

ATM-900 Series Acoustic Telemetry Modems

User's Manual

P/N M-270-26, Rev. A



Teledyne Benthos, Inc.
49 Edgerton Drive
North Falmouth, MA 02556
U.S.A.

Tel: +1 (508) 563-1000
Fax: +1 (508) 563-6444

www.benthos.com

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Preface

Congratulations on your purchase of a Teledyne Benthos acoustic telemetry modem! The ATM-900 and UDB-9400 Series Acoustic Telemetry Modems, which employ the latest in digital signal processing technologies, are the most advanced underwater modems available. They offer a low cost yet reliable and effective alternative to many underwater communications systems.

This manual provides information on setting up, testing and operating the ATM-900 and UDB-9400 Series Acoustic Telemetry Modems. It is divided into the following ten sections:

Section 1 - Overview reviews wireless underwater communications systems, the available acoustic telemetry modem types, typical applications, and the advanced modulation techniques used.

Section 2 - Specifications lists the specifications for the acoustic telemetry modems, the remote transducers and the battery packs.

Section 3 - Deployment Considerations reviews important installation considerations to ensure the best possible modem performance.

Section 4 - Setup and Test provides instructions for unpacking and setting up the acoustic telemetry modems.

Section 5 - Modem Operation provides an overall description of the acoustic telemetry modems operation, including the different operating modes, their associated Command Line for Acoustic Modem (CLAM) shell user interface commands and how to enter them.

Section 6 - Modem AT Command Set provides descriptions of each of the acoustic telemetry modem AT commands supported by the CLAM shell user interface and how to enter and use them.

Section 7 - Modem Configuration Parameters provides descriptions of each of the available acoustic telemetry modem configuration parameters and how to set them.

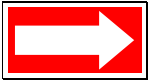
Section 8 - Maintenance and Troubleshooting provides instructions for cleaning and inspecting the acoustic telemetry modems, changing the modem battery packs and troubleshooting operational problems that might occur.

Section 9 - Drawings includes outline drawings of the acoustic telemetry modems to assist in their installation and setup.

Section 10 - Modem Spares, Accessories and Part Designator Includes lists of spares and accessories for the acoustic telemetry modems along with a part designator for simplified ordering.

Notes and Warnings

Where applicable, special notes and warnings are presented as follows:



NOTE A referral to another part of this manual or to another reference; a recommendation to check that certain criteria are met before proceeding further in a step or sequence; or general information applicable to the setup and operation of the Teledyne Benthos acoustic telemetry modems.



WARNING A reminder that dangerous or damaging consequences could result if certain recommended procedures are not followed.

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We welcome your comments and suggestions for improving our products and documentation as well as developing better ways of serving you with acoustic technology. Therefore, please contact Customer Service should you have any comments or suggestions about this manual or the Teledyne Benthos acoustic telemetry modems, or if you require service or support.

Please contact us at:

TELEDYNE BENTHOS, INC.
Attention: Customer Service
49 Edgerton Drive
North Falmouth, MA 02556
U.S.A.

Telephone: +1 (508) 563-1000
Fax: +1 (508) 563-6444
E-mail: benthos@teledyne.com

www.benthos.com

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1 Overview

The Teledyne Benthos acoustic telemetry modems make up the Communications product line and include the ATM-900 and UDB-9400 Series Acoustic Telemetry Modems and the Smart Modem Acoustic Release Technology (SMART) releases which combine all of the functions of the ATM-900 Series Acoustic Telemetry Modems with a release mechanism.



NOTE ATM-900 designates any of the Teledyne Benthos ATM acoustic telemetry modems, such as the ATM-926, the ATM-925, the ATM-965, and others. Teledyne Benthos acoustic modem technology is based on a core set of highly efficient digital signal processing (DSP) electronics. This architecture allows for interoperability and acoustic communications of all the equipment. While this manual illustrates a number of typical applications and operational setups, it is important to remember that all of the modems are interchangeable. For example, the typical use of an ATM-925 or ATM-965 Acoustic Telemetry Modem is in subsea applications, but these modems could easily be used in surface applications as well, such as over the side of a boat or installed on a buoy.

Wireless Underwater Communications

The ATM-900 and UDB-9400 Series Acoustic Telemetry Modems provide wireless bi-directional underwater communications between a "local host" and a "remote host" as illustrated in the system block diagram in Figure 1-1. The local host is typically a PC, and the remote host, an instrument. The local host connects to a "local modem" over an RS-232 or RS-422 serial interface, and the remote host connects to a "remote modem," also over an RS-232 or RS-422 serial interface. The local and remote modems can be a UDB-9400 and a ATM-900 Series Acoustic Telemetry Modem, respectively, or their roles can be reversed. They can also *both* be ATM-900 Series or UDB-9400 Series. The local and remote hosts can also both be PCs or instruments. In all cases the two modems, and hence the two hosts, are acoustically linked enabling bi-directional half duplex communications between them. A single local modem can also communicate over the acoustic link with multiple remote modems and hence multiple instruments as illustrated in the system block diagram in Figure 1-2.

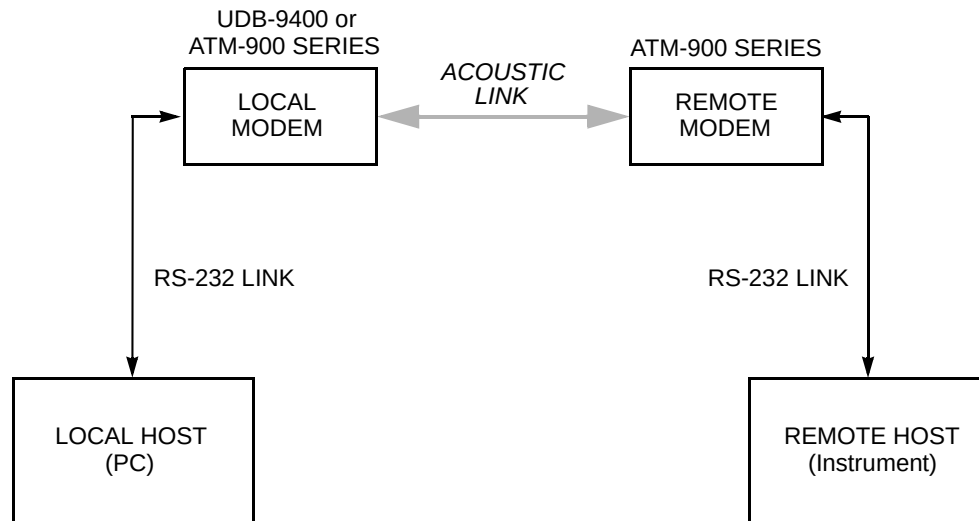


Figure 1-1 Wireless Underwater Communications System Block Diagram

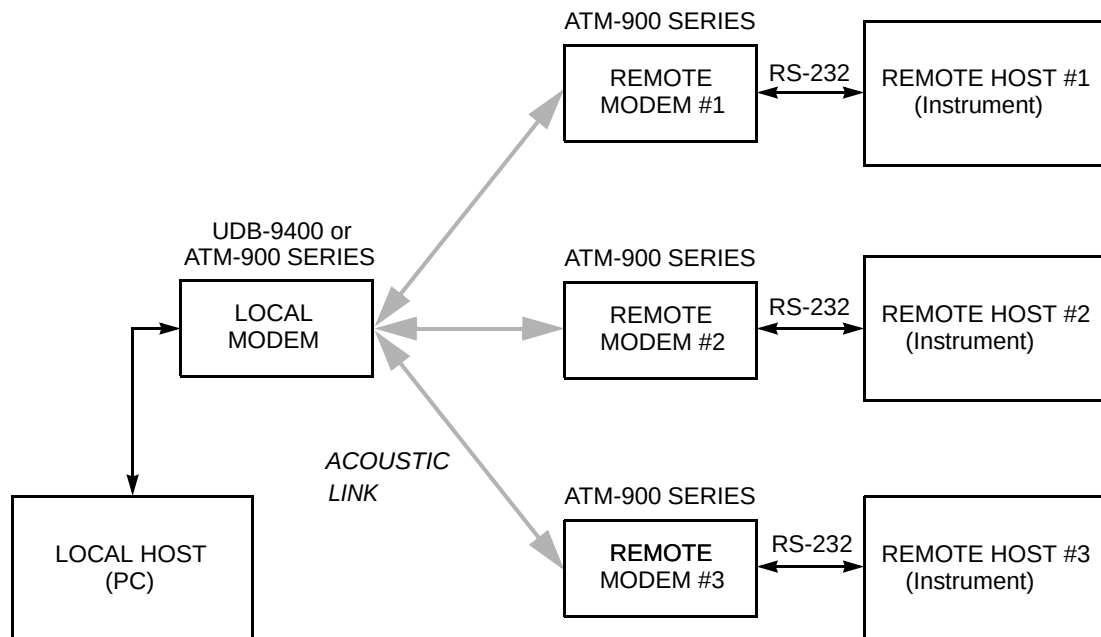


Figure 1-2 Wireless Underwater Communications, Multiple Remote Modems Block Diagram

Commands and Data

Communications between modems are of two general types, commands and data. Commands are output by the local host processor to the local modem over the RS-232 or RS-422 serial interface, and they are executed either by this modem or transmitted over the acoustic link to be executed by the remote modem. Data are output either by the local host processor to the local modem or by the remote host processor to the remote modem, or both, to be exchanged freely and bi-directionally between the two hosts over the acoustic link as if they were connected directly over an RS-232 or RS-422 serial interface. Which communications type is determined by the operating mode of the modem. For information about the modem operating modes, refer to Section 5, "Modem Operation."

Acoustic Bit Rates

The ATM-900 and UDB-9400 Series Acoustic Telemetry Modems can transmit data over the acoustic link at bit rates as high as 15,360 bits/sec and receive data at bit rates as high as 2400 bits/sec. The UDB-9400 Series can *both* transmit *and* receive at bit rates as high as 15,360 bits/sec, and with the optional Coprocessor board installed, some of the ATM-900 Series can also transmit and receive at these higher bit rates.

Modulation Techniques

The ATM-900 and UDB-9400 Series Acoustic Telemetry Modems are the most advanced, the most multipath and noise tolerant, and the most cost efficient ever available. They are designed to meet both the high data rate requirements of commercial users, and the higher reliability, lower data rate requirements of the military. Hence the modems employ two modulation techniques: phase shift keying (PSK), which provides the highest bit rate, and multiple frequency shift keying (MFSK), which provides good reliability in a multipath environment or when the modems are required to operate in a low signal-to-noise (SNR) environment. PSK modulation allows the modems to operate at up to 15,360 bits/sec. It also has high bandwidth efficiency and is primarily used when multipath interference is generally minimal, such as in the vertical channel. The UDB-9400 Series uses PSK modulation to both transmit and receive data. The ATM-900 Series can transmit data using PSK modulation, but receives data using MFSK modulation only. However, with the optional Coprocessor board installed, some of the ATM-900 Series can both transmit and receive using PSK modulation and achieve the same higher bit rates. MFSK modulation is a spread spectrum modulation process that transmits multiple tones simultaneously. MFSK has a maximum bit rate of 2400 bits/sec and has good reliability even in a high multipath environment.

Typical Applications

Teledyne Benthos ATM-900 and UDB-9400 Series Acoustic Telemetry Modems are used in numerous applications, including acquisition of real time or stored data from subsea instruments; command and control of autonomous underwater vehicles (AUVs), wellheads and pipeline valves; data repeaters for underwater local area networks; and release of moored instrument arrays. Refer to "Modem and Remote Transducer Types" on page 1-11 for information on the types of modems called out below.

Remote Data Acquisition

A common application for the ATM-900 and UDB-9400 Series Acoustic Telemetry Modems is the acquisition of real-time or stored data from deployed underwater instruments as illustrated in Figure 1-3. In this setup one or more ATM-925 or ATM-965 Acoustic Telemetry Modems are deployed, each with an instrument, such as an Acoustic Doppler Current Profiler (ADCP), a Conductivity/Temperature/Depth (CTD) sensor or a tide

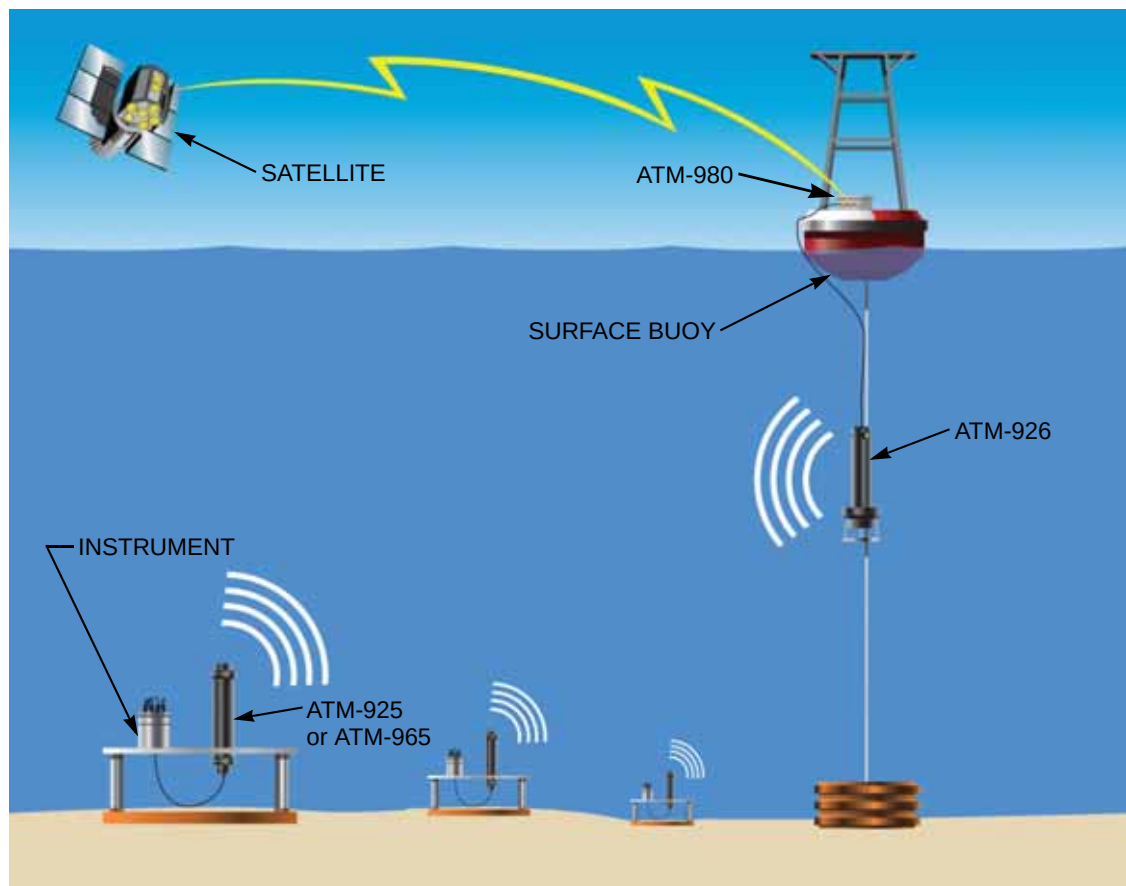


Figure 1-3 Data Acquisition and RF Link to Remote Station

gauge. The modems input data from the instruments over their RS-232 or RS-422 serial interfaces and either immediately transmit the data to a receiving modem or store the data for transmission at a later time. The data are transmitted to a single ATM-926 Acoustic Telemetry Modem that is connected to an ATM-980 Buoy Box installed on a surface buoy. The ATM-926 outputs the received data over its RS-422 serial interface to the buoy box, and the buoy box can optionally transmit the data over an RF link, such as a cellular phone or satellite, or output the data to an onboard processor. Use of modems in this application eliminates the need to install expensive electrical cable between a deployed instrument and a surface buoy and is especially useful when multiple instruments that are deployed within the same area must communicate by way of the same RF channel.

In a similar application, a UDB-9400 Universal Deck Box can be used to retrieve data that have been collected by multiple deployed instruments over a period of time and stored by the modems. This setup is illustrated in Figure 1-5. The data stored by the modems are periodically retrieved.

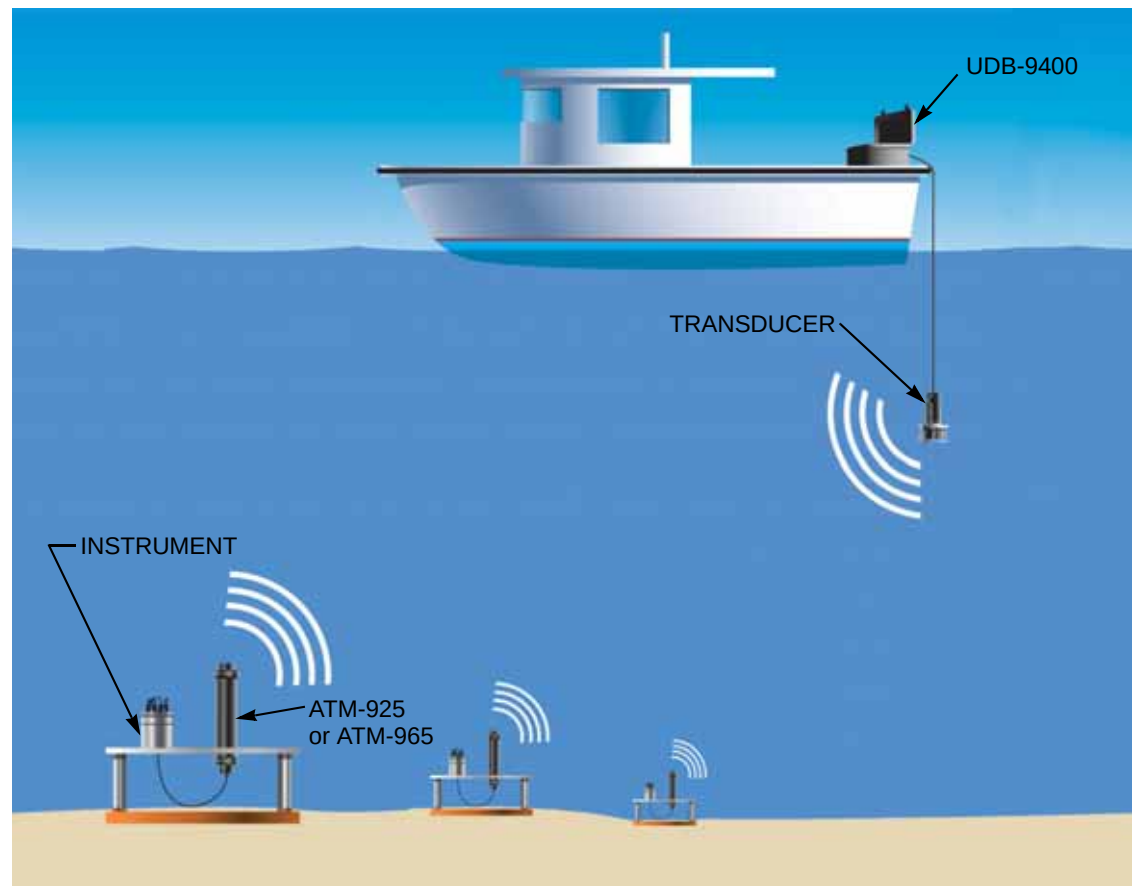


Figure 1-4 Periodic Acquisition of Stored Data

AUV Command and Control

AUVs can only be controlled by an acoustic link. The ATM-900 and UDB-9400 Series Acoustic Telemetry Modems provide this capability by allowing commands to be transmitted to an AUV. Furthermore, since the modems provide two-way communications, AUV position and status information, as well as other data can be received from the AUV. An example of this application is illustrated in Figure 1-5. In this setup the modems provide the communications link between an AUV and a surface station. A UDB-9400 Universal Deck Box connected to a host processor is used in the surface station, and an ATM-903 Modem Board Set is used aboard the AUV.

In a similar command and control application in the offshore oil and gas industry, a UDB-9400 Universal Deck Box can be used to retrieve sensor data from remote underwater instrumentation and communicate with and control wellheads and pipeline valves as illustrated in Figure 1-6.

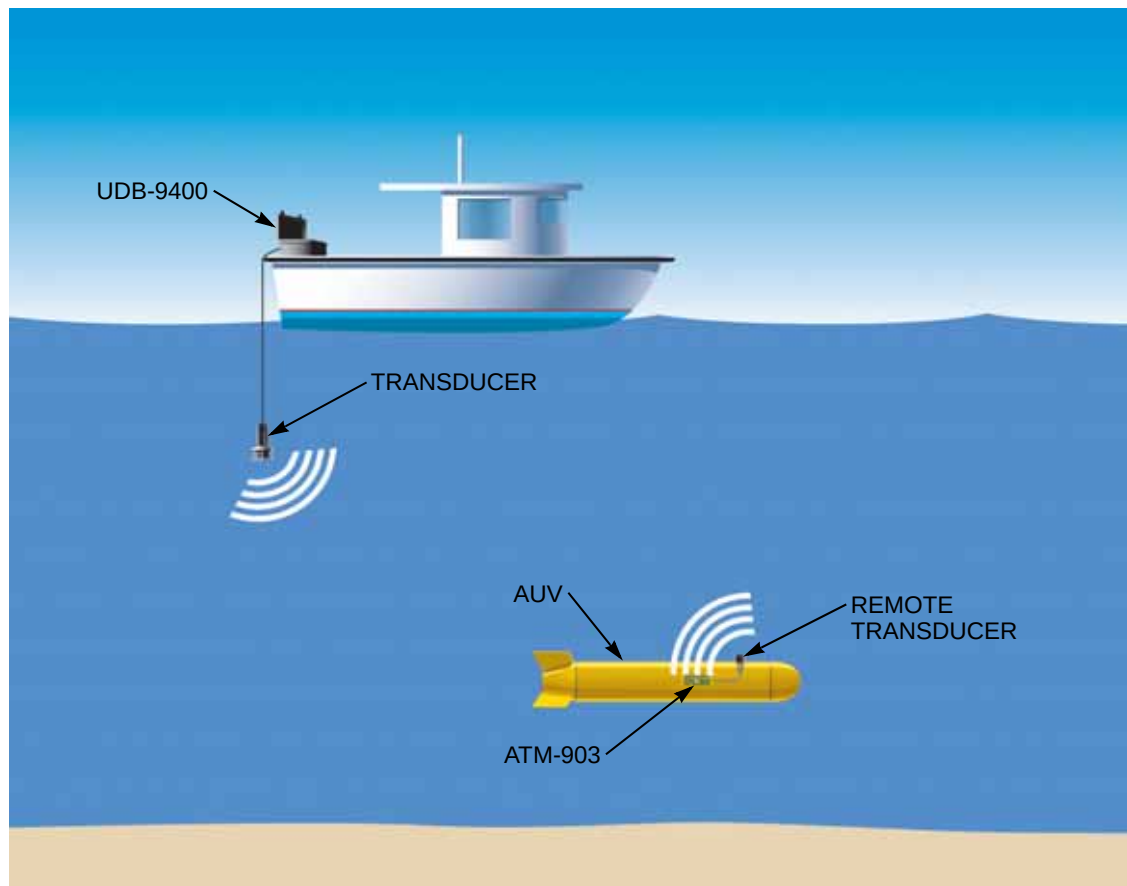


Figure 1-5 Command and Control of an AUV

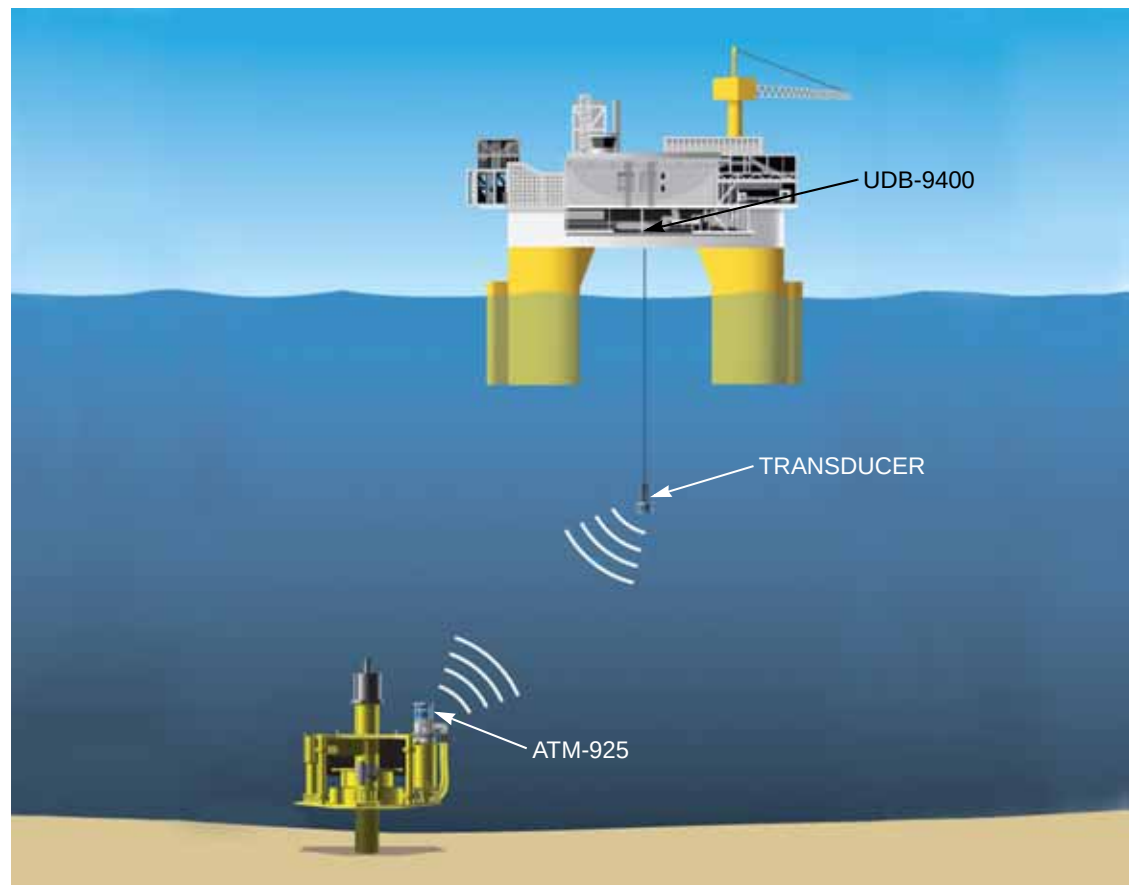


Figure 1-6 Wellhead Command and Control and Data Acquisition

Underwater Local Area Networks

The SM-75 SMART Modem is ideally suited as a network repeater in underwater local area networks. The SMART Modem can also be commanded to operate as a transponder for easy relocation. The combined modem and release functions, along with built-in flotation makes the SMART Modem easy to deploy and recover, and upon recovery, it can be easily re-armed and redeployed.

Release of Moored Instrument Arrays

An SR-50 or SR-100 SMART Release can be used to release moored instrument arrays. The SMART Release also functions to assist in the relocation of the array as it can be commanded to operate as a transponder for measuring slant range. Upon recovery, it can be easily re-armed and redeployed. The battery life is up to two years, depending on the number of transponder replies and the amount of data transmitted and received.

Modem Performance Factors

The primary function of modems is to both transmit and receive signals that represent digital data—binary ones and zeros—over what usually is a hard wired link such as a telephone line. In fact, the word modem is derived from the terms modulation and demodulation, which refer to the coding and transmission, and the receiving and decoding of digital data, respectively. Two key factors measure a modem's performance: speed and reliability. Speed is measured by determining the number of bits transmitted per second, which is referred to as the bit rate. Reliability is measured by determining the bit error rate, which is the ratio of the number of bits received in error to the total number of bits transmitted. Except when noise interference is high, modems that transmit and receive data over phone lines or microwave links typically function nearly error free, and at bit rates of 128,000 bits/sec or more. In addition, repeater systems allow virtually unlimited transmission ranges. Those same performance factors are also used to measure the capabilities of the ATM-900 and UDB-9400 Series Acoustic Telemetry Modems. However, with the transmission medium being water and the transmitted signals being sound, a number of physical barriers exist that constrain those performance factors, physical barriers that are not present in either wire or microwave links.

Barriers to Underwater Communications

The major factors that constrain the performance of any communications system that uses water as a communications medium are the relatively slow speed of sound in water, the signal fading characteristics due to sound absorption and destructive interference, the multipath interference due to sea surface and sea floor reflections, and reflections from nearby objects.

Sound Speed in Seawater

The speed of sound in seawater, on average, is about 1500 meters/sec. This is compared to electromagnetic signals that are carried on a wire or transmitted as radio signals and travel at nearly the speed of light. However, the relatively slow speed of sound in seawater has no direct effect on the bit rate of the modems; it affects only the time period between the transmission of a signal and its reception. In most applications this delay is not of much concern, as the alternative is to use a hard wired connection, which is sometimes prohibitively expensive or not feasible.

Signal Fading

Signal fading is primarily caused by spreading loss and the absorption of sound in water, but it is also caused by destructive interference due to multipath, a situation where signals of like frequency nearly cancel each other out. This frequency dependent fading occurs when a multipath induced reflection of the transmitted signal arrives at the receiving transducer at the same time as a transmitted signal of the same frequency. The result is a reduction in the amplitude of both signals. Signal fading due to spreading loss is a result of the dispersion of energy as it radiates outwardly from the transmitting transducer. And signal fading due to the absorption of sound in water increases with increasing frequency. To a lesser extent, environmental factors such as temperature, pressure, and salinity also affect absorption, and absorption also occurs at the sea floor.

Multipath Interference and Reflections

The factor that most restricts both the bit rate and the reliability of an acoustic modem is multipath. Multipath, which is particularly severe when attempting to communicate over the horizontal channel in shallow water, is the result of sea surface and sea floor reflections, reflections from objects that are near the receiving modem, and refractions from thermal gradients and water turbulence. Using directional remote transducers reduces the effects of multipath when the transducers are aimed at each other, yet reflections from objects such as piers or boats that are near the receiving transducer cause overlapping of the received signals, resulting in decreased reliability. In addition, multipath is usually not stationary; hence even techniques used to track and reduce the effects of multipath do not significantly improve modem performance in increasingly dynamic multipath situations. As a result, multipath forces continual trade-offs in the speed, the reliability, and the cost of acoustic modem.

Methods for Increasing Reliability

Three methods are provided by the ATM-900 and UDB-9400 Series Acoustic Telemetry Modems to increase communications reliability: convolutional coding, multipath guard period, and data redundancy. Convolutional coding uses error correcting algorithms that are determined from the data that are to be transmitted. Multipath guard period, which is used only with MFSK modulation, provides a short delay between data frames to allow for the dispersion of the multipath signals. And data redundancy essentially repeats the transmission of a series of data bits.

Convolutional Coding

Convolutional coding is the most effective of the three methods provided for increasing reliability. The the ATM-900 and UDB-9400 Series Acoustic Telemetry Modems use constraint-length 9, rate 1/2 convolutional coding for forward error correction. Therefore every bit of information input into the encoder affects 16 output channel symbols, enabling the recovery of the information even when a few symbols are lost at the receiver. The *effective* bit rate—or throughput, however, is reduced by half.

Multipath Guard Period

To further increase reliability, especially in high multipath situations where signal overlap can occur, a selectable delay can be inserted between data frames. The delay is selected based on the length of time the multipath is present in the communications channel. Again, the bit rate is affected. Multipath guard period is not used with the PSK modulation technique.

For example, a multipath guard period of 25 milliseconds adds 25 milliseconds to the duration of each data frame, which is also 25 milliseconds; hence the bit rate is reduced to half of what it is without the multipath guard period. For a multipath guard period of 12.5 milliseconds, the bit rate is reduced to two thirds.

Data Redundancy

Data redundancy, which is also referred to as frequency diversity, is a method whereby the same data bits are transmitted two or more times in the same data frame.

For example, if the bit rate is 600 bits/sec, a data redundancy of two reduces the effective bit rate to half this rate, or 300 bits/sec.

Modem and Remote Transducer Types

The ATM-900 and UDB-9400 Series Acoustic Telemetry Modems are composed of five different types:

- Surface modems
- Subsea modems
- SMART releases
- Modem board set
- Compact modems

The surface modems consist of two modem configurations, a deck box and a buoy box; the subsea modems are modems with either a built-in transducer or provisions for the use of a remote transducer; the SMART releases are subsea modems that include a built-in transducer and a release mechanism; the modem board set is for original equipment manufacturer (OEM) applications and includes a circuit board set and a remote transducer; and the Compact Modems are modems designed for long term deployment.

Along with the different types of modems, four types of remote transducers are available:

- Omnidirectional LF
- Omnidirectional MF
- Directional LF
- Directional MF

The "LF" designation is for low frequency, and the "MF," medium frequency. The remote transducers are used with some types of subsea modems and the modem board set, connecting to them with a supplied cable.

Surface Modems

The surface modems are UDB-9400 Series Acoustic Telemetry Modems and consist of the following configurations:

UDB-9400 Universal Deck Box. Connects to a surface host processor and can transmit and receive data at bit rates as high as 15,360 bits/sec.

ATM-980 Buoy Box. Designed to be connected to a subsea modem and installed on a surface buoy.

UDB-9400 Universal Deck Box

The UDB-9400 Universal Deck Box, which is shown with its transducer in Figure 1-7, is used to communicate with any of the subsea modems, the SMART releases or other deck boxes, and it can activate the release mechanism of a SMART release. The UDB-9400 Universal Deck Box is powered with 85–264 VAC, 47–63 Hz or 21–28 VDC and includes the transducer, a transducer cable, an AC power cable, and an accessories case. The deck box can be connected to a host processor through its RS-232/422 serial port and includes a speaker and volume control for audio verification of transmitted data. The deck box is configured to operate in the low frequency 9–14 kHz (LF) or medium frequency 16–21 kHz (MF) band and is available in both portable and rack mount configurations.



Figure 1-7 The UDB-9400 Universal Deck Box—Portable and Rack Mount Configurations



NOTE For detailed information on the Teledyne Benthos UDB-9400 Universal Deck Box, refer to its user's manual.

ATM-980 and ATM-980RF Buoy Boxes

The ATM-980 Buoy Box is for installation on a surface buoy. It is housed in a waterproof enclosure and includes a connector for connecting to an ATM-926 Acoustic Telemetry Modem and a connector for both DC power and RS-232 serial communications with a host processor. For an ATM-980RF, which is shown in Figure 1-8, an RF connector is also included for RF wireless data communications.

When installed on a surface buoy and connected to an ATM-926 Acoustic Telemetry Modem over its RS-422 serial interface, the buoy box can communicate with other modems. Data received from those modems are output to the host processor and can be transmitted over an RF link to a remote station. Similarly, the modems can receive commands or data from the remote station.



Figure 1-8 The ATM-980RF Buoy Box

Subsea Modems

The subsea modems are ATM-900 Series Acoustic Telemetry Modems and consist of the following configurations:

ATM-914 Acoustic Telemetry Modem. Connects to a remote omnidirectional or directional transducer and operates to a depth of 500 m (1640 ft).

ATM-915 Acoustic Telemetry Modem. Includes a built-in omnidirectional or directional transducer and operates to a depth of 500 m (1640 ft).

ATM-916 Acoustic Telemetry Modem. Includes a built-in omnidirectional or directional transducer, is externally powered only, and operates to a depth of 500 m (1640 ft).

ATM-924 Acoustic Telemetry Modem. Connects to a remote omnidirectional or directional transducer and operates to a depth of 2000 m (6560 ft).

ATM-925 Acoustic Telemetry Modem. Includes a built-in omnidirectional or directional transducer and operates to a depth of 2000 m (6560 ft).

ATM-926 Acoustic Telemetry Modem. Includes a built-in omnidirectional or directional transducer, is externally powered only, and operates to a depth of 2000 m (6560 ft).

ATM-964 Acoustic Telemetry Modem. Connects to a remote omnidirectional or directional transducer and operates to a depth of 6000 m (19,680 ft).

ATM-965 Acoustic Telemetry Modem. Includes a built-in directional transducer and operates to a depth of 6000 m (19,680 ft).

ATM-966 Acoustic Telemetry Modem. Includes a built-in omnidirectional or directional transducer, is externally powered only, and operates to a depth of 6000 m (19,680 ft).

ATM-915 and ATM-914 Acoustic Telemetry Modems

The ATM-915 Acoustic Telemetry Modem is shown in Figure 1-9. The ATM-915 is completely self-contained in a PVC housing and includes a modem battery pack and a built-in omnidirectional or directional transducer. The ATM-914 is similar to the ATM-915 but does not include a built-in transducer. Instead, a 2-meter cable is provided which connects from the modem to a remote transducer. Both modems also include a power/serial connector which is used to input external power instead of using the internal battery pack, and to connect to either an RS-232 or an RS-422 serial interface.



Figure 1-9 The ATM-915 Acoustic Telemetry Modem

ATM-916 Acoustic Telemetry Modem

The ATM-916 Acoustic Telemetry Modem, which is shown in Figure 1-10, is externally powered only. It is contained in a PVC housing and includes a built-in omnidirectional or directional transducer. The ATM-916 also includes a power/serial connector. The connector is used to input external power and to connect to either an RS-232 or an RS-422 serial interface.



Figure 1-10 The ATM-916 Acoustic Telemetry Modem

ATM-925 and ATM-924 Acoustic Telemetry Modems

The ATM-925 Acoustic Telemetry Modem is shown in Figure 1-11. The ATM-925 is completely self contained in a hard coat anodized aluminum housing and includes a modem battery pack and a built-in omnidirectional or directional transducer. The ATM-924 is similar to the ATM-925 but does not include a built-in transducer. Instead, a 2-meter cable is provided which connects from the modem to a remote transducer. Both modems also include a power/serial connector which is used to input external power instead of using the internal battery pack, and to connect to either an RS-232 or an RS-422 serial interface.



Figure 1-11 The ATM-925 Acoustic Telemetry Modem

ATM-926 Acoustic Telemetry Modem

The ATM-926 Acoustic Telemetry Modem, which is shown in Figure 1-12, is externally powered only. It is contained in a hard coat anodized aluminum housing and includes a built-in omnidirectional or directional transducer. The ATM-926 also includes a power/serial connector. The connector is used to input external power and to connect to either an RS-232 or an RS-422 serial interface.



Figure 1-12 The ATM-926 Acoustic Telemetry Modem

ATM-965 and ATM-964 Acoustic Telemetry Modems

The ATM-965 Acoustic Telemetry Modem is shown in Figure 1-13. The ATM-965 is completely self contained and includes a modem battery pack and a built-in omnidirectional or directional transducer. The ATM-965 modem functions the same as all the other modems. However, the housing, which is constructed of thick-walled hard coat anodized aluminum, is designed for deployment to full ocean depth. The ATM-964 is similar to the ATM-965 but does not include a built-in transducer. Instead, a 2-meter cable is provided which connects from the modem to a remote transducer that is also included. Both modems also include a power/serial connector which is used to input external power instead of using the internal battery pack, and to connect to either an RS-232 or an RS-422 serial interface.



Figure 1-13 The ATM-965 Acoustic Telemetry Modem

ATM-966 Acoustic Telemetry Modem

The ATM-966 Acoustic Telemetry Modem, which is shown in Figure 1-14, is externally powered only. It is contained in a thick-walled hard coat anodized aluminum housing which is designed for deployment to full ocean depth and includes a built-in omnidirectional or directional transducer. The ATM-966 also includes a power/serial connector. The connector is used to input external power and to connect to either an RS-232 or an RS-422 serial interface.



Figure 1-14 The ATM-966 Acoustic Telemetry Modem

SMART Releases

The SMART releases include the following:

SR-50 SMART Release. Designed for short range, light load, shallow water applications and operates to a depth of 305 m (1000 ft).

SR-100 SMART Release. Designed for long range, heavy duty, deep or shallow water applications and operates to a depth of 12,000 m (39,360 ft).

SM-75 SMART Modem. Designed for long range, deep or shallow water applications and operates to a depth of 6700 m (22,000 ft).



NOTE For detailed information on the Teledyne Benthos SMART releases, refer to their respective user's manual.

SR-50 SMART Release

The SR-50 SMART Release is shown in Figure 1-15. The SR-50 combines the same reliable motorized release mechanism used in the Teledyne Benthos 867-A Shallow Water Acoustic Transponding Release with the same modem technology provided by the ATM-900 Series Acoustic Telemetry Modems. It is completely self contained in a PVC housing and includes a modem battery pack and a built-in or remote omnidirectional transducer. The SR-50 is designed for short range, light load, shallow water release of moored instrument arrays. It can support a static or dynamic load of 455 kg (1000 lb) and can be operate as a transponder.



Figure 1-15 The SR-50 SMART Release

SR-100 SMART Release

The SR-100 SMART Release is shown in Figure 1-16. The SR-100 combines the same reliable high torque motorized release mechanism used in the Benthos 865-A Deep Sea Acoustic Release with the same modem technology provided by the ATM-900 Series Acoustic Telemetry Modems. It is completely self contained in a stainless steel housing and includes a modem battery pack and a built-in omnidirectional transducer. The SR-100 is designed for long range, heavy duty, full ocean depth or shallow water release of moored instrument arrays. It can support a static load of 4540 kg (10,000 lb) and operate as a transponder.



Figure 1-16 The SR-100 SMART Release

SM-75 SMART Modem

The SM-75 SMART Modem is shown in Figure 1-17. The SM-75 combines the same reliable electrolytic dissolving wire ("burn wire") type release mechanism used in the Benthos Model TR-6000 Series Recoverable Acoustic Transponder with the same modem technology provided by the ATM-900 Series Acoustic Telemetry Modems. It is self buoyant and completely self contained in a 13 or 17-inch glass sphere housing that is encapsulated in a yellow ribbed hard hat. It also includes an internal battery pack and a built-in omnidirectional transducer. The SM-75 is designed for long range, deep or shallow water applications and can release loads as heavy as 227 kg (500 lb). It can also operate as a transponder.



Figure 1-17 The SR-75 SMART Modem

ATM-903 and ATM-900 Modem Board Set

The ATM-903 Modem Board Set is shown in Figure 1-18. The ATM-903 includes a circuit board set mounted to a chassis and an omnidirectional or directional transducer. The modem is externally powered and is designed for original equipment manufacture (OEM) applications, where the modem is integrated into a housing or chassis of another manufacturer's design. The ATM-900 Board Set includes the board set only. No transducer is supplied.



Figure 1-18 *The ATM-903 Modem Board Set*

Compact Modems

The Teledyne Benthos Compact Modems are similar to the ATM-900 Series Acoustic Telemetry Modems but have a smaller form factor and are sold in quantities as OEM board sets only. A Compact Modem is capable of performing most of the commands and has most of the same features as an ATM-900 Series Acoustic Telemetry Modem. However, it transmits at a lower power level and is designed to remain in a low power state during most of its deployment. In addition, a Compact Modem requires that it first be awakened from its low power state before it will respond to any commands.

For more information on the Compact Modems, contact Teledyne Benthos. For information on how to contact Teledyne Benthos, refer to "Customer Service" on page vi.

Remote Transducers

The remote transducers consist of two types:

Remote Omnidirectional Transducer. An omnidirectional transducer that is available in either the low frequency (LF) or medium frequency (MF) band.

Remote Directional Transducer. A directional transducer that is available in either the low frequency (LF) or medium frequency (MF) band.

Remote Omnidirectional Transducer

The remote omnidirectional transducer is available in two frequency bands: 9–14 kHz (LF) and 16–21 kHz (MF). The omnidirectional transducer provides toroidal transmit and receive beam patterns. It is best used in both deep and shallow water applications where the direction of the receiving transducer is not known or is not fixed. However, because of its toroidal beam pattern, the directivity index is relatively small, and the multipath is more severe than a directional transducer with the same input power level, as the energy is more widely distributed. The remote omnidirectional transducer's typical vertical beam pattern for both the LF and MF versions are shown in Figure 1-19.

Remote Directional Transducer

The remote directional transducer is available in two frequency bands: 9–14 kHz (LF) and 16–21 kHz (MF). Whenever possible, the remote directional transducer should be used, as it provides conical transmit and receive beam patterns. And because the energy is focused into a narrow beam, it provides a higher directivity index than the remote omnidirectional transducer with the same input power level. The remote directional transducer is most effective when used in the vertical channel, or when the transducer can be pointed toward the receiving transducer in the horizontal channel. In the latter case, multipath due to sea surface and sea floor reflections is minimized as most of the energy is directed horizontally. The remote directional transducer's typical vertical beam pattern for both the LF and MF versions are shown in Figure 1-20 on page 1-23.

Acoustic Baffles

An acoustic baffle, when installed on a remote transducer, effectively reduces the effects of noise or multipath signals that arrive from the back of the transducer. Teledyne Benthos can custom design and built acoustic baffles for any of the remote transducers, or they can be obtained from other sources if required. Refer to "Customer Service" on page vi for information on how to contact Teledyne Benthos for detailed specifications.

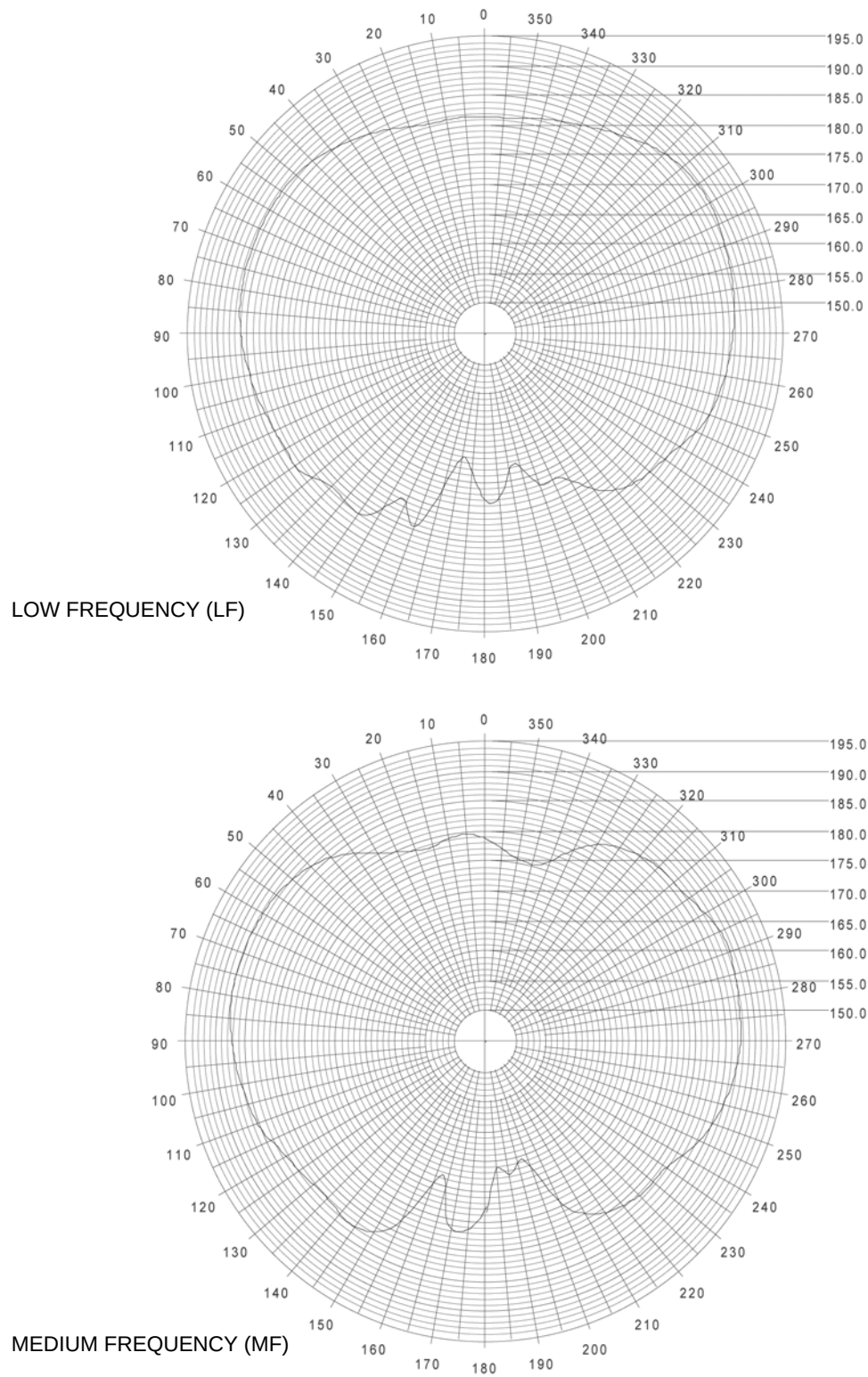


Figure 1-19 Remote Omnidirectional Transducer, LF and MF Vertical Beam Patterns

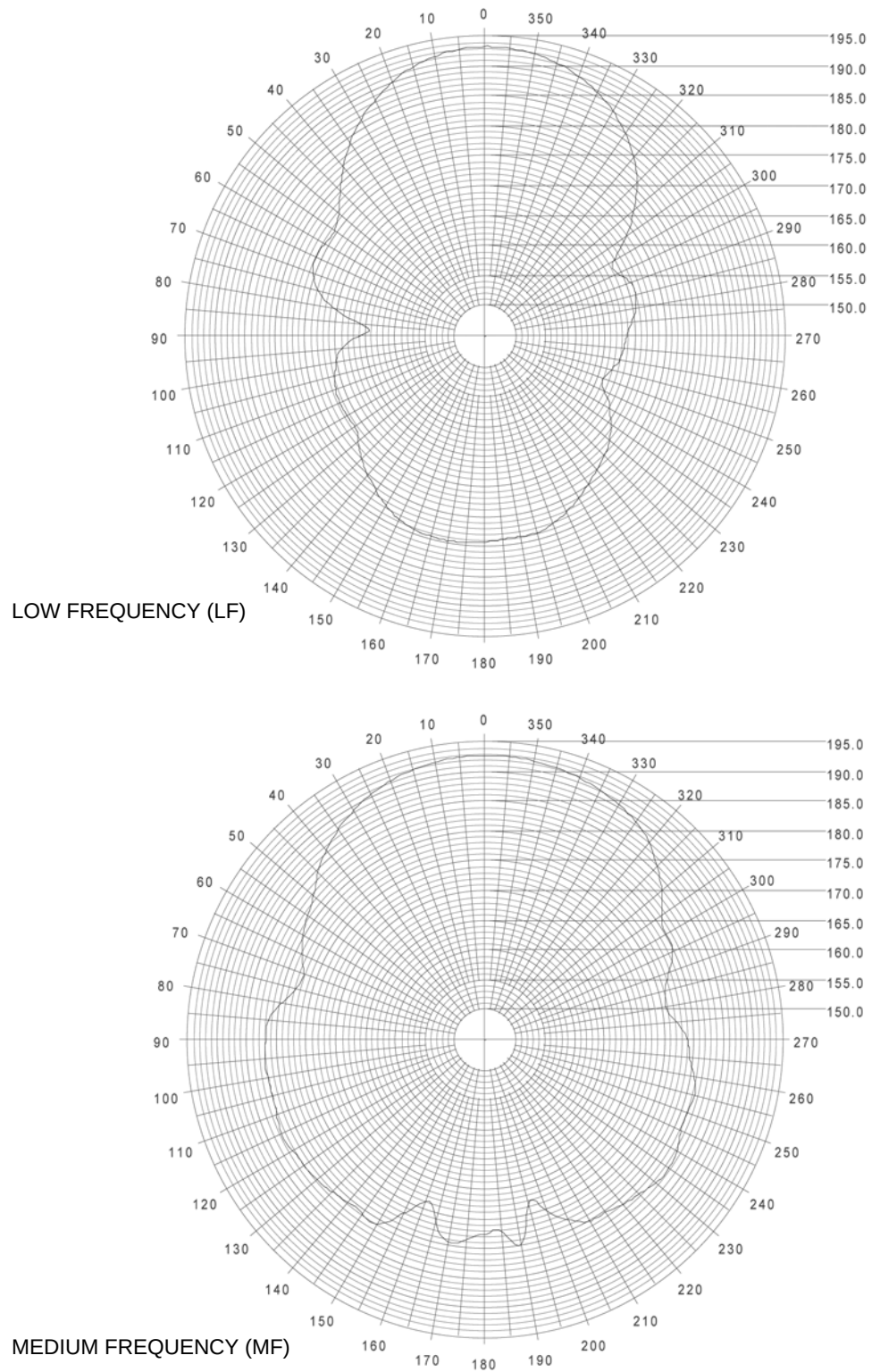


Figure 1-20 Remote Directional Transducer, LF and MF Vertical Beam Patterns

2 Specifications

This section provides the specifications for the Teledyne Benthos ATM-900 Series Acoustic Telemetry Modems, including the remote transducers and the modem battery packs. All specifications are subject to change without notice.



