

Revolutionize Underwater Acoustic Communication

38,400 Baud, Power Efficient, Highly Robust

Underwater Acoustic Modems



Based on cutting-edge **Broadband Acoustic Spread Spectrum** technology, LinkQuest's extensive line of high speed underwater acoustic modems have revolutionized underwater acoustic communication. The advanced technologies have achieved:

- Dramatically improved data rate up to 38,400 bits/s
- Unprecedented reliability with bit error rate of less than 10^{-9}
- Significantly reduced power consumption

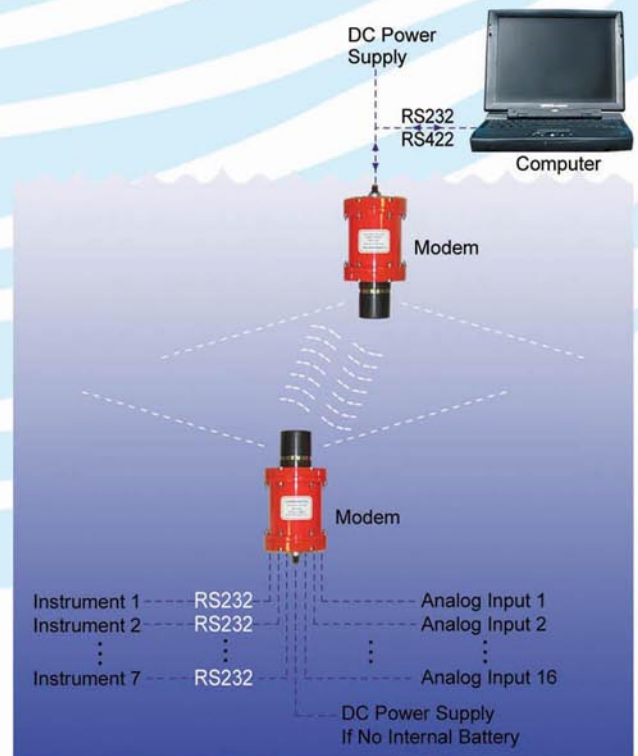
MAIN FEATURES

- The best selling underwater acoustic modems in the world
 - Transport over 95% of world's acoustic comm data
 - Largest undersea acoustic communication networks
 - World record in uploading more than 50 Gbytes of data from a single pair of modems on an AUV
 - The world's first long-term high speed acoustic communication from offshore drilling DP vessels
 - World record in acoustic uploading 200 Mbytes of Acoustic Current Profiler recorder data in less than a year
 - Over 200 successful deployments with Acoustic Current Profilers and current meters
 - World record in transporting more than 800 Mbytes of real-time wave data using a single battery pack
- A modem pair forms a completely transparent wireless RS-232 connection
 - No need to modify instrument software
 - Most advanced high speed digital modem technology
 - State of the art DSP technology
 - Broadband transducer technology
 - Sophisticated two-way communication protocol
 - Reduced cost, easier maintenance and better reliability over conventional cable communications
 - Intergrated into LinkQuest's **TrackLink** USBL tracking systems and **PinPoint** LBL acoustic positioning systems
 - **Data fusion** option to interface to multiple instruments and log data in compact flash disk

SYSTEM FEATURES

- **Broadband Acoustic Spread Spectrum** technology
- Advanced hybrid modulation scheme
- Channel equalization to combat multipaths
- Highly effective error correction coding
- Automatic rate adaptation
- Horizontal and vertical environments

LinkQuest's modems have been widely deployed all over the world for offshore oil field applications, environmental monitoring, AUV high speed data link, AUV command and control, manned submersibles, underwater constructions and acoustic data uploading applications. Clients include Fugro Chance, Fugro GEOS, Fugro Survey, Kongsberg, Boeing, Oceaneering, BP, Shell, ExxonMobil, Total, Petrobras, C&C Technologies, Mitsubishi, NOAA PMEL, NOAA AOML, NOAA NOS, NOAA National Data Buoy Center, WHOI, USGS, Environment Canada, Japan Marine Science and Technology Center, Dunstaffnage Marine Lab (UK), Proudman Oceanographic Laboratory (UK), CEFAS (UK), Institute of Marine Research (Norway), ENEA (Italy), Australian Institute of Marine Science, The University of Maryland, Virginia Institute of Marine Science, National University of Singapore, and US Navy.



