The Aquadopp® Profiler measures water column current profiles using acoustic Doppler technology. Designed for a wide range of applications from coasts to rivers, the Aqudopp® Profiler is a small, lightweight, and cost-effective solution for shallow water (<100 m) deployments. It can be deployed on the bottom, on a buoy, or on a mooring line. The profiler is a complete system and includes all parts required for a self contained deployment with internal batteries and a data logger. Additional configurations are available for online data communication.

Aquadopp© Profiler

- Surface to bottom velocity profiles
- Profiling ranges from 0.5 to 90 m
- Online data communications
- Small, light, easy to deploy
- Great value

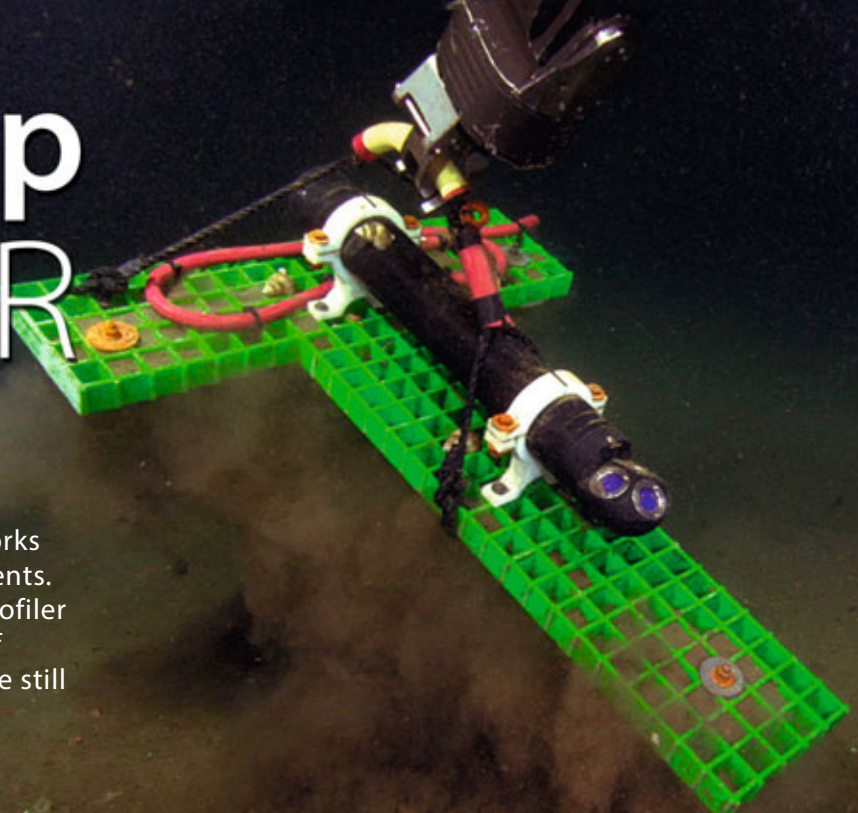CURRENT AND WAVE MEASUREMENTS IN THE OCEAN, LAKE AND LABORATORY

NORTEK

www.nortek-as.com
True innovation makes a difference

Aquadopp
PROFILER

The Nortek Aquadopp® Profiler is designed with flexibility in mind. It is small, easy to use, and works equally well in ocean, coastal, or river environments. From its introduction in 2000, the Aquadopp® Profiler has represented a completely new generation of current profilers, and remains at the cutting edge still today.

Typical Applications

Small and easy-to-use, the acoustic doppler Aquadopp® Profiler has become a favorite for use in estuaries and shallow coastal water.

It is a cost-effective tool for any shallow water (<100 m) environment, functioning equally well in typical ocean surface waters as high sediment suspension areas near the coast or in rivers. Typical applications include coastal studies as well as studies in rivers, lakes and channels, and online monitoring.

The Aquadopp® Profiler can be deployed on any fixed structure - small, low cost bottom frames, mooring lines, surface buoys, etc.