NOTE For the UDB-9400 Series Acoustic Telemetry Modem specifications, refer to the UDB-9400 Universal Deck Box User’s Manual.



NOTE For detailed dimensional outline information for each of the modems, refer to Section 9, "Drawings."

General

Except where noted otherwise, the general specifications listed below apply to all of the ATM-900 Series Acoustic Telemetry Modems.

Frequency band:	9–14 kHz (LF), 16–21 kHz (MF) or 22.6–27.7 kHz (Band C)
Data modulation:	PSK and MFSK
Bit rate:	2560–15,360 bits/sec (PSK transmit); 140–2400 bits/sec (MFSK transmit and receive)
Addressable modems:	250
Processing features:	Data redundancy 1/2 rate convolutional coding Multipath guard period
Temperature, operating:	-5°C to 50°C (23°F to 122°F)
Temperature, nonoperating:	-45°C to 85°C (-49°F to 185°F)
Serial interface:	RS-232/422 at 115,200; 57,600; 38,400; 19,200; 9600; 4800; 2400; or 1200 baud

Flow control:	RS-232—hardware RTS/CTS handshaking or software XON/XOFF RS-422—software XON/XOFF handshaking
External DC input power:	12–36 VDC
Average transmit power @ 21 VDC:	20 watts at power level 8 14 watts at power level 7 10 watts at power level 6 7 watts at power level 5 5 watts at power level 4 3.5 watts at power level 3 2.5 watts at power level 2 >2 watts at power level 1 (depending on transducer)
Peak transmit current:	3 A, 50 ms @ 21 VDC
Receive active power:	720 mw max @ 24VDC 650 mw typ @ 24 VDC
Lowpower state power:	12.0 mw max @ 24 VDC 10.2 mw typ @ 24 VDC
Low frequency (LF) omnidirectional transducer:	Frequency band: 9–14 kHz Source level: 185 dB re 1 μ Pa @ 1 m typ Beam pattern: toroidal $\pm 40^\circ$ @ 12 khz typ
Medium frequency (MF) omnidirectional transducer:	Frequency band: 16–21 kHz Source level: 183 dB re 1 μ Pa @ 1 m typ Beam pattern: toroidal $\pm 40^\circ$ @ 18 khz typ
Low frequency (LF) directional transducer:	Frequency band: 9–14 kHz Source level: 190 dB re 1 μ Pa @ 1 m typ Beam pattern: conical $\pm 20^\circ$ @ 12 khz typ (ATM-914, ATM-924, ATM-964, and ATM- 903 only)

**Medium frequency (MF)
directional transducer:**

Frequency band: 16–21 kHz
Source level: 190 dB re 1 μ Pa @ 1 m typ
Beam pattern: conical $\pm 30^\circ$ @ 18 kHz typ

**Band C omnidirectional
transducer:**

Frequency band: 22.6–27.7 kHz
Source level: 178 dB re 1 μ Pa @ 1 m typ
Beam pattern: toroidal $\pm 40^\circ$ @ 25 kHz typ

Operator controls:

Plunger type on/off switch (not included on ATM-900 and ATM-903 modems)

Device enable:

Active low, open collector output. Maximum sink current is 20 mA, maximum applied voltage is 40 VDC, and maximum power is 150 mw.

Real-Time Clock

All the Teledyne Benthos ATM-900 and UDB-9400 Series Acoustic Telemetry Modems include a temperature compensated real-time clock for the date and time. When the modem is powered on, the clock uses the modem batteries or external power to keep time, and when powered off, the modem uses a backup lithium coin cell.

Clock accuracy:

± 1 minute/year or ± 2 PPM (0° to $+40^\circ\text{C}$)
 ± 4 minute/year or ± 7.5 PPM (-40° to $+85^\circ\text{C}$)

Coin cell life:

1.4 years min, 2 years typ

ATM-914 Subsea Modem

The ATM-914 Acoustic Telemetry Modem is a 500-meter (1640 ft) depth rated subsea modem that includes an internal modem battery pack and connects to any of the remote transducers with a supplied 2-meter cable. The modem can operate on its battery pack or on external DC power.



NOTE The default power level setting for the ATM-914 Acoustic Telemetry Modems is 6. These modems can be operated at that level indefinitely. However, due to excessive heat that can quickly build up in the PVC housing during continuous transmissions, operation at higher power levels should be limited. Refer to "TxPower" on page 7-47 for more information.

Housing construction:	PVC
Dimensions:	Reference Drawing B270-437 on page 9-4.
Mounting:	316 stainless steel sidebar
Weight in air:	9.1 kg (20 lb)
Weight in water:	3.2 kg (7 lb)
Operating depth:	500 m (1640 ft)
POWER/SERIAL connector:	MCBH16M
TRANSDUCER connector:	MCBH3F

ATM-915 Subsea Modem

The ATM-915 Acoustic Telemetry Modem is a completely self contained 500-meter (1640 ft) depth rated subsea modem with a built-in omnidirectional or directional transducer and an internal modem battery pack. The modem can operate on its battery pack or on external DC power.



NOTE The default power level setting for the ATM-915 Acoustic Telemetry Modems is 6. These modems can be operated at that level indefinitely. However, due to excessive heat that can quickly build up in the PVC housing during continuous transmissions, operation at higher power levels should be limited. Refer to "TxPower" on page 7-47 for more information.

Housing construction:	PVC
Dimensions:	Reference Drawing B270-432 on page 9-5.
Mounting:	316 stainless steel sidebar
Weight in air:	10.8 kg (24 lb)
Weight in water:	3.6 kg (8 lb)
Operating depth:	500 m (1640 ft)
POWER/SERIAL connector:	MCBH16M

ATM-916 Subsea Modem

The ATM-916 Acoustic Telemetry Modem is a 500-meter (1640 ft) depth rated subsea modem with a built-in omnidirectional or directional transducer. The modem operates on external DC power only.



NOTE The default power level setting for the ATM-916 Acoustic Telemetry Modems is 6. These modems can be operated at that level indefinitely. However, due to excessive heat that can quickly build up in the PVC housing during continuous transmissions, operation at higher power levels should be limited. Refer to "TxPower" on page 7-47 for more information.

Housing construction:	PVC
Dimensions:	Reference Drawing B270-433 on page 9-6.
Mounting:	316 stainless steel sidebar
Weight in air:	4.5 kg (10 lb)
Weight in water:	1.8 kg (4 lb)
Operating depth:	500 m (1640 ft)
POWER/SERIAL connector:	MCBH16M

ATM-924 Subsea Modem

The ATM-924 Acoustic Telemetry Modem is a 2000-meter (6560 ft) depth rated subsea modem that includes an internal modem battery pack and connects to any of the remote transducers with a supplied 2-meter cable. The modem can operate on its battery pack or on external DC power.

Housing construction:	Hard coat anodized aluminum
Dimensions:	Reference Drawing B270-088 on page 9-7.
Mounting:	316 stainless steel sidebar
Weight in air:	9.5 kg (21 lb)
Weight in water:	3.2 kg (7 lb)
Operating depth:	2000 m (6560 ft)
POWER/SERIAL connector:	MCBH16M
TRANSDUCER connector:	MCBH3F

ATM-925 Subsea Modem

The ATM-925 Acoustic Telemetry Modem is a completely self contained 2000-meter (6560 ft) depth rated subsea modem with a built-in omnidirectional or directional transducer and an internal modem battery pack. The modem can operate on its battery pack or on external DC power.

Housing construction:	Hard coat anodized aluminum
Dimensions:	Reference Drawing B270-053 on page 9-8.
Mounting:	316 stainless steel sidebar
Weight in air:	10.9 kg (24 lb), LF omni 10.4 kg (23 lb), MF omni 12.2 kg (27 lb), MF dir
Weight in water:	3.6 kg (8 lb), LF omni 3.6 kg (8 lb), MF omni 3.6 kg (8 lb), MF dir
Operating depth:	2000 m (6560 ft)
POWER/SERIAL connector:	MCBH16M

ATM-926 Subsea Modem

The ATM-926 Acoustic Telemetry Modem is a 2000-meter (6560 ft) depth rated subsea modem with a built-in omnidirectional or directional transducer. The modem operates on external DC power only.

Housing construction:	Hard coat anodized aluminum
Dimensions:	Reference Drawing B270-060 on page 9-9.
Weight in air:	2.7 kg (6.0 lb)
Weight in water:	1.3 kg (2.9 lb)
Operating depth:	2000 m (6560 ft)
POWER/SERIAL Connector:	MCBH16M

ATM-964 Subsea Modem

The ATM-964 Acoustic Telemetry Modem is a 6000-meter (19,680 ft) depth rated subsea modem that includes an internal modem battery pack and connects to any of the remote transducers with a supplied 2-meter cable. The modem can operate on its battery pack or on external DC power.

Housing construction:	Hard coat anodized aluminum
Dimensions:	Reference Drawing B270-089 on page 9-10.
Mounting:	316 stainless steel sidebar
Weight in air:	16.4 kg (36 lb)
Weight in water:	7.7 kg (17 lb)
Operating depth:	6000 m (19,680 ft)
POWER/SERIAL connector:	MCBH16M
TRANSDUCER connector:	MCBH3F

ATM-965 Subsea Modem

The ATM-965 Acoustic Telemetry Modem is a completely self contained 6000-meter (19,680 ft) depth rated subsea modem with a built-in omnidirectional or directional transducer and an internal modem battery pack. The modem can operate on its battery pack or on external DC power.

Housing construction:	Hard coat anodized aluminum
Dimensions:	Reference Drawing B270-056 on page 9-11.
Mounting:	316 stainless steel sidebar
Weight in air:	16.4 kg (36 lb)
Weight in water:	7.7 kg (17 lb)
Operating depth:	6000 m (19,680 ft)
POWER/SERIAL Connector:	MCBH16M

ATM-966 Subsea Modem

The ATM-966 Acoustic Telemetry Modem is a 6000-meter (19,680 ft) depth rated subsea modem with a built-in omnidirectional or directional transducer. The modem operates on external DC power only.

Housing construction:	Hard coat anodized aluminum
Dimensions:	Reference Drawing B270-259 on page 9-12.
Weight in air:	6.8 kg (15.0 lb), LF omni 6.3 kg (13.8 lb), MF omni 8.9 kg (19.6 lb), MF dir
Weight in water:	2.3 kg (5.0 lb), LF omni 2.1 kg (4.6 lb), MF omni 3.0 kg (6.5 lb), MF dir
Operating depth:	6000 m (19,680 ft)
POWER/SERIAL Connector:	MCBH16M

ATM-900 Modem Board Set

The ATM-900 Modem Board Set includes a circuit board set mounted to a chassis. It is externally powered, does not include a transducer and is typically sold as spares.

Chassis Dimensions:	6.9 cm (2.72 in.) wide by 4.6 cm (1.8 in.) high by 14.0 cm (5.5 in.) long
Mounting:	Chassis mounting holes
Weight:	0.57 kg (1.25 lb)

ATM-903 Modem Board Set

The ATM-903 Modem Board Set includes both a circuit board set mounted to a chassis and a remote directional or omnidirectional transducer. It is externally powered and is designed for OEM applications.

Chassis Dimensions:	6.9 cm (2.72 in.) wide by 4.6 cm (1.8 in.) high by 14.0 cm (5.5 in.) long
Mounting:	Chassis mounting holes
Weight:	0.57 kg (1.25 lb)

Remote Omnidirectional Transducer

The remote omnidirectional transducer is used with the ATM-914, ATM-924 and ATM-964 Acoustic Telemetry Modems and the ATM-903 Modem Board Set. It is also optionally available with the ATM-900 Modem Board set. The remote omnidirectional transducer is available in two frequencies: low frequency (LF) and medium frequency (MF).

Low frequency (LF):	Frequency band: 9–14 kHz Source level: 185 dB re 1 μ Pa @ 1 m typ Beam pattern: toroidal $\pm 40^\circ$ @ 12 khz typ
Medium frequency (MF):	Frequency band: 16–21 kHz Source level: 183 dB re 1 μ Pa @ 1 m typ Beam pattern: toroidal $\pm 40^\circ$ @ 18 khz typ

Housing construction:	PVC and 316 stainless steel
Dimensions:	15.2 cm (6.0 in.) diameter by 8.6 cm (3.4 in.) long
Weight in air:	2.2 kg (4.8 lb), LF 1.0 kg (2.3 lb), MF
Weight in water:	1.4 kg (3.0 lb), LF 0.45 kg (1.0 lb), MF
Operating depth:	6000 m (19,680 ft)

Remote Directional Transducer

The remote directional transducer is used with the ATM-914, ATM-924 and ATM-964 Acoustic Telemetry Modems and the ATM-903 Modem Board Set. It is also optionally available with the ATM-900 Modem Board set. The remote directional transducer is available in two frequencies: low frequency (LF) and medium frequency (MF).

Low frequency (LF):	Frequency band: 9–14 kHz Source level: 190 dB re 1 μ Pa @ 1 m typ Beam pattern: conical $\pm 20^\circ$ @ 12 kHz typ
Medium frequency (MF):	Frequency band: 16–21 kHz Source level: 190 dB re 1 μ Pa @ 1 m typ Beam pattern: conical $\pm 30^\circ$ @ 18 kHz typ
Housing construction:	PVC and 316 stainless steel (MF) Hard coat anodized aluminum (LF)
Dimensions:	20.3 cm (8.0 in.) diameter by 19.7 cm (7.75 in.) long (LF) 15.2 cm (6.0 in.) diameter by 15.7 cm (6.2 in.) long (MF)
Weight in air:	11.8 kg (26 lb), LF 3.2 kg (7.1 lb), MF
Weight in water:	5.4 kg (12 lb), LF 1.4 kg (3.1 lb), MF
Operating depth:	6000 m (19,680 ft)

Modem Battery Pack Capacities

Two modem battery packs are available. One is specifically used for the ATM-914, ATM-915, ATM-924 and ATM-925 Acoustic Telemetry Modems, and the other for the ATM-964 and ATM-965 Acoustic Telemetry Modems. They differ only in their size and watt-hour capacity. Both packs use alkaline batteries.

Modem Battery Pack Capacity for ATM-914/915/924/925 Acoustic Telemetry Modems

Capacity (at power level 08): 250 watt-hours (when transmit power is consistently at the max power level 08)

Capacity (at power level 07): 300 watt-hours (when transmit power is limited to power level 07)



NOTE Stated capacities are at an ambient temperature of 21°C. When operating at 0°C, the battery capacity needs to be derated by 25%.

Modem Battery Pack Capacity for ATM-964/965 Acoustic Telemetry Modems

The battery packs for the ATM-964 and the ATM-965 Acoustic Telemetry Modems are actually composed of two separate battery packs, each purchased individually. The capacities stated below are for the combination of the two packs.

Capacity (at power level 08): 400 watt-hours (when transmit power is consistently at the max power level 08)

Capacity (at power level 07): 450 watt-hours (when transmit power is limited to power level 07)



NOTE Stated capacities are at an ambient temperature of 21°C. When operating at 0°C, the battery capacity needs to be derated by 25%.

3 Deployment Considerations

A number of factors must be considered before deploying a Teledyne Benthos ATM-900 or UDB-9400 Series Acoustic Telemetry Modem. These include the choice of a remote transducer, the required operating depth, the required communications range, the multipath and noise conditions, and the physical protection of the modems. This section reviews these factors and also presents some typical installation configurations for the modems.

Remote Transducer Selection

When an ATM-914, ATM-924, ATM-964, or ATM-903 Acoustic Telemetry Modem, each of which use a remote transducer, is to be installed, the type of remote transducer to use should be carefully selected to best suit the application. Refer to "Remote Transducers" on page 1-20 for general information on the available remote transducers, and to Section 2, "Specifications," for detailed specifications. Also refer to Section 9, "Drawings," for dimensioned outline drawings.

The remote omnidirectional transducer LF and MF beam patterns are shown in Figure 1-19 on page 1-22. Its beam patterns show that it transmits and receives signals in a toroidal pattern. This transducer should be selected when the horizontal direction or the depth of the receiving modem is not known or is not always the same. However, more power is required compared to a directional transducer to produce an equivalent source level, and the effects of multipath are usually greater.

The remote directional transducer LF and MF beam patterns are shown in Figure 1-20 on page 1-23. Whenever possible, this transducer should be selected. Its transmit and receive beam patterns are that of a narrow cone; hence it is a good choice when the depth and direction of the receiving modem is known and is stable, and the transducer can be pointed at the receiving modem. This transducer requires the least amount of power to produce the equivalent source level of an omnidirectional transducer, and it provides the best protection against the effects of multipath.

Modem Battery Pack

For the subsea modems that use a modem battery pack, the capacity of the battery pack determines both the amount of data a modem can transmit and the modem's useful deployment life.



WARNING The installation of a battery pack that is not inspected or approved by Teledyne Benthos may cause destruction of the modem housing or electronics should the battery pack rupture, leak, outgas, or improperly discharge. Any of these conditions can cause a buildup of gas inside the housing which may result in an explosion and personal injury or death. If it is suspected that a battery pack has discharged inside a housing, move the modem to a safe location as quickly as possible.

Battery Pack Power Usage

In the lowpower state, where the modem is switched on but is inactive, a very small amount of power, a maximum of 16.8 mw, is drawn from the modem battery pack. Therefore, the battery pack can provide power in the lowpower state for over 2 years. However, when the DSP and the receiver are active, hence not in the lowpower state, a relatively large amount of power, a maximum of 768 mw, is drawn from the battery pack while the modem receives data or commands. The most power, a maximum of 20 watts which occurs at a power level of 8, is drawn when the modem is transmitting. Therefore, unless a modem is to be deployed for well over a year with few transmissions, it is the amount of data to be transmitted that determines its useful deployment life.

Processing Overhead

When transmitting a packet of data, which can range from 1 byte to 4096 bytes, additional overhead for each packet is added. For every 256 bytes, 2 bytes are added for the checksum pass or fail results (CRC). In addition, for every packet the transmitter is on for an additional 0.8 seconds for the acquisition and header and an additional 0.4 seconds for the lowpower wakeup. Therefore, there is an additional 1.2 seconds of overhead for every packet transmitted. So if a number of packets containing less than 4096 bytes are transmitted periodically, then this overhead should be taken into account. But if a large amount of data is transmitted, with each packet containing 4096 bytes, then the overhead can be neglected for a first approximation of the battery capacity.

Modem Battery Pack Capacity Calculations

The modem battery pack, which uses alkaline batteries, provides an output of 21 V and a capacity of either 300 watt-hours for an ATM-914, ATM-915, ATM-924, or ATM-925, or 450 watt-hours for an ATM-964 or ATM-965 Acoustic Telemetry Modem.



NOTE The capacity of stored alkaline batteries decreases by approximately 5% per year at 21°C. When supplying power to a load in a 0°C environment, the capacity of alkaline batteries decreases by 25%. Therefore, do not use a modem battery pack that is greater than two years old, and replace any modem battery pack that measures less than 90% of its rated capacity, unless a very short deployment is planned.

Verifying the Modem Battery Pack Capacity for a Short Deployment

To verify that the modem battery pack has adequate capacity for the amount of data to be transmitted during a short deployment of 30 days or less, first determine the bit rate that is to be used. Then, referring to Section 2, "Specifications," determine the transmitter power. For a short deployment the lowpower state power can be neglected. The required capacity in watt-hours can be calculated by using the following equation:

$$\text{Watt-hours} = D * P / (R * 450)$$

Where

D = the amount of data to be transmitted in bytes

P = the transmitter power in watts

R = the bit rate in bits/second

The constant 450 is derived from 8 bits/byte and 3,600 seconds/hour, converting bits/sec to bytes/hour.

For example, an ATM-924 Acoustic Telemetry Modem will be used during a short deployment in a 21°C environment to transmit 3 Mbytes of data at 1200 bits/sec at power level 8. Since at this power level the transmitter power is 20 watts, the capacity requirement of the modem battery pack is:

$$\begin{aligned} \text{Watt-hours} &= (3 \text{ Mbytes})[(20 \text{ watts}/(1200 \text{ bits/sec} \times 450)] \\ &= 11 \text{ watt-hours} \end{aligned}$$

Referring to "Modem Battery Pack Capacities" on page 2-11, it can be seen that a modem battery pack for an ATM-914, ATM-915, ATM-924, ATM-925, ATM-964, and ATM-965 Acoustic Telemetry Modem is more than adequate.

An Example Deployment Calculation

The example below shows how to calculate the number of deployment days an ATM-925 Acoustic Telemetry Modem can operate when transmitting 500 bytes of data every 30 minutes and the modem is powered from its internal battery pack. The deployment conditions are the following:

Bit rate: 600 bits/sec
Temperature: 0°C
Transmit power: 20 watts (power level 8)

Start by calculating the amount of time to transmit the bytes in a packet. First, add the CRC to the packet. Since the packet is 500 bytes, there are two 256-byte subpackets, so 4 bytes must be added for a total of 504 bytes.

$$\begin{aligned}\text{Byte transmit time} &= (504 \text{ bytes}) * (8 \text{ bits/byte}) / (600 \text{ bits/sec}) \\ &= 6.72 \text{ seconds}\end{aligned}$$

Now add the 0.8 seconds for the acquisition and header and 0.4 seconds for the lowpower wakeup to calculate the total time to transmit a packet.

$$\begin{aligned}\text{Packet transmit time} &= 6.72 + 0.8 + 0.4 \\ &= 7.92 \text{ seconds}\end{aligned}$$

Calculate the number of packets transmitted per day.

$$\begin{aligned}\text{Packets/day} &= (24 \text{ hours/day}) * (60 \text{ minutes/hour}) / (30 \text{ minutes/packet}) \\ &= 48 \text{ packets/day}\end{aligned}$$

Then calculate the number of hours transmitting per day.

$$\begin{aligned}\text{Transmission hours/day} &= (48 \text{ packets/day}) * (7.92 \text{ seconds/packet}) \\ &\quad * (1 \text{ hour}/3600 \text{ seconds}) \\ &= 0.106 \text{ hours/day}\end{aligned}$$

With the number of hours transmitting per day known, calculate the watt-hours used to transmit per day.

$$\begin{aligned}\text{Watt-hours/day} &= 0.106 \text{ hours/day} * 20 \text{ watts} \\ &= 2.12 \text{ watt-hours/day}\end{aligned}$$

Calculate the time spent in the lowpower state per day.

$$\begin{aligned}\text{Lowpower state time/day} &= 24 \text{ hours/day} - 0.106 \text{ hours/day} \\ &= 23.89 \text{ hours/day}\end{aligned}$$

Calculate the power per day consumed in the lowpower state.

$$\begin{aligned}\text{Lowpower state power/day} &= 23.89 \text{ hours} * 16.8 \text{ mw} * 1 \text{ watt}/1000 \text{ mw} \\ &= 0.4 \text{ watt-hours/day}\end{aligned}$$

Calculate the total power consumed per day.

$$\begin{aligned}\text{Total power/day} &= 0.4 + 2.12 \\ &= 2.52 \text{ watt-hours/day}\end{aligned}$$

Since the modem is transmitting at power level 8, which is the maximum power, the total capacity of the battery is 250 Watt-hours. Given that the deployment is at 0°C, the battery must be derated for temperature. Reducing the capacity by 25% provides a total available capacity of $250 * 0.75$, or 187.5 watt-hours. Therefore, the total number of days the modem can be deployed and continue to transmit at full power is

$$\begin{aligned}\text{Deployment days} &= (187.5 \text{ watt-hours}) / (2.52 \text{ watt-hours/day}) \\ &= 74 \text{ days}\end{aligned}$$

Although at the end of the 74 days the battery will not have the capacity to continue to transmit at full power, it will have remaining capacity to transmit at a reduced power level. When a modem reaches the point that the battery can no longer support full power transmission, it will reduce its power level. A modem that is transmitting at power level 7 will only require 14 watts. At this power level the battery capacity is 300 watt-hours. Repeating the above calculation for a modem transmitting at 14 watts will show that the modem will consume 1.88 watt-hours per day. For the average transmit power for each of the power level settings, refer to Section 2, "Specifications." Therefore, with the capacity of the battery being 300 - 250, or 50 watt-hours, and derating the 50 watt-hours for temperature, provides $50 * 0.75$ or 37.5 watt-hours remaining capacity. Therefore, the total number days the modem will continue operating at power level 7 is

$$\begin{aligned}\text{Additional days at level 7} &= (37.5 \text{ watt-hours}) / (1.88 \text{ watt-hours/day}) \\ &= 20 \text{ days}\end{aligned}$$

Alternatively, if the modem is at power level 7 for the entire deployment, then the battery capacity available would be 300 watt-hours. Derating for temperature provides $300 * 0.75$, or 225 watt-hours. Transmitting at power level 7 consumes 1.88 watt-hours/ day.

$$\begin{aligned}\text{Deployment days at level 7} &= (225.0 \text{ watt-hours}) / (1.88 \text{ watt-hours/day}) \\ &= 119 \text{ days}\end{aligned}$$

Modem Operating Depth

The rated operating depth of an ATM-910 Series Acoustic Telemetry Modem is 500 meters; for an ATM-920 Series, it is 2000 meters, and for an ATM-960 Series, 6000 meters. For custom applications a higher depth rating can be provided. Refer to "Customer Service" on page vi for information on how to contact Benthos should a higher rating be required.



WARNING Do not subject a subsea modem or remote transducer to a depth that exceeds its depth rating as damage or destruction could occur.

Modem Communications Range

The communications range between two ATM-900 or UDB-9400 Series Acoustic Telemetry Modems depends on many factors: the transmitting modem's source level, the depth of the modems, the transducer orientations, the operating frequency band, the beam pattern of the transducers, the multipath and ambient noise conditions, and other factors. In general, horizontal ranges of two to three kilometers are typical with omnidirectional transducers and can be extended with the use of directional transducers. When the installation and environmental conditions are known, the approximate expected range can be estimated.

Multipath and Noise

Because of the advanced modulation techniques used by the ATM-900 and UDB-9400 Series Acoustic Telemetry Modem, reliable operation can be obtained even in relatively severe multipath and noise conditions, but usually at the expense of a reduced bit rate. Refer to "Modulation Techniques" on page 1-3 for an explanation of the modulation techniques. However, paying

particular attention to the modems' remote transducer orientations, their height above the bottom, or their depth below the surface, can reduce the effects of multipath and ambient noise. In some instances the use of acoustic baffles can further improve performance. In addition, the operating frequencies of other acoustic equipment in the area are an important consideration when attempting to achieve optimum performance from the modems.

Transducer Orientation

If possible, when using a remote directional transducer, orient the transducer such that it is pointing toward the receiving modem. When using an omnidirectional transducer, which has a toroidal beam pattern, the strongest response is in the horizontal plane which is off to the side. Refer to "Modem and Remote Transducer Types" on page 1-11 for more information on the omnidirectional and directional transducers.

Use of an Acoustic Baffle

For installations with relatively high multipath and ambient noise conditions, such as surface and bottom multipath reflections, ship noise, sea state noise, and other nearby acoustical noise sources, an acoustic baffle can be installed on the transducer. The acoustic baffle minimizes the effects of multipath signals and noise sources that arrive from behind the remote transducer. Teledyne Benthos can custom design and built acoustic baffles for any of the remote transducers, or they can be obtained from other sources if required. Refer to "Customer Service" on page vi for information on how to contact Teledyne Benthos for detailed specifications.

Height Above the Bottom and Distance Below the Surface

Adjusting the height of a remote transducer above the bottom for fixed bottom installations can reduce the effects of multipath. Generally, raising a transducer that is close to the bottom such that it is two or three meters above the bottom will usually reduce multipath from bottom reflections. Similarly, for a remote transducer that is near the surface, lowering the transducer will generally reduce the effects of multipath from surface reflections, and it will reduce the effects of both ship noise and surface noise.

Other Acoustic Devices

If there is other active acoustic devices in the vicinity of a modem which transmit at frequencies within or near the operating frequency of the modems, modem performance will likely be reduced. The installation and use of other equipment near a modem should be carefully considered prior to and after installing and deploying a modem.

Typical Deployment Configurations

The deployment configurations for the ATM-900 and UDB-9400 Series Acoustic Telemetry Modems should take into account the required modem operating depth and communications range, the multipath and noise influences, and other factors. As there are many possible deployment configurations that will take these factors into account, especially for the subsea modems, typical deployment configurations are presented only. In addition, refer to Section 4, "Setup and Test," for information on the cables and connectors used to connect the modems. The modems should be set up and tested prior to deployment.

Each subsea modem is encased within an anodized aluminum housing. Each remote transducer is encapsulated in a protective urethane mold and mounted to an anodized aluminum housing. These configurations provide a high degree of protection from physical damage. However, for all installation configurations, any installed cables that provide external power to the modem or connect to a remote transducer should be properly secured to prevent crimping or accidental disconnection.

UDB-9400 Transducer Deployment

The transducer supplied with the UDB-9400 Universal Deck Box is used as a dunking transducer. The transducer cable is used both to connect to the transducer and to lower it into the water. The weight of the transducer will assist in keeping it vertical when it is in the water. This cable must be strain relieved at the transducer end. Therefore, a Kellums grip is installed on the cable for this purpose. To strain relieve the cable, tie a nylon line from the loop in the Kellums grip to one of the holes in the connector guard. When securing the line, ensure that there is sufficient slack in the section of cable between the Kellums grip and the transducer connection to relieve any strain.

Subsea Modem Deployment

A subsea modem is typically moored on the sea floor, attached to a subsea structure, or installed on an AUV. In all cases the modem's built-in transducer or its remote transducer should be mounted such that it is oriented correctly. Refer to "Transducer Orientation" on page 3-7 for more specific requirements, and to Section 9, "Drawings," for detailed dimensional information on the subsea modems and remote transducers. When a subsea modem is moored, it should be securely anchored using a clump weight. And if it is moored or attached to a subsea structure, it should be pulled up vertically using flotation. The sidebar that is attached to the modem housing is used both to attach the flotation and to anchor the modem to a clump weight or to a structure.

Corrosion Protection

When mounting a subsea modem, it is very important to configure the mounting arrangement such that corrosion of the modem housing is prevented or minimized. It is best to avoid mounting the modem housing or sidebar directly to a metallic surface. Instead, it is best to use a mounting system made from rubber, plastic, composite, or a non-metallic material. Also, if at all possible, mount the modem using the attached sidebar which is made of stainless steel. Mounting the modem directly to a metallic surface, especially if it is made of a dissimilar metal, will cause premature corrosion and failure of the housing. For information on the housing and sidebar material, contact Teledyne Benthos. For information on how to contact Teledyne Benthos, refer to "Customer Service" on page vi.

O-Ring Inspection

When deploying a subsea modem that has *not* been opened since being sealed at the factory, no O-ring maintenance is required. However, if a subsea modem has been opened, the O-ring should be carefully inspected and, if necessary, replaced. Refer to "Cleaning or Replacing an O-ring" on page 8-11 for instructions on how to clean or replace an O-ring.

4 Setup and Test

This section provides instructions on how to unpack and set up the Teledyne Benthos ATM-900 and UDB-9400 Series Acoustic Telemetry Modems.



NOTE For instructions on how to set up the SR-50 and SR-100 SMART Releases and the SM-75 SMART Modem, refer to their respective user's manual.

Unpacking and Inspection

The acoustic telemetry modems, their associated components, and this manual are carefully packed in sealed boxes. Every effort is made to pack the modems to protect them during shipment. However, carefully inspect the boxes for any signs of external damage and immediately report any damage to Teledyne Benthos and to the freight carrier.

After inspecting the boxes, locate and remove the packing list. While referring to the packing list, carefully remove the contents of each of the boxes, checking the items against the packing list to verify that all the items on the list are included. Inspect the items for any physical damage that might have occurred during shipment. Immediately report any damage to Teledyne Benthos and to the freight carrier.

UDB-9400 Components

The UDB-9400 Universal Deck Box includes the following components:

- UDB-9400 Universal Deck Box with internal batteries
- Transducer
- Transducer cable
- Accessories case
- AC power cable
- UDB-9400 Universal Deck Box User's Manual

ATM-914 Components

The ATM-914 Acoustic Telemetry Modem includes the following components:

- ATM-914 Series Acoustic Telemetry Modem with internal alkaline battery pack and stainless steel mounting sidebar
- MCIL16F to serial port 1 DB9 RS-232, serial port 2 DB9 RS-232, and DC power connection
- MCIL3M to MCIL3F transducer cable
- Remote transducer
- MCDC16F dummy connector
- MCDC3M dummy connector
- ATM-900 Series Acoustic Telemetry Modems User's Manual

ATM-915 Components

The ATM-915 Acoustic Telemetry Modem includes the following components:

- ATM-915 Series Acoustic Telemetry Modem with internal alkaline battery pack and stainless steel mounting sidebar
- MCIL16F to serial port 1 DB9 RS-232, serial port 2 DB9 RS-232, and DC power connection
- MCDC16F dummy connector
- ATM-900 Series Acoustic Telemetry Modems User's Manual

ATM-916 Components

The ATM-916 Acoustic Telemetry Modem includes the following components:

- ATM-916 Series Acoustic Telemetry Modem
- MCIL16F to serial port 1 DB9 RS-232, serial port 2 DB9 RS-232, and DC power connection
- MCDC16F dummy connector
- ATM-900 Series Acoustic Telemetry Modems User's Manual

ATM-924 Components

The ATM-924 Acoustic Telemetry Modem includes the following components:

- ATM-924 Series Acoustic Telemetry Modem with internal alkaline battery pack and stainless steel mounting sidebar
- MCIL16F to serial port 1 DB9 RS-232, serial port 2 DB9 RS-232, and DC power connection
- MCIL3M to MCIL3F transducer cable
- Remote transducer
- MCDC16F dummy connector
- MCDC3M dummy connector
- ATM-900 Series Acoustic Telemetry Modems User's Manual

ATM-925 Components

The ATM-925 Acoustic Telemetry Modem includes the following components:

- ATM-925 Series Acoustic Telemetry Modem with internal alkaline battery pack and stainless steel mounting sidebar
- MCIL16F to serial port 1 DB9 RS-232, serial port 2 DB9 RS-232, and DC power connection
- MCDC16F dummy connector
- ATM-900 Series Acoustic Telemetry Modems User's Manual

ATM-926 Components

The ATM-926 Acoustic Telemetry Modem includes the following components:

- ATM-926 Series Acoustic Telemetry Modem
- MCIL16F to serial port 1 DB9 RS-232, serial port 2 DB9 RS-232, and DC power connection
- MCDC16F dummy connector
- ATM-900 Series Acoustic Telemetry Modems User's Manual

ATM-964 Components

The ATM-964 Acoustic Telemetry Modem includes the following components:

- ATM-964 Series Acoustic Telemetry Modem with internal alkaline battery pack and stainless steel mounting sidebar
- MCIL16F to serial port 1 DB9 RS-232, serial port 2 DB9 RS-232, and DC power connection
- MCIL3M to MCIL3F transducer cable
- Remote transducer
- MCDC16F dummy connector
- MCDC3M dummy connector
- ATM-900 Series Acoustic Telemetry Modems User's Manual

ATM-965 Components

The ATM-965 Acoustic Telemetry Modem includes the following components:

- ATM-965 Series Acoustic Telemetry Modem with internal alkaline battery pack and stainless steel mounting sidebar
- MCIL16F to serial port 1 DB9 RS-232, serial port 2 DB9 RS-232, and DC power connection
- MCDC16F dummy connector
- ATM-900 Series Acoustic Telemetry Modems User's Manual

ATM-966 Components

The ATM-966 Acoustic Telemetry Modem includes the following components:

- ATM-966 Series Acoustic Telemetry Modem
- MCIL16F to serial port 1 DB9 RS-232, serial port 2 DB9 RS-232, and DC power connection
- MCDC16F dummy connector
- ATM-900 Series Acoustic Telemetry Modems User's Manual

ATM-900 Components

The ATM-900 Board Set includes the following components:

- 2-conductor shielded internal transducer cable
- 10-pin Molex connector to DB9 RS-232 cable
- 5-pin Molex connector to DC power cable
- 6-pin Molex connector to DB9 RS-232 cable (w/dual serial option only)
- ATM-900 Series Board Set
- ATM-900 Series Acoustic Telemetry Modems User's Manual

ATM-903 Components

The ATM-903 Board Set includes the following components:

- 2-conductor shielded internal transducer cable
- 10-pin Molex connector to DB9 RS-232 cable
- 5-pin Molex connector to DC power cable
- 6-pin Molex connector to DB9 RS-232 cable (w/dual serial option only)
- ATM-903 Series Board Set
- Remote transducer
- MCIL3F with 2 meters of underwater cable transducer pigtail
- MCD3M dummy connector
- ATM-900 Series Acoustic Telemetry Modems User's Manual

ATM-980 Components

The ATM-980 Buoy Box includes the following components:

- ATM-980 Buoy Box
- MCIL4M DC power pigtail
- MCIL4M DC power and RS-232 pigtail
- ATM-900 Series Acoustic Telemetry Modems User's Manual

Modem Connections

Although some cables are included with the modems, special installations might require customer supplied cables and connectors. For this purpose complete connector and pinout descriptions for the subsea modems are provided in the following pages. For detailed wiring information on the UDB-9400, refer to its user's manual.

UDB-9400 Universal Deck Box Connections

All the connections to the UDB-9400 Universal Deck Box are made using front panel mounted connectors. These connectors are shown in Figure 4-1 and are described below.

PWR:	5-pin bulkhead connector—connects to the AC power source.
XDCR:	12-pin bulkhead connector—connects to the transducer.
AUX:	15-pin bulkhead connector—available for connection to headphones and to external 10–30 VDC power (optional). Also provides spare outputs and inputs and a transmit sync output.
COM1:	DB-9S connector—female serial port connector that connects to the host processor and is used for sending and receiving acoustic telemetry modem commands and data.
COM2:	DB-9S connector—female serial port connector that connects to a PC and is used for inputting commands and outputting round trip travel times and status information in a manner that emulates the DS-7000 Acoustic Deck Set.

Subsea Modem Connections

All the subsea modems include a POWER/SERIAL connector on the connector end cap for the external power and RS-232/422 connections. The ATM-914, ATM-924 and ATM-964 Acoustic Telemetry Modems also include a TRANSDUCER connector on the top end cap for connecting to the supplied remote transducer. A 2-meter cable is also supplied with the modem for this purpose.

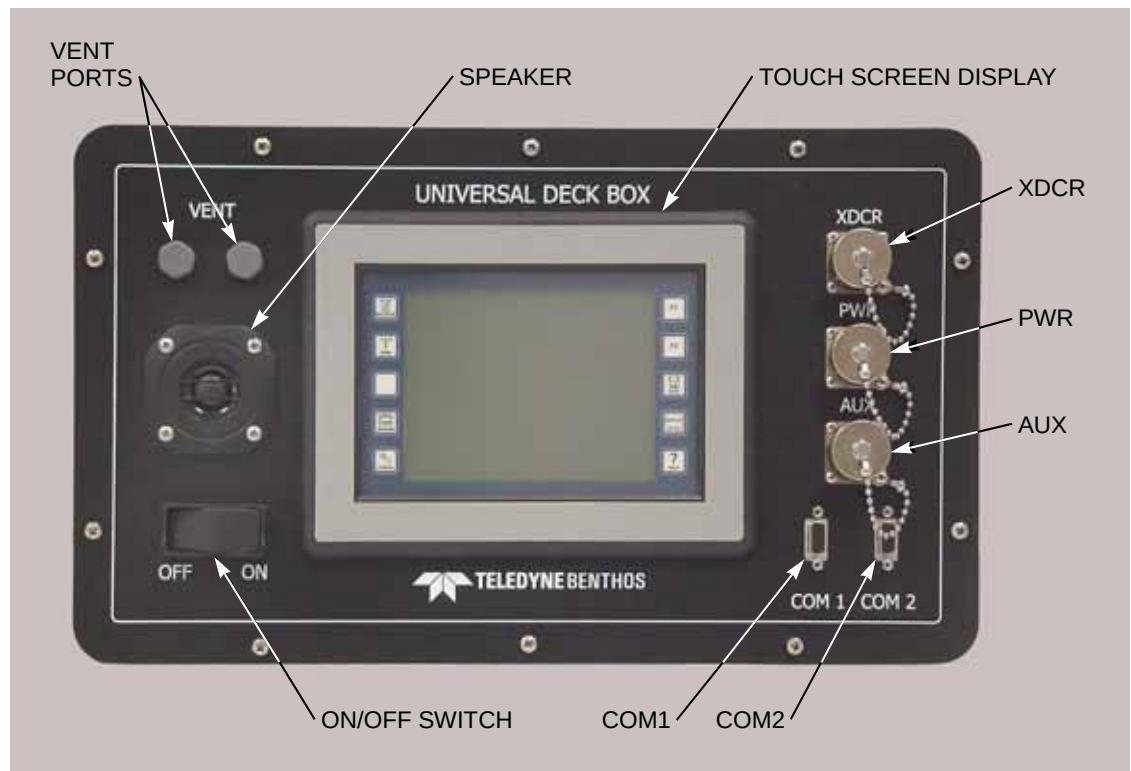


Figure 4-1 UDB-9400 Front Panel Operator Functions and Connectors

Modem Operator Functions

All the modems can be controlled directly from the connected host processor, including the keyboard of a PC if a PC is used as the host processor. In addition, for the UDB-9400 only, operator functions are provided on a touch screen display that is mounted to the front panel. The subsea modems have only one operator function, an on/off switch that powers up and powers down the modem.

UDB-9400 Universal Deck Box Operator Functions

The operator functions for the UDB-9400 Universal Deck Box are shown in Figure 4-1. They include the following:

- | | |
|------------------------------|---|
| OFF/ON switch: | Rocker switch—turns the UDB-9400 on or off. |
| Touch screen display: | Displays data and enables operator input and control; includes a built-in speaker that provides |

audio outputs, including a beep when a touch screen display control is touched or an error occurs.

Speaker: Provides an audio verification of transmitted and received data, pings and replies.

Vent ports: Allow pressure relief from battery outgassing during charging without ingressing water.

Subsea Modem Operator Functions

The only operator function on the subsea modems is the on/off switch which is located on the side of the transducer end cap. To turn on the modem, push the switch all the way in. To turn off the modem, pull the switch all the way out. This configuration causes the modem to turn on automatically when deployed due to ambient pressure.



Figure 4-2 Subsea Modem On/Off Switch



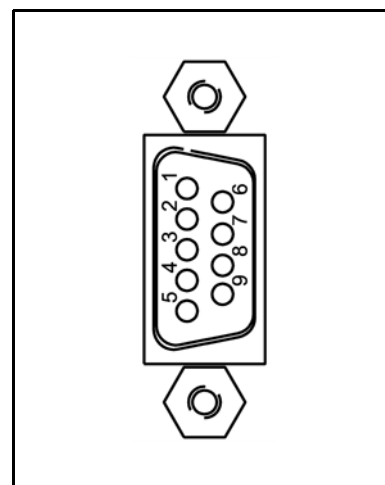
NOTE The on/off switch on a subsea modem is protected with a red rubber cap. This cap must be removed before the switch can be operated and must be left off when deploying the modem.

Setting Up the Modems

To check and operate the modems, they must be connected to their host processors and transducers. A host processor can be either a PC or an instrument. The information presented in the following pages encompasses connecting the modems to PCs so that their operation can be verified and the acoustic link can be checked in air. If an instrument is to be used as a host processor, refer also to the documentation provided with the instrument.

Setting up the UDB-9400 Universal Deck Box

Setting up the UDB-9400 Universal Deck Box requires making the power and serial interface connections and connecting the transducer. When connecting the deck box to a PC, refer to Figure 4-3 for the COM1 connector pin orientation and to Table 4-1 for the pinout information.



**Figure 4-3 UDB-9400
COM1 Connector, Face
View**

Table 4-1 UDB-9400 COM1 Connector Pinouts

PIN	LABEL	FUNCTION	SIGNAL DIRECTION
2	TXD/RX(-)	RS-232 Transmit/RS-422 Receive(-)	Modem to Host/ Host to Modem
3	RXD	RS-232 Receive	Host to Modem
4	TX(+)	RS-422 Transmit(+)	Modem to Host
5	GND	Ground	
6	TX(-)	RS-422 Transmit(-)	Modem to Host
7	CTS	Clear to Send	Host to Modem
8	RTS/RX(+)	Request to Send/RS-422 Receive(+)	Modem to Host/ Host to Modem

Perform the steps listed below to connect a transducer and a PC to a UDB-9400 Universal Deck Box. Refer to "UDB-9400 Universal Deck Box Connections" on page 4-5 for information on the deck box connectors and their locations.

1. Connect the transducer cable from the XDCC connector on the deck box to the bulkhead connector on the transducer. Both the cable and the transducer are supplied with the deck box.
2. Connect the AC power cable from the PWR connector on the deck box to the AC power source.
3. Connect an RS-232 serial cable from the COM1 connector on the deck box to an available serial COM port on the PC. Refer to Table 4-1 on page 4-9 for the connector pinout information. A straight wire, pin for pin connection to the PC's serial COM port is what is required as shown in Table 4-2. The table shows the connections for a DB-9 serial port connector typically used on laptop computers.

**Table 4-2 UDB-9400 COM1 Connector to DB-9
Pin-to-Pin Connections**

UDB-9400 COM1 CONNECTOR			SIGNAL DIRECTION	HOST PC DB-9 CONNECTOR		
PIN	LABEL	FUNCTION		PIN	LABEL	FUNCTION
2	TXD	Transmit	Modem to Host	2	RXD	Receive
3	RXD	Receive	Host to Modem	3	TXD	Transmit
8	RTS	Request to Send	Modem to Host	8	CTS	Clear to Send
5	GND	Ground	—	5	GND	Ground

Setting up the Subsea Modems

Setting up any of the subsea modems requires making the power and serial interface connections, and for an ATM-914, ATM-924 or ATM-964 Acoustic Telemetry Modem, the transducer connections.

Power and Serial Interface Connections.

The power and serial interface connections are made with the POWER/SERIAL connector located on the connector end cap of the subsea modem. Either an RS-232 or an RS-422 serial interface connection can be made. When connecting the subsea modem to a PC or to an instrument, refer to

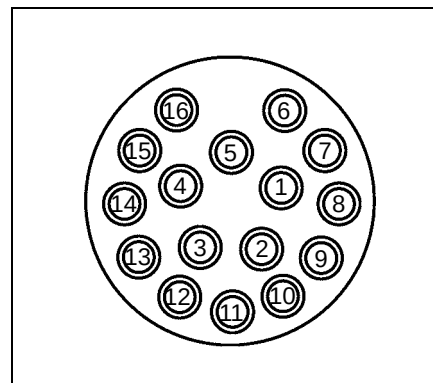


Figure 4-4 Subsea Modem POWER/SERIAL Connector, Face View

Table 4-3 Subsea Modem POWER/SERIAL Connector Pinouts

PIN	LABEL	PORT	FUNCTION	SIGNAL DIRECTION
1	Power	—	External Power Input (21–28 VDC)	To Modem
2	Spare		Reserved	—
3	GND		Ground	
4	TX(+)	1	RS-422 Transmit(+)	Modem to Host
5	DE		Device Enable (See NOTE below.)	Modem to Host
6	RTS/RX(+)		Request to Send/RS-422 Receive(+)	Modem to Host/ Host to Modem
7	TX(-)		RS-422 Transmit(-)	Modem to Host
8	RXD		RS-232 Receive	Host to Modem
9	TXD/RX(-)		RS-232 Transmit/RS-422 Receive(-)	Modem to Host/ Host to Modem
10	GND		Ground	
11	RXD	2	RS-232 Receive	Host to Modem
12	TXD		RS-232 Transmit	Modem to Host
13	RTS	2	Request to Send	Host to Modem
14	DE		Device Enable (See NOTE below.)	Modem to Host
15	GND		Ground	
16	Spare	—	Reserved	—

Figure 4-4 for the POWER/SERIAL connector pin orientation, and to Table 4-3 for the pinout information. The POWER/SERIAL connector is a 16-pin Impulse MCBH16M bulkhead connector that requires an Impulse MCIL16F mating connector pigtail.



NOTE The Device Enable output is on when the modem is sending data to the host or if the modem receives the Dial command (ATD). Refer to "Device Enable" on page 5-65 for more information. Refer also to Section 2, "Specifications," for the electrical specifications.



NOTE When the modem is switched on, the internal batteries automatically power the modem when there is no external power or if the external power drops below 22 VDC.

