Acoustic Telemetry Modems

User's Manual

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Preface

Congratulations on your purchase of a Teledyne Benthos acoustic telemetry modem! The ATM-88X and UDB-9000 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-88X and UDB-9000 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, setting up and testing the acoustic telemetry modems, and includes some simple procedures to verify operation.

Section 5 - UDB-9000 Universal Deck Box Basic Operation provides instructions on how to use the touch screen display of the UDB-9000 Universal Deck box to operate the acoustic telemetry modems, including sending commands and data, receiving data and acquiring ranges.

Section 6 - Modem Operating Modes and Commands describes the modem operating modes and provides detailed descriptions of the modem commands and how to use them.

Section 7 - Modem Operating Parameters (S Registers) provides detailed descriptions of the modem operating parameters, or S Registers, and how to set them.

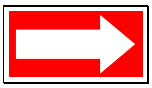
Section 8 - Maintenance and Troubleshooting provides instructions for cleaning and inspecting the modems, changing the modem battery packs, and troubleshooting operational problems that might occur.

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

Section 10 - Modem Components and Accessories Includes lists of the available acoustic telemetry modems, remote transducers, OEM kits, battery packs, and cables.

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.

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Contents

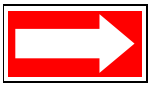
5 Operation using the Touch Screen Display 5-1

List of Figures

List of Tables

1 Overview

The Teledyne Benthos acoustic telemetry modems make up the "Telesonar" product line and include the ATM-88X and UDB-9000 Series Acoustic Telemetry Modems and the Smart Modem Acoustic Release Technology (SMART) releases which combine all of the functions of the ATM-88X Series Acoustic Telemetry Modems with a release mechanism.



NOTE ATM-88X designates any of the Teledyne Benthos ATM acoustic telemetry modems, such as the ATM-886, the ATM-885, the ATM-887, 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-885 or ATM-887 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-88X and UDB-9000 Series Acoustic Telemetry Modems provide wireless bidirectional 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-9000 and a ATM-88X Series Acoustic Telemetry Modem, respectively, or their roles can be reversed. They can also *both* be ATM-88X Series or UDB-9000 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 back and forth 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.

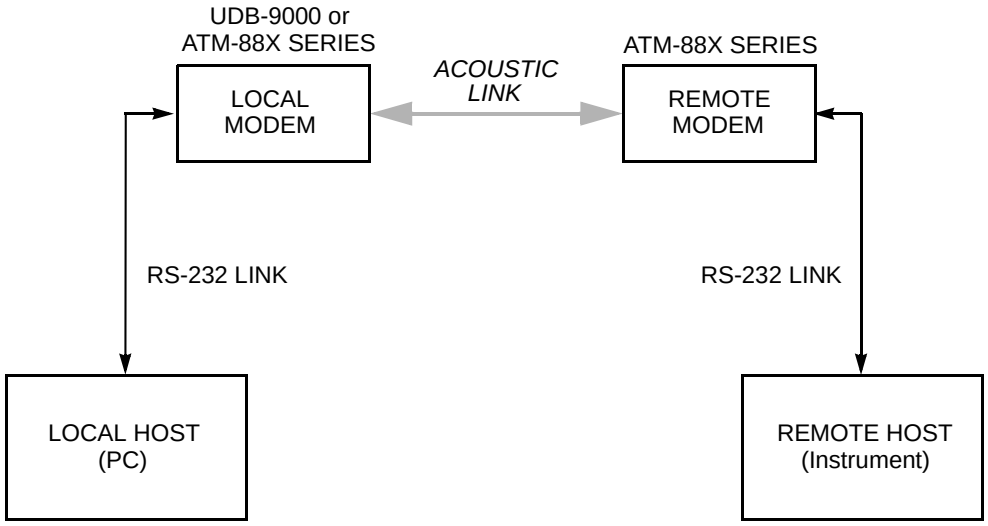


Figure 1-1 Wireless Underwater Communications System Block Diagram

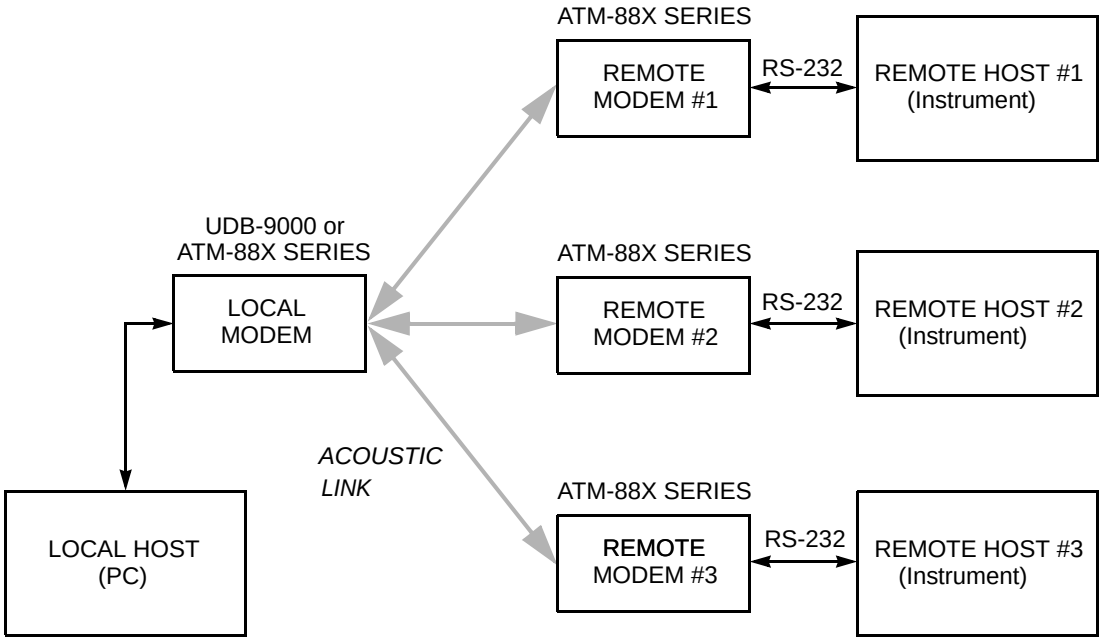


Figure 1-2 Wireless Underwater Communications, Multiple Remote Modems Block Diagram

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 bidirectionally between the two hosts over the acoustic link as if the 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 "Operating Modes" on page 6-1.

Acoustic Bit Rates

The ATM-88X and UDB-9000 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-9000 Series can *both* transmit *and* receive at bit rates as high as 15,360 bits/sec.

Modulation Techniques

The ATM-88X and UDB-9000 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-9000 Series uses PSK modulation to both transmit and receive data. The ATM-88X Series can transmit data using PSK modulation, but receives data using MFSK modulation only. 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-88X and UDB-9000 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-88X and UDB-9000 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-885 or ATM-887 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

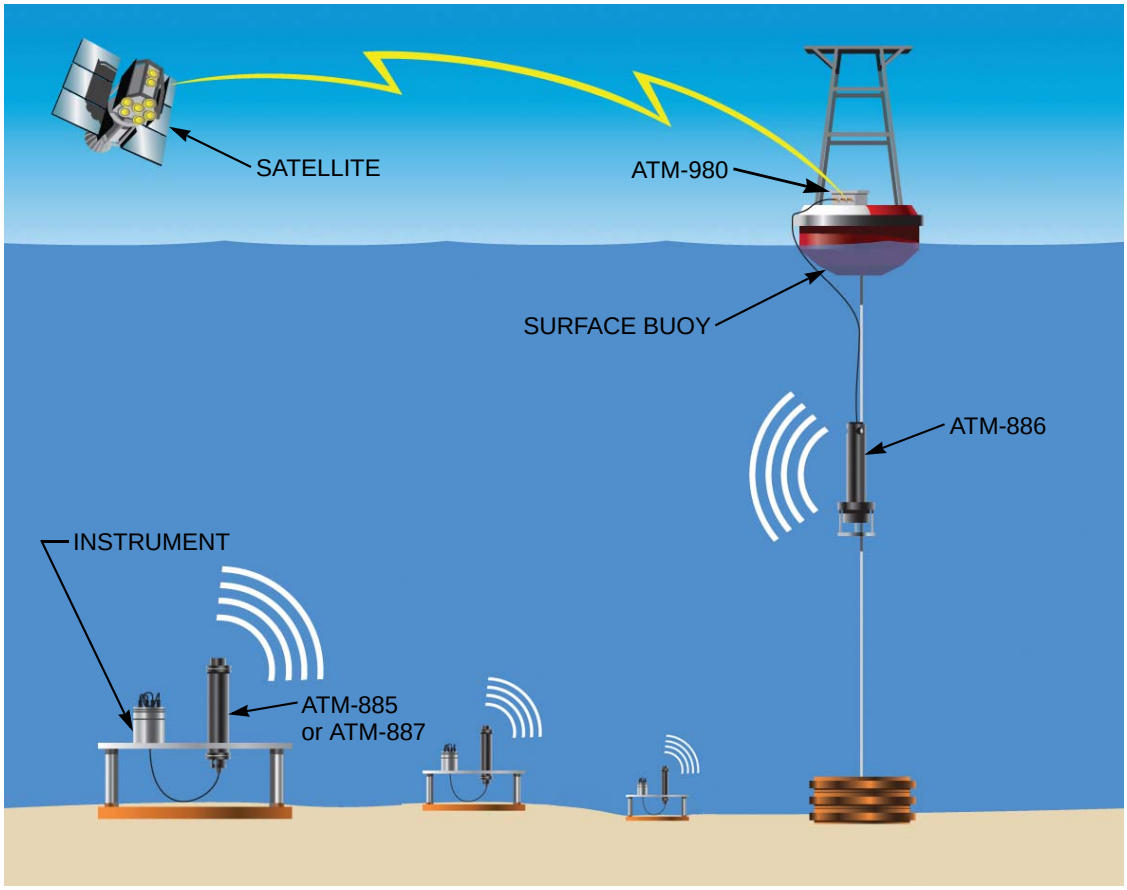


Figure 1-3 Data Acquisition and RF Link to Remote Station

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-886 Acoustic Telemetry Modem that is connected to an ATM-980 Buoy Box installed on a surface buoy. The ATM-886 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-9000 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.

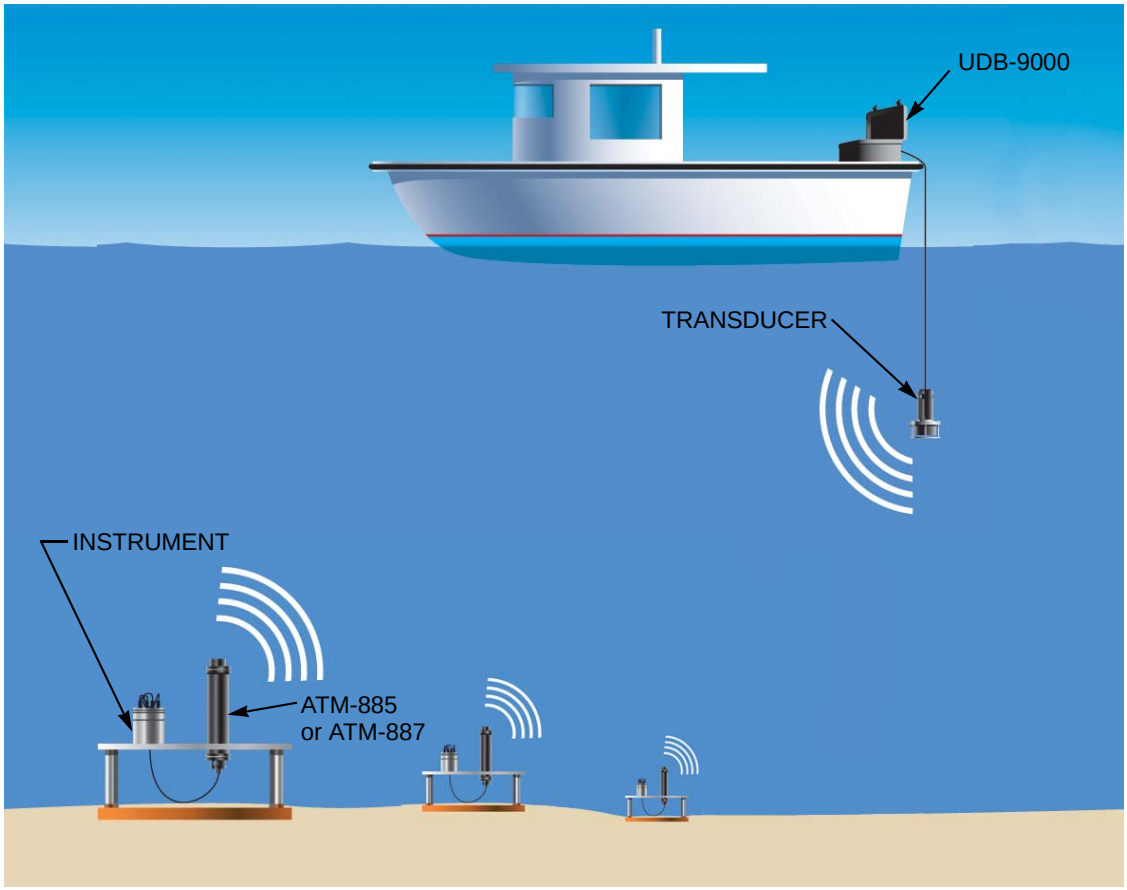


Figure 1-4 Periodic Acquisition of Stored Data

AUV Command and Control

AUVs can only be controlled by an acoustic link. The ATM-88X and UDB-9000 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-9000 Universal Deck Box connected to a host processor is used in the surface station, and an ATM-885PCB Modem Board Set is used aboard the AUV.

In a similar command and control application in the offshore oil and gas industry, a UDB-9000 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.

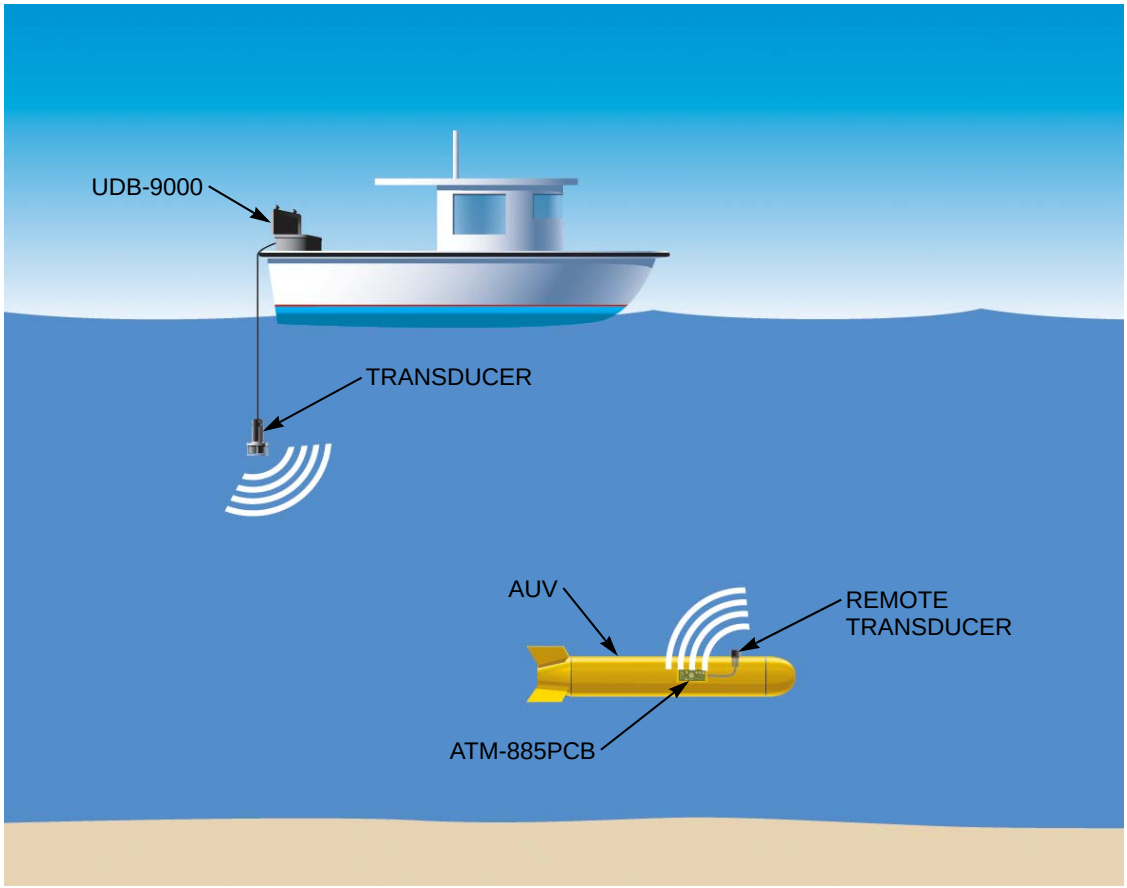


Figure 1-5 Command and Control of an AUV

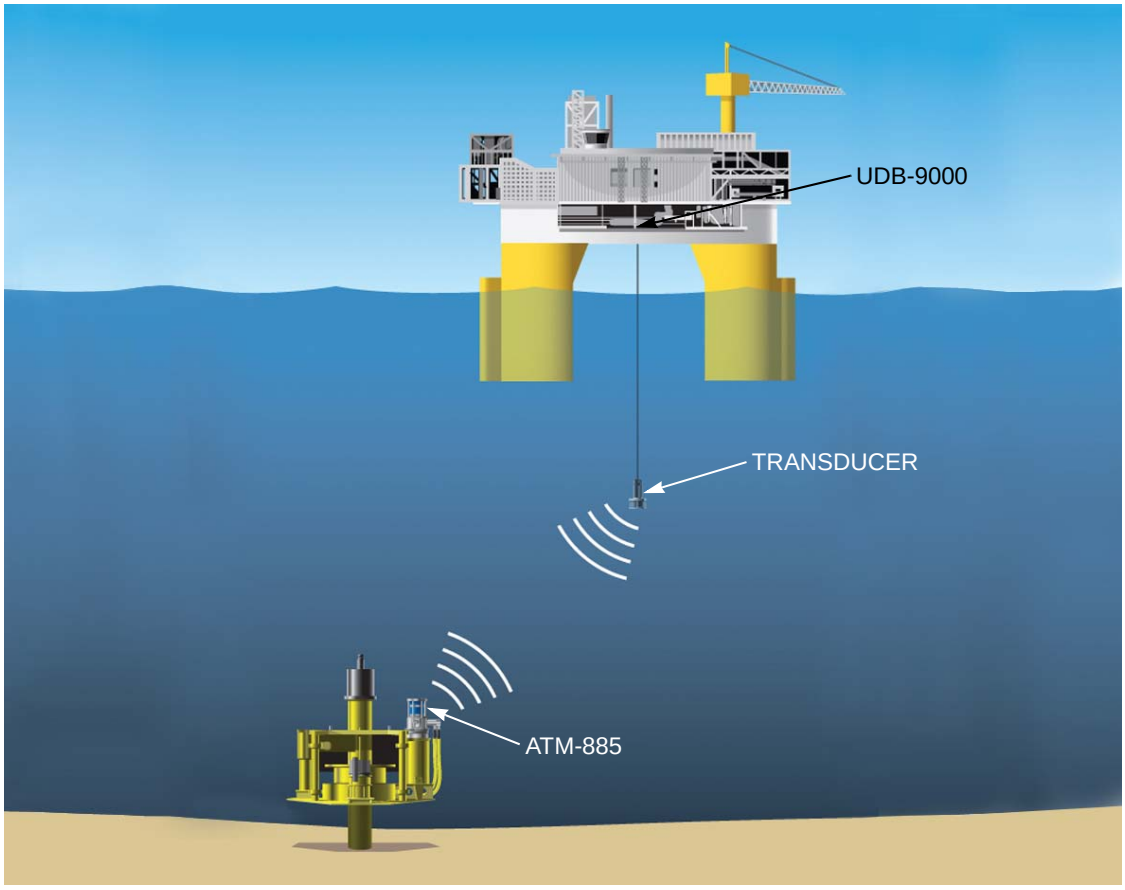


Figure 1-6 Wellhead Command and Control and Data Acquisition

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-88X and UDB-9000 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. 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-88X and UDB-9000 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 thee methods provided for increasing reliability. The the ATM-88X and UDB-9000 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-88X and UDB-9000 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-9000 Series Acoustic Telemetry Modems and consist of the following configurations:

UDB-9000 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-9000 Universal Deck Box

The UDB-9000 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-9000 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.

UDB-9000 (PORTABLE)

UDB-9000 (RACK MOUNT)

Figure 1-7 The UDB-9000 Universal Deck Box—Portable and Rack Mount Configurations

NOTE For detailed information on the Teledyne Benthos UDB-9000 Universal Deck Box, refer to its user's manual.

ATM-980 and ATM-980RF Buoy Boxes

Figure 1-8 The ATM-980RF Buoy Box

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-886 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-886 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.

Subsea Modems

The subsea modems are ATM-88X Series Acoustic Telemetry Modems and consist of the following configurations:

ATM-885 Acoustic Telemetry Modem. Includes a built-in omnidirectional or directional transducer and operates to a depth of 2000 m (6560 ft).

ATM-885R Acoustic Telemetry Modem. Connects to a remote omnidirectional or directional transducer and operates to a depth of 2000 m (6560 ft).

ATM-887 Acoustic Telemetry Modem. Includes a built-in directional transducer and operates to a depth of 6000 m (19,680 ft).

ATM-887R Acoustic Telemetry Modem. Connects to a remote omnidirectional or directional transducer and operates to a depth of 6000 m (19,680 ft).

ATM-886 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-886 Deep 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-885 and ATM-885R Acoustic Telemetry Modems

Figure 1-9 The ATM-885 Acoustic Telemetry Modem

The ATM-885 Acoustic Telemetry Modem is shown in Figure 1-9. The ATM-885 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-885R is similar to the ATM-885 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.

ATM-887 and ATM-887R Acoustic Telemetry Modems

Figure 1-10 The ATM-887 Acoustic Telemetry Modem

The ATM-887 Acoustic Telemetry Modem is shown in Figure 1-10. The ATM-887 is completely self contained and includes a modem battery pack and a built-in omnidirectional or directional transducer. The ATM-887 modem functions the same as all the other modems. However, the housing, which is constructed of thick-walled hard coat anodized and painted aluminum, is designed for deployment to full ocean depth. The ATM-887R is similar to the

ATM-887 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.

ATM-886 Acoustic Telemetry Modem

The ATM-886 Acoustic Telemetry Modem, which is shown in Figure 1-11, 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-886 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 1-11 The ATM-886 Acoustic Telemetry Modem

ATM-886 Deep Acoustic Telemetry Modem

The ATM-886 Deep 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-886 Deep 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-886 Deep 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

Figure 1-13 The SR-50 SMART Release

The SR-50 SMART Release is shown in Figure 1-13. 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-88X 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.

SR-100 SMART Release

Figure 1-14 The SR-100 SMART Release

The SR-100 SMART Release is shown in Figure 1-14. 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-88X 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.

SM-75 SMART Modem

Figure 1-15 The SR-75 SMART Modem

The SM-75 SMART Modem is shown in Figure 1-15. 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-88X 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.

ATM-885PCB Modem Board Set

The ATM-885PCB Modem Board Set is shown in Figure 1-16. The ATM-885PCB 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.

Figure 1-16 The ATM-885PCB Modem Board Set

Compact Modems

The Teledyne Benthos Compact Modems are similar to the ATM-88X 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-88X 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

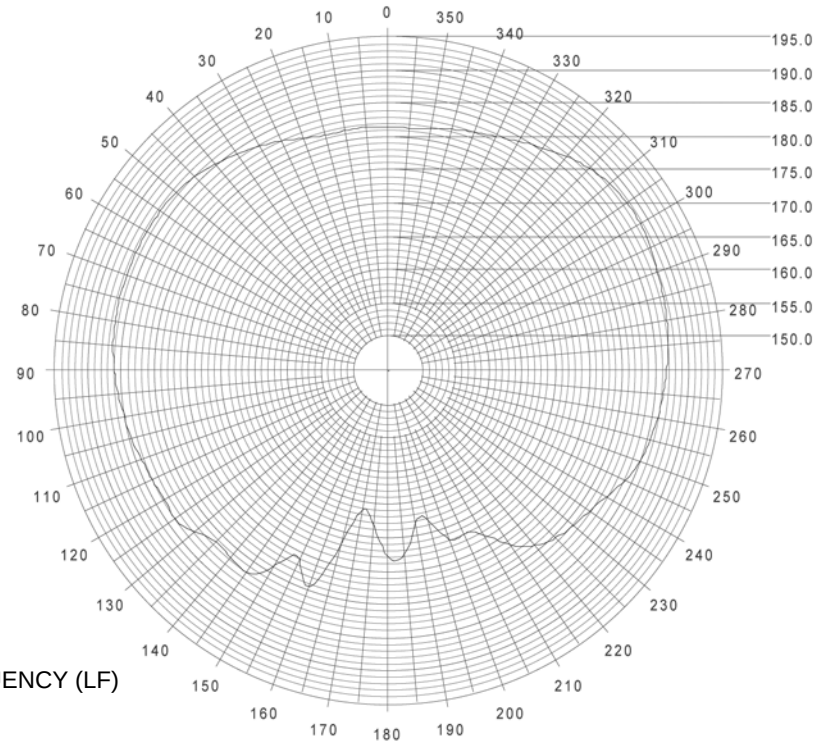
The remote omnidirectional transducer is available in two frequency bands: 9–14 kHz (LF) and 16–21 kHz (MF). The omnidirectional transducer provides toroidal transmit and receive beam patterns. It is best used in both deep and shallow water applications where the direction of the receiving transducer 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 1-17.

Remote Directional Transducer

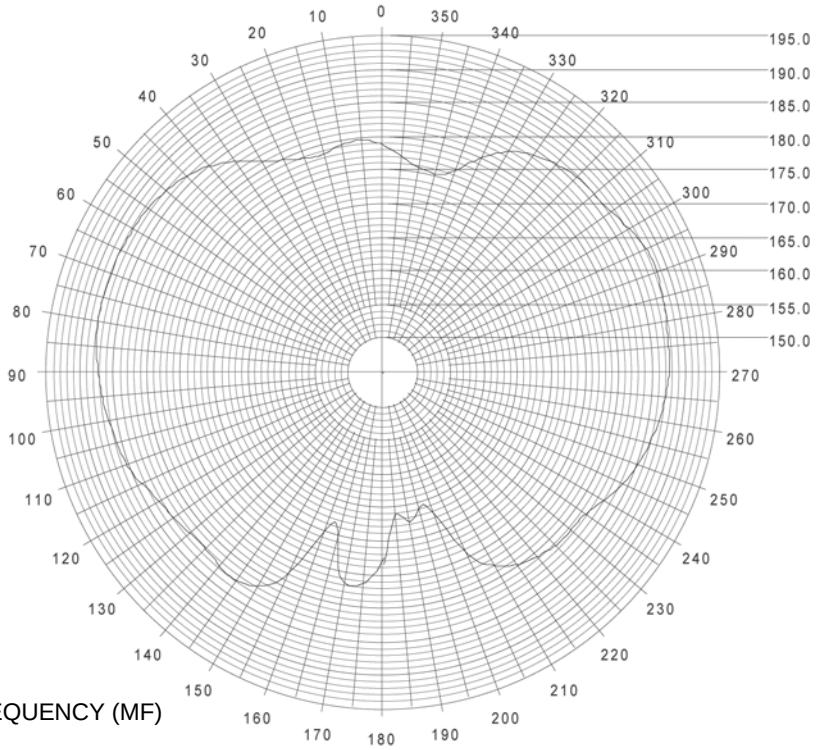
The remote directional transducer is available in two frequency bands: 9–14 kHz (LF) and 16–21 kHz (MF). Whenever possible, the remote directional transducer should be used, as it provides conical transmit and receive beam patterns. And because the energy is focused into a narrow beam, it provides a 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 1-18 on page 1-21.

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. Acoustic baffles are available for all the remote transducers. Refer to "Customer Service" on page vi for information on how to contact Teledyne Benthos for detailed specifications.

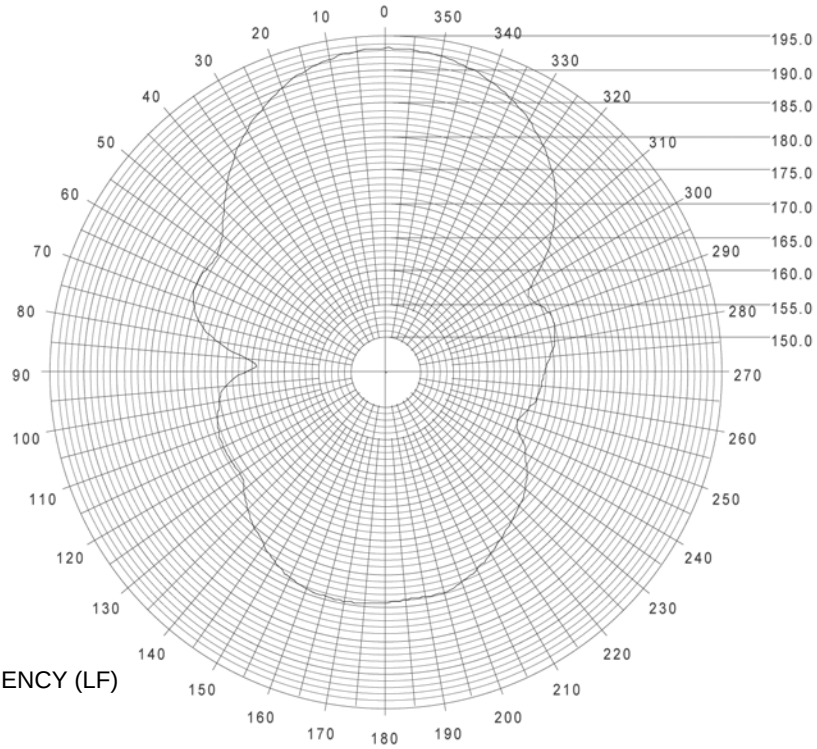


LOW FREQUENCY (LF)

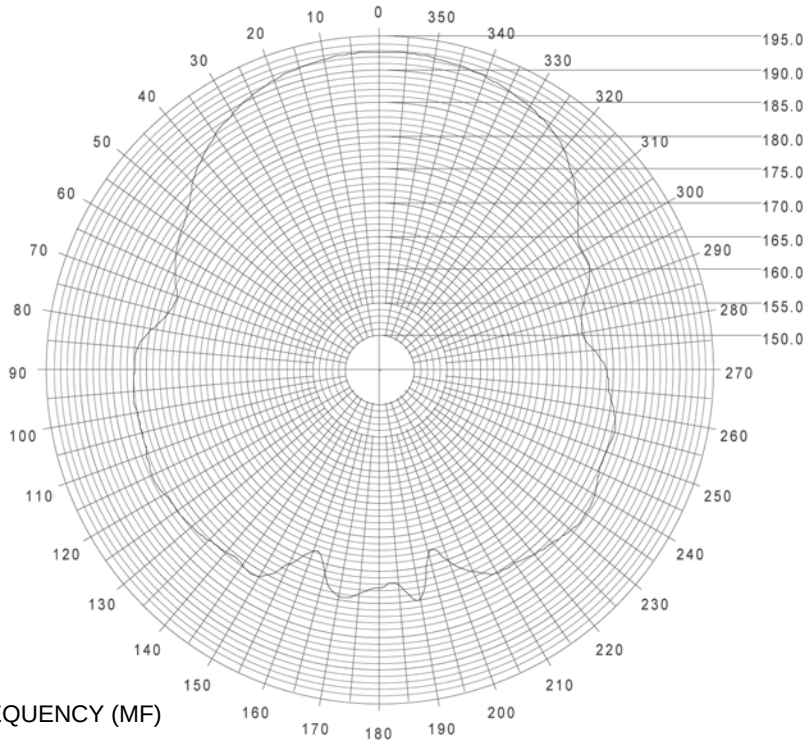


MEDIUM FREQUENCY (MF)

Figure 1-17 Remote Omnidirectional Transducer, LF and MF Vertical Beam Patterns



LOW FREQUENCY (LF)



MEDIUM FREQUENCY (MF)

Figure 1-18 Remote Directional Transducer, LF and MF Vertical Beam Patterns

2 Specifications

This section provides the specifications for the Teledyne Benthos ATM-88X and UDB-9000 Series Acoustic Telemetry Modems, including the remote transducers and the modem battery packs. All specifications are subject to change without notice.

General

Except as noted below, the general specifications apply to all of the ATM-88X and UDB-9000 Series Acoustic Telemetry Modems.

Frequency band:	9–14 kHz (LF) or 16–21 kHz (MF)
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 (for firmware Version 6.9.4 and later)
Processing features:	Data redundancy 1/2 rate convolutional coding Multipath guard period

NOTE The operating and nonoperating temperatures listed below are for the subsea modems only. For the UDB-9000 operating and nonoperating temperatures, refer to "Environmental" on page 2-2.

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 9600, 4800, 2400, or 1200 baud
Flow control:	RS-232—hardware RTS/CTS handshaking or software XON/XOFF RS-422—software XON/XOFF handshaking

UDB-9000 Universal Deck Box

The UDB-9000 Universal Deck Box is used to communicate with the subsea modems or another deck box. In addition, a host processor can be connected to the deck box through an RS-232/422 serial interface.

