HYDRA-DS Ammonium & HYDRA-DS Nitrate Analyzers

ELECTRO-CHEMICAL DEVICES

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, NH_4^+-N
  - HYDRA-DS-NO3
    - Nitrate as Nitrogen, NO_3^--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, $NH_4 \rightarrow NO_3$
  - De-Nitrification, $NO_3 \rightarrow N$
  - 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 NH_3/NH_4 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 NH_3/NH_4 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 NH_3/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

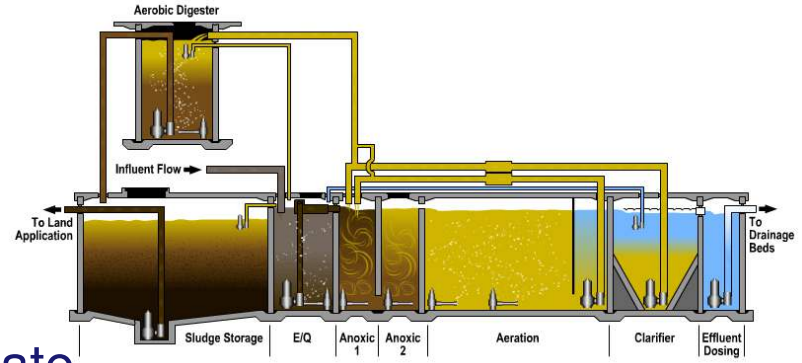
- Optimize the Nitrification
  - Real time $NH_4^+ \rightarrow NO_3^-$
  - High Nutrient Load infers a High O_2 requirement
  - The Nitrification rate is proportional to the O_2 ppm
  - Adding O_2 uses more power but lowers the time needed for Nitrification
- Use Hydra-DS-NH4 to control aeration
  - 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
    - $NH_4 \downarrow NO_3 \uparrow$
  - Denitrification (Anoxic)
    - Aeration OFF, Mixer ON
    - $NO_3 \downarrow N_2$ gas $\uparrow$
    - small amount $NH_4 \uparrow$
  - Nutrient Removal Phosphate
    - Aeration ON
    - Sludge Absorbs PO_4
    - $NH_4\downarrow$, $NO_3\downarrow$, $PO_4\downarrow$



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

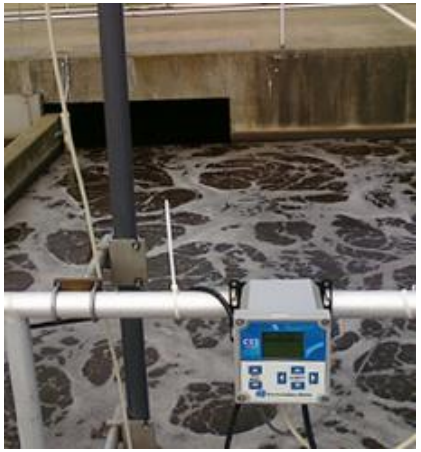
- The HYDRA-DS sensor is designed with few serviceable parts
  - (3) Easily replaceable electrodes
  - Spray Nozzle with wrench flats and ¼-20 thread
  - Screw off Sensor Guard with air purge hole, eliminates trap air bubbles
  - ¼” Compression Fitting on Air Feed Line

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.