To connect the modem to a power supply and to an instrument using the RS-232 or RS-422 interface, refer to the pinout information provided in Table 4-3 on page 4-11 for the POWER/SERIAL connector, and to the connector information provided with the instrument. A mating connector pigtail is provided for this purpose.

To connect a subsea modem to a power supply and to a PC, perform the steps listed below.

1. Connect the connector pigtail to the POWER/SERIAL connector.
2. Refer to Table 4-4 and connect the pins listed to an available serial COM port on the PC. The table shows the connections for a DB-9 serial port connector typically used on laptop computers.
3. Refer to Table 4-3 on page 4-11 and connect the DC power and ground pins to the DC power supply if one is used

Transducer Connections. For an ATM-914, ATM-924 or ATM-964 Acoustic Telemetry Modem, connect the supplied transducer cable to the TRANSDUCER connector on the modem and to the bulkhead connector on the remote transducer.

**Table 4-4 Subsea Modem POWER/SERIAL Connector to DB-9
Pin-to-Pin Connections**

SUBSEA MODEM POWER/SERIAL CONNECTOR				SIGNAL DIRECTION	HOST PC DB-9 CONNECTOR PORT 1			HOST PC DB-9 CONNECTOR PORT 2		
PIN	LABEL	PORT	FUNCTION		PIN	LABEL	FUNCTION	PIN	LABEL	FUNCTION
10	GND	1	Ground		5	GND	Ground	—		
6	RTS		Request to Send	Modem to Host	8	CTS	Clear to Send			
8	RXD		Receive	Host to Modem	3	TXD	Transmit			
9	TXD		Transmit	Modem to Host	2	RXD	Receive			
11	RXD	2	Receive	Host to Modem	—			3	TXD	Transmit
12	TXD		Transmit	Modem to Host				2	RXD	Receive
13	RTS		Request to Send	Modem to Host				8	CTS	Clear to Send
15	GND		Ground					5	GND	Ground

Setting up the ATM-900 and ATM-903 Board Sets

The ATM-900 and ATM-903 Board Sets are set up with all of the connections made directly to the boards.

Power and Serial Interface Connections.

The power and serial interface connections, RS-232 or RS-422, are made with separate connectors on the ATM-900 and ATM-903 Board Sets. When connecting an ATM-900 or ATM-903 to a PC or to an instrument, power is connected to J3 of the Transmit/Receiver Board, and one of two serial interface connections is made to J7 of the DSP Board. Refer to Figure 4-5 for the DSP Board serial connector J7 pin orientation, and to Table 4-5 on page 4-15 for the pinout information. Refer to Table 4-7 on page 4-16 for the power connector J3 pinouts. J3 requires a Molex 09-50-3051 mating connector with Molex 08-50-0185 pins. J7 requires a Molex 22-55-2101 mating connector with Molex 16-02-1117 pins and Molex 15-04-5104 clip. In addition, a Molex 15-04-0292 key must be inserted into pin 1 of the 22-55-2101 connector. J7 is serial port 1.

The second serial interface connection is made to J8. Refer to Figure 4-6 for the DSP Board serial connector J8 pin orientation, and to Table 4-6 for the pinout information. J8 requires a Hirose DF11-6DS-2C mating connector with Hirose DF11-2428SCA pins. J8 is serial port 2.

The locations of the connectors are shown in Drawing B-270-156. The drawing is included in Section 9, "Drawings."

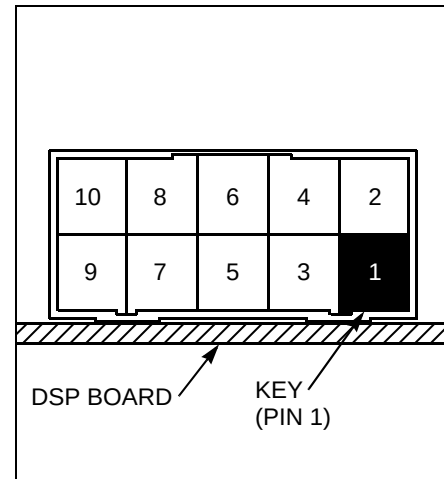


Figure 4-5 ATM-900 and ATM-903 DSP Board Serial Connector J7, Face View

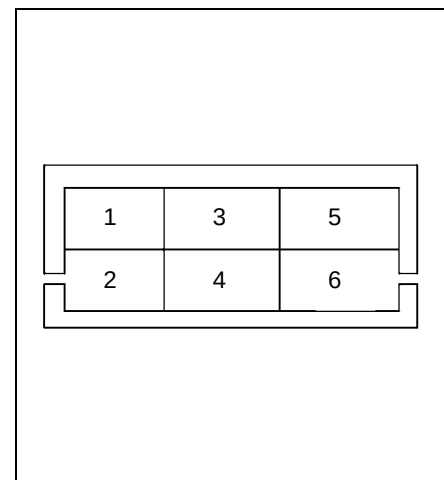


Figure 4-6 ATM-900 and ATM-903 DSP Board Serial Connector J8, Face View

**Table 4-5 ATM-900 and ATM-903 DSP Board Serial Port 1
Connector J7 Pinouts**

PIN	LABEL	FUNCTION	SIGNAL DIRECTION
1	Keyed Pin		
2	No Connection		
3	GND	Ground	
4	TXD/RX(-)	RS-232 Transmit/RS-422 Receive(-)	Modem to Host/ Host to Modem
5	TX(+)	RS-422 Transmit(+)	Modem to Host
6	RXD	RS-232 Receive	Host to Modem
7	DE	Device Enable (See NOTE below.)	Modem to Host
8	No Connection		
9	TX(-)	RS-422 Transmit(-)	Modem to Host
10	RTS/RX(+)	Request to Send/RS-422 Receive(+)	Modem to Host/ Host to Modem

**Table 4-6 ATM-900 and ATM-903 DSP Board Serial Port 2
Connector J8 Pinouts**

PIN	LABEL	FUNCTION	SIGNAL DIRECTION
1	RTS	Request to Send	Modem to Host
2	No Connection		
3	GND	Ground	
4	TXD	RS-232 Transmit	Modem to Host
5	DE	Device Enable (See NOTE below.)	Modem to Host
6	RXD	RS-232 Receive	Host to Modem



NOTE The Device Enable output is on when the modem is sending data to the host or if the modem receives the Dial command (ATD). Refer to "Device Enable" on page 5-65 for more information. Refer also to Section 2, "Specifications," for the electrical specifications.

Table 4-7 ATM-900 and ATM-903 Transmit/Receive Board Power Connector J3 Pinouts

PIN	FUNCTION
1	Reserved
2	Ground
3	External Power Input 1 (12–36 VDC)
4	Ground
5	External Power Input 2 (12–36 VDC)

Perform the steps listed below to connect an ATM-900 or ATM-903 to a DC power supply and to an instrument or PC.



WARNING Pin 5 is NOT protected against reverse polarity. DO NOT connect Pin 5 to the negative of the DC power supply as damage to the modem will occur. If reverse polarity protection is required, connect Pin 3 to the DC power supply positive instead as described below for Step 4.

1. Refer to Table 4-7 and connect Pin 5 to the DC power supply positive through a 6-Amp inline fuse.
2. Connect Pin 4 to the DC power supply negative.
3. If connecting serial port 1 of the ATM-900 or ATM-903 to an instrument, refer to Table 4-5 on page 4-15 and connect the pins listed to the RS-232 or RS-422 interface of the instrument. For serial port 2, refer to Table 4-6 on page 4-15 and connect the pins listed to the RS-232 interface.

If connecting the ATM-900 or ATM-903 to a PC, refer to Table 4-8 for serial port 1 or to Table 4-9 for serial port 2 and connect the pins listed to an available serial COM port on the PC. The tables show the connections for a DB-9 serial port connector typically used on laptop computers.

If required, continue with the steps listed below to connect a second DC power supply as a backup or if reverse polarity protection is required when connecting a single supply.



NOTE Pin 3 is diode protected against reverse polarity. Connect Pin 3 to the DC power supply positive when reverse polarity protection is required. Some power loss will result due to the power dissipation across the diode.

4. Refer to Table 4-7 on page 4-16 and connect Pin 3 to the DC power supply positive through a 6-Amp inline fuse
5. Connect Pin 2 to the DC power supply negative.

Table 4-8 ATM-900 and ATM-903 DSP Board Serial Port 1 Connector J7 to DB-9 Pin-to-Pin Connections

ATM-900 and ATM-903 DSP BOARD SERIAL PORT 1 CONNECTOR J7			SIGNAL DIRECTION	HOST PC DB-9 CONNECTOR		
PIN	LABEL	FUNCTION		PIN	LABEL	FUNCTION
3	GND	Ground		5	GND	Ground
4	TXD	Transmit	Modem to Host	2	RXD	Receive
6	RXD	Receive	Host to Modem	3	TXD	Transmit
10	RTS	Request to Send	Modem to Host	8	CTS	Clear to Send

Table 4-9 ATM-900 and ATM-903 DSP Board Serial Port 2 Connector J8 to DB-9 Pin-to-Pin Connections

ATM-900 and ATM-903 DSP BOARD SERIAL PORT 2 CONNECTOR J8			SIGNAL DIRECTION	HOST PC DB-9 CONNECTOR		
PIN	LABEL	FUNCTION		PIN	LABEL	FUNCTION
1	RTS	Request to Send	Modem to Host	8	CTS	Clear to Send
3	GND	Ground		5	GND	Ground
4	TXD	Transmit	Modem to Host	2	RXD	Receive
6	RXD	Receive	Host to Modem	3	TXD	Transmit

ATM-903 Transducer Connections. The ATM-903 includes a remote transducer and a transducer cable. Connect the transducer cable to the transducer and to J1 of the Transmitter Board. Table 4-10 shows the pinout information for the connectors on the transducer cable. J1 requires a Molex 50-57-9405 mating connector with Molex 16-02-1117 pins. A wiring diagram for the transducer cable is shown in Figure 4-7. The transducer cable connector on the transducer is an Impulse MCIL3F connector.

Table 4-10 ATM-903 Transducer Cable Wiring

TRANSMITTER BOARD J1	FUNCTION	TRANSDUCER CABLE TRANSducer CONNECTOR
1	Transducer (-)	2
2	—	No Connection
3	Transducer (+)	3
4	—	No Connection
5	Shield	1

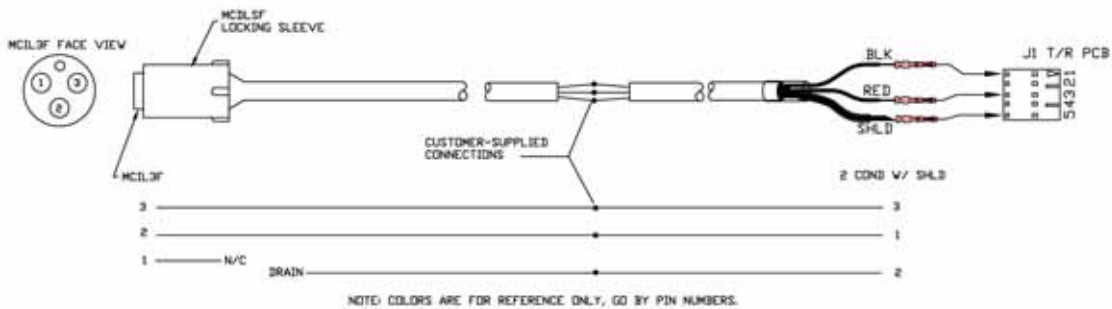


Figure 4-7 ATM-903 Transducer Cable Wiring Diagram

Setting up the ATM-980 and ATM-980RF Buoy Boxes

Setting up the ATM-980 and ATM-980RF Buoy Boxes requires making the power and serial interface connections to a power supply and a host processor, and connecting to a subsea modem, typically an ATM-926 Acoustic Telemetry Modem. For the ATM-980RF Buoy Box only, an RF connector is also included for connection to an RF antenna.

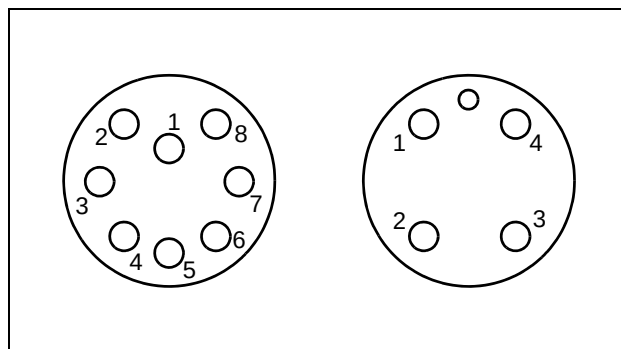


Figure 4-8 8-Pin and 4-Pin Connectors

Power and Serial Interface Connections. The power and serial interface connections to the power supply and a host processor are made with the 4-pin connector located on the side of the buoy box. The serial interface connection is RS-232 only. Refer to Figure 4-8 for the connector pin orientation, and to Table 4-11 for the pinout information. The 4-pin connector is an Impulse MCBH-4-FS bulkhead connector that requires an Impulse MCIL-4-M mating connector pigtail. A cable pigtail is supplied.

Table 4-11 ATM-980 4-Pin Connector Pinouts

PIN	LABEL	FUNCTION	SIGNAL DIRECTION
1	Power	External Power Input (24 VDC)	To Buoy Box
2	TXD	RS-232 Transmit	Buoy Box to Host
3	GND	Ground	
4	RXD	RS-232 Receive	Host to Buoy Box

Subsea Modem Connections. The modem connections to the subsea modem are made with the 8-pin connector located on the side of the buoy box. Refer to Figure 4-8 for the connector pin orientation, and to Table 4-12 for the pinout information. The 8-pin connector is an Impulse MCBH-8-FS bulkhead connector that requires an Impulse MCIL-8-M mating connector. A cable is separately available with an MCIL-8-M connector on one end for connecting to the buoy box, and a MIL-9-FS connector on the opposite end for connecting to the subsea modem.

Table 4-12 ATM-980 8-Pin Connector Pinouts

PIN	LABEL	FUNCTION	SIGNAL DIRECTION
1	Power	External Power Input (24 VDC)	To Modem
2	GND	Ground	
3	TX(+)	RS-422 Transmit(+)	Modem to Buoy Box
4	RTS/RX(+)	Request to Send/RS-422 Receive(+)	Buoy Box to Modem
5	TX(-)	RS-422 Transmit(-)	Modem to Buoy Box
6	TXD/RX(-)	RS-232 Transmit/RS-422 Receive(-)	Buoy Box to Modem
7	DE	Device Enable	Modem to Buoy Box
8	RXD	RS-232 Receive	Buoy Box to Modem

Setting up the Host Processor

If a PC is to be used as the host processor, it must be set up to run a terminal program, such as ProComm Plus, which is available from DataStorm Technologies, or Tera Term, which can be downloaded from <http://logmett.com/index.php?/products/teraterm.html>. The serial port used to connect to the modem must be selected and correctly configured using the terminal program.

If an instrument is to be used as the host processor, refer to the documentation provided with the instrument for the setup information.

After connecting the modem to the PC as described in "Setting Up the Modems" on page 4-9, perform the steps listed below to prepare the PC.

1. Install the terminal program communications software on the PC.
2. Start the terminal program, select the serial port that is connected to the modem and configure the port as follows:

Baud Rate: 9600 baud

Parity: None

Data Bits: 8

Stop Bits: 1

In addition, the terminal emulation type should be set to the VT-100 or, if VT-100 is not available, ANSI.

5 Modem Operation

This section provides an overall description of the Teledyne Benthos ATM-900 and UDB-9400 Series Acoustic Telemetry Modems operation, including the different operating modes, their associated commands and how to enter them. The modem commands, which are input to a modem from its host processor over the serial interface, control the operation of the modem. Therefore an understanding of the operating modes and commands is important when integrating and operating the modems with other subsea instrument packages.



NOTE To enter commands the modem must be connected to a computer that is set up to run a terminal program, such as ProComm Plus or Tera Term. Refer to "Setting Up the Modems" on page 4-9 for instructions on how to connect the modem to a PC and to "Setting up the Host Processor" on page 4-20 for instructions on how to set up the PC as the local host processor.

Modem commands are entered using the Command Line for Acoustic Modem (CLAM) shell user interface. The CLAM shell provides both user input and output and is similar to that provided on Unix platforms and includes commands for command history, command concatenation, tab completion, aliasing, and others. The CLAM shell also supports the AT command set which is similar to the Hayes standard AT commands that is used for dial-up modems. All the AT commands begin with "AT." For a detailed description of the available AT commands and how to use them, refer to Section 6, "Modem AT Command Set." Many of these commands are called out in this section.

Although the modem commands control the operation of the modems, configuration parameters directly affect how some of the commands are applied and how a modem functions in each of its operating modes. For a detailed description of the configuration parameters and how to set them, refer to Section 7, "Modem Configuration Parameters." A number of the configuration parameters are called out in this section.



NOTE When entering a configuration parameter setting, the configuration parameter name is prefixed with the character "@," followed by the character "=" and then the setting itself. This format is used throughout this manual when referring to an actual configuration parameter setting.

Online Mode

When a modem is in Online mode and is online with a remote modem, input from its host processor over the serial interface is treated as data which are freely exchanged between the local and remote host processors.

A modem will go into Online mode when it is powered up *only* if @OpMode=Online, which is the factory default setting. In this case any input to the modem over the serial interface is transmitted to the remote modem whose address is the setting of its RemoteAddr configuration parameter. Therefore @OpMode=Online allows the modem to go online automatically with that remote modem after being powered up or awakened from its lowpower state. The remote modem can be in any mode.

A modem can be placed into Online mode and go online with a remote modem regardless which mode the remote modem is in, and in any of the following ways:

Using the Dial command (ATDn). From Command mode only, entering the Dial command will cause the modem to go into Online mode and to go online with the remote modem at address n. The Dial command also sets the RemoteAddr configuration parameter setting of the remote modem to the address of the local modem and the RemoteAddr configuration parameter setting of the local modem to the address of the remote modem.

Using the Online command (ATO). From Command mode only, entering the Online command will cause the modem to go into Online mode and to go online with the remote modem whose address is the setting of its RemoteAddr configuration parameter. The Online command also sets @OpMode=Online which ensures the modem will remain online if the modem is awakened from the lowpower state.

Setting @OpMode=Online. From Command mode only, setting @OpMode=Online will cause the modem to go into Online mode and to go online with the remote modem whose address is the setting of its RemoteAddr configuration parameter. Setting @OpMode=Online also ensures the modem will remain online if power is cycled or the modem is awakened from the lowpower state.

Cycling power—@OpMode=Online. If @OpMode=Online and cfg store is used to save the configuration parameter settings, powering down the modem and then powering up the modem will place it into Online mode and the modem will be online with the remote modem whose address is the setting of its RemoteAddr configuration parameter.

Receiving a Dial command (ATDn) from a remote modem. If the modem receives a Dial command from a remote modem, the modem will go into Online mode and go online with the remote modem.

Transmit Data Buffers

Each modem includes eight internal 4-kbyte transmit data buffers for a total buffer size of 32 kbytes. This allows data that are input to the modem over the serial interface to be organized into eight 4-kbytes packets. After a transmit data buffer has filled, the modem will immediately transmit the entire data packet. If data are input to the modem, but the transmit data buffer does not fill, the modem will transmit the partial data packet after a preset time called the forwarding delay. The forwarding delay is determined by the setting of the FwdDelay configuration parameter and ranges from 50 milliseconds to 5 seconds in 50-millisecond intervals.



WARNING If the Online Interrupt command (+++) is entered to place the modem into Command mode while data remains in a partially filled 4-kbyte transmit data buffer, the data will not be transmitted and the buffer will be cleared. Refer to "Online Interrupt +++" on page 6-6 for information on the Online Interrupt command.

While data are being transmitted from a 4-kbyte transmit data buffer, data can continue to be input to the modem over the serial interface, filling the additional 4-kbyte transmit data buffers. Since the serial interface baud rate is typically faster than the acoustic bit rate, having the eight 4-kbyte transmit data buffers allows a faster serial interface baud rate for up to 32 kbytes of data. If an instrument is expected to output a continuous stream of data to the modem that exceeds 32 kbytes, flow control must be used to prevent loss of data. For information how to set the flow control, refer to "P1FlowCtrl" on page 7-9 for serial port 1 and to "P2FlowCtrl" on page 7-15 for serial port 2.



WARNING If flow control is *not* used and data are input to the modem when all eight of the 4-kbyte transmit data buffers are full, the data will be ignored, hence lost.

If data retry, as determined by the setting of the DataRetry configuration parameter, is enabled, the total buffer size is reduced to 28 kbyte, as one of the 4-kbyte transmit data buffers is reserved for retransmission of the data

should an error occur. If disabled, the full 32 kbytes are available. For information on the DataRetry configuration parameter, refer to "DataRetry" on page 7-35. Flow control will ensure there is no loss of data, as when the eight 4-kbyte transmit data buffers are full, flow control will not allow the host processor to output data to the modem.

Data Format

Data, including parity, that are input to a modem over the serial interface when the modem is in Online mode can be in any format that fits into 8-bit bytes. For example, the data can be 7 bits with parity, 8-bit ASCII or 8-bit binary. However, it cannot be 8 bits with parity.

Online Break

A local modem that is connected to a PC will detect a serial port break if it is sent over the serial interface from the PC. If the local modem is online with a remote modem, it will command the remote modem to send the equivalent break on its serial interface. If the remote modem is connected to an RD Instruments Acoustic Doppler Current Profiler (ADCP), the break will wake up and reset the current meter. Therefore, the current meter essentially performs in the same manner as it would if it received the break directly from the PC.

Error Checking

With each 4-kbyte data packet transmitted, a checksum is calculated and also transmitted. The modem that receives the packet also calculates a checksum and compares it to the transmitted checksum. If enabled with the setting of the Verbose configuration parameter, the received data statistics comprising the checksum pass or fail results (CRC), the multipath delay (MPD), the signal-to-noise ratio (SNR), the relative speed between the local and remote modems (SPD), the automatic gain control (AGC), and the corrected channel errors (CCERR) are displayed. Refer to "Acoustic Link Test ATXn" on page 6-23 for a detailed description of the received data statistics. The Verbose configuration parameter must be set to 2 or higher for the received data statistics to be displayed. In addition, the ShowBadData configuration parameter must be set to Ena to display data packets with failed CRCs.

Command Mode

When a modem is in Command mode, input from its host processor over the serial interface is treated as commands. A modem will go into Command mode when it is powered up *only* if @OpMode=Command.



NOTE The factory default setting of the OpMode configuration parameter is Online, which causes the modem to go into Online mode when it is powered up.

When powered up in any mode, a modem will display a banner message. The banner message includes the frequency band, such as LF or MF, the firmware version, and the current date and time as shown in the following example:

```
Teledyne Benthos ATM-900 Series  
LF Frequency Band  
Standard Modem Version 8.0.1  
Jan 6 2011 18:16:52  
CONNECT 00800 bits/sec
```

The banner message is suppressed when @Verbose=0.

There are two basic types of commands provided by the CLAM shell and the AT command set that it supports: commands that are executed by the local modem—the modem where the commands are entered over the serial interface—and commands that are sent by the local modem over the acoustic link to be executed by a remote modem. The commands perform a number of different functions: setting of the local modem's configuration parameters, going online with a remote modem, reading a remote modem's configuration parameter settings, testing the acoustic link between the local and remote modems, and many others. When a command is entered, the modem will indicate the execution of the command with a message and then display the command prompt.

A modem can be placed into Command mode in any of the following ways:

Using the Online Interrupt command (+++). Entering the Online Interrupt command will place the modem into Command mode. Refer to "Online Interrupt +++" on page 6-6 for information on the Online Interrupt command.

Cycling power—@OpMode=Command. If @OpMode=Command *and* *cfg store* is used to save the configuration parameter settings, powering down the modem and then powering up the modem will place the modem into Command mode.

Acoustic Command Execution

When a modem receives a command over the acoustic link, it will respond in one of the following ways:

Go into one of two of the operating modes. If the command is the Dial command (ATDn), then the modem will go into Online mode; if it is the Remote Datalogger Disable command (AT\$BDn) *and* the modem is in Datalogger mode, then also Online mode; if it is the Remote Datalogger Enable command (AT\$BEn), then Datalogger mode.

Go into the lowpower state. If the command is the Hang Up command (ATH), the modem will go into the lowpower state without transmitting an acknowledgment.

Transmit an acknowledgment. If the command is one that does not require that the modem transmit back specific information, the modem will execute the command and transmit an acknowledgment. For example, if a modem receives the Remote Power command (AT\$Pn,m), it executes the command by setting the transmit power level to level m, and then it transmits an acknowledgment at the new transmit power level.

Transmit information. If the command is one that requires that the modem transmit back specific information, the modem will transmit the requested information. For example, if a modem receives the Remote Bytes Stored command (AT\$BNn), it executes the command by transmitting the number of bytes stored in its data logger memory.

Entering Commands

Commands can only be entered when a modem has been connected to a host processor and is in Command mode. For information on how to set up the modem, refer to "Setting Up the Modems" on page 4-9. The commands are input to the modem from its host processor over the serial interface at the baud rate of the serial interface. The data format for the commands is ASCII with 8 bits, no parity and 1 stop bit.



NOTE Any reference to a local modem in the command descriptions that follow refers to the modem to which commands and data are input from the host processor over the serial interface. Any reference to a remote modem refers to the modem to which acoustic commands are sent and from which data and acknowledgments are received over the acoustic link.

If an external PC is used as the host processor, commands can be entered from the keyboard and data and messages displayed on the monitor. Commands are entered at the command prompt, and every command must be followed by pressing Enter for the command to be executed.

To enter a command, type the command in accordance with the command entry requirements. Keyboard functions, such as Backspace, Delete and Left and Right Arrows can be used if needed. For CLAM shell commands only, multiple commands can be entered on a single line by separating them with a semicolon (;). However, this command concatenation feature should be used carefully, as it can sometimes produce undesirable results, depending on the commands selected and the number of them.

Command Line Shortcuts

To make inputting and editing of command lines easier, the following command line shortcuts are available:

Ctrl-A. Returns the cursor to the start of the command line without deleting any characters.

Ctrl-D. Terminates certain commands. In particular it will terminate any command that is expecting an input stream.

Ctrl-K. Deletes all the characters on the command line from the cursor position to the end of the line.

Ctrl-U. Deletes the entire command line.

Left and Right Arrow keys. Moves the cursor left and right on the command line.

Up and Down Arrow keys. Scrolls up and down through the command line history buffer.

Tab Completion

Tab completion, which applies to CLAM shell commands, saves typing by automatically completing partially entered commands, file names and configuration parameters based on available matches. If a single match is found, the command, file name or configuration parameter entry is completed. If two or more possible matches are found, a partial completion is attempted up to the first character difference, and then all the possible matches are displayed as a guide for entering additional characters or as a simple help feature to indicate what commands are available. To use the tab completion feature, enter one or more characters, and then press Tab. Tab completion can be used multiple times on a single line.



NOTE Tab completion cannot be used when entering AT commands.

Command Prompts

The command prompt includes any combination of the ">" character, the privilege level and the history number as in the following example:

user:5>

Any one or a combination of these characters are selectable, or no prompt can be selected. The command prompt is selected using the prompt configuration parameter.

To select the prompt, enter @prompt= followed by a numerical code as follows:

- 1** >
- 2** Privilege level
- 4** Command history number

To select two or all three prompts, create the code by adding the corresponding numbers. For example, setting @prompt=7 will create the following prompt:

user:36>

for a privilege level of user. To select no prompt, enter @prompt=0. To display the codes for the prompts, enter @prompt. For more information on the Prompt configuration parameter, command, refer to "Prompt" on page 7-22.

Strict AT

Although both CLAM shell and AT commands can be used interchangeably, a modem can be commanded to accept *only* AT commands by entering `strictat` or by setting `@StrictAT=Ena`. To return to normal operation, enter `nostrictat`. For descriptions of the AT commands and how to enter them, refer to Section 6, "Modem AT Command Set." For information on the `strictat` command, refer to "strictat" on page 5-14, and for the `nostrictat` command, "nostrictat" on page 5-14.

Command Numbers and History

Beginning on power up each entered command is counted, and the current command number can be displayed as the prompt or as part of the prompt as described in "Command Prompts" on page 5-8. In addition, the last 10 commands can be displayed using the `hist` command, and any one of them can be selected for re-entering or for executing.

To display the last 10 commands, enter `hist`. To execute a previously executed command again, enter `!` followed by the command number. For example, entering `! 25` will execute command number 25 if it is one of the last 10 commands executed. Alternatively, to select a previously executed command for re-entry, use the Up and Down arrow keys, and then press Enter to execute it. For more information on the `hist` command, refer to "hist" on page 5-13.

Privilege Levels

All commands have a privilege level associated with it. To view or execute a particular command, it must be included in the currently assigned privilege level. The current privilege level can be displayed as the prompt or as part of the prompt as described in "Command Prompts" on page 5-8. Three privilege levels are available:

- safe
- user
- update

The safe privilege level only allows the execution of AT commands as well as a very restricted set of CLAM shell commands, such as `setpriv`, `help`, and `hist`. It should be used to avoid unintentional entries. The user privilege level is the default. It allows entry of most commands and grants access to the file system commands. The update privilege level should only be used when replacing or updating the modem boot loader.

The privilege level is set using the `setpriv` command. For example, entering `setpriv safe` assigns the safe privilege level. The `setpriv` command can also be used to list the available privileges. For more information on the `setpriv` command, refer to "setpriv" on page 5-13.

Command Aliases

One or more aliases can be created for any command. They are typically used for the more frequently entered commands to reduce the number of entered characters. For example, an alias of "sf" can be created for the `setpriv` command as follows:

```
alias sf setpriv safe
```

The command from which the alias is created can still be used. To remove the alias, the `unalias` command can be used as in the following example:

```
unalias sf
```

The `alias` command can also be used to display the current list of aliases and to display the command assigned to an alias. For more information on the `alias` command, refer to "alias" on page 5-11, and for `unalias`, refer to "unalias" on page 5-12.

Command Syntax

CLAM shell command descriptions use the Wirth Syntax Notation as follows:

command	Plain text is literal
[option]	Optional
{file}	Optional repetition of zero or more
<value>	Text or numerical content
a b	A choice of a or b
()	Grouping

Parser Commands

The following parser commands are available:

- alias
- unalias
- help
- hist
- setpriv
- strictat
- nostrictat

alias

The `alias` command creates an alias for a single command or for multiple commands in a command string. One or more aliases can be created for any command. They are typically used for the more frequently entered commands to reduce the number of entered characters.

Syntax: `alias [<alias> [<cmd>]]`
 or
 `alias [<alias> "[{<cmd>}]"`

Privilege: user

Example 1: To create the alias "sf" to set the privilege level to safe, enter:

```
alias sf setpriv safe
```

The alias "sf" can now be used instead of or in addition to the `setpriv safe` command.

Example 2: To create an alias "userat" for the two concatenated commands `setpriv user` and `strictat`, enter:

```
alias userat "setpriv user;strictat"
```

The alias "userat" can now be used instead of or in addition to the concatenated `setpriv user` and `strictat` commands. The quotes are used to create an alias for the entire line and prevent the command concatenation special character(;) and space from treating the line as two separate commands.

The `alias` command can also be used to display the current list of aliases and to display the command assigned to an alias. To display the list, enter just `alias`. To display the assigned command for an alias, enter `alias` followed by the alias.

Example 3: To display the current list of aliases, enter:

```
alias
```

Example 4: To display the assigned command for the alias `sf`, enter:

```
alias sf
```

unalias

The `unalias` command removes the alias created with the `alias` command.

Syntax: `unalias <alias>`

Privilege: `user`

Example: To remove the alias "sf" for the `setprive safe` command, enter:

```
unalias sf
```

help

The `help` command displays the syntax for all the available commands or a specific command under the current privilege level.

Syntax: `help [sectlist|<sect_name>|<command>]`

Privilege: `safe`

Example 1: To display help for all the commands, enter:

```
help
```

Example 2: To display help for the `setpriv` command, enter:

```
help setpriv
```

hist

The `hist` command displays the last 10 commands entered along with their sequential number which begins at power up.

Syntax: `hist`

Privilege: `safe`

Example 1: To display the last 10 commands entered and their sequential number, enter:

`hist`

To select a displayed command for re-entry, use the Up and Down arrow keys. To execute a displayed command, enter `!` followed by the command number.

Example 2: To execute command number 25, enter:

`!25`

setpriv

The `setpriv` command sets the current privilege level. Three privilege levels are available without requiring a password: `safe`, `user` and `update`. Three additional available privilege levels require passwords: `factory`, `diag`, and `sys`.

Syntax: `setpriv safe|user|update|factory|diag|sys`

Privilege: `safe`

Example 1: To set the current privilege level to `user`, enter:

`setpriv user`

The `setpriv` command can also be used to list the available privilege levels, both those that do not require a password and those that do.

Example 2: To list the available privilege levels, enter:

`setpriv`

strictat

The `strictat` command enables processing of the AT command set only. With the exception of the `nostrictat` command, CLAM shell commands are not processed.

Syntax: `strictat`

Privilege: `user`

Example: To enable processing of the AT command set only, enter:
`strictat`

nostrictat

The `nostrictat` command enables processing of both AT and CLAM shell commands.

Syntax: `nostrictat`

Privilege: `user`

Example: To enable processing of both AT and CLAM shell commands, enter:
`nostrictat`

Datalogger Mode

When a modem is in Datalogger mode, input from its host processor over the serial interface is treated as data which are stored in the flash memory of the modem's data logger. Up to 6 MB of data can be stored. The data are also partitioned into discrete, searchable records with metadata tags that allow them to be searched and filtered. Ring buffer and fixed buffer configurations are also supported with both local and remote retrieval functions.

A modem will go into Datalogger mode when it is powered up *only* if `@OpMode=Datalog`. Data stored in the data logger memory are *not* lost when the modem is powered down. The contents of the data logger memory of a remote modem can be read or cleared at any time over the acoustic link. The number of bytes of data stored can also be read. The same is true for a local modem over the serial interface.

A modem can be placed into Datalogger mode in any of the following ways:

Setting `@OpMode=Datalog`. From Command mode only, setting `@OpMode=Datalog` will place the modem into Datalogger mode.

Receiving a Remote Datalogger Enable command (`AT$BEn`). If the modem receives a Remote Datalogger Enable command from another modem, the modem will go into Datalogger mode, and the `OpMode` configuration parameter will be set to `Datalog`.

Cycling power—`@OpMode=Datalog`. If `@OpMode=Datalog` and `cfg store` is used to save the configuration parameter settings, powering down the modem and then powering up the modem will place the modem into Datalogger mode.

Data Storage

The data logger can hold up to 6 MB of data in either one of two storage modes: flat mode where data accumulates up to the 6-MB limit at which recording stops, or ring buffer mode where the data are accumulated until the 6-MB limit is reached at which point the oldest 384 kbytes are erased and new incoming data continues to be recorded. These modes are selected with the `RingBuf` configuration parameter.

Record Parceling

The data logger saves data in discrete records which are indexed and are searchable. The way in which a record is partitioned can occur in one of the following ways:

- When the maximum record size of 4096 bytes is reached.
- When @LogMode=FwdDelay and no further characters have been received for the time specified by the setting of the FwdDelay configuration parameter.
- When @LogMode=Sentinel and the ASCII character specified by the setting of the Sentinel configuration parameter.
- When @LogMode=ChrCount and the number of characters specified by the setting of the ChrCount configuration parameter.
- When @AcData=Datalog or UART+Datalog to store data received over the acoustic link in the data logger. For example, if data are received while the data logger is configured to log data, the data become a single record, regardless of its length or sentinel characters.
- When @AcStats=Stats, Timestamp or Stats+Time to store statistics based on received data over the acoustic link in the data logger. For example, if statistics are received while the data logger is configured to log statistics, the statistics become a single record, regardless of its length or sentinel characters.

Search and Retrieval

Data can be searched for and retrieved from the local and remote modems either as single contiguous blocks or as discrete records. For contiguous block retrieval, where there are both 4-kbyte blocks and 256-byte sub-blocks, AT commands are used. For descriptions of the AT commands and how to enter them, refer to Section 6, "Modem AT Command Set." When retrieving data as contiguous blocks, no time stamps are provided. For discrete record retrieval, records of a particular type and with time stamps can be selected. Single records and multiple records over any specified range can be retrieved from the local and remote modems with a 64-kbyte limit per command execution on the remote modem only.

Data Logger Commands

The following data logger commands are available:

- `dlfind`
- `dlldlist`
- `dlrecs`
- `rdlfind`
- `rdldlist`
- `rdlrecs`
- `ATBC`
- `AT$BCn`
- `AT$BEn`
- `AT$BDn`

dlfind

The `dlfind` command extracts and displays data logger records from the local modem in accordance with specified search parameters. These search parameters contain one or more of the following:

- Starting point
- Ending point
- Step interval
- Flags

The starting and ending point parameters can be in the form of a time stamp in years, months, days, hours, minutes, and seconds; a record number referenced to the start or the end of the data logger's data set; or the number of records from the starting point. The step interval specifies how many records should be skipped when displaying data. For example, an interval of 15 would display the first and then every 15th record from the starting point to the ending point. If no step interval is specified, then every record from the starting point to the ending point would be displayed. The flags parameter specifies the types of records to be displayed. Valid flags are the following:

p1	Data received on serial port 1
p2	Data received on serial port 2
ac	Data received as an acoustic packet and the related statistics
xp	Transponder reply detections
di	Internally generated diagnostic information
mmp	Data received as an MMP message
dev	Data entered using the /dev/log device

Multiple flag types may be joined with "&." Not specifying a flag will include all flags. In addition, an optional "-i" modifier will cause metadata to be displayed for each record along with the record itself. The metadata is composed of the record number, the time stamp, the file size in bytes, and the flags for each record.

Each record in the data logger has a record number associated with it, where the first record is record number 0. Therefore, for example, the fifth record is record number 4; the sixth record, number 5, and so on. Negative record numbers are also used. Negative record numbers specify records from the last record in the data logger. For example, record number -1 is the last record, record number -2 is the second from the last, record number -5 is the fifth record from the last, and so on.

The CLAM shell command parameters determine which search criteria are to be applied and whether metadata is to be provided for each record displayed. The command parameters are the following:

-i	Metadata
recno	Record number
@time	Time stamp
numrec	Record number
step	Record step
flags	Flags
All	Extracts and displays all of the data logger records

The time stamp is in YYYYMMDDhhmmss format where YYYY is required and can be followed, in order, by one or more of the rest of the parts.

Syntax: `dlfind [-i] [+|-<recno>|@<time> [+|-<recno>|@<time>|<numrecs>]
 [<step>] [<flags>]`

Privilege: user

Example 1: To extract and display the data logger records from the local modem for the year 2011, enter:

```
dlfind @2011
```

Example 2: To extract and display the data logger records from the local modem for the year 2011 along with the metadata for each, enter:

```
dlfind -i @2011
```

Example 3: To extract and display the data logger records from the local modem for the period January 3, 2011 to February 7, 2011, enter:

```
dlfind @20110103 @20110207
```

Example 4: To extract and display the data logger records from the local modem for the period January 3, 2011 to February 7, 2011 along with the metadata for each, enter:

```
dlfind -i @20110103 @20110207
```

Example 5: To extract and display the first and then every 10th record from the data logger of the local modem for the period January 3, 2011 to February 7, 2011 along with the metadata for each, enter:

```
dlfind -i @20110103 @20110207 /10
```

Example 6: To extract and display the first 100 records from the data logger of the local modem from noon on January 3, 2011, along with the metadata for each, enter:

```
dlfind -i @20110103120000 100
```

Example 7: To extract and display the first 100 records from the data logger of the local modem from noon on January 3, 2011 that were received on serial port 1, along with the metadata for each, enter:

```
dlfind -i @20110103120000 100 p1
```

Example 8: To extract and display the first 100 records from the data logger of the local modem from noon on January 3, 2011 that were received on serial port 1 or were received acoustically, along with the metadata for each, enter:

```
dlfind -i @20110103120000 100 p1&ac
```

Example 9: To extract and display the first and then every 5th record of the first 100 records from the data logger of the local modem from noon on January 3, 2011 that were received on serial port 1 or were received acoustically, along with the metadata for each, enter:

```
dlfind -i @20110103120000 100 /5 p1&ac
```

Example 10: To extract and display every record from the data logger of the local modem, enter:

```
dlfind 0 -1 or dlfind all
```

Example 11: To extract and display the third through the second to the last record from the data logger of the local modem, enter:

```
dlfind +2 -2
```

Example 12: To extract and display record number 30 of the data logger of the local modem, enter:

```
dlfind +30
```

Example 13: To extract and display the 30th record from the end of the data logger of the local modem, enter:

```
dlfind -30
```

Example 14: To extract and display 7 records starting from record number 30 of the data logger of the local modem, enter:

```
dlfind +30 7
```

Example 15: To extract and display 7 records starting from the 30th record from the end of the data logger of the local modem, enter:

```
dlfind -30 7
```

Example 16: To extract and display all records starting from the 30th record from the end of the data logger of the local modem, enter:

```
dlfind -30 -1
```

dllist

The `dllist` command displays the number of bytes and the number of records in the data logger of the local modem, along with the time stamps for the first and last record. Each time stamp comprises the year, month, day, hour, minute, and second the record was created. The Local Bytes Stored command (ATBN) can also be used to display only the total number of bytes stored.

Syntax: `dllist`

Privilege: `user`

Example: To display the number of bytes, the number of records and the first and last record time stamps in the data logger of the local modem, enter:

```
dllist
```

```
or
```

```
ATBN
```

dlrecs

The `dlrecs` command displays, in accordance with specified search parameters, the number of bytes and the number of records in the data logger of the local modem, along with the approximate time in seconds that it will take to transmit them to a remote modem at the current acoustic bit rate of the local modem. The acoustic bit rate is determined by the setting of the `TxRate` configuration parameter in the local modem, and the search parameters are the same as that for the `dlfind` command as described in "dlfind" on page 5-17.

Syntax: `dlrecs [-i] [+|-<recno>|@<time> [+|-<recno>|@<time>|<numrecs>]
[/<step>] [<flags>]`

Privilege: user

Example: To display the number of bytes and the number of records in the data logger of the local modem and the approximate time to transmit them at the current acoustic bit rate setting for the year 2011, enter:

```
dlrecs @2011
```

As in the example above, all of the examples provided for the `dlfind` command as described in "dlfind" on page 5-17 apply in exactly the same way for the `dlrecs` command.

rdlfind

The `rdlfind` command causes a remote modem to extract and to transmit over the acoustic link its data logger records, up to 64 kbytes at a time, in accordance with specified search parameters. Except for the additional command parameter "addr," which is the remote modem address, these search parameters are the same as that for the `dlfind` command as described in "dlfind" on page 5-17.

Syntax: `rdlfind <addr> [-i] [+|-<recno>|@<time>
[+|-<recno>|@<time>|<numrecs>] [/<step>] [<flags>]`

Privilege: user

Example: To search for and display the data logger records from the remote modem at address 5 for the year 2011, enter:

```
dlfind 5 @2011
```

As in the example above, with the exception of the additional command parameter "addr," all of the examples provided for the `dlfind` command as described in "dlfind" on page 5-17 apply in exactly the same way for the `rdlfind` command.

rdllist

The `rdllist` command causes a remote modem to transmit over the acoustic link the number of bytes and the number of records in its data logger, along with the time stamps for the first and last record. Each time stamp comprises the year, month, day, hour, minute, and second the record was created. The only command parameter is "addr," which is the remote modem address.

Syntax: `rdllist <addr>`

Privilege: user

Example: To display the number of bytes, the number of records and the first and last record time stamps in the data logger of the remote modem at address 5, enter:

```
rdllist 5
```



WARNING Do not use the Remote Bytes Stored command (AT\$BNn) in place of the `rdllist` command to display the total number of bytes stored if the expected total is greater than 4 MB, otherwise the reported number will be incorrect. Always use `rdllist` for this purpose to be certain of a correct result.

rdlrecs

The `rdlrecs` command causes a remote modem to transmit over the acoustic link, in accordance with specified search parameters, the number of bytes and the number of records in its data logger, along with the approximate time in seconds that it will take to transmit them to the local modem at the current acoustic bit rate of the remote modem. The acoustic bit rate is determined by the setting of the TxRate configuration parameter in the remote modem, and except for the additional command parameter "addr," which is the remote modem address, the search parameters are the same as that for the `dlfind` command as described in "dlfind" on page 5-17.

Syntax: `rdlrecs <addr> [-i] +|-<recno>|@<time>
[+|-<recno>|@<time>|<numrecs>] [/<step>] [<flags>]`

Privilege: user

Example: To search for and display the number of bytes and the number of records in the data logger of the remote modem at address 5 and the approximate time to transmit them at the current acoustic bit rate setting for the year 2011, enter:

```
dlrecs @2011
```

As in the example above, with the exception of the additional command parameter "addr," all of the examples provided for the `dlfind` command as described in "dlfind" on page 5-17 apply in exactly the same way for the `rdlrecs` command.

ATBC

The Clear Local Data Logger command (ATBC) clears the contents of the data logger memory of the local modem.

Syntax: ATBC

Privilege: user

Example: To clear the contents of the data logger memory of the local modem, enter:

ATBC

AT\$BCn

The Clear Remote Data Logger command (AT\$BCn) clears the contents of the data logger memory of the remote modem at address n.

Syntax: AT\$BCn

Privilege: user

Example: To clear the contents of the data logger memory of the remote modem at address 5, enter:

AT\$BC5

AT\$BEn

The Remote Data Logger Enable command (AT\$BEn) causes the remote modem at address n to go into Datalogger mode.

Syntax: AT\$BEn

Privilege: user

Example: To cause the remote modem at address 5 to go into Datalogger mode, enter:

AT\$BE5

AT\$BDn

The Remote Data Logger Disable command (AT\$BDn) causes the remote modem at address n to go into Online mode and to go online with the local modem if the remote modem is in Datalogger mode.

Syntax: AT\$BDn

Privilege: user

Example: To cause the remote modem at address 5 to go into Online mode and to go online with the local modem if the remote modem is in Datalogger mode, enter:

AT\$BD5

Dual Serial Port Feature Option

In its standard configuration a modem allows input of data from a single instrument for the purpose of transmitting the data to a remote modem or storing the data in the modem's data logger memory. However, an optional Dual Serial Port feature is available which allows two instruments to be connected to a single modem for the same purpose. In addition, data that are transmitted to a remote modem can be routed to specific serial ports of that modem through the use of a transport addressing scheme. Transport addressing enables configuration of the transmitting and receiving modems such that data that are input to either serial port 1 or serial port 2, or both, of the transmitting modem can be output on either serial port 1 or serial port 2, or both, of the receiving modem in any combination. When just storing data to a modem's data logger memory, the data are tagged in accordance with which serial port the data were input on.

The Dual Serial Port feature requires the purchase and installation of a feature key in the internal flash memory of the modem. The Dual Serial Port feature key is modem serial number based and is available from Teledyne Benthos. When installed, the configuration parameters associated with it become available and the feature can be used.

The following configuration parameters are associated with the Dual Serial Port feature:

- InputMode
- TPortMode
- SrcP1
- SrcP2
- Dst1
- Dst2

The InputMode configuration parameter is available only if the Dual Serial Port feature key is installed. If not installed, the configuration parameter name is not visible when listing parameters using configuration system commands such as `cfg all`.

InputMode Configuration Parameter

The InputMode configuration parameter has two available settings: Single and Dual. When @InputMode=Single, the modem allows one instrument to be connected and it must be connected to serial port 1. This serial port will receive data from the instrument when the modem is in Online or Datalogger mode and will receive and process commands when the modem is in Command mode. When @InputMode=Dual, serial port 2 is also available for the connection of an instrument and will receive data from the instrument when the modem is in Online or Datalogger mode. Serial port 2 will not process any acoustic communications commands. Therefore serial port 1 should always be used when in Command mode.

Dual Serial Port Data Logging

When a modem is in Datalogger mode with @InputMode=Dual, data can be input to either serial port 1 or serial port 2, or both. The data will be stored in the data logger memory of the modem, and data records will be generated in accordance with the setting of the LogMode configuration parameter which is described below. Each record will be tagged with metadata which includes, among other information, a flag that indicates which serial port the data were input to. This flag can be used when retrieving the data to separate the data from the two serial ports. For more information about the metadata flags, refer to "Data Logger Commands" on page 5-17. Data stored in the data logger memory are partitioned into discrete records in accordance with the setting of the LogMode configuration parameter for which three settings are available:

FwdDelay. When @LogMode=FwdDelay, a data record is generated once data input begins and no additional characters are received for the amount of time configured by the setting of the FwdDelay configuration parameter. The timing for each serial port is separate, allowing records to be generated asynchronously from each.

Sentinel. When @LogMode=Sentinel, a data record is generated when the ASCII code of a character received on a serial port matches the setting of the Sentinel configuration parameter. Monitoring for the ASCII code for each serial port is separate, allowing records to be generated asynchronously from each.

ChrCount. When @LogMode=ChrCount, a data record is generated when the number of characters specified by the setting of the ChrCount configuration parameter is received. The character count is monitored separately for each serial port, allowing records to be generated asynchronously from each.

Entering the Online Interrupt command (+++) on either serial port while in Online or Datalogger mode will cause the modem to go into Command mode and will display the command prompt. Any data that have been stored in the data logger memory since the last record will be made a new record. This is the case regardless of the setting of @LogMode. Therefore a record might be generated before the specified forwarding delay, character count, or sentinel character is received.

Dual Online Mode

When the modem is in Online mode with @InputMode=Dual, data can be input to either serial port 1 or serial port 2, or both, for transmission over the acoustic link to a remote modem. The data packets generated from data that are input to either serial port are kept separate and are transmitted in turn. When the modem goes into Online mode with @InputMode=Dual, the message "CONNECT nnnnn bits/sec" will be displayed on both serial ports, where "nnnnn" is the acoustic bit rate. For this message to be displayed, the Verbose configuration parameter must be set to 1 or higher. At this point, data can be input to either serial port. When characters cease to be input for the amount of time configured by the setting of the FwdDelay configuration parameter, the packet containing the characters entered up to that point will be transmitted. The packets for each serial port are kept separate so there is no interleaving of characters even if data are input to both serial ports simultaneously. The packets will be transmitted in the order in which they are received.



NOTE Messages requiring a high Verbose configuration parameter setting, such as "Forwarding delay up" and "full packet" will be output on serial port 1 regardless of which serial port the data triggering the message was input to.

Entering the Online Interrupt command (+++) on either serial port will cause the modem to go into Command mode and display the command prompt. Any untransmitted data that were input to the modem on a serial port while it was in Online mode will be lost and not be transmitted regardless which serial port the Online Interrupt command (+++) was input to.