Physical Characteristics

Case construction:	ABS, injected molded
Case type:	Splashproof with cover open; waterproof to 1 m of water depth with cover closed and latched
Dimensions:	44.4 cm (17.5 in.) wide by 29.8 cm (11.75 in.) deep by 17.8 cm (7.0 in.) high
Weight:	10.9 kg (24) lb; comprises deck box (Case 1)
	10.9 kg (24) lb; comprises transducer, 25-m transducer cable and AC power cable (Case 2)

Environmental

Temperature, operating:	-10°C to 60°C (14°F to 140°F)
Temperature, nonoperating:	-20°C to 70°C (-4°F to 158°F)
Relative humidity, operating:	10–60% noncondensing
Relative humidity, nonoperating:	100% for 72 hours w/temperature caused condensation; dry for operation
Shock, operating:	3 G for 11, ±1 ms in all 3 axis
Shock, nonoperating:	3 G for 11, ±1 ms in all 3 axis
Vibration, operating:	4–15 Hz @ 0.030, ±0.006 in. single amplitude
Vibration, nonoperating:	4–15 Hz @ 0.030, ±0.006 in. single amplitude

Power Requirements

AC input power:	85–264 VAC, 47–63 Hz, 50 watts typical
DC input power:	10–30 VDC; minimum 12 VDC required to charge the batteries
Batteries:	2 internal rechargeable 12 V, 5 A·h batteries
AC power cable length:	1.8 m (6 ft)
AUX cable length:	0.9 m (3 ft); cable is optional

Input/Output

Operator functions:	Power switch Touch screen display
Displays and indicators:	Touch screen display Speaker
External connections:	Power Transducer Auxiliary COM1 serial port COM2 serial port

Transducers

LF omnidirectional:	Frequency band: 9–14 kHz Source level: 185 dB re 1 μPa @ 1 m typ Beam pattern: toroidal ±40° @ 12 khz typ
MF omnidirectional:	Frequency band: 16–21 kHz Source level: 183 dB re 1 μPa @ 1 m typ Beam pattern: toroidal ±40° @ 18 khz typ
MF directional:	Frequency band: 16–21 kHz Source level: 190 dB re 1 μPa @ 1 m typ Beam pattern: conical ±30° @ 18 khz typ
Transducer cable length:	25 m (82 ft) standard; 50 m (164 ft), 75 m (246 ft), 100 m (328 ft), or 200 m (656 ft) optional

Preamp gain:	30 dB
Housing construction:	Delrin
Guard construction:	316 stainless steel
Dimensions:	14.0 cm (5.5 in.) diameter by 26.4 cm (10.4 in.) long
Weight in air:	5.0 kg (11.0 lb)
Operating depth:	300 m (984 ft)

ATM-885 Subsea Modem

The ATM-885 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 either on its battery pack or on external DC power.

Physical Characteristics

Housing construction:	Hard coat anodized aluminum
Dimensions:	14.0 cm (5.5 in.) diameter by 86.1 cm (33.9 in.) long (w/MF dir), or by 76.5 cm (30.1 in.) long (w/LF or MF omni)
Mounting:	316 stainless steel sidebar
Weight in air:	11 kg (24 lb)
Weight in water:	5 kg (11 lb)
Operating depth:	2000 m (6560 ft)

Power Requirements

External DC input power:	12–36 VDC

Average transmit power @ 21 VDC:	20 watts at power level 08 14 watts at power level 07 10 watts at power level 06 7 watts at power level 05 5 watts at power level 04 3.5 watts at power level 03 2.5 watts at power level 02 >2 watts at power level 01 (depending on transducer)
Peak transmit current:	3 A, 50 ms @ 21 VDC
Receive active power:	756 mw max @ 24VDC
Lowpower state power:	16.8 mw max @ 24 VDC

Input/Output

Operator controls:	Plunger type on/off switch
Power:	External DC power input
Signal:	RS-232/422 serial interface (data)
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.
POWER/SERIAL connector:	MBH-9-MP

Transducers

LF omnidirectional:	Frequency band: 9–14 kHz Source level: 185 dB re 1 μPa @ 1 m typ Beam pattern: toroidal ±40° @ 12 khz typ
MF omnidirectional:	Frequency band: 16–21 kHz Source level: 183 dB re 1 μPa @ 1 m typ Beam pattern: toroidal ±40° @ 18 khz typ
MF directional:	Frequency band: 16–21 kHz Source level: 190 dB re 1 μPa @ 1 m typ Beam pattern: conical ±30° @ 18 khz typ

ATM-885R Subsea Modem

The ATM-885R 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 either on its battery pack or on external DC power.

Physical Characteristics

Housing construction: Hard coat anodized aluminum

Dimensions: 8.9 cm (3.5 in.) diameter by 77.2 cm (30.4 in.) long

Mounting: 316 stainless steel sidebar

Weight in air: 11 kg (24 lb)

Weight in water: 5 kg (11 lb)

Operating depth: 2000 m (6560 ft)

Power Requirements

External DC input power: 12–36 VDC

Average transmit power @ 21 VDC:
20 watts at power level 08
14 watts at power level 07
10 watts at power level 06
7 watts at power level 05
5 watts at power level 04
3.5 watts at power level 03
2.5 watts at power level 02
>2 watts at power level 01 (depending on transducer)

Peak transmit current: 3 A, 50 ms @ 21 VDC

Receive active power: 756 mw max @ 24VDC

Lowpower state power: 16.8 mw max @ 24 VDC

Input/Output

Operator controls:	Plunger type on/off switch
Power:	External DC power input
Signal:	RS-232/422 serial interface (data) Transducer
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.
POWER/SERIAL connector:	MBH-9-MP
TRANSDUCER connector:	MCBH3F

Transducers

LF omnidirectional:	Frequency band: 9–14 kHz Source level: 185 dB re 1 μPa @ 1 m typ Beam pattern: toroidal ±40° @ 12 khz typ
LF directional:	Frequency band: 9–14 kHz Source level: 190 dB re 1 μPa @ 1 m typ Beam pattern: conical ±20° @ 12 khz typ
MF omnidirectional:	Frequency band: 16–21 kHz Source level: 183 dB re 1 μPa @ 1 m typ Beam pattern: toroidal ±40° @ 18 khz typ
MF directional:	Frequency band: 16–21 kHz Source level: 190 dB re 1 μPa @ 1 m typ Beam pattern: conical ±30° @ 18 khz typ

ATM-887 Subsea Modem

The ATM-887 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 either on its battery pack or on external DC power.

Physical Characteristics

Housing construction:	Hard coat anodized aluminum
Dimensions:	12.7 cm (5.0 in.) diameter by 76.7 cm (30.2 in.) long (w/MF dir), or by 73.7 cm (29.0 in.) long (w/ LF and MF omni)
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 Requirements

External DC input power:	12–36 VDC
Average transmit power @ 21 VDC:	20 watts at power level 08 14 watts at power level 07 10 watts at power level 06 7 watts at power level 05 5 watts at power level 04 3.5 watts at power level 03 2.5 watts at power level 02 >2 watts at power level 01 (depending on transducer)
Peak transmit current:	3 A, 50 ms @ 21 VDC
Receive active power:	756 mw max @ 24VDC
Lowpower state power:	16.8 mw max @ 24 VDC

Input/Output

Operator controls:	Plunger type on/off switch
Power:	External DC power input
Signal:	RS-232 serial interface (data)

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.

POWER/SERIAL Connector: MBH-9-MP

Transducers

LF omnidirectional:
Frequency band: 9–14 kHz
Source level: 185 dB re 1 μPa @ 1 m typ
Beam pattern: toroidal ±40° @ 12 khz typ

MF omnidirectional:
Frequency band: 16–21 kHz
Source level: 183 dB re 1 μPa @ 1 m typ
Beam pattern: toroidal ±40° @ 18 khz typ

MF directional:
Frequency band: 16–21 kHz
Source level: 190 dB re 1 μPa @ 1 m typ
Beam pattern: conical ±30° @ 18 khz typ

ATM-887R Subsea Modem

The ATM-885R 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 either on its battery pack or on external DC power.

Physical Characteristics

Housing construction: Hard coat anodized aluminum

Dimensions: 12.7 cm (5.0 in.) diameter by
73.7 cm (29.0 in.) long

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 Requirements

External DC input power:	12–36 VDC
Average transmit power @ 21 VDC:	20 watts at power level 08 14 watts at power level 07 10 watts at power level 06 7 watts at power level 05 5 watts at power level 04 3.5 watts at power level 03 2.5 watts at power level 02 >2 watts at power level 01 (depending on transducer)
Peak transmit current:	3 A, 50 ms @ 21 VDC
Receive active power:	756 mw max @ 24VDC
Lowpower state power:	16.8 mw max @ 24 VDC

Input/Output

Operator controls:	Plunger type on/off switch
Power:	DC power input
Signal:	RS-232 serial interface (data)
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.
POWER/SERIAL connector:	MBH-9-MP
TRANSDUCER connector:	MCBH3F

Transducers

LF omnidirectional:
Frequency band: 9–14 kHz
Source level: 185 dB re 1 μPa @ 1 m typ
Beam pattern: toroidal ±40° @ 12 khz typ

LF directional:
Frequency band: 9–14 kHz
Source level: 190 dB re 1 μPa @ 1 m typ
Beam pattern: conical ±20° @ 12 khz typ

MF omnidirectional:
Frequency band: 16–21 kHz
Source level: 183 dB re 1 μPa @ 1 m typ
Beam pattern: toroidal ±40° @ 18 khz typ

MF directional:
Frequency band: 16–21 kHz
Source level: 190 dB re 1 μPa @ 1 m typ
Beam pattern: conical ±30° @ 18 khz typ

ATM-886 Subsea Modem

The ATM-886 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.

Physical Characteristics

Housing construction: Hard coat anodized aluminum

Dimensions:
14.0 cm (5.5 in.) diameter by
44.2 cm (17.4 in.) long (w/MF dir), or by
36.6 cm (14.4 in.) long (w/LF and MF omni)

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 Requirements

External DC input power: 12–36 VDC

Average transmit power @ 21 VDC:

20 watts at power level 08
14 watts at power level 07
10 watts at power level 06
7 watts at power level 05
5 watts at power level 04
3.5 watts at power level 03
2.5 watts at power level 02
>2 watts at power level 01 (depending on transducer)

Peak transmit current: 3 A, 50 ms @ 21 VDC

Receive active power: 756 mw max @ 24VDC

Lowpower state power: 16.8 mw max @ 24 VDC

Input/Output

Power: External DC power input

Signal: RS-232/422 serial interface (data)

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.

POWER/SERIAL Connector: MBH-9-MP

Transducers

LF omnidirectional:
Frequency band: 9–14 kHz
Source level: 185 dB re 1 μPa @ 1 m typ
Beam pattern: toroidal ±40° @ 12 khz typ

MF omnidirectional:
Frequency band: 16–21 kHz
Source level: 183 dB re 1 μPa @ 1 m typ
Beam pattern: toroidal ±40° @ 18 khz typ

MF directional:
Frequency band: 16–21 kHz
Source level: 190 dB re 1 μPa @ 1 m typ
Beam pattern: conical ±30° @ 18 khz typ

ATM-886 Deep Subsea Modem

The ATM-886 Deep 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.

Physical Characteristics

Housing construction:	Hard coat anodized aluminum
Dimensions:	12.7 cm (5.0 in.) diameter by 36.8 cm (14.5 in.) long (LF omni) 12.7 cm (5.0 in.) diameter by 36.8 cm (14.2 in.) long (MF omni) 12.7 cm (5.0 in.) diameter by 45.0 cm (17.7 in.) long (MF dir)
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 Requirements

External DC input power:	12–36 VDC
Average transmit power @ 21 VDC:	20 watts at power level 08 14 watts at power level 07 10 watts at power level 06 7 watts at power level 05 5 watts at power level 04 3.5 watts at power level 03 2.5 watts at power level 02 >2 watts at power level 01 (depending on transducer)

Peak transmit current: 3 A, 50 ms @ 21 VDC

Receive active power: 756 mw max @ 24VDC

Lowpower state power: 16.8 mw max @ 24 VDC

Input/Output

Power: External DC power input

Signal: RS-232/422 serial interface (data)

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.

POWER/SERIAL Connector: MBH-9-MP

Transducers

LF omnidirectional:
Frequency band: 9–14 kHz
Source level: 185 dB re 1 μPa @ 1 m typ
Beam pattern: toroidal ±40° @ 12 khz typ

MF omnidirectional:
Frequency band: 16–21 kHz
Source level: 183 dB re 1 μPa @ 1 m typ
Beam pattern: toroidal ±40° @ 18 khz typ

MF directional:
Frequency band: 16–21 kHz
Source level: 190 dB re 1 μPa @ 1 m typ
Beam pattern: conical ±30° @ 18 khz typ

ATM-885PCB Modem Board Set

The ATM-885PCB 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.

Physical Characteristics

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)

Power Requirements

External DC input power:	12–36 VDC
Average transmit power @ 21 VDC:	20 watts at power level 08 14 watts at power level 07 10 watts at power level 06 7 watts at power level 05 5 watts at power level 04 3.5 watts at power level 03 2.5 watts at power level 02 >2 watts at power level 01 (depending on transducer)
Peak transmit current:	3 A, 50 ms @ 21 VDC
Receive active power:	756 mw max @ 24VDC
Lowpower state power:	16.8 mw max @ 24 VDC

Input/Output

Power:	External DC power input
Signal:	RS-232/422 serial interface (data) Transducer
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.

Transducers

LF omnidirectional:	Frequency band: 9–14 kHz Source level: 185 dB re 1 μPa @ 1 m typ Beam pattern: toroidal ±40° @ 12 khz typ

LF directional:
Frequency band: 9–14 kHz
Source level: 190 dB re 1 μPa @ 1 m typ
Beam pattern: conical ±20° @ 12 khz typ

MF omnidirectional:
Frequency band: 16–21 kHz
Source level: 183 dB re 1 μPa @ 1 m typ
Beam pattern: toroidal ±40° @ 18 khz typ

MF directional:
Frequency band: 16–21 kHz
Source level: 190 dB re 1 μPa @ 1 m typ
Beam pattern: conical ±30° @ 18 khz typ

Remote Omnidirectional Transducer

The remote omnidirectional transducer is used with the ATM-885R Acoustic Telemetry Modem or the ATM-885PCB 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 μPa @ 1 m typ
Beam pattern: toroidal ±40° @ 12 khz typ

Medium frequency (MF):
Frequency band: 16–21 kHz
Source level: 183 dB re 1 μPa @ 1 m typ
Beam pattern: toroidal ±40° @ 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-885R Acoustic Telemetry Modem or the ATM-885PCB 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 μPa @ 1 m typ Beam pattern: conical ±20° @ 12 khz typ
Medium frequency (MF):	Frequency band: 16–21 kHz Source level: 190 dB re 1 μPa @ 1 m typ Beam pattern: conical ±30° @ 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)

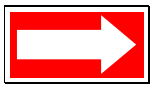
Modem Battery Pack Capacities

Two modem battery packs are available. One is specifically used for the ATM-885 and ATM-885R Acoustic Telemetry Modems, and the other for the ATM-887 and ATM-887R Acoustic Telemetry Modems. They differ only in their size and watt-hour capacity. Both packs use alkaline batteries.

Modem Battery Pack Capacity for ATM-885/885R 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)



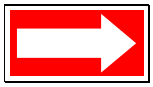
NOTE Stated capacities are at an ambient temperature of 21°C. When operating at 0°C, the battery capacity needs to be derated by 25%.

Modem Battery Pack Capacity for ATM-887/887R Acoustic Telemetry Modems

The battery packs for the ATM-887 and the ATM-887R 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-88X 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-885R, an ATM-887R, or an ATM-885PCB 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 1-18 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 1-17 on page 1-20. 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 1-18 on page 1-21. 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

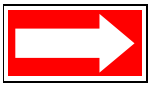
In the lowpower state, where the modem is switched on but is inactive, a very small amount of power, a maximum of 16.8 mw, is drawn from the modem battery pack. Therefore, the battery pack can provide power in the lowpower state for over 2 years. However, when the DSP and the receiver are active, hence 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 08, 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-885 or ATM-885R, or 450 watt-hours for an ATM-887 or ATM-887R 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-885R 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 08. Since at this power level the transmitter power is 20 watts, the capacity requirement of the modem battery pack is:

$$\text{Watt-hours} = (3 \text{ Mbytes})[(20 \text{ watts}/(1200 \text{ bits/sec} \times 450)]$$

$$= 11 \text{ watt-hours}$$

Referring to "Modem Battery Pack Capacities" on page 2-17, it can be seen that a modem battery pack for an ATM-885, an ATM-885R, an ATM-887, and an ATM-887R 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-885 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 08)

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.

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

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.

$$\text{Packet transmit time} = 6.72 + 0.8 + 0.4$$
$$= 7.92 \text{ seconds}$$

Calculate the number of packets transmitted per day.

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

Then calculate the number of hours transmitting per day.

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

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

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

Calculate the time spent in the lowpower state per day.

Lowpower state time/day = 24 hours/day - 0.106 hours/day
= 23.89 hours/day

Calculate the power per day consumed in the lowpower state.

Lowpower state power/day = 23.89 hours * 16.8 mw * 1 watt/1000 mw
= 0.4 watt-hours/day

Calculate the total power consumed per day.

Total power/day = 0.4 + 2.12
= 2.52 watt-hours/day

Since the modem is transmitting at power level 08, 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

Deployment days = (187.5 watt-hours)/(2.52 watt-hours/day)
= 74 days

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 07 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 07 is

Additional days at level 07 = (37.5 watt-hours)/(1.88 watt-hours/day)
= 20 days

Alternatively, if the modem is at power level 07 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 07 consumes 1.88 watt-hours/ day.

Deployment days at level 07 = (225.0 watt-hours)/(1.88 watt-hours/day)

= 119 days

Modem Operating Depth

The rated operating depth of an ATM-885, an ATM-885R and an ATM-886 Acoustic Telemetry Modem is 2000 meters. For an ATM-887 and an ATM-887R Acoustic Telemetry Modem, and for a remote transducer, the rated operating depth is 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-88X or UDB-9000 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-88X and UDB-9000 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. Acoustic baffles are available for all the remote transducers. Refer to "Customer Service" on page vi for information on how to contact 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-88X and UDB-9000 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-9000 Transducer Deployment

The transducer supplied with the UDB-9000 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

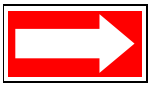
When mounting a subsea modem, it is very important to configure the mounting arrangement such that corrosion of the modem housing is prevented or minimized. It is best to avoid mounting the modem housing or sidebar directly to a metallic surface. Instead, it is best to use a mounting system made from 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 8-7 for instructions on how to clean or replace an O-ring.

4 Setup and Test

This section provides instructions on how to unpack, set up and verify operation of the Teledyne Benthos ATM-88X and UDB-9000 Series Acoustic Telemetry Modems. In addition, some simple startup procedures are provided that will help to quickly verify that the modems are operating properly and that commands and data are reliably transmitted and received.



NOTE For instructions on how to set up and test 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-9000 Components

The UDB-9000 Universal Deck Box includes the following components:

- UDB-9000 Universal Deck Box with internal batteries
- Transducer
- Transducer cable
- Accessories case
- AC power cable
- UDB-9000 Universal Deck Box User's Manual

ATM-885 Components

The ATM-885 Acoustic Telemetry Modem includes the following components:

- ATM-885 Acoustic Telemetry Modem with internal alkaline battery pack and steel mounting sidebar
- MIL-9-FS to DB9 RS-232/DC power pigtail
- MDC-9-FS dummy connector
- Acoustic Telemetry Modems User's Manual

ATM-885R Components

The ATM-885R Acoustic Telemetry Modem includes the following components:

- ATM-885R Acoustic Telemetry Modem with internal alkaline battery pack and steel mounting sidebar
- MCIL3M to MCIL3F transducer cable
- Remote transducer
- MIL-9-FS to DB9 RS-232/DC power pigtail
- MDC-9-FS dummy connector
- MCDC3M dummy connector
- Acoustic Telemetry Modems User's Manual

ATM-885PCB Components

The ATM-885PCB Board Set includes the following components:

- ATM-885PCB Board Set
- Remote transducer
- 2-conductor shielded internal transducer cable
- MCIL3F with 2 meters of underwater cable transducer pigtail
- ATM-885 OEM PCB to DB9 RS-232 cable
- ATM-885 OEM PCB to DC power cable
- Acoustic Telemetry Modems User's Manual

ATM-887 Components

The ATM-887 Acoustic Telemetry Modem includes the following components:

- ATM-887 Acoustic Telemetry Modem with two internal alkaline battery packs and stainless steel mounting sidebar
- MIL-9-FS to DB9 RS-232/DC power pigtail
- MDC-9-FS dummy connector
- Acoustic Telemetry Modems User's Manual

ATM-887R Components

The ATM-887R Acoustic Telemetry Modem includes the following components:

- ATM-887R Acoustic Telemetry Modem with two internal alkaline battery packs and stainless steel mounting sidebar
- MCIL3M to MCIL3F transducer cable
- Remote transducer
- MIL-9-FS to DB9 RS-232/DC power pigtail
- MDC-9-FS dummy connector
- MCDC3M dummy connector
- Acoustic Telemetry Modems User's Manual

ATM-886 and ATM-886 Deep Components

The ATM-886 and ATM-886 Deep Acoustic Telemetry Modems include the following components:

- ATM-886 or ATM-886 Deep Acoustic Telemetry Modem
- MIL-9-FS to DB9 RS-232/DC power pigtail
- MDC-9-FS dummy connector
- Acoustic Telemetry Modems User's Manual

ATM-980 Components

The ATM-980 Buoy Box includes the following components:

- ATM-980 Buoy Box
- MCIL-4-M DC power pigtail
- MCIL-4-M DC power and RS-232 pigtail
- 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-9000, refer to its user's manual.

UDB-9000 Universal Deck Box Connections

All the connections to the UDB-9000 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-885R and ATM-887R 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.

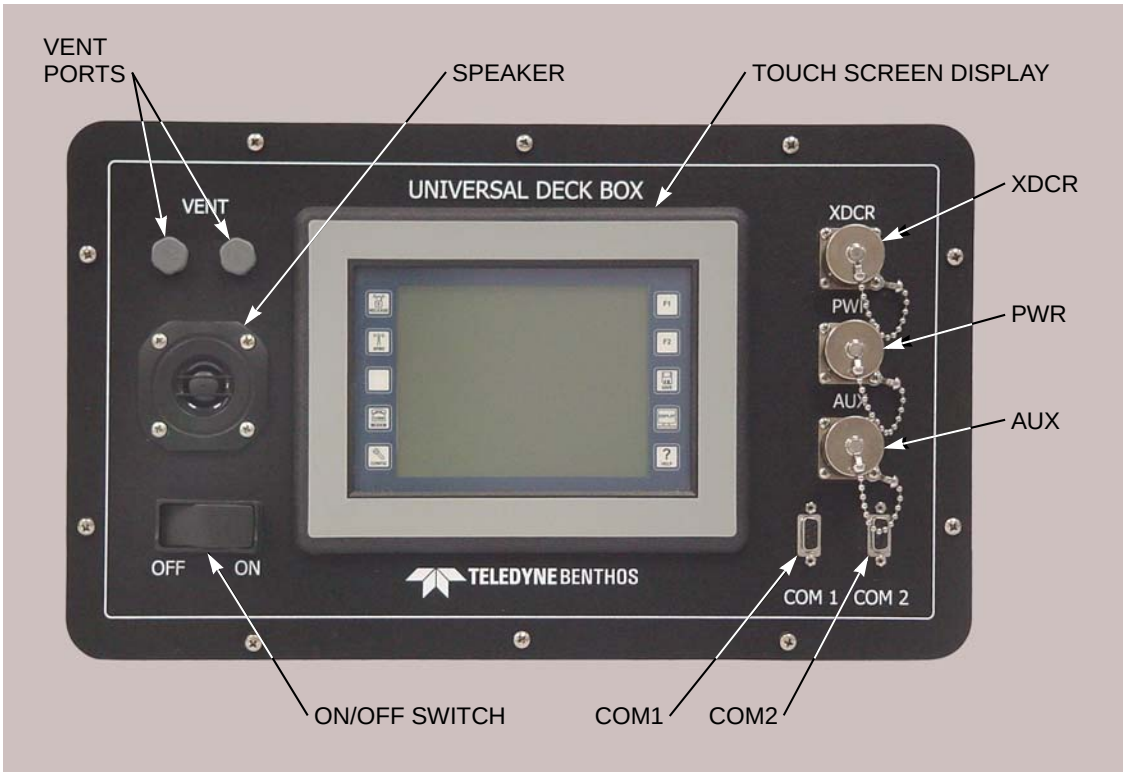


Figure 4-1 UDB-9000 Front Panel Operator Functions and Connectors

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-9000 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-9000 Universal Deck Box Operator Functions

The operator functions for the UDB-9000 Universal Deck Box are shown in Figure 4-1. They include the following:

OFF/ON switch: Rocker switch—turns the UDB-9000 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.

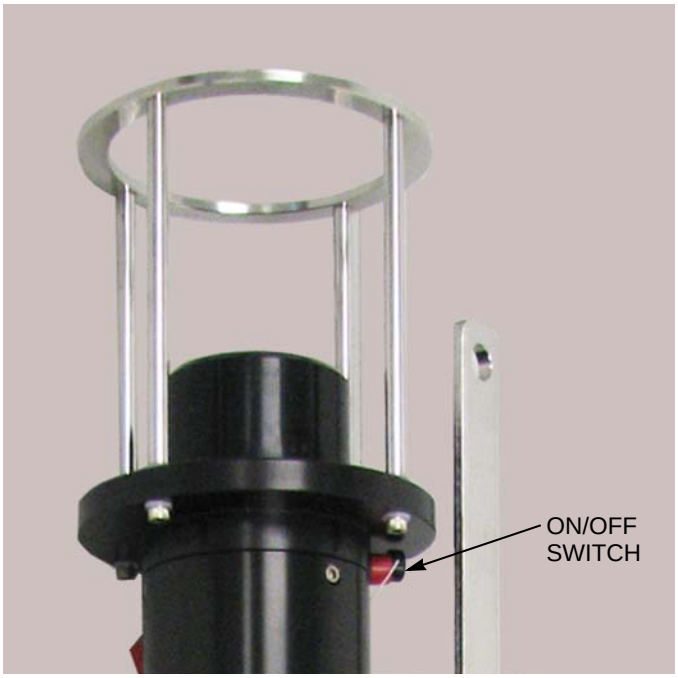


Figure 4-2 Subsea Modem On/Off Switch

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-9000 Universal Deck Box

Setting up the UDB-9000 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.

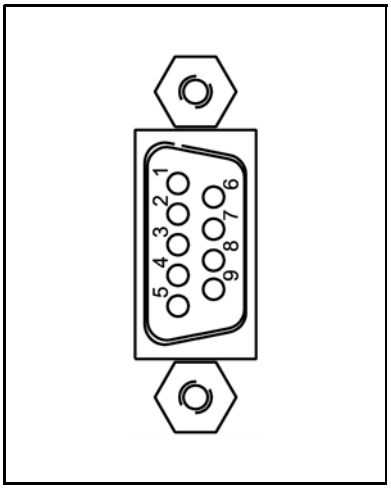


Figure 4-3 UDB-9000 COM1 Connector

Table 4-1 UDB-9000 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	Common 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-9000 Universal Deck Box. Refer to "UDB-9000 Universal Deck Box Connections" on page 4-4 for information on the deck box connectors and their locations.

1. Connect the transducer cable from the XDCR 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 4-7 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-9000 COM1 Connector to DB-9 Pin-to-Pin Connections

UDB-9000 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-885R or ATM-887R Acoustic Telemetry Modem, the transducer connections.

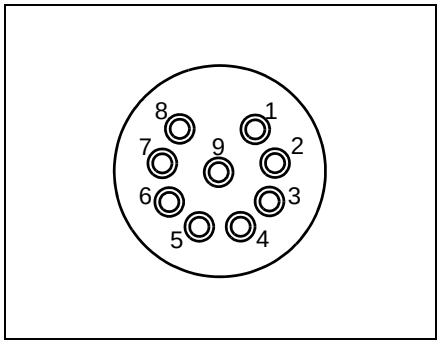


Figure 4-4 Subsea Modem POWER/SERIAL Connector

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 for the POWER/SERIAL connector pin orientation, and to Table 4-3 for the pinout information. The POWER/SERIAL connector is a 9-pin Impulse MBH-9-MP bulkhead connector that requires an Impulse MIL-9-FS mating connector pigtail.

Table 4-3 Subsea Modem POWER/SERIAL Connector Pinouts

PIN	LABEL	FUNCTION	SIGNAL DIRECTION
1	Power	External Power Input (21–28 VDC)	To Modem
2	—	Reserved	—
3	GND	Common Ground	
4	TX(+)	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

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 6-3 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 4-9 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 4-9 and connect the DC power and ground pins to the DC power supply if one is used.

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		
PIN	**LABEL**	**FUNCTION**		**PIN**	**LABEL**	**FUNCTION**
3	GND	Common 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

Transducer Connections. For an ATM-885R or ATM-887R Acoustic Telemetry Modem, connect the supplied transducer cable to the TRANSDUCER connector on the modem and to the bulkhead connector on the remote transducer.

Setting up the ATM-885PCB Board Set

The ATM-885PCB Board Set is 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-885PCB Board Set. When connecting an ATM-885PCB to a PC or to an instrument, power is connected to J3 of the Transmit/Receiver Board, and the serial interface connection 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 for the pinout information. Refer to Table 4-6 on page 4-12 for the power connector J3 pinouts. The locations of the connectors are shown in Drawing B-270-156. The drawing is included in Section 9, "Drawings."

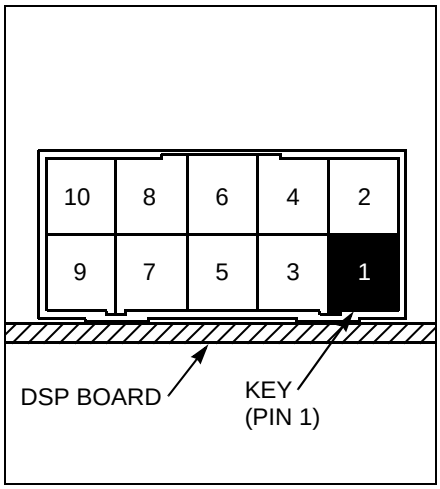


Figure 4-5 ATM-885PCB DSP Board Serial Connector J7

Table 4-5 ATM-885PCB DSP Board Serial Connector J7 Pinouts

PIN	LABEL	FUNCTION	SIGNAL DIRECTION
1	Keyed Pin		
2	No Connection		
3	GND	Common 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

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 6-3 for more information. Refer also to Section 2, "Specifications," for the electrical specifications.

Table 4-6 ATM-885PCB 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-885PCB 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 4-6 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 the ATM-885PCB to an instrument, refer to Table 4-5 on page 4-11 and connect the pins listed to the RS-232 or RS-422 interface of the instrument.

   If connecting the ATM-885PCB to a PC, refer to Table 4-7 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.

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 4-6 on page 4-12 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 4-7 ATM-885PCB DSP Board Serial Connector J7 to DB-9 Pin-to-Pin Connections

ATM-885PCB DSP BOARD SERIAL CONNECTOR J7			SIGNAL DIRECTION	HOST PC DB-9 CONNECTOR		
PIN	LABEL	FUNCTION		PIN	LABEL	FUNCTION
3	GND	Common 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

ATM-885PCB Transducer Connections. The ATM-885PCB includes a remote transducer and a transducer cable. Connect the transducer cable to the transducer and to J1of the Transmitter Board. Table 4-8 shows the pinout information for the connectors on the transducer cable. A wiring diagram for the transducer cable is shown in Figure 4-6. The transducer cable transducer connector is an Impulse MCIL3F connector.

Table 4-8 ATM-885PCB 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**

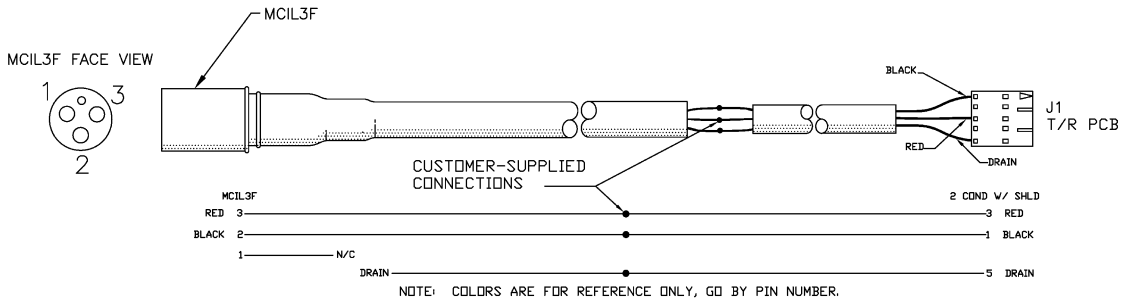


Figure 4-6 ATM-885PCB Transducer Cable Wiring Diagram

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-886 Acoustic Telemetry Modem. For the ATM-980RF Buoy Box only, an RF connector is also included for connection to an RF antenna.