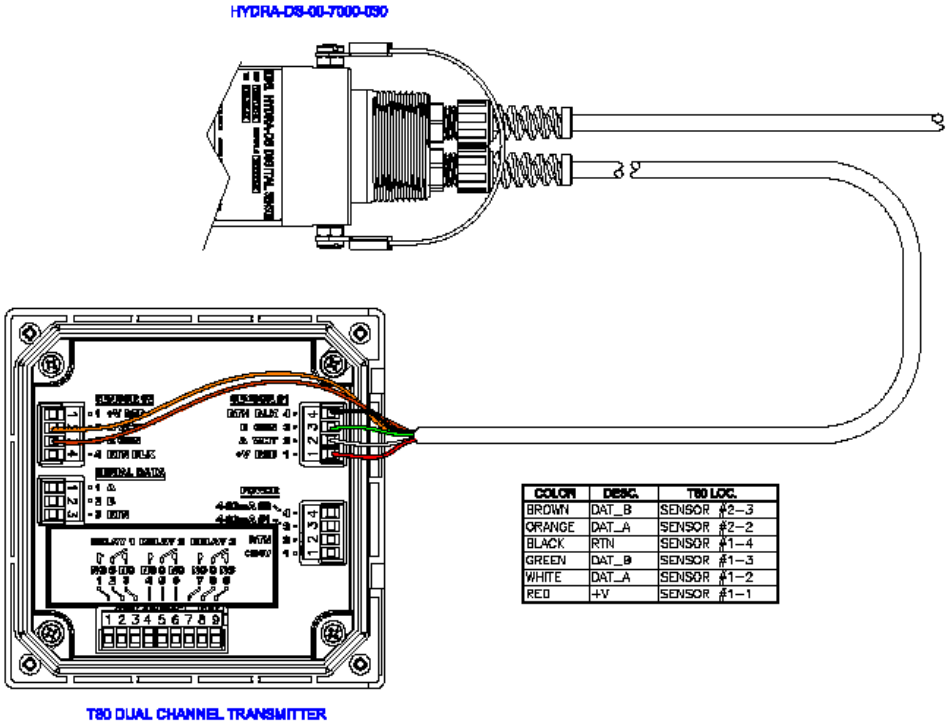
Start Up Guide

- Mount the Analyzer within 30 ft of the sensor's installation point.
- Connect a solenoid controlled ¼" air line to the HYDRA tube fitting. (feed the air tube through the Immersion Assembly)
- Connect the immersion assembly (1 ¼" 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

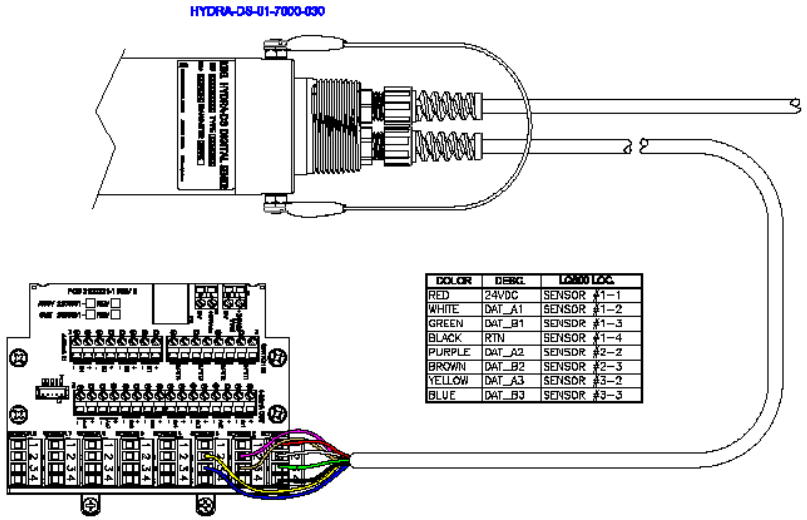


COLOR	DESC.	T80 LOC.
BROWN	DAT_B	SENSOR #2-3
ORANGE	DAT_A	SENSOR #2-2
BLACK	RTN	SENSOR #1-4
GREEN	DAT_B	SENSOR #1-3
WHITE	DAT_A	SENSOR #1-2
RED	+V	SENSOR #1-1

- 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.

Electro-Chemical Devices

Thank You,

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Electro-Chemical Devices
1500 N. Kellogg Dr.
Anaheim, Ca 92807
www.ecdi.com

Phone: +1-714-695-0051
+1-800-729-1333
Fax: +1-714-695-0057
email: sales@ecdi.com