TPortMode Configuration Parameter

When transport addressing is enabled, a transport address is attached to each transmitted data packet based on which serial port the data was input to. There are four valid transport addresses: 1, 2, 3, and 4. When a packet with a transport address is received by a modem that also has transport addressing enabled, the packet will be output in accordance with the transport address.



NOTE Transport address 3 and 4 are reserved and are not currently used.

The TPortMode configuration parameter has two available settings: InpMode and AlwaysOn. When @TPortMode=InpMode, transport addressing is in accordance with the setting of the InpMode configuration parameter. When @TPortMode=AlwaysOn, transport addressing is always enabled regardless of the setting of the InputMode configuration parameter.

TportMode=InpMode

With @TPortMode=InpMode, transport addressing is in accordance with the setting of the InpMode configuration parameter for which two settings are available:

@InputMode=Single When InputMode=Single, transport addressing is disabled. Data that are input on serial port 1 of the local modem will be transmitted with no transport address attached to the data packets. Any data packets received from a remote modem with or without a transport address attached will be output on serial port 1.

@Inputmode=Dual When InputMode=Dual, transport addressing is enabled. Data that are input on either serial port 1 or serial port 2 of the local modem will have a transport address attached when the data packets are transmitted. The transport address will be in accordance with the settings of the SrcP1 and SrcP2 configuration parameters for serial port 1 and serial port 2, respectively. Any data packets received from a remote modem with a transport address attached will be routed in accordance with the settings of the Dst1 and Dst2 configuration parameters.

TportMode=AlwaysOn

With @TPortMode=AlwaysOn, transport addressing is always enabled regardless of the setting of the InputMode configuration parameter. Data that are input on either serial port 1 or serial port 2 of the local modem will have a transport address attached when the data packets are transmitted. The transport address will be in accordance with the settings of the SrcP1 and SrcP2 configuration parameters for serial port 1 and serial port 2, respectively. Any data packets received from a remote modem with a transport address attached will be routed in accordance with the settings of the Dst1 and Dst2 configuration parameters.

SrcP1 and SrcP2 Configuration Parameters

The settings of the SrcP1 and SrcP2 configuration parameters are the transport addresses to be attached to data packets generated from data that are input to serial port 1 and serial port 2, respectively. When the data packets are received by the remote modem, the transport addresses will be used to determine to which serial port on that modem the data will be output.

Dst1, Dst2, Dst3, and Dst4 Configuration Parameters

The settings of the Dst1, Dst2, Dst3, and Dst4 configuration parameters are the serial ports that data packets received over the acoustic link with transport address 1, 2, 3, and 4, respectively, will be output. However, Dst3 and Dst4 are reserved and are not currently used. The available values for these configuration parameters are P1 and P2 for serial port 1 and serial port 2, respectively. For example, if a data packet is received with a transport address of 1 and @Dst1=P1, that packet will be output on serial port 1 if transport addressing is enabled on the receiving modem. Similarly, if @Dst1=P2, the packet will be output on serial port 2.

Flow Control

When @InputMode=Dual, both serial port 1 and serial port 2 share the same eight internal 4-kbyte transmit data buffers. One buffer is reserved for each port. Therefore flow control should be used whenever both instruments are expected to output a continuous stream of data that altogether exceeds 28k kbytes, or 24 kbytes if @DataRetry=Ena.

Default Transport Addressing

There are two cases where the default setting for transport addressing will meet most communication requirements. The first is communications between a topside and subsea ATM-900 Series Acoustic Telemetry Modem, and the second, communications between a UDB-9400 Series Acoustic Telemetry Modem and a subsea ATM-900 Series Acoustic Telemetry Modem.

Default Transport Addressing—Topside and Subsea Modems

A configuration that shows the default transport addressing for a topside ATM-900 Series Acoustic Telemetry Modem communicating with a subsea ATM-900 Series Acoustic Telemetry Modem that has two instruments connected to it is shown in Figure 5-1. In this setup both modems have the Dual Serial Port feature installed with transport addressing enabled by setting @InputMode=Dual. The default configuration for the transmitting modem is such that data packets generated from data that are input on serial port 1 and serial port 2 have transport addresses 1 and 2 attached, respectively. For the receiving modem, the default configuration is such that data packets that are received with transport addresses 1 and 2 attached are output on serial port 1 and serial port 2, respectively. This setup causes data that are input to serial port 1 of the transmitting modem to be output on serial port 1 of the remote modem, and data that are input to serial port 2 on the transmitting modem to be output on serial port 2 of the remote modem.

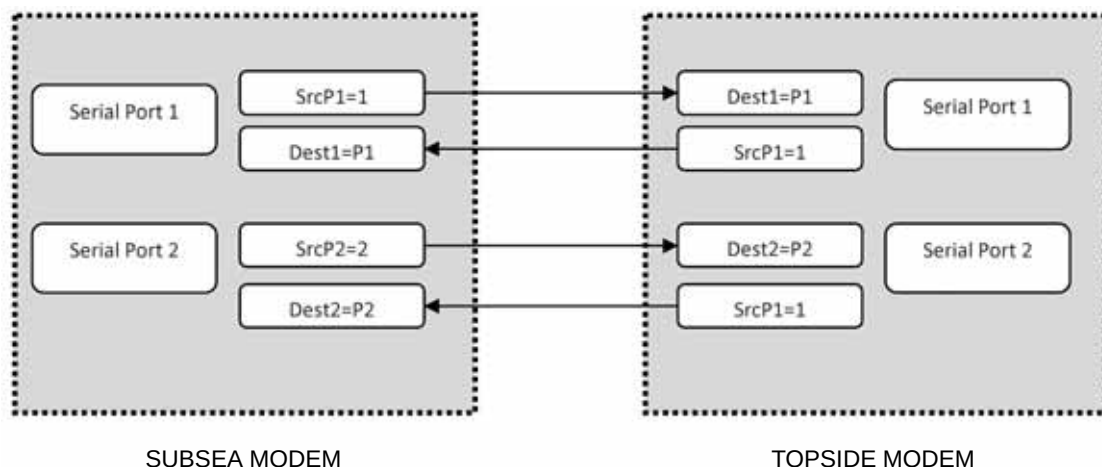


Figure 5-1 Default Transport Addressing—Topside and Subsea ATM-900 Series Acoustic Telemetry Modems

The following configuration parameter settings are the default settings in both the topside and subsea modems for transport addressing:

- @SrcP1=1
- @SrcP2=2
- @Dst1=P1
- @Dst2=P2

Default Transport Addressing—UDB-9400 and Subsea Modems

A configuration that shows the default transport addressing for a UDB-9400 Series Acoustic Telemetry Modem communicating with a subsea ATM-900 Series Acoustic Telemetry Modem with two instruments connected to it is shown in Figure 5-2. In this setup both modems have the Dual Serial Port feature installed with transport addressing enabled by setting @InputMode=Dual. However, the UDB-9400 has only serial port 1 available; serial port 2 is used internally for communications with the display. Therefore transport addressing for the UDB-9400 is set up such that all received data packets are output on serial port 1, regardless of the transport address attached to the data packets. When the UDB-9400 transmits data packets to the subsea modem, the data can be routed to either serial port 1 or serial port 2 of that modem by modifying the SrcP1 configuration parameter on the UDB-9400.

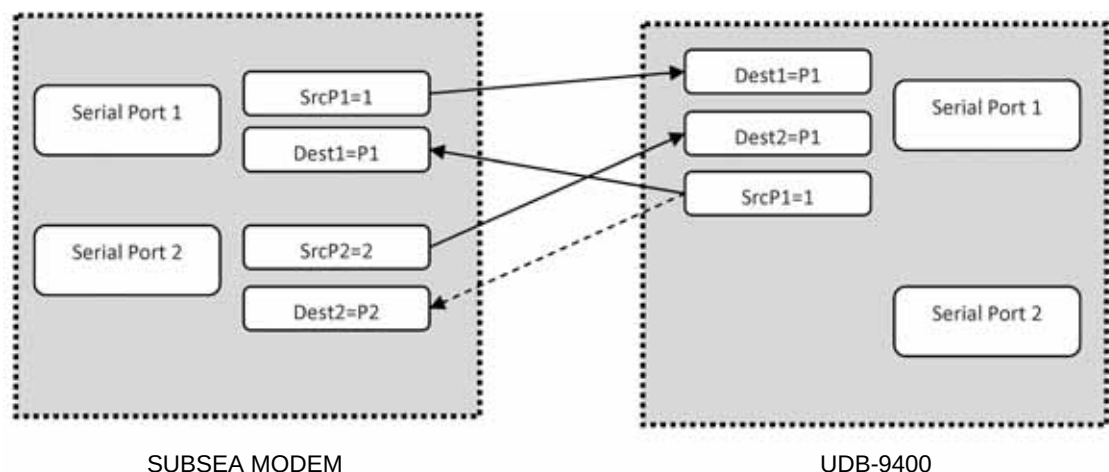


Figure 5-2 Default Transport Addressing—Topside ATM-900 Series and Subsea ATM-900 Series Acoustic Telemetry Modems

The following configuration parameter settings are the default settings in the subsea modem for transport addressing:

- @SrcP1=1
- @Dst1=P1
- @Dst2=P2

The transport addressing setup required for the UDB-9400 such that transmitted data packets to the subsea modem from the UDB-9400 are output on serial port 1 of the subsea modem, and received data packets from the subsea modem that were input to either serial port 1 or serial port 2 of the subsea modem are output on serial port 1 of the UDB-9400 is the following:

- @SrcP1=1
- @Dst1=P1
- @Dst2=P1

The transport addressing setup required for the UDB-9400 such that transmitted data packets to the subsea modem from the UDB-9400 are output on serial port 2 of the subsea modem, and received data packets from the subsea modem that were input to either serial port 1 or serial port 2 of the subsea modem are output on serial port 1 of the UDB-9400 is the following:

- @SrcP1=2
- @SrcP2=2
- @Dst1=P1
- @Dst2=P1

Backward Compatibility

Data packets generated by ATM-900 Series Acoustic Telemetry Modems that carry a transport address cannot be received by older series modems. However, they can be received if the packets have no transport address attached. To generate data packets without transport addresses attached, set @TPortMode=InpMode and @InputMode=Single. Data packets will still be received from older series modems, but the data will always be output on serial port 1.

Lowpower State

When there is no input to a modem either from its host processor over the serial interface or from a remote modem over the acoustic link, the modem will go from its receive active state into the lowpower state after a preset time. The lowpower state conserves battery power. For the power consumption in the lowpower state and the receive active state, refer to Section 2, "Specifications." The preset time is the idle time and is determined by the setting of the IdleTimer configuration parameter. The idle time is reset to zero when the modem receives input either from its host processor or from a remote modem. In addition, when the modem goes into the lowpower state, the message "Lowpower" is displayed if @Verbose=1 or greater.

When a modem is not being powered by batteries, the idle time should be disabled to prevent the modem from ever going into the lowpower state. This improves operating efficiency as the modem never has to be reawakened from the lowpower state. To disable the idle time, enter @IdleTimer=0.



WARNING Although the idle time can be set to prevent the modem from ever going into the lowpower state, this setting will rapidly deplete the capacity of the modem battery pack. Hence if batteries are being used to power the modem, the idle time should be set as short as possible.

A modem can be placed into the lowpower state in any of the following ways:

Using the Lowpower State command (ATL). Entering the Lowpower State command will cause the modem to go into the lowpower state. When awakened, the modem will go into the operating mode determined by the setting of the OpMode configuration parameter.

Entering the Hang Up command (ATH). Entering the Hang Up command will cause all the remote modems to go into the lowpower state. When awakened, a modem will go into the operating mode determined by the setting of the OpMode configuration parameter.

Allowing the idle time to expire. Allowing the idle time to expire will cause the modem to go into the lowpower state. When awakened, the modem will go into the operating mode determined by the setting of the OpMode configuration parameter.

Waking up a Modem

When a modem is in the lowpower state, its receiver is still active. Therefore it can be awakened by input either from its host processor over the serial interface or from a remote modem over the acoustic link. For the modem to be awakened acoustically, a lowpower wakeup signal must be transmitted by the transmitting modem. To enable the transmission of the lowpower wakeup signal, set @WakeTones=Ena. In addition, if @Verbose=3, a modem will display the message "UART Wakeup" if it was awakened by input from its host processor over the serial interface or "Acoustic Wakeup" if it was awakened by input over the acoustic link.

If a modem is awakened by the host processor, it goes into the receive active state and into the operating mode determined by the setting of the OpMode configuration parameter. If the modem receives a signal over the acoustic link from a remote modem, it goes into the receive active state and checks the signal to see if it is being addressed—either with its unique address or with the global address that is the same for all the modems. If the modem does not recognize its address or the global address, it returns to the lowpower state. If it recognizes the signal as containing a valid address, it will remain in the receive active state and go into the operating mode determined by the setting of the OpMode configuration parameter.

Lowpower State Commands

The following lowpower state commands are available:

- ATL
- ATH

ATL

The Lowpower State command (ATL) causes the local modem to go into the lowpower state.

Syntax: ATL

Privilege: user

Example: To cause the local modem to go into the lowpower state, enter:

ATL

ATH

The Hang Up command (ATH) causes all the remote modems to go into the lowpower state. This command is a global command.

Syntax: ATH

Privilege: user

Example: To cause all the remote modems to go into the lowpower state, enter:
 ATH

File System

A modem includes a file system for the storage of files and the mounting of devices. All file references are from the root directory which is denoted with a single forward slash (/) on the command line. The root directory is RAM based, therefore the directories and files in it are not saved when the modem is powered down. Additional devices and files are attached to the file system by mounting them so that they appear as subdirectories under the root directory. There are several mount points available, some by default and some depending on the presences of other devices. Three of them are described below.

Flash File System

The flash file system (ffs) mount point is the flash file system. It provides non-volatile storage in the internal flash memory of the modem. Files stored in this area will be preserved following a system reset.

External SD Card

The external SD card (SD) mount point is a file system that maps to a FAT32 file system on an external secure digital (SD) or high capacity secure digital (HCSD) card. This mount is only present if an optional SD carrier board is installed and a properly formatted SD card is inserted in one of the slots.

System Devices

The system devices (dev) mount holds a list of the active devices in the system. These devices include the serial ports and the sonar devices.

File Attributes

Each file in the file system has two sets of attributes. One set determines the privilege level of the file, and the other consists of a group of four flags. There are three privilege levels: safe, user and update. They are described in "Privilege Levels" on page 5-9. Of the four flags, one denotes the file type, and the other three indicate permissions.

The flags are the following:

- d, m or –** The file is a directory (d), a mount point (m) or a regular file (–).
- r or –** The file can be read at all privilege levels (r) or cannot be read (–).
- w or –** The file can be written to or deleted at all privilege levels (w) or cannot be written to or deleted (–).
- x or –** The file is executable at all privilege levels (x) or is not executable (–).

The flags can be displayed for each file when listing them. They are followed on the same line with the privilege level for the file. The file attributes can be changed at this privilege level or higher, but not at a lower privilege level. For example, the following file attributes indicate the file is a directory that can be read from, written to or deleted, is executable, and is associated with the user privilege level:

drwx user

Therefore at the user level or higher, the file attributes can be changed.

Directories

Directories may be created and deleted in the root directory (/) or the flash file system (ffs) only. The directories are created using the `mkdir` command and deleted using the `rmdir` command.

8-Bit Versus 16-bit Wide Files

By default files are read and written to as 8-bit words, even though the file storage is actually 16 bits wide. However, for more efficient use of memory, the files can be read from and written to as 16-bit words by appending the characters `":w"` or `":16"` to the file name.

Redirection

By default any output generated by a command is output to the device that sent the command, such as a computer or terminal. However, this output can be redirected elsewhere, such as to a file or a device.

Redirecting the output is performed by entering one of the following:

- > Redirects the output to write to the named device.
- >> Redirects the output to write to the named file in append mode.

Similarly, to redirect the input resulting from a command from a device, the following is entered:

- < Redirects the input from the named device.

Examples are the following:

To read the contents of the file named "textfile" and redirect it to transmit the contents acoustically instead of being displayed, enter:

```
cat /textfile > /dev/modem
```

To transmit a Range command to a remote modem at address 1 and store the output in a file named "ranges.txt" in the flash file system, enter:

```
atr1 > /ffs/ranges.txt
```

To transmit a Range command to a remote modem at address 1 and append the output to a file named "ranges.txt" in the flash file system, enter:

```
atr1 >> /ffs/ranges.txt
```

Tab Completion for File System Names

Tab completion is available for file system names. To use tab completion for file system names, enter a forward slash (/) followed by the first character of the file system name, and then press the Tab key. Tab completion will complete the file name entry or provide a list of possible matches as a guide for entering additional characters.

File System Commands

The following file system commands are available:

- cat
- cp
- df
- ls
- mkdir
- mv

- rm
- rmdir
- rb
- rx
- rz
- sb
- sx
- sz

cat

The cat (concatenate) command displays the contents of a specified file.

Syntax: cat {<path>/} <file>

Privilege: user

Example 1: To display the contents of the file named "mydatafile1" in the root directory, enter:

```
cat /mydatafile1
```

Example 2: To display the contents of the file named "mylogfile1" in the flash file system, enter:

```
cat /ffs/mylogfile1
```

cp

The cp (copy) command copies the contents of a specified source file to a destination file. If the destination file does not exist, it is automatically created.

Syntax: cp <src path> <dst path>

Privilege: user

Example 1: To copy the contents of the file named "mydatafile1" in the root directory to the file named "mydatafile2" in the root directory, enter:

```
cp /mydatafile1 /mydatafile2
```

Example 2: To copy the contents of the file named "mydatafile1" in the root directory to the file named "mylogfile1" in the flash file system, enter:

```
cp /mydatafile1 /ffs/mylogfile1
```

df

The **df** (display file) command displays the file system usage in bytes for the specified mount point, or if no mount point is specified, the file system usage for all the files in the root directory. The displayed usage comprises the file system size, the amount of storage used, the amount of storage available, and the percentage of available storage used. In addition, the number of bytes shown will include some unusable overhead bytes. Therefore a completely full file system will still show some space free even though no more data can be stored.

Syntax: **df** [<mount>]

Privilege: user

Example 1: To display the file system usage for the root directory and all the files in it, enter:

df

Example 2: To display the file system usage for the flash file system, enter:

df /ffs

ls

The **ls** (list) command displays a list of files and devices in the specified path, or if no path is specified, a list of all files and devices in the root directory. An optional "-w" modifier will cause the files and devices to be displayed in wide format, and an optional "-l" modifier will cause the file attributes to be displayed along with the files and devices. A listed file that is followed by a forward slash (/) is a directory. If no slash is present, it is a regular file.

Syntax: **ls** [-l|w] [<path>]

Privilege: user

Example 1: To list the files and devices in the root directory, enter:

ls

Example 2: To list the files and devices along with the file attributes in the flash file system, enter:

ls -l /ffs

mkdir

The **mkdir** (make directory) command creates a directory of a specified name.

Syntax: **mkdir** {<path>/}<dir>

Privilege: user

Example 1: To make the directory named "datafiles" in the root directory, enter:

```
mkdir /datafiles
```

Example 2: To make the directory named "logfiles" in the flash file system, enter:

```
mkdir /ffs/logfiles
```

mv

The **mv** (move) command moves the specified file to one of a new name.

Syntax: **mv** <src path> <dst path>

Privilege: user

Example 1: To move the file named "mydatafile2" in the root directory to a file named "mydatafile3," enter:

```
mv /mydatafile2 /mydatafile3
```

Example 2: To move the file named "mylogfile1" in the flash file system to a file named "mylogfile2," enter:

```
mv /ffs/mylogfile1 /ffs/mylogfile2
```

rm

The **rm** (remove file) command removes the specified file.

Syntax: **rm** {<path>/}<file>

Privilege: user

Example 1: To remove the file named "mydatafile1" in the root directory, enter:

```
rm /mydatafile1
```

Example 2: To remove the file named "mylogfile2" from the flash file system, enter:

```
rm /ffs/mylogfile2
```

rmdir

The `rmdir` (remove directory) command removes the specified directory. The directory cannot have any files, devices or subdirectories. If it does, they must be removed first.

Syntax: `rmdir {<path>/}<dir>`

Privilege: user

Example 1: To remove the directory named "datafiles" in the root directory, enter:

```
rmdir /datafiles
```

Example 2: To remove the directory named "logfiles" from the flash file system, enter:

```
rmdir /ffs/logfiles
```

rb

The `rb` (Y-modem receive) command causes the modem to use the receive Y-Modem protocol to receive one or more files from a host PC to the root directory of the modem file system. An optional "-f" modifier will save the file to /ffs instead of the root directory.

Syntax: `rb [-f]`

Privilege: user

Example: To transfer the files named "newdatafile1" and "newdatafile2" on the host PC to the root directory of the modem file system, first enter:

```
rz
```

The modem responds with:

```
rb ready. To begin transfer, type "sb file ..." to  
your modem program
```

Next, set the communications program on the PC to send using the Y-Modem protocol. Select the directory that contains the newdatafile1 and newdatafile2 files, and then open the files. The newdatafile1 and newdatafile2 files on the host PC will be transferred to the root directory of the modem file system.

rx

The **rx** (X-modem receive) command causes the modem to use the receive X-Modem protocol to receive the contents of a file from a host PC to the root directory of the modem file system. An optional "-f" modifier will save the file to /ffs instead of the root directory.

Syntax: **rx** [-f] [<path>]<file>

Privilege: user

Example: To transfer the contents of the file named "newdatafile1" on the host PC to a file named "datafile1" on the root directory of the modem file system, first enter:

```
rx /datafile1
```

The modem responds with:

```
rz: ready to receive /datafile1
```

Next, set the communications program on the PC to send using the X-Modem protocol. Select the directory that contains the newdatafile1 file, and then open the file. The contents of newdatafile1 on the host PC will be transferred to datafile1 on the root directory of the modem file system.

rz

The **rz** (Z-modem receive) command causes the modem to use the receive Z-Modem protocol to receive a file from a host PC to the root directory of the modem file system. An optional "-f" modifier will save the file to /ffs instead of the root directory.

Syntax: **rz** [-f]

Privilege: user

Example: To transfer the file named "newdatafile1" on the host PC to the root directory of the modem file system, first enter:

```
rz
```

The modem responds with:

```
rz ready. To begin transfer, type "sz file ..." to  
your modem program
```

Next, set the communications program on the PC to send using the Z-Modem protocol. Select the directory that contains the newdatafile1 file, and then open the file. The newdatafile1 file on the host PC will be transferred to the root directory of the modem file system.

sb

The sb (Y-modem send) command causes the modem to use the transmit Y-Modem protocol to transmit one or more files from the modem file system to a host PC.

Syntax: sb {<path>/}<file>

Privilege: user

Example: To transfer the files named "datafile1" and "datafile2" on the root directory of the modem file system to a host PC, first enter:

```
sb /datafile1 /datafile2
```

Next, set the communications program on the PC to receive using the Y-Modem protocol. The datafile1 and datafile2 files on the root directory of the modem file system will be transferred to the root directory of the host PC.

sx

The sx (X-modem send) command causes the modem to use the transmit X-Modem protocol to transmit the contents of a file from the modem file system.

Syntax: sx {<path>/}<file>

Privilege: user

Example: To transfer the contents of the file named "datafile1" on the root directory of the modem file system to a file named "newdatafile1" on the host PC, first enter:

```
sx /datafile1
```

Next, set the communications program on the PC to receive using the X-Modem protocol. Select the directory to save the file, and then open a file named "newdatafile1." The contents of datafile1 on the root directory of the modem file system will be transferred to newdatafile1 on the host PC.

SZ

The sz (Z-modem send) command causes the modem to use the transmit Z-Modem protocol to transmit a file from the modem file system to a host PC.

Syntax: sz {<path>/}<file>

Privilege: user

Example: To transfer the file named "datafile1" on the root directory of the modem file system to a host PC, first enter:

```
sz /datafile1
```

Next, set the communications program on the PC to receive using the Z-Modem protocol. The datafile1 file on the root directory of the modem file system will be transferred to the root directory of the host PC.

Configuration System

The configuration system for a modem comprises all of its configuration parameters. These parameters determine how the modem operates in all of its operating modes and how some of the commands are executed. They include the serial interface baud rate, the acoustic bit rate, the modem address, the idle time, the transmit power level, the forwarding delay, and many others. The configuration parameters are the same as the S Registers used in modems prior to the ATM-900 Series, and these S Register settings can still be changed using the AT command set. However, there are more configuration parameters than the original number of S Registers, and they use descriptive names instead of S Register numbers. All of the configuration parameters can be displayed and set using CLAM shell commands and command line shortcuts. A help feature also is provided that displays the configuration parameters, their corresponding S Register numbers where applicable, the current setting, and the available settings or range of settings.

Configuration Files

The configuration parameters are stored in configuration files in the flash file system of the modem. There are two pre-installed configuration files, `standard.ini` and `factcfg.ini`. Any number of additional configuration files containing the configuration parameters can also be created, each for a different modem configuration. These new files can be saved on the modem and used to easily reconfigure the modem or exported to a computer where they can be used to configure other modems. The contents of any configuration file can be displayed by using the `cat` command. The syntax of the displayed contents conforms to the INI format from Microsoft Corporation for its brevity and simplicity, where the section header is listed in square brackets, and the section ends at the beginning of a new section or at the end of the file.

Standard.ini File

When a modem is powered up, the configuration parameter settings are automatically loaded from the `standard.ini` file. Any changes made to the configuration parameter settings, whether from a saved configuration file or by changing some of the configuration parameter settings directly, can be saved to the `standard.ini` file by entering `cfg store`. When saving changes to the `standard.ini` file, a backup file, `standard.bak`, is automatically created of the old `standard.ini` file.

Factcfg.ini File

The factcfg.ini file stores the factory configuration parameter settings. The configuration parameters in this file cannot be deleted or changed except by factory trained personnel. The configuration parameters can be set to the factory settings at any time by entering `factory_reset`. Then they can be saved to the standard.ini file by entering `cfg_store`. If requested, the factcfg.ini file can be used to configure a modem to a user's specific requirements before shipping it.

Configuration Parameter Sections

There are 10 configuration parameter sections in the standard.ini and factcfg.ini files, each containing a group of related configuration parameters:

- Version
- Serial
- System
- Coproc
- Datalog
- Modem
- Release
- Test
- Xpnd
- Transport

Entering `@` will display the list of these sections. To display a list of the configuration parameters in a specific section, enter `@` followed by the section name. For example, to display a list of the configuration parameters in the Modem section, enter `@modem`. The parameters are displayed as shown in Figure 5-3.

```
user:1>@modem
```

S	Modem Params	Value	Range
7	AcRspTmOut	7.5000	2.0 - 99.5 sec (0.5 sec increments)
2	DataRetry	Dis	Ena, Dis
28	DevEnable	0 (Auto)	0 (Auto), 1 (MBARI), 2 (Manual)
8	FwdDelay	3.0000	0.05 to 5 sec (50ms increments)
18	LocalAddr	0	0..249
15	OpMode	1 (Online)	0 (Command), 1 (Online), 2 (Datalog), 4 (TM-4), 6 (ContXpnd)
	PrintHex	Dis	Ena, Dis
14	RemoteAddr	0	0 - 249, 255
5	^RxPktType	0 (MFSK)	0 (MFSK), 1 (FHOP), 2 (Xpnd), 3 (Chirp)
16	ShowBadData	Ena	Ena, Dis
	StartTones	Ena	Ena, Dis
	StrictAT	Dis	Ena, Dis
4	TxRate	5 (800)	2 (140), 3 (300), 4 (600), 5 (800), 6 (1066), 7 (1200), 8 (2400), 9 (2560), 10 (5120), 11 (7680), 12 (10240), 13 (15360)
6	TxPower	8 (Max)	1 (-21dB), 2 (-18dB), 3 (-15dB), 4 (-12dB), 5 (-9dB), 6 (-6dB), 7 (-3dB), 8 (Max)
17	WakeTones	Ena	Ena, Dis
	InputMode	1 (Single)	1 (Single), 2 (Dual)

Figure 5-3 List of Configuration Parameters for the Modem Section of the Standard.ini File

The columns in the list are defined as follows:

S	S Register equivalent of the configuration parameter if any.
Modem Params	The configuration parameter name.
Value	The current setting of the configuration parameter.
Range	The available settings or range of settings for the configuration parameter.

To display a list of all the configuration parameters for all the sections, enter `cfg all`. Configuration parameter names prefixed by "^" cannot be changed at the current user level.

Tab Completion for Configuration System

Tab completion is available for configuration system commands, section names and configuration parameter settings. To use tab completion, enter the character "@" followed by the first character of the entry, and then press Tab. Tab completion will complete the entry or provide a list of possible matches as a guide for entering additional characters. To complete the setting after entering the character "=", enter the first character of the setting, and then press Tab. Again, tab completion will complete the entry or provide a list of possible matches as a guide for entering additional characters.

Configuration System Commands

The following configuration system commands are available:

- @
- cfg all
- @<section>
- @<parameter name>
- @<parameter>=<value>
- cfg load [<filename>]
- cfg store [<filename>]
- factory_reset
- #<address> @ <parameter name>=<value>
- #<address> cfg store

@

The @ command lists all of the configuration parameter sections.

Syntax: @

Privilege: user

Example: To list all of the configuration parameter sections, enter:

@

cfg all

The `cfg all` command lists all of the configuration parameter sections along with the configuration parameters in each. For each parameter the S Register equivalent, if applicable, is displayed along with the parameter name, its current setting, and the available settings or range of settings.

Syntax: `cfg all`

Privilege: `user`

Example: To list all of the configuration parameter sections along with the configuration parameters in each, enter:

`cfg all`

@<section name>

The `@ <section name>` command lists all of the configuration parameters in the named section. For each parameter the S Register equivalent, if applicable, is displayed along with the parameter name, its current setting, and the available settings or range of settings.

Syntax: `@<section name>`

Privilege: `user`

Example: To list all of the configuration parameters in the modem section, enter:

`@modem`

@<parameter name>

The `@<parameter name>` command displays the setting for the named parameter.

Syntax: `@<parameter name>`

Privilege: `user`

Example: To display the setting for the TxPower configuration parameter, enter:

`@txpower`

@<parameter name>=<value>

The @<parameter name>=<value> command sets the named parameter to the desired setting. Many configuration parameters have enumerations which allow you to enter a number for the setting. For example, the TxPower configuration parameter can be set to "3" for -15 db or to "-15db" for -15 db. Shown in Figure 5-3 on page 5-48 are the available settings for the TxPower configuration parameter.

Syntax: @<parameter name>=<value>

Privilege: user

Example 1: To set the TxPower configuration parameter to -15 db using the enumerated value "3," enter:

```
@txpower=3
```

Example 2: To set the TxPower configuration parameter -15 db without using the enumerated value, enter:

```
@txpower=-15db
```

cfg load

The cfg load command imports a specified configuration file, or if no file is specified, it loads the configuration parameters from the standard.ini file. This command can be used to configure the modem from any number of previously saved configuration files or from the standard.ini file.

Syntax: cfg load [<filename>]

Privilege: user

Example 1: To load the configuration file named "newstandard1" from the flash file system, enter:

```
cfg load /ffs/newstandard1
```

Example 2: To load the standard.ini file, enter:

```
cfg load
```

To save the modem configuration to the standard.ini file, enter:

```
cfg store
```

cfg store

The `cfg store` command exports the current modem configuration to a specified configuration file, or if no file is specified, it saves the current modem configuration to the `standard.ini` file. This command can be used to create any number of configuration files that can be used to configure the modem or to export to a computer for configuring other modems. The current modem configuration can be saved to the `standard.ini` file by entering `cfg store`.

Syntax: `cfg store [<filename>]`

Privilege: `user`

Example 1: To export the current modem configuration to a file named "newstandard1" in the flash file system, enter:

`cfg store /ffs/newstandard1`

Example 2: To save the current modem configuration to the `standard.ini` file, enter:

`cfg store`

factory_reset

The `factory_reset` command loads the configuration parameters from the `factcfg.ini` file. The Factory Reset command (`AT&F`) can also be used for this purpose.

Syntax: `factory_reset`

Privilege: `user`

Example: To load the configuration parameters from the `factcfg.ini` file, enter:

`factory_reset`

or

`AT&F`

To save the modem configuration to the `standard.ini` file, enter:

`cfg store`

#<address> @ <parameter name>=<value>

The #<address> @ <parameter name>=<value> command sets the named configuration parameter of the remote modem at the specified address to the desired setting.

Syntax: #<address> @ <parameter name>=<value>

Privilege: user

Example: To set the TxPower configuration parameter of the remote modem at address 5 to -9dB, enter:

#5 @ TxPower=-9db

#<address> cfg store

The #<address> cfg store command saves the current modem configuration of the remote modem at the specified address to its standard.ini file.

Syntax: #<address> cfg store

Privilege: user

Example: To save the current modem configuration of the remote modem at address 5 to its standard.ini file, enter:

#5 cfg store

Transponder Mode

A modem can be used to acquire and display the two-way sound travel time to any Teledyne Benthos manufactured acoustic transponder or release, or to any transponder or release that transmits and replies in the 9–14 kHz frequency range of an LF modem. This time is acquired by using the Transpond (ATNm) command which causes the modem to transmit an interrogation pulse of frequency m. After a specified lockout time, the modem will listen for a reply from the transponder. The time from the start of the interrogation pulse to that of detecting the reply, less the turn-around-time of the transponder, is the two-way travel time.

Multi-Receive

If the Multi-Receive feature key is purchased and installed in the modem, the modem can receive frequencies in the range 7–16 kHz automatically without setting a specific receive frequency. The modem listens for frequencies on separate channels 250 Hz apart throughout the range. However, filtering enables only frequencies in the range 9–14 kHz to be detected.

Required Configuration Parameter Settings

The Transpond (ATNm) command requires that the following configuration parameters be correctly set for an accurate two-way travel time measurement:

TxToneDur. The TxToneDur configuration parameter sets the transmit pulse width of the modem in tenths of milliseconds. The range of available settings is from 100 to 250 in integer increments for a transmit pulse width of 10 ms to 25 ms in 0.1-ms increments. The default setting is 100 for 10 ms.

RxToneDur. The RxToneDur configuration parameter sets the receive pulse width of the modem. The available settings are 0 for 12.5 ms, 1 for 6.25 ms and from 5 to 15 in integer increments for a receive pulse width of 5 ms to 15 ms in 1-ms increments. The RxToneDur setting should be approximately the same as the remote transponder's transmit pulse width. The default setting is 10 for 10 ms.

RxFreq. The RxFreq configuration parameter sets the receive frequency of the modem. The range of available settings is from 0 to 35000 in integer increments for a receive frequency of 7000 Hz to 16,000 Hz in 250-Hz increments. The RxFreq setting should be the same as the transponder transmit frequency unless the Multi-Receive feature key is installed in which case it does not apply. The default setting is 11000 for 11,000 Hz.

TAT. The TAT configuration parameter should be set to the turn-around-time of the transponder. The turn-around-time is the time in milliseconds from when the transponder receives an interrogation pulse to when it transmits the reply. It is subtracted from the measured two-way travel time. The range of available settings is from 0 to 1000 in integer increments for a turn-around-time of 0 ms to 100 ms in 0.1-ms increments. The default setting is 0 for 0 ms.

RxLockout. The RxLockout configuration parameter sets the lockout time of the modem. The lockout time is a period that begins at the start of the interrogation pulse during which the modem will ignore any received replies from the transponder. The range of available settings is from 0 to 1000 in integer increments for a lockout time of 0 ms to 1000 ms in 1-ms increments. The RxLockout setting prevents interrogation pulse transmission echoes from nearby objects from being detected as replies. The default setting is 75 for 75 ms.

AcRspTmOut. The AcRspTmOut configuration parameter sets the acoustic response timeout of the modem. It is the period during which the modem will listen for the reply from the transponder. At the end of this period, if no reply is received, the modem displays the message "Response Not Received." The range of available settings is from 2.0 to 99.5 sec in 0.5 sec increments. The default setting is 7.5 for 7.5 sec.



NOTE The AcRspTmOut configuration parameter setting applies to all of the acoustic commands that require an acknowledgement be received.

RxThresh. The RxThresh configuration parameter sets the number of standard deviations that a detected signal must rise above the background noise level at that frequency before it is marked as a received transponder reply. The lower this setting the more sensitive is the receiver and the more likely a detected signal will be marked as a received reply. However, with a low setting there is also a greater likelihood of "false positives," where a detected signal is incorrectly marked as a received reply. The higher the setting the less sensitive is the receiver and the less likely a detected signal will be marked as a received reply. Therefore a high setting increases the likelihood of missing valid detections. The receive threshold should be adjusted in accordance with the background noise such as to minimize false positives and negatives. The range of available settings is from 10 to 256 in integer increments. The default setting is 10.

Transponder Commands

The following transponder commands are available:

- rxadj
- ATNm

rxadj

The rxadj command allows adjustment of the transpond receive threshold on a per-frequency basis, varying it from the threshold setting provided by the RxThresh configuration parameter which sets the threshold for all the frequencies. The adjustment range is from -1.00 to +1.00 in 0.01 increments for each frequency, where a negative value decreases the sensitivity and a positive value increases it. A value of -1.00 effectively sets an infinite threshold, filtering the frequency out, and a value of +1.00 sets the threshold to 10 standard deviations, the highest sensitivity. A setting of 0.00 leaves the threshold unchanged from that of the RxThresh configuration parameter setting. Every value between -1.00 and +1.00 sets the threshold for that frequency along a curve from 256 sigmas (minimum sensitivity) down to 10 sigmas (maximum sensitivity) passing through the RxThresh value at 0.0. Thresholds for all frequencies from 7 to 16 kHz in 250-Hz increments can be adjusted.

Syntax: rxadj [<freq_kHz> [<adjustment>] | reset | save]

Privilege: user

Example 1: To list the receive threshold adjustments for all the frequencies, enter:

```
rxadj
```

The receive threshold adjustments are listed as shown in Figure 5-4.

Example 2: To adjust the receive threshold for the 10.5 kHz frequency to 0.2, enter:

```
rxadj 10.5 .2
```

Example 3: To reset all the receive threshold adjustments to 0.00, enter:

```
rxadj reset
```

Example 4: To save all the receive thresholds:

```
rxadj save
```

The thresholds are save to a file named ".xpndadj" in the flash file system, and they remain in effect even after cycling power to the modem.

```

user:1>rxadj
Receive sensitivity adjustments by frequency:
07.00 kHz  0.00    07.25 kHz  0.00    07.50 kHz  0.00    07.75 kHz  0.00
08.00 kHz  0.00    08.25 kHz  0.00    08.50 kHz  0.20    08.75 kHz  0.00
09.00 kHz  0.00    09.25 kHz  0.00    09.50 kHz  0.00    09.75 kHz  0.00
10.00 kHz  0.20    10.25 kHz  0.00    10.50 kHz  0.10    10.75 kHz  0.00
11.00 kHz  0.00    11.25 kHz  0.00    11.50 kHz -0.20    11.75 kHz  0.00
12.00 kHz  0.00    12.25 kHz -0.10    12.50 kHz  0.00    12.75 kHz  0.00
13.00 kHz  0.00    13.25 kHz  0.00    13.50 kHz  0.00    13.75 kHz  0.00
14.00 kHz  0.00    14.25 kHz  0.00    14.50 kHz  0.00    14.75 kHz  0.00
15.00 kHz  0.00    15.25 kHz  0.00    15.50 kHz  0.00    15.75 kHz  0.00
16.00 kHz  0.00
ok

```

Figure 5-4 Example List of Receive Threshold Adjustments

ATNm

The Transpond (ATNm) command causes the local modem to display the two-way travel time in milliseconds from the modem to a transponder of interrogation frequency m, where m is 7000 to 16000 in increments of 250 for 7000 Hz to 16,000 Hz in increments of 250 Hz. However, filtering enables the modem to detect replies only in the range 9–14 kHz. The UDB-9400 Series Acoustic Telemetry Modems use a 7–16 kHz band pass filter. This filter is also available upon request for an ATM-Series Acoustic Telemetry Modem.

Syntax: ATNm

Privilege: user

Example 1: To acquire the two-way travel time to a transponder with a receive frequency of 9 kHz, a reply frequency of 14 kHz, a turn-around-time of 15 ms, and a transmit pulse width of 12 ms; and use a transmit pulse width of 12 ms, a threshold of 15, a lockout time of 50 ms, and an acoustic response timeout of 10 seconds:

If the multi-receive feature key is *not* installed, set the RxFreq configuration parameter to 14000 by entering:

```
@rxfreq=14000
```

Set the TAT configuration parameter to 150 ms by entering:

```
@TAT=150
```

Set the RxToneDur configuration parameter to 12 by entering:

```
@rxtonedur=12
```

Set the TxToneDur configuration parameter to 120 by entering:

```
@txtonedur=120
```

Set the RxThresh configuration parameter to 15 by entering:

```
@rxthresh=15
```

Set the RxLockout configuration parameter to 50 by entering:

```
@rxlockout=50
```

Set the AcRspTmOut configuration parameter to 10 by entering:

```
@acrsptmout=10
```

Then enter:

```
ATN9000
```

Example 2: The Teledyne Benthos TR6001 transponders have selectable receive frequencies from 7.0 kHz to 15.0 kHz in 250-Hz increments. They reply at selectable frequencies from 7.0 kHz to 16.0 kHz in 500-Hz increments. The standard turn-around-time is 3 ms, and the standard transmit and receive pulse widths are 10 ms. To acquire the two-way travel time to a TR6000 transponder with the receive frequency set to 10 kHz and the reply frequency set to 12.5 kHz, and use a threshold of 10, a lockout time of 100 ms, and an acoustic response timeout of 13 seconds:

Set the RxFreq configuration parameter to 12500 by entering:

```
@rxfreq=12500
```

Set the TAT configuration parameter to 30 by entering:

```
@TAT=30
```

Set the RxToneDur configuration parameter to 10 by entering:

```
@rxtonedur=10
```

Set the TxToneDur configuration parameter to 100 by entering:

```
@txtonedur=100
```

Set the RxThresh configuration parameter to 10 by entering:

```
@rxthresh=10
```

Set the RxLockout configuration parameter to 100 by entering:

```
@rxlockout=100
```

Set the AcRspTmOut configuration parameter to 13 by entering:

```
@acrsptmout=13
```

Then enter:

```
ATN10000
```

SMART Releases and Modems

The Teledyne Benthos Smart Modem Acoustic Release Technology (SMART) Releases and SMART Modems are combination acoustic releases and acoustic modems. They perform the same functions as the ATM-900 Series Acoustic Telemetry Modems plus they can be commanded to release themselves from their moorings. The commands incorporate the same highly reliable modulation techniques as are used by the acoustic modem.

SR-50 and SR-100 SMART Releases

The Teledyne Benthos SR-50 and SR-100 SMART Releases are combination acoustic releases and acoustic modems that provide reliable wireless digital communications with other deployed underwater instrument packages and surface or subsea platforms. They use a motorized type release mechanism to release themselves from their moorings. The acoustic telemetry is disabled when the battery voltage falls below a safe threshold at which only the release and transponder functions and the ability to send status messages can be activated.

SM-75 SMART Modem

The Teledyne Benthos SM-75 Smart Modem is a combination full ocean depth acoustic release and an acoustic modem that provides reliable wireless digital communications with other deployed underwater instrument packages and surface or subsea platforms. It uses an electrolytic dissolving wire ("burn wire") type release mechanism to release itself from its mooring. The acoustic telemetry is disabled when the battery voltage falls below a safe threshold at which only the release and transponder functions and the ability to send status messages can be activated.

SMART Release and Modem Commands

The following SMART Release and Modem commands are available:

- getcurrent
- AT\$Tn
- AT\$Rn,m
- AT\$Nn,m
- #n getcurrent

getcurrent

When an SM-75 SMART Modem is in the process of being released, the burn wire current is sampled and stored once per minute. The `getcurrent` command displays the sampled currents in amperes of a local SM-75 SMART modem.

Syntax: `getcurrent`

Privilege: `user`

Example: To display the burn wire current samples of a local SM-75 SMART modem in the process of being released, enter:

`getcurrent`

AT\$Tn

The Release Status command (`AT$Tn`) displays the status of the SMART Release or the SMART Modem at address `n`.

Syntax: `AT$Tn`

Privilege: `user`

Example: To display the status of the SR-100 SMART Release at address 5, enter:

`AT$T5`

AT\$Rn,m

The Release command (`AT$Rn,m`) activates the release mechanism of the SMART Release at address `n` with release code `m` where the release code is the serial number of the release.

Syntax: `AT$Rn,m`

Privilege: `user`

Example: To activate the release mechanism of the SMART Release at address 5 with release code 188, enter:

`AT$R5,188`

The message "Valid release code-waiting for confirmation..." should be displayed followed by the message "RELEASED and CONFIRMED" when released.

AT\$Nn,m

The Burn Wire Release command (AT\$Nn,m) activates the burn wire release of the SMART Modem at address n with release code m where the release code is the serial number of the modem. When activated, the burn wire dissolves and the modem releases itself from its mooring.

Syntax: AT\$Nn,m

Privilege: user

Example: To activate the burn wire release of the SMART Modem at address 5 with release code 198, enter

AT\$N5,198

The message "Valid Release Code-Waiting for Burn..." should be displayed and the dissolving wire module will be activated. Once the burn wire has fully burned, the message "Burn wire RELEASED" should be displayed when released.

#n getcurrent

When an SM-75 SMART Modem is in the process of being released, the burn wire current is sampled and stored once per minute. The #n getcurrent command displays the sampled currents in amperes of a remote SM-75 SMART modem at address n.

Syntax: #n getcurrent

Privilege: user

Example: To display the burn wire current samples of a remote SM-75 SMART modem at address 5 in the process of being released, enter:

#5 getcurrent

Real-Time Clock

A modem includes a battery backed real time clock and is shipped with the UTC time setting. Refer to "Real-Time Clock" on page 2-3 for the real-time clock specifications. The date and time are read from the real-time clock when the modem is powered up. The clock uses an internal one pulse per second (1PPS) signal to keep time, but it is possible to switch to an external 1PPS signal source, such as a GPS, for a more accurate time. If this configuration is desired, contact Teledyne Benthos. For information on how to contact Teledyne Benthos, refer to "Customer Service" on page vi. In addition, setting @Verbose=3 enables time stamping of all received and transmitted acoustic messages as in the following example.

```
user:3>at$S1  
TX time:13:12:44.9812  
Rx Time:13:12:46.8740
```

For additional specifications on the real-time clock, refer to Section 5, "Modem Operation."

SyncPPS Configuration Parameter

The SyncPPS configuration parameter has four options for driving the real-time clock, two internal and two external:

Off. With @SyncPPS=off, the date and time are driven from the internal real-time clock, and the RX and TX time stamps, which are shown when @Verbose=3, will be at a 1.56 ms accuracy.

RTC. With @SyncPPS=RTC, the date and time are driven from the internal real-time clock, and the RX and TX time stamps, which are shown at verbose level 3, will be at a 0.1 ms time accuracy. With this setting the modem is prevented from entering the Lowpower state, which allows the modem to maintain a high accuracy on the time stamps.

Ext0. With @SyncPPS=Ext0, the real-time clock is externally driven. Contact Teledyne Benthos for further information.

Ext1. With @SyncPPS=Ext1, the real-time clock is externally driven. Contact Teledyne Benthos for further information.

Real-Time Clock Commands

The following Real-Time Clock Commands are available:

- date
- uptime
- rtc battery

date

The `date` command sets or displays the current time and date. It also provides the ability to add or to subtract one second from the current time to aid in synchronizing the real-time clock. Optional "-12" and "-24" modifiers are available for 12-hour and 24-hour time displays.

Syntax: [-t<hh:mm:ss>] [-d<mm/dd/yyyy>] [-12|-24] [+sec] [-sec]

Privilege: user

Example 1: To display the time and date, enter:

`date`

Example 2: To set the time and date to 09:55:30 P.M. on March 18, 2011 and display 12-hour time, enter:

`date -t21:55:30 -d03/18/2011 -12`

Example 3: To set the time and date to 09:55:30 on March 18, 2011 and display 24-hour time, enter:

`date -t21:55:30 -d03/18/2011 -24`

Example 4: To subtract one second from the current time, enter:

`date -sec`

uptime

The `uptime` command displays the time at which the modem was powered up, as read from the real-time clock chip.

Syntax: uptime

Privilege: user

Example: To display the time and date at which the modem was powered up, enter:

`uptime`

rtc_battery

The `rtc_battery` command displays the real-time clock battery voltage.

Syntax: `rtc_battery`

Privilege: `user`

Example: To display the real-time clock battery voltage, enter:
 `uptime`



NOTE The real-time clock battery is an Energizer CR1632 or equivalent and should be replaced after two years of modem off time or when the battery voltage is less than 2.7 VDC. For instructions on how to replace the real-time clock battery, refer to "Changing the Real-Time Clock Battery" on page 8-7.

Device Enable

Device Enable is an output provided by all the modems. Refer to "Setting Up the Modems" on page 4-9 for connection information. Device Enable can be used to switch on a modem's host processor when the modem is ready to send data to it that were received over the acoustic link, and to switch off the host processor when the modem is in the lowpower state, such as when it receives the Hangup command (ATH), the Lowpower State command (ATL) or the idle time expires.

Automatic Device Enable Setting

The Device Enable output can be set automatically or with a command, or with a command only. For Device Enable to be set automatically or with a command, the DevEnable configuration parameter must be set to Auto, and to be set with a command only, to Manual. In the automatic case, when the Device Enable output is off, it will turn on automatically *only* if the modem receives data over the acoustic link, 80 ms prior to sending the data to the host, or if it receives the Dial command (ATD). Whenever the Device Enable output is on, it will switch up to 20 mA to ground. Whenever it is off, it is a high impedance. Refer to Section 2, "Specifications," for additional electrical specifications.

Device Enable Commands

The following device enable commands are available:

- ATTDm,p
- AT\$Xn,m,p

ATTDm,p

The Local Device Enable command (ATTDm,p) sets or clears the Device Enable output of serial port p of the local modem, where m=0 clears (high impedance) and m=1 sets (low impedance) the output. If p is left out, serial port 1 is assumed.

Syntax: ATTDm

Privilege: user

Example 1: To set the Device Enable output of serial port 2 of the local modem, enter:

ATTD1, 2

Example 2: To clear the Device Enable output of serial port 1 of the local modem, enter:

ATTD0, 1

or

ATTD0

AT\$Xn,m,p

The Remote Device Enable command (AT\$Xn,m,p) sets or clears the Device Enable output of serial port p of the remote modem at address n, where m=0 clears (high impedance) and m=1 sets (low impedance) the output. If p is left out, serial port 1 is assumed.