Underwater Acoustic Modem Models

Broadband Acoustic Spread Spectrum Technology

UWM1000



- RS-232 data rate: 9600 bits/second
- Payload data rate: 7000 bits/second
- Acoustic link: 17.8 Kbits/second
- Bit error rate: less than 10^{-9}
- Working range: 350 meters
- Maximum depth: 200 meters
- Environments:
Near-vertical or horizontal
- Transmit mode power consumption:
1 Watt (narrow and wide beam)
2 Watts (omni-directional)
- Receive mode power consumption:
0.75 Watt
- Sleep mode power consumption:
8 mW
- Beamwidth of transducer:
120 degrees (wide beam) or
210 degrees (omni-directional) or
70 degrees (narrow beam)
- Operating Frequency:
26.77 to 44.62 kHz
- Voltage: 12 to 24 volts
- Overall length: 235.7 mm
- Housing diameter: 87.2 to 126.2 mm
- Weight out of water: 4.2 kg
- Weight in water: 2.3 kg
- RS-232 input data buffer: 900 Kbytes
- Optional Higher Data Rate:
19,200 baud
- Options: Data Fusion

UWM2000



- RS-232 data rate: 9600 bits/second
- Payload data rate: 6600 bits/second
- Acoustic link: 17.8 Kbits/second
- Bit error rate: less than 10^{-9}
- Working range:
1500 meters (narrow beam)
1200 meters (omni-directional)
- Maximum depth: 2000 or 4000 meters
- Environments:
Near-vertical or horizontal
- Transmit mode power consumption:
2 or 8 Watts
- Receive mode power consumption:
0.8 Watt
- Sleep mode power consumption:
8 mW
- Beamwidth of transducer:
70 degrees (narrow beam) or
210 degrees (omni-directional)
- Operating Frequency:
26.77 to 44.62 kHz
- Voltage: 12 to 24 volts
- Overall length: 249.7 mm
- Housing diameter: 87.2 to 126.2 mm
- Weight out of water: 4.8 kg
- Weight in water: 2.6 kg
- RS-232 input data buffer: 900 Kbytes
- Optional Higher Data Rate:
19,200 baud
- Options: Data Fusion, High Transmit power

UWM2000H



- RS-232 data rate: 1500 bits/second
- Payload data rate:
300 to 1200 bits/second
- Acoustic link: 17.8 Kbits/second
- Bit error rate: less than 10^{-9}
- Working range:
1200 meters (omni-directional)
1500 meters (narrow beam)
- Maximum depth:
2000 meters
- Environments: Long-range shallow to very shallow water environments with very harsh multi-path conditions
- Transmit mode power consumption:
2 or 8 Watts
- Receive mode power consumption:
0.8 Watt
- Sleep mode power consumption:
8 mW
- Beamwidth of transducer:
70 degrees (narrow beam) or
210 degrees (omni-directional)
- Operating Frequency:
26.77 to 44.62 kHz
- Voltage: 12 to 24 volts
- Overall length: 249.7 mm
- Housing diameter: 87.2 to 126.2 mm
- Weight out of water: 4.8 kg
- Weight in water: 2.6 kg
- RS-232 input data buffer: 500 Kbytes
- Options: Data Fusion, Higher Transmit Power

UWM2200



- RS-232 data rate: 19,200 bits/second
- Payload data rate: 14,000 bits/second
- Acoustic link: 35.7 Kbits/second
- Bit error rate: less than 10^{-9}
- Working range: 1000 meters
- Maximum depth:
1000 meters or 2000 meters
- Environments:
Near-vertical or horizontal
- Transmit mode power consumption:
6 Watts
- Receive mode power consumption:
1 Watt
- Sleep mode power consumption:
12 mW
- Beamwidth of transducer: 90 degrees
- Operating Frequency:
53.55 to 89.25 kHz
- Voltage: 12 to 24 volts
- Transducer Housing Dimension:
25.0 mm(diameter) x 85.0 mm(length)
- Electronics Housing Dimension:
126.2 mm(diameter) x 160.0 mm(length)
- Weight out of water: 3.0 kg
- Weight in water: 1.4 kg
- RS-232 input data buffer: 900 Kbytes
- RS-232 Configuration:
19,200 baud, 1 start bit, 1 stop bit, no parity bit, and no flow control
- Optional data rate: 38,400 baud
- Options: Data Fusion

