Appendix G

Equipment Specifications

(Compact Disk)

SPXD 600/610 SERIAL DIGITAL INTERFACE SUBMERSIBLE PRESSURE TRANSDUCER

- Serial Digital Communications via SDI-12 Commands (SDI-12 Subset)
- Factory Serviceable Design
- High Static Accuracy & Repeatability
- Fully Temperature Compensated
- Reverse Polarity Protection
- Integral Transient Protection
- SPXD 610 includes Temperature Output

The SPXD-600 Submersible Pressure Transducer is designed to provide reliable, accurate water pressure/level measurements. The SPXD-610 provides a temperature measurement in addition to the pressure measurement (pressure output first in PSI, then Temperature in °C). This device is intended to combine the excellent performance of the KWK analog pressure transmitter with the convenience of the SDI-12 interface and commands. The result is a device with performance exceeding the requirements of many water level measurement applications and the simplicity of the three-wire SDI-12 connection scheme with pricing at the analog pressure transmitter level.

This unit incorporates an embedded microcontroller and 24 Bit A/D converter. Combining the sensor, analog measurement and signal processing within a single housing results in the integration of state-of-the-art sensor and measurement technology. The design utilizes an isolated silicon strain gauge sensor housed in a 316 Stainless Steel package to enhance reliability. The rugged construction makes the SPXD-600 suitable for liquid level measurement in water wells, lakes, streams and tanks.

Fully temperature compensated, the SPXD-600 is specified for operation over the 0 – 50°C (32 – 122 °F) temperature range. Static accuracy is specified at 0.1 % Span. Standard pressure ranges include 0 – 5, 15, 30, 50 and 100 PSIG (Vented).

The cable incorporates a vent tube to compensate for atmospheric pressure fluctuations (Gauge Units). The jacket is made of a rugged polyurethane and is designed to remain flexible and tough, even under harsh environmental conditions.

KWK Technologies, Inc. 509-466-5871 Fax: 509-468-7560 SPXD600_Rev0107A
1818 W Francis Ave #386
Spokane, WA 99205
www.kwktechnologies.com
Specifications Subject to Change Without Notice

Specifications (Firmware V1.1)

Electrical Specifications:

Excitation: 8 – 24 VDC
Operating Current: ~1.4 mA quiescent, ~7 mA peak during wake/measurement cycle
Sensors can be powered down between measurements to extend system battery life.
Operating Temperature Range: 0 – 60 °C, Nonfreezing

Wiring:

Red: + Power, 8 to 24 VDC
Black: Ground
Brown: SDI-12 Data line
Shield: Not Connected To Transducer Body. Recommend Connect to Ground at Host.

Communications:

Protocol: SDI-12 Subset. Supported Commands: a!, ?!, aM!, aD0!, aAb! (Supports wild card '?' address)
Hardware: SDI-12 Compatible Interface
Byte Frame Per SDI-12: 1 Start Bit, 7 Data Bits, 1 Parity Bit, Even Parity, 1 Stop Bit
Baud Rate: 1200 Bits/Second Per SDI-12
Output Units: PSI, °C (SPXD-610)
Note: 1 second delay after completion of measurement before initiating another measurement suggested. This also applies to applications with multiple sensors (each with a unique address) on a single bus system.
Use of '?!' command or wild card '?' address is limited to one sensor on bus to avoid contention.

Pressure Measurement Specifications:

Static Accuracy: 0.1 %Span (B.F.S.L.)[1]
Thermal Shift Zero: +/- 1.0% Span[2] (5 PSIG Range)
+/- 0.40 % Span[2] (All Other Standard Ranges)
Thermal Shift Span: +/- 0.75 % Span[2] (5 PSIG Range)
+/- 0.40 % Span[2] (All Other Standard Ranges)

Mechanical Construction:

Diameter: 1.0"
Length: 13" (includes Flex Seal/Strain Relief)
Sensor Element and Body: 316 Stainless
Top Cap and End Cone Assembly: Delrin
Other wetted materials: Viton, Nylon, Buna-N

Cable:

Diameter: 0.290" Nominal
Shielded, 9 Conductor #24 AWG, Polyethylene Insulators
Jacket: Polyurethane
Integral Vent Tube
Cable Resistance: 0.026 Ohm/Ft Typ., TCR: 0.3%/°C

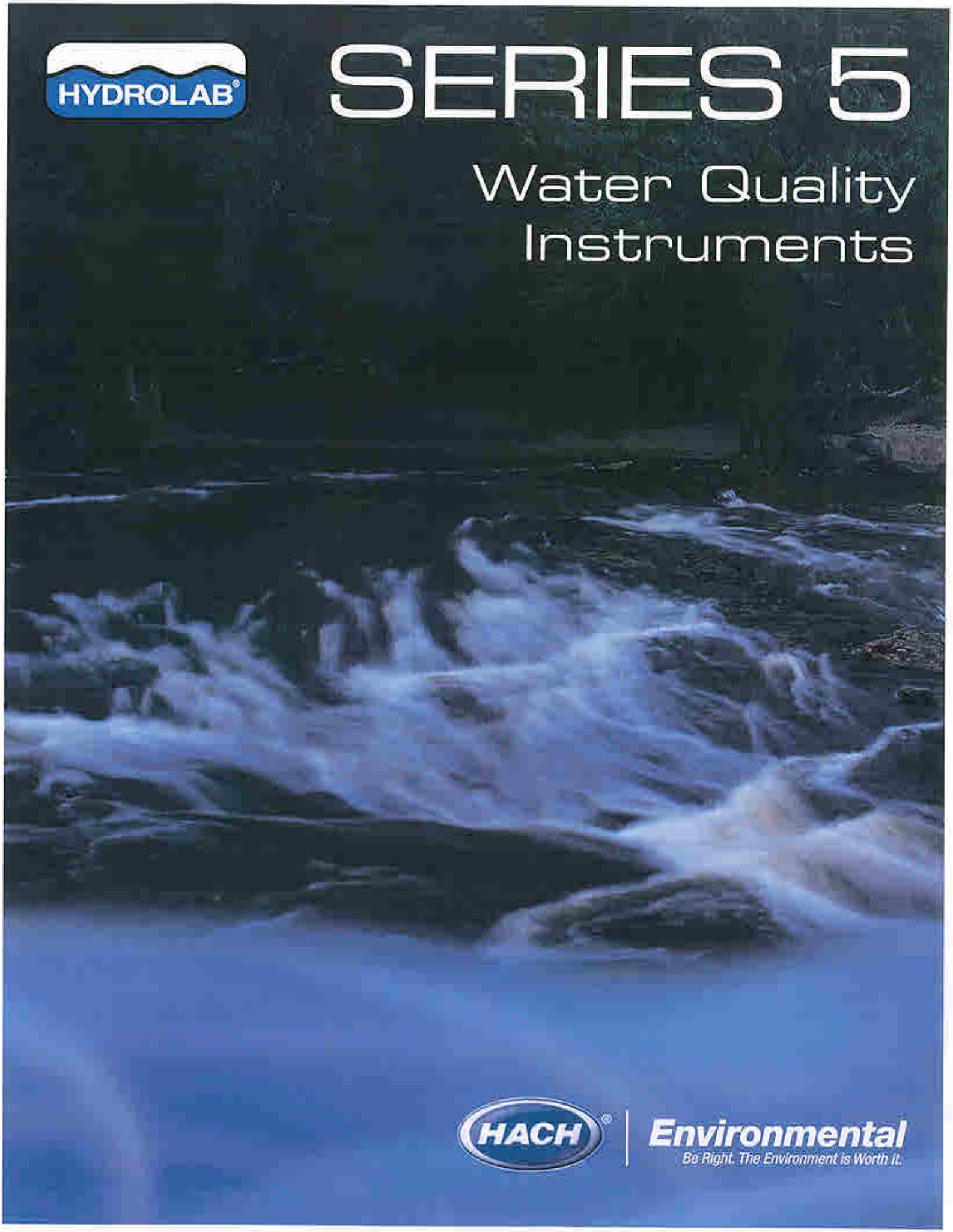
Notes:

1. Includes Linearity, Repeatability and Pressure Hysteresis at 25 °C.
2. 0 – 50 °C, Referenced to 25°C.

HYDROLAB®

SERIES 5

Water Quality Instruments



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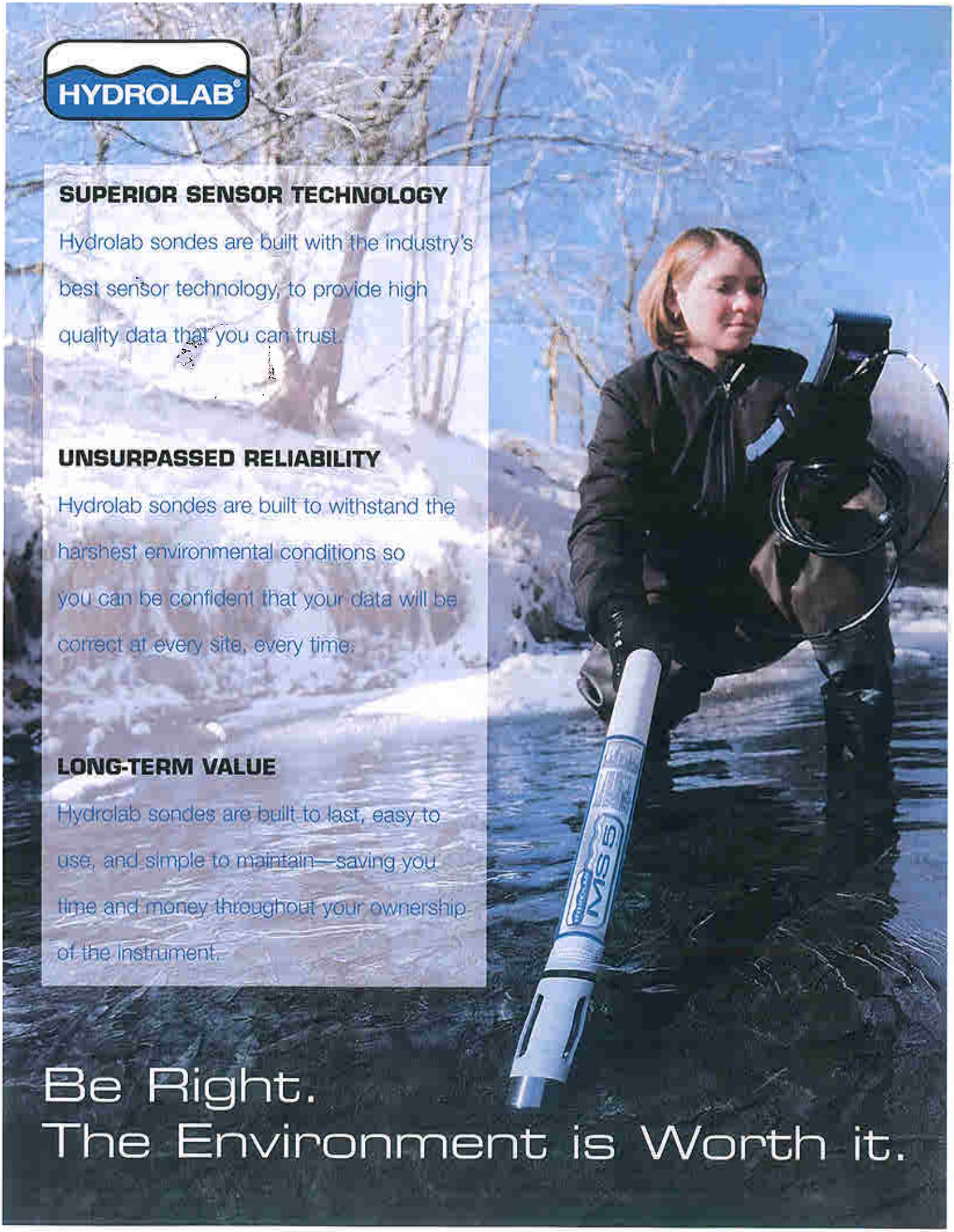
Be Right. The Environment is Worth it.