Syntax: AT\$Xn,m,p

Privilege: user

Example 1: To set the Device Enable output of serial port 2 of the remote modem at address 5, enter:

AT\$X5, 1, 2

Example 2: To clear the Device Enable output of serial port 1 of the remote modem at address 5, enter:

AT\$X5, 0, 1

or

AT\$X5, 0

Acoustic Test

Several diagnostic commands are available to measure the level of in band background noise or signals being received by the modem. This measurement is determined by monitoring the automatic gain control (AGC) output which continuously adjusts the gain of the modem receiver to maintain a fixed output amplitude. The AGC ranges from 0 dB to 91 dB for the ATM-900 Series Acoustic Telemetry Modems and 0 to 77 dB for the UDB-9400 Acoustic Telemetry Modems. A low value indicates a strong signal or background noise is being received and relatively little gain is required, and a high value indicates a weak signal or background noise is being received and a relatively high gain is required. In addition, although the AGC operates on in band signals only, very high out of band noise or signals will affect the gain. The AGC output is also useful as a quick check of the performance of the modem receiver. This check is called a "tap test" and is performed by tapping the transducer while monitoring the gain. If the receiver is functioning properly, tapping the transducer decreases the gain. Transmissions from other modems will also result in a low AGC output.

Background Noise Interpretations

The AGC output, as measured for the purpose of determining the level of in band noise or signals, can be interpreted as follows:

Greater than 70 dB:	When the modem is not in the water and is in relatively quiet in-air acoustic conditions.
60–70 dB:	Extremely quiet acoustic conditions which is ideal for long range acoustic communications.
50–60 dB:	Typical acoustic conditions where some background noise is present.
40–50 dB:	Noisy conditions. Communication is possible, but the range is reduced. When tapping or rubbing the modem transducer, the AGC should be at least this low.
Less than 40 dB:	Extremely noisy conditions where only some communication is possible. These conditions could be caused from interference or radiated electrical noise.

Acoustic Test Commands

The following acoustic test commands are available:

- spectrum
- ATTNn
- ATT2
- ATT1
- AT\$G

spectrum

The `spectrum` command starts the graphical spectral analyzer which displays the Spectral Frequency Graph, a dynamically updated plot of the amount of received energy across the entire receive bandwidth of the modem. The graph may be zoomed in to, zoomed out of and scaled. It can also display either a single line plot or a bar plot. For the graph to display properly, the terminal program must be configured to emulate ANSI BBS or VT-100.

Syntax: spectrum

Privilege: user

Example: To start the graphical spectral analyzer, enter:
spectrum

An example Spectral Frequency Graph is shown in Figure 5-5.

To stop the graphical spectral analyzer display, enter:
x

ATTNn

The AGC Diagnostic command (ATTNn) enables or disables the display of the automatic gain control (AGC) output of the local modem, where n=0 disables the display, and n=1 enables the display. The displayed values indicate the relative amount of background signal or noise present. Low values indicate a strong received signal, and high values, a weak received signal. The values are averages and range from 0 dB to 91 dB, updated once a second.

Syntax: ATTNn

Privilege: user

Example: To enable the display of the AGC output once per second of the local modem, enter:
ATTN1

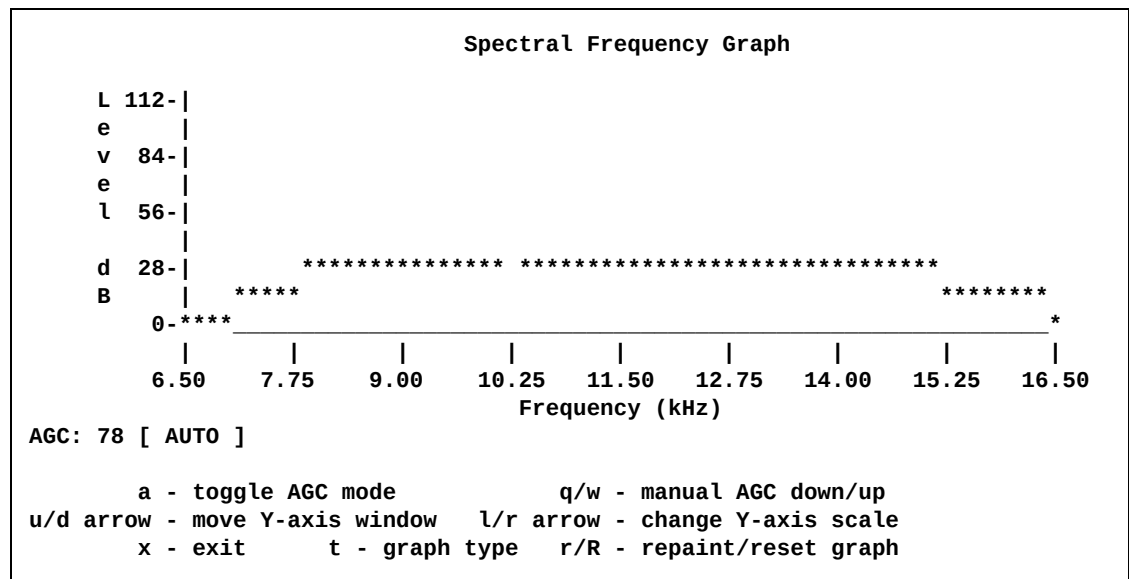


Figure 5-5 Example of Spectral Frequency Graph

ATT2

The AGC Diagnostic Enable command (ATT2) enables the display of the minimum and maximum automatic gain control (AGC) outputs of the local modem once per second. The displayed values are an indication of the relative amount of background noise present when there are no modems transmitting. Low values indicate a strong received signal, and high values, a weak received signal. The AGC ranges are 0–91 dB for the ATM-900 Series Acoustic Telemetry Modems and 0–77 dB for the UDB-9400 Series Acoustic Telemetry Modems.

Syntax: ATT2

Privilege: user

Example: To enable the display of the minimum and maximum AGC values once per second of the local modem, enter:

ATT2

The values are displayed as dashed pairs, where the first value of each pair is the minimum gain, and the second, the maximum.

To stop the display, enter:

ATT1

ATT1

The AGC Diagnostic Disable command (ATT1) disables the display of the minimum and maximum automatic gain control (AGC) outputs of the local modem.

Syntax: ATT1

Privilege: user

Example: To disable the display of the minimum and maximum AGC values of the local modem, enter:

ATT1

AT\$G

The Output Remote AGC command (AT\$G) outputs ten seconds of AGC history from the remote modem at address n. The history begins ten seconds prior to receipt of the command and ends at the receipt of the command. For every sample two numbers are output, one is the highest AGC measurement during a one second interval and the other, the lowest. The displayed values indicate the relative amount of background signal or noise present. Low values indicate a strong received signal, and high values, a weak received signal. The AGC ranges are 0–91 dB for the ATM-900 Series Acoustic Telemetry Modems and 0–77 dB for the UDB-9400 Series Acoustic Telemetry Modems.

Syntax: AT\$Gn

Privilege: user

Example: To output ten seconds of AGC history from the remote modem at address 5, enter:

AT\$G5

The values are displayed as dashed pairs, where the first value of each pair is the minimum gain, and the second, the maximum.

6 Modem AT Command Set

This section provides descriptions of each of the available Teledyne Benthos ATM-900 and UDB-9400 Series Acoustic Telemetry Modem AT commands supported by the CLAM shell user interface and how to enter and use them. The modem AT commands, which are input to a modem from its host processor over the serial interface, control the operation of the modem. An understanding of the AT commands is important when integrating and operating the modems with other subsea instrument packages.

The modem AT commands are listed in Table 6-1 on page 6-2. Also listed in the table are the page references to where detailed descriptions of the commands are provided. Some of the descriptions of the modem AT commands call out configuration parameters. For a detailed description of the configuration parameters and how to set them, refer to Section 7, "Modem Configuration Parameters."



NOTE To enter commands the modem must be connected to a computer that is set up to run a terminal program, such as ProComm Plus or Tera Term. Refer to "Setting Up the Modems" on page 4-9 for instructions on how to connect the modem to a PC and to "Setting up the Host Processor" on page 4-20 for instructions on how to set up the PC as the local host processor.



NOTE AT commands can only be entered on serial port 1 of ATM-900 Series Acoustic Telemetry Modems.

**Table 6-1 ATM-900 and UDB-9400 Series Acoustic Telemetry Modems
AT Command Set**

Command Syntax	Command Name	Result	Page
+++	Online Interrupt	Causes the local modem to go into Command mode.	6-6
AT [Enter]	Attention	Resets the local modem idle time timer and verifies communications between the host processor and the modem.	6-8
ATC [Enter]	Check Mode	Checks the operating mode of the local modem.	6-9
ATI [Enter]	Check Version	Checks the version number and the modification date and time of the firmware in the local modem.	6-10
ATES [Enter]	Reboot	Reboots the firmware of the local modem.	6-11
AT\$ESn [Enter]	Remote Acoustic Reset	Resets the remote modem at address n.	6-12
ATEU [Enter]	Update Firmware	Initiates the local modem firmware update procedure.	6-13
ATDn [Enter]	Dial	Causes the local modem to go into Online mode and to go online with the remote modem at address n.	6-15
AT&F [Enter]	Factory Reset	Resets the local modem's configuration parameter settings to their factory default settings.	6-17
ATH [Enter]	Hang Up	Causes all the remote modems to go into the lowpower state.	6-18
ATO [Enter]	Online	Causes the local modem to go into Online mode from Command mode.	6-19
AT\$Kn,p [Enter]	Remote Break	Causes the remote modem at address n to send a break on its serial port p and to go online with the local modem.	6-21
ATXn [Enter]	Acoustic Link Test	Tests the acoustic link with the modem at address n.	6-23
ATYn [Enter]	Multiple Bit Rate Test	Tests the acoustic link with the modem at address n at multiple bit rates.	6-26

**Table 6-1 ATM-900 and UDB-9400 Series Acoustic Telemetry Modems
AT Command Set (Continued)**

Command Syntax	Command Name	Result	Page
AT\$Pn,m [Enter]	Remote Power	Sets the transmit power level of the remote modem at address n to level m.	6-29
AT\$An,m [Enter]	Remote Bit Rate	Sets the transmitting acoustic bit rate of the remote modem at address n to m.	6-31
ATSn? [Enter]	Read Register	Displays the setting of the local modem's configuration parameter n.	6-33
AT\$Sn [Enter]	Read Remote Registers	Displays the configuration parameter settings of the remote modem at address n.	6-35
ATSn=n [Enter]	Set Register	Sets the local modem's configuration parameter number n to the value entered following "=".	6-37
AT&W [Enter]	Write	Saves the local modem's configuration parameter settings as the new startup configuration.	6-39
ATL [Enter]	Lowpower State	Forces the idle time of the local modem to expire, which in turn causes the modem to go into the lowpower state.	6-40
ATTDm	Local Device Enable	Sets or clears the Device Enable output of serial port p of the local modem.	6-42
AT\$Xn,m,p	Remote Device Enable	Sets or clears the Device Enable output of serial port p of the remote modem at address n.	6-43
ATRn [Enter]	Range	Displays the range from the local modem to the remote modem at address n.	6-45
ATV [Enter]	Local Battery Voltage	Displays the input power supply voltage and internal temperature of the local modem.	6-47
AT\$Vn [Enter]	Remote Battery Voltage	Displays the input power supply and real-time clock battery voltages of the remote modem at address n.	6-48
AT\$BEn [Enter]	Remote Data Logger Enable	Causes the remote modem at address n to go into Datalogger mode.	6-50

**Table 6-1 ATM-900 and UDB-9400 Series Acoustic Telemetry Modems
AT Command Set (Continued)**

Command Syntax	Command Name	Result	Page
AT\$BDn [Enter]	Remote Data Logger Disable	Causes the remote modem at address n to go into Online mode if it is in Datalogger mode.	6-51
AT\$BTn [Enter]	Read Remote Data Logger	Displays the contents of the data logger memory of the remote modem at address n.	6-52
AT\$BBn,m [Enter]	Output Data Logger Block	Outputs block m of the remote modem at address n.	6-54
AT\$BSn,m	Output Data Logger Sub-Block	Outputs 256-byte sub-blocks beginning at sub-block m of the remote modem at address n.	6-56
AT\$BCn [Enter]	Clear Remote Data Logger	Clears the contents of the data logger memory of the remote modem at address n.	6-58
AT\$BNn [Enter]	Remote Bytes Stored	Displays the number of bytes of data stored in the data logger memory of the remote modem at address n.	6-59
ATBC [Enter]	Clear Local Data Logger	Clears the contents of the data logger memory of the local modem.	6-61
ATBN [Enter]	Local Bytes Stored	Displays the number of bytes of data stored in the data logger memory of the local modem.	6-62
ATBT [Enter]	Output Local Data Logger	Outputs the contents of the data logger memory of the local modem over the serial interface.	6-63
ATBPn [Enter]	Output Local Page	Outputs the contents of page n of the data logger memory of the local modem over the serial interface.	6-65
ATTNn [Enter]	AGC Diagnostic	Enables or disables the display of the AGC output of the local modem.	6-67
AT\$Gn	Output Remote AGC	Outputs ten seconds of AGC history from the remote modem at address n.	6-69
ATT2	AGC Diagnostic Enable	Enables the display of the minimum and maximum AGC outputs of the local modem.	6-72

**Table 6-1 ATM-900 and UDB-9400 Series Acoustic Telemetry Modems
AT Command Set (Continued)**

Command Syntax	Command Name	Result	Page
ATT1	AGC Diagnostic Disable	Disables the display of the minimum and maximum AGC outputs of the local modem.	6-74
AT\$Tn [Enter]	Release Status	Displays the status of the SMART Release or the SMART Modem at address n.	6-75
AT\$Rn,m [Enter]	Release	Activates the release mechanism of the SMART Release at address n with release code m.	6-77
AT\$Nn,m	Burn Wire Release	Activates the burn wire release of the SMART Modem at address n with release code m.	6-78
ATWn,m	Compact Modem Wakeup	Wakes up a Compact Modem at address n and sets the idle time to m.	6-79
ATNm	Transpond	Causes the local modem to display the two-way travel time from the modem to a transponder of interrogation frequency m.	6-80

Online Interrupt

+++

Syntax

+++

Definition

The Online Interrupt command causes the local modem to go into Command mode. When a local modem is in Online mode and is online with a remote modem, every character that is input to the local modem from its host processor over the serial interface is transmitted to the remote modem. Similarly, every character that is input to the remote modem from its host processor over the serial interface is transmitted to the local modem. However, if the characters +++ are typed in rapid succession when the local modem is not transmitting or receiving data, either over the serial interface or over the acoustic link, the modem will switch to Command mode, and the remote modem will remain in Online mode. Similarly, when the local modem is in Datalogger mode, every character that is input to the modem from its host processor over the serial interface is stored in the modem's data logger memory. And if the characters +++ are typed in rapid succession when the modem is not transmitting or receiving data, either over the serial interface or over the acoustic link, the local modem will switch to Command mode.



WARNING If +++ is entered after data have been input to the modem over the serial interface, but before the forwarding delay has elapsed, the data will be lost. The setting of the FwdDelay configuration parameter determines the forwarding delay.

How to Use

To use the Online Interrupt command, type +++ rapidly.

The local modem will indicate that it has gone into Command mode by displaying the command prompt.

Special Considerations

The Online Interrupt command uses three plus characters—typed in rapid succession—because of the low probability that a string of three plus signs would be part of any data stream. To further ensure that these characters are not part of a data stream, the local modem requires three additional conditions for recognizing an interrupt:

1. There are no characters entered before the first plus sign is entered for a period that is longer than one second.
2. There are no other characters entered between entering any two plus signs.
3. The time interval between entering any two plus signs is less than one second.

The three conditions are shown graphically in Figure 6-1.

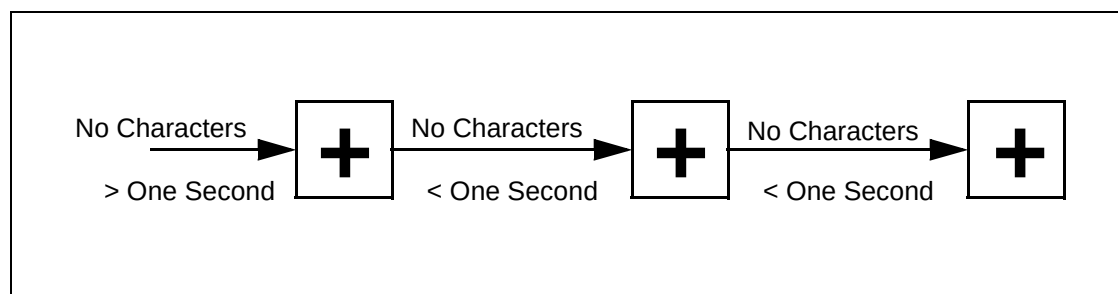


Figure 6-1 Conditions for Recognizing an Online Interrupt Command

Attention

AT

Syntax

AT [Enter]

Definition

The Attention command resets the local modem's idle time timer and verifies that the communications link between the host processor and the modem is functioning properly.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.

How to Use

To use the Attention command, type AT, and then press Enter.

The local modem will indicate that it has verified communications with its host processor by responding with the message "OK" and displaying the command prompt.

Check Mode

ATC

Syntax

ATC [Enter]

Definition

The Check Mode command checks the operating mode of the local modem, and the modem displays one of the following:

Acquisition mode:	Listening for an incoming data packet.
Receiving packet:	Receiving a data packet.
Transmitting:	Transmitting a data packet.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.

How to Use

To use the Check Mode command, type ATC, and then press Enter.

The local modem will display its operating mode as described above.

Check Version

ATI

Syntax

ATI [Enter] or Version [Enter]

Definition

The Check Version command checks the version number and modification date and time of the firmware, the modem build date, the PLD (Programmable Logic Device) version, and the modem serial number in the local modem for the following modem types:

Standard Modem: The modem is an ATM-900 Series Acoustic Telemetry Modem, a SMART Release (SR-50 or SR-100), or a SMART Modem (SM-75).

Universal Deck Box: The modem is a UDB-9400 Series Acoustic Telemetry Modem.

Compact Modem: The modem is a Compact Modem.

This information, along with the firmware version numbers of the programmable logic devices in the modem, is displayed by the local modem.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.

How to Use

To use the Check Version command, type ATI, and then press Enter.

The local modem will display the modem type, the version number, the modification date and time of its firmware, the build date, the PLD versions, the modem serial number, and the firmware version numbers of the programmable logic devices.

Reboot

ATES

Syntax

ATES [Enter]

Definition

The Reboot command reboots the firmware of the local modem causing the modem to reset in the same manner as it would when the power is cycled off and then on. This process takes about five seconds.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.

How to Use

To use the Reboot command, type ATES, and then press Enter.

The local modem will reboot its firmware and automatically enter Command mode.

Remote Acoustic Reset

AT\$ESn

Syntax

AT\$ESn [Enter]

Definition

The Remote Acoustic Reset command resets the remote modem at address n.



NOTE For the local modem to execute entered commands, the modem must be in **Command mode**—with the command prompt displayed. If the modem is not in **Command mode**, refer to page 5-6 for instructions on how to place the modem into **Command mode**.

How to Use

To use the Remote Acoustic Reset command, type AT\$ES followed by the address of the remote modem, and then press Enter.

The remote modem will reset.

Special Considerations

If all attempts to communicate with the remote modem fail, the Remote Acoustic Reset command should be used to reset the modem.

Update Firmware

ATEU

Syntax

ATEU [Enter]

Definition

The Update Firmware command initiates the local modem firmware update procedure. When entering this command, instructions are provided on how to update the modem firmware by using the Xmodem or 1K-Xmodem transfer protocol and a terminal program to transfer the new firmware file to the modem. Once the firmware is transferred, the modem will automatically reboot and enter Command mode.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.

How to Use

To use the Update Firmware command, type ATEU, and then press Enter.

The modem will display a prompt requesting that the baud rate be switched to 115,200 followed by a request to continue with the update procedure. At this point the firmware can be updated by transferring the new firmware file over to the modem using the Xmodem or 1K-Xmodem transfer protocol.

Special Considerations

When using the Update Firmware command, take note of the following:

- If the Update Firmware command is entered and the baud rate is not switched to 115,200 baud within 30 seconds, the modem will reboot.
- Should for any reason the firmware update be interrupted, the modem will no longer respond to commands, as the original firmware will have been erased. Should this situation occur, the modem will automatically enter the boot loader and display the boot loader prompt (Boot). At this prompt type "update," and then press Enter. The modem will again

respond with similar instructions as that provided by the Update Firmware command on how to update the firmware. Once the file is transferred, type "reboot," and then press enter, or cycle the power off and then on.

Dial

ATDn

Syntax

ATDn [Enter]

Definition

The Dial command causes the local modem to go into Online mode from Command mode and to go online with the remote modem at address n.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.

How to Use

To use the Dial command, type ATD followed by the address of the remote modem, and then press Enter.

The local modem will go online with the remote modem, and then the local modem will display the message "CONNECT" followed by the transmitting acoustic bit rate of the local modem.

When the local and remote modems are online, the local modem will transmit all the data received from its host processor to the remote modem, which will in turn output the data to its host processor. Similarly, the remote modem will transmit all the data received from its host processor to the local modem, which will in turn output the data to its host processor.

Special Considerations

When using the Dial command, take note of the following:

- To display the message "CONNECT" followed by the transmitting acoustic bit rate and many other messages, the Verbose configuration parameter must be set to 1 or higher, where 1 is the factory default setting.
- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of AcRspTmOut configuration parameter. If an

acknowledgment is not received, "Response Not Received" will be displayed.

- The Dial command sets the RemoteAddr configuration parameter of the remote modem to the address of the local modem.



NOTE The Dial command sets the RemoteAddr configuration parameter of the remote modem to the address of the local modem.

- The Dial command sets the RemoteAddr configuration parameter of the local modem to the address of the remote modem.
- If it is desired to enter commands after going online with the remote modem, type +++ in rapid succession to cause the local modem to go into Command mode. Then enter the desired commands. To go back online with the same remote modem, use the Dial command.
- If the remote modem goes into the lowpower state and @OpMode=Command, then the modem will go into Command mode. To go back online with the same remote modem, use the Dial command.

Factory Reset

AT &F

Syntax

AT&F [Enter] or factory_reset [Enter]

Definition

The Factory Reset command resets the local modem's configuration parameter settings to their factory default settings.



NOTE For the local modem to execute entered commands, the modem must be in **Command mode**—with the command prompt displayed. If the modem is not in **Command mode**, refer to page 5-6 for instructions on how to place the modem into **Command mode**.



WARNING The Factory Reset command will set the serial port baud rates and protocol to the factory defaults which may prevent communication with the host computer if the current settings are different than the default ones.

How to Use

To use the Factory Reset command, type AT&F, and then press Enter.

The local modem will reset its configuration parameters to their factory default settings, and respond with the message "Factory Reset."

Special Considerations

When using the Factory Reset command, take note of the following:

- Using the Write command (AT&W) or entering `cfg store` after using the Factory Reset command will save the configuration parameter factory default settings as the startup configuration, which is the configuration parameter settings when the modem is powered up.
- When the modem is powered up, the configuration parameters will be set to their startup configuration. This configuration is not necessarily the factory default settings, as the configuration parameter settings may have been changed and then saved as the new startup configuration with the Write command (AT&W) or by entering `cfg store`.

Hang Up

ATH

Syntax

ATH [Enter]

Definition

The Hang Up command causes all the remote modems to go into the lowpower state. It is not possible to send a Hang Up command to a specific modem.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.

How to Use

To use the Hang Up command, type ATH, and then press Enter.

The local modem will send the Hang Up command to address 255, which each modem will recognize as one of its addresses. When the local modem has completed the transmission, it will respond with the message "Off Line."

Special Considerations

When using the Hang Up command, take note of the following:

- When a remote modem receives the Hang Up command, it will not send an acknowledgment to the local modem. Instead, it will cease transmissions and go into the lowpower state.
- Because a remote modem goes into the lowpower state when it receives the Hang Up command, its Device Enable output will turn off. Refer to "Device Enable" on page 5-65 for information on the Device Enable output.

Online

ATO

Syntax

ATO [Enter]

Definition

The Online command causes the local modem to go into Online mode from Command mode and to go online with the remote modem whose address is the setting of the local modem's RemoteAddr configuration parameter. The command also sets @OpMode=Online of the local modem. This setting ensures the modem will remain online after the local modem is powered down and then powered up again, or is awakened from the lowpower state.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.

How to Use

To use the Online command, type ATO, and then press Enter.

The local modem will go online with the remote modem, and then the local modem will display the message "CONNECT" followed by the transmitting acoustic bit rate of the local modem.

When the local and remote modems are online, the local modem will transmit all the data received from its host processor to the remote modem, which will in turn output the data to its host processor. Similarly, the remote modem will transmit all the data received from its host processor to the local modem, which will in turn output the data to its host processor.

Special Considerations

When using the Online command, take note of the following:

- To display the message "CONNECT" followed by the acoustic bit rate and many other messages, the Verbose configuration parameter must be set to 1 or higher, where 1 is the factory default setting.

- If it is desired to enter commands after going online with the remote modem, type +++ in rapid succession to cause the local modem to go into Command mode. Then enter the desired commands. To go back online with the same remote modem, use the Online command.

Remote Break

AT\$Kn,p

Syntax

AT\$Kn [Enter]

Definition

Causes the remote modem at address *n* to send a break on its serial port *p* and to go online with the local modem. If *p* is left out, serial port 1 is assumed.

The settings for *p* are 1 and 2 as follows:

- 1: Serial port 1.
- 2: Serial port 2.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.

How to Use

To use the Remote Break command, type AT\$K followed by the address of the remote modem, the comma character ",", and the serial port number, and then press Enter.

The remote modem will send a break on the specified serial port and then the local modem will go online with the remote modem and display the message "CONNECT" followed by the transmitting acoustic bit rate of the local modem.

When the local and remote modems are online, the local modem will transmit all the data received from its host processor to the remote modem, which will in turn output the data to its host processor. Similarly, the remote modem will transmit all the data received from its host processor to the local modem, which will in turn output the data to its host processor.

Special Considerations

When using the Remote Break command, take note of the following:

- To display the message "CONNECT" followed by the transmitting acoustic bit rate and many other messages, the Verbose configuration parameter must be set to 1 or higher, where 1 is the factory default setting.
- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If an acknowledgment is not received, "Response Not Received" will be displayed.
- The Remote Break command sets the RemotAddr configuration parameter of the remote modem to the address of the local modem.
- The Remote Break command sets RemotAddr configuration parameter of the local modem to the address of the remote modem.
- If it is desired to enter commands after going online with the remote modem, type +++ in rapid succession to cause the local modem to go into Command mode. Then enter the desired commands. To go back online with the same remote modem, use the Dial command.
- If the remote modem goes into the lowpower state and @OpMode=Command, then the modem will go into Command mode. To go back online with the same remote modem, use the Dial command.

Acoustic Link Test

ATXn

Syntax

ATXn [Enter]

Definition

The Acoustic Link Test command tests the acoustic link between the local modem and the remote modem at address n by causing the remote modem to transmit one of 8 different length preset test messages at the acoustic bit rate determined by the setting of the TxRate configuration parameter of the remote modem. The preset test message length and whether the message is displayed when received by the local modem is determined by the settings of the PktSize and PktEcho configuration parameters, respectively.

In addition, the local modem measures and displays the following, which are the received data statistics:

ERR:	Errors—the number of bits received that did not match the test message.
CRC:	Checksum—pass or fail, where a pass condition signifies no errors were detected, and a fail condition signifies one or more bit errors were detected.
MPD:	Multipath Delay—in milliseconds, where the higher the number the greater the multipath. The range is from 0 to 50.
SNR:	Signal to Noise Ratio—A metric that provides information on the quality of the processed signal. The value is not related to the input SNR, but instead takes into account all the processing and the effects of multipath.
SPD:	Speed—the relative speed in knots between the local and remote modems, where a negative number indicates the modems are moving farther apart and a positive number indicates the modems are moving closer together.
AGC:	Automatic Gain Control—a decimal number where the lower the number the less gain, which means a strong input signal was received. Similarly, the higher the number the more gain, which means a weak input signal was received. The lowest gain indication is 00, and the highest is 91.
CCERR:	Corrected Channel Error—Metric 0–14.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.

How to Use

To use the Acoustic Link Test command, type ATX followed by the address of the remote modem, and then press Enter.

The remote modem will transmit the preset test message selected by the setting of the local modem's PktSize configuration parameter at the bit rate determined by the setting of the remote modem's TxRate configuration parameter, and the local modem will display the received data statistics described above. In addition, if @PktEcho=Ena, the local modem will display the preset test message which consists of the alphanumeric ASCII character set.

Special Considerations

When using the Acoustic Link Test command, take note of the following:

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of AcRspTmOut configuration parameter. If an acknowledgment is not received, "Response Not Received" will be displayed.



WARNING The ATXn command sets the RemoteAddr configuration parameter of the remote modem to the address of the local modem. If the remote modem will later be used in Online mode, then its RemoteAddr configuration parameter may need to be set back to the setting it was before the ATXn command was sent to it. To display the setting of the RemoteAddr configuration parameter of the remote modem *before* using the ATXn command, enter #n @RemoteAddr where n is the address of the remote modem. To return the setting to its original value *after* using the ATXn command, enter #n @RemoteAddr=<value>, where "value" is the original setting. If the original setting is not known, use the Remote Reset command (AT\$ESn) to reboot the modem and set all of its configuration parameters back to their previously saved values.

- To optimize the performance and efficiency of the modems, consider reducing the transmit power level of the remote modem with the Remote Power command (AT\$Pn,m) and use the Acoustic Link Test command to verify a low error rate—8 or less. Also consider increasing the remote modem's transmitting acoustic bit rate by changing the setting of the TxRate configuration parameter with the Remote Bit Rate command (AT\$An,m). Again, use the Acoustic Link Test command to verify a low error rate. Similarly, if a high error rate is observed, consider increasing the transmit power level or decreasing the transmitting acoustic bit rate, or both.
- The RemoteAddr configuration parameter on the remote modem will be set to address of the local modem.

Multiple Bit Rate Test

ATYn

Syntax

ATYn [Enter]

Definition

The Multiple Bit Rate Test command tests the acoustic link between the local modem and the remote modem at address n by causing the remote modem to transmit a 256-byte preset test message multiple times, one time for each of the acoustic bit rates listed below. If @PktEcho=Ena, the preset test message is displayed when received by the local modem. If the local modem is an ATM-900 Series Acoustic Telemetry Modem, six different acoustic bit rates are used to transmit the preset test message: 300, 600, 800, 1000, 1200, and 2400 bits/sec. If the local modem is a UDB-9400 Series Acoustic Telemetry Modem, these bit rates plus five additional bit rates are used: 2560; 5120; 7680; 10,240; and 15,360 bits/sec.

In addition, the local modem measures and displays the following, which are the received data statistics:

ERR:	Errors—the number of bits received that did not match the test message.
CRC:	Checksum—pass or fail, where a pass condition signifies no errors were detected, and a fail condition signifies one or more bit errors were detected.
MPD:	Multipath Delay—in milliseconds, where the higher the number the greater the multipath. The range is from 0 to 50.
SNR:	Signal to Noise Ratio—A metric that provides information on the quality of the processed signal. The value is not related to the input SNR, but instead takes into account all the processing and the effects of multipath.
SPD:	Speed—the relative speed in knots between the local and remote modems, where a negative number indicates the modems are moving farther apart and a positive number indicates the modems are moving closer together.
AGC:	Automatic Gain Control—a decimal number where the lower the number the less gain, which means a strong input signal was received. Similarly, the higher the number the more gain, which means a weak input signal was received. The lowest gain indication is 00, and the highest is 91.

CCERR: Corrected Channel Error—Metric 0–14.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.

How to Use

To use the Multiple Bit Rate Test command, type ATY followed by the address of the remote modem, and then press Enter.

The remote modem will transmit the 256-byte preset test message at each of the different bit rates, and the local modem will display the received data statistics described above. In addition, depending on the setting of the PktSize and PktEcho configuration parameters, the local modem will display the preset test message which consists of the alphanumeric ASCII character set.

Special Considerations

When using the Multiple Bit Rate Test command, take note of the following:

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If an acknowledgment is not received, "Response Not Received" will be displayed.



WARNING The ATYn command sets the RemoteAddr configuration parameter of the remote modem to the address of the local modem. If the remote modem will later be used in Online mode, then its RemoteAddr configuration parameter may need to be set back to the setting it was before the ATYn command was sent to it. To display the setting of the RemoteAddr configuration parameter of the remote modem *before* using the ATYn command, enter #n @RemoteAddr where n is the address of the remote modem. To return the setting to its original value *after* using the ATYn command, enter #n @RemoteAddr=<value>, where "value" is the original setting. If the original setting is not known, use the Remote Reset command (AT\$ESn) to reboot the modem and set all of its configuration parameters back to their previously saved values.

- To optimize the performance and efficiency of the modems, consider reducing the transmit power level of the remote modem with the Remote Power command (AT\$Pn,m) and use the Multiple Bit Rate Test command to verify a low error rate—8 or less. Also consider increasing the remote modem's transmitting acoustic bit rate by changing the setting of the TxRate configuration parameter with the Remote Bit Rate command (AT\$An,m). Again, use the Multiple Bit Rate Test command to verify a low error rate. Similarly, if a high error rate is observed, consider increasing the transmit power level or decreasing the transmitting acoustic bit rate, or both.

Remote Power

AT\$Pn,m

Syntax

AT\$Pn,m [Enter]

Definition

The Remote Power command sets the transmit power level of the remote modem at address n to level m. The range of settings for m is from 1 to 8 for a range of 0 dB to -21 dB of attenuation in -3 dB steps, where 0 dB is the maximum transmit power level and -21 dB is the minimum transmit power level as follows:

- 1: -21 dB (minimum power level)
- 2: -18 dB
- 3: -15 dB
- 4: -12 dB
- 5: -09 dB
- 6: -06 dB
- 7: -03 dB
- 8: 00 dB (maximum power level)



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.



WARNING Exceeding the recommended power level and continuous transmission time limits for an ATM-914, ATM-915 or ATM-916 Acoustic Telemetry Modems may cause the transmitter to overheat and to automatically shut down. Should this condition occur, a message will be output on the serial interface indicating such. Once the modem cools down it will be able to transmit again. To display the internal temperature of the local modem, use the ATV command.

How to Use

To use the Remote Power command, type AT\$P followed by the address of the remote modem, the comma character "," and the value of m as determined by the required transmit power level, and then press Enter.

The remote modem will set its transmit power level, and then the local modem will respond with the message "OK."

Special Considerations

When using the Remote Power command, take note of the following:

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If an acknowledgment is not received, "Response Not Received" will be displayed.

Remote Bit Rate

AT\$An,m

Syntax

AT\$An,m [Enter]

Definition

The Remote Bit Rate command sets the transmitting acoustic bit rate of the remote modem at address n to m. The range of settings for m is from 2 to 13 as follows:

- 2: 140 bits/sec MFSK repeated four times with rate 1/2 convolutional coding and 25-ms multipath guard period
- 3: 300 bits/sec MFSK repeated twice with rate 1/2 convolutional coding and 25-ms multipath guard period
- 4: 600 bits/sec MFSK with rate 1/2 convolutional coding and 25-ms multipath guard period
- 5: 800 bits/sec MFSK with rate 1/2 convolutional coding and 12.5-ms multipath guard period
- 6: 1066 bits/sec MFSK with rate 1/2 convolutional coding and 3.125-ms multipath guard period
- 7: 1200 bits/sec MFSK with rate 1/2 convolutional coding
- 8: 2400 bits/sec MFSK
- 9: 2560 bits/sec PSK, with rate 1/2 convolutional coding
- 10: 5120 bits/sec PSK, with rate 1/2 convolutional coding
- 11: 7680 bits/sec PSK, with rate 1/2 convolutional coding
- 12: 10,240 bits/sec PSK
- 13: 15,360 bits/sec PSK



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.

How to Use

To use the Remote Bit Rate command, type AT\$A followed by the address of the remote modem, the comma character ",", and the value of m as determined by the required acoustic bit rate, and then press Enter.

The remote modem will set its transmitting acoustic bit rate, and then the local modem will respond with the message "OK."

Special Considerations

When using the Remote Bit Rate command, take note of the following:

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If an acknowledgment is not received, "Response Not Received" will be displayed.
- The Remote Bit Rate command sets the TxRate configuration parameter of the remote modem to the selected value.
- Settings 9–13 are available for a UDB-9400 Series Acoustic Telemetry Modem only.

Read Register

ATSn?

Syntax

ATSn? [Enter] or ATS? [Enter]

Definition

The Read Register command causes the local modem to display the setting of its S Register n, or if the S Register number is not specified, the settings of all its S Registers.



NOTE S Registers are available for backward compatibility, as they perform many of the same functions as those of the configuration parameters. Changing the setting of a configuration parameter will automatically change the setting of its equivalent S Register if there is one. The reverse is also true. However, only a limited set of configuration parameters can be accessed with S Registers. Therefore using the configuration parameters instead of the S Registers is highly recommended.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.

How to Use

To use the Read Register command, type ATS and the number of the S Register that is to be read, followed by a question mark (?). Or type ATS? to read the first 21 S Registers, and then press Enter.

The local modem will display its S Register setting or settings. An example that uses the Read Register command is shown in Figure 6-2, where all the S Register settings were displayed by entering ATS?

Special Considerations

The S Register settings can be interpreted from Table 7-1 on page 7-2, which includes page references to where detailed descriptions are provided.

```
user:1>ats?  
Local Sregisters  
S00=080 S01=000 S02=000 S03=130 S04=005 S05=000 S06=008  
S07=015 S08=060 S09=000 S10=036 S11=000 S12=000 S13=001  
S14=000 S15=001 S16=001 S17=001 S18=000 S19=000 S20=000
```

Figure 6-2 Read Register Command and Resulting Display

Read Remote Registers

AT\$Sn

Syntax

AT\$Sn [Enter]

Definition

The Read Remote Registers command causes the local modem to display the S Register settings of the remote modem at address n.



NOTE S Registers are available for backward compatibility, as they perform many of the same functions as those of the configuration parameters. Changing the setting of a configuration parameter will automatically change the setting of its equivalent S Register if there is one. The reverse is also true. However, only a limited set of configuration parameters can be accessed with S Registers. Therefore using the configuration parameters instead of the S Registers is highly recommended.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.

How to Use

To use the Read Remote Registers command, type AT\$S followed by the address of the remote modem, and then press Enter.

The local modem will display the S Register settings of the remote modem. An example that uses the Read Remote Registers command is shown in Figure 6-3, where the S Register settings of the remote modem with address 1 were displayed by entering AT\$S1.

Special Considerations

When using the Read Remote Registers command, take note of the following:

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by

the setting of the AcRspTmOut configuration parameter. If an acknowledgment is not received, "Response Not Received" will be displayed.

- The S Register settings can be interpreted from Table 7-1 on page 7-2, which includes page references to where detailed descriptions are provided.

```
user:1>at$s1
Remote Sregisters
S00=080 S01=000 S02=000 S03=130 S04=003 S05=000 S06=001
S07=015 S08=060 S09=000 S10=036 S11=000 S12=000 S13=001
S14=000 S15=001 S16=001 S17=001 S18=001 S19=000 S20=000
```

Figure 6-3 Read Remote Registers Command and Resulting Display

Set Register

ATS_n=_n

Syntax

ATS_n=_n [Enter]

Definition

The Set Register command sets the local modem's S Register number _n to the value entered following "=".



NOTE S Registers are available for backward compatibility, as they perform many of the same functions as those of the configuration parameters. Changing the setting of a configuration parameter will automatically change the setting of its equivalent S Register if there is one. The reverse is also true. However, only a limited set of configuration parameters can be accessed with S Registers. Therefore using the configuration parameters instead of the S Registers is highly recommended.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.

How to Use

To use the Set Register command, type ATS and the S Register number to be set, followed by the equal character "=" and the setting desired, and then press Enter.

The local modem will set the S Register setting and respond with the message "OK."

Special Considerations

When using the Set Register command, take note of the following:

- Entering `cfg store` after using the Set Register command will save the S Register setting as part of the startup configuration, which is the S Register settings when the modem is powered up.

- If at any time it is desired to return the S Register settings to the values they were when the modem was first powered up—and `cfg_store` was not used to save the S Register settings as part of the startup configuration—power down the modem, and then power up the modem again.

Write

AT & W

Syntax

AT&W [Enter] or cfg store [Enter]

Definition

The Write command saves the configuration parameter settings of the local modem as the new startup configuration.



NOTE For the local modem to execute entered commands, the modem must be in **Command mode**—with the command prompt displayed. If the modem is not in **Command mode**, refer to page 5-6 for instructions on how to place the modem into **Command mode**.

How to Use

To use the Write command, type AT&W, and then press Enter.

The local modem will save its current configuration parameter settings as the startup configuration, and then respond with the message "Registers Stored."



WARNING If power is lost while the Write command is being executed, all the configuration parameter settings will revert to their factory default settings upon power up.

Special Considerations

When using the Write command, take note of the following:

- When the modem is powered up, the configuration parameters will be set to their new startup configuration. The configuration parameter settings can again be changed with the Set Register command (ATSn=n) or @<parameter name>=<value>, and then saved as the new startup configuration with the Write command or by entering `cfg store`.

Lowpower State

ATL

Syntax

ATL [Enter]

Definition

The Lowpower State command forces the idle time of the local modem to expire, which in turn causes the modem to go into the lowpower state.



NOTE For the local modem to execute entered commands, the modem must be in **Command mode**—with the command prompt displayed. If the modem is not in **Command mode**, refer to page 5-6 for instructions on how to place the modem into **Command mode**.

How to Use

To use the Lowpower State command, type ATL, and then press Enter.

The local modem will immediately go into the lowpower state and respond with the message "Lowpower."



WARNING Depending on the setting of the P1FlowCtl configuration parameter, the RS-232 driver may be set to turn off whenever the modem is in the lowpower state. Refer to "P1FlowCtl" on page 7-9 for information on the P1FlowCtl configuration parameter. Therefore, hardware RTS/CTS handshaking *must* be disabled at the host processor when sending the first byte of data to the modem over the serial interface. After the first byte is sent, handshaking can be turned on again or left disabled.

Special Considerations

When using the Lowpower State command, take note of the following:

- To display the message "Lowpower" and many other messages, the Verbose configuration parameter must be set to 1 or higher, where 1 is the factory default setting.

- The local modem can be awakened by input either from its host processor over the serial interface or from a remote modem over the acoustic link. When awakened, the modem will go into the operating mode determined by the setting of the OpMode configuration parameter.
- When the modem is in the lowpower state, the Device Enable output is turned off. Refer to "Device Enable" on page 5-65 for information on the Device Enable output.

Local Device Enable

ATTDm,p

ATTDm [Enter]

Definition

Sets or clears the Device Enable output of serial port p of the local modem. If p is left out, serial port 1 is assumed. The Device Enable output can also be set or cleared *both* as described in "SMART Releases and Modems" on page 5-59 *and* with the Local Device Enable command by setting @DevEnable=Auto which is its default setting. To set or clear the Device Enable output *only* with the Local Device Enable command, the DevEnable configuration parameter must be set to Manual.

The settings for m are 0 and 1 as follows:

- 0: Clear Device Enable output (high impedance).
- 1: Set Device Enable output (low impedance).

The settings for p are 1 and 2 as follows:

- 1: Serial port 1.
- 2: Serial port 2.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.

How to Use

To use the Local Device Enable command, type ATTD followed by the value of m as determined by the required setting, and then press Enter.

The local modem will clear or set the Device Enable output.

Remote Device Enable

AT\$Xn,m,p

AT\$Xn,m,p [Enter]

Definition

The Remote Device Enable command sets or clears the Device Enable output of serial port p of the remote modem at address n. If p is left out, serial port 1 is assumed. The Device Enable output can also be set or cleared both as described in "Device Enable" on page 5-65 *and* with the Remote Device Enable command by setting @DevEnable=Auto which is its default setting. To set or clear the Device Enable output *only* with the Remote Device Enable command, the DevEnable configuration parameter must be set to Manual.

The settings for m are 0 and 1 as follows:

- 0: Clear Device Enable output (high impedance).
- 1: Set Device Enable output (low impedance).

The settings for p are 1 and 2 as follows:

- 1: Serial port 1.
- 2: Serial port 2.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.

How to Use

To use the Remote Device Enable command, type AT\$X followed by the address of the remote modem, the comma character ",", the value of m as determined by the required setting, another comma character, and the serial port number, and then press Enter.

The remote modem will clear or set the Device Enable output of the specified serial port.

Special Considerations

When using the Remote Device Enable command, take note of the following:

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If an acknowledgment is not received, "Response Not Received" will be displayed.

Range

ATRn

Syntax

ATRn [Enter]

Definition

The Range command causes the local modem to display the range from the local modem to the remote modem at address n. The displayed range is in meters with a resolution of 0.1 meters. In addition, the information displayed and the format are dependent on the setting of the Verbose configuration parameter as listed below.

Output format @Verbose=0 and 1:

Range <local address> to <remote address> : <range> m

Output format @Verbose=2:

Range <local address> to <remote address> : <range> m speed <relative speed> m/s

Output format @Verbose=3:

TX time: hh:mm:ss.nnnn

RX time: hh:mm:ss.nnnn

Range <local address> to <remote address> : <range> m (Round-trip <range> ms) speed <relative speed> m/s

For @Verbose=3, hh is hours, mm is minutes, ss is seconds, and nnnn is tenths of milliseconds.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.

How to Use

To use the Range command, type ATR followed by the address of the remote modem, and then press Enter.

The local modem will respond by displaying the range in meters to the remote modem. The displayed information will be in accordance with the Verbose configuration parameter.

Special Considerations

When using the Range command, take note of the following:

- The displayed range is the one-way range to the remote modem and is determined acoustically based on a sound speed in seawater of 1500 meters/second.
- To acquire the range to a remote modem, the local modem transmits an interrogation signal to the remote modem, and when the remote modem receives the signal, it responds with a reply. The local modem must receive the reply from the remote modem within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If a reply is not received, "Response Not Received" will be displayed.
- The output format is for ATM-900 and UDB-9400 Series Acoustic Telemetry Modems only.

Local Battery Voltage

ATV

Syntax

ATV [Enter]

Definition

The Local Battery Voltage command causes the local modem to display the input power supply voltage—whether it is from the transmitter battery or an external power source—and the internal temperature. Refer to Table 8-1 on page 8-3 for the estimated modem battery pack capacity remaining versus the voltage of the transmitter power supply.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.



WARNING Exceeding the recommended power level and continuous transmission time limits for an ATM-914, ATM-915 or ATM-916 Acoustic Telemetry Modems may cause the transmitter to overheat and to automatically shut down. Should this condition occur, a message will be output on the serial interface indicating such. Once the modem cools down it will be able to transmit again.

How to Use

To use the Local Battery Voltage command, type ATV, and then press Enter.

The local modem will display its input power supply voltage in volts and its internal temperature in degrees Celsius.

Special Considerations

When using the Local Battery Voltage command, take note of the following:

- The accuracy of the input power supply voltage measurement is ± 1.0 volts.
- Should the internal temperature of the modem exceed 80°C, the modem transmitter will shut down. Once cooled to 60°C, the transmitter will again be operational.

Remote Battery Voltage

AT\$Vn

Syntax

AT\$Vn [Enter]

The Remote Battery Voltage command causes the local modem to display the input power supply voltage—whether it is from the transmitter battery or an external power source—and the real-time clock battery voltage of the remote modem at address n. Refer to Table 8-1 on page 8-3 for the estimated modem battery pack capacity remaining versus the voltage of the transmitter power supply.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.

How to Use

To use the Remote Battery Voltage command, type AT\$V followed by the address of the remote modem, and then press Enter.

The local modem will display the input power supply and real-time clock battery voltages in volts of the remote modem.

Special Considerations

When using the Remote Battery Voltage command, take note of the following:

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If an acknowledgment is not received, "Response Not Received" will be displayed.
- The accuracy of the input power supply voltage measurement is ± 1.0 volts.
- The real-time clock battery voltage is displayed following "DSP Bat =."
- If the real-time clock battery is installed and has sufficient capacity, its voltage will be 2.7 VDC or higher.

- If the real-time clock battery voltage is less than 2.7 VDC, the battery is either not installed or has little remaining capacity and should be replaced.

Remote Data Logger Enable

AT\$BEn

Syntax

AT\$BEn [Enter]

Definition

The Remote Data Logger Enable command causes the remote modem at address n to go into Datalogger mode.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.

How to Use

To use the Remote Data Logger Enable command, type AT\$BE followed by the address of the remote modem, and then press Enter.

The remote modem will go into Datalogger mode, and then the local modem will respond with the message "OK."

Special Considerations

When using the Remote Data Logger Enable command, take note of the following:

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If an acknowledgment is not received, "Response Not Received" will be displayed.
- The Remote Data Logger Enable command sets @OpMode=Datalog of the remote modem.

Remote Data Logger Disable

AT\$BDn

Syntax

AT\$BDn [Enter]

Definition

The Remote Data Logger Disable command causes the remote modem at address n to go into Online mode and to go online with the local modem if the remote modem is in Datalogger mode.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.

How to Use

To use the Remote Data Logger Disable command, type AT\$BD followed by the address of the remote modem, and then press Enter.

The local modem will go online with the remote modem if the remote modem is in Datalogger mode, and then respond with the message "OK."

Special Considerations

When using the Remote Data Logger Disable command, take note of the following:

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If an acknowledgment is not received, "Response Not Received" will be displayed.
- The Remote Data Logger Disable command sets @OpMode=Online of the remote modem.
- The Remote Data Logger Disable command has no effect on the remote modem if the remote modem is not in Datalogger mode.

Read Remote Data Logger

AT\$BTn

Syntax

AT\$BTn [Enter]

Definition

The Read Remote Data Logger command causes the local modem to display the contents of the data logger memory of the remote modem at address n.



NOTE For the local modem to execute entered commands, the modem must be in **Command mode**—with the command prompt displayed. If the modem is not in **Command mode**, refer to page 5-6 for instructions on how to place the modem into **Command mode**.

Use of the `rdlfind` command instead of the Read Remote Data Logger command is recommended unless it is desired to display the contents of the entire data logger memory, in which case the Read Remote Data Logger command can be used.



WARNING If data are stored in the data logger from multiple sources, using the Read Remote Data Logger or `rdlfind` command will *not* display the contents of the data logger memory as separate records.

