

HYDRA-DS Ammonium & HYDRA-DS Nitrate Analyzers





HYDRA-DS Overview

- ❖ The HYDRA-DS Analyzers are a Family of Nitrogen Analyzers
 - T80 or LQ800 with interactive measurement channels
 - Single Integrated Sensor with multiple measurements
- ❖ Measurement of Nitrogen as Ammonium or Nitrate
 - HYDRA-DS-NH4
 - Ammonium as Nitrogen, $\text{NH}_4^{+}\text{-N}$
 - HYDRA-DS-NO3
 - Nitrate as Nitrogen, $\text{NO}_3^{-}\text{-N}$





HYDRA-DS Overview

❖ Suggested Applications

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





HYDRA-DS Overview

- ❖ The HYDRA Simplifies the Real Time Measurement of Ammonium and Nitrate ions
 - One Single Integrated Sensor
 - Digital 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-DS-NH4 Sensor

- Measures the Nutrient Load of Wastewater
- Rugged PVC Housing
- (3) DS80s in one body
 - Ammonium ISE
 - Potassium ISE
 - pH Electrode
 - Temperature sensor
 - Analog to Digital Signal Conditioners
- Integral Spray Cleaner





What is the HYDRA-DS-NO3?

❖ HYDRA-NO3 Sensor

- Tracks Nitrification Progress, $\text{NH}_4 \rightarrow \text{NO}_3$
- De-Nitrification, $\text{NO}_3 \rightarrow \text{N}$
- Rugged PVC Housing
- (3) S80s or DS80s in one body
 - Nitrate ISE
 - Chloride ISE
 - Optional pH Electrode
 - Temperature sensor
 - Analog to Digital Signal Conditioners
- Integral Spray Cleaner





T80 Transmitter for HYDRA-DS

❖ T80 Transmitter

- Used for the HYDRA-DS (NH₄ or NO₃)
- Automatic pH Compensation for Total NH₃/NH₄ calculation
- Corrects for Potassium Ion or Chloride Ion Interference
- 3 Configurable Relay
- (2) 4-20 mA Outputs



LQ800 Multi Channel Controller for HYDRA-DS

❖ LQ800 Multi Channel Controller

- Used for the HYDRA-DS (NH₄ or NO₃)
- Up to (2) HYDRA-DS with pH
- Automatic pH Compensation for Total NH₃/NH₄ calculation
- Corrects for Potassium Ion or Chloride Ion Interference
- 8 Configurable Relay
- (8) 4-20 mA Outputs





Where is the HYDRA-DS Used?

❖ Municipal Wastewater 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-DS-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, NH_4^+ into Nitrate, NO_3^-
- ❖ The Microbes that perform this oxidation chemistry are suspended in the Activated Sludge
 - Adding Activated Sludge adds capacity
 - Increases Turbidity (TR80/TR82)
- ❖ Nitrification is an Aerobic process
 - High O_2 yields High Nitrification
 - The microbes respire and perform the oxidation
 - Adding Nutrient or Sludge increases the O_2 demand (DO82)





Aeration Basin

- ❖ Optimize the Nitrification
 - Real time $\text{NH}_4^+ \rightarrow \text{NO}_3^-$
 - High Nutrient Load infers a High O_2 requirement
 - The Nitrification rate is proportional to the O_2 ppm
 - Adding O_2 uses more power but lowers the time needed for Nitrification
- ❖ Use Hydra-DS-NH4 to control aeration
 - Low NH_4^+ : minimal aeration even though O_2 is Low
 - Higher NH_4^+ : aeration under O_2 Sensor control
- ❖ Nitrification Cycle Complete
 - Reduce the Aeration for Anoxic Denitrification or send to the Clarifier





Secondary Clarifier

- ❖ Secondary Clarifier
 - All the NH_4^+ has been converted to 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 O_2 and coerced to metabolize the Oxygen from the NO_3 releasing Nitrogen gas
 - Anoxic (low O_2)
 - Anaerobic (no O_2)