With a flexible design, options are available for the Aquadopp® Profiler to reduce blanking distance, increase vertical resolution, calculate full directional wave spectra, and profile horizontally in 2D.

The Aquadopp® Profiler Design

The Aquadopp® Profiler measures high-quality, accurate, and unbiased three-component (East, North, Up) current profile data using acoustic Doppler technology. It can measure speed and direction in up to 128 different layers of the water column.

System electronics integrate Doppler velocity with temperature, pressure, tilt, and compass information – all standard with each instrument.

The Aquadopp® Profiler has a built-in solid state data recorder and batteries. State-of-the-art power management and miniaturized electronics combine in a compact single-canister design that is suitable for real-time operation or self-contained deployments. Online telemetry options include cellphone or radio modems and the Nortek AOS.

The Aquadopp® Profiler provides significant advantages for your project:

- All plastic and titanium parts eliminate corrosion
- No moving parts that can be blocked or damaged
- Remote sampling volume is not affected by bio-fouling
- Z-Cell option eliminates blanking distance
- Effective directional wave gauge
- Internal compass, tilt, pressure, and temperature sensors
- Online data communication options
- Small and light weight (less than 3.5 kg)
- Log data from external analog sensors, such as OBS or CT sensors

A variety of transducer head designs allow flexibility in deployment and measurement needs:

| Sidelooking | 1MHz and 2MHz | 400kHz | 600kHz | Z-Cell 600kHz | Z-Cell 1MHz |

HR Profiler

The High Resolution (HR) firmware upgrade turns the Aquadopp® Profiler (1 and 2 MHz models) into a high resolution profiler operating at sub-cm scales with sampling rates as fast as 8 Hz.

Though primarily designed for mean flow studies, the robust computational algorithms of the HR Profiler make it possible to measure conditions with significant flow variations. Whether measuring bottom boundary layers, internal wave generation in lakes, flow under ice, or low energy environments, the HR Profiler is the perfect tool.

To measure velocity profiles at such a fine vertical resolution (as small as 0.7 cm), the HR firmware implements a pulse-coherent processing technique that provides extremely low noise measurements.
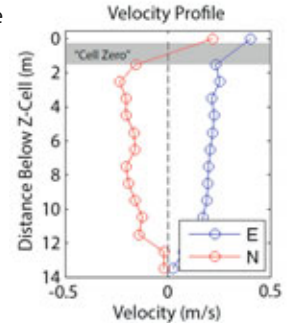
HR Profiler Features:

- Internal data recording (16 GB)
- Reduced blanking distance (5 cm)
- 3D velocity profiles, 0.7 - 5 cm resolution
- Continuous (1 Hz) and burst (max 8 Hz) sampling modes
- Extended velocity range mode for energetic environments
- Configurable for selected beam samplings (1, 2 or 3 beams)
- Measures to within a few cm of the bottom (or ice layer)
- Easily switch between "normal" and HR Profiler modes
- Simultaneous measurements of velocity profiles and acoustic scattering strength
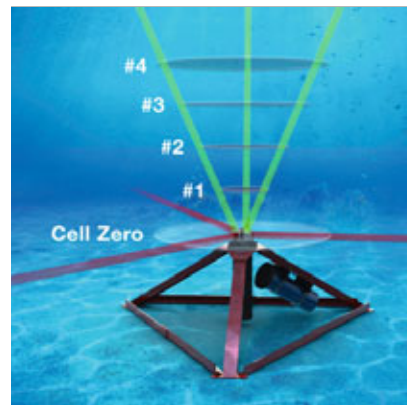
Z-Cell

A standard current profiler cannot measure currents near its transducers. This blanking distance of a few meters can cause the instrument to miss key current velocity data at the boundary layer, either close to the surface or seabed.

Studies show that the surface current can be quite different from what is normally observed 2-3 m below the surface, especially in regions with shallow thermoclines or stong winds.

The Aquadopp® Z-Cell, a hardware and firmware extension to the 1 MHz and 600 kHz Aquadopp® Profilers, eliminates this blanking distance. By adding an extra set of horizontal transducers (2 MHz) to the Aquadopp® Profiler, the Z-Cell is able to measure the 2D current velocity at the level of the instrument or "Cell Zero."