How to Use

To use the Read Remote Data Logger command, type AT\$BT followed by the address of the remote modem, and then press Enter.

The local modem will display the contents of the remote modem's data logger memory.

Special Considerations

When using the Read Remote Data Logger command, take note of the following:

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of the `AcRspTmOut` configuration parameter. If an

acknowledgment is not received, "Response Not Received" will be displayed.

- The contents of the remote modem's data logger memory are transmitted at the bit rate set by the TxRate configuration parameter of the remote modem.
- While the contents of the remote modem's data logger memory are being transmitted, communications with or between other remote modems is not possible.
- The capacity of the remote modem's battery pack must be sufficient to transmit the contents of the remote modem's data logger memory. Refer to "Modem Battery Pack Capacity Calculations" on page 3-3 for information on how to calculate the required battery pack capacity.



NOTE The remote modem can also be recovered and the contents of its data logger memory downloaded over its serial interface by using the Output Local Data Logger command (ATBT). Refer to "Output Local Data Logger ATBT" on page 6-63 for instructions.

Output Data Logger Block

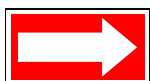
AT\$BBn,m

Syntax

AT\$BBn,m [Enter]

Definition

The Output Data Logger Block command causes the remote modem at address n to output the contents of block m of its data logger memory over the acoustic link. The range of block numbers is from 0 to 199, and each block contains a maximum of 4 kbytes of data.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.

Use of the rdlfind command instead of the Output Data Logger Block command is recommended unless it is desired to display the contents of the entire block, in which case the Output Data Logger Block command can be used.



WARNING If data are stored in the data logger from multiple sources, using the Read Data Logger Block or rdlfind command will not display the contents of the data logger memory as separate records.

How to Use

To use the Output Data Logger Block command, type AT\$BB followed by the address of the remote modem, the comma character ",", and the selected block number of the remote modem's data logger memory, and then press Enter.

The remote modem will output the contents of the selected data logger block over the acoustic link.

Special Considerations

When using the Output Data Logger Block command, take note of the following:

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If an acknowledgment is not received, "Response Not Received" will be displayed.
- The contents of the remote modem's data logger block are transmitted at the bit rate set by the TxRate configuration parameter of the remote modem.
- While the contents of the remote modem's data logger block are being transmitted, communications with or between other remote modems is not possible.

Output Data Logger Sub-Block AT\$BSn,m

Syntax

AT\$BSn,m [Enter]

Definition

The Output Data Logger Sub-Block command causes the remote modem at address n to output the contents of its 256-byte sub-blocks beginning at sub-block m of its data logger memory over the acoustic link. The number of sub-blocks transmitted is determined by the setting of the SubBlks configuration parameter of the remote modem.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.

Use of the rdlfind command instead of the Output Data Logger Sub-Block command is recommended unless it is desired to display the entire contents of each sub-block, in which case the Output Data Logger Sub-Block command can be used.



WARNING If data are stored in the data logger from multiple sources, using the Datalogger Sub-Block or rdlfind command will not display the contents of the data logger memory as separate records.

How to Use

To use the Output Datalogger Sub-Block command, type AT\$BS followed by the address of the remote modem, the comma character ",", and the selected beginning block number of the remote modem's data logger memory, and then press Enter.

The remote modem will output the contents of the selected data logger sub-blocks over the acoustic link.

Special Considerations

When using the Output Datalogger Sub-Block command, take note of the following:

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If an acknowledgment is not received, "Response Not Received" will be displayed.
- The contents of the remote modem's data logger block are transmitted at the bit rate set by the TxRate configuration parameter of the remote modem.
- While the contents of the remote modem's data logger sub-blocks are being transmitted, communications with or between other remote modems is not possible.
- While the contents of the remote modem's data logger sub-blocks are being transmitted, any input received over the serial link will not be transmitted until after the sub-blocks are transmitted.

Clear Remote Data Logger

AT\$BCn

Syntax

AT\$BCn [Enter]

Definition

The Clear Remote Data Logger command causes the remote modem at address n to clear the contents of its data logger memory.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.

How to Use

To use the Clear Remote Data Logger command, type AT\$BC followed by the address of the remote modem, and then press Enter.

The remote modem will clear the contents of its data logger memory, and then the local modem will respond with the message "OK."

Special Considerations

When using the Clear Remote Data Logger command, take note of the following:

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If an acknowledgment is not received, "Response Not Received" will be displayed.
- The time required to clear a remote modem's data logger memory is up to 20 seconds depending on how much data are stored plus the one-way sound travel time for the acoustic command to reach the remote modem. Since sound travels at about 1500 meters/second in seawater, it will take approximately 22 seconds to clear the data logger memory of a remote modem that is 3000 meters away from the local modem.

Remote Bytes Stored

AT\$BNn

Syntax

AT\$BNn [Enter]

Definition

The Remote Bytes Stored command causes the local modem to display the number of bytes of data stored in the data logger memory of the remote modem at address n.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.

Use of the rdllist command instead of the Remote Bytes Stored command is recommended unless it is expected that 4 MB or less of data are stored, in which case the Remote Bytes Stored command can be used.



WARNING Do not use the Remote Bytes Stored command in place of the rdllist command to display the total number of bytes stored if the expected total is greater than 4 MB, otherwise the reported number will be incorrect. Always use rdllist for this purpose to be certain of a correct result.

How to Use

To use the Remote Bytes Stored command, type AT\$BN followed by the address of the remote modem, and then press Enter.

The local modem will display the number of bytes of data stored in the remote modem's data logger memory.

Special Considerations

When using the Remote Bytes Stored command, take note of the following:

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If an

acknowledgment is not received, "Response Not Received" will be displayed.

Clear Local Data Logger

ATBC

Syntax

ATBC [Enter]

Definition

The Clear Local Data Logger command causes the local modem to clear the contents of its data logger memory.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.

How to Use

To use the Clear Local Data Logger command, type ATBC, and then press Enter.

The local modem will clear the contents of its data logger memory. While clearing the memory, the message "20 Seconds to clear..." is displayed followed by "Buffer Cleared" when the memory is cleared.

Special Considerations

When using the Clear Local Data Logger command, take note of the following:

- The time required to clear the local modem's data logger memory is approximately 20 seconds.
- While the contents of the local modem's data logger memory are being cleared, the local modem will not accept any input over the serial interface or over the acoustic link.

Local Bytes Stored

ATBN

Syntax

ATBN [Enter]

Definition

The Local Bytes Stored command causes the local modem to display the number of bytes of data stored in its data logger memory.



NOTE For the local modem to execute entered commands, the modem must be in **Command mode**—with the command prompt displayed. If the modem is not in **Command mode**, refer to page 5-6 for instructions on how to place the modem into **Command mode**.

Use of the dlist command instead of the Local Bytes Stored command is recommended, as the number of records and a time stamp of the first and last record is included.

How to Use

To use the Local Bytes Stored command, type ATBN, and then press Enter.

The local modem will display the number of bytes of data stored in its data logger memory.

Output Local Data Logger

ATBT

Syntax

ATBT [Enter]

Definition

The Output Local Data Logger command causes the local modem to output the contents of its data logger memory over the serial interface.



NOTE For the local modem to execute entered commands, the modem must be in **Command mode**—with the command prompt displayed. If the modem is not in **Command mode**, refer to page 5-6 for instructions on how to place the modem into **Command mode**.

Use of the `dlfind` command instead of the Output Local Data Logger command is recommended unless it is desired to display the contents of the entire data logger memory, in which case the Output Local Data Logger command can be used.



WARNING If data are stored in the data logger from multiple sources, using the Output Local Data Logger or `dlfind` command will *not* display the contents of the data logger memory as separate records.

How to Use

To use the Output Local Data Logger command, type ATBT, and then press Enter.

The local modem will output the contents of its data logger memory over the serial interface.

Special Considerations

When using the Output Local Data Logger command, take note of the following:

- The contents of the local modem's data logger memory do not change when it is output over the serial interface.

- While the contents of the local modem's data logger memory are being output, the local modem will not accept any input over the serial interface or over the acoustic link.

Output Local Page

ATBPn

Syntax

ATBPn [Enter]

Definition

The Output Local Page command causes the local modem to output the contents of page n of its data logger memory over the serial interface. The range of page numbers is from 1 to 16, and each page contains a maximum of 384 kbytes of data.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.

Use of the dlfind command instead of the Output Local Page command is recommended unless it is desired to display the contents of the entire page, in which case the Output Local Page command can be used.



WARNING If data are stored in the data logger from multiple sources, using the Output Local Page or dlfind command will *not* display the contents of the data logger memory as separate records.

How to Use

To use the Output Local Page command, type ATBP followed by the selected data logger page number of the local modem's data logger memory, and then press Enter.

The local modem will output the contents of the selected data logger page over the serial interface.

Special Considerations

When using the Output Local Page command, take note of the following:

- The contents of the local modem's data logger page do not change when it is output over the serial interface.
- While the contents of the local modem's data logger page are being output, the local modem will not accept any input over the serial interface or over the acoustic link.

AGC Diagnostic

ATTNn

Syntax

ATTNn [Enter]

Definition

The AGC Diagnostic command enables or disables the display of the automatic gain control (AGC) output of the local modem. When enabled, the display is updated once a second. The displayed values are averages and range from 0 dB to 91 dB for the ATM-900 Series Acoustic Telemetry Modems and 0 to 77 dB for the UDB-9400 Series Acoustic Telemetry Modems. Low values indicate a strong signal is being received, and high values indicate a weak signal is being received. The displayed values are also an indication of the relative amount of background noise present when there are no modems transmitting.

The settings for n are 0 and 1 as follows:

- 0: Disable display of AGC output
- 1: Enable display of AGC output.

For ATM-900 Series Acoustic Telemetry Modems only, the following is a rough guide for interpreting the relative amount of background noise when there are *no* modems transmitting:

Greater than 70 dB:	When the modem is not in the water and is in relatively quiet in-air acoustic conditions.
60–70 dB:	Extremely quiet acoustic conditions which is ideal for long range acoustic communications.
50–60 dB:	Typical acoustic conditions where some background noise is present.
40–50 dB:	Noisy conditions. Communication is possible, but the range is reduced. When tapping or rubbing the modem transducer, the AGC should be at least this low.
Less than 40 dB:	Extremely noisy conditions where only some communication is possible. These conditions could be caused from interference or radiated electrical noise.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.

How to Use

To use the AGC Diagnostic command, type ATTN followed by the value of n as determined by the required setting, and then press Enter.

The local modem will enable or disable the display of its AGC output. If enabled, the local modem will respond with the message "AGC test ON." If disabled, the local modem will respond with the message "AGC test OFF."

Output Remote AGC

AT\$Gn

Syntax

AT\$Gn [Enter]

Definition

The Output Remote AGC command causes the remote modem at address *n* to output ten seconds of automatic gain control (AGC) history over the acoustic link in chronological order beginning ten seconds prior to receipt of the command and ending at the receipt of the command. For every sample two numbers are output, one is the highest AGC measurement during a one second interval, and the other, the lowest. Low values indicate a strong received signal, and high values, a weak received signal. The AGC ranges are 0–91 dB for the ATM-900 Series Acoustic Telemetry Modems and 0–77 dB for the UDB-9400 Series Acoustic Telemetry Modems.

For ATM-900 Series Acoustic Telemetry Modems only, the following is a rough guide for interpreting the relative amount of background noise when there are *no* modems transmitting:

Greater than 70 dB:	When the modem is not in the water and is in relatively quiet in-air acoustic conditions.
60–70 dB:	Extremely quiet acoustic conditions which is ideal for long range acoustic communications.
50–60 dB:	Typical acoustic conditions where some background noise is present.
40–50 dB:	Noisy conditions. Communication is possible, but the range is reduced. When tapping or rubbing the modem transducer, the AGC should be at least this low.
Less than 40 dB:	Extremely noisy conditions where only some communication is possible. These conditions could be caused from interference or radiated electrical noise.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.

How to Use

To use the Output Remote AGC command, type AT\$G followed by the address of the remote modem, and then press Enter.

The remote modem will output ten seconds of AGC history over the acoustic link. An example of an actual measurement is shown in Figure 6-4, where the leftmost pair of numbers are the *earliest*. The rightmost, *most recent* pair occur during receipt of the command where the AGC is lowest, indicating a relatively strong input signal.

Special Considerations

When using the Output Remote AGC command, take note of the following:

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If an acknowledgment is not received, "Response Not Received" will be displayed.

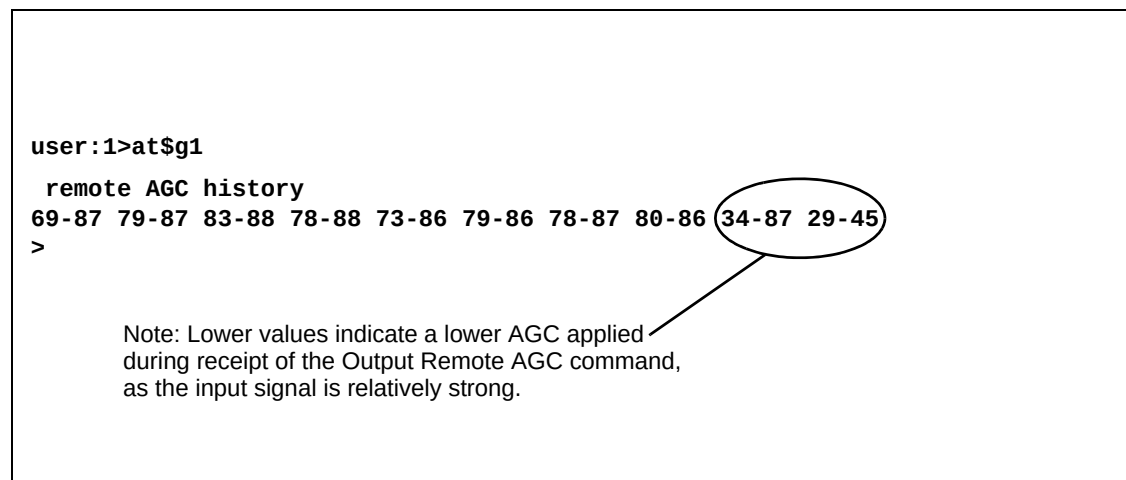


Figure 6-4 Output Remote AGC Command and Resulting Display

- The AGC history is the last 10 samples at one sample per second that occur *at and prior to* the receipt of the Output Remote AGC command.

- The last one or two AGC samples occur while receiving the Output Remote AGC command, and therefore are lower indicating a relatively strong input signal.
- The AGC history is transmitted at the bit rate set by the TxRate configuration parameter of the remote modem.
- While the AGC history is being transmitted, communications with or between other remote modems is not possible.
- While the AGC history of the remote modem is being transmitted, any input received over the serial link will not be transmitted until after the history is transmitted.

AGC Diagnostic Enable

ATT2

Syntax

ATT2 [Enter]

Definition

The AGC Diagnostic Enable command enables the display of the minimum and maximum automatic gain control (AGC) outputs of the local modem once per second. The displayed values are an indication of the relative amount of background noise present when there are no modems transmitting. Low values indicate a strong received signal, and high values, a weak received signal. The AGC ranges are 0–91 dB for the ATM-900 Series Acoustic Telemetry Modems and 0–77 dB for the UDB-9400 Series Acoustic Telemetry Modems.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.

For ATM-900 Series Acoustic Telemetry Modems only, the following is a rough guide for interpreting the relative amount of background noise when there are *no* modems transmitting:

Greater than 70 dB:	When the modem is not in the water and is in relatively quiet in-air acoustic conditions.
60–70 dB:	Extremely quiet acoustic conditions which is ideal for long range acoustic communications.
50–60 dB:	Typical acoustic conditions where some background noise is present.
40–50 dB:	Noisy conditions. Communication is possible, but the range is reduced. When tapping or rubbing the modem transducer, the AGC should be at least this low.
Less than 40 dB:	Extremely noisy conditions where only some communication is possible. These conditions could be caused from interference or radiated electrical noise.

How to Use

To use the AGC Diagnostic command, type ATT2, and then press Enter.

The local modem will output minimum and maximum AGC once per second. An example of actual measurements is shown in Figure 6-5.

```
user:1>att2
AGC Test
user:2>77-81 78-81 78-81 78-82 78-81 77-82 77-81 78-81 77-82 77-81 78-81 78-
81 77-81 78-81 78-81 78-82 77-81 77-81 77-81 78-81 78-81 78-81 78-81 77-81 78-
81 78-81 78-81 78-81 77-82 77-81 77-81 77-81 77-81 77-81 77-81 78-81 78-
81 77-81 77-81 78-81 77-81 77-82 77-81 77-81 77-81 78-81 77-81 77-81 78-81 77-
81 77-81 76-81 77-81 77-81 78-81 77-81 77-81 77-81 76-81 78-81 77-81 77-81 77-
81 77-81 77-81 77-81 78-81 78-81 77-82 77-81 77-81 77-81 77-81 77-81 77-81 77-
81 78-81 78-81 77-82 77-81 77-81 77-81 77-81 77-81 77-81 77-81 78-81 78-81 77-
81 77-81 78-81 77-81 77-82 77-81 77-81 77-81 78-81 77-81 77-81 78-81 77-81 77-
81 76-81 77-81 77-81 78-81 77-81 77-82 77-81 77-81 77-81 77-81 77-81 77-81 77-
81 78-81 78-81 77-81 77-81 78-81 77-81 77-82 77-81 77-81 77-81 78-81 77-81 77-
```

***Figure 6-5 Output AGC Diagnostic Command and Resulting Display
for an ATM-900 Series Acoustic Telemetry Modem***

AGC Diagnostic Disable

ATT1

Syntax

ATT1 [Enter]

Definition

The AGC Diagnostic Disable command disables the display of the minimum and maximum automatic gain control (AGC) outputs of the local modem.



NOTE For the local modem to execute entered commands, the modem must be in **Command mode**—with the command prompt displayed. If the modem is not in **Command mode**, refer to page 5-6 for instructions on how to place the modem into **Command mode**.

How to Use

To use the AGC Diagnostic disable command, type ATT1, and then press Enter.

The local modem will disable the display of its AGC output.

Release Status

AT\$Tn

Syntax

AT\$Tn [Enter]

Definition

The Release Status command causes a SMART Release (SR-50 or SR-100); a SMART Modem (SM-75); or an ATM-900 or UDB-9400 Series Acoustic Telemetry Modem at address n to transmit its status, the type of status information being different for each modem configuration. The status information is displayed by the local modem.

For a SMART Release, the local modem displays the following status information:

ARMED:	Displayed when no Release command has been received.
RELEASED and CONFIRMED:	Displayed when the release mechanism has been activated and the release has released from its mooring.
RELEASED and NOT CONFIRMED:	Displayed when the release mechanism has been activated but the release has not released from its mooring.
Tilt Sensor: Tilted:	Displayed when the release is tilted at a angle of greater than 25° from vertical.
Tilt Sensor: OK:	Displayed when the release is not tilted or is tilted at an angle is less than 25° from vertical.
Battery: OK:	Displayed when the battery is good and does not need to be replaced.
Battery: Reduced:	Displayed when the battery capacity is reduced. The transmit power level is capped at 7 (-03 dB).
Battery: Low:	Displayed when the battery capacity is low. The transmit power level is capped at 6 (-06 dB).

For a SMART Modem, the local modem displays the following status information:

ARMED:	Displayed when no Release command has been received and the dissolving wire module is currently not activated.
Burn Wire Activated:	Displayed when the dissolving wire module is currently activated.
Burn Wire Released, Unit Tilted:	Displayed when the SM-75 has been released.
Battery: Reduced:	Displayed when the battery is low and should be replaced.
Battery: OK:	Displayed when the battery is good and does not need to be replaced.
Battery: Reduced:	Displayed when the battery capacity is reduced. The transmit power level is capped at 7 (-03 dB).
Battery: Low:	Displayed when the battery capacity is low. Data transmissions are not allowed.

For an ATM-900 or UDB-9400 Series Acoustic Telemetry Modem, the local modem displays the following:

Standard Modem



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.

How to Use

To use the Release Status command, type AT\$T followed by the address of the release, and then press Enter.

The release will transmit its release status and the local modem will display the information described above.

Release

AT\$Rn,m

Syntax

AT\$Rn,m [Enter]

Definition

The Release command causes the SMART Release at address n with release code m to activate its release mechanism.



NOTE For the local modem to execute entered commands, the modem must be in **Command mode**—with the command prompt displayed. If the modem is not in **Command mode**, refer to page 5-6 for instructions on how to place the modem into **Command mode**.

How to Use

To use the Release Status command, type AT\$R followed by the address of the release, the comma character "," and the release code, and then press Enter.

The message "Valid release code-waiting for confirmation..." should be displayed. If the release code is incorrect, the message "Invalid release code" will be displayed, instead. If the correct release code was received, the next message displayed should be "RELEASED and CONFIRMED," which acknowledges that the release mechanism has been activated and that the release has released itself from its mooring. If, instead, the message "RELEASED and NOT CONFIRMED" is displayed, the release mechanism has been activated but the release has not released itself from its mooring.

Burn Wire Release

AT\$Nn,m

Syntax

AT\$Nn,m [Enter]

Definition

The Burn Wire Release command causes the SMART Modem at address n with release code m to activate its burn wire release.



NOTE For the local modem to execute entered commands, the modem must be in **Command mode**—with the command prompt displayed. If the modem is not in **Command mode**, refer to page 5-6 for instructions on how to place the modem into **Command mode**.

How to Use

To use the Burn Wire Release command, type AT\$N followed by the address of the release, a comma character "," and the release code, and then press Enter.

The message "Valid Release Code-Waiting for Burn..." should be displayed. If the release code is incorrect, the message "Invalid Release Code" will be displayed, instead. If the correct release code was received, the dissolving wire module will be activated, during which the SMART Modem will continue to respond to acoustic commands if they are sent. For example, sending the Release Status command (AT\$Tn) during this time should display the message "Burn Wire Activated," which acknowledges that the dissolving wire module is currently activated. Once the burn wire has fully burned, the SMART Modem will tilt which will cause it to transmit an acknowledgement. If the acknowledgement is received, the message "Burn wire RELEASED" will be displayed. Typically it takes 10 minutes for the burn wire to dissolve, but it could take up to 30 minutes. After 30 minutes, the burn wire will be shut down. If not released, the command can be resent.

Compact Modem Wakeup

ATWn,m

Syntax

ATWn,m [Enter]

Definition

The Compact Modem Wakeup command causes the local modem to transmit a wakeup signal of duration m followed immediately by the compact modem address n. A compact modem is normally in a hibernate state where everything is essentially shut down, even the receiver. However, while in this hibernate state, the modem will activate its receiver and listen for a wakeup signal from a transmitting modem for 150 ms every wakeup period. This period is the setting of the CMWakeHib configuration parameter in the Compact Modem. The transmitted wakeup signal must be equal in duration to the wakeup period of the Compact Modem to guarantee that it will be received by the modem during the 150-ms listening period, immediately after which the modem will determine if it is the one being addressed.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.

How to Use

To use the Compact Modem Wakeup command, type ATW followed by the address of the Compact Modem, the comma character ",", and the idle time, and then press Enter.

The local modem will transmit a wakeup command to the Compact Modem and set the idle time.

Special Considerations

When using the Compact Modem Wakeup command, take note of the following:

- When not specifying a value of m, or when specifying 0, the idle time is set to 3 minutes which is the built-in default value.

Transpond

ATNm

Syntax

ATNm [Enter]

Definition

The Transpond command causes the local modem to display the two-way travel time in milliseconds from the modem to a transponder of interrogation frequency m, where m is 7000 to 16000 in increments of 250 for 7000 Hz to 16,000 Hz in increments of 250 Hz. However, filtering enables the modem to detect replies only in the range 9–14 kHz. The UDB-9400 Series Acoustic Telemetry Modems use a 7–16 kHz band pass filter. This filter is also available upon request for an ATM-Series Acoustic Telemetry Modem.



NOTE For the local modem to execute entered commands, the modem must be in Command mode—with the command prompt displayed. If the modem is not in Command mode, refer to page 5-6 for instructions on how to place the modem into Command mode.



NOTE Refer to "Transponder Mode" on page 5-54 for information on acquiring and displaying the two-way sound travel time to any Teledyne Benthos manufactured acoustic transponder or release.

How to Use

To use the Transpond command, type ATN followed by the interrogation frequency of the transponder in hertz, and then press Enter.

The two-way travel time in milliseconds from the modem to the transponder is displayed.

7 Modem Configuration Parameters

This section provides descriptions of each of the available Teledyne Benthos ATM-900 and UDB-9400 Series Acoustic Telemetry Modem configuration parameters and how to set them. The configuration parameters, which are provided by the configuration system for the modem, determine how the modem operates in all of its operating modes and how some of the commands are executed. They include the serial interface baud rate, the acoustic bit rate, the modem address, the idle time, the transmit power level, the forwarding delay, and many others. The configuration parameters are the same as the S Registers used in modems prior to the ATM-900 Series, and these S Register settings can still be changed using commands in the AT command set. For a detailed description of the available AT commands and how to use them, refer to Section 6, "Modem AT Command Set."



NOTE S Registers are available for backward compatibility, as they perform many of the functions of the configuration parameters. They can be set interchangeably with the configuration parameters, and changing the setting of a configuration parameter will automatically change the setting of its equivalent S Register if there is one. The reverse is also true. However, using *only* the S Registers to control the functions of the modems limits the functions that can be performed. Therefore, setting the configuration parameters instead of setting the S Registers is highly recommended.

The configuration parameters are displayed, imported, exported, and stored using the configuration commands provided by the configuration system as described in "Configuration System" on page 5-46. The available configuration parameters are listed in Table 7-1 on page 7-2. Also listed in the table are short descriptions, the equivalent S Registers, if any, and the page references to where detailed descriptions of the configuration parameters are provided. In addition, Table 7-2 on page 7-6 lists all of the factory set configuration parameters. These parameters can be viewed but not changed at the User privilege level.

The configuration parameters are organized into 10 separate sections as described in "Configuration Parameter Sections" on page 5-47. Each section is composed of related configuration parameters. To display the sections and the configuration parameters in them, enter `cfg all`.

Table 7-1 ATM-900 and UDB-9400 Series Acoustic Telemetry Modem Configuration Parameters

Name	Description	Factory Default	S Register	Page
SERIAL				
P1Baud	Serial port 1 baud rate.	9600	S3	7-7
P1EchoChar	Serial port 1 echo enable/disable.	Dis	S3	7-8
P1FlowCtrl	Serial port 1 flow control.	0 (None)	S11	7-9
P1Protocol	Serial port 1 protocol.	0 (RS-232)	S3	7-10
P1StripB7	Serial port 1 strip bit 7.	Dis	—	7-11
P2Baud	Serial port 2 baud rate.	9600 ^a	—	7-12
P2EchoChar	Serial port 2 echo enable/disable.	Dis	—	7-14
P2FlowCtrl	Serial port 2 flow control.	0 (None)	—	7-15
P2StripB7	Serial port 2 strip bit 7.	Dis	—	7-16
SYSTEM				
SyncPPS	1 PPS clock source.	0 (Off)	—	7-17
IdleTimer	Low power idle timer.	00:03:00 ^b	S10 ^c	7-18
Verbose	Display verbosity.	1	S13	7-20
Prompt	Prompt setting.	7	—	7-22
CMWakeHib	Compact modem wakeup period.	9 (48sec)	—	7-23
CMFastWake	Fast compact modem wakeup scheme enable/disable.	Ena	—	7-24
COPROC				
CPBoard	Coprocessor board presence.	0 (Off)	S9	7-25
DATALOG				
AcData	Output or store received data.	0 (UART)	S22	7-27
AcStats	Store received data and time stamps.	0 (Off)	—	7-28
RingBuf	Data storage mode.	Dis	S37	7-29

Table 7-1 ATM-900 and UDB-9400 Series Acoustic Telemetry Modem Configuration Parameters (Continued)

Name	Description	Factory Default	S Register	Page
SubBlks	Number of sub-blocks to transmit.	1	S57	7-30
LogMode	Data storage method.	0 (FwdDelay)	—	7-31
Sentinel	Character for data partitioning.	0	—	7-32
ChrCount	Character count for data partitioning.	1024	—	7-33
LogStore	Data logger storage medium.	0 (Local)	—	7-35
MODEM				
DataRetry	Data retry enable/disable.	Dis	—	7-35
AcRspTmOut	Modem acoustic response timeout.	7.5	S7	7-36
OpMode	Modem operating mode.	1 (Online)	S15	7-38
DevEnable	Device enable performance.	0 (Auto)	S28	7-39
FwdDelay	Modem forwarding delay.	3.0	S8	7-40
LocalAddr	Local modem address.	0	S18	7-41
RemoteAddr	Online remote modem address.	0	S14	7-42
ShowBadData	Display packet errors enable/disable.	Ena	S16	7-43
StartTones	Play start tones enable/disable.	Ena	—	7-44
TxRate	Transmitting acoustic bit rate.	5 (800)	S4	7-45
TxPower	Transmit power level.	8 (Max)	S6	7-47
WakeTones	Wakeup signal enable/disable.	Ena	S17	7-49
PrintHex	Display data in hex enable/disable.	Dis	—	7-50
StrictAT	AT commands enable/disable	Dis	—	7-51
InputMode^d	Single/Dual serial port selection.	1 (Single)	—	7-52

Table 7-1 ATM-900 and UDB-9400 Series Acoustic Telemetry Modem Configuration Parameters (Continued)

Name	Description	Factory Default	S Register	Page
RELEASE				
TimedRelease	Elapsed time to release activation.	0	S50	7-53
TRANSPORT				
TPortMode	Routing of data input on serial port 1 and serial port 2.	0 (InpMode)	—	7-54
SrcP1	Transport address that will be attached to transmitted data that are input to serial port 1.	1	—	7-56
SrcP2	Transport address that will be attached to transmitted data that are input to serial port 2.	2	—	7-57
Dst1	Serial port on which data received over the acoustic link with transport address 1 will be output.	1 (P1)	—	7-58
Dst2	Serial port on which data received over the acoustic link with transport address 2 will be output.	2 (P2) ^e	—	7-59
Dst3	Reserved	—	—	7-60
Dst4	Reserved	—	—	7-61
TEST				
SimAcDly	Simulated acoustic delay.	0	—	7-62
PktEcho	Test message display enable/disable.	0	S12	7-63
PktSize	Test message size.	0 (8B)	S12	7-64
RcvAll	Receive all data enable/disable.	Dis	—	7-65
XPND				
RxFreq	Modem receive frequency.	10	S53	7-66
RxThresh	Detected signal standard deviation.	10	S21	7-67

Table 7-1 ATM-900 and UDB-9400 Series Acoustic Telemetry Modem Configuration Parameters (Continued)

Name	Description	Factory Default	S Register	Page
RxToneDur	Modem receive pulse width.	10	S32	7-68
RxLockout	Modem lockout time.	75	S55	7-69
TxToneDur	Modem transmit pulse width.	100	S32	7-70
TAT	Transponder turn-around-time.	0	S40	7-71

-
- a. Factory default setting applies to an ATM-900 Series Acoustic Telemetry Modem only. For a UDB-9400 Series Acoustic Telemetry Modem, @P2Baud=115,200.
 - b. Factory default setting applies to an ATM-900 Series Acoustic Telemetry Modem only. For a UDB-9400 Series Acoustic Telemetry Modem, @IdleTimer=0.
 - c. S Register 10 does not correspond with the full range of the IdleTimer configuration parameter.
 - d. Available only if the Dual Serial Port feature key is installed. If not installed, the configuration parameter name is not visible when listing parameters using configuration system commands such as `cfg all`.
 - e. Factory default setting applies to an ATM-900 Series Acoustic Telemetry Modem only. For a UDB-9400 Series Acoustic Telemetry Modem, @Dst2=P1.

**Table 7-2 ATM-900 and UDB-9400 Series Acoustic Telemetry Modem
Factory Default Configuration Parameters**

Name	Factory Default	S Register
SERIAL		
P1Mode	0 (Cooked)	
P2Mode	0 (Cooked)	
SYSTEM		
CarrFreq	Model specific	S24
HalfBW	1	S23
FHThresh	100	
RlsType	Model specific	S44
WakeThresh	524	
AuxImp	Dis	
AuxOut	0	
COPROC		
FdFwdTaps	20	S30
FdBckTaps	4	S31
MODEM		
RxPktType	0 (MFSK)	S5
RELEASE		
FSKRlsDur	8	S51
LstCommsCnt	0	S39
RlsCode	Unit specific	S41
TRANSPORT		
L4Enable	Ena	
TEST		
RspDelayl	Dis	
DbgLvl	0	
XPND		
AGCRef	60	S58

P1Baud

Default Setting

9600 Serial port 1 is configured for 9600 baud.

Definition

The setting of the P1Baud configuration parameter is the baud rate of serial port 1.

Available Settings

The available settings for the P1Baud configuration parameter are listed below.

1200:	1200 baud
2400:	2400 baud
4800:	4800 baud
9600:	9600 baud
19200:	19200 baud
38400:	38400 baud
57600:	57600 baud
115200:	115200 baud



WARNING Changes to the P1Baud configuration parameter take place immediately. Therefore be sure to set the baud rate of the host processor to the same baud rate, otherwise it will not be possible for the host processor to establish communications with the modem.

Special Considerations

When setting the P1Baud configuration parameter, take note of the following:

- When connecting an instrument to the modem, and with the P1Baud configuration parameter set to the default 9600 for 9600 baud, the instrument's serial port should be configured as follows:

Baud rate:	9600 baud
Parity:	none
Data bits:	8
Stop bits:	1

P1EchoChar

Default Setting

Dis Characters entered from the keyboard for serial port 1 are echoed.

Definition

The setting of the P1EchoChar configuration parameter determines whether characters entered from the keyboard for serial port 1 are echoed back to the host computer.

Available Settings

There are two available settings for the P1EchoChar configuration parameter as listed below.

Ena: Enables echoing of characters entered from the keyboard for serial port 1.

Dis: Disables echoing of characters entered from the keyboard for serial port 1.

If a PC is being used as the host processor, and it is desired to display all of the characters entered from the keyboard, select Ena.

Special Considerations

When setting the P1EchoCar configuration parameter, take note of the following:

- In Command mode using the keyboard arrow keys for command history and line editing are best viewed when @P1EchoChar=Ena.
- In Online mode having @P1EchoChar=Ena may affect the connected instrument.
- If @P1EchoChar=Dis, then use the terminal program's echo capability.
- If double characters are displayed, then either turn off the terminal program's echo or set @P1EchoChar=Dis.

P1FlowCtrl

Default Setting

0 (None) There is no handshaking for serial port 1.

Definition

The setting of the P1FlowCtrl configuration parameter determines whether hardware RTS/CTS handshaking or software XON/XOFF handshaking is used for flow control, or if no handshaking is used. The setting also determines whether the RS-232 driver for serial port 1 is turned off or left on when a modem is in the lowpower state. Turning off the driver conserves battery power.

Available Settings

There available settings for the P1FlowCtrl configuration parameter are listed below.

- 0 (None): Selects no handshaking and turns off the RS-232 driver for serial port 1 when the modem is in the lowpower state.
- 1 (SW): Selects software XON/XOFF handshaking and turns off the RS-232 driver for serial port 1 when the modem is in the lowpower state.
- 2 (HW): Selects hardware RTS/CTS handshaking and leaves the RS-232 driver for serial port 1 turned on when the modem is in the lowpower state. However, the modem draws an additional 2 mA of current which shortens the modem battery pack life.
- 3 (HW-LP): Selects hardware RTS/CTS handshaking and turns off the RS-232 driver for serial port 1 when the modem is in the lowpower state. Therefore when the modem is in the lowpower state, there is no handshaking.



WARNING A setting of @P1FlowCtrl=HW-LP will turn off the RS-232 driver whenever the modem is in the lowpower state. Therefore hardware RTS/CTS handshaking *must* be disabled at the host processor when sending the first byte of data to the modem over the serial interface. After the first byte is sent, handshaking can be turned on again or left disabled.

P1Protocol

Default Setting

0 (RS-232) Serial port 1 is configured as an RS-232 serial interface.

Definition

The setting of the P1Protocol configuration parameter determines whether serial port 1 is configured as an RS-232 or RS-422 serial interface.



NOTE A setting of 1 (RS-422) will disable serial port 2.

Available Settings

There are two available settings for the P1Protocol configuration parameter as listed below.

- 0 (RS-232): Configures serial port 1 as an RS-232 serial interface.
- 1 (RS-422): Configures serial port 1 as an RS-422 serial interface.

Special Considerations

When setting the P1Protocol configuration parameter, take note of the following:

- After changing from RS-232 to RS-422, an RS-422 connection is required to switch back to RS-232. The opposite is true after changing from RS-422 to RS-232.

P1StripB7

Default Setting

Dis Serial port 1 is configured to use all 8 bits for data and 1 stop bit.

Definition

The setting of the P1StripB7 configuration parameter determines whether serial port 1 will use 8 bits or strip the last bit and allow only 7 bits.

Available Settings

There are two available settings for the P1StripB7 configuration parameter as listed below.

Ena: Configures serial port 1 to strip and ignore the parity bit and allow 7 data bits and 1 stop bit. This allows 7,E,1 or 7,O,1 formats.

Dis: Configures serial port 1 to use all 8 bits for data and 1 stop bit.



NOTE In most cases @P1StripB7=Dis unless receiving serial data with a format of 7,E,1 or 7,O,1.

P2Baud

Default Setting

9600 Serial port 2 is configured for 9600 baud.

Definition

The setting of the P2Baud configuration parameter is the baud rate of serial port 2.

Available Settings

The available settings for the P2Baud configuration parameter are listed below.

1200:	1200 baud
2400:	2400 baud
4800:	4800 baud
9600:	9600 baud
19200:	19200 baud
38400:	38400 baud
57600:	57600 baud
115200:	115200 baud



WARNING Changes to the P2Baud configuration parameter take place immediately. Therefore be sure to set the baud rate of the host processor to the same baud rate, otherwise it will not be possible for the host processor to establish communications with the modem.

Special Considerations

When setting the P2Baud configuration parameter, take note of the following:

- When connecting an instrument to the modem, and with the P2Baud configuration parameter set to the default 9600 for 9600 baud, the instrument's serial port should be configured as follows:

Baud rate:	9600 baud
Parity:	none
Data bits:	8
Stop bits:	1

- @P2Baud=115200 is the default setting for an ATM-9400 Series Acoustic Telemetry Modem.

P2EchoChar

Default Setting

Dis Characters entered from the keyboard for serial port 2 are echoed.

Definition

The setting of the P2EchoChar configuration parameter determines whether characters entered from the keyboard for serial port 2 are echoed back to the host computer.

Available Settings

There are two available settings for the P2EchoChar configuration parameter as listed below.

Ena: Enables echoing of characters entered from the keyboard for serial port 2.

Dis: Disables echoing of characters entered from the keyboard for serial port 2.

If a PC is being used as the host processor, and it is desired to display all of the characters entered from the keyboard, select Ena.

Special Considerations

When setting the P2EchoCar configuration parameter, take note of the following:

- In Command mode using the keyboard arrow keys for command history and line editing are best viewed when @P2EchoChar=Ena.
- In Online mode having @P2EchoChar=Ena may affect the connected instrument.
- If @P2EchoChar=Dis, then use the terminal program's echo capability.
- If double characters are displayed, then either turn off the terminal program's echo or set @P2EchoChar=Dis.

P2FlowCtrl

Default Setting

0 (None) There is no handshaking for serial port 2.

Definition

The setting of the P2FlowCtrl configuration parameter determines whether XON/XOFF handshaking is used for flow control, or if no handshaking is used. The setting also determines whether the RS-232 driver for serial port 2 is turned off or left on when a modem is in the lowpower state. Turning off the driver conserves battery power.

Available Settings

There available settings for the P2FlowCtrl configuration parameter are listed below.

- 0 (None): Selects no handshaking and turns off the RS-232 driver for serial port 2 when the modem is in the lowpower state.
- 1 (SW): Selects software XON/XOFF handshaking and turns off the RS-232 driver for serial port 2 when the modem is in the lowpower state.

P2StripB7

Default Setting

Dis Serial port 2 is configured to use all 8 bits for data and 1 stop bit.

Definition

The setting of the P2StripB7 configuration parameter determines whether serial port 2 will use 8 bits or strip the last bit and allow only 7 bits.

Available Settings

There are two available settings for the P2StripB7 configuration parameter as listed below.

Ena: Configures serial port 2 to strip and ignore the parity bit and allow 7 data bits and 1 stop bit. This allows 7,E,1 or 7,O,1 formats.

Dis: Configures serial port 2 to use all 8 bits for data and 1 stop bit.



NOTE In most cases @P2StripB7=Dis unless receiving serial data with a format of 7,E,1 or 7,O,1.

SyncPPS

Default Setting

0 (Off) The date and time are driven from the internal real-time clock.

Definition

The setting of the SyncPPS configuration parameter determines whether the internal real-time clock provides the one pulse per second (1PPS) signal to keep time or an external 1PPS, such as a GPS, is used.

Available Settings

The available settings for the SyncPPS configuration parameter are listed below.

- 0 (Off): The date and time are driven from the internal real-time clock, and the RX and TX time stamps, which are shown at verbose level 3, will be at a 1.56 ms time accuracy.
- 1 (Ext0): The real-time clock is externally driven. Contact Teledyne Benthos for further information.
- 2 (RTC): The date and time are driven from the internal real-time clock, and the RX and TX time stamps, which are shown at verbose level 3, will be at a 0.1 ms time accuracy. With this setting the modem is prevented from entering the Lowpower state, which allows the modem to maintain a high accuracy on the time stamps.
- 3 (Ext1): The real-time clock is externally driven. Contact Teledyne Benthos for further information.

IdleTimer

Default Setting

00:03:00

If the local modem does not receive input from its host processor over the serial interface or from a remote modem over the acoustic link in 3 minutes, it will go into the lowpower state.

Definition

The setting of the IdleTimer configuration parameter determines the time after which a modem will go into the lowpower state if there is no input either from the serial interface or from a remote modem over the acoustic link. For a Compact Modem the modem goes into its hibernate state.

Available Settings

The range of settings for the IdleTimer configuration parameter is from 1 second to 23 hours, 59 minutes and 59 seconds in the following format:

hh:mm:ss

where "hh" is hours, "mm" is minutes and "ss" is seconds. A setting of 0 disables the IdleTimer.

Special Considerations

When setting the IdleTimer configuration parameter, take note of the following:

- The default IdleTimer configuration parameter setting for a UDB-9400 Series Acoustic Telemetry Modem is 0.
- If a remote modem will be accessed periodically to retrieve a small amount of data, the idle time should be set relatively short. If there will be more frequent and more interactive sessions, the idle time should be set relatively long to avoid the need to frequently reawaken the modem from its lowpower state.
- Setting the IdleTimer configuration parameter will automatically set S Register 10 to the setting that corresponds to the same time or the time that is within the 5-second increment allowed by S Register 10 up to a maximum of 1270 seconds (21 minutes and 10 seconds).

- Setting S Register 10 will automatically set the IdleTimer configuration parameter to the same time.

When a modem is not being powered by batteries, the idle time should be disabled to prevent the modem from ever going into the lowpower state. This improves operating efficiency as the modem never has to be reawakened from the lowpower state.

Verbose

Default Setting

- 1 Data and some diagnostic messages are displayed when received by the local modem.

Definition

The setting of the Verbose configuration parameter determines whether only data, or data and other information, when received by the local modem, are displayed.



NOTE Should a fatal error occur, it is displayed regardless of the setting of the Verbose configuration parameter.

Available Settings

The range of settings for the Verbose configuration parameter is from 0 to 4 as listed below.

- 0: Only data are displayed.
- 1: Data and some diagnostic messages are displayed.
- 2: Data, most diagnostic messages, and received data statistics are displayed.
- 3: Data, additional diagnostic messages, and received data statistics are displayed.
- 4: For factory use only.

With a setting of 2 or higher, data, along with received data statistics, are displayed in the following general format:

DATA(# of bytes of data): the actual data

Source:xx Destination:xx

CRC:Pass/Fail MPD:x.x SNR:xx.x SPD:+/-xx.x AGC:x.x CCERR:xx

The received data statistics shown above are composed of the following:

Source:	The address of the modem that transmitted the data.
Destination:	The address of the modem that received the data.
CRC:	Checksum—pass or fail, where a pass condition signifies no errors were detected, and a fail condition signifies one or more bit errors were detected.
MPD:	Multipath Delay—in milliseconds, where the higher the number the greater the multipath. The range is from 0 to 50.
SNR:	Signal to Noise Ratio—A metric that provides information on the quality of the processed signal. The value is not related to the input SNR, but instead takes into account all the processing and the effects of multipath.
SPD:	Speed—the relative speed in knots between the local and remote modems, where a negative number indicates the modems are moving farther apart and a positive number indicates the modems are moving closer together.
AGC:	Automatic Gain Control—a decimal number where the lower the number the less gain, which means a strong input signal was received. Similarly, the higher the number the more gain, which means a weak input signal was received. The lowest gain indication is 00, and the highest is 95.
CCERR:	Corrected Channel Error—Metric 0–14.

Special Considerations

When setting the Verbose configuration parameter, take note of the following:

- When a PC is used as the host processor, the Verbose configuration parameter should be set to 1 or higher.
- When an instrument is used as the host processor, the Verbose configuration parameter should be set to 0. This setting will avoid errors that might occur should the instrument be unable to recognize the diagnostic messages or received data statistics.

Prompt

Default Setting

- 7 The command prompt combines the ">" character with the privilege level and the command history number.

Definition

The Prompt configuration parameter determines the characters displayed for the command prompt which can include any combination of the ">" character, the privilege level and the history number as in the following example:

user:5>

Available Settings

The available settings for the Prompt configuration parameter are listed below.

- 0: No command prompt is selected.
- 1: The ">" character is displayed.
Example: user
- 3: Combines the ">" character with the privilege level.
Example: user>
- 4: The command history number is displayed.
Example: :5
- 5: Combines the ">" character with the command history number.
Example: :5>
- 6: Combines the privilege level with the command history level.
Example: user:5
- 7: Combines the ">" character with the privilege level and the command history number.
Example: user:6>

CMWakeHib

Default Setting

9 (48sec)	The wakeup period of the compact modem is 48 seconds.
-----------	---

Definition

The setting of the CMWakeHib configuration parameter, which applies only to compact modems, determines the wakeup period of the modem. A compact modem is normally in a hibernate state where everything is essentially shut down, even the receiver. However, while in this hibernate state, the modem will activate its receiver and listen for a wakeup signal from a transmitting modem for 150 ms every wakeup period. The length of the wakeup period determines how often the Compact Modem will listen for a wakeup signal. A shorter wakeup period means that the modem will listen more frequently and therefore can be awakened quicker. A longer wakeup period means that the modem will listen less frequently and therefore will be awakened slower. A shorter wakeup period uses more power than a longer wakeup period.

Available Settings

The available settings for the CMWakeHib configuration parameter, are listed below.

-1 (Off):	The compact modem wakeup is off.
0 (2sec):	2 seconds (compact modem firmware versions prior to 1.2.7)
1 (3sec):	3 seconds
2 (4sec):	4 seconds
3 (6sec):	6 seconds
4 (8sec):	8 seconds
5 (12sec):	12 seconds
6 (16sec):	16 seconds
7 (24sec):	24 seconds
8 (32sec):	32 seconds
9 (48sec):	48 seconds
11 (96sec):	96 seconds (compact modem firmware versions 1.2.7 and higher)

CMFastWake

Default Setting

Ena The fast wakeup scheme for waking up a compact modem is enabled.

Definition

The setting of the CMCastWake configuration parameter determines whether the slow wakeup scheme is used to wake up a compact modem or the fast wakeup scheme. The slow wakeup scheme is implemented in all UDB-9400 Universal Deck Boxes, in standard modems of all firmware versions, and in Compact Modems with firmware versions prior to 1.2.7 only. The fast wakeup scheme is implemented in UDB-9400 Universal Deck Boxes with firmware versions 1.9.9 and higher, in standard modems with firmware versions 6.9.4 and higher, and in Compact Modems with firmware versions 1.2.7 and higher. This provides backwards compatibility with those compact modems that use the slow wakeup scheme. Table 7-3 summarizes which firmware versions provide which wakeup scheme for the deck box and modems.

Table 7-3 UDB-9400 Deck Box, Standard Modem and Compact Modem Firmware Versions Versus Slow and Fast Wakeup Schemes

PRODUCT AND FIRMWARE VERSION	SLOW	FAST
UDB-9400 Universal Deck Box (prior to 1.9.9)	•	
UDB-9400 Universal Deck Box (1.9.9 and higher)	•	•
Standard modem (prior to 6.9.4)	•	
Standard modem (6.9.4 and higher)	•	•
Compact Modem (prior to 1.2.7)	•	
Compact Modem (1.2.7 and higher)		•

Available Settings

The available settings for CMCastWake configuration parameter are listed below.

Ena: Enables the fast wakeup scheme for waking up a compact modem.

Dis: Disables the fast wakeup scheme for waking up a compact modem and instead uses the slow wakeup scheme.

CPBoard

Default Setting

0 (Off) The Coprocessor board is disabled.

Definition

The setting of the CPBoard configuration parameter determines whether the Coprocessor board is enabled, and if enabled, whether it is enabled only when receiving data or at all times, or if it is enabled for firmware updating only.

Available Settings

The available settings for the CPBoard configuration parameter are listed below.

- | | |
|---------------|--|
| 0 (Off): | Disables the Coprocessor board. |
| 1 (Pwrsave): | Enables the Coprocessor board, but places it in a low power state in between receiving data packets. The board will be powered up in full when a new data packet is received and put back into its low power state after receiving the packet. |
| 2 (AlwaysOn): | Enables the Coprocessor board, keeping it fully powered at all times. |
| 3 (Program): | Enables the Coprocessor board but does not establish communications with it. This setting is used only for updating the firmware on the board. |

Special Considerations

When setting the CPBoard configuration parameter, take note of the following:

- Only UDB-9400 Series Acoustic Telemetry Modems have a Coprocessor board installed.
- The Coprocessor board must be enabled for the modem to receive at the high bit rates of 2560–15,360 bits/sec.
- Enabling the Coprocessor board when the board is not present forces the CPBoard configuration parameter setting to 0.

- When setting the CPBoard configuration parameter to 1 or 2, the modem will respond with the message "coprocessor ver x.x" if the Coprocessor board is installed and fully operational.
- When setting the CPBoard configuration parameter to 1 or 2, the modem will respond with the message "coprocessor not responding" if the Coprocessor board is not installed or is installed and not fully operational.

AcData

Default Setting

0 (UART)

Data received over the acoustic link are output over the serial interface.