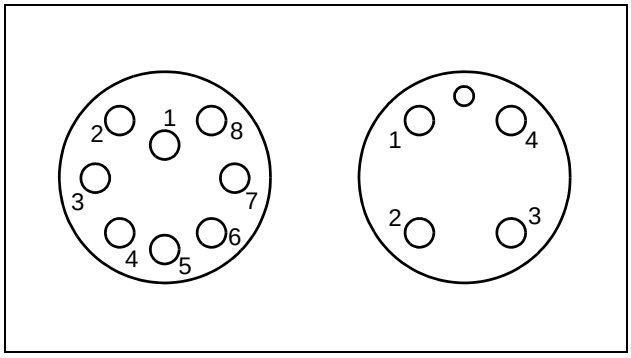


Figure 4-7 8-Pin and 4-Pin Connectors

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 4-7 for the connector pin orientation, and to Table 4-9 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 4-9 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	Common 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 4-7 for the connector pin orientation, and to Table 4-10 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 4-10 ATM-980 8-Pin Connector Pinouts

PIN	LABEL	FUNCTION	SIGNAL DIRECTION
1	Power	External Power Input (24 VDC)	To Modem
2	GND	Common 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 Hyperterminal, which is provided with the Windows operating system; or DumbTerm, which is available from RDI Instruments. 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 4-7, 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

Checking the Modems and Host Processors

Once the modems and host processors are set up, some simple preliminary checks can be made to verify that the modems are operating properly and that all of the connections are correct.

Verifying Operation of the UDB-9000 Universal Deck Box

If a UDB-9000 Universal Deck Box is set up, perform the steps listed below to check its operation.

1. Switch the OFF/ON switch on the front panel of the deck box to ON.

   The opening screen will appear in the touch screen display followed by the welcome screen or the last screen that was open when the deck box was last turned off.

2. Rub the transducer to check the connection between the transducer and the deck box. When rubbing the transducer, sounds should be heard coming from the speaker on the front panel. If the sounds cannot be heard, increase the speaker volume. For instructions on how to adjust the speaker volume, refer to "Adjusting the Speaker Volume" on page 5-8.
3. Switch the OFF/ON switch on the front panel of the deck box to OFF.

Verifying a Modem's Operating Parameters

When a modem is powered up, it will initialize a number of modem operating parameters, such as the serial interface and transmitting acoustic bit rates, the modem address, and other parameters. These operating parameters are stored in S Registers, and they can be changed from the host processor by using modem commands. A changed S Register setting can also be made the new default setting, which is its setting when the modem is powered up. Detailed information on how to enter modem commands is presented in Section 6, "Modem Operating Modes and Commands," and detailed information on the S Registers and how to set them is presented in Section 7, "Modem Operating Parameters (S Registers)."

Perform the steps listed below to verify that the host processor is communicating properly with the modem and the S Registers are initialized.

1. Turn on the PC and run the terminal program.
2. If the UDB-9000 Universal Deck Box is being used as the modem, switch the OFF/ON switch on the front panel to ON. If a subsea modem is being used as the modem, switch on the modem by pushing in the switch on the side of the end cap.

   The banner message followed by the command prompt (>) is displayed. The message includes the frequency band (LF or MF), the firmware version and the command prompt as shown in the following example for a UDB-9000 Universal Deck Box:

   Benthos UDB-9000-M
   LF Frequency Band
   Universal Deck Box modem-enabled version 1.9.8 (4G)
   >

   Similarly, for an ATM-88X Series Acoustic Telemetry Modem, the banner message is as in the following example:

   Benthos ATM-88X 4G
   LF Frequency Band
   Standard Modem Version 6.9.3 (4G)
   >

3. At the command prompt type ATS?, and then press Enter.

   The S Register settings of the modem are displayed as in the following example:

   Local Registers

   S00=069 S01=001 S02=000 S03=001 S04=005 S05=000 S06=008

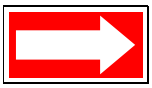
   S07=015 S08=060 S09=000 S10=255 S11=001 S12=000 S13=002

   S14=001 S15=000 S16=000 S17=001 S18=000 S19=000 S20=000

   >

Setting a Modem's Operating Parameters

The S Register settings of the modem can be set whenever the modem is in Command mode, the mode in which the command prompt (>) is displayed. If the modem is not in Command mode, type +++ in rapid succession. The command prompt will be displayed. The Set Register Command (ATSn=n) is used to set an S Register setting, where the first n in the command is the S Register number and the n following the equal character (=) is the desired setting. The Write command (AT&W) can be used to save the S Register settings as the new startup configuration, where the changed settings become the new default settings, which are the settings when the modem is powered up.



NOTE Refer to Section 6, "Modem Operating Modes and Commands," for detailed information on the modem commands and how enter them.

Perform the steps listed below to verify that the S Registers can be set by setting S Register 4 to 07 and making it the default setting for the startup configuration.

1. At the command prompt (>) type ATS4=07, and then press Enter. The command is executed, the modem responds with the message "OK," and the command prompt is again displayed:

   ATS4=07
   >01200 bits/sec
   OK
   >

   This sets the transmitting acoustic bit rate of the modem to 1200 bits/sec.

2. Type AT&W, and then press Enter. The command is executed and the command prompt is once again displayed:

   AT&W
   Sregisters Stored
   >

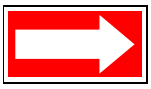
   The setting of S Register 4 is now the default setting. Therefore, whenever the modem is powered up, the S4 setting will be 07.

Checking the Acoustic Link between Two Modems in Air

To check the acoustic link between two modems in air, both modems must be set up with at least one modem connected to a host processor.

Perform the steps listed below to test the acoustic link between two modems.

1. Place the modems or the modem's remote transducers within a foot of each other. Be sure no obstacles are between them.
2. Turn on the PC and run the terminal program.



NOTE If the modems are being checked for the first time, their addresses are both 00. Both modems can have the same address for this test.

3. If the UDB-9000 Universal Deck Box is being used as the modem, switch the OFF/ON switch on the front panel to ON. If a subsea modem is being used as the modem, switch on the modem by pushing in the switch on the side of the end cap.

   The banner message followed by the command prompt (>) is displayed. The message includes the frequency band (LF or MF), the firmware version and the command prompt as shown in the following example for a UDB-9000 Universal Deck Box:

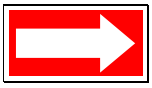
   Benthos UDB-9000-M
   LF Frequency Band
   Universal Deck Box modem-enabled version 1.9.8 (4G)
   >

   Similarly, for an ATM-88X Series Acoustic Telemetry Modem, the banner message is as in the following example:

Benthos ATM-88X 4G
LF Frequency Band
Standard Modem Version 6.9.3 (4G)
>

4. Type AT, and then press Enter.

   The message "OK" and the command prompt are displayed.



NOTE When checking the acoustic link in air, should the link appear not to be working, vary the separation of the transducers. In addition, it may be required to change the transmit power level of the local modem, usually to a lower level. The transmit power level is set by using the Set Register command (ATSn=n) to change the setting of S Register 6. For instructions on how to use the Set Register command, refer to "Set Register ATSn=n" on page 6-51. Refer also to "Transmit Power Level S6" on page 7-11 for information on the available transmit power level settings.

5. Enter the Acoustic Link Test command (ATXn), where n is the address of the modem that will receive the command, and then press Enter.

   The modem transmits a preset test message over the acoustic link, and the following information, which is the received data statistics about the received message, is displayed:

ERR:	Number of bits not matching the test message.
CRC:	Checksum.
MPD:	Multipath delay.
SNR:	Signal-to-noise ratio.
SPD:	Relative speed between the modems.
AGC:	Automatic gain control output.
CCERR:	Number of corrected errors.

   Refer to "Acoustic Link Test ATXn" on page 6-39 for more information on the Acoustic Link Test command and the received data statistics.

6. Type AT$Sn, where n is the address of the modem that will receive the command, and then press Enter.

The modem transmits its S Register settings over the acoustic link, and they are displayed as in the following example:

Remote Registers

S00=069 S01=001 S02=000 S03=002 S04=005 S05=000 S06=008

S07=015 S08=060 S09=000 S10=255 S11=000 S12=000 S13=003

S14=000 S15=000 S16=000 S17=001 S18=001 S19=000 S20=000

>

5 Operation using the Touch Screen Display

This section provides some basic instructions on how to use the touch screen display of the UDB-9000 Universal Deck Box to operate Teledyne Benthos ATM-88X and UDB-9000 Series Acoustic Telemetry Modems, including SMART releases and Compact Modems. Operations include acquiring ranges, sending commands and sending and receiving data. To perform these operations, the deck box must be set up and installed as described in "Setting up the UDB-9000 Universal Deck Box" on page 4-7. For complete operating instructions encompassing all of the deck box features, refer to its user's manual.

Activating the Touch Screen Display

The touch screen display is activated when the UDB-9000 is turned on. To turn on the deck box, switch the OFF/ON switch to ON. The opening screen will appear in the touch screen display as shown in Figure 5-1. In about five seconds, and if this is the first time the deck box has been turned on, it will open a welcome screen. Otherwise it will open to the screen that was open the last time the Save function button was pressed as described "Save and Help Functions" on page 5-4.

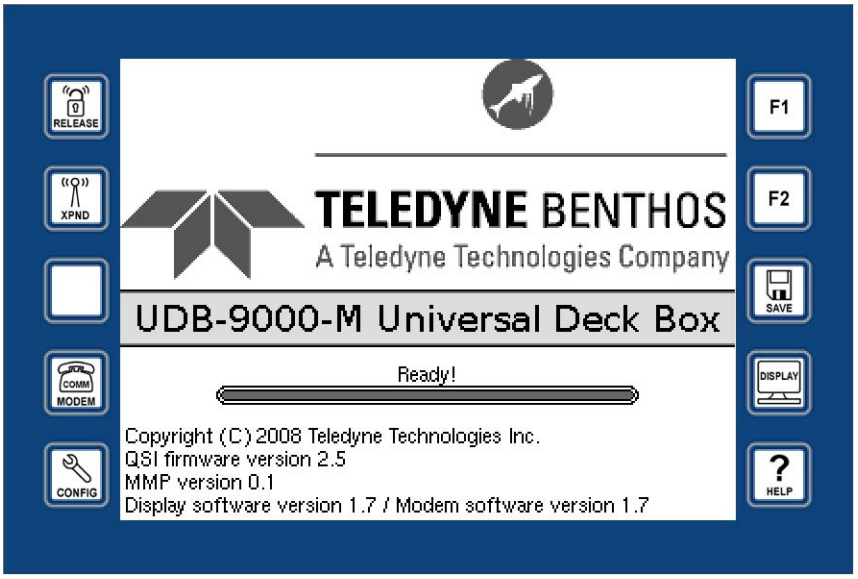


Figure 5-1 Opening Screen

Touch Screen Display Overview

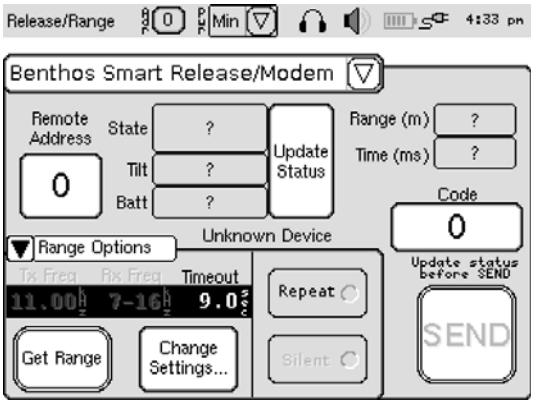
The touch screen display includes ten function buttons which provide access to five main screens and to save and help functions. Seven of the buttons are active. The buttons are located along the left and right edges of the touch screen display, five on each side as shown in Figure 5-1. They are always visible, but depending on the operating state of the UDB-9000, they are at times disabled. The touch screen display also includes a Status and Control bar which is shown in Figure 5-5 on page 5-5. It is located at the top of every screen and, like the function buttons, is always visible

Main Screens

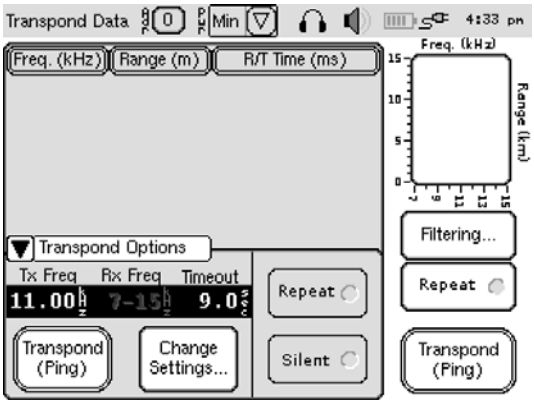
Any one of the five main screens can be accessed at most any time by touching its corresponding function button. Altogether the screens provide access to all of the operational features and displays of the UDB-9000. They are shown in Figure 5-2 and are described below.

Release/Range. Opens the Release/Range screen where acoustic release commands can be sent and ranges to transponders and releases can be acquired. This screen also allows the selection of the UDB-9000 transpond parameter settings, which comprises the transmit frequency, the transmit and receive pulse widths, the turn around time, the timeout, and the detect threshold. In addition, from this screen a Compact Modem wakeup signal can be sent to activate the Teledyne Benthos Compact Modems.

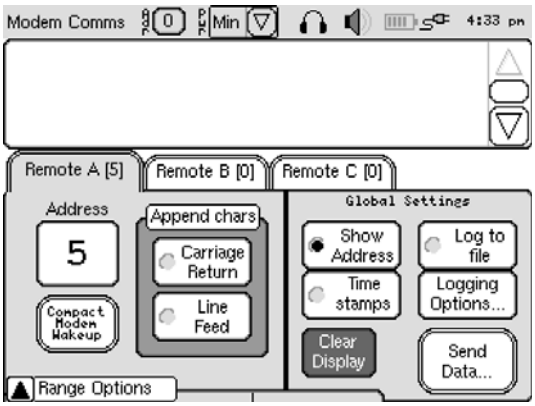
Transpond Data. Opens the Transpond Data screen where the received transponder reply frequencies, ranges and the round trip travel times are displayed for each transmitted ping. From this screen filters can be applied to block the display of ranges for specific reply frequencies, or the ranges for all the received replies can be blocked from being displayed, or no blocking can be applied to display all the ranges. In addition, the display of the range for only the first received reply of a selected receive frequency can be picked. A thumbnail graph that plots each of the received reply frequencies in kilohertz versus the range in kilometers is also provided on this screen, as is access to the same transponder parameter settings as the Release/ Range screen.



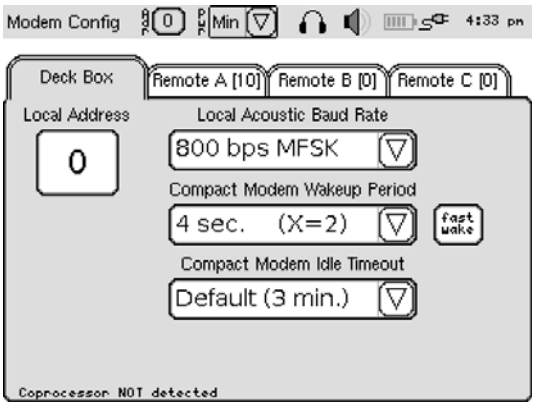
RELEASE/RANGE SCREEN



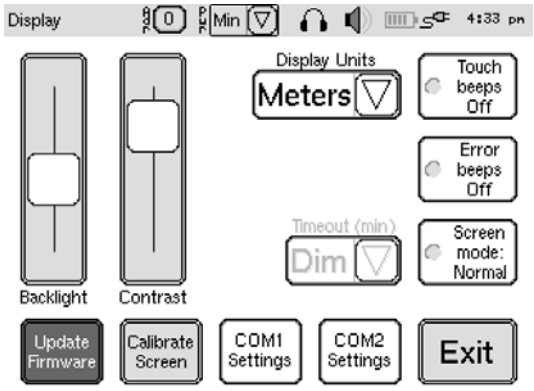
TRANSPOND DATA SCREEN



MODEM COMMS SCREEN



MODEM CONFIG SCREEN



DISPLAY SCREEN

Figure 5-2 UDB-9000 Touch Screen Main Screens

Modem Comms. Opens the Modem Comms screen where many of the functions of the Teledyne Benthos acoustic telemetry modems can be operated, including the wakeup of Teledyne Benthos Compact Modems.

Modem Config. Opens the Modem Config screen where the settings of the local and remote acoustic telemetry modems can be configured. The local modem is the UDB-9000. The remote modem is any modem that it is configured to communicate with.

Display. Opens the Display screen where display contrast and brightness can be adjusted, the touch and error beeps enabled or disabled, and the COM1 and COM2 serial port settings configured. This screen also allows the updating of the touch screen and the UDB-9000 modem function firmware.

Save and Help Functions

The save and help functions can be accessed at most any time by touching their corresponding function button. These functions are described below.

Save. Saves all of the current configuration settings. When the deck box is turned off and then on again, the configuration settings are unchanged and the screen last opened appears.

Help. Opens the Help screen which provides content sensitive help for many of the operator functions of the UDB-9000. An example of help for the Release/Range screen is shown in Figure 5-3. When the Help screen is active, none of the touch screen controls outside of the Help screen can be operated. To view hidden text, touch and drag the scroll bar up or down.

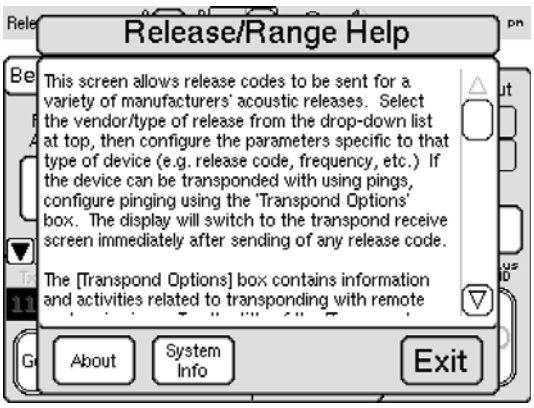


Figure 5-3 Help for the Release/Range Screen

For Teledyne Benthos copyright and contact information, touch About. The About pop-up opens as shown in Figure 5-4. And for system information, touch System Info. The System Info pop-up opens which is also shown in Figure 5-4. To close either of these pop-ups, touch the X mark. To close the Help screen, touch Exit.

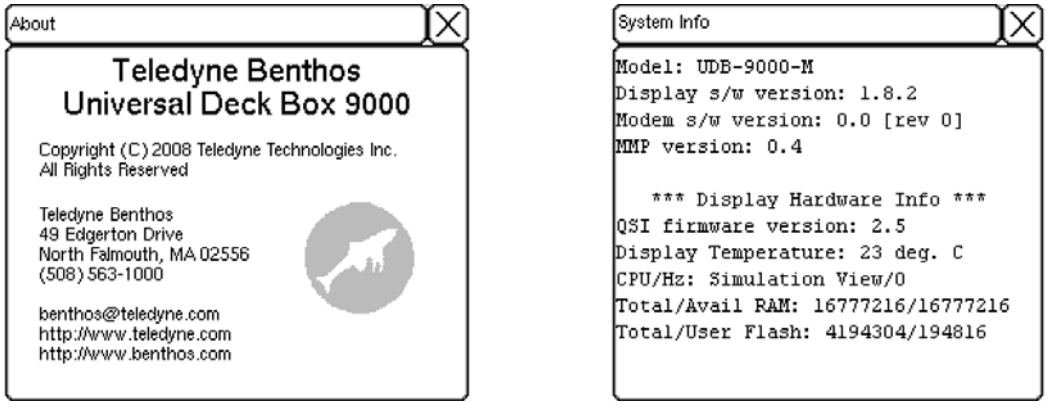


Figure 5-4 About and System Info Pop-ups

Status and Control Bar

The Status and Control bar is shown in Figure 5-5. The Status and Control bar includes controls which are used to set the address of the UDB-9000 modem function, the transmit power, and the time and date. In addition, the headphone and speaker volumes can be adjusted or muted. These controls are sometimes disabled, however, depending on the operating state of the UDB-9000. The Status and Control bar also includes the screen name, a time and date display, and status indicators which indicate the battery level, whether the battery is charging or is fully charged, and whether the deck box is being powered by internal batteries or by external AC or DC power.

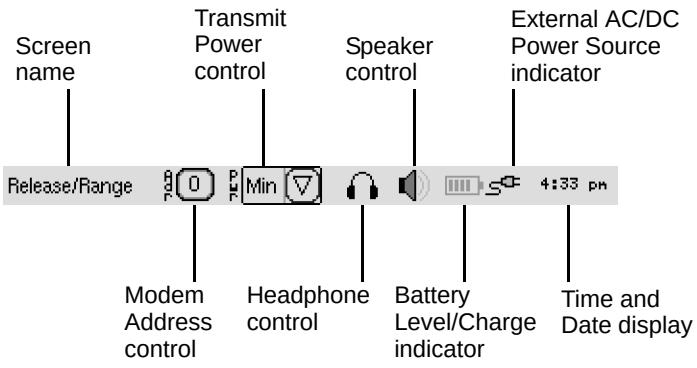


Figure 5-5 Status and Control Bar

General Setup

The general setup of the UDB-9000 involves selecting the modem address and transmit power level, adjusting the headphones and speaker volumes, setting the time and date, adjusting the touch screen display backlight and contrast, configuring the power saver and the serial ports, and selecting the audible beep and units preferences. Altogether these adjustments and selections are made from the Status and Control bar and the Display screen. The Status and Control bar is shown in Figure 5-5 on page 5-5, and the Display screen, in Figure 5-2 on page 3-3.

Selecting the Local Modem Address

The local modem is the modem function of the UDB-9000. Like any acoustic telemetry modem it includes a modem address. This address can be any address; however, it should be different than any remote modem in the communications network.

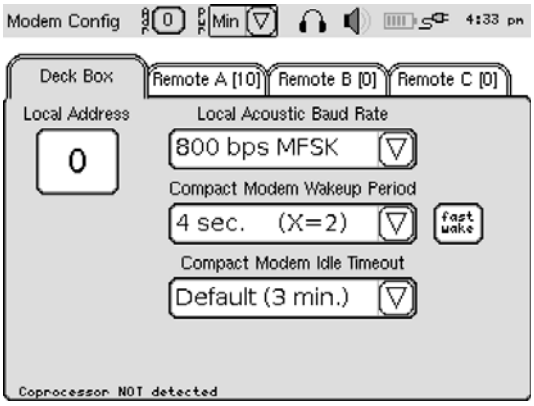


Figure 5-6 Modem Config Screen—Deck Box Tab

To select the local modem address:

1. Touch the Modem Address control on the Status and Control bar, or touch the Modem Config function button.

   The Modem Config screen opens to the Deck Box tab as shown in Figure 5-6.

2. Touch the Local Address setting.

   The modem address keypad opens as shown in Figure 5-7.

3. Enter the local modem address, two characters maximum, and then touch OK. To backspace and delete a character, touch the Delete pad.

4. Touch Exit to close the Modem Config screen.

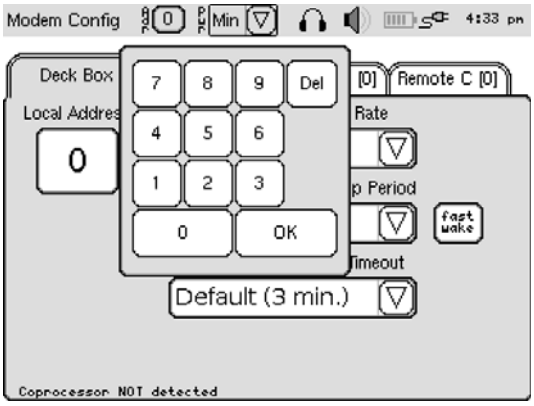


Figure 5-7 Modem Address Keypad

Selecting the Transmit Power Level

The transmit power level of the UDB-9000 can be selected by selecting an attenuation in decibels, or by selecting minimum for the lowest power (maximum attenuation) or maximum for the highest power (no attenuation).

To select the transmit power level:

1. Touch the Transmit Power control on the Status and Control bar.

   A drop-down list opens as shown in Figure 5-8.

2. Select the attenuation level from the drop-down list.

   The drop-down list closes and the new transmit power level is displayed.

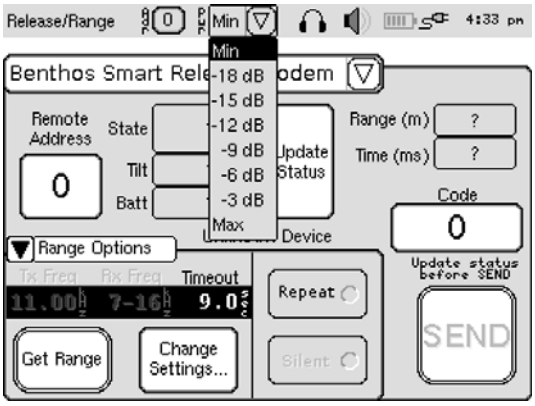


Figure 5-8 Transmit Power Control Drop-Down List

Adjusting the Headphones Volume

The headphone volume can be adjusted or the headphones muted. To mute the headphones, touch the Headphone control. Touch it again to turn the headphones back on. When muted, the Headphone control displays an X across it.

To adjust the headphones volume:

1. Touch and hold the Headphone control on the Status and Control bar.

   The Phones Vol pop-up opens as shown in Figure 5-9.

2. Touch and drag the slider up or down to adjust the volume, or touch directly on the slide at the desired location. The headphones can also be muted by touching the Mute check box. When muted, a

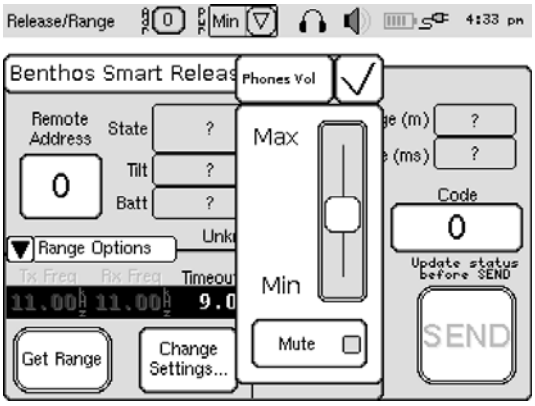


Figure 5-9 Phones Vol Pop-Up

check will appear in the box. To turn the headphones back on, touch the box again.

3. Touch the check mark to close the Phones Vol pop-up and save the volume or mute setting.

Adjusting the Speaker Volume

The speaker volume can be adjusted or the speaker muted. To mute the speaker, touch the Speaker control. Touch it again to turn the speaker back on. When muted, the Speaker control displays an X across it.

To adjust the speaker volume:

1. Touch and hold the Speaker control on the Status and Control bar.

   The Speaker Vol pop-up opens as shown in Figure 5-10.

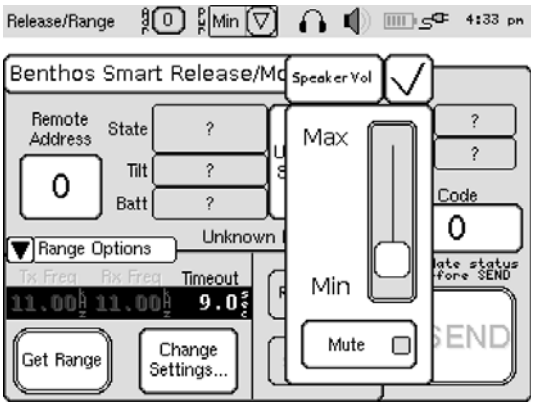


Figure 5-10 Speaker Vol Pop-Up

2. Touch and drag the slider up or down to adjust the volume, or touch anywhere in the slide to move the slider to that location. The speaker can also be muted by touching the Mute check box. When muted, a check will appear in the box. To turn the speaker back on, touch the box again.

3. Touch the check mark to close the Speaker Vol pop-up and save the volume or mute setting.

Setting the Time and Date and Viewing the Clock Battery Voltage

The time and the date can be set, and the time can be displayed in 12-hour or 24-hour time. In addition, the clock battery voltage can be viewed.

To set the time and date and view the clock battery voltage:

1. Touch and hold the Time and Date display.

   The Set Time/Date pop-up opens as shown in Figure 5-11. The clock battery voltage can be viewed in the lower left corner of the pop-up.

2. Select 24 hr. Time if it is desired to display 24-hour time.

3. Select Show Seconds if it is desired to display seconds.
4. Tap, or touch and hold, the up or down arrow of the hours setting to set the hour. The hours setting is to the far left.
5. Tap, or touch and hold, the up or down arrow of the minutes setting to set the minute. The minutes setting is to the right of the hours setting.
6. If 24 hr. Time was not selected, select AM or PM.

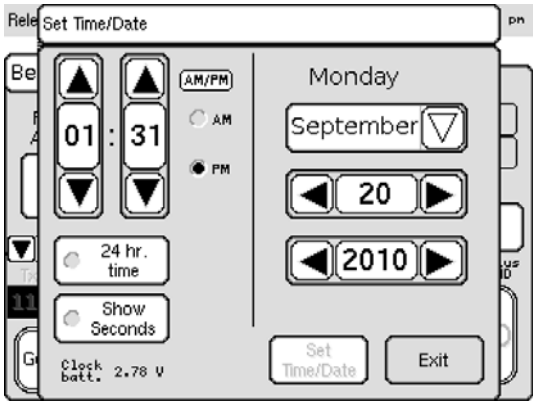


Figure 5-11 Set Time and Date Pop-Up

7. Touch the month setting.
8. A drop-down list opens as shown in Figure 5-12.
9. Touch the desired month in the drop-down list. If the month is hidden, tap the up or down arrow or drag the slider up or down to show it.
10. Tap, or touch and hold, the left or right arrow of the days setting to set the day. The day setting is immediately below the month setting.

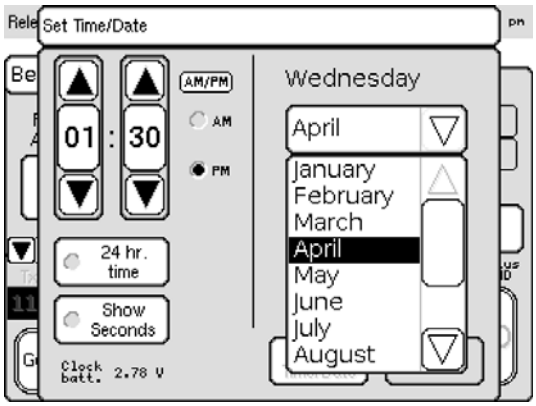


Figure 5-12 Month Pop-Up

11. Tap, or touch and hold, the left or right arrow of the years setting to set the year. The years setting is immediately below the days setting.

    The correct day for the selected month, day and year is displayed above the month setting.

12. Touch Set Time/Date to save the new time and date settings; touch Exit to leave them as is.

    The Set Time/Date pop-up closes.

Viewing the Battery Level/Charge and External AC/DC Power Source Indicators

The Battery Level/Charge indicator provides an analog indication of the energy remaining in the two internal batteries. It also indicates when the batteries are being charged or if there are no batteries installed. The External AC/DC Power Source indicator indicates whether external AC or DC power is powering the UDB-9000. The external DC power capability is optional, and batteries are installed only in the portable configuration.

The Battery Level/Charge indicator provides the following indications:

Indicates that the batteries are low and should be recharged.

Indicates that the batteries are fully charged.

Indicates that the batteries are being charged. The batteries are charged from external AC or DC power. The external DC power capability is optional for the UDB-9000.

Indicates that the deck box is being powered by external AC or DC power.

The External AC/DC Power Source indicator provides the following indications.

Indicates that external AC power is powering the deck box. When no indicator is shown, the deck box is being powered by its internal batteries.

Indicates that external DC power is powering the deck box. When no indicator is shown, the deck box is being powered by its internal batteries.

Viewing the Time and Date Display

The Time and Date display can be viewed in any one of three modes: Time, Date or Alternate. The Alternate mode alternates from displaying time to displaying date. To go from one mode to the next, touch the display. The name of the mode is displayed briefly before switching to it.

Adjusting the Touch Screen Display Backlight and Contrast

The touch screen display backlight and contrast can be adjusted to account for room lighting and viewing angle.

To adjust the touch screen display backlight and contrast:

1. Touch the Display function button.

   The Display screen opens as shown in Figure 5-13.

2. Touch and drag the Backlight slider up to increase the backlight intensity or down to decrease the intensity. Or touch anywhere in the slide to move the slide to that location.

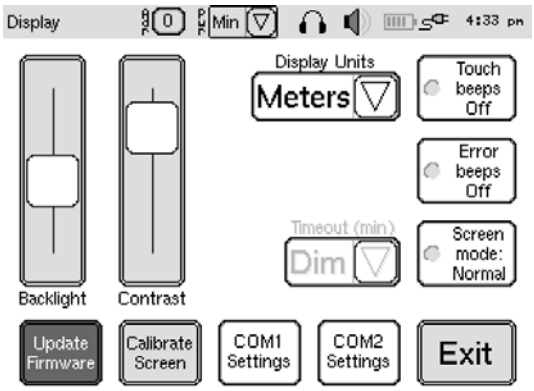


Figure 5-13 Display Screen

3. Touch and drag the Contrast slider up to increase the contrast or down to decrease the contrast. Or touch anywhere in the slide to move the slide to that location.

4. Touch Exit to close the Display screen.

Configuring the Power Saver

The UDB-9000 includes a power saver which dims the backlight and turns off the displays after a predetermined time, or just dims the backlight, depending on the selection. There are two screen modes, Normal and Save:

Normal mode. The power saver is off. The touch screen backlight is on, and the screens in the touch screen display are visible at all times.

Save mode. The power saver is on. The touch screen display backlight will dim in one minute if the screen is not touched and then turn on again when it is touched. Similarly, if the screen is not touched for a predetermined time, the displays will no longer be visible, but every ten seconds the Teledyne Benthos logo will appear for one second to indicate that the deck box is on. When the screen is touched, the displays will be visible again. However, the turning off of the displays can be disabled. Touching the screen once when the power saver is on will not activate any of the controls.