Profilers with the Aquadopp® Z-Cell extension can be mounted on a surface buoy or bottom frame.

The monitoring of near surface currents, enabled by the Aquadopp® Z-Cell, may aid in the study of harmful algal Blooms, sediment plumes, HAZMAT spill tracking, and search and rescue efforts.
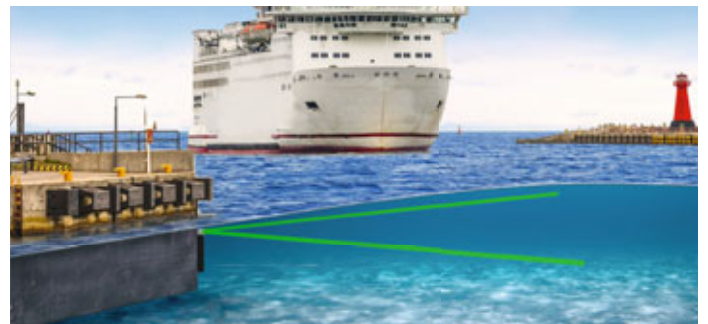
PUV Waves

The Aquadopp® Profiler can be configured as a combined wave and current system, collecting (PUV) wave height, period and direction data interleaved (at 1 Hz or 2 Hz) with mean current profiles. Configuring the Aquadopp® Profiler for wave measurement is done through the standard Aquapro software.

The PUV method is used to calculate the full directional wave spectra from the raw data, based on linear wave theory. Pressure is used to estimate non-directional parameters (height and period), and the combination of the pressure and the two horizontal velocity components U and V are used to calculate wave direction.

As a wave sensor, the Aquadopp® Profiler requires extra internal memory and battery capacity, but it is clearly the most cost-effective PUV instrument in the market.

Horizontal Profiling

Some applications require 2D horizontal current profiles rather than the standard vertical 3D profiles. This is possible with all Aquadopp Profilers (except the 400 kHz model) through a special 2D side-looking transducer arrangement.

The 2D side-looking Aquadopp® head can be used to measure 2D (East and North) flow away from walls or boundaries. Typical applications include channel flow monitoring where the Aquadopp® is mounted on the channel wall – protected from floating debris – and measurements are made in the free flow away from the wall.

Additional applications that may benefit from this feature include harbors and port entrances with complex current regimes, as well as loading buoys and offshore platforms where maneuvering of ships is critical.

SeaState - Online Deployment

SeaState is an online software that provides real time, 2-way communication with the Aquadopp® Profiler. This communication allows a researcher the agility to examine dynamic coastal systems, adjusting sampling regimes in real time to capture small scale episodic events.

SeaState works in conjunction with the standard Aquadopp® Profiler software, using the profilers software to configurate the instrument and to initiate data collection.

In addition to real time communication, the SeaState software collects, processes, records and displays current and wave data in real time as graphical images. These images are useful for engineering, monitoring, and scientific applications, and the intuitive graphics can provide a solution for displaying complex data for the public and decision makers.

SeaReport - Post Processing Toolbox

SeaReport is an easy to use, graphical data processing and reporting software suitable for engineers and data analyzers.

SeaReport accepts raw data files from Aquadopp® Profilers and provides quick and precise insight into the data. Outputs include graphics of simple time series, maps with rose plot overlays and data tables with statistical information. Graphics are resizable, providing the ability to zoom in on a subset of the data.

An often challenging task when analyzing data is quality control. SeaReport offers integrated quality control of sensor and profiler data, ensuring statistical results are not biased by artifacts.

A complete data report can be generated from SeaReport by simply pressing a button. Reports are created in Microsoft Word, with data presented in tabular and graphic format.

AOS - Autonomous Online System

The Nortek Autonomous Online System (AOS) offers online access to ocean current and wave data from virtually any location worldwide through Iridium data telemetry. It is a complete data collection solution that includes a local power supply and online data display.