Definition

The setting of the AcData configuration parameter determines whether data received over the acoustic link are output over the serial interface, stored in the data logger or both.

Available Settings

The available settings for the AcData configuration parameter are listed below.

0 (UART):

Data received over the acoustic link are output over the serial interface.

1 (Datalog):

Data received over the acoustic link are stored in the data logger.

2 (UART+ Datalog):

Data received over the acoustic link are both output over the serial interface and stored in the data logger.

AcStats

Default Setting

0 (Off) Statistics and time stamps for data received over the acoustic link are not stored in the data logger memory.

Definition

The setting of the AcStats configuration parameter determines whether statistics and time stamps for data received over the acoustic link are stored in the data logger memory.

Available Settings

The available settings for the AcStats configuration parameter are listed below.

0 (Off):	Statistics and time stamps for data received over the acoustic link are not stored in the data logger memory.
1 (Stats):	Statistics for data received over the acoustic link are stored in the data logger memory.
4 (TimeStamp):	Time stamps for data received over the acoustic link are stored in the data logger memory.
5 (Stats+Time):	Statistics and time stamps for data received over the acoustic link are stored in the data logger memory.

RingBuf

Default Setting

Dis	The data logger will record up to 6 MB of data and then stop recording.
-----	---

Definition

The setting of the RingBuf configuration parameter determines whether the data logger will record data in flat mode where up to 6 MB of data are recorded and then recording stops, or in ring buffer mode where data are recorded in a 6-MB "ring" buffer. When recording data in the ring buffer and the buffer fills, the oldest 384 kbytes of data are erased making room for new data which can continue to be recorded until the 6-MB ring buffer is again filled. This cycle repeats continuously as long as new data are received, ensuring that the latest 6 MB of data are always available. The data can be received acoustic data if the AcData configuration parameter is set to 1 or 2, or the data can be data received on the serial interface if the OpMode configuration parameter is set to 2.

Available Settings

There are two available settings for the Ringbuf configuration parameter as listed below.

- Ena: The data logger will continuously record data in the 6-MB ring buffer.
- Dis: The data logger will record up to 6 MB of data and then recording will stop.

Special Considerations

When setting the Ringbuf configuration parameter, take note of the following:

- To store data received over the acoustic link in the data logger memory, the AcData configuration parameter must be set to 1 or 2.
- To store data received over the serial interface in the data logger memory, the OpMode configuration parameter must be set to 2.

SubBlks

Default Setting

1 The number of sub-blocks transmitted is 1.

Definition

The setting of the SubBlks configuration parameter determines the number of sub-blocks transmitted when using the Output Datalogger Sub-Block command (AT\$BSn,m).

Available Settings

The range of settings for the SubBlks configuration parameter is from 1 to 15.

LogMode

Default Setting

0 (FwdDelay) Once characters are received on the serial interface, if no more characters are received for the amount of time configured by the FwdDelay configuration parameter, a discrete record is created and the characters are stored in the data logger memory.

Definition

The setting of the LogMode configuration parameter determines how records are indexed in the data logger memory. The setting applies to both serial port 1 and serial port 2 when @InputMode=Dual.

Available Settings

The available settings for the LogMode configuration parameter are listed below.

0 (FwdDelay):	Once characters are received on the serial interface, if no more characters are received for the amount of time configured by the FwdDelay configuration parameter, a discrete record is created and the characters are stored in the data logger memory.
1 (Sentinel):	When the ASCII code of a character received on the serial interface matches the setting of the Sentinel configuration parameter, a discrete record is created and subsequently received characters are stored in the data logger memory.
2 (ChrCount):	When the number of characters received on the serial interface matches the number configured by the setting of the ChrCount configuration parameter, a discrete record is created and the characters are stored in the data logger memory.

Sentinel

Default Setting

0 The ASCII code for the character 0 will be used as a sentinel.

Definition

The setting of the Sentinel configuration parameter, which applies only when the @LogMode=Sentinel, is the character for the ASCII code that is to be used as a sentinel for partitioning data received on a the serial interface into discrete records. Monitoring for the ASCII code is performed separately for serial port 1 and serial port 2 when @InputMode=Dual.

Available Settings

The range of available settings for the Sentinel configuration parameter is 0 to 255.

Special Considerations

When setting the Sentinel configuration parameter, take note of the following:

- The sentinel character should be the last character in a data string and therefore is typically 13 for a carriage return or 10 for a line feed.
- The sentinel character is included in the record and is the last character in the record.



WARNING If data are input without the sentinel character, the modem will not go into the lowpower state until the sentinel character is received.

ChrCount

Default Setting

1024

The ASCII code for the character 0 will be used as a sentinel.

Definition

The setting of the ChrCount configuration parameter, which applies only when the LogMode configuration parameter is set to ChrCount, is the number of characters to receive on the serial interface before a discrete record is stored in the data logger memory. Monitoring for the character count is performed separately for serial port 1 and serial port 2 when @InputMode=Dual.

Available Settings

The range of available settings for the Sentinel configuration parameter is 0 to 4096.



WARNING The modem will not go into the lowpower state until the full character count is received.

LogStore

Default Setting

0 (Local) Data are stored in the data logger memory of the local modem.

Definition

The setting of the LogStore configuration parameter determines which storage medium on the local modem the data logger information will be stored.

Available Settings

There are two available settings for the LogStore configuration parameter as listed below.

- 0 (Local): Data are stored in the data logger memory of the modem.
- 1 (SDHC): Data are stored in a secure digital high capacity (SDHC) card. Currently not supported.

DataRetry

Default Setting

Dis Data retry is disabled.

Definition

The setting of the DataRetry configuration parameter determines whether an acoustic data packet that is received with errors is retransmitted. When enabled, an acknowledgement is required after transmitting each data packet, and the data are retransmitted up to two times if errors are detected or if no acknowledgement is received. When disabled, data are transmitted only once.



NOTE As each packet of data contains sixteen 256-byte cells for a total of 4 kbytes, when data retry is enabled, only the 256-byte cells containing errors are retransmitted.

Available Settings

There are two available settings for the DataRetry configuration parameter as listed below.

Ena: Enables data retry.

Dis: Disables data retry.

Special Considerations

When setting the DataRetry configuration parameter, take note of the following,

- If the DataRetry configuration parameter is enabled, and if more than 28 kbytes of data are to be transmitted, then hardware RTS/CTS handshaking should be used.
- If the DataRetry configuration parameter is disabled, and if more than 32 kbytes of data are to be transmitted, then hardware RTS/CTS handshaking should be used.

AcRspTmOut

Default Setting

7.5 The local modem will wait 7.5 seconds after sending an acoustic command to a remote modem for the remote modem to acknowledge receipt of the command.

Definition

The setting of the AcRspTmOut configuration parameter determines the acoustic response timeout, which is the time during which a local modem will wait for an acknowledgment to an acoustic command sent to a remote modem. If no acknowledgment is received, the local modem will output the results message "Response Not Received." When setting the AcRspTmOut configuration parameter, the total two-way sound travel time to the remote modem must be taken into account, along with approximately 3.5 seconds for the remote modem to transmit an acknowledgement to the command.

Available Settings

The range of settings for the AcRspTmOut configuration parameter is from 2.0 to 99.5 seconds in 0.5-second increments.

Special Considerations

When setting the AcRspTmOut configuration parameter, take note of the following.

- The acoustic response timeout should be increased as the range between a local and remote modem increases. As sound travels at about 1500 meters/sec in seawater, the total time for the sound to travel a distance of 6000 meters, for example, is about 4 seconds. Considering also the 3.5 seconds it takes for the remote modem to transmit an acknowledgement, the AcRspTmOut configuration parameter setting of 7.5 seconds is sufficient for modem ranges equal to or less than 3000 meters, which is equivalent to a two-way distance of 6000 meters.

- As another example, for an AcRspTmOut configuration parameter setting of 17.5 seconds, subtracting 3.5 seconds for the time it takes for the remote modem to transmit an acknowledgement leaves 14 seconds for the two-way travel time, which is equivalent to 7 seconds of one-way travel time. With sound traveling at 1500 meters/sec in seawater, the range to the modem can be as long as 10,500 meters.
- If the range to the modem exceeds that accounted for by the setting of the AcRspTmOut configuration parameter, the local modem will output the results message "Response Not Received." This message may also be followed by the message "ACK" *if @Verbose=2 and* the acknowledgement is received after the acoustic response timeout.
- For a UDB-9400 Universal Deck box, changing the Timeout setting in the Transpond Parameters pop-up will change the setting of the AcRspTmOut configuration parameter. As this setting could be as low as 2 seconds, it may have to be changed for an acknowledgement to be received.

OpMode

Default Setting

- | | |
|------------|---|
| 1 (Online) | When the modem is powered up or awakened from the lowpower state, the modem will go into Online mode. |
|------------|---|

Definition

The setting of the OpMode configuration parameter determines the operating mode that a modem will go into when it is powered up or when the modem is awakened from the lowpower state.

Available Settings

The available settings for the OpMode configuration parameter are listed below.

- | | |
|--------------|---|
| 0 (Command): | Command mode

(Refer to "Command Mode" on page 5-5 for information on Command mode.) |
| 1 (Online): | Online mode

(Refer to "Online Mode" on page 5-2 for information on Online mode.) |
| 2 (Datalog): | Datalog mode

(Refer to "Datalogger Mode" on page 5-15 for information on Datalogger mode.) |

DevEnable

Default Setting

0 (Auto)	The Device Enable output is set automatically for character output and can also be set with the Local Device Enable (ATTDm) and Remote Device Enable (AT\$Xn,m) commands.
----------	---

Definition

The setting of the DevEnable configuration parameter determines whether the Device Enable output is set automatically or with a command, or set only with a command.

Available Settings

The available settings for the DevEnable configuration parameter are listed below.

0 (Auto):	The Device Enable output is set automatically for character output and can also be set with the Local Device Enable (ATTDm) and Remote Device Enable (AT\$Xn,m) commands. The Device Enable output will also operate as described in "Device Enable" on page 5-65.
1 (MBARI):	Reserved and should not be used.
2 (Manual):	The Device Enable output is set only with the Local Device Enable (ATTDm) and Remote Device Enable (AT\$Xn,m) commands. It will not be set automatically.

FwdDelay

Default Setting

3.0 The modem will transmit any buffered data if it is in Online mode or store the data in the data logger memory if it is in Datalogger mode when the corresponding buffer is full or 3.0 seconds after the last data are input, whichever occurs first.

Definition

The setting of the FwdDelay configuration parameter determines the forwarding delay of a modem. When a local modem is online with a remote modem, the local modem accumulates data in its 4-kbyte transmit data buffers. These data are input from its host processor over the serial interface. Immediately after the first transmit data buffer has filled, the 4-kbyte data packet is transmitted. However, if the transmit data buffer does not fill, the data are transmitted anyway a preset time after the last data are input. This time is the forwarding delay. Similarly, when a modem is in Datalogger mode, the data in the transmit data buffer are transferred to the data logger memory immediately after the buffer has filled, or after the forwarding delay.



NOTE While data are being transmitted from a 4-kbyte transmit data buffer, data can continue to be input to the modem over the serial interface, filling the additional 4-kbyte transmit data buffers.

Available Settings

The range of settings for the FwdDelay configuration parameter is from 0.05 to 5 seconds in 50-millisecond increments.

Special Considerations

When setting FwdDelay configuration parameter, take note of the following:

- The transmission efficiency is improved if the 4-kbyte transmit data buffer is allowed to fill before transmitting the data.

LocalAddr

Default Setting

0 The address of the modem is 0.

Definition

The setting of the LocalAddr configuration parameter determines the address of the modem.

Available Settings

The range of settings for the LocalAddr configuration parameter is from 0 to 249. This provides a total of 250 unique addresses.

Special Considerations

When setting the LocalAddr configuration parameter, take note of the following:

- The LocalAddr configuration parameter cannot be changed remotely over the acoustic link, therefore it is important that the correct address be set prior to deploying the modem.
- The same address can be used for more than one modem; however, this may not be desirable in some situations.

RemoteAddr

Default Setting

0 The address of the remote modem that the local modem is online with is 0.

Definition

The setting of the RemoteAddr configuration parameter is the address of the remote modem that the local modem is online with when the local modem is powered up or awakened from the lowpower state. This occurs only if @OpMode=1.

Available Settings

The range of settings for the RemoteAddr configuration parameter is from 0 to 249 and 255. This provides a total of 250 addresses plus the global address 255.

Special Considerations

When setting the RemoteAddr configuration parameter, take note of the following:

- The Dial command (ATDn) sets the RemoteAddr configuration parameter of the remote modem to the address of the local modem.
- The Dial command (ATDn) sets the RemoteAddr configuration parameter of the local modem to the address of the remote modem.
- If @RemoteAddr=255, data sent from the address will be received by all modems.

ShowBadData

Default Setting

Ena Data packets containing errors are displayed.

Definition

The setting of the ShowBadData configuration parameter determines whether data packets that contain errors are displayed.

Available Settings

There are two available settings for the ShowBadData configuration parameter as listed below.

Ena: Data packets containing errors are displayed.

Dis: Data packets containing errors are not displayed.

StartTones

Default Setting

Ena On power up or when rebooted, the modem transducer will beep four times in rapid secession.

Definition

The setting of the StartTones configuration parameter determines whether the modem transducer will beep when the modem is powered up or rebooted.

Available Settings

There are two available settings for the StartTones configuration parameter as listed below.

Ena: On power up or when rebooted, the modem transducer will beep four times in rapid secession.

Dis: The modem transducer will not beep when the modem is powered up or rebooted.

TxRate

Default Setting

5 (800) The transmitting acoustic bit rate of the modem is 800 bits/second, with rate 1/2 convolutional coding and 12.5-ms multipath guard period.

Definition

The setting of the TxRate configuration parameter determines the transmitting acoustic bit rate, the modulation technique—MFSK or PSK—and whether any one or more of the three methods for increased reliability are used, which are data redundancy, convolutional coding and multipath guard period.



NOTE The setting of the TxRate configuration parameter determines the transmitting acoustic bit rate only. The receiving modem will receive data and commands from the transmitting modem regardless of the bit rate of the transmitting modem. Therefore the bit rates can be different in each direction for an asymmetrical acoustic link. Only a UDB-9400 Series Acoustic Telemetry Modem, however, can receive the bit rates of settings 9–13 below.

Available Settings

The range of settings for the TxRate configuration parameter is from 2 to 13 as follows:

- | | |
|-----------|---|
| 2 (140): | 140 bits/sec MFSK repeated four times with rate 1/2 convolutional coding and 25-ms multipath guard period |
| 3 (300): | 300 bits/sec MFSK repeated twice with rate 1/2 convolutional coding and 25-ms multipath guard period |
| 4 (600): | 600 bits/sec MFSK with rate 1/2 convolutional coding and 25-ms multipath guard period |
| 5 (800): | 800 bits/sec MFSK with rate 1/2 convolutional coding and 12.5-ms multipath guard period |
| 6 (1066): | 1066 bits/sec MFSK with rate 1/2 convolutional coding and 3.125-ms multipath guard period |

- 7 (1200): 1200 bits/sec MFSK with rate 1/2 convolutional coding
- 8 (2400): 2400 bits/sec MFSK
- 9 (2560): 2560 bits/sec PSK, with rate 1/2 convolutional coding
- 10 (5120): 5120 bits/sec PSK, with rate 1/2 convolutional coding
- 11 (7680): 7680 bits/sec PSK, with rate 1/2 convolutional coding
- 12 (10240): 10,240 bits/sec PSK
- 13 (15360): 15,360 bits/sec PSK

Special Considerations

When setting the TxRate configuration parameter, take note of the following:

- To maximize the modem battery pack life for the amount of data transmitted, use the highest acoustic bit rate that yields good results.
- When selecting a bit rate that includes a multipath guard period, the selection should include the multipath guard period that is longer than the multipath delay. The multipath delay is measured and displayed as a part of the received data statistics when using the Acoustic Link Test command (ATXn).
- The transmitting acoustic bit rates of settings 9–13 can be received by an UDB-9400 Series Acoustic Telemetry Modem only.

TxPower

Default Setting

8 (Max) The transmit power level of the modem is set to 0 dB, which is the highest power level.

Definition

The setting of the TxPower configuration parameter determines the transmit power level of a modem.

Available Settings

The range of settings for the TxPower configuration parameter is from 1 to 8 for a range of 0 dB to -21 dB of attenuation in -3 dB steps, where 0 dB is the maximum transmit power level and -21 dB is the minimum transmit power level as follows:

- | | |
|-------------|---------------------------------|
| 1 (-21 dB): | -21 dB (minimum transmit power) |
| 2 (-18 dB): | -18 dB |
| 3 (-15 dB): | -15 dB |
| 4 (-12 dB): | -12 dB |
| 5 (-09 dB): | -09 dB |
| 6 (-06 dB): | -06 dB |
| 7 (-03 dB): | -03 dB |
| 8 (Max): | 00 dB (maximum transmit power) |

Special Considerations

When setting the TxPower configuration parameter, take note of the following:

- The transmit power of the modem can be changed remotely with the Remote Power command (AT\$Pn,m).
- To maximize the modem battery pack life, use the lowest power setting that yields good communications.
- The minimum power may be less than -21 dB, depending on the input voltage and the transducer.

- When transmitting at power level 7 for an ATM-914, ATM-915 or ATM-916 Acoustic Telemetry Modem in a 23°C environment at 21 VDC, limit continuous transmissions to 45 minutes, and then allow the modem to cool for 10 minutes before retransmitting. When using power level 8, limit any continuous transmissions to 15 minutes, and then allow the modem to cool for 10 minutes before retransmitting.



WARNING Exceeding the recommended power level and continuous transmission time limits for an ATM-914, ATM-915 or ATM-916 Acoustic Telemetry Modems may cause the transmitter to overheat and to automatically shut down. Should this condition occur, a message will be output on the serial interface indicating such. Once the modem cools down it will be able to transmit again. To display the internal temperature of the local modem, use the ATV command.

WakeTones

Default Setting

Ena The lowpower wakeup signal is transmitted at the beginning of every data packet.

Definition

The setting of the WakeTones configuration parameter enables or disables transmission of the lowpower wakeup signal at the beginning of every data packet. The lowpower wakeup signal is a 375-ms long signal that wakes up all the remote modems that are in the lowpower state.

Available Settings

There are two available settings for the WakeTones configuration parameter as listed below.

Ena: Enables the lowpower wakeup signal.

Dis: Disables the lowpower wakeup signal.

Special Considerations

When setting the WakeTones configuration parameter, take note of the following:

- The lowpower wakeup signal should be disabled only for the transmitting modem, and only if it is known that the receiving modem will never go into the lowpower state. To prevent the receiving modem from going into the lowpower state, set its IdleTimer configuration parameter to 0.
- Disabling the lowpower wakeup signal lengthens the modem battery pack life for the transmitting modem.

PrintHex

Default Setting

Dis When displaying data bytes received acoustically from a remote modem, the data are displayed in ASCII format.

Definition

The setting of the PrintHex configuration parameter determines whether data bytes received from a remote modem are displayed in ASCII or hexadecimal format.

Available Settings

There are two available settings for the PrintHex configuration parameter as listed below.

- Ena: Displays hexadecimal values of the data bytes received acoustically from a remote modem.
- Dis: Displays the ASCII values of the data bytes received acoustically from a remote modem.

Special Considerations

When setting the PrintHex configuration parameter, take note of the following:

- The PrintHex configuration parameter, when enabled, allows comparison of a binary file sent from a remote modem to the output of the local modem.

StrictAT

Default Setting

Dis	The modem will process both CLAM shell and AT commands.
-----	---

Definition

The setting of the StrictAT configuration parameter determines whether the modem will process both CLAM shell and AT commands or just AT commands.

Available Settings

There are two available settings for the StrictAT configuration parameter as listed below.

Ena: The modem will process only AT commands.

Dis: The modem will process both CLAM shell and AT commands.

InputMode

Default Setting

1 (Single) The modem will allow only one instrument to be connected to the modem for the input of data.

Definition

The setting of the InputMode configuration parameter determines whether one or two instruments can be connected to the modem for the input of data and whether transport information will be sent with the data.



NOTE For the InputMode configuration parameter to be available, a Dual Serial Port feature key must be purchased and installed in the modem.

Available Settings

There are two available settings for the InputMode configuration parameter as listed below.

- 1 (Single): The modem will allow only one instrument to be connected to the modem for the input of data when the modem is in Online or Datalogger mode. The instrument must be connected to serial port 1. Transport information will be transmitted with the data packets only if @TPortMode=Always.
- 2 (Dual): Two instruments can be connected to the modem, one to serial port 1 and the other to serial port 2. Both serial ports will input data when the modem is in Online or Datalogger mode. Transport information will be transmitted with the data packets.

Special Considerations

When setting the InputMode configuration parameter, take note of the following:

- Serial port 1 should always be used when in Command mode.
- Although serial port 2 can be used for some CLAM shell commands, it will not accept any AT commands.
- Command mode is not affected by the setting of the InputMode configuration parameter.

TimedRelease

Default Setting

0 The timed release is disabled.

Definition

The setting of the TimedRelease configuration parameter is the elapsed time in hours after power up before activation of the release of a SMART Release or SMART Modem.

Available Settings

The range of settings for the TimedRelease configuration parameter is from 0 to 999, where 0 disables the timed release function, and each increment represents one hour for a range of 1 to 999 hours of delay before the release is activated.

Special Considerations

When setting the TimedRelease configuration parameter, take note of the following:

- The setting of the TimedRelease configuration parameter must be saved by entering `cfg store`.
- The timer starts when the modem is powered up, when a Remote Acoustic Reset command (`AT$ESn`) is sent or with any other type of reset.

TPortMode

Default Setting

0 (InpMode) Transport addressing is in accordance with the setting of the InputMode configuration parameter.

Definition

The setting of the TPortMode configuration parameter determines whether transport addresses are attached to transmitted data packets.

Available Settings

There are two available settings for the TPortMode configuration parameter as listed below.

0 (InpMode): Transport addressing is in accordance with the setting of the InputMode configuration parameter.

When @InputMode=Single, transport addressing is disabled and data that are input to serial port 1 of the local modem and transmitted to a remote modem will include no transport address attached to the data packets. Data packets that are received over the acoustic link from a remote modem with or without a transport address attached will be routed to serial port 1.

When @InputMode=Dual, transport addressing is enabled, and data that are input to serial port 1 of the local modem and transmitted to a remote modem will include a transport address attached to the data packets in accordance with the setting of the SrcP1 configuration parameter, indicating to the remote modem which port on the local modem the data were input. The same is true for serial port 2 and the setting of the SrcP2 configuration parameter. Data packets that are received over the acoustic link from a remote modem with a transport address attached will be routed in accordance with the setting of the Dst1 and Dst2 configuration parameters to serial port 1 or to serial port 2.

- 1 (AlwaysOn): Transport addressing is always enabled regardless of the setting of the InputMode configuration parameter. Data that are input to serial port 1 of the local modem and transmitted to a remote modem will include a transport address attached to the data packets in accordance with the setting of the SrcP1 configuration parameter, indicating to the remote modem which port on the local modem the data were input. The same is true for serial port 2 and the setting of the SrcP2 configuration parameter. Data packets that are received over the acoustic link from a remote modem with a transport address attached will be routed in accordance with the setting of the Dst1 and Dst2 configuration parameters to serial port 1 or to serial port 2.

SrcP1

Default Setting

- | | |
|---|---|
| 1 | The transport address for data input on serial port 1 is 1. |
|---|---|

Definition

The setting of the SrcP1 configuration parameter is the transport address that will be attached to transmitted data packets that are generated from data that are input to serial port 1 when @TPortMode=AlwaysOn, or when @TPortMode=InpMode and @InputMode=Dual.

Available Settings

The available settings for the SrcP1 configuration parameter are listed below.

- 1: The transport address for data input on serial port 1 is 1.
- 2: The transport address for data input on serial port 1 is 2.
- 3: Reserved.
- 4: Reserved.

Special Considerations

When setting the SrcP1 configuration parameter, take note of the following:

- If @TPortMode=InpMode and @InputMode=Single, no transport addresses will be attached to transmitted data packets.

SrcP2

Default Setting

2 The transport address for data input on serial port 2 is 2.

Definition

The setting of the SrcP2 configuration parameter is the transport address that will be attached to transmitted data packets that are generated from data that are input to serial port 2 when @TPortMode=AlwaysOn, or when @TPortMode=InpMode and @InputMode=Dual.

Available Settings

The available settings for the SrcP2 configuration parameter are listed below.

- 1: The transport address for data input on serial port 2 is 1.
- 2: The transport address for data input on serial port 2 is 2.
- 3: Reserved.
- 4: Reserved.

Special Considerations

When setting the SrcP2 configuration parameter, take note of the following:

- If @TPortMode=InpMode and @InputMode=Single, no transport addresses will be attached to transmitted data packets.

Dst1

Default Setting

1 (P1) Data received over the acoustic link with transport address 1 will be output on serial port 1.

Definition

The setting of the Dst1 configuration parameter determines to which serial port, serial port 1 or serial port 2, that data packets received over the acoustic link with transport address 1 will be output when @TPortMode=AlwaysOn, or when @TPortMode=InpMode and @InputMode=Dual.

Available Settings

There are two available settings for the Dst1 configuration parameter as listed below.

- 1 (P1): Data received over the acoustic link with transport address 1 will be output on serial port 1.
- 2 (P2): Data received over the acoustic link with transport address 1 will be output on serial port 2.

Special Considerations

When setting the Dst1 configuration parameter, take note of the following:

- The Dst1 configuration parameter does not apply when @TportMode=InpMode and @InputMode=Single. In this case data packets with transport addresses attached will be output on serial port 1.

Dst2

Default Setting

2 (P2) Data received over the acoustic link with transport address 2 will be output on serial port 2.

Definition

The setting of the Dst2 configuration parameter determines to which serial port, serial port 1 or serial port 2, that data packets received over the acoustic link with transport address 2 will be output when @TPortMode=AlwaysOn, or when @TPortMode=InpMode and @InputMode=Dual.

Available Settings

There are two available settings for the Dst2 configuration parameter as listed below.

- 1 (P1): Data received over the acoustic link with transport address 2 will be output on serial port 1.
- 2 (P2): Data received over the acoustic link with transport address 2 will be output on serial port 2.

Special Considerations

When setting the Dst2 configuration parameter, take note of the following:

- The Dst2 configuration parameter does not apply when @TportMode=InpMode and @InputMode=Single. In this case data packets with transport addresses attached will be output on serial port 1.
- For a UDB-9400 Series Acoustic Telemetry Modem, @Dst2=P1 is the default setting.

Dst3
(Reserved)

Dst4
(Reserved)

SimAcDly

Default Setting

0 The simulated acoustic delay is 0 ms.

Definition

The setting of the SimAcDly configuration parameter simulates the acoustic delay that would occur when sending and receiving data or commands over the acoustic link in water. It applies only to the transmitting modem and is useful when testing the modems in air.

Available Settings

The range of settings for the SimAcDly configuration parameter is from 0 to 30000 ms in 1-ms increments.

PktEcho

Default Setting

0	When the local modem transmits the Acoustic Link Test command (ATXn) to a remote modem, the preset test message transmitted by the remote modem will not be displayed when the message is received by the local modem.
---	--

Definition

The setting of the PktEch configuration parameter determines whether the local modem will display the preset test message received from a remote modem. The remote modem will transmit the preset test message when it receives the Acoustic Link Test command (ATXn) from the local modem.

Available Settings

There are two available settings for the PktEcho configuration parameter as listed below.

- Ena: Enables the display of the preset test message when received from a remote modem.
- Dis: Disables the display of the preset test message when received from a remote modem.

PktSize

Default Setting

0 (8B) When the local modem transmits the Acoustic Link Test command (ATXn) to a remote modem, the remote modem will transmit an 8-byte preset test message.

Definition

The setting of the PktSize configuration parameter determines the test message size in bytes that a remote modem will be commanded to transmit when it receives the Acoustic Link Test command (ATXn) from the local modem.

Available Settings

The available settings for the PktSize configuration parameter are listed below.

- 0 (8B): 8-byte message
- 1 (32B): 32-byte message
- 2 (128B): 128-byte message
- 3 (256B): 256-byte message
- 4 (512B): 512-byte message
- 5 (1024B): 1024-byte message
- 6 (2048B): 2048-byte message
- 7 (4096B): 4096-byte message

RcvAll

Default Setting

Dis	The local modem will not receive data from all transmitting modems, only the data addressed to itself.
-----	--

Definition

The setting of the RcvAll configuration parameter determines whether the local modem will receive all data transmitted from other modems or only the data addressed to itself.

Available Settings

There are two available settings for the RcvAll configuration parameter as listed below.

Ena: Enables the local modem to receive data from all transmitting modems.

Dis: Disables the local modem from receiving data from all transmitting modems. Only the data addressed to itself is received.

RxFreq

Default Setting

11000 The local modem's receive frequency is 11000 Hz.

Definition

The setting of the RxFreq configuration parameter is the receive frequency of the modem in hertz and must be correctly set when using the Transpond (ATNm) command to acquire the two-way sound travel time to a transponder. The RxFreq setting should be the same as the transponder transmit frequency unless the Multi-Receive feature key is installed in which case it does not apply.

Available Settings

The range of available settings for the RxFreq configuration parameter is from 0 to 35000 in integer increments for a receive frequency of 7000 Hz to 16,000 Hz in 250-Hz increments.

RxThresh

Default Setting

10

The number of standard deviations that a detected signal must rise above the background noise level before it is marked as a received transponder reply by the local modem is 10.

Definition

The setting of the RxThresh configuration parameter is the number of standard deviations that a detected signal must rise above the background noise level at that frequency before it is marked as a received transponder reply. It must be correctly set when using the Transpond (ATNm) command to acquire the two-way sound travel time to a transponder. The lower this setting the more sensitive is the receiver and the more likely a detected signal will be marked as a received reply. However, with a low setting there is also a greater likelihood of "false positives," where a detected signal is incorrectly marked as a received reply. The higher the setting the less sensitive is the receiver and the less likely a detected signal will be marked as a received reply. Therefore a high setting increases the likelihood of missing valid detections. The receive threshold should be adjusted in accordance with the background noise such as to minimize false positives and negatives.

Available Settings

The range of available settings for the RxThresh configuration parameter is from 10 to 256 in integer increments. The default setting is 10.

RxToneDur

Default Setting

10 (10ms) The local modem's receive pulse width is 10 ms.

Definition

The setting of the RxToneDur configuration parameter determines the receive pulse width of the modem and must be correctly set when using the Transpond (ATNm) command to acquire the two-way sound travel time to a transponder. The RxToneDur setting should be approximately the same as the transponder transmit pulse width.

Available Settings

The available settings for the RxToneDur configuration parameter are listed below.

0 (12.5ms):	12.5 ms
1 (6.25ms):	6.25 ms
5 (5ms):	5 ms
6 (6ms):	6 ms
7 (7ms):	7 ms
8 (8ms):	8 ms
9 (9ms):	9 ms
10 (10ms):	10 ms
11 (11ms):	11 ms
12 (12ms):	12 ms
13 (13ms):	13 ms
14 (14ms):	14 ms
15 (15ms):	15 ms

RxLockout

Default Setting

75 The local modem's lockout time is 75 ms.

Definition

The setting of the RxLockout configuration parameter is the lockout time in milliseconds of the local modem and must be correctly set when using the Transpond (ATNm) command to acquire the two-way sound travel time to a transponder. The lockout time is a period that begins at the start of the interrogation pulse during which the modem will ignore any received replies from the transponder. The RxLockout setting prevents interrogation pulse transmission echoes from nearby objects from being detected as replies

Available Settings

The range of available settings for the RxLockout configuration parameter is from 0 to 1000 in integer increments for a lockout time of 0 ms to 1000 ms in 1-ms increments.

TxToneDur

Default Setting

100 The local modem's transmit pulse width is 10.0 ms.

Definition

The setting of the RxToneDur configuration parameter determines the transmit pulse width of the modem and must be correctly set when using the Transpond (ATNm) command to acquire the two-way sound travel time to a transponder.

Available Settings

The range of available settings for the TxToneDur configuration parameter is from 100 to 250 in integer increments for a transmit pulse width of 10 ms to 25 ms in 0.1-ms increments.

TAT

Default Setting

0 The local modem's turn-around-time is 0 ms.

Definition

The setting of the TAT configuration parameter is the turn-around-time of the transponder and must be correctly set when using the Transpond (ATNm) command to acquire the two-way sound travel time to a transponder. The turn-around-time is the time in milliseconds from when the transponder receives an interrogation pulse to when it transmits the reply. It is subtracted from the measured two-way travel time.

Available Settings

The range of available settings for the TAT configuration parameter is from 0 to 1000 in integer increments for a turn-around-time of 0 ms to 100.0 ms in 0.1-ms increments.

8 Maintenance and Troubleshooting

This section encompasses the recommended care and maintenance procedures for the subsea modem components of the Teledyne Benthos ATM-900 Series Acoustic Telemetry Modems. Adherence to these procedures will help to ensure many years of continuous, reliable performance from the modems. In addition, a troubleshooting guide is provided which will assist in isolating and correcting a few of the basic operational problems that could occur during setup or deployment.



NOTE For maintenance and troubleshooting of the UDB-9400 Universal Deck Box, the SR-50 and SR-100 SMART Releases and the SM-75 SMART Modem, refer to their respective user's manual.

The care and maintenance of the modems involve three areas: general cleaning and inspection, changing the modem battery packs, and cleaning or replacing the O-rings. The tools required for these tasks include the following:

- 9/64 Allen wrench
- 5/32 Allen wrench
- Phillips head screwdriver
- Flat head screwdriver
- Wire cutters
- Silicone O-ring lubricant
- Isopropyl alcohol
- Alcohol wipes
- Lint-free cloths or paper towels
- Electrical tape

General Cleaning and Inspection

After retrieving a subsea modem, clean and inspect the modem as follows:

1. Turn the modem off by pulling the on/off switch all the way out. Refer to Figure 4-2 on page 4-8 for the location of the modem on/off switch.
2. Using a cloth or paper towel dry the modem thoroughly.
3. Unplug the cable from the POWER/SERIAL connector on the modem, inspect and clean the cable, and then clean the connector with an alcohol wipe.

4. Lubricate the POWER/SERIAL connector pins with a light coat of silicone lubricant and install the dummy connector supplied with the modem.



NOTE Be especially careful not to get any lubricant on the face of the transducer as this will severely degrade its performance.

For the ATM-914, ATM-924 and ATM-964 Acoustic Telemetry Modems, perform all the steps listed below. For the ATM-915, ATM-916, ATM-925, ATM-926, ATM-965, and ATM-966 modems, go to Step 7.

5. Unplug the remote transducer cable from both the remote transducer connector on the modem and the connector on the remote transducer, inspect and clean the cable, and then clean the connectors with an alcohol wipe.
6. Lubricate the connector pins on both the remote transducer connector on the modem and the connector on the remote transducer with a light coat of silicone lubricant and install the dummy connectors supplied.
7. Wash down the modem with clean, *fresh* water and remove any debris that may have become attached to the housing.
8. Clean the transducer with a mild, non-abrasive detergent, being careful to remove any buildup. After cleaning, spray the transducer again with fresh water.



NOTE Do not use an ammonia-based cleaner such as a glass cleaner to clean the transducer.

9. Carefully inspect the transducer for any signs of damage.

Changing the Modem Battery Packs

The subsea modems, except for the ATM-916, ATM-926 and ATM-966 Acoustic Telemetry Modems, have an internal modem battery pack which will occasionally require changing. To change the battery pack, the modem requires disassembly, and the procedures for disassembling the ATM-914, ATM-915, ATM-925, and ATM-926 Acoustic Telemetry Modems are different than those for the ATM-964 and ATM-965 modems.



WARNING The installation of a battery pack that is not inspected or approved by Teledyne Benthos may cause destruction of the modem housing or electronics should the battery pack rupture, leak, outgas, or improperly discharge. Any of these conditions can cause a buildup of gas inside the housing which may result in an explosion and personal injury or death. If it is suspected that a battery pack has discharged inside a housing, move the modem to a safe location as quickly as possible.

Checking the Modem Battery Pack

The best way to determine the remaining capacity of a modem battery pack is to keep track of the watt-hours consumed. If unable to do this, then the capacity of the battery pack can be estimated by measuring the battery pack voltage. To check the battery pack voltage after removing it from a modem, connect a 150-ohm, 3-watt resistor across the battery pack terminals, measure the voltage across the load resistor with a digital multimeter, and then refer to Table 8-1 to determine the battery pack capacity.

Table 8-1 Modem Battery Pack Capacity vs. Voltage

Voltage Under 150-Ohm Load (volts)	Capacity Remaining (%)
20	90–100%
19	90–70%
18	50–70%
17	40–60%
16	10–30%
15	<10%

Changing the ATM-914, ATM-915, ATM-924, or ATM-925 Modem Battery Pack

For the ATM-914, ATM-915, ATM-924, and ATM-925 Acoustic Telemetry Modems, both end caps require removal when changing the modem battery pack. First, the POWER/SERIAL connector end cap must be removed, and then the transducer end cap for the ATM-915 and ATM-925 or the remote transducer connector end cap for an ATM-914 and ATM-924.

To change the modem battery pack for an ATM-914, ATM-915, ATM-924, or ATM-925:

1. Turn the modem off by pulling the on/off switch all the way out. Refer to Figure 4-2 on page 4-8 for the location of the modem on/off switch.
2. With the modem on its side and resting on a flat surface, use a 9/64 Allen wrench to remove the three socket head screws that attach the POWER/SERIAL connector end cap to the housing.
3. Carefully pull the end cap straight out from the housing. If required, rotate the end cap slightly while pulling.
4. Disconnect the in-line connector that connects the battery pack to the connector on the POWER/SERIAL connector end cap.
5. Using a 9/64 Allen wrench remove the three socket head screws that attach the remote transducer connector end cap for an ATM-914 or ATM-924 Acoustic Telemetry Modem, or the transducer end cap for an ATM-915 or ATM-925 Acoustic Telemetry Modem.
6. Carefully pull the end cap straight out from the housing. If required, rotate the end cap slightly while pulling. When clear of the housing, continue to pull the end cap out while pushing on the battery pack from the other end of the housing. Pull the end cap out far enough to access the 5-pin power connector on the top of the circuit board.
7. Disconnect the 5-pin power connector.
8. Cut the wire tie with wire cutters and remove the 10-pin serial cable connector by first pressing down on the locking sleeve tab to unlock it, then slide the locking sleeve along the wire harness out of the way, grab the cable connector, and gently pull to disconnect it.
9. Place the end cap assembly on a clean, flat surface.
10. Remove the battery pack by first pushing it out from the POWER/SERIAL connector end cap end and then removing it from the opposite end.
11. Refer to "Cleaning or Replacing an O-ring" on page 8-11 and clean or replace the O-rings on both end caps.
12. Insert the new battery pack into the housing from the remote transducer connector end cap end for an ATM-924 Acoustic Telemetry Modem, or from the transducer end cap end for an ATM-925 Acoustic Telemetry Modem.

13. Connect the 10-pin serial connector to the circuit board and secure it with the locking sleeve.
14. Connect the 5-pin serial connector to the circuit board.
15. Slide the chassis and the battery pack together into the housing, and then press the end cap into the housing, being careful not to pinch the wires.
16. Line up the three holes in the end cap with the three holes in the housing, and secure the end cap to the housing with the three hex head screws.
17. Connect the in-line connector that connects the battery pack to the connector on the POWER/SERIAL connector end cap, and then press the end cap into the housing, being careful not to pinch the wires.
18. Line up the three holes in the end cap with the three holes in the housing, and secure the end cap to the housing with the three hex head screws.

Changing the ATM-964 or ATM-965 Modem Battery Pack

For the ATM-964 and ATM-965 Acoustic Telemetry Modems, both end caps require removal when changing the modem battery pack. First, the top end cap for an ATM-964 or the transducer end cap for an ATM-965 must be removed, and then the POWER/SERIAL connector end cap.

To change the modem battery pack for an ATM-964 or ATM-965:

1. Turn the modem off by pulling the on/off switch all the way out. Refer to Figure 4-2 on page 4-8 for the location of the modem on/off switch.
2. Using a flat head screwdriver loosen the remote transducer connector end cap for an ATM-964 Acoustic Telemetry Modem or the stainless steel band clamp on the transducer end cap for an ATM-965 Acoustic Telemetry Modem. Slide the band clamp down along the housing out of the way.
3. With the modem on its side and resting on a flat surface, carefully pull the end cap straight out from the housing, far enough to access the connectors on the circuit board. If required, rotate the end cap slightly while pulling.
4. Disconnect the 5-pin power and 10-pin serial cable connectors that connect to the circuit board and set the end cap assembly aside.

5. Using a flat head screwdriver loosen the stainless steel band clamp on the POWER/SERIAL connector end cap. Slide the clamp down along the housing and out of the way.
6. Carefully pull the end cap straight out, completely removing it and the battery tray with the installed battery packs from the housing. If required, rotate the end cap slightly while pulling.
7. Remove one of the battery retainer bars by removing the four Phillips head screws that secure it.
8. One at a time remove the two battery packs from the battery tray, and then remove the electrical tape that secures the in-line connectors and disconnect them.
9. Install the new battery packs into the battery tray one at a time.
10. Connect the in-line connectors and wrap each of them with electrical tape.
11. Tuck the battery wires and the in-line connectors out of the way between the two battery packs.
12. Install the battery retainer bar and secure it with the four Phillips head screws.
13. Refer to "Cleaning or Replacing an O-ring" on page 8-11 and clean or replace the O-rings on both end caps.
14. Feed the wire harness through the housing and slide the battery pack into the housing until the gland seal O-ring on the end cap is against the housing. Be careful not to scrape the O-ring surface on the inside wall of the housing.
15. When the gland seal O-ring is against the housing, apply equal pressure against the end cap and press it into the housing until the face seal O-ring is firmly seated against the housing. If required, rotate the end cap slightly when pressing it into the housing.
16. Slide the stainless steel band clamp back into position between the end cap and the housing and tighten the clamp.
17. Connect the 5-pin power and 10-pin serial cable connectors to the circuit board.
18. Slide the chassis into the housing until the gland seal O-ring on the end cap is against the housing, being careful not to scrape the O-ring surface on the inside wall of the housing.

19. When the gland seal O-ring is against the housing, apply equal pressure against the end cap and press it into the housing until the face seal O-ring is firmly seated against the housing. If required, rotate the end cap slightly when pressing it into the housing.
20. Slide the stainless steel band clamp back into position between the end cap and the housing and tighten the clamp.

Changing the Real-Time Clock Battery

The subsea modems include a real-time clock battery for powering the real-time clock when the modem is powered down. To change the real-time clock battery, the modem requires disassembly, and the procedures for disassembling the ATM-914, ATM-915, ATM-924 and ATM-925; the ATM-916 and ATM-926; and the AM-964, ATM-965 and ATM-966 Acoustic Telemetry Modems are different.

The real-time clock battery is an Energizer CR1632 or equivalent and should be replaced after two years of modem off time or when the battery voltage is less than 2.7 VDC. To display the real-time clock battery voltage, use the `rtc_battery` command.

Changing the ATM-914, ATM-915, ATM-924, or ATM-925 Real-Time Clock Battery

For the ATM-914, ATM-915, ATM924, and ATM-925 Acoustic Telemetry Modems, both end caps require removal when changing the real-time clock battery. First, the POWER/SERIAL connector end cap must be removed, and then the transducer end cap for an ATM-915 and ATM-925 or the remote transducer connector end cap for an ATM-914 and ATM-924.

To change the real-time clock battery for an ATM-914, ATM-915, ATM924, or ATM-925:

1. Turn the modem off by pulling the on/off switch all the way out. Refer to Figure 4-2 on page 4-8 for the location of the modem on/off switch.
2. With the modem on its side and resting on a flat surface, use a 9/64 Allen wrench to remove the three socket head screws that attach the POWER/SERIAL connector end cap to the housing.
3. Carefully pull the end cap straight out from the housing. If required, rotate the end cap slightly while pulling.

4. Disconnect the in-line connector that connects the battery pack to the connector on the POWER/SERIAL connector end cap.
5. Using a 9/64 Allen wrench remove the three socket head screws that attach the remote transducer connector end cap for an ATM-914 or ATM-924 Acoustic Telemetry Modem, or the transducer end cap for an ATM-915 and ATM-925 Acoustic Telemetry Modem.
6. Carefully pull the end cap straight out from the housing. If required, rotate the end cap slightly while pulling. When clear of the housing, continue to pull the end cap out while pushing on the battery pack from the other end of the housing. Pull the end cap out far enough to access the 5-pin power connector on the top of the circuit board.
7. Disconnect the 5-pin power connector.
8. Remove the old real-time clock battery and dispose of it in accordance with local regulations. The battery is located on the edge of the DSP board. Refer to Drawing B-270-156 in Section 9, "Drawings," for its exact location.
9. Install the new real-time clock battery in the holder with the positive side of the battery facing up.
10. Refer to "Cleaning or Replacing an O-ring" on page 8-11 and clean or replace the O-rings on both end caps.
11. Connect the 5-pin serial connector to the circuit board.
12. Slide the chassis and the battery pack together into the housing, and then press the end cap into the housing, being careful not to pinch the wires.
13. Line up the three holes in the end cap with the three holes in the housing, and secure the end cap to the housing with the three hex head screws.
14. Connect the in-line connector that connects the battery pack to the connector on the POWER/SERIAL connector end cap, and then press the end cap into the housing, being careful not to pinch the wires.
15. Line up the three holes in the end cap with the three holes in the housing, and secure the end cap to the housing with the three hex head screws.

Changing the ATM-916 or ATM-926 Real-Time Clock Battery

For the ATM-916 and ATM-926 Acoustic Telemetry Modems, only the transducer end cap requires removal when changing the real-time clock battery.

To change the real-time clock battery for an ATM-916 or ATM-926:

1. Turn the modem off by pulling the on/off switch all the way out. Refer to Figure 4-2 on page 4-8 for the location of the modem on/off switch.
2. Using a 9/64 Allen wrench remove the three socket head screws that attach the transducer end cap.
3. Carefully pull the end cap straight out from the housing. If required, rotate the end cap slightly while pulling.
4. Disconnect the 5-pin power connector.
5. Remove the old real-time clock battery and dispose of it in accordance with local regulations. The battery is located on the edge of the DSP board. Refer to Drawing B-270-156 in Section 9, "Drawings," for its exact location.
6. Install the new real-time clock battery in the holder with the positive side of the battery facing up.
7. Refer to "Cleaning or Replacing an O-ring" on page 8-11 and clean or replace the O-rings on both end caps.
8. Connect the 5-pin serial connector to the circuit board.
9. Slide the chassis into the housing, and then press the end cap into the housing, being careful not to pinch the wires.
10. Line up the three holes in the end cap with the three holes in the housing, and secure the end cap to the housing with the three hex head screws.

Changing the ATM-964, ATM-965 or ATM-966 Real-Time Clock Battery

For the ATM-964, ATM-965 and ATM-966 Acoustic Telemetry Modems, only one end cap requires removal when changing the real-time clock battery—the top end cap for an ATM-964 or the transducer end cap for an ATM-965 or ATM-966.

To change the real-time clock battery for an ATM-964, ATM-965 or ATM-966:

1. Turn the modem off by pulling the on/off switch all the way out. Refer to Figure 4-2 on page 4-8 for the location of the modem on/off switch.
2. Using a flat head screwdriver loosen the remote transducer connector end cap for an ATM-964 Acoustic Telemetry Modem or the stainless steel band clamp on the transducer end cap for an ATM-965 or ATM-966 Acoustic Telemetry Modem. Slide the band clamp down along the housing out of the way.
3. With the modem on its side and resting on a flat surface, carefully pull the end cap straight out from the housing, far enough to access the connectors on the circuit board. If required, rotate the end cap slightly while pulling.
4. Disconnect the 5-pin power and 10-pin serial cable connectors that connect to the circuit board and set the end cap assembly aside.
5. Remove the old real-time clock battery and dispose of it in accordance with local regulations. The battery is located on the edge of the DSP board. Refer to Drawing B-270-156 in Section 9, "Drawings," for its exact location.
6. Install the new real-time clock battery in the holder with the positive side of the battery facing up.
7. Refer to "Cleaning or Replacing an O-ring" on page 8-11 and clean or replace the O-rings on both end caps.
8. Connect the 5-pin power and 10-pin serial cable connectors to the circuit board.
9. Slide the chassis into the housing until the gland seal O-ring on the end cap is against the housing, being careful not to scrape the O-ring surface on the inside wall of the housing
10. When the gland seal O-ring is against the housing, apply equal pressure against the end cap and press it into the housing until the face seal O-ring is firmly seated against the housing. If required, rotate the end cap slightly when pressing it into the housing.
11. Slide the stainless steel band clamp back into position between the end cap and the housing and tighten the clamp.

Cleaning or Replacing an O-ring

When cleaning or replacing an O-ring, be aware of the following:

- Isopropyl alcohol should be used when cleaning an O-ring.
- Once an O-ring is cleaned and inspected, it should be immediately lubricated with silicone lubricant and installed. O-rings not installed immediately must be relubricated.
- Do not leave a lubricated O-ring sitting on a bench, as it will pick up contaminants.
- The purpose of the silicone lubricant is to allow the O-ring to move into its natural location, which is in the O-ring groove. The lubricant does not create the seal.
- Minimize any stretching when cleaning an O-ring.
- Do not force an O-ring over sharp corners or edges.
- Ensure that the O-ring, its groove and the O-ring surface of the housing are clean.
- When reassembling a housing, use a straight, longitudinal movement. Rotating the housing may cause the O-ring to pinch.

To clean or replace an O-ring:

1. Remove the O-ring using an O-ring removal tool or other suitable device. Be careful not to damage the O-ring.
2. Using isopropyl alcohol and a lint-free cloth or paper towel, thoroughly clean the O-ring groove and the O-ring surface inside the housing.
3. Carefully inspect the O-ring groove and the O-ring surface for any scratches, nicks or dirt and clean them again if necessary.
4. Allow the surfaces of the O-ring groove and the housing to thoroughly dry.
5. Clean the O-ring with a lint-free cloth or paper towel and a small amount of isopropyl alcohol. Do not use cotton or other materials that leave fibers behind. Avoid stretching the O-ring.
6. Inspect the O-ring for any scratches, cracks or nicks. Discard the O-ring if any of these conditions are present.

7. Using clean fingers, apply a *light*, even coat of silicone lubricant to the O-ring. Spread the lubricant evenly over the entire surface. If necessary, when working with a radial seal, a small amount of the same lubricant can be applied to the O-ring surface inside the housing where the O-ring will seal.