To configure the power saver settings:

1. Touch the Display function button.

   The Display screen opens.

2. When in Save mode, the Screen mode button indicates Screen mode: Save. In Normal mode it indicates Screen mode: Normal. Touch the button repeatedly to select Save mode.

3. Touch the Timeout setting. This setting is only available when in Save mode.

   A drop-down list opens as shown in Figure 5-14.

4. Select the time in minutes after which to turn the displays off. A selection of Dim will only dim the backlight; the displays will remain visible at all times.

5. Touch Exit to close the Display screen.

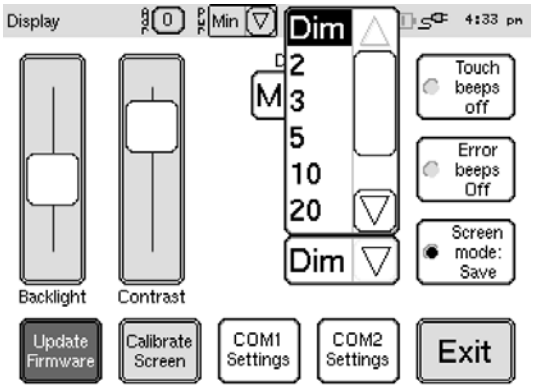


Figure 5-14 Timeout Drop-Down List

Configuring the Serial Ports

There are two serial ports, COM1 and COM2. COM1, which can be configured for RS-232 or RS-422 operation, connects to a PC and is used for external control of the acoustic telemetry modem function of the UDB-9000. This serial port is also used to send and receive data. COM2, which is configured for RS-232 operation only, also connects to a PC and is used to emulate the DS-7000 Acoustic Deck Set external interface.

COM2 can also be disabled or set to enable CLAM Shell pass-through, which allows two devices, such as PCs, to be separately connected to the deck box using the two COM ports. The two devices can independently and seamlessly communicate with two separate remote modems.

To configure the COM1 serial port:

1. Touch the Display function button.

   The Display screen opens.

2. Touch COM1 Settings.

   The COM1 Configuration pop-up opens as shown in Figure 5-15.

3. Touch the Baud Rate setting and select the baud rate from the drop-down list box.
4. Touch the Data Bits setting and select 7 or 8 data bits.
5. Touch the Duplex setting and select half or full duplex.
6. Touch the Flow Control setting and select Xon/Xoff, hardware or none.
7. Touch the Operation Mode setting and select RS-232 or RS-422 for the serial interface.
8. Touch the check mark to close the COM1 configuration pop-up and save the COM1 serial port settings.

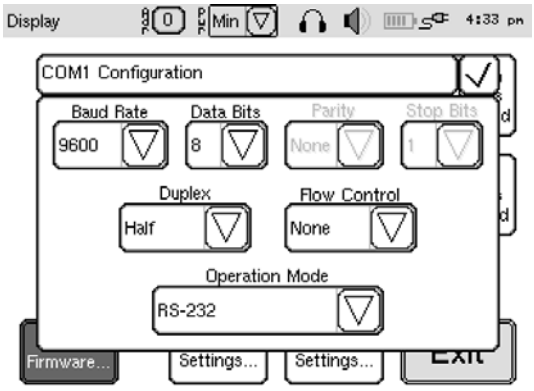


Figure 5-15 COM1 Configuration Pop-Up

9. Touch Exit to close the Display screen.

To configure the COM2 serial port:

1. Touch the Display function button.

   The Display screen opens.

2. Touch COM2 Settings.

   The COM2 Configuration pop-up opens as shown in Figure 5-16.

3. Touch the Baud Rate setting and select the baud rate from the drop-down list box.
4. Touch the Data Bits setting and select 7 or 8 data bits.
5. Touch the Parity setting and select odd, even or no parity.
6. Touch the Stop Bits setting and select 1 or 2 stop bits.
7. Touch the Duplex setting and select half or full duplex.

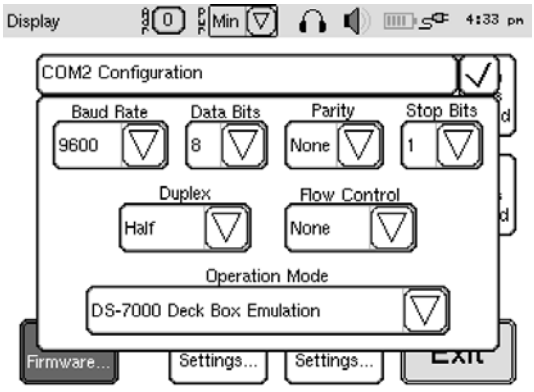


Figure 5-16 COM2 Configuration Pop-Up

8. Touch the Flow Control setting and select Xon/Xoff, hardware or none.
9. Touch the Operation Mode setting and select Disabled, DS-7000 Deck Box Emulation or CLAM Shell pass-through.
10. Touch the check mark to close the COM2 Configuration pop-up and save the COM2 serial port settings.
11. Touch Exit to close the Display screen.

Selecting the Beep and Units Preferences

The UDB-9000 provides an audible beep when touching a control or when an error occurs. Both the control and error beeps can be individually enabled or disabled. In addition, meters or feet can be selected for the displayed ranges.

To select the beep and units preferences:

1. Touch the Display function button.

   The Display screen opens.
2. When touch beeps is on, the Touch beeps button indicates Touch Beeps on. When touch beeps is off, it indicates Touch beeps off. Touch the button repeatedly to select on or off for the touch beeps.
3. When error beeps is on, the Error beeps button indicates Error Beeps on. When error beeps is off, it indicates Error beeps off. Touch the button repeatedly to select on or off for the error beeps.
4. Touch the Display Units setting and select Meters or Feet.
5. Touch Exit to close the Display screen.

Working with Information Windows

When using the UDB-9000 with Teledyne Benthos acoustic telemetry modems, SMART releases, SMART modems, and Compact Modems, information windows will occasionally open over the currently open screen in the touch screen display. These windows provide status information on the operation currently being performed, such as ranging to a modem, waking up a Compact Modem, testing the acoustic link, and other operations. Information windows also display data, such as range, received data statistics and other information. There are two types of information windows, locked and unlocked.

Locked Information Windows

A locked information window is an information window that opens when the deck box is waiting for a response from a modem. It cannot be manually closed. A locked information window can be easily identified, as the screen that it overlays is dimmed as shown in Figure 5-17. A locked information window will automatically close when the operation being performed is complete.

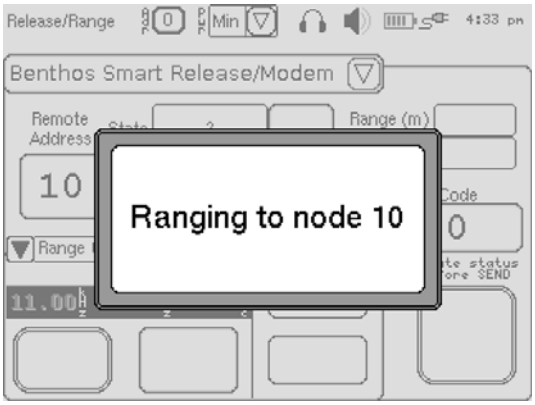


Figure 5-17 Example of a Locked Information Window

Unlocked Information Windows

An unlocked information window is an information window that displays data. It can be manually closed at any time by touching anywhere inside the window. Unlike a locked information window, the screen that an unlocked information window overlays is not dimmed as shown in Figure 5-18. An unlocked information window will automatically close after several seconds if it is not manually closed.

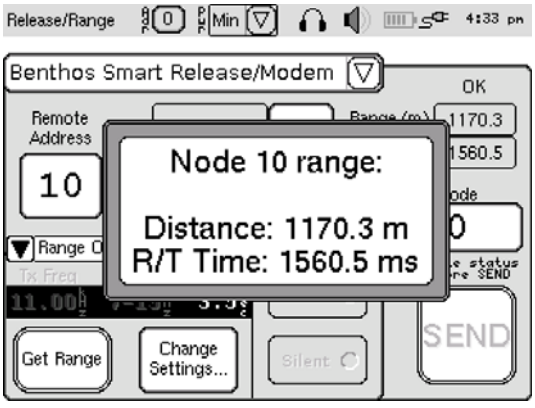


Figure 5-18 Example of Unlocked Information Window

Waking up a Compact Modem

The Teledyne Benthos Compact Modems function the same as all the other Teledyne Benthos manufactured acoustic telemetry modems, including SMART releases and SMART modems. However, because the Compact Modems are designed for long deployment, they are in a low power state most of the time. While in this low power state, a Compact Modem will not be able to receive commands or to transmit messages. The modem must be awakened first before it can perform these functions.

There are two wakeup schemes, "slow" and "fast." The slow wakeup scheme is implemented in all UDB-9000 Universal Deck Boxes 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-9000 Universal Deck Boxes with firmware versions 1.9.9 and higher only and in Compact Modems with firmware versions 1.2.7 and higher only. Therefore, a deck box with firmware version 1.9.9 and higher can wake up any Compact Modem regardless of the wakeup scheme used. This provides backwards compatibility with those modems that use the slow wakeup scheme. Table 5-1 summarizes which firmware versions provide which wakeup scheme for the UDB-9000 Universal Deck Boxes and Compact Modems.

Table 5-1 UDB-9000 Universal Deck Box and Compact Modem Firmware Versions Versus Slow and Fast Wakeup Schemes

PRODUCT AND FIRMWARE VERSION	SLOW	FAST
UDB-9000 Universal Deck Box (prior to 1.9.9)	•	
UDB-9000 Universal Deck Box (1.9.9 and higher)	•	•
Compact Modem (prior to 1.2.7)	•	
Compact Modem (1.2.7 and higher)		•

Selecting Slow or Fast Wakeup Scheme for a Compact Modem

To select slow or fast wakeup scheme for a Compact Modem:

1. Touch the Modem Address control on the Status and Control bar, or touch the Modem Config function button.

   The Modem Config screen opens to the Deck Box tab.

2. If fast wake is currently selected, this condition is indicated on the Deck Box tab by the fast wake button as shown in Figure 5-19. Touch this button to select slow wake.

   If slow wake is currently selected, this condition is indicated on the Deck Box tab by the slow wake button. The button is also highlighted. Touch this button to select fast wake.

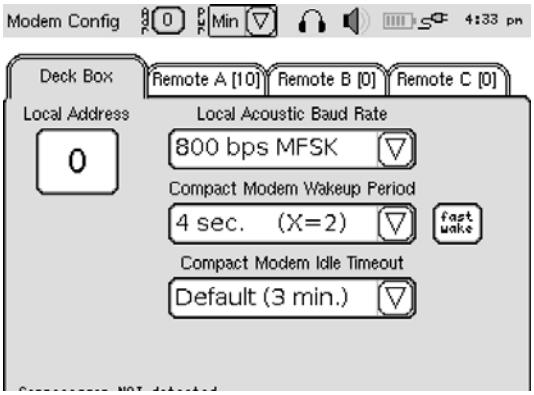


Figure 5-19 Modem Config Screen—Fast Wake Selected

Selecting the Wakeup Period for a Compact Modem

The UDB-9000 wakes up a Compact Modem by transmitting a wakeup signal. Although a Compact Modem is in its low power state most of the time, it will periodically listen for this signal. The time between which a Compact Modem listens for the wakeup signal is the wakeup period and is preset by the user for each Compact Modem. The wakeup period must first be selected before the deck box can be used to wake up a Compact Modem.

NOTE Two wakeup periods are compatible with *either* the slow *or* the fast wakeup scheme, but not both. The other selections are common to both wakeup schemes. When selecting a wakeup period that is not compatible with the selected wakeup scheme, an information window temporarily opens explaining this condition. A similar response occurs when selecting a wakeup scheme, slow or fast, that is not compatible with the selected wakeup period.

To select the wakeup period for a Compact Modem:

1. Touch the Modem Address control on the Status and Control bar, or touch the Modem Config function button.

   The Modem Config screen opens to the Deck Box tab.

2. Determine the wakeup period setting for the Compact Modem.
3. Select the wakeup period from the Compact Modem Wakeup Period drop-down list as shown in Figure 5-20.

After a wakeup signal is transmitted to the Compact Modem as described in "Transmitting a Wakeup Signal to a Compact Modem" on page 5-19, the duration of the transmission sequence will be set such that it will be present when the Compact Modem listens for it. The longer the wakeup period, the longer the sequence.

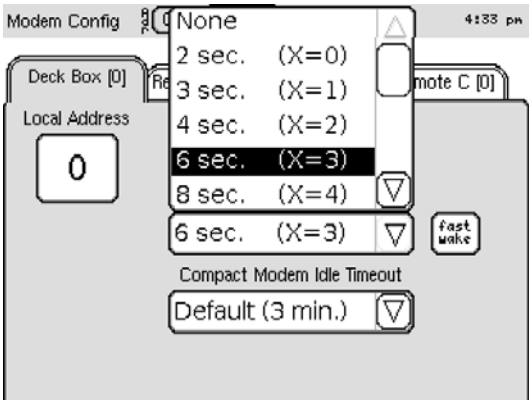


Figure 5-20 Modem Config Screen—Wakeup Period Selected

Selecting the Idle Timeout for a Remote Compact Modem

The idle timeout is the time after which a local modem will go into the lowpower state if there is no input either from its host processor over the serial interface or from a remote modem over the acoustic link. Beginning with the UDB-9000 firmware version 1.9.11 and the Compact Modem firmware version 1.2.8, the idle timeout for a remote Compact Modem can be selected. Prior to version 1.2.8 for the Compact Modem firmware, a fixed idle timeout of three minutes was used and could not be changed.

The range of allowable values for the idle timeout is from 15 to 90 minutes in 15-minute intervals. The default timeout of 3 minutes can also be selected.

To select the idle timeout for a Compact Modem:

1. Touch the Modem Address control on the Status and Control bar, or touch the Modem Config function button.

   The Modem Config screen opens to the Deck Box tab.

2. Select the Idle Timeout from the Compact Modem Idle Timeout drop-down list as shown in Figure 5-21.

   After a wakeup signal is transmitted to the Compact Modem as described in "Transmitting a Wakeup Signal to a Compact Modem" on page 5-19, the idle timeout will be set.

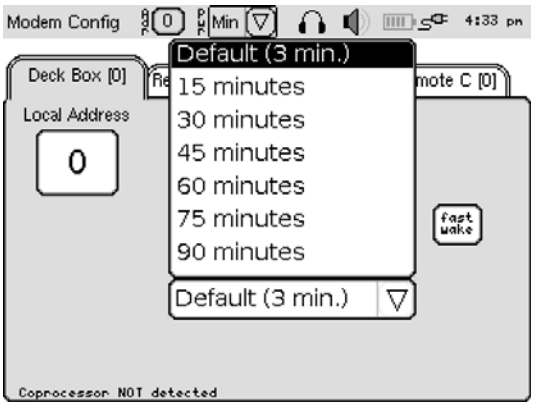


Figure 5-21 Modem Config Screen—Idle Timeout Selected

Transmitting a Wakeup Signal to a Compact Modem

To ensure that when transmitting the wakeup signal to a Compact Modem it will wake up, select the wakeup period for the modem as described in "Selecting the Wakeup Period for a Compact Modem" on page 5-17.

To transmit a wakeup signal to a Compact Modem, touch Compact Modem Wakeup. The Compact Modem Wakeup button is available in the Release/Range screen when the Benthos Smart Release/Modem pop-up is open as shown in Figure 5-22. The button is also available in the Modem Comms screen and on the Remote tabs of the Modem Config screen. If the button is not visible, touch Range Options to close the Range Options pop-up. The button is located behind this pop-up.

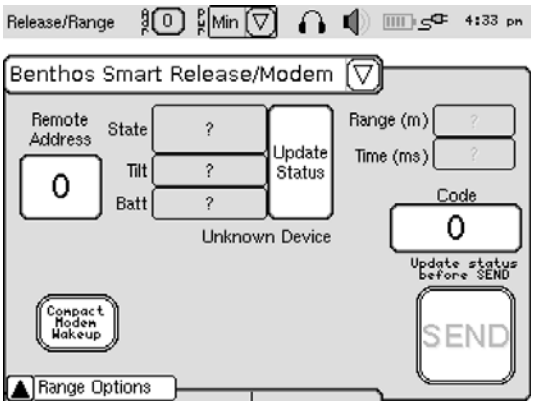


Figure 5-22 Compact Modem Button in the Release/Range Screen

The wakeup signal is transmitted and an information window opens during the duration of the transmission sequence as shown in Figure 5-23. The window also displays the length of the sequence in seconds. If the modem is not awakened, a no response indication is displayed in an alert window.

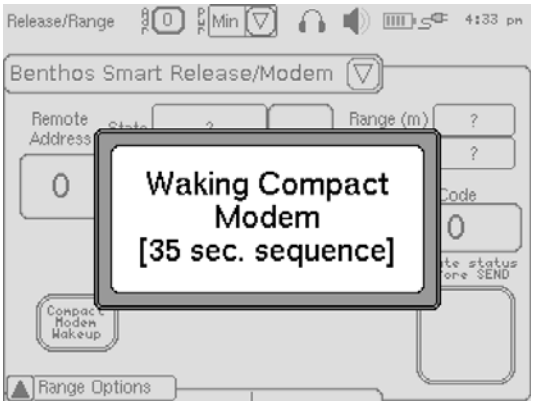


Figure 5-23 Waking up a Compact Modem

Ranging to a Remote Modem

The UDB-9000 can be used to acquire and display ranges to, and to acquire and display the status of, any Teledyne Benthos manufactured acoustic telemetry modem, including SMART releases and SMART modems. Before acquiring ranges or status, always ensure that the transducer is connected.

NOTE Range can also be acquired and displayed in the Modem Comms screen. Refer to "Acquiring and Displaying Ranges in the Modem Comms Screen" on page 5-31.

Acquiring and Displaying the Range to a Remote Modem

To acquire and display the range to a remote modem:

1. Touch the Release/Range function button.

   The Release/Range screen opens.

2. Select Benthos Smart Release/ Modem from the drop-down list as shown in Figure 5-24.

   The Benthos Smart Release/ Modem pop-up opens as shown in Figure 5-25.

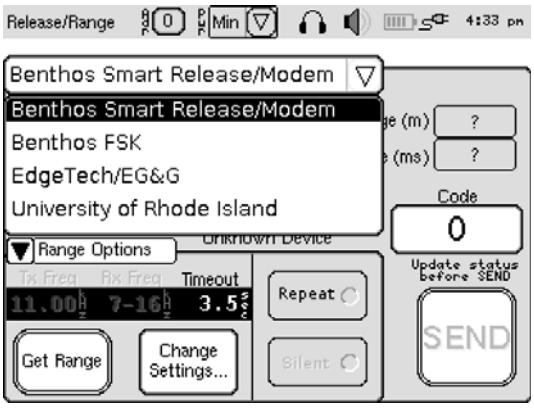


Figure 5-24 Release/Range Screen—Benthos Smart Release/Modem Selected

3. Touch the Remote Address setting.

   The remote address keypad opens as shown in Figure 5-25.

4. Enter the address of the SMART release or modem, and then touch OK. To backspace and delete a character, touch the Delete pad.

   The keypad closes and the address is displayed as the Remote Address setting.

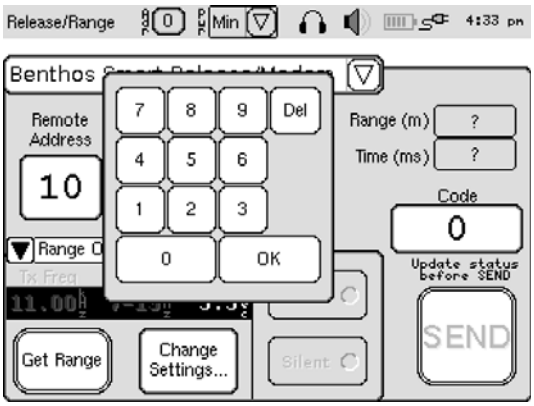


Figure 5-25 Remote Address Keypad

5. Touch Range Options to open the Range Options pop-up if it is not already open as shown.

NOTE The Range Options pop-up is also available on the Remote tabs of the Modem Comms and Modem Config screens where as many as three modem addresses can be entered, one on each tab. The ranges are displayed on the tabs in the Modem Config screen.

6. Touch Change Settings.

   The Transpond Parameters pop-up opens as shown in Figure 5-26.

7. Using the up or down arrow, select the deck box timeout in seconds.

   The timeout determines how long after transmitting a range command the deck box waits to receive the range information. When sending multiple range commands, it is the time between them.

8. Touch Exit to close the Transpond Parameters pop-up.

9. Touch Get Range.

   The range command is sent and an information window temporarily opens confirming the sent command along with the SMART release or modem address. In addition, "Ranging..." flashes in the Benthos Smart Release/Modem pop-up. When the range is acquired, it is displayed in another temporary information window in units of meters or feet as shown in Figure 5-27, along with the round trip time in milliseconds. Refer to "Selecting the Beep and Units Preferences" on page 5-14 to select meters or feet for the range display. The same range information is also displayed in the Benthos Smart Release/Modem pop-up along with an "OK" indication. If the range is not acquired, a no response indication is displayed in the information window and "Timed Out" is displayed in the pop-up.

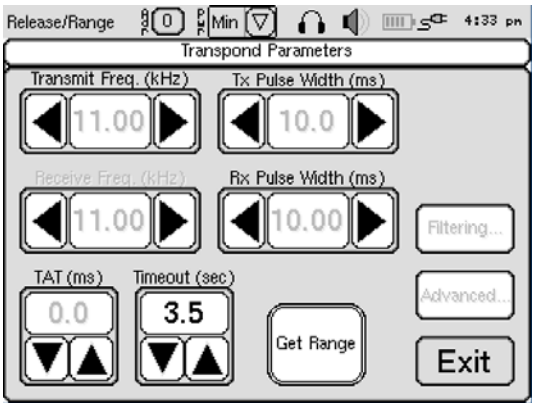


Figure 5-26 Transpond Parameters Pop-Up

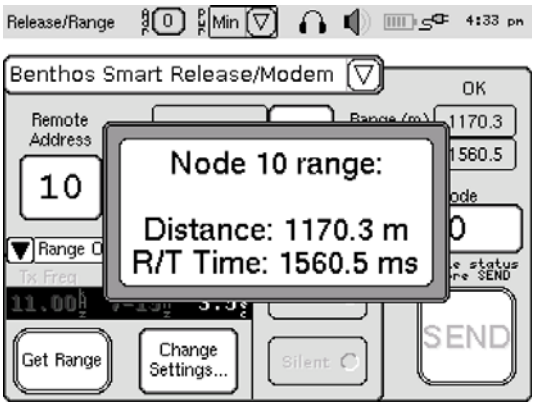


Figure 5-27 Information Window with Displayed Range Information

Acquiring and Displaying Ranges to a Remote Modem Continuously

Ranges to a remote modem can be acquired continuously by sending the range command at the end of each timeout. To acquire and display ranges continuously, acquire and display ranges as described in "Acquiring and Displaying the Range to a Remote Modem" on page 5-20, and touch Repeat before touching Get Range. To stop ranging, touch Cancel Repeat Range in the information window.

Acquiring and Displaying Status Information from a Remote Modem

The status of a remote modem can be acquired and displayed at any time. However, for SMART releases and modems, the status *must* be acquired before they can be released.

To acquire and display status information from a remote modem:

1. Touch the Release/Range function button.

   The Release/Range screen opens.

2. Select Benthos Smart Release/Modem from the drop-down list.

   The Benthos Smart Release/Modem pop-up opens.

3. Touch the Remote Address setting.

   The remote address keypad opens.

4. Enter the address of the SMART release or modem, and then touch OK. To backspace and delete a character, touch the Delete pad.

   The keypad closes and the address is displayed as the Remote Address Setting.

5. Touch Update Status.

   The status command is sent and an information window temporarily opens indicating that the status is updating. When the status information is acquired, it's receipt is acknowledged in another information window as shown in Figure 5-28, along with the type of SMART release or modem.

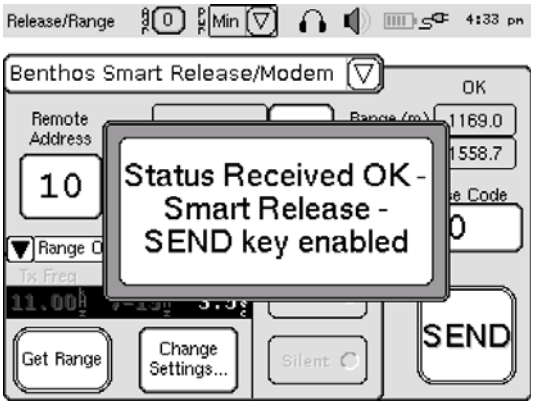


Figure 5-28 Information Window Acknowledging Receipt of Status Information

When the window closes, the status information is displayed in the Benthos Smart Release/ Modem pop-up along with the type of modem as shown in Figure 5-29. If the status information is not acquired, a no response indication is displayed in the window.

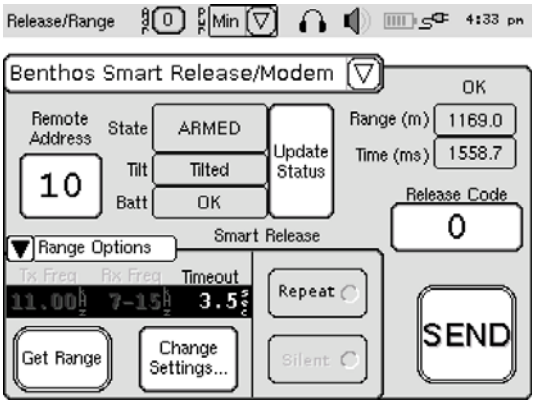


Figure 5-29 Displayed Status Information and Type of SMART Release or Modem

NOTE For the types of status information that can be displayed for a SMART release or modem, refer to its user's manual.

Configuring and Checking a Remote Modem

If desired, the acoustic bit rate and the transmit power level of a remote modem can be configured and checked. The modem firmware version can also be checked. Although only one modem can be configured at a time, the configuration can be prepared prior to updating for up to three modems, designated Remote A, Remote B and Remote C. However, before a remote modem can be configured, its address must be selected. Before sending commands, always ensure that the transducer is connected.

Selecting the Remote Modem Address

To select the address of the remote modem to be configured:

1. Touch the Modem Address control on the Status and Control bar, or touch the Modem Config function button.

   The Modem Config screen opens to the Deck Box tab.

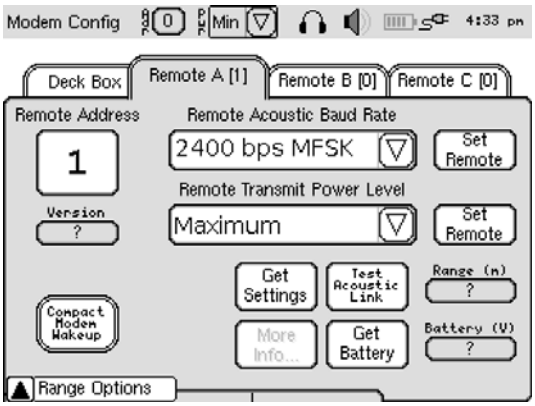


Figure 5-30 Modem Config Screen—Remote A Tab

2. Touch the Remote A, Remote B or Remote C tab to open the tab. The tab label indicates the current remote modem address setting. The Remote A tab is shown in Figure 5-30 on page 5-23.
3. Touch the Remote Address setting.

   The remote address keypad opens as shown in Figure 5-31.
4. Enter the remote modem address, two characters maximum, and then touch OK. To backspace and delete a character, touch the Delete pad.

   The keypad closes and the modem address is displayed as the Remote Address setting.

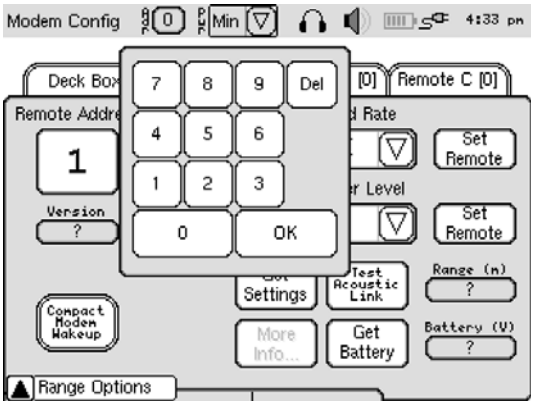


Figure 5-31 Remote Address Keypad

5. If desired, select the remote modem address for one or both of the remaining tabs.

Configuring the Bit Rate and Transmit Power Level of a Remote Modem

To configure the bit rate and transmit power level of a remote modem:

1. Touch the tab in the Modem Config screen for the modem to be configured.
2. On the tab, touch the Remote Acoustic Baud Rate setting and select the bit rate for the remote modem.
3. Touch Set Remote for the remote acoustic bit rate setting.

   An information window temporarily opens indicating that the remote modem settings are being updated. When complete, the update is confirmed, and then the Set Remote button becomes unavailable for that remote acoustic bit rate selection only. If the update is not confirmed, a no response indication is displayed in the window.
4. Touch the Remote Transmit Power Level setting and select the attenuation level for the remote modem.

5. Touch Set Remote for remote transmit power level setting.

   An information window temporarily opens indicating that the remote modem settings are being updated. When complete, the update is confirmed, and then the Set Remote button becomes unavailable for that remote transmit power level selection only. If the update is not confirmed, a no response indication is displayed in the window.

Checking the Bit Rate, Transmit Power Level and Firmware Version of a Remote Modem

To check the bit rate, transmit power level and firmware version of a remote modem:

1. Touch the tab in the Modem Config screen for the modem to be checked.
2. On the tab, touch Get Settings.

   An information window temporarily opens indicating that the remote modem settings are being updated on the tab. When complete, receipt of the settings is confirmed. When the window closes, the remote modem bit rate and transmit settings are displayed on the tab along with the firmware version of the remote modem. The Set Remote buttons also become unavailable for these selections only. If the update is not confirmed, a no response indication is displayed in the window.

   A confirmed update also makes the More Info button available. Touching this button opens the Remote Additional Info pop-up which displays additional information about the remote modem as shown in Figure 5-32.

3. Touch the X mark to close the Remote Additional Info pop-up.

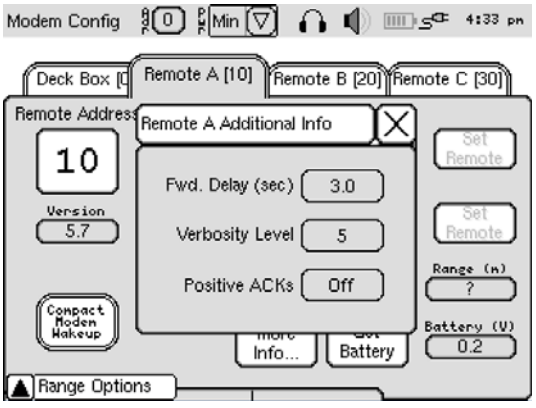


Figure 5-32 Remote Additional Info Pop-Up

Checking the Battery Level of a Remote Modem

To check the battery level of a remote modem:

1. Touch the tab in the Modem Config screen for the modem whose battery level is to be checked.
2. On the tab, touch Get Battery.

   An information window temporarily opens indicating that the deck box is acquiring the battery level. When the battery level is acquired, the value is displayed in the window as shown in Figure 5-33. In addition, the battery voltage is displayed on the tab. If the battery level is not acquired, a no response indication is displayed in an alert window.

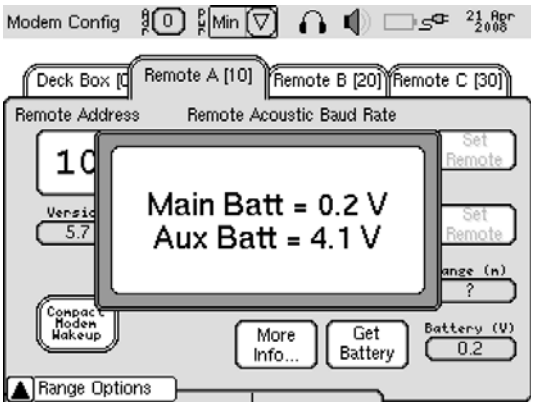


Figure 5-33 Information Window with Displayed Battery Level

Acquiring and Displaying Ranges in the Modem Config Screen

To acquire and display ranges in the Modem Config screen:

1. Touch the tab in the Modem Config screen for the modem to range on.
2. Touch Range Options to open the Range Options pop-up if it is not already open as shown in Figure 5-34.

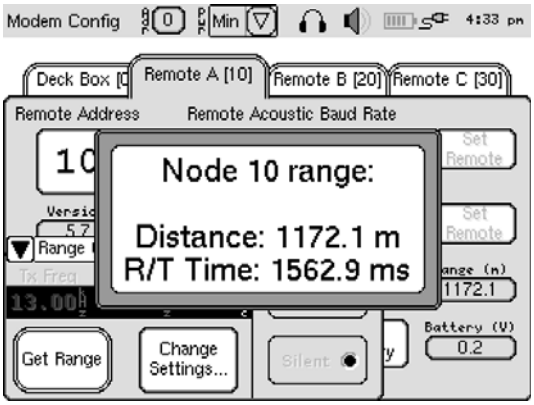


Figure 5-34 Displayed Ranges in the Modem Config Screen

3. Touch Get Range.

   The range command is sent and an information window temporarily opens confirming the sent command along with the SMART release or modem address. When the range is acquired, it is displayed in another temporary information window in units of meters or feet as shown in

Figure 5-34, along with the round trip time in milliseconds. Refer to "Selecting the Beep and Units Preferences" on page 5-14 to select meters or feet for the range display. The same range information is also displayed on the tab. If the range is not acquired, a no response indication is displayed in the information window.

