NO}_3$  is fully compensated for pH, Interfering Ions and Temperature
- ❖ All Measurements displayed on Home Screen
- ❖ Familiar C22 menus and functionality
- ❖ Factory Calibrated for easy Start Up
- ❖ (2) Configured 4-20 mA Outputs
  - mA1:  $\text{NH}_4$ -N or  $\text{NO}_3$ -N 0.1 - 20 ppm
  - mA2 pH 0-14
- ❖ Timer Controlled Relay for actuating the Cleaning Cycles
- ❖ Automatic Output Hold Function during Cleaning Cycles
- ❖ Hi/Lo Alarm Relay





# Serviceable Components

## ❖ The HYDRA sensor is designed with few serviceable parts

- (3) Easily replaceable electrodes
- Spray Nozzle with wrench flats and 1/4-20 thread
- Screw off Sensor Guard with air purge hole, eliminates trap air bubbles
- 1/4" Compression Fitting on Air Feed Line

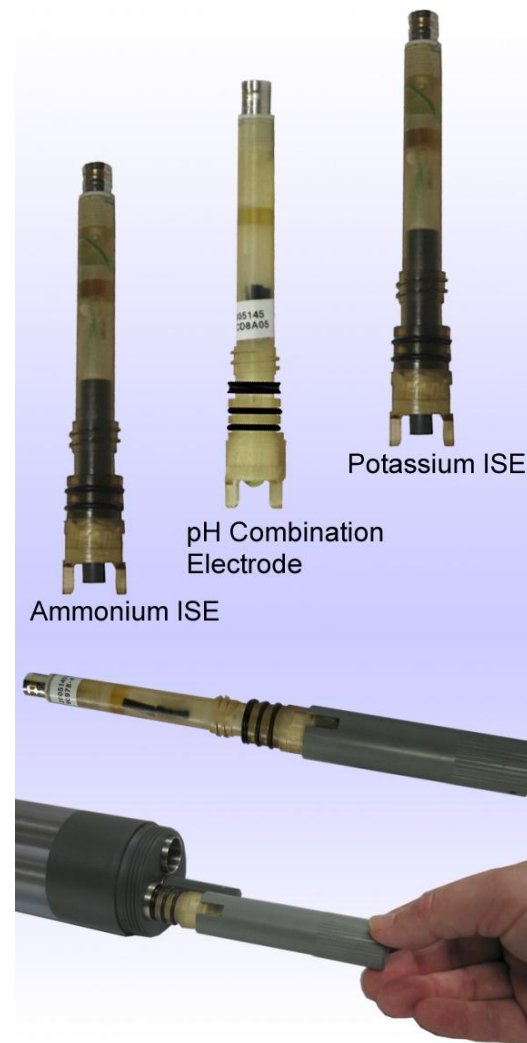






# Electrode Replacement

- ❖ Remove the Sensor Guard, rinse the electrodes with fresh water and then tamp dry with a paper towel.
- ❖ Using the supplied Insertion Tool unscrew the electrode to be serviced.
- ❖ Repair or replace the electrode.
- ❖ Apply a thin film of o-ring grease to the o-rings of the serviced/new electrode and a thin coat to the inside rim of the SS tube.
- ❖ Place the electrode into the Insertion tool and thread the sensor into the housing.
- ❖ Replace the Sensor Guard.





# Start Up Guide

- ❖ Mount the Analyzer within 30 ft of the sensor's installation point.
- ❖ Connect a solenoid controlled 1/4" air line to the HYDRA tube fitting. (feed the air tube through the Immersion Assembly)
- ❖ Connect the immersion assembly (1 1/4" FNPT) to the HYDRA Sensor.
- ❖ Insert the sensor into the tank and attach the HYDRA using the Handrail Mounting Kit



S17000 Series  
#67  
All Models



- ✓ Ideal for Compressed Air, Inert Gas, Water and Synthetic Oils
- ✓ Available in Normally Open or Normally Closed
- ✓ Process Temperature to 137°C (280°F)
- ✓ 3 W, AC Coils Standard, 12 or 14 W, AC or DC Coils Available

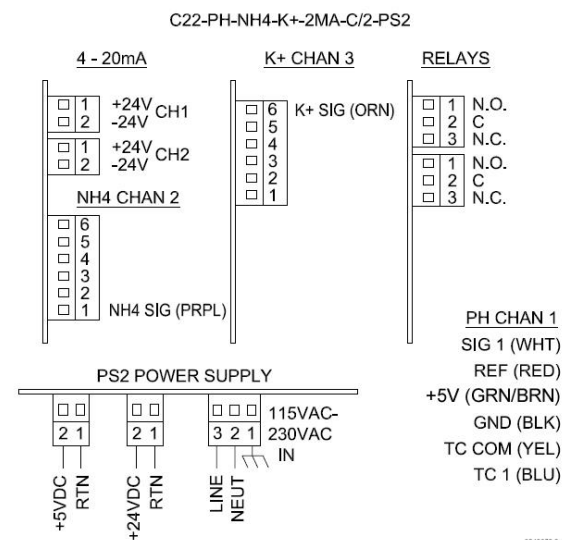
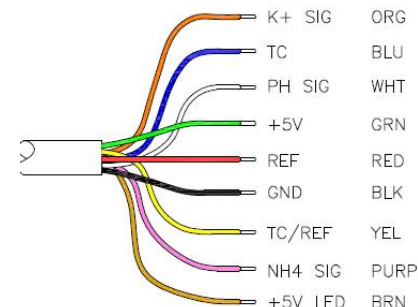
S17 10000 Series 3-way solenoid valves are direct acting valves featuring bronze, stainless steel, aluminum and 316L steel bodies. The nominal pressure range from -1 to 12.7 MPa (0 to 180 PSI) is ideal for hydraulic fluids such as compressed air, oil, water, and synthetic oils. A standard connector is





# Start Up Guide

- ❖ Wire the Sensor,
- ❖ the Outputs,
- ❖ Relay 1 to the Solenoid (not supplied)
- ❖ Relay 2 For HI/Lo Alarm
- ❖ Supply Power.
- ❖ Check the default Configuration, Cleaning Cycle, Alarm, Outputs, in the Instruction Manual, adjust if necessary.



9240630.2



# Start Up Guide

- ❖ The HYDRA is up and running
  - The Air Blast spray cleaner will actuate once every hour for 10 seconds to keep the measuring electrodes clean
  - Wait several hours for the sensors to equilibrate to the Process conditions
  - Verify readings versus a laboratory test and Standardize the reading if necessary
- ❖ Visually inspect the sensor for coatings weekly and verify calibration versus laboratory measurement.





# Electro-Chemical Devices

## Contact ECD

For over 30 years Electro-Chemical Devices (ECD) has been a recognized leader in industrial process instrumentation:

Liquid analytical sensors, controllers, transmitters, analyzers and electrodes.

**Electro-Chemical Devices**

1681 Kettering  
Irvine, CA 92614

Phone: +1-949-336-6060

+1-800-729-1333

Fax: +1-949-336-6064

email: [sales@ecdi.com](mailto:sales@ecdi.com)

web: [www.ecdi.com](http://www.ecdi.com)