Underwater Acoustic Modem Models

Broadband Acoustic Spread Spectrum Technology

UWM3000



- RS-232 data rate: 2500 bits/second
- Payload data rate: 2000 bits/second
- Acoustic link: 5000 bits/second
- Bit error rate: less than 10^{-9}
- Working range: 3000 meters or 5000 meters (high power option)
- Maximum depth: 2000, 4000 or 7000 meters
- Environments: Near-vertical or horizontal
- Transmit mode power consumption: 3 to 12 Watts
- Receive mode power consumption: 0.8 Watt
- Sleep mode power consumption: 8 mW
- Beamwidth of transducer: 210 degrees (omni-directional)
- Operating Frequency: 7.5 to 12.5 kHz
- Voltage: 18 to 28 volts
- Overall length: 236 mm
- Housing diameter: 126 mm
- Weight out of water: 4.1 kg
- Weight in water: 1.9 kg
- RS-232 input data buffer: 900 Kbytes
- Optional Higher Data Rate: 5,000 baud
- Options: Data Fusion, Higher Transmit Power

UWM3000H



- RS-232 data rate: 400 bits/second
- Payload data rate: 80 to 320 bits/second
- Acoustic link: 5000 bits/second
- Bit error rate: less than 10^{-9}
- Working range: 3000 meters or 6000 meters (high power option)
- Maximum depth: 2000, 4000 or 7000 meters
- Environments: Long-range shallow to very shallow water environments with very harsh multi-path conditions
- Transmit mode power consumption: 3 to 12 Watts
- Receive mode power consumption: 0.8 Watt
- Sleep mode power consumption: 8 mW
- Beamwidth of transducer: 210 degrees (omni-directional)
- Operating Frequency: 7.5 to 12.5 kHz
- Voltage: 18 to 28 volts
- Overall length: 236 mm
- Housing diameter: 126 mm
- Weight out of water: 4.1 kg
- Weight in water: 1.9 kg
- RS-232 input data buffer: 500 Kbytes
- Options: Data Fusion, Higher Transmit Power

UWM4000



- RS-232 data rate: 4800 bits/second
- Payload data rate: 3200 bits/second
- Acoustic link: 8500 bits/second
- Bit error rate: less than 10^{-9}
- Working range: 4000 meters
- Maximum depth: 3000 or 7000 meters
- Environments: Near-vertical or horizontal
- Transmit mode power consumption: 7 Watts
- Receive mode power consumption: 0.8 Watt
- Sleep mode power consumption: 8 mW
- Beamwidth of transducer: 70 degrees
- Operating Frequency: 12.75 to 21.25 kHz
- Voltage: 12 to 28 volts
- Overall length: 286 mm
- Housing diameter: 144 mm
- Weight out of water: 7.6 kg
- Weight in water: 4.1 kg
- RS-232 input data buffer: 900 Kbytes
- Optional Higher Data Rate: 9,600 baud
- Options: Data Fusion, Higher Transmit Power

UWM10000



- RS-232 data rate: 2500 bits/second
- Payload data rate: 2000 bits/second
- Acoustic link: 5000 bits/second
- Bit error rate: less than 10^{-7}
- Working range: 7000 meters (omni-directional) 10000 meters (directional)
- Maximum depth: 2000, 4000 or 7000 meters
- Environments: Near-vertical or horizontal
- Transmit mode power consumption: 40 Watts
- Receive mode power consumption: 0.9 Watt
- Sleep mode power consumption: 9 mW
- Beamwidth of transducer: 210 degrees (omni-directional) 70 degrees (directional)
- Operating Frequency: 7.5 to 12.5 kHz
- Voltage: 18 to 28 volts
- Overall length: 580 mm
- Housing diameter: 150 mm
- Weight out of water: 21 kg
- RS-232 input data buffer: 900 Kbytes
- Optional Higher Data Rate: 5,000 baud
- Options: Data Fusion

COMMON SPECIFICATIONS:

- RS-232 Configuration: 9600 baud, 1 start bit, 1 stop bit, no parity bit, and no flow control
- Operating temperature: -5 to 45 °C
- Storage temperature: -25 to 75 °C

Data Fusion Option

All models of LinkQuest's acoustic modems can incorporate data fusion functions. The modems can interface to up to 7 underwater sensors or devices using the RS-232 interface. These systems can also sample up to 16 analog inputs simultaneously and provide up to 2 Gbytes of permanent storage on a compact flash disk.