HYDROLAB®
SUPERIOR SENSOR TECHNOLOGY
Hydrolab sondes are built with the industry's best sensor technology, to provide high quality data that you can trust.
UNSURPASSED RELIABILITY
Hydrolab sondes are built to withstand the harshest environmental conditions so you can be confident that your data will be correct at every site, every time.
LONG-TERM VALUE
Hydrolab sondes are built to last, easy to use, and simple to maintain—saving you time and money throughout your ownership of the instrument.
MS5
Be Right.
The Environment is Worth it.

SERIES 5
Water Quality Instruments

SONDES

MS5

- Four built-in expansion ports configured to fit your specific needs
- Measures up to 10 parameters simultaneously
- Compact and lightweight 1.75" diameter housing fits into groundwater wells
- Used for attended or unattended monitoring

DS5

- Seven built-in expansion ports configured to fit your specific needs
- Measures up to 15 parameters simultaneously
- Capable of measurements using any of Hydrolab's 15 sensors
- Used for attended or unattended monitoring

DS5X

- Ideal for "X-tended" deployments in environments where fouling and sediment are abundant
- Central cleaning system wipes away fouling from adjacent sensors to reduce the maintenance frequency
- Seven built-in expansion ports configured to fit your specific needs
- Measures up to 15 parameters simultaneously

COMMUNICATIONS

SURVEYOR

- Complete set-up capability allows users to leave their laptops in their offices
- Designed specifically for use in severe field conditions, the Surveyor can take a beating on land or in the water and still deliver your data
- Displays data in real-time or can store up to 375,000 measurements
- Oversize screen with backlight allows data to be viewed in any conditions
- Available with optional GPS and Barometric Pressure capabilities

HYDRAS 3 LT

- Real-time, multi-parameter time series graphing and vertical profiling
- Simple, point and click calibration of any parameter
- One-click download for field data collection
- User-programmable stability check on each sensor
- Included free with every Series 5 sonde

SENSORS

Hach LDO®

- Longest lasting calibrations
- Features the best accuracy available for DO measurement
- No membranes so maintenance is simple
- Clark Cell also available

Conductivity

- Open cell allows reliable measurements in any environmental condition —sediment falls to the bottom and bubbles rise to the top

pH

- Reference electrode is easily refilled in seconds—independent of the pH sensor
- pH sensor does not need replacement when reference electrode is depleted; simply refill the reference

Turbidity: Self-Cleaning

- User-programmable self-cleaning system can perform up to 10 cleaning cycles before each reading
- 3000 NTU range allows Turbidity tracking even during rain storms or other events that could cause abnormally high readings
- 4-Beam and Standard Turbidity also available

Depth

- Optimized for depths down to 10m, 25m, 100m, or 200m

Chlorophyll a

- Ultra-compact size designed by Turner Designs specifically for integration into Hydrolab sondes
- Provides the most accurate measurement of Chlorophyll a because of electronic filtration of ambient light, efficient optical coupling, and quality optical components.

Blue-Green Algae

- Real-time measurement identifies potential algal blooms before they become problematic, allowing time for corrective action
- Ultra-compact size designed by Turner Designs specifically for integration into Hydrolab sondes
- Provides the most accurate measurement of phycocyanin or phycoerythrin because of electronic filtration of ambient light, efficient optical coupling and quality optical components

Ion-Selective Electrodes

- Available for monitoring Ammonia/ Ammonium, Nitrate, or Chloride

ORP

- Uses a simple platinum band that donates or accepts electrons to monitor chemical reactions, quantify ion activity, or determine the oxidizing or reducing properties of a solution

Total Dissolved Gas

- Real-time measurement indicates water supersaturated with atmospheric gases, which can cause gas bubble gill disease in aquatic organisms

Rhodamine WT

- Ultra-compact size designed by Turner Designs specifically for integration into Hydrolab sondes
- Provides the most accurate measurement of Rhodamine WT because of electronic filtration of ambient light, efficient optical coupling, and quality optical components

PAR

- Provides a real-time measurement of sunlight intensity, which influences biota that rely on photosynthesis for nutrition

Temperature

- Provides critical compensation for Dissolved Oxygen, Conductivity, pH, and nutrient sensors
- Included with every sonde