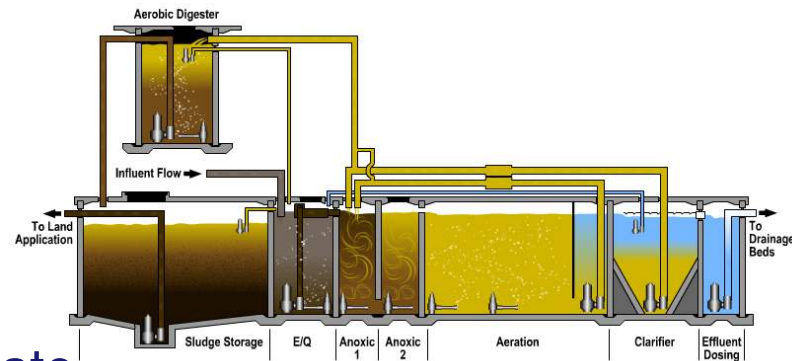
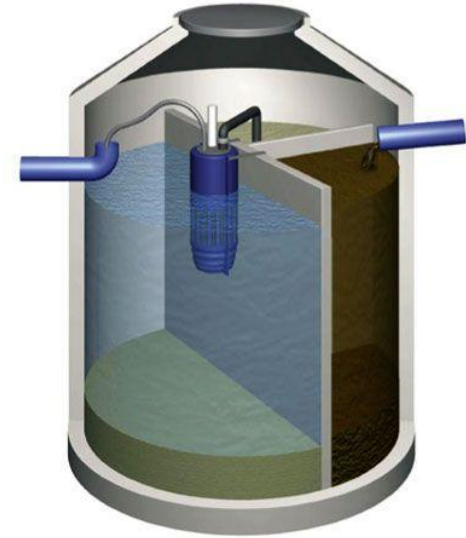




Anoxic Basin, SBR

❖ Sequential Batch Reactor

- SBR cycles between Aerobic → Anoxic → Aerobic, all in one vessel or sequence
- Separate aerator and a mechanical mixer
- HYDRA-DS-NH₄ and HYDRA-DS-NO₃ are both used
- Nitrification (Aerobic)
 - Aeration ON
 - NH₄ ↓ NO₃ ↑
- Denitrification (Anoxic)
 - Aeration OFF, Mixer ON
 - NO₃ ↓ N₂ gas ↑
 - small amount NH₄ ↑
- Nutrient Removal Phosphate
 - Aeration ON
 - Sludge Absorbs PO₄
 - NH₄ ↓, NO₃ ↓, PO₄ ↓





Anaerobic Denitrification

- ❖ Nitrate from Secondary Clarifier is reduced to Nitrogen Gas
- ❖ Denitrification requires zero ppm Oxygen environment
- ❖ Methanol is used as a carbon source to drive the microbes to Denitrify by increasing the COD
- ❖ HYDRA-DS-NO3 allows feed forward control of the Methanol addition based on Nitrate Concentration and Flow rate.
- ❖ Accurate Methanol dosing saves money





Final Effluent & Environmental

- ❖ HYDRA-DS-NH4 and HYDRA-DS-NO3 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-NO3- 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-DS-NH4 can be used to monitor the agricultural NH_4^+ run off into Lakes and Streams





Serviceable Components

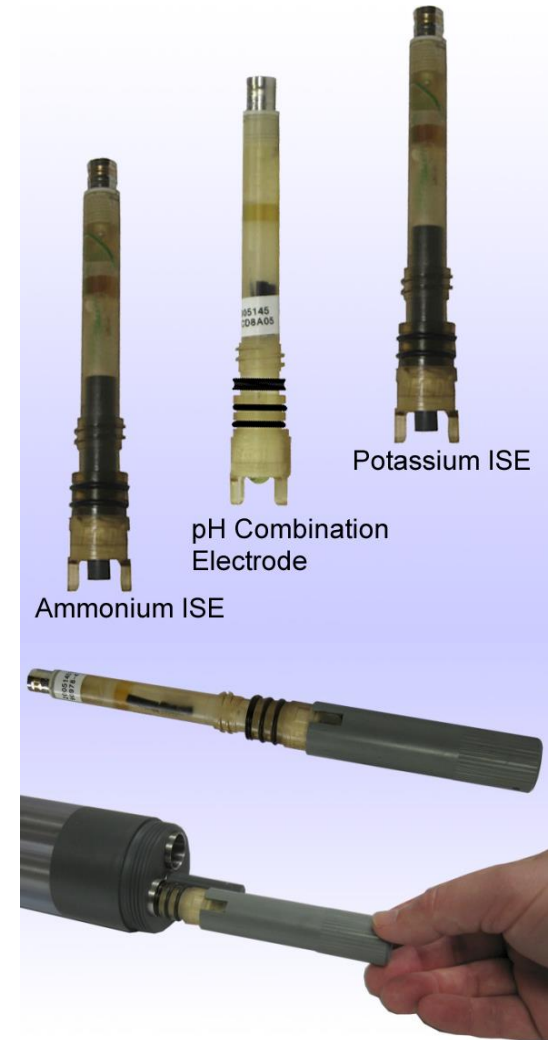
- ❖ The HYDRA-DS sensor is designed with few serviceable parts
 - (3) Easily replaceable electrodes
 - Spray Nozzle with wrench flats and 1/4-20 thread
 - Screw off Sensor Guard with air purge hole, eliminates trap air bubbles
 - 1/4" Compression Fitting on Air Feed Line