Testing the Acoustic Link with a Remote Modem

The acoustic link between the UDB-9000 and a remote modem can be tested by commanding the remote modem to transmit a preset test message at each of several bit rates. The UDB-9000 measures and displays the received data statistics which can be used to evaluate the acoustic link.

To test the acoustic link with a remote modem:

1. Touch the tab in the Modem Config screen for the modem to be tested.
2. On the tab, touch Test Acoustic Link.

   An information window temporarily opens indicating that the acoustic link for the remote modem is being tested. When complete, the window closes, and the Acoustic Link Stats pop-up opens which displays the received data statistics as shown in Figure 5-35. If the test message is not received, a no response indication is displayed in the information window.

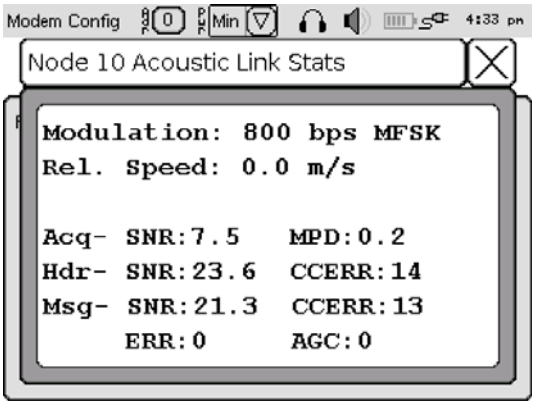


Figure 5-35 Acoustic Link Stats Pop-Up

3. Touch the X mark to close the Acoustic Link Stats pop-up.

The PSNR value is a measure of the processed SNR or signal quality. It is affected by both signal strength and multipath. It can be used to determine what the power level should be set to. Based on Table 5-2 on page 28 adjust the power level and acoustic bit rate accordingly.

Table 5-2 PSNR Value and Required Action

PSNR VALUE	ACTION REQUIRED
20+	Signal quality is high. Can use a lower power level or higher acoustic bit rate.
19–25	Signal quality is good.
14–12	Signal quality is acceptable. If multipath is a factor, a lower power level may improve the signal quality, otherwise go to a higher power level.
11–10	Signal quality is low. If multipath is a factor, a lower power level may improve the signal quality, otherwise go to a higher power level. Also try lowering the acoustic bit rate.
10>	Signal quality is poor. If multipath is a factor, a lower power level may improve the signal quality, otherwise go to a higher power level, also try lowering the acoustic bit rate.

Communicating with a Remote Modem

The UDB-9000 can be used to send commands to an instrument that is connected to a remote modem and to receive messages from a remote modem. The commands to be sent are entered and displayed in the touch screen display using an on screen keyboard. Although only one command can be created and sent at a time, the command settings can be prepared prior to creating and sending the commands for up to three modems, designated Remote A, Remote B and Remote C. However, before communicating with a remote modem, its address must be selected. Before sending commands, always ensure that the transducer is connected.

Selecting the Remote Modem Address

To select the address of the remote modem to be communicated with:

1. Touch the Modem Comms function button.

   The Modem Comms screen opens.

2. Touch the Remote A, Remote B or Remote C tab to open the tab. The tab label indicates the current remote modem address setting.

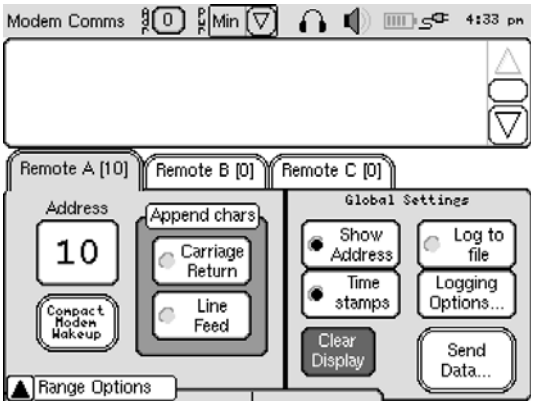


Figure 5-36 Modem Comms Screen

The Remote A tab is shown in Figure 5-36 on page 5-28.

3. Touch the Address setting.

   The address keypad opens as shown in Figure 5-37.

4. Enter the remote modem address, two characters maximum, and then touch OK. To backspace and delete a character, touch the Delete pad.

   The keypad closes and the address is displayed as the Address setting.

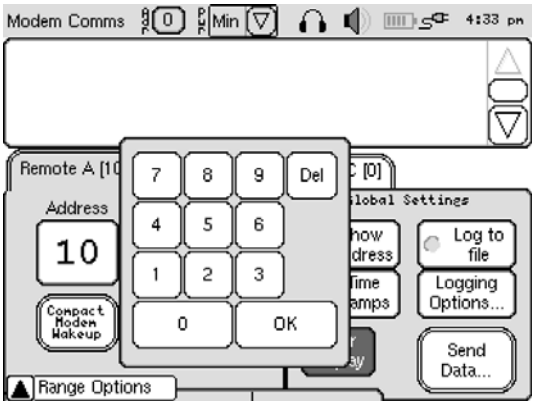


Figure 5-37 Address Keypad

5. If desired, select the remote modem address for one or both of the remaining tabs.

Sending Data to an Instrument that is Connected to a Remote Modem

Similar to being online with a remote modem, data can be sent to an instrument, such as an Acoustic Doppler Current Profiler (ADCP), that is connected to a remote modem. The data are sent to the modem, and the modem sends the data to the instrument. Responses from the instrument are sent to the modem which transmits them to the UDB-9000 where they are displayed.

To send data to an instrument that is connected to a remote modem:

1. Touch the tab in the Modem Comms screen for the modem to be communicated with.
2. To append a carriage return with the data sent, touch Carriage Return on the tab; to append a line feed, touch Line feed. These selections are applied to the open tab only.
3. To display the remote modem address with the sent data, touch Show Address; to display the date and time of the sent data, touch Time Stamps. These selections are applied to all three tabs, Modem A, Modem B and Modem C.

4. Touch Send Data.

A keyboard opens as shown in Figure 5-38.

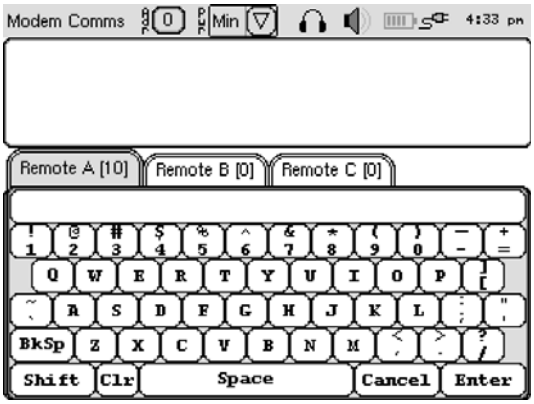


Figure 5-38 Keyboard

5. Enter the data to be sent, a maximum of 50 characters, by touching the appropriate keys. The data are displayed immediately above the keyboard as shown in Figure 5-39. To switch back and forth from lower case to upper case letters, touch Shift. To clear any entered data, touch Clr. To cancel sending the messge and close the keyboard, touch Cancel.

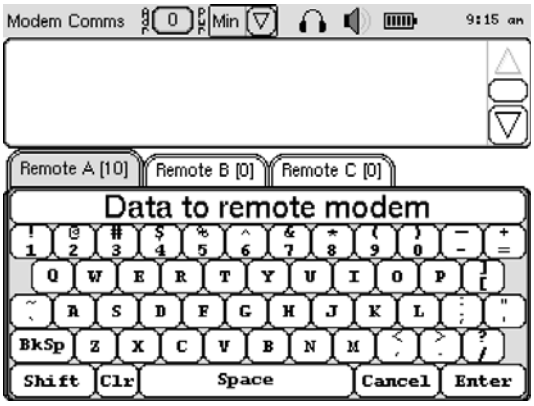


Figure 5-39 Data to be Sent

6. To send the data, touch Enter.

The data are sent and are displayed in the display box above the tabs as shown in Figure 5-40. If selected, carriage return and line feed characters are sent with the data but are not displayed. If selected, the remote modem address and the date and time are displayed with the data. When the amount of data exceeds the display capacity of the scroll box, up and down arrows appear to the right of the scroll box to enable scrolling through the lines.

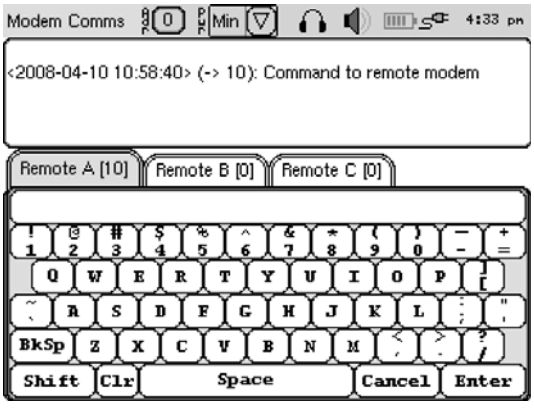


Figure 5-40 Sent Data

7. Enter and send additional data as required, and then touch Cancel to close the keyboard.
8. To clear the display, touch Clear Display.

   The Confirm Log Clear window opens as shown in Figure 5-41.
9. Touch Yes, erase to clear the display.

   The Confirm Log Clear window closes and the display is cleared.

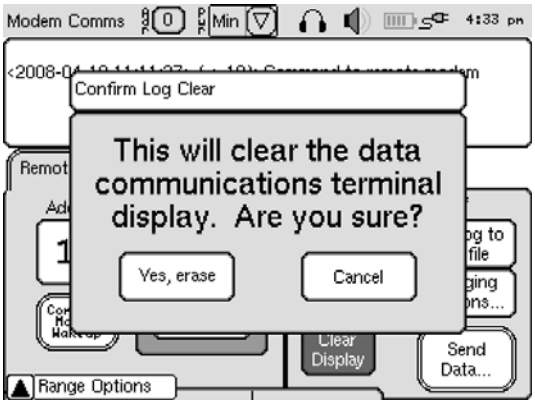


Figure 5-41 Confirm Log Clear Window

Acquiring and Displaying Ranges in the Modem Comms Screen

To acquire and display ranges in the Modem Comms screen:

1. Touch the tab in the Modem Comms screen for the modem to be ranged to.
2. Touch Range Options to open the Range Options pop-up if it is not already open as shown in Figure 5-42.

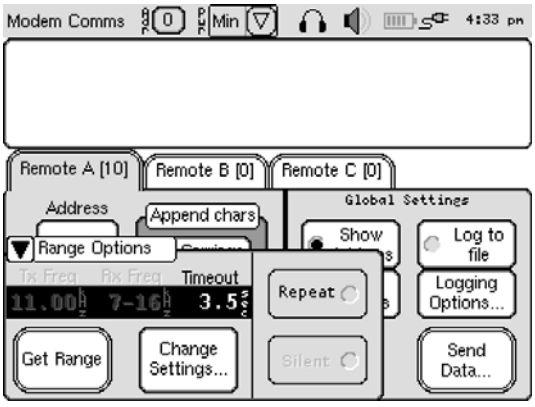


Figure 5-42 Range Options Pop-Up in the Modem Comms Screen

3. If required, touch Change Settings and select the timeout. For more information about the timeout function, refer to "Acquiring and Displaying the Range to a Remote Modem" on page 5-20.
4. Touch Get Range.

   The range information is displayed, along with any sent and received data, in the display box as shown in Figure 5-43.

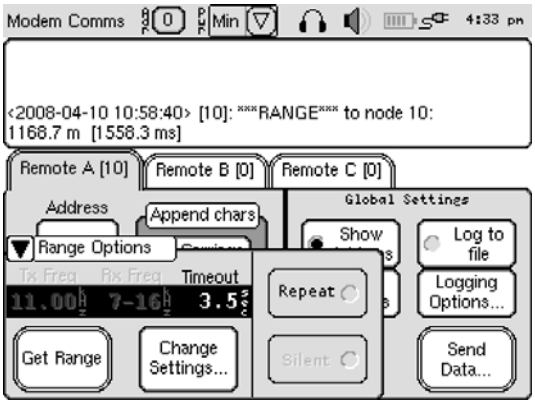


Figure 5-43 Displayed Ranges in the Modem Comms Screen

Receiving Data from Remote Modems

Data can be received from any remote modem, and when received, they are displayed in the touch screen display—along with any ranges, time stamps, remote modem addresses, and sent messages—when the Modem Comms screen is open. To display the remote modem addresses and the time stamps, Show Address and Time Stamps must be selected as shown in Figure 5-36 on page 5-28. Data can be received regardless which screen is open at the time of receipt. When a message is received, an audio indication is output and the Modem Address control on the Status and Control bar flashes. Refer to "Status and Control Bar" on page 5-5 for a description of this bar.

Saving to a Log File

The text displayed in the display box in the Modem Comms screen can be saved to a log file as ASCII text. To begin saving the text, select Log to File in the Modem Comms screen on any of the three tabs. Only the text displayed after selecting Log to File will be saved.

Limiting the Size of the Log File

The size of the log file containing saved text can be limited to a fixed number of lines, or the size can be limited to the 1 MB data log file storage capacity. Text logging stops when this limit is reached and "Log File Full" is displayed.

To limit the size of the log file:

1. Touch Logging Options in the Modem Comms screen on any of the three tabs.

   The Modem Comms Logging Options window opens as shown in Figure 5-44.

2. Touch the Log Capacity setting, and then select the file size.

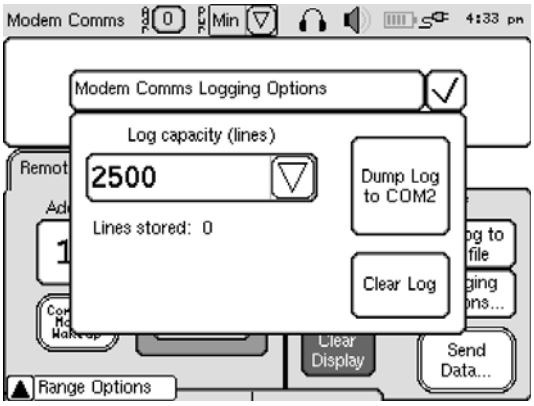


Figure 5-44 Modem Comms Logging Options Window

Exporting the Log File

The log file containing saved text can be exported as ASCII text for viewing in any text editor. For the log file to be exported, a serial port of a PC must be connected to the COM2 serial port of the UDB-9000, and the PC must be running a terminal program.

To export the log file:

1. Touch Logging Options in the Modem Comms screen on any of the three tabs.

   The Modem Comms Logging Options window opens as shown in Figure 5-44 on page 5-32.

2. Touch Dump Log to COM2.

   The log file is exported. When exporting is complete an information window temporarily opens with the message "Done outputting Log."

Clearing the Log File

To clear the log file:

1. Touch Logging Options in the Modem Comms screen on any of the three tabs.

   The Modem Comms Logging Options window opens as shown in Figure 5-44 on page 5-32.

2. Touch Clear Log.

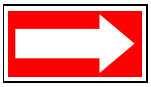
   The log file is cleared.

6 Modem Operating Modes and Commands

This section provides an overall description of the Teledyne Benthos ATM-88X and UDB-9000 Series Acoustic Telemetry Modem operating modes, along with descriptions of each of the modem commands and how to enter and use them. The operating modes determine how a modem handles data and commands. The modem 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 operating modes and commands is important when integrating and operating the modems with other subsea instrument packages.

The modem commands are listed in Table 6-1 on page 6-11. Also listed in the table are the page references to where detailed descriptions of the commands are provided.

Although the modem commands control the operation of the modems, the operating parameters, which are determined from settings that are stored in 21 nonvolatile memory locations called S Registers, directly affect how many of the commands are applied and how a modem functions in each of its operating modes. For a detailed description of the S Registers and how to set them, refer to Section 7, "Modem Operating Parameters (S Registers)." Many of the S Registers are called out in this section.



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, Hyperterminal or DumbTerm. DumbTerm is available from RD Instruments. Refer to "Setting Up the Modems" on page 4-7 for instructions on how to connect the modem to a PC and how to set up the PC as the local host processor.

Operating Modes

The ATM-88X and UDB-9000 Series Acoustic Telemetry Modems operate in three distinct operating modes: Online mode, Command mode, and Datalogger mode. Essentially, the operating modes determine how a modem handles input from its host processor over the serial interface. In Online mode the input is treated as data which are freely exchanged between the local and

remote host processors. In Command mode the input is treated as commands which instruct the modem to perform various functions, including sending commands to remote modems. In Datalogger mode the input is also treated as data, but in this case the data are stored in the flash memory of the modem's data logger. At any time these data can be transmitted acoustically to another modem. When a modem is powered up, it immediately goes into one of the three operating modes as determined by the setting of S Register 15: 00 for Command mode, 01 for Online mode, or 02 for Datalogger mode. However, after powering up, it is possible to change the operating mode, regardless of the setting of S Register 15.

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 S Register 15 is set to 01, 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 S Register 14. Therefore, setting S Register 15 to 01 allows the modem to go online automatically with any remote modem whose address is the setting of S Register 14 after being powered up or awakened from its lowpower state.

A modem can be placed into Online mode 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.

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 modem whose address is the setting of S Register 14. The Online command also sets S Register 15 to 01.

Setting S Register 15 to 01. From Command mode only, setting S Register 15 to 01 will cause the modem to go into Online mode and to go online with the remote modem whose address is the setting of S Register 14.

Using the Lowpower State command (ATL)—S Register 15 set to 01. From Command mode only *and* if S Register 15 is set to 01, entering the Lowpower State command will place the modem into Online mode. The

modem will also go into the lowpower state. When awakened, the modem will be online with the remote modem whose address is the setting of S Register 14.

Allowing the idle time to expire—S Register 15 set to 01. If S Register 15 is set to 01, allowing the idle time to expire will place the modem into Online mode. The modem will also go into the lowpower state. When awakened, the modem will be online with the remote modem whose address is the setting of S Register 14.

Cycling power—S Register 15 set to 01. If S Register 15 is set to 01, powering down the modem and then powering up the modem will place the modem into Online mode and the modem will be online with the remote modem whose address is the setting of S Register 14.

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.

Receiving a Remote Data Logger Disable command (AT$BDn) when it is in Datalogger mode. If the modem receives a Remote Data Logger Disable command from another modem *and* it is in Datalogger mode, the modem will go into Online mode, and S Register 15 will be set to 01.

Device Enable

Device Enable is an output provided by all the modems. Refer to "Setting Up the Modems" on page 4-7 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. If the Device Enable output is off, it will turn on *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). When the Device Enable output is on, it will switch up to 20 mA to ground. When it is off, it is a high impedance. Refer to Section 2, "Specifications," for additional electrical specifications.

Transmit Data Buffers

Each modem includes four internal 4-kbyte transmit data buffers for a total buffer size of 16 kbytes. This allows data that are input to the modem over the serial interface to be organized into four packets of 4 kbytes. After a transmit

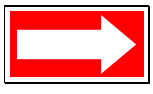
data buffer has filled, the modem immediately transmits the data. If data are input to the modem, but the transmit data buffer does not fill, the modem will wait a preset time—called the forwarding delay—after the last data are input, and then transmit the partial packet. The forwarding delay is determined by the setting of S Register 8 and ranges from 50 milliseconds to 5 seconds.

WARNING If the Online Interrupt command (+++) is entered to place the modem into Command mode while data remains in the 4-kbyte transmit data buffer, the data will not be transmitted and the buffer will be cleared. Refer to "Online Interrupt +++" on page 6-15 for information on the Online Interrupt command.

The 4-kbyte transmit data buffers also allow a faster serial interface baud rate than the acoustic bit rate. For example, the serial interface baud rate can be 9600 bits/sec while the acoustic bit rate is 600 bits/sec. However, when the serial interface baud rate is faster than the acoustic bit rate, no more than 16 kbytes of data can be input to the modem without loss of data unless handshaking is used.

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

Although the use of handshaking, which uses the RS-232 signal RTS, is optional, it is highly recommended when more than 16 kbytes of data are to be transmitted and packet retry, as determined by the setting of S Register 2, is disabled; 12 kbytes if enabled. Refer to "Packet Retry S2" on page 7-5 for information on S Register 2. Handshaking will ensure there is no loss of data, as when the four 4-kbyte transmit data buffers are full, handshaking will not allow the host processor to output data to the modem.



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.

Refer to "Setting Up the Modems" on page 4-7 for information on how to set up the modems. The recommended setup uses the RS-232 handshaking signal RTS when connecting the modems.

Data Format

Data, including parity, that are input to the 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 bits with no parity, or 8-bit binary words. However, it cannot be 8 bits with parity.

Online Break

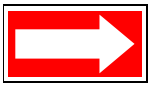
A local modem that is connected to a PC will detect a break if it is sent over the serial interface from the PC. If the local modem is online with a remote modem, it will command the remote modem to send the equivalent break on its serial interface. If the remote modem is connected to an RD Instruments 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 S Register 13, 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 output (AGC), and the corrected channel errors (CCERR) are displayed. Refer to "Acoustic Link Test ATXn" on page 6-39 for a detailed description of the received data statistics. S Register 13 must be set to 02 or 03 for the received data statistics to be displayed.

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 S Register 15 is set to 00.



NOTE The factory default setting of S Register 15 is 01, which causes the modem to go into Online mode when it is powered up.

When powered up in Command mode, and if a PC is used as the host processor, the monitor will display the banner message. The message includes the frequency band (LF or MF), the firmware version and the command prompt (>) as shown in the following example:

Benthos ATM-88X 4G
LF Frequency Band
Standard Modem Version 6.9.3 (4G)
>

To display this message and many other messages, S Register 13 must be set to 01, 02, or 03 where 01 is the factory default setting.

In Command mode any of the commands can be entered. There are two basic types of commands: 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: configuring the local modem's S Register settings, going online with a remote modem, reading a remote modem's S Register 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 6-15 for information on the Online Interrupt command.

Cycling power—S Register 15 set to 00. If S Register 15 is set to 00, powering down the modem and then powering up the modem will place the modem into Command mode.

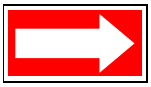
Allowing the idle time to expire—S Register 15 set to 00. If S Register 15 is set to 00, allowing the idle time to expire will place the modem into Command mode and into the lowpower state. Refer to "Lowpower State" below for information on the lowpower state and the idle time.

Lowpower State

In any of the operating modes, when there is no input to the modem either from its host processor over the serial interface or from a remote modem over the acoustic link, the modem will go into the lowpower state after a preset time. The lowpower state conserves battery power as only the modem's receiver is active. The preset time is the idle time and is determined by the setting of S Register 10. When the modem goes into the lowpower state, the message "Lowpower" is displayed on the monitor of the host PC if a PC is used as the host processor. The idle time is reset to zero when the modem receives input either from its host processor or from a remote modem.

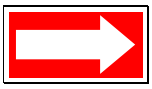
WARNING Although the idle time can be set to prevent the modem from going into the lowpower state for an indefinite time, if the modem is being powered by batteries, this setting will rapidly deplete the capacity of the modem battery pack. Hence if batteries are being used to power the modem, it is important that the idle time be set as short as possible.

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.



NOTE 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 S Register 17 of the transmitting modem to 01.

If the modem is awakened by the host processor, it immediately goes into the operating mode determined by the setting of S Register 15. If the modem receives a signal over the acoustic link from a remote modem, it immediately 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 remains in the lowpower state. If it recognizes the signal as containing a valid address, it will go out of the lowpower state and into the operating mode determined by the setting of S Register 15.



NOTE When a modem is not being powered by batteries, the idle time should be set to prevent the modem from going into the lowpower state for an indefinite time. This improves operating efficiency as the modem never has to be reawakened from its lowpower state. The idle time can be set to indefinite by setting S Register 10 to 255.

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 Data Logger Disable command (AT$BDn) *and* the modem is in Datalogger mode, then also Online mode; if it is the Remote Data Logger Enable command (AT$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 Register command (AT$Sn), it executes the command by transmitting its S Register settings.

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 704 kbytes of data can be stored. A modem will go into Datalogger mode when it is powered up *only* if S Register 15 is set to 02. 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 S Register 15 to 02. From Command mode only, setting S Register 15 to 02 will place the modem into Datalogger mode.

Using the Lowpower State command (ATL)—S Register 15 set to 02. From Command mode only, if S Register 15 is set to 02, entering the Lowpower State command will place the modem into Datalogger mode and into the lowpower state.

Receiving a Remote Data Logger Enable command (AT$BEn). If the modem receives a Remote Data Logger Enable command from another modem, the modem will go into Datalogger mode, and S Register 15 will be set to 02.

Cycling power—S Register 15 is set to 02. If S Register 15 is set to 02, powering down the modem and then powering up the modem will place the modem into Datalogger mode.

Allowing the idle time to expire—S Register 15 is set to 02. If S Register 15 is set to 02, allowing the idle time to expire will place the modem into Datalogger mode and into the lowpower state.

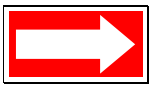
When the modem is in Datalogger mode, data that are input to the modem over the serial interface are stored in an 8-kbyte temporary data buffer. After the temporary data buffer has filled, the data are immediately transferred to the data logger memory. If the temporary data buffer has not filled, the modem will wait a preset time—called the forwarding delay—after the last data are input, and then transfer the data. The forwarding delay is determined by the setting of S Register 8. The delay settings range from 50 milliseconds to 5 seconds.

WARNING If the Online Interrupt command (+++) is entered to place the modem into Command mode while data remains in the 8-kbyte temporary data buffer, the data will not be transferred and the buffer will be cleared.

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 4-7. 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.

The modem commands are listed in Table 6-1 on page 6-11. Also listed in the table are the page references to where detailed descriptions of the commands are provided.



NOTE Any reference to a local modem in the table or in the detailed descriptions 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 place the modem into Command mode, do one of the following:

- Ensuring first that there is no serial input for at least one second, enter +++ rapidly.
- If S Register 15 is set to 00, power down and then power up the modem.
- If S Register 15 is set to 00, wait for the idle time to expire.

The modem will go into Command mode and display the command prompt (>).

To enter a command, type the command in accordance with the commands listed in Table 6-1 and in the detailed descriptions of the commands that follow.

Table 6-1 ATM-88X and UDB-9000 Series Acoustic Telemetry Modems Command Set

Command Syntax	Command Name	Result	Page
+++	Online Interrupt	Causes the local modem to go into Command mode.	6-15
AT [Enter]	Attention	Resets the local modem idle time timer and verifies communications between the host processor and the modem.	6-17
ATC [Enter]	Check Mode	Checks the operating mode of the local modem.	6-19
ATI [Enter]	Check Version	Checks the version number and the modification date and time of the firmware in the local modem.	6-21
ATES [Enter]	Reboot	Reboots the firmware of the local modem.	6-23
AT$ESn [Enter]	Remote Acoustic Reset	Resets the remote modem at address n.	6-25
ATEU [Enter]	Update Firmware	Initiates the local modem firmware update procedure.	6-27
ATDn [Enter]	Dial	Causes the local modem to go into Online mode and to go online with the remote modem at address n.	6-29
AT&F [Enter]	Factory Reset	Resets the local modem's S Register settings to their factory default settings.	6-31
ATH [Enter]	Hang Up	Causes all the remote modems to go into the lowpower state.	6-33
ATO [Enter]	Online	Causes the local modem to go into Online mode from Command mode.	6-35
AT$Kn [Enter]	Remote Break	Causes the remote modem at address n to send a break on its serial interface and to go online with the local modem.	6-37
ATXn [Enter]	Acoustic Link Test	Tests the acoustic link with the modem at address n.	6-39
ATYn [Enter]	Multiple Bit Rate Test	Tests the acoustic link with the modem at address n at multiple bit rates.	6-41

Table 6-1 ATM-88X and UDB-9000 Series Acoustic Telemetry Modems Command Set (Continued)

Command Syntax	Command Name	Result	Page
AT$Pn,m [Enter]	Remote Power	Sets the transmit power level of the remote modem at address n to level m.	6-43
AT$An,m [Enter]	Remote Bit Rate	Sets the transmitting acoustic bit rate of the remote modem at address n to m.	6-45
ATSn? [Enter]	Read Register	Displays the setting of the local modem's S Register n.	6-47
AT$Sn [Enter]	Read Remote Registers	Displays the S Register settings of the remote modem at address n.	6-49
ATSn=n [Enter]	Set Register	Sets the local modem's S Register number n to the value entered following "=."	6-51
AT&W [Enter]	Write	Saves the local modem's S Register settings as the new startup configuration.	6-53
ATL [Enter]	Lowpower State	Forces the idle time of the local modem to expire, which in turn causes the modem to go into the lowpower state	6-55
ATTDm	Local Device Enable	Sets or clears the Device Enable output of the local modem.	6-57
AT$Xn,m	Remote Device Enable	Sets or clears the Device Enable output of the remote modem at address n.	6-59
ATRn [Enter]	Range	Displays the range from the local modem to the remote modem at address n.	6-61
ATV [Enter]	Local Battery Voltage	Displays the input power supply voltage and internal temperature of the local modem.	6-63
AT$Vn [Enter]	Remote Battery Voltage	Displays the input power supply and real-time clock battery voltages of the remote modem at address n.	6-65
AT$BEn [Enter]	Remote Data Logger Enable	Causes the remote modem at address n to go into Datalogger mode.	6-67
AT$BDn [Enter]	Remote Data Logger Disable	Causes the remote modem at address n to go into Command mode if it is in Datalogger mode.	6-69

Table 6-1 ATM-88X and UDB-9000 Series Acoustic Telemetry Modems Command Set (Continued)

Command Syntax	Command Name	Result	Page
AT$BTn [Enter]	Read Remote Data Logger	Displays the contents of the data logger memory of the remote modem at address n.	6-71
AT$BBn,m [Enter]	Output Data Logger Block	Outputs block m of the remote modem at address n.	6-73
AT$BSn,m	Output Datalogger Sub-Block	Outputs 256-byte sub-blocks beginning at sub-block m of the remote modem at address n.	6-75
AT$BCn [Enter]	Clear Remote Data Logger	Clears the contents of the data logger memory of the remote modem at address n.	6-77
AT$BNn [Enter]	Remote Bytes Stored	Displays the number of bytes of data stored in the data logger memory of the remote modem at address n.	6-79
ATBC [Enter]	Clear Local Data Logger	Clears the contents of the data logger memory of the local modem.	6-81
ATBN [Enter]	Local Bytes Stored	Displays the number of bytes of data stored in the data logger memory of the local modem.	6-83
ATBT [Enter]	Output Local Data Logger	Outputs the contents of the data logger memory of the local modem over the serial interface.	6-85
ATBPn [Enter]	Output Local Page	Outputs the contents of page n of the data logger memory of the local modem over the serial interface.	6-87
ATTNn [Enter]	AGC Diagnostic	Enables or disables the display of the automatic gain control (AGC) output of the local modem.	6-89
AT$Gn	Output Remote AGC	Outputs ten seconds of AGC history from the remote modem at address n.	6-91
AT$Tn [Enter]	Release Status	Displays the status of the SMART Release or SMART Modem at address n.	6-93
AT$Rn,m [Enter]	Release	Activates the release mechanism of the SMART Release at address n with release code m.	6-95

Table 6-1 ATM-88X and UDB-9000 Series Acoustic Telemetry Modems Command Set (Continued)

Command Syntax	Command Name	Result	Page
AT$Nn,m	Burn Wire Release	Activates the burn wire release of the SMART Modem at address n with release code m.	6-97
ATWn,m	Compact Modem Wakeup	Wakes up a Compact Modem at address n and sets the idle time to m.	6-99

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 S Register 8 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.

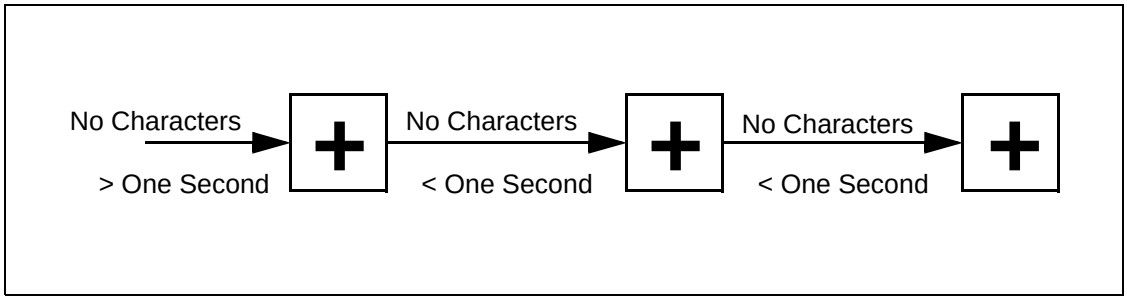


Figure 6-1 Conditions for Recognizing an Online Interrupt Command

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 6-10 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 (>).

Special Considerations

To display the message "OK" and many other messages, S Register 13 must be set to either 01 or 02, where 01 is the factory default setting.

Check Mode ATC

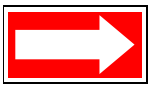
Syntax

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 6-10 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

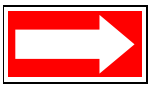
ATI [Enter]

Definition

The Check Version command checks the version number and the modification date and time of the firmware in the local modem for the following modem types:

Standard Modem:	The modem is an ATM-88X 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-9000 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 6-10 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 and the modification date and time of its firmware, 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 6-10 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.

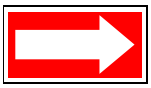
Remote Acoustic Reset AT$ESn

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 6-10 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.