HYDROLAB®

SPECIFICATIONS

Sondes

Size
DataSonde:
Outer diameter – 3.5"/8.9 cm
Length – 23"/58.4 cm
MiniSonde:
Outer diameter – 1.75"/4.4 cm
Length – 29.5"/74.9 cm (with battery pack)

Weight
DataSonde:
7.4 lbs/3.35 kg (typical)
MiniSonde:
2.9 lbs/1.3 kg
(typical with battery pack)

Computer Interface
RS-232, SDI-12, RS-485

Memory
120,000 measurements

Battery Supply
DataSonde: 8 C batteries
MiniSonde: 8 AA batteries

Operating Temperature
-5 to 50°C

Maximum Depth
225 m

Sensors

	Range	***Accuracy***	***Resolution***
Hach LDO™	0 to 20 mg/L	± 0.1 mg/L @ < 8mg/L ± 0.2 mg/L @ > 8mg/L	0.01 mg/L
Polarographic DO	0 to 50 mg/L	± 0.2 mg/L @ < 20mg/L ± 0.6 mg/L @ > 20 mg/L	0.01 mg/L
Conductivity	0 to 100 mS/cm	± 0.5% of reading ± 0.001 mS/cm	4 digits
Salinity	0 to 70 ppt	± 0.2 ppt	0.01 ppt
pH	0 to 14 pH units	± 0.2 units	0.01 units
Turbidity, Self-Cleaning	0-3000 NTU	*Compared to StablCal* 1% up to 100 NTU 3% from 100-400 NTU 5% from 400-3000 NTU	0.1 NTU from 0-400 NTU; 1 NTU for >400 NTU
Turbidity, 4-Beam	0-1000 NTU	5% of reading; or ± 1 NTU	0.1 NTU from 0-100 NTU; 1 NTU for >100 NTU
Depth	0 to 10m (Vented Level) 0 to 25m 0 to 100m 0 to 200m	± 0.003 meters ± 0.05 meters ± 0.05 meters ± 0.1 meters	0.001 meters 0.01 meters 0.01 meters 0.1 meters
Chlorophyll a	*Dynamic Range* Low sensitivity: 0.03-500µg/L Med. sensitivity: 0.03-50µg/L High sensitivity: 0.03-5µg/L	± 3% for signal level equivalents of 1 ppb rhodamine WT dye or higher using a rhodamine sensor	0.01 µg/L
Blue-Green Algae	*Dynamic Range* Low sensitivity: 100-2,000,000 cells/mL Med. sensitivity: 100-200,000 cells/mL High sensitivity: 100-20,000 cells/mL	± 3% for signal level equivalents of 1 ppb rhodamine WT dye or higher using a rhodamine sensor	20 cells/mL
Ion Selective Electrodes			
Ammonia Max Depth: 15 meters	0 to 100 mg/L-N	Greater of ± 5% of reading, or ± 2 mg/L-N	0.01 mg/L-N
Nitrate Max Depth: 15 meters	0 to 100 mg/L-N	Greater of ± 5% of reading, or ± 2 mg/L-N	0.01 mg/L-N
Chloride Max Depth: 15 meters	0.5 to 18000 mg/L	Greater of ± 5% of reading, or ± 2 mg/L	4 digits
TDG (Total Dissolved Gas)	400 to 1300 mmHg	± 0.1% of span	1.0 mmHg
ORP	-999 to 999 mV	± 20 mV	1 mV
Rhodamine WT	*Dynamic Range* Low sensitivity: 0.04-1000 ppb Med. sensitivity: 0.04-100 ppb High sensitivity: 0.04-10 ppb	± 3% for signal level equivalents of 1 ppb rhodamine WT dye or higher using a rhodamine sensor	0.01 ppb
PAR	0 to 10,000 µmol $s^{-1}m^{-2}$	± 5% of reading, or ± 1 µmol $s^{-1}m^{-2}$	1 µmol $s^{-1}m^{-2}$
Temperature	-5 to 50°C	± 0.10°C	0.01°C

HYDROLAB®

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HACH® Environmental
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Hach Environmental
5600 Lindbergh Drive
Loveland, CO 80539

(800) 949-3766
(970) 669-3050
fax (970) 461-3921

hachenvironmental.com