Higher Power Option

Typically increases transmit power by 6 dB.

LinkQuest Acoustic Modems In Action

1. Offshore Oil Field Applications

• **Fugro Chance** has successfully used UWM2000 modems with Data Fusion Option to monitor compass, pitch, roll, depth, temperature, and load cell information in real time in various pipeline recovery and underwater construction projects.



• **LinkQuest's** high speed modems have been extensively used to monitor sensors in oil field seismic exploration.

• **2H offshore** of UK uses UWM4000 modems to monitor vibration and tension of the riser on oil platforms in Indonesia.



• **LinkQuest's** UWM2000 acoustic modems have played a vital role in assisting the installation of offshore oil platforms in West Africa.

• **Petrobras** purchases UWM3000 and UWM2000 modems for offshore oil production projects.

• **Ashtead Technology** orders 6 UWM3000 modems to use with underwater Gyros.

2. Real-time Monitoring And Control Of Underwater Sensors

• **Fugro GEOS** has successfully deployed LinkQuest's acoustic modems for monitoring the ocean currents using ADCPs from more than a dozen of DP vessels and oil platforms in North Sea, Indian Ocean and West Africa.



• **NOAA's National Ocean Service, Center for Operational Oceanographic Products and Services (CO-OPS)** achieves real-time wave monitoring using LinkQuest acoustic modems. Over 800 mbytes of wave data, along with current data, have been transported over the acoustic link in less than six months.



• **USGS** monitors Lower Hudson river discharge and sediment flux using UWM2000 modems.

• **NOAA Atlantic Oceanographic and Meteorological Laboratory (AOML)** installed UWM2000H acoustic modems for real-time current monitoring over 800 meters of range at Florida coast.

• **Bodega Marine Laboratory** monitors ocean current using UWM1000 modems in Bodega Bay of Northern California.



3. AUV and Manned Submersible Data Upload, Command And Control

• **C&C Technologies Inc.** has used UWM4010 high speed data telemetry acoustic modems extensively on the first commercially operated deepwater AUV, Kongsberg Hugin 3000. The UWM4010

modems have uploaded **50 Gigabytes** of sub-bottom profiler and sidescan sonar images and other AUV status information in worldwide deployments since mid-2000. LinkQuest's UWM4010 modems are the only acoustic modems which have transported multi-gigabytes of data traffic annually in the real world.



LinkQuest provides UWM4010 high speed modems to the Kongsberg Hugin 3000 deepwater AUVs operated by **Geoconsult AS** and **Fugro Survey**.

The team formed by **Boeing, Fugro and Oceaneering** uses high power command and control acoustic modems and high speed data telemetry acoustic modems (models UWM3010 and UWM4010) on its commercial deepwater AUV Echo Ranger.

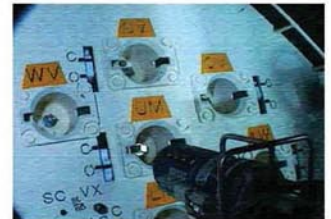


• **US Navy** uses UWM3000 modems to obtain status updates from and command and control four advanced Seahorse AUVs.

• **Hafmynd** of Iceland orders UWM2000H modems for its Gavia AUVs.

• **Kongsberg** uses UWM3000+ modems, a combination of UWM3000 and UWM3000H modems, to monitor and control Hugin 1000 AUV.

• **Deep Marine Technology Inc.** and **Subseatech** of Korea use LinkQuest's UWM2000 modems for uploading images and status from their Deepworker 2000 manned submersibles.



4. Acoustic Data Uploading From Moored Underwater Instruments



• **Walsh Environmental Inc.** has used the UWM1000 modems to upload more than 300 mbytes of current data from ADCPs deployed at 3 different sites in Gulf of Mexico.

• **Specialty Devices of Huston, Texas** uses UWM2000 and UWM4000 modems to upload data from undersea sensors.

• **National University of Singapore** deploys a 13-modem undersea network to transport data from underwater multi-sensor data acquisition systems.