The AOS data display provides an easy and intuitive user interface. Key parameters are presented graphically and historical data are available for download to Excel. Built in GPS and map functionality help track the AOS unit in situ.

The Nortek AOS hardware has been designed to operate in harsh environments. It's weather proof and rugged enclosure has been tested in cold and humid conditions.

How AOS Works
Current profile data from the Aquadopp® Profiler are transmitted via serial interface and cable to the AOS box. The AOS Iridium satellite modem communicates data to the AOS-server, and the AOS-server stores and provides data for presentation online.

No software installation or programming is required. Simply deploy the Aquadopp® Profiler, connect the AOS interface unit, push the "ON" button, and access your data on the Internet.
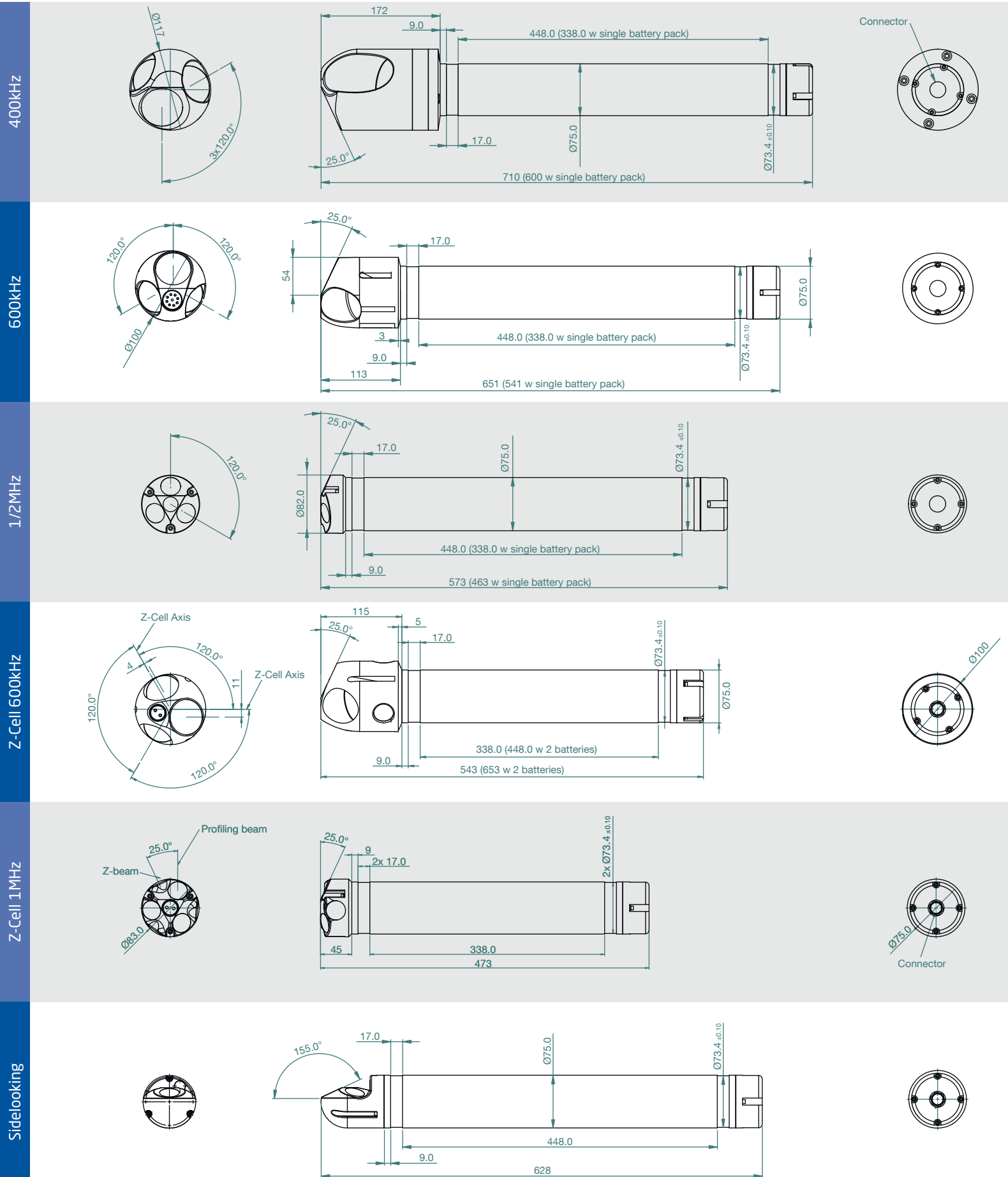
Data Access
Data are stored on a secure server hosted by Nortek. Upon logging on to the AOS webportal and registering your profiler, you will gain immediate access to data on the server. The server updates frequently, enabling continuous access to real time data.