WARNING Apply only a thin coat of silicone lubricant. Too much lubricant could displace the O-ring when it is under pressure.

8. Install the O-ring into the O-ring groove.

Troubleshooting

If during the setup or deployment of an ATM-900 or UDB-9400 Series Acoustic Telemetry Modem, the modem does not appear to be functioning properly, use the troubleshooting guide in this section for assistance. The troubleshooting guide will help to quickly isolate a few basic operational problems that could occur. However, should further help be required, contact Teledyne Benthos directly. Refer to "Customer Service" on page vi for information on how to contact Teledyne Benthos.

The troubleshooting guide includes a list of symptoms along with a list of recommended checks designed to lead to the most likely cause.

There is no banner message displayed on the monitor of the host PC connected to a modem when the modem is switched on.

- A. Verify that the host PC serial port is configured correctly, with the correct baud rate, parity, number of data bits, and number of stop bits. Refer to "Setting up the Host Processor" on page 4-20.
- B. Verify that the terminal program communications software is running.
- C. Verify that the verbose level as determined from S Register 13 is set to 01, 02 or 03. Refer to "Verbose" on page 7-20 for information on the Verbose configuration parameter.
- D. If the modem has an internal battery pack, verify that it has not been depleted.
- E. Verify that the RS-232 serial cable is configured correctly and that it is connected to the correct serial port on the host PC. Refer to "Setting Up the Modems" on page 4-9.

The monitor of the host PC connected to a subsea modem displays the banner message when the modem is switched on, but there is no displayed response to commands entered from the keyboard of the host PC.

- A. Verify that the terminal program communications software echo feature, if it has one, is turned on.
- B. If the terminal program communications software does not have an echo feature, enter the Read Register command (ATSn?), where n is 3, to verify that the baud rate selection, as determined by the setting of S Register 3, is one with echo on. Refer to "P1Baud" on page 7-7 for information on S Register 3.

There is serial communications with the local modem but no transmissions can be heard from the local modem after entering a command that requires the modem to transmit an acoustic command.

- A. If the UDB-9400 Universal Deck Box is the local modem, increase the volume setting.
- B. If the local modem is an UDB-9400 Universal Deck Box, or an ATM-914, ATM-924 or ATM-964 Acoustic Telemetry Modem, check the transducer connections.
- C. Verify that the verbose level as determined from S Register 13 is set to 01, 02, or 03. Refer to "Verbose" on page 7-20 for information on the Verbose configuration parameter.

With the verbose level set to 01 or higher, errors—if any—will be displayed which will help in isolating the problem.

- D. Verify that the command is being sent correctly. Refer to Table 6-1 on page 6-2 for a list of the available commands and their syntax.
- E. If the modem is a subsea modem, verify that the modem battery pack has not been depleted.

After entering a command that requires the modem to transmit an acoustic command, transmissions can be heard from the local modem, but there are no responses heard from the remote modem.

- A. Verify that the correct address for the remote modem is being entered when entering the command.
- B. Verify that the correct modem transducers have been selected and that they are oriented correctly. Refer to "Remote Transducer Selection" on page 3-1 for information on making the optimum selection.

C. Verify that the remote modem is switched on.

For a subsea modem deployed in deep water, water pressure will push the on/off switch in, turning on the modem. If deployed in shallow water, it may be necessary to retrieve the modem to verify that it is turned on.

D. If the remote modem is a subsea modem, verify that the modem battery pack has not been depleted.

9 Drawings

This section includes the outline and wiring drawings for the Teledyne Benthos ATM-900 and UDB-9400 Series Acoustic Telemetry Modems. Refer to these drawings when setting up and installing the modems.

Surface Modems

A-270-108	Outline, UDB-9400 Universal Deck Box
C-270-215	Outline, ATM-980 Buoy Box

Subsea Modems

B-270-437	Outline, ATM-914
B-270-432	Outline, ATM-915
B-270-433	Outline, ATM-916
D-270-088	Outline, ATM-924 Modem
D-270-053	Outline, ATM-925 Modem
D-270-060	Outline, ATM-926 Modem
D-270-089	Outline, ATM-964 Modem
D-270-056	Outline, ATM-965 Modem
C-270-259	Outline, ATM-966 Modem

Modem Board Sets

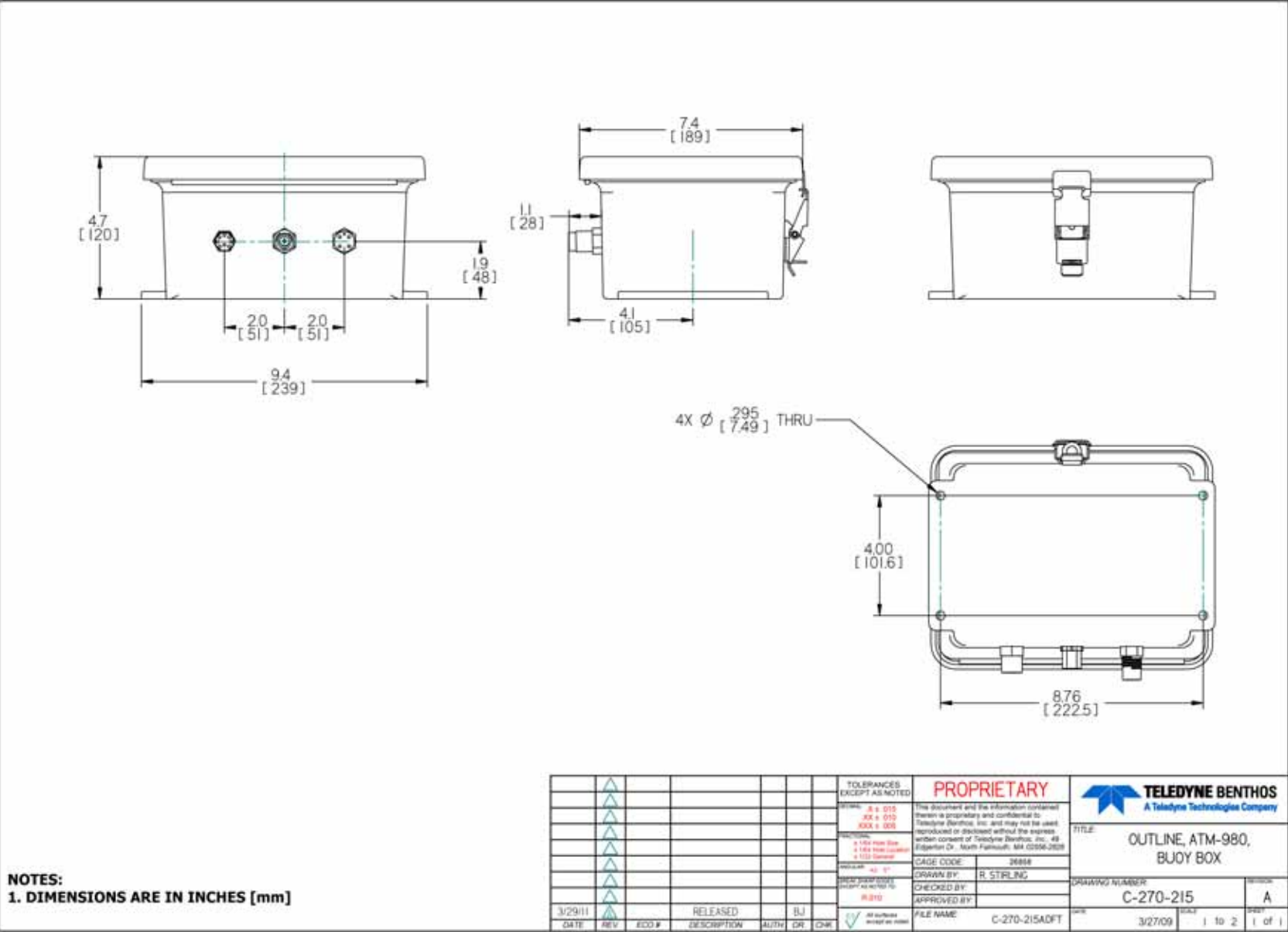
B-270-156	Outline, ATM-900 OEM Board Set
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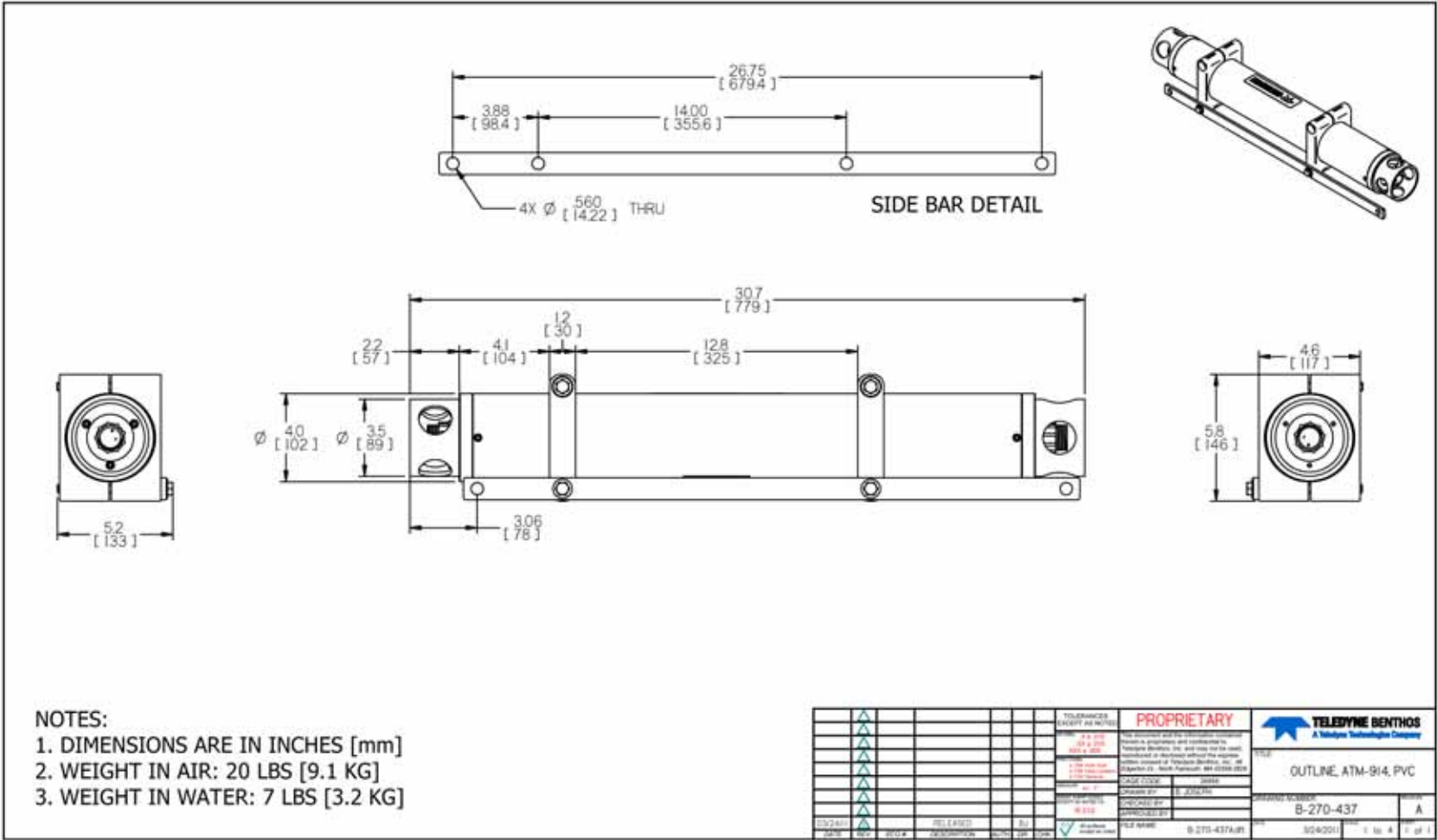
Remote Transducers

B-270-267	Outline, Remote LF and MF Omnidirectional Transducers
B-270-337	Outline, Remote LF Directional Transducer
B-270-371	Outline, Remote MF Directional Transducer



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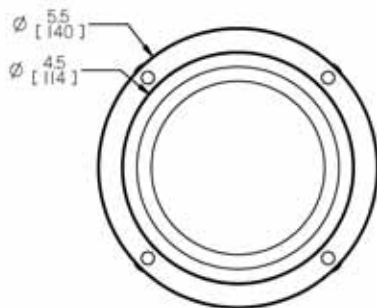
3.88 [98.4]

14.00 [355.6]

26.75 [679.4]

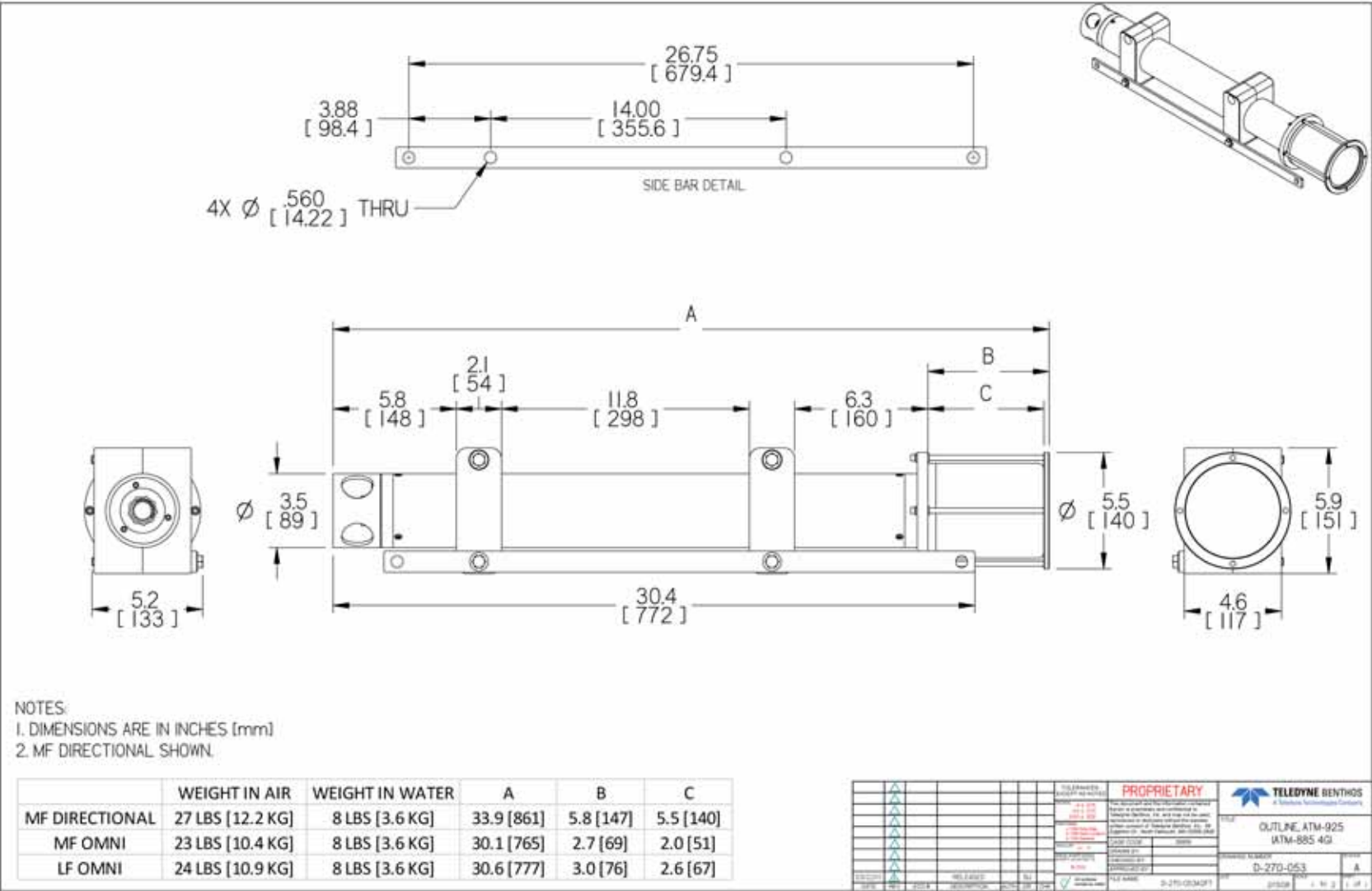
1. DIMENSIONS ARE IN INCHES [mm]
2. LF OMNI TRANSDUCER SHOWN.
3. WEIGHT IN AIR: 24 LBS [10.8 KG]
4. WEIGHT IN WATER: 8 LBS [3.6 KG]

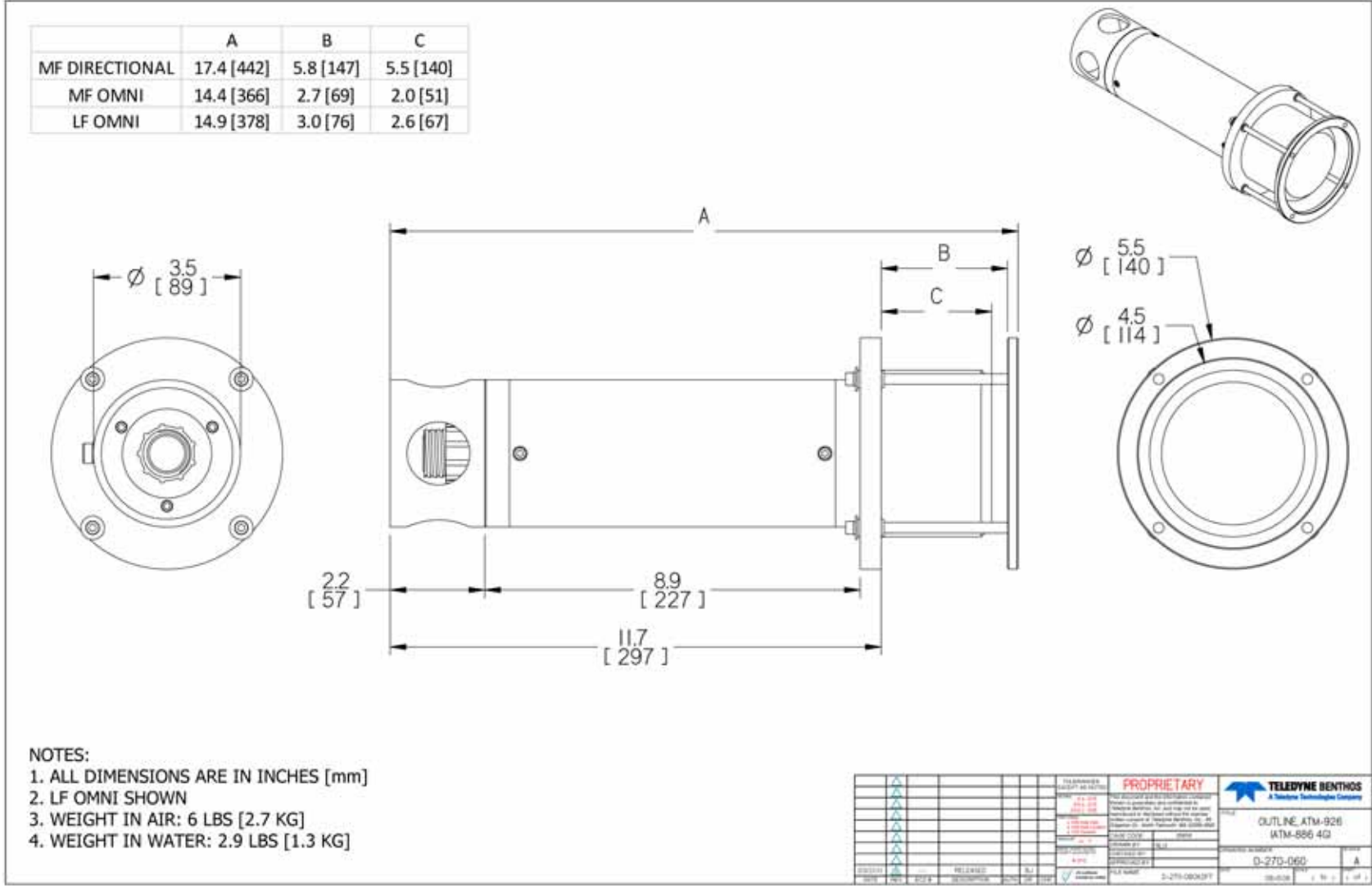
[illegible]

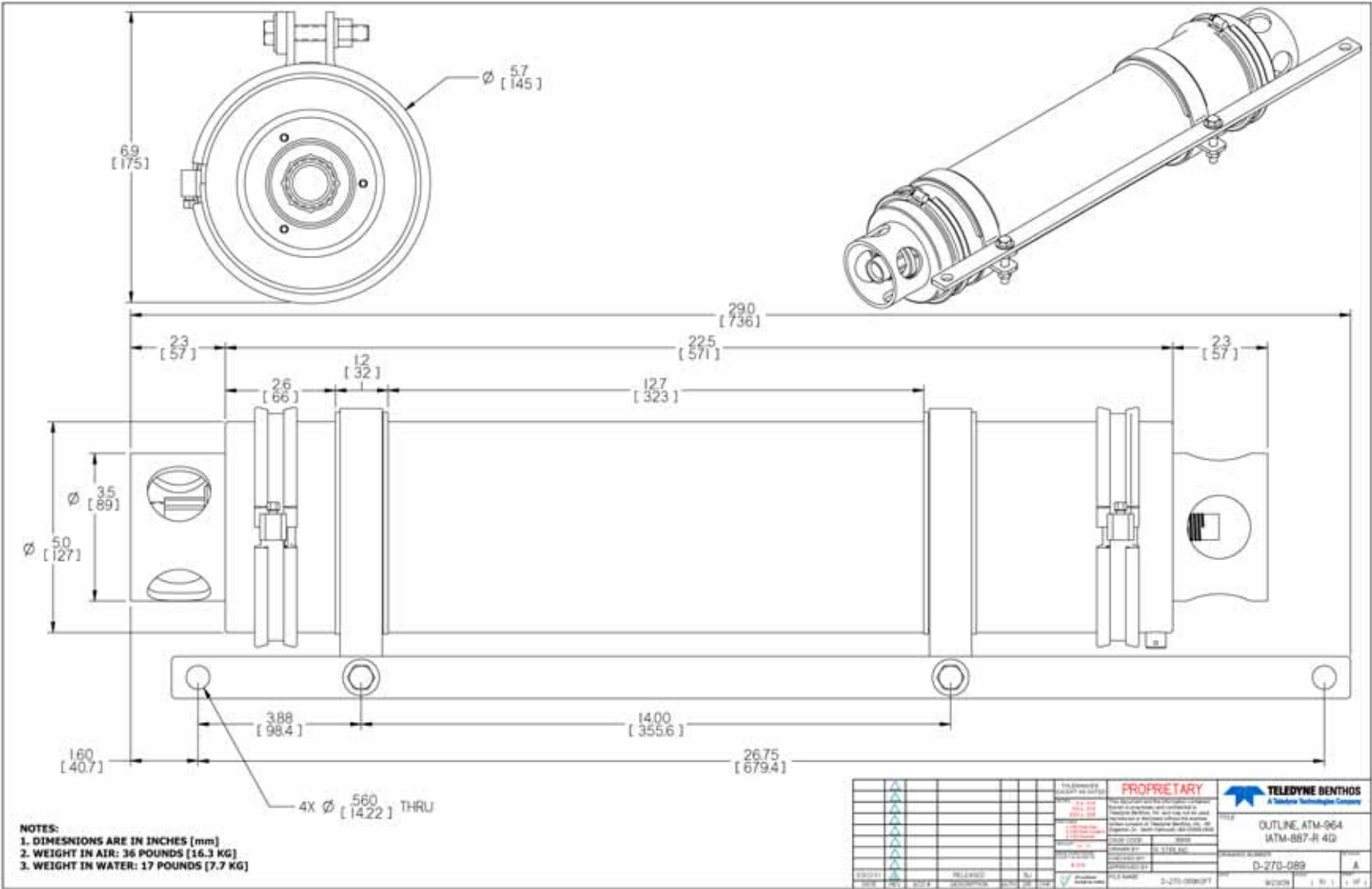


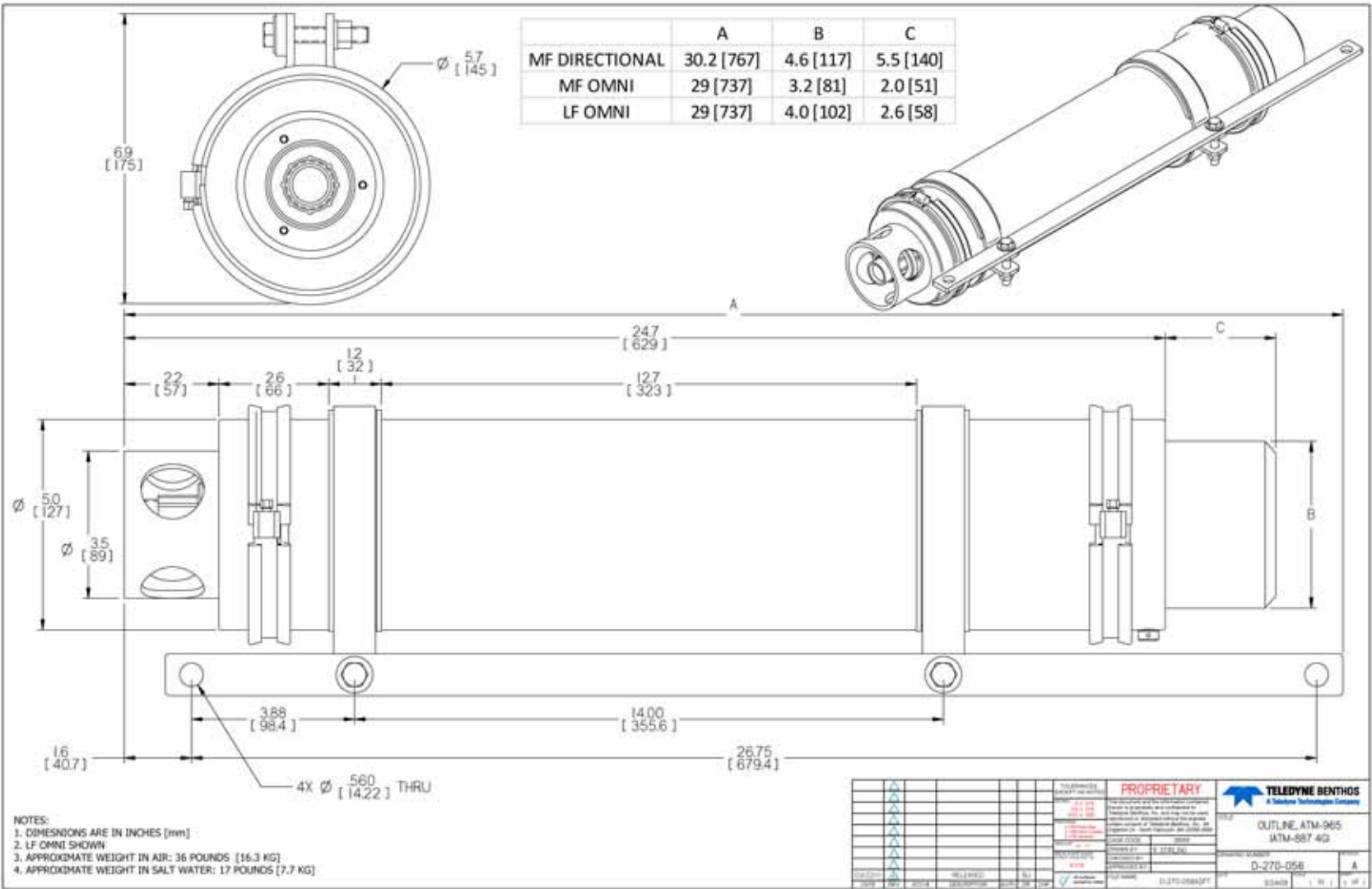
1. DIMENSIONS ARE IN INCHES [mm]
2. LF OMNI TRANSDUCER SHOWN.
3. WEIGHT IN AIR: 10 LBS [4.5 KG]
4. WEIGHT IN WATER: 4 LBS [1.8 KG]

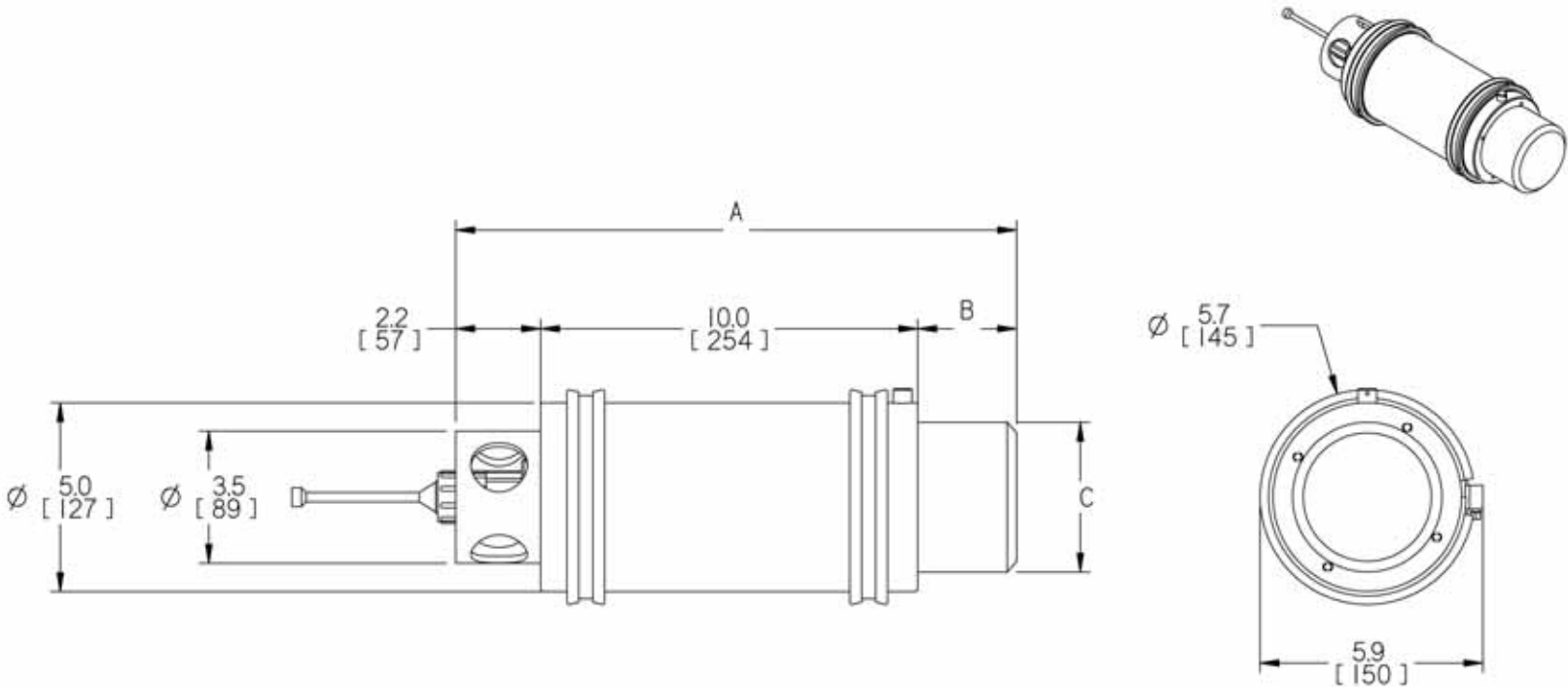
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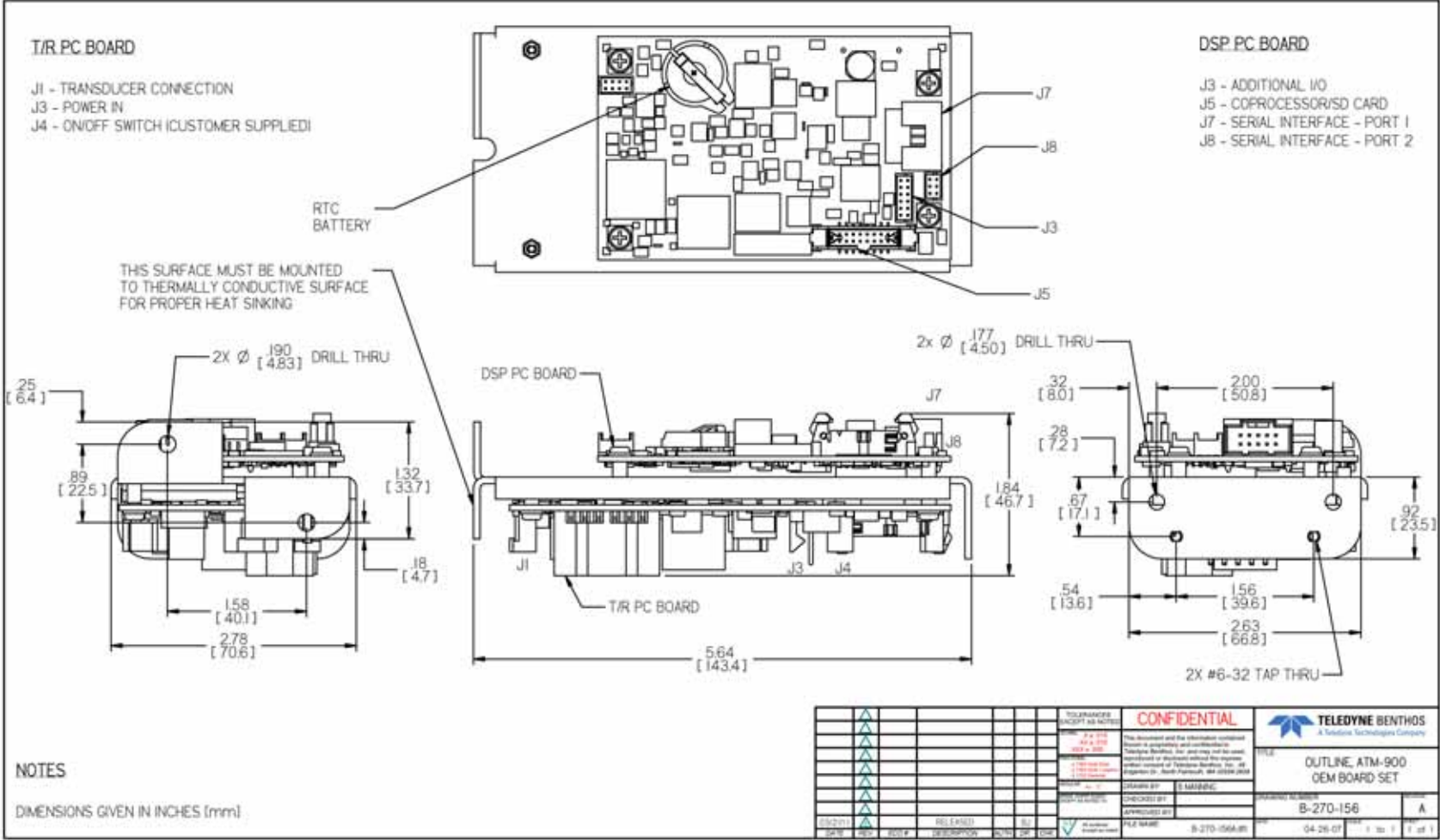


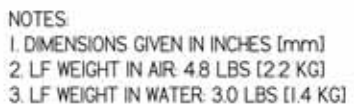


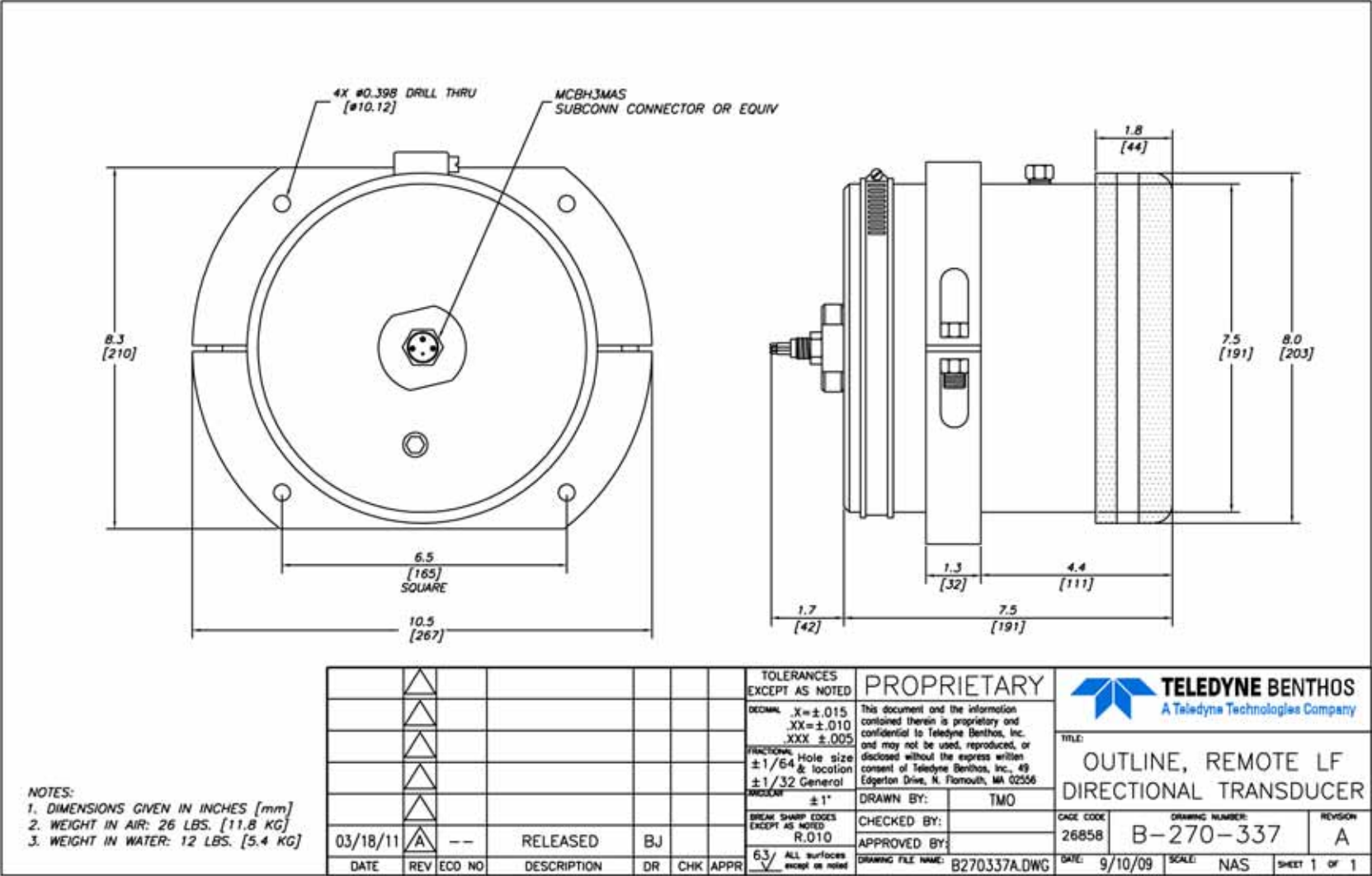
TRANSDUCER	WEIGHT IN AIR	WEIGHT IN WATER	A	B	C
LF OMNI	15.0 LBS (6.8 KG)	5.0 LBS (2.3 KG)	14.5 (368.3)	2.3 (58.4)	4.0 (101.6)
MF OMNI	13.8 LBS (6.3 KG)	4.6 LBS (2.1 KG)	14.2 (360.7)	2.0 (50.8)	2.9 (73.7)
MF DIRECTIONAL	19.5 LBS (8.8 KG)	6.5 LBS (2.9 KG)	17.7 (449.6)	5.5 (139.7)	4.6 (116.8)

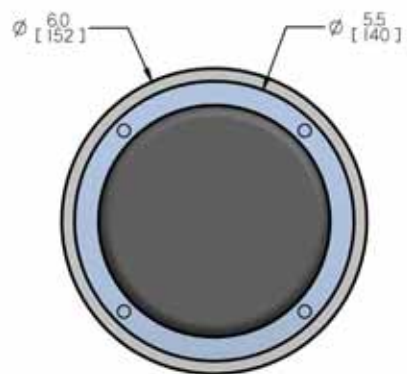
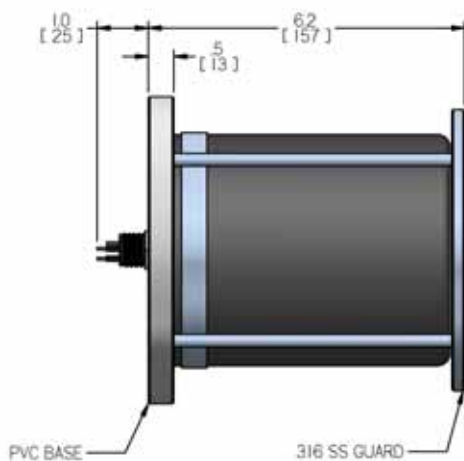
NOTE:
1. DIMENSIONS ARE IN INCHES [mm]
2. LF OMNI TRANSDUCER SHOWN.

				TOLERANCES EXCEPT AS NOTED				PROPRIETARY This document and the information contained therein is proprietary and confidential to Teledyne Benthos, Inc. and may not be used, reproduced or disclosed without the express written consent of Teledyne Benthos, Inc., 48 Edgerton Dr., North Falmouth, MA 02556-2656				 TELEDYNE BENTHOS A Teledyne Technologies Company			
				DECIMALS .X & .015 XX & .010 XXX & .005 FRACTIONS 1/32, 1/16, 1/8, 1/4, 1/2, 3/4, 1, 2, 3, 4, 5, 6, 8, 10, 12, 16, 20, 24, 30, 36, 40, 48, 60, 72, 96, 120, 144, 180, 240, 360, 480, 720, 1440 ANGLES .01, .05, .1, .2, .5, 1, 2, 5, 10, 15, 30, 45, 60, 90, 120, 150, 180, 270, 360 HOLE LOCATIONS .005 HOLE DIA. .005 HOLE LOCATIONS .005 HOLE DIA. .005				CAGE CODE 26558				TITLE: OUTLINE, ATM-966 (ATM-886D)			
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				CHECKED BY				APPROVED BY				DATE 4/6/10			
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1. DIMENSIONS GIVEN IN INCHES [mm]
2. WEIGHT IN AIR: 7.1 LBS [3.2 KG]
3. WEIGHT IN WATER: 3.1 LBS [1.4 KG]

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10 Modem Spares, Accessories and Part Number Designator

This section comprises lists of the Teledyne Benthos ATM-900 and UDB-9400 Series Acoustic Telemetry Modems spares and accessories. Also included is a modem part number designator which provides an easy method for designating the specific part number for a modem when placing an order.

Modem Spares and Accessories

Table 10-1 through Table 10-6 in the following pages provide part number, descriptions and required quantities for spares and accessories for the ATM-9400, ATM-900, ATM-910, ATM-920, and ATM-960 Series Acoustic Telemetry Modems.

Table 10-1 UDB-9400 Series Universal Deck Box Spares

PART NUMBER	DESCRIPTION	QTY PER UNIT
B-270-197-1	Deck Cable, 25-Meter	1
B-270-197-2	Deck Cable, 50-Meter	1
B-270-197-3	Deck Cable, 75-Meter	1
B-270-197-4	Deck Cable, 100-Meter	1
B-270-197-5	Deck Cable, 200-Meter	1
B-270-167-1	Transducer, LF Omnidirectional	1
B-270-167-2	Transducer, MF Omnidirectional	1
B-270-167-3	Transducer, Band C Omnidirectional	1
014337	Hull Mount Transducer Interface Box	1
B-270-171	Transducer, Protective Cage	1
000683	O-ring, Radial (Parker 2-233 N0674-70)	1
012620	Connector, Dummy	1
002017	Connector, Locking Sleeve	1
B-875-4	Cable, AC Power	1

Table 10-2 ATM-910 Series Acoustic Telemetry Modem Spares

PART NUMBER	DESCRIPTION	QTY PER UNIT
D-270-102	378 watt-hour alkaline battery pack	1
000683	O-ring, Radial (Parker 2-233 N0674-70)	4
B-270-408	16-Pin Programming Cable	1
008336	Connector, Dummy Plug	1
005855	Connector, Locking Sleeve	1
B-270-171	Transducer, Protective Cage	1

Table 10-3 ATM-920 Series Acoustic Telemetry Modem Spares

PART NUMBER	DESCRIPTION	QTY PER UNIT
D-270-102	378 Watt-hour Alkaline Battery Pack	1
000683	O-Ring, Radial (Parker 2-233 N0674-70)	2
B-270-408	16-Pin Programming Cable	1
008336	Connector, Dummy Plug	1
005855	Connector, Locking Sleeve	1
B-270-171	Transducer, Protective Cage	1

Table 10-4 ATM-960 Series Acoustic Telemetry Modem Spares

PART NUMBER	DESCRIPTION	QTY PER UNIT
001402	294 Watt-hour Alkaline Battery Pack	2
000679	O-Ring, Radial (Parker 2-241 N0674-70)	2
000677	O-Ring, Face (Parker 2-245 N0674-70)	2
B-270-408	16-Pin Programming Cable	1
008336	Connector, Dummy Plug	1
005855	Connector, Locking Sleeve	1
B-270-171	Transducer, Protective Cage	1

Table 10-5 ATM-900 Series Acoustic Telemetry Modem Spares

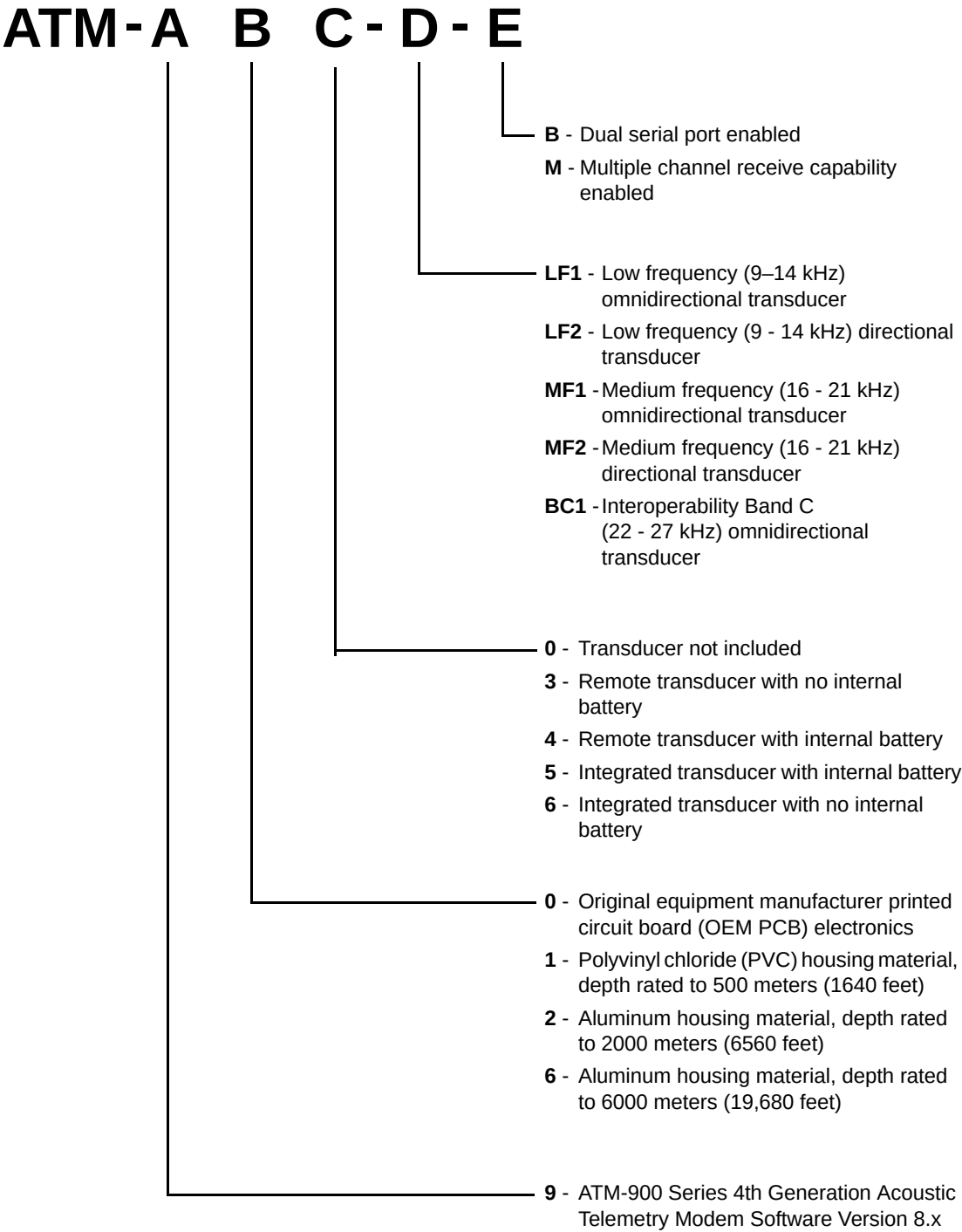
PART NUMBER	DESCRIPTION	QTY PER UNIT
012619	Transducer, Pigtail	1
007984	Cable, Power 12-36 VDC	1
007986	Cable, Serial Interface (Serial Port 1)	1
A-270-115	Cable, Serial Interface (Serial Port 2)	1
B-270-171	Transducer, Protective Cage	1

Table 10-6 Cables

PART NUMBER	DESCRIPTION	QTY PER UNIT
B-270-408	16-Pin Programming Cable	1
B-270-415-2	16-Pin Pigtail Cable, 2-Meter	1
B-270-415-3	16-Pin Pigtail Cable, 3-Meter	1
B-270-415-5	16-Pin Pigtail Cable, 5-Meter	1
B-270-415-10	16-pin pigtail cable, 10-Meter	1
B-270-415-25	16-pin pigtail cable, 25-Meter	1
B-270-415-50	16-pin pigtail cable, 50-Meter	1
B-270-415-100	16-pin pigtail cable, 100-Meter	1
B-270-415-200	16-pin pigtail cable, 200-Meter	1

Modem Part Number Designation

The ATM-900 Series Acoustic Telemetry Modems use an identification number scheme that allows the model number to be used as the part number. This method simplifies the ordering and support processes. To designate the part number for a modem specification, follow the legend shown in Figure 10-1.



NOTE: Specification designators A through D are required, whereas specification designator E is for selected options.

Figure 10-1 ATM-900 Series Part Number Designator Legend