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

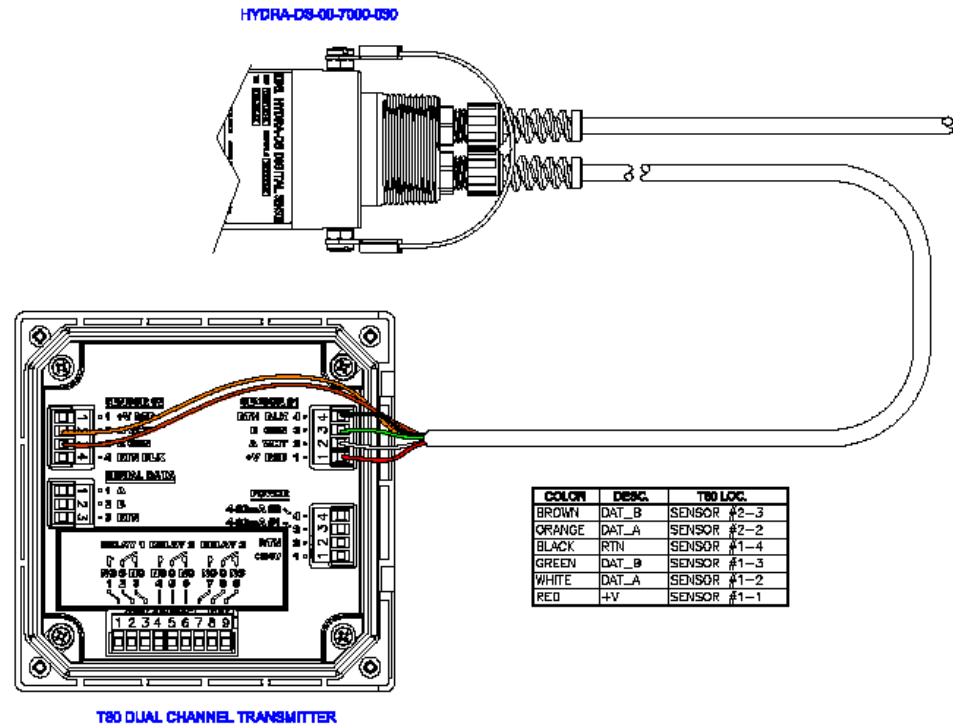
- ❖ Mount the Analyzer within 30 ft of the sensor's installation point.
- ❖ Connect a solenoid controlled 1/4" air line to the HYDRA tube fitting. (feed the air tube through the Immersion Assembly)
- ❖ Connect the immersion assembly (1 1/4" FNPT) to the HYDRA Sensor.
- ❖ Insert the sensor into the tank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





Start Up Guide

❖ T80 Wiring

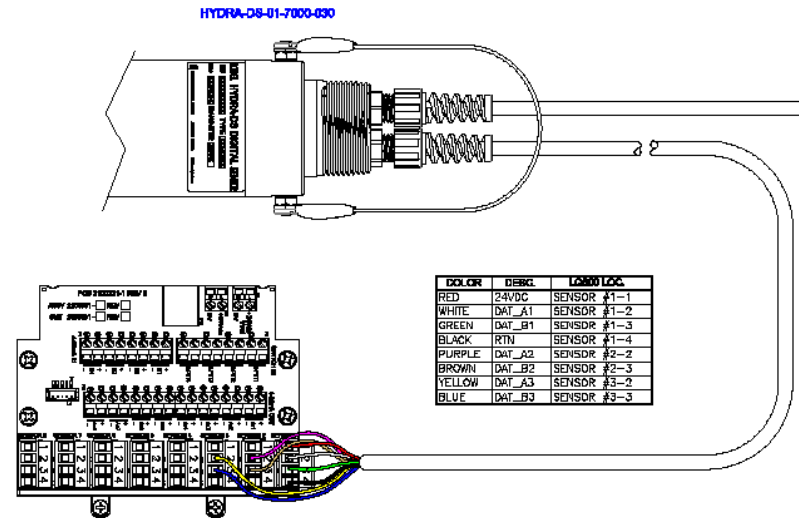


- Check the default Configuration, Cleaning Cycle, Alarm, Outputs, in the Instruction Manual, adjust if necessary.



Start Up Guide

❖ LQ800 Wiring :



- Check the default Configuration, Cleaning Cycle, Alarm, Outputs, in the Instruction Manual, adjust if necessary.



Start Up Guide

- ❖ The HYDRA is up and running
 - The Air Blast spray cleaner will actuate once every hour for 15 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.





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