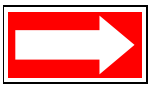
Update Firmware ATEU

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 6-10 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

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 (user:1>). 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.

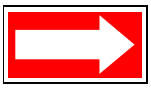
Dial ATDn

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 6-10 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, S Register 13 must be set to either 01 or 02, where 01 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 S Register 7. If an acknowledgment is not received, "Response Not Received" will be displayed.

- The Dial command sets S Register 14 of the remote modem to the address of the local modem.
- The Dial command sets S Register 14 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 S Register 15 is set to 00, then the modem will go into Command mode. To go back online with the same remote modem, use the Dial command.

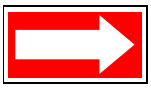
Factory Reset AT&F

Syntax

AT&F [Enter]

Definition

The Factory Reset command resets the local modem's S Register 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 6-10 for instructions on how to place the modem into Command mode.

How to Use

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

The local modem will reset its S Registers 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) after using the Factory Reset command will save the S Register factory default settings as the startup configuration, which is the S Register settings when the modem is powered up.
- When the modem is powered up, the S Registers will be set to their startup configuration. This configuration is not necessarily the factory default settings, as the S Register settings may have been changed with the Set Register command (ATSn=n), and then saved as the new startup configuration with the Write command (AT&W).

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 6-10 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 FF, 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:

- To display the message "Off Line" and many other messages, S Register 13 must be set to either 01 or 02, where 01 is the factory default setting.
- 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 6-3 for information on the Device Enable output.

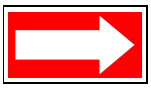
Online ATO

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 S Register 14. The command also sets the local modem's S Register 15 to 01. 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 6-10 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, S Register 13 must be set to either 01 or 02, where 01 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.

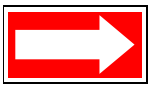
Remote Break AT$Kn

Syntax

AT$Kn [Enter]

Definition

The Remote Break command causes the remote modem at address n to send a break on its serial interface and to go online with 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 6-10 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, and then press Enter.

The remote modem will send a break on its serial interface, 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, S Register 13 must be set to either 01 or 02, where 01 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 S Register 7. If an acknowledgment is not received, "Response Not Received" will be displayed.

- The Remote Break command sets S Register 14 of the remote modem to the address of the local modem.
- The Remote Break command sets S Register 14 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 S Register 15 is set to 00, 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 preset test messages at the acoustic bit rate determined by the setting of S Register 4 of the remote modem. Which preset test message is transmitted and whether the message is displayed when received by the local modem is determined by the setting of S Register 12.

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—in dB, where the higher the value the better the acoustic environment.

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.

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 6-10 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 S Register 12 at the bit rate determined by the setting of the remote modem's S Register 4, and the local modem will display the received data statistics described above. In addition, depending on the setting of S Register 12, 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 S Register 7. If an acknowledgment is not received, "Response Not Received" will be displayed.
- 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$Pn,m) and use the Acoustic Link Test command to verify a low error rate—8 or less. Also consider increasing the remote modem's transmitting acoustic bit rate by changing the setting of its S Register 4 with the Remote Bit Rate command (AT$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.

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. Depending on the setting of S Register 12, the preset test message is displayed when received by the local modem. If the local modem is an ATM-88X 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-9000 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—in dB, where the higher the value the better the acoustic environment.

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.

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 6-10 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 S Register 12, 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 S Register 7. If an acknowledgment is not received, "Response Not Received" will be displayed.
- 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$Pn,m) and use the Multiple Bit Rate Test command to verify a low error rate—8 or less. Also consider increasing the remote modem's transmitting acoustic bit rate by changing the setting of its S Register 4 with the Remote Bit Rate command (AT$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 01 to 08 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:

01: -21 dB (minimum power level)

02: -18 dB

03: -15 dB

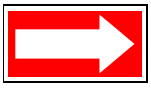
04: -12 dB

05: -09 dB

06: -06 dB

07: -03 dB

08: 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 6-10 for instructions on how to place the modem into Command mode.

How to Use

To use the Remote Power command, type AT$P followed by the address of the remote modem, a 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:

- To display the message "OK" and many other messages, S Register 13 must be set to either 01 or 02, where 01 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 S Register 7. 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 02 to 13 as follows:

02: 140 bits/sec MFSK repeated four times with rate 1/2 convolutional coding and 25-ms multipath guard period

03: 300 bits/sec MFSK repeated twice with rate 1/2 convolutional coding and 25-ms multipath guard period

04: 600 bits/sec MFSK with rate 1/2 convolutional coding and 25-ms multipath guard period

05: 800 bits/sec MFSK with rate 1/2 convolutional coding and 12.5-ms multipath guard period

06: 1066 bits/sec MFSK with rate 1/2 convolutional coding and 3.125-ms multipath guard period

07: 1200 bits/sec MFSK with rate 1/2 convolutional coding

08: 2400 bits/sec MFSK

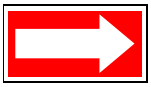
09: 2560 bits/sec PSK, with rate 1/2 convolutional coding

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 6-10 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, a 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 Power command, take note of the following:

- To display the message "OK" and many other messages, S Register 13 must be set to either 01 or 02, where 01 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 S Register 7. If an acknowledgment is not received, "Response Not Received" will be displayed.
- The Remote Bit Rate command sets S Register 4 of the remote modem to the selected value.
- Settings 09–13 are available for a UDB-9000 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 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 6-10 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 all the 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 Registers were displayed by entering ATS?

Special Considerations

The S Register settings can be interpreted from Table 7-1, “ATM-88X and UDB-9000 Series Acoustic Telemetry Modem S Registers,” on page 2, which includes page references to where detailed descriptions are provided.

```
>ATS?

Local Registers
S00=069  S01=001  S02=000  S03=001  S04=005  S05=000  S06=008
S07=015  S08=060  S09=000  S10=255  S11=001  S12=000  S13=002
S14=001  S15=000  S16=000  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 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 6-10 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 S Register 7. If an acknowledgment is not received, "Response Not Received" will be displayed.
- The S Register settings can be interpreted from Table 7-1, “ATM-88X and UDB-9000 Series Acoustic Telemetry Modem S Registers,” on page 2, which includes page references to where detailed descriptions are provided.