The flexible AOS data display allows the interface to be tailored to your specific requirements and preferences. Displays may be made either private or public (all or in part). Number of cells and transmit interval may also be reconfigured from the online interface.

Data volume and cost can be kept to a minimum through options to control which data are transfered over the iridium data link and focus on vital data subsets. Full datasets are stored on the profiler itself in the internal data logger.

The cost of the AOS system includes: (1) a fixed cost related to basic hosting services and iridium subscription and (2) a variable cost based on actual data transfer volume.

All systems are shipped standard with space for a double-sized 100Wh alkaline battery.
Available options include canisters with space for a single-sized battery or no battery at all.

400kHz

Ø117
3x120.0°
172
9.0
448.0 (338.0 w single battery pack)
Connector
17.0
Ø75.0
25.0°
Ø73.4 ±0.10
710 (600 w single battery pack)

600kHz

120.0°
120.0°
Ø100
25.0°
17.0
54
Ø75.0
3
448.0 (338.0 w single battery pack)
9.0
Ø73.4 ±0.10
113
651 (541 w single battery pack)

1/2MHz

120.0°
25.0°
17.0
Ø75.0
Ø73.4 ±0.10
Ø82.0
448.0 (338.0 w single battery pack)
9.0
573 (463 w single battery pack)

Z-Cell 600kHz

Z-Cell Axis
120.0°
4
11
Z-Cell Axis
120.0°
120.0°
115
5
25.0°
17.0
Ø73.4 ±0.10
Ø75.0
Ø100
338.0 (448.0 w 2 batteries)
9.0
543 (653 w 2 batteries)

Z-Cell 1MHz

Profiling beam
25.0°
Z-beam
Ø83.0
9
2x 17.0
2x Ø73.4 ±0.10
45
338.0
473
Ø75.0
Connector

Sidelooking

155.0°
17.0
Ø75.0
Ø73.4 ±0.10
448.0
9.0
628

All dimensions in mm.

Water velocity measurement

Acoustic frequency:	**0.4MHz**	**0.6MHz**	**1.0MHz**	**2.0MHz**
Maximum profiling range*:	60–90m	30–40m	12–20m	4–10m
Cell size:	2–8m	1–4m	0.3–4m	0.1–2m
Beam width:	3.7°	3.0°	3.4°	1.7°
Minimum blanking:	1m	0.50m	0.20m	0.05m
Number of beams:	3			
Maximum # cells:	128			
Velocity Range:	±10m/s (inquire for extended range)			
Accuracy:	1% of measured value ±0.5cm/s			
Max. Sampling rate:	1Hz			
Velocity uncertainty:	Consult software program			

*) The Aquadopp profiler measures the current profile in a user specified number of cells from the instrument out to a maximum range that depends on the acoustic scattering conditions. The lower range should be expected with clear water and small cells and the higher range with large cells and acoustically turbid water.