```
>AT$S1

Remote Registers
S00=069  S01=001  S02=000  S03=002  S04=005  S05=000  S06=008
S07=015  S08=060  S09=000  S10=255  S11=000  S12=000  S13=003
S14=000  S15=000  S16=000  S17=001  S18=001  S19=000  S20=000
>
```

Figure 6-3 Read Remote Registers Command and Resulting Display

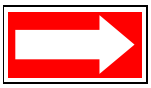
Set Register ATSn=n

Syntax

ATSn=n [Enter]

Definition

The Set Register command sets the local modem's S Register number n to the value entered following "=."



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 6-10 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:

- To display the message "OK" and many other messages, S Register 13 must be set to either 01 or 02, where 01 is the factory default setting.
- 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 the Write command (AT&W) 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.
- Using the Write command (AT&W) 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.

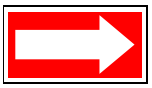
Write AT&W

Syntax

AT&W [Enter]

Definition

The Write command saves the S Register 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 6-10 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 S Register settings as the startup configuration, and then respond with the message "Sregisters Stored."

WARNING If power is lost while the Write command is being executed, all the S Register settings will revert to their factory default settings upon power up.

Special Considerations

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

- To display the message "Sregisters Stored" and many other messages, S Register 13 must be set to either 01 or 02, where 01 is the factory default setting.
- When the modem is powered up, the S Registers will be set to their new startup configuration. The S Register settings can again be changed with the Set Register command (ATSn=n), and then saved as the new startup configuration with the Write command.

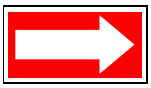
Lowpower State ATL

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 6-10 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 S Register 11, the RS-232 driver may be set to turn off whenever the modem is in the lowpower state. Refer to "RS-232 Driver/Flow Control S11" on page 7-21 for information on S Register 11. 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, S Register 13 must be set to either 01 or 02, where 01 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 S Register 15.
- When the modem is in the lowpower state, the Device Enable output is turned off. Refer to "Device Enable" on page 6-3 for information on the Device Enable output.

Local Device Enable ATTDm

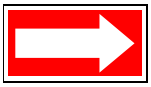
ATTDm [Enter]

Definition

The Local Device Enable command sets or clears the Device Enable output of the local modem. The Device Enable output can also be set or cleared *both* as described in "Device Enable" on page 6-3 *and* with the Local Device Enable command by setting S Register 28 of the local modem to 00, which is its default setting. To set or clear the Device Enable output *only* with the Local Device Enable command, S Register 28 must be set to 02. The settings for m are 00 and 01 as follows:

00: Clear Device Enable output (high impedance).

01: Set Device Enable output (low impedance).



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 6-10 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

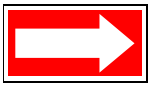
AT$Xn,m [Enter]

Definition

The Remote Device Enable command sets or clears the Device Enable output of the remote modem at address n. The Device Enable output can also be set or cleared *both* as described in "Device Enable" on page 6-3 *and* with the Remote Device Enable command by setting S Register 28 of the remote modem to 00, which is its default setting. To set or clear the Device Enable output *only* with the Remote Device Enable command, S Register 28 must be set to 02. The settings for m are 00 and 01 as follows:

00: Clear Device Enable output (high impedance).

01: Set Device Enable output (low impedance).



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 6-10 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, a comma character (,), and the value of m as determined by the required setting, and then press Enter.

The remote modem will clear or set the Device Enable output.

Special Considerations

When using the Remote Device Enable command, take note of the following:

- To display the message "OK" and many other messages, S Register 13 must be set to either 01 or 02, where 01 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 S Register 7. If an acknowledgment is not received, "Response Not Received" will be displayed.

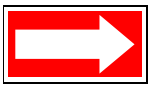
Range ATRn

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 from 0 to 999.9 meters in increments of tenths of meters, and 1000 to 9999 meters in increments of one meter.



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 6-10 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.

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 S Register 7. If a reply is not received, "Response Not Received" will be displayed.

Local Battery Voltage ATV

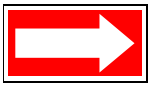
Syntax

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.

NOTE Older versions of the ATM-88X Series Acoustic Telemetry Modems display two power supply voltages, a transmitter and a DSP/receiver. They *do not* display temperature.



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 6-10 for instructions on how to place the modem into Command mode.

How to Use

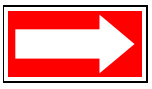
To use the Local Battery Voltage command, type ATV, and then press Enter.

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.



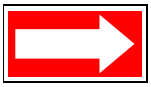
NOTE Refer to Table 8-1 on page 8-3 for the estimated modem battery pack capacity remaining versus the voltage of the transmitter power supply.

Remote Battery Voltage AT$Vn

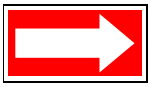
Syntax

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.



NOTE Older versions of the ATM-88X Series Acoustic Telemetry Modems display two power supply voltages, a transmitter and a DSP/receiver. They *do not* display the real-time clock battery voltage.



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 6-10 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 S Register 7. 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.

NOTE 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.

- 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 2.8 volts or higher.
- If the real-time clock battery voltage is less than 2.8 volts, the battery is either not installed or has little remaining capacity and should be replaced.

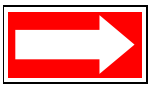
Remote Data Logger Enable AT$BEn

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 6-10 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:

- To display the message "OK" and many other messages, S Register 13 must be set to either 01 or 02, where 01 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 S Register 7. If an acknowledgment is not received, "Response Not Received" will be displayed.
- The Remote Data Logger Enable command sets S Register 15 of the remote modem to 02.

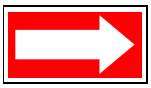
Remote Data Logger Disable AT$BDn

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 6-10 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:

- To display the message "OK" and many other messages, S Register 13 must be set to either 01 or 02, where 01 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 S Register 7. If an acknowledgment is not received, "Response Not Received" will be displayed.
- The Remote Data Logger Disable command sets S Register 15 of the remote modem to 01.
- The Remote Data Logger Disable command has no effect on the remote modem if the remote modem is not in Datalogger mode.

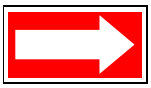
Read Remote Data Logger AT$BTn

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 6-10 for instructions on how to place the modem into Command mode.

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.

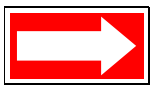
The local modem will display the contents of the remote modem's data logger memory.

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 S Register 7. 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 S Register 4 of the remote modem. If the 704-kbyte data logger memory is full, downloading its contents at a bit rate of 1200 bits/second will take a minimum of 1.3 hours. Slower bit rates will increase the time.
- While the contents of the remote modem's data logger memory are being transmitted, communications with or between other remote modems is not possible.

- While the contents of the remote modem's data logger memory are being transmitted, any input received over the serial link will not be transmitted until after the memory is transmitted.
- 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 6-85 for instructions.

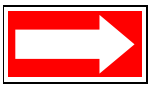
Output Data Logger Block AT$BBn,m

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 6-10 for instructions on how to place the modem into Command mode.

How to Use

To use the Output Data Logger Block command, type AT$BB followed by the address of the remote modem, a 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 S Register 7. 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 S Register 4 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.

- While the contents of the remote modem's data logger block are being transmitted, any input received over the serial link will not be transmitted until after the block is transmitted.

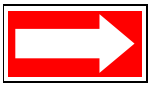
Output Datalogger Sub-Block AT$BSn,m

Syntax

AT$BSn,m [Enter]

Definition

The Output Datalogger 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 S Register 57 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 6-10 for instructions on how to place the modem into Command mode.

How to Use

To use the Output Datalogger Sub-Block command, type AT$BS followed by the address of the remote modem, a 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 transmitted sub-blocks will not cross 64K page boundaries. Transmission will cease at the end of a 64K page. If a boundary is encountered, send another Output Datalogger Sub-Block command beginning at the first sub-block on the next 64K page.
- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of S Register 7. 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 S Register 4 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.

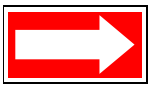
Clear Remote Data Logger AT$BCn

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 6-10 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:

- To display the message "OK" and many other messages, S Register 13 must be set to either 01 or 02, where 01 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 S Register 7. 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 approximately 20 seconds 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.

- While the contents of the remote modem's data logger memory are being cleared, the remote modem will not accept any input over the serial interface or over the acoustic link.

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 6-10 for instructions on how to place the modem into Command mode.

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 S Register 7. If an acknowledgment is not received, "Response Not Received" will be displayed.
- While the number of bytes of data stored in the data logger memory of the remote modem is being transmitted, any input received over the serial link will not be transmitted until after the number is transmitted.

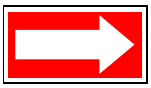
Clear Local Data Logger ATBC

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 6-10 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:

- To display the message "20 Seconds to clear..." and many other messages, S Register 13 must be set to either 01 or 02, where 01 is the factory default setting.
- 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.

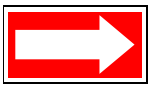
Local Bytes Stored ATBN

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 6-10 for instructions on how to place the modem into Command mode.

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.

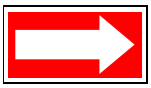
Output Local Data Logger ATBT

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 6-10 for instructions on how to place the modem into Command mode.

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.

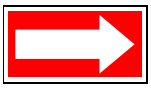
Output Local Page ATBPn

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 11, and each page contains a maximum of 64 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 6-10 for instructions on how to place the modem into Command mode.

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 value ranges from -5 dB to 80 dB, where a small value indicates a strong signal is being received, and a large value indicates a weak signal is being received. The displayed value is also an indication of the relative amount of background noise present when there are no modems transmitting.

The settings for n are 00 and 01 as follows:

00: Disable display of AGC output

01: Enable display of AGC output.

The following is a rough guide for interpreting the relative amount of background noise when there are *no* modems transmitting:

Greater than 85 dB:	No signal. Indicates a problem with the transducer or preamplifier. Ensure that the transducer is connected.
55–85 dB:	Normal range. Indicates quiet conditions.
25–55 dB:	Some background noise. Although communications over the acoustic link is possible, the range will be reduced.
Less than 25 dB:	Considerable background noise. Communications over the acoustic link will be severely limited.

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 6-10 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."

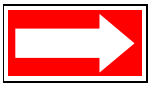
Output Remote AGC AT$Gn

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. A high AGC value means the gain is high, indicating a quiet environment; a low AGC value means the gain is low, indicating a noisy environment. The AGC ranges are 0–91 dB for the ATM-88X Series Acoustic Telemetry Modems and 0–77 dB for the UDB-9000 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 6-10 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 S Register 7. If an acknowledgment is not received, "Response Not Received" will be displayed.

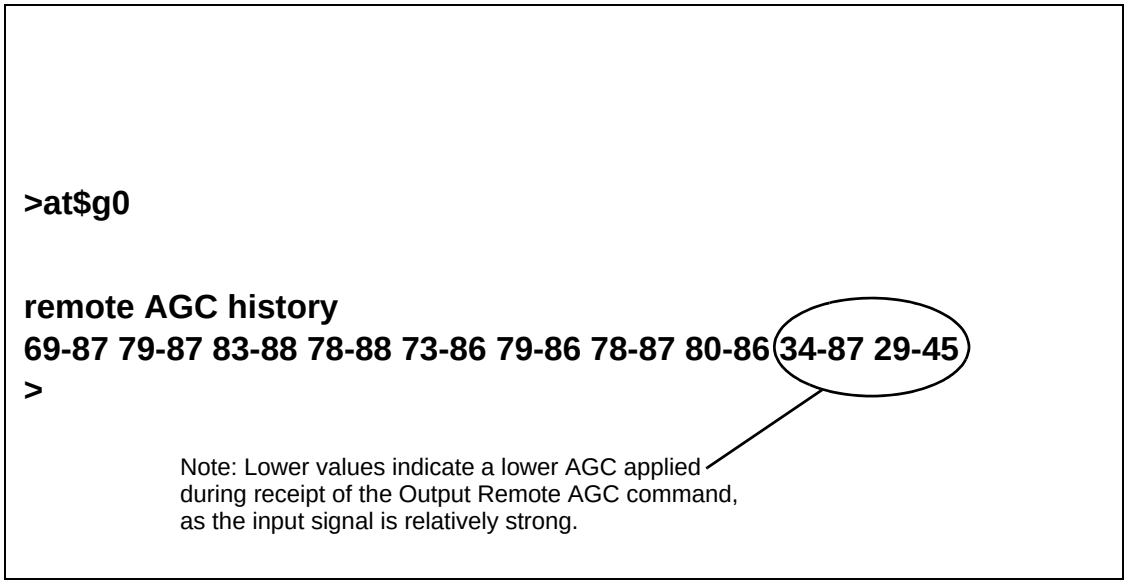


Figure 6-4 Output Remote AGC Command and Resulting Display

- 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 S Register 4 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.

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-88X or UDB-9000 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:

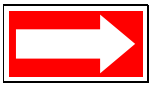
ARMED:	Displayed when no Release command has been received.
RELEASED and CONFIRMED:	Displayed when the release mechanism has been activated and the release has released from its mooring.
RELEASED and NOT CONFIRMED:	Displayed when the release mechanism has been activated but the release has not released 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 07 (-03 dB).
Battery: Low:	Displayed when the battery capacity is low. The transmit power level is capped at 06 (-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 07 (-03 dB).
Battery: Low:	Displayed when the battery capacity is low. Data transmissions are not allowed.

For an ATM-88X or UDB-9000 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 6-10 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.

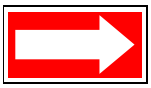
Release AT$Rn,m

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 6-10 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, a 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.

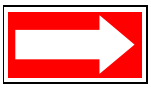
Burn Wire Release AT$Nn,m

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 6-10 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.

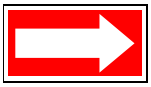
Compact Modem Wakeup ATWn,m

Syntax

ATWn,m [Enter]

Definition

The Compact Modem Wakeup command causes the Compact Modem at address n to wake up by transmitting a wakeup signal. Although a Compact Modem is in its low power state most of the time, it will periodically listen for this signal. The time between which a Compact Modem listens for the wakeup signal is the wakeup period and is preset by the user for a Compact Modem in S Register 10. The wakeup period must first be selected before the Compact Modem Wakeup command can be used to wake up a Compact Modem. The Compact Modem Wakeup command also sets the idle time of the Compact Modem to m once the modem is awakened. The range of idle times is from 1 to 90 minutes.



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 6-10 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, a 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.

7 Modem Operating Parameters (S Registers)

The ATM-88X and UDB-9000 Series Acoustic Telemetry Modem operating parameters are determined from settings that are stored in nonvolatile memory locations called S Registers. The operating parameters include the serial interface and transmitting acoustic bit rates, the modem address, the idle time, the transmit power level, the forwarding delay, and a number of other parameters that affect the operation of the modem.

The modem operating parameters and their corresponding S Register settings are listed in Table 7-1 on page 7-2. Also listed in the table are the page references to where detailed descriptions of the S Registers and their available settings are provided.

The S Register settings of a local modem can only be made when the 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 4-7.

When the modem is powered up, the S Register settings are automatically set to their default settings, which is their startup configuration. Any changes made to the S Register settings can be saved as the new startup configuration with the Write command (AT&W), and the changed settings become the new default settings. In addition, the S Registers can be set to their original factory default startup configuration at any time with the Factory Reset command (AT&F).

To place the modem into Command mode, do one of the following:

- Enter +++ rapidly.
- If S Register 15 is set to 00, power down and then power up the modem.
- If S Register 15 is set to 00, wait for the idle time to expire.

  The modem will go into Command mode and display the command prompt (>).

To make the S Register setting, type ATS and the S Register number to be set, followed by the equal character (=) and the setting desired, and then press Enter.

Table 7-1 ATM-88X and UDB-9000 Series Acoustic Telemetry Modem S Registers

S Register	Name	Factory Default Setting	Page
S0	Software Version Number	<Version>	7-3
S2	Packet Retry	00	7-5
S3	Serial Baud Rate	02	7-7
S4	Acoustic Bit Rate	05	7-9
S6	Transmit Power Level	08	7-11
S7	Acoustic Response Timeout	15	7-13
S8	Forwarding Delay	60	7-15
S9	Coprocessor Board[a]	00 or 01	7-17
S10	Idle Time	36	7-19
S11	RS-232 Driver/Flow Control	00	7-21
S12	ATX Test Message Length	00	7-23
S13	Verbose Level	01	7-25
S14	Remote Address	00	7-27
S15	Operating Mode	01	7-29
S16	Error Display	00	7-31
S17	Lowpower Wakeup	01	7-33
S18	Modem Address	00	7-35
S22	Received Acoustic Data Routing[b]	00	7-37
S28	Device Enable Line Control[b]	00	7-39
S37	Datalogger Recording Mode[b]	00	7-41
S50	Timed Release[b]	00	7-43
S57	Datalogger Sub-Blocks[b]	01	7-45

a. For an UDB-9000 Series Acoustic Telemetry Modem, S Register 9 is factory set to 01; for an ATM-88X Series, 00.

b. S Registers 21 and higher are factory S Registers. To make the setting for a factory S Register, type ATS and the S Register number to be set, followed by the asterisk character (*) and the setting desired, and then press Enter. DO NOT change any of the factory S Registers that are not listed in Table 7-1.

Software Version Number S0

Default Setting

<Version> The software version number.

Definition

The setting of S Register 0 is the software version number. For example, a setting of 040 is Version 4.0, and a setting of 041 is Version 4.1.

Available Settings

The setting of S Register 0 is factory set and cannot be changed.

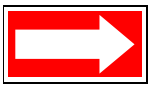
Packet Retry S2

Default Setting

00 Packet retry is disabled.

Definition

The setting of S Register 2 determines whether packet retry is enabled or disabled. When enabled, an acknowledgement is required after transmitting each packet of data, 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 packet retry is enabled, only the 256-byte cells containing errors are retransmitted.

Available Settings

There are two available settings for S Register 2 as listed below.

00: Disables packet retry.

01: Enables packet retry.

Special Considerations

When setting S Register 2, take note of the following,

- If packet retry is enabled, and if more than 12 kbytes of data are to be transmitted, then hardware RTS/CTS handshaking should be used.
- If packet retry is disabled, and if more than 16 kbytes of data are to be transmitted, then hardware RTS/CTS handshaking should be used.

Serial Baud Rate S3

Default Setting

02	The baud rate of the modem's RS-232/422 serial interface is 9600 baud with no echo.

Definition

The setting of S Register 3 determines the baud rate of a modem's RS-232/422 serial interface.

Available Settings

The available settings for S Register 3 are listed below and include settings with and without echo. 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 from the settings with echo only if the PC's terminal program does not have echo capability. If the terminal program has echo capability, select from the settings without echo and turn the program's echo feature on.

05:	1200 baud RS-232 (no echo)	133:	1200 baud RS-232 (w/echo)
00:	2400 baud RS-232 (no echo)	128:	2400 baud RS-232 (w/echo)
01:	4800 baud RS-232 (no echo)	124:	4800 baud RS-232 (w/echo)
02:	9600 baud RS-232 (no echo)	130:	9600 baud RS-232 (w/echo)
13:	1200 baud RS-422 (no echo)	141:	1200 baud RS-422 (w/echo)
08:	2400 baud RS-422 (no echo)	136:	2400 baud RS-422 (w/echo)
09:	4800 baud RS-422 (no echo)	137:	4800 baud RS-422 (w/echo)
10:	9600 baud RS-422 (no echo)	138:	9600 baud RS-422 (w/echo)

WARNING If the baud rate of the modem's serial interface is changed, be sure to set the baud rate of its 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 S Register 3, take note of the following:

- When connecting an instrument to the modem, and with S Register 3 set to the default 02 for 9600 baud with no echo, the instrument's serial port should be configured as follows:

  Baud rate: 9600 baud

  Parity: none

  Data bits: 8

  Stop bits: 1

- To have a changed S Register 3 setting take effect, enter the Lowpower State command (ATL) to place the modem into the lowpower state, and then enter the Attention command (AT) to bring the modem out of the lowpower state. Or instead, use the Write command (AT&W) to save the S Register setting as part of the startup configuration, then power down and then power up the modem.
- 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.

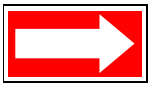
Acoustic Bit Rate S4

Default Setting

05 — 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 S Register 4 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 S Register 4 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-9000 Series Acoustic Telemetry Modem, however, can receive the bit rates of settings 09–13 below.

Available Settings

The range of settings for S Register 4 is from 02 to 13 as follows:

02: 140 bits/sec MFSK repeated four times with rate 1/2 convolutional coding and 25-ms multipath guard period

03: 300 bits/sec MFSK repeated twice with rate 1/2 convolutional coding and 25-ms multipath guard period

04: 600 bits/sec MFSK with rate 1/2 convolutional coding and 25-ms multipath guard period

05: 800 bits/sec MFSK with rate 1/2 convolutional coding and 12.5-ms multipath guard period

06: 1066 bits/sec MFSK with rate 1/2 convolutional coding and 3.125-ms multipath guard period

07: 1200 bits/sec MFSK with rate 1/2 convolutional coding

08: 2400 bits/sec MFSK

09: 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

Special Considerations

When setting S Register 4, 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 09–13 can be received by an UDB-9000 Series Acoustic Telemetry Modem only.

Transmit Power Level S6

Default Setting

08	The transmit power level of the modem is set to 0 dB, which is the highest power level.

Definition

The setting of S Register 6 determines the transmit power level of a modem.

Available Settings

The range of settings for S Register 6 is from 01 to 08 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:

01: -21 dB (minimum transmit power)

02: -18 dB

03: -15 dB

04: -12 dB

05: -09 dB

06: -06 dB

07: -03 dB

08: 00 dB (maximum transmit power)

Special Considerations

When setting S Register 6, 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.

Acoustic Response Timeout S7

Default Setting

15	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 S Register 7 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 S Register 7, the total two-way travel time of sound 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 S Register 7 is from 04 to 199, where each increment represents 0.5 seconds for a time range of 2.0 to 99.5 seconds.

Special Considerations

When setting S Register 7, 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 default S Register 7 setting of 15 for 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, an S Register 7 setting of 35 provides an acoustic response timeout 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 S Register 7, the local modem will output the results message “Response Not Received.” This message may also be followed by the message "ACK" *if* S Register 13 is set to 03 *and* the acknowledgement is received after the acoustic response timeout.
- For a UDB-9000 Universal Deck box, changing the Timeout setting in the Transpond Parameters pop-up will change the setting of S Register 7. As this setting could be as low as 2 seconds, it may have to be changed for an acknowledgement to be received. For information about the Timeout setting, refer to "Acquiring and Displaying the Range to a Remote Modem" on page 5-20.

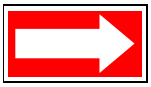
Forwarding Delay S8

Default Setting

60	The modem will transmit the data in one of its four 4-kbyte transmit data buffers, or transfer the data in its 8-kbyte temporary data buffer to the data logger memory when the corresponding buffer is full or 3 seconds after the last data are input, whichever occurs first.

Definition

The setting of S Register 8 determines the forwarding delay of a modem. When a local modem is online with a remote modem, the local modem accumulates data in its four 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 its 8-kbyte temporary 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 S Register 8 is from 01 to 100, where each increment represents 0.05 seconds for a time range of 0.05 to 5.0 seconds.

Special Considerations

When setting S Register 8, 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.
- Handshaking should be used to ensure there is no loss of data when the 8-kbyte temporary data buffer or all four of the 4-kbyte transmit data

buffers are full. This also applies when the modem is transferring data from the temporary data buffer to the data logger memory, transmitting the contents of the data logger memory over the acoustic link, or clearing the contents of data logger memory.

Coprocessor Board S9

Default Setting

00	The Coprocessor Board is disabled or is not installed in the modem.

Definition