HR Mode Water velocity measurement

Acoustic frequency:	**1.0MHz**	**2.0MHz**		
Maximum profiling range*:	6m	3m		
Cell size:	20-300mm	7-150mm		
Beam width:	3.4°	1.7°		
Minimum blanking:	0.2m	0.03m		
Maximum # cells:	128			
Range/velocity limitations:	Product of profiling range and velocity should not exeed 0.5m2/s (2MHz system) or 1.0m2/s for (1MHz system)			
Accuracy:	1% of measured value ±0.5cm/s			
Max. Sampling rate:	1Hz (continous mode), 8Hz (burst mode)			
Velocity uncertainty:	Consult software program			

Cell zero (optional for 0.6MHz and 1MHz tranducers)

Cell zero acoustic frequency:	2Mz
Maximum profiling range*:	0.4-0.9m
Number of beams:	3

Echo intensity

Sampling:	Same as velocity
Resolution:	0.45dB
Dynamic range:	90dB

Standard sensors

Temperature:	Thermistor embedded
Range:	–4°C to 30°C
Accuracy/resolution:	0.1°C/0.01°C
Time response:	10 min
Compass:	Magnetometer
Accuracy/resolution:	2°/0.1° for tilt <20°
Tilt:	Liquid level
Accuracy/resolution:	0.2°/0.1°
Maximum tilt:	30°
Up or down:	Automatic detect
Pressure:	Piezoresistive
Range:	0–100m (standard), inquire for options
Accuracy/resolution:	0.5%/0.005% of full scale

Analog inputs

Number of channels:	2
Voltage supply:	Three options selectable through firmware commands: •Battery voltage / 500 mA •+5V / 250 mA •+12V /100 mA
Voltage input:	0–5V
Resolution:	16 bit A/D

Data communication

I/O:	RS232, RS422. Software supports most commercially available USB–RS232 converters
Communication Baud rate:	300–115200 (baud)
Recorder download baud rate:	600/1200 k.Baud for both RS232 and RS422

Data recording

Capacity:	9 MB, can add 32/176/352/MB & 4GB Prolog
Data record:	32 bytes + 9×Ncells
Mode:	Stop when full (default) or wrap mode
Software:	AquaPro
Operating system:	Windows®XP, Windows® 7
Functions:	Deployment planning, data retrieval, ASCII conversion, online data collection, and graphical display

Power

DC Input:	9-15VDC
Peak current:	3A
Max average consumption at 1Hz:	0.2–1.5W
Sleep consumption:	0.0003 mW (RS232), 0.005 mW (RS422)
Transmit power:	0.3–20W, 3 adjustable levels

Real time clock

Accuracy:	+/- 1min/year
Backup in absence of power:	4 weeks

Internal batteries

Type/capacity:	18 AA Alkaline cells/50Wh
New battery voltage:	13.5VDC
Duration (10-minute avg.):	80 days for 2MHz, 0.5m cells 50 days for 1MHz, 1.0m cells

Exact battery consumption and velocity uncertainty are complex functions of the deployment configuration. Please consult the AquaPro software for more exact predictions.

Materials

Standard:	Delrin and polyurethane plastics with titanium screws
Intermediate and deepwater models:	Titanium and Delrin plastics

Connectors

Bulkhead (Impulse):	MCBH-8-FS
Cable:	PMCIL-8-MP on 10-m polyurethane cable

Environmental

Operating temperature:	–5°C to 35°C
Storage temperature:	–20°C to 60°C
Shock and vibration:	IEC 721–3–2
Depth rating:	300m

Dimensions

	0.4MHz	0.6MHz	1MHz/2MHz
Weight in air:	3.4 kg	2.9 kg	2.2 kg
Weight in water:	0.2 kg	0.4 kg	0.2 kg
Length:	see dimensional drawings		
Diameter:	see dimensional drawings		

Options

Batteries:	Lithium, Li-Io rechargeable
External batteries:	Alkaline, Lithium or Lithium Ion. See battery brochure for details
Transducer head:	Right angle head for 1 or 2MHz. Inquire for special configurations
Deep water systems:	Inquire for 3000m & 6000m versions
Communication:	Request special harness for RS422

TS-031-en-06.2013

http://www.youtube.com/NortekInfo
http://www.facebook.com/norteknews
http://twitter.com/norteknews

TRUE INNOVATION MAKES A DIFFERENCE