The setting of S Register 9 determines whether the Coprocessor Board is installed and enabled.

Available Settings

There are two available settings for S Register 9 as listed below.

00: Disables the Coprocessor Board.

01: Enables the Coprocessor Board.

Special Considerations

When setting S Register 9, take note of the following:

- Only UDB-9000 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 causes the setting of S Register 9 to reset to 00 automatically.
- When setting S Register 9 to 01, the modem will respond with the message "coprocessor ver x.x" if the Coprocessor Board is installed and fully operational.
- When setting S Register 9 to 01, the modem will respond with the message "coprocessor error" if the Coprocessor Board is not installed or is installed and not fully operational.

Idle Time S10

Default Setting

36 — 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 180 seconds, it will go into the lowpower state.

Definition

The setting of S Register 10 determines the idle time, which is the time after which a modem will go into the lowpower state if there is no input either from its host processor over the serial interface or from a remote modem over the acoustic link.

WARNING Depending on the setting of S Register 11, the RS-232 driver may be set to turn off whenever the modem is in the lowpower state. Refer to "RS-232 Driver/Flow Control S11" on page 7-21 for information on S Register 11. 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.

Available Settings

The range of settings for S Register 10 is from 01 to 60, where each increment represents 5 seconds for a time range of 5 to 300 seconds. In addition, 00 sets the idle time to 2 seconds and 255 prevents the modem from going into the lowpower state indefinitely.

Special Considerations

When setting S Register 10, take note of the following:

- The default S Register 10 for a UDB-9000 is 309.
- S Register 10 settings of greater than 255 are for the Compact Modem wakeup only.
- If a remote modem will be accessed once a day 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.

- When a modem is not being powered by batteries, the idle time should be set long, or indefinite. This improves operating efficiency, as the modem never has to be reawakened from its lowpower state.

RS-232 Driver/Flow Control S11

Default Setting

00 There is no handshaking.

Definition

The setting of S Register 11 determines whether the RS-232 driver is turned off or left on when a modem is in the lowpower state. Turning off the driver conserves battery power. The setting also determines whether hardware RTS/CTS handshaking or software XON/XOFF handshaking is used for flow control, or if no handshaking is used.

WARNING A setting of 01 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.

Available Settings

There are three available settings for S Register 11 as listed below.

00: Selects no handshaking and turns off the RS-232 driver when the modem is in the lowpower state.

01: Selects hardware RTS/CTS handshaking and turns off the RS-232 driver when the modem is in the lowpower state. Therefore when the modem is in the lowpower state, there is no handshaking.

02: Selects hardware RTS/CTS handshaking and leaves the RS-232 driver 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.

03: Selects software XON/XOFF handshaking and turns off the RS-232 driver when the modem is in the lowpower state.

ATX Test Message Length S12

Default Setting

00	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, and when the message is received by the local modem, it will not be displayed.

Definition

The setting of S Register 12 determines which of 8 preset test messages a remote modem will be commanded to transmit when it receives the Acoustic Link Test command (ATXn) from the local modem. The setting also determines whether the preset message, when received by the local modem, is displayed.

Available Settings

There are 16 available settings for S Register 12 as listed below.

00: 8-byte message (no display)	128: 8-byte message (w/display)
01: 32-byte message (no display)	129: 32-byte message (w/display)
02: 128-byte message (no display)	130: 128-byte message (w/display)
03: 256-byte message (no display)	131: 256-byte message (w/display)
04: 512-byte message (no display)	132: 512-byte message (w/display)
05: 1024-byte message (no display)	133: 1024-byte message (w/display)
06: 2048-byte message (no display)	134: 2048-byte message (w/display)
07: 4096-byte message (no display)	135: 4096-byte message (w/display)

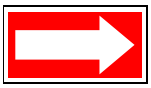
Verbose Level S13

Default Setting

01	The verbose level of the modem is set to the level which displays data and some diagnostic messages.

Definition

The setting of S Register 13 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 S Register 13.

Available Settings

The range of settings for S Register 13 is from 00 to 04 as listed below.

00: Only data are displayed.

01: Data and some diagnostic messages are displayed.

02: Data, most diagnostic messages, and received data statistics are displayed.

03: Data, additional diagnostic messages, and received data statistics are displayed.

04: For factory use only.

With a setting of 02 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—in dB, where the higher the value the better the acoustic environment.

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 S Register 13, take note of the following:

- When a PC is used as the host processor, S Register 13 should be set to 01.
- When an instrument is used as the host processor, S Register 13 should be set to 00. This will avoid errors that might occur should the instrument be unable to recognize the diagnostic messages or received data statistics.

Remote Address S14

Default Setting

00	The address of the remote modem that the local modem is online with is 00.

Definition

The setting of S Register 14 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 S Register 15 is set to 01.

Available Settings

The range of settings for S Register 14 is from 00 to 99. This provides a total of 100 addresses.

Special Considerations

When setting S Register 14, take note of the following:

- The Dial command (ATDn) sets S Register 14 of the remote modem to the address of the local modem.
- The Dial command (ATDn) sets S Register 14 of the local modem to the address of the remote modem.

Operating Mode S15

Default Setting

01	When the modem is powered up or awakened from the lowpower state, the modem will go into Online mode.

Definition

The setting of S Register 15 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 range of settings for S Register 15 is from 00 to 02 as listed below.

00: Command mode

01: Online mode

02: Datalogger mode

Error Display S16

Default Setting

00 Data packets containing errors are displayed.

Definition

The setting of S Register 16 determines whether data packets that contain errors are displayed.

Available Settings

There are two available settings for S Register 16 as listed below.

00: Data packets containing errors are displayed.

01: Data packets containing errors are not displayed.

Lowpower Wakeup S17

Default Setting

01	The lowpower wakeup signal is transmitted at the beginning of every data packet.

Definition

The setting of S Register 17 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 S Register 15 as listed below.

00: Disables the lowpower wakeup signal.

01: Enables the lowpower wakeup signal.

Special Considerations

When setting S Register 17, 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 S Register 10 to 255.
- Disabling the lowpower wakeup signal lengthens the modem battery pack life for the transmitting modem.

Modem Address S18

Default Setting

00	The address of the modem is 00.

Definition

The setting of S Register 18 determines the address of the modem.

Available Settings

The range of settings for S Register 18 is from 00 to 99. This provides a total of 100 addresses.

Special Considerations

When setting S Register 18, take note of the following:

- S Register 18 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.

Received Acoustic Data Routing S22

Default Setting

00	Data received over the acoustic link are output over the serial interface.

Definition

The setting of S Register 22 determines whether data received over the acoustic link are output over the serial interface, stored in the data logger or both.

Available Settings

There are three available settings for S Register 22 as listed below.

00: Data received over the acoustic link are output over the serial interface.

01: Data received over the acoustic link are stored in the data logger.

02: Data received over the acoustic link are both output over the serial interface and stored in the data logger.

Device Enable Line Control S28

Default Setting

00	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 S Register 28 determines whether the Device Enable output is set automatically or with a command, or set only with a command.

Available Settings

There are three available settings for S Register 28 as listed below.

00: 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 6-3.

01: Reserved and should not be used.

02: 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.

Datalogger Recording Mode S37

Default Setting

00	The data logger will record up to 704 kbytes of data.

Definition

The setting of S Register 37 determines whether the data logger will record up to 704 kbytes of data and then stop, or record data in a 128-kbyte "ring" buffer. The ring buffer comprises two contiguous 64-kbyte buffers where data are initially recorded in the first buffer, and when this buffer is filled, recorded in the second. When the second buffer is filled, the first buffer is erased and data are again recorded in this buffer. When the first buffer is again filled, the second buffer is erased and then filled again. Data are recorded continuously in this manner ensuring that the latest 64 kbytes of data are always available. The data can be received acoustic data if S Register 22 is set to 01 or 02, or the data can be data received on the serial interface if S Register 15 is set to 02.

Available Settings

There are two available settings for S Register 37 as listed below.

00: The data logger will record up to 704 kbytes of data.

01: The data logger will record to a 128-kbyte ring buffer.

Special Considerations

When setting S Register 17, take note of the following:

- To store data received over the acoustic link in the data logger, S Register 22 must be set to 00 or 02.
- To store data received over the serial interface in the data logger, S Register 15 must be set to 02.
- When S Register 37 is changed, the data logger memory is erased.

Timed Release S50

Default Setting

00	The timed release is disabled.

Definition

The setting of S Register 50 enables or disables the timed release of a SMART Release or SMART Modem. When enabled, the release will be activated a predetermined time after power up.

Available Settings

The range of settings for S Register 50 is from 000 to 999, where 000 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 S Register 50, take note of the following:

- The setting of S Register 50 must be saved using the Write command (AT&W).
- 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.

Datalogger Sub-Blocks S57

Default Setting

01	The number of sub-blocks transmitted is 1.

Definition

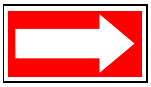
The setting of S Register 57 determines the number of sub-blocks transmitted when using the Output Datalogger Sub-Block command (AT$BSn,m).

Available Settings

The range of settings for S Register 57 is from 01 to 15.

8 Maintenance and Troubleshooting

This section encompasses the recommended care and maintenance procedures for the subsea modem components of the Teledyne Benthos ATM-88X and UDB-9000 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-9000 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:

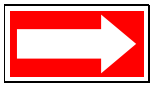
- 9/64 Allen wrench
- 5/32 Allen wrench
- Phillips head screwdriver
- Flat head screwdriver
- Wire cutters
- Silicone O-ring lubricant
- Isopropyl alcohol
- Alcohol wipes
- Lint-free cloths or paper towels
- Electrical tape

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 4-6 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.

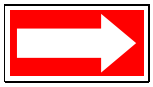
4. Lubricate the POWER/SERIAL connector pins with a light coat of silicone lubricant and install the dummy connector supplied with the modem.



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-885R and ATM-887R Acoustic Telemetry Modems, perform all the steps listed below. For the ATM-885 and ATM-887 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-886 Acoustic Telemetry Modem, 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-885 and ATM-885R Acoustic Telemetry Modems are different than those for the ATM-887 and ATM-887R Acoustic Telemetry 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-885 or ATM-885R Modem Battery Pack

For either the ATM-885 or the ATM-885R Acoustic Telemetry Modem, 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 an ATM-885 Acoustic Telemetry Modem or the remote transducer connector end cap for an ATM-885R Acoustic Telemetry Modem.

To change the modem battery pack for an ATM-885 or ATM-885R:

1. Turn the modem off by pulling the on/off switch all the way out. Refer to Figure 4-2 on page 4-6 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 transducer end cap for an ATM-885 Acoustic Telemetry Modem, or the remote transducer connector end cap for an ATM-885R 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 8-7 and clean or replace the O-rings on both end caps.

12. Insert the new battery pack into the housing from the transducer end cap end for an ATM-885 Acoustic Telemetry Modem, or from the remote transducer connector end cap end for an ATM-885R Acoustic Telemetry Modem, and slide the battery pack into the housing about half way.
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-887 or ATM-887R Modem Battery Pack

For either the ATM-887 or the ATM-887R Acoustic Telemetry Modem, both end caps require removal when changing the modem battery pack. First, the transducer end cap for an ATM-887 Acoustic Telemetry Modem or the top end cap for an ATM-887R Acoustic Telemetry Modem must be removed, and then the POWER/SERIAL connector end cap.

To change the modem battery pack for an ATM-887 or ATM-887R:

1. Turn the modem off by pulling the on/off switch all the way out. Refer to Figure 4-2 on page 4-6 for the location of the modem on/off switch.
2. Using a flat head screwdriver loosen the stainless steel band clamp on the transducer end cap for an ATM-887 Acoustic Telemetry Modem or the remote transducer connector end cap for an ATM-887R 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 8-7 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.

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-88X or UDB-9000 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 Benthos directly. Refer to "Customer Service" on page vi for information on how to contact 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 4-15.

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 Level S13" on page 7-25 for information on S Register 13.

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 4-7.

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 "Serial Baud Rate S3" 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-9000 Universal Deck Box is the local modem, increase the volume setting. Refer to "Adjusting the Speaker Volume" on page 5-8 for instructions on how to adjust the volume.

B. If the local modem is an UDB-9000 Universal Deck Box, or an ATM-885R or ATM-887R 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 Level S13" on page 7-25 for information on S Register 13.

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 6-11 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-88X and UDB-9000 Series Acoustic Telemetry Modems, including the surface and subsea modems, the modem board sets, and the remote transducers. Refer to these drawings when setting up and installing the modems.

Surface Modems

A-270-108	Outline, UDB-9000 Universal Deck Box
C-270-215	Outline, ATM-980 Buoy Box

Subsea Modems

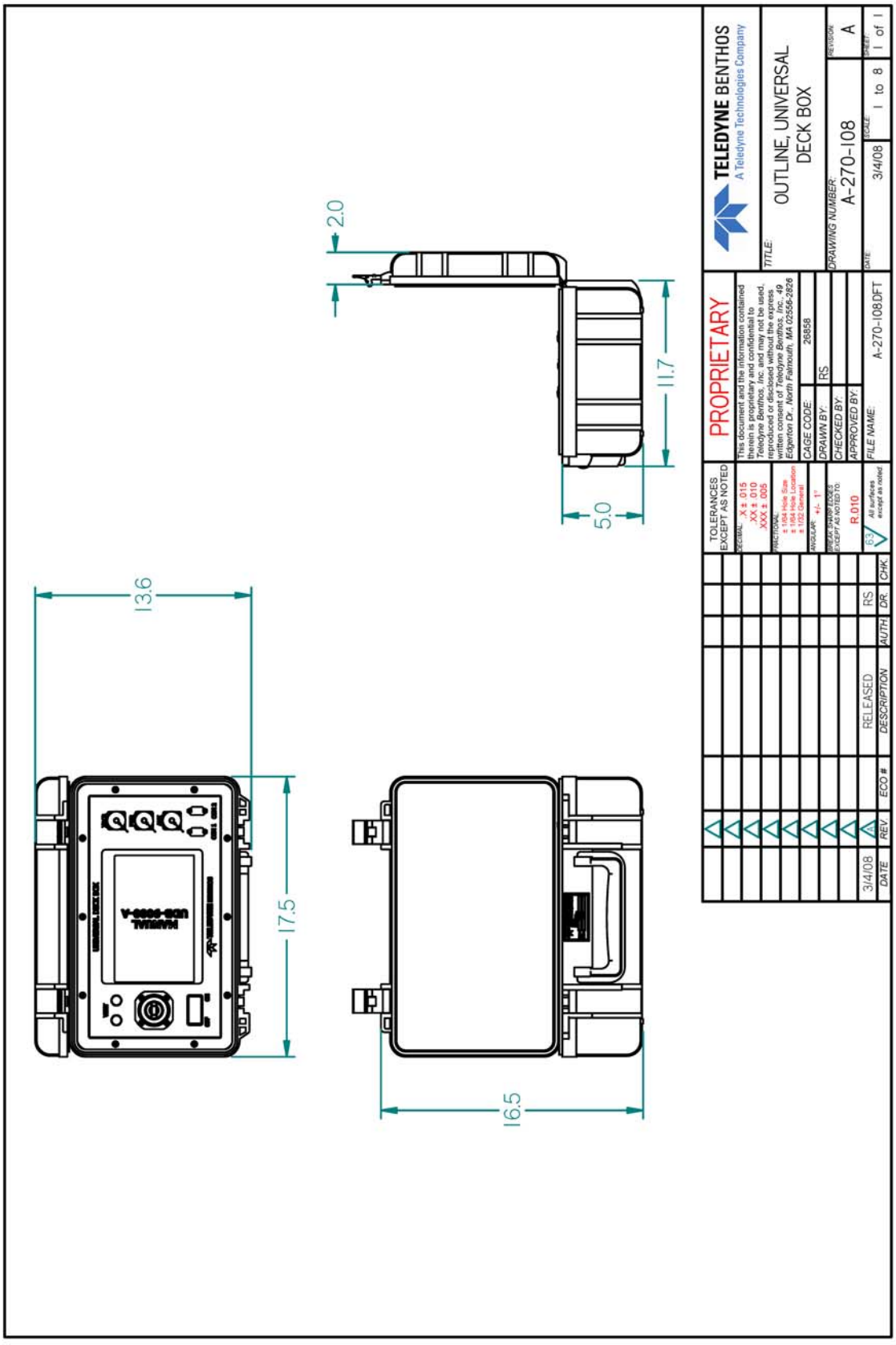
D-270-53	Outline, ATM-885 Modem
D-270-88	Outline, ATM-885R Modem
D-270-60	Outline, ATM-886 Modem
D-270-259	Outline, ATM-886 Modem, Deep
D-270-56	Outline, ATM-887 Modem
D-270-89	Outline, ATM-887R Modem

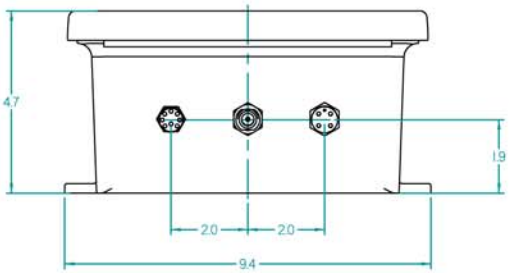
Modem Board Sets

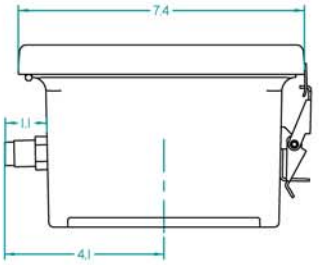
B-270-156	Outline, ATM-900 OEM Board Set

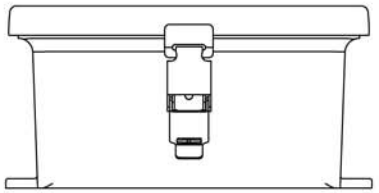
Remote Transducers

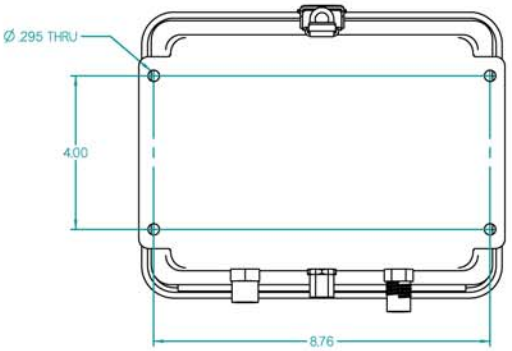
B-270-267	Outline, Remote LF amd MF Omnidirectional Transducers
B-270-337	Outline, Remote LF Directional Transducer
B-270-371	Outline, Remote MF Directional Transducer


2.0
11.7
5.0
13.6
17.5
16.5
TELEDYNE BENTHOS
A Teledyne Technologies Company
PROPRIETARY
TITLE:
OUTLINE, UNIVERSAL DECK BOX
DRAWING NUMBER:
A-270-108
REVISION:
A
SCALE:
1 to 8
SHEET:
1 of 1
DATE:
3/4/08
CAGE CODE:
26858
DRAWN BY:
RS
CHECKED BY:
APPROVED BY:
FILE NAME:
A-270-108.DFT
TOLERANCES EXCEPT AS NOTED
R.010
3/4/08
RELEASED
RS









NOTES:
1. ALL DIMENSIONS ARE IN INCHES.
2. DESIGN SUBJECT TO CHANGE.

DATE	REV	ECO NO	DESCRIPTION	DR	CHK	APPR
09-10-09	A	----	OUTLINE DRAWING	TMO		

TOLERANCES EXCEPT AS NOTED
DECIMAL X=±.015 .XX=±.010 .XXX ±.005
FRACTIONAL ±1/64 Hole size &location ±1/32 General
ANGULAR ±1°
BREAK SHARP EDGES EXCEPT AS NOTED R.010
63 ALL surfaces except as noted

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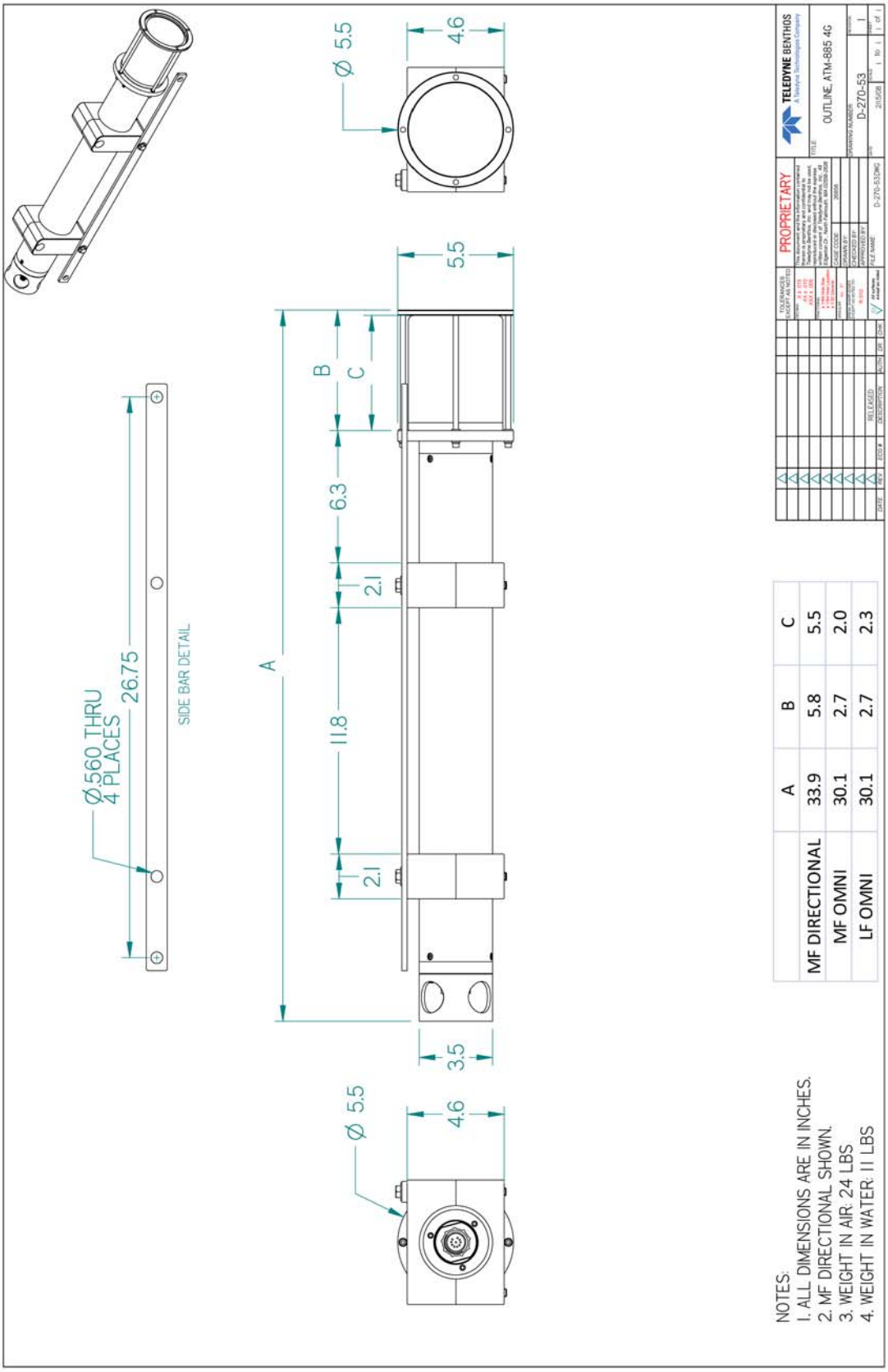
DRAWN BY: TMO
CHECKED BY:
APPROVED BY:
DRAWING FILE NAME: C270215.DWG

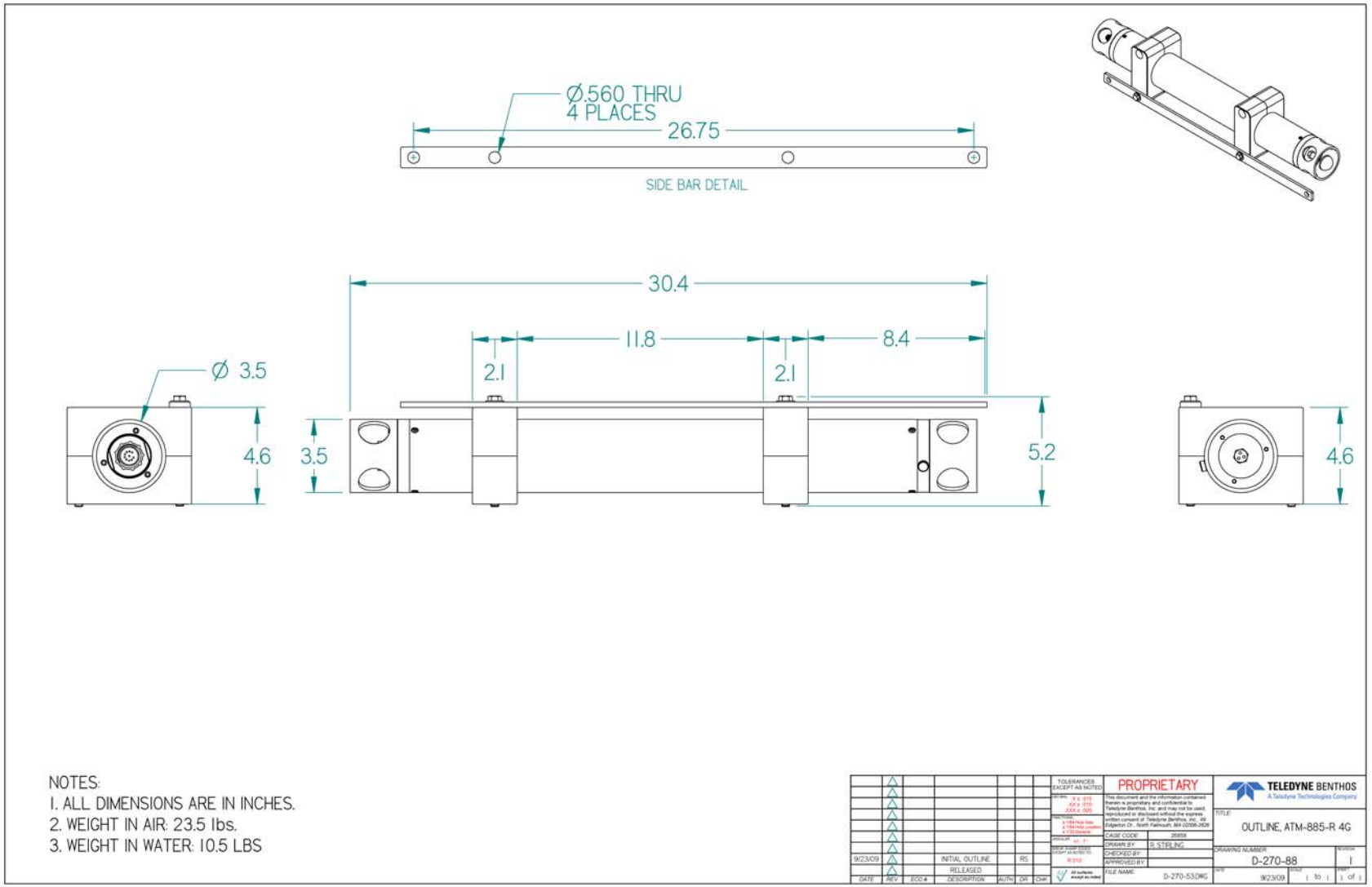
TELEDYNE BENTHOS
A Teledyne Technologies Company

TITLE: OUTLINE, ATM-980 BUOY BOX

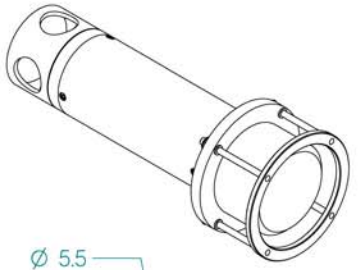
CAGE CODE 26858 | DRAWING NUMBER: C-270-215 | REVISION 1
DATE: 9/10/09 | SCALE: FULL | SHEET 1 OF 1

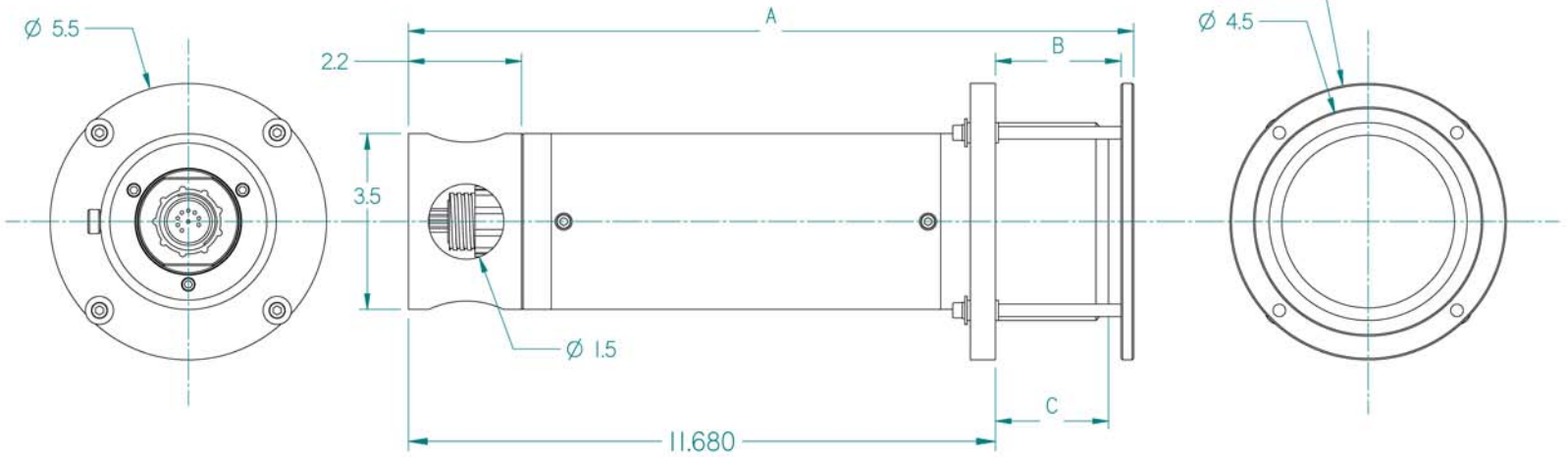


	A	B	C
MF DIRECTIONAL	33.9	5.8	5.5
MF OMNI	30.1	2.7	2.0
LF OMNI	30.1	2.7	2.3


Ø.560 THRU
4 PLACES
26.75
SIDE BAR DETAIL
30.4
11.8
8.4
2.1
2.1
Ø 3.5
4.6
3.5
5.2
4.6
NOTES:
1. ALL DIMENSIONS ARE IN INCHES.
2. WEIGHT IN AIR: 23.5 lbs.
3. WEIGHT IN WATER: 10.5 LBS
PROPRIETARY
TELEDYNE BENTHOS
A Teledyne Technologies Company
OUTLINE, ATM-885-R 4G
D-270-88
D-270-53.DWG
9/23/09
INITIAL OUTLINE
RELEASED

NOTES:
1. ALL DIMENSIONS ARE IN INCHES.
2. WEIGHT IN AIR: 6 LBS
3. WEIGHT IN SALT WATER: APPROX 2.9 LBS
4. LF OMNI SHOWN.





	A	B	C
MF DIRECTIONAL	17.4	5.8	5.5
MF OMNI	14.4	2.7	2.0
LF OMNI	14.4	2.7	2.3

8.20.08		—	RELEASED		NLH					
DATE		REV.	ECO #	DESCRIPTION		AUTH	DR.	CHK		

TOLERANCES EXCEPT AS NOTED:
DECIMALS: X ± .015, XX ± .010, XXX ± .005
FRACTIONS: ± 1/64 Hole Size, ± 1/32 Hole Location, ± 1/32 General
ANGLES: ± 1°
BREAK EDGES TO: 0.010 except as noted
All surfaces except as noted

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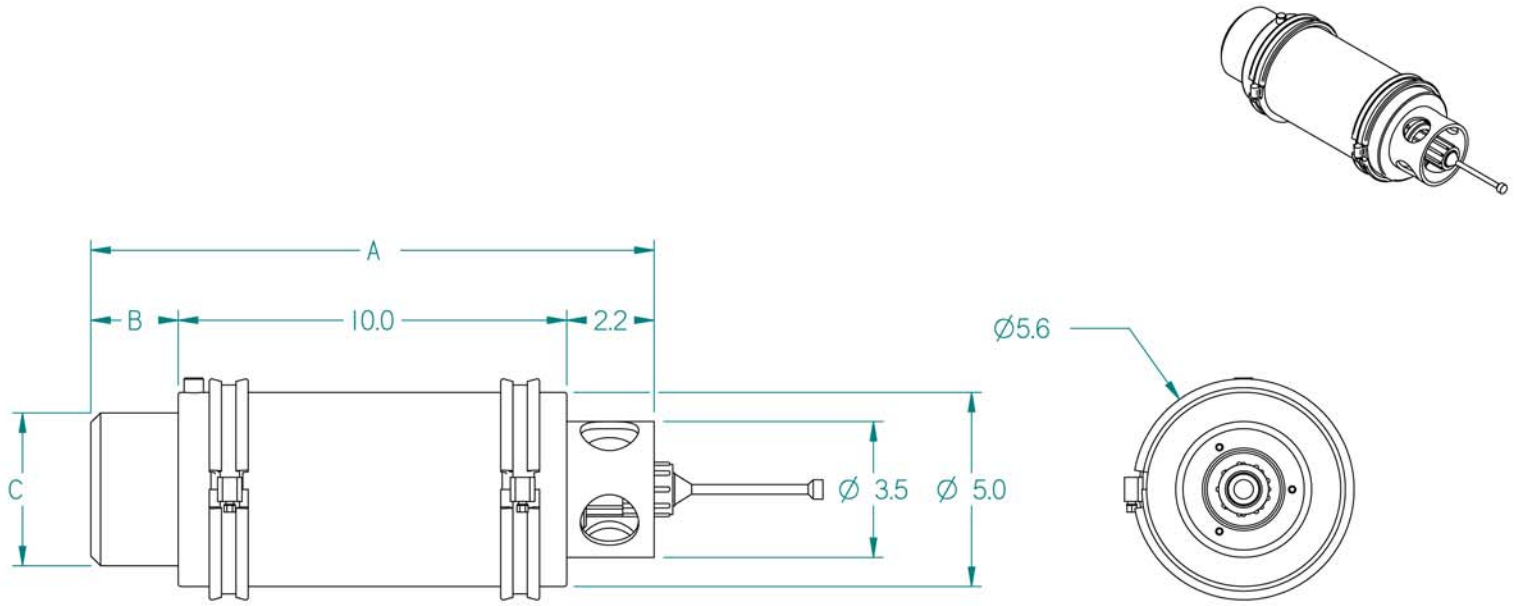
CAGE CODE: 26559
DRAWN BY: NLH
CHECKED BY:
APPROVED BY:
FILE NAME: D270-60 R1.DFT

TELEDYNE BENTHOS
A Teledyne Technologies Company

TITLE: OUTLINE, ATM-886 4G,
DRAWING NUMBER: D270-60
REVISION: I
DATE: 08.15.08
SHEET 1 of 1



PART NUMBER	TRANSDUCER	WEIGHT IN AIR	WEIGHT IN WATER	A	B	C
C-270-255-1	LF OMNI	15.0 LBS	5.0	14.5	2.3	4.0
C-270-255-2	MF OMNI	13.8 LBS	4.6	14.2	2.0	2.9
C-270-255-3	MF DIRECTIONAL	19.5 LBS	6.5	17.7	5.5	4.6

ALL DIMENSIONS ARE IN INCHES.
LF OMNI TRANSDUCER SHOWN.

DATE	REV.	ECO #	DESCRIPTION	AUTH.	DR.	CHK.
4/8/10	A		RELEASED		RS	

TOLERANCES EXCEPT AS NOTED
DECIMAL: .X ± .015, .XX ± .010, .XXX ± .005
FRACTIONAL: ± 1/64 Hole Size, ± 1/64 Hole Location, ± 1/32 General
ANGULAR: +/- 1°
BREAK SHARP EDGES EXCEPT AS NOTED TO: R.010
All surfaces except as noted

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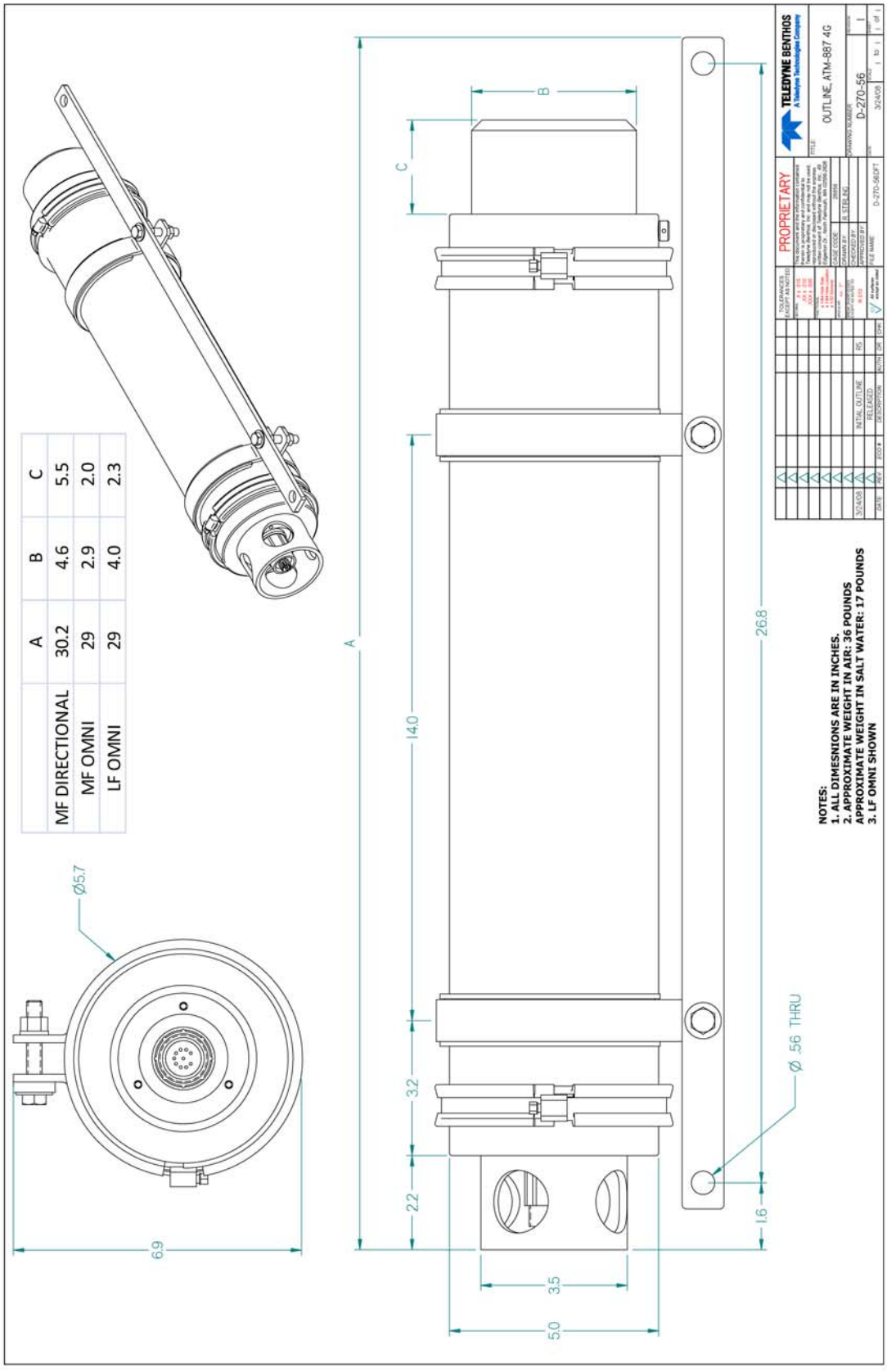
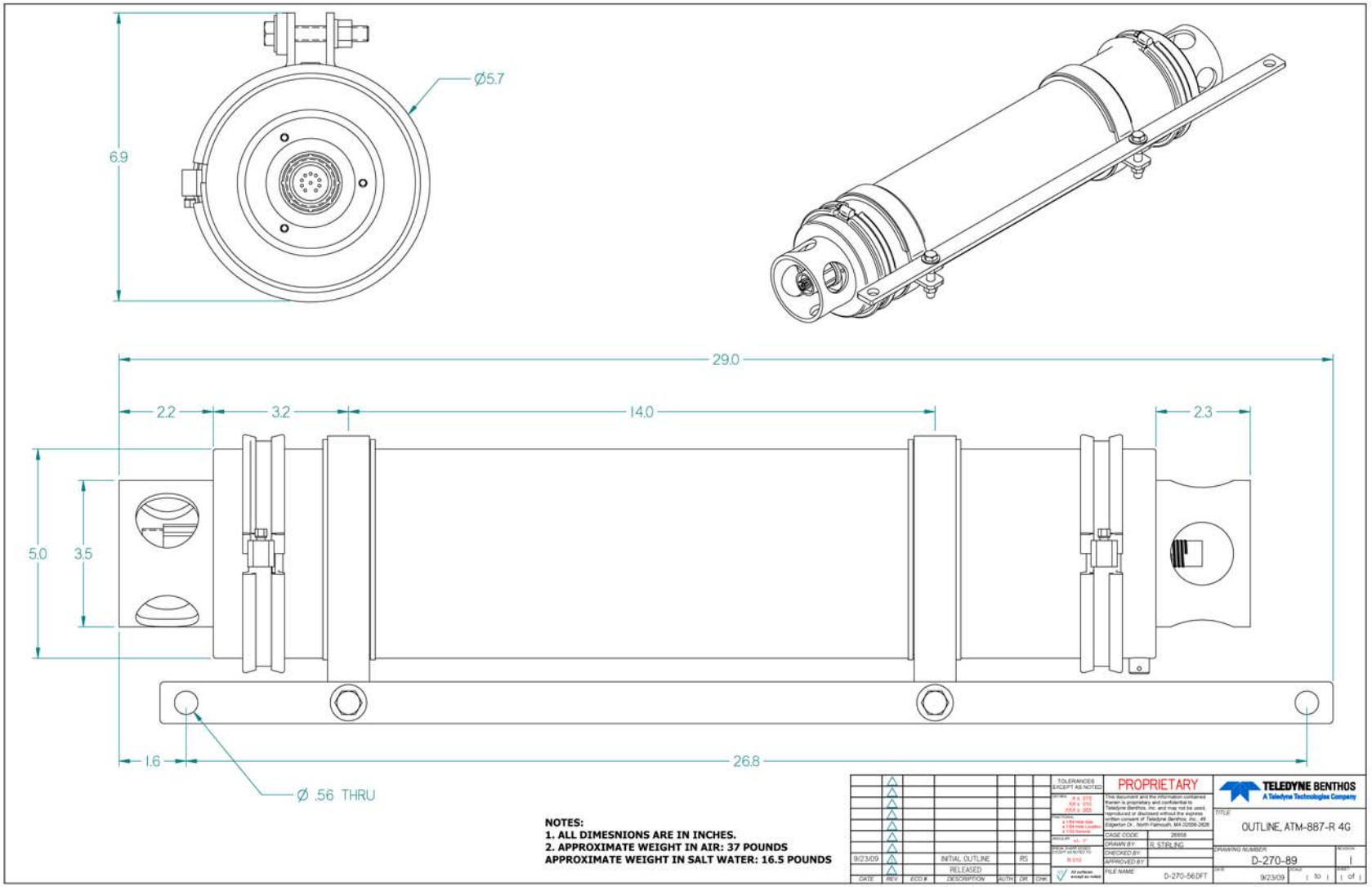
CAGE CODE: 26858
DRAWN BY: R. STIRLING
CHECKED BY:
APPROVED BY:
FILE NAME: C-270-259RevA.DFT

TELEDYNE BENTHOS
A Teledyne Technologies Company

TITLE: OUTLINE, ATM-886D 4G LF OMNI
DRAWING NUMBER: C-270-259
REVISION: A
DATE: 4/6/10
SCALE: 1 to 1
SHEET: 1 of 1



	A	B	C
MF DIRECTIONAL	30.2	4.6	5.5
MF OMNI	29	2.9	2.0
LF OMNI	29	4.0	2.3



NOTES:
1. ALL DIMESNIONS ARE IN INCHES.
2. APPROXIMATE WEIGHT IN AIR: 37 POUNDS
APPROXIMATE WEIGHT IN SALT WATER: 16.5 POUNDS

DATE	REV	ECO #	DESCRIPTION	AUTH	DR	CHK
9/23/09			INITIAL OUTLINE		RS	
			RELEASED			

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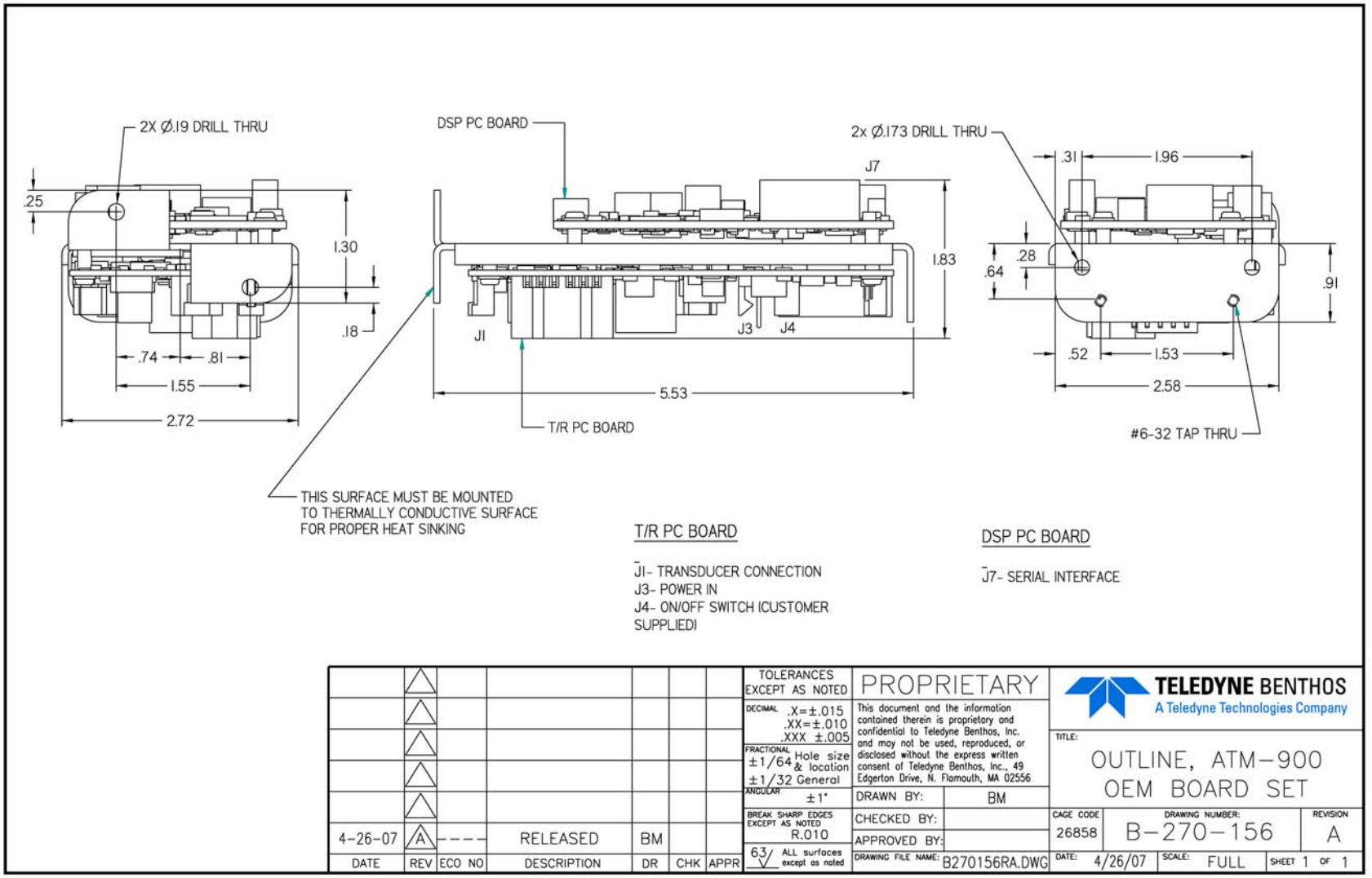
CAGE CODE: 26958
DRAWN BY: R. STERLING
CHECKED BY:
APPROVED BY:
FILE NAME: D-270-56.DFT

TELEDYNE BENTHOS
A Teledyne Technologies Company

TITLE: OUTLINE, ATM-887-R 4G

DRAWING NUMBER: D-270-89 REVISION: I

DATE: 9/23/09 SCALE: 1 : 10 SHEET: 1 of 1



T/R PC BOARD

J1- TRANSDUCER CONNECTION
J3- POWER IN
J4- ON/OFF SWITCH (CUSTOMER SUPPLIED)

DSP PC BOARD

J7- SERIAL INTERFACE

4-26-07	A	----	RELEASED	BM			
DATE	REV	ECO NO	DESCRIPTION	DR	CHK	APPR	

TOLERANCES EXCEPT AS NOTED
DECIMAL .X=±.015 .XX=±.010 .XXX ±.005
FRACTIONAL ±1/64 Hole size & location ±1/32 General
ANGULAR ±1°
BREAK SHARP EDGES EXCEPT AS NOTED R.010
63 ALL surfaces except as noted

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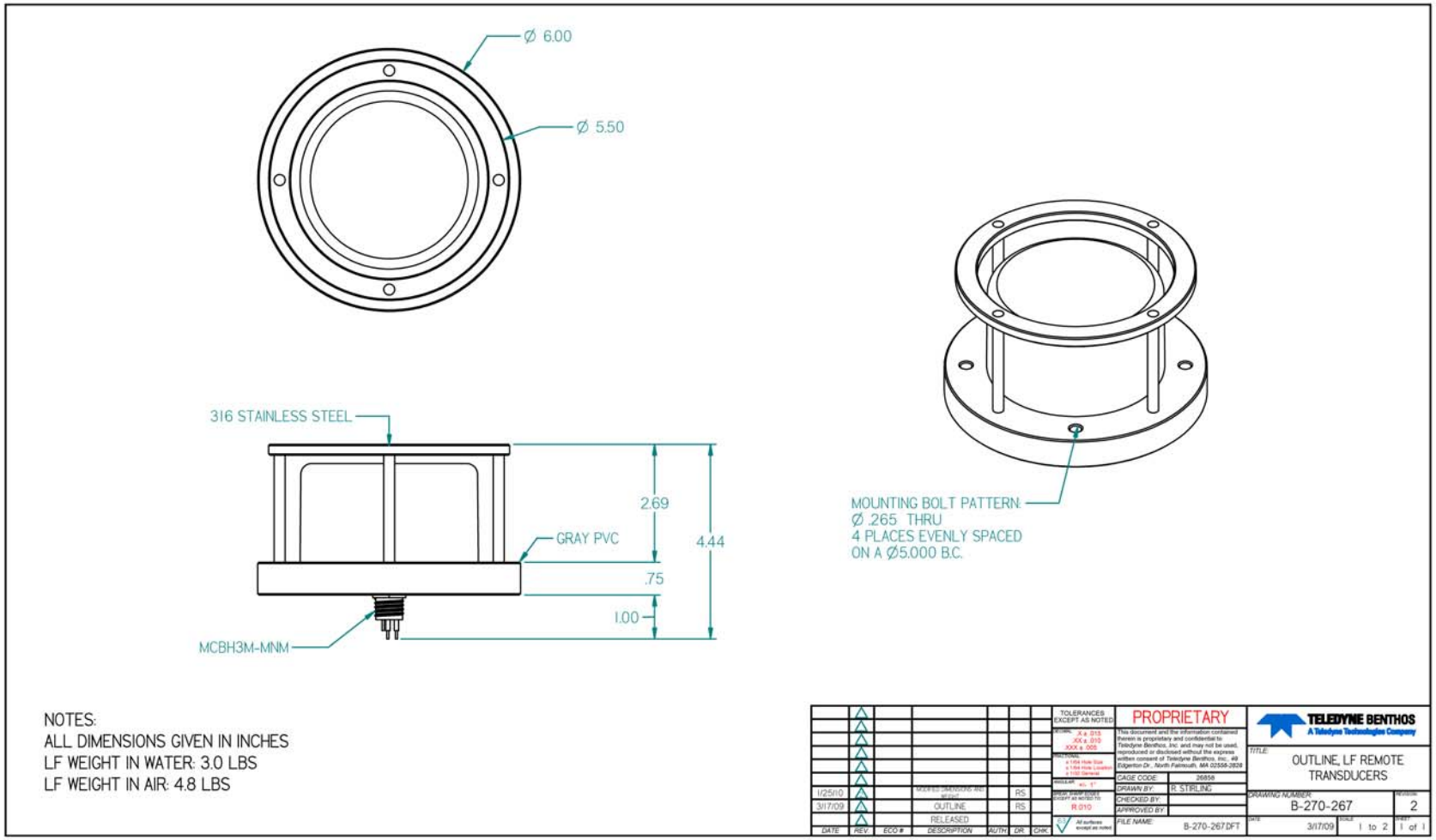
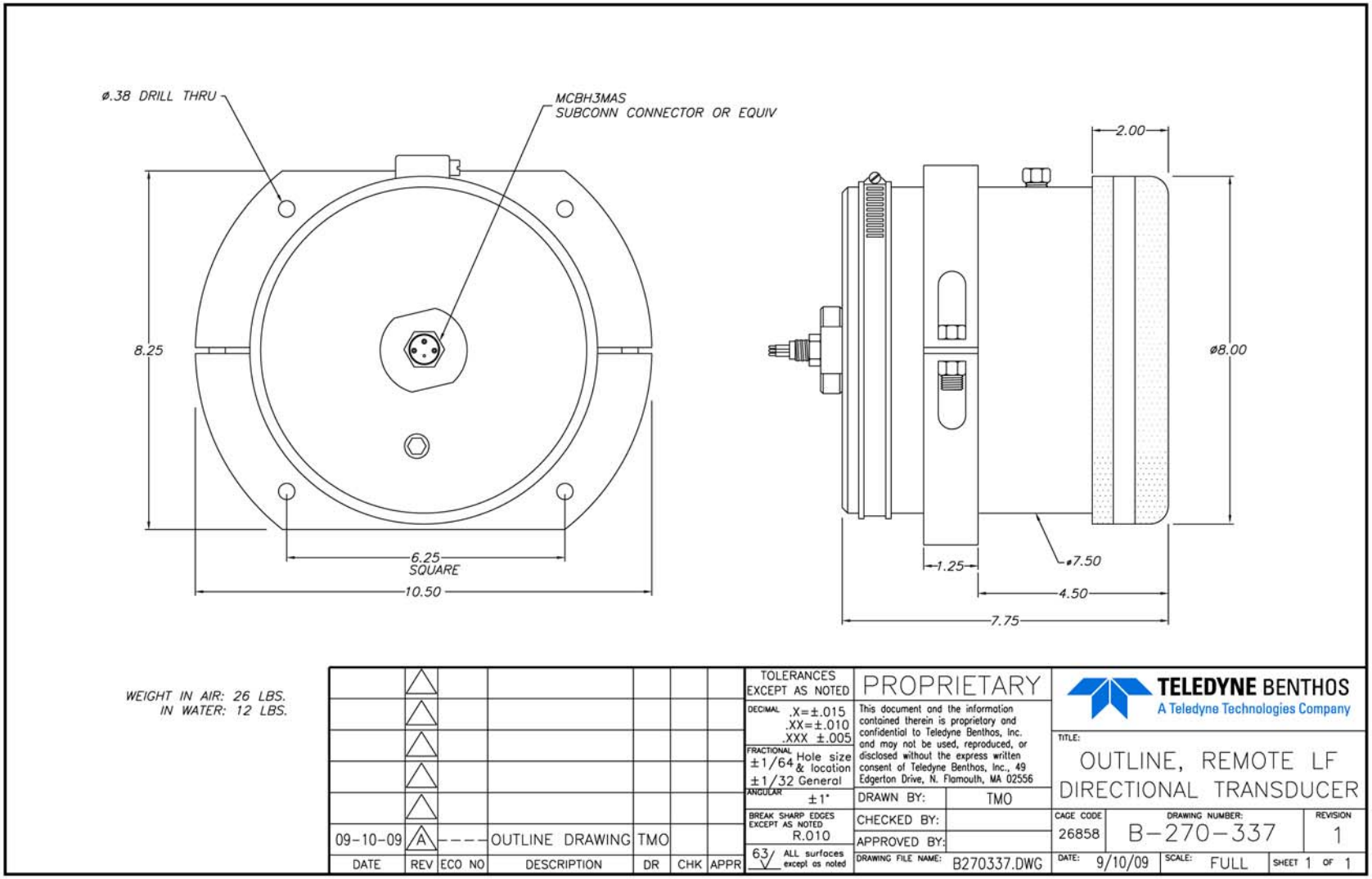
DRAWN BY: BM
CHECKED BY:
APPROVED BY:
DRAWING FILE NAME: B270156RA.DWG

TELEDYNE BENTHOS
A Teledyne Technologies Company

TITLE: OUTLINE, ATM-900 OEM BOARD SET

CAGE CODE 26858 | DRAWING NUMBER: B-270-156 | REVISION A
DATE: 4/26/07 | SCALE: FULL | SHEET 1 OF 1


Ø 6.00
Ø 5.50
316 STAINLESS STEEL
2.69
GRAY PVC
4.44
.75
1.00
MCBH3M-MNM
MOUNTING BOLT PATTERN:
Ø .265 THRU
4 PLACES EVENLY SPACED
ON A Ø5.000 B.C.
NOTES:
ALL DIMENSIONS GIVEN IN INCHES
LF WEIGHT IN WATER: 3.0 LBS
LF WEIGHT IN AIR: 4.8 LBS
PROPRIETARY
TELEDYNE BENTHOS
A Teledyne Technologies Company
TITLE:
OUTLINE, LF REMOTE TRANSDUCERS
DRAWING NUMBER:
B-270-267
SIZE
2
DATE
3/17/09
SCALE
1 to 2
SHEET
1 of 1
CAGE CODE:
26858
DRAWN BY:
R. STIRLING
CHECKED BY:
APPROVED BY:
FILE NAME:
B-270-267.DFT
1/25/10
3/17/09
RS
RS
OUTLINE
RELEASED
DATE
REV.
ECO #
DESCRIPTION
AUTH
DR.
CHK.



WEIGHT IN AIR: 26 LBS.
IN WATER: 12 LBS.

DATE	REV	ECO NO	DESCRIPTION	DR	CHK	APPR
09-10-09	A	----	OUTLINE DRAWING	TMO		

TOLERANCES EXCEPT AS NOTED
DECIMAL .X=±.015 .XX=±.010 .XXX ±.005
FRACTIONAL ±1/64 Hole size & location ±1/32 General
ANGULAR ±1°
BREAK SHARP EDGES EXCEPT AS NOTED R.010
63 ALL surfaces except as noted

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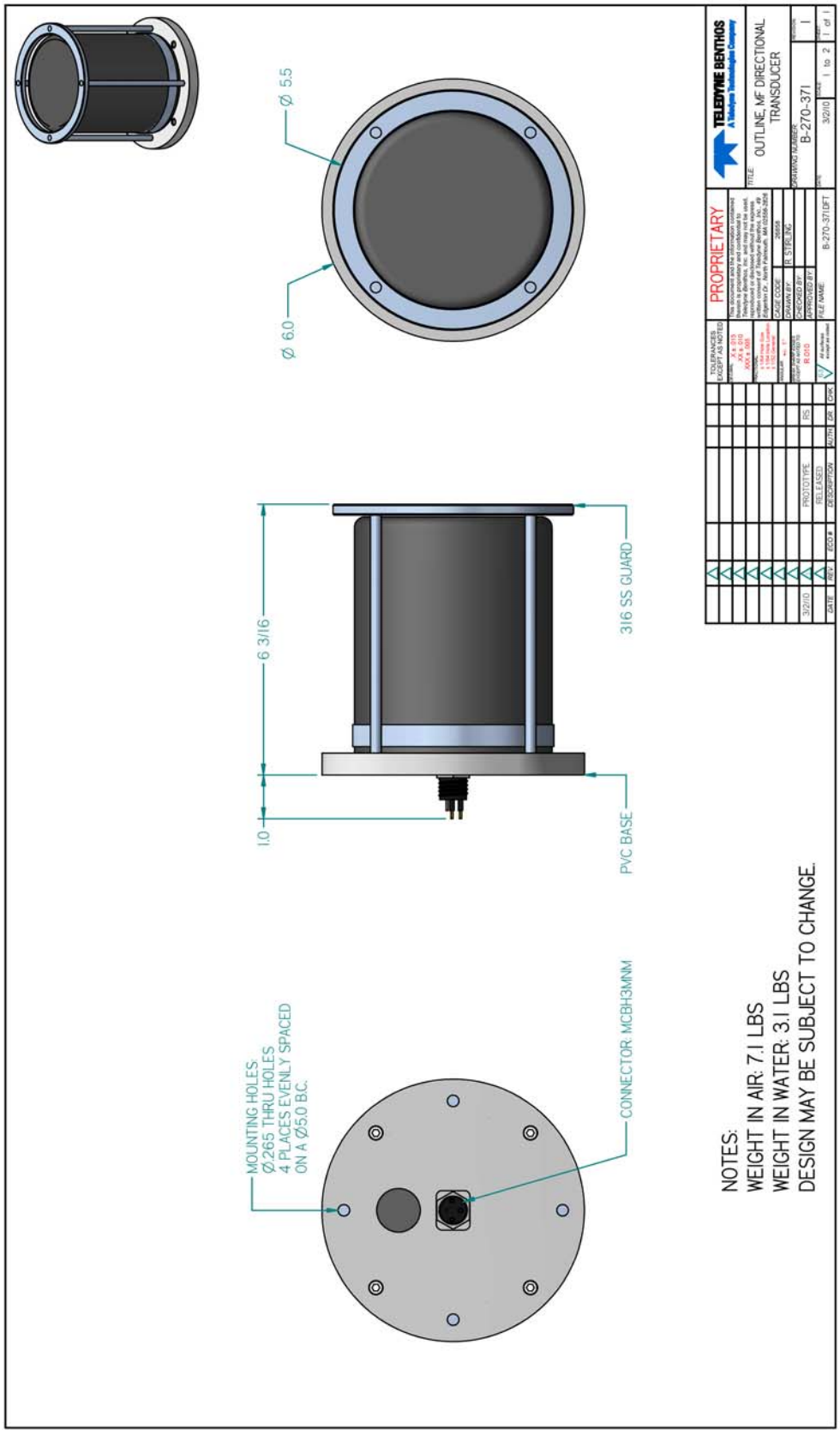
DRAWN BY: TMO
CHECKED BY:
APPROVED BY:
DRAWING FILE NAME: B270337.DWG

TELEDYNE BENTHOS
A Teledyne Technologies Company

TITLE: OUTLINE, REMOTE LF DIRECTIONAL TRANSDUCER

CAGE CODE 26858 | DRAWING NUMBER: B-270-337 | REVISION 1
DATE: 9/10/09 | SCALE: FULL | SHEET 1 OF 1


Ø 5.5
Ø 6.0
6 3/16
1.0
316 SS GUARD
PVC BASE
MOUNTING HOLES
Ø.265 THRU HOLES
4 PLACES EVENLY SPACED
ON A Ø5.0 B.C.
CONNECTOR: MCBH3MNM
NOTES:
WEIGHT IN AIR: 7.1 LBS
WEIGHT IN WATER: 3.1 LBS
DESIGN MAY BE SUBJECT TO CHANGE.
PROPRIETARY
TELEDYNE BENTHOS
OUTLINE, MF DIRECTIONAL TRANSDUCER
B-270-371
B-270-371DFT
3/2/10

10 Modem Components and Accessories

This section comprises lists of the Teledyne Benthos ATM-88X and UDB-9000 Series Acoustic Telemetry Modems and accessories.

Table 10-1 Acoustic Telemetry Modems—Surface

MODEL NUMBER	DESCRIPTION	PART NUMBER
UDB-9000-M (LF)	Universal Deck Box, LF, portable, w/LF transducer and 25-m cable	013189
UDB-9000-M (LF)	Universal Deck Box, LF, portable	D-270-47-2
UDB-9000-MR (LF)	Universal Deck Box, LF, rack mount	013187
UDB-9000-E (LF)	Universal Deck Box, LF, portable, single receive, w/LF transducer and 25-m cable	013641
UDB-9000-E (LF)	Universal Deck Box, LF, portable, single receive	D-270-47-3
UDB-9000-M (MF)	Universal Deck Box, MF, portable, w/MF transducer and 25-m cable	013642
UDB-9000-M (MF)	Universal Deck Box, MF, portable	D-270-47-4
ATM-980	Buoy Box w/RS-422 converter	C-270-194
ATM-980RF	Buoy Box w/RS-422 converter and 900-MHz RF radio	C-270-194-1

Table 10-2 Acoustic Telemetry Modems—Subsea (2000 m)

MODEL NUMBER	DESCRIPTION	PART NUMBER
ATM-885/LF-O	Modem, LF, omni	013308
ATM-885/MF-O	Modem, MF, omni	013446
ATM-885/MF-D	Modem, MF, dir	013688
ATM-885R/LF-O	Modem, remote transducer, LF, omni	014091
ATM-885R/MF-O	Modem, remote transducer, MF, omni	014092
ATM-885R/LF-D	Modem, remote transducer, LF, directional	014153
ATM-885R/MF-D	Modem, remote transducer, MF, directional	014154
ATM-886/LF-O	Modem, LF, omni	013428
ATM-886/MF-O	Modem, MF, omni	013449
ATM-886/MF-D	Modem, MF, directional	013687

Table 10-3 Acoustic Telemetry Modems—Subsea (6000 m)

MODEL NUMBER	DESCRIPTION	PART NUMBER
ATM-887/LF-O	Modem, LF, omni	013447
ATM-887/MF-O	Modem, MF, omni	013448
ATM-887/MF-D	Modem, MF, dir	013686
ATM-887R/LF-O	Modem, remote transducer, LF, omni	014155
ATM-887R/MF-O	Modem, remote transducer, MF, omni	014156
ATM-887R/LF-D	Modem, remote transducer, LF, directional	014157
ATM-887R/MF-D	Modem, remote transducer, MF, directional	014158
ATM-886D/LF-O	Modem, LF, Omni, Deep	014338
ATM-886D/MF-O	Modem, MF, Omni, Deep	014342
ATM-886D/MF-Dir	Modem, MF, Dir, Deep	014343

Table 10-4 Remote Transducers

MODEL NUMBER	DESCRIPTION	PART NUMBER
LF-O	Remote transducer, LF, omni, PVC	C-270-221
MF-O	Remote transducer, MF, omni, PVC	C-270-220
LF-D	Remote transducer, LF, directional	C846-0135
MF-D	Remote transducer, MF, directional, PVC	C-270-257

Table 10-5 OEM Kits

MODEL NUMBER	DESCRIPTION	PART NUMBER
ATM-885PCB/LF-O	Modem board set, LF, omni	013307
ATM-885PCB/MF-O	Modem board set, MF, omni	013450
ATM-885PCB/LF-D	Modem board set, LF, directional	014116
ATM-885PCB/MF-D	Modem board set, MF, directional	013684

.

Table 10-6 Refurb Kits

DESCRIPTION	PART NUMBER
ATM-885/886 Refurb Kit (includes O-rings, lubricant, swab, screws, and instructions); required when opening any ATM-885 or ATM-886.	A-270-59
ATM-887 Refurb Kit (includes O-rings, lubricant, swab, instructions); required when opening any ATM-887	A-270-60

Table 10-7 Modem Battery Packs

DESCRIPTION	PART NUMBER
ATM-887 Alkaline Battery Pack (2 required per modem)	001402
ATM-885 Alkaline Battery Pack	007624
SR-100/SR-50 Alkaline Battery Pack	C846-0004
SM-75 Alkaline Battery Pack	C847-0003
ATM-885 Battery Replacement Kit (includes one ATM-885 Alkaline Battery Pack and one ATM-885/886 Refurb Kit)	011657
ATM-887 Battery Replacement Kit (includes two ATM-887 Alkaline Battery Packs and one ATM-887 Refurb Kit)	011658
1176 W·Hr Deep Modem External Battery Housing, depth rated to 6000 meters (includes alkaline batteries and manual)	D-270-36

Table 10-8 Cables

DESCRIPTION	PART NUMBER
Battery Parallel Cable (for parallel connection of multiple battery housings); 2-meter length	B-270-109
Modem, Battery, ADCP Y-Cable (for connecting an ATM-88X Acoustic Telemetry Modem external battery housing and Teledyne RD Instruments Workhorse ADCP)	B-270-110
ATM-886 4G 2-Meter Cable, MIL9F to MCIL8M for RS-422	B-270-200-2
ATM-886 4G 10-Meter Cable, MIL9F to MCIL8M for RS-422	B-270-200-10
ATM-886 4G 25-Meter Cable, MIL9F to MCIL8M for RS-422	B-270-200-25
ATM-886 4G 50-Meter Cable, MIL9F to MCIL8M for RS-422	B-270-200-50
ATM-886 4G 100-Meter Cable, MIL9F to MCIL8M for RS-422	B-270-200-100
ATM-886 4G 2 Meter Pigtail, MIL9F RS-232, RS-422	B-270-330-2
ATM-886 4G 10 Meter Pigtail, MIL9F RS-232, RS-422	B-270-330-10
ATM-886 4G 25 Meter Pigtail, MIL9F RS-232, RS-422	B-270-330-25
ATM-886 4G 50 Meter Pigtail, MIL9F RS-232, RS-422	B-270-330-50
ATM-886 4G 100 Meter Pigtail, MIL9F, RS-422	B-270-330-100
ATM-886 4G 200 Meter Pigtail, MIL9F, RS-422	B-270-330-200
ATM-88X Teledyne RDI ADCP	B-270-71
Smart Teledyne RDI ADCP	B-270-126

Table 10-9 UDB-9000 Universal Deck Box Accessories

DESCRIPTION	PART NUMBER
UDB-9000 Transducer Deck Cable, 25 meters	B-270-197-1
UDB-9000 Transducer Deck Cable, 50 meters	B-270-197-2
UDB-9000 Transducer Deck Cable, 75 meters	B-270-197-3
UDB-9000 Transducer Deck Cable, 100 meters	B-270-197-4
UDB-9000 Transducer Deck Cable, 200 meters	B-270-197-5
UDB-9000 Transducer, LF	C-270-167-1
UDB-9000 Transducer, MF	C